Tahera Diamond Corporation
P.O. Box 2341
Yellowknife, NT
X1A 2P4
Tel. (780) 644-9116
Fax (780) 644-9181

General Operational Monitoring Plan
Water Licence **2AM-JER0410**
Jericho Diamond Mine
Nunavut, Canada

Submitted to:

Nunavut Water Board

Gjoa Haven, NU

Submitted by:

Tahera Diamond Corporation
Jericho Diamond Mine
Nunavut

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EXECUTIVE SUMMARY

This general monitoring plan is an update of the plan submitted to Nunavut Water Board March 2005. The Plan fulfills the requirements of Jericho Water Licence **NWB1JER410** now **2AM-JER0410** Part L, Conditions Applying to General and Aquatic Effects Monitoring Plans, Section 1 which requires a general monitoring plan for the mine. The objective of the plan is to provide a framework for general environmental monitoring at Jericho; aquatic biota monitoring is discussed in detail in a companion document: Aquatic Effects Monitoring Plan. This plan update covers the operations phase of the Jericho Diamond Mine.

Site monitoring includes all areas of the mine where seepage occurs or where surface water is collected and treated; both quality and quantity are monitored. As well the amount of ore, wastes and overburden or till handled is tracked and reported monthly, as required by the Water Licence.

Receiving environment monitoring covered in this plan focuses on water chemistry. Control and potentially affected sites are monitored on a monthly basis; three sites not directly affected by mine operations are monitored annually. Controls include upstream and downstream and a separate drainage basin. Potentially affected sites are close to the discharge and some distance away from the discharge (nearfield and farfield). Since the mine has the potential to affect both federally controlled and Inuit lands, sampling occurs on both.

A total of 18 receiving water quality sites, including the water intake and Processed Kimberlite Containment Area (PKCA) discharge, are included in the surveillance network program; eight of these sites were included in the baseline water quality monitoring program which commenced in 1995. Up to 14 sampling locations are located on the Jericho Diamond Mine site exclusive of seeps. Thermistor strings have been installed on dams to monitor temperature changes in these facilities.

Triggers that will invoke adaptive management for the site would be significant changes in water chemistry of monitored water or significant changes in the thermal regime for dams and stockpiles. Exceedance of site specific water quality guidelines in the receiving environment or significant changes in aquatic biota noted from the aquatic effects monitoring program (discussed elsewhere) would also trigger adaptive management to improve mitigation and reduce concentrations of problematic water parameters where possible.

All data are stored electronically on the mine's EQWIN database software, and on paper. Reports are prepared as required by the Water Licence, both monthly or annually.

1.0 INTRODUCTION

The Jericho Diamond Project was developed by Tahera Diamond Corporation on behalf of its wholly owned subsidiary, Benachee Resources Inc. The mine site is located approximately 420 km north northeast of Yellowknife, NWT, in the West Kitikmeot region of Nunavut.

A copy of the recommendation to the Minister of DIAND for a Project Water Licence was received from Nunavut Water Board 22 December 2004 and sign off by the DIAND Minister 26 January 2005. A number of plans were developed under the terms of the Water Licence and the general monitoring plan is detailed in this document.

This general monitoring plan fulfills the requirements of Jericho Water Licence 2AM-JER410 Part L, Conditions Applying to General and Aquatic Effects Monitoring Plans, Section 1 which requires a monitoring plan for the mine as set out under Schedule L, Section 1. The following terms apply:

a. Updated operation monitoring plan which reflects the requirements of the licence.

2.0 OBJECTIVES AND SCOPE OF THE GENERAL MONITORING PLAN

2.1 Objectives

- To provide a framework for general environmental monitoring at the Jericho Diamond Mine Site and surrounding environment.

- To provide information on the extent of influence of mine operations on the water chemistry of site and receiving waters for the mine.

- To build on the water quality data base at the Jericho Diamond Mine.

- To allow feedback to the adaptive management plan which will be used to assess mitigation and management at the mine.

- To provide data to modify and improve mitigation where indicated.

2.2 Scope

The general monitoring plan covers site and receiving environment monitoring as set out in the Jericho Diamond Mine Water Licence. A separate plan was developed for aquatic effects monitoring and relevant parts of this plan are also included in the aquatic effects monitoring plan. This plan update covers the mining operations phase.

Closure monitoring (including temporary, indefinite and permanent shutdown) is discussed in the Closure and Reclamation Plan for the project and will be updated as required by the Water Licence in that plan.

3.0 OVERVIEW

3.1 Site Monitoring

The monitoring locations representing internal flows at the site (i.e. to the pit sump or PKCA) are intended to provide an early indication of how the systems are performing. This information will be used by the mine operator to make adaptive management decisions and projections of PKCA discharge water quality. All site monitoring is on a monthly basis.

3.1.1 Flows and Water Chemistry

Flows and water quality are monitored at key locations in the site water management system to anticipate any significant deviations from the conditions assumed in the current water and load balance that could indicate the need for management to ensure that the PKCA discharges continue to meet discharge criteria. The site monitoring program is complemented by monitoring of the waste rock, kimberlite, processed kimberlite solids, recovery plant rejects, monitoring of receiving water quality, and environmental effects monitoring. Details of those other programs are provided in the *Waste Rock Management Plans, Part 1 and 2* (SRK 2005, SRK 2006) and the *Aquatic Effects Monitoring Program* (Mainstream Aquatics 2004).

Key locations in the site water monitoring network are shown on Figure 2. These include:

- Temporary or permanent collection ditches or ponds A, B and C, which may be used as control structures to direct water to the pit sump or PKCA during operations
- The pit sump.
- The process plant supernatant.
- Treated sewage effluent.
- PKCA pond water.
- PKCA discharge water.
- Stream C3 during PKCA discharge for signs of erosion (periodically, as required).

Sampling of the PKCA inflows is on a monthly basis year round; supernatant samples are collected and provided by the diamond plant lab staff. The sewage treatment plant inlet and outlet is sampled weekly. The PKCA discharge is monitored on a weekly basis during the discharge period from June through September; flows are continuously monitored.

The methods for estimating flow vary. Any pumped flows are equipped with totalizer meters to record the total throughput of water occurring between sampling events. Piped flows directed by gravity are measured using bucket and stopwatch methods.

An annual seepage survey is completed along the down-gradient side of each of waste rock dump, ore stockpile, coarse PK stockpile, recovery plant stockpile and any sumps in the plant area to develop a better understanding of variations in source concentrations from different areas of site. This information is used to optimize the water management system. For example, seeps that meet discharge criteria may be managed separately from those that do not. Based on Ekati Diamond Mine™ seepage chemistry, this sampling will take place in July or August to coincide with maximum seepage concentrations. It should be noted that the provision of routine monitoring stations at each of the collection points ensures that seepage and runoff from the waste rock is monitored on a seasonal basis. Therefore an annual seepage survey is considered sufficient for characterizing variability in the source concentrations from different areas of the dumps and stockpiles.

3.1.2 Solids Geochemistry

Geochemical monitoring is carried out to confirm the geochemical properties of the waste rock, low-grade kimberlite ore, fine PK, coarse PK and recovery plant rejects.

Waste rock and low-grade kimberlite ore samples are collected as grab samples from the muck pile produced by blasting. Characterization of the waste rock includes:

- Sample collection every other week.
- Sample collection from each rock type present in the blast (i.e. granite/granodiorite, pegmatite, diabase, waste kimberlite).
- Geological description of the sample by a geologist or engineer, and general geological observations of the blasted rock, such as presence and composition of any xenoliths, occurrence of sulphide minerals etc.
- Testing of paste pH, reaction with HCl, and total sulphur on every sample. Full ABA analyses and ICP-metals performed on every 10th sample.
- Testing of a duplicate sample every 10th sample.

3.1.3 Ground Ice

During collection of the waste rock samples, blasted rock and freshly blasted rock faces are examined for presence of significant quantities of ground ice. If present, the quantity of ice will be estimated, and samples of the ice lenses will be collected and submitted for water quality analyses to characterize the quality of ice melt water that would report to the pit or waste rock dumps. The frequency of sampling would depend on the amount of ice encountered, and the water quality data from the first few samples. To date (2007) little ground ice has been encountered.

3.1.4 Thermal Monitoring

Two thermistors per dam have been installed in the frozen zone of each of the dams. Thermistor readings are collected on a monthly basis for a period of two years, or until a clear pattern has been established. Thereafter the reading frequency will be quarterly.

3.1.5 Site Surveys and Visual Inspections

Three pairs of survey hubs will be established on each of the dams to monitor dam movements should they occur.

During the active development of each of the mine components, site staff will carry out daily inspections of these facilities (PKCA, including dams, all collection ponds, water control dikes, waste rock dumps and stockpiles), including slope stability, seepage and conformity to the development footprint. When activity ceases on an interim or seasonal basis, the inspection frequency shifts to monthly. Following completion of a component, inspections will continue on a semi-annual basis to closure.

Formal semi-annual inspections are also carried out by site personnel, one of which is conducted by an independent professional geotechnical or civil engineer.

Stream C3 is inspected periodically as required during PKCA discharge to determine whether bank or bed erosion is occurring. Should erosion occur, pumping/discharge will cease and rock armouring will be placed at the erosion site prior to commencement of pumping/discharge.

The water management facilities which specifically include the collector ditches as well as various sumps are monitored by site staff on a daily basis during freshet, weekly during summer and fall and once during the winter.

3.1.6 Stream Flows

An automated water level recorder equipped with a radio link is installed near the outlet to Lake C3 prior to mine start up. Appendix B contains information on the equipment that is used for this application. The recorder is fitted with a radio link to the environment office where data can be monitored in real time if required. The water level recorder is operated whenever PKCA discharge is occurring. A minimum of three (3) benchmarks were established on bedrock near the site to allow lake levels to be periodically surveyed in order to calibrate actual lake levels with the recorder's readings. A suitable location was selected in the C3 outlet stream (Jericho River) to measure stream discharge. The stage discharge curve developed as part of baseline studies and reported in the Jericho Final EIS was upgraded with additional information to improve the relationship between lake water level and lake outlet discharge. This relationship, coupled with continuous monitoring of lake levels when the Jericho River is flowing from Lake C3 (summer only as the River freezes completely in winter) is used to determine Lake C3 discharge.

In order to provide data for operation of the Stream C1 diversion, this stream is also gauged at the transition pool 2 (Figure 3) by means of a continuous height recorder (pressure transducer).

Stream C3 divides into a number of channels 100 to 300 m above Lake C3 (up to 10 depending on discharge levels) and is therefore problematic to measure discharge. Spot readings in the channels are obtained periodically throughout the open water season.

3.1.7 Receiving Environment Water Quality Monitoring

The objective of the water quality monitoring program is to the detect changes in water chemistry caused by mining activities. Discharges from the PKCA are predicted to be above CCME Aquatic Life Guidelines and for most parameters above background concentrations in the receiving environment. Appendix A lists sample bottles, preservatives, holding times and analyses for water chemistry. The discharge criteria for the PKCA and site-specific water quality criteria developed for Jericho can be found in Appendix C. Fallout of suspended particulate from blasting could increase ammonia and suspended particulate concentrations in water bodies within the mine site as well.

Monitoring stations were established (a) at two control sites one within the Jericho River drainage basin and one in a separate basin), (b) near to the discharge location for PKCA and (d) in lakes on and adjacent to the mine site and (e) in lakes within the Jericho River at some distance from the mine.

During summer, water is collected 1.0 m below the surface in lakes with a Van Dorn sampler and below the surface in streams, uncapping and allowing bottles to fill, recapping and then resurfacing. Raw water sample bottles are rinsed three times; other sample bottles are not rinsed.

During periods of ice cover (i.e., the April and December sampling periods), holes are drilled through the ice cover by a gas powered ice auger for the collection of surface grab water samples. Samples will be collected approximately 1.0 m below the water surface exposed in the holes with a Van Dorn sampler. Rinsing of sample containers with in-situ water is impractical due to the cold weather; consequently, laboratory prepared sample containers are used.

Dissolved metal samples are not field filtered but sent to the analysis laboratory for filtering through a 0.45 µm nullepore filter. Total metals samples are preserved with AA grade nitric acid. Total organic carbon samples are preserved with AA grade sulphuric acid. A 2-L sample of raw water is not preserved. All samples are kept cool during storage and air transported to the analytical laboratory.

Schedule 1 lists the monitoring stations and the frequency of monitoring. Detection limits to be used in laboratory analyses are listed in Table 3-1.

Table 3-1: Water Sample Laboratory Detection Limits

Water Quality Parameter	Detection Limits (mg/L or parameter units)	Water Quality Parameter	Detection Limits (mg/L or parameter units)
Physical Tests		**Total & Dissolved Metals**	
Conductivity (umhos/cm)	2	Cobalt (Co)	0.0001
Hardness $CaCO_3$	0.05	Copper (Cu)	0.0001
pH	0.01	Iron (Fe)	0.03
Total Suspended Solids	3	Lead (Pb)	0.00005
Total Dissolved Solids	3	Lithium (Li)	0.001
Dissolved Anions		Magnesium (Mg)	0.05
Alkalinity-Total, bicarbonate $CaCO_3$	1	Manganese (Mn)	0.00005
Chloride Cl	0.5	Mercury (Hg)	0.00005
Sulphate SO_4	1	Molybdenum (Mo)	0.00005
Nutrients		Nickel (Ni)	0.0001
Nitrate (NO_3)	0.005	Phosphorus (P)	0.3
Nitrite (NO_2)	0.002	Potassium (K)	2
Ammonia (NH_3)	0.005	Selenium (Se)	0.001
Total Dissolved Phosphorus	0.001	Silicon (Si)	0.05
Total Phosphorus	0.001	Silver (Ag)	0.00001
Total & Dissolved Metals		Sodium (Na)	2
Aluminum (Al)	0.001	Strontium (Sr)	0.0001
Antimony (Sb)	0.00005	Thallium (Tl)	0.00005
Arsenic (As)	0.0001	Tin (Sn)	0.0001
Barium (Ba)	0.00005	Titanium (Ti)	0.01
Beryllium (Be)	0.0005	Uranium (U)	0.001
Bismuth (Bi)	0.0005	Vanadium (Va)	0.001
Boron (B)	0.001	Zinc (Zn)	0.001
Cadmium (Cd)	0.00005	**Organic Parameters**	
Calcium (Ca)	0.05	Total Organic Carbon (TOC)	0.01
Chromium (Cr)	0.0005	Total Inorganic Carbon (TIC)	0.01

Parameters that will be measured in the field for each station are listed in Table 3-2.

Table 3-2: Field Water Quality Monitoring Parameters

Sampler's name	Field pH
Station number	Water temperature
Single or replicate sample	Dissolved oxygen (where appropriate)
Conductivity	Oxidation Reduction Potential (where appropriate)
Date and time	Water transparency (secci disk) (where appropriate)
Type and number of bottles filled	Any other field measurements, e.g. weather
Sample depth (for depth profiles)	

General water parameters (pH, dissolved anions, nutrients) are analyzed in accordance with procedures described in "Methods for Chemical Analysis of Water and Wastes" (United States Environmental Protection Agency), "Manual for the Chemical Analysis of Water, Wastewaters, Sediments and Biological Tissues" (British Columbia Ministry of the Environment), and/or "Standard Methods for the Examination of Water and Wastewater" (21st Ed. 2005; American Public Health Association).

Total and dissolved metals and organic parameter samples are analyzed in accordance with procedures described in "Standard Methods for the Examination of Water and Wastewater", 21st Edition (American Public Health Association, 2005). Metals analysis is by Inductively Coupled Plasma-Mass Spectrophotometry (ICP-MS). Organic parameters are analyzed using a gas chromatograph - flame ionization detector (GC/FID). Mercury will be analyzed by cold vapour AA.

3.1.8 Receiving Environment Sediment Sampling

The General Monitoring Plan deals with lake bottom sediment collection for chemistry. Measurement of suspended sediment accumulation is discussed in the Aquatic Effects Monitoring Plan.

Sediment samples are collected with a stainless steel Ekman grab sampler and processed with a Teflon coated spoon. Samples are taken from the top 10 cm of the dredgate from the central part of the grab. The Ekman grab sampler and sampling spoon are thoroughly washed with sample station lake water prior to collecting the sample. Sediment samples are placed either in clean plastic bags. Sample information is marked on the outside of the bag with a waterproof ink marker. Only new bags are used to store samples.

Sediment samples are collected at a subset of the water chemistry stations:

WQ-04	Lake C3
WQ-06	Carat Lake
WQ-08	Jericho Lake
WQ-09	Jericho River
WQ-10	Control Lake
WQ-11	Cigar Lake
WQ-13	Lake C1

Replicate sediment samples at each site are collected by sequentially dropping a stainless steel Ekman dredge to the bottom at the sediment sample location and having the replicates analyzed separately. This provides a measure of the inherent microspacial variability of benthic sediments. It also ensures that outliers are manifested. Five replicates are collected at each site.

3.2 Monitoring Activities and Schedules

1. Pursuant to Water Licence Part E, Conditions Applying to Water Use, Section 1, a totalizing meter was installed at the water intake line at Carat Lake and a log of water use kept for inspection at the Jericho Diamond Mine.

2. Pursuant to Water Licence Schedule L, Conditions Applying to General and Aquatic Effects Monitoring Plans, Section 4dvii, the level of Carat Lake is monitored at the water intake.

3. Pursuant to Water Licence Part F, Conditions Applying to Water Management, Section 4c, a minimum of weekly inspection of water management structures is carried out during the open water period. Inspection reports are filed with the Mine Manager after each inspection and reports maintained for review by a Nunavut Water Board Inspector upon request.

4. Pursuant to Water Licence Part G, Conditions Applying to Waste Management, Section 1, totalizing meters are installed on:

    a. the main tailings discharge line from the diamond processing plant;
    b. the discharge line from the sewage treatment plant;
    c. the final discharge line from the PKCA;
    d. any other internal pumped discharge lines that may from time to time be required as part of liquid waste management.

    Logs of discharges are kept for inspection at the Jericho Diamond Mine.

5. Pursuant to Water Licence Part G, Section 2d, a minimum of weekly inspection of waste management structures is carried out throughout the mining operation period. Inspection reports are filed with the Mine Manager after each inspection and reports maintained for review by a Nunavut Water Board Inspector upon request.

6. Pursuant to Water Licence Part G, Section 3, a minimum of weekly inspection of earthworks, retention structures, dams and diversion structures, stockpiles, dumps, berms and pit slopes is carried out throughout the mining operation period. Inspection reports are filed with the Mine Manager after each inspection and reports maintained for review by a Nunavut Water Board Inspector upon request.

7. Pursuant to Water Licence Part G, Sections 6a, 6b, 7a and 7b all discharges from the PKCA to Stream C3 at monitoring station JER-WQ2 are analyzed for the parameters listed in Schedule 1. With discharge from the waste water treatment plant to the PKCA the following additional parameters are monitored:

    a. Biochemical Oxygen Demand
    b. Oil and Grease
    c. Faecal Coliforms

Acute toxicity is also monitored before discharge and monthly thereafter using rainbow trout and *Daphnia magna* according to Environmental Protection Series Biological Test Method EPS/1/RM/13 and EPS/1/RM/14, respectively.

8. Pursuant to Water Licence Part H, Conditions Applying to Waste Management Plans, Section 4 during the first year of operation, recovery plant rejects (coarse PK) were collected once every two weeks. Samples were submitted for testing of paste pH, reactivity with HCl, and total sulphur. Full ABA analyses, ICP-metals and uranium analyses was performed on every 10th sample. At the end of the sampling period an analysis report will be prepared and submitted as an addendum to the Waste Rock Management Plan.

9. Pursuant to Water Licence Part K, Conditions Applying to General and Aquatic Effects Monitoring, Section 2, a continuous water height recorder was installed in Lake C3 near its outlet in May 2006. The recorder was fitted with a radio link to the environment office where data can be monitored in real time if required. The water height recorder is operated throughout the open water season. A minimum of three (3) benchmarks were established on bedrock to allow lake levels to be periodically surveyed in order to calibrate actual lake levels with the recorders readings. A suitable location was selected in the C3 outlet stream (Jericho River) to measure stream discharge. The stage discharge curve developed for the Final EIS was upgraded with additional information to allow a relationship between lake water level and lake outlet discharge to be determined. This relationship, coupled with continuous monitoring of lake levels when the Jericho River is flowing from Lake C3 (summer only as the River freezes completely in winter) is used to determine Lake C3 discharge.

10. Pursuant to Water Licence Part K, Section 4, water quality monitoring is conducted according to the schedules set out in Schedule 1.

11. Pursuant to Water Licence Part K, Section 12, flows is measured as per Schedule 1. In addition to flows listed in Schedule 1:

    a. The volume of PKCA reclaim water is monitored when water is being reclaimed.
    b. The weight of solids in tonnes and volume of liquid fractions in m^3 of each waste pumped to the PKCA.
    c. The volume of sewage sludge removed from the Waste Water Treatment Plant.

12. Pursuant to Water Licence Part K, Section 13, the following quantities produced or stockpiled are monitored and recorded on a monthly basis:
    a. processed ore;
    b. waste rock;
    c. coarse PK;
    d. till and overburden.

13. Pursuant to Water Licence Part L, Conditions Applying to General and Aquatic Effects Monitoring Plans, Section 9, an annual seepage survey is conducted during summer months. A report is submitted to NWB within 60 days of completion of the survey.

14. Pursuant to Water Licence Schedule L, Conditions Applying to General and Aquatic Effects Monitoring Plans, Section 1c, the conditions of Stream C3 channel are monitored during PKCA release as well as water levels and discharges near the mouth.

15. Pursuant to Water Licence Schedule L, Section 4 d iv, chronic toxicity tests are conducted on water collected at the edge of the mixing zone in Lake C3 during the open water season when PKCA discharge is occurring. Environment Canada Biological Test Method EPS /1/RM/21 (1992) is used.

3.3 Monitoring Summary

3.3.1 Site Water, Ore and Waste

Specific locations at each facility have been to be field fit. The following sites are monitored:

- SW-1: sewage treatment plant discharge
- SW-2: open pit sump
- SW-3: process plant supernatant
- SW-4: downstream of divider dyke
- SW-8: East sump
- SW-9: rock dump 1 seepage (annual)
- SW10: rock dump 2 seepage (annual)
- SW11: coarse PK stockpile (no seepage to 2007)
- SW12: ore stockpile (no seepage to 2007)
- SW13: low grade ore stockpile (no seepage to 2007)
- SW14: recovery plant rejects (no seepage to 2007).

