

**Mount Nansen  
Water Resources Investigations  
Quarterly Report  
January - March 2014**

**Prepared for:**

**Yukon**

Energy Mines and Resources  
Assessment and Abandoned Mines

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## EXECUTIVE SUMMARY

EDI Environmental Dynamics Inc. (EDI) was retained by Yukon Government, Assessment and Abandoned Mines (AAM) in 2013 to conduct the Water Resource Investigations 2013/14 program at the Mount Nansen Site. This program involves surface water hydrometric and water quality monitoring, and meteorology for five watersheds at the Mount Nansen Site. The data presented in this report comprises the fourth quarter of the program (Q4), from January 1, 2014 to March 31, 2014.

Over the course of the Q4 period, three monitoring events took place:

- January 13-15, 2014
- February 10-12, 2014
- March 10-12, 2014

Several changes to the program scope were implemented during the Q4 period; including the removal of five hydrometric stations and five water quality sites, plus the addition of one water quality site.

The monitoring objectives during this period were to collect surface water data through the late winter period. Hydrometric monitoring was completed at 14 hydrometric stations. Monitoring at each station included discharge measurements and water level surveys where continuous stage data loggers are installed. Four of the fourteen stations have continuous water level loggers installed for the winter period, while the remaining stations serve as instantaneous discharge measurement locations. Stream gauging methods included the velocity-area method (mid-section method), salt dilution gauging and volumetric method.

Water quality sampling was completed at 18 water quality sites. Water samples were collected at each site along with *in situ* water quality parameters such as water temperature, specific conductivity, pH and turbidity. Water samples were analyzed for total and dissolved metals, anions and nutrients, routine parameters, and cyanides, in addition to a drinking water samples from a drinking water well.

This report summarizes the site conditions between January 1, 2014 and March 31, 2014 and presents the collected data for the same time period. A description of the methodologies used for each component is also provided. Hydrometric results include stream discharge measurements, updated rating curve expressions for each station (where possible) and hydrographs. Water quality results include a summary of parameters that exceed the Canadian Council of Ministers of Environment Aquatic Life guidelines and/or the Mount Nansen Effluent Quality Standards, *in situ* water quality parameters. A brief description of the daily and hourly meteorological data for the Q4 period is also presented. A copy of the updated hydrometric, water quality and meteorological databases, containing all raw data, accompanies this report.



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# 1 INTRODUCTION

Yukon Government Assessment and Abandoned Mines (AAM) retained the services of EDI Environmental Dynamics Inc. (EDI) in 2013 to conduct the Water Resource Investigations 2013/14 program at the Mount Nansen Site. This program involves three monitoring components: surface water hydrology, surface water quality, and meteorology. This report represents the data report for the fourth quarter (Q4) of the program, from January 1, 2014 to March 31, 2014.

The Q4 period consisted of a single monthly monitoring event for each month in the quarter. The dates of each monitoring event were:

- January 13-15, 2014
- February 10-12, 2014
- March 10-12, 2014

This report outlines the methodology used for all program components, presents the results for each monitoring event and provides recommendations to implement within the program. The data included in this report for each component is summarized Table 1-1, below.

**Table 1-1. Summary of meteorology, hydrology and water quality data included in this report.**

Monitoring Component	Data Included	Section
Meteorology	• Summary of daily meteorological data	• 3.1
	• Hourly meteorological plots	• Appendix F
Hydrology	• Rating curve data summary tables	• 3.2
	• Database tables	• Appendix D
	• Field data sheets	• Appendix C
Water Quality	• Guideline/standard exceedance summary tables	• 3.3
	• <i>In situ</i> water quality data summary tables	• 3.3
	• Lab results table and QA/QC analysis	• Appendix E
	• Field data sheets	• Appendix C



## 1.1 SITE CONDITIONS

Site conditions during the Q4 period were typical of the late winter period with cold ambient air temperatures and precipitation falling as snow. The following specific observations were made during each trip to the Mount Nansen Site:

- **January 13-15, 2014** – Air temperatures varied from cold to unseasonably warm, ranging from -2 °C to -32°C during the January 2014 investigation. Continuous ice cover was present across the site with ice thickness ranging from 0.05 m to 0.90 m, with the exception of open water leads in sections of Victoria Creek. Significant quantities of aufies remain present within the Dome Creek watercourse and at the Victoria Creek at Road station/site. Water levels at all stations and sites were typical of the mid-winter period, with discharges ranging from low to moderate. Many water quality sampling sites and hydrometric stations remain frozen to substrate with no detectable flowing water (i.e. Pony Creek, sections of Dome Creek, and Back Creek).
- **February 10-12, 2014** – Air temperatures were cold with persistently very cold temperatures ranging from -30 °C to -40 °C for the duration of the investigation. Weather conditions were clear with occasional light winds. Continuous ice cover was present on all watercourses, with ice thickness ranging from 0.05 m to 1 m. Water levels at all stations and sites were typical of the late-winter period, with low discharges.
- **March 10-12, 2014** – Air temperatures were seasonably warm, with temperatures ranging from +2 °C to -5 °C. Weather conditions were clear with light winds. Continuous snow and ice cover was present across the site with ice thickness ranging from 0.05 m to 1.08 m. Water levels at all stations and sites were very low and typical of the late-winter period.



## 2 METHODOLOGY

The Mount Nansen surface water and meteorological monitoring network consists of several discrete components: meteorology, surface water hydrology, and surface water quality. The following sections describe the monitoring network and the various meteorological, hydrometric, and water quality sampling methods used during the Q4 period (January 1, 2014 to March 31, 2014).

The Q4 report is a continuation of the previous quarterly programs (EDI 2013a, EDI 2013b and EDI 2014). Methods have remained consistent from the previous investigation periods, with slight changes to the monitoring network due to program scope changes occurring in January 2014.

### 2.1 MONITORING NETWORK DESCRIPTION

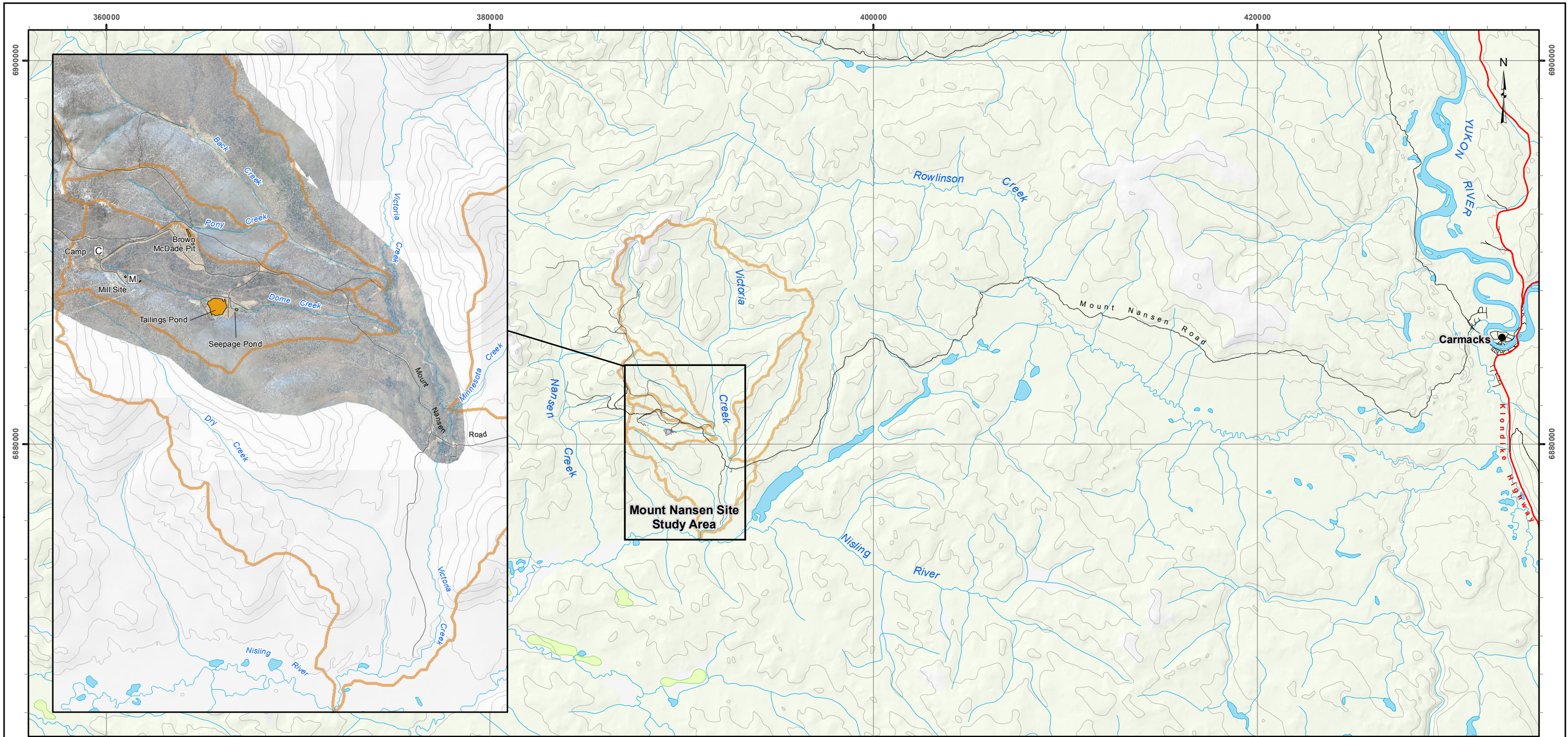
The Mount Nansen Site lies within the Victoria Creek drainage which is a tributary to the Nisling River. Several smaller watercourses drain the mine site area, including Dome Creek and Pony Creek. Dome Creek is a tributary to Victoria Creek and originates upstream of the mill, flows through the valley and is diverted around the tailings pond. Pony Creek lies within the northern portion of the mine site area to the north of the Brown-McDade pit lake. Pony Creek is a tributary to Back Creek, which flows into Victoria Creek upstream of the Dome Creek confluence. Minnesota Creek also flows into Victoria Creek downstream of the Dome Creek confluence. See Figure 1 and Figure 2 for a regional overview of the watersheds present within the study area as well as water resources investigation site and station locations.

Several changes to the program scope were implemented during the Q4 period; including the removal of five hydrometric stations (H-DC-DX, H-DC-U1, H-DC-U2, H-VC-REF, and H-MN) and five water quality sites (WQ-DC-U1, WQ-DC-U2, WQ-VC-REF, WQ-MN, and WQ-DRY), plus the addition of one water quality site (WQ-DC-B). As of January 1, 2014, there were a total of 14 hydrometric stations and 18 surface water quality sites positioned throughout the five drainages on-site. The list and location of hydrometric stations is summarized in Table 2.1 below and identified in Figure 2.



Table 2-1. List of hydrometric stations and water quality sites at the Mount Nansen Site as of January 1, 2014 based on scope changes.

Station/Site Name	Hydrology	Water Quality	Station/Site ID
Upper Pony Creek	✓	✓	H/WQ-PC-U
Pony Creek Downstream of Pit	✓	✓	H-PC-DSP/WQ-PC-D
Dome Creek at DX	Removed	✓	WQ-DC-DX
Dome Creek at DX+105	✓	✓	H/WQ-DC-DX+105
Upper Dome Creek 1	Removed	Removed	H/WQ-DC-U1
Upper Dome Creek 2	Removed	Removed	H/WQ-DC-U2
Dome Creek at D1b	✓	✓	H/WQ-DC-D1b
Diversion Channel at Bridge	✓	Added	H/WQ-DC-B
Middle Dome Creek	✓	✓	H-DC-M/WQ-DC-U
Dome Creek at Road	✓	✓	H/WQ-DC-R
Seepage Pond Outflow	✓	✓	H/WQ-SEEP
Tailings Pond	✓	✓	H/WQ-TP
Brown-McDade Pit Lake	-	✓	WQ-PIT-1,2,3
Mill Site Seep 03	-	✓	WQ-MS-S-03
Back Creek	✓	✓	H/WQ-BC
Minnesota Creek	Removed	Removed	H/WQ-MN
Victoria Creek Reference	Removed	Removed	H/WQ-VC-REF
Upper Victoria Creek	✓	✓	H/WQ-VC-U
Victoria Creek Downstream of Back Creek	✓	✓	H/WQ-VC-DBC
Victoria Creek Upstream of Minnesota Creek	✓	✓	H/WQ-VC-UMN
Victoria Creek at Road	✓	✓	H/WQ-VC-R
Pump House Well	-	✓	WQ-PW
Dry Creek Reference	-	Removed	WQ-DRY



### Regional Overview Map of Mount Nansen Site Area

**Legend**

- Secondary Road
- Highway
- Topographic Contour
- Watercourse
- Waterbody
- Wetland Area
- Drainage Areas (Local)

1:50,000 and 1:250,000 Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.

Digital Elevation Model provided by Geomatics - Yukon Government via online source (Corporate Spatial Warehouse) [www.geomaticsyukon.ca](http://www.geomaticsyukon.ca).

Watercourse, drainage areas and Mount Nansen Road layers digitized / modified by EDI (2011) using orthophotos provided by Yukon Government, Energy, Mines and Resources (2011).

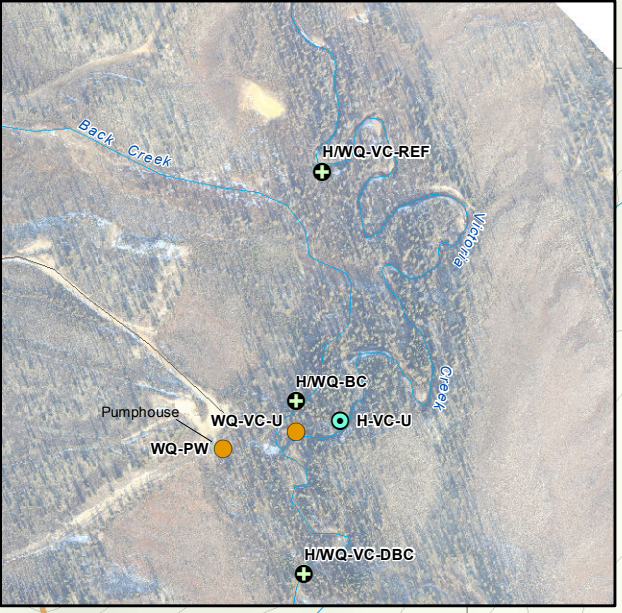
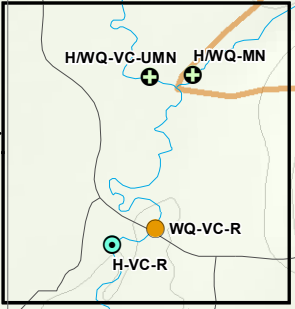
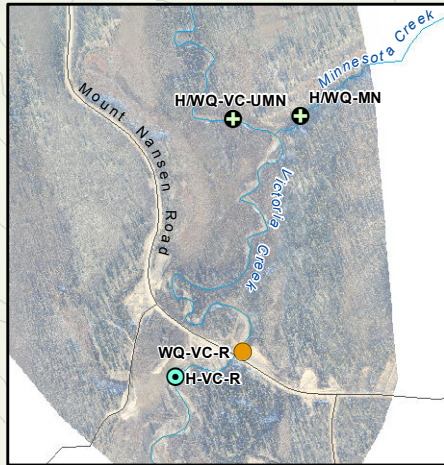
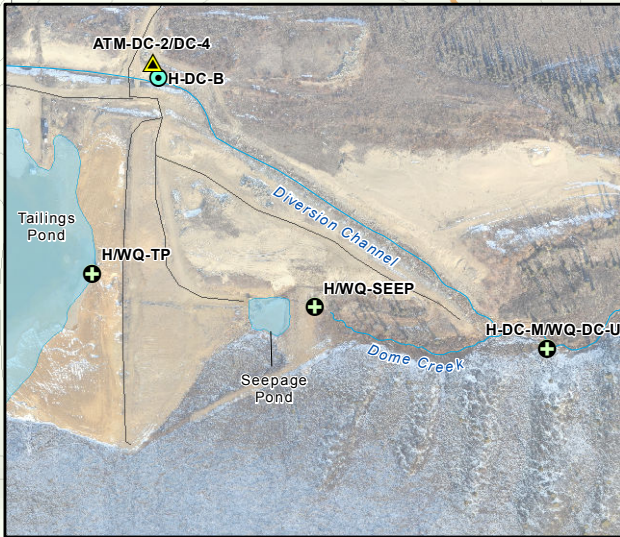
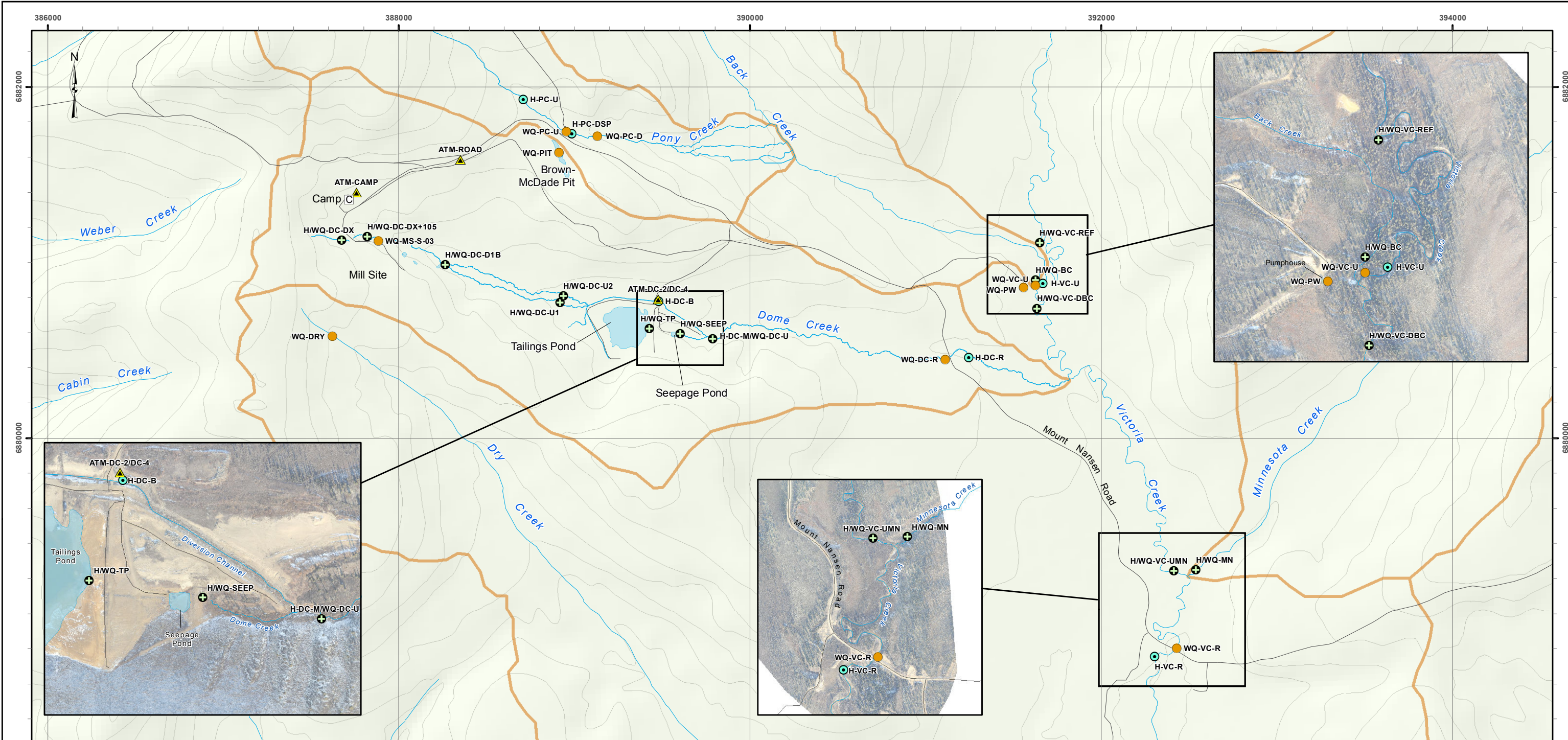
This document is not an official land survey and the spatial data presented is subject to change.



Map Scale = 1:200,000 (printed on 11 x 17)  
Map Projection: North American Datum 1983 UTM Zone 8N

Drawn: LG	Checked: MM	<b>FIGURE 1</b>	Date: 20/03/2014
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**Mount Nansen Site: Hydrometric Stations and Water Quality Sites**

- Legend**
- Atmospheric Station (label ex: ATM-DC-2)
  - Hydrometric Station and Water Quality Site (label ex: H/WQ-VC-UMN)
  - Hydrometric Station (label ex: H-VC-R)
  - Water Quality Site (label ex: WQ-PC-U)
  - Unpaved Road/Access
  - Drainage Areas (Local)

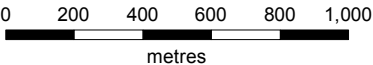
1:50,000 and 1:250,000 Topographic Spatial Data provided by Geomatics - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.

Digital Elevation Model provided by Geomatics - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.

Watercourse, drainage areas and Mount Nansen Road layers digitized / modified by EDI (2011) using orthophotos provided by Yukon Government, Energy, Mines and Resources (2011).

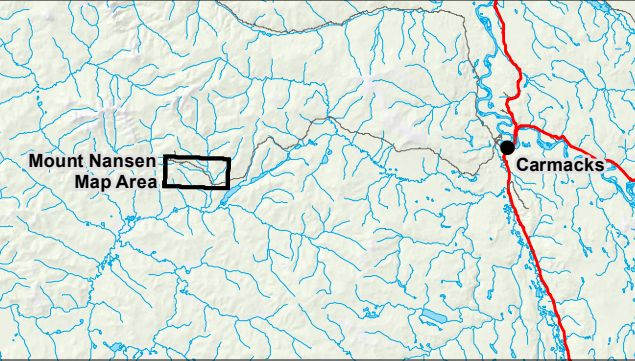
Project data displayed is site specific. Data collected by EDI Environmental Dynamics Inc. (2013) was obtained using Garmin GPS technology.

This document is not an official land survey and the spatial data presented is subject to change.



Map Scale = 1:22,000 (printed on 11 x 17)  
Map Projection: North American Datum 1983 UTM Zone 8N

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## 2.2 METEOROLOGY

A Campbell Scientific meteorological station (ATM-ROAD AAM) was established at the Mount Nansen Site in October 2011. The station is located adjacent to the Mount Nansen Road, east of the camp (Figure 2). This station replaced the HOBO Onset weather station that was located near the camp kitchen (ATM-CAMP AAM), which operated from 2009 to 2011. The ATM-ROAD AAM station is administered by Northern Avcom and data is accessible through an internet download. EDI is responsible for downloading and compiling these raw data into a database. A basic quality control/quality assurance review is completed upon data retrieval; however, EDI is not responsible for meteorological station instrumentation maintenance or sensor calibration.

The ATM-ROAD AAM station records air temperature, ground temperature, humidity, rainfall, snow depth, net shortwave and long-wave radiation, total radiation, wind speed, wind direction and battery voltage (Table 2-2). Barometric pressure (mbar) data collection at the station began on August 30, 2012.

**Table 2-2. Summary of weather data parameters collected at Mount Nansen Meteorological Station (ATM-ROAD AAM)**

<b>Meteorological Parameter</b>	<b>Units</b>	<b>Notes</b>
<b>Daily Collection</b>		
Air Temperature Maximum	°C	Measured every 5 minutes. Daily maximum value is reported.
Air Temperature Minimum	°C	Measured every 5 minutes. Daily minimum value is reported.
Humidity Maximum	%	Measured every 5 minutes. Daily maximum value is reported.
Humidity Minimum	%	Measured every 5 minutes. Daily minimum value is reported.
Snow Depth	cm	Reports the depth of snow at the end of the day.
Battery Voltage	Volts	Measured every 5 minutes. Daily minimum value is reported
<b>Hourly Collection</b>		
Net Shortwave	W/m <sup>2</sup>	Measured every 5 minutes. Hourly average is reported.
Net Longwave	W/m <sup>2</sup>	Measured every 5 minutes. Hourly average is reported.
Net Total Radiation	W/m <sup>2</sup>	Measured every 5 minutes. Hourly average is reported.
Wind Speed	m/s	Measured every 5 minutes. Hourly average is reported.
Wind Direction	degrees	Measured every 5 minutes. Hourly average is reported.
Precipitation	mm	Total precipitation recorded hourly.
Snow Depth	cm	Hourly sample recorded.
Air Temperature	°C	Measured every 5 minutes. Hourly average is reported.
Humidity	%	Measured every 5 minutes. Hourly average is reported.
Ground Temperature Surface	°C	Hourly sample recorded.
Barometric Pressure	mbar	Hourly sampling began August 30, 2012 at 15:00

## 2.3 HYDROLOGY

The methods used for the 2013/14 hydrometric monitoring program closely follow that outlined by EDI (2013c) in the *Mount Nansen Site Hydrologic Monitoring: 2012-2013* report including data management and data processing methodology.



Discharge and/or stage were measured at 14 different hydrometric stations either continuously with water level loggers or instantaneously during each site visit depending on field conditions. There were ten combined continuous/instantaneous hydrometric stations and four instantaneous hydrometric stations (Table 2-2). Only four of these stations (H-DC-M, H-VC-U, H-VC-DBC, and H-VC-R) remain active through the Q3 and Q4 winter months. During each monitoring event, instantaneous discharge measurements were made at all sites (continuous/instantaneous) as long as channel conditions allowed.

A detailed description of each hydrometric station is found in Appendix D. Table 2-3 summarizes the hydrometric station characteristics that comprise the monitoring network at the Mount Nansen site.

Methods employed for discharge measurement in 2014 included:

- the velocity-area mid-section method;
- volumetric measurements at perched outlets such as culverts and pipes; and,
- salt dilution gauging (brine salt slug injection) methods.

The velocity-area mid-section method is standardized by British Columbia's Resources Information Standards Committee (RISC 2009), however many of the channels at the site are inappropriate for using this method (*i.e.*, too shallow, too narrow or low discharge). In such cases, alternative methods including salt-dilution gauging and volumetric measurements are used. When salt dilution or volumetric measurements are made, field crews collect replicate measurements and mean resultant discharge estimates are calculated. An elevation survey is completed during each hydrometric station visit where there are continuous data loggers installed. These surveys were used to monitor shifts in benchmarks, station, and staff gauge elevations. Due to periglacial processes, shifting installations are common and require post-collection data adjustments.

Given the small channel sizes and relatively low discharge at many stations, the minimum reportable discharge is set to 0.001 m<sup>3</sup>/s or 1 L/s; this value is lower than what is typically reported for other hydrometric programs (e.g., Water Survey of Canada uses +/-0.01 m<sup>3</sup>/s for open water conditions). Field methods used at Mount Nansen can accommodate this higher resolution of discharge under ideal conditions, however measurement uncertainty for each method should be considered when interpreting results. Measurement uncertainty is partly based on instrument accuracy (Appendix D, Table D-1). Discharges calculated for several stations were less than 0.001 m<sup>3</sup>/s and reported as 0.000 m<sup>3</sup>/s, below reportable confidence limits.

All velocity-area measurements of stream discharge used the Sontek Acoustic Doppler Velocimeter (ADV). The ADV is advantageous to the hydrometric program because it has the ability to collect velocity measurements in two dimensions and thus compensate for measurement error associated with velocity angles. The ADV also provides a variety of quality control and assurance assessments in real-time, reducing field measurement error. The absence of moving parts on the acoustic sensor also decreases measurement error during winter conditions when moving parts tend to freeze.



Table 2-3. Mount Nansen hydrometric station information, January 1 to March 31, 2014.

HID <sup>1</sup>	Hydrometric Station Name	Type <sup>2</sup>	Location <sup>3</sup>		Drainage Area (km <sup>2</sup> )	Elevation <sup>4</sup> (m)
			Easting	Northing		
ATM-DC2	Barometric at Diversion Channel	ATM	389476	6880792	-	1099
ATM-DC3	Barometric at Diversion Channel	ATM	389476	6880792	-	1099
ATM-DC4	Barometric at Diversion Channel	ATM	389476	6880792	-	1100
H-PC-U	Upper Pony Creek	I	388709	6881930	0.8	1227
H-PC-DSP	Pony Creek Downstream of Pit	I	388986	6881734	1.0	1191
H-DC-DX+105	Dome Creek at DX+105	I	387820	6881150	0.9	1204
H-DC-D1b	Dome Creek at D1b	I	388262	6881000	1.4	1156
H-DC-B	Diversion Channel at Bridge	I	389480	6880780	3.0	1095
H-DC-M	Middle Dome Creek	C/CW	389788	6880565	3.3	1065
H-TP	Tailings Pond	I	389427	6880625	-	1093
H-SEEP	Seepage Pond Outflow	I	389604	6880598	-	1072
H-DC-R	Dome Creek at Road	I	392540	6879249	4.5	1020
H-BC	Back Creek	I	391626	6880901	10.4	1021
H-VC-U	Upper Victoria Creek	C/CW	391667	6880882	64.6	1019
H-VC-DBC	Victoria Creek Downstream of Back Creek	C/CW	391627	6880840	75.0	1017
H-VC-UMN	Victoria Creek Upstream of Minnesota Creek	C	392413	6879244	83.4	986
H-VC-R	Victoria Creek at Road	C/CW	392305	6878755	97.7	975

Notes:

1 - HID = unique station identifier that corresponds with hydrometric database tables.

2 - Station Type: ATM = atmospheric pressure monitoring; C = continuous water level monitoring with instantaneous discharge rating measurements; I = instantaneous discharge measurement; CW = continuous winter water level monitoring with instantaneous discharge rating measurements.

3 - NAD 83, UTM Zone 8.

4 - Elevations for hydrometric stations are estimates based on field data collected by handheld Garmin GPS units.

### 2.3.1 Velocity-Area Mid-Section

The velocity-area mid-section method was used to determine discharge at hydrometric stations where channel criteria met those outlined in standard guidance documents (RISC 2009; WSC 1999). Cross-section



locations were established for each hydrometric station where this method was applied; these cross-sections were located in close proximity to continuous data logger installations.

Using the continuity relationship for discharge ( $Q$ ),

$$Q = v \cdot A = b d v \quad [1]$$

Depth ( $d$ ), velocity ( $v$ ) and width ( $b$ ) measurements were obtained for at least 20 panels across the metering cross-section. The cross-section panel width and depth were multiplied by the velocity and averaged over 40 seconds (RISC 2009) to obtain an instantaneous discharge measurement ( $q$ ) for each panel. Panel discharges were subsequently summed to obtain total discharge. The discharge for the first and last panels was calculated using half the distance from the edge to the first and last mid-panel verticals.

The velocity-area discharge calculation is described by the following equations:

$$q_n = v_n d_n \frac{(b_{n+1} - b_{n-1})}{2} \quad [2]$$

$$Q = q_1 + q_2 + q_3 + q_4 + q_5 + \dots q_n \quad [3]$$

Where SI units of  $m^3/s$ ,  $m/s$ , and  $m$  are used for discharge, velocity and depth respectively.

The current meter used to obtain the velocity measurements is a 2-dimension, side looking, FlowTracker Handheld Acoustic Doppler Velocimeter (ADV) (Sontek/YSI Inc. 2009). The FlowTracker is used by both the Water Survey of Canada and the U.S. Geological Survey. The FlowTracker computer calculates discharge using the mid-section method and calculates the statistical discharge uncertainty based on methods developed by the U.S. Geological Survey (Cohn *et al.* 2006). This method of calculating uncertainty accounts for the uncertainty associated with width, depth and accuracy of the FlowTracker calibration and the effects of channel variability on depth and velocity across the cross-section (Sontek/YSI 1999). The statistical discharge uncertainty calculated by the FlowTracker at Mount Nansen was typically less than  $\pm 5\%$ . An uncertainty of  $\pm 10\%$  is considered by industry as acceptable for the velocity-area mid-section method. The statistical uncertainty was applied for all velocity-area discharge measurements obtained with the ADV.

### 2.3.2 Salt Dilution Gauging

Salt dilution gauging was used at hydrometric stations where the channel conditions were not suitable for using a current meter. Typically this occurred when water depths were less than 0.05 m, channel widths were less than 3.0 m or during winter months when ice was prohibitively thick for conducting velocity-area measurements beneath the ice.

There are three different methods of salt dilution gauging: constant rate injection (brine); slug injection (brine) and dry salt injection. Method selection depends on the magnitude of discharge to be measured, channel conditions and feasibility for remote sites as the required equipment varies for each method. All methods require the selection of an input (injection) site and a downstream electrical conductivity



measurement site. The distance between these sites (mixing length) is optimized for the minimum distance required for complete mixing of the fully dissolved salt tracer.

Specific channel conditions during open water and winter periods are required for successful salt dilution gauging. These criteria ensure that complete lateral and vertical mixing occurs in as short a distance as possible: minimal pools; no backwater areas; no braiding; little to no in-stream vegetation; and no losses or gains of water (Moore 2004; Laberge Environmental Services 1999).

Channel geomorphology and winter temperatures required some adaptations to the methodology presented in Moore (2004; 2005), therefore field protocols and subsequent calculations were modified to incorporate methods presented in Kite (1994) and Laberge Environmental Services (1999). Laberge Environmental Services (1999) describes practical, field tested and validated protocols for winter low flow measurements in the Yukon with a focus on streams with high background conductivities similar to the Mount Nansen region. However, the methods and calculations provided by Moore (2004, 2005) were used as they were thought to be significantly more robust and adaptable to site-specific stream conditions.

The gram conductivity of salt, the conductivity of 1 g NaCl in 1 m<sup>3</sup> of solution at 25 °C, is non-linear at higher background conductivities (Laberge Environmental Services 1999). Background specific conductance at the hydrometric stations range widely, from ~29 µS/cm to upwards of 1,500 µS/cm. The field protocol presented in Moore (2004; 2005) accounts for the non-linearity of the gram conductivity but requires additional field calibration tests for each visit and each gauging location. This method was not practical during extremely cold temperatures but was employed whenever possible in the Q4 period.

The slug injection (brine) method was selected for use at the Mount Nansen Site hydrometric stations because this method was most feasible for the remote sites, channel conditions, discharges and the most efficient method for the field monitoring program. In addition, the use of brine slugs allows for shorter mixing lengths to be used; ideal for channels at Mount Nansen. Measurement reaches were carefully selected to meet the measurement criteria and overlap with the physical location of continuous water level loggers. Salt injection sites were located upstream of constrictions (e.g., culverts) where possible to facilitate full mixing. A conductivity meter records specific conductance approximately 60 m downstream for the smaller creeks and approximately 90 m for Victoria Creek, depending on channel conditions.

The same measurement reach was used for each field visit unless changes to the channel conditions warranted minor adjustments to the measurement locations. The slug injection method requires an electrical conductivity meter (YSI ProPlus Multi-Meters with logging capabilities) to be set up at the downstream end of the measurement reach. Background electrical conductivity was logged for several minutes before the slug injection to allow for the instrument to equilibrate and to measure background variability. Specific electrical conductance<sup>1</sup> (SPC) is measured (logged) because the values are compensated for water temperature. A known mass of salt (NaCl) is dissolved into a graduated bucket of stream water at the injection site. Once fully dissolved, the salt slug is injected at the upstream site and the electrical conductivity

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<sup>1</sup> Specific electrical conductivity measured by the YSI ProPlus and the YSI 556 multi-meters are linearly compensated for temperature. The multi-meters are calibrated daily during each field visit before use.



of the salt wave is measured at the downstream location at two to five second intervals depending on the stream velocity. Two trials were conducted at each station. When possible, a secondary method of discharge measurement was used to validate the salt dilution measurement (*i.e.*, volumetric discharge measurement, ADV measurement).

The formula used to calculate discharge for the Mount Nansen salt slug injections is:

$$Q = \frac{V_{ss}}{1000 \cdot CF \cdot T \cdot \tau \cdot \sum(SPC_t - SPC_o)} \quad [4]$$

Where  $Q$  is discharge ( $m^3/s$ ),  $V_{ss}$  is the volume of salt slug injection (L),  $\tau$  is the time interval in seconds and  $SPC_t$  and  $SPC_o$  are the measured and background conductivity at time interval  $t$ , respectively. The  $CF \cdot T$  value is the calibration factor that accounts for the non-linearity of electrical conductance and salt concentration in stream water. The  $CF \cdot T$  value is taken as the slope of the line of  $SPC$  and relative concentration of the salt slug in an aliquot of sample stream water. The target peak specific conductance for the salt wave was an increase of at least ten-times the resolution of the conductivity meter used. Typically, an increase between 10% and 50% of  $SPC_o$  was achieved, above the required increase of 2 to 5  $\mu S/cm$ .

Stream discharge was calculated for each salt slug trial using Equation [4] and averaged to provide a discharge estimate. The average estimated measurement accuracy for the salt dilution gauging method is  $\pm 20\%$ . However, salt dilution gauging accuracy will vary between each station due to differences in individual channel conditions and stream water velocities.

In some instances where ambient air temperatures were prohibitively cold (*i.e.*,  $< -30^\circ C$ ), the dry salt slug injection method using a mass-balance approach was used. This was due to limitations that rapidly freezing water placed on equipment, field procedures and safety of field personnel. The formula for calculating discharge using the dry salt slug injection differs slightly from equation [4], and follows the calculations provided by Moore (2004). The discharge calculation formula for the dry salt slug injection is:

$$Q = \frac{m}{\sum(EC - EC_o) \cdot CF \cdot t_{int}} \quad [5]$$

Where  $m$  is the mass of salt used for the dry slug injection,  $EC$  is the electrical conductivity measured at a defined time interval ( $t_{int}$ ),  $EC_o$  is the background electrical conductivity.  $CF$  is a site-specific constant that is determined by measuring changes in specific conductivity with known masses of salt. Stream discharge was calculated using equation 5 for each salt slug trial during the January 11-12 and February 10-11 field visit. The estimated measurement accuracy for dry salt slug injection is  $\pm 30\%$ . However, the discharge uncertainty varies considerably between each station due to differences in channel conditions and stream water velocities.

### 2.3.3 Volumetric

Volumetric discharge measurement is ideal for low flows because all the stream flow is captured in a bucket of a known volume at a confined outlet or constriction in the channel. Channel constrictions created by



culverts, pipes and weirs provided an opportunity to measure stream flow by measuring the time to fill a bucket of known volume. The volumetric method for measuring discharge is used periodically at two stations at Mount Nansen where a culvert or pipe is available (H-PC-U; H-SEEP). During extreme low flows it is also possible to obtain volumetric estimates at H-DC-DX+105.

The volumetric measurement is completed using a graduated 20 L bucket and a timing device. The time required to fill the volume is recorded over five separate volumetric trials. All five volumetric trials are averaged to provide a discharge estimate. The estimated measurement accuracy is  $\pm 30\%$ .

The volumetric measurement method employed at H-SEEP (Tailings Dam Seepage Pond pump pipe outlet) is used to validate daily instantaneous measurements read at the flow meter attached to the pump that is used to manage water levels in the Seepage Pond. Daily flow meter readings were collected by the site maintenance crews and data is maintained by AAM. EDI staff collects concurrent flow meter readings when volumetric measurements are made at the pipe outlet.

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#### 2.3.4 Ice-cover Hydrometrics

Hydrologic measurements completed during periods when the channel is covered with ice have lower accuracy than open channel measurements because the standard hydrometric methods are based on open channel hydraulic relationships between the impelling and resisting forces of flow. Ice increases the resistance to flow, slowing velocities and increasing the water surface elevation (backwater effect). Frazil ice, anchor ice, slush and ice jams influence the water surface profile and effective depth of flow in the channel. As a result, the relationship between stage and discharge changes during the winter. Cold temperatures frequently cause problems with measurement equipment, including continuous water level loggers. In the Yukon, winter measurement instruments are usually working at or beyond the cold temperature operating limits and resultant data is carefully analyzed and often excluded from analysis. All measurements collected when ice was observed in the channel were flagged in the data record with 'B'; the standard data flag used by the WSC indicating backwater or ice effects. Measurements influenced by ice are not included in the open water stage-discharge rating curve development.

In Victoria Creek, the velocity-area and salt dilution methods were feasible during ice-cover periods when ice thicknesses and ambient air temperatures were not prohibitive. Salt dilution was used on the smaller channels if they were not frozen to the bed. Regardless of the technique used, careful attention was paid to ice and flow conditions. In many of the streams at the Mount Nansen Site, multiple layers of ice are present with flow travelling through complex networks within and on the surface of the ice. In such conditions, discharge measurement becomes increasingly uncertain and are not performed.

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#### 2.3.5 Hydrometric Leveling Surveys

Hydrometric leveling surveys are performed during each visit at stations where continuous data loggers are installed. The purpose of the survey is to tie the data logger water levels to the local station datum. Each station has a local, relative datum defined by benchmarks in close proximity to the data logger and stilling well. Three benchmarks are installed at each continuous station as per RISC (2009) Data Grade A



guidelines. Each survey includes a survey with a level and rod for Benchmark 1 (BM1), Benchmark 2 (BM2), Benchmark 3 (BM3), the top of the staff gauge (TOS), the water surface elevation (WATER) and the elevation of the fixed-length logger apparatus (named LOGGERROD). The elevation of Benchmark 1 at every station defines a local elevation of 3.000 m above datum. The local datum is always located below the elevation of zero flow. The benchmarks and the top of the staff gauge are regularly checked for shifting as a result of periglacial processes and survey error. While there is some apparent movement in the benchmark elevations and occasionally anomalous survey data, the water surface elevation data was carefully reviewed using staff gauge readings and the field records of stilling well maintenance (logger or staff gauge shifts) before applying local datum offsets to the raw data logger record. All suspect data is excluded from the corrected data. All stage data is presented in metres referenced to the local datum (L.D.) unless otherwise noted.

### 2.3.6 Hydrometric Validation & QA/QC Program

The velocity-area, weir and volumetric hydrometric measurement methods used for the Mount Nansen hydrometric program are standardized by the WSC and the USGS. Several stations do not meet standardized criteria. At these stations, alternative methods (e.g., salt dilution) are used. In some cases, concurrent standardized methods (e.g., velocity-area measurements) allow for the validation and calibration of alternate methods. Concurrent measurements also facilitate uncertainty estimates for stream discharge measurements.

Quality control and quality assurance (QA/QC) checks begin during field visits. The Flow Tracker ADV provides numerous QA/QC checks in real-time during velocity measurements that allow the field crew to increase the precision of the measurements. Upon return from the field, data entry staff performs preliminary checks and reviews of the raw data and discharge calculations prior to the production of trip and quarterly reports. A third round of QA/QC is completed during data entry into the hydrometric database. A final QA/QC is completed during the development of rating curves and hydrographs for each hydrometric station.

### 2.3.7 Rating Curve Development

Rating curves are based on open channel hydraulic relationships between stage (water level) and discharge. They are based on open-water conditions only and are not representative of ice-cover channel conditions. The y-axis represents the recorded stage level at the gauge and the x-axis the discharge. The rating curve equation represents the hydraulic reaction of flow a smoothly varying channel with increasing stage (or a constant control point at all stages) (Maidment 1993). The rating curve equation [6] has the form:

$$Q = C(h + a)^N \quad [7]$$

Where  $Q$  is discharge in  $m^3/s$ ,  $C$  is typically proportional to the channel width,  $(h+a)$  represents the depth of water above the stage of zero flow (water level where flow becomes zero) and the value of  $N$  is a function of the channel geometry (Maidment, 1993). If the pressure transducer is below the point of zero flow, the value of 'a' is negative; conversely a positive 'a' value indicates that it is above. Typically as the stage





increases, the hydraulic control shifts from low flow hydraulic control to channel friction control or to ice related controls. As a result multiple rating curve expressions for a single channel and various stages are often required to accurately represent the full range of flows.

By taking the log of both sides of the rating curve in equation [7], we obtain:

$$\log Q = \log C + N \log(h + a) \quad [8]$$

the rating curve equation [8] takes the linear form  $y=mx+b$  and can be fit to the discharge rating points as a straight line. Rating curves may be developed using several different methods including fitting the calibration points by eye and the maximum likelihood solution. Given the small size of the channels at the Mount Nansen Site, the narrow range of stage changes, and channel instabilities, each rating curves is developed by fitting by eye within the Aquarius Time-Series Software environment (Aquarius Informatics Inc. 2012).

Rating curves are developed for stations with continuous water level loggers using surveyed water levels (stage) and instantaneous discharge measurements. A rating curve is considered preliminary if the following conditions are met: there are less than 10 reliable rating measurements (RISC 2009), if rating measurements do not capture an acceptable range of flows (*i.e.*, 10 %-200 % of mean discharge (MD)), or, if there is a high rating curve error.

Rating curves are developed with rating measurements obtained when the channel is ice free. Any rating measurement obtained during ice conditions are reported simply as instantaneous measurements. Rating curves are valid only for a defined rating period. A rating period represents a section of time where both the channel and hydrometric installation are stable.

The highest flows recorded for the Mount Nansen hydrometric program were measured in the spring of 2013. Timely monitoring events during the spring freshet period allow the capture of higher spring flows. A conservative approach was adopted for presenting the continuous hydrometric record in this report. Predicting flood or low flows can introduce error into hydrologic analysis and should be carefully considered in the context of channel hydraulic geometry.

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### 2.3.8 Continuous Stage and Discharge

A combination of HOB0 (Model: U20-001-04, Onset Corporation) and Levelogger (Model Gold 3001, Solinst) pressure transducers are used on site. Two barometric and temperature data loggers (ATM-DC2 (HOB0) and ATM-DC4 (Solinst)) were maintained in the middle of the watershed near hydrometric station H-DC-B. All of the data loggers are non-vented pressure transducers that record water or air temperature and pressure. Measurement accuracy details for the pressure transducers are located in Appendix D.

The hydrostatic pressure data was compensated for atmospheric pressure using data from the barometric pressure logger located at ATM-DC2. Data from the redundant barometric loggers was not required.



Sensor depth below the surface of the water was calculated manually for the HOBO loggers submerged in the streams using the following relationship from the Euler equation [8] where:

$$H = \frac{P}{\gamma} + z \quad [9]$$

Hydraulic head ( $H$ ) or water depth above the sensor, hydrostatic pressure ( $P$ ) in Pa, the specific weight of water  $\gamma = \rho g$  where  $\rho$  is the density of water at a given temperature ( $\text{kg m}^{-3}$ ),  $g$  is acceleration due to gravity ( $\text{m}\cdot\text{s}^{-2}$ ) and  $z$  is elevation above a datum. Density of water varies with temperature and given the wide range in stream temperatures throughout the year, the density was computed using the Thiesen-Scheel-Diesselhorst equation [9] (Maidment 1993):

$$\rho = 1000 \left[ 1 - \frac{t+288.94}{508929.2(t+68.12963)} (t - 3.9863)^2 \right] \quad [10]$$

Where  $t$  = temperature ( $^{\circ}\text{C}$ ). The Solinst logger records at stream sites did not require water depth conversions because water depth is automatically calculated as an output from the record.

Continuous stage records are collected at 15 minute intervals and re-sampled to 30 minute intervals. Continuous discharge is calculated using the stage-discharge rating curve developed for the rating period at each respective station. The continuous stage record (rather than discharge record) is presented for stations where developing reliable rating curves is considered unsuitable due to channel conditions and available measurement techniques.

### 2.3.9 Hydrometric Data Management

Hydrometric data is compiled into a MS Access database after each visit to the Mount Nansen Site (EDI 13-Y-0167 Hydrology Database 2013.accdb). The hydrometric database is designed to hold raw field data including hydrometric station metadata, station history, field measurements, survey data and data logger files. The hydrometric database also contains tracking information such that each stage of QA/QC can be checked for completion.

## 2.4 WATER QUALITY

Water samples were collected at each of the 18 water quality sites, if conditions allowed, along with *in situ* data, photo documentation, and general site comments during each field visit. A list of sites, locations and sampling information are provided in Table 2-4. During the Q4 period, sampling occurred on a monthly basis in January, February, and March 2014. Details on the field methodology, laboratory analysis, QA/QC program and data analysis are provided in the following sections.



Table 2-4 Mount Nansen water quality site and sampling information.

Water Quality Site Name	Site ID	Site Location <sup>1</sup>		Sampling Frequency	Parameters Included in Lab Analysis <sup>2</sup>
		Easting	Northing		
<b>Pony Creek upstream</b>	WQ-PC-U	388955	6881745	Monthly	Standard Package
<b>Pony Creek downstream</b>	WQ-PC-D	389131	6881719	Monthly	Standard Package
<b>Pit Lake (3 samples)</b>	WQ-PIT-1,2,3	388913	6881625	Monthly	Pit Lake Package
<b>Dome Creek at DX</b>	WQ-DC-DX	387674	6881127	Monthly	Standard Package
<b>Dome Creek at DX+105</b>	WQ-DC-DX+105	387820	6881150	Monthly	Standard Package
<b>Dome Creek at D1b</b>	WQ-DC-D1b	388264	6880989	Monthly	Standard Package
<b>Diversion Channel at Bridge <sup>3</sup></b>	WQ-DC-B	389479	6880779	Monthly	Standard Package
<b>Upper Dome Creek</b>	WQ-DC-U	389788	6880565	Monthly	Standard Package
<b>Dome Creek at Road</b>	WQ-DC-R	391111	6880449	Monthly	Standard Package
<b>Tailings Pond</b>	WQ-TP	389427	6880625	Monthly	Standard Package
<b>Seepage Pond Outlet Pipe</b>	WQ-SEEP	389604	6880598	Variable <sup>4</sup>	Standard Package, LT50
<b>Mill Site Seep 03</b>	WQ-MS-S-03	387884	6881121	Monthly	Standard Package
<b>Back Creek</b>	WQ-BC	391626	6880901	Monthly	Standard Package
<b>Upper Victoria Creek</b>	WQ-VC-U	391626	6880872	Monthly	Standard Package
<b>Victoria Creek downstream Back Creek</b>	WQ-VC-DBC	391633	6880740	Monthly	Standard Package
<b>Victoria upstream of Minnesota</b>	WQ-VC-UMN	392413	6879244	Monthly	Standard Package
<b>Victoria Creek at Road</b>	WQ-VC-R	392431	6878802	Monthly	Standard Package
<b>Pump House Well</b>	WQ-PW	391558	6880856	Monthly	Drinking Water Package

1 - NAD 83, UTM Zone 8.

2 - Parameters included in various sampling packages are explained in greater detail in Section 2.4.2, below.

3 - The coordinates for WQ-DC-B are estimated based on the location of H-DC-B, however the water quality samples are actually collected just upstream of the bridge.

4 - Sampling frequency for this site was variable as the WQ-SEEP site is sampled on a monthly basis for the standard package samples and every second month for the LT50 samples.



### 2.4.1 Field Sampling Methods

An Oakton T100 turbidity meter was used to collect *in situ* turbidity (NTU). This meter was calibrated on a monthly basis according to instrument specifications. A YSI ProPlus multi-meter was used to collect *in situ* water temperature (degrees Celsius), pH (pH units), specific conductivity ( $\mu\text{S}/\text{cm}$ ), and in some cases dissolved oxygen (mg/L, for the pit lake). Field crews calibrated the YSI meter on a daily basis prior to each field day. Field data was recorded on standard field datasheets including station name, sample identifier, sample date and time, water temperature, specific conductivity, pH, photo numbers and a record of qualitative site conditions including flow stage (low, moderate, high), turbidity (clear, low, moderate, high), and ice observations.

Laboratory-cleaned bottles were filled using clean techniques (*i.e.*, nitrile gloves, appropriate bottle handling) and samples were filtered and preserved on site, as directed by the lab (ALS Laboratories). Samples from the pit lake were taken from the same general location on the lake at three different depths, from the surface, at mid depth and just off the bottom. There was ice cover over the pit lake during the Q4 quarter, and the surface sample was collected from just below the base of the ice surface. A Van Dorn sampler was used to collect all samples and is also used to measure the depth.

Samples were kept in coolers immediately following collection, and were kept from freezing by keeping them inside a truck, before being transferred to the Mount Nansen Site sample refrigerator. For chemical analysis, Chain of Custody forms were included in each sample cooler, and samples were delivered to ALS Laboratories upon arrival back in Whitehorse, YT to ensure lab holding times were met.

### 2.4.2 Laboratory Analysis

All surface water quality laboratory analysis was conducted by ALS. Several lab analysis packages have been organized for the Mount Nansen Site, including a pit lake package (WQ-PIT), a drinking water package (WQ-PW), an LT50 package (WQ-SEEP), and a standard site package (all other sites). The parameters included in each package are outlined in Table 2-5.

**Table 2-5 Laboratory analysis parameters included in various ‘packages’ created for surface water quality sampling at Mount Nansen (continues on next page).**

Analysis Package	Parameters Included
Standard Site Package	<p><b>Cyanides:</b> Cyanate, Total Cyanide (as Strong Acid Dissociable), Weak Acid Dissociable, Thiocyanate</p> <p><b>Physical Tests:</b> Conductivity, Hardness, pH, Total Dissolved Solids, Total Suspended Solids</p> <p><b>Anions and Nutrients:</b> Bicarbonate, Carbonate, Hydroxide, Total Alkalinity, Total Ammonia, Chloride, Fluoride, Nitrate, Nitrite, Sulphate</p> <p><b>Total Metals:</b> Aluminum, Antimony, Arsenic, Barium, Beryllium, Bismuth, Boron, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Lithium, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Phosphorus, Potassium, Selenium, Silicon, Silver, Sodium, Strontium, Sulfur, Thallium, Tin, Titanium, Uranium,</p>



Analysis Package	Parameters Included
	<p>Vanadium, Zinc.</p> <p><b>Dissolved Metals:</b> Aluminum, Antimony, Arsenic, Barium, Beryllium, Bismuth, Boron, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Lithium, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Phosphorus, Potassium, Selenium, Silicon, Silver, Sodium, Strontium, Sulfur, Thallium, Tin, Titanium, Uranium, Vanadium, Zinc.</p>
Pit Lake Package	<p><b>Physical Tests:</b> Conductivity, Hardness, pH, Total Dissolved Solids, Total Suspended Solids</p> <p><b>Anions and Nutrients:</b> Bicarbonate, Carbonate, Hydroxide, Total Alkalinity, Total Ammonia, Chloride, Fluoride, Nitrate, Nitrite, Sulphate</p> <p><b>Total Metals:</b> Aluminum, Antimony, Arsenic, Barium, Beryllium, Bismuth, Boron, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Lithium, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Phosphorus, Potassium, Selenium, Silicon, Silver, Sodium, Strontium, Sulfur, Thallium, Tin, Titanium, Uranium, Vanadium, Zinc.</p> <p><b>Dissolved Metals:</b> Aluminum, Antimony, Arsenic, Barium, Beryllium, Bismuth, Boron, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Lithium, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Phosphorus, Potassium, Selenium, Silicon, Silver, Sodium, Strontium, Sulfur, Thallium, Tin, Titanium, Uranium, Vanadium, Zinc.</p>
Drinking Water Package	<p><b>Physical Tests:</b> True Colour, Conductivity, Hardness, pH, Total Dissolved Solids, Turbidity</p> <p><b>Anions and Nutrients:</b> Alkalinity, Total, Chloride, Fluoride, Nitrate, Nitrite, Sulphate</p> <p><b>Total Metals:</b> Aluminum, Antimony, Arsenic, Barium, Boron, Cadmium, Calcium, Chromium, Copper, Iron, Lead, Magnesium, Manganese, Mercury, Potassium, Selenium, Sodium, Uranium, Zinc.</p>
LT50	LT50 test, 96-hr test to be conducted with Rainbow trout.

### 2.4.3 QA/QC Program

A QA/QC sampling program was conducted as part of the monitoring program, including two duplicate samples, a field blank sample and a trip blank sample. These are described in detail below:

- Duplicate samples are essentially sample replicates collected at the same date, time and location as the regular sample. All sampling methodology is the same, as if it is a separate site. Duplicates were collected from two sites, randomly selected, during each trip. The duplicate samples were conducted to check the accuracy and precision of the laboratory analysis.
- The field blank sample was collected on site as well, where a set of sample bottles was filled with deionized water at some point during the sampling trip. Sampling methodology was the same as if sampling from a stream, with filtering and preserving as required. The purpose of a field blank is to identify any contamination introduced to the sample from the sampler or the supplies (filter, syringe, bottle, or preservative).



- The travel blank was a sample set provided by the laboratory to be carried by the staff to and from site during the field work. The travel blank was not opened at any time during the trip. The purpose of including a travel blank is to identify any contamination of the sample caused during transportation or storage.

Following receipt of the laboratory analysis results, a review of the QA/QC sample results was completed. This involved comparing the duplicate samples and the regular samples collected at the randomly selected replicate stations to ensure they were within acceptable limits of each other (within +/-10%). Field and travel blank sample data was also reviewed to ensure that concentrations of all potential contaminants were low to below detection limits.

#### 2.4.4 Data Analysis

For the purpose of this data report, the data were reviewed and parameters of concern were graphed and compared with the Canadian Council of Ministers of the Environment (CCME) guidelines for the protection of freshwater aquatic life (CCME-AL; CCME 2013; Table 2-6), and with the Effluent Quality Standards (EQS) outlined in Yukon Water Board Water license No. QZ94-004, issued to BYG Natural Resources Inc. on February 13, 1996 (Table 2-7). Drinking water quality from the WQ-PW site was compared to the applicable Guidelines for Canadian Drinking Water Quality (Health Canada 2012; Table 2-8).

**Table 2-6. CCME-AL Guidelines applicable to Mount Nansen surface water quality sampling program (CCME 2013) (continues on next page).**

Water Quality Parameter	CCME-AL Guideline	Units	Comments
Aluminum (Al)	0.1 mg/L	mg/L	CCME is 0.1 at pH > 6.5, if pH is lower than 6.5, guideline is set at 0.005 mg/L
Ammonia (Total N)	0.75 mg/L	mg/L	Guideline is temperature and pH dependent. This represents a highly conservative guideline calculated for a pH of 8.5 and a water temperature of 0°C. Guideline decreases with increasing pH and temperature.
Arsenic (As)	0.005	mg/L	-
Cadmium (Cd)	0.000033	mg/L	Guideline is hardness dependent; this value is for a hardness of 100 mg/L, conservative for the Mount Nansen Site.
Chloride (Cl)	120	mg/L	-
Chromium (Cr)	0.0089	mg/L	-
Copper (Cu)	0.002	mg/L	Guideline is hardness dependent; this value is for a hardness of 100 mg/L, conservative for the Mount Nansen Site.
Total Cyanide	0.005	mg/L	SAD Cyanide is used as a measure of total cyanide
Fluoride (F)	0.120	mg/L	-
Iron (Fe)	0.3	mg/L	-
Lead (Pb)	0.003	mg/L	Guideline is hardness dependent; this value is for a hardness of



Water Quality Parameter	CCME-AL Guideline	Units	Comments
			100 mg/L, conservative for the Mount Nansen Site.
Mercury (Hg)	0.000026	mg/L	-
Molybdenum (Mo)	0.0073	mg/L	-
Nickel (Ni)	0.1	mg/L	Guideline is hardness dependent; this value is for a hardness of 100 mg/L, conservative for the Mount Nansen Site.
Nitrate (N)	13	mg/L	-
Nitrite (N)	0.06	mg/L	-
pH	6.5 - 9.0	pH	-
Selenium (Se)	0.001	mg/L	-
Silver (Ag)	0.0001	mg/L	-
Thallium (Tl)	0.0008	mg/L	-
Uranium (U)	0.015	mg/L	-
Zinc (Zn)	0.03	mg/L	-

Table 2-7 Mount Nansen Effluent Quality Standards outlined in Yukon Water License #QZ94-004.

Water Quality Parameter	Effluent Discharge Standard
pH	6.0 to 8.5 pH
Total Suspended Solids (TSS)	50 mg/L
Toxicity (LT50 – 96 hr. for rainbow trout, pH non-adjusted)	100%
WAD Cyanide	0.1 mg/L
Total (SAD) Cyanide	0.3 mg/L
Antimony (Total)	0.15 mg/L
Arsenic (Dissolved)	0.15 mg/L
Barium (Total)	1.0 mg/L
Cadmium (Total)	0.02 mg/L
Chromium (Total)	0.04 mg/L
Copper (Total)	0.2 mg/L
Iron (Total)	1.0 mg/L
Lead (Total)	0.1 mg/L
Manganese (Total)	0.5 mg/L
Mercury (Total)	0.005 mg/L
Nickel (Total)	0.3 mg/L
Silver (Total)	0.10 mg/L
Zinc (Total)	0.30 mg/L



Table 2-8 Applicable Guidelines for Canadian Drinking Water Quality for WQ-PW (Health Canada 2012).

<b>Water Quality Parameter</b>	<b>Health Canada Guideline</b>
Antimony	0.006 mg/L
Arsenic	0.010 mg/L
Barium	1.0 mg/L
Boron	5.0 mg/L
Cadmium	0.005 mg/L
Chromium	0.05 mg/L
Cyanide	0.20 mg/L
Fluoride	1.5 mg/L
Lead	0.010 mg/L
Mercury	0.001 mg/L
Nitrate	45 mg/L
Selenium	0.01 mg/L
Uranium	0.02 mg/L





## 3 RESULTS

Results are separated into the three program components: meteorology, hydrology, and water quality results. Select field photographs for the second quarter period and for each site and station are provided in Appendix A. A record of which sites were sampled during each field visit during the first quarter period is available in Appendix B. All field datasheets for hydrology and water quality are provided in Appendix C. All hydrometric data is provided in Appendix D and water quality data in Appendix E. Meteorological data is provided in Appendix F.

The description and discussion of the results presented in this document is limited to the data collected in the Q4 period, with some comparisons to previous quarterly results to show trends.

### 3.1 METEOROLOGY

Meteorological data from the ATM-ROAD AAM station is summarized below for the Q4 period. Meteorological data is only available between January 1 to 21, 2014 as a result of station maintenance and calibrations. Therefore, a complete record of meteorological conditions during the Q4 period is not presented. All available data from ATM-ROAD AAM station is plotted in Appendix F, with selected summary statistics tabulated for air and ground temperature, rainfall, snow depth, wind direction and wind speed. A brief description of the meteorological conditions is presented in the following sections.

#### 3.1.1 Air and Ground Temperature

Minimum mean daily air temperature for the available data was  $-20.1^{\circ}\text{C}$  on January 13, 2014. Maximum mean daily air temperature was  $1.0^{\circ}\text{C}$  on January 18, 2014. Mean air temperatures fluctuated through early January and were slightly above seasonal for the beginning of Q4.

Mean daily ground temperatures reached a maximum of  $-2.5^{\circ}\text{C}$  on January 19, 2014. Minimum mean daily ground temperatures reached  $-4.6^{\circ}\text{C}$  on January 14, 2014. Mean daily ground temperatures remained below  $0^{\circ}\text{C}$  for the period of available data in the beginning of Q4.

#### 3.1.2 Precipitation

Precipitation measured as rainfall occurred sporadically between January 1 and January 21, 2014. Rainfall occurred on January 17 and 18 at a rate of 0.02 mm/hour, with total daily rainfall of 0.3 mm on each day. The majority of precipitation falls as snow during the winter months. Snow accumulation began on October 9 and steadily increased to 53.8 cm depth at the station by January 21, 2014.

#### 3.1.3 Wind

Wind speeds are generally low, with maximum mean daily wind speed of 3.9 m/s (14 km/h) occurring on January 19, 2014. Dominant wind directions at the Mount Nansen Site are south, southwest and southeast.



The highest instantaneous wind speed recorded during the Q3 period was 11.9 m/s (42.8 km/h) which occurred on January 18 12, 2013.

#### 3.1.4 Short and Long Wave Radiation

Net radiation is the balance of solar energy emitted from the sun in the form of short- and long-wave radiation and the surface of the earth. The balance of radiation fluxes exhibits the seasonal pattern typical of northern latitudes with similar vegetation cover. As ground surface attributes change (*i.e.*, the accumulation and disappearance of snow) and solar insolation angles shift in the spring and fall, the net solar radiation swings from  $\sim 0 \text{ W/m}^2$  to over  $500 \text{ W/m}^2$  in the summer months. Net radiation exhibits a diurnal cycle associated with increases and decreases in received solar insolation. During the early record of the Q4 period, net radiation values circulate around  $0 \text{ W/m}^2$ .

#### 3.1.5 Relative Humidity

Relative humidity at Mount Nansen generally remains above 30%, and fluctuates up to 100%. Relative humidity remains elevated in the late fall and winter months. Persistently cooler temperatures and higher relative humidity is observed throughout early Q4 record, with minimum daily mean values of 66% and maximum daily mean relative humidity of 92.1%.

### 3.2 HYDROLOGY

Up to a total of three discharge measurement events were performed between January 1, 2014 and March 31, 2014 and are included in this quarterly report. A summary of each hydrometric measurement event is presented in Appendix D, in addition to the measured discharge, river stage elevations and hydrographs are presented for each station. Hydrometric data from the Q4 period is appended to the Q1, Q2 and Q3 monitoring and time-series data.

The following sections describe the results from each gauging station. Several stations remained frozen to substrate or unsuitable for sampling based on ice conditions during Q4 period, including H-PC-U, H-PC-DSP, H-DC-D1b, H-DC-B, H-DC-R, and H-BC. No water level data was recorded for H-SEEP or H-TP due to ice cover. Also, as discussed in Section 2 - Methodology (Table 2-1) several stations were removed from the scope of the program, including H-DX, H-DC-U1, H-DC-U2, H-VC-REF, and H-MN.

Some hydrometric stations in the upper reaches of the Dome Creek watershed have higher discharge estimate uncertainty or an absence of measurement because of environmental factors complicating field measurement. These environmental factors included discharge below reportable confidence limits (*i.e.*,  $<0.001 \text{ m}^3/\text{s}$ ), the presence and accumulation of aufeis, and extreme cold temperatures limiting the usage of electronic field equipment. Professional judgement was used to assess the limits of stream gauging instruments and appropriate methods for low-flow and ice-cover conditions.

A full summary of hydrometric monitoring records for the previous quarterly monitoring periods is recorded in Appendix D, Table D-3. Barometric pressure time-series, hydrographs, water surface stage



elevations and rating curves are presented in Appendix D for all stations. A copy of the updated hydrometric database containing all raw field data accompanies this report.

Hydrometric gauging and data collection at all stations is designed to meet the Grade A data standard defined by British Columbia's RISC (see RISC, 2009). The Grade A data standard is the highest level of data quality in the hierarchy of provincial standards and is similar to that in the National standards. Grade A criteria are met when instrumentation, stream channel conditions, field procedures, data calculation and assessment meet the requirements specified in RISC (2009). However, due to small channel sizes, discharge rating accuracy and challenging operating conditions at the site, data is considered to be on average "Grade B". Uncertainties associated with the instruments used for hydrometric monitoring is presented in Table D-1 in Appendix D.

### 3.2.1 Dome Creek

#### 3.2.1.1 H-DC-DX

The highest elevation hydrometric station in the Dome Creek watershed is H-DC-DX which has a small contributing basin ( $\sim 0.21 \text{ km}^2$ ). The station was originally established for water quality sampling (station WQ-DC-DX) as an upstream control site. H-DC-DX was removed as of January, 2014 from the monitoring network. As a result, no discharge measurements were taken during Q4 period. Results for this station is limited to those previously reported in the Q3 report (EDI 2014).

#### 3.2.1.2 H-DC-DX+105

Located 105 m downstream of H-DC-DX, station H-DC-DX+105 represents a drainage area of  $0.52 \text{ km}^2$ . The station typically has thinner ice or remains ice-free longer than H-DC-DX into the winter months. This is because the station receives slightly more groundwater contributions associated with the road and mill building pad cut out upstream of the station. The channel is poorly defined with a bed of predominantly sand and silts. Channel depth averages 0.60 m wide and 0.05 m deep and is generally unsuitable for cross-section area and salt dilution gauging. One discharge measurement was completed at this station between January 1, 2014 and March 31, 2014. Very low discharges and ice cover were encountered at the station on all visits. The flow measured was  $0.002 \text{ m}^3/\text{s}$  in ice-covered conditions.

#### 3.2.1.3 H-DC-D1b

H-DC-D1b was established in June of 2012 following discoveries that additional channels of Dome Creek were present in the vicinity of H-DC-D1. The channel at H-DC-D1b is approximately 0.35 m wide, 0.13 m deep, and is unsuitable for cross-section velocity and salt dilution gauging. Similar to other stations within the Dome Creek watershed, thick layers of aufeis (commonly referred to as creek 'glaciation') develops through the winter period as a surface expression of groundwater contribution to the channel. Complex, braided channels develop within the ice cover during the spring melt period, making hydrometric gauging



nearly impossible. No discharge measurements were collected at H-DC-D1b during the Q4 period as a result of significant ice accumulation and complex flow networks.

#### 3.2.1.4 H-DC-U1 and H-DC-U2

Gauging stations H-DC-U1 and H-DC-U2 were removed from the monitoring network in January, 2014. As a result, no discharge measurements were collected from these locations during the Q4 period. Results for these two stations are limited to those previously reported in the Q3 report (EDI 2014).

#### 3.2.1.5 H-DC-B

The H-DC-B station is a continuous gauging station established at the downstream end of the Dome Creek diversion channel, downstream of the channel bridge. The channel is approximately 1.27 m wide and 0.15 m deep with significant quantities of sediment transport downstream as a result of channel disturbance through the winter period, non-cohesive bank material and erosion of upstream bank material during rain events.

The continuous gauging station was established on May 27, 2013 when the channel was ice-free and removed on October 15, 2013. The stilling well at this station was removed for the 2013/2014 winter due to ongoing channel maintenance work to reduce icing issues at the bridge location. Due to diversion channel maintenance and ice removal during the winter months and unsuitable gauging conditions, no discharge measurements were collected for H-DC-B during the Q4 period. Station discharge measurements collected at H-DC-B since monitoring began in 2013 are presented in Appendix D.

#### 3.2.1.6 H-DC-M

A continuous monitoring station operates within the middle reaches of Dome Creek at H-DC-M, downstream of the seepage pond outlet. This station is intended to measure the cumulative flow from the seepage pond outlet and the diversion channel (H-SEEP and H-DC-B). Continuous stage measurements were collected over the 2012-2013 winter period (EDI 2013c) and continued over the winter period of 2013-2014.

The channel is moderately well defined within fine grained substrate. Some cobble to boulder sized material persists upstream in the diversion channel where stream gradients are greater. The channel averages 1.08 m in width and 0.16 m in depth. Salt dilution gauging was the primary discharge method measurement due to channel conditions being unsuitable for the ADV.

Continuous water stage elevations and discharge measurements are presented in Appendix D which covers Q1 through Q4 monitoring periods. Discharge measurements during the Q4 period were collected on January 15, 2014 (0.007 m<sup>3</sup>/s), February 10, 2014 (0.007 m<sup>3</sup>/s) and March 10, 2014 (0.004 m<sup>3</sup>/s). H-DC-M stage time-series and hydrographs are presented in Appendix D.



A rating curve for H-DC-M was established for the station following the 2012-2013 monitoring year (EDI 2013c). This rating curve was subsequently updated with additional measurements collected during high flows and additional measurements obtained in Q1 through Q3 of 2014. Table 3-1 summarizes the rating curve expressions presented for the 2012-2013 and 2013-2014 rating period.

**Table 3-1 Middle Dome Creek (H-DC-M) open water rating curve equations.**

Stage (m)	Discharge (m <sup>3</sup> /s)	Offset (m)	Slope	Equation
Rating Curve, April, 2012 to March, 2013 (EDI 2013c)				
1.556	0.005	1.5	-----	-----
1.701	0.060	1.5	1.986	$Q = 1.44074 (h-1.5)^{1.98631}$
2.003	0.356	1.5	1.950	$Q = 1.35912 (h-1.5)^{1.94996}$
Rating Curve, April, 2013 to March, 2014				
1.550	0.001	1.52	-	-
1.891	0.771	1.52	2.558	$Q=10.60 (h-1.52)^{2.64}$

### 3.2.1.7 H-DC-R

The station at H-DC-R was re-established on June 10, 2013. The station was re-established at this time because this section of Dome Creek accumulates significant quantities of ice due to the broad, flat nature of the valley bottom. The station was removed prior to the winter months in October, 2013. As a result of ice accumulation within the Dome creek valley throughout the winter period, no discharge measurements were collected during the Q4 period at the H-DC-R station. The rating curve equations for H-DC-R are shown in Table 3-2.

**Table 3-2. Dome Creek at the Road (H-DC-R) open water rating equations.**

Stage (m)	Discharge (m <sup>3</sup> /s)	Offset (m)	Slope	Equation
Rating Curve, April, 2012 to March, 2013 (EDI 2013c)				
0.2747	0.002	0.16	-----	-----
0.6621	0.100	0.16	2.758	$Q = 0.666494 (h-0.16)^{2.75760}$
1.062	0.477	0.16	2.671	$Q = 0.628053 (h-0.16)^{2.67137}$
Rating Curve, April, 2013 to March, 2014				
0.274	0.002	0.125	-	-
1.062	0.477	0.125	2.98	$Q = 0.579 (h - 0.125)^{2.98}$

### 3.2.2 Back Creek

#### 3.2.2.1 Back Creek (H-BC)

A continuous station on Back Creek at H-BC was re-installed on May 16, 2013 when the channel was ice-free. The channel is stable and entrenched into alluvial sediments of both the Back Creek and Victoria Creek floodplains. Upstream placer activity increases the sediment load observed within the creek. Wetted channel



width averages 1.30 m and 0.20 m in depth. Small channel sizes prohibit the use of the ADV as a standard discharge measurement method; therefore, all other discharge measurements were made using the salt dilution method. The station was removed on October 16, 2013 prior to the channel becoming filled in with ice. Discharge measured at the time of station removal was 0.006 m<sup>3</sup>/s. No stations discharge measurements were collected during the Q4 period due to overflow ice accumulation and an absence of flow at H-BC. Previously reported open water rating curves in the Q3 report remain unchanged for the Q4 reporting period. Rating curves are presented in Table 3-3. Time-series water stage and hydrographs for the 2013-2014 monitoring year presented in Appendix D.

**Table 3-3. Back Creek (H-BC) open water rating curve equations.**

Stage (m)	Discharge (m <sup>3</sup> /s)	Offset (m)	Slope	Equation
Rating Curve, April, 2012 to March, 2013 (EDI 2013c)				
1.630	0.001	1.62	-----	-----
1.893	0.063	1.62	1.252	$Q = 0.319 (h-1.62)^{1.252}$
2.168	0.602	1.62	3.244	$Q = 4.239 (h-1.62)^{3.244}$
Rating Curve, April, 2013 to March, 2014				
1.63	0.001	1.49	-	-
2.168	0.602	1.49	4.057	$Q = 2.91 (h - 1.49)^{4.06}$

### 3.2.3 Minnesota Creek

#### 3.2.3.1 Minnesota Creek (H-MN)

The station on Minnesota Creek was re-established on May 23, 2013. The station was removed on October 16, 2013 prior to the channel becoming frozen. Discharge measurements were discontinued at the H-MN station in January, 2014 and the station is no longer a component of the monitoring network at the Mount Nansen site. As a result, no discharge measurements were taken during Q4 period. Results for this station are limited to those previously reported in the Q3 report (EDI 2014).

The Minnesota Creek channel is well defined with nearly vertical banks near the station and a cobble/gravel bed. The channel averages 1.12 m in width and 0.41 m in depth. Maximum discharge recorded during the 2013 spring freshet was 0.443 m<sup>3</sup>/s.

Preliminary rating curves for H-MN are presented in Table 3-4 in addition to the curves from the previous rating period. Station rating curves are still considered preliminary and should only be used as an estimate of discharge at the H-MN station. According to the station hydrograph, discharge at H-MN ranged from 0.015 m<sup>3</sup>/s to 0.210 m<sup>3</sup>/s.



Table 3-4. Minnesota Creek (H-MN) open water rating curve equations.

Stage (m)	Discharge (m <sup>3</sup> /s)	Offset (m)	Slope	Equation
Rating Curve, April, 2012 to March, 2013 (EDI 2013c)				
0.9095	0.006	0.5	-----	-----
1.086	0.114	0.5	8.461	$Q = 10.4987 (h-0.5)^{8.46114}$
1.231	0.820	0.5	8.918	$Q = 13.4031 (h-0.5)^{8.91813}$
Rating Curve, April, 2013 to March, 2014				
0.902	0.011	0.5	-	-
1.339	0.985	0.5	6.172	$Q = 2.910 (h-0.5)^{6.172}$

### 3.2.4 Victoria Creek

#### 3.2.4.1 Victoria Creek Reference (H-VC-REF)

The H-VC-REF station is located upstream of the Back Creek confluence and hydraulically upstream of Mount Nansen Site influences. A data logger was re-deployed at this station on May 16, 2013. A single discharge measurement was collected from H-VC-REF on January 14, 2014 at 0.164 m<sup>3</sup>/s using the salt slug injection method. The station was subsequently removed from the monitoring network in January, 2014. Discharge measurements are no longer collected at H-VC-REF. Rating curves for the 2013-2014 rating period are reported in the Q3 report (EDI 2014).

