Aquatic Ecosystem Monitoring Program, Faro Mine, Yukon (Updated 2010)

Prepared for:

Assessment and Abandoned Mines Branch
Government of Yukon
Whitehorse, Yukon

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EXECUTIVE SUMMARY

Background

The Faro Mine complex (Faro complex), near Faro, Yukon, includes two mines: the Faro Mine and Mill (Faro site) and Vangorda/Grum Mines (Vangorda site), which are located approximately 12 km apart. All operations were terminated in April 1998 due to poor economic circumstances and the site went into receivership. The Yukon Government now has responsibility for the site and has been managing the development of a site closure plan. As part of the closure planning process, Minnow Environmental Inc. was asked to develop a comprehensive, site-wide, long-term environmental monitoring program (LTMP).

The goal of the long-term monitoring program (LTMP) is to track environmental conditions within and around the Faro complex over time, to assess the conditions relative to predictions, and to verify that remediation and treatment options implemented at the site are having the desired effect. It has been estimated that peaks in metal loadings from the tailings area will occur over the next several to many decades, so monitoring will be long-term and associated with considerable cumulative cost. Therefore, it will be important for the program to measure only what is necessary and relevant at any given time and to adapt to changes as they occur (e.g., potentially worsening water quality associated with acidification and metal leaching from waste rock and tailings). The initial scope of the LTMP should be commensurate with the relatively limited magnitude and spatial extent of mine-related effects that are currently evident downstream of the site (Minnow 2007a, 2009). The frequency of monitoring must be sufficient to provide adequate warning of changes, particularly degradation, so that appropriate responses can be made (e.g., changes to monitoring, mitigation, or remediation). Similarly, reductions in the scope or frequency of monitoring should be considered in response to improving conditions.

The LTMP at the Faro Mine, Yukon, will be comprised of three sub-programs, each with its own sub-objectives. One component will be an aquatic ecosystem monitoring program (AEMP), which is the subject of this document. The AEMP will assess the chemical and biological condition of the aquatic environments receiving mine drainage. A perimeter monitoring program will also be developed to measure the concentrations and loadings of mine-related substances at the perimeter of the Faro and Vangorda sites where contaminants are released from the mine sites (source areas) to the natural environment (downstream surface waters). The objective of the third sub-program, the source area monitoring program, will be to track source conditions relative to predictions and monitor the performance of any treatment systems and/or mitigation. This will include assessment of

contaminant concentrations and movements within/from waste rock, pits, seeps, groundwater, surface water conduits, and the Faro tailings basin. The approach and framework for the AEMP presented in this document can be a template for developing the approach and framework for the other two sub-programs. Both the source area and perimeter monitoring programs should be harmonized as much as possible with the AEMP described herein with respect to sampling locations and frequencies, as well as the substances monitored, to ensure any future environmental changes can be directly linked to applicable sources.

Aquatic Ecosystem Monitoring

The AEMP will integrate biological and chemical information for a weight of evidence approach, including the following components:

- surface water quality and flow,
- benthic invertebrate community monitoring, and
- fish community and population assessment.

Each of these is briefly describe below, along with a summaries of the associated quality management plan, reporting requirements and guidance for implementation.

Surface Water Quality and Flow

The Faro Mine complex is influencing water quality in the Rose and Vangorda Creek drainages, but is not presently affecting water quality in the Pelly River. Within the Rose Creek drainage, water quality is most notably affected upstream of the Anvil Creek confluence (e.g., Stations X14 to R4). Mean concentrations of mine-related metals in lower Anvil Creek (A1) are statistically similar to background levels except with respect to elevated levels of major ions such as calcium, magnesium, potassium, sodium and sulphate. Routine, long-term water quality monitoring is recommended at mine-exposed stations R8, X2, R1, X3, X10, X14, R4, VGMAIN, V5, and V8, as well as at five reference stations within the same drainages but upstream of mine influence (FC, R7, USFR, V1, and VR), and two stations that have a history of drinking water use by First Nations (Grum Corner and K8). Additional stations may need to be monitored temporarily until specific mine closure activities are completed. Some other stations that are currently monitored should continue to be monitored outside of the AEMP to serve different objectives (e.g., perimeter and source area monitoring programs). Samples should be collected thrice annually in late March, late May and October to capture representative high, low and mid-range concentrations, recognizing

that highs and lows do not occur in the same months for all substances. Water samples should be analyzed for total metals (cadmium, calcium, cobalt, iron, lead, magnesium, manganese, nickel, potassium, silver, sodium, strontium, uranium, zinc), ammonia, hardness, nitrate, sulphate, total dissolved solids, and turbidity, along with specific conductance, temperature, and pH measured in the field at the time of sample collections. Water quality data should be compared to criteria for protection of aquatic life and to past concentrations reported for the same stations. Concentrations at Grum corner and K8 should also be compared to drinking water guidelines. Flow will be monitored at X2, X14 and V8, to allow for computation of loadings at these locations and track potential changes in flow regimes over time. Measurements should be taken synoptic with chemical sampling to allow for accurate loadings estimates at those stations.

Benthic Invertebrate Communities

Benthic invertebrates are good, community-level integrators of localized conditions over time, they are important components of aquatic food webs and there are standardized methods for their collection and evaluation. Therefore, benthic invertebrate community monitoring will be an important component of the AEMP at the Faro Mine complex. To date, benthic community assessments at the Faro and Vangorda sites have indicated negligible mine-related impact. Most historical studies have relied on deployment of artificial substrates, which have the advantage of controlling for natural differences in substrate among exposed and reference areas, but may bias collections toward organisms that happen to drift from upstream and colonize on the substrates over the short (typically 6-week) period they are deployed. Recent studies conducted to evaluate the efficacy of alternative sampling methods showed artificial substrate collection was less apt to detect reference-exposure area differences than Hess or kick sampling. Kick sampling is recommended for future surveys at Faro based on possible future opportunity to share data with the federal CABIN (Canadian Aquatic Biomonitoring Network) database, which includes data for other reference areas in the Yukon, and/or with other monitoring programs within the Yukon.

Based on recent site-specific investigations for the Faro Mine, a Reference Condition Approach (RCA) sampling design will be most cost-effective for long-term benthic community monitoring. Initially, monitoring should be conducted at six exposure areas reflecting near-field and far-field conditions in the Rose and Vangorda Creek drainages (X14, R4, V5, V8, VGMAIN, and X2). A previous study involving formal evaluation of habitat characteristics in both exposure and reference areas identified six to 10 reference areas near the Faro Mine that will be suitable for the evaluation of each exposure area (Minnow 2009). However, additional reference areas should be sought to increase the precision and accuracy of the

biomonitoring program. Although all exposure areas should be sampled in each benthic community survey, only a subset (25%) of the reference areas needs to be sampled in each survey. The reference areas sampled in each survey should be those that were least recently sampled previously such that all areas are re-sampled at least every fourth survey. The newest data for each reference area should be used to replace previous results and thus ensure the reference data set remains updated. Statistical comparisons between exposure and reference areas should be made for a variety of community characteristics (organism abundance, number of taxa, the first three axes from Correspondance Analysis of the data set, and proportions of dominant taxa) to assess benthic invertebrate community health. Surveys should be repeated over time as discussed below. The magnitude of reference-exposure area differences should be tracked to determine if conditions are worsening, improving, or remaining stable over time.

Fish Communities

Fish tend to occupy the upper trophic levels of aquatic ecosystems and are often their most visible and valued components. Both population and community-level assessment can be used as indicators of longer-term exposure conditions (e.g., over years). Therefore, fish community composition and relative species abundance should be tracked at key near-field locations near the Faro complex over time (R2, V8, Rose Creek Diversion) and compared to the communities at two or three reference areas possessing similar habitat characteristics (e.g., Anvil Creek well upstream of the Rose-Anvil confluence, the large tributary to Anvil Creek downstream of the Rose-Anvil confluence and/or Blind Creek). The recommended methods for fish community characterization are similar to those used in previous surveys, including collection of fish by backpack electrofisher and minnow traps. Also, slimy sculpin populations will be assessed using indicators of population health such as mean length, mean weight, weight relative to length (condition), and length frequency distributions for each mine-exposed area compared to reference areas (sample sizes permitting). Survey results should also be compared to past studies. The surveys will be conducted in late August when water levels and velocity are most apt to be low to moderate and fish distributions relatively stable. Analysis of metal content in fish tissues is not recommended at the present time.

Quality and Safety Management Plan

A number of formal procedures must be implemented to assure the quality and integrity of data produced by the monitoring programs at Faro and to ensure the safety of personnel visiting the site to collect samples. This includes clearly defining and communicating responsibilities and reporting channels, as well as site health and safety protocols. Standard

operating procedures (SOPs) should be developed, implemented, and updated as appropriate for such things as sample collection methods, the cleaning of sampling equipment before and after use, calibration and maintenance of field instruments, proper sample labelling, laboratory sample submission procedures (including chains of custody), data handling, and data quality control. Quality control samples (e.g., blank samples, replicate samples, and matrix spike recoveries) need to be collected and evaluated relative to pre-defined data quality objectives and reported. Specific quality assurance-quality control (QA-QC) requirements have been outlined for each component of the AEMP.

Schedule and Reporting

Monitoring of water quality at surface water stations will be on-going to provide regular assessment of conditions and adequate warning of any substantial changes. Such data will be formally reported in Annual Water Quality Reports. Annual Reports should present concentrations (and loadings where applicable) relative to previous years, and identify any issues encountered since the previous reporting period (e.g., missed samples, data quality problems, etc.).

Biological data (e.g., benthic invertebrates and fish) will be assessed and reported at a lower frequency in Comprehensive Aquatic Ecosystem Study Reports. A five-year monitoring interval is recommended post-closure, consistent with the gradual change expected in water quality over time and an appropriate time interval over which measurable biological change may be detectable. Surface water data reported in Annual Reports should also be summarized in the Comprehensive Reports, where interpretation can be integrated with the results of biological surveys. If the first few cycles of post-closure monitoring (e.g., 15-20 years of monitoring on a 5-year cycle) indicate that mine-related impacts are minor and that conditions continue to be relatively stable, it would be appropriate to reduce the frequency of comprehensive monitoring (e.g., once every 10 years), with a trigger identified in the site's Adaptive Management Plan to increase the frequency based on specific increases in the loadings/concentrations of key mine-related substances or any biological surveys that clearly show degradation relative to previous surveys. Biological monitoring should be more frequent (e.g., every 3 years) during the period when the site is being actively modified in preparation for closure, during which time water quality, and therefore biological impacts, will be less predictable.

Triggers for Change

Future increases or decreases in the scope and/or frequency of aquatic ecosystem monitoring should be based on the findings of Annual Water Quality Monitoring Reports or

Comprehensive Aquatic Ecosystem Study Reports. For example, a trigger to expand the spatial extent or frequency of monitoring (i.e., add a downstream station or conduct another study sooner than formerly scheduled) might be predicated on directly observing biological effects or a step-change increase in contaminant concentrations that could be expected to adversely affect biota downstream. Such triggers should be outlined in the Adaptive Management Plan for the site, along with a description of the action to be taken if and when the trigger threshold is exceeded. This approach will ensure the AEMP is appropriately scoped relative to current conditions and can be modified in response to any future improvements or degradation.

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1.0 INTRODUCTION

1.1 Project Background

The Faro Mine complex, near Faro, Yukon, includes two mines: the Faro Mine and Mill (Faro site) and Vangorda/Grum Mines (Vangorda site), which are located approximately 12 km apart (Figure 1.1). The complex was formerly owned by the Anvil Range Mining Corporation and produced lead and zinc concentrates which were extracted for lead, zinc, silver, and gold. The Faro site was mined between 1969 and 1992, while the Vangorda site was developed and mined between 1986 and 1998. Milling continued at Faro until April 1998, when all operations were terminated due to poor economic circumstances and projections, and the site went into receivership. Until early 2009, management of the mine property was under the direction of Deloitte and Touche Inc., acting as the court appointed Interim Receiver. Site Care and Maintenance responsibilities were transferred in early 2009 to a contractor acting on behalf of the Yukon Government.

The Yukon government and its consultants, working with the federal government, Selkirk First Nation, and Ross River Dena Council, have been preparing a comprehensive closure plan for the abandoned Faro Mine complex. Before the closure plan can be implemented, it will be subject to regulatory assessment and approval processes carried out through the Yukon Environmental and Socio-Economic Assessment Board under the *Yukon Environmental and Socio-Economic Assessment Act* (YESAA). A Water License, issued under the *Waters Act* by the Yukon Water Board, will also be required.

To support the site closure plan, Minnow Environmental Inc. was asked to develop a comprehensive, site-wide environmental monitoring program to be implemented upon mine closure. We have referred to this as the long-term monitoring program (LTMP). One component of the LTMP will be an Aquatic Ecosystem Monitoring Program (AEMP), which is the subject of this document. It is anticipated that the AEMP will be phased in, as appropriate, during the closure process but that some modifications may need to be made during that time to accommodate closure activities and associated environmental concerns.

1.2 Framework for the Long-Term Monitoring Program

The goal of the long-term monitoring program (LTMP) is to track environmental conditions within and around the Faro complex over time, to assess the conditions relative to predictions, and to verify that remediation and treatment options implemented at the site are having the desired effect. Technical studies conducted at the site indicate that acidification and leaching processes have the potential, depending on the options implemented for mine

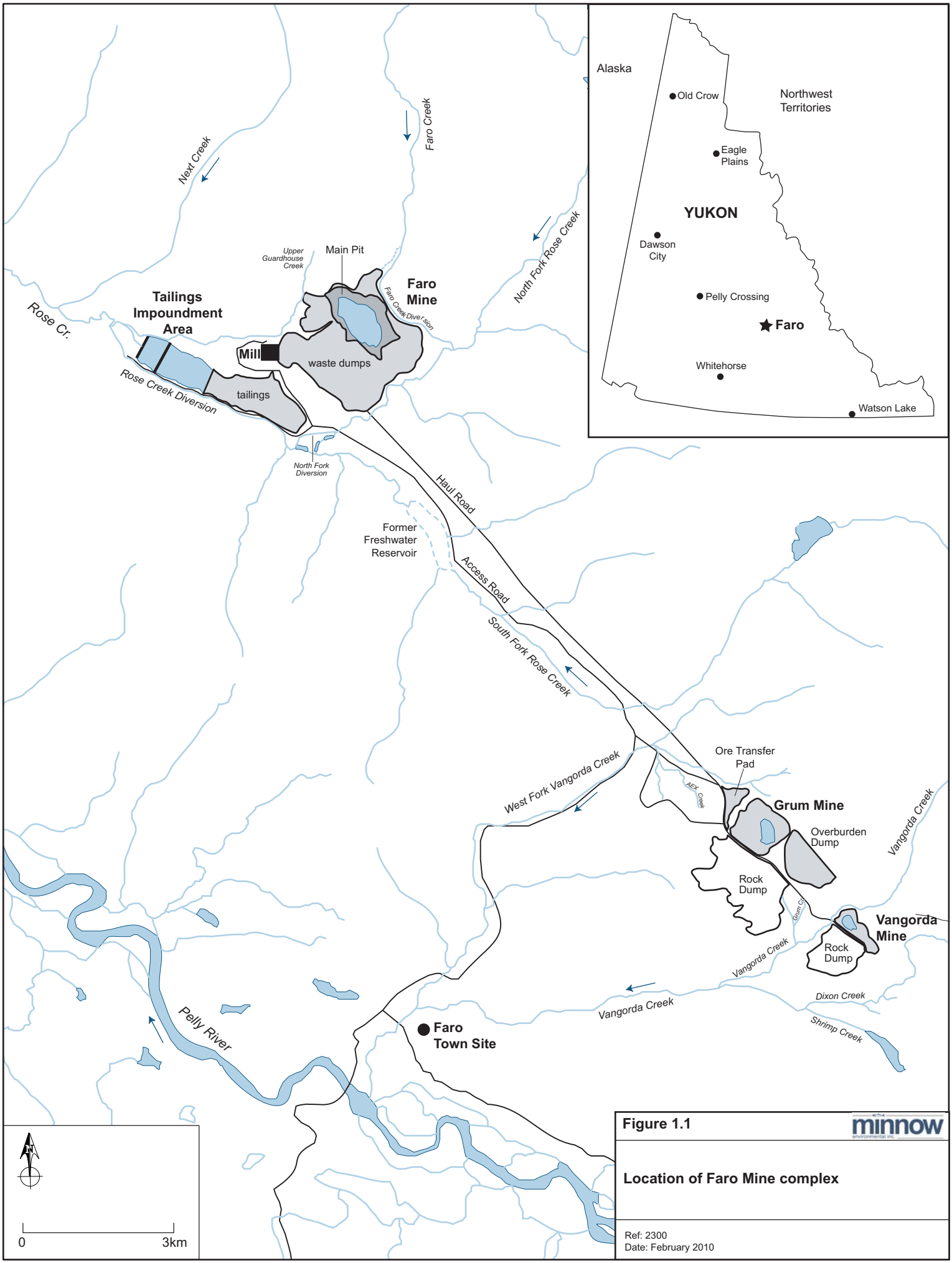


Figure 1.1

minnow environmental inc.

Location of Faro Mine complex

Ref: 2300
Date: February 2010

closure, to result in substantial increases in metal loadings to surface waters downstream of the Faro Mine complex over the next several to many decades. So, monitoring will be long-term and associated with considerable cumulative cost. Consequently, it will be important for the program to measure only what is necessary and relevant at any given time and to adapt to changes as they occur (e.g., respond to worsening water quality associated with acidification and metal leaching from waste rock and tailings). The initial scope of the LTMP should be commensurate with the relatively limited magnitude and spatial extent of mine-related effects that are currently evident (Minnow 2007a, 2009). The frequency of monitoring must be sufficient to provide adequate warning of changes, particularly degradation, so that appropriate responses can be made (e.g., changes to monitoring, mitigation, or remediation). Similarly, reductions in the scope or frequency of monitoring should be considered in response to improving conditions.

It is expected that the LTMP will have three components: 1) source area monitoring; 2) perimeter monitoring (points of contaminant release to downstream aquatic environments); and 3) aquatic ecological monitoring. Each program will have its own monitoring objectives, but will be linked by common approaches. This document describes the recommended AEMP, which will assess the chemical and biological condition of the aquatic environments receiving mine drainage. A perimeter monitoring program, to be developed separately, will measure the concentrations and loadings of mine-related substances at the perimeter of the Faro and Vangorda sites where contaminants are released from the mine sites (source areas) to the natural environment (downstream surface waters). The objective of the third sub-program, the source area monitoring program, will be to track source conditions relative to predictions and monitor the performance of any treatment systems and/or mitigation. This will include assessment of contaminant concentrations and movements within/from waste rock, pits, seeps, groundwater, surface water conduits, and the Faro tailings basin. The approach and framework for the AEMP presented in this document should be considered in the development of the other two sub-programs so that the source area and perimeter monitoring programs are harmonized as much as possible with the AEMP with respect to sampling locations and frequency, as well as the substances measured. This will ensure any future environmental impacts can be directly linked to applicable sources.

1.2 Aquatic Ecosystem Monitoring Program Overview and Objectives

As noted above, the AEMP represents one of the three sub-programs of the LTMP at the Faro Mine complex. The first step in the development of the AEMP involved review and re-evaluation of the results of previous studies and monitoring at the Faro Mine complex (Minnow 2007a). Thereafter, a general framework for the long-term monitoring program was

developed, but key information gaps were identified that precluded finalization of an optimized design (Minnow 2007b). In order to fill the key data gaps, an Interim Aquatic Monitoring Program was undertaken in conjunction with monitoring being undertaken at the Vangorda site in 2007 and Rose/Anvil Creeks in 2008 under the current Water License (Minnow 2009). This information, along with a new analysis of recent water quality data, is presented in this report, where appropriate, to justify the recommendations for the AEMP presented herein.

One of the objectives of this project was to identify the most cost effective monitoring design by determining the minimum sample types, sample locations, and sampling frequencies necessary to adequately evaluate chemical and biological conditions in surface water downstream of the mines and track changes in these over time. Furthermore, options for sample collection methods and sampling design were evaluated to ensure that the study results would be sensitive to changes in environmental conditions (degradation or improvement) over time.

This document outlines the rationale and approach for a comprehensive AEMP that will be implemented as part of the LTMP at Faro. The program will integrate biological and chemical information for a weight of evidence approach, including the following components:

- water chemistry,
- water flow,
- benthic invertebrate community monitoring, and
- fish community and population assessment.

Details for each of these components are presented in this report, along with requirements for quality management, reporting, and implementation.

1.3 Report Organization

The next four sections of the report describe the main components of the AEMP for the Faro Mine complex, including sampling locations and frequency, as well as monitoring endpoints, for water quality (Section 2.0), sediment quality (Section 3.0), benthic invertebrate (Section 4.0), and fish (Section 5.0). Supporting information and rationales are provided in each section, including a discussion of current conditions at the Faro Mine complex. The requirements for a Quality Management Plan are outlined in Section 6.0. The schedule and scope for reporting are presented in Section 7.0. Section 8.0 discusses the development of triggers for ensuring that the scope of the monitoring program is modified, as appropriate, in

response to findings. A summary of the entire program is provided in Section 9.0. Section 10.0 presents the references cited throughout the report.

2.0 SURFACE WATER MONITORING

2.1 Current Conditions

An analysis of recent data (2005-2009), presented in Appendix C, indicates that water quality in the Pelly River is not affected by discharges from the Faro Mine complex. However, the mine is influencing water quality in the Rose-Anvil Creek and Vangorda Creek drainages based on elevated concentrations of substances such as calcium, magnesium, manganese, sodium, strontium, and sulphate relative to background (reference) stations. Comparison of the water quality data to effects-based benchmarks such as Canadian or provincial water quality guidelines indicates that effects on biota, if any, are likely limited to the reaches nearest mine sources (Appendix C). This is corroborated by the results of biological surveys, which indicate that benthic invertebrate and fish communities sampled downstream of the Faro Mine complex have community characteristics similar to those observed in local reference streams uninfluenced by mine activity (Sections 4.0 and 5.0). Assessment of the degree of mine influence on Vangorda Creek is confounded by the presence of a large landslide on West Fork Vangorda Creek, which may be heavily influencing water quality in downstream areas of the West Fork and lower Vangorda Creek (Appendix C).

2.2 Considerations for Future Monitoring

Water quality monitoring is central to an integrated, long-term environmental monitoring program for the Faro complex since the ultimate fate of most mine-related contaminants will be discharge to downstream surface water bodies, either directly or via groundwater pathways. Any future increases in metal loadings to surface waters will become apparent as increases in water concentrations prior to measurable changes in biological communities. Therefore, the frequency of surface water monitoring should be greater than that of biological monitoring. Selected surface water monitoring locations should provide unique information and only contaminants that can be conclusively associated with the Faro Mine complex (i.e., are currently or predicted to become elevated relative to background) should be routinely monitored and reported.

2.3 Sampling Locations

In a regulatory framework, monitoring stations at an industrial site are often added over time in response to specific concerns, events (e.g., spills), or information needs which may no longer be relevant. Therefore, it was appropriate to review all surface water stations that are currently required by the site's Water Licences, and those that are or have been voluntarily

monitored, to determine if each one is still relevant and should be included in the AEMP. Each station was recommended for inclusion in the AEMP if it:

- is located on a surface water body which does or could be expected to support fish;
- does not represent a source (e.g., seep) nor can it be considered a perimeter station (the point at which a contaminant enters the natural environment from the area of mine disturbance) since long-term monitoring programs for these types of stations will be developed separately[1];
- currently shows elevated concentrations of one or more mine-related substances or is a suitable reference station; and
- provides unique information relative to all other stations.

Also, selection of stations considered that water quality is minimally influenced in Anvil Creek below the confluence with Rose Creek and is not at all affected in the Pelly River (Appendix C). Based on a review of the monitoring stations for which data have been archived in the site water quality database, a total of 17 surface water monitoring stations are recommended for inclusion in the AEMP post-closure (Table 2.1; Figure 2.1). This includes 10 surface water areas downstream of known or possible mine sources (R8, X2, R1, X3, X10, X14, R4, VGMAIN, V5, and V8). This list includes stations for characterizing near-field water quality conditions downstream of mine sources, as well as stations located further downstream (i.e., far-field stations V8 and R4) that can be used to corroborate near-field findings and also verify the spatial extent of any measurable influence on biological communities (also see Sections 4.0 and 5.0). Monitoring is not proposed downstream of the confluence of Rose and Anvil Creeks, nor in the Pelly River at the present time, based on limited mine-related water quality influence in the former and none in the latter (Appendix C). Therefore, the proposed stations provide adequate spatial coverage in the context of current conditions at the site. The program design will remain sufficiently flexible that stations can be added or eliminated in the future in response to findings (Section 8.0).

Also included will be five reference areas within the same drainages, but upstream of mine influence (FC, R7, USFR, V1, and VR) that will track any changes in background water quality over time (e.g., due to climate change or other non-mine-related factors). Two more

[1] One exception is station X14, which can be considered representative of near-field water quality downstream of the Faro tailings area and is included in this document in that context, but it also represents a perimeter monitoring station and will thus serve both monitoring programs.

Table 2.1: Summary of recommended changes to surface water monitoring for AEMP at Faro Complex, Yukon. Some stations recommended for elimination from AEMP should continue to be monitored for other purposes (e.g., "perimeter" or "source area" characterizations) (see rationale column).

Water Body	Database Station ID	Station Description (historical monitoring stations described as indicated in site water quality database)	Previous Monitoring Requirement Under Site Water License	Add (A), Retain (R), Eliminate (E), or Monitor Temporarily (T) in AEMP	Rationale
Faro Creek	FC	Faro Creek above diversion channel		A	Represents Faro Creek background water quality. Similar information to FDU, but FDU may be slightly influenced by its location in the upper diversion and by drainage from the North Valley Interceptor. Add FC and eliminate FDU.
	FDU	FDU, Faro Creek Diversion U/S Valley Dump	✓	E	Has been actively monitored in the past. Almost background water quality in Faro Creek but potentially slightly influenced by its location in the upper diversion and by drainage from the North Valley Interceptor. Retain FC and eliminate FDU.
	FDU2	Faro Creek Diversion at corner		E	Not actively monitored. Short-term purpose served and no longer relevant.
	FVW	Faro Valley Intercept		E	Not monitored since 1992. Essentially clean water, but FC would better represent reference conditions.
	FCD	Mid Faro Ck. Diversion adjacent NE Waste Dumps		E	Not monitored since 2004. Information similar to that provided by FAROCR.
	FDL	Mid Faro Creek Diversion	✓	E	Actively monitored. Similar location to FCD, and data similar to FAROCR.
	FAROCR	Faro Cr. Diversion u/s confluence with North Fork Rose Cr.	✓	E	Has been actively monitored in the past. Reflects potential effects on Faro Creek of any drainage from NE waste dumps or input from the waste rock lining the diversion channel d/s of FDU. Any substantive mine-related contaminant contributions will be reflected at R8 and an increasing contaminant trend should prompt resumption of monitoring at FAROCR.
North Fork Rose Creek	R7	N Fork of Rose Creek above Faro Ck Diversion	✓	R	Actively monitored. Background station with good long-term records. Also a benthic community monitoring location.
	R8	N Fork of Rose Creek 900 m below Faro Ck Div.	✓	R	Has been actively monitored in the past. Reflects combined background water quality of Faro Creek and North Fork Rose Creek. Reflects any influence on water quality associated with Faro Creek diversion. Serves as baseline for evaluating potential mine inputs to North Fork Rose Creek further downstream.
	R9	N Fork of Rose Creek adjacent BH1 and BH2	✓	E (or T)	Has been actively monitored. Reflects potential input from Northeast Dumps, although little influence on water quality to date and ultimately reports through X2. Not necessary unless to pin-point sources of contaminants showing up at downstream stations at which time monitoring could be resumed here and data compared to existing baseline.
	R10	North Fork of Rose Creek u/s of rock drain	✓	E (or T)	Has been actively monitored. Reflects Zone 2 outwash, although little influence on water quality to date and ultimately reports through X2. Eliminate or retain temporarily until closure remediation (e.g., raising and lining of channel) complete.
	NF1	North Fork Rose Creek Site 1 u/s of Haul Road	✓	E (or T)	Has been actively monitored. Reflects upstream inputs and additional clean water drainage from southeast. Ultimately reports through X2. Eliminate or retain temporarily until closure remediation (e.g., raising and lining of channel) complete.
	NF2	North Fork Rose Creek Site 2 d/s of Haul Road	✓	E (or T)	Has been actively monitored. Reflects potential inflow under Haul Road, although little influence on water quality to date. Ultimately reports through X2. Eliminate or retain temporarily until closure remediation (e.g., raising and lining of channel) complete.
	X2	N Fork of Rose Creek u/s of mine access road	✓	R	Actively monitored with good long-term records. Input from upstream sources and groundwater via S-series wells currently evident. Good location for monitoring cumulative inputs to North Fork Rose Creek. Any unexpected changes should trigger resumption of monitoring at upstream stations and comparison of data to existing records for those stations.
Guardhouse Creek and North Wall Interceptor	W10	Upper Guardhouse Ck u/s of NW Dump	✓	T	Has been actively monitored. Represents background conditions for (very small) Guardhouse Creek. Monitor until toe of waste dump is moved back from creek channel and conditions at W8 return to background (then eliminate). Makes a very small contribution to total background flows at Faro site.
	W8	Upper Guardhouse Creek d/s of NW Dump	✓	T	Has been actively monitored. Identifies loadings from the Upper Northwest Dump to Upper Guardhouse Cr. Move slightly downstream to ensure all contributions from dump are captured. Monitor until toe of waste dump is moved back from creek channel and conditions at W8 return to background (then eliminate). This water will continue to be diverted around contaminated areas downstream via North Wall Interceptor ditch (not a natural channel).
	NWI	North Wall Interceptor		E	Not monitored since 1996. Similar to W8 and NWINT. Not a natural channel. Possibly resume monitoring as a "source area" monitoring station to capture any unexpected upstream loads and contribute to site water balance.
	NWINT	NW Interceptor ditch u/s of X5		E	Not monitored since 1999. Similar to W8 and NWI. Not a natural channel.
South Fork Rose Creek and Tailings Diversion	USFR	Rose Creek upstream of Haul Road		A	Represents South Fork Rose Creek background water quality.
	GCULV	Grum Culvert-Ross River resident usage		R (as Grum Corner)	Has been actively monitored. Represents a drinking water station for Ross River First Nation. Station should be re-named 'Grum Corner' since it is usually verbally referenced as such.
	K8	Ross River resident usage	✓	R	Has been actively monitored. Drinking water station for Ross River First Nation.
	FWSD1	Fresh Water Supply Dam - Station One		E	Only monitored 2004-2005 for TSS during construction activities associated with FWSD removal. Represented background water quality.
	FWSD5	Fresh Water Supply Dam - Station Five		E	Only monitored 2005-2005 to evaluate effects of FWSD removal project (TSS).
	FWSD6	Fresh Water Supply Dam - Station Six		E	Only monitored twice (2004, 2006). May be influenced by storage of material near FWSD that is potentially acid generating.
	R1	Rose Creek upstream of Pumphouse Pond	✓	R	Has been actively monitored. May be influenced by upstream tributaries draining across Haul Road but otherwise clean. Along with X2, reflects inputs to Rose Creek Diversion Channel measured at X3.
	SFORKROSE	S Fork Rose Creek upstream of pumphouse		E	Not actively monitored. Short-term purpose served and no longer relevant.
	X3	S Fork Rose Creek at the pumphouse reservoir	✓	R	Actively monitored. Reflects quality of combined flows from North and South Forks Rose Creek. Will reflect any loadings to North Fork Rose Creek d/s of X2 and, in comparison to X10 data, will assist to identify any substantial lateral migration of contaminants from tailings.
	X10	Rose Creek Diversion Channel below weirs		R	Actively monitored (monthly). Provides long record of WQ upstream of major mine loads from tailings area and treatment plant discharge.
	X10A	Rose Creek just upstream of counfluence with X13/X5		E	Not actively monitored. Short-term purpose served and no longer relevant.
	X10B	Rose Creek just upstream of counfluence with X13/X5		E	Not actively monitored. Short-term purpose served and no longer relevant.
	ROSESTVREC	Rose Creek downstream of Stevens Recorder		E	Not actively monitored. Short-term purpose served and no longer relevant.
Rose Creek Downstream of Mine	X14	Rose Cr downstream of the diversion channel	✓	R	Actively monitored. Reflects all combined inputs from Faro site and is also the main water quality "compliance point" for the site. Should also be considered a "perimeter" monitoring station.
	R2	Rose Creek just d/s X14	✓	E	Has generally been monitored twice per year; samples collected more frequently just u/s at X14 (redundant). Reflects near-field mine influence. Historical benthic invertebrate community health monitoring location.
	R3	Rose Creek between R2 and R4	✓	E	Historically monitored twice per year and then monthly since August 2007. Reflects conditions in Rose Creek midway between mine and Anvil Creek confluence. Historical benthic invertebrate community health monitoring location. Redundant with R4.
	R4	Rose Creek upstream of Anvil Creek	✓	R	Historically monitored twice per year and then monthly since August 2007. Reflects conditions in lower Rose Creek. Benthic invertebrate community health monitoring location.
Anvil Creek	R5	Anvil Creek downstream of Rose Creek	✓	E	Has been monitored twice per year. Reflects combined flows of Rose and Anvil Creeks. Historical benthic invertebrate community health monitoring location. Current mine influence in Anvil Creek is minor. Monitoring can be reinstated in future if source loadings increase such that increasing trends are evident at R4, and R4 concentrations are such that effects on biota would be predicted in lower Anvil Creek.
	R6	Anvil Creek upstream of Rose Creek	✓	E	Historically monitored twice per year and then monthly since Aug 2007. Reference station u/s Rose Creek confluence. Historical benthic invertebrate community health monitoring station. Not required unless and until monitoring routinely instituted on lower Anvil Creek below Rose Creek confluence.
	R11/A1	Mouth of Anvil Creek		E	Historically monitored twice per year, then monthly or every other month Sept 2007 to Aug 2009. Reflects Anvil Creek water quality at mouth to Pelly River. If monitored in future, A1 is better station code than historical code R11.
	Anvil Cr	Anvil Cr above Pelly R	✓	E	No data in database. Probably same or similar location to A1 and R11. Need to consolidate for long-term monitoring as Station A1.
Pelly River	P1	Pelly River upstream of Vangorda site (reference)		E	Monthly monitoring Sept 2007-Aug 2009. Monitoring has served its purpose (see comments for P4). Upstream reference station.
	P2	Pelly River d/s of Vangorda site		E	Monthly monitoring Sept 2007-Aug 2009. Monitoring has served its purpose (see comments for P4).
	P3	Pelly River u/s of Anvil Creek		E	Monthly monitoring Sept 2007-Aug 2009. Monitoring has served its purpose (see comments for P4).
	P4	Pelly River d/s of Anvil Creek		E	Monthly monitoring Sept 2007-Aug 2009. Monitoring has served its purpose to identify there is currently no measurable mine-related influence on Pelly River water quality and establish baseline water quality record. Monitoring could be reinstated in future if triggered based on sufficiently elevated mine loadings that effects on Pelly River water quality are expected.
Vangorda Creek	V1	Vangorda Creek, u/s mine and Blind Cr. Rd.	✓	R	Reflects background water quality. Benthic invertebrate community health monitoring location.
	V2	Grum Creek upstream of confluence with Vangorda Creek	✓	E	Reflects influence on Grum Creek of Grum waste rock dumps. Potentially include in perimeter or source area monitoring program.
	V27	Vangorda Creek, just upstr. of Shrimp	✓	E	Reflects combined influence of Grum and Vangorda sites on Vangorda Creek. Historical benthic invertebrate community health monitoring location. Monitor as a "perimeter" location. No fish in upper Vangorda Creek reaches so biological monitoring will focus on downstream reaches (e.g., VGMAIN, V8).
	VGMAIN	Main fork Vangorda Creek (upstream West Fork)	✓	R	Reflects all mine inputs to main stem Vangorda Creek upstream of West Fork confluence. Good counterpart to V5 on West Fork.
	V26	Little Creek between pit and dumps flowing into Dixon Creek		E	Not monitored since 1995. Precise location unknown (not on maps).
	V20	Vangorda pit, SE interceptor ditch d/s of V26	✓	E	Actively monitored. Reflects potential Vangorda waste rock drainage via Dixon Creek. Typically dry in summer. Background loads like small. Input is reflect at V4.
	V4	Shrimp Creek, u/s Vangorda Creek confluence	✓	E	Reflects any input from Vangorda rock dump via Dixon and Shrimp Creek. Monitor as a "perimeter" station. No fish in upper Vangorda Creek reaches so biological monitoring will focus on downstream reaches (e.g., VGMAIN, V8).
	VR	West Fork of Vangorda Creek u/s Haul Road		A	New reference station for West Fork Vangorda Creek monitored since 2007.
	V17A	Tribuary to West Fork Vangorda Creek (Ore Transfer Pad)	✓	E	Reflects any ARD input from Ore Transfer Pad. Input captured at V6A.
	V6A	AEX Creek	✓	E	Reflects input from Ore Transfer Pad and other local runoff. Input will be reflected at new station in West Fork Vangorda Creek d/s of AEX Creek. Potentially include in perimeter monitoring program.
	New	West Fork d/s AEX Creek		T	Reflects influence on West Fork Vangorda Creek of mine drainages to AEX Creek and upstream of landslide. Monitor until sources of contaminant loadings to West Fork are characterized then determine best long-term monitoring locations.
	New	West Fork d/s landslide and u/s Grum waste rock drainage		T	Reflects contaminants leached from landslide to West Fork Vangorda Creek. Monitor until sources of contaminant loadings to West Fork are characterized then determine best long-term monitoring locations.
	V5	West Fork of Vangorda Creek at gravel pit	✓	R	Reflects any mine influence on West Fork Vangorda Creek u/s of confluence with Main Fork.
	V8	Lower Vangorda Creek at the footbridge	✓	R	Reflects combined influence of Grum and Vangorda via main and west branches Vangorda Creek. Also near Faro townsite.
	VXX	Main Fork Vangorda Creek calculated at 67% of V8		E	Not actively monitored. Short-term purpose served and no longer relevant. Precise location unknown (not on maps).
	VGGR	Vangorda Creek at Grum turn off		E	Not actively monitored. Short-term purpose served and no longer relevant. Precise location unknown (not on maps).

Mine-exposed stations recommended for inclusion in Aquatic Ecosystem Monitoring Program.
Reference stations recommended for inclusion in Aquatic Ecosystem Monitoring Program.
Special surface water monitoring stations.
Stations that may need to be monitored temporarily during closure.

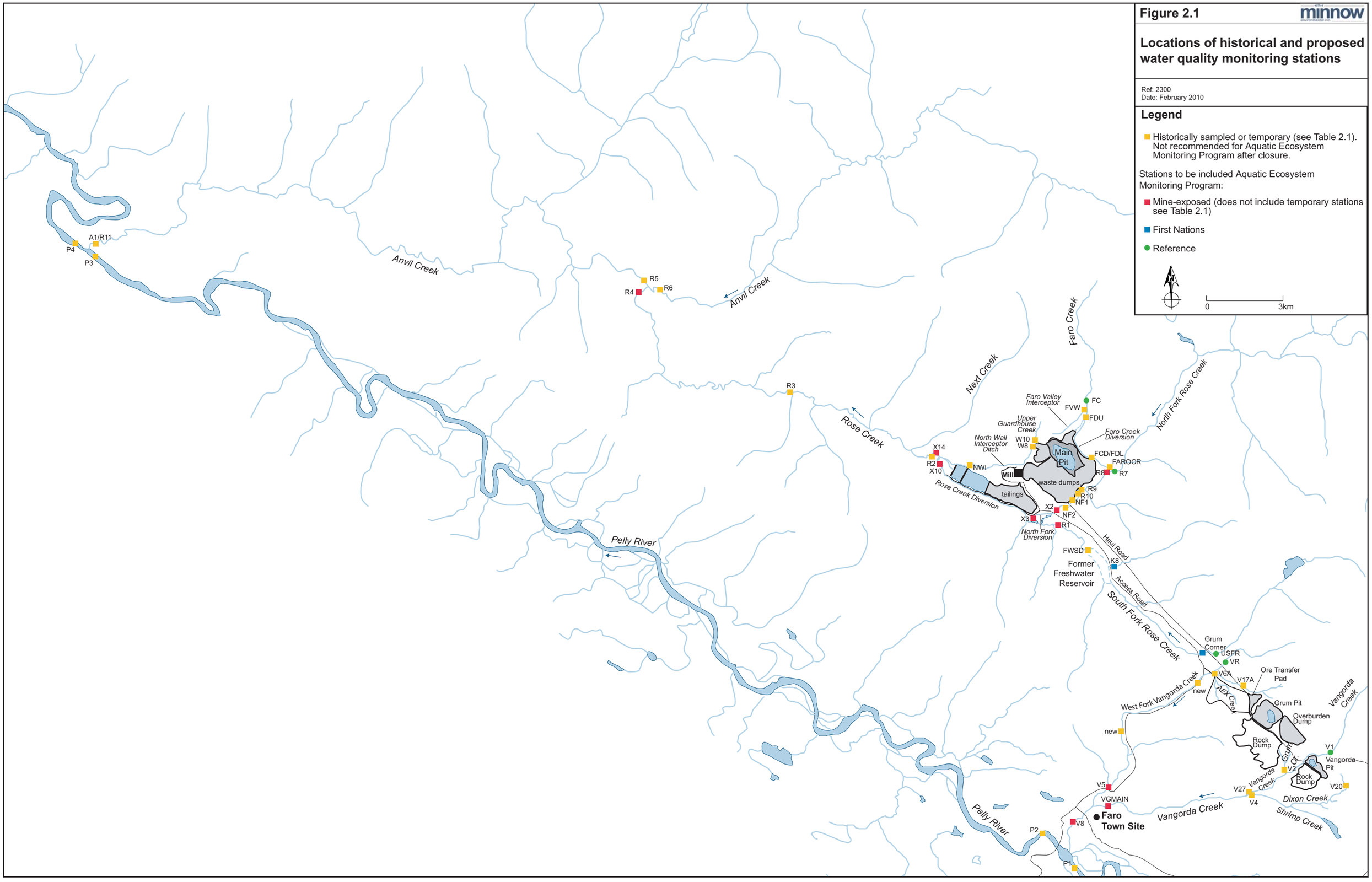


Figure 2.1

minnow environmental inc.

Locations of historical and proposed water quality monitoring stations

Ref: 2300
Date: February 2010

Legend

- Historically sampled or temporary (see Table 2.1). Not recommended for Aquatic Ecosystem Monitoring Program after closure.

Stations to be included Aquatic Ecosystem Monitoring Program:

- Mine-exposed (does not include temporary stations see Table 2.1)
- First Nations
- Reference

N

0 3km

stations are included that have a history of drinking water use by First Nations (Grum Corner and K8).

It is also recommended that two new areas be monitored temporarily along West Fork Vangorda Creek bracketing the landslide across the creek. Once relative contaminant contributions from all sources to West Fork Vangorda Creek have been characterized (e.g., landslide versus mine sources), it may be appropriate to make further modifications to monitoring locations along this branch (e.g., reduce or move stations). Also, additional stations may need to be monitored along the North Fork Rose Creek and upper Guardhouse Creek until associated remediation is completed (Table 2.1).

2.4 Monitoring Endpoints

2.4.1 Chemistry

A total of 27 substances were measured at concentrations above the background benchmarks (which represent the upper range of concentrations in local reference streams) in at least 10% of samples collected at near-field stations (X2, X14, or V27) between 2005 and mid 2009 (Appendix Table C.1). These are substances that reflect mine influence ("mine indicator" substances) and thus should be considered for inclusion in long-term monitoring. Of these, most were strongly correlated with each other (Tables B.16 and B.17), which indicates a high degree of redundancy (i.e., one substance predicts the increase or decrease of others). Therefore, some of the mine indicator substances whose concentrations were only slightly elevated above background levels in most areas, and for which water quality guidelines are absent and aquatic toxicity data are very limited (e.g., lithium, titanium, fluoride, chloride, colour, phosphorus), can be excluded from monitoring without compromising future opportunities to track changing conditions and assess potential impacts to aquatic biota. Valid arguments could be made for discontinued monitoring of additional substances, but at the modest sampling frequencies that are being recommended (Section 2.5), the cost-savings would be negligible. Therefore, it is recommended that the following 21 substances be included in routine water quality monitoring: cadmium, calcium, cobalt, iron, lead, magnesium, manganese, nickel, potassium, silver, sodium, strontium, uranium, zinc, ammonia, hardness, nitrate, sulphate, total dissolved solids, and turbidity, along with field measurements of temperature, pH, and specific conductance[2] at the time of sample collection. In addition to potential chemical influences, impacts to receiving

[2] Measurement of specific conductance, which standardizes conductivity measurements to a common temperature (usually 25°C), will eliminate the confounding influence of water temperature that is associated with field conductivity measurements.

environments may include changes in temperature associated with the implementation of groundwater recapture systems.

2.4.2 Total Versus Filtered Metals

Water quality monitoring conducted at the Faro site in recent years has included analysis of both total and filtered metal concentrations, where the latter is defined as the concentration of metal in a water sample that is passed through a 0.45 um filter. This practice increases the costs for sample collection and data management and doubles the cost of laboratory analysis. Also, differences in filtering methods, such as filter diameter, filter manufacturer, volume of sample processed, and amount of sediment in the sample, can result in significant variation in the concentrations of metals reported as being in the dissolved form (Horowitz et al. 1996). Although filtered metal concentrations are often considered a more relevant indicator of the metal concentrations present in a form that might be harmful to aquatic biota (i.e., bioavailable; Prothro 1993), the metal species passing through a 0.45 um filter are not necessarily truly dissolved (i.e., colloidal forms may also pass through; EVS 1997). Also, the metal species present in filtered samples can vary widely in toxicity (Campbell 1995, Deaver and Rodgers 1996, DiToro et al. 2005) and thus samples with the same concentration of filtered metal can have very different toxicities. Furthermore, Canadian water quality guidelines, to which site water quality data will be compared, are based on total, rather than filtered metal concentrations. Finally, total concentrations of mine-related substances are mostly below levels of concern, except in occasional samples (Appendices B and C). Therefore, measurement of total metal concentrations will be adequate for routine surface water quality monitoring at the Faro Mine complex.

2.4.3 Flow

Seasonal and annual discharges (flows) vary widely in the creeks downstream of the Faro complex in response to temperature (frozen versus flowing conditions) and precipitation events (SRK 2006). This affects the concentrations of mine-related contaminants released to surface waters, causing wide variation in concentrations of some substances at any given station within and among years. Flow measurement will be particularly important at perimeter stations (where contaminants leave the mine sites) since this information can be used, along with synoptically measured contaminant concentrations, to calculate and track contaminant loadings to surface waters downstream of the mines. However, in aquatic receiving environments, concentrations are more relevant than loads in terms of evaluating potential effects on aquatic biota. Since surface water concentrations will be part of routine monitoring, there will be limited need for flow monitoring at surface water stations over the long-term. Flow monitoring is recommended at stations in both the Rose and Vangorda

Creek drainages, to track any changes in flow regimes that may occur over time as a result of climate change or groundwater recapture and other closure activities that affect flow. Changes in flow could alter physical habitat available to fish and/or cause receiving environment concentrations to differ from predictions. Continuous flow monitoring is currently being undertaken at Rose Creek station X14 (a surface water and perimeter station), as well as at Vangorda Creek station V8 (a surface water station). Flow monitoring is also recommended at X2 to track changes associated with groundwater recapture and reconfiguration of the North Fork Rose Creek channel during closure.

2.5 Sampling Frequency

In general, optimization of water sampling frequency depends on the objectives of monitoring. To assess seasonal cycles and/or determine within year means and variances it is necessary to sample multiple times per year (typically monthly or more often), which is often useful in early years of a monitoring program. To monitor and evaluate longer term trends (over more than 5 years), it may be adequate to sample a single standardized time per year (or perhaps twice per year if the goal is to track capture two conditions like “average” and “high” concentration periods which occur at different times of the year), with more frequent within-year sampling providing diminishing returns per unit cost.

An analysis of temporal variability in contaminant concentrations was conducted for the purpose of identifying optimal surface water sampling frequencies for the long-term monitoring program at the Faro Mine complex (Appendix D). The assessment focused on calcium, sulphate, and zinc which are all mine indicator substances having high proportions of detected concentrations at key surface water stations. Data were analyzed for two reference stations (V1, R7) and four stations exposed to mine influences (V5, V8, X2, X14), all of which had good data records and represent the two watersheds receiving mine drainage (Vangorda Creek and Rose Creek). Key conclusions are summarized below with more detailed discussion of methods and results provided in Appendix D.

Seasonal cycles for calcium and sulphate were significant, strong, and similar at all six stations, accounting for a high proportion of overall data variance (up to 74%) compared to low and usually non-significant among-year variance (≤7%). Highest values for these substances occurred December to April, while low and mid-range values were typically observed May-July, and August-November, respectively. For zinc, seasonal cycles were relatively weak, accounting for only about 10% of total variance, compared to among-year variance, which accounted for 10-20% of total variance. Also, concentrations tended to be somewhat higher in mid-year (April-July) at exposed Vangorda stations (V5, V8), whereas exposed Rose Creek stations (X2, X14) were typically lower mid-year (June-August) (i.e.,

opposite pattern). The extent to which factors unrelated to the mine (e.g., landslide on West Fork Vangorda) have influenced the results for V5 and V8 is currently unknown, but is being investigated through addition of more monitoring stations along West Fork Vangorda Creek beginning in fall 2009.

Based on analysis of past water quality data (Appendix D) and evaluation of post-closure water quality predictions, thrice annual sampling in March (2nd half), May (2nd half), and October would be adequate to capture representative high, low, and mid-range concentrations (but not necessarily in that order, depending on the station). More frequent (i.e., monthly) sampling is unwarranted and unnecessarily costly for tracking long-term trends because the statistical benefits per unit cost of increasing replication within years diminish rapidly as the number of sample years increases.

2.6 Data Analysis and Reporting

Water quality data should be analyzed by comparing concentrations in mine-exposed areas to effects-based benchmarks (e.g., water quality criteria; Appendix A) and to past concentrations reported for the same station. Comparisons should also be made to site-specific water quality objectives (SSWQO), if any are developed for the Faro Mine complex in the future. Data for Grum Corner and K8 should be compared to drinking water guidelines. As described in Section 7.0, water data should be presented in annual water quality reports (limited interpretation) as well as in comprehensive study reports to be completed every 5 years (more detailed interpretation and integration with biological monitoring results).

2.7 Summary

The Faro Mine complex is influencing water quality in the Rose and Vangorda Creek drainages, but is not presently affecting water quality in the Pelly River. Within the Rose Creek drainage, water quality is most notably affected upstream of the Anvil Creek confluence (e.g., Stations X14 to R4). Mean concentrations of mine-related metals in lower Anvil Creek (A1) are statistically similar to background levels except with respect to elevated levels of major ions such as calcium, magnesium, potassium, sodium and sulphate. Routine, long-term water quality monitoring is recommended at mine-exposed stations R8, X2, R1, X3, X10, X14, R4, VGMAIN, V5, and V8, as well as at five reference stations within the same drainages but upstream of mine influence (FC, R7, USFR, V1, and VR), and two stations that have a history of drinking water use by First Nations (Grum Corner and K8). Additional stations may need to be monitored temporarily until specific mine closure activities are completed. Some other stations that are currently monitored should continue to be

monitored outside of the AEMP to serve different objectives (e.g., perimeter and source area monitoring programs). Samples should be collected thrice annually in late March, late May and October to capture representative high, low and mid-range concentrations, recognizing that highs and lows do not occur in the same months for all substances. Water samples should be analyzed for total metals (cadmium, calcium, cobalt, iron, lead, magnesium, manganese, nickel, potassium, silver, sodium, strontium, uranium, zinc), ammonia, hardness, nitrate, sulphate, total dissolved solids, and turbidity, along with specific conductance, temperature, and pH measured in the field at the time of sample collections. Water quality data should be compared to criteria for protection of aquatic life and to past concentrations reported for the same stations. Concentrations at Grum corner and K8 should also be compared to drinking water guidelines. Flow will be monitored at X14 and V8, to allow for computation of loadings at these locations and track potential changes in flow regimes over time.

3.0 SEDIMENT MONITORING

3.1 Current Conditions

Sediment quality sampling has been conducted in the Rose-Anvil and Vangorda Creek systems since as early as 1973 and 1991, respectively, and the results available to 2006 were summarized by Minnow (2007a). There was some study-to-study variability in terms of precise sampling station locations, laboratory equipment/techniques, and the metal substances reported. However, general patterns in sediment chemistry data were reasonably comparable among studies. Typically fine-grained sediment samples were collected in triplicate from streambed deposits using a trowel or shovel, then placed into glass jars, refrigerated, and shipped to a laboratory for analysis of metal content. Because fine sediment deposits were sparse in some areas, samples were sometimes collected from areas that were or are sometimes dry (i.e., above the water line and, not necessarily available to aquatic biota). Metals analyses were usually performed on the fraction of sediment samples that passed through a 100 mesh sieve (0.15 mm). Metal concentrations were elevated in the fine fraction of sediment samples collected downstream of the mine, particularly arsenic, lead, and zinc, which exceeded Canadian Sediment Quality Guideline (CSQG) Probable Effect Levels (PEL) (Minnow 2007a, 2009). However, bulk sediment concentrations, on which CSQG are based, were not measured until recently (see below).

Further investigations of near-field sediment quality were undertaken in 2007 and 2008 (Minnow 2009). Despite again showing concentrations of arsenic, lead, and zinc above PEL in the fine fraction of sediments collected downstream of the Faro Mine complex (V27, X2, R2), whole sediment concentrations did not always exceed PEL and these (whole) samples were not toxic to the invertebrate *Hyallela azteca* in 14-day laboratory exposures (Minnow 2009). Metal levels in whole sediments were typically about one-third those measured in the fine fraction, consistent with the observation that fine deposits downstream of the Faro Mine are largely comprised of sand and gravel (typically >97%), with minimal fine particles (silt and clay)[3].

3.2 Considerations for Future Monitoring

Mine-related metals accumulate in bedload sediments when metals transported in the water column adsorb onto fine particulate materials or form chemical precipitates and eventually settle to the bottom (Ongley 1996, McKay et al. 2001, DiToro et al. 2005). Accumulation is most apt to occur in slow-flowing or still aquatic environments, particularly those with

[3] X2 was an exception having substrate comprised of 30% fine particles (Minnow 2009).

substantial concentrations of suspended particles, than in fast-flowing environments. At Faro, aquatic receiving environments are typically moderate to swiftly flowing with low concentrations of total suspended solids (<5 mg/L; Minnow 2007a), except during high flow events (e.g., spring melt and/or heavy rain events) when flow conditions are particularly conducive to scour rather deposition. Therefore, accumulation of fine particles (e.g., silt, clay) downstream of the Faro Mine complex is limited, with bottom substrates being primarily coarse materials (sand, gravel, rocks). Consequently, benthic invertebrate communities are probably primarily exposed to mine-related substances via water than sediment-detrital pathways. Furthermore, as noted above, laboratory tests of fine sediment samples collected downstream of the Faro Mine complex (near-field) did not cause toxicity to benthic organisms.

Consequently, sediment quality monitoring makes little contribution to the understanding of aquatic ecological conditions downstream of the mine and is not recommended as part of the AEMP. The information to be gained is not commensurate with the added cost of sediment sample collection and analysis, data evaluation and reporting. However, if in the future the downstream flow regimes and/or suspended solids loadings change such that increased metal deposition becomes a valid concern, the need for potential sediment quality monitoring should be re-evaluated.

4.0 BENTHIC INVERTEBRATE COMMUNITY MONITORING

4.1 Current Conditions

Numerous benthic invertebrate surveys have been conducted in the Rose/Anvil watershed since 1973 (Minnow 2007a, 2009). Artificial substrates have been used for invertebrate collections in the majority of studies, although other study aspects varied, particularly in early years, such as the timing of sampling, number of replicate or composited samples per station, community metrics reported, and/or level of taxonomy (Minnow 2007a). From 1991 to 2008, benthic invertebrate population monitoring was conducted annually (Rose and Vangorda Creek drainages in alternate years) at standardized station locations downstream of the Faro Mine complex as required by the site Water License. The artificial substrate data collected between 2000 and 2006 were recently included in a statistical evaluation of mine-related impact on downstream benthic communities based on a control-impact (reference-exposure comparison) approach (Minnow 2007a). A subsequent study was conducted in 2007-08 to verify current conditions and evaluate the relative effectiveness of different sampling methods (artificial substrates, Hess, or kick sampling) and statistical sampling designs (control-impact or reference condition approach) for long-term benthic invertebrate community monitoring at the Faro Mine complex (Minnow 2009). The results of these recent studies are summarized below.

Benthic community health was assessed for the period 2000-2006 based on artificial substrates deployed for six-week periods in the Rose/Anvil (even years) or Vangorda (odd years) Creek drainages (Minnow 2007a). The data indicated some differences in benthic invertebrate community composition between mine-exposed areas (e.g., R2-R4, V27) and reference areas (e.g., R6 and R7 for Rose Creek drainage and V1 for Vangorda Creek drainage). However, such differences were not consistent with those typically associated with effluent impacts. For example, higher percentages of mayflies (Ephemeroptera), stoneflies (Plecoptera) and caddisflies (Trichoptera; collectively referred to as EPT), which are often considered sensitive to pollution, were found downstream of the Faro site than at upstream reference areas. Differences were also observed between Vangorda Creek (e.g., V27) and West Fork Vangorda Creek (V5) that may be attributable to factors other than mine influence (e.g., natural habitat differences between the tributaries and/or a non-mine-related landslide on the west branch). Temporal variability (among years) was as large as spatial variability (among areas). Overall, mine-related influences on benthic invertebrate communities appear to be relatively minor based on artificial substrate sampling.

Programs undertaken in 2007 (Vangorda Creek drainage) and 2008 (Rose Creek drainage) sampled benthic invertebrate communities using a variety of methods (artificial substrates, Hess, kick and sweep) and sampling designs (control-impact, reference condition approach) (Minnow 2009). Regardless of the approach, differences between mine-exposed and reference communities were judged to be relatively small. Mine-exposed communities were statistically different from reference based on mean benthic invertebrate community characteristics but none of the mine-exposed areas evaluated in the study were conclusively outside the range of local reference areas (Minnow 2009). For example, based on a reference condition approach (RCA) sampling design and Hess collection method, several benthic community metrics (e.g., evenness) for areas downstream of the Faro site (X2 and R2) were significantly different ($p < 0.1$) than the average reference condition but were not significantly outside the range observed in reference streams with comparable physical habitat. Similarly, several benthic community metrics for areas downstream of the Grum/Vangorda site (V2, V5, and V8, using Hess and RCA) were significantly different from average reference condition but not significantly outside the range of reference conditions. The other method-study design combinations investigated also supported the overall conclusion that mine-exposed benthic communities were somewhat different than average reference communities but not outside the range seen in comparable reference streams in the region, suggesting negligible ecologically meaningful mine-related impact.

4.2 Considerations for Future Monitoring

Benthic invertebrates are excellent biomonitors for assessing potential effects of the chemical condition of water and sediment on the health of aquatic systems (Barbour et al. 1999, Feltmate and Fraser 1999) because they:

- are good indicators of localized conditions (they generally have limited migration patterns or a sessile mode of life);
- integrate the effects of short-term environmental variations over the longer-term;
- reflect the community level of organization, including a range of trophic levels and pollution tolerance, providing numerous useful assessment endpoints;
- are relatively easy to identify to family and many taxa can be identified to lower taxonomic levels with ease;
- are often abundant in areas where fish abundance may be low;
- are relatively easy to sample, with minimal detrimental effect on the resident community, and requiring few people and inexpensive gear; and

- serve as an important direct or indirect food source for fish.

Consequently, benthic invertebrate community sampling allows for the tracking of potential effects or improvements among areas and over time through assessment of community characteristics. For these reasons, the assessment of benthic invertebrate community health downstream of the Faro complex will be an important component of the long-term aquatic ecosystem monitoring at Faro.

Several studies were conducted in the mid-1990s to evaluate the best approaches for assessing mine-related impacts on benthic invertebrate communities in Canada (summarized by ESG 1999). In addition, benthic community assessments conducted in Vangorda Creek in 2007 and Rose Creek in 2008 involved a comparative evaluation of options for sample collection and sampling design to determine the best approach for long-term monitoring at Faro. The relevant conclusions of these reports are referenced, as appropriate, in the following sections to support the specific recommendations for benthic community assessment at Faro.

4.3 Sampling Design

The primary goal of each benthic invertebrate survey will be to assess the magnitude and spatial extent of any mine-related impacts. Spatial sampling designs that have been used in benthic invertebrate community surveys include Control-Impact (CI) designs, Reference Condition Approach (RCA), and gradient designs (Ellis and Schneider 1997; Taylor 1997; Taylor and Bailey 1997; Environment Canada 2002). Gradient and multiple gradient designs work best where environmental/habitat characteristics are relatively homogenous with the exception of a gradient of progressively decreasing concentrations with distance away from a point-source of contamination. However, at the Faro Mine complex, multiple mine sources drain into various streams with varied habitat characteristics such as size, elevation, gradient, substrate type, so a gradient sampling design would not be preferred. Hence the two designs considered for long-term monitoring at Faro Mine included CI and RCA.

A before-after control-impact (BACI) design (Green 1979, Bernstein and Zalinski 1983, Smith et al. 1983, Stewart-Oaten et al. 1986, Underwood 1991, 1992, 1994, Underwood and Chapman 2003) is generally considered to be the optimal sampling design for situations where the location of future disturbance is known but has yet to occur, and where one or more appropriate control areas can be found (Bowman and Somers 2005). In this design, the potentially impacted areas (I) are compared with unaffected control areas (C) both before (B) and after (A) the disturbance has occurred. If, as in the case of the Faro Mine complex, the area is already disturbed, a simple control-impact (CI) design is often applied and

statistical differences in benthic community characteristics observed between control areas (mostly referred to as “reference” areas in this report) and impacted areas (more aptly called “exposed” or “influenced” areas until an impact is proven) are presumed to be due to the disturbance (e.g, presence of a mine). However, this inference is valid only if reference and exposure areas are comparable in all other respects than the disturbance, an assumption that cannot be tested, because the “before” measurement is missing (Osenberg and Schmitt 1996). While this issue is minimized in CI designs through selection of reference areas with habitat characteristics similar to the exposure area, it is impossible to exactly match all habitat characteristics among all areas sampled (e.g., gradient, substrate type, distance to source, depth, flow velocity). Consequently, a weakness of the CI design is that reference-exposure differences between areas for benthic invertebrate community characteristics may simply reflect subtle habitat differences rather than mine influences. The fewer the reference areas being tested, the greater the risk of this occurring. In other words, the inclusion of more reference areas takes into account the natural variability that occurs among areas with similar habitat.

RCA was specifically developed to take among-reference-area variability into account and thus improve the probability that an observed reference-exposure difference is truly due to the disturbance being tested (Rosenburg et al. 1998, Reynoldson et al. 2005). In RCA, samples are collected from one or more exposure areas and statistically compared to samples from multiple reference areas (e.g., 20-50 areas; Bowman and Somers 2005). There are currently several RCA programs in development across Canada (Rosenburg et al. 1998, Reynoldson et al. 1997, 2005; Sylvestre et al. 2005; Sarrazin-Delay et al. 2006), including the Yukon (Branton et al. 2006, Bailey et al. 2007), but most have been designed for broad-based assessment across wide geographic areas. Modifications to those approaches have been recommended for assessment of site-specific impacts within a regulatory framework (details in Sections 4.4.2 and 4.8). For example, rather than randomly sampling a range of aquatic ecosystem types and sizes as is done for regional RCAs, site-specific impact assessments should involve sampling of only reference areas that closely resemble the habitat of the exposure area(s) of interest (e.g., stream order, gradient, bedrock geology etc.) followed by formal tests to select the ones most appropriate for comparison to specific exposure areas (Section 4.4.2). By doing this at Faro, reference-exposure area differences were detected with fewer than the recommended 20-50 reference area samples (e.g., 6-10; Minnow 2009).

Both CI and RCA sampling designs were used to evaluate benthic invertebrate community health at the Faro Mine complex in 2007 and 2008 (Minnow 2009). The RCA sampling

design was at least as sensitive as the CI design for detecting reference-exposure differences when the same suite of reference areas was used in both assessments. A further advantage of RCA over CI is that it can take into account the range of variability among reference areas, not just the central tendency (i.e., mean). Furthermore, RCA is not predicated on within-area sample replication so that, even though more reference areas need to be sampled, the overall sampling effort at Faro Mine is expected to be much less for an RCA than for a CI sampling design over the long term (Minnow 2009). Consequently, an RCA design has been recommended for the aquatic ecological program (more details below).

4.4 Sampling Locations

4.4.1 Exposure Areas

Since benthic invertebrate survey results will be used to measure the biological response to changes in chemical conditions downstream of the mines, benthic sampling areas should correspond with at least some of those used for water quality monitoring. This will allow for correlation of chemistry results with measures of benthic community structure. In addition, replicate stations within an area (for 10% of total samples) will need to be sampled to measure within-area variability for QA-QC (Section 6.6).

The exposure areas X2 and X14/R2[4] are near-field areas where mine-related effects on biota would be most apt to occur. Therefore, these areas are recommended for inclusion in future benthic invertebrate community surveys at the Faro Mine complex (Figure 4.1). Recent surveys indicate that current mine-related effects, if any, on benthic invertebrate communities at these locations are minor (Minnow 2007a, 2009). Although, in the past, V27 has been the near-field sampling area for the Grum/Vangorda site, V27 or a station located farther upstream (with easier access) should be included in a future perimeter monitoring program, with benthic community monitoring moved downstream to VGMAIN, which would provide a counterpart to V5 on West Fork Vangorda Creek[5]. Far-field areas R4 and V8 are also recommended for inclusion in future surveys as they will assist in monitoring the magnitude and spatial extent of potential mine-related impacts. Sampling is not presently recommended downstream of R4 and V8, because there is no evidence that mine-related

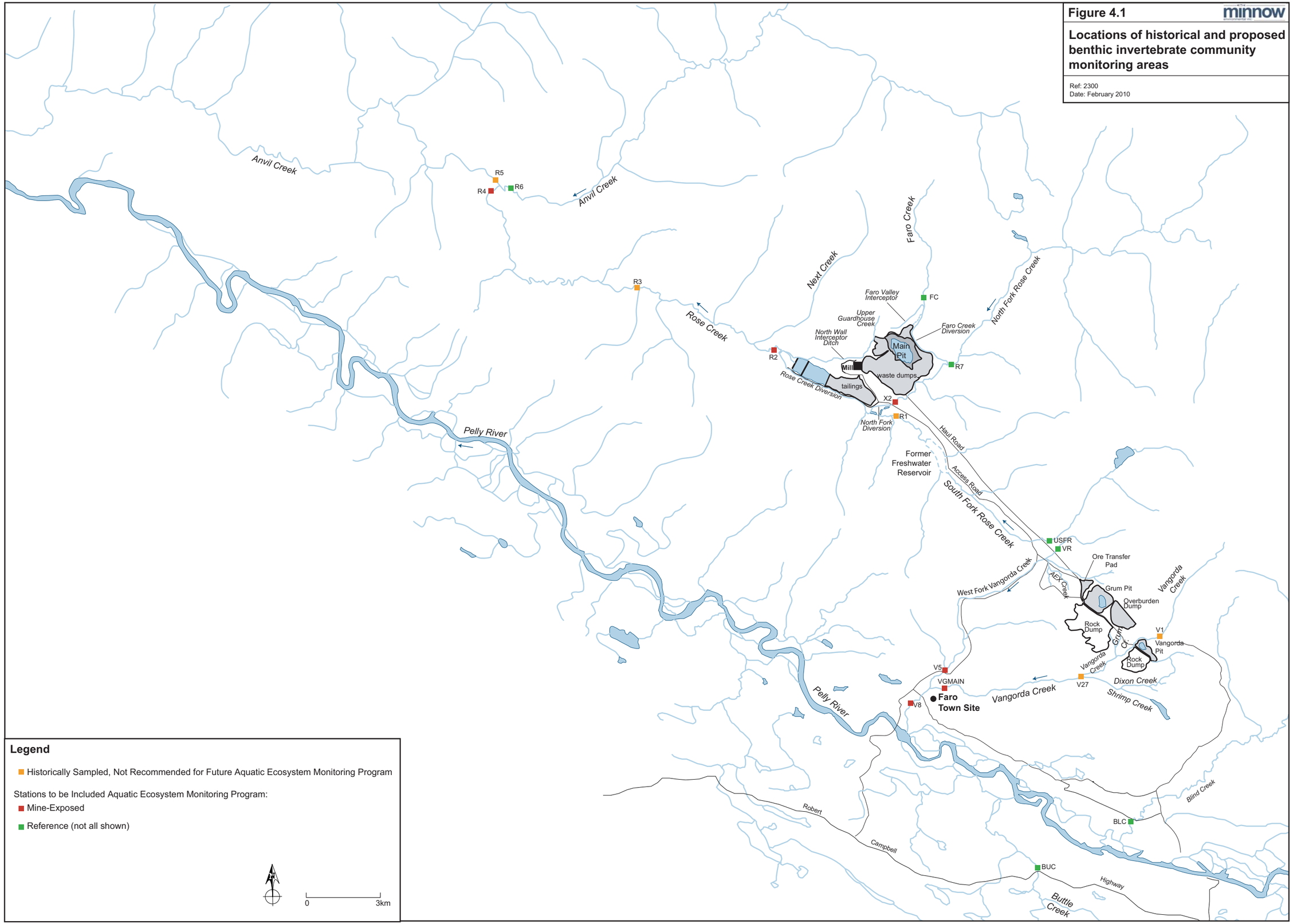
[4] In the past, benthic invertebrate community sampling has been done at R2, located approximately 200 m downstream of water quality monitoring station X14.
[5] Together, V5 and V27 measure relative influences on lower Vangorda Creek. However, as noted in Section 2.3, there may be non-mine sources influencing West Fork Vangorda Creek (e.g., landslide). After sufficient water quality data have been collected to characterize mine influence relative to other factors upstream of V5, the recommended locations for benthic community monitoring at the Vangorda site should be re-evaluated.

Figure 4.1

minnow environmental inc.

Locations of historical and proposed benthic invertebrate community monitoring areas

Ref: 2300
Date: February 2010



effects on benthic invertebrates presently extend below the Rose-Anvil confluence or into the Pelly River. If future monitoring indicates deterioration of conditions at either R4 or V8, consideration should be given to extending the sampling program to areas further downstream in the next cycle of study.

Water quality will also be routinely monitored at the locations recommended for benthic community monitoring (see Section 2.3), thus allowing for integrated interpretation of the data.

4.4.2 Reference Areas

The success of spatial sampling designs relying on reference-exposure area comparisons is predicated on habitat comparability among areas. That is, the natural variability of habitat characteristics should be minimized within and among areas so such differences do not mask or confound the detection of mine-related differences in benthic communities. Therefore, the selection of reference areas is important to the outcome of a biological community assessment.

In a RCA approach, 'stable' habitat characteristics that are negligibly influenced by human activities (e.g., bedrock type or basin size as opposed to characteristics like water chemistry) are used to select reference areas that most closely match the exposure areas being investigated. RCA based on the CABIN (Canadian Aquatic Biomonitoring Network) sampling protocol has most often involved reference area selection using models designed for regional-level assessments encompassing a relatively wide range of habitat types. In such cases, ordination or clustering techniques based on biological community characteristics are used to define reference area groups and the habitat characteristics most strongly associated with differentiation of these groups are used to match exposure stations with an appropriate reference group for assessment of potential anthropogenic impact. However, the resulting models often group together reference areas possessing a relatively broad range of habitat characteristics which do not closely match the characteristics of a given exposure area. In other words, a superior reference data set would likely have resulted by targeting reference sample collection at only reference areas with habitat characteristics similar to the exposure area. Therefore, for site-specific impact assessments such as at the Faro Mine complex, a more targeted approach is recommended for reference area selection as described below.

Recognizing that the near-field exposure areas in the Rose/Anvil and Vangorda watersheds vary somewhat in habitat characteristics, a similar (but still fairly narrow) range of reference habitats was sought and sampled in the vicinity of the Faro Mine complex (Minnow 2009).

Weather conditions at the time precluded searching for candidate reference areas by helicopter so the study included only reference areas accessible by road in the general vicinity of Faro (a total of 13 were sampled). A subsequent, detailed habitat-matching exercise for reference and mine-exposed areas at the Faro Mine involved consideration of stream characteristics that are not altered by discharge of mine contaminants, such as basin size, distance to source, bedrock geology, upstream gradient, stream depth, width, substrate type, and flow velocity, which were determined using a Geographic Information System (GIS) and selected field measurements (Minnow 2009). The evaluation showed that percent volcanic bedrock and coniferous forest cover in the basin, as well as water velocity measured at the time of sample collection were the habitat characteristics most highly correlated (i.e., r > 0.6) with benthic invertebrate community descriptors (the first three axes from Correspondence Analysis of the benthic community data matrix, organism abundance, taxon richness, % EPT, % chironomids, diversity, and evenness) (Minnow 2009). Reference areas were then ranked from best to worst habitat match with each exposure area based on overall similarity (i.e., low Euclidean distance[6] between areas for measures of volcanic bedrock, coniferous cover, and water velocity; Minnow 2009). Between six and ten reference areas were identified as good matches for each of the three drainages evaluated (Table 4.1). This is less than the minimum of 20 reference areas previously recommended for reference-exposure comparisons in RCA (Bowman and Somers 2005), but proved to be adequate to detect deviations of mine-exposed benthic communities from central and non-central reference conditions, and was comparable in this respect (sensitivity) to a CI sampling design conducted assessed at the same time. It was concluded that the matching of appropriate reference and exposure areas using characteristics summarized from GIS mapping improved the sensitivity of the analyses relative to approaches normally applied in regional RCA monitoring programs.

Although the results were satisfactory, increasing the number of reference areas would improve characterization of natural variability and increase statistical power to detect ecologically meaningful differences and decrease false detections of differences that are not mine related. It is thus recommended that future surveys target additional reference areas to achieve a minimum of 10 and ideally 15-20 suitable reference area matches per exposure area. As noted in Table 4.1, some reference areas will be suitable matches for more than one exposure area, which will reduce the total number of reference areas required. All new

[6] If p and q represent two points in space, the Euclidean distance between p = (p1, p2,..., pn) and q = (q1, q2,..., qn) is given by:

$$\mathrm{d}(\mathbf{p},\mathbf{q}) = \sqrt{(p_1-q_1)^2+(p_2-q_2)^2+\cdots+(p_n-q_n)^2} = \sqrt{\sum_{i=1}^{n}(p_i-q_i)^2}.$$

Table 4.1: Ranking of reference areas in terms of habitat similarity (1=best match) to exposure areas (adapted from Minnow 2009). Only reference areas with a Euclidean distance of≤ 2.1 for habitat variables relative to exposure area were assigned a rank, so all ranked reference-exposure area pairs reflect better habitat matches than area pairs with no rank (blank cells).

Reference Area	Reference Station Ranks Relative to Exposure Areas										
	Vangorda Creek				Upper Rose Creek			Lower Rose Creek			
	V27	V5	V8	Best overall matches for group	X2	R2	Best overall matches for group	R3	R4	R5	Best overall matches for group
BEC										8	
BLC	5	1	3	√	10	9	√	5	4	4	√
BTT										9	
BUC					6	2	√	10	10		
FC	7				2	3	√	8	8		
GRC			7		8	5	√	7	6	6	√
HOC	9	2	1	√	9	8	√	4	2	2	√
NEC	1	3	6	√	4	4	√	2	5	7	√
R6		7	2					11	11	1	√
R7	3	4	4	√	1	1	√	1	1	3	√
STC	8	5	5	√	7	6	√	3	3	5	√
USFR	6				3	7	√	9	9		
V1	4							12			
VR	2	6	8	√	5	10	√	6	7	10	√

candidate sampling areas could be evaluated in advance of sampling using GIS to target areas within the same ecoregion as the exposure sites that also have comparable habitat (stream size, bedrock geology, and coniferous cover), thereby focusing field sampling costs on those most likely to be found suitable. Also, recognizing that there are initiatives underway within the Yukon to assess regional samples following RCA (Environment Canada 2009, Branton et al. 2006, Bailey et al. 2007, Yukon Placer Aquatic Health Working Group 2007), it would be of interest to investigate whether suitable reference area data already exist for other regions of the Yukon. In addition, there may be other mine sites within the Yukon with whom reference area data could be shared. Once suitable candidate areas are identified, as many areas as possible should be sampled during the first cycle of implementation, but only a subset of areas needs be re-sampled in each of the future surveys (See Section 4.6).

4.5 Sampling Methods

Historical benthic invertebrate community monitoring at Faro has predominantly employed the use of artificial substrates. This method is often used in areas that are difficult to sample by other methods (e.g., bedrock, boulder, or shifting substrates; deep or high velocity water) or where substrate types vary among the areas of interest. However, such samples may not adequately represent the resident benthic assemblage, particularly because the samplers are typically deployed for relatively short periods (5-6 weeks) during which variation in water temperature and flow conditions relative to previous years may affect colonization patterns and confound temporal comparisons. This may partially explain why high year-to-year variability and decreased sensitivity relative to natural substrate sampling has been observed among previous artificial substrate surveys (Minnow 2007a). Furthermore, artificial substrates require two site visits for sampling (one to set and one to retrieve) and are vulnerable to loss (e.g., from high flows or human or animal disturbances) or incomplete sampling (e.g., reductions in flow that leave samplers exposed). Studies conducted in the mid-1990s to evaluate the best approaches for assessing mine-related impacts on benthic invertebrate communities in Canada concluded that artificial substrates are generally unnecessary in shallow streams and rivers with cobble or gravel bottoms where it is easy to sample communities inhabiting natural substrates (Golder 1995, ESG 1999). Current technical guidance for national monitoring programs at operating mines stipulates that artificial substrates should be used only in situations where it has been shown that suitable natural substrates are not present or other viable alternatives are unavailable (Environment Canada 2002). Furthermore, recent studies showed that community assessments at the Faro Mine complex based on artificial substrates were less sensitive than those that sampled

resident benthic invertebrates (by Hess or kick and sweep methods) for detecting differences in mine-impacted benthic communities relative to those in reference areas (Minnow 2009). Kilgour et al. (2004) also observed that artificial substrates were less sensitive in detecting reference-exposure area differences than samples of resident benthic communities (using Surber or Ponar grab samplers). Thus, it is recommended that sampling of resident benthic communities, rather than artificial substrates, be used for early detection, verification, and mitigation of possible future aquatic resource impairments at the Faro Mine complex.

Of the methods available for sampling resident benthic communities, the relative efficacy of Hess and kick-net sampling was tested at the Faro Mine complex in 2007-08 (Minnow 2009). These methods also offer different advantages and disadvantages. Consistent with other method comparison studies (e.g., Bowman 2007), bioassessments at Faro based on data collected with a fixed-area sampler (i.e., Hess) were comparable to those based on data collected using a kick-net (Minnow 2009). Within a traditional control-impact (CI) sampling design, Hess and kick sampling detected the same number of significant reference-exposure differences, but based on different benthic community metrics (Minnow 2009). Using a RCA sampling design, the kick sampling method was slightly more sensitive for detecting differences between the exposure and reference areas than the Hess sampling method. Also, if kick net sampling is utilized, it may be possible to share data for reference areas in the vicinity of Faro Mine with other kick-net based sampling programs in the Yukon through the Canadian Aquatic Biomonitoring Network (CABIN) (Environment Canada 2009). Thus, kick net sampling with a site-specific RCA sampling design represents the most sensitive and economical approach for aquatic ecosystem monitoring at the Faro Mine complex.

Kick net sampling should follow established methods (Reynoldson et al. 1999). This includes use of a net with 400 um mesh size. This is slightly larger than the 243-300 um mesh size used in recent surveys at the Faro Mine (Burns 2000-2009; Minnow 2009) but this change is not expected to adversely affect study results and may actually reduce data “noise” by eliminating immature stages of some species that are too small to precisely identify.

4.6 Implementation and Schedule

Benthic invertebrate samples should be collected in late summer or early fall, when water flows tend to be low and benthic invertebrate diversity and organism sizes are near or approaching maximal. A total of six exposure areas (X2, X14/R2, R4, VGMAIN, V5, V8) should be sampled during each cycle of routine monitoring (Section 4.4.1). Previous studies have shown that short-term temporal variability (e.g., ≤5 years) associated with a group of reference areas in RCA tends to be comparable to the spatial variability among areas (Bowman et al. 2006). Therefore, it will not be necessary to re-sample all reference areas in

every cycle of study. However, reference area communities may gradually change over the longer term (e.g., decades) in response to factors such as climate change. Therefore, it is recommended that each survey include a subset of the reference areas identified as suitable matches for one or more of the exposure areas (Section 4.4.2). For the first cycle of implementation, some of the reference data reported by Minnow (2009) can be used (areas with check marks in Table 4.1), 4-6 of which should be re-sampled (new data to replace older data), along with sample collection at all new candidate reference areas (identified as described in Section 4.4.2). In subsequent cycles, reference samples should be collected at a minimum of 25% of the reference areas such that data for each reference area are updated at least every fourth study. For reference areas that were previously sampled, the newest sample data should replace the older sample data since inclusion of multiple sample results for any given reference area would represent pseudo-replication.

In addition, duplicate field samples should be collected at two randomly selected areas during each survey for QA/QC purposes (Section 6.6).

The overall schedule for biological monitoring is discussed in Section 7.3.

4.7 Monitoring Endpoints

Ideally, the endpoints selected to describe benthic invertebrate communities will be those that provide the most useful and unique information with greatest sensitivity and lowest effort/cost (Taylor and Bailey 1977). Based on extensive reviews of the literature, organism density (or abundance) and species richness were among the endpoints recommended for federal monitoring programs at operating mines based on a long history of use and the conclusion that they are reasonably descriptive (ESG 1999). However, these metrics alone may be inadequate to detect mine-related effects, because an impacted area may still support similar numbers of individuals and taxa as an unimpacted area if sensitive taxa are replaced by more tolerant taxa (ESG 1999).

Correspondence Analysis (CA) is a multivariate technique that can be used to describe not only which stations have distinct benthic communities but also how these benthic communities differ among stations (*i.e.*, which particular taxa differ). CA is used to calculate “axes”, which can be thought of as new variables summarizing variation in the relative abundance of benthic taxa among samples. When depicted in two-dimensional plots, taxa that tend to co-occur will have similar CA axis scores and will plot together, while those that rarely co-occur plot farther apart. Similarly, stations sharing many taxa plot closest to one another, while those with little in common plot farther apart. The greatest variation among either taxa or stations is explained by the first axis, with other axes accounting for

progressively less variation. It is recommended that the first three CA axes be included among the benthic community characteristics reported for surveys conducted at the Faro Mine. Indices of diversity, evenness or similarity, are not recommended, since they tend to be redundant (contribute little or no unique information) relative to one or more the characteristics recommended above (density/abundance, taxon richness, CA axes) (Kilgour et al. 2004).

Past studies at the Faro Mine have also reported proportions of dominant taxa (e.g., Burns 2000-2006), an approach that is considered reliable for assessing metal-related effects on benthic invertebrate communities (Taylor and Bailey 1997) and assists in describing the general community composition. Therefore, it is recommended that organism abundance, taxon richness, the first three CA axes, and the proportions of dominant taxa (e.g., two or three dominant orders, families or genera) be reported for benthic invertebrate community assessments at Faro. This suite of endpoints should be used to describe community health and used together in a weight of evidence approach to conclude if mine-related effects are occurring (ESG 1999).

4.8 Data Analysis

4.8.1 Reference Area Matching

Selection of appropriate reference areas for each exposure area should follow the methods used by Minnow (2009) and summarized as follows. Initially, reference areas were targeted in the field based on visual assessment of habitat similarity to the exposure areas of interest. Habitat characteristics unlikely to be influenced by anthropogenic disturbances were later determined for each area using GIS (i.e., upstream basin perimeter, upstream basin area, stream order, station elevation, source elevation, distance to stream source, average upstream gradient, bedrock geology), as well as field measurements (stream depth, wetted width, and flow velocity)[7]. The stable habitat characteristics most strongly correlated with biological community characteristics of reference areas (e.g., $r > 0.6$) and not strongly correlated with other habitat variables (e.g., $r < 0.6$) were identified as the key characteristics to be used in matching appropriate reference areas for each exposure area (e.g., percent coniferous cover, percent volcanic bedrock, and stream velocity). The Euclidean distances of these characteristics between each exposure and reference area were computed and ranked (also see Section 4.4.2). The smaller the Euclidean distance between an exposure area and a reference area, the better the habitat match. A maximum Euclidean distance of

[7] This is a slightly reduced list relative to that considered by Minnow (2009), based on removal of characteristics judged in hindsight to be less useful or reliably measured.

approximately two (2.1) was used to identify 6-10 matching reference areas per exposure from a suite of 13 reference areas sampled near the Faro Mine, with some reference areas being suitable matches for more than one exposure area. The Euclidean distance selected as the cut-off for identifying suitable matches may need to be adjusted in the next evaluation, based on the inclusion of additional reference areas (which may also influence the characteristics that habitat best predict benthic community composition). Candidate reference areas for future sampling can be identified in advance by using GIS to identify local streams most likely to have habitat characteristics similar to the exposure areas.

4.8.2 Evaluation of Exposure Areas

In RCA, the biological community at an exposure area is compared to the range of communities found at minimally impacted reference areas with comparable habitat characteristics (e.g., Bailey et al. 2004). RCA data can be analyzed using a multi-metric or multivariate approach. Metrics (e.g., % chironomids) are useful because they respond to stress in a predictable way but information on community structure is lost when data are summarized into metrics. Multivariate analysis (e.g., CA) may not be as intuitive to all audiences but it has benefits such as identifying unexpected trends and accounting for interactions and redundancies in community data. Neither the typical multi-metric or multivariate analyses incorporate formal statistical hypothesis testing. Test Site Analysis (TSA), is an alternative approach that combines multi-metric, multivariate, and hypothesis testing analyses (Bowman and Somers 2006). TSA has been shown to generate results with a similar or lower probability of generating false positive (Type I error) or false negative (Type II error) outcomes relative to the other approaches (Bowman and Somers 2006). Thus, it is recommended that the TSA method be used to statistically test whether community attributes of an exposure area are within the range found at suitable reference areas with similar habitat (Bowman and Somers 2006). A TSA using ordination axes scores is comparable to the multivariate Benthic Assessment of Sediment (BEAST) bioassessment approach used in the federal CABIN program but unlike BEAST, it provides a statistically rigorous assessment (i.e., hypothesis test) of the condition of the benthic invertebrate community within each exposure area relative to those in the set of reference areas with comparable habitat. The calculations used to perform TSA are outlined in Bowman and Somers (2006).

The central probability value in TSA (cP) is analogous to traditional t-test or post-hoc ANOVA tests, indicating the probability the value at an exposure area is different than the *mean* value for reference areas. The non-central probability value (ncP) generated in TSA indicates the likelihood an exposure area is in (ncP>0.90) or outside of (ncP<0.1) reference condition, with values between 0.1 and 0.9 indicating uncertainty with respect to whether area is inside our

outside reference. This achieves a reasonable balance between the probability of making both Type I errors (incorrectly deeming a site impaired) and Type II errors (incorrectly deeming a site unimpaired).

Over time the magnitude of reference-exposure area differences can be tracked to identify if conditions are changing. For example, an increasing departure of an exposure area from the reference condition would be indicative of worsening conditions while convergence over time with the reference condition would indicate that conditions are improving. Any substantive change in either direction should prompt a review of the sampling design to determine if the scope of the monitoring program (e.g., number of sampling areas or sampling frequency) should be increased (if conditions are worsening) or decreased (if improving) (also see Section 8.0).

4.9 Reporting

Conditions at the time of sampling must be recorded for each area (e.g., weather, water velocity, stream wetted width and mean depth, water clarity). Water temperature, conductivity, dissolved oxygen (concentration and percent saturation), and pH should also be recorded at each station on field sheets, along with station location using a Global Positioning System (GPS). Interpretive reports should describe the sampling methods, laboratory processing of samples, and approach used in data analysis. Reported data should include the raw taxon abundances, computed endpoints (Section 4.7) and supporting field measurements for each station. Also, for reference data sets and any individual areas with multiple sample stations, summary statistics should be presented for each endpoint. (e.g., mean, sample size (n), standard deviation, standard error, and 90% confidence interval. Reported statistical results should identify significance (P) values used and clearly indicate how the data were handled with respect to test assumptions.

4.10 Summary

Benthic invertebrates are good, community-level integrators of localized conditions over time, they are important components of aquatic food webs and there are standardized methods for their collection and evaluation. Therefore, benthic invertebrate community monitoring will be an important component of the AEMP at the Faro Mine complex. To date, benthic community assessments at the Faro and Vangorda sites have indicated negligible mine-related impact. Most historical studies have relied on deployment of artificial substrates, which have the advantage of controlling for natural differences in substrate among exposed and reference areas, but may bias collections toward organisms that happen to drift from upstream and colonize on the substrates over the short (typically 6-week) period they are

deployed. Recent studies conducted to evaluate the efficacy of alternative sampling methods showed artificial substrate collection was less apt to detect reference-exposure area differences than Hess or kick sampling. Kick sampling is recommended for future surveys at Faro based on possible future opportunity to share data with the federal CABIN (Canadian Aquatic Biomonitoring Network) database, which includes data for other reference areas in the Yukon, and/or with other monitoring programs within the Yukon.

Based on recent site-specific investigations for the Faro Mine, a Reference Condition Approach (RCA) sampling design will be most cost-effective for long-term benthic community monitoring. Initially, monitoring should be conducted at six exposure areas reflecting near-field and far-field conditions in the Rose and Vangorda Creek drainages (X14, R4, V5, V8, VGMAIN, and X2). A previous study involving formal evaluation of habitat characteristics in both exposure and reference areas identified six to 10 reference areas near the Faro Mine that will be suitable for the evaluation of each exposure area (Minnow 2009). However, additional reference areas should be sought to increase the precision and accuracy of the biomonitoring program. Although all exposure areas should be sampled in each benthic community survey, only a subset (25%) of the reference areas needs to be sampled in each survey. The reference areas sampled in each survey should be those that were least recently sampled previously such that all areas are re-sampled at least every fourth survey. The newest data for each reference area should be used to replace previous results and thus ensure the reference data set remains updated. Statistical comparisons between exposure and reference areas should be made for a variety of community characteristics (organism abundance, number of taxa, the first three axes from Correspondance Analysis of the data set, and proportions of dominant taxa) to assess benthic invertebrate community health. Surveys should be repeated over time as discussed below. The magnitude of reference-exposure area differences should be tracked to determine if conditions are worsening, improving, or remaining stable over time.

5.0 MONITORING OF FISH

5.1 Current Conditions

Fish communities in the Rose/Anvil and Vangorda systems are comprised of arctic grayling, Chinook salmon, slimy sculpin, round whitefish, burbot, and longnose sucker, with slimy sculpin being relatively more widely distributed and abundant than the other species (Minnow 2007a). Differences in sampling designs and methods over the years have precluded definitive conclusions regarding changes in fish community composition over time, but conditions may have slightly improved in recent years based on reports of juvenile Chinook salmon in upper Rose Creek in 2004 and 2005 (e.g., near stations R1 and R2), where none had been reported in previous surveys (Minnow 2007). Adult Chinook salmon were observed spawning in Anvil Creek in 2005 (Station A4; ACG et al. 2006) and the presence of fertilized salmon eggs in the stomach of an arctic grayling male captured near R1 in South Fork Rose Creek in 2005 (WMEC 2005) suggested salmon spawning may occur nearby. This was recently validated by direct observation of spawning salmon in the Rose Creek Diversion Channel in August 2009 (P. Sparling, WMEC, pers. comm.).