A seepage survey monitors all seepages from waste and water management structures on the site annually in the summer.

Quantities of ore, waste and till/overburden generated during mining are recorded.

The following volumes are monitored:

- Daily intake water volume at the main intake in Carat Lake.
- Volume of water from runoff collection ponds.
- Volume of water reclaimed from the PKCA when water recycling occurs.
- Daily volume of water discharged from the PKCA.
- Daily volume of mine water and seepage pumped from the open pit, ponds and other site water management facilities. (Note: operationally it may not be possible to separate runoff and mine water collected in site water management facilities.)
- Daily volume of treated sewage effluent discharged from the Waste Water Treatment Plant.
- The volume of sewage sludge removed from the Waste Water Treatment Plant.
- The weight of solids and volume of liquids pumped to the PKCA from the diamond processing plant.

3.3.2 Receiving Environment Water Quality and Quantity

All receiving environment water quality and flow monitoring is listed in Schedule 1.

Lake levels are monitored continuously at the Carat Lake water intake and Lake C3 outlet (open water only) by means of water level recorders.

The following flows are monitored:

- Stream C3 near its mouth during PKCA discharge.
- Jericho River at the outlet of Lake C3 during periods of flow (spring-summer-fall).
- Stream C1 at pond 2 (lower energy dissipation pool).

Acute toxicity tests using rainbow trout and *Daphnia magna* are conducted monthly on PKCA discharge. Chronic toxicity testing is conducted on *Ceriodaphnia dubia* monthly during the open water season from water collected at the edge of the 200 m mixing zone in Lake C3.

Figure 4 is a flow sheet of monitoring requirements at Jericho. Table 3-3 lists the NAD 27, Zone 12 UTM coordinates for water chemistry sample sites.

Table 3-3: Water Chemistry Monitoring Station UTMs

Stn	Description	UTM Coordinates
C1 Hydro	C1 Channel staff Gauge 486.135 at 1m on staff Gauge	12 W 477988 7319589
CAMP		12 W 477326 7318748
WQ01	Freshwater intake	12 W 478170 7320220
WQ02	PKCA discharge	12 W 476086 7318652
WQ03	Stream C3 above mouth	12 W 475253 7319227
WQ04	Lake C3 south basin	12 W 474856 7319664
WQ05	Lake C3 outlet	12 W 475173 7320577
WQ06	Carat Lake centre basin	12 W 477456 7320636
WQ07	Carat Lake outlet	12 W 478071 7321390
WQ08	Jericho Lake north basin	12 W 478626 7323712
WQ09	Jericho River downstream	12 W 478547 7324466
WQ10	Control Lake	12 W 473685 7318692
WQ11	Cigar Lake	12 W 469655 7320300
WQ12	Stream C1 above mouth	12 W 478468 7319843
WQ13	Lake C1	12 W 477614 7319366
WQ14	Lake C4	12 W 479261 7320239
WQ15	Stream C4 above mouth	12 W 479916 7319009
WQ16	Lynne Lake	12 W 478864 7318711
WQ17	Key Lake	12 W 478051 7318235
WQ18	Ash Lake	12 W 478051 7318235
WQ19	Stream C1 outlet in Carat Lake	12 W 478270 7320080
WQ20	Stream C3 outlet in Lake C3	12 W 475020 7319280

Schedule 2 lists analysis methods, detection limits, volume of sample required, type of preservation and type of container required for water chemistry. Schedule 3 lists maximum holding times for water chemistry samples. Schedule 4 is a field check list for water chemistry.

Appendix D contains a copy of the current (2007) chain of custody forms.

Appendix E contains standard operating procedures for:

- field water quality sample collection
- processed kimberlite sampling
- rock sampling for geochemical testing
- stream discharge measurements

4.0 REPORTING AND DATA ANALYSIS

4.1 Data Analysis

All raw abiotic and biotic data collected as part of the monitoring plan are stored in an EQWIN database. The determination of an effect, whether that be abiotic or biotic, will be identified through a rigorous data analysis exercise. Initially, the analysis of the data will focus on a geographic comparison between upstream distant controls, proximal stations and distal downstream locations. Eventually as data is accumulated, temporal trends will be evaluated and comparisons with baseline data will become important.

The monitoring program is designed for comparison among sampling stations, rather than water bodies or watersheds. Monitoring of the abiotic environment will occur at the same locations over time, thus should statistically be treated as a repeated measures analysis of variance. Variance of a given abiotic parameter will occur in space (among stations) and in time. In order to distinguish between these two potential sources of variance, the analysis of variance model, designed to test for spatial effects (among station variance), will consider each of these factors and the potential interaction between these two factors.

The analysis of the temporal trend will proceed through a stepwise process initiated by simple charting over time of the parameter concentrations at each station. To quantitatively investigate suspected temporal trends, the logical statistical tool is regression analysis. If a parameter of potential concern is indicating an increasing (or decreasing) trend a regression analysis will be conducted across time. To determine whether or not the trend differs from those at other stations, either up gradient or down gradient, a statistical test to investigate the differences in slopes will be performed (analysis of covariance).

4.1.1 Site Monitoring

Standard measures of central tendency (mean or median, standard deviation) will be calculated for each data set. Trend analyses will be performed annually on data exhibiting trends. The focus of site water chemistry monitoring is to determine the sources of potentially problematic parameters. The proposed statistical analyses will allow this determination.

Site thermal monitoring data will undergo the same statistical analyses for the same purpose.

Certain monitoring data (e.g. volume of water use, volume of water pumped from collection facilities, volume of recycled water) only require totalizing.

PKCA discharge volume will be compared to Lake C3 discharge to determine theoretical dilution factors for discharge water.

4.1.2 Receiving Environment

4.1.2.1 Stream C3 Discharge

Stream C3 discharge during PKCA discharge will be monitored periodically and compared to the natural hydrograph developed as part of baseline studies. The purpose will be to mirror as much as possible, the natural hydrograph of Stream C3 during PKCA discharge.

4.1.2.2 Jericho River Discharge from Lake C3

Development of a stage-discharge relationship from continuous measurement of lake water levels and periodic measurement of river discharge were previously discussed.

4.1.2.3 Stream C1 Discharge

Seasonal variation in discharge through the diversion will be compared to the background data collected during baseline studies and during early mine operations to determine whether a significant drop in water discharge has occurred. Any contact water in the Stream C1 drainage basin that meets discharge criteria could be discharged to the stream based on Water Licence terms (Water Licence Part F, Item d).

4.1.2.4 Carat Lake Water Level

Carat Lake level is continuously monitored at the water intake. An estimate of the drawdown of the lake, if measurable, is determined from the data. Since there are no background data on Carat Lake water level seasonal variations, the lake level records will be compared to lake bathymetry to determine the percentage of total lake water volume drawn off for mine use.

4.1.2.5 Water Chemistry

Water chemistry data analyses will include:

- Within sample variation at each site using measures of central tendency (range, mean or median, standard deviation).

- Spatial variability in parameters controlled by the project water licence.

- Spatial trends quantitative analysis: To test whether there is any difference among stations a repeated measures factorial analysis of variance (ANOVA) test will be performed with normalized data for parameters controlled by the project water licence for Stations within the Jericho River (Control, C3, Carat, Jericho Lakes and Jericho River downstream of Jericho Lake).

- Qualitative temporal trends will be evaluated using time series charts. Quantitative temporal trends, as required, will be investigated with regression analysis and determinations of differences among slopes (analysis of covariance).

- Quantitative temporal trends among sites on the Jericho drainage using ANOVA. Again, an increase in metals coupled with biological effects will trigger adaptive management.

4.2 Reporting

Reporting requirements of the Jericho Water Licence with respect to general monitoring activities are discussed in this section. The format of the Water Licence is again followed for ease of reference to the Licence.

1. Pursuant to Water Licence Part B, Section 6, all reports will be submitted as three paper copies and one electronic copy.

2. Pursuant to Water Licence Part F, Section 4c, inspection records of all water management engineered structures will be kept by the Mine Manager for inspection by a NWB Inspector.

3. Pursuant to Water Licence Part F, Section 4e, independent geotechnical engineer’s reports will be submitted to the NWB within sixty days of completion of the inspection.

4. Pursuant to Water Licence Part G, Section 2d, inspection records of all waste management structures will be kept by the Mine Manager for inspection by a NWB Inspector.

5. Pursuant to Water Licence Part G, Section 2g, independent geotechnical engineer's report will be submitted to the NWB within sixty days of completion of the inspection.

6. Pursuant to Water Licence Part H, Section 4, a report identifying the characteristics of the recovery plant rejects and plans for management will be submitted after the first year of operation.

7. Pursuant to Water Licence Part L, Section 9, the annual seepage survey report will be submitted to the NWB within 60 days of the completion of the survey.

8. Pursuant to Water Licence Part L, Section 14, all data and information from surveys will be submitted to NWB in electronic and printed format including the results of the QA/QC program.

9. Pursuant to Water Licence Part M, Section 7, an annual report will be submitted by 31 March for the preceding year, including an updated estimate of the total mine closure restoration liability using the current version of RECLAIM, or equivalent.

Reporting of spills or other extra-ordinary events is not listed here, nor is any other occasional reporting requirements as set out in the Jericho Water Licence.

For ease of reference, reporting requirements of the Jericho Water Licence are summarized in Table 4-1.

Table 4-1: Jericho Water Licence Reporting Requirements Summary

Report	Water Licence Reference	Frequency	Due Date
Inspection reports, water management facilities	Part F, 4c	Weekly or more frequently	On file for review by NWB
Inspection reports, waste management facilities	Part G, 2d	Weekly or more frequently	On file for review by NWB
Independent geotechnical engineer's reports • PKCA dams • Ponds • Waste rock dumps • Stockpiles • Landfarm • Landfill • Fuel farm	Part F, 4e; Part G, 2g	Annual	Within 60 days of inspection
Recovery plant rejects characterization	Part H, 4	Once	1 year after operation begins
Seepage survey report	Part L, 9	Annual	Within 60 days of survey
Data and information from surveys	Part L, 14	As collected	To NWB as collected in paper and electronic form
Update of reclamation liabilities	Part M, 7	Annual	March 31 of the following year

5.0 TRIGGERS FOR ACTION

5.1 Site Monitoring

No water exceeding Water Licence criteria will be discharged to the environment. Contact water not meeting criteria will be pumped to the PKCA.

Geotechnical stability issues will be dealt with on a case by case basis with appropriate action to re-establish stability.

5.2 Receiving Environment Water Chemistry

In general exposure site exceedance of site-specific water quality guidelines outside of the initial dilution zone will be a trigger for action. Increases mirrored at control sites and reasonably ascribable to natural causes will not trigger remedial action. The management strategy will be to first isolate the probable cause(s). Should the probable cause be PKCA discharge, management strategies discussed in the Water Licence application include alternate treatment methods for PKCA supernatant water such as increased storage time, spray irrigation (when approved) and controlled phosphate addition to the PKCA. If the source is other than PKCA discharge, appropriate action will be instituted to eliminate or adequately control discharge from the source.

5.3 Toxicity Testing

Failure of acute toxicity tests will trigger cessation of discharge until acute toxicity tests again pass. Failure of chronic toxicity tests will trigger an investigation of water chemistry, Lake C3 outflows and any other parameters that are appropriate to determine the possible cause. Chronic toxicity tests are to be performed on a monthly basis and take 21 days to complete; thus a failed test would be routinely followed by another test, except at the end of the season when PKCA discharge ceases.

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SCHEDULE 1

Water Quality Monitoring Schedules

Table 1 – Water Quality Parameters

Test Group	Analytical Parameters	Measurement Units
Routine – R	Alkalinity, acidity, chloride, carbonate, bicarbonate, total hardness, hydroxide, sulphate, total suspended solids (TSS), total dissolved solids (TDS), total organic carbon (TOC), total inorganic carbon (TIC) pH (field and lab) ORP (field) Conductivity (field and lab) Temperature (field) Turbidity	mg/L pH units mV µS/cm °C NTU
Metals (Total – unfiltered) – MT and Metals (Dissolved – filtered) – MD	T- Aluminum T – Arsenic T- Cadmium T – Chromium T – Copper T – Lead T – Molybdenum T – Nickel T – Uranium T – Zinc D - Aluminum	mg/L
ICP-T, ICP-D; ICP Metals Scan (Total and dissolved) to include	Ca, Mg, Na, K, Al, As, Ba, B, Be, Cd, Cr, Co, Cu, Fe, Hg, Pb, Mn, Mo, Ni, Se, Sr, U, V, Zn	mg/L
Nutrients – N	Total Ammonia – N, Nitrate – N, Nitrite – N Total Phosphorus, orthophosphorus	mg N/L mg/L
Biological – B	Biochemical Oxygen Demand Fecal Coliform	mg/L CFU/100 mL
Potable Water – PW	Fecal Coliform ICP metals (Total and dissolved) TSS	CFU/100 mL mg/L mg/L
Dissolved Oxygen Profile – DO		

Table 2 – Receiving Environment Water Quality Monitoring Requirements[1]

Station	Location	Phase	Test Group	Freq	Flow	Freq
JER-WQ1	Carat Lake – Freshwater Intake	Operation	PW	M2	m^3/day	C
JER-WQ2	PKCA Discharge	Construction	Turbidity (correlated with TSS)	D	m^3/day	D
		Operation	R, ICP-T, ICP-D, N B	W M2	m^3/day	C
JER-WQ3	Stream C3 upstream of Lake C3	Pre-construction[a]	R, ICP-T, ICP-D, N	M2		
		Construction	R, ICP-T, ICP-D, N	M2		
		Operation	R, ICP-T, ICP-D, N	M2		
JER-WQ4	Lake C3 South Basin	Pre-construction	R, ICP-T, ICP-D, N DO	A1		
		Construction	R, ICP-T, ICP-D, N	M1		
		Operation	R, ICP-T, ICP-D, N	M1		
JER-WQ5	Lake C3 Outlet	Pre-construction			m^3	C[b]
		Construction	R, ICP-T, ICP-D, N	M2	m^3	C
		Operation	R, ICP-T, ICP-D, N	M2	m^3	C
JER-WQ6	Carat Lake Centre Basin	Pre-construction	DO	A1		
		Construction	R, ICP-T, ICP-D, N	M1		
		Operation	R, ICP-T, ICP-D, N	M1		
JER-WQ7	Carat Lake Outlet	Construction	R, ICP-T, ICP-D, N	M2		
		Operation	R, ICP-T, ICP-D, N	M2		
JER-WQ8	Jericho Lake North Basin	Pre-construction	R, ICP-T, ICP-D, N, DO	A1		
		Construction	R, ICP-T, ICP-D, N	M1		
		Operation	R, ICP-T, ICP-D, N	M1		
JER-WQ9	Jericho River Downstream of Jericho Lake	Construction	R, ICP-T, ICP-D, N	M1		
		Operation	R, ICP-T, ICP-D, N	M1		
JER-WQ10	Control Lake	Construction	R, ICP-T, ICP-D, N	M1		
		Operation	R, ICP-T, ICP-D, N	M1		
JER-WQ11	Cigar Lake (2nd Control Lake)	Construction	R, ICP-T, ICP-D, N	M1		
		Operation	R, ICP-T, ICP-D, N	M1		
JER-WQ12	Stream C1 Upstream of Carat Lake[c]	Construction	R, ICP-T, ICP-D, N	M2	m^3	CS
		Operation	R, ICP-T, ICP-D, N	M2	m^3	CS
JER-WQ13	Lake C1	Pre-construction	R, ICP-T, ICP-D, N, DO	A1		
		Construction	R, ICP-T, ICP-D, N	M1		
		Operation	R, ICP-T, ICP-D, N	M1		
JER-WQ14	Lake C4[d]	Pre-construction	R, ICP-T, ICP-D, N, DO	A1		
		Construction	R, ICP-T, ICP-D, N	M2		
		Operation	R, ICP-T, ICP-D, N	M2		
JER-WQ15	Stream C4 upstream of Carat Lake	Construction	R, ICP-T, ICP-D, N	M2		
		Operation	R, ICP-T, ICP-D, N	M2		
JER-WQ16	Lynne Lake	Operation	R, ICP-T, ICP-D, N	A2		

---

[1] A1: Annual once in winter
A2: Annual once in summer
M1: Monthly; mid Apr, Jun, Jul, Aug, Sept, Dec
M2: Monthly; once during Jun, Jul, Aug, Sep
PW: Potable Water

W: Weekly
D: Daily
C: Continuous
CS: Continuous Seasonal

Station	Location	Phase	Test Group	Freq	Flow	Freq
JER-WQ17	Key lake	Operation	R, ICP-T, ICP-D, N	A2		
JER-WQ18	Ash Lake	Operation	R, ICP-T, ICP-D, N	A2		

Notes

[a] Pre-construction will occur in the winter and Stream C3 does not flow in the winter as stated in the Jericho Final EIS. Sampling will be conducted as soon as flows commence the first spring during construction.

[b] Jericho River at the outlet of Lake C3 does not flow in the winter and therefore cannot be measured, as stated in the Jericho Final EIS. Lake C3 water levels will not change throughout the winter period, although it will be possible to record water levels continuously throughout the winter.

[c] The flow monitoring location for Stream C1 once the diversion is constructed (Year 3) is pool 2. Prior to construction the monitoring location will be upstream at the baseline monitoring site for the stream to provide continuity with background flow data. As well, the lower stream is braided and not suitable for flow measurement.

[d] Lake C4 freezes completely to the bottom in winter, as stated in the Jericho Final EIS. Therefore no water can be collected during pre-construction or until the ice melts (typically in May or early June. Water cannot be collected on the M1 schedule since the lake is complete frozen in mid April and mid December. Water will be collected on the M2 schedule.

Locations are shown on Figure 1.

[1] A1: Annual once in winter
A2: Annual once in summer
M1: Monthly; mid Apr, Jun, Jul, Aug, Sept, Dec
M2: Monthly; once during Jun, Jul, Aug, Sep
PW: Potable Water

W: Weekly
D: Daily
C: Continuous
CS: Continuous Seasonal

Table 3 – Site Water Quality and Thermal Monitoring Stations[2]

Station	Location	Phase	Test Group	Freq	Flow	Freq
JER-SW1	Sewage Treatment Plant Effluent	Construction	R, ICP-T, ICP-D, N, B	M	m^3	C
		Operation	R, ICP-T, ICP-D, N, B	M	m^3	C
JER-SW2	Open Pit	Construction	R, ICP-T, ICP-D, N	M	m^3	C
		Operation	R, ICP-T, ICP-D, N	M	m^3	C
JER-SW3	Process Plant Supernatant	Construction	R, ICP-T, ICP-D, N	M	m^3	C
		Operation	R, ICP-T, ICP-D, N	M	m^3	C
JER-SW4	PKCA Pond Water	Construction	R, ICP-T, ICP-D, N	M		
		Operation	R, ICP-T, ICP-D, N	M		
JER-SW5	Temporary/permanent Collection Ditches	Construction	R, ICP-T, ICP-D, N	M3		
		Operation	R, ICP-T, ICP-D, N	M3		
JER-SW6	Collection Pond A	When in Use	R, ICP-T, ICP-D, N	M2	m^3	
JER-SW7	Collection Pond B	When in Use	R, ICP-T, ICP-D, N	M2	m^3	
JER-SW8	Collection Pond C	When in Use	R, ICP-T, ICP-D, N	M2	m^3	
JER-SW9	Rock Dump 1 Seepage	Operation	R, ICP-T, ICP-D, N	A3		
JER-SW10	Rock Dump 2 Seepage	Operation	R, ICP-T, ICP-D, N	A3		
JER-SW11	Coarse PK Stockpile	Operation	R, ICP-T, ICP-D, N	A3		
JER-SW12	Ore Stockpile	Operation	R, ICP-T, ICP-D, N	A3		
JER-SW13	Low Grade Ore Stockpile	Operation	R, ICP-T, ICP-D, N	A3		
JER-SW14	Recovery Plant Rejects	Operation	R, ICP-T, ICP-D, N	A3		
	West Dam Thermistor 1	Upon Installation	Temperature	M		
	West Dam Thermistor 2	Upon Installation	Temperature	M		
	East Dam Thermistor 1	Upon Installation	Temperature	M		
	East Dam Thermistor 2	Upon Installation	Temperature	M		
	Southeast Dam Thermistor 1	Upon Installation	Temperature	M		
	Southeast Dam Thermistor 2	Upon Installation	Temperature	M		
	Waste Dump 1 Thermistor 1	Upon Installation	Temperature	M		
	Waste Dump 1 Thermistor 2	Upon Installation	Temperature	M		
	Waste Dump 2 Thermistor 1	Upon Installation	Temperature	M		
	Waste Dump 2 Thermistor 2	Upon Installation	Temperature	M		
	Coarse PK Stockpile Thermistor 1	Upon Installation	Temperature	M		
	Coarse PK Stockpile Thermistor 2	Upon Installation	Temperature	M		

Approximate locations are shown on Figure 2.