The applied rating curves for H-VC-REF are presented in Table 3-5 for the 2013-2014 rating period. Rating curve expressions for the previous 2012-2013 rating period are also presented. Time-series stage and hydrograph data are presented in Appendix D. Based on the station hydrograph, a high-flow event associated with spring freshet occurred on May 27, 2013 at 6.9 m<sup>3</sup>/s. A subsequent precipitation-induced high flow event occurred on July 22, 2013 at 1.38 m<sup>3</sup>/s.

Table 3-5. Victoria Creek Reference (H-VC-REF) open water rating curve equations.

Stage (m)	Discharge (m <sup>3</sup> /s)	Offset (m)	Slope	Equation
Rating Curve, April, 2012 to March, 2013 (EDI 2013c)				
1.255	0.015	1.2	-----	-----
1.816	0.475	1.2	1.420	$Q = 0.945289 (h-1.2)^{1.41949}$
2.12	1.933	1.2	3.498	$Q = 2.58760 (h-1.2)^{3.49788}$
2.386	4.395	1.2	3.234	$Q = 2.53134 (h-1.2)^{3.23424}$
Rating Curve, April, 2013 to March, 2014				
1.69	0.18	1.45		
2.386	4.395	1.45	2.348	$Q = 5.13 (h - 1.45)^{2.35}$



3.2.4.2 Upper Victoria Creek (H-VC-U)

The Upper Victoria Creek gauging station (H-VC-U) continuously monitors Victoria Creek stage elevations downstream of the former H-VC-REF station, and approximately 65 metres upstream of the Back Creek confluence. A thin ice cover during the winter months indicates the presence of groundwater contributions to the channel in the vicinity. Discharge measurements were collected at H-VC-U on January 14 using the ADV (0.134 m<sup>3</sup>/s), February 11 using a salt-dilution method (0.061 m<sup>3</sup>/s) and March 11 using the ADV (0.013 m<sup>3</sup>/s) during the Q4 monitoring period. Rating curves for the 2012-2013 and 2013-2014 rating periods are presented in Table 3-6.

Continuous stage records and time-series hydrographs for April 1, 2013 through March 31, 2014 are presented in Appendix D. Based on the 2013-2014 rating curve, the estimated maximum discharge over the period of record was 5.165 m<sup>3</sup>/s (May 27, 2013).

Table 3-6. Upper Victoria Creek (H-VC-U) open water rating curve equations.

Stage (m)	Discharge (m <sup>3</sup> /s)	Offset (m)	Slope	Equation
Rating Curve, April, 2012 to March, 2013 (EDI 2013c)				
1.986	0.038	1.85	-----	-----
2.385	2.632	1.85	3.098	Q = 18.2757 (h-1.85) <sup>3.09810</sup>
2.641	8.465	1.85	2.987	Q = 17.0539 (h-1.85) <sup>2.98748</sup>
Rating Curve, April, 2013 to March, 2014				
2.018	0.109	1.86		
2.516	5.770	1.86	2.789	Q = 18.702 (h - 1.86) <sup>2.789</sup>

3.2.4.3 Victoria Creek, downstream of Back Creek (H-VC-DBC)

The continuous gauging station H-VC-DBC was visited three times during the Q4 period. Two measurements were collected using the ADV method (cross-section area) on January 14, 2014 (0.104 m<sup>3</sup>/s) and March 11, 2014 (0.045 m<sup>3</sup>/s). A single salt dilution method was used to collect discharge on February 11, 2013 and was measured at 0.148 m<sup>3</sup>/s. Based on continuous measurements collected from the station, mean discharge between April 1 and March 31, 2014 at H-VC-DBC was 0.571 m<sup>3</sup>/s. Maximum discharge is estimated at 4.226 m<sup>3</sup>/s.

Continuous stage measurements and hydrograph is presented in Appendix D. Rating curve expressions are shown in Table 3-7.

Table 3-7. Victoria Creek, downstream of Back Creek (H-VC-DBC) open water rating curve equations.

Stage (m)	Discharge (m <sup>3</sup> /s)	Offset (m)	Slope	Equation
Rating Curve, April, 2012 to March, 2013 (EDI 2013c)				
1.681	0.178	1.316	-----	-----
2.048	2.090	1.316	3.538	Q = 6.30234 (h-1.316) <sup>3.53797</sup>
2.315	9.631	1.316	4.913	Q = 9.67846 (h-1.316) <sup>4.91302</sup>





Stage (m)	Discharge (m <sup>3</sup> /s)	Offset (m)	Slope	Equation
Rating Curve, April, 2013 to March, 2014				
1.720	0.109	1.65		Q = 6.189 (h - 1.65) <sup>1.568</sup>
2.147	5.220	1.65	1.568	

3.2.4.4 Victoria Creek, upstream of Minnesota Creek (H-VC-UMN)

Victoria Creek upstream of Minnesota Creek (H-VC-UMN) is located in a straight reach upstream of the Minnesota Creek confluence. Originally established as an instantaneous discharge measurement location, a continuous station was deployed in 2012. In 2013, a logger and staff gauge were re-deployed at the same location on May 15, 2013. Prior to channel icing, the logger was removed on October 16, 2013. The channel averages 5.7 m in width and 0.20 m in depth, with channel conditions suitable for standard discharge measurement methods using the ADV. Three discharge measurements were collected during the Q4 monitoring period using the ADV and salt slug injection methods. Measured discharge was 0.091 m<sup>3</sup>/s on January 14 (ADV), 0.109 m<sup>3</sup>/s on February 11 (salt-dilution) and 0.003 m<sup>3</sup>/s on March 11, 2014 (ADV).

Rating curve expressions for H-VC-UMN are presented in Table 3-8 and include previously reported rating curve expressions for the 2012-2013 rating period. Winter discharge measurements collected during the Q4 period were not used in rating curve expressions due to the presence of ice in the channel.

Table 3-8. Victoria Creek, upstream of Minnesota Creek (H-VC-UMN) open water rating curve equations.

Stage (m)	Discharge (m <sup>3</sup> /s)	Offset (m)	Slope	Equation
Rating Curve, April, 2012 to March, 2013 (EDI 2013c)				
1.382	0.019	0.979	-----	-----
1.780	1.214	0.979	6.037	Q = 4.63406 (h-0.979) <sup>6.03671</sup>
1.954	3.684	0.979	5.647	Q = 4.25022 (h-0.979) <sup>5.64705</sup>
2.140	9.980	0.979	5.708	Q = 4.25676 (h-0.979) <sup>5.70783</sup>
Rating Curve, April, 2013 to March, 2014				
1.411	0.049	0.98		Q = 4.066 (h - 0.979) <sup>5.250</sup>
2.066	6.271	0.98	4.250	

According to continuous logger records over the period of record, peak discharges associated spring freshet occurred on May 27, 2013 with maximum discharge of 6.023 m<sup>3</sup>/s. Continuous stage measurements were discontinued on October 16, 2013. The continuous stage and hydrograph records for H-VC-UMN are found in Appendix D.

3.2.4.5 Victoria Creek at Road (H-VC-R)

Victoria Creek at Road (H-VC-R) station was established in 2011 as a continuous gauging station. The station is located 90 metres downstream of the Mount Nansen Road culvert in a low gradient, meandering section of the channel. Channel widths average 6.7 m and 0.25 m in depth at the discharge measurement location. Three discharge measurements were collected during the Q4 monitoring period using the ADV



and salt slug injection methods. Measured discharge was 0.170 m<sup>3</sup>/s on January 13, 0.063 m<sup>3</sup>/s on February 10 and 0.030 m<sup>3</sup>/s on March 10, 2014. Discharge measurements collected at the H-VC-R station do not appear to follow a systematic increase in flow as expected as the most down-stream station when compared to discharge in the upper portions of the Victoria Creek channel. We suspect that ice accumulation and ice effects were great enough to increase the uncertainty in discharge measurements completed. Rating curve expressions for the H-VC-R station are presented in Table 3-9 in addition to the 2012-2013 monitoring period rating curve expressions. Continuous stage measurements are collected at H-VC-R. Stage time-series and hydrographs are presented in Appendix D.

**Table 3-9. Victoria Creek at Road (H-VC-R) open water rating curve equations.**

Stage (m)	Discharge (m <sup>3</sup> /s)	Offset (m)	Slope	Equation
Rating Curve, April, 2012 to March, 2013 (EDI 2013c)				
1.849	0.057	1.51	-----	-----
2.196	4.015	1.51	6.041	$Q = 39.1267 (h-1.51)^{6.04113}$
2.307	9.974	1.51	6.067	$Q = 39.5133 (h-1.51)^{6.06722}$
Rating Curve, April, 2013 to September, 2013				
2.010	0.149	1.90		
2.541	10.340	1.90	2.406	$Q = 30.139 (h - 1.90)^{2.406}$

### 3.2.5 Pony Creek

#### 3.2.5.1 Upper Pony Creek (H-PC-U)

The Upper Pony Creek gauging station was established in 2009 to supplement a hydrogeological investigation (AECOM, 2010). Located in the upper reaches of Pony Creek, the station drains an area of 0.84 km<sup>2</sup> which has been historically disturbed by mineral exploration activities and more recently, by placer mining activities. The channel near the station is approximately 0.1 to 0.3 metres deep and 0.25 to 0.75 metres wide and is dominated by shrubs, mosses and grasses along the banks of the channel. A v-notch weir was installed to measure discharges at the station and used for hydrometric measurements in 2012-2013. Following freshet in 2013, the channel at the H-PC-U gauging station had bifurcated around the weir structure and backwater pond, re-joining its original channel immediately downstream. A continuous monitoring station was established on May 16, 2013 using a stilling well, staff gauge and data logger.

Due to the absence of flow at the H-PC-U station, no discharge measurements were collected during the Q4 period. No rating curves exist for the H-PC-U station apart from the weir structure that no longer has water flowing through it. This is due to the change in channel morphology and limited confidence in the rating measurements to produce a robust estimate using a rating curve expression. Therefore, only continuous stage elevations and instantaneous discharge measurements collected at H-PC-U are presented in Appendix D.



### 3.2.5.2 Pony Creek Downstream of Pit (H-PC-DSP)

A second hydrometric station is located downstream of H-PC-U below the Back Creek access road culvert and is named H-PC-DSP. The station was originally installed to supplement a hydrogeological investigation. Average widths for the channel at the station range from 0.15 to 0.50 m while depths range from 0.05 to 0.20 m. Due to channel morphology and conditions, only salt dilution gauging and volumetric methods are used to estimate discharge at H-PC-DSP. A small rock weir was installed as a control immediately downstream of the stilling well and appears to be functioning as an effective control. Due to the absence of flow along the Pony Creek channel, no discharge measurements were collected during the Q4 period.

Due to the large uncertainty associated with the collected rating measurements and stage data, no rating curve is applied to water stage recordings at the H-PC-DSP station. Continuous time-series stage elevations and instantaneous discharge measurements are presented in Appendix D.

## 3.3 WATER QUALITY

Water quality results for sampling within the Q4 period are discussed for each creek in the sections below. Note as discussed in Section 2 - Methodology (Table 2-1), several sites were removed from the program scope during the Q4 period, including WQ-DC-U1, WQ-DC-U2, WQ-VC-REF, WQ-DRY, WQ-MN, while WQ-DC-B was added to the program. Several sites were also frozen to substrate or unsuitable for sampling based on ice conditions for either the entire Q4 period or just a portion, including sites WQ-PC-U, WQ-PC-D, WQ-DC-DX, WQ-DC-DX+105, WQ-DC-D1b, WQ-DC-B, WQ-DC-R, and WQ-MN.

The following water quality results include a summary of samples that exceeded guidelines and standards for each site and sampling trip, as well as *in situ* water quality parameters. To provide some context, results are compared to CCME-AL guidelines as well as Nansen EQS values; however, not all drainages have equivalent levels of aquatic life. For example, only Victoria Creek and Back Creek are fish bearing streams, either year-round or seasonally, respectively.

Copies of all water quality data with samples that exceeded guidelines and standards are highlighted for each sampling trip are provided in Appendix E.

### 3.3.1 Dome Creek

During Q4 period, only three sites on Dome Creek were sampled, WQ-DC-DX+105, WQ-DC-B, and WQ-DC-U, as the remaining sites became covered heavily with ice during the Q3 period and froze to substrate. The WQ-DC-B site was added to the program scope in January 2014, to replace the WQ-DC-U1 and WQ-DC-U2 sites which were discontinued, and provide a sample mid-way between the Dome Creek sites upstream and downstream of the tailings and seepage ponds.

WQ-DC-B was only sampled during the February 2014 trip, when water was found to be flowing beneath the ice. The sample collected at that site exceeded the CCME-AL guidelines for F, Cd, Fe, and Zn and the Mount Nansen EQS also for Fe and Mn. Concentrations for most metals at this site were lower than for the either the site upstream (WQ-DC-DX+105) or downstream (WQ-DC-U) during the February 2014 trip.



Water quality samples were collected at the WQ-DC-DX+105 site during the January 2014 and February 2014 trips. The site was frozen to substrate during the March 2014 trip. Samples from January and February exceeded the CCME-AL guidelines for As, Cd, and Fe. Zinc concentrations exceeded both the CCME-AL guideline and Mount Nansen EQS value for both samples collected in the Q4 period. The Mn concentrations exceeded the Mount Nansen EQS value. The CCME-AL guideline for F was also exceeded in the February 2014 samples.

The WQ-DC-U site was sampled during all three monitoring trips of the Q4 period. During all events, NH<sub>3</sub>, Al, As, Cd, Cu, Fe, Mn exceeded the CCME-AL and/or the Mount Nansen EQS. The CCME-AL guideline for F was also exceeded in the March 2014 samples. Cyanide concentrations did not exceed water quality criteria during the Q4 investigation period. These results are similar to results from previous quarters. A summary of sample parameters that exceeded the water quality criteria for each sampling trip is provided in Table 3-10. Appendix E has additional tables of raw data values for the lab analysis (Table E1-E3) as well as figures showing concentrations of various contaminants of concern for the Dome Creek sites for the 2013-14 investigation period (Q1 through Q4; Figure E1-E5).

**Table 3-10. Summary of parameters that exceeded CCME-AL guidelines and/or Mount Nansen EQS for each site visit and site within the upper Dome Creek watershed for the Q4 period (January 1 to March 31, 2014).**

Sampling Trip Date	WQ-DC-DX+105	WQ-DC-B	WQ-DC-U
January 13-15, 2014	As, Cd, Fe, Mn, Zn	No Sample	NH <sub>3</sub> , Al, As, Cd, Cu, Fe, Mn,
February 10-12, 2014	F, As, Cd, Fe, Mn, Zn	F, Cd, Fe, Mn, Zn	NH <sub>3</sub> , Al, As, Cd, Cu, Fe, Mn
March 10-12, 2014	No Sample	No Sample	NH <sub>3</sub> , F, Al, As, Cd, Cu, Fe, Mn

A summary of *in situ* water quality parameters for the Dome Creek sites for Q4 are provided in Table 3-11. In general, water temperatures remained around zero degrees, with the WQ-DC-DX+105 having the highest temperatures for the duration of the Q4 period. Specific conductivity, pH and turbidity were variable over the period.

**Table 3-11. *In-situ* water quality data for sites within the Dome Creek watershed for the Q4 period (January 1 to March 31, 2014).**

Site ID	Date	Water Temp. (°C)	Specific Conductivity (µS/cm)	pH	Turbidity (NTU)
WQ-DC-DX+105	13-Jan-14	0.40	1165	7.22	2.50
WQ-DC-DX+105	11-Feb-14	0.50	965	7.33	3.90
WQ-DC-DX+105	10-Mar-14	<i>Frozen to Substrate</i>			
WQ-DC-B	13-Jan-14	<i>Frozen to Substrate</i>			
WQ-DC-B	11-Feb-14	0.06	1810	6.93	21.10
WQ-DC-B	10-Mar-14	<i>Frozen to Substrate</i>			



Site ID	Date	Water Temp. (°C)	Specific Conductivity (µS/cm)	pH	Turbidity (NTU)
WQ-DC-U	13-Jan-14	-0.10	1680	7.27	31.40
WQ-DC-U	11-Feb-14	0.00	1415	7.17	42.00
WQ-DC-U	10-Mar-14	0.00	1678	7.08	12.10

### 3.3.2 Brown-McDade Pit Lake

The Brown-McDade pit lake was sampled during three events over the Q4 investigation period. From the January 2014 to March 2014 sampling event, ice thickness increased from 0.70 m to 1.08 m. During the Q4 period, the total water depth at the sampling location was 7.5 m below the ice surface. During all Q4 sampling events, the surface sample was collected just below the ice surface, the middle sample was collected 3.5 m below the ice, and the bottom sample was collected 7 m below the ice.

All pit lake samples consistently exceeded the CCME-AL guidelines for As, Cd, Cu, and Zn (Table 3-12; Appendix E). The Zn concentrations from all samples also exceeded the Mount Nansen EQS value. The Mount Nansen EQS value for Mn was also exceeded on one occasion from the WQ-PIT-3 sample from the January 2014 trip (Table 3-12; Appendix E). Concentrations of F in all pit samples also exceeded the CCME-AL guideline during the February and March 2014 trips (Table 3-12; Appendix E). In general, the WQ-PIT-3 samples taken from the bottom of the water column typically had the highest metal concentrations as this sample location has the most contact with rock substrate of the pit lake. Results from Q4 are similar to previous quarterly results. Please refer to Appendix E for raw data tables for Q4 lab results (Table E1-E3), as well as Figures E6-E10 which show pit lake metal concentrations for the complete 2013-14 investigation period (Q1 through Q4).

**Table 3-12. Summary of parameters that exceeded CCME-AL guidelines for the Brown McDade Pit Lake for each sampling depth for the Q4 period (January 1 to March 31, 2014).**

Sampling Trip Date	WQ-PIT-1 (surface)	WQ-PIT-2 (mid-depth)	WQ-PIT-3 (bottom)
January 13-15, 2014	As, Cd, Cu, Zn	As, Cd, Cu, Zn	As, Cd, Cu, Mn, Zn
February 10-12, 2014	F, As, Cd, Cu, Zn	F, As, Cd, Cu, Zn	F, As, Cd, Cu, Zn
March 10-12, 2014	F, As, Cd, Cu, Zn	F, As, Cd, Cu, Zn	F, As, Cd, Cu, Zn

See Table 3-13 for a summary of *in situ* water quality parameters for the pit lake. Water temperatures from below the ice surface of the pit lake ranged from 0.3 °C to 1.0 °C from January to March 2014. Water temperatures at the bottom of the pit lake ranged from 4.6 °C to 5.2 °C from January to March 2014. Specific conductivity was highest typically from the bottom sample depth (WQ-PIT-3) and dissolved oxygen was lowest from this depth. The pH varied from 6.80 to 7.46 from all sample depths.

Table 3-13. *In-situ* water quality data for the Brown McDade Pit Lake for the Q4 period (January 1 to March 31, 2014).

Site ID	Sample Depth (m)	Date	Water Temp. (°C)	Specific Conductivity (µS/cm)	pH	Turbidity <sup>1</sup> (NTU)	Dissolved Oxygen <sup>1</sup> (mg/L)
WQ-PIT-1	0.30	14-Jan-14	0.30	2040	7.46	1.13	8.06
WQ-PIT-1	0.30	12-Feb-14	0.10	1992	7.42	n/a	n/a
WQ-PIT-1	0.30	11-Mar-14	1.00	2092	7.31	0.57	6.00
WQ-PIT-2	3.0	14-Jan-14	4.60	2322	6.97	0.53	3.45
WQ-PIT-2	3.5	12-Feb-14	4.00	1990	7.01	n/a	n/a
WQ-PIT-2	3.0	11-Mar-14	2.20	2072	7.24	0.54	5.53
WQ-PIT-3	7.0	14-Jan-14	5.20	2687	6.81	1.43	1.02
WQ-PIT-3	7.0	12-Feb-14	3.90	1991	7.10	n/a	n/a
WQ-PIT-3	7.0	11-Mar-14	4.60	2695	6.80	1.36	0.43

Note: <sup>1</sup> – dissolved oxygen and turbidity could not be measured during the February 2014 event due to very cold temperatures and an equipment malfunction.

### 3.3.3 Tailings, Seepage Pond Discharge, and Mill Seeps

The tailings pond (WQ-TP) and seepage pond discharge site (WQ-SEEP) were sampled during every visit of the Q4 period. Water quality at the WQ-TP site consistently exceeded the CCME-AL guidelines and/or the Nansen EQS for As, Cd, Cu, Mn and Zn, in addition to NH<sub>3</sub>, Al and Fe on a few occasions (Table 3-14; Appendix E: Tables E1, E3). The WQ-SEEP site consistently exceeded the CCME-AL guidelines and/or the EQS for NH<sub>3</sub>, Al, As, Cd, Cu, Fe, and Mn, as well as F on one occasion. These results are similar to results from all previous quarters. Note the Mn criteria are based on the Mount Nansen EQS, as there are no CCME-AL guidelines for these parameters. Most parameters that exceeded criteria identified at these sites are the CCME-AL guidelines; however, Fe exceeded both the CCME-AL and EQS values for all events. Please refer to Appendix E for raw data tables for Q4 lab results (Table E1-E3), as well as Figures E6-E10 which show seep and tailings pond metal concentrations for the complete 2013-14 investigation period (Q1 through Q4).

The WQ-MS-S-03 seep was sampled during the January 2014 and March 2014 sampling events of the Q4 period. The site was frozen to substrate during the February 2014 trip. The site consistently exceeded guidelines and/or standards for F, As, Cd, Fe, Pb, Mn, Ag and Zn, as well as TSS, Al and Cu during the March 2014 event only (Table 3-14; Appendix E). Note TSS and Mn exceeded the Mount Nansen EQS, as there are no CCME-AL guidelines for these parameters. Most other parameters that exceeded criteria noted below are based on the CCME-AL guidelines; however, Fe exceeded both the CCME-AL and EQS values during both sampling events. Appendix E has additional tables of raw data values for the lab analysis (Table E1-E3) as well as figures showing concentrations of metals of concern for the WQ-MS-S-03 site for the entire 2013-14 investigation period (Q1 through Q4; Figure E1-E5).

LT50 samples from the WQ-SEEP site are scheduled on a bi-monthly basis, but during the Q4 period three monthly sampling events were conducted. This was because the LT50 sample from January 2014 failed the 96-hr rainbow trout acute toxicity test for the first time in years of the program, and additional follow up



was required. Typically the LT50 results for the WQ-SEEP site show an LT50 result of greater than 96 hrs (*i.e.*, 100% fish survival after 96 hours in the sample). The January 2014 96-hr LT50 result was 10.7 hours, indicating that the median lethal time at which there was 50% fish mortality was 10.7 hours. According to the lab report, all test fish stock information and lab parameters were within acceptable standards and all standard methods were followed. EDI assessed the other water quality results for the WQ-SEEP, and the January 2014 results appear to be consistent with previous results, suggesting that the January 2014 LT50 results was an anomaly or lab error. The follow-up LT50 samples collected in February and March 2014 passed the test (LT50 >96 hours), with no toxicity for rainbow trout.

**Table 3-14. Summary of parameters that exceeded CCME-AL guidelines and/or Mount Nansen EQS for WQ-TP, WQ-SEEP and WQ-MS-S-03 for the Q4 period (January 1 to March 31, 2014).**

Sampling Trip Date	WQ-TP	WQ-SEEP	WQ-MS-S-03
January 13-15, 2014	As, Cd, Cu, Mn, Zn	NH <sub>3</sub> , Al, As, Cd, Cu, Fe, Mn	F, As, Cd, Fe, Pb, Mn, Ag, Zn
February 10-12, 2014	F, As, Cd, Cu, Fe, Mn, Zn	NH <sub>3</sub> , F, Al, As, Cd, Cu, Fe, Mn	No Sample
March 10-12, 2014	NH <sub>3</sub> , F, Al, As, Cd, Cu, Fe, Mn, Zn	NH <sub>3</sub> , F, Al, As, Cd, Cu, Fe, Mn	TSS, F, Al, As, Cd, Cu, Fe, Pb, Mn, Ag, Zn

*In situ* water quality parameters for each trip and each site are summarized in Table 3-16. Water temperatures recorded in the tailings pond remained slightly above zero degrees from January 2014 to March 2014. Specific conductivity values increased at both the WQ-TP and WQ-SEEP sites while pH decreased slightly from January to March. Turbidity values were highest at the WQ-SEEP site overall, which is a common result for the site. *In situ* water quality measurements at the WQ-MS-S-03 showed similar trends over time as the WQ-TP and WQ-SEEP sites, with increasing specific conductivity and decreasing pH. Water temperatures also remained slightly above zero degrees, ranging from 0.30 to 0.50 °C.

**Table 3-15. *In situ* water quality data for WQ-TP, WQ-SEEP and WQ-MS-S-03 for the Q4 period (January 1 to March 31, 2014).**

Site ID	Date	Water Temp. (°C)	Specific Conductivity (µS/cm)	pH	Turbidity (NTU)
WQ-MS-S-03	13-Jan-14	0.30	1172	7.25	1.82
WQ-MS-S-03	11-Feb-14		<i>Frozen to Substrate</i>		
WQ-MS-S-03	11-Mar-14	0.50	1200	6.87	26.20
WQ-SEEP	13-Jan-14	0.00	1759	7.03	50.80
WQ-SEEP	11-Feb-14	0.00	1566	7.56	48.60
WQ-SEEP	10-Mar-14	0.80	1818	6.82	9.54
WQ-TP	13-Jan-14	0.10	1788	7.41	4.76
WQ-TP	11-Feb-14	0.60	1979	7.30	4.23
WQ-TP	10-Mar-14	0.40	2626	7.20	7.67



### 3.3.4 Victoria Creek

Victoria Creek was sampled at five sites upstream and downstream of the mine site during the Q4 period. The WQ-VC-REF site was removed from the project scope following the January 2014 trip, therefore there is only one sampling event reported for the Q4 period. Also, samples and measurements for the WQ-VC-R site were collected at the winter sampling location, at WQ-VC-R+150 located 150 m downstream of the culvert, which is consistent with the December 2013 sampling event.

Water quality at all sites exceeded the CCME-AL guideline for Al during all sampling events (Table 3-16). Several samples also exceeded the CCME-AL guideline for Cd, including WQ-VC-DBC and WQ-VC-UMN during the January 2014 sampling event, and WQ-VC-U and WQ-VC-DBC during the March 2014 sampling event (Table 3-16). No Victoria Creek samples exceeded any of the Mount Nansen EQS values. Please refer to Appendix E for raw data tables for Q4 lab results (Table E1-E3), as well as Figures E11-E14 which show metal concentrations for Victoria Creek sites for the complete 2013-14 investigation period (Q1 through Q4).

**Table 3-16. Summary of parameters that exceeded CCME-AL guidelines and/or Mount Nansen EQS for sites within the Victoria Creek watershed for the Q4 period (January 1 to March 31, 2014).**

Sampling Trip Dates	WQ-VC-REF <sup>1</sup>	WQ-VC-U	WQ-VC-DBC	WQ-VC-UMN	WQ-VC-R+150 <sup>2</sup>
January 13-15, 2014	Al	Al	Al, Cd	Al, Cd	Al
February 10-12, 2014	N/A	Al	Al	Al	Al
March 10-12, 2014	N/A	Al, Cd	Al, Cd	Al	Al

Note:

1 – The WQ-VC-REF site was removed from the scope in January 2014, following the January trip.

2 – The WQ-VC-R+150 site is the WQ-VC-R winter sampling location (150 m downstream of the culvert), as the regular WQ-VC-R site freezes to substrate with thick overflow ice.

*In situ* water quality parameters for each trip are summarized in Table 3-17. Water temperatures remained near zero degrees at all Victoria Creek sites during the Q4 period, aside from a slight warming towards March 2014. Specific conductivity and pH fluctuated for most sites from January 2014 to March 2014, ranging from 177.8  $\mu\text{S}/\text{cm}$  to 251.1  $\mu\text{S}/\text{cm}$  and pH 6.84 to pH 7.43. Turbidity at most sites remained relatively low, ranging from 0.08 NTU to 1.81 NTU.

**Table 3-17. *In situ* water quality data for sites within the Victoria Creek watershed for the Q4 period (January 1 to March 31, 2014).**

Site ID	Date	Water Temp. (°C)	Specific Conductivity ( $\mu\text{S}/\text{cm}$ )	pH	Turbidity (NTU)
WQ-VC-REF <sup>1</sup>	14-Jan-14	0.00	221.3	7.31	0.33
WQ-VC-U	14-Jan-14	0.00	221.9	7.22	0.75
WQ-VC-U	11-Feb-14	0.00	177.8	7.18	0.32
WQ-VC-U	11-Mar-14	0.20	231.8	6.84	0.13





Site ID	Date	Water Temp. (°C)	Specific Conductivity (µS/cm)	pH	Turbidity (NTU)
WQ-VC-DBC	14-Jan-14	0.00	220.1	7.26	0.87
WQ-VC-DBC	11-Feb-14	0.00	177.8	7.18	1.38
WQ-VC-DBC	11-Mar-14	0.10	238.0	6.99	0.28
WQ-VC-UMN	14-Jan-14	0.00	237.8	7.11	0.91
WQ-VC-UMN	11-Feb-14	0.00	206.9	7.05	1.81
WQ-VC-UMN	11-Mar-14	0.30	240.9	7.04	0.36
WQ-VC-R+150 <sup>2</sup>	13-Jan-14	0.00	235.4	7.14	0.65
WQ-VC-R+150	11-Feb-14	0.10	204.0	7.43	0.60
WQ-VC-R+150	10-Mar-14	0.00	251.1	7.04	0.08

Note:

1 – The WQ-VC-REF site was removed from the scope in January 2014, following the January trip.

2 – The WQ-VC-R+150 site is the WQ-VC-R winter sampling location (150 m downstream of the culvert), as the regular WQ-VC-R site freezes to substrate with thick overflow ice.

### 3.3.5 Back Creek

The Back Creek site was only sampled during the March 10-12, 2014 trip during the Q4 period. Prior to this, the site had been frozen to substrate since the October 2013 sampling event. For the March 2014 samples, the only CCME-AL guidelines that were exceeded were for Al and Cd (Table 3-18). Refer to Appendix E - Tables E1-E3 for Q4 raw lab data and Figures E11-E14 showing Back Creek metal concentrations for the complete 2013-14 investigation period (Q1 through Q4). *In situ* water quality data for the Q4 period is shown in Table 3-19, with a water temperature during the March trip of zero degrees, a specific conductivity of 251.6 µS/cm, a pH of 7.25, and a turbidity of 0.63 NTU.

Table 3-18. Summary of parameters that exceeded CCME-AL guidelines and/or Mount Nansen EQS for WQ-BC for the Q4 period (January 1 to March 31, 2014).

Sampling Trip Date	WQ-BC
March 10-12, 2014	Al, Cd

Table 3-19. *In situ* water quality data for WQ-BC for the Q4 period (January 1 to March 31, 2014).

Site ID	Date	Water Temp. (°C)	Specific Conductivity (µS/cm)	pH	Turbidity (NTU)
WQ-BC	13-Jan-14		Frozen to Substrate		
WQ-BC	11-Feb-14		Frozen to Substrate		
WQ-BC	11-Mar-14	0.00	251.6	7.25	0.63



### 3.3.6 Minnesota Creek

This site was removed from the program scope in January 2014 and was therefore not sampled during the Q4 period.

### 3.3.7 Pony Creek

Pony Creek was not sampled during the Q4 period as both the upstream and downstream sites remained frozen to substrate, which is typical for the time of year. Nevertheless, a summary of metal concentrations of concern for the complete 2013-14 investigation period (Q1 through Q4) is provided in Appendix E for the WQ-PC-D and WQ-PC-U sites (Figures E11-E14).

### 3.3.8 Pump House Well

The pump house well was sampled during the February 2014 and March 2014 sampling events of the Q4 period. Drinking water package samples were collected. There were no water quality criteria that were exceeded from the Health Canada Guidelines for Canadian Drinking Water, the CCME-AL guidelines or the Mount Nansen EQS.

### 3.3.9 QA/QC Program

Field blank and travel blank samples were included on every trip during the Q4 period. Two duplicate samples were also collected during each sampling event. Table 3-20 summarizes the sample trip dates and sites where duplicate samples were collected. All field blank and travel blank samples showed no contamination through field sampling methodologies, transportation or storage (Appendix E).

Duplicate samples were compared for each trip to check the accuracy and precision of the laboratory analysis. Differences were within +/-10% for most parameters; however, some differences of over +/-10% were identified (Appendix E). Average percent differences for QA/QC sample sets ranged from 5% to 9%. Some of the duplicate sites had either relatively high TSS and/or large differences in TSS values within the duplicate sample set. These factors can lead to variability in metal concentrations as many metals bind more readily to sediment particles. Some differences may also be attributed to sampling conditions based on ice conditions. See Appendix E - Tables E1-E3 for parameters that were flagged as greater than +/-10%.

**Table 3-20. Summary of sites randomly selected as duplicate samples for each sampling trip over the Q4 period (January 1 to March 31, 2014).**

Sampling Trip Date	Replicate #1	Replicate #2
January 13-15, 2014	WQ-SEEP-r	WQ-VC-REF-r
February 10-12, 2014	WQ-SEEP-r	n/a <sup>1</sup>
February 10-12, 2014	WQ-SEEP-r	WQ-VC-DBC-r

Note:

1 – There were less than 10 total samples during this trip, so only one replicate was required.



## 4 CONCLUSIONS & RECOMMENDATIONS

Based on results of the Q4 period of the Mount Nansen Water Resources Investigations Program from January 1, 2014 to March 31, 2014, EDI recommends that monitoring should continue as scheduled for 2014/15 investigations with added consideration of several recommendations outlined below. These recommendations attempt to improve the overall program data quality and efficiency.

- Volumetric measurements at H-SEEP are redundant based on available flow meter (totalizer) instrumentation in the pump house. Flow records maintained by on-going care and maintenance staff should be considered sufficient for hydrometric monitoring of the H-SEEP location, which has been confirmed by concurrent measurements over the last 2 years. Confirmation measurements can periodically be taken to confirm flow meter readings.
- We recommend repositioning the weir structure at H-PC-U to better capture flows and provide a measure of discharge originating in the upper reaches of Pony Creek.
- Installation of a weir structure at H-DC-DX+105, H-DC-M and H-DC-R in to provide a more robust estimate of discharge along the Dome Creek channel.



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Disclaimer:

Maps presented in this document are a geographical representation of known features. Although the data collected and presented herein has been obtained with the utmost attention to quality, this document is not an official land survey and should not be considered for spatial calculation. EDI Environmental Dynamics Inc. does not accept any liability for errors, omissions or inaccuracies in the data.



## **APPENDIX A      Q4 SITE AND STATION PHOTOGRAPHS**

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## Dome Creek Sites/Stations



**Photo 1. H/WQ-DC-DX+105, looking downstream  
(February 11, 2014).**



**Photo 2. H/WQ-DC-B, looking upstream  
(January 14, 2014).**



**Photo 3. H-DC-M/WQ-DC-U, looking upstream  
(March 10, 2014).**



## Victoria Creek & Back Creek Sites/Stations



**Photo 1. H-VC-U, looking downstream  
(March 11, 2014).**



**Photo 2. WQ-VC-U, looking downstream  
(February 11, 2014).**



**Photo 3. H-VC-DBC, looking upstream  
(March 11, 2014).**



**Photo 4. WQ-VC-DBC, upstream  
(February 11, 2014).**



**Photo 5. H/WQ-VC-UMN, looking downstream (March 11, 2014).**



**Photo 6. H-VC-R, looking upstream (February 10, 2014).**



**Photo 7. WQ-VC-R+150 (winter sampling site), looking downstream (February 11, 2014).**



**Photo 8. H/WQ-BC, looking downstream (March 11, 2014).**



## Pit Lake/Tailings Pond/Seep Sites



**Photo 1. H/WQ-SEEP  
(January 13, 2014).**



**Photo 2. WQ-PIT  
(March 11, 2014).**



**Photo 3. WQ-MS-S-03, looking downstream  
(March 11, 2014).**



**Photo 4. WQ-TP (January 13, 2014)**



## **APPENDIX B      Q4 MONITORING VISIT RECORD**

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Table B-1. Record of sites sampled and stations monitored during each site visit during the Q4 period, January 1 to March 31, 2014.

Station/Site Name	January 13-15 2014	February 10-12, 2014	March 10-12, 2014
H-PC-U/WQ-PC-U	N	N	N
H-PC-DSP/WQ-PC-D	N	N	N
WQ-DC-DX	N	N	N
H-DC-DX+105/WQ-DC-DX+105	Y	Y	N
H-DC-D1b/WQ-DC-D1b	N	Y	N
H-DC-B/WQ-DC-B	N	Y <sub>w</sub>	N
H-DC-M/WQ-DC-U	Y	Y	Y
H-DC-R/WQ-DC-R	N	N	N
H-SEEP/WQ-SEEP	Y <sub>w</sub>	Y <sub>w</sub>	Y <sub>w</sub>
H-TP/WQ-TP	Y <sub>w</sub>	Y <sub>w</sub>	Y <sub>w</sub>
WQ-PIT-1,2,3	Y	Y	Y
WQ-MS-S-03	Y	N	Y
H-BC/WQ-BC	N	N	Y <sub>w</sub>
H-VC-REF/WQ-VC-REF	Y	n/a	n/a
H-VC-U/WQ-VC-U	Y	Y	Y
H-VC-DBC/WQ-VC-DBC	Y	Y	Y
H-VC-UMN/WQ-VC-UMN	Y	Y	Y
H-VC-R/WQ-VC-R+150	Y	Y	Y
WQ-PW	n/a	Y	Y

Codes

N – site or station not sampled due to no observations of flow or lack of suitable conditions for sampling

Y – water sampling conducted and/or discharge measurement collected

Y<sub>w</sub> – water quality only

Y<sub>h</sub> – hydrology only

n/a – not applicable as sampling/monitoring not required (removed from scope)

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## APPENDIX C      Q4 EDI FIELD DATA SHEETS

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General Site Tasks/ Communications

- 1) Download ALL data loggers present.
- 2) If a measurement is not feasible, fully document why and take photos.
- 3) Fill in ALL data boxes & Site Comment boxes on field sheets to document site conditions (even if site is unchanged).
- 4) During salt slugs, minimum SPC rise is only +10x resolution of conductivity meter.
- 5) Salt slug calibration tests can be done at the end of the day at the bunkhouse.
- 6) Attempt to get paired SS and ADV measurements where ice cover is sufficiently thin to measure with the ADV.

#	Complete	HID	Station Name	Station Type	Site Tasks	Survey Required	Logger Type Serial #	Q Method	Additional Materials Required	Date	Time	SG	Logger
						Yes/No				yy.mm.dd	HH:MM	(m)	(m)
1	<input checked="" type="checkbox"/>	ATM-DC2	Atmospheric at Diversion Channel	Continuous Baro Logger	1) HOBO download	NO	HOBO	None	None	2014-JAN-	15:45 16:25	n/a	
2	<input checked="" type="checkbox"/>	ATM-DC4	Atmospheric at Diversion Channel (Back-up)	Continuous Baro Logger	1) Solinst download 2) Clear Solinst logger data	NO	Solinst Baro-logger	None	None	2014-JAN-	15:45 16:25	n/a	
3	<input type="checkbox"/>	H-PC-U	Upper Pony Creek	Instantaneous	Unsuitable for sampling Dry/Frozen/Overflow	NO	n/a	Salt (0.01 kg) CF.T	None	2014-JAN-			
4	<input checked="" type="checkbox"/>	H-PC-DSP	Pony Creek Downstream of Pit	Instantaneous	Unsuitable for sampling Dry/Frozen/Overflow	NO	n/a	Volumetric Salt (0.01 kg) CF.T	None	2014-JAN-			
5	<input type="checkbox"/>	H-DC-DX	Dome Creek DX	Discontinued	Discontinued	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
6	<input checked="" type="checkbox"/>	H-DC-DX+105	Dome Creek DX+105	Instantaneous	1) Q measurement	n/a	n/a	Salt (0.01 kg) CF.T	None	2014-JAN-	17:07	n/a	
8	<input type="checkbox"/>	H-DC-D1b	Dome Creek D1b	Instantaneous	Unsuitable for sampling Dry/Frozen/Overflow	n/a	n/a	Salt (0.01 kg) CF.T	None	2014-JAN-		n/a	
9	<input type="checkbox"/>	H-DC-U1	Upper Dome Creek 1	Discontinued	Discontinued	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
10	<input type="checkbox"/>	H-DC-U2	Upper Dome Creek 2	Discontinued	Discontinued	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
11	<input checked="" type="checkbox"/>	H-DC-B	Diversion Channel at Bridge	Continuous	1) Q measurement	NO	n/a	Salt (0.05 kg) CF.T	None	2014-JAN-			
12	<input checked="" type="checkbox"/>	H-DC-M	Middle Dome Creek	Continuous	1) Q measurement 2) Logger download.	YES	Solinst 1050018	Salt (0.1 kg) CF.T	None	2014-JAN-13	14:15		
13	<input type="checkbox"/>	H-DC-R	Dome Creek at Road	Continuous	Unsuitable for sampling Dry/Frozen/Overflow	n/a	n/a	Volumetric Salt (0.1 kg) CF.T	None	2014-JAN-	overflow		

\* check reading around  
 Time of DL loggers  
 Brought into vehicle for  
 DL Due to Problems & cold

no flow

\* Ice snow layers to water  
 flowing between make sample  
 make better photos 107-111

Photo 0072 4/5 0073 D/S  
 13 Jan 2014 13:35

H-DC-B  
 H-PC-DBC  
 H-VC-UMX  
 H-VC-DBC  
 H-VC-U  
 H-VC-REF  
 W/W - p.1-1,2,3



#	Complete	HID	Station Name	Station Type	Site Tasks	Survey Required	Logger Type Serial #	Q Method	Additional Materials Required	Date	Time	SG	Logger
						Yes/No				yy.mm.dd	HH:MM	(m)	(m)
14	<input checked="" type="checkbox"/>	H-VC-REF	Victoria Creek Reference	Continuous	1) Q measurement (ADV if possible, SS)	NO	n/a	ADV SS (0.2 kg)	None	2014-JAN-			
15	<input checked="" type="checkbox"/>	H-VC-U	Upper Victoria Creek	Continuous	1) Q measurement (ADV + SS) 2) Logger download.	YES	Solinst 1049522	ADV SS (0.2 kg)	None	2014-JAN-			
16	<input checked="" type="checkbox"/>	H-VC-DBC	Victoria Creek D/S of Back Creek	Continuous	1) Q measurement (ADV + SS) 2) Logger download.	YES	Solinst 1049137	ADV SS (0.2 kg)	None	2014-JAN-			
17	<input type="checkbox"/>	H-BC	Back Creek	Continuous	Unsuitable for sampling Dry/Frozen/Overflow	NO	n/a	Salt (0.025 kg) CF.T	None	2014-JAN-			
18	<input checked="" type="checkbox"/>	H-VC-UMN	Victoria Creek U/S of Minnesota Creek	Continuous	1) Q measurement (ADV + SS)	NO	n/a	ADV SS (0.2 kg)	None	2014-JAN-			
19	<input type="checkbox"/>	H-MN	Minnesota Creek	Discontinued	Discontinued	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
20	<input checked="" type="checkbox"/>	H-VC-R	Victoria Creek at Road	Continuous	1) Q measurement (ADV + SS) 2) Logger download.	YES	Solinst 1041103	ADV SS (0.2 kg) CF.T	None	2014-JAN-13	13:04		
21	<input checked="" type="checkbox"/>	H-SEEP	Seepage Pond Outlet	Instantaneous / Water Level	1) Q measurement at pipe outlet 2) Q measurement at flow meter in pumphouse 3) Staff Gauge Reading in Pond	NO	n/a	Volumetric	None	2014-JAN-	14:50		Ice
22	<input checked="" type="checkbox"/>	H-TP	Tailings Pond	Water Level Only	1) Staff Gauge Reading (if possible).	NO	n/a	None	None	2014-JAN-13	15:32		Ice



JAN

HID: H DC PX #105		Date: 13 DECEMBER-2013		Discharge Measurement Instruments + Methods						
Station Name: DX 105	Q Measurement Start Time: 17:07 (HH:MM)		PDT   PST	<input checked="" type="checkbox"/> SWOFFER   <input type="checkbox"/> PYGMY   <input type="checkbox"/> ADV   <input type="checkbox"/> MID-SECT   <input type="checkbox"/> POINT						
	Q Measurement End Time:		(HH:MM) PDT   PST	<input checked="" type="checkbox"/> SALT TRACER   <input type="checkbox"/> WEIR   <input type="checkbox"/> VOLUMETRIC   <input type="checkbox"/> FLOAT   <input type="checkbox"/> ROD						
	Logger Download/Inst Time:		(HH:MM) PDT   PST	Channel Conditions <input type="checkbox"/> NONE   <input checked="" type="checkbox"/> ICE   <input type="checkbox"/> BACKWATER   <input type="checkbox"/> > BANKFULL   <input type="checkbox"/> ZERO FLOW   <input type="checkbox"/> HIGH SUSP. SED.						
Logger: Serial #	HOBO   Solinst   <input checked="" type="checkbox"/> N/A			GPS Waypoint		ZONE	EASTING	NORTHING		
Photo # [U/S]	93	[D/S]	94	[RDB]	95	[LDB]	0096	[STAFF/WEIR]		
Site Comments				SLUG   CONSTANT RATE   <input checked="" type="checkbox"/> DRY   <input checked="" type="checkbox"/> LOGGED   <input type="checkbox"/> MANUAL   <input checked="" type="checkbox"/> SPC   <input type="checkbox"/> IEC   <input type="checkbox"/> CF.T YES   <input type="checkbox"/> NO						
? ?				Trial Time		SPC <sub>B</sub>   SPC <sub>P</sub>	Mix Length	Mass of Salt	Mix Vol.	[Salt Slug]
						EC <sub>0</sub> (uS/cm)   EC <sub>10</sub> (uS/cm)	L <sub>m</sub> (m)	Ms <sub>2</sub> (kg)	Volume (L)	Css (kg/L)
				1 (17:15)		1173   11273	18	0.01	Dry (10)	
				2 (17:29)		1165	18	0.01	Dry (10)	
Channel Measurements				V <sub>1</sub> for Sec. Mix (mL)		Vol. Added (mL)		SPC (uS/cm)	Temp	
Staff Gauge Height (m):		Weir Head (m):		Csec (g/L):		Vol. Calib. Tank (L):		SPC <sub>0</sub> Calib. Tank		
Water Temperature (°C): 0.1°C		Average Width (m):		CF.T =		CF.T				
Water Surface Slope (%):		Average Depth (m):		Qsalt =						
Measurement Summary		Primary	Secondary	Notes:						
Meas. Type: Salt				High Q uncertainty due to poor salt curves.						
Measurement ID (MID): 920				Volume (L) =						
Average Q (m³/s): 0.0021				Time (sec) [1]		[2]		[3] [4] [5]		
Q Meas. Accuracy +/- [%]:				Average Q (L/s) =						
Average Velocity (m/s):				Avg. Q <sub>vol</sub> (L/s) =						
Cross-Sectional Area (m²):				Avg. Q <sub>vol</sub> (m³/s) =						
Hydrometric Levels - Survey										
YES <input checked="" type="checkbox"/> NO <input type="checkbox"/> REASON: No Station			Survey Time (HH:MM): (WATER)		BM Shift: Yes  No		Logger Shift: Yes  No		Staff Gauge Shifted?: Yes  No	
Circuit #1	HI	Rod Read	Elevation (m)	± 0.003	Circuit #2	HI	Rod Read	Elevation (m)	Station Measurements	
Station	A	B	C		Station	A	B	C		
BM1	A-B=C		3.000		BM1			3.000	Log'r Rod Length:	
BM2	A-B=C				BM2				Log'r Rod to Botm:	
BM3	A-B=C				BM3					
TOS	A-B=C				TOS					
WATER	A-B=C				WATER					
LOG'R ROD:	A-B=C				LOG'R ROD:					
HWM/CON	A-B=C				HWM/CON					
BANKFULL	A-B=C				BANKFULL					
	A-B=C				BS (BM1)					



HID: 4 DC M		Date: 13 DECEMBER-2013		Discharge Measurement Instruments + Methods							
Station Name: Dome Creek #111	Q Measurement Start Time: 14:15		PDT   PST		YSI   SWOFFER   PYGMY   ADV MID-SECT   POINT						
	Q Measurement End Time:		PDT   PST		SALT TRACER   WEIR   VOLUMETRIC   FLOAT   ROD						
	Logger Download/Inst Time:		PDT   PST		Channel Conditions						
Logger Reading (m)		[ ] downloaded		NONE   ICE   BACKWATER   > BANKFULL   ZERO FLOW   HIGH SUSP. SED.							
Logger: Serial #	HOBO   Solinst   N/A			GPS Waypoint		ZONE	FASTING	NORTHING			
Photo # [U/S]	76	[D/S]	77	[RDB]	78	[LDB]	79	[STAFF/WEIR]			
Site Comments				SLUG   CONSTANT RATE   DRY   LOGGED   MANUAL   SPC   EC CFT YES   NO							
Dry salt slug completed @ Sta - only one survey circuit completed				Trial Time		SPC <sub>B</sub>   SPC <sub>P</sub>		Mix Length	Mass of Salt	Mix Vol.	[Salt Slug]
						EC <sub>0</sub> (uS/cm)   EC <sub>pk</sub> (uS/cm)		L <sub>m</sub> (m)	Ms <sub>0</sub> (kg)	Volume (L)	Css (kg/L)
				1 (14:15)		1682   1867		42	0.100	Dry (1L)	
2 (14:35)		1701		42	0.100	Dry (1L)					
3 ( : )											
Channel Measurements				Salt Tracer							
Staff Gauge Height (m): /				V <sub>1</sub> for Sec. Mix (mL)		Vol. Added (mL)		SPC (uS/cm)		Temp	
Weir Head (m): /				Csec (g/L): 20 g/L		1 0		1773		1.5	
Water Temperature (°C): /				Vol. Calib. Tank (L): 500 mL		2 10		1816		0.9	
Water Surface Slope (%): /				SPC <sub>0</sub> Calib. Tank		3 10		1807		0.7	
Average Width (m): /				CF.T = 2.9 x 10 <sup>-1</sup>		4 10		1803		1.0	
Average Depth (m): /				Qsalt = 0.207		5 10		1812		0.8	
Measurement Summary				Notes: 1. Best salt tracer dissolved higher than steel.		6 10					
Meas. Type: Salt		Secondary		7 0		8 10		1821		1.3	
Measurement ID (MID): 921				8 10		9 10		2663		1.3	
Average Q (m³/s): 0.207				9 10				3553499		1.4	
Q Meas. Accuracy +/- [%]:				Volum.		Volume (L) =					
Average Velocity (m/s):				Time (sec) [1]		[2]		[3]		[4]	
Cross-Sectional Area (m²):				Average Q (L/s) =		Avg. Q <sub>val</sub> (L/s) =		Avg Q <sub>val</sub> (m³/s) =		[5]	
Hydrometric Levels - Survey											
YES   NO   REASON:			Survey Time (HH.MM): (WATER) 14:14		BM Shift: Yes   No		Logger Shift: Yes   No		Staff Gauge Shifted?: Yes   No		
Circuit #1	HI	Rod Read	Elevation (m)	± 0.003	Circuit #2	HI	Rod Read	Elevation (m)	Station Measurements		
Station	A	B	C		Station	A	B	C			
BM1	4.602	1.602	3.000		BM1			3.000	Log'r Rod Length:		
BM2		2.266	2.336		BM2			A-B =	Log'r Rod to Botm: /		
BM3		1.880	2.922		BM3			A-B =			
TOS		2.114	2.488		TOS			A-B =			
WATER		2.980	1.622		WATER			A-B =			
LOG'R ROD:		1.882	2.72		LOG'R ROD:			A-B =			
HWM/CON		/	A-B =		HWM/CON			A-B =			
BANKFULL		/	A-B =		BANKFULL			A-B =			
BS (BM1)		1.602	3.000	± 0.003	BS (BM1)			A-B =			



HID	H VC REF		Date	19 DECEMBER-2013	Discharge Measurement Instruments + Methods				
Station Name	Victoria Reference		Q Measurement Start Time:	15:14 (HH:MM) PDT   PST	YSI SWOFFER   PYGMY   ADV MID-SECT   POINT				
			Q Measurement End Time:	15:42 (HH:MM) PDT   PST	SALT TRACER   WEIR   VOLUMETRIC   FLOAT   ROD				
			Logger Download/Inst Time:	(HH:MM) PDT   PST	Channel Conditions				
Logger	Serial #	HOBO   Solinst		N/A	GPS Waypoint		NONE   ICE   BACKWATER   > BANKFULL   ZERO FLOW   HIGH SUSP. SED.		
Photo #	[U/S] 339	[D/S] 340	[RDB] 343	[LDB] 344	[STAFF/WEIR]				
Site Comments			SLUG   CONSTANT RATE   <input checked="" type="checkbox"/> LOGGED   MANUAL <input checked="" type="checkbox"/> SPC   EC C.F.T. YES   NO						
No comments provided for field trip.			Trial Time		SPC <sub>B</sub>   SPC <sub>P</sub>	Mix Length	Mass of Salt	Mix Vol.	[Salt Slug]
					EC <sub>0</sub> (uS/cm)   EC <sub>pk</sub> (uS/cm)	L <sub>m</sub> (m)	M <sub>s</sub> (kg)	Volume (L)	Css (kg/L)
			1 (15:14)		221.3   249.7	28	0.200 kg	Dry (10)	
2 (15:28)		221.7	28	0.200 kg	Dry (10)				
3 ( )									
Channel Measurements			V <sub>i</sub> for Sec. Mix (mL)						
Staff Gauge Height (m):	/		Csec (g/L):		20 g/L		Vol. Added (mL)	SPC (uS/cm)	Temp
Weir Head (m):	/		Vol. Calib. Tank (L):		1 L 500 mL		1. 0	246.0	0.6 °C
Water Temperature (°C):	0.0 °C		SPC <sub>0</sub> Calib. Tank				2. 10	1044	0.6 °C
Water Surface Slope (%):	/		C.F.T =		2.5 x 10 <sup>-1</sup>		3. 10	1824	0.7 °C
Average Width (m):	/		Qsalt =		0.164		4. 10	2698	0.6 °C
Average Depth (m):	/		Notes:		Dry SS, dry CFT used		5.		
Measurement Summary	Primary	Secondary	Volume (L) =						
Meas. Type:	Salt		Time (sec) [1]						
Measurement ID (MID):	922		Average Q (L/s) =						
Average Q (m³/s):	0.164		Avg. Q <sub>vol</sub> (m³/s) =						
Q Meas. Accuracy +/- [%]:	/		Hydrometric Levels - Survey						
Average Velocity (m/s):	/		YES   NO   REASON: No Station						
Cross-Sectional Area (m²):	/		Survey Time (HH:MM): (WATER)						
			BM Shift: Yes   No						
			Logger Shift: Yes   No						
			Staff Gauge Shifted?: Yes   No						
Circuit #1	HI	Rod Read	Elevation (m)	± 0.003	Circuit #2	HI	Rod Read	Elevation (m)	Station Measurements
Station	A	B	C		Station	A	B	C	
BM1	A+B-C		3.000		BM1			3.000	Log'r Rod Length:
BM2	A+B-C		A-B=		BM2			A-B=	Log'r Rod to Botm:
BM3	A+B-C		A-B=		BM3			A-B=	
TOS	A-B=C		A-B=		TOS			A-B=	
WATER	A+B-C		A-B=		WATER			A-B=	
LOG'R ROD:	A+B-C		A-B=		LOG'R ROD:			A-B=	
HWM/CON	A+B-C		A-B=		HWM/CON			A-B=	
BANKFULL	A+B-C		A-B=		BANKFULL			A-B=	
	A+B-C		A-B=		BS (BM1)			A-B=	



HID	H-VC-u		Date	14 DECEMBER-2013		Discharge Measurement Instruments + Methods				
Station Name	Upper Victoria Creek		Q Measurement Start Time:	13:57 (HH:MM)	PDT   PST	YSI   SWOFFER   PYGMY   ADV	MID-SECT   POINT			
			Q Measurement End Time:	14:35 (HH:MM)	PDT   PST	SALT TRACER   WEIR   VOLUMETRIC   FLOAT   ROD				
			Logger Download/Inst Time:	13:41 (HH:MM)	PDT   PST	Channel Conditions				
Logger:	Serial #	HOBO (Solinst) N/A		GPS Waypoint		NONE   ICE   BACKWATER   > BANKFULL   ZERO FLOW   HIGH SUSP. SED.				
Photo #	[U/S] 334	[D/S] 335	[RDB] 0337	[LDB] 336	[STAFF/WEIR] 333					
Site Comments			SLUG   CONSTANT RATE   DRY   LOGGED   MANUAL   SPO/EC							CF.T YES   NO
Juv GR obs approx 90mm length			Trial Time	SPC <sub>B</sub>   SPC <sub>P</sub>	Mix Length	Mass of Salt	Mix Vol.	[Salt Slug]		
				EC <sub>B</sub> (uS/cm)   EC <sub>P</sub> (uS/cm)	L <sub>m</sub> (m)	M <sub>s</sub> (kg)	Volume (L)	C <sub>ss</sub> (kg/L)		
			1 (14:22)	220.01   324.3	40m	0.200	1L (dry)			
Channel Measurements			V <sub>i</sub> for Sec. Mix (mL)							CF.T
Staff Gauge Height (m):	0.141		Csec (g/L):	1 g/L		Vol. Added (mL)	SPC (uS/cm)	Temp		
Weir Head (m):			Vol. Calib. Tank (L):	1 L		1	229.0	2.3°C		
Water Temperature (°C):	0.1		SPC <sub>0</sub> Calib. Tank			2	1166	2.1°C		
Water Surface Slope (%):			CF.T =	2.16 x 10 <sup>-1</sup>		3	2076	2.3°C		
Average Width (m):	3.500		Q <sub>salt</sub> =	0.134		4	2848	2.6°C		
Average Depth (m):	0.165		Notes:	Dry SS.						
Measurement Summary	Primary	Secondary	Volum.							
Meas. Type:	ADV	SALT	Volume (L) =							
Measurement ID (MID):	923	924	Time (sec) [1]	[2]	[3]	[4]	[5]			
Average Q (m <sup>3</sup> /s):	0.0872	0.134	Average Q (L/s) =							
Q Meas. Accuracy +/- [%]:	5.6		Avg. Q <sub>vol</sub> (L/s) =							
Average Velocity (m/s):	0.151									
Cross-Sectional Area (m <sup>2</sup> ):	0.577									
Hydrometric Levels - Survey										
YES   NO   REASON:			Survey Time (HH:MM):	(WATER)	BM Shift: Yes   No	Logger Shift: Yes   No	Staff Gauge Shifted? Yes   No			
Circuit #1	HI	Rod Read	Elevation (m)	± 0.003	Circuit #2	HI	Rod Read	Elevation (m)	Station Measurements	
Station	A	B	C		Station	A	B	C		
BM1	4.410	1.410	3.000		BM1	4.409	1.409	3.000	Log'r Rod Length:	
BM2	4.410	1.052	3.358		BM2			A-B =	Log'r Rod to Botm:	
BM3	4.410	1.165	3.245		BM3			A-B =		
TOS	4.410	1.505	2.905		TOS			A-B =		
WATER	4.410	2.361	2.049		WATER			A-B =		
LOG'R ROD:	4.410	1.261	3.149		LOG'R ROD:			A-B =		
HWM/CON			A-B =		HWM/CON			A-B =		
BANKFULL			A-B =		BANKFULL			A-B =		
			A-B =		BS (BM1)			A-B =		

0.09m = ice thickness  
 0.08m = bed to bottom ice





HID	H-VC-D3C		Date	14 DECEMBER 2013		Discharge Measurement Instruments + Methods			
Station Name	Victoria Cr. Downstream of BACK CH.		Q Measurement Start Time:	12:30 (HH:MM)	PDT   PST	YSI   SWOFFER   PYGMY   ADV	MID-SECT   POINT		
			Q Measurement End Time:	13:10 (HH:MM)	PDT   PST	SALT TRACER   WEIR   VOLUMETRIC   FLOAT   ROD			
			Logger Download/Inst Time:	12:25 (HH:MM)	PDT   PST	Channel Conditions			
Logger:	Serial #	HOBO   Solinst   N/A		GPS Waypoint		NONE   ICE   BACKWATER   > BANKFULL   ZERO FLOW   HIGH SUSP. SED.			
Photo #	[U/S] 220	[D/S] 321	[RDB] 323 (LG)	[LDB] 322	[STAFF/WEIR] 326				
Site Comments			SLUG   CONSTANT RATE   DRY		LOGGED	MANUAL	SPC	EC	CF.T YES   NO
			Trial Time	SPC <sub>B</sub>   SPC <sub>P</sub>	Mix Length	Mass of Salt	Mix Vol.	[Salt Slug]	
			EC <sub>O</sub> (uS/cm)   EC <sub>P</sub> (uS/cm)	L <sub>m</sub> (m)	M <sub>S</sub> (kg)	Volume (L)	C <sub>SS</sub> (kg/L)		
			1 (12:37)	229.8   299.2	40	0.200	Dry (1L)		
			2 (12:48)	229.8	40	0.200	Dry (1L)		
			3 ( )						
Channel Measurements			V <sub>1</sub> for Sec. Mix (mL)	-1 g/L		Vol. Added (mL)	SPC (uS/cm)	Temp	
Staff Gauge Height (m):	0.437		Csec (g/L):	1 g/L		1. 0	249.0	1.3°C	
Weir Head (m):			Vol. Calib. Tank (L):	1 L		2. 10	948	1.0°C	
Water Temperature (°C):	-0.1°C		SPC <sub>0</sub> Calib. Tank			3. 10	1619	1.0°C	
Water Surface Slope (%):	/		CF.T =	2.9 x 10 <sup>-1</sup>		4. 10	2345	0.9°C	
Average Width (m):	3.620		Q <sub>salt</sub> =	0.170		5.			
Average Depth (m):	0.142		Notes:	Dry SS		6.			
Measurement Summary	Primary	Secondary							
Meas. Type:	ADV	Salt							
Measurement ID (MID):	425	926							
Average Q (m³/s):	0.1035	0.170							
Q Meas. Accuracy +/- [%]:	4.4								
Average Velocity (m/s):	0.203								
Cross-Sectional Area (m²):	0.510								
Hydrometric Levels - Survey									
YES   NO   REASON:			Survey Time (HH:MM):	(WATER)	BM Shift: Yes  No	Logger Shift: Yes  No	Staff Gauge Shifted?: Yes  No		
Circuit #1	HI	Rod Read	Elevation (m)	± 0.003	Circuit #2	HI	Rod Read	Elevation (m)	Station Measurements
Station	A	B	C		Station	A	B	C	
BM1	4.485	1.485	3.000		BM1	4.485	1.485	3.000	Log'r Rod Length:
BM2	4.485	1.458	3.027		BM2				Log'r Rod to Botm:
BM3	4.485	1.569	2.916		BM3				
TOS	4.485	2.135	2.350		TOS				
WATER	4.485	2.701	1.784		WATER				
LOG'R ROD:	4.485	1.917	2.568		LOG'R ROD:				
HWM/CON	A-B=		A-B=		HWM/CON				
BANKFULL	A-B=		A-B=		BANKFULL				
	A-B=		A-B=		BS (BM1)				

Bed to water (bottom of ice) = 0.41m  
 ice thickness = 0.1m

Field Staff: LG, JM, DS  
 Data Entry By: CL  
 Reviewed By:   
 Date: 24 MAR 2014



HID: H VC UNM		Date: 14 DECEMBER-2013		Discharge Measurement Instruments + Methods											
Station Name: Victoria creek up stream of Pinnacole creek	Q Measurement Start Time: 4:30		PDT   PST		SWOFFER   PYGMY   MID-SECT   POINT										
	Q Measurement End Time: 11:30		PDT   PST		SALT TRACER   WEIR   VOLUMETRIC   FLOAT   ROD										
	Logger Download/Inst Time: /		PDT   PST		Channel Conditions										
	Logger Reading (m): /		[ ] downloaded		NONE   ICE   BACKWATER   > BANKFULL   ZERO FLOW   HIGH SUSP. SED										
Logger: Serial #	HOBO   Solinst   N/A			GPS Waypoint		ZONE: EASTING NORTHING									
Photo # [U/S]	[D/S]	[RDB]	[LDB]	[STAFF/WEIR]											
Site Comments: Open water section @ weir site this ice snow covered over the way				SLUG   CONSTANT RATE   LOGGED   MANUAL   SPC   EC   CF.T YES   NO											
Channel Measurements		Salt Tracer		Trial Time		SPC <sub>B</sub>   SPC <sub>P</sub>		Mix Length		Mass of Salt		Mix Vol.		[Salt Slug]	
Staff Gauge Height (m): /				EC <sub>B</sub> (uS/cm)   EC <sub>P</sub> (uS/cm)		L <sub>m</sub> (m)		M <sub>s</sub> (kg)		Volume (L)		C <sub>SS</sub> (kg/L)			
Weir Head (m): /				1 (10:33)		238.7   294.2		43		0.200 kg		Dry (1L)			
Water Temperature (°C): 2.0				2 (10:47)		239.0		43		0.200 kg		Dry (1L)			
Water Surface Slope (%): /				3 ( : )		/									
Average Width (m): /				V <sub>1</sub> for Sec. Mix (mL)		/				Vol. Added (mL)		SPC (uS/cm)		Temp	
Average Depth (m): /				C <sub>sec</sub> (g/L):		1 g/L				1. 0		238.7		1.8°C	
Measurement Summary				Vol. Calib. Tank (L):		1 L				2. 10		1008		1.7°C	
Meas. Type: ADV				SPC <sub>0</sub> Calib. Tank		/				3. 16		1682		1.5°C	
Measurment ID (MID): 927				CF.T =		2.7 x 10 <sup>-1</sup>				4.					
Average Q (m³/s): 0.0194		Q <sub>salt</sub> =		0.157				5.							
Q Meas. Accuracy +/- (%): 10%		Notes: Dry SS						6.							
Average Velocity (m/s): 0.196		Volume (L) =						7.							
Cross-Sectional Area (m²): 0.467		Time (sec) [1]						8.							
		Average Q (L/s) =						9.							
		Avg. Q <sub>vol</sub> (L/s) =													
		Avg. Q <sub>vol</sub> (m³/s) =													
Hydrometric Levels - Survey															
YES   NO   REASON			Survey Time (HH:MM): (WATER)		BM Shift: Yes  No		Logger Shift: Yes  No		Staff Gauge Shifted?: Yes  No						
Circuit #1	H I	Rod Read	Elevation (m)	± 0.003	Circuit #2	H I	Rod Read	Elevation (m)	Station Measurements						
Station	A	B	C		Station	A	B	C							
BM1			3.000		BM1			3.000	Log'r Rod Length:						
BM2			A-B=		BM2			A-B=	Log'r Rod to Botm:						
BM3			A-B=		BM3			A-B=							
TOS			A-B=		TOS			A-B=							
WATER			A-D=		WATER			A-D=							
LOG'R ROD:			A-B=		LOG'R ROD:			A-B=							
HWM/CON			A-B=		HWM/CON			A-B=							
BANKFULL			A-B=		BANKFULL			A-B=							
			A-B=		BS (BM1)			A-B=							

Field Staff: LG, JM, DS  
 Date Entry By: [Signature] Date: 24 MAR 2014  
 Reviewed By: [Signature] Date:



HID: HVC R		Date: 13 DECEMBER 2013		Discharge Measurement Instruments + Methods							
Station Name: Victoria @ Road	Q Measurement Start Time: 13:04 (HH:MM) PDT   PST		YSI   SWOFFER   PYGMY   ADV MID-SECT   POINT								
	Q Measurement End Time: 13:22 (HH:MM) PDT   PST		SALT TRACER   WEIR   VOLUMETRIC   FLOAT   ROD								
	Logger Download/Inst Time: / (HH:MM) PDT   PST		Channel Conditions								
Logger Reading (m): / [ ] downloaded		NONE   <del>CB</del> BACKWATER   > BANKFULL   ZERO FLOW   HIGH SUSP. SED.									
Logger: Serial #	HOBO   <del>901inst</del>   N/A		GPS Waypoint		ZONE	EASTING	NORTHING				
Photo # [U/S]	0064	[D/S]	0065	[RDB]	0066	[LDB]	0067	[STAFF/WEIR]	0068		
Site Comments				SLUG   CONSTANT RATE   <del>DRY</del>   LOGGED   <del>MANUAL</del>   <del>SP</del>   EC   CF.T YES   NO							
channel over flow too higher than Bank full Saltist level logger would not DL check cable msg showing No visible dmg to Logger cable of direct travel cable Detected Suspect direct level cable due to sec.				Trial Time		SPC <sub>B</sub>   SPC <sub>P</sub>	Mix Length	Mass of Salt	Mix Vol.	[Salt Slug]	
						EC <sub>O</sub> (uS/cm)   EC <sub>P</sub> (uS/cm)	L <sub>m</sub> (m)	Ms <sub>s</sub> (kg)	Volume (L)	Css (kg/L)	
				1 (13:04)	234.4	270	34m	0.200 kg	Dry (12)		
Channel Measurements Staff Gauge Height (m): / Weir Head (m): / Water Temperature (°C): 0.0 Water Surface Slope (%): / Average Width (m): / Average Depth (m): /				V <sub>1</sub> for Sec. Mix (mL)			Dry SS	Vol. Added (mL)	SPC (uS/cm)	Temp	
				Csec (g/L):		1 g/L					
				Vol. Calib. Tank (L):		1L					
Measurement Summary Meas. Type: Salt Measurement ID (MID): 929 Average Q (m³/s): 0.170 Q Meas. Accuracy +/- [%]: Average Velocity (m/s): Cross-Sectional Area (m²):				SPC <sub>O</sub> Calib. Tank							
				CF.T =		2.2 x 10 <sup>-1</sup>					
				Qsalt =		0.170					
Volum. Volume (L) = Time (sec) [1] Average Q (L/s) = Avg. Q <sub>vol</sub> (L/s) =				Notes: 500mL sec set @ 20g/L 500mL Cal Tank							
Hydrometric Levels - Survey											
YES   NO   REASON:			Survey Time (HH:MM): (WATER) 13:15		BM Shift: Yes  No		Logger Shift: Yes  No		Staff Gauge Shifted?: Yes  No		
Circuit #1	HI	Rod Read	Elevation (m)	± 0.003	Circuit #2	HI	Rod Read	Elevation (m)	Station Measurements		
Station	A	B	C		Station	A	B	C			
BM1	4.280	1.280	3.000		BM1			3.000	Log'r Rod Length:		
BM2	A-B-C	0.858	3.482		BM2			A-B=	Log'r Rod to Botm:		
BM3	A-B-C	1.112	3.168		BM3			A-B=			
TOS	ICE	/	A-B=		TOS			A-B=			
WATER	A-B-C	2.294	1.980		WATER			A-B=			
LOG'R ROD:	A-B-C	1.468	2.812		LOG'R ROD:			A-B=			
HWM/CON	A-B-C	/	A-B=		HWM/CON			A-B=			
BANKFULL	A-B-C	/	A-B=		BANKFULL			A-B=			
BS:	A-B-C	1.280	3.000		BS (BM1)			A-B=			

Bed - w lvl = 47cm  
 Bed - Top of sec = 129 cm  
 Ice = 90 cm

Field Staff: LG, JM, DS  
 Data Entry By: [Signature] Date: 29th March 2014  
 Reviewed By: [Signature] Date:



HID: H SEEP		Date: 13 DECEMBER-2013		Discharge Measurement Instruments + Methods					
Station Name: Seepage Pond	Q Measurement Start Time: 15:13 (HH:MM) PDT   PST		YSI   SWOFFER   PYGMY   ADV MID-SECT.   POINT						
	Q Measurement End Time: (HH:MM) PDT   PST		SALT TRACER   WEIR   VOLUMETRIC   FLOAT   ROD						
	Logger Download/Inst Time: (HH:MM) PDT   PST		Channel Conditions						
Logger Reading (m) [ ] downloaded		NONE   ICE   BACKWATER   > BANKFULL   ZERO FLOW   HIGH SUSP. SED							
Logger: Serial #	HOBO   Solinst   N/A		GPS Waypoint		ZONE	EASTING	NORTHING		
Photo # [U/S]	[D/S] 83	[RDB]	[LDB]	[STAFF/WEIR]					
Site Comments: ? Volumetric Q taken @ pipe outlet		Salt Tracer		SLUG   CONSTANT RATE   DRY LOGGED   MANUAL SPC   EC CF.T YES   NO					
Channel Measurements				Trial Time	SPC <sub>B</sub>   SPC <sub>P</sub>	Mix Length	Mass of Salt	Mix Vol.	[Salt Slug]
				EC <sub>O</sub> (uS/cm)   EC <sub>P</sub> (uS/cm)	L <sub>m</sub> (m)	Ms <sub>s</sub> (kg)	Volume (L)	Css (kg/L)	
				1 ( : )					
				2 ( : )					
				3 ( : )					
Measurement Summary				V <sub>1</sub> for Sec. Mix (mL)	±1.0%		Vol. Added (mL)	SPC (uS/cm)	Temp
Staff Gauge Height (m):				Csec (g/L):	1 g/L		1.		
Weir Head (m):				Vol. Calib. Tank (L):	1 L		2.		
Water Temperature (°C):				SPC <sub>0</sub> Calib. Tank			3.		
Water Surface Slope (%):		CF.T =			4.				
Average Width (m):		Q <sub>salt</sub> =			5.				
Average Depth (m):		Notes:			6.				
Meas. Type: ✓	Primary	Secondary			7.				
Measurement ID (MID): 930					8.				
Average Q (m³/s): 0.00235					9.				
Q Meas. Accuracy +/- [%]:									
Average Velocity (m/s):									
Cross-Sectional Area (m²):									
Volum.		Volume (L) = 11	12	10	10	10			
		Time (sec) [1] 4.00	[2] 4.50	[3] 4.00	[4] 5.44	[5] 6			
		Average Q (L/s) = 2.75	3.00	2.5	1.84	1.67			
		Avg. Q <sub>vol</sub> (L/s) = 2.35		Avg Q <sub>vol</sub> (m³/s) =	0.00235				
Hydrometric Levels - Survey									
YES   NO   REASON: NO station	Survey Time (HH:MM): (WATER)		BM Shift: Yes  No		Logger Shift: Yes  No		Staff Gauge Shifted?: Yes  No		
Circuit #1	H I	Rod Read	Elevation (m)	± 0.003	Circuit #2	H I	Rod Read	Elevation (m)	Station Measurements
Station	A	B	C		Station	A	B	C	
BM1	A-B+C		3.000		BM1			3.000	Log'r Rod Length:
BM2	A+B+C		A-B=		BM2			A-B=	Log'r Rod to Botm:
BM3	A+B+C		A-B=		BM3			A-B=	
TOS	A-B+C		A-B=		TOS			A-B=	
WATER	A-B+C		A-B=		WATER			A-B=	
LOG'R ROD:	A-B+C		A-B=		LOG'R ROD:			A-B=	
HWM/CON	A-B+C		A-B=		HWM/CON			A-B=	
BANKFULL	A-B+C		A-B=		BANKFULL			A-B=	
	A-B+C		A-B=		BS (BM1)			A-B=	



- 1) Download ALL data loggers present.
- 2) If a measurement is not feasible, fully document why and take photos.
- 3) Fill in ALL data boxes & Site Comment boxes on field sheets to document site conditions (even if site is unchanged).
- 4) During salt slugs, minimum SPC rise is only +10x resolution of conductivity meter.
- 5) Salt slug calibration tests can be done at the end of the day at the bunkhouse.
- 6) Attempt to get paired SS and ADV measurements where ice cover is sufficiently thin to measure with the ADV.

General Site Tasks/ Communications

#	Complete	HID	Station Name	Station Type	Site Tasks	Survey Required	Logger Type Serial #	Q Method	Additional Materials Required	Date	Time	SG	Logger
						Yes/No				yy.mm.dd	HH:MM	(m)	(m)
1	[ ]	ATM-DC2	Atmospheric at Diversion Channel	Continuous Baro Logger	1) HOBO download	NO	HOBO	None	None	2014-FEB-11		n/a	
2	[ ]	ATM-DC4	Atmospheric at Diversion Channel (Back-up)	Continuous Baro Logger	1) Solinst download 2) Clear Solinst logger data	NO	Solinst Baro-logger	None	None	2014-FEB-11		n/a	
3	[ ]	H-PC-U	Upper Pony Creek	Instantaneous	Unsuitable for sampling Dry/Frozen/Overflow	NO	n/a	Salt (0.01 kg) CF.T	None	2014-FEB-X			
4	[ ]	H-PC-DSP	Pony Creek Downstream of Pit	Instantaneous	Unsuitable for sampling Dry/Frozen/Overflow	NO	n/a	Volumetric Salt (0.01 kg) CF.T	None	2014-FEB-X			
5	[ ]	H-DC-DX	Dome Creek DX	Discontinued	Discontinued	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
6	[ ]	H-DC-DX+105	Dome Creek DX+105	Instantaneous	1) Q measurement	n/a	n/a	Salt (0.01 kg) CF.T	None	2014-FEB-10		n/a	
8	[ ]	H-DC-D1b	Dome Creek D1b	Instantaneous	Unsuitable for sampling Dry/Frozen/Overflow	n/a	n/a	Salt (0.01 kg) CF.T	None	2014-FEB-X		n/a	
9	[ ]	H-DC-U1	Upper Dome Creek 1	Discontinued	Discontinued	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
10	[ ]	H-DC-U2	Upper Dome Creek 2	Discontinued	Discontinued	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
11	[ ]	H-DC-B	Diversion Channel at Bridge	Continuous	1) Q measurement	NO	n/a	Salt (0.05 kg) CF.T	None	2014-FEB-X			
12	[✓]	H-DC-M	Middle Dome Creek	Continuous	1) Q measurement 2) Logger download	YES	Solinst 1050018	Salt (0.1 kg) CF.T	None	2014-FEB-10	1725	-	-
13	[✓]	H-DC-R	Dome Creek at Road	Continuous	Unsuitable for sampling Dry/Frozen/Overflow	n/a	n/a	Volumetric Salt (0.1 kg) CF.T	None	2014-FEB-10		-	-

- did not DL

- did not DL

- no Q, instrument fail

too much water



#	Complete	HID	Station Name	Station Type	Site Tasks	Survey Required	Logger Type Serial #	Q Method	Additional Materials Required	Date	Time	SG	Logger
						Yes/No				yy.mm.dd	HH:MM	(m)	(m)
14	[ ]	H-VC-REF	Victoria Creek Reference	Continuous	1) Q measurement (ADV if possible, SS)	NO	n/a	ADV SS (0.2 kg)	None	2014-FEB-			
15	[x]	H-VC-U	Upper Victoria Creek	Continuous	1) Q measurement (ADV + SS) 2) Logger download.	YES	Solinst 1049522	ADV SS (0.2 kg)	None	2014-FEB-11			
16	[x]	H-VC-DBC	Victoria Creek D/S of Back Creek	Continuous	1) Q measurement (ADV + SS) 2) Logger download.	YES	Solinst 1049137	ADV SS (0.2 kg)	None	2014-FEB-11			
17	[ ]	H-BC	Back Creek	Continuous	Unsuitable for sampling Dry/Frozen/Overflow	NO	n/a	Salt (0.025 kg) CF.T	None	2014-FEB-			
18	[x]	H-VC-UMN	Victoria Creek U/S of Minnesota Creek	Continuous	1) Q measurement (ADV + SS)	NO	n/a	ADV SS (0.2 kg)	None	2014-FEB-11	10:14	-	-
19	[ ]	H-MN	Minnesota Creek	Discontinued	Discontinued	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
20	[x]	H-VC-R	Victoria Creek at Road	Continuous	1) Q measurement (ADV + SS) 2) Logger download.	YES no	Solinst 1041103	ADV SS (0.2 kg) CF.T	None	2014-FEB-10	15:35	-	-
21	[ ]	H-SEEP	Seepage Pond Outlet	Instantaneous / Water Level	1) Q measurement at pipe outlet 2) Q measurement at flow meter in pumphouse 3) Staff Gauge Reading in Pond	NO	n/a	Volumetric	None	2014-FEB-			
22	[ ]	H-TP	Tailings Pond	Water Level Only	1) Staff Gauge Reading (if possible)	NO	n/a	None	None	2014-FEB-			

Project #: 1-0189  
 Project Name: mt. Rainier



Weather: -31 C

11 FEB 2014

HID	Date	Discharge Measurement Instruments + Methods						
Station Name: <u>Vehoveck Upper</u>	Q Measurement Start Time: <u>12:19</u> (HH:MM) PDT   PST	YSI   SWOFFER   PYGMY   ADV   MID-SECT   POINT						
	Q Measurement End Time: <u>12:20</u> (HH:MM) PDT   PST	SALT TRACER   WEIR   VOLUMETRIC   FLOAT   ROD						
	Logger Download/Inst Time: (HH:MM) PDT   PST	Channel Conditions						
	Logger Reading (m)	NONE   CE   BACKWATER   > BANKFULL   ZERO FLOW   HIGH SUSP. SED.						
Logger: Serial #	HOBO   Solinst   N/A	GPS Waypoint		ZONE	EASTING	NORTHING		
Photo # [U/S]	[D/S]	[RDB]	[LDB]	[STAFF/WEIR]				
Site Comments		SLUG   CONSTANT RATE   DRY LOGGED   MANUAL SPC   EC CF.T YES   NO						
<p>V. Cold SS did not work, too cold to put salt into solution. Visible salt remained on channel bed</p> <p>Logger did not d/L due to cold temps.</p>		Trial Time	SPC <sub>B</sub>   SPC <sub>P</sub>	Mix Length	Mass of Salt	Mix Vol.	[Salt Slug]	
			EC <sub>0</sub> (uS/cm)   EC <sub>pk</sub> (uS/cm)	L <sub>m</sub> (m)	Ms <sub>s</sub> (kg)	Volume (L)	Css (kg/L)	
		1 ( 12 : 19 )	179   310	~60	0.20	DRY		
Channel Measurements		Salt Tracer						
Staff Gauge Height (m):		V <sub>1</sub> for Sec. Mix (mL)		Vol. Added (mL)	SPC (uS/cm)	Temp		
Weir Head (m):		Csec (g/L):	1 g/L	1.				
Water Temperature (°C):		Vol. Calib. Tank (L):	1 L	2.				
Water Surface Slope (%):		SPC <sub>0</sub> Calib. Tank		3.				
Average Width (m):		CF.T =	2.16 x 10 <sup>-1</sup>	4.				
Average Depth (m):		Q <sub>salt</sub> =	0.122	5.				
Measurement Summary	Primary	Secondary		6.				
Meas. Type:	SS			7.				
Measurement ID (MID):	916.			8.				
Average Q (m³/s):	0.061			9.				
Q Meas. Accuracy +/- [%]:	High (± 20%)							
Average Velocity (m/s):								
Cross-Sectional Area (m²):								
		Volum.						
		Volume (L) =						
		Time (sec) [1]	[2]	[3]	[4]	[5]		
		Average Q (L/s) =						
		Avg. Q <sub>vol</sub> (L/s) =						
Hydrometric Levels - Survey								
YES   NO   REASON	Survey Time (HH:MM)	(WATER)	BM Shift: Yes   No	Logger Shift: Yes   No	Staff Gauge Shifted?: Yes   No			
		± 0.003						
Circuit #1	H I	Rod Read	Elevation (m)	Circuit #2	H I	Rod Read	Elevation (m)	Station Measurements
Station	A	B	C	Station	A	B	C	
BM1	4.419	1.419	3.000	BM1	4.393	1.393	3.000	Log'r Rod Length:
BM2		1.061	3.358	BM2		1.034	3.359	Log'r Rod to Botm:
BM3		1.174	3.245	BM3		1.148	3.245	
TOS			A-B =	TOS			A-B =	
WATER		2.462	1.957	WATER		2.425	2.014	
LOG'R ROD:		1.268	3.157	LOG'R ROD:		1.243	3.150	
HWM/CON			A-B =	HWM/CON			A-B =	
BANKFULL			A-B =	BANKFULL			A-B =	
			A-B =	BS (BM1)			A-B =	

↳ # might be off, due to moving bubble.

Field Staff: CL TH DS  
 Data Entry By: CL Date: 24 Feb 2014  
 Reviewed By: \_\_\_\_\_ Date: \_\_\_\_\_

Project # \_\_\_\_\_  
 Project Name: \_\_\_\_\_



Weather: 41, clear

FEB 2017

HID: <u>FFVC-08C</u>		Date: <u>11 NOV 2013</u>	Discharge Measurement Instruments + Methods									
Station Name: <u>Jickonia Ch. Downstream of Buck Ch.</u>	Q Measurement Start Time: <u>11:06</u> (HH:MM) PDT   PST		YSI   SWOFFER   PYGMY   ADV   MID-SECT   POINT									
	Q Measurement End Time: <u>12:30</u> (HH:MM) PDT   PST		<del>SALT TRACER</del>   WEIR   VOLUMETRIC   FLOAT   ROD									
	Logger Download/Inst Time: <u>---</u> (HH:MM) PDT   PST		Channel Conditions									
	Logger Reading (m): <u>---</u> [ ] downloaded		NONE   ICE   BACKWATER   > BANKFULL   ZERO FLOW   HIGH SUSP. SED.									
Logger: Serial #	HOBO   <del>Solinst</del>   N/A		GPS W waypoint		ZONE	EASTING	NORTHING					
Photo # [U/S]	[D/S]	[RDB]	[LDB]	[STAFF/WEIR]								
Site Comments			SLUG   CONSTANT RATE   DRY LOGGED   MANUAL SPC   EC CF.T YES   NO									
<p>low flow. then ice cover over channel.          ADV. due to cold temps          Solinst logger would not d/L due to cold temps</p>			Trial Time	SPC <sub>B</sub>   SPC <sub>P</sub>	Mix Length	Mass of Salt	Mix Vol.	[Salt Slug]				
				EC <sub>B</sub> (uS/cm)   EC <sub>P</sub> (uS/cm)	L <sub>m</sub> (m)	M <sub>s</sub> (kg)	Volume (L)	C <sub>ss</sub> (kg/L)				
			1 (11:07)	187.8   240		0.20	DRY					
			2 (11:12)	187.8   240		0.20	DRY					
Channel Measurements			Salt Tracer									
Staff Gauge Height (m):			V <sub>1</sub> for Sec. Mix (mL)	±1 / C <sub>ss</sub>		Vol. Added (mL)	SPC (uS/cm)	Temp				
Weir Head (m):			Csec (g/L):	1 g/L		1.						
Water Temperature (°C):			Vol. Calib. Tank (L):	1 L		2.						
Water Surface Slope (%):			SPC <sub>0</sub> Calib. Tank			3.						
Average Width (m):			CF.T =	2.9 x 10 <sup>-1</sup>		4.						
Average Depth (m):			Q <sub>salt</sub> =	0.147		5.						
Measurement Summary	Primary	Secondary	Notes: CF.T could not be completed due to cold temps - use ERAT from prev. trip.			6.						
Meas. Type:	SS		Volum.					7.				
Measurement ID (MID):	917							Volume (L) =			8.	
Average Q (m³/s):	0.148							Time (sec) [1]	[2]	[3]	[4]	[5]
Q Meas. Accuracy +/- [%]:	high ±30%							Average Q (L/s) =				
Average Velocity (m/s):			Avg. Q <sub>vol</sub> (L/s) =									
Cross-Sectional Area (m²):			Hydrometric Levels - Survey									
YES   NO   REASON:			Survey Time (HH:MM): (WATER)	BM Shift: Yes No	Logger Shift: Yes No	Staff Gauge Shifted? Yes No						
Circuit #1	H I	Rod Read	Elevation (m)	± 0.003	Circuit #2	H I	Rod Read	Elevation (m)	Station Measurements			
Station	A	B	C		Station	A	B	C				
BM1	4.501	1.501	3.000		BM1	4.545	1.545	3.000	Log'r Rod Length:			
BM2	A-B+C	1.473	3.028		BM2		1.517	3.028	Log'r Rod to Boim:			
BM3	A-B+C	1.585	2.916		BM3		1.627	2.918				
TOS	A-B+C		A-B=		TOS			A-B=				
WATER	A-B+C	2.689	1.812		WATER		2.735	1.810				
LOG'R ROD:	A-B+C	1.930	2.571		LOG'R ROD:		1.973	2.572				
HWM/CON	A-B+C		A-B=		HWM/CON			A-B=				
BANKFULL	A-B+C		A-B=		BANKFULL			A-B=				
	A-B+C		A-B=		BS (BM1)			A-B=				

Field Staff: CL TH DH  
 Data Entry By: CL Date: 24 MAR 2017  
 Reviewed By: \_\_\_\_\_ Date: \_\_\_\_\_



Project # 1-017  
 Project Name: mt. Mansfield



Weather: -4C = Sun

HID	H-JC-UMM		Date	11 NOV 2014	Discharge Measurement Instruments + Methods					
Station Name	Victoria Cr. Upstream of Minnesota		Q Measurement Start Time:	9:30	PDT   PST	YSI   SWOFFER   PYGMY   <b>ADV</b>   MID-SECT   POINT				
			Q Measurement End Time:	10:14	PDT   PST	<b>SALT TRACER</b>   WEIR   VOLUMETRIC   FLOAT   ROD				
			Logger Download/Inst Time:	-	PDT   PST	Channel Conditions				
			Logger Reading (m)	-	[ ] downloaded	NONE   ICE   BACKWATER   > BANKFULL   ZERO FLOW   HIGH SUSP. SED.				
Logger: Serial #	HOBO   Solinst   <b>N/A</b>			GPS Waypoint		ZONE	EASTING	NORTHING		
Photo # [U/S]	<u>0612</u>	[D/S]	<u>0013</u>	[RDB]	<u>0015</u>	[LDB]	<u>0014</u>	[STAFF/WEIR]		
Site Comments				SLUG   CONSTANT RATE   DRY   LOGGED   MANUAL   SPC   EC   CF.T YES   NO						
V. cold. V. low flow. high uncertainty in Q Hc of backwater - ADV non-functional due to cold temps.				Trial Time	SPC <sub>B</sub>   SPC <sub>P</sub>	Mix Length	Mass of Salt	Mix Vol.	[Salt Slug]	
					EC <sub>B</sub> (uS/cm)   EC <sub>P</sub> (uS/cm)	L <sub>m</sub> (m)	Ms <sub>a</sub> (kg)	Volume (L)	Css (kg/L)	
				1 ( 9 : 37 )	254   1359.5	63	0.2	DRY		
				2 ( 9 : 46 )	208.1   1040	63	0.2	DRY		
Channel Measurements				Salt Tracer						
Staff Gauge Height (m):	frozen/ice		V <sub>1</sub> for Sec. Mix (mL)	1 L		Vol. Added (mL)		SPC (uS/cm)	Temp	
Weir Head (m):			Csec (g/L):	1 g/L		1				
Water Temperature (°C):	0°C		Vol. Calib. Tank (L):	1 L		2				
Water Surface Slope (%):			SPC <sub>0</sub> Calib. Tank			3				
Average Width (m):			CF.T =	2.7 x 10 <sup>-1</sup>		4				
Average Depth (m):			Qsalt =	0.109		5				
Measurement Summary	Primary	Secondary	Notes:		V. complex channel, 45 deg		6			
Meas. Type:	SS		slow		7		8			
Measurement ID (MID):	918				8		9			
Average Q (m³/s):	0.109		Volume (L) =			9				
Q Meas. Accuracy +/- [%]:	high ± 30%		Time (sec) [1]	[2]		[3]		[4]	[5]	
Average Velocity (m/s):			Average Q (L/s) =			Avg Q <sub>vol</sub> (m³/s) =				
Cross-Sectional Area (m²):			Avg. Q <sub>vol</sub> (L/s) =							
Hydrometric Levels - Survey										
YES   NO   REASON:	No solo sta' installed			Survey Time (HH:MM):	(WATER)	BM Shift: Yes   No	Logger Shift: Yes   No	Staff Gauge Shifted?: Yes   No		
Circuit #1	H I	Rod Read	Elevation (m)	± 0.003	Circuit #2	H I	Rod Read	Elevation (m)	Station Measurements	
Station	A	B	C		Station	A	B	C		
BM1	A-B=C		3.000		BM1			3.000	Log'r Rod Length:	
BM2	A-B=C		A-B=C		BM2			A-B=C	Log'r Rod to Botm:	
BM3	A-B=C		A-B=C		BM3			A-B=C		
TOS	A-B=C		A-B=C		TOS			A-B=C		
WATER	A-B=C		A-B=C		WATER			A-B=C		
LOG'R ROD:	A-B=C		A-B=C		LOG'R ROD:			A-B=C		
HWM/CON	A-B=C		A-B=C		HWM/CON			A-B=C		
BANKFULL	A-B=C		A-B=C		BANKFULL			A-B=C		
	A-B=C		A-B=C		BS (BM1)			A-B=C		

Field Staff: CL TH DH  
 Data Entry By: CL Date: 24 MAR 2014  
 Reviewed By: \_\_\_\_\_ Date: \_\_\_\_\_

Project # 1-0167  
 Project Name: \_\_\_\_\_



Weather: Sunny, -30°C

YNB-YSI SS with captured partial flows in separate channel.

HID	<u>11-VC-R</u>	Date	<u>10 FEB NOV-2013</u>	Discharge Measurement Instruments + Methods		
Station Name	<u>Victoria Ch Road</u>	Q Measurement Start Time:	<u>14:14</u> (HH:MM) PDT   PST	YSI   SWOFFER   PYGMY   <u>ADV</u>	MID-SECT.   POINT	
		Q Measurement End Time:	<u>15:34</u> (HH:MM) PDT   PST	<u>SALT TRACER</u>   WEIR   VOLUMETRIC   FLOAT   ROD		
		Logger Download/Inst Time:	<u>14:23</u> (HH:MM) PDT   PST	Channel Conditions		
	Logger Reading (m)	<u>-</u>	[ ] downloaded	NONE   ICE   BACKWATER   > BANKFULL   ZERO FLOW   HIGH SUSP. SED.		
Logger:	Serial # <u>999</u>	HOBO   Solinst   <u>N/A</u>		GPS Waypoint	ZONE	EASTING NORTHING
Photo #	[U/S] <u>LB-03 RB-02</u>	[D/S] - <u>001</u>	[RDB] <u>002</u>	[LDB] <u>003</u>	[STAFF/WEIR]	<u>-</u>

**Site Comments**  
 U. Thick overbank measured @ 100m E/S of station. Challenges @ ADV. ADV was not working, could not get Q.

Channel Measurements		
Staff Gauge Height (m):	<u>-</u>	
Weir Head (m):	<u>-</u>	
Water Temperature (°C):	<u>0°C</u>	
Water Surface Slope (%):	<u>-</u>	
Average Width (m):	<u>-</u>	
Average Depth (m):	<u>-</u>	
Measurement Summary		
	Primary	Secondary
Meas. Type:	<u>ADV</u>	<u>SS</u>
Measurement ID (MID):	<u>-</u>	<u>919</u>
Average Q (m³/s):	<u>-</u>	<u>0.063</u>
Q Meas. Accuracy +/- [%]:	<u>-</u>	<u>high 250%</u>
Average Velocity (m/s):	<u>-</u>	<u>-</u>
Cross-Sectional Area (m²):	<u>-</u>	<u>-</u>

SLUG   CONSTANT RATE   DRY LOGGED   MANUAL SPC   EC C.F.T. YES   NO						
Trial Time	SPC <sub>B</sub>   SPC <sub>P</sub>	Mix Length	Mass of Salt	Mix Vol.	[Salt Slug]	
	EC <sub>B</sub> (uS/cm)   EC <sub>P</sub> (uS/cm)	L <sub>m</sub> (m)	Ms <sub>s</sub> (kg)	Volume (L)	C <sub>ss</sub> (kg/L)	
1 (14:34)	203.1   212.9	-100m	0.2	EDry		
2 (15:27)	205.7   535.2	16	0.2	Dry		
3 ( : )	—   —	—	—	—		
V <sub>i</sub> for Sec. Mix (mL)	= 1 Cap		Vol. Added (mL)		SPC (uS/cm)	Temp
Csec (g/L):	1 g/L	<i>multiple channels at inst location. Not capturing all flows. C.F.T.</i>	1			
Vol. Calib. Tank (L):	1 L		2			
SPC <sub>0</sub> Calib. Tank			3			
C.F.T. =	<u>2.25 x 10<sup>-7</sup></u>		4			
Q <sub>salt</sub> =	<u>0.07</u>		5			
<i>Notes: U. low flow. Suspect Q b/c of multiple channels under 100m. Shylened mixing L. on</i>						
Volume (L) =						
Time (sec) [1]		[2]	[3]	[4]	[5]	
Average Q (L/s) =						
Avg. Q <sub>vol</sub> (L/s) =						

Hydrometric Levels - Survey								
YES   NO   REASON:			Survey Time (HH:MM): (WATER) <u>15:45</u>	BM Shift: Yes   No	Logger Shift: Yes   No	Staff Gauge Shifted? Yes   No		
Circuit #1	H I	Rod Read	Elevation (m)	± 0.003	Circuit #2	Rod Read	Elevation (m)	Station Measurements
Station	A	B	C		Station	A	C	
BM1	<u>4.333</u>	<u>1.333</u>	<u>3.000</u>		BM1	<u>1.278</u>	<u>3.000</u>	Log'r Rod Length:
BM2	<u>3.908</u>	<u>-0.903</u>	<u>3.425</u>		BM2	<u>0.852</u>	<u>3.453</u>	Log'r Rod to Botm:
BM3	<u>4.165</u>	<u>1.165</u>	<u>3.168</u>		BM3	<u>1.109</u>	<u>3.169</u>	
TOS					TOS			
WATER	<u>5.412</u>	<u>2.412</u>	<u>1.921</u>		WATER	<u>2.359</u>	<u>1.919</u>	
LOG'R ROD:	<u>4.512</u>	<u>1.512</u>	<u>2.821</u>		LOG'R ROD:	<u>1.468</u>	<u>2.810</u>	
HWM/CON					HWM/CON			
BANKFULL					BANKFULL			
					BS (BM1)			

Field Staff: TIT DIA CL  
 Data Entry By: CL Date: 24 MAR 2019  
 Reviewed By: \_\_\_\_\_ Date: \_\_\_\_\_

Project #: \_\_\_\_\_  
 Project Name: \_\_\_\_\_



10T Hydro. mon. Gaug.

Weather: = 30 - clear

11 FEB 2014

HID	H-9C-DX-105		Date	DECEMBER-2013		Discharge Measurement Instruments + Methods						
Station Name	Pome creek @ Dx+105		Q Measurement Start Time:	16:54	(HH:MM)	PDT   PST	YSI   SWOFFER   PYGMY   ADV MID-SECT.   POINT					
			Q Measurement End Time:	18:00	(HH:MM)	PDT   PST	SALT TRACER   WEIR   VOLUMETRIC   FLOAT   ROD					
			Logger Download/Inst Time:	---	(HH:MM)	PDT   PST	Channel Conditions					
			Logger Reading (m)	---	[ ]	downloaded	NONE   <del>WEIR</del> BACKWATER   > BANKFULL   ZERO FLOW   HIGH SUSP. SED.					
Logger:	Serial #	HOBO   Solinst   <del>MDA</del>			GPS Waypoint		ZONE	EASTING	NORTHING			
Photo #	[U/S] 57	[D/S] 58	[RDB] 59	[LDB] 59	[STAFF/WEIR] ---							
Site Comments			SLUG   CONSTANT RATE   DRY LOGGED   MANUAL SPC   EC CF.T YES  NO									
V. low flow shortened mixing length & may not have salt slug *logger stopped logging data - data full!			Trial Time	SPC <sub>B</sub>   SPC <sub>P</sub>		Mix Length	Mass of Salt	Mix Vol.	[Salt Slug]			
				EC <sub>B</sub> (uS/cm)   EC <sub>P</sub> (uS/cm)		L <sub>m</sub> (m)	M <sub>s</sub> (kg)	Volume (L)	C <sub>ss</sub> (kg/L)			
			1 (17:02)	929   1192		9m	0.025	dry				
			2 (---)	11   ---		9m		dry				
Channel Measurements			Salt Tracer									
Staff Gauge Height (m):	---		V <sub>1</sub> for Sec. Mix (mL)	= 1 / C <sub>sec</sub>		Vol. Added (mL)		SPC (uS/cm)		Temp		
Weir Head (m):	---		C <sub>sec</sub> (g/L):	1 g/L		1.						
Water Temperature (°C):	6.0		Vol. Calib. Tank (L):	1L		2.						
Water Surface Slope (%):	---		SPC <sub>0</sub> Calib. Tank	---		3.						
Average Width (m):	---		CF.T =	None X		4.						
Average Depth (m):	---		Q <sub>salt</sub> =	None X		5.						
Measurement Summary	Primary	Secondary	Notes:		Trial 2 did not work, Trial 1 only 75% tipped. - did not get a Q!		6.					
Meas. Type:	SS		Volume (L) =		7.							
Measurement ID (MID):	914		Time (sec) [1]		[2]		[3]		[4]		[5]	
Average Q (m³/s):	NO Q		Average Q (L/s) =		8.							
Q Meas. Accuracy +/- [%]:	logger failure		Avg. Q <sub>vol</sub> (L/s) =		9.							
Average Velocity (m/s):	---		Avg Q <sub>vol</sub> (m³/s) =									
Cross-Sectional Area (m²):	---		Hydrometric Levels - Survey									
YES   NO   REASON: NO Station present			Survey Time (HH:MM):	(WATER)	BM Shift: Yes  No	Logger Shift: Yes  No	Staff Gauge Shifted?: Yes  No					
Circuit #1	H I	Rod Read	Elevation (m)	± 0.003	Circuit #2	H I	Rod Read	Elevation (m)	Station Measurements			
Station	A	B	C		Station	A	B	C				
BM1	A-B=C		3.000		BM1			3.000	Log'r Rod Length:			
BM2	A-B=C		A-B=		BM2			A-B=	Log'r Rod to Botm:			
BM3	A-B=C		A-B=		BM3			A-B=				
TOS	A-B=C		A-B=		TOS			A-B=				
WATER	A-B=C		A-B=		WATER			A-B=				
LOG'R ROD:	A-B=C		A-B=		LOG'R ROD:			A-B=				
HWM/CON	A-B=C		A-B=		HWM/CON			A-B=				
BANKFULL	A-B=C		A-B=		BANKFULL			A-B=				
	A-B=C		A-B=		BS (BM1)			A-B=				

Field Staff: Ben TH DH  
 Data Entry By: ca Date: 24-MAR-2014  
 Reviewed By: \_\_\_\_\_ Date: \_\_\_\_\_

#	Complete	HID	Station Name	Station Type	Site Tasks	Survey Required	Logger Type Serial #	Q Method	Additional Materials Required	Date	Time	SG	Logger
						Yes/No				yy.mm.dd	HH:MM	(m)	(m)
14	[ ]	H-VC-REF	Victoria Creek Reference	Discontinued	Discontinued	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
15	[✓]	H-VC-U	Upper Victoria Creek	Continuous	1) Q measurement (ADV + SS) 2) Logger download.	YES	Solinst 1049522	ADV SS (0.2 kg)	None	2014-MAR-11	13:45		-0.5206
16	[✓]	H-VC-DBC	Victoria Creek D/S of Back Creek	Continuous	1) Q measurement (ADV + SS) 2) Logger download.	YES	Solinst 1049137	ADV SS (0.2 kg)	None	2014-MAR-11	12:06		-0.2816
17	[✗]	H-BC	Back Creek	Continuous	Unsuitable for sampling Dry/Frozen/Overflow	NO	n/a	Salt (0.025 kg) CF.T	None	2014-MAR-11	15:35		
18	[✓]	H-VC-UMN	Victoria Creek U/S of Minnesota Creek	Continuous	1) Q measurement (ADV + SS)	NO	n/a	ADV SS (0.2 kg)	None	2014-MAR-11	10:04		
19	[ ]	H-MN	Minnesota Creek	Discontinued	Discontinued	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
20	[✓]	H-VC-R	Victoria Creek at Road	Continuous	1) Q measurement (ADV + SS) 2) Logger download.	YES	Solinst 1041103	ADV SS (0.2 kg) CF.T	None	2014-MAR-10	13:56		
21	[✓]	H-SEEP	Seepage Pond Outlet	Instantaneous / Water Level	1) Q measurement at pipe outlet 2) Q measurement at flow meter in pumphouse 3) Staff Gauge Reading in Pond	NO	n/a	Volumetric	None	2014-MAR-10	18:00		
22	[✓]	H-TP	Tailings Pond	Water Level Only	1) Staff Gauge Reading (if possible).	NO	n/a	None	None	2014-MAR-10	18:55		

layers of ice + slush, no hydro done.

Flow too low for ADV, salt only

H-DC-R / WQ-DC-R photos: v/s 260 d/s 259 → lots of overflow Time 16:30

H-DC-B Dry / Frozen to bed. Photos: v/s 281, L/S 280, d/s 279, v/s 278, overview 277/276 Time: 18:30

WQ / H DC - U1 / U2 tons of overflow. Photos: 284 + 285 Time 19:10

H-DC-DX + 105 Dry / Frozen to bed. Investigated @ YSI site + WQ site. Photos: v/s 295, d/s 296, RDB 297, LAB 298

H-DC-DSP Culvert: 328, v/s: 329, d/s 330 Frozen, no flow. Time: 15:50

General Site Tasks/ Communications

- 1) Download ALL data loggers present.
- 2) If a measurement is not feasible, fully document why and take photos.
- 3) Fill in ALL data boxes & Site Comment boxes on field sheets to document site conditions (even if site is unchanged).
- 4) During salt slugs, minimum SPC rise is only +10x resolution of conductivity meter.
- 5) Salt slug calibration tests can be done at the end of the day at the bunkhouse.
- 6) Attempt to get paired SS and ADV measurements where ice cover is sufficiently thin to measure with the ADV.

#	Complete	HID	Station Name	Station Type	Site Tasks	Survey Required	Logger Type Serial #	Q Method	Additional Materials Required	Date	Time	SG	Logger
						Yes/No				yy.mm.dd	HH:MM	(m)	(m)
1	<input checked="" type="checkbox"/>	ATM-DC2	Atmospheric at Diversion Channel	Continuous Baro Logger	1) HOBO download	NO	HOBO	None	None	2014-MAR-10	19:20	n/a	
2	<input checked="" type="checkbox"/>	ATM-DC4	Atmospheric at Diversion Channel (Back-up)	Continuous Baro Logger	1) Solinst download 2) Clear Solinst logger data #1041027	NO	Solinst Baro-logger	None	None	2014-MAR-10	19:20	n/a	-0.6339
3	<input type="checkbox"/>	H-PC-U	Upper Pony Creek	Instantaneous	Unsuitable for sampling Dry/Frozen/Overflow	NO	n/a	Salt (0.01 kg) CF.T	None	2014-MAR-			
4	<input checked="" type="checkbox"/>	H-PC-DSP	Pony Creek Downstream of Pit	Instantaneous	Unsuitable for sampling Dry/Frozen/Overflow	NO	n/a	Volumetric Salt (0.01 kg) CF.T	None	2014-MAR-11	15:50		
5	<input type="checkbox"/>	H-DC-DX	Dome Creek DX	Discontinued	Discontinued	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
6	<input checked="" type="checkbox"/>	H-DC-DX+105	Dome Creek DX+105	Instantaneous	1) Q measurement	n/a	n/a	Salt (0.01 kg) CF.T	None	2014-MAR-11	9:00	n/a	
8	<input type="checkbox"/>	H-DC-D1b	Dome Creek D1b	Instantaneous	Unsuitable for sampling Dry/Frozen/Overflow	n/a	n/a	Salt (0.01 kg) CF.T	None	2014-MAR-		n/a	
9	<input type="checkbox"/>	H-DC-U1	Upper Dome Creek 1	Discontinued	Discontinued	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
10	<input type="checkbox"/>	H-DC-U2	Upper Dome Creek 2	Discontinued	Discontinued	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
11	<input checked="" type="checkbox"/>	H-DC-B	Diversion Channel at Bridge	Continuous	1) Q measurement (if channel conditions permit)	NO	n/a	Salt (0.05 kg) CF.T	None	2014-MAR-10	18:30	/	/
12	<input checked="" type="checkbox"/>	H-DC-M	Middle Dome Creek	Continuous	1) Q measurement 2) Logger download.	YES	Solinst 1050018	Salt (0.1 kg) CF.T	None	2014-MAR-10	16:50		-0.3557
13	<input checked="" type="checkbox"/>	H-DC-R	Dome Creek at Road	Continuous	Unsuitable for sampling Dry/Frozen/Overflow	n/a	n/a	Volumetric Salt (0.1 kg) CF.T	None	2014-MAR-10	16:30		

Logger is full, did not overwrite, restarted.

Frozen, no flow

Frozen to Bed.

lots of over flow, no sampling, March 10, 2014 19:10 - Photos.

Frozen to bed, no flow, Photos.



Field Staff: JM, DI, DS.

Project #: Y-0233 (13-7-0167)  
 Project Name: Nansen



Weather: -5°C, dry, light  
 wind,

HID	H-VC-UMN		Date	11 MARCH 2014		Discharge Measurement Instruments + Methods																			
Station Name	Victoria Creek U/S of Minnesota Creek.		Q Measurement Start Time:	10:04	(HH:MM)	PDT   PST	YSI   SWOFFER   PYGMY   ADV   MID-SECT   POINT																		
			Q Measurement End Time:		(HH:MM)	PDT   PST	SALT TRACER   WEIR   VOLUMETRIC   FLOAT   ROD																		
			Logger Download/Inst Time:	/	(HH:MM)	PDT   PST	Channel Conditions																		
			Logger Reading (m)	/	[ ]	downloaded	NONE   CE   BACKWATER   > BANKFULL   ZERO FLOW   HIGH SUSP. SED.																		
Logger: Serial #	/		HOBO   Solinst   <u>N/A</u>			GPS Waypoint		ZONE		EASTING	NORTHING														
Photo # [U/S]	301		[D/S]	299		[RDB]	302		[LDB]	300		[STAFF/WEIR]	306/307												
Site Comments			Aug. water depth. 6.1cm. Substrate small cobble/leaf gravel. Water level too low for ADV Photo's 304+305 First salt slug took a very long time, shortened distance. Bathymetry near well is 36cm.																						
Channel Measurements			Staff Gauge Height (m): 0.471 Weir Head (m): Water Temperature (°C): 0.1°C Water Surface Slope (%): Average Width (m): Average Depth (m):																						
Measurement Summary			<table border="1"> <tr> <th>Primary</th> <th>Secondary</th> </tr> <tr> <td>Meas. Type:</td> <td>SS</td> </tr> <tr> <td>Measurement ID (MID):</td> <td>431</td> </tr> <tr> <td>Average Q (m³/s):</td> <td>0.0032</td> </tr> <tr> <td>Q Meas. Accuracy +/- [%]:</td> <td>/</td> </tr> <tr> <td>Average Velocity (m/s):</td> <td>/</td> </tr> <tr> <td>Cross-Sectional Area (m²):</td> <td>/</td> </tr> </table>									Primary	Secondary	Meas. Type:	SS	Measurement ID (MID):	431	Average Q (m³/s):	0.0032	Q Meas. Accuracy +/- [%]:	/	Average Velocity (m/s):	/	Cross-Sectional Area (m²):	/
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Cross-Sectional Area (m²):	/																								
Salt Tracer			Trial Time   SPC <sub>B</sub>   SPC <sub>P</sub>   Mix Length   Mass of Salt   Mix Vol.   [Salt Slug] EC <sub>0</sub> (uS/cm)   EC <sub>pk</sub> (uS/cm)   L <sub>m</sub> (m)   M <sub>s</sub> (kg)   Volume (L)   C <sub>ss</sub> (kg/L)																						
Volum.			V <sub>1</sub> for Sec. Mix (mL)   SPC (uS/cm)   Temp Csec (g/L):   Vol. Added (mL)   SPC (uS/cm)   Temp Vol. Calib. Tank (L):   SPC <sub>0</sub> Calib. Tank CF.T =   Qsalt = Notes: 25mL S.S. into 500mL CK.																						
Hydrometric Levels - Survey			YES   NO   REASON: <u>No logger</u>   Survey Time (HH:MM): (WATER)   BM Shift: Yes   No   Logger Shift: Yes   No   Staff Gauge Shifted?: Yes   No																						
Circuit #1	H I	Rod Read	Elevation (m)	± 0.003	Circuit #2	H I	Rod Read	Elevation (m)	Station Measurements																
Station	A	B	C		Station	A	B	C																	
BM1	A = B + C		3.000		BM1			3.000	Log'r Rod Length:																
BM2	A = B + C		A - B =		BM2			A - B =	Log'r Rod to Botm:																
BM3	A = B + C		A - B =		BM3			A - B =																	
TOS	A = B + C		A - B =		TOS			A - B =																	
WATER	A = B + C		A - B =		WATER			A - B =																	
LOG'R ROD:	A = B + C		A - B =		LOG'R ROD:			A - B =																	
HWM/CON	A = B + C		A - B =		HWM/CON			A - B =																	
BANKFULL	A = B + C		A - B =		BANKFULL			A - B =																	
	A = B + C		A - B =		BS (BM1)			A - B =																	

Field Staff: DH, SM, DS  
 Data Entry By: AL Date: 24 MAR 2014  
 Reviewed By: \_\_\_\_\_ Date: \_\_\_\_\_



Project #: 1-0233 (13-4-0167)  
 Project Name: J. Nansen



Weather: -2°C, sunny, windy

HID	H-VC-U		Date	11 MARCH 2014		Discharge Measurement Instruments + Methods																																																																																																																							
Station Name	Upper Victoria Creek		Q Measurement Start Time:	14:14 (HH:MM)	PDT   PST	YSI   SWOFFER   PYGMY   ADV	(MID-SECT)   POINT																																																																																																																						
			Q Measurement End Time:	14:55 (HH:MM)	PDT   PST	SALT TRACER   WEIR   VOLUMETRIC   FLOAT   ROD																																																																																																																							
			Logger Download/Inst Time:	13:45 (HH:MM)	PDT   PST	Channel Conditions																																																																																																																							
Logger	Serial #	104 9522	HOBO   Solinst   N/A	GPS Waypoint		ZONE	EASTING	NORTHING																																																																																																																					
Photo #	(U/S)	0319	(D/S)	322	(RDB)	0320	(LDB)	0321	(STAFF/WEIR)																																																																																																																				
Site Comments			Solinst full, downloaded + restarted.																																																																																																																										
Channel Measurements			<table border="1"> <tr> <td>Staff Gauge Height (m):</td> <td></td> <td>Meas. Type:</td> <td>ADV</td> </tr> <tr> <td>Weir Head (m):</td> <td></td> <td>Measurement ID (MID):</td> <td>934</td> </tr> <tr> <td>Water Temperature (°C):</td> <td>0.1°C</td> <td>Average Q (m³/s):</td> <td>0.0127</td> </tr> <tr> <td>Water Surface Slope (%):</td> <td></td> <td>Q Meas. Accuracy +/- (%):</td> <td>11.7%</td> </tr> <tr> <td>Average Width (m):</td> <td>1.9</td> <td>Average Velocity (m/s):</td> <td>0.079</td> </tr> <tr> <td>Average Depth (m):</td> <td>0.085</td> <td>Cross-Sectional Area (m²):</td> <td>0.161</td> </tr> </table>							Staff Gauge Height (m):		Meas. Type:	ADV	Weir Head (m):		Measurement ID (MID):	934	Water Temperature (°C):	0.1°C	Average Q (m³/s):	0.0127	Water Surface Slope (%):		Q Meas. Accuracy +/- (%):	11.7%	Average Width (m):	1.9	Average Velocity (m/s):	0.079	Average Depth (m):	0.085	Cross-Sectional Area (m²):	0.161																																																																																												
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Field Staff: SM, DH, DS.  
 Data Entry By: CL Date: 24 March 2014  
 Reviewed By: Date:



Project #: 1-0233(13-4-0167)  
 Project Name: Nansen



Weather: -5°C, overcast, windy

HID	H-SEEP		Date	10 MARCH 2014		Discharge Measurement Instruments + Methods						
Station Name	Seepage Pond Outlet		Q Measurement Start Time:	7	(HH:MM) PDT   PST	YSI   SWOFFER   PYGMY   ADV MID-SECT   POINT						
			Q Measurement End Time:		(HH:MM) PDT   PST	SALT TRACER   WEIR   (VOLUMETRIC)   FLOAT   ROD						
			Logger Download/Inst Time:		(HH:MM) PDT   PST	Channel Conditions						
	Logger Reading (m)		[ ] downloaded			NONE (ICE) BACKWATER   > BANKFULL   ZERO FLOW   HIGH SUSP. SED.						
Logger:	Serial #	HOBO   Solinst (N/A)			GPS Waypoint		ZONE	EASTING	NORTHING			
Photo #	[U/S]	[D/S]	270		[RDB]	[LDB]	[STAFF/WEIR]					
Site Comments			SLUG   CONSTANT RATE   DRY LOGGED   MANUAL SPC   EC CF.T YES   NO									
814792 162.386 (Bottom) Photos: 271-272			Trial Time		SPC <sub>B</sub>   SPC <sub>P</sub>	Mix Length	Mass of Salt	Mix Vol.	[Salt Slug]			
					EC <sub>B</sub> (uS/cm)   EC <sub>P</sub> (uS/cm)	L <sub>m</sub> (m)	Ms <sub>s</sub> (kg)	Volume (L)	C <sub>ss</sub> (kg/L)			
			1 ( : )		_____   _____							
			2 ( : )		_____   _____							
Channel Measurements			V <sub>1</sub> for Sec. Mix (mL)		= 1 / C <sub>ss</sub>	Vol. Added (mL)		SPC (uS/cm)	Temp			
Staff Gauge Height (m):		Weir Head (m):		Csec (g/L):		1 g/L		1				
Water Temperature (°C):		Vol. Calib. Tank (L):		1 L		2		3				
Water Surface Slope (%):		SPC <sub>0</sub> Calib. Tank		CF.T =		4		5				
Average Width (m):		Notes:		6		7		8				
Average Depth (m):		7		8		9		9				
Measurement Summary		Primary	Secondary		Volum.		Volume (L) =	16L	16L	15L	16L	16L
Meas. Type:		Meas. ID (MID):		935	Time (sec) [1]		5.25	[2] 5.38	[3] 5.43	[4] 5.34	[5] 5.44	
Average Q (m³/s):		Q Meas. Accuracy +/- [%]:		0.0029	Average Q (L/s) =		3.05	2.97	2.76	2.99	2.94	
Average Velocity (m/s):		109%		Avg. Q <sub>vol</sub> (L/s) =		2.942		Avg Q <sub>vol</sub> (m³/s) =		0.0029		
Cross-Sectional Area (m²):												
Hydrometric Levels - Survey												
YES (NO) REASON:	N/A		Survey Time (HH:MM)	(WATER)	BM Shift: Yes   No	Logger Shift: Yes   No	Staff Gauge Shifted? Yes   No					
Circuit #1	HI	Rod Read	Elevation (m)	± 0.003	Circuit #2	HI	Rod Read	Elevation (m)	Station Measurements			
Station	A	B	C		Station	A	B	C				
BM1	A=B+C		3.000		BM1			3.000	Log'r Rod Length:			
BM2	A=B+C		A-B=		BM2			A-B=	Log'r Rod to Botm:			
BM3	A=B+C		A-B=		BM3			A-B=				
TOS	A=B+C		A-B=		TOS			A-B=				
WATER	A=B+C		A-B=		WATER			A-B=				
LOG'R ROD:	A=B+C		A-B=		LOG'R ROD:			A-B=				
HWM/CON	A=B+C		A-B=		HWM/CON			A-B=				
BANKFULL	A=B+C		A-B=		BANKFULL			A-B=				
	A=B+C		A-B=		BS (BM1)			A-B=				

Field Staff: SM / DH / DS  
 Data Entry By: [Signature] Date: 24 MAR 2014  
 Reviewed By: [Signature] Date: [Signature]

Project # 4-0233 (13-4-0167)  
 Project Name: Nansen



Weather: -5°C, sunny, calm

HID	H-UC-R+150		Date	10 MARCH 2014		Discharge Measurement Instruments + Methods														
Station Name	Victoria Creek at Road		Q Measurement Start Time:	14:54	PDT   PST	YSI   SWOFFER   PYGMY   ADV   MID-SECT   POINT														
			Q Measurement End Time:	15:52	PDT   PST	SALT TRACER   WEIR   VOLUMETRIC   FLOAT   ROD														
			Logger Download/Inst Time:	/	PDT   PST	Channel Conditions														
			Logger Reading (m)	Not downloaded [ ] downloaded	NONE   ICE   BACKWATER   > BANKFULL   ZERO FLOW   HIGH SUSP. SED.															
Logger: Serial #	HOB0 (Solinst) N/A		GPS Waypoint		NAD 83 08V 0392290 6878642															
Photo # [U/S]	<del>0244</del> 256		[D/S]	<del>0245</del> 0255		[RDB]	0247 250		[LDB]	<del>0246</del> 0249		[STAFF/WEIR]	N/A							
Site Comments			SLUG CONSTANT RATE   DRY			LOGGED   MANUAL			SPC   EC			CF.T   YES   NO								
Ice thickness @ well 108cm, no flowing H <sub>2</sub> O found. Over icing affecting LDB. *logger not downloaded, cable connection error. Ice thickness @ ADV site 18cm *ADV file was saved as H-UC-U			Trial Time			SPC <sub>B</sub>   SPC <sub>P</sub>		Mix Length		Mass of Salt		Mix Vol.		[Salt Slug]						
						EC <sub>B</sub> (uS/cm)   EC <sub>P</sub> (uS/cm)		L <sub>m</sub> (m)		Ms <sub>s</sub> (kg)		Volume (L)		C <sub>ss</sub> (kg/L)						
			1 ( 14 : 20 )			256.3   263.1		15 m		0.200 kg		10 L		0.02						
			2 ( 15 : 12 )			263.7   296.1														
			3 ( : )																	
			V <sub>1</sub> for Sec. Mix (mL)			50 mL				Vol. Added (mL)		SPC (uS/cm)		Temp						
			Csec (g/L):			1 g/L				1. 0.0		262.5		0.0						
			Vol. Calib. Tank (L):			1 L				2. 10 mL		282.2		0.0						
			SPC <sub>0</sub> Calib. Tank							3. 2 mL		289.0		0.0						
			CF.T =			2.18 x 10 <sup>-5</sup>				4. 2 mL		292.8		0.0						
Q <sub>salt</sub> =							5. 2 mL		295.2		0.0									
Notes:			CF.T: 25mL 3.5 into 500mL CK.				6. 2 mL		301.2		0.0									
Channel Measurements			Volum.			Volume (L) =														
Staff Gauge Height (m):						Time (sec) [1]			[2]			[3]								
Weir Head (m):						Average Q (L/s) =			[4]			[5]								
Water Temperature (°C):			-0.1 °C			Avg. Q <sub>vol</sub> (L/s) =			Avg Q <sub>vol</sub> (m <sup>3</sup> /s) =											
Water Surface Slope (%):																				
Average Width (m):			4.7 m																	
Average Depth (m):			0.118 m																	
Measurement Summary			Primary			Secondary														
Meas. Type:			ADV																	
Measurement ID (MID):			936																	
Average Q (m <sup>3</sup> /s):			0.0296																	
Q Meas. Accuracy +/- (%):			8%																	
Average Velocity (m/s):			0.054																	
Cross-Sectional Area (m <sup>2</sup> ):			0.553																	
Hydrometric Levels - Survey																				
YES   NO   REASON:			Survey Time (HH:MM)			(WATER)			N/A			BM Shift: Yes   No			Logger Shift: Yes   No			Staff Gauge Shifted?: Yes   No		
Circuit #1	H I		Rod Read		Elevation (m)		± 0.003		Circuit #2		H I		Rod Read		Elevation (m)		Station Measurements			
Station	A		B		C				Station		A		B		C					
BM1	4.268		1.268		3.000				BM1						3.000		Log'r Rod Length:			
BM2	A=B+C		0.841		3.427				BM2						A-B=		Log'r Rod to Botm:			
BM3	A=B+C		1.101		3.167				BM3						A-B=					
TOS	A=B+C				A-B=				TOS						A-B=					
WATER	A=B+C				A-B=				WATER						A-B=					
LOG'R ROD:	A=B+C		1.458		2.810				LOG'R ROD:						A-B=					
HWM/CON	A=B+C				A-B=				HWM/CON						A-B=					
BANKFULL	A=B+C				A-B=				BANKFULL						A-B=					
BM1	A=B+C		1.268		3.000				BS (BM1)						A-B=					

Notes ADV: x sec. cut through ice, mid-section of transect caused direction of flow to change due to dis mid section frozen to bed.  
 Moved WQ collection + Hydrology to UTM location due to overflow + diff. costly finding channel / flow

Field Staff: SM, DS, DH  
 Data Entry By: SM Date: 24 MAR 2014  
 Reviewed By: SM Date: 24 MAR 2014

Project #: 1-0233 (13-4-0167)  
 Project Name: R.F. Nansen



Weather: -39C, overcast, light wind.

HID	H-DC-M		Date	10 MARCH 2014		Discharge Measurement Instruments + Methods																																																																																																																			
Station Name	Dane creek mobile		Q Measurement Start Time:	(HH:MM) PDT   PST	<input checked="" type="checkbox"/> SWOFFER   PYGMY   ADV MID-SECT   POINT <input checked="" type="checkbox"/> SALT TRACER   WEIR   VOLUMETRIC   FLOAT   ROD																																																																																																																				
			Q Measurement End Time:	(HH:MM) PDT   PST	Channel Conditions																																																																																																																				
			Logger Download/Inst Time:	16:45 *accepting to PDPT   PST	NONE   CE   BACKWATER   > BANKFULL   ZERO FLOW   HIGH SUSP. SED.																																																																																																																				
Logger Reading (m)	-0.3557		Logger Reading (m)	-0.3557		GPS Waypoint		ZONE	EASTING	NORTHING																																																																																																															
Logger: Serial #	105 0018		HOBO   Solinst	N/A		GPS Waypoint		ZONE	EASTING	NORTHING																																																																																																															
Photo # [U/S]	262		[D/S]	263		[RDB]	264		[LDB]	0265																																																																																																															
Site Comments			Logger Mem Full did not appear to be overwriting. Logger <sup>D/S</sup> closed & started.																																																																																																																						
Channel Measurements			SLUG CONSTANT RATE   DRY LOGGED MANUAL SPC   EC CF.T YES   NO <table border="1"> <thead> <tr> <th>Trial Time</th> <th>SPC<sub>B</sub>   SPC<sub>P</sub></th> <th>Mix Length</th> <th>Mass of Salt</th> <th>Mix Vol.</th> <th>[Salt Slug]</th> </tr> <tr> <td></td> <td>EC<sub>B</sub>(uS/cm)   EC<sub>P</sub>(uS/cm)</td> <td>L<sub>m</sub> (m)</td> <td>Ms<sub>s</sub> (kg)</td> <td>Volume (L)</td> <td>Css (kg/L)</td> </tr> </thead> <tbody> <tr> <td>1 (17 : 12)</td> <td>1676   2313</td> <td></td> <td>0.100kg</td> <td>10 L</td> <td>0.01</td> </tr> <tr> <td>2 (17 : 25)</td> <td>1676   2300</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>3 ( : )</td> <td>   </td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>									Trial Time	SPC <sub>B</sub>   SPC <sub>P</sub>	Mix Length	Mass of Salt	Mix Vol.	[Salt Slug]		EC <sub>B</sub> (uS/cm)   EC <sub>P</sub> (uS/cm)	L <sub>m</sub> (m)	Ms <sub>s</sub> (kg)	Volume (L)	Css (kg/L)	1 (17 : 12)	1676   2313		0.100kg	10 L	0.01	2 (17 : 25)	1676   2300					3 ( : )																																																																																					
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Hydrometric Levels - Survey			<table border="1"> <thead> <tr> <th>Circuit #1</th> <th>H I</th> <th>Rod Read</th> <th>Elevation (m)</th> <th>± 0.003</th> <th>Circuit #2</th> <th>H I</th> <th>Rod Read</th> <th>Elevation (m)</th> <th>Station Measurements</th> </tr> <tr> <td>Station</td> <td>A</td> <td>B</td> <td>C</td> <td></td> <td>Station</td> <td>A</td> <td>B</td> <td>C</td> <td></td> </tr> </thead> <tbody> <tr> <td>BM1</td> <td>4506</td> <td>1506</td> <td>3.000</td> <td></td> <td>BM1</td> <td></td> <td></td> <td>3.000</td> <td>Log'r Rod Length:</td> </tr> <tr> <td>BM2</td> <td>A=B+C</td> <td>2180</td> <td>2.326</td> <td></td> <td>BM2</td> <td></td> <td></td> <td>A-B=</td> <td>Log'r Rod to Botm:</td> </tr> <tr> <td>BM3</td> <td>A=B+C</td> <td>1788</td> <td>2.718</td> <td></td> <td>BM3</td> <td></td> <td></td> <td>A-B=</td> <td></td> </tr> <tr> <td>TOS</td> <td>A=B+C</td> <td>2033</td> <td>2.473</td> <td></td> <td>TOS</td> <td></td> <td></td> <td>A-B=</td> <td></td> </tr> <tr> <td>WATER</td> <td>A=B+C</td> <td></td> <td>A-B=</td> <td></td> <td>WATER</td> <td></td> <td></td> <td>A-B=</td> <td></td> </tr> <tr> <td>LOG'R ROD:</td> <td>A=B+C</td> <td>1793</td> <td>2.713</td> <td></td> <td>LOG'R ROD:</td> <td></td> <td></td> <td>A-B=</td> <td></td> </tr> <tr> <td>HWM/CON</td> <td>A=B+C</td> <td></td> <td>A-B=</td> <td></td> <td>HWM/CON</td> <td></td> <td></td> <td>A-B=</td> <td></td> </tr> <tr> <td>BANKFULL</td> <td>A=B+C</td> <td></td> <td>A-B=</td> <td></td> <td>BANKFULL</td> <td></td> <td></td> <td>A-B=</td> <td></td> </tr> <tr> <td></td> <td>A=B+C</td> <td>1505</td> <td>3.001</td> <td></td> <td>BS (BM1)</td> <td></td> <td></td> <td>A-B=</td> <td></td> </tr> </tbody> </table>									Circuit #1	H I	Rod Read	Elevation (m)	± 0.003	Circuit #2	H I	Rod Read	Elevation (m)	Station Measurements	Station	A	B	C		Station	A	B	C		BM1	4506	1506	3.000		BM1			3.000	Log'r Rod Length:	BM2	A=B+C	2180	2.326		BM2			A-B=	Log'r Rod to Botm:	BM3	A=B+C	1788	2.718		BM3			A-B=		TOS	A=B+C	2033	2.473		TOS			A-B=		WATER	A=B+C		A-B=		WATER			A-B=		LOG'R ROD:	A=B+C	1793	2.713		LOG'R ROD:			A-B=		HWM/CON	A=B+C		A-B=		HWM/CON			A-B=		BANKFULL	A=B+C		A-B=		BANKFULL			A-B=			A=B+C	1505	3.001		BS (BM1)			A-B=	
Circuit #1	H I	Rod Read	Elevation (m)	± 0.003	Circuit #2	H I	Rod Read	Elevation (m)	Station Measurements																																																																																																																
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BM3	A=B+C	1788	2.718		BM3			A-B=																																																																																																																	
TOS	A=B+C	2033	2.473		TOS			A-B=																																																																																																																	
WATER	A=B+C		A-B=		WATER			A-B=																																																																																																																	
LOG'R ROD:	A=B+C	1793	2.713		LOG'R ROD:			A-B=																																																																																																																	
HWM/CON	A=B+C		A-B=		HWM/CON			A-B=																																																																																																																	
BANKFULL	A=B+C		A-B=		BANKFULL			A-B=																																																																																																																	
	A=B+C	1505	3.001		BS (BM1)			A-B=																																																																																																																	

Field Staff: JM/DH/DS  
 Data Entry By: CL Date: 24 MAR 2014  
 Reviewed By: Date:

Project #: 13-Y-0167

Project Name: Mount Nansen - Water Quality



Field Dates: Jan 13-14, 2014

**General Site Tasks/ Communications**

**Pay attention to new bottles - Regular sites = 9 bottles (2 filtered). Pit samples = 6 bottles (2 filtered). The following sites have been removed from the program: PW, MN, DC-U2, DRY.**

#	[ ]	Lab Sample Identifier	WQ ID	Station Name	Site Tasks	Date	Time
						yy.mm.dd	HH:MM
1	[ ]	0167-140113 - 011	✓ WQ-SEEP	Seepage	LT50	14.01.13	14:50
2	[ ]	0167-140113 - 009	✓ WQ-TP	Tailings Pond		14.01.13	15:32
3	[ ]	0167-140113 - 010	WQ-DC-DX+105	Dome Creek at DX+105		14.01.13	16:45
4	[ ]	0167-140113 - 014	✓ WQ-DC-U	Upper Dome		14.01.13	13:54
5	[ ]	0167-140113 - 008	WQ-MS-S-03	Mill Seep 03		14.01.13	16:46
6	[ ]	0167-140114 - 006	WQ-VC-U	Upper Victoria Creek		14.01.14	13:25
7	[ ]	0167-140114 - 013	WQ-VC-REF	Victoria Creek Reference		14.01.14	15:00
8	[ ]	0167-140113 - 015	✓ WQ-VC-R	Victoria Creek at Road	sample from winter site	14.01.13	12:45
9	[ ]	0167-140114 - 007	WQ-VC-DBC	Victoria Creek D/S Back Creek		14.01.14	13:05
10	[ ]	0167-140114 - 005	WQ-VC-UMN	Victoria Creek U/S Minnesota Creek		14.01.14	08:52
11	[ ]	0167-140114 - 017	WQ-PIT-1	Pit top	record DO in mg/L 8.06	14.01.14	16:46
12	[ ]	0167-140114 - 018	WQ-PIT-2	Pit middle	record DO in mg/L 3.45	14.01.14	16:42
13	[ ]	0167-140114 - 016	WQ-PIT-3	Pit bottom	record DO in mg/L 1.02	14.01.14	16:39
14	[ ]	0167-140113 - 012	✓ Field Replicate 1	SEEP		14.01.13	14:50
15	[ ]	0167-140114 - 001	Field Replicate 2	VC-REF		14.01.14	15:00
16	[ ]	0167-1401 -	Field Blank			14.01.14	
17	[ ]	TRAVEL BLANK	Travel Blank				



Project No.: 13-Y-0167

Weather: -12 overcast calm

Field Samplers: JM, LG, DS

Project Name: Mount Nansen Water Quality

B4 Sea up

Page 1 of 4

YSI Calibrated? Yes / No

Date / Time: 07:00 14 Jan 14

Site Information		Site Information	
Site Name:	WQ-VC-UJN	Site Name:	WQ-VC-DBL
Sample Identifier:	0167-1401 14 - 005	Sample Identifier:	0167-1401 14 - 007
Sample Date and Time:	08:52 14 Jan 14	Sample Date and Time:	14 JAN 14 13:05
Replicate ID (if applicable)		Replicate ID (if applicable)	
Field Measured Parameters		Field Measured Parameters	
Temperature:	0.0°C	Temperature:	0.0
Specific Conductivity (SPC):	237.8	Specific Conductivity (SPC):	220.1
pH:	7.11	pH:	7.26
Turbidity:	0.91	Turbidity:	0.87
Site Conditions		Site Conditions	
flow level:	Low	flow level:	normal (low)
turbidity (clear, light, mod, high):		turbidity (clear, light, mod, high):	clear
ice thickness (if applicable)	> 5cm	ice thickness (if applicable)	0.12m
Notes	Photo Numbers	Notes	Photo Numbers
(if pit incl. DO and ice thickness)	Upstream: 104 Downstream: 105 Overview: 106 Datasheet:	(if pit incl. DO and ice thickness)	Upstream: <del>320</del> 327 Downstream: <del>321</del> 328 Overview: <del>325</del> 329 Datasheet: 324

Site Information		Site Information	
Site Name:	WQ-VC-U	Site Name:	WQ-VC-REF
Sample Identifier:	0167-1401 14 - 006	Sample Identifier:	0167-1401 14 - 013
Sample Date and Time:	14 JAN 14 1325	Sample Date and Time:	14 JAN 14 1500
Replicate ID (if applicable)	N/A	Replicate ID (if applicable)	0167 140114 - 001
Field Measured Parameters		Field Measured Parameters	
Temperature:	0.0	Temperature:	0.0
Specific Conductivity (SPC):	221.9	Specific Conductivity (SPC):	221.3
pH:	7.22	pH:	7.31
Turbidity:	0.75m	Turbidity:	0.33
Site Conditions		Site Conditions	
flow level:	low	flow level:	low
turbidity (clear, light, mod, high):		turbidity (clear, light, mod, high):	
ice thickness (if applicable)	0.02m	ice thickness (if applicable)	0.25m
Notes	Photo Numbers	Notes	Photo Numbers
(if pit incl. DO and ice thickness)	Upstream: 331 Downstream: 332 Overview: 333 Datasheet: 330	(if pit incl. DO and ice thickness)	Upstream: 337 Downstream: 340 Overview: 341 Datasheet: 342

Field Blank ID \_\_\_\_\_

Trip Blank ID \_\_\_\_\_



Van der  
YSI / turb  
Ice auger  
Sample  
Ice Scoop

Project No.: 13-Y-0167

Weather: -3, over cast, calm

Field Samplers: JM, LG, DS

Project Name: Mount Nansen Water Quality

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YSI Calibrated? Yes / No

Date / Time: 14 Jan 2014

Site Information		Site Information	
Site Name:	WQ Pit 1 (surface)	Site Name:	WQ Pit 2 (M.A)
Sample Identifier:	0167-1401 14 - 017	Sample Identifier:	0167-1401 14 - 018
Sample Date and Time:	16:46 14 Jan 2014	Sample Date and Time:	16:42 14 Jan 2014
Replicate ID (if applicable)	—	Replicate ID (if applicable)	—
Field Measured Parameters		Field Measured Parameters	
Temperature:	0.3	Temperature:	4.6
Specific Conductivity (SPC):	2040	Specific Conductivity (SPC):	2322
pH:	7.46	pH:	6.77
Turbidity:	1.13	Turbidity:	0.53
Site Conditions		Site Conditions	
flow level:	✓	flow level:	✓
turbidity (clear, light, mod, high):		turbidity (clear, light, mod, high):	
ice thickness (if applicable)		ice thickness (if applicable)	
Notes	Photo Numbers	Notes	Photo Numbers
(if pit incl. DO and ice thickness) Total Depth 7.5m Ice Thickness 70cm Taken Below Ice DO 56.1 % 8.06 mg/L	Upstream: / Downstream: / Overview: / Datasheet: 245	(if pit incl. DO and ice thickness) DO 27.0 % 3.45 mg/L Depth 3m	Upstream: / Downstream: / Overview: / Datasheet: /

Site Information		Site Information	
Site Name:	WQ Pit 3 (Bottom)	Site Name:	
Sample Identifier:	0167-1401 14 - 016	Sample Identifier:	0167-1401 -
Sample Date and Time:	16:39 14 Jan 2014	Sample Date and Time:	
Replicate ID (if applicable)	—	Replicate ID (if applicable)	
Field Measured Parameters		Field Measured Parameters	
Temperature:	5.2	Temperature:	
Specific Conductivity (SPC):	206.2687	Specific Conductivity (SPC):	
pH:	6.81	pH:	
Turbidity:	1.43	Turbidity:	
Site Conditions		Site Conditions	
flow level:	✓	flow level:	
turbidity (clear, light, mod, high):		turbidity (clear, light, mod, high):	
ice thickness (if applicable)		ice thickness (if applicable)	
Notes	Photo Numbers	Notes	Photo Numbers
(if pit incl. DO and ice thickness) DO 8.2 % 1.03 mg/L Depth 7m	Upstream: / Downstream: / Overview: / Datasheet: /	(if pit incl. DO and ice thickness)	Upstream: / Downstream: / Overview: / Datasheet: /

Field Blank ID \_\_\_\_\_  
Trip Blank ID \_\_\_\_\_



Project No.: 13-Y-0167

Weather: -32°c clear calm

Field Samplers: JM, LG, DS

Project Name: Mount Nansen Water Quality

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YSI Calibrated? Yes / No

Date / Time: 11:30 13 Jan 2014

Site Information		Site Information	
Site Name:	<u>WQ VC R + 150</u>	Site Name:	<u>WQ -DC - U</u>
Sample Identifier:	<u>0167-1401 13 - 015</u>	Sample Identifier:	<u>0167-1401 13 - 014</u>
Sample Date and Time:	<u>12:45 13 Jan 2014</u>	Sample Date and Time:	<u>13:54 13 Jan 2014</u>
Replicate ID (if applicable)	<u>      </u>	Replicate ID (if applicable)	<u>      </u>
Field Measured Parameters		Field Measured Parameters	
Temperature:	<u>0.0</u>	Temperature:	<u>-0.1</u>
Specific Conductivity (SPC):	<u>235.4</u>	Specific Conductivity (SPC):	<u>1680</u>
pH:	<u>7.14</u>	pH:	<u>7.27</u>
Turbidity:	<u>0.65</u>	Turbidity:	<u>31.4</u>
Site Conditions		Site Conditions	
flow level:	<u>low</u>	flow level:	<u>      </u>
turbidity (clear, light, mod, high):	<u>      </u>	turbidity (clear, light, mod, high):	<u>      </u>
ice thickness (if applicable)	<u>4cm</u>	ice thickness (if applicable)	<u>      </u>
Notes	Photo Numbers	Notes	Photo Numbers
(if pit incl. DO and ice thickness)	Upstream: <u>69</u>	(if pit incl. DO and ice thickness)	Upstream: <u>80</u>
<u>Mount site DO 18cm</u>	Downstream: <u>70</u>	<u>Ice thickness 2.5cm up to</u>	Downstream: <u>81</u>
<u>from water site due to thick</u>	Overview: <u>71</u>	<u>12cm in some spots</u>	Overview: <u>82</u>
<u>ice made to access water</u>	Datasheet:		Datasheet:
<u>60cm Hit substrate</u>			
<u>Turb &amp; filter back on track</u>			

Site Information		Site Information	
Site Name:	<u>WQ SEEP</u>	Site Name:	<u>WQ TP</u>
Sample Identifier:	<u>0167-1401 13 - 011</u>	Sample Identifier:	<u>0167-1401 13 - 009</u>
Sample Date and Time:	<u>14:50</u>	Sample Date and Time:	<u>2014 Jan 13 15:32</u>
Replicate ID (if applicable)	<u>0167 1401 13 012</u>	Replicate ID (if applicable)	<u>      </u>
Field Measured Parameters		Field Measured Parameters	
Temperature:	<u>0.0°C</u>	Temperature:	<u>0.1</u>
Specific Conductivity (SPC):	<u>1759</u>	Specific Conductivity (SPC):	<u>1788</u>
pH:	<u>7.03</u>	pH:	<u>7.41</u>
Turbidity:	<u>50.8</u>	Turbidity:	<u>4.76</u>
Site Conditions		Site Conditions	
flow level:	<u>N/A</u>	flow level:	<u>N/A</u>
turbidity (clear, light, mod, high):	<u>      </u>	turbidity (clear, light, mod, high):	<u>      </u>
ice thickness (if applicable)	<u>      </u>	ice thickness (if applicable)	<u>0.5m</u>
Notes	Photo Numbers	Notes	Photo Numbers
(if pit incl. DO and ice thickness)	Upstream: <u>83</u>	(if pit incl. DO and ice thickness)	Upstream: <u>319 (LG)</u>
	Downstream: <u>      </u>		Downstream: <u>      </u>
	Overview: <u>      </u>		Overview: <u>      </u>
	Datasheet:		Datasheet: <u>      </u>

Field Blank ID \_\_\_\_\_  
 Trip Blank ID \_\_\_\_\_



Project No.: 13-Y-0167

Weather: -10 overcast calm

Field Samplers: JM, LG, DS

Project Name: Mount Nansen Water Quality

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YSI Calibrated? Yes / No

Date / Time: 13 Jan 2014

Site Information		Site Information	
Site Name:	<u>WQ DX +105</u>	Site Name:	<u>WQ MS 03</u> <del>008</del>
Sample Identifier:	<u>0167-1401 13 - 010</u>	Sample Identifier:	<u>0167-1401 13 - 008</u>
Sample Date and Time:	<u>Jan 13 2014 16:45</u>	Sample Date and Time:	<u>16 46, 20 14 Jan 13</u>
Replicate ID (if applicable)	<u>—</u>	Replicate ID (if applicable)	<u>—</u>
Field Measured Parameters		Field Measured Parameters	
Temperature:	<u>0.4°C</u>	Temperature:	<u>0.3°C</u>
Specific Conductivity (SPC):	<u>1165</u>	Specific Conductivity (SPC):	<u>1172</u>
pH:	<u>7.22</u>	pH:	<u>7.25</u>
Turbidity:	<u>2.50</u>	Turbidity:	<u>1.82</u>
Site Conditions		Site Conditions	
flow level:	<u>low</u>	flow level:	<u>low/med</u>
turbidity (clear, light, mod, high):		turbidity (clear, light, mod, high):	
ice thickness (if applicable)	<u><del>0</del> snow covered creek w/ thin ice</u>	ice thickness (if applicable)	<u>N/A snow atop of water</u>
Notes	Photo Numbers	Notes	Photo Numbers
(if pit incl. DO and ice thickness)	Upstream: <u>0090</u>	(if pit incl. DO and ice thickness)	Upstream: <u>087</u>
	Downstream: <u>0091</u>		Downstream: <u>088</u>
	Overview: <u>0092</u>		Overview: <u>089</u>
	Datasheet:		Datasheet:

Site Information		Site Information	
Site Name:		Site Name:	
Sample Identifier:	<u>0167-1401 -</u>	Sample Identifier:	<u>0167-1401 -</u>
Sample Date and Time:		Sample Date and Time:	
Replicate ID (if applicable)		Replicate ID (if applicable)	
Field Measured Parameters		Field Measured Parameters	
Temperature:		Temperature:	
Specific Conductivity (SPC):		Specific Conductivity (SPC):	
pH:		pH:	
Turbidity:		Turbidity:	
Site Conditions		Site Conditions	
flow level:		flow level:	
turbidity (clear, light, mod, high):		turbidity (clear, light, mod, high):	
ice thickness (if applicable)		ice thickness (if applicable)	
Notes	Photo Numbers	Notes	Photo Numbers
(if pit incl. DO and ice thickness)	Upstream:	(if pit incl. DO and ice thickness)	Upstream:
	Downstream:		Downstream:
	Overview:		Overview:
	Datasheet:		Datasheet:

Field Blank ID \_\_\_\_\_

Trip Blank ID \_\_\_\_\_



Project #: 13-Y-0167

Project Name: Mount Nansen - Water Quality



Field Dates: FEB 10-12 2014

**General Site Tasks/ Communications**

Pay attention to new bottles - Regular sites = 9 bottles (2 filtered). Pit samples = 6 bottles (2 filtered). The following sites have been removed from the program: PW, MN, DC-U1, DC-U2, DRY, VC-REF,

#		Lab Sample Identifier	WQ ID	Station Name	Site Tasks	Date	Time
						yy.mm.dd	HH:MM
1	[✓]	REP 009 ✓ 0167-1402 11 - 005 ✓	WQ-SEEP	Seepage	LT50	14.FEB. 11	14:20
2	[✓]	0167-1402 11 - 005 ✓	WQ-TP	Tailings Pond		14.FEB. 12	1500
3	[✓]	0167-1402 11 - 001 ✓	WQ-DC-DX+105	Dome Creek at DX+105		14.FEB. 11	1600
4	[✓]	0167-1402 11 - 010 ✓	WQ-DC-U	Upper Dome		14.FEB. 11	1455 1400
5	[✓]	0167-1402 11 - 002 ✓	WQ-DC-B	Dome Creek at Bridge (Diversion Channel)	NEW SITE - Dome Creek at Bridge - sample if flowing U/S of bridge	14.FEB. 11	1520
6	[ ]	0167-1402 <del>11 - 008</del>	WQ-MS-S-03	Mill Seep 03	<del>Wavy line</del>	14.FEB. <del>11</del>	<del>11:15</del>
7	[✓]	0167-1402 11 - 008 ✓	WQ-VC-U	Upper Victoria Creek		14.FEB. 11	11:15
8	[✓]	0167-1402 11 - 007 ✓	WQ-VC-R	Victoria Creek at Road	sample from winter site (near hydro site)	14.FEB. 11	830
9	[✓]	0167-1402 11 - 009 ✓	WQ-VC-DBC	Victoria Creek D/S Back Creek		14.FEB. 11	1050
10	[✓]	0167-1402 11 - 006 ✓	WQ-VC-UMN	Victoria Creek U/S Minnesota Creek		14.FEB. 11	006
11	[✓]	0167-1402 12 - 016	WQ-PIT-1	Pit top	record DO in mg/L, ice thickness	14.FEB. 12	9:00
12	[✓]	0167-1402 12 - 018	WQ-PIT-2	Pit middle	record DO in mg/L, ice thickness	14.FEB. 12	9:30
13	[✓]	0167-1402 12 - 017	WQ-PIT-3	Pit bottom	record DO in mg/L, ice thickness	14.FEB. 12	9:22
14	[✓]	0167-1402 11 - 004 ✓	Field Replicate 1	FIELD REP	SEEP	14.FEB. 11	14:20
15	[✓]	0167-1402 - N/A ✓	Field Replicate 2		LESS THAN 710 SITES	14.FEB. <del>11</del>	n/a
16	[✓]	0167-1402 12 - Field Blank ✓	Field Blank			14.FEB. <del>11</del>	n/a
17	[✓]	TRAVEL BLANK ✓	Travel Blank				

~~0167-1402 11 - 000~~ ~~0167-1402 11 - 003~~ ~~Middle dome (6)~~

~~14 FEB 11~~ ~~1400~~



Project No.: 13-Y-0167

Weather: cold - 40°C to -24°C  
clear + sunny

Field Samplers: CL TH  
DS

Project Name: Mount Nansen Water Quality

Page 1 of 4

YSI Calibrated?  Yes /  No

Date / Time: FEB 11 2014 730AM

Site Information		Site Information	
Site Name:	<u>WA-VC-R+150</u>	Site Name:	<u>WO-VC-LMN</u>
Sample Identifier:	<u>0167-140211 - 007</u>	Sample Identifier:	<u>0167-140211 - 006</u>
Sample Date and Time:	<u>11-Feb-14 8:30</u>	Sample Date and Time:	<u>Feb-11-14 9:15</u>
Replicate ID (if applicable)		Replicate ID (if applicable)	
Field Measured Parameters		Field Measured Parameters	
Temperature:	<u>0.1°C</u>	Temperature:	<u>0.0</u>
Specific Conductivity (SPC):	<u>204.0</u>	Specific Conductivity (SPC):	<u>206.9</u>
pH:	<u>7.43</u>	pH:	<u>7.05</u>
Turbidity:	<u>0.60</u>	Turbidity:	<u>1.81</u>
Site Conditions		Site Conditions	
flow level:	<u>low</u>	flow level:	<u>low</u>
turbidity (clear, light, mod, high):	<u>clear</u>	turbidity (clear, light, mod, high):	<u>low</u>
ice thickness (if applicable)	<u>~1m w overflow</u>	ice thickness (if applicable)	<u>30cm</u>
Notes	Photo Numbers	Notes	Photo Numbers
(if pit incl. DO and ice thickness)	Upstream: <u>009</u>	(if pit incl. DO and ice thickness)	Upstream: <u>0012</u>
<u>Very low flow</u>	Downstream: <u>010</u>	<u>Very low flow</u>	Downstream: <u>0013</u>
<u>-40°C outside, no</u>	Overview: <u>011</u>	<u>Turb measured @</u>	Overview: <u>0015</u>
<u>field turb taken, collected</u>	Datasheet:	<u>bankhouse</u>	Datasheet:
<u>sample &amp; measured in</u>		<u>thin ice along</u>	
<u>bankhouse. Thick ice.</u>		<u>RDP.</u>	

Site Information		Site Information	
Site Name:	<u>KWA-VC-DBC</u>	Site Name:	<u>WA-VC-U</u>
Sample Identifier:	<u>0167-140211 - 009</u>	Sample Identifier:	<u>0167-140211 - 008</u>
Sample Date and Time:	<u>Feb 11, 2014 1050</u>	Sample Date and Time:	<u>Feb 11, 2014 11:55</u>
Replicate ID (if applicable)		Replicate ID (if applicable)	
Field Measured Parameters		Field Measured Parameters	
Temperature:	<u>0.0</u>	Temperature:	<u>0.0</u>
Specific Conductivity (SPC):	<u>177.8</u>	Specific Conductivity (SPC):	<u>177.8</u>
pH:	<u>7.18</u>	pH:	<u>7.18</u>
Turbidity:	<u>1.38</u>	Turbidity:	<u>0.32</u>
Site Conditions		Site Conditions	
flow level:	<u>low bankflow</u>	flow level:	<u>low</u>
turbidity (clear, light, mod, high):	<u>20cm</u>	turbidity (clear, light, mod, high):	
ice thickness (if applicable)	<u>20cm</u>	ice thickness (if applicable)	<u>~15cm</u>
Notes	Photo Numbers	Notes	Photo Numbers
(if pit incl. DO and ice thickness)	Upstream: <u>0024</u>	(if pit incl. DO and ice thickness)	Upstream: <u>0027</u>
<u>Very low flow</u>	Downstream: <u>0025</u>	<u>low flow, typical</u>	Downstream: <u>0028</u>
<u>no open water</u>	Overview: <u>0024</u>	<u>winter condition</u>	Overview: <u>0029</u>
	Datasheet:	<u>thin ice area for</u>	Datasheet:
		<u>sampling.</u>	

Field Blank ID 0167-140211-000 FIELD-BLANK  
Trip Blank ID TRAVEL BLANK



Project No.: 13-Y-0167

Weather: -40°C to -24°C  
clear, calm, sunny

Field Samplers: CL, PS, TH

Project Name: Mount Nansen Water Quality

Page 2 of 4

YSI Calibrated?  Yes  No

Date / Time: 7:30 Feb 11, 2014

Site Information		Site Information	
Site Name:	WQ-DC-U	Site Name:	WQ-SEEP
Sample Identifier:	0167-1402 11 - 010	Sample Identifier:	0167-1402 11 - 015
Sample Date and Time:	Feb 11, 2014 1400	Sample Date and Time:	Feb 11, 2014 1420
Replicate ID (if applicable)		Replicate ID (if applicable)	0167-140211-004
Field Measured Parameters		Field Measured Parameters	
Temperature:	0.0	Temperature:	0.0
Specific Conductivity (SPC):	1415	Specific Conductivity (SPC):	1510
pH:	7.17	pH:	7.56
Turbidity:	42.0	Turbidity:	48.6
Site Conditions		Site Conditions	
flow level:	low	flow level:	n/a
turbidity (clear, light, mod, high):	mod	turbidity (clear, light, mod, high):	mod
ice thickness (if applicable)	30cm	ice thickness (if applicable)	n/a
Notes	Photo Numbers	Notes	Photo Numbers
(if pit incl. DO and ice thickness) typical winter conditions. very low flow. some suspended sediment while creating sample hole.	Upstream: 0035 Downstream: 0034 Overview: 0036 Datasheet:	(if pit incl. DO and ice thickness) LTSO collected.	Upstream: Downstream: Overview: 038 Datasheet:

Site Information		Site Information	
Site Name:	WQ-TP	Site Name:	WQ-DC-B
Sample Identifier:	0167-1402 11 - 003	Sample Identifier:	0167-1402 11 - 002 <del>530</del>
Sample Date and Time:	11 Feb-14 1500	Sample Date and Time:	Feb 11, 2014 1520
Replicate ID (if applicable)		Replicate ID (if applicable)	
Field Measured Parameters		Field Measured Parameters	
Temperature:	0.60C	Temperature:	0.06
Specific Conductivity (SPC):	1979	Specific Conductivity (SPC):	1910
pH:	7.30	pH:	6.93
Turbidity:	4.23	Turbidity:	21.1
Site Conditions		Site Conditions	
flow level:	low	flow level:	low
turbidity (clear, light, mod, high):	low	turbidity (clear, light, mod, high):	low
ice thickness (if applicable)	~40cm	ice thickness (if applicable)	~1m
Notes	Photo Numbers	Notes	Photo Numbers
(if pit incl. DO and ice thickness) usual winter conditions. <del>sample not taken</del> <del>under ice</del>	Upstream: <del>0035</del> Downstream: <del>0034</del> Overview: 0036 + 41 Datasheet:	(if pit incl. DO and ice thickness) some flow through ice. sample collected from this rock site. channel had been excavated 2wks prior.	Upstream: 044 Downstream: 043 Overview: 045 Datasheet:

Field Blank ID \_\_\_\_\_  
Trip Blank ID \_\_\_\_\_

\*US of bridge



Project No.: 13-Y-0167

Weather: -25°C Sunny

Field Samplers: CL, TH  
DS

Project Name: Mount Nansen Water Quality

Page 3 of 4

YSI Calibrated?  Yes /  No

Date / Time: 11 Feb 2014 7:30

Site Information		Site Information	
Site Name:	<u>WA-DC-DX+105</u>	Site Name:	<u>WA-DC-DX</u>
Sample Identifier:	<u>0167-1402 11-001</u>	Sample Identifier:	<u>0167-1402</u>
Sample Date and Time:	<u>11 Feb 2014 1600</u>	Sample Date and Time:	<u>No SAMPLE</u>
Replicate ID (if applicable)		Replicate ID (if applicable)	<u>No SAMPLE</u>
Field Measured Parameters		Field Measured Parameters	
Temperature:	<u>0.5</u>	Temperature:	
Specific Conductivity (SPC):	<u>965</u>	Specific Conductivity (SPC):	
pH:	<u>7.33</u>	pH:	
Turbidity:	<u>3.90</u>	Turbidity:	
Site Conditions		Site Conditions	
flow level:	<u>Very low</u>	flow level:	
turbidity (clear, light, mod, high):	<u>low</u>	turbidity (clear, light, mod, high):	
ice thickness (if applicable)	<u>15cm</u>	ice thickness (if applicable)	
Notes	Photo Numbers	Notes	Photo Numbers
(if pit incl. DO and ice thickness)	Upstream: <u>0057</u>	(if pit incl. DO and ice thickness)	Upstream:
<u>Thin ice under snow. low flow</u>	Downstream: <u>0058</u>	<u>no water under ice</u>	Downstream:
	Overview: <u>0059</u>	<u>for sampling - frozen to ground</u>	Overview:
	Datasheet:		Datasheet:

Site Information		Site Information	
Site Name:	<u>WA-DC-D + PC-U</u>	Site Name:	<u>WA-DC-DIB</u>
Sample Identifier:	<u>0167-1402</u>	Sample Identifier:	<u>0167-1402</u>
Sample Date and Time:	<u>11 Feb</u>	Sample Date and Time:	<u>No SAMPLE</u>
Replicate ID (if applicable)	<u>NO SAMPLES</u>	Replicate ID (if applicable)	<u>NO SAMPLE</u>
Field Measured Parameters		Field Measured Parameters	
Temperature:		Temperature:	
Specific Conductivity (SPC):		Specific Conductivity (SPC):	
pH:		pH:	
Turbidity:		Turbidity:	
Site Conditions		Site Conditions	
flow level:		flow level:	
turbidity (clear, light, mod, high):		turbidity (clear, light, mod, high):	
ice thickness (if applicable)		ice thickness (if applicable)	
Notes	Photo Numbers	Notes	Photo Numbers
(if pit incl. DO and ice thickness)	Upstream:	(if pit incl. DO and ice thickness)	Upstream:
<u>Flow to led</u>	Downstream:	<u>overflow ice,</u>	Downstream:
<u>NO SAMPLE</u>	Overview:	<u>no flow</u>	Overview:
	Datasheet:	<u>NO SAMPLE</u>	Datasheet:

Field Blank ID \_\_\_\_\_  
Trip Blank ID \_\_\_\_\_



Project No.: 13-Y-0167

Weather: -37°C sunny

Field Samplers: CL, TH  
DS

Project Name: Mount Nansen Water Quality

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YSI Calibrated? Yes / No

Date / Time: 12-Feb-2014 730.

Site Information		Site Information	
Site Name:	<u>WQ-DC-R</u>	Site Name:	<u>WQ-PIT-1</u>
Sample Identifier:	<u>0167-1402</u>	Sample Identifier:	<u>0167-1402 12-016</u>
Sample Date and Time:	<u>NO SAMPLE</u>	Sample Date and Time:	<u>12-Feb-14 09:00</u>
Replicate ID (if applicable)		Replicate ID (if applicable)	
Field Measured Parameters		Field Measured Parameters	
Temperature:		Temperature:	<u>0.1°C</u>
Specific Conductivity (SPC):		Specific Conductivity (SPC):	<u>1992</u> TOTAL DIFFTLY
pH:		pH:	<u>7.42</u> 7.5m
Turbidity:		Turbidity:	<u>n/a</u> No D.O.
Site Conditions		Site Conditions	
flow level:		flow level:	<u>n/a</u>
turbidity (clear, light, mod, high):		turbidity (clear, light, mod, high):	<u>clear</u>
ice thickness (if applicable)		ice thickness (if applicable)	<u>~1m</u>
Notes	Photo Numbers	Notes	Photo Numbers
(if pit incl. DO and ice thickness)	Upstream:	(if pit incl. DO and ice thickness)	Upstream:
<u>NO SAMPLE</u>	Downstream:	<u>Sample taken just</u>	Downstream:
<u>overflow + NO</u>	Overview:	<u>below ice surface</u>	Overview:
<u>FLOW</u>	Datasheet:		Datasheet:
		<u>No turbo or DO due to</u>	
		<u>cold (metre malfunction)</u>	

Site Information		Site Information	
Site Name:	<u>WQ-PIT-2</u>	Site Name:	<u>WQ-PIT-3</u>
Sample Identifier:	<u>0167-1402 12-018</u>	Sample Identifier:	<u>0167-1402 12-017</u>
Sample Date and Time:	<u>12 Feb 2014 930</u>	Sample Date and Time:	<u>12-Feb-14 9:22</u>
Replicate ID (if applicable)		Replicate ID (if applicable)	
Field Measured Parameters		Field Measured Parameters	
Temperature:	<u>4.0</u>	Temperature:	<u>3.9</u>
Specific Conductivity (SPC):	<u>1990</u>	Specific Conductivity (SPC):	<u>1991</u>
pH:	<u>7.01</u>	pH:	<u>7.00</u>
Turbidity:	<u>n/a</u> No D.O.	Turbidity:	<u>n/a</u> No D.O.
Site Conditions		Site Conditions	
flow level:	<u>n/a</u>	flow level:	<u>n/a</u>
turbidity (clear, light, mod, high):	<u>clear</u>	turbidity (clear, light, mod, high):	<u>clear</u>
ice thickness (if applicable)	<u>~1m</u>	ice thickness (if applicable)	<u>~1m</u>
Notes	Photo Numbers	Notes	Photo Numbers
(if pit incl. DO and ice thickness)	Upstream:	(if pit incl. DO and ice thickness)	Upstream:
<u>sample taken from</u>	Downstream:	<u>sample taken at</u>	Downstream:
<u>3.5m</u>	Overview:	<u>7.0m</u>	Overview:
	Datasheet:		Datasheet:
<u>No TURB or DO</u>		<u>No TURB or DO due</u>	
<u>due to metres in</u>		<u>to metres in cold (malfunction)</u>	
		<u>cold (malfunction)</u>	

Field Blank ID \_\_\_\_\_  
Trip Blank ID \_\_\_\_\_

WQ-PW  
0167-1402 12-019  
Feb 12, 2014 10:25  
Temp 0°C

Project #: 13-167

Project Name: Mount Nansen - Water Quality



Field Dates: March 10 + 11, 2014

**General Site Tasks/ Communications**

Pay attention to new bottles - Regular sites = 9 bottles (2 filtered). Pit samples = 6 bottles (2 filtered). The following sites have been removed from the program: MN, DC-U1, DC-U2, DRY, VC-REF,

#		Lab Sample Identifier	WQ ID	Station Name	Site Tasks	Date	Time
						yy.mm.dd	HH:MM
1	[M]	0167-1403 10 - 008	WQ-SEEP	Seepage	LT50	14.03.10	18:00
2	[M]	0167-1403 10 - 010	WQ-TP	Tailings Pond		14.03.10	18:55
3	[M]	0167-1403 / - /	WQ-DC-DX+105	Dome Creek at DX+105	Dry / Frozen to bed No samples taken.	14.03.11	9:00
4	[M]	0167-1403 10 - 006	WQ-DC-U	Upper Dome		14.03.10	16:50
5	[M]	0167-1403 / - /	WQ-DC-B	Dome Creek at Bridge (Diversion Channel)	NEW SITE - Dome Creek at Bridge - sample if flowing Dry	14.03.10	18:30 ←
6	[M]	0167-1403 11 - 012	WQ-MS-S-03	Mill Seep 03		14.03.11	8:50
7	✓	0167-1403 11 - 017	WQ-PW	Pumphouse Well	Drinking water sample set from ALS	14.03.11	15:15
8	[M]	0167-1403 11 - 004	WQ-VC-U	Upper Victoria Creek		14.03.11	13:42
9	[M]	0167-1403 10 - 001	WQ-VC-R+150	Victoria Creek at Road	sample from winter site (near hydro site)	14.03.10	13:56
10	[M]	0167-1403 11 - 013	WQ-VC-DBC	Victoria Creek D/S Back Creek		14.03.11	12:50
11	[M]	0167-1403 11 - 011	WQ-VC-UMN	Victoria Creek U/S Minnesota Creek		14.03.11	09:42
12	[M]	0167-1403 11 - 016	WQ-PIT-1	Pit top	record DO in mg/L, ice thickness	14.03.11	16:45
13	[M]	0167-1403 11 - 015	WQ-PIT-2	Pit middle	record DO in mg/L, ice thickness	14.03.11	16:40
14	[M]	0167-1403 11 - 014	WQ-PIT-3	Pit bottom	record DO in mg/L, ice thickness	14.03.11	16:35
15	[M]	0167-1403 10 - 009	Field Replicate 1	WQ-SEEP		14.03.10	18:00
16	[M]	0167-1403 11 - 005	Field Replicate 2	WQ-VC-DBC	Take a 2nd rep, only if more than 10 regular samples are collected on the trip.	14.03.11	12:40
17	[M]	0167-1403 10 - Field Blank	Field Blank	Field Blank		14.03.10	19:44
18	[M]	TRAVEL BLANK	Travel Blank				

Frozen to Bed. No Sample!

19 ✓ 0167-1403 11 - 003 WQ-BC Back Creek 14.03.11 15:35



Project No.: 13-Y-0167

Weather: -5°C, sunny, calm

Field Samplers: JM, DS, OH

Project Name: Mount Nansen Water Quality

Page 1 of 4

YSI Calibrated?  Yes / No

Date / Time: 10 March 2014 12:20

Site Information		Site Information	
Site Name:	WQ-VC-R+150	Site Name:	WQ-DC-U
Sample Identifier:	0167-1403 10 - 001	Sample Identifier:	0167-1403 10 - 006
Sample Date and Time:	10 Mar 2014 13:56	Sample Date and Time:	10 Mar 2014 16:50
Replicate ID (if applicable)	✓	Replicate ID (if applicable)	✓
Field Measured Parameters		Field Measured Parameters	
Temperature:	0.0°C	Temperature:	0.0°C
Specific Conductivity (SPC):	251.1	Specific Conductivity (SPC):	1678
pH:	7.04	pH:	7.08
Turbidity:	0.08 NTU	Turbidity:	12.1
Site Conditions		Site Conditions	
flow level:	Low	flow level:	low
turbidity (clear, light, mod, high):	Clear	turbidity (clear, light, mod, high):	light
ice thickness (if applicable)	18 cm	ice thickness (if applicable)	30 cm
Notes	Photo Numbers	Notes	Photo Numbers
(if pit incl. DO and ice thickness)	Upstream: 0251	(if pit incl. DO and ice thickness)	Upstream: 262
Ice thickness 18 cm.	Downstream: 0252		Downstream: 263
	Overview: 0253		Overview: 266
	Datasheet: 0254		Datasheet:

Site Information		Site Information	
Site Name:	WQ - Seep.	Site Name:	WQ TP
Sample Identifier:	0167-1403 10 - 008	Sample Identifier:	0167-1403 10 - 010
Sample Date and Time:	March 10/2014 18:00	Sample Date and Time:	14 03 10 18:55
Replicate ID (if applicable)	0167-140310 - 009	Replicate ID (if applicable)	✓
Field Measured Parameters		Field Measured Parameters	
Temperature:	0.8°C	Temperature:	0.4°C
Specific Conductivity (SPC):	1818	Specific Conductivity (SPC):	2626
pH:	6.82	pH:	7.20
Turbidity:	9.54	Turbidity:	7.67
Site Conditions		Site Conditions	
flow level:	Normal	flow level:	Normal winter level
turbidity (clear, light, mod, high):	light	turbidity (clear, light, mod, high):	light
ice thickness (if applicable)	N/A.	ice thickness (if applicable)	65 cm
Notes	Photo Numbers	Notes	Photo Numbers
(if pit incl. DO and ice thickness)	Upstream: ✓	(if pit incl. DO and ice thickness)	Upstream: ✓
	Downstream: ✓		Downstream: ✓
	Overview: 270		Overview: 282/283
	Datasheet:		Datasheet: ✓

Field Blank ID \_\_\_\_\_  
 Trip Blank ID \_\_\_\_\_



Project No.: 13-Y-0167  
 Project Name: Mount Nansen Water Quality  
 Page 2 of 4

Weather: -5°C, sunny, light wind Field Samplers: JM, DS, DH

YSI Calibrated? Yes No

Date/Time: March 11, 2014 7:30

Site Information		Site Information	
Site Name:	WQ-MS-5-03	Site Name:	WQ-DC-DX+105
Sample Identifier:	0167-1403 11 - 012	Sample Identifier:	0167-1403 <del>11 - 011</del>
Sample Date and Time:	March 11, 2014 8:50	Sample Date and Time:	March 11, 2014 <del>9:00</del>
Replicate ID (if applicable)	/	Replicate ID (if applicable)	<del>0167-1403 11 - 013</del>
Field Measured Parameters		Field Measured Parameters	
Temperature:	0.5 °C	Temperature:	/
Specific Conductivity (SPC):	1200	Specific Conductivity (SPC):	/
pH:	6.87	pH:	/
Turbidity:	26.2	Turbidity:	/
Site Conditions		Site Conditions	
flow level:	low	flow level:	Frozen to bed, no flow
turbidity (clear, light, mod, high):	light - mod.	turbidity (clear, light, mod, high):	/
ice thickness (if applicable)	1cm to 6cm.	ice thickness (if applicable)	28 cm
Notes	Photo Numbers	Notes	Photo Numbers
(if pit incl. DO and ice thickness)	Upstream: 289	(if pit incl. DO and ice thickness)	Upstream: 295
	Downstream: 291		Downstream: 296
	Overview: 292 1290	Dry, Frozen to Bed!	Overview: 294 293
	Datasheet:	Investigated @ YSI site + WQ site.	Datasheet: LDB 0298
			RDB 0297

Site Information		Site Information	
Site Name:	WQ-VC-VMN	Site Name:	WQ-VC-DRC
Sample Identifier:	0167-1403 11 - 011	Sample Identifier:	0167-1403 11 - 013 12:50
Sample Date and Time:	March 11/2014 9:42	Sample Date and Time:	March 11, 2014 <del>12:40</del>
Replicate ID (if applicable)	/	Replicate ID (if applicable)	0167-1403 11 - 005 12:40
Field Measured Parameters		Field Measured Parameters	
Temperature:	0.3 °C	Temperature:	0.1 °C
Specific Conductivity (SPC):	240.9	Specific Conductivity (SPC):	238.0
pH:	7.04	pH:	6.99
Turbidity:	0.36 NTU	Turbidity:	0.28 NTU
Site Conditions		Site Conditions	
flow level:	low	flow level:	low
turbidity (clear, light, mod, high):	(clear)	turbidity (clear, light, mod, high):	Clear
ice thickness (if applicable)	20cm	ice thickness (if applicable)	30cm ice w 50cm snow on top
Notes	Photo Numbers	Notes	Photo Numbers
(if pit incl. DO and ice thickness)	Upstream: 299	(if pit incl. DO and ice thickness)	Upstream: 312
	Downstream: 301		Downstream: 313
	Overview: 303		Overview: 0314
	Datasheet:		Datasheet: 0315

Field Blank ID \_\_\_\_\_  
 Trip Blank ID \_\_\_\_\_





Project No.: 13-Y-0167

Weather: -2°C, sunny, light wind

Field Samplers: DA, JM, DS

Project Name: Mount Nansen Water Quality

Page 3 of 4

YSI Calibrated?  Yes  No

Date / Time: March 11/2014 7:30

Site Information		Site Information	
Site Name:	WQ-VC-U	Site Name:	WQ-PW
Sample Identifier:	0167-1403 11 - 004	Sample Identifier:	0167-1403 11 - 017
Sample Date and Time:	March 11/2014 13:42	Sample Date and Time:	March 11/2014 15:15
Replicate ID (if applicable)	<del>115</del>	Replicate ID (if applicable)	—
Field Measured Parameters		Field Measured Parameters	
Temperature:	0.2°C	Temperature:	0.5°C
Specific Conductivity (SPC):	231.8	Specific Conductivity (SPC):	372.0
pH:	6.84	pH:	7.51
Turbidity:	0.13 NTU	Turbidity:	0.12 NTU
Site Conditions		Site Conditions	
flow level:	low	flow level:	✓
turbidity (clear, light, mod, high):	clear	turbidity (clear, light, mod, high):	clear
ice thickness (if applicable)	15 cm	ice thickness (if applicable)	✓
Notes	Photo Numbers	Notes	Photo Numbers
(if pit incl. DO and ice thickness)	Upstream: 0317	(if pit incl. DO and ice thickness)	Upstream: ✓
<i>WQ-VC-U</i>	Downstream: 0316		Downstream: ✓
	Overview: 0318		Overview: 323 + 324
	Datasheet:		Datasheet:

Site Information		Site Information	
Site Name:	WQ-BC	Site Name:	WQ-Pit 3 (Bottom)
Sample Identifier:	0167-1403 11 - 003	Sample Identifier:	0167-1403 11 - 014
Sample Date and Time:	March 11/2014 15:35	Sample Date and Time:	March 11/2014 16:35
Replicate ID (if applicable)	—	Replicate ID (if applicable)	—
Field Measured Parameters		Field Measured Parameters	
Temperature:	0.0°C	Temperature:	4.6
Specific Conductivity (SPC):	251.6	Specific Conductivity (SPC):	2695
pH:	7.25	pH:	6.8
Turbidity:	0.63	Turbidity:	1.36
Site Conditions		Site Conditions	
flow level:	Over flow conditions, almost to bank full.	flow level:	✓
turbidity (clear, light, mod, high):	clear	turbidity (clear, light, mod, high):	
ice thickness (if applicable)	54 cm	ice thickness (if applicable)	1.08 m
Notes	Photo Numbers	Notes	Photo Numbers
(if pit incl. DO and ice thickness)	Upstream: 0325	(if pit incl. DO and ice thickness)	Upstream:
Water depth = 78 cm	Downstream: 0326	DO % 3.4	Downstream:
Ice thickness 54 cm	Overview: 0327	DO mg/L 0.43	Overview: 0331 - 332
At 38 cm from surface there is slush layer.	Datasheet:	Water depth: 7.0 m	Datasheet:
		Total depth 7.5 m	

Field Blank ID \_\_\_\_\_

Trip Blank ID \_\_\_\_\_



Project No.: 13-Y-0167

Weather: +2°C, sunny, windy

Field Samplers: SM, DS, D11

Project Name: Mount Nansen Water Quality

Page 4 of 4

YSI Calibrated?  Yes / No

Date / Time: 11 March 2014 7:30

Site Information		Site Information	
Site Name:	<u>WQ - Pit 2 (Mid)</u>	Site Name:	<u>WQ - Pit - 1 (Top)</u>
Sample Identifier:	<u>0167-1403 11 - 015</u>	Sample Identifier:	<u>0167-1403 11 - 016</u>
Sample Date and Time:	<u>March 11/2014 16:40</u>	Sample Date and Time:	<u>March 11/2014 16:45</u>
Replicate ID (if applicable)	<u>/</u>	Replicate ID (if applicable)	<u>/</u>
Field Measured Parameters		Field Measured Parameters	
Temperature:	<u>2.2 °C</u>	Temperature:	<u>1.0 °C</u>
Specific Conductivity (SPC):	<u>2072</u>	Specific Conductivity (SPC):	<u>2092</u>
pH:	<u>7.24</u>	pH:	<u>7.31</u>
Turbidity:	<u>0.54</u>	Turbidity:	<u>0.57</u>
Site Conditions		Site Conditions	
flow level:	<u>/</u>	flow level:	<u>/</u>
turbidity (clear, light, mod, high):		turbidity (clear, light, mod, high):	
ice thickness (if applicable)	<u>1.08 m</u>	ice thickness (if applicable)	<u>1.08 m</u>
Notes	Photo Numbers	Notes	Photo Numbers
(if pit Incl. DO and Ice thickness)	Upstream:	(if pit Incl. DO and Ice thickness)	Upstream:
<u>DO% 40.2</u>	Downstream:	<u>DO% 42.5 %</u>	Downstream:
<u>DO mg/L 5.53</u>	Overview: <u>331-332</u>	<u>DO mg/L 6.00</u>	Overview: <u>331-332</u>
<u>Water depth: 3.0 m</u>	Datasheet:	<del>XXXXXXXXXX</del>	Datasheet:
		<u>(just below ice surface)</u>	

Site Information		Site Information	
Site Name:		Site Name:	
Sample Identifier:	<u>0167-1403 -</u>	Sample Identifier:	<u>0167-1403 -</u>
Sample Date and Time:		Sample Date and Time:	
Replicate ID (if applicable)		Replicate ID (if applicable)	
Field Measured Parameters		Field Measured Parameters	
Temperature:		Temperature:	
Specific Conductivity (SPC):		Specific Conductivity (SPC):	
pH:		pH:	
Turbidity:		Turbidity:	
Site Conditions		Site Conditions	
flow level:		flow level:	
turbidity (clear, light, mod, high):		turbidity (clear, light, mod, high):	
ice thickness (if applicable)		ice thickness (if applicable)	
Notes	Photo Numbers	Notes	Photo Numbers
(if pit Incl. DO and Ice thickness)	Upstream:	(if pit Incl. DO and Ice thickness)	Upstream:
	Downstream:		Downstream:
	Overview:		Overview:
	Datasheet:		Datasheet:

Field Blank ID \_\_\_\_\_  
 Trip Blank ID \_\_\_\_\_



## APPENDIX D      Q4 SURFACE WATER HYDROLOGY DATA

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Table D-1. Hydrometric Instrument Accuracy.

Units	Instrument Accuracy
Acoustic Doppler Velocimeter (ADV)	± 1%
Swoffer Current Meter	± 1%
Staff Gauge	± 1 mm
Survey Rod	± 1 mm
Measuring Tape	± 1 mm
YSI ProPlus Multi-Meter - Temperature	± 0.2 °C
YSI ProPlus Multi-Meter - Specific Conductivity	0.5% of reading or 0.001 µs/cm, whichever is greater
Stop Watch	± 0.01 s
HOBO Pressure Transducer- Pressure	± .03 kPa ; ± 0.003 m
HOBO Pressure Transducer- Temperature	± 0.37 (at 20C) (-20 to -50C Op. Range)
Solinst Barologger	± 0.001 m
Solinst Pressure Transducer - Pressure	± 0.003 m
Solinst Pressure Transducer - Temperature	± 0.05 °C (-10 to +40 C Comp. Range)
Graduated Bucket	± .5 L
Lab Scale	± 0.00005 kg



Table D-2. Hydrometric station monitoring record from Q1 (April 1) through Q3 (December 31), 2013.

HID	Monitoring Start	Q1		Q2		Q3		Q4		Logger Type	Rating Curve Status <sup>1</sup>	Method
		Measurements	Measurements	Measurements	Measurements	Measurements	Measurements	Measurements	Measurements			
		# Q	# Rating	# Q	# Rating	# Q	# Rating	# Q	# Rating			
ATM-DC-2	N/A	N/A	N/A	N/A	N/A					HOBO	N/A	N/A
ATM-DC-3	N/A	N/A	N/A	N/A	N/A					HOBO	N/A	N/A
ATM-DC-4	N/A	N/A	N/A	N/A	N/A					Solinst	N/A	N/A
H-PC-U	01-May-12	7	5	3	3					Solinst	P	SS,V
H-PC-DSP	07-Jun-11	6	5	3	3					HOBO	P	SS, V
H-DC-DX	01-May-12	5	N/A	3	N/A					HOBO	N/A	SS, V
H-DX+105	01-May-12	8	N/A	3	N/A					HOBO	N/A	SS, V
H-TP	21-Aug-12	N/A	N/A	N/A	N/A					HOBO	N/A	SG
H-SEEP	17-Apr-12	5	N/A	3	N/A					HOBO	N/A	V, Flow Meter
H-DC-B	17-Apr-12	6	3	3	3	3	0	0	0	Solinst	P	SS
H-DC-M	17-Apr-12	7	5	3	3	3	1	3	0	Solinst	P	SS
H-DC-R	01-May-12	3	2	3	3	3	0	0	0	Solinst	P	ADV, SS, V
H-BC	30-Apr-12	6	6	3	3	3	0	0	0	HOBO	P	ADV, SS
H-MN	17-Apr-12	7	6	3	3	3	1	0	0	HOBO	P	ADV, SS
H-VC-REF	17-Nov-11	6	6	3	3	3	1	1	0	HOBO	P	ADV, SS
H-VC-U	16-Apr-12	8	6	3	3	3	1	3	0	Solinst	P	ADV, SS
H-VC-DBC	11-Dec-12	9	7	3	3	3	2	3	0	Solinst	P	ADV, SS
H-VC-UMN	14-Apr-12	9	6	3	3	3	2	3	0	HOBO	P	ADV, SS
H-VC-R	02-May-12	8	6	3	3	3	2	3	0	Solinst	P	ADV, SS

Q - Discharge  
P – preliminary  
SS – Salt Slug, V – volumetric, ADV – acoustic Doppler velocimeter, Flow Meter – Flow master totalizer.



Table D-3 Hydrometric data summary for station visits between April 1 and March 31, 2014.

Mid	HID	Measurement		Measurement	Staff Gauge	Discharge	Water Surface Elevation	Data
		Date	Time					
		(DD/MM/YYYY)	(HH:MM)					
741	H-BC	16/05/2013	13:20	ADV	0.445	0.340	2.082	
742	H-BC	16/05/2013	13:20	SS	0.18	0.180	2.082	
760	H-BC	22/05/2013	12:25	SS	0.298	0.616	1.926	
770	H-BC	28/05/2013	15:33	ADV	0.38	0.292	2.009	
789	H-BC	11/06/2013	12:42	SS	0.26	0.110	1.925	
810	H-BC	25/06/2013	11:54	SS	0.198	0.017	1.849	
824	H-BC	16/07/2013	12:36	SS	0.172	0.003	1.833	
835	H-BC	14/08/2013	10:45	SS	0.191	0.015	1.68	
871	H-BC	24/09/2013	12:20	SS	0.27	0.053	1.931	
865	H-BC	16/10/2013	13:48	SS	0.425	0.006	2.093	B
719	H-DC-B	06/05/2013	17:00	SS		0.022		
732	H-DC-B	15/05/2013	11:20	SS		0.119		B
750	H-DC-B	21/05/2013	14:44	SS		0.107		
766	H-DC-B	27/05/2013	15:40	SS	0.21	0.304	1.571	
784	H-DC-B	10/06/2013	16:31	SS	0.159	0.427	1.52	
804	H-DC-B	24/06/2013	14:36	SS	0.108	0.021	1.46	
816	H-DC-B	15/07/2013	15:21	SS	0.088	0.016	1.432	
845	H-DC-B	13/08/2013	14:24	SS	0.09	0.005	1.441	
880	H-DC-B	23/09/2013	15:18	SS	0.146	0.028	1.503	
858	H-DC-B	15/10/2013	15:17	SS	0.172	0.012	1.518	B
899	H-DC-B	12/11/2013	16:20	SS		0.000		B/X
761	H-DC-D1	29/05/2013	11:52	SS		0.012		B
764	H-DC-D1B	29/05/2013	11:11	SS		0.010		B
782	H-DC-D1B	10/06/2013	19:02	SS		0.003		
801	H-DC-D1b	25/06/2013	16:20	SS		0.007		



Mid	HID	Measurement		Measurement	Staff Gauge	Discharge	Water Surface Elevation	Data
		Date	Time					Flag
		(DD/MM/YYYY)	(HH:MM)					Type
820	H-DC-D1b	16/07/2013	17:54	SS		0.001		
840	H-DC-D1b	14/08/2013	14:58	SS		0.003		
885	H-DC-D1b	23/09/2013	18:17	SS		0.025		
855	H-DC-D1B	16/10/2013	18:21	SS		0.014		B
890	H-DC-D1b	14/11/2013	09:44	SS		0.000		B/X
758	H-DC-DX	21/05/2013	18:25	SS		0.003		
762	H-DC-DX	29/05/2013	13:44	SS		0.002		
779	H-DC-DX	12/06/2013	12:31	SS		0.002		
780	H-DC-DX	12/06/2013	12:31	V		0.002		
799	H-DC-DX	25/06/2013	17:40	V	0.00014			
827	H-DC-DX	16/07/2013	18:00	V		0.000		
888	H-DC-DX	23/09/2013	18:46	V		0.001		
717	H-DC-DX+105	06/05/2013	17:42	SS		0.002		
729	H-DC-DX+105	15/05/2013	15:06	SS		0.015		B
730	H-DC-DX+105	15/05/2013	15:06	V		0.007		B
747	H-DC-DX+105	21/05/2013	17:41	SS		0.011		B
748	H-DC-DX+105	21/05/2013	17:41	V		0.002		B
763	H-DC-DX+105	29/05/2013	12:57	SS		0.025		
781	H-DC-DX+105	11/06/2013	19:17	SS		0.005		
800	H-DC-DX+105	25/06/2013	17:17	SS		0.002		
832	H-DC-DX+105	16/07/2013	18:41	SS		0.002		
850	H-DC-DX+105	13/08/2013	17:57	SS		0.003		
886	H-DC-DX+105	23/09/2013	18:46	SS		0.002		
889	H-DC-DX+105	14/11/2013	10:40	SS		0.002		B
905	H-DC-DX+105	17/12/2013	11:18	SS		0.002		B/X
920	H-DC-DX+105	13/01/2014	17:07	SS		0.002		B





Mid	HID	Measurement		Measurement	Staff Gauge	Discharge	Water Surface Elevation	Data
		Date	Time					
		(DD/MM/YYYY)	(HH:MM)					
854	H-DC-DX+105/205	16/10/2013	19:26	SS		0.001		B
706	H-DC-M	15/04/2013	16:18	SS		0.000		B/E
720	H-DC-M	06/05/2013	15:53	NONE				
731	H-DC-M	15/05/2013	10:58	SS	0.1308	0.131	1.762	B
749	H-DC-M	21/05/2013	13:55	SS	0.24	0.456	1.707	
767	H-DC-M	27/05/2013	14:30	SS	0.332	0.210		
785	H-DC-M	10/06/2013	15:48	SS	0.208	0.104	1.667	
805	H-DC-M	24/06/2013	14:00	SS	0.181	0.019	1.62	
815	H-DC-M	15/07/2013	14:25	SS	0.167	0.009	1.628	
846	H-DC-M	13/08/2013	13:34	SS	0.15	0.007	1.638	
879	H-DC-M	23/09/2013	14:41	SS	0.18	0.073	1.67	
860	H-DC-M	15/10/2013	14:31	SS	0.158	0.017	1.651	B
898	H-DC-M	12/11/2013	15:28	SS	0.129	0.014	1.627	B
906	H-DC-M	17/12/2013	09:12	SS		0.007		B/X
921	H-DC-M	13/01/2014	14:15	SS		0.007	1.622	B
915	H-DC-M	10/02/2014	16:50	SS		0.007	1.618	B
937	H-DC-M	10/03/2014	16:45	SS		0.004		B
721	H-DC-R	06/05/2013	14:58	NONE				
786	H-DC-R	10/06/2013	14:41	SS	0.35	0.064	0.696	
806	H-DC-R	24/06/2013	13:10	SS	0.146	0.024	0.44	
823	H-DC-R	15/07/2013	13:27	SS	0.085	0.013	0.364	
847	H-DC-R	13/08/2013	12:50	SS	0.103	0.012	0.401	
877	H-DC-R	23/09/2013	13:45	SS	0.285	0.085	0.571	
861	H-DC-R	15/10/2013	13:27	SS	0.284	0.011	0.582	B
897	H-DC-R	12/11/2013	14:08	SS		0.004		B



Mid	HID	Measurement		Measurement	Staff Gauge	Discharge	Water Surface Elevation	Data
		Date	Time					
		(DD/MM/YYYY)	(HH:MM)					
802	H-DC-U1	24/06/2013	15:23	SS		0.004		
829	H-DC-U1	15/07/2013	16:22	SS		0.002		
844	H-DC-U1	13/08/2013	15:21	SS		0.002		
882	H-DC-U1	23/09/2013	16:06	SS		0.013		
856	H-DC-U1	15/10/2013	16:13	SS		0.002		B
900	H-DC-U1	12/11/2013	16:45	SS		0.000		B/X
765	H-DC-U2	27/05/2013	16:24	SS		0.060		B
783	H-DC-U2	10/06/2013	17:45	SS		0.025		
803	H-DC-U2	24/06/2013	15:55	SS		0.016		
830	H-DC-U2	15/07/2013	17:10	SS		0.006		
843	H-DC-U2	13/08/2013	15:50	SS		0.007		
881	H-DC-U2	23/09/2013	16:20	SS		0.007		
857	H-DC-U2	15/10/2013	16:55	SS		0.007		B
901	H-DC-U2	12/11/2013	17:06	SS		0.000		B/X
740	H-MN	16/05/2013	08:37	ADV		0.353		B
739	H-MN	16/05/2013	08:37	SS		0.076		B
759	H-MN	22/05/2013	08:44	SS	0.918	0.010	1.474	
773	H-MN	28/05/2013	09:56	ADV	0.526	0.087	1.061	
774	H-MN	28/05/2013	09:56	SS	0.526	0.048	1.061	
792	H-MN	11/06/2013	09:37	SS	0.552	0.156	1.087	
812	H-MN	25/06/2013	08:16	SS	0.424	0.030	0.965	
818	H-MN	16/07/2013	08:49	SS	0.39	0.018	0.938	
839	H-MN	14/08/2013	08:00	ADV	0.43	0.038	0.985	
875	H-MN	24/09/2013	08:00	ADV	0.538	0.123	1.098	
867	H-MN	16/10/2013	09:16	SS	0.448	0.008	1.009	B
904	H-MN	13/11/2013	09:40	SS		0.045		B



Mid	HID	Measurement		Measurement	Staff Gauge	Discharge	Water Surface Elevation	Data
		Date	Time					
		(DD/MM/YYYY)	(HH:MM)					
722	H-PC-DSP	08/05/2013	09:35	V		0.000		
736	H-PC-DSP	15/05/2013	12:41	SS	0.328	0.019	2.524	
752	H-PC-DSP	21/05/2013	15:31	SS	0.28	0.004	2.472	
778	H-PC-DSP	28/05/2013	18:50	SS	0.304	0.016	2.499	
796	H-PC-DSP	12/06/2013	09:46	SS	0.234	0.008	2.405	
798	H-PC-DSP	24/06/2013	17:45	V	0.165	0.001	2.351	
826	H-PC-DSP	16/07/2013	16:51	V	0.13	0.000	2.432	
842	H-PC-DSP	13/08/2013	16:25	V	0.149	0.000	2.329	
883	H-PC-DSP	23/09/2013	16:51	V	0.268	0.005	2.435	
853	H-PC-DSP	16/10/2013	17:08	V	0.244	0.002	2.422	B
734	H-PC-U	15/05/2013	13:33	SS		0.019		B
735	H-PC-U	15/05/2013	13:33	V		0.003		B
751	H-PC-U	21/05/2013	16:20	SS	0.292	0.011	2.465	
776	H-PC-U	27/05/2013	18:26	SS	0.355	0.023	2.526	
777	H-PC-U	27/05/2013	18:26	V	0.355	0.001	2.526	
795	H-PC-U	12/06/2013	10:48	SS	0.239	0.008	2.577	
797	H-PC-U	24/06/2013	18:07	SS	0.173	0.001	2.432	
817	H-PC-U	15/07/2013	18:15	V	0.152	0.000	2.396	
841	H-PC-U	13/08/2013	17:10	SS	0.201	0.002	2.45	
884	H-PC-U	23/09/2013	17:15	SS	0.27	0.009	2.51	
852	H-PC-U	15/10/2013	18:07	SS	0.288	0.002	2.529	B
902	H-PC-U	12/11/2013	18:26	SS		0.001		B
712	H-SEEP	17/04/2013	12:04	V		0.003		B/E
718	H-SEEP	08/05/2013	09:47	V		0.003		
733	H-SEEP	15/05/2013	11:00	V		0.003		
794	H-SEEP	11/06/2013	16:53	V		0.002		



Mid	HID	Measurement		Measurement	Staff Gauge	Discharge	Water Surface Elevation	Data
		Date	Time					
		(DD/MM/YYYY)	(HH:MM)					
814	H-SEEP	25/06/2013	15:07	V		0.003		
821	H-SEEP	16/07/2013	15:45	V		0.003		
833	H-SEEP	13/08/2013	13:05	V	0.4	0.003		
876	H-SEEP	24/09/2013	15:55	V		0.004		
869	H-SEEP	16/10/2013	18:58	V		0.005		
892	H-Seep	13/11/2013	17:05	V		0.003		B
912	H-SEEP	17/12/2013	10:00	V		0.003		X
930	H-SEEP	13/01/2014	15:13	V		0.002		B
935	H-SEEP	10/03/2014	13:00	V		0.003		B
714	H-VC-DBC	16/04/2013	13:46	ADV		0.061		B/E
709	H-VC-DBC	16/04/2013	13:45	SS		0.030		B/E
725	H-VC-DBC	07/05/2013	12:18	ADV	0.462	0.210	1.815	
726	H-VC-DBC	07/05/2013	12:19	SS	0.426	0.150	1.815	
746	H-VC-DBC	16/05/2013	11:50	ADV	0.725	2.612	2.085	
757	H-VC-DBC	22/05/2013	10:40	ADV	0.564	0.801	1.885	
771	H-VC-DBC	28/05/2013	14:05	ADV	0.79	2.080	2.155	
790	H-VC-DBC	11/06/2013	11:10	ADV	0.528	0.565	1.878	
809	H-VC-DBC	25/06/2013	10:30	ADV	0.432	0.230	1.767	
828	H-VC-DBC	16/07/2013	11:00	ADV	0.381	0.114	1.721	
837	H-VC-DBC	14/08/2013	09:53	ADV	0.455	0.313	1.792	
873	H-VC-DBC	24/09/2013	10:50	ADV	0.568	0.785	1.895	
864	H-VC-DBC	16/10/2013	11:56	ADV	0.478	0.385	1.815	B
894	H-VC-DBC	13/11/2013	12:57	ADV		0.237	1.554	B
895	H-VC-DBC	13/11/2013	12:58	SS		0.200	1.554	B
909	H-VC-DBC	17/12/2013	15:00	SS		0.204		B/X
925	H-VC-DBC	14/01/2014	12:30	ADV		0.104	1.784	B



Mid	HID	Measurement		Measurement	Staff Gauge	Discharge	Water Surface Elevation	Data
		Date	Time					
		(DD/MM/YYYY)	(HH:MM)					
926	H-VC-DBC	14/01/2014	12:37	SS		0.170	1.784	B
917	H-VC-DBC	11/02/2014	11:10	SS		0.148	1.812	B
933	H-VC-DBC	11/03/2014	12:00	ADV		0.045		B
932	H-VC-DBC	11/03/2014	12:00	SS		0.018		B
716	H-VC-R	15/04/2013	13:00	ADV		0.034		B/E
711	H-VC-R	15/04/2013	13:00	SS,		0.040		B/E
727	H-VC-R	06/05/2013	13:05	ADV	0.362	0.122	1.928	
728	H-VC-R	06/05/2013	13:05	SS	0.362	0.100	1.928	
745	H-VC-R	15/05/2013	08:15	ADV	0.674	3.208	2.314	
754	H-VC-R	21/05/2013	12:23	ADV	0.656	1.221	2.222	
775	H-VC-R	27/05/2013	12:53	ADV	0.71	3.597	2.303	
793	H-VC-R	10/06/2013	13:23	ADV	0.55	0.735	2.114	
813	H-VC-R	24/06/2013	12:02	ADV	0.488	0.289	2.053	
831	H-VC-R	15/07/2013	12:23	ADV	0.457	0.160	2.015	
848	H-VC-R	13/08/2013	11:45	ADV	0.5	0.370	2.07	
878	H-VC-R	23/09/2013	12:30	ADV	0.575	0.949	2.136	
868	H-VC-R	15/10/2013	12:09	ADV	0.523	0.379	2.091	B
896	H-VC-R	12/11/2013	12:54	ADV	0.586	0.296	2.152	B
911	H-VC-R	16/12/2013	16:05	SS		0.253		B/X
929	H-VC-R	13/01/2014	13:04	SS		0.170	1.986	B
919	H-VC-R	10/02/2014	15:00	SS		0.063	1.919	B
936	H-VC-R	10/03/2014	14:54	ADV		0.030		B
707	H-VC-REF	16/04/2013	18:02	SS		0.080		B/E
744	H-VC-REF	16/05/2013	14:30	ADV	0.801	2.074	2.096	
755	H-VC-REF	22/05/2013	13:43	ADV	0.539	0.679	1.848	
768	H-VC-REF	28/05/2013	16:33	ADV	0.87	2.026	2.208	



Mid	HID	Measurement		Measurement	Staff Gauge	Discharge	Water Surface Elevation	Data
		Date	Time					
		(DD/MM/YYYY)	(HH:MM)					
787	H-VC-REF	11/06/2013	13:11	ADV	0.55	0.540	1.846	
807	H-VC-REF	25/06/2013	12:01	ADV	0.395	0.186	1.696	
825	H-VC-REF	16/07/2013	12:43	ADV	0.351	0.108	1.573	
834	H-VC-REF	14/08/2013	10:55	ADV	0.449	0.279	1.758	
870	H-VC-REF	24/09/2013	12:50	ADV	0.604	0.750	1.927	
862	H-VC-REF	16/10/2013	14:00	ADV	0.638	0.530	1.94	B
893	H-VC-REF	13/11/2013	15:40	SS		0.357		B
907	H-VC-REF	17/12/2013	18:00	SS		0.256		B/X
922	H-VC-REF	14/01/2014	15:14	SS		0.164		B
713	H-VC-U	16/04/2013	15:59	ADV		0.062		B/E
708	H-VC-U	16/04/2013	15:59	SS		0.020		B/E
724	H-VC-U	07/05/2013	14:12	ADV	0.145	0.125	2.036	
743	H-VC-U	16/05/2013	12:33	ADV	0.448	2.136	2.329	
756	H-VC-U	22/05/2013	11:30	ADV	0.3	0.727	2.174	
769	H-VC-U	28/05/2013	14:51	ADV	0.495	2.701	2.354	
788	H-VC-U	11/06/2013	11:43	ADV	0.238	0.488	2.134	
808	H-VC-U	25/06/2013	11:11	ADV	0.169	0.208	2.066	
822	H-VC-U	16/07/2013	11:46	ADV	0.125	0.115	2.028	
836	H-VC-U	14/08/2013	10:20	ADV	0.198	0.278	2.086	
872	H-VC-U	24/09/2013	11:30	ADV	0.272	0.741	2.172	
863	H-VC-U	16/10/2013	12:40	ADV	0.212	0.405	2.117	B
891	H-VC-U	13/11/2013	14:30	ss		0.499	2.116	B
908	H-VC-U	17/12/2013	17:01	SS		0.064		B/X
923	H-VC-U	14/01/2014	13:52	ADV		0.087	2.049	B
924	H-VC-U	14/01/2014	14:12	SS		0.134	2.049	B
916	H-VC-U	11/02/2014	12:20	SS		0.061	1.957	B



Mid	HID	Measurement		Measurement	Staff Gauge	Discharge	Water Surface Elevation	Data
		Date	Time					
		(DD/MM/YYYY)	(HH:MM)					
934	H-VC-U	11/03/2014	14:14	ADV		0.013		B
938	H-VC-U	11/03/2014	14:14	SS		0.034		B
715	H-VC-UMN	16/04/2013	10:44	ADV		0.059		B/E
710	H-VC-UMN	16/04/2013	10:44	SS		0.120		B/E
723	H-VC-UMN	07/05/2013	10:11	ADV		0.162		
738	H-VC-UMN	16/05/2013	10:06	ADV	0.885	2.062	1.877	
737	H-VC-UMN	16/05/2013	10:06	SS	0.885	1.970	1.877	
753	H-VC-UMN	22/05/2013	09:15	ADV	0.685	0.448	1.615	
772	H-VC-UMN	28/05/2013	10:45	ADV	0.965	3.283	1.931	
791	H-VC-UMN	11/06/2013	09:56	ADV	0.711	0.662	1.692	
811	H-VC-UMN	25/06/2013	08:31	ADV	0.634	0.247	1.602	
819	H-VC-UMN	16/07/2013	09:11	ADV	0.594	0.126	1.572	
838	H-VC-UMN	14/08/2013	08:26	ADV	0.65	0.321	1.631	
874	H-VC-UMN	24/09/2013	10:07	ADV	0.745	0.783	1.72	
866	H-VC-UMN	16/10/2013	10:20	ADV	0.658	0.538	1.651	B
903	H-VC-UMN	13/11/2013	10:28	SS		0.788		B
910	H-VC-UMN	17/12/2013	13:30	SS		0.252		B/X
927	H-VC-UMN	14/01/2014	10:30	ADV		0.091		B
928	H-VC-UMN	14/01/2014	10:38	SS		0.157		B
918	H-VC-UMN	11/02/2014	09:40	SS		0.109		B
931	H-VC-UMN	11/03/2014	10:04	SS		0.003		B

Notes:

MID = Measurement ID , unique measurement identifier in the hydrometric database.

HID = Hydrometric ID, unique hydrometric station identifier in hydrometric database.

L.D. = Local datum.

Measurement types: ADV – acoustic Doppler velocimeter; SS – salt dilution, slug injection; V – volumetric; CM – current meter; W – weir; N – no measurement obtained.

Data Flag = B – Ice Present, X – Poor channel conditions not appropriate for discharge measurement, E – Estimated Value



Table D-4. Hydrometric survey data summary from April 1 to March 31, 2014.

Station	MID	Date	Time	BM 1 (m L.D.)	BM 2 (m L.D.)	BM 3 (m L.D.)	LoggerRod* (m L.D.)	TOS (m L.D.)	Water Surface (m L.D.)
H-BC	741	16/05/2013	13:50	3	3.002	3.036	2.879	2.644	2.082
H-BC	760	22/05/2013	13:05	3	3.002	3.037	2.88	2.644	1.924
H-BC	770	28/05/2013	16:00	3	3.004	3.037	2.881	2.645	2.009
H-BC	789	11/06/2013	13:03	3	2.947	3.038	2.879	2.644	1.925
H-BC	810	25/06/2013	12:00	3	3.015	3.05	2.886	2.651	1.849
H-BC	824	16/07/2013	13:10	3	3.012	3.063	2.898	2.663	1.833
H-BC	835	14/08/2013	10:55	3	3.005	3.059	2.9	2.665	1.86
H-BC	871	24/09/2013	12:40	3	3.005	3.055	2.9	2.666	1.93
H-BC	865	16/10/2013	13:51	3	3.003	3.057	2.899	2.665	2.093
H-DC-B	766	27/05/2013	17:45	3	3.358	2.996	2.526	2.349	1.577
H-DC-B	784	10/06/2013	16:41	3	3.357	2.996	2.525	1.773	1.52
H-DC-B	804	24/06/2013	14:40	3	3.356	2.994	2.934	2.344	1.46
H-DC-B	816	15/07/2013	15:30	3	3.357	2.994	2.934		1.432
H-DC-B	816	15/07/2013	15:38	3	3.357	2.995		2.351	
H-DC-B	845	13/08/2013	15:00	3	3.355	2.994	2.853	2.346	1.441
H-DC-B	880	23/09/2013	15:42	3		2.943	2.857	2.344	1.503
H-DC-B	858	15/10/2013	15:30	3	3.355	2.994	2.855	2.344	1.518
H-DC-M	720	06/05/2013	16:10	3	2.3125			2.4625	1.631
H-DC-M	731	15/05/2013	10:18	3	2.314			2.462	1.762
H-DC-M	749	21/05/2013	14:20	3	2.313	2.714	2.688	2.463	1.707
H-DC-M	785	10/06/2013	16:00	3	2.311	2.712	2.686	2.46	1.667
H-DC-M	805	24/06/2013	14:13	3	2.312	2.712	2.678	2.454	1.62
H-DC-M	815	15/07/2013	14:30	3	2.325	2.722	2.689	2.462	1.628
H-DC-M	845	13/08/2013	14:06	3	2.34	2.731	2.721	2.49	1.638
H-DC-M	879	23/09/2013	14:40	3	2.338	2.725	2.726	2.495	1.67
H-DC-M	860	15/10/2013	14:35	3	2.342	2.721	2.727	2.494	1.651





Station	MID	Date	Time	BM 1 (m L.D.)	BM 2 (m L.D.)	BM 3 (m L.D.)	LoggerRod* (m L.D.)	TOS (m L.D.)	Water Surface (m L.D.)
H-DC-M	898	12/11/2013	15:47	3	2.345	2.724	2.727	2.495	1.627
H-DC-M	921	13/01/2014	14:14	3	2.336	2.722	2.72	2.488	1.622
H-DC-M	915	10/02/2014	17:20	3	2.331	2.72	2.715		1.618
H-DC-M	937	10/03/2014	16:45	3	2.326	2.718	2.713	2.473	
H-DC-R	786	10/06/2013	14:55	3	2.936	2.323	1.693	1.296	0.696
H-DC-R	806	24/06/2013	13:26	3	2.939	2.322	2.061	1.284	0.44
H-DC-R	823	15/07/2013	13:27	3	2.948	2.317	1.675	1.28	0.364
H-DC-R	847	13/08/2013	13:21	3	2.965	2.323	1.697	1.299	0.401
H-DC-R	877	23/09/2013	13:45	3	2.95	2.308	1.691	1.294	0.571
H-DC-R	861	15/10/2013	13:25	3	2.959	2.305	1.693	1.297	0.582
H-MN	759	22/05/2013	09:15	3	2.322	2.726		1.548	1.474
H-MN	773	28/05/2013	09:30	3	2.331	2.725	2.088	1.546	1.061
H-MN	792	11/06/2013	10:05	3	2.332	2.717	2.064	1.55	1.087
H-MN	812	25/06/2013	08:30	3	2.328	2.711	2.068	1.548	0.965
H-MN	818	16/07/2013	08:55	3	2.309	2.708	2.069	1.548	0.938
H-MN	839	14/08/2013	08:10	3	2.308	2.705	1.875	1.555	0.985
H-MN	875	24/09/2013	08:32	3	2.303	2.704	2.082	1.55	1.098
H-MN	867	16/10/2013	09:27	3	2.297	2.702	2.088	1.569	1.009
H-PC-DSP	736	15/05/2013	12:41	3	3.216	3.686	3.449	3.2	2.524
H-PC-DSP	752	21/05/2013	16:06	3	3.247	3.686	3.448	3.2	2.472
H-PC-DSP	778	28/05/2013	19:02	3	3.217	3.675	3.451	3.202	2.499
H-PC-DSP	796	12/06/2013	10:06	3	3.216	3.643	3.436	3.186	2.405
H-PC-DSP	789	24/06/2013	17:56	3					
H-PC-DSP	798	24/06/2013	17:56		3.218	3.65	3.43	3.18	2.351
H-PC-DSP	826	16/07/2013	17:00	3	3.216	3.651	2.316	3.181	3.432
H-PC-DSP	842	13/08/2013	16:45	3	3.214	3.649	3.429	3.181	2.329
H-PC-DSP	883	23/09/2013	15:52	3	3.215	3.655	3.429	3.182	2.435



Station	MID	Date	Time	BM 1 (m L.D.)	BM 2 (m L.D.)	BM 3 (m L.D.)	LoggerRod* (m L.D.)	TOS (m L.D.)	Water Surface (m L.D.)
H-PC-DSP	853	15/10/2013	17:15	3	3.212	3.651	3.428	3.179	2.422
H-PC-U	751	21/05/2013	17:00	3	3.56	3.86	3.477		2.465
H-PC-U	751	21/05/2013	17:30	3	3.559	3.86	3.421		2.471
H-PC-U	776	27/05/2013	18:26	3	3.565	3.866	3.428	3.188	2.526
H-PC-U	795	12/06/2013	11:05	3	3.56	3.91	3.479	3.239	2.477
H-PC-U	797	24/06/2013	18:30	3	3.574	3.923	3.499	3.257	2.988
H-PC-U	817	15/07/2013	18:50	3	3.577	3.926	2.331	3.244	2.396
H-PC-U	841	13/08/2013	17:30	3	3.577	3.929	3.483	3.242	2.449
H-PC-U	884	23/09/2013	17:21	3	3.58	3.927	3.478	3.237	2.51
H-PC-U	852	15/10/2013	18:30	3	4.401	3.924	3.469	3.23	2.529
H-VC-DBC	709	16/04/2013	14:00	3	3.027	2.919		2.352	
H-VC-DBC	725	07/05/2013	13:10	3	3.027	2.918		2.3505	1.813
H-VC-DBC	757	22/05/2013	11:00	3	3.027	2.917	2.561	2.343	1.885
H-VC-DBC	771	28/05/2013	14:05	3	3.027	2.911	2.855	2.335	2.146
H-VC-DBC	790	11/06/2013	11:13	3	3.027	2.916	2.556	2.338	1.878
H-VC-DBC	808	25/06/2013	10:35		3.026	2.912	2.557	2.337	1.767
H-VC-DBC	809	25/06/2013	10:35	3					
H-VC-DBC	828	16/07/2013	11:15	3	3.026	2.912	2.557	2.338	1.721
H-VC-DBC	837	14/08/2013	09:53	3	3.025	2.908	2.555	2.338	1.792
H-VC-DBC	873	24/09/2013	11:15	3	3.027	2.903	2.559	2.341	1.894
H-VC-DBC	864	16/10/2013	12:00	3	3.024	2.906	2.554	2.336	1.815
H-VC-DBC	894	13/11/2013	13:29	3	3.025	2.909	2.557	2.34	2.554
H-VC-DBC	925	14/01/2014	13:10	3	3.027	2.916	2.568	2.35	1.784
H-VC-DBC	917	11/02/2014	11:06	3	3.028	2.916	2.571		1.812
H-VC-DBC	932	11/03/2014	12:06	3	3.026	2.916	2.571	2.354	
H-VC-R	711	15/04/2013	12:00	3	3.422	3.168		2.56	
H-VC-R	727	06/05/2013	14:20	3	3.4265	3.171		2.561	1.9305



Station	MID	Date	Time	BM 1 (m L.D.)	BM 2 (m L.D.)	BM 3 (m L.D.)	LoggerRod* (m L.D.)	TOS (m L.D.)	Water Surface (m L.D.)
H-VC-R	745	15/05/2013	14:30	3	3.422	3.169		2.624	2.314
H-VC-R	746	16/05/2013	11:50	3	3.027	2.918		2.345	2.085
H-VC-R	754	21/05/2013	12:53	3	3.422	3.168		2.625	2.222
H-VC-R	754	21/05/2013	13:20	3			2.779	2.559	2.221
H-VC-R	775	27/05/2013	13:00	3	3.423	3.171	2.785	2.565	2.303
H-VC-R	793	10/06/2013	13:20	3	3.423	3.17	2.79	2.568	2.114
H-VC-R	813	24/06/2013	12:40	3	3.424	3.169	2.79	2.568	2.053
H-VC-R	831	15/07/2013	12:23	3	3.425	3.17	2.791	2.568	2.015
H-VC-R	848	13/08/2013	12:30	3	3.425	3.17	2.791	2.57	2.07
H-VC-R	878	23/09/2013	12:30	3	3.415	3.168	2.789	2.518	2.136
H-VC-R	868	15/10/2013	12:18	3	3.423	3.17	2.791	2.569	2.091
H-VC-R	896	12/11/2013	13:06	3	3.42	3.166	2.805	2.565	2.152
H-VC-R	929	13/01/2014	13:15	3	3.422	3.168	2.812		1.986
H-VC-R	919	10/02/2014	15:45	3	3.425	3.168	2.821		1.921
H-VC-R	936	10/03/2014	15:52	3	3.427	3.167	2.81		
H-VC-REF	744	16/05/2013	14:30	3	2.968	3.047	2.504	2.31	2.096
H-VC-REF	755	22/05/2013	13:30	3	2.967	3.046	2.502		1.848
H-VC-REF	768	28/05/2013	16:50	3	2.967	3.048	2.535	2.303	2.208
H-VC-REF	787	11/06/2013	13:25	3	2.966	3.043	1.829	2.303	2.258
H-VC-REF	807	25/06/2013	12:40	3	2.964	3.041	2.573	2.302	1.696
H-VC-REF	825	16/07/2013	13:29	3	2.973	3.045	1.664	2.307	1.573
H-VC-REF	834	14/08/2013	11:40	3	2.983	3.044	2.624	1.322	1.758
H-VC-REF	870	24/09/2013	13:17	3	2.988	3.039	2.636	2.33	1.927
H-VC-REF	862	16/10/2013	14:00	3	2.994	3.036	2.637	2.332	1.94
H-VC-U	708	16/04/2013	17:00	3	3.362	3.244		2.888	
H-VC-U	724	07/05/2013	15:05	3	3.364	3.245		2.887	2.036
H-VC-U	724	07/05/2013	15:06	3	3.363	3.243		2.888	2.036



Station	MID	Date	Time	BM 1 (m L.D.)	BM 2 (m L.D.)	BM 3 (m L.D.)	LoggerRod* (m L.D.)	TOS (m L.D.)	Water Surface (m L.D.)
H-VC-U	743	16/05/2013	12:33	3	3.363	3.244		2.889	2.329
H-VC-U	756	22/05/2013	12:20	3	3.362	3.244	3.135	2.889	2.174
H-VC-U	769	28/05/2013	15:28	3	3.363	3.24	3.134	2.889	2.304
H-VC-U	788	11/06/2013	12:41	3	3.16	3.243	3.137	2.892	2.134
H-VC-U	808	25/06/2013	11:20	3	3.361	3.247	3.144	2.897	2.066
H-VC-U	822	16/07/2013	12:20	3	3.363	3.248	3.146	2.9	2.028
H-VC-U	836	14/08/2013	10:27	3	3.36	3.243	3.145	2.899	2.086
H-VC-U	872	24/09/2013	11:35	3	3.357	3.243	3.143	2.897	2.172
H-VC-U	863	16/10/2013	13:00	3	3.359	3.242	3.143	2.897	2.117
H-VC-U	891	13/11/2013	14:45	3	3.357	3.241	3.147	2.901	2.116
H-VC-U	923	14/01/2014	14:35	3	3.358	3.245	3.149	2.905	2.049
H-VC-U	916	11/02/2014	12:30	3	3.358	3.245	3.151		1.957
H-VC-U	934	11/03/2014	14:55	3	3.36	3.245	3.15	2.906	
H-VC-UMN	738	16/05/2013	10:06	3	3.007	2.678	2.199	1.983	1.877
H-VC-UMN	753	21/05/2013	09:51	3	3.006	2.679	2.198	1.99	1.615
H-VC-UMN	772	28/05/2013	11:45	3	3.006	2.677	2.201	1.986	1.931
H-VC-UMN	791	11/06/2013	10:30	3	3.007	2.678	2.203	1.983	1.692
H-VC-UMN	811	25/06/2013	09:18	3	3.007	2.678	2.203	1.984	1.602
H-VC-UMN	819	16/07/2013	09:48	3	3.008	2.677	1.203	1.986	1.572
H-VC-UMN	838	14/08/2013	08:30	3	3.005	2.676	2.209	1.989	1.631
H-VC-UMN	874	24/09/2013	10:07	3	2.999	2.642	2.203	2.035	1.72
H-VC-UMN	866	16/10/2013	10:16	3	3.003	2.676	2.206	1.99	1.651

Notes:

L.D. = Local datum.

TOS = Top of Staff Gauge

LoggerRod = Top of fixed-length data logger installation rod.

\*\*Zero flow elevation estimates obtained from the 2012/13 surface water and meteorological monitoring report.



Table D-5. Seepage Pond discharge volumetric measurements, April 1 to December 31, 2013.

HID	Measurement Date		Method	Discharge	
	Date	Time		m <sup>3</sup> /s	L/s
H-SEEP	17/04/2013	12:04	V	0.003	3
H-SEEP	08/05/2013	09:47	V	0.003	3
H-SEEP	15/05/2013	11:00	V	0.003	3
H-SEEP	11/06/2013	16:53	V	0.002	2
H-SEEP	25/06/2013	15:07	V	0.003	3
H-SEEP	16/07/2013	15:55	V	0.003	3
H-SEEP	13/08/2013	13:05	V	0.003	3
H-SEEP	24/09/2013	15:55	V	0.004	4
H-SEEP	16/10/2013	18:58	V	0.005	5
H-SEEP	13/11/2013	17:05	V	0.003	3
H-SEEP	17/12/2013	10:00	V	0.003	3
H-SEEP	13/01/2014	15:13	V	0.002	2
H-SEEP	No volumetric measurement taken; operating temperatures < -40°C.				
H-SEEP	10/03/2014	13:00	V	0.003	3

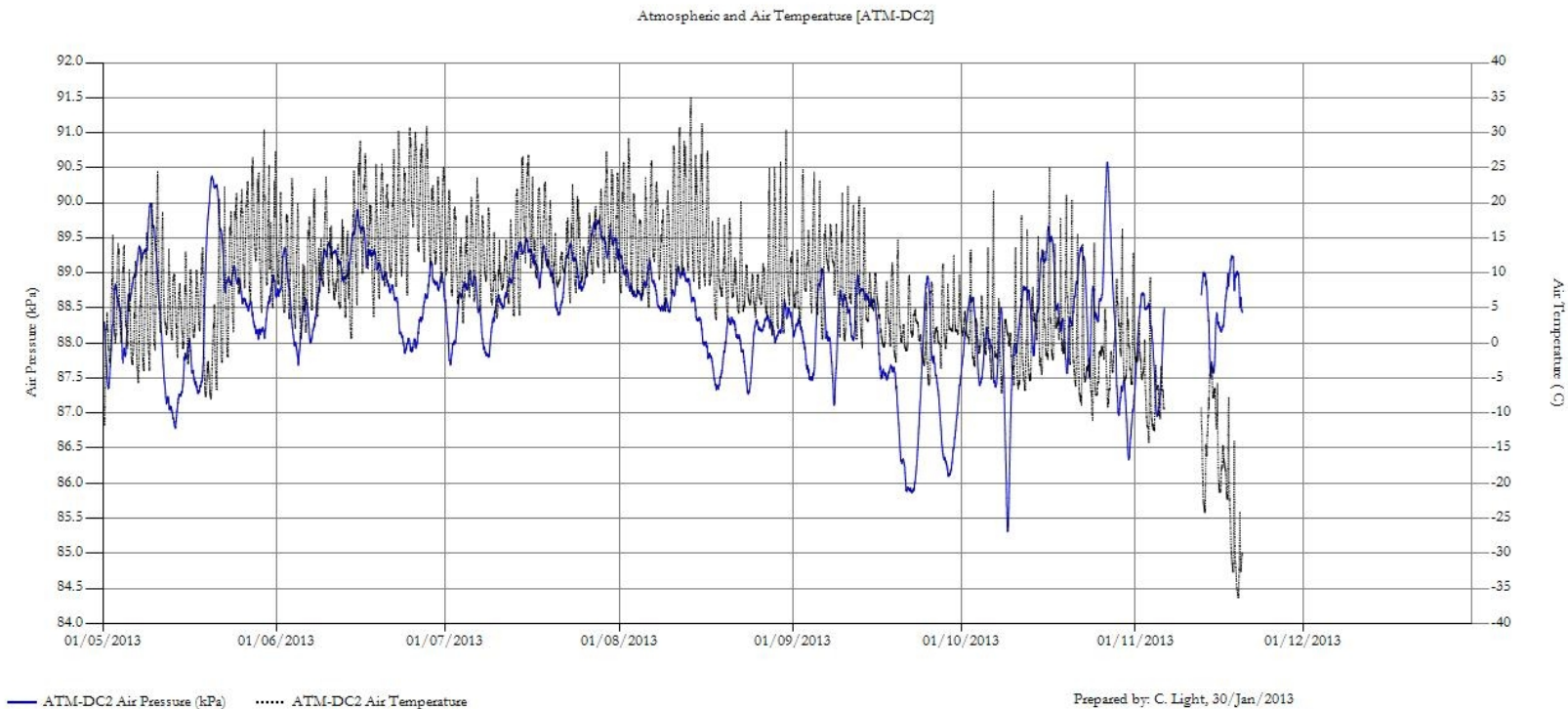


Figure D-1 ATM-DC2 atmospheric pressure and air temperature.

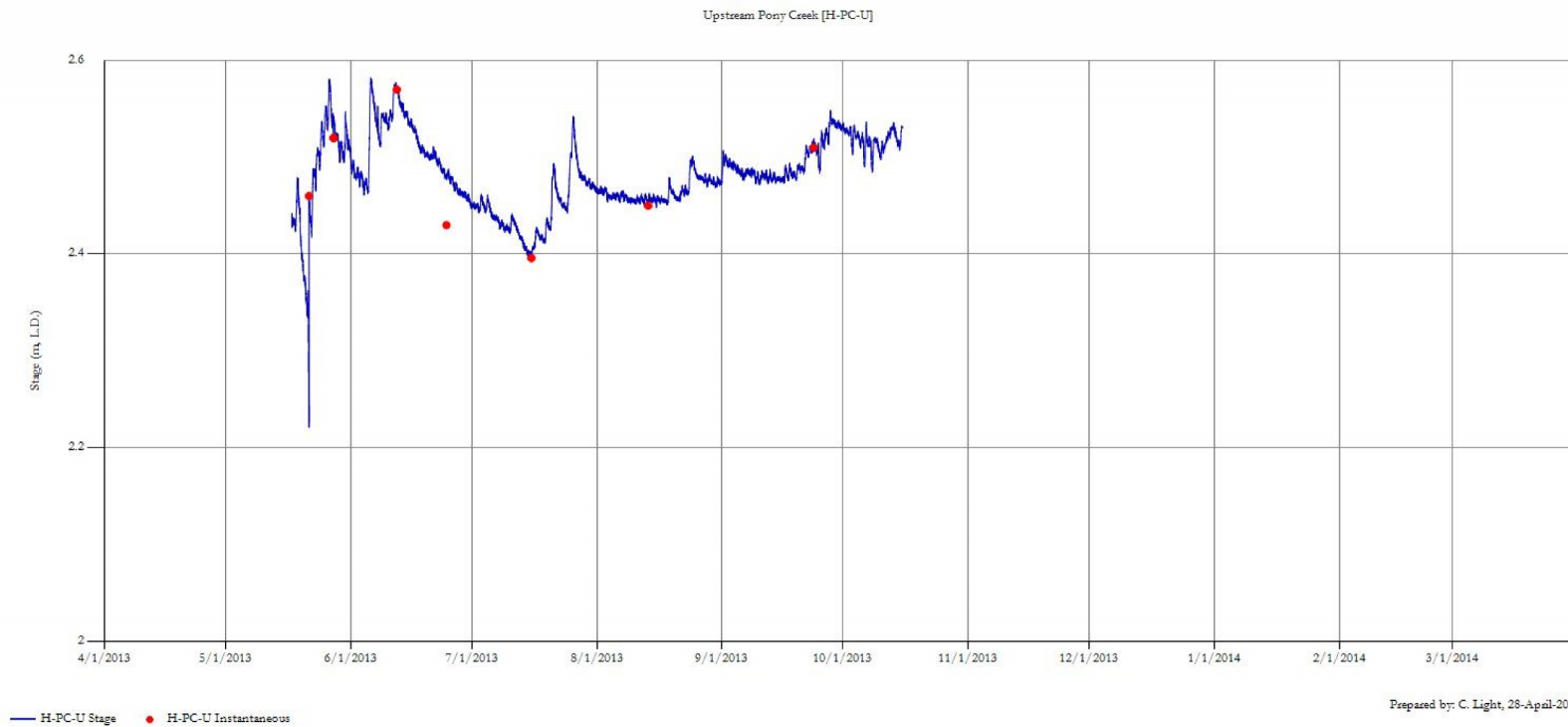


Figure D-2 H-PC-U Stage.

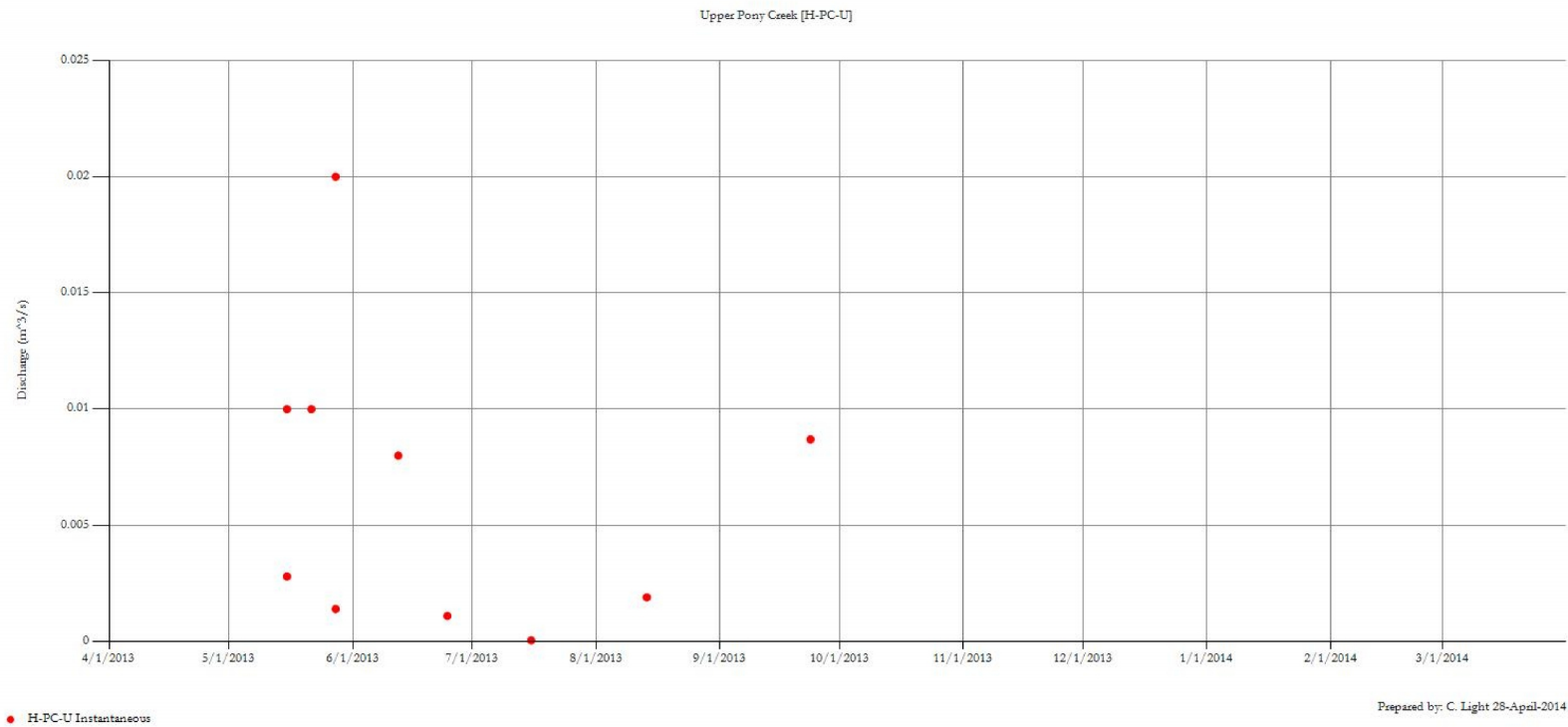


Figure D-3 H-PC-U Instantaneous Discharge.



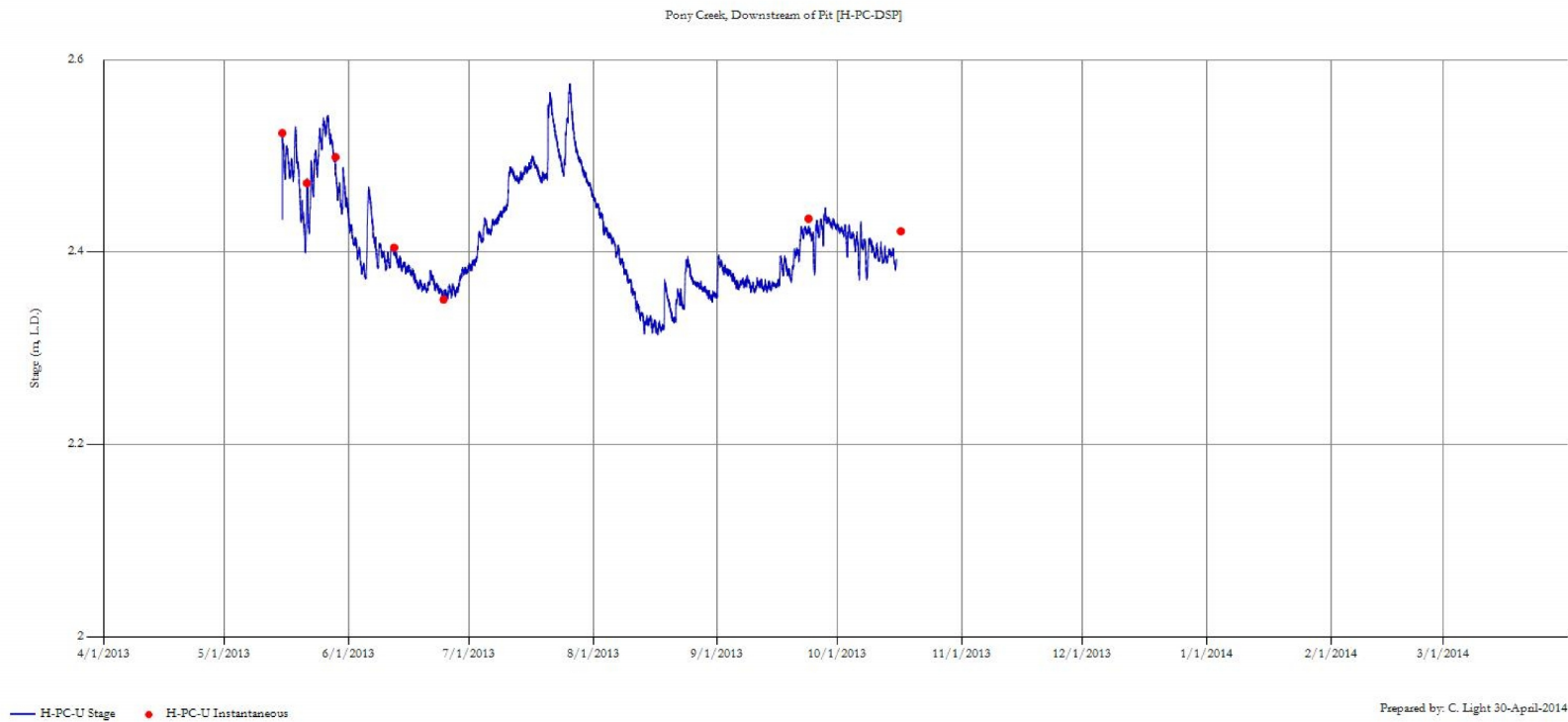


Figure D-4 H-PC-DSP Stage.

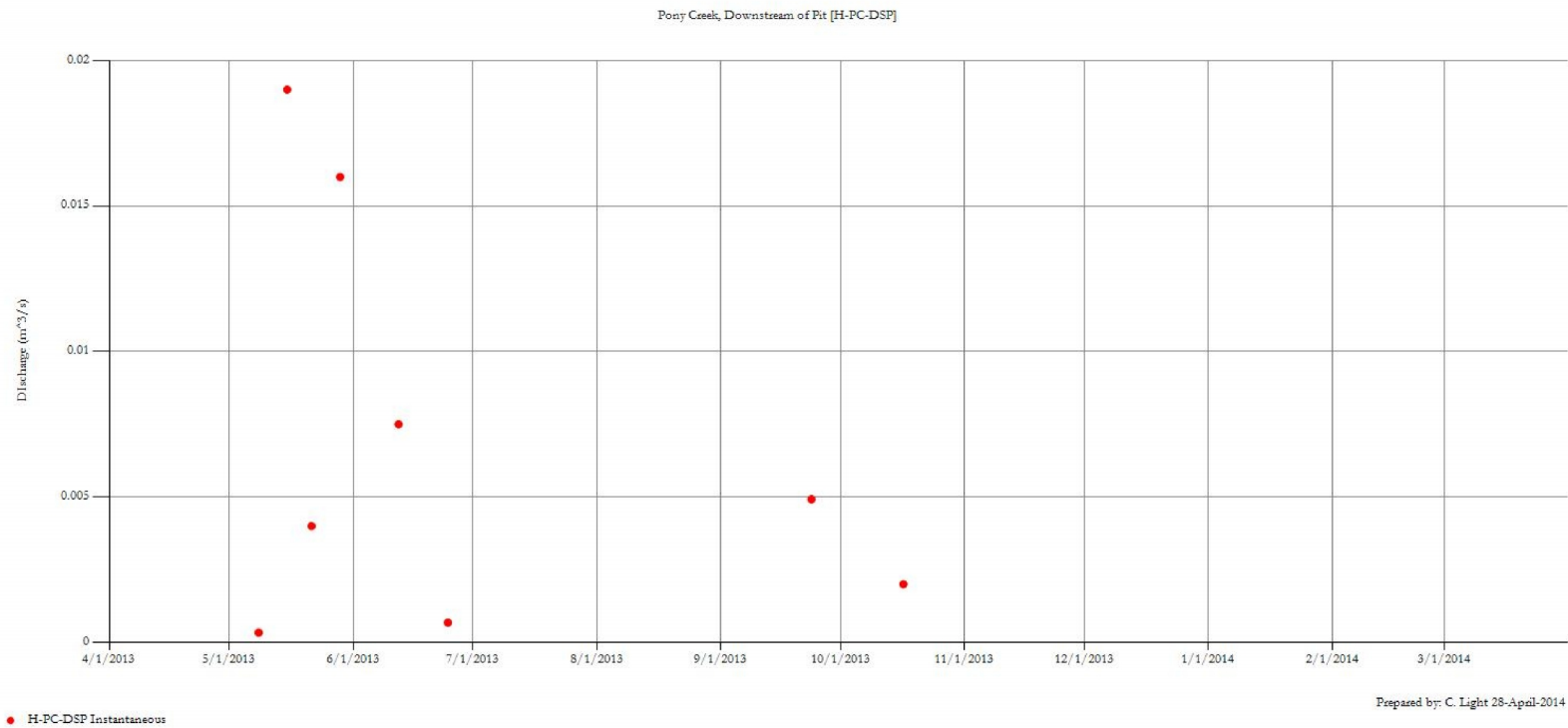


Figure D-5 H-PC-DSP Instantaneous Discharge.

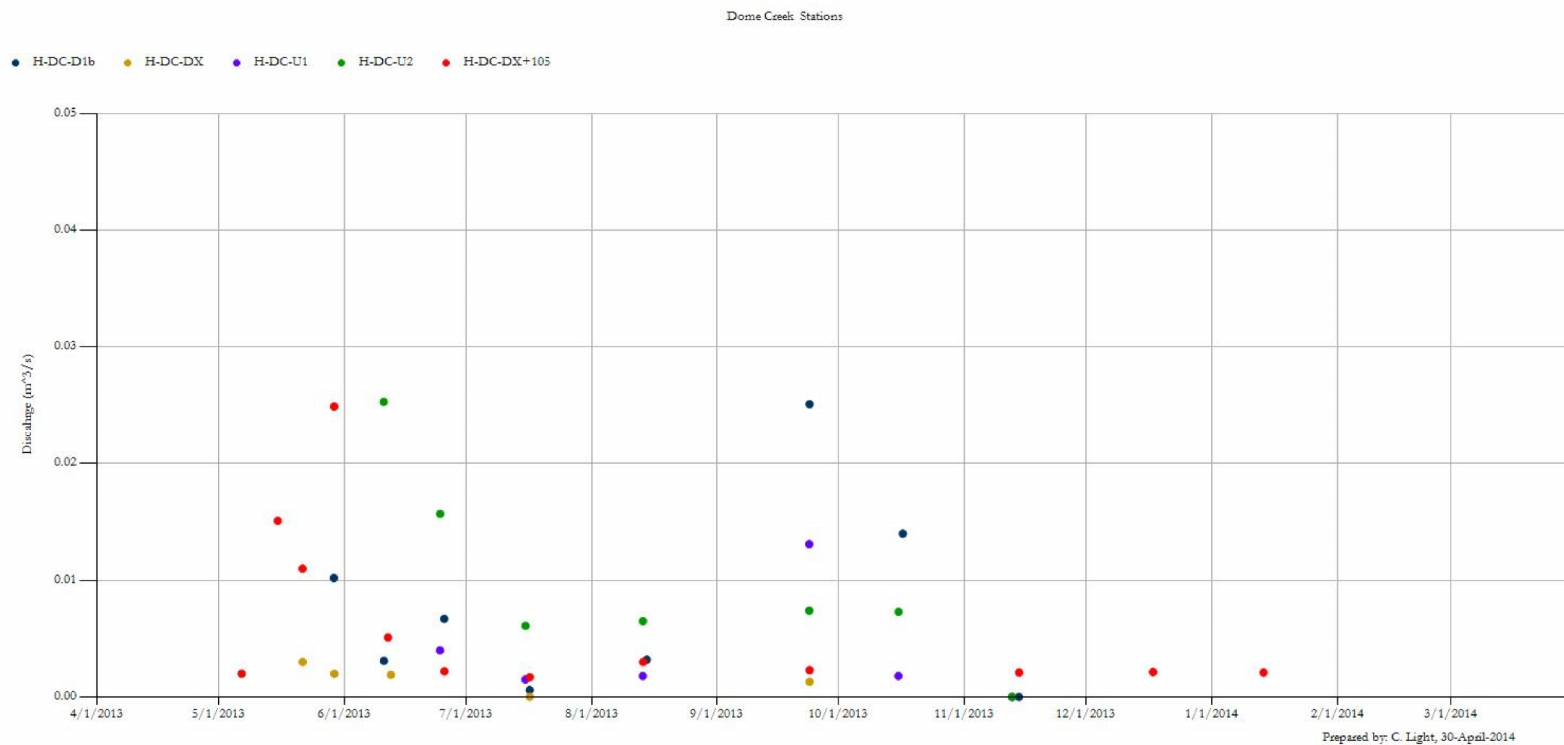


Figure D-6 Upper Dome Creek Instantaneous Discharge.

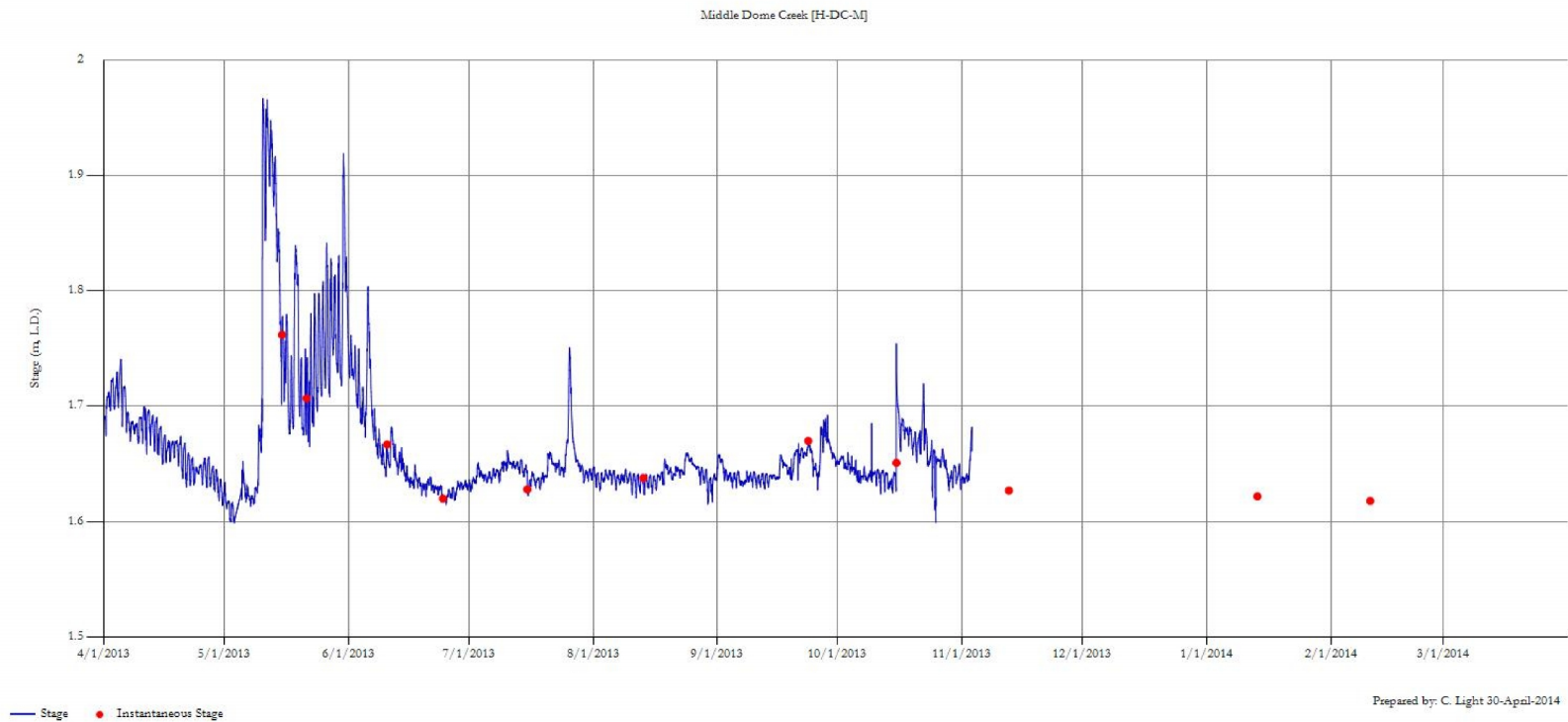


Figure D-7 H-DC-M Stage.

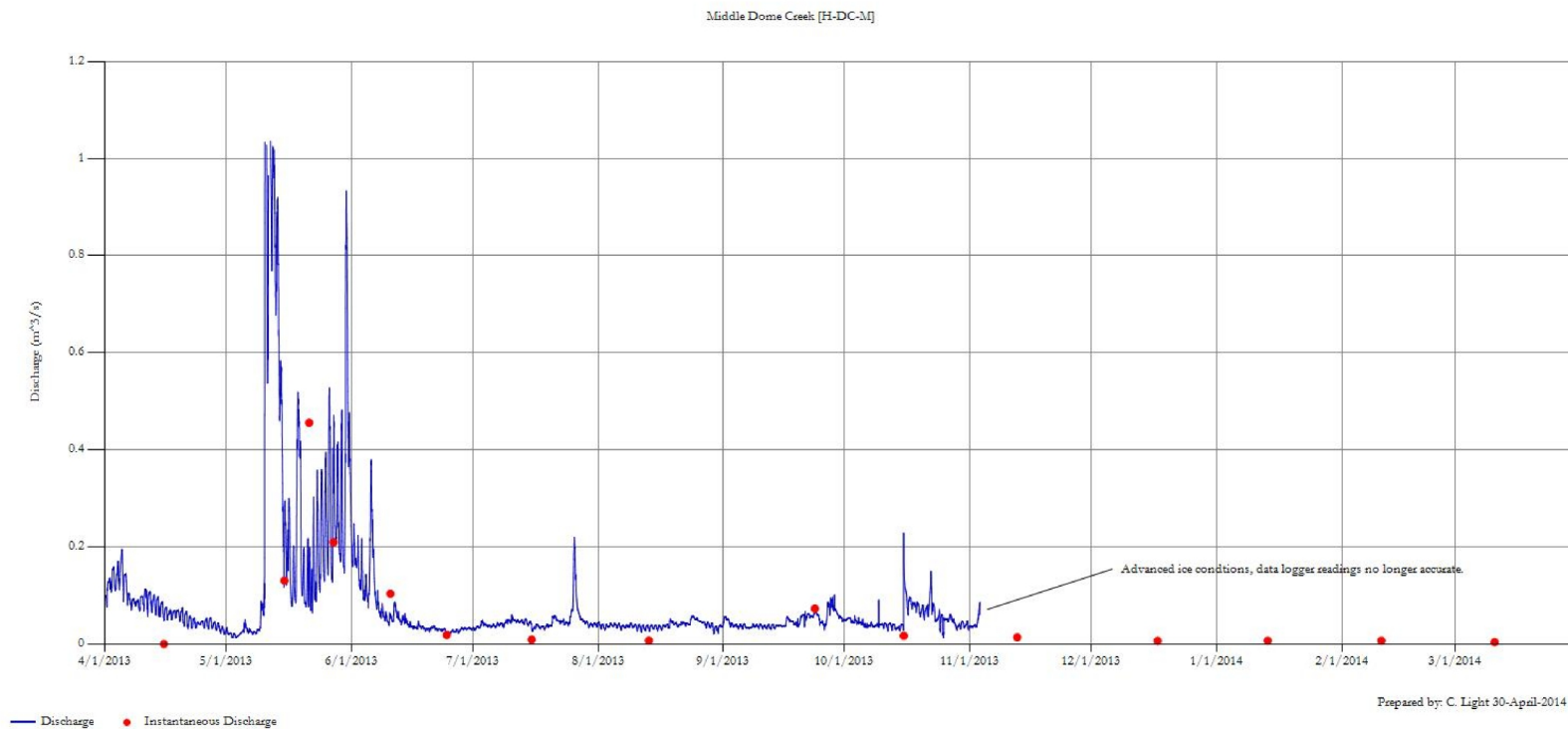


Figure D-8 H-DC-M Hydrograph.

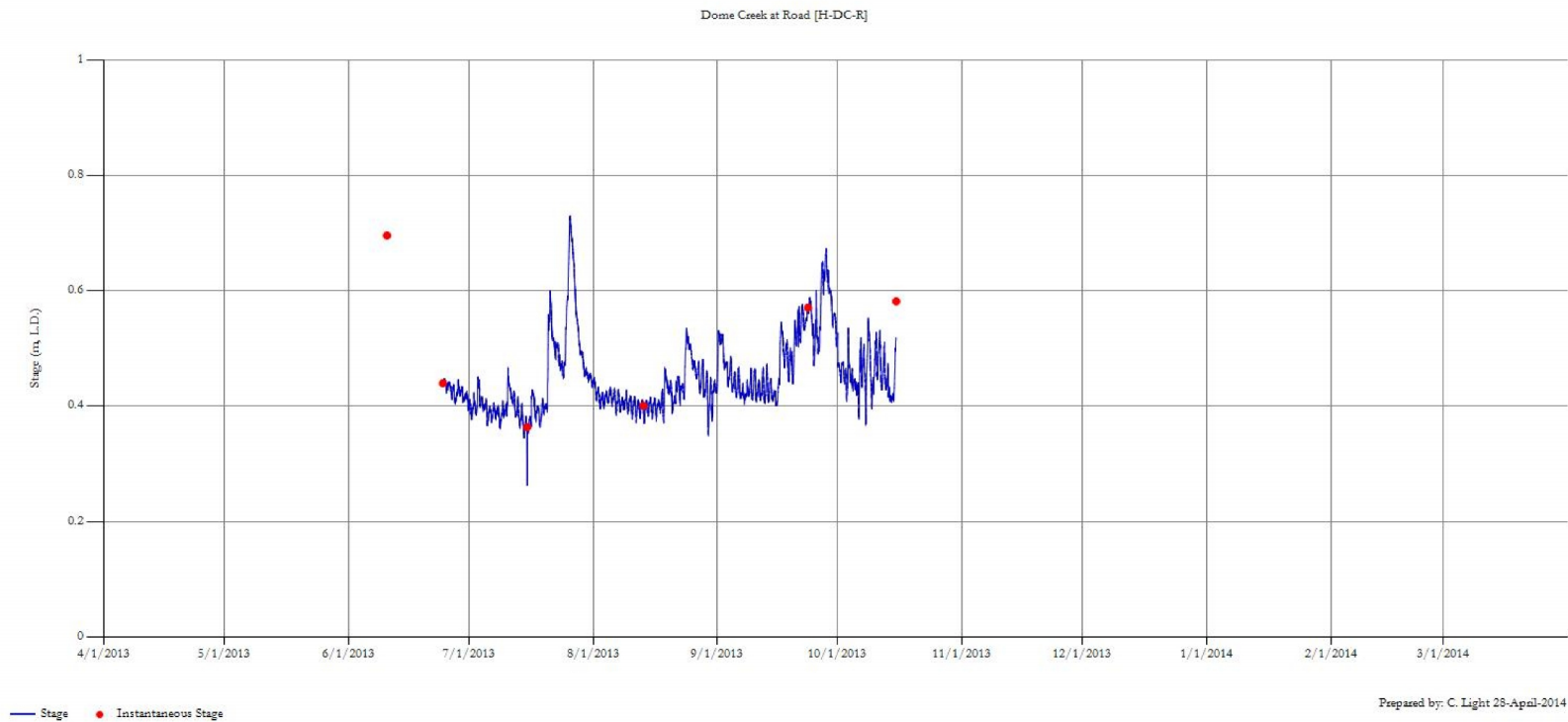


Figure D-9 H-DC-R Stage (note stage record started in May 2013, when continuous logger was installed).

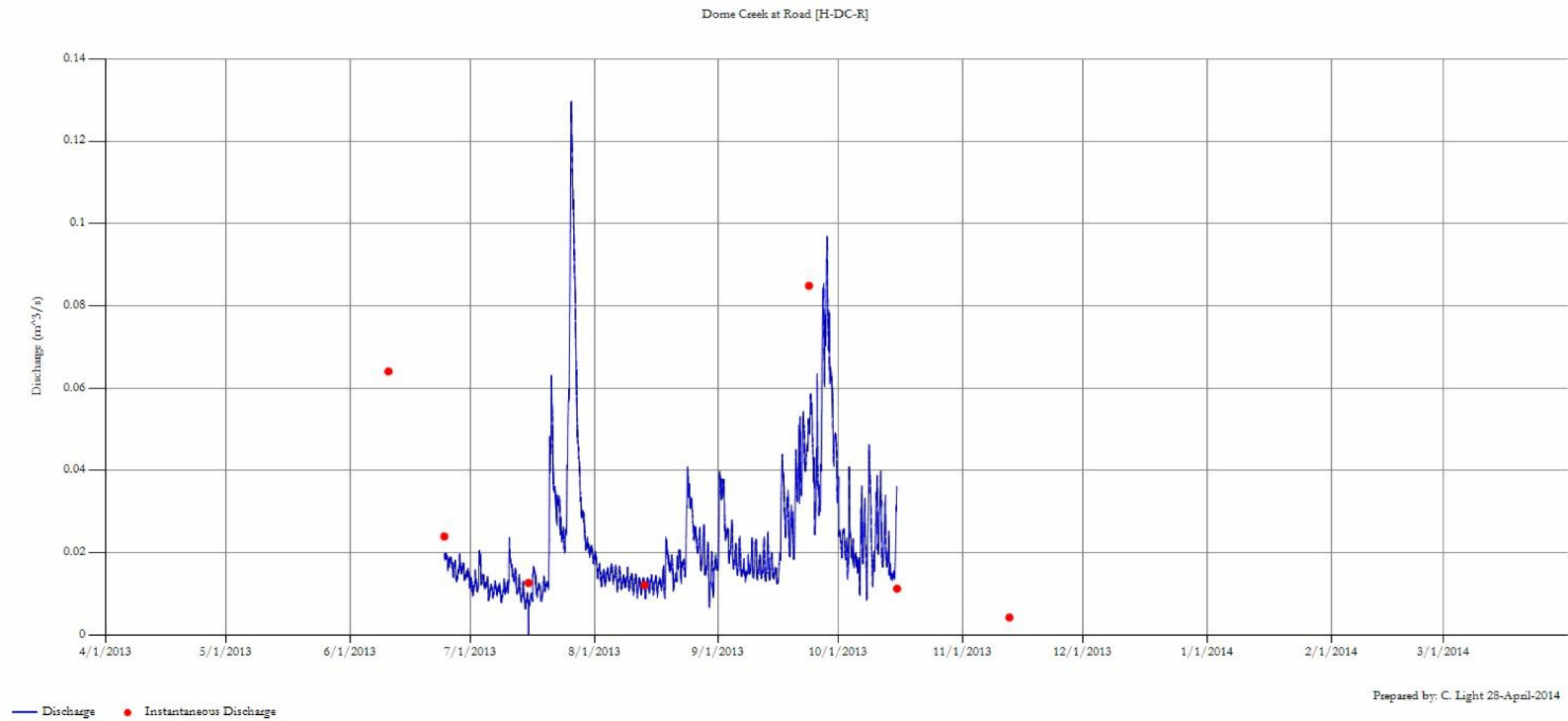


Figure D-10 H-DC-R Hydrograph (note stage record started in May 2013, when continuous logger was installed).

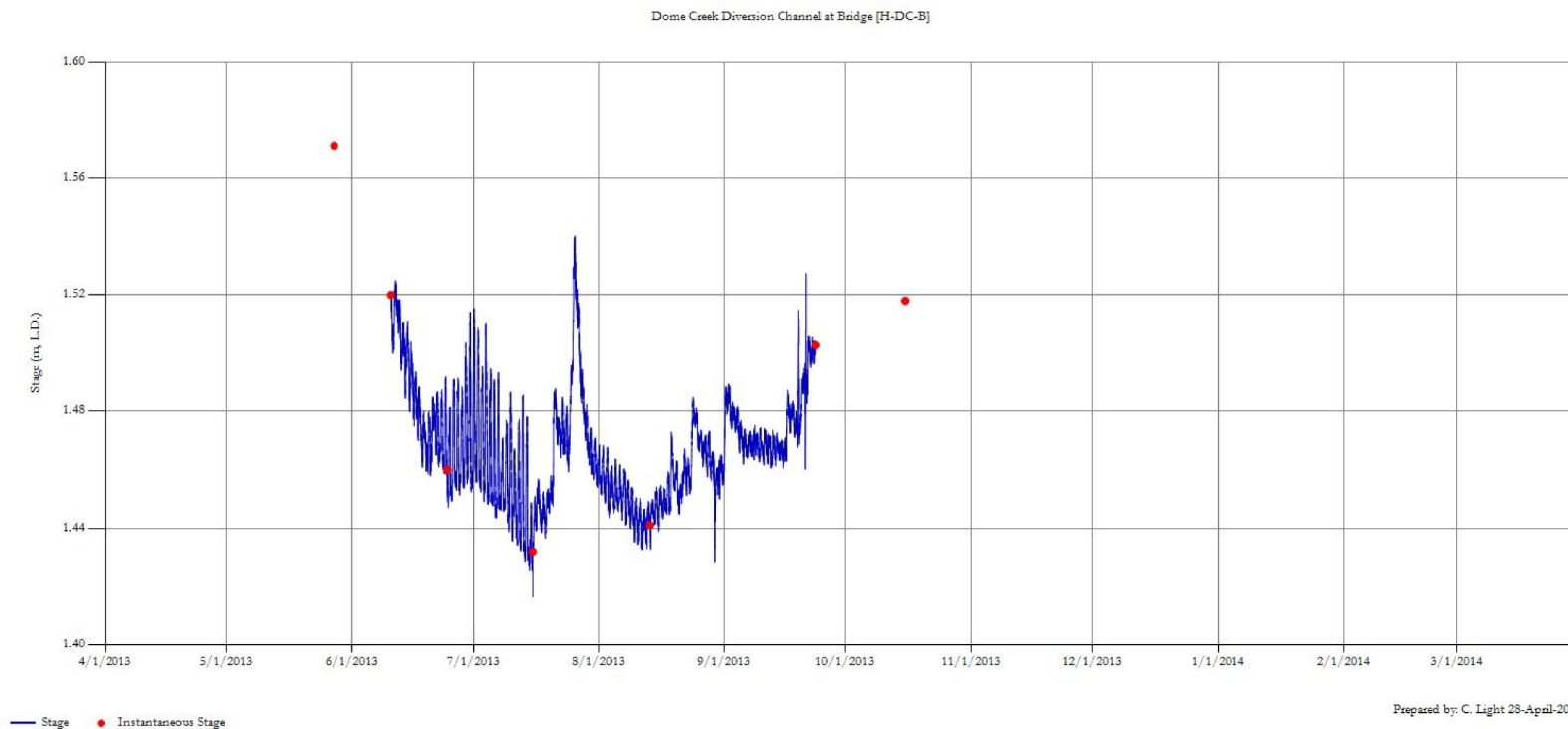


Figure D-11 H-DC-B Stage.



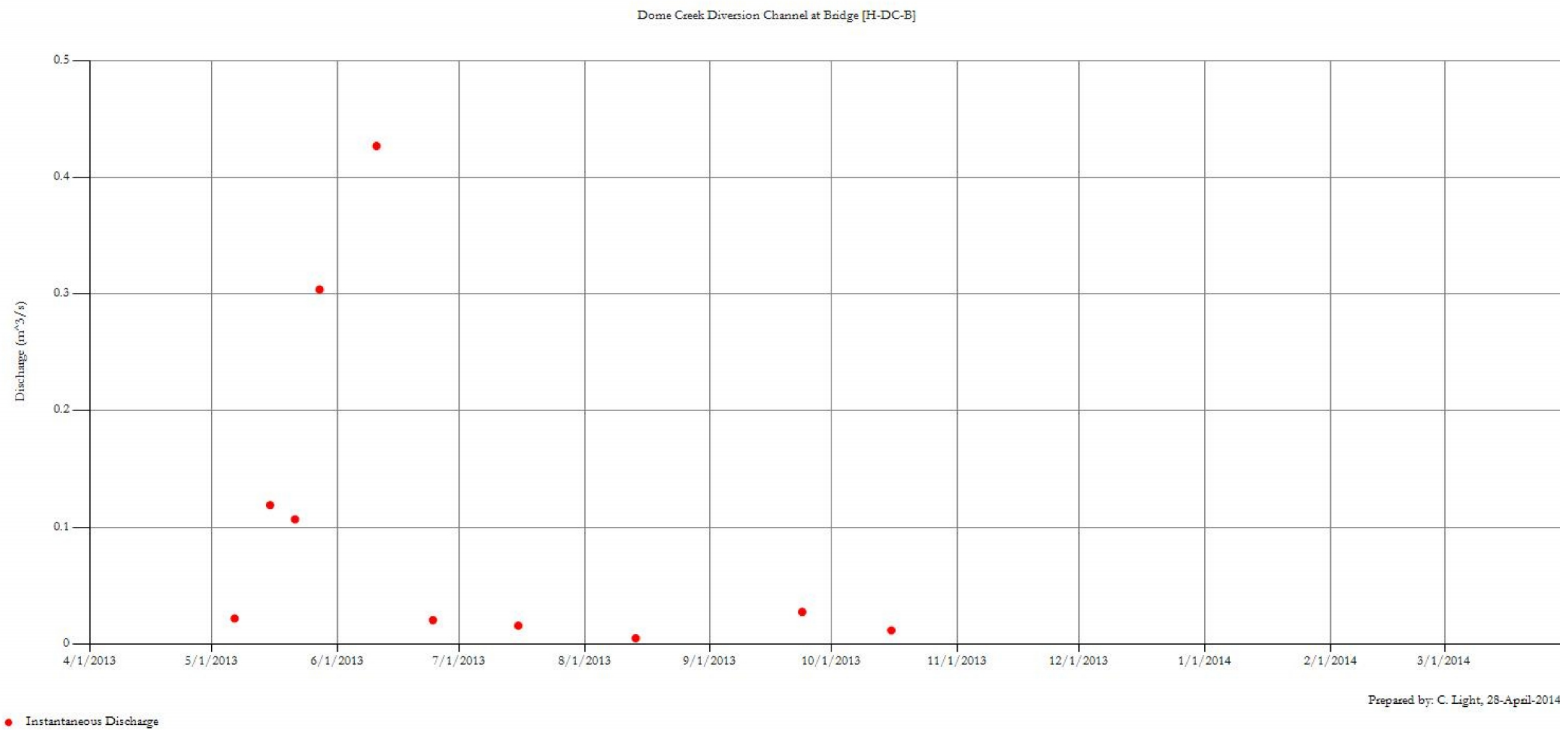


Figure D-12 H-DC-B Instantaneous Discharge.

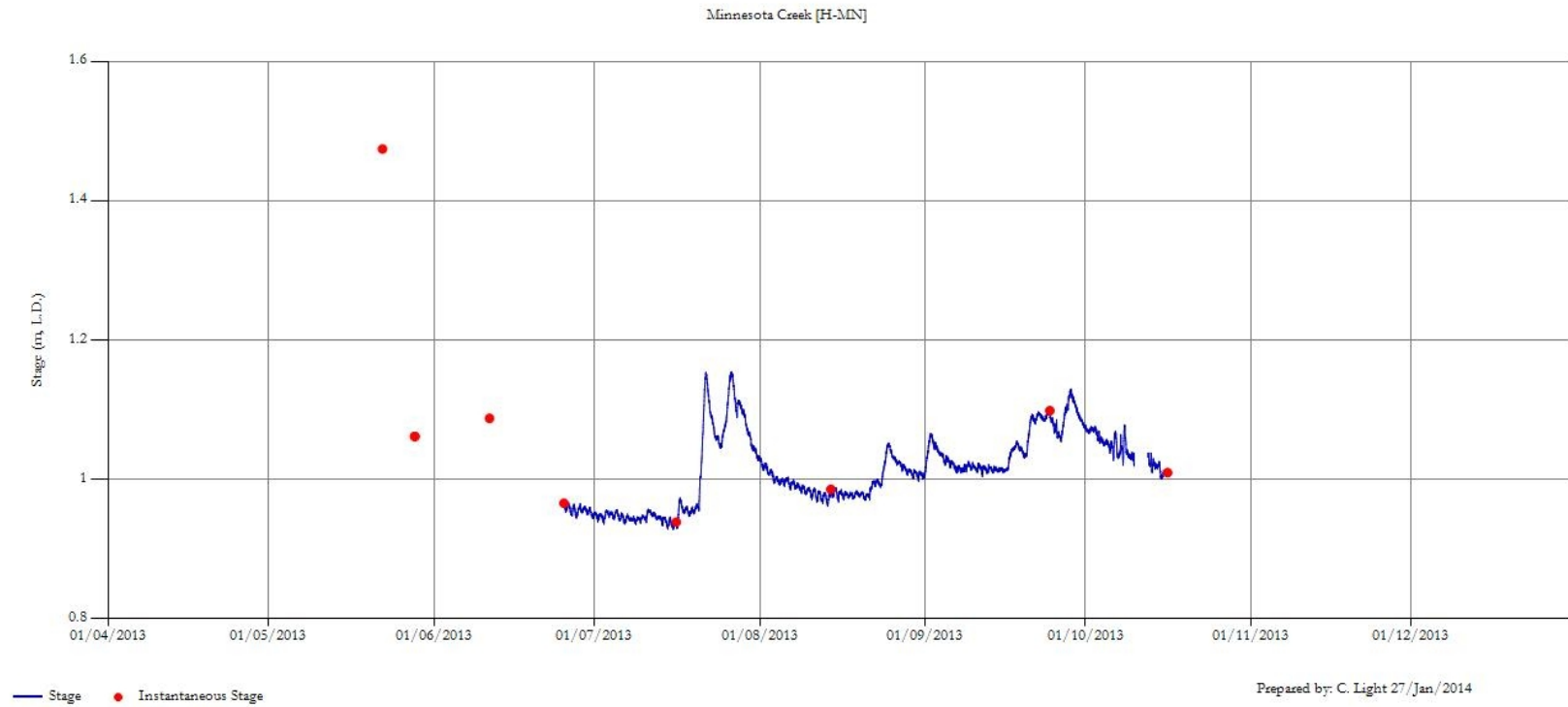


Figure D-13 H-MN Stage.

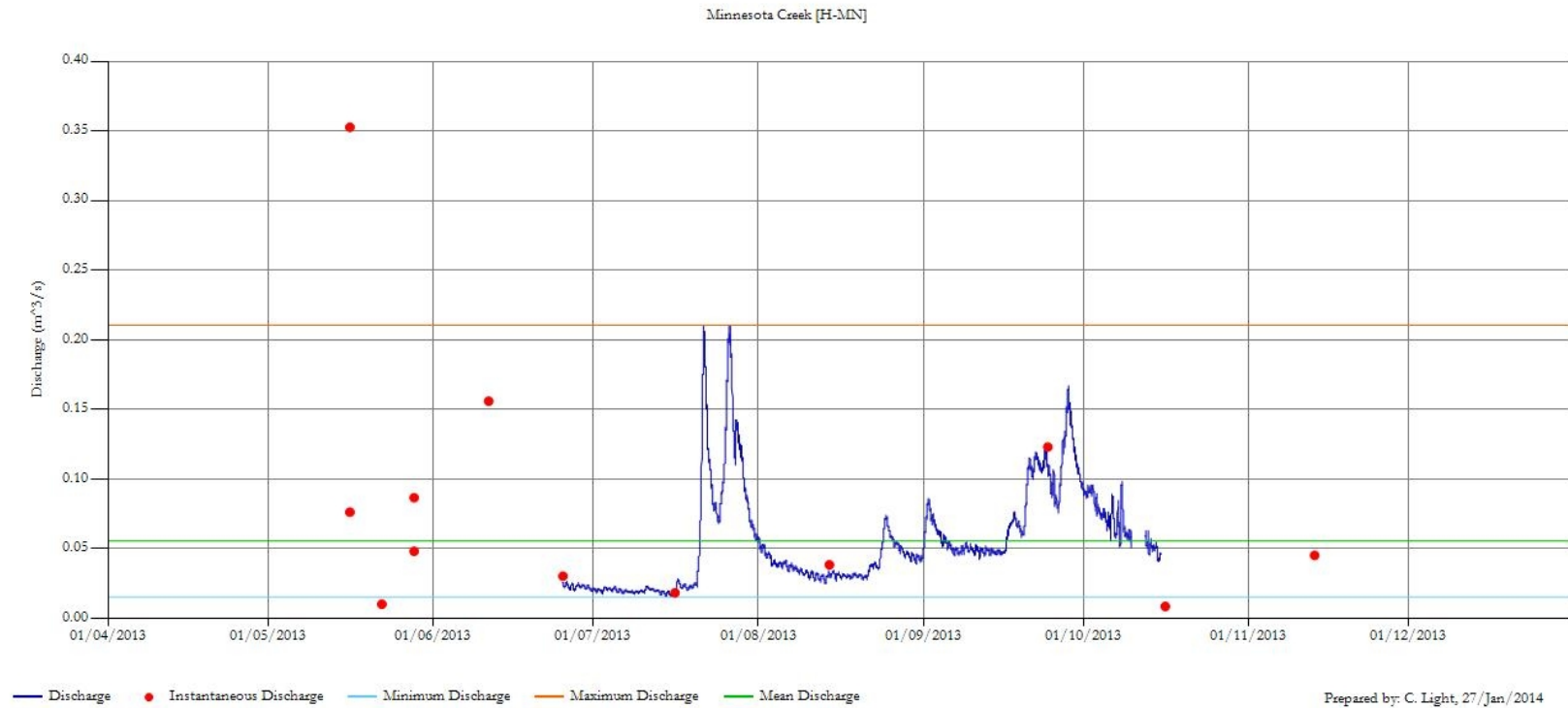


Figure D-14 H-MN Hydrograph.

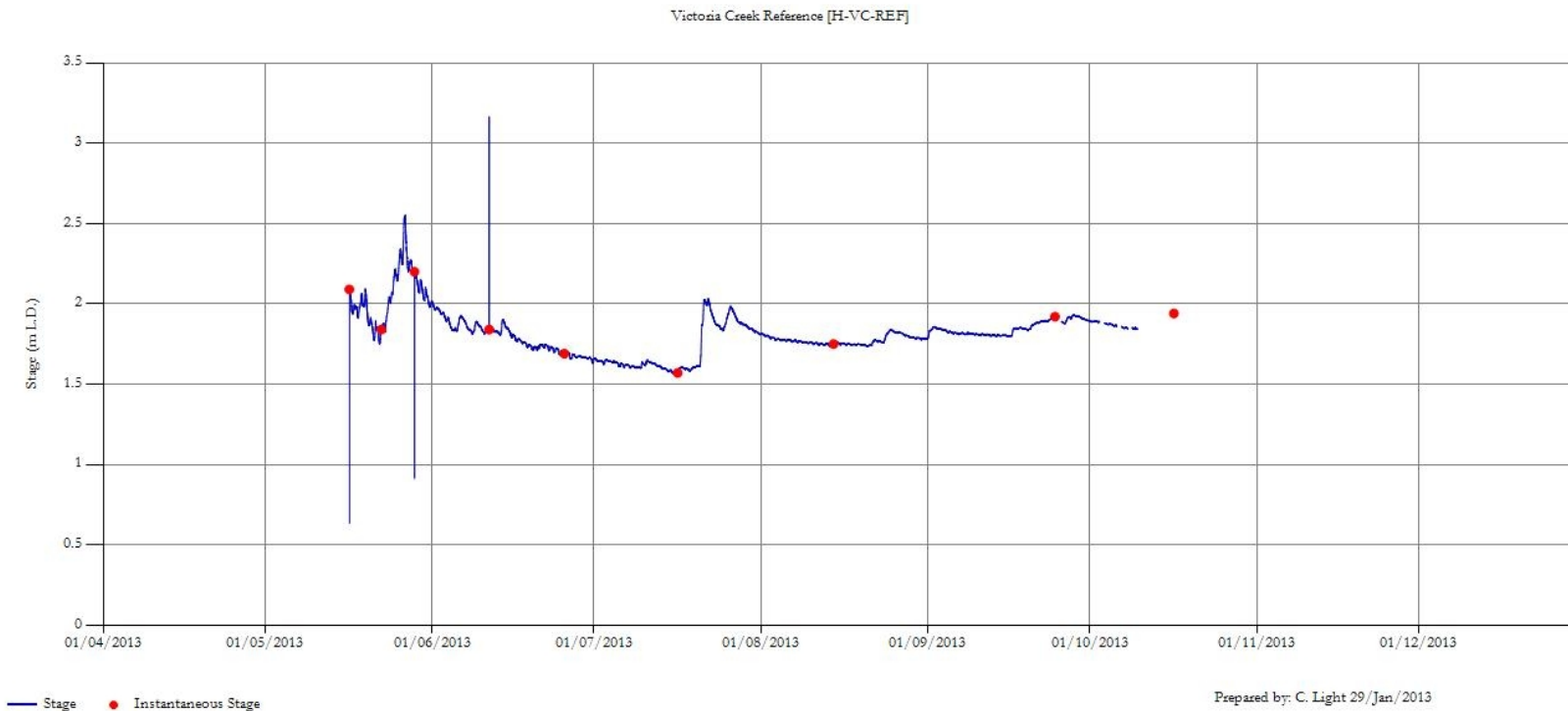


Figure D-15 H-VC-REF Stage

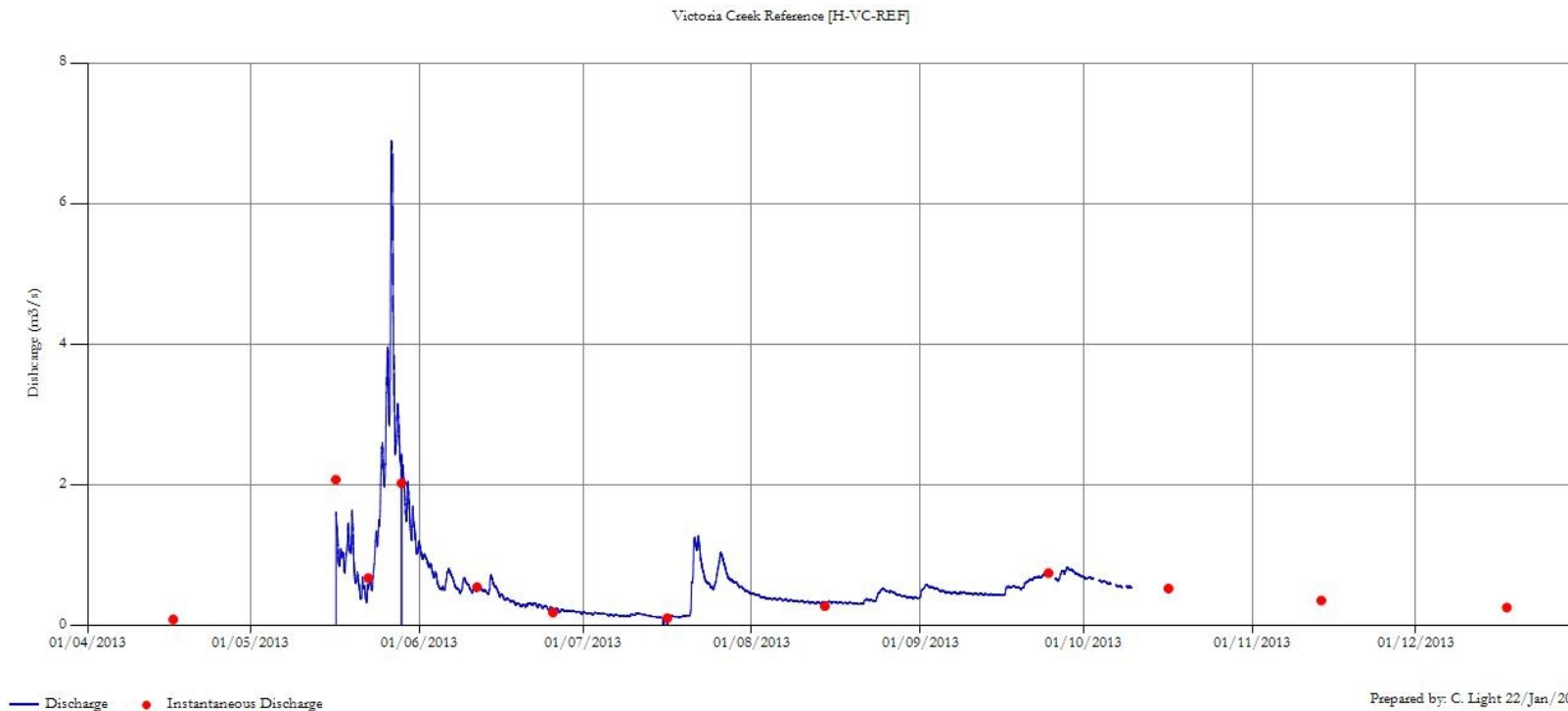


Figure D-16 H-VC-REF Hydrograph.

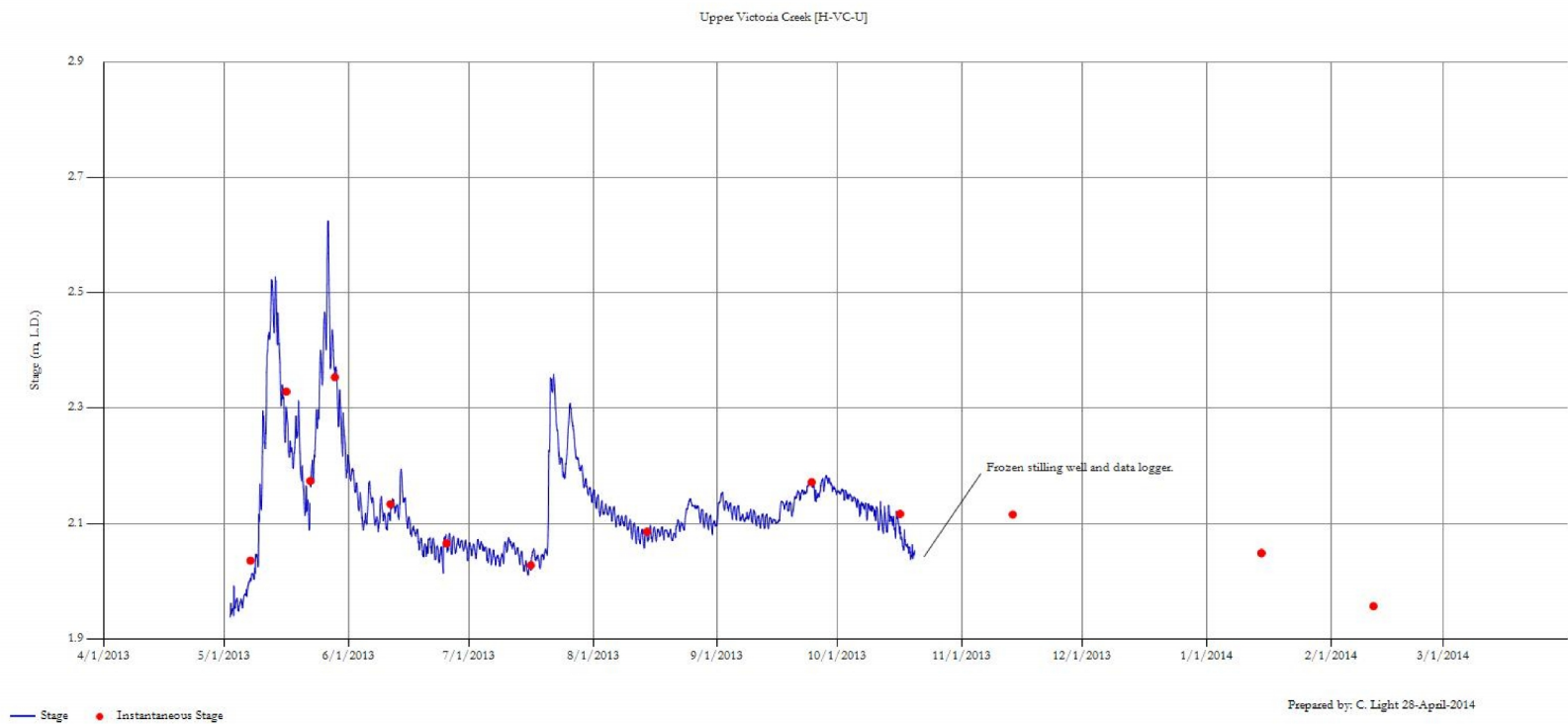


Figure D-17 H-VC-U Stage.

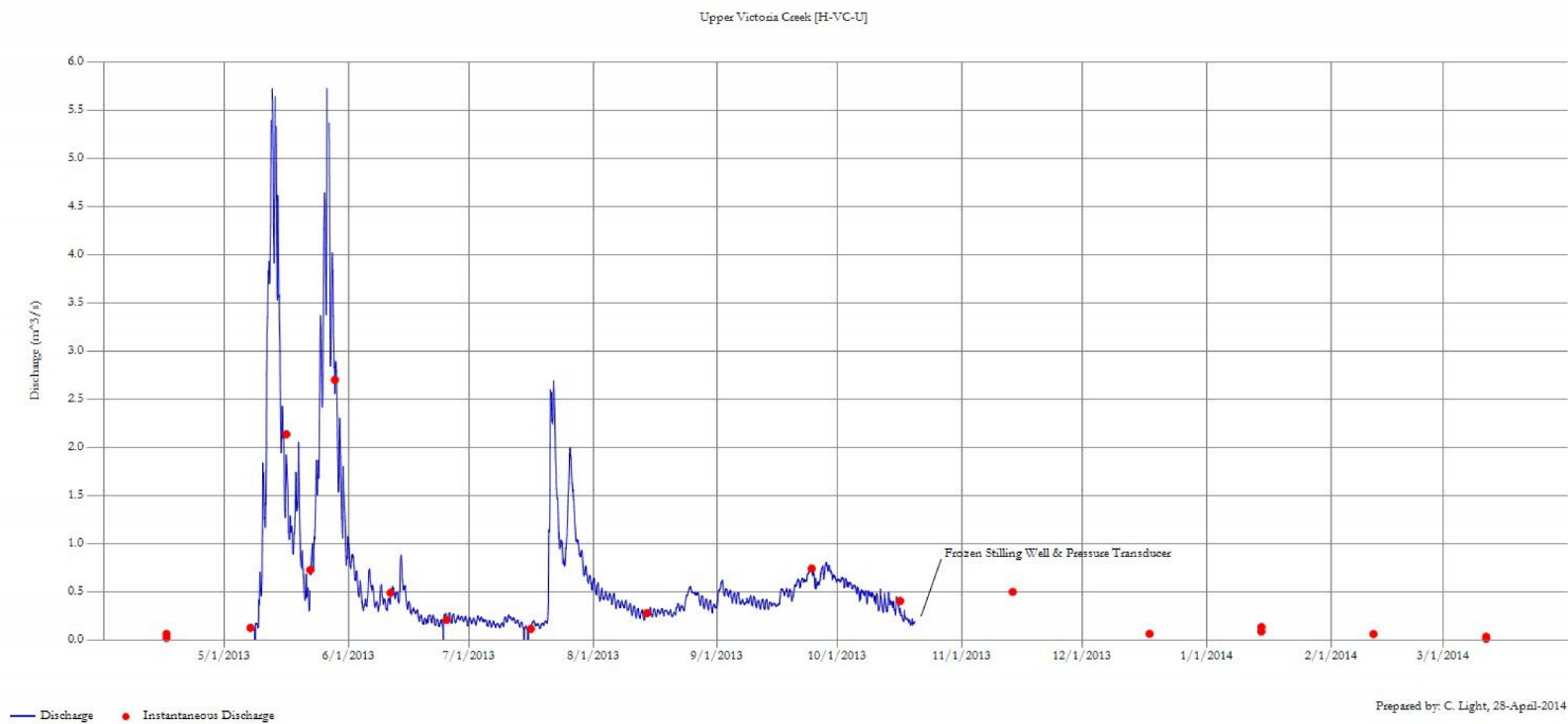


Figure D-18 H-VC-U Hydrograph.

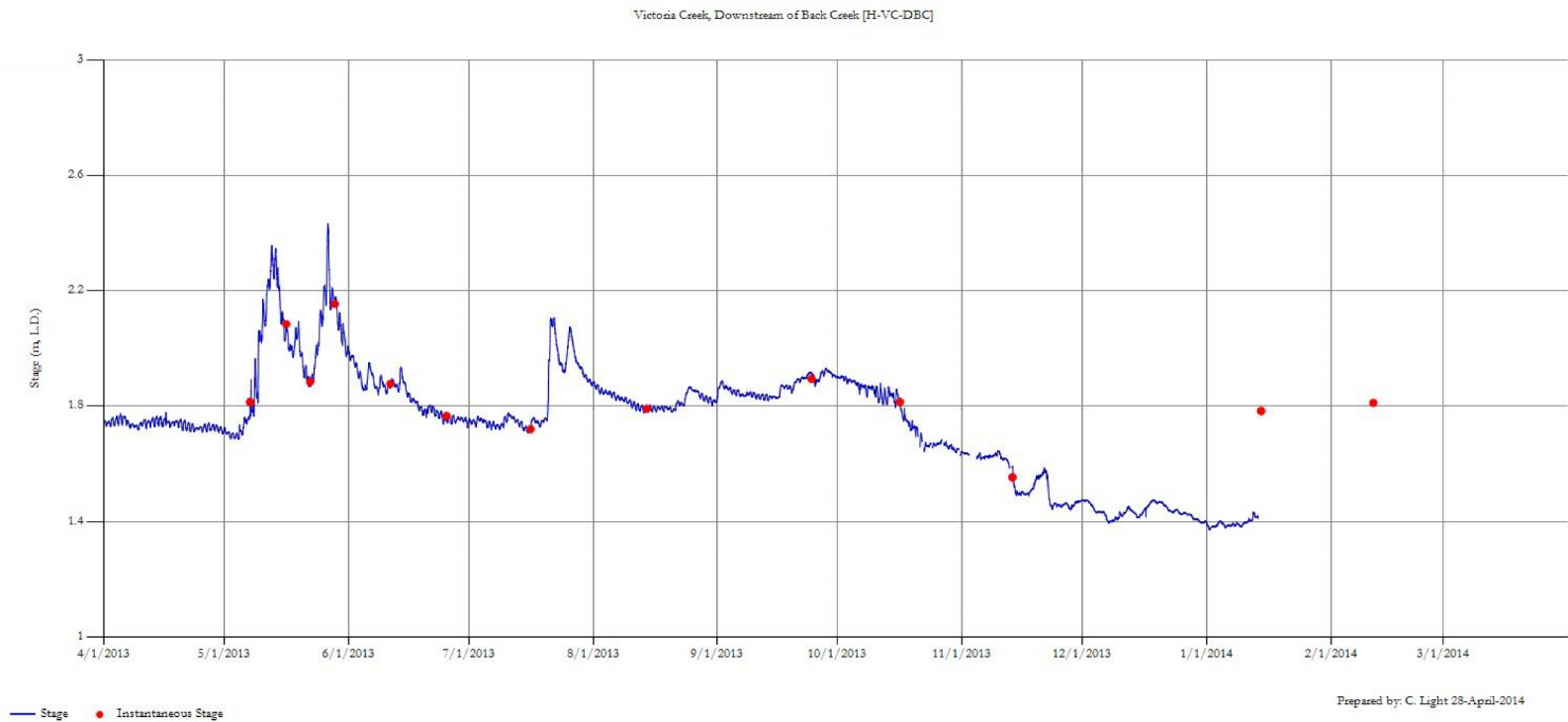


Figure D-19 H-VC-DBC Stage.



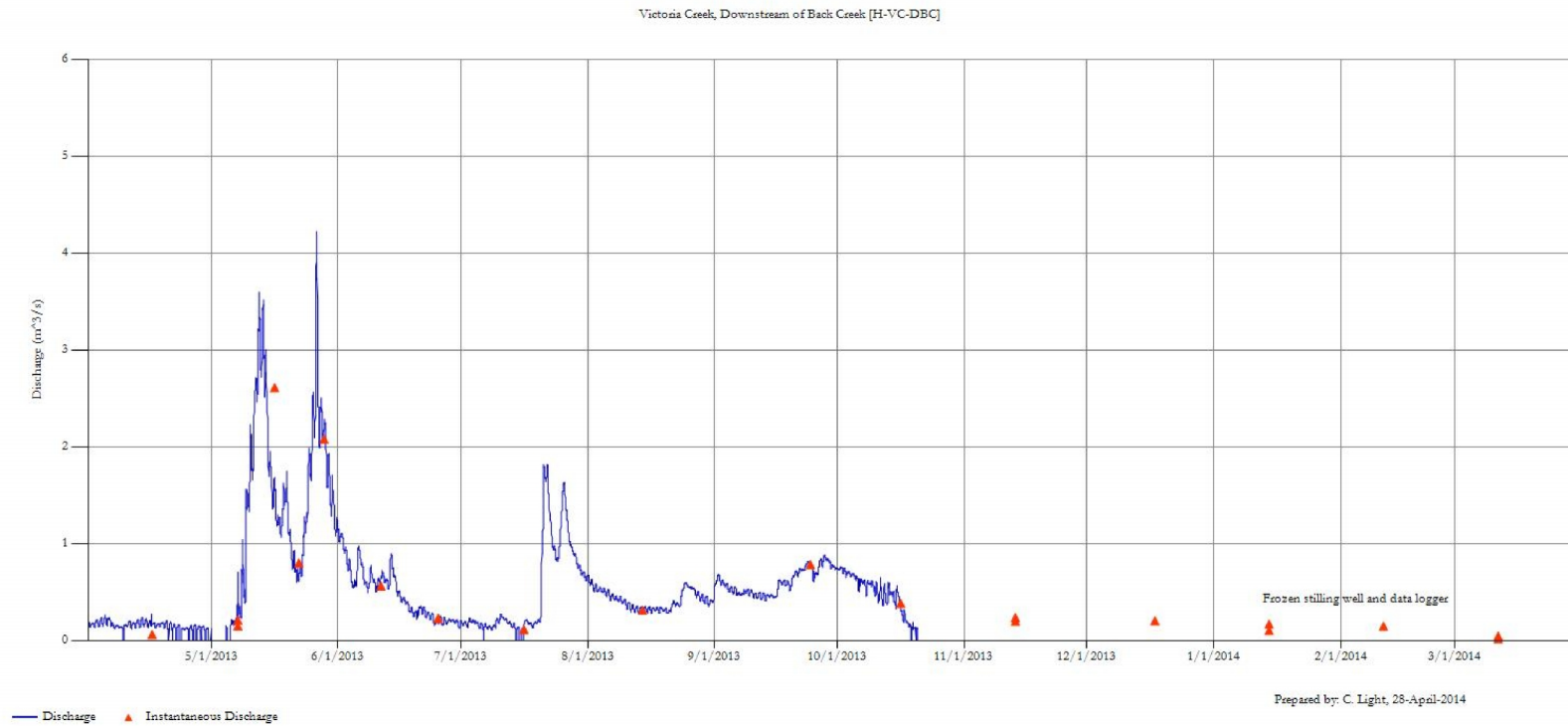


Figure D-20 H-VC-DBC Hydrograph.

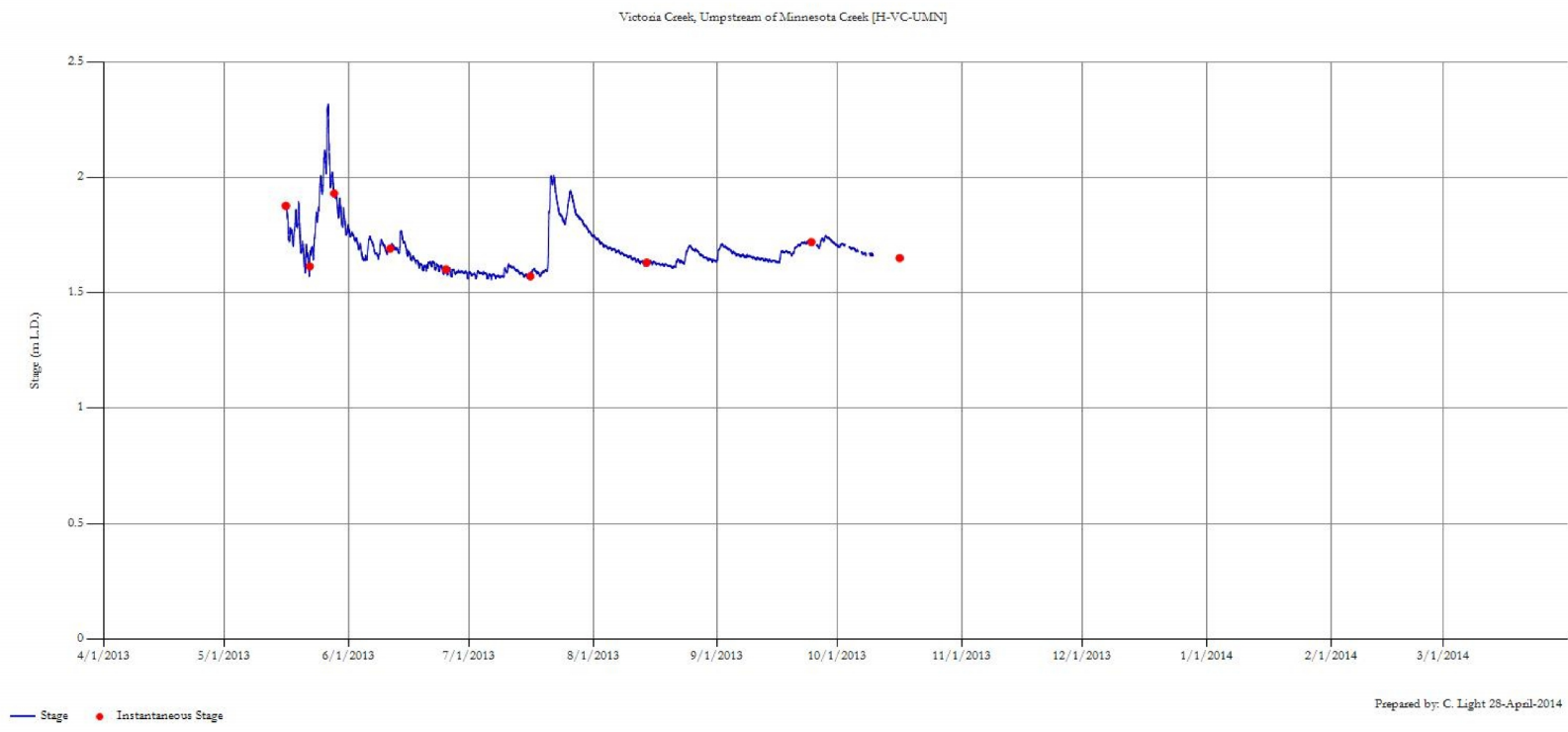


Figure D-21 H-VC-UMN Stage.

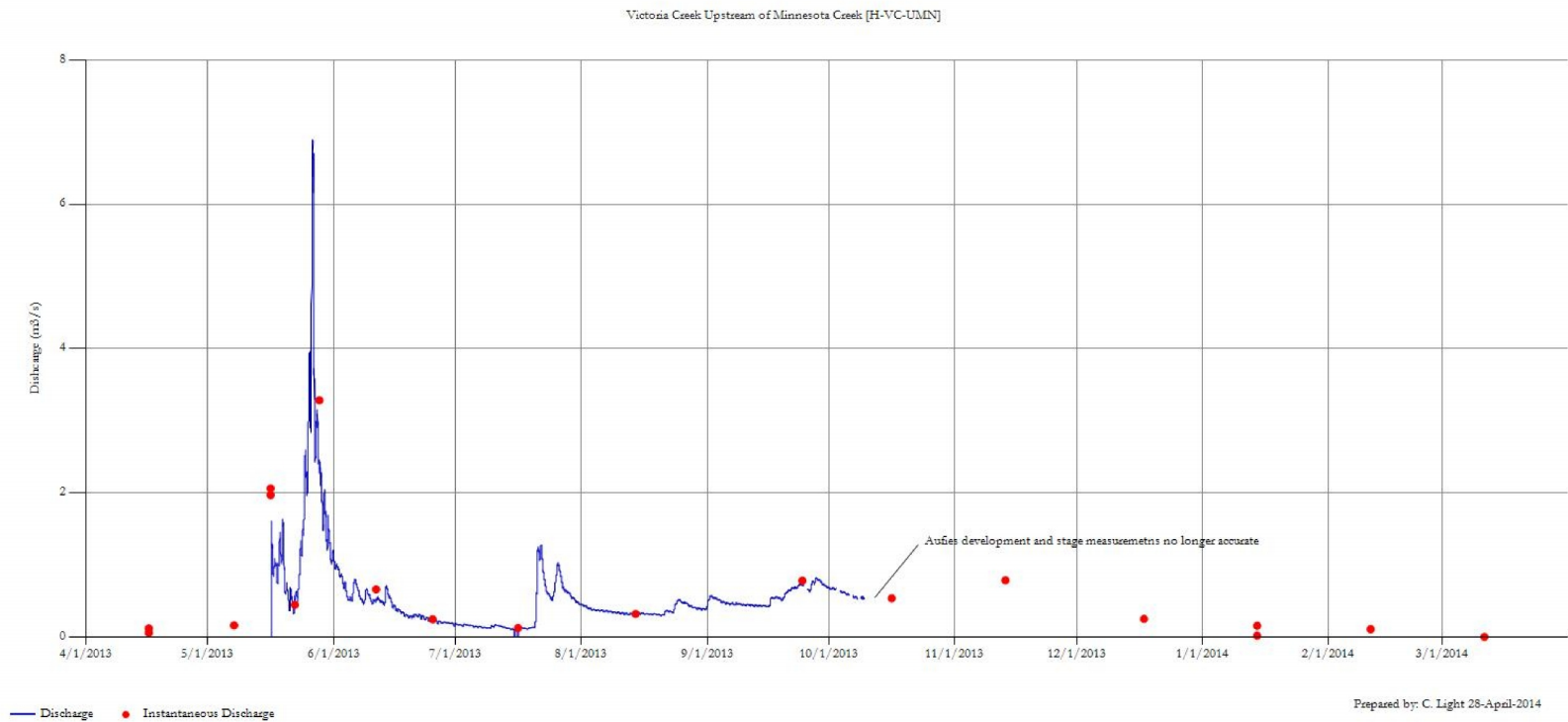


Figure D-22 H-VC-UMN Hydrograph.

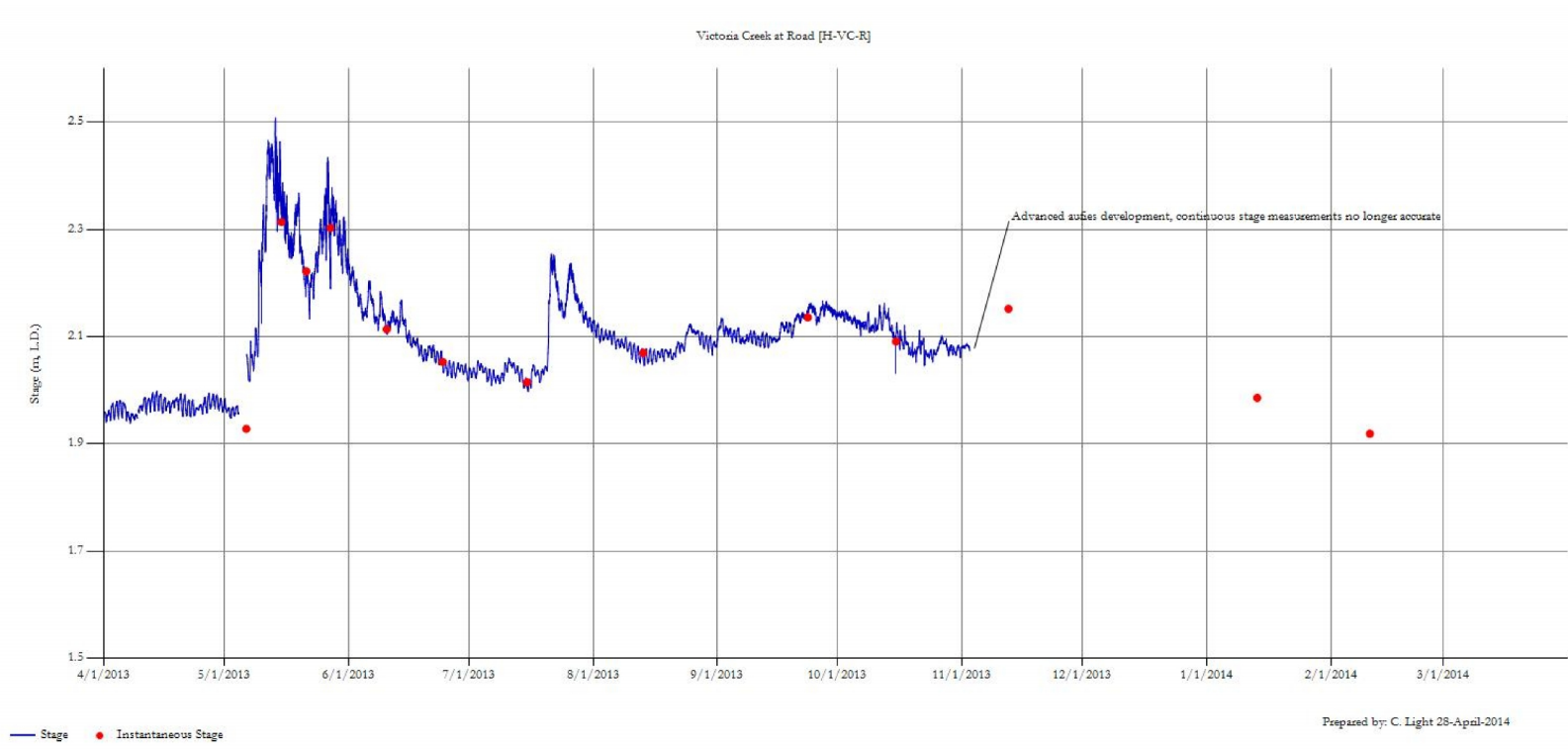


Figure D-23 H-VC-R Stage.

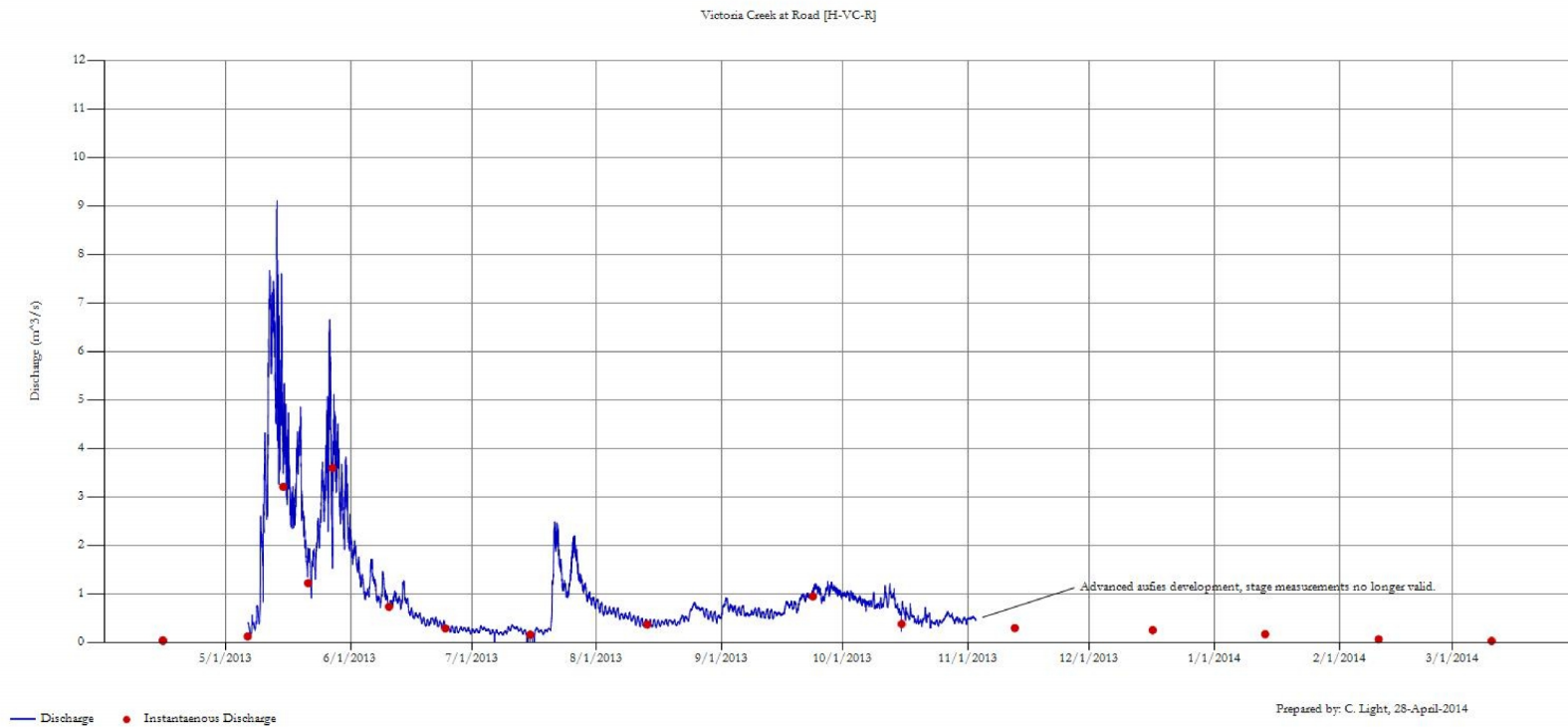


Figure D-24 H-VC-R Hydrograph.

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## APPENDIX E      Q4 SURFACE WATER QUALITY DATA

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Figure E-1. Concentrations of aluminum, arsenic and ammonia for sites on Upper Dome Creek (left column) and Lower Dome Creek (right column).

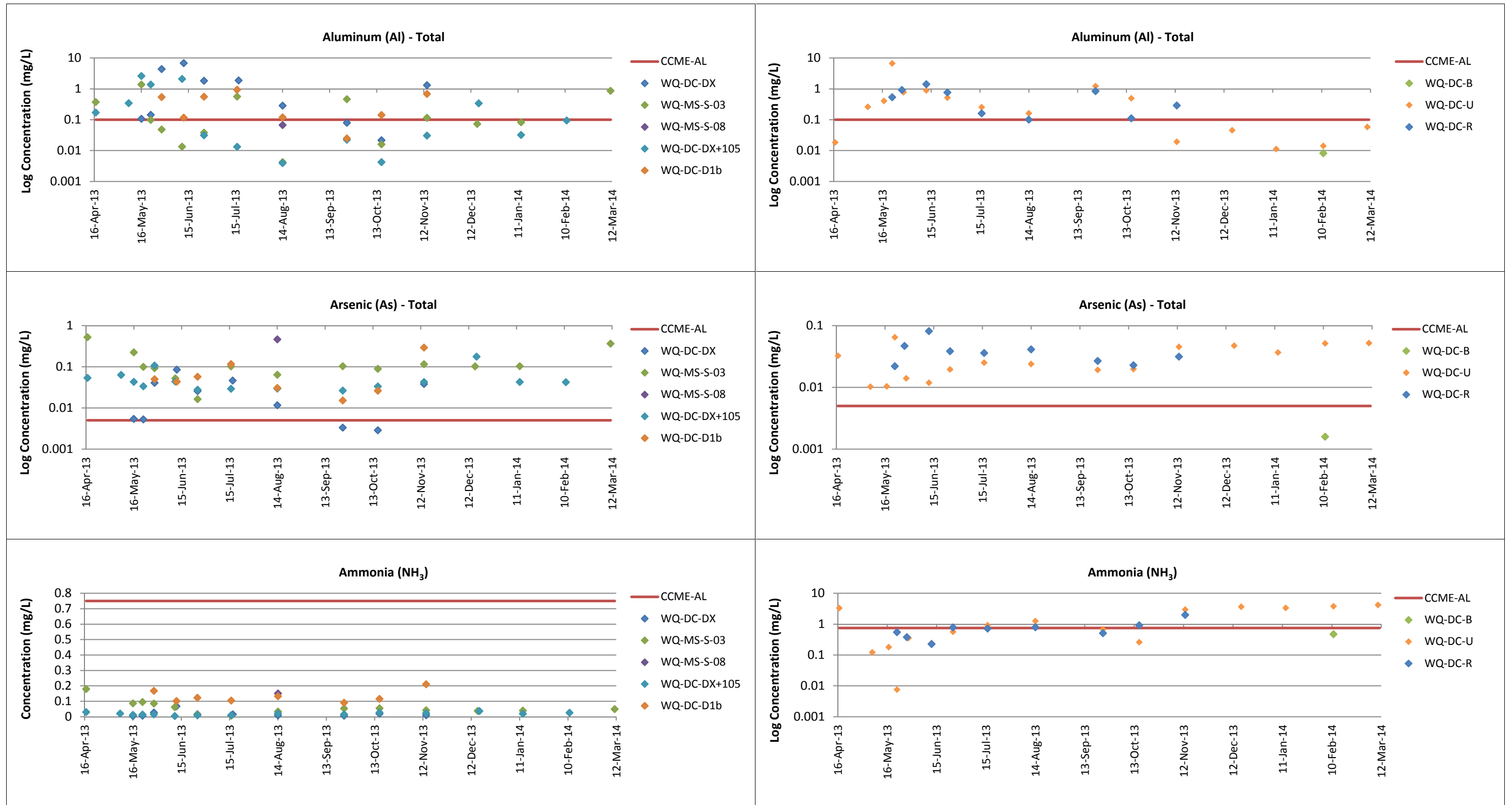




Figure E-2. Concentrations of cadmium, chromium and copper for sites on Dome Creek (Left column: Upper Dome Creek sites, Right Column: Lower Dome Creek sites).

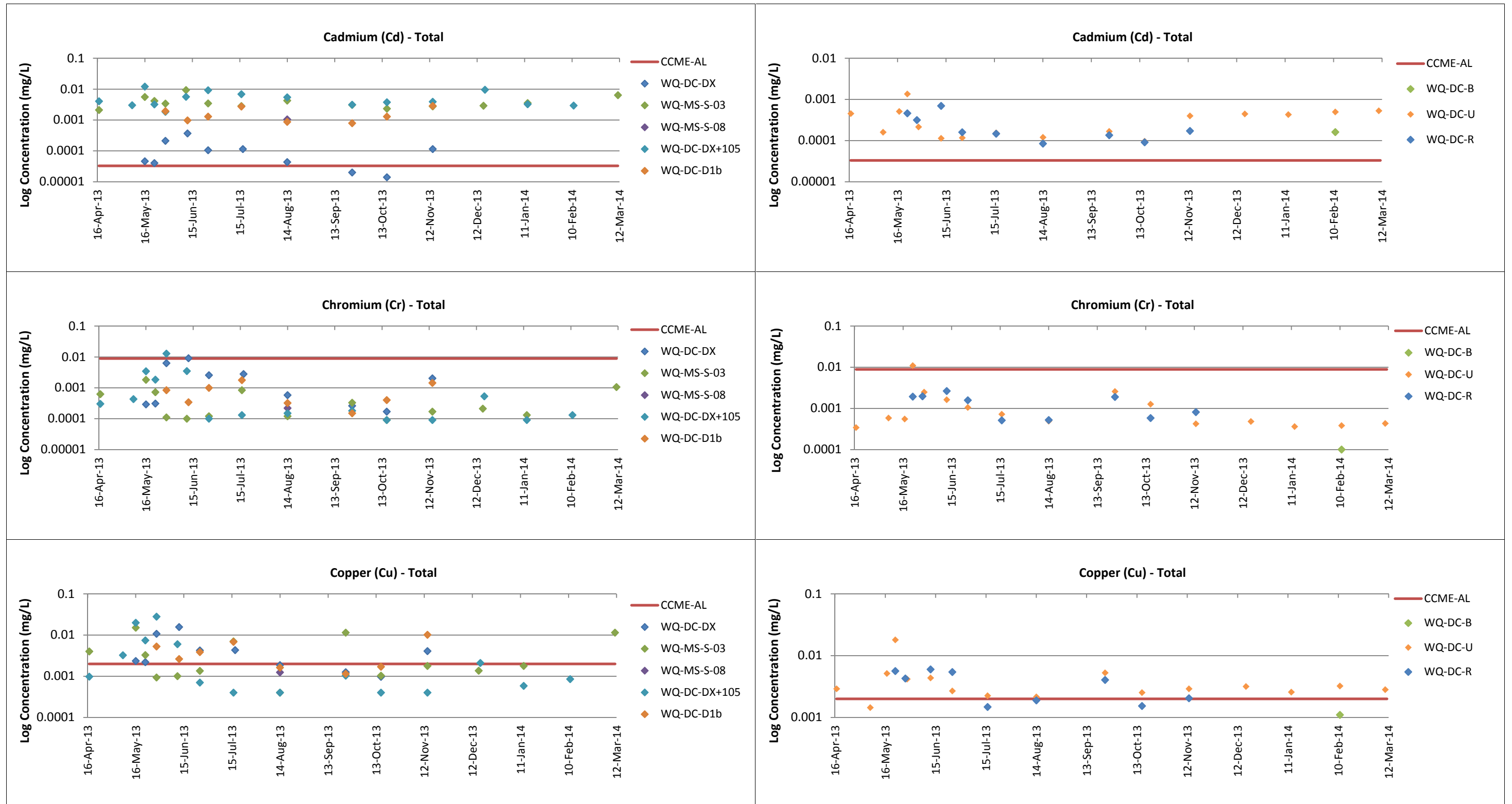




Figure E-3. Concentrations of iron, lead, and manganese for sites on Dome Creek (Left column: Upper Dome Creek sites, Right Column: Lower Dome Creek sites).

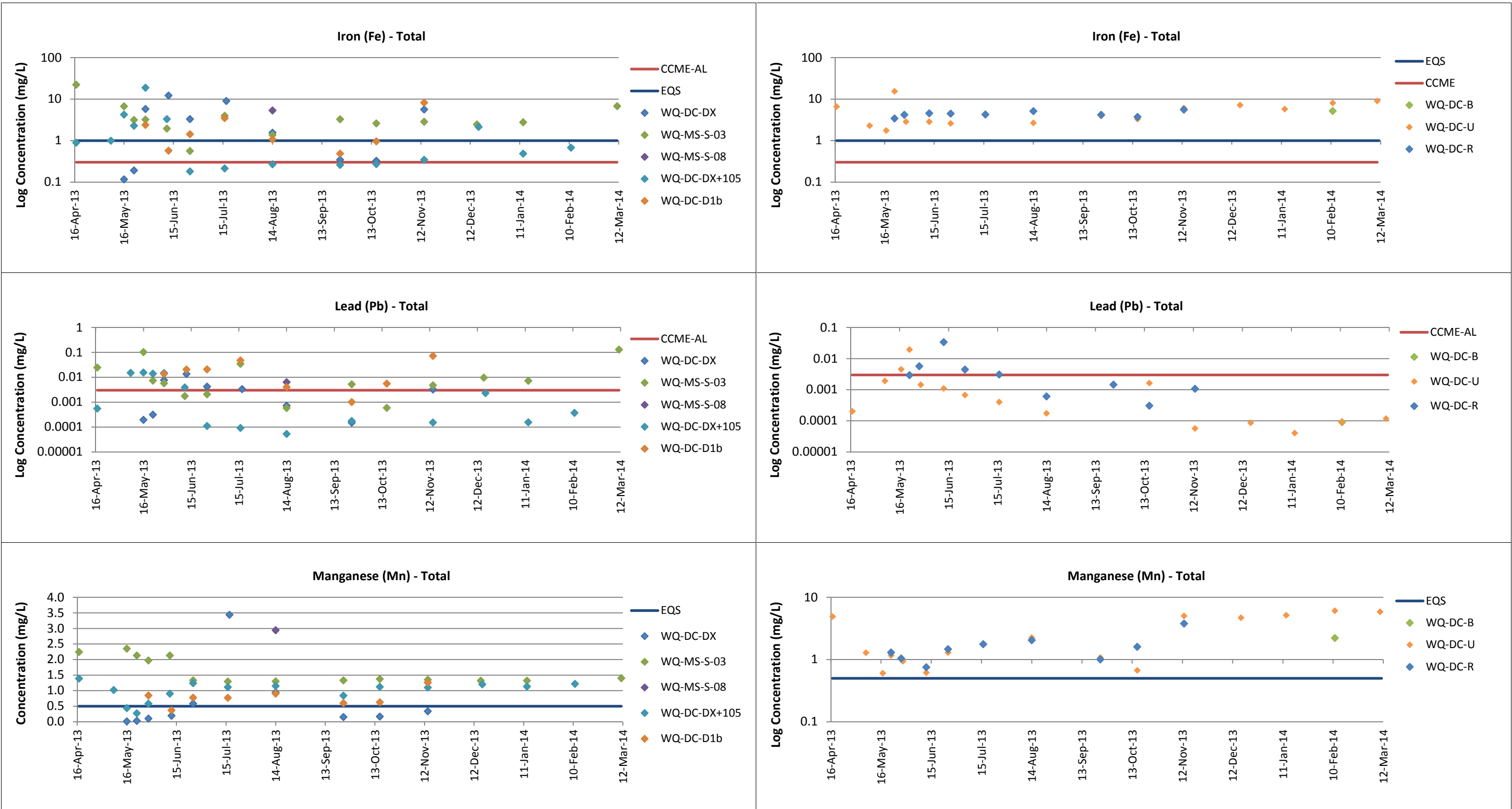




Figure E-4. Concentrations of mercury, silver and zinc for sites on Dome Creek (Left column: Upper Dome Creek sites, Right Column: Lower Dome Creek sites).

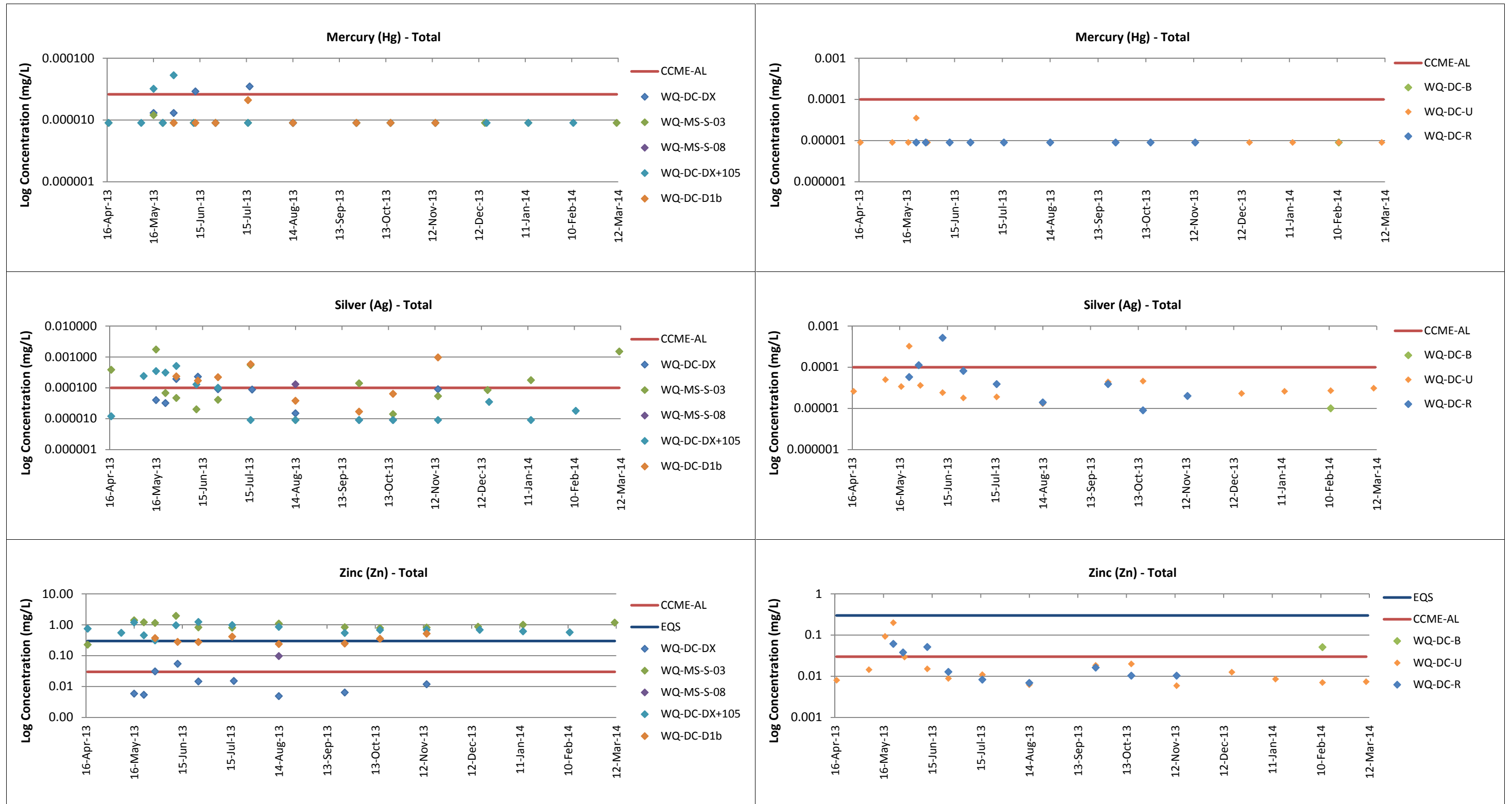




Figure E-5. Concentrations of total suspended solids for sites on Dome Creek (Left column: Upper Dome Creek sites, Right Column: Lower Dome Creek sites).

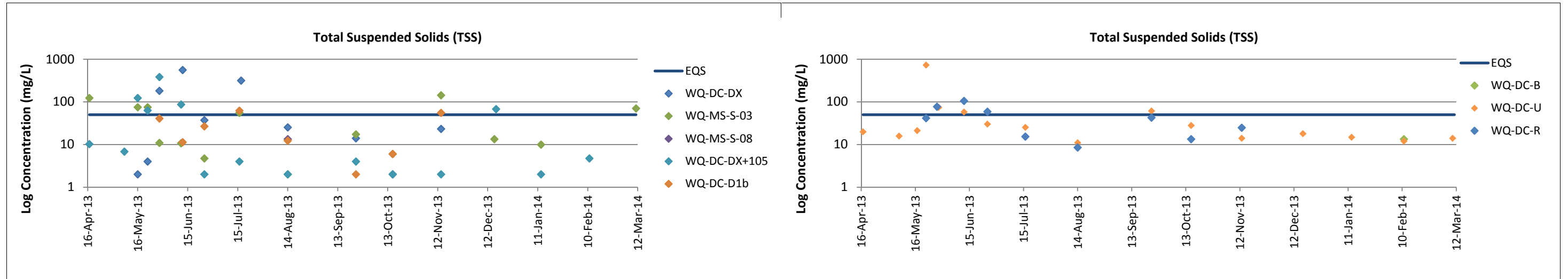


Figure E-6. Concentrations of total suspended solids for the tailings pond and seepage site (left column) and the Brown-McDade pit lake site (right column).

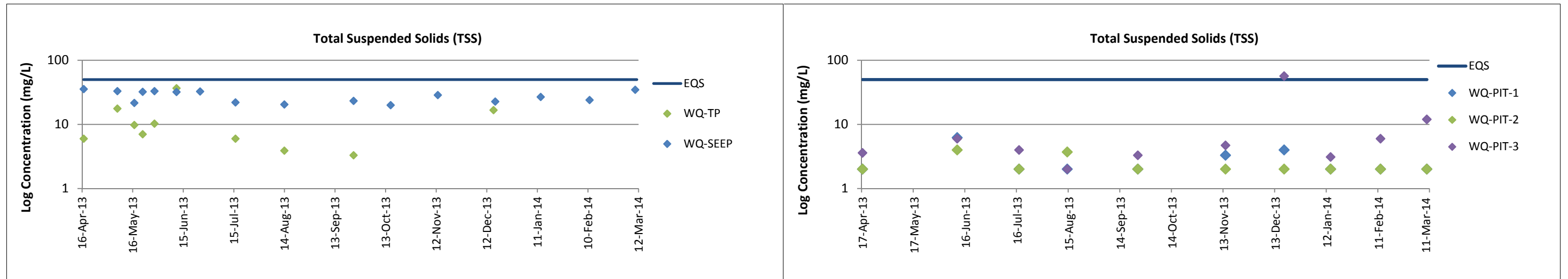




Figure E-7. Concentrations of aluminum, arsenic and ammonia for the tailings pond and seepage site (left column) and the Brown-McDade pit lake site (right column).

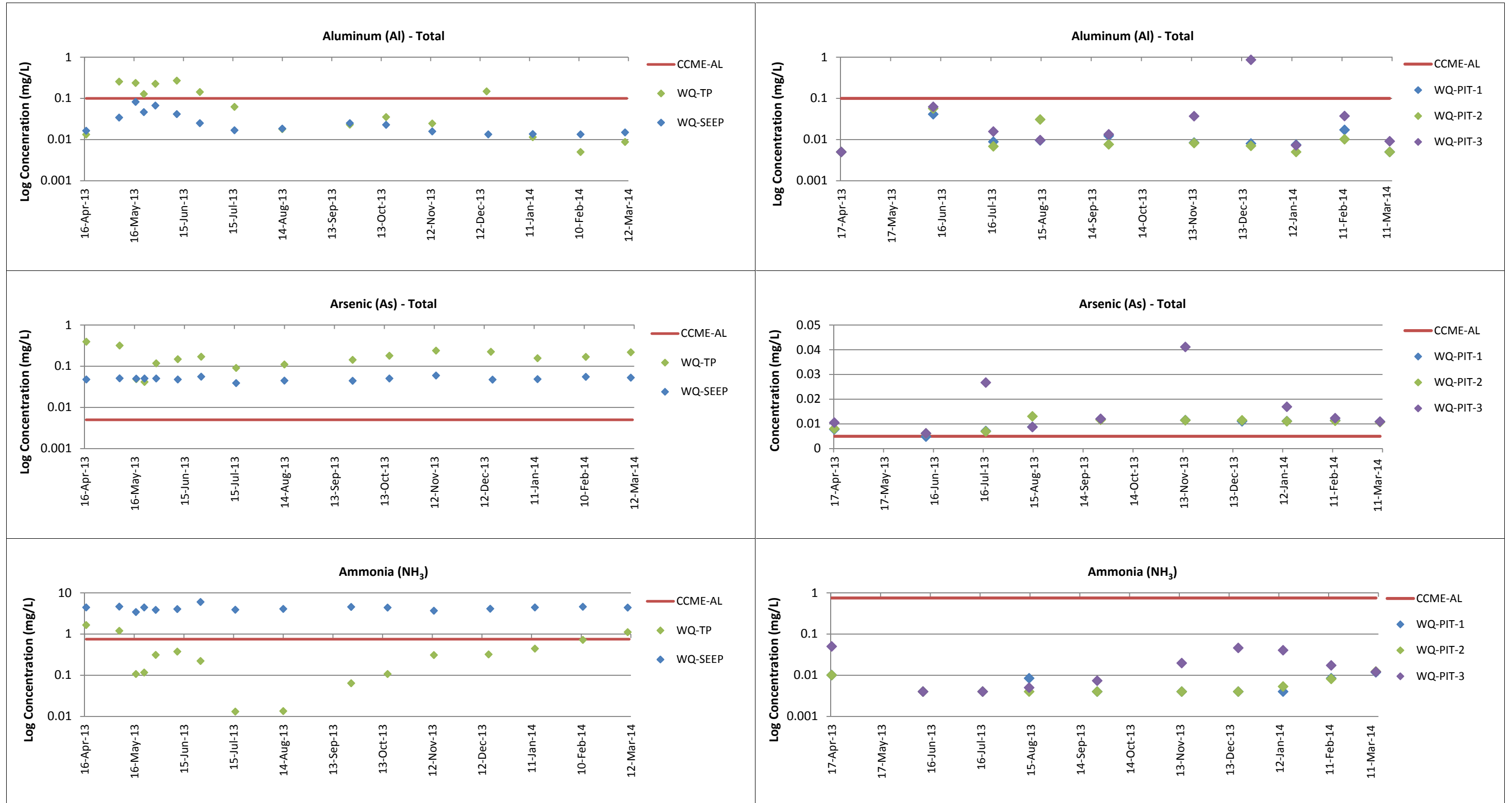




Figure E-8. Concentrations of cadmium, chromium and copper for the tailings pond and seepage site (left column) and the Brown-McDade pit lake site (right column).

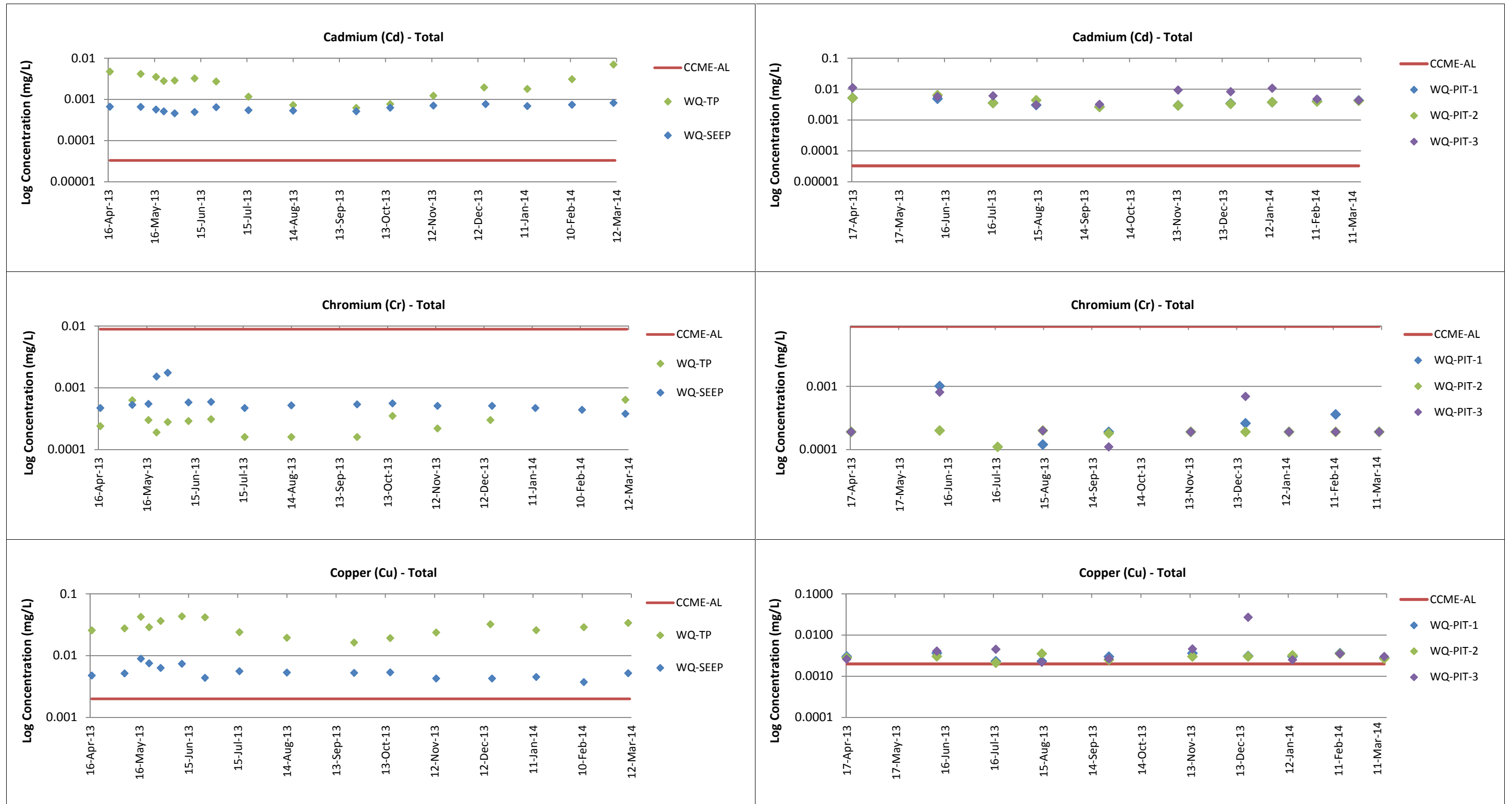




Figure E-9. Concentrations of iron, lead and manganese for the tailings pond and seepage site (left column) and the Brown-McDade pit lake site (right column).

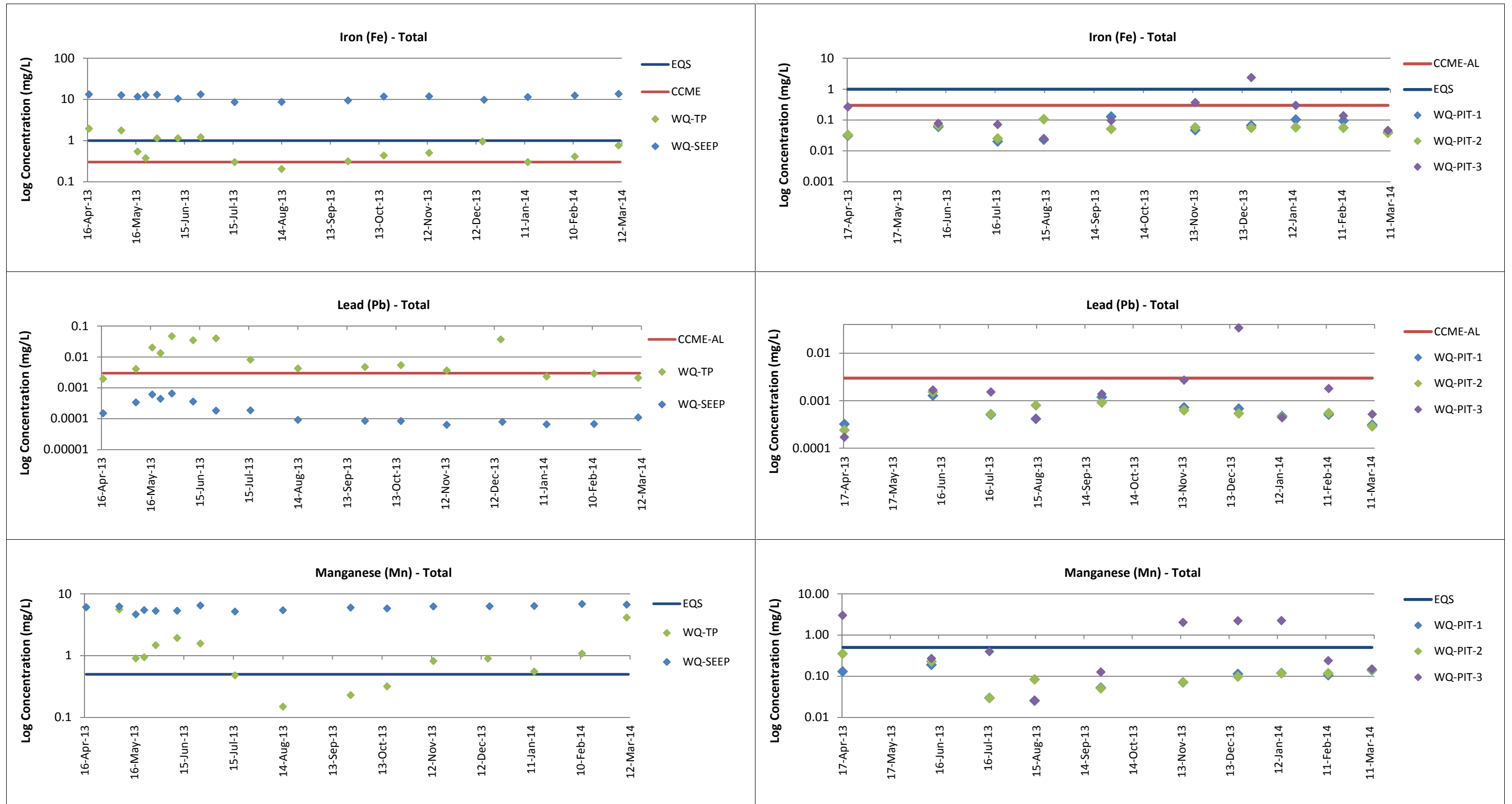






Figure E-10. Concentrations of mercury, silver and zinc for the tailings pond and seepage site (left column) and the Brown-McDade pit lake site (right column).

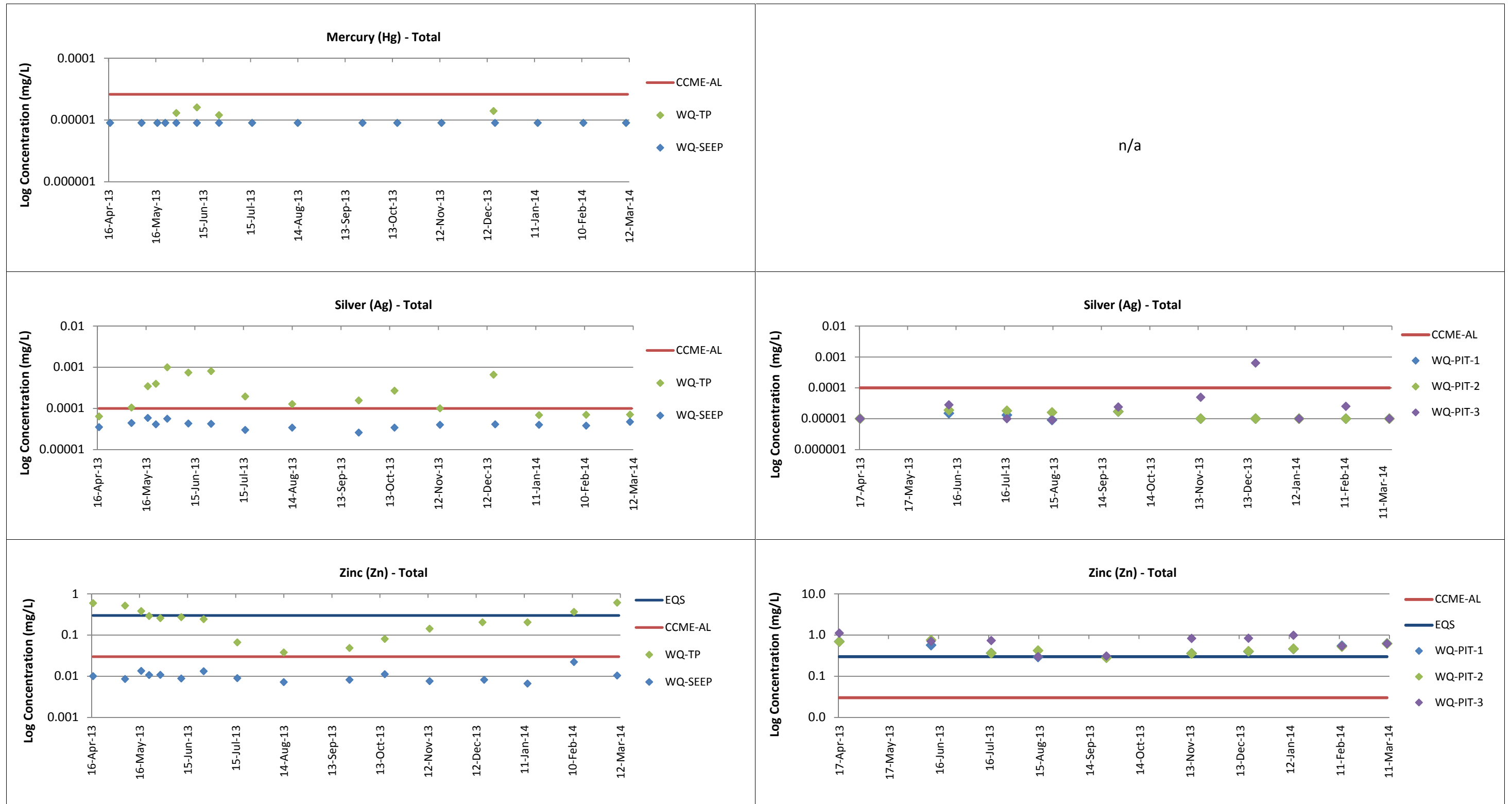




Figure E-11. Concentrations of aluminum, arsenic and total suspended solids for sites on Victoria Creek (left column) and sites on Back and Pony creeks (right column).

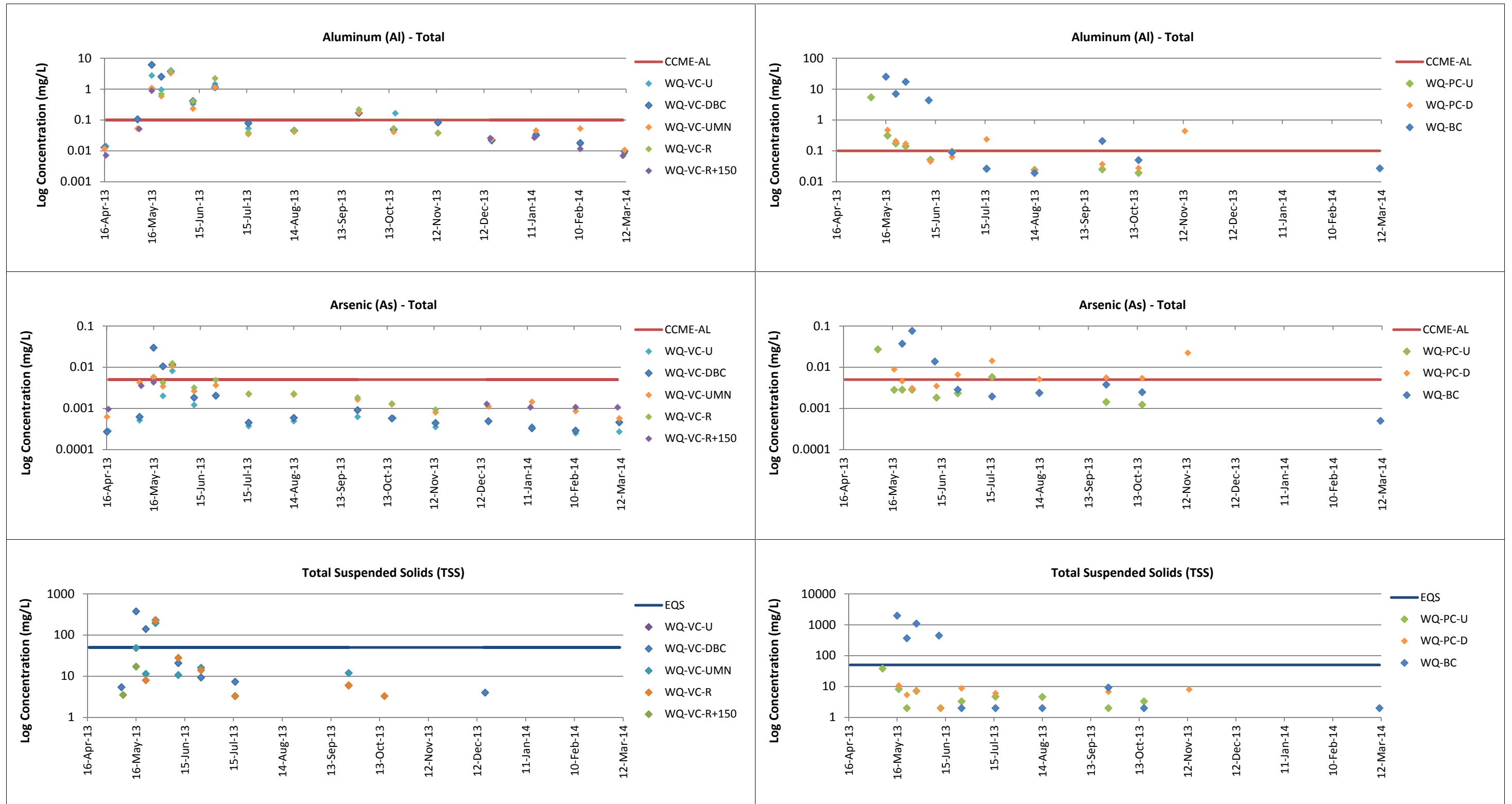




Figure E-12. Concentrations of cadmium, chromium and copper for sites on Victoria Creek (left column) and sites on Back and Pony creeks (right column).

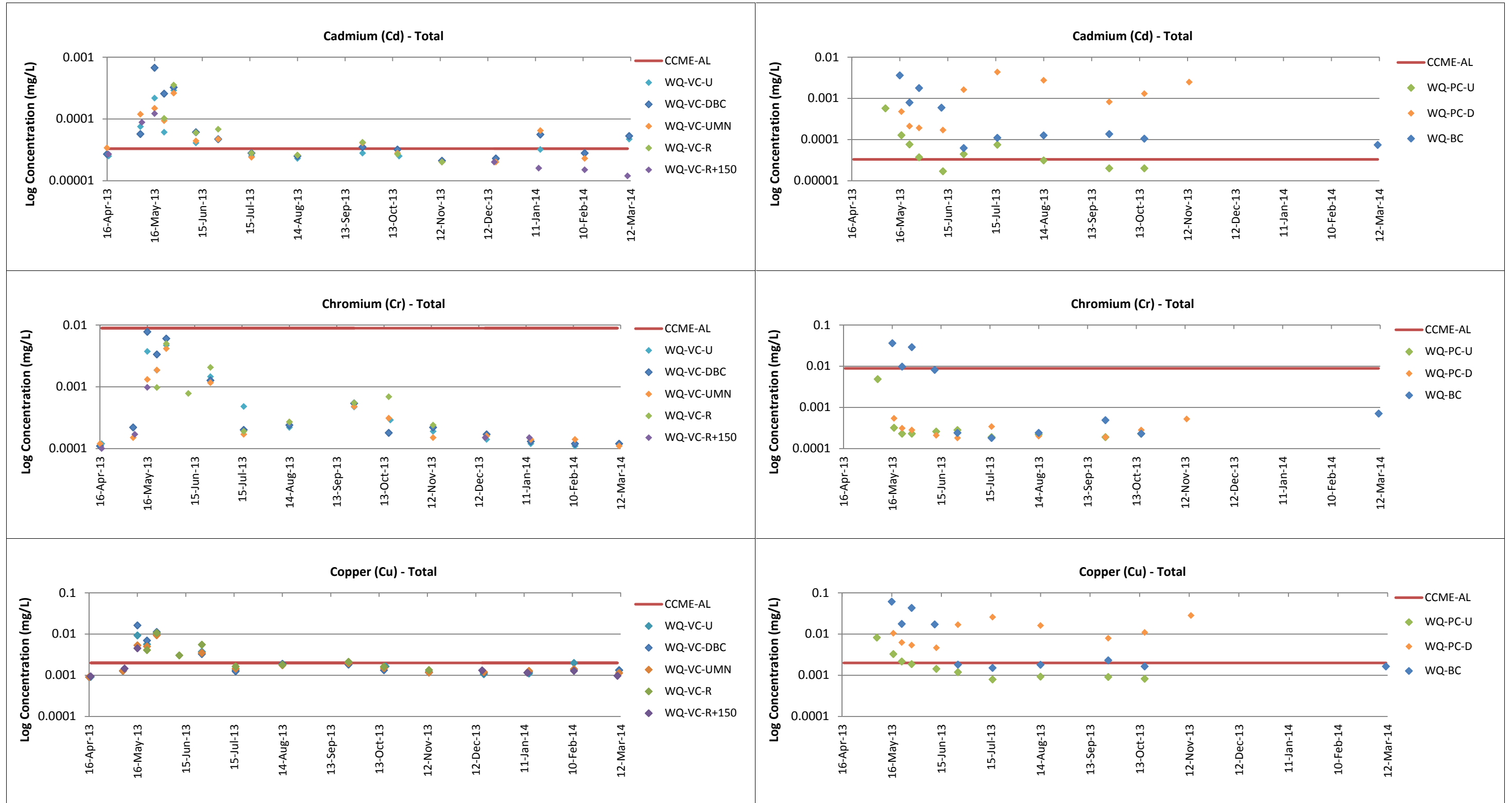




Figure E-13. Concentrations of iron, lead and manganese for sites on Victoria Creek (left column) and sites on Back and Pony creeks (right column).

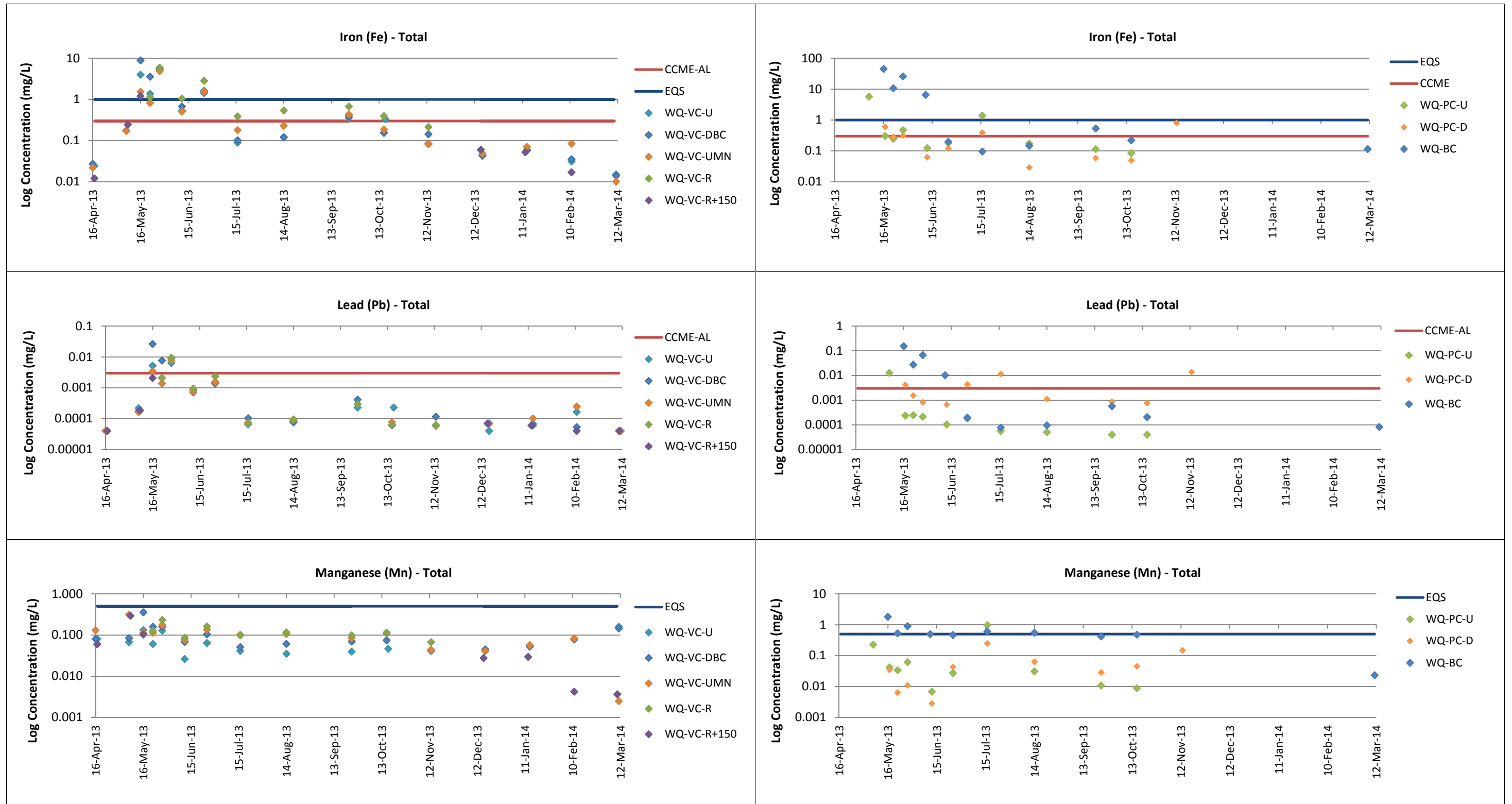




Figure E-14. Concentrations of mercury, silver and zinc for sites on Victoria Creek (left column) and sites on Back and Pony creeks (right column).

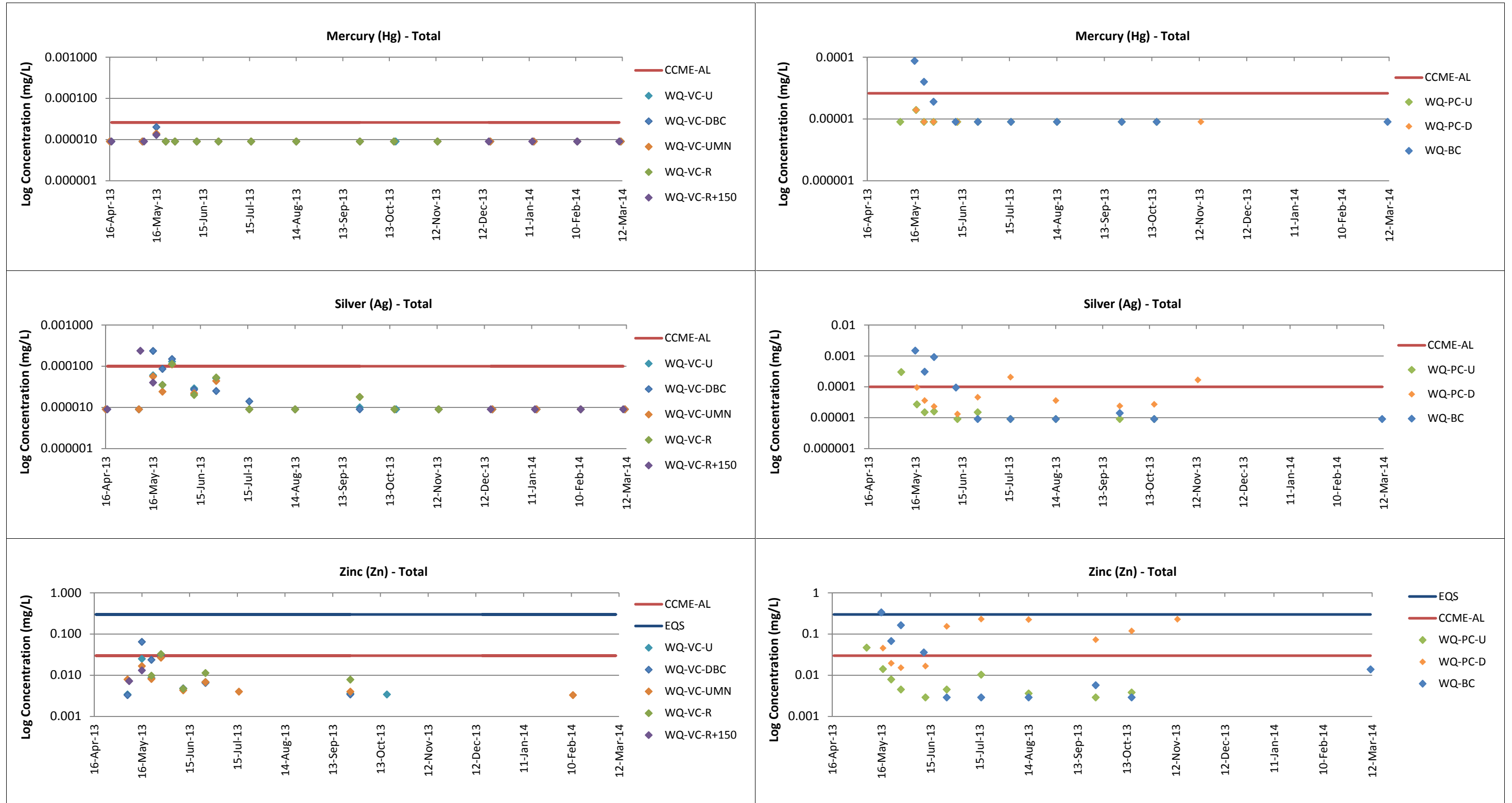




Table E-1. Water Quality Results for the January 13-15, 2014 Trip.

Analyte	Units	CCME-WATER-F-AL	Mount Nansen Effluent Discharge Standards	Sample ID WQ Site ID Date Sampled Detection Limit	0167-140113-015 WQ-VC-R+150 1/13/2014	0167-140113-014 WQ-DC-U 1/13/2014	0167-140113-011 WQ-SEEP 1/13/2014	0167-140113-012 WQ-SEEP-r 1/13/2014	QA/QC WQ-SEEP	0167-140113-009 WQ-TP 1/13/2014	0167-140113-010 WQ-DC-DX+105 1/13/2014	0167-140113-008 WQ-MS-S-03 1/13/2014	0167-140114-018 WQ-PIT-2 1/14/2014	0167-140114-016 WQ-PIT-3 1/14/2014
Temperature (in-situ)	°C	-	-	-	0	-0.1	0	-	-	0.1	0.4	0.3	4.6	5.2
Specific Conductivity (in-situ)	µS/cm	-	-	-	235.4	1680	1759	-	-	17.88	165	1172	2322	2687
pH (in-situ)	-	6.5 - 9.0	6.0 - 8.5	-	7.14	7.27	7.03	-	-	7.41	7.22	7.25	6.97	6.81
Turbidity (In-situ)	NTU	-	-	-	0.65	31.3	50.8	-	-	4.76	2.5	1.82	0.53	1.43
Dissolved Oxygen (in-situ)	mg/L	-	-	-	-	-	-	-	-	-	-	-	3.45	1.02
Colour, True	CU	15	-	5	-	-	-	-	-	-	-	-	-	-
Conductivity	µS/cm	-	-	2	226	1670	1750	1740	1%	2080	1140	1170	1950	2520
Hardness (as CaCO3)	mg/L	-	-	0.5	127	1040	1020	1040	2%	1330	717	719	1300	1690
pH (lab)	pH	6.5 - 9.0	6.0 - 8.5	0.1	7.75	7.78	7.48	7.5	0%	7.8	7.89	7.91	8.03	7.72
Total Suspended Solids	mg/L	-	50	3	<3.0	14.8	26.8	29.5	10%	<3.0	<3.0	9.9	<3.0	3.1
Total Dissolved Solids	mg/L	-	-	1	144	1250	1500	1520	1%	1560	885	913	1800	2490
Alkalinity, Bicarbonate (as CaCO3)	mg/L	-	-	1	90.4	241	236	235	0%	163	257	252	189	216
Alkalinity, Carbonate (as CaCO3)	mg/L	-	-	1	<1.0	<1.0	<1.0	<1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity, Hydroxide (as CaCO3)	mg/L	-	-	1	<1.0	<1.0	<1.0	<1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity, Total (as CaCO3)	mg/L	-	-	1	90.4	241	236	235	0%	163	257	252	189	216
Ammonia, Total (as N)	mg/L	0.75	-	0.005	<0.0050	<b>3.38</b>	<b>4.43</b>	<b>4.33</b>	2%	0.444	0.0195	0.0398	0.0053	0.0402
Chloride (Cl)	mg/L	120	-	0.5	<0.50	10	12	11	8%	12	<5.0	<5.0	<10	11
Fluoride (F)	mg/L	0.12	-	0.02	0.048	<0.40	<0.40	<0.40	-	<0.40	<0.20	<b>0.21</b>	<0.40	<0.40
Nitrate (as N)	mg/L	13	-	0.005	0.129	0.93	1.3	1.3	0%	0.52	0.063	<0.050	<0.10	0.12
Nitrite (as N)	mg/L	0.06	-	0.001	<0.0010	0.031	0.049	0.04	<b>18%</b>	<0.020	<0.010	<0.010	<0.020	<0.020
Sulfate (SO4)	mg/L	-	-	0.5	27.1	850	882	877	1%	1240	430	453	1130	1600
Cyanide, Weak Acid Diss	mg/L	-	0.1	0.005	<0.0050	0.0123	0.0102	0.0125	<b>23%</b>	<0.0050	<0.0050	<0.0050	-	-
Cyanide, Total	mg/L	-	0.3	0.005	<0.0050	0.0455	0.0618	0.0692	<b>12%</b>	<0.0050	<0.0050	<0.0050	-	-
Cyanate	mg/L	-	-	0.2	<2.0	1.23	<2.0	0.48	-	<2.0	<2.0	<2.0	-	-
Thiocyanate (SCN)	mg/L	-	-	0.5	<0.50	1.4	2.66	2.68	1%	<0.50	<0.50	<0.50	-	-
Aluminum (Al)-Total	mg/L	0.1	-	0.003	0.0267	0.0113	0.0136	0.0187	<b>38%</b>	0.0114	0.0319	0.0824	<0.0060	0.0072
Antimony (Sb)-Total	mg/L	-	0.15	0.0001	0.00034	0.00068	0.00064	0.00066	3%	0.0499	0.00997	0.0166	0.00366	0.00088
Arsenic (As)-Total	mg/L	0.005	-	0.0001	0.00106	<b>0.037</b>	<b>0.0483</b>	<b>0.0484</b>	0%	<b>0.157</b>	<b>0.0425</b>	<b>0.103</b>	<b>0.011</b>	<b>0.0169</b>
Barium (Ba)-Total	mg/L	-	1	0.00005	0.0843	0.0683	0.0601	0.0613	2%	0.02	0.0124	0.0197	0.0127	0.00765
Beryllium (Be)-Total	mg/L	-	-	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	-	<0.00020	<0.00010	<0.00010	<0.00020	<0.00020
Bismuth (Bi)-Total	mg/L	-	-	0.0005	<0.00050	<0.00050	<0.00050	<0.00050	-	<0.0010	<0.00050	<0.00050	<0.0010	<0.0010
Boron (B)-Total	mg/L	-	-	0.01	<0.010	0.06	0.077	0.073	5%	0.147	<0.010	<0.010	<0.020	<0.020
Cadmium (Cd)-Total	mg/L	0.000033	0.02	0.00001	0.000016	<b>0.000428</b>	<b>0.000687</b>	<b>0.000701</b>	2%	<b>0.00179</b>	<b>0.00322</b>	<b>0.00352</b>	<b>0.00373</b>	<b>0.0107</b>
Calcium (Ca)-Total	mg/L	-	-	0.05	31.4	280	296	296	0%	396	182	190	351	494
Chromium (Cr)-Total	mg/L	0.0089	0.04	0.0001	0.00015	0.00036	0.00047	0.00047	0%	<0.00020	<0.00010	0.00013	<0.00020	<0.00020
Cobalt (Co)-Total	mg/L	-	-	0.0001	<0.00010	0.00585	0.008	0.00804	1%	0.00094	0.00052	0.00103	<0.00020	0.00129
Copper (Cu)-Total	mg/L	0.002	0.2	0.0005	0.00115	<b>0.00257</b>	<b>0.0045</b>	<b>0.00406</b>	10%	<b>0.0259</b>	0.00058	0.00178	<b>0.0032</b>	<b>0.0025</b>
Iron (Fe)-Total	mg/L	0.3	1	0.01	0.052	<b>5.73</b>	<b>11.4</b>	<b>11.3</b>	1%	0.3	<b>0.484</b>	<b>2.76</b>	0.058	0.298
Lead (Pb)-Total	mg/L	0.003	0.1	0.00005	0.00006	<0.000050	0.000066	0.00007	6%	0.00231	0.000154	<b>0.00717</b>	0.00045	0.00044
Lithium (Li)-Total	mg/L	-	-	0.0005	0.00104	0.00121	0.00093	0.00063	<b>32%</b>	0.0127	0.00813	0.00972	0.0094	0.011
Magnesium (Mg)-Total	mg/L	-	-	0.1	10.5	76.3	68.4	68.4	0%	88	63.3	65.3	100	140
Manganese (Mn)-Total	mg/L	-	0.5	0.00005	0.0295	<b>5.15</b>	<b>6.39</b>	<b>6.4</b>	0%	<b>0.553</b>	<b>1.13</b>	<b>1.32</b>	0.117	<b>2.24</b>
Mercury (Hg)-Total	mg/L	0.000026	0.005	0.00001	<0.000010	<0.000010	<0.000010	<0.000010	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Total	mg/L	0.0073	-	0.00005	0.000372	0.000872	0.00101	0.00101	0%	0.00184	0.000397	0.000367	0.00017	<0.00010
Nickel (Ni)-Total	mg/L	0.1	0.3	0.0005	<0.00050	0.00219	0.00274	0.00275	0%	0.0022	0.00156	0.00198	<0.0010	0.0014
Phosphorus (P)-Total	mg/L	-	-	0.05	<0.050	<0.050	<0.050	<0.050	-	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium (K)-Total	mg/L	-	-	0.1	0.76	5.96	6.78	6.68	1%	23.2	3.76	3.61	3.99	5.57
Selenium (Se)-Total	mg/L	0.001	-	0.0001	<0.00010	0.0002	0.00023	0.00027	<b>17%</b>	<0.00020	<0.00010	<0.00010	<0.00020	<0.00020
Silicon (Si)-Total	mg/L	-	-	0.05	6.2	7.07	7.13	7.06	1%	2.99	6.74	6.94	3.54	3.88
Silver (Ag)-Total	mg/L	0.0001	0.1	0.00001	<0.000010	0.000026	0.00004	0.000044	10%	0.000069	<0.000010	<b>0.000176</b>	<0.000020	<0.000020
Sodium (Na)-Total	mg/L	-	-	0.05	3.24	31.2	37.8	38.8	3%	30	5.09	4.69	13.6	16.5
Strontium (Sr)-Total	mg/L	-	-	0.0002	0.305	0.848	0.817	0.841	3%	0.988	0.409	0.444	1.13	1.31
Sulfur (S)-Total	mg/L	-	-	0.5	9.32	263	283	282	0%	395	139	147	348	510
Thallium (Tl)-Total	mg/L	0.0008	-	0.00001	<0.000010	<0.000010	<0.000010	0.000011	10%	0.000319	0.000093	0.000101	0.00007	0.000117
Tin (Sn)-Total	mg/L	-	-	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	-	<0.00020	<0.00010	<0.00010	<0.00020	<0.00020
Titanium (Ti)-Total	mg/L	-	-	0.01	<0.010	<0.010	<0.010	<0.010	-	<0.020	<0.010	<0.010	<0.020	<0.020
Uranium (U)-Total	mg/L	0.015	-	0.00001	0.000652	0.00257	0.00286	0.00292	2%	0.00191	0.00435	0.00392	0.00464	0.00399
Vanadium (V)-Total	mg/L	-	-	0.001	<0.0010	0.0013	0.0018	0.0018	0%	<0.0020	<0.0010	<0.0010	<0.0020	<0.0020
Zinc (Zn)-Total	mg/L	0.03	0.3	0.003	<0.0030	0.0085	0.0066	0.0066	0%	<b>0.205</b>	<b>0.614</b>	<b>0.998</b>	<b>0.462</b>	<b>0.987</b>
Dissolved Metals Filtration Location				n/a	FIELD	FIELD	FIELD	FIELD	-	FIELD	FIELD	FIELD	FIELD	FIELD
Aluminum (Al)-Dissolved	mg/L	0.005	-	0.001	<b>0.0073</b>	<b>0.0063</b>	<b>0.0103</b>	<b>0.0091</b>	<b>12%</b>	<0.0020	0.0013	0.0013	<0.0020	0.0024
Antimony (Sb)-Dissolved	mg/L	-	-	0.0001	0.00033	0.00061	0.00055	0.00054	2%	0.0481	0.00986	0.0155	0.00361	0.0008
Arsenic (As)-Dissolved	mg/L	0.005	0.15	0.0001	0.00094	<b>0.0282</b>	<b>0.0332</b>	<b>0.0334</b>	1%	<b>0.107</b>	<b>0.0156</b>	<b>0.0676</b>	<b>0.00842</b>	<b>0.0101</b>
Barium (Ba)-Dissolved	mg/L	-	-	0.00005	0.0868	0.0653	0.0568	0.0586	3%	0.0194	0.0119	0.0164	0.0126	0.00797
Beryllium (Be)-Dissolved	mg/L	-	-	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	-	<0.00020	<0.00010	<0.00010	<0.00020	<0.00020
Bismuth (Bi)-Dissolved	mg/L	-	-	0.0005	<0.00050	<0.00050	<0.00050	<0.00050	-	<0.0010	<0.00050	<0.00050	<0.0010	<0.0010



Table E-1. Water Quality Results for the January 13-15, 2014 Trip.

Analyte	Units	CCME-WATER-F-AL	Mount Nansen Effluent Discharge Standards	Sample ID WQ Site ID Date Sampled Detection Limit	0167-140113-015 WQ-VC-R+150 1/13/2014	0167-140113-014 WQ-DC-U 1/13/2014	0167-140113-011 WQ-SEEP 1/13/2014	0167-140113-012 WQ-SEEP-r 1/13/2014	QA/QC WQ-SEEP	0167-140113-009 WQ-TP 1/13/2014	0167-140113-010 WQ-DC-DX+105 1/13/2014	0167-140113-008 WQ-MS-S-03 1/13/2014	0167-140114-018 WQ-PIT-2 1/14/2014	0167-140114-016 WQ-PIT-3 1/14/2014
Boron (B)-Dissolved	mg/L	-	-	0.01	<0.010	0.059	0.073	0.071	3%	0.141	<0.010	<0.010	<0.020	<0.020
Cadmium (Cd)-Dissolved	mg/L	0.00033	-	0.00001	0.000016	<b>0.000237</b>	<b>0.000501</b>	<b>0.000345</b>	<b>31%</b>	<b>0.00169</b>	<b>0.000866</b>	<b>0.000416</b>	<b>0.00368</b>	<b>0.0109</b>
Calcium (Ca)-Dissolved	mg/L	-	-	0.05	32.5	288	296	302	2%	390	183	185	357	461
Chromium (Cr)-Dissolved	mg/L	0.0089	-	0.0001	<0.00010	0.00027	0.00036	0.00032	<b>11%</b>	<0.00020	<0.00010	<0.00010	<0.00020	<0.00020
Cobalt (Co)-Dissolved	mg/L	-	-	0.0001	<0.00010	0.00588	0.0077	0.00783	2%	0.00093	0.00048	0.00094	<0.00020	0.00111
Copper (Cu)-Dissolved	mg/L	0.002	-	0.0002	0.00108	0.00116	0.0017	0.00163	4%	<b>0.0236</b>	<0.00020	<0.00020	<b>0.00218</b>	0.00149
Iron (Fe)-Dissolved	mg/L	0.3	-	0.01	0.014	<b>3.59</b>	<b>7.81</b>	<b>8.01</b>	3%	0.043	0.221	<b>2.08</b>	<0.010	0.116
Lead (Pb)-Dissolved	mg/L	0.001	-	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	-	0.00035	<0.000050	0.000121	<0.00010	<0.00010
Lithium (Li)-Dissolved	mg/L	-	-	0.0005	0.00099	0.00119	0.00085	0.00077	9%	0.0123	0.00906	0.00947	0.0092	0.011
Magnesium (Mg)-Dissolved	mg/L	-	-	0.1	11	78.6	67.1	68.7	2%	85.7	63.2	62.5	98.2	131
Manganese (Mn)-Dissolved	mg/L	-	-	0.00005	0.0271	5.3	6.18	6.2	0%	0.522	1.08	1.27	0.104	2.32
Mercury (Hg)-Dissolved	mg/L	0.00026	-	0.00001	<0.000010	<0.000010	<0.000010	<0.000010	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	mg/L	0.073	-	0.00005	0.000358	0.000828	0.000956	0.000945	1%	0.00177	0.000396	0.000324	0.00015	<0.00010
Nickel (Ni)-Dissolved	mg/L	0.1	-	0.0005	<0.00050	0.00219	0.00264	0.00263	0%	0.0021	0.00142	0.00188	<0.0010	0.0014
Phosphorus (P)-Dissolved	mg/L	-	-	0.05	<0.050	<0.050	<0.050	<0.050	-	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium (K)-Dissolved	mg/L	-	-	0.1	0.79	6.2	6.72	6.81	1%	22.9	3.79	3.47	4.07	5.13
Selenium (Se)-Dissolved	mg/L	0.001	-	0.0001	<0.00010	0.00021	0.00021	0.00027	<b>29%</b>	<0.00020	<0.00010	<0.00010	<0.00020	<0.00020
Silicon (Si)-Dissolved	mg/L	-	-	0.05	6.44	7.2	6.92	7.07	2%	2.92	6.68	6.56	3.6	3.58
Silver (Ag)-Dissolved	mg/L	0.0001	-	0.00001	<0.000010	<0.000010	0.000013	0.000013	0%	<0.000020	<0.000010	<0.000010	<0.000020	<0.000020
Sodium (Na)-Dissolved	mg/L	-	-	0.05	3.4	32.4	37	38.3	4%	29.9	4.97	4.35	13.1	16.7
Strontium (Sr)-Dissolved	mg/L	-	-	0.0002	0.298	0.874	0.821	0.826	1%	0.974	0.421	0.417	1.11	1.29
Sulfur (S)-Dissolved	mg/L	-	-	0.5	9.38	267	273	277	1%	380	136	139	337	471
Thallium (Tl)-Dissolved	mg/L	0.0008	-	0.00001	<0.000010	<0.000010	<0.000010	<0.000010	-	0.000306	0.000083	0.000077	0.000067	0.000122
Tin (Sn)-Dissolved	mg/L	-	-	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	-	<0.00020	<0.00010	<0.00010	<0.00020	<0.00020
Titanium (Ti)-Dissolved	mg/L	-	-	0.01	<0.010	<0.010	<0.010	<0.010	-	<0.020	<0.010	<0.010	<0.020	<0.020
Uranium (U)-Dissolved	mg/L	0.015	-	0.00001	0.000648	0.00258	0.00279	0.00287	3%	0.00183	0.00428	0.00368	0.00454	0.00405
Vanadium (V)-Dissolved	mg/L	-	-	0.001	<0.0010	<0.0010	0.0013	0.0012	8%	<0.0020	<0.0010	<0.0010	<0.0020	<0.0020
Zinc (Zn)-Dissolved	mg/L	0.03	-	0.001	0.001	0.008	0.0061	0.0057	7%	<b>0.199</b>	<b>0.598</b>	<b>0.971</b>	<b>0.446</b>	<b>0.992</b>



Table E-1. Water Quality Results for the January 13-15, 2014 Trip.

Analyte	Units	CCME-WATER-F-AL	Mount Nansen Effluent Discharge Standards	Sample ID WQ Site ID Date Sampled Detection Limit	0167-140114-017 WQ-PIT-1 1/14/2014	0167-140114-013 WQ-VC-REF 1/14/2014	0167-140114-001 WQ-VC-REF-r 1/14/2014	QA/QC WQ-VC-REF	0167-140114-005 WQ-VC-UMN 1/14/2014	0167-140114-007 WQ-VC-DBC 1/14/2014	0167-140114-TRAVEL-BLANK TRAVEL BLANK 1/15/2014	0167-140114-FIELD-BLANK FIELD BLANK 1/13/2014
Temperature (in-situ)	°C	-	-	-	0.3	0	-	-	0	0	-	-
Specific Conductivity (in-situ)	µS/cm	-	-	-	2040	222.3	-	-	237.8	220.1	-	-
pH (in-situ)	-	6.5 - 9.0	6.0 - 8.5	-	7.46	7.31	-	-	7.11	7.26	-	-
Turbidity (In-situ)	NTU	-	-	-	1.13	0.33	-	-	0.91	0.87	-	-
Dissolved Oxygen (in-situ)	mg/L	-	-	-	8.06	-	-	-	-	-	-	-
Colour, True	CU	15	-	5	-	-	-	-	-	-	-	-
Conductivity	µS/cm	-	-	2	1970	220	218	1%	233	220	<2.0	<2.0
Hardness (as CaCO3)	mg/L	-	-	0.5	1300	115	118	3%	123	120	<0.50	<0.50
pH (lab)	pH	6.5 - 9.0	6.0 - 8.5	0.1	7.98	7.93	7.9	0%	7.86	7.92	<b>5.69</b>	<b>5.6</b>
Total Suspended Solids	mg/L	-	50	3	<3.0	<3.0	<3.0	-	<3.0	<3.0	<3.0	<3.0
Total Dissolved Solids	mg/L	-	-	1	1790	138	122	<b>12%</b>	105	132	<10	<10
Alkalinity, Bicarbonate (as CaCO3)	mg/L	-	-	1	184	92	92.2	0%	92	89.3	<1.0	<1.0
Alkalinity, Carbonate (as CaCO3)	mg/L	-	-	1	<1.0	<1.0	<1.0	-	<1.0	<1.0	<1.0	<1.0
Alkalinity, Hydroxide (as CaCO3)	mg/L	-	-	1	<1.0	<1.0	<1.0	-	<1.0	<1.0	<1.0	<1.0
Alkalinity, Total (as CaCO3)	mg/L	-	-	1	184	92	92.2	0%	92	89.3	<1.0	<1.0
Ammonia, Total (as N)	mg/L	0.75	-	0.005	<0.0050	<0.0050	<0.0050	-	<0.0050	<b>0.99</b>	0.0069	<0.0050
Chloride (Cl)	mg/L	120	-	0.5	11	<0.50	<0.50	-	<0.50	<0.50	<0.50	<0.50
Fluoride (F)	mg/L	0.12	-	0.02	<0.40	0.045	0.046	2%	0.048	0.044	<0.020	<0.020
Nitrate (as N)	mg/L	13	-	0.005	<0.10	0.134	0.133	1%	0.122	0.156	<0.0050	<0.0050
Nitrite (as N)	mg/L	0.06	-	0.001	<0.020	<0.0010	<0.0010	-	<0.0010	<0.0010	<0.0010	<0.0010
Sulfate (SO4)	mg/L	-	-	0.5	1140	19.5	19.5	0%	27.1	20.1	<0.50	<0.50
Cyanide, Weak Acid Diss	mg/L	-	0.1	0.005	-	<0.0050	<0.0050	-	<0.0050	<0.0050	<0.0050	<0.0050
Cyanide, Total	mg/L	-	0.3	0.005	-	<0.0050	<0.0050	-	<0.0050	<0.0050	<0.0050	<0.0050
Cyanate	mg/L	-	-	0.2	-	<0.20	<0.20	-	<0.20	<0.20	<0.20	<0.20
Thiocyanate (SCN)	mg/L	-	-	0.5	-	<0.50	<0.50	-	<0.50	<0.50	<0.50	<0.50
Aluminum (Al)-Total	mg/L	0.1	-	0.003	0.0075	0.0217	0.0198	9%	0.0451	0.0322	<0.0030	<0.0030
Antimony (Sb)-Total	mg/L	-	0.15	0.001	0.0038	0.00016	0.00016	0%	0.00034	0.00016	<0.00010	<0.00010
Arsenic (As)-Total	mg/L	0.005	-	0.001	<b>0.0111</b>	0.00046	0.00028	<b>39%</b>	0.00144	0.00033	<0.00010	<0.00010
Barium (Ba)-Total	mg/L	-	1	0.00005	0.0127	0.0864	0.0878	2%	0.0889	0.0895	<0.000050	<0.000050
Beryllium (Be)-Total	mg/L	-	-	0.0001	<0.00020	<0.00010	<0.00010	-	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth (Bi)-Total	mg/L	-	-	0.0005	<0.0010	<0.00050	<0.00050	-	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)-Total	mg/L	-	-	0.01	<0.020	<0.010	<0.010	-	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)-Total	mg/L	0.000033	0.02	0.00001	<b>0.00374</b>	0.00002	0.000022	10%	<b>0.000065</b>	<b>0.000056</b>	<0.000010	<0.000010
Calcium (Ca)-Total	mg/L	-	-	0.05	355	29.8	30.2	1%	32	31.2	<0.050	<0.050
Chromium (Cr)-Total	mg/L	0.0089	0.04	0.0001	<0.00020	0.00014	0.00012	<b>14%</b>	0.00014	0.00013	<0.00010	<0.00010
Cobalt (Co)-Total	mg/L	-	-	0.0001	<0.00020	<0.00010	<0.00010	-	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)-Total	mg/L	0.002	0.2	0.0005	<b>0.003</b>	0.00109	0.00115	6%	0.00127	0.00119	<0.00050	<0.00050
Iron (Fe)-Total	mg/L	0.3	1	0.01	0.103	0.047	0.048	2%	0.07	0.057	<0.010	<0.010
Lead (Pb)-Total	mg/L	0.003	0.1	0.00005	0.00047	<0.000050	<0.000050	-	0.000102	0.000067	<0.000050	<0.000050
Lithium (Li)-Total	mg/L	-	-	0.0005	0.0096	0.00088	0.00115	<b>31%</b>	0.00061	0.0009	<0.00050	<0.00050
Magnesium (Mg)-Total	mg/L	-	-	10.2	10.2	10.2	10.2	1%	10.6	10.3	<0.10	<0.10
Manganese (Mn)-Total	mg/L	-	0.5	0.00005	0.119	0.0367	0.0372	1%	0.0568	0.0522	<0.000050	<0.000050
Mercury (Hg)-Total	mg/L	0.000026	0.005	0.00001	<0.000010	<0.000010	<0.000010	-	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Total	mg/L	0.0073	-	0.00005	0.00016	0.000394	0.000433	10%	0.000352	0.000353	<0.000050	<0.000050
Nickel (Ni)-Total	mg/L	0.1	0.3	0.0005	<0.0010	<0.00050	<0.00050	-	0.00054	<0.00050	<0.00050	<0.00050
Phosphorus (P)-Total	mg/L	-	-	0.05	<0.050	<0.050	<0.050	-	<0.050	<0.050	<0.050	<0.050
Potassium (K)-Total	mg/L	-	-	0.1	4.14	0.67	0.71	6%	0.75	0.74	<0.10	<0.10
Selenium (Se)-Total	mg/L	0.001	-	0.0001	<0.00020	0.00041	<0.00010	<b>76%</b>	<0.00010	0.00045	<0.00010	<0.00010
Silicon (Si)-Total	mg/L	-	-	0.05	3.64	6.25	6.41	3%	6.42	6.57	<0.050	<0.050
Silver (Ag)-Total	mg/L	0.0001	0.1	0.00001	<0.000020	<0.000010	<0.000010	-	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)-Total	mg/L	-	-	0.05	14.2	2.54	2.59	2%	2.98	2.56	<0.050	<0.050
Strontium (Sr)-Total	mg/L	-	-	0.0002	1.16	0.321	0.314	2%	0.306	0.303	<0.00020	<0.00020
Sulfur (S)-Total	mg/L	-	-	0.5	354	6.71	6.73	0%	8.96	6.86	<0.50	<0.50
Thallium (Tl)-Total	mg/L	0.0008	-	0.00001	0.000074	<0.000010	<0.000010	-	<0.000010	<0.000010	<0.000010	<0.000010
Tin (Sn)-Total	mg/L	-	-	0.0001	<0.00020	<0.00010	<0.00010	-	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)-Total	mg/L	-	-	0.01	<0.020	<0.010	<0.010	-	<0.010	<0.010	<0.010	<0.010
Uranium (U)-Total	mg/L	0.015	-	0.00001	0.00479	0.000661	0.000641	3%	0.000653	0.000593	<0.000010	<0.000010
Vanadium (V)-Total	mg/L	-	-	0.001	<0.0020	<0.0010	<0.0010	-	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)-Total	mg/L	0.03	0.3	0.003	<b>0.459</b>	<0.0030	<0.0030	-	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals Filtration Location		-	-	n/a	FIELD	FIELD	FIELD	-	FIELD	FIELD	-	FIELD
Aluminum (Al)-Dissolved	mg/L	0.005	-	0.001	<0.0020	<b>0.0083</b>	<b>0.0089</b>	7%	<b>0.0078</b>	<b>0.008</b>	-	<0.0010
Antimony (Sb)-Dissolved	mg/L	-	-	0.0001	0.00357	<0.00010	0.00011	-	0.00025	<0.00010	-	<0.00010
Arsenic (As)-Dissolved	mg/L	0.005	0.15	0.0001	<b>0.00844</b>	0.00021	0.00028	<b>33%</b>	0.00082	0.00023	-	<0.00010
Barium (Ba)-Dissolved	mg/L	-	-	0.00005	0.0128	0.0881	0.0838	5%	0.0839	0.0871	-	<0.000050
Beryllium (Be)-Dissolved	mg/L	-	-	0.0001	<0.00020	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010
Bismuth (Bi)-Dissolved	mg/L	-	-	0.0005	<0.0010	<0.00050	<0.00050	-	<0.00050	<0.00050	-	<0.00050





Table E-1. Water Quality Results for the January 13-15, 2014 Trip.

Analyte	Units	CCME-WATER-F-AL	Mount Nansen Effluent Discharge Standards	Sample ID WQ Site ID Date Sampled Detection Limit	0167-140114-017 WQ-PIT-1 1/14/2014	0167-140114-013 WQ-VC-REF 1/14/2014	0167-140114-001 WQ-VC-REF-r 1/14/2014	QA/QC WQ-VC-REF	0167-140114-005 WQ-VC-UMN 1/14/2014	0167-140114-007 WQ-VC-DBC 1/14/2014	0167-140114-TRAVEL-BLANK TRAVEL BLANK 1/15/2014	0167-140114-FIELD-BLANK FIELD BLANK 1/13/2014
Boron (B)-Dissolved	mg/L	-	-	0.01	<0.020	<0.010	<0.010	-	<0.010	<0.010	-	<0.010
Cadmium (Cd)-Dissolved	mg/L	0.00033	-	0.0001	<b>0.0037</b>	0.00016	0.00018	13%	0.00017	<b>0.00048</b>	-	<0.00010
Calcium (Ca)-Dissolved	mg/L	-	-	0.05	353	29.5	30.4	3%	31.9	31	-	<0.050
Chromium (Cr)-Dissolved	mg/L	0.0089	-	0.0001	<0.00020	<0.00010	<0.00010	-	0.00014	<0.00010	-	<0.00010
Cobalt (Co)-Dissolved	mg/L	-	-	0.0001	<0.00020	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010
Copper (Cu)-Dissolved	mg/L	0.002	-	0.0002	<b>0.0027</b>	0.00085	0.00082	4%	0.00098	0.0009	-	<0.00020
Iron (Fe)-Dissolved	mg/L	0.3	-	0.01	<0.010	0.013	0.017	31%	0.013	0.013	-	<0.010
Lead (Pb)-Dissolved	mg/L	0.001	-	0.00005	<0.00010	<0.000050	<0.000050	-	<0.000050	<0.000050	-	<0.000050
Lithium (Li)-Dissolved	mg/L	-	-	0.0005	0.0094	0.00085	0.00106	25%	0.00064	0.0008	-	<0.00050
Magnesium (Mg)-Dissolved	mg/L	-	-	0.1	102	10.1	10.2	1%	10.5	10.3	-	<0.10
Manganese (Mn)-Dissolved	mg/L	-	-	0.00005	0.107	0.0342	0.0344	1%	0.0475	0.049	-	<0.000050
Mercury (Hg)-Dissolved	mg/L	0.000026	-	0.00001	<0.000010	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000010
Molybdenum (Mo)-Dissolved	mg/L	0.073	-	0.00005	0.00014	0.000352	0.000384	9%	0.000367	0.00035	-	<0.000050
Nickel (Ni)-Dissolved	mg/L	0.1	-	0.0005	<0.0010	<0.00050	<0.00050	-	<0.00050	<0.00050	-	<0.00050
Phosphorus (P)-Dissolved	mg/L	-	-	0.05	<0.050	<0.050	<0.050	-	<0.050	<0.050	-	<0.050
Potassium (K)-Dissolved	mg/L	-	-	0.1	4.07	0.61	0.71	16%	0.75	0.71	-	<0.10
Selenium (Se)-Dissolved	mg/L	0.001	-	0.0001	<0.00020	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010
Silicon (Si)-Dissolved	mg/L	-	-	0.05	3.6	6.08	6.34	4%	6.29	6.41	-	<0.050
Silver (Ag)-Dissolved	mg/L	0.0001	-	0.00001	<0.000020	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000010
Sodium (Na)-Dissolved	mg/L	-	-	0.05	13.1	2.53	2.59	2%	2.91	2.57	-	<0.050
Strontium (Sr)-Dissolved	mg/L	-	-	0.0002	1.13	0.301	0.307	2%	0.301	0.308	-	<0.00020
Sulfur (S)-Dissolved	mg/L	-	-	0.5	345	6.61	6.52	1%	8.76	6.67	-	<0.50
Thallium (Tl)-Dissolved	mg/L	0.0008	-	0.00001	0.00007	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000010
Tin (Sn)-Dissolved	mg/L	-	-	0.0001	<0.00020	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010
Titanium (Ti)-Dissolved	mg/L	-	-	0.01	<0.020	<0.010	<0.010	-	<0.010	<0.010	-	<0.010
Uranium (U)-Dissolved	mg/L	0.015	-	0.00001	0.00452	0.000628	0.000628	0%	0.000606	0.0006	-	<0.000010
Vanadium (V)-Dissolved	mg/L	-	-	0.001	<0.0020	<0.0010	<0.0010	-	<0.0010	<0.0010	-	<0.0010
Zinc (Zn)-Dissolved	mg/L	0.03	-	0.001	<b>0.454</b>	0.0012	<0.0010	-	0.0014	<0.0010	-	<0.0010



Table E-1. Water Quality Results for the January 13-15, 2014 Trip.

Analyte	Units	CCME-WATER-F-AL	Mount Nansen Effluent Discharge Standards	Sample ID WQ Site ID Date Sampled Detection Limit	0167-140114-006 WQ-VC-U 1/14/2014
Temperature (in-situ)	°C	-	-	-	0
Specific Conductivity (in-situ)	µS/cm	-	-	-	221.9
pH (in-situ)	-	6.5 - 9.0	6.0 - 8.5	-	7.22
Turbidity (In-situ)	NTU	-	-	-	0.75
Dissolved Oxygen (in-situ)	mg/L	-	-	-	-
Colour, True	CU	15	-	5	-
Conductivity	µS/cm	-	-	2	217
Hardness (as CaCO3)	mg/L	-	-	0.5	117
pH (lab)	pH	6.5 - 9.0	6.0 - 8.5	0.1	7.84
Total Suspended Solids	mg/L	-	50	3	<3.0
Total Dissolved Solids	mg/L	-	-	1	137
Alkalinity, Bicarbonate (as CaCO3)	mg/L	-	-	1	90.3
Alkalinity, Carbonate (as CaCO3)	mg/L	-	-	1	<1.0
Alkalinity, Hydroxide (as CaCO3)	mg/L	-	-	1	<1.0
Alkalinity, Total (as CaCO3)	mg/L	-	-	1	90.3
Ammonia, Total (as N)	mg/L	0.75	-	0.005	0.54
Chloride (Cl)	mg/L	120	-	0.5	<0.50
Fluoride (F)	mg/L	0.12	-	0.02	0.046
Nitrate (as N)	mg/L	13	-	0.005	0.125
Nitrite (as N)	mg/L	0.06	-	0.001	<0.0010
Sulfate (SO4)	mg/L	-	-	0.5	20.3
Cyanide, Weak Acid Diss	mg/L	-	0.1	0.005	<0.0050
Cyanide, Total	mg/L	-	0.3	0.005	<0.0050
Cyanate	mg/L	-	-	0.2	<0.20
Thiocyanate (SCN)	mg/L	-	-	0.5	<0.50
Aluminum (Al)-Total	mg/L	0.1	-	0.003	0.0359
Antimony (Sb)-Total	mg/L	-	0.15	0.0001	0.00015
Arsenic (As)-Total	mg/L	0.005	-	0.0001	0.00036
Barium (Ba)-Total	mg/L	-	1	0.00005	0.0892
Beryllium (Be)-Total	mg/L	-	-	0.0001	<0.00010
Bismuth (Bi)-Total	mg/L	-	-	0.0005	<0.00050
Boron (B)-Total	mg/L	-	-	0.01	<0.010
Cadmium (Cd)-Total	mg/L	0.000033	0.02	0.00001	0.000032
Calcium (Ca)-Total	mg/L	-	-	0.05	29.8
Chromium (Cr)-Total	mg/L	0.0089	0.04	0.0001	0.00012
Cobalt (Co)-Total	mg/L	-	-	0.0001	<0.00010
Copper (Cu)-Total	mg/L	0.002	0.2	0.0005	0.0011
Iron (Fe)-Total	mg/L	0.3	1	0.01	0.06
Lead (Pb)-Total	mg/L	0.003	0.1	0.00005	0.00006
Lithium (Li)-Total	mg/L	-	-	0.0005	0.0008
Magnesium (Mg)-Total	mg/L	-	-	0.1	9.91
Manganese (Mn)-Total	mg/L	-	0.5	0.00005	0.0529
Mercury (Hg)-Total	mg/L	0.000026	0.005	0.00001	<0.000010
Molybdenum (Mo)-Total	mg/L	0.0073	-	0.00005	0.000371
Nickel (Ni)-Total	mg/L	0.1	0.3	0.0005	<0.00050
Phosphorus (P)-Total	mg/L	-	-	0.05	<0.050
Potassium (K)-Total	mg/L	-	-	0.1	0.68
Selenium (Se)-Total	mg/L	0.001	-	0.0001	0.00024
Silicon (Si)-Total	mg/L	-	-	0.05	6.21
Silver (Ag)-Total	mg/L	0.0001	0.1	0.00001	<0.000010
Sodium (Na)-Total	mg/L	-	-	0.05	2.62
Strontium (Sr)-Total	mg/L	-	-	0.0002	0.312
Sulfur (S)-Total	mg/L	-	-	0.5	7.02
Thallium (Tl)-Total	mg/L	0.0008	-	0.00001	<0.000010
Tin (Sn)-Total	mg/L	-	-	0.0001	<0.00010
Titanium (Ti)-Total	mg/L	-	-	0.01	<0.010
Uranium (U)-Total	mg/L	0.015	-	0.00001	0.000622
Vanadium (V)-Total	mg/L	-	-	0.001	<0.0010
Zinc (Zn)-Total	mg/L	0.03	0.3	0.003	<0.0030
Dissolved Metals Filtration Location		-	-	n/a	FIELD
Aluminum (Al)-Dissolved	mg/L	0.005	-	0.001	<b>0.0095</b>
Antimony (Sb)-Dissolved	mg/L	-	-	0.0001	<0.00010
Arsenic (As)-Dissolved	mg/L	0.005	0.15	0.0001	0.00025
Barium (Ba)-Dissolved	mg/L	-	-	0.00005	0.088
Beryllium (Be)-Dissolved	mg/L	-	-	0.0001	<0.00010
Bismuth (Bi)-Dissolved	mg/L	-	-	0.0005	<0.00050

Applied - Federal CCME Canadian Environmental Quality Guidelines (JUL, 2012),  
Guidelines: CCME: Freshwater Aquatic Life

- Mount Nansen Effluent Quality Standards

Color Key: **Exceeds CCME Guideline**

**Exceeds MN Effluent Quality Standards (EQS)**

**Exceeds both CCME and EQS**

**QA/QC Assessment - highlighted if > +/- 10%**

Note: For those guidelines that are hardness dependent, the most conservative guideline has been applied.



Table E-1. Water Quality Results for the January 13-15, 2014 Trip.

Analyte	Units	CCME-WATER-F-AL	Mount Nansen Effluent Discharge Standards	Sample ID WQ Site ID Date Sampled Detection Limit	0167-140114-006 WQ-VC-U 1/14/2014
Boron (B)-Dissolved	mg/L	-	-	0.01	<0.010
Cadmium (Cd)-Dissolved	mg/L	0.00033	-	0.00001	0.00002
Calcium (Ca)-Dissolved	mg/L	-	-	0.05	30.3
Chromium (Cr)-Dissolved	mg/L	0.0089	-	0.0001	<0.00010
Cobalt (Co)-Dissolved	mg/L	-	-	0.0001	<0.00010
Copper (Cu)-Dissolved	mg/L	0.002	-	0.0002	0.00089
Iron (Fe)-Dissolved	mg/L	0.3	-	0.01	0.013
Lead (Pb)-Dissolved	mg/L	0.001	-	0.00005	<0.000050
Lithium (Li)-Dissolved	mg/L	-	-	0.0005	0.00089
Magnesium (Mg)-Dissolved	mg/L	-	-	0.1	10.1
Manganese (Mn)-Dissolved	mg/L	-	-	0.00005	0.0485
Mercury (Hg)-Dissolved	mg/L	0.00026	-	0.00001	<0.000010
Molybdenum (Mo)-Dissolved	mg/L	0.073	-	0.00005	0.000361
Nickel (Ni)-Dissolved	mg/L	0.1	-	0.0005	<0.00050
Phosphorus (P)-Dissolved	mg/L	-	-	0.05	<0.050
Potassium (K)-Dissolved	mg/L	-	-	0.1	0.69
Selenium (Se)-Dissolved	mg/L	0.001	-	0.0001	0.00025
Silicon (Si)-Dissolved	mg/L	-	-	0.05	6.25
Silver (Ag)-Dissolved	mg/L	0.0001	-	0.00001	<0.000010
Sodium (Na)-Dissolved	mg/L	-	-	0.05	2.65
Strontium (Sr)-Dissolved	mg/L	-	-	0.0002	0.301
Sulfur (S)-Dissolved	mg/L	-	-	0.5	6.81
Thallium (Tl)-Dissolved	mg/L	0.0008	-	0.00001	<0.000010
Tin (Sn)-Dissolved	mg/L	-	-	0.0001	<0.00010
Titanium (Ti)-Dissolved	mg/L	-	-	0.01	<0.010
Uranium (U)-Dissolved	mg/L	0.015	-	0.00001	0.000588
Vanadium (V)-Dissolved	mg/L	-	-	0.001	<0.0010
Zinc (Zn)-Dissolved	mg/L	0.03	-	0.001	<0.0010



Table E-2. Water Quality Results for the February 10-12, 2014 Trip.

Analyte	Units	CCME-WATER-F-AL	Mount Nansen Effluent Discharge Standards	Sample ID WQ Site ID Date Sampled Detection Limit	0167-140212-016 WQ-PIT-1 02/12/2014	0167-140212-017 WQ-PIT-3 02/12/2014	0167-140212-018 WQ-PIT-2 02/12/2014	0167-140212-019 WQ-PW 02/12/2014	0167-140211-006 WQ-VC-UMN 02/11/2014	0167-140211-003 WQ-TP 02/11/2014	0167-140211-008 WQ-VC-U 02/11/2014	0167-140211-002 WQ-DC-B 02/11/2014
Temperature (in-situ)	°C	-	-	-	0.1	3.9	4	-	0	0.6	0	0
Specific Conductivity (in-situ)	µS/cm	-	-	-	1992	1991	1990	-	206.9	1979	177.8	1810
pH (in-situ)	-	6.5 - 9.0	6.0 - 8.5	-	7.42	7.1	7.01	-	7.05	7.3	7.18	6.93
Turbidity (In-situ)	NTU	-	-	-	-	-	-	-	1.81	4.23	0.32	21.1
Dissolved Oxygen (in-situ)	mg/L	-	-	-	-	-	-	-	-	-	-	-
Colour, True	CU	15	-	5	-	-	-	<5.0	-	-	-	-
Conductivity	µS/cm	-	-	2	1990	1980	1970	327	248	2250	219	2070
Hardness (as CaCO3)	mg/L	-	-	0.5	1300	1280	1310	192	124	1370	112	1340
pH (lab)	pH	6.5 - 9.0	6.0 - 8.5	0.1	8	7.95	7.99	7.65	7.88	7.92	7.85	7.74
Total Suspended Solids	mg/L	-	50	3	<3.0	6	<3.0	-	<3.0	<3.0	<3.0	13.3
Total Dissolved Solids	mg/L	-	-	1	1730	1690	1680	200	134	1970	115	1760
Alkalinity, Bicarbonate (as CaCO3)	mg/L	-	-	1	200	185	196	-	92.3	182	87.7	284
Alkalinity, Carbonate (as CaCO3)	mg/L	-	-	1	<1.0	<1.0	<1.0	-	<1.0	<1.0	<1.0	<1.0
Alkalinity, Hydroxide (as CaCO3)	mg/L	-	-	1	<1.0	<1.0	<1.0	-	<1.0	<1.0	<1.0	<1.0
Alkalinity, Total (as CaCO3)	mg/L	-	-	1	200	185	196	161	92.3	182	87.7	284
Ammonia, Total (as N)	mg/L	0.75	-	0.005	0.0084	0.0173	0.0081	-	<0.0050	0.719	<0.0050	0.472
Chloride (Cl)	mg/L	120	-	0.5	<5.0	<5.0	<5.0	<0.50	<0.50	<5.0	<0.50	<5.0
Fluoride (F)	mg/L	0.12	-	0.02	<b>0.38</b>	<b>0.35</b>	<b>0.3</b>	0.105	0.049	<b>0.42</b>	0.046	<b>0.2</b>
Nitrate (as N)	mg/L	13	-	0.005	0.077	0.207	<0.050	0.129	0.141	0.237	0.165	0.061
Nitrite (as N)	mg/L	0.06	-	0.001	<0.010	<0.010	<0.010	<0.0010	<0.0010	<0.010	<0.0010	<0.010
Sulfate (SO4)	mg/L	-	-	0.5	1130	1100	1080	32.6	30.7	1310	20	1120
Cyanide, Weak Acid Diss	mg/L	-	0.1	0.005	-	-	-	-	<0.0050	<0.0050	<0.0050	<0.0050
Cyanide, Total	mg/L	-	0.3	0.005	-	-	-	-	<0.0050	<0.0050	<0.0050	<0.0050
Cyanate	mg/L	-	-	0.2	-	-	-	-	<2.0	<0.20	<0.20	<0.20
Thiocyanate (SCN)	mg/L	-	-	0.5	-	-	-	-	<0.50	<0.50	<0.50	<0.50
Aluminum (Al)-Total	mg/L	0.1	-	0.003	0.0171	0.0372	0.0101	<0.010	0.0524	<0.0060	0.0166	0.0082
Antimony (Sb)-Total	mg/L	-	0.15	0.0001	0.00388	0.0027	0.00376	<0.00050	0.00025	0.0472	0.00011	0.00123
Arsenic (As)-Total	mg/L	0.005	-	0.0001	<b>0.0114</b>	<b>0.0123</b>	<b>0.0112</b>	0.00037	0.00086	<b>0.169</b>	0.00025	0.00159
Barium (Ba)-Total	mg/L	-	1	0.00005	0.0128	0.0154	0.0123	0.082	0.0777	0.0197	0.0812	0.0743
Beryllium (Be)-Total	mg/L	-	-	0.0001	<0.00020	<0.00020	<0.00020	-	<0.00010	<0.00020	<0.00010	<0.00020
Bismuth (Bi)-Total	mg/L	-	-	0.0005	<0.0010	<0.0010	<0.0010	-	<0.00050	<0.0010	<0.00050	<0.0010
Boron (B)-Total	mg/L	-	-	0.01	<0.020	<0.020	<0.020	<0.10	<0.010	0.178	<0.010	<0.020
Cadmium (Cd)-Total	mg/L	0.000033	0.02	0.00001	<b>0.00404</b>	<b>0.00471</b>	<b>0.00394</b>	<0.00020	0.000023	<b>0.00309</b>	0.000028	<b>0.00016</b>
Calcium (Ca)-Total	mg/L	-	-	0.05	359	359	356	44.5	32.1	419	27.8	318
Chromium (Cr)-Total	mg/L	0.0089	0.04	0.0001	0.00036	<0.00020	<0.00020	<0.0020	0.00014	<0.00020	0.00011	<0.00020
Cobalt (Co)-Total	mg/L	-	-	0.0001	<0.00020	<0.00020	<0.00020	-	<0.00010	0.00096	<0.00010	0.00169
Copper (Cu)-Total	mg/L	0.002	0.2	0.0005	<b>0.0036</b>	<b>0.0035</b>	<b>0.0035</b>	<0.0010	0.0014	<b>0.0288</b>	0.00198	0.0011
Iron (Fe)-Total	mg/L	0.3	1	0.01	0.095	0.137	0.056	<0.030	0.084	<b>0.41</b>	0.031	<b>5.16</b>
Lead (Pb)-Total	mg/L	0.003	0.1	0.00005	0.00051	0.0018	0.00055	0.00071	0.000249	0.00291	0.000165	<0.00010
Lithium (Li)-Total	mg/L	-	-	0.0005	0.0107	0.0094	0.0093	-	0.00059	0.0151	<0.00050	0.0029
Magnesium (Mg)-Total	mg/L	-	-	0.1	97.7	95.4	95.4	19.6	10.7	91.6	9.64	142
Manganese (Mn)-Total	mg/L	-	0.5	0.00005	0.106	0.238	0.117	<0.0020	0.0829	<b>1.08</b>	0.0776	<b>2.22</b>
Mercury (Hg)-Total	mg/L	0.000026	0.005	0.00001	<0.000010	<0.000010	<0.000010	<0.00020	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Total	mg/L	0.0073	-	0.00005	0.00015	0.00011	0.00015	-	0.000308	0.002	0.000324	0.00033
Nickel (Ni)-Total	mg/L	0.1	0.3	0.0005	<0.0010	<0.0010	<0.0010	-	0.00075	0.0027	0.00052	0.0017
Phosphorus (P)-Total	mg/L	-	-	0.05	<0.050	<0.050	<0.050	-	<0.050	<0.050	<0.050	<0.050
Potassium (K)-Total	mg/L	-	-	0.1	3.97	3.91	3.98	0.86	0.8	24.2	0.7	4.01
Selenium (Se)-Total	mg/L	0.001	-	0.0001	<0.00020	<0.00020	<0.00020	<0.0010	<0.00010	<0.00020	<0.00010	<0.00020
Silicon (Si)-Total	mg/L	-	-	0.05	3.64	3.55	3.57	-	6.23	3.26	6.26	8.57
Silver (Ag)-Total	mg/L	0.0001	0.1	0.00001	<0.000020	0.000025	<0.000020	-	<0.000010	0.00007	<0.000010	<0.000020
Sodium (Na)-Total	mg/L	-	-	0.05	14.2	14	13.8	4.8	3.47	34	2.77	16.8
Strontium (Sr)-Total	mg/L	-	-	0.0002	1.22	1.19	1.16	-	0.304	1.13	0.302	1.13
Sulfur (S)-Total	mg/L	-	-	0.5	369	368	363	-	10.3	424	6.95	356
Thallium (Tl)-Total	mg/L	0.0008	-	0.00001	0.000075	0.000071	0.000072	-	<0.000010	0.000355	<0.000010	<0.000020
Tin (Sn)-Total	mg/L	-	-	0.0001	<0.00020	<0.00020	<0.00020	-	<0.00010	<0.00020	<0.00010	<0.00020
Titanium (Ti)-Total	mg/L	-	-	0.01	<0.020	<0.020	<0.020	-	<0.010	<0.020	<0.010	<0.020



Table E-2. Water Quality Results for the February 10-12, 2014 Trip.

Analyte	Units	CCME-WATER-F-AL	Mount Nansen Effluent Discharge Standards	Sample ID WQ Site ID Date Sampled Detection Limit	0167-140212-016 WQ-PIT-1 02/12/2014	0167-140212-017 WQ-PIT-3 02/12/2014	0167-140212-018 WQ-PIT-2 02/12/2014	0167-140212-019 WQ-PW 02/12/2014	0167-140211-006 WQ-VC-UMN 02/11/2014	0167-140211-003 WQ-TP 02/11/2014	0167-140211-008 WQ-VC-U 02/11/2014	0167-140211-002 WQ-DC-B 02/11/2014
Uranium (U)-Total	mg/L	0.015	-	0.00001	0.00468	0.00468	0.00455	0.00176	0.000625	0.00195	0.000548	0.00408
Vanadium (V)-Total	mg/L	-	-	0.001	<0.0020	<0.0020	<0.0020	-	<0.0010	<0.0020	<0.0010	<0.0020
Zinc (Zn)-Total	mg/L	0.03	0.3	0.003	0.549	0.535	0.521	<0.050	0.0033	0.366	<0.0030	0.0506
Dissolved Metals Filtration Location		-	-	n/a	FIELD	FIELD	FIELD	-	FIELD	FIELD	FIELD	FIELD
Aluminum (Al)-Dissolved	mg/L	0.005	-	0.001	<0.0020	<0.0020	<0.0020	-	0.0072	<0.0020	0.0074	0.0025
Antimony (Sb)-Dissolved	mg/L	-	-	0.0001	0.00368	0.00267	0.00376	-	0.00023	0.0451	<0.00010	0.00117
Arsenic (As)-Dissolved	mg/L	0.005	0.15	0.0001	0.00884	0.00842	0.00881	-	0.0007	0.0981	0.00021	0.00079
Barium (Ba)-Dissolved	mg/L	-	-	0.00005	0.0121	0.0101	0.0126	-	0.0794	0.0199	0.0814	0.0695
Beryllium (Be)-Dissolved	mg/L	-	-	0.0001	<0.00020	<0.00020	<0.00020	-	<0.00010	<0.00020	<0.00010	<0.00020
Bismuth (Bi)-Dissolved	mg/L	-	-	0.0005	<0.0010	<0.0010	<0.0010	-	<0.00050	<0.0010	<0.00050	<0.0010
Boron (B)-Dissolved	mg/L	-	-	0.01	<0.020	<0.020	<0.020	-	<0.010	0.163	<0.010	<0.020
Cadmium (Cd)-Dissolved	mg/L	0.000033	-	0.00001	0.00397	0.00412	0.00379	-	0.00002	0.00294	0.000026	0.000149
Calcium (Ca)-Dissolved	mg/L	-	-	0.05	366	357	364	-	31.7	401	28.6	310
Chromium (Cr)-Dissolved	mg/L	0.0089	-	0.0001	<0.00020	<0.00020	<0.00020	-	<0.00010	<0.00020	<0.00010	<0.00020
Cobalt (Co)-Dissolved	mg/L	-	-	0.0001	<0.00020	<0.00020	<0.00020	-	<0.00010	0.00091	<0.00010	0.00166
Copper (Cu)-Dissolved	mg/L	0.002	-	0.0002	0.00252	0.00204	0.00234	-	0.00105	0.0255	0.00109	0.00055
Iron (Fe)-Dissolved	mg/L	0.3	-	0.01	<0.010	<0.010	<0.010	-	0.014	0.043	0.013	3.55
Lead (Pb)-Dissolved	mg/L	0.001	-	0.00005	<0.00010	<0.00010	<0.00010	-	<0.000050	0.00032	<0.000050	<0.00010
Lithium (Li)-Dissolved	mg/L	-	-	0.0005	0.0098	0.0091	0.009	-	<0.00050	0.0143	<0.00050	0.0027
Magnesium (Mg)-Dissolved	mg/L	-	-	0.1	94.5	95.3	97	-	10.9	88.3	9.88	138
Manganese (Mn)-Dissolved	mg/L	-	-	0.00005	0.0856	0.188	0.101	-	0.0718	1.03	0.0742	2.15
Mercury (Hg)-Dissolved	mg/L	0.000026	-	0.00001	<0.000010	<0.000010	<0.000010	-	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	mg/L	0.073	-	0.00005	0.00015	0.00011	0.00014	-	0.000301	0.00192	0.000298	0.00031
Nickel (Ni)-Dissolved	mg/L	0.1	-	0.0005	<0.0010	<0.0010	<0.0010	-	<0.00050	0.0026	<0.00050	0.0017
Phosphorus (P)-Dissolved	mg/L	-	-	0.05	<0.050	<0.050	<0.050	-	<0.050	<0.050	<0.050	<0.050
Potassium (K)-Dissolved	mg/L	-	-	0.1	4.08	3.98	4.05	-	0.76	25	0.71	3.96
Selenium (Se)-Dissolved	mg/L	0.001	-	0.0001	<0.00020	<0.00020	<0.00020	-	<0.00010	<0.00020	<0.00010	<0.00020
Silicon (Si)-Dissolved	mg/L	-	-	0.05	3.67	3.46	3.6	-	6.21	3.18	6.36	8.25
Silver (Ag)-Dissolved	mg/L	0.0001	-	0.00001	<0.000020	<0.000020	<0.000020	-	<0.000010	0.000021	<0.000010	<0.000020
Sodium (Na)-Dissolved	mg/L	-	-	0.05	13.7	13.7	13.6	-	3.44	33.6	2.61	16.7
Strontium (Sr)-Dissolved	mg/L	-	-	0.0002	1.19	1.13	1.14	-	0.3	1.13	0.295	1.12
Sulfur (S)-Dissolved	mg/L	-	-	0.5	353	359	362	-	10.4	416	6.93	340
Thallium (Tl)-Dissolved	mg/L	0.0008	-	0.00001	0.000072	0.000068	0.00007	-	<0.000010	0.000355	<0.000010	<0.000020
Tin (Sn)-Dissolved	mg/L	-	-	0.0001	<0.00020	<0.00020	<0.00020	-	<0.00010	<0.00020	<0.00010	<0.00020
Titanium (Ti)-Dissolved	mg/L	-	-	0.01	<0.020	<0.020	<0.020	-	<0.010	<0.020	<0.010	<0.020
Uranium (U)-Dissolved	mg/L	0.015	-	0.00001	0.00448	0.00451	0.00444	-	0.0006	0.00194	0.000536	0.00382
Vanadium (V)-Dissolved	mg/L	-	-	0.001	<0.0020	<0.0020	<0.0020	-	<0.0010	<0.0020	<0.0010	<0.0020
Zinc (Zn)-Dissolved	mg/L	0.03	-	0.001	0.544	0.517	0.513	-	0.0017	0.355	<0.0010	0.0496

Applied Guidelines: - Federal CCME Canadian Environmental Quality Guidelines (JUL, 2012), CCME: Freshwater Aquatic Life

- Mount Nansen Effluent Quality Standards

Color Key: Exceeds CCME Guideline

Exceeds MN Effluent Quality Standards (EQS)

Exceeds both CCME and EQS

QA/QC Assessment - highlighted if > +/- 10%

Note: For those guidelines that are hardness dependent, the most conservative guideline has been applied.



Table E-2. Water Quality Results for the February 10-12, 2014 Trip.

Analyte	Units	CCME-WATER-F-AL	Mount Nansen Effluent Discharge Standards	Sample ID WQ Site ID Date Sampled Detection Limit	0167-140211-010 WQ-DC-U 02/11/2014	0167-140211-009 WQ-VC-DBC 02/11/2014	0167-140211-007 WQ-VC-R+150 02/11/2014	0167-140211-004 WQ-SEEP-r 02/11/2014	0167-140211-005 WQ-SEEP 02/11/2014	QA/QC WQ-SEEP	0167-140211-001 WQ-DC-DX+105 02/11/2014
Temperature (in-situ)	°C	-	-	-	0	0	0.1	-	0	-	0.5
Specific Conductivity (in-situ)	µS/cm	-	-	-	1415	177.8	204	-	1566	-	965
pH (in-situ)	-	6.5 - 9.0	6.0 - 8.5	-	7.17	7.18	7.43	-	7.56	-	7.33
Turbidity (In-situ)	NTU	-	-	-	42	1.38	0.6	-	48.6	-	3.9
Dissolved Oxygen (in-situ)	mg/L	-	-	-	-	-	-	-	-	-	-
Colour, True	CU	15	-	5	-	-	-	-	-	-	-
Conductivity	µS/cm	-	-	2	1640	220	242	1710	1770	4%	1130
Hardness (as CaCO3)	mg/L	-	-	0.5	928	112	120	1000	1000	0%	672
pH (lab)	pH	6.5 - 9.0	6.0 - 8.5	0.1	7.9	7.87	7.92	7.8	7.84	1%	8.05
Total Suspended Solids	mg/L	-	50	3	12	<3.0	<3.0	24	24	0%	4.7
Total Dissolved Solids	mg/L	-	-	1	1310	117	129	1430	1430	0%	796
Alkalinity, Bicarbonate (as CaCO3)	mg/L	-	-	1	225	90	89.1	222	224	1%	244
Alkalinity, Carbonate (as CaCO3)	mg/L	-	-	1	<1.0	<1.0	<1.0	<1.0	<1.0	-	<1.0
Alkalinity, Hydroxide (as CaCO3)	mg/L	-	-	1	<1.0	<1.0	<1.0	<1.0	<1.0	-	<1.0
Alkalinity, Total (as CaCO3)	mg/L	-	-	1	225	90	89.1	222	224	1%	244
Ammonia, Total (as N)	mg/L	0.75	-	0.005	<b>3.81</b>	<0.0050	<0.0050	<b>4.81</b>	<b>4.61</b>	4%	0.0258
Chloride (Cl)	mg/L	120	-	0.5	<5.0	<0.50	<0.50	<5.0	<5.0	-	<5.0
Fluoride (F)	mg/L	0.12	-	0.02	<0.20	0.044	0.05	<b>0.23</b>	<b>0.27</b>	17%	<b>0.34</b>
Nitrate (as N)	mg/L	13	-	0.005	0.88	0.151	0.148	1.13	1.13	0%	<0.050
Nitrite (as N)	mg/L	0.06	-	0.001	0.025	<0.0010	<0.0010	0.035	0.032	9%	<0.010
Sulfate (SO4)	mg/L	-	-	0.5	786	20.2	29.6	869	865	0%	408
Cyanide, Weak Acid Diss	mg/L	-	0.1	0.005	0.011	<0.0050	<0.0050	0.0107	0.0124	16%	<0.0050
Cyanide, Total	mg/L	-	0.3	0.005	0.0353	<0.0050	<0.0050	0.0486	0.0624	28%	<0.0050
Cyanate	mg/L	-	-	0.2	1.14	<0.20	<0.20	0.54	1.11	106%	<0.20
Thiocyanate (SCN)	mg/L	-	-	0.5	1.66	<0.50	<0.50	2.57	2.55	1%	<0.50
Aluminum (Al)-Total	mg/L	0.1	-	0.003	0.0142	0.0179	0.0116	0.014	0.0134	4%	0.094
Antimony (Sb)-Total	mg/L	-	0.15	0.0001	0.00055	0.00011	0.00043	0.00071	0.00068	4%	0.00905
Arsenic (As)-Total	mg/L	0.005	-	0.0001	<b>0.0517</b>	0.00029	0.00107	<b>0.0558</b>	<b>0.0551</b>	1%	<b>0.0424</b>
Barium (Ba)-Total	mg/L	-	1	0.00005	0.0618	0.0857	0.0779	0.0592	0.0592	0%	0.0128
Beryllium (Be)-Total	mg/L	-	-	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	-	<0.00010
Bismuth (Bi)-Total	mg/L	-	-	0.0005	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	-	<0.00050
Boron (B)-Total	mg/L	-	-	0.01	0.074	<0.010	<0.010	0.088	0.086	2%	<0.010
Cadmium (Cd)-Total	mg/L	0.000033	0.02	0.00001	<b>0.000493</b>	0.000028	0.000015	<b>0.000743</b>	<b>0.00074</b>	0%	<b>0.00294</b>
Calcium (Ca)-Total	mg/L	-	-	0.05	267	28.8	30.7	295	298	1%	170
Chromium (Cr)-Total	mg/L	0.0089	0.04	0.0001	0.00038	0.00012	<0.00010	0.00045	0.00044	2%	0.00013
Cobalt (Co)-Total	mg/L	-	-	0.0001	0.00634	<0.00010	<0.00010	0.0078	0.00764	2%	0.00056
Copper (Cu)-Total	mg/L	0.002	0.2	0.0005	<b>0.00322</b>	0.0014	0.00128	<b>0.00447</b>	<b>0.00372</b>	17%	0.00085
Iron (Fe)-Total	mg/L	0.3	1	0.01	<b>8.07</b>	0.035	0.017	<b>12.4</b>	<b>12.4</b>	0%	<b>0.675</b>
Lead (Pb)-Total	mg/L	0.003	0.1	0.00005	0.000092	0.000053	<0.000050	0.000195	0.000067	66%	0.000373
Lithium (Li)-Total	mg/L	-	-	0.0005	<0.00050	<0.00050	0.00087	0.0009	0.00093	3%	0.00874
Magnesium (Mg)-Total	mg/L	-	-	0.1	65.2	9.95	10.8	66.4	66.3	0%	59.3
Manganese (Mn)-Total	mg/L	-	0.5	0.00005	<b>6.05</b>	0.0814	0.0042	<b>6.95</b>	<b>6.85</b>	1%	<b>1.22</b>
Mercury (Hg)-Total	mg/L	0.000026	0.005	0.00001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	-	<0.000010
Molybdenum (Mo)-Total	mg/L	0.0073	-	0.00005	0.000923	0.000346	0.000347	0.00104	0.00111	7%	0.000396
Nickel (Ni)-Total	mg/L	0.1	0.3	0.0005	0.00232	<0.00050	<0.00050	0.00268	0.00265	1%	0.00142
Phosphorus (P)-Total	mg/L	-	-	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	-	<0.050
Potassium (K)-Total	mg/L	-	-	0.1	5.93	0.73	0.85	6.57	6.58	0%	3.58
Selenium (Se)-Total	mg/L	0.001	-	0.0001	0.00019	<0.00010	<0.00010	0.00025	0.00022	12%	<0.00010
Silicon (Si)-Total	mg/L	-	-	0.05	6.82	6.38	6.12	7.07	7.03	1%	6.59
Silver (Ag)-Total	mg/L	0.0001	0.1	0.00001	0.000027	<0.000010	<0.000010	0.000038	0.000038	0%	0.000018
Sodium (Na)-Total	mg/L	-	-	0.05	32.9	2.72	3.35	38.8	38.5	1%	4.87
Strontium (Sr)-Total	mg/L	-	-	0.0002	0.848	0.301	0.278	0.862	0.896	4%	0.415
Sulfur (S)-Total	mg/L	-	-	0.5	255	7.18	10.1	281	283	1%	134
Thallium (Tl)-Total	mg/L	0.0008	-	0.00001	<0.000010	<0.000010	<0.000010	<0.000010	0.000011	22%	0.000094
Tin (Sn)-Total	mg/L	-	-	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	-	<0.00010
Titanium (Ti)-Total	mg/L	-	-	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	-	<0.010



Table E-2. Water Quality Results for the February 10-12, 2014 Trip.

Analyte	Units	CCME-WATER-F-AL	Mount Nansen Effluent Discharge Standards	Sample ID WQ Site ID Date Sampled Detection Limit	0167-140211-010 WQ-DC-U 02/11/2014	0167-140211-009 WQ-VC-DBC 02/11/2014	0167-140211-007 WQ-VC-R+150 02/11/2014	0167-140211-004 WQ-SEEP-r 02/11/2014	0167-140211-005 WQ-SEEP 02/11/2014	QA/QC WQ-SEEP	0167-140211-001 WQ-DC-DX+105 02/11/2014
Uranium (U)-Total	mg/L	0.015	-	0.00001	0.00221	0.000589	0.00065	0.00268	0.0028	-4%	0.00417
Vanadium (V)-Total	mg/L	-	-	0.001	0.0012	<0.0010	<0.0010	0.0016	0.0016	0%	<0.0010
Zinc (Zn)-Total	mg/L	0.03	0.3	0.003	0.007	<0.0030	<0.0030	0.0098	0.0221	126%	0.57
Dissolved Metals Filtration Location		-	-	n/a	FIELD	FIELD	FIELD	FIELD	FIELD	-	FIELD
Aluminum (Al)-Dissolved	mg/L	0.005	-	0.001	0.0061	0.0082	0.0057	0.0085	0.0098	15%	<0.0010
Antimony (Sb)-Dissolved	mg/L	-	-	0.0001	0.0005	<0.00010	0.00043	0.00063	0.00063	0%	0.00901
Arsenic (As)-Dissolved	mg/L	0.005	0.15	0.0001	0.0381	0.00021	0.00102	0.0401	0.0407	1%	0.0192
Barium (Ba)-Dissolved	mg/L	-	-	0.00005	0.0625	0.085	0.0784	0.0553	0.055	1%	0.0123
Beryllium (Be)-Dissolved	mg/L	-	-	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	-	<0.00010
Bismuth (Bi)-Dissolved	mg/L	-	-	0.0005	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	-	<0.00050
Boron (B)-Dissolved	mg/L	-	-	0.01	0.065	<0.010	<0.010	0.078	0.077	1%	<0.010
Cadmium (Cd)-Dissolved	mg/L	0.000033	-	0.00001	0.000218	0.000028	0.000014	0.000335	0.000335	0%	0.000538
Calcium (Ca)-Dissolved	mg/L	-	-	0.05	265	28.4	30.5	293	292	0%	171
Chromium (Cr)-Dissolved	mg/L	0.0089	-	0.0001	0.00027	<0.00010	<0.00010	0.00034	0.00023	32%	<0.00010
Cobalt (Co)-Dissolved	mg/L	-	-	0.0001	0.00588	<0.00010	<0.00010	0.00752	0.00753	0%	0.00051
Copper (Cu)-Dissolved	mg/L	0.002	-	0.0002	0.00113	0.00114	0.00102	0.00148	0.00149	1%	<0.00020
Iron (Fe)-Dissolved	mg/L	0.3	-	0.01	5.33	0.013	<0.010	8.93	8.84	1%	0.313
Lead (Pb)-Dissolved	mg/L	0.001	-	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	-	<0.000050
Lithium (Li)-Dissolved	mg/L	-	-	0.0005	0.00069	0.00053	0.00084	0.00069	0.00061	12%	0.00825
Magnesium (Mg)-Dissolved	mg/L	-	-	0.1	64.6	9.85	10.5	66	65.6	1%	59.4
Manganese (Mn)-Dissolved	mg/L	-	-	0.00005	5.68	0.0777	0.0018	6.6	6.53	1%	1.19
Mercury (Hg)-Dissolved	mg/L	0.000026	-	0.00001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	-	<0.000010
Molybdenum (Mo)-Dissolved	mg/L	0.073	-	0.00005	0.000822	0.000327	0.000342	0.000929	0.00096	3%	0.000368
Nickel (Ni)-Dissolved	mg/L	0.1	-	0.0005	0.00208	<0.00050	<0.00050	0.00258	0.00263	2%	0.00137
Phosphorus (P)-Dissolved	mg/L	-	-	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	-	<0.050
Potassium (K)-Dissolved	mg/L	-	-	0.1	5.91	0.71	0.84	6.52	6.47	1%	3.58
Selenium (Se)-Dissolved	mg/L	0.001	-	0.0001	0.00018	<0.00010	<0.00010	0.00023	0.00024	4%	<0.00010
Silicon (Si)-Dissolved	mg/L	-	-	0.05	6.63	6.25	5.92	6.76	6.76	0%	6.42
Silver (Ag)-Dissolved	mg/L	0.0001	-	0.00001	0.000013	<0.000010	<0.000010	0.000015	0.000012	20%	<0.000010
Sodium (Na)-Dissolved	mg/L	-	-	0.05	32	2.66	3.42	37.5	36.7	2%	4.79
Strontium (Sr)-Dissolved	mg/L	-	-	0.0002	0.801	0.301	0.277	0.828	0.836	1%	0.4
Sulfur (S)-Dissolved	mg/L	-	-	0.5	248	6.92	9.7	276	274	1%	132
Thallium (Tl)-Dissolved	mg/L	0.0008	-	0.00001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	-	0.000082
Tin (Sn)-Dissolved	mg/L	-	-	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	-	<0.00010
Titanium (Ti)-Dissolved	mg/L	-	-	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	-	<0.010
Uranium (U)-Dissolved	mg/L	0.015	-	0.00001	0.00221	0.000562	0.000638	0.00257	0.0026	1%	0.00411
Vanadium (V)-Dissolved	mg/L	-	-	0.001	<0.0010	<0.0010	<0.0010	0.0012	0.0012	0%	<0.0010
Zinc (Zn)-Dissolved	mg/L	0.03	-	0.001	0.0059	0.0011	0.0013	0.0075	0.0074	1%	0.551



Table E-2. Water Quality Results for the February 10-12, 2014 Trip.

Analyte	Units	CCME-WATER-F-AL	Mount Nansen Effluent Discharge Standards	Sample ID WQ Site ID Date Sampled Detection Limit	0167-140212-FIELD-BLANK FIELD BLANK 02/12/2014	0167-140212-TRAVEL BLANK TRAVEL BLANK 02/12/2014
Temperature (in-situ)	°C	-	-	-	-	-
Specific Conductivity (in-situ)	µS/cm	-	-	-	-	-
pH (in-situ)	-	6.5 - 9.0	6.0 - 8.5	-	-	-
Turbidity (In-situ)	NTU	-	-	-	-	-
Dissolved Oxygen (in-situ)	mg/L	-	-	-	-	-
Colour, True	CU	15	-	5	-	-
Conductivity	µS/cm	-	-	2	<2.0	<2.0
Hardness (as CaCO3)	mg/L	-	-	0.5	<0.50	<0.50
pH (lab)	pH	6.5 - 9.0	6.0 - 8.5	0.1	<b>5.29</b>	<b>6.08</b>
Total Suspended Solids	mg/L	-	50	3	<3.0	<3.0
Total Dissolved Solids	mg/L	-	-	1	<1.0	<1.0
Alkalinity, Bicarbonate (as CaCO3)	mg/L	-	-	1	<1.0	<1.0
Alkalinity, Carbonate (as CaCO3)	mg/L	-	-	1	<1.0	<1.0
Alkalinity, Hydroxide (as CaCO3)	mg/L	-	-	1	<1.0	<1.0
Alkalinity, Total (as CaCO3)	mg/L	-	-	1	<1.0	<1.0
Ammonia, Total (as N)	mg/L	0.75	-	0.005	<0.0050	<0.0050
Chloride (Cl)	mg/L	120	-	0.5	<0.50	<0.50
Fluoride (F)	mg/L	0.12	-	0.02	<0.020	<0.020
Nitrate (as N)	mg/L	13	-	0.005	0.0547	<0.0050
Nitrite (as N)	mg/L	0.06	-	0.001	<0.0010	<0.0010
Sulfate (SO4)	mg/L	-	-	0.5	<0.50	<0.50
Cyanide, Weak Acid Diss	mg/L	-	0.1	0.005	<0.0050	<0.0050
Cyanide, Total	mg/L	-	0.3	0.005	<0.0050	<0.0050
Cyanate	mg/L	-	-	0.2	<0.20	<0.20
Thiocyanate (SCN)	mg/L	-	-	0.5	<0.50	<0.50
Aluminum (Al)-Total	mg/L	0.1	-	0.003	<0.0030	<0.0030
Antimony (Sb)-Total	mg/L	-	0.15	0.0001	<0.00010	<0.00010
Arsenic (As)-Total	mg/L	0.005	-	0.0001	<0.00010	<0.00010
Barium (Ba)-Total	mg/L	-	1	0.00005	<0.000050	<0.000050
Beryllium (Be)-Total	mg/L	-	-	0.0001	<0.00010	<0.00010
Bismuth (Bi)-Total	mg/L	-	-	0.0005	<0.00050	<0.00050
Boron (B)-Total	mg/L	-	-	0.01	<0.010	<0.010
Cadmium (Cd)-Total	mg/L	0.000033	0.02	0.00001	<0.000010	<0.000010
Calcium (Ca)-Total	mg/L	-	-	0.05	<0.050	<0.050
Chromium (Cr)-Total	mg/L	0.0089	0.04	0.0001	<0.00010	<0.00010
Cobalt (Co)-Total	mg/L	-	-	0.0001	<0.00010	<0.00010
Copper (Cu)-Total	mg/L	0.002	0.2	0.0005	<0.00050	<0.00050
Iron (Fe)-Total	mg/L	0.3	1	0.01	<0.010	<0.010
Lead (Pb)-Total	mg/L	0.003	0.1	0.00005	<0.000050	<0.000050
Lithium (Li)-Total	mg/L	-	-	0.0005	<0.00050	<0.00050
Magnesium (Mg)-Total	mg/L	-	-	0.1	<0.10	<0.10
Manganese (Mn)-Total	mg/L	-	0.5	0.00005	<0.000050	<0.000050
Mercury (Hg)-Total	mg/L	0.000026	0.005	0.00001	<0.000010	<0.000010
Molybdenum (Mo)-Total	mg/L	0.0073	-	0.00005	<0.000050	<0.000050
Nickel (Ni)-Total	mg/L	0.1	0.3	0.0005	<0.00050	<0.00050
Phosphorus (P)-Total	mg/L	-	-	0.05	<0.050	<0.050
Potassium (K)-Total	mg/L	-	-	0.1	<0.10	<0.10
Selenium (Se)-Total	mg/L	0.001	-	0.0001	<0.00010	<0.00010
Silicon (Si)-Total	mg/L	-	-	0.05	<0.050	<0.050
Silver (Ag)-Total	mg/L	0.0001	0.1	0.00001	<0.000010	<0.000010
Sodium (Na)-Total	mg/L	-	-	0.05	<0.050	<0.050
Strontium (Sr)-Total	mg/L	-	-	0.0002	<0.00020	<0.00020
Sulfur (S)-Total	mg/L	-	-	0.5	<0.50	<0.50
Thallium (Tl)-Total	mg/L	0.0008	-	0.00001	<0.000010	<0.000010
Tin (Sn)-Total	mg/L	-	-	0.0001	<0.00010	<0.00010
Titanium (Ti)-Total	mg/L	-	-	0.01	<0.010	<0.010





Table E-2. Water Quality Results for the February 10-12, 2014 Trip.

Analyte	Units	CCME-WATER-F-AL	Mount Nansen Effluent Discharge Standards	Sample ID WQ Site ID Date Sampled Detection Limit	0167-140212-FIELD-BLANK FIELD BLANK 02/12/2014	0167-140212-TRAVEL BLANK TRAVEL BLANK 02/12/2014
Uranium (U)-Total	mg/L	0.015	-	0.00001	<0.000010	<0.000010
Vanadium (V)-Total	mg/L	-	-	0.001	<0.0010	<0.0010
Zinc (Zn)-Total	mg/L	0.03	0.3	0.003	<0.0030	<0.0030
Dissolved Metals Filtration Location		-	-	n/a	FIELD	-
Aluminum (Al)-Dissolved	mg/L	0.005	-	0.001	<0.0010	-
Antimony (Sb)-Dissolved	mg/L	-	-	0.0001	<0.00010	-
Arsenic (As)-Dissolved	mg/L	0.005	0.15	0.0001	<0.00010	-
Barium (Ba)-Dissolved	mg/L	-	-	0.00005	<0.000050	-
Beryllium (Be)-Dissolved	mg/L	-	-	0.0001	<0.00010	-
Bismuth (Bi)-Dissolved	mg/L	-	-	0.0005	<0.00050	-
Boron (B)-Dissolved	mg/L	-	-	0.01	<0.010	-
Cadmium (Cd)-Dissolved	mg/L	0.000033	-	0.00001	<0.000010	-
Calcium (Ca)-Dissolved	mg/L	-	-	0.05	<0.050	-
Chromium (Cr)-Dissolved	mg/L	0.0089	-	0.0001	<0.00010	-
Cobalt (Co)-Dissolved	mg/L	-	-	0.0001	<0.00010	-
Copper (Cu)-Dissolved	mg/L	0.002	-	0.0002	<0.00020	-
Iron (Fe)-Dissolved	mg/L	0.3	-	0.01	<0.010	-
Lead (Pb)-Dissolved	mg/L	0.001	-	0.00005	<0.000050	-
Lithium (Li)-Dissolved	mg/L	-	-	0.0005	<0.00050	-
Magnesium (Mg)-Dissolved	mg/L	-	-	0.1	<0.10	-
Manganese (Mn)-Dissolved	mg/L	-	-	0.00005	<0.000050	-
Mercury (Hg)-Dissolved	mg/L	0.000026	-	0.00001	<0.000010	-
Molybdenum (Mo)-Dissolved	mg/L	0.073	-	0.00005	<0.000050	-
Nickel (Ni)-Dissolved	mg/L	0.1	-	0.0005	<0.00050	-
Phosphorus (P)-Dissolved	mg/L	-	-	0.05	<0.050	-
Potassium (K)-Dissolved	mg/L	-	-	0.1	<0.10	-
Selenium (Se)-Dissolved	mg/L	0.001	-	0.0001	<0.00010	-
Silicon (Si)-Dissolved	mg/L	-	-	0.05	<0.050	-
Silver (Ag)-Dissolved	mg/L	0.0001	-	0.00001	<0.000010	-
Sodium (Na)-Dissolved	mg/L	-	-	0.05	<0.050	-
Strontium (Sr)-Dissolved	mg/L	-	-	0.0002	<0.00020	-
Sulfur (S)-Dissolved	mg/L	-	-	0.5	<0.50	-
Thallium (Tl)-Dissolved	mg/L	0.0008	-	0.00001	<0.000010	-
Tin (Sn)-Dissolved	mg/L	-	-	0.0001	<0.00010	-
Titanium (Ti)-Dissolved	mg/L	-	-	0.01	<0.010	-
Uranium (U)-Dissolved	mg/L	0.015	-	0.00001	<0.000010	-
Vanadium (V)-Dissolved	mg/L	-	-	0.001	<0.0010	-
Zinc (Zn)-Dissolved	mg/L	0.03	-	0.001	<0.0010	-



Table E-3. Water Quality Results for the March 10-12, 2014 Trip.

Analyte	Units	CCME-WATER-F-AL	Mount Nansen Effluent Discharge Standards	Sample ID WQ Site ID Date Sampled Detection Limit	0167-140311-004 WQ-VC-U 11-Mar-14	0167-140311-005 WQ-VC-DBC-r 11-Mar-14	0167-140311-013 WQ-VC-DBC 11-Mar-14	QC/QC WQ-VC-DBC	0167-140310-008 WQ-SEEP 10-Mar-14	0167-140310-009 WQ-SEEP-r 10-Mar-14	QA/QC WQ-SEEP	0167-140310-010 WQ-TP 10-Mar-14
Temperature (in-situ)	°C	-	-	-	0.2	-	0.1	-	0.8	-	-	0.4
Specific Conductivity (in-situ)	µS/cm	-	-	-	231.8	-	238	-	1818	-	-	2626
pH (in-situ)	-	6.5 - 9.0	6.0 - 8.5	-	6.84	-	6.99	-	6.82	-	-	7.2
Turbidity (In-situ)	NTU	-	-	-	0.13	-	0.28	-	9.54	-	-	7.67
Dissolved Oxygen (in-situ)	mg/L	-	-	-	-	-	-	-	-	-	-	-
Colour, True	CU	15	-	5	-	-	-	-	-	-	-	-
Conductivity	µS/cm	-	-	2	218	231	231	0%	1710	1750	2%	2540
Hardness (as CaCO3)	mg/L	-	-	0.5	121	125	125	0%	1050	1050	0%	1700
pH (lab)	pH	6.5 - 9.0	6.0 - 8.5	0.1	7.58	7.66	7.64	0%	7.56	7.73	2%	7.82
Total Suspended Solids	mg/L	-	50	3	<3.0	<3.0	<3.0	-	34.7	32	8%	<3.0
Total Dissolved Solids	mg/L	-	-	1	127	131	131	0%	1450	1450	0%	2400
Alkalinity, Bicarbonate (as CaCO3)	mg/L	-	-	1	95.5	99.8	99.6	0%	235	235	0%	228
Alkalinity, Carbonate (as CaCO3)	mg/L	-	-	1	<1.0	<1.0	<1.0	-	<1.0	<1.0	-	<1.0
Alkalinity, Hydroxide (as CaCO3)	mg/L	-	-	1	<1.0	<1.0	<1.0	-	<1.0	<1.0	-	<1.0
Alkalinity, Total (as CaCO3)	mg/L	-	-	1	95.5	99.8	99.6	0%	235	235	0%	228
Ammonia, Total (as N)	mg/L	0.75	-	0.005	<0.0050	<0.0050	<0.0050	-	4.4	4.41	0%	1.11
Chloride (Cl)	mg/L	120	-	0.5	<0.50	<0.50	<0.50	-	<5.0	<5.0	-	<10
Fluoride (F)	mg/L	0.12	-	0.02	0.045	0.047	0.047	0%	0.38	0.36	5%	0.73
Nitrate (as N)	mg/L	13	-	0.005	0.112	0.104	0.103	1%	0.993	0.993	0%	0.16
Nitrite (as N)	mg/L	0.06	-	0.001	<0.0010	<0.0010	<0.0010	-	0.033	0.037	12%	<0.020
Sulfate (SO4)	mg/L	-	-	0.5	23.4	23.1	23	0%	854	863	1%	1580
Cyanide, Weak Acid Diss	mg/L	-	0.1	0.005	<0.0050	<0.0050	<0.0050	-	0.0112	0.0108	4%	<0.0050
Cyanide, Total	mg/L	-	0.3	0.005	<0.0050	<0.0050	<0.0050	-	0.0488	0.0467	4%	<0.0050
Cyanate	mg/L	-	-	0.2	<0.20	<0.20	<0.20	-	0.6	<0.20	68%	0.75
Thiocyanate (SCN)	mg/L	-	-	0.5	<0.50	<0.50	<0.50	-	2.8	2.78	1%	<0.50
Aluminum (Al)-Total	mg/L	0.1	-	0.003	0.0083	0.0095	0.0097	2%	0.0149	0.0151	1%	0.0087
Antimony (Sb)-Total	mg/L	-	0.15	0.0001	0.0001	<0.00010	0.0001	11%	0.00072	0.00074	3%	0.0391
Arsenic (As)-Total	mg/L	0.005	-	0.0001	0.00027	0.0003	0.00046	53%	0.0529	0.0542	2%	0.217
Barium (Ba)-Total	mg/L	-	1	0.00005	0.0903	0.0935	0.0945	1%	0.0566	0.0601	6%	0.0242
Beryllium (Be)-Total	mg/L	-	-	0.0001	<0.00010	<0.00010	<0.00010	-	<0.00020	<0.00010	-	<0.00020
Bismuth (Bi)-Total	mg/L	-	-	0.0005	<0.00050	<0.00050	<0.00050	-	<0.0010	<0.00050	-	<0.0010
Boron (B)-Total	mg/L	-	-	0.01	<0.010	<0.010	<0.010	-	0.083	0.097	17%	0.174
Cadmium (Cd)-Total	mg/L	0.000033	0.02	0.00001	0.000047	0.000054	0.000053	2%	0.000823	0.00088	7%	0.00704
Calcium (Ca)-Total	mg/L	-	-	0.05	32	32.2	32.6	1%	309	306	1%	504
Chromium (Cr)-Total	mg/L	0.0089	0.04	0.0001	0.00012	0.00011	0.00012	9%	0.00038	0.00044	16%	0.00064
Cobalt (Co)-Total	mg/L	-	-	0.0001	<0.00010	<0.00010	<0.00010	-	0.00775	0.00771	1%	0.00131
Copper (Cu)-Total	mg/L	0.002	0.2	0.0005	0.00132	0.0013	0.00132	2%	0.0052	0.00425	18%	0.0338
Iron (Fe)-Total	mg/L	0.3	1	0.01	0.015	0.015	0.014	7%	13.6	13.4	1%	0.762
Lead (Pb)-Total	mg/L	0.003	0.1	0.00005	<0.000050	<0.000050	<0.000050	-	0.00011	0.000122	11%	0.00209
Lithium (Li)-Total	mg/L	-	-	0.0005	<0.00050	0.00057	<0.00050	14%	<0.0010	0.00115	22%	0.0142
Magnesium (Mg)-Total	mg/L	-	-	0.1	9.59	10.1	10.1	0%	64.7	64.7	0%	103
Manganese (Mn)-Total	mg/L	-	0.5	0.00005	0.16	0.149	0.145	3%	6.68	6.61	1%	4.15
Mercury (Hg)-Total	mg/L	0.000026	0.005	0.00001	<0.000010	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000010
Molybdenum (Mo)-Total	mg/L	0.0073	-	0.00005	0.000296	0.000331	0.000327	1%	0.00106	0.00108	2%	0.0034
Nickel (Ni)-Total	mg/L	0.1	0.3	0.0005	0.00075	0.00064	0.00068	6%	0.0029	0.00268	8%	0.0046
Phosphorus (P)-Total	mg/L	-	-	0.05	<0.050	<0.050	<0.050	-	<0.050	<0.050	-	<0.050
Potassium (K)-Total	mg/L	-	-	0.1	0.77	0.92	0.9	2%	6.87	6.91	1%	29.6
Selenium (Se)-Total	mg/L	0.001	-	0.0001	<0.00010	<0.00010	<0.00010	-	<0.00020	0.00024	21%	<0.00020
Silicon (Si)-Total	mg/L	-	-	0.05	6.38	6.6	6.66	1%	7.29	7.29	0%	3.87
Silver (Ag)-Total	mg/L	0.0001	0.1	0.00001	<0.000010	<0.000010	<0.000010	-	0.000047	0.000041	13%	0.000071
Sodium (Na)-Total	mg/L	-	-	0.05	2.79	3.02	2.9	4%	38.9	36.2	7%	37.6
Strontium (Sr)-Total	mg/L	-	-	0.0002	0.295	0.321	0.315	2%	0.816	0.871	7%	1.25
Sulfur (S)-Total	mg/L	-	-	0.5	7.75	7.55	7.69	2%	288	282	2%	497
Thallium (Tl)-Total	mg/L	0.0008	-	0.00001	<0.000010	<0.000010	<0.000010	-	<0.000020	<0.000010	-	0.000484
Tin (Sn)-Total	mg/L	-	-	0.0001	<0.00010	<0.00010	<0.00010	-	<0.00020	<0.00010	-	<0.00020
Titanium (Ti)-Total	mg/L	-	-	0.01	<0.010	<0.010	<0.010	-	<0.020	<0.010	-	<0.020
Uranium (U)-Total	mg/L	0.015	-	0.00001	0.000507	0.000623	0.000599	4%	0.00263	0.00261	1%	0.00244



Table E-3. Water Quality Results for the March 10-12, 2014 Trip.

Analyte	Units	CCME-WATER-F-AL	Mount Nansen Effluent Discharge Standards	Sample ID WQ Site ID Date Sampled Detection Limit	0167-140311-004 WQ-VC-U 11-Mar-14	0167-140311-005 WQ-VC-DBC-r 11-Mar-14	0167-140311-013 WQ-VC-DBC 11-Mar-14	QC/QC WQ-VC-DBC	0167-140310-008 WQ-SEEP 10-Mar-14	0167-140310-009 WQ-SEEP-r 10-Mar-14	QA/QC WQ-SEEP	0167-140310-010 WQ-TP 10-Mar-14
Vanadium (V)-Total	mg/L	-	-	0.001	<0.0010	<0.0010	<0.0010	-	<0.0020	0.0017	12%	<0.0020
Zinc (Zn)-Total	mg/L	0.03	0.3	0.003	<0.0030	<0.0030	<0.0030	-	0.0104	0.0105	1%	0.612
Dissolved Metals Filtration Location		-	-	n/a	FIELD	FIELD	FIELD	-	FIELD	FIELD	-	FIELD
Aluminum (Al)-Dissolved	mg/L	0.005	-	0.001	0.0063	0.0064	0.007	9%	0.0111	0.0128	15%	<0.0020
Antimony (Sb)-Dissolved	mg/L	-	-	0.0001	<0.00010	<0.00010	<0.00010	-	0.00068	0.00071	4%	0.0383
Arsenic (As)-Dissolved	mg/L	0.005	0.15	0.0001	0.00025	0.00029	0.00028	3%	0.0396	0.0425	7%	0.0706
Barium (Ba)-Dissolved	mg/L	-	-	0.00005	0.0916	0.0949	0.0988	4%	0.0563	0.0589	5%	0.0242
Beryllium (Be)-Dissolved	mg/L	-	-	0.0001	<0.00010	<0.00010	<0.00010	-	<0.00020	<0.00010	-	<0.00020
Bismuth (Bi)-Dissolved	mg/L	-	-	0.0005	<0.00050	<0.00050	<0.00050	-	<0.0010	<0.00050	-	<0.0010
Boron (B)-Dissolved	mg/L	-	-	0.01	<0.010	<0.010	<0.010	-	0.083	0.091	10%	0.168
Cadmium (Cd)-Dissolved	mg/L	0.000033	-	0.00001	0.000049	0.000058	0.000058	0%	0.000362	0.000346	4%	0.00674
Calcium (Ca)-Dissolved	mg/L	-	-	0.05	32.6	33.5	33.5	0%	313	311	1%	507
Chromium (Cr)-Dissolved	mg/L	0.0089	-	0.0001	<0.00010	<0.00010	<0.00010	-	<0.00020	0.00035	46%	<0.00020
Cobalt (Co)-Dissolved	mg/L	-	-	0.0001	<0.00010	<0.00010	<0.00010	-	0.00756	0.00758	0%	0.00124
Copper (Cu)-Dissolved	mg/L	0.002	-	0.0002	0.00126	0.00123	0.00124	1%	0.00218	0.00168	23%	0.0295
Iron (Fe)-Dissolved	mg/L	0.3	-	0.01	0.011	<0.010	<0.010	-	12.6	12.6	0%	0.045
Lead (Pb)-Dissolved	mg/L	0.001	-	0.00005	<0.000050	<0.000050	<0.000050	-	<0.00010	<0.000050	-	0.00013
Lithium (Li)-Dissolved	mg/L	-	-	0.0005	<0.00050	<0.00050	<0.00050	-	<0.0010	0.00121	26%	0.0137
Magnesium (Mg)-Dissolved	mg/L	-	-	0.1	9.68	10.1	10.2	1%	66.2	65.9	0%	106
Manganese (Mn)-Dissolved	mg/L	-	-	0.00005	0.16	0.144	0.144	0%	6.58	6.65	1%	4.07
Mercury (Hg)-Dissolved	mg/L	0.000026	-	0.00001	<0.000010	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000010
Molybdenum (Mo)-Dissolved	mg/L	0.073	-	0.00005	0.000277	0.000318	0.0003	6%	0.00104	0.00103	1%	0.0032
Nickel (Ni)-Dissolved	mg/L	0.1	-	0.0005	0.00077	0.00063	0.00065	3%	0.0027	0.00266	1%	0.0045
Phosphorus (P)-Dissolved	mg/L	-	-	0.05	<0.050	<0.050	<0.050	-	<0.050	<0.050	-	<0.050
Potassium (K)-Dissolved	mg/L	-	-	0.1	0.77	0.85	0.88	4%	7.12	7.23	2%	30.7
Selenium (Se)-Dissolved	mg/L	0.001	-	0.0001	<0.00010	<0.00010	<0.00010	-	0.00021	0.00023	10%	<0.00020
Silicon (Si)-Dissolved	mg/L	-	-	0.05	6.53	6.76	6.81	1%	7.31	7.23	1%	3.81
Silver (Ag)-Dissolved	mg/L	0.0001	-	0.00001	<0.000010	<0.000010	<0.000010	-	<0.000020	0.000021	10%	<0.000020
Sodium (Na)-Dissolved	mg/L	-	-	0.05	2.91	2.91	2.93	1%	38.3	36.7	4%	38.8
Strontium (Sr)-Dissolved	mg/L	-	-	0.0002	0.296	0.301	0.307	2%	0.835	0.87	4%	1.19
Sulfur (S)-Dissolved	mg/L	-	-	0.5	7.68	7.5	7.53	0%	276	276	0%	485
Thallium (Tl)-Dissolved	mg/L	0.0008	-	0.00001	<0.000010	<0.000010	<0.000010	-	<0.000020	0.00001	90%	0.000481
Tin (Sn)-Dissolved	mg/L	-	-	0.0001	<0.00010	<0.00010	<0.00010	-	<0.00020	<0.00010	-	<0.00020
Titanium (Ti)-Dissolved	mg/L	-	-	0.01	<0.010	<0.010	<0.010	-	<0.020	<0.010	-	<0.020
Uranium (U)-Dissolved	mg/L	0.015	-	0.00001	0.0005	0.00057	0.000577	1%	0.00268	0.00249	7%	0.00241
Vanadium (V)-Dissolved	mg/L	-	-	0.001	<0.0010	<0.0010	<0.0010	-	<0.0020	0.0013	46%	<0.0020
Zinc (Zn)-Dissolved	mg/L	0.03	-	0.001	<0.0010	0.0012	0.0013	8%	0.0096	0.0097	1%	0.599

Applied Guidelines: - Federal CCME Canadian Environmental Quality Guidelines (JUL, 2012), CCME: Freshwater Aquatic Life

- Mount Nansen Effluent Quality Standards

Color Key: Exceeds CCME Guideline

Exceeds MN Effluent Quality Standards (EQS)

Exceeds both CCME and EQS

QA/QC Assessment - highlighted if > +/- 10%

Note: For those guidelines that are hardness dependent, the most conservative guideline has been applied.



Table E-3. Water Quality Results for the March 10-12, 2014 Trip.

Analyte	Units	CCME-WATER-F-AL	Mount Nansen Effluent Discharge Standards	Sample ID WQ Site ID Date Sampled Detection Limit	0167-140311-003 WQ-BC 11-Mar-14	0167-140310-001 WQ-VC-R+150 10-Mar-14	0167-140310-006 WQ-DC-U 10-Mar-14	0167-140311-012 WQ-MS-S-03 11-Mar-14	0167-140311-011 WQ-VC-UMN 11-Mar-14	0167-140311-016 WQ-PIT-1 11-Mar-14	0167-140311-015 WQ-PIT-2 11-Mar-14	0167-140311-014 WQ-PIT-3 11-Mar-14
Temperature (in-situ)	°C	-	-	-	0	0	0	0.5	0.3	1	2.2	4.6
Specific Conductivity (in-situ)	µS/cm	-	-	-	251.6	251.1	1678	1200	240.9	2092	2072	2695
pH (in-situ)	-	6.5 - 9.0	6.0 - 8.5	-	7.25	7.04	7.08	6.87	7.04	7.31	7.24	6.8
Turbidity (In-situ)	NTU	-	-	-	0.63	0.08	12.1	26.2	0.36	0.57	0.54	1.36
Dissolved Oxygen (in-situ)	mg/L	-	-	-	-	-	-	-	-	6	5.53	0.43
Colour, True	CU	15	-	5	-	-	-	-	-	-	-	-
Conductivity	µS/cm	-	-	2	246	249	1590	1160	237	2010	2010	2020
Hardness (as CaCO3)	mg/L	-	-	0.5	130	135	985	757	127	1400	1380	1380
pH (lab)	pH	6.5 - 9.0	6.0 - 8.5	0.1	7.85	7.76	7.76	7.7	7.62	7.95	7.94	7.93
Total Suspended Solids	mg/L	-	50	3	<3.0	<3.0	14	<b>70</b>	<3.0	<3.0	<3.0	12
Total Dissolved Solids	mg/L	-	-	1	137	144	1330	872	136	1790	1800	1800
Alkalinity, Bicarbonate (as CaCO3)	mg/L	-	-	1	109	99.1	225	259	91.3	216	215	217
Alkalinity, Carbonate (as CaCO3)	mg/L	-	-	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity, Hydroxide (as CaCO3)	mg/L	-	-	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity, Total (as CaCO3)	mg/L	-	-	1	109	99.1	225	259	91.3	216	215	217
Ammonia, Total (as N)	mg/L	0.75	-	0.005	<0.0050	<0.0050	<b>4.24</b>	0.0491	<0.0050	0.0117	0.0123	0.0121
Chloride (Cl)	mg/L	120	-	0.5	<0.50	<0.50	<5.0	<5.0	<0.50	<5.0	<5.0	<5.0
Fluoride (F)	mg/L	0.12	-	0.02	0.056	0.052	<b>0.44</b>	<b>0.39</b>	0.05	<b>0.37</b>	<b>0.49</b>	<b>0.38</b>
Nitrate (as N)	mg/L	13	-	0.005	0.0731	0.186	0.686	<0.050	0.164	0.062	0.098	0.064
Nitrite (as N)	mg/L	0.06	-	0.001	<0.0010	<0.0010	0.024	<0.010	<0.0010	<0.010	<0.010	<0.010
Sulfate (SO4)	mg/L	-	-	0.5	21.8	32.8	777	441	31.8	1150	1160	1160
Cyanide, Weak Acid Diss	mg/L	-	0.1	0.005	<0.0050	<0.0050	0.0109	<0.0050	<0.0050	-	-	-
Cyanide, Total	mg/L	-	0.3	0.005	<0.0050	<0.0050	0.0317	<0.0050	<0.0050	-	-	-
Cyanate	mg/L	-	-	0.2	<0.20	<0.20	1.89	<0.20	<0.20	-	-	-
Thiocyanate (SCN)	mg/L	-	-	0.5	<0.50	<0.50	1.84	<0.50	<0.50	-	-	-
Aluminum (Al)-Total	mg/L	0.1	-	0.003	0.027	0.0069	0.0582	<b>0.862</b>	0.0106	<0.0060	<0.0060	0.0091
Antimony (Sb)-Total	mg/L	-	0.15	0.0001	0.00012	0.00045	0.00053	0.0383	0.00059	0.00358	0.0036	0.0036
Arsenic (As)-Total	mg/L	0.005	-	0.0001	0.0005	0.00106	<b>0.0524</b>	<b>0.366</b>	0.00057	<b>0.0108</b>	<b>0.0107</b>	<b>0.0109</b>
Barium (Ba)-Total	mg/L	-	1	0.00005	0.0946	0.0819	0.0632	0.0401	0.0702	0.0136	0.0131	0.0134
Beryllium (Be)-Total	mg/L	-	-	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00020	<0.00020	<0.00020
Bismuth (Bi)-Total	mg/L	-	-	0.0005	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.0010	<0.0010	<0.0010
Boron (B)-Total	mg/L	-	-	0.01	<0.010	<0.010	0.067	<0.010	<0.010	<0.020	<0.020	<0.020
Cadmium (Cd)-Total	mg/L	0.000033	0.02	0.00001	<b>0.000074</b>	0.000012	<b>0.000529</b>	<b>0.00637</b>	<0.000010	<b>0.00429</b>	<b>0.00417</b>	<b>0.00433</b>
Calcium (Ca)-Total	mg/L	-	-	0.05	34.3	33.5	274	190	32.3	386	378	365
Chromium (Cr)-Total	mg/L	0.0089	0.04	0.0001	0.00071	<0.00010	0.00043	0.00105	0.00011	<0.00020	<0.00020	<0.00020
Cobalt (Co)-Total	mg/L	-	-	0.0001	<0.00010	<0.00010	0.00648	0.00161	<0.00010	<0.00020	<0.00020	<0.00020
Copper (Cu)-Total	mg/L	0.002	0.2	0.0005	0.00164	0.00097	<b>0.00281</b>	<b>0.0114</b>	0.00113	<b>0.0028</b>	<b>0.0027</b>	<b>0.003</b>
Iron (Fe)-Total	mg/L	0.3	1	0.01	0.114	<0.010	<b>9.01</b>	<b>6.73</b>	0.01	0.039	0.038	0.046
Lead (Pb)-Total	mg/L	0.003	0.1	0.00005	0.000082	<0.000050	0.000117	<b>0.129</b>	<0.000050	0.00031	0.00029	0.00052
Lithium (Li)-Total	mg/L	-	-	0.0005	<0.00050	0.00151	<0.00050	0.00883	0.00061	0.0093	0.0093	0.0097
Magnesium (Mg)-Total	mg/L	-	-	0.1	11.2	11.8	61.4	61.5	10.3	101	99.5	97.2
Manganese (Mn)-Total	mg/L	-	0.5	0.00005	0.0233	0.00364	<b>5.84</b>	<b>1.4</b>	0.0025	0.14	0.144	0.149
Mercury (Hg)-Total	mg/L	0.000026	0.005	0.00001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Total	mg/L	0.0073	-	0.00005	0.000346	0.000377	0.000916	0.000398	0.000259	0.00013	0.00014	0.00016
Nickel (Ni)-Total	mg/L	0.1	0.3	0.0005	0.00056	<0.00050	0.00225	0.00284	<0.00050	<0.0010	<0.0010	<0.0010
Phosphorus (P)-Total	mg/L	-	-	0.05	<0.050	<0.050	<0.050	0.16	<0.050	<0.050	<0.050	<0.050
Potassium (K)-Total	mg/L	-	-	0.1	1.49	1	6.27	3.73	0.9	4.45	4.32	4.15
Selenium (Se)-Total	mg/L	0.001	-	0.0001	<0.00010	<0.00010	0.00017	<0.00010	<0.00010	<0.00020	<0.00020	<0.00020
Silicon (Si)-Total	mg/L	-	-	0.05	7.9	6.28	6.82	8.14	6.29	3.97	3.89	3.7
Silver (Ag)-Total	mg/L	0.0001	0.1	0.00001	<0.000010	<0.000010	0.000031	<b>0.0015</b>	<0.000010	<0.000020	<0.000020	<0.000020
Sodium (Na)-Total	mg/L	-	-	0.05	3.27	3.5	33	4.57	3.23	14.5	14.6	14.5
Strontium (Sr)-Total	mg/L	-	-	0.0002	0.329	0.284	0.781	0.431	0.278	1.22	1.23	1.2
Sulfur (S)-Total	mg/L	-	-	0.5	7.4	10.9	254	146	10.5	379	376	368
Thallium (Tl)-Total	mg/L	0.0008	-	0.00001	<0.000010	<0.000010	<0.000010	0.000167	<0.000010	0.00008	0.000081	0.000081
Tin (Sn)-Total	mg/L	-	-	0.0001	<0.00010	<0.00010	0.00014	0.00014	<0.00010	<0.00020	<0.00020	<0.00020
Titanium (Ti)-Total	mg/L	-	-	0.01	<0.010	<0.010	<0.010	0.047	<0.010	<0.020	<0.020	<0.020
Uranium (U)-Total	mg/L	0.015	-	0.00001	0.000548	0.000566	0.00206	0.00394	0.000364	0.00507	0.00507	0.00497



Table E-3. Water Quality Results for the March 10-12, 2014 Trip.

Analyte	Units	CCME-WATER-F-AL	Mount Nansen Effluent Discharge Standards	Sample ID WQ Site ID Date Sampled Detection Limit	0167-140311-003 WQ-BC 11-Mar-14	0167-140310-001 WQ-VC-R+150 10-Mar-14	0167-140310-006 WQ-DC-U 10-Mar-14	0167-140311-012 WQ-MS-S-03 11-Mar-14	0167-140311-011 WQ-VC-UMN 11-Mar-14	0167-140311-016 WQ-PIT-1 11-Mar-14	0167-140311-015 WQ-PIT-2 11-Mar-14	0167-140311-014 WQ-PIT-3 11-Mar-14
Vanadium (V)-Total	mg/L	-	-	0.001	<0.0010	<0.0010	0.0015	0.004	<0.0010	<0.0020	<0.0020	<0.0020
Zinc (Zn)-Total	mg/L	0.03	0.3	0.003	0.0138	<0.0030	0.0073	<b>1.18</b>	<0.0030	<b>0.625</b>	<b>0.618</b>	<b>0.618</b>
Dissolved Metals Filtration Location		-	-	n/a	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD
Aluminum (Al)-Dissolved	mg/L	0.005	-	0.001	<b>0.0082</b>	<b>0.0089</b>	<b>0.0072</b>	0.0021	<b>0.0057</b>	<0.0020	<0.0020	<0.0020
Antimony (Sb)-Dissolved	mg/L	-	-	0.0001	0.00012	0.00045	0.00046	0.0169	0.00061	0.00344	0.0036	0.00343
Arsenic (As)-Dissolved	mg/L	0.005	0.15	0.0001	0.00037	0.00107	<b>0.0304</b>	<b>0.0648</b>	0.00054	<b>0.00862</b>	<b>0.00864</b>	<b>0.00869</b>
Barium (Ba)-Dissolved	mg/L	-	-	0.00005	0.0902	0.0884	0.062	0.0185	0.0713	0.0133	0.0131	0.013
Beryllium (Be)-Dissolved	mg/L	-	-	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00020	<0.00020	<0.00020
Bismuth (Bi)-Dissolved	mg/L	-	-	0.0005	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.0010	<0.0010	<0.0010
Boron (B)-Dissolved	mg/L	-	-	0.01	<0.010	<0.010	0.065	<0.010	<0.010	<0.020	<0.020	<0.020
Cadmium (Cd)-Dissolved	mg/L	0.000033	-	0.00001	<b>0.000067</b>	0.000012	<b>0.000201</b>	<b>0.000878</b>	<0.000010	<b>0.00409</b>	<b>0.00422</b>	<b>0.00411</b>
Calcium (Ca)-Dissolved	mg/L	-	-	0.05	34.2	34.4	289	199	34	392	386	386
Chromium (Cr)-Dissolved	mg/L	0.0089	-	0.0001	0.00043	<0.00010	0.00025	<0.00010	<0.00010	<0.00020	<0.00020	<0.00020
Cobalt (Co)-Dissolved	mg/L	-	-	0.0001	<0.00010	<0.00010	0.00643	0.001	<0.00010	<0.00020	<0.00020	<0.00020
Copper (Cu)-Dissolved	mg/L	0.002	-	0.0002	0.00145	0.00094	0.00113	<0.00020	0.00103	<b>0.00219</b>	<b>0.00226</b>	<b>0.00223</b>
Iron (Fe)-Dissolved	mg/L	0.3	-	0.01	<0.010	<0.010	<b>5.65</b>	<b>2.3</b>	<0.010	<0.010	<0.010	<0.010
Lead (Pb)-Dissolved	mg/L	0.001	-	0.00005	<0.000050	<0.000050	<0.000050	0.000568	<0.000050	<0.00010	<0.00010	<0.00010
Lithium (Li)-Dissolved	mg/L	-	-	0.0005	<0.00050	0.00158	<0.00050	0.00802	0.00066	0.0088	0.0098	0.0086
Magnesium (Mg)-Dissolved	mg/L	-	-	0.1	10.8	11.8	64.1	63.4	10.3	103	101	100
Manganese (Mn)-Dissolved	mg/L	-	-	0.00005	0.0188	0.00341	5.9	1.36	0.000735	0.109	0.113	0.119
Mercury (Hg)-Dissolved	mg/L	0.000026	-	0.00001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	mg/L	0.073	-	0.00005	0.000332	0.000362	0.000879	0.000275	0.000254	0.00013	0.00013	0.00013
Nickel (Ni)-Dissolved	mg/L	0.1	-	0.0005	<0.00050	<0.00050	0.00222	0.00215	<0.00050	<0.0010	<0.0010	<0.0010
Phosphorus (P)-Dissolved	mg/L	-	-	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium (K)-Dissolved	mg/L	-	-	0.1	1.32	0.96	6.67	3.51	0.86	4.27	4.19	4.24
Selenium (Se)-Dissolved	mg/L	0.001	-	0.0001	<0.00010	<0.00010	0.00017	<0.00010	<0.00010	<0.00020	<0.00020	<0.00020
Silicon (Si)-Dissolved	mg/L	-	-	0.05	7.74	6.36	6.78	6.6	6.47	3.89	3.85	3.85
Silver (Ag)-Dissolved	mg/L	0.0001	-	0.00001	<0.000010	<0.000010	0.000012	<0.000010	<0.000010	<0.000020	<0.000020	<0.000020
Sodium (Na)-Dissolved	mg/L	-	-	0.05	3.31	3.6	34.2	4.65	3.26	14.4	14.1	14.2
Strontium (Sr)-Dissolved	mg/L	-	-	0.0002	0.325	0.284	0.77	0.4	0.274	1.18	1.21	1.18
Sulfur (S)-Dissolved	mg/L	-	-	0.5	7.18	10.8	255	144	10.5	368	365	366
Thallium (Tl)-Dissolved	mg/L	0.0008	-	0.00001	<0.000010	<0.000010	<0.000010	0.000088	<0.000010	0.000077	0.000078	0.000079
Tin (Sn)-Dissolved	mg/L	-	-	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00020	<0.00020	<0.00020
Titanium (Ti)-Dissolved	mg/L	-	-	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.020	<0.020	<0.020
Uranium (U)-Dissolved	mg/L	0.015	-	0.00001	0.000515	0.000543	0.00204	0.00368	0.000342	0.00491	0.00482	0.0048
Vanadium (V)-Dissolved	mg/L	-	-	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0020	<0.0020	<0.0020
Zinc (Zn)-Dissolved	mg/L	0.03	-	0.001	0.0113	<0.0010	0.0058	1.06	<0.0010	0.61	0.614	0.608



Table E-3. Water Quality Results for the March 10-12, 2014 Trip.

Analyte	Units	CCME-WATER-F-AL	Mount Nansen Effluent Discharge Standards	Sample ID WQ Site ID Date Sampled Detection Limit	0167-140311-017 WQ-PW 11-Mar-14	0167-1403-TRAVEL-BLANK TRAVEL BLANK 12-Mar-14	0167-140310-FIELD-BLANK FIELD BLANK 10-Mar-14
Temperature (in-situ)	°C	-	-	-	0.5	-	-
Specific Conductivity (in-situ)	µS/cm	-	-	-	372	-	-
pH (in-situ)	-	6.5 - 9.0	6.0 - 8.5	-	7.51	-	-
Turbidity (In-situ)	NTU	-	-	-	0.12	-	-
Dissolved Oxygen (in-situ)	mg/L	-	-	-	-	-	-
Colour, True	CU	15	-	5	<5.0	-	-
Conductivity	µS/cm	-	-	2	357	<2.0	<2.0
Hardness (as CaCO3)	mg/L	-	-	0.5	199	<0.50	<0.50
pH (lab)	pH	6.5 - 9.0	6.0 - 8.5	0.1	7.76	<b>5.72</b>	<b>5.93</b>
Total Suspended Solids	mg/L	-	50	3	-	<3.0	<3.0
Total Dissolved Solids	mg/L	-	-	1	211	<1.0	<1.0
Alkalinity, Bicarbonate (as CaCO3)	mg/L	-	-	1	-	<1.0	<1.0
Alkalinity, Carbonate (as CaCO3)	mg/L	-	-	1	-	<1.0	<1.0
Alkalinity, Hydroxide (as CaCO3)	mg/L	-	-	1	-	<1.0	<1.0
Alkalinity, Total (as CaCO3)	mg/L	-	-	1	172	<1.0	<1.0
Ammonia, Total (as N)	mg/L	0.75	-	0.005	-	<0.0050	<0.0050
Chloride (Cl)	mg/L	120	-	0.5	<0.50	<0.50	<0.50
Fluoride (F)	mg/L	0.12	-	0.02	0.105	<0.020	<0.020
Nitrate (as N)	mg/L	13	-	0.005	0.129	<0.0050	<0.0050
Nitrite (as N)	mg/L	0.06	-	0.001	<0.0010	<0.0010	<0.0010
Sulfate (SO4)	mg/L	-	-	0.5	34.6	<0.50	<0.50
Cyanide, Weak Acid Diss	mg/L	-	0.1	0.005	-	<0.0050	<0.0050
Cyanide, Total	mg/L	-	0.3	0.005	-	<0.0050	<0.0050
Cyanate	mg/L	-	-	0.2	-	<0.20	<0.20
Thiocyanate (SCN)	mg/L	-	-	0.5	-	<0.50	<0.50
Aluminum (Al)-Total	mg/L	0.1	-	0.003	<0.010	<0.0030	<0.0030
Antimony (Sb)-Total	mg/L	-	0.15	0.0001	<0.00050	<0.00010	<0.00010
Arsenic (As)-Total	mg/L	0.005	-	0.0001	0.00039	<0.00010	<0.00010
Barium (Ba)-Total	mg/L	-	1	0.00005	0.084	<0.000050	<0.000050
Beryllium (Be)-Total	mg/L	-	-	0.0001	-	<0.00010	<0.00010
Bismuth (Bi)-Total	mg/L	-	-	0.0005	-	<0.00050	<0.00050
Boron (B)-Total	mg/L	-	-	0.01	<0.10	<0.010	<0.010
Cadmium (Cd)-Total	mg/L	0.000033	0.02	0.00001	<0.00020	<0.000010	<0.000010
Calcium (Ca)-Total	mg/L	-	-	0.05	47.2	<0.050	<0.050
Chromium (Cr)-Total	mg/L	0.0089	0.04	0.0001	<0.0020	<0.00010	<0.00010
Cobalt (Co)-Total	mg/L	-	-	0.0001	-	<0.00010	<0.00010
Copper (Cu)-Total	mg/L	0.002	0.2	0.0005	<0.0010	<0.00050	<0.00050
Iron (Fe)-Total	mg/L	0.3	1	0.01	<0.030	<0.010	<0.010
Lead (Pb)-Total	mg/L	0.003	0.1	0.00005	0.00065	<0.000050	<0.000050
Lithium (Li)-Total	mg/L	-	-	0.0005	-	<0.00050	<0.00050
Magnesium (Mg)-Total	mg/L	-	-	0.1	19.6	<0.10	<0.10
Manganese (Mn)-Total	mg/L	-	0.5	0.00005	<0.0020	<0.000050	<0.000050
Mercury (Hg)-Total	mg/L	0.000026	0.005	0.00001	<0.00020	<0.000010	<0.000010
Molybdenum (Mo)-Total	mg/L	0.0073	-	0.00005	-	<0.000050	<0.000050
Nickel (Ni)-Total	mg/L	0.1	0.3	0.0005	-	<0.00050	<0.00050
Phosphorus (P)-Total	mg/L	-	-	0.05	-	<0.050	<0.050
Potassium (K)-Total	mg/L	-	-	0.1	0.9	<0.10	<0.10
Selenium (Se)-Total	mg/L	0.001	-	0.0001	<0.0010	<0.00010	<0.00010
Silicon (Si)-Total	mg/L	-	-	0.05	-	<0.050	<0.050
Silver (Ag)-Total	mg/L	0.0001	0.1	0.00001	-	<0.000010	<0.000010
Sodium (Na)-Total	mg/L	-	-	0.05	5.2	<0.050	<0.050
Strontium (Sr)-Total	mg/L	-	-	0.0002	-	<0.00020	<0.00020
Sulfur (S)-Total	mg/L	-	-	0.5	-	<0.50	<0.50
Thallium (Tl)-Total	mg/L	0.0008	-	0.00001	-	<0.000010	<0.000010
Tin (Sn)-Total	mg/L	-	-	0.0001	-	<0.00010	<0.00010
Titanium (Ti)-Total	mg/L	-	-	0.01	-	<0.010	<0.010
Uranium (U)-Total	mg/L	0.015	-	0.00001	0.00197	<0.000010	<0.000010



Table E-3. Water Quality Results for the March 10-12, 2014 Trip.

Analyte	Units	CCME-WATER-F-AL	Mount Nansen Effluent Discharge Standards	Sample ID WQ Site ID Date Sampled Detection Limit	0167-140311-017 WQ-PW 11-Mar-14	0167-1403-TRAVEL-BLANK TRAVEL BLANK 12-Mar-14	0167-140310-FIELD-BLANK FIELD BLANK 10-Mar-14
Vanadium (V)-Total	mg/L	-	-	0.001	-	<0.0010	<0.0010
Zinc (Zn)-Total	mg/L	0.03	0.3	0.003	<0.050	<0.0030	<0.0030
Dissolved Metals Filtration Location		-	-	n/a	-	-	FIELD
Aluminum (Al)-Dissolved	mg/L	0.005	-	0.001	-	-	<0.0010
Antimony (Sb)-Dissolved	mg/L	-	-	0.0001	-	-	<0.00010
Arsenic (As)-Dissolved	mg/L	0.005	0.15	0.0001	-	-	<0.00010
Barium (Ba)-Dissolved	mg/L	-	-	0.00005	-	-	<0.000050
Beryllium (Be)-Dissolved	mg/L	-	-	0.0001	-	-	<0.00010
Bismuth (Bi)-Dissolved	mg/L	-	-	0.0005	-	-	<0.00050
Boron (B)-Dissolved	mg/L	-	-	0.01	-	-	<0.010
Cadmium (Cd)-Dissolved	mg/L	0.000033	-	0.00001	-	-	<0.000010
Calcium (Ca)-Dissolved	mg/L	-	-	0.05	-	-	<0.050
Chromium (Cr)-Dissolved	mg/L	0.0089	-	0.0001	-	-	<0.00010
Cobalt (Co)-Dissolved	mg/L	-	-	0.0001	-	-	<0.00010
Copper (Cu)-Dissolved	mg/L	0.002	-	0.0002	-	-	<0.00020
Iron (Fe)-Dissolved	mg/L	0.3	-	0.01	-	-	<0.010
Lead (Pb)-Dissolved	mg/L	0.001	-	0.00005	-	-	<0.000050
Lithium (Li)-Dissolved	mg/L	-	-	0.0005	-	-	<0.00050
Magnesium (Mg)-Dissolved	mg/L	-	-	0.1	-	-	<0.10
Manganese (Mn)-Dissolved	mg/L	-	-	0.00005	-	-	<0.000050
Mercury (Hg)-Dissolved	mg/L	0.000026	-	0.00001	-	-	<0.000010
Molybdenum (Mo)-Dissolved	mg/L	0.073	-	0.00005	-	-	<0.000050
Nickel (Ni)-Dissolved	mg/L	0.1	-	0.0005	-	-	<0.00050
Phosphorus (P)-Dissolved	mg/L	-	-	0.05	-	-	<0.050
Potassium (K)-Dissolved	mg/L	-	-	0.1	-	-	<0.10
Selenium (Se)-Dissolved	mg/L	0.001	-	0.0001	-	-	<0.00010
Silicon (Si)-Dissolved	mg/L	-	-	0.05	-	-	<0.050
Silver (Ag)-Dissolved	mg/L	0.0001	-	0.00001	-	-	<0.000010
Sodium (Na)-Dissolved	mg/L	-	-	0.05	-	-	<0.050
Strontium (Sr)-Dissolved	mg/L	-	-	0.0002	-	-	<0.00020
Sulfur (S)-Dissolved	mg/L	-	-	0.5	-	-	<0.50
Thallium (Tl)-Dissolved	mg/L	0.0008	-	0.00001	-	-	<0.000010
Tin (Sn)-Dissolved	mg/L	-	-	0.0001	-	-	<0.00010
Titanium (Ti)-Dissolved	mg/L	-	-	0.01	-	-	<0.010
Uranium (U)-Dissolved	mg/L	0.015	-	0.00001	-	-	<0.000010
Vanadium (V)-Dissolved	mg/L	-	-	0.001	-	-	<0.0010
Zinc (Zn)-Dissolved	mg/L	0.03	-	0.001	-	-	<0.0010

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## APPENDIX F      Q4 METEOROLOGICAL DATA

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Table F-1. Mount Nansen Daily Meteorological Data (April 1 to January 21, 2014)

Date	Air Temperature (°C)			Ground Temperature (°C)			Rainfall (mm)		Snow Depth (cm)	Wind Speed (m/s)		Wind Direction (deg.)
	Min.	Max.	Mean	Min.	Max.	Mean	Max.	Mean	Max.	Max.	Mean	Mean
01/04/2013	-6.52	-1.58	-4.26	-3.72	-3.47	-3.6	0.2	0.0	67	2.04	1.16	203
02/04/2013	-8.58	-3.88	-6.56	-3.48	-3.28	-3.4	2.1	0.1	195	5.22	3.03	266
03/04/2013	-12.49	-3.38	-7.79	-3.30	-3.26	-3.3	0.2	0.0	70	4.24	1.95	225
04/04/2013	-17.72	-12.13	-14.96	-3.73	-3.28	-3.5	0.0	0.0	69	4.32	2.41	155
05/04/2013	-17.96	-11.67	-14.80	-4.31	-3.79	-4.1	0.0	0.0	68	4.38	3.11	75
06/04/2013	-17.90	-7.02	-12.72	-5.78	-4.31	-5.2	0.0	0.0	68	5.43	4.22	57
07/04/2013	-6.89	1.18	-1.93	-5.33	-3.47	-4.3	0.0	0.0	67	7.52	5.02	148
08/04/2013	-4.05	0.21	-1.93	-3.45	-2.97	-3.2	0.0	0.0	66	6.63	4.89	165
09/04/2013	-7.72	1.16	-2.37	-3.02	-2.62	-2.9	0.0	0.0	66	12.69	6.67	146
10/04/2013	-12.14	-5.30	-8.32	-2.80	-2.63	-2.7	0.0	0.0	64	7.03	3.90	210
11/04/2013	-13.61	-6.08	-10.30	-3.19	-2.82	-3.1	0.0	0.0	63	5.29	2.03	153
12/04/2013	-13.55	-8.90	-11.49	-3.87	-3.21	-3.6	0.0	0.0	63	5.99	4.84	84
13/04/2013	-14.48	-6.64	-10.73	-4.01	-3.83	-3.9	0.0	0.0	63	3.47	1.71	232
14/04/2013	-13.36	-5.85	-9.45	-3.98	-3.82	-3.9	0.0	0.0	63	3.39	1.46	266
15/04/2013	-10.64	-2.25	-6.99	-4.06	-3.77	-3.9	0.0	0.0	63	3.90	3.06	121
16/04/2013	-9.92	-4.48	-6.81	-3.77	-3.40	-3.6	0.0	0.0	69	3.64	1.69	122
17/04/2013	-8.84	-1.61	-6.02	-3.38	-3.07	-3.2	3.0	0.2	70	3.94	1.49	236
18/04/2013	-12.13	-7.67	-9.84	-3.07	-3.00	-3.0	0.6	0.0	70	4.10	2.77	282
19/04/2013	-13.75	-6.61	-10.79	-3.10	-3.00	-3.0	0.2	0.0	70	3.36	2.11	266
20/04/2013	-13.31	-3.12	-7.54	-3.22	-3.10	-3.2	0.3	0.0	69	3.56	1.68	198
21/04/2013	-9.80	0.15	-4.58	-3.26	-3.20	-3.2	0.0	0.0	69	3.86	1.83	215
22/04/2013	-6.65	2.03	-2.26	-3.24	-3.09	-3.2	0.0	0.0	68	3.73	1.83	227
23/04/2013	-5.58	2.63	-1.15	-3.09	-2.91	-3.0	0.0	0.0	67	4.20	2.30	228
24/04/2013	-6.26	-2.28	-3.42	-2.91	-2.62	-2.8	1.0	0.1	71	4.01	2.78	259
25/04/2013	-9.51	-3.81	-6.61	-2.62	-2.47	-2.5	0.1	0.0	71	5.19	2.71	223
26/04/2013	-13.88	-7.48	-10.34	-2.63	-2.45	-2.5	0.0	0.0	70	6.37	2.43	278
27/04/2013	-12.80	-6.70	-9.95	-2.88	-2.65	-2.8	0.0	0.0	69	2.61	1.56	276
28/04/2013	-17.27	-9.52	-13.11	-3.27	-2.88	-3.1	0.0	0.0	69	3.35	2.15	285
29/04/2013	-14.90	-4.49	-9.29	-3.34	-3.27	-3.3	0.0	0.0	69	3.82	2.32	270
30/04/2013	-10.06	-2.65	-6.13	-3.26	-3.03	-3.2	0.0	0.0	69	2.92	2.07	219
01/05/2013	-7.99	-1.91	-4.29	-3.02	-2.77	-2.9	0.2	0.0	70	4.16	1.90	136
02/05/2013	-2.57	5.57	1.62	-2.77	-0.11	-1.9	0.0	0.0	70	6.46	3.42	207
03/05/2013	-0.27	6.33	2.97	-0.50	0.04	-0.2	0.0	0.0	64	6.72	4.95	191
04/05/2013	0.51	6.15	3.38	0.01	0.17	0.1	0.0	0.0	59	9.68	5.17	182
05/05/2013	-2.12	1.78	0.08	-0.73	0.11	-0.2	0.0	0.0	45	8.99	3.19	225



Date	Air Temperature (°C)			Ground Temperature (°C)			Rainfall (mm)		Snow Depth (cm)	Wind Speed (m/s)		Wind Direction (deg.)
	Min.	Max.	Mean	Min.	Max.	Mean	Max.	Mean	Max.	Max.	Mean	Mean
06/05/2013	-4.60	2.02	-1.68	-0.67	0.14	-0.3	0.0	0.0	40	2.91	1.45	216
07/05/2013	-3.28	3.41	-0.18	-1.13	0.22	-0.4	0.0	0.0	37	2.51	1.47	240
08/05/2013	-1.51	4.97	1.88	-0.87	0.26	-0.2	0.0	0.0	34	1.87	1.13	228
09/05/2013	-2.66	6.74	2.73	-1.21	0.42	-0.2	0.0	0.0	33	2.93	2.01	174
10/05/2013	2.32	11.55	6.96	-0.32	1.06	0.4	0.0	0.0	30	2.72	1.69	101
11/05/2013	2.66	10.65	5.99	-0.03	1.86	0.8	0.9	0.2	26	3.31	1.76	190
12/05/2013	0.00	6.15	2.65	0.12	2.97	1.2	0.5	0.1	21	4.67	2.90	238
13/05/2013	0.77	6.48	3.40	-0.03	4.91	2.2	0.2	0.0	17	7.75	3.90	194
14/05/2013	-0.67	5.23	2.44	-1.07	4.72	1.6	0.0	0.0	13	6.36	4.04	197
15/05/2013	-2.19	4.05	1.19	-1.27	4.47	1.3	1.1	0.1	12	6.44	3.23	204
16/05/2013	-2.53	5.07	1.34	-1.76	5.18	1.3	0.0	0.0	11	7.44	3.79	194
17/05/2013	-0.30	6.93	3.07	-0.72	4.84	1.6	0.0	0.0	8	8.40	5.89	172
18/05/2013	-4.26	7.33	3.60	-1.45	7.69	3.1	0.0	0.0	5	7.89	5.86	180
19/05/2013	-9.25	-5.55	-7.28	-4.40	-2.02	-3.2	0.0	0.0	2	5.67	3.99	263
20/05/2013	-9.09	0.29	-4.50	-5.15	0.38	-2.2	0.1	0.0	1	3.50	2.19	229
21/05/2013	-3.84	5.62	1.33	-3.91	5.16	1.1	0.0	0.0	1	3.25	2.00	102
22/05/2013	0.51	8.17	4.19	-1.33	10.59	4.2	0.0	0.0	0	5.18	3.00	66
23/05/2013	0.17	11.65	6.36	-1.01	11.24	5.7	0.0	0.0	0	3.88	1.95	146
24/05/2013	5.51	13.27	9.95	1.87	12.66	8.1	0.0	0.0	0	4.62	3.11	55
25/05/2013	7.80	16.27	11.67	5.64	16.78	10.5	0.0	0.0	1	3.16	1.97	141
26/05/2013	8.21	17.43	12.98	6.61	18.66	12.9	0.0	0.0	1	6.63	3.89	188
27/05/2013	9.64	18.65	13.97	6.49	20.45	13.0	0.0	0.0	1	4.29	2.01	154
28/05/2013	9.09	16.77	13.33	9.79	17.60	13.0	0.1	0.0	0	4.71	2.65	192
29/05/2013	7.33	17.87	12.35	5.46	20.68	13.0	0.0	0.0	0	4.65	2.08	153
30/05/2013	9.39	17.11	12.12	8.72	21.66	13.0	6.0	0.3	0	3.48	1.99	183
31/05/2013	9.37	18.67	13.45	6.04	19.98	13.4	0.4	0.0	0	4.34	1.90	185
01/06/2013	5.86	14.80	10.65	8.12	17.44	11.9	0.6	0.0	0	3.84	1.79	175
02/06/2013	3.39	12.63	7.45	6.10	14.39	9.8	0.7	0.1	0	3.07	1.53	163
03/06/2013	4.07	13.90	9.06	4.27	18.06	11.3	0.0	0.0	1	6.82	3.58	178
04/06/2013	1.77	11.64	6.34	2.48	16.98	9.8	0.0	0.0	1	7.48	4.36	204
05/06/2013	-0.19	7.06	3.20	2.26	11.00	5.7	4.3	0.5	1	5.37	2.73	219
06/06/2013	1.93	11.34	7.33	2.33	13.83	8.4	0.1	0.0	1	3.46	2.47	157
07/06/2013	6.46	12.70	9.45	5.01	14.22	9.9	0.1	0.0	0	5.62	2.72	124
08/06/2013	5.88	11.44	8.40	4.97	11.59	8.6	2.5	0.2	0	3.62	1.84	249
09/06/2013	7.44	16.07	11.53	6.35	17.12	11.6	0.0	0.0	1	3.68	2.20	218
10/06/2013	7.13	13.63	10.09	7.83	15.62	10.8	1.5	0.2	0	3.55	2.33	236
11/06/2013	5.44	9.45	6.80	6.01	10.90	8.1	2.5	0.2	0	2.13	1.38	237



Date	Air Temperature (°C)			Ground Temperature (°C)			Rainfall (mm)		Snow Depth (cm)	Wind Speed (m/s)		Wind Direction (deg.)
	Min.	Max.	Mean	Min.	Max.	Mean	Max.	Mean	Max.	Max.	Mean	Mean
12/06/2013	4.45	11.24	7.52	5.24	13.00	8.8	0.3	0.0	1	4.92	1.91	176
13/06/2013	4.58	10.91	7.08	4.80	13.36	8.8	1.3	0.1	1	5.35	1.88	149
14/06/2013	4.37	15.59	9.82	2.67	17.76	10.8	0.0	0.0	1	2.56	1.28	186
15/06/2013	9.52	19.75	15.10	6.47	21.74	15.4	0.0	0.0	0	3.20	1.74	186
16/06/2013	13.60	21.50	17.76	11.58	22.38	17.3	0.0	0.0	0	3.04	2.17	271
17/06/2013	7.01	15.86	11.77	9.48	16.86	13.7	0.0	0.0	1	7.22	4.37	112
18/06/2013	3.83	15.29	10.22	5.21	18.73	12.6	0.0	0.0	0	5.61	4.27	65
19/06/2013	8.16	18.18	13.79	8.27	22.32	16.1	0.0	0.0	1	3.19	2.14	116
20/06/2013	10.77	17.88	14.65	10.07	21.11	16.0	1.2	0.1	1	4.80	1.58	129
21/06/2013	8.73	19.20	13.21	10.24	19.31	14.5	1.9	0.1	1	4.14	2.22	163
22/06/2013	10.85	20.26	15.52	8.72	24.93	16.7	0.0	0.0	1	3.51	2.06	181
23/06/2013	10.46	17.88	14.13	11.26	23.58	17.2	0.0	0.0	1	4.40	2.47	199
24/06/2013	11.26	23.19	17.67	9.86	27.97	19.7	0.0	0.0	1	5.02	2.31	98
25/06/2013	16.30	24.11	20.18	15.94	29.44	22.2	0.0	0.0	1	6.05	4.02	75
26/06/2013	14.38	22.32	18.68	14.81	29.22	21.8	0.0	0.0	1	3.63	2.32	93
27/06/2013	15.96	25.73	20.48	14.50	31.18	23.2	0.0	0.0	1	4.07	2.06	174
28/06/2013	10.25	18.17	14.74	13.46	23.80	18.6	1.4	0.1	2	4.59	2.30	180
29/06/2013	10.41	19.00	14.42	13.02	26.69	18.6	0.4	0.0	1	3.37	1.81	207
30/06/2013	11.48	20.59	15.92	11.92	28.30	20.3	0.0	0.0	1	5.44	2.65	180
01/07/2013	9.60	17.97	13.10	11.21	25.23	17.4	0.0	0.0	1	6.75	4.75	184
02/07/2013	6.86	15.76	11.09	9.55	23.24	16.0	0.1	0.0	1	6.42	4.15	208
03/07/2013	4.88	11.30	7.41	8.33	16.24	11.5	2.7	0.2	12	4.87	3.11	239
04/07/2013	4.04	13.02	8.17	5.91	15.63	10.5	0.6	0.1	4	3.21	2.06	235
05/07/2013	5.62	16.03	11.13	7.10	22.64	14.7	0.0	0.0	1	4.36	2.53	199
06/07/2013	6.80	16.61	12.06	8.95	22.87	16.1	0.0	0.0	1	3.56	1.83	165
07/07/2013	6.15	14.83	10.35	7.92	21.93	15.0	0.0	0.0	1	7.41	4.36	189
08/07/2013	7.08	14.73	10.42	9.65	21.19	14.4	0.0	0.0	1	8.07	4.85	185
09/07/2013	4.07	11.39	6.18	7.75	17.78	10.8	1.7	0.1	14	3.87	2.29	216
10/07/2013	3.14	10.54	6.61	5.58	14.24	9.4	2.0	0.2	3	2.92	1.44	202
11/07/2013	6.42	11.51	8.64	7.44	12.22	9.6	0.7	0.1	1	2.70	1.97	266
12/07/2013	4.94	12.79	8.58	5.55	15.83	10.2	0.2	0.0	1	3.28	1.89	197
13/07/2013	5.44	15.29	10.56	5.17	20.27	13.4	0.0	0.0	1	3.78	2.23	133
14/07/2013	8.34	21.30	15.21	6.65	24.74	16.7	0.0	0.0	1	3.41	1.54	212
15/07/2013	14.52	22.69	18.36	13.17	24.28	19.4	0.0	0.0	1	3.33	2.16	276
16/07/2013	12.16	21.06	15.12	12.67	24.02	16.3	1.0	0.1	2	4.14	2.14	235
17/07/2013	10.63	19.12	14.34	11.02	22.50	16.1	0.6	0.0	2	3.54	1.24	172
18/07/2013	9.46	18.60	13.92	10.81	22.39	16.6	0.4	0.0	2	2.62	1.57	253



Date	Air Temperature (°C)			Ground Temperature (°C)			Rainfall (mm)		Snow Depth (cm)	Wind Speed (m/s)		Wind Direction (deg.)
	Min.	Max.	Mean	Min.	Max.	Mean	Max.	Mean	Max.	Max.	Mean	Mean
19/07/2013	9.82	16.60	12.84	11.81	18.72	14.8	1.7	0.2	1	3.88	2.03	228
20/07/2013	7.19	12.49	9.23	9.26	15.62	11.2	5.4	0.6	4	3.62	1.96	247
21/07/2013	7.49	10.70	8.93	8.84	12.80	10.6	2.1	0.4	5	3.03	1.81	271
22/07/2013	8.53	14.41	10.52	9.31	14.94	11.6	1.1	0.1	1	6.45	3.35	72
23/07/2013	9.83	17.83	13.33	7.37	21.53	14.5	0.3	0.0	1	3.48	1.21	208
24/07/2013	10.86	18.00	14.01	9.12	20.77	14.5	3.4	0.2	2	3.40	1.40	193
25/07/2013	7.64	11.84	9.50	9.53	15.85	12.0	3.6	0.8	13	3.97	2.26	225
26/07/2013	8.76	15.47	11.93	10.01	17.41	13.5	1.2	0.1	2	2.98	1.60	244
27/07/2013	9.74	16.14	12.79	9.61	17.47	13.2	0.3	0.0	1	3.21	1.92	268
28/07/2013	10.85	18.27	14.64	11.23	19.30	15.3	0.9	0.1	1	2.81	1.58	259
29/07/2013	11.66	22.62	17.13	10.13	25.35	17.9	0.0	0.0	12	2.93	1.77	206
30/07/2013	13.92	20.70	16.47	12.35	23.44	17.1	0.0	0.0	1	2.57	1.73	258
31/07/2013	11.10	19.66	15.20	11.32	22.79	16.3	0.0	0.0	12	4.99	1.59	199
01/08/2013	9.23	19.45	14.37	9.76	23.84	16.9	0.0	0.0	1	4.05	1.36	151
02/08/2013	12.97	22.60	17.74	10.66	28.53	19.3	0.0	0.0	1	3.63	1.93	185
03/08/2013	11.25	18.33	14.58	10.30	23.18	17.1	0.0	0.0	1	5.33	3.44	191
04/08/2013	8.94	14.93	11.92	10.19	20.27	15.0	0.0	0.0	1	3.50	2.45	202
05/08/2013	6.81	16.91	11.15	8.73	22.06	13.7	0.7	0.0	195	3.24	2.09	201
06/08/2013	8.75	19.18	14.08	7.15	23.66	15.9	0.0	0.0	12	3.90	1.64	141
07/08/2013	10.44	18.65	14.74	11.70	22.53	16.9	0.7	0.0	2	5.83	3.45	98
08/08/2013	9.28	14.65	11.98	9.59	18.52	14.1	0.0	0.0	1	5.91	3.72	194
09/08/2013	6.49	17.44	11.68	7.27	23.50	15.0	0.0	0.0	1	4.77	2.77	202
10/08/2013	7.60	20.54	14.04	9.13	26.10	17.0	0.0	0.0	1	3.37	2.23	184
11/08/2013	11.18	23.01	17.07	11.18	27.64	19.1	0.0	0.0	1	3.00	1.56	164
12/08/2013	15.24	23.65	19.69	12.27	27.84	19.8	0.0	0.0	1	3.80	1.50	132
13/08/2013	15.56	23.96	19.09	13.22	28.87	20.6	0.0	0.0	1	4.17	1.72	143
14/08/2013	11.05	21.58	16.30	12.48	26.65	18.3	0.0	0.0	0	2.54	1.49	189
15/08/2013	14.01	21.49	17.03	10.90	25.78	18.1	0.0	0.0	1	2.91	1.23	142
16/08/2013	11.28	18.57	14.48	11.40	23.95	17.0	0.0	0.0	1	3.31	2.01	186
17/08/2013	7.58	14.06	10.19	9.43	19.67	13.7	0.0	0.0	1	4.28	2.47	202
18/08/2013	6.33	13.85	8.90	6.82	19.68	11.6	5.1	0.4	3	3.40	2.17	204
19/08/2013	5.40	11.22	7.70	8.06	13.10	9.9	0.2	0.0	1	3.95	2.57	245
20/08/2013	4.06	13.70	8.75	4.54	16.90	10.7	0.0	0.0	2	4.39	3.05	221
21/08/2013	5.35	9.89	6.70	6.76	13.46	9.1	2.1	0.1	1	3.05	1.64	207
22/08/2013	4.27	12.99	7.35	5.98	16.99	9.8	1.8	0.2	2	4.25	1.85	198
23/08/2013	4.59	8.81	6.43	5.91	11.76	8.4	1.8	0.3	2	2.85	1.82	211
24/08/2013	4.01	7.78	5.67	6.12	10.22	7.7	1.5	0.3	2	2.93	1.55	233



Date	Air Temperature (°C)			Ground Temperature (°C)			Rainfall (mm)		Snow Depth (cm)	Wind Speed (m/s)		Wind Direction (deg.)
	Min.	Max.	Mean	Min.	Max.	Mean	Max.	Mean	Max.	Max.	Mean	Mean
25/08/2013	2.61	6.53	4.55	3.67	8.98	6.3	0.1	0.0	1	3.72	2.49	95
26/08/2013	4.66	8.78	6.22	5.91	11.13	7.9	0.0	0.0	1	3.09	1.30	174
27/08/2013	4.18	11.81	7.41	4.57	12.77	8.4	0.0	0.0	1	2.48	1.33	130
28/08/2013	5.19	15.48	9.86	2.37	17.20	9.7	0.0	0.0	1	3.73	1.96	143
29/08/2013	5.41	14.33	9.72	3.86	17.41	10.4	0.0	0.0	1	4.62	2.26	170
30/08/2013	5.06	16.70	10.84	3.68	21.05	11.9	0.0	0.0	1	3.45	1.75	183
31/08/2013	6.13	10.57	8.33	7.10	12.48	9.9	1.3	0.1	2	2.61	1.43	144
01/09/2013	4.04	8.12	5.58	5.98	10.95	7.8	2.5	0.4	2	2.99	1.44	137
02/09/2013	4.54	16.90	9.51	4.09	17.57	10.0	0.0	0.0	1	3.78	2.12	168
03/09/2013	7.53	12.16	9.47	6.86	12.60	9.0	0.0	0.0	1	6.88	3.81	201
04/09/2013	6.74	15.90	10.76	4.43	15.86	9.9	0.0	0.0	1	7.21	4.81	205
05/09/2013	4.98	13.74	8.71	4.62	15.43	9.5	0.0	0.0	1	3.98	2.31	205
06/09/2013	3.34	12.84	8.33	2.91	13.55	8.3	0.0	0.0	1	10.12	4.76	189
07/09/2013	8.78	14.17	11.21	7.15	15.68	11.1	0.0	0.0	1	7.25	5.08	179
08/09/2013	5.91	12.65	9.59	6.98	13.47	9.9	1.1	0.1	1	6.94	4.09	189
09/09/2013	2.44	10.95	6.58	1.92	14.14	7.7	0.0	0.0	1	4.14	2.79	220
10/09/2013	3.17	12.94	7.31	2.73	13.92	7.6	0.0	0.0	1	4.00	2.26	193
11/09/2013	4.90	13.45	8.73	5.89	13.69	8.9	0.2	0.0	1	9.02	4.46	171
12/09/2013	3.14	12.68	7.92	1.47	14.99	8.1	0.0	0.0	1	3.09	1.97	176
13/09/2013	2.46	12.37	7.37	1.52	14.48	7.6	0.0	0.0	1	3.02	1.81	201
14/09/2013	4.62	6.90	5.73	4.68	8.27	6.2	0.3	0.0	1	2.40	0.73	147
15/09/2013	4.11	7.15	5.38	4.93	8.00	6.2	0.0	0.0	1	4.83	2.55	126
16/09/2013	-1.25	4.76	1.73	0.33	5.10	2.5	1.9	0.3	5	5.93	2.67	119
17/09/2013	-1.30	4.88	1.38	0.14	6.25	2.5	2.6	0.2	1	3.99	1.68	109
18/09/2013	0.93	7.11	3.61	0.02	8.28	3.7	0.1	0.0	1	5.24	2.66	187
19/09/2013	0.04	6.94	2.84	-1.12	7.69	2.9	0.5	0.0	1	4.62	2.57	137
20/09/2013	-2.04	1.16	-0.48	0.38	3.02	1.5	1.9	0.3	9	3.59	1.36	162
21/09/2013	-2.53	5.22	1.16	0.03	6.39	2.4	3.0	0.2	3	4.48	2.33	112
22/09/2013	-0.20	2.85	1.48	0.70	3.45	2.1	0.6	0.1	1	4.57	3.19	55
23/09/2013	-3.36	2.68	-0.15	-0.54	2.60	1.6	0.8	0.1	1	3.83	1.72	184
24/09/2013	-4.92	-1.85	-3.29	-1.61	0.75	-0.7	0.1	0.0	1	2.86	1.72	233
25/09/2013	-3.14	6.45	1.78	-2.30	4.05	0.8	0.1	0.0	1	4.43	2.24	140
26/09/2013	-0.63	3.07	0.98	0.19	1.08	0.7	1.2	0.3	4	4.40	2.27	210
27/09/2013	-2.65	5.17	1.52	-2.19	3.15	0.7	3.5	0.3	195	6.13	2.68	162
28/09/2013	0.01	3.29	1.07	-0.23	2.54	0.8	0.0	0.0	1	5.87	4.44	45
29/09/2013	0.64	4.18	1.52	0.49	3.53	1.4	0.0	0.0	0	6.86	5.12	35
30/09/2013	0.12	2.83	1.55	0.35	2.85	1.4	0.0	0.0	1	5.82	4.62	32



Date	Air Temperature (°C)			Ground Temperature (°C)			Rainfall (mm)		Snow Depth (cm)	Wind Speed (m/s)		Wind Direction (deg.)
	Min.	Max.	Mean	Min.	Max.	Mean	Max.	Mean	Max.	Max.	Mean	Mean
01/10/2013	-0.04	1.62	0.96	0.60	2.44	1.2	0.4	0.1	1	3.67	2.51	48
02/10/2013	-0.55	5.15	1.43	-0.39	5.94	1.9	0.3	0.0	1	4.32	1.83	190
03/10/2013	-0.84	1.90	0.14	-1.72	0.99	-0.4	0.0	0.0	1	5.02	2.43	142
04/10/2013	-0.84	2.69	0.50	-0.76	2.85	0.7	0.0	0.0	1	3.09	1.49	175
05/10/2013	-2.53	3.52	-0.20	-1.36	2.53	0.0	0.0	0.0	1	2.64	1.53	216
06/10/2013	-2.04	4.57	0.64	-3.05	3.15	-0.1	0.0	0.0	1	3.13	1.74	158
07/10/2013	-3.35	1.52	-0.68	-2.65	1.30	-0.6	0.0	0.0	1	3.84	1.92	247
08/10/2013	-4.52	2.17	-1.03	-3.91	0.67	-1.4	0.0	0.0	1	6.22	2.30	148
09/10/2013	-3.93	0.95	-0.97	-1.62	0.30	-0.3	0.0	0.0	15	4.98	4.04	228
10/10/2013	-5.35	1.17	-2.46	-2.65	-0.13	-1.6	1.0	0.2	14	3.21	1.62	202
11/10/2013	-3.13	3.03	-0.50	-2.80	0.06	-1.4	0.9	0.1	12	2.83	1.91	229
12/10/2013	-2.81	2.04	-0.96	-2.74	-0.34	-1.8	0.0	0.0	11	2.68	1.46	221
13/10/2013	-3.33	3.64	0.46	-2.54	0.59	-0.8	0.0	0.0	10	5.27	2.83	135
14/10/2013	-0.57	5.57	2.59	-2.30	1.24	-0.1	0.0	0.0	9	6.07	2.58	216
15/10/2013	-2.28	3.97	0.68	-2.88	1.17	-0.8	0.0	0.0	9	4.67	2.93	223
16/10/2013	-0.07	8.05	3.24	-1.65	2.10	0.2	0.0	0.0	9	4.61	2.81	235
17/10/2013	1.18	5.37	3.62	-1.35	1.89	0.2	0.0	0.0	9	4.04	1.58	179
18/10/2013	1.86	7.44	3.68	-0.69	2.01	0.6	0.0	0.0	9	4.31	2.87	219
19/10/2013	1.12	7.29	3.86	-1.14	2.87	0.6	0.0	0.0	8	8.60	4.43	192
20/10/2013	0.35	5.18	2.54	-2.09	2.18	-0.3	0.0	0.0	7	5.29	1.93	216
21/10/2013	-3.42	2.28	-1.15	-4.75	0.44	-2.6	0.0	0.0	7	3.29	2.20	237
22/10/2013	-3.97	0.78	-2.47	-5.70	-0.38	-3.8	0.0	0.0	7	2.86	1.84	159
23/10/2013	-6.46	-3.93	-4.66	-4.42	-2.17	-3.3	0.0	0.0	21	5.11	2.99	85
24/10/2013	-8.99	-2.60	-6.03	-4.01	-1.86	-3.0	0.1	0.0	21	4.92	1.71	148
25/10/2013	-2.77	-0.53	-1.52	-3.24	-0.59	-1.8	0.2	0.0	22	2.53	0.93	146
26/10/2013	-5.74	-0.21	-2.59	-2.46	-0.57	-1.1	0.1	0.0	27	4.31	2.34	199
27/10/2013	-5.87	-0.77	-3.23	-2.58	-1.04	-1.8	0.0	0.0	24	2.61	1.50	101
28/10/2013	0.17	6.25	4.01	-1.21	1.03	0.1	2.9	0.5	24	9.94	4.56	198
29/10/2013	-1.50	4.81	0.96	-3.14	0.43	-1.0	0.1	0.0	20	6.43	3.56	224
30/10/2013	-2.27	0.54	-1.08	-3.02	-0.58	-1.8	0.0	0.0	20	3.30	1.34	123
31/10/2013	-2.13	2.82	-0.61	-3.29	-0.38	-2.1	0.0	0.0	20	3.50	2.22	222
01/11/2013	-3.47	-0.62	-2.31	-2.36	-0.54	-1.8	0.0	0.0	19	3.48	1.78	211
02/11/2013	-6.55	-3.84	-4.97	-5.06	-1.82	-3.1	0.0	0.0	20	2.28	1.00	196
03/11/2013	-7.83	-3.41	-6.26	-6.60	-3.73	-5.4	0.0	0.0	195	3.37	1.85	217
04/11/2013	-8.80	-6.86	-7.59	-7.10	-4.25	-5.7	0.0	0.0	20	3.90	1.83	50
05/11/2013	-8.86	-4.87	-6.78	-5.99	-3.26	-4.7	0.0	0.0	22	2.61	0.96	191
06/11/2013	-12.41	-8.21	-10.43	-6.81	-5.25	-5.8	0.0	0.0	22	2.89	1.36	199





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Date	Air Temperature (°C)			Ground Temperature (°C)			Rainfall (mm)		Snow Depth (cm)	Wind Speed (m/s)		Wind Direction (deg.)
	Min.	Max.	Mean	Min.	Max.	Mean	Max.	Mean	Max.	Max.	Mean	Mean
07/11/2013	-15.33	-11.03	-12.74	-8.16	-5.39	-6.4	0.0	0.0	24	1.21	0.47	143
08/11/2013	-22.88	-15.08	-18.66	-10.53	-7.08	-8.5	0.0	0.0	24	0.99	0.42	193
09/11/2013	-23.92	-12.26	-17.47	-11.33	-8.05	-9.8	0.0	0.0	24	1.15	0.41	144
10/11/2013	-14.67	-3.54	-7.19	-8.69	-3.48	-5.6	0.0	0.0	23	4.70	2.32	212
11/11/2013	-11.96	-2.54	-7.26	-6.01	-4.24	-5.2	0.0	0.0	24	2.06	1.04	200
12/11/2013	-16.18	-10.92	-12.35	-8.60	-5.72	-6.4	0.0	0.0	24	2.80	1.47	223
13/11/2013	-19.11	-6.25	-13.72	-10.11	-4.54	-7.9	0.0	0.0	24	4.09	1.98	209
14/11/2013	-7.89	-3.35	-5.58	-4.58	-2.66	-3.4	0.0	0.0	28	6.40	3.29	261
15/11/2013	-18.19	-7.23	-13.09	-6.21	-3.28	-4.4	0.0	0.0	28	3.87	2.31	265
16/11/2013	-18.94	-16.65	-17.68	-6.17	-5.52	-5.7	0.0	0.0	28	2.18	1.30	262
17/11/2013	-23.38	-19.14	-21.33	-7.79	-5.80	-6.8	0.0	0.0	28	3.66	1.92	266
18/11/2013	-27.82	-22.45	-25.09	-9.49	-7.81	-8.6	0.0	0.0	28	1.99	0.35	164
19/11/2013	-31.74	-26.55	-28.57	-10.10	-8.78	-9.6	0.0	0.0	28	1.01	0.27	134
20/11/2013	-30.45	-26.29	-28.97	-10.78	-8.68	-9.8	0.0	0.0	28	1.79	0.48	171
21/11/2013	-30.10	-23.53	-26.43	-11.26	-10.50	-10.9	0.0	0.0	28	5.05	3.80	36
22/11/2013	-23.78	-0.47	-8.86	-10.54	-3.70	-6.5	0.0	0.0	29	8.96	4.34	111
23/11/2013	-12.71	-1.52	-6.00	-5.04	-3.24	-3.8	0.0	0.0	29	7.36	3.66	198
24/11/2013	-11.85	-7.59	-9.97	-5.37	-4.73	-5.1	0.0	0.0	29	3.43	2.35	222
25/11/2013	-12.19	-9.25	-11.09	-5.39	-4.85	-5.2	0.0	0.0	30	3.90	2.86	40
26/11/2013	-14.35	-7.25	-11.03	-4.73	-4.15	-4.4	0.0	0.0	31	2.51	0.61	162
27/11/2013	-8.33	-6.16	-7.32	-4.41	-3.33	-3.8	0.0	0.0	33	5.11	2.60	76
28/11/2013	-18.26	-6.61	-13.76	-3.83	-3.14	-3.6	0.0	0.0	39	3.93	1.56	200
29/11/2013	-24.64	-18.52	-22.82	-5.07	-3.84	-4.6	0.0	0.0	39	3.92	2.68	253
30/11/2013	-27.00	-24.04	-25.37	-6.03	-5.06	-5.5	0.0	0.0	36	2.19	0.96	172
01/12/2013	-26.84	-21.65	-24.45	-6.40	-6.07	-6.3	0.0	0.0	36	3.39	1.80	237
02/12/2013	-22.16	-11.10	-16.71	-6.47	-5.68	-6.2	0.0	0.0	35	3.26	0.75	160
03/12/2013	-13.51	-8.25	-11.25	-5.62	-4.83	-5.3	0.0	0.0	35	1.74	0.74	191
04/12/2013	-11.06	-8.02	-9.14	-4.96	-4.17	-4.5	0.0	0.0	35	1.35	0.68	171
05/12/2013	-13.37	-6.84	-10.65	-5.77	-5.08	-5.5	0.0	0.0	35	0.88	0.27	154
06/12/2013	-14.28	-1.71	-9.30	-5.90	-3.59	-5.0	0.0	0.0	35	3.13	1.34	212
07/12/2013	-2.38	1.21	-0.13	-3.45	-2.00	-2.6	0.0	0.0	35	4.67	3.30	273
08/12/2013	-2.76	0.30	-0.93	-2.20	-1.97	-2.1	0.0	0.0	35	4.74	2.75	251
09/12/2013	-6.07	-1.15	-3.93	-2.37	-2.06	-2.2	0.0	0.0	35	4.12	2.72	257
10/12/2013	-11.31	-5.94	-9.64	-2.99	-2.35	-2.7	0.0	0.0	39	2.06	0.76	184
11/12/2013	-19.55	-12.40	-17.58	-7.49	-2.90	-5.7	0.0	0.0	40	10.43	7.71	34
12/12/2013	-20.74	-19.35	-19.78	-7.75	-6.90	-7.4	0.0	0.0	37	7.35	5.85	53
13/12/2013	-21.90	-18.22	-20.58	-7.24	-6.88	-7.0	0.0	0.0	37	7.24	5.02	36



Date	Air Temperature (°C)			Ground Temperature (°C)			Rainfall (mm)		Snow Depth (cm)	Wind Speed (m/s)		Wind Direction (deg.)
	Min.	Max.	Mean	Min.	Max.	Mean	Max.	Mean	Max.	Max.	Mean	Mean
14/12/2013	-18.42	-3.97	-9.36	-6.84	-4.00	-5.3	0.0	0.0	37	5.25	2.39	93
15/12/2013	-16.38	-6.72	-11.90	-4.66	-3.79	-4.3	0.0	0.0	38	7.31	2.73	171
16/12/2013	-27.01	-17.60	-23.49	-6.91	-4.71	-5.8	0.0	0.0	38	2.05	0.68	180
17/12/2013	-27.75	-24.87	-26.54	-8.18	-6.99	-7.7	0.0	0.0	38	3.04	1.40	212
18/12/2013	-25.79	-16.35	-21.88	-8.18	-7.45	-7.9	0.0	0.0	38	4.46	1.89	196
19/12/2013	-19.81	-14.28	-16.62	-7.37	-6.06	-6.6	0.0	0.0	38	3.31	0.96	210
20/12/2013	-20.54	-16.16	-18.00	-7.10	-6.77	-6.9	0.0	0.0	38	0.64	0.13	151
21/12/2013	-16.25	-14.08	-15.26	-6.73	-5.79	-6.1	0.0	0.0	38	1.09	0.37	97
22/12/2013	-15.51	-12.63	-14.16	-5.77	-4.97	-5.4	0.0	0.0	41	3.26	1.37	126
23/12/2013	-21.49	-16.14	-17.99	-5.38	-4.94	-5.1	0.0	0.0	48	5.05	2.48	237
24/12/2013	-24.01	-19.49	-21.69	-6.49	-5.49	-6.2	0.0	0.0	47	3.55	1.62	129
25/12/2013	-24.20	-18.11	-20.46	-6.09	-5.66	-5.8	0.0	0.0	46	3.82	0.72	166
26/12/2013	-28.74	-24.72	-26.64	-7.62	-5.94	-6.8	0.0	0.0	45	0.79	0.20	166
27/12/2013	-27.52	-23.35	-25.09	-7.68	-6.62	-7.1	0.0	0.0	44	3.53	1.49	85
28/12/2013	-23.84	-16.93	-19.92	-7.35	-6.37	-6.9	0.0	0.0	44	5.23	2.61	60
29/12/2013	-21.63	-15.28	-18.45	-6.29	-5.87	-6.0	0.0	0.0	44	3.42	0.82	134
30/12/2013	-17.08	-14.99	-16.05	-5.95	-5.23	-5.7	0.0	0.0	47	4.42	3.38	38
31/12/2013	-17.64	-10.83	-15.58	-5.25	-5.11	-5.2	0.0	0.0	47	2.96	1.17	63
01/01/2014	-12.57	-4.15	-7.66	-5.10	-3.94	-4.5	0.0	0.0	47	5.92	3.63	117
02/01/2014	-8.33	-5.34	-6.78	-3.90	-3.73	-3.8	0.0	0.0	47	5.25	3.39	258
03/01/2014	-11.54	-7.35	-9.60	-3.90	-3.68	-3.7	0.0	0.0	47	3.37	1.40	213
04/01/2014	-14.28	-11.74	-13.05	-4.46	-3.94	-4.3	0.0	0.0	49	5.05	2.48	67
05/01/2014	-13.02	-2.98	-6.32	-4.44	-3.51	-4.0	0.0	0.0	49	4.47	2.27	123
06/01/2014	-6.86	-3.88	-5.26	-3.50	-3.46	-3.5	0.0	0.0	49	3.46	1.99	158
07/01/2014	-8.56	-5.58	-6.58	-3.57	-3.42	-3.5	0.0	0.0	48	1.98	0.65	194
08/01/2014	-10.74	-5.87	-8.04	-3.56	-3.39	-3.5	0.0	0.0	195	2.57	0.96	193
09/01/2014	-14.16	-7.65	-9.28	-3.56	-3.34	-3.5	0.0	0.0	195	5.08	3.00	113
10/01/2014	-15.10	-11.51	-13.10	-3.64	-3.39	-3.5	0.0	0.0	54	4.65	1.36	194
11/01/2014	-20.83	-14.34	-18.67	-4.09	-3.66	-3.9	0.0	0.0	55	1.86	0.37	137
12/01/2014	-23.70	-16.46	-20.14	-4.70	-4.09	-4.5	0.0	0.0	55	2.99	0.87	170
13/01/2014	-16.20	-9.09	-12.65	-4.65	-4.46	-4.6	0.0	0.0	54	4.06	2.32	202
14/01/2014	-9.64	-3.28	-5.74	-4.43	-3.75	-4.1	0.0	0.0	55	7.62	2.74	176
15/01/2014	-6.24	-2.24	-4.44	-3.73	-3.40	-3.6	0.0	0.0	55	7.77	3.83	213
16/01/2014	-2.62	2.79	-0.66	-3.38	-2.94	-3.2	0.3	0.0	54	8.05	3.19	196
17/01/2014	-0.50	2.89	0.85	-2.93	-2.65	-2.8	0.3	0.0	54	11.89	3.61	185
18/01/2014	-4.92	0.44	-1.44	-2.64	-2.47	-2.5	0.1	0.0	55	6.10	3.99	202
19/01/2014	-6.23	-4.26	-5.01	-2.77	-2.47	-2.6	0.0	0.0	55	4.91	2.43	187



Date	Air Temperature (°C)			Ground Temperature (°C)			Rainfall (mm)		Snow Depth (cm) Max.	Wind Speed (m/s)		Wind Direction (deg.) Mean
	Min.	Max.	Mean	Min.	Max.	Mean	Max.	Mean		Max.	Mean	
20/01/2014	-6.38	-2.73	-4.96	-2.94	-2.79	-2.9	0.0	0.0	54	3.75	1.80	199
21/01/2014	-6.86	-2.23	-5.85	-3.10	-2.96	-3.1	0.0	0.0	54	4.71	3.51	62

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Mount Nansen Meteorological Station - Air and Ground Surface Temperature

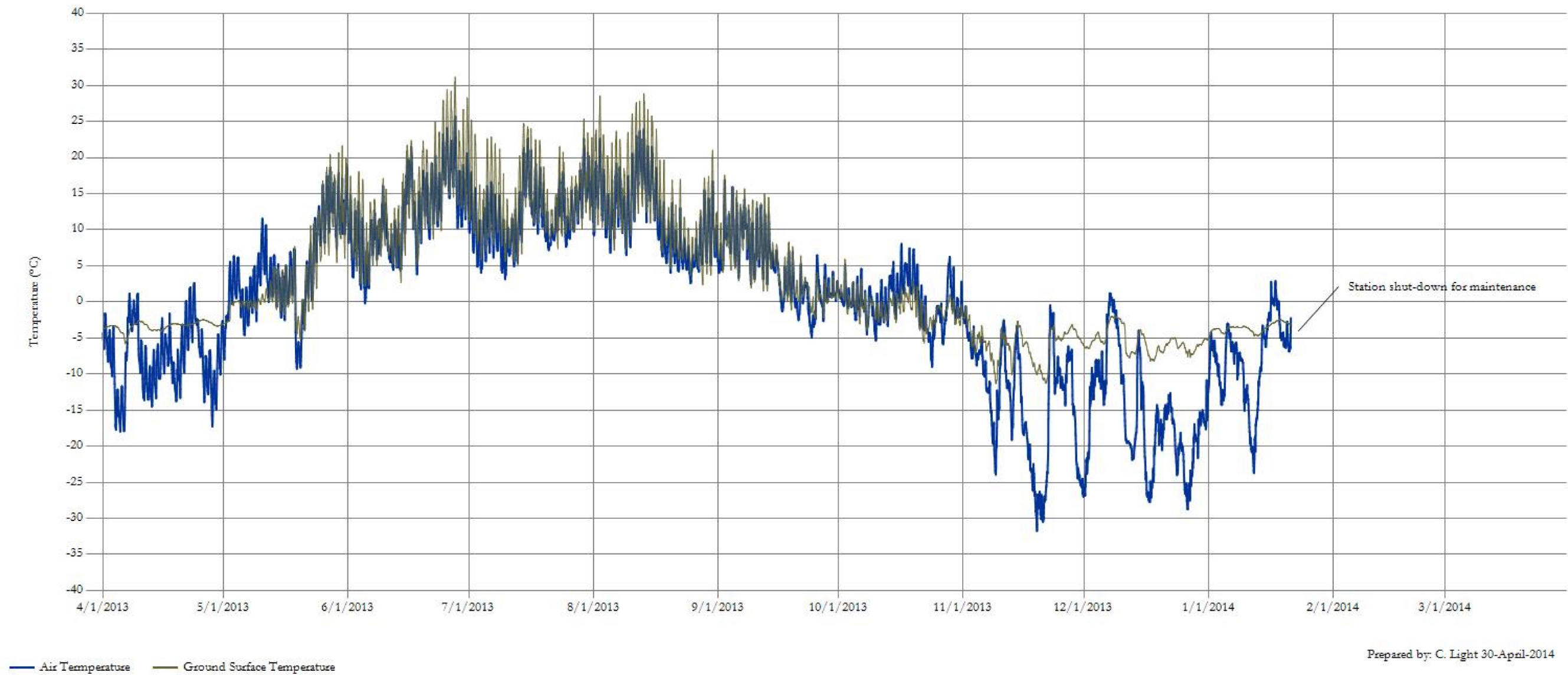


Figure F-1 Mount Nansen mean hourly air and ground temperature, April 1 to January 21, 2014.

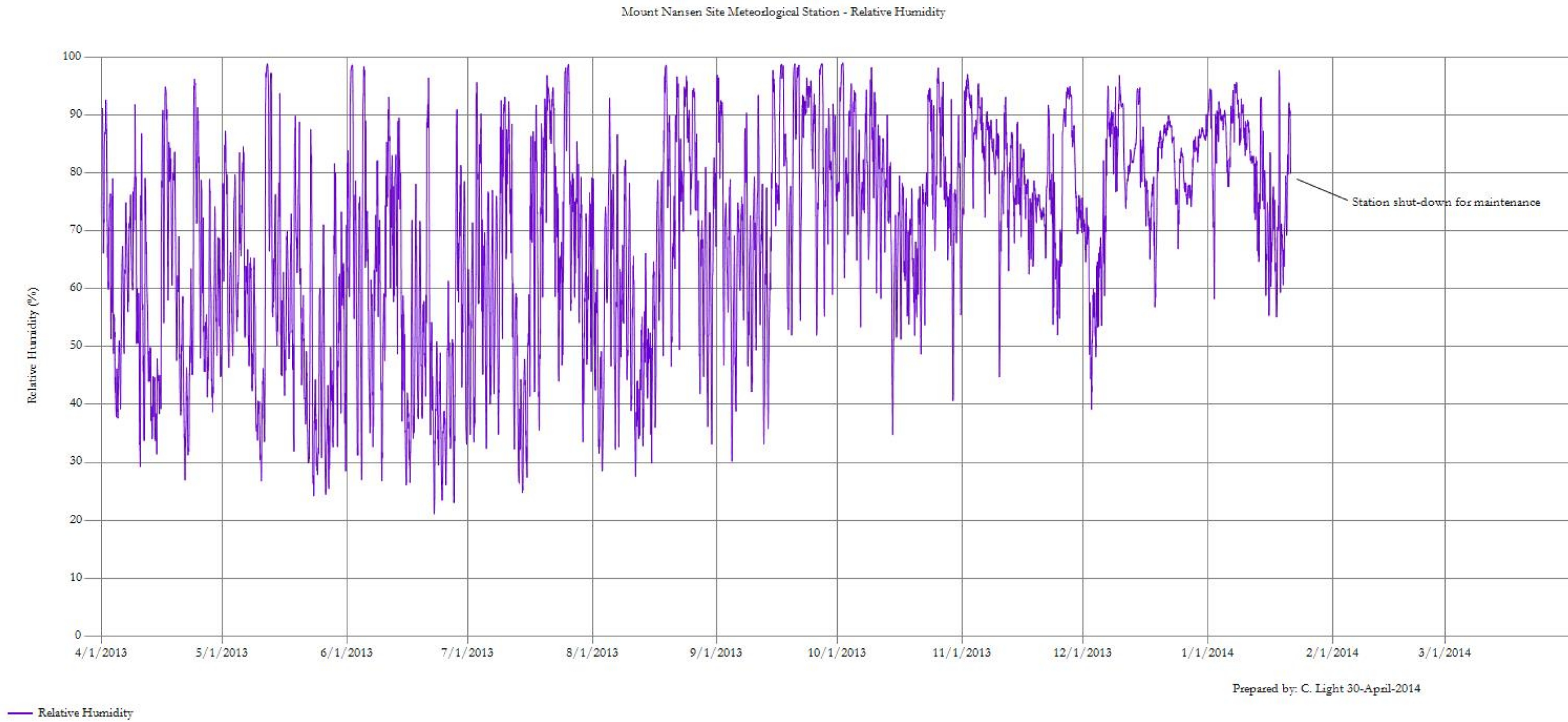


Figure F-2 Mount Nansen mean hourly relative humidity, April 1 to January 21, 2014.

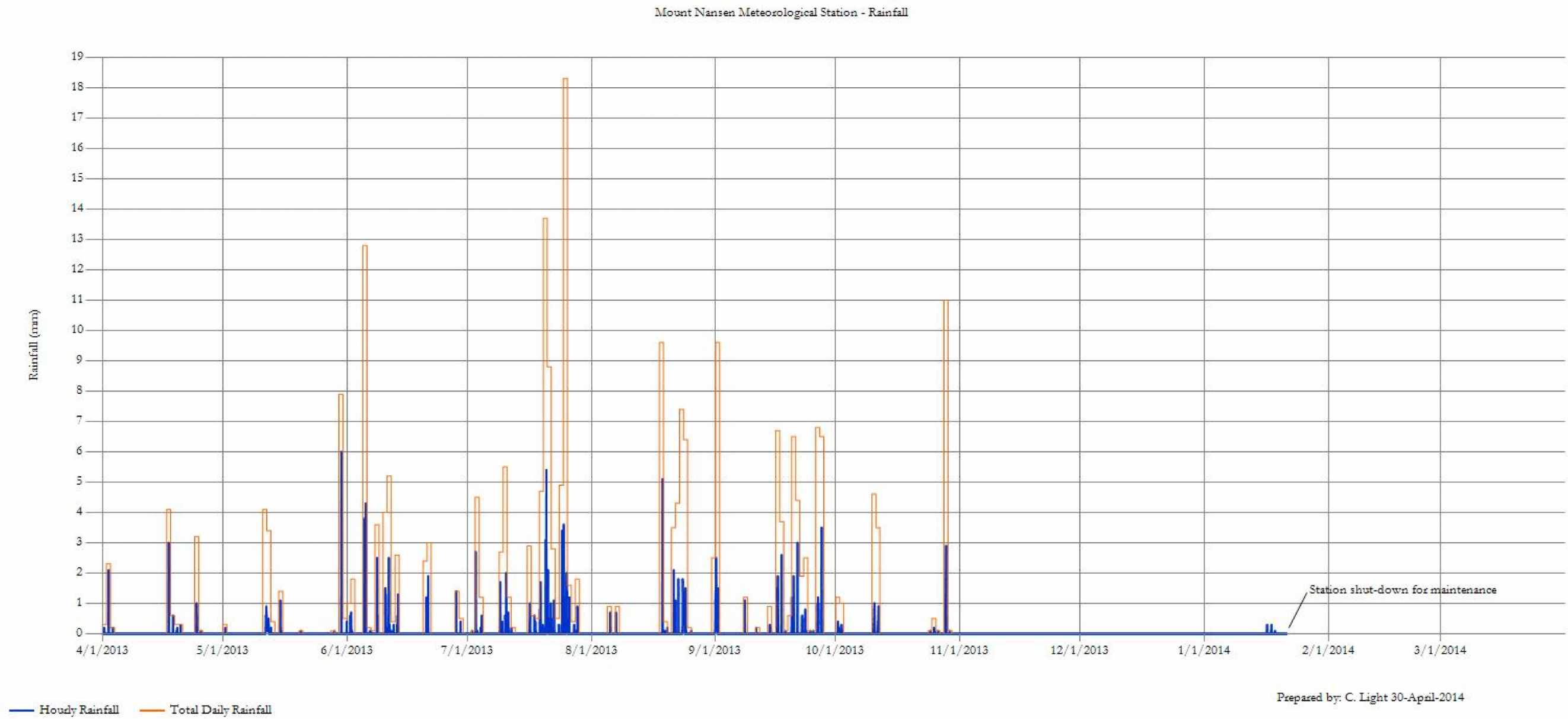


Figure F-3 Mount Nansen cumulative daily and hourly precipitation as rainfall, April 1 to January 21, 2014.



Mount Nansen Site Meteorological Station - Snow Depth



Figure F-4 Mount Nansen mean hourly snow depth, April 1 to January 21, 2014.





Mount Nansen Site Meteorological Station - Radiative Fluxes

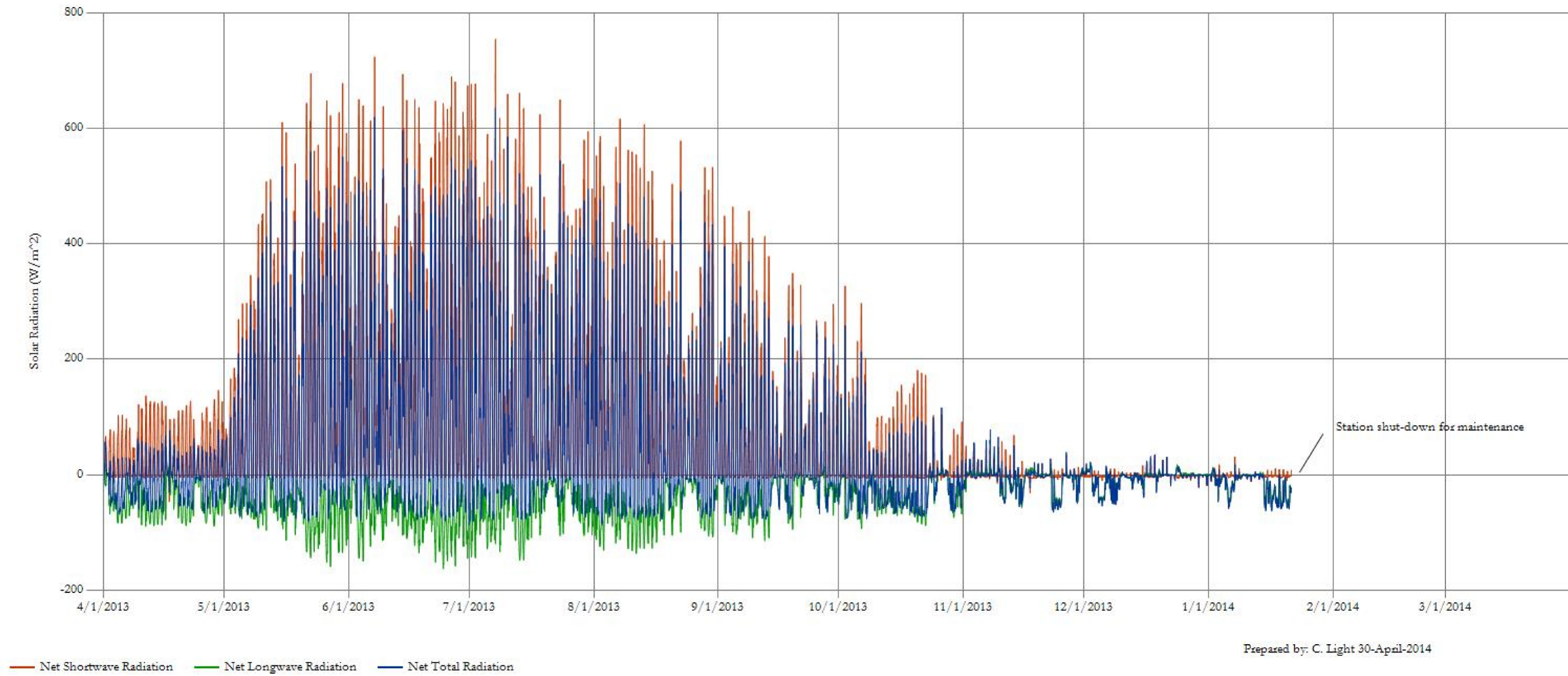


Figure F-5 Mount Nansen mean hourly net shortwave, long wave and total radiation, April 1 to January 21, 2014.



Mount Nansen Meteorological Station - Wind Speed

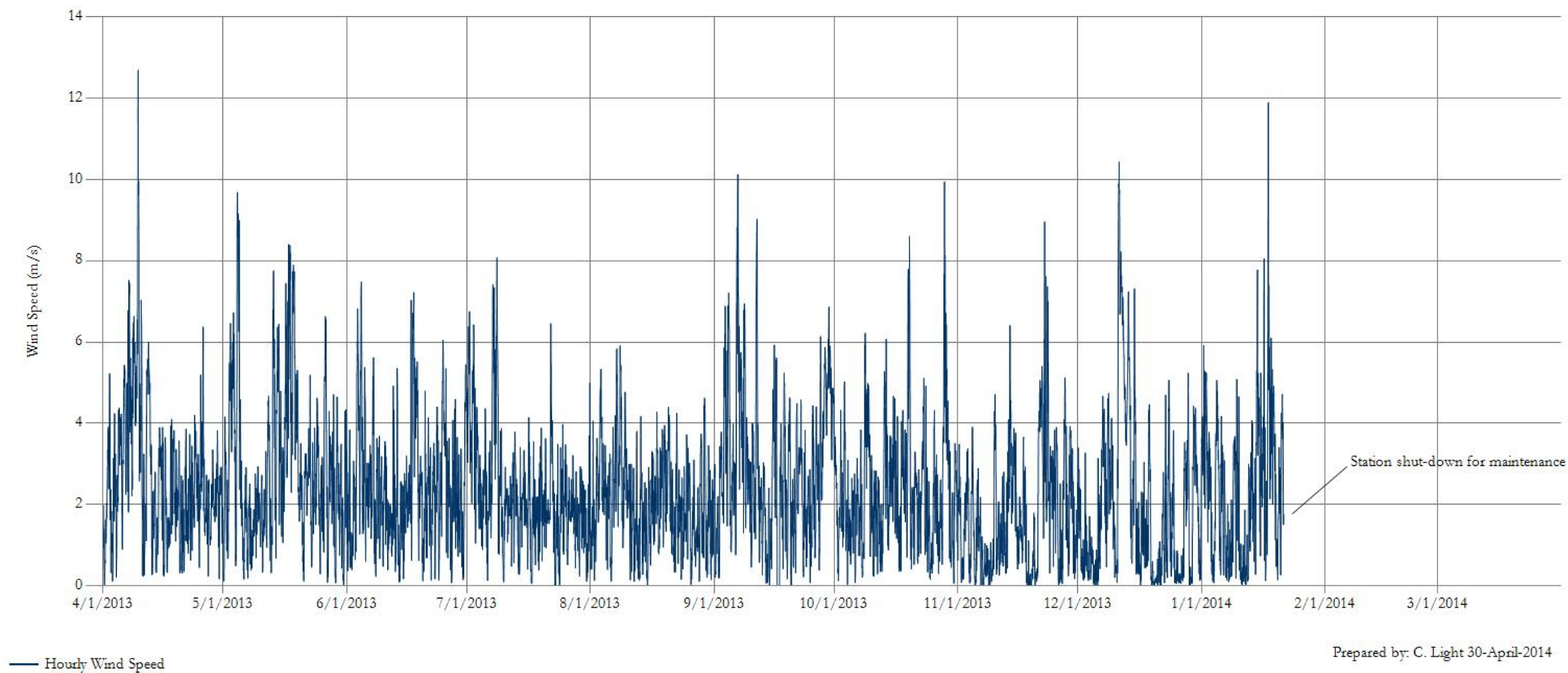
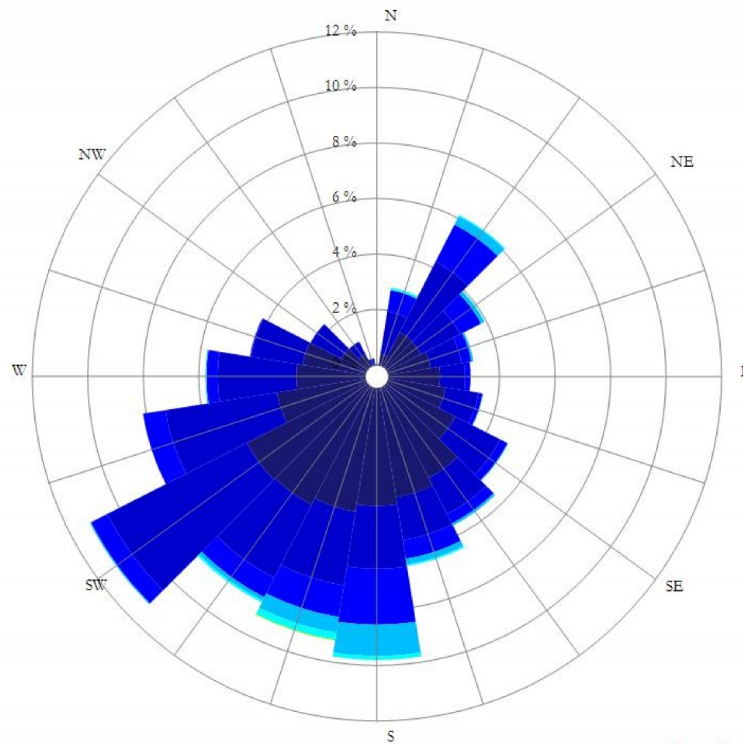


Figure F-6 Mount Nansen mean hourly wind speed, April 1 to January 21, 2014.



Prepared by: C.Light 30-April-2014

Figure F-7 Mount Nansen wind speed and direction, April 1 to January 21, 2014.