5.2 Considerations for Future Monitoring

Monitoring of fish is justifiable for numerous reasons (Barbour et al. 1999):

- Fish are good indicators of long-term (several years) effects and broad habitat conditions (Karr et al. 1986).
- Fish assemblages generally include a range of species that represent a variety of trophic levels (omnivores, herbivores, insectivores, planktivores, piscivores) and contaminant sensitivities.
- Fish are at the top of the aquatic food web and are consumed by humans, making them important for assessing contamination.
- Fish are relatively easy to collect and identify to the species level. Most specimens can be sorted and identified in the field by experienced fisheries professionals, and subsequently released unharmed.
- Environmental requirements of many fish are comparatively well known. Life history information is extensive for many species, and information on fish distributions may also be available.

- Aquatic life uses (water quality standards) are typically characterized in terms of fisheries (coldwater, coolwater, warmwater, sport, forage). Monitoring fish provides direct evaluation of "fishability" and "fish propagation", which emphasizes the importance of fish to sport, subsistence, and commercial fishermen.
- Fish account for a large proportion of endangered vertebrate species and subspecies (Warren and Burr 1994).

Monitoring of fish may include assessment of fish community composition, population health, tissue pathology, biochemical (biomarker) responses, and/or contaminant concentrations in tissues (EVS 1999). In the hierarchy of biological organization from the molecular to the ecosystem level, physiological processes affecting cellular and subcellular structure and function are generally the earliest responses to environmental stress (EVS 1999). However, sub-organism-level responses are more difficult to relate to community sustainability than direct measures or indicators of population or community health. Another consideration is that many measurements that are used to assess individual or population health necessitate that fish be sacrificed (e.g., to extract tissue samples, major organs, and/or bony ageing structures), which is undesirable in areas, such as those near the Faro Mine, where fish densities are naturally low.

As noted above (Section 5.1) previous monitoring of fish at Faro has focused on relative fish abundance and community composition among areas based on non-destructive sampling (catch-release). It can be difficult to implement community surveys quantitatively (e.g., Moran-Zippin population estimates) in aquatic habitats such as those near the Faro Mine (e.g., stream size, depth, flow, and/or rocky substrate), where it is challenging to completely isolate fish within particular stream reaches by setting block nets across the stream. Also, it is costly to achieve the level of station replication within areas that is necessary to make statistical comparisons of relative abundance among areas. Therefore, it is recommended that a qualitative assessment of community composition be undertaken similar to those completed in previous years. Also, lengths and weights should be measured on all specimens caught to provide an indication of relative population health for each species in exposed versus reference areas. In particular, the recommended sampling effort may yield sufficient numbers of slimy sculpin to permit statistical comparisons among areas. More details are provided below

5.3 Approach and Sampling Locations

Improvements or degradation in fish community composition should be tracked at key locations near the Faro complex over time. As recent surveys of fish and benthic

invertebrates have indicated little or no mine-related impact in the receiving waters downstream of the Faro and Vangorda mine sites, it is recommended that samples be collected at only one area downstream of each mine site (Faro and Grum-Vangorda). For the Faro site, this would be at or downstream of R2 (but upstream of R3, Figure 5.1). At the Vangorda site, sampling would occur in the vicinity of Station V8, since fish have not been found closer to the Grum-Vangorda source areas. These will be the main areas at which potential impacts on fish will be observed. However, supplementary sampling is also recommended in the Rose Creek Diversion channel, where a population of slimy sculpin resides and, as in past surveys, opportunistic observations can continue to be made of the utilization of this area by spawning salmon in late August (P. Sparling, pers. comm.). Increases or decreases in the utilization of the Rose Creek Diversion by fish over time may indicate improving or degrading conditions, respectively (associated with upstream inputs or tailings area seepage).

It is recommended that fish communities also be sampled in at least two reference areas as an indicator of the natural condition and variability of unimpacted regional populations. Candidate sampling areas include Anvil Creek well upstream of R6 (to minimize the likelihood that the fish sampled have been exposed to discharge from the mine), the next major tributary to Anvil Creek downstream of the Rose-Anvil confluence, and/or Blind Creek (Figure 5.1). The specific reaches sampled should have habitat characteristics that are as similar as possible to each other with respect to gradient, water velocity, depth, aquatic and riparian vegetation, and substrate type.

Generally, the preferred sampling season for fish communities is August, when stream and river flows are moderate to low, and tend to be less variable than during other seasons. Although some fish species are capable of extensive migration, fish populations and individual fish tend to remain in the same area during summer (Funk 1957, Gerking 1959, Cairns and Kaesler 1971). Also, fish sampling will be most cost-effective in late summer, when it can be coordinated with benthic invertebrate sample collection, and utilization of mine-exposed areas by spawning salmon can be opportunistically assessed. Thus the proposed timing and approach are similar to that employed in recent years at the Faro complex (WMEC 2004, 2005).

5.4 Sampling Methods

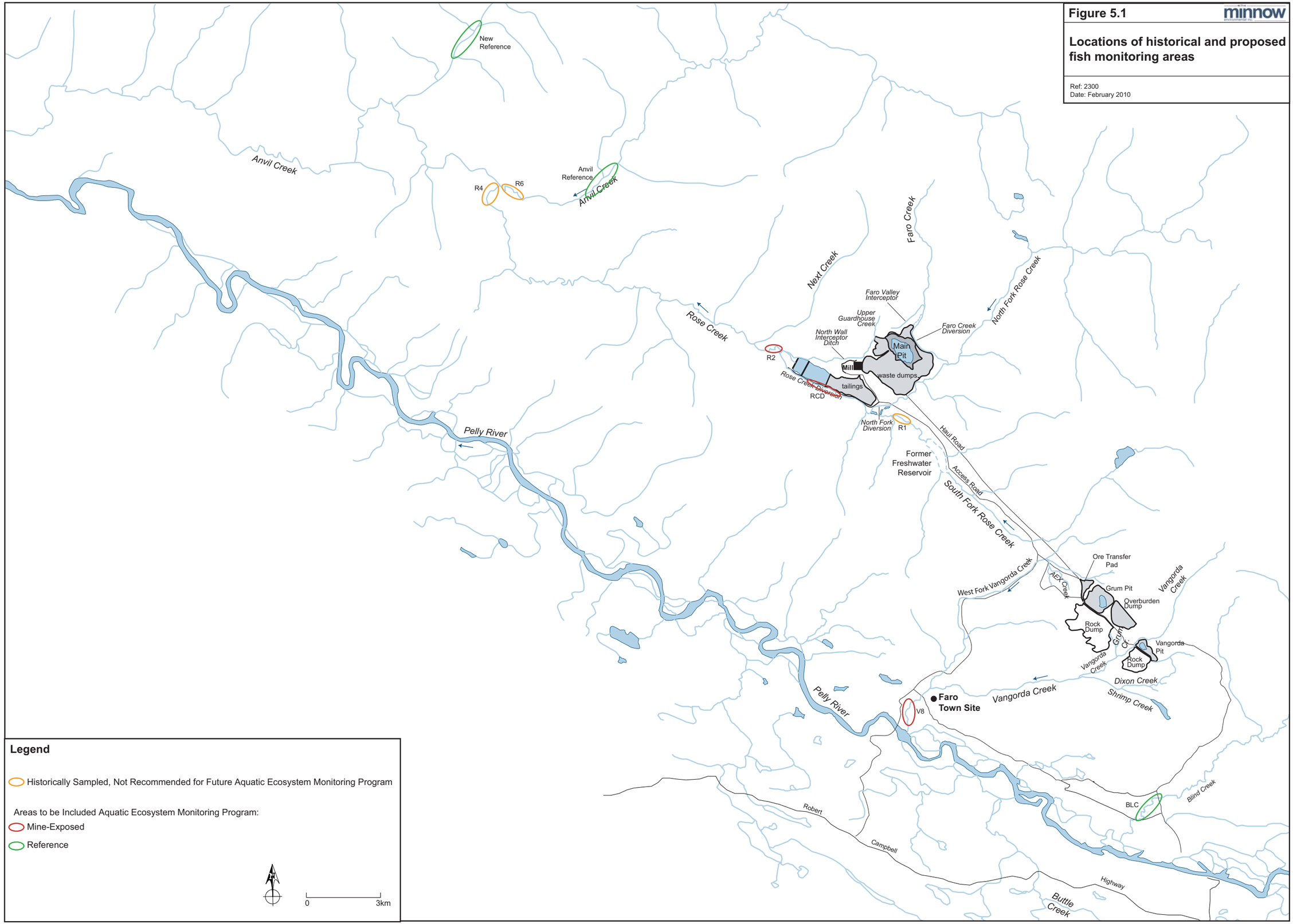
Methods and fishing effort should be standardized among sampling areas so that valid comparisons between mine-exposed and reference areas can be made. Past surveys have shown that all habitats in the vicinity of Faro mine are relatively unproductive (i.e., limited fish abundance), so every effort should be made to return fish unharmed to the areas in which

Figure 5.1

minnow environmental inc.

Locations of historical and proposed fish monitoring areas

Ref: 2300
Date: February 2010



they were caught. Fish should be collected using backpack electrofishing[8] and Gee-type minnow traps. In each area, electrofishing should involve 900-1,000 seconds of shocking effort over a reach of approximately 100 m. Each area should be sampled by moving in an upstream direction and sweeping back and forth from shore to opposite shore (provided flow conditions permit crossing the channel). The electrofisher operator should be accompanied by another crew member who retrieves the fish with a dip net and holding bucket[9]. All fish collected should be held until the electrofishing has been completed to avoid recapturing the same fish. Also, ten minnow traps should be deployed overnight in each area but slightly upstream of the area being electrofished to avoid any disturbance caused by electrofishing and to avoid re-fishing the same area being electrofished. Minnow traps should be baited to attract a range of species. The same reaches should be fished in successive studies to make results comparable over time.

5.5 Measurements, Endpoints, and Reporting

5.5.1 Fish Community

Conditions at the time of sampling must be recorded for each area (e.g., weather, water velocity, stream bankfull and wetted width, stream mean depth, water clarity, bank stability, substrate characteristics). Water temperature, conductivity, dissolved oxygen (concentration and percent saturation), and pH should also be recorded in each area. The upstream and downstream boundaries of each area (reach) that was electrofished should be determined using a GPS and recorded on field sheets, along with the duration of current deployment (total seconds of shocking time) and electrofisher settings. The GPS coordinates of each minnow trap should also be recorded on field sheets, along with set and lift times for each trap and the type of bait used. All fish caught should be identified and enumerated, and the lengths and weights of all specimens should be measured and recorded. Fish age cannot be reliably determined without sacrificing the fish (e.g., using otoliths or other bony structures) so this will not be required except in the case of any individuals that die unexpectedly prior to release. Catch per unit effort (CPUE) will be calculated for each species and collection method based on the number caught per unit of time. For each area and fishing method, the total catch (all species), total number of each species, total and species biomasses (sum of body weights), and CPUE (each species) should be determined and reported. Copies of field sheets and photos of each area should also be provided in the report. Any changes in

[8] May not be permitted in the Blind Creek reference area during salmon spawning season.
[9] Fish retrieval may be more efficient if there are two crew members with dip nets, but, if done, the same level of effort should be employed in all future surveys to ensure results can be compared among surveys over time.

habitat conditions relative to previous surveys should be noted (e.g., channel alignment, bank erosion, sediment deposits, etc.).

5.5.2 Slimy Sculpin Population Assessment

If sufficient numbers of slimy sculpin (*Cottus cognatus)* can be obtained in reference and exposure areas (e.g., minimum of 20 per area captured by electrofishing alone[10]), it is recommended that additional data analyses be completed to indicate relative population health among areas (below). The advantages of this species are that it is fairly widely distributed in the Rose/Anvil and Vangorda watersheds, it is more abundant than other fish species near Faro (Minnow 2007a), and it tends to have a small home range so it reflects localized conditions (Gray et al. 2004, Brasfield 2007). Slimy sculpin reach sexual maturity at approximately 3 years of age and they have a life span of approximately 10 years (Coker et al. 2001, Scott and Crossman 1998) so they respond relatively quickly to changes in environmental conditions compared to populations of other longer-lived species. Like arctic grayling and young burbot, slimy sculpin feed on immature aquatic insects such as mayflies (Ephemeroptera), caddisflies (Trichoptera), true flies (Diptera), stoneflies (Plecoptera) and dragonflies (Odonata; Scott and Crossman 1998, WMEC 2005). Sculpin are also preyed upon by large burbot and grayling (Scott and Crossman 1998, WMEC 2005). Therefore, they are an integral component of the food web in surface waters near the Faro mine.

Therefore, in addition to the endpoints identified in Section 5.5.1, mean length, mean weight, and weight relative to length (condition) should be reported for slimy sculpin caught by electrofishing[9]. Young of the year (YOY) should be evaluated separate from older fish. In addition, sculpin length frequency distributions should be plotted separately for each area. Sample sizes permitting, reference-exposure area comparisons should be made using analysis of variance (ANOVA), analysis of co-variance (ANCOVA), or non-parametric equivalents, as appropriate. In addition, the data for each area should be compared to past studies results to assess potential changes over time.

5.5.3 Tissue Concentrations

Mining activities have had only very minor influences on tissue metal concentrations of fish collected in the Rose-Anvil and Vangorda Creek systems, with no clear temporal trends suggested by the available data (Minnow 2007a). Concentrations of cadmium, copper, manganese and zinc were well below human and wildlife consumption benchmarks since the

[10] Electrofishing is the most effective method for capture of slimy sculpin and it is desirable to base size frequency distributions on fish captured by a single method to avoid gear selection bias in the results.

late 1970s in both the Rose-Anvil and Vangorda Creek systems. Arsenic, lead and mercury tissue metal levels have occasionally exceeded respective consumption benchmark levels (most notably in 1992 and 1997), but similar concentrations were observed in reference samples in those years suggesting tissue metal levels may sometimes be higher naturally. Alternatively, the wide variation observed in tissue concentrations at specific areas over time may indicate periodic problems with analytical laboratory accuracy or precision, especially in areas where there has been limited variation in average water concentrations. Regardless, the Faro Mine does not appear to be causing elevations in fish tissue levels that are of concern with respect to human or wildlife consumption and fish tissue monitoring is not recommended as part of the AEMP. A trigger to re-consider fish tissue monitoring should be developed as part of the Adaptive Management Plan for the site (Section 8.0).

5.6 Summary

Fish tend to occupy the upper trophic levels of aquatic ecosystems and are often their most visible and valued components. Both population and community-level assessment can be used as indicators of longer-term exposure conditions (e.g., over years). Therefore, fish community composition and relative species abundance should be tracked at key near-field locations near the Faro complex over time (R2, V8, Rose Creek Diversion) and compared to the communities at two or three reference areas possessing similar habitat characteristics (e.g., Anvil Creek well upstream of the Rose-Anvil confluence, the large tributary to Anvil Creek downstream of the Rose-Anvil confluence and/or Blind Creek). The recommended methods for fish community characterization are similar to those used in previous surveys, including collection of fish by backpack electrofisher and minnow traps. Also, slimy sculpin populations will be assessed using indicators of population health such as mean length, mean weight, weight relative to length (condition), and length frequency distributions for each mine-exposed area compared to reference areas (sample sizes permitting). Survey results should also be compared to past studies. The surveys will be conducted in late August when water levels and velocity are most apt to be low to moderate and fish distributions relatively stable. Analysis of metal content in fish tissues is not recommended at the present time.

6.0 QUALITY MANAGEMENT PLAN

A number of formal procedures, outlined herein, must be implemented to assure the quality and integrity of data produced by the LTMP at Faro Such procedures pertain to organization and reporting channels, developing and maintaining standard operating procedures (SOPs), personnel training, as well as data quality and data management.

6.1 Responsibilities, Controls, and Reporting Channels

The Yukon Government currently has responsibility for managing activities and monitoring at the Faro Mine complex. While responsibility for specific tasks may be delegated to other government personnel or to contractors, someone within the Yukon Government should be designated with overall responsible for the management and quality of the long-term monitoring, including routine water quality monitoring (on-going), comprehensive studies of aquatic ecosystem health (periodic), resources and support for training (as required), water quality database management (on-going), and data quality assurance (on-going). Responsibility for data quality includes managing and updating SOPs, monitoring and enforcing data quality control and assessment procedures, and periodic audits of field activities to ensure approved methods are being followed. To the extent such responsibilities are delegated, a reporting structure should be defined that clearly identifies names, contact information, and respective responsibilities and authorities. This structure should be clearly communicated to individuals responsible for sample/data collection and management, updated as required, and included in annual water quality reports (Section 7.2) to ensure this information is broadly disseminated.

6.2 Training, Health and Safety Requirements

All staff and consultants involved in the LTMP at Faro Mine must be appropriately trained and experienced for their respective responsibilities (e.g., sample collection and handling; analyses; data entry; reporting etc.). If not already in place, a policy should be developed that clearly defines health and safety protocols and requirements for people conducting monitoring activities at the mine site, including any requirements for site safety induction.

6.3 Consistency (SOPs)

Consistency is an important component of a quality management program. To minimize field and laboratory error and to maintain consistency in data collected in the LTMP, SOPs should be developed, implemented, and updated as appropriate for such things as sample collection methods, the cleaning of sampling equipment before and after use, calibration and maintenance of field instruments, proper sample labelling, laboratory sample submissions

(including chains of custody), data handling, and data quality control. In addition, a process and schedule for updating SOPs should also be developed. All current SOPs should be maintained in a centralized location accessible to all appropriate users. Any short-term changes to the specified methods should be documented in field notes, in the water quality database (water data only) and in reports in which the data are presented.

6.4 Overview and Definitions for Data Quality Assurance

Although the general intent and process for data quality assurance has become increasingly standardized, the terminology and definitions used in controlling and describing the quality of environmental data varies among geographical locations, regulatory agencies, accreditation bodies, and practitioners. For the purpose of the monitoring conducted at the Faro Mine complex, the terminology and processes relating to data quality are defined below.

Quality Assurance (QA) is a set of operating principles that, if strictly followed, will produce data with a quality that is defined and satisfies the intended use of the data. Included in QA are **quality control (QC)** and **quality assessment**. Quality control involves special actions taken to measure and control data errors and variability associated with sampling, analysis, and reporting such that the resulting data are sufficiently accurate and precise to serve the purpose(s) for which they are collected. Ideally, performance elements will be controlled such that the variability observed in the data can be assumed to reflect real spatial or temporal variability. QC in an environmental monitoring program typically includes such elements as laboratory method detection limits for chemical analyses, as well as requirements for collection and analysis of field and laboratory replicate samples, field and laboratory blank analysis, recovery of known chemical additions to samples (spike recoveries), analysis of standard reference materials, etc. (more below).

Data quality objectives (DQOs) represent the performance expectations for QC elements. DQOs have been developed for the environmental monitoring program at Faro (Section 6.6). These should be periodically reviewed and updated based on the results of data quality assessments conducted over time.

Data quality assessment (DQA) is the process of comparing actual field and laboratory performance to the DQOs to determine the overall quality of the data. The goal of data quality assessment is to identify any significant issues with the data (e.g., performance outside of accepted boundaries) and to take action in a timely and efficient manner to address errors and concerns. This will ensure that the data are associated with a defined level of quality and thus enhance the defensibility of the data in the context of its ultimate use.

Data validation is the additional process of applying preliminary statistical analyses to routinely collected monitoring data (e.g., water data) to identify any data points that fall outside expected limits (i.e., flagged data). Flagged data trigger additional assessment, and possible re-sampling, to determine whether the result is valid or is the result of an error or upset condition. Data validation should be conducted at a pre-defined frequency commensurate with the frequency of data uploads to the central database (i.e., soon after uploading, perhaps on a monthly basis) to ensure that only reliable data are archived.

All data must undergo data quality assessment and validation *prior* to any use of the data in statistical analysis or interpretation regarding environmental conditions at the Faro complex. This rigorous level of QA provides added confidence in the overall interpretation and conclusions of the program by ensuring that all data are defensible.

Data extraction refers to the process of downloading water quality data from the central database. The purpose of any data retrieval will affect the type, quantity and configuration of the data set that is ultimately downloaded. This is because the central database will likely include data collected through a variety of programs including routine water quality monitoring (e.g, to serve a site Water License) as well as periodic monitoring (e.g., water samples collected during biological monitoring programs), and/or special investigations. Data will be extracted from the database to satisfy annual regulatory reporting requirements (Section 7.2), and to satisfy other project-specific objectives. Summary statistics (e.g., means, standard deviations) for a particular monitoring station/substance and time period may vary depending on whether all samples or only selected samples are queried. Development of data extraction protocols ensures consistency of data downloads for specified purposes (e.g., annual reporting) and allows for any apparent discrepancies among downloaded data sets (e.g., different mean values associated with the same specific station, substance, and time period) to be traced back to possible differences in how the database was queried.

6.5 Laboratory Selection

Laboratories vary in their ability to consistently achieve specific DQOs, to follow up on any identified data issues, to produce clear and concise reports in formats that facilitate ready transfer of information to project databases, and in the costs charged for analyses. Therefore, it is appropriate to periodically re-evaluate the laboratory being used for analysis of Faro Mine samples against other qualified laboratories (e.g., every 3-5 years). At those times, the laboratories being evaluated should be provided with relevant project DQOs, approximate annual sample quantities, and requirements for data and QC reporting, and be asked to identify their capabilities with respect to relevant experience, available

instrumentation, client service, QA/QC performance and reporting, and analytical costs. The laboratory should also identify if any of the requested analyses must be sub-contracted out to another location, whether in the same or to a different company.

6.6 Data Quality Objectives and Quality Control

DQOs are statements of desired sensitivity, precision and accuracy in order to permit a defined level of confidence in drawing conclusions from the data of the entire monitoring program. DQOs established for the Faro complex serve as criteria for data acceptability and consider the intended use of the data and the technical feasibility of collecting data of such quality.

Assurance of adequate data quality is only possible when specific data uses and data quality objectives have been defined. Data quality objectives may pertain to factors such as sensitivity, precision, accuracy, comparability, compatibility, representativeness and completeness. Data quality objectives have been developed accordingly for chemical and biological measurements made as part of the long-term aquatic ecological monitoring program (Table 6.1). These data quality objectives include negligible contaminant levels in all blank samples, acceptable variability between field and laboratory duplicate samples, efficient recovery of laboratory matrix spike amounts and minimal bias in analytical estimates for certified reference materials. Each type of quality control sample is explained in more detail below.

6.6.1 Quality Control Sample Types

Quality control (QC) samples are taken in the field and in the laboratory. General guidelines for the type of quality control samples required to track and minimize the effects of bias and imprecision in the sampling effort are outlined below. The number of QC samples should correspond to a minimum of 10% of the total number of samples taken in the sampling period the QC samples are intended to represent. Quality control samples are integral to a quality assurance program, and recommendations for their use should be strictly adhered to. Types of QC samples that will be used in the LTMP at Faro are listed below.

Field (Bottle) Blanks: A field blank is a sample of distilled/de-ionized water that is placed in a bottle identical to those used for all environmental samples at a randomly selected sampling location. The field blank allows assessment of the potential contamination of the sample by the bottle itself, preservatives, dust, and sample handling. This type of sample is usually incorporated in water sampling programs, prepared by field personnel, and submitted to the laboratory with the other samples.

Table 6.1: Data Quality Objectives for Aquatic Ecological Samples, Faro Mine Complex

Quality Control Measure	Quality Control Sample Type/Check	Study Component				
		Water Quality	Sediment Quality	Benthic Invertebrate Community	Fish Tissue Quality	Fish Morphometrics
Method Detection Limits (MDL)	Comparison actual MDL versus target MDL	MDL for each parameter should be at least as low as applicable guidelines, ideally ≤1/10th guideline value[a]	MDL for each parameter should be at least as low as applicable guidelines, ideally ≤1/10th guideline value[a]	n/a	MDL for each parameter should be at least as low as applicable guidelines, ideally ≤1/10th guideline value[a]	n/a
Blank Analysis	Field or Laboratory Blank	<two-times the laboratory MDL	two-times the laboratory MDL (optional)	n/a	n/a	n/a
Field Precision	Field Duplicates	20% RPD[b] between duplicates	40% RPD between duplicates	n/a	20% RPD between duplicates	n/a
Laboratory Precision	Laboratory Duplicates	10% RPD between duplicates	20% RPD between duplicates	n/a	20% RPD between duplicates	n/a
	Sub-Sampling Error	n/a	n/a	20% difference between sub-samples	n/a	n/a
Accuracy	Certified Reference Material (QC Standard)	90-110% of actual concentration	80-120% of actual concentration	n/a	80-120% of actual concentration	n/a
	Matrix Spike	90-110% recovery	80-120% recovery	n/a	80-120% recovery	n/a
	Organism Recovery	n/a	n/a	minimum 90% recovery	n/a	n/a
	Instrument Accuracy	n/a	n/a	n/a	n/a	use instruments that provide measurement accuracy of ≤10% for weight (whole organism or tissue) and length

[a] or below predictions, if applicable and no guideline exists for the substance.
[b] RPD - Relative Percent Difference
n/a - not applicable

Field Duplicates: A field duplicate is a randomly selected sample that is taken at the same time and location as a regular field sample (i.e., side by side). The samples are prepared and analyzed in an identical manner. The data from field duplicate samples reflect the natural spatial and/or temporal variability, as well as the variability associated with sample collection and handling methods. These types of sample are applied in water, sediment, and tissue chemistry sampling programs, and are collected by field personnel and submitted to the laboratory along with the other field samples.

Laboratory Blanks: A laboratory blank is a randomly selected laboratory analysis vial that is filled with distilled water and/or appropriate laboratory reagent(s) and then analyzed as a regular sample. The laboratory blank is similar to the field (bottle) blank and allows an assessment of the potential contribution of the analysis vial, laboratory reagents, or laboratory cross-contamination to reported analyte concentrations. This type of QC sample may apply to water (common) or sediment (less common) sampling programs and is prepared, analyzed, and reported by the analytical laboratory.

Laboratory Duplicates: A laboratory duplicate is a sample that has been submitted for analysis and is randomly split in the laboratory into two sub samples that are analyzed independently. The laboratory duplicate sample results reflect the variability introduced during laboratory sample handling and analysis. This type of QC sample applies to water, sediment, and tissue chemistry sampling programs and is prepared, analyzed, and reported by the analytical laboratory.

Matrix Spike Recoveries: A matrix spike involves the addition of a known quantity of chemical (e.g., metal) to an environmental sample. The spiked sample is analyzed and the resulting chemical concentration is compared to the results for the unspiked sample to determine the percentage of the spike amount that was recovered in the analysis of the spiked sample. This type of QC sample applies to water, sediment, and tissue chemistry sampling programs. The samples are prepared, analyzed, and reported by the analytical laboratory.

Certified Reference Materials: Certified reference materials (CRM) or reference samples have a known concentration of specified substance(s). The CRM is prepared and analyzed in a manner identical to the field-collected samples. The certified reference material allows an assessment of analytical accuracy and allows for instrument calibration. This type of QC sample applies to water, sediment, and tissue chemistry sampling programs. The samples are prepared, analyzed, and reported by the analytical laboratory.

6.6.2 Quality Control for Chemical Analyses

Based on the above, DQOs for water samples have been established (Table 6.1), with further explanation provided below:

Method Detection Limits

Method detection limits (MDLs) are the smallest concentration of an analyte that can be measured with a defined certainty of being distinguishable from a blank sample. MDLs vary depending on the analyte, sample matrix, analytical method and instrumentation used. Analytical method detection limits should be at least as low at the water quality guidelines to which the data will be compared and preferably 1/10th that value or lower since analytical precision is reduced at concentrations approaching the MDL (McQuaker 1999). Target MDLs for Faro Mine samples should be periodically reviewed with the analytical laboratory responsible for the majority of sample analyses for the site and adjusted as appropriate to reflect any changes in laboratory methods or instrumentation, or the requirements of data users.

Blanks

Blank samples should contain no quantifiable residue of any contaminants. To allow for a very small margin of error, the DQO for blank samples is sometimes set at twice the MDL routinely achieved for each analyte (also assuming MDL is sufficiently low, e.g., below relevant guidelines).

Precision

Precision is a measure of how closely replicate samples agree with one another. Precision can be expressed in various ways: as the standard deviation, relative standard deviation (RSD), or the relative percent difference (RPD) of replicate results. In the evaluation of environmental samples, the standard deviation (SD) alone is rarely used, because the magnitude of analyte concentration in samples usually influences the magnitude of standard deviation among samples and thus precludes setting a single SD as a data quality objective (DQO). Therefore, either the RSD or RPD method is preferred, because each expresses the variability among replicates relative to the arithmetic mean of replicate sample results (either field or laboratory replicate samples). In the case of two replicate samples (duplicates), RPD seems to be most frequently applied, and is used to estimate precision as follows:

Relative Percent Difference (RPD) of Duplicate Analyses

%RPD = 100 x ABS(A-B)/MEAN(A,B) (1) after Csuros (1997)

where: A is the result of the first analysis of a sample,

B is the result of the second analysis of a sample,

ABS (A-B) is the absolute value of the difference between duplicate results,

MEAN (A,B) is the arithmetic mean of duplicates A and B.

If, in the future, three or more replicate analyses become routinely incorporated in the LTMP, all results should be expressed as RSD, according to the following:

Relative Standard Deviation (RSD) of Multiple Replicates

%RSD = 100 x s/ MEAN (replicates) (2) after Csuros (1997)

where: s is the standard deviation, and

MEAN (replicates) is the arithmetic mean of all replicate results.

It should be recognized that replicate analyses conducted on samples containing concentrations of substances approaching the MDL will tend to show less precision than samples containing concentrations more than five or ten times the MDL.

Accuracy

Accuracy is the degree to which a measured value agrees with the “true” (expected) value. Accuracy is generally expressed as percentage recovery (%R) of a known amount. For certified reference materials, the total analyte concentration in a sample matrix is known and therefore the percent recovery is calculated as shown in formula 3, below. For spiked samples, the spike amount is known and compared to the difference in total analyte concentration measured in spiked and unspiked samples (formula 4).

%R = 100 x measured value /known value (3) after Csuros (1997)

$\%R = 100(X_s - X_u)/K$ (4) after USEPA (in Patnaik, 1997)

where X_s = measured amount in the spiked sample,

X_u = measured amount in the unspiked sample, and

K = known spike amount.

The measured amount in an unspiked sample may be the result of a single analysis or the average of duplicate analyses.

6.6.3 Quality Control for Biological Samples

Benthic Invertebrate Community Assessment

Requirements for benthic invertebrate data quality assurance include:

- documentation of study design and objectives;
- documented standard operating procedures for field and laboratory work;
- use of appropriately qualified and trained personnel for sample collection;
- use of a qualified laboratory for benthic invertebrate sorting and taxonomic identifications;
- documentation of data quality objectives and performance;
- an average of 95% recovery of invertebrates from samples with no samples having less than 90% recovery;
- calculation of the error associated with any subsampling techniques by examining a minimum of 10% of samples to verify that sub-sampling accuracy and precision are within 20%;
- archiving of sorted invertebrates and bench sheets until the study report has been completed and undergone any external technical review; and
- compilation of a voucher (reference) collection.

Fish

Minimum requirements for assurance of fish data quality are:

- documentation of study design and objectives;
- documented standard operating procedures for field and laboratory work;
- use of appropriately qualified and trained personnel for sample collection;
- use of instruments that allow for measurement of length and weight (whole body or tissues) with an accuracy of 10% or less;
- use of a qualified laboratory for analysis of fish ages; and

- submission of approximately 10% of age structures to a separate laboratory for third-party verification.

6.7 Data Quality Assessment

In order to assess whether the overall quality of the LTMP is assured, formal data quality assessment (DQA) procedures must be utilized. The overall objective of a quality assurance program is to control measurement errors to acceptable levels thus ensuring the data are of known quality and useful. DQA will involve evaluation of how well DQOs and other QC requirements were adhered to, as discussed below.

6.7.1 Water Quality Data

For water monitoring, DQA should be undertaken periodically on an informal basis (immediately following uploads to the central database) and annually on a more formal basis. The informal monthly assessment will be geared to pinpointing and correcting errors, while the annual assessment will involve formal quality assurance reporting (also see Section 7.2). The detailed processes for detecting data quality anomalies will depend on the capabilities of the database utilized for long-term information storage and management, but should aim to detect data outside of the expected range for each station. Formal reporting will be based on a direct comparison of QC sample results with the objectives specified in Table 6.1. Annual, formal data quality assessment reports will include QC data and a memorandum summarizing the significant findings. Formal quality assurance reporting will also include an assessment of the implications of not having met specific data quality objectives, if applicable, and recommendations for improvement. Formal quality assurance reports must be reviewed by the person/people responsible for managing/coordinating the environmental monitoring program, then filed as part of the long-term quality assurance record of the monitoring program and included with the Annual Reports (Section 7.2). This will provide data users with a consistent record of data quality and can be used to determine or review the cause of any inconsistencies over time.

6.7.2 Sediment (if applicable)

The DQA for sediment should follow a similar process to that described for water data, including evaluation of the MDLs, field precision, and analytical precision and accuracy achieved relative to the DQOs established for the program. The information should be documented in any comprehensive study reports that include sediment quality monitoring.

6.7.3 Biological Data

The quality of the biological data will be evaluated on the basis of the information listed in Section 6.6.3 and Table 6.1. The information should be documented in all comprehensive study reports that include the corresponding biological components (e.g., benthic invertebrates and fish data).

7.0 SCHEDULE AND REPORTING

7.1 Overview

Water quality is expected to change over decades following mine closure, so the monitoring program must have a very long-term perspective. Monitoring of water quality at perimeter and surface water stations will be on-going (Section 2.0) to provide regular assessment of conditions and adequate warning of any substantial changes, with formal reports being completed on an annual basis (Section 7.2). For the comprehensive biological studies, a five-year monitoring interval is recommended post-closure (see Section 7.3), consistent with the gradual change expected in water quality over time and an appropriate time interval over which measurable biological change may be detectable. However, biological monitoring should be more frequent (e.g., every 3 years) during the period when the site is being actively modified in preparation for closure, at which time water quality, and therefore biological impacts, will be less predictable.

Based on the above, it is expected that two types of reports will be recommended for documenting the results of the AEMP. These include Annual Water Quality Reports and periodic Comprehensive Aquatic Ecosystem Study Reports. Annual Reports (Section 7.2) should report concentrations (and loadings where applicable) relative to water quality guidelines and previous years, as well as any issues encountered (e.g., missed samples, data quality problems, etc., as outlined in Section 6.0). Surface water data should also be summarized in the five-year comprehensive report, where interpretation can be integrated with the results of biological surveys (Section 7.3). If the first few cycles of monitoring (e.g., 15-20 years of monitoring on a 5-year cycle) confirm that mine-related impacts are minor and that conditions continue to be relatively stable, it would be appropriate to reduce the frequency of comprehensive monitoring (e.g., once every 10 years), with a trigger in place (Section 8.0) to increase the frequency based on specific increases in the loadings or concentrations of key mine-related substances or any biological surveys that clearly show degradation relative to previous surveys.

7.2 Annual Water Quality Reports

The objective of Annual Water Quality Reports is to regularly assess and report current water quality conditions relative to water quality criteria and past results (e.g., any trends or step changes), so that any step-changes in condition are detected promptly, and to demonstrate to stakeholders that the ecological monitoring is being implemented competently and conditions at the site are being adequately managed. The report will present the surface

water quality monitoring results obtained over the previous year and will include the following information:

- locations and dates monitored;
- samples collected at each station and methods employed;
- data quality assessment methods and results (as outlined in Sections 6.6 and 6.7);
- explanation of outliers found in data validation and the action taken as a result (Section 6.4);
- results of surface water monitoring including:
    - tables that compare concentrations relative to applicable benchmarks (e.g., water quality guidelines) and background concentrations;
    - graphs to show changes in the concentrations of key substances over time at each station, particular those approaching or exceeding water quality guidelines;
- description(s) of any additional water quality monitoring planned or implemented; and
- recommendations for potential changes to the program along with the rationale.

Although the requirements of source area and perimeter monitoring for the LTMP have yet to be developed, such monitoring results should also be included in the annual water quality report. Statistical analyses, if any, and data interpretation can be brief and limited to key observations; more detailed assessment will be done in periodic comprehensive study reports (Section 7.3). The Annual Water Quality Report should present the data in a clear and concise manner, with detailed data presented in appendices as required. A template should be developed in the first year of implementation to establish a standardized format for subsequent annual reports. The potential need for an alternate format for reporting to First Nations should also be determined at that time and developed, if required.

7.3 Comprehensive Study Reports

The Comprehensive Aquatic Ecosystem Study Reports will summarize the water quality data collected since the previous study was completed (likely every 3 years until closure and then every 5 to 10 years as discussed in Section 7.1), highlighting any significant issues or findings reported in the Annual Water Quality Reports completed during that time (Section 7.2). In addition, the results of the biological surveys (benthic invertebrate and fish) will be

presented with integrated interpretation, conclusions, and recommendations. Specifically, the reports will include the following information:

- descriptions of the methods used in each component of the program;
- review of quality control procedures and data quality assessment (as outlined in Sections 6.6 and 6.7);
- presentation of the results for all components of the monitoring program including summary information (main body of report) and raw data (appendices);
- integration of the results of water monitoring (and sediment chemistry if included in any future studies) with the biological data (fish and benthos) to identify and evaluate relationships;
- assessment of any spatial and temporal changes in the receiving environment since the previous study;
- assessment of the conditions in the receiving environment relative to predicted changes; and
- recommendations for any changes to subsequent monitoring cycles.

8.0 TRIGGERS FOR CHANGE

As noted throughout this document, the scope of the AEMP should remain flexible so it can respond to previous findings. In particular, future increases or decreases in the scope and/or frequency of aquatic ecosystem monitoring should be triggered by the findings of Annual Water Quality Monitoring Reports or the Comprehensive Aquatic Ecosystem Study Reports. For example, a trigger to expand the spatial extent or frequency of monitoring (i.e., add a downstream station or conduct another study sooner than formerly scheduled) might be predicated on having observed unexpected biological effects in the most recent comprehensive study report or having observed a step-change increase in the load and concentration of a contaminant such that a measurable effect on biota might be expected. These triggers should be outlined in the Adaptive Management Plan for the site, along with a description of the action to be taken if and when the trigger threshold is exceeded. This approach will ensure the AEMP is appropriately scoped relative to existing conditions and can be modified in response to any future improvements or degradation.

9.0 SUMMARY

9.1 Overall Framework

The Faro Mine complex (Faro complex), near Faro, Yukon, includes two mines: the Faro Mine and Mill (Faro site) and Vangorda/Grum Mines (Vangorda site), which are located approximately 12 km apart. All operations were terminated in April 1998 due to poor economic circumstances and the site went into receivership. The Yukon Government now has responsibility for the site and has been managing the development of a site closure plan. As part of the closure planning process, Minnow Environmental Inc. was asked to develop a comprehensive, site-wide, long-term environmental monitoring program (LTMP). One component of this will be an aquatic ecosystem monitoring program (AEMP), which is the subject of this document.

9.2 Aquatic Ecosystem Monitoring

The AEMP will assess the chemical and biological condition of the aquatic environments receiving mine drainage. The AEMP will integrate biological and chemical information for a weight-of-evidence approach, including the following components:

- surface water quality and flow,
- benthic invertebrate community monitoring, and
- fish community and population assessment.

Each of these is briefly describe below, along with a summaries of the associated quality management plan, reporting requirements and guidance for implementation.

9.3 Surface Water Quality and Flow

The Faro Mine complex is influencing water quality in the Rose and Vangorda Creek drainages, but is not presently affecting water quality in the Pelly River. Within the Rose Creek drainage, water quality is most notably affected upstream of the Anvil Creek confluence (e.g., Stations X14 to R4). Mean concentrations of mine-related metals in lower Anvil Creek (A1) are statistically similar to background levels except with respect to elevated levels of major ions such as calcium, magnesium, potassium, sodium and sulphate. Routine, long-term water quality monitoring is recommended at mine-exposed stations R8, X2, R1, X3, X10, X14, R4, VGMAIN, V5, and V8, as well as at five reference stations within the same drainages but upstream of mine influence (FC, R7, USFR, V1, and VR), and two stations that have a history of drinking water use by First Nations (Grum Corner and K8). Additional

stations may need to be monitored temporarily until specific mine closure activities are completed. Some other stations that are currently monitored should continue to be monitored outside of the AEMP to serve different objectives (e.g., perimeter and source area monitoring programs). Samples should be collected thrice annually in late March, late May and October to capture representative high, low and mid-range concentrations, recognizing that highs and lows do not occur in the same months for all substances. Water samples should be analyzed for total metals (cadmium, calcium, cobalt, iron, lead, magnesium, manganese, nickel, potassium, silver, sodium, strontium, uranium, zinc), ammonia, hardness, nitrate, sulphate, total dissolved solids, and turbidity, along with specific conductance, temperature, and pH measured in the field at the time of sample collections. Water quality data should be compared to criteria for protection of aquatic life and to past concentrations reported for the same stations. Concentrations at Grum corner and K8 should also be compared to drinking water guidelines. Flow will be monitored at X2, X14 and V8, to allow for computation of loadings at these locations and track potential changes in flow regimes over time.

9.4 Benthic Invertebrate Communities

Benthic invertebrates are good, community-level integrators of localized conditions over time, they are important components of aquatic food webs and there are standardized methods for their collection and evaluation. Therefore, benthic invertebrate community monitoring will be an important component of the AEMP at the Faro Mine complex. To date, benthic community assessments at the Faro and Vangorda sites have indicated negligible mine-related impact. Most historical studies have relied on deployment of artificial substrates, which have the advantage of controlling for natural differences in substrate among exposed and reference areas, but may bias collections toward organisms that happen to drift from upstream and colonize on the substrates over the short (typically 6-week) period they are deployed. Recent studies conducted to evaluate the efficacy of alternative sampling methods showed artificial substrate collection was less apt to detect reference-exposure area differences than Hess or kick sampling. Kick sampling is recommended for future surveys at Faro based on possible future opportunity to share data with the federal CABIN (Canadian Aquatic Biomonitoring Network) database, which includes data for other reference areas in the Yukon, and/or with other monitoring programs within the Yukon.

Based on recent site-specific investigations for the Faro Mine, a Reference Condition Approach (RCA) sampling design will be most cost-effective for long-term benthic community monitoring. Initially, monitoring should be conducted at six exposure areas reflecting near-field and far-field conditions in the Rose and Vangorda Creek drainages (X14, R4, V5, V8,

VGMAIN, and X2). A previous study involving formal evaluation of habitat characteristics in both exposure and reference areas identified six to 10 reference areas near the Faro Mine that will be suitable for the evaluation of each exposure area (Minnow 2009). However, additional reference areas should be sought to increase the precision and accuracy of the biomonitoring program. Although all exposure areas should be sampled in each benthic community survey, only a subset (25%) of the reference areas needs to be sampled in each survey. The reference areas sampled in each survey should be those that were least recently sampled previously such that all areas are re-sampled at least every fourth survey. The newest data for each reference area should be used to replace previous results and thus ensure the reference data set remains updated. Statistical comparisons between exposure and reference areas should be made for a variety of community characteristics (organism abundance, number of taxa, the first three axes from Correspondance Analysis of the data set, and proportions of dominant taxa) to assess benthic invertebrate community health. Surveys should be repeated over time as discussed below. The magnitude of reference-exposure area differences should be tracked to determine if conditions are worsening, improving, or remaining stable over time.

9.5 Fish Communities

Fish tend to occupy the upper trophic levels of aquatic ecosystems and are often their most visible and valued components. Both population and community-level assessment can be used as indicators of longer-term exposure conditions (e.g., over years). Therefore, fish community composition and relative species abundance should be tracked at key near-field locations near the Faro complex over time (R2, V8, Rose Creek Diversion) and compared to the communities at two or three reference areas possessing similar habitat characteristics (e.g., Anvil Creek well upstream of the Rose-Anvil confluence, the large tributary to Anvil Creek downstream of the Rose-Anvil confluence and/or Blind Creek). The recommended methods for fish community characterization are similar to those used in previous surveys, including collection of fish by backpack electrofisher and minnow traps. Also, slimy sculpin populations will be assessed using indicators of population health such as mean length, mean weight, weight relative to length (condition), and length frequency distributions for each mine-exposed area compared to reference areas (sample sizes permitting). Survey results should also be compared to past studies. The surveys will be conducted in late August when water levels and velocity are most apt to be low to moderate and fish distributions relatively stable. Analysis of metal content in fish tissues is not recommended at the present time.

9.6 Quality and Safety Management Plan

A number of formal procedures must be implemented to assure the quality and integrity of data produced by the monitoring programs at Faro and to ensure the safety of personnel visiting the site to collect samples. This includes clearly defining and communicating responsibilities and reporting channels, as well as site health and safety protocols. Standard operating procedures (SOPs) should be developed, implemented, and updated as appropriate for such things as sample collection methods, the cleaning of sampling equipment before and after use, calibration and maintenance of field instruments, proper sample labelling, laboratory sample submission procedures (including chains of custody), data handling, and data quality control. Quality control samples (e.g., blank samples, replicate samples, and matrix spike recoveries) need to be collected and evaluated relative to pre-defined data quality objectives and reported. Specific quality assurance-quality control (QA-QC) requirements have been outlined for each component of the AEMP.

9.7 Schedule and Reporting

Monitoring of water quality at surface water stations will be on-going to provide regular assessment of conditions and adequate warning of any substantial changes. Such data will be formally reported in Annual Water Quality Reports. Annual Reports should present concentrations (and loadings where applicable) relative to previous years, and identify any issues encountered since the previous reporting period (e.g., missed samples, data quality problems, etc.).

Biological data (e.g., benthic invertebrates and fish) will be assessed and reported at a lower frequency in Comprehensive Aquatic Ecosystem Study Reports. A five-year monitoring interval is recommended post-closure, consistent with the gradual change expected in water quality over time and an appropriate time interval over which measurable biological change may be detectable. Surface water data reported in Annual Reports should also be summarized in the Comprehensive Reports, where interpretation can be integrated with the results of biological surveys. If the first few cycles of post-closure monitoring (e.g., 15-20 years of monitoring on a 5-year cycle) indicate that mine-related impacts are minor and that conditions continue to be relatively stable, it would be appropriate to reduce the frequency of comprehensive monitoring (e.g., once every 10 years), with a trigger identified in the site's Adaptive Management Plan to increase the frequency based on specific increases in the loadings/concentrations of key mine-related substances or any biological surveys that clearly show degradation relative to previous surveys. Biological monitoring should be more frequent (e.g., every 3 years) during the period when the site is being actively modified in preparation

for closure, during which time water quality, and therefore biological impacts, will be less predictable.

9.8 Triggers for Change

Future increases or decreases in the scope and/or frequency of aquatic ecosystem monitoring should be based on the findings of Annual Water Quality Monitoring Reports or Comprehensive Aquatic Ecosystem Study Reports. For example, a trigger to expand the spatial extent or frequency of monitoring (i.e., add a downstream station or conduct another study sooner than formerly scheduled) might be predicated on directly observing biological effects or a step-change increase in contaminant concentrations that could be expected to adversely affect biota downstream. Such triggers should be outlined in the Adaptive Management Plan for the site, along with a description of the action to be taken if and when the trigger threshold is exceeded. This approach will ensure the AEMP is appropriately scoped relative to current conditions and can be modified in response to any future improvements or degradation.

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APPENDIX A

WATER QUALITY BENCHMARKS

APPENDIX A: WATER QUALITY BENCHMARKS

A.1 Selection of Effects-Based Benchmarks

In all cases where a Canadian water quality guideline (CWQG) exists for a parameter, such a guideline was selected as the benchmark for evaluation of water quality at Faro (Tables A.1 and A.2). In the absence of a CWQG, the most conservative provincial water quality criterion from British Columbia, Saskatchewan, or Ontario was selected, if such value(s) existed. An exception was the uranium guideline from Saskatchewan which is based on more recent information than the Ontario water quality objective for uranium. In the absence of either a Canadian or provincial criterion for protection of aquatic life, a Canadian drinking water quality guideline was selected. For parameters for which no water quality criteria have been developed, alternative benchmarks (provided by Senes Consultants Limited, who is responsible for the Faro Mine Human and Ecological Risk Assessment) were identified that represent a low- or no- observed effect concentration reported in the scientific literature for a sensitive aquatic species.

Some water quality criteria vary on the basis of water hardness (aluminum, beryllium cadmium, copper, lead, manganese, nickel). In such cases, the criterion corresponding to a hardness of 100 mg/L as $CaCO_3$ was selected. Although some reference and negligibly-influenced surface waters in the vicinity of Faro mine have lower mean water hardness than 100 mg/L (e.g., 60-70 mg/L), the receiving waters in which elevated metal levels are sometimes found (and are therefore of potential concern) also have elevated water hardness. For example, mean water hardness concentrations at mine-influenced stations such as X2, X14, R2-R11, V27, and V8 are all >100 mg/L (Minnow 2007). Although hardness values at these stations are occasionally lower, such cases tend to be associated with periods of high precipitation or snowmelt when metal levels also tend to be diluted. A hardness value of 100 mg/L can be considered conservative since water hardness concentrations of up to 793 mg/L (X-14, Minnow 2007) have been observed in mine-affected areas.

In the case of total alkalinity and total suspended solids, the available water quality criteria are expressed as a change relative to background concentrations (Table A.2). In these cases, background values reported in this study were used for deriving the water quality benchmarks.

The CWQG for ammonia is expressed on the basis of un-ionized ammonia, which comprises an increasing fraction of the total ammonia present in water as either water pH or temperature increases (or both). Because the temperature and pH of surface

waters near Faro rarely rise above 15°C or 8.5, respectively, it is conservative to use as the benchmark the total ammonia concentration corresponding to an un-ionized concentration of 0.019 mg/L (the CWQG) under such conditions (Table A.2).

Although separate CWQGs exist for the two main valence states of chromium, speciation of chromium in water samples is not readily available from commercial laboratories and the lower value of 0.001 mg/L (for hexavalent chromium) is generally applied for data screening purposes.

A.2 Background Benchmarks

A.2.1 Methods

Previous evaluations of water quality data resulted in recommendations to initiate sampling at additional reference areas in the vicinity of the Faro Mine complex and to obtain lower laboratory method detection limits for certain parameters (Minnow 2007a,b). Based on the recommendations, a two-year supplemental water quality sampling program was initiated in September 2007 by Access Consulting on behalf of local First Nations to augment data collected under the site Water License. In 2008, water quality data collected for reference stations under the site Water License, by Access, and in other technical studies for the site were incorporated into the development of draft background benchmarks that could be used to support various technical studies associated with Faro Mine closure planning (Minnow 2008). However, it was recognized that these benchmarks would need to be updated upon completion of the supplementary monitoring program by Access. This was done in the current study and included analysis of water quality data for reference stations collected during the period January 2005 to June 2009 following methods previously described by Minnow (2008). In brief, all available data for local reference stations were pooled and used to compute summary statistics, including the 95th percentile, which was used to estimate the upper range of background concentrations (background benchmark). The premise is that concentrations of potential concern in mine-exposed areas will be those that are clearly above background levels. Exceptions included dissolved oxygen, alkalinity, and pH for which reduced concentrations would be of primary concern. In those cases the 5th percentile was used as the background benchmark and lower concentrations in mine-exposed areas would be indicative of mine influence.

Raw data are presented in Table A.3, showing summary statistics for each parameter as well as any outliers removed from the data set for each parameter.

A.2.2 Results

Background benchmarks were updated for the period 2005-2009 and were generally comparable to those presented by Minnow (2008) for the period 2005-2007 (Table A.4). Exceptions were largely attributable to the larger sample size for each parameter (double or more relative to that presented by Minnow 2008), as well as retention of some values in the data sets of this study which were previously assumed to be outliers (i.e., collection of additional data in the meantime has shown such values are rare but real).

Table A.1: Effects-based water quality benchmarks.

Measurements	Units	Water quality criteria						Alternative Aquatic Effects-Based Benchmarks[e]
		Canadian water quality guideline (for protection of FW aquatic life)[a]	British Columbia (freshwater)[b]	Saskatchewan[c]	Ontario Provincial Water Quality Objective[d]	Canadian Drinking Water Quality Guideline[a]	Canadian Council of Ministers of the Environment (CCME) proposed guidelines	
Total metals								
Aluminum	mg/L	0.005 - 0.100[g]	0.05	0.005 - 0.100[g]	0.015 - 0.075[h]	0.1		
Antimony	mg/L				0.02[h]	0.006		0.15[i]
Arsenic	mg/L	0.005	0.005	0.005	0.005[h]	0.005 proposed		
Barium	mg/L					1.0		5.8[j]
Beryllium	mg/L				0.011 - 1.1[k]			0.0038[l]
Bismuth	mg/L							0.26[m]
Boron	mg/L		1.2		0.2[h]	5.000		
Cadmium	mg/L	0.000017 or more depending on hardness[B]		0.000017 or more depending on hardness[B]	0.0001 - 0.0005[h]	0.005	0.00022	
Calcium	mg/L							116[j]
Chromium	mg/L	0.001 (hexavalent), 0.0089 (trivalent)		0.001 (hexavalent), 0.0089 (trivalent)	0.001 (hexavalent), 0.0089 (trivalent)	0.05		
Cobalt	mg/L		0.004		0.0009			
Copper	mg/L	0.002-0.004[n]	0.002-0.008[o]	0.002-0.004[n]	0.001-0.005[h]	1.0[p]		
Iron	mg/L	0.3		0.3	0.300	0.3[p]		
Lead	mg/L	0.001 - 0.007[q]	0.005-0.011[o]	0.001 - 0.007[q]	0.001 - 0.005[h]	0.010		
Lithium	mg/L							0.65[F]
Magnesium	mg/L							82[j]
Manganese	mg/L		0.7 - 1.9[o]			0.05[k]		
Mercury	ug/L	0.026[r] (0.004)[s]	0.004 - 0.02[s]	0.026[r]	0.2 (filtered)	1.0		
Molybdenum	mg/L	0.073	1		0.04[h]			
Nickel	mg/L	0.025 - 0.150[t]		0.025 - 0.150[t]	0.025			
Potassium	mg/L							53[j]
Selenium	mg/L	0.001	0.002	0.001	0.100	0.01		
Silicon	mg/L							
Silver	mg/L	0.0001	0.00005/0.0015[u]	0.0001	0.0001			
Sodium	mg/L					200[p]		680[j]
Strontium	mg/L							9.3[v]
Sulphur	mg/L							
Tellurium	mg/L							
Thallium	mg/L	0.0008			0.0003[h]			
Thorium	mg/L							
Tin	mg/L							0.35[j]
Titanium	mg/L							1.83[w]
Tungsten	mg/L				0.03[h]			
Turbidity	mg/L			0.015	0.005[h]	0.02		0.011[x]
Vanadium	mg/L				0.006[h]			0.024[y]
Zinc	mg/L	0.030	0.0075-0.090[o]	0.030	0.02[h]	5.0	0.017	
Zirconium	mg/L				0.004			548[z]
Non-metals								
Alkalinity - phenolphthalein	mg/L as $CaCO_3$							
Alkalinity - Total	mg/L as $CaCO_3$				no decreases more than 25% of natural concentration[f]			
Ammonia - total	mg/L	0.24[A]	1.9[A]		0.25[A]			
Bicarbonate	mg/L							
Carbonate	mg/L							
Chloride - dissolved	mg/L					250[p]		
Colour	CU							
Conductivity - laboratory	µS/cm							
Conductivity - in situ	µS/cm							
Cyanide - weak acid dissociable	mg/L	0.005 (free)	0.01		0.005 (free)	0.2		
Dissolved oxygen - in situ	mg/L	6.5 - 9.5[D,E]	5 - 11[E]		5 - 8[D,E]			
Dissolved oxygen - in situ	%				54 - 63[D,E]			
Dissolved organic carbon	mg/L							
Fluoride	mg/L	0.120				1.5		
Hardness - dissolved	mg/L as $CaCO_3$							
Hardness - Total	mg/L as $CaCO_3$							
Hydroxide	mg/L							
Nitrate	mg/L	13	40		narrative	10		
Nitrite	mg/L	0.06	0.02-0.2[C]		0.06	3.2		
Nitrate plus nitrite	mg/L							
pH - Laboratory	pH units	6.5-9.0	6.5 - 9.0		6.5-8.5	6.5-8.5		
pH - in situ	pH units	6.5-9.0	6.5 - 9.0		6.5-8.5	6.5-8.5		
Phosphorus - nutrient analysis	mg/L		0.005-0.015 (lakes)		0.03 for rivers[h]			
Sulphate	mg/L		50			500[p]		
Temperature - in situ	˚C							
Total organic carbon	mg/L							
Total dissolved solids - lab.	mg/L					500[p]		
Total suspended solids	mg/L	no more than 5 mg/L above background[f]	< 25 mg/L above background in 24 hours					
Turbidity	NTU		no more than 2 NTU above background					

criteria selected for effects-based benchmark

[a] CCME (Canadian Council of Ministers of the Environment). 1999. Canadian Environmental Quality Guidelines. 1999 (plus updates), Canadian Council of Ministers of the Environment, Winnipeg
[b] BCMOE (British Columbia Ministry of Environment). 2006. British Columbia Approved Water Quality Guidelines (Criteria), 2006 Edition. Updated August 2006. For parameters with both maximum and 30-day average values, the 30-d average is shown.
[c] Saskatchewan Environment. 2006. Surface Water Quality Objectives. Interim Edition. EPB356. July 2006. 9pp.
[d] OMOE (Ontario Ministry of Environment and Energy). 1994. Policies, Guidelines, Provincial Water Quality Objectives of the Ministry of the Environment and Energy (Ontario), July 1994
[e] toxicity reference value for most sensitive aquatic receptor (aquatic plants, phytoplankton, benthic invertebrates, zooplankton, fish). From Senes Consultants Limited, Richmond Hill, Ontario.
[f] computed from data presented in this report and shown in Table A.2
[g] 0.005 mg/L at pH<6.5; 0.1 mg/L at pH ≥ 6.5
[h] interim objective
[i] for phytoplankton; U.S. EPA (United States Environmental Protection Agency). 1978. In-depth Studies on Health and Environmental Impacts of Selected Water Pollutants. Contract No. 68-0104646, U.S. EPA, Duluth, MN.
[j] for zooplankton; Biesinger, K.E. and G.M. Christensen. 1982. Effects of Varioue Metals on Survival, Growth, Reproduction, and Metabolism of *Daphnia magna*. *J. Fish. Res. Bd. Canada.* 29:1691-1700.
[k] 0.011 for hardness <75 mg/L and 1.1 for hardness >75 mg/L.
[l] for zooplankton; Kimball, G. n.d. The Effects of Lesser Known Metals and One Organic to Fathead minnows [*Pimephales promelas*] and *Daphnia magna*. U.S. Environmental Protection Agency, Duluth, MN.
[m] Khangarot, B.S. 1991. Toxicity of Metals to a Freshwater Tubificid Worm, Tubifex tubifex (Muller) Bull.Environ.Contam.Toxicol. 46:906-912
[n] 0.002 at [$CaCO_3$] = 0-120 mg/L, 0.003 at [$CaCO_3$] = 120-180 mg/L, 0.004 at [$CaCO_3$] > 180 mg/L
[o] for hardnesses ranging between 25 and 300 mg/L, respectively
[p] Canadian drinking water quality guideline, aesthetic objective (CCME 1999).
[q] 0.001 at [$CaCO_3$] = 0-60 mg/L, 0.002 at [$CaCO^3$] = 60-120 mg/L, 0.004 at [$CaCO_3$] = 120-180 mg/L, 0.007 at [$CaCO_3$] > 180 mg/L
[r] Inorganic mercury
[s] Organic mercury
[t] 0.025 at [$CaCO_3$] = 0-60 mg/L, 0.065 at [$CaCO^3$] = 60-120 mg/L, 0.110 at [$CaCO_3$] = 120-180 mg/L, 0.150 at [$CaCO_3$] > 180 mg/L
[u] hardnesses of ≤100 mg/L and >100 mg/L, respectively
[v] for fish; Dwyer, F.J., S.A. Burch, C.G. Ingersoll, and J.B. Hunn 1992 Toxicity of Trace Element and Salinity Mixtures to Striped Bass (Morone saxatilis) and Daphnia magna. Environ.Toxicol.Chem. 11(4):513-520
[w] for fish; Birge, W.J., J.A. Black, A.G. Westerman, and J.E. Hudson. 1979. In: C. Gale (Ed.) EPA-600/9-80-022, Oil Shale Symposium: Sampling, Analysis and Quality Assurance, March 1979, U.S. EPA, Cincinnati, OH: 519-534 (US NTIS PB80-221435).
[x] for phytoplankton and zooplankton; Franklin, N.M., J.L.Stauber, S.J. Markich, and R.P. Lim. 2000. pH-dependent Toxicity of Copper and Uranium to a Tropical Freshwater Algae (*Chlorella sp*.). *Aquatic Toxicology*. 48:275-289.
[y] for benthic invertebrates; Fargasova, A. 1997. Sensitivity of *Chironomus plumosus* Larvae to V^{5+}, Mo^{6+}, Mn^{2+}, Ni^{2+}, Cu^{2+}, and Cu^{+} Metal Ions and their Combinations. *Bull. Environ. Contam. Toxicol.* 59(1):956-962.
[z] Cushman, R.M, S.G. Hildebrand, R.H. Strand, and R.M. Anderson. 1977. The Toxicity of 35 Trace Elements in Coal to Freshwater Biota: A Data Base with Automated Retrieval Capabilities. ORNL/TM-5793. Oak Ridge National Laboratory.
[A] based on conservative assumption of pH 8.5 and temperature of 15C to achieve un-ionized ammonia of <0.02 mg/L
[B] CWQG for cadmium = $10^{(0.86[\log(\text{hardness})] - 3.2)}$ in ug/L
[C] Depends on chloride concentration
[D] for cold water streams
[E] lower end of range is applicable for protecting early life-stages
[F] for Hyallela azteca; Borgman, U., Y. Couillard, P. Doyle, and D.G. Dixon. 2005. Toxicity of sixty-three metals and metalloids to Hyallela azteca at two levels of water hardness. Environ. Toxicol. Chem. 24:641-652.

Table A.2: Selected water quality effects benchmarks for Faro Mine closure assessment.

Measurements	Units	Selected water quality benchmarks[a]
Total metals		
Aluminum	mg/L	0.1
Antimony	mg/L	0.02
Arsenic	mg/L	0.005
Barium	mg/L	1.0
Beryllium	mg/L	1.1
Bismuth	mg/L	0.26
Boron	mg/L	1.2
Cadmium	mg/L	0.00003
Calcium	mg/L	116
Chromium	mg/L	0.001
Cobalt	mg/L	0.004
Copper	mg/L	0.002
Iron	mg/L	0.3
Lead	mg/L	0.002
Lithium	mg/L	0.65
Magnesium	mg/L	82
Manganese	mg/L	1
Mercury	mg/L	0.000026
Molybdenum	mg/L	0.073
Nickel	mg/L	0.065
Potassium	mg/L	53
Selenium	mg/L	0.001
Silicon	mg/L	
Silver	mg/L	0.0001
Sodium	mg/L	200
Strontium	mg/L	9.3
Sulphur	mg/L	
Tellurium	mg/L	
Thallium	mg/L	0.0008
Thorium	mg/L	
Tin	mg/L	0.35
Titanium	mg/L	1.83
Uranium	mg/L	0.015
Vanadium	mg/L	0.006
Zinc	mg/L	0.030
Zirconium	mg/L	0.004
Non-metals		
Alkalinity - phenolphthalein	mg/L as $CaCO_3$	
Alkalinity - Total	mg/L as $CaCO_3$	7.1[b]
Ammonia - total	mg/L	0.24
Bicarbonate	mg/L	
Carbonate	mg/L	
Chloride - dissolved	mg/L	250
Colour	CU	
Conductivity - laboratory	µS/cm	
Conductivity - in situ	µS/cm	
Cyanide - weak acid dissociable	mg/L	0.005 (free)
Dissolved oxygen - in situ	mg/L	6.5 (minimum)
Dissolved oxygen - in situ	%	
Dissolved organic carbon	mg/L	
Fluoride	mg/L	0.12
Hardness - dissolved	mg/L as $CaCO_3$	
Hardness - Total	mg/L as $CaCO_3$	
Hydroxide	mg/L	
Nitrate	mg/L	13
Nitrite	mg/L	0.06
Nitrate plus nitrite	mg/L	
pH - Laboratory	pH units	6.5-9.0
pH - in situ	pH units	6.5-9.0
Phosphorus - nutrient analysis	mg/L	0.03
Sulphate	mg/L	50
Temperature - in situ	˚C	
Total organic carbon	mg/L	
Total dissolved solids - lab.	mg/L	500
Total suspended solids	mg/L	25[c]
Turbidity	NTU	2.7

[a] Benchmarks were selected from relevant water quality criteria as shown in Appendix Table A.1.

[b] Represents a 25% decrease below lower background benchmark of 9.5 mg/L reported in this study.

[c] Based on an increase of 5 mg/L above upper background benchmark of 20 mg/L reported in this study.

Table A.3: Background water quality, Faro Mine 2005 - 2009

Station	Date	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Magnesium	Manganese	Mercuy	Molybdenum	Nickel	Potassium	Selenium	Silicon	Silver	Sodium	Strontium	Tellurium	Thallium
	Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
FC	25-Sep-07	0.0797	0.00006	0.0002	0.0129	<0.00001	<0.000005	<0.005	0.00001	3.54	0.001	0.00005	0.0009	0.066	0.00032	0.0012	0.83	0.00261		0.00006	<0.00002	0.142	<0.00004	6.29	<0.000005	2.18	0.0222		<0.000002
FC	25-Oct-07	0.037	<0.00002	0.0001	0.0156	0.00001	<0.000005	<0.005	0.000013	3.91	0.0001	0.000018	0.00047	0.033	0.000104	0.002	0.76	0.00105		0.00005	0.00022	0.13	<0.00004	5.87	<0.000005	1.8	0.0264		<0.000002
FC	21-Nov-07	0.0322	<0.00002	0.00006	0.0172	<0.00001	<0.000005	<0.005	0.000009	4.27	0.0001	0.000015	0.00051	0.031	0.000152	0.0019	0.77	0.00089		0.00008	0.00024	0.16	<0.00004	7.43	<0.000005	1.69	0.0261		0.000002
FC	13-Dec-07	0.0293	<0.00002	0.00008	0.0176	<0.00001	<0.000005	<0.005	0.000009	4.87	0.0001	0.000019	0.00039	0.024	0.000088	0.0025	0.94	0.0007		0.00008	0.00023	0.17	<0.00004	7.54	<0.000005	2.07	0.0296		0.000002
FC	24-Jan-08	0.0212	0.00002	0.00008	0.0178	<0.00001	<0.000005	<0.005	0.000008	5.03	<0.0001	0.000015	0.00042	0.021	0.000066	0.0021	1	0.00062		0.00009	0.0002	0.2	<0.00004	7.4	<0.000005	2.23	0.031		<0.000002
FC	21-Feb-08	0.0208	0.00002	0.00007	0.0191	<0.00001	<0.000005	<0.005	0.00001	5.29	0.0001	0.000015	0.00028	0.023	0.000097	0.0025	1.08	0.00115		0.00018	0.00015	0.21	<0.00004	6.92	<0.000005	2.39	0.0327		0.000002
FC	11-Mar-08	0.0172	0.00002	0.00008	0.0197	<0.00001	<0.000005	<0.005	0.000013	5.64	<0.0001	0.000012	0.00035	0.017	0.000105	0.0028	1.12	0.00085		0.00011	0.00017	0.21	<0.00004	7.16	<0.000005	2.43	0.0342		0.000004
FC	29-Apr-08	0.019	<0.00002	0.00008	0.0204	<0.00001	<0.000005	<0.05	0.000014	6.02	<0.0001	0.000017	0.00024	0.018	0.000201	0.0031	1.29	0.0013		0.00011	0.00018	0.25	<0.00004	6.27	<0.000005	2.57	0.0366		<0.000002
FC	22-May-08	0.18	0.00004	0.00026	0.0168	0.00005	<0.000005	<0.05	0.000071	3.05	0.0002	0.000098	0.00206	0.172	0.00195	0.0012	0.6	0.00999		<0.00005	0.00074	1.11	<0.00004	3.65	0.000012	<0.05	0.019		0.000006
FC	25-Jun-08	0.0852	0.00003	0.00011	0.0122	0.00003	<0.000005	<0.05	0.000019	2.47	0.0002	0.000038	0.00089	0.055	0.000215	0.0015	0.49	0.00141		<0.00005	0.00041	0.15	<0.00004	4.98	<0.000005	1.27	0.0168		0.000003
FC	30-Jul-08	0.077	0.00005	0.00014	0.0151	0.00003	<0.000005	<0.05	0.000027	3.51	0.0002	0.000051	0.0011	0.062	0.000403	0.0016	0.71	0.00238		<0.00005	0.00047	0.12	<0.00004	6.56	<0.000005	2.46	0.0229		
FC	22-Aug-08	0.108	0.00003	0.00022	0.0162	0.00003	<0.000005	<0.05	0.000016	3.7	0.0003	0.000084	0.00138	0.139	0.000849	0.0017	0.79	0.00436		0.00006	0.00051	0.12	<0.00004	6.5	<0.000005	1.71	0.0226		0.000004
FC	18-Sep-08	0.106	<0.00002	0.00014	0.015	0.00003	<0.000005	<0.05	0.000011	2.95	0.0001	0.000055	0.00086	0.096	0.000404	0.0012	0.59	0.00246		<0.00005	0.00036	0.12	<0.00004	5.8	<0.000005	1.5	0.02		0.000004
FC	07-Oct-08	0.0894	0.00003	0.00011	0.0133	0.00002	<0.000005	<0.05	0.000009	2.91	0.0002	0.000044	0.00076	0.065	0.000324	0.0013	0.59	0.00208		<0.00005	0.00031	<0.05	<0.00004	6.58	0.000005	1.45	0.0191		<0.000002
FC	11-Dec-08	0.0474	0.00002	0.00006	0.0169	0.00001	<0.000005	<0.05	0.000031	4.35	0.0002	0.000017	0.00052	0.032	0.000176	0.0019	0.91	0.00069		0.00007	0.00022	0.15	<0.00004	7.21	<0.000005	1.85	0.0271		<0.000002
FC	25-Feb-09	0.0244		0.00007	0.0194				0.000012	5.44		0.000014	0.00030	0.02	0.000102	0.0023	1.09	0.00098		0.00009	0.00016	0.2		7.18		1.99	0.0344		
FC	27-Mar-09	0.0157	0.00002	0.00004	0.0192				0.000006	5.61		0.000016	0.00025	0.015	0.000061	0.0027	1.23	0.00088		0.0001	0.00015	0.22		8.01		2.27	0.034		
FC	7-Apr-09																												
FC	5-May-09	1.24	0.0001	0.0016	0.0693	0.00025	0.000051		0.000391	7.4	0.0027	0.00251	0.00927	1.54	0.0301	0.0035	1.59	0.11		0.00017	0.00678	1.55	0.00013	3.5	0.000024	0.72	0.0358		0.000039
FC	20-May-09	0.137	0.00004	0.00024	0.018	0.00005	<0.000005	<0.05	0.000062	3.31	<0.0001	0.000056	0.00182	0.139	0.00164	0.0013	0.66	0.00477		<0.00005	0.00067	0.83	0.00005	3.97	0.000005	1	0.0211		0.000005
FC	10-Jun-09	0.0914	0.00006	0.0003	0.0130	0.00003	<0.000005		0.000024	3.25	<0.0001	0.000061	0.00157	0.076	0.00352	<0.0005	0.67	0.00213		0.00012	0.00083	0.28	0.00010	4.58	<0.000005	1.12	0.0184		0.000007
FC	23-Jun-09	0.1110	0.00003	0.00015	0.0127	0.00002	<0.000005	<0.05	0.000013	3.11	0.0009	0.000042	0.00112	0.077	0.0003	0.0012	0.81	0.00239		<0.00005	0.00045	<0.04	<0.000005	6.57	0.0207	1.76	0.000004		<0.00001
R6	29-Mar-05	0.017	<0.001	<0.001	0.094	<0.001	<0.001	<0.05	<0.0002	77.8	<0.001	<0.001	<0.001	0.11	<0.001	0.004	16	0.018	<0.00002	0.0014	<0.001	1.9	<0.001	12.8	0.0017	5.5	0.25	<0.001	<0.0001
R6	17-Aug-05	0.028	<0.001	<0.001	0.068	<0.001	<0.001	<0.05	<0.0002	43.7	<0.001	<0.001	<0.001	<0.05	<0.001	0.001	11.8	0.014	<0.00002	0.001	<0.001	1	0.002	8.8	<0.00025	1.41		<0.001	<0.0001
R6	21-Feb-06	0.14	<0.001	<0.001	0.093	<0.001	<0.001	<0.05	<0.0002	49.5	0.003	<0.001	0.003	0.18	<0.001	0.003	11.3	0.014	<0.00002	0.0013	0.002	1.4	<0.001	5.4	<0.00025	2.38	0.14	<0.001	<0.0001
R6	07-Aug-06	0.019	<0.001	<0.001	0.064	<0.001	<0.001	<0.05	<0.0002	40	<0.001	<0.001	<0.001	0.12	<0.001	0.002	10.6	0.012	<0.00002	0.0011	<0.001	0.9	<0.001	4.4	<0.00025	1.66	0.11	<0.001	<0.0001
R6	20-Feb-07	0.013	<0.001	<0.001	0.092	<0.001	<0.001	<0.05	<0.0002	48.7	<0.001	<0.001	<0.001	0.09	<0.001	0.002	10.7	0.011	<0.00002	0.0012	<0.001	1.4	<0.001	5	<0.00025	2.18	0.14	<0.001	<0.0001
R6	17-Aug-07	0.014	<0.001	<0.001	0.078	<0.001	<0.001	<0.05	<0.0002	35.3	<0.001	<0.001	<0.001	0.16	<0.001	<0.005	10.7	0.01	<0.00002	0.0009	<0.001	1	<0.001	3.4	<0.00025	1.66	0.11	<0.001	<0.0001
R6	26-Sep-07	0.0316	0.00011	<0.00002	0.0642	<0.00001	<0.000005	<0.005	0.00002	39.6	0.0017	0.00005	0.0007	0.148	0.0002	0.0015	10.4	0.0171		0.0011	<0.00002	0.988	0.0007	4.03	<0.000005	2.06	0.106		<0.000002
R6	24-Oct-07	0.0079	0.00013	0.00045	0.0761	<0.00001	<0.000005	<0.005	0.000019	44.1	0.0001	0.000036	0.00043	0.101	0.000091	0.0023	10.8	0.0188		0.00125	0.00027	1.11	0.00071	4	0.00002	2.16	0.134		<0.000002
R6	22-Nov-07	0.0067	0.00013	0.00029	0.0887	<0.00001	<0.000005	<0.005	0.00001	46	<0.0001	0.000013	0.00035	0.051	0.000017	0.0022	10.3	0.00512		0.00129	0.00023	1.15	0.0008	4.89	<0.000005	1.69	0.139		<0.000002
R6	14-Dec-07	0.0141	0.0001	0.00045	0.0878	<0.00001	<0.000005	<0.005	0.000013	47.7	0.0001	0.000042	0.00036	0.147	0.000034	0.0024	11.3	0.0208		0.00116	0.00025	1.2	0.00073	4.81	<0.000005	2.04	0.14		<0.000002
R6	23-Jan-08	0.0056	0.00011	0.00042	0.095	<0.00001	<0.000005	<0.005	0.000013	48.3	<0.0001	0.000025	0.00029	0.117	0.000029	0.0024	11.3	0.0111		0.00131	0.00024	1.26	0.00083	4.77	<0.000005	2.12	0.151		<0.000002
R6	20-Feb-08	0.0063	0.00011	0.00045	0.0962	<0.00001	<0.000005	<0.005	0.000013	46.7	0.0001	0.000022	0.00038	0.132	0.000029	0.0026	10.3	0.00985		0.00136	0.00022	1.32	0.00076	4.62	<0.000005	2.22	0.146		<0.000002
R6	04-Mar-08	0.006	<0.001	0.001	0.099	<0.001	<0.001	<0.05	<0.0002	49.7	<0.001	<0.001	<0.001	0.14	<0.001	0.002	14.9	0.01	<0.00002	0.0013	<0.001	1.5	0.003	4.8	<0.00025	2.93	0.19	<0.001	<0.0001
R6	13-Mar-08	0.0042	0.00011	0.00048	0.0958	<0.00001	<0.000005	<0.005	0.000007	48.8	<0.0001	0.00002	0.00029	0.148	0.000054	0.0026	10.9	0.00945		0.00138	0.00022	1.33	0.00079	4.91	<0.000005	2.15	0.148		<0.000002
R6	28-Apr-08	0.0115	0.00011	0.00064	0.0887	<0.00001	<0.000005	<0.05	0.000013	43.1	<0.0001	0.000044	0.00028	0.281	0.000078	0.0023	9.63	0.018		0.00127	0.00022	1.32	0.00073	4.05	<0.000005	1.94	0.139		<0.000002
R6	21-May-08	0.244	0.00012	0.00081	0.0404	0.00004	0.000006	<0.05	0.000074	16.5	0.0005	0.000264	0.00292	0.568	0.00048	0.0012	4.66	0.0398		0.00055	0.00183	1.39	0.00029	3.18	0.000008	0.75	0.0469		0.000007
R6	24-Jun-08	0.23	0.00013	0.00066	0.0433	0.00004	0.000006	<0.05	0.000052	20.6	0.0005	0.000231	0.00209	0.433	0.000575	0.0015	5.77	0.0342		0.00062	0.00115	0.69	0.0004	3.43	0.000009	0.97	0.0592		0.000007
R6	22-Jul-08	0.0606	0.00012	0.00046	0.0488	0.00001	<0.000005	<0.05	0.000023	32.1	0.0003	0.000064	0.00097	0.125	0.00009	0.0013	8.47	0.0128		0.0008	0.00056	0.76	0.00074	4.26	<0.000005	1.35	0.0854		0.000003
R6	29-Jul-08	0.0332	0.00012	0.00038	0.0541	<0.00001	<0.000005	<0.05	0.000015	34.8	0.0001	0.000051	0.00078	0.09	0.000142	0.0016	9.03	0.0117		0.00101	0.00042	0.84	0.00075	4.4	<0.000005	2.18	0.0998		<0.000002
R6	19-Aug-08	0.028	<0.001	<0.001	0.056	<0.001	<0.001	<0.05	<0.0002	39	<0.001	<0.001	<0.001	0.2	<0.001	0.002	11.7	0.013	<0.00002	0.0011	<0.001	1.1	<0.001	5	<0.00025	1.89	0.12	<0.001	<0.0001
R6	04-Sep-08	0.0419	0.00012	0.0004	0.058	<0.00001	<0.000005	<0.05	0.000019	35.6	0.0002	0.000055	0.00083	0.124	0.000049	0.0017	9.7	0.013		0.00093	0.00052	0.91	0.00067	4.66	<0.000005	1.63	0.104		<0.000002
R6	17-Sep-08	0.0346	0.00011	0.0004	0.0569	<0.00001	<0.000005	<0.05	0.00002	35.6	0.0001	0.000049	0.00074	0.106	0.000057	0.0016	9.41	0.013		0.00089	0.00046	0.94	0.00059	4.36	<0.000005	1.56	0.101		0.000003
R6	08-Oct-08	0.0346	0.00011	0.00041	0.062	<0.00001	<0.000005	<0.05	0.000016	39.9	0.0002	0.000047	0.00068	0.11	0.000109	0.0019	10.7	0.0165		0.00099	0.00041	0.73	<0.00004	4.13	0.000005	1.73	0.111		<0.000002
R6	10-Dec-08	0.0338	0.00017	0.00042	0.0844	<0.00001	<0.000005	<0.05	0.000017	48.8	0.0002	0.000052	0.00045	0.134	0.00014	0.0025	12.3	0.018		0.00124	0.00034	1.24	0.00097	5.09	<0.000005	2.01	0.141		<0.000002
R6	24-Feb-09	0.0059	0.0001	0.00021	0.0808		0.000007		0.000015	74.6	0.0002	0.000038	0.00062	0.037	0.000204	0.0044	15.8	0.0316		0.00057	0.00083	1.68	0.00069	5.42		4.9	0.251		
R6	26-Mar-09	0.0089	0.00013	0.00052	0.0903				0.000059	48		0.00003	0.00059	0.177	0.000194	0.0026	11.1	0.0123		0.00124	0.00024	1.29	0.00092	5.45		2.02	0.15		
R6	20-May-09	0.11	0.00012	0.00069	0.0495	0.00002	<0.000005	<0.05	0.00006	25.5	0.0001	0.000166	0.00194	0.396	0.000289	0.0015	7.01	0.0421		0.00071	0.0011	1.18	0.00049	3.45	<0.000005	1.06	0.0739		0.000004
R6	23-Jun-09	0.0738	0.00013	0.00042	0.0508	0.00001	<0.000005	<0.05	0.000017	30.5	0.0003	0.000065	0.00104	0.162	0.000341	0.0015	8.03	0.0127		0.00086	0.00058	0.61	<0.000005	3.9	0.0851	1.54	0.000003		<0.00001
R7	21-Jan-05																												
R7	22-Jan-05	0.01	<0.001	<0.001	0.068	<0.001	<0.001	<0.05	<0.0002	40.3	<0.001	<0.001	<0.001	0.2	<0.001	0.008	8.7	0.15	<0.00002	0.0007	<0.001	1	<0.001	12.3	<0.00025	2.99	0.16	<0.001	<0.0001
R7	09-Feb-05	0.005	<0.001	<0.001	0.068	<0.001	<0.001	<0.05	<0.0002	40.6	<0.001	<0.001	<0.001	<0.05	<0.001	0.007	7.88	0.014	<0.00002	0.0007	<0.001	0.9	<0.001	12.6	<0.00025	3.24	0.16	<0.001	<0.0001
R7	14-Mar-05	0.018	<0.001	<0.001	0.077	<0.001	<0.001	<0.05	<0.0002	43.9	<0.001	<0.001	<0.001	0.22	<0.001	0.008	7.99	0.01	<0.00002	0.0009	<0.001	1.2	<0.001	14	<0.00025	3.76	0.19	<0.001	<0.0001
R7	11-Apr-05	0.007	<0.001	<0.001	0.065	<0.001	<0.001	<0.05	<0.0002	39.9	<0.001	<0.001	<0.001	0.07	<0.001	0.008	7.85	0.005	<0.00002	0.0008	<0.001	1	<0.001	13.2	<0.00025	3.45	0.18	<0.001	<0.0001
R7	09-May-05	0.31	<0.001	0.001	0.031	<0.001	<0.001	<0.05	<0.0002	8.41	<0.001	<0.001	0.002	0.72	<0.001	0.001	1.62	0.056	<0.00002	<0.0005	0.001	1.4	<0.001	5.3	<0.00025	0.8	0.035	<0.001	<0.0001
R7	20-Jun-05	0.072	<0.001	<0.001	0.038	<0.001	<0.001	<0.05	<0.0002	19.6	<0.001	<0.001	<0.001	0.22	<0.001	0.002	4.65	0.019	<0.00002	<0.0005	<0.001	0.5	<0.001	9.7		1.56	0.07	<0.001	<0.0001
R7	26-Jul-05	0.038	<0.001	<0.001	0.048	<0.001	<0.001	<0.05	<0.0002	21.8	<0.001	<0.001	0.003	0.07	<0.001	0.003	4.16	0.023	<0.00002	<0.0005	<0.001	0.4	<0.001	10.5	<0.00025	1.7	0.091	<0.001	<0.0001
R7	23-Aug-05	0.024	<0.001	0.001	0.046	<0.001	<0.001	<0.05	<0.0002	29.7	<0.001	<0.001	<0.001	0.11	<0.001	0.004	6.01	0.024	<0.00002	0.0005	<0.001	0.5	0.001	10	<0.00025	2.11	0.11	<0.001	<0.0001
R7	06-Sep-05	0.02	<0.001	<0.001	0.042	<0.001	<0.001	<0.05	<0.0002	23.7	<0.001	<0.001	<0.001	0.19	<0.001	0.003	5.07	0.02	<0.00002	<0.0005	<0.001	0.5	<0.001	10.8	<0.00025	2.62	0.1	<0.001	<0.0001
R7	11-Oct-05	0.029	<0.001	<0.001	0.054	<0.001	<0.001	<0.05	<0.0002	30.6	<0.001	<0.001	<0.001	0.11	<0.001	0.004	6.57	0.026	<0.00002	0.0005	<0.001	0.7	<0.001	12.8	<0.00025	2.32	0.12	<0.001	<0.0001
R7	02-Nov-05	0.01	<0.001	<0.001	0.058	<0.001	<0.001	<0.05	<0.0002	33.6	<0.001	<0.001	<0.001	<0.05	<0.001	0.005	6.73	0.013	<0.00002	0.0006	<0.001	0.7	<0.001	12.4	<0.00025	2.1	0.13	<0.001	<0.0001
R7	13-Dec-05	0.009	<0.001	<0.001	0.07	<0.001	<0.001	<0.05	<0.0002	37.3	<0.001	<0.001	<0.001	0.11	<0.001	0.007	7.33	0.015	<0.00002	0.0006	<0.001	0.8	<0.001	5.9	<0.00025	2.73	0.13	<0.001	<0.0001
R7	24-Jan-06	0.008	<0.001	<0.001	0.069	<0.001	<0.001	<0.05	<0.0002	38.3	<0.001	<0.001	<0.001	0.13	<0.001	0.008	8.11	0.009	<0.00002	0.0007	<0.001	0.7	<0.001	6.3	<0.00025	3.03	0.15	<0.001	<0.0001
R7	14-Feb-06	0.017	<0.001	<0.001	0.072	<0.001	<0.001	<0.05	<0.0002	39.2	<0.001	<0.001	<0.001	0.08	<0.001	0.008	8.16	0.009	<0.00002	0.0008	<0.001	1	0.002	6.2	<0.00025	3.22	0.16	<0.001	<0.0001
R7	25-Mar-06	<0.005	<0.001	<0.001	0.072	<0.001	<0.001	<0.05	<0.0002	41.2	<0.001	<0.001	<0.001	<0.05	<0.001	0.009	8.41	0.009	<0.00002	0.0008	<0.001	1.1	<0.001	5.9	<0.00025	3.38	0.16	<0.001	<0.0001
R7	24-Apr-06	<0.005	<0.001	<0.001	0.073	<0.001	<0.001	<0.05	<0.0002	38	<0.001	<0.001	<0.001	<0.05	<0.001	0.008	7.46	0.008	<0.00002	0.0008	<0.001	1	<0.001	5.2	<0.00025	3.12	0.17	<0.001	<0.0001
R7	18-May-06	0.26	<0.001	0.001	0.038	<0.001	<0.001	<0.05	<0.0002	10	<0.001	<0.001	0.002	0.84	<0.001	0.002	1.86	0.09	<0.00002	<0.0005	0.001	1.6	<0.001	2.4	<0.00025	0.77	0.041	<0.001	<0.0001
R7	19-Jun-06	0.097	<0.001	<0.001	0.035	<0.001	<0.001	<0.05	<0.0002	17.5	<0.001	<0.001	<0.001	0.23	<0.001	0.002	3.73	0.016	<0.00002	<0.0005	<0.001	0.5	<0.001	3.7	<0.00025	1.39	0.059	<0.001	<0.0001
R7	17-Jul-06	0.052	<0.001	<0.001	0.039	<0.001	<0.001	<0.05	<0.0002	21.8	<0.001	<0.001	<0.001	0.19	<0.001	0.008	5.2	0.017	<0.00002	<0.0005	0.001	0.4	<0.001	4.4	<0.00025	1.66	0.073	<0.001	<0.0001
R7	22-Aug-06	0.018	<0.001	<0.001	0.041	<0.001	<0.001	<0.05	<0.0002	23.1	<0.001	<0.001	<0.001	0.11	<0.001	0.003	4.51	0.014	<0.00002	<0.0005	<0.001	0.5	<0.001	4.5	<0.00025	1.94	0.088	<0.001	<0.0001
R7	12-Sep-06	0.019	<0.001	<0.001	0.038	<0.001	<0.001	<0.05	<0.0002	21.8	<0.001	<0.001	<0.001	0.18	<0.001	0.003	4.81	0.017	<0.00002	<0.0005	<0.001	0.4	<0.001	5	<0.00025	1.93	0.084	<0.001	<0.0001
R7	16-Oct-06	0.014	<0.001	<0.001	0.054	<0.001	<0.001	<0.05	<0.0002	29.9	<0.001	<0.001	<0.001	0.11	<0.001	0.005	6.17	0.017	<0.00002	<0.0005	<0.001	0.7	<0.001	4.5	<0.00025	2.52	0.11	<0.001	<0.0001
R7	14-Nov-06	0.014	<0.001	<0.001	0.066	<0.001	<0.001	<0.05	<0.0002	34.4	<0.001	<0.001	<0.001	0.09	<0.001	0.005	7.47	0.014	<0.00002	0.0006	<0.001	0.6	<0.001	5.5	<0.00025	2.74	0.14	<0.001	<0.0001
R7	14-Dec-06	0.008	<0.001	<0.001	0.074	<0.001	<0.001	<0.05	<0.0002	37.8	<0.001	<0.001	<0.001	0.09	<0.001	0.007	7.72	0.014	<0.00002	0.0006	<0.001	0.9	<0.001	5.7	<0.00025	2.85	0.15	<0.001	<0.0001
R7	14-Feb-07	0.007	<0.001	<0.001	0.071	<0.001	<0.001	<0.05	<0.0002	42.2	<0.001	<0.001	<0.001	0.1	<0.001	0.008	8.57	0.007	<0.00002	0.0007	<0.001	1	<0.001	5.4	<0.00025	3.34	0.16	<0.001	<0.0001
R7	12-Mar-07	<0.005	<0.001	<0.001	0.083	<0.001	<0.001	<0.05	<0.0002	43.8	<0.001	<0.001	<0.001	0.09	<0.001	0.011	9.05	0.008	<0.00002	0.0009	<0.001	1.2	<0.001	5.8	<0.00025	3.71	0.18	<0.001	<0.0001
R7	27-Mar-07	0.015	<0.0002	0.0004	0.085	<0.0002	<0.0002	<0.01	0.00001	43.6	<0.0002	<0.0002	0.0003	0.06	<0.0002	0.0098	9.19	0.0061	<0.000015	0.0009	0.0004	1.13	0.0005	6.22	<0.00005	3.96	0.183	<0.0002	<0.00002
R7	19-Apr-07	0.007	<0.001	<0.001	0.076	<0.001	<0.001	<0.05	<0.0002	42.3	<0.001	<0.001	0.002	0.13	<0.001	0.007	8.08	0.012	<0.00002	0.0009	<0.001	1.2	<0.001	5.2	<0.00025	3.15	0.19	<0.001	<0.0001
R7	15-May-07	0.35	<0.001	0.002	0.047	<0.001	<0.001	<0.05	<0.0002	14.1	0.002	<0.001	0.002	1.41	<0.001	<0.005	2.79	0.14	<0.00002	0.0008	0.001	1.6	<0.001	3.7	<0.00025	1.14	0.061	<0.001	<0.0001
R7	19-Jun-07	0.095	<0.001	<0.001	0.039	<0.001	<0.001	<0.05	<0.0002	18.9	<0.001	<0.001	0.001	0.27	<0.001	<0.005	4.61	0.016	<0.00002	0.0005	<0.001	0.6	<0.001	3.8	<0.00025	1.6	0.067	<0.001	<0.0001
R7	17-Jul-07	0.06	<0.001	<0.001	0.038	<0.001	<0.001	<0.05	<0.0002	15.6	<0.001	<0.001	<0.001	0.16	<0.001	<0.005	3.45	0.012	<0.00002	<0.0005	<0.001	0.3	<0.001	4	<0.00025	1.38	0.067	<0.001	<0.0001