---

[2] A3: Annual during seepage survey
M: Monthly
M1: Monthly; mid Apr, Jun, Jul, Aug, Sep, Dec
M2: Monthly once during Jun, Jul, Aug, Sep
M3: during periods of flow
W: Weekly D: Daily C: Continuous CS: Continuous Seasonal

Schedule 2: Water Chemistry Sample Parameters

Parameter	**Reference Method**	**ALS Reporting Detection Limit (mg/L)**	**Volume of Sample (mL)**	**Type of preservation**	**Type of container**	**COC Code**
BOD5	APHA 5210B	5	200	4 Degrees C	1L Plastic *	Biological
Fecal Coliform	APHA 9222 D	1 MPN	250	Sodium thiosulphate	250 mL Plastic, sterilized	Biological
Dissolved Metals		various	250 *****	Nitric acid	250 mL Plastic ***	Dissolved Metals
Ammonia	APHA 4500 NH3 F	0.005	20	4 Degrees C	1L Plastic *	Nutrients
Nitrate	APHA 4110 Ion Chrom.	0.005	20 ***	4 Degrees C	1L Plastic *	Nutrients
Nitrite	APHA 4110 Ion Chrom.	0.002	20 ***	4 Degrees C	1L Plastic *	Nutrients
Orthophosphate	APHA 4500 PBE	0.002	20	4 Degrees C	1L Plastic *	Nutrients
Total Phosphorus	APHA 4500 PBE	0.001	20	4 Degrees C	1L Plastic *	Nutrients
Oil and Grease	APHA 5520 C	5	500	Sulphuric acid	2X500 mL Glass, amber	O&G
TOC	APHA 5310 B	0.01	125	Hydrochloric acid	125 mL Glass, amber	Routine
Acidity (CaCO3)	APHA 2310 B	1	50 **	4 Degrees C	1L Plastic *	Routine
Alkalinity-Total CaCO3	APHA 2320 B	1	50 **	4 Degrees C	1L Plastic *	Routine
Bicarbonate (HCO3)	APHA 2320 B	1	50 **	4 Degrees C	1L Plastic *	Routine
Carbonate (CO3)	APHA 2320 B	1	50 **	4 Degrees C	1L Plastic *	Routine
Chloride	APHA 4110 Ion Chrom.	0.5	20 ***	4 Degrees C	1L Plastic *	Routine
Conductivity (uS/cm)	APHA 2510 B	0.2 uS/cm	20 *	4 Degrees C	1L Plastic *	Routine
Hardness (CaCO3)	APHA 2340 B	0.5	50	4 Degrees C	1L Plastic *	Routine
Hydroxide	APHA 2320 B	1	50 **	4 Degrees C	1L Plastic *	Routine
pH	APHA 4500 H	0.01	20 *	4 Degrees C	1L Plastic *	Routine
Sulphate	APHA 4110 Ion Chrom.	0.5	20 ***	4 Degrees C	1L Plastic *	Routine
TIC	APHA 5310 B	0.01	125	4 Degrees C	1L Plastic *	Routine
Total Dissolved Phosphorus	APHA 4500 PBE	0.002	20	4 Degrees C	1L Plastic *	Routine
Total Dissolved Solids	APHA 1030 F	10	150	4 Degrees C	1L Plastic *	Routine
Total Suspended Solids	APHA 2540 D	3	150	4 Degrees C	1L Plastic *	Routine
Turbidity (NTU)	APHA 2130 B	0.1 NTU	20	4 Degrees C	1L Plastic *	Routine
Total Kjeldahl Nitrogen	APHA 4500 N C	0.05	50	Sulphuric acid	250 mL Glass, amber	TKN
Total Metals		various	250 ****	Nitric acid	250 mL Plastic **	Total Metals

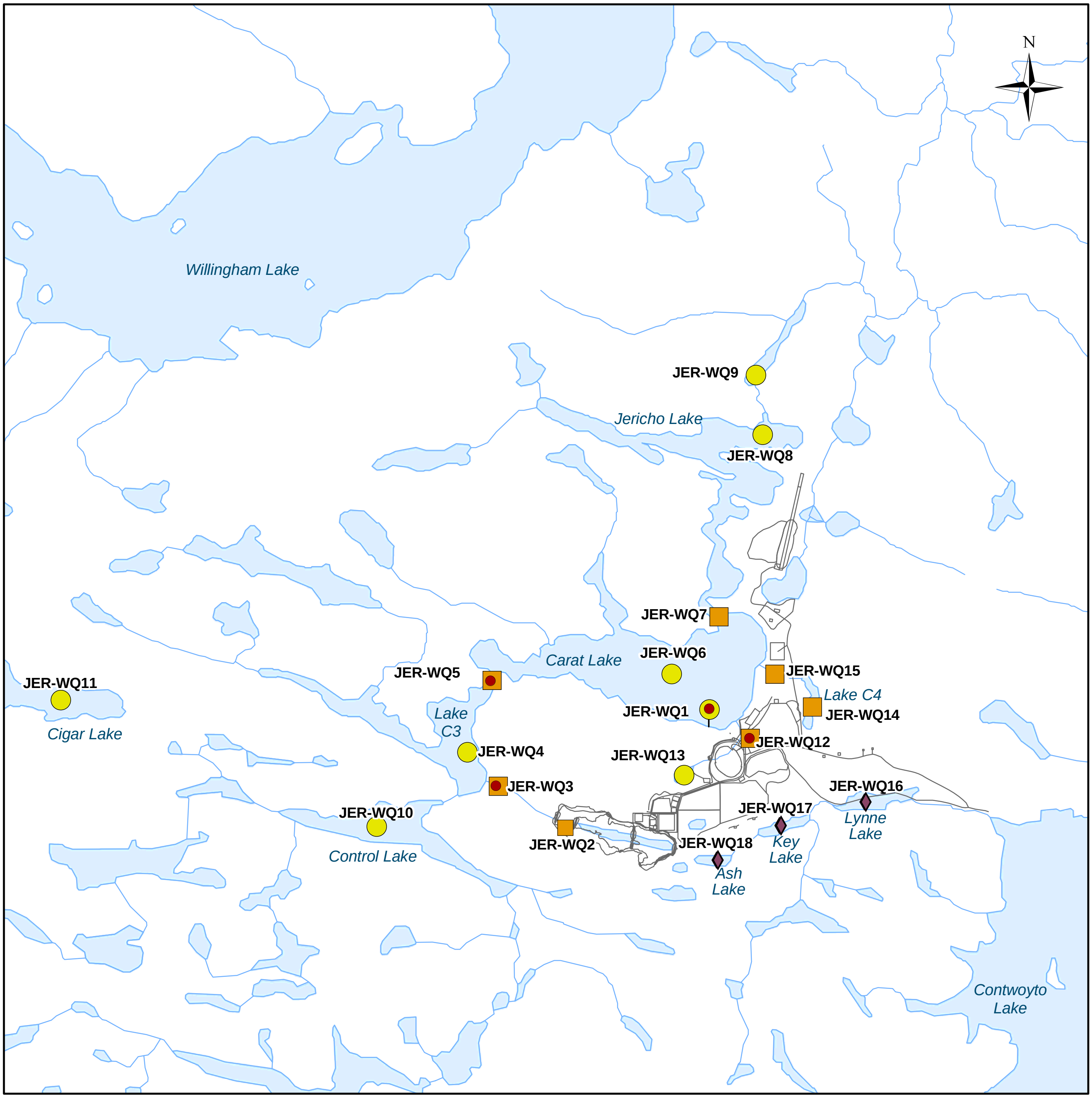
SCHEDULE 3: WATER SAMPLE HOLDING TIMES

Alkalinity - 14 Days
Acidity - 14 Days
Chloride - 28 Days
Carbonate - 14 Days
BiCarbonate - 14 Days
Total hardness - Calculated From Metals
Hydroxide - 72 hours
Sulphate - 28 days
TSS/TDS - 7 days
TOC - 28 days
TIC – 72 Hours
pH (lab) - 72 hours
Turbidity - 72 hours
Metals (not including Hg) - 6 months
Metals (Hg) - 28 days
Ammonia - 28 days
Nitrate - 48 hours
Nitrite - 48 hours
Total Phospohorus - 48 hours
OrthoPhosphate - 48 hours
BOD - 48 hours
Fecal Coliform - 24 hours
Dissolved Oxygen - 8 hours

SCHEDULE 4: WATER QUALITY SAMPLING FIELD CHECK LIST

JERICHO DIAMOND MINE WATER CHEMISTRY FIELD CHECK LIST

	UTM NAD 27 Z12														YSI Multiprobe					
Stn	E	N	Date	Time	Sampler	Sample Depth	Raw Water	Total Metals	Dissolved Metals	Hg - Lo Level	TKN	TOC	Coliform	BOD	pH	Temp	Cond	DO %	DO mg/L	ORP



Legend

- ● Year Round Water Quality
- ■ Summer Only Water Quality
- ◆ Once Per Summer
- ● Flow Monitoring - Open Water

Scale: 1:75,000

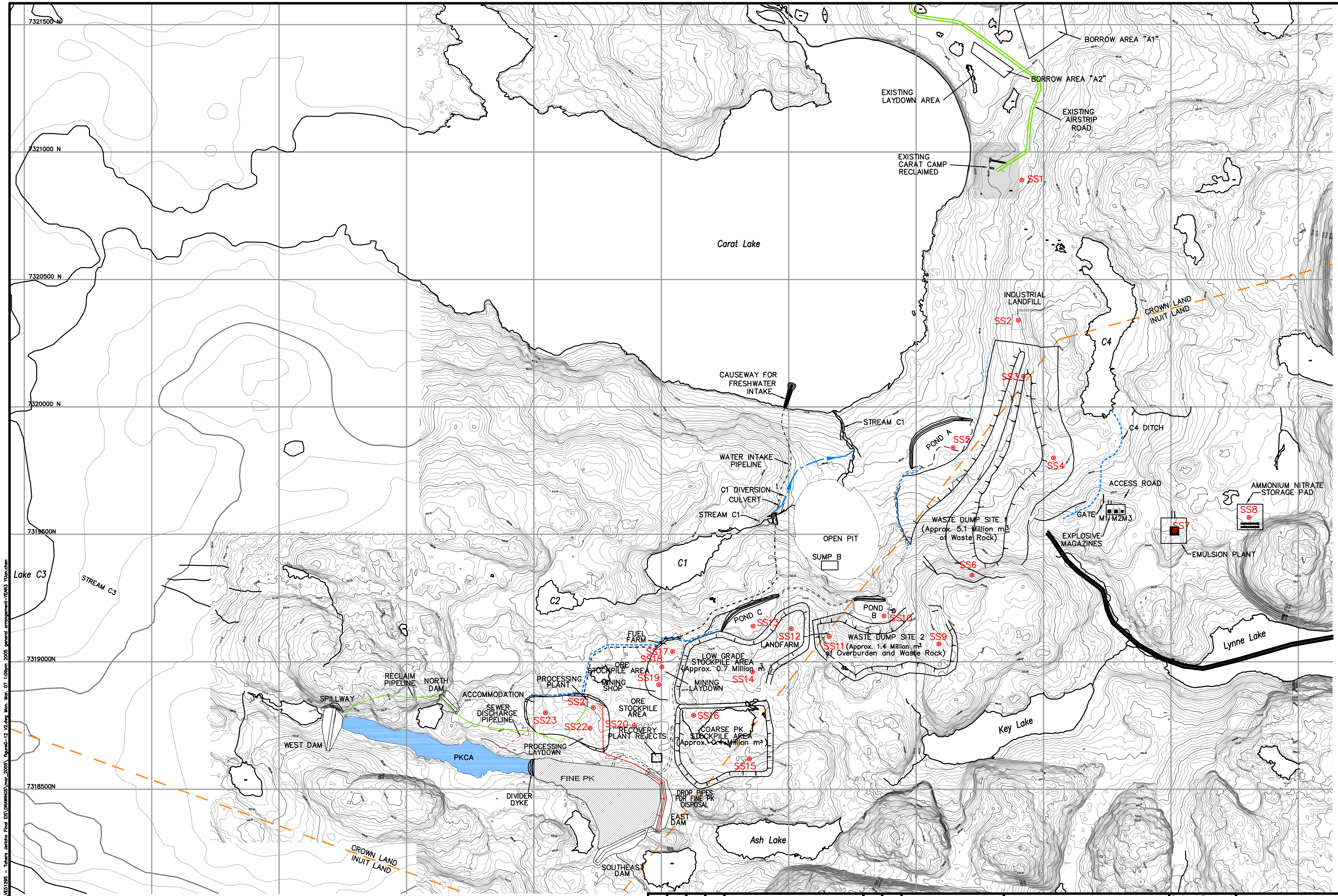
CLIENT:
Tahera Diamond Corporation

PROJECT:
Jericho Diamond Mine

Receiving Environment Water Quality and Flow Monitoring Sites

DATE: March 18, 2005	ANALYST: KKQ	**Figure 1**
JOB No: VE51295-1000	QA/QC: KKQ	PDF FILE: VE51295_Figure1.pdf
GIS FILE: Figure 1 Water Quality SitesV2.mxd		amec
PROJECTION: UTM Zone 12	DATUM: NAD27	

Path: Y:\GIS\Projects\VE\VE51295_Jericho\Mapping\AEP



N

LEGEND

🟩	EXISTING ROAD
═ ═	EXISTING ROAD (APPROXIMATE LOCATION)
🟧	ROAD REQUIRED BY YEAR 3
═	WINTER ROAD
-·-·-	FRESH WATER PIPELINE
-·-·-	MINE WATER PIPELINE
——	FINE PK DISCHARGE PIPELINE
——	RECLAIM PIPELINE
-·-·-	SEWER PIPELINE
●-●-●	PKCA DISCHARGE PIPELINE
- - - -	DITCH
⊙ SS1	SOIL SAMPLE LOCATION

NOTES:

1. LAYOUTS ARE APPROXIMATE AND MAY NOT REFLECT ACTUAL SIZE AND FOOTPRINT LOCATIONS
2. SHOULD THE GRADE OF THE LOW GRADE MATERIAL BE FAVORABLE, THIS MATERIAL MAY GET PROCESSED WHICH WOULD LEAD TO A REDUCTION IN THE SIZE OF THE STOCKPILE
3. THE TIMING OF THE CONSTRUCTION AT THE NORTH DAM, AND THE COMPLETION OF THE EAST AND SOUTHEAST DAMS WILL BE REVIEWED ANNUALLY UNTIL THE DAMS ARE CONSTRUCTED OR OPERATIONS CEASE.
4. THE TIMING OF THE CONSTRUCTION OF POND B WILL BE REVIEWED ANNUALLY.
5. STOCKPILE FOR CENTRAL AND NORTH KIMBERLITE LOBES SHOW MAXIMUM LIMITS. ACTUAL FOOTPRINTS MAY VARY.

TAHERA CORPORATION
JERICHO LAKE SOUTHWEST EXTENSION

Date of Photography: August 5, 1995.
Scale of Photography: 1:10 000
Survey control supplied by: Canamera Geological Ltd.
Survey control based on: UTM Projection, NAD 27, Zone 12
Compiled by The ORTHOSHOP, Calgary, October 1995.
WO 7423

SOURCE: SRK CONSULTING

0m 10 20 30 40 50 60
1 : 1500

REV	D	M	Y	ISSUE/REVISION DESCRIPTION	ENG.	APPR.
G						
F						
E						
D						
C						
B						
A						

amec

AMEC Earth & Environmental
2227 Douglas Road
Burnaby, B.C.
V5C 5A9
Tel. 294-3811
Fax. 294-4664

Client
Tahera
Diamond Corporation

Designed By:	BO
Drawn By:	YC
Checked By:	BO
Reviewed by:	BO
Scale:	AS SHOWN

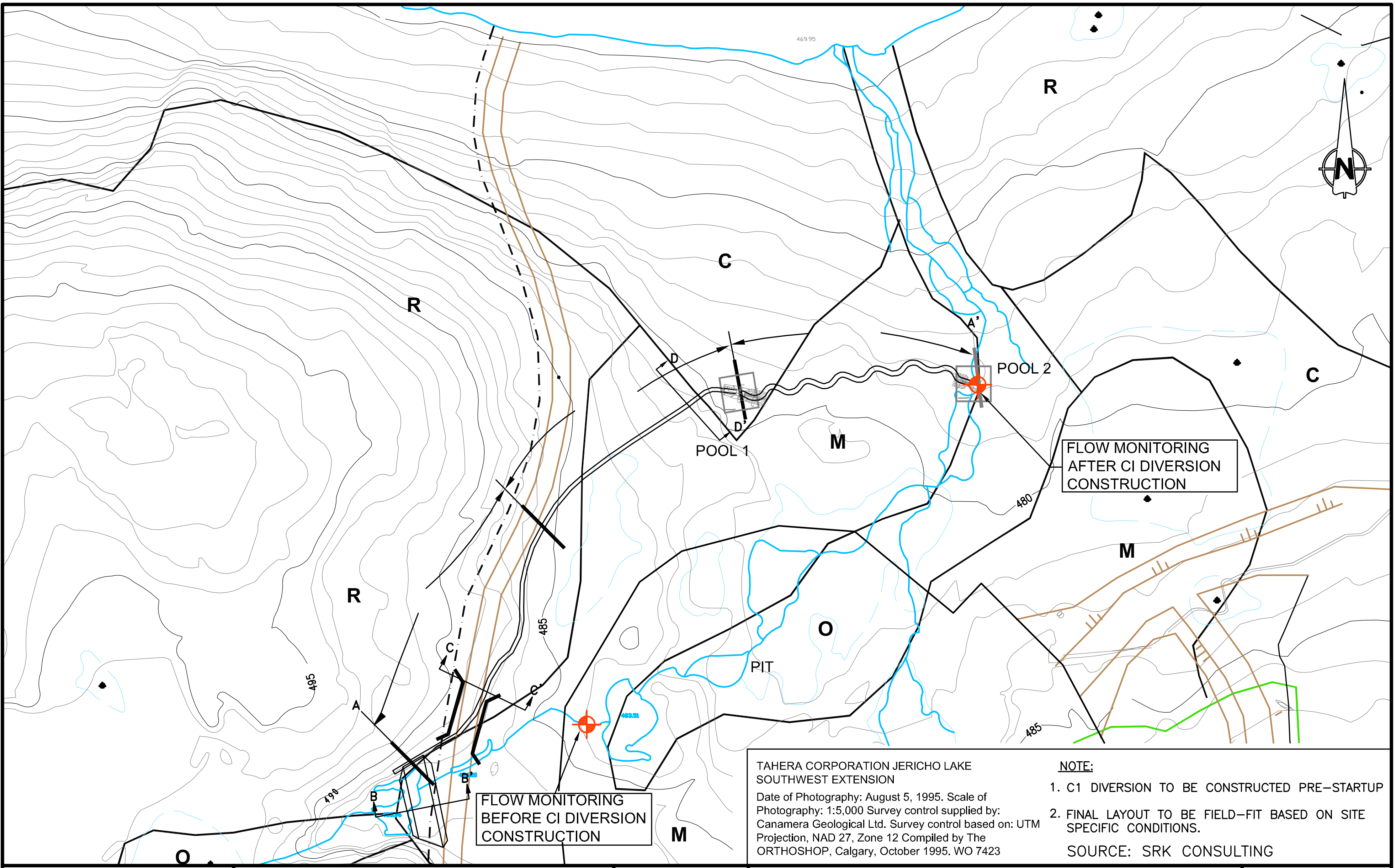
Project:
JERICO DIAMOND PROJECT

Title:
SITE MONITORING LOCATION MAP

Project No.:	VE51295-1000
CADD File:	
Date:	MARCH 2005
Drawing No.:	
Figure No.:	Figure 2

*PLOT 1:1=A1 N:\Projects\51000\51200\VE51295 – Tahera Jericho Final EIS\DRAWINGS\mar_2005\ figureG–12 V2.dwg Mon. Mar. 07 1:09pm 2005 general arrangement–YEAR3 YUan.chen

*PLOT 1:1=D N:\Projects\51000\51200\VE51295 – Tahera Jericho Final EIS\DRAWINGS\mar_2005\ figureW-2-sept-cam.dwg Mon. Mar. 14 9:31am 2005 C1-DIVERSION YUan.chen



TAHERA CORPORATION JERICHO LAKE SOUTHWEST EXTENSION

Date of Photography: August 5, 1995. Scale of Photography: 1:5,000 Survey control supplied by: Canamera Geological Ltd. Survey control based on: UTM Projection, NAD 27, Zone 12 Compiled by The ORTHOSHOP, Calgary, October 1995. WO 7423

NOTE:

1. C1 DIVERSION TO BE CONSTRUCTED PRE–STARTUP
2. FINAL LAYOUT TO BE FIELD–FIT BASED ON SITE SPECIFIC CONDITIONS.

SOURCE: SRK CONSULTING

amec

AMEC Earth & Environmental
2227 Douglas Road
Burnaby, B.C.
V5C 5A9
Tel. 294-3811
Fax. 294-4664

Client

Tahera
Diamond Corporation

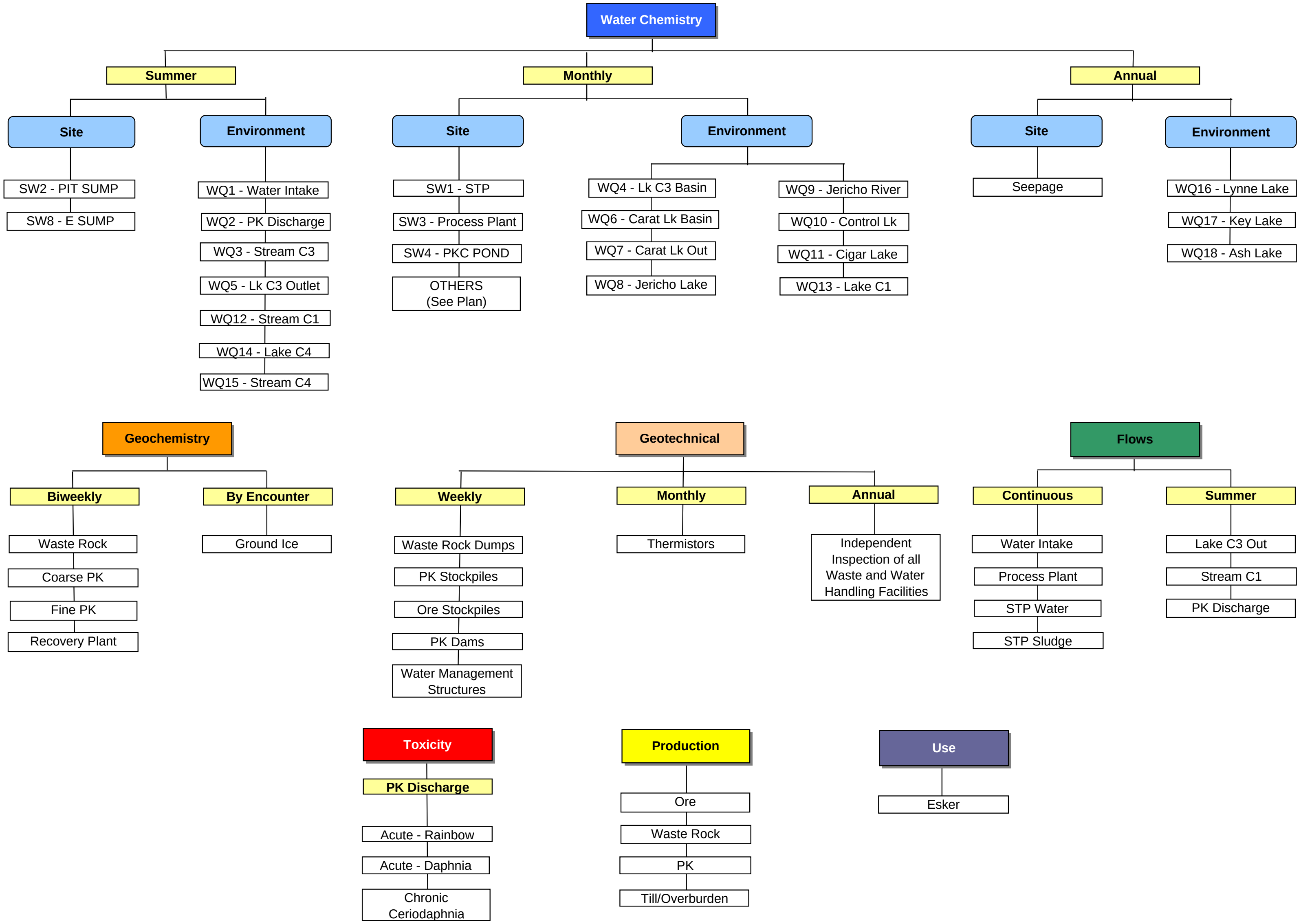
DWN BY:	YC
CHK'D BY:	BO
APP.	BO
SCALE	1:3000

JERICHO DIAMOND MINE

C1 DIVERSION
PLAN AND CROSS SECTION

DATE:	MAR. 2005
PROJECT NO:	VE51295
REV. NO.:	-
FIGURE No.	Figure 3

FIGURE 4: MONITORING FLOW SHEET



APPENDIX A
C3 WATER LEVEL RECORDER AND RADIO LINK EQUIPMENT

CR10X Measurement and Control System

A Rugged Instrument with Research-Grade Performance

The CR10X is a rugged measurement and control system that delivers accurate, reliable measurements in a variety of applications. Designed for both research and day-to-day monitoring operations, the CR10X combines the ability to measure virtually any sensor with the control capability to respond to specific site conditions (e.g., open flood gates, turn fans off/on). From simple to complex, Campbell Scientific data acquisition systems are at work on every continent, at sea, and in space.