Table A.3: Background water quality, Faro Mine 2005 - 2009

Station	Date	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Magnesium	Manganese	Mercuy	Molybdenum	Nickel	Potassium	Selenium	Silicon	Silver	Sodium	Strontium	Tellurium	Thallium
	Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
R7	14-Aug-07	0.1	<0.001	<0.001	0.045	<0.001	<0.001	<0.05	0.0004	23.3	<0.001	<0.001	<0.001	0.18	<0.001	<0.005	5.09	0.014	<0.00002	0.0007	0.001	0.5	0.002	4.2	<0.00025	1.91	0.09	0.001	0.0002
R7	11-Sep-07	0.083	<0.001	<0.001	0.041	<0.001	<0.001	<0.05	<0.0002	16.7	<0.001	<0.001	<0.001	0.3	<0.001	<0.001	3.63	0.027	<0.00002	<0.0005	<0.001	0.5	<0.001	4.1	<0.00025	1.59	0.07	<0.001	<0.0001
R7	23-Oct-07	0.01	<0.001	<0.001	0.052	<0.001	<0.001	<0.05	<0.0002	27.9	<0.001	<0.001	<0.001	0.12	<0.001	0.004	6.35	0.015	<0.00002	<0.0005	<0.001	0.7	<0.001	4.7	<0.00025	2.44	0.12	<0.001	<0.0001
R7	14-Nov-07	0.04	<0.001	<0.001	0.056	<0.001	<0.001	<0.05	<0.0002	33.5	<0.001	<0.001	<0.001	0.1	<0.001	0.004	6.74	0.013	<0.00002	0.0006	<0.001	0.8	<0.001	5.4	<0.00025	2.44	0.12	<0.001	<0.0001
R7	09-Dec-07	0.021	<0.001	<0.001	0.059	<0.001	<0.001	<0.05	<0.0002	33.2	<0.001	<0.001	<0.001	0.12	<0.001	0.002	6.48	0.012	<0.00002	0.0005	<0.001	0.8	<0.001	5	<0.00025	2.36	0.13	<0.001	<0.0001
R7	08-Jan-08	0.017	0.003	<0.001	0.063	<0.001	<0.001	<0.05	<0.0002	36	<0.001	<0.001	<0.001	0.11	<0.001	0.005	7.14	0.008	<0.00002	0.0007	<0.001	0.9	<0.001	5.1	<0.00025	2.66	0.14	<0.001	<0.0001
R7	19-Feb-08	0.01	<0.001	<0.001	0.073	<0.001	<0.001	<0.05	<0.0002	39.2	0.001	<0.001	<0.001	<0.05	<0.001	0.007	8.12	0.009	<0.00002	0.0009	<0.001	0.8	<0.001	5.9	<0.00025	3.21	0.17	<0.001	<0.0001
R7	18-Mar-08	0.008	<0.001	<0.001	0.077	<0.001	<0.001	<0.05	<0.0002	40.1	<0.001	<0.001	<0.001	0.05	<0.001	0.007	9.39	0.006	<0.00002	0.0009	<0.001	1.1	<0.001	6.6	<0.00025	3.81	0.17	<0.001	<0.0001
R7	14-Apr-08	<0.005	<0.001	<0.001	0.076	<0.001	<0.001	<0.05	<0.0002	42.5	<0.001	<0.001	<0.001	<0.05	<0.001	0.008	8.37	0.006	<0.00002	0.001	<0.001	1.1	<0.001	6.8	<0.00025	3.42	0.18	<0.001	<0.0001
R7	15-May-08	0.15	<0.001	<0.001	0.037	<0.001	<0.001	<0.05	<0.0002	12	<0.001	<0.001	0.002	0.47	<0.001	0.002	2.33	0.038	<0.00002	<0.0005	0.001	1.5	<0.001	2.7	<0.00025	1.05	0.051	<0.001	<0.0001
R7	25-May-08	0.281	0.00009	0.00141	0.0308	0.00005	0.000007	<0.05	0.000071	7.87	0.0004	0.000316	0.00239	0.893	0.000954		1.34	0.0752		0.00024	0.00124	0.93	0.00013		0.000012	0.71	0.0385		0.000008
R7	17-Jun-08	0.12	<0.001	<0.001	0.039	<0.001	<0.001	<0.05	<0.0002	19.5	<0.001	<0.001	0.001	0.18	<0.001	<0.001	4.87	0.015	<0.00002	<0.0005	<0.001	0.6	<0.001	4.7	<0.00025	1.69	0.071	<0.001	<0.0001
R7	15-Jul-08	0.59	<0.001	<0.001	0.039	<0.001	<0.001	<0.05	<0.0002	14.1	<0.001	<0.001	0.003	0.98	0.001	0.003	2.86	0.033	<0.00002	<0.0005	0.002	0.5	<0.001	5.6	0.0004	1.28	0.057	<0.001	<0.0001
R7	22-Jul-08	0.0439	0.00008	0.00055	0.036	<0.00001	<0.000005	<0.05	0.000009	18.9	0.0003	0.000047	0.00073	0.114	0.000085	0.0017	3.98	0.0147		0.00036	0.00038	0.34	0.00026	4.36	<0.000005	1.37	0.0687		0.000002
R7	12-Aug-08	0.017	<0.001	<0.001	0.044	<0.001	<0.001	<0.05	<0.0002	22.8	<0.001	<0.001	<0.001	0.22	0.002	0.002	4.65	0.021	<0.00002	<0.0005	<0.001	0.5	<0.001	4.8	<0.00025	1.78	0.084	<0.001	<0.0001
R7	21-Aug-08	0.0187	0.00008	0.00064	0.0477	<0.00001	<0.000005	<0.05	0.00001	23.9	<0.0001	0.000038	0.00175	0.152	0.000312	0.003	5	0.0166		0.0005	0.00039	0.5	0.00024	5.6	<0.000005	2.04	0.0977		<0.000002
R7	04-Sep-08	0.0289	0.00008	0.00053	0.0401	<0.00001	<0.000005	<0.05	0.000011	21	<0.0001	0.000041	0.00069	0.105	0.000086	0.0022	4.2	0.0155		0.00041	0.00036	0.45	0.00029	5.05	<0.000005	1.64	0.0809		<0.000002
R7	15-Sep-08	0.087	<0.001	<0.001	0.036	<0.001	<0.001	<0.05	<0.0002	17.5	<0.001	<0.001	0.001	0.22	0.003	0.002	3.59	0.019	<0.00002	<0.0005	<0.001	0.4	<0.001	4.9	<0.00025	1.59	0.084	<0.001	<0.0001
R7	15-Oct-08	0.019	<0.001	<0.001	0.042	<0.001	<0.001	<0.05	<0.0002	24.3	<0.001	<0.001	<0.001	0.05	<0.001	0.003	4.49	0.019	<0.00002	<0.0005	<0.001	0.5	<0.001	4.9	<0.00025	1.67	0.095	<0.001	<0.0001
R7	04-Nov-08	0.032	<0.001	<0.001	0.054	<0.001	<0.001	<0.05	<0.0002	29.7	<0.001	<0.001	<0.001	<0.05	<0.001	0.003	6.07	0.015	<0.00002	0.0006	<0.001	0.7	<0.001	5.3	<0.00025	2.22	0.12	<0.001	<0.0001
R7	02-Dec-08	0.029	<0.001	<0.001	0.058	<0.001	<0.001	<0.05	<0.0002	35.3	<0.001	<0.001	<0.001	0.09	<0.001	0.005	6.74	0.022	<0.00002	0.0006	<0.001	0.9	<0.001	6.5	<0.00025	2.67	0.13	<0.001	<0.0001
R7	13-Jan-09	0.013	<0.001	<0.001	0.072	<0.001	<0.001	<0.05	<0.0002	39.3	<0.001	<0.001	<0.001	0.12	<0.001	0.009	8.06	0.017	<0.00002	0.0009	<0.001	0.9	<0.001	6	<0.00025	2.86	0.16	<0.001	<0.0001
R7	03-Feb-09	0.022	<0.001	<0.001	0.07	<0.001	<0.001	<0.05	<0.0002	38.6	<0.001	<0.001	<0.001	0.2	<0.001	0.006	7.82	0.018	<0.00002	0.0008	<0.001	0.9	<0.001	5.6	<0.00025	2.98	0.18	<0.001	<0.0001
R7	4-Mar-09	0.0045	0.00008	0.00052	0.0714	<0.00001	<0.000005		0.000007	41.4	<0.0001	0.000017	0.00028	0.088	0.000052	0.0078	7.97	0.0118		0.00097	0.00017	0.96	0.00052	5.62	<0.000005	3.1	0.177		<0.000002
R7	7-Apr-09	0.0034	0.00008	0.00048	0.0759	<0.00001	<0.000005		0.000006	41.3	<0.0001	0.000016	0.00178	0.075	0.000022	0.0097	8.03	0.0101		0.00091	0.00019	0.99	0.00049	5.59	<0.000005	3.09	0.178		<0.000002
R7	5-May-09	0.144	0.00007	0.0012	0.0303	0.00003	<0.000005		0.000073	8.3	<0.0001	0.000108	0.00188	0.432	0.001	0.0015	1.66	0.0369		0.00023	0.00089	1.75	0.00012	2.3	0.00001	0.66	0.0368		0.000004
R7	10-Jun-09	0.057	0.00007	0.00048	0.0272	0.00001	<0.000005		0.000007	12.8	<0.0001	0.000041	0.00071	0.117	0.000296	<0.0005	2.68	0.0113		0.0003	0.00029	0.43	0.00022	3.23	<0.000005	0.99	0.0498		0.000002
USFR	27-Mar-07	0.02	<0.0002	0.0002	0.055	<0.0002	<0.0002	<0.01	0.00001	17.6	<0.0002	<0.0002	0.0004	0.07	<0.0002	0.0014	3.44	0.0017	<0.000015	0.0007	0.0007	0.63	<0.0002	5.24	<0.00005	2.88	0.087	<0.0002	<0.00002
USFR	25-Aug-07	0.0263	<0.00005	0.0003	0.025	<0.00005	<0.00005	<0.008	<0.00001	8.82	<0.0002	0.00004	0.0004	0.164	0.0001		1.32	0.00959	<0.00005	0.0003	<0.0005	0.285	<0.0005		<0.00001	1.92	0.0495		<0.00005
USFR	24-May-08	0.15	0.00004	0.00056	0.0237	0.00004	0.000008	<0.05	0.000033	4.98	0.0002	0.000144	0.00115	0.44	0.000719		0.7	0.0445		0.00023	0.00052	0.74	0.00006		0.000006	0.84	0.0293		0.000006
USFR	19-Aug-08	0.0295	0.00004	0.0003	0.0244	0.00001	<0.000005	<0.05	0.000009	6.81	<0.0001	0.00003	0.00058	0.119	0.000108	0.0008	1.1	0.00728		0.00022	0.00033	0.23	0.00005	4.1	<0.000005	1.49	0.0422		<0.000002
V1	07-Mar-05	0.012	<0.001	<0.001	0.037	<0.001	<0.001	<0.05	<0.0002	17.9	<0.001	<0.001	<0.001	0.08	<0.001	0.001	2.87	<0.001	<0.00002	0.0006	<0.001	1.4	<0.001	10.7	<0.00025	2.71	0.08	<0.001	<0.0001
V1	07-Jun-05	0.043	<0.001	0.002	0.016	<0.001	<0.001	0.07	<0.0002	6.03	0.001	<0.001	0.002	0.09	<0.001	<0.001	0.75	0.002	<0.00002	<0.0005	<0.001	0.8	0.011	8.2	<0.00025	1.61	0.03	<0.001	<0.0001
V1	12-Sep-05	0.013	<0.001	<0.001	0.025	<0.001	<0.001	<0.05	<0.0002	9.61	<0.001	<0.001	<0.001	<0.05	<0.001	<0.001	1.3	0.001	<0.00002	<0.0005	<0.001	0.3	<0.001	7	<0.00025	1.7	0.044	<0.001	<0.0001
V1	01-Dec-05	0.006	<0.001	<0.001	0.037	<0.001	<0.001	<0.05	<0.0002	14.7	<0.001	<0.001	<0.001	<0.05	<0.001	<0.001	2.46	<0.001	<0.00002	0.0005	<0.001	0.6	<0.001	4.8	<0.00025	1.89	0.068	<0.001	<0.0001
V1	20-Mar-06	0.99	<0.001	0.001	0.12	<0.001	<0.001	0.12	<0.0002	18.7	<0.001	<0.001	<0.001	<0.05	<0.001	0.002	2.89	<0.001	<0.00002	0.0007	<0.001	0.6	<0.001	5.2	<0.00025	2.27	0.11	<0.001	<0.0001
V1	05-Jun-06	0.099	<0.001	<0.001	0.013	<0.001	<0.001	<0.05	<0.0002	4.31	<0.001	<0.001	<0.001	0.14	<0.001	<0.001	0.64	0.005	<0.00002	<0.0005	<0.001	0.4	<0.001	2.4	<0.00025	0.87	0.022	<0.001	<0.0001
V1	09-Jun-06	0.024	<0.001	<0.001	0.025	<0.001	<0.001	<0.05	<0.0002	9.48	<0.001	<0.001	<0.001	<0.05	<0.001	<0.001	1.4	<0.001	<0.00002	<0.0005	<0.001	0.3	<0.001	4.2	<0.00025	1.79	0.052	<0.001	<0.0001
V1	06-Sep-06	0.024	<0.001	<0.001	0.025	<0.001	<0.001	<0.05	<0.0002	9.48	<0.001	<0.001	<0.001	<0.05	<0.001	<0.001	1.4	<0.001	<0.00002	<0.0005	<0.001	0.3	<0.001	4.2	<0.00025	1.79	0.052	<0.001	<0.0001
V1	27-Mar-07	0.007	<0.0002	0.0003	0.043	<0.0002	<0.0002	<0.01	0.00001	16.8	<0.0002	<0.0002	0.0003	0.01	0.0002	0.0014	3.07	0.0004	<0.000015	0.0007	0.0004	0.64	<0.0002	5.32	<0.00005	2.46	0.078	<0.0002	<0.00002
V1	18-Jun-07	0.033	<0.001	<0.001	0.014	<0.001	<0.001	<0.05	<0.0002	6.62	<0.001	<0.001	<0.001	0.07	<0.001	<0.005	0.97	0.014	<0.00002	<0.0005	<0.001	0.4	<0.001	2.9	<0.00025	1.89	0.03	<0.001	0.0001
V1	28-Aug-07	0.0143	<0.00005	0.0002	0.0257	<0.00005	<0.00005	<0.008	<0.00001	10.6	<0.0002	<0.00002	0.0004	0.027	0.00004		1.45	0.00076	<0.00005	0.00023	<0.0005	0.343	<0.0005		<0.00001	2.09	0.0539		<0.00005
V1	29-Aug-07																												
V1	24-Sep-07	0.012	<0.001	<0.001	0.022	<0.001	<0.001	<0.05	<0.0002	7.73	<0.001	<0.001	<0.001	<0.05	<0.001	<0.001	1.11	0.002		<0.0005	<0.001	0.3	<0.001	3.5	<0.00025	1.64	0.042	<0.001	<0.0001
V1	26-Sep-07	0.0115	<0.00002	<0.00002	0.0246	<0.00001	<0.005	<0.005	<0.000005	9.38	<0.0001	<0.000005	0.0004	0.019	0.00002	0.0008	1.29	0.00069		0.00019	<0.00002	0.317	<0.00004	3.96	<0.000005	1.78	0.0476		<0.000002
V1	24-Oct-07	0.0077	0.00003	0.00022	0.0301	<0.00001	<0.005	<0.005	0.000036	11.8	0.0001	0.00001	0.00034	0.015	0.000214	0.0012	1.67	0.00077		0.00031	0.00021	0.37	0.0001	4	<0.000005	1.81	0.0636		<0.000002
V1	22-Nov-07	0.0059	0.00003	0.00026	0.0333	<0.00001	<0.005	<0.005	0.000007	15.4	<0.0001	0.000013	0.00029	0.008	0.000014	0.0012	2.4	0.00042		0.00044	0.00024	0.49	0.00015	5.73	<0.000005	2.1	0.0724		<0.000002
V1	10-Dec-07	0.006	<0.001	<0.001	0.032	<0.001	<0.001	<0.05	<0.0002	13.3	<0.001	<0.001	<0.001	<0.05	<0.001	0.001	2.22	0.002	<0.00002	0.0005	<0.001	0.6	<0.001	4.5	<0.00025	2.27	0.065	<0.001	<0.0001
V1	14-Dec-07	0.0051	0.00004	0.00029	0.0386	<0.00001	<0.005	<0.005	0.000023	15.8	<0.0001	0.000023	0.00033	0.005	0.000008	0.0014	2.34	0.00072		0.0005	0.00025	0.5	0.00015	4.89	<0.000005	2.13	0.0784		0.000002
V1	23-Jan-08	0.0048	0.00004	0.00029	0.0416	<0.00001	<0.005	<0.005	0.000008	16.1	<0.0001	0.000013	0.00026	0.007	0.000027	0.0013	2.68	0.00056		0.00063	0.0002	0.52	0.00019	4.72	<0.000005	2.08	0.0843		<0.000002
V1	21-Feb-08	0.0052	0.00004	0.00031	0.0409	<0.00001	<0.005	<0.005	0.000006	17.4	0.0001	0.000011	0.0002	0.006	0.00001	0.0014	2.69	0.00062		0.00066	0.00021	0.58	0.0002	5.75	<0.000005	2.31	0.0823		<0.000002
V1	10-Mar-08	<0.005	<0.001	<0.001	0.044	<0.001	<0.001	<0.05	<0.0002	18.5	<0.001	<0.001	<0.001	<0.05	<0.001	0.002	3.06	<0.001	<0.00002	0.0007	<0.001	0.7	<0.001	5.9	<0.00025	2.58	0.094	<0.001	<0.0001
V1	11-Mar-08	0.0041	0.00004	0.00029	0.0403	<0.00001	<0.005	<0.005	0.000006	17.1	<0.0001	0.000013	0.00025	0.005	0.000035	0.0013	2.77	0.00062		0.0007	0.00024	0.59	0.00014	4.94	<0.000005	2.28	0.0819		<0.000002
V1	29-Apr-08	0.0039	0.00004	0.0003	0.0392	<0.00001	<0.005	<0.005	0.000007	16.3	<0.0001	0.000012	0.00016	0.005	0.000059	0.0013	2.54	0.00061		0.0007	0.00025	0.58	0.00019	5.45	<0.000005	2.08	0.0817		0.000002
V1	22-May-08	0.0928	0.00004	0.00039	0.0257	0.00002	<0.005	<0.005	0.000114	9.36	0.0002	0.000116	0.00159	0.168	0.00123	0.0009	1.46	0.0228		0.00014	0.00099	1.43	0.00008	3.87	0.000007	1.35	0.0444		0.000003
V1	24-May-08	0.137	0.00003	0.00063	0.0248	0.00003	<0.000005	<0.05	0.000047	7.4	0.0001	0.000255	0.00123	0.344	0.000748		1.12	0.0471		0.0001	0.00082	0.98	0.00008		0.000009	0.96	0.0378		0.000005
V1	10-Jun-08	0.068	<0.001	<0.001	0.015	<0.001	<0.001	<0.05	<0.0002	5.56	<0.001	<0.001	0.002	0.09	<0.001	<0.001	0.87	0.023	<0.00002	<0.0005	<0.001	0.4	<0.001	3.1	0.0005	1.05	0.028	<0.001	<0.0001
V1	25-Jun-08	0.0605	0.00003	0.0002	0.0144	0.00002	<0.005	<0.005	<0.000005	5.38	0.0001	0.000038	0.00053	0.055	0.000136	0.0008	0.75	0.00259		0.00007	0.0003	0.31	<0.00004	3.07	<0.000005	0.96	0.0289		0.000002
V1	29-Jul-08	0.0254	0.00003	0.00023	0.0247	<0.00001	<0.005	<0.005	0.000011	10.4	0.0001	0.000021	0.00056	0.031	0.000112	0.0009	1.5	0.00083		0.00016	0.00028	0.37	0	4.58	<0.000005	2.32	0.0515		<0.000002
V1	02-Sep-08	0.028	<0.001	<0.001	0.02	<0.001	<0.001	<0.05	<0.0002	7.89	<0.001	<0.001	<0.001	<0.05	<0.001	<0.001	1.11	0.001	<0.00002	<0.0005	<0.001	0.3	<0.001	4.2	<0.00025	1.48	0.042	<0.001	<0.0001
V1	17-Sep-08	0.0225	0.00002	0.00021	0.0239	0.00001	<0.005	<0.005	0.000009	9.76	<0.0001	0.000023	0.00059	0.027	0.000195	0.0008	1.44	0.00116		0.00014	0.00025	0.38	0.00008	4.14	<0.000005	1.53	0.0496		0.000004
V1	02-Dec-08	0.019	<0.001	<0.001	0.038	<0.001	<0.001	<0.05	<0.0002	16.8	<0.001	<0.001	<0.001	<0.05	<0.001	0.001	2.88	0.001	<0.00002	<0.0005	<0.001	0.6	<0.001	6.2	<0.00025	2.3	0.072	<0.001	<0.0001
V1	11-Dec-08	0.018	0.00004	0.00025	0.0367	<0.00001	<0.000005	<0.05	0.000009	16.2	0.0001	0.000014	0.00112	0.008	0.000192	0.0012	2.62	0.00021		0.00047	0.00025	0.53	0.00018	5.23	<0.000005	1.95	0.077		<0.000002
V1	25-Feb-09	0.007	0.00004	0.00029	0.0404		0.000006		0.000021	16.9		0.00001	0.00028	0.005	0.000201	0.0013	2.56	0.00066		0.0007	0.00019	0.55	0.00021	4.7		1.83	0.0861		
V1	4-Mar-09	0.0044	0.00004	0.00031	0.038	<0.00001	<0.005		0.000009	17.4	<0.0001	0.000011	0.00027	0.005	0.000023	0.0013	2.96	0.00016		0.00068	0.00021	0.57	0.00022	6.1	<0.000005	2.07	0.0863		<0.000002
V1	26-Mar-09	0.004	0.00003	0.0003	0.0394				0.000006	16.7		0.000011	0.00017	0.002	0.000008	0.0013	2.72	0.00014		0.0007	0.00017	0.57	0.00023	5.15		1.9	0.0848		
V1	8-Apr-09	0.0039	0.00003	0.00033	0.0382	<0.00001	<0.005		0.000009	18	<0.0001	0.000006	0.00021	0.004	0.000025	0.0013	2.96	0.00018		0.0007	0.0002	0.6	0.0002	4.72	<0.000005	2.14	0.0808		<0.000002
V1	5-May-09	0.0976	0.00002	0.00046	0.0229	0.00003	<0.005		0.000041	5.01	<0.0001	0.000111	0.00099	0.243	0.000331	0.0009	0.85	0.0147		0.00012	0.00061	1.41	0.00006	2.35	0.000006	0.79	0.0278		0.000004
V1	10-Jun-09	0.0447	0.00003	0.00025	0.0155	0.00002	<0.005		0.000008	6.12	<0.0001	0.00003	0.00047	0.047	0.000061	<0.0005	0.86	0.00111		0.00010	0.00022	0.34	0.00005	2.95	<0.000005	0.98	0.0305		<0.000002
VR	27-Mar-07	0.024	<0.0002	0.0002	0.038	<0.0002	<0.0002	<0.01	0.00002	13.4	<0.0002	<0.0002	0.0005	0.03	0.0002	0.0004	2.62	0.0012	<0.000015	<0.0001	0.0003	0.73	<0.0002	5.49	<0.00005	2.06	0.064	<0.0002	<0.00002
VR	25-Aug-07	0.0306	<0.00005	<0.0001	0.0287	<0.00005	<0.00005	<0.008	0.00001	10.9	<0.0002	0.00002	0.0006	0.031	0.00007		1.94	0.00106	< 0.00005	0.00014	<0.0005	0.326	<0.0005		<0.00001	1.93	0.054		<0.00005
VR	26-Sep-07	0.0627	<0.00005	<0.0001	0.0251	<0.00005	<0.00005	<0.008	0.00001	8.85	0.0015	0.00006	0.0008	0.042	0.00016	<0.0002	1.66	0.00107	<0.00001	0.00013	<0.0005	0.347	<0.0005	4.23	<0.00001	2.23	0.042		<0.00005
VR	25-Oct-07	0.0205	0.00002	0.00018	0.028	0.00001	<0.000005	<0.005	0.000036	9.89	0.0002	0.00002	0.00088	0.024	0.00032	<0.0005	1.74	0.0018		0.00013	0.00021	0.32	<0.00004	4.08	<0.000005	1.54	0.0529		0.000002
VR	21-Nov-07	0.0245	0.00003	0.00017	0.0327	0.00001	<0.000005	<0.005	0.000012	11	<0.0001	0.000017	0.00045	0.027	0.000149	<0.0005	1.83	0.00176		0.00015	0.00017	0.36	<0.00004	4.5	<0.000005	1.41	0.0566		0.000002
VR	13-Dec-07	0.0286	0.0001	0.00021	0.0338	0.00002	<0.000005	<0.005	0.000026	12.3	0.0001	0.000028	0.00104	0.029	0.000347	0.0006	2.11	0.00267		0.00013	0.00038	0.47	0.00006	5.1	<0.000005	1.78	0.0601		0.000003
VR	24-Jan-08									11.9							2.22					0.41				1.64			
VR	21-Feb-08									12.6							2.2					0.54				1.79			
VR	11-Mar-08									13.2							2.34					0.52				1.76			
VR	29-Apr-08									13.8							2.52					1.2				2.14			
VR	22-May-08									6.28							1.15					1.03				1			
VR	24-May-08	0.421	0.00004	0.00153	0.0354	0.00014	0.000015	<0.05	0.000127	5.09	0.0003	0.000455	0.00272	0.488	0.00543		0.89	0.0781		0.00008	0.00097	0.79	0.00005		0.000014	0.8	0.0292		0.000013
VR	25-Jun-08									4.54							0.8					0.24				1.03			
VR	29-Jul-08									7.02							1.3					0.27				2.23			
VR	19-Aug-08	0.0337	0.00003	0.00023	0.0262	0.00002	<0.000005	<0.05	0.000013	8.15	<0.0001	0.000023	0.0007	0.021	0.000051	<0.0005	1.52	0.00077		0.00011	0.0002	0.29	0.00005	5.7	<0.000005	1.52	0.0458		0.000003
VR	17-Sep-08									7.02							1.27					0.31				1.39			

Table A.3: Background water quality, Faro Mine 2005 - 2009

Station	Date	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Magnesium	Manganese	Mercuy	Molybdenum	Nickel	Potassium	Selenium	Silicon	Silver	Sodium	Strontium	Tellurium	Thallium
	Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
VR	07-Oct-08									7.64							1.46					<0.05				1.46			
VR	11-Dec-08	0.0459	0.00003	0.0002	0.0298	0.00002	<0.000005	<0.05	0.000017	10.9	<0.0001	0.000028	0.00377	0.04	0.000602	<0.0005	2	0.00256		0.00013	0.00015	0.38	0.00005	4.97	<0.000005	1.57	0.0556		0.000003
VR	25-Feb-09	1.43	0.00011	0.00323	0.107	0.00045	0.000021		0.000531	13.2	0.0008	0.00118	0.00551	1.82	0.0142	0.0016	2.19	0.293		0.00009	0.00174	0.54	0.00011	5.55	0.00002	1.43	0.0717		0.000048
VR	20-May-09	0.133	0.00005	0.00068	0.0257	0.00005	0.000006	<0.05	0.000043	7.41	<0.0001	0.000079	0.00156	0.129	0.00127	0.0005	1.41	0.00727		0.00012	0.00049	0.6	0.00006	3.96	0.000008	1.15	0.039		0.000005
VR	23-Jun-09	0.0641	0.00004	0.00047	0.0184	0.00002	0.000008	<0.05	0.000107	7.35	0.0009	0.000175	0.00155	0.075	0.000277	<0.0005	1.6	0.00578		0.0001	0.00041	0.14	0.000009	4.34	0.0359	1.96	0.000011		<0.00001
W10	22-Jun-05	0.043	<0.001	<0.001	0.015	<0.001	<0.001	<0.05	<0.0002	16.1	<0.001	<0.001	0.001	<0.05	<0.001	<0.001	2.11	<0.001	<0.00002	<0.0005	<0.001	0.5	<0.001	14.7	<0.00025	1.79	0.053	<0.001	<0.0001
W10	20-Sep-05	0.012	<0.001	<0.001	0.018	<0.001	<0.001	<0.05	<0.0002	20	<0.001	<0.001	0.001	<0.05	<0.001	0.001	2.5	<0.001	<0.00002	<0.0005	<0.001	0.6	<0.001	16	<0.00025	1.97	0.063	<0.001	<0.0001
W10	07-Jun-06	0.043	<0.001	<0.001	0.009	<0.001	<0.001	<0.05	<0.0002	8.92	<0.001	<0.001	0.002	<0.05	<0.001	0.002	1.16	<0.001	<0.00002	<0.0005	<0.001	0.4	<0.001	4.7	<0.00025	1.26	0.027	<0.001	<0.0001
W10	18-Sep-06	0.011	<0.001	<0.001	0.018	<0.001	<0.001	<0.05	<0.0002	18.9	<0.001	<0.001	<0.001	<0.05	<0.001	0.001	2.41	<0.001	<0.00002	<0.0005	<0.001	0.6	<0.001	7.1	<0.00025	1.87	0.059	<0.001	<0.0001
W10	11-Jun-07	0.13	<0.001	<0.001	0.011	<0.001	<0.001	<0.05	<0.0002	7.67	<0.001	<0.001	0.003	0.14	<0.001	<0.005	1.04	0.003	<0.00002	<0.0005	<0.001	0.4	<0.001	4.8	<0.00025	1.3	0.028	<0.001	<0.0001
W10	25-Sep-07	0.0511	<0.00002	0.0001	0.0134	<0.00001	<0.000005	<0.005	0.00003	16.7	<0.0001	0.00004	0.0011	0.054	0.00031	0.0011	2.13	0.00174		0.0002	<0.00002	0.454	<0.00004	6.05	<0.000005	1.85	0.0541		<0.000002
W10	02-Oct-07	0.02	<0.001	<0.001	0.014	<0.001	<0.001	<0.05	<0.0002	15.1	<0.001	<0.001	<0.001	<0.05	<0.001	<0.001	1.81	0.007	<0.00002	<0.0005	<0.001	0.4	<0.001	5.7	<0.00025	1.77	0.049	<0.001	<0.0001
W10	25-Oct-07	0.0125	0.00003	0.00012	0.0167	<0.00001	<0.000005	<0.005	0.000018	17.3	<0.0001	0.000014	0.00085	0.015	0.000134	0.0012	2.16	0.00045		0.00019	0.00029	0.42	0.00005	5.42	<0.000005	1.77	0.0619		<0.000002
W10	21-May-08	0.153	0.00004	0.00035	0.0127	0.00004	0.000019	<0.05	0.000072	7.47	0.0002	0.000112	0.00256	0.149	0.00229	0.001	1.09	0.0119		0.00009	0.00072	1.09	0.00005	3.36	0.000018	0.83	0.0252		0.000007
W10	01-Jun-08	0.057	<0.001	<0.001	0.008	<0.001	<0.001	<0.05	<0.0002	7.88	<0.001	<0.001	0.002	<0.05	<0.001	<0.001	1.04	<0.001	<0.00002	<0.0005	<0.001	0.4	<0.001	5	<0.00025	1.4	0.027	<0.001	<0.0001
W10	24-Jun-08	0.0292	0.00004	0.00017	0.0125	0.00002	<0.000005	<0.05	0.000017	12.1	0.0001	0.000027	0.00145	0.024	0.000155	0.0012	1.59	0.00035		0.00019	0.00049	0.41	<0.00004	5.62	<0.000005	1.54	0.0434		0.000004
W10	30-Jul-08	0.0234	0.00004	0.00014	0.0143	0.00002	<0.000005	<0.05	0.000021	14.9	0.0002	0.000025	0.00143	0.02	0.000344	0.0011	1.88	0.00046		0.00021	0.00043	0.39	<0.00004	6.49	<0.000005	2.89	0.0532		0.000004
W10	17-Sep-08	0.0217	0.00003	0.00014	0.0135	0.00002	<0.000005	<0.05	0.000022	14.9	<0.0001	0.000025	0.00132	0.018	0.000085	0.001	1.92	0.00035		0.00019	0.00042	0.45	0.00005	5.81	<0.000005	1.68	0.0501		0.000003
W10	29-Sep-08	0.035	<0.001	<0.001	0.014	<0.001	<0.001	<0.05	<0.0002	16	<0.001	<0.001	0.001	<0.05	<0.001	<0.001	2.14	<0.001	<0.00002	<0.0005	<0.001	0.5	<0.001	6.7	<0.00025	1.95	0.056	<0.001	<0.0001
W10	08-Oct-08	0.022	0.00003	0.00013	0.0132	0.00001	<0.000005	<0.05	0.000048	14.9	0.0001	0.000022	0.00111	0.017	0.000304	0.0011	1.98	0.00043		0.0002	0.00037	0.05	<0.00004	5.99	0.000005	1.62	0.0504		<0.000002
W10	7-Apr-09																												
W10	4-May-09	0.158	0.00005	0.00048	0.0156	0.00003	<0.000005		0.000166	6.56	<0.0001	0.000072	0.00259	0.133	0.00234	0.0009	0.99	0.00445		0.00007	0.00067	1.48	0.00005	1.99	0.000022	0.45	0.0234		0.000006
W10	10-Jun-09	0.0362	0.00004	0.0002	0.0108	0.00002	<0.000005		0.000013	10.2	<0.0001	0.000023	0.00175	0.03	0.000648	<0.0005	1.3	0.00083		0.0002	0.00049	0.38	0.00006	5.76	<0.000005	1.38	0.0362		0.000004
NEC/NXT	25-Aug-07																												
NEC/NXT	26-Aug-07	0.0172	<0.00005	<0.0001	0.0256	<0.00005	<0.00005	<0.008	0.00001	16.5	<0.0002	<0.00002	0.0006	0.014	0.00005		2.47	0.00035	<0.00005	0.00024	<0.0005	0.522	<0.0005		<0.00001	2.37	0.0661		<0.00005
1st Trib Rose	27-Mar-07	0.007	<0.0002	0.0002	0.039	<0.0002	<0.0002	<0.01	0.00001	25	<0.0002	<0.0002	0.0004	0.02	0.0004	0.0022	3.57	0.0006	<0.000015	<0.0001	0.0003	0.74	<0.0002	5.88	<0.00005	2.91	0.138	<0.0002	<0.00002
n [a]		179	178	179	179	173	175	160	100	188	174	179	179	179	179	171	188	179	87	179	179	188	175	171	88	188	178	85	172
minimum [a]		0.0034	0.00002	0.00002	0.008	0.00001	0.000005	0.005	0.000005	2.47	0.0001	0.000005	0.00016	0.002	0.000008	0.0002	0.49	0.00014	0.00001	0.00005	0.00002	0.04	0.000005	1.99	0.000005	0.05	0.000003	0.0002	0.000002
maximum [a]		1.430	0.003	0.003	0.120	0.001	0.005	0.120	0.001	77.8	0.003	0.002510	0.00927	1.82	0.030100	0.0110	16	0.29300	0.00005	0.00140	0.00678	1.9	0.003000	16.0	0.00005	5.50	0.251	0.001	0.0002
mean [a,b]		0.0714	0.0003	0.00046	0.0428	0.0002	0.0005	0.0202	0.00004	20.8	0.0004	0.00027	0.0009	0.142	0.0007	0.0025	4.28	0.0145	0.00001	0.0005	0.0005	0.6828	0.0004	5.64	0.00001	1.96	0.0821	0.0005	0.00003
standard deviation (SD) [a,b]		0.1704	0.0003	0.0004	0.0251	0.0002	0.0007	0.0131	0.0001	15.07	0.0004	0.0003	0.0010	0.243	0.0025	0.0024	3.63	0.0297	0.000002	0.0004	0.0006	0.4060	0.0004	2.38	0.00001	0.78	0.0520	0.0001	0.00003
max detection limit [a]		0.005	0.001	0.001	-	0.001	0.005	0.05	0.00001	-	0.001	0.001	0.001	0.05	0.001	0.005	-	0.001	0.0001	0.0005	0.001	0.05	0.001	-	0.0001	0.05	-	0.0010	0.0001
# < detection limit [a]		5	96	78	0	129	163	158	4	0	121	88	61	25	79	32	0	12	87	46	81	3	109	0	68	1	0	84	128
% < detection limit [a]		3%	54%	44%	0%	75%	93%	99%	4%	0%	70%	49%	34%	14%	44%	19%	0%	7%	100%	26%	45%	2%	62%	0%	77%	1%	0%	99%	74%
95th percentile		0.246	0.001	0.001	0.090	0.001	0.005	0.05	0.00011	47	0.001	0.001	0.003	0.47	0.002	0.008	11	0.045	0.00002	0.0012	0.001	1.4	0.001	11.6	0.000021	3.3	0.18	0.001	0.0001
5th percentile		0.005	0.00002	0.00008	0.013	0.00001	0.00001	0.005	0.00001	3.8	0.0001	0.00001	0.0003	0.01	0.00003	0.001	0.8	0.0004	0.00002	0.0001	0.0002	0.1	0.00004	3.1	0.000005	0.8	0.02	0.0004	0.000002
background benchmark		0.246	<0.001	<0.001	0.090	<0.001	<0.005	<0.05	0.00011	47	<0.001	<0.001	0.003	0.47	0.002	0.008	11	0.045	<0.00002	0.0012	<0.001	1.4	<0.001	11.6	0.000021	3.3	0.18	<0.001	<0.0001
current water quality criterion		0.1	0.02	0.005	1.0	1.1	0.26	1.2	0.00003	116	0.001	0.004	0.002	0.3	0.002	-	82	1.0	0.000026	0.073	0.065	53	0.001	-	0.0001	200	9.3	-	0.0008
source		CCME	OMOE	CCME	CCME	OMOE	Alternate	BCMOE	CCME	Alternate	CCME	BCMOE	CCME	CCME	CCME	-	Alternate	BCMOE	CCME	CCME	CCME	Alternate	CCME	-	CCME	CCME	Alternate	-	CCME
proposed new criterion		-	-	-	-	-	-	-	0.00022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
source		-	-	-	-	-	-	-	CCME	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
# > current water quality criterion		27	0	0	0	0	0	0	24	0	5	0	14	15	7	-	0	0	2	0	0	0	4	-	0	0	0	-	0
% > current water quality criterion		15%	0%	0%	0%	0%	0%	0%	24%	0%	3%	0%	8%	8%	4%	-	0%	0%	2%	0%	0%	0%	2%	-	0%	0%	0%	-	0%

< DL greater than guideline, removed
statistical outlier that was removed (mean + 3 SD)
statistical outlier that was not removed (mean + 3 SD)
unusual datum that was removed (silver) or modified (temperature negative values set as "0")

[a] excluding sensored data
[b] values reported as less than the detection limit were used at 1/2 the detection limit for calculation

Table A.3: Background water quality, Faro Mine 2005 - 2009

Station	Date	Thorium	Tin	Titanium	Uranium	Vanadium	Zinc	Zirconium	Alkalinity-C	Alkalinity-H	Alkalinity-PP	Alkalkinity-Total	Ammonia-(total)	Bicarbonate	Chloride	Colour	Conductivity-Field	Conductivity-Lab	Cyanide-WAD	Dissolved Organic Carbon	Dissolved Oxygen	Dissolved Oxygen	Fluoride	Hardness-Dissolved	Hardness-Total	Nitrate	Nitrite	Nitrogen - total	pH-Field
	Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	CU	µS/cm	µS/cm	mg/L	mg/L	mg/L	%	mg/L		mg/L	mg/L	mg/L	mg/L	pH unit
FC	25-Sep-07		<0.00001	0.0014	0.00015	0.00014	0.0061	0.00028	<0.5	<0.5	<0.5	11.6	<0.005	14.1	<0.5		338	29	<0.0005	2.9	10.43		0.09	11.5	12.2	<0.02	<0.005		6.85
FC	25-Oct-07		<0.00001	0.0007	0.000123	<0.0002	0.0018	<0.0001	<0.5	<0.5	<0.5	14	<0.005	17	<0.5		40.2	37	<0.0005	2.1	11.65	80.1	0.08	13.6	12.9	<0.02	<0.005		6.84
FC	21-Nov-07		<0.00001	<0.0005	0.0001	0.0003	0.0021	<0.0001	<0.5	<0.5	<0.5	15	<0.005	18	<0.5		71.3	37	<0.0005	1.2	13.01		0.1	15.1	13.8	0.02	<0.005		6.45
FC	13-Dec-07		<0.00001	<0.0005	0.00009	<0.0002	0.0015	<0.0001	<0.5	<0.5	<0.5	17	<0.005	21	<0.5		29.3	41	<0.0005	1.8			0.11	16.2	16	0.04	<0.005		8.01
FC	24-Jan-08		<0.00001	<0.0005	0.000071	<0.0002	0.0018	<0.0001	<0.5	<0.5	<0.5	18	<0.005	22	<0.5		74.2	43	<0.0005	1.1			0.1	16.6	16.7	0.06	<0.005		7.8
FC	21-Feb-08		<0.00001	<0.0005	0.000064	0.0003	0.0015	<0.0001	<0.5	<0.5	<0.5	23	<0.005	28	<0.5		487	49	<0.0005	0.7	11.95	82.7	0.12	19.1	17.7	0.08	<0.005		7.15
FC	11-Mar-08		<0.00001	<0.0005	0.000063	<0.0002	0.0045	<0.0001	<0.5	<0.5	<0.5	23	<0.005	28	<0.5		53.3	48	<0.0005	0.9	10.25	73.8	0.13	19	18.7	0.08	<0.005		6.1
FC	29-Apr-08		<0.00001	<0.0005	0.000065	<0.0002	0.0053	<0.0001	<0.5	<0.5	<0.5	24	<0.005	29	<0.5		55	52	<0.0005	1.2	12.04	82.9	0.13	20.6	20.4	0.09	<0.005		7.34
FC	22-May-08		<0.00001	0.0021	0.000264	<0.0002	0.0194	0.0002	<0.5	<0.5	<0.5	7.1	<0.005	8.7	0.6		23.8	22	<0.0005	11.3		78.4	0.04	9.9	10.1	<0.02	<0.005		6.49
FC	25-Jun-08		<0.00001	0.0007	0.000226	<0.0002	0.0032	0.0002	<0.5	<0.5	<0.5	5.1	<0.005	6.3	<0.5		27.2	23	<0.0005	5	9.93	80.9	0.06	8.3	8.2	<0.02	<0.005		6.55
FC	30-Jul-08		<0.00001	0.0009	0.000192	0.0002	0.005	0.0002	<0.5	<0.5	<0.5	13	<0.005	15	0.7		35.6	35	<0.0005	4.2	10.45	83.8	0.06	11.1	11.7	<0.02	<0.005		6.84
FC	22-Aug-08		<0.00001	0.0027	0.000195	0.0003	0.0035	0.0001	<0.5	<0.5	<0.5	11	0.02	13	<0.5				<0.0005		3.9		0.07		12.5	<0.02	<0.005		
FC	18-Sep-08		<0.00001	0.0016	0.000198	0.0002	0.0025	0.0002	<0.5	<0.5	<0.5	9.1	<0.005	11	0.7		28.9	26	<0.0005	3.8	11.05	84.7	0.07	9.9	9.8	<0.02	<0.005		6.26
FC	07-Oct-08		0.0011	0.000167	<0.000002	0.0024	0.0001	0.0001	<0.5	<0.5	<0.5	9.4	<0.005	11	1		30.9	23	0.0005	2.6			0.07	9.7	9.7	<0.02	<0.005		7.52
FC	11-Dec-08		0.01	0.0008	0.0001	0.0003	0.0025	<0.0001	<0.5	<0.5	<0.5	16	<0.005	20	0.8		103	37	0.0005	1.5			0.09	15	14.6	0.03	<0.005		
FC	25-Feb-09				0.000069		0.0019					22		27	0.6			47					0.12	18	18.1	0.08			7.5
FC	27-Mar-09				0.000064	0.0003	0.0011					24	0.034	29	4.1			50		0.7			0.13	19.4	19.1	0.1			7.5
FC	7-Apr-09																								10.9				
FC	5-May-09		0.00003	0.0292	0.000561	0.0034	0.0832	0.0007	<0.5	<0.5	<0.5	11	0.02	14	0.9			43		19.4				16.9	25			<0.05	7
FC	20-May-09		<0.00001	0.0013	0.000259	<0.0002	0.014	0.0002	<0.5	<0.5	<0.5	9.5	<0.005	12	0.9			25	<0.0005	12			0.05	11.1	11	<0.02	<0.005		7.1
FC	10-Jun-09		<0.00001	0.0012	0.000283	<0.0002	0.0076	0.0002	<0.5	<0.5	<0.5	10	<0.005	12	0.9			34		4.8				10.8				<0.05	7.1
FC	23-Jun-09		0.0011	0.000224	<0.0002	0.0045	0.0002	0.00017	<0.5	<0.5	<0.5	10	<0.005	12	<0.5			23	<0.0005	5.4			0.07	10.8	11.1	<0.02	<0.005		7.2
R6	29-Mar-05	<0.0005	<0.001	<0.001	0.0031	<0.001	0.006	<0.01	<0.5	<0.5		135	<0.01	165		<5		382							261				7.5
R6	17-Aug-05	<0.0005	<0.001	<0.001	0.0017	<0.001	<0.005	<0.01	<0.5	<0.5		122	<0.01	148		5		240							158				8
R6	21-Feb-06	<0.0005	0.002	<0.001	0.0023	<0.001	0.006	<0.01	<0.5	<0.5		143	0.01	174		<5		317							170				7.9
R6	07-Aug-06	<0.0005	<0.001	<0.001	0.0015	<0.001	<0.005	<0.01	2.3	<0.5		132	<0.01	157		<5		277							144				8.1
R6	20-Feb-07	<0.0005	<0.001	<0.001	0.0022	<0.001	<0.005	<0.01	<0.5	<0.5		159	0.02	194		<5		301							166				8.3
R6	17-Aug-07	<0.0005	<0.001	<0.001	0.0018	<0.001	<0.005	<0.01	<0.5	<0.5		140	<0.01	171		7		263							132				8.1
R6	26-Sep-07		<0.00001	0.0008	0.00165	0.00017	0.005	0.00012	<0.5	<0.5	<0.5	120	<0.005	147	<0.5			264	<0.0005	2.5			0.08	147	141	0.09	<0.005		8.21
R6	24-Oct-07		0.00001	0.0006	0.00219	<0.0002	0.0009	0.0004	<0.5	<0.5	<0.5	141	<0.005	172	<0.5		337	307	<0.0005	1.4	14.65	101.3	0.08	156	155	0.36	<0.005		8.1
R6	22-Nov-07		<0.00001	<0.0005	0.00231	<0.0002	0.0004	<0.0001	<0.5	<0.5	<0.5	140	<0.005	180	<0.5		351	310	<0.0005	0.6	14.58	100	0.08	178	157	0.19	<0.005		7.85
R6	14-Dec-07		<0.00001	<0.0005	0.0023	<0.0002	0.0006	<0.0001	<0.5	<0.5	<0.5	150	<0.005	180	<0.5		379	320	<0.0005	0.6			0.08	170	166	0.2	<0.005		7.99
R6	23-Jan-08		<0.00001	<0.0005	0.00248	<0.0002	0.0008	<0.0001	<0.5	<0.5	<0.5	140	<0.005	180	<0.5		272	320	<0.0005	1	11.08	42.8	0.07	169	167	0.22	<0.005		6.8
R6	20-Feb-08		<0.00001	<0.0005	0.00244	<0.0002	0.0014	<0.0001	<0.5	<0.5	<0.5	150	<0.005	190	<0.5		355	330	<0.0005	1.1		85.1	0.08	173	159	0.2	<0.005		7.6
R6	04-Mar-08	<0.0005	<0.001	<0.001	0.0021	<0.001	<0.005	<0.01	<0.5	<0.5		159	<0.01	194		<5		323							186				7.8
R6	13-Mar-08		<0.00001	<0.0005	0.0024	<0.0002	0.0037	<0.0001	<0.5	<0.5	<0.5	150	<0.005	180	<0.5		214	310	<0.0005	0.8	12.54	83.5	0.08	171	167	0.2	0.007		6.43
R6	28-Apr-08		<0.00001	<0.0005	0.00225	<0.0002	0.004	<0.0001	<0.5	<0.5	<0.5	130	<0.005	160	<0.5		314	290	<0.0005	1.1	11.15	80.5	0.07	157	147	0.14	<0.005		7.96
R6	21-May-08		0.00007	0.0104	0.000577	0.0008	0.0053	0.0003	<0.5	<0.5	<0.5	49	<0.005	59	1.2		118.2	110	<0.0005	12.2		88.6	0.03	58.9	60.3	0.03	<0.005		7.91
R6	24-Jun-08		<0.00001	0.0068	0.00083	0.0007	0.0034	0.0002	<0.5	<0.5	<0.5	68	<0.005	83	0.7		163.5	160	<0.0005	6.4	11.14	89.8	0.05	80.2	75.2	0.02	<0.005		7.44
R6	22-Jul-08		<0.00001	0.0023	0.00117	0.0002	0.0008	0.0001	<0.5	<0.5	<0.5	99	<0.01	120										116	115				
R6	29-Jul-08		<0.00001	0.0007	0.00144	0.0002	0.0015	<0.0001	<0.5	<0.5	<0.5	120	<0.005	140	0.7		260	260	<0.0005	3.4	9.87	86.6	0.06	131	124	0.11	<0.005		8.34
R6	19-Aug-08	<0.0005	<0.001	<0.001	0.0015	<0.001	<0.005	<0.01	2.6	<0.5		151	0.01			7		258						179	146				8
R6	04-Sep-08		<0.00001	0.0014	0.00145	<0.0002	0.0006	<0.0001	<0.5	<0.5	<0.5	110	<0.01	130				260						136	129				
R6	17-Sep-08		<0.00001	0.0012	0.00139	<0.0002	0.0006	<0.0001	<0.5	<0.5	<0.5	120	<0.005	140	0.6		270	250	0.0005	4.3	11.84	88.8	0.07	134	128	0.09	<0.005		7.79
R6	08-Oct-08		<0.00001	0.00166	<0.000002	0.0011	<0.0001	0.00101	1.5	<0.5	1.2	130	<0.005	150	1.3		281	280	<0.0005	1			0.07	143	144	0.1	<0.005		8.35
R6	10-Dec-08		0.00002	0.0015	0.00235	<0.0002	0.0018	<0.0001	<0.5	<0.5	<0.5	150	<0.005	180	<0.5		414	310	<0.0005	1.8			0.08	176	172	0.2	<0.005		7.38
R6	24-Feb-09		0.00002		0.00238		0.0086					150	0.007	180	1			490		1.8			0.13	233	251	0.24			8.1
R6	26-Mar-09				0.00256		0.0013					160	0.03	190				340		1			0.09	165	166	0.22			8.2
R6	20-May-09		<0.00001	0.0036	0.00112	<0.0002	0.0023	0.0002	<0.5	<0.5	<0.5	88	<0.005	110	1.1			190	<0.0005	8.2			0.05	96.5	92.6	0.06	<0.005		8.1
R6	23-Jun-09		0.0021	0.00129	<0.0002	0.0026	0.0001	0.00084	<0.5	<0.5	<0.5	110	<0.005	130	0.7			210	<0.0005	4.4			0.06	104	109	0.05	<0.005		8.1
R7	21-Jan-05																												7.3
R7	22-Jan-05	<0.0005	<0.001	<0.001	0.002	<0.001	0.035	<0.01					<0.01					240							133				
R7	09-Feb-05	<0.0005	<0.001	<0.001	0.0021	<0.001	0.025	<0.01					0.02					240							134				7.4
R7	14-Mar-05	<0.0005	<0.001	0.001	0.0024	<0.001	0.013	<0.01					0.01					229							143				7.8
R7	11-Apr-05	<0.0005	<0.001	<0.001	0.0023	<0.001	<0.005	<0.01										238							132				7.7
R7	09-May-05	<0.0005	<0.001	0.008	<0.0005	<0.001	0.007	<0.01					0.02					53							28				7.8
R7	20-Jun-05	<0.0005	<0.001	0.002	0.0007	<0.001	<0.005	<0.01					0.07					133							68				7.9
R7	26-Jul-05	<0.0005	<0.001	0.001	0.0008	<0.001	<0.005	<0.01					0.03					144							72				7.6
R7	23-Aug-05	<0.0005	<0.001	<0.001	0.0011	<0.001	<0.005	<0.01					<0.01					157							99				7.7
R7	06-Sep-05	0.002	<0.001	<0.001	0.0013	<0.001	0.006	<0.01					<0.01					140							80				8.1
R7	11-Oct-05	<0.0005	0.002	0.001	0.0011	<0.001	<0.005	<0.01					0.02					145							103				7.7
R7	02-Nov-05	<0.0005	<0.001	<0.001	0.0016	<0.001	<0.005	<0.01					<0.01					172							112				7.9
R7	13-Dec-05	<0.0005	<0.001	<0.001	0.0016	<0.001	<0.005	<0.01					<0.01					236							123				7.6
R7	24-Jan-06	<0.0005	<0.001	<0.001	0.0018	<0.001	0.005	<0.01					<0.01					260							129				8
R7	14-Feb-06	<0.0005	<0.001	<0.001	0.002	<0.001	0.01	<0.01					0.01					264							132				7.7
R7	25-Mar-06	<0.0005	<0.001	<0.001	0.0024	<0.001	<0.005	<0.01					<0.01					289							138				7.8
R7	24-Apr-06	<0.0005	<0.001	<0.001	0.002	<0.001	<0.005	<0.01					0.01					278							126				8
R7	18-May-06	<0.0005	<0.001	0.007	<0.0005	<0.001	0.006	<0.01					<0.01					64							33				8.2
R7	19-Jun-06	<0.0005	<0.001	0.002	0.0007	<0.001	<0.005	<0.01					<0.01					111							59				8
R7	17-Jul-06	<0.0005	<0.001	<0.001	0.0006	<0.001	<0.005	<0.01					<0.01					151							76				8
R7	22-Aug-06	<0.0005	<0.001	<0.001	0.0008	<0.001	<0.005	<0.01					0.02					154							76				7.9
R7	12-Sep-06	<0.0005	<0.001	<0.001	0.0007	<0.001	<0.005	<0.01					0.01					159							74				8
R7	16-Oct-06	<0.0005	<0.001	<0.001	0.0014	<0.001	<0.005	<0.01					<0.01					263							100				7.9
R7	14-Nov-06	<0.0005	<0.001	<0.001	0.0019	<0.001	<0.005	<0.01					<0.01					240							117				7.8
R7	14-Dec-06	<0.0005	<0.001	<0.001	0.0023	<0.001	<0.005	<0.01					<0.01					267							126				7.8
R7	14-Feb-07	<0.0005	<0.001	<0.001	0.0025	<0.001	<0.005	<0.01					0.02					264							141				7.8
R7	12-Mar-07	<0.0005	<0.001	<0.001	0.003	<0.001	<0.005	<0.01					0.03					260							147				8
R7	27-Mar-07	<0.0001	<0.0002	0.0005	0.0034	<0.0002	<0.001	<0.002	<0.5	<0.5		157		191	<0.2	<5		294							147				
R7	19-Apr-07	<0.0005	<0.001	<0.001	0.0022	<0.001	0.016	<0.01					<0.01					275							139				7.7
R7	15-May-07	<0.0005	<0.001	0.014	0.0005	0.001	0.007	<0.01					0.02					95							47				7.6
R7	19-Jun-07	<0.0005	<0.001	0.004	0.0008	<0.001	0.017	<0.01					<0.01					126							66				7.9
R7	17-Jul-07	<0.0005	<0.001	0.002	<0.0005	<0.001	<0.005	<0.01					<0.01					126							53				7.7

Table A.3: Background water quality, Faro Mine 2005 - 2009

Station	Date	Thorium	Tin	Titanium	Uranium	Vanadium	Zinc	Zirconium	Alkalinity-C	Alkalinity-H	Alkalinity-PP	Alkalkinity-Total	Ammonia-(total)	Bicarbonate	Chloride	Colour	Conductivity-Field	Conductivity-Lab	Cyanide-WAD	Dissolved Organic Carbon	Dissolved Oxygen	Dissolved Oxygen	Fluoride	Hardness-Dissolved	Hardness-Total	Nitrate	Nitrite	Nitrogen - total	pH-Field
	Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	CU	µS/cm	µS/cm	mg/L	mg/L	mg/L	%	mg/L		mg/L	mg/L	mg/L	mg/L	pH unit
R7	14-Aug-07	<0.0005	<0.001	0.003	0.001	<0.001	<0.005	<0.01					0.02					151							79				7.7
R7	11-Sep-07	<0.0005	<0.001	0.004	0.0007	<0.001	0.011	<0.01					0.02					131							57				7.5
R7	23-Oct-07	<0.0005	<0.001	<0.001	0.0012	<0.001	<0.005	<0.01					<0.01					192							96				7.8
R7	14-Nov-07	<0.0005	<0.001	<0.001	0.0013	<0.001	<0.005	<0.01					0.02					213							112				7.6
R7	09-Dec-07	<0.0005	<0.001	<0.001	0.0017	<0.001	<0.005	<0.01					0.02					234							110				7.4
R7	08-Jan-08	<0.0005	<0.001	<0.001	0.0018	<0.001	0.008	<0.01					0.01					251							119				7.9
R7	19-Feb-08	<0.0005	<0.001	<0.001	0.0015	0.002	<0.005	<0.01					0.01					269							132				8.1
R7	18-Mar-08	<0.0005	<0.001	<0.001	0.0025	<0.001	<0.005	<0.01					<0.01					268							139				7.5
R7	14-Apr-08	<0.0005	<0.001	<0.001	0.0026	<0.001	<0.005	<0.01					0.02					259							141				7.7
R7	15-May-08	<0.0005	<0.001	0.004	0.0005	<0.001	0.014	<0.01					0.03					72							40				8.8
R7	25-May-08		0.00001	0.0113	0.000385	0.0006	0.01	0.0003	<0.5	<0.5	<0.5	17	0.15	21	1.9				<0.0005	9.6			0.05		25.2	<0.02	<0.005	0.28	
R7	17-Jun-08	<0.0005	<0.001	0.004	0.0007	<0.001	0.008	<0.01					0.02					106							69				8.2
R7	15-Jul-08	<0.0005	<0.001	0.03	0.0005	0.001	0.012	<0.01					<0.01					93							47				7.8
R7	22-Jul-08		<0.00001	0.0017	0.000638	0.0003	0.0008	0.0001	<0.5	<0.5	<0.5	58	<0.01	71										67.9	63.6				
R7	12-Aug-08	<0.0005	<0.001	0.002	0.0007	<0.001	<0.005	<0.01					0.01					147							76				7.6
R7	21-Aug-08		<0.00001	<0.0005	0.000962	<0.0002	0.0016	<0.0001	<0.5	<0.5	<0.5	78	<0.01	96	<0.5				<0.0005	3.7			0.09	81	80.1	<0.02	<0.005	0.07	
R7	04-Sep-08		<0.00001	0.0007	0.000789	<0.0002	0.0008	<0.0001	<0.5	<0.5	<0.5	62	0.04	76				150						68.7	69.7				
R7	15-Sep-08	<0.0005	<0.001	0.003	0.0009	<0.001	<0.005	<0.01					0.02					138							58				7.3
R7	15-Oct-08	<0.0005	<0.001	<0.001	0.001	<0.001	<0.005	<0.01					0.02					170							79				7.6
R7	04-Nov-08	<0.0005	<0.001	<0.001	0.0013	<0.001	<0.005	<0.01					0.02					187							99				8.2
R7	02-Dec-08	<0.0005	<0.001	<0.001	0.0017	<0.001	0.014	<0.01					0.02					218							116				7.8
R7	13-Jan-09	<0.0005	<0.001	<0.001	0.0024	<0.001	<0.005	<0.01					0.01					254							131				7.5
R7	03-Feb-09	<0.0005	<0.001	<0.001	0.0021	<0.001	<0.005	<0.01					0.03					249							129				7.7
R7	4-Mar-09		<0.00001	<0.0005	0.00261	<0.0002	0.0007	<0.0001	<0.5	<0.5	<0.5	130	0.09	160	0.6			260		1.4				136	136			<0.05	8.2
R7	7-Apr-09		<0.00001	<0.0005	0.00276	<0.0002	0.0017	<0.0001	<0.5	<0.5	<0.5	140	<0.01	170	<0.5			270		1.6				134	136			<0.05	8.1
R7	5-May-09		<0.00001	0.0023	0.00027	<0.0002	0.0092	0.0002	<0.5	<0.5	<0.5	26	0.02	31	1.2			55		21.8				29.1	27.5			<0.05	7.4
R7	10-Jun-09		<0.00001	0.0013	0.000546	<0.0002	0.0015	0.0001	<0.5	<0.5	<0.5	44	<0.005	54	0.7			96		3.9				44.7				<0.05	7.8
USFR	27-Mar-07	<0.0001	<0.0002	0.0007	0.0024	<0.0002	<0.001	<0.002	<0.5	<0.5		63.3		77.2	<0.2	<5		130							58.2				
USFR	25-Aug-07		<0.00005	0.0008	0.00029	0.00008	0.0019	<0.005			<0.5	21.9	<0.005		<0.5		60	59		1.9	9.1	81.3	0.07	26.1		<0.02	<0.005		7.08
USFR	24-May-08		0.00001	0.0047	0.000871	0.0003	0.0089	0.0002	<0.5	<0.5	<0.5	7.6	0.16	9.2	0.9				<0.0005	6.6			0.05		15.3	<0.02	<0.005	0.24	
USFR	19-Aug-08		<0.00001	0.0015	0.000388	<0.0002	0.0013	<0.0001	<0.5	<0.5	<0.5	17	<0.01	20	<0.5				<0.0005	3.7			0.06	21.3	21.5	<0.02	<0.005	0.07	
V1	07-Mar-05	<0.0005	<0.001	<0.001	0.0014	<0.001	0.011	<0.01					<0.01			<5		95							56				
V1	07-Jun-05	<0.0005	<0.001	0.001	<0.0005	<0.001	0.006	<0.01	<0.5	<0.5		18.8	0.03	23		7		42							18				7
V1	12-Sep-05	<0.0005	0.002	<0.001	<0.0005	<0.001	<0.005	<0.01					<0.01			5		67							29				8
V1	01-Dec-05	<0.0005	<0.001	<0.001	0.0006	<0.001	<0.005	<0.01	<0.5	<0.5		35.5	<0.01	43.3		<5		104							47				8.1
V1	20-Mar-06	<0.0005	<0.001	0.001	0.0012	<0.001	0.038	<0.01	<0.5	<0.5		45.4	<0.01	55.4		<5		121							59				8.1
V1	05-Jun-06	<0.0005	<0.001	0.003	<0.0005	<0.001	<0.005	<0.01	<0.5	<0.5		14.8	<0.01	18.1		**20**		35							13				8.3
V1	09-Jun-06	<0.0005	<0.001	<0.001	<0.0005	<0.001	<0.005	<0.01	<0.5	<0.5		26.2	<0.01	32		<5		73							29				8.1
V1	06-Sep-06	<0.0005	<0.001	<0.001	<0.0005	<0.001	<0.005	<0.01	<0.5	<0.5		26.2	<0.01	32		<5		73							29				8.1
V1	27-Mar-07	<0.0001	<0.0002	0.0003	0.0025	<0.0002	<0.001	<0.002	<0.5	<0.5		53.5		65.3	<0.2	<5		125							54.5				
V1	18-Jun-07	<0.0005	<0.001	0.002	<0.0005	<0.001	<0.005	<0.01	<0.5	<0.5		21.4	<0.01	26.1		8		48							21				7.5
V1	28-Aug-07		<0.00005	<0.0005	0.00031	<0.00005	0.0027	<0.005			<0.5	24.4	<0.005		<0.5		48	71		1.4	12.1	98.5	0.07	30.8		<0.02	<0.005		6.52
V1	29-Aug-07																43				12.8	99.1							6.37
V1	24-Sep-07	<0.0005	<0.001	<0.001	<0.0005	<0.001	0.006	<0.01	<0.5	<0.5		25.8	<0.01	31.5		<5		71							26				7.2
V1	26-Sep-07		<0.00001	<0.0005	0.0003	<0.0002	0.0012	0.00012	<0.5	<0.5	<0.5	22.2	<0.005	27	<0.5			66	<0.0005	0.7			0.08	30.5	28.7	0.03	<0.005		7.58
V1	24-Oct-07		0.00013	<0.0005	0.000522	<0.0002	0.0013	<0.0001	<0.5	<0.5	<0.5	32.1	<0.005	39.1	<0.5		60.4	90	<0.0005	1.3	12	81.9	0.08	37.9	36.3	0.82	<0.005		7.69
V1	22-Nov-07		0.00001	<0.0005	0.000646	<0.0002	0.0006	<0.0001	<0.5	<0.5	<0.5	37	<0.005	46	<0.5		99.4	100	<0.0005	1.4			0.09	49	48.3	0.06	<0.005		7.25
V1	10-Dec-07	<0.0005	<0.001	<0.001	0.0008	<0.001	<0.005	<0.01	<0.5	<0.5		40.3	<0.01	49.2		<5		106							42				7.6
V1	14-Dec-07		<0.00001	<0.0005	0.00094	<0.0002	0.0009	<0.0001	<0.5	<0.5	<0.5	42	<0.005	51	<0.5		320	110	<0.0005	1.1			0.1	50.7	49	0.09	<0.005		8.01
V1	23-Jan-08		<0.00001	<0.0005	0.0012	<0.0002	0.0005	<0.0001	<0.5	<0.5	<0.5	42	<0.005	52	<0.5		126.4	110	<0.0005	1.5			0.1	51.3	51.3	0.11	<0.005		7.28
V1	21-Feb-08		<0.00001	<0.0005	0.00135	<0.0002	0.0005	<0.0001	<0.5	<0.5	<0.5	48	<0.005	58	<0.5		126.5	120	<0.0005	0.7	12.59	86.7	0.15	52.5	54.6	0.12	<0.005		6.86
V1	10-Mar-08	<0.0005	<0.001	<0.001	0.0014	<0.001	<0.005	<0.01	<0.5	<0.5		49.4	<0.01	60.2		<5		116							59				7.2
V1	11-Mar-08		<0.00001	<0.0005	0.00147	<0.0002	0.0041	<0.0001	<0.5	<0.5	<0.5	47	<0.005	57	<0.5		125.4	120	<0.0005	0.8		81.7	0.12	54	54.1	0.13	0.005		6.3
V1	29-Apr-08		<0.00001	<0.0005	0.00144	<0.0002	0.004	<0.0001	<0.5	<0.5	<0.5	45	<0.005	55	<0.5		129	120	<0.0005	0.8	11.23	78.4	0.11	53.4	51.2	0.12	<0.005		7.82
V1	22-May-08		<0.00001	0.0012	0.000459	<0.0002	0.0166	0.0002	<0.5	<0.5	<0.5	22	<0.005	26	0.7		70.1	62	<0.0005	9.3		82.5	0.04	33.7	29.4	<0.02	0.005		7.7
V1	24-May-08		<0.00001	0.0021	0.000613	<0.0002	0.0058	0.0001	<0.5	<0.5	<0.5	15	0.13	18	0.8				<0.0005	7.5			0.05		23.1	<0.02	<0.005	0.17	
V1	10-Jun-08	<0.0005	<0.001	0.001	<0.0005	<0.001	<0.005	<0.01	<0.5	<0.5		16.2	0.02	19.7		18		42							17				7.5
V1	25-Jun-08		<0.00001	0.0006	0.000399	<0.0002	0.0012	0.0001	<0.5	<0.5	<0.5	12	<0.005	15	<0.5		48.8	43	<0.0005	3	10.81	85.4	0.05	18	16.5	<0.02	<0.005		6.76
V1	29-Jul-08		<0.00001	<0.0005	0.000374	<0.0002	0.0016	<0.0001	<0.5	<0.5	<0.5	27	<0.005	33	0.7		92.3	78	<0.0005	2.5		84.1	0.06	32.7	32.2	<0.02	<0.005		7.45
V1	02-Sep-08	<0.0005	<0.001	<0.001	<0.0005	<0.001	<0.005	<0.01	<0.5	<0.5		28.2	<0.01	34.5		8		62							24				8.3
V1	17-Sep-08		0.00001	0.0005	0.000343	<0.0002	0.0032	<0.0001	<0.5	<0.5	<0.5	29	<0.005	36	0.7		83.4	73	<0.0005	2.6	11.12	83.4	0.06	33.3	30.3	<0.02	<0.005		6.93
V1	02-Dec-08	<0.0005	<0.001	<0.001	0.0007	<0.001	<0.005	<0.01	<0.5	<0.5		40.8	0.02	49.8		<5		107							54				8.2
V1	11-Dec-08		0.05	<0.0005	0.000918	<0.0002	0.0015	<0.0001	<0.5	<0.5	<0.5	44	<0.005	54	1.6		303	110	<0.0005	1.6			0.09	51.4	51.3	0.06	<0.005		
V1	25-Feb-09				0.00151		0.0014					50		61				120					0.12	51.3	52.8	0.12			7.9
V1	4-Mar-09		<0.00001	<0.0005	0.00162	<0.0002	0.0006	<0.0001	<0.5	<0.5	<0.5	51	<0.01	62	<0.5			120		1.5				53.3	55.7			<0.05	7.8
V1	26-Mar-09				0.00172		0.0003					51	0.027	63				130		1.1			0.12	52.8	52.8	0.14			7.9
V1	8-Apr-09		<0.00001	<0.0005	0.00165	<0.0002	0.0007	<0.0001	<0.5	<0.5	<0.5	52	<0.01	64	<0.5			130		1.9				53.4	57.2			<0.05	7.8
V1	5-May-09		<0.00001	0.0013	0.000554	<0.0002	0.004	0.0001	<0.5	<0.5	<0.5	13	0.05	16	1.0			39		10.4				15.8	16			<0.05	7.2
V1	10-Jun-09		<0.00001	0.0007	0.000388	<0.0002	0.0005	<0.0001	<0.5	<0.5	<0.5	16	<0.005	20	0.6			45		2.9				18.1	18.8			<0.05	7.2
VR	27-Mar-07	<0.0001	<0.0002	0.0006	0.0008	<0.0002	0.001	<0.002	<0.5	<0.5		45.1		55	0.32	<5		103							44.2				
VR	25-Aug-07		<0.00005	<0.0005	0.00037	<0.00005	0.0021	<0.005			<0.5	30.6	<0.005		<0.5		97	75		3.1	10.8	84	0.08	35		<0.02	<0.005		4.73
VR	26-Sep-07		<0.00005	0.0041	0.00035	0.00005	0.0049	0.23	<0.5	<0.5	<0.5	26	<0.005	31.7	<0.5			62	<0.0005	2.5			0.08	30.3	28.9	<0.02	<0.005		7.3
VR	25-Oct-07		0.00005	<0.0005	0.000409	0.0002	0.0024	0.0001	<0.5	<0.5	<0.5	30.2	0.009	36.8	<0.5		84	76		2.1	12.42	85.1	0.07	33	31.8	0.11	<0.005		
VR	21-Nov-07		<0.00001	<0.0005	0.000437	0.0002	0.0009	<0.0001	<0.5	<0.5	<0.5	32	0.028	40	<0.5		102.8	79	<0.0005	1.2	13.04		0.07	37.7	35	0.05	<0.005		6.87
VR	13-Dec-07		0.00003	<0.0005	0.000433	<0.0002	0.0031	0.0001	<0.5	<0.5	<0.5	35	<0.005	42	<0.5		212	85	<0.0005	1.4			0.08	38.7	39.3	0.06	<0.005		8.44
VR	24-Jan-08								<0.5	<0.5	<0.5	36	<0.005	44	<0.5		188	89	<0.0005	1.6			0.07	40.9	39	0.08	<0.005		7.5
VR	21-Feb-08								<0.5	<0.5	<0.5	40	<0.005	49	<0.5		88.7	97	<0.0005	1.6	11.09	76.7	0.07	42.7	40.5	0.06	<0.005		7.7
VR	11-Mar-08								<0.5	<0.5	<0.5	41	<0.005	51	<0.5		113.1	94	<0.0005	1.8	11.49	78.9	0.08	44.3	42.6	0.08	0.005		7.43
VR	29-Apr-08								<0.5	<0.5	<0.5	41	0.006	50	1.1		112.5	100	<0.0005	2.4	10.89	80.3	0.07	45.6	44.9	0.07	<0.005		7.45
VR	22-May-08								<0.5	<0.5	<0.5	12	<0.005	14	0.7		188.8	38	<0.0005	16.4		83.2	0.04	19.7	20.4	<0.02	<0.005		7.1
VR	24-May-08		<0.00001	0.0087	0.00169	0.0006	0.0137	0.0004	<0.5	<0.5	<0.5	7.7	<0.01	9.4	0.6				<0.0005	11.9			0.06		16.4	<0.02	<0.005	0.28	
VR	25-Jun-08								<0.5	<0.5	<0.5	9.6	<0.005	12	<0.5		37.7	35	<0.0005	4.6	11.19	82.5	0.07	15	14.6	<0.02	<0.005		6.73
VR	29-Jul-08								<0.5	<0.5	<0.5	21	<0.005	26	0.9		63.8	55	<0.0005	4.4	10.28	82.1	0.06	23.2	22.9	<0.02	<0.005		6.61
VR	19-Aug-08		<0.00001	<0.0005	0.000397	<0.0002	0.0007	0.0002	<0.5	<0.5	<0.5	25	<0.01	31	0.6				<0.0005	4.2			0.06	26.3	26.6	<0.02	<0.005	0.11	
VR	17-Sep-08								<0.5	<0.5	<0.5	21	<0.005	25	40		56.5	51	<0.0005	4.8	10.99	83.1	0.09	22.7	22.8	<0.02	<0.005		6.37

Table A.3: Background water quality, Faro Mine 2005 - 2009

Station	Date	Thorium	Tin	Titanium	Uranium	Vanadium	Zinc	Zirconium	Alkalinity-C	Alkalinity-H	Alkalinity-PP	Alkalkinity-Total	Ammonia-(total)	Bicarbonate	Chloride	Colour	Conductivity-Field	Conductivity-Lab	Cyanide-WAD	Dissolved Organic Carbon	Dissolved Oxygen	Dissolved Oxygen	Fluoride	Hardness-Dissolved	Hardness-Total	Nitrate	Nitrite	Nitrogen - total	pH-Field
	Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	CU	µS/cm	µS/cm	mg/L	mg/L	mg/L	%	mg/L		mg/L	mg/L	mg/L	mg/L	pH unit
VR	07-Oct-08								<0.5	<0.5	<0.5	25	<0.005	30	1		68.5	54	<0.0005	1.8			0.07	26.1	25.1	<0.02	<0.005		6.8
VR	11-Dec-08		0.00002	0.0013	0.000481	<0.0002	0.0025	0.0001	<0.5	<0.5	<0.5	33	<0.005	40	0.5		78.3	78	<0.0005	2.9			0.07	36.4	35.3	0.04	<0.005		
VR	25-Feb-09		0.00002	0.0181	0.00619	0.002	0.0273	0.0004				38	0.006	46	0.7			89		0.9			0.07	43.1	42.1	0.09			7.7
VR	20-May-09		<0.00001	0.0021	0.000739	0.0003	0.0042	0.0003	<0.5	<0.5	<0.5	23	<0.005	28	0.7			53	<0.0005	8.9			0.06	25.4	24.3	<0.02	<0.005		7.5
VR	23-Jun-09		0.0006	0.000476	<0.0002	0.0034	0.0002	0.00031	<0.5	<0.5	<0.5	24	<0.005	29	0.5			50	<0.0005	4.9			0.07	22.2	24.9	<0.02	<0.005		7.6
W10	22-Jun-05	<0.0005	0.001	0.002	<0.0005	<0.001	<0.005	<0.01					<0.01					98							49				7.5
W10	20-Sep-05	<0.0005	<0.001	<0.001	<0.0005	<0.001	0.005	<0.01					<0.01					107							60				7.9
W10	07-Jun-06	<0.0005	<0.001	<0.001	<0.0005	<0.001	<0.005	<0.01					<0.01					62							27				7.9
W10	18-Sep-06	<0.0005	<0.001	<0.001	<0.0005	<0.001	<0.005	<0.01					<0.01					123							57				7.8
W10	11-Jun-07	<0.0005	<0.001	0.003	<0.0005	<0.001	0.008	<0.01					0.04					55											7.2
W10	25-Sep-07		<0.00001	0.0019	0.00011	0.00021	0.0062	0.00022	<0.5	<0.5	<0.5	47.2	<0.005	57.6	<0.5		113.5	101	<0.0005	3.5	10.8		0.11	52	50.4	<0.02	<0.005		7.38
W10	02-Oct-07	<0.0005	<0.001	<0.001	<0.0005	<0.001	0.023	<0.01					<0.01					106							45				7.7
W10	25-Oct-07		0.00001	<0.0005	0.000117	<0.0002	0.0017	<0.0001	<0.5	<0.5	<0.5	52.4	<0.005	63.9	<0.5		126.2	114	<0.0005	2.8	11.47	79.5	0.09	52.4	52.2	<0.02	<0.005		7.4
W10	21-May-08		<0.00001	0.0034	0.000122	<0.0002	0.0164	0.0002	<0.5	<0.5	<0.5	17	<0.005	21	1.3		46.8	43	<0.0005	11.4		84.4	0.04	21.9	23.1	<0.02	<0.005		7.08
W10	01-Jun-08	<0.0005	<0.001	<0.001	<0.0005	<0.001	<0.005	<0.01					<0.01					54							24				7.6
W10	24-Jun-08		<0.00001	<0.0005	0.000114	<0.0002	0.0023	0.0002	<0.5	<0.5	<0.5	34	<0.005	42	<0.5		86.6	82	<0.0005	4.5	9.66	76.5	0.09	37.6	36.7	<0.02	<0.005		7.46
W10	30-Jul-08		<0.00001	<0.0005	0.000126	0.0002	0.0045	0.0001	<0.5	<0.5	<0.5	49	<0.005	59	<0.5		123.8	110	<0.0005	4.6	10.57	82.1	0.08	47.7	44.9	<0.02	<0.005		7.41
W10	17-Sep-08		<0.00001	<0.0005	0.000113	<0.0002	0.0018	0.0001	<0.5	<0.5	<0.5	45	<0.005	55	0.7		106.7	94	<0.0005	4.9	11.5	86.6	0.09	44.8	45	<0.02	<0.005		7.14
W10	29-Sep-08	<0.0005	<0.001	<0.001	<0.0005	<0.001	<0.005	<0.01					0.04					95							49				7.1
W10	08-Oct-08		<0.00001	0.000125	<0.000002	0.0026	0.0001	0.0004	<0.5	<0.5	<0.5	48	<0.005	58	1		113.8	100	0.0006	3.2			0.1	46	45.4	<0.02	<0.005		
W10	7-Apr-09																								30.8				
W10	4-May-09		<0.00001	0.001	0.000062	<0.0002	0.0389	0.0002	<0.5	<0.5	<0.5	15	0.06	18	1.2			41		23.5				21.2	20.5			<0.05	7.2
W10	10-Jun-09		<0.00001	0.0013	0.000137	0.0002	0.0046	0.0002	<0.5	<0.5	<0.5	33	<0.005	41	0.9			72		5.6				29.6				<0.05	7.7
NEC/NXT	25-Aug-07																136				11.4	87.5							7.50
NEC/NXT	26-Aug-07		<0.00005	<0.0005	0.00029	0.00006	0.0019	<0.005			<0.5	47.4	<0.005		<0.5			102		2.7			0.09	49.7		<0.02	<0.005		
1st Trib Rose	27-Mar-07	<0.0001	<0.0002	0.0004	0.0078	<0.0002	0.001	<0.002				78.2		95.3	<0.2			168							77.1				
n [a]		84	174	173	179	174	179	91	117	117	96	129	180	124	100	26	62	178	75	96	41	44	87	99	182	87	80	19	165
minimum [a]		0.0001	0.00001	0.000125	0.000002	0.00005	0.0001	0.0001	0.5	0.5	0.5	5.1	0.005	6.3	0.2	5	23.8	22	0.0005	0.6	3.9	42.8	0.03	8.3	8.2	0.02	0.005	0.05	6.1
maximum [a]		0.0005	0.050	0.030	0.0078	0.0045	0.0832	0.0050	2.6	0.5	1.2	160	0.160	194	4.1	18	414	490	0.0006	23.5	14.65	101.3	0.15	233	261	0.82	0.007	0.280	8.800
mean [a,b]		0.0002	0.0006	0.0017	0.0011	0.0004	0.0051	0.0003	0.30	0.25	0.26	54.0	0.0117	65.7	0.56	4.2	135.2	142.2	0.0003	4.1	11.24	83.40	0.0792	58.6	70.6	0.07	0.0027	0.080	7.6
standard deviation (SD) [a,b]		0.00005	0.0039	0.0038	0.0011	0.0006	0.0086	0.0005	0.31	0	0.10	47.2	0.0217	57.2	0.51	3.4	103.4	95.6	0.0001	4.5	1.65	8.62	0.0242	53.2	52.8	0.11	0.0007	0.092	0.5
max detection limit [a]		0.0005	0.001	0.001	0.0005	0.001	0.005	0.005	0.5	0.5	0.5	-	0.01	-	0.5	5	-	-	0.0005	-	-	-	-	-	-	0.02	0.005	0.05	-
# < detection limit [a]		84	149	94	26	137	58	46	114	117	95	0	125	0	54	18	0	0	71	0	0	0	0	0	0	40	76	12	0
% < detection limit [a]		100%	86%	54%	15%	79%	32%	51%	97%	100%	99%	0%	69%	0%	54%	69%	0%	0%	95%	0%	0%	0%	0%	0%	0%	46%	95%	63%	0%
95th percentile		0.0005	0.001	0.0069	0.0025	0.001	0.017	0.002	0.5	0.5	0.5	150	0.04	180	1.2	8	350	310	0.0005	12.1	13.0	99.0	0.13	171	166	0.21	0.005	0.28	8.20
5th percentile		0.0002	0.00001	0.0005	0.0001	0.0002	0.001	0.0001	0.5	0.5	0.5	9.5	0.01	12.0	0.5	5.0	29.4	35.0	0.0005	0.70	9.7	76.5	0.04	10.8	12.5	0.02	0.005	0.05	6.53
background benchmark		<0.0005	<0.001	0.0069	0.0025	<0.001	0.017	<0.002	<0.5	<0.5	<0.5	9.5	0.04	12.0	1.2	8	350	310	<0.0005	12.1	9.7	76.5	0.13	171	166	0.21	<0.005	0.28	6.53
current water quality criterion		-	0.35	1.83	0.015	0.006	0.030	0.004	-	-	-	7.1	0.24	-	250	-	-	-	0.005	-	6.5	-	0.12	-	-	13	0.06	-	6.5-9.0
source		-	Alternate	Alternate	SE	OMOE	CCME	OMOE	-	-	-	OMOE	CCME	-	CCME	-		-	CCME	-	CCME	-	CCME	-	-	CCME	CCME	-	CCME
proposed new criterion		-	-	-	-	-	0.017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
source		-	-	-	-	-	CCME	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
# > current water quality criterion		-	0	0	0	0	4	3	-	-	-	1	0	-	0	-	-	-	0	-	1	-	5	-	-	0	0	-	8
% > current water quality criterion		-	0%	0%	0%	0%	2%	3%	-	-	-	1%	0%	-	0%	-	-	-	0%	-	2%	-	6%	-	-	0%	0%	-	5%

< DL greater than guideline, removed
statistical outlier that was removed (mean + 3 SD)
statistical outlier that was not removed (mean + 3 SD)
unusual datum that was removed (silver) or modified (temperature negative values set as "0")

[a] excluding sensored data
[b] values reported as less than the detection limit were used at 1/2 the detection limit for calculation

Table A.3: Background water quality, Faro Mine 2005 - 2009

Station	Date	pH-Lab	Phosphorus	Sulphate	Temperature-Field	Total Dissolved Solids	Total Organic Carbon	TSS	Turbidity
	Units	pH unit	mg/L	mg/L	°C	mg/L	mg/L	mg/L	NTU
FC	25-Sep-07	7.4	<0.005	1.2	2.4	40	2.8	2	
FC	25-Oct-07	7.4	<0.005	2.6	-1	34	2.1	<1	
FC	21-Nov-07	7.5	<0.005	2.4	0.2	28	1	<1	
FC	13-Dec-07	7.6	<0.005	2.9	0.3	46	1.6	<1	
FC	24-Jan-08	7.6	<0.005	1.7		52	1	<1	
FC	21-Feb-08	7.6	<0.005	2.4	-0.5	44	<0.5	<1	
FC	11-Mar-08	7.5	<0.005	2	-0.5	76	0.9	<1	
FC	29-Apr-08	7.6	<0.005	2.7	-0.5	44	1.2	<1	
FC	22-May-08	7	0.017	<0.5	-0.5	48	12.1	3	
FC	25-Jun-08	6.9	<0.005	<0.5	5.5	16	5.2	<1	
FC	30-Jul-08	7.4	<0.005	0.6	4.9	32	3.8	<1	
FC	22-Aug-08		0.02	0.9		30		5	
FC	18-Sep-08	7.2	0.007	0.8	3.5	50	3.8	2	
FC	07-Oct-08	7.3	<0.005	2.2	-1	22	2.5	3	
FC	11-Dec-08	7.4		1.5	0.4	22	1.5	1	
FC	25-Feb-09			2.5		42			
FC	27-Mar-09		0.01	3		30	0.8		
FC	7-Apr-09								
FC	5-May-09			<0.5		42	19.7	260	
FC	20-May-09		0.009	<0.5		24	11.3	2	
FC	10-Jun-09			<0.5		20	4.7	<1	
FC	23-Jun-09		<0.005	<0.5		20	5.4	1	
R6	29-Mar-05		<0.15	80.1	0.5			<1	0.31
R6	17-Aug-05		<0.15	19.3	7.3			2	0.35
R6	21-Feb-06		<0.15	20.4	0.9			<1	0.67
R6	07-Aug-06		<0.15	20	6			<1	0.36
R6	20-Feb-07		<0.15	19.5	-0.2			<1	0.7
R6	17-Aug-07		<0.15	20.2	9.3			<1	0.42
R6	26-Sep-07	8.3	<0.005	19.6	1.4	178	2.4	<1	
R6	24-Oct-07	8.3	<0.005	24	-1	180	1.4	<1	
R6	22-Nov-07	8.1	<0.005	24.7	-0.5	170	1.1	<1	
R6	14-Dec-07	8.2	<0.005	23.5	0.1	180	0.6	2	
R6	23-Jan-08	8.1	<0.005	23.3	-0.5	200	1	<1	
R6	20-Feb-08	8.3	0.005	23	-0.5	180	1.4	1	
R6	04-Mar-08		<0.15	21.4	0.6			<1	0.64
R6	13-Mar-08	8.2	<0.005	21.7	-0.5	220	0.7	<1	
R6	28-Apr-08	8.3	0.009	20	-0.5	180	1.2	1	
R6	21-May-08	7.9	0.019	<0.5	3	110	13	20	
R6	24-Jun-08	8.1	<0.005	10	4.5	110	7	27	
R6	22-Jul-08	8.1		17				5	
R6	29-Jul-08	8.3	<0.005	18	5.3	180	3.2	2	
R6	19-Aug-08		<0.15	18.8	8.5			1	0.37
R6	04-Sep-08	8.3		19				3	
R6	17-Sep-08	8.3	0.007	21	3	170	3.5	2	
R6	08-Oct-08	8.4	<0.005	21	-1	160	1.9	<1	
R6	10-Dec-08	8.1		24	0.3	210	1.5	3	
R6	24-Feb-09			98		300	1.8		
R6	26-Mar-09		0.006	25		200	0.8		
R6	20-May-09		0.02	13		110	7.5	13	
R6	23-Jun-09		0.009	15		130	3.6	12	
R7	21-Jan-05				-0.5				
R7	22-Jan-05		<0.15	10				<1	
R7	09-Feb-05		<0.15	8.2	0.5			<1	
R7	14-Mar-05		<0.15	9.1	0.7			<1	
R7	11-Apr-05		<0.15	8.9	1.5			<1	
R7	09-May-05		0.2	1.7	3			15	
R7	20-Jun-05		<0.15	6.5	8.9			2	
R7	26-Jul-05		<0.15	6.9	7.7			<1	
R7	23-Aug-05		<0.15	7.2	6			<1	
R7	06-Sep-05		<0.15	7.5	5.5			<1	
R7	11-Oct-05		<0.15	7.97	0.8			<1	
R7	02-Nov-05		<0.15	8.85	0.3			<1	
R7	13-Dec-05		<0.15	16.9	0.1			<1	
R7	24-Jan-06		<0.15	10.1	-0.7			<1	
R7	14-Feb-06		<0.15	11	0.8			<1	
R7	25-Mar-06		<0.15	10.7	1.1			<1	
R7	24-Apr-06		<0.15	9.73	1.4			<1	
R7	18-May-06		<0.15	2.14	0.2			13	
R7	19-Jun-06		<0.15	5.52	4.8			4	
R7	17-Jul-06		<0.15		7.5			2	
R7	22-Aug-06		<0.15	6.97	6.6			<1	
R7	12-Sep-06		<0.15	7.2	4			<1	
R7	16-Oct-06		<0.15	8.07	0.3			<1	
R7	14-Nov-06		<0.15	9.81	-0.8			<1	
R7	14-Dec-06		<0.15	11.2	-0.1			<1	
R7	14-Feb-07		<0.15	9.86	-0.1			<1	
R7	12-Mar-07		<0.15	10.5	0.2			<1	
R7	27-Mar-07	7.77	<0.03	10.6				<1	0.43
R7	19-Apr-07		<0.15	11.1	0.2			<1	
R7	15-May-07		<0.15	8.22	0.4			21	
R7	19-Jun-07		<0.15	6.36	5.5			3	
R7	17-Jul-07		<0.15	5.62	7.9			3	

Table A.3: Background water quality, Faro Mine 2005 - 2009

Station	Date	pH-Lab	Phosphorus	Sulphate	Temperature-Field	Total Dissolved Solids	Total Organic Carbon	TSS	Turbidity
	Units	pH unit	mg/L	mg/L	°C	mg/L	mg/L	mg/L	NTU
R7	14-Aug-07		<0.15	7.28	7.5			2	
R7	11-Sep-07		<0.15	6.9	6.8			5	
R7	23-Oct-07		<0.15	9.33	0.4			<1	
R7	14-Nov-07		<0.15	9.18	0			<1	
R7	09-Dec-07		<0.15	9.73	0			<1	
R7	08-Jan-08		<0.15	9.67	0.3			<1	
R7	19-Feb-08		<0.15	8.99	1			<1	
R7	18-Mar-08		<0.15	9.94	2.9			<1	
R7	14-Apr-08		<0.15	10.4	1.4			<1	
R7	15-May-08		<0.15	2.2	1.3			3	
R7	25-May-08			<0.5		52	10.4	33	
R7	17-Jun-08		<0.15	5.76	6.8			4	
R7	15-Jul-08		<0.15	4.18	6.6			43	
R7	22-Jul-08	7.8		6.9				3	
R7	12-Aug-08		<0.15	6.52	7.7			<1	
R7	21-Aug-08		0.025	6.6		98		<1	
R7	04-Sep-08	8.1		7.1				2	
R7	15-Sep-08		<0.15	6.76	5.6			1	
R7	15-Oct-08		<0.15	7.72	1.9			<1	
R7	04-Nov-08		<0.15	8.48	1.3			<1	
R7	02-Dec-08		<0.15	8.96	1.2			3	
R7	13-Jan-09		<0.15	10.4	0.9			<1	
R7	03-Feb-09		<0.15	10.8	1.4			<1	
R7	4-Mar-09			17		160	1.5	<1	
R7	7-Apr-09			17		170	1.1	<1	
R7	5-May-09			<0.5		54	21.3	5	
R7	10-Jun-09			5.3		60	3.7	6	
USFR	27-Mar-07	7.54	<0.03	5.67				<1	0.45
USFR	25-Aug-07		<0.005	5.5	10.1	50	2.7	1	
USFR	24-May-08			<0.5		34	6.7	20	
USFR	19-Aug-08		0.018	4.4		50		<1	
V1	07-Mar-05		<0.15	10.7				<1	0.1
V1	07-Jun-05		<0.15	4.6	4			1	0.35
V1	12-Sep-05		<0.15	10.5	7.1			<1	0.26
V1	01-Dec-05		<0.15	10.8	-0.6			<1	0.18
V1	20-Mar-06		<0.15	10.8	0.8			<1	0.16
V1	05-Jun-06		<0.15	3.62	1.2			3	0.77
V1	09-Jun-06		<0.15	9.71	4.1			<1	0.2
V1	06-Sep-06		<0.15	9.71	4.1			<1	0.2
V1	27-Mar-07	7.57	<0.03	10				<1	0.11
V1	18-Jun-07		<0.15	5.31	4.2			<1	0.27
V1	28-Aug-07		0.01	8.9	6.3	54	2	<1	
V1	29-Aug-07				4.5				
V1	24-Sep-07		<0.15	9.75	0.9			<1	0.16
V1	26-Sep-07	7.6	<0.005	9.7	2	88	0.8	<1	
V1	24-Oct-07	7.8	<0.005	11.8	-1	54	1.2	<1	
V1	22-Nov-07	7.8	<0.005	12.4	0	60	1.1	<1	
V1	10-Dec-07		<0.15	11.3	2.6			<1	0.11
V1	14-Dec-07	7.9	<0.005	12	0.1	80	0.8	<1	
V1	23-Jan-08	7.9	<0.005	12.2		58	0.8	<1	
V1	21-Feb-08	8	<0.005	12.2	-0.5	82	0.7	<1	
V1	10-Mar-08		<0.15	12.3	0.5			<1	<0.1
V1	11-Mar-08	7.9	<0.005	11.9	-0.5	88	0.8	<1	
V1	29-Apr-08	7.9	0.006	11	-0.5	86	0.9	<1	
V1	22-May-08	7.4	0.088	1.4	0	60	9.4	<1	
V1	24-May-08			1.6		52	8	16	
V1	10-Jun-08		<0.15	4.25	3.9			<1	0.5
V1	25-Jun-08	7.2	<0.005	3.8	4.5	38	3	2	
V1	29-Jul-08	7.7	<0.005	7.3	6.1	58	2.4	<1	
V1	02-Sep-08		<0.15	7.22	6.4			6	0.3
V1	17-Sep-08	7.5	<0.005	7.7	4	72	2.9	<1	
V1	02-Dec-08		<0.15	10.8	0			<1	0.11
V1	11-Dec-08	7.8		11	0.1	100	1.5	1	
V1	25-Feb-09			12		92			
V1	4-Mar-09			12		96	1	<1	
V1	26-Mar-09			12		66	1.3		
V1	8-Apr-09			13		90	2	<1	
V1	5-May-09			<0.5		38	10.6	5	
V1	10-Jun-09			6.2		36	2.5	<1	
VR	27-Mar-07	7.02	<0.03	6.54				<1	0.41
VR	25-Aug-07		<0.005	4.2	4.7	62	3.3	<1	
VR	26-Sep-07	7.7	<0.1	5	1.4	64	2.7	<1	
VR	25-Oct-07	7.7	<0.005	7.8	-1	54	2.1	1	
VR	21-Nov-07	7.7	<0.005	7.1	-0.2	44	0.6	<1	
VR	13-Dec-07	7.7	<0.005	7	0.1	66	2.8	3	
VR	24-Jan-08	7.8	0.032	5.9		30	1.7	96	
VR	21-Feb-08	7.9	<0.005	8.1	-0.5	64	1.2	<1	
VR	11-Mar-08	7.5	<0.005	6.6	-0.1	76	1.8	1	
VR	29-Apr-08	7.7	0.027	7.2	0	66	2.6	4	
VR	22-May-08	7.3	0.062	<0.5	1	38	16.5	41	
VR	24-May-08			3.4		34	12.2	100	
VR	25-Jun-08	7.2	0.006	<0.5	2	32	5	3	
VR	29-Jul-08	7.6	<0.005	4.1	4.6	40	4.4	<1	
VR	19-Aug-08		0.013	4.6		60		<1	
VR	17-Sep-08	7.4	<0.005	4.4	3.5	50	4.1	<1	

Table A.3: Background water quality, Faro Mine 2005 - 2009

Station	Date	pH-Lab	Phosphorus	Sulphate	Temperature-Field	Total Dissolved Solids	Total Organic Carbon	TSS	Turbidity
	Units	pH unit	mg/L	mg/L	°C	mg/L	mg/L	mg/L	NTU
VR	07-Oct-08	7.6	<0.005	6.9	-0.5	28	2.9	<1	
VR	11-Dec-08	7.6		6.3	0.1	44	2.6	2	
VR	25-Feb-09			7.6		78	1.9	400	
VR	20-May-09		0.009	1.3		38	9	11	
VR	23-Jun-09		<0.005	2.4		40	4.6	1	
W10	22-Jun-05		<0.15	3.4	7.4			<1	
W10	20-Sep-05		<0.15	4.2	5			1	
W10	07-Jun-06		<0.15	3.01	2.5			<1	
W10	18-Sep-06		<0.15	3.48	2			<1	
W10	11-Jun-07		<0.15	2.5	3.2			3	
W10	25-Sep-07	7.9	<0.005	3.7	1.1	80	3.4	1	
W10	02-Oct-07		<0.15	4.11	1.1			<1	
W10	25-Oct-07	7.9	<0.005	4.3	-1.5	78	2.8	<1	
W10	21-May-08	7.5	0.014	<0.5	0	44	12.1	3	
W10	01-Jun-08		<0.15	2.97	5.1			<1	
W10	24-Jun-08	7.7	<0.005	1.1		66	4.6	2	
W10	30-Jul-08	8	<0.005	3.3	3.8	66	4.4	<1	
W10	17-Sep-08	7.8	<0.005	3.9	3.5	88	4.2	<1	
W10	29-Sep-08		<0.15	3.96	3			2	
W10	08-Oct-08	8	<0.005	4.8	-0.05	74	3.4	<1	
W10	7-Apr-09								
W10	4-May-09			<0.5		40	19.8	1	
W10	10-Jun-09			1.4		56	5.2	1	
NEC/NXT	25-Aug-07				4.2				
NEC/NXT	26-Aug-07		<0.005	2.4		78	3.2	<1	
1st Trib Rose	27-Mar-07	7.75		11.1				<1	0.14
n [a]		71	78	187	142	99	93	182	28
minimum [a]		6.9	0.005	0.5	0	16	0.5	1	0.10
maximum [a]		8.400	0.200	98.0	10.1	300	21	400	0.77
mean [a,b]		7.7	0.0106	9.08	2.4	79	4.10	7.3	0.32
standard deviation (SD) [a,b]		0.3	0.0253	10.38	2.7	56	4.45	36.8	0.20
max detection limit [a]		-	0.03	0.5	-	-	0.5	1.0	0.1
# < detection limit [a]		0	53	15	0	0	1	110	1
% < detection limit [a]		0%	68%	8%	0%	0%	1%	60%	4%
95th percentile		8.30	0.03	21.6	7.5	182	13	20	0.69
5th percentile		7.20	0.01	0.50	0.0	23.8	0.76	1.0	0.1
background benchmark		7.20	<0.03	21.6	7.5	182	13	20	0.69
current water quality criterion		6.5-9.0	0.03	50	-	500	-	8	2.7
source		CCME	OMOE	BCMOE	-	CCME	-	CCME	BCMOE
proposed new criterion		-	-	-	-	-	-	-	-
source		-	-	-	-	-	-	-	-
# > current water quality criterion		0	4	2	-	0	-	17	0
% > current water quality criterion		0%	5%	1%	-	0%	-	9%	0%

< DL greater than guideline, removed
statistical outlier that was removed (mean + 3 SD)
statistical outlier that was not removed (mean + 3 SD)
unusual datum that was removed (silver) or modified (temperature negative values set as "0")

[a] excluding sensored data

[b] values reported as less than the detection limit were used at 1/2 the detection limit for calculation

Table A.4: Water quality data and summary statistics for station VR (reference), Faro Mine, Yukon.