Measurement Example — Weather Station

Measurements: The CR10X measures wind speed and direction, air temperature, relative humidity, precipitation, barometric pressure, soil moisture and temperature, and solar radiation. Scan rates are programmable from 1/64 second to 2.5 hours.

Data Processing: Output intervals for raw or processed data are user-specified. Typically, hourly and daily summaries (e.g., maxima, minima, averages, histograms) are stored. Conditional outputs, such as rainfall intensity, can also be processed and stored.

Data Storage: The non-volatile Flash memory and lithium-backed SRAM store up to 62,000 data points—equating to more than three months of data when typical hourly and daily outputs are stored from a typical meteorological application. An optional memory expansion allows the CR10X to store more than one million data points—or about 12 years' worth of meteorological data.

Data Retrieval: Data can be transferred to a computer using telephones (including cellular or voice-synthesized), radio telemetry, short-haul modems, satellite transmitters, multidrop modems, Ethernet, or storage modules.

12-Volt Power: The low-power design allows the CR10X to operate up to one year on a 7 Ahr, unregulated 12 Vdc source, depending on scan rate, number of sensors, data retrieval method, and external temperature.

Measurement and Control Example — Head Gates

Measurements: The CR10X measures water level upstream, downstream, and in a diversion ditch.

Data Storage/Processing/Retrieval: Data are recorded over time, showing trends. The CR10X calculates flow and summarizes the data as averages, maxima, or totals. A PC, PDA or keyboard display can show both real-time and summarized data.

Equipment Control: The CR10X controls multiple headgates based on measured conditions, flow, or time. The control capabilities of the CR10X allow levels to be maintained, even in the absence of a manager. The gates can also be controlled remotely by the water master if conditions change.

Alarms: If high or low water levels are detected, the CR10X can initiate on-site alarms, data or voice-synthesized warning calls, or activate pagers.

Cover Photos At left: CR10X. From top right: *Water Resources* Reservoir gate control via radio telemetry, Emery County, Utah; *Industrial/Automotive* Super Comp dragster performance testing, (photo courtesy of RPM photography); *Meteorology* Weather station installation, St. Mary's Lake, Glacier National Park, Montana; *Geotechnical/Historical Preservation* CR10X monitors cracks in the southwest bastion of fort, Castillo de San Marcos National Monument, St. Augustine, Florida.

Applications

The measurement precision, flexibility, long-term reliability, and economical price of the CR10X make it ideal for scientific, commercial, and industrial applications.

Meteorology

The CR10X is used in long-term climatological monitoring, meteorological research, and routine weather measurement applications. Sensors the CR10X can measure include:

- cup, propeller, and sonic anemometers
- tipping bucket and weighing rain gages
- wind vanes
- evaporation pans and lysimeters
- pyranometers
- ultrasonic distance sensors
- thermistors, thermocouples, and RTDs
- capacitance and strain gage barometric pressure sensors
- RH sensors
- cooled mirror hygrometers

Weather station at Denali National Park, Alaska, monitors meteorological and soil conditions.

The CR10X can output data in your choice of units (e.g., wind speed in miles per hour, meters per second, or knots). Standard CR10X outputs include wind vector averaging, sigma, theta, histograms, saturation vapor pressure, and vapor pressure from wet/dry bulb temperatures.

Air Quality

The CR10X can monitor and control gas analyzers, particle samplers, and visibility sensors. The CR10X can also automatically control calibration sequences and compute conditional averages that exclude invalid data (e.g., data recorded during power failures or calibration intervals).

Network of approximately 20 stations continuously monitors air quality, northern Oquirrh Mountains, Utah.

Agriculture and Agricultural Research

The versatility of the CR10X allows measurement of agricultural processes and equipment in applications such as:

- plant water research
- canopy energy balance
- machinery performance
- plant pathology
- crop management decisions
- food processing/storage
- frost prediction
- irrigation scheduling
- integrated pest management

Typical agricultural research sites integrate meteorological, soil, and crop measurements.

Soil Moisture

The CR10X is compatible with the following soil moisture measurement technologies:

- **Soil moisture blocks** are inexpensive sensors that estimate soil water potential.
- **Matric water potential sensors** also estimate soil water potential but are more durable than soil moisture blocks.
- **Time-Domain Reflectometry Systems (TDR)** use a reflectometer controlled by a CR10X to accurately measure soil water content. Multiplexers allow sequential measurement of a large number of probes by one reflectometer, reducing cost per measurement.
- **Self-contained water content reflectometers** are sensors that emit and measure a TDR pulse.
- **Tensiometers** measure the soil pore pressure of irrigated soils and calculate soil moisture.

Industry

Vehicle Testing

The CR10X performs well in cold/hot temperature, high altitude, off-highway, and cross-country tests. It can measure temperature, fuel flow, velocity, acceleration, engine RPM, force, displacement, and electrical system load. The CR10X is often interfaced to a dashboard-mounted heads up display for luminescent data display in real time.

HVAC Systems

The CR10X optimizes HVAC performance by monitoring and controlling pumps, fans, and starter motors.

Process Control

Both product and assembly line status can be monitored simultaneously, providing on-line quality control while minimizing production down-time.

Water Resources

The CR10X is well-suited to remote, unattended monitoring of hydrologic conditions. Many hydrologic sensors, including SDI-12 sensors, interface directly to the CR10X.

Typical hydrologic measurements:

- **Water level** is monitored with incremental shaft encoders, double bubblers, ultrasonic level transducers, resistance tapes, or strain gage or vibrating wire pressure transducers. Some shaft encoders require a QD1 Interface. Vibrating wire transducers require an AVW1, AVW4, or AVW100 Interface.
- **Well draw-down tests** use a pressure transducer measured at logarithmic intervals or at a rate based on incremental changes in water level.
- **Ionic conductivity** measurements use one of the switched excitation ports from the CR10X.
- **Samplers** are controlled by the CR10X as a function of time, water quality, or water level.
- **Alarm and pump actuation** are controlled through digital I/O ports that operate external relay drivers.

Datalogger measures water level using a shaft encoder, then calculates flow. The data are telemetered, via radio, to the water master for further processing, review, and archive. Stilling well at diversionary dam, Emery County, Utah.

Mining, Earth Science, and Geotechnical

The small size, low power requirements, and wide operating temperature range of the CR10X make it a good choice for these remote, typically harsh applications. Multiple CR10Xs can be accessed via telemetry allowing monitoring and review of measurements across an entire study area. Vibrating wire sensors, strain gages, load cells, pressure transducers, linear and string potentiometers, GPS receivers, and frequency output devices are regularly used in these systems.

Historical Preservation

Weather measurements on the Sphinx provided input for its preservation, Cairo, Egypt.

The CR10X's small size, versatility, and expandability allow it to simultaneously monitor environmental variables that could be detrimental to works of art (e.g., relative humidity, solar radiation, air temperature, water table level, gas concentrations). By using multiplexers or SDMs, these parameters (and others) can be monitored at a number of locations in a building or across a structure. This enables comprehensive monitoring, management, remediation efforts, and documentation.

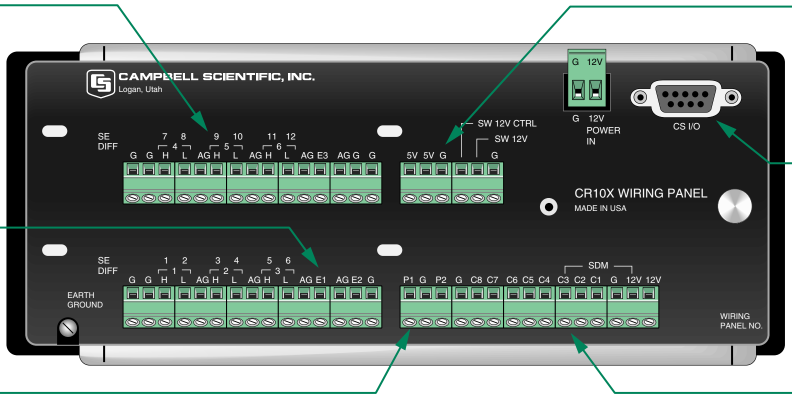
Other Applications

- Avalanche control, snow science, and Arctic research
- Highway and pavement studies
- Sporting events
- Space research

Our dataloggers measured the effects of gravity on a test structure aboard a NASA low-gravity flight.

System Description

The CR10X consists of a Measurement and Control Module and a detachable Wiring Panel. The Mean Time Between Failures (MTBF) for the CR10X is over 180 years. Standard operating range is -25° to +50°C; an optional extended range of -55° to +85°C is available.



6 Differential (12 single-ended) Analog Inputs for measuring voltage levels on five software selectable voltage ranges.

3 Switched Excitation Channels for precision excitation of sensors or short-term actuation of external devices. Excitation is programmable over a ±2500 mV range.

2 Pulse Counting Channels for switch closures, high frequency pulses, or low level ac measurement.

Power and Ground Connections for 12 V external batteries or peripherals or for 5 V peripherals. Switched 12 V terminal is controlled by any digital output.

9-Pin CS I/O Port for connection of data storage, retrieval, and telecommunications peripherals.

8 Digital Inputs/Outputs for output control, sensing status, and reading SDM peripherals or SDI-12 sensors.

Measurement and Control Module

The module measures sensors, drives direct communications and telecommunications, reduces data, controls external devices, and stores data and programs in on-board, non-volatile storage. The electronics are RF shielded and glitch protected by the sealed, stainless steel canister. A battery-backed clock assures accurate timekeeping. The module can simultaneously provide measurement and communication functions.

The CR10X contains a comprehensive set of processing, math, and program control instructions to build a datalogger program. The maximum rate the CR10X can execute its program is 64 times per second. (The maximum rate a single input can be measured is 750 samples per second.) Data and programs are stored either in non-volatile Flash memory or battery-backed SRAM. The standard memory stores 62,000 data points. Optional versions store up to one million data points.

Datalogger Operating Systems

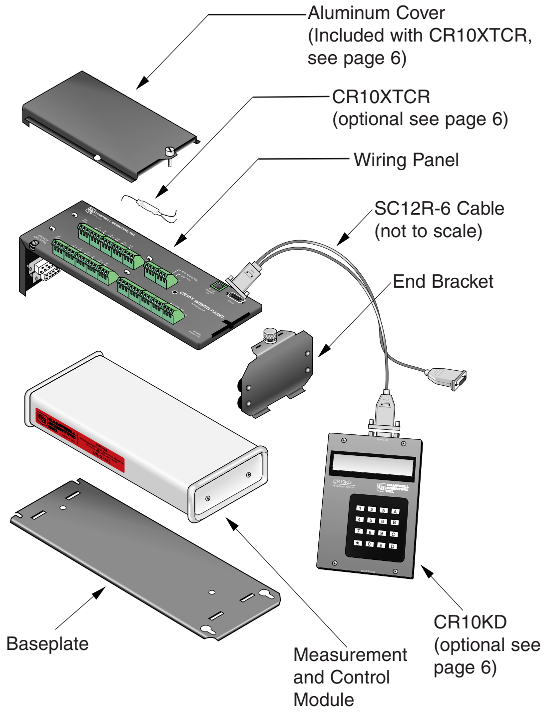
Options for the CR10X Operating System (OS) include array-based, table, Pakbus, Modbus, and ALERT. The array-based OS stores arrays of data at specified intervals or when a measured condition has been met. Two final storage areas are provided for storing the arrays. Table OS groups similar data in separate tables. Pakbus OS enables the CR10X to communicate with CR200-series dataloggers that are in the same network. Pakbus OS stores data in the same format as the table OS. The Modbus OS allows the CR10X to interface with SCADA or MMI software, and ALERT OS allows the CR10X to be used in an ALERT system. Operating System is specified at time of CR10X purchase but can be changed easily if application needs change.

SC12 and SC12R-6 Cables

The SC12 is a two-foot cable that connects communication devices to the CR10X's 9-pin serial port. The SC12 is shipped with most of our communication devices, including our phone modems, satellite transmitters, and keyboard display. The SC12R-6 is a six-foot cable that is purchased separately.

Wiring Panel

The Wiring Panel includes screw terminals for sensor connections and a 9-pin CS I/O port. An end bracket attaches the Wiring Panel to the Control Module and to an enclosure-mounted or free-standing baseplate. The Control Module easily disconnects from the Wiring Panel allowing field replacement without rewiring the sensors. Gas tubes on the wiring panel provide rugged electrostatic discharge protection.



Peripherals

Typical field-based CR10X systems include a data retrieval option, power supply, and environmental enclosure. Peripherals that expand the CR10X's measurement and control capabilities are also available.

Data Storage and Retrieval Options

To determine the best option for your application, consider the accessibility of your site, availability of services (e.g., cellular phone or satellite coverage), quantity of data to collect, and desired time between data-collection sessions.

Telephone Networks use landlines, or cellular CDMA transceivers for communications between the datalogger and PC. Our voice-synthesized modem allows a CR10X to “speak” to you or transmit data to a computer.

Radio Frequency (RF) Communications are supported via UHF, VHF, spread spectrum, or meteor burst radios.

Direct Links use either an SC32B Interface or an SC-USB Interface to provide an optically isolated connection between the CR10X and a laptop or desktop computer. The SC32B connects to a computer RS-232 port and the SC-USB connects to a USB port.

PDAs can set the CR10X’s clock, monitor real-time data, retrieve data, graph data, and transfer CR10X programs. PDAs with a Palm™ OS require PConnect software (purchased separately). These PDAs communicate with the CR10X via a direct serial connection, spread spectrum radio, or the SC-IRDA infrared wireless interface. PDAs with a Windows® CE OS require PConnectCE software (purchased separately). These PDAs communicate with the CR10X via a direct serial connection or spread spectrum radio.

Short Haul Modems provide local communications between the CR10X and a PC with an RS-232 serial port.

Multidrop Interface links a central computer to one or more dataloggers over a distance of 4000 ft.

Satellite Transmitters transmit data via the GOES, or Argos, satellite systems. Campbell Scientific’s SAT HDR GOES transmitter has been certified by NESDIS for High Data Rates (HDR).

Ethernet Communications Peripherals allow the CR10X to communicate over a local network or the Internet.

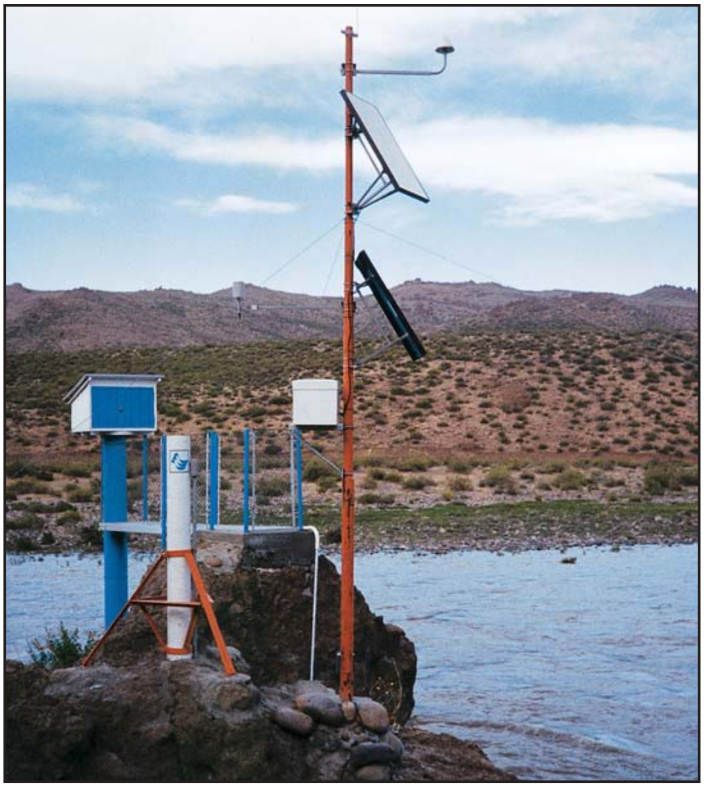
Storage Modules reliably store data and datalogger programs. This allows you to transport programs between the datalogger and PC or use the storage modules to serve as an independent backup of the datalogger data. The storage modules are not compatible with the Table and Pakbus datalogger operating systems.

CR10KD Keyboard Display programs the CR10X, manually initiates data transfer, and displays data. One CR10KD can be carried from station to station in a CR10X network.

Other Displays such as the DataView Display Unit and the DSP4 Heads Up Display can be used with the CR10X. DataView provides a two-line, 32-character LCD that displays one real-time value, a description, and units. The DSP4 Heads Up Display is typically used in vehicle testing applications.

Thermocouple Reference Thermistor

Campbell Scientific offers the CR10XTCR which provides a temperature reference for thermocouple measurements. It requires one single-ended analog input channel. A cover that reduces temperature gradients along the input terminals is included.



A satellite transmitter provides telecommunications for remote Argentine stations where phone lines are impractical.

Channel Expandability

The already formidable measurement and control capabilities can be expanded using CSI multiplexers and Synchronous Devices for Measurement (SDMs). SDMs are addressable peripherals that expand digital I/O ports, plus interval channels analog output ports, and datalogger measurement capabilities. Up to 16 SDMs can be connected to three CR10X control ports.

Multiplexers increase the number of sensors that can be measured by a CR10X by sequentially connecting each sensor to the datalogger. Several multiplexers can be connected to, and controlled by, a single CR10X.

Enclosures

A CR10X housed in a weather-resistant enclosure can collect data under extremely harsh conditions. The enclosure protects the CR10X from dust, water, sunlight, or pollutants. Typically a 12” x 14” or 16” x 18” enclosure is used. They are NEMA 4X enclosures modified for cable entry. The enclosures attach to a flat surface, 1.00" to 1.25" IPS pipe, or vertical mast or leg of a tripod or tower. These white fiberglass-reinforced polyester enclosures are UV-stabilized and reflect solar radiation, reducing temperature gradients inside the housing. An internal mounting plate is prepunched for easy system configuration and exchange of equipment in the field. A lockable hasp adds security.

Power Supplies

Any 12 Vdc source can power the CR10X; a PS100 or BPALK is typically used. The PS100 includes one 7 Ahr rechargeable battery, charged with ac power (requires the optional wall charger) or a solar panel. The BPALK consists of eight non-rechargeable D-cell alkaline batteries with a 7.5 Ahr rating at 20°C. An external AA-cell pack that supplies power while the D-cells are replaced is included.

The BP12 and BP24 battery packs are also available. The BP12 and BP24 have nominal ratings of 12 and 24 Ahrs, respectively. The batteries should be connected to a charging regulator and a charging source. For information about analyzing your system's power requirements, see our Power Supply product literature or Application Note 5-F. Both can be obtained from www.campbellsci.com

Systems that include high current drain peripherals such as satellite transmitters or are located where it's inconvenient to replace batteries might require batteries with larger Ahr capacities than our PS100 or BPALK. Campbell Scientific offers the BP12 and BP24 battery packs for these systems.

Software Packages

Campbell Scientific software supports datalogger programming, communications between the datalogger and PC, and data display. Brief descriptions follow; for more information, see our literature or Web site.

Starter Software

Our Starter Software can be downloaded at no charge from www.campbellsci.com/resource.html. Our Resource CD also provides this software as well as PDF versions of our literature and manuals.

SCWin Program Builder creates datalogger programs requiring only sensor measurement and data output. It supports 120 sensors and multiplexers.

PC200W Starter Software allows you to transfer a program to, or retrieve data from, a CR10X via a direct communications link.