Station	Date	Cadmium	Calcium	Cobalt	Iron	Lead	Lithium	Magnesium	Manganese	Nickel	Potassium	Silver	Sodium	Strontium	Titanium	Uranium	Zinc	Ammonia-(total)	Chloride	Colour	Conductivity-Lab	Fluoride	Hardness-Total	Nitrate	Phosphorus	Sulphate	Total Dissolved Solids	Total Organic Carbon	Turbidity
	Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	CU	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	NTU
VR	27-Mar-07	0.00002	13.4	<0.0002	0.03	0.0002	0.0004	2.62	0.0012	0.0003	0.73	<0.00005	2.06	0.064	0.0006	0.0008	0.001		0.32	<5	103		44.2		<0.03	6.54			0.41
VR	25-Aug-07	0.00001	10.9	0.00002	0.031	0.00007		1.94	0.00106	<0.0005	0.326	<0.00001	1.93	0.054	<0.0005	0.00037	0.0021	<0.005	<0.5		75	0.08		<0.02	<0.005	4.2	62	3.3	
VR	26-Sep-07	0.00001	8.85	0.00006	0.042	0.00016	<0.0002	1.66	0.00107	<0.0005	0.347	<0.00001	2.23	0.042	0.0041	0.00035	0.0049	<0.005	<0.5		62	0.08	28.9	<0.02	<0.1	5	64	2.7	
VR	25-Oct-07	0.000036	9.89	0.00002	0.024	0.00032	<0.0005	1.74	0.0018	0.00021	0.32	<0.000005	1.54	0.0529	<0.0005	0.000409	0.0024	0.009	<0.5		76	0.07	31.8	0.11	<0.005	7.8	54	2.1	
VR	21-Nov-07	0.000012	11	0.000017	0.027	0.000149	<0.0005	1.83	0.00176	0.00017	0.36	<0.000005	1.41	0.0566	<0.0005	0.000437	0.0009	0.028	<0.5		79	0.07	35	0.05	<0.005	7.1	44	0.6	
VR	13-Dec-07	0.000026	12.3	0.000028	0.029	0.000347	0.0006	2.11	0.00267	0.00038	0.47	<0.000005	1.78	0.0601	<0.0005	0.000433	0.0031	<0.005	<0.5		85	0.08	39.3	0.06	<0.005	7	66	2.8	
VR	24-Jan-08		11.9					2.22			0.41		1.64					<0.005	<0.5		89	0.07	39	0.08	0.032	5.9	30	1.7	
VR	21-Feb-08		12.6					2.2			0.54		1.79					<0.005	<0.5		97	0.07	40.5	0.06	<0.005	8.1	64	1.2	
VR	11-Mar-08		13.2					2.34			0.52		1.76					<0.005	<0.5		94	0.08	42.6	0.08	<0.005	6.6	76	1.8	
VR	29-Apr-08		13.8					2.52			1.2		2.14					0.006	1.1		100	0.07	44.9	0.07	0.027	7.2	66	2.6	
VR	22-May-08		6.28					1.15			1.03		1					<0.005	0.7		38	0.04	20.4	<0.02	0.062	<0.5	38	16.5	
VR	24-May-08	0.000127	5.09	0.000455	0.488	0.00543		0.89	0.0781	0.00097	0.79	0.000014	0.8	0.0292	0.0087	0.00169	0.0137	<0.01	0.6			0.06	16.4	<0.02		3.4	34	12.2	
VR	25-Jun-08		4.54					0.8			0.24		1.03					<0.005	<0.5		35	0.07	14.6	<0.02	0.006	<0.5	32	5	
VR	29-Jul-08		7.02					1.3			0.27		2.23					<0.005	0.9		55	0.06	22.9	<0.02	<0.005	4.1	40	4.4	
VR	19-Aug-08	0.000013	8.15	0.000023	0.021	0.000051	<0.0005	1.52	0.00077	0.0002	0.29	<0.000005	1.52	0.0458	<0.0005	0.000397	0.0007	<0.01	0.6			0.06	26.6	<0.02	0.013	4.6	60		
VR	17-Sep-08		7.02					1.27			0.31		1.39					<0.005	40		51	0.09	22.8	<0.02	<0.005	4.4	50	4.1	
VR	07-Oct-08		7.64					1.46			<0.05		1.46					<0.005	1		54	0.07	25.1	<0.02	<0.005	6.9	28	2.9	
VR	11-Dec-08	0.000017	10.9	0.000028	0.04	0.000602	<0.0005	2	0.00256	0.00015	0.38	<0.000005	1.57	0.0556	0.0013	0.000481	0.0025	<0.005	0.5		78	0.07	35.3	0.04		6.3	44	2.6	
VR	25-Feb-09	0.000531	13.2	0.00118	1.82	0.0142	0.0016	2.19	0.293	0.00174	0.54	0.00002	1.43	0.0717	0.0181	0.00619	0.0273	0.006	0.7		89	0.07	42.1	0.09		7.6	78	1.9	
VR	20-May-09	0.000043	7.41	0.000079	0.129	0.00127	0.0005	1.41	0.00727	0.00049	0.6	0.000008	1.15	0.039	0.0021	0.000739	0.0042	<0.005	0.7		53	0.06	24.3	<0.02	0.009	1.3	38	9	
VR	23-Jun-09	0.000107	7.35	0.000175	0.075	0.000277	<0.0005	1.6	0.00578	0.00041	0.14	0.0359	1.96	0.000011	0.000476	<0.0002	0.0002	<0.005	0.5		50	0.07	24.9	<0.02	<0.005	2.4	40	4.6	
n [a]		12	21	12	12	12	10	21	12	12	21	12	21	12	12	12	12	20	20	1	19	20	20	20	18	21	20	19	1
minimum [a]		0.00001	4.54	0.000017	0.021	0.000051	0.0002	0.8	0.00077	0.00015	0.05	0.000005	0.8	0.000011	0.000476	0.0002	0.0002	0.005	0.32	5	35	0.04	14.6	0.02	0.005	0.5	28	0.6	0.41
maximum [a]		0.001	13.8	0.001	1.82	0.014	0.002	2.62	0.293	0.002	1.2	0.036	2.23	0.072	0.018	0.006	0.027	0.028	1	5	103	0.09	44.9	0.110	0.1	8.1	78	16.5	0.41
mean [a,b]		0.00008	9.64	0.00018	0.23	0.0019	0.00045	1.75	0.033	0.00046	0.47	0.003	1.61	0.048	0.0031	0.0010	0.0053	0.0047	0.49	2.5	72	0.07	31.1	0.04	0.01	5.1	50	4.3	0.41
standard deviation (SD) [a,b]		0.0001	2.93	0.0003	0.52	0.0041	0.0004	0.51	0.085	0.0005	0.28	0.010	0.41	0.019	0.0054	0.0017	0.0078	0.0058	0.28	-	21	0.011	9.6	0.03	0.02	2.4	16	4	-
max detection limit (DL) [a]		-	-	0.0002	-	-	0.0005	-	-	0.0005	0.05	0.00005	-	-	0.0005	0.0002	-	0.01	0.5	5	-	-	-	0.02	0.1	0.5	-	-	-
# < detection limit [a]		0	0	1	0	0	6	0	0	2	1	8	0	0	5	1	0	16	9	1	0	0	0	11	12	2	0	0	0
% < detection limit [a]		0%	0%	8%	0%	0%	60%	0%	0%	17%	5%	67%	0%	0%	42%	8%	0%	80%	45%	100%	0%	0%	0%	55%	67%	10%	0%	0%	0%
95th percentile		0.00031	13.4	0.0008	1.09	0.009	0.001	2.52	0.17	0.0013	1.03	0.016	2.23	0.067	0.013	0.0037	0.02	0.01	1.0	5	100	0.08	44.2	0.091	0.07	7.8	76	12.6	0.41
5th percentile		0.000010	5.1	0.00002	0.023	0.00006	0.0003	0.89	0.0009	0.00016	0.14	0.000005	1.0	0.016	0.00049	0.00028	0.0005	0.005	0.5	5	38	0.06	16.3	0.020	0.005	0.5	30	1.1	0.41
background (BG) benchmark		0.00011	47	<0.001	0.47	0.002	0.008	11	0.045	<0.001	1.4	0.000021	3.3	0.18	0.0069	0.0025	0.017	0.040	1.2	8	310	0.13	166	0.21	<0.03	21.6	182	13	0.69
current water quality criterion		0.00003	116	0.004	0.3	0.002	-	82	1.0	0.065	53	0.0001	200	9.3	1.83	0.015	0.030	0.24	250	-	-	0.12	-	13	0.03	50	500	-	2.7
source		CCME	Alternate	BCMOE	CCME	CCME	-	Alternate	BCMOE	CCME	Alternate	CCME	CCME	Alternate	Alternate	SE	CCME	CCME	CCME	-	-	CCME	-	CCME	OMOE	BCMOE	CCME	-	BCMOE
proposed new criterion		0.00022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.017	-	-	-	-	-	-	-	-	-	-	-	-
source		CCME	-	-	-	-	-	-	-	-	-	-	-	-	-	-	CCME	-	-	-	-	-	-	-	-	-	-	-	-
# > current water quality criterion		5	0	0	2	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0
% > current water quality criterion		42%	0%	0%	17%	17%	0%	0%	0%	0%	0%	8%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	17%	0%	0%	0%	0%

< DL greater than guideline, removed
statistical outlier that was removed (mean + 3 SD)
statistical outlier that was not removed (mean + 3 SD)
unusual datum that was removed (silver) or modified (temperature negative values set as "0")

[a] excluding sensored data
[b] values reported as less than the detection limit were used at 1/2 the detection limit for calculation

Table A.5: Background benchmarks and selected criteria for evaluation of water quality at Faro Mine, Yukon.

Measurements	Units	Water quality benchmark[a]		Upper Background Benchmark[b]	
		Value	Source	2005-2007 data (Minnow 2008)	2005-2009 data (herein)
Total metals					
Aluminum	mg/L	0.1	CWQG	0.156	0.246
Antimony	mg/L	0.02	OPWQO	< 0.001	<0.001
Arsenic	mg/L	0.005	CWQG	< 0.001	<0.001
Barium	mg/L	1.0	CDWQG	0.088	0.090
Beryllium	mg/L	1.1	OPWQO	< 0.001	<0.001
Bismuth	mg/L	0.26	AAEBB	< 0.001	<0.005
Boron	mg/L	1.2	BCWQG	< 0.05	<0.05
Cadmium	mg/L	0.00003	CWQG	0.00004	0.00011
Calcium	mg/L	116	AAEBB, SKWQG	44.9	47
Chromium	mg/L	0.001	CWQG, SK, OPWQO	< 0.001	<0.001
Cobalt	mg/L	0.004	BCWQG	< 0.001	<0.001
Copper	mg/L	0.002	CWQG	0.002	0.003
Iron	mg/L	0.3	CWQG	0.246	0.47
Lead	mg/L	0.002	CWQG	< 0.001	0.002
Lithium	mg/L			0.008	0.008
Magnesium	mg/L	82	AAEBB	10.74	11
Manganese	mg/L	1	BCWQG	0.0264	0.045
Mercury	mg/L	0.000026	OWQG, SKWQG	< 0.00002	<0.00002
Molybdenum	mg/L	0.073	CWQG	0.00118	0.0012
Nickel	mg/L	0.065	CWQG	< 0.001	<0.001
Potassium	mg/L	53	AAEBB	1.4	1.4
Selenium	mg/L	0.001	CWQG	< 0.001	<0.001
Silicon	mg/L			13.68	11.6
Silver	mg/L	0.0001	CWQG	< 0.00005	0.000021
Sodium	mg/L	200	CDWQG	3.41	3.3
Strontium	mg/L	9.3	AAEBB	0.18	0.18
Tellurium	mg/L			< 0.001	<0.001
Thallium	mg/L	0.0008	CWQG	< 0.0001	<0.0001
Thorium	mg/L			< 0.0005	<0.0005
Tin	mg/L	0.35	AAEBB	< 0.001	<0.001
Titanium	mg/L	1.83	AAEBB	0.004	0.0069
Uranium	mg/L	0.015	SKWQG	0.0025	0.0025
Vanadium	mg/L	0.006	OPWQO	< 0.001	<0.001
Zinc	mg/L	0.030	CWQG	0.0164	0.017
Zirconium	mg/L	0.004	OPWQO	< 0.005	<0.002
Non-metals					
Alkalinity - Bicarbonate	mg/L			17.9 [b]	12.0 [b]
Alkalinity - Total	mg/L as $CaCO_3$	7.1	OPWQO	14.8 [b]	9.5 [b]
Ammonia - total	mg/L	0.24	CWQG	0.030	0.040
Chloride - dissolved	mg/L	250	CDWQG	< 0.5	1.2
Colour	CU			7	8
Conductivity - in situ	µS/cm			350	350
Conductivity - laboratory	µS/cm			303	310
Cyanide - weak acid dissociable	mg/L	0.005 (free)	CWQG	< 0.0005	<0.0005
Dissolved organic carbon	mg/L			3.1	12.1
Dissolved oxygen - in situ	mg/L	6.5 (minimum)	CWQG	10.23 [b]	9.7 [b]
Dissolved oxygen - in situ	%			80 [b]	76.5 [b]
Fluoride	mg/L	0.12	CWQG	0.11	0.13
Hardness - dissolved	mg/L as $CaCO_3$			169	171
Hardness - Total	mg/L as $CaCO_3$			158	166
Nitrate	mg/L	13	CWQG	0.35	0.21
Nitrite	mg/L	0.06	CWQG	< 0.005	<0.005
pH - in situ	pH units	6.5-9.0	CWQG	6.58 [b]	6.53 [b]
pH - Laboratory	pH units	6.5-9.0	CWQG	7.08 [b]	7.20 [b]
Phosphorus	mg/L	0.03	OPWQO	<0.05	<0.03
Sulphate	mg/L	50	BCWQG	20.3	21.6
Total dissolved solids	mg/L	500	CDWQG	180	182
Total organic carbon	mg/L			3.3	13
Total suspended solids	mg/L	28	CWQG	3	20
Turbidity	NTU	2.7	BCWQG	0.76	0.69

background benchmark exceeds the effects-based water quality benchmark for that parameter.

[a] Details were provided by Minnow 2008, except that criteria for total alkalinity (decrease of no more than 25% of background) and total suspended solids (increase of no more than 5 mg/L above background) have been updated based on updated background data presented herein.

[b] lower benchmark values (5th percentile) presented for alkalinity, DO, pH

CWQG = Canadian Water Quality Guidelines; OPWQO = Ontario Provincial Water Quality Objectives; CDWQG = Canadian Drinking Water Quality Guidelines; AAEBB = Alternative Aquatic Effects Based Benchmark; BCWQG = British Columbia Water Quality Guideline; SKWQG = Saskatchewan Water Quality Guideline

APPENDIX B

WATER QUALITY IN EXPOSURE AREAS

Table B.1: Faro Near-field Exposure Station X14 Data 2005 - 2009

Station ID	Date	Aluminum mg/L	Antimony mg/L	Arsenic mg/L	Barium mg/L	Beryllium mg/L	Bismuth mg/L	Boron mg/L	Cadmium mg/L	Calcium mg/L	Chromium mg/L	Cobalt mg/L	Copper mg/L	Iron mg/L	Lead mg/L	Lithium mg/L	Magnesium mg/L	Manganese mg/L	Mercury mg/L	Molybdenum mg/L	Nickel mg/L	Potassium mg/L	Selenium mg/L	Silicon mg/L	Silver mg/L	Sodium mg/L
X14	21-Jan-05	0.015	<0.001	<0.001	0.075	<0.001	<0.001	<0.05	<0.0002	93	<0.001	0.001	<0.001	0.44	<0.001	0.007	19.5	1.89	<0.00002	0.0007	0.004	2	<0.001	11.8	<0.00025	9.27
X14	08-Feb-05	0.009	<0.001	<0.001	0.079	<0.001	<0.001	<0.05	<0.0002	106	<0.001	0.002	<0.001	0.41	<0.001	0.008	23	2.17	<0.00002	0.0008	0.004	2.3	<0.001	14.4	<0.00025	11
X14	01-Mar-05																									
X14	08-Mar-05	0.016	<0.001	<0.001	0.068	<0.001	<0.001	<0.05	<0.0002	187	<0.001	0.007	0.001	0.55	<0.001	0.013	41.7	6.69	<0.00002	0.0012	0.015	4.9	<0.001	14.4	0.0012	22.5
X14	14-Mar-05	0.016	<0.001	<0.001	0.052	<0.001	<0.001	<0.05	<0.0002	217	<0.001	0.011	0.001	0.61	<0.001	0.01	42.2	11.2	<0.00002	0.0008	0.022	3.9	<0.001	13.5	<0.00025	24.9
X14	22-Mar-05	0.009	<0.001	<0.001	0.051	<0.001	<0.001	<0.05	<0.0002	236	<0.001	0.012	<0.001	0.57	<0.001	0.012	49.6	10.6	<0.00002	0.0008	0.022	4.6	<0.001	15.2	<0.00025	27.7
X14	11-Apr-05	0.008	<0.001	<0.001	0.074	<0.001	<0.001	<0.05	<0.0002	93.2	<0.001	<0.001	<0.001	0.28	<0.001	0.007	19.9	1.62	<0.00002	0.0008	0.004	2.1	<0.001	13.5	<0.00025	9.65
X14	10-May-05	0.31	<0.001	0.001	0.036	<0.001	<0.001	<0.05	<0.0002	22	<0.001	<0.001	0.003	0.86	0.006	0.002	4.71	0.41	<0.00002	<0.0005	0.003	1.3	<0.001	5.6	<0.00025	2
X14	31-May-05	0.091	<0.001	<0.001	0.026	<0.001	<0.001	<0.05	<0.0002	26.5	<0.001	<0.001	0.001	0.24	0.001	0.002	6.64	0.19	<0.00002	<0.0005	0.001	0.9	<0.001	9.3	<0.00025	2.56
X14	11-Jun-05	0.063	<0.001	<0.001	0.032	<0.001	<0.001	<0.05	<0.0002	28.9	<0.001	<0.001	<0.001	0.25	0.001	0.003	6.62	0.23	<0.00002	<0.0005	0.001	0.8	<0.001	8.3	<0.00025	3.13
X14	19-Jun-05	0.046	<0.001	<0.001	0.038	<0.001	<0.001	<0.05	<0.0002	38.8	<0.001	<0.001	0.001	0.28	<0.001	0.004	8.88	0.32	<0.00002	<0.0005	0.001	1	<0.001	9.5	<0.00025	3.5
X14	21-Jun-05	0.041	<0.001	<0.001	0.04	<0.001	<0.001	<0.05	<0.0002	41	<0.001	<0.001	<0.001	0.34	<0.001	0.005	9.14	0.4	<0.00002	<0.0005	0.002	1.1	<0.001	8.9	<0.00025	3.75
X14	02-Jul-05	0.008	<0.001	<0.001	0.039	<0.001	<0.001	<0.05	0.0003	44.3	<0.001	<0.001	<0.001	0.12	<0.001	0.007	10.2	0.3	<0.00002	0.0006	0.002	1.3	<0.001	10	<0.00025	4.71
X14	10-Jul-05	0.028	<0.001	<0.001	0.04	<0.001	<0.001	<0.05	<0.0002	44.4	<0.001	<0.001	0.002	0.28	<0.001	0.005	10.4	0.45	<0.00002	0.0005	0.002	1.3	<0.001	9.7	<0.00025	4.11
X14	17-Jul-05	0.021	<0.001	<0.001	0.046	<0.001	<0.001	<0.05	<0.0002	48.7	<0.001	<0.001	<0.001	0.28	<0.001	0.005	11.4	0.54	<0.00002	0.0005	0.002	1.4	<0.001	10.3	<0.00025	4.47
X14	24-Jul-05	0.02	<0.001	<0.001	0.045	<0.001	<0.001	<0.05	<0.0002	45.4	<0.001	<0.001	<0.001	0.3	<0.001	0.006	11.3	0.47	<0.00002	0.0005	0.002	1.2	<0.001	9.8	<0.00025	4.24
X14	25-Jul-05	0.023	<0.001	<0.001	0.046	<0.001	<0.001	<0.05	<0.0002	41.4	<0.001	<0.001	<0.001	0.14	<0.001	0.006	9.66	0.36	<0.00002	<0.0005	<0.001	1.2	<0.001	9.8	<0.00025	3.68
X14	31-Jul-05	0.032	<0.001	<0.001	0.042	<0.001	<0.001	<0.05	<0.0002	38.3	<0.001	<0.001	0.001	0.23	<0.001	0.004	8.81	0.38	0.00002	<0.0005	0.001	1.1	<0.001	10.6	<0.00025	3.43
X14	06-Aug-05	0.021	<0.001	<0.001	0.05	<0.001	<0.001	<0.05	<0.0002	49.2	<0.001	<0.001	0.001	0.28	0.001	0.006	11.5	0.59	<0.00002	0.0006	0.002	1.4	0.002	9.8	0.0003	4.54
X14	13-Aug-05	0.016	<0.001	<0.001	0.053	<0.001	<0.001	<0.05	<0.0002	58.6	<0.001	0.001	<0.001	0.29	<0.001	0.007	14.5	0.92	<0.00002	0.0007	0.002	1.6	<0.001	10	<0.00025	5.75
X14	20-Aug-05	0.011	<0.001	0.001	0.048	<0.001	<0.001	<0.05	<0.0002	56	<0.001	0.001	<0.001	0.22	<0.001	0.006	13.3	0.89	<0.00002	0.0006	0.002	1.5	0.001	8.3	<0.00025	4.82
X14	23-Aug-05	0.022	<0.001	<0.001	0.047	<0.001	<0.001	<0.05	<0.0002	58.5	<0.001	<0.001	<0.001	0.25	<0.001	0.008	14.5	0.8	<0.00002	0.0007	0.002	1.7	<0.001	9	<0.00025	5.96
X14	27-Aug-05	0.02	<0.001	<0.001	0.046	<0.001	<0.001	<0.05	<0.0002	50.3	<0.001	<0.001	0.004	0.25	0.003	0.006	11.5	0.84	<0.00002	0.0005	0.003	1.5	0.002	8.1	<0.00025	4.72
X14	05-Sep-05	0.013	<0.001	<0.001	0.043	<0.001	<0.001	<0.05	<0.0002	58.4	<0.001	0.001	0.001	0.4	<0.001	0.008	13.6	0.85	<0.00002	0.0009	0.003	1.8	<0.001	9.3	<0.00025	5.45
X14	06-Sep-05	0.015	<0.001	<0.001	0.042	<0.001	<0.001	<0.05	<0.0002	58.9	<0.001	<0.001	<0.001	0.42	<0.001	0.008	13.6	0.78	<0.00002	0.0014	0.002	1.8	<0.001	9.4	<0.00025	5.47
X14	11-Sep-05	0.014	<0.001	<0.001	0.046	<0.001	<0.001	<0.05	<0.0002	58.3	<0.001	<0.001	<0.001	0.24	<0.001	0.007	12.8	0.82	<0.00002	0.0006	0.002	1.6	<0.001	9.5	<0.00025	5.44
X14	18-Sep-05	0.017	<0.001	<0.001	0.042	<0.001	<0.001	<0.05	<0.0002	56	<0.001	<0.001	<0.001	0.19	<0.001	0.006	11.3	0.58	<0.00002	<0.0005	0.002	1.5	<0.001	10.5	<0.00025	5.19
X14	24-Sep-05	0.015	<0.001	<0.001	0.046	<0.001	<0.001	<0.05	<0.0002	52.4	<0.001	<0.001	<0.001	0.19	<0.001	0.005	10.6	0.64	<0.00002	<0.0005	0.002	1.3	<0.001	8.5	<0.00025	4.68
X14	01-Oct-05	0.01	<0.001	<0.001	0.053	<0.001	<0.001	<0.05	<0.0002	62	<0.001	0.001	<0.001	0.34	0.001	0.006	13.1	1.15	<0.00002	<0.0005	0.003	1.5	<0.001	9.7	<0.00025	6.11
X14	11-Oct-05	<0.005	<0.001	<0.001	0.051	<0.001	<0.001	<0.05	<0.0002	40.5	<0.001	<0.001	<0.001	0.24	<0.001	0.003	9.78	0.33	<0.00002	<0.0005	0.001	1	<0.001	9.8	<0.00025	3.09
X14	02-Nov-05	0.018	<0.001	<0.001	0.064	<0.001	<0.001	<0.05	<0.0002	53.8	<0.001	<0.001	<0.001	0.29	<0.001	0.005	12.6	0.62	<0.00002	0.0005	0.001	1.2	<0.001	11.8	<0.00025	4.17
X14	15-Dec-05	0.01	<0.001	<0.001	0.073	<0.001	<0.001	<0.05	<0.0002	73.3	<0.001	<0.001	0.002	0.34	<0.001	0.007	16.3	1.23	<0.00002	0.0006	0.001	1.6	<0.001	6.1	<0.00025	6.67
X14	23-Jan-06	0.007	<0.001	<0.001	0.072	<0.001	<0.001	<0.05	<0.0002	88.8	<0.001	0.001	<0.001	0.37	<0.001	0.008	20.5	1.89	<0.00002	0.0007	0.004	1.7	<0.001	6	<0.00025	8.78
X14	14-Feb-06	0.023	<0.001	<0.001	0.074	<0.001	<0.001	<0.05	<0.0002	105	<0.001	0.002	<0.001	0.41	<0.001	0.008	24	2.34	<0.00002	0.0008	0.004	2.3	0.001	6.3	<0.00025	11.3
X14	24-Mar-06	<0.005	<0.001	<0.001	0.08	<0.001	<0.001	<0.05	<0.0002	119	<0.001	0.002	<0.001	0.29	<0.001	0.01	26.8	2.6	<0.00002	0.0008	0.005	2.6	<0.001	6.5	<0.00025	12.8
X14	25-Apr-06	0.008	<0.001	<0.001	0.07	<0.001	<0.001	<0.05	<0.0002	102	<0.001	0.002	<0.001	0.56	<0.001	0.008	22.8	2.32	<0.00002	0.0008	0.005	2.3	<0.001	5.7	<0.00025	10.6
X14	09-May-06	0.044	<0.001	<0.001	0.045	<0.001	<0.001	<0.05	<0.0002	132	<0.001	0.004	0.002	0.57	0.002	0.009	28.4	3.33	<0.00002	0.0007	0.009	3.1	<0.001	5.9	<0.00025	13.7
X14	18-May-06	0.15	<0.001	<0.001	0.028	<0.001	<0.001	<0.05	<0.0002	16.1	<0.001	<0.001	0.003	0.58	0.003	0.002	3.46	0.19	<0.00002	<0.0005	0.002	1.6	<0.001	2.5	<0.00025	1.37
X14	23-May-06	0.26	<0.001	<0.001	0.028	<0.001	<0.001	<0.05	<0.0002	21	<0.001	<0.001	0.003	0.71	0.005	0.002	4.05	0.44	<0.00002	<0.0005	<0.001	1.3	<0.001	2.2	<0.00025	1.68
X14	30-May-06	0.13	<0.001	<0.001	0.029	<0.001	<0.001	<0.05	<0.0002	32	<0.001	<0.001	0.002	0.41	0.002	0.002	6.37	0.73	<0.00002	<0.0005	0.002	1.1	<0.001	3.1	<0.00025	2.79
X14	06-Jun-06	0.17	<0.001	<0.001	0.03	<0.001	<0.001	<0.05	<0.0002	26.6	<0.001	<0.001	0.002	0.38	0.002	0.002	5.48	0.39	<0.00002	<0.0005	0.002	1	<0.001	3.2	<0.00025	2.49
X14	19-Jun-06	0.066	<0.001	<0.001	0.034	<0.001	<0.001	<0.05	<0.0002	39.1	<0.001	<0.001	0.001	0.27	<0.001	0.003	7.87	0.54	<0.00002	<0.0005	0.002	1	<0.001	3.5	<0.00025	3.44
X14	20-Jun-06	0.048	<0.001	<0.001	0.037	<0.001	<0.001	<0.05	<0.0002	43.3	<0.001	<0.001	0.001	0.27	<0.001	0.004	8.67	0.54	<0.00002	<0.0005	0.002	1.2	<0.001	3.7	<0.00025	3.74
X14	11-Jul-06	0.039	<0.001	<0.001	0.035	<0.001	<0.001	<0.05	<0.0002	40.1	<0.001	<0.001	0.001	0.23	<0.001	0.004	8.42	0.38	<0.00002	<0.0005	0.001	1	<0.001	4.2	<0.00025	3.53
X14	17-Jul-06	0.038	<0.001	<0.001	0.038	<0.001	<0.001	<0.05	<0.0002	49.3	<0.001	<0.001	0.001	0.28	<0.001	0.019	11	0.74	<0.00002	0.0005	0.002	1.2	<0.001	4	<0.00025	4.4
X14	18-Jul-06	0.039	<0.001	<0.001	0.038	<0.001	<0.001	<0.05	<0.0002	50.6	<0.001	<0.001	0.001	0.3	<0.001	0.018	11.6	0.84	<0.00002	0.0005	0.002	1.3	<0.001	4.2	<0.00025	4.68
X14	25-Jul-06	<0.005	<0.001	<0.001	0.044	<0.001	<0.001	<0.05	<0.0002	61.7	<0.001	<0.001	<0.001	0.3	<0.001	0.006	11.8	0.7	<0.00002	0.0005	0.002	1.5	<0.001	3.9	<0.00025	5.23
X14	01-Aug-06	0.046	<0.001	<0.001	0.049	<0.001	<0.001	<0.05	<0.0002	56.4	<0.001	<0.001	<0.001	0.37	<0.001	0.006	11.1	0.53	<0.00002	0.0005	<0.001	1.5	<0.001	4.1	<0.00025	4.75
X14	15-Aug-06	0.041	<0.001	<0.001	0.035	<0.001	<0.001	<0.05	<0.0002	42.1	<0.001	<0.001	<0.001	0.25	<0.001	0.004	9.16	0.66	<0.00002	<0.0005	0.002	1.1	<0.001	4.5	<0.00025	4.18
X14	21-Aug-06	0.018	<0.001	<0.001	0.04	<0.001	<0.001	<0.05	<0.0002	43.7	<0.001	<0.001	0.001	0.17	<0.001	0.005	9.09	0.46	<0.00002	<0.0005	0.002	1.1	<0.001	3.9	<0.00025	3.95
X14	22-Aug-06	0.033	<0.001	<0.001	0.04	<0.001	<0.001	<0.05	<0.0002	44	<0.001	<0.001	0.001	0.26	<0.001	0.005	9.11	0.6	<0.00002	<0.0005	0.002	1.1	<0.001	3.8	<0.00025	4.13
X14	29-Aug-06	0.023	<0.001	<0.001	0.041	<0.001	<0.001	<0.05	<0.0002	54.4	<0.001	<0.001	<0.001	0.26	<0.001	0.007	11.2	0.86	<0.00002	0.0005	0.002	1.5	<0.001	4.2	<0.00025	5.27
X14	05-Sep-06	0.029	<0.001	<0.001	0.044	<0.001	<0.001	<0.05	<0.0002	41.6	<0.001	<0.001	<0.001	0.29	<0.001	0.004	8.93	0.51	<0.00002	<0.0005	0.001	1.1	<0.001	4.3	<0.00025	3.64
X14	12-Sep-06	0.009	<0.001	<0.001	0.045	<0.001	<0.001	<0.05	<0.0002	31.7	<0.001	<0.001	<0.001	0.12	<0.001	0.003	7.21	0.21	<0.00002	<0.0005	<0.001	0.7	<0.001	4.3	<0.00025	2.62
X14	17-Oct-06	0.017	<0.001	<0.001	0.054	<0.001	<0.001	<0.05	<0.0002	49.4	<0.001	<0.001	0.001	0.36	<0.001	0.004	11.7	0.64	<0.00002	0.0005	0.004	1.2	<0.001	4.4	<0.00025	4.54
X14	14-Nov-06	0.031	<0.001	<0.001	0.068	<0.001	<0.001	<0.05	<0.0002	66.1	<0.001	<0.001	<0.001	0.3	<0.001	0.005	15.7	1.1	<0.00002	0.0006	0.003	1.5	<0.001	5.5	<0.00025	6.08
X14	13-Dec-06	0.015	<0.001	<0.001	0.08	<0.001	<0.001	<0.05	<0.0002	85.1	<0.001	<0.001	<0.001	0.32	<0.001	0.007	18.2	1.55	<0.00002	0.0006	0.003	1.9	<0.001	5.7	<0.00025	7.65
X14	16-Jan-07	0.021	<0.001	<0.001	0.074	<0.001	<0.001	<0.05	<0.0002	103	<0.001	0.002	0.001	0.41	<0.001	0.008	23.4	2.38	<0.00002	0.0008	0.005	2.1	<0.001	5.7	<0.00025	9.85
X14	15-Feb-07	0.006	<0.001	<0.001	0.07	<0.001	<0.001	<0.05	<0.0002	121	<0.001	0.002	0.001	0.36	<0.001	0.008	26	2.8	<0.00002	0.0008	0.005	2.4	<0.001	6.1	0.0023	11.7
X14	12-Mar-07	0.046	<0.001	<0.001	0.076	<0.001	<0.001	<0.05	<0.0002	162	<0.001	0.003	0.001	0.73	<0.001	0.01	34.7	4.45	<0.00002	0.001	0.007	3.3	<0.001	5.9	<0.00025	16.9
X14	10-Apr-07	0.58	<0.001	0.002	0.052	<0.001	<0.001	<0.05	<0.0002	243	<0.001	0.015	0.003	1.59	0.008	0.014	49.8	16	<0.00002	0.002	0.03	4.5	0.001	7.3	<0.00025	22.9
X14	19-Apr-07	0.019	<0.001	<0.001	0.075	<0.001	<0.001	<0.05	<0.0002	108	<0.001	0.001	<0.001	0.37	<0.001	0.008	22.6	2.44	<0.00002	0.0009	0.005	2.5	<0.001	5.8	<0.00025	9.69
X14	14-May-07	0.14	<0.001	<0.001	0.039	<0.001	<0.001	<0.05	<0.0002	27.9	0.001	<0.001	0.003	0.68	0.003	<0.005	6.65	0.38	<0.00002	<0.0005	0.002	1.6	<0.001	3.8	<0.00025	2.43
X14	15-May-07	0.21	<0.001	<0.001	0.041	<0.001	<0.001	<0.05	<0.0002	28.3	<0.001	<0.001	0.003	0.91	0.004	<0.005	6.52	0.42	<0.00002	0.0005	0.003	1.6	<0.001	3.9	<0.00025	2.44
X14	22-May-07	0.4	<0.001	<0.001	0.034	<0.001	<0.001	<0.05	<0.0002	26.4	<0.001	<0.001	0.003	0.97	0.007	<0.005	5.29	0.45	<0.00002	<0.0005	0.003	1.6	<0.001	2.7	<0.00025	2.21
X14	29-May-07	0.39	<0.001	<0.001	0.032	<0.001	<0.001	<0.05	<0.0002	24.5	<0.001	<0.001	0.003	0.76	0.004	<0.005	5.59	0.47	<0.00002	<0.0005	0.003	1.4	<0.001	3.1	<0.00025	2.56
X14	05-Jun-07	0.53	<0.001	<0.001	0.027	<0.001	<0.001	<0.05	<0.0002	16.1	<0.001	<0.001	0.002	0.93	0.003	<0.005	3.24	0.24	<0.00002	<0.0005	0.002	0.9	<0.001	2.7	<0.00025	1.64
X14	12-Jun-07	0.36	<0.001	<0.001	0.035	<0.001	<0.001	<0.05	<0.0002	22.1	<0.001	<0.001	0.002	0.64	0.004	<0.005	4.78	0.25	<0.00002	<0.0005	0.002	0.9	<0.001	4.3	<0.00025	2.21
X14	18-Jun-07	0.055	<0.001	<0.001	0.028	<0.001	<0.001	<0.05	<0.0002	29.2	<0.001	<0.001	0.001	0.21	<0.001	<0.005	6.22	0.4	<0.00002	<0.0005	0.001	0.8	<0.001	2.7	<0.00025	2.66
X14	19-Jun-07	0.061	<0.001	<0.001	0.033	<0.001	<0.001	<0.05	<0.0002	41.5	<0.001	<0.001	0.001	0.27	<0.001	<0.005	8.61	0.61	<0.00002	<0.0005	0.002	1.1	<0.001	3.2	<0.00025	3.71
X14	26-Jun-07	0.16	<0.001	<0.001	0.034	<0.001	<0.001	<0.05	<0.0002	30	<0.001	<0.001	0.002	0.31	0.002	<0.005	6.48	0.32	<0.00002	<0.0005	0.002	0.9	<0.001	3.9	<0.00025	2.69
X14	03-Jul-07	0.072	<0.001	<0.001	0.038	<0.001	<0.001	<0.05	<0.0002	31.4	<0.001	<0.001	0.001	0.22	<0.001	<0.005	7.12	0.36	<0.00002	<0.0005	0.002	0.9	<0.001	3.7	<0.00025	2.79
X14	10-Jul-07	0.15	<0.001	<0.001	0.044	<0.001	<0.001	<0.05	0.0003	49.8	0.001	<0.001	0.012	0.41	0.002	<0.005	9.82	0.75	<0.00002	0.0008	0.005	1.4	<0.001	3.8	<0.00025	4.19
X14	16-Jul-07	0.067	<0.001	<0.001	0.042	<0.001	<0.001	<0.05	<0.0002	39.4	<0.001	<0.001	0.001	0.28	0.003	<0.005	8.55	0.55	<0.00002	0.0005	0.002	1.1	<0.001	4.4	<0.00025	3.71
X14	17-Jul-07	0.063	<0.001	<0.001	0.036	<0.001	<0.001	<0.05	<0.0002	32.9	<0.001	<0.001	0.003	0.25	0.002	<0.005	7.31	0.43	<0.00002	<0.0005	0.002	1.1	<0.001	4	<0.00025	3.67
X14	24-Jul-07	0.039	<0.001	<0.001	0.047	<0.001	<0.001	<0.05	<0.0002	64.6	<0.001	0.001	0.001	0.38	<0.001	0.007	12.9	1.01	<0.00002	0.0005	0.003	1.6	0.001	4.1	0.0007	5.38
X14	31-Jul-07	0.028	<0.001	<0.001	0.043	<0.001	<0.001	<0.05	<0.0002	56	<0.001	<0.001	<0.001	0.26	<0.001	0.007	12.3	0.8	<0.00002	0.0007	0.002	1.6	<0.001	4	<0.00025	5.08

Table B.1: Faro Near-field Exposure Station X14 Data 2005 - 2009

Station ID	Date	Aluminum mg/L	Antimony mg/L	Arsenic mg/L	Barium mg/L	Beryllium mg/L	Bismuth mg/L	Boron mg/L	Cadmium mg/L	Calcium mg/L	Chromium mg/L	Cobalt mg/L	Copper mg/L	Iron mg/L	Lead mg/L	Lithium mg/L	Magnesium mg/L	Manganese mg/L	Mercury mg/L	Molybdenum mg/L	Nickel mg/L	Potassium mg/L	Selenium mg/L	Silicon mg/L	Silver mg/L	Sodium mg/L
X14	07-Aug-07	0.024	<0.001	<0.001	0.046	<0.001	<0.001	<0.05	<0.0002	52	<0.001	<0.001	<0.001	0.54	<0.001	0.005	11.5	0.97	<0.00002	0.0006	0.003	1.3	<0.001	4.4	<0.00025	4.83
X14	13-Aug-07	0.081	<0.001	<0.001	0.043	<0.001	<0.001	<0.05	<0.0002	69.3	<0.001	0.001	0.001	0.47	<0.001	0.009	15	1.21	<0.00002	0.0007	0.003	1.9	<0.001	3.6	<0.00025	6.52
X14	14-Aug-07	0.024	<0.001	<0.001	0.047	<0.001	<0.001	<0.05	<0.0002	55.7	<0.001	<0.001	<0.001	0.19	<0.001	0.006	12.6	0.93	<0.00002	0.0006	0.003	1.5	<0.001	4	<0.00025	5.15
X14	21-Aug-07	0.042	<0.001	<0.001	0.052	<0.001	<0.001	<0.05	<0.0002	63	<0.001	0.002	<0.001	0.37	<0.001	0.008	14.3	1.37	<0.00002	0.0006	0.003	1.8	0.001	3.3	<0.00025	7.4
X14	28-Aug-07	0.005	<0.001	<0.001	0.046	<0.001	<0.001	<0.05	<0.0002	58	<0.001	0.001	0.002	0.29	<0.001	0.006	12.6	1.08	<0.00002	0.0005	0.003	1.6	<0.001	3.9	<0.00025	5.2
X14	04-Sep-07	0.013	<0.001	<0.001	0.042	<0.001	<0.001	<0.05	0.0002	56.5	<0.001	0.001	0.001	0.3	<0.001	<1	13.1	1.17	<0.00002	0.0009	0.003	1.7	<0.001	4	<0.00025	6.26
X14	10-Sep-07	0.023	<0.001	<0.001	0.045	<0.001	<0.001	<0.05	<0.0002	50.5	<0.001	0.001	<0.001	0.26	<0.001	0.005	12	1.2	<0.00002	0.0007	0.003	1.4	<0.001	3.7	<0.00025	4.79
X14	11-Sep-07	0.066	<0.001	<0.001	0.045	<0.001	<0.001	<0.05	<0.0002	43.7	<0.001	<0.001	0.002	0.41	0.002	0.004	10.8	0.84	<0.00002	0.0006	0.003	1.4	<0.001	4.9	<0.00025	4.55
X14	17-Sep-07	0.021	<0.001	<0.001	0.038	<0.001	<0.001	<0.05	<0.0002	40.9	<0.001	<0.001	<0.001	0.26	<0.001	0.004	9.55	0.91	<0.00002	<0.0005	0.002	1.1	<0.001	3.9	<0.00025	4.02
X14	25-Sep-07	0.0271	0.00008	0.0005	0.0424	<0.00001	<0.000005	<0.005	0.00002	34.4	<0.0001	0.00023	0.0006	0.25	0.00045	0.0025	7.52	0.262		0.00046	0.0009	0.773	<0.00004	4.1	<0.000005	2.68
X14	23-Oct-07	0.056	<0.001	<0.001	0.051	<0.001	<0.001	<0.05	<0.0002	93.5	<0.001	0.003	0.001	0.52	0.001	0.007	21.5	3.26	<0.00002	0.0009	0.008	2.1	<0.001	4.9	<0.00025	8.97
X14	25-Oct-07	0.0025	0.00012	0.00033	0.0539	<0.00001	<0.000005	<0.005	0.000056	99.3	<0.0001	0.00363	0.00045	0.178	0.000301	0.0088	20.6	3.65		0.00069	0.00792	2.12	0.00024	4.27	<0.000005	8.77
X14	29-Oct-07	0.017	<0.001	<0.001	0.047	<0.001	<0.001	<0.05	<0.0002	75.9	<0.001	0.003	<0.001	0.32	0.001	0.006	17.8	2.71	<0.00002	0.0008	0.006	1.8	<0.001	4.4	<0.00025	7.24
X14	14-Nov-07	0.04	<0.001	<0.001	0.058	<0.001	<0.001	<0.05	<0.0002	59.5	<0.001	<0.001	<0.001	0.23	<0.001	0.004	13.2	0.83	<0.00002	0.0007	0.002	1.4	<0.001	5.3	<0.00025	4.87
X14	21-Nov-07	0.0059	0.00007	0.00029	0.0683	<0.00001	<0.000005	<0.005	0.000035	64.3	<0.0001	0.000626	0.00046	0.263	0.000268	0.0054	12.5	1.02		0.00065	0.00205	1.38	0.0003	5.17	<0.000005	4.53
X14	10-Dec-07	0.017	<0.001	<0.001	0.062	<0.001	<0.001	<0.05	<0.0002	72.8	<0.001	<0.001	<0.001	0.31	<0.001	0.005	15.5	1.49	<0.00002	0.0007	0.003	1.5	<0.001	5	<0.00025	5.92
X14	13-Dec-07	0.0088	0.00006	0.00035	0.0724	<0.00001	<0.000005	<0.005	0.000042	82.9	0.0001	0.00107	0.00042	0.293	0.000214	0.0071	17.4	1.61		0.00074	0.00312	1.66	0.00034	5.75	<0.000005	6.7
X14	08-Jan-08	0.007	<0.001	<0.001	0.065	<0.001	<0.001	<0.05	<0.0002	88.1	<0.001	0.001	<0.001	0.4	<0.001	0.006	19.2	1.97	<0.00002	0.0008	0.004	1.9	<0.001	5.4	<0.00025	7.46
X14	24-Jan-08	0.0042	0.00006	0.00038	0.0688	<0.00001	<0.000005	<0.005	0.00005	110	<0.0001	0.00158	0.00036	0.366	0.000137	0.007	21.8	2.45		0.00074	0.00415	2	0.00036	5.93	<0.000005	8.67
X14	19-Feb-08	0.019	<0.001	<0.001	0.069	<0.001	<0.001	<0.05	<0.0002	120	<0.001	0.002	<0.001	0.53	<0.001	0.007	25.6	3.26	<0.00002	0.0011	0.006	2.5	0.001	5.8	<0.00025	10.7
X14	20-Feb-08	0.0133	0.00006	0.00043	0.0777	<0.00001	<0.000005	<0.005	0.000062	125	<0.0001	0.00217	0.00031	0.386	0.000204	0.0093	26.5	3.36		0.00096	0.00546	2.41	0.00036	5.67	0.000005	11.3
X14	11-Mar-08	0.0078	0.00006	0.00047	0.0752	<0.00001	<0.000005	<0.005	0.000061	130	<0.0001	0.00243	0.00034	0.407	0.000186	0.009	27.3	3.57		0.00082	0.00586	2.42	0.00031	6.7	<0.000005	11.9
X14	18-Mar-08	0.022	<0.001	<0.001	0.075	<0.001	<0.001	<0.05	<0.0002	113	<0.001	0.002	0.001	0.39	0.001	0.005	28.1	3.27	<0.00002	0.0009	0.006	2.3	0.001	6.6	<0.00025	13.7
X14	14-Apr-08	0.13	<0.001	0.001	0.062	<0.001	<0.001	<0.05	<0.0002	181	<0.001	0.007	0.002	0.77	0.002	0.013	40.5	7.38	<0.00002	0.0016	0.016	3.8	0.002	6.4	<0.00025	18.4
X14	15-Apr-08	0.12	<0.001	0.001	0.063	<0.001	<0.001	<0.05	<0.0002	176	<0.001	0.007	0.002	0.72	0.002	0.012	40.6	7.32	<0.00002	0.0015	0.015	3.7	0.001	6.2	<0.00025	19.2
X14	22-Apr-08	0.071	<0.001	<0.001	0.055	<0.001	<0.001	<0.05	<0.0002	191	<0.001	0.008	0.001	0.42	0.001	0.013	32.6	8.13	<0.00002	0.0015	0.016	3.4	<0.001	5.5	<0.00025	15.3
X14	29-Apr-08	0.1	<0.001	<0.001	0.05	<0.001	<0.001	<0.05	<0.0002	170	<0.001	0.006	0.002	0.45	0.001	0.011	35.3	6.15	<0.00002	0.0014	0.014	3.4	0.001	5	<0.00025	15.6
X14	06-May-08	0.097	<0.001	<0.001	0.045	<0.001	<0.001	<0.05	<0.0002	101	<0.001	0.003	0.003	0.53	0.002	0.008	21.8	2.46	<0.00002	0.0008	0.007	3.2	<0.001	3.8	<0.00025	9.42
X14	13-May-08	0.23	<0.001	0.001	0.036	<0.001	<0.001	<0.05	<0.0002	44.5	<0.001	0.001	0.003	1	0.004	0.003	8.23	1.13	<0.00002	<0.0005	0.004	2	0.001	2.7	<0.00025	3.42
X14	15-May-08	0.15	<0.001	<0.001	0.035	<0.001	<0.001	<0.05	<0.0002	49	<0.001	0.001	0.003	0.65	0.003	0.004	9.13	0.99	<0.00002	0.0005	0.004	2	<0.001	3.1	<0.00025	3.88
X14	20-May-08	0.3	<0.001	<0.001	0.033	<0.001	<0.001	<0.05	<0.0002	23.5	<0.001	<0.001	0.003	0.75	0.003	0.002	5.28	0.34	<0.00002	<0.0005	0.002	1.6	<0.001	2.5	<0.00025	1.91
X14	22-May-08	0.231	0.00009	0.00088	0.0344	0.00004	0.00001	<0.05	0.000051	23.8	0.0005	0.000534	0.00253	0.592	0.00378	0.0025	5.08	0.316		0.00027	0.0021	1.37	0.00013	2.72	0.000009	1.8
X14	26-May-08	0.277	0.00009	0.0012	0.0334	0.00006	0.000015	<0.05	0.000079	22.5	0.0006	0.000862	0.00274	0.875	0.00678		3.97	0.482		0.00025	0.0026	1.12	0.00011		0.000011	1.62
X14	27-May-08	0.5	<0.001	0.001	0.028	<0.001	<0.001	<0.05	<0.0002	14.9	0.001	<0.001	0.003	0.91	0.006	0.002	3.57	0.2	<0.00002	<0.0005	0.002	1.1	<0.001	3.1	<0.00025	1.49
X14	03-Jun-08	0.13	<0.001	<0.001	0.028	<0.001	<0.001	<0.05	<0.0002	26.2	<0.001	<0.001	0.001	0.28	0.002	0.002	5.49	0.24	<0.00002	<0.0005	0.001	1	<0.001	3.1	<0.00025	2.33
X14	10-Jun-08	0.13	<0.001	<0.001	0.031	<0.001	<0.001	<0.05	<0.0002	29.1	<0.001	<0.001	0.002	0.31	0.001	0.003	7.25	0.51	<0.00002	<0.0005	0.002	0.9	<0.001	4.6	0.0003	2.88
X14	16-Jun-08	0.047	<0.001	<0.001	0.028	<0.001	<0.001	<0.05	<0.0002	31.7	<0.001	<0.001	0.001	0.16	<0.001	0.001	8.56	0.3	<0.00002	<0.0005	0.001	1	<0.001	3.9	<0.00025	3.39
X14	17-Jun-08	0.048	<0.001	<0.001	0.029	<0.001	<0.001	<0.05	<0.0002	30.5	<0.001	<0.001	<0.001	0.19	<0.001	0.003	6.22	0.34	<0.00002	<0.0005	<0.001	0.9	<0.001	3.4	<0.00025	2.57
X14	24-Jun-08	0.56	<0.001	0.001	0.033	<0.001	<0.001	<0.05	<0.0002	17.7	<0.001	0.001	0.002	1.1	0.005	0.003	3.98	0.51	<0.00002	<0.0005	0.002	0.8	<0.001	4.2	<0.00025	1.81
X14	01-Jul-08	0.045	<0.001	<0.001	0.033	<0.001	<0.001	<0.05	<0.0002	41.2	<0.001	0.001	0.001	0.24	<0.001	0.003	9.82	1.14	<0.00002	0.0006	0.004	1.1	<0.001	4	<0.00025	3.84
X14	08-Jul-08	0.045	<0.001	<0.001	0.035	<0.001	<0.001	<0.05	<0.0002	35	<0.001	<0.001	<0.001	0.13	<0.001	0.004	7.62	0.64	<0.00002	0.0005	0.002	0.9	<0.001	4.1	<0.00025	2.79
X14	14-Jul-08	0.069	<0.001	<0.001	0.035	<0.001	<0.001	<0.05	<0.0002	30.3	<0.001	<0.001	0.001	0.3	<0.001	0.004	6.94	0.46	<0.00002	<0.0005	0.002	0.7	<0.001	4.8	<0.00025	2.43
X14	16-Jul-08	0.29	<0.001	<0.001	0.031	<0.001	<0.001	<0.05	<0.0002	28.1	<0.001	<0.001	0.003	0.57	0.003	0.002	6.08	0.47	<0.00002	<0.0005	0.003	0.9	<0.001	5.6	<0.00025	2.37
X14	22-Jul-08	0.046	<0.001	<0.001	0.04	<0.001	<0.001	<0.05	<0.0002	37	<0.001	<0.001	0.001	0.24	<0.001	0.003	8.69	0.46	<0.00002	<0.0005	0.002	0.9	<0.001	4.9	<0.00025	3.04
X14	30-Jul-08	0.0317	0.00008	0.00042	0.0445	<0.00001	<0.000005	<0.05	0.000029	47.1	0.0001	0.000879	0.00079	0.235	0.000458	0.0046	9.51	0.764		0.00049	0.0022	1.07	0.00022	4.47	<0.000005	4.08
X14	31-Jul-08	0.017	<0.001	<0.001	0.036	<0.001	<0.001	<0.05	<0.0002	41.2	<0.001	<0.001	0.001	0.23	<0.001	0.004	8.66	0.76	<0.00002	<0.0005	0.002	1	0.001	3.7	<0.00025	3.63
X14	05-Aug-08	0.038	<0.001	<0.001	0.049	<0.001	<0.001	<0.05	<0.0002	52.2	<0.001	0.001	0.001	0.32	0.002	0.005	11.4	1	<0.00002	<0.0005	0.003	1.3	<0.001	4.5	<0.00025	4.28
X14	11-Aug-08	0.043	<0.001	<0.001	0.048	<0.001	<0.001	<0.05	<0.0002	48.1	<0.001	0.001	<0.001	0.37	<0.001	0.004	12.3	1.14	<0.00002	<0.0005	0.003	1.3	<0.001	7.7	<0.00025	4.34
X14	12-Aug-08	0.044	<0.001	<0.001	0.05	<0.001	<0.001	<0.05	<0.0002	48.8	<0.001	<0.001	0.001	0.37	<0.001	0.006	12.2	0.79	<0.00002	<0.0005	0.003	1.3	<0.001	8.1	<0.00025	4.34
X14	19-Aug-08	0.023	<0.001	<0.001	0.041	<0.001	<0.001	<0.05	<0.0002	48	<0.001	0.001	0.001	0.37	<0.001	0.005	11.6	0.97	<0.00002	0.0007	0.003	1.3	<0.001	5.3	<0.00025	4.17
X14	28-Aug-08	0.1	<0.001	<0.001	0.04	<0.001	<0.001	<0.05	<0.0002	33.8	<0.001	<0.001	0.002	0.3	<0.001	0.003	7.65	0.38	<0.00002	0.0006	0.002	0.9	<0.001	5	<0.00025	2.52
X14	02-Sep-08	0.038	<0.001	<0.001	0.04	<0.001	<0.001	<0.05	<0.0002	41.3	<0.001	<0.001	0.001	0.21	<0.001	0.004	8.54	0.53	<0.00002	<0.0005	0.002	1.1	<0.001	4.5	<0.00025	2.9
X14	09-Sep-08	0.07	<0.001	<0.001	0.037	<0.001	<0.001	<0.05	<0.0002	34.2	<0.001	<0.001	0.002	0.17	<0.001	0.003	7.45	0.33	<0.00002	<0.0005	0.002	0.9	<0.001	4.9	<0.00025	2.79
X14	15-Sep-08	0.022	<0.001	<0.001	0.041	<0.001	<0.001	<0.05	<0.0002	42.9	<0.001	<0.001	<0.001	0.23	<0.001	0.004	9.05	0.51	<0.00002	<0.0005	0.002	1.1	<0.001	4.5	<0.00025	3.16
X14	16-Sep-08	0.028	<0.001	<0.001	0.04	<0.001	<0.001	<0.05	<0.0002	41.3	<0.001	<0.001	0.001	0.26	<0.001	0.004	8.48	0.49	<0.00002	<0.0005	0.002	1	<0.001	4.3	<0.00025	3.01
X14	18-Sep-08	0.0296	0.00008	0.00041	0.0434	<0.00001	<0.000005	<0.05	0.000029	46.6	0.0001	0.000633	0.00193	0.211	0.000506	0.0045	9.14	0.489		0.00044	0.00163	1.11	0.00029	4.29	<0.000005	3.2
X14	23-Sep-08	0.019	<0.001	<0.001	0.042	<0.001	<0.001	<0.05	<0.0002	48.2	<0.001	<0.001	<0.001	0.24	<0.001	0.005	9.86	0.62	<0.00002	<0.0005	0.002	1.1	<0.001	4.4	<0.00025	3.54
X14	30-Sep-08	0.035	<0.001	0.001	0.044	<0.001	<0.001	<0.05	<0.0002	49.9	<0.001	<0.001	<0.001	0.21	<0.001	0.004	8.7	0.72	<0.00002	0.0005	0.002	1.1	<0.001	4.4	<0.00025	2.98
X14	07-Oct-08	0.032	<0.001	<0.001	0.047	<0.001	<0.001	<0.05	<0.0002	50.3	<0.001	<0.001	<0.001	0.3	<0.001	0.004	10.9	0.78	<0.00002	0.0006	0.002	1.1	<0.001	5.1	<0.00025	3.6
X14	14-Oct-08	0.031	<0.001	<0.001	0.045	<0.001	<0.001	<0.05	<0.0002	61.5	<0.001	0.002	<0.001	0.25	<0.001	0.005	12.3	1.58	<0.00002	0.0007	0.005	1.3	0.001	5.1	<0.00025	4.23
X14	15-Oct-08	0.022	<0.001	<0.001	0.046	<0.001	<0.001	<0.05	<0.0002	61.8	<0.001	0.002	<0.001	0.24	0.001	0.005	11.6	1.41	<0.00002	0.001	0.004	1.3	<0.001	5	<0.00025	4.05
X14	21-Oct-08	0.084	<0.001	<0.001	0.053	<0.001	<0.001	<0.05	<0.0002	65	0.005	0.003	0.001	0.52	<0.001	0.006	13.9	2.22	<0.00002	0.0012	0.01	1.3	0.002	4.9	<0.00025	5
X14	04-Nov-08	0.028	<0.001	<0.001	0.055	<0.001	<0.001	<0.05	<0.0002	44.5	<0.001	<0.001	<0.001	0.26	<0.001	0.003	11.3	0.49	<0.00002	0.0007	0.002	1.2	<0.001	5.2	<0.00025	3.52
X14	01-Dec-08	0.019	<0.001	<0.001	0.07	<0.001	<0.001	<0.05	<0.0002	67	<0.001	<0.001	<0.001	0.42	<0.001	0.005	16.6	1.12	<0.00002	0.0007	0.002	1.5	<0.001	6.7	<0.00025	5.62
X14	10-Dec-08	0.0204	0.00007	0.00034	0.0652	<0.00001	<0.000005	<0.05	0.000036	64.8	0.0001	0.000811	0.00045	0.339	0.000277	0.0056	14.4	1.03		0.00066	0.00233	1.37	0.00044	5.89	<0.000005	4.85
X14	02-Feb-09	0.048	<0.001	<0.001	0.071	<0.001	<0.001	<0.05	<0.0002	85.7	<0.001	0.002	<0.001	0.66	<0.001	0.006	19.4	2.33	<0.00002	0.0009	0.005	1.8	<0.001	5.7	<0.00025	7.12
X14	25-Feb-09	0.0274	0.00006	0.00061	0.0693				0.000096	125	0.0001	0.0027	0.00035	0.632	0.000434	0.009	26.1	3.85		0.00084	0.00636	2.37	0.0004	6.22		9.9
X14	3-Mar-09	0.0164	0.00015	0.00048	0.0685	<0.00001	<0.000005		0.000083	108	0.0001	0.00199	0.00061	0.476	0.000458	0.0081	23.2	2.75		0.00085	0.005	2.14	0.00046	5.97	<0.000005	8.74
X14	27-Mar-09	0.0078	0.00006	0.00043	0.0684				0.000069	108		0.00205	0.00029	0.474	0.000208	0.0085	23.7	2.91		0.0008	0.00494	2.08	0.00042	6.29		8.94
X14	2-Apr-09	0.012	0.0002	0.0005	0.0562	<0.00005	<0.00003		0.00013	215	<0.0005	0.00909	0.0004	0.36	0.00067	0.014	41.9	7.92		0.0008	0.0179	4.03	0.0003	6.34	<0.00003	17.2
X14	8-Apr-09	0.008	0.0004	0.0005	0.0502	<0.00005	<0.00003		0.00015	213	<0.0005	0.0143	0.0005	0.316	0.00034	0.014	44.8	10.6		0.0008	0.0288	3.75	0.0004	5.9	<0.00003	18.4
X14	16-Apr-09	0.022	0.0001	0.0006	0.0464	<0.00005	<0.00003		0.00011	215	<0.0005	0.0182	0.0004	0.452	0.00045	0.013	46.1	12.7		0.0007	0.0337	3.58	0.0003	6.21	<0.00003	18.1
X14	23-Apr-09	0.007	0.0004	0.0003	0.0485	<0.00005	<0.00003		0.0001	212	<0.0005	0.0191	0.0003	0.38	0.00094	0.012	48.2	13.3		0.0008	0.0368	3.54	0.0003	6.66	<0.00003	18.3
X14	29-Apr-09	0.052	<0.0001	0.0006	0.0493	<0.00005	<0.00003		0.00011	222	<0.0005	0.0214	0.0005	0.416	0.00074	0.012	48.9	14.2		0.0007	0.0371	3.65	0.0003	6.36	<0.00003	18.5
X14	7-May-09	0.242	0.00012	0.00164	0.0351	0.00004	0.000014		0.000209	22.2	0.0003	0.000899	0.00413	1.06	0.012	0.0024	4.44	0.359		0.00022	0.00252	1.51	0.00012	2.81	0.000006	1.63
X14	14-May-09	0.0652	0.00009	0.00064	0.0377	0.00002	<0.000005		0.000056	59.4	<0.0001	0.00126	0.00156	0.376	0.00134	0.0045	10.8	1.02		0.0004	0.00324	1.75	0.0002	3.59	<0.000005	3.82
X14	21-May-09	0.228	0.00011	0.00123	0.039	0.00005	0.000016		0.000083	29.1	0.0002	0.00086	0.00264	1.01	0.00782	0.0029	6.29	0.455		0.00031	0.00242	1.17	0.00012	2.83	0.000014	1.98

Table B.1: Faro Near-field Exposure Station X14 Data 2005 - 2009

Station ID	Date	Aluminum mg/L	Antimony mg/L	Arsenic mg/L	Barium mg/L	Beryllium mg/L	Bismuth mg/L	Boron mg/L	Cadmium mg/L	Calcium mg/L	Chromium mg/L	Cobalt mg/L	Copper mg/L	Iron mg/L	Lead mg/L	Lithium mg/L	Magnesium mg/L	Manganese mg/L	Mercury mg/L	Molybdenum mg/L	Nickel mg/L	Potassium mg/L	Selenium mg/L	Silicon mg/L	Silver mg/L	Sodium mg/L
X14	31-May-09	0.0922	0.00006	0.00052	0.0303	0.00002	<0.000005		0.000034	23.3	<0.0001	0.000368	0.00125	0.259	0.00157	0.0019	5.03	0.246		0.00027	0.00117	0.84	0.00014	3.18	0.000007	1.55
X14	7-Jun-09	0.0782	0.00007	0.00042	0.0234	<0.00001	<0.000005		0.000016	18.4	<0.0001	0.000307	0.00098	0.189	0.000892	0.0007	3.63	0.212		0.00027	0.00088	0.6	0.00012	2.99	<0.000005	1.36
X14	8-Jun-09	0.066	0.00007	0.00043	0.0231	<0.00001	<0.000005		0.000026	18.9	<0.0001	0.000397	0.00121	0.195	0.00168	0.0019	4.04	0.263		0.00024	0.00111	0.67	0.00012	2.94	<0.000005	1.54
X14	14-Jun-09	0.0272	0.00007	0.0004	0.0343	<0.00001	<0.000005		0.00004	36.9	<0.0001	0.000617	0.00072	0.188	0.000563	0.003	7.96	0.497		0.00036	0.00143	0.85	0.00023	3.48	<0.000005	2.48
n [a]		157	157	157	157	155	155	142	30	157	156	157	157	157	157	155	157	157	130	157	157	157	157	156	30	157
minimum [a]		0.0025	0.00006	0.00029	0.0231	0.00001	0.000005	0.005	0.000016	14.9	0.0001	0.00023	0.00029	0.12	0.000137	0.0007	3.24	0.19	0.00002	0.00022	0.00088	0.6	0.00004	2.2	0.000005	1.36
maximum [a]		0.58	0.001	0.002	0.08	0.001	0.001	0.05	0.0003	243	0.005	0.0214	0.012	1.59	0.012	0.019	49.8	16	0.00002	0.002	0.0371	4.9	0.002	15.2	0.0023	27.7
mean [a,b]		0.0738	0.0004	0.0005	0.0473	0.0004	0.0004	0.0239	0.00009	67.8	0.0005	0.00183	0.0012	0.397	0.0013	0.0057	14.69	1.8086	0.00001	0.0006	0.0045	1.6454	0.0005	5.70	0.00017	6.20
standard deviation (SD) [a,b]		0.1095	0.0002	0.0002	0.0143	0.0002	0.0002	0.0049	0.00008	50.7	0.0004	0.00345	0.0012	0.228	0.0017	0.0033	10.68	2.8114	0.00000	0.0003	0.0064	0.8536	0.0003	2.66	0.00048	5.08
max detection limit (DL) [a]		0.005	0.001	0.001	0	0.001	0.001	0.05	0	0	0.001	0.001	0.001	0	0.001	0.005	0	0	0.00002	0.0005	0.001	0	0.001	0	0.00003	0
# < detection limit [a]		3	131	121	0	149	151	142	0	0	142	84	56	0	89	13	0	0	129	54	5	0	115	0	19	0
% < detection limit [a]		2%	83%	77%	0%	96%	97%	100%	0%	0%	91%	54%	36%	0%	57%	8%	0%	0%	99%	34%	3%	0%	73%	0%	63%	0%
background (BG) benchmark		0.2460	<0.001	<0.001	0.090	<0.001	<0.005	<0.05	0.00011	47	<0.001	<0.001	0.003	0.47	0.002	0.008	11	0.045	<0.00002	0.0012	<0.001	1.4	<0.001	11.6	0.000021	3.3
% samples > BG benchmark [c]		8%	0%	3%	0%	0%	0%	0%	20%	57%	1%	25%	2%	24%	14%	16%	53%	100%	0%	4%	88%	46%	3%	4%	33%	72%
background mean		0.0714	0.0003	0.0005	0.0428	0.0002	0.0005	0.0202	0.00004	20.8	0.0004	0.00027	0.0009	0.142	0.0007	0.0025	4.28	0.0145	0.00001	0.0005	0.0005	0.6828	0.0004	5.64	0.00001	1.96
station mean > BG mean [c]		1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1
current water quality criterion		0.1	0.02	0.005	1.0	1.1	0.26	1.2	0.00003	116	0.001	0.004	0.002	0.3	0.002	-	82	1.0	0.000026	0.073	0.065	53	0.001	-	0.0001	200
source		CCME	OMOE	CCME	CCME	OMOE	Alternate	BCMOE	CCME	Alternate	CCME	BCMOE	CCME	CCME	CCME	-	Alternate	BCMOE	CCME	CCME	CCME	Alternate	CCME	-	CCME	CCME
proposed new criterion		-	-	-	-	-	-	-	0.00022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
source		-	-	-	-	-	-	-	CCME	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
# > current water quality criterion		28	0	0	0	0	0	0	25	21	1	13	21	82	22	-	0	61	0	0	0	0	4	-	5	0
% > current water quality criterion		18%	0%	0%	0%	0%	0%	0%	83%	13%	1%	8%	13%	52%	14%	-	0%	39%	0%	0%	0%	0%	3%	-	17%	0%

< DL greater than guideline, removed
statistical outlier that was removed (mean + 3 SD)
statistical outlier that was not removed (mean + 3 SD)
unusual datum that was removed (silver) or modified (temperature negative values set as "0")

[a] excluding sensored data
[b] values reported as less than the detection limit were used at 1/2 the detection limit for calculation
[c] alkalinity, bicarbonate, dissolved oxygen and pH evaluated at less than the lower benchmark (5th percentile of background values)

Table B.1: Faro Near-field Exposure Station X14 Data 2005 - 2009

Station ID	Date	Strontium mg/L	Tellurium mg/L	Thallium mg/L	Thorium mg/L	Tin mg/L	Titanium mg/L	Uranium mg/L	Vanadium mg/L	Zinc mg/L	Zirconium mg/L	Alkalinity-C mg/L	Alkalinity-H mg/L	Alkalinity-PP mg/L	Alkalinity-T mg/L	Ammonia mg/L	Bicarbonate mg/L	Chloride mg/L	Colour CU	Conductivity-Field uS/cm	Conductivity-Lab uS/cm	Cyanide-WAD mg/L	DOC mg/L	DO mg/L	DO %	Fluoride mg/L
X14	21-Jan-05	0.31	<0.001	<0.0001	<0.0005	<0.001	0.001	0.0027	<0.001	0.028	<0.01					0.1					598					
X14	08-Feb-05	0.36	<0.001	<0.0001	<0.0005	<0.001	0.001	0.0032	<0.001	0.028	<0.01					0.11					588					
X14	01-Mar-05																									
X14	08-Mar-05	0.56	<0.001	<0.0001	<0.0005	<0.001	0.001	0.0041	<0.001	0.25	<0.01					0.42			<5		748					
X14	14-Mar-05	0.6	<0.001	<0.0001	<0.0005	<0.001	0.001	0.0039	<0.001	0.19	<0.01					0.56					1330					
X14	22-Mar-05	0.63	<0.001	<0.0001	<0.0005	<0.001	0.001	0.0043	<0.001	0.2	<0.01					0.54			<5		1220					
X14	11-Apr-05	0.32	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0031	<0.001	0.019	<0.01					0.04			<5		562					
X14	10-May-05	0.078	<0.001	<0.0001	<0.0005	<0.001	0.009	0.0005	<0.001	0.035	<0.01					0.04			75		149					
X14	31-May-05	0.094	<0.001	<0.0001	<0.0005	<0.001	0.002	0.0007	<0.001	0.019	<0.01					0.03			15		185					
X14	11-Jun-05	0.11	<0.001	<0.0001	<0.0005	<0.001	0.003	0.0006	<0.001	0.017	<0.01					0.03			10		207					
X14	19-Jun-05	0.14	<0.001	<0.0001	<0.0005	<0.001	0.001	0.0009	<0.001	0.022	<0.01					0.01			8		267					
X14	21-Jun-05	0.15	<0.001	<0.0001	<0.0005	<0.001	0.001	0.0009	<0.001	0.027	<0.01					0.01			8		284					
X14	02-Jul-05	0.17	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0009	<0.001	0.011	<0.01					0.02			8		301					
X14	10-Jul-05	0.16	<0.001	<0.0001	<0.0005	<0.001	0.001	0.001	<0.001	0.029	<0.01	<0.5	<0.5		85.3	0.05	104		10		325					
X14	17-Jul-05	0.18	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.001	<0.001	0.035	<0.01					0.11			8		332					
X14	24-Jul-05	0.17	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0012	<0.001	0.032	<0.01					0.11			13		1030					
X14	25-Jul-05	0.16	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0011	<0.001	0.024	<0.01	<0.5	<0.5		93.3	0.1	114		8		279					
X14	31-Jul-05	0.15	<0.001	<0.0001	<0.0005	<0.001	0.002	0.0009	<0.001	0.029	<0.01	<0.5	<0.5		105	0.07	111		15		270					
X14	06-Aug-05	0.19	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0012	<0.001	0.037	<0.01					0.1			7		331					
X14	13-Aug-05	0.23	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0014	<0.001	0.051	<0.01					0.12			7		377					
X14	20-Aug-05	0.21	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0014	<0.001	0.051	<0.01					0.11			5		349					
X14	23-Aug-05	0.22	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0015	<0.001	0.05	<0.01	<0.5	<0.5		100	0.13	123				314					
X14	27-Aug-05	0.19	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0011	<0.001	0.049	<0.01					0.12			7		286					
X14	05-Sep-05	0.21	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0014	<0.001	0.06	<0.01				139	0.15			6		288					
X14	06-Sep-05	0.21	<0.001	<0.0001	0.0016	<0.001	<0.001	0.0015	<0.001	0.057	<0.01	<0.5	<0.5		97.1	0.16	118				411					
X14	11-Sep-05	0.21	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0011	<0.001	0.05	<0.01		<0.5		130	0.15	123		7		340					
X14	18-Sep-05	0.21	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0011	<0.001	0.03	<0.01				123	0.11			6		305					
X14	24-Sep-05	0.18	<0.001	<0.0001	<0.0005	0.005	<0.001	0.0009	<0.001	0.034	<0.01				111	0.11			7		321					
X14	01-Oct-05	0.22	<0.001	<0.0001	<0.0005	0.002	<0.001	0.0013	<0.001	0.066	<0.01					0.11			<5		296					
X14	11-Oct-05	0.16	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0014	<0.001	0.028	<0.01	<0.5			101	0.05			7		192					
X14	02-Nov-05	0.19	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0018	<0.001	0.043	<0.01	<0.5	<0.5		121	0.01	148		<5		252					
X14	15-Dec-05	0.25	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0022	<0.001	0.056	<0.01	<0.5	<0.5		140	0.04	171		<5		477					
X14	23-Jan-06	0.3	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0025	<0.001	0.062	<0.01	<0.5	<0.5		159	0.09	194		<5		625					
X14	14-Feb-06	0.33	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0029	<0.001	0.04	<0.01	<0.5	<0.5		169	0.11	206		<5		706					
X14	24-Mar-06	0.37	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0033	<0.001	0.044	<0.01	<0.5	<0.5		192	0.13	234		<5		803					
X14	25-Apr-06	0.33	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0028	<0.001	0.045	<0.01	<0.5	<0.5		170	0.1	208		<5		714					
X14	09-May-06	0.43	<0.001	0.0002	<0.0005	<0.001	0.003	0.002	<0.001	0.17	<0.01	<0.5	<0.5		119	0.22	145		8		895					
X14	18-May-06	0.06	<0.001	<0.0001	<0.0005	<0.001	0.004	<0.0005	<0.001	0.03	<0.01	<0.5	<0.5		38.2	<0.01	46.6		117		120					
X14	23-May-06	0.067	<0.001	<0.0001	<0.0005	<0.001	0.008	0.0005	<0.001	0.035	<0.01	<0.5	<0.5		36.2	0.03	44.2		90		150					
X14	30-May-06	0.099	<0.001	<0.0001	<0.0005	<0.001	0.005	0.0008	<0.001	0.028	<0.01	<0.5	<0.5		53.4	0.04	65.1		45		236					
X14	06-Jun-06	0.088	<0.001	<0.0001	<0.0005	<0.001	0.005	0.0006	<0.001	0.022	<0.01					0.02			35		198					
X14	19-Jun-06	0.13	<0.001	<0.0001	<0.0005	<0.001	0.002	0.0009	<0.001	0.027	<0.01	<0.5	<0.5		61	0.02	74.4		18		253					
X14	20-Jun-06	0.14	<0.001	<0.0001	<0.0005	<0.001	0.003	0.0009	<0.001	0.026	<0.01					0.03			10		280					
X14	11-Jul-06	0.14	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0007	<0.001	0.016	<0.01					0.05			10		282					
X14	17-Jul-06	0.17	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0008	<0.001	0.023	<0.01	<0.5	<0.5		84.8	0.09	103		7		367					
X14	18-Jul-06	0.17	<0.001	<0.0001	<0.0005	<0.001	0.004	0.0009	<0.001	0.033	<0.01					0.08			7		372					
X14	25-Jul-06	0.21	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0011	<0.001	0.028	<0.01					0.14			6		428					
X14	01-Aug-06	0.2	<0.001	<0.0001	<0.0005	<0.001	0.002	0.0013	<0.001	0.023	<0.01					0.09			5		380					
X14	15-Aug-06	0.15	<0.001	<0.0001	<0.0005	<0.001	0.001	0.0007	<0.001	0.028	<0.01					0.07			8		331					
X14	21-Aug-06	0.15	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.001	<0.001	0.026	<0.01	<0.5	<0.5		90.5	0.06	110		7		328					
X14	22-Aug-06	0.15	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0009	<0.001	0.027	<0.01	<0.5	<0.5		87.2	0.08	106		7		326					
X14	29-Aug-06	0.18	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0011	<0.001	0.039	<0.01					0.13			7		388					
X14	05-Sep-06	0.15	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0011	<0.001	0.025	<0.01	<0.5	<0.5		92.7	0.05	113		<5		299					
X14	12-Sep-06	0.12	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.001	<0.001	0.018	<0.01	<0.5	<0.5		91.7	0.01	112		8		242					
X14	17-Oct-06	0.18	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0018	<0.001	0.032	<0.01	<0.5	<0.5		128	0.05	156		<5		355					
X14	14-Nov-06	0.25	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0022	<0.001	0.055	<0.01	<0.5	<0.5		148	0.06	174		<5		454					
X14	13-Dec-06	0.29	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0034	<0.001	0.06	<0.01	<0.5	<0.5		175	0.07	213		<5		592					
X14	16-Jan-07	0.34	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0028	<0.001	0.053	<0.01	<0.5	<0.5		189	0.14	230		<5		699					
X14	15-Feb-07	0.37	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0033	<0.001	0.031	<0.01	<0.5	<0.5		196	0.15	239		<5		801					
X14	12-Mar-07	0.49	<0.001	<0.0001	<0.0005	<0.001	0.002	0.0039	<0.001	0.024	<0.01	<0.5	<0.5		233	0.26	285		<5		1030					
X14	10-Apr-07	0.63	<0.001	<0.0001	<0.0005	<0.001	0.034	0.0045	0.001	0.22	<0.01	<0.5	<0.5		240	0.5	293		<5		1630					
X14	19-Apr-07	0.35	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0031	<0.001	0.07	<0.01	<0.5	<0.5		193	0.12	235		<5		669					
X14	14-May-07	0.11	<0.001	<0.0001	<0.0005	<0.001	0.005	0.001	<0.001	0.043	<0.01	<0.5	<0.5		72.2	0.04	88.1		70		208					
X14	15-May-07	0.11	<0.001	<0.0001	<0.0005	<0.001	0.008	0.0009	<0.001	0.045	<0.01	<0.5	<0.5		69.7	0.01	85.1		70		197					
X14	22-May-07	0.086	<0.001	<0.0001	<0.0005	<0.001	0.013	0.0005	0.001	0.034	<0.01	<0.5	<0.5		47.1	0.05	57.5		110		194					
X14	29-May-07	0.079	<0.001	<0.0001	<0.0005	<0.001	0.012	0.0007	<0.001	0.016	<0.01	<0.5	<0.5		49.6	0.03	60.5		70		176					
X14	05-Jun-07	0.055	<0.001	<0.0001	<0.0005	<0.001	0.019	0.0006	0.001	0.014	<0.01	<0.5	<0.5		32.5	0.04	39.6		35		112					
X14	12-Jun-07	0.08	<0.001	<0.0001	<0.0005	<0.001	0.014	0.0006	<0.001	0.016	<0.01	<0.5	<0.5		47.6	0.04	58.1		55		156					
X14	18-Jun-07	0.096	<0.001	<0.0001	<0.0005	<0.001	0.001	0.0008	<0.001	0.019	<0.01	<0.5	<0.5		73.4	0.05	89.5		18		274					
X14	19-Jun-07	0.13	<0.001	<0.0001	<0.0005	<0.001	0.002	0.001	<0.001	0.019	<0.01	<0.5	<0.5		79.1	0.06	96.6		12		315					
X14	26-Jun-07	0.1	<0.001	<0.0001	<0.0005	<0.001	0.005	0.0008	<0.001	0.02	<0.01	<0.5	<0.5		73.6	0.04	89.8		35		239					
X14	03-Jul-07	0.12	<0.001	<0.0001	<0.0005	<0.001	0.002	0.0008	<0.001	0.019	<0.01	<0.5	<0.5		72.9	0.06	88.9		18		253					
X14	10-Jul-07	0.18	<0.001	<0.0001	<0.0005	0.002	0.003	0.0011	<0.001	0.066	<0.01	<0.5	<0.5		95.6	0.18	117		8		384					
X14	16-Jul-07	0.16	<0.001	<0.0001	<0.0005	<0.001	0.002	0.0009	<0.001	0.025	<0.01	<0.5	<0.5		76.3	0.06	93.1		<5		290					
X14	17-Jul-07	0.13	<0.001	<0.0001	<0.0005	<0.001	0.002	0.0007	<0.001	0.023	<0.01	<0.5	<0.5		76.2	0.06	93		7		281					
X14	24-Jul-07	0.21	<0.001	<0.0001	<0.0005	<0.001	0.002	0.0012	<0.001	0.031	<0.01	<0.5	<0.5		101	0.14	123		7		402					
X14	31-Jul-07	0.2	<0.001	<0.0001	<0.0005	<0.001	0.001	0.0013	<0.001	0.022	<0.01	<0.5	<0.5		97.4	0.11	119		7		391					