Datalogger Support Software

The LoggerNet 2.X-series is our full-featured software package that supports:

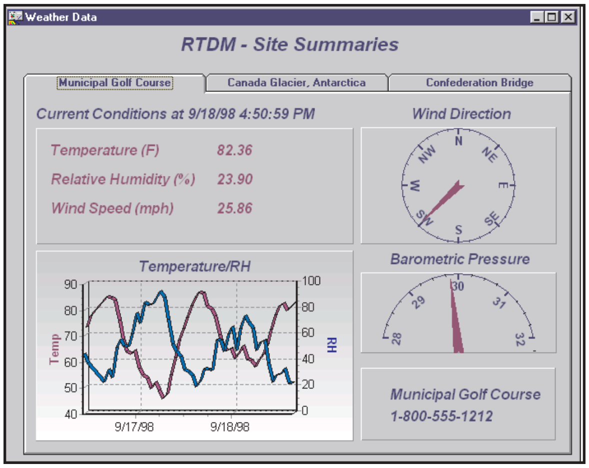
- direct connection and telecommunications links
- combinations of communication options (e.g., phone-to-RF)
- manual and scheduled data collection
- programming for most commercially available sensors as well as devices such as SDMs, multiplexers, and relays
- storage module communication
- multitab data displays that can include alarms, sliders, graphs, toggles, tables and/or gauges

Campbell Scientific offers several programs that are intended to be used with our LoggerNet software. All of these programs require a licensed copy of LoggerNet running on a PC. The programs are:

- **Baler** stores LoggerNet data into new files so that the data can be imported to a data base or third-party analysis program
- **RTMC Web Server** converts real-time data displays into HTML files
- **RTMCRT** allows remote PCs to display and print real-time data
- **LoggerNetData** allows users at remote PCs to post-process LoggerNet data, generate reports, and display LoggerNet data
- **CSI OPC server** allows third-party OPC compatible graphic packages to view our datalogger data
- **LoggerNet-SDK** allows software developers to create and freely distribute custom applications that communicate with our dataloggers

Real-Time Data Monitor (RTDM)

RTDM allows experienced users to create custom graphic screens. RTDM supports automatic generation of JPEG output for Internet display. Developer and display-only versions are also available.



RTDM - Site Summaries

Current Conditions at 9/18/98 4:50:59 PM

Temperature (F) 82.36
Relative Humidity (%) 23.90
Wind Speed (mph) 25.86

Municipal Golf Course
1-800-555-1212

RTDM is powerful, versatile software that can display real-time or archived data in bar, lines, area, or point charts. Automatic generation of JPEG outputs facilitates displaying information on Internet pages.

CR10X Specifications

Electrical specifications are valid over a -25° to +50°C range unless otherwise specified; non-condensing environment required. To maintain electrical specifications, Campbell Scientific recommends recalibrating dataloggers every two years.

PROGRAM EXECUTION RATE

Program is synchronized with real-time up to 64 Hz. One channel can be measured at this rate with uninterrupted data transfer. Burst measurements up to 750 Hz are possible over short intervals.

ANALOG INPUTS

NUMBER OF CHANNELS: 6 differential or 12 single-ended, individually configured. Channel expansion provided by AM16/32 or AM416 Relay Multiplexers and AM25T Thermocouple Multiplexers.

ACCURACY: ±0.1% of FSR (-25° to 50°C);
±0.05% of FSR (0° to 40°C);
e.g., ±0.1% FSR = ±5.0 mV for ±2500 mV range

RANGE AND RESOLUTION:

Full Scale Input Range (mV)	*Resolution (µV)*	
	Differential	*Single-Ended*
±2500	333	666
±250	33.3	66.6
±25	3.33	6.66
±7.5	1.00	2.00
±2.5	0.33	0.66

INPUT SAMPLE RATES: Includes the measurement time and conversion to engineering units. The fast and slow measurements integrate the signal for 0.25 and 2.72 ms, respectively. Differential measurements incorporate two integrations with reversed input polarities to reduce thermal offset and common mode errors.

Fast single-ended voltage:	2.6 ms
Fast differential voltage:	4.2 ms
Slow single-ended voltage:	5.1 ms
Slow differential voltage:	9.2 ms
Differential with 60 Hz rejection:	25.9 ms
Fast differential thermocouple:	8.6 ms

INPUT NOISE VOLTAGE (for ±2.5 mV range):
Fast differential: 0.82 µV rms
Slow differential: 0.25 µV rms
Differential with 60 Hz rejection: 0.18 µV rms

COMMON MODE RANGE: ±2.5 V

DC COMMON MODE REJECTION: >140 dB

NORMAL MODE REJECTION: 70 dB (60 Hz with slow differential measurement)

INPUT CURRENT: ±9 nA maximum

INPUT RESISTANCE: 20 Gohms typical

ANALOG OUTPUTS

DESCRIPTION: 3 switched, active only during measurement, one at a time.

RANGE: ±2.5 V

RESOLUTION: 0.67 mV

ACCURACY: ±5 mV; ±2.5 mV (0° to 40°C)

CURRENT SOURCING: 25 mA

CURRENT SINKING: 25 mA

FREQUENCY SWEEP FUNCTION: The switched outputs provide a programmable swept frequency, 0 to 2.5 V square wave for exciting vibrating wire transducers.

RESISTANCE MEASUREMENTS

MEASUREMENT TYPES: The CR10X provides ratiometric bridge measurements of 4- and 6-wire full bridge, and 2-, 3-, and 4-wire half bridges. Precise dual polarity excitation using any of the switched outputs eliminates dc errors. Conductivity measurements use a dual polarity 0.75 ms excitation to minimize polarization errors.

ACCURACY: ±0.02% of FSR plus bridge resistor error.

PERIOD AVERAGING MEASUREMENTS

The average period for a single cycle is determined by measuring the duration of a specified number of cycles. Any of the 12 single-ended analog input channels can be used. Signal attentuation and ac coupling are typically required.

INPUT FREQUENCY RANGE:

Signal peak-to-peak[1] ***Min.***	***Max.***	***Min. Pulse w.***	***Max Freq.***[2]
500 mV	5.0 V	2.5 µs	200 kHz
10 mV	2.0 V	10 µs	50 kHz
5 mV	2.0 V	62 µs	8 kHz
2 mV	2.0 V	100 µs	5 kHz

[1] Signals centered around datalogger ground
[2] Assuming 50% duty cycle

RESOLUTION: 35 ns divided by the number of cycles measured

ACCURACY: ±0.01% of reading (number of cycles 100)
±0.03% of reading (number of cycles <100)

TIME REQUIRED FOR MEASUREMENT: Signal period times the number of cycles measured plus 1.5 cycles + 2 ms

PULSE COUNTERS

NUMBER OF PULSE COUNTER CHANNELS: 2 eight-bit or 1 sixteen-bit; software selectable as switch closure, high frequency pulse, and low level ac.

MAXIMUM COUNT RATE: 16 kHz, eight-bit counter; 400 kHz, sixteen-bit counter. Channels are scanned at 8 or 64 Hz (software selectable).

SWITCH CLOSURE MODE
Minimum Switch Closed Time: 5 ms
Minimum Switch Open Time: 6 ms
Maximum Bounce Time: 1 ms open without being counted

HIGH FREQUENCY PULSE MODE
Minimum Pulse Width: 1.2 µs
Maximum Input Frequency: 400 kHz
Voltage Thresholds: Count upon transition from below 1.5 V to above 3.5 V at low frequencies. Larger input transitions are required at high frequencies because of input filter with 1.2 µs time constant. Signals up to 400 kHz will be counted if centered around +2.5 V with deviations ± 2.5 V for 1.2 µs.
Maximum Input Voltage: ±20 V

LOW LEVEL AC MODE
(Typical of magnetic pulse flow transducers or other low voltage, sine wave outputs.)

Input Hysteresis: 14 mV

Maximum ac Input Voltage: ±20 V

Minimum ac Input Voltage:

(Sine wave mV RMS)	Range (Hz)
20	1.0 to 1000
200	0.5 to 10,000
1000	0.3 to 16,000

DIGITAL I/O PORTS

8 ports, software selectable as binary inputs or control outputs. 3 ports can be configured to count switch closures up to 40 Hz.

OUTPUT VOLTAGES (no load): high 5.0 V ±0.1 V; low < 0.1 V

OUTPUT RESISTANCE: 500 ohms

INPUT STATE: high 3.0 to 5.5 V; low -0.5 to 0.8 V

INPUT RESISTANCE: 100 kohms

SDI-12 INTERFACE STANDARD

Digital I/O Ports C1-C8 support SDI-12 asynchronous communication; up to ten SDI-12 sensors can be connected to each port. Meets SDI-12 Standard version 1.2 for datalogger and sensor modes.

CR10XTCR THERMOCOUPLE REFERENCE

POLYNOMIAL LINEARIZATION ERROR: Typically <±0.5°C (-35° to +50°C), <±0.1°C (-24° to +45°C).

INTERCHANGEABILITY ERROR: Typically <±0.2°C (0° to +60°C) increasing to ±0.4°C (at -35°C).

CE COMPLIANCE (as of 09/01)

STANDARD(S) TO WHICH CONFORMITY IS DECLARED:
EN55022: 1995 and EN61326: 1998

EMI and ESD PROTECTION

IMMUNITY: Meets or exceeds following standards:
ESD: per IEC 1000-4-2; ±8 kV air, ±4 kV contact discharge
RF: per IEC 1000-4-3; 3 V/m, 80-1000 MHz
EFT: per IEC 1000-4-4; 1 kV power, 500 V I/O
Surge: per IEC 1000-4-5; 1 kV power and I/O
Conducted: per IEC 1000-4-6; 3 V 150 kHz-80 MHz

Emissions and immunity performance criteria available on request.

CPU AND INTERFACE

PROCESSOR: Hitachi 6303

PROGRAM STORAGE: Up to 16 kbytes for active program; additional 16 kbytes for alternate programs. Operating system stored in 128 kbytes Flash memory.

DATA STORAGE: 128 kbytes SRAM standard (approximately 60,000 data values). Additional 2 Mbytes Flash available as an option.

OPTIONAL KEYBOARD DISPLAY: 8-digit LCD (0.5" digits)

PERIPHERAL INTERFACE: 9 pin D-type connector for keyboard display, storage module, modem, printer, card storage module, and RS-232 adapter.

BAUD RATES: Selectable at 300, 1200, 9600 and 76,800 bps for synchronous devices. ASCII communication protocol is one start bit, one stop bit, eight data bits (no parity).

CLOCK ACCURACY: ±1 minute per month

SYSTEM POWER REQUIREMENTS

VOLTAGE: 9.6 to 16 Vdc

TYPICAL CURRENT DRAIN: 1.3 mA quiescent, 13 mA during processing, and 46 mA during analog measurement.

BATTERIES: Any 12 V battery can be connected as a primary power source. Several power supply options are available from Campbell Scientific. The Model CR2430 lithium battery for clock and SRAM backup has a capacity of 270 mAhr.

PHYSICAL SPECIFICATIONS

SIZE: 7.8" x 3.5" x 1.5" - Measurement & Control Module; 9" x 3.5" x 2.9" - with CR10WP Wiring Panel. Additional clearance required for serial cable and sensor leads.

WEIGHT: 2 lbs

WARRANTY

Three years against defects in materials and workmanship.

We recommend that you confirm system configuration and critical specifications with Campbell Scientific before purchase.

CAMPBELLSCIENTIFIC
CANADA CORP.
11564 - 149 street - edmonton - alberta - T5M 1W7
tel 780.454.2505 fax 780.454.2655
www.campbellsci.ca

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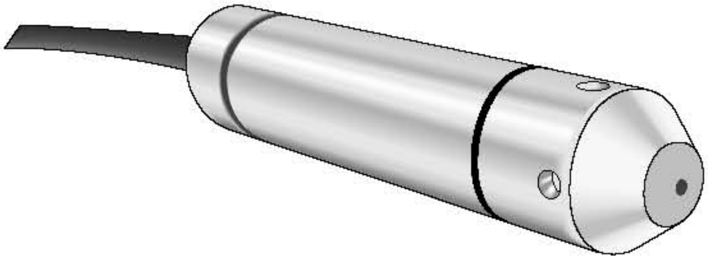
Submersible Pressure Transducers

Models Keller169-L and Keller173-L



These submersible pressure transducers, manufactured by Pressure Systems, measure surface water, ground water, or hostile fluid levels. They are piezoresistive sensors that incorporate an isolated stainless steel diaphragm into a stainless steel package. The sensor assembly is housed in welded 316 SS or titanium case that includes a diaphragm shield for protection against debris.

Each transducer is shipped with a calibration sheet. The sheet specifies I/O conditions, as well as actual data reflecting the unit's static accuracy and thermal characteristics. Each vented transducer is also shipped with a desiccant tube to extract water vapor from air entering the vent tube.

These units are designed for installation in a Class 1, Division 1, Groups A, B, C and D; Class II, Division 1, Groups E, F and G; and Class III Division 1 hazardous location when connected to an approved electrical barrier.

Features

- High static accuracy and repeatability
- Small, rugged package
- User-specified pressure ranges available
- Welded 316 stainless steel construction
- Computer tested, calibrated and serialized
- Unique cable seal system
- Fully temperature compensated
- Compatible with Campbell Scientific's CR510, CR10(X), CR23X, CR7, CR5000 and CR9000 dataloggers

Ordering Information

When ordering a transducer, specify the desired psi range, choose either a polyurethane-jacketed or Tefzel-jacketed cable and specify the lead length, in feet, after the L.

Keller169_L	Four-wire pressure transducer with an accuracy of ±0.25% FSO. Compatible with the PST3/8 system and connects directly to a multiplexer. Requires an L7977 resistor assembly to connect with a datalogger.
Keller173_L	Four-wire pressure transducer with an accuracy of ±0.1% FSO. Compatible with the PST3/8 system and connects directly to a multiplexer. Requires an L7977 resistor assembly to connect to a datalogger.
L7977	100 Ohm Shunt Resistor Assembly for the Keller169-L or Keller173-L
L14421	Optional titanium housing for the Keller169-L or Keller173-L
L13462	Optional ¼″ NPT Pressure Cap
L7421	Optional Split Mesh Grip

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CANADA CORP.
11564 - 149 street - edmonton - alberta - T5M 1W7
tel 780.454.2505 fax 780.454.2655
www.campbellsci.ca

Manufacturer's Specifications (Pressure Systems)

Performance

User Specified Pressure Ranges:	0-2 through 0-300 psig (Keller169-L, Keller173-L)
Static Accuracy:*	±0.25% FSO BFSL (Keller169-L) ±0.1% FSO BFSL (Keller173-L)
Thermal Error:**	0.022% FSO $^\circ C^{-1}$ worst case
Proof Pressure:	1.5 x rated pressure
Burst Pressure:	2.0 x rated pressure
Resolution:	Infinitesimal

* Static accuracy includes the combined errors due to nonlinearity, hysteresis and nonrepeatability on a Best Fit Straight Line (BFSL) basis, at 25°C, per ISA S51.1.

**Thermal error is the maximum allowable deviation from the Best Fit Straight Line due to a change in temperature, per ISA S51.1.

Environmental

Compensated temperature range:	0° to 27°C
Operating temperature range:	-20° to 60°C

Physical

Weight:	4 oz., 113 g (not including cable)
Cable:	Polyurethane-jacketed or Tefzel-jacketed, shielded cable with polyethylene vent tube and Kevlar tension members. Pull strength is 200 lbs. Conductors are 22 awg. Approximate weight is 0.04 lb, (18 g) per foot. Polyurethane-jacketed cables contain water-block tape to prevent moisture intrusion through small cuts in the cable from reaching the transducer.
Dimensions:	
Transducer:	4.5″ (11.4 cm) length, 1.0″ (2.5 cm) diameter
Cable:	0.28″ (0.71 cm) diameter
Output:	30 to 65 mV full scale at 0.5 mA excitation, ratiometric (Keller169-L, Keller173-L)

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CANADA CORP.
11564 - 149 street - edmonton - alberta - T5M 1W7
tel 780.454.2505 fax 780.454.2655
www.campbellsci.ca

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Spread Spectrum Radio Modems

Models RF400, RF410, RF415

Spread spectrum radios spread the normally narrowband information signal over a relatively wide band of frequencies. This allows the communications to be more immune to noise and interference from RF sources such as pagers, cellular phones and multipath.[1] The RF400-series modems reduce susceptibility to RF interference from other spread spectrum devices by providing user-selectable frequency hopping patterns.

The RF400-series spread spectrum radio modems support point-to-point and point-to-multipoint datalogger communications. They can serve as a field modem/radio while connected to the datalogger or as a base station modem/radio when connected to a computer. The RF400-series modems can also be used for general purpose wireless data communications.

Features

- Individual FCC license not required[2]
- Transmission distance of one to 10 miles using inexpensive omnidirectional antennas (shown), several times that using higher gain directional antennas (please note that line-of-sight obstructions and RF interference will affect transmission distance)
- Low power consumption
- 9-pin CS I/O port that connects directly to the datalogger (no additional interface required)
- 9-pin RS-232 port that connects directly to a computer serial port or other RS-232 device
- 25-channel frequency-hopping radio
- Built-in simplified and advanced setup menus for configuring port modes, network/radio addresses, hop table, and power saving modes
- Setup that allows different addresses for multiple dataloggers in a point-to-multipoint network (call about repeater capability)
- Settings stored in non-volatile memory

1. *The operating frequency band of these radio modems may be shared with other non-licensed services such as cordless telephones and with licensed services including emergency, broadcast, and air-traffic control.*
2. *RF400-series modems, like all FCC Part 15 devices, are not allowed to cause harmful interference to licensed radio communications and must accept any interference that they receive. Most Campbell Scientific users operate in open or remote locations where interference is unlikely. If there is a problem, interference can be reduced using methods such as moving the device, reorienting or using a different type of antenna, or adding RF shielding. We recommend the use of licensed UHF or VHF narrowband frequencies for critical communication links.*

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CANADA CORP.
11564 - 149 street - edmonton - alberta - T5M 1W7
tel 780.454.2505 fax 780.454.2655
www.campbellsci.ca

Specifications

Operating Frequency:	910 to 918 MHz RF400, 920 to 928 MHz RF410, 2.450 to 2.460 GHz RF415
Type:	Frequency Hopping Spread Spectrum (FHSS) Transceiver
I/O Data Rate:	9600 bps
Channel Capacity:	65,000 Network Identifiers share 25 hop channels
Frequency Hopping Patterns:	Six different selectable patterns
Frequency Control:	Direct FM
Receiver Sensitivity:	-110 dBm (-104 dBm RF415) at 10^{-4} bit error rate (Campbell Scientific protocols will issue retries wherever a bit error occurs)
Interference Rejection:	70 dB at pager and cellular phone frequencies
Transmitter Power Output:	100 mW nominal (RF400, RF410) 60 mW nominal (RF415)
Antenna Connector:	Reverse polarity SMA
FCC ID:	OUR9XTREAM (RF400, RF410) OUR-24XSTREAM (RF415)
Operating Temperature Range:	-25° to +50°C standard, -55° to +85°C extended
Dimensions:	4.75 x 2.75 x 1.3 inches (12.1 cm x 7.0 cm x 3.3 cm)
Power:	9 to 16 Vdc
Average Current Drain:	<1 mA stand-by (assuming power-saving options used), 24 mA while receiving, <75 mA while transmitting (RF400, RF410) 36 mA while receiving, 75 mA while transmitting (RF415)
LEDs:	Power on, TX, RX, diagnostics
CS I/O Connector:	9-pin “D” Male for all needed communications lines. Newer loggers provide power to the radio on this connector. Older loggers may require optional power cable #14291*
RS-232 Connector:	9-pin “D” Female for TX, RX, CTS, ground RS-232 levels
Power Connector:	Barrel connector, center positive 12 V for use in base station configuration or with older dataloggers (newer loggers provide power to the radio on the CS I/O connector)
Compatible Devices:	21X(L), CR10(X)*, CR200-series, CR23X, CR510, CR7, CR5000, CR500, RAD Modem, and COM200/COM210 (with A100/PS100 at a nondatalogger site)

**Older wiring panels (CR10 silver or CR10 black with gray terminal strips) will require optional power cable L14291.*

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RF415 antennas

2.4 GHz, Indoor Omnidirectional

L16005	0 dBd, ½ wave whip articulating. RPSMA connector connects directly to radio; no antenna cable needed.

2.4 GHz, Outdoor Yagi

L16755	13 dBd with mounts. Has Type N female connector; requires an antenna cable to connect to radio.

Antenna Cables and Surge Protectors for Outdoor Antennas

Recommended for cable lengths <10 ft

COAX RPSMA-L	Low-loss RG58 antenna cable with reverse polarity, SMA connector and type N male connector. Specify length, in feet, after L.

Recommended for cable lengths >10 ft and/or use with lightning protection

RG8 NM/NM-L	Low-loss RG8 antenna cable with type N male to type N male connectors (requires L14462 or L16982). Specify length, in feet, after L.
L14462	Antenna surge protector kit for 900 MHz radios. Includes one COAX RPSMA-L1.5. Requires RG8 NM/NM-L cable.
L16982	Antenna surge protector kit for 2.4 GHz radios. Includes one COAX RPSMA-L1.5. Requires RG8 NM/NM-L cable.

Additional accessories

L14162	Mounting bracket kit
L14291	Optional power cable

The L16005 antenna has an articulating knuckle joint that can be oriented vertically or at right angles.

For the L16755 Yagi antenna, the primary and secondary elements are enclosed in a white cylinder.

The purchase of an antenna cable (COAX RPSMA-L shown) is required for our outdoor antennas.

The surge protectors help protect the radios from electrical transients conducted through the antenna cable.

APPENDIX B
PKCA DISCHARGE CRITERIA AND SITE-SPECIFIC WATER QUALITY OBJECTIVES

Discharge Criteria at JER-WQ2-Discharge from the PKCA

Parameter	Maximum Average Conc. (4-sample running average) (mg/L)	Maximum Grab Concentration (mg/L)
Total Aluminum	1.5	3.0
Dissolved Aluminum	1.0	2.0
Total Arsenic	0.05	0.10
Total Cadmium	0.0012	0.0024
Total Chromium	0.087	0.170
Total Copper	0.02	0.04
Total Lead	0.01	0.02
Total Molybdenum	0.73	1.50
Total Nickel	0.05	0.10
Total Uranium	0.5	1.0
Total Zinc	0.25	0.50
Total Ammonia	6	12
Nitrate	28	56
Nitrite	2.5	5.0
Phosphorus	0.2	0.4
Chloride	500	1000
TDS	2000	4000
TSS	15	25
pH (pH units)	6-8.8	6-8.8
BOD5	15	25
Oil&Grease	3.0	5.0
Faecal Coliforms (CFU/100n	10	20

Water Licence 2AM-JER0410 Effective December 21, 2004 until December 31, 2010

ATTACHMENT O1

Proposed Site-Specific Water Quality Criteria for Copper, Cadmium, Aluminum and Nitrite

AMEC Earth & Environmental
a division of AMEC Americas Limited
2227 Douglas Road, Burnaby, BC
Canada V5C 5A9
Tel   +1 (604) 294-3811
Fax +1 (604) 294-4664
www.amec.com

PROPOSED SITE-SPECIFIC WATER QUALITY CRITERIA FOR COPPER, CADMIUM, ALUMINUM AND NITRITE

Submitted to:

Tahera Diamond Corporation

Submitted by:

AMEC Earth & Environmental,
a division of AMEC Americas Limited

Burnaby, BC

10 August 2004

VE51295.800

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IMPORTANT NOTICE

This report was prepared exclusively for Tahera Corporation by AMEC Earth & Environmental, a division of AMEC Americas Limited (AMEC). The quality of information, conclusions and estimates contained herein is consistent with the level of effort involved in AMEC services and based on: i) information available at the time of preparation, ii) data supplied by outside sources, and iii) the assumptions, conditions and qualifications set forth in this report. This report is intended to be used by Tahera Corporation only, subject to the terms and conditions of its contract with AMEC. Any other use of, or reliance on, this report by any third party is at that party's sole risk.

1.0 INTRODUCTION

Tahera Corporation is in the process of applying for a water licence for the Jericho Mine. As part of this application, it is necessary to determine discharge criteria for various parameters in order to meet targets for acceptable water quality in the receiving environment.

The purpose of this review is to determine whether the data used to derive the CCME guidelines for copper, cadmium, aluminum and nitrite are appropriate for the Jericho Mine to use as targets for receiving environment water quality guidelines. In particular, the species which were used in the CCME derivations were reviewed to determine whether they reflect of the type of species which occur in Lake C3 and Carat Lake. In addition, the safety margins associated with the guidelines were reviewed to determine whether they were unnecessarily conservative. Proposed site-specific guidelines are presented where appropriate. Note that wherever the term "guideline" is used, it is the a guideline for the protection of chronic health of organisms in the receiving environment.

2.0 COPPER

2.1 Comparison of CCME and USEPA Guidelines

The CCME guideline for copper is 2 µg/L for waters with a hardness of less than 120 mg/L, as $CaCO_3$. This guideline is conservative compared with the USEPA chronic criterion for copper, which is linked to hardness across the full range of hardnesses (Figure 1) (USEPA, 2002). The difference between the guidelines results from differences in their intent. In particular, the CCME guideline is designed to be protective of the most sensitive endpoint from the most sensitive test, whereas the USEPA guideline is designed to protect overall ecosystem function, but recognizes that there may be impacts on individual species. The USEPA guideline is designed to be protective of 95% of the genera tested.

LC_{50} data from acute toxicity tests that were used as part of the CCME guideline derivation ranged from 16.7 µg/L to greater than 10 mg/L for tests conducted at a hardness of 50 mg/L (which corresponds to the approximate hardness of the discharge at a 20-fold dilution). Chronic toxicity data evaluated in the CCME guideline were taken from the derivation of the USEPA guideline for copper, in which chronic toxicity test data for five invertebrate and ten fish species were summarized. The values for fish were generally the most sensitive and ranged from 3.9 µg/L for early life-stage tests with brook trout, to 60.4 µg/L for an early life-stage test with northern pike.

Birge and Black (1979) reported chronic toxicity test data for rainbow trout, catfish, goldfish and bass, which demonstrated that rainbow trout were 60 to 70 times more sensitive than the other species, and exhibited LC50 values of approximately 100 µg/L Cu. Based on these data and a summary of other data from the literature, these authors concluded that the practical limits for copper should be established in the range of 2 – 5 µg/L in soft or medium hard water, and 5 –8 µg/L in hard water.

Early life-stages of amphibians are potentially more sensitive to copper than salmonids; however, no amphibians occur in arctic ecosystems and, consequently, these data need not be considered.

The USEPA has recently released a draft revised water quality criteria document for copper (USEPA, 2003). As part of this derivation, the Agency has summarized the available data for copper toxicity. Chronic toxicity data summarized in this draft document is presented in Figure 1, compared with the current USEPA and CCME guidelines. It should be noted that the chronic toxicity data is presented on the basis of dissolved copper.

2.2 Factors Affecting Copper Toxicity

The toxicity of copper is dependant on a number of water quality characteristics, such as hardness, alkalinity and pH. In addition, copper can also form complexes with Dissolved Organic Material (DOM), resulting in a decrease in the observed toxicity. In general, increases in pH, alkalinity, DOM and hardness all result in a decrease in toxicity of copper. As a result of the substantial effect that these parameters can have on toxicity, the USEPA is currently revising its water quality criteria for this metal to incorporate the effects of various ions and DOM on the toxicity of copper (USEPA, 2003).

2.3 Proposed Guideline

Background concentrations of copper in Lake C3 have typically been 2 µg/L, which is equivalent to the CCME criterion value for the hardness of the lake. The proposed guideline for the Jericho site is 4 µg/L. This value generally falls below reported data for adverse effects associated with copper. In fact, the only chronic value from the recent USEPA data summary (USEPA, 2003) that fell below this value was for a rotifer, *Brachionus calyciflorus*. Although rotifers are present in the lake, the particular species tested is not. The relative sensitivity of the rotifer species present in the lake compared with *B. calyciflorus* is not known.

In a study of biota in Lake C3 conducted in 1999 (RL&L, 2000), the density of rotifers was approximately 20,000/m^3 compared with approximately 200 cladocerans/m^3 and 13,000 copepods/m^3; however, when evaluated on the basis of biomass, rotifers comprised a small proportion of the zooplankton. Biomass of rotifers was less than 500 µg/m^3, whereas cladocerans exceeded 100,000 µg/m^3, and copepods exceeded 30,000 µg/m^3. Thus, it is likely that, overall, rotifers comprise a relatively small percentage of the diet of fish in the lake; however, they may provide an important dietary component for larval fish, particularly round whitefish.

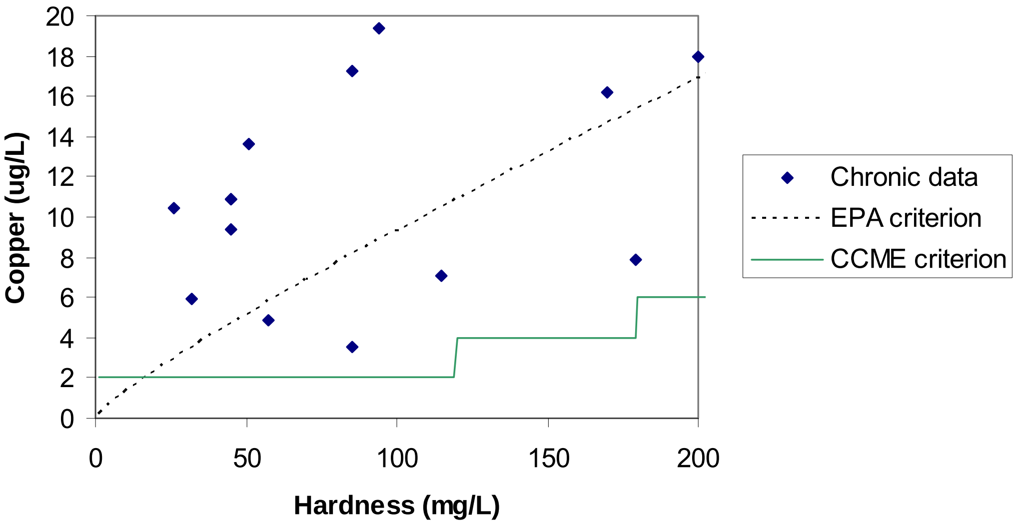
This proposed value also exceeds acute toxicity data from one study for the cladoceran *Bosmina longirostris*, which has been reported to exhibit a 48-hr LC50 for copper of 1.4 and 3.7 µg/L under low and high food conditions, respectively (Koivisto et al., 1992). However, these values are substantially lower than other data for this species in which adverse effects were observed in a chronic (14-d) exposure to concentrations ranging from 10 – 18 µg/L, but no effects on survival were observed within 48 hr at these concentrations (Koivisto and Ketola, 1995). Note that these two studies were not included in either the USEPA or CCME derivations of copper criteria. Moreover, the results of the two studies are somewhat contradictory in terms of concentrations that caused effects, and chemical concentrations were not measured. Thus, their relevance to the dataset as a whole and to the specific study site is uncertain. *B. longirostris* were present in Lake C3 in a baseline study conducted in 1999, but represented a relatively small contribution to zooplankton biomass.

A guideline greater than 4 µg/L may be appropriate based on the water quality conditions associated with the site. For example, the presence of DOM may reduce the bioavailability of copper in the discharge. Given the preponderance of zooplankton in the diet of fish in the lakes studied in the region, caution is advised in applying a criterion in which the “effects” range overlaps or approaches the sensitivity exhibited by taxa present in the system.

2.4 Summary

A water quality guideline of 4 µg/L copper is proposed for the Jericho site. Effects at or below this level have been observed with one species of cladoceran, which is present in Lake C3, and to a rotifer; however, these organisms appear to represent a relatively minor contribution to the zooplankton. Furthermore, the lake has typically contained background concentrations of copper of 2 µg/L; thus, this reflects a relatively small increase from background.

Figure 1. Chronic toxicity data summarized in the draft USEPA criterion compared with the current USEPA and CCME criteria for copper.



3.0 CADMIUM

3.1 Basis for CCME and USEPA Guidelines

The CCME freshwater criterion for cadmium of 0.017 µg/L was derived based on application of a safety factor of 0.1 to the lowest reported effect level for the most sensitive species. This lowest value was for adverse effects on reproduction in a 21-day test with *Daphnia magna,* reported by Biesinger and Christensen (1972). In addition to the criterion value of 0.017 µg/L, the CCME also provided an equation to calculate a site-specific water quality criterion based on water hardness, as follows:

$$\text{Water Quality Guideline } (\mu\text{g/L Cd}) = 10^{(0.86[\log(\text{hardness})]-3.2)}$$

The USEPA presented revised water quality guidelines for cadmium in 2001, which updated the previous USEPA guidance based on a comprehensive review of available data. This document summarized acute toxicity data from 39 species of invertebrates, 24 species of fish and two amphibians. For data from acute toxicity tests, salmonids represented six of the seven most sensitive species tested, and *D. magna* was the most sensitive invertebrate species tested.

Chronic toxicity data summarized by USEPA (2001) included data for seven invertebrate and fourteen fish species. The USEPA derivation did not use the data presented by Biesinger and Christensen (1972) because the concentrations of cadmium were not measured in that study; however, the Agency did use results for other 21-d *D. magna* tests which exhibited effects at similar concentrations. Corrected to a hardness of 50 mg/L, the lowest chronic values utilized by USEPA (2001) were for *D. magna* (0.12 to 0.15 µg/L), followed by the freshwater amphipod *Hyalella azteca* (0.27 ug/L). All other chronic values exceeded 1 µg/L. Interestingly, *Ceriodaphnia dubia*, another cladoceran which is widely used in toxicity tests, was substantially less sensitive to cadmium than *D. magna*, having a chronic value of 27 µg/L at a hardness of 50 mg/L.

3.2 Comparison of CCME and USEPA Guidelines

There is a substantial difference between the USEPA and CCME guidelines for cadmium, primarily associated with a ten-fold safety factor that was applied to the lowest toxicity value in the literature at the time the CCME guideline was derived. In comparison, the USEPA guidelines for acute and chronic toxicity utilized the entire dataset of suitable toxicity test results derive numbers that would protect 95% of tested genera. Thus, the USEPA guidelines are designed to be protective of overall ecosystem function, but datapoints from some toxicity tests are expected to fall below the calculated criteria values.

The toxicity data used in the USEPA criteria derivation, as well as the data upon which the CCME guideline was primarily based are shown in Figure 2. Figure 3 provides a comparison of the most sensitive of these data with the hardness dependent site-specific CCME criteria and the USEPA guidelines. Clearly, the CCME guidelines reflect a highly conservative position with respect to environmental safety since the toxicity data fall well above the curve associated with this criterion.

3.3 Proposed Site-Specific Modification to the CCME Guideline

Cladocerans are an important component of the ecosystem in Lake C3 and species of *Daphnia* (the genus associated with the lowest effect level) are present. Furthermore, field studies have shown that two of the cladocerans present in Lake C3 are sensitive to cadmium. Lawrence and Holoka (1987) showed that a 14-day exposure of 1 µg/L cadmium resulted in a 60 – 70% reduction in biomass of zooplankton at pH 6.7 – 6.8. Cladocerans (*Bosmina longirostris* and *Holopedium gibberum*) were more sensitive than the other species evaluated (calanoid and cyclopoid copepods). Similarly, Marshall and Mellinger (1980) demonstrated that zooplankton density was adversely affected in an exposure to 1.2 µg/L Cd.

Marshall et al. (1981) also reported adverse effects on zooplankton density and diversity resulting from a 3-wk exposure to 1 µg/L cadmium. These authors suggested that adverse effects may occur on zooplankton communities at concentrations of 0.2 µg/L and higher. *H. gibberum* was more sensitive to cadmium than *B. longirostris* or *Daphnia galitea*; the abundance of the latter two species was essentially unaffected, whereas *H. gibberum* were largely eliminated as a result of the exposure. These results have significant relevance to the proposed discharge site; *H. gibberum* represented more than 50% of the density and 99% of the biomass of cladocerans in Lake C3 in a survey conducted in 1999 (RL&L, 2000).

A two-fold safety margin should be sufficient to determine a concentration at which no effect would be expected in the tests used to derive the guideline. Thus, applying a safety factor of two to the lowest effect value of 0.17 µg/L from Biesinger and Christensen (1972) would appear to be sufficient to protect even the most sensitive test organism. Similarly, values can be calculated across a range of hardnesses using the hardness dependant calculation provided in the CCME guidance. These data are shown in Table 1 and are also presented in Figure 4. As the figure shows, all of the known toxicity values are above the proposed guideline, suggesting that this proposed guideline should be protective of aquatic resources in the receiving environment.

3.4 Summary

The CCME water quality criteria for cadmium are highly conservative with respect to risk for adverse effects associated with aquatic biota. An alternative guideline has been proposed here which applies a safety factor of two to the most sensitive data, rather than a factor of ten. This proposed guideline still falls below concentrations associated with adverse effects in the literature and, therefore, is expected to be protective.

It does not appear appropriate to establish a higher criterion than that proposed here because of the sensitivity to cadmium of the cladoceran *H. gibberum*, which dominated the zooplankton biomass in Lake C3 in the 1999 survey. Since the diet of fish in the lake was composed of 50 - 90% zooplankton, this species is clearly of a high degree of importance in this ecosystem. If *H. gibberum* are adversely affected as a result of exposure to elevated concentrations of cadmium, it is likely that other less sensitive species of cladoceran present in the lake, such as

B. longirostris, will increase in density. However, the larger size of *H. gibberum* likely makes it more desirable as a prey species for the larger fish.

It should be noted that water quality characteristics such as DOM can reduce the toxicity of this metal and, consequently, if meeting this guideline will be problematic, additional investigations could be conducted to determine whether the specific conditions associated with the lake and discharge warrant a higher guideline at this particular site.

Table 1. CCME and USEPA guidelines for cadmium (µg/L) over a range of hardnesses, in addition to the proposed guideline based on the CCME data, but incorporating a safety factor of two rather than ten.

Hardness (mg/L as $CaCO_3$)	USEPA chronic criterion	CCME criterion	Hardness adjusted CCME criterion	Proposed Jericho criterion
10	0.049	0.017	0.005	0.023
20	0.082	0.017	0.008	0.041
30	0.111	0.017	0.012	0.059
40	0.137	0.017	0.015	0.075
50	0.162	0.017	0.018	0.091
60	0.185	0.017	0.021	0.107
70	0.208	0.017	0.024	0.122
80	0.229	0.017	0.027	0.137
90	0.250	0.017	0.030	0.151
100	0.271	0.017	0.033	0.166

Figure 2. Toxicity data used for derivation of the USEPA and CCME water quality criteria for cadmium.

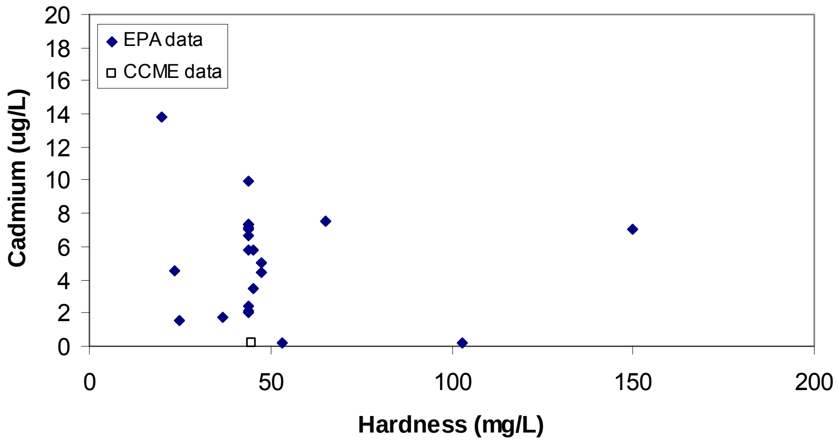


Figure 3. CCME and USEPA water quality criteria for cadmium compared with the most sensitive data from CCME and USEPA criteria derivations.

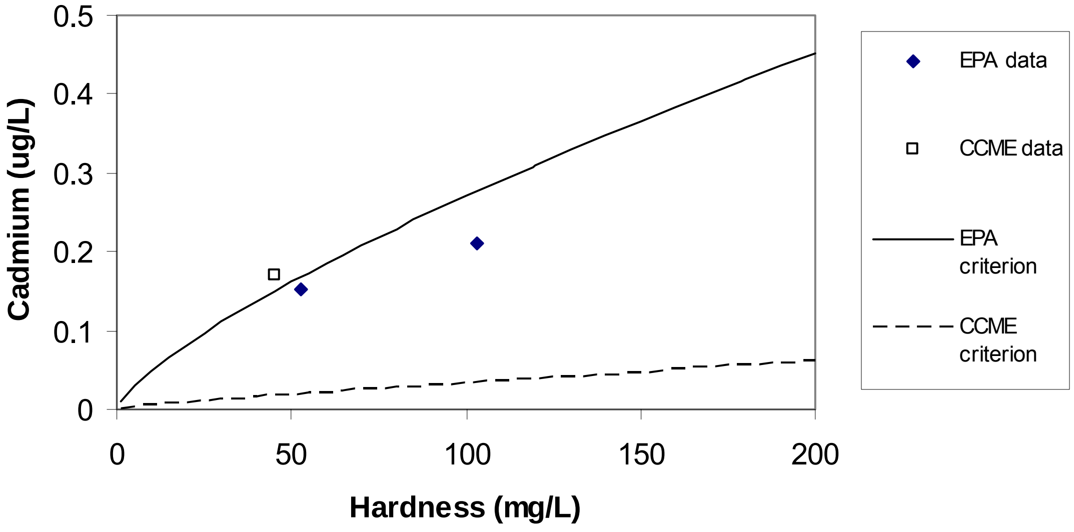
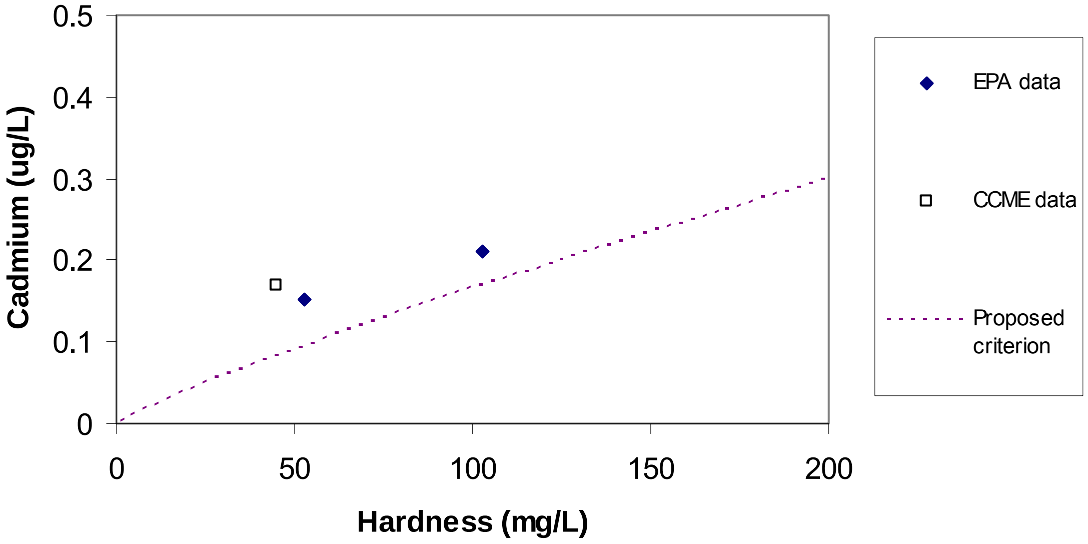


Figure 4. Proposed water quality criteria for cadmium compared with the most sensitive data from CCME and USEPA criteria derivations.



4.0 ALUMINUM

4.1 Summary of Aluminum Chemistry

Aluminum chemistry is complex because, dissolved in water, this metal can be present as a number of monomeric and polymeric hydroxide complexes, as well as Al^{3+}. In addition, this metal forms complexes with a number of other ligands, most notably fluoride, dissolved organic material (DOM), phosphorus, silicon and sulfate. Each of these forms have their own chemical and toxicological properties and, consequently, the characteristics of the matrix in which aluminum is dissolved can have a profound effect on the toxicity of this metal.