Table B.1: Faro Near-field Exposure Station X14 Data 2005 - 2009

Station ID	Date	Strontium mg/L	Tellurium mg/L	Thallium mg/L	Thorium mg/L	Tin mg/L	Titanium mg/L	Uranium mg/L	Vanadium mg/L	Zinc mg/L	Zirconium mg/L	Alkalinity-C mg/L	Alkalinity-H mg/L	Alkalinity-PP mg/L	Alkalinity-T mg/L	Ammonia mg/L	Bicarbonate mg/L	Chloride mg/L	Colour CU	Conductivity-Field uS/cm	Conductivity-Lab uS/cm	Cyanide-WAD mg/L	DOC mg/L	DO mg/L	DO %	Fluoride mg/L
X14	07-Aug-07	0.2	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0013	<0.001	0.026	<0.01	<0.5	<0.5		108	0.13	131		8		391					
X14	13-Aug-07	0.25	<0.001	<0.0001	<0.0005	<0.001	0.003	0.0014	<0.001	0.033	<0.01	<0.5	<0.5		109	0.26	133		<5		494					
X14	14-Aug-07	0.21	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0014	<0.001	0.032	<0.01	<0.5	<0.5		104	0.14	127		7		391					
X14	21-Aug-07	0.24	<0.001	<0.0001	<0.0005	<0.001	0.001	0.0013	<0.001	0.037	<0.01	<0.5	<0.5		112	0.17	137		<5		502					
X14	28-Aug-07	0.19	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0013	<0.001	0.034	<0.01	<0.5	<0.5		104	0.13	127		7		425					
X14	04-Sep-07	0.23	<0.001	0.0002	<0.0005	<0.001	<0.001	0.0018	<0.001	0.038	<0.01	<0.5	<0.5		104	0.14	127		<5		433					
X14	10-Sep-07	0.18	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0014	<0.001	0.038	<0.01	<0.5	<0.5		103	0.12	125		7		402					
X14	11-Sep-07	0.17	<0.001	<0.0001	<0.0005	<0.001	0.002	0.0011	<0.001	0.033	<0.01	<0.5	<0.5		81.4	0.09	99.3		13		286					
X14	17-Sep-07	0.14	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0011	<0.001	0.027	<0.01	<0.5	<0.5		88.5	0.12	108		7		318					
X14	25-Sep-07	0.129		<0.000002		<0.00001	0.0011	0.00119	0.00011	0.0225	0.00013	<0.5	<0.5	<0.5	85.2	<0.005	104	<0.5		261	238	<0.0005	2.4	11		0.12
X14	23-Oct-07	0.3	<0.001	<0.0001	<0.0005	<0.001	0.002	0.002	<0.001	0.07	<0.01	<0.5	<0.5		131	0.18	160		<5		647					
X14	25-Oct-07	0.333		0.000038		<0.00001	<0.0005	0.0026	<0.0002	0.0789	<0.0001	<0.5	<0.5	<0.5	137	0.168	168	0.8		705	685	<0.0005	1.7	12.32	92.1	0.14
X14	29-Oct-07	0.26	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0016	<0.001	0.069	<0.01	<0.5	<0.5		124	0.13	151		<5		574					
X14	14-Nov-07	0.21	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0017	<0.001	0.051	<0.01	<0.5	<0.5		124	0.06	151		<5		373					
X14	21-Nov-07	0.232		0.000005		<0.00001	<0.0005	0.00226	<0.0002	0.0508	<0.0001	<0.5	<0.5	<0.5	130	0.063	160	<0.5		479	420	<0.0005	0.8	12.24		0.14
X14	10-Dec-07	0.25	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0023	<0.001	0.052	<0.01	<0.5	<0.5		146	0.08	178		<5		541					
X14	13-Dec-07	0.28		0.000006		<0.00001	<0.0005	0.00291	<0.0002	0.0517	<0.0001	<0.5	<0.5	<0.5	150	0.065	180	0.6		373	530	<0.0005	2			0.15
X14	08-Jan-08	0.31	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0024	<0.001	0.049	<0.01	<0.5	<0.5		141	0.09	173		<5		606					
X14	24-Jan-08	0.32		0.000006		0.00001	<0.0005	0.00307	<0.0002	0.0498	<0.0001	<0.5	<0.5	<0.5	160	0.097	190	<0.5		696	660	<0.0005	1			0.13
X14	19-Feb-08	0.4	<0.001	<0.0001	<0.0005	<0.001	0.001	0.0023	<0.001	0.052	<0.01	<0.5	<0.5		194	0.16	236		<5		813					
X14	20-Feb-08	0.383		0.00001		<0.00001	0.0007	0.00379	<0.0002	0.0481	<0.0001	<0.5	<0.5	<0.5	200	0.128	250	23.1		925	840	<0.0005	1.3	11.24	82.1	0.14
X14	11-Mar-08	0.387		0.000008		<0.00001	0.0008	0.00368	<0.0002	0.0555	<0.0001	<0.5	<0.5	<0.5	190	0.138	230	0.8		834	800	<0.0005	1.3	11.03	78	0.17
X14	18-Mar-08	0.36	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0043	<0.001	0.058	<0.01	<0.5	<0.5		204	0.15	249		<5		797					
X14	14-Apr-08	0.58	<0.001	<0.0001	<0.0005	<0.001	0.006	0.0043	<0.001	0.1	<0.01	<0.5	<0.5		197	0.38	241		<5		1130					
X14	15-Apr-08	0.58	<0.001	<0.0001	<0.0005	<0.001	0.006	0.0044	<0.001	0.096	<0.01	<0.5	<0.5		204	0.37	249		<5		1150					
X14	22-Apr-08	0.64	<0.001	<0.0001	<0.0005	<0.001	0.003	0.0036	<0.001	0.089	<0.01	<0.5	<0.5		205	0.37	250		<5		1190					
X14	29-Apr-08	0.53	<0.001	0.0001	<0.0005	<0.001	0.003	0.003	<0.001	0.13	<0.01	<0.5	<0.5	<0.5	142	0.3	173	1.3	<5	1151	1080	<0.0005	0.8	11.09	82.1	0.13
X14	06-May-08	0.35	<0.001	<0.0001	<0.0005	<0.001	0.004	0.0019	<0.001	0.12	<0.01	<0.5	<0.5		89.8	0.21	110		35		699					
X14	13-May-08	0.17	<0.001	<0.0001	<0.0005	<0.001	0.007	0.0008	<0.001	0.071	<0.01	<0.5	<0.5		45.7	0.07	55.8		110		299					
X14	15-May-08	0.16	<0.001	<0.0001	<0.0005	<0.001	0.005	0.0009	<0.001	0.059	<0.01	<0.5	<0.5		50.2	0.09	61.2		88		330					
X14	20-May-08	0.084	<0.001	<0.0001	<0.0005	<0.001	0.009	<0.0005	<0.001	0.034	<0.01	<0.5	<0.5		34.5	0.04	42.1		113		166					
X14	22-May-08	0.0874		0.000019		<0.00001	0.0086	0.00059	0.0005	0.0266	0.0003	<0.5	<0.5	<0.5	39	0.006	47			181.3	180	<0.0005	12.2		85.3	0.05
X14	26-May-08	0.0637		0.000016		0.00002	0.0069	0.00055	0.0006	0.0412	0.0003	<0.5	<0.5	<0.5	29	0.14	35	0.7				<0.0005	7.8			0.07
X14	27-May-08	0.055	<0.001	<0.0001	<0.0005	<0.001	0.017	<0.0005	0.003	0.025	<0.01	<0.5	<0.5		27	0.02	32.9		50		105					
X14	03-Jun-08	0.092	<0.001	<0.0001	<0.0005	<0.001	0.005	0.0006	<0.001	0.015	<0.01	<0.5	<0.5		40.9	0.03	49.8		30		186					
X14	10-Jun-08	0.093	<0.001	<0.0001	<0.0005	<0.001	0.004	0.0006	<0.001	0.025	<0.01	<0.5	<0.5		50.4	0.04	61.5		25		208					
X14	16-Jun-08	0.12	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0008	<0.001	0.021	<0.01	<0.5	<0.5		54.3	0.04	66.3		13		235					
X14	17-Jun-08	0.1	<0.001	<0.0001	<0.0005	<0.001	0.002	0.0007	<0.001	0.018	<0.01	<0.5	<0.5		52.2	0.05	63.7		12		223					
X14	24-Jun-08	0.064	<0.001	<0.0001	<0.0005	<0.001	0.026	0.0006	0.001	0.027	<0.01	<0.5	<0.5	<0.5	34.6	0.03	42.2	0.6	40	162.5	137	0.0006	5.1	10.63	88.3	0.07
X14	01-Jul-08	0.15	<0.001	<0.0001	<0.0005	<0.001	0.001	0.0009	<0.001	0.041	<0.01	<0.5	<0.5		63.6	0.07	77.5		<5		289					
X14	08-Jul-08	0.13	<0.001	<0.0001	<0.0005	<0.001	0.001	0.0009	<0.001	0.026	<0.01	<0.5	<0.5		83	0.03	101		10		257					
X14	14-Jul-08	0.11	<0.001	<0.0001	<0.0005	<0.001	0.002	0.0008	<0.001	0.022	<0.01	<0.5	<0.5		81	0.03	98.8		17		217					
X14	16-Jul-08	0.1	<0.001	<0.0001	<0.0005	<0.001	0.011	0.0006	<0.001	0.031	<0.01	<0.5	<0.5		59.8	0.03	72.9		45		172					
X14	22-Jul-08	0.14	<0.001	<0.0001	<0.0005	<0.001	0.001	0.001	<0.001	0.022	<0.01	<0.5	<0.5		80.9	0.05	98.7		13		237					
X14	30-Jul-08	0.179		0.000023		<0.00001	0.0008	0.00134	<0.0002	0.0246	<0.0001	<0.5	<0.5	<0.5	89	0.034	110	1		327	330	<0.0005	3.6	10.32	86.9	0.1
X14	31-Jul-08	0.17	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0013	<0.001	0.027	<0.01	<0.5	<0.5		106	0.07	129		7		315					
X14	05-Aug-08	0.18	<0.001	<0.0001	<0.0005	<0.001	0.001	0.0013	<0.001	0.033	<0.01	<0.5	<0.5		108	0.09	131		7		348					
X14	11-Aug-08	0.18	<0.001	<0.0001	<0.0005	<0.001	0.001	0.0015	<0.001	0.028	<0.01	<0.5	<0.5		91.9	0.07	112		7		336					
X14	12-Aug-08	0.19	<0.001	<0.0001	<0.0005	<0.001	0.001	0.0014	<0.001	0.032	<0.01	<0.5	<0.5		109	0.09	132		7		337					
X14	19-Aug-08	0.18	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0012	<0.001	0.031	<0.01	<0.5	<0.5		112	0.06	137		10		318					
X14	28-Aug-08	0.13	<0.001	<0.0001	<0.0005	<0.001	0.007	0.0008	<0.001	0.018	<0.01	<0.5	<0.5		82.2	0.04	100		25		206					
X14	02-Sep-08	0.15	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0009	<0.001	0.023	<0.01	<0.5	<0.5		99.5	0.05	121		13		275					
X14	09-Sep-08	0.13	<0.001	<0.0001	<0.0005	<0.001	0.002	0.0008	<0.001	0.016	<0.01	<0.5	<0.5		85.9	0.05	105		18		231					
X14	15-Sep-08	0.19	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0014	<0.001	0.025	<0.01	<0.5	<0.5		91.9	0.07	112		8		291					
X14	16-Sep-08	0.18	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0014	<0.001	0.023	<0.01	<0.5	<0.5		91.1	0.06	111		8		291					
X14	18-Sep-08	0.176		0.000028		0.0001	0.001	0.00117	<0.0002	0.0249	<0.0001	<0.5	<0.5	<0.5	84	0.036	100	<0.5		328	310	<0.0005	2.7	11.38	89.1	0.11
X14	23-Sep-08	0.22	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0015	<0.001	0.031	<0.01	<0.5	<0.5		89.7	0.06	109		7		328					
X14	30-Sep-08	0.19	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0013	<0.001	0.036	<0.01	<0.5	<0.5		89.5	0.08	109		8		322					
X14	07-Oct-08	0.18	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0014	<0.001	0.044	<0.01	<0.5	<0.5	<0.5	48.8	0.07	59.5	1.2	8	971	350	<0.0005	2.3			0.11
X14	14-Oct-08	0.22	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0015	<0.001	0.059	<0.01	<0.5	<0.5		129	0.08	157		7		441					
X14	15-Oct-08	0.23	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0015	<0.001	0.06	<0.01	<0.5	<0.5		121	0.09	148		8		419					
X14	21-Oct-08	0.24	<0.001	<0.0001	<0.0005	<0.001	0.002	0.0019	<0.001	0.076	<0.01	<0.5	<0.5		138	0.07	169		8		473					
X14	04-Nov-08	0.16	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0017	<0.001	0.062	<0.01	<0.5	<0.5		105	0.03	128		5		305					
X14	01-Dec-08	0.24	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.002	<0.001	0.075	<0.01	<0.5	<0.5		121	0.05	148		<5		390					
X14	10-Dec-08	0.233		0.000005		<0.00001	0.0006	0.00256	<0.0002	0.0624	<0.0001	<0.5	<0.5	<0.5	130	0.032	160	1		613	420	0.0005	2.1			0.13
X14	02-Feb-09	0.32	<0.001	<0.0001	<0.0005	<0.001	0.002	0.0029	<0.001	0.1	<0.01	<0.5	<0.5		173	0.09	211		<5		585					
X14	25-Feb-09	0.399		0.000009			0.0011	0.00362		0.0938					190	0.152	230	1.1			860		1.2			0.16
X14	3-Mar-09	0.351		0.000007		<0.00001	0.0005	0.00338	<0.0002	0.088	<0.0001	<0.5	<0.5	<0.5	170	0.1	210	1.6			680		1.7			
X14	27-Mar-09	0.354		0.000006				0.00349		0.0692					180	0.124	220	0.6			760		1			0.17
X14	2-Apr-09	0.588		0.0001		<0.00005	<0.003	0.00369	<0.001	0.131	<0.0005	<0.5	<0.5	<0.5	200	0.57	250	1			1200		2.3			
X14	8-Apr-09	0.614		0.00009		<0.00005	<0.003	0.00417	<0.001	0.146	<0.0005	<0.5	<0.5	<0.5	210	0.39	260	1.8			1400		1.5			
X14	16-Apr-09	0.609		0.00007		<0.00005	0.005	0.00419	0.001	0.156	<0.0005	<0.5	<0.5	<0.5	220	0.4	270	1.3			1400		2.1			
X14	23-Apr-09	0.614		0.00006		<0.00005	<0.003	0.00418	<0.001	0.16	<0.0005	<0.5	<0.5	<0.5	220	0.34	270	1.5			1500		2.5			
X14	29-Apr-09	0.612		0.00005		<0.00005	<0.003	0.0036	<0.001	0.183	<0.0005	<0.5	<0.5	<0.5	210	0.18	260	2.4			1400		1.3			
X14	7-May-09	0.0825		0.00002		0.00002	0.0075	0.000575	0.0003	0.143	0.0003	<0.5	<0.5	<0.5	35	0.05	42	1.3			170		15.2			
X14	14-May-09	0.19		0.000035		<0.00001	0.0033	0.00113	0.0002	0.0506	0.0001	<0.5	<0.5	<0.5	77	0.09	94	1.7			400		10			
X14	21-May-09	0.106		0.000029		<0.00001	0.0071	0.000855	0.001	0.0439	0.0002	<0.5	<0.5	<0.5	53	0.05	64	0.9			210		7.5			

Table B.1: Faro Near-field Exposure Station X14 Data 2005 - 2009

Station ID	Date	Strontium mg/L	Tellurium mg/L	Thallium mg/L	Thorium mg/L	Tin mg/L	Titanium mg/L	Uranium mg/L	Vanadium mg/L	Zinc mg/L	Zirconium mg/L	Alkalinity-C mg/L	Alkalinity-H mg/L	Alkalinity-PP mg/L	Alkalinity-T mg/L	Ammonia mg/L	Bicarbonate mg/L	Chloride mg/L	Colour CU	Conductivity-Field uS/cm	Conductivity-Lab uS/cm	Cyanide-WAD mg/L	DOC mg/L	DO mg/L	DO %	Fluoride mg/L
X14	31-May-09	0.0861		0.000015		<0.00001	0.0023	0.000665	0.0003	0.0176	0.0002	<0.5	<0.5	<0.5	50	0.05	61	1.1			180		4.7			
X14	7-Jun-09	0.0688		0.000011		<0.00001	0.0015	0.00052	<0.0002	0.0132	0.0001	<0.5	<0.5	<0.5	39	0.01	48	0.6			140		4.2			
X14	8-Jun-09	0.0687		0.000014		<0.00001	0.0021	0.000555	<0.0002	0.0182	0.0001	<0.5	<0.5	<0.5	38	0.05	46	0.8			140		4.6			
X14	14-Jun-09	0.128		0.000025		<0.00001	0.0017	0.00103	<0.0002	0.0221	<0.0001	<0.5	<0.5	<0.5	68	0.04	83	1.2			260		3.1			
n [a]		157	130	157	130	155	156	157	155	157	25	124	124	28	130	157	126	29	125	14	156	15	30	9	8	17
minimum [a]		0.055	0.001	0.000002	0.0005	0.00001	0.0005	0.0005	0.00011	0.011	0.0001	0.5	0.5	0.5	27	0.005	32.9	0.5	5	162.5	105	0.0005	0.8	10.32	78	0.05
maximum [a]		0.64	0.001	0.0002	0.0016	0.005	0.034	0.0045	0.003	0.25	0.0005	0.5	0.5	0.5	240	0.57	293	23.1	117	1151	1630	0.0006	15.2	12.32	92.1	0.17
mean [a,b]		0.2268	0.0005	0.00005	0.0003	0.0005	0.0027	0.0017	0.0005	0.0495	0.0001	0.25	0.25	0.25	110.0	0.1080	133.6	1.76	16.5	571.9	455.2	0.0003	3.7	11.25	85.49	0.1229
standard deviation (SD) [a,b]		0.1426	0.0000	0.00002	0.0001	0.0004	0.0045	0.0011	0.0003	0.0421	0.0001	0.00	0.00	0.00	52.8	0.1076	65.6	4.14	25.0	317.1	314.9	0.0001	3.5	0.66	4.56	0.0348
max detection limit (DL) [a]		0	0.001	0.0001	0.0005	0.001	0.003	0.0005	0.001	0	0.0005	0.5	0.5	0.5	0	0.01	0	0.5	5	0	0	0.0005	0	0	0	0
# < detection limit [a]		0	130	128	129	148	69	3	142	0	16	124	124	28	0	2	0	4	37	0	0	13	0	0	0	0
% < detection limit [a]		0%	100%	82%	99%	95%	44%	2%	92%	0%	64%	100%	100%	100%	0%	1%	0%	14%	30%	0%	0%	87%	0%	0%	0%	0%
background (BG) benchmark		0.18	<0.001	<0.0001	<0.0005	<0.001	0.0069	0.0025	<0.001	0.017	<0.002	<0.5	<0.5	<0.5	9.5	0.040	180	1.2	8	350	310	<0.0005	12.1	9.7	76.5	0.13
% samples > BG benchmark [c]		49%	0%	1%	1%	2%	11%	22%	1%	94%	0%	0%	0%	0%	0%	75%	78%	31%	34%	64%	60%	7%	7%	0%	0%	41%
background mean		0.0821	0.0005	0.00003	0.0002	0.0006	0.0017	0.0011	0.0004	0.0051	0.0003	0.30	0.25	0.26	54.0	0.0117	65.7	0.56	4.2	135.2	142.2	0.0003	4.1	11.24	83.40	0.0792
station mean > BG mean [c]		1	1	1	1	0	1	1	1	1	0	1	0	1	0	1	0	1	1	1	1	1	0	0	0	1
current water quality criterion		9.3	-	0.0008	-	0.35	1.83	0.015	0.006	0.030	0.004	-	-	-	7.1	0.24	-	250	-	-	-	0.005	-	6.5	-	0.12
source		Alternate	-	CCME	-	Alternate	Alternate	SE	OMOE	CCME	OMOE	-	-	-	OMOE	CCME	-	CCME	-		-	CCME	-	CCME	-	CCME
proposed new criterion		-	-	-	-	-	-	-	-	0.017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
source		-	-	-	-	-	-	-	-	CCME	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
# > current water quality criterion		0	-	0	-	0	0	0	0	93	0	-	-	-	0	14	-	0	-	-	-	0	-	0	-	10
% > current water quality criterion		0%	-	0%	-	0%	0%	0%	0%	59%	0%	-	-	-	0%	9%	-	0%	-	-	-	0%	-	0%	-	59%

< DL greater than guideline, removed
statistical outlier that was removed (mean + 3 SD)
statistical outlier that was not removed (mean + 3 SD)
unusual datum that was removed (silver) or modified (temperature negative values set as "0")

[a] excluding sensored data
[b] values reported as less than the detection limit were used at 1/2 the detection limit for calculation
[c] alkalinity, bicarbonate, dissolved oxygen and pH evaluated at less than the lower benchmark (5th percentile of background values)

Table B.1: Faro Near-field Exposure Station X14 Data 2005 - 2009

Station ID	Date	Hardness-Dissolved mg/L	Hardness-Total mg/L	Nitrate mg/L	Nitrite mg/L	Nitrogen mg/L	pH-field	pH-Lab	Phosphorus mg/L	Sulphate mg/L	TEMP-F °C	TDS mg/L	TOC mg/L	TSS mg/L	Turbidity NTU
X14	21-Jan-05		313				7.5		<0.15	182	0.5			1	
X14	08-Feb-05		359				7.7		<0.15	165	0.5			<1	
X14	01-Mar-05														
X14	08-Mar-05		639						<0.15	409				<1	2.5
X14	14-Mar-05		717				7.3			541	3			1	
X14	22-Mar-05		793						<0.15	557				<1	1.7
X14	11-Apr-05		315				7.6		<0.15	145	2.6			<1	2
X14	10-May-05		74				7.5		<0.15	34.3	3			16	5.9
X14	31-May-05		94						0.2	40.7				4	0.95
X14	11-Jun-05		100						<0.15	45.2				4	2.1
X14	19-Jun-05		133						<0.15	64.2				1	1.4
X14	21-Jun-05		140				7.9		<0.15	77.1	8.3			1	0.98
X14	02-Jul-05		153				7.9		<0.15	86.1	10.8			2	0.82
X14	10-Jul-05		154				8		<0.15	89.7	9.6			<1	1.5
X14	17-Jul-05		169				7.7		<0.15	91.6	10.7			<1	1.2
X14	24-Jul-05		160				8.2		<0.15	79.7	8.9			<1	1.3
X14	25-Jul-05		143				8		<0.15	71.4	9.9			<1	0.86
X14	31-Jul-05		132				7.8		<0.15	65.4	8.9			1	1.4
X14	06-Aug-05		170				8.1		<0.15	88.9	10.1			<1	1.3
X14	13-Aug-05		206				8		<0.15	111	12.8			<1	1.6
X14	20-Aug-05		195				7.9		<0.15	109	9.1			<1	1.5
X14	23-Aug-05		206				8		<0.15	109	8.9			1	
X14	27-Aug-05		173				8		<0.15	97.7	9.3			<1	2.2
X14	05-Sep-05		202				8.2		<0.15		8.1			<1	1.4
X14	06-Sep-05		203				8.3		<0.15	136	8.7			<1	
X14	11-Sep-05		198				8		<0.15		6.7			<1	1.3
X14	18-Sep-05		187				8.2		<0.15		5.9			1	1.1
X14	24-Sep-05		174				8.2		<0.15		6.6			1	1.1
X14	01-Oct-05		209				7.9		<0.15	129	4			<1	1.1
X14	11-Oct-05		142				8.4		<0.15	41.4	1.7			1	1.5
X14	02-Nov-05		187				8		<0.15	67	0.6			<1	1.9
X14	15-Dec-05		250				7.7		<0.15	111	0.8			<1	2
X14	23-Jan-06		306				7.7		<0.15	181	1			<1	3
X14	14-Feb-06		361				7.8		<0.15	254	0.4			2	3.1
X14	24-Mar-06		407				7.8		<0.15	259	1.1			<1	2
X14	25-Apr-06		348				8.2		<0.15	225	0.6			2	2.8
X14	09-May-06		446				7.9		<0.15	339	1.2			12	5.9
X14	18-May-06		55				8.3		<0.15	16.8	0.5			6	3
X14	23-May-06		69				7.9		<0.15	34.5	1.2			17	6.7
X14	30-May-06		106				7.9		<0.15	56.8	4			8	2.9
X14	06-Jun-06		89				8.1		<0.15	43.6	3.7			7	2.5
X14	19-Jun-06		130				7.8		<0.15	63.5	8.4			2	0.77
X14	20-Jun-06		144				8		<0.15	73.5	7.2			3	0.91
X14	11-Jul-06		135				8.2		<0.15	70.9	12.3			2	0.8
X14	17-Jul-06		168				7.9		<0.15	107	11			2	0.69
X14	18-Jul-06		174				8		<0.15	109	9.2			2	0.74
X14	25-Jul-06		203				7.8		<0.15	137	9.9			3	1.5
X14	01-Aug-06		187				7.8		<0.15	104	10.3			3	0.86
X14	15-Aug-06		143				7.7		<0.15	94.7	7.9			2	0.96
X14	21-Aug-06		147				8		<0.15	82.2	8.3			<1	0.78
X14	22-Aug-06		147				8.2		<0.15	83.3	10			<1	0.79
X14	29-Aug-06		182				7.8		<0.15	117	6.4			<1	0.77
X14	05-Sep-06		141				8.1		<0.15	64.9	7.9			2	1.2
X14	12-Sep-06		109				8.1		<0.15	32.8	5.6			<1	0.61
X14	17-Oct-06		172				8		<0.15	65.4	-0.5			<1	1.3
X14	14-Nov-06		230				7.6		<0.15	111	0			<1	1.5
X14	13-Dec-06		288				7.7		<0.15	164	0.2			1	2.2
X14	16-Jan-07		354				7.6		<0.15	225	0			1	2.7
X14	15-Feb-07		409				7.6		<0.15	273	-0.1			1	2.4
X14	12-Mar-07		547				7.5		<0.15	420	0.2			4	4.6
X14	10-Apr-07		812				7.4		<0.15	704	3.4			46	17
X14	19-Apr-07		363				7.5		<0.15	216	0.4			<1	1.8
X14	14-May-07		97				7.7		<0.15	31.1	0.5			6	4.5
X14	15-May-07		98				7.7		<0.15	29.4	0.9			12	6.7
X14	22-May-07		88				7.7		<0.15	46	0.8			14	10
X14	29-May-07		84				7.5		<0.15	42.9	4.7			23	8
X14	05-Jun-07		54				7.4		<0.15	22.9	5.9			30	13
X14	12-Jun-07		75				7.5		<0.15	31.4	7.3			19	10
X14	18-Jun-07		99				8		<0.15	66	10.5			4	2
X14	19-Jun-07		139				8		<0.15	82.6	9.7			3	1.5
X14	26-Jun-07		102				7.8		<0.15	45.6	7.7			<1	3
X14	03-Jul-07		108				7.7		<0.15	53.6	9.5			3	1.2
X14	10-Jul-07		165				7.8		<0.15	99.3	9			4	1.5
X14	16-Jul-07		134				7.5		<0.15	68	9.8			3	2.1
X14	17-Jul-07		112				7.6		<0.15	135	9.9			3	2.7
X14	24-Jul-07		215				8.1		<0.15	110	10.8			3	0.86
X14	31-Jul-07		191				7.7		<0.15	111	11.4			2	0.76

Table B.1: Faro Near-field Exposure Station X14 Data 2005 - 2009

Station ID	Date	Hardness-Dissolved mg/L	Hardness-Total mg/L	Nitrate mg/L	Nitrite mg/L	Nitrogen mg/L	pH-field	pH-Lab	Phosphorus mg/L	Sulphate mg/L	TEMP-F °C	TDS mg/L	TOC mg/L	TSS mg/L	Turbidity NTU
X14	07-Aug-07		177				7.8		<0.15	118	9.3			3	2
X14	13-Aug-07		235				7.7		<0.15	158	8.6			6	2.5
X14	14-Aug-07		191				8		<0.15	121	8.5			2	1.2
X14	21-Aug-07		217				7.9		<0.15	163	10.8			3	0.91
X14	28-Aug-07		197				7.6		<0.15	117	5.8			<1	0.84
X14	04-Sep-07		195				7.7		<0.15	132	6.1			<1	1.1
X14	10-Sep-07		175				7.7		<0.15	122	7.6			<1	0.85
X14	11-Sep-07		154				7.7		<0.15	78.4	7			4	3.2
X14	17-Sep-07		142				7.7		<0.15	81.1	5.7			<1	1
X14	25-Sep-07	124	117		<0.005		8.04	8.1	<0.005	36.6	2.2	158	2.4	4	
X14	23-Oct-07		322				7.7		<0.15	219	0.5			3	3
X14	25-Oct-07	339	333	0.12	<0.005		7.41	8.1	0.006	248	-0.5	460	1.9	5	
X14	29-Oct-07		263				7.8		<0.15	183	2.9			<1	1.7
X14	14-Nov-07		203				7.5		<0.15	81.5	1.4			<1	0.85
X14	21-Nov-07	222	212	0.16	<0.005		7.26	8	<0.005	89.7	0.8	280	1.2	<1	
X14	10-Dec-07		246				7.2		<0.15	135	0.4			1	2.1
X14	13-Dec-07	279	279	0.19	<0.005		7.44	8.1	<0.005	119	0.1	340	1.5	1	
X14	08-Jan-08		299				7.7		<0.15	172	0.4			<1	2.1
X14	24-Jan-08	350	364	0.22	<0.005		7.5	8.1	<0.005	191		460	0.8	1	
X14	19-Feb-08		406				7.6		<0.15	254	2			3	3.5
X14	20-Feb-08	417	422	0.22	<0.005		7.3	8.2	<0.005	279	0	570	0.9	2	
X14	11-Mar-08	436	437	0.22	<0.005		6.36	7.9	<0.005	303	0.5	590	1.5	1	
X14	18-Mar-08		399				7.5		<0.15	275	1.3			1	3.1
X14	14-Apr-08		619				7.5		<0.15	466	3.5			12	6.2
X14	15-Apr-08		607				7.7		<0.15	467	2.8			8	4.3
X14	22-Apr-08		613				7.6		<0.15	504	4			3	3
X14	29-Apr-08	604	570	0.16	<0.005		7.9	8.1	<0.15	472	5.8	830	0.9	4	2.6
X14	06-May-08		343				7.9		<0.15	269	3			6	7
X14	13-May-08		145				8.6		<0.15	97.2	3.3			9	3.6
X14	15-May-08		160				8.5		<0.15	108	3.5			7	3.5
X14	20-May-08		80				8.4		<0.15	39.5	4.3			7	6.1
X14	22-May-08	82.4	80.4	0.02	<0.005		7.5	7.8	0.034	44	1	130	12.3	13	
X14	26-May-08		72.4	0.03	<0.005	0.31	8.3			26		100	9.4	33	
X14	27-May-08		52						<0.15	19.5	6.5			6	12
X14	03-Jun-08		88				8.3		<0.15	45.9	7.4			<1	3
X14	10-Jun-08		103				8.3		<0.15	47.6	6			4	2.5
X14	16-Jun-08		114				8		<0.15	56.1	8.5			2	2
X14	17-Jun-08		102				7.9		<0.15	56.8	10.7			<1	2.5
X14	24-Jun-08	68.4	61	0.04	<0.005		8.3	7.6	<0.15	30.4	8.6	100	5.1	29	12
X14	01-Jul-08		143				8		<0.15	78.3	10.3			1	0.63
X14	08-Jul-08		119				8.4		<0.15	59	10			<1	0.7
X14	14-Jul-08		104				7.9		<0.15	40.7	9.5			2	0.8
X14	16-Jul-08		95				7.9		<0.15	33.6	9			9	6
X14	22-Jul-08		128				7.8		<0.15	48.2	8.4			<1	1
X14	30-Jul-08	156	157	0.04	<0.005		7.95	8.1	<0.005	66	7	190	3.5	1	
X14	31-Jul-08		139				8.1		<0.15	76.6	8.1			<1	0.71
X14	05-Aug-08		178				8		<0.15	93.8	10.7			1	0.75
X14	11-Aug-08		171				8		<0.15	86.3	11			<1	0.75
X14	12-Aug-08		172				7.9		<0.15	82.8	10.9			<1	0.71
X14	19-Aug-08		168				7.9		<0.15	75.9	9.9			2	0.78
X14	28-Aug-08		116				7.7		<0.15	34	7			3	2
X14	02-Sep-08		138				8		<0.15	60.1	7.3			1	1.3
X14	09-Sep-08		116				8.1		<0.15	49.8	7.7			3	2.1
X14	15-Sep-08		145				7.8		<0.15	68	6.4			1	0.73
X14	16-Sep-08		138				7.3		<0.15	66.8	5.5			1	0.48
X14	18-Sep-08	152	154	0.04	<0.005		7.31	8	<0.005	69	4.5	230	2.5	1	
X14	23-Sep-08		161				7.8		<0.15	84.3	2.8			<1	0.66
X14	30-Sep-08		160				7.7		<0.15	79.8	3.4			<1	0.62
X14	07-Oct-08	161	171	0.05	<0.005		8.2	8.2	<0.15	79.7	3.1	210	2.1	3	0.7
X14	14-Oct-08		204				8.1		<0.15	122	2.5			1	1.5
X14	15-Oct-08		202				7.8		<0.15	111	2.5			1	0.9
X14	21-Oct-08		220				7.8		<0.15	130	3.2			4	2
X14	04-Nov-08		158				7.5		<0.15	51.2	1.8			<1	0.77
X14	01-Dec-08		236				7.9		<0.15	79	0.3			<1	1.4
X14	10-Dec-08	224	221	0.15	<0.005			7.9		77	0.2	320	1.9	2	
X14	02-Feb-09		294				7.7	8.01	<0.15	161	0.9			2	2.7
X14	25-Feb-09	441	421	0.17			8			280		580	1.1	4	
X14	3-Mar-09	362	364			<0.05	8.1			190		470	1.8	3	
X14	27-Mar-09	386	368	0.19			8			210		510	0.9	2	
X14	2-Apr-09	669	709			<0.3	8.1			550		980	2.2	7	
X14	8-Apr-09	723	716			<0.3	7.9			360		760	1	5	
X14	16-Apr-09	787	728			<0.3	7.9			710		1200	1.5	4	
X14	23-Apr-09	754	729			<0.3	8			650		1200	2.2	2	
X14	29-Apr-09	814	757			<0.3	8			710		1100	0.9	3	
X14	7-May-09	78.5	73.6			<0.05	7.6			45		160	15.3	22	
X14	14-May-09	189	193			<0.05	8.1			110		270	8.9	7	
X14	21-May-09	97	98.4			<0.05	7.8			51		170	7.6	27	

Table B.1: Faro Near-field Exposure Station X14 Data 2005 - 2009

Station ID	Date	Hardness-Dissolved mg/L	Hardness-Total mg/L	Nitrate mg/L	Nitrite mg/L	Nitrogen mg/L	pH-field	pH-Lab	Phosphorus mg/L	Sulphate mg/L	TEMP-F °C	TDS mg/L	TOC mg/L	TSS mg/L	Turbidity NTU
X14	31-May-09	80.2	78.8			<0.05	7.9			41		160	5.7	17	
X14	7-Jun-09	62.7	60.8			<0.05	7.9			29		90	5.6	8	
X14	8-Jun-09	63.5	63.9			<0.05	7.5			30		100	4.4	6	
X14	14-Jun-09	125	125			<0.05	8			64		180	3.1	3	
n [a]		29	157	16	15	14	150	15	11	153	135	30	30	157	125
minimum [a]		62.7	52	0.02	0.005	0.05	6.36	7.6	0.005	16.8	0	90	0.8	1	0.48
maximum [a]		814	812	0.22	0.005	0.31	8.6	8.2	0.2	710	12.8	1200	15.3	46	17
mean [a,b]		318.9	230.0	0.13	0.0025	0.090	7.8	8.0	0.0236	143.57	5.4	430	3.67	4.2	2.55
standard deviation (SD) [a,b]		244.4	170.4	0.08	0.0000	0.088	0.3	0.2	0.0592	145.68	3.8	341	3.66	6.8	2.74
max detection limit (DL) [a]		0	0	0	0.005	0.3	0	0	0.005	0	0	0	0	1	0
# < detection limit [a]		0	0	0	15	13	0	0	8	0	0	0	0	47	0
% < detection limit [a]		0%	0%	0%	100%	93%	0%	0%	73%	0%	0%	0%	0%	30%	0%
background (BG) benchmark		171	166	0.21	<0.005	0.28	6.53	7.20	<0.03	21.6	7.5	182	13	20	0.69
% samples > BG benchmark [c]		59%	54%	19%	0%	43%	1%	0%	18%	99%	39%	67%	3%	4%	95%
background mean		58.6	70.6	0.07	0.0027	0.080	7.6	7.7	0.0106	9.08	2.4	79	4.10	7.3	0.32
station mean > BG mean [c]		1	1	1	0	1	0	0	1	1	1	1	0	0	1
current water quality criterion		-	-	13	0.06	-	6.5-9.0	6.5-9.0	0.03	50	-	500	-	8	2.7
source		-	-	CCME	CCME	-	CCME	CCME	OMOE	BCMOE	-	CCME	-	CCME	BCMOE
proposed new criterion		-	-	-	-	-	-	-	-	-	-	-	-	-	-
source		-	-	-	-	-	-	-	-	-	-	-	-	-	-
# > current water quality criterion		-	-	0	0	-	1	0	2	121	-	10	-	18	32
% > current water quality criterion		-	-	0%	0%	-	1%	0%	18%	79%	-	33%	-	11%	26%

< DL greater than guideline, removed
statistical outlier that was removed (mean + 3 SD)
statistical outlier that was not removed (mean + 3 SD)
unusual datum that was removed (silver) or modified (temperature negative values set as "0")

[a] excluding sensored data
[b] values reported as less than the detection limit were used at 1/2 the detection limit for calculation
[c] alkalinity, bicarbonate, dissolved oxygen and pH evaluated at less than the lower benchmark (5th percentile of background values)

Table B.2: Faro Near-field Exposure Station X2 Data 2005 - 2009

Station ID	Date	Aluminum mg/L	Antimony mg/L	Arsenic mg/L	Barium mg/L	Beryllium mg/L	Bismuth mg/L	Boron mg/L	Cadmium mg/L	Calcium mg/L	Chromium mg/L	Cobalt mg/L	Copper mg/L	Iron mg/L	Lead mg/L	Lithium mg/L	Magnesium mg/L	Manganese mg/L	Mercury mg/L	Molybdenum mg/L	Nickel mg/L	Potassium mg/L	Selenium mg/L	Silicon mg/L	Silver mg/L	Sodium mg/L	Strontium mg/L	Tellurium mg/L	Thallium mg/L	Thorium mg/L
X2	21-Jan-05	0.059	<0.001	<0.001	0.077	<0.001	<0.001	<0.05	<0.0002	50.2	<0.001	<0.001	0.002	0.33	<0.001	0.008	11.6	0.094	<0.00002	0.0007	0.001	1.1	<0.001	13.8	<0.00025	3.75	0.21	<0.001	<0.0001	<0.0005
X2	08-Feb-05	0.007	<0.001	<0.001	0.079	<0.001	<0.001	<0.05	<0.0002	53.4	<0.001	<0.001	<0.001	0.2	<0.001	0.009	12.9	0.092	<0.00002	0.0008	<0.001	1.3	<0.001	14.8	<0.00025	4.31	0.23	<0.001	<0.0001	<0.0005
X2	15-Mar-05	0.01	<0.001	<0.001	0.07	<0.001	<0.001	<0.05	<0.0002	47.6	<0.001	<0.001	<0.001	0.18	<0.001	0.009	10.8	0.091	<0.00002	0.0009	0.001	1.3	<0.001	11.2	<0.00025	3.57	0.2	<0.001	<0.0001	<0.0005
X2	11-Apr-05	0.007	<0.001	<0.001	0.068	<0.001	<0.001	<0.05	<0.0002	45.3	<0.001	<0.001	<0.001	0.18	<0.001	0.008	10.9	0.091	<0.00002	0.0008	0.001	1.1	<0.001	13.4	<0.00025	3.72	0.2	<0.001	<0.0001	<0.0005
X2	09-May-05	0.27	<0.001	0.001	0.03	<0.001	<0.001	<0.05	<0.0002	9.71	<0.001	<0.001	0.003	0.66	0.007	0.002	2.03	0.051	<0.00002	<0.0005	0.002	1.3	<0.001	5.3	<0.00025	0.91	0.043	<0.001	<0.0001	<0.0005
X2	20-Jun-05	0.11	<0.001	<0.001	0.041	<0.001	<0.001	<0.05	<0.0002	21.2	<0.001	<0.001	0.001	0.25	0.002	0.003	4.99	0.029	<0.00002	<0.0005	<0.001	0.5	<0.001	9.9	<0.00025	1.77	0.083	<0.001	<0.0001	<0.0005
X2	25-Jul-05	0.029	<0.001	<0.001	0.041	<0.001	<0.001	<0.05	<0.0002	21.7	<0.001	<0.001	0.001	0.07	<0.001	0.003	4.51	0.019	<0.00002	<0.0005	<0.001	0.4	<0.001	10.7	<0.00025	1.73	0.092	<0.001	<0.0001	<0.0005
X2	22-Aug-05	0.025	<0.001	<0.001	0.05	<0.001	<0.001	<0.05	<0.0002	31.1	<0.001	<0.001	<0.001	0.1	<0.001	0.004	7.29	0.05	<0.00002	<0.0005	<0.001	0.7	<0.001	10.9	<0.00025	3.05	0.12	<0.001	<0.0001	<0.0005
X2	05-Sep-05	0.016	<0.001	<0.001	0.041	<0.001	<0.001	<0.05	<0.0002	26.9	<0.001	<0.001	<0.001	0.23	<0.001	0.004	5.93	0.048	<0.00002	0.0009	<0.001	0.7	<0.001	10.7	<0.00025	2.05	0.11	<0.001	<0.0001	0.0006
X2	10-Oct-05	<0.005	<0.001	<0.001	0.044	<0.001	<0.001	<0.05	<0.0002	27.9	<0.001	<0.001	<0.001	<0.05	<0.001	0.004	6.3	0.047	<0.00002	<0.0005	<0.001	0.7	<0.001	10.5	<0.00025	2.07	0.12	<0.001	<0.0001	<0.0005
X2	01-Nov-05	0.015	<0.001	<0.001	0.059	<0.001	<0.001	<0.05	<0.0002	34.6	<0.001	<0.001	<0.001	<0.05	<0.001	0.005	8.45	0.09	<0.00002	0.0006	0.001	0.8	<0.001	12.3	<0.00025	2.26	0.14	<0.001	<0.0001	<0.0005
X2	13-Dec-05	0.017	<0.001	<0.001	0.07	<0.001	<0.001	<0.05	<0.0002	41.9	<0.001	<0.001	<0.001	0.18	<0.001	0.007	10	0.09	<0.00002	0.0007	<0.001	1	<0.001	6.2	<0.00025	3.14	0.16	<0.001	<0.0001	<0.0005
X2	23-Jan-06	0.008	<0.001	<0.001	0.083	<0.001	<0.001	<0.05	<0.0002	51.9	<0.001	<0.001	<0.001	0.17	<0.001	0.009	13.4	0.12	<0.00002	0.0008	0.001	1.1	<0.001	7	<0.00025	3.76	0.22	<0.001	<0.0001	<0.0005
X2	14-Feb-06	0.016	<0.001	<0.001	0.074	<0.001	<0.001	<0.05	<0.0002	45.8	<0.001	<0.001	<0.001	0.16	<0.001	0.009	11.7	0.1	<0.00002	0.0008	<0.001	1.1	<0.001	6.4	<0.00025	3.7	0.19	<0.001	<0.0001	<0.0005
X2	24-Apr-06	0.008	<0.001	<0.001	0.072	<0.001	<0.001	<0.05	<0.0002	46	0.001	<0.001	<0.001	0.19	<0.001	0.009	11.7	0.16	<0.00002	0.0008	0.002	1.3	<0.001	5.6	<0.00025	3.72	0.19	<0.001	<0.0001	<0.0005
X2	17-May-06	0.18	<0.001	0.001	0.027	<0.001	<0.001	<0.05	<0.0002	9.94	<0.001	<0.001	0.003	0.62	0.004	0.002	2.16	0.059	<0.00002	<0.0005	0.002	1.6	<0.001	2.3	<0.00025	0.9	0.042	<0.001	<0.0001	<0.0005
X2	19-Jun-06	0.073	<0.001	<0.001	0.035	<0.001	<0.001	<0.05	<0.0002	17.6	<0.001	<0.001	0.001	0.19	0.001	0.002	3.98	0.024	<0.00002	<0.0005	<0.001	0.5	<0.001	3.7	<0.00025	1.47	0.065	<0.001	<0.0001	<0.0005
X2	18-Jul-06	0.054	<0.001	<0.001	0.04	<0.001	<0.001	<0.05	<0.0002	22.7	<0.001	<0.005	0.001	0.17	<0.001	0.009	5.4	0.027	<0.00002	<0.0005	<0.001	0.5	<0.001	4.2	<0.00025	1.68	0.08	<0.001	<0.0001	<0.0005
X2	21-Aug-06	0.015	<0.001	<0.001	0.045	<0.001	<0.001	<0.05	<0.0002	25.8	<0.001	<0.001	<0.001	0.12	<0.001	0.003	5.42	0.033	<0.00002	<0.0005	<0.001	0.6	<0.001	4.7	<0.00025	2.13	0.099	<0.001	<0.0001	<0.0005
X2	11-Sep-06	0.022	<0.001	<0.001	0.04	<0.001	<0.001	<0.05	<0.0002	23.6	<0.001	<0.005	<0.001	0.2	<0.001	0.003	5.53	0.038	<0.00002	<0.0005	<0.001	0.5	<0.001	5.3	<0.00025	2.07	0.092	<0.001	<0.0001	<0.0005
X2	16-Oct-06	0.028	<0.001	<0.001	0.057	<0.001	<0.001	<0.05	<0.0002	34.2	<0.001	<0.001	0.001	0.4	0.001	0.005	9.29	0.21	<0.00002	0.0005	0.001	0.8	<0.001	5	<0.00025	2.78	0.14	<0.001	<0.0001	<0.0005
X2	14-Nov-06	0.018	<0.001	<0.001	0.072	<0.001	<0.001	<0.05	<0.0002	41.6	<0.001	<0.001	<0.001	0.08	<0.001	0.006	10.3	0.11	<0.00002	0.0006	0.001	0.9	<0.001	5.7	<0.00025	3.11	0.17	<0.001	<0.0001	<0.0005
X2	18-Apr-07	0.021	<0.001	<0.001	0.075	<0.001	<0.001	<0.05	<0.0002	48	<0.001	<0.001	<0.001	0.29	<0.001	0.01	12.2	0.16	<0.00002	0.0008	0.002	1.7	<0.001	6.3	<0.00025	3.97	0.21	<0.001	<0.0001	<0.0005
X2	14-May-07	0.1	<0.001	<0.001	0.039	<0.001	<0.001	<0.05	<0.0002	19.6	0.001	<0.001	0.003	0.5	0.002	<0.005	4.47	0.068	<0.00002	<0.0005	0.002	1.7	<0.001	4	<0.00025	1.74	0.087	<0.001	<0.0001	<0.0005
X2	18-Jun-07	0.11	<0.001	<0.001	0.036	<0.001	<0.001	<0.05	<0.0002	17.3	<0.001	<0.001	0.002	0.28	0.002	<0.005	4.32	0.03	<0.00002	<0.0005	0.001	0.6	<0.001	3.9	<0.00025	1.63	0.065	<0.001	<0.0001	<0.0005
X2	16-Jul-07	0.098	<0.001	<0.001	0.037	<0.001	<0.001	<0.05	<0.0002	16.7	<0.001	<0.001	0.001	0.25	0.004	<0.005	4.15	0.026	<0.00002	<0.0005	<0.001	0.5	<0.001	4.5	<0.00025	1.64	0.075	<0.001	<0.0001	<0.0005
X2	13-Aug-07	0.021	<0.001	<0.001	0.044	<0.001	<0.001	<0.05	0.0002	26.1	<0.001	<0.001	0.001	0.19	<0.001	<0.005	6.08	0.044	<0.00002	0.0007	0.001	0.6	<0.001	3.8	<0.00025	2.13	0.11	<0.001	0.0002	<0.0005
X2	10-Sep-07	0.015	<0.001	<0.001	0.046	<0.001	<0.001	<0.05	<0.0002	21.2	<0.001	<0.001	<0.001	0.15	<0.001	0.002	4.88	0.034	<0.00002	<0.0005	<0.001	0.5	<0.001	4.1	<0.00025	1.93	0.077	<0.001	<0.0001	<0.0005
X2	22-Oct-07	0.03	<0.001	<0.001	0.056	<0.001	<0.001	<0.05	<0.0002	31.5	<0.001	<0.001	<0.001	0.3	0.004	0.004	7.55	0.11	<0.00002	0.0006	0.001	0.8	<0.001	5.1	<0.00025	2.54	0.12	<0.001	<0.0001	<0.0005
X2	13-Nov-07	0.039	<0.001	<0.001	0.057	<0.001	<0.001	<0.05	<0.0002	36.5	<0.001	<0.001	<0.001	0.15	<0.001	0.005	8.75	0.098	<0.00002	0.0006	<0.001	0.9	<0.001	5.7	<0.00025	2.85	0.14	<0.001	<0.0001	<0.0005
X2	09-Dec-07	0.009	<0.001	<0.001	0.063	<0.001	<0.001	<0.05	<0.0002	37.8	<0.001	<0.001	<0.001	0.2	<0.001	0.005	8.71	0.1	<0.00002	0.0005	0.001	0.9	<0.001	5.4	<0.00025	2.61	0.15	<0.001	<0.0001	<0.0005
X2	07-Jan-08	0.017	<0.001	<0.001	0.053	<0.001	<0.001	<0.05	<0.0002	33.3	<0.001	<0.001	<0.001	0.14	<0.001	0.006	8.71	0.08	<0.00002	0.0005	<0.001	0.9	<0.001	4.6	<0.00025	2.68	0.13	<0.001	<0.0001	<0.0005
X2	18-Feb-08	0.025	<0.001	<0.001	0.069	<0.001	<0.001	<0.05	<0.0002	47.4	<0.001	<0.001	<0.001	0.26	<0.001	0.007	12.1	0.17	<0.00002	0.0007	0.002	1.3	<0.001	5.9	<0.00025	3.74	0.21	<0.001	<0.0001	<0.0005
X2	17-Mar-08	<0.005	<0.001	<0.001	0.077	<0.001	<0.001	<0.05	<0.0002	39.6	<0.001	<0.001	<0.001	0.19	<0.001	0.005	12.7	0.16	<0.00002	0.0007	0.002	1.1	<0.001	6.6	<0.00025	4.41	0.18	<0.001	<0.0001	<0.0005
X2	14-Apr-08	0.012	<0.001	<0.001	0.076	<0.001	<0.001	<0.05	<0.0002	44.9	<0.001	<0.001	<0.001	0.26	<0.001	0.009	12.1	0.15	<0.00002	0.0009	0.001	1.2	<0.001	5.8	<0.00025	3.9	0.21	<0.001	<0.0001	<0.0005
X2	14-May-08	0.19	<0.001	0.001	0.031	<0.001	<0.001	<0.05	<0.0002	12.1	<0.001	<0.001	0.003	0.47	0.003	0.002	2.63	0.06	<0.00002	<0.0005	0.002	1.6	<0.001	2.5	<0.00025	1.01	0.053	<0.001	<0.0001	<0.0005
X2	12-Jun-08	0.156	<0.0005	0.0006	0.032	<0.001		<0.1	0.00003	14.2	<0.001	<0.0003	<0.002	0.257	0.00184	<0.005	3.25	0.0262	<0.00002	<0.001	0.001	<2	<0.001		<0.00002	<2		<0.001	<0.0002	
X2	16-Jun-08	0.14	<0.001	<0.001	0.037	<0.001	<0.001	<0.05	<0.0002	19.3	<0.001	<0.001	0.002	0.25	0.002	0.002	4.7	0.033	<0.00002	<0.0005	<0.001	0.6	<0.001	5.3	<0.00025	1.72	0.073		<0.0001	<0.0005
X2	14-Jul-08	0.08	<0.001	<0.001	0.03	<0.001	<0.001	<0.05	<0.0002	15.6	<0.001	<0.001	0.001	0.16	0.001	<0.001	3.54	0.017	<0.00002	<0.0005	<0.001	0.5	<0.001	5.5	<0.00025	1.38	0.063	<0.001	<0.0001	<0.0005
X2	22-Jul-08	0.0435	0.00008	0.00052	0.034	0.00001	<0.000005	<0.05	0.000026	18.8	0.0002	0.00007	0.00136	0.101	0.000883	0.002	4.14	0.0191		0.00035	0.00069	0.43	0.00024	4.53	<0.000005	1.5	0.0705		0.000003	
X2	11-Aug-08	0.048	<0.001	<0.001	0.044	<0.001	<0.001	<0.05	<0.0002	21.6	<0.001	<0.001	<0.001	0.18	<0.001	<0.001	5.79	0.035	<0.00002	<0.0005	<0.001	0.6	<0.001	8.5	<0.00025	1.98	0.089	<0.001	<0.0001	<0.0005
X2	19-Aug-08	0.0246	0.00008	0.00056	0.0428	<0.00001	<0.000005	<0.05	0.000018	23.3	<0.0001	0.000085	0.00079	0.153	0.000767	0.003	5.37	0.0359		0.00044	0.00075	0.53	0.00022	5.8	<0.000005	2.03	0.1		0.000004	
X2	25-Aug-08	0.309	0.0001	0.00127	0.0443	0.00005	0.000018	<0.05	0.000074	15.7	0.0007	0.00049	0.00231	0.834	0.00743	0.0025	3.41	0.103		0.00026	0.00181	0.68	0.00019	5.35	0.00001	1.9	0.0674		0.000011	
X2	15-Sep-08	0.034	<0.001	<0.001	0.036	<0.001	<0.001	<0.05	<0.0002	19.9	<0.001	<0.001	0.002	0.13	<0.001	0.002	4.33	0.027	<0.00002	<0.0005	0.002	0.5	<0.001	5	<0.00025	1.71	0.099	<0.001	<0.0001	<0.0005
X2	15-Oct-08	0.043	<0.001	<0.001	0.044	<0.001	<0.001	<0.05	<0.0002	25.4	<0.001	<0.001	<0.001	0.07	<0.001	0.003	5.31	0.052	<0.00002	0.0007	<0.001	0.6	<0.001	5.3	<0.00025	1.82	0.1	<0.001	<0.0001	<0.0005
X2	03-Nov-08	0.049	<0.001	<0.001	0.055	<0.001	<0.001	<0.05	0.0003	32.7	<0.001	<0.001	<0.001	0.07	0.001	0.004	8.23	0.12	<0.00002	0.0006	0.002	0.9	<0.001	5.6	<0.00025	2.54	0.13	<0.001	<0.0001	<0.0005
X2	01-Dec-08	0.031	<0.001	<0.001	0.065	<0.001	<0.001	<0.05	<0.0002	38.7	<0.001	<0.001	<0.001	0.29	0.001	0.006	10.2	0.13	<0.00002	0.0007	0.001	0.9	<0.001	6.8	<0.00025	3.37	0.14	<0.001	<0.0001	<0.0005
X2	12-Jan-09	0.016	<0.001	<0.001	0.073	<0.001	<0.001	<0.05	<0.0002	47.4	<0.001	<0.001	<0.001	0.2	<0.001	0.01	12.9	0.22	<0.00002	0.0009	0.002	1.1	<0.001	6.4	<0.00025	3.34	0.2	<0.001	<0.0001	<0.0005
X2	02-Feb-09	0.013	<0.001	<0.001	0.072	<0.001	<0.001	<0.05	<0.0002	44.8	<0.001	<0.001	<0.001	0.25	<0.001	0.007	11.2	0.16	<0.00002	0.0008	0.001	1	<0.001	5.8	<0.00025	3.25	0.21	<0.001	<0.0001	<0.0005
X2	3-Mar-09	0.0069	0.00007	0.0004	0.0701	<0.00001	<0.000005		0.000034	47	<0.0001	0.000259	0.00043	0.158	0.000293	0.0084	11.7	0.159		0.00088	0.00143	1.09	0.00052	6.47	<0.000005	3.27	0.2		0.000002	
X2	6-Apr-09	0.0063	0.00008	0.00041	0.0746	<0.00001	<0.000005		0.000029	46.2	<0.0001	0.000253	0.00029	0.151	0.000281	0.0105	11.6	0.144		0.00084	0.00129	1.12	0.00049	5.85	<0.000005	3.48	0.198		0.000002	
X2	6-May-09	0.199	0.00008	0.00115	0.0294	0.00004	0.00001		0.000229	9.53	0.0001	0.00053	0.00334	0.485	0.00747	0.0021	2.53	0.0664		0.00022	0.0025	1.67	0.00013	2.35	0.000012	1.01	0.0452		0.000012	
X2	8-Jun-09	0.109	0.00007	0.00045	0.0234	0.00001	0.000009		0.000033	9.83	<0.0001	0.000087	0.00123	0.171	0.00154	0.0005	2.01	0.0147		0.00019	0.00066	0.52	0.00012	3.35	<0.000005	0.95	0.0412		0.000005	
n [a]		53	53	53	53	53	52	49	10	53	53	51	53	53	53	53	53	53	46	53	53	53	53	52	8	53	52	45	53	45
minimum [a]		0.005	0.0001	0.0004	0.023	0.00001	0.00001	0.050	0.00002	10	0.0001	0.0001	0.0003	0.05	0.0003	0.0005	2.01	0.0147	0.00002	0.00019	0.00066	0.4	0.00012	2.3	0.000005	0.9	0.0412	0.001	0.000002	0.0005
maximum [a]		0.309	0.0010	0.0013	0.083	0.00100	0.00100	0.100	0.00030	53	0.0010	0.0010	0.0033	0.83	0.0075	0.0105	13.4	0.22	0.00002	0.001	0.0025	2	0.001	14.8	0.00002	4.41	0.23	0.001	0.0002	0.0006
mean [a,b]		0.0564	0.0004	0.0006	0.0525	0.0004	0.0004	0.0255	0.00010	30.4	0.0005	0.00046	0.0010	0.232	0.0013	0.0048	7.44	0.0816	0.00001	0.0005	0.0011	0.9026	0.0005	6.46	0.00001	2.47	0.1277	0.0005	0.00005	0.0003
standard deviation (SD) [a,b]		0.0689	0.0001	0.0002	0.0171	0.0002	0.0002	0.0036	0.00010	13.2	0.0002	0.00012	0.0008	0.156	0.0017	0.0029	3.54	0.0537	0.00000	0.0003	0.0006	0.3634	0.0001	2.96	0.000004	0.99	0.0575	0.0000	0.00003	0.0001
max detection limit (DL) [a]		0.005	0.001	0.001	0	0.001	0.001	0.1	0	0	0.001	0.001	0.002	0.05	0.001	0.005	0	0	0.00002	0.001	0.001	2	0.001	0	0.00002	2	0	0.001	0.0002	0.0005
# < detection limit [a]		2	46	42	0	49	49	49	0	0	48	44	30	2	31	7	0	0	46	20	20	1	46	0	6	1	0	45	45	44
% < detection limit [a]		4%	87%	79%	0%	92%	94%	100%	0%	0%	91%	86%	57%	4%	58%	13%	0%	0%	100%	38%	38%	2%	87%	0%	75%	2%	0%	100%	85%	98%
background (BG) benchmark		0.2460	<0.001	<0.001	0.090	<0.001	<0.005	<0.05	0.00011	47	<0.001	<0.001	0.003	0.47	0.002	0.008	11	0.045	<0.00002	0.0012	<0.001	1.4	<0.001	11.6	0.000021	3.3	0.18	<0.001	<0.0001	<0.0005
% samples > BG benchmark [c]		4%	0%	4%	0%	0%	0%	2%	30%	13%	0%	0%	2%	9%	13%	21%	25%	66%	0%	0%	28%	11%	0%	8%	0%	26%	27%	0%	4%	2%
background mean		0.0714	0.0003	0.0005	0.0428	0.0002	0.0005	0.0202	0.00004	20.8	0.0004	0.00027	0.0009	0.142	0.0007	0.0025	4.28	0.0145	0.00001	0.0005	0.0005	0.6828	0.0004	5.64	0.00001	1.96	0.0821	0.0005	0.00003	0.0002
station mean > BG mean [c]		0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1
current water quality criterion		0.1	0.02	0.005	1.0	1.1	0.26	1.2	0.00003	116	0.001	0.004	0.002	0.3	0.002	-	82	1.0	0.000026	0.073	0.065	53	0.001	-	0.0001	200	9.3	-	0.0008	-
source		CCME	OMOE	CCME	CCME	OMOE	Alternate	BCMOE	CCME	Alternate	CCME	BCMOE	CCME	CCME	CCME	-	Alternate	BCMOE	CCME	CCME	CCME	Alternate	CCME	-	CCME	CCME	Alternate	-	CCME	-
proposed new criterion		-	-	-	-	-	-	-	0.00022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
source		-	-	-	-	-	-	-	CCME	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
# > current water quality criterion		10	0	0	0	0	0	0	6	0	0	0	6	8	7	-	0	0	0	0	0	0	0	-	0	0	0	-	0	-
% > current water quality criterion		19%	0%	0%	0%	0%	0%	0%	60%	0%	0%	0%	11%	15%	13%	-	0%	0%	0%	0%	0%	0%	0%	-	0%	0%	0%	-	0%	-

< DL greater than guideline, removed
statistical outlier that was removed (mean + 3 SD)
statistical outlier that was not removed (mean + 3 SD)
unusual datum that was removed (silver) or modified (temperature negative values set as "0")

[a] excluding sensored data
[b] values reported as less than the detection limit were used at 1/2 the detection limit for calculation
[c] alkalinity, bicarbonate, dissolved oxygen and pH evaluated at less than the lower benchmark (5th percentile of background values)

Table B.2: Faro Near-field Exposure Station X2 Data 2005 - 2009

Station ID	Date	Tin mg/L	Titanium mg/L	Uranium mg/L	Vanadium mg/L	Zinc mg/L	Zirconium mg/L	Alkalinity-C mg/L	Alkalinity-H mg/L	Alkalinity-PP mg/L	Alkalinity-T mg/L	Ammonia mg/L	Bicarbonate mg/L	Chloride mg/L	Colour CU	Conductivity-Field uS/cm	Conductivity-Lab uS/cm	Cyanide-WAD mg/L	DOC mg/L	DO mg/L	DO %	Fluoride mg/L	Hardness-Dissolved mg/L	Hardness-Total mg/L	Nitrate mg/L	Nitrite mg/L
X2	21-Jan-05	<0.001	0.003	0.0024	<0.001	0.031	<0.01					<0.01					308							173		
X2	08-Feb-05	<0.001	<0.001	0.0028	<0.001	0.035	<0.01					<0.01					305							187		
X2	15-Mar-05	<0.001	<0.001	0.0027	<0.001	0.031	<0.01					0.04					289							163		
X2	11-Apr-05	<0.001	<0.001	0.0025	<0.001	0.038	<0.01					<0.01					276							158		
X2	09-May-05	<0.001	0.008	<0.0005	<0.001	0.031	<0.01					0.02					61							33		
X2	20-Jun-05	<0.001	0.002	0.0008	<0.001	0.016	<0.01					<0.01					149							74		
X2	25-Jul-05	<0.001	0.001	0.0007	<0.001	0.015	<0.01					0.03					146							73		
X2	22-Aug-05	<0.001	<0.001	0.0012	<0.001	0.023	<0.01					<0.01					185							108		
X2	05-Sep-05	<0.001	<0.001	0.0011	<0.001	0.036	<0.01					<0.01					164							92		
X2	10-Oct-05	<0.001	<0.001	0.001	<0.001	0.028	<0.01					0.02					163							96		
X2	01-Nov-05	<0.001	<0.001	0.0015	<0.001	0.035	<0.01					<0.01			<5		202							121		
X2	13-Dec-05	<0.001	<0.001	0.0019	<0.001	0.058	<0.01					<0.01			<5		283							146		
X2	23-Jan-06	<0.001	<0.001	0.0024	<0.001	0.094	<0.01					<0.01			<5		324							185		
X2	14-Feb-06	<0.001	<0.001	0.0023	<0.001	0.035	<0.01					0.01			<5		327							163		
X2	24-Apr-06	<0.001	<0.001	0.0023	<0.001	0.14	<0.01					<0.01			<5		344							163		
X2	17-May-06	<0.001	0.004	<0.0005	<0.001	0.042	<0.01					<0.01			117		71							34		
X2	19-Jun-06	<0.001	0.002	0.0007	<0.001	0.017	<0.01					<0.01			18		118							60		
X2	18-Jul-06	<0.001	<0.001	0.0007	<0.001	0.02	<0.01					0.06			<5		163							79		
X2	21-Aug-06	<0.001	<0.001	0.0009	<0.001	0.023	<0.01					<0.01			8		170							87		
X2	11-Sep-06	<0.001	<0.001	0.0008	<0.001	0.023	<0.01					0.01			8		173							82		
X2	16-Oct-06	<0.001	<0.001	0.0013	<0.001	0.065	<0.01					<0.01			<5		248							124		
X2	14-Nov-06	<0.001	<0.001	0.0021	<0.001	0.064	<0.01					<0.01			<5		291							146		
X2	18-Apr-07	<0.001	<0.001	0.0026	<0.001	0.18	<0.01					0.01			<5		342							170		
X2	14-May-07	<0.001	0.003	0.0008	<0.001	0.068	<0.01					0.04			90		136							67		
X2	18-Jun-07	<0.001	0.005	0.0007	<0.001	0.029	<0.01					0.01			25		121							61		
X2	16-Jul-07	<0.001	0.003	0.0005	<0.001	0.025	<0.01					<0.01			13		132							59		
X2	13-Aug-07	<0.001	<0.001	0.0012	<0.001	0.031	<0.01					0.03			7		191							90		
X2	10-Sep-07	<0.001	<0.001	0.0009	<0.001	0.025	<0.01					0.02			7		171							73		
X2	22-Oct-07	<0.001	0.001	0.0013	<0.001	0.063	<0.01					<0.01			7		210							110		
X2	13-Nov-07	<0.001	<0.001	0.0014	<0.001	0.068	<0.01					0.02			<5		229							127		
X2	09-Dec-07	<0.001	<0.001	0.0018	<0.001	0.097	<0.01					0.02			<5		278							130		
X2	07-Jan-08	<0.001	<0.001	0.0016	<0.001	0.056	<0.01					0.01			<5		297							119		
X2	18-Feb-08	<0.001	<0.001	0.0018	<0.001	0.099	<0.01					<0.01			<5		339							168		
X2	17-Mar-08	<0.001	<0.001	0.0034	<0.001	0.094	<0.01					<0.01			<5		328							151		
X2	14-Apr-08	<0.001	0.002	0.0028	<0.001	0.097	<0.01					0.03			<5		317							162		
X2	14-May-08	<0.001	0.004	<0.0005	<0.001	0.076	<0.01					0.03			117		80							41		
X2	12-Jun-08	<0.0005	<0.01	0.00057	<0.001	0.0256						<0.02		<0.5			99.7					0.066		48.5	0.0064	0.0012
X2	16-Jun-08	<0.001	0.004	0.0007	<0.001	0.037	<0.01					<0.01			18		105							68		
X2	14-Jul-08	<0.001	0.002	<0.0005	<0.001	0.024	<0.01					0.12			25		110							54		
X2	22-Jul-08	<0.00001	0.0014	0.00065	0.0003	0.0225	0.0001	<0.5	<0.5	<0.5	55	<0.01	67										67.1	63.9		
X2	11-Aug-08	<0.001	0.002	0.0009	<0.001	0.03	<0.01					0.01			12		151							78		
X2	19-Aug-08	<0.00001	0.0006	0.000881	<0.0002	0.036	<0.0001	<0.5	<0.5	<0.5	76	<0.01	93	<0.5				<0.0005	4.6			0.09	80	80.2	0.02	<0.005
X2	25-Aug-08	0.00001	0.0114	0.000556	0.0007	0.0431	0.0003	<0.5	<0.5	<0.5	44	<0.005	54				110						51.1	53.2		
X2	15-Sep-08	<0.001	<0.001	0.001	<0.001	0.024	<0.01					0.02			8		138							68		
X2	15-Oct-08	<0.001	<0.001	0.0011	<0.001	0.039	<0.01					0.05			7		180							85		
X2	03-Nov-08	<0.001	<0.001	0.0014	<0.001	0.1	<0.01					0.01			7		211							116		
X2	01-Dec-08	<0.001	<0.001	0.0016	<0.001	0.092	<0.01					0.03			<5		247							139		
X2	12-Jan-09	<0.001	<0.001	0.0028	<0.001	0.2	<0.01					0.03			<5		324							172		
X2	02-Feb-09	<0.001	<0.001	0.0025	<0.001	0.14	<0.01					<0.01			<5		301							158		
X2	3-Mar-09	0.00001	<0.0005	0.00283	<0.0002	0.121	<0.0001	<0.5	<0.5	<0.5	130	<0.01	160	<0.5			320		1.5				167	166		
X2	6-Apr-09	<0.00001	<0.0005	0.00299	<0.0002	0.0994	<0.0001	<0.5	<0.5	<0.5	140	<0.01	170	<0.5			320		1.2				163	163		
X2	6-May-09	0.00002	0.004	0.000322	0.0003	0.168	0.0003	<0.5	<0.5	<0.5	26	0.1	31	1.3			71		19.7				33.6	34.2		
X2	8-Jun-09	<0.00001	0.0026	0.000351	0.0002	0.0092	0.0001	<0.5	<0.5	<0.5	29	<0.01	36	0.6			68		6.4				31.7	32.8		
n [a]		53	53	53	53	53	7	7	7	7	7	53	7	6	35	0	51	1	5	0	0	2	7	53	2	2
minimum [a]		0.00001	0.0005	0.000322	0.0002	0.0092	0.0001	0.5	0.5	0.5	26	0.005	31	0.5	5		61	0.0005	1.2			0.066	31.7	32.8	0.0064	0.0012
maximum [a]		0.001	0.0114	0.0034	0.001	0.2	0.0003	0.5	0.5	0.5	140	0.12	170	1.3	117		344	0.0005	19.7			0.09	167	187	0.02	0.005
mean [a,b]		0.0004	0.0016	0.0014	0.0005	0.0588	0.0001	0.25	0.25	0.25	71.4	0.0174	87.3	0.48	15.4		209.5	0.0003	6.7			0.0780	84.8	106.7	0.01	0.0019
standard deviation (SD) [a,b]		0.0002	0.0021	0.0009	0.0001	0.0452	0.0001	0.00	0.00	0.00	46.6	0.0227	57.0	0.42	29.7		89.9	#DIV/0!	7.6			0.0170	57.4	47.4	0.01	0.0009
max detection limit (DL) [a]		0.001	0.01	0.0005	0.001	0	0.0001	0.5	0.5	0.5	0	0.02	0	0.5	5	0	0	0.0005	0	0	0	0	0	0	0	0.005
# < detection limit [a]		50	33	4	49	0	3	7	7	7	0	28	0	4	18		0	1	0			0	0	0	0	1
% < detection limit [a]		94%	62%	8%	92%	0%	43%	100%	100%	100%	0%	53%	0%	67%	51%		0%	100%	0%			0%	0%	0%	0%	50%
background (BG) benchmark		<0.001	0.0069	0.0025	<0.001	0.017	<0.002	<0.5	<0.5	<0.5	9.5	0.040	180	1.2	8	350	310	<0.0005	12.1	9.7	76.5	0.13	171	166	0.21	<0.005
% samples > BG benchmark [c]		0%	6%	15%	0%	92%	0%	0%	0%	0%	0%	8%	100%	17%	26%		20%	0%	20%			0%	0%	11%	0%	0%
background mean		0.0006	0.0017	0.0011	0.0004	0.0051	0.0003	0.30	0.25	0.26	54.0	0.0117	65.7	0.56	4.2	135.2	142.2	0.0003	4.1	11.24	83.40	0.0792	58.6	70.6	0.07	0.0027
station mean > BG mean [c]		0	0	1	1	1	0	1	0	1	0	1	0	0	1		1	0	1			0	1	1	0	0
current water quality criterion		0.35	1.83	0.015	0.006	0.030	0.004	-	-	-	7.1	0.24	-	250	-	-	-	0.005	-	6.5	-	0.12	-	-	13	0.06
source		Alternate	Alternate	SE	OMOE	CCME	OMOE	-	-	-	OMOE	CCME	-	CCME	-		-	CCME	-	CCME	-	CCME	-	-	CCME	CCME
proposed new criterion		-	-	-	-	0.017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
source		-	-	-	-	CCME	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
# > current water quality criterion		0	0	0	0	36	0	-	-	-	0	0	-	0	-	-	-	0	-	0	-	0	-	-	0	0
% > current water quality criterion		0%	0%	0%	0%	68%	0%	-	-	-	0%	0%	-	0%	-	-	-	0%	-	-	-	0%	-	-	0%	0%

< DL greater than guideline, removed
statistical outlier that was removed (mean + 3 SD)
statistical outlier that was not removed (mean + 3 SD)
unusual datum that was removed (silver) or modified (temperature negative values set as "0")

[a] excluding sensored data
[b] values reported as less than the detection limit were used at 1/2 the detection limit for calculation
[c] alkalinity, bicarbonate, dissolved oxygen and pH evaluated at less than the lower benchmark (5th percentile of background values)

Table B.2: Faro Near-field Exposure Station X2 Data 2005 - 2009

Station ID	Date	Nitrogen mg/L	pH-field	pH-Lab	Phosphorus mg/L	Sulphate mg/L	TEMP-F °C	TDS mg/L	TOC mg/L	TSS mg/L	Turbidity NTU
X2	21-Jan-05		7.2		<0.15	37.2	-0.3			1	
X2	08-Feb-05		7.7		<0.15	31.8	-0.1			<1	
X2	15-Mar-05		7.8		<0.15	33.2	1.3			<1	
X2	11-Apr-05		7.4		<0.15	34	0.5			<1	
X2	09-May-05		7.4		<0.15	4	1.6			9	
X2	20-Jun-05		7.7		<0.15	10.5	8			2	
X2	25-Jul-05		7.5		<0.15	10.6	6.7			1	
X2	22-Aug-05		7.5		<0.15	15.1	7.3			<1	
X2	05-Sep-05		7.6		<0.15	16.4	6.1			<1	
X2	10-Oct-05		8		<0.15	16.6	2.6			<1	
X2	01-Nov-05		7.7		<0.15	24.6	0.9			2	1.2
X2	13-Dec-05		7.2		<0.15	28.1	0.6			<1	1.2
X2	23-Jan-06		7.5		<0.15	37.2	0.7			<1	0.89
X2	14-Feb-06		7.8		<0.15	39.7	0.6			<1	0.72
X2	24-Apr-06		7.7		<0.15	38.8	1			<1	1.2
X2	17-May-06		8		<0.15	4.85	0.1			7	3.7
X2	19-Jun-06		7.6		<0.15	8.95	5.7			8	0.72
X2	18-Jul-06		7.8		<0.15	11.7	7.9			2	0.47
X2	21-Aug-06		7.6		<0.15	12.2	5.5			<1	0.5
X2	11-Sep-06		7.7		<0.15	12.8	4.2			<1	0.47
X2	16-Oct-06		7.8		<0.15	27.4	-0.3			1	1.2
X2	14-Nov-06		7.5		<0.15	31.1	0.1			<1	0.42
X2	18-Apr-07		7.2		<0.15	33.7	0.2			<1	0.95
X2	14-May-07		7.4		<0.15	12.8	0.3			3	2.3
X2	18-Jun-07		7.6		<0.15	9.25	5.8			5	2.2
X2	16-Jul-07		7.3		<0.15	10.1	7.9			4	2.5
X2	13-Aug-07		7.4		<0.15	15.3	6.1			<1	0.56
X2	10-Sep-07		7.1		<0.15	14.2	6.4			<1	0.52
X2	22-Oct-07		7.5		<0.15	19.9	0.2			<1	1.5
X2	13-Nov-07		7.3		<0.15	24.5	0			<1	0.71
X2	09-Dec-07		7.3		<0.15	28.1	2.3			1	1.5
X2	07-Jan-08		7.5		<0.15	30.9	0.1			<1	0.58
X2	18-Feb-08		7.2		<0.15	36.4	1.3			<1	0.84
X2	17-Mar-08		7.4		<0.15	38.2	0.4			<1	0.86
X2	14-Apr-08		7.5		<0.15	36.3	1.8			<1	1.6
X2	14-May-08		8.4		<0.15	6.12	1.3			2	2.5
X2	12-Jun-08					7.92					
X2	16-Jun-08		7.8		<0.15	8.35	5.8			4	2.4
X2	14-Jul-08		7.8		<0.15	7.3	7.9			<1	1.9
X2	22-Jul-08					9.7				2	
X2	11-Aug-08		7.9		<0.15	11.7	8.3			<1	0.61
X2	19-Aug-08	0.15			0.017	9.7		110		5	
X2	25-Aug-08					8.1				30	
X2	15-Sep-08		8		<0.15	10.1	5.3			<1	0.65
X2	15-Oct-08		7.6		<0.15	14.6	1.6			<1	0.55
X2	03-Nov-08		7.7		<0.15	22.2	1.1			<1	0.75
X2	01-Dec-08		8.2		<0.15	23.7	0.2			3	1.5
X2	12-Jan-09		7.6		<0.15	44	0			<1	0.92
X2	02-Feb-09		7.9		<0.15	35.3	0.1			<1	0.74
X2	3-Mar-09	<0.05	8			38		200	1.4	1	
X2	6-Apr-09	<0.05	7.8			39		210	1	<1	
X2	6-May-09	<0.05	7.5			<0.5		70	18.4	7	
X2	8-Jun-09	<0.05	7.6			4		62	5.3	6	
n [a]		5	49	0	1	53	45	5	4	52	35
minimum [a]		0.05	7.1		0.017	0.5	0	62	1	1	0.42
maximum [a]		0.15	8.4		0.017	44	8.3	210	18.4	30	3.7
mean [a,b]		0.050	7.6		0.0170	20.69	2.8	130	6.53	2.3	1.20
standard deviation (SD) [a,b]		0.056	0.3			12.42	3.0	71	8.15	4.5	0.77
max detection limit (DL) [a]		0.05	0	0	0	0.5	0	0	0	1	0
# < detection limit [a]		4	0		0	1	0	0	0	30	0
% < detection limit [a]		80%	0%		0%	2%	0%	0%	0%	58%	0%
background (BG) benchmark		0.28	6.53	7.20	<0.03	21.6	7.5	182	13	20	0.69
% samples > BG benchmark [c]		0%	0%		0%	45%	11%	40%	25%	2%	71%
background mean		0.080	7.6	7.7	0.0106	9.08	2.4	79	4.10	7.3	0.32
station mean > BG mean [c]		0	0		1	1	1	1	1	0	1
current water quality criterion		-	6.5-9.0	6.5-9.0	0.03	50	-	500	-	8	2.7
source		-	CCME	CCME	OMOE	BCMOE	-	CCME	-	CCME	BCMOE
proposed new criterion		-	-	-	-	-	-	-	-	-	-
source		-	-	-	-	-	-	-	-	-	-
# > current water quality criterion		-	0	-	0	0	-	0	-	2	1
% > current water quality criterion		-	0%	-	0%	0%	-	0%	-	4%	3%

< DL greater than guideline, removed
statistical outlier that was removed (mean + 3 SD)
statistical outlier that was not removed (mean + 3 SD)
unusual datum that was removed (silver) or modified (temperature negative values set as "0")

[a] excluding sensored data
[b] values reported as less than the detection limit were used at 1/2 the detection limit for calculation
[c] alkalinity, bicarbonate, dissolved oxygen and pH evaluated at less than the lower benchmark (5th percentile of background values)

Table B.3: Faro Near-field Exposure Station V27 Data 2005 - 2009

Station ID	Date	Aluminum mg/L	Antimony mg/L	Arsenic mg/L	Barium mg/L	Beryllium mg/L	Bismuth mg/L	Boron mg/L	Cadmium mg/L	Calcium mg/L	Chromium mg/L	Cobalt mg/L	Copper mg/L	Iron mg/L	Lead mg/L	Lithium mg/L	Magnesium mg/L	Manganese mg/L	Mercury mg/L	Molybdenum mg/L	Nickel mg/L	Potassium mg/L	Selenium mg/L	Silicon mg/L	Silver mg/L
V27	26-May-05	0.12	<0.001	<0.001	0.018	<0.001	<0.001	<0.05	<0.0002	14.3	<0.001	<0.001	0.002	0.19	0.002	0.001	5.25	0.008	<0.00002	<0.0005	0.001	0.6	<0.001	8	<0.00025
V27	21-Sep-05	0.023	<0.001	<0.001	0.026	<0.001	<0.001	<0.05	<0.0002	22.3	<0.001	<0.001	<0.001	<0.05	<0.001	0.002	6.83	0.008	<0.00002	<0.0005	<0.001	0.5	<0.001	9.3	<0.00025
V27	29-May-06	0.083	<0.001	<0.001	0.019	<0.001	<0.001	<0.05	<0.0002	14.9	<0.001	<0.001	0.002	0.16	0.002	<0.001	4.37	0.023	<0.00002	<0.0005	<0.001	0.8	<0.001	2.8	<0.00025
V27	01-Aug-06	0.021	<0.001	<0.001	0.032	<0.001	<0.001	<0.05	<0.0002	28.2	<0.001	<0.001	0.002	0.06	<0.001	0.002	9.46	0.004	<0.00002	<0.0005	<0.001	0.6	<0.001	4.5	<0.00025
V27	26-Sep-06	<0.005	<0.001	<0.001	0.029	<0.001	<0.001	<0.05	<0.0002	24.2	<0.001	<0.001	<0.001	<0.05	<0.001	0.001	8.2	0.003	<0.00002	<0.0005	<0.001	0.5	<0.001	4	<0.00025
V27	04-Jun-07	0.16	<0.001	<0.001	0.012	<0.001	<0.001	<0.05	<0.0002	4.68	<0.001	<0.001	0.001	0.36	0.002	<0.005	1.35	0.039	<0.00002	<0.0005	<0.001	0.5	<0.001	1.6	<0.00025
V27	25-Jul-07	0.021	<0.001	<0.001	0.03	<0.001	<0.001	<0.05	<0.0002	26.5	<0.001	<0.001	0.001	0.09	<0.001	<0.005	8.22	0.004	<0.00002	<0.0005	0.001	0.6	<0.001	4.2	<0.00025
V27	28-Aug-07	0.0184	0.00007	0.0004	0.0326	0.05	<0.00005	<0.008	0.00005	28.3	<0.0002	0.04	0.0009	0.049	0.00052		8.55	0.0035	<0.00005	0.00032	<0.0005	0.525	<0.0005		<0.00001
V27	26-Sep-07	0.02	0.00006	<0.00002	0.03	<0.00001	<0.000005	<0.005	0.00004	24.4	0	0.00004	0.0011	0.038	0.00038	0.0013	7.52	0.0033		0.0003	<0.00002	0.454	<0.00004	3.89	<0.000005
V27	10-Oct-07	0.018	<0.001	<0.001	0.035	<0.001	<0.001	<0.05	<0.0002	28.6	<0.001	<0.001	<0.001	0.07	<0.001	<0.001	8.86	0.003	<0.00002	<0.0005	<0.001	0.5	<0.001	3.8	<0.00025
V27	24-Oct-07	0.0106	0.0001	0.0004	0.0438	<0.00001	<0.000005	<0.005	0.000081	38.6	0.0001	0.000029	0.00077	0.041	0.000456	0.0021	12.7	0.00275		0.00045	0.00059	0.58	0.00028	4.03	<0.000005
V27	22-Nov-07	0.0065	0.0001	0.00041	0.0488	<0.00001	<0.000005	<0.005	0.000054	50.6	0.0005	0.000015	0.00073	0.011	0.000179	0.0021	18	0.00095		0.00059	0.00061	0.71	0.00031	5.66	<0.000005
V27	14-Dec-07	0.0054	0.00013	0.00039	0.0571	<0.00001	<0.000005	<0.005	0.000054	52.8	<0.0001	0.000015	0.00062	0.009	0.000134	0.0025	18.8	0.00105		0.00063	0.00064	0.71	0.00036	5.07	<0.000005
V27	23-Jan-08	0.005	0.00011	0.00048	0.0613	<0.00001	<0.000005	<0.005	0.000047	59.8	<0.0001	0.00002	0.00052	0.012	0.000212	0.0024	22.3	0.0019		0.00073	0.00058	0.78	0.00041	4.63	<0.000005
V27	20-Feb-08	0.0053	0.0001	0.00048	0.0581	<0.00001	<0.000005	<0.005	0.000047	63.6	<0.0001	0.000022	0.00047	0.012	0.000166	0.0024	23.2	0.00214		0.00075	0.00063	0.84	0.00042	5.9	<0.000005
V27	13-Mar-08	0.0035	0.0001	0.00051	0.0594	<0.00001	<0.000005	<0.005	0.000059	70.2	0.0001	0.00002	0.00047	0.007	0.00012	0.0026	27	0.00134		0.00077	0.00064	0.9	0.00033	5.15	<0.000005
V27	28-Apr-08	0.0113	0.00013	0.0006	0.0623	<0.00001	<0.000005	<0.005	0.000073	76.2	<0.0001	0.000044	0.00077	0.031	0.000655	0.0027	27.1	0.00407		0.00059	0.00085	1.02	0.00043	4.63	<0.000005
V27	21-May-08	0.427	0.00012	0.00349	0.0506	0.00006	0.000013	<0.005	0.000406	23.3	0.0007	0.00293	0.00759	1.33	0.0244	0.0017	7.89	0.279		0.00028	0.00359	1.47	0.00021	4.74	0.000019
V27	19-Jun-08	0.059	<0.001	<0.001	0.022	<0.001	<0.001	<0.05	0.0003	35.6	<0.001	<0.001	0.002	0.12	0.001	0.003	7.76	0.21	<0.00002	<0.0005	<0.001	0.6	<0.001	2.9	<0.00025
V27	24-Jun-08	0.148	0.00006	0.00067	0.0254	0.00003	<0.000005	<0.005	0.000182	21.6	0.0003	0.000331	0.00166	0.258	0.00476	0.0023	5.34	0.123		0.00014	0.0011	0.44	0.00004	2.8	0.000014
V27	29-Jul-08	0.0287	0.00006	0.00029	0.0458	<0.00001	<0.000005	<0.005	0.000439	82	<0.0001	0.000397	0.00165	0.051	0.00052	0.007	19	0.317		0.0003	0	0.81	0.00026	4.03	<0.000005
V27	19-Aug-08	0.027	<0.001	<0.001	0.045	<0.001	<0.001	<0.05	<0.0002	95.3	<0.001	<0.001	0.002	0.18	<0.001	0.007	20.5	0.013	<0.00002	<0.0005	<0.001	1.1	<0.001	4.7	<0.00025
V27	23-Sep-08	0.02	<0.001	<0.001	0.031	<0.001	<0.001	<0.05	<0.0002	29.3	<0.001	<0.001	0.001	0.06	<0.001	0.001	10.4	0.007	<0.00002	<0.0005	<0.001	0.5	<0.001	4.3	<0.00025
V27	10-Dec-08	0.0161	0.00011	0.00045	0.0592	<0.00001	<0.000005	<0.05	0.000068	76.5	0.0002	0.000022	0.00109	0.014	0.000191	0.0028	32.7	0.00123		0.00071	0.00092	0.94	0.00062	5.1	<0.000005
V27	24-Feb-09	0.007	0.00013	0.00058	0.0684				0.00008	91.7	0.0002	0.000018	0.00076	0.006	0.000119	0.003	40.2	0.00103		0.00092	0.0008	1.05	0.00062	4.89	
n [a]		25	25	25	25	24	24	24	15	25	24	25	25	25	25	24	25	25	11	25	24	25	25	24	13
minimum [a]		0.0035	0.0001	0.00002	0.012	0.00001	0.00001	0.005	0.00004	5	0.0001	0.00002	0.0005	0.01	0.0001	0.001	1.35	0.00095	0.00002	0.00014	0.00002	0.44	0.00004	1.6	0.000005
maximum [a]		0.427	0.0010	0.0035	0.068	0.05000	0.00100	0.050	0.00044	95	0.0010	0.0400	0.0076	1.33	0.0244	0.007	40.2	0.317	0.00002	0.00092	0.00359	1.47	0.001	9.3	0.000019
mean [a,b]		0.0507	0.0003	0.0006	0.0401	0.0023	0.0002	0.0138	0.00013	43.3	0.0003	0.00198	0.0013	0.128	0.0017	0.0024	14.46	0.0426	0.00001	0.0004	0.0007	0.7212	0.0004	4.61	0.000005
standard deviation (SD) [a,b]		0.0902	0.0002	0.0006	0.0163	0.0102	0.0003	0.0114	0.00014	26.4	0.0002	0.00794	0.0014	0.266	0.0048	0.0016	9.92	0.0901	0.00000	0.0002	0.0007	0.2521	0.0002	1.59	0.00001
max detection limit (DL) [a]		0.005	0.001	0.001	0	0.001	0.001	0.05	0	0	0.001	0.001	0.001	0.05	0.001	0.005	0	0	0.00002	0.0005	0.001	0	0.001	0	0.00001
# < detection limit [a]		1	11	12	0	21	23	24	0	0	17	11	3	2	7	4	0	0	11	11	11	0	13	0	11
% < detection limit [a]		4%	44%	48%	0%	88%	96%	100%	0%	0%	71%	44%	12%	8%	28%	17%	0%	0%	100%	44%	46%	0%	52%	0%	85%
background (BG) benchmark		0.2460	<0.001	<0.001	0.090	<0.001	<0.005	<0.05	0.00011	47	<0.001	<0.001	0.003	0.47	0.002	0.008	11	0.045	<0.00002	0.0012	<0.001	1.4	<0.001	11.6	0.000021
% samples > BG benchmark [c]		4%	0%	4%	0%	4%	0%	0%	27%	40%	0%	8%	4%	4%	8%	0%	44%	16%	0%	0%	8%	4%	0%	0%	0%
background mean		0.0714	0.0003	0.0005	0.0428	0.0002	0.0005	0.0202	0.00004	20.8	0.0004	0.00027	0.0009	0.142	0.0007	0.0025	4.28	0.0145	0.00001	0.0005	0.0005	0.6828	0.0004	5.64	0.00001
station mean > BG mean [c]		0	1	1	0	1	0	0	1	1	0	1	1	0	1	0	1	1	0	0	1	1	1	0	0
current water quality criterion		0.1	0.02	0.005	1.0	1.1	0.26	1.2	0.00003	116	0.001	0.004	0.002	0.3	0.002	-	82	1.0	0.000026	0.073	0.065	53	0.001	-	0.0001
source		CCME	OMOE	CCME	CCME	OMOE	Alternate	BCMOE	CCME	Alternate	CCME	BCMOE	CCME	CCME	CCME	-	Alternate	BCMOE	CCME	CCME	CCME	Alternate	CCME	-	CCME
proposed new criterion		-	-	-	-	-	-	-	0.00022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
source		-	-	-	-	-	-	-	CCME	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
# > current water quality criterion		4	0	0	0	0	0	0	15	0	0	1	1	2	2	-	0	0	0	0	0	0	0	-	0
% > current water quality criterion		16%	0%	0%	0%	0%	0%	0%	100%	0%	0%	4%	4%	8%	8%	-	0%	0%	0%	0%	0%	0%	0%	-	0%

< DL greater than guideline, removed
statistical outlier that was removed (mean + 3 SD)
statistical outlier that was not removed (mean + 3 SD)
unusual datum that was removed (silver) or modified (temperature negative values set as "0")

[a] excluding sensored data
[b] values reported as less than the detection limit were used at 1/2 the detection limit for calculation
[c] alkalinity, bicarbonate, dissolved oxygen and pH evaluated at less than the lower benchmark (5th percentile of background values)

Table B.3: Faro Near-field Exposure Station V27 Data 2005 - 2009

Station ID	Date	Sodium mg/L	Strontium mg/L	Tellurium mg/L	Thallium mg/L	Thorium mg/L	Tin mg/L	Titanium mg/L	Uranium mg/L	Vanadium mg/L	Zinc mg/L	Zirconium mg/L	Alkalinity-C mg/L	Alkalinity-H mg/L	Alkalinity-PP mg/L	Alkalinity-T mg/L	Ammonia mg/L	Bicarbonate mg/L	Chloride mg/L	Colour CU	Conductivity-Field uS/cm	Conductivity-Lab uS/cm	Cyanide-WAD mg/L	DOC mg/L	DO mg/L	DO %
V27	26-May-05	1.39	0.054	<0.001	<0.0001	<0.0005	<0.001	0.003	0.001	<0.001	0.031	<0.01					<0.01					185				
V27	21-Sep-05	2.03	0.087	<0.001	<0.0001	<0.0005	0.005	0.001	0.0009	<0.001	0.017	<0.01				48.5	<0.01			<5		152				
V27	29-May-06	1.22	0.052	<0.001	<0.0001	<0.0005	<0.001	0.001	0.0009	<0.001	0.022	<0.01					0.02			35		129				
V27	01-Aug-06	2.14	0.11	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0014	<0.001	0.018	<0.01					<0.01			<5		235				
V27	26-Sep-06	2.05	0.093	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0013	<0.001	0.023	<0.01					<0.01			<5		221				
V27	04-Jun-07	0.69	0.02	<0.001	<0.0001	<0.0005	<0.001	0.005	<0.0005	<0.001	0.016	<0.01					0.03			28		47				
V27	25-Jul-07	2.12	0.095	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.001	<0.001	0.031	<0.01					<0.01			6		204				
V27	28-Aug-07	2.54	0.104		<0.00005		<0.00005	0.0007	0.00126	<0.00005	0.0318	<0.005			<0.5	52.3	<0.005					210		1.8		
V27	26-Sep-07	2.65	0.0978		<0.000002		<0.00001	<0.0005	0.00125	<0.0002	0.0257	0.0002	<0.5	<0.5	<0.5	46.8	<0.005	57.1				195	<0.0005	1.7	218	
V27	10-Oct-07	2.01	0.1	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0018	<0.001	0.026	<0.01					<0.01			<5		239				
V27	24-Oct-07	2.57	0.159		0.000006		0.00002	<0.0005	0.00264	<0.0002	0.0253	<0.0001	<0.5	<0.5	<0.5	72.7	<0.005	88.7			354	319	<0.0005	1.3	12.8	90.1
V27	22-Nov-07	3.78	0.188		0.000006		0.00002	<0.0005	0.00362	<0.0002	0.0274	<0.0001	<0.5	<0.5	<0.5	87	<0.005	110			133.7	390	<0.0005	2.8		
V27	14-Dec-07	3.05	0.211		0.000008		<0.00001	<0.0005	0.00442	<0.0002	0.0262	<0.0001	<0.5	<0.5	<0.5	95	<0.005	120			1096	420	<0.0005	1.2		
V27	23-Jan-08	3.26	0.229		0.000006		0.00007	<0.0005	0.00528	<0.0002	0.0254	<0.0001	<0.5	<0.5	<0.5	100	<0.005	120			494	460	<0.0005	0.8		
V27	20-Feb-08	3.64	0.23		0.000006		0.00001	<0.0005	0.00523	<0.0002	0.0284	<0.0001	<0.5	<0.5	<0.5	110	<0.005	140			535	490	<0.0005	1.2	9.72	75.3
V27	13-Mar-08	3.96	0.241		0.000008		<0.00001	<0.0005	0.0059	<0.0002	0.0313	<0.0001	<0.5	<0.5	<0.5	120	<0.005	140			498	530	<0.0005	1.1		86.6
V27	28-Apr-08	3.37	0.272		0.000009		<0.00001	<0.0005	0.00532	<0.0002	0.0362	<0.0001	<0.5	<0.5	<0.5	100	<0.005	120			567	560	<0.0005	0.7	10.13	82.4
V27	21-May-08	1.6	0.0871		0.000044		0.00003	0.0086	0.00163	0.0006	0.138	0.0005	<0.5	<0.5	<0.5	41	<0.005	51			191.3	180	<0.0005	9.2		86.8
V27	19-Jun-08	1.38	0.13	<0.001	<0.0001	<0.0005	<0.001	0.001	0.0008	<0.001	0.046	<0.01					0.01			10		233				
V27	24-Jun-08	1.1	0.086		0.000035		<0.00001	0.0035	0.000819	<0.0002	0	0.0002	<0.5	<0.5	<0.5	21	<0.005	26			186.2	180	<0.0005	3.1	10.4	85.3
V27	29-Jul-08	3.14	0.298		0.000109		<0.00001	<0.0005	0.00184	<0.0002	0.0707	<0.0001	<0.5	<0.5	<0.5	54	<0.005	65			527	560	<0.0005	3	10.21	86.8
V27	19-Aug-08	2.97	0.37	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.002	<0.001	0.053	<0.01					0.02			<5		574				
V27	23-Sep-08	2.06	0.14	<0.001	<0.0001	<0.0005	<0.001	<0.001	0.0024	<0.001	0.032	<0.01					0.01			<5		244				
V27	10-Dec-08	3.49	0.272		0.00001		<0.00001	<0.0005	0.00692	<0.0002	0.0384	<0.0001	<0.5	<0.5	<0.5	120	<0.005	150			642	580	<0.0005	0.7		
V27	24-Feb-09	3.76	0.335		0.000011				0.00876		0.0317					140	0.006	170				740		0.7		
n [a]		25	25	11	25	11	24	24	25	24	24	12	12	12	13	15	25	13	0	10	11	25	12	14	5	7
minimum [a]		0.69	0.02	0.001	0.000002	0.0005	0.00001	0.0005	0.0005	0.00005	0.016	0.0001	0.5	0.5	0.5	21	0.005	26		5	133.7	47	0.0005	0.7	9.72	75.3
maximum [a]		3.96	0.37	0.001	0.000109	0.0005	0.005	0.0086	0.00876	0.001	0.138	0.0005	0.5	0.5	0.5	140	0.03	170		35	1096	740	0.0005	9.2	12.8	90.1
mean [a,b]		2.48	0.1624	0.0005	0.00003	0.0003	0.0004	0.0012	0.0027	0.0003	0.0355	0.0001	0.25	0.25	0.25	80.6	0.0063	104.4		9.4	474.9	331.1	0.0003	2.1	10.65	84.76
standard deviation (SD) [a,b]		0.94	0.0958	0.0000	0.00003	0.0000	0.0010	0.0020	0.0023	0.0002	0.0249	0.0001	0.00	0.00	0.00	35.2	0.0070	43.5		12.0	269.1	182.9	0.0000	2.2	1.23	4.75
max detection limit (DL) [a]		0	0	0.001	0.0001	0.0005	0.001	0.001	0.0005	0.001	0	0.0001	0.5	0.5	0.5	0	0.01	0	0	5	0	0	0.0005	0	0	0
# < detection limit [a]		0	0	11	13	11	18	16	1	23	0	9	12	12	13	0	19	0		6	0	0	12	0	0	0
% < detection limit [a]		0%	0%	100%	52%	100%	75%	67%	4%	96%	0%	75%	100%	100%	100%	0%	76%	0%		60%	0%	0%	100%	0%	0%	0%
background (BG) benchmark		3.3	0.18	<0.001	<0.0001	<0.0005	<0.001	0.0069	0.0025	<0.001	0.017	<0.002	<0.5	<0.5	<0.5	9.5	0.040	12.0	1.2	8	350	310	<0.0005	12.1	9.7	76.5
% samples > BG benchmark [c]		24%	40%	0%	4%	0%	4%	4%	36%	0%	92%	0%	0%	0%	0%	0%	0%	0%		30%	73%	44%	0%	0%	0%	14%
background mean		1.96	0.0821	0.0005	0.00003	0.0002	0.0006	0.0017	0.0011	0.0004	0.0051	0.0003	0.30	0.25	0.26	54.0	0.0117	65.7	0.56	4.2	135.2	142.2	0.0003	4.1	11.24	83.40
station mean > BG mean [c]		1	1	1	1	1	0	0	1	0	1	0	1	0	1	0	0	0		1	1	1	0	0	1	0
current water quality criterion		200	9.3	-	0.0008	-	0.35	1.83	0.015	0.006	0.030	0.004	-	-	-	7.1	0.24	-	250	-	-	-	0.005	-	6.5	-
source		CCME	Alternate	-	CCME	-	Alternate	Alternate	SE	OMOE	CCME	OMOE	-	-	-	OMOE	CCME	-	CCME	-		-	CCME	-	CCME	-
proposed new criterion		-	-	-	-	-	-	-	-	-	0.017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
source		-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
# > current water quality criterion		0	0	-	0	-	0	0	0	0	12	0	-	-	-	0	0	-	0	-	-	-	0	-	0	-
% > current water quality criterion		0%	0%	-	0%	-	0%	0%	0%	0%	50%	0%	-	-	-	0%	0%	-	#DIV/0!	-	-	-	0%	-	0%	-

< DL greater than guideline, removed
statistical outlier that was removed (mean + 3 SD)
statistical outlier that was not removed (mean + 3 SD)
unusual datum that was removed (silver) or modified (temperature negative values set as "0")

[a] excluding sensored data
[b] values reported as less than the detection limit were used at 1/2 the detection limit for calculation
[c] alkalinity, bicarbonate, dissolved oxygen and pH evaluated at less than the lower benchmark (5th percentile of background values)

Table B.3: Faro Near-field Exposure Station V27 Data 2005 - 2009

Station ID	Date	Fluoride mg/L	Hardness-Dissolved mg/L	Hardness-Total mg/L	Nitrate mg/L	Nitrite mg/L	Nitrogen mg/L	pH-field	pH-Lab	Phosphorus mg/L	Sulphate mg/L	TEMP-F °C	TDS mg/L	TOC mg/L	TSS mg/L	Turbidity NTU
V27	26-May-05			57						0.2	28.5				3	
V27	21-Sep-05			84						<0.15	48.5				2	0.33
V27	29-May-06			55				8.2		<0.15	25.3	3.2			3	1.5
V27	01-Aug-06			110				7.9		<0.15	56.4	9.4			<1	0.24
V27	26-Sep-06			94				7.9		<0.15	52	9.4			<1	0.16
V27	04-Jun-07			17				7.5		<0.15	8.46	4.5			6	3.3
V27	25-Jul-07			100				7.8		<0.15	47.5	10.1			<1	0.65
V27	28-Aug-07	0.08	102		0.13	<0.005				<0.005	49.3		140	2.2	<1	
V27	26-Sep-07	0.09	97.5	92	0.16	<0.005		7.85	8	<0.005	50.2	2.7	136	1.4	<1	
V27	10-Oct-07			108				7.7		<0.15	64.1	1.3			<1	0.25
V27	24-Oct-07	0.09	152	148	0.3	<0.005		7.64	8	<0.005	85.5	-1	194	1.1	1	
V27	22-Nov-07	0.1	202	201	0.43	<0.005		8.18	8.1	<0.005	99	0	250	2.3	<1	
V27	14-Dec-07	0.11	212	209	0.51	<0.005		8.3	8.1	<0.005	106	0.2	270	0.8	<1	
V27	23-Jan-08	0.1	251	241	0.6	<0.005		7.39	8.1	<0.005	130		320		<1	
V27	20-Feb-08	0.1	255	254	0.62	<0.005		8.4	8.2	<0.005	132	-0.5	320	0.6	<1	
V27	13-Mar-08	0.11	281	286	0.77	0.005		6.4	8.1	<0.005	170	-0.5	400	0.9	<1	
V27	28-Apr-08	0.11	298	302	0.7	<0.005		8	8.1	<0.005	170	-0.5	390	1.5	6	
V27	21-May-08	0.06	89.7	90.7	<0.02	<0.005		7.22	7.9	0.017	47	2.5	140	0.7	61	
V27	19-Jun-08			121				8.1		<0.15	88.5	6.3		9.3	3	0.7
V27	24-Jun-08	0.06	77.3	76	0.06	<0.005		7.19	7.6	0.016	50	5.5	120		12	
V27	29-Jul-08	0.1	287	283	0.18	<0.005		8.13	8	<0.005	220	7.3	370	3.1	<1	
V27	19-Aug-08			323				7.7		<0.15	249	10		2.9	<1	0.3
V27	23-Sep-08			116				8		<0.15	65	2.3			<1	0.43
V27	10-Dec-08	0.09	325	326	0.99	<0.005		7.6	8.1		170	0.2	460	0.8	1	
V27	24-Feb-09	0.12	392	395	1.46			8.2			250		490	0.8		
n [a]		14	14	24	14	13	0	22	12	13	25	20	14	14	24	10
minimum [a]		0.06	77.3	17	0.02	0.005		6.4	7.6	0.005	8.46	0	120	0.6	1	0.16
maximum [a]		0.12	392	395	1.46	0.005		8.4	8.2	0.2	250	10.1	490	9.3	61	3.3
mean [a,b]		0.0943	215.8	170.4	0.49	0.0027		7.8	8.0	0.0198	98.49	3.7	286	2.03	4.4	0.79
standard deviation (SD) [a,b]		0.0179	99.3	106.0	0.40	0.0007		0.5	0.2	0.0544	70.00	3.8	126	2.25	12.4	0.97
max detection limit (DL) [a]		0	0	0	0.02	0.005	0	0	0	0.005	0	0	0	0	1	0
# < detection limit [a]		0	0	0	1	12		0	0	10	0	0	0	0	14	0
% < detection limit [a]		0%	0%	0%	7%	92%		0%	0%	77%	0%	0%	0%	0%	58%	0%
background (BG) benchmark		0.13	171	166	0.21	<0.005	0.28	6.53	7.20	<0.03	21.6	7.5	182	13	20	0.69
% samples > BG benchmark [c]		0%	64%	42%	64%	0%		5%	0%	8%	96%	20%	71%	0%	4%	30%
background mean		0.0792	58.6	70.6	0.07	0.0027	0.080	7.6	7.7	0.0106	9.08	2.4	79	4.10	7.3	0.32
station mean > BG mean [c]		1	1	1	1	1		0	0	1	1	1	1	0	0	1
current water quality criterion		0.12	-	-	13	0.06	-	6.5-9.0	6.5-9.0	0.03	50	-	500	-	8	2.7
source		CCME	-	-	CCME	CCME	-	CCME	CCME	OMOE	BCMOE	-	CCME	-	CCME	BCMOE
proposed new criterion		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
source		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
# > current water quality criterion		0	-	-	0	0	-	1	0	1	17	-	0	-	2	1
% > current water quality criterion		0%	-	-	0%	0%	-	5%	0%	8%	68%	-	0%	-	8%	10%

< DL greater than guideline, removed
statistical outlier that was removed (mean + 3 SD)
statistical outlier that was not removed (mean + 3 SD)
unusual datum that was removed (silver) or modified (temperature negative values set as "0")

[a] excluding sensored data
[b] values reported as less than the detection limit were used at 1/2 the detection limit for calculation
[c] alkalinity, bicarbonate, dissolved oxygen and pH evaluated at less than the lower benchmark (5th percentile of background values)

Table B.4: Water quality data and summary statistics for station V6A, Faro Mine, Yukon.