The toxicity of aluminum is also highly dependent on pH and, in general, is substantially higher under acidic conditions than in neutral waters. This is largely related to the solubility of the most toxicologically significant forms, $Al(OH)_2^+$ and Al^{3+}, which are relatively insoluble above pH 6. Consequently, the vast majority of toxicity data in the literature have been obtained from tests conducted in acidic conditions and are not directly relevant to Jericho. Toxicity of aluminum has also been shown to be increased at alkaline pH as a result of the increased solubility of $Al(OH)_4^-$ above pH 8. The effect of pH on the toxicity of aluminum is generally associated with alterations in the solubility and speciation of the various complexes.

4.2 Basis for CCME Guideline

The CCME guideline for aluminum has separate criteria of 0.005 mg/L for environments with pH equal to or less than 6.5, and 0.1 mg/L for waters with pH values which exceed 6.5. The guidelines are identified as being “tentative” because of significant gaps in knowledge and the complexity of aluminum chemistry.

Relatively few studies included in the derivation of the aluminum criterion were conducted in the range of pH associated with the receiving environment at Jericho (pH 6.5 – 7.5). Adverse effects on survival (37% mortality) were observed using *Tanytarius dissimilis*, a chironomid, following long term exposure (55 days) to a 0.8 mg/L Al solution at pH 6.8 (Lamb and Bailey, 1981). A 50% impairment of *Daphnia magna* reproduction was reported at a concentration of 0.68 mg/L at pH 6.5 to 7.5 (Schofield and Trojnar, 1980). Although apparently not included in the CCME guideline, Biesinger and Christensen (1972) reported similar data for *D. magna*; 50 and 16% impairment of reproduction was observed in a 21-day exposure at aluminum concentrations of 0.68 and 0.32 mg/L Al in Lake Superior water (pH 7.4 – 8.2).

4.3 Site Specific Factors Affecting Aluminum Toxicity

The pH of the receiving environment at Jericho is generally between 6.5 and 7.5; consequently, the CCME guideline of 0.1 mg/L applies at this site because the solubility of aluminum is predicted to be low across this range of pH.

Aluminum in the discharge will be predominantly present as aluminum silicates, which are components of a wide variety of minerals. In general, toxicity data from the literature are from tests conducted by addition of aluminum salts (e.g., chloride or sulphate) to the test media, resulting in formation of Al^{3+} and aluminum hydroxide complexes. Aluminum silicates appear to exhibit a lower degree of toxicity; this has been demonstrated previously with a fish, a diatom and a green alga (data summarized by Gensemer and Playle, 1999). Thus, the data used to derive the CCME guideline are likely conservative in relation any effects associated with aluminum silicates.

Interestingly, the most dominant cladoceran species in the lakes associated with the Jericho site (*Holopedium gibberum*) appears to be less sensitive to aluminum than other cladocerans. This species was found in an aluminum contaminated lake (0.49 mg/L Al) in a study of acidified Ontario lakes (Bleiwas, 1983), and has been shown to be relatively insensitive to aluminum in laboratory toxicity tests (Havas and Likens, 1985); no adverse effects on survival were observed with this species in an exposure to 1 mg/L Al at pH 6.5.

4.4 Summary

As a result of the complexity of aluminum chemistry and associated toxicity, it is problematic to establish guidelines that are protective for all sites without being unnecessarily conservative. The CCME guideline of 0.1 mg/L provides approximately a 3-fold safety factor over the most sensitive toxicity endpoint within the pH range of interest. A two-fold safety margin below the most sensitive data would likely be sufficient to protect aquatic life. Thus, a site-specific guideline of 0.16 mg/L is proposed. It should be noted that this value is likely conservative with respect to the potential for effects in the receiving environment at this particular site because of the mitigating effects of silicates and neutral pH on aluminum toxicity. However, determining the extent to which these parameters would mitigate toxicity would require a site-specific investigation.

5.0 NITRITE

5.1 Basis for the CCME Guideline for Nitrite

Salmonids are generally considered to be among the most sensitive species to nitrite (Lewis and Morris, 1986). Elevated nitrite concentrations cause methemoglobinemia resulting in a reduction of the oxygen carrying capacity of the blood (Brown and McLeay, 1975), in addition to exhibiting adverse effects on the liver (Jensen, 1996) and the retina (Hofer and Gatumu, 1994).

Russo et al. (1974) reported 96-hr LC50 values for toxicity of nitrite to rainbow trout ranging from 0.19 to 0.39 mg/L. These authors also reported that the highest concentration tested that did not result in mortalities to rainbow trout in a 10-day exposure was 0.06 mg/L for 235 g fish and 0.14 mg/L for 2.3 g fish; 240-hr LC50 estimates were 0.39 and 0.20 in these tests, respectively.

Steelhead trout exhibited a small amount of tissue damage in the gills following a 6-month exposure to 0.06 mg/L, although no adverse effects were observed on survival or growth (Wedemeyer and Yasatuke, 1978).

Thurston et al. (1978) reported 96-hr LC50s for cutthroat trout of 0.5 – 0.6 mg/L and 0.4 mg/L for a 36 day exposure, and concluded that cutthroat trout were generally similar to rainbow trout in their sensitivity to this parameter. In summarizing the available literature, these authors concluded that LC50 values fall in the range of 0.2 to 0.4 for rainbow trout and 0.4 to 0.6 for cutthroat trout.

The CCME guideline for nitrite is 0.06 mg/L and is largely based on the data presented above for rainbow and cutthroat trout. This value is approximately one-third of the lowest reported LC50 from the studies identified above of 0.19 mg/L (Russo et al., 1973).

5.2 Relevance of the Guideline to the Receiving Environment at Jericho

The data upon which the CCME guideline was derived appear to be applicable to the receiving environment at Jericho because salmonids occur in the receiving environment. However, information on the mechanism of nitrite toxicity have been presented which are applicable to determining safe levels for this parameter to salmonids under the water quality conditions associated with this particular site and discharge.

Uptake of nitrite across the gill generally occurs through chloride channels, which are responsible for maintaining the chloride gradient across the gill in freshwater fish. In particular, these channels are designed to concentrate chloride inside the gill relative to the external environment. Because nitrite is able to enter the fish through these channels, under some circumstances, salmonids will also concentrate nitrite against its concentration gradient (Bath and Eddy, 1980), such that the internal concentration of this parameter can exceed the external concentrations.

Elevated external concentrations of chloride inhibit uptake and toxicity of nitrite, likely as a result of competition at the uptake sites. For example, Eddy et al. (1983) demonstrated that nitrite was almost harmless to Atlantic salmon except in waters with very low chloride concentration. Bartlett and Neumann (1998) also reported decreased toxicity of nitrite to brown trout alevins in water with 10 mg/L, relative to 3 mg/L chloride. Similarly, Russo et al. (1981) demonstrated that increasing chloride from approximately 1 to 10 mg/L resulted in a ten-fold reduction in the sensitivity of trout in a 96-hr exposure.

Wedemeyer and Yasatuke (1978) showed that acute nitrite toxicity to salmonids is ameliorated by the addition of calcium chloride and sodium chloride. Addition of 25 mg/L calcium chloride to the exposure water decreased the toxicity of nitrite by a factor of twelve (LC50 values were 0.6 and 7.3 mg/L NO_2 in 2 and 19 mg/L chloride solutions). Addition of sodium chloride did not have as dramatic an effect, resulting in only a two-fold reduction in toxicity between concentrations of 1 and 18 mg/L chloride. The much lower degree of toxicity reduction associated with sodium chloride addition than with calcium chloride does not appear to agree with other literature, which demonstrate that chloride is the primary factor responsible for modulation of nitrite toxicity to salmonids (Lewis and Morris, 1986). The explanation for the inconsistency in these data is not known; regardless, all of the data demonstrate that the presence of chloride ameliorates the toxicity of nitrite to salmonids.

Acute toxicity data (LC50s) summarized above are presented in Figure 5 in relation to the chloride concentration in the water in which the tests were conducted. Only the maximum and minimum value are shown (connected by a line) for studies in which multiple data points were reported for the same chloride concentration. In general, toxicity is substantially reduced with increasing chloride concentration. As indicated above, the salmonid toxicity data resulting from sodium chloride additions conducted by Wedemeyer and Yasatuke (1978) do not appear to agree with the other data with regard to the degree of protection afforded by chloride; these data are shown as open round datapoints in Figure 5 to distinguish them from the remainder of the dataset. In a review of the effects of nitrite of toxicity to fishes, Lewis and Morris (1986) excluded these data as inconsistent; however, in taking a conservative approach to developing a proposed site-specific guideline, we have included those data, regardless.

Average discharge conditions at Jericho are predicted to contain approximately 490 mg/L of chloride. Thus, a twenty-fold dilution of the discharge will contain approximately 20 mg/L chloride. Tests conducted in water with 10 mg/L chloride, or higher, all exhibited LC50s exceeding 3 mg/L nitrite, except for the LC50 data of 0.8 – 1.5 mg/L nitrite for the NaCl spiked waters from Wedemeyer and Yasatuke (1978). Thus, the LC50 data for sodium chloride spiked water from Wedemeyer and Yasatuke (1978) reflect a highly conservative estimate of the LC50 to salmonids across this range of chloride concentrations, particularly considering that the chloride in the discharge is present with a mixture of counter-ions, in particular, magnesium, calcium and sodium, rather than sodium alone.

Consistent with the original CCME derivation, applying a three-fold safety margin to the lowest value reported by Wedemeyer and Yasatuke (1978) results in a site-specific guideline value of

0.25 mg/L nitrite for chloride concentrations of 20 mg/L or higher. The CCME guideline (0.06 mg/L) appears appropriate for waters with a chloride concentrations less than 1 mg/L. Extrapolating between these values results in a proposed guideline for nitrite for waters with chloride concentrations between 1 and 20 mg/L chloride given by the equation:

Proposed nitrite guideline (mg/L NO_2-N) = (0.01 x [chloride (mg/L)]) + 0.05

The proposed site-specific guidelines are shown in Figure 6 in relation to the most sensitive data from Figure 1. This figure shows that the proposed guideline is well below all reported LC50 values for chloride.

5.3 Summary

The CCME guideline for nitrite is based on toxicity to salmonids. Data in the literature demonstrate that uptake and toxicity of nitrite to salmonids is directly linked to chloride concentrations in the sample matrix; thus, it appears appropriate to alter the guideline in cases where chloride concentrations are elevated, as will occur at the Jericho mine. Proposed guideline values are shown in Figure 6 and summarized in Table 2.

A 10-, 20- and 50-fold dilution of the discharge would contain approximately 47, 24 mg/L and 10 mg/L chloride under average conditions, at which point the proposed guideline would be 0.25, 0.25 and 0.15 mg/L nitrite, respectively.

Table 2. Proposed site-specific water quality guideline for nitrite.

Chloride Concentration (mg/L)	Proposed Nitrite Guideline (mg/L NO_2-N)
≤ 1	0.06
2	0.07
5	0.10
10	0.15
15	0.20
≥ 20	0.25

Figure 5. LC50 data for nitrite presented on the basis of chloride concentration in the water used for the test. Open round datapoints are from Wedemeyer and Yasatuke (1978) and are conservative indicators of potential for effects at the corresponding chloride levels.

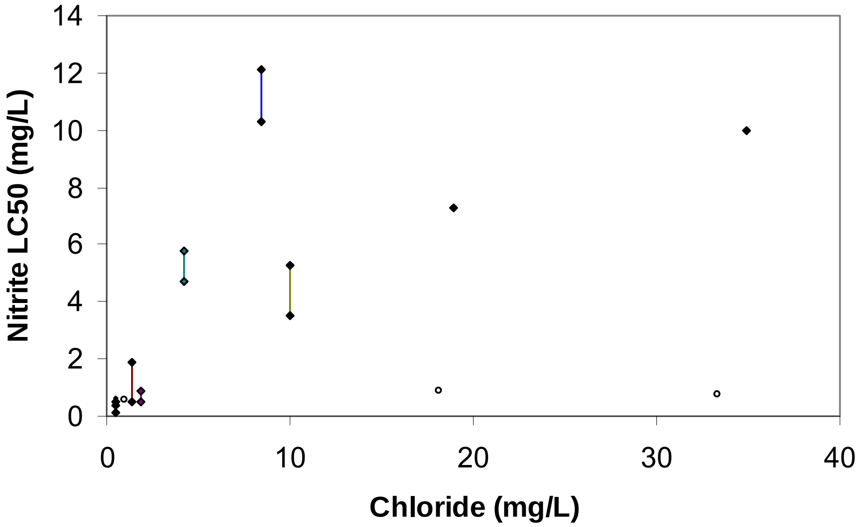
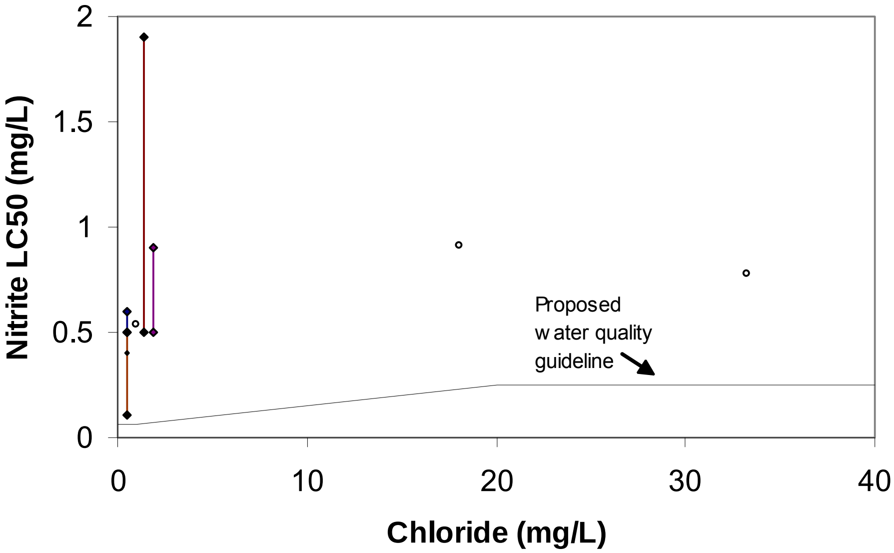


Figure 6. Proposed site-specific water quality guideline for nitrite compared with the most sensitive salmonid LC50 data from the literature.



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APPENDIX C
CoCs

ALS Environmental
ANALYTICAL CHEMISTRY & TESTING SERVICES

www.alsenviro.com

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Fort St. John BC, Box 256, 9831 - 98A Avenue, V1J 6W7, Tel: 250-261-5517 Fax: 250-261-5587
Grand Prairie AB, 9505 - 111 Street, T8V 5W1, Tel: 780-539-5196 Toll Free: 1-800-668-9878 Fax: 780-513-2191
Fort McMurray AB, Bay 1, 245 Macdonald Cr, T9H 4B5, Tel: 780-791-1524 Fax: 780-791-1586
Edmonton AB, 9936 - 67th Avenue, T6E 0P5, Tel: 780-413-5227 Toll Free: 1-800-668-9878 Fax: 780-437-2311
Calgary AB, Bay 7, 1313 - 44th Avenue NE, T2E 6L5, Tel: 403-291-9897 Toll Free: 1-800-668-9878 Fax: 403-291-0298
Saskatoon SK, 819 - 58th Street East, S7K 6X5, Tel: 306-668-8370 Toll Free: 1-800-667-7645 Fax: 306-668-8383

SEND REPORT TO:

CHAIN OF CUSTODY FORM

PAGE OF

COMPANY:		ATTN:	
ADDRESS:			
CITY:	PROV:	POSTAL CODE:	
TEL:	FAX:	SAMPLER:	
PROJECT NAME AND NO.:		QUOTE NO:	
PO NO.:	ALS CONTACT:		

REPORT FORMAT: ☐ HARDCOPY ☐ EMAIL - ADDRESS: ______
☐ FAX ☐ EXCEL ☐ PDF ☐ OTHER:

ANALYSIS REQUESTED:

	WO#	SAMPLE IDENTIFICATION	DATE / TIME COLLECTED		MATRIX															NOTES (sample specific comments, due dates, etc.)
			YYYY-MM-DD	TIME																
FOR LAB USE ONLY																				

TURN AROUND REQUIRED: ● ROUTINE ○ RUSH **SPECIFY DATE:** ______ (surcharge may apply)

SEND INVOICE TO: ☐ SAME AS REPORT ☐ DIFFERENT FROM REPORT (provide details below)

INVOICE FORMAT: ☐ HARDCOPY ☐ PDF ☐ FAX

SPECIAL INSTRUCTIONS:

RELINQUISHED BY:	DATE:		RECEIVED BY:	DATE:	
	TIME:			TIME:	
RELINQUISHED BY:	DATE:		RECEIVED BY:	DATE:	
	TIME:			TIME:	

FOR LAB USE ONLY

Cooler Seal Intact? ___Yes ___No ___N/A	Sample Temperature: _____^{o}C Frozen? ___Yes ___No	Cooling Method? ___Icepacks ___Ice ___None

Tahera
Diamond Corporation

Processed Kimberlite

CHAIN OF CUSTODY/ANALYTICAL REQUEST FORM

Lab Sample ID

DATE SUBMITTED:
DATE REQUIRED: ASAP
SERVICE REQUESTED:
REGULAR
PRIORITY (50% SURCHARGE)
EMERGENCY (100% SURCHARGE)

Sample ID Tahera	**Sampled By**	**Date Sampled**	**Sample Type**	Reaction w/ HCl	Paaste pH	ABA Analysis	ICP-MS Metals	T-Uranium	T-Sulfur							**Lab Sample ID:**

INFORMATION:
Tahera Diamond Corporation

Attn: Cheryl Wray/Mike Tanguay
Tahera Diamond Corporation
c/o Arctic Sunwest Charters
100 Dickens Street
Yellowknife, NT X1A 2P8
Phone: 780-644-9129

NO. SAMPLES:
NO. COOLERS
DROPPED OFF BY:
DATE:
TIME:
RECEIVED BY:
DATE:
TIME:

FOR LABORATORY USE ONLY
SAMPLE CONDITION UPON RECEIPT:
FROZEN:
COLD:
AMBIENT
OTHER (BREAKAGE, LEAKAGE, ETC.):
DATE DUE (Date Received + 5 days):

Tahera
Diamond Corporation

WASTE ROCK

CHAIN OF CUSTODY/ANALYTICAL REQUEST FORM

Lab Sample ID

DATE SUBMITTED:
DATE REQUIRED: ASAP
SERVICE REQUESTED:
REGULAR
PRIORITY (50% SURCHARGE)
EMERGENCY (100% SURCHARGE)

Sample ID Tahera	Sampled By	Date Sampled	Sample Type	Reaction w/ HCL	Paste pH	ABA Analysis	ICP-MS Metals	T-Uranium	T-Copper	T-Sulfur						Lab Sample ID:

INFORMATION:
Tahera Diamond Corporation

Attn: Cheryl Wray
Tahera Diamond Corporation
c/o Arctic Sunwest Charters
100 Dickens Street
Yellowknife, NT X1A 2P8
Phone: 780-644-9129

NO. SAMPLES:
NO. COOLERS
DROPPED OFF BY:
DATE:
TIME:
RECEIVED BY:
DATE:
TIME:

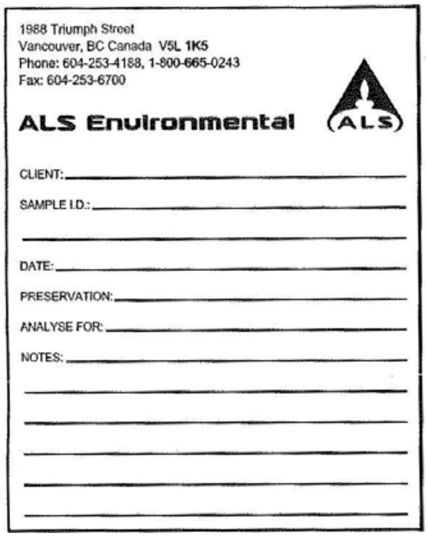
FOR LABORATORY USE ONLY
SAMPLE CONDITION UPON RECEIPT:
FROZEN:
COLD:
AMBIENT
OTHER (BREAKAGE, LEAKAGE, ETC.):
DATE DUE (Date Received + 5 days):

APPENDIX D
SAMPLING SOPs

Water Chemistry Sampling Guide

Field Sampling Procedures

1. Fill in bottle labels prior to sampling; a sample is shown below:



1988 Triumph Street
Vancouver, BC Canada V5L 1K5
Phone: 604-253-4188, 1-800-665-0243
Fax: 604-253-6700

ALS Environmental

CLIENT: ____________________

SAMPLE I.D.: ____________________

____

DATE: ____________________

PRESERVATION: ____________________

ANALYSE FOR: ____________________

NOTES: ____________________

2. Collect all water samples from lakes with the Van Dorn bottle from -1 m depth. Rinse the bottle in lake water to be collected prior to filling.
3. Operator of boat or auger does not collect water.
4. Use latex gloves where possible when handling bottles; do not touch the inside of cap or the rim of sample bottles.
5. Place filled bottles in cooler to keep from freezing in winter and cool in summer.
6. Measure and record field parameters with the YSI Multiprobe.
7. Fill in the field check list.

ENVIRONMENTAL SAMPLING GUIDE

This sampling guide presents only general information for commonly requested parameters in water, soil or sediment samples. It is not possible to specify detailed sampling and preservation methods for the collection of all types of samples because of varied study objectives. ALS Environmental currently provides analysis for more than 2000 parameters in a wide variety of sample types including water, seawater, soil, sediment, biota, and air. Please review relevant reference materials or contact ALS Environmental regarding sampling and analysis for parameters or sample types that are not listed here.

The result of any test procedure is dependent on the condition of the sample on which it is performed. The primary objective of sampling is to collect a portion of material in a small enough quantity to be conveniently transported to and handled in the lab, while still accurately representing the material being tested.

General Sampling Guidelines

- ALS Environmental provides all routine sample containers, labels, preservation chemicals, and field filtration kits free of charge.
- The holding times listed are recommended maximum times that samples may be held between collection and extraction or analysis. Unique sample composition may make the practical holding times shorter or longer.
- A separate container is not required for each parameter requested. More than one parameter can be analysed from the same container if the recommended container type and preservation are the same.
- **Appropriate precautions must be taken when using chemical preservatives.** In general, avoid inhaling fumes and contact with skin, eyes, and clothing.
- Please contact ALS Environmental if you need further information.