		Cadmium	Calcium	Cobalt	Iron	Lead	Lithium	Magnesium	Manganese	Nickel	Potassium	Silver	Sodium	Strontium	Titanium	Uranium	Zinc	Ammonia	Chloride	Colour	Conductivity-Lab	Fluoride	Hardness-Total	Nitrate	Phosphorus	Sulphate	TDS	TOC	Turbidity
Station ID	Date	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L			uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	NTU
V6A	07-Mar-05	<0.0002	54.4	<0.001	0.08	<0.001	0.001	11.2	0.004	<0.001	0.8	<0.00025	2.41	0.24	<0.001	0.0051	0.022	<0.01		<5	218		182		<0.15	52.1			0.31
V6A	07-Jun-05	<0.0002	23.3	<0.001	0.16	<0.001	<0.001	4.47	0.007	<0.001	0.9	<0.00025	1.98	0.098	0.002	0.0012	0.029	0.04		18	140		77		<0.15	21.3			0.44
V6A	12-Sep-05	<0.0002	27.2	<0.001	0.19	<0.001	<0.001	6.12	0.008	<0.001	0.4	<0.00025	1.73	0.1	0.009	0.0013	0.014	0.01		7	164		93		<0.15	27.3			0.51
V6A	01-Dec-05	<0.0002	45	<0.001	0.1	<0.001	0.002	11.1	0.027	<0.001	0.5	<0.00025	2.05	0.18	0.002	0.0026	0.031	0.02		<5	315		158		<0.15	53.5			0.69
V6A	05-Jun-06	<0.0002	14	<0.001	0.26	0.001	<0.001	2.94	0.015	<0.001	0.4	<0.00025	1.25	0.053	0.003	0.001	0.026	<0.01		45	99		47		<0.15	13.6			1.1
V6A	09-Jun-06	<0.0002	22.4	<0.001	0.14	0.001	<0.001	4.59	0.007	<0.001	0.3	<0.00025	1.68	0.097	<0.001	0.0014	0.013	<0.01		7	168		75		<0.15	20.1			0.52
V6A	06-Sep-06	<0.0002	22.4	<0.001	0.14	0.001	<0.001	4.59	0.007	<0.001	0.3	<0.00025	1.68	0.097	<0.001	0.0014	0.013	<0.01		7	168		75		<0.15	20.1			0.52
V6A	18-Jun-07	<0.0002	16.1	<0.001	0.61	0.002	<0.005	3.34	0.016	0.001	0.4	<0.00025	1.44	0.066	0.017	0.0024	0.029	0.01		35	114		54		<0.15	13.6			2
V6A	24-Sep-07	<0.0002	24.2	<0.001	0.11	<0.001	<0.001	5.34	0.006	<0.001	0.4	<0.00025	1.66	0.098	<0.001	0.0016	0.014	0.32		7	183		81.6		<0.15	28			0.31
V6A	25-Sep-07	0.00003	26.7	0.00005	0.126	0.00049	0.001	5.65	0.00638	<0.00002	0.38	<0.000005	1.8	0.117	0.0016	0.00181	0.0163	<0.005	<0.5		180	0.1	90	0.18	<0.005	28.3	128	2.8	
V6A	24-Oct-07	0.000039	32.9	0.000034	0.076	0.000365	0.0012	6.84	0.00786	0.00023	0.36	<0.000005	1.77	0.146	<0.0005	0.00279	0.0134	0.008	<0.5		235	0.09	110	0.3	<0.005	36.3	146	2.1	
V6A	21-Nov-07	0.000038	39.5	0.000032	0.097	0.000359	0.0011	7.63	0.00696	0.00028	0.42	<0.000005	1.64	0.172	<0.0005	0.00341	0.0137	0.006	<0.5		270	0.09	130	0.4	<0.005	45.2	170	1.3	
V6A	09-Dec-07	<0.0002	40.3	<0.001	0.25	0.001	<0.001	8.14	0.02	<0.001	0.5	<0.00025	1.71	0.17	0.002	0.0032	0.025	0.04		<5	294		134		<0.15	49.1			2.1
V6A	13-Dec-07	0.000039	44.4	0.000039	0.107	0.000468	0.0014	9.19	0.00723	0.00032	0.5	<0.000005	2.03	0.186	<0.0005	0.00356	0.0166	0.007	<0.5		290	0.1	149	0.41	<0.005	46.1	180	1.4	
V6A	24-Jan-08	0.000042	48	0.000054	0.116	0.000634	0.0013	10.2	0.00737	0.00033	0.53	<0.000005	2	0.208	0.0009	0.00437	0.0157	<0.005	<0.5		310	0.08	162	0.35	<0.005	50.9	180	1.3	
V6A	21-Feb-08	0.000051	54.8	0.000048	0.06	0.000173	0.0019	11.4	0.0057	0.00026	0.65	<0.000005	2.05	0.243	<0.0005	0.00916	0.0186	<0.005	<0.5		360	0.13	184	0.23	0.005	53.1	220	1.1	
V6A	10-Mar-08	<0.0002	52	<0.001	<0.05	<0.001	0.002	11.1	0.007	<0.001	0.6	<0.00025	2.13	0.25	<0.001	0.0065	0.03	<0.01		<5	354		176		<0.15	56.1			0.16
V6A	11-Mar-08	0.000065	55.1	0.000021	0.038	0.000109	0.0019	11.3	0.00409	0.00027	0.6	<0.000005	2.02	0.251	<0.0005	0.00753	0.0251	<0.005	<0.5		350	0.12	184	0.28	<0.005	50.3	250	1.3	
V6A	28-Apr-08	0.000093	54.1	0.000045	0.048	0.000311	0.0016	11.1	0.00594	0.00028	0.65	<0.000005	2.01	0.256	0.0006	0.00654	0.0182	<0.005	0.6		350	0.1	181	0.35	0.005	55	240	1.3	
V6A	21-May-08	0.000623	20.5	0.00153	1.02	0.0109	0.0017	5.81	0.195	0.00285	1.15	0.000008	11	0.0802	0.0132	0.00152	0.375	<0.005	1		150	0.04	75.2	0.16	0.013	30	120	13.6	
V6A	10-Jun-08	<0.0002	17.9	<0.001	0.21	<0.001	<0.001	4.39	0.012	<0.001	0.4	0.0004	1.59	0.071	0.002	0.0012	0.03	0.05		25	116		63		<0.15	19.3			0.75
V6A	24-Jun-08	0.000112	13.1	0.000183	0.256	0.00324	0.0011	2.76	0.0127	0.00084	0.31	0.00001	1.2	0.0601	0.0041	0.000912	0.0509	<0.005	0.7		96	0.08	44.2	<0.02	0.011	14	88	7.6	
V6A	30-Jul-08	0.000059	28.9	0.000057	0.133	0.00083	0.0011	6.94	0.00761	0.00046	0.35	<0.000005	2.4	0.128	0.0008	0.00217	0.0273	<0.005	0.9		220	0.08	101	0.15	<0.005	35	110	4.1	
V6A	02-Sep-08	<0.0002	23.9	<0.001	0.11	<0.001	<0.001	5.95	0.007	<0.001	0.4	<0.00025	1.52	0.1	<0.001	0.0013	0.056	0.01		18	174		84		<0.15	32.8			0.8
V6A	17-Sep-08	0.000058	26.9	0.000041	0.097	0.000488	0.0011	7.07	0.00675	0.0004	0.39	<0.000005	1.59	0.117	0.0009	0.00189	0.0416	<0.005	<0.5		200	0.09	96.2	0.33	<0.005	40	200	5.3	
V6A	08-Oct-08	0.000103	30.5	0.000067	0.1	0.000829	0.0012	8.69	0.00964	0.00054	0.12	0.000005	1.65	0.127	0.00232	<0.000002	0.0001	<0.005	1		240	0.09	112	0.31	0.006	39	200	3	
V6A	02-Dec-08	<0.0002	58.6	<0.001	0.18	<0.001	0.002	17	0.015	<0.001	0.6	<0.00025	2.6	0.25	<0.001	0.0036	0.054	0.04		<5	346		217		<0.15	79.2			0.52
V6A	10-Dec-08	0.000064	52.2	0.000064	0.118	0.00076	0.0015	13.7	0.0119	0.00045	0.52	<0.000005	2.01	0.215	0.0011	0.00385	0.0469	<0.005	1.2		330	0.12	187	0.71		67	310	2	
V6A	24-Feb-09	0.000273	120	0.000042	0.04	0.00121	0.0056	16.9	0.0211	0.00068	1.37		4.02	0.6		0.0295	0.115		2.3		680	0.28	368	0.23		130	450	3.7	
V6A	26-Mar-09	0.00006	62.2	0.000029	0.025	0.000299	0.0016	13.3	0.00409	0.00033	0.62		1.98	0.272		0.00716	0.0275	0.023			410	0.11	210	0.64	0.006	81	250	1.2	
V6A	20-May-09	0.000117	27.1	0.000185	0.216	0.00288	0.0012	6.83	0.0294	0.00109	0.69	0.000007	1.17	0.112	0.0017	0.00214	0.111	<0.005	0.9		210	0.07	95.9	0.3	0.009	39	120	6.7	
V6A	23-Jun-09	0.000053	22.2	0.000198	0.274	0.00805	0.001	5.61	0.0199	0.00067	0.08	0.0971	1.7	0.000012	0.00166	<0.0002	0.0002	0.007	0.5		170	0.09	78.5	0.13	0.008	28	110	4.2	
n [a]		32	32	32	32	32	32	32	32	32	32	16	32	32	30	32	32	31	17	14	32	18	32	18	16	32	18	18	14
minimum [a]		0.00003	13.1	0.000021	0.025	0.000109	0.001	2.76	0.004	0.00002	0.08	0.000005	1.17	0.000012	0.0005	0.000002	0.0001	0.005	0.5	5	96	0.04	44.2	0.02	0.005	13.6	88	1.1	0.16
maximum [a]		0.000623	120	0.00153	1.02	0.0109	0.0056	17	0.195	0.00285	1.37	0.0004	11	0.6	0.017	0.0295	0.375	0.32	2.3	45	680	0.28	368	0.71	0.013	130	450	13.6	2.1
mean [a,b]		0.00010	37.52500	0.00030	0.17225	0.00134	0.00133	8.16219	0.01649	0.00056	0.51844	0.00003	2.17094	0.16126	0.00235	0.00382	0.04122	0.02084	0.65294	12.96429	247.00000	0.10333	127.33125	0.30389	0.00519	42.32188	192.88889	3.55556	0.76643
standard deviation (SD) [a,b]		0.00010	21.10170	0.00031	0.18970	0.00227	0.00096	3.79910	0.03323	0.00047	0.26134	0.00010	1.69002	0.10792	0.00389	0.00521	0.06606	0.05712	0.54212	13.57949	118.36684	0.04863	67.05795	0.16999	0.00343	23.86075	88.12884	3.18918	0.59210
max detection limit (DL) [a]		0.0002	0	0.001	0.05	0.001	0.005	0	0	0.001	0	0.000005	0	0	0.001	0.0002	0	0.01	0.5	5	0	0	0	0.02	0.005	0	0	0	0
# < detection limit [a]		14	0	14	1	9	10	0	0	14	0	11	0	0	12	2	0	17	8	5	0	0	0	1	8	0	0	0	0
% < detection limit [a]		44%	0%	44%	3%	28%	31%	0%	0%	44%	0%	69%	0%	0%	40%	6%	0%	55%	47%	36%	0%	0%	0%	6%	50%	0%	0%	0%	0%
background (BG) benchmark		0.00011	47	<0.001	0.47	0.002	0.008	11	0.045	<0.001	1.4	0.000021	3.3	0.18	0.0069	0.0025	0.017	0.040	1.2	8	310	0.13	166	0.21	<0.03	21.6	182	13	0.69
% samples > BG benchmark		56%	31%	0%	6%	13%	0%	31%	3%	0%	0%	6%	6%	34%	10%	47%	66%	6%	6%	36%	28%	6%	28%	72%	0%	78%	44%	6%	36%
background mean		0.00004	20.8	0.00027	0.142	0.0007	0.0025	4.28	0.0145	0.0005	0.6828	0.00001	1.96	0.0821	0.0017	0.0011	0.0051	0.0117	0.56	4.2	142.2	0.0792	70.6	0.07	0.0106	9.08	79	4.10	0.32
station mean > BG mean		1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1
current water quality criterion		0.00003	116	0.004	0.3	0.002	-	82	1.0	0.065	53	0.0001	200	9.3	1.83	0.015	0.030	0.24	250	-	-	0.12	-	13	0.03	50	500	-	2.7
source		CCME	Alternate	BCMOE	CCME	CCME	-	Alternate	BCMOE	CCME	Alternate	CCME	CCME	Alternate	Alternate	SE	CCME	CCME	CCME	-	-	CCME	-	CCME	OMOE	BCMOE	CCME	-	BCMOE
proposed new criterion		0.00022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.017	-	-	-	-	-	-	-	-	-	-	-	-
source		CCME	-	-	-	-	-	-	-	-	-	-	-	-	-	-	CCME	-	-	-	-	-	-	-	-	-	-	-	-
# > current water quality criterion		31	1	0	2	4	0	0	0	0	0	1	0	0	0	1	9	1	0	0	0	2	0	0	0	11	0	0	0
% > current water quality criterion		97%	3%	0%	6%	13%	-	0%	0%	0%	0%	6%	0%	0%	0%	3%	28%	3%	0%	-	-	11%	-	0%	0%	34%	0%	-	0%

< DL greater than guideline, removed
statistical outlier that was removed (mean + 3 SD)
statistical outlier that was not removed (mean + 3 SD)
unusual datum that was removed (silver) or modified (temperature negative values set as "0")

[a] excluding sensored data
[b] values reported as less than the detection limit were used at 1/2 the detection limit for calculation

Table B.5: Water Quality Data at Station V5.

Station I.D.	Date	Cadmium mg/L	Calcium mg/L	Cobalt mg/L	Iron mg/L	Lead mg/L	Lithium mg/L	Magnesium mg/L	Manganese mg/L	Nickel mg/L	Potassium mg/L	Silver mg/L	Sodium mg/L	Strontium mg/L	Titanium mg/L	Uranium mg/L	Zinc mg/L	Ammonia mg/L	Chloride mg/L	Colour CU	Conductivity µS/cm	Fluoride mg/L	Hardness mg/L	Nitrate mg/L	Phosphorus mg/L	Sulphate mg/L	TDS mg/L	TOC mg/L	Turbidity NTU
V5	21-Jan-05	<0.0002	95.7	<0.001	0.22	<0.001	0.005	41.5	0.011	0.002	1.4	<0.00025	4.92	0.37	0.001	0.0054	<0.005	<0.01		<5	676		410		<0.15	148			1.2
V5	11-Apr-05	<0.0002	92.8	<0.001	0.11	<0.001	0.005	41.6	0.007	0.002	1.4	0.0004	5.37	0.36	0.001	0.0054	0.011	<0.01		<5	706		404		<0.15	167			1.1
V5	09-May-05	0.0002	30.8	0.002	3.54	0.005	0.004	11.8	0.15	0.012	1.4	<0.00025	1.53	0.12	0.048	0.0011	0.03	0.02		100	172		126		0.6	28			54
V5	20-Jun-05	<0.0002	49.1	<0.001	0.37	<0.001	0.004	19.6	0.019	0.002	0.9	<0.00025	3.24	0.21	0.009	0.0024	<0.005	0.11		8	347		203		<0.15	53.1			2.7
V5	25-Jul-05	<0.0002	54.3	<0.001	1.9	0.002	0.006	22.4	0.058	0.005	1.1	<0.00025	3.19	0.23	0.032	0.0028	0.011	0.02		13	372		228		0.2	69.5			35
V5	22-Aug-05	<0.0002	65.1	<0.001	0.2	<0.001	0.005	26.2	0.028	0.002	1	<0.00025	3.54	0.27	0.003	0.0034	<0.005	<0.01		7	373		270		<0.15	75.3			5
V5	05-Sep-05	<0.0002	59.3	<0.001	0.33	<0.001	0.004	24.3	0.031	0.002	1.1	<0.00025	3.35	0.25	0.002	0.0032	0.014	<0.01			286		248		<0.15	78			
V5	10-Oct-05	<0.0002	63.5	<0.001	0.19	<0.001	0.004	27.5	0.026	0.002	1	<0.00025	3.62	0.25	0.002	0.0026	<0.005	0.02			256		272		<0.15	73.9			
V5	01-Nov-05	<0.0002	69.6	<0.001	0.15	<0.001	0.004	28.7	0.016	0.002	1	<0.00025	3.42	0.29	0.002	0.0039	<0.005	<0.01		5	306		292		<0.15	87.5			3
V5	24-Jan-06	<0.0002	92	<0.001	0.13	<0.001	0.006	42	0.013	0.001	1.1	<0.00025	4.92	0.36	<0.001	0.005	0.011	<0.01		<5	737		403		<0.15	153			1.6
V5	13-Feb-06	<0.0002	94.9	<0.001	0.12	<0.001	0.006	43.4	0.018	0.001	1.4	<0.00025	5.2	0.38	<0.001	0.0052	0.013	0.01		<5	754		416		<0.15	174			0.9
V5	17-May-06	0.0002	32.6	0.002	4.47	0.007	0.006	13.3	0.16	0.012	2	<0.00025	1.63	0.13	0.06	0.0014	0.032	<0.01		117	245		136		<0.15	35.7			90
V5	19-Jun-06	<0.0002	37.2	0.001	1.98	0.003	0.004	13.8	0.059	0.005	0.9	<0.00025	2.36	0.13	0.03	0.0018	0.011	<0.01		45	258		150		<0.15	35.4			32
V5	17-Jul-06	<0.0002	45	0.001	2.29	0.002	0.017	18.8	0.06	0.005	1	<0.00025	2.88	0.17	0.032	0.0019	0.012	<0.01		25	337		190		<0.15				34
V5	21-Aug-06	0.0003	58	0.005	11	0.01	0.015	26	0.19	0.02	2.2	<0.00025	3.4	0.24	0.16	0.0032	0.046	<0.01		25	428		252		0.2	62.9			205
V5	11-Sep-06	<0.0002	50.9	<0.001	0.96	<0.001	0.004	22.4	0.029	0.003	0.8	<0.00025	3.06	0.2	0.013	0.0024	0.007	<0.01		8	453		220		<0.15	65.9			19
V5	16-Oct-06	<0.0002	70.5	<0.001	0.23	<0.001	0.005	30.9	0.013	0.001	1	<0.00025	3.9	0.28	0.003	0.004	<0.005	<0.01		<5	554		304		<0.15	92.4			3
V5	14-Nov-06	<0.0002	81.3	<0.001	0.28	<0.001	0.004	36.2	0.018	0.002	1	<0.00025	4.39	0.33	0.003	0.0047	0.009	<0.01		<5	641		352		<0.15	115			3.1
V5	13-Dec-06	<0.0002	87.7	<0.001	0.15	<0.001	0.005	37.2	0.014	0.002	1.3	<0.00025	4.53	0.34	0.002	0.0059	<0.005	<0.01		<5	718		372		<0.15	136			3.3
V5	15-Jan-07	<0.0002	101	<0.001	0.09	<0.001	0.006	44.5	0.011	0.002	1.4	<0.00025	4.86	0.4	0.001	0.0062	0.009	0.01		<5	793		436		<0.15	167			2
V5	14-May-07	<0.0002	43.1	<0.001	0.76	0.001	<0.005	17	0.042	0.003	1.5	<0.00025	2.42	0.18	0.01	0.0023	0.02	0.01		70	348		178		<0.15	47.3			12
V5	18-Jun-07	<0.0002	39.7	<0.001	1.46	0.002	<0.005	16.5	0.041	0.004	0.9	<0.00025	2.69	0.15	0.022	0.002	0.035	0.01		45	305		167		<0.15	39.1			22
V5	16-Jul-07	0.0002	46	0.004	7.35	0.009	0.011	19.8	0.14	0.016	1.6	<0.00025	2.73	0.21	0.12	0.0026	0.035	0.01		8	388		196		0.2	55.7			155
V5	13-Aug-07	<0.0002	61.6	<0.001	0.36	<0.001	<0.005	25.4	0.026	0.002	1	<0.00025	3.39	0.25	0.004	0.0036	0.009	0.03		<5	484		259		<0.15	77.5			7.3
V5	29-Aug-07	0.00004	77.8	0.00027	0.464	0.00052		28.7	0.0218	0.0018	1.15	<0.00001	4.12	0.27	0.0083	0.00405	0.0039	<0.005	2.1		533	0.19	246	0.03	0.017	75.6	354	3.5	
V5	10-Sep-07	<0.0002	58.3	<0.001	0.2	<0.001	0.003	24.4	0.012	0.001	1	<0.00025	3.37	0.28	0.003	0.0039	<0.005	0.03		<5	494		287		<0.15	84			3.2
V5	23-Oct-07	<0.0002	66.9	<0.001	0.42	<0.001	0.004	29.1	0.015	0.002	1.1	<0.00025	3.99	0.28	0.005	0.0035	0.007	<0.01		7	533		320		<0.15	93.6			8.1
V5	13-Nov-07	<0.0002	77.6	<0.001	0.63	<0.001	0.004	30.6	0.027	0.002	1.2	<0.00025	3.91	0.29	0.008	0.0037	0.009	0.02		<5	539		321		<0.15	103			9.4
V5	09-Dec-07	<0.0002	75.6	<0.001	0.41	<0.001	0.002	32.1	0.024	0.002	1.2	<0.00025	3.86	0.29	0.005	0.0048	0.007	0.03		<5	640		333		<0.15	120			10
V5	07-Jan-08	<0.0002	79.4	<0.001	0.26	<0.001	0.004	32.6	0.015	0.001	1.2	<0.00025	3.95	0.32	0.003	0.0041	0.02	0.02		<5	681		181		<0.15	132			3
V5	14-May-08	0.0002	43.2	0.002	2.91	0.009	0.005	17.7	0.13	0.012	1.9	<0.00025	2.15	0.16	0.045	0.002	0.026	0.05		150	302		144		0.2	45.2			47
V5	16-Jun-08	<0.0002	35.3	<0.001	0.59	0.001	0.002	13.5	0.029	0.003	0.8	<0.00025	2.32	0.14	0.009	0.0016	0.015	<0.01		20	278		160		<0.15	38.8			15
V5	14-Jul-08	<0.0002	39.1	0.002	3.19	0.004	0.009	15.2	0.081	0.009	1.1	<0.00025	2.62	0.15	0.046	0.0016	0.023	<0.01		70	281		258		0.2	33.8			30
V5	11-Aug-08	<0.0002	62.2	0.001	2.42	0.002	0.005	25	0.065	0.005	1.2	<0.00025	3.2	0.24	0.036	0.0031	0.014	0.02		7	436		229		<0.15	65.1			40
V5	15-Sep-08	<0.0002	54.2	0.005	8.34	0.008	0.011	22.7	0.17	0.017	1.9	<0.00025	2.89	0.28	0.12	0.0037	0.038	0.04		25	390		249		0.2	55.1			178
V5	15-Oct-08	<0.0002	63.1	<0.001	0.14	<0.001	0.004	22.1	0.038	0.002	0.9	<0.00025	2.75	0.26	0.002	0.0033	0.006	0.02		7	487		321		<0.15	73.3			5.3
V5	03-Nov-08	<0.0002	76.9	<0.001	0.25	<0.001	0.003	31.2	0.04	0.003	1.2	0.0003	3.93	0.31	0.003	0.0042	0.011	0.02		7	545		369		<0.15	85.6			5.6
V5	01-Dec-08	<0.0002	85.9	<0.001	0.16	<0.001	0.005	37.4	0.028	0.002	1.3	<0.00025	4.55	0.35	0.002	0.004	0.039	0.01		<5	603		480		<0.15	102			1.4
V5	3-Mar-09	0.000084	111	0.000142	0.124	0.000253	0.0058	49.3	0.0183	0.00202	1.50	<0.000005	5.08	0.425	0.0017	0.00705	0.0041	0.08	7.0		800		435				150		
V5	6-Apr-09	0.000061	98.9	0.000085	0.06	0.000175	0.006	45.6	0.0131	0.00164	1.40	<0.000005	4.75	0.394	0.0006	0.00688	0.0030	0.02	3.2		820		112				570		
V5	6-May-09	0.000484	29.6	0.00318	2.49	0.0124	0.0037	9.28	0.242	0.00931	1.79	0.000029	1.03	0.115	0.0312	0.00118	0.0453	0.07	1.9		190		153				180		
V5	10-Jun-09	0.000055	38.0	0.000355	0.247	0.00128	0.0014	14.1	0.0357	0.00199	0.68	<0.000005	2.24	0.15	0.0026	0.00210	0.0059	<0.005	1.4		310						210		
n [a]		10	42	42	42	42	41	42	42	42	42	7	42	42	42	42	42	42	5	35	42	1	41	1	8	37	5	1	35
minimum [a]		0.00004	29.6	0.000085	0.06	0.000175	0.0014	9.28	0.007	0.001	0.68	0.000005	1.03	0.115	0.0006	0.0011	0.003	0.005	1.4	5	172	0.19	112	0.03	0.017	28	150	3.5	0.9
maximum [a]		0.000484	111	0.005	11	0.0124	0.017	49.3	0.242	0.02	2.2	0.0004	5.37	0.425	0.16	0.00705	0.046	0.11	7	150	820	0.19	480	0.03	0.6	174	570	3.5	205
mean [a,b]		0.00018	64.2	0.00101	1.475	0.0022	0.0053	26.94	0.0520	0.0045	1.2362	0.00011	3.46	0.2572	0.0212	0.0035	0.0146	0.0183	3.12	23.0	471.4	0.1900	270.3	0.03	0.2271	84.98	293	3.50	29.95
standard deviation (SD) [a,b]		0.00014	21.9	0.00120	2.395	0.0031	0.0032	10.42	0.0572	0.0048	0.3434	0.00017	1.05	0.0857	0.0356	0.0015	0.0128	0.0225	2.27	36.2	184.8	-	98.4	-	0.1637	40.98	174	-	50.63
max detection limit (DL) [a]		-	-	0.001	-	0.001	0.005	-	-	-	-	0.00001	-	-	0.001	-	0.005	0.01	-	5	-	-	-	-	-	-	-	-	-
#< detection limit [a]		0	0	27	0	23	3	0	0	0	0	4	0	0	2	0	8	19	0	14	0	0	0	0	0	0	0	0	0
%< detection limit [a]		0	0	64	0	55	7	0	0	0	0	57	0	0	5	0	19	45	0	40	0	0	0	0	0	0	0	0	0
background (BG) benchmark		0.00011	47	<0.001	0.47	0.002	0.008	11	0.045	<0.001	1.4	0.000021	3.3	0.18	0.0069	0.0025	0.017	0.040	1.2	8	310	0.13	166	0.21	<0.03	21.6	182	13	0.69
% samples > BG benchmark [b]		60%	71%	19%	40%	21%	12%	98%	29%	88%	19%	43%	57%	74%	45%	69%	29%	10%	100%	34%	71%	100%	83%	0%	88%	100%	60%	0%	100%
background mean		0.00004	20.8	0.00027	0.142	0.0007	0.0025	4.28	0.0145	0.0005	0.6828	0.00001	1.96	0.0821	0.0017	0.0011	0.0051	0.0117	0.56	4.2	142.2	0.0792	70.6	0.07	0.0106	9.08	79	4.10	0.32
station mean > BG mean [b]		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1
current water quality criterion		0.00003	116	0.004	0.3	0.002	-	82	1.0	0.065	53	0.0001	200	9.3	1.83	0.015	0.030	0.24	250	-	-	0.12	-	13	0.03	50	500	-	2.7
source		CCME	Alternate	BCMOE	CCME	CCME	-	Alternate	BCMOE	CCME	Alternate	CCME	CCME	Alternate	Alternate	SE	CCME	CCME	CCME	-	-	CCME	-	CCME	OMOE	BCMOE	CCME	-	BCMOE
proposed new criterion		0.00022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.017	-	-	-	-	-	-	-	-	-	-	-	-
source		CCME	-	-	-	-	-	-	-	-	-	-	-	-	-	-	CCME	-	-	-	-	-	-	-	-	-	-	-	-
# > current water quality criterion		10	0	2	23	9	-	0	0	0	0	2	0	0	0	0	7	0	0	-	-	1	-	0	7	29	1	-	28
% > current water quality criterion		100%	0%	5%	55%	21%	-	0%	0%	0%	0%	29%	0%	0%	0%	0%	17%	0%	0%	-	-	100%	-	0%	88%	78%	20%	-	80%

< DL greater than guideline, removed

statistical outlier that was removed (mean + 3 SD)

statistical outlier that was not removed (mean + 3 SD)

unusual datum that was removed (silver) or modified (temperature negative values set as "0")

[a] excluding sensored data

[b] values reported as less than the detection limit were used at 1/2 the detection limit for calculation

Table B.6: Water Quality Data at Station V8.

Station I.D.	Date	Cadmium mg/L	Calcium mg/L	Cobalt mg/L	Iron mg/L	Lead mg/L	Lithium mg/L	Magnesium mg/L	Manganese mg/L	Nickel mg/L	Potassium mg/L	Silver mg/L	Sodium mg/L	Strontium mg/L	Titanium mg/L	Uranium mg/L	Zinc mg/L	Ammonia mg/L	Chloride mg/L	Colour CU	Conductivity µS/cm	Fluoride mg/L	Hardness mg/L	Nitrate mg/L	Phosphorus mg/L	Sulphate mg/L	TDS mg/L	TOC mg/L	Turbidity NTU
V8	21-Jan-05	<0.0002	87.5	<0.001	0.18	<0.001	0.005	37.5	0.035	0.002	1.3	<0.00025	4.55	0.36	<0.001	0.0071	0.012	<0.01		<5	628		373		<0.15	159			0.49
V8	08-Feb-05	<0.0002	87.1	<0.001	<0.05	<0.001	0.005	37.8	0.034	0.002	1.3	<0.00025	4.71	0.35	<0.001	0.0074	0.014	0.01		<5	632		374		<0.15	155			0.27
V8	15-Mar-05	<0.0002	97	<0.001	0.26	<0.001	0.005	36.9	0.037	0.003	1.3	<0.00025	5.31	0.39	<0.001	0.0082	0.009	0.04		<5	661		395		<0.15	176			0.35
V8	11-Apr-05	<0.0002	88.1	<0.001	0.13	<0.001	0.006	39.4	0.033	0.002	1.4	<0.00025	5.04	0.37	<0.001	0.008	0.011	<0.01		<5	662		382		<0.15	175			0.43
V8	09-May-05	<0.0002	28.8	0.001	1.92	0.007	0.003	10.7	0.094	0.007	1.2	<0.00025	1.5	0.11	0.025	0.0014	0.037	0.04		75	174		116		0.3	33.3			30
V8	20-Jun-05	<0.0002	55.4	<0.001	0.27	<0.001	0.005	18.4	0.047	0.001	0.9	<0.00025	2.64	0.24	0.001	0.0021	0.022	0.13		7	390		214		<0.15	133			0.56
V8	25-Jul-05	<0.0002	84.4	<0.001	0.44	<0.001	0.008	26.8	0.32	0.002	1.1	<0.00025	3.2	0.36	0.007	0.0028	0.024	0.03		6	581		321		<0.15	238			7.4
V8	22-Aug-05	<0.0002	120	<0.001	<0.05	<0.001	0.01	36.3	0.38	<0.001	1.3	<0.00025	3.73	0.48	0.001	0.0034	0.015	<0.01		<5	716		449		<0.15	312			1.3
V8	05-Sep-05	<0.0002	51.8	<0.001	0.19	<0.001	0.004	19.6	0.016	0.002	0.9	<0.00025	2.87	0.21	0.002	0.0031	0.026	<0.01			267		210		<0.15	102			
V8	10-Oct-05	<0.0002	55.8	<0.001	<0.05	<0.001	0.004	23.7	0.015	0.001	0.9	<0.00025	3.25	0.23	<0.001	0.003	0.007	0.06			237		237		<0.15	82.1			
V8	01-Nov-05	<0.0002	65.4	<0.001	0.05	0.007	0.005	27	0.015	0.001	0.9	<0.00025	3.2	0.28	<0.001	0.0047	0.031	<0.01		<5	302		275		<0.15	112			0.54
V8	14-Dec-05	<0.0002	77.4	<0.001	0.13	<0.001	0.005	32.6	0.028	<0.001	1.1	<0.00025	4.15	0.28	<0.001	0.0052	0.022	<0.01		<5	614		328		<0.15	139			0.71
V8	24-Jan-06	<0.0002	87.6	<0.001	0.14	<0.001	0.006	39.9	0.029	0.002	1.1	<0.00025	4.89	0.36	<0.001	0.0067	0.015	<0.01		<5	673		384		<0.15	166			0.42
V8	13-Feb-06	<0.0002	87.2	<0.001	0.07	<0.001	0.006	39.5	0.028	0.002	1.4	<0.00025	5.01	0.36	<0.001	0.0071	0.017	<0.01		<5	694		381		<0.15	191			0.49
V8	24-Mar-06	<0.0002	91.6	<0.001	<0.05	<0.001	0.006	42	0.035	0.002	1.4	<0.00025	5.16	0.37	<0.001	0.0081	0.019	<0.01		<5	781		402		<0.15	204			0.34
V8	24-Apr-06	<0.0002	82.1	<0.001	<0.05	<0.001	0.005	36.6	0.029	0.003	1.3	<0.00025	4.45	0.35	<0.001	0.0067	0.013	<0.01		<5	737		356		<0.15	184			0.36
V8	17-May-06	<0.0002	34.8	0.001	1.71	0.005	0.003	13.7	0.098	0.006	1.6	<0.00025	1.67	0.13	0.022	0.002	0.022	<0.01		83	272		143		<0.15	51.9			30
V8	19-Jun-06	<0.0002	29.9	<0.001	0.82	0.002	0.003	10.6	0.03	0.002	0.8	<0.00025	1.97	0.11	0.014	0.0018	0.011	<0.01		25	220		118		<0.15	35			12
V8	17-Jul-06	<0.0002	34.7	<0.001	0.64	<0.001	0.01	13.8	0.018	0.002	0.7	<0.00025	2.34	0.13	0.008	0.0017	0.01	<0.01		8	271		143		<0.15				8.9
V8	21-Aug-06	<0.0002	76.1	<0.001	0.69	<0.001	0.004	16.8	0.019	<0.02	0.8	<0.00025	2.83	0.17	0.01	0.0022	0.01	<0.005	2.1	7	339	0.5	309		<0.15	61.5	396		14
V8	21-Aug-06	<0.002	41.9	0.007	0.049	0.04		36.6	0.014	0.002			4.3	0.328	<0.002		0.028	<0.01			580		174		0.07	85			<1
V8	11-Sep-06	<0.0002	38.8	<0.001	0.25	<0.001	0.003	16.8	0.011	0.001	0.6	<0.00025	2.7	0.15	0.003	0.0021	0.01	<0.01		8	339		166		<0.15	58.7			4
V8	16-Oct-06	<0.0002	53.3	<0.001	0.42	<0.001	0.004	23.5	0.024	0.002	0.9	<0.00025	3.42	0.21	0.006	0.0038	0.011	<0.01		<5	434		230		<0.15	84			7
V8	14-Nov-06	<0.0002	69.2	<0.001	0.12	<0.001	0.004	33.7	0.016	0.001	0.9	<0.00025	4.09	0.32	0.004	0.0057	0.013	<0.01		<5	585		312		<0.15	130			0.43
V8	13-Dec-06	<0.0002	77.3	<0.001	0.08	<0.001	0.005	32.8	0.017	0.002	1.1	<0.00025	4.28	0.31	<0.001	0.0071	0.028	<0.01		<5	633		328		<0.15	144			0.47
V8	15-Jan-07	<0.0002	83.8	<0.001	0.06	<0.001	0.005	37	0.034	0.003	1.2	<0.00025	4.61	0.36	<0.001	0.0072	0.064	0.01		<5	673		362		<0.15	165			0.47
V8	13-Feb-07	<0.0002	84.9	<0.001	0.14	<0.001	0.005	38.2	0.018	0.002	1.3	<0.00025	4.66	0.36	<0.001	0.0074	0.011	0.02		<5	695		369		<0.15	163			0.27
V8	11-Mar-07	<0.0002	90.9	<0.001	0.12	<0.001	0.007	44.3	0.028	0.003	1.5	<0.00025	5.38	0.41	<0.001	0.0089	0.028	0.02		<5	715		410		<0.15	201			0.24
V8	18-Apr-07	<0.0002	85.5	<0.001	0.2	<0.001	0.004	38.1	0.028	0.006	1.5	<0.00025	4.59	0.37	<0.001	0.0063	0.045	0.01		<5	729		371		<0.15	185			0.65
V8	14-May-07	<0.0002	47.1	<0.001	0.49	<0.001	<0.005	19.3	0.026	0.004	1.5	<0.00025	2.48	0.19	0.008	0.0037	0.018	0.02		70	361		197		<0.15	61.2			5.5
V8	18-Jun-07	<0.0002	26.9	<0.001	0.5	<0.001	<0.005	11	0.019	0.002	0.7	<0.00025	2.01	0.1	0.008	0.0016	0.03	<0.01		18	232		112		<0.15	35.8			7.1
V8	16-Jul-07	<0.0002	32.3	<0.001	2.13	0.002	<0.005	12.8	0.038	0.005	0.9	<0.00025	2.14	0.15	0.036	0.002	0.017	<0.01		8	288		133		<0.15	48.4			44
V8	13-Aug-07	<0.0002	48.4	<0.001	0.1	<0.001	<0.005	19.7	0.011	0.001	0.8	<0.00025	3.08	0.2	<0.001	0.0032	0.019	0.02		<5	363		202		<0.15	73			1.5
V8	27-Aug-07	0.00004	52.8	0.00012	0.18	0.00032		20	0.011	0.0011	0.911	<0.00001	3.48	0.203	0.0027	0.00323	0.009	<0.005	0.8		398	0.13		0.08	0.012	66.5	264	2.6	
V8	27-Aug-07		54.9	0.00014	0.177	0.0003		19.7			0.892		3.33	0.191		0.00315	0.0091				396				0.008	65.9	260	2.4	
V8	10-Sep-07	<0.0002	42.3	<0.001	0.07	<0.001	0.002	18.1	0.006	0.001	0.8	<0.00025	2.77	0.18	<0.001	0.0033	0.007	0.02		<5	361		180		<0.15	74			0.6
V8	23-Oct-07	<0.0002	60.6	<0.001	0.13	<0.001	0.003	26.4	0.009	0.001	1	<0.00025	3.84	0.27	<0.001	0.0044	0.01	<0.01		<5	476		260		<0.15	99.8			1.7
V8	13-Nov-07	<0.0002	66.5	<0.001	0.15	<0.001	0.004	28.1	0.011	0.001	1.1	<0.00025	3.82	0.27	<0.001	0.0046	0.01	0.02		<5	514		282		<0.15	111			2.1
V8	09-Dec-07	<0.0002	68.3	<0.001	0.18	<0.001	0.002	29.7	0.016	0.002	1.1	<0.00025	3.81	0.28	<0.001	0.006	0.013	<0.01		<5	588		293		<0.15	129			2.5
V8	07-Jan-08	<0.0002	70.5	<0.001	0.12	<0.001	0.004	29.6	0.014	0.002	1.2	<0.00025	3.79	0.3	<0.001	0.0056	0.016	<0.01		<5	610		298		<0.15	137			0.4
V8	18-Feb-08	<0.0002	85.6	<0.001	<0.05	<0.001	0.005	37.4	0.019	0.002	1.2	<0.00025	4.74	0.37	<0.001	0.0054	0.015	0.02		<5	675		368		<0.15	150			0.38
V8	17-Mar-08	<0.0002	85.6	<0.001	0.1	<0.001	0.005	44.5	0.016	0.002	1.4	<0.00025	5.72	0.35	<0.001	0.0082	0.011	<0.01		<5	691		398		<0.15	168			0.46
V8	14-Apr-08	<0.0002	86.4	<0.001	0.12	<0.001	0.006	42.2	0.016	0.002	1.5	<0.00025	5.67	0.4	<0.001	0.0083	0.011	0.03		<5	712		390		<0.15	165			0.47
V8	14-May-08	<0.0002	42.7	<0.001	1.33	0.002	0.003	17.8	0.06	0.006	1.6	<0.00025	2.18	0.16	0.024	0.0027	0.022	0.02		88	345		180		<0.15	69.6			20
V8	26-May-08	0.000219	22.8	0.00135	1.02	0.00769		7.75	0.141	0.00454	0.98	0.00001	1.21	0.0903	0.0099	0.00129	0.0412	0.19	3.1			0.11	88.8	0.05	<0.15	23	120	8.4	
V8	16-Jun-08	<0.0002	37.4	<0.001	0.15	<0.001	0.002	12.1	0.11	0.001	0.7	<0.00025	1.8	0.14	0.003	0.0014	0.035	<0.01		10	295		143		<0.15	86.7			2.1
V8	14-Jul-08	<0.0002	44	<0.001	0.86	0.002	0.005	14.4	0.039	0.003	0.7	<0.00025	2.06	0.17	0.011	0.0019	0.025	0.04		35	326		169		<0.15	78.7			12
V8	11-Aug-08	<0.0002	74.8	<0.001	0.3	<0.001	0.004	22.1	0.016	0.001	0.9	<0.00025	2.8	0.27	0.004	0.003	0.019	<0.01		7	503		278		<0.15	149			6.1
V8	15-Sep-08	<0.0002	42.8	0.001	2.01	0.002	0.004	16.6	0.053	0.005	1	<0.00025	2.44	0.21	0.031	0.0034	0.02	0.04		25	324		175		<0.15	56.8			45
V8	15-Oct-08	<0.0002	57	<0.001	<0.05	<0.001	0.003	20.6	0.016	0.001	0.9	<0.00025	2.67	0.23	0.001	0.0037	0.013	0.02		<5	446		227		<0.15	83.8			2
V8	03-Nov-08	0.0002	71.6	<0.001	0.54	0.002	0.003	29.4	0.032	0.003	1.2	0.0004	3.8	0.3	0.008	0.0054	0.019	0.02		<5	510		300		<0.15	104			1.8
V8	01-Dec-08	<0.0002	90.5	<0.001	0.06	<0.001	0.005	40.3	0.014	0.002	1.3	<0.00025	4.65	0.37	<0.001	0.0063	0.035	<0.01		<5	603		392		<0.15	134			0.65
V8	12-Jan-09	<0.0002	93.7	<0.001	0.12	<0.001	0.007	40.1	0.012	0.002	1.2	<0.00025	4.34	0.36	0.001	0.0086	0.015	0.01		<5	718		399		<0.15	183			1.5
V8	02-Feb-09	<0.0002	93.7	<0.001	0.25	<0.001	0.004	43.6	0.011	0.002	1.2	<0.00025	4.68	0.41	0.001	0.0078	0.018	<0.01		<5	727		414			182			0.5
V8	3-Mar-09	0.000074	107	0.000089	0.05	0.000117	0.0056	49.2	0.00873	0.0021	1.42	<0.000005	5.22	0.43	0.0008	0.0104	0.0141	0.01	2.7		770		471				520	2.3	
V8	6-Apr-09	0.000067	98	0.000088	0.03	0.000074	0.0059	46.3	0.00734	0.00235	1.36	<0.000005	4.82	0.394	<0.0005	0.0103	0.0137	0.02	1.9		800		435				570	3.4	
V8	6-May-09	0.000282	30.1	0.00194	1.37	0.0167	0.0	11.4	0.134	0.0057	1.72	0.00003	1.29	0.114	0.0245	0.00164	0.0441	0.07	1.8		230		122				220	20.4	
V8	10-Jun-09	0.000038	29.1	0.000175	0.137	0.001	0.0009	11.1	0.0133	0.00113	0.59	<0.000005	1.71	0.115		0.00217	0.0101	<0.005	0.7		250		118				190	2.7	
n [a]		7	58	58	58	58	54	58	57	57	57	7	58	58	56	57	58	57	7	48	57	3	56	2	4	53	8	7	49
minimum [a]		0.000038	22.8	0.000088	0.03	0.000074	0.0009	7.75	0.006	0.001	0.59	0.000005	1.21	0.0903	0.0005	0.00129	0.007	0.005	0.7	5	174	0.11	88.8	0.05	0.008	23	120	2.3	0.24
maximum [a]		0.000282	120	0.007	2.13	0.04	0.01	49.2	0.38	0.02	1.72	0.0004	5.72	0.48	0.036	0.0104	0.064	0.19	3.1	88	800	0.5	471	0.08	0.3	312	570	20.4	45
mean [a,b]		0.00013	65.7	0.00064	0.378	0.0020	0.0045	27.62	0.0423	0.0025	1.1136	0.00006	3.57	0.2703	0.0052	0.0048	0.0194	0.0191	1.87	11.7	504.3	0.2467	279.6	0.07	0.0975	121.90	318	6.03	5.73
standard deviation (SD) [a,b]		0.00010	24.2	0.00089	0.528	0.0057	0.0018	11.62	0.0663	0.0018	0.2796	0.00015	1.23	0.1038	0.0085	0.0026	0.0112	0.0312	0.89	21.7	186.0	0.2196	108.2	0.02	0.1379	59.75	161	6.70	10.59
max detection limit (DL) [a]		-	-	0.001	0.05	0.001	0.005	-	-	0.02	-	0.00001	-	-	0.002	-	-	0.01	-	75	-	-	-	-	-	-	-	-	1
#< detection limit [a]		0	0	47	7	41	4	0	0	3	0	4	0	0	28	0	0	31	0	33	0	0	0	0	0	0	0	0	1
%< detection limit [a]		0	0	81	12	71	7	0	0	5	0	57	0	0	50	0	0	54	0	69	0	0	0	0	0	0	0	0	2
background (BG) benchmark		0.00011	47	<0.001	0.47	0.002	0.008	11	0.045	<0.001	1.4	0.000021	3.3	0.18	0.0069	0.0025	0.017	0.040	1.2	8	310	0.13	166	0.21	<0.03	21.6	182	13	0.69
% samples > BG benchmark [b]		43%	71%	5%	24%	10%	4%	93%	18%	75%	14%	29%	57%	74%	27%	75%	45%	7%	71%	19%	79%	33%	80%	0%	50%	100%	88%	14%	53%
background mean		0.00004	20.8	0.00027	0.142	0.0007	0.0025	4.28	0.0145	0.0005	0.6828	0.00001	1.96	0.0821	0.0017	0.0011	0.0051	0.0117	0.56	4.2	142.2	0.0792	70.6	0.07	0.0106	9.08	79	4.10	0.32
station mean > BG mean [b]		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1
current water quality criterion		0.00003	116	0.004	0.3	0.002	-	82	1.0	0.065	53	0.0001	200	9.3	1.83	0.015	0.030	0.24	250	-	-	0.12	-	13	0.03	50	500	-	2.7
source		CCME	Alternate	BCMOE	CCME	CCME	-	Alternate	BCMOE	CCME	Alternate	CCME	CCME	Alternate	Alternate	SE	CCME	CCME	CCME	-	-	CCME	-	CCME	OMOE	BCMOE	CCME	-	BCMOE
proposed new criterion		0.00022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.017	-	-	-	-	-	-	-	-	-	-	-	-
source		CCME	-	-	-	-	-	-	-	-	-	-	-	-	-	-	CCME	-	-	-	-	-	-	-	-	-	-	-	-
# > current water quality criterion		7	1	1	16	6	-	0	0	0	0	1	0	0	0	0	8	0	0	-	-	2	-	0	2	48	2	-	15
% > current water quality criterion		100%	2%	2%	28%	10%	-	0%	0%	0%	0%	14%	0%	0%	0%	0%	14%	0%	0%	-	-	67%	-	0%	50%	91%	25%	-	31%

< DL greater than guideline, removed
statistical outlier that was removed (mean + 3 SD)
statistical outlier that was not removed (mean + 3 SD)
unusual datum that was removed (silver) or modified (temperature negative values set as "0")

[a] excluding sensored data
[b] values reported as less than the detection limit were used at 1/2 the detection limit for calculation

Table B.7: Water Quality Data at Station R2.

Station I.D.	Date	Cadmium mg/L	Calcium mg/L	Cobalt mg/L	Iron mg/L	Lead mg/L	Lithium mg/L	Magnesium mg/L	Manganese mg/L	Nickel mg/L	Potassium mg/L	Silver mg/L	Sodium mg/L	Strontium mg/L	Titanium mg/L	Uranium mg/L	Zinc mg/L	Ammonia mg/L	Chloride mg/L	Colour CU	Conductivity µS/cm	Fluoride mg/L	Hardness mg/L	Nitrate mg/L	Phosphorus mg/L	Sulphate mg/L	TDS mg/L	TOC mg/L	Turbidity NTU
R2	29-Mar-05	<0.0002	107	0.001	0.36	<0.001	0.008	22.7	1.79	0.002	2.3	0.0004	10.6	0.37	<0.001	0.0033	0.023	0.08		<5	578		361		<0.15	154			1.8
R2	17-Aug-05	<0.0002	60.8	<0.001	0.24	<0.001	0.007	14.7	0.76	0.002	1.7	<0.00025	5.3	0.23	<0.001	0.0015	0.045	0.14		5	351		212		<0.15	114			1.3
R2	21-Feb-06	<0.0002	100	0.002	0.45	<0.001	0.008	22.4	2.12	0.004	2.2	<0.00025	10.3	0.31	0.001	0.0031	0.052	0.11		<5	667		343		<0.15	202			2.7
R2	08-Aug-06	<0.0002	47.4	<0.001	0.24	<0.001	0.004	9.49	0.51	0.002	1	<0.00025	4.03	0.17	<0.001	0.001	0.022	0.09		7	341		158		<0.15	88.2			0.74
R2	20-Feb-07	<0.0002	126	0.002	0.37	<0.001	0.009	26.9	3.02	0.006	2.7	<0.00025	12.7	0.39	<0.001	0.0033	0.031	0.19		<5	815		425		<0.15	288			2.5
R2	17-Aug-07	<0.0002	60.2	0.001	0.28	<0.001	0.008	13.7	1.14	0.003	1.8	<0.00025	5.49	0.22	<0.001	0.0016	0.033	0.19		7	471		207		<0.15	150			0.85
R2	03-Mar-08	<0.0002	128	0.002	0.43	<0.001	0.009	32.2	3.5	0.006	2.7	<0.00025	13.7	0.44	<0.001	0.0032	0.046	0.14		<5	831		452		<0.15	281			3.5
R2	21-Jul-08	0.000022	32.6	0.000481	0.149	0.000425	0.0029	6.96	0.416	0.0015	0.74	<0.000005	2.38	0.116	0.0014	0.00096	0.0162	0.01					110			48			
R2	19-Aug-08	<0.0002	45.9	<0.001	0.09	<0.001	0.004	10.1	0.81	0.003	1.2	<0.00025	3.61	0.16	<0.001	0.0012	0.025	0.06		10	316		156		<0.15	74.9			0.6
R2	20-Aug-08	0.000023	48.7	0.00082	0.243	0.000311	0.0051	10.9	0.717	0.00217	1.16	<0.000005	3.98	0.184	<0.0005	0.00134	0.0278	0.05	0.7			0.1	166	0.04	0.019	66	240		
R2	25-Aug-08	0.000078	23.7	0.000764	0.954	0.00433	0.0026	5.56	0.252	0.0024	0.79	0.000008	2.07	0.0936	0.0125	0.000746	0.0318	<0.005			170		82.2			23			
n [a]		3	11	11	11	11	11	11	11	11	11	4	11	11	11	11	11	11	1	8	9	1	11	1	1	11	1	0	8
minimum [a]		0.000022	23.7	0.000481	0.09	0.000311	0.0026	5.56	0.252	0.0015	0.74	0.000005	2.07	0.0936	0.0005	0.000746	0.0162	0.005	0.7	5	170	0.1	82.2	0.04	0.019	23	240	-	0.6
maximum [a]		0.000078	128	0.002	0.954	0.00433	0.009	32.2	3.5	0.006	2.7	0.0004	13.7	0.44	0.0125	0.0033	0.052	0.19	0.7	10	831	0.1	452	0.04	0.019	288	240	-	3.5
mean [a,b]		0.00004	71	0.00105	0.346	0.0008	0.0061	15.96	1.3668	0.0031	1.6627	0.00010	6.74	0.2440	0.0017	0.0019	0.0321	0.0966	0.70	4.9	504.4	0.1000	242.9	0.04	0.0190	135.37	240	-	1.75
standard deviation (SD) [a,b]		0.00003	37	0.00064	0.230	0.0012	0.0025	8.76	1.0983	0.0016	0.7339	0.00020	4.25	0.1166	0.0036	0.0011	0.0112	0.0645	-	2.9	232.8	-	129.3	-	-	89.95	-	-	1.06
max detection limit (DL) [a]		-	-	0.001	-	0.001	-	-	-	-	-	0.000005	-	-	0.001	-	-	0.005	-	5	-	-	-	-	-	-	-	-	-
#< detection limit [a]		0	0	3	0	8	0	0	0	0	0	2	0	0	8	0	0	1	0	4	0	0	0	0	0	0	0	-	0
%< detection limit [a]		0	0	27	0	73	0	0	0	0	0	50	0	0	73	0	0	9	0	50	0	0	0	0	0	0	0	-	0
background (BG) benchmark		0.00011	47	<0.001	0.470	0.002	0.008	11	0.045	<0.001	1.4	0.000021	3.3	0.18	0.0069	0.0025	0.017	0.040	1.2	8	310	0.13	166	0.21	<0.03	21.6	182	13	0.69
% samples > BG benchmark [b]		0%	73%	27%	9%	9%	18%	55%	100%	100%	55%	25%	82%	64%	9%	36%	91%	82%	0%	13%	89%	0%	55%	0%	0%	100%	100%	-	88%
background mean		0.00004	20.8	0.00027	0.142	0.0007	0.0025	4.28	0.0145	0.0005	0.6828	0.00001	1.96	0.0821	0.0017	0.0011	0.0051	0.0117	0.56	4.2	142.2	0.0792	70.6	0.07	0.0106	9.08	79	4.10	0.32
station mean > BG mean [b]		1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	0	1
current water quality criterion		0.00003	116	0.004	0.3	0.002	-	82	1.0	0.065	53	0.0001	200	9.3	1.83	0.015	0.030	0.24	250	-	-	0.12	-	13	0.03	50	500	-	2.7
source		CCME	Alternate	BCMOE	CCME	CCME	-	Alternate	BCMOE	CCME	Alternate	CCME	CCME	Alternate	Alternate	SE	CCME	CCME	CCME	-	-	CCME	-	CCME	OMOE	BCMOE	CCME	-	BCMOE
proposed new criterion		0.00022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.017	-	-	-	-	-	-	-	-	-	-	-	-
source		CCME	-	-	-	-	-	-	-	-	-	-	-	-	-	-	CCME	-	-	-	-	-	-	-	-	-	-	-	-
# > current water quality criterion		1	2	0	5	1	-	0	5	0	0	1	0	0	0	0	6	0	0	-	-	0	-	0	0	9	0	-	1
% > current water quality criterion		33%	18%	0%	45%	9%	-	0%	45%	0%	0%	25%	0%	0%	0%	0%	55%	0%	0%	-	-	0%	-	0%	0%	82%	0%	-	13%

< DL greater than guideline, removed
statistical outlier that was removed (mean + 3 SD)
statistical outlier that was not removed (mean + 3 SD)
unusual datum that was removed (silver) or modified (temperature negative values set as "0")

[a] excluding sensored data
[b] values reported as less than the detection limit were used at 1/2 the detection limit for calculation

Table B.8: Water Quality Data at Station R3.

Station I.D.	Date	Cadmium mg/L	Calcium mg/L	Cobalt mg/L	Iron mg/L	Lead mg/L	Lithium mg/L	Magnesium mg/L	Manganese mg/L	Nickel mg/L	Potassium mg/L	Silver mg/L	Sodium mg/L	Strontium mg/L	Titanium mg/L	Uranium mg/L	Zinc mg/L	Ammonia mg/L	Chloride mg/L	Colour CU	Conductivity µS/cm	Fluoride mg/L	Hardness mg/L	Nitrate mg/L	Phosphorus mg/L	Sulphate mg/L	TDS mg/L	TOC mg/L	Turbidity NTU
R3	29-Mar-05	<0.0002	99	<0.001	0.09	<0.001	0.006	21	0.076	<0.001	2.1	0.0006	8.7	0.33	<0.001	0.0028	0.01	<0.01		<5	539		334		<0.15	133			0.3
R3	17-Aug-05	<0.0002	54.4	<0.001	0.14	<0.001	0.006	12.6	0.54	0.001	1.5	<0.00025	4.4	0.2	<0.001	0.0014	0.034	0.08		7	356		188		<0.15	91.3			1.2
R3	21-Feb-06	<0.0002	80.2	<0.001	<0.05	<0.001	0.006	17.5	0.6	0.002	1.8	<0.00025	7.72	0.26	<0.001	0.0025	0.022	0.05		<5	553		272		<0.15	143			0.49
R3	07-Aug-06	<0.0002	48.2	<0.001	0.17	<0.001	0.004	9.49	0.35	0.001	1	<0.00025	4.02	0.17	<0.001	0.001	0.017	0.06		<5	333		160		<0.15	81.3			0.6
R3	20-Feb-07	<0.0002	96.6	<0.001	<0.05	<0.001	0.006	20.6	1.16	0.003	2.1	0.0004	8.74	0.31	<0.001	0.0026	0.017	0.08		<5	619		327		<0.15	187			0.32
R3	17-Aug-07	<0.0002	55	<0.001	0.15	<0.001	0.006	12.4	0.8	0.002	1.6	<0.00025	5.59	0.21	<0.001	0.0015	0.019	0.08		<5	406		189		<0.15	131			0.62
R3	26-Sep-07	0.00002	34.8	0.00015	0.193	0.00037	0.0021	7.56	0.176	0.0007	0.836	<0.000005	3.08	0.127	0.001	0.00113	0.0221	<0.005	<0.5		231	0.12	118	0.06	<0.005	33	148	2.2	
R3	24-Oct-07	0.000046	82.2	0.00183	0.193	0.000901	0.0067	17.1	2.08	0.00427	1.74	<0.000005	6.69	0.285	<0.0005	0.00228	0.0427	0.097	<0.5		582	0.13	276	0.15	<0.005	170	396	1.6	
R3	22-Nov-07	0.000032	56.7	0.0002	0.094	0.000202	0.0042	10.9	0.389	0.00122	1.24	0.000042	3.63	0.206	<0.0005	0.0019	0.0274	0.029	0.6		390	0.12	187	0.18	<0.005	74.7	240	0.6	
R3	14-Dec-07	0.000026	63.5	0.000263	0.076	0.000126	0.0052	12.9	0.554	0.00155	1.53	<0.000005	4.61	0.237	<0.0005	0.00228	0.0268	0.027	<0.5		450	0.13	212	0.21	<0.005	85.7	290	1.1	
R3	23-Jan-08	0.000102	76.9	0.000968	0.863	0.00436	0.0043	15	0.728	0.00249	1.52	0.00001	4.95	0.257	0.0052	0.00301	0.0647	<0.005	<0.5		460	0.1	254	0.3	<0.005	98.4	310	1.4	
R3	20-Feb-08	0.000014	89.1	0.000078	0.024	0.000033	0.0054	19.2	0.0918	0.00131	1.78	<0.000005	7.12	0.282	<0.0005	0.00273	0.0076	0.019	<0.5		610	0.12	301	0.26	<0.005	152	390	1.1	
R3	04-Mar-08	<0.0002	96.4	<0.001	<0.05	<0.001	0.007	25.5	0.67	0.003	2.1	<0.00025	10.1	0.35	<0.001	0.0028	0.019	0.06		<5	648		346		<0.15	186			0.36
R3	13-Mar-08	0.000015	92.6	0.000089	0.039	0.000059	0.0058	19.4	0.102	0.00142	1.8	<0.000005	7.35	0.299	<0.0005	0.00291	0.0116	0.028	0.6		600	0.13	311	0.27	<0.005	201	470	0.9	
R3	28-Apr-08	0.000067	151	0.00286	0.109	0.000268	0.0085	28.8	3.19	0.00881	2.78	<0.000005	11.9	0.466	<0.0005	0.00334	0.0654	0.099	1.1		920	0.13	495	0.24	<0.005	360	610	0.9	
R3	21-May-08	0.000082	23.7	0.000798	0.786	0.00471	0.0023	5.01	0.551	0.00296	1.42	0.000013	1.78	0.0857	0.0093	0.00058	0.0356	<0.005	1.9		160	0.05	79.9	0.03	0.014	41	140	13.3	
R3	24-Jun-08	0.000089	17.3	0.00116	1.27	0.00694	0.003	3.74	0.53	0.00294	0.76	0.000016	1.65	0.0699	0.0219	0.000889	0.0325	0.012	<0.5		140	0.09	58.6	0.02	0	27	96	6	
R3	22-Jul-08	0.000022	32.1	0.000332	0.126	0.000429	0.0028	6.6	0.286	0.0012	0.75	<0.000005	2.31	0.113	0.0014	0.000892	0.0135	0.03					107			43			
R3	29-Jul-08	0.000022	40.6	0.000422	0.138	0.000292	0.0036	8.29	0.396	0.00143	0.95	<0.000005	3.76	0.151	<0.0005	0.00112	0.0157	0.017	1		300	0.09	136	0.06	<0.005	54	170	3.6	
R3	19-Aug-08	<0.0002	42.7	<0.001	0.08	0.001	0.003	9.86	0.43	0.002	1.1	<0.00025	3.29	0.15	<0.001	0.0011	0.018	0.02		8	290		147		<0.15	60.2			0.51
R3	04-Sep-08	0.000024	42.9	0.000507	0.14	0.000374	0.0038	8.49	0.443	0.00151	1	<0.000005	2.97	0.157	0.0008	0.00111	0.0171	0.03			290		142			50			
R3	17-Sep-08	0.00003	40	0.000398	0.171	0.000328	0.0036	8.28	0.301	0.00124	1	<0.000005	2.72	0.151	0.0015	0.00105	0.0173	0.019	1		290	0.11	134	0.06	0.007	73	210	3.3	
R3	08-Oct-08	0.00005	44.3	0.000494	0.149	0.00026	0.0033	9.32	0.424	0.00147	0.38	0.000005	2.93	0.164	0.00137	<0.00000	<0.0001	0.011	1.4		310	0.1	149	0.08	<0.005	56	210	2.6	
R3	10-Dec-08	0.000028	55.7	0.000164	0.08	0.000557	0.0042	12.5	0.225	0.00091	1.31	<0.000005	3.83	0.197	0.0008	0.00209	0.0207	0.006	0.9		360	0.11	190	0.18		58	290	2.2	
R3	24-Feb-09	0.000039	82.9	0.000052	0.112	0.000126	0.0061	17.8	0.725	0.000439	0.464		5.98	0.269		0.00249	0.0444	0.04	1.3		550	0.14	280	0.27			460		
R3	26-Mar-09	0.000017	82.4	0.000214	0.063	0.00005	0.0057	18.1	0.313	0.00174	1.67		6.07	0.281		0.00273	0.02	0.057			590	0.15	280	0.25			390		
R3	20-May-09	0.000052	35.7	0.000621	0.405	0.00214	0.0032	7.24	0.439	0.00193	1.15	<0.000005	2.25	0.124	0.0028	0.000915	0.0314	0.017	1.1		270	0.08	119	0.07	0.009		170		
R3	23-Jun-09	0.000025	38.3	0.000626	0.165	0.00055	0.0033	8.42	0.464	0.0016	0.25	0.135	2.85	0.000023	0.00102	<0.0002	<0.0001	0.012	0.7		280	0.1	130	0.06	<0.005		180		
n [a]		20	28	28	28	28	28	28	28	28	28	19	28	27	26	28	28	28	17	8	27	18	28	18	14	24	18	14	8
minimum [a]		0.000014	17.3	0.000052	0.024	0.000033	0.0021	3.74	0.076	0.000439	0.25	0.000005	1.65	0.0699	0.0005	0.000002	0.0001	0.005	0.5	5	140	0.05	58.6	0.02	0.005	27	96	0.6	0.3
maximum [a]		0.000102	151	0.00286	1.27	0.00694	0.0085	28.8	3.19	0.00881	2.78	0.0006	11.9	0.466	0.0219	0.00334	0.0654	0.099	1.9	8	920	0.15	495	0.3	0.014	360	610	13.3	1.2
mean [a,b]		0.00004	62.7	0.00058	0.211	0.0010	0.0047	13.34	0.6084	0.0020	1.3439	0.00006	5.04	0.2186	0.0020	0.0018	0.0240	0.0354	0.77	3.8	426.9	0.1111	211.5	0.15	0.0041	107.90	287	2.91	0.55
standard deviation (SD) [a,b]		0.00003	29.7	0.00058	0.288	0.0016	0.0016	6.31	0.6368	0.0016	0.5862	0.00016	2.66	0.0912	0.0045	0.0009	0.0158	0.0299	0.50	2.3	178.9	0.0242	99.8	0.10	0.0035	75.53	140	3.32	0.29
max detection limit (DL) [a]		-	-	0.001	0.05	0.001	-	-	-	0.001	-	0.000005	-	-	0.001	0.0002	0.0001	0.01	0.5	5	-	-	334	-	0.005	-	-	-	-
#< detection limit [a]		0	0	8	3	7	0	0	0	1	0	12	0	0	15	2	2	4	6	6	0	0	6	0	11	0	0	0	0
%< detection limit [a]		0	0	29	11	25	0	0	0	4	0	63	0	0	58	7	7	14	35	75	0	0	21	0	79	0	0	0	0
background (BG) benchmark		0.00011	47	<0.001	0.47	0.002	0.008	11	0.045	<0.001	1.4	0.000021	3.3	0.18	0.0069	0.0025	0.017	0.040	1.2	8	310	0.13	166	0.21	<0.03	21.6	182	13	0.69
% samples > BG benchmark [b]		0%	61%	11%	11%	14%	4%	54%	100%	79%	50%	16%	64%	59%	8%	29%	68%	32%	18%	0%	63%	11%	57%	33%	0%	100%	67%	7%	13%
background mean		0.00004	20.8	0.00027	0.142	0.0007	0.0025	4.28	0.0145	0.0005	0.6828	0.00001	1.96	0.0821	0.0017	0.0011	0.0051	0.0117	0.56	4.2	142.2	0.0792	70.6	0.07	0.0106	9.08	79	4.10	0.32
station mean > BG mean [b]		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	0	1
current water quality criterion		0.00003	116	0.004	0.3	0.002	-	82	1.0	0.065	53	0.0001	200	9.3	1.83	0.015	0.030	0.24	250	-	-	0.12	-	13	0.03	50	500	-	2.7
source		CCME	Alternate	BCMOE	CCME	CCME	-	Alternate	BCMOE	CCME	Alternate	CCME	CCME	Alternate	Alternate	SE	CCME	CCME	CCME	-	-	CCME	-	CCME	OMOE	BCMOE	CCME	-	BCMOE
proposed new criterion		0.00022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.017	-	-	-	-	-	-	-	-	-	-	-	-
source		CCME	-	-	-	-	-	-	-	-	-	-	-	-	-	-	CCME	-	-	-	-	-	-	-	-	-	-	-	-
# > current water quality criterion		9	1	0	4	4	-	0	3	0	0	2	0	0	0	0	8	0	0	-	-	6	-	0	0	19	1	-	0
% > current water quality criterion		45%	4%	0%	14%	14%	-	0%	11%	0%	0%	11%	0%	0%	0%	0%	29%	0%	0%	-	-	33%	-	0%	0%	79%	6%	-	0%

< DL greater than guideline, removed

statistical outlier that was removed (mean + 3 SD)

statistical outlier that was not removed (mean + 3 SD)

unusual datum that was removed (silver) or modified (temperature negative values set as "0")

[a] excluding sensored data

[b] values reported as less than the detection limit were used at 1/2 the detection limit for calculation

Table B.9: Water Quality Data at Station R4.

Station I.D.	Date	Cadmium mg/L	Calcium mg/L	Cobalt mg/L	Iron mg/L	Lead mg/L	Lithium mg/L	Magnesium mg/L	Manganese mg/L	Nickel mg/L	Potassium mg/L	Silver mg/L	Sodium mg/L	Strontium mg/L	Titanium mg/L	Uranium mg/L	Zinc mg/L	Ammonia mg/L	Chloride mg/L	Colour CU	Conductivity µS/cm	Fluoride mg/L	Hardness mg/L	Nitrate mg/L	Phosphorus mg/L	Sulphate mg/L	TDS mg/L	TOC mg/L	Turbidity NTU
R4	29-Mar-05	<0.0002	77.4	<0.001	0.1	<0.001	0.004	15.7	0.017	<0.001	1.9	0.0006	5.48	0.24	<0.001	0.003	<0.005	<0.01		<5	386		258		<0.15	81.6			0.34
R4	17-Aug-05	<0.0002	53.6	<0.001	0.11	<0.001	0.005	12.1	0.41	0.001	1.4	<0.00025	3.95	0.2	<0.001	0.0014	0.025	0.02		5	302		184		<0.15	77.6			0.67
R4	21-Feb-06	<0.0002	73.6	<0.001	<0.05	<0.001	0.004	15.9	0.03	<0.001	1.7	<0.00025	6.16	0.24	<0.001	0.0024	0.005	0.01		<5	489		250		<0.15	127			0.26
R4	07-Aug-06	<0.0002	45.2	<0.001	0.11	<0.001	0.004	8.94	0.17	0.001	1.1	<0.00025	3.53	0.15	<0.001	0.0009	0.011	0.02		7	330		150		<0.15	74.9			0.45
R4	20-Feb-07	<0.0002	77.6	<0.001	<0.05	<0.001	0.004	16.4	0.026	0.001	1.8	<0.00025	5.91	0.26	<0.001	0.0024	<0.005	0.02		<5	514		262		<0.15	126			0.19
R4	17-Aug-07	<0.0002	52.5	<0.001	0.17	<0.001	0.005	12	0.47	0.002	1.6	<0.00025	4.94	0.19	<0.001	0.0015	0.012	0.04		<5	380		180		<0.15	113			0.43
R4	26-Sep-07	0.00001	34.6	0.00011	0.15	0.00038	0.0019	7.43	0.124	0.0005	0.899	<0.000005	2.79	0.125	<0.0005	0.00111	0.0156	<0.005	<0.5		238	0.1	117	0.07	<0.005	26.4	153	2.7	
R4	24-Oct-07	0.00006	69.6	0.00064	0.081	0.000416	0.0051	14.4	0.938	0.00203	1.56	<0.000005	6.03	0.245	<0.0005	0.00204	0.0244	0.042	<0.5		497	0.12	233	0.16	<0.005	125	320	1.8	
R4	22-Nov-07	0.000022	55.4	0.000045	0.048	0.000129	0.0037	10.5	0.0949	0.00079	1.31	0.000019	3.38	0.194	<0.0005	0.0018	0.0147	0.014	<0.5		370	0.12	181	0.19	<0.005	69.6	230	2.1	
R4	14-Dec-07	0.00002	63.7	0.000057	0.047	0.000177	0.004	13	0.109	0.00082	1.45	<0.000005	4.45	0.216	<0.0005	0.00221	0.0131	0.016	<0.5		420	0.12	213	0.22	<0.005	77.6	260	1.4	
R4	23-Jan-08	0.000011	79.2	0.000038	0.031	0.000129	0.0042	15.3	0.0273	0.00077	1.62	<0.000005	5.25	0.248	<0.0005	0.00255	0.0053	<0.005	<0.5		470	0.1	261	0.28	<0.005	97.5	320	1.2	
R4	20-Feb-08	0.000007	78.4	0.000028	0.017	0.000036	0.0042	16.2	0.023	0.00053	1.69	<0.000005	5.72	0.258	<0.0005	0.00279	0.0031	<0.005	<0.5		540	0.11	262	0.27	<0.005	125	340	1.4	
R4	04-Mar-08	<0.0002	85	<0.001	<0.05	<0.001	0.004	21.2	0.025	<0.001	1.9	<0.00025	7.38	0.31	<0.001	0.0026	<0.005	<0.01		<5	536		300		<0.15	132			0.2
R4	13-Mar-08	0.000025	82.6	0.000034	0.021	0.000057	0.0045	17	0.0216	0.00055	1.73	<0.000005	6.12	0.27	<0.0005	0.00283	0.0065	<0.005	<0.5		530	0.12	276	0.28	<0.005	142	360	1.2	
R4	28-Apr-08	0.000057	121	0.000667	0.064	0.000196	0.0064	23.6	1.12	0.00442	2.38	<0.000005	9.45	0.383	<0.0005	0.00307	0.0338	0.021	0.9		780	0.12	400	0.3	<0.005	270	560	1.7	
R4	21-May-08	0.000046	23.1	0.000197	0.808	0.000976	0.0019	4.96	0.141	0.00212	1.34	<0.000005	1.67	0.0785	0.003	0.000495	0.0209	<0.005	1.4		160	0.05	78	0.05	0.014	34	130	12.8	
R4	24-Jun-08	0.000139	17.9	0.0014	1.27	0.00974	0.0029	3.86	0.654	0.00375	0.78	0.000025	1.64	0.0702	0.0218	0.000897	0.0443	<0.005	<0.5		130	0.08	60.6	0.03	0.005	26	100	6.6	
R4	22-Jul-08	0.000026	32.8	0.000242	0.14	0.000605	0.0025	6.76	0.208	0.0014	0.8	<0.000005	2.22	0.114	0.0021	0.000874	0.0111	<0.01					110			41			
R4	29-Jul-08	0.000022	41	0.000309	0.144	0.000446	0.0034	8.3	0.316	0.00148	1.01	<0.000005	3.66	0.151	0.0008	0.00114	0.0136	0.006	1.1		290	0.09	136	0.08	<0.005	50	180	3.8	
R4	19-Aug-08	<0.0002	40.6	<0.001	0.23	<0.001	0.003	9.72	0.37	0.002	1.2	<0.00025	3.28	0.16	<0.001	0.0011	0.015	0.02		8	279		142		<0.15	54.6			0.45
R4	04-Sep-08	0.00003	40.4	0.000341	0.154	0.00049	0.0033	8.4	0.311	0.00163	1.01	<0.000005	2.75	0.146	0.0015	0.00105	0.014	0.03			280		135			44			
R4	17-Sep-08	0.000032	39.9	0.000336	0.162	0.00038	0.0034	8.18	0.264	0.00149	1.05	<0.000005	2.72	0.146	0.0018	0.00102	0.0162	0.015	0.7		280	0.1	133	0.06	<0.005	48	200	3.7	
R4	08-Oct-08	0.000036	42.2	0.000374	0.15	0.000302	0.0032	8.88	0.34	0.0015	0.53	<0.000005	2.69	0.153	0.00129	<0.000002	<0.0001	<0.005	1.5		310	0.1	142	0.09	<0.005	52	250	1.4	
R4	10-Dec-08	0.000018	56.4	0.000072	0.07	0.000181	0.0038	12	0.114	0.00091	1.33	<0.000005	3.62	0.191	0.0008	0.00195	0.0169	0.026	0.9		360	0.11	190	0.19		54	290	1.7	
R4	24-Feb-09	0.00004	45.1	0.000079	0.226	0.000497	0.0024	10.30	0.028	0.00036	1.2		1.87	0.136	0.0015	0.0021	0.0035	0.012	1		330	0.09	155	0.21			180		
R4	26-Mar-09	0.000014	76.2	0.000034	0.026	0.000025	0.0043	16.00	0.000568	0.00069	1.65		5.11	0.253		0.00267	0.005	0.055			530	0.14	256	0.27			320		
R4	20-May-09	0.000055	38.6	0.000575	0.436	0.0029	0.0033	7.89	0.41	0.00247	1.3	0.00001	2.46	0.132	0.0054	0.00099	0.0289	0.006	1.1		270	0.08	129	0.07	0.01		180		
R4	23-Jun-09	0.000031	39.3	0.000454	0.162	0.000568	0.0033	8.38	0.374	0.00169	0.35	0.14	2.84	0.017	0.00102	<0.0002	<0.0001	0.005	0.7		290	0.1	133	0.08	0.009		180		
	n [a]	20	28	28	28	28	28	28	27	28	28	18	28	28	27	28	28	28	17	8	27	18	28	18	15	24	18	14	8
	minimum [a]	0.000007	17.9	0.000028	0.017	0.000025	0.0019	3.86	0.017	0.00036	0.35	0.000005	1.64	0.017	0.0005	0.000002	0.0001	0.005	0.5	5	130	0.05	60.6	0.03	0.005	26	100	1.2	0.19
	maximum [a]	0.000139	121	0.0014	1.27	0.00974	0.0064	23.6	1.12	0.00442	2.38	0.0006	9.45	0.383	0.0218	0.00307	0.0443	0.055	1.5	8	780	0.14	400	0.3	0.014	270	560	12.8	0.67
	mean [a,b]	0.00004	56.5	0.00036	0.179	0.0008	0.0037	11.90	0.2643	0.0014	1.3425	0.00004	4.18	0.1885	0.0017	0.0017	0.0131	0.0147	0.66	4.1	381.1	0.1028	190.2	0.16	0.0044	86.20	253	3.11	0.37
	standard deviation (SD) [a,b]	0.00003	22.9	0.00030	0.266	0.0018	0.0010	4.75	0.2800	0.0010	0.4500	0.00014	1.89	0.0784	0.0042	0.0009	0.0108	0.0138	0.45	2.3	140.6	0.0205	76.7	0.09	0.0036	53.73	109	3.16	0.16
	max detection limit (DL) [a]	-	-	0.001	0.05	0.001	-	-	-	0.001	-	0.000005	-	-	0.001	0.0002	0.005	0.01	0.5	5	-	-	-	-	0.005	-	-	-	-
	#< detection limit [a]	0	0	8	3	8	0	0	0	3	0	14	0	0	16	2	5	10	8	5	0	0	0	0	11	0	0	0	0
	%< detection limit [a]	0	0	29	11	29	0	0	0	11	0	78	0	0	59	7	18	36	47	63	0	0	0	0	73	0	0	0	0
	background (BG) benchmark	0.00011	47	<0.001	0.47	0.002	0.008	11	0.045	<0.001	1.4	0.000021	3.3	0.18	0.0069	0.0025	0.017	0.040	1.2	8	310	0.13	166	0.21	<0.03	21.6	182	13	0.69
	% samples > BG benchmark [b]	5%	54%	4%	7%	7%	0%	50%	70%	0%	43%	11%	61%	54%	4%	25%	21%	7%	12%	0%	59%	6%	54%	33%	0%	100%	61%	0%	0%
	background mean	0.00004	20.8	0.00027	0.142	0.0007	0.0025	4.28	0.0145	0.0005	0.6828	0.00001	1.96	0.0821	0.0017	0.0011	0.0051	0.0117	0.56	4.2	142.2	0.0792	70.6	0.07	0.0106	9.08	79	4.10	0.32
	station mean > BG mean [b]	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	1	0	1
	current water quality criterion	0.00003	116	0.004	0.3	0.002	-	82	1.0	0.065	53	0.0001	200	9.3	1.83	0.015	0.030	0.24	250	-	-	0.12	-	13	0.03	50	500	-	2.7
	source	CCME	Alternate	BCMOE	CCME	CCME	-	Alternate	BCMOE	CCME	Alternate	CCME	CCME	Alternate	Alternate	SE	CCME	CCME	CCME	-	-	CCME	-	CCME	OMOE	BCMOE	CCME	-	BCMOE
	proposed new criterion	0.00022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.017	-	-	-	-	-	-	-	-	-	-	-	-
	source	CCME	-	-	-	-	-	-	-	-	-	-	-	-	-	-	CCME	-	-	-	-	-	-	-	-	-	-	-	-
	# > current water quality criterion	9	1	0	3	2	-	0	1	0	0	1	0	0	0	0	2	0	0	-	-	1	-	0	0	17	1	-	0
	% > current water quality criterion	45%	4%	0%	11%	7%	-	0%	4%	0%	0%	6%	0%	0%	0%	0%	7%	0%	0%	-	-	6%	-	0%	0%	71%	6%	-	0%

< DL greater than guideline, removed

statistical outlier that was removed (mean + 3 SD)

statistical outlier that was not removed (mean + 3 SD)

unusual datum that was removed (silver) or modified (temperature negative values set as "0")

[a] excluding sensored data

[b] values reported as less than the detection limit were used at 1/2 the detection limit for calculation

Table B.10: Water Quality Data at Station R5.

Station I.D.	Date	Cadmium mg/L	Calcium mg/L	Cobalt mg/L	Iron mg/L	Lead mg/L	Lithium mg/L	Magnesium mg/L	Manganese mg/L	Nickel mg/L	Potassium mg/L	Silver mg/L	Sodium mg/L	Strontium mg/L	Titanium mg/L	Uranium mg/L	Zinc mg/L	Ammonia mg/L	Chloride mg/L	Colour CU	Conductivity µS/cm	Fluoride mg/L	Hardness mg/L	Nitrate mg/L	Phosphorus mg/L	Sulphate mg/L	TDS mg/L	TOC mg/L	Turbidity NTU
R5	29-Mar-05	<0.0002	81.5	<0.001	0.11	<0.001	0.004	16.7	0.019	<0.001	2	0.0006	5.75	0.26	<0.001	0.0032	0.007	<0.01		<5	383		272		<0.15	80.3			0.47
R5	17-Aug-05	<0.0002	44.5	<0.001	<0.05	<0.001	0.002	11.7	0.077	<0.001	1	<0.00025	1.78	0.13	<0.001	0.0016	<0.005	<0.01		5	252		159		<0.15	27.9			0.46
R5	07-Aug-06	<0.0002	39.3	<0.001	0.11	<0.001	0.002	10.5	0.016	<0.001	0.9	<0.00025	1.67	0.11	<0.001	0.0014	<0.005	<0.01		<5	279		141		<0.15	21.7			0.46
R5	17-Aug-07	<0.0002	36.3	<0.001	0.17	<0.001	<0.005	10.8	0.037	<0.001	1	<0.00025	1.87	0.11	<0.001	0.0018	<0.005	<0.01		7	270		135		<0.15	25.2			0.4
R5	04-Mar-08	<0.0002	58.2	<0.001	0.12	<0.001	0.003	15.4	0.01	0.003	1.6	<0.00025	3.13	0.2	<0.001	0.0026	<0.005	<0.01		<5	321		209		<0.15	21.4			0.6
R5	22-Jul-08	0.000019	32.6	0.000092	0.133	0.000164	0.0014	8.48	0.0286	0.00066	0.78	<0.000005	1.42	0.0875	0.0029	0.00119	0.0017	<0.01					116			20			
R5	19-Aug-08	<0.0002	37.8	<0.001	0.21	<0.001	0.002	11.4	0.035	<0.001	1.1	<0.00025	1.95	0.12	0.001	0.0014	0.005	0.01		8	261		141		<0.15	20.8			0.42
R5	04-Sep-08	0.000019	36.6	0.000088	0.136	0.000123	0.0017	9.75	0.0396	0.0006	0.93	<0.000005	1.71	0.108	0.0014	0.00143	0.0022	0.04			260		131			22			
	n [a]	2	8	8	8	8	8	8	8	8	8	3	8	8	8	8	8	8	0	6	7	0	8	0	0	8	0	0	6
	minimum [a]	0.000019	32.6	0.000088	0.05	0.000123	0.0014	8.48	0.01	0.0006	0.78	0.000005	1.42	0.0875	0.001	0.00119	0.0017	0.01	-	5	252	-	116	-	-	20	-	-	0.4
	maximum [a]	0.000019	81.5	0.001	0.21	0.001	0.005	16.7	0.077	0.003	2	0.0006	5.75	0.26	0.0029	0.0032	0.007	0.04	-	8	383	-	272	-	-	80.3	-	-	0.6
	mean [a,b]	0.00002	45.9	0.00040	0.127	0.0004	0.0023	11.84	0.0328	0.0008	1.1638	0.00020	2.41	0.1407	0.00098	0.0018	0.0032	0.0100	-	4.6	289.4	-	163.0	-	-	29.91	-	-	0.47
	standard deviation (SD) [a,b]	0.00000	16.4	0.00019	0.053	0.0002	0.0008	2.80	0.0208	0.0009	0.4173	0.00034	1.44	0.0586	0.00085	0.0007	0.0018	0.0122	-	2.5	47.1	-	52.1	-	-	20.53	-	-	0.07
	max detection limit (DL) [a]	-	-	0.001	0.05	0.001	0.005	-	-	0.001	-	0.000005	-	-	0.001	-	0.005	0.01	-	5	-	-	-	-	-	-	-	-	-
	#< detection limit [a]	0	0	6	1	6	1	0	0	5	0	2	0	0	5	0	4	6	-	3	0	-	0	-	-	0	-	-	0
	%< detection limit [a]	0	0	75	13	75	13	0	0	63	0	67	0	0	63	0	50	75	-	50	0	-	0	-	-	0	-	-	0
	background (BG) benchmark	0.00011	47	<0.001	0.470	0.002	0.008	11	0.045	<0.001	1.4	0.000021	3.3	0.18	0.0069	0.0025	0.017	0.040	1.2	8	310	0.13	166	0.21	<0.03	21.6	182	13	0.69
	% samples > BG benchmark [b]	0%	25%	0%	0%	0%	0%	50%	13%	13%	25%	33%	13%	25%	0%	25%	0%	0%	-	0%	29%	-	25%	-	-	63%	-	-	0%
	background mean	0.00004	20.8	0.00027	0.142	0.0007	0.0025	4.28	0.0145	0.0005	0.6828	0.00001	1.96	0.0821	0.0017	0.0011	0.0051	0.0117	0.56	4.2	142.2	0.0792	70.6	0.07	0.0106	9.08	79	4.10	0.32
	station mean > BG mean [b]	0	1	1	0	0	0	1	1	1	1	1	1	1	0	1	0	0	-	1	1	-	1	-	-	1	-	-	1
	current water quality criterion	0.00003	116	0.004	0.3	0.002	-	82	1.0	0.065	53	0.0001	200	9.3	1.83	0.015	0.030	0.24	250	-	-	0.12	-	13	0.03	50	500	-	2.7
	source	CCME	Alternate	BCMOE	CCME	CCME	-	Alternate	BCMOE	CCME	Alternate	CCME	CCME	Alternate	Alternate	SE	CCME	CCME	CCME	-	-	CCME	-	CCME	OMOE	BCMOE	CCME	-	BCMOE
	proposed new criterion	0.00022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.017	-	-	-	-	-	-	-	-	-	-	-	-
	source	CCME	-	-	-	-	-	-	-	-	-	-	-	-	-	-	CCME	-	-	-	-	-	-	-	-	-	-	-	-
	# > current water quality criterion	0	0	0	0	0	-	0	0	0	0	1	0	0	0	0	0	0	-	-	-	-	0	-	-	1	-	-	0
	% > current water quality criterion	0%	0%	0%	0%	0%	-	0%	0%	0%	0%	33%	0%	0%	0%	0%	0%	0%	-	-	-	-	0%	-	-	13%	-	-	0%

< DL greater than guideline, removed
statistical outlier that was removed (mean + 3 SD)
statistical outlier that was not removed (mean + 3 SD)
unusual datum that was removed (silver) or modified (temperature negative values set as "0")

[a] excluding sensored data
[b] values reported as less than the detection limit were used at 1/2 the detection limit for calculation

Table B.11: Water Quality Data at Station A1.

Station I.D.	Date	Cadmium mg/L	Calcium mg/L	Cobalt mg/L	Iron mg/L	Lead mg/L	Lithium mg/L	Magnesium mg/L	Manganese mg/L	Nickel mg/L	Potassium mg/L	Silver mg/L	Sodium mg/L	Strontium mg/L	Titanium mg/L	Uranium mg/L	Zinc mg/L	Ammonia mg/L	Chloride mg/L	Colour CU	Conductivity µS/cm	Fluoride mg/L	Hardness mg/L	Nitrate mg/L	Phosphorus mg/L	Sulphate mg/L	TDS mg/L	TOC mg/L	Turbidity NTU
A1/R11	26-Sep-07	0.00001	36.5	0.00007	0.143	0.00024	0.0023	8.2	0.0345	0.0006	1.07	<0.000005	2.66	0.112	0.0014	0.00145	0.0076	<0.005	<0.5		236	0.11	125	0.07	<0.005	33.3	156	3.3	
A1/R11	24-Oct-07	0.000025	52.1	0.000084	0.097	0.000249	0.004	11.2	0.0508	0.00069	1.43	<0.000005	3.59	0.178	0.0016	0.00217	0.0027	<0.005	<0.5		364	0.11	176	0.13	0.007	59.2	232	2.2	
A1/R11	22-Nov-07	0.000013	49.9	0.000027	0.037	0.000074	0.0033	9.87	0.00647	0.00048	1.51	<0.000005	2.7	0.162	0.0007	0.00198	0.002	<0.005	<0.5		330	0.11	165	0.15	<0.005	44.8	200	2.5	
A1/R11	14-Dec-07	0.000027	50.6	0.000022	0.019	0.000083	0.0034	10.7	0.00396	0.00042	1.46	<0.000005	3.16	0.156	<0.0005	0.00212	0.0022	0.021	<0.5		340	0.12	170	0.21	<0.005	43.5	220	1.6	
A1/R11	23-Jan-08	0.000006	53.2	0.000022	0.02	0.000033	0.0034	11.5	0.00414	0.00035	1.46	<0.000005	3.39	0.177	<0.0005	0.00249	0.0013	<0.005	<0.5		350	0.1	180	0.25	<0.005	60.6	220	1	
A1/R11	20-Feb-08	0.000011	55.2	0.00002	0.018	0.000033	0.0036	11.7	0.00435	0.00035	1.57	<0.000005	3.78	0.177	<0.0005	0.00251	0.0012	<0.005	<0.5		370	0.1	186	0.24	<0.005	55	220	1.7	
A1/R11	13-Mar-08	0.00001	56.2	0.000023	0.029	0.00008	0.0037	11.8	0.00746	0.00033	1.56	<0.000005	3.8	0.18	<0.0005	0.00256	0.0046	<0.005	0.7		380	0.11	189	0.25	0.005	53.4	250	1.1	
A1/R11	28-Apr-08	0.000045	68	0.000125	0.164	0.000341	0.0042	13.1	0.0464	0.00103	1.86	<0.000005	4.24	0.214	0.0036	0.00252	0.0073	<0.005	9		430	0.1	224	0.17	0.014	88	290	1.8	
A1/R11	21-May-08	0.00012	20.4	0.000857	1.07	0.00313	0.0024	4.756	0.346	0.00419	1.52	0.00002	1.35	0.066	0.0236	0.000691	0.0229	<0.005	1.1		130	0.05	70.5	0.03	0.017	18	7.8	15.1	
A1/R11	24-Jun-08	0.00017	19.8	0.00103	1.13	0.00468	0.0027	4.59	0.331	0.00398	0.86	0.000026	1.39	0.0694	0.0182	0.000866	0.0238	<0.005	0.7		150	0.07	68.3	0.03	0.007	19	110	8.3	
A1/R11	17-Sep-08	0.000037	35.1	0.000234	0.274	0.000394	0.0028	7.71	0.0902	0.00168	1.12	<0.000005	2.17	0.12	0.0061	0.00121	0.0061	<0.005	0.6		240	0.09	119	0.06	0.013	34	170	5.1	
A1/R11	08-Oct-08	0.000022	37.5	0.00016	0.162	0.000262	0.0027	8.23	0.102	0.00123	0.59	0.000005	2.22	0.12	0.00144	<0.000002	0.0001	<0.005	1.3		260	0.09	127	0.08	0.008	34	170	3.1	
A1/R11	10-Dec-08	0.000017	48	0.000034	0.047	0.000191	0.0034	10.5	0.00587	0.00061	1.42	<0.000005	2.77	0.154	0.0011	0.00217	0.0048	0.008	0.7		320	0.1	163	0.17		40	200	1.2	
A1/R11	24-Feb-09	0.000084	56.1	0.000414	0.551	0.00167	0.0038	11.7	0.123	0.00158	1.63		3.18	0.181	0.0137	0.0023	0.0099	0.007	0.9		370	0.11	188	0.27		50	200	2.1	
A1/R11	26-Mar-09	0.00002	53.5	0.000044	0.074	0.00012	0.0036	11.4	0.00891	0.00046	1.51		3.25	0.178	0.0007	0.00258	0.0017	0.027			380	0.12	180	0.27		58	230	1.4	
A1/R11	20-May-09	0.000088	33.6	0.000417	0.559	0.00145	0.0031	7.2	0.139	0.00269	1.4	0.00001	1.97	0.11	0.0096	0.00129	0.0114	<0.005	1.1		240	0.08	113	0.06	0.04	43	180	9.7	
A1/R11	23-Jun-09	0.000028	32.7	0.000241	0.32	0.000632	0.0026	7.27	0.0703	0.00161	0.44	0.000105	2.17	0.000009	0.00122	0.0004	0.0001	<0.005	0.8		230	0.08	112	0.04	0.024	30	140	4	
n [a]		17	17	17	17	17	17	17	17	17	17	15	17	16	17	17	17	17	15	0	17	17	17	17	14	17	16	17	0
minimum [a]		0.000006	19.8	0.00002	0.018	0.000033	0.0023	4.59	0.00396	0.00033	0.44	0.000005	1.35	0.066	0.0005	0.000002	0.0001	0.005	0.5	-	130	0.05	68.3	0.03	0.005	18	110	1	-
maximum [a]		0.00017	68	0.00103	1.13	0.00468	0.0042	13.1	0.346	0.00419	1.86	0.000105	4.24	0.214	0.0236	0.00258	0.0238	0.027	1.3	-	430	0.12	224	0.27	0.04	88	290	15.1	-
mean [a,b]		0.00004	44.6	0.00022	0.277	0.0008	0.0032	9.50	0.0808	0.0013	1.3182	0.00001	2.81	0.1472	0.0049	0.0017	0.0065	0.0056	0.63	-	301.2	0.0971	150.3	0.15	0.0105	44.93	199	3.84	-
standard deviation (SD) [a,b]		0.00005	13.4	0.00030	0.354	0.0013	0.0006	2.55	0.1067	0.0012	0.3799	0.00003	0.84	0.0428	0.0071	0.0008	0.0072	0.0072	0.37	-	85.9	0.0186	44.0	0.09	0.0107	17.14	44	3.82	-
max detection limit (DL) [a]		-	-	-	-	-	-	-	-	-	-	0.000005	-	-	0.0005	0.000002	-	0.005	0.5	-	-	-	-	-	0.005	-	-	-	-
#< detection limit [a]		0	0	0	0	0	0	0	0	0	0	10	0	0	4	1	0	13	6	-	0	0	0	0	5	0	0	0	-
%< detection limit [a]		0	0	0	0	0	0	0	0	0	0	67	0	0	24	6	0	76	40	-	0	0	0	0	36	0	0	0	-
background (BG) benchmark		0.00011	47	<0.001	0.470	0.002	0.008	11	0.045	<0.001	1.4	0.000021	3.3	0.18	0.0069	0.0025	0.017	0.040	1.2	8	310	0.13	166	0.21	<0.03	21.6	182	13	0.69
% samples > BG benchmark [b]		12%	59%	6%	24%	12%	0%	41%	53%	47%	65%	13%	29%	13%	24%	24%	12%	0%	7%	-	59%	0%	47%	29%	7%	88%	63%	6%	-
background mean		0.00004	20.8	0.00027	0.142	0.0007	0.0025	4.28	0.0145	0.0005	0.6828	0.00001	1.96	0.0821	0.0017	0.0011	0.0051	0.0117	0.56	4.2	142.2	0.0792	70.6	0.07	0.0106	9.08	79	4.10	0.32
station mean > BG mean [b]		1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	-	1	1	1	1	0	1	1	0	-
current water quality criterion		0.00003	116	0.004	0.3	0.002	-	82	1.0	0.065	53	0.0001	200	9.3	1.83	0.015	0.030	0.24	250	-	-	0.12	-	13	0.03	50	500	-	2.7
source		CCME	Alternate	BCMOE	CCME	CCME	-	Alternate	BCMOE	CCME	Alternate	CCME	CCME	Alternate	Alternate	SE	CCME	CCME	CCME	-	-	CCME	-	CCME	OMOE	BCMOE	CCME	-	BCMOE
proposed new criterion		0.00022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.017	-	-	-	-	-	-	-	-	-	-	-	-
source		CCME	-	-	-	-	-	-	-	-	-	-	-	-	-	-	CCME	-	-	-	-	-	-	-	-	-	-	-	-
# > current water quality criterion		6	0	0	5	2	-	0	0	0	0	1	0	0	0	0	0	0	0	-	-	0	-	0	1	6	0	-	-
% > current water quality criterion		35%	0%	0%	29%	12%	-	0%	0%	0%	0%	7%	0%	0%	0%	0%	0%	0%	0%	-	-	0%	-	0%	7%	35%	0%	-	-

< DL greater than guideline, removed
statistical outlier that was removed (mean + 3 SD)
statistical outlier that was not removed (mean + 3 SD)
unusual datum that was removed (silver) or modified (temperature negative values set as "0")

[a] excluding sensored data
[b] values reported as less than the detection limit were used at 1/2 the detection limit for calculation

Table B.12: Water Quality Data at Station P1 (reference).

Station I.D.	Date	Cadmium mg/L	Calcium mg/L	Cobalt mg/L	Iron mg/L	Lead mg/L	Lithium mg/L	Magnesium mg/L	Manganese mg/L	Nickel mg/L	Potassium mg/L	Silver mg/L	Sodium mg/L	Strontium mg/L	Titanium mg/L	Uranium mg/L	Zinc mg/L	Ammonia mg/L	Chloride mg/L	Colour CU	Conductivity µS/cm	Fluoride mg/L	Hardness mg/L	Nitrate mg/L	Phosphorus mg/L	Sulphate mg/L	TDS mg/L	TOC mg/L	Turbidity NTU
P1	26-Sep-07	0.00015	39.9	0.00015	0.253	0.00025	0.0026	13.1	0.0212	0.0049	0.665	<0.000005	2.12	0.164	0.0027	0.00131	0.0184	<0.005	<0.5		292	0.14	154	<0.02	0.011	55.5	206	3.5	
P1	24-Oct-07	0.000219	45.5	0.000077	0.163	0.00013	0.0039	14.7	0.0204	0.00452	0.69	<0.000005	2.25	0.202	0.0009	0.00171	0.0142	<0.005	<0.5		350	0.12	174	<0.02	0.007	62.5	214	3.9	
P1	22-Nov-07	0.000172	55.5	0.000041	0.082	0.000135	0.0039	18.4	0.0119	0.00471	0.88	0.000007	2.4	0.222	0.001	0.00189	0.017	<0.005	<0.5		390	0.12	214	0.05	0.005	68.5	240	4	
P1	14-Dec-07	0.000169	56.8	0.000026	0.04	0.000074	0.0041	18.1	0.0117	0.00406	0.88	<0.000005	2.43	0.224	<0.0005	0.00199	0.0234	0.006	<0.5		400	0.13	216	0.08	<0.005	67.3	250	2.5	
P1	24-Jan-08	0.00013	54.4	0.000019	0.04	0.000022	0.0034	18.4	0.0106	0.00317	0.83	<0.000005	2.43	0.22	<0.0005	0.00189	0.0188	<0.005	<0.5		390	0.1	211	0.1	<0.005	66	240	1.8	
P1	20-Feb-08	0.000123	54.8	0.000018	0.024	0.000019	0.0037	18	0.0103	0.00252	0.83	<0.000005	2.5	0.222	<0.0005	0.00204	0.0161	<0.005	<0.5		420	0.12	211	0.11	<0.005	66.1	240	1.9	
P1	12-Mar-08	0.000108	56	0.000024	0.032	0.000026	0.004	18.5	0.0129	0.0025	0.83	<0.000005	2.46	0.23	<0.0005	0.00212	0.0175	<0.005	<0.5		400	0.12	216	0.11	<0.005	66.3	340	1.9	
P1	28-Apr-08	0.000159	54.3	0.000059	0.095	0.000144	0.0037	17.2	0.0159	0.00247	0.87	<0.000005	2.25	0.224	0.0006	0.00218	0.0165	<0.005	0.7		380	0.11	206	0.04	0.01	63	240	1.1	
P1	21-May-08	0.0011	27.8	0.00232	3.11	0.00378	0.0028	9.04	0.266	0.0151	1.12	0.000105	1.23	0.111	0.0219	0.001	0.085	0.013	18		170	0.07	107	<0.02	0.021	29	130	11.6	
P1	24-Jun-08	0.000442	37.4	0	1.44	0.00241	0.0028	12	0.1	0.00606	0.67	0.000039	1.04	0.146	0.0082	0.00132	0.0347	<0.005	<0.5		250	0.11	143	0.02	0.142	42	150	3.1	
P1	29-Jul-08	0	40.3	0.000157	0.232	0.000339	0.0031	12.9	0.0181	0.00355	0.62	0.000008	2.25	0.172	0.0026	0.00145	0.0103	<0.005	1.5		310	0.11	154	<0.02	0.013	48	160	4	
P1	17-Sep-08	0.000214	37.4	0.000253	0.32	0	0.0028	12.4	0.0287	0.00572	0.62	0.000005	1.51	0.162	0.0044	0	0.0202	<0.005	0.6		270	0.12	144	<0.02	0.024	54	200	5.5	
P1	08-Oct-08	0	38	0.000214	0.251	0.00026	0.003	13	0.0271	0.00627	1.09	0.000005	1.56	0.159	0.00127	0.0004	0.0001	<0.005	4		290	0.12	148	<0.02	0.009	47	86	3.6	
P1	10-Dec-08	0.000183	52.5	0.000042	0.069	0.000158	0.0037	17.6	0.0131	0.00493	0.81	<0.000005	2.2	0.212	0.001	0.0019	0.0261	<0.005	0.8		370	0.12	204	0.09		61	210	2.4	
P1	24-Feb-09	0.000188	60.1	0.000035	0.052	0.000078	0.0031	16.3	0.0427	0.00252	0.79		1.73	0.241		0.00152	0.0113	0.014			420	0.11	217	0.05		63	250	1.4	
P1	26-Mar-09	0.000073	54.5	0.000028	0.006	0.000014	0.0029	15.2	0.011	0.00089	0.78		1.74	0.221		0.00119	0.0035	<0.005	1.8		410	0.11	198			68	250	2.1	
P1	20-May-09	0.000251	31.4	0.000282	0.469	0.000522	0.0026	10.3	0.0425	0.00512	0.91	0.000009	1.51	0.131	0.0044	0.00113	0.0155		1		240	0.09	121	0.02	0.04	36	210	9.8	
P1	23-Jun-09	0.000201	31.9	0.000369	0.489	0.000724	0.0025	10.2	0.039	0.00481	0.96	0.132	1.37	0.00001	0.0011	0.0007	0.0002	<0.005	<0.5		240	0.11	121	0.02	0.006	38	150	4.3	
n [a]		16	18	17	18	17	18	18	18	18	18	15	18	17	16	17	18	17	17	0	18	18	18	17	15	18	18	18	0
minimum [a]		0.000073	27.8	0.000018	0.006	0.000014	0.0025	9.04	0.0103	0.00089	0.62	0.000005	1.04	0.111	0.0005	0.0004	0.0001	0.005	0.5	-	170	0.07	107	0.02	0.005	29	86	1.1	-
maximum [a]		0.0011	60.1	0.00232	3.11	0.00378	0.0041	18.5	0.266	0.0151	1.12	0.000105	2.5	0.241	0.0219	0.00218	0.085	0.014	18	-	420	0.14	217	0.11	0.142	68.5	340	11.6	-
mean [a,b]		0.00024	46.0	0.00024	0.398	0.00053	0.0033	14.7	0.0391	0.0047	0.8247	0.00001	1.94	0.1919	0.0032	0.0015	0.0194	0.0040	1.80	-	332.9	0.1128	175.5	0.04	0.0199	55.62	209	3.80	-
standard deviation (SD) [a,b]		0.00024	10.5	0.00055	0.755	0.0010	0.0005	3.2	0.0606	0.0030	0.1427	0.00003	0.48	0.0398	0.0054	0.0005	0.0185	0.0037	4.28	-	76.4	0.0153	38.8	0.04	0.0353	12.60	58	2.78	-
max detection limit (DL) [a]		-	-	-	-	-	-	-	-	-	-	0.000005	-	-	0.0005	-	-	0.005	0.5	-	-	-	-	0.02	0.005	-	-	-	-
#< detection limit [a]		0	0	0	0	0	0	0	0	0	0	8	0	0	4	0	0	14	9	-	0	0	0	6	4	0	0	0	-
%< detection limit [a]		0	0	0	0	0	0	0	0	0	0	53	0	0	25	0	0	82	53	-	0	0	0	35	27	0	0	0	-
background (BG) benchmark		0.00011	47	<0.001	0.470	0.002	0.008	11	0.045	<0.001	1.4	0.000021	3.3	0.18	0.0069	0.0025	0.017	0.040	1.2	8	310	0.13	166	0.21	<0.03	21.6	182	13	0.69
% samples > BG benchmark [b]		88%	50%	6%	17%	12%	0%	83%	11%	94%	0%	13%	0%	59%	13%	0%	44%	0%	24%	-	56%	6%	56%	0%	13%	100%	72%	0%	-
background mean		0.00004	20.8	0.00027	0.142	0.0007	0.0025	4.28	0.0145	0.0005	0.6828	0.00001	1.96	0.0821	0.0017	0.0011	0.0051	0.0117	0.56	4.2	142.2	0.0792	70.6	0.07	0.0106	9.08	79	4.10	0.32
station mean > BG mean [b]		1	1	0	1	0	1	1	1	1	1	1	0	1	1	1	1	0	1	-	1	1	1	0	1	1	1	0	-
current water quality criterion		0.00003	116	0.004	0.3	0.002	-	82	1.0	0.065	53	0.0001	200	9.3	1.83	0.015	0.030	0.24	250	-	-	0.12	-	13	0.03	50	500	-	2.7
source		CCME	Alternate	BCMOE	CCME	CCME	-	Alternate	BCMOE	CCME	Alternate	CCME	CCME	Alternate	Alternate	SE	CCME	CCME	CCME	-	-	CCME	-	CCME	OMOE	BCMOE	CCME	-	BCMOE
proposed new criterion		0.00022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.017	-	-	-	-	-	-	-	-	-	-	-	-
source		CCME	-	-	-	-	-	-	-	-	-	-	-	-	-	-	CCME	-	-	-	-	-	-	-	-	-	-	-	-
# > current water quality criterion		16	0	0	5	2	-	0	0	0	0	1	0	0	0	0	2	0	0	-	-	2	-	0	2	12	0	-	-
% > current water quality criterion		100%	0%	0%	28%	12%	-	0%	0%	0%	0%	7%	0%	0%	0%	0%	11%	0%	0%	-	-	11%	-	0%	13%	67%	0%	-	-

< DL greater than guideline, removed
statistical outlier that was removed (mean + 3 SD)
statistical outlier that was not removed (mean + 3 SD)
unusual datum that was removed (silver) or modified (temperature negative values set as "0")

[a] excluding sensored data
[b] values reported as less than the detection limit were used at 1/2 the detection limit for calculation

Table B.13: Water Quality Data at Station P2.

Station I.D.	Date	Cadmium mg/L	Calcium mg/L	Cobalt mg/L	Iron mg/L	Lead mg/L	Lithium mg/L	Magnesium mg/L	Manganese mg/L	Nickel mg/L	Potassium mg/L	Silver mg/L	Sodium mg/L	Strontium mg/L	Titanium mg/L	Uranium mg/L	Zinc mg/L	Ammonia mg/L	Chloride mg/L	Colour CU	Conductivity µS/cm	Fluoride mg/L	Hardness mg/L	Nitrate mg/L	Phosphorus mg/L	Sulphate mg/L	TDS mg/L	TOC mg/L	Turbidity NTU
P2	27-Sep-07	0.00015	39.5	0.00014	0.247	0.00018	0.0026	13.1	0.0196	0.0049	0.664	<0.000005	1.69	0.165	0.0022	0.00123	0.0179	<0.005	<0.5		294	0.13	153	<0.02	0.007	54.5	171	4.1	
P2	24-Oct-07	0.000204	45.8	0.000112	0.21	0.000189	0.0036	14.9	0.0267	0.00479	0.69	<0.000005	2.05	0.201	0.0016	0.00169	0.0149	<0.005	<0.5		352	0.13	176	0.02	0.013	62.9	214	3.7	
P2	22-Nov-07	0.000179	55.2	0.00004	0.076	0.000162	0.0041	18.5	0.0114	0.00469	0.91	<0.000005	2.46	0.228	0.0009	0.00191	0.0174	0.023	<0.5		380	0.13	214	0.05	0.008	68.2	230	4.5	
P2	14-Dec-07	0.000179	55.6	0.000038	0.041	0.000106	0.0046	17.9	0.013	0.00419	0.86	<0.000005	2.41	0.234	<0.0005	0.00189	0.0238	0.026	<0.5		390	0.13	213	0.08	0.006	62.6	230	3.3	
P2	24-Jan-08	0.000127	56.7	0.000021	0.045	0.00001	0.0034	18.3	0.0131	0.00302	0.85	<0.000005	2.38	0.229	<0.0005	0.00188	0.0173	<0.005	<0.5		400	0.1	217	0.1	<0.005	65.7	230	1.7	
P2	20-Feb-08	0.000128	58.8	0.000022	0.026	0.000012	0.0037	19	0.0156	0.00266	0.87	<0.000005	2.64	0.231	<0.0005	0.00213	0.0159	<0.005	<0.5		420	0.11	225	0.1	<0.005	69.8	250	2.3	
P2	12-Mar-08	0.000103	56.5	0.00002	0.03	0.000056	0.0039	18.8	0.0141	0.00264	0.84	<0.000005	2.49	0.23	<0.0005	0.00212	0.0181	<0.005	<0.5		390	0.11	218	0.11	<0.005	66.6	280	2.1	
P2	28-Apr-08	0.000097	55.2	0.000039	0.052	0.000072	0.0034	17.2	0.0285	0.00226	0.84	<0.000005	2.21	0.221	<0.0005	0.00209	0.0136	<0.005	0.7		390	0.11	209	0.03	0.005	61	250	0.9	
P2	21-May-08	0.000452	24.9	0.000771	1.17	0.00134	0.0023	7.99	0.097	0.00819	1.27	0.000042	1.21	0.0999	0.016	0.000749	0.0348	<0.005	26		170	0.07	95.1	<0.02	0.019	31	120	11.4	
P2	24-Jun-08	0.000505	38.2	0.00141	1.97	0.00276	0.0031	12.2	0.108	0.00735	0.69	0.000045	1.04	0.148	0.0115	0.00135	0.0401	<0.005	<0.5		250	0.11	145	0.02	0.005	43	170	3.7	
P2	29-Jul-08	0.000124	37.5	0.00012	0.16	0.000234	0.003	12	0.0167	0.00308	0.57	<0.000005	2.14	0.168	0.001	0.00142	0.0116	<0.005	1		310	0.11	143	<0.02	0.013	52	190	3.8	
P2	17-Sep-08	0.000209	38.2	0.00024	0.299	0.000297	0.003	12.6	0.0279	0.00559	0.64	<0.000005	1.8	0.161	0.0039	0.0012	0.0229	0.007	0.8		280	0.12	147	<0.02	0.023	50	210	5.1	
P2	08-Oct-08	0.000209	37.5	0.00016	0.21	0.000236	0.0031	12.7	0.0218	0.00583	1.18	0.000004	1.54	0.159	0.00128	0.0003	0.0001	<0.005	0.9		300	0.12	146	<0.02	0.005	44	190	3.5	
P2	10-Dec-08	0.000171	55.1	0.000247	0.251	0.000224	0.0031	15.8	0.347	0.00208	0.79	<0.000005	1.71	0.211	0.001	0.000731	0.0079	0.029	0.9		370	0.12	202	<0.02		50	210	1.3	
P2	24-Feb-09	0.000053	59.1	0.000033	0.033	0.000052	0.0029	17.9	0.0149	0.00066	0.72		2.06	0.232		0.00182	0.0027				420	0.1	221	0.09		63	320	1.8	
P2	26-Mar-09	0.000111	52.4	0.00002	0.03	0.000018	0.0036	17.4	0.0102	0.00254	0.79		2.23	0.23		0.00214	0.0152	0.027	0.9		420	0.12	202	0.11		72	250	2.3	
P2	20-May-09	0.000246	30.7	0.000256	0.469	0.000523	0.0025	10.1	0.0411	0.00488	0.86	0.000005	1.45	0.131	0.0052	0.00112	0.0153	<0.005	1		240	0.09	118	0.03	0.043	49	180	9.5	
P2	23-Jun-09																												
P2	23-Jun-09	0.000226	31.6	0.000335	0.466	0.000908	0.0026	10.2	0.0377	0.00474	0.95	0.138	1.39	0.000008	0.0011	0.0007	0.0002	0.015	0.8		240	0.11	121	0.03	0.043	37	140	3.9	
n [a]		18	18	18	18	18	18	18	18	18	18	15	18	17	16	18	18	17	17	0	18	18	18	18	15	18	18	18	0
minimum [a]		0.000053	24.9	0.00002	0.026	0.00001	0.0023	7.99	0.0102	0.00066	0.57	0.000004	1.04	0.0999	0.0005	0.0003	0.0001	0.005	0.5	-	170	0.07	95.1	0.02	0.005	31	120	0.9	-
maximum [a]		0.000505	59.1	0.00141	1.97	0.00276	0.0046	19	0.347	0.00819	1.27	0.000045	2.64	0.234	0.016	0.00214	0.0401	0.029	26	-	420	0.13	225	0.11	0.043	72	320	11.4	-
mean [a,b]		0.00019	46.0	0.00022	0.321	0.00041	0.00325	14.81	0.0480	0.00412	0.8324	0.00001	1.94	0.1929	0.0029	0.0015	0.0161	0.0091	2.06	-	334.2	0.1122	175.8	0.05	0.0132	55.68	213	3.83	-
standard deviation (SD) [a,b]		0.00012	11.2	0.00035	0.495	0.00068	0.00060	3.50	0.0796	0.00193	0.1760	0.00001	0.48	0.0427	0.0045	0.0006	0.0104	0.0103	6.18	-	75.8	0.0156	42.3	0.04	0.0135	11.89	49	2.69	-
max detection limit (DL) [a]		-	-	-	-	-	-	-	-	-	-	0.000005	-	-	0.0005	-	-	0.005	0.5	-	-	-	-	0.02	0.005	-	-	-	-
#< detection limit [a]		0	0	0	0	0	0	0	0	0	0	11	0	0	5	0	0	11	8	-	0	0	0	6	3	0	0	0	-
%< detection limit [a]		0	0	0	0	0	0	0	0	0	0	73	0	0	31	0	0	65	47	-	0	0	0	33	20	0	0	0	-
background (BG) benchmark		0.00011	47	<0.001	0.470	0.002	0.008	11	0.045	<0.001	1.4	0.000021	3.3	0.18	0.0069	0.0025	0.017	0.040	1.2	8	310	0.13	166	0.21	<0.03	21.6	182	13	0.69
% samples > BG benchmark [b]		83%	50%	6%	11%	6%	0%	83%	17%	94%	0%	13%	0%	59%	13%	0%	44%	0%	6%	-	56%	0%	56%	0%	13%	100%	72%	0%	-
background mean		0.00004	20.8	0.00027	0.142	0.0007	0.0025	4.28	0.0145	0.0005	0.6828	0.00001	1.96	0.0821	0.0017	0.0011	0.0051	0.0117	0.56	4.2	142.2	0.0792	70.6	0.07	0.0106	9.08	79	4.10	0.32
station mean > BG mean [b]		1	1	0	1	0	1	1	1	1	1	1	0	1	1	1	1	0	1	-	1	1	1	0	1	1	1	0	-
current water quality criterion		0.00003	116	0.004	0.3	0.002	-	82	1.0	0.065	53	0.0001	200	9.3	1.83	0.015	0.030	0.24	250	-	-	0.12	-	13	0.03	50	500	-	2.7
source		CCME	Alternate	BCMOE	CCME	CCME	-	Alternate	BCMOE	CCME	Alternate	CCME	CCME	Alternate	Alternate	SE	CCME	CCME	CCME	-	-	CCME	-	CCME	OMOE	BCMOE	CCME	-	BCMOE
proposed new criterion		0.00022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.017	-	-	-	-	-	-	-	-	-	-	-	-
source		CCME	-	-	-	-	-	-	-	-	-	-	-	-	-	-	CCME	-	-	-	-	-	-	-	-	-	-	-	-
# > current water quality criterion		18	0	0	4	1	-	0	0	0	0	0	0	0	0	0	2	0	0	-	-	4	-	0	2	11	0	-	-
% > current water quality criterion		100%	0%	0%	22%	6%	-	0%	0%	0%	0%	0%	0%	0%	0%	0%	11%	0%	0%	-	-	22%	-	0%	13%	61%	0%	-	-

< DL greater than guideline, removed
statistical outlier that was removed (mean + 3 SD)
statistical outlier that was not removed (mean + 3 SD)
unusual datum that was removed (silver) or modified (temperature negative values set as "0")

[a] excluding sensored data
[b] values reported as less than the detection limit were used at 1/2 the detection limit for calculation

Table B.14: Water Quality Data at Station P3.

Station I.D.	Date	Cadmium mg/L	Calcium mg/L	Cobalt mg/L	Iron mg/L	Lead mg/L	Lithium mg/L	Magnesium mg/L	Manganese mg/L	Nickel mg/L	Potassium mg/L	Silver mg/L	Sodium mg/L	Strontium mg/L	Titanium mg/L	Uranium mg/L	Zinc mg/L	Ammonia mg/L	Chloride mg/L	Colour CU	Conductivity µS/cm	Fluoride mg/L	Hardness mg/L	Nitrate mg/L	Phosphorus mg/L	Sulphate mg/L	TDS mg/L	TOC mg/L	Turbidity NTU
P3	26-Sep-07	0.00011	40.9	0.00019	0.261	0.00023	0.0027	13	0.0201	0.0046	0.769	<0.000005	2.43	0.171	0.0077	0.00133	0.0144	<0.005	<0.5		293	0.14	156	<0.02	0.009	53.3	196	3.3	
P3	24-Oct-07	0.000145	45.4	0.00007	0.145	0.000087	0.0036	14.4	0.0189	0.0039	0.73	<0.000005	2.13	0.196	0.0015	0.00171	0.0101	<0.005	<0.5		349	0.13	173	<0.02	0.008	59.8	202	3.3	
P3	22-Nov-07	0.000082	55.8	0.000039	0.05	0.000073	0.0035	14.8	0.0095	0.00233	1.3	<0.000005	2.98	0.198	<0.0005	0.00188	0.0063	0.006	<0.5		360	0.13	200	0.08	<0.005	57.4	220	1.9	
P3	14-Dec-07	0.000129	54.4	0.000032	0.027	0.000074	0.0039	15.7	0.0122	0.00302	1.13	<0.000005	2.65	0.209	<0.0005	0.00189	0.0145	0.007	<0.5		380	0.12	200	0.09	<0.005	58.4	230	1.8	
P3	23-Jan-08	0.000034	51.5	0.000016	0.008	0.000043	0.0029	11.1	0.00044	0.00051	1.33	<0.000005	2.98	0.167	<0.0005	0.00256	0.0014	<0.005	<0.5		340	0.08	174	0.25	<0.005	49.2	220	1.1	
P3	20-Feb-08	0.000039	56.9	0.000015	0.005	0.000008	0.0031	12.3	0.0014	0.00059	1.44	<0.000005	3.4	0.174	<0.0005	0.00245	0.0028	<0.005	<0.5		370	0.09	193	0.24	<0.005	53.3	220	1.2	
P3	13-Mar-08	0.00008	56.3	0.000022	0.021	0.000051	0.0035	16.3	0.00939	0.00165	1.07	<0.000005	2.92	0.213	<0.0005	0.00211	0.0123	<0.005	<0.5		390	0.12	208	0.14	<0.005	60.6	280	1.9	
P3	28-Apr-08	0.000058	55.6	0.000026	0.035	0.000074	0.0031	13.8	0.00882	0.00135	1.17	<0.000005	3.21	0.198	<0.0005	0.00202	0.0055	<0.005	0.8		370	0.11	196	0.09	<0.005	60	220	0.5	
P3	21-May-08	0.00083	28.1	0.00168	2.39	0.00324	0.0028	8.96	0.195	0.0126	1.16	0.000094	1.28	0.11	0.0219	0.00101	0.0569	<0.005	1		180	0.07	107	<0.02	0.02	27	130	12.3	
P3	24-Jun-08	0.000279	33.3	0.000628	0.78	0.00166	0.0028	10.6	0.0729	0.00438	0.6	0.000022	1.06	0.138	0.005	0.00117	0.0223	<0.005	<0.5		250	0.11	127	<0.02	0.007	43	150	2.6	
P3	29-Jul-08	0.000108	40.3	0.000124	0.169	0.000309	0.003	12.1	0.0176	0.00274	0.71	0.000006	2.45	0.167	0.0014	0.00148	0.0104	0.006	1		320	0.11	150	0.03	0.014	49	190	3.7	
P3	17-Sep-08	0.000187	37.7	0.000246	0.344	0.000325	0.003	12	0.0309	0.00503	0.67	0.000006	1.56	0.165	0.0039	0.00125	0.018	<0.005	1		280	0.12	144	<0.02	0.027	50	210	5.2	
P3	08-Oct-08	0.000226	43.7	0.000317	0.363	0.000604	0.0031	12.2	0.0456	0.00469	0.82	0.000005	2.04	0.161	0.00137	0.0006	0.0001	<0.005	0.8		310	0.12	159	0.05	0.038	40	210	3.9	
P3	10-Dec-08	0.000159	52.2	0.000073	0.084	0.000256	0.0037	17.8	0.0176	0.00464	0.83	<0.000005	2.26	0.212	0.0012	0.00191	0.0212	<0.005	1		370	0.12	204	0.06		58	230	2.4	
P3	24-Feb-09	0.000049	53.4	0.000071	0.109	0.000148	0.0028	10.9	0.00868	0.00065	1.38		2.78	0.169		0.00211	0.0032	0.032			360	0.1	178	0.21	0.008	47	200	1.6	
P3	24-Feb-09	0.00004	51	0.000016	0.009	0.000008	0.0027	11.5	0.00208	0.00064	1.27		2.77	0.173	0.001	0.00236	0.0022				370	0.1	175	0.25		53	240	1.4	
P3	20-May-09	0.000199	35.4	0.000255	0.434	0.000495	0.0026	10.2	0.0358	0.00417	0.99	0.000006	1.74	0.137	0.0036	0.00132	0.012	<0.005	1.1		280	0.09	130	0.05	0.039	60	180	9.1	
P3	23-Jun-09	0.000223	33.9	0.000451	0.597	0.00101	0.0028	10.8	0.0523	0.00481	0.92	0.000141	1.52	0.000011	0.00119	0.0009	0.0002	<0.005	0.7		250	0.11	129	0.05	0.064	38	160	4.1	
n [a]		18	18	18	18	18	18	18	18	18	18	16	18	17	17	18	18	17	16	0	18	18	18	18	16	18	18	18	0
minimum [a]		0.000034	28.1	0.000015	0.005	0.000008	0.0026	8.96	0.00044	0.00051	0.6	0.000005	1.06	0.11	0.0005	0.0006	0.0001	0.005	0.5	-	180	0.07	107	0.02	0.005	27	130	0.5	-
maximum [a]		0.00083	56.9	0.00168	2.39	0.00324	0.0039	17.8	0.195	0.0126	1.44	0.000141	3.4	0.213	0.0219	0.00256	0.0569	0.032	1.1	-	390	0.14	208	0.25	0.064	60.6	280	12.3	-
mean [a,b]		0.00017	45.9	0.00024	0.324	0.00048	0.00309	12.69	0.0311	0.00346	1.0161	0.00002	2.34	0.1740	0.0030	0.0017	0.0119	0.0049	0.59	-	323.4	0.1094	166.8	0.09	0.0156	50.94	205	3.41	-
standard deviation (SD) [a,b]		0.00018	9.4	0.00040	0.562	0.00081	0.00039	2.34	0.0453	0.00283	0.2688	0.00004	0.69	0.0285	0.0053	0.0006	0.0133	0.0071	0.36	-	57.5	0.0183	30.7	0.09	0.0179	9.22	35	2.97	-
max detection limit (DL) [a]		-	-	-	-	-	-	-	-	-	-	0.000005	-	-	0.0005	-	-	0.005	0.5	-	-	-	-	0.02	0.005	-	-	-	-
#< detection limit [a]		0	0	0	0	0	0	0	0	0	0	9	0	0	6	0	0	13	8	-	0	0	0	5	6	0	0	0	-
%< detection limit [a]		0	0	0	0	0	0	0	0	0	0	56	0	0	35	0	0	76	50	-	0	0	0	28	38	0	0	0	-
background (BG) benchmark		0.00011	47	<0.001	0.470	0.002	0.008	11	0.045	<0.001	1.4	0.000021	3.3	0.18	0.0069	0.0025	0.017	0.040	1.2	8	310	0.13	166	0.21	<0.03	21.6	182	13	0.69
% samples > BG benchmark [b]		50%	50%	6%	17%	6%	0%	72%	22%	78%	6%	19%	6%	35%	12%	6%	22%	0%	0%	-	61%	6%	56%	17%	19%	100%	78%	0%	-
background mean		0.00004	20.8	0.00027	0.142	0.0007	0.0025	4.28	0.0145	0.0005	0.6828	0.00001	1.96	0.0821	0.0017	0.0011	0.0051	0.0117	0.56	4.2	142.2	0.0792	70.6	0.07	0.0106	9.08	79	4.10	0.32
station mean > BG mean [b]		1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	-	1	1	1	1	1	1	1	0	-
current water quality criterion		0.00003	116	0.004	0.3	0.002	-	82	1.0	0.065	53	0.0001	200	9.3	1.83	0.015	0.030	0.24	250	-	-	0.12	-	13	0.03	50	500	-	2.7
source		CCME	Alternate	BCMOE	CCME	CCME	-	Alternate	BCMOE	CCME	Alternate	CCME	CCME	Alternate	Alternate	SE	CCME	CCME	CCME	-	-	CCME	-	CCME	OMOE	BCMOE	CCME	-	BCMOE
proposed new criterion		0.00022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.017	-	-	-	-	-	-	-	-	-	-	-	-
source		CCME	-	-	-	-	-	-	-	-	-	-	-	-	-	-	CCME	-	-	-	-	-	-	-	-	-	-	-	-
# > current water quality criterion		18	0	0	6	1	-	0	0	0	0	1	0	0	0	0	1	0	0	-	-	3	-	0	3	10	0	-	-
% > current water quality criterion		100%	0%	0%	33%	6%	-	0%	0%	0%	0%	6%	0%	0%	0%	0%	6%	0%	0%	-	-	17%	-	0%	19%	56%	0%	-	-

< DL greater than guideline, removed
statistical outlier that was removed (mean + 3 SD)
statistical outlier that was not removed (mean + 3 SD)
unusual datum that was removed (silver) or modified (temperature negative values set as "0")

[a] excluding sensored data
[b] values reported as less than the detection limit were used at 1/2 the detection limit for calculation

Table B.15: Water Quality Data at Station P4.

Station I.D.	Date	Cadmium mg/L	Calcium mg/L	Cobalt mg/L	Iron mg/L	Lead mg/L	Lithium mg/L	Magnesium mg/L	Manganese mg/L	Nickel mg/L	Potassium mg/L	Silver mg/L	Sodium mg/L	Strontium mg/L	Titanium mg/L	Uranium mg/L	Zinc mg/L	Ammonia mg/L	Chloride mg/L	Colour CU	Conductivity µS/cm	Fluoride mg/L	Hardness mg/L	Nitrate mg/L	Phosphorus mg/L	Sulphate mg/L	TDS mg/L	TOC mg/L	Turbidity NTU
P4	26-Sep-07	0.00009	38.2	0.0001	0.199	0.00026	0.0025	11.3	0.0226	0.0031	0.78	<0.000005	2.52	0.145	0.002	0.00136	0.014	<0.005	<0.5		271	0.13	142	0.02	0.006	45.4	184	3.4	
P4	24-Oct-07	0.000177	45.8	0.000096	0.181	0.000217	0.0037	14.3	0.0267	0.00383	0.78	<0.000005	2.23	0.196	0.0011	0.00175	0.0107	<0.005	<0.5		351	0.12	173	<0.02	0.008	60.1	202	3.5	
P4	22-Nov-07	0.000099	51.8	0.000033	0.057	0.000168	0.0037	14.1	0.0111	0.00268	1.07	<0.000005	2.3	0.208	<0.0005	0.00196	0.0078	0.025	<0.5		370	0.12	187	0.08	<0.005	61.2	230	4.2	
P4	14-Dec-07	0.000147	56	0.000033	0.036	0.000187	0.0041	16.9	0.0145	0.00358	0.99	<0.000005	2.61	0.222	<0.0005	0.00203	0.0175	0.008	<0.5		390	0.13	209	0.09	<0.005	61.1	250	2.1	
P4	23-Jan-08	0.000118	54.3	0.000041	0.043	0.000143	0.0039	18.5	0.029	0.00283	0.96	<0.000005	2.59	0.234	<0.0005	0.002	0.0152	<0.005	<0.5		400	0.14	212	0.23	<0.005	62.2	260	1.7	
P4	20-Feb-08	0.000104	55.6	0.00003	0.028	0.000017	0.0038	18.4	0.021	0.00234	0.88	<0.000005	2.76	0.228	<0.0005	0.00207	0.0128	<0.005	<0.5		430	0.13	214	0.1	<0.005	67.3	250	2.2	
P4	13-Mar-08	0.000094	55.9	0.000028	0.038	0.000042	0.0039	18.5	0.0174	0.00241	0.82	<0.000005	2.51	0.231	<0.0005	0.00209	0.0156	<0.005	<0.5		410	0.12	216	0.1	<0.005	64.1	340	1.9	
P4	28-Apr-08	0.000092	52.8	0.000044	0.065	0.000081	0.0035	16.5	0.0201	0.00217	0.82	<0.000005	2.21	0.213	<0.0005	0.002	0.0116	0.046	10		370	0.11	200	0.04	<0.005	61	230	1.3	
P4	21-May-08	0.000634	27.2	0.00134	1.8	0.00248	0.0025	8.69	0.157	0.0106	1.11	0.00009	1.27	0.107	0.0154	0.0009	0.0458	<0.005	14		180	0.07	104	0.03	0.022	29	140	12.2	
P4	24-Jun-08	0.000302	31.2	0.000879	1.14	0.00289	0.0028	9.54	0.157	0.00495	0.7	0.000022	1.17	0.126	0.0101	0.00115	0.0267	<0.005	1.2		220	0.09	117	0.02	0.005	37	140	4.8	
P4	29-Jul-08	0.000074	37.1	0.000117	0.164	0.000326	0.003	10.4	0.0304	0.00225	0.75	0.000006	2.4	0.153	0.0012	0.0014	0.0076	<0.005	0.9		290	0.1	136	0.09	0.012	44	160	3.8	
P4	17-Sep-08	0.00015	36.8	0.000245	0.313	0.000377	0.0028	10.7	0.0489	0.00402	0.79	<0.000005	1.72	0.139	0.0044	0.00116	0.0142	<0.005	0.5		260	0.11	136	<0.02	0.022	40	170	5.3	
P4	08-Oct-08	0.000165	39.9	0.000134	0.165	0.000254	0.003	12.9	0.0189	0.00489	1.02	0.000004	1.74	0.164	0.00129	0.0003	0.0001	<0.005	1.2		300	0.13	153	<0.02	0.009	50	210	4.9	
P4	10-Dec-08	0.000224	51.5	0.000282	0.388	0.000648	0.0036	17.4	0.0369	0.00544	0.8	0.006	2.13	0.209	0.0032	0.00189	0.026	<0.005	0.8		370	0.11	200	0.07		58	270	2.6	
P4	24-Feb-09	0.000033	53.8	0.000021	0.01	0.000029	0.0036	14.8	0.0117	0.00046	1.68		4.15	0.227		0.00142	0.0022		1.1		390	0.28	196	0.03	0.011	36	210	1.1	
P4	26-Mar-09	0.000099	51.9	0.000022	0.034	0.000041	0.0035	16.9	0.0134	0.00198	0.87		2.27	0.217		0.00205	0.0113	0.034			420	0.13	199	0.11		69	260	1.8	
P4	20-May-09	0.000212	33	0.000382	0.567	0.000962	0.0028	9.51	0.0773	0.00479	1.11	0.000011	1.69	0.126	0.0069	0.00119	0.0148	<0.005	1.2		240	0.09	121	0.03	0.054	48	170	7.9	
P4	23-Jun-09	0.000226	33.6	0.000591	0.759	0.00113	0.0028	10.3	0.0686	0.00483	0.84	0.000134	1.56	0.000012	0.00117	0.0011	0.0002	0.005	0.8		240	0.11	126	0.02	0.16	36	140	3.8	
n [a]		18	18	18	18	18	18	18	18	18	18	15	18	17	16	18	18	17	17	0	18	18	18	18	16	18	18	18	0
minimum [a]		0.000033	27.2	0.000021	0.01	0.000017	0.0025	8.69	0.0111	0.00046	0.7	0.000004	1.17	0.107	0.0005	0.0003	0.0001	0.005	0.5	-	180	0.07	104	0.02	0.005	29	140	1.1	-
maximum [a]		0.000634	56	0.00134	1.8	0.00289	0.0041	18.5	0.157	0.0106	1.68	0.000134	4.15	0.234	0.0154	0.00209	0.0458	0.046	14	-	430	0.28	216	0.23	0.16	69	340	12.2	-
mean [a,b]		0.00017	44.8	0.00025	0.333	0.0006	0.0033	13.87	0.0435	0.0037	0.9317	0.00002	2.21	0.1850	0.0030	0.0015	0.0141	0.0087	1.97	-	327.9	0.1233	168.9	0.06	0.0203	51.63	212	3.81	-
standard deviation (SD) [a,b]		0.00013	10.0	0.00036	0.475	0.0008	0.0005	3.51	0.0453	0.0022	0.2255	0.00004	0.67	0.0438	0.0043	0.0005	0.0107	0.0132	3.86	-	78.0	0.0430	39.0	0.06	0.0395	12.51	55	2.71	-
max detection limit (DL) [a]		-	-	-	-	-	-	-	-	-	-	0.000005	-	-	0.0005	-	-	0.005	0.5	-	-	-	-	0.02	0.005	-	-	-	-
#< detection limit [a]		0	0	0	0	0	0	0	0	0	0	9	0	0	6	0	0	12	7	-	0	0	0	3	6	0	0	0	-
%< detection limit [a]		0	0	0	0	0	0	0	0	0	0	60	0	0	38	0	0	71	41	-	0	0	0	17	38	0	0	0	-
background (BG) benchmark		0.00011	47	<0.001	0.470	0.002	0.008	11	0.045	<0.001	1.4	0.000021	3.3	0.18	0.0069	0.0025	0.017	0.040	1.2	8	310	0.13	166	0.21	<0.03	21.6	182	13	0.69
% samples > BG benchmark [b]		56%	50%	6%	22%	11%	0%	67%	28%	94%	6%	20%	6%	59%	13%	0%	22%	6%	12%	-	56%	11%	56%	6%	13%	100%	67%	0%	-
background mean		0.00004	20.8	0.00027	0.142	0.0007	0.0025	4.28	0.0145	0.0005	0.6828	0.00001	1.96	0.0821	0.0017	0.0011	0.0051	0.0117	0.56	4.2	142.2	0.0792	70.6	0.07	0.0106	9.08	79	4.10	0.32
station mean > BG mean [b]		1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	-	1	1	1	0	1	1	1	0	-
current water quality criterion		0.00003	116	0.004	0.3	0.002	-	82	1.0	0.065	53	0.0001	200	9.3	1.83	0.015	0.030	0.24	250	-	-	0.12	-	13	0.03	50	500	-	2.7
source		CCME	Alternate	BCMOE	CCME	CCME	-	Alternate	BCMOE	CCME	Alternate	CCME	CCME	Alternate	Alternate	SE	CCME	CCME	CCME	-	-	CCME	-	CCME	OMOE	BCMOE	CCME	-	BCMOE
proposed new criterion		0.00022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.017	-	-	-	-	-	-	-	-	-	-	-	-
source		CCME	-	-	-	-	-	-	-	-	-	-	-	-	-	-	CCME	-	-	-	-	-	-	-	-	-	-	-	-
# > current water quality criterion		18	0	0	6	2	-	0	0	0	0	1	0	0	0	0	1	0	0	-	-	7	-	0	2	9	0	-	-
% > current water quality criterion		100%	0%	0%	33%	11%	-	0%	0%	0%	0%	7%	0%	0%	0%	0%	6%	0%	0%	-	-	39%	-	0%	13%	50%	0%	-	-

< DL greater than guideline, removed
statistical outlier that was removed (mean + 3 SD)
statistical outlier that was not removed (mean + 3 SD)
unusual datum that was removed (silver) or modified (temperature negative values set as "0")

[a] excluding sensored data
[b] values reported as less than the detection limit were used at 1/2 the detection limit for calculation

Table B.16: Pearson correlation analysis performed on mine indicator parameters, Faro Mine, Yukon.

		log_{10} cadmium	log_{10} calcium	log_{10} cobalt	log_{10} iron	log_{10} lead	log_{10} lithium	log_{10} magnesium	log_{10} manganese	log_{10} nickel	log_{10} potassium	log_{10} silver	log_{10} sodium	log_{10} strontium	log_{10} titanium	log_{10} uranium	log_{10} zinc	log_{10} ammonia	log_{10} chloride	log_{10} colour	log_{10} conductivity	log_{10} fluoride	log_{10} hardness	log_{10} nitrate	log_{10} phosphorous	log_{10} sulfate	log_{10} TDS	log_{10} TOC	log_{10} turbidity
log_{10} cadmium	Pearson Correlation		0.007	0.414	0.271	0.424	0.166	-0.014	0.203	0.187	0.115	0.501	0.059	-0.010	0.169	-0.144	0.085	0.202	0.388	-0.030	-0.044	-0.203	-0.006	-0.020	0.464	0.015	0.244	0.085	-0.093
	Sig. (2-tailed)		0.914	0.000	0.000	0.000	0.011	0.837	0.002	0.004	0.079	0.009	0.368	0.879	0.010	0.028	0.195	0.002	0.021	0.696	0.507	0.257	0.930	0.915	0.019	0.818	0.091	0.565	0.228
	N		235	235	235	235	232	235	235	234	235	26	235	234	233	235	234	235	35	170	232	33	234	32	25	231	49	48	170
log_{10} calcium	Pearson Correlation			0.366	0.093	-0.449	0.714	0.974	0.619	0.667	0.765	0.337	0.960	0.988	-0.298	0.820	0.547	0.601	0.382	-0.583	0.977	0.850	0.998	0.649	-0.645	0.910	0.985	-0.619	0.094
	Sig. (2-tailed)			0.000	0.154	0.000	0.000	0.000	0.000	0.000	0.000	0.093	0.000	0.000	0.000	0.000	0.000	0.000	0.024	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.223
	N			235	235	235	232	235	235	234	235	26	235	234	233	235	234	235	35	170	232	33	234	32	25	231	49	48	170
log_{10} cobalt	Pearson Correlation				0.624	0.256	0.497	0.257	0.674	0.676	0.517	0.625	0.467	0.323	0.249	0.055	0.402	0.601	0.475	-0.223	0.321	0.144	0.350	-0.492	0.208	0.304	0.375	0.082	0.289
	Sig. (2-tailed)				0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.404	0.000	0.000	0.004	0.003	0.000	0.425	0.000	0.004	0.318	0.000	0.008	0.580	0.000
	N				235	235	232	235	235	234	235	26	235	234	233	235	234	235	35	170	232	33	234	32	25	231	49	48	170
log_{10} iron	Pearson Correlation					0.613	0.302	-0.055	0.726	0.581	0.538	0.596	0.225	0.048	0.612	-0.241	0.282	0.545	0.265	0.421	0.058	-0.039	0.043	-0.731	0.350	0.090	-0.062	0.392	0.806
	Sig. (2-tailed)					0.000	0.000	0.399	0.000	0.000	0.000	0.001	0.001	0.462	0.000	0.000	0.000	0.000	0.124	0.000	0.382	0.828	0.516	0.000	0.086	0.172	0.672	0.006	0.000
	N					235	232	235	235	234	235	26	235	234	233	235	234	235	35	170	232	33	234	32	25	231	49	48	170
log_{10} lead	Pearson Correlation						-0.209	-0.514	0.111	0.107	0.006	0.268	-0.359	-0.472	0.766	-0.593	0.002	0.031	-0.028	0.713	-0.461	-0.736	-0.476	-0.752	0.586	-0.374	-0.527	0.690	0.700
	Sig. (2-tailed)						0.001	0.000	0.089	0.102	0.925	0.185	0.000	0.000	0.000	0.000	0.970	0.641	0.873	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000
	N						232	235	235	234	235	26	235	234	233	235	234	235	35	170	232	33	234	32	25	231	49	48	170
log_{10} lithium	Pearson Correlation							0.654	0.621	0.560	0.677	0.542	0.740	0.732	-0.135	0.531	0.524	0.557	0.280	-0.450	0.679	0.671	0.698	-0.064	-0.488	0.571	0.804	-0.381	0.142
	Sig. (2-tailed)							0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.041	0.000	0.000	0.000	0.109	0.000	0.000	0.000	0.000	0.735	0.016	0.000	0.000	0.009	0.065
	N							232	232	231	232	25	232	231	230	232	231	232	34	169	230	31	232	30	24	228	47	46	169
log_{10} magnesium	Pearson Correlation								0.467	0.573	0.688	0.145	0.920	0.973	-0.365	0.894	0.543	0.478	0.382	-0.646	0.967	0.719	0.987	0.850	-0.633	0.894	0.961	-0.731	0.031
	Sig. (2-tailed)								0.000	0.000	0.000	0.481	0.000	0.000	0.000	0.000	0.000	0.000	0.024	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.684
	N								235	234	235	26	235	234	233	235	234	235	35	170	232	33	234	32	25	231	49	48	170
log_{10} manganese	Pearson Correlation									0.801	0.789	0.807	0.706	0.572	0.158	0.192	0.412	0.822	0.445	-0.157	0.577	0.347	0.576	-0.463	0.024	0.594	0.406	0.084	0.458
	Sig. (2-tailed)									0.000	0.000	0.000	0.000	0.000	0.016	0.003	0.000	0.000	0.007	0.041	0.000	0.048	0.000	0.008	0.910	0.000	0.004	0.570	0.000
	N									234	235	26	235	234	233	235	234	235	35	170	232	33	234	32	25	231	49	48	170
log_{10} nickel	Pearson Correlation										0.824	0.663	0.722	0.622	0.251	0.359	0.561	0.765	0.445	-0.105	0.647	0.356	0.642	-0.220	0.032	0.614	0.630	-0.068	0.459
	Sig. (2-tailed)										0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.175	0.000	0.045	0.000	0.235	0.883	0.000	0.000	0.651	0.000
	N										234	25	234	233	232	234	233	234	35	170	231	32	233	31	24	230	48	47	170
log_{10} potassium	Pearson Correlation											0.670	0.822	0.748	0.139	0.497	0.620	0.748	0.449	-0.107	0.726	0.499	0.746	-0.095	-0.179	0.696	0.762	-0.224	0.486
	Sig. (2-tailed)											0.000	0.000	0.000	0.034	0.000	0.000	0.000	0.007	0.164	0.000	0.003	0.000	0.607	0.391	0.000	0.000	0.127	0.000
	N											26	235	234	233	235	234	235	35	170	232	33	234	32	25	231	49	48	170
log_{10} silver	Pearson Correlation												0.606	0.282	0.269	-0.126	0.180	0.886	-0.243	-0.705	0.212	-0.905	0.270	-0.901	0.874	0.238	-0.690	0.220	0.310
	Sig. (2-tailed)												0.001	0.172	0.184	0.540	0.389	0.000	0.643	0.184	0.321	0.000	0.192	0.000	0.000	0.242	0.002	0.430	0.611
	N												26	25	26	26	25	26	6	5	24	15	25	15	13	26	18	15	5
log_{10} sodium	Pearson Correlation													0.941	-0.221	0.736	0.520	0.697	0.390	-0.539	0.935	0.872	0.952	0.398	-0.519	0.872	0.942	-0.588	0.191
	Sig. (2-tailed)													0.000	0.001	0.000	0.000	0.000	0.020	0.000	0.000	0.000	0.000	0.024	0.008	0.000	0.000	0.000	0.012
	N													234	233	235	234	235	35	170	232	33	234	32	25	231	49	48	170
log_{10} strontium	Pearson Correlation														-0.343	0.847	0.565	0.552	0.340	-0.630	0.965	0.834	0.989	0.622	-0.704	0.874	0.978	-0.646	0.032
	Sig. (2-tailed)														0.000	0.000	0.000	0.000	0.049	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.675
	N														232	234	233	234	34	170	231	32	233	31	25	230	49	48	170
log_{10} titanium	Pearson Correlation															-0.461	-0.007	0.104	0.055	0.721	-0.306	-0.655	-0.323	-0.716	0.679	-0.207	-0.205	0.541	0.752
	Sig. (2-tailed)															0.000	0.919	0.114	0.759	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.168	0.000	0.000
	N															233	232	233	34	170	230	31	232	30	25	229	47	46	170
log_{10} uranium	Pearson Correlation																0.536	0.192	0.278	-0.693	0.819	0.622	0.847	0.912	-0.619	0.693	0.822	-0.852	-0.070
	Sig. (2-tailed)																0.000	0.003	0.105	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.364
	N																234	235	35	170	232	33	234	32	25	231	49	48	170
log_{10} zinc	Pearson Correlation																	0.325	0.302	-0.280	0.519	0.356	0.547	-0.069	-0.148	0.367	0.568	-0.176	0.149
	Sig. (2-tailed)																	0.000	0.078	0.000	0.000	0.045	0.000	0.714	0.490	0.000	0.000	0.232	0.053
	N																	234	35	170	231	32	233	31	24	230	48	48	170
log_{10} ammonia	Pearson Correlation																		0.476	-0.193	0.583	0.539	0.566	-0.248	-0.058	0.598	0.505	0.071	0.317
	Sig. (2-tailed)																		0.004	0.012	0.000	0.001	0.000	0.171	0.782	0.000	0.000	0.632	0.000
	N																		35	170	232	33	234	32	25	231	49	48	170
log_{10} chloride	Pearson Correlation																			-0.992	0.373	0.227	0.383	0.324	-0.174	0.359	0.396	-0.106	-0.840
	Sig. (2-tailed)																			0.078	0.032	0.365	0.023	0.204	0.631	0.034	0.020	0.558	0.365
	N																			3	33	18	35	17	10	35	34	33	3
log_{10} colour	Pearson Correlation																				-0.579	-0.999	-0.603	-0.778	.(a)	-0.445	-0.888	0.553	0.528
	Sig. (2-tailed)																				0.000	0.030	0.000	0.433	.	0.000	0.304	0.333	0.000
	N																				170	3	170	3	1	166	3	5	170
log_{10} conductivity	Pearson Correlation																					0.818	0.979	0.673	-0.595	0.924	0.987	-0.632	0.073
	Sig. (2-tailed)																					0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.342
	N																					31	231	30	24	228	47	47	170
log_{10} fluoride	Pearson Correlation																						0.817	0.511	-0.753	0.683	0.783	-0.504	-0.736
	Sig. (2-tailed)																						0.000	0.003	0.000	0.000	0.000	0.005	0.473
	N																						32	32	23	33	32	29	3
log_{10} hardness	Pearson Correlation																							0.736	-0.685	0.911	0.987	-0.664	0.075
	Sig. (2-tailed)																							0.000	0.000	0.000	0.000	0.000	0.328
	N																							31	24	230	48	47	170
log_{10} nitrate	Pearson Correlation																								-0.728	0.732	0.650	-0.652	-0.193
	Sig. (2-tailed)																								0.000	0.000	0.000	0.000	0.876
	N																								22	32	31	28	3
log_{10} phosphorous	Pearson Correlation																									-0.555	-0.594	0.448	.(a)
	Sig. (2-tailed)																									0.004	0.003	0.048	.
	N																									25	23	20	1
log_{10} sulfate	Pearson Correlation																										0.908	-0.589	0.157
	Sig. (2-tailed)																										0.000	0.000	0.044
	N																										49	48	166
log_{10} TDS	Pearson Correlation																											-0.604	-0.387
	Sig. (2-tailed)																											0.000	0.747
	N																											46	3
log_{10} TOC	Pearson Correlation																												-0.017
	Sig. (2-tailed)																												0.978
	N																												5
log_{10} turbidity	Pearson Correlation																												
	Sig. (2-tailed)																												
	N																												

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).
(a) Cannot be computed because at least one of the variables is constant.
Correlation is significant at the 0.0004 level (2-tailed), following Bonferroni's correction (0.05/112 comparisons)

Table B.17: Spearman Rank correlation analysis performed on mine indicator parameters, Faro Mine, Yukon.

		cadmium	calcium	cobalt	iron	lead	lithium	magnesium	manganese	nickel	potassium	silver	sodium	strontium	titanium	uranium	zinc	ammonia	chloride	colour	conductivity	fluoride	hardness	nitrate	phosphorous	sulfate	TDS	TOC	turbidity
cadmium	Correlation Coefficient		-0.099	.288(**)	.141(*)	.473(**)	0.052	-0.119	0.053	.132(*)	0.058	0.232	-0.017	-0.122	.192(**)	-.196(**)	0.055	0.122	.645(**)	0.061	-.158(*)	-0.064	-0.119	0.123	0.365	-0.089	.328(*)	-0.018	-0.108
	Sig. (2-tailed)		0.131	0.000	0.03	0.000	0.43	0.068	0.417	0.043	0.375	0.101	0.794	0.062	0.003	0.003	0.403	0.063	0.000	0.428	0.016	0.724	0.069	0.501	0.073	0.176	0.021	0.901	0.159
	N		235	235	235	235	232	235	235	235	235	51	235	234	233	235	235	235	35	170	232	33	234	32	25	231	49	48	170
calcium	Correlation Coefficient			.458(**)	.221(**)	-.480(**)	.737(**)	.970(**)	.737(**)	.566(**)	.724(**)	-.283(*)	.943(**)	.984(**)	-.374(**)	.829(**)	.542(**)	.610(**)	.429(*)	-.621(**)	.970(**)	.849(**)	.997(**)	.599(**)	-.618(**)	.904(**)	.985(**)	-.575(**)	0.1
	Sig. (2-tailed)			0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.044	0.000	0.000	0.000	0.000	0.000	0.000	0.01	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.193
	N			235	235	235	232	235	235	235	235	51	235	234	233	235	235	235	35	170	232	33	234	32	25	231	49	48	170
cobalt	Correlation Coefficient				.415(**)	0.033	.547(**)	.418(**)	.602(**)	.633(**)	.538(**)	-0.259	.531(**)	.439(**)	0.121	.322(**)	.374(**)	.587(**)	.632(**)	-.313(**)	.429(**)	0.302	.457(**)	-.464(**)	0.283	.442(**)	.407(**)	-0.006	.302(**)
	Sig. (2-tailed)				0.000	0.613	0.000	0.000	0.000	0.000	0.000	0.066	0.000	0.000	0.065	0.000	0.000	0.000	0.000	0.000	0.000	0.088	0.000	0.007	0.171	0.000	0.004	0.97	0.000
	N				235	235	232	235	235	235	235	51	235	234	233	235	235	235	35	170	232	33	234	32	25	231	49	48	170
iron	Correlation Coefficient					.479(**)	.288(**)	.136(*)	.617(**)	.719(**)	.668(**)	-0.215	.306(**)	.172(**)	.571(**)	-0.028	.343(**)	.519(**)	.491(**)	.165(*)	.207(**)	0.085	.191(**)	-.619(**)	0.339	.270(**)	0.039	0.256	.751(**)
	Sig. (2-tailed)					0.000	0.000	0.038	0.000	0.000	0.000	0.129	0.000	0.008	0.000	0.667	0.000	0.000	0.003	0.031	0.002	0.64	0.003	0.000	0.097	0.000	0.792	0.079	0.000
	N					235	232	235	235	235	235	51	235	234	233	235	235	235	35	170	232	33	234	32	25	231	49	48	170
lead	Correlation Coefficient						-.250(**)	-.530(**)	-0.071	.136(*)	0.018	0.225	-.387(**)	-.498(**)	.734(**)	-.579(**)	-0.082	0.005	0.175	.545(**)	-.504(**)	-.574(**)	-.508(**)	-.800(**)	.691(**)	-.379(**)	-.541(**)	.711(**)	.631(**)
	Sig. (2-tailed)						0.000	0.000	0.277	0.038	0.78	0.113	0.000	0.000	0.000	0.000	0.212	0.943	0.314	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N						232	235	235	235	235	51	235	234	233	235	235	235	35	170	232	33	234	32	25	231	49	48	170
lithium	Correlation Coefficient							.709(**)	.604(**)	.506(**)	.668(**)	-0.185	.770(**)	.758(**)	-.176(**)	.601(**)	.539(**)	.569(**)	0.3	-.567(**)	.705(**)	.733(**)	.731(**)	-0.11	-0.39	.560(**)	.790(**)	-.292(*)	0.131
	Sig. (2-tailed)							0.000	0.000	0.000	0.000	0.202	0.000	0.000	0.008	0.000	0.000	0.000	0.085	0.000	0.000	0.000	0.000	0.564	0.06	0.000	0.000	0.049	0.09
	N							232	232	232	232	49	232	231	230	232	232	232	34	169	230	31	232	30	24	228	47	46	169
magnesium	Correlation Coefficient								.623(**)	.476(**)	.655(**)	-0.178	.909(**)	.972(**)	-.440(**)	.901(**)	.561(**)	.498(**)	.420(*)	-.725(**)	.954(**)	.645(**)	.984(**)	.818(**)	-.654(**)	.869(**)	.966(**)	-.685(**)	0.05
	Sig. (2-tailed)								0.000	0.000	0.000	0.21	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.515
	N								235	235	235	51	235	234	233	235	235	235	35	170	232	33	234	32	25	231	49	48	170
manganese	Correlation Coefficient									.869(**)	.818(**)	-.432(**)	.818(**)	.677(**)	0.045	.382(**)	.416(**)	.857(**)	.551(**)	-.281(**)	.713(**)	.556(**)	.705(**)	-.378(*)	0.109	.758(**)	.529(**)	-0.016	.363(**)
	Sig. (2-tailed)									0.000	0.000	0.002	0.000	0.000	0.497	0.000	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.033	0.603	0.000	0.000	0.912	0.000
	N									235	235	51	235	234	233	235	235	235	35	170	232	33	234	32	25	231	49	48	170
nickel	Correlation Coefficient										.814(**)	-.302(*)	.652(**)	.522(**)	.226(**)	.285(**)	.467(**)	.782(**)	.602(**)	-0.144	.565(**)	.486(**)	.540(**)	-0.321	0.264	.604(**)	.470(**)	-0.037	.446(**)
	Sig. (2-tailed)										0.000	0.031	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.06	0.000	0.004	0.000	0.074	0.202	0.000	0.001	0.803	0.000
	N										235	51	235	234	233	235	235	235	35	170	232	33	234	32	25	231	49	48	170
potassium	Correlation Coefficient											-.277(*)	.776(**)	.707(**)	0.098	.461(**)	.598(**)	.742(**)	.543(**)	-.269(**)	.691(**)	.587(**)	.705(**)	-0.123	-0.088	.687(**)	.704(**)	-0.221	.477(**)
	Sig. (2-tailed)											0.049	0.000	0.000	0.137	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.503	0.676	0.000	0.000	0.131	0.000
	N											51	235	234	233	235	235	235	35	170	232	33	234	32	25	231	49	48	170
silver	Correlation Coefficient												-0.216	-0.235	-0.009	-0.09	-0.128	-.353(*)	-.415(*)	-.892(*)	-0.26	-.650(**)	-0.239	-0.021	0.28	-0.266	-.352(*)	-0.302	0.079
	Sig. (2-tailed)												0.127	0.1	0.948	0.532	0.369	0.011	0.022	0.042	0.074	0.000	0.095	0.918	0.196	0.059	0.021	0.058	0.9
	N												51	50	51	51	51	51	30	5	48	27	50	26	23	51	43	40	5
sodium	Correlation Coefficient													.919(**)	-.301(**)	.722(**)	.482(**)	.709(**)	.406(*)	-.575(**)	.922(**)	.899(**)	.937(**)	.432(*)	-.591(**)	.869(**)	.931(**)	-.564(**)	.171(*)
	Sig. (2-tailed)													0.000	0.000	0.000	0.000	0.000	0.015	0.000	0.000	0.000	0.000	0.013	0.002	0.000	0.000	0.000	0.025
	N													234	233	235	235	235	35	170	232	33	234	32	25	231	49	48	170
strontium	Correlation Coefficient														-.399(**)	.874(**)	.570(**)	.553(**)	.386(*)	-.672(**)	.954(**)	.834(**)	.986(**)	.565(**)	-.617(**)	.858(**)	.986(**)	-.584(**)	0.066
	Sig. (2-tailed)														0.000	0.000	0.000	0.000	0.024	0.000	0.000	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.392
	N														232	234	234	234	34	170	231	32	233	31	25	230	49	48	170
titanium	Correlation Coefficient															-.522(**)	-0.092	0.096	.340(*)	.578(**)	-.379(**)	-.357(*)	-.404(**)	-.764(**)	.638(**)	-.256(**)	-0.275	.511(**)	.647(**)
	Sig. (2-tailed)															0.000	0.16	0.144	0.049	0.000	0.000	0.049	0.000	0.000	0.001	0.000	0.061	0.000	0.000
	N															233	233	233	34	170	230	31	232	30	25	229	47	46	170
uranium	Correlation Coefficient																.578(**)	.242(**)	.337(*)	-.818(**)	.819(**)	.515(**)	.856(**)	.929(**)	-.656(**)	.662(**)	.831(**)	-.803(**)	-0.084
	Sig. (2-tailed)																0.000	0.000	0.048	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.274
	N																235	235	35	170	232	33	234	32	25	231	49	48	170
zinc	Correlation Coefficient																	.319(**)	.462(**)	-.466(**)	.519(**)	.499(**)	.549(**)	0.013	-0.046	.365(**)	.571(**)	-0.228	.155(*)
	Sig. (2-tailed)																	0.000	0.005	0.000	0.000	0.003	0.000	0.945	0.828	0.000	0.000	0.119	0.044
	N																	235	35	170	232	33	234	32	25	231	49	48	170
ammonia	Correlation Coefficient																		.620(**)	-.208(**)	.605(**)	.597(**)	.578(**)	-0.303	0.099	.663(**)	.466(**)	0.086	.291(**)
	Sig. (2-tailed)																		0.000	0.006	0.000	0.000	0.000	0.092	0.637	0.000	0.001	0.561	0.000
	N																		35	170	232	33	234	32	25	231	49	48	170
chloride	Correlation Coefficient																			-1.000(**)	.450(**)	0.277	.446(**)	0.295	-0.088	.517(**)	.427(*)	0.015	-0.5
	Sig. (2-tailed)																			0.000	0.009	0.266	0.007	0.251	0.809	0.001	0.012	0.933	0.667
	N																			3	33	18	35	17	10	35	34	33	3
colour	Correlation Coefficient																				-.609(**)	-1.000(**)	-.653(**)	-1.000(**)	.	-.433(**)	-1.000(**)	0.718	.280(**)
	Sig. (2-tailed)																				0.000	0.000	0.000	0.000	.	0.000	0.000	0.172	0.000
	N																				170	3	170	3	1	166	3	5	170
conductivity	Correlation Coefficient																					.782(**)	.971(**)	.591(**)	-.568(**)	.915(**)	.989(**)	-.579(**)	0.067
	Sig. (2-tailed)																					0.000	0.000	0.001	0.004	0.000	0.000	0.000	0.383
	N																					31	231	30	24	228	47	47	170
fluoride	Correlation Coefficient																						.793(**)	.422(*)	-.495(*)	.727(**)	.793(**)	-0.277	-0.5
	Sig. (2-tailed)																						0.000	0.016	0.016	0.000	0.000	0.146	0.667
	N																						32	32	23	33	32	29	3
hardness	Correlation Coefficient																							.642(**)	-.630(**)	.900(**)	.992(**)	-.611(**)	0.084
	Sig. (2-tailed)																							0.000	0.001	0.000	0.000	0.000	0.276
	N																							31	24	230	48	47	170
nitrate	Correlation Coefficient																								-.675(**)	.692(**)	.621(**)	-.608(**)	-0.5
	Sig. (2-tailed)																								0.001	0.000	0.000	0.001	0.667
	N																								22	32	31	28	3
phosphorous	Correlation Coefficient																									-.577(**)	-.487(*)	0.102	.
	Sig. (2-tailed)																									0.003	0.018	0.669	.
	N																									25	23	20	1
sulfate	Correlation Coefficient																										.966(**)	-.532(**)	.178(*)
	Sig. (2-tailed)																										0.000	0.000	0.022
	N																										49	48	166
TDS	Correlation Coefficient																											-.583(**)	-0.5
	Sig. (2-tailed)																											0.000	0.667
	N																											46	3
TOC	Correlation Coefficient																												-0.051
	Sig. (2-tailed)																												0.935
	N																												5
turbidity	Correlation Coefficient																												
	Sig. (2-tailed)																												
	N																												

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).
Correlation is significant at 0.0004 level (2-tailed) corrected using Bonferroni's correction (0.05/112 comparisons)

APPENDIX C

WATER QUALITY EVALUATION
(2005-2009)

C1.0 INTRODUCTION

Technical studies associated with the Faro Mine closure plan have focussed on water quality data collected since 2005, following improvements in mid-2004 regarding the quality of laboratory data. Subsequent water quality evaluations resulted in recommendations to initiate sampling at additional reference and exposure areas in the vicinity of the Faro Mine complex, to increase the frequency of sampling at some locations, and to obtain lower laboratory method detection limits for certain substances (Minnow 2007a,b). Based on the recommendations, a two-year supplemental water quality sampling program was initiated in September 2007 by Access Consulting on behalf of local First Nations to augment data collected under the site Water License. For the following evaluation of water quality, data for the period 2005-2009 were compiled and analyzed to evaluate the magnitude and spatial extent of current mine influence on water quality downstream.

C2.0 METHODS

Water quality data for surface water stations were provided to Minnow by the Yukon Government for the period 2005-2009. Near-field stations X2 (North Fork Rose Creek downstream of Faro pit and waste rock as well as associated groundwater inputs), X14 (Rose Creek immediately downstream of Faro tailings area), and V27 (Vangorda Creek downstream of Grum and Vangorda pits) were used to identify substances sometimes or always present downstream of the Faro Mine complex at concentrations outside the range of natural background concentrations. This was done by identifying the percentage of samples measured at each near-field station that exceeded the upper background benchmark (95th percentile as shown in Appendix A of the main report). Exceptions included alkalinity, dissolved oxygen and pH, for which the percentages of samples with concentrations below the lower background benchmark were identified (5th percentile). By definition, approximately 5% of samples for any substance could be expected to be below the 5th and above the 95th percentiles, respectively. To assure greater certainty in the conclusions of the evaluation (avoid false positive results), substances were identified for which at least 10% of samples were outside of the background range *and* for which the station mean exceeded the background mean. These are the substances that reflect mine influence and thus considered to be “mine indicators”. The concentrations of mine indicators were then evaluated at other surface water stations in the vicinity of Faro mine (e.g., far-field stations) to identify the spatial extent of mine influence on water quality. As for the three near-field stations discussed above (X2, X14, V27), the other downstream stations were considered to have water quality reflecting mine influence if any mine indicators were measured at concentrations outside the background range in more than 10% of samples, and the station mean exceeded the background mean for the same substance.

C3.0 RESULTS

C3.1 Identification of "Mine Indicator" Substances

Water concentrations were evaluated for 64 metal and non-metal substances measured at near-field exposure stations X2, X14, and V27 (Appendix B of the main report, Tables B.1-B.3). A total of 27 substances were reported at concentrations above the background benchmarks in at least 10% of samples collected at one or more of the stations (i.e., mine indicators; Table C.1). Of these substances, concentrations of cobalt, manganese, nickel, silver, zinc, ammonia, nitrate, sulphate, total dissolved solids, and turbidity were elevated by the greatest amounts (>5X background mean) at near-field stations (Table C.2). Analytical method detection limits for some substances (e.g., cadmium, phosphorus, silver) were poor for the majority of samples (associated with routine site monitoring data, not supplemental samples collected by Access), and it is suspected that many of the highest reported concentrations may reflect analytical inaccuracy. Improvements in analytical detection limits achieved in 2009 by changing the laboratory associated with routine monitoring for the site may show that some of the 27 substances are not true mine indicator substances, at which time they should be eliminated from the long-term monitoring program at Faro Mine.

C3.2 Spatial Extent of Measurable Water Quality Influence

Water concentrations of the same 27 mine indicator substances were then evaluated at other key surface water stations to determine how far downstream mine influence on water quality was detectable. Water quality influence was evident at the most downstream stations on Anvil Creek (A1) and Vangorda Creek (V8) in terms of both the frequency of samples (Table C.3) and mean concentrations (Table C.4) that were above background levels for numerous mine-indicator substances. These primarily included major ions (calcium, magnesium, potassium, sodium, sulphate), which were approximately twice mean background concentrations at lower Anvil Creek station A1, and other substances that reflect the presence of such ions (hardness, total dissolved solids). This list differs from the list of substances most elevated at near-field stations (cobalt, manganese, nickel, silver, zinc, ammonia, nitrate, sulphate, total dissolved solids, and turbidity) indicating a shift in relative concentrations of mine indicator substances with distance downstream. Metals levels were statistically indistinguishable from background levels at A.1.

Comparison of the data for near-field station V27 and far-field station V8 showed that mine indicators were more elevated in concentration further downstream at V8 (Tables C.3 and C.4). This suggests that a substantial component of the mine indicator concentrations measured at V8 is attributable to inputs from West Fork Vangorda Creek. Mean concentrations measured at

V6A, a tributary to upper West Fork Vangorda Creek, were generally lower than those measured further downstream at V5 (Table C.5), indicating an intermediate source, such as the landslide located between V6A and V5 and/or unmonitored inputs from the Grum Pit area downstream of the landslide. Water quality monitoring was initiated at additional stations along West Fork Vangorda Creek in early fall 2009 to determine the source and verify the extent to which elevated concentrations at V8 can be attributed to mine-related sources. Once adequate data are available and have been assessed, changes to the long-term water quality monitoring program recommended in this report may be warranted.

No mine-related influence was evident in the Pelly River based on similar water quality at mine-exposed stations compared to station P1 located upstream of both Vangorda and Anvil Creeks (Table C.6).

C3.3 Potential Zones of Water Quality Effect

Mine indicators were identified based on concentrations being measured above the range of background at near-field monitoring stations (Section C3.1). However, such concentrations are not necessarily associated with adverse effects on aquatic biota. In fact, mean concentrations were close to or less than the corresponding effects-based benchmark (typically a water quality criterion for protection of aquatic life; see Appendix A of the main report) for most mine indicator substances (Table C.7). There are no effects-based benchmarks for colour, conductivity, or hardness as they reflect the aggregate concentrations of various substances having different (presumed relatively low) toxicity. Mean cadmium, iron, zinc, sulphate, and turbidity concentrations were elevated relative to water quality guidelines for protection of aquatic life at some near-field stations, particularly at X14 in Rose Creek. However, further downstream in Rose Creek at station R4 (just upstream of the confluence with Anvil Creek), concentrations rarely exceeded effects-based benchmarks (Appendix Table B.9).

Water quality guidelines for cadmium and zinc are currently being updated (Environment Canada 2008, 2009) and the proposed revised guidelines were also considered in assessing water quality for the Faro Mine complex (Table C.7). The proposed hardness-based guideline for cadmium will be substantially higher (of 0.00022 mg/L at hardness of 100 mg/L) than the existing guideline (0.00003 mg/L at hardness 100 mg/L). Concentrations in recent years have usually been below the new guideline, which indicates that cadmium concentrations in water are not likely affecting downstream biota at the present time (Table C.4 and C.7, Appendix Tables B.1-B.11). However, the revised guideline for zinc will be hardness-based and slightly lower when applied to water hardness of 150 or less (e.g., 0.017 mg/L at hardness 100 mg/L) than the existing guideline which is independent of water hardness (0.03 mg/L). This suggests slightly

greater potential for near-field effects than is indicated by the current water quality guideline, but zinc effects would still be unlikely at far-field stations based on mean concentrations near or below the proposed guideline (Tables C.4 and C.7, Appendix Tables B.1-B.11; also see Minnow 2009 for more detailed analysis). Also, sulphate concentrations measured at R4 were frequently (71% of samples) above a 30-d exposure guideline for sulphate of 50 mg/L (BCMOE; see Appendix B), but sulphate effects are generally associated with concentrations above 250 mg/L (Minnow 2009), a value which was rarely exceeded; except sometimes at X14 Appendix Tables B.1-B.11).

Overall, the results indicate that there is a measurable mine-related influence on water quality in the Rose-Anvil and Vangorda Creek drainages to the terminus of these creeks at the Pelly River, but mine-related effects on aquatic biota in the Rose-Anvil system, if any, are limited to areas closer to mine sources (e.g., upstream of the Rose-Anvil confluence). Relative mine influence on Vangorda Creek biota is confounded by the presence of a large landslide on the West Fork which may be heavily influencing the water quality of the West Fork and lower Vangorda Creek. Regardless, effects do not currently extend into the Pelly River because no mine-related effect on water quality was detectable there.

Table C.1: Substances exceeding background benchmarks in more than 10% of samples [a] at X14, X2 and V27 ("mine indicators"), Faro Mine, Yukon. Blank cells represent parameters for which <10% of samples were elevated relative to background.

Parameters	% Samples Above Background Benchmark [b]		
	X14	X2	V27
Cadmium	20	30	27
Calcium	57	13	40
Cobalt	25		
Iron	24		
Lead	14	13	
Lithium	16	21	
Magnesium	53	25	44
Manganese	100	66	16
Nickel	88	28	
Potassium	46	11	
Silver	33	ID	
Sodium	72	26	24
Strontium	49	27	40
Titanium	11		
Uranium	22	15	36
Zinc	94	92	92
Ammonia	75		
Chloride	31	ID	ID
Colour	34	26	30
Conductivity-lab	60	20	44
Fluoride	41	ID	
Total Hardness	54	11	42
Nitrate	19	ID	64
Phosphorus	18		
Sulphate	99	45	96
Total Dissolved Solids	67	ID	71
Turbidity	95	71	30

ID - insufficient data (n<10 samples)

[a] And station mean exceeded background mean

[b] Benchmark based on 95th percentile of pooled reference station data (Appendix A of main report)

Table C.2: Ratio of station mean to background mean for mine indicator parameters at near-field stations. Highlighted substances had mean concentrations at least five times the background mean at one or more near-field stations.

	X14	X2	V27
Cadmium	2.4	2.6	3.6
Calcium	3.3	1.5	2.1
Cobalt	6.7	1.7	7.2
Iron	2.8	1.6	0.90
Lead	1.8	1.9	2.4
Lithium	2.2	1.9	0.95
Magnesium	3.4	1.7	3.4
Manganese	125	5.6	2.9
Nickel	8.8	2.1	1.4
Potassium	2.4	1.3	1.1
Silver	31	1.0	0.90
Sodium	3.2	1.3	1.3
Strontium	2.8	1.6	2.0
Titanium	1.6	1.0	0.72
Uranium	1.6	1.3	2.6
Zinc	9.8	12	7.0
Ammonia	9.2	1.5	0.54
Chloride	3.2	0.87	-
Colour	3.9	3.6	2.2
Conductivity-Lab	3.2	1.5	2.3
Fluoride	1.6	1.0	1.2
Hardness-Total	3.3	1.5	2.4
Nitrate	1.8	0.19	7.0
Phosphorus	2.2	1.6	1.9
Sulphate	16	2.3	11
Total Dissolved Solids	5.5	1.7	3.6
Total Organic Carbon	0.89	1.6	0.49
Turbidity	7.8	3.7	2.4

Table C.3: Substances exceeding background benchmarks in more than 10% of samples [a] at stations downstream of Faro Mine. Blank cells represent parameters for which <10% of samples were elevated relative to background.

Parameters	% Samples Above Background Benchmark							
	West Fork Vangorda Creek	Vangorda Creek		North Fork Rose Creek	Rose Creek			Anvil Creek
	minimally-exposed?	near-field	far-field	near-field	near-field	far-field	far-field	far-field
	V5	V27	V8	X2	X14	R3	R4	A1
Cadmium	60	27	43	30	20			12
Calcium	71	40	71	13	57	61	54	59
Cobalt	19				25	11		
Iron	40		24		24	11		24
Lead	21		10	13	14	14		12
Lithium	12			21	16		11	
Magnesium	98	44	93	25	53	54	50	41
Manganese	29	16	18	66	100	100	68	53
Nickel	88		75	28	88	79		47
Potassium	19		14	11	46	50	43	65
Silver	ID		ID	ID	33	20	16	13
Sodium	57	24	57	26	72	64	61	29
Strontium	74	40	74	27	49	57	54	13
Titanium	45		27		11			24
Uranium	69	36	75	15	22	29	25	24
Zinc	29	92	45	92	94	68	21	12
Ammonia	10				75	32		
Chloride	ID	ID	ID	ID	31	18	12	13
Colour	34	30	19	26	34	ID	ID	ID
Conductivity-lab	71	44	79	20	60	63	59	59
Fluoride	ID		ID	ID	41	11		
Hardness	83	42	80	11	54	57	54	47
Nitrate	ID	64	ID	ID	19	33	33	29
Phosphorus	88		ID		18			
Sulphate	100	96	100	45	99	100	100	88
Total Dissolved Solids	ID	71	88	ID	67	67	61	63
Turbidity	100	30	53	71	95	13	ID	ID

ID - insufficient data (n<10 samples)

[a] And station mean was above background mean.

Table C.4: Statistical comparisons of water quality at exposure stations compared to mean of pooled reference station data. Highlighted exposure station means were significantly different from the reference mean in ANOVA follow by post-hoc tests [a] (p<0.05).

Parameters	Units	Mean of Pooled Reference Station Data	Mine-Exposed Station Means						
			Vangorda Creek			Rose-Anvil drainage			
			near-field		far-field	near-field		far-field	
			V5	V27	V8	X2	X14	R4	A1
Cadmium	mg/L	0.000037	0.000182	0.000132	0.000131	0.0000970	0.000089	0.000035	0.000043
Calcium	mg/L	20.76	64.16	43.34	65.72	30.43	67.83	56.53	44.61
Cobalt	mg/L	0.000275	0.00101	0.00198	0.000645	0.000459	0.00183	0.000358	0.000225
Iron	mg/L	0.142	1.475	0.128	0.378	0.232	0.397	0.179	0.277
Lead	mg/L	0.000709	0.00217	0.00173	0.00203	0.00134	0.00128	0.000808	0.000804
Lithium	mg/L	0.00255	0.00525	0.00241	0.00447	0.0048	0.00571	0.00374	0.00324
Magnesium	mg/L	4.28	26.94	14.46	27.62	7.44	14.69	11.90	9.50
Manganese	mg/L	0.0145	0.0520	0.0426	0.0423	0.0816	1.809	0.264	0.0808
Nickel	mg/L	0.000516	0.00447	0.000738	0.00251	0.00106	0.00453	0.00137	0.00131
Potassium	mg/L	0.683	1.236	0.721	1.114	0.903	1.645	1.342	1.318
Silver[b]	mg/L	0.000005	0.000106	0.000005	0.000065	0.000006	0.000165	0.000038	0.000013
Sodium	mg/L	1.962	3.458	2.479	3.566	2.466	6.2	4.181	2.811
Strontium	mg/L	0.0821	0.257	0.162	0.27	0.128	0.227	0.188	0.147
Titanium[b]	mg/L	0.0017	0.0212	0.00122	0.00520	0.00163	0.00267	0.00174	0.00494
Uranium	mg/L	0.00107	0.0035	0.00275	0.00481	0.00142	0.00166	0.00168	0.00172
Zinc	mg/L	0.00506	0.0146	0.0355	0.0194	0.0588	0.0495	0.0131	0.00645
Ammonia	mg/L	0.0117	0.0183	0.00634	0.0191	0.0174	0.108	0.0147	0.00562
Chloride[b]	mg/L	0.555	3.12	-	1.871	0.483	1.759	0.665	0.627
Colour	CU	4.231	22.971	9.4	11.667	15.4	16.46	4.0625	-
Conductivity-lab	uS/cm	142.2	471.4	331.1	504.3	209.5	455.2	381.2	301.2
Fluoride	mg/L	0.0792	-	0.0943	0.247	0.078	0.123	0.103	0.0971
Hardness	mg/L	70.6	270.3	170.4	279.6	106.7	230.0	190.2	150.3
Nitrate	mg/L	0.0706	-	0.494	0.065	0.0132	0.126	0.161	0.146
Phosphorus[b]	mg/L	0.0106	0.227	0.0198	0.0975	-	0.0236	0.00437	0.0105
Sulphate	mg/L	9.08	84.98	98.49	121.90	20.69	143.57	86.20	44.93
Total Dissolved Solids	mg/L	78.6	292.8	285.7	317.5	130.4	429.9	252.9	199.3
Turbidity	-	0.324	29.949	0.786	5.734	1.195	2.545	0.374	-

[a] Dunnett's test if variances were homogeneous based on Levene's Test, otherwise Dunnett's T3 test was used (assumes unequal variance).
[b] ANOVA was significant, but individual exposure means were not different from reference in post-hoc tests (p<0.05).
- insufficient data

Table C.5: Statistical comparisons of water quality at V5 and V6A exposure stations compared to upstream reference (VR). Highlighted means were statistically different from reference in ANOVA followed by post-hoc tests [a] (p<0.05).

Parameters	Units	Reference (VR) Mean	Mine-Exposed Station Means	
			V6A	V5
Cadmium	mg/L	0.000079	0.000104	0.000182
Calcium	mg/L	9.64	37.53	64.16
Cobalt	mg/L	0.000182	0.000304	0.00101
Iron	mg/L	0.23	0.172	1.475
Lead	mg/L	0.00192	0.001340	0.00217
Lithium	mg/L	0.000445	0.00133	0.00525
Magnesium	mg/L	1.75	8.16	26.94
Manganese	mg/L	0.0331	0.0165	0.0520
Nickel	mg/L	0.00046	0.000556	0.00447
Potassium	mg/L	0.468	0.518	1.236
Silver	mg/L	0.003	0.000029	0.000106
Sodium	mg/L	1.61	2.171	3.458
Strontium	mg/L	0.0476	0.161	0.257
Titanium	mg/L	0.00305	0.00235	0.0212
Uranium	mg/L	0.00103	0.00382	0.0035
Zinc	mg/L	0.00525	0.0412	0.0146
Ammonia	mg/L	0.0047	0.0208	0.0183
Chloride[b]	mg/L	0.494	0.653	3.12
Colour	CU	-	12.964	22.971
Conductivity-lab	uS/cm	71.7	247.0	471.4
Fluoride	mg/L	0.0695	0.103	-
Hardness	mg/L	31.1	127.3	270.3
Nitrate	mg/L	0.0375	0.0401	-
Phosphorus	mg/L	0.0133	0.00519	0.227
Sulphate	mg/L	5.09	42.32	84.98
Total Dissolved Solids	mg/L	50.4	192.9	292.8
Turbidity	-	-	0.766	29.949

[a] Dunnett's test if variances were homogeneous based on Levene's Test, otherwise Dunnett's T3 test was used (which assumes unequal variance).

[b] ANOVA result significant, but post-hoc difference between this station and reference is not significant

- insufficient data

Table C.6: Statistical comparisons of water quality at Pelly River exposure stations compared to upstream reference. None of the exposure station means were significantly different from the P1 reference mean in ANOVA followed by post-hoc tests (p<0.05).

Parameters	Units	Pelly River Reference (P1) Mean	Pelly River Mine-Exposed Station Means		
			P2	P3	P4
Cadmium	mg/L	0.000243	0.000193	0.000165	0.000169
Calcium	mg/L	46.03	46.03	45.88	44.80
Cobalt	mg/L	0.000242	0.000224	0.000237	0.000245
Iron	mg/L	0.398	0.321	0.324	0.333
Lead	mg/L	0.000534	0.00041	0.000483	0.000570
Lithium	mg/L	0.00326	0.00325	0.00309	0.00331
Magnesium	mg/L	14.74	14.81	12.69	13.87
Manganese	mg/L	0.0391	0.0480	0.0311	0.0435
Nickel	mg/L	0.00466	0.00412	0.00346	0.00373
Potassium[a]	mg/L	0.825	0.832	1.016	0.932
Silver	mg/L	0.000013	0.000008	0.000019	0.000019
Sodium	mg/L	1.943	1.939	2.342	2.213
Strontium	mg/L	0.192	0.193	0.174	0.185
Titanium	mg/L	0.00319	0.00293	0.00302	0.00302
Uranium	mg/L	0.00151	0.00147	0.00167	0.00155
Zinc	mg/L	0.0194	0.0161	0.0119	0.0141
Ammonia	mg/L	0.004	0.00909	0.00491	0.00871
Chloride	mg/L	1.803	2.059	0.588	1.968
Colour[b]	CU	-	-	-	-
Conductivity-lab	uS/cm	332.9	334.2	323.4	327.9
Fluoride	mg/L	0.113	0.112	0.109	0.123
Hardness	mg/L	175.5	175.8	166.8	168.9
Nitrate	mg/L	0.0441	0.0461	0.0911	0.0606
Phosphorus	mg/L	0.0199	0.0132	0.0156	0.0203
Sulphate	mg/L	55.62	55.68	50.94	51.63
Total Dissolved Solids	mg/L	209.2	213.1	204.9	212.0
Total Organic Carbon	mg/L	3.800	3.828	3.406	3.806
Turbidity[b]	-	-	-	-	-

[a] ANOVA result significant, but post-hoc difference between this station and reference is not significant

[b] insufficient data for colour and turbidity

Table C.7: Ratio of station mean to effects-based benchmark[a] for mine indicator parameters at near-field stations. Highlighted substances had mean concentration at least two times the effects-based benchmark at one or more stations.

	Vangorda Creek			Rose Creek				Anvil Creek
	near-field		far-field	near-field		far-field		far-field
	V5	V27	V8	X2	X14	R3	R4	A1
Cadmium - existing CCME guideline	6.1	4.4	4.4	3.2	3.0	1.3	1.2	1.4
Cadmium - proposed CCME guideline	0.83	0.60	0.60	0.44	0.40	0.18	0.16	0.20
Calcium	0.55	0.37	0.57	0.26	0.58	0.54	0.49	0.38
Cobalt	0.25	0.49	0.16	0.11	0.46	0.14	0.09	0.06
Iron	4.9	0.43	1.3	0.77	1.3	0.70	0.60	0.92
Lead	1.1	0.87	1.0	0.67	0.64	0.49	0.40	0.40
Lithium	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	0.33	0.18	0.34	0.09	0.18	0.16	0.15	0.12
Manganese	0.05	0.04	0.04	0.08	1.8	0.61	0.26	0.08
Nickel	0.07	0.01	0.04	0.02	0.07	0.03	0.02	0.02
Potassium	0.02	0.01	0.02	0.02	0.03	0.03	0.03	0.02
Silver	1.1	0.05	0.65	0.06	1.7	0.59	0.38	0.13
Sodium	0.02	0.01	0.02	0.01	0.03	0.03	0.02	0.01
Strontium	0.03	0.02	0.03	0.01	0.02	0.02	0.02	0.02
Titanium	0.01	0.001	0.003	0.001	0.001	0.001	0.001	0.003
Uranium	0.23	0.18	0.32	0.09	0.11	0.12	0.11	0.11
Zinc - existing CCME guideline	0.49	1.2	0.65	2.0	1.7	0.80	0.44	0.22
Zinc - proposed CCME guideline	0.86	2.1	1.1	3.5	2.9	1.4	0.77	0.38
Ammonia	0.08	0.03	0.08	0.07	0.45	0.15	0.06	0.02
Chloride	0.01	no data	0.01	0.002	0.01	0.003	0.002	0.0030
Colour	NA	NA	NA	NA	NA	NA	NA	NA
Conductivity-Lab	NA	NA	NA	NA	NA	NA	NA	NA
Fluoride	1.6	0.79	2.1	0.65	1.0	0.93	0.86	0.81
Hardness-Total	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate	0.002	0.04	0.01	0.001	0.01	0.01	0.01	0.01
Phosphorus	7.6	0.66	3.3	0.57	0.79	0.14	0.15	0.35
Sulphate	1.7	2.0	2.4	0.41	2.87	2.2	1.7	0.90
Total Dissolved Solids	0.59	0.57	0.64	0.26	0.86	0.57	0.51	0.40
Total Organic Carbon	NA	NA	NA	NA	NA	NA	NA	NA
Turbidity	15	0.39	2.9	0.60	1.3	0.28	0.19	no data

[a] Typically a water quality criterion for protection of aquatic life. See Appendix A.
NA - not applicable - no effects-based benchmark for these substances

APPENDIX D

TEMPORAL ANALYSIS OF WATER QUALITY

Technical Report

Faro Mine Receiving Water Quality Sampling Frequency: Review and Recommendations

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EXECUTIVE SUMMARY

Paine, Ledge and Associates (PLA) of North Vancouver, BC was asked by Minnow Environmental Inc. of Georgetown, ON to review past receiving water quality monitoring data and sampling frequencies for the Faro mine site in the Yukon. The primary objective was to recommend appropriate future sampling frequencies.

The review examined past data, and especially seasonal cycles, for three key variables (calcium, sulphate and zinc) at both Reference and Exposed stations in Vangorda and Rose Creeks. Over the past 20 years, sampling frequencies have been quarterly to monthly or more frequent at key stations exposed to mine discharges (Exposed stations). A concerted effort (monthly or more frequent sampling) has been made in the past 3-5 years to address past "gaps" or "deficiencies" in monitoring key Exposed and Reference stations. Past data are therefore adequate to address short-term (1-5 year) objectives such as estimating annual means and seasonal cycles.

In the future, long-term trends (progressive increases or decreases in water quality) and other changes over time will be of primary interest. Significant cost savings can be achieved if sampling frequency can be reduced to, e.g., 2 to 4 sample times per year. This review indicated that three sample times per year would be adequate to track trends for both "worst-case" and "average/typical" conditions for key variables and stations:

- March/April (late winter),
- May/June (spring), and
- September/October (fall)

Those recommended sample times recognize that:

1. March/April and May/June are critical times when high or low values occur, although whether high or low values occur in March/April versus May/June differs among variables and stations.
2. September/October generally represent times when variable values are "average", either because there is minimal seasonal variance except for the occurrence of minima or maxima in March/April or May/June or because fall represents the midpoint of the transition from May/June minima (or maxima) to March April maxima (or minima) when strong seasonal cycles occur.

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1 Introduction

1.1 Background and Objectives

Since 2007, water quality sampling in the Faro study area has been conducted monthly or more frequently at key stations, although samples were occasionally not collected at some stations in some months. Prior to 2007, sampling frequency varied from once annually to several times monthly. At some stations, water quality records extend back to the 1970s, with annual sampling conducted since 1987. The objective of this review was to assess existing water quality data to recommend cost-effective future sampling frequencies and times. The review was conducted by Paine, Ledge and Associates (PLA) of North Vancouver, BC, at the request of Minnow Environmental Inc. of Georgetown, ON, and was intended to supplement other technical material provided in a broader review of environmental monitoring at the Faro mine site.

1.2 Assumptions

Tracking long-term trends and other changes over time was assumed to be the primary objective for future monitoring and data analyses. Trends for both "worst-case" (i.e., values of greatest concern) and "average" values and times will be of interest. For most variables, worst-case values are higher values, especially values exceeding Reference benchmarks. For pH, lower values would represent worst-case (i.e., acidic water). Lower values are also of interest for calcium and hardness, since metal toxicity increases in softer water. Average or mid-range values are relevant for assessing potential chronic exposure effects on biota, and more generally, for tracking trends for "typical" conditions.

At the remote Faro site, water quality sampling involves significant costs for travel, field labour, shipping and laboratory analyses. Therefore, costs can be substantially reduced by reducing the current monthly (or more frequent) sampling, provided that the objective of tracking long-term trends for worst-case and average seasons can be met. It would also be costly to use different sample times for different variables or stations, so standardized or common sample times (=synoptic sampling) would be preferred, even if those times were not "optimal" for all variables and stations. Synoptic sampling also has considerable statistical advantages. Correlations can be calculated among variables measured at the same times, and analyses of differences among years or stations can be "stratified" by sample time (e.g., May compared to May), a powerful approach when seasonal cycles are strong (van Belle and Hughes 1984).

1.3 Theory

In water quality monitoring programs, samples are collected at t times per year at s stations for n years. This review primarily focuses on selecting sample times within years. Sample allocation in terms of numbers of sample times per year (t) versus the number of years (n) depends on the temporal (and spatial) scale of interest, and more generally, on program purposes (Loftis et al. 1991). A brief review of the relevant statistical theory is provided below.

For short-term purposes such as estimating annual means or assessing seasonal cycles in one or a few years, the number of sample times within years should be maximized within practical and cost limits (Table 1). Monthly sampling is usually adequate, although more frequent (e.g., weekly or bi-weekly) sampling will always improve the precision and power of any statistical

estimates and analyses, and can be useful for exploratory analyses in the initial years of monitoring programs.

Over longer terms (i.e., n>5 and especially n>20 years), trends (progressive increases or decreases in water quality) over decades or even centuries are of primary interest. Collecting multiple samples (technically, subsamples) within years will always reduce error variances and increase power for trend analyses, and at least two sample times per year would be required to track trends for both worst-case and average values. However, as the number of years increases in long-term programs, subsamples within years provide diminishing statistical returns (i.e., increases in power and precision) per unit cost ("the problem of diminishing returns"; Dixon and Chiswell 1996). Years are the primary replicates for any trend test, and extensive subsampling within one or a few years will not provide any additional information about the rate at which conditions are changing over the long term. When non-trend variance among years is significant, extensive subsampling within years becomes even less cost-effective.

Annual means, and trends for those means, are typically not of interest in trend monitoring. Instead, trends are usually calculated for each sample time ("season" in the water quality literature) and the mean (common) trend over all seasons calculated and tested using Mann-Kendall and van Belle Tests provided in Gilbert (1987). Existing data from the Faro site are more than adequate to assess seasonal cycles for key stations, as this review indicates.

Trends for worst-case values can be tracked by sampling when values are likely to be high (Table 1). Trends for average values can be tracked by sampling when values are likely to be in the mid-range, which can be accomplished by avoiding sampling when values are likely to be high or low. These approaches are most effective when seasonal cycles are strong and the months when high and low values are likely to occur can be predicted. In the absence of strong seasonality, almost any choice of sample month(s) will suffice. For example, one could sample regularly (e.g., quarterly) or "opportunistically" (e.g., when field trips are conducted for other purposes, or when otherwise convenient). Analyzing trends for worst-case and average values also loses meaning when seasonal cycles are weak or absent, since those values could occur at any time (i.e., there would be no worst-case or average times).

2 Methods

2.1 Stations, Variables and Years

Analyses and assessment of sampling frequencies focused on concentrations of three substances (calcium, sulphate and zinc) at two Reference and four Exposed stations (Table 2). Calcium, sulphate and zinc were measured in most samples, and frequently exceeded Reference benchmarks at Exposed stations. Total rather than dissolved concentrations were analyzed because they were measured more frequently. The six stations selected provided one frequently monitored upstream Reference station and two frequently monitored downstream Exposed stations on each of Rose and Vangorda Creeks.

Table 2 also provides the years used for each substance and station in statistical analyses. The selected years represented relatively continuous periods of record in which variable values were measured annually (i.e., in every year), with approximately quarterly or more frequent measurements within each year. There were data collected prior to the periods of record analyzed, but with infrequent (i.e., less than quarterly) sampling within years, large differences in sampling frequency among years, or "gaps" between years (i.e., samples were not collected in every year). Continuous periods of record were more extensive for the Exposed stations (especially the Rose Creek stations) than for the Reference stations, and calcium was rarely measured prior to the mid-1990s. Station X14 was often sampled several times per month; other stations were usually sampled monthly or less frequently.

No calcium concentrations included in analyses were less than detection limits (DL). Four sulphate values were <DL, and were set to ½ the highest DL of 1 mg/L, or 0.05 mg/L. There were no sulphate concentrations ≥DL but <1 mg/L. Most Reference zinc concentrations were <DL, which varied from 0.001 to 0.01 mg/L. For the Exposed stations, zinc concentrations <0.01 mg/L (the highest DL) were set at 0.005 mg/L, regardless of whether they were <DL or ≥DL. At Station V5, 33 (of 141) zinc concentrations from 1997-2009 were <DL and another 29 concentrations were ≥DL but <0.01 mg/L. Thus, setting all concentrations <0.01 mg/L to 0.005 mg/L for 44% of samples lost information on variance at lower zinc levels, which may have affected analyses and results. In contrast, there were only 13 (of 177), 18 (of 294) and 12 (of 410) zinc concentrations <0.01 mg/L at Stations V8, X2 and X14, respectively. Thus, with <10% of values affected, setting concentrations <0.01 mg/L to 0.005 mg/L should have minimal effects on analyses and results for those three Exposed stations.

2.2 Data Analysis

For each *Y* variable (calcium, sulphate, zinc), regression analyses testing variances within and among years were conducted for each station (Section 2.2.1). Some follow-up analyses were conducted based on the regression results, primarily to simplify presentation in tables and figures. Analyses of Reference zinc concentrations were not conducted because of the high frequency of values <DL. The phrase "approximate" is frequently used here and in Section 3 because sample sizes within years, and within months, were not equal within stations. More exact estimates and results can only be obtained with equal sample sizes within years and within months. All analyses were conducted using SYSTAT Version 11 (2004) and Microsoft Excel 2002.

2.2.1 Regression Analyses

The basic regression model used for analyses of Y variables was:

$$Y = C + a_i + b_1 \cos m' + b_2 \sin m' + b_3 \cos m' \times \sin m' \qquad (1)$$

C=overall regression intercept
a_i=adjustment to intercept for ith year
$m' = \frac{2\pi(m-0.5)}{12}$, with m=month (i.e., m=1 (Jan) to 12 (Dec)).

All variable values were $\log_{10}$-transformed for regression analyses.

C values provide the approximate mean of log-transformed values across all times; back-transformed values (antilog C) provide approximate geometric means (GM) or medians of untransformed values. If a_i differ significantly among years (i.e., if the a_i or Year term is significant), then Y values differ significantly and consistently among years in all or most months (e.g., Y values may be consistently higher in 2008 than in 2007). Some of the differences among years could represent trend variance of interest, rather than non-trend variance among years.

The cos- and sin-transformed values of month describe seasonal cycles within years. In Equation 1, 0.5 is subtracted from m to centre sample times to mid-month and over the year. Cos-transformed month values are lowest in June and July (m=6 and 7) and highest in Dec and Jan (m=1 and 12) (Figure 1). Sin-transformed month values follow the same cycle as cos-transformed values, but with maxima and minima occurring three months earlier. The interaction term or $\cos m' \times \sin m'$ term can theoretically identify two cycles within a year. In practice, two annual cycles rarely occur. Instead, significant $\cos m' \times \sin m'$ terms usually indicate asymmetrical cycles, with portions of the symmetrical cos or sin cycles "flattened" or "extended".

2.2.2 Variance Components

SYSTAT provides the overall R^2 for the basic regression model, or the proportion of total variance in Y attributable to among-year plus within-year seasonal variance (=R^2 between observed and predicted model {Equation 1} values). To provide separate estimates of among-year versus within-year seasonal variances:

3. R^2 were calculated between observed values and values predicted using regression coefficients from Equation 1, but with all a_i set to 0 (i.e., among-year variance assumed to be 0). Those "seasonal" R^2 provide an estimate of the proportion of total variance attributable to seasonal cycles within the "average" year.
4. Seasonal R^2 were then subtracted from overall R^2 to provide an estimate of the proportion of total variance attributable to differences among years.

The proportion of variance "not explained" by the regression model (i.e., not attributable to among-year variance and seasonal cycles) is then (1 – overall R^2) (=error or residual variance). Error variances incorporate:

1. Variance within months, which was not accounted for in the regression model. The model assumed that all values within months were collected at the same time (i.e., no distinction was made between sample dates within months).
2. "Lack of fit" to the specific model used, which could include variance attributable to more complex seasonal cycles than the cos and sin cycles in Figure 1 or to interactions between Year and Month (i.e., differences in seasonal cycles among years).
3. General field sampling and analytical error.

For the most part, these sources of error variance can be considered largely outside investigator control.

Within-year seasonal, among-year, and error variance proportions can be converted to percentages of total variance by multiplying those proportions by 100.

For log-transformed values, approximate Coefficients of Variation (CV; SD as % of mean) can be calculated from regression error variances (Mean Square Error, or MSE) using:

$$\mathrm{CV} = 100 \times \left(\mathrm{antilog}\sqrt{\mathrm{MSE}} - 1\right) \qquad (2)$$

For example, if MSE=0.01, $\sqrt{\mathrm{MSE}}$ =0.1, antilog $\sqrt{\mathrm{MSE}}$ =1.26, and approximate CV=100×(1.26−1) or 26%.

2.2.3 Other Methods

Monthly variable values were expressed as percentages (%) of annual maxima and medians for presentation purposes, and to remove differences among years.

Trends for the Exposed stations were briefly assessed by calculating Spearman rank correlations (r_s) between annual medians versus year. Trends were not assessed for Reference stations because sample sizes were small (n<10 years; Table 2). The objective was to estimate how much of the variance among years was attributable to trend versus "random" non-trend variance. To assess the effectiveness of using a single sample time to track trends for average values, trend r_s for September (an "average" month) for zinc at the four Exposed stations.

3 Results

3.1 Overview

Figure 2 provides time series plots for calcium, sulphate and zinc concentrations for Stations V1 (Vangorda Reference) and X14 (Rose Exposed) from 1987 (X14) or 1988 (V1) to mid-2009 to illustrate the general nature of the Faro data analyzed. The horizontal dashed lines in Figure 2 are Reference benchmarks (see Appendix A of main report); symbols (solid circles) represent individual values and lines represent monthly means. Note that:

- sampling frequencies were much greater for Station X14 than for Station V1;
- concentrations of the three substances, and frequencies of exceedances of benchmarks, were much greater for Station X14 than for Station V1; and
- most zinc concentrations at Station V1, especially in recent years, were less than 0.01 mg/L (the highest DL) and are plotted as 0.005 mg/L

Concentrations of the three substances analyzed were highly variable over time at both stations and at other stations, with most of the variance occurring within years (=within-year variance, some or most of which was predictable seasonal variance). Long-term trends are not visually obvious, although trends (decreases in concentration over time) were significant at Station X14 for median sulphate and zinc concentrations (Section 3.5).

Table 3 provides a summary of variance components for all three substances analysed; Table 4 provides a summary of when high, mid-range and low values occurred; Tables 5 to 7 provide more complete results for each substance.

3.2 Calcium

Seasonal cycles for total calcium were strong and similar at all six stations, accounting for 49% of total variance at Station X14 to 74% of total variance at Station V1 (Table 3). In contrast, variance among years accounted for only 2-7% of the total variance. Error variances were greater for Station X14 (approximate CV=56%) than for the other five stations (approximate CV=27-36%).

Figure 3 plots total calcium concentrations versus month for the years analyzed (provided in Table 2). In Figure 3 and similar plots for sulphate and zinc:

1. The horizontal dashed lines are Reference benchmarks.
2. The solid lines are predicted seasonal cycles based on Equation 1 with a_i=0 (i.e., seasonal cycles for the "average" year).
3. Distributions of individual Reference station values within months are shown as "dot density" plots (there were too few values/years to use box plots); distributions of Exposed values within months are shown as box plots.
4. For the box plots, the central boxes provide the mid-range or central 50% of values. The horizontal lines within the boxes are medians. The vertical lines extending from the boxes ("whiskers") encompass most of the remaining values. The asterisks (*) represent "outside

values" and the open circles (○) represent "far outside values" (which could be considered outliers).

For all six stations, regression slopes (b_1 from Equation 1) for cos-transformed month values were positive and significant at $p \leq 0.001$ (Table 5). Slopes (b_2) for sin-transformed month values were also positive for every station, and significant at $p \leq 0.001$ for the four Exposed stations with larger sample sizes. Slopes (b_3) for the cos $m' \times$ sin m' interaction term were also positive for every station, and significant at $p \leq 0.01$ for Station V1 (with the smallest sample size) and significant at $p \leq 0.001$ for the other five stations. The net result, as indicated by both predicted and observed values in Figure 3, was that calcium concentrations were highest in the first four months of the year (January to April), decreased substantially in May, then progressively increased from June to December. In statistical terms:

- the cos cycle in Figure 1 with mid-year (June-July) minima described the basic cycle, but
- minima occurred approximately a month earlier (May-June) because of the positive slopes for sin-transformed month values, and
- with the significant interaction term, cycles were asymmetrical, with an extended period of increase after mid-year and maxima extending over the first four months of the year

Figure 4 plots calcium concentrations as % of annual maxima. With minimal differences among years, standardizing calcium concentrations to annual maxima generally reproduced the seasonal cycles for "raw" values in Figure 3. Except at Station X14 in some years, annual sample maxima were based on relatively small sample sizes within years (usually <10 sample times) and would underestimate the "true" maxima one would obtain from daily sampling. Consequently, standardization to annual maxima was primarily useful for indicating when monthly values approached or were equal to "practical" maxima based on past quarterly to monthly sampling. For calcium, all but one (of 71) past annual maxima (the horizontal dashed lines at 100% of maxima) occurred from December to April, and May-June values were rarely greater than 50% of maxima.

Figure 5 plots calcium concentrations as % of annual medians. Again, with minimal differences among years, these plots generally reproduced seasonal cycles for the "raw" values in Figure 3. In the past, "average" values closer to annual medians (the horizontal dashed line at 100% of medians) were more likely to occur in late summer/fall (August-October).

Other points worth noting based on the more detailed results for calcium in Table 5 are:

1. There were few outliers as defined by SYSTAT "Warnings", which are basically observed values $\geq 3\sqrt{\text{MSE}}$ from predicted values, with $p<0.05$ that such extreme values would occur by chance for the sample sizes analyzed. In general, there will be fewer SYSTAT "outliers" than "far outside values" in box plots.
2. Antilog C (from Equation 1) provides approximate median calcium concentrations for each station for the years analyzed. As Figure 3 indicates, concentrations were lowest at Reference Station V1, similar at Reference Station R7 and Exposed Station X2, and approximately 3 times greater than "average" Reference concentrations at the three other Exposed stations.

3. F values >1 for "Year (a_i)" indicate added variance among years. That added variance was significant only for Station V8, and only at $0.01<p<0.05$, consistent with the small proportion of variance attributable to differences among years in Table 3.

Calcium is the ideal variable in terms of requiring the minimum number of easily selected sample times per year. At all six stations analyzed, most of the variance of calcium was attributable to predictable and strong seasonal cycles (Table 3). Variances among years and non-seasonal variances within years (error CV) were minimal. Table 4 provides ranges of sample months suitable for tracking trends for worst-case/high, average/mid-range and low (if of interest) calcium concentrations. Any single sample month could be selected within the suggested ranges (e.g., based on convenience or to coincide with suitable times for sampling other variables). The only minor exception may be Station X14, where concentrations increased from January to April (Figure 3 to 5). Therefore, for Station X14, April might be a marginally better choice as a worst-case time than the first three months of the year. However, even January values at Station X14 were generally greater than annual medians (i.e., high) in most cases, and low or below-median values also occasionally occurred in April (Figure 5).

3.3 Sulphate

Results for sulphate were similar to results for analyses of calcium, except that seasonal cycles were somewhat weaker and error variances higher. Seasonal cycles accounted for 37-59% of total variance; differences among years accounted for 2-10% of total variance; approximate error CV were 53-87% (Table 3).

At all six stations, the highest sulphate concentrations occurred in December (Reference stations) or January (Exposed stations) to April, decreased in May, remained low in June/July at the Exposed stations, then increased from August through December (Figures 6 to 8). Regression slopes (b_1) for cos-transformed month values for all six stations were positive and significant at $p<0.001$ (Table 6). Slopes (b_2) for sin-transformed values were positive and significant at $p\leq0.01$ for the Exposed stations ($p\leq0.001$, except for Station X2) but not for the Reference stations. Slopes for (b_3) for the $\cos\ m' \times \sin\ m'$ interaction term were also positive and significant. As for calcium, the cos cycle in Figure 1 with mid-year minima was the basic cycle for sulphate, but with minima occurring approximately one month before mid-year and cycles asymmetrical.

Other points worth noting based on the more detailed results for sulphate in Table 6 are:

1. There were few outliers as defined by SYSTAT "Warnings".
2. Approximate median sulphate concentrations (antilog C) were similar at the two Reference stations, approximately double Reference concentrations at Exposed Station X2, and an order of magnitude higher than Reference concentrations at the other three Exposed stations. The differences in sulphate concentrations among stations are also evident in Figure 6, despite the relatively high seasonal and other within-year variances. Differences among stations were not analyzed in detail, but with most sulphate concentrations at Stations V5, V8 and X14 exceeding the Reference benchmark (21.6 mg/L) (Figure 6), *all* months arguably represent worst-case times for those three stations.

3. Added variance among years for Station X14 was highly significant ($p \leq 0.001$) and large ($F > 3$). However, the differences among years at Station X14 accounted for only 10% of total variance versus the 40% of total variance accounted for by seasonal cycles (Table 3).

Table 4 provides suggested ranges of sample times for tracking trends for high, mid-range and low sulphate concentrations. The suggested ranges are broader and probably more subjective than for calcium, given the weaker seasonal cycles and higher error variances for sulphate. However, a single sample time (i.e., month) within each of the suggested ranges for tracking long-term trends for high and mid-range sulphate and calcium values would be sufficient (low sulphate values are presumably of less interest).

3.4 Zinc

Time series for Reference zinc concentrations were not analyzed because of the high frequency of concentrations less than the highest DL of 0.01 mg/L. Results for the four Exposed stations were dramatically different than results for calcium and sulphate (Table 3). Seasonal cycles for zinc were weak, accounting for approximately 10% of total variance, and differed between the Vangorda and Rose Creek stations (see below). In contrast, differences among years accounted for 15-22% of total variance. Error variances were also higher than for calcium and sulphate, with CV near or greater than 100%.

At the two Vangorda Creek stations (V5, V8), the highest zinc concentrations occurred in May, and concentrations were also higher in June and July than in other months (Figures 9 to 11). Regression slopes (b_1) for cos-transformed month values for the two stations were negative and significant at $p \leq 0.05$ (Table 7). Slopes (b_2) for sin-transformed values were positive for both stations but not significant for Station V8. Slopes for (b_3) for the cos $m' \times$ sin m' interaction term were negative for both stations but not significant for Station V5. The basic cycle was an inverted version of the cos cycle in Figure 1, with maxima rather than minima occurring just before mid-year (i.e., in May).

In contrast, *minimum* zinc concentrations at the two Rose Creek stations (X2 and X14) occurred at approximately mid-year (June to August) and higher values more likely to occur in winter (November/December to April) (Figures 9 to 11). Regression slopes (b_1) for cos-transformed month values for the two stations were positive and significant at $p \leq 0.001$ (Table 7). Slopes (b_2) for sin-transformed values were positive for both stations but not significant for Station X14. Slopes for (b_3) for the cos $m' \times$ sin m' interaction term were negative for both stations but not significant for Station X2. The basic cycle was the cos cycle in Figure 1, qualitatively similar to the stronger cycles for calcium and sulphate, but with minima for zinc occurring one or a few months later than minima for calcium and sulphate.

Other points worth noting based on the more detailed results for sulphate in Table 7 are:

1. There were few outliers as defined by SYSTAT "Warnings", despite the relatively high frequency of "outside values" ("*" in box plots) in Figure 9.
2. Approximate median sulphate concentrations (antilog C) were ranked V5<V8<X2<X14. At Station V5, relatively few concentrations exceeded the Reference benchmark of 0.017 mg/L; at Station X14, most concentrations exceeded the benchmark (Figure 9).

3. Added variance among years for all four Exposed stations was highly significant ($p \leq 0.001$) and large ($F \approx 3$). At all four stations, variance among years represented a greater proportion of total variance than did seasonal variance (Table 3). Given the highly significant among-year variances at all four stations, sampling more than a few times per year *would not* be cost-effective despite the high error variances for zinc.

Given the weak seasonal cycles for zinc, and the differences in those cycles between the Exposed Vangorda versus Rose Creek stations, it would be difficult to select two common sample times within years for tracking trends for worst-case/high and average/mid-range zinc concentrations in both streams. In Vangorda Creek, sampling in May (and perhaps June and July) would be more likely to provide higher zinc concentrations than sampling in other months (Table 4). However, calcium and sulphate concentrations would be lowest then. Average/mid-range values (or more correctly, a wide range of values) could occur in Vangorda Creek at any time other than May to July. For Rose Creek, sampling in June to August should be avoided unless low zinc concentrations are of interest. Otherwise, the same or similar sample times suggested for tracking trends for high and mid-range calcium and sulphate values could be used (i.e., early in the year for high values and in late summer/fall for mid-range values).

3.5 Trends

Table 8 provides Spearman rank correlations (r_s) between annual calcium, sulphate and zinc medians versus year (i.e., trend correlations) for the four Exposed stations. There were no significant trends for calcium. Median sulphate concentrations decreased significantly over time at Station X14, the only station where sulphate concentrations differed significantly among years (Table 7).

Trends for zinc were of more interest and relevance, since there were highly significant differences in zinc concentrations among years at all four Exposed stations (Table 7). Median zinc concentrations decreased significantly over time at Stations V5, V8 and X14 (Table 8). The percentage of variance among years attributable to trends ($=100 \times r_s^2$) for the four Exposed stations ranged from approximately 10% for Station X2 to approximately 50% for Station V8. Those estimates apply to rank-transformed values, but other approaches applied to log-transformed values yield similar estimates. Trends could account for up to 50% (10-25% would be a more realistic general estimate) of the highly significant variance of zinc concentrations among years, but the remaining "random" non-trend variance among years would still be similar to or greater than predictable seasonal variance, and extensive subsampling within years would still not be cost-effective.

Table 8 also provides trend correlations based on zinc concentrations from September, which can be considered an "average" month or at least a month in which high or low concentrations would be less likely to occur (Table 4). September trends reproduced trends for medians based on ≥4 samples/year for Stations V5, V8 and X14, although the September trend for Station V5 was not significant. These preliminary results suggest that a single "average" sample time can reproduce trends for annual medians (i.e., "average" values) based on multiple sample times, even for a variable (zinc) with high variance within months and weak seasonal cycles. Existing data for the four Exposed stations are more than adequate to further explore whether that conclusion is

applicable to other variables and sample months, and more generally, to track past 10-20 year trends.

4 Discussion and Recommendations

Based on analyses of the three selected substances (calcium, sulphate, zinc) at six key stations, more than two sample times per year would be required to track trends for both worst-case and average values (Table 4). In other words, there are no single "optimal" sample times that apply to all variables and stations considered. However, after at least three years of recent monthly or more frequent monitoring at the two Reference stations (R7, V1), and at least 10 years of quarterly or more frequent monitoring at the four Exposed stations (V5, V8, X2, X14):

1. Existing data are more than adequate for the short-term purposes/analyses in Table 1.
2. Existing data are also more than adequate to examine 10-20 year trends for the four Exposed stations in more detail than in this review (Section 3.5).
3. The "problem of diminishing returns" applies; continued monthly sampling will not be cost-effective for tracking long-term trends.

Based on the above, sampling three or four times per year would be the best practical option for the future. Regular quarterly sampling would provide a reasonably wide range of values for most variables and may be convenient for scheduling. However, costs could further be reduced by sampling three rather than four times per year, in:

- March/April (late winter),
- May/June (spring), and
- Sept/Oct (fall)

These proposed sample times basically represent quarterly sampling with the last quarter (Oct-Dec) omitted and/or a single sample collected at the midpoint of the last two quarters (July-Dec). For the three variables analyzed, March/April and May/June represent times at which extremes are more likely to occur, although whether those extremes are high or low values varied among variables and stations. Sept/Oct is a time when values are "average" or at least changing from minima to maxima or vice versa. Assuming that extremes will generally occur in early to mid-year, sampling more than once later in the year (i.e., in both Quarter 3 and Quarter 4) is unnecessary.

Seasonal cycles for iron, manganese and pH, three other variables of interest, were qualitatively examined, to determine if thrice-yearly sampling as suggested above would be adequate and more generally applicable. Seasonal cycles for those variables followed one of two basic "patterns" (or were a mix of the two patterns):

1. The calcium/sulphate pattern: strong seasonal cycles, with maxima (or minima) occurring in March/April and minima (or maxima) occurring in May/June.
2. The zinc pattern: weak seasonal cycles differing between Vangorda versus Rose Creek Exposed stations, but with either maxima or minima occurring early to mid-year.

Therefore, thrice-yearly sampling, which effectively assumes that extremes will not occur later in the year, should be adequate for most variables.

The three suggested sample times also match reasonably well with predicted times of low, mid-range and high calcium, sulphate and zinc concentrations predicted at the four Exposed stations by water quality models, based on the current seasonal (spring to fall) or proposed year-round discharge regime for managed sources.

5 References Cited

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TABLES

Table 1. Recommended water quality sampling frequencies and times for short- and long-term monitoring purposes

General Purpose	Sampling Times/Frequency
Short term (*n*=1-5 years)	
Annual means and SD	Annual monthly or more frequent sampling
Seasonal cycles	Annual monthly or more frequent sampling
Longer term (*n*>5 years)	
Trend (Worst-case/High values)	Seasonal cycle present: sample only in month(s) when *Y* values are highest Seasonal cycle absent: regular or opportunistic sampling
Trend (Average/Mid-range values)	Seasonal cycle present: *avoid* sampling in month(s) when *Y* values are highest or lowest Seasonal cycle absent: regular or opportunistic sampling

Table 2. Stations and years used in quantitative analyses

Station	Location	Years analyzed		
		Calcium	Sulphate	Zinc
Reference				
R7	N Fork Rose Creek	2004-2009	2004-2009	2004-2009
V1	upper Vangorda Creek	2007-2009	2007-2009	2007-2009
Exposed				
V5	W fork Vangorda Creek	1997-2009	1997-2009	1997-2009
V8	lower Vangorda Creek	1995-2009	1995-2009	1995-2009
X2	N fork Rose Creek	1993-2009	1993-2009	1987-2009
X14	Rose Creek	1993-2009	1987-2009	1987-2009

Table 3. Approximate variance estimates

Variable	Station	No. years	No. values	Approx. % of total variance		Approx. error CV (%)
				Seasonal cycle	Among years	
Calcium	R7	6	70	58	3	36
	V1	3	31	74	2	26
	V5	13	141	65	5	27
	V8	15	172	52	7	34
	X2	17	198	59	5	36
	X14	17	309	49	2	56
Sulphate	R7	6	69	37	4	69
	V1	3	31	55	2	71
	V5	13	141	59	2	53
	V8	15	177	35	6	72
	X2	17	197	47	7	59
	X14	23	389	40	10	87
Zinc	V5	13	141	10	21	143
	V8	15	177	5	19	99
	X2	23	294	10	22	111
	X14	23	410	13	15	98

Notes: Seasonal and among-year variance percentages calculated as described in Section 2.2.2, based on R^2 from Tables 5 to 8
CV=Coefficient of Variation (SD as % mean) for untransformed values (calculated from Equation 2)

Table 4. Suggested sample times for tracking trends for variable values within selected ranges

Variable	Values	Sample months		
		Reference (R7, V1)	Exposed	
			Vangorda Creek (V5, V8)	Rose Creek (X2, X14)
Calcium	High	Jan-April	Jan-April	Jan-April
	Mid-range	Aug-Oct	Aug-Oct	Aug-Oct
	Low	May-June	May-June	May-June
Sulphate	High	Dec-April	Jan-April	Jan-April
	Mid-range	Aug-Oct	Aug-Oct	Aug-Oct
	Low	May	May-July	May-July
Zinc	High	Most values near or below recent DL	May	Dec-April?
	Mid-range		?	?
	Low		?	June-Aug

Table 5. Seasonal regression results for calcium

		Station					
		Reference		Exposed			
		R7	**V1**	**V5**	**V8**	**X2**	**X14**
Years		2004-2009	2007-2009	1997-2009	1995-2009	1993-2009	1993-2009
No. values		70	31	141	172	198	309
No. outliers		0	1	0	0	1	0
Overall R^2		0.610	0.750	0.700	0.590	0.636	0.487
Seasonal R^2		0.580	0.735	0.648	0.521	0.585	0.466
Difference		0.030	0.015	0.052	0.068	0.051	0.020
antilog C	mg/L	27	11	71	60	30	64
Year (a_i)	F	0.94	0.46	1.79	1.82	1.57	0.68
	p	NS	NS	NS	*	NS	NS
Cos month	Slope (b_1)	**0.201**	**0.192**	**0.192**	**0.175**	**0.213**	**0.233**
	p	***	***	***	***	***	***
Sin month	Slope (b_2)	0.040	0.087	**0.050**	**0.054**	**0.056**	**0.105**
	p	NS	*	***	***	***	***
Cos × Sin	Slope (b_3)	**0.183**	0.152	**0.162**	**0.141**	**0.142**	**0.206**
	p	***	**	***	***	***	***
Approx. error CV (%)		36	26	27	34	36	56

Notes: NS=p>0.05; *=p≤0.05; **=p<0.01; ***=p≤0.001 (in bold)
CV=Coefficient of Variation (SD as % mean) for untransformed values (calculated from Equation 2)\

Table 6. Seasonal regression results for sulphate

		Station					
		Reference		Exposed			
		R7	**V1**	**V5**	**V8**	**X2**	**X14**
Years		2004-2009	2007-2009	1997-2009	1995-2009	1993-2009	1987-2009
No. values		69	31	141	177	197	389
No. outliers		2	1	1	0	2	1
Overall R^2		0.409	0.575	0.615	0.409	0.541	0.498
Seasonal R^2		0.366	0.554	0.594	0.348	0.470	0.395
Difference		0.042	0.021	0.020	0.061	0.071	0.103
antilog C	mg/L	8	8	95	96	16	124
Year (a_i)	F	0.86	0.42	0.54	1.17	1.70	**3.38**
	p	NS	NS	NS	NS	NS	***
Cos month	Slope (b_1)	**0.204**	**0.254**	**0.288**	**0.206**	**0.264**	**0.282**
	p	***	***	***	***	***	***
Sin month	Slope (b_2)	–0.017	–0.025	**0.099**	**0.088**	0.058	**0.157**
	p	NS	NS	***	***	**	***
Cos × Sin	Slope (b_3)	**0.268**	0.412	**0.216**	**0.194**	**0.170**	**0.244**
	p	***	**	***	***	***	***
Approx. CV (%)		69	71	53	72	59	87

Notes: NS=p>0.05; *=p≤0.05; **=p<0.01; ***=p≤0.001 (in bold)
CV=Coefficient of Variation (SD as % mean) for untransformed values (calculated from Equation 2)

Table 7. Seasonal regression results for zinc

		Station			
		V5	**V8**	**X2**	**X14**
Years		1997-2009	1995-2009	1987-2009	1987-2009
No. values		141	177	294	410
No. outliers		1	0	0	1
Overall R^2		0.307	0.241	0.314	0.280
Seasonal R^2		0.101	0.051	0.097	0.131
Difference		0.206	0.189	0.217	0.149
antilog C	mg/L	0.012	0.022	0.032	0.056
Year (a_i)	F	**3.09**	**2.80**	**3.84**	**2.96**
	p	*****	*****	*****	*****
Cos month	Slope (b_1)	–0.156	–0.073	**0.094**	**0.149**
	p	**	*	*****	*****
Sin month	Slope (b_2)	0.104	0.037	**0.141**	0.030
	p	*	NS	*****	NS
Cos × Sin	Slope (b_3)	–0.140	–0.132	–0.062	**–0.075**
	p	NS	*	NS	*****
Approx. CV (%)		143	99	111	98

Notes: NS=p>0.05; *=p≤0.05; **=p<0.01; ***=p≤0.001 (in bold)
CV=Coefficient of Variation (SD as % mean) for untransformed values (calculated from Equation 2)

Table 8. Trend correlations for Exposed stations

Variable	**Statistic**	**Station**			
		V5	**V8**	**X2**	**X14**
Calcium	No. years	13	15	17	17
	Trend r_s (medians)	–0.129	0.446	0.074	–0.194
Sulphate	No. years	13	15	17	23
	Trend r_s (medians)	–0.297	0.457	0.387	–0.564**
Zinc	No. years	13	15	23	23
	Trend r_s (medians)	–0.595*	–0.730**	0.326	–0.511*
	No. Sept values	16	18	25	40
	Trend r_s	–0.461	–0.723**	–0.193	**–0.728*** **

Notes: NS=p>0.05; *=p≤0.05; **=p<0.01; ***=p≤0.001 (in bold)

FIGURES

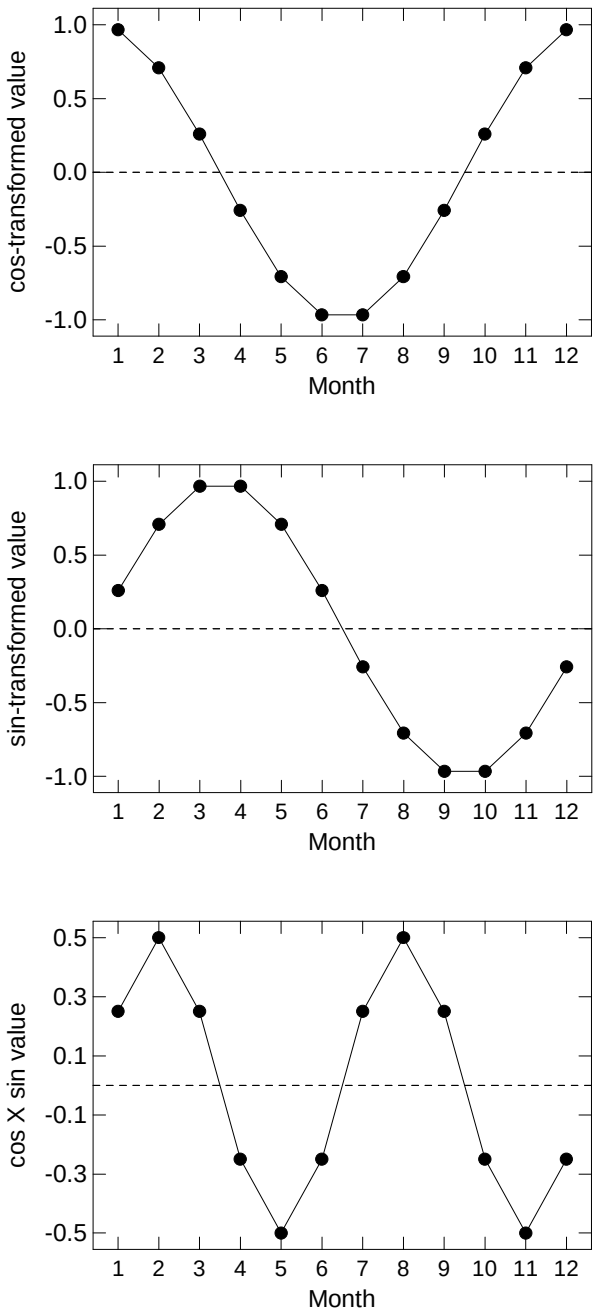


Figure 1. Cos- and sin-transformed month values

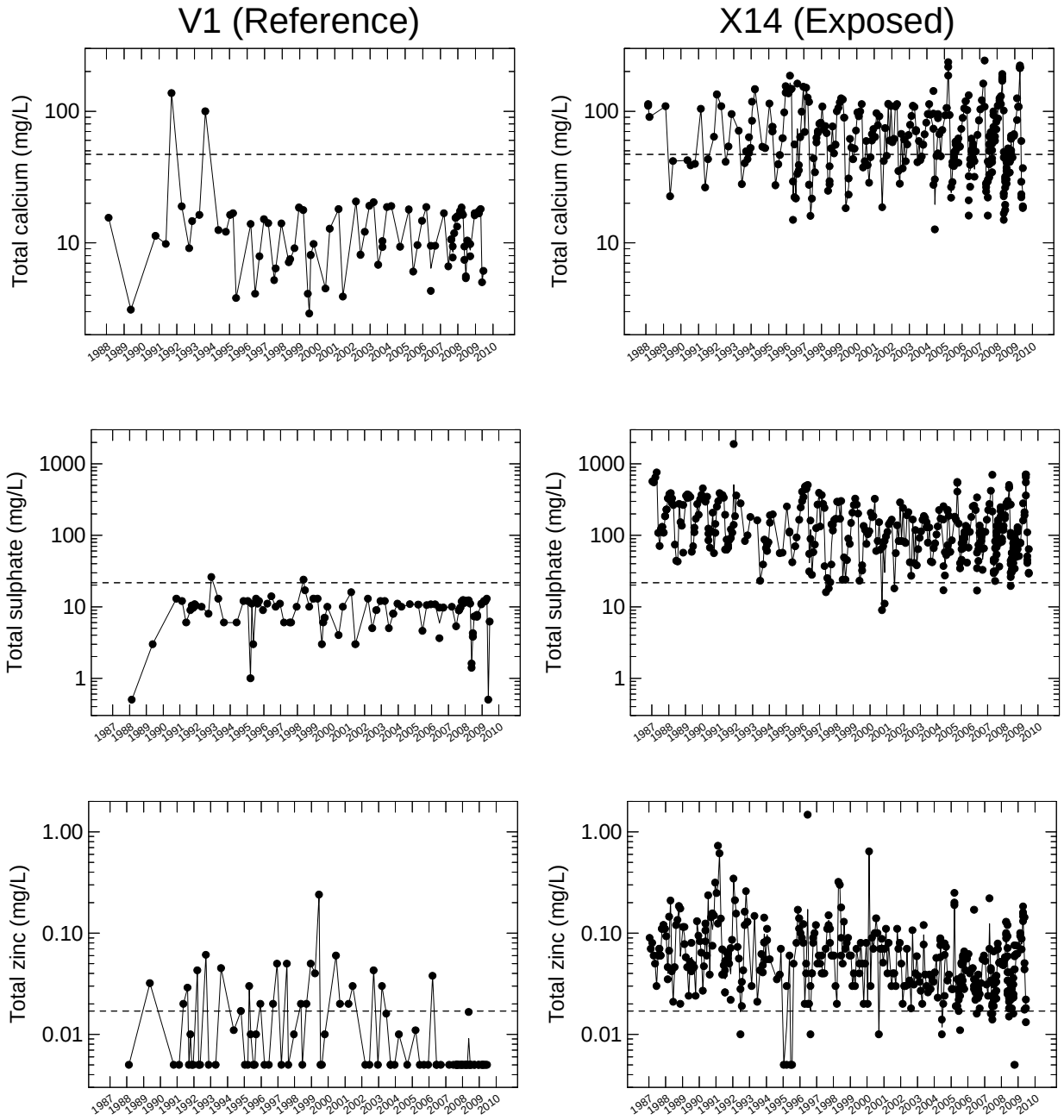


Figure 2. Time series for calcium, sulphate and zinc at Stations V1 and X14

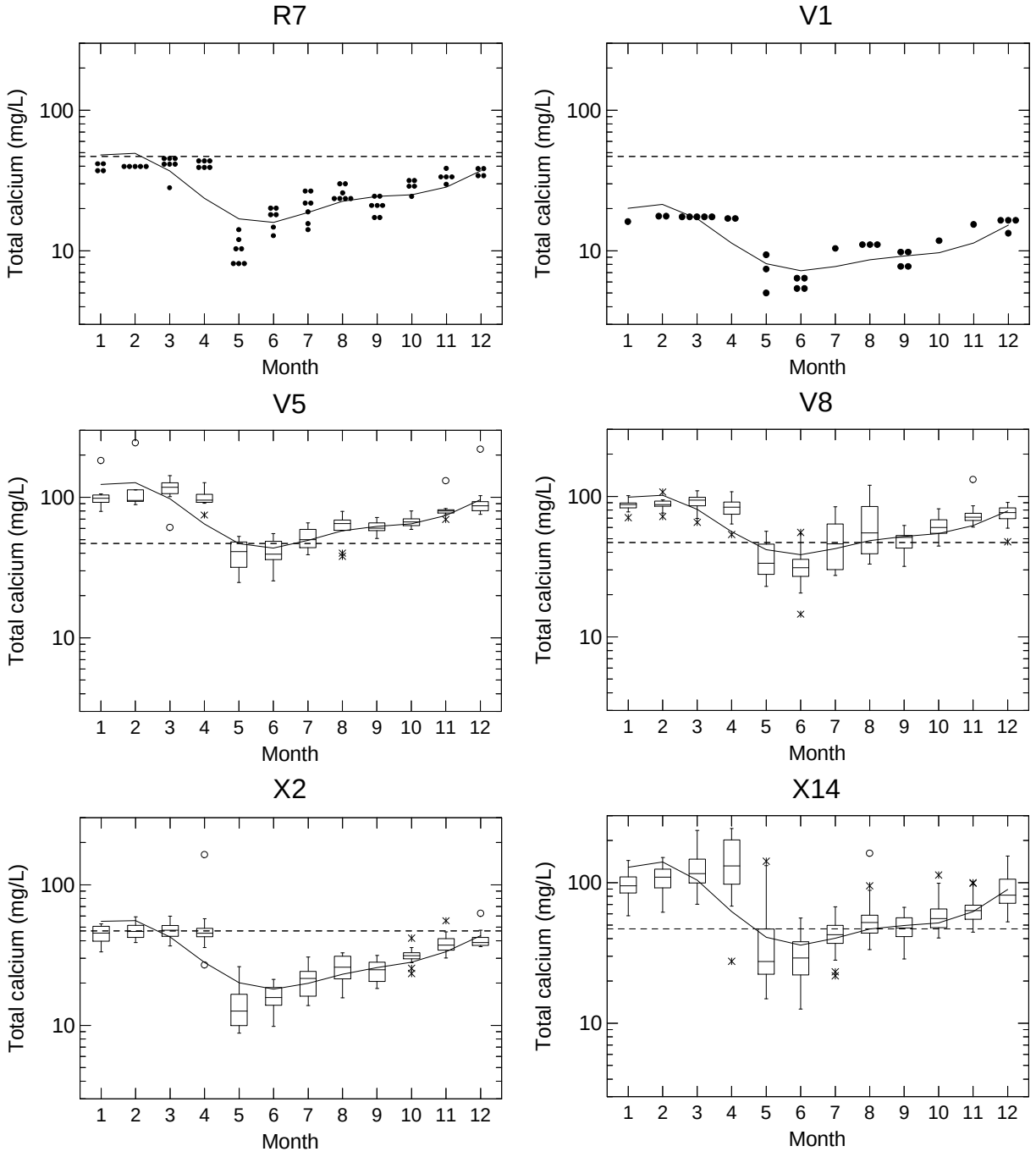


Figure 3. Distributions of calcium concentrations within months

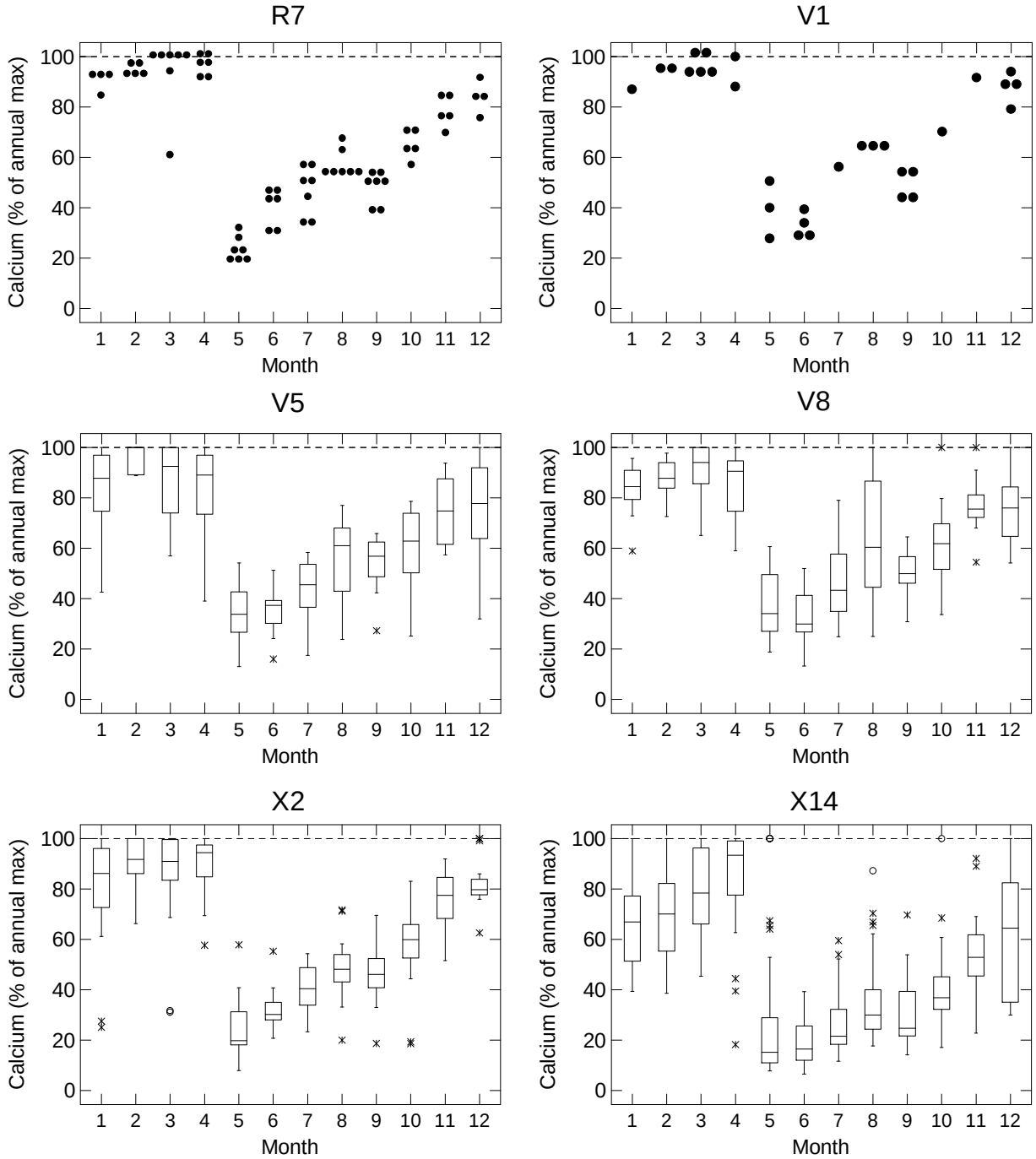


Figure 4. Distributions of calcium concentrations within months, standardized to annual maxima

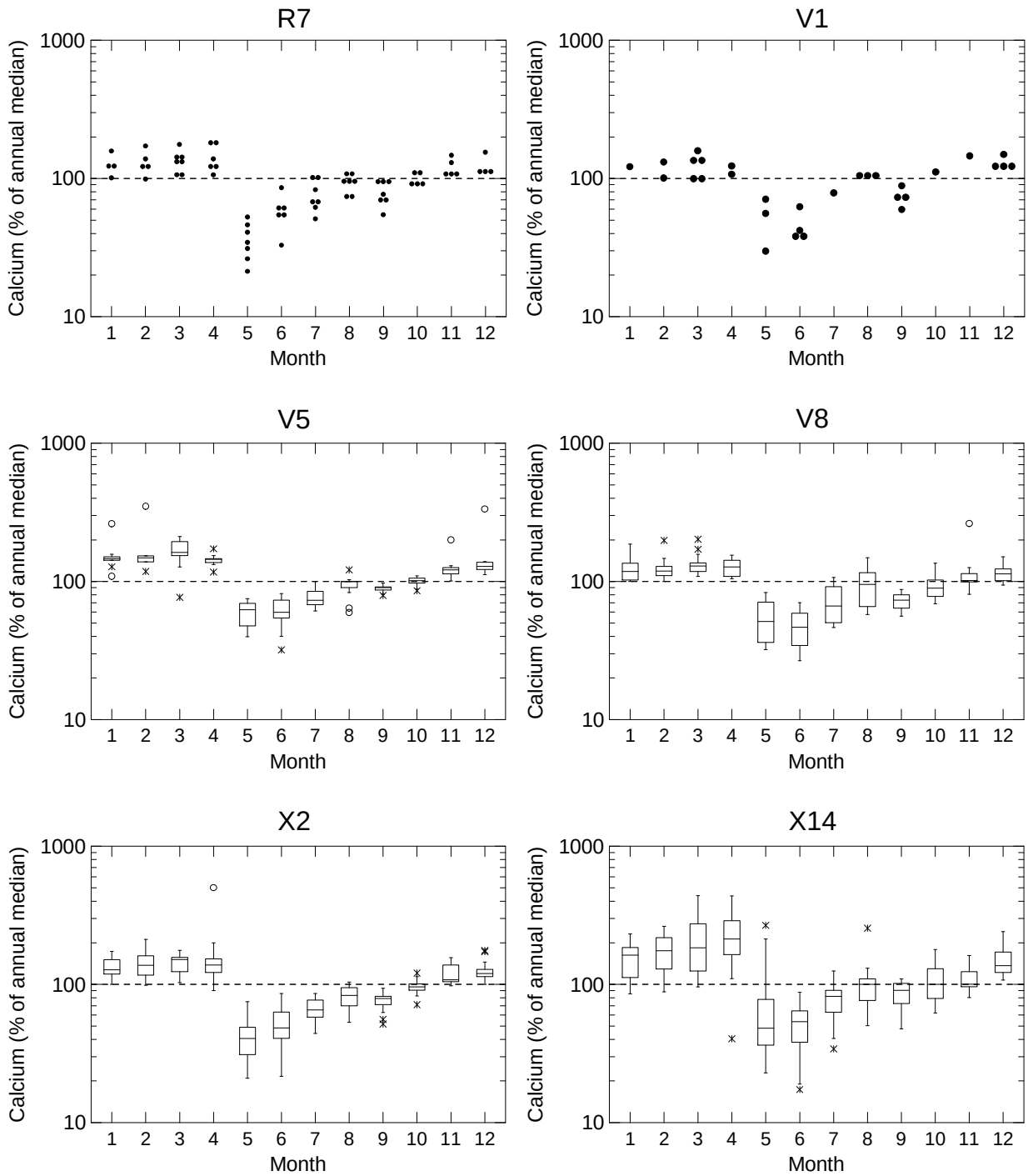


Figure 5. Distributions of calcium concentrations within months, standardized to annual medians

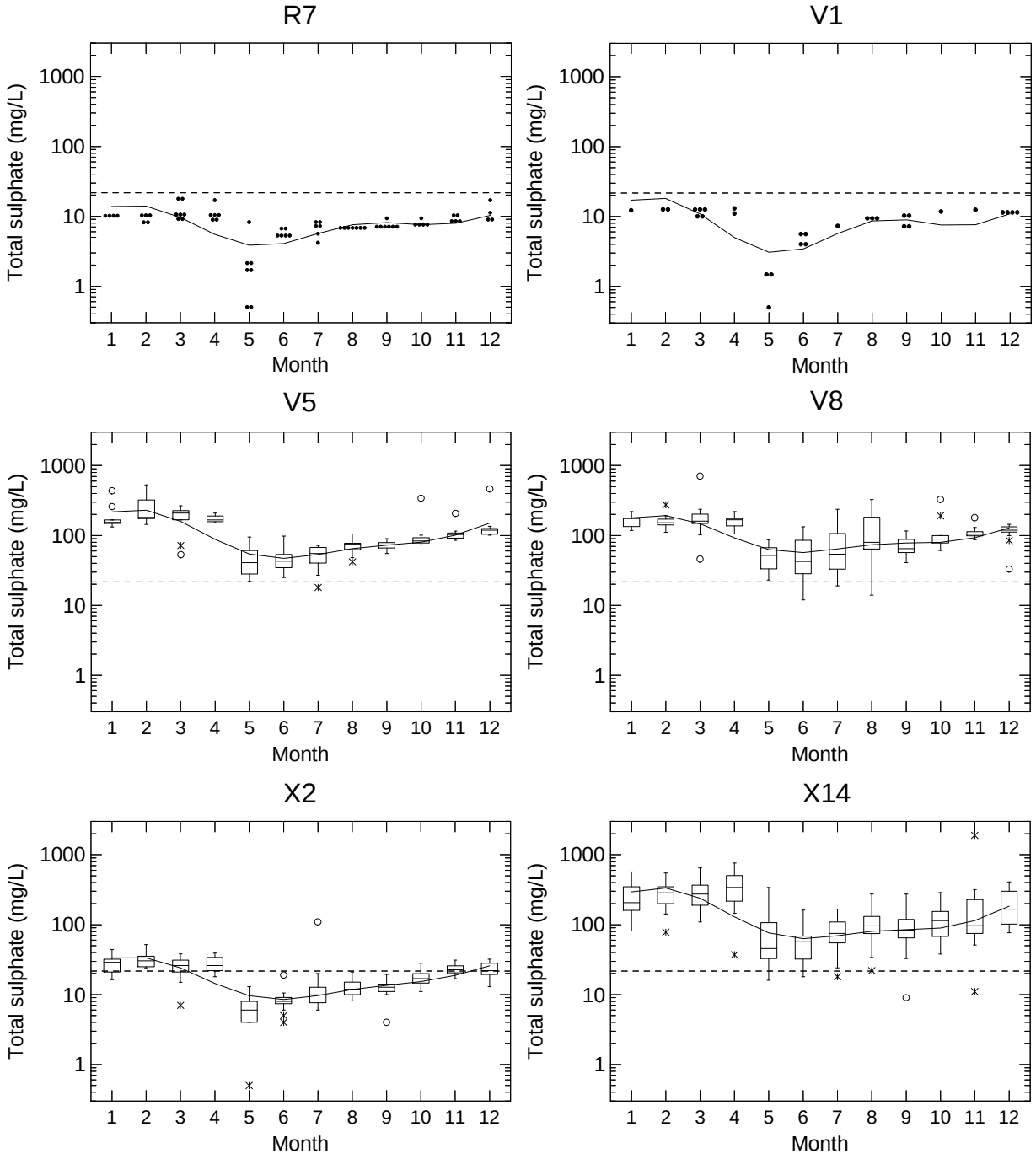


Figure 6. Distributions of sulphate concentrations within months

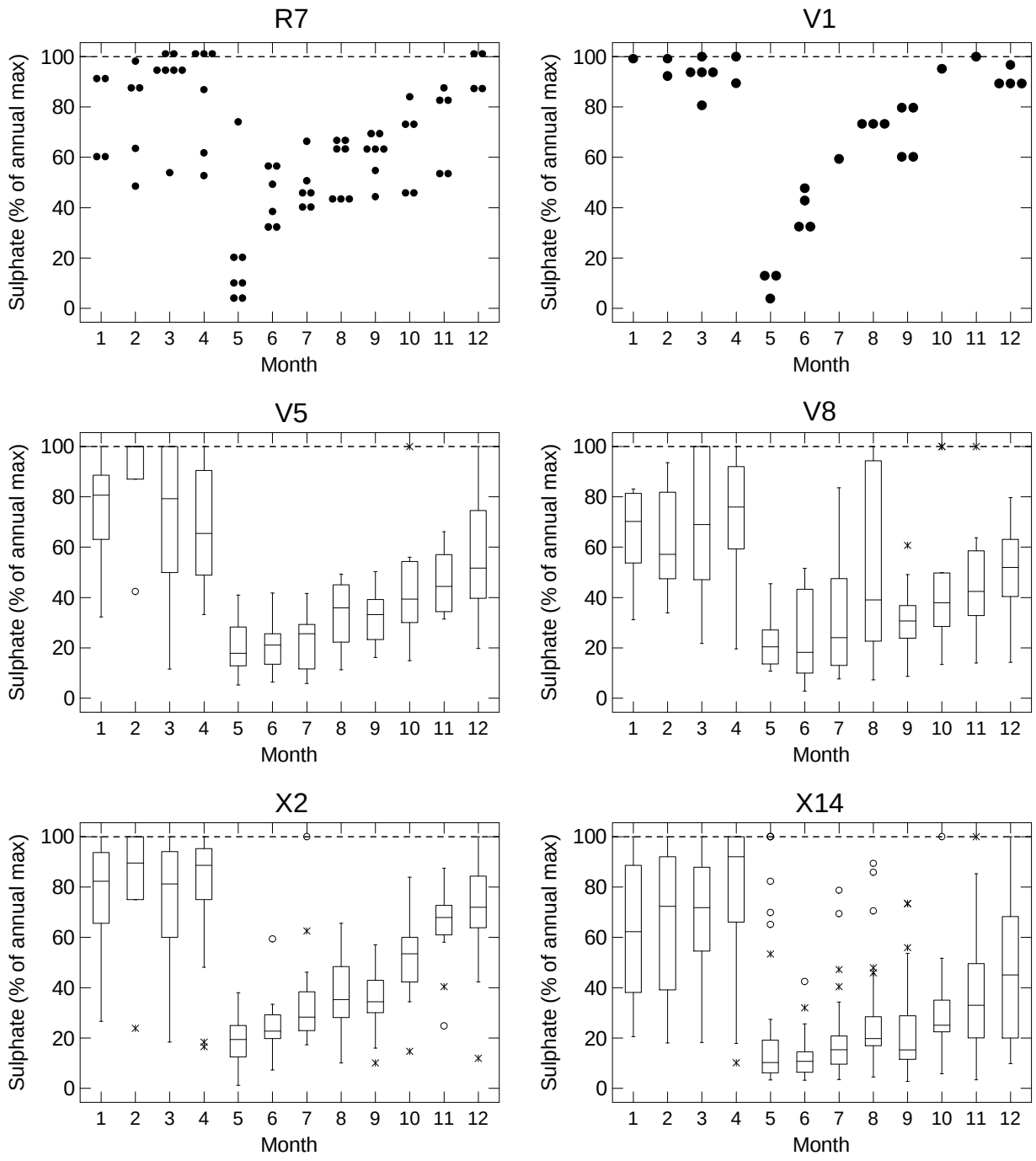


Figure 7. Distributions of sulphate concentrations within months, standardized to annual maxima

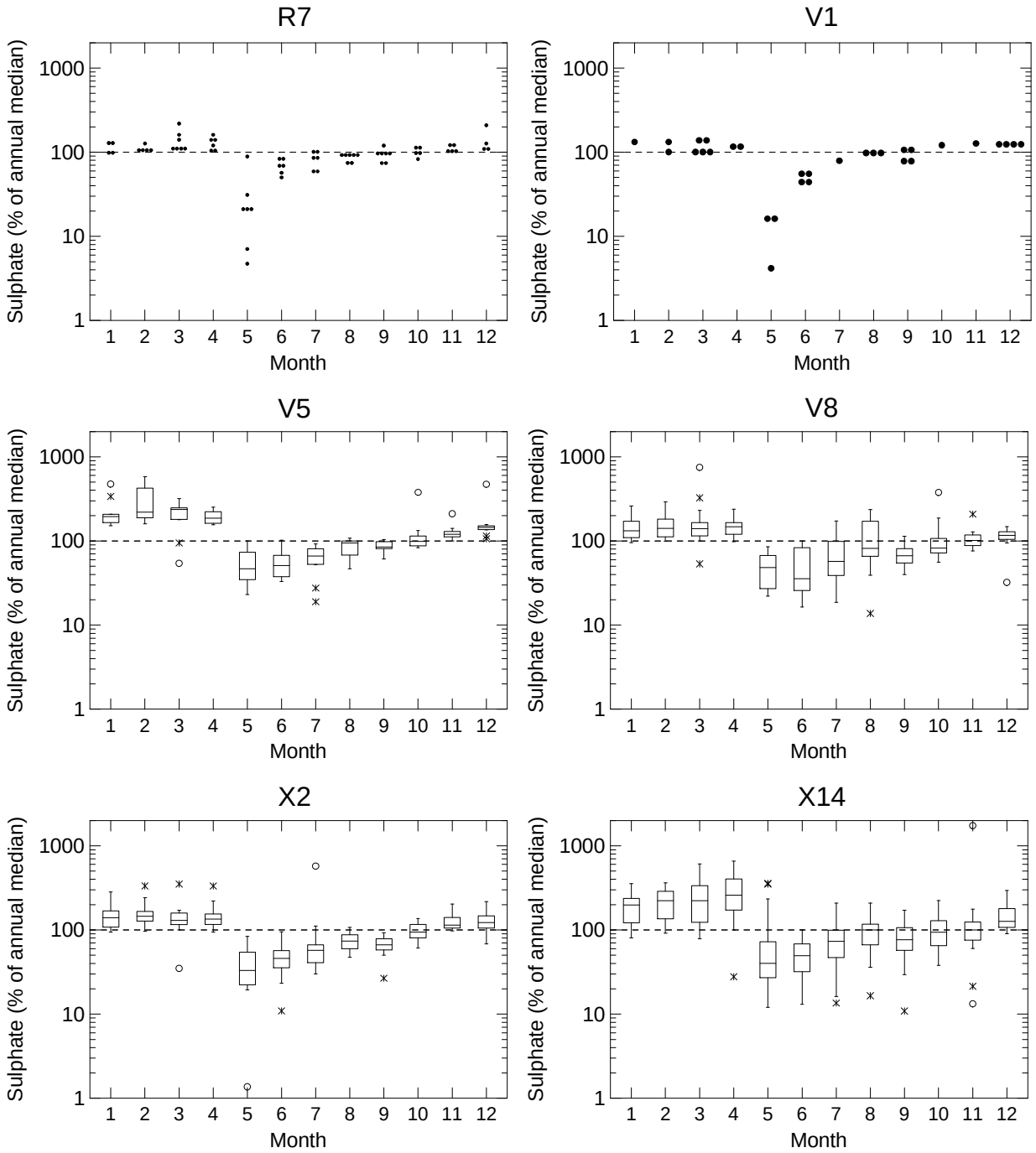


Figure 8. Distributions of sulphate concentrations within months, standardized to annual medians

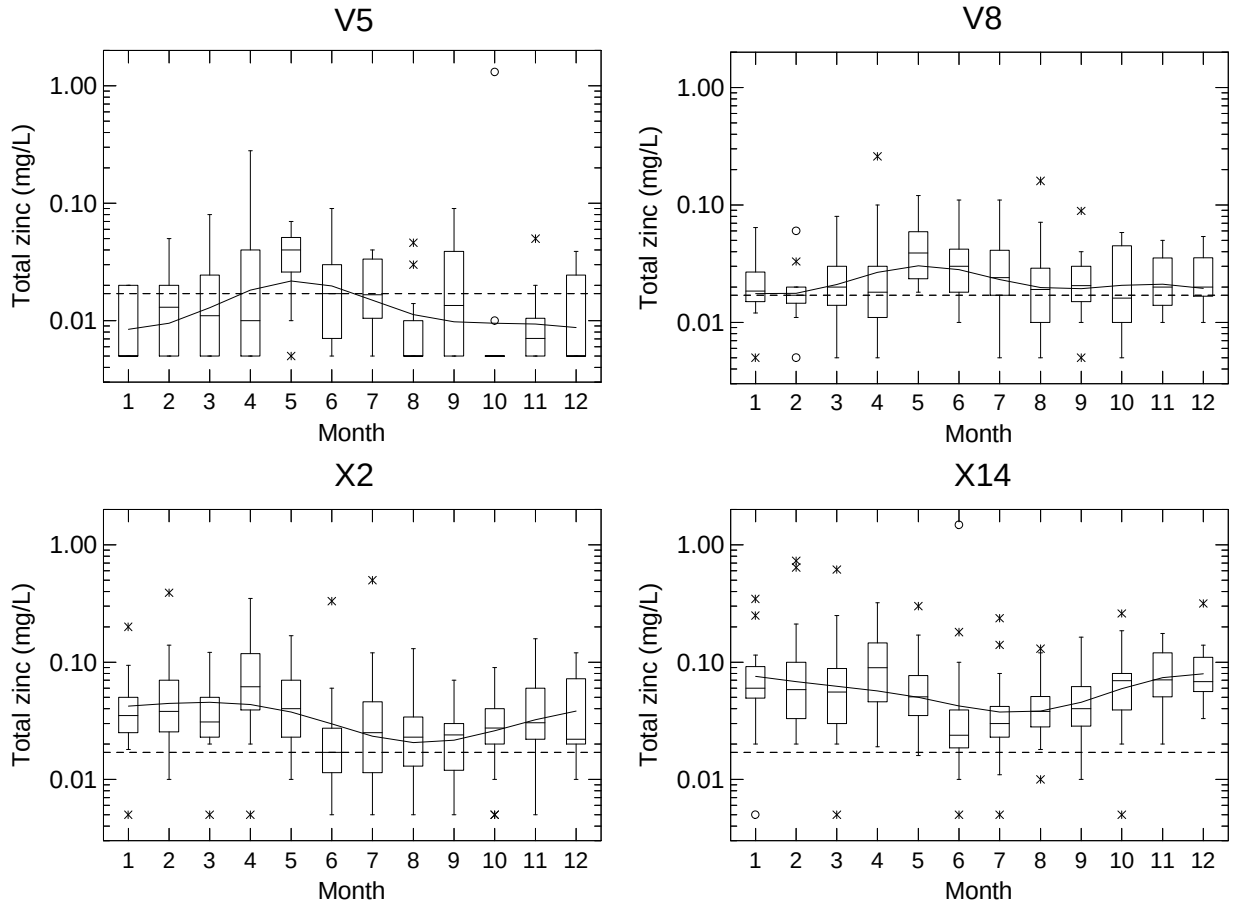


Figure 9. Distributions of zinc concentrations within months

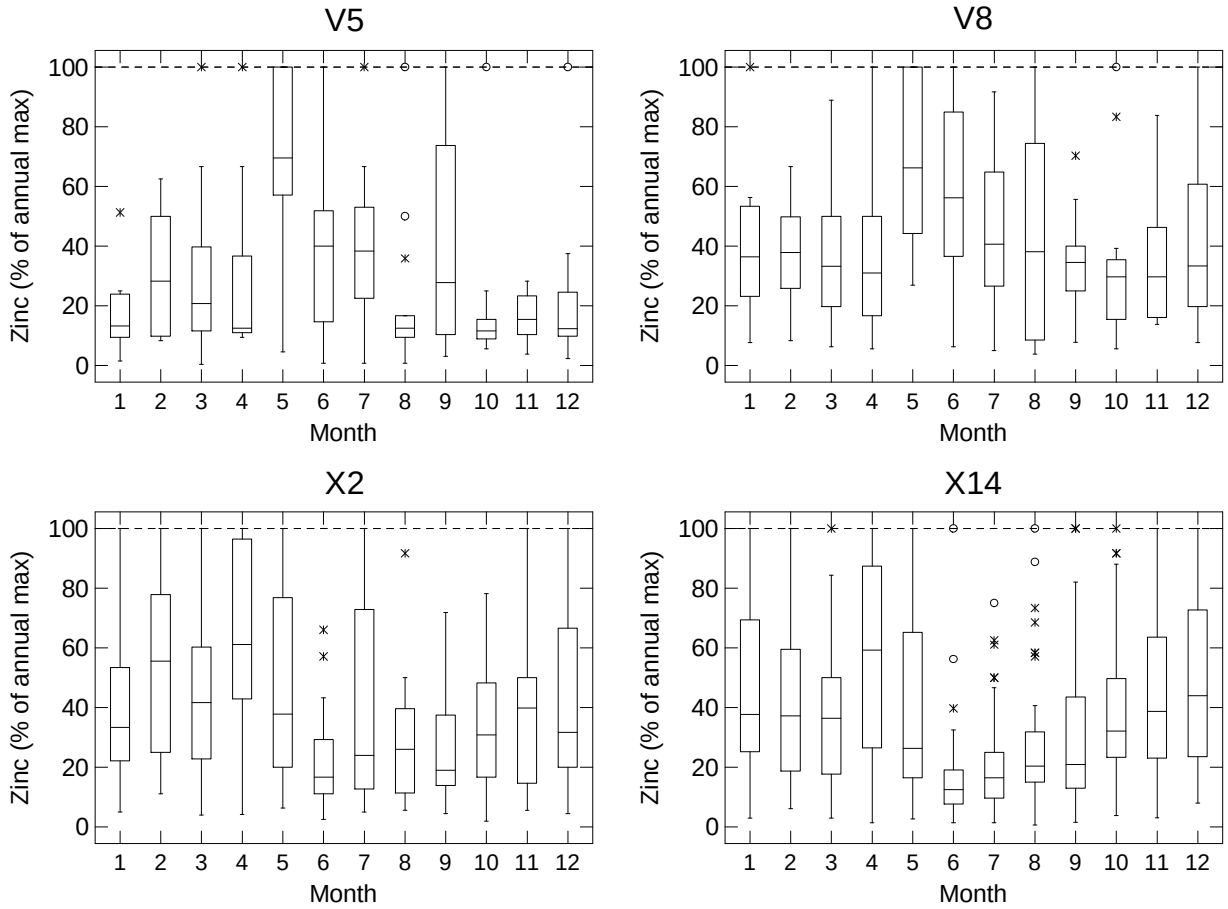


Figure 10. Distributions of zinc concentrations within months, standardized to annual maxima

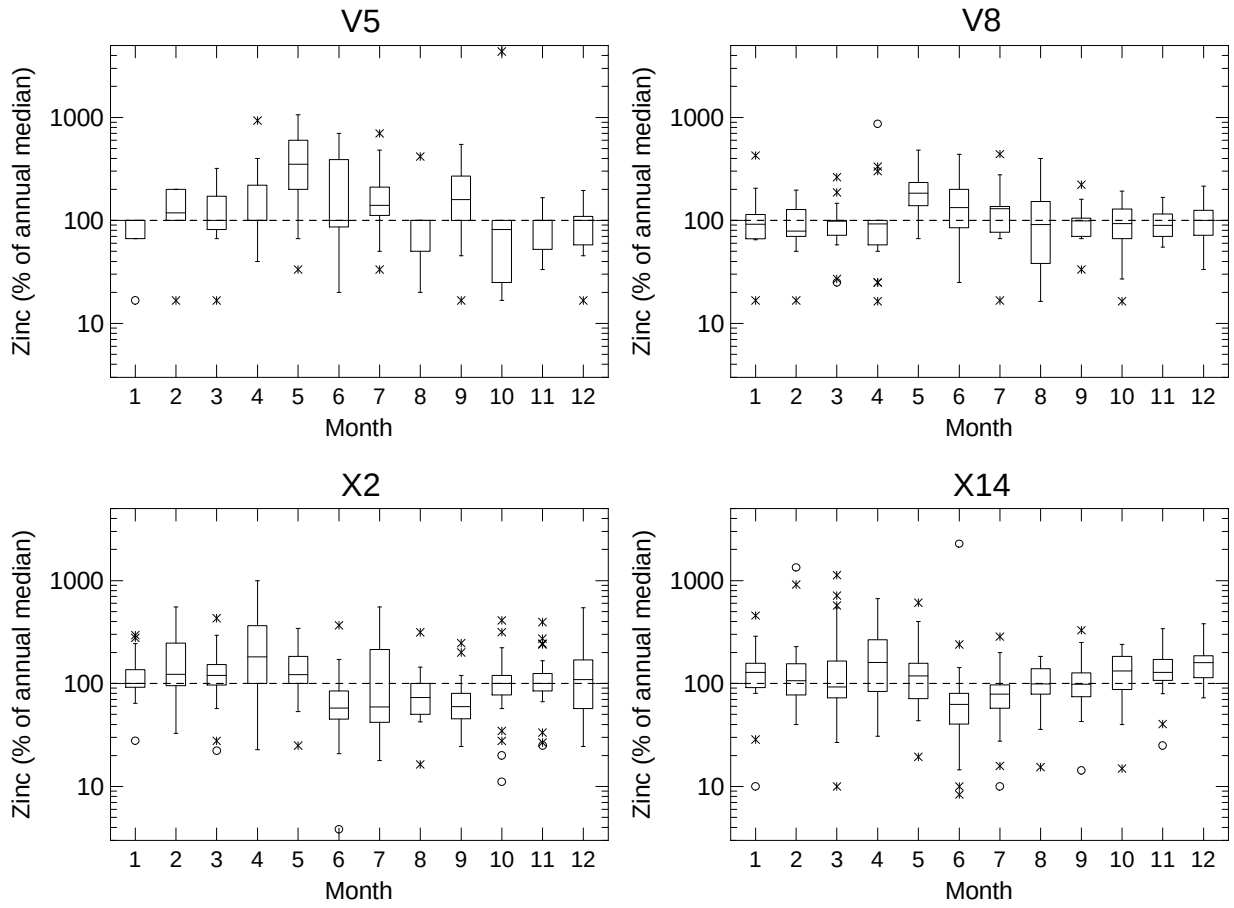


Figure 11. Distributions of zinc concentrations within months, standardized to annual medians

APPENDIX E

WMEC SURVEY
2009

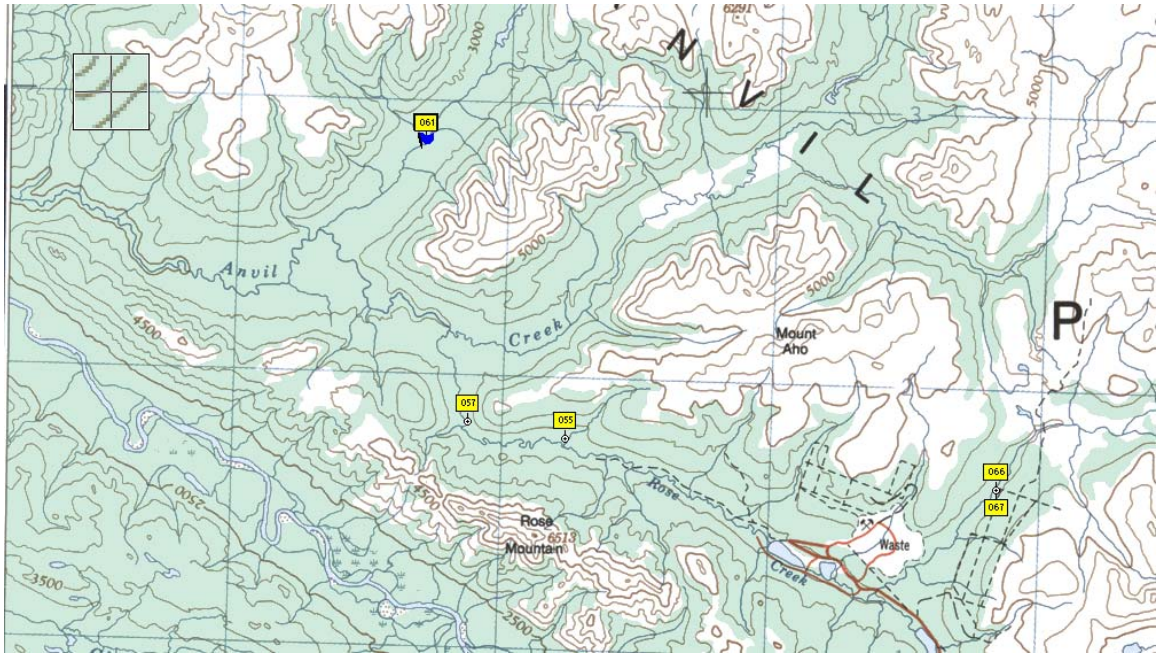
Summary of Findings

New site evaluations for Faro, Yukon conducted during August, 2009 by WMEC

Several new sites in the Faro area were assessed during August of 2009 for the potential to provide long term monitoring sites. The sites evaluated were all in areas unaffected by mine influence.

Two sites; one on the North Fork of Rose Creek and the other on a tributary to Anvil Creek downstream of the confluence with Rose Creek, were investigated for potential for monitoring fish, benthics and water. Tributaries to Rose Creek upstream of Anvil Creek were evaluated for potential for benthic invertebrate collection site.

The site on the tributary to Anvil Creek (way point 61, Figure 1) is approximately 5 km upstream of Anvil Creek. At the time of investigation an unusual upwelling of turbid water approximately half way down to Anvil from the sample site precluded sampling any lower on the creek. The site chosen is in an open meadow with buck brush and has a small tributary entering from the NW at the upstream end of the site. The creek has good flows with an average width of 4 meters and an average depth of 0.6 meters at low flow, velocities were below 1 m/sec in all areas. The site is comprised of a glide/pool/riffle/pool/glide sequence providing a wide variety of cover types and habitats. Substrates consist of boulders to gravels.



Map of the Faro area showing new sample locations, 2009. Site 61 is an unnamed tributary to Anvil Creek that was sampled as per the Aquatic monitoring protocols. Sites 66 and 67 on North Fork Rose Creek were sampled but had no fish during the sample period. Site 55 is a small creek with helicopter access on the opposite bank of Rose Creek. And site 57 has potential for extended slimy sculpin collections.

Summary of 2009 Results

During the summer of 2009 water levels were low for most of June and July when fish in the Faro area typically colonize upstream habits. Water levels rose again during August due to steady rainfalls. Fish utilization was affected at some of the sample locations. Site R1 had very few fish due to a lack of flow and cover. Site V8 also had similar low numbers of fish. Water levels were rising during the sampling period.

During mid August of 2009 a spawning pair of chinook salmon were observed building a redd and actively spawning in the Rose Creek Diversion Channel. The pair were observed at a location in the channel opposite and downstream of the cross valley damn. Investigation into the site during September showed evidence that the site had likely been used for spawning in previous years.