Water Samples

- Fill the bottles leaving enough room to add the preservatives, if required, and allow for mixing, unless "No Headspace" is specified.
- For parameters where "No Headspace" is required, it is important to minimize air bubbles in the sample. Fill each container carefully until a meniscus forms above the lip. Tighten the lid down over the meniscus. If any significant air bubbles are visible, the sample should be recollected using a fresh container.
- Sample preservation should be performed immediately upon collection. If preservation is not possible, keep samples cold (4°C) and deliver them to the lab as soon as possible.
- **If preservatives have already been added to the container (this will be indicated on the label) DO NOT RINSE the containers prior to filling them.**

Soil / Sediment Samples

- Soil or sediment samples are not preserved but should be kept cold (4°C).
- Fill containers as full as possible and use the appropriate lid.

For All Samples

1. Seal sample containers well.
2. Label all sample containers clearly with non-removable markings.
3. **Keep all water, soil and sediment samples cold (4°C) but avoid freezing unless otherwise instructed. Biota samples should be frozen.**
4. Complete sample submission or chain of custody forms with all information requested.
5. Pack the samples carefully in a transport cooler or box, to avoid sample breakage.
6. Send the samples to ALS Environmental as soon as possible after collection.

References

APHA = Standard Methods for the Examination of Water and Wastewater, American Public Health Association (APHA).
BCHP = British Columbia Ministry of Health Planning
BCWLAP = British Columbia Ministry of Water, Land and Air Protection.
CCME = Canadian Council of Ministers of the Environment
EPA = US Environmental Protection Agency. Test Methods for Evaluating Solid Wastes SW-846 and / or Methods and Guidance for Analysis of Water.
Puget = Recommended Guidelines for Sampling Marine Sediment, Water Column, and Tissue in Puget Sound, as prepared for US Environmental Protection Agency, Region 10.
P = Plastic [High Density Polyethylene (HDPE) or equivalent]
G = Glass

PARAMETERS IN SOIL / SEDIMENT	MINIMUM WEIGHT	CONTAINER TYPE	PRESERVATION & STORAGE	HOLDING TIME SAMPLE (EXTRACT)	REFERENCE
Inorganic Parameters - Soil / Sediment					
AVS / SEM	125 g	G	No Headspace	14 d	EPA
Particle Size	250 g	G or P	None	6 m	Puget
TOC or Moisture	125 g	G or P	None	14 d / 6 m (frozen)	Puget
Nitrogen, Total	125 g	G or P	None	28 d	Puget
Sulphides, Total	125 g	G or P	None	7 d	Puget
Metals	125 g	G	None	6 m	EPA & BCWLAP
Mercury	125 g	G	None	28 d	EPA & BCWLAP
Organic Parameters - Soil / Sediment					
Volatile Organics (1)	125 g	G, Teflon Lid	No Headspace	7-14 d (40 d)	EPA & BCWLAP
Semi-Volatile (Extractable) Organics (1)	125 g	G, Teflon Lid	None	14 d (40 d)	EPA & BCWLAP
Oil & Grease (Total or Mineral)	125 g	G, Teflon Lid	None	28 d (40 d)	EPA

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(Rev. August 2004)

PARAMETERS IN WATER	MINIMUM VOLUME	CONTAINER TYPE	PRESERVATION & STORAGE (COLOUR OF CAP OR STICKER)	HOLDING TIME SAMPLE (EXTRACT)	REFERENCE(S)
Inorganic Parameters - Water					
Acidity / Alkalinity	100 mL	P or G	None	14 d / 72 hrs	APHA / BCWALP
Ammonia	100 mL	P or G	H_2SO_4 (2, 3) (yellow)	28 d	APHA
Ammonia -Low Level	100 mL	P or G	None	24 hrs / 72 hrs	APHA / BCWALP
Bacteriological Tests	250 mL	P or G Sterile	$Na_2S_2O_3$	24 hrs/30 hrs/48 hrs	APHA/BCHP/BCWALP
BOD	250 mL	P or G	None	48 hrs	APHA
Chloride or Sulphate	100 mL	P or G	None	28 d	APHA
Chromium VI	100 mL	P or G	None	24 hrs	EPA
COD	50 mL	P or G	H_2SO_4 (2, 3) (yellow)	28 d	APHA
Colour	50 mL	P or G	None	48 hrs	APHA
Conductivity	100 mL	P or G	None	28 d / 72 hrs	APHA / BCWALP
Cyanide	1000 mL	P or G	NaOH, Dark (4, 5, 6) (blue)	14 d	APHA
Dissolved Oxygen	100 mL	G	No Headspace/Winkler Kit/Dark	8 hrs	APHA
DOC	100 mL	G	Filtration, HCl (2, 3) (orange)	28 d after filtration	APHA
Fluoride	100 mL	P	None	28 d	APHA
Hardness	100 mL	P or G	HNO_3 (2) (clear)	6 m	APHA
Metals, Dissolved	100 mL	P or G	Filtration, HNO_3 (2, 7) (clear)	6 m after filtration	EPA
Metals, Total	100 mL	P or G	HNO_3 (2, 7) (clear)	6 m	EPA
Mercury	100 mL	P or G	HNO_3 (2) (clear)	28 d	EPA
Nitrate or Nitrite	100 mL	P or G	None	48 hrs	APHA & BCWALP
Nitrate + Nitrite (N+N)	100 mL	P or G	None (8)	48 hrs / 72 hrs	APHA / BCWALP
pH	50 mL	P or G	None	0.25 hrs / 72 hrs	APHA / BCWALP
Phenols (4AAP, colourimetric)	100 mL	P or G	H_2SO_4 (2, 3) (yellow)	28 d	APHA
Phosphate	100 mL	P or G	None	48 hrs	EPA & BCWALP
Residual Chlorine	100 mL	P or G	None	0.25 hrs	APHA
Solids (TDS / TSS)	250 mL	P or G	None	7 d	APHA
Sulphide	100 mL	P or G	Zinc Acetate (red) & NaOH (blue)	7 d	APHA
Surfactants	500 mL	P or G	None	as soon as possible	APHA
Tannin / Lignin	100 mL	P or G	None	as soon as possible	APHA
THMFP	1 L	G	None	as soon as possible	APHA
TKN / Organic N / TN	100 mL	P or G	HCl (2, 3) (orange)	28 d	APHA
TOC	100 mL	G	HCl (2, 3) (orange)	28 d	APHA
Turbidity	100 mL	P or G	Dark	48 hrs / 72 hrs	APHA / BCWALP
Organic Parameters - Water					
Volatile Organics:					
VOC, BETX, VPH, MTBE, CCME F1	2 x 40 mL	G Vial, Teflon cap	No Headspace(9), HCl, H_2SO_4 or $CuSO_4$	7-14 d	EPA, BCWLAP & CCME
Semi-Volatile (Extractable) Organics:					
EPH, CCME F2	500 mL (10, 11)	G, Teflon cap	None	7 d (40 d)	BCWLAP & CCME
Formaldehyde	2 X 40 mL	G, Teflon cap	None	7 d	EPA
Glycols	40 mL	G, Teflon cap	None or H_2SO_4 (12) (yellow)	7 d	EPA
Herbicides	1000 mL	G, Teflon cap	Contact ALS Environmental	7 d (40 d)	EPA
Phenolics (Chlorinated & Non-Chlorinated)	500 mL	G, Teflon cap	None (9)	7 d (40 d)	EPA
Light Gases	40 mL	G, Teflon cap	H_2SO_4 (yellow)	7 d	EPA
Organochlorine Pesticides (OCP)	1000 mL	G, Teflon cap	None (9)	7 d (40 d)	EPA
Organophosphorous Pesticides (OPP)	1000 mL	G, Teflon cap	NaOH or H_2SO_4 (13)	7 d (40 d)	EPA
Polycyclic Aromatic Hydrocarbons (PAH)	500 mL (10, 11)	G Amber, Teflon cap	Dark, None (9)	7 d (40 d)	EPA
Polychlorinated Biphenyls (PCB)	500 mL	G, Teflon cap	None (9)	7 d (40 d)	EPA
Resin Acids / Fatty Acids	500 mL	G, Teflon cap	None (9)	7 d (40 d)	EPA
Oil & Grease (Total or Mineral)	500 mL (9)	G, Teflon cap	H_2SO_4 (yellow) or HCl (2) (orange)	28 d (40 d)	EPA & APHA
Dioxins / Furans	1000 mL	G Amber, Teflon cap	Dark, None (9, 14)	30 d (45 d)	EPA

1. See Organic Parameters - Water for examples of parameters in this group.
2. Adjust samples to pH<2 with the specified acid.
3. Analyse immediately if not preserved.
4. If oxidizing agents (eg. Chlorine) are present, add 0.1g of sodium arsenite ($NaAsO_2$) per litre of sample. Refer to APHA for details.
5. For samples where sulfide may be present, analyse immediately or pre-treat with $PbCO_3$.
6. Adjust samples to pH > 12 with NaOH.
7. If ultra-low detection limits are required (or for seawater samples) special plastic bottles must be used. Please contact ALS Environmental.
8. When sample is preserved with H_2SO_4 holding time is 28 days, but NO_3 and NO_2 cannot be determined as individual species.
9. For samples for THM analysis where free chlorine might be present, EPA recommends preservation with 80 mg of sodium thiosulfate ($Na_2S_2O_3$) per litre of sample. This preservative can be supplied by ALS Environmental by special request.
10. Since the entire sample is used for analysis, laboratory replicates cannot be performed. Therefore, we recommend that a field replicate is submitted (as a backup) in case the sample has to be re-analysed.
11. EPH & PAH can be analysed from the same container and are required to calculate Light & Heavy Extractable Petroleum Hydrocarbons (LEPH & HEPH).
12. If samples are preserved with H_2SO_4, the holding time for Ethylene Glycol is 14 days.
13. Adjust samples to pH 5-8 using NaOH or H_2SO_4.
14. If sample pH is >9, adjust to pH 7-9 with H_2SO_4.

Process Kimberlite Sampling Guide

TAHERA
DIAMOND CORPORATION

Processed Kimberlite Sampling

Owner: Environment	**Approver:** HSE Manager	**Issue Number:** 1.0	**Creation Date: 16-Feb-06**
			Revision Date:

1. Objectives

This procedure has been prepared to provide process plant lab technicians with directions for collecting processed kimberlite samples for ABA analysis.

2. Scope

This procedure covers the collection of coarse processed kimberlite rejects (CPK), fine processed kimberlite slurry (FPK) and recovery circuit rejects (RR).

3. Definitions

4. References

- Jericho Water Licence NWB1JER0410 Part H, Item 3 and Schedule H, Item 2
- Tahera Diamond Corporation-Waste Rock Management Plan (Part 2, Kimberlite Ore, Coarse Processed Kimberlite and Recovery Circuit Rejects)

5. General Procedures

Process plant lab technicians:

Technicians will be required to collect samples every two weeks on Tuesday. There are three samples to be collected;

- Coarse Processed Kimberlite (CPK) from CV-08
- Recovery Circuit Rejects (RR) from CV-10
- Fine processed kimberlite slurry (FPK) from the tailings line

Following is a description of sample labelling and collection for each sample.

Coarse Processed Kimberlite (CPK)

- Label a Ziploc freezer bag with the sample location and date. For example a sample of coarse rejects collected on February 16, 2006 would be labelled as CPK-16/Feb/06.
- Fill the bag completely with coarse rejects sample from CV-08
- Contact the environment department for sample pick up

Recovery Circuit Rejects (RR)

- Label a Ziploc freezer bag with the sample location and date. For example a sample of recovery rejects collected on February 16, 2006 would be labelled as RR-16/Feb/06.
- Fill the bag completely with recovery rejects sample from CV-10
- Contact the environment department for sample pick up

Fine Processed Kimberlite (FPK)

- Label a Ziploc freezer bag with the sample location and date. For example a sample of fine processed kimberlite collected on February 16, 2006 would be labelled as FPK-16/Feb/06.
- Collect a cut of kimberlite slurry from the tailings outflow pipe
- Allow the sample to settle for 24 hours in the met lab
- Contact the environment department they will collect a sample of clear water from the top of the bucket
- Drain off the water after the water sample has been collected.
- Fill the previously labelled Ziploc bag with the settled solids
- Environment will take the samples for shipment

Environment Staff:

Environment staff are responsible for picking up the samples from the met lab and shipment to the laboratory. As well as collection of a monthly water sample (JER-SW3) of the supernatant liquid from the fine kimberlite sample.

Samples are recorded in the Processed kimberlite sampling log, and a chain of custody is completed. The samples require paste pH, reaction w/ HCl and total sulphur every fifth sample requires paste pH, reaction w/ HCl, Total Sulphur, Full ABA, ICP-Metals and Total Uranium. Every fifth sample is identified on the sampling log.

Sample Shipment:

- Samples are packaged in a cooler and labelled for shipment to ALS Chemex

ALS Chemex

212 Brooksbank Ave

North Vancouver, BC

V7J 2C1

Phone: 604-984-0221

The chain of custody is packaged in a Ziploc bag and placed inside the cooler with the samples.

A Tahera shipping order form is also completed and the samples taken to shipping and receiving for shipment.

6. Records

- \\10.3.7.1\Environment\Waste Rock Samples\Processed Kimberlite Sampling Log
- Chain of Custody Form

Solids Geochemistry

Geochemical monitoring will be carried out to confirm the geochemical properties of the waste rock and overburden. Characterization of the waste rock will include:

- Sample collection every week for the first year of mining, and, assuming that the testing data indicates minimal variability in the geochemistry of the waste rock, the sample frequency would be reduced for the remaining years of mining.

- Sample collection from each rock type present (i.e. granite/granodiorite, pegmatite, diabase,)

- Geological descriptions of the samples and general geological observations of the blasted rock, including observations of the presence and composition of any large xenoliths, and the occurrence of sulphide minerals will be made and recorded by appropriately trained staff.

- Testing of paste pH, reaction with dilute HCl, total sulphur, copper and uranium analyses on every sample. (Uranium analyses may be discontinued after the first year of testing if uniformity can be demonstrated). Full ABA analyses and ICP-metals would be performed on every fourth sample for the first two years of mining, and then, assuming the material is reasonably consistent, the frequency would be reduced to every 10th sample for the remainder of the mining operations.

- Testing of a duplicate sample every 10th sample.

In addition, once per year, accessible areas of the pit walls will systematically examined to identify any areas of sulphide mineralization, and to map major rock types. The results will be recorded on bench plans.

Overburden samples will be collected and submitted for full ABA and ICP analyses once every two months.

Waste Rock Sampling:

Labeling is as follows:

e.g. - Pit-Rock type-Bench-Pattern

JER-D-465-12

We are also required to collect a duplicate sample every ten samples, to accommodate this we would append L1 to the name of the sample. In the above example the two samples sent to the lab would be labeled

JER-D-465-12
JER-D-465-12-L1

We should also write the date on the sample bag. My preference is in this format (dd-mmm-yy ie 26-Nov-05) so there is never any confusion between month and day.

CCME Guidelines for Total Metals for Fresh Water for Drill cuttings

Parameter	Guideline (mg/L)
Al (Aluminum)	0.1
As (Aresnic)	0.005
Cd (cadmium)	0.00002
Cr (Chromium)	0.001
Cu (Copper)	0.002
Fe (Iron)	0.3
Pb (Lead)	0.001
Ni (Nickel)	0.025
Se (selenium)	0.001
Ag (Silver)	0.0001
Tl (Thallium)	0.0008
Zn (Zinc)	0.03

Stream Flow Measurement Procedures

Objective

This document advises Tahera employees and contractors, of the respective procedures that must be followed when conducting stream flow sampling for environmental monitoring programs to obtain an accurate measurement of the stream water discharge.

Scope

This procedure applies to all Tahera Environment employees and contractors that conduct stream flow sampling as part of the environmental monitoring programs at the Jericho project

Introduction

Due to the required consistency of stream flow data collected for environmental monitoring programs, this procedure has been implemented to standardize data collection.

Definitions

Hydrology Station	A wooden or metal structure located at the stream edge with a staff gauge and a metal box that houses a data logger.
Staff Gauge	A large metal ruler attached vertically to a hydrology station that indicates the water level in centimeters and meters.
Stream Velocity Meter	This is the name of the meter which digitally displays the flow information. It is attached to a wading rod and reads the stream flow rate.

Preparation

Hazards

- Use caution when entering fast flowing waters.
- Use caution when entering deep water.
- Use caution when measuring in ice covered stream beds
- Use caution when measuring during spring breakup (large blocks of ice)
- Stream bed may be slippery.
- Water will be very cold.
- Watch for grizzly bears.
- Use caution when loading and unloading the helicopter.
- Use caution when entering and exiting the helicopter.

Tools

- A map indicating location of stream flow sites.
- GPS coordinates of each station for field crew and pilot.

- Stream velocity meter
- Stream flow wading rod
- Spare equipment for the stream flow rod (propellers, nose pieces, etc)
- Extra batteries for stream velocity metre
- 50metre measuring tape.
- Chest waders for each person
- Life vests for those persons working in the stream
- Clipboard
- Data sheets
- Extra pencils
- Calculator
- Radio
- Extra clothes
- Warm gloves
- Bug jacket (when applicable)
- Floater suit (when applicable)
- Safety line (when applicable)

Requirements

- Information on the task the procedure is being based on.
- Knowledge of how to use a Stream flow meter and wading rod.
- Helicopter orientation if going to sites without road access.

Tasks

1.Equipment Preparation

Ensure that you have all of the tools required and they are in good, working condition.

Environment staff, students and contractors

2.Staff Gauge Reading

- Read and record the water level on the staff gauge. Increments are in centimeters. Readings should be to 3 decimals (eg. 0.675m). If the staff gauge is surrounded by snow/ice it should be noted on the stream flow sheets. In addition, if the staff gauge appears damaged or knocked over it should also be noted.

Environment staff, students and contractors

3.Choosing the stream transect site

Site selection for the transect is based on the following requirements:

- An area that is safe to cross.
- Free of nearby upstream obstructions (large boulders, thick vegetation and islands).
- Has a stream bed that is as flat as possible.
- Near the hydrology station.
- Flows should be fast enough that the flow meter shows a reading, but ideally flows must not be turbulent.
- Transect should be in a straight section of stream with even flow
- After the initial selection of the site during the first visit of the season, this same site should be used for the remainder of the season. It may be helpful to mark the site with rebar or a rock with flagging tape on each stream bank. Varying water levels may require that the cross sections selected for the flow measurements are moved up or downstream throughout the year.

Environment staff, students and contractors

4.Set up for Stream Flow Measurements

- Fill in required information on data sheets (date, station name, time, weather, sampler initials, staff gauge reading)
- Run the meter tape across the width of the stream from one stream bank to the other. Secure it with rebar or rocks to prevent the tape from dipping into the water or coming loose. This cross section must cover all channels of a braided stream.
- Record the reading on the measuring tape at the point where the water begins on both banks.
- Subtract the larger number from the smaller number to calculate the width of the stream.

Environment staff, students and contractors

5. Determine Measurement Intervals

To determine the intervals at which to take the velocity and depth measurements, follow these guidelines:

- Stream width is **<3m**, then **10** measurement points
- Stream width is **≥3m**, then **20** measurement points required
- Stream width **>20m**, then take a measurement every metre
- The more measurement points taken, the more accurate the flow measurement will get. For example:
- If a stream width is 15.25 metres then to figure out the measurement point,
- 15.25/20 = 0.76 (round to two decimal places). Take your first measurement at the shortest distance from the bank where the water is sufficiently deep to allow a measurement to be taken. Then start your 20 points 0.76m from your first reading.

Environment staff, students and contractors

6.Determine Depth for Flow Measurement

To determine the depth, at which the reading is taken, follow these guidelines:

- Water depth **≤0.75m**, take 1 measurement at **40%of the total depth**
- (60% below the water surface)
- Water depth **>0.75m**, take a reading at **20%** and **80% of the total depth.**
- (80% below the water surface = 20% of total depth)
- (20% below the water surface = 80% of total depth)
- Example:

The depth in a particular point is 0.65m, then to take a measurement that is 40% of the depth, 0.65 x 0.40 = 0.26m. The reading would be taken 0.26m from the bottom of the stream flow rod.

- The water depth at each interval along the metre tape should be recorded. Velocity measurements are to be taken at the same location as the depth readings.

Environment staff, students and contractors

7.Things to Remember When Taking the Flow Measurement

The following things that should be remembered when measuring stream flow:

- Always stand downstream of the rod when you are taking the measurement.
- The propeller should be facing upstream perpendicular to the measuring tape
- The propeller only spins in one direction when facing upstream. The propeller will spin the opposite direction when you are standing in backwaters, note this reading as a negative reading.
- When taking the flow measurement use the maximum possible averaging time (approximately 25 seconds) on the flow metre.

Environment staff, students and contractors

8.Operating the Flow Meter.	Refer to the instruction manuals for operation instructions when using the flow meter. • Locate your point on the metre tape. Record this. • Measure the depth of the water at the point on the transect. Record this. • Adjust the flow rod so the propeller is at the proper height, according to the water depth. • Take an average flow measurement. Record this. • Continue to record the point, the depth and the average flow reading for each point along the transect.	**Environment staff, students and contractors**
9. Before leaving the site.	• Before leaving a stream flow site ensure that all the required information has been recorded and no equipment has been left behind.	**Environment staff, students and contractors**

Documents and Records

Tahera
Diamond Corporation

Stream Flow Monitoring

Location:

Date (DD/Month/YY):

Time (24 hour):

Observer:

Weather: Clouds (in 10th) Precipitation (Y/N)
Snowpatches visible (Y/N)

Tape Measure Reading at the Left Streambank (i.e. depth of water is zero) - when looking upstream (m):

Tape Measure Reading at the Right Streambank (i.e. depth of water is zero) - when looking upstream (m):

Staff Gauge Reading (m):

Tape Measure	Total Depth	Velocity		
		60% OR	20%	80%
(m)	(cm)	(m/s)	(m/s)	(m/s)
		NOTE: If depth > 0.75 m take velocity measurements at 20% AND 80% of depth		

Location:
Date:
Page No: