# Mount Nansen Water Resources Investigations Quarterly Report (Q3) October – December, 2014

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# EXECUTIVE SUMMARY

EDI Environmental Dynamics Inc. (EDI) was retained by Yukon Government, Assessment and Abandoned Mines (AAM) in 2014 to conduct the Water Resource Investigations 2014/15 program at the Mount Nansen Site. This program involves meteorological monitoring and surface water hydrometric and water quality monitoring at the Mount Nansen Site, including sites and stations on Dome Creek, Victoria Creek, Back Creek and Pony Creek. The data presented in this report comprises the third quarter of the program (Q3), from October 1 to December 31, 2014, which involved three monthly monitoring events: October 14-16, 2014, November 12-14, 2014, and December 15-16, 2014.

Daily and hourly **meteorological data** for the Q3 period is presented in this report. Overall, air temperatures during the period ranged from -20.5°C to 7.9°C at the ATM-ROAD AAM station. A total of 14.1 mm of rain fell during the Q3 period, mostly in October 2014. In addition to rain, snow fell during the Q3 period. Most of the snow fell in November and December 2014, with a cumulative snowfall of 41.5 cm by December 31, 2014. Of note snow depth data collected by the snow sensor is currently under review, based on erroneous data identified in October 2014. EDI collected field snow depth measurements in November and December 2014 to ground truth the snow sensor data, which appears to be overestimating snow depth. Investigations are ongoing with additional ground trothing in 2015.

**Hydrometric monitoring** was completed at up to 13 hydrometric stations during the three measurement events, five of these stations also collected continuous winter water level data to develop an understanding of hydrologic behaviour and timing in the winter; rating cures were not applied. Monitoring at each station included discharge measurements and water level surveys at continuous stations where conditions are suitable. Hydrometric results in this report include water level elevations, discharge measurements and hydrographs. During the Q3 period, typical hydrologic conditions were delayed; observations indicated standing water or flow between layered ice later into the season than observed in past years. Several continuous data loggers experienced malfunctions in Q3; one of these was a logger deployed for the winter period in Victoria Creek, however there is surrogate data available from other stations on the creek. Discharge measurements at the v-notch weir at H-DC-M WP were obtained throughout the Q3 period.

**Water quality** sampling was completed at the 23 regular water quality sites, if conditions allowed. Water samples were collected at each site along with *in situ* water quality parameters. 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 and a toxicity sample from the seepage pond discharge. Results presented in this report include a summary of parameters that exceed applicable water quality guidelines and standards. In general, water chemistry results for the Q3 period are similar to previous quarters. Many sites had frozen to substrate during the Q3 period, by either November or December 2014 (e.g., WQ-PC-U, WQ-PC-D, WQ-DC-DX, WQ-DC-D1b, WQ-DC-B, WQ-DC-R, WQ-BC, WQ-CH-P-13-01, and WQ-DESS-01, 02, 03). The four sites on Victoria Creek remained flowing through the Q3 period (WQ-VC-U, WQ-VC-DBC, WQ-VC-UMN, and WQ-VC-R), along with two sites on Dome Creek (WQ-DC-DX+105 and WQ-DC-U). The tailings pond, pit lake and seepage pond discharge were also sampled through all visits of Q3.

# AUTHORSHIP

This report was prepared by EDI Environmental Dynamics Inc. The EDI staff who contributed to this project includes:

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# 1 INTRODUCTION

Yukon Government Assessment and Abandoned Mines (AAM) retained the services of EDI Environmental Dynamics Inc. (EDI) in 2014 to conduct the Water Resource Investigations 2014/15 program at the Mount Nansen Site. This program involves three monitoring components: surface water hydrology, surface water quality, and meteorology. Data is reported on a quarterly basis. This report presents the data for the third quarter (Q3) of the program, from October 1, 2014 to December 31, 2014.

The Q3 period consisted of three monthly monitoring events during the fall and early-winter period:

- October 14-16, 2014
- November 12-14, 2014
- December 15-16, 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 in Table 1, below.

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

| Monitoring Component | Data Included | Section |
|---|---|---|
| Meteorology | • Summary of daily meteorological data<br>• Hourly meteorological plots | • 3.1, APPENDIX F<br>• APPENDIX F |
| Hydrology | • Monthly discharge values<br>• Rating curve data summary tables<br>• Database tables<br>• Stage-discharge and hydrographs | • 3.2, APPENDIX D<br>• 3.2<br>• APPENDIX D<br>• APPENDIX D |
| Water Quality | • Summary of guideline/standard exceedances<br>• *In situ* water quality data summary tables<br>• Lab result plots<br>• Lab results table and QA/QC analysis | • 3.3, APPENDIX E<br>• 3.3<br>• APPENDIX E<br>• APPENDIX E |

## 1.1 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 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.

The 2014/15 project scope has some differences from the previous year's programs (2013/14, 2012/13), particularly the addition of several surface water quality sites, including the three Dome Creek east slope seeps, the WQ-CH-P-13-01 seep, and WQ-LW-SEEP-01 seep. The list of water quality sites and hydrometric stations that were part of the Q3 investigation period are presented below (Table 2). Refer to Section 2.2 and 2.3 for coordinates.

**Table 2. List of surface water monitoring locations at the Mount Nansen Site investigated during Q3.**

| 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 | - | ✓ | WQ-DC-DX |
| Dome Creek at DX+105 | ✓ | ✓ | H/WQ-DC-DX+105 |
| Dome Creek at D1b | ✓ | ✓ | H/WQ-DC-D1b |
| Diversion Channel at Bridge | ✓ | ✓ | 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 08 | - | ✓ | WQ-MS-S-08 |
| Back Creek | ✓ | ✓ | H/WQ-BC |
| 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 |
| Dome East Slope Seep 01 | - | ✓ | WQ-DESS-01 |
| Dome East Slope Seep 02 | - | ✓ | WQ-DESS-02 |
| Dome East Slope Seep 03 | - | ✓ | WQ-DESS-03 |
| CH-P-13-01 | - | ✓ | WQ-CH-P-13-01 |
| Lower West Toe of Waste Rock Dump Seep 01 | - | ✓ | WQ-LW-SEEP-01 |

# Regional Overview Map of Mount Nansen Site Area

**Legend**

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



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).

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

0 2 4 6 8 10
Kilometres

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

| Drawn: | Checked: | | |
|---|---|---|---|
| LG | MM | FIGURE 1 | Date: 20/03/2014 |

Alaska, USA
Yukon
Northwest Territories
Map Area
Carmacks
Whitehorse

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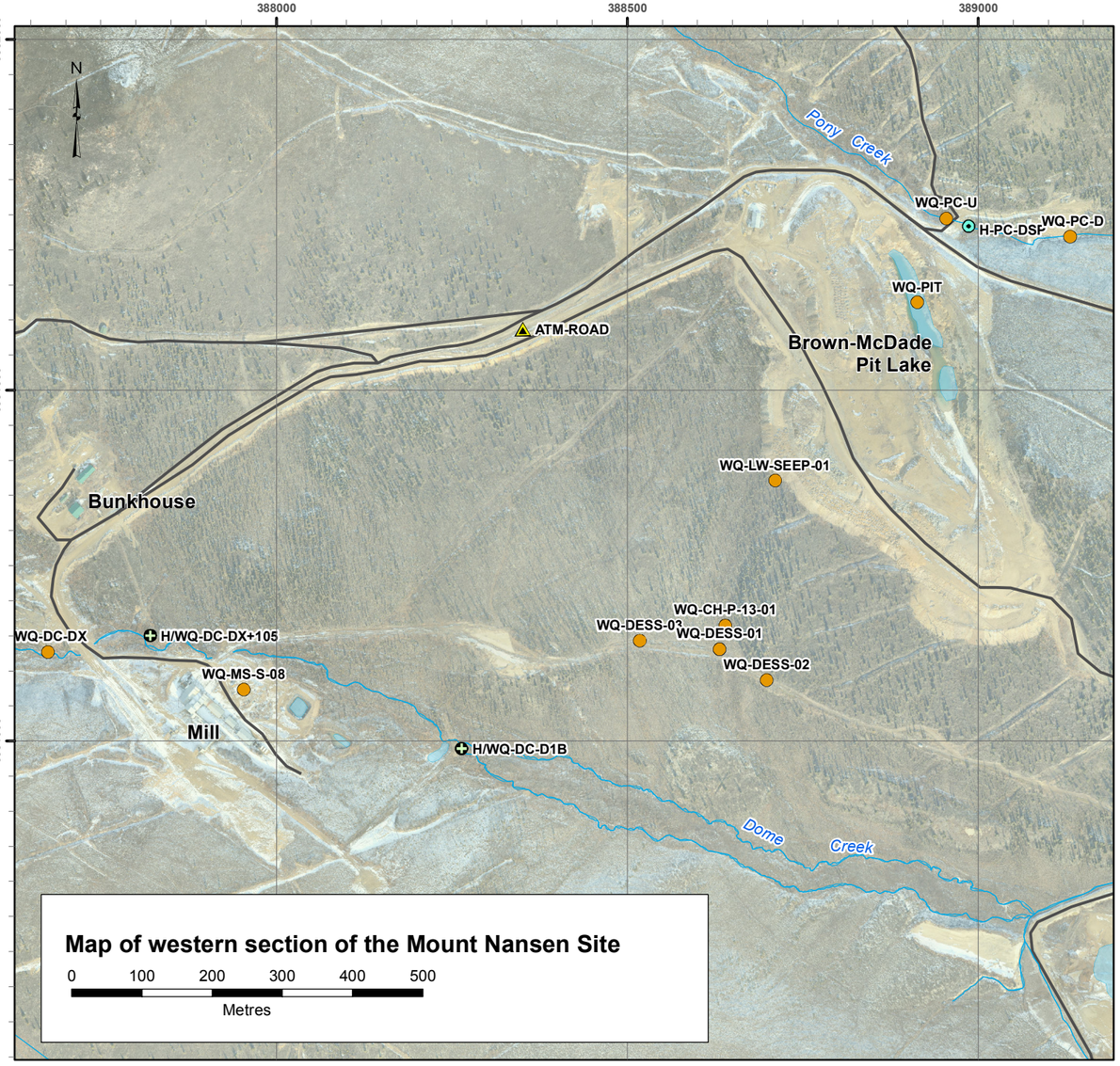
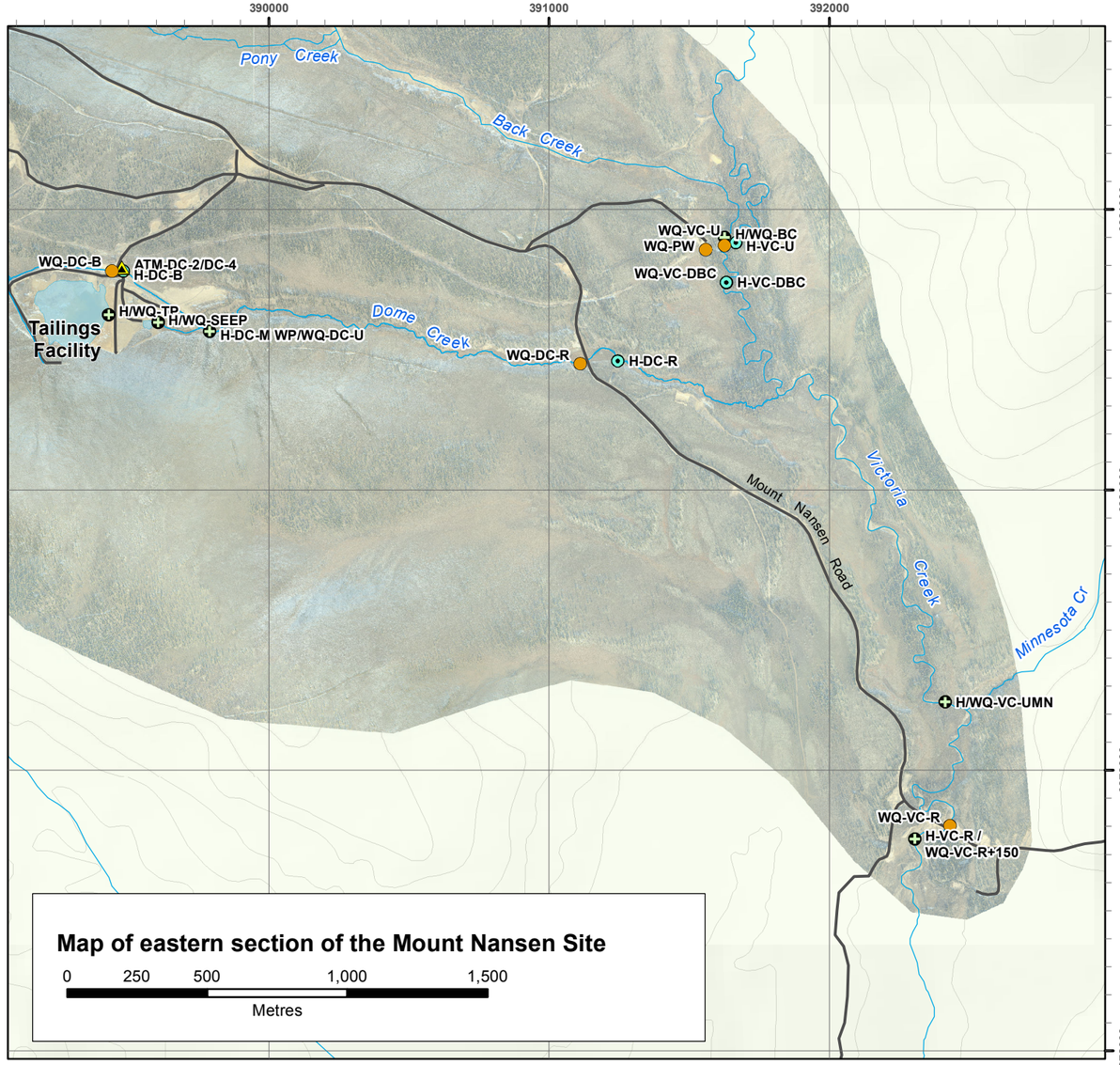



# Mount Nansen Site: Hydrometric Stations and Water Quality Sites

**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

Notes:

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).

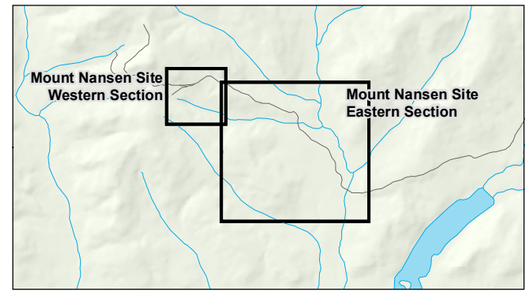
Imagery provided by Yukon Government - Energy, Mines and Resources - Abandoned Mines Branch.

Project data displayed is site specific. Data collected by EDI Environmental Dynamics Inc. (2014) was obtained using Garmin GPS technology.

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

Map Projection: North American Datum 1983 UTM Zone 8N

| Drawn: | Checked: | FIGURE 2 | Date: 30/01/2015 |
|---|---|---|---|
| LG | MM | | |




Yukon EDI

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## 1.2 Site Conditions

Site conditions during the Q3 period were typical of the fall and early-winter period, with low water levels, ice cover, and snow. Air temperatures were relatively mild for the quarter with minimal snow cover. The following specific observations were made during each trip to the Mount Nansen Site:

- **October 14-16, 2014** – Air temperatures during the trip ranged from -4°C to 1°C. Weather conditions were overcast with periods of light snow and approximately 2 cm of snow accumulation. Water levels at most stations and sites were considered moderate to high, similar to the September 2014 trip. Most waterbodies had ice cover, including the pit lake and tailings pond, and ice was beginning to form across most creeks in the area, with only Victoria Creek remaining ice free. The pit lake was not safe for sampling due to open water areas observed along the margins and areas of thinner ice. The WQ/H-DC-DX+105 site/station had substantial algal growth in the stream, and conditions remained unsuitable for a discharge measurement. The WQ-DC-DX site was the only site close to freezing to substrate, with only 5 cm of water flowing beneath the ice. The WQ-MS-S-08 site was dry with no flow observed. Construction of an emergency spillway at the tailings pond was taking place in October, resulting in some additional sedimentation in the middle Dome Creek area, particularly within the weir pond at H-DC-M WP.

- **November 12-14, 2014** – Air temperatures during the trip ranged from -20°C to -8°C. Weather conditions were clear and calm during the monitoring program. A temperature inversion was present at the site, with colder temperatures experienced in the valley bottoms compared to the mill and bunkhouse areas. Discharge conditions were low and typical of the winter period. All waterbodies and watercourses had ice cover to some extent and many sites and stations were frozen to bed or dry. Aufeis conditions were developing in the lower and upper Dome Creek areas, with thick layers of ice across the valley floor, and several Dome Creek sites and stations were frozen to bed. Seep sites along the Dome Creek valley were mostly frozen to substrate (WQ-CH-P-13-01, WQ-LW-SEEP-01 and WQ-DESS-01/03). Pony Creek was nearly frozen to bed at most locations, with only the downstream water quality site (WQ-PC-D) having sufficient flow for sampling. Back Creek was covered in thick ice with an air space and dry substrate material. The algal growth present at the H-DC-DX+105 station had died off and conditions were suitable for a discharge measurement. Thicker overflow ice was developing up and downstream of the Victoria Creek road crossing, with limited flow beneath the ice surface at the WQ-VC-R site.

- **December 15-16, 2014** – Air temperatures during the trip ranged from -10°C to -3°C. Weather conditions were partly cloudy and calm during the monitoring program. A temperature inversion was present at the site, with colder temperatures experienced in the valley bottoms compared to the mill and bunkhouse areas. Discharge conditions were low and typical of the winter period. All waterbodies and watercourses had ice cover to some extent and many sites and stations were frozen to bed or dry, including sites and stations on Dome Creek, Pony Creek, Back Creek, and

the Dome Creek diversion channel. Aufeis conditions were continuing to develop in lower and upper Dome Creek, with thick layers of ice across the valley floor. Overflow conditions were observed up and downstream of the Victoria Creek road crossing, in the vicinity of WQ/H-VC-R. Due to these conditions, the water quality samples were collected from the winter sampling location at WQ-VC-R+150 (downstream of the road crossing ~150 m). The site care and maintenance provider, Denison Environmental Services (DES), was having difficulties with the pump at the seepage pond in December 2014, which affected flow rates at the H/WQ-SEEP and water levels downstream in Dome Creek at H-DC-M. DES was also conducting maintenance activities within the Dome Creek diversion channel, clearing ice from around the WQ-DC-B site.

# 2 METHODOLOGY

The Mount Nansen surface water and meteorological monitoring program consists of several discrete components: meteorology, surface water hydrology and surface water quality. The following sub-sections include descriptions of site/station locations and general program methodology for each component. Detailed methodology has been included in APPENDIX A for reference.

## 2.1 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). 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 copy of the updated database is provided with this report. 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 station records air and ground temperature, humidity, rainfall, snow depth, net shortwave and long-wave radiation, total radiation, wind speed, wind direction and battery voltage (Table 3). There is also a barometric logger at ATM-DC-4 within the Dome Creek diversion channel area, which collects barometric pressure and air temperature for use in the hydrometric program.

**Table 3. Summary of weather data parameters collected at Mount Nansen Meteorological Station (ATM-ROAD AAM)**

| Meteorological Parameter Daily Collection | Units | Notes |
|---|---|---|
| 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 |
| **Hourly Collection** | | |
| Net Shortwave | $W/m^2$ | Measured every 5 minutes; Hourly average is reported |
| Net Longwave | $W/m^2$ | Measured every 5 minutes; Hourly average is reported |
| Net Total Radiation | $W/m^2$ | 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 |
| Rainfall | mm | Total hourly rainfall |
| 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 sample recorded |

## 2.2 Hydrology

The Mount Nansen hydrometric program includes collecting discharge and/or stage data at 13 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 4). During the winter months, half of the continuous loggers are removed because channel conditions are not appropriate for continuous winter stage measurements. Pressure transducers at five hydrometric stations (H-DC-M, H-VC-U, H-VC-DBC, H-VC-UMN and H-VC-R) remained active through the winter 2014/15 period (Q3 and Q4) and the continuous records and field observations were used to determine if the data logger was frozen to the bed. Depending on freeze-up and winter channel conditions, several of the data loggers may freeze to bed thus no longer collect useful information. During each monitoring event, instantaneous discharge measurements were made at all sites (continuous/instantaneous) as long as channel conditions allowed. Instantaneous discharge measurements and concurrent water surface elevations are used to develop a stage-discharge rating curve equation for the open-water season that is used to convert the continuous stage data to discharge values. During the winter, the continuous record of stage is not converted to discharge. In addition to the 13 hydrometric stations, there are two atmospheric stations with barometric loggers that collect atmospheric pressure to be used in compensating water level logger data.

The hydrometric station characteristics that comprise the monitoring network at the Mount Nansen site are summarized (Table 4). A detailed description of each hydrometric station is found in APPENDIX D.

Methods employed for discharge measurement in Q3 included:

- the velocity-area mid-section method;
- volumetric measurements at perched outlets such as culverts, weirs 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 $m^3/s$ 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 $m^3/s$ 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 $m^3/s$ and reported as 0.000 $m^3/s$, 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.

For more detailed explanation of methodology used for discharge measurements, hydrometric levelling surveys, hydrometric validation and QA/QC, rating curve development, continuous stage and discharge and overall data management see APPENDIX A.

**Table 4. Mount Nansen hydrometric and atmospheric station information.**

| HID[1] | Hydrometric Station Name | Type[2] | Location [3] Easting | Northing | Drainage Area ($km^2$) | Elevation [4] (m) |
|---|---|---|---|---|---|---|
| **ATM-DC2** | Barometric at Diversion Channel (Back-Up) | ATM | 389476 | 6880792 | - | 1099 |
| **ATM-DC4** | Barometric at Diversion Channel | ATM | 389476 | 6880792 | - | 1100 |
| **H-PC-DSP** | Pony Creek Downstream of Pit | C | 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 | C | 389480 | 6880780 | 3.0 | 1095 |
| **H-DC-M/ H-DC-M WP** | Middle Dome Creek/ Weir Pond | 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 | C | 392540 | 6879249 | 4.5 | 1020 |
| **H-BC** | Back Creek | C | 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/CW | 392413 | 6879244 | 83.4 | 986 |
| **H-VC-R** | Victoria Creek at Road | C/CW | 392305 | 6878755 | 97.7 | 975 |

Notes: – on the following page.

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 Water Quality

Water quality sampling occurred on a monthly basis during the Q3 period. Water samples were collected at each of the 23 water quality sites (Table 5) depending on suitable conditions, along with *in situ* data, photo documentation, and general site comments during each field visit. Since the Q3 period represents the early-winter season, many sites were expected to freeze to substrate during this period, such as sites on Pony Creek, most of Dome Creek, Back Creek and many of the seep sites. As such the winter program through Q3 and into Q4 includes a reduced number of sites remaining active through the winter period, including four sites on Victoria Creek, two sites on Dome Creek which are not affected by aufeis conditions, and the tailings pond, seepage pond discharge, and pit lake.

The sampling frequency varies by site, as some sites are sampled monthly, seasonally or only three times per year. Samples are submitted for analysis to ALS in Whitehorse, YT under chain of custody documentation. A 'standard site package' includes lab analysis of cyanides, routine physical tests, anions and nutrients, total metals, and dissolved metals. The 'pit lake package' is similar to the standard package, but excludes cyanides. The 'drinking water package' includes physical tests, anions and nutrients, total metals and bacteriological tests (total coliforms and *E. coli*). A toxicity test for rainbow trout (LT50) is completed for one sample at one site (WQ-SEEP) every second month. The *in situ* water quality data that is collected includes water temperature, specific conductivity, pH and turbidity. A list of sampling sites, coordinates and sampling information is provided in Table 5.

The water quality field program also includes collection of QA/QC samples including: replicate samples, field blanks, and travel blanks. Details on the specific field methodologies, laboratory analysis, QA/QC program, and data analysis are provided for reference in APPENDIX A. Once both the *in situ* and laboratory data have been reviewed for QA/QC it is entered into the project database (Microsoft Access).

Lab data is analyzed and compared to the Canadian Council of Ministers of the Environment (CCME) guidelines for the protection of freshwater aquatic life (CCME-AL; CCME 2014) as well as the Mount Nansen Effluent Quality Standards (EQS) outlined in Yukon Water Board Water license No. QZ94-004, issued to BYG Natural Resources Inc. on February 13, 1996. The drinking water sample results are compared to the applicable Guidelines for Canadian Drinking Water Quality (Health Canada 2012). See APPENDIX A for applicable guideline and standard values.

Table 5. Mount Nansen water quality site and sampling information.

| Water Quality Site Name | Site ID | Site Location [1] Easting | Northing | Sampling Frequency | Parameters Included in Lab Analysis [2] |
|---|---|---|---|---|---|
| **Pony Creek upstream** | WQ-PC-U | 388955 | 6881745 | Monthly | Standard Package |
| **Pony Creek downstream** | WQ-PC-D | 389131 | 6881719 | Monthly | Standard Package |
| **Pit Lake (3 samples)** | WQ-PIT-1,2,3 | 388913 | 6881625 | Monthly | Pit Lake Package |
| **Dome Creek at DX** | WQ-DC-DX | 387674 | 6881127 | Monthly | Standard Package |
| **Dome Creek at DX+105** | WQ-DC-DX+105 | 387820 | 6881150 | Monthly | Standard Package |
| **Dome Creek at D1b** | WQ-DC-D1b | 388264 | 6880989 | Monthly | Standard Package |
| **Diversion Channel at Bridge** | WQ-DC-B | 389439 | 6880781 | Monthly | Standard Package |
| **Upper Dome Creek** | WQ-DC-U | 389788 | 6880565 | Monthly | Standard Package |
| **Dome Creek at Road** | WQ-DC-R | 391111 | 6880449 | Monthly | Standard Package |
| **Tailings Pond** | WQ-TP | 389427 | 6880625 | Monthly | Standard Package |
| **Seepage Pond Outlet Pipe** | WQ-SEEP | 389604 | 6880598 | Variable[3] | Standard Package, LT50 |
| **Mill Site Seep 08** | WQ-MS-S-08 | 387954 | 6881073 | 3X Per Year | Standard Package |
| **Back Creek** | WQ-BC | 391626 | 6880901 | Monthly | Standard Package |
| **Upper Victoria Creek** | WQ-VC-U | 391626 | 6880872 | Monthly | Standard Package |
| **Victoria Creek downstream Back Creek** | WQ-VC-DBC | 391633 | 6880740 | Monthly | Standard Package |
| **Victoria upstream of Minnesota** | WQ-VC-UMN | 392413 | 6879244 | Monthly | Standard Package |
| **Victoria Creek at Road** | WQ-VC-R | 392431 | 6878802 | Monthly | Standard Package |
| **Victoria Creek at Road (winter location)** | WQ-VC-R+150 | 392305 | 6878755 | Monthly | Standard Package |
| **Pump House Well** | WQ-PW | 391558 | 6880856 | Monthly | Drinking Water Package |
| **Dome East Slope Seep 01** | WQ-DESS-01 | 388632 | 6881131 | Seasonal[4] | Standard Package |
| **Dome East Slope Seep 02** | WQ-DESS-02 | 388699 | 6881087 | Seasonal [4] | Standard Package |
| **Dome East Slope Seep 03** | WQ-DESS-03 | 388518 | 6881143 | Seasonal [4] | Standard Package |

| Water Quality Site Name | Site ID | Site Location [1] Easting | Northing | Sampling Frequency | Parameters Included in Lab Analysis [2] |
|---|---|---|---|---|---|
| **Upwelling near CH-P-13-01** | WQ-CH-P-13-01 | 388640 | 6881165 | Monthly | Standard Package |
| **Lower West Toe of Waste Rock Pile Seep** | WQ-LW-Seep-01 | 388711 | 6881371 | Seasonal [4] | Standard Package |

Notes:

1 - NAD 83, UTM Zone 8.

2 - Parameters included in various sampling packages are explained in greater detail in Appendix A.

3 - 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.

4 - Sampling frequency for these sites is seasonal as these seeps are to be sampled during freshet and every three months thereafter.

# 3 RESULTS

Results are separated into the three program components in the sections below: meteorology, hydrology, and water quality. The description and discussion of the results presented in this document is limited to the data collected in the Q3 period, unless otherwise noted. Data can also be found in the following appendices:

- Select field photographs for the period and for each site and station are provided in APPENDIX B;
- A record of which sites were sampled during each field visit during the period is available in APPENDIX C;
- Hydrometric data is provided in APPENDIX D;
- Water quality data is provided in APPENDIX E; and
- Meteorological data is provided in APPENDIX F.

All raw data is provided in the corresponding Microsoft Access databases submitted with this report.

- EDI_14Y0455_Meteorological_Database_2014-2015.accdb
- EDI_14Y0455_Hydrology_Database_2014-2015.accdb
- EDI_14Y0455_Water_Quality_Database_2014-2015.accdb

## 3.1 Meteorology

Meteorological data from the ATM-ROAD AAM station is summarized below for the Q3 period with comparison to values from the Q1 to Q2 period for applicable parameters. Select summary statistics are described for air and ground temperature, precipitation, wind direction and wind speed, short and long-wave radiation and relative humidity. All relevant data from the ATM-ROAD AAM station is plotted in APPENDIX F (Figures F-1 to F-8). Daily summary statistics for the Q3 period from the meteorological station are provided in APPENDIX F (Table F-1).

### 3.1.1 Air and Ground Temperature

Air temperatures at the Mount Nansen site gradually declined from October to November 2014, remaining relatively stable into December 2014 (APPENDIX F: Figure F-1). Mean daily temperatures remained below zero starting on October 14, 2014. The mean monthly temperature for October 2014 was 3.1°C, -7.5°C for November, and -8.0°C for December 2014. The minimum hourly air temperature recorded at the ATM-ROAD AAM station for the Q3 period was -20.5°C on November 28, 2014. However, temperature inversions are common at the Mount Nansen site in the winter, with much colder temperatures in the valley bottoms than at higher elevations. For example, the air temperature recorded at the ATM-DC-4 station, which is located along the Dome Creek diversion channel, reached a minimum temperature of -28.2°C on November 28, 2014 (APPENDIX F: Figure F-2). The maximum air temperature recorded at the ATM-ROAD AAM station during the Q3 period was 7.9°C on October 10, 2014 (APPENDIX F: Figure F-1).

Ground temperatures showed a similar trend to air temperatures during the Q3 period, declining from October to November, and then remaining relatively constant through December (APPENDIX F: Figure F-1). Monthly means ranged from 1.9°C in October 2014, -4.7°C in November 2014, to -4.0°C in December 2014. Maximum hourly ground temperature recorded for the Q3 period was 2.9°C on October 11, 2014 with a minimum hourly ground temperature of -9.4°C recorded on November 28, 2014. These dates coincide closely with maximum and minimum air temperatures.

### 3.1.2 Precipitation

Precipitation measured as rainfall during the Q3 period occurred in October 2014 with minimal amounts of rainfall recorded in November 2014 (APPENDIX F: Figure F-3). A total of 14.1 mm of rain fell during the Q3 period with a total accumulation of 236.5 mm of rain falling over the Q1 to Q3 period. The maximum hourly rainfall rate recorded at the station during the Q3 period was 1.9 mm/hr (October 10, 2014), in comparison to 10.1 mm/hr recorded over the Q1 to Q2 period.

Precipitation measured as snowfall occurred throughout the Q3 period; however, EDI observed potential errors in the snow sensor data on October 17, 2014. Based on a review of summer data from the sensor (snow free period), snow depth values were recorded ranging from -1.0 cm to +3.5 cm. These values are assumed to be measurement error associated with the uneven barren ground surface. EDI recommended that snow depth measurements be collected in the field during the monthly water resources investigations starting in November 2014, to ground truth the snow depth collected by the sensor data at ATM-ROAD AAM station. For the Q3 period, EDI collected a snow depth measurement adjacent to the meteorological station using a ruler on November 14, 2014 and December 16, 2014. These values were compared to the snow depths recorded by the snow sensor for the same date and time (Table 6). On average the snow sensor snow depths were 5.4 cm higher than the field measured values (Table 6).

The potential overestimation of snow depth by the snow sensor is still being investigated into 2015 (Q4 period), but must be taken into account when reviewing snow data for the meteorological station for Q3. As of the end of the Q3 period (December 31, 2014), the snow sensor recorded a maximum of 41.5 cm depth (APPENDIX F: Figure F-4). For comparison to the previous year's data for this period, the snow depth by December 31, 2013 was 47.0 cm (Q3 period from 2013/14 program).

**Table 6. Snow depth comparisons between the snow sensor reading and the reading collected from field measurement.**

| Date/Time | Snow Depth (cm) | | Difference in Readings |
|---|---|---|---|
| | Field Reading | Snow Sensor Reading | |
| November 14, 2014 10:40 am | 17.0 | 21.5 | 4.5 cm |
| December 16, 2014 15:55 pm | 29.0 | 35.3 | 6.3 cm |
| | | Average | 5.4 cm |

### 3.1.3 Wind

Dominant wind directions at the Mount Nansen Site during the Q3 period were northeast and west-southwest (APPENDIX F: Figure F-5). The maximum wind speed during the Q3 period was 7.4 m/s (26.7 km/hr), somewhat lower than the maximum wind speed recorded during the Q1 to Q2 period at 9.9 m/s (35.7 km/hr) (APPENDIX F: Figure F-6). Overall, wind speeds were generally low during the Q3 period with an average wind speed of 2.04 m/s (7.35 km/hr) for the Q3 period.

### 3.1.4 Shortwave and Longwave Radiation

Net radiation is the balance of solar energy emitted from the sun in the form of shortwave and longwave radiation with the surface of the earth. This balancing act of radiation fluxes produces the seasonal patterns typical in northern latitudes. As ground surface contributes to 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 ~0 $W/m^2$ (spring and fall) to over 600 $W/m^2$ (summer). Net radiation exhibits a diurnal cycle associated with increases and decreases in the amount of received solar insolation. In other words, low net radiation values are due to reduced solar insolation and tilt away from the sun, whereas high net radiation values are due to greater solar insolation or tilt towards the sun.

From the Q1 to Q3 period, net radiation values gradually decreased (APPENDIX F: Figure F-7). The mean net radiation from Q1 to Q3 (56.303 W/ $m^2$) was higher than the mean net radiation in Q3 (3.606 W/ $m^2$), due to reduced solar insolation and tilt away from the sun during the fall and winter months. There was more fluctuation of short and longwave radiation during the Q1to Q3 periods than the Q3 period alone. From Q1 to Q3, shortwave radiation fluctuated from -19.500 W/ $m^2$ to 782.200 W/ $m^2$ and longwave radiation fluctuated from -156.800 W/ $m^2$ to 22.980 W/ $m^2$. During the Q3 period the shortwave radiation fluctuated from 19.500 W/ $m^2$ to 245.200 W/ $m^2$ and the longwave radiation fluctuated from -79.410 W/ $m^2$ to 22.980 W/ $m^2$.

### 3.1.5 Relative Humidity

During the Q3 period, relative humidity at Mount Nansen generally remained above 22.7% and fluctuated up to 99.2% (APPENDIX F: Figure F-8). This is comparable to relative humidity found during the Q1 and Q2 period.

## 3.2 Hydrology

Three hydrologic measurement events occurred between October 1, 2014 and December 31, 2014 and are included in this quarterly report. There were 13 hydrometric stations where instantaneous hydrologic measurements were obtained during this period; five of these stations also collected continuous water level data over the winter period to add to the continuous record of stage levels. Winter rating curves are not developed for this project. The hydrologic records in this report cover the period October 1, 2014 to December 31, 2014 corresponding to the Q3 period.

Notable Winter Events:

- Barometric loggers ATM-DC2 (HOBO) and ATM-DC4 (Solinst) were downloaded on each visit during Q3.
- Direct-read cables were installed at five stations in October 2014 and the remainder of the data loggers were removed for winter. Where winter damage was anticipated to stilling wells and staff gauges, these were removed as well.
- Back Creek was not frozen to bed, the channel was dry with suspended ice for a portion of the Q3 period (November 2014). On the December 2014 trip, the channel had small areas of standing water and slush beneath the ice on the December 2014 trip – this has never been observed before as the channel typically remains dry through the winter.
- H-DC-DX+105 – no usable measurements were obtained from this station during Q3, either not suitable for measurement or the discharge values were lower than reporting limits (i.e., less than 0.001 $m^3/s$).
- The H-DC-B benchmark BM1 was destroyed/missing in October possibly due to construction activity in the area.
- Troubleshooting with the FlowTracker ADV in January 2015 (Q4 period) identified intermittent instrument malfunctions. Issues appear to have begun in December 2014. Data was obtained on all trips, one measurement with ADV considered unreliable (H-VC-R, December 2014).
- Review of the data from the Solinst pressure transducer from H-VC-U identified potential damage to the logger on December 9, 2014. This stilling well location has been known to freeze to substrate over the winter and temperature data from the logger verified that this occurred in Q3. The pressure transducer sensor is protected from freezing prior to the onset of ice however a number of factors may have contributed to the sensor damage including battery exposure to cold temperatures after freezing in the ice, sedimentation of the stilling well during the open water season and general wear and tear as the logger is near the end of its lifespan. This logger will be replaced for the 2015 open water season.
- The time change to Pacific Standard Time occurred on November 2, 2014. During the trip subsequent to the time change, several data loggers required maintenance and in completing this work the time stamps were changed from Pacific Daylight Time (PDT) to Pacific Standard Time (PST). Normally all data loggers operate year round in PDT therefore it should be noted that logger data from November 13, 2014 to December 31, 2014 reflect PST. The loggers will switch to PDT during the beginning of daylight savings time, March 8, 2015.

The following sections describe the results from each gauging station. A summary of each hydrometric measurement event is presented in APPENDIX D, Table D-3 in addition to the measured discharge, river stage record and hydrographs are presented for each station. 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

Throughout the year, hydrometric stations in the upper reaches of the Dome Creek watershed have higher discharge measurement uncertainty due to the small size of the channel and environmental factors that complicate standard field measurement methods. These environmental factors included discharge below reportable confidence limits (*i.e.,* <0.001 $m^3/s$), excessive vegetation in the channel, and the presence and accumulation of aufeis into spring. Professional judgement was used to assess the channel conditions for obtaining good quality discharge measurements and the appropriate measurement methods during the Q3 period.

#### 3.2.1.1 H-DC-DX+105

Located 105 m downstream of WQ-DC-DX, station H-DC-DX+105 represents a drainage area of 0.52 $km^2$. The station receives 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. Discharge measurements were attempted during each of the three site visits during the monitoring period; however the channel conditions were unsuitable on October 15, 2014 for any hydrometric measurement methods due to substantial algal growth in the channel and the development of a deep pool in the measurement reach. Nearby reaches were investigated for measurement suitability, but none were found. By November 2014 the algal growth in the channel had disappeared and thin (3 cm thick) ice had formed over a portion of the channel. The channel conditions in November and December 2014 were acceptable for conducting salt tracer measurement; however, the resultant discharge values were less than 0.001 $m^3/s$ (<1 L/s) on both visits and were therefore below reporting limits.

It is recommended that if future hydrologic monitoring is required at this station during summer and/or year round, that a small, temporary weir or flume structure is installed to confine flow so that a volumetric measurement can be obtained.

Station discharge measurements collected at H-DC-DX+105 are presented in APPENDIX D, Figure D-2.

#### 3.2.1.2 H-DC-D1b

This station represents surface flows in Dome Creek downstream of the mill site and upstream of the diversion channel and tailings facility. There is also an older tailings pond upstream of the station. However, data from this station only represents a portion of the runoff contributions to the diversion channel and tailings facility given the morphology of the watershed.

The channel at H-DC-D1b is approximately 0.35 m wide, 0.13 m deep, and is unsuitable for the cross-section velocity method and frequently unsuitable for salt dilution gauging. Similar to other stations within the Dome Creek watershed, thick layers of aufeis (commonly referred to as creek 'glaciation') develop through the winter period (typically late during the Q3 period and into Q4) as a surface expression of the groundwater contributions to the channel. Complex, braided channels develop within the ice cover during the spring melt period, making hydrometric gauging impossible. During the ice-free months the channel is confined and deeply incised into the substrate. The channel banks are flanked by willow roots where the fine-grained substrate is eroding around them. The salt tracer measurement reach is a relatively short, steep section of the channel where full mixing can occur. At the downstream end of the measurement reach the water flows over a small waterfall and abruptly reports to a sub-surface channel. Since the establishment of this station in 2012, the location of where the flow reports to sub-surface has migrated upstream.

During the Q3 period, one discharge measurement using a salt tracer was obtained prior to complete freeze-up on October 15, 2014 (0.010 $m^3/s$) which is slightly higher than measurements obtained during July, August and September; however, the Q2 report anecdotally describes an apparent mis-match between observed flow conditions and the calculated discharges during the summer. During the October 2014 visit, the channel was 80% covered with ice ranging from 3 to 10 cm. On November 13, 2014 the channel was frozen to bed in layers of solid and slushy ice. No discharge measurements were obtained in November or December 2014, and the station is expected to remain frozen until spring melt in April to May 2015.

During 2014 measurements became more difficult to obtain using salt tracers at this station due to subtle changes in the channel (increasing pool depth at the input site, channel incision and increased influence of roots in the measurement reach). Using salt tracers at this station is currently the only option for measurement unless a weir or flume structure is installed. Data collection at this station should be re-considered for the 2015 open water season; weighing the value of data for water balance and water quality modelling against the cost of installing a weir or flume structure.

Station discharge measurements collected at H-DC-D1b are presented in APPENDIX D, Figure D-2.

#### 3.2.1.3 H-DC-B

The H-DC-B station is a continuous gauging station during the open-water season established at the downstream end of the Dome Creek diversion channel, downstream of the bridge. The channel is approximately 1.3 m wide and 0.2 m deep with substantial quantities of fine grained sediment transported past the station due to channel disturbance (excavations to maintain conveyance in the diversion channel) through the spring and summer periods, non-cohesive bank material, and the erosion of upstream bank

material during rain events. During the winter the station is decommissioned due to substantial ice accumulation and regular excavations in the channel to maintain conveyance under the bridge. While flow is present during the winter, the water typically travels through numerous layers of ice and accurate discharge measurements cannot be obtained. The station is visited during each winter trip in the case that recent excavation activities have produced temporary channel conditions conducive to measuring discharge accurately.

One discharge measurement was obtained at H-DC-B during the Q3 period on October 15, 2014 (0.027 $m^3/s$) using a salt tracer. Approximately 50% of the channel was covered with ice 3 to 5 cm thick. The stilling well and logger were removed for the winter period, after completing the hydrometric levelling survey. Benchmark 1 was missing from the station and the survey was conducted using the remaining two benchmarks. Construction activity in the vicinity of the bridge may have damaged Benchmark 1, which was located along the diversion channel berm. The station was visited on November 13, 2014 and was frozen to substrate with thick ice filling the channel. The channel was dredged by DES on December 16, 2014 and no water was observed.

The continuous water level record from July 15, 2014 to September 16, 2014 was corrupted and the data was not able to be recovered. Please refer to the Q2 report for more detailed information about the continuous stage record for H-DC-B. The station discharge measurement collected at H-DC-B during Q3 is presented in APPENDIX D, Figure D-3.

#### 3.2.1.4 H-TP

The tailings pond station (H-TP) is a water level monitoring station only. There are three staff gauges installed at the tailings pond, to measure a full depth of 3 m; the lowest of which is not normally visible. Staff gauge readings are collected when the tailings pond is ice free. No staff gauge readings were obtained during Q3 due to ice on the tailings pond.

#### 3.2.1.5 H-SEEP

The Seepage Pond Outlet (H-SEEP) is an instantaneous hydrometric monitoring station where a volumetric measurement is collected during each site visit. Volumetric measurements are collected at the pipe outlet that discharges to Dome Creek. In addition, readings are obtained from the flow meter operated by AAM/DES in the Seepage Pond pump house. The pump house flow meter units of measurement are litres per minute (L/min). DES manages pumping rates from the seepage pond on a daily basis by maintaining pond levels at 0.200 m on the staff gauge installed at the pump house, and recording pump rates (based on communications with R. Wilkinson, DES). AAM indicated that during the Q3 period there were two events where pumping flow varied more than normal (See Appendix D, Figure D-5) (J. Moore, *pers. comm.,* Jan. 7, 2015). The first event began on November 27, 2014 when the pump was discovered to be leaking, and subsequently failed the following day. A temporary pump operated until December 2, 2014. The second event occurred on December 22, 2014 when the pumping rates were reduced to attempt to elevate the ice cover on the pond and reduce overflow ice conditions in the pond area (See Appendix D, Figure D-4).

Volumetric measurements at the pipe outlet and readings observed at the flow meter (shown in *italics*) were collected on October 14, 2014 (0.003 $m^3/s$, *189.451 L/min*), November 13, 2014 (0.003 $m^3/s$, *155.891 L/min*), and December 15, 2014 (0.003 $m^3/s$, *181.151 L/min*). The volumetric measurements at the pipe outlet and the flow meter measurements obtained by EDI were in good agreement during Q3 (APPENDIX D, Table D-5). While the volumetric measurements collected by EDI indicate a constant discharge rate, the daily instantaneous record provided by DES shows that there is some day to day variability; this is shown in the plots of EDI and DES measurements (APPENDIX D, Figure D-4). DES measurements are obtained at the end of each day from the flow meter in the pump house.

#### 3.2.1.6 H-DC-M and H-DC-M WP

A continuous monitoring station operates within the middle reaches of Dome Creek at H-DC-M, downstream of the seepage pond outlet and the diversion channel 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). 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. In previous quarters and years of the program, salt dilution gauging was the primary discharge method measurement due to channel conditions being unsuitable for the ADV. In addition, this site is typically maintained as a continuous hydrometric station during the winter; the only continuous winter station on Dome Creek. During the winter months instantaneous discharge measurements can be difficult due to ice conditions and channel avulsion (due to ice). The conditions also produced poor data quality from the continuous logger.

In April 2014, EDI identified that the hydrometric measurements obtained at this site could be improved (by reducing discharge measurement uncertainty) with the installation of a v-notch weir at a location approximately 15 m upstream of the existing station. A v-notch weir and a new water level logger were installed by EDI in the head pond on May 20, 2014 and completed on June 23, 2014. The weir provides an opportunity for volumetric measurements and discharge measurements based on a rating equation for the weir structure; both methods will reduce uncertainty associated with salt tracers at this station. The weir pond also provides a more stable location for continuous water level data collection.

This new station was named H-DC-M WP; the old logger at H-DC-M remained in place during the Q2 and Q3 period, and will remain there until the new station is well established. Discharge measurements were obtained using volumetric measurements and water level elevations at the weir were obtained for rating equation calibration.

Continuous water stage elevations and discharge measurements are presented in APPENDIX D, Figure D-5, which covers the Q1 and Q2 monitoring period. During the Q3 period there were three discharge measurements obtained at H-DC-M WP using the volumetric method at the weir outlet. On October 13, 2014 the discharge was 0.014 $m^3/s$. At the end of August 2014 excavations were occurring in the diversion channel upstream to improve conveyance and a relatively intense rainstorm occurred. While there were no field observations at the H-DC-M hydrometric station at the end of August 2014, evidence observed during the September 16, 2014 field visit indicated that a large amount of sediment had been transported down the

channel and deposited in the weir head pond. The pond was filled with sediment to within approximately 15 cm of the top edge of the weir and the water level logger was buried in approximately 0.30 m of sediment. This sediment deposition rendered the continuous stage record from the new H-DC-M WP water level logger between August and September suspect and the data was removed from the plots. Further, the weir measurement from September 2014 could not be used because the head pond depths were significantly altered from the original design depths. The weir pond was excavated in October 2014 in a combined effort by AAM and EDI. There is potential for the weir pond to be affected by sedimentation again in the future due to upstream construction/maintenance work and/or heavy rain events, which may require occasional maintenance, thus conditions within the head pond will be monitored monthly.

Discharge declined to 0.004 $m^3/s$ on November 13, 2014 and 0.004 $m^3/s$ on December 15, 2014. The instantaneous discharge data indicates that flow from the diversion channel contributed approximately 0.011 $m^3/s$ (11 L/s) to the flow at H-DC-M WP; the remainder was contributed by flow from H-SEEP. In November and December 2014 the difference between H-SEEP and H-DC-M WP was an order of magnitude lower (1 L/s) corresponding with the freezing of the diversion channel and reduction of flow contribution to Dome Creek. During November and December 2014 the majority of the flow at H-DC-M WP (0.004 $m^3/s$) is attributed to flow from the seepage pond pump (0.003 $m^3/s$; Section 3.2.1.5).

Table 7 summarizes the rating curve expressions presented for the 2012-2013, 2013-2014 rating periods for H-DC-M; with the installation of H-DC-M WP a new rating relationship will be developed. A relationship between volumetric and weir measurements could not be established during 2014 due to sedimentation in the weir therefore a relationship will be determined in the open-water season of 2015 and then the H-DC-M logger can be discontinued in 2015.

**Table 7. Middle Dome Creek (H-DC-M) open water rating curve equations.**

| Stage (m) | Discharge ($m^3/s$) | Offset (m) | Slope | Equation |
|---|---|---|---|---|
| Rating Curve, April, 2012 to March, 2013 (EDI 2013) | | | | |
| 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 (EDI 2014a) | | | | |
| 1.550 | 0.001 | 1.52 | - | - |
| 1.891 | 0.771 | 1.52 | 2.558 | $Q=10.60 (h-1.52)^{2.64}$ |
| Rating Curve, April, 2014 to June, 2014 (EDI 2014b) | | | | |
| Insufficient measurement events to produce a curve for Q1 | - | - | - | - |
| Rating Curve, July 2014 to December, 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 after the 2013-14 winter on June 23, 2014 for the open-water season. 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 and location at the downstream end of the watershed.

During the Q3 period one discharge measurement was obtained using the salt tracer method. On October 14, 2014 ice was beginning to form across the channel and the discharge was 0.022 $m^3/s$. The logger was removed for the winter in October, a review of the data indicated that the attempted reprogramming of the logger was unsuccessful and no continuous data is available for Q3. In November 2014 there were standing pools of water present under the ice but no apparent flow therefore discharge was not measured. Other sections of the channel in the vicinity of the station had layered ice with slushy water moving throughout. In December 2014, thick ice was continuing to develop up and downstream of the road crossing (although it appeared to be to a lesser extent than previous years), but the channel conditions remained unsuitable for discharge measurements.

The continuous water level record from July 15, 2014 to September 16, 2014 was corrupted and the data was not able to be recovered. As a result the continuous stage record is shortened for the Q2 period and was not converted to a continuous discharge record. Time-series water stage and hydrographs for the Q3 monitoring period are presented in APPENDIX D, Figure D-6. Please refer to the Q2 report for detailed information about the continuous stage record for H-DC-R. The most recent rating curve is presented in Table 8 was used to convert the Q1 and Q2 stage data to discharge values.

**Table 8. Dome Creek at the Road (H-DC-R) open water rating equations.**

| Stage (m) | Discharge ($m^3/s$) | Offset (m) | Slope | Equation |
|---|---|---|---|---|
| Rating Curve, April, 2012 to March, 2013 (EDI 2013) | | | | |
| 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 (EDI 2014a) | | | | |
| 0.274 | 0.002 | 0.125 | - | - |
| 1.062 | 0.477 | 0.125 | 2.98 | $Q = 0.579\ (h - 0.125)^{2.98}$ |
| Rating Curve, April 2014 to June, 2014 (EDI 2014b) | | | | |
| Insufficient measurement events to produce a curve for Q1 | - | - | - | - |
| Rating Curve, April, 2013 to September 2014 (portion of continuous stage data corrupted, equation not applied) | | | | |
| 0.274 | 0.274 | 0.274 | 0.274 | 0.274 |
| 1.062 | 1.062 | 1.062 | 1.062 | 1.062 |

### 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 21, 2014 when the channel was ice-free and removed for the winter period on October 15, 2014. The channel is stable and entrenched into alluvial sediments of both the Back Creek and Victoria Creek floodplains. During the winter the channel is typically frozen to the bed and no flow is observed. Small channel sizes prohibit the use of the ADV as a standard discharge measurement method; therefore, all discharge measurements were made using the salt dilution method.

During the Q3 period one discharge measurement was obtained prior to winter freeze-up. The measurement was obtained on October 15, 2014 using the salt tracer method. The measured discharge (0.045 $m^3/s$) was lower than that measured in September 2014 as would be expected as the flow declines to winter low flows. The October 2014 discharge is a similar value to October measurements obtained in the years 2011, 2012, 2013, 2014. In November and December 2014 the winter conditions were different than observations in previous years. Typically the channel freezes over and becomes dry to the bed between October and November, remaining that way for the duration of the winter. In November 2014, a layer of ice developed over flowing water that subsequently declined to zero flow without freezing. In December 2014, the formerly dry channel was filled with a small amount of standing water and slush. There was no apparent flow in December that could be measured using any of the hydrometric methods, but the fact that unfrozen conditions were present indicates a change from normal hydrologic conditions. While the reason for the unusual conditions is not known with certainty, the observations are likely related to the relatively warm start to the winter. A review of a simple surface water balance between H-VC-DBC, H-VC-U and H-H-BC in 2014 reveals that there is groundwater component to the surface flow at H-VC-DBC. A portion of this may be contributed from shallow groundwater flow from the Back Creek watershed, but further analysis is required.

There was no rating curve developed in Q3 due to the presence of ice conditions. Time-series water stage and hydrographs for the Q3 monitoring period are presented in APPENDIX D, Figure D-7. Please refer to the Q2 report for detailed information about the continuous stage record for Back Creek. The most recent rating curve is presented in Table 9 was used to convert the Q1 and Q2 stage data to discharge values.

**Table 9. Back Creek (H-BC) open water rating curve equations.**

| Stage (m) | Discharge ($m^3/s$) | Offset (m) | Slope | Equation |
|---|---|---|---|---|
| Rating Curve, April, 2012 to March, 2013 (EDI 2013) | | | | |
| 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 | $Q = 4.239\ (h-1.62)^{3.244}$ |

| Stage (m) | Discharge ($m^3/s$) | Offset (m) | Slope | Equation |
|---|---|---|---|---|
| Rating Curve, April, 2013 to March, 2014 (EDI 2014a) | | | | |
| 1.63<br>2.168 | 0.001<br>0.602 | 1.49<br>1.49 | -<br>4.057 | -<br>$Q = 2.91 (h - 1.49)^{4.06}$ |
| Rating Curve, April, 2014 to June 2014 (EDI 2014b) | | | | |
| Insufficient measurement events to produce a curve for Q1 | - | - | - | - |
| Rating Curve, April, 2014 to December 2014 | | | | |
| Insufficient measurement events to produce an updated curve for Q1/Q2/Q3. April 2013-March 2014 rating curve applied to 2014/15 Q2 data. | - | - | - | - |

### 3.2.3 Victoria Creek

#### 3.2.3.1 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 (decommissioned in January 2014), and approximately 65 metres upstream of the Back Creek confluence. Based on continuous measurements collected from the station during the spring, the peak stage occurred on May 9, 2014 and declined to summer low flows during Q2. The responses of Victoria Creek to rainfall events during the Q2 period were prominent in the hydrograph for H-VC-U (APPENDIX D). Ice was present on the stream banks in October 2014 and ice cover with open leads was present by November 2014 and continued through the winter. Open leads were present upstream and downstream of the continuous logger station indicating that groundwater flux to the channel is present. Elsewhere the ice cover was 10 to 20 cm thick, including along the stream margins (including the stilling well).

Discharge measurements were collected at H-VC-U during Q3 on October 15, 2014 (0.423 $m^3/s$), November 13, 2014 (0.185 $m^3/s$) and December 16, 2014 (0.127 $m^3/s$) using the velocity-area mid-section method with an ADV; the ice cover was cleared to obtain the cross-section measurement. The streamflow under ice continued to decline toward baseflow conditions during Q3. It is anticipated that discharge will continue to decrease until April 2015.

A continuous water level logger was installed at H-VC-U for the winter period to monitor changes in water level. It is recommended that location of the continuous data logger and stilling well be re-located to a pool immediately upstream of the existing station (right bank) in spring 2015 prior to freshet if possible. Several factors including peak flow sediment deposits and ice conditions in the channel are contributing to sedimentation in the stilling well during summer and the stilling well to freeze to bed in winter. Neither situation is beneficial for the data logger or for the analysis of the data. Near the end of December 2014 the logger malfunctioned and requires replacement. Data loggers located downstream continue to function and

this data can be used as a surrogate to the H-VC-U during the winter (assuming Back Creek does not flow during winter).

Rating curves that convert stage to discharge values were not applied during winter due to ice effects on the channel therefore the rating equations were not updated for Q3. Rating curves for the 2012-2013 and 2013-2014 rating periods are presented in Table 10. Continuous stage records and time-series hydrographs for April 1, 2014 through December 31, 2014 are presented in APPENDIX D, Figure D-8.

**Table 10. Upper Victoria Creek (H-VC-U) open water rating curve equations.**

| Stage (m) | Discharge ($m^3/s$) | Offset (m) | Slope | Equation |
|---|---|---|---|---|
| Rating Curve, April, 2012 to March, 2013 (EDI 2013) | | | | |
| 1.986 | 0.038 | 1.85 | - | - |
| 2.385 | 2.632 | 1.85 | 3.098 | $Q = 18.2757\ (h\text{-}1.85)^{3.09810}$ |
| 2.641 | 8.465 | 1.85 | 2.987 | $Q = 17.0539\ (h\text{-}1.85)^{2.98748}$ |
| Rating Curve, April, 2013 to March, 2014 (EDI 2014a) | | | | |
| 2.018 | 0.109 | 1.86 | - | - |
| 2.516 | 5.770 | 1.86 | 2.789 | $Q = 18.702\ (h - 1.86)^{2.789}$ |
| Rating Curve, April 2013 to June, 2014 (EDI 2014b) | | | | |
| Insufficient measurement events to produce a curve for Q1 | - | - | - | - |
| Rating Curve, April, 2013 to April, 2014 | | | | |
| 1.980 | 0.04 | 1.86 | - | |
| 2.300 | 1.65 | 1.86 | 2.863 | $Q = 10.874 * (h\text{-}1.86)^{2.172}$ |
| 2.641 | 7.87 | 1.86 | 2.723 | $Q = 20.997 * (h\text{-}1.86)^{2.633}$ |
| Rating Curve, April, 2014 to October, 2014 (Note: Q2 2014 data amended) | | | | |
| 2.023 | 0.09 | 1.96 | - | |
| 2.343 | 2.13 | 1.96 | 1.777 | $Q = 11.702 * (h\text{-}1.96)^{1.777}$ |

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

The Victoria Creek gauging station downstream of Back Creek (H-VC-DBC) continuously monitors Victoria Creek stage elevations downstream of the Back Creek confluence. Based on continuous measurements collected from the station during the spring, the peak stage occurred on May 9, 2014 and declined to summer low flows during Q2. The channel was predominantly ice free in October 2014; ice cover was present at the station by November 2014 ranging from 10 to 20 cm thick and in some places anchor ice was present obstructing streamflow in the middle of the channel.

The continuous gauging station H-VC-DBC was visited three times during the Q3 period. Discharge measurements were collected using the ADV on October 15, 2014 (0.478 $m^3/s$), November 13, 2014 (0.227 $m^3/s$) and December 16, 2014 (0.178 $m^3/s$).

A continuous water level logger was installed at H-VC-DBC for the winter period to monitor changes in water level. Rating curves that convert stage to discharge values were not applied during winter due to ice effects on the channel therefore the rating equations were not updated for Q3. The continuous stage record and hydrograph are presented in APPENDIX D, Figure D-9. Rating curve expressions are shown in Table 11 and include previously reported rating curve expressions for the 2012-2013 and 2013-2014 rating periods.

**Table 11. Victoria Creek, downstream of Back Creek (H-VC-DBC) open water rating curve equations.**

| Stage (m) | Discharge ($m^3/s$) | Offset (m) | Slope | Equation |
|---|---|---|---|---|
| Rating Curve, April, 2012 to March, 2013 (EDI 2013) | | | | |
| 1.681 | 0.178 | 1.316 | - | - |
| 2.048 | 2.090 | 1.316 | 3.538 | $Q = 6.30234 (h-1.316)^{3.53797}$ |
| 2.315 | 9.631 | 1.316 | 4.913 | $Q = 9.67846 (h-1.316)^{4.91302}$ |
| Rating Curve, April, 2013 to March, 2014 (EDI 2014a) | | | | |
| 1.720 | 0.109 | 1.65 | - | - |
| 2.147 | 5.220 | 1.65 | 1.568 | $Q = 6.189 (h - 1.65)^{1.568}$ |
| Rating Curve, April, 2013 to June, 2014 (EDI 2014b) | | | | |
| Insufficient measurement events to produce a curve for Q1 | - | - | - | - |
| Rating Curve, April, 2013 to September, 2014 | | | | |
| 1.61 | 0.04 | 1.35 | - | |
| 2.34 | 7.65 | 1.35 | 3.929 | $Q = 7.958 * (h-1.35)^{3.929}$ |

### 3.2.3.3 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. 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. Based on continuous measurements collected from the station during the spring, the peak stage occurred on May 9, 2014 and declined to summer low flows during Q2. Ice began to form on the banks in October 2014 and by November 2014 ice cover was present with an open lead upstream of the station indicating groundwater flux to the channel. Ice thickness varied from 3 to 20 cm on the November 2014 trip.

Three discharge measurements were collected during the Q3 monitoring period. Discharge was measured using the ADV on October 14, 2014 (0.511 $m^3/s$), November 12, 2014 (0.199$m^3/s$) and on December 15, 2014 (0.140 $m^3/s$). Rating curve expressions for H-VC-UMN are presented in Table 12 and include previously reported rating curve expressions for the 2012-2013 and 2013-2014 rating periods.

A continuous water level logger was installed at H-VC-UMN for the winter period to monitor changes in water level. Rating curves that convert stage to discharge values were not applied during winter due to ice effects on the channel therefore the rating equations were not updated for Q3. The continuous stage and hydrograph records for H-VC-UMN are found in APPENDIX D, Figure D-10.

**Table 12. Victoria Creek, upstream of Minnesota Creek (H-VC-UMN) open water rating curve equations.**

| Stage (m) | Discharge ($m^3/s$) | Offset (m) | Slope | Equation |
|---|---|---|---|---|
| Rating Curve, April, 2012 to March, 2013 (EDI 2013) | | | | |
| 1.382 | 0.019 | 0.979 | ----- | ----- |
| 1.780 | 1.214 | 0.979 | 6.037 | $Q = 4.63406\ (h-0.979)^{6.03671}$ |
| 1.954 | 3.684 | 0.979 | 5.647 | $Q = 4.25022\ (h-0.979)^{5.64705}$ |
| 2.140 | 9.980 | 0.979 | 5.708 | $Q = 4.25676\ (h-0.979)^{5.70783}$ |
| Rating Curve, April, 2013 to March, 2014 (EDI 2014a) | | | | |
| 1.411 | 0.049 | 0.98 | | |
| 2.066 | 6.271 | 0.98 | 4.250 | $Q = 4.066\ (h - 0.979)^{5.250}$ |
| Rating Curve, May, 2014 to June, 2014 (EDI 2014b) | | | | |
| Insufficient measurement events to produce a curve for Q1 | - | - | - | - |
| Rating Curve, April, 2013 to April, 2014 | | | | |
| 1.50 | 0.10 | 0.99 | - | |
| 2.06 | 6.03 | 0.99 | 5.53 | $Q = 4.15\ (h - 0.99)^{5.532}$ |
| Rating Curve, April, 2014 to December, 2014 (Note: Q2 2014 data amended) | | | | |
| 1.30 | 0.003 | | - | |
| 1.644 | 0.39 | 1.28 | 1.74 | $Q = 2.28\ (h - 1.28)^{1.743}$ |
| 2.06 | 6.03 | 1.28 | 3.59 | $Q = 14.70\ (h - 1.28)^{3.586}$ |

### 3.2.3.4 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 measurements average 6.7 m in width and 0.25 m in depth at the discharge measurement location. The channel geometry and downstream hydraulic control (riffle) shifted after the 2014 freshet due to a large pulse of sediment deposited in the immediate vicinity of the hydrometric station.

This change to channel geometry also caused the relationship between stage and discharge to change therefore a new rating period was initiated on May 20, 2014 (Q1).

Ice formation during the Q3 period above and below the Victoria Creek road crossing was thicker and more extensive than in past years. Overflow ice from the main culvert typically extends downstream of the road but does not normally extend past the hydrometric station. A second culvert was installed at the road crossing in spring 2014 and overflow ice is also flowing downstream from this location as well. In the Q3 period, extremely thick ice has extended to the station and has likely confined flow under ice in such a way the logger may no longer be submerged in flowing water. The discharge measurement location was moved downstream to a location where ice was thinner or open leads were visible approximately 100 m downstream of the station. A salt tracer was attempted in December 2014 but it did not produce acceptable results due to the ice conditions.

Three discharge measurements were collected during the Q3 monitoring period using the ADV method on October 14, 2014 (0.577 $m^3/s$), November 12, 2014 (0.252 $m^3/s$) and on December 15, 2014 (0.013 $m^3/s$). Notably, the flow measured in December 2014 is an order of magnitude lower than that measured at upstream hydrometric locations (e.g., in December, H-VC-UMN was 0.140 $m^3/s$, Section 3.2.3.3). As evidenced by the open water leads observed throughout the Victoria Creek channel, groundwater flux appears to play an important role in maintaining winter flows, however the role of ice accumulations in the channel may also play a role. The substantial ice accumulation (storage) in Victoria Creek upstream of the Mount Nansen access road also appears to be contributing to the attenuation of flow at H-VC-R. Given that the geometry of the channel changed due to sediment depositions in 2014 (during freshet) and that ice accumulation appears to be hindering measurements since the additional culvert was put in place it is recommended that the station is relocated in spring 2015 prior freshet if possible, to ensure that the continuous logger remains wetted year round. There are potential locations downstream of the existing well that could be investigated.

A continuous water level logger was installed at H-VC-R for the winter period to monitor changes in water level. Rating curves that convert stage to discharge values were not applied during winter due to ice effects on the channel therefore the rating equations were not updated for Q3. Rating curve expressions for the H-VC-R station are presented in Table 13 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, Figure D-11.

**Table 13. Victoria Creek at Road (H-VC-R) open water rating curve equations.**

| Stage (m) | Discharge ($m^3/s$) | Offset (m) | Slope | Equation |
|---|---|---|---|---|
| Rating Curve, April, 2012 to March, 2013 (EDI 2013) | | | | |
| 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 (EDI 2014a) | | | | |
| 2.010 | 0.149 | 1.90 | - | - |

| | | | | |
|---|---|---|---|---|
| 2.541 | 10.340 | 1.90 | 2.406 | $Q = 30.139 (h - 1.90)^{2.406}$ |
| Rating Curve, May 2014 to June 2014 (EDI 2014b) | | | | |
| Insufficient measurement events to produce a curve for Q1 | - | - | - | - |
| Rating Curve, April, 2013 to December, 2014 | | | | |
| 1.90<br>2.43 | 0.02<br>6.59 | 1.58<br>1.58 | -<br>5.934 | -<br>$Q = 17.288 (h - 1.58)^{5.934}$ |

### 3.2.4 Pony Creek

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

Pony Creek Downstream of the Pit (H-PC-DSP) station was originally installed to supplement a hydrogeological investigation. Average widths for the channel at the station range from 0.15 m to 0.50 m while depths range from 0.05 to 0.20 m. Current channel morphology and conditions indicate that the best method of discharge measurement is the volumetric method from the culvert at the Pony Creek road crossing. A small rock weir and a stilling are located 10 m downstream of the culvert, and the rock weri appears to be functioning as an effective control. As of May 8, 2014, a Solinst data logger has been recording continuous stage data only. The data logger was removed on October 14, 2014 for the winter 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.

One discharge measurement was collected during the Q3 period using the volumetric method in October 2014; in November and December 2014 there was zero flow in the channel and the station was frozen to the substrate. The single discharge measurement obtained on October 14, 2014 was 0.003 $m^3/s$. Continuous time-series stage elevations and instantaneous discharge measurements are presented in APPENDIX D, Figure D-12.

## 3.3 Water Quality

Water quality results for the Q3 investigation period are discussed for each sampling area in the sections below. The reported results include a summary of samples that exceeded guidelines and/or standards for each site and sampling trip, as well as *in situ* water quality parameters. Detailed lab result data is provided in APPENDIX E, in graphical and table format, and is compared to the CCME-AL guidelines and the Mount Nansen EQS. The graphical format displays data from Q1, Q2 and Q3 for quarterly comparisons.

### 3.3.1 Tailings Pond & Seepage Pond Discharge

The tailings pond and seepage pond discharge sites, WQ-TP and WQ-SEEP, were sampled during every visit of the Q3 period. Both sites exceeded the guideline and/or standard criteria for arsenic, cadmium and copper (Table 14; APPENDIX E). The tailings pond samples also consistently exceeded the CCME-AL for lead, silver and zinc, and on one occasion fluoride. The seepage pond samples also consistently exceeded the

guidelines and/or standards for ammonia, iron and manganese. These results are similar to results from the previous quarters (EDI 2014b,c) and the 2013/14 program (EDI 2014a).

Samples from WQ-TP and WQ-SEEP may also exceed the CCME-AL interim guideline for fluoride on some occasions; however because samples are diluted and detection limits are adjusted to protect lab instrumentation there is uncertainty in this result. The lab commonly has to dilute several samples (e.g. chloride, fluoride, nitrate and nitrite) for testing in order to protect lab instrumentation from samples with high conductivity and high sulfate concentrations. Consequently, the detection limits have to be adjusted. This is typically not a concern for our analysis unless the adjusted detection limit is above a CCME-AL guideline or Mount Nansen EQS value, which occurs in the case of fluoride. The interim CCME-AL guideline for fluoride is 0.12 mg/L and when the lab adjusts the fluoride detection limit it is raised from 0.02 to 0.20 mg/L in most cases. This is a common occurrence for Mount Nansen samples and is typically required for samples from the seep, tailings pond, pit lake and Dome Creek where there are high sulfates and high conductivities. To re-analyze fluoride in these cases, a different method would be required. At this time AAM has requested that EDI continue to use consistent methods to previous years.

Toxicity samples from WQ-SEEP were collected on November 13, 2014. The sample passed the lab test, with the 96 hour LT50 result being greater than 96 hours, with no fish mortalities and no fish with any signs of stress. This is consistent with other results from previous quarters.

Total and weak acid dissociable (WAD) cyanide concentrations during the Q3 investigation period did not exceed Mount Nansen EQS criteria (0.3 and 0.1 mg/L, respectively). Cyanide concentrations in samples from the WQ-TP site were below detection limits (detection limits: 0.005 mg/L). Cyanide concentrations in the WQ-SEEP samples were above detection limits for both total cyanide (0.049 to 0.083 mg/L; APPENDIX E) and WAD cyanide (0.012 to 0.019 mg/L; APPENDIX E).

**Table 14. Summary of parameters that exceeded CCME-AL guidelines and/or Mount Nansen EQS for WQ-TP and WQ-SEEP for the Q3 period. Parameters in red bold text exceed both standard and guideline values.**

| Sampling Trip Date | WQ-TP | WQ-SEEP |
|---|---|---|
| October 14-16, 2014 | As, Cd, Cu, Fe, Pb, Ag, Zn | $NH_3$, As, Cd, Cu, **Fe**, Mn |
| November 12-14, 2014 | As, Cd, Cu, Fe, Pb, Ag, Zn | $NH_3$, As, Cd, Cu, **Fe**, Mn |
| December 15-16, 2014 | F, As, Cd, Cu, Pb, Ag, Zn | $NH_3$, As, Cd, Cu, **Fe**, Mn |

*In situ* water quality parameters for the WQ-TP and WQ-SEEP sites for each trip of Q3 are summarized in Table 15. Water temperatures were between 0.6 °C and 2.2 °C from October to December 2014. Specific conductivity ranged from 1,335 to 1,796 µS/cm and pH from pH 6.79 to 7.88 for the Q3 period. Turbidity was between 4.41 and 31.30 NTU during the period (Table 15).

**Table 15. *In situ* water quality data for WQ-TP and WQ-SEEP for the Q3 period.**

| Site ID | Date | Water Temp. (°C) | Specific Conductivity (µS/cm) | pH | Turbidity (NTU) |
|---|---|---|---|---|---|
| WQ-TP | 14-Oct-14 | 2.2 | 1,335 | 7.88 | 26.80 |
| WQ-TP | 13-Nov-14 | 1.8 | 1,511 | 7.42 | 4.41 |
| WQ-TP | 16-Dec-14 | 1.2 | 1,701 | 7.53 | 4.89 |
| WQ-SEEP | 14-Oct-14 | 1.9 | 1,758 | 6.90 | 31.30 |
| WQ-SEEP | 13-Nov-14 | 1.5 | 1,796 | 6.79 | 24.10 |
| WQ-SEEP | 15-Dec-14 | 0.6 | 1,620 | 7.10 | 17.81 |

### 3.3.2 Dome Creek

All six sites on Dome Creek were sampled at the start of Q3 period in October 2014. However, by the November 2014 trip most sites had frozen to substrate for the winter, except for WQ-DC-DX+105 and WQ-DC-U. The WQ-DC-DX+105 site remains flowing through the winter due to groundwater influences, while the WQ-DC-U site remains flowing through the winter due to contributions from the seepage pond discharge pipe, which pipes water from the seepage pond.

The most upstream site north of the mill, WQ-DC-DX, was sampled only during the October 2014 event as the site had frozen to substrate by the November 2014 sampling event. The October 2014 samples exceeded the CCME-AL guideline criteria for aluminum and iron (Table 16; APPENDIX E).

The WQ-DC-DX+105 site, which lies 105 m downstream from WQ-DC-DX, was sampled on all Q3 trips. The samples consistently exceeded the CCME-AL guidelines and/or standards for arsenic, cadmium, iron, manganese and zinc during all sampling events (Table 16; APPENDIX E). These results are similar to the previous quarterly results for the site.

The WQ-DC-D1b site lies down valley from the mill and downstream of an older tailings pond. This site was sampled only in October 2014, before the creek froze to substrate. The samples from this site exceeded the guideline and/or standard criteria for total suspended solids (TSS), aluminum, arsenic, cadmium, copper, iron, lead, manganese and zinc (Table 16; APPENDIX E).

The WQ-DC-B site within the Dome Creek diversion channel was sampled in October 2014, prior to freeze up, and exceeded guidelines and/or standards for arsenic, cadmium, iron and manganese (Table 17; APPENDIX E). This site can occasionally be sampled during the winter, if the channel is dredged for maintenance, allowing the stream to flow for a short period of time prior to freezing in multiple layers of overflow ice with water seeping between ice layers. However, in November and December 2014, no water was detected and thus site conditions were not suitable for sampling.

The WQ-DC-U site, which lies downstream of WQ-DC-B and the seepage pond discharge site (WQ-SEEP), was sampled during all Q3 trips. The samples consistently exceeded the guidelines and/or standards

for ammonia, arsenic, cadmium, iron, and manganese (Table 17; APPENDIX E). Some samples also exceeded the CCME-AL guideline values for aluminum, copper, lead and zinc.

The most downstream site on Dome Creek, WQ-DC-R, was sampled during the October 2014 trip of Q3, before the creek froze to substrate for the winter period. The October 2014 samples exceeded the guidelines and/or standards for aluminum, arsenic, cadmium, copper, iron, and manganese (Table 17; APPENDIX E).

As noted with the WQ-SEEP and WQ-TP sites in Section 3.3.1, samples for chloride, fluoride, nitrate and nitrite are commonly diluted and the detection limits adjusted for sites on Dome Creek due to higher conductivities and sulfates which could damage lab instrumentation. Many results for fluoride concentrations are reported as below the adjusted detection limit of 0.20 mg/L (APPENDIX E), and thus may exceed the CCME-AL interim guideline for fluoride of 0.12 mg/L. While detection limits for chloride, nitrate and nitrite were also adjusted, the adjusted detection limits remain below the CCME-AL guidelines.

Total and WAD cyanide concentrations for Dome Creek sites during the Q3 investigation period did not exceed Mount Nansen EQS criteria (0.3 and 0.1 mg/L, respectively). Only cyanide concentrations for WQ-DC-U were above detection limits during Q3 (detection limits: 0.005 mg/L). Total cyanide concentrations ranged from 0.010 to 0.047 mg/L, and WAD cyanide ranged from 0.011 to 0.015 mg/L (APPENDIX E).

**Table 16. Summary of parameters that exceeded CCME-AL guidelines and/or Mount Nansen EQS at the upper Dome Creek sites for the Q3 period. Parameters in red bold text exceed both standard and guideline values.**

| Sampling Trip Date | WQ-DC-DX | WQ-DC-DX+105 | WQ-DC-D1b |
|---|---|---|---|
| October 14-16, 2014 | Al, Fe (duplicate + As, Cd, Cu) | As, Cd, Fe, Mn, **Zn** | TSS, Al, As, Cd, Cu, **Fe**, Pb, Mn, **Zn** |
| November 12-14, 2014 | Frozen to substrate | As, Cd, Fe, Mn, **Zn** | Frozen to substrate |
| December 15-16, 2014 | Frozen to substrate | As, Cd, Fe, Mn, **Zn** | Frozen to substrate |

**Table 17. Summary of parameters that exceeded CCME-AL guidelines and/or Mount Nansen EQS for the lower Dome Creek sites for the Q3 period. Parameters in red bold text exceed both standard and guideline values.**

| Sampling Trip Date | WQ-DC-B | WQ-DC-U | WQ-DC-R |
|---|---|---|---|
| October 14-16, 2014 | As, Cd, **Fe**, Mn | $NH_3$, Al, As, Cd, Cu, **Fe**, Pb, Mn, Zn | Al, As, Cd, Cu, **Fe**, Mn |
| November 12-14, 2014 | Frozen to substrate | $NH_3$, As, Cd, **Fe**, Mn | Frozen to substrate |
| December 15-16, 2014 | Frozen to substrate | $NH_3$, As, Cd, Cu, **Fe**, Mn | Frozen to substrate |

*In situ* water quality parameters for the Dome Creek sites for Q3 are summarized in Table 18. Water temperatures in Dome Creek ranged from 0 °C to 0.6 °C. Specific conductivity in Dome Creek ranged from 574 to 1,569 µS/cm, and was lowest at the WQ-DC-DX site and highest at the WQ-DC-D1b site. The pH throughout Dome Creek remained neutral during the Q3 period, ranging from pH 6.80 to 7.87. Turbidity was variable, ranging from 1.65 to 26.00 NTU during the Q3 period.

**Table 18. *In-situ* water quality data for the Dome Creek sites for the Q3 period.**

| Site ID | Date | Water Temp. (°C) | Specific Conductivity (µS/cm) | pH | Turbidity (NTU) |
|---|---|---|---|---|---|
| WQ-DC-DX | 15-Oct-14 | 0.1 | 574 | 7.60 | 11.55 |
| WQ-DC-DX | 13-Nov-14 | | Frozen to substrate | | |
| WQ-DC-DX | 16-Dec-14 | | Frozen to substrate | | |
| WQ-DC-DX+105 | 15-Oct-14 | 0.6 | 1,181 | 7.14 | 2.68 |
| WQ-DC-DX+105 | 13-Nov-14 | 0.6 | 1,184 | 6.80 | 2.78 |
| WQ-DC-DX+105 | 16-Dec-14 | 0.5 | 1,193 | 7.25 | 1.65 |
| WQ-DC-D1b | 15-Oct-14 | 0.1 | 1,569 | 7.87 | 20.00 |
| WQ-DC-D1b | 14-Nov-14 | | Frozen to substrate | | |
| WQ-DC-D1b | 16-Dec-14 | | Frozen to substrate | | |
| WQ-DC-B | 15-Oct-14 | 0.0 | 1,239 | 7.45 | 6.91 |
| WQ-DC-B | 13-Nov-14 | | Frozen to substrate | | |
| WQ-DC-B | 15-Dec-14 | | Frozen to substrate | | |
| WQ-DC-U | 15-Oct-14 | 0.2 | 1,301 | 7.44 | 13.07 |
| WQ-DC-U | 13-Nov-14 | 0.0 | 1,552 | 6.90 | 12.33 |
| WQ-DC-U | 15-Dec-14 | 0.0 | 1,334 | 7.29 | 11.08 |
| WQ-DC-R | 14-Oct-14 | 0.5 | 1,103 | 7.64 | 26.00 |
| WQ-DC-R | 14-Nov-14 | | Frozen to substrate | | |
| WQ-DC-R | 16-Dec-14 | | Frozen to substrate | | |

### 3.3.3 Regular Seep Sites

There are a total of six surface water seep sites included in the 2014/15 program. The WQ-DESS-01, 02, 03, and the LW-SEEP-01 are sampled on a seasonal basis (spring freshet, summer, fall, and winter). The WQ-CH-P-13-01 and WQ-MS-S-08 sites are sampled monthly when suitable conditions exist.

The WQ-LW-SEEP-01 site on the lower west waste rock dump was scheduled for sampling in November 2014, but was dry at the time of the visit. This is consistent with previous attempts to sample the site in Q1 and Q2. The Dome East Slope Seeps (WQ-DESS-01, -02, -03) were scheduled for sampling during the November 2014 trip; however there was thick ice at the seep areas and only WQ-DESS-02 had flowing water present that was suitable for sampling. The samples from the WQ-DESS-02 site exceeded the CCME guidelines for nitrate and cadmium (Table 19; APPENDIX E). This is similar to Q1 and Q2 results for the WQ-DESS-02 site (EDI 2014b,c).

The WQ-CH-P-13-01 site was sampled during the October 2014 trip and then froze to substrate by the November 2014 trip for the winter period. The October 2014 samples exceeded the guideline and/or standard criteria for aluminum, cadmium and zinc, which is consistent with previous quarterly reports (EDI 2014b,c).

The WQ-MS-S-08 site located near the mill site was not sampled during the Q3 period due to dry surface water conditions. This is similar to Q2 observations. This site only appears to have surface flow during the freshet period (Q1), while during other times of year flows underground and may report to the surface at another location. See Section 4 for recommendations for this site.

As noted in Section 3.3.1 and 3.3.2, samples for chloride, fluoride, nitrate and nitrite are commonly diluted and the detection limits adjusted for sites on Dome Creek due to higher conductivities and sulfates which have the potential to damage lab instrumentation. Many results for fluoride concentrations are reported as below adjusted detection limits of 0.20 mg/L (APPENDIX E), and thus may exceed the CCME-AL interim guideline for fluoride of 0.12 mg/L. While detection limits for chloride, nitrate and nitrite were also adjusted, the reported detection limits are below CCME-AL guidelines.

**Table 19. Summary of parameters that exceeded CCME-AL guidelines and/or Mount Nansen EQS for the WQ-DESS-01 to 03 sites for the Q3 period. Parameters in red bold text exceed both standard and guideline values.**

| Sampling Trip Date | WQ-DESS-01 | WQ-DESS-02 | WQ-DESS-03 |
|---|---|---|---|
| October 14-16, 2014 | Not scheduled | Not scheduled | Not scheduled |
| November 12-14, 2014 | Frozen to substrate | $NO_3$-, Cd | Frozen to substrate |
| December 15-16, 2014 | Not scheduled | Not scheduled | Not scheduled |

**Table 20. Summary of parameters that exceeded CCME-AL guidelines and/or Mount Nansen EQS for the WQ-CH-P-13-01, WQ-MS-S-08 and WQ-LW-SEEP-01 sites for the Q3 period. Parameters in red bold text exceed both standard and guideline values.**

| Sampling Trip Date | WQ-CH-P-13-01 | WQ-MS-S-08 | WQ-LW-SEEP-01 |
|---|---|---|---|
| October 14-16, 2014 | Al, Cd, **Zn** | Dry | Not scheduled |
| November 12-14, 2014 | Frozen to substrate | Dry | Frozen to substrate |
| December 15-16, 2014 | Frozen to substrate | Dry | Not scheduled |

*In situ* water quality data was collected at the WQ-DESS-02 and WQ-CH-P-13-01 sites during the Q3 period, as these were the only sites scheduled with suitable sampling conditions. Water temperatures for both sites were just above zero degrees, with high conductivity, neutral pH, and low turbidity (Table 21).

**Table 21. *In situ* water quality data for regular seep sites for the Q3 period.**

| Site ID | Date | Water Temp. (°C) | Specific Conductivity (µS/cm) | pH | Turbidity (NTU) |
|---|---|---|---|---|---|
| WQ-DESS-01 | 15-Oct-14 | Not scheduled | | | |
| WQ-DESS-01 | 13-Nov-14 | Frozen to substrate | | | |
| WQ-DESS-01 | 16-Dec-14 | Not scheduled | | | |
| WQ-DESS-02 | 15-Oct-14 | Not scheduled | | | |
| WQ-DESS-02 | 13-Nov-14 | 0.4 | 2,054 | 7.41 | 1.09 |
| WQ-DESS-02 | 16-Dec-14 | Not scheduled | | | |
| WQ-DESS-03 | 15-Oct-14 | Not scheduled | | | |
| WQ-DESS-03 | 13-Nov-14 | Frozen to substrate | | | |
| WQ-DESS-03 | 16-Dec-14 | Not scheduled | | | |
| WQ-CH-P-13-01 | 15-Oct-14 | 0.6 | 1,513 | 7.41 | 1.57 |
| WQ-CH-P-13-01 | 13-Nov-14 | Frozen to substrate | | | |
| WQ-CH-P-13-01 | 16-Dec-14 | Frozen to substrate | | | |
| WQ-LW-SEEP-01 | 15-Oct-14 | Not scheduled | | | |
| WQ-LW-SEEP-01 | 13-Nov-14 | Dry | | | |
| WQ-LW-SEEP-01 | 16-Dec-14 | Not scheduled | | | |
| WQ-MS-S-08 | 15-Oct-14 | Dry | | | |
| WQ-MS-S-08 | 13-Nov-14 | Dry | | | |
| WQ-MS-S-08 | 16-Dec-14 | Dry | | | |

### 3.3.4 Brown-McDade Pit Lake

The Brown-McDade pit lake was sampled during two out of three events during the Q3 investigation period. The pit lake could not be sampled during the October 2014 trip due to unsafe ice conditions for sampling. Samples from November and December 2014 consistently exceeded the CCME-AL guidelines for arsenic, cadmium, and zinc, at all three sample depths (surface, middle and bottom; Table 22; APPENDIX E). The zinc concentrations from all samples also exceeded the Mount Nansen EQS value (Table 22; APPENDIX E). All samples, except for the WQ-PIT-3 sample from November 2014, also exceeded the CCME-AL guideline for copper. The Mount Nansen EQS value for manganese was also exceeded for the WQ-PIT-3 sample from November 2014 (Table 22; APPENDIX E). These results are consistent with previous quarterly results (EDI 2014b,c).

Fluoride concentrations exceeded the CCME-AL guideline from the middle and bottom samples in December 2014. The top pit lake sample may also exceed the fluoride interim guideline; however the result was reported below the adjusted detection limit of 0.20 mg/L, which is above the guideline value of 0.12 mg/L. This may also be the case for the November 2014 samples, as all fluoride results were reported as <0.20 mg/L (Table 22; APPENDIX E). Refer to Section 3.3.1 for additional details on why detection limits are adjusted by the lab for some analyses - this is a common occurrence at sites where conductivity and sulfate concentrations are high and have the potential to damage lab instrumentation if not diluted.

**Table 22. Summary of parameters that exceeded CCME-AL guidelines and/or Mount Nansen EQS for the Brown McDade Pit Lake for the Q3 period. Parameters in red bold text exceed both standard and guideline values.**

| Sampling Trip Date | WQ-PIT-1 (surface) | WQ-PIT-2 (mid-depth) | WQ-PIT-3 (bottom) |
|---|---|---|---|
| October 14-16, 2014 | Unsafe for sampling | Unsafe for sampling | Unsafe for sampling |
| November 12-14, 2014 | As, Cd, Cu, **Zn** | As, Cd, Cu, **Zn** | As, Cd, Mn, **Zn** |
| December 15-16, 2014 | As, Cd, Cu, **Zn** | F, As, Cd, Cu, **Zn** | F, As, Cd, Cu, **Zn** |

*In situ* water quality data was collected along with samples for lab analysis during the Q3 period. Water temperatures in the pit lake ranged from 0.3 to 5.5 °C, with thermal stratification of warmer water towards the bottom of the lake and colder water closer to the ice surface (Table 23). Specific conductivities ranged from 1,719 to 2,185 µS/cm, and were highest from the bottom sample depth (WQ-PIT-3; Table 23). The pH in the pit lake varied from pH 6.84 to 7.52. Turbidity of all samples ranged from 0.35 to 1.26 NTU. Dissolved oxygen ranged from 0.7 to 8.5 mg/L during the winter period, and was lowest at the bottom of the pit lake and highest towards the middle and/or surface of the lake.

**Table 23. *In-situ* water quality data for the Brown McDade Pit Lake for the Q3 period.**

| Date | Site ID | Sample Depth (m) | Water Temp. (°C) | Specific Conductivity (µS/cm) | pH | Turbidity (NTU) | Dissolved Oxygen[1] (mg/L) |
|---|---|---|---|---|---|---|---|
| 15-Oct-14 | WQ-PIT-1 | n/a | Ice unsafe for sampling | | | | |
| | WQ-PIT-2 | n/a | Ice unsafe for sampling | | | | |
| | WQ-PIT-3 | n/a | Ice unsafe for sampling | | | | |
| 14-Nov-14 | WQ-PIT-1 | 0.3 | 1.9 | 1,730 | 7.05 | 0.35 | 7.3 |
| | WQ-PIT-2 | 3.0 | 2.7 | 1,775 | 7.03 | 1.26 | 6.6 |
| | WQ-PIT-3 | 2.5 | 4.0 | 2,185 | 6.84 | 0.72 | 0.7 |
| 16-Dec-14 | WQ-PIT-1 | 0.3 | 0.5 | 1,719 | 7.33 | 0.88 | 3.6 |
| | WQ-PIT-2 | 5.5 | 2.8 | 1,834 | 7.52 | 0.82 | 8.5 |
| | WQ-PIT-3 | 5.0 | 3.2 | 1,866 | 7.13 | 0.62 | 1.6 |

### 3.3.5 Pony Creek

During the Q3 period, the WQ-PC-U site was sampled during the October 2014 trip before freezing to substrate for the winter. The WQ-PC-D site, downstream from WQ-PC-U, was sampled during the October and November 2014 trips, as the site continued to have some flow, likely related to groundwater contributions as water temperatures remained above zero degrees. The downstream site had frozen to substrate by the December 2014 trip.

The samples from WQ-PC-U in October 2014 did not exceed any water quality guideline or standard criteria (Table 24; APPENDIX E). These results are typical for this site, as it lies upstream of the impacts of the Mount Nansen Mine. The samples from the WQ-PC-D site consistently exceeded the CCME-AL guidelines for arsenic, cadmium, copper and zinc. The October 2014 sample also exceeded the CCME-AL guideline for aluminum. The zinc concentration also exceeded the Mount Nansen EQS criteria during the November 2014 trip. Note the portion of the creek just upstream from the WQ-PC-D sampling location runs through an old waste rock pile which results in higher metals concentrations than found in samples from the WQ-PC-U samples (which is upstream of the waste rock area).

**Table 24. Summary of parameters that exceeded CCME-AL guidelines and/or Mount Nansen EQS for the Pony Creek sites for the Q3 period. Parameters in red bold text exceed both standard and guideline values.**

| Sampling Trip Date | WQ-PC-U | WQ-PC-D |
|---|---|---|
| October 14-16, 2014 | None | Al, As, Cd, Cu, Zn |
| November 12-14, 2014 | Frozen to substrate | As, Cd, Cu, **Zn** |
| December 15-16, 2014 | Frozen to substrate | Frozen to substrate |

*In situ* water quality data for the Pony Creek sites for the Q3 period are shown in Table 25. Water temperatures ranged from 0.0 to 0.6°C with specific conductivities in the range of 344 to 369 µS/cm. The pH at the both sites remained around neutral for the Q3 period. Turbidity ranged from 0.21 to 3.00 NTU.

**Table 25. I*n situ* water quality data for the Pony Creek sites for the Q3 period.**

| Site ID | Date | Water Temp. (°C) | Specific Conductivity (µS/cm) | pH | Turbidity (NTU) |
|---|---|---|---|---|---|
| WQ-PC-U | 14-Oct-14 | 0.0 | 344 | 7.50 | 0.44 |
| WQ-PC-U | 12-Nov-14 | Frozen to substrate | | | |
| WQ-PC-U | 15-Dec-14 | Frozen to substrate | | | |
| WQ-PC-D | 14-Oct-14 | 0.6 | 350 | 7.47 | 0.21 |
| WQ-PC-D | 12-Nov-14 | 0.2 | 369 | 6.94 | 3.00 |
| WQ-PC-D | 15-Dec-14 | Frozen to substrate | | | |

### 3.3.6 Back Creek

During the Q3 investigation period, the Back Creek site was sampled only during the October 2014 sampling event. Conditions at the site in November 2014 were ice covered and dry beneath the ice, which is typical for the winter season. During the December 2014 trip the site remained dry with a small area of standing water and slush beneath the ice, not suitable for sampling.

The samples collected on the October 2014 trip exceeded guideline and/or standard criteria for TSS, aluminum, arsenic, cadmium, copper, iron, lead and manganese (Table 26; APPENDIX E). These results are similar to previous quarterly results (EDI 2014b,c). This site is located downstream of placer mining

operations and typically has elevated TSS and turbidity when the placer mine is active, in addition to higher concentrations of total metals. The higher the TSS, typically the higher concentrations for some total metals.

**Table 26. Summary of parameters that exceeded CCME-AL guidelines and/or Mount Nansen EQS for WQ-BC for the Q3 period. Parameters in red bold text exceed both standard and guideline values.**

| Sampling Trip Date | WQ-BC |
|---|---|
| October 14-16, 2014 | TSS, Al, As, Cd, Cu, **Fe**, Pb, Mn |
| November 12-14, 2014 | Dry |
| December 15-16, 2014 | Dry |

*In situ* water quality data at the Back Creek site for the Q3 period is shown in Table 27. Water temperature during the October 2014 trip, was zero degrees. Specific conductivity was 616 µS/cm, the pH was 8.01, and the turbidity was 4.09 NTU.

**Table 27. I*n situ* water quality data for WQ-BC for the Q3 period.**

| Site ID | Date | Water Temp. (°C) | Specific Conductivity (µS/cm) | pH | Turbidity (NTU) |
|---|---|---|---|---|---|
| WQ-BC | 15-Oct-14 | 0.0 | 616 | 8.01 | 4.09 |
| WQ-BC | 13-Nov-14 | Frozen to substrate | | | |
| WQ-BC | 16-Dec-14 | Frozen to substrate | | | |

### 3.3.7 Victoria Creek

Victoria Creek was sampled at all four sites during the Q3 period (WQ-VC-U, WQ-VC-DBC, WQ-VC-UMN and WQ-VC-R). The water samples from WQ-VC-U, the most upstream site on Victoria Creek, did not exceed any guideline or standard criteria during the Q3 investigation period (Table 28; APPENDIX E). This site lies upstream of any impacts from the Mount Nansen Mine or Back Creek placer mine operations.

The remaining three sites on Victoria Creek (WQ-VC-DBC, WQ-VC-UMN and WQ-VC-R/+150) only exceeded the aluminum, cadmium and iron CCME-AL guidelines during the October 2014 sampling event. During the November and December 2014 sampling events, results were below guideline values. This is likely due to Back Creek being dry in November and December 2014, with limited contributes to Victoria Creek unless through groundwater.

Note the Victoria Creek at Road site was sampled from the winter sampling location (WQ-VC-R+150) on the December 2014 trip, as aufeis conditions had developed up and downstream of the road crossing making sampling impossible at the typical WQ-VC-R location. The winter sampling location is 150 m downstream of the regular sampling site.

**Table 28. Summary of parameters that exceeded CCME-AL guidelines and/or Mount Nansen EQS for sites within the Victoria Creek watershed for the Q3 period. Parameters in red bold text exceed both standard and guideline values.**

| Sampling Trip Dates | WQ-VC-U | WQ-VC-DBC | WQ-VC-UMN | WQ-VC-R/ WQ-VC-R+150 |
|---|---|---|---|---|
| October 14-16, 2014 | None | Al, Cd, Fe | Al, Cd, Fe | Al, Cd, Fe |
| November 12-14, 2014 | None | None | None | None |
| December 15-16, 2014 | None | None | None | None |

*In situ* water quality parameters for the Victoria Creek sites during each trip in Q3 are summarized in Table 29. Water temperatures during the Q3 period ranged from 0.0 to 1.1 °C (Table 29). Specific conductivity remained relatively consistent through Victoria Creek, ranging from 168 to 231 µS/cm. The pH across the Victoria Creek sites ranged from pH 6.70 to 7.92. Turbidity during the period ranged from 0.20 to 5.39 NTU.

**Table 29. *In situ* water quality data for sites within Victoria Creek for the Q3 period.**

| Site ID | Date | Water Temp. (°C) | Specific Conductivity (µS/cm) | pH | Turbidity (NTU) |
|---|---|---|---|---|---|
| WQ-VC-U | 15-Oct-14 | 0.5 | 174 | 7.73 | 0.99 |
| WQ-VC-U | 13-Nov-14 | 0.1 | 208 | 7.05 | 0.65 |
| WQ-VC-U | 16-Dec-14 | 0.1 | 215 | 7.21 | 0.29 |
| WQ-VC-DBC | 15-Oct-14 | 0.4 | 188 | 7.78 | 3.77 |
| WQ-VC-DBC | 13-Nov-14 | 0.1 | 210 | 6.82 | 0.56 |
| WQ-VC-DBC | 16-Dec-14 | 0.0 | 216 | 7.34 | 0.20 |
| WQ-VC-UMN | 14-Oct-14 | 1.1 | 228 | 7.92 | 4.43 |
| WQ-VC-UMN | 12-Nov-14 | 0.1 | 223 | 7.42 | 0.71 |
| WQ-VC-UMN | 15-Dec-14 | 0.0 | 168 | 7.19 | 0.66 |
| WQ-VC-R | 14-Oct-14 | 0.9 | 214 | 7.86 | 5.39 |
| WQ-VC-R | 12-Nov-14 | 0.1 | 222 | 7.32 | 1.42 |
| WQ-VC-R+150 | 15-Dec-14 | 0.0 | 231 | 6.70 | 0.61 |

### 3.3.8 Pump House Well

The pump house well (WQ-PW) was sampled during all visits of the Q3 period. Drinking water package samples were collected in addition to bacteriological samples, except during the November 2014 sampling event when a bacteriological sample could not be collected due to the trip schedule (returning to Whitehorse, YT on a Friday when the lab does not accept samples).

None of the Q3 samples exceeded the Health Canada Guidelines for Canadian Drinking Water, the CCME-AL guidelines or the Mount Nansen EQS. The October and December 2014 bacteriological samples

collected by EDI were free of *E. coli* and total coliforms. DES collected their monthly bacteriological sample November 12, 2014, which was also free of *E. coli* and total coliforms.

Water quality parameters collected *in situ* are presented in Table 30. Water temperatures ranged from 0.5°C to 1.2°C, specific conductivity ranged from 371 to 390 µS/cm, pH ranged from pH 6.13 to pH 7.74, and turbidity ranged from 0.00 to 0.17 NTU (Table 30). All results are within range of the Q1 and Q2 results (EDI 2014b,c).

**Table 30. I*n situ* water quality data for WQ-PW for the Q3 period.**

| Site ID | Date | Water Temp. (°C) | Specific Conductivity (µS/cm) | pH | Turbidity (NTU) |
|---|---|---|---|---|---|
| WQ-PW | 15-Oct-14 | 0.8 | 371 | 7.74 | 0.17 |
| WQ-PW | 14-Nov-14 | 1.2 | 380 | 6.13 | 0.00 |
| WQ-PW | 16-Dec-14 | 0.5 | 390 | 6.76 | 0.00 |

### 3.3.9 QA/QC Program

Field blank and travel blank samples were included on every trip during the Q3 period. In general, field and travel blank samples showed no contamination from field sampling methodologies or transportation and storage (*i.e.,* all anion and metal concentrations were below detection limits). The one exception was the November 2014 travel blank sample, which had an ammonia concentration above the detection limit. This can occur when the travel blank sample provided by the lab is older. No contamination from actual transportation or storage is suspected.

At least one replicate sample was also collected during each sampling event. Table 31 summarizes the sites where replicate samples were collected during each trip. Replicate sample sets 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, indicating some variability in lab results. See APPENDIX E - Tables E-1–E-3 for parameters that were flagged as greater than +/-10% (highlighted in yellow).

Average percent differences for replicate sample sets ranged from 4% to 18% (Table 31). The average percent difference of 4% to 8% is normal for the Mount Nansen program and provides an indication of lab precision, while the average percent difference of 18% is relatively high for the program, and is likely attributed to highly variable site conditions, such as fluctuating TSS concentrations. Some of the duplicate sites with larger differences had either relatively high TSS and/or large differences in TSS values within the replicate sample sets. TSS concentrations are generally associated with total metals concentrations as metals are often bound to the suspended sediments. For example, the WQ-DC-DX-r replicate sample from the October 2014 trip had a TSS concentration 67% greater than the regular WQ-DC-DX sample. This resulted in large percent differences in numerous total metals, including but not limited to aluminum, arsenic, barium, cadmium, chromium, iron and copper (APPENDIX E). This is an extreme case and many of the other replicate sample sets were within acceptable ranges (<10% difference).

**Table 31. Summary of sites randomly selected as replicate samples for each sampling trip over the Q2 period, with average percent differences in brackets.**

| Sampling Trip Date | Replicate #1 | Replicate #2 |
|---|---|---|
| October 14-16, 2014 | WQ-VC-UMN-r (4%) | WQ-DC-DX-r (18%) |
| November 12-14, 2014 | WQ-DC-U-r (4%) | n/a |
| December 15-16, 2014 | WQ-VC-DBC-r (5%) | n/a |

# 4 CONCLUSIONS & RECOMMENDATIONS

Based on results of the Q3 period of the Mount Nansen Water Resources Investigations Program from October 1, 2014 to December 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.

- Manual snow depth data should continue to be collected into 2015 so that the measurement uncertainty of the snow sensor at the Mount Nansen can be established.

- It is recommended that location of the H-VC-U continuous data logger and stilling well be re-located to a pool immediately upstream of the existing station (right bank) in spring 2015. Several factors including peak flow sediment deposits and ice conditions in the channel are contributing to sedimentation in the stilling well during summer and causing the stilling well to freeze to bed in winter. The data logger at this station is malfunctioning and requires replacement, however this is likely not feasible until break-up occurs. It may be prudent to replace some or all other loggers on Site as many loggers are likely nearing the end of their lifespan.

- The geometry of the channel at H-VC-R changed due to sediment depositions in 2014 (during freshet). Substantial ice accumulation (storage) in Victoria Creek upstream of the Mount Nansen access road appears to be contributing to the attenuation of flow at H-VC-R. The ice accumulation and sediment deposits are hindering measurements at the station therefore it is recommended that the H-VC-R station be relocated downstream of the existing well in spring 2015 prior freshet if possible. This will ensure that the measurement location is stable and the continuous logger remains wetted year round.

- The H-DC-M weir pond will likely require continued maintenance due to sedimentation, particularly following rain storms and excavation work upstream which mobilize sediment into the stream.

- EDI will continue to sample the water quality sites in the fourth quarter (Q4) as scheduled and depending on site conditions. Based on EDI's past experience at the Mount Nansen Site, many of the sites frozen to substrate during the Q3 period are expected to remain frozen through the winter. Depending on weather conditions towards the end of the Q4 period, some sites may begin flowing again, for example Back Creek, while others will remain frozen to substrate likely into April and May 2015, such as sites on Dome Creek where thick aufeis conditions exist through winter and spring (WQ-DC-R, WQ-DC-D1b, and WQ-DX). EDI will re-assess conditions during Q4, and sample sites accordingly based on site conditions.

- The WQ-MS-S-08 site had no surface flows during all trips of the Q3 period (similar to the Q2 period). This particular site appears to have surface flow only during the freshet period, and during other times of year may report to the surface at other locations. There are multiple seeps down valley of the mill area that are flowing at particular times of year (mostly during spring and fall), and many have been documented in past investigations (September 2011). If a better understanding of

mill seep water quality is required for the project, it may be more valuable to put a concerted effort into documenting seeps in the larger mill site area (similar to the September 2011 program conducted by Diane Lister and EDI), with at least two sampling events in 2015 (May and September).

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# APPENDIX A. SUPPORTING METHODOLOGY

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## HYDROLOGY METHODOLOGY

### 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 ($Q$),

$$Q = v \cdot A = bdv \qquad [1]$$

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:

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

$$Q = q_1 + q_2 + q_3 + q_4 + q_5 + \cdots q_n \qquad [3]$$

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 ±5%. An uncertainty of ±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.

### 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 2004a; Moore 2004b; 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 (2004a; 2004b; 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 $m^3$ 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 (2004a; 2004b; 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 Q1 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[1] (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 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:

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

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.T value is the calibration factor that accounts for the non-linearity of electrical conductance and salt concentration in stream water. The CF.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 $SPC_0$ was achieved, above the required increase of 2 to 5 µS/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 ± 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°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:

$$Q = \frac{m}{\sum(EC - EC_0) \cdot CF \cdot t_{int}} \qquad [5]$$

Where *m* is the mass of salt used for the dry slug injection, EC is the electrical conductivity measured at a defined time interval ($t_{int}$), $EC_0$ 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 monitoring period. The estimated measurement accuracy for dry salt slug injection is ±30%. However, the discharge uncertainty varies considerably between each station due to differences in channel conditions and stream water velocities.

[1] 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.

## 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 ± 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.

## 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 measurements become increasingly uncertain and are not performed.

## 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.

## 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.

## 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:

$$Q = C(h + a)^N \qquad [6]$$

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:

$$\log Q = logC + N\ log(h + a) \qquad [7]$$

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. 2014).

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.

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.

## Continuous Stage and Discharge

A combination of HOBO (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 (HOBO) 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.

The hydrostatic pressure data was compensated for atmospheric pressure using data from the barometric pressure logger located at ATM-DC4. 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:

$$H = \frac{P}{\gamma} + z \qquad [8]$$

Hydraulic head ($H$) or water depth above the sensor, hydrostatic pressure ($P$) in Pa, the specific weight of water $\gamma = pg$ where $p$ is the density of water at a given temperature (kg·m$^{-3}$), $g$ is acceleration due to gravity (m·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):

$$\rho = 1000\left[1 - \frac{t+288.94}{508929.2(t+68.12963)}(t-3.9863)^2\right] \qquad [9]$$

Where $t$ = temperature (°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.

### Hydrometric Data Management

Hydrometric data is compiled into a MS Access database after each visit to the Mount Nansen Site (*EDI 14-Y-0455 Hydrology Database.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 is also used for QA/QC.

## WATER QUALITY METHODOLOGY

### Field Sampling Methods

An Oakton T100 turbidity meter was used to collect *in situ* turbidity (NTU). This meter is 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 (µS/cm). Field crews calibrated the YSI meter prior to each trip and as required in the field. A YSI ProODO meter was used to measure dissolved oxygen (mg/L) from the pit lake (this probe does not require any calibration). Field data is recorded on standard field datasheets including site 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 (if present).

Laboratory-cleaned bottles are filled using clean techniques (*i.e.,* nitrile gloves, appropriate bottle handling) and samples are filtered and preserved on site, as directed by the lab (ALS Laboratories). Samples from the pit lake are taken from the same general location on the lake at three different depths, from the surface, at mid depth and just off the bottom. In the event that ice covers the water surface, an ice auger is used to access the water column. A Kemmerer sampler is used to collect all pit samples and is also used to measure the depth. When the pit lake is ice free, a row boat is used to access the sampling location, and samples are collected again with the Kemmerer.

Samples are kept in coolers immediately following collection, and later transferred to the Mount Nansen Site sample refrigerator until they could be transferred to Whitehorse on the final day of each sampling event. For chemical analysis, Chain of Custody forms, supplied by the lab, are included in each sample cooler, and samples are delivered to ALS Laboratories upon arrival back in Whitehorse, YT to ensure lab holding times were met.

## Laboratory Analysis

All surface water quality laboratory analysis is 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 A-1.

**Table A-1. 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 | **Cyanides:** Cyanate, Total Cyanide (as Strong Acid Dissociable), Weak Acid Dissociable, Thiocyanate |
| | **Physical Tests:** Conductivity, Hardness, pH, Total Dissolved Solids, Total Suspended Solids |
| | **Anions and Nutrients:** Bicarbonate, Carbonate, Hydroxide, Total Alkalinity, Total Ammonia, Chloride, Fluoride, Nitrate, Nitrite, Sulphate |
| | **Total Metals**: 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. |
| | **Dissolved Metals:** 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. |
| Pit Lake Package | **Physical Tests:** Conductivity, Hardness, pH, Total Dissolved Solids, Total Suspended Solids |
| | **Anions and Nutrients:** Bicarbonate, Carbonate, Hydroxide, Total Alkalinity, Total Ammonia, Chloride, Fluoride, Nitrate, Nitrite, Sulphate |
| | **Total Metals:** Aluminum, Antimony, Arsenic, Barium, Beryllium, Bismuth, Boron, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Lithium, Magnesium, |

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

## QA/QC Program

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

- Replicate 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. Replicates are collected from one to three sites, randomly selected, during each trip, depending on the total number of sites per trip, to cover approximately 10% of the total sites sampled. The replicate samples are collected to check the accuracy and precision of the laboratory analysis, as well as a measure of the variability in water quality at a site for a given time.
- The field blank samples are collected on site, where a set of sample bottles is filled with deionized water at some point during the sampling trip. Sampling methodology is 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 during the act of field sampling (*i.e.*, sample filling/handling, exposure to questionable air quality) or via the supplies (filter, syringe, bottle, or preservative).
- The travel blank is a sample set provided by the laboratory to be carried by the staff to and from site during the field work. The travel blank is 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 is completed. This involved comparing the replicate samples and the regular samples collected at the randomly selected replicate sites to ensure they are within acceptable limits of each other (within +/-10%). Field and travel

blank sample data is also reviewed to ensure that concentrations of all potential contaminants are low to below detection limits.

## Data Analysis

Data are reviewed and parameters of concern are graphed and compared with the Canadian Council of Ministers of the Environment (CCME) guidelines for the protection of freshwater aquatic life (CCME-AL; CCME 2014; Table A-2), 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 A-3). Drinking water quality from the WQ-PW site is compared to the applicable Guidelines for Canadian Drinking Water Quality (Health Canada 2012; Table A-4).

**Table A-2. CCME-AL guidelines applicable to Mount Nansen surface water quality sampling program (CCME 2014).**

| Water Quality Parameter | CCME-AL Guideline | Units | Comments |
|---|---|---|---|
| Aluminum (Al) | 0.1 | 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 | 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 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 | - |

| Water Quality Parameter | CCME-AL Guideline | Units | Comments |
|---|---|---|---|
| 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 A-3. 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) | 0.3 mg/L |

Table A-4. Applicable Guidelines for Canadian Drinking Water Quality for WQ-PW (Health Canada 2012).

| Water Quality Parameter | Health Canada Guideline |
|---|---|
| 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 |
| Fluoride | 1.5 mg/L |

| Water Quality Parameter | Health Canada Guideline |
|---|---|
| Lead | 0.010 mg/L |
| Mercury | 0.001 mg/L |
| Nitrate | 45 mg/L |
| Selenium | 0.01 mg/L |
| Uranium | 0.02 mg/L |

# APPENDIX B. Q3 PHOTOGRAPHS

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## Dome Creek Sites/Stations

**Photo 1. WQ-DC-DX, looking downstream (October 15, 2014).**

**Photo 2. H/WQ-DC-DX+105, looking upstream (October 15, 2014).**

**Photo 3. H/WQ-DC-D1b, looking upstream (October 15, 2014).**

**Photo 4. H-DC-B station looking downstream (October 15, 2014).**

**Photo 5. WQ-DC-B looking downstream (October 15, 2014).**

**Photo 6. Diversion channel being dredged upstream of WQ-DC-B (December 15, 2014).**

**Photo 7. WQ-DC-U looking downstream (old H-DC-M logger and stilling well on right) (October 15, 2014).**

**Photo 8. WQ-DC-U looking downstream from sample location (also shows old H-DC-M stilling well) (December 15, 2015).**

**Photo 9. H-DC-U WP looking upstream (October 15, 2014).**

**Photo 10. H-DC-M WP looking upstream at weir pond (November 12, 2014).**

**Photo 11. H-DC-R, looking downstream at stilling well (October 14, 2014).**

**Photo 12. H-DC-R looking upstream from station (November 12, 2014).**

**Photo 13. WQ-DC-R looking downstream.**

**Photo 14. WQ-DC-R looking upstream at aufeis conditions developing.**

## Victoria Creek Sites/Stations

**Photo 15. H-VC-U, looking upstream (November 13, 2014).**

**Photo 16. WQ-VC-U, looking downstream towards Back Creek confluence (November 13, 2014).**

**Photo 17. H-VC-DBC, looking downstream (November 13, 2014).**

**Photo 18. WQ-VC-DBC, looking upstream (November 13, 2014).**

**Photo 19. H/WQ-VC-UMN, looking upstream (November 12, 2014).**

**Photo 20. H-VC-UMN stilling well on left downstream bank (December 15, 2014).**

**Photo 21. WQ-VC-R looking upstream from road crossing (November 12, 2014).**

**Photo 22. H-VC-R looking upstream - showing overflow ice conditions coming down from culverts (December 15, 2014).**

**Photo 23. H-VC-R and WQ-VC-R+150, looking upstream (December 15, 2014).**

## Back Creek Sites/Stations

Photo 24. H/WQ-BC, looking upstream (October 15, 2014).

Photo 25. H/WQ-BC, looking upstream (December 16, 2014).

## Pony Creek Sites/Stations

Photo 26. H-PC-DSP culvert looking upstream (October 14, 2014).

Photo 27. H-PC-DSP looking across to right downstream bank at station (October 14, 2014).

**Photo 28. WQ-PC-D, looking upstream (November 12, 2014).**

**Photo 29. WQ-PC-U, looking upstream (October 14, 2014).**

## Pit Lake/Tailings Pond/Seepage Pond Discharge

**Photo 30. H/WQ-SEEP (November 13, 2014).**

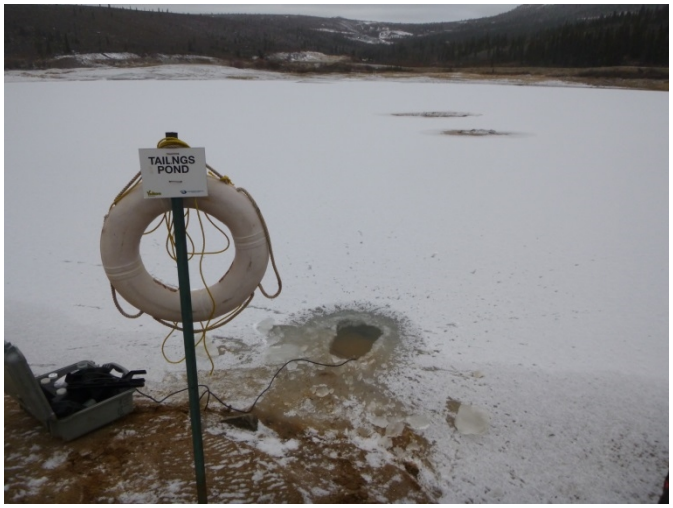


**Photo 31. H/WQ-TP (October 14, 2014).**

**Photo 32. Seepage pond showing overflow ice development in pond (December 15, 2014).**

**Photo 20. WQ-PIT sampling location (November 14, 2014).**

## Regular Seep Sites

**Photo 24. WQ-LW-SEEP-01 (November 14, 2014).**

**Photo 25. WQ-CH-P-13-01, looking upstream (November 13, 2014).**

**Photo 26. WQ-DESS-01, looking upstream (November 13, 2014).**

**Photo 27. WQ-DESS-02, looking up slope to seep location (November 13, 2014).**

**Photo 28. WQ-DESS-03 (November 13, 2014).**

**NO PHOTO**

**AVAILABLE**

**Photo 29. WQ-MS-S-08 no suitable photo for Q3 period available.**

## Pump House Well

**Photo 30. WQ-PW (November 14, 2014).**

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# APPENDIX C. Q3 VISIT RECORD

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**Table C-1. Record of sites sampled and stations monitored during each site visit during the Q3 period, October 1 to December 31, 2014.**

| Station/Site Name | October 14-16, 2014 | November 12-14, 2014 | December 15-16, 2014 |
|---|---|---|---|
| WQ-PC-U | Y | N | N |
| H-PC-DSP/WQ-PC-D | Y | $Y_w$ | N |
| WQ-PIT-1,2,3 | N | Y | Y |
| WQ-DC-DX | Y | N | N |
| H/WQ-DC-DX+105 | $Y_w$ | Y | Y |
| H/WQ-DC-D1b | Y | N | N |
| H/WQ-DC-B | Y | N | N |
| H-DC-M/WQ-DC-U | Y | Y | Y |
| H/WQ-DC-R | Y | N | N |
| H/WQ-TP | $Y_w$ | $Y_w$ | $Y_w$ |
| H/WQ-SEEP | Y | Y | Y |
| WQ-MS-S-08 | N | N | N |
| H/WQ-BC | Y | N | N |
| H/WQ-VC-U | Y | Y | Y |
| H/WQ-VC-DBC | Y | Y | Y |
| H/WQ-VC-UMN | Y | Y | Y |
| H/WQ-VC-R | Y | Y | $Y_h$ |
| WQ-VC-R+150 | n/a | n/a | Y |
| WQ-PW | Y | Y | Y |
| WQ-DESS-01 | n/a | N | n/a |
| WQ-DESS-02 | n/a | Y | n/a |
| WQ-DESS-03 | n/a | N | n/a |
| WQ-CH-P-13-01 | Y | N | N |
| WQ-LW-Seep-01 | n/a | N | n/a |

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
$Y_w$ – water quality only (if a combined hydrology station and water quality site)
$Y_h$ – hydrology only (if a combined hydrology station and water quality site)
n/a – not applicable as sampling/monitoring not scheduled for respective sampling event

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# APPENDIX D. HYDROLOGY DATA

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## Table D-1. Hydrometric Instrument Accuracy.

| Instrument | Parameter | Instrument Accuracy |
|---|---|---|
| Acoustic Doppler Velocimeter (ADV) | Velocity | ± 1% |
| Swoffer Current Meter | Velocity | ± 1% |
| Staff Gauge | Water depth | ± 1 mm |
| Survey Rod | Elevation | ± 1 mm |
| Measuring Tape | Distance | ± 1 mm |
| YSI ProPlus Multi-Meter | Temperature | ± 0.2 $^{0}$C |
| YSI ProPlus Multi-Meter | Specific Conductivity | 0.5% of reading or 0.001 µs/cm, whichever is greater |
| Stop Watch | Time | ± 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 | Pressure | ± 0.001 m |
| Solinst Pressure Transducer - Pressure | Pressure | ± 0.003 m |
| Solinst Pressure Transducer | Temperature | ± 0.05 $^{0}$C (-10 to +40 C Comp. Range) |
| Graduated Bucket | Volume | ± .5 L |
| Graduated Cylinders | Volume | ± 2 mL |
| Lab Scale | Mass | ± 0.00005 kg |

## Table D-2. Hydrometric station monitoring record to the end of Q3 (April 1 through December 31, 2014).

| HID | Monitoring Start | Q1 Measurements | | Q2 Measurements | | Q3 Measurements | | Q4 Measurements | | Logger Type | Rating Curve Status[1] | Method |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | # | # Q Ratings | # | # Q Ratings | # | # Q Ratings | # | # Q Rating | | | |
| ATM-DC-2 | Continuous Year-Round | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | HOBO | N/A | N/A |
| ATM-DC-4 | Continuous Year-Round | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | Solinst | N/A | N/A |
| H-PC-U | 14-Apr-14 | 4 | N/A | Discontinued/Destroyed July, 2014 | | | | | | Solinst | N/A | SS,V |
| H-PC-DSP | 14-Apr-14 | 5 | 3 | 3 | 2 | 1 | 1 | N/A | N/A | Solinst | P | SS, V |
| H-DX+105 | 14-Apr-14 | 3 | N/A | 0 | N/A | 2 | N/A | N/A | N/A | N/A | N/A | SS, V |
| H-DC-D1b | 14-Apr-14 | 1 | N/A | 3 | N/A | 1 | N/A | N/A | N/A | N/A | N/A | SS |
| H-TP | 14-Apr-14 | 2 | N/A | 3 | N/A | 0 | N/A | N/A | N/A | N/A | N/A | SG |
| H-SEEP | 14-Apr-14 | 4 | N/A | 3 | N/A | 3 | N/A | N/A | N/A | N/A | N/A | V, Flow Meter |
| H-DC-B | 14-Apr-14 | 3 | 1 | 3 | 3 | 1 | 1 | N/A | N/A | HOBO | P | SS |
| H-DC-M | 14-Apr-14 | 5 | 4 | 3 | 3 | 2 | N/A | N/A | N/A | Solinst | P | SS, V |
| H-DC-M WP | 23-Jun-14 | 1 | N/A | 3 | 3 | 2 | 1 | N/A | N/A | Solinst | P | V, Weir |
| H-DC-R | 14-Apr-14 | 3 | 3 | 3 | 3 | 1 | 1 | N/A | N/A | HOBO | P | ADV, SS, V |
| H-BC | 15-Apr-14 | 3 | 2 | 3 | 1 | 1 | 1 | N/A | N/A | Solinst | P | ADV, SS |
| H-VC-U | 15-Apr-14 | 6 | 4 | 3 | 3 | 2 | 1 | N/A | N/A | Solinst | P | ADV, SS |
| H-VC-DBC | 15-Apr-14 | 5 | 3 | 3 | 3 | 3 | 1 | N/A | N/A | Solinst | P | ADV, SS |
| H-VC-UMN | 15-Apr-14 | 6 | 2 | 3 | 3 | 3 | 1 | N/A | N/A | Solinst | P | ADV, SS |
| H-VC-R | 15-Apr-14 | 4 | 1 | 3 | 3 | 3 | 1 | N/A | N/A | 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 December 31, 2014.

| HID | Date | Time | Measurement | Staff Gauge | Discharge | Data Flag | Water Surface Elevation |
|---|---|---|---|---|---|---|---|
| | (DD/MM/YYYY) | (HH:MM) | Type | (m, ± 2 mm) | ($m^3/s$) | Flag | (m L.D., ± 5 mm) |
| ATM-DC2 | 4/14/2014 | 16:49 | N | - | - | - | - |
| ATM-DC2 | 5/8/2014 | - | N | - | - | - | - |
| ATM-DC2 | 5/20/2014 | 15:00 | N | - | - | - | - |
| ATM-DC2 | 6/23/2014 | 9:00 | N | - | - | - | - |
| ATM-DC2 | 7/15/2014 | 12:48 | N | - | - | - | - |
| ATM-DC2 | 8/12/2014 | 10:22 | N | - | - | - | - |
| ATM-DC2 | 9/16/2014 | 16:00 | N | - | - | - | - |
| ATM-DC4 | 4/14/2014 | 16:38 | N | - | - | - | - |
| ATM-DC4 | 5/8/2014 | - | N | - | - | - | - |
| ATM-DC4 | 5/20/2014 | 15:24 | N | - | - | - | - |
| ATM-DC4 | 6/24/2014 | 8:56 | N | - | - | - | - |
| ATM-DC4 | 7/15/2014 | 12:49 | N | - | - | - | - |
| ATM-DC4 | 8/12/2014 | 10:18 | N | - | - | - | - |
| ATM-DC4 | 9/16/2014 | 16:00 | N | - | - | - | - |
| ATM-DC4 | 10/15/2014 | 9:05 | N | - | - | - | - |
| ATM-DC4 | 11/13/2014 | 15:17 | N | - | - | - | - |
| ATM-DC4 | 12/15/2014 | 16:55 | N | - | - | - | - |
| H-BC | 4/15/2014 | 11:50 | N | 0.000 | 0.000 | X | |
| H-BC | 5/9/2014 | 11:25 | SS | 0.420 | 0.373 | - | 2.060 |
| H-BC | 5/21/2014 | 12:10 | SS | 0.201 | 0.047 | - | 1.847 |
| H-BC | 6/24/2014 | 20:38 | N | 0.000 | 0.000 | X | - |
| H-BC | 7/14/2014 | 15:33 | N | 0.000 | 0.000 | X | - |
| H-BC | 8/11/2014 | 19:28 | N | 0.055 | 0.000 | X | - |
| H-BC | 9/16/2014 | 12:44 | SS | 0.173 | 0.070 | - | 1.858 |
| H-BC | 15/10/2014 | 12:50 | SS | 0.163 | 0.045 | B | 1.859 |
| H-BC | 13/11/2014 | 10:00 | N | - | - | X | - |
| H-BC | 12/16/2014 | 10:30 | N | - | - | X | - |
| H-DC-B | 4/14/2014 | 16:15 | N | - | 0.000 | X | - |
| H-DC-B | 5/8/2014 | 14:37 | SS | | 0.119 | - | 1.810 |
| H-DC-B | 5/8/2014 | 14:37 | SS | | 0.119 | - | 1.808 |
| H-DC-B | 5/20/2014 | 15:17 | SS | | 0.04 | - | - |

| HID | Date | Time | Measurement | Staff Gauge | Discharge | Data Flag | Water Surface Elevation |
|---|---|---|---|---|---|---|---|
| | (DD/MM/YYYY) | (HH:MM) | Type | (m, ± 2 mm) | ($m^3/s$) | Flag | (m L.D., ± 5 mm) |
| H-DC-B | 6/24/2014 | 10:40 | SS | | 0.01 | - | 1.430 |
| H-DC-B | 7/15/2014 | 13:19 | SS | 0.165 | 0.004 | - | - |
| H-DC-B | 8/12/2014 | 10:51 | SS | 0.19 | 0.01 | - | - |
| H-DC-B | 9/16/2014 | 15:59 | SS | 0.201 | 0.014 | - | 1.458 |
| H-DC-B | 10/15/2014 | 8:22 | SS | 0.219 | 0.027 | B | - |
| H-DC-B | 11/13/2014 | 13:00 | N | - | - | - | - |
| H-DC-B | 12/15/2014 | 16:00 | N | - | - | - | - |
| H-DC-D1b | 4/14/2014 | - | N | - | 0 | X | - |
| H-DC-D1b | 5/8/2014 | 15:00 | N | | - | X | - |
| H-DC-D1b | 5/21/2014 | 18:07 | N | - | - | X | - |
| H-DC-D1b | 6/24/2014 | 13:35 | SS | - | 0.005 | E | - |
| H-DC-D1b | 7/15/2014 | 17:45 | SS | - | 0.002 | - | - |
| H-DC-D1b | 8/12/2014 | 14:08 | SS | - | 0.005 | - | - |
| H-DC-D1b | 9/17/2014 | 11:11 | SS | - | 0.004 | - | - |
| H-DC-D1b | 10/15/2014 | 15:39 | SS | - | 0.010 | UR | - |
| H-DC-D1b | 11/13/2014 | 17:15 | N | - | - | X | - |
| H-DC-D1b | 12/15/2014 | - | N | - | - | X | - |
| H-DC-DX+105 | 4/14/2014 | 17:18 | N | - | 0.000 | X | - |
| H-DC-DX+105 | 5/8/2014 | 17:11 | SS | - | 0.019 | - | - |
| H-DC-DX+105 | 5/21/2014 | 15:08 | SS | - | 0.011 | E | - |
| H-DC-DX+105 | 6/24/2014 | 15:15 | SS | - | 0.001 | E | - |
| H-DC-DX+105 | 7/15/2014 | 18:43 | N | - | - | X | - |
| H-DC-DX+105 | 8/12/2014 | 15:15 | N | - | - | X | - |
| H-DC-DX+105 | 9/16/2014 | 18:00 | N | - | - | X | - |
| H-DC-DX+105 | 10/15/2014 | - | N | - | - | X | - |
| H-DC-DX+105 | 11/12/2014 | 17:54 | SS | - | 0.000 | O | - |
| H-DC-DX+105 | 12/16/2014 | 14:39 | SS | - | 0.001 | B | - |
| H-DC-M | 4/14/2014 | 14:40 | SS | - | 0.002 | B | 1.617 |
| H-DC-M | 5/8/2014 | 13:59 | SS | 0.322 | 0.154 | - | 1.798 |
| H-DC-M | 5/20/2014 | 14:30 | SS | 0.194 | 0.045 | - | 1.667 |
| H-DC-M | 6/23/2014 | 18:49 | V | 0.150 | 0.009 | - | 1.621 |
| H-DC-M | 6/23/2014 | 18:49 | SS | 0.150 | 0.012 | - | 1.621 |
| H-DC-M | 6/23/2014 | 18:49 | V | 0.150 | 0.009 | - | 1.619 |

| HID | Date | Time | Measurement | Staff Gauge | Discharge | Data Flag | Water Surface Elevation |
|---|---|---|---|---|---|---|---|
| | (DD/MM/YYYY) | (HH:MM) | Type | (m, ± 2 mm) | ($m^3/s$) | Flag | (m L.D., ± 5 mm) |
| H-DC-M | 6/23/2014 | 18:49 | SS | 0.150 | 0.012 | - | 1.619 |
| H-DC-M | 7/15/2014 | 12:30 | V | 0.148 | 0.005 | - | - |
| H-DC-M | 9/16/2014 | 14:15 | V | 0.158 | - | X | - |
| H-DC-M | 10/15/2014 | 10:41 | V | 0.159 | 0.014 | B | - |
| H-DC-M | 11/13/2014 | 13:12 | V | 0.123 | 0.004 | B | 2.294 |
| H-DC-M | 12/15/2014 | 16:05 | V | - | 0.004 | B | - |
| H-DC-M WP | 6/23/2014 | 18:49 | V | - | 0.009 | - | - |
| H-DC-M WP | 7/15/2014 | 14:30 | V | - | 0.005 | - | 2.242 |
| H-DC-M WP | 8/12/2014 | 9:15 | V | 0.382 | 0.010 | - | - |
| H-DC-M WP | 9/16/2014 | 14:15 | V | - | 0.014 | - | 2.296 |
| H-DC-M WP | 10/15/2014 | 10:41 | V | - | 0.014 | B | - |
| H-DC-M WP | 11/13/2014 | 13:14 | V | - | 0.004 | B | 2.294 |
| H-DC-M WP | 12/15/2014 | 16:05 | V | - | 0.004 | B | 2.156 |
| H-DC-R | 4/14/2014 | 13:58 | N | - | - | X | - |
| H-DC-R | 5/8/2014 | 13:24 | SS | - | 0.152 | B | - |
| H-DC-R | 5/20/2014 | 13:48 | SS | - | 0.056 | - | - |
| H-DC-R | 6/23/2014 | 17:17 | SS | 0.301 | 0.014 | - | 0.428 |
| H-DC-R | 7/15/2014 | 11:18 | SS | 0.262 | 0.009 | - | - |
| H-DC-R | 8/11/2014 | 16:26 | SS | 0.295 | 0.023 | - | - |
| H-DC-R | 9/16/2014 | 8:58 | SS | 0.355 | 0.024 | - | 0.501 |
| H-DC-R | 10/14/2014 | 16:02 | SS | 0.377 | 0.022 | B | 0.516 |
| H-DC-R | 11/12/2014 | 15:30 | N | - | - | X | - |
| H-DC-R | 12/15/2014 | - | N | - | - | X | - |
| H-PC-DSP | 4/14/2014 | 19:10 | N | 0.000 | 0.000 | X | - |
| H-PC-DSP | 5/8/2014 | 15:29 | SS | 0.318 | 0.027 | - | 2.493 |
| H-PC-DSP | 5/8/2014 | 15:29 | SS | 0.318 | 0.027 | - | 2.491 |
| H-PC-DSP | 5/20/2014 | 15:56 | SS | 0.296 | 0.006 | - | 2.456 |
| H-PC-DSP | 5/20/2014 | 15:56 | V | 0.296 | 0.005 | - | 2.456 |
| H-PC-DSP | 6/24/2014 | 16:54 | V | 0.171 | 0.001 | - | 2.323 |
| H-PC-DSP | 6/24/2014 | 16:54 | V | 0.171 | 0.001 | - | 2.325 |
| H-PC-DSP | 7/14/2014 | 17:45 | V | 0.000 | 0.002 | - | - |
| H-PC-DSP | 8/12/2014 | 12:34 | V | 0.162 | 0.494 | - | - |
| H-PC-DSP | 9/15/2014 | 17:50 | V | 0.276 | 0.003 | - | 2.425 |

| HID | Date | Time | Measurement | Staff Gauge | Discharge | Data Flag | Water Surface Elevation |
|---|---|---|---|---|---|---|---|
| | (DD/MM/YYYY) | (HH:MM) | Type | (m, ± 2 mm) | ($m^3/s$) | Flag | (m L.D., ± 5 mm) |
| H-PC-DSP | 10/14/2014 | 17:24 | V | 0.312 | 0.003 | B | 2.460 |
| H-PC-DSP | 11/12/2014 | 16:50 | N | - | - | X | - |
| H-PC-DSP | 12/15/2014 | - | N | - | - | X | - |
| H-PC-U | 4/14/2014 | - | N | - | 0.000 | X | - |
| H-PC-U | 5/8/2014 | 16:12 | SS | - | 0.024 | - | - |
| H-PC-U | 5/20/2014 | 16:46 | SS | - | 0.006 | - | - |
| H-PC-U | 6/23/2014 | 13:25 | SS | - | 0.001 | - | - |
| H-SEEP | 4/14/2014 | 15:40 | V | - | 0.003 | - | - |
| H-SEEP | 5/9/2014 | 13:03 | N | - | - | - | - |
| H-SEEP | 5/21/2014 | 13:15 | V | - | 0.001 | - | - |
| H-SEEP | 6/24/2014 | 9:28 | V | 0.208 | 0.003 | - | - |
| H-SEEP | 7/16/2014 | 10:25 | V | 0.205 | 0.003 | - | - |
| H-SEEP | 8/12/2014 | 10:00 | V | 0.230 | 0.003 | - | - |
| H-SEEP | 9/16/2014 | 15:21 | V | 0.200 | 0.003 | - | - |
| H-SEEP | 10/14/2014 | 18:07 | V | - | 0.003 | - | - |
| H-SEEP | 11/13/2014 | 14:00 | V | - | 0.003 | - | - |
| H-SEEP | 12/15/2014 | 16:40 | V | - | 0.003 | - | - |
| H-TP | 4/14/2014 | 15:16 | N | - | - | X | - |
| H-TP | 5/9/2014 | 13:25 | N | 1.855 | - | - | - |
| H-TP | 5/21/2014 | 13:35 | N | 1.877 | - | - | - |
| H-TP | 6/24/2014 | 9:45 | N | 1.629 | - | - | - |
| H-TP | 7/15/2014 | 16:30 | N | 1.475 | - | - | - |
| H-TP | 8/12/2014 | 11:20 | N | 1.388 | - | - | - |
| H-TP | 9/16/2014 | 16:42 | N | 1.376 | - | - | - |
| H-TP | 10/14/2014 | - | N | - | - | - | - |
| H-TP | 11/13/2014 | - | N | - | - | - | - |
| H-TP | 12/15/2014 | - | N | - | - | - | - |
| H-VC-DBC | 4/15/2014 | 9:50 | CM-MID | 0.368 | 0.047 | B | 1.724 |
| H-VC-DBC | 4/15/2014 | 9:50 | SS | 0.368 | 0.044 | B | 1.724 |
| H-VC-DBC | 5/9/2014 | 11:40 | ADV-MID | 0.732 | 2.388 | - | 2.086 |
| H-VC-DBC | 5/9/2014 | 11:40 | ADV-MID | 0.732 | 2.388 | - | 2.083 |
| H-VC-DBC | 5/21/2014 | 10:25 | ADV-MID | 0.526 | 0.627 | - | 1.878 |
| H-VC-DBC | 6/24/2014 | 19:28 | ADV-MID | 0.406 | 0.177 | - | 1.748 |

| HID | Date | Time | Measurement | Staff Gauge | Discharge | Data Flag | Water Surface Elevation |
|---|---|---|---|---|---|---|---|
| | (DD/MM/YYYY) | (HH:MM) | Type | (m, ± 2 mm) | ($m^3/s$) | Flag | (m L.D., ± 5 mm) |
| H-VC-DBC | 6/24/2014 | 19:28 | ADV-MID | 0.406 | 0.177 | - | 1.751 |
| H-VC-DBC | 7/14/2014 | 14:40 | ADV-MID | 0.378 | 0.104 | - | 1.729 |
| H-VC-DBC | 8/11/2014 | 17:45 | ADV-MID | 0.433 | 0.288 | - | - |
| H-VC-DBC | 9/16/2014 | 10:07 | ADV-MID | 0.526 | 0.670 | - | 1.874 |
| H-VC-DBC | 10/15/2014 | 11:20 | ADV-MID | 0.495 | 0.478 | B | 1.845 |
| H-VC-DBC | 11/13/2014 | 9:30 | ADV-MID | - | 0.227 | B | - |
| H-VC-DBC | 12/16/2014 | 9:25 | ADV-MID | - | 0.178 | B | - |
| H-VC-R | 5/8/2014 | 11:54 | ADV-MID | 0.765 | 3.204 | - | 2.338 |
| H-VC-R | 5/8/2014 | 11:54 | ADV-MID | 0.765 | 3.204 | - | 2.345 |
| H-VC-R | 5/8/2014 | 11:54 | ADV-MID | 0.765 | 3.204 | - | 2.337 |
| H-VC-R | 5/20/2014 | 13:03 | ADV-MID | 0.594 | 0.758 | - | 2.167 |
| H-VC-R | 6/23/2014 | 16:03 | ADV-MID | 0.487 | 0.179 | SH-L | 2.061 |
| H-VC-R | 7/14/2014 | 16:46 | ADV-MID | 0.471 | 0.121 | - | 2.050 |
| H-VC-R | 8/11/2014 | 12:40 | ADV-MID | 0.522 | 0.329 | - | - |
| H-VC-R | 9/15/2014 | 14:39 | ADV-MID | 0.579 | 0.770 | - | 2.173 |
| H-VC-U | 5/9/2014 | 11:37 | ADV-MID | 0.415 | 1.929 | - | 2.313 |
| H-VC-U | 5/9/2014 | 11:37 | ADV-MID | 0.415 | 1.929 | - | 2.315 |
| H-VC-U | 5/21/2014 | 11:21 | SS | 0.227 | 0.392 | - | 2.133 |
| H-VC-U | 5/21/2014 | 11:21 | ADV-MID | 0.227 | 0.556 | - | 2.133 |
| H-VC-U | 6/24/2014 | 20:05 | ADV-MID | 0.138 | 0.172 | - | 2.048 |
| H-VC-U | 7/14/2014 | 13:09 | ADV-MID | 0.113 | 0.144 | - | 2.021 |
| H-VC-U | 8/11/2014 | 18:52 | ADV-MID | 0.160 | 0.261 | - | - |
| H-VC-U | 9/16/2014 | 11:20 | ADV-MID | 0.238 | 0.571 | - | 2.147 |
| H-VC-U | 10/15/2014 | 12:18 | ADV-MID | 0.201 | 0.422 | | 2.113 |
| H-VC-U | 11/13/2014 | 10:40 | ADV-MID | - | 0.185 | - | - |
| H-VC-U | 12/16/2014 | 10:15 | ADV-MID | - | - | S | - |
| H-VC-UMN | 4/15/2014 | 8:40 | SS | 0.528 | 0.019 | B | - |
| H-VC-UMN | 4/15/2014 | 8:40 | CM-MID | 0.528 | 0.022 | B | - |
| H-VC-UMN | 5/9/2014 | 8:30 | ADV-MID | 0.900 | 2.605 | - | 1.918 |
| H-VC-UMN | 5/9/2014 | 8:30 | ADV-MID | 0.900 | 2.605 | - | 1.919 |
| H-VC-UMN | 5/21/2014 | 8:51 | SS | 0.709 | 0.741 | - | 1.695 |
| H-VC-UMN | 5/21/2014 | 8:51 | ADV-MID | 0.709 | 0.702 | SH-SG | 1.695 |
| H-VC-UMN | 6/24/2014 | 18:29 | ADV-MID | 0.592 | 0.188 | - | 1.587 |

| HID | Date | Time | Measurement | Staff Gauge | Discharge | Data Flag | Water Surface Elevation |
|---|---|---|---|---|---|---|---|
| | (DD/MM/YYYY) | (HH:MM) | Type | (m, ± 2 mm) | ($m^3/s$) | Flag | (m L.D., ± 5 mm) |
| H-VC-UMN | 7/15/2014 | 9:00 | ADV-MID | 0.571 | 0.120 | - | 1.569 |
| H-VC-UMN | 8/11/2014 | 15:00 | ADV-MID | 0.622 | 0.283 | - | - |
| H-VC-UMN | 9/15/2014 | 16:10 | ADV-MID | 0.700 | 0.660 | - | 1.681 |
| H-VC-UMN | 10/14/2014 | 14:30 | ADV-MID | 0.677 | 0.511 | B | 1.665 |
| H-VC-UMN | 11/12/2014 | 14:35 | ADV-MID | 0.677 | 0.199 | B | - |
| H-VC-UMN | 12/15/2014 | 14:38 | ADV-MID | 0.677 | 0.134 | B | - |

Notes:
HID = Hydrometric ID, unique hydrometric station identifier in hydrometric database.
L.D. = Local datum.
Measurement types: ADV – acoustic Doppler volocimeter; 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 through December 31, 2014.

| Station | Date | Time | BM 1 | BM 2 | BM 3 | Logger Rod | TOS | Water Surface |
|---|---|---|---|---|---|---|---|---|
| | | | (m L.D.) | (m L.D.) | (m L.D.) | (m L.D.) | (m L.D.) | (m L.D.) |
| H-BC | 5/9/2014 | 11:40 | 3 | 2.991 | 3.018 | 2.876 | 2.640 | 2.060 |
| H-BC | 5/21/2014 | 12:21 | 3 | 3.009 | 3.028 | 2.881 | 2.645 | 1.847 |
| H-BC | 9/16/2014 | 13:03 | 3 | 3.016 | 3.065 | 2.919 | 2.686 | 1.858 |
| H-BC | 9/16/2014 | 13:03 | 3 | 3.016 | 3.065 | 2.919 | 2.686 | 1.858 |
| H-BC | 10/15/2014 | 13:11 | 3 | 3.015 | 3.066 | 2.919 | 2.686 | 1.859 |
| H-DC-B | 5/8/2014 | - | 3 | 3.355 | 2.997 | - | - | 1.809 |
| H-DC-B | 6/24/2014 | 10:50 | 3 | 3.351 | 2.993 | 2.775 | - | 1.431 |
| H-DC-B | 9/16/2014 | 16:27 | 3 | 3.351 | 2.993 | 2.796 | 2.252 | 1.458 |
| H-DC-B | 9/16/2014 | 16:27 | 3 | 3.351 | 2.993 | 2.796 | 2.252 | 1.458 |
| H-DC-M | 4/14/2014 | 14:32 | 3 | 2.713 | 2.319 | 2.711 | 2.480 | 1.617 |
| H-DC-M | 5/8/2014 | 14:10 | 3 | 2.313 | 2.713 | 2.727 | 2.479 | 1.798 |
| H-DC-M | 5/20/2014 | 14:34 | 3 | 2.315 | 2.712 | 2.709 | 2.478 | 1.667 |
| H-DC-M | 6/23/2014 | 19:23 | 3 | 2.519 | 2.718 | 2.702 | 2.470 | 1.620 |

| Station | Date | Time | BM 1 | BM 2 | BM 3 | Logger Rod | TOS | Water Surface |
|---|---|---|---|---|---|---|---|---|
| | | | (m L.D.) | (m L.D.) | (m L.D.) | (m L.D.) | (m L.D.) | (m L.D.) |
| H-DC-M | 7/14/2014 | 14:45 | 3 | 2.338 | 2.725 | 2.716 | 2.483 | 1.617 |
| H-DC-M | 7/14/2014 | 14:45 | 3 | 2.338 | 2.725 | 2.716 | 2.483 | 1.617 |
| H-DC-M | 9/16/2014 | 15:00 | 2.035* | 1.756 | 1.376 | - | - | - |
| H-DC-M | 9/16/2014 | 15:00 | 2.035* | 1.756 | 1.376 | - | - | - |
| H-DC-M WP | 7/15/2014 | 15:45 | 3 | 2.284 | 2.875 | 3.523 | 2.973 | 2.242 |
| H-DC-M WP | 7/15/2014 | 15:45 | 3 | 2.284 | 2.875 | 3.523 | 2.973 | 2.242 |
| H-DC-M WP | 9/16/2014 | 15:00 | 3 | 2.287 | 2.876 | - | - | 2.296 |
| H-DC-M WP | 9/16/2014 | 15:00 | 3 | 2.287 | 2.876 | - | - | 2.296 |
| H-DC-M WP | 10/15/2014 | 10:32 | 3 | 2.285 | 2.874 | 3.561 | 2.967 | 2.291 |
| H-DC-M WP | 11/13/2014 | 13:20 | 3 | 2.292 | 2.872 | 3.558 | 2.964 | 2.220 |
| H-DC-R | 6/23/2014 | | 3 | 2.973 | 2.3125 | 1.968 | 1.132 | 0.425 |
| H-DC-R | 9/16/2014 | 9:01 | 3 | 2.986 | 2.314 | 1.984 | 1.15 | 0.502 |
| H-DC-R | 10/14/2014 | 16:25 | 3 | 2.988 | 2.313 | 1.989 | 1.152 | 0.516 |
| H-PC-DSP | 5/8/2014 | 15:56 | 3 | 3.658 | 3.248 | 3.424 | 3.1725 | 2.492 |
| H-PC-DSP | 5/20/2014 | 16:09 | 3 | 3.250 | 3.635 | 3.418 | 3.169 | 2.456 |
| H-PC-DSP | 6/24/2014 | 17:00 | 3 | 3.2425 | 3.6225 | 3.3965 | 3.148 | 2.324 |
| H-PC-DSP | 9/15/2014 | 17:40 | 3 | 3.242 | 3.625 | 3.398 | 3.148 | 2.425 |
| H-PC-DSP | 10/14/2014 | 17:14 | 3 | 3.241 | 3.625 | 3.396 | 3.148 | 2.460 |
| H-VC-DBC | 4/15/2014 | 10:40 | 3 | 3.029 | 2.919 | 2.571 | 2.354 | 1.724 |
| H-VC-DBC | 5/9/2014 | 9:50 | 3 | 3.024 | 2.917 | 2.565 | 2.341 | 2.084 |
| H-VC-DBC | 5/21/2014 | 10:37 | 3 | 3.028 | 2.918 | 2.568 | 2.355 | 1.878 |
| H-VC-DBC | 6/24/2014 | 19:33 | 3 | 3.026 | 2.910 | 2.567 | 2.348 | 1.749 |
| H-VC-DBC | 7/14/2014 | 14:55 | 3 | 3.026 | 2.911 | 2.569 | 2.35 | 1.729 |
| H-VC-DBC | 9/16/2014 | 10:28 | 3 | 3.027 | 1.911 | 2.567 | 2.349 | 1.877 |
| H-VC-DBC | 10/15/2014 | 11:34 | 3 | 3.027 | 2.909 | 2.567 | 2.349 | 1.845 |
| H-VC-DBC | 11/13/2014 | 10:22 | 3 | 3.028 | 2.910 | 2.570 | 2.351 | - |
| H-VC-R | 4/14/2014 | 13:20 | 3 | 3.431 | 3.170 | 2.812 | 2.573 | - |

| Station | Date | Time | BM 1 | BM 2 | BM 3 | Logger Rod | TOS | Water Surface |
|---|---|---|---|---|---|---|---|---|
| | | | (m L.D.) | (m L.D.) | (m L.D.) | (m L.D.) | (m L.D.) | (m L.D.) |
| H-VC-R | 4/14/2014 | 13:20 | 3 | 3.431 | 3.170 | 2.812 | 2.573 | - |
| H-VC-R | 5/8/2014 | 12:20 | 3 | 3.4315 | 3.171 | 2.811 | - | 2.34 |
| H-VC-R | 5/8/2014 | 12:20 | 3 | 3.432 | 3.171 | 2.811 | - | 2.34 |
| H-VC-R | 5/20/2014 | 13:16 | 3 | 3.426 | 3.172 | 2.870 | 2.575 | 2.167 |
| H-VC-R | 5/20/2014 | 13:16 | 3 | 3.426 | 3.172 | 2.87 | 2.575 | 2.167 |
| H-VC-R | 6/23/2014 | 16:22 | 3 | 3.417 | 3.167 | 2.891 | 2.575 | 2.059 |
| H-VC-R | 6/23/2014 | 16:22 | 3 | 3.417 | 3.167 | 2.891 | 2.575 | 2.059 |
| H-VC-R | 7/14/2014 | 16:50 | 3 | 3.423 | 3.167 | 2.893 | 3.579 | 2.05 |
| H-VC-R | 9/15/2014 | 14:50 | 3 | 3.433 | 3.178 | 2.902 | 2.588 | 2.173 |
| H-VC-R | 10/14/2014 | 13:44 | 3 | 3.426 | 3.175 | 2.898 | 2.585 | 2.139 |
| H-VC-R | 11/12/2014 | 13:44 | 3 | 3.427 | 3.172 | 2.896 | 2.581 | - |
| H-VC-U | 4/15/2014 | | 3 | 3.359 | 3.243 | 3.15 | 2.904 | - |
| H-VC-U | 5/9/2014 | 10:40 | 3 | 3.361 | 3.244 | 3.149 | 2.902 | 2.314 |
| H-VC-U | 5/21/2014 | 11:45 | 3 | 3.359 | 3.242 | 3.148 | 2.904 | 2.133 |
| H-VC-U | 6/24/2014 | 20:31 | 3 | 3.356 | 3.244 | 3.1555 | 2.910 | 2.048 |
| H-VC-U | 7/14/2014 | 13:55 | 3 | 3.356 | 3.243 | 3.156 | 2.91 | 2.026 |
| H-VC-U | 9/16/2014 | 11:34 | 3 | 3.357 | 3.241 | 3.156 | 2.91 | 2.147 |
| H-VC-U | 10/15/2014 | 12:22 | 3 | 3.352 | 3.242 | 3.156 | 2.912 | 2.113 |
| H-VC-U | 11/13/2014 | 11:00 | 3 | 3.355 | 3.238 | 3.158 | 2.913 | - |
| H-VC-UMN | 5/9/2014 | 9:00 | 3 | 3.008 | 2.678 | 2.191 | 1.984 | 1.918 |
| H-VC-UMN | 5/21/2014 | 9:18 | 3 | 3.007 | 2.678 | 2.207 | 1.993 | 1.695 |
| H-VC-UMN | 6/24/2014 | 18:27 | 3 | 3.009 | 2.677 | 2.21 | 1.996 | 1.588 |
| H-VC-UMN | 7/15/2014 | 9:00 | 3 | 3.007 | 2.678 | 2.212 | 1.997 | 1.57 |
| H-VC-UMN | 9/15/2014 | 16:52 | 3 | 3.004 | 2.673 | 2.214 | 1.999 | 1.681 |
| H-VC-UMN | 10/14/2014 | 14:31 | 3 | 3.005 | 2.674 | 2.213 | 1.999 | - |
| H-VC-UMN | 11/12/2014 | 15:15 | 3 | 3.006 | 2.671 | 2.210 | 2.004 | - |

Notes:
L.D. = Local datum TOS = Top of Staff Gauge LoggerRod = Top of fixed-length data logger installation rod *Survey measurements obtained using H-DC-M WP local datum

## Table D-5. Seepage Pond discharge volumetric measurements, April 1 to December 31, 2014.

| HID | Measurement Date | | Method | Discharge | |
|---|---|---|---|---|---|
| | Date | Time | | $m^3/s$ | L/s |
| H-SEEP | 4/14/2014 | 15:40 | V | 0.003 | 3 |
| H-SEEP | 5/9/2014 | 13:03 | - | - | - |
| H-SEEP | 5/21/2014 | 13:15 | V | 0.001 | 1 |
| H-SEEP | 6/24/2014 | 9:28 | V | 0.003 | 3 |
| H-SEEP | 7/16/2014 | 10:25 | V | 0.003 | 3 |
| H-SEEP | 8/12/2014 | 10:00 | V | 0.003 | 3 |
| H-SEEP | 9/16/2014 | 15:21 | V | 0.003 | 3 |
| H-SEEP | 10/14/2014 | 18:07 | V | 0.003 | 3 |
| H-SEEP | 11/13/2014 | 14:00 | V | 0.003 | 3 |
| H-SEEP | 12/15/2014 | 16:40 | V | 0.003 | 3 |

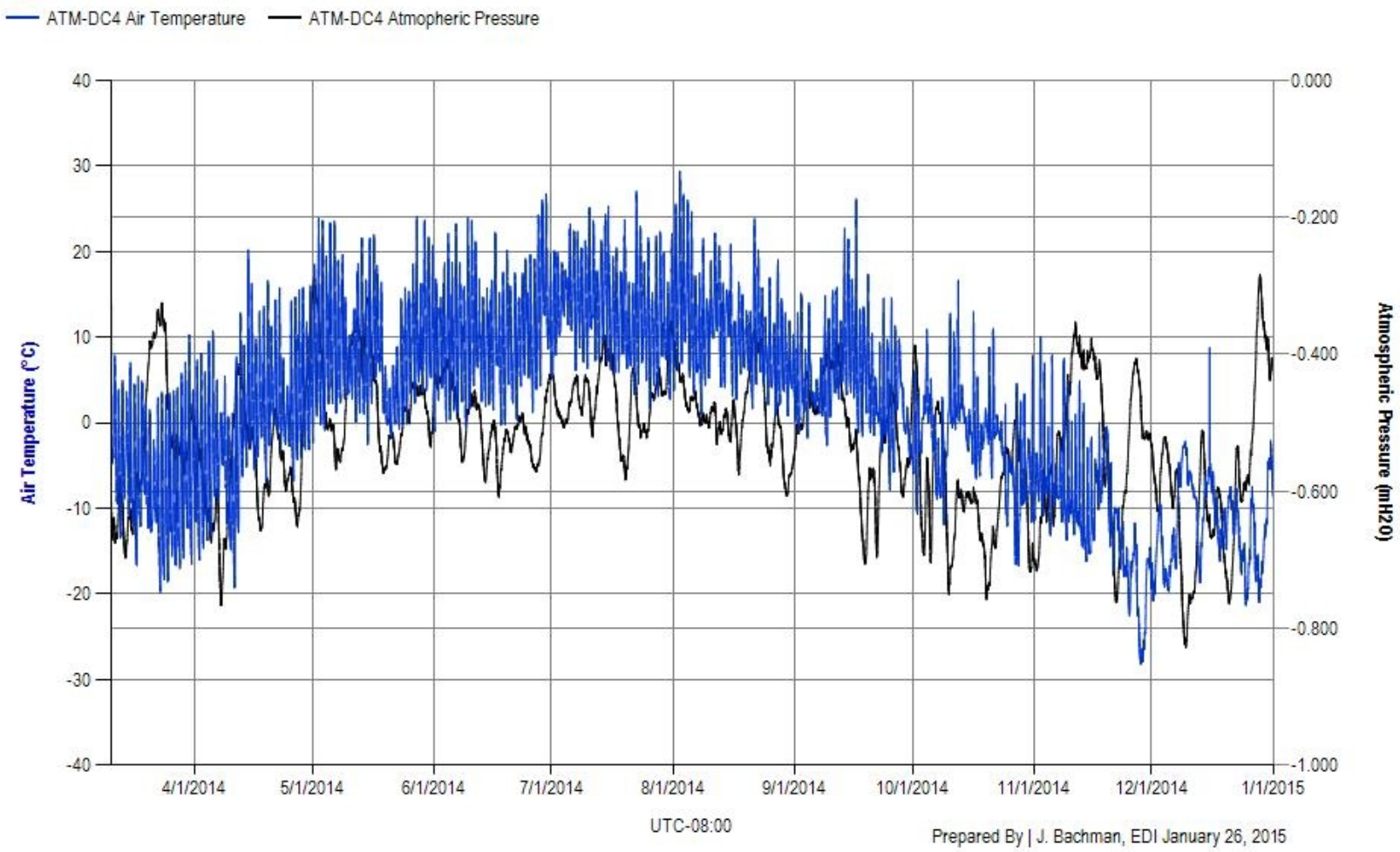


**Figure D-1. ATM-DC4 atmospheric pressure and air temperature.**

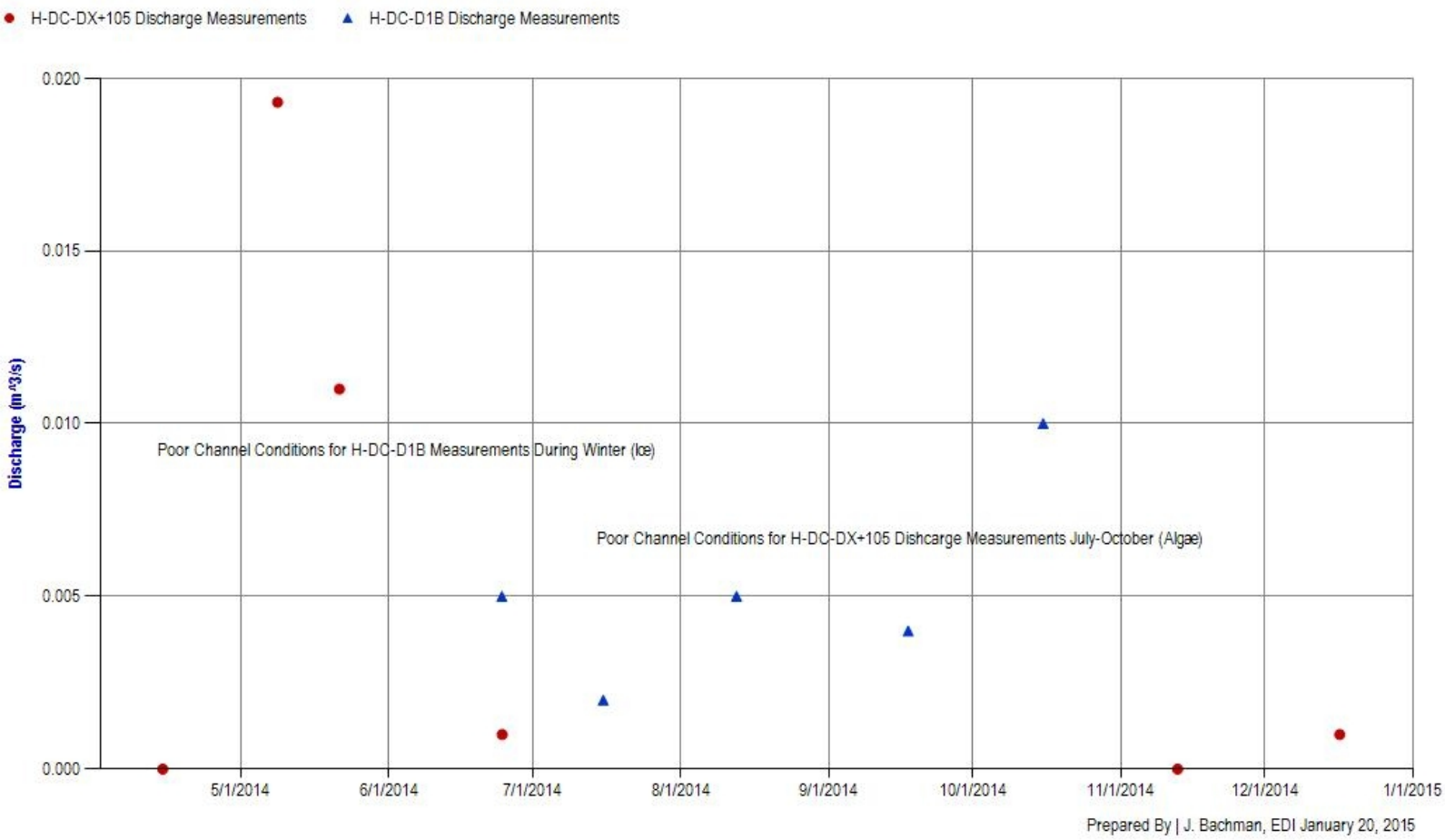


**Figure D-2. Instantaneous discharge measurements from the upper Dome Stations: H-DC-DX+105 and H-DC-D1B.**

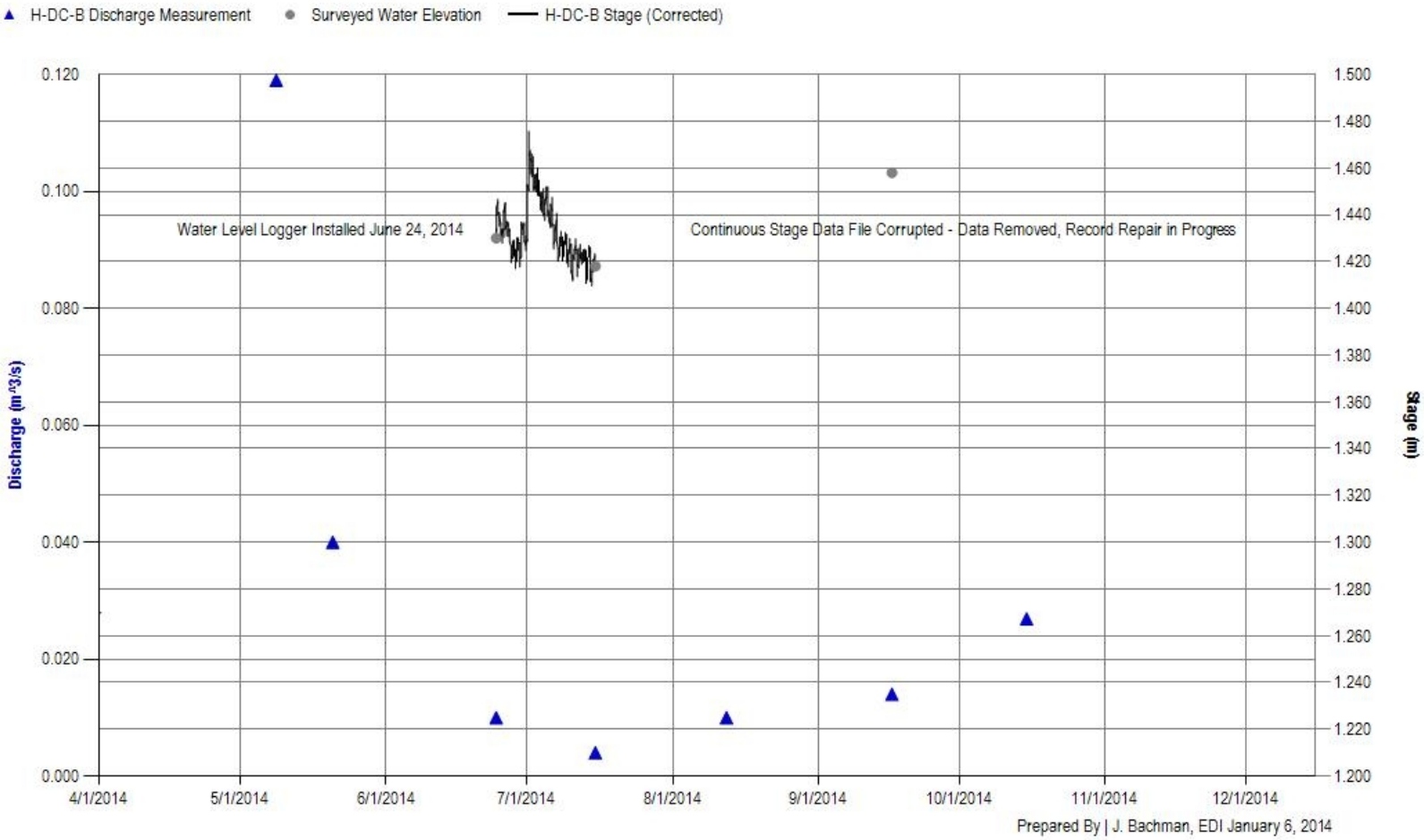


**Figure D-3. Instantaneous discharge and continuous stage measurements at H-DC-B.**

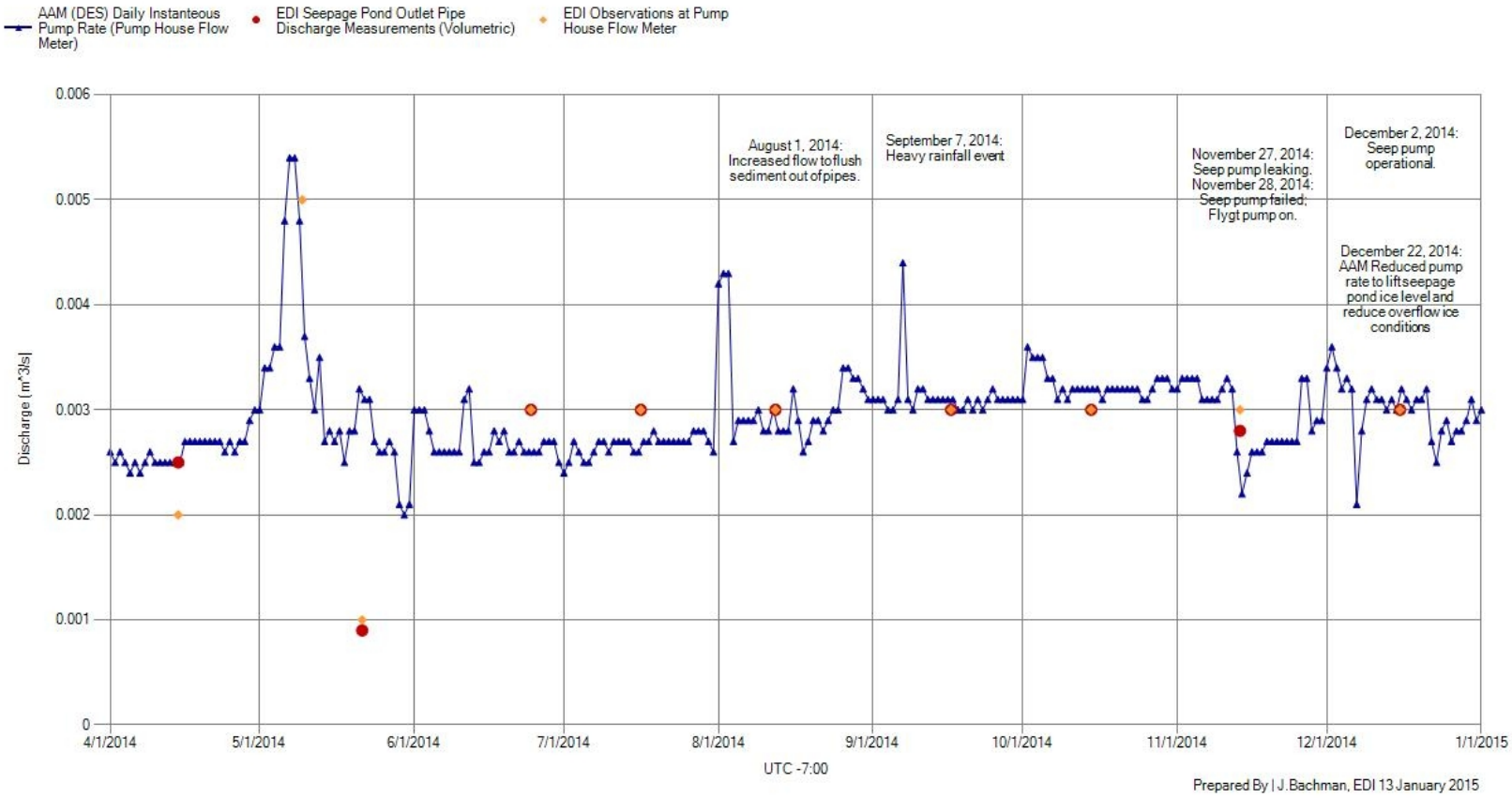


**Figure D-4. Instantaneous discharge measurements at H-SEEP, and Pump House Flow Meter.**

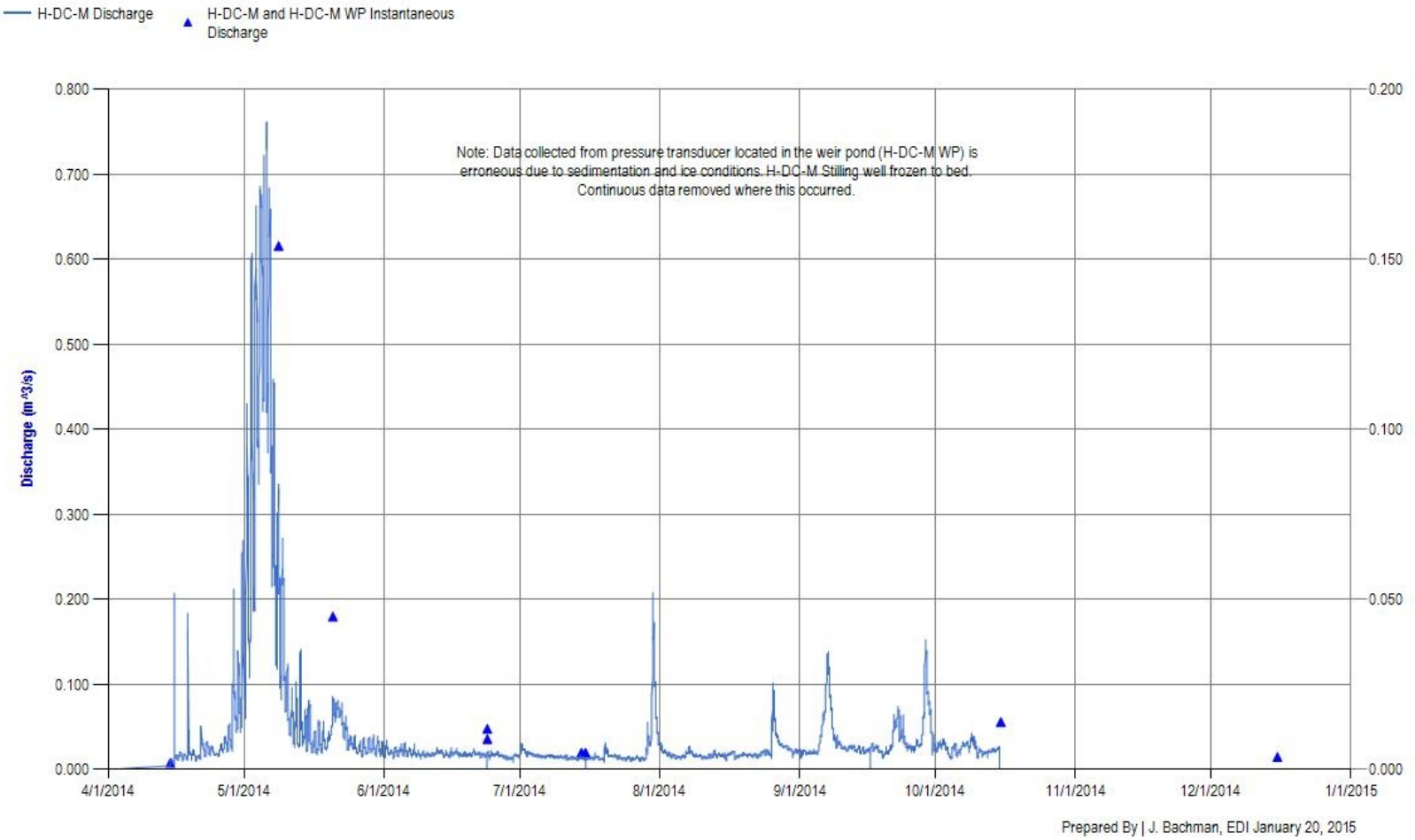


**Figure D-5. Instantaneous and continuous stage and discharge measurements at H-DC-M and H-DC-M WP.**

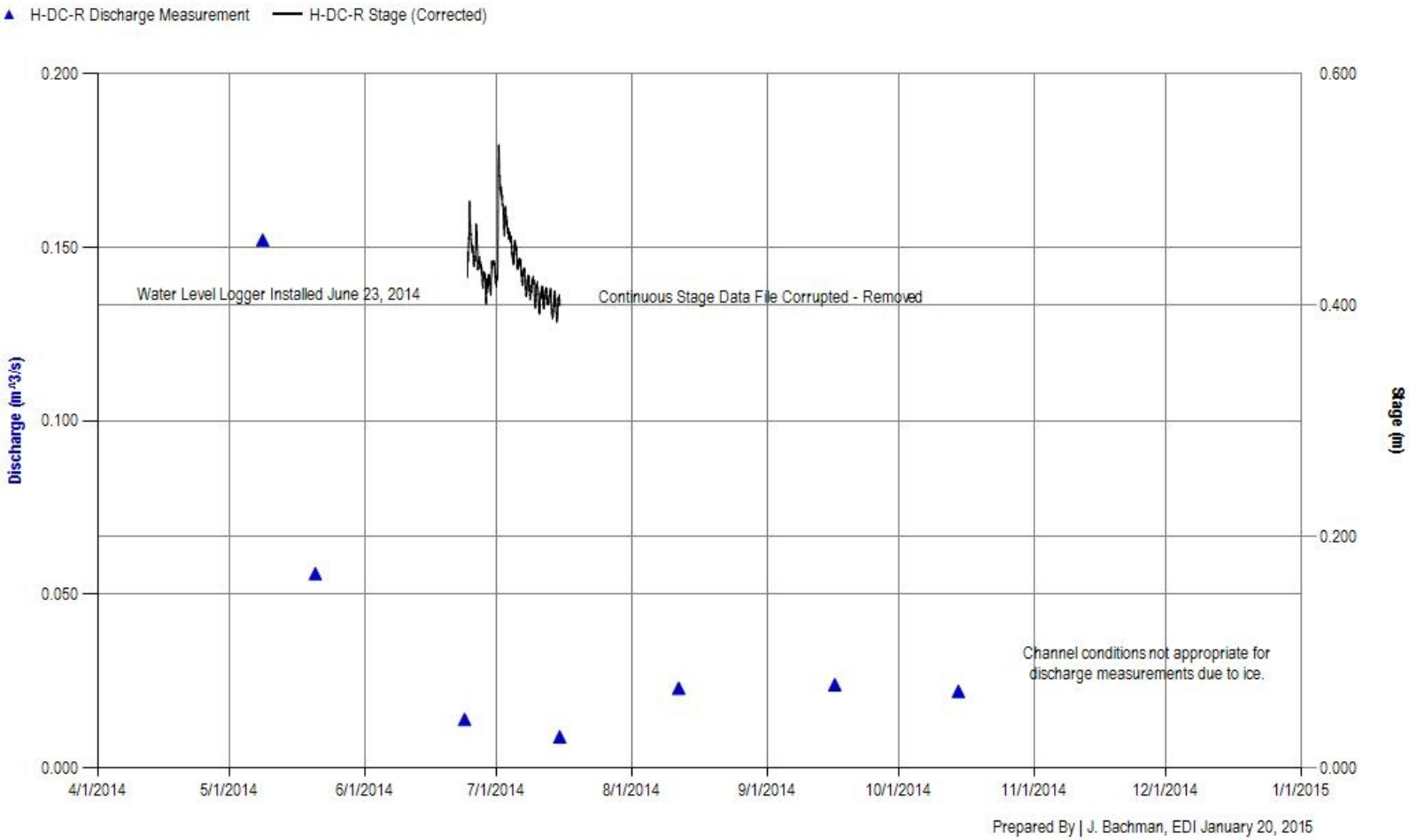


**Figure D-6. Instantaneous discharge and stage measurements with continuous stage record at H-DC-R.**

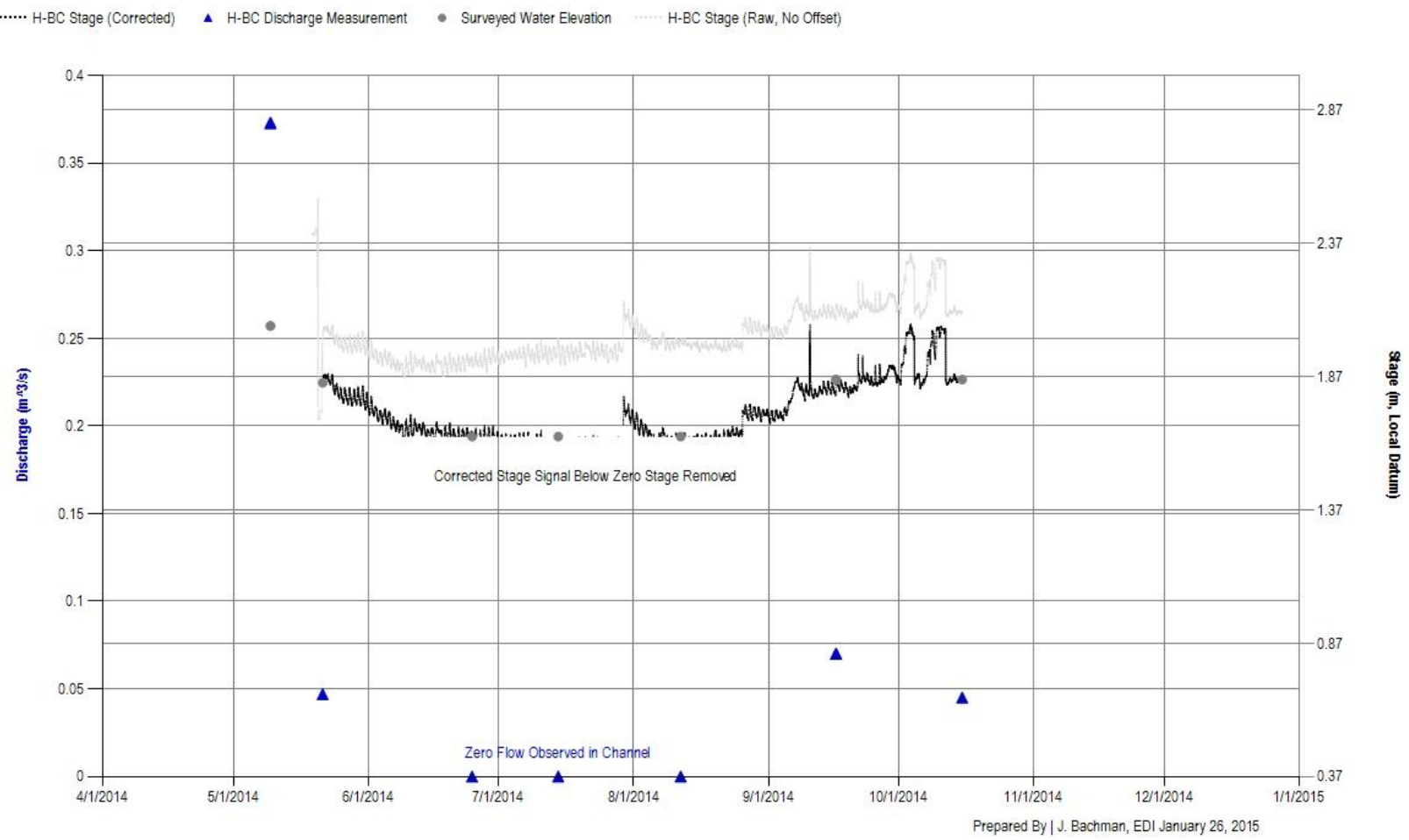


**Figure D-7. Instantaneous and continuous discharge and stage measuremetns at H-BC.**

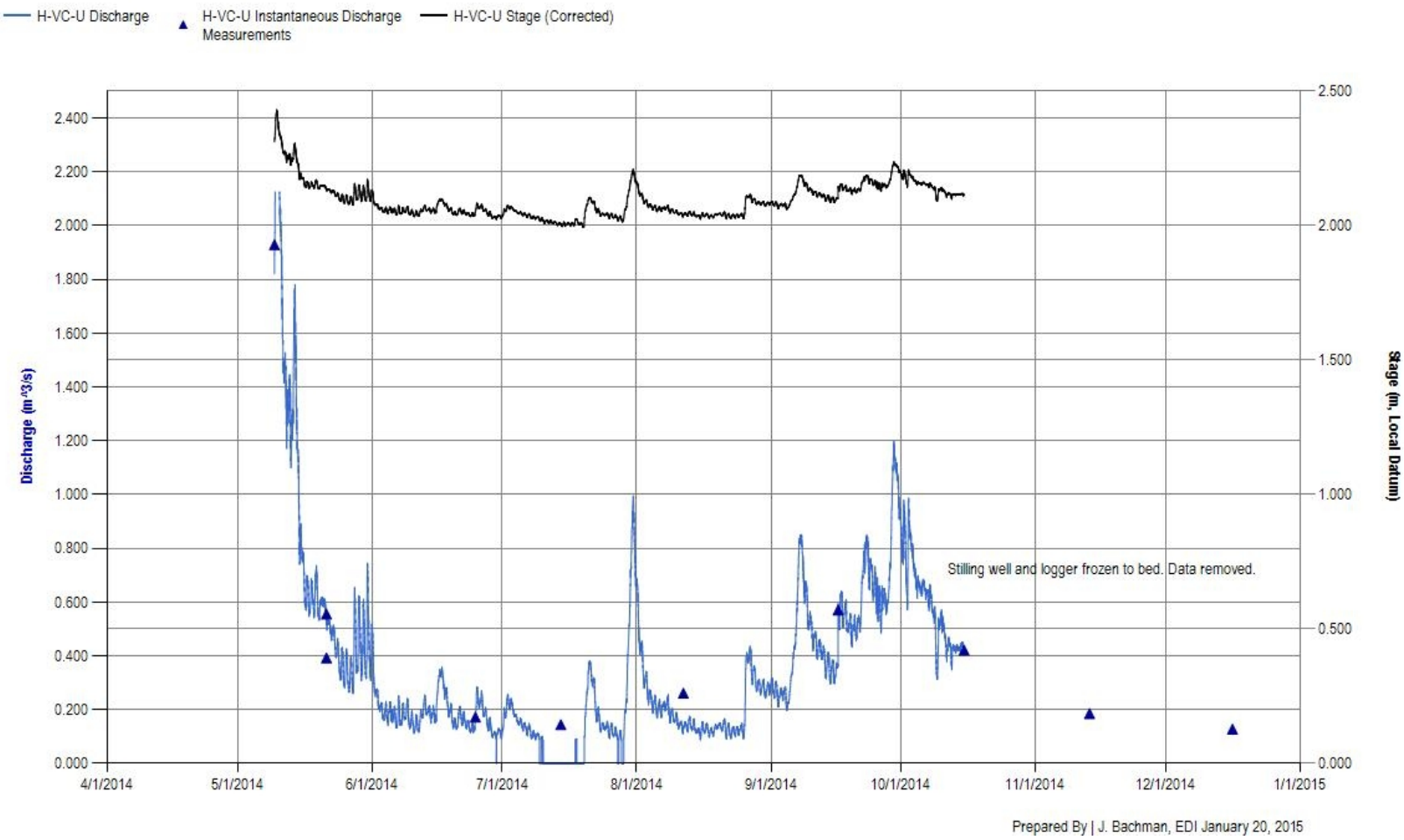


**Figure D-8. Instantaneous and continuous discharge and stage measurements at H-VC-U. Note: the continuous record was corrected using a new (preliminary) rating curve equation that differs than that used in Q2.**

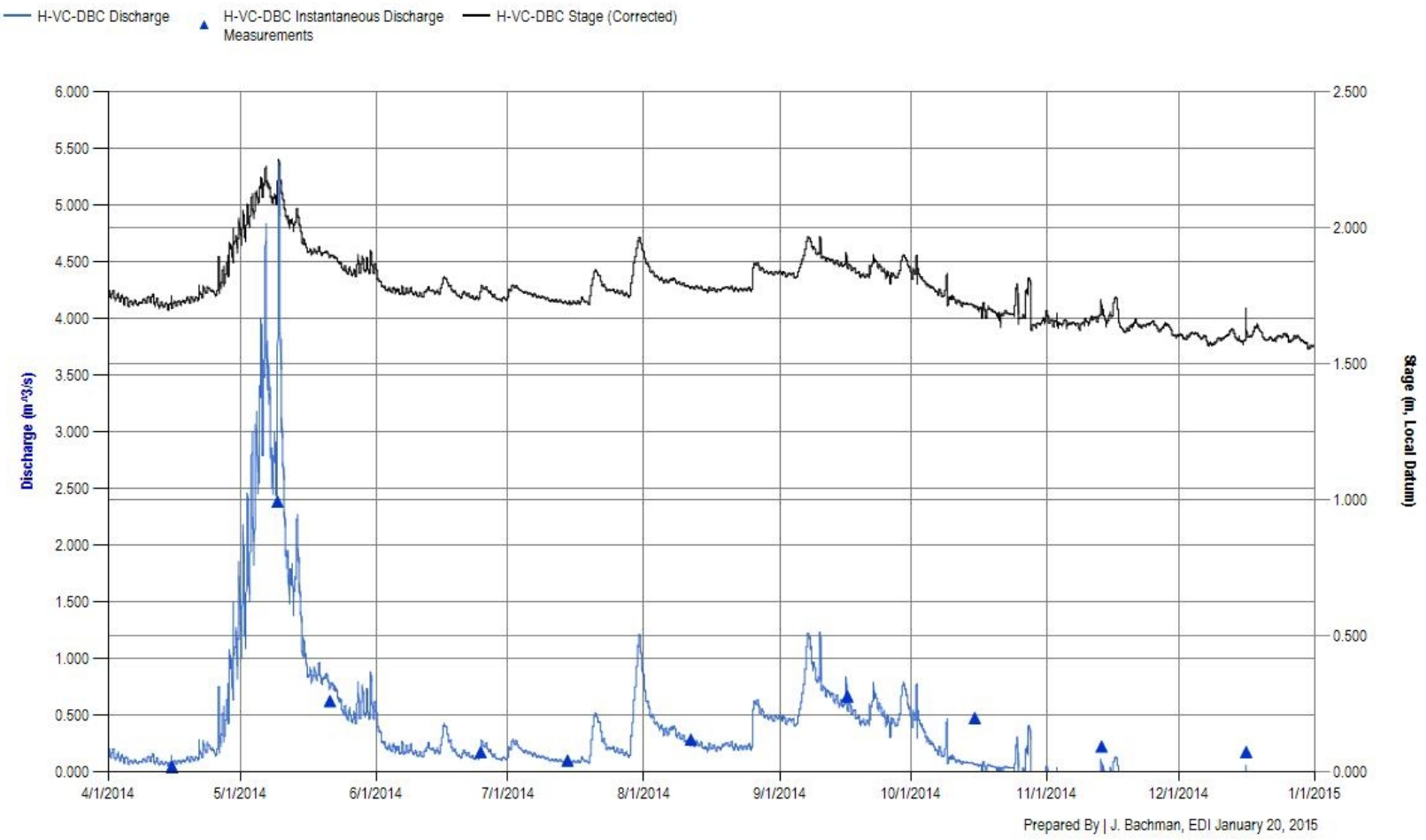


**Figure D-9. Instantaneous and continuous stage and discharge measurements at H-VC-DBC.**

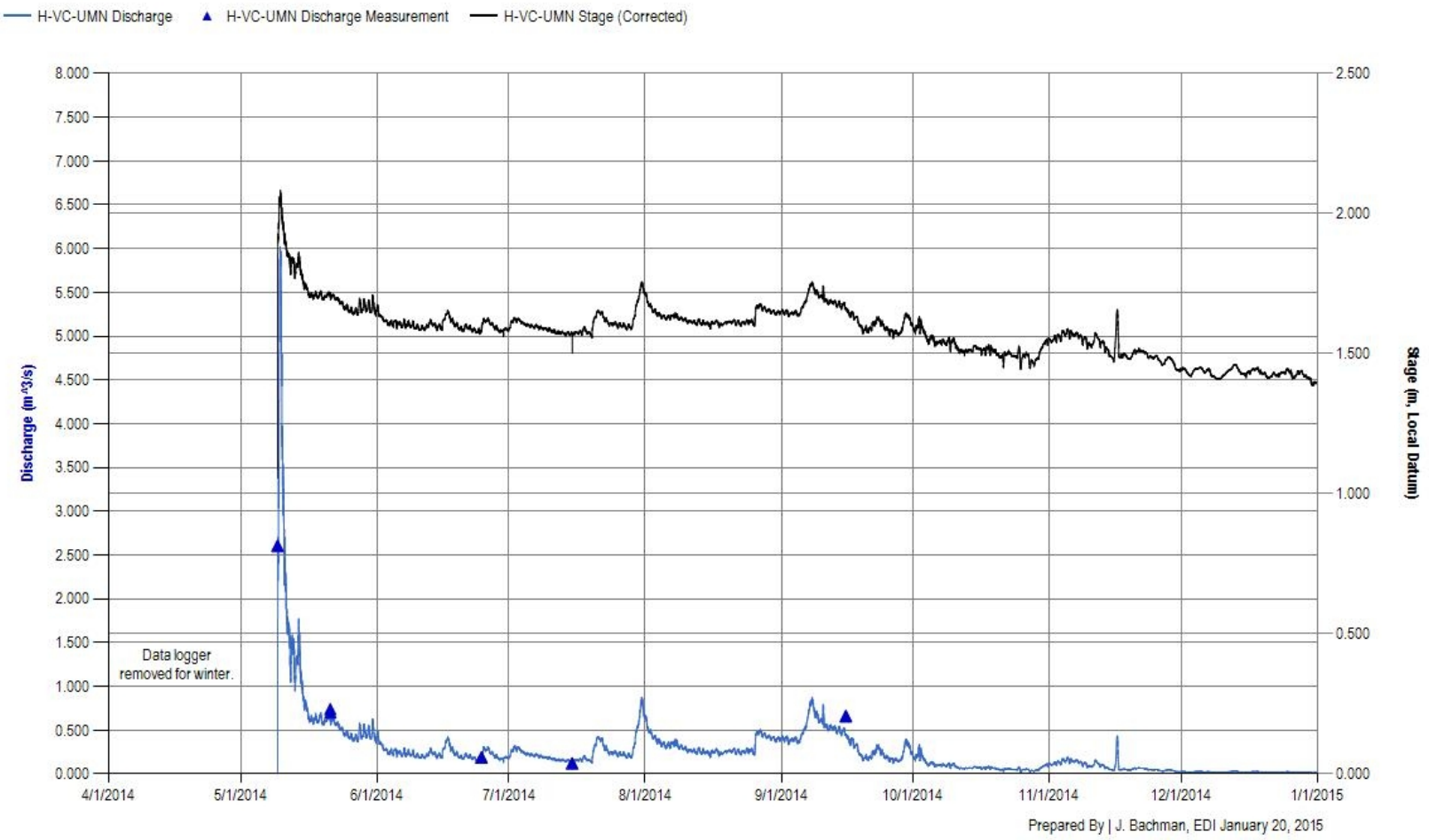


**Figure D-10. Instantaneous and continuous stage and discharge measurements at H-VC-UMN. Note: the continuous record was corrected using a new (preliminary) rating curve equation that differs than that used in Q2.**

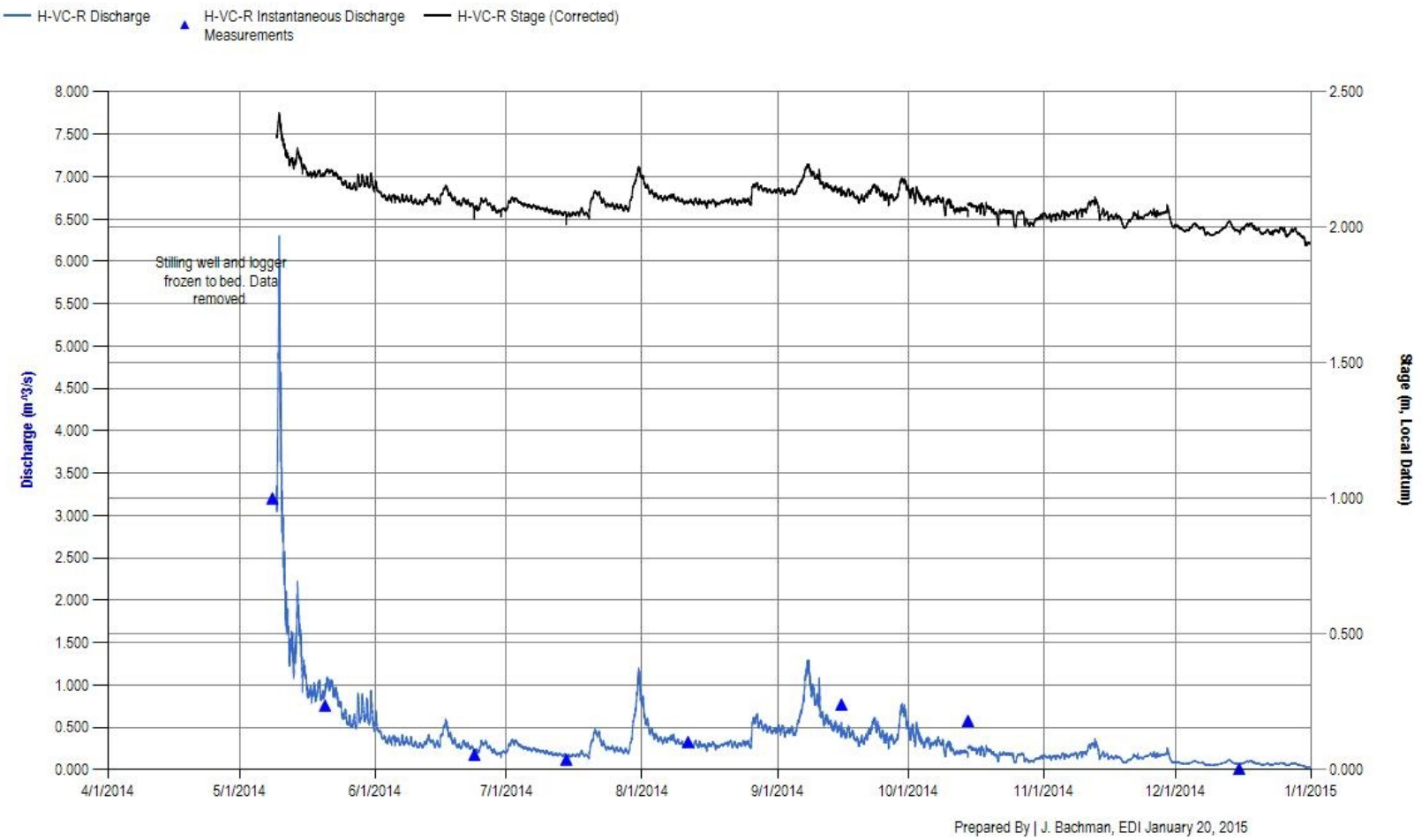


**Figure D-11. Instantaneous and continuous stage and discharge measurements at H-VC-R.**

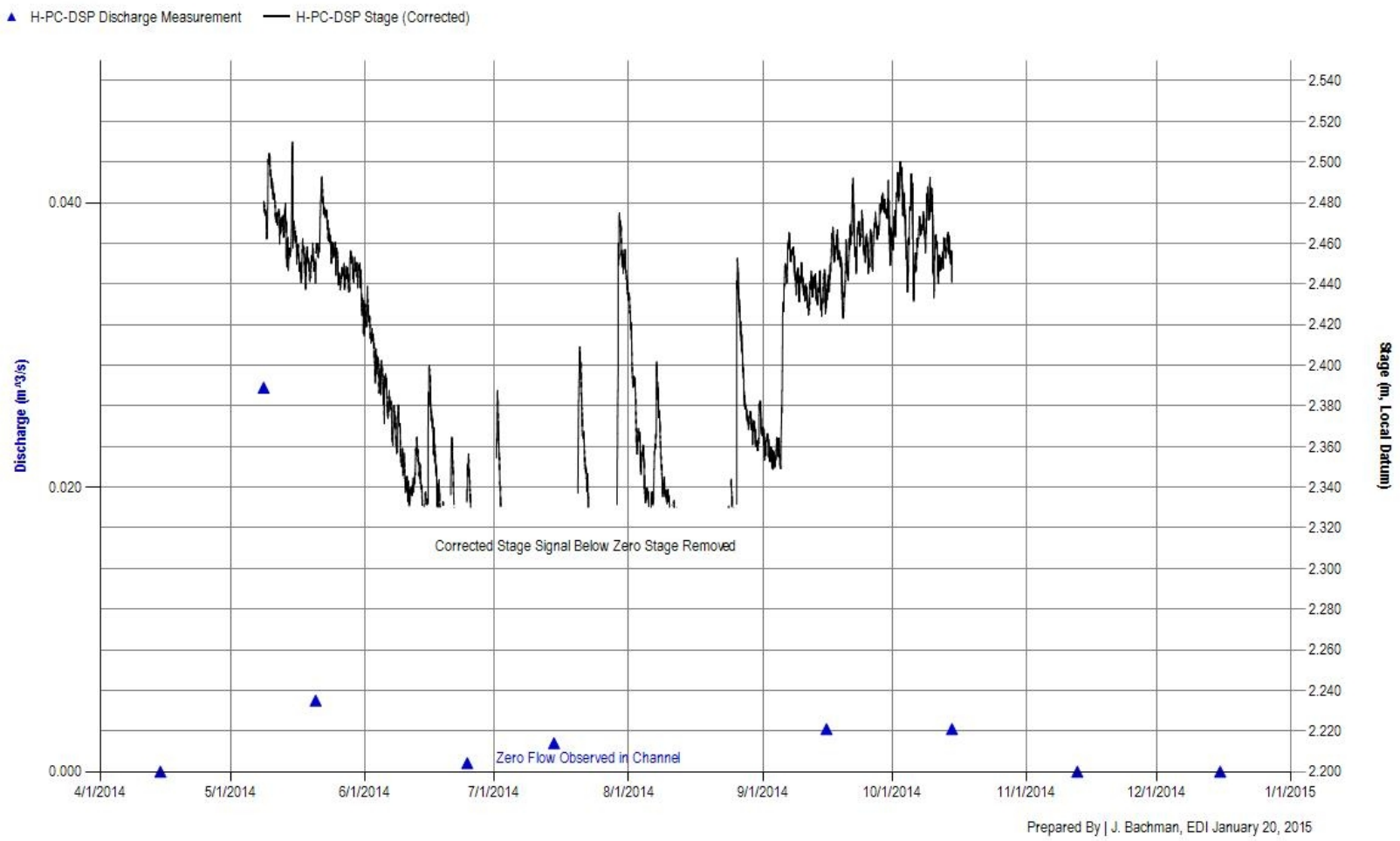


**Figure D-12. Instantaneous discharge and discharge measurements with continuous stage H-PC-DSP.**

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# APPENDIX E. WATER QUALITY DATA

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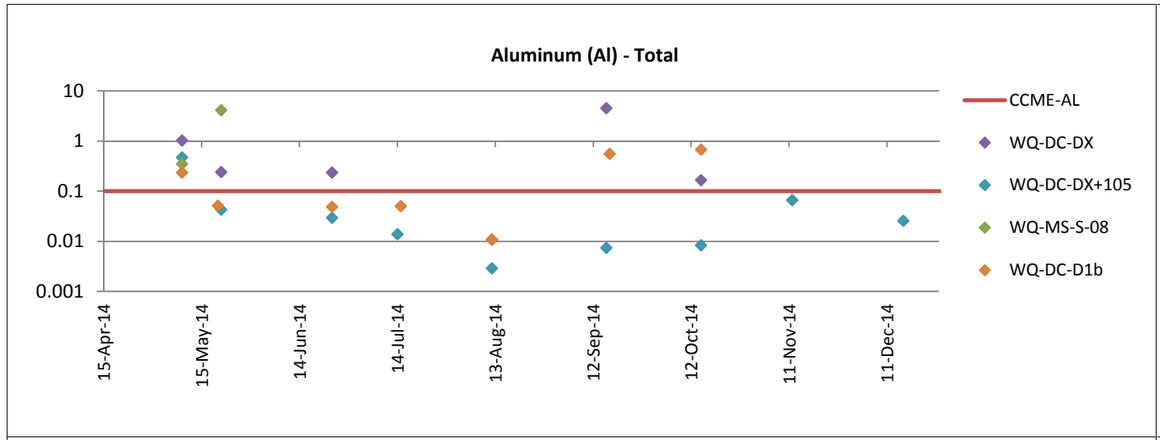
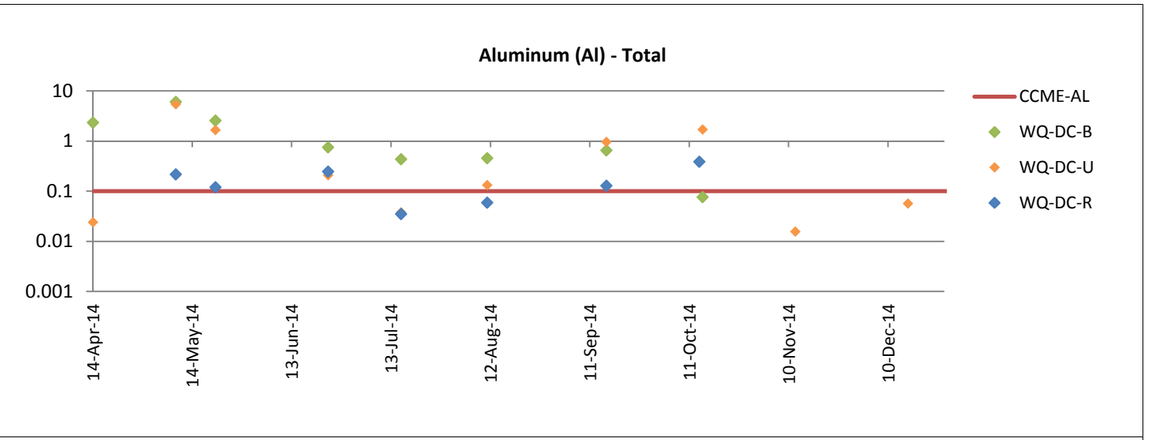
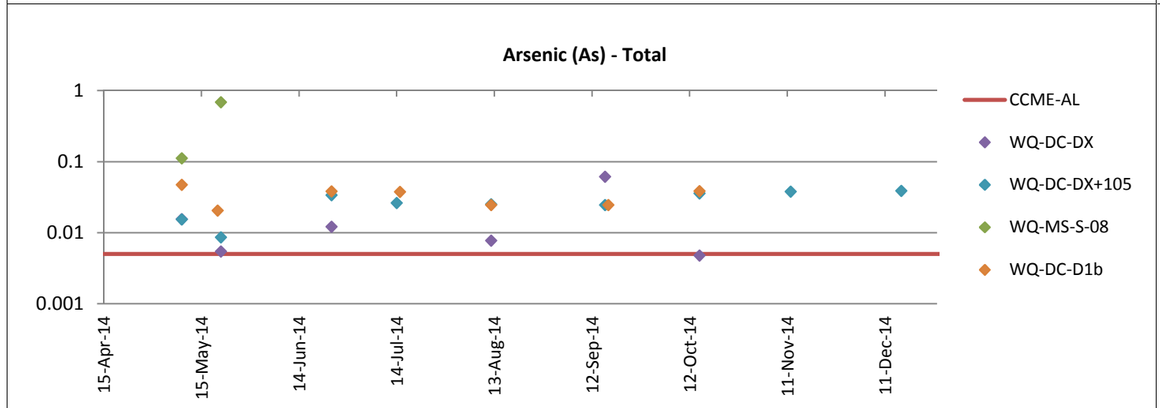
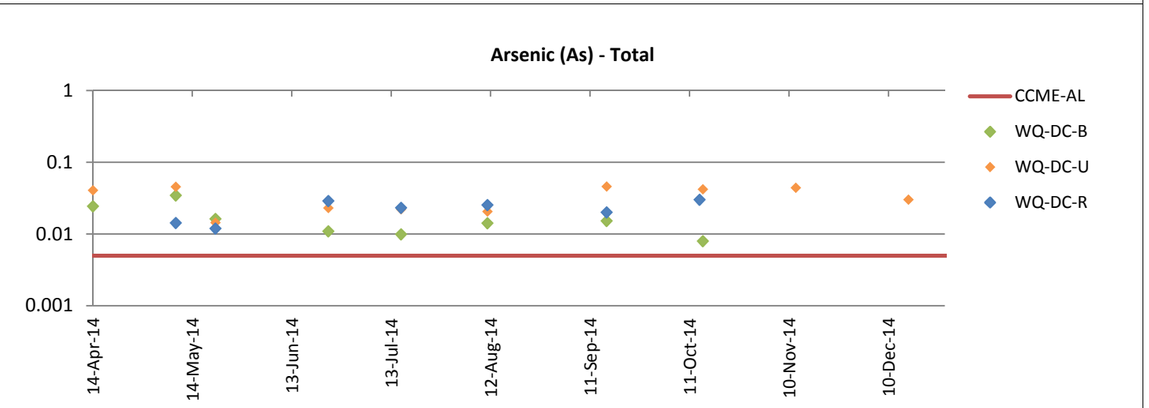
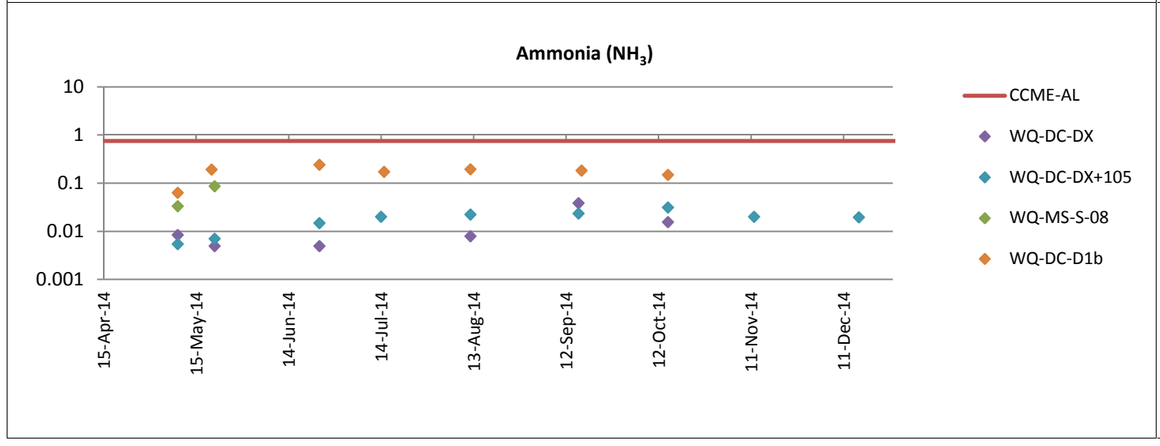
**Figure E-1. Concentrations of aluminum, arsenic and ammonia for sites on Upper Dome Creek (left column) and Lower Dome Creek (right column) - y-axis in log concentration (mg/L).**



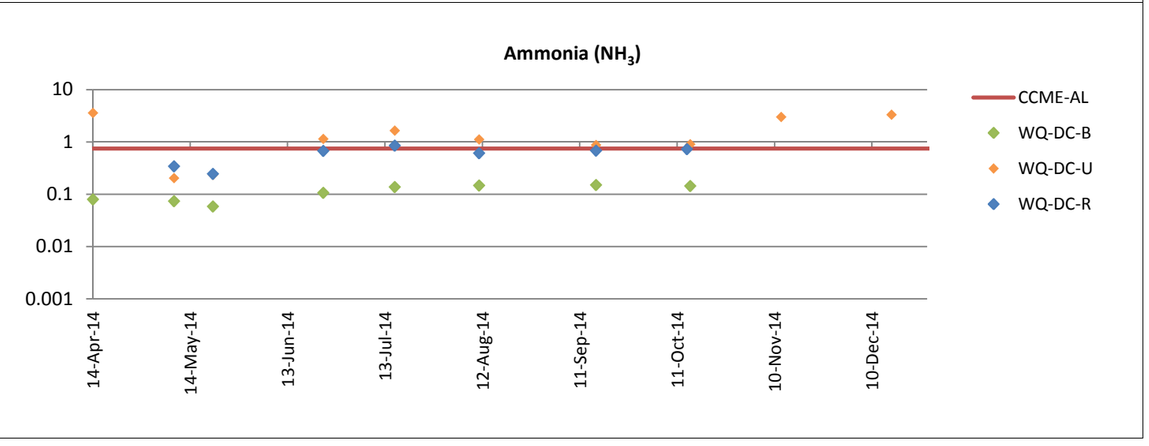



Figure E-2. Concentrations of cadmium, chromium and copper for sites on Dome Creek (Left column: Upper Dome Creek sites, Right Column: Lower Dome Creek sites) - y-axis in log concentration (mg/L).

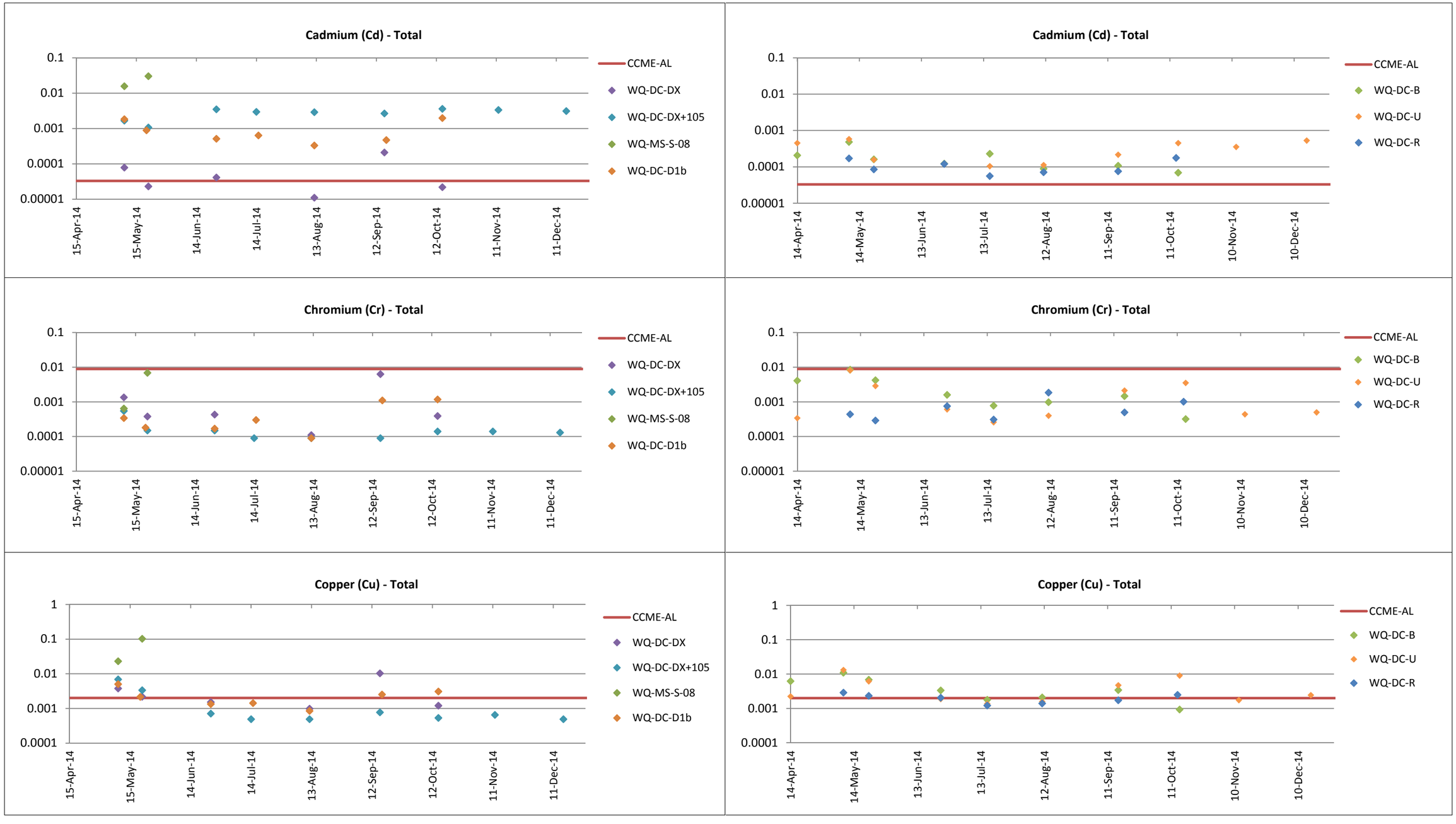


Figure E-3. Concentrations of iron, lead, and manganese for sites on Dome Creek (Left column: Upper Dome Creek sites, Right Column: Lower Dome Creek sites) - y-axis in log concentration (mg/L).

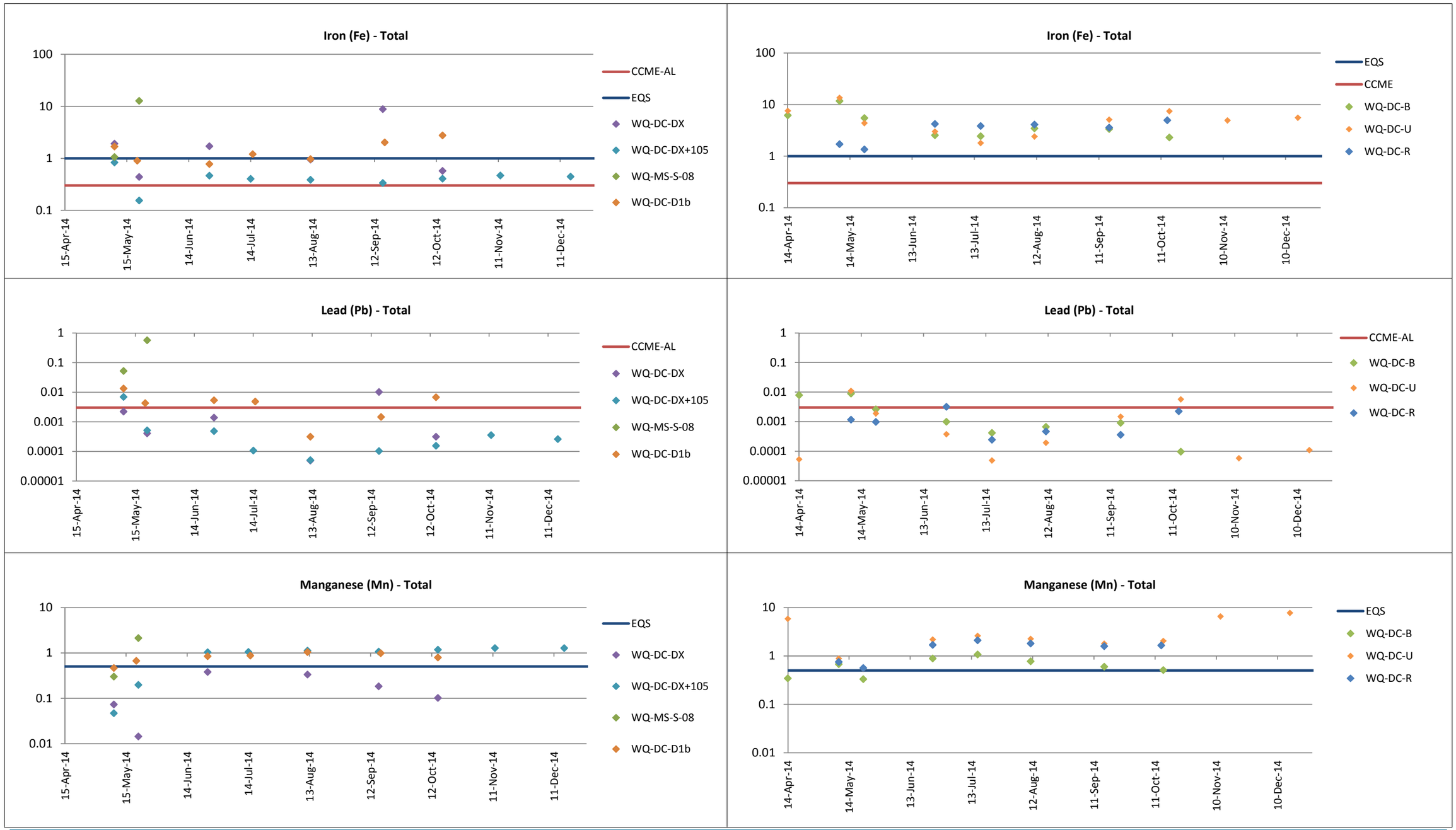


Figure E-4. Concentrations of mercury, silver and zinc for sites on Dome Creek (Left column: Upper Dome Creek sites, Right Column: Lower Dome Creek sites) - y-axis in log concentration (mg/L).

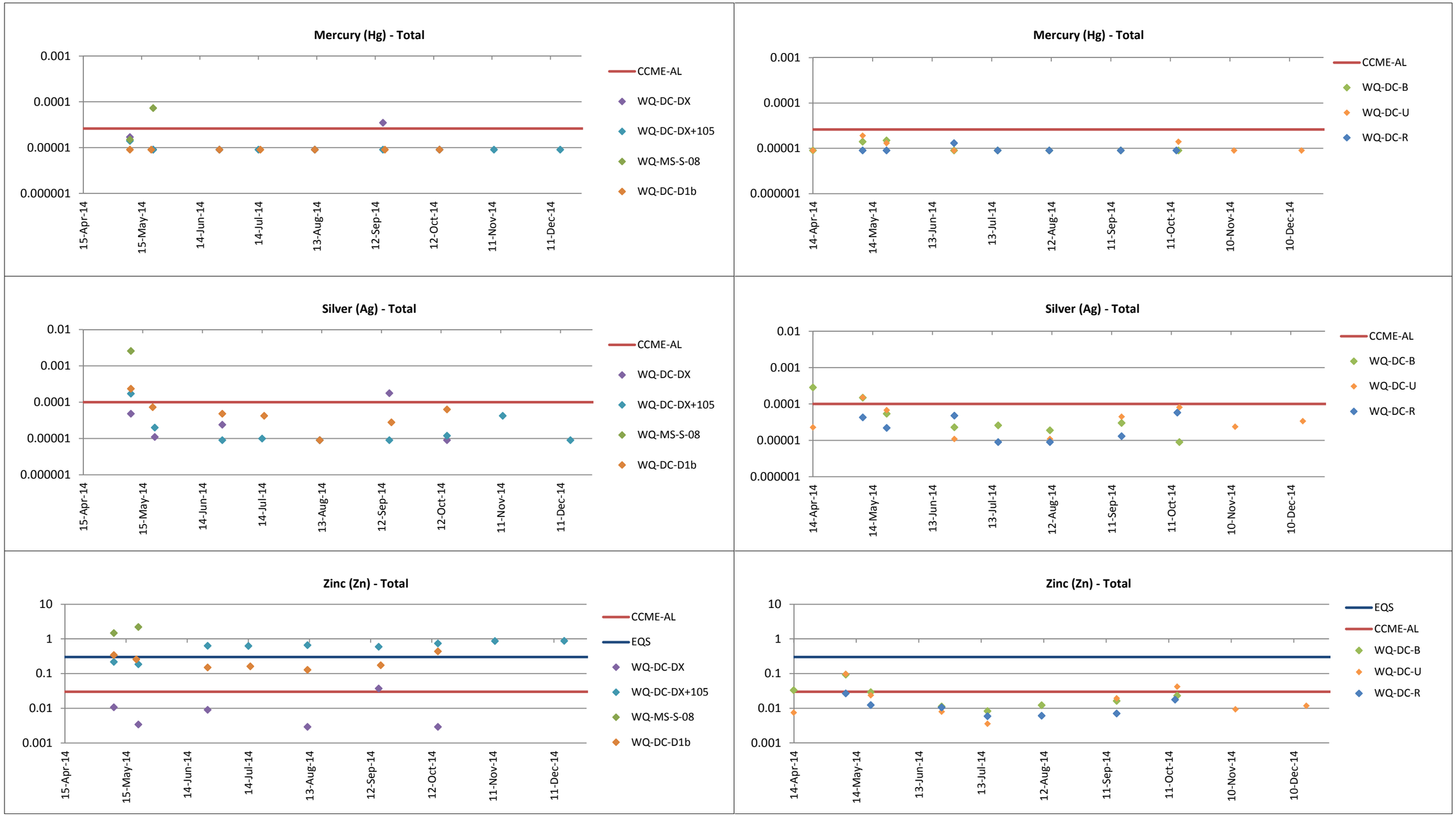


Figure E-5. Concentrations of total suspended solids for sites on Dome Creek (Left column: Upper Dome Creek sites, Right Column: Lower Dome Creek sites) - y-axis in log concentration (mg/L).

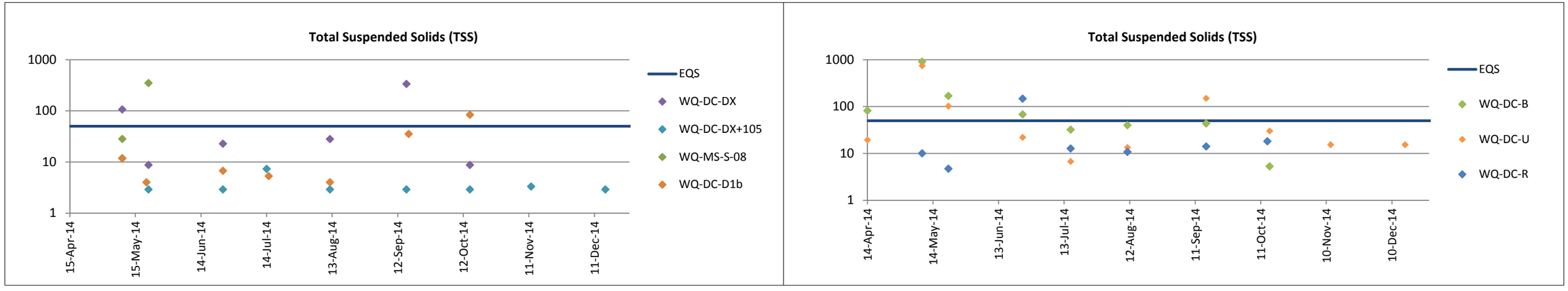



Figure E-6. Concentrations of total and WAD cyanide for the tailings pond and seepage site (left column) and Lower Dome Creek sites (right column) - y-axis in log concentration (mg/L).

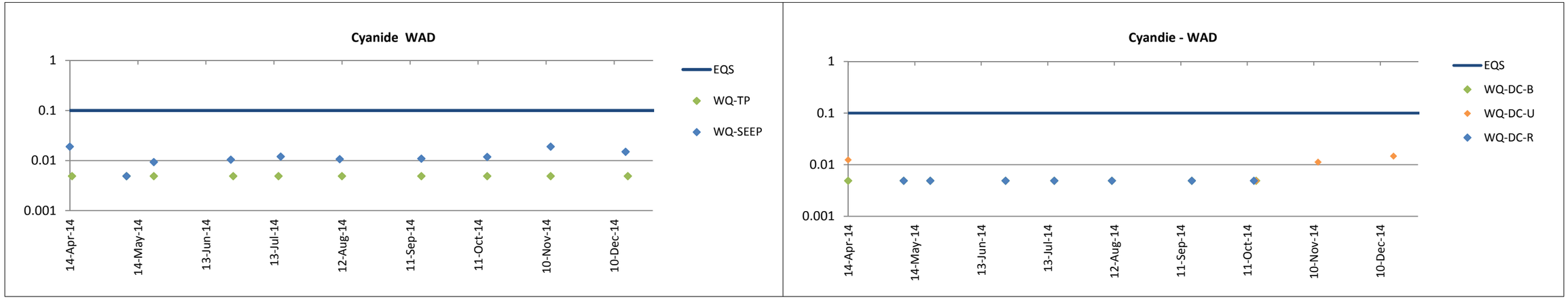


Figure E-7. Concentrations of aluminum, arsenic and ammonia for the tailings pond and seepage site (left column) and the Brown-McDade pit lake site (right column) - y-axis in log concentration (mg/L).

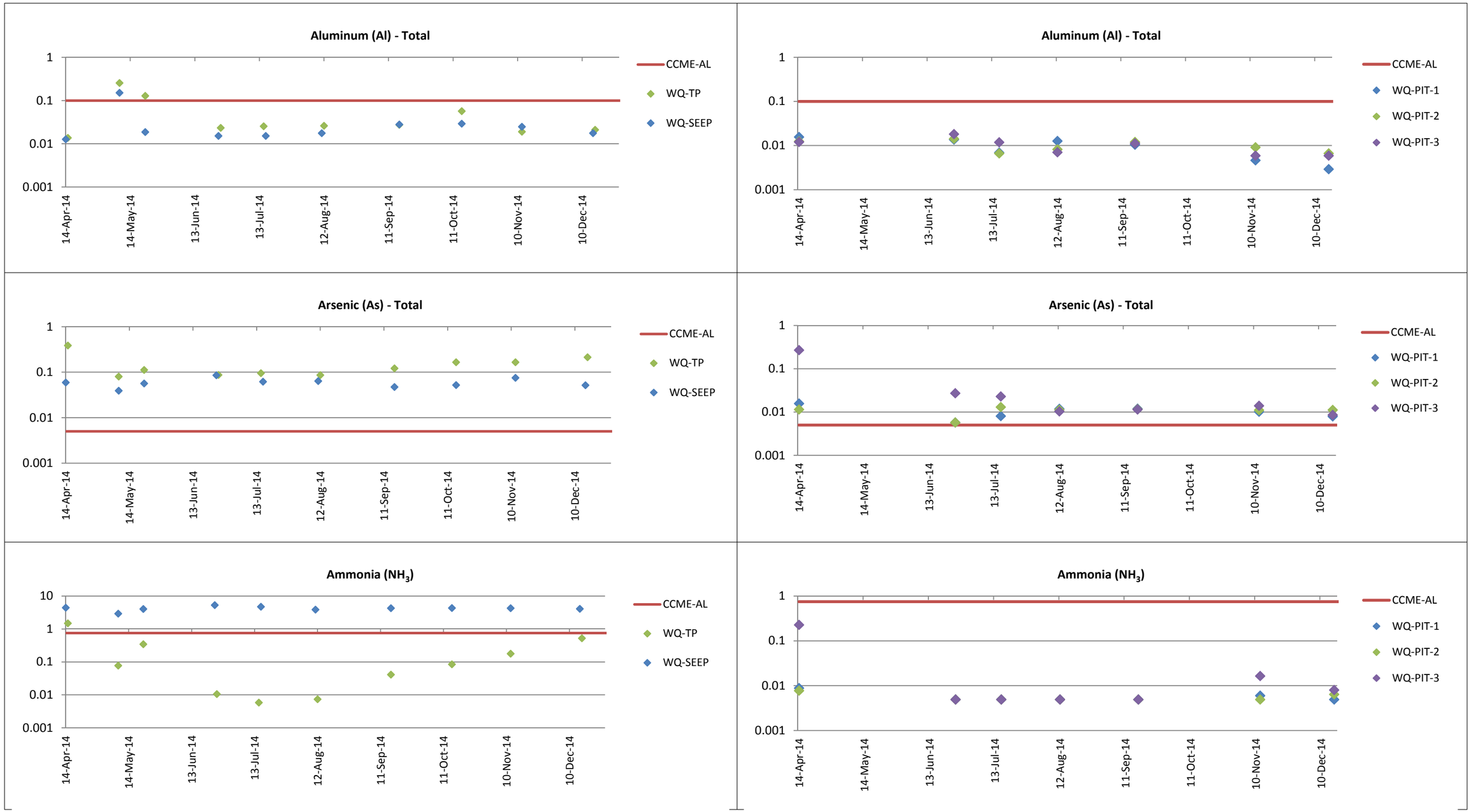


Figure E-8. Concentrations of cadmium, chromium and copper for the tailings pond and seepage site (left column) and the Brown-McDade pit lake site (right column) - y-axis in log concentration (mg/L).

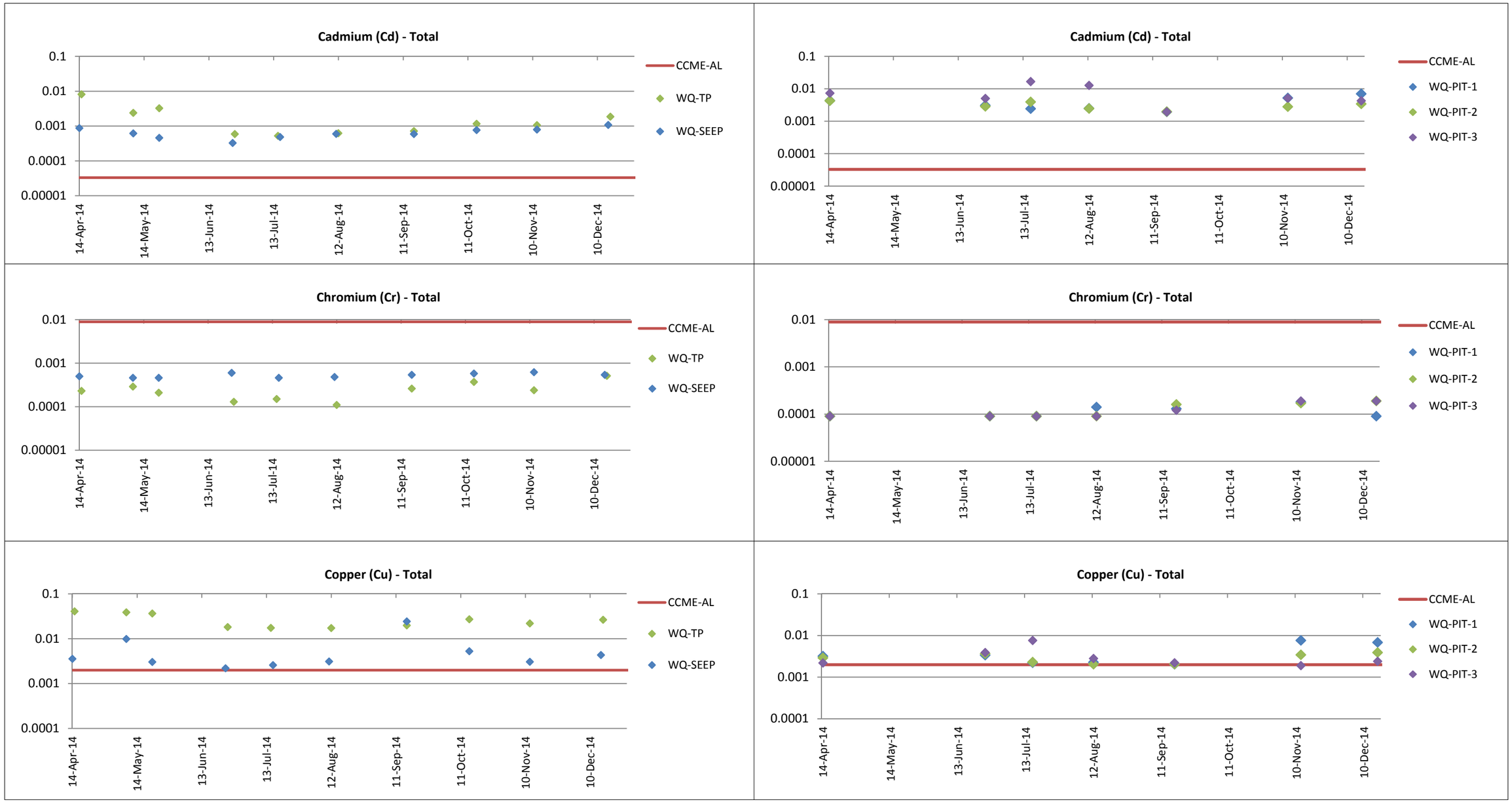
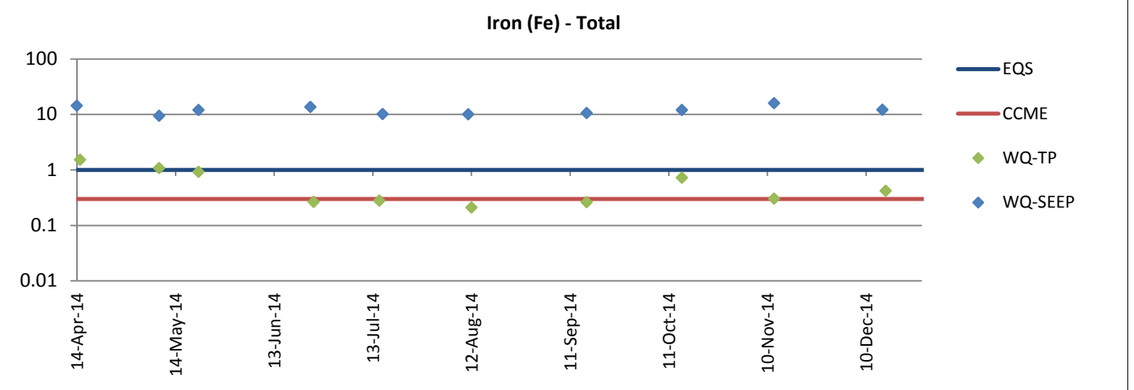
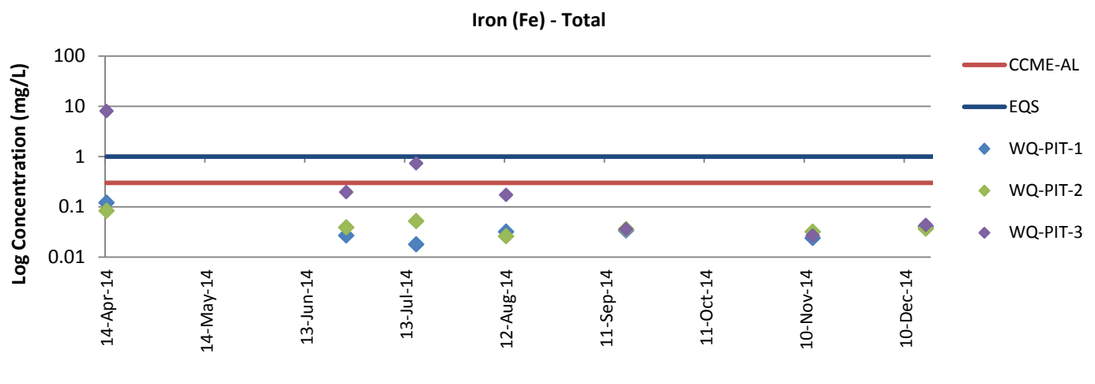
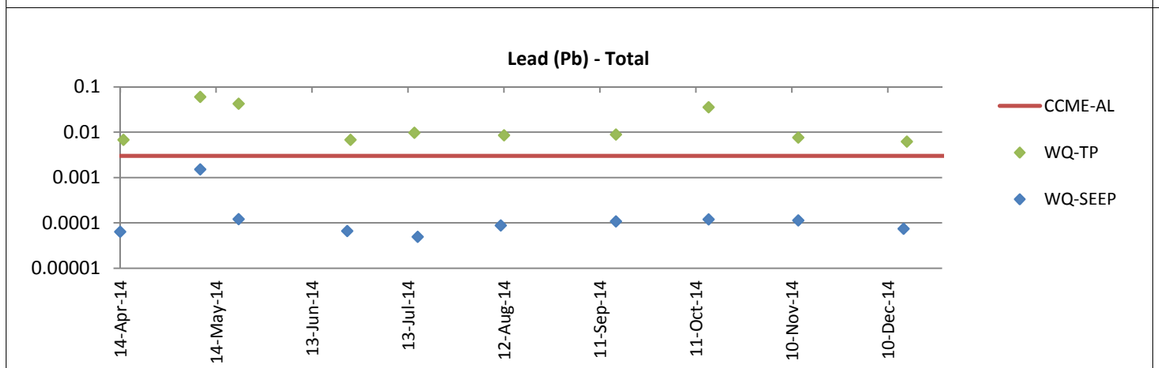
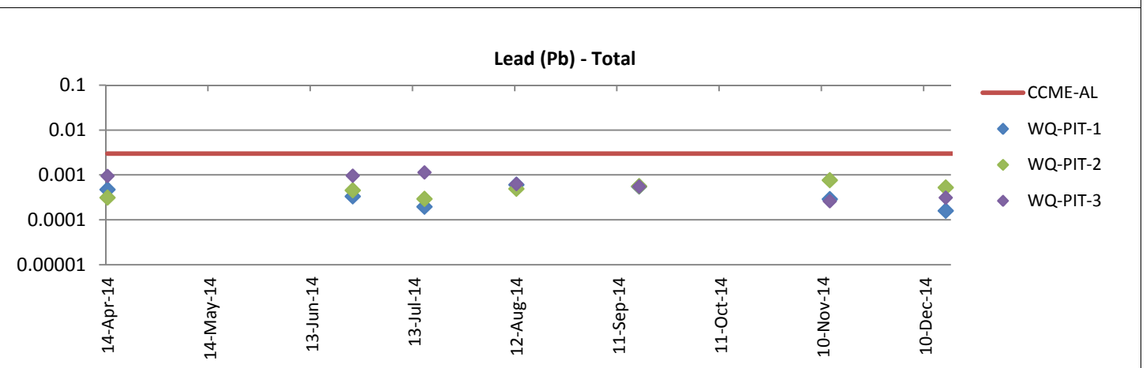


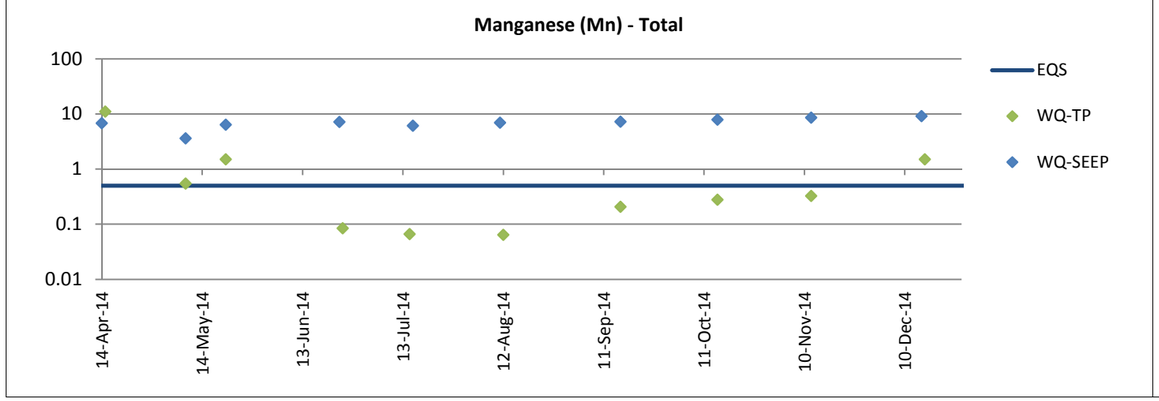
Figure E-9. Concentrations of iron, lead and manganese for the tailings pond and seepage site (left column) and the Brown-McDade pit lake site (right column) - y-axis in log concentration (mg/L).



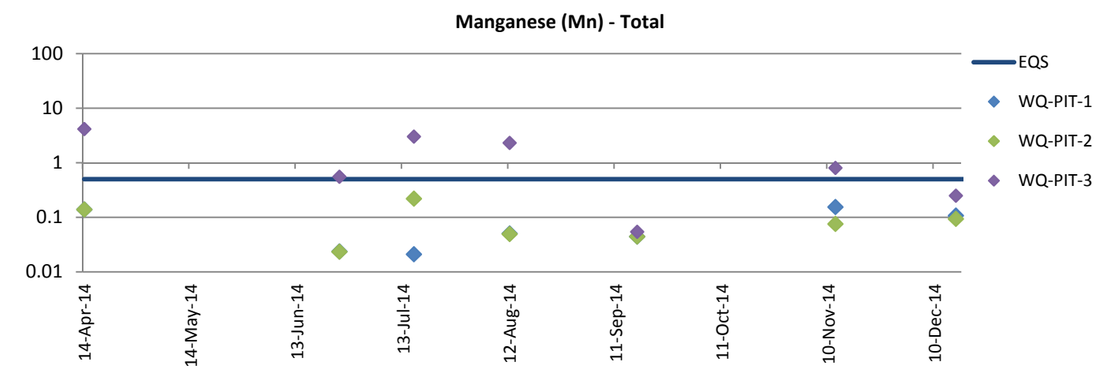
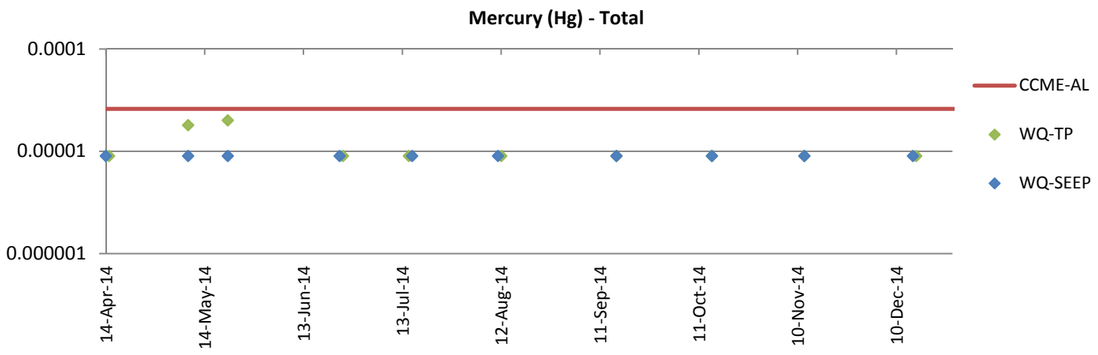
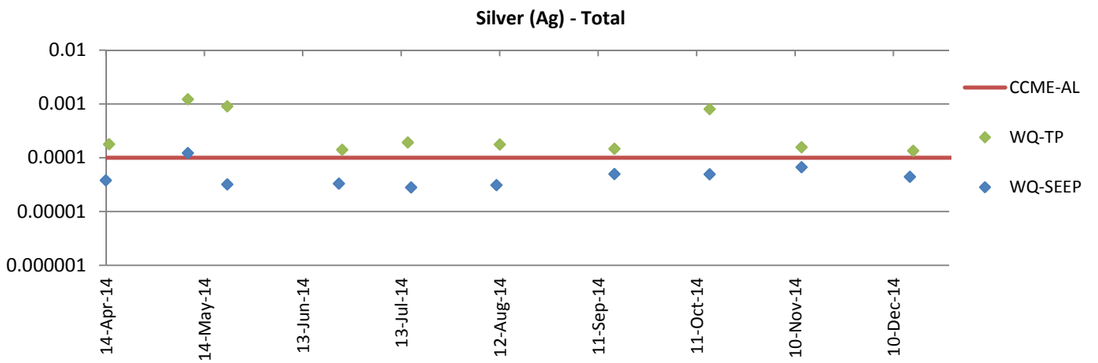



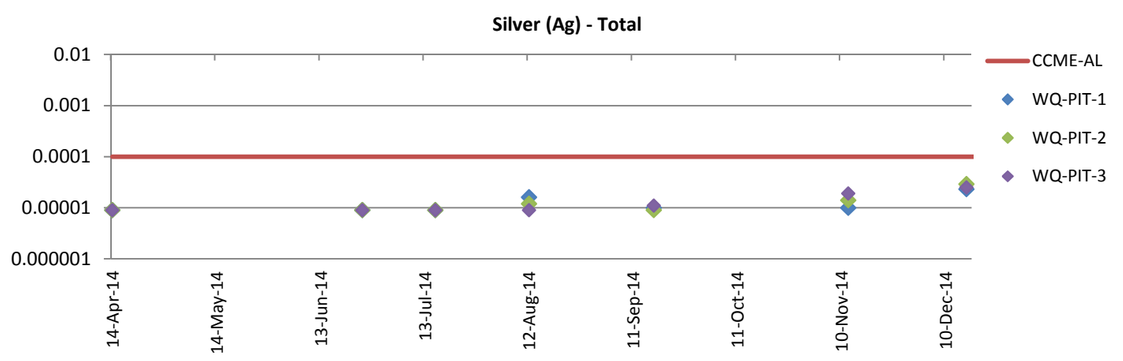
Figure E-10. Concentrations of mercury, silver and zinc for the tailings pond and seepage site (left column) and the Brown-McDade pit lake site (right column) – y-axis in log concentration (mg/L).

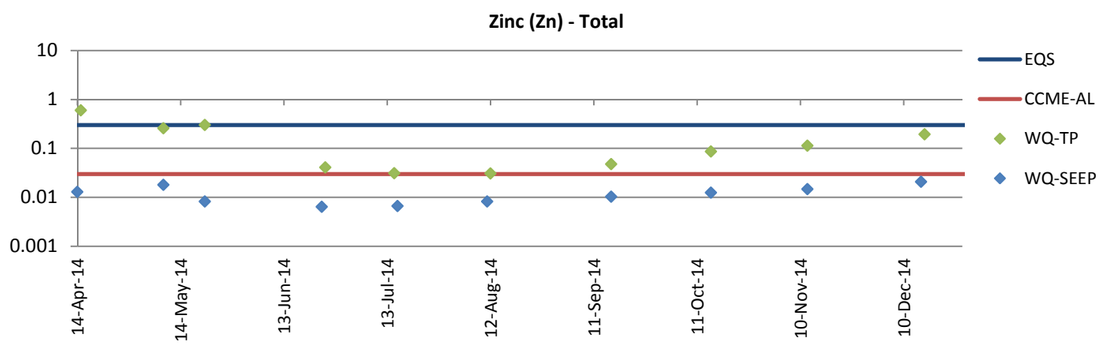



n/a

(all below detection limit)



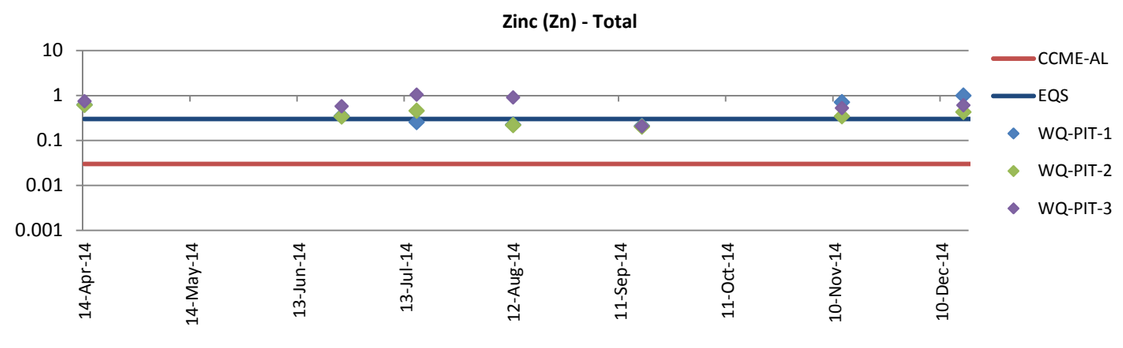



Figure E-11. Concentrations of total suspended solids for the tailings pond and seepage site (left column) and the Brown-McDade pit lake site (right column) - y-axis in log concentration (mg/L).

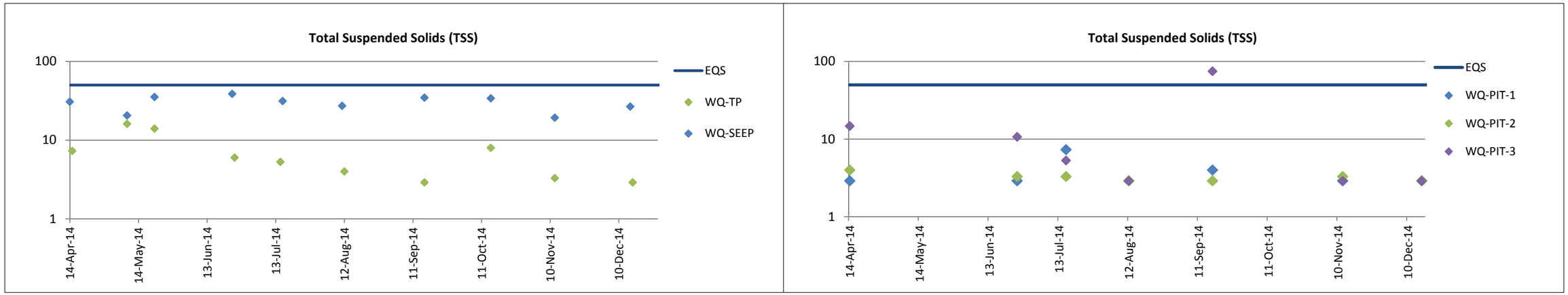



Figure E-12. Concentrations of total suspended solids for the Victoria Creek sites (left column) and the Back and Pony creek sites (right column) - y-axis in log concentration (mg/L).

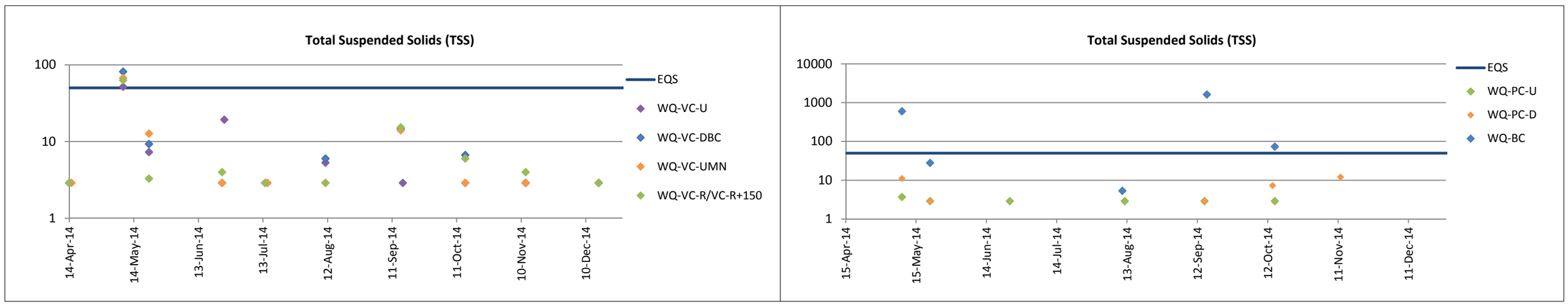
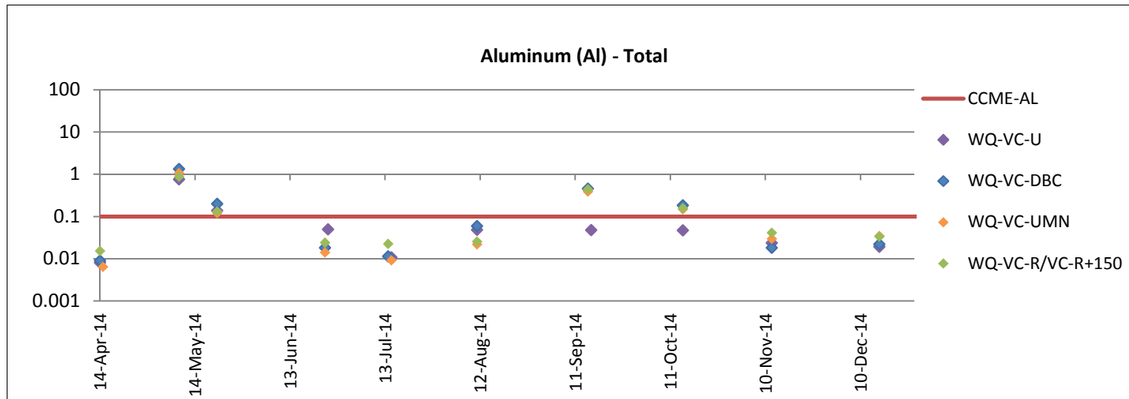
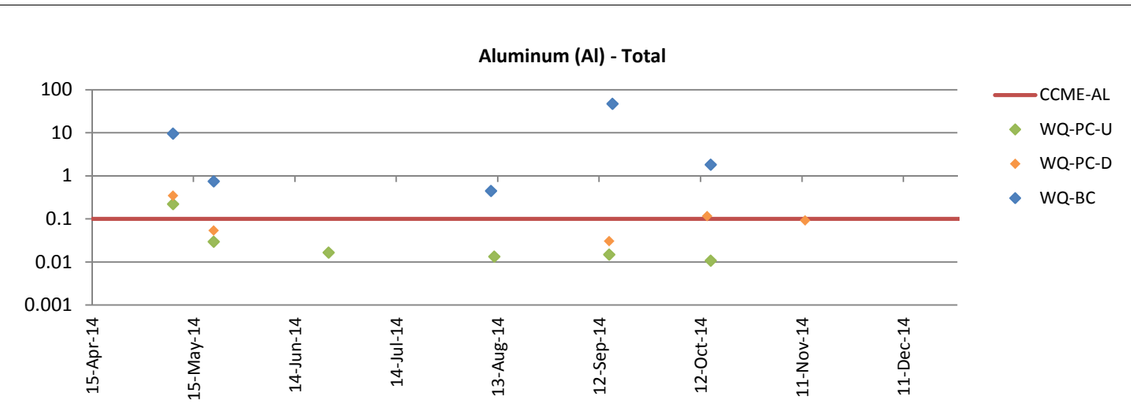
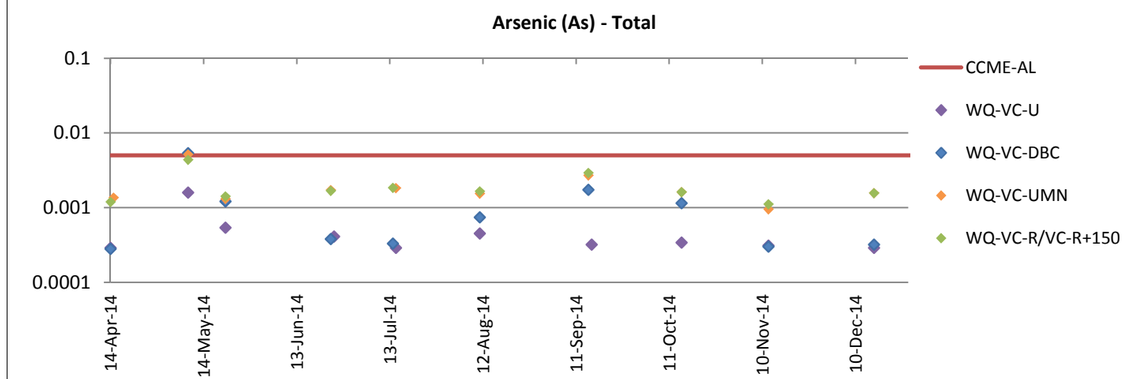
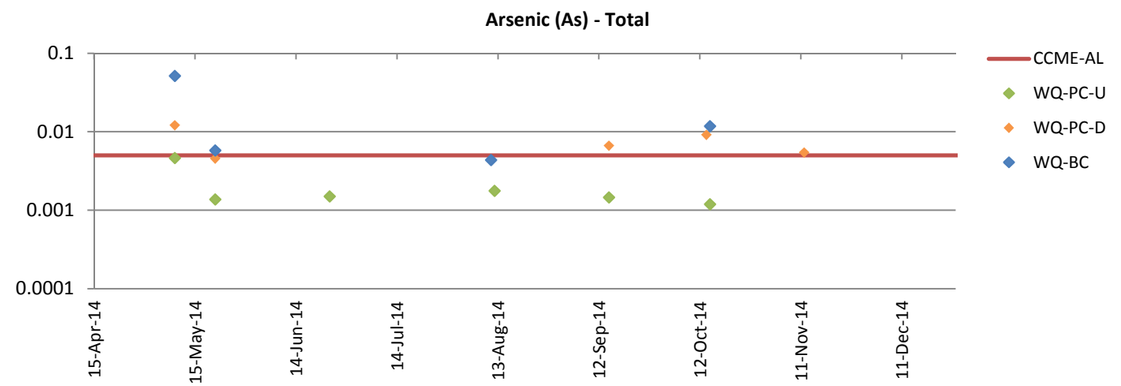


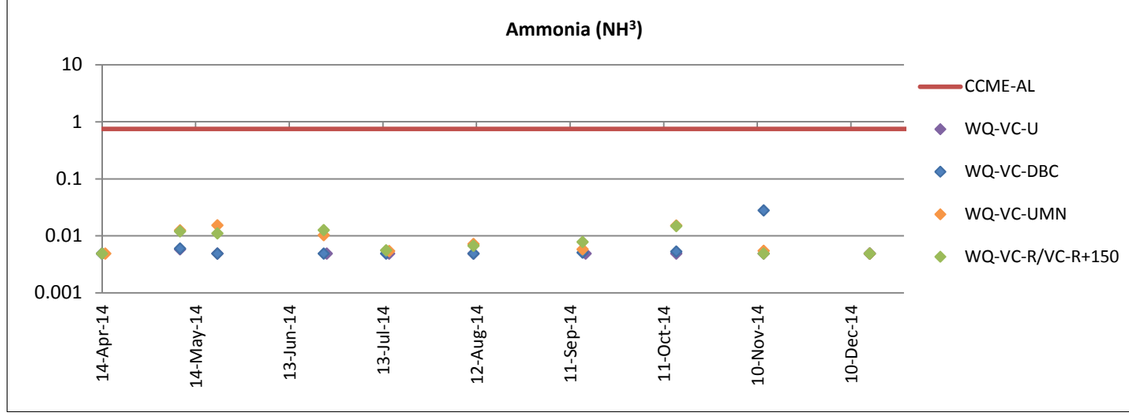
Figure E-13. Concentrations of aluminum, arsenic and ammonia for sites on Victoria Creek (left column) and sites on Back and Pony creeks (right column) – y-axis in log concentration (mg/L).



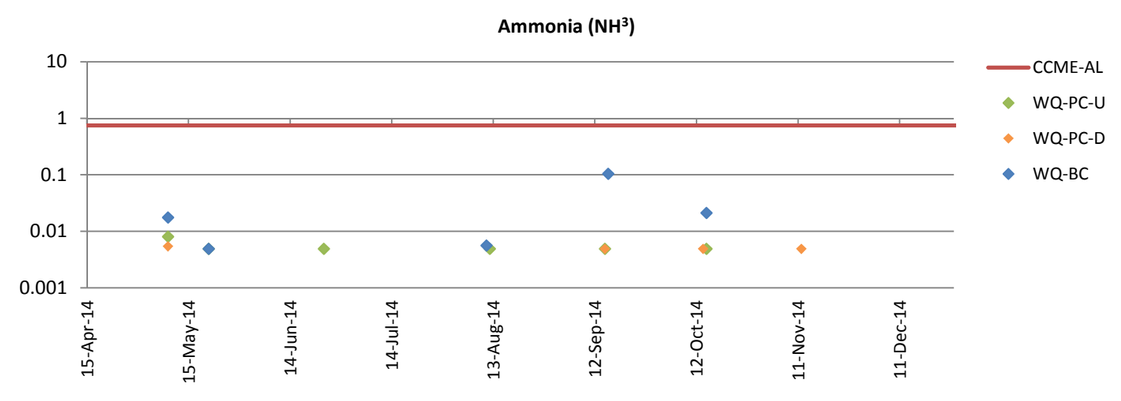
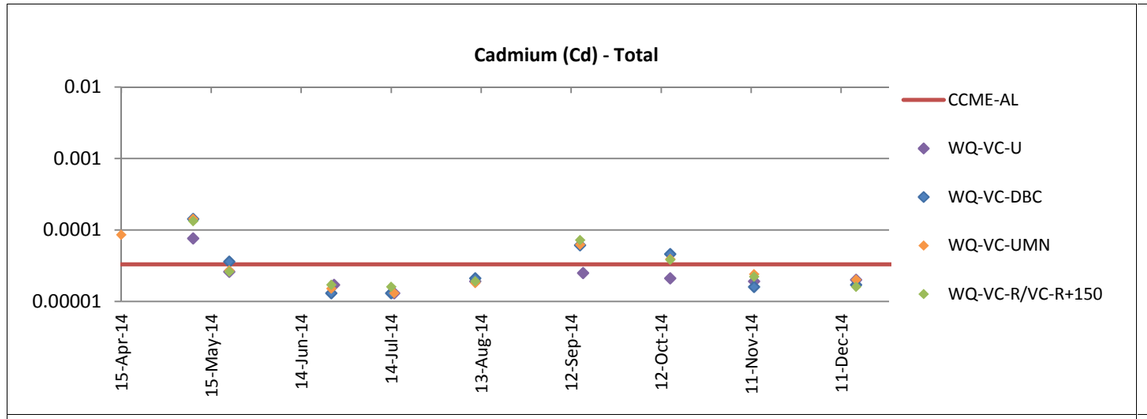
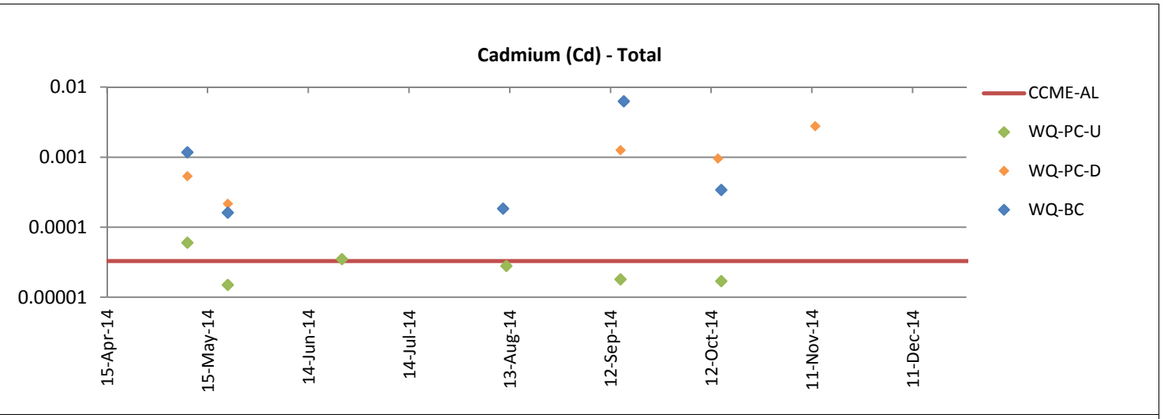
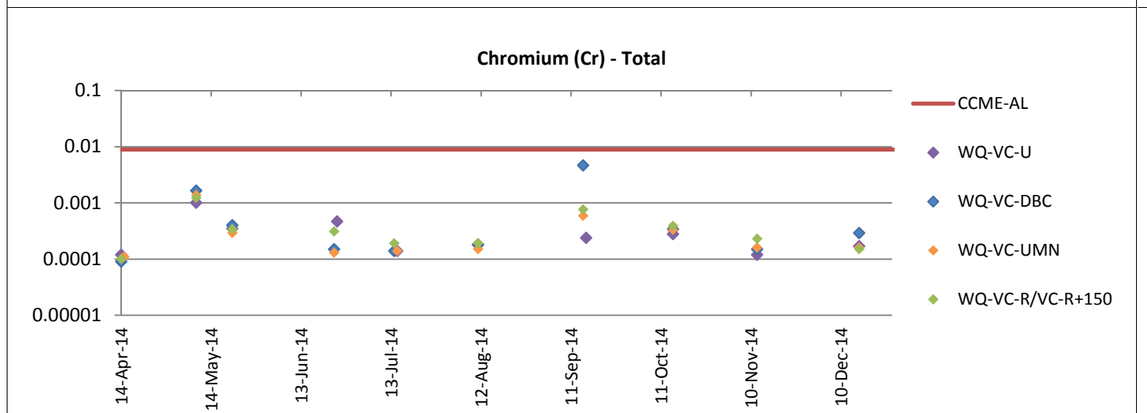
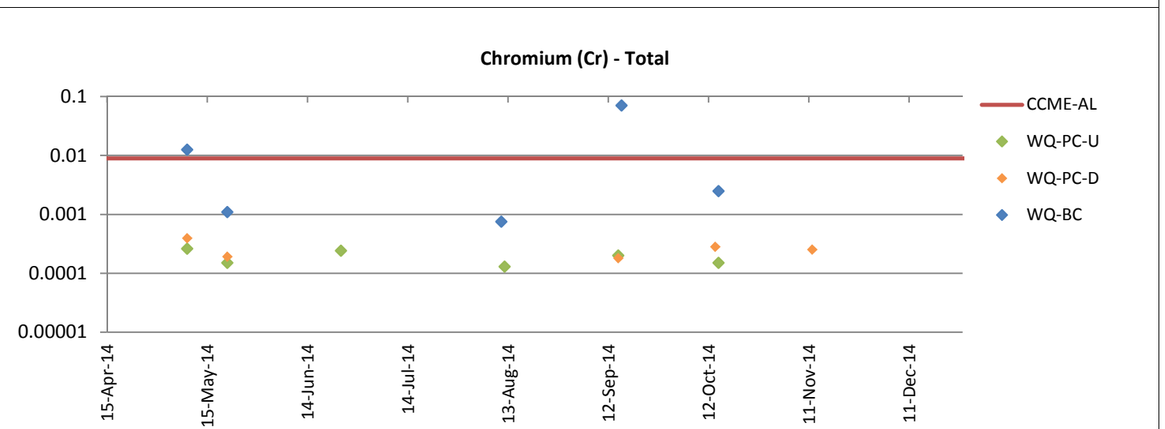



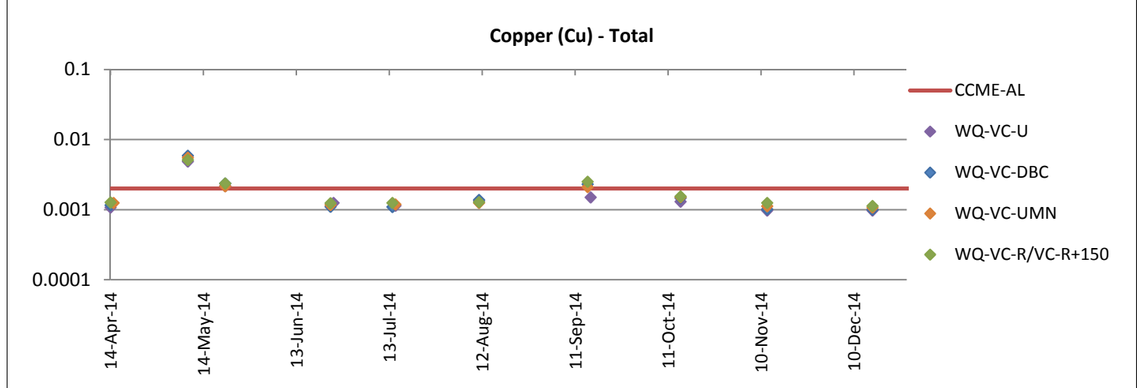
Figure E-14. Concentrations of cadmium, chromium and copper for sites on Victoria Creek (left column) and sites on Back and Pony creeks (right column) - y-axis in log concentration (mg/L).



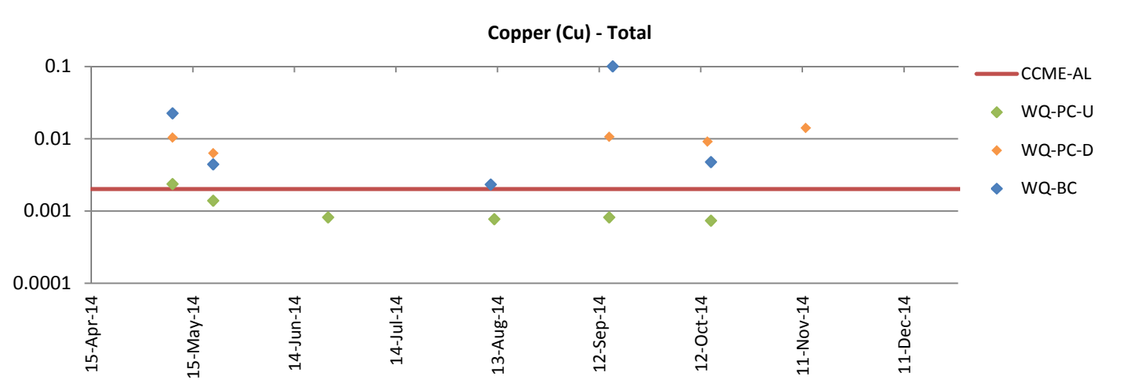
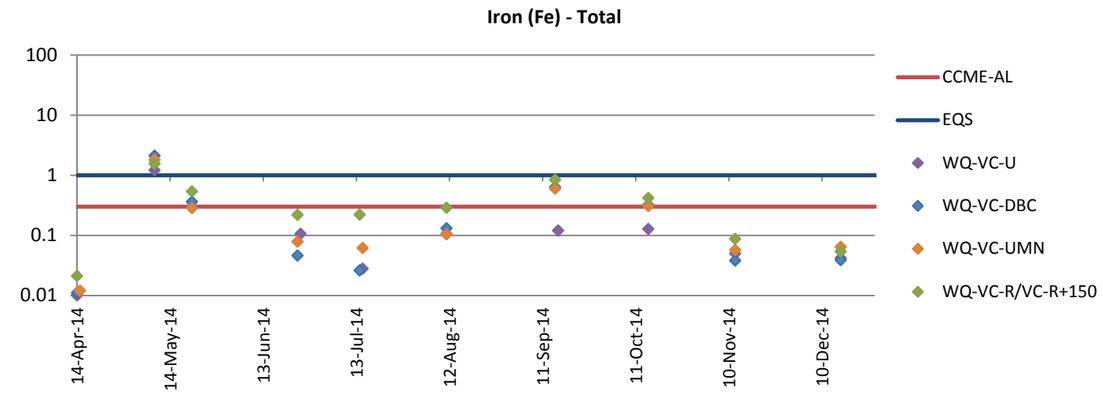
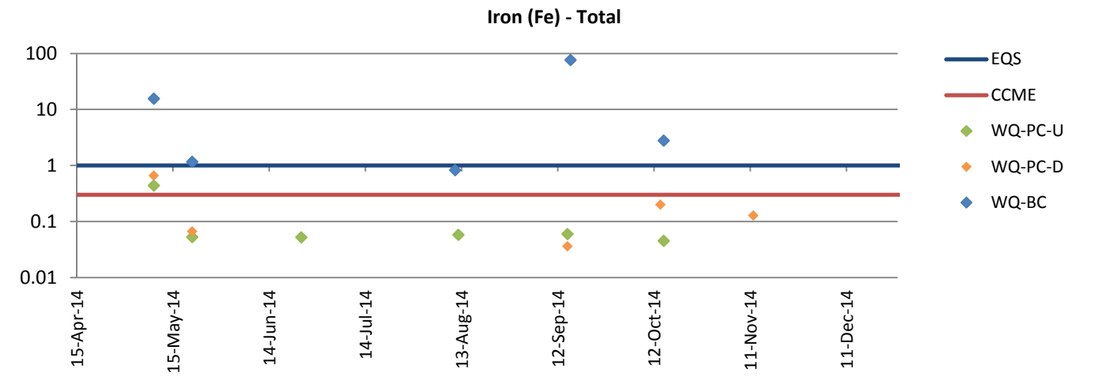
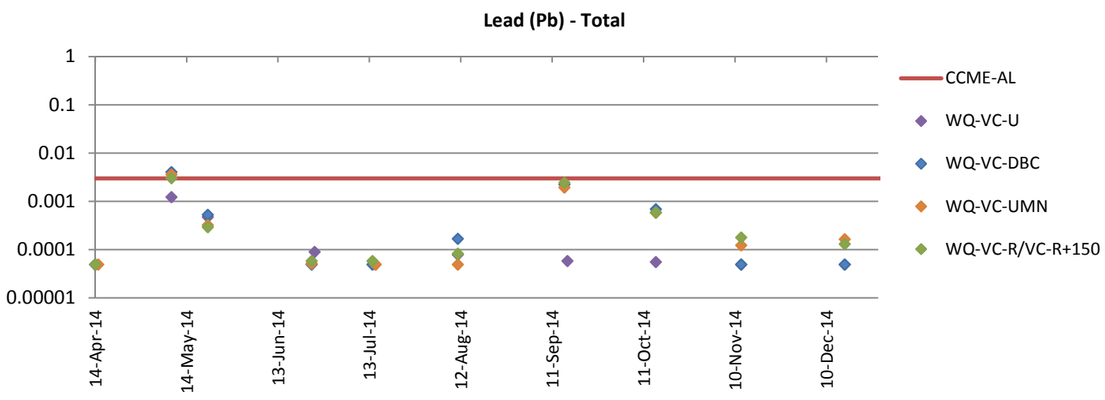
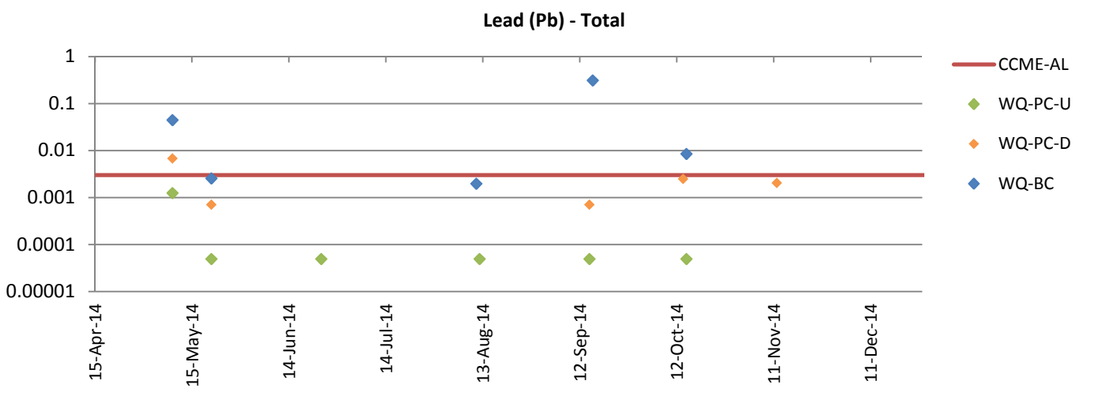



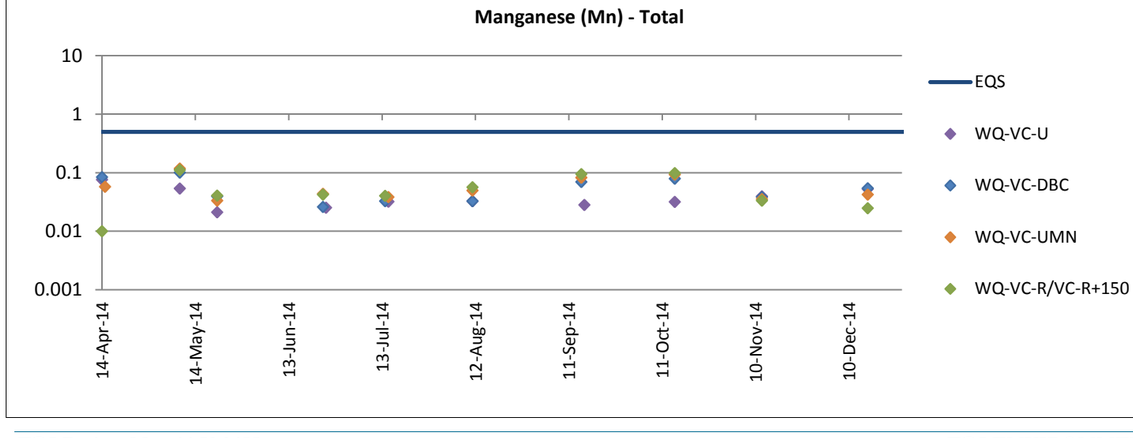
Figure E-15. Concentrations of iron, lead and manganese for sites on Victoria Creek (left column) and sites on Back and Pony creeks (right column) - y-axis in log concentration (mg/L).



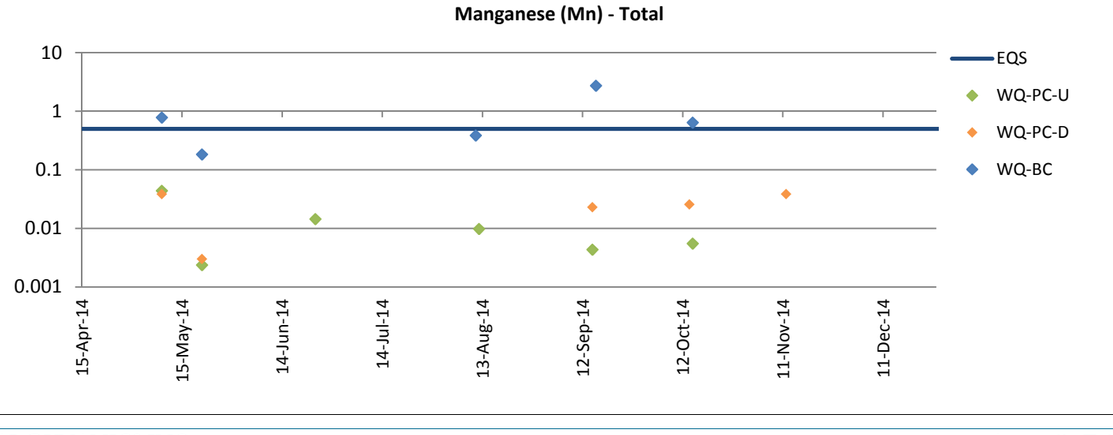
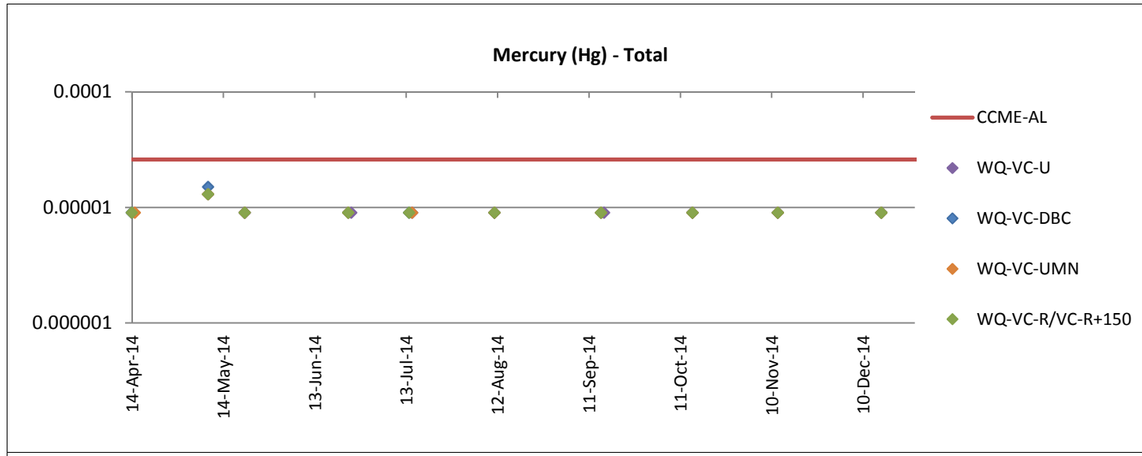
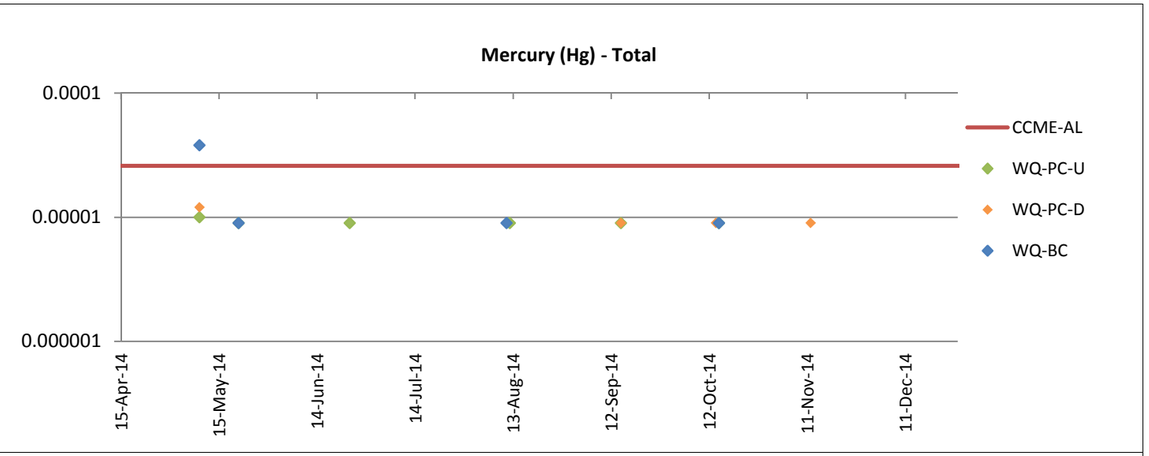
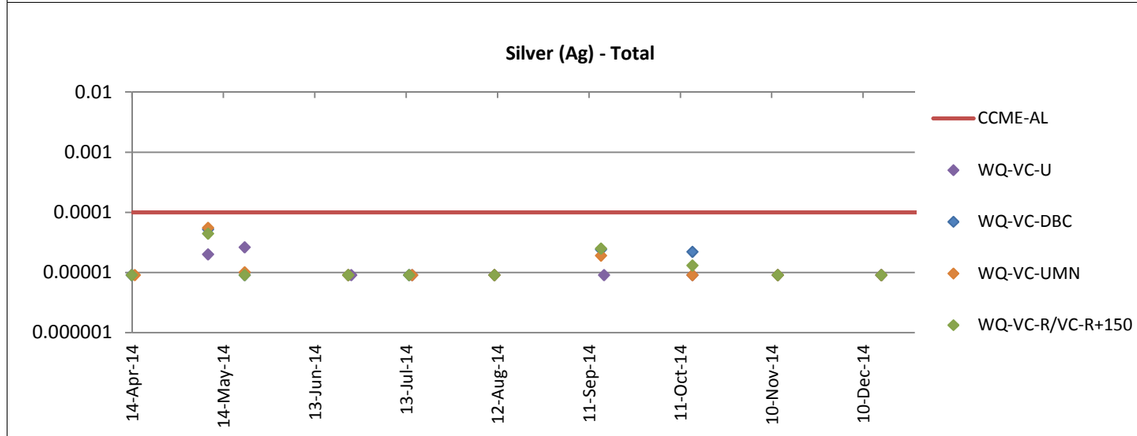
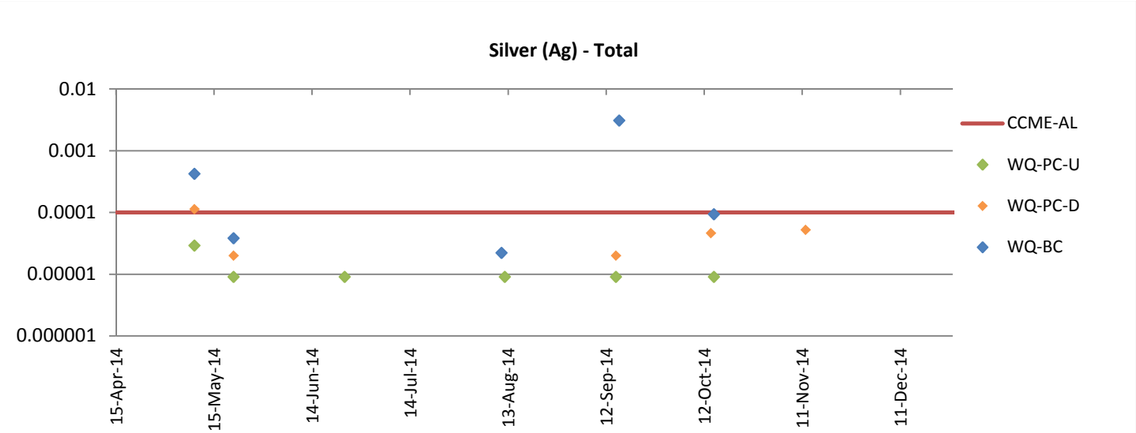



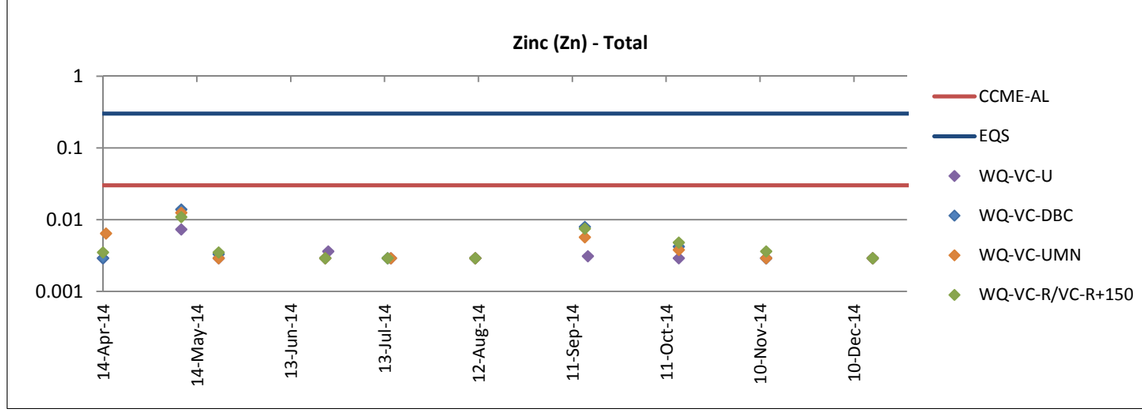
Figure E-16. Concentrations of mercury, silver and zinc for sites on Victoria Creek (left column) and sites on Back and Pony creeks (right column) - y-axis in log concentration (mg/L).



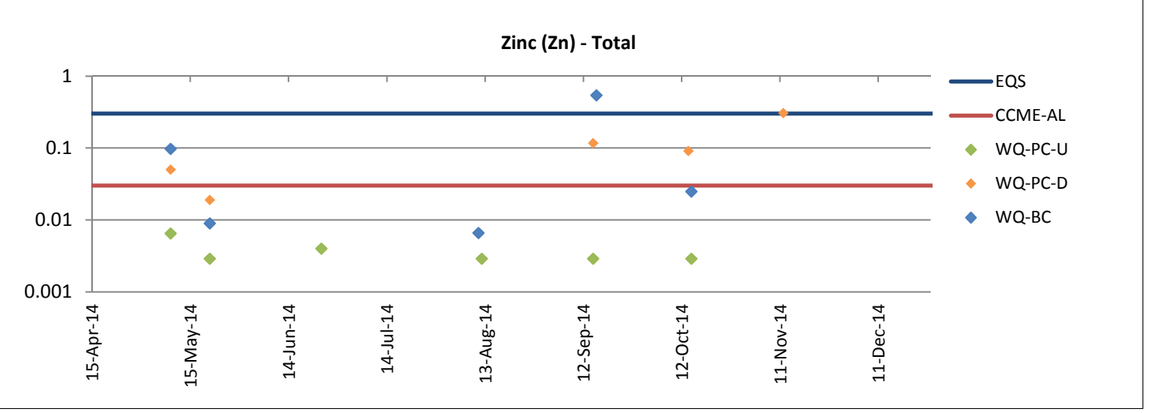



Figure E-17. Concentrations of aluminum, arsenic, total suspended solids, cadmium, chromium and copper for the regular seep sites - y-axis in log concentration (mg/L).

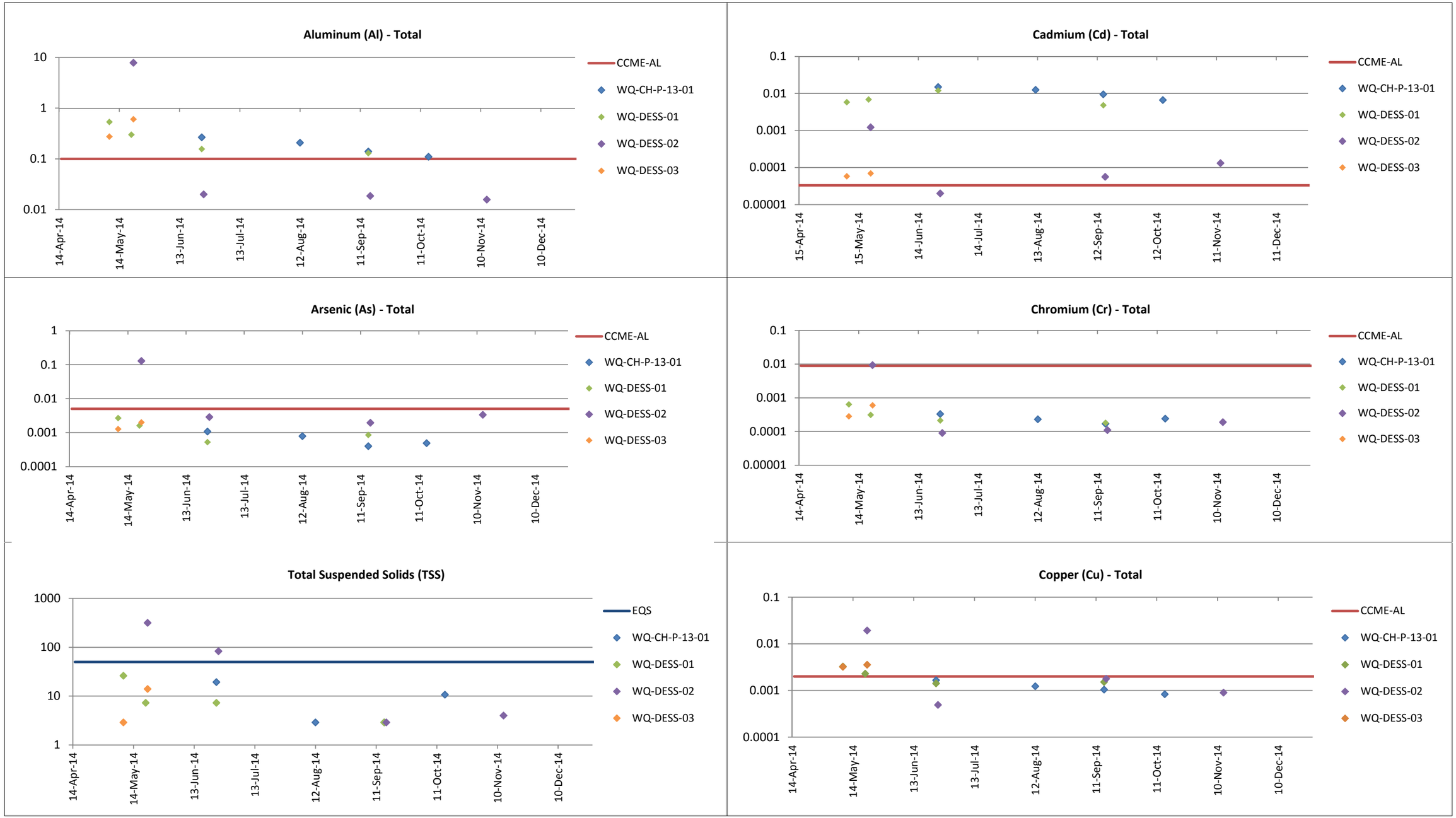


Figure E-18. Concentrations of iron, lead, manganese, mercury, silver and zinc for the regular seep sites - y-axis in log concentration (mg/L).

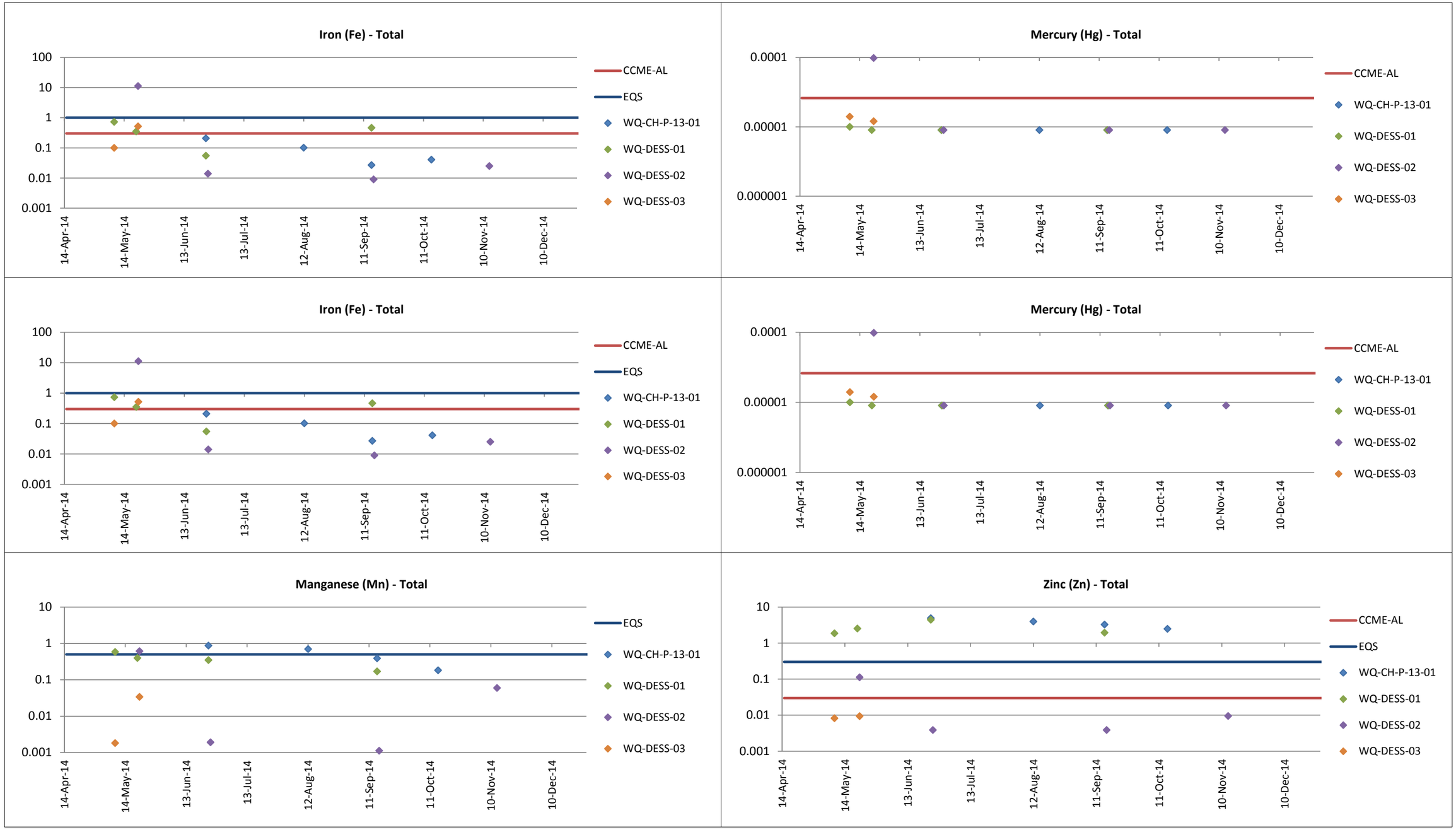


**Table E-1. Summary of Water Quality Results for the October 14-16, 2014 Trip.**

| Analyte | Units | CCME-WATER-F-AL | Mount Nansen Effluent Discharge Standards | Sample ID<br>WQ Site ID<br>Date Sampled<br>Detection Limit | 0455-141014-014<br>WQ-SEEP<br>14-Oct-14 | 0455-141014-012<br>WQ-TP<br>14-Oct-14 | 0455-141015-005<br>WQ-DC-DX-r<br>15-Oct-14<br>QA/QC | 0455-141015-021<br>WQ-DC-DX<br>15-Oct-14 | QA/QC<br>Replicate Sample<br>WQ-DC-DX | 0455-141015-004<br>WQ-DC-DX+105<br>15-Oct-14 | 0455-141015-008<br>WQ-CH-P-13-01 *<br>15-Oct-14 | 0455-141015-007<br>WQ-DC-D1b<br>15-Oct-14 | 0455-141015-006<br>WQ-DC-B<br>15-Oct-14 | 0455-141015-003<br>WQ-DC-U **<br>15-Oct-14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Temperature (in-situ) | °C | - | - | - | 1.9 | 2.2 | - | 0.1 | - | 0.6 | 0.6 | 0.1 | 0.0 | 0.2 |
| Specific Conductivity (in-situ) | µS/cm | - | - | - | 1758 | 1335 | - | 574.4 | - | 1181 | 1513 | 1569 | 1239 | 1301 |
| pH (in-situ) | pH | 6.5 - 9.0 | 6.0 - 8.5 | - | 6.9 | 7.88 | - | 7.6 | - | 7.14 | 7.41 | 7.87 | 7.45 | 7.44 |
| Turbidity (In-situ) | NTU | - | - | - | 31.30 | 26.80 | - | 11.55 | - | 2.68 | 1.57 | 20.00 | 6.91 | 13.07 |
| Dissolved Oxygen (in-situ) | mg/L | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Colour, True | CU | 15 | - | 5 | - | - | - | - | - | - | - | - | - | - |
| Conductivity | µS/cm | - | - | 2 | 1710 | 1310 | 573 | 562 | 2% | 1160 | 1410 | 1520 | 1200 | 1270 |
| Hardness (as CaCO3) | mg/L | - | - | 0.5 | 952 | 752 | 298 | 296 | 1% | 692 | 779 | 978 | 743 | 750 |
| pH (lab) | pH | 6.5 - 9.0 | 6.0 - 8.5 | 0.1 | 7.80 | 8.00 | 8.06 | 8.08 | 0% | 7.99 | 7.09 | 8.25 | 8.12 | 8.19 |
| Total Suspended Solids | mg/L | - | 50 | 3 | 34 | 8 | 26.7 | 8.7 | 67% | <3.0 | 10.7 | ***83.3*** | 5.3 | 30 |
| Total Dissolved Solids | mg/L | - | - | 1 | 1370 | 1030 | 376 | 368 | 2% | 844 | 1120 | 1200 | 914 | 972 |
| Alkalinity, Bicarbonate (as CaCO3) | mg/L | - | - | 1 | 255 | 87.7 | 115 | 111 | 3% | 300 | 11.8 | 299 | 198 | 206 |
| Alkalinity, Carbonate (as CaCO3) | mg/L | - | - | 1 | <1.0 | <1.0 | <1.0 | <1.0 | <DL | <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 | <DL | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Alkalinity, Total (as CaCO3) | mg/L | - | - | 1 | 255 | 87.7 | 115 | 111 | 3% | 300 | 11.8 | 299 | 198 | 206 |
| Ammonia, Total (as N) | mg/L | 0.75 | - | 0.005 | ***4.33*** | 0.0842 | 0.0161 | 0.0154 | 4% | 0.0313 | 0.0095 | 0.148 | 0.143 | ***0.897*** |
| Chloride (Cl) | mg/L | 120 | - | 0.5 | <5.0 | <5.0 | <0.50 | <0.50 | <DL | <5.0 | <5.0 | <5.0 | <5.0 | <5.0 |
| Fluoride (F) | mg/L | 0.12 | - | 0.02 | <0.20 | <0.20 | 0.055 | 0.055 | 0% | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 |
| Nitrate (as N) | mg/L | 13 | - | 0.005 | 0.958 | 0.088 | 0.0609 | 0.0626 | 3% | <0.050 | 0.326 | 0.14 | 0.214 | 0.367 |
| Nitrite (as N) | mg/L | 0.06 | - | 0.001 | 0.017 | <0.010 | <0.0010 | <0.0010 | <DL | <0.010 | <0.010 | <0.010 | <0.010 | 0.016 |
| Sulfate (SO4) | mg/L | - | - | 0.5 | 804 | 677 | 193 | 189 | 2% | 416 | 830 | 683 | 535 | 573 |
| Cyanide, Weak Acid Diss | mg/L | - | 0.1 | 0.005 | 0.0118 | <0.0050 | <0.0050 | <0.0050 | <DL | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| Cyanide, Total | mg/L | - | 0.3 | 0.005 | 0.049 | <0.0050 | <0.0050 | <0.0050 | <DL | <0.0050 | <0.0050 | <0.0050 | <0.0050 | 0.0103 |
| Cyanate | mg/L | - | - | 0.2 | <0.20 | <0.20 | <2.0 | <0.20 | <DL | <0.20 | <0.20 | <0.20 | <0.20 | <2.0 |
| Thiocyanate (SCN) | mg/L | - | - | 0.5 | 3.01 | <0.50 | <0.50 | <0.50 | <DL | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 |
| Aluminum (Al)-Total | mg/L | 0.1 | - | 0.003 | 0.0291 | 0.0569 | ***0.852*** | ***0.166*** | 81% | 0.0083 | ***0.11*** | ***0.677*** | 0.076 | ***1.69*** |
| Antimony (Sb)-Total | mg/L | - | 0.15 | 0.0001 | 0.0005 | 0.0382 | 0.00152 | 0.00127 | 16% | 0.0105 | 0.00012 | 0.0129 | 0.00255 | 0.00248 |
| Arsenic (As)-Total | mg/L | 0.005 | - | 0.0001 | ***0.0521*** | ***0.166*** | ***0.0144*** | 0.00476 | 67% | ***0.0357*** | 0.00049 | ***0.0383*** | ***0.00793*** | ***0.0418*** |
| Barium (Ba)-Total | mg/L | - | 1 | 0.00005 | 0.0691 | 0.0109 | 0.0529 | 0.0437 | 17% | 0.0126 | 0.0085 | 0.0346 | 0.0394 | 0.0844 |
| Beryllium (Be)-Total | mg/L | - | - | 0.0001 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <DL | <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 | <DL | <0.00050 | <0.00050 | <0.00050 | <0.00050 | <0.00050 |
| Boron (B)-Total | mg/L | - | - | 0.01 | 0.061 | 0.08 | <0.010 | <0.010 | <DL | <0.010 | <0.010 | 0.036 | 0.02 | 0.027 |
| Cadmium (Cd)-Total | mg/L | 0.000033 | 0.02 | 0.00001 | ***0.000768*** | ***0.00116*** | ***0.000052*** | 0.000022 | 58% | ***0.00359*** | ***0.00663*** | ***0.00196*** | ***0.000069*** | ***0.000451*** |
| Calcium (Ca)-Total | mg/L | - | - | 0.05 | 283 | 201 | 79.5 | 78 | 2% | 176 | 245 | 215 | 159 | 176 |
| Chromium (Cr)-Total | mg/L | 0.0089 | 0.04 | 0.0001 | 0.00058 | 0.00037 | 0.0011 | 0.00039 | 65% | 0.00014 | 0.00024 | 0.00117 | 0.00032 | 0.00353 |
| Cobalt (Co)-Total | mg/L | - | - | 0.0001 | 0.00911 | 0.00059 | 0.00066 | 0.00025 | 62% | 0.0006 | <0.00010 | 0.00077 | 0.00039 | 0.00331 |
| Copper (Cu)-Total | mg/L | 0.002 | 0.2 | 0.0005 | ***0.00528*** | ***0.0272*** | ***0.00248*** | 0.0012 | 52% | 0.00053 | 0.00083 | ***0.00309*** | 0.00093 | ***0.00901*** |
| Iron (Fe)-Total | mg/L | 0.3 | 1 | 0.01 | ***12*** | ***0.729*** | ***2.02*** | ***0.575*** | 72% | ***0.406*** | 0.041 | ***2.76*** | ***2.3*** | ***7.44*** |
| Lead (Pb)-Total | mg/L | 0.003 | 0.1 | 0.00005 | 0.00012 | ***0.0354*** | 0.00168 | 0.000312 | 81% | 0.000155 | <0.000050 | ***0.00677*** | 0.000096 | ***0.00569*** |
| Lithium (Li)-Total | mg/L | - | - | 0.0005 | 0.00092 | 0.00698 | 0.0008 | <0.00050 | <DL | 0.00837 | 0.00187 | 0.00755 | 0.00323 | 0.00348 |
| Magnesium (Mg)-Total | mg/L | - | - | 0.1 | 60 | 43.7 | 22.4 | 21.5 | 4% | 61.5 | 70.1 | 99.7 | 74.2 | 68 |
| Manganese (Mn)-Total | mg/L | - | 0.5 | 0.00005 | ***7.86*** | 0.277 | 0.138 | 0.102 | 26% | ***1.18*** | 0.183 | ***0.791*** | ***0.509*** | ***2.04*** |
| Mercury (Hg)-Total | mg/L | 0.000026 | 0.005 | 0.00001 | <0.000010 | <0.000010 | <0.000010 | <0.000010 | <DL | <0.000010 | <0.000010 | <0.000010 | <0.000010 | 0.000014 |
| Molybdenum (Mo)-Total | mg/L | 0.0073 | - | 0.00005 | 0.000863 | 0.00128 | 0.000068 | 0.000057 | 16% | 0.000318 | <0.000050 | 0.000218 | 0.000282 | 0.000494 |
| Nickel (Ni)-Total | mg/L | 0.1 | 0.3 | 0.0005 | 0.00342 | 0.00093 | 0.00096 | <0.00050 | <DL | 0.00164 | 0.0055 | 0.00161 | 0.00087 | 0.00411 |
| Phosphorus (P)-Total | mg/L | - | - | 0.05 | <0.050 | <0.050 | 0.084 | <0.050 | <DL | <0.050 | <0.050 | <0.050 | <0.050 | 0.132 |
| Potassium (K)-Total | mg/L | - | - | 0.1 | 6.61 | 12.9 | 4.55 | 4.51 | 1% | 3.57 | 0.44 | 4.31 | 2.72 | 3.46 |
| Selenium (Se)-Total | mg/L | 0.001 | - | 0.0001 | 0.00024 | <0.00010 | <0.00010 | <0.00010 | <DL | <0.00010 | 0.00012 | 0.0001 | <0.00010 | 0.00026 |
| Silicon (Si)-Total | mg/L | - | - | 0.05 | 6.97 | 1.02 | 5.84 | 4.89 | 16% | 6.39 | 7.88 | 6.91 | 6.09 | 8.28 |
| Silver (Ag)-Total | mg/L | 0.0001 | 0.1 | 0.00001 | 0.000049 | ***0.000803*** | 0.000034 | <0.000010 | <DL | 0.000012 | <0.000010 | 0.000063 | <0.000010 | 0.000082 |
| Sodium (Na)-Total | mg/L | - | - | 0.05 | 37.8 | 16.1 | 3.8 | 3.69 | 3% | 5.11 | 6.57 | 6.59 | 7.07 | 12.5 |
| Strontium (Sr)-Total | mg/L | - | - | 0.0002 | 0.8 | 0.552 | 0.244 | 0.245 | 0% | 0.43 | 0.545 | 0.538 | 0.485 | 0.544 |
| Sulfur (S)-Total | mg/L | - | - | 0.5 | 274 | 216 | 65.9 | 64.7 | 2% | 140 | 294 | 223 | 176 | 185 |
| Thallium (Tl)-Total | mg/L | 0.0008 | - | 0.00001 | 0.000012 | 0.000164 | 0.000027 | <0.000010 | <DL | 0.000108 | <0.000010 | 0.000044 | <0.000010 | 0.000031 |
| Tin (Sn)-Total | mg/L | - | - | 0.0001 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <DL | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <0.00010 |
| Titanium (Ti)-Total | mg/L | - | - | 0.01 | <0.010 | <0.010 | 0.04 | <0.010 | <DL | <0.010 | <0.010 | 0.034 | <0.010 | 0.094 |
| Uranium (U)-Total | mg/L | 0.015 | - | 0.00001 | 0.00211 | 0.000947 | 0.000313 | 0.000264 | 16% | 0.00424 | 0.00001 | 0.00306 | 0.00196 | 0.00208 |
| Vanadium (V)-Total | mg/L | - | - | 0.001 | 0.002 | <0.0010 | 0.0038 | 0.001 | 74% | <0.0010 | <0.0010 | 0.0029 | <0.0010 | 0.0105 |
| Zinc (Zn)-Total | mg/L | 0.03 | 0.3 | 0.003 | 0.0125 | ***0.0863*** | 0.0077 | <0.0030 | <DL | ***0.743*** | ***2.48*** | ***0.439*** | 0.0231 | ***0.0421*** |
| Dissolved Metals Filtration Location | | - | - | n/a | FIELD | FIELD | FIELD | FIELD | - | FIELD | FIELD | FIELD | FIELD | FIELD |
| Aluminum (Al)-Dissolved | mg/L | 0.1 | - | 0.001 | 0.0139 | 0.0043 | 0.0075 | 0.0065 | 13% | <0.0010 | ***0.142*** | 0.004 | 0.0197 | 0.0132 |
| Antimony (Sb)-Dissolved | mg/L | - | - | 0.0001 | 0.00045 | 0.0354 | 0.00119 | 0.00117 | 2% | 0.0103 | <0.00010 | 0.0126 | 0.0026 | 0.00183 |
| Arsenic (As)-Dissolved | mg/L | 0.005 | 0.15 | 0.0001 | ***0.0415*** | ***0.0935*** | 0.00288 | 0.00288 | 0% | ***0.0111*** | 0.00041 | ***0.0128*** | ***0.00576*** | ***0.0108*** |
| Barium (Ba)-Dissolved | mg/L | - | - | 0.00005 | 0.065 | 0.0101 | 0.0432 | 0.0424 | 2% | 0.0122 | 0.00839 | 0.0255 | 0.0395 | 0.0447 |
| Beryllium (Be)-Dissolved | mg/L | - | - | 0.0001 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <DL | <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 | <DL | <0.00050 | <0.00050 | <0.00050 | <0.00050 | <0.00050 |

**Table E-1. Summary of Water Quality Results for the October 14-16, 2014 Trip.**

| Analyte | Units | CCME-WATER-F-AL | Mount Nansen Effluent Discharge Standards | Sample ID<br>WQ Site ID<br>Date Sampled<br>Detection Limit | 0455-141014-014<br>WQ-SEEP<br>14-Oct-14 | 0455-141014-012<br>WQ-TP<br>14-Oct-14 | 0455-141015-005<br>WQ-DC-DX-r<br>15-Oct-14<br>QA/QC | 0455-141015-021<br>WQ-DC-DX<br>15-Oct-14 | QA/QC<br>Replicate Sample<br>WQ-DC-DX | 0455-141015-004<br>WQ-DC-DX+105<br>15-Oct-14 | 0455-141015-008<br>WQ-CH-P-13-01 *<br>15-Oct-14 | 0455-141015-007<br>WQ-DC-D1b<br>15-Oct-14 | 0455-141015-006<br>WQ-DC-B<br>15-Oct-14 | 0455-141015-003<br>WQ-DC-U **<br>15-Oct-14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Boron (B)-Dissolved | mg/L | - | - | 0.01 | 0.055 | 0.078 | <0.010 | <0.010 | <DL | <0.010 | <0.010 | 0.035 | 0.018 | 0.026 |
| Cadmium (Cd)-Dissolved | mg/L | 0.000033 | - | 0.00001 | ***0.000407*** | ***0.000836*** | 0.000015 | 0.000016 | 7% | ***0.00149*** | ***0.0087*** | ***0.000238*** | 0.000023 | ***0.000078*** |
| Calcium (Ca)-Dissolved | mg/L | - | - | 0.05 | 281 | 223 | 82 | 81.8 | 0% | 176 | 198 | 221 | 168 | 182 |
| Chromium (Cr)-Dissolved | mg/L | 0.0089 | - | 0.0001 | 0.00037 | <0.00010 | <0.00010 | 0.00011 | <DL | <0.00010 | 0.00012 | <0.00010 | <0.00010 | 0.00014 |
| Cobalt (Co)-Dissolved | mg/L | - | - | 0.0001 | 0.0089 | 0.00055 | 0.00017 | 0.00017 | 0% | 0.00058 | <0.00010 | 0.00026 | 0.00038 | 0.00176 |
| Copper (Cu)-Dissolved | mg/L | 0.002 | - | 0.0002 | ***0.00244*** | ***0.0165*** | 0.00083 | 0.00085 | 2% | <0.00020 | 0.00092 | 0.00067 | 0.00061 | 0.0009 |
| Iron (Fe)-Dissolved | mg/L | 0.3 | - | 0.01 | ***9.63*** | 0.014 | 0.256 | 0.279 | 9% | 0.106 | 0.036 | ***0.543*** | ***1.7*** | ***0.733*** |
| Lead (Pb)-Dissolved | mg/L | 0.003 | - | 0.00005 | <0.000050 | 0.000378 | <0.000050 | <0.000050 | <DL | <0.000050 | <0.000050 | <0.000050 | <0.000050 | <0.000050 |
| Lithium (Li)-Dissolved | mg/L | - | - | 0.0005 | 0.00092 | 0.00771 | <0.00050 | <0.00050 | <DL | 0.00824 | 0.00164 | 0.00756 | 0.00337 | 0.00247 |
| Magnesium (Mg)-Dissolved | mg/L | - | - | 0.1 | 60.9 | 47.5 | 22.6 | 22.3 | 1% | 61.1 | 68.8 | 103 | 78.7 | 71.7 |
| Manganese (Mn)-Dissolved | mg/L | - | - | 0.00005 | 7.5 | 0.239 | 0.11 | 0.123 | 12% | 1.14 | 0.282 | 0.699 | 0.522 | 1.87 |
| Mercury (Hg)-Dissolved | mg/L | 0.000026 | - | 0.00001 | <0.000010 | <0.000010 | <0.000010 | <0.000010 | <DL | <0.000010 | <0.000010 | <0.000010 | <0.000010 | <0.000010 |
| Molybdenum (Mo)-Dissolved | mg/L | 0.0073 | - | 0.00005 | 0.000782 | 0.00131 | <0.000050 | <0.000050 | <DL | 0.000294 | <0.000050 | 0.000188 | 0.000264 | 0.000372 |
| Nickel (Ni)-Dissolved | mg/L | 0.1 | - | 0.0005 | 0.00313 | 0.0008 | <0.00050 | <0.00050 | <DL | 0.00157 | 0.00642 | 0.00078 | 0.00078 | 0.00109 |
| Phosphorus (P)-Dissolved | mg/L | - | - | 0.05 | <0.050 | <0.050 | <0.050 | <0.050 | <DL | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| Potassium (K)-Dissolved | mg/L | - | - | 0.1 | 6.63 | 14.5 | 4.6 | 4.65 | 1% | 3.58 | 0.31 | 4.34 | 2.85 | 3.4 |
| Selenium (Se)-Dissolved | mg/L | 0.001 | - | 0.0001 | 0.00022 | <0.00010 | <0.00010 | 0.00011 | <DL | <0.00010 | <0.00010 | <0.00010 | <0.00010 | 0.0001 |
| Silicon (Si)-Dissolved | mg/L | - | - | 0.05 | 6.87 | 1.03 | 4.8 | 4.9 | 2% | 6.37 | 8.83 | 5.96 | 6.27 | 6.07 |
| Silver (Ag)-Dissolved | mg/L | 0.0001 | - | 0.00001 | <0.000010 | 0.000024 | <0.000010 | <0.000010 | <DL | <0.000010 | <0.000010 | <0.000010 | <0.000010 | <0.000010 |
| Sodium (Na)-Dissolved | mg/L | - | - | 0.05 | 36.9 | 17.1 | 3.92 | 3.75 | 4% | 4.94 | 5.59 | 6.95 | 7.33 | 12.8 |
| Strontium (Sr)-Dissolved | mg/L | - | - | 0.0002 | 0.769 | 0.595 | 0.25 | 0.244 | 2% | 0.417 | 0.459 | 0.527 | 0.486 | 0.526 |
| Sulfur (S)-Dissolved | mg/L | - | - | 0.5 | 272 | 232 | 67.5 | 66.2 | 2% | 136 | 250 | 226 | 181 | 193 |
| Thallium (Tl)-Dissolved | mg/L | 0.0008 | - | 0.00001 | 0.00001 | 0.00016 | <0.000010 | <0.000010 | <DL | 0.000097 | <0.000010 | 0.000027 | <0.000010 | <0.000010 |
| Tin (Sn)-Dissolved | mg/L | - | - | 0.0001 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <DL | <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 | <DL | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Uranium (U)-Dissolved | mg/L | 0.015 | - | 0.00001 | 0.00201 | 0.000964 | 0.000241 | 0.000238 | 1% | 0.0041 | <0.000010 | 0.00298 | 0.00195 | 0.0018 |
| Vanadium (V)-Dissolved | mg/L | - | - | 0.001 | 0.0016 | <0.0010 | <0.0010 | <0.0010 | <DL | <0.0010 | <0.0010 | <0.0010 | <0.0010 | <0.0010 |
| Zinc (Zn)-Dissolved | mg/L | 0.03 | - | 0.001 | 0.0108 | ***0.0585*** | 0.0013 | <0.0010 | <DL | ***0.732*** | ***3.15*** | ***0.355*** | 0.0191 | 0.0105 |

**Applied Guidelines: 'Federal CCME Canadian Environmental Quality Guidelines (May 2014), CCME: Freshwater Aquatic Life**
**'Mount Nansen Effluent Discharge Standards**

| COLOUR KEY: |
|---|
| ***Exceeds CCME Guideline*** |
| ***Exceeds MN Effluent Discharge Standards*** |
| ***Exceeds both CCME and MN Standards*** |
| Data flag for Detection Limit Adjustment --> Please refer to the lab COA report and lab excel report for more info |
| Exceeds 10% difference threshold for QA/QC replicate samples. Note <DL = below detection limit |

*For those guidelines that are hardness dependent (Cd, Cu, Pb, Ni), the most conservative guideline has been applied. Same for guidelines that are pH and temperature dependent (Ammonia and Aluminum), unless otherwise noted.*

**Notes:**

* WQ-CH-P-13-01: The aluminum, cadmium, manganese and zinc concentrations are higher in the dissolved metals sample than the total metals sample. All other metals concentrations are higher in the total vs. dissolved samples. Typically dissolved metals concentrations are lower than total metals concentrations, although there can be exceptions, as seen in the the case of those four parameters.

** The WQ-DC-U mercury sample originally had to be diluted (due to large organics in sample) and this resulted in the detection limit being adjusted above the CCME guidleilne value (from 0.00001 to 0.00005 mg/L). EDI asked ALS to re-analyze the sample and see if the result could be reported below that adjusted detection limit. The reported result here is below detection limit, but has also exceeded the recommended hold times.

*** WQ-PW is a drinking water sample and the analysis package has different detection limits than all other samples. The results are also compard to the *Guidelines for Canadian Drinking Water Quality* (Health Canada, October 2014) versus the CCME or MN Effluent Quality Standards.

**Table E-1. Summary of Water Quality Results for the October 14-16, 2014 Trip.**

| Analyte | Units | CCME-WATER-F-AL | Mount Nansen Effluent Discharge Standards | Sample ID<br>WQ Site ID<br>Date Sampled<br>Detection Limit | 0455-141014-009<br>WQ-DC-R<br>14-Oct-14 | 0455-141014-016<br>WQ-PC-D<br>14-Oct-14 | 0455-141014-011<br>WQ-PC-U<br>14-Oct-14 | 0455-141014-015<br>WQ-VC-UMN<br>14-Oct-14 | 0455-141014-013<br>WQ-VC-UMN-r<br>14-Oct-14<br>QA/QC | QA/QC<br>Replicate Sample<br>WQ-VC-UMN | 0455-141015-017<br>WQ-VC-DBC<br>15-Oct-14 | 0455-141014-010<br>WQ-VC-R<br>14-Oct-14 | 0455-141015-019<br>WQ-VC-U<br>15-Oct-14 | 0455-141015-018<br>WQ-BC<br>15-Oct-14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Temperature (in-situ) | °C | - | - | - | 0.5 | 0.6 | 0.0 | 1.1 | - | - | 0.4 | 0.9 | 0.5 | 0.0 |
| Specific Conductivity (in-situ) | µS/cm | - | - | - | 1103 | 350.2 | 343.8 | 228.2 | - | - | 187.6 | 213.9 | 174.2 | 315.6 |
| pH (in-situ) | pH | 6.5 - 9.0 | 6.0 - 8.5 | - | 7.64 | 7.47 | 7.5 | 7.92 | - | - | 7.78 | 7.86 | 7.33 | 8.01 |
| Turbidity (In-situ) | NTU | - | - | - | 26.00 | 0.21 | 0.44 | 4.43 | - | - | 3.77 | 5.39 | 0.99 | 4.09 |
| Dissolved Oxygen (in-situ) | mg/L | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Colour, True | CU | 15 | - | 5 | - | - | - | - | - | - | - | - | - | - |
| Conductivity | µS/cm | - | - | 2 | 1080 | 347 | 346 | 227 | 226 | 0% | 187 | 213 | 203 | 313 |
| Hardness (as CaCO3) | mg/L | - | - | 0.5 | 622 | 170 | 165 | 112 | 110 | 2% | 91.7 | 103 | 86.3 | 158 |
| pH (lab) | pH | 6.5 - 9.0 | 6.0 - 8.5 | 0.1 | 8.15 | 7.82 | 7.92 | 8.05 | 8.07 | 0% | 8.08 | 8.07 | 8.09 | 8.14 |
| Total Suspended Solids | mg/L | - | 50 | 3 | 18 | 7.3 | <3.0 | <3.0 | 5.3 | 45% | 6.7 | 6 | <3.0 | ***74*** |
| Total Dissolved Solids | mg/L | - | - | 1 | 802 | 214 | 210 | 130 | 130 | 0% | 104 | 122 | 105 | 189 |
| Alkalinity, Bicarbonate (as CaCO3) | mg/L | - | - | 1 | 180 | 68.4 | 62.2 | 85.8 | 86.2 | 0% | 82.8 | 81.1 | 95.7 | 106 |
| Alkalinity, Carbonate (as CaCO3) | mg/L | - | - | 1 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <DL | <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 | <DL | <1.0 | <1.0 | <1.0 | <1.0 |
| Alkalinity, Total (as CaCO3) | mg/L | - | - | 1 | 180 | 68.4 | 62.2 | 85.8 | 86.2 | 0% | 82.8 | 81.1 | 95.7 | 106 |
| Ammonia, Total (as N) | mg/L | 0.75 | - | 0.005 | 0.73 | <0.0050 | <0.0050 | 0.0152 | 0.0158 | 4% | 0.0053 | 0.0149 | <0.0050 | 0.0212 |
| Chloride (Cl) | mg/L | 120 | - | 0.5 | <5.0 | <0.50 | <0.50 | <0.50 | <0.50 | <DL | <0.50 | <0.50 | <0.50 | <0.50 |
| Fluoride (F) | mg/L | 0.12 | - | 0.02 | <0.20 | 0.043 | 0.046 | 0.047 | 0.05 | 6% | 0.05 | 0.05 | 0.045 | 0.072 |
| Nitrate (as N) | mg/L | 13 | - | 0.005 | 0.378 | 0.06 | 0.0383 | 0.134 | 0.133 | 1% | 0.127 | 0.128 | 0.124 | 0.0828 |
| Nitrite (as N) | mg/L | 0.06 | - | 0.001 | 0.012 | <0.0010 | <0.0010 | <0.0010 | <0.0010 | <DL | <0.0010 | <0.0010 | <0.0010 | 0.0011 |
| Sulfate (SO4) | mg/L | - | - | 0.5 | 464 | 107 | 110 | 36.1 | 36 | 0% | 19.2 | 33.2 | 14.3 | 63.7 |
| Cyanide, Weak Acid Diss | mg/L | - | 0.1 | 0.005 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <DL | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| Cyanide, Total | mg/L | - | 0.3 | 0.005 | 0.0068 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <DL | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| Cyanate | mg/L | - | - | 0.2 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <DL | <0.20 | <0.20 | <0.20 | <0.20 |
| Thiocyanate (SCN) | mg/L | - | - | 0.5 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <DL | <0.50 | <0.50 | <0.50 | <0.50 |
| Aluminum (Al)-Total | mg/L | 0.1 | - | 0.003 | ***0.387*** | ***0.115*** | 0.0108 | ***0.148*** | ***0.152*** | 3% | ***0.183*** | ***0.156*** | 0.0469 | ***1.83*** |
| Antimony (Sb)-Total | mg/L | - | 0.15 | 0.0001 | 0.00187 | 0.00237 | 0.00041 | 0.00021 | 0.0002 | 5% | 0.00015 | 0.00022 | <0.00010 | 0.00064 |
| Arsenic (As)-Total | mg/L | 0.005 | - | 0.0001 | ***0.03*** | ***0.00918*** | 0.00119 | 0.00162 | 0.00159 | 2% | 0.00115 | 0.00162 | 0.00034 | ***0.0118*** |
| Barium (Ba)-Total | mg/L | - | 1 | 0.00005 | 0.0538 | 0.0306 | 0.0337 | 0.0598 | 0.0585 | 2% | 0.0614 | 0.0601 | 0.0587 | 0.0964 |
| Beryllium (Be)-Total | mg/L | - | - | 0.0001 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <DL | <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 | <DL | <0.00050 | <0.00050 | <0.00050 | <0.00050 |
| Boron (B)-Total | mg/L | - | - | 0.01 | 0.025 | <0.010 | <0.010 | <0.010 | <0.010 | <DL | <0.010 | <0.010 | <0.010 | <0.010 |
| Cadmium (Cd)-Total | mg/L | 0.000033 | 0.02 | 0.00001 | ***0.000177*** | ***0.000951*** | 0.000017 | ***0.000039*** | ***0.000038*** | 3% | ***0.000046*** | ***0.000038*** | 0.000021 | ***0.00034*** |
| Calcium (Ca)-Total | mg/L | - | - | 0.05 | 144 | 47.1 | 47.7 | 28.7 | 28.4 | 1% | 24 | 26.7 | 21.4 | 43.7 |
| Chromium (Cr)-Total | mg/L | 0.0089 | 0.04 | 0.0001 | 0.00101 | 0.00028 | 0.00015 | 0.00033 | 0.00034 | 3% | 0.00034 | 0.00039 | 0.00028 | 0.00249 |
| Cobalt (Co)-Total | mg/L | - | - | 0.0001 | 0.00169 | 0.0001 | <0.00010 | 0.00018 | 0.00018 | 0% | 0.00016 | 0.00021 | 0.0001 | 0.00107 |
| Copper (Cu)-Total | mg/L | 0.002 | 0.2 | 0.0005 | ***0.00249*** | ***0.00909*** | 0.00073 | 0.0015 | 0.00149 | 1% | 0.00146 | 0.00154 | 0.0013 | ***0.00473*** |
| Iron (Fe)-Total | mg/L | 0.3 | 1 | 0.01 | ***4.95*** | 0.199 | 0.045 | ***0.309*** | ***0.304*** | 2% | ***0.322*** | ***0.421*** | 0.128 | ***2.8*** |
| Lead (Pb)-Total | mg/L | 0.003 | 0.1 | 0.00005 | 0.00225 | 0.00246 | <0.000050 | 0.000575 | 0.000539 | 6% | 0.000686 | 0.000584 | 0.000055 | ***0.00843*** |
| Lithium (Li)-Total | mg/L | - | - | 0.0005 | 0.00217 | 0.00059 | 0.00057 | 0.00057 | 0.0006 | 5% | 0.00078 | 0.00063 | 0.00062 | 0.00186 |
| Magnesium (Mg)-Total | mg/L | - | - | 0.1 | 55.2 | 11.1 | 10.8 | 9.59 | 9.5 | 1% | 7.77 | 8.72 | 7.15 | 10.9 |
| Manganese (Mn)-Total | mg/L | - | 0.5 | 0.00005 | ***1.65*** | 0.0255 | 0.00551 | 0.0924 | 0.0939 | 2% | 0.0792 | 0.0982 | 0.0317 | ***0.636*** |
| Mercury (Hg)-Total | mg/L | 0.000026 | 0.005 | 0.00001 | <0.000010 | <0.000010 | <0.000010 | <0.000010 | <0.000010 | <DL | <0.000010 | <0.000010 | <0.000010 | <0.000010 |
| Molybdenum (Mo)-Total | mg/L | 0.0073 | - | 0.00005 | 0.000397 | 0.000061 | 0.000056 | 0.000393 | 0.00038 | 3% | 0.000419 | 0.000383 | 0.000329 | 0.00101 |
| Nickel (Ni)-Total | mg/L | 0.1 | 0.3 | 0.0005 | 0.00158 | 0.00052 | <0.00050 | <0.00050 | <0.00050 | <DL | 0.00052 | 0.00059 | <0.00050 | 0.00203 |
| Phosphorus (P)-Total | mg/L | - | - | 0.05 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <DL | <0.050 | <0.050 | <0.050 | 0.065 |
| Potassium (K)-Total | mg/L | - | - | 0.1 | 2.79 | 0.52 | 0.46 | 0.64 | 0.62 | 3% | 0.57 | 0.65 | 0.52 | 1.2 |
| Selenium (Se)-Total | mg/L | 0.001 | - | 0.0001 | 0.00014 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <DL | <0.00010 | <0.00010 | <0.00010 | <0.00010 |
| Silicon (Si)-Total | mg/L | - | - | 0.05 | 6.47 | 6.23 | 7 | 6.01 | 5.95 | 1% | 6.27 | 6.34 | 5.78 | 9.75 |
| Silver (Ag)-Total | mg/L | 0.0001 | 0.1 | 0.00001 | 0.000058 | 0.000046 | <0.000010 | <0.000010 | <0.000010 | <DL | 0.000022 | 0.000013 | <0.000010 | 0.000093 |
| Sodium (Na)-Total | mg/L | - | - | 0.05 | 11.4 | 3.75 | 3.88 | 2.76 | 2.73 | 1% | 2.31 | 2.68 | 2.2 | 3.48 |
| Strontium (Sr)-Total | mg/L | - | - | 0.0002 | 0.456 | 0.309 | 0.338 | 0.243 | 0.253 | 4% | 0.253 | 0.238 | 0.241 | 0.278 |
| Sulfur (S)-Total | mg/L | - | - | 0.5 | 149 | 35.5 | 38.7 | 12.2 | 12.1 | 1% | 6.88 | 11.5 | 5.3 | 21.7 |
| Thallium (Tl)-Total | mg/L | 0.0008 | - | 0.00001 | 0.000012 | <0.000010 | <0.000010 | <0.000010 | <0.000010 | <DL | 0.00001 | <0.000010 | <0.000010 | 0.000043 |
| Tin (Sn)-Total | mg/L | - | - | 0.0001 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <DL | <0.00010 | <0.00010 | <0.00010 | <0.00010 |
| Titanium (Ti)-Total | mg/L | - | - | 0.01 | 0.018 | <0.010 | <0.010 | <0.010 | <0.010 | <DL | <0.010 | <0.010 | <0.010 | 0.075 |
| Uranium (U)-Total | mg/L | 0.015 | - | 0.00001 | 0.00145 | 0.000188 | 0.000099 | 0.000544 | 0.000525 | 3% | 0.000534 | 0.00052 | 0.000442 | 0.00136 |
| Vanadium (V)-Total | mg/L | - | - | 0.001 | 0.0025 | <0.0010 | <0.0010 | <0.0010 | <0.0010 | <DL | <0.0010 | <0.0010 | <0.0010 | 0.0049 |
| Zinc (Zn)-Total | mg/L | 0.03 | 0.3 | 0.003 | 0.0178 | ***0.0915*** | <0.0030 | 0.0038 | 0.0043 | 13% | 0.0042 | 0.0048 | <0.0030 | 0.0249 |
| Dissolved Metals Filtration Location | | - | - | n/a | FIELD | FIELD | FIELD | FIELD | FIELD | - | FIELD | FIELD | FIELD | FIELD |
| Aluminum (Al)-Dissolved | mg/L | 0.1 | - | 0.001 | 0.014 | 0.0131 | 0.0093 | 0.0162 | 0.016 | 1% | 0.0171 | 0.021 | 0.0171 | 0.0124 |
| Antimony (Sb)-Dissolved | mg/L | - | - | 0.0001 | 0.00141 | 0.00203 | 0.00043 | 0.00018 | 0.00017 | 6% | <0.00010 | 0.00016 | <0.00010 | 0.00024 |
| Arsenic (As)-Dissolved | mg/L | 0.005 | 0.15 | 0.0001 | ***0.00836*** | ***0.00564*** | 0.00111 | 0.00081 | 0.00078 | 4% | 0.00045 | 0.00084 | 0.0003 | 0.00214 |
| Barium (Ba)-Dissolved | mg/L | - | - | 0.00005 | 0.0455 | 0.0295 | 0.034 | 0.0584 | 0.0566 | 3% | 0.0573 | 0.0575 | 0.0595 | 0.0647 |
| Beryllium (Be)-Dissolved | mg/L | - | - | 0.0001 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <DL | <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 | <DL | <0.00050 | <0.00050 | <0.00050 | <0.00050 |

**Table E-1. Summary of Water Quality Results for the October 14-16, 2014 Trip.**

| Analyte | Units | CCME-WATER-F-AL | Mount Nansen Effluent Discharge Standards | Sample ID<br>WQ Site ID<br>Date Sampled<br>Detection Limit | 0455-141014-009<br>WQ-DC-R<br>14-Oct-14 | 0455-141014-016<br>WQ-PC-D<br>14-Oct-14 | 0455-141014-011<br>WQ-PC-U<br>14-Oct-14 | 0455-141014-015<br>WQ-VC-UMN<br>14-Oct-14 | 0455-141014-013<br>WQ-VC-UMN-r<br>14-Oct-14<br>QA/QC | QA/QC<br>Replicate Sample<br>WQ-VC-UMN | 0455-141015-017<br>WQ-VC-DBC<br>15-Oct-14 | 0455-141014-010<br>WQ-VC-R<br>14-Oct-14 | 0455-141015-019<br>WQ-VC-U<br>15-Oct-14 | 0455-141015-018<br>WQ-BC<br>15-Oct-14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Boron (B)-Dissolved | mg/L | - | - | 0.01 | 0.02 | <0.010 | <0.010 | <0.010 | <0.010 | <DL | <0.010 | <0.010 | <0.010 | <0.010 |
| Cadmium (Cd)-Dissolved | mg/L | 0.000033 | - | 0.00001 | ***0.000052*** | ***0.00103*** | 0.000014 | 0.000028 | 0.000027 | 4% | 0.000028 | 0.000028 | 0.000017 | ***0.000133*** |
| Calcium (Ca)-Dissolved | mg/L | - | - | 0.05 | 153 | 49 | 48 | 29 | 28.6 | 1% | 24 | 26.9 | 22.3 | 45.3 |
| Chromium (Cr)-Dissolved | mg/L | 0.0089 | - | 0.0001 | 0.00021 | <0.00010 | <0.00010 | 0.00013 | 0.00011 | 15% | <0.00010 | 0.00015 | 0.00012 | 0.00012 |
| Cobalt (Co)-Dissolved | mg/L | - | - | 0.0001 | 0.00149 | <0.00010 | <0.00010 | 0.00011 | 0.00011 | 0% | <0.00010 | 0.00014 | <0.00010 | 0.00027 |
| Copper (Cu)-Dissolved | mg/L | 0.002 | - | 0.0002 | 0.00082 | ***0.00806*** | 0.00066 | 0.00113 | 0.00111 | 2% | 0.00108 | 0.00116 | 0.00109 | 0.00134 |
| Iron (Fe)-Dissolved | mg/L | 0.3 | - | 0.01 | ***0.922*** | 0.012 | 0.029 | 0.056 | 0.059 | 5% | 0.06 | 0.119 | 0.059 | 0.086 |
| Lead (Pb)-Dissolved | mg/L | 0.003 | - | 0.00005 | <0.000050 | 0.00024 | <0.000050 | <0.000050 | <0.000050 | <DL | <0.000050 | <0.000050 | <0.000050 | 0.000068 |
| Lithium (Li)-Dissolved | mg/L | - | - | 0.0005 | 0.00202 | 0.00053 | 0.00053 | 0.00054 | 0.00061 | 13% | 0.00064 | 0.00068 | 0.0007 | 0.00108 |
| Magnesium (Mg)-Dissolved | mg/L | - | - | 0.1 | 58 | 11.5 | 10.9 | 9.54 | 9.38 | 2% | 7.73 | 8.76 | 7.46 | 11 |
| Manganese (Mn)-Dissolved | mg/L | - | - | 0.00005 | 1.63 | 0.0221 | 0.00511 | 0.0837 | 0.0836 | 0% | 0.0717 | 0.0868 | 0.0283 | 0.547 |
| Mercury (Hg)-Dissolved | mg/L | 0.000026 | - | 0.00001 | <0.000010 | <0.000010 | <0.000010 | <0.000010 | <0.000010 | <DL | <0.000010 | <0.000010 | <0.000010 | <0.000010 |
| Molybdenum (Mo)-Dissolved | mg/L | 0.0073 | - | 0.00005 | 0.00034 | 0.000053 | <0.000050 | 0.000358 | 0.000355 | 1% | 0.000361 | 0.000329 | 0.000312 | 0.000838 |
| Nickel (Ni)-Dissolved | mg/L | 0.1 | - | 0.0005 | 0.00107 | <0.00050 | <0.00050 | <0.00050 | <0.00050 | <DL | <0.00050 | <0.00050 | <0.00050 | 0.00065 |
| Phosphorus (P)-Dissolved | mg/L | - | - | 0.05 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <DL | <0.050 | <0.050 | <0.050 | <0.050 |
| Potassium (K)-Dissolved | mg/L | - | - | 0.1 | 2.9 | 0.51 | 0.44 | 0.57 | 0.57 | 0% | 0.53 | 0.63 | 0.51 | 0.83 |
| Selenium (Se)-Dissolved | mg/L | 0.001 | - | 0.0001 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <DL | <0.00010 | <0.00010 | <0.00010 | <0.00010 |
| Silicon (Si)-Dissolved | mg/L | - | - | 0.05 | 6.01 | 6.27 | 6.99 | 5.85 | 5.79 | 1% | 6.01 | 6.14 | 5.94 | 7.04 |
| Silver (Ag)-Dissolved | mg/L | 0.0001 | - | 0.00001 | <0.000010 | <0.000010 | <0.000010 | <0.000010 | <0.000010 | <DL | <0.000010 | <0.000010 | <0.000010 | <0.000010 |
| Sodium (Na)-Dissolved | mg/L | - | - | 0.05 | 11.6 | 3.84 | 3.83 | 2.78 | 2.73 | 2% | 2.34 | 2.63 | 2.21 | 3.46 |
| Strontium (Sr)-Dissolved | mg/L | - | - | 0.0002 | 0.459 | 0.308 | 0.328 | 0.248 | 0.249 | 0% | 0.246 | 0.235 | 0.241 | 0.275 |
| Sulfur (S)-Dissolved | mg/L | - | - | 0.5 | 156 | 36.3 | 38.5 | 12.2 | 12.2 | 0% | 6.88 | 11.5 | 5.44 | 22.2 |
| Thallium (Tl)-Dissolved | mg/L | 0.0008 | - | 0.00001 | <0.000010 | <0.000010 | <0.000010 | <0.000010 | <0.000010 | <DL | <0.000010 | <0.000010 | <0.000010 | <0.000010 |
| Tin (Sn)-Dissolved | mg/L | - | - | 0.0001 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <DL | <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 | <DL | <0.010 | <0.010 | <0.010 | <0.010 |
| Uranium (U)-Dissolved | mg/L | 0.015 | - | 0.00001 | 0.00145 | 0.00018 | 0.000092 | 0.000516 | 0.000502 | 3% | 0.000496 | 0.000487 | 0.00043 | 0.00125 |
| Vanadium (V)-Dissolved | mg/L | - | - | 0.001 | <0.0010 | <0.0010 | <0.0010 | <0.0010 | <0.0010 | <DL | <0.0010 | <0.0010 | <0.0010 | <0.0010 |
| Zinc (Zn)-Dissolved | mg/L | 0.03 | - | 0.001 | 0.0053 | ***0.101*** | 0.0017 | 0.0019 | 0.0015 | 21% | 0.0014 | 0.0017 | 0.0017 | 0.0034 |

**Applied Guidelines: 'Federal CCME Canadian Environmental Quality Guidelines (May 2014), CCME: Freshwater Aquatic Life**
**'Mount Nansen Effluent Discharge Standards**

| COLOUR KEY: |
|---|
| ***Exceeds CCME Guideline*** |
| ***Exceeds MN Effluent Discharge Standards*** |
| ***Exceeds both CCME and MN Standards*** |
| Data flag for Detection Limit Adjustment --> Please refer to the lab COA report and lab excel report for more info |
| Exceeds 10% difference threshold for QA/QC replicate samples. Note <DL = below detection limit |

*For those guidelines that are hardness dependent (Cd, Cu, Pb, Ni), the most conservative guideline has been applied. Same for guidelines that are pH and temperature dependent (Ammonia and Aluminum), unless otherwise noted.*

**Table E-1. Summary of Water Quality Results for the October 14-16, 2014 Trip.**

| Analyte | Units | CCME-WATER-F-AL | Mount Nansen Effluent Discharge Standards | Sample ID<br>WQ Site ID<br>Date Sampled<br>Detection Limit | 0455-141015-025<br>WQ-PW***<br>15-Oct-14 | 0455-141015-TRAVEL-BLANK<br>Travel Blank | 0455-141015-FIELD-BLANK<br>Field Blank<br>15-Oct-14 |
|---|---|---|---|---|---|---|---|
| Temperature (in-situ) | °C | - | - | - | 0.8 | - | - |
| Specific Conductivity (in-situ) | µS/cm | - | - | - | 371 | - | - |
| pH (in-situ) | pH | 6.5 - 9.0 | 6.0 - 8.5 | - | 7.74 | - | - |
| Turbidity (In-situ) | NTU | - | - | - | 0.17 | - | - |
| Dissolved Oxygen (in-situ) | mg/L | - | - | - | - | - | - |
| Colour, True | CU | 15 | - | 5 | <5.0 | - | - |
| Conductivity | µS/cm | - | - | 2 | 339 | - | <2.0 |
| Hardness (as CaCO3) | mg/L | - | - | 0.5 | 193 | <0.50 | <0.50 |
| pH (lab) | pH | 6.5 - 9.0 | 6.0 - 8.5 | 0.1 | 7.9 | - | ***5.65*** |
| Total Suspended Solids | mg/L | - | 50 | 3 | - | - | <3.0 |
| Total Dissolved Solids | mg/L | - | - | 1 | 211 | - | <1.0 |
| Alkalinity, Bicarbonate (as CaCO3) | mg/L | - | - | 1 | - | - | <1.0 |
| 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 | 179 | - | <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 | 0.096 | - | <0.020 |
| Nitrate (as N) | mg/L | 13 | - | 0.005 | 0.118 | - | <0.0050 |
| Nitrite (as N) | mg/L | 0.06 | - | 0.001 | <0.0010 | - | <0.0010 |
| Sulfate (SO4) | mg/L | - | - | 0.5 | 33.5 | - | <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 |
| 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 | 0.00041 | <0.00010 | <0.00010 |
| Barium (Ba)-Total | mg/L | - | 1 | 0.00005 | 0.085 | <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 | 44.4 | <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 | 0.00072 | <0.000050 | <0.000050 |
| Lithium (Li)-Total | mg/L | - | - | 0.0005 | - | <0.00050 | <0.00050 |
| Magnesium (Mg)-Total | mg/L | - | - | 0.1 | 20 | <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 | 4.8 | <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 | 0.00183 | <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 | <0.050 | <0.0030 | <0.0030 |
| Dissolved Metals Filtration Location | | - | - | n/a | - | - | FIELD |
| Aluminum (Al)-Dissolved | mg/L | 0.1 | - | 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 |

**Table E-1. Summary of Water Quality Results for the October 14-16, 2014 Trip.**

| Analyte | Units | CCME-WATER-F-AL | Mount Nansen Effluent Discharge Standards | Sample ID<br>WQ Site ID<br>Date Sampled<br>Detection Limit | 0455-141015-025<br>WQ-PW***<br>15-Oct-14 | 0455-141015-TRAVEL-BLANK<br>Travel Blank | 0455-141015-FIELD-BLANK<br>Field Blank<br>15-Oct-14 |
|---|---|---|---|---|---|---|---|
| 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 | 0.003 | - | 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 | 0.0073 | - | 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 |

**Applied Guidelines: 'Federal CCME Canadian Environmental Quality Guidelines (May 2014), CCME: Freshwater Aquatic Life**
**'Mount Nansen Effluent Discharge Standards**

| COLOUR KEY: |
|---|
| ***Exceeds CCME Guideline*** |
| ***Exceeds MN Effluent Discharge Standards*** |
| ***Exceeds both CCME and MN Standards*** |
| Data flag for Detection Limit Adjustment --> Please refer to the lab COA report and lab excel report for more info |
| Exceeds 10% difference threshold for QA/QC replicate samples. Note <DL = below detection limit |

*For those guidelines that are hardness dependent (Cd, Cu, Pb, Ni), the most conservative guideline has been applied. Same for guidelines that are pH and temperature dependent (Ammonia and Aluminum), unless otherwise noted.*

**Table E-2. Summary of Water Quality Results for the November 12-14, 2014 Trip.**

| Analyte | Units | CCME-WATER-F-AL | Mount Nansen Effluent Discharge Standards | Sample ID<br>WQ Site ID<br>Date Sampled<br>Detection Limit | 0455-141113-002<br>WQ-VC-DBC<br>13-Nov-14 | 0455-141112-018<br>WQ-PC-D<br>12-Nov-14 | 0455-141112-008<br>WQ-VC-UMN<br>12-Nov-14 | 0455-141112-005<br>WQ-VC-R *<br>12-Nov-14 | 0455-141113-025<br>WQ-DC-DX+105<br>13-Nov-14 | 0455-141113-003<br>WQ-SEEP<br>13-Nov-14 | 0455-141113-007<br>WQ-TP<br>13-Nov-14 | 0455-141113-011<br>WQ-DESS-02<br>13-Nov-14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Temperature (in-situ) | °C | - | - | - | -0.1 | 0.2 | -0.1 | 0.1 | 0.6 | 1.5 | 1.8 | 0.4 |
| Specific Conductivity (in-situ) | µS/cm | - | - | - | 210.3 | 369.4 | 222.7 | 222.2 | 1,184 | 1,796 | 1,511 | 2,054 |
| pH (in-situ) | pH | 6.5 - 9.0 | 6.0 - 8.5 | - | 6.82 | 6.94 | 7.42 | 7.32 | 6.8 | 6.79 | 7.42 | 7.41 |
| Turbidity (In-situ) | NTU | - | - | - | 0.56 | 3.00 | 0.71 | 1.42 | 2.78 | 24.10 | 4.41 | 1.09 |
| Dissolved Oxygen (in-situ - Pit only) | mg/L | - | - | - | - | - | - | - | - | - | - | - |
| Colour, True | CU | 15 | - | 5 | - | - | - | - | - | - | - | - |
| Conductivity | µS/cm | - | - | 2 | 212 | 436 | 223 | 263 | 1180 | 1710 | 1490 | 1990 |
| Hardness (as CaCO3) | mg/L | - | - | 0.5 | 106 | 228 | 113 | 113 | 710 | 958 | 838 | 1240 |
| pH (lab) | pH | 6.5 - 9.0 | 6.0 - 8.5 | 0.1 | 8.09 | 7.90 | 8.08 | 8.13 | 8.16 | 8.00 | 8.09 | 8.06 |
| Total Suspended Solids | mg/L | - | 50 | 3 | <3.0 | 12 | <3.0 | 4 | 3.3 | 19.3 | 3.3 | 4 |
| Total Dissolved Solids | mg/L | - | - | 1 | 115 | 267 | 121 | 130 | 845 | 1340 | 1180 | 1670 |
| Alkalinity, Bicarbonate (as CaCO3) | mg/L | - | - | 1 | 92.6 | 105 | 88.4 | 107 | 282 | 249 | 107 | 134 |
| 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 | 92.6 | 105 | 88.4 | 107 | 282 | 249 | 107 | 134 |
| Ammonia, Total (as N) | mg/L | 0.75 | - | 0.005 | 0.0281 | <0.0050 | 0.0055 | <0.0050 | 0.02 | ***4.28*** | 0.177 | 0.008 |
| Chloride (Cl) | mg/L | 120 | - | 0.5 | <0.50 | <0.50 | <0.50 | <0.50 | <5.0 | <5.0 | <5.0 | <5.0 |
| Fluoride (F) | mg/L | 0.12 | - | 0.02 | 0.045 | 0.055 | 0.046 | 0.048 | <0.20 | <0.20 | <0.20 | <0.20 |
| Nitrate (as N) | mg/L | 13 | - | 0.005 | 0.149 | 0.0193 | 0.141 | 0.129 | <0.050 | 0.654 | 0.104 | ***13.2*** |
| Nitrite (as N) | mg/L | 0.06 | - | 0.001 | <0.0010 | <0.0010 | <0.0010 | <0.0010 | <0.010 | 0.021 | <0.010 | <0.010 |
| Sulfate (SO4) | mg/L | - | - | 0.5 | 18.6 | 118 | 24.6 | 22.8 | 421 | 783 | 774 | 1070 |
| Cyanide, Weak Acid Diss | mg/L | - | 0.1 | 0.005 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | 0.019 | <0.0050 | <0.0050 |
| Cyanide, Total | mg/L | - | 0.3 | 0.005 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | 0.069 | <0.0050 | <0.0050 |
| Cyanate | mg/L | - | - | 0.2 | <2.0 | <0.20 | <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 | 3.7 | <0.50 | <0.50 |
| Aluminum (Al)-Total | mg/L | 0.1 | - | 0.003 | 0.0181 | 0.0917 | 0.0294 | 0.0411 | 0.066 | 0.0247 | 0.0189 | 0.0157 |
| Antimony (Sb)-Total | mg/L | - | 0.15 | 0.0001 | <0.00010 | 0.00433 | 0.00025 | 0.00026 | 0.0109 | 0.00048 | 0.0384 | 0.00036 |
| Arsenic (As)-Total | mg/L | 0.005 | - | 0.0001 | 0.0003 | ***0.00543*** | 0.00095 | 0.00111 | ***0.0378*** | ***0.075*** | ***0.166*** | 0.00335 |
| Barium (Ba)-Total | mg/L | - | 1 | 0.00005 | 0.0729 | 0.024 | 0.0708 | 0.0709 | 0.0123 | 0.064 | 0.0124 | 0.0392 |
| Beryllium (Be)-Total | mg/L | - | - | 0.0001 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <0.00020 |
| Bismuth (Bi)-Total | mg/L | - | - | 0.0005 | <0.00050 | <0.00050 | <0.00050 | <0.00050 | <0.00050 | <0.00050 | <0.00050 | <0.0010 |
| Boron (B)-Total | mg/L | - | - | 0.01 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | 0.06 | 0.09 | <0.020 |
| Cadmium (Cd)-Total | mg/L | 0.000033 | 0.02 | 0.00001 | 0.000016 | ***0.00275*** | 0.000024 | 0.000022 | ***0.00335*** | ***0.000792*** | ***0.00106*** | ***0.000132*** |
| Calcium (Ca)-Total | mg/L | - | - | 0.05 | 26.7 | 64.4 | 29.1 | 28.8 | 178 | 264 | 241 | 374 |
| Chromium (Cr)-Total | mg/L | 0.0089 | 0.04 | 0.0001 | 0.00015 | 0.00025 | 0.00016 | 0.00023 | 0.00014 | 0.00062 | 0.00024 | <0.00020 |
| Cobalt (Co)-Total | mg/L | - | - | 0.0001 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | 0.00064 | 0.00767 | 0.00066 | <0.00020 |
| Copper (Cu)-Total | mg/L | 0.002 | 0.2 | 0.0005 | 0.00101 | ***0.014*** | 0.00112 | 0.00124 | 0.00065 | ***0.00306*** | ***0.022*** | <0.0010 |
| Iron (Fe)-Total | mg/L | 0.3 | 1 | 0.01 | 0.038 | 0.128 | 0.057 | 0.088 | ***0.467*** | ***16*** | ***0.304*** | 0.025 |
| Lead (Pb)-Total | mg/L | 0.003 | 0.1 | 0.00005 | <0.000050 | 0.00204 | 0.000122 | 0.000178 | 0.000356 | 0.000114 | ***0.00758*** | <0.00010 |
| Lithium (Li)-Total | mg/L | - | - | 0.0005 | 0.00085 | 0.00201 | 0.00059 | 0.00068 | 0.0102 | 0.00059 | 0.00834 | <0.0010 |
| Magnesium (Mg)-Total | mg/L | - | - | 0.1 | 9.35 | 15 | 10 | 9.74 | 61.7 | 64.1 | 51.2 | 64.3 |
| Manganese (Mn)-Total | mg/L | - | 0.5 | 0.00005 | 0.0382 | 0.0386 | 0.0351 | 0.0331 | ***1.28*** | ***8.62*** | 0.327 | 0.0596 |
| 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 | 0.000395 | 0.000066 | 0.000377 | 0.000378 | 0.000354 | 0.00101 | 0.00147 | 0.00022 |
| Nickel (Ni)-Total | mg/L | 0.1 | 0.3 | 0.0005 | <0.00050 | 0.00093 | <0.00050 | <0.00050 | 0.00189 | 0.00302 | 0.00116 | <0.0010 |
| Phosphorus (P)-Total | mg/L | - | - | 0.05 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 | <0.050 |
| Potassium (K)-Total | mg/L | - | - | 0.1 | 0.65 | 0.87 | 0.73 | 0.69 | 3.92 | 6.56 | 16.6 | 1.21 |
| Selenium (Se)-Total | mg/L | 0.001 | - | 0.0001 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | 0.00028 | <0.00010 | 0.00044 |
| Silicon (Si)-Total | mg/L | - | - | 0.05 | 5.94 | 6.29 | 6.12 | 6.04 | 6.55 | 7.61 | 1.44 | 5.43 |
| Silver (Ag)-Total | mg/L | 0.0001 | 0.1 | 0.00001 | <0.000010 | 0.000052 | <0.000010 | <0.000010 | 0.000042 | 0.000067 | ***0.000157*** | <0.000020 |
| Sodium (Na)-Total | mg/L | - | - | 0.05 | 2.62 | 4.17 | 2.97 | 2.98 | 5.35 | 34.5 | 18.8 | 9.76 |
| Strontium (Sr)-Total | mg/L | - | - | 0.0002 | 0.317 | 0.456 | 0.31 | 0.302 | 0.464 | 0.787 | 0.637 | 0.827 |
| Sulfur (S)-Total | mg/L | - | - | 0.5 | 6.51 | 40 | 8.61 | 8.44 | 142 | 261 | 256 | 351 |
| Thallium (Tl)-Total | mg/L | 0.0008 | - | 0.00001 | <0.000010 | 0.00001 | <0.000010 | <0.000010 | 0.0001 | <0.000010 | 0.000196 | <0.000020 |
| Tin (Sn)-Total | mg/L | - | - | 0.0001 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <0.00020 |
| Titanium (Ti)-Total | mg/L | - | - | 0.01 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.020 |
| Uranium (U)-Total | mg/L | 0.015 | - | 0.00001 | 0.000581 | 0.000487 | 0.00058 | 0.000577 | 0.00434 | 0.00181 | 0.00111 | 0.00182 |

**Table E-2. Summary of Water Quality Results for the November 12-14, 2014 Trip.**

| Analyte | Units | CCME-WATER-F-AL | Mount Nansen Effluent Discharge Standards | Sample ID<br>WQ Site ID<br>Date Sampled<br>Detection Limit | 0455-141113-002<br>WQ-VC-DBC<br>13-Nov-14 | 0455-141112-018<br>WQ-PC-D<br>12-Nov-14 | 0455-141112-008<br>WQ-VC-UMN<br>12-Nov-14 | 0455-141112-005<br>WQ-VC-R *<br>12-Nov-14 | 0455-141113-025<br>WQ-DC-DX+105<br>13-Nov-14 | 0455-141113-003<br>WQ-SEEP<br>13-Nov-14 | 0455-141113-007<br>WQ-TP<br>13-Nov-14 | 0455-141113-011<br>WQ-DESS-02<br>13-Nov-14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Vanadium (V)-Total | mg/L | - | - | 0.001 | <0.0010 | <0.0010 | <0.0010 | <0.0010 | <0.0010 | 0.0024 | <0.0010 | <0.0020 |
| Zinc (Zn)-Total | mg/L | 0.03 | 0.3 | 0.003 | <0.0030 | ***0.306*** | <0.0030 | 0.0036 | ***0.872*** | 0.0147 | ***0.114*** | 0.0095 |
| Dissolved Metals Filtration Location | | - | - | n/a | FIELD | FIELD | FIELD | FIELD | FIELD | FIELD | FIELD | FIELD |
| Aluminum (Al)-Dissolved | mg/L | 0.1 | - | 0.001 | 0.0077 | 0.0101 | 0.0074 | 0.0082 | <0.0010 | 0.0122 | 0.003 | 0.006 |
| Antimony (Sb)-Dissolved | mg/L | - | - | 0.0001 | <0.00010 | 0.00393 | 0.00024 | 0.00025 | 0.011 | 0.00043 | 0.0375 | 0.00037 |
| Arsenic (As)-Dissolved | mg/L | 0.005 | 0.15 | 0.0001 | 0.00029 | 0.0032 | 0.00093 | 0.00091 | ***0.0135*** | ***0.0595*** | ***0.107*** | 0.00312 |
| Barium (Ba)-Dissolved | mg/L | - | - | 0.00005 | 0.0727 | 0.0227 | 0.0696 | 0.07 | 0.0112 | 0.0629 | 0.0119 | 0.0389 |
| Beryllium (Be)-Dissolved | mg/L | - | - | 0.0001 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <0.00020 |
| Bismuth (Bi)-Dissolved | mg/L | - | - | 0.0005 | <0.00050 | <0.00050 | <0.00050 | <0.00050 | <0.00050 | <0.00050 | <0.00050 | <0.0010 |
| Boron (B)-Dissolved | mg/L | - | - | 0.01 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | 0.053 | 0.08 | <0.020 |
| Cadmium (Cd)-Dissolved | mg/L | 0.000033 | - | 0.00001 | 0.000019 | ***0.00283*** | 0.000017 | 0.000016 | ***0.00179*** | ***0.000298*** | ***0.000933*** | ***0.000132*** |
| Calcium (Ca)-Dissolved | mg/L | - | - | 0.05 | 26.9 | 66.1 | 29 | 28.9 | 181 | 272 | 248 | 386 |
| Chromium (Cr)-Dissolved | mg/L | 0.0089 | - | 0.0001 | <0.00010 | <0.00010 | <0.00010 | 0.0009 | <0.00010 | 0.00043 | <0.00010 | <0.00020 |
| Cobalt (Co)-Dissolved | mg/L | - | - | 0.0001 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | 0.00063 | 0.00756 | 0.00061 | <0.00020 |
| Copper (Cu)-Dissolved | mg/L | 0.002 | - | 0.0002 | 0.00091 | ***0.0124*** | 0.00097 | 0.00104 | 0.00026 | 0.00115 | ***0.0179*** | 0.00056 |
| Iron (Fe)-Dissolved | mg/L | 0.3 | - | 0.01 | 0.017 | <0.010 | 0.017 | 0.028 | 0.124 | ***14.4*** | 0.011 | <0.010 |
| Lead (Pb)-Dissolved | mg/L | 0.003 | - | 0.00005 | <0.000050 | 0.000324 | <0.000050 | <0.000050 | <0.000050 | <0.000050 | 0.000225 | <0.00010 |
| Lithium (Li)-Dissolved | mg/L | - | - | 0.0005 | 0.0009 | 0.00178 | 0.00075 | 0.00083 | 0.0102 | <0.00050 | 0.00755 | <0.0010 |
| Magnesium (Mg)-Dissolved | mg/L | - | - | 0.1 | 9.36 | 15.2 | 9.97 | 9.86 | 62.6 | 67.8 | 53 | 66.3 |
| Manganese (Mn)-Dissolved | mg/L | - | - | 0.00005 | 0.037 | 0.0343 | 0.0308 | 0.0281 | 1.23 | 8.61 | 0.314 | 0.059 |
| 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 | 0.0073 | - | 0.00005 | 0.000359 | 0.000052 | 0.000353 | 0.00035 | 0.000346 | 0.000963 | 0.00137 | 0.00021 |
| Nickel (Ni)-Dissolved | mg/L | 0.1 | - | 0.0005 | <0.00050 | 0.00085 | <0.00050 | 0.00083 | 0.00173 | 0.00302 | 0.00101 | <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 | 0.63 | 0.84 | 0.71 | 0.73 | 3.76 | 6.89 | 17.4 | 1.18 |
| Selenium (Se)-Dissolved | mg/L | 0.001 | - | 0.0001 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | 0.00027 | <0.00010 | 0.00039 |
| Silicon (Si)-Dissolved | mg/L | - | - | 0.05 | 5.94 | 6.3 | 6.05 | 6.11 | 6.44 | 7.74 | 1.44 | 5.51 |
| Silver (Ag)-Dissolved | mg/L | 0.0001 | - | 0.00001 | <0.000010 | <0.000010 | <0.000010 | <0.000010 | <0.000010 | <0.000010 | 0.000026 | <0.000020 |
| Sodium (Na)-Dissolved | mg/L | - | - | 0.05 | 2.68 | 4.11 | 2.94 | 2.95 | 5.24 | 34.6 | 19.2 | 9.62 |
| Strontium (Sr)-Dissolved | mg/L | - | - | 0.0002 | 0.307 | 0.427 | 0.297 | 0.297 | 0.457 | 0.809 | 0.657 | 0.847 |
| Sulfur (S)-Dissolved | mg/L | - | - | 0.5 | 6.45 | 39.6 | 8.49 | 8.35 | 141 | 263 | 255 | 349 |
| Thallium (Tl)-Dissolved | mg/L | 0.0008 | - | 0.00001 | <0.000010 | <0.000010 | <0.000010 | <0.000010 | 0.000092 | <0.000010 | 0.000174 | <0.000020 |
| Tin (Sn)-Dissolved | mg/L | - | - | 0.0001 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <0.00020 |
| Titanium (Ti)-Dissolved | mg/L | - | - | 0.01 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.020 |
| Uranium (U)-Dissolved | mg/L | 0.015 | - | 0.00001 | 0.000554 | 0.000459 | 0.000555 | 0.000549 | 0.00422 | 0.00185 | 0.00105 | 0.00183 |
| Vanadium (V)-Dissolved | mg/L | - | - | 0.001 | <0.0010 | <0.0010 | <0.0010 | <0.0010 | <0.0010 | 0.0019 | <0.0010 | <0.0020 |
| Zinc (Zn)-Dissolved | mg/L | 0.03 | - | 0.001 | 0.0015 | ***0.314*** | <0.0010 | 0.0024 | ***0.878*** | 0.0115 | ***0.097*** | 0.0083 |

**Applied Guidelines: 'Federal CCME Canadian Environmental Quality Guidelines (May 2014), CCME: Freshwater Aquatic Life**
**'Mount Nansen Effluent Discharge Standards**

| COLOUR KEY: |
|---|
| ***Exceeds CCME Guideline*** |
| ***Exceeds MN Effluent Discharge Standards*** |
| ***Exceeds both CCME and MN Standards*** |
| Data flag for Detection Limit Adjustment --> Please refer to the lab COA report and lab excel report for more info |
| Exceeds 10% difference threshold for QA/QC replicate samples. Note <DL = below detection limit |

*For those guidelines that are hardness dependent (Cd, Cu, Pb, Ni), the most conservative guideline has been applied. Same for guidelines that are pH and temperature dependent (Ammonia and Aluminum), unless otherwise noted.*

**Notes:**

* WQ-VC-R: The chromium concentration is higher in the dissolved metals sample than the total metals sample. All other metals concentrations are higher in the total vs. dissolved samples. Typically dissolved metals concentrations are lower than total metals concentrations, although there can be exceptions, as seen in the the case of this sample.

** The QA/QC Travel Blank sample had an ammonia concentration above the detection limit. This can occur to the NH3 sample when the lab supplied travel blank samples are somewhat older. We do not suspect any contamination from contamaination from travel and transport of the sample.

*** WQ-PW is a drinking water sample and the analysis package has different detection limits than all other samples. The results are also compard to the *Guidelines for Canadian Drinking Water Quality* (Health Canada, October 2014) versus the CCME or MN Effluent Quality Standards.

**Table E-2. Summary of Water Quality Results for the November 12-14, 2014 Trip.**

| Analyte | Units | CCME-WATER-F-AL | Mount Nansen Effluent Discharge Standards | Sample ID<br>WQ Site ID<br>Date Sampled<br>Detection Limit | 0455-141113-001<br>WQ-VC-U<br>13-Nov-14 | 0455-141113-006<br>WQ-DC-U-r<br>13-Nov-14<br>QA/QC | 0455-141113-004<br>WQ-DC-U<br>13-Nov-14 | QA/QC<br>Replicate Sample<br>WQ-DC-U | 0455-141114-022<br>WQ-PIT-1 (top)<br>14-Nov-14<br>(Depth: 0.3 m) | 0455-141114-020<br>WQ-PIT-2 (middle)<br>14-Nov-14<br>(Depth: 3.0 m) | 0455-141114-021<br>WQ-PIT-3 (bottom)<br>14-Nov-14<br>(Depth: 5.5 m) | 0455-141114-023<br>WQ-PW***<br>14-Nov-14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Temperature (in-situ) | °C | - | - | - | -0.1 | - | 0.0 | - | 1.9 | 2.7 | 4.0 | 1.2 |
| Specific Conductivity (in-situ) | µS/cm | - | - | - | 208.1 | - | 1,552 | - | 1,730 | 1,775 | 2,185 | 379.9 |
| pH (in-situ) | pH | 6.5 - 9.0 | 6.0 - 8.5 | - | 7.05 | - | 6.9 | - | 7.05 | 7.03 | 6.84 | 6.13 |
| Turbidity (In-situ) | NTU | - | - | - | 0.65 | - | 12.33 | - | 0.88 | 1.26 | 0.72 | 0.00 |
| Dissolved Oxygen (in-situ - Pit only) | mg/L | - | - | - | - | - | - | - | 7.28 | 6.55 | 0.73 | - |
| Colour, True | CU | 15 | - | 5 | - | - | - | - | - | - | - | <5.0 |
| Conductivity | µS/cm | - | - | 2 | 209 | 1490 | 1540 | 3% | 1580 | 1750 | 2090 | 386 |
| Hardness (as CaCO3) | mg/L | - | - | 0.5 | 108 | 871 | 847 | 3% | 994 | 1070 | 1260 | 196 |
| pH (lab) | pH | 6.5 - 9.0 | 6.0 - 8.5 | 0.1 | 8.06 | 8.10 | 8.08 | 0% | 8.16 | 8.20 | 8.11 | 7.80 |
| Total Suspended Solids | mg/L | - | 50 | 3 | <3.0 | 14.7 | 15.3 | 4% | <3.0 | 3.3 | <3.0 | - |
| Total Dissolved Solids | mg/L | - | - | 1 | 112 | 1140 | 1150 | 1% | 1230 | 1380 | 1750 | 213 |
| Alkalinity, Bicarbonate (as CaCO3) | mg/L | - | - | 1 | 87.5 | 237 | 243 | 3% | 200 | 181 | 206 | - |
| Alkalinity, Carbonate (as CaCO3) | mg/L | - | - | 1 | <1.0 | <1.0 | <1.0 | <DL | <1.0 | <1.0 | <1.0 | - |
| Alkalinity, Hydroxide (as CaCO3) | mg/L | - | - | 1 | <1.0 | <1.0 | <1.0 | <DL | <1.0 | <1.0 | <1.0 | - |
| Alkalinity, Total (as CaCO3) | mg/L | - | - | 1 | 87.5 | 237 | 243 | 3% | 200 | 181 | 206 | 175 |
| Ammonia, Total (as N) | mg/L | 0.75 | - | 0.005 | <0.0050 | ***3.16*** | ***2.99*** | 5% | 0.006 | <0.0050 | 0.0164 | - |
| Chloride (Cl) | mg/L | 120 | - | 0.5 | <0.50 | <5.0 | <5.0 | <DL | <5.0 | <5.0 | <5.0 | <0.50 |
| Fluoride (F) | mg/L | 0.12 | - | 0.02 | 0.046 | <0.20 | <0.20 | <DL | <0.20 | <0.20 | <0.20 | 0.095 |
| Nitrate (as N) | mg/L | 13 | - | 0.005 | 0.151 | 0.351 | 0.38 | 8% | 0.338 | <0.050 | <0.050 | 0.116 |
| Nitrite (as N) | mg/L | 0.06 | - | 0.001 | <0.0010 | 0.013 | 0.014 | 8% | <0.010 | <0.010 | <0.010 | <0.0010 |
| Sulfate (SO4) | mg/L | - | - | 0.5 | 18.5 | 646 | 653 | 1% | 751 | 880 | 1170 | 36.2 |
| Cyanide, Weak Acid Diss | mg/L | - | 0.1 | 0.005 | <0.0050 | 0.0156 | 0.0113 | 28% | - | - | - | - |
| Cyanide, Total | mg/L | - | 0.3 | 0.005 | <0.0050 | 0.0319 | 0.0318 | 0% | - | - | - | - |
| Cyanate | mg/L | - | - | 0.2 | <0.20 | 0.36 | 0.42 | 17% | - | - | - | - |
| Thiocyanate (SCN) | mg/L | - | - | 0.5 | <0.50 | 1.72 | 1.67 | 3% | - | - | - | - |
| Aluminum (Al)-Total | mg/L | 0.1 | - | 0.003 | 0.0235 | 0.0155 | 0.0156 | 1% | 0.0046 | 0.0091 | <0.0060 | <0.010 |
| Antimony (Sb)-Total | mg/L | - | 0.15 | 0.0001 | <0.00010 | 0.00039 | 0.00035 | 10% | 0.00606 | 0.00352 | 0.00155 | <0.00050 |
| Arsenic (As)-Total | mg/L | 0.005 | - | 0.0001 | 0.00031 | ***0.0439*** | ***0.0441*** | 0% | ***0.0102*** | ***0.0111*** | ***0.014*** | 0.00037 |
| Barium (Ba)-Total | mg/L | - | 1 | 0.00005 | 0.0734 | 0.0626 | 0.0631 | 1% | 0.011 | 0.0122 | 0.00645 | 0.086 |
| Beryllium (Be)-Total | mg/L | - | - | 0.0001 | <0.00010 | <0.00010 | <0.00010 | <DL | <0.00010 | <0.00010 | <0.00020 | - |
| Bismuth (Bi)-Total | mg/L | - | - | 0.0005 | <0.00050 | <0.00050 | <0.00050 | <DL | <0.00050 | <0.00050 | <0.0010 | - |
| Boron (B)-Total | mg/L | - | - | 0.01 | <0.010 | 0.045 | 0.047 | 4% | <0.010 | <0.010 | <0.020 | <0.10 |
| Cadmium (Cd)-Total | mg/L | 0.000033 | 0.02 | 0.00001 | 0.000019 | ***0.000337*** | ***0.000353*** | 5% | ***0.00525*** | ***0.0028*** | ***0.00518*** | <0.00020 |
| Calcium (Ca)-Total | mg/L | - | - | 0.05 | 26.6 | 234 | 235 | 0% | 256 | 289 | 347 | 44.8 |
| Chromium (Cr)-Total | mg/L | 0.0089 | 0.04 | 0.0001 | 0.00012 | 0.00037 | 0.00044 | 19% | 0.00018 | 0.00017 | <0.00020 | <0.0020 |
| Cobalt (Co)-Total | mg/L | - | - | 0.0001 | <0.00010 | 0.00539 | 0.00532 | 1% | <0.00010 | <0.00010 | 0.00036 | - |
| Copper (Cu)-Total | mg/L | 0.002 | 0.2 | 0.0005 | 0.00097 | 0.00166 | 0.00174 | 5% | ***0.00761*** | ***0.00344*** | 0.0019 | <0.0010 |
| Iron (Fe)-Total | mg/L | 0.3 | 1 | 0.01 | 0.05 | ***5.03*** | ***4.91*** | 2% | 0.024 | 0.032 | 0.027 | <0.030 |
| Lead (Pb)-Total | mg/L | 0.003 | 0.1 | 0.00005 | <0.000050 | 0.00006 | 0.000058 | 3% | 0.000288 | 0.000759 | 0.00026 | 0.00067 |
| Lithium (Li)-Total | mg/L | - | - | 0.0005 | 0.00106 | 0.00054 | 0.00064 | 19% | 0.0082 | 0.00724 | 0.009 | - |
| Magnesium (Mg)-Total | mg/L | - | - | 0.1 | 9.54 | 62.7 | 62.7 | 0% | 77.1 | 85.3 | 97.3 | 20.4 |
| Manganese (Mn)-Total | mg/L | - | 0.5 | 0.00005 | 0.0394 | ***6.39*** | ***6.53*** | 2% | 0.154 | 0.0756 | ***0.802*** | <0.0020 |
| Mercury (Hg)-Total | mg/L | 0.000026 | 0.005 | 0.00001 | <0.000010 | <0.000010 | <0.000010 | <DL | <0.000010 | <0.000010 | <0.000010 | <0.00020 |
| Molybdenum (Mo)-Total | mg/L | 0.0073 | - | 0.00005 | 0.000406 | 0.000828 | 0.000819 | 1% | 0.0003 | 0.000145 | <0.00010 | - |
| Nickel (Ni)-Total | mg/L | 0.1 | 0.3 | 0.0005 | <0.00050 | 0.00215 | 0.00216 | 0% | 0.00128 | <0.00050 | <0.0010 | - |
| Phosphorus (P)-Total | mg/L | - | - | 0.05 | <0.050 | <0.050 | <0.050 | <DL | <0.050 | <0.050 | <0.050 | - |
| Potassium (K)-Total | mg/L | - | - | 0.1 | 0.66 | 5.61 | 5.46 | 3% | 3.48 | 4.09 | 3.96 | 0.92 |
| Selenium (Se)-Total | mg/L | 0.001 | - | 0.0001 | <0.00010 | 0.00019 | 0.00018 | 5% | <0.00010 | <0.00010 | <0.00020 | <0.0010 |
| Silicon (Si)-Total | mg/L | - | - | 0.05 | 6.16 | 6.91 | 6.85 | 1% | 4.58 | 3.51 | 3.51 | - |
| Silver (Ag)-Total | mg/L | 0.0001 | 0.1 | 0.00001 | <0.000010 | 0.000026 | 0.000024 | 8% | 0.00001 | 0.000014 | <0.000020 | - |
| Sodium (Na)-Total | mg/L | - | - | 0.05 | 2.62 | 27.1 | 28 | 3% | 12.4 | 12.3 | 15.3 | 4.6 |
| Strontium (Sr)-Total | mg/L | - | - | 0.0002 | 0.326 | 0.72 | 0.703 | 2% | 1.06 | 1.02 | 1.24 | - |
| Sulfur (S)-Total | mg/L | - | - | 0.5 | 6.52 | 227 | 229 | 1% | 252 | 317 | 389 | - |
| Thallium (Tl)-Total | mg/L | 0.0008 | - | 0.00001 | <0.000010 | <0.000010 | <0.000010 | <DL | 0.000065 | 0.000057 | 0.000066 | - |
| Tin (Sn)-Total | mg/L | - | - | 0.0001 | <0.00010 | <0.00010 | <0.00010 | <DL | <0.00010 | <0.00010 | <0.00020 | - |
| Titanium (Ti)-Total | mg/L | - | - | 0.01 | <0.010 | <0.010 | <0.010 | <DL | <0.010 | <0.010 | <0.020 | - |
| Uranium (U)-Total | mg/L | 0.015 | - | 0.00001 | 0.000574 | 0.00154 | 0.0015 | 3% | 0.00401 | 0.00408 | 0.00474 | 0.00191 |

**Table E-2. Summary of Water Quality Results for the November 12-14, 2014 Trip.**

| Analyte | Units | CCME-WATER-F-AL | Mount Nansen Effluent Discharge Standards | Sample ID<br>WQ Site ID<br>Date Sampled<br>Detection Limit | 0455-141113-001<br>WQ-VC-U<br>13-Nov-14 | 0455-141113-006<br>WQ-DC-U-r<br>13-Nov-14<br>QA/QC | 0455-141113-004<br>WQ-DC-U<br>13-Nov-14 | QA/QC<br>Replicate Sample<br>WQ-DC-U | 0455-141114-022<br>WQ-PIT-1 (top)<br>14-Nov-14<br>(Depth: 0.3 m) | 0455-141114-020<br>WQ-PIT-2 (middle)<br>14-Nov-14<br>(Depth: 3.0 m) | 0455-141114-021<br>WQ-PIT-3 (bottom)<br>14-Nov-14<br>(Depth: 5.5 m) | 0455-141114-023<br>WQ-PW***<br>14-Nov-14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Vanadium (V)-Total | mg/L | - | - | 0.001 | <0.0010 | 0.0011 | 0.0011 | 0% | <0.0010 | <0.0010 | <0.0020 | - |
| Zinc (Zn)-Total | mg/L | 0.03 | 0.3 | 0.003 | <0.0030 | 0.0082 | 0.0094 | 15% | ***0.711*** | ***0.344*** | ***0.523*** | <0.050 |
| Dissolved Metals Filtration Location | | - | - | n/a | FIELD | FIELD | FIELD | - | FIELD | FIELD | FIELD | - |
| Aluminum (Al)-Dissolved | mg/L | 0.1 | - | 0.001 | 0.0078 | 0.0083 | 0.0081 | 2% | <0.0010 | 0.0012 | <0.0020 | - |
| Antimony (Sb)-Dissolved | mg/L | - | - | 0.0001 | <0.00010 | 0.00034 | 0.00031 | 9% | 0.00595 | 0.0035 | 0.00139 | - |
| Arsenic (As)-Dissolved | mg/L | 0.005 | 0.15 | 0.0001 | 0.00025 | ***0.0382*** | ***0.0383*** | 0% | ***0.00949*** | ***0.00986*** | ***0.0118*** | - |
| Barium (Ba)-Dissolved | mg/L | - | - | 0.00005 | 0.0732 | 0.0614 | 0.0608 | 1% | 0.0109 | 0.0122 | 0.00636 | - |
| Beryllium (Be)-Dissolved | mg/L | - | - | 0.0001 | <0.00010 | <0.00010 | <0.00010 | <DL | <0.00010 | <0.00010 | <0.00020 | - |
| Bismuth (Bi)-Dissolved | mg/L | - | - | 0.0005 | <0.00050 | <0.00050 | <0.00050 | <DL | <0.00050 | <0.00050 | <0.0010 | - |
| Boron (B)-Dissolved | mg/L | - | - | 0.01 | <0.010 | 0.04 | 0.039 | 3% | <0.010 | <0.010 | <0.020 | - |
| Cadmium (Cd)-Dissolved | mg/L | 0.000033 | - | 0.00001 | 0.000016 | ***0.000191*** | ***0.000179*** | 6% | ***0.00517*** | ***0.00267*** | ***0.00506*** | - |
| Calcium (Ca)-Dissolved | mg/L | - | - | 0.05 | 27.4 | 242 | 234 | 3% | 263 | 292 | 346 | - |
| Chromium (Cr)-Dissolved | mg/L | 0.0089 | - | 0.0001 | <0.00010 | 0.00023 | 0.00022 | 4% | <0.00010 | <0.00010 | <0.00020 | - |
| Cobalt (Co)-Dissolved | mg/L | - | - | 0.0001 | <0.00010 | 0.00524 | 0.00526 | 0% | <0.00010 | <0.00010 | 0.00027 | - |
| Copper (Cu)-Dissolved | mg/L | 0.002 | - | 0.0002 | 0.00088 | 0.00092 | 0.00092 | 0% | ***0.00701*** | ***0.00257*** | 0.00145 | - |
| Iron (Fe)-Dissolved | mg/L | 0.3 | - | 0.01 | 0.017 | ***3.97*** | ***3.86*** | 3% | <0.010 | <0.010 | <0.010 | - |
| Lead (Pb)-Dissolved | mg/L | 0.003 | - | 0.00005 | <0.000050 | <0.000050 | <0.000050 | <DL | <0.000050 | <0.000050 | <0.00010 | - |
| Lithium (Li)-Dissolved | mg/L | - | - | 0.0005 | 0.00101 | 0.00051 | <0.00050 | <DL | 0.00763 | 0.00674 | 0.0089 | - |
| Magnesium (Mg)-Dissolved | mg/L | - | - | 0.1 | 9.66 | 64.9 | 63.9 | 2% | 81.6 | 82.1 | 95 | - |
| Manganese (Mn)-Dissolved | mg/L | - | - | 0.00005 | 0.0364 | 6.48 | 6.52 | 1% | 0.148 | 0.034 | 0.678 | - |
| Mercury (Hg)-Dissolved | mg/L | 0.000026 | - | 0.00001 | <0.000010 | <0.000010 | <0.000010 | <DL | <0.000010 | <0.000010 | <0.000010 | - |
| Molybdenum (Mo)-Dissolved | mg/L | 0.0073 | - | 0.00005 | 0.000357 | 0.000728 | 0.000717 | 2% | 0.000272 | 0.000131 | <0.00010 | - |
| Nickel (Ni)-Dissolved | mg/L | 0.1 | - | 0.0005 | <0.00050 | 0.00213 | 0.00209 | 2% | 0.00126 | <0.00050 | <0.0010 | - |
| Phosphorus (P)-Dissolved | mg/L | - | - | 0.05 | <0.050 | <0.050 | <0.050 | <DL | <0.050 | <0.050 | <0.050 | - |
| Potassium (K)-Dissolved | mg/L | - | - | 0.1 | 0.67 | 5.7 | 5.54 | 3% | 3.77 | 4 | 3.97 | - |
| Selenium (Se)-Dissolved | mg/L | 0.001 | - | 0.0001 | <0.00010 | 0.00018 | 0.00018 | 0% | <0.00010 | <0.00010 | <0.00020 | - |
| Silicon (Si)-Dissolved | mg/L | - | - | 0.05 | 6.2 | 6.95 | 6.76 | 3% | 4.69 | 3.47 | 3.5 | - |
| Silver (Ag)-Dissolved | mg/L | 0.0001 | - | 0.00001 | <0.000010 | <0.000010 | <0.000010 | <DL | <0.000010 | <0.000010 | <0.000020 | - |
| Sodium (Na)-Dissolved | mg/L | - | - | 0.05 | 2.6 | 27.4 | 27.7 | 1% | 12.2 | 12 | 14.9 | - |
| Strontium (Sr)-Dissolved | mg/L | - | - | 0.0002 | 0.301 | 0.696 | 0.679 | 2% | 1.08 | 0.992 | 1.2 | - |
| Sulfur (S)-Dissolved | mg/L | - | - | 0.5 | 6.56 | 224 | 222 | 1% | 261 | 303 | 373 | - |
| Thallium (Tl)-Dissolved | mg/L | 0.0008 | - | 0.00001 | <0.000010 | <0.000010 | <0.000010 | <DL | 0.000061 | 0.000056 | 0.000066 | - |
| Tin (Sn)-Dissolved | mg/L | - | - | 0.0001 | <0.00010 | <0.00010 | <0.00010 | <DL | <0.00010 | <0.00010 | <0.00020 | - |
| Titanium (Ti)-Dissolved | mg/L | - | - | 0.01 | <0.010 | <0.010 | <0.010 | <DL | <0.010 | <0.010 | <0.020 | - |
| Uranium (U)-Dissolved | mg/L | 0.015 | - | 0.00001 | 0.000544 | 0.00152 | 0.00143 | 6% | 0.0038 | 0.00399 | 0.00464 | - |
| Vanadium (V)-Dissolved | mg/L | - | - | 0.001 | <0.0010 | <0.0010 | <0.0010 | <DL | <0.0010 | <0.0010 | <0.0020 | - |
| Zinc (Zn)-Dissolved | mg/L | 0.03 | - | 0.001 | 0.0015 | 0.0067 | 0.007 | 4% | ***0.696*** | ***0.343*** | ***0.505*** | - |

**Applied Guidelines: 'Federal CCME Canadian Environmental Quality Guidelines (May 2014), CCME: Freshwater Aquatic Life**
**'Mount Nansen Effluent Discharge Standards**

| COLOUR KEY: |
|---|
| ***Exceeds CCME Guideline*** |
| ***Exceeds MN Effluent Discharge Standards*** |
| ***Exceeds both CCME and MN Standards*** |
| Data flag for Detection Limit Adjustment --> Please refer to the lab COA report and lab excel report for more info |
| Exceeds 10% difference threshold for QA/QC replicate samples. Note <DL = below detection limit |

*For those guidelines that are hardness dependent (Cd, Cu, Pb, Ni), the most conservative guideline has been applied. Same for guidelines that are pH and temperature dependent (Ammonia and Aluminum), unless otherwise noted.*

**Table E-2. Summary of Water Quality Results for the November 12-14, 2014 Trip.**

| Analyte | Units | CCME-WATER-F-AL | Mount Nansen Effluent Discharge Standards | Sample ID<br>WQ Site ID<br>Date Sampled<br>Detection Limit | 0455-141114-FIELD-BLANK<br>Field Blank<br>14-Nov-14 | 0455-141114-TRAVEL-BLANK<br>Travel Blank ** |
|---|---|---|---|---|---|---|
| Temperature (in-situ) | °C | - | - | - | - | - |
| Specific Conductivity (in-situ) | µS/cm | - | - | - | - | - |
| pH (in-situ) | pH | 6.5 - 9.0 | 6.0 - 8.5 | - | - | - |
| Turbidity (In-situ) | NTU | - | - | - | - | - |
| Dissolved Oxygen (in-situ - Pit only) | mg/L | - | - | - | - | - |
| Colour, True | CU | 15 | - | 5 | - | - |
| Conductivity | µS/cm | - | - | 2 | <2.0 | <2.0 |
| Hardness (as CaCO3) | mg/L | - | - | 0.5 | <0.50 | - |
| pH (lab) | pH | 6.5 - 9.0 | 6.0 - 8.5 | 0.1 | ***5.57*** | ***5.73*** |
| 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 | 0.0081 |
| 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 | <0.0050 | <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 |
| Cyanide, Total | mg/L | - | 0.3 | 0.005 | - | <0.0050 |
| Cyanate | mg/L | - | - | 0.2 | <0.20 | <2.0 |
| 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 |
| Uranium (U)-Total | mg/L | 0.015 | - | 0.00001 | <0.000010 | <0.000010 |

**Table E-2. Summary of Water Quality Results for the November 12-14, 2014 Trip.**

| Analyte | Units | CCME-WATER-F-AL | Mount Nansen Effluent Discharge Standards | Sample ID<br>WQ Site ID<br>Date Sampled<br>Detection Limit | 0455-141114-FIELD-BLANK<br>Field Blank<br>14-Nov-14 | 0455-141114-TRAVEL-BLANK<br>Travel Blank ** |
|---|---|---|---|---|---|---|
| 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 | 0.1 | - | 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 | 0.003 | - | 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 | 0.0073 | - | 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 | - |

**Applied Guidelines: 'Federal CCME Canadian Environmental Quality Guidelines (May 2014), CCME: Freshwater Aquatic Life**
**'Mount Nansen Effluent Discharge Standards**

| COLOUR KEY: |
|---|
| ***Exceeds CCME Guideline*** |
| ***Exceeds MN Effluent Discharge Standards*** |
| ***Exceeds both CCME and MN Standards*** |
| Data flag for Detection Limit Adjustment --> Please refer to the lab COA report and lab excel report for more info |
| Exceeds 10% difference threshold for QA/QC replicate samples. Note <DL = below detection limit |

*For those guidelines that are hardness dependent (Cd, Cu, Pb, Ni), the most conservative guideline has been applied. Same for guidelines that are pH and temperature dependent (Ammonia and Aluminum), unless otherwise noted.*

**Table E-3. Summary of Water Quality Results for the December 15-16, 2014 Trip.**

| Analyte | Units | CCME-WATER-F-AL | Mount Nansen Effluent Discharge Standards | Sample ID<br>WQ Site ID<br>Date Sampled<br>Detection Limit | 0455-141216-001<br>WQ-DC-DX+105<br>16-Dec-14 | 0455-141216-008<br>WQ-TP<br>16-Dec-14 | 0455-141215-010<br>WQ-SEEP<br>15-Dec-14 | 0455-141215-009<br>WQ-DC-U<br>15-Dec-14 | 0455-141216-003<br>WQ-VC-U<br>16-Dec-14 | 0455-141215-007<br>WQ-VC-UMN<br>15-Dec-14 | 0455-141215-006<br>WQ-VC-R+150<br>15-Dec-14 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Temperature (in-situ) | °C | - | - | - | 0.5 | 1.2 | 0.6 | 0.0 | 0.1 | 0.0 | 0.0 |
| Specific Conductivity (in-situ) | µS/cm | - | - | - | 1193 | 1701 | 1620 | 1334 | 215.4 | 167.8 | 230.5 |
| pH (in-situ) | pH | 6.5 - 9.0 | 6.0 - 8.5 | - | 7.25 | 7.53 | 7.10 | 7.29 | 7.21 | 7.19 | 6.70 |
| Turbidity (In-situ) | NTU | - | - | - | 1.65 | 4.89 | 17.81 | 11.08 | 0.29 | 0.66 | 0.61 |
| Dissolved Oxygen (in-situ - Pit only) | mg/L | - | - | - | - | - | - | - | - | - | - |
| Colour, True | CU | 15 | - | 5 | - | - | - | - | - | - | - |
| Conductivity | µS/cm | - | - | 2 | 1180 | 1670 | 1670 | 1530 | 218 | 229 | 231 |
| Hardness (as CaCO3) | mg/L | - | - | 0.5 | 691 | 964 | 927 | 864 | 110 | 116 | 115 |
| pH (lab) | pH | 6.5 - 9.0 | 6.0 - 8.5 | 0.1 | 7.93 | 8.01 | 7.69 | 7.84 | 8.01 | 8.00 | 7.99 |
| Total Suspended Solids | mg/L | - | 50 | 3 | <3.0 | <3.0 | 26.7 | 15.3 | <3.0 | <3.0 | <3.0 |
| Total Dissolved Solids | mg/L | - | - | 1 | 853 | 1370 | 1340 | 1210 | 118 | 126 | 126 |
| Alkalinity, Bicarbonate (as CaCO3) | mg/L | - | - | 1 | 281 | 143 | 244 | 232 | 92.8 | 94.1 | 93 |
| 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 | 281 | 143 | 244 | 232 | 92.8 | 94.1 | 93 |
| Ammonia, Total (as N) | mg/L | 0.75 | - | 0.005 | 0.0195 | 0.521 | ***4.07*** | ***3.29*** | <0.0050 | <0.0050 | <0.0050 |
| Chloride (Cl) | mg/L | 120 | - | 0.5 | <5.0 | <5.0 | 6.5 | <5.0 | <0.50 | <0.50 | <0.50 |
| Fluoride (F) | mg/L | 0.12 | - | 0.02 | <0.20 | ***0.24*** | <0.20 | <0.20 | 0.05 | 0.051 | 0.051 |
| Nitrate (as N) | mg/L | 13 | - | 0.005 | <0.050 | 0.152 | 1.05 | 0.635 | 0.156 | 0.149 | 0.148 |
| Nitrite (as N) | mg/L | 0.06 | - | 0.001 | <0.010 | <0.010 | 0.056 | 0.021 | <0.0010 | <0.0010 | <0.0010 |
| Sulfate (SO4) | mg/L | - | - | 0.5 | 436 | 889 | 782 | 713 | 20.2 | 25.6 | 26.3 |
| Cyanide, Weak Acid Diss | mg/L | - | 0.1 | 0.005 | <0.0050 | <0.0050 | 0.015 | 0.0147 | <0.0050 | <0.0050 | <0.0050 |
| Cyanide, Total | mg/L | - | 0.3 | 0.005 | <0.0050 | <0.0050 | 0.0826 | 0.0469 | <0.0050 | <0.0050 | <0.0050 |
| Cyanate | mg/L | - | - | 0.2 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 |
| Thiocyanate (SCN) | mg/L | - | - | 0.5 | <0.50 | <0.50 | 3.02 | 1.68 | <0.50 | <0.50 | <0.50 |
| Aluminum (Al)-Total | mg/L | 0.1 | - | 0.003 | 0.0257 | 0.021 | 0.0176 | 0.0565 | 0.0192 | 0.0341 | 0.0331 |
| Antimony (Sb)-Total | mg/L | - | 0.15 | 0.0001 | 0.0106 | 0.0366 | 0.00061 | 0.00047 | 0.00011 | 0.00036 | 0.00043 |
| Arsenic (As)-Total | mg/L | 0.005 | - | 0.0001 | ***0.0386*** | ***0.214*** | ***0.0518*** | ***0.0301*** | 0.00029 | 0.00157 | 0.00157 |
| Barium (Ba)-Total | mg/L | - | 1.0 | 0.00005 | 0.0115 | 0.0179 | 0.0544 | 0.0565 | 0.0753 | 0.0715 | 0.0717 |
| Beryllium (Be)-Total | mg/L | - | - | 0.0001 | <0.00010 | <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 | <0.00050 |
| Boron (B)-Total | mg/L | - | - | 0.01 | <0.010 | 0.09 | 0.057 | 0.048 | <0.010 | <0.010 | <0.010 |
| Cadmium (Cd)-Total | mg/L | 0.000033 | 0.02 | 0.00001 | ***0.0031*** | ***0.00187*** | ***0.00108*** | ***0.000529*** | 0.00002 | 0.00002 | 0.000016 |
| Calcium (Ca)-Total | mg/L | - | - | 0.05 | 173 | 283 | 260 | 237 | 28.2 | 29.8 | 29.2 |
| Chromium (Cr)-Total | mg/L | 0.0089 | 0.04 | 0.0001 | 0.00013 | 0.00051 | 0.00054 | 0.0005 | 0.00017 | 0.00016 | 0.00015 |
| Cobalt (Co)-Total | mg/L | - | - | 0.0001 | 0.00066 | 0.00092 | 0.00868 | 0.00652 | <0.00010 | <0.00010 | <0.00010 |
| Copper (Cu)-Total | mg/L | 0.002 | 0.2 | 0.0005 | <0.00050 | ***0.0266*** | ***0.00434*** | ***0.00244*** | 0.00097 | 0.00107 | 0.00113 |
| Iron (Fe)-Total | mg/L | 0.3 | 1.0 | 0.01 | ***0.445*** | ***0.422*** | ***12.2*** | ***5.57*** | 0.042 | 0.064 | 0.054 |
| Lead (Pb)-Total | mg/L | 0.003 | 0.1 | 0.00005 | 0.00026 | ***0.00619*** | 0.000074 | 0.00011 | <0.000050 | 0.000162 | 0.00013 |
| Lithium (Li)-Total | mg/L | - | - | 0.0005 | 0.00695 | 0.0079 | 0.00055 | 0.00071 | <0.00050 | <0.00050 | <0.00050 |
| Magnesium (Mg)-Total | mg/L | - | - | 0.1 | 60.7 | 59.1 | 59.9 | 59.7 | 9.45 | 10 | 9.96 |
| Manganese (Mn)-Total | mg/L | - | 0.5 | 0.00005 | ***1.28*** | ***1.51*** | ***9.18*** | ***7.73*** | 0.0524 | 0.0422 | 0.0246 |
| 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 | 0.000371 | 0.00194 | 0.00107 | 0.000881 | 0.00038 | 0.000392 | 0.000402 |
| Nickel (Ni)-Total | mg/L | 0.1 | 0.3 | 0.0005 | 0.00181 | 0.00191 | 0.00373 | 0.00265 | <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 | 3.48 | 17.9 | 6.05 | 5.31 | 0.67 | 0.69 | 0.65 |
| Selenium (Se)-Total | mg/L | 0.001 | - | 0.0001 | <0.00010 | <0.00010 | 0.00021 | 0.00018 | <0.00010 | <0.00010 | <0.00010 |
| Silicon (Si)-Total | mg/L | - | - | 0.05 | 6.37 | 2.13 | 7.17 | 6.7 | 6.03 | 6.09 | 6.14 |
| Silver (Ag)-Total | mg/L | 0.0001 | 0.1 | 0.00001 | <0.000010 | ***0.000135*** | 0.000044 | 0.000034 | <0.000010 | <0.000010 | <0.000010 |
| Sodium (Na)-Total | mg/L | - | - | 0.05 | 4.88 | 21.5 | 33 | 27.6 | 2.62 | 2.99 | 2.94 |
| Strontium (Sr)-Total | mg/L | - | - | 0.0002 | 0.44 | 0.802 | 0.784 | 0.732 | 0.317 | 0.307 | 0.312 |
| Sulfur (S)-Total | mg/L | - | - | 0.5 | 136 | 279 | 243 | 221 | 6.76 | 8.51 | 8.85 |
| Thallium (Tl)-Total | mg/L | 0.0008 | - | 0.00001 | 0.000097 | 0.000253 | <0.000010 | <0.000010 | <0.000010 | <0.000010 | <0.000010 |
| Tin (Sn)-Total | mg/L | - | - | 0.0001 | <0.00010 | <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 | <0.010 |

**Table E-3. Summary of Water Quality Results for the December 15-16, 2014 Trip.**

| Analyte | Units | CCME-WATER-F-AL | Mount Nansen Effluent Discharge Standards | Sample ID<br>WQ Site ID<br>Date Sampled<br>Detection Limit | 0455-141216-001<br>WQ-DC-DX+105<br>16-Dec-14 | 0455-141216-008<br>WQ-TP<br>16-Dec-14 | 0455-141215-010<br>WQ-SEEP<br>15-Dec-14 | 0455-141215-009<br>WQ-DC-U<br>15-Dec-14 | 0455-141216-003<br>WQ-VC-U<br>16-Dec-14 | 0455-141215-007<br>WQ-VC-UMN<br>15-Dec-14 | 0455-141215-006<br>WQ-VC-R+150<br>15-Dec-14 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Uranium (U)-Total | mg/L | 0.015 | - | 0.00001 | 0.00447 | 0.00131 | 0.00222 | 0.00187 | 0.000657 | 0.000688 | 0.000681 |
| Vanadium (V)-Total | mg/L | - | - | 0.001 | <0.0010 | <0.0010 | 0.0019 | 0.0013 | <0.0010 | <0.0010 | <0.0010 |
| Zinc (Zn)-Total | mg/L | 0.03 | 0.3 | 0.003 | ***0.876*** | ***0.195*** | 0.0208 | 0.0119 | <0.0030 | <0.0030 | <0.0030 |
| Dissolved Metals Filtration Location | | - | - | n/a | FIELD | FIELD | FIELD | FIELD | FIELD | FIELD | FIELD |
| Aluminum (Al)-Dissolved | mg/L | 0.1 | - | 0.001 | 0.001 | 0.002 | 0.0106 | 0.0073 | 0.007 | 0.0057 | 0.0058 |
| Antimony (Sb)-Dissolved | mg/L | - | - | 0.0001 | 0.0107 | 0.0362 | 0.00057 | 0.00041 | <0.00010 | 0.00033 | 0.0004 |
| Arsenic (As)-Dissolved | mg/L | 0.005 | 0.15 | 0.0001 | ***0.0162*** | ***0.132*** | ***0.0423*** | ***0.0261*** | 0.00024 | 0.00138 | 0.00129 |
| Barium (Ba)-Dissolved | mg/L | - | - | 0.00005 | 0.0116 | 0.0172 | 0.0552 | 0.0566 | 0.0754 | 0.0696 | 0.0702 |
| Beryllium (Be)-Dissolved | mg/L | - | - | 0.0001 | <0.00010 | <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 | <0.00050 |
| Boron (B)-Dissolved | mg/L | - | - | 0.01 | <0.010 | 0.091 | 0.054 | 0.044 | <0.010 | <0.010 | <0.010 |
| Cadmium (Cd)-Dissolved | mg/L | 0.000033 | - | 0.00001 | ***0.00136*** | ***0.00177*** | ***0.000544*** | ***0.000334*** | 0.00002 | 0.000021 | 0.000017 |
| Calcium (Ca)-Dissolved | mg/L | - | - | 0.05 | 178 | 291 | 269 | 245 | 28.4 | 30 | 29.6 |
| Chromium (Cr)-Dissolved | mg/L | 0.0089 | - | 0.0001 | <0.00010 | 0.00021 | 0.00038 | 0.00026 | <0.00010 | <0.00010 | <0.00010 |
| Cobalt (Co)-Dissolved | mg/L | - | - | 0.0001 | 0.00066 | 0.00084 | 0.00884 | 0.00645 | <0.00010 | <0.00010 | <0.00010 |
| Copper (Cu)-Dissolved | mg/L | 0.002 | - | 0.0002 | <0.00020 | ***0.0229*** | 0.00185 | 0.00126 | 0.00089 | 0.00116 | 0.00098 |
| Iron (Fe)-Dissolved | mg/L | 0.3 | - | 0.01 | 0.193 | 0.031 | ***11.3*** | ***4.72*** | 0.015 | 0.013 | <0.010 |
| Lead (Pb)-Dissolved | mg/L | 0.003 | - | 0.00005 | <0.000050 | 0.000237 | <0.000050 | <0.000050 | <0.000050 | <0.000050 | <0.000050 |
| Lithium (Li)-Dissolved | mg/L | - | - | 0.0005 | 0.00755 | 0.00879 | 0.00056 | 0.00078 | <0.00050 | <0.00050 | <0.00050 |
| Magnesium (Mg)-Dissolved | mg/L | - | - | 0.1 | 60.1 | 57.7 | 62.1 | 61.3 | 9.57 | 10 | 10 |
| Manganese (Mn)-Dissolved | mg/L | - | - | 0.00005 | 1.28 | 1.5 | 9.47 | 7.68 | 0.051 | 0.0359 | 0.0201 |
| 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 | 0.0073 | - | 0.00005 | 0.000364 | 0.0019 | 0.000922 | 0.000875 | 0.000355 | 0.000366 | 0.000363 |
| Nickel (Ni)-Dissolved | mg/L | 0.1 | - | 0.0005 | 0.00172 | 0.00188 | 0.0038 | 0.00263 | <0.00050 | 0.00098 | <0.00050 |
| 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 | 3.51 | 18 | 6.15 | 5.52 | 0.65 | 0.67 | 0.71 |
| Selenium (Se)-Dissolved | mg/L | 0.001 | - | 0.0001 | <0.00010 | <0.00010 | 0.00027 | 0.00019 | <0.00010 | <0.00010 | <0.00010 |
| Silicon (Si)-Dissolved | mg/L | - | - | 0.05 | 6.35 | 2.1 | 7.27 | 6.76 | 6.05 | 6.06 | 6.05 |
| Silver (Ag)-Dissolved | mg/L | 0.0001 | - | 0.00001 | <0.000010 | 0.000023 | <0.000010 | <0.000010 | <0.000010 | <0.000010 | <0.000010 |
| Sodium (Na)-Dissolved | mg/L | - | - | 0.05 | 4.86 | 22.1 | 34.6 | 27.8 | 2.63 | 2.95 | 2.92 |
| Strontium (Sr)-Dissolved | mg/L | - | - | 0.0002 | 0.439 | 0.799 | 0.8 | 0.735 | 0.312 | 0.303 | 0.296 |
| Sulfur (S)-Dissolved | mg/L | - | - | 0.5 | 134 | 276 | 249 | 224 | 6.77 | 8.4 | 8.7 |
| Thallium (Tl)-Dissolved | mg/L | 0.0008 | - | 0.00001 | 0.000091 | 0.000245 | <0.000010 | <0.000010 | <0.000010 | <0.000010 | <0.000010 |
| Tin (Sn)-Dissolved | mg/L | - | - | 0.0001 | <0.00010 | <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 | <0.010 |
| Uranium (U)-Dissolved | mg/L | 0.015 | - | 0.00001 | 0.00435 | 0.00128 | 0.00228 | 0.00183 | 0.000631 | 0.000655 | 0.00062 |
| Vanadium (V)-Dissolved | mg/L | - | - | 0.001 | <0.0010 | <0.0010 | 0.0016 | <0.0010 | <0.0010 | <0.0010 | <0.0010 |
| Zinc (Zn)-Dissolved | mg/L | 0.03 | - | 0.001 | ***0.875*** | ***0.186*** | 0.0211 | 0.0105 | <0.0010 | 0.0023 | 0.0015 |

**Applied Guidelines: 'Federal CCME Canadian Environmental Quality Guidelines (May 2014), CCME: Freshwater Aquatic Life**
**'Mount Nansen Effluent Discharge Standards**

| COLOUR KEY: |
|---|
| ***Exceeds CCME Guideline*** |
| ***Exceeds MN Effluent Discharge Standards*** |
| ***Exceeds both CCME and MN Standards*** |
| Data flag for Detection Limit Adjustment --> Please refer to the lab COA report and lab excel report for more info |
| Exceeds 10% difference threshold for QA/QC replicate samples. Note <DL = below detection limit |

*For those guidelines that are hardness dependent (Cd, Cu, Pb, Ni), the most conservative guideline has been applied. Same for guidelines that are pH and temperature dependent (Ammonia and Aluminum), unless otherwise noted.*

**Notes:**

*WQ-PW is a drinking water sample and the analysis package has different detection limits than all other samples. The results are also compard to the *Guidelines for Canadian Drinking Water Quality* (Health Canada, October 2014) versus the CCME or MN Effluent Quality Standards.

**Table E-3. Summary of Water Quality Results for the December 15-16, 2014 Trip.**

| Analyte | Units | CCME-WATER-F-AL | Mount Nansen Effluent Discharge Standards | Sample ID<br>WQ Site ID<br>Date Sampled<br>Detection Limit | 0455-141216-004<br>WQ-VC-DBC<br>16-Dec-14 | 0455-141216-005<br>WQ-VC-DBC-r<br>16-Dec-14 | QA/QC<br>Replicate Sample<br>WQ-VC-DBC | 0455-141216-022<br>WQ-PIT-1 (top)<br>16-Dec-14<br>(Depth: 0.30 m) | 0455-141216-021<br>WQ-PIT-2 (middle)<br>16-Dec-14<br>(Depth: 2.5 m) | 0455-141216-020<br>WQ-PIT-3 (bottom)<br>16-Dec-14<br>(Depth: 5.0 m) | 0455-141216-023<br>WQ-PW *<br>16-Dec-14 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Temperature (in-situ) | °C | - | - | - | 0.0 | - | - | 0.5 | 2.8 | 3.2 | 0.5 |
| Specific Conductivity (in-situ) | µS/cm | - | - | - | 215.9 | - | - | 1719 | 1834 | 1866 | 389.6 |
| pH (in-situ) | pH | 6.5 - 9.0 | 6.0 - 8.5 | - | 7.34 | - | - | 7.33 | 7.52 | 7.13 | 6.76 |
| Turbidity (In-situ) | NTU | - | - | - | 0.20 | - | - | 0.35 | 0.82 | 0.62 | 0.00 |
| Dissolved Oxygen (in-situ - Pit only) | mg/L | - | - | - | - | - | - | 3.6 | 8.47 | 1.58 | - |
| Colour, True | CU | 15 | - | 5 | - | - | - | - | - | - | <5.0 |
| Conductivity | µS/cm | - | - | 2 | 218 | 216 | 1% | 1430 | 1760 | 1900 | 395 |
| Hardness (as CaCO3) | mg/L | - | - | 0.5 | 110 | 111 | 1% | 888 | 1150 | 1210 | 208 |
| pH (lab) | pH | 6.5 - 9.0 | 6.0 - 8.5 | 0.1 | 8.06 | 8.02 | 0% | 7.91 | 8.03 | 7.93 | 7.71 |
| Total Suspended Solids | mg/L | - | 50 | 3 | <3.0 | <3.0 | <DL | <3.0 | <3.0 | <3.0 | - |
| Total Dissolved Solids | mg/L | - | - | 1 | 118 | 118 | 0% | 1120 | 1470 | 1600 | 222 |
| Alkalinity, Bicarbonate (as CaCO3) | mg/L | - | - | 1 | 93.6 | 92.7 | 1% | 248 | 200 | 216 | - |
| Alkalinity, Carbonate (as CaCO3) | mg/L | - | - | 1 | <1.0 | <1.0 | <DL | <1.0 | <1.0 | <1.0 | - |
| Alkalinity, Hydroxide (as CaCO3) | mg/L | - | - | 1 | <1.0 | <1.0 | <DL | <1.0 | <1.0 | <1.0 | - |
| Alkalinity, Total (as CaCO3) | mg/L | - | - | 1 | 93.6 | 92.7 | 1% | 248 | 200 | 216 | 178 |
| Ammonia, Total (as N) | mg/L | 0.75 | - | 0.005 | <0.0050 | <0.0050 | <DL | <0.0050 | 0.0064 | 0.008 | - |
| Chloride (Cl) | mg/L | 120 | - | 0.5 | <0.50 | <0.50 | <DL | <5.0 | <5.0 | <5.0 | <0.50 |
| Fluoride (F) | mg/L | 0.12 | - | 0.02 | 0.051 | 0.051 | 0% | <0.20 | ***0.21*** | ***0.20*** | 0.1 |
| Nitrate (as N) | mg/L | 13 | - | 0.005 | 0.158 | 0.159 | 1% | 0.631 | 0.105 | 0.065 | 0.12 |
| Nitrite (as N) | mg/L | 0.06 | - | 0.001 | <0.0010 | <0.0010 | <DL | <0.010 | <0.010 | <0.010 | <0.0010 |
| Sulfate (SO4) | mg/L | - | - | 0.5 | 19.7 | 19.7 | 0% | 638 | 928 | 1020 | 39.2 |
| Cyanide, Weak Acid Diss | mg/L | - | 0.1 | 0.005 | <0.0050 | <0.0050 | <DL | - | - | - | - |
| Cyanide, Total | mg/L | - | 0.3 | 0.005 | <0.0050 | <0.0050 | <DL | - | - | - | - |
| Cyanate | mg/L | - | - | 0.2 | <0.20 | <0.20 | <DL | - | - | - | - |
| Thiocyanate (SCN) | mg/L | - | - | 0.5 | <0.50 | <0.50 | <DL | - | - | - | - |
| Aluminum (Al)-Total | mg/L | 0.1 | - | 0.003 | 0.022 | 0.0202 | 8% | <0.0030 | 0.0066 | <0.0060 | <0.010 |
| Antimony (Sb)-Total | mg/L | - | 0.15 | 0.0001 | <0.00010 | 0.0001 | <DL | 0.00672 | 0.00392 | 0.0019 | <0.00050 |
| Arsenic (As)-Total | mg/L | 0.005 | - | 0.0001 | 0.00032 | 0.00027 | 16% | ***0.00792*** | ***0.0112*** | ***0.00857*** | 0.00037 |
| Barium (Ba)-Total | mg/L | - | 1.0 | 0.00005 | 0.0746 | 0.0759 | 2% | 0.011 | 0.0127 | 0.0113 | 0.093 |
| Beryllium (Be)-Total | mg/L | - | - | 0.0001 | <0.00010 | <0.00010 | <DL | <0.00010 | <0.00020 | <0.00020 | - |
| Bismuth (Bi)-Total | mg/L | - | - | 0.0005 | <0.00050 | <0.00050 | <DL | <0.00050 | <0.0010 | <0.0010 | - |
| Boron (B)-Total | mg/L | - | - | 0.01 | <0.010 | <0.010 | <DL | <0.010 | <0.020 | <0.020 | <0.10 |
| Cadmium (Cd)-Total | mg/L | 0.000033 | 0.02 | 0.00001 | 0.000017 | 0.000020 | 18% | ***0.00703*** | ***0.00342*** | ***0.0043*** | <0.00020 |
| Calcium (Ca)-Total | mg/L | - | - | 0.05 | 27.7 | 28.1 | 1% | 246 | 312 | 329 | 47.7 |
| Chromium (Cr)-Total | mg/L | 0.0089 | 0.04 | 0.0001 | 0.00029 | 0.00018 | 38% | <0.00010 | <0.00020 | <0.00020 | <0.0020 |
| Cobalt (Co)-Total | mg/L | - | - | 0.0001 | <0.00010 | <0.00010 | <DL | <0.00010 | <0.00020 | <0.00020 | - |
| Copper (Cu)-Total | mg/L | 0.002 | 0.2 | 0.0005 | 0.001 | 0.00097 | 3% | ***0.00685*** | ***0.0039*** | ***0.0024*** | <0.0010 |
| Iron (Fe)-Total | mg/L | 0.3 | 1.0 | 0.01 | 0.039 | 0.037 | 5% | 0.041 | 0.037 | 0.044 | <0.030 |
| Lead (Pb)-Total | mg/L | 0.003 | 0.1 | 0.00005 | <0.000050 | <0.000050 | <DL | 0.000158 | 0.00052 | 0.00031 | 0.00068 |
| Lithium (Li)-Total | mg/L | - | - | 0.0005 | <0.00050 | <0.00050 | <DL | 0.00794 | 0.0087 | 0.0091 | - |
| Magnesium (Mg)-Total | mg/L | - | - | 0.1 | 9.26 | 9.54 | 3% | 62.7 | 83 | 87.7 | 21.6 |
| Manganese (Mn)-Total | mg/L | - | 0.5 | 0.00005 | 0.054 | 0.0538 | 0% | 0.107 | 0.0931 | 0.248 | <0.0020 |
| Mercury (Hg)-Total | mg/L | 0.000026 | 0.005 | 0.00001 | <0.000010 | <0.000010 | <DL | <0.000010 | <0.000010 | <0.000010 | <0.00020 |
| Molybdenum (Mo)-Total | mg/L | 0.0073 | - | 0.00005 | 0.000401 | 0.000375 | 6% | 0.000193 | 0.00012 | <0.00010 | - |
| Nickel (Ni)-Total | mg/L | 0.1 | 0.3 | 0.0005 | <0.00050 | <0.00050 | <DL | 0.00109 | <0.0010 | <0.0010 | - |
| Phosphorus (P)-Total | mg/L | - | - | 0.05 | <0.050 | <0.050 | <DL | <0.050 | <0.050 | <0.050 | - |
| Potassium (K)-Total | mg/L | - | - | 0.1 | 0.60 | 0.67 | 12% | 3.02 | 3.82 | 3.84 | 0.85 |
| Selenium (Se)-Total | mg/L | 0.001 | - | 0.0001 | <0.00010 | <0.00010 | <DL | <0.00010 | <0.00020 | <0.00020 | <0.0010 |
| Silicon (Si)-Total | mg/L | - | - | 0.05 | 5.9 | 6.03 | 2% | 5.43 | 3.65 | 3.71 | - |
| Silver (Ag)-Total | mg/L | 0.0001 | 0.1 | 0.00001 | <0.000010 | <0.000010 | <DL | 0.000023 | 0.000029 | 0.000025 | - |
| Sodium (Na)-Total | mg/L | - | - | 0.05 | 2.64 | 2.69 | 2% | 10.8 | 12.1 | 14.7 | 5.3 |
| Strontium (Sr)-Total | mg/L | - | - | 0.0002 | 0.314 | 0.317 | 1% | 0.965 | 1.07 | 1.15 | - |
| Sulfur (S)-Total | mg/L | - | - | 0.5 | 6.54 | 6.68 | 2% | 216 | 310 | 329 | - |
| Thallium (Tl)-Total | mg/L | 0.0008 | - | 0.00001 | <0.000010 | <0.000010 | <DL | 0.000075 | 0.000062 | 0.000042 | - |
| Tin (Sn)-Total | mg/L | - | - | 0.0001 | <0.00010 | <0.00010 | <DL | <0.00010 | <0.00020 | <0.00020 | - |
| Titanium (Ti)-Total | mg/L | - | - | 0.01 | <0.010 | <0.010 | <DL | <0.010 | <0.020 | <0.020 | - |

**Table E-3. Summary of Water Quality Results for the December 15-16, 2014 Trip.**

| Analyte | Units | CCME-WATER-F-AL | Mount Nansen Effluent Discharge Standards | Sample ID<br>WQ Site ID<br>Date Sampled<br>Detection Limit | 0455-141216-004<br>WQ-VC-DBC<br>16-Dec-14 | 0455-141216-005<br>WQ-VC-DBC-r<br>16-Dec-14 | QA/QC<br>Replicate Sample<br>WQ-VC-DBC | 0455-141216-022<br>WQ-PIT-1 (top)<br>16-Dec-14<br>(Depth: 0.30 m) | 0455-141216-021<br>WQ-PIT-2 (middle)<br>16-Dec-14<br>(Depth: 2.5 m) | 0455-141216-020<br>WQ-PIT-3 (bottom)<br>16-Dec-14<br>(Depth: 5.0 m) | 0455-141216-023<br>WQ-PW *<br>16-Dec-14 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Uranium (U)-Total | mg/L | 0.015 | - | 0.00001 | 0.000671 | 0.000663 | 1% | 0.00374 | 0.00433 | 0.00502 | 0.002 |
| Vanadium (V)-Total | mg/L | - | - | 0.001 | <0.0010 | <0.0010 | <DL | <0.0010 | <0.0020 | <0.0020 | - |
| Zinc (Zn)-Total | mg/L | 0.03 | 0.3 | 0.003 | <0.0030 | <0.0030 | <DL | ***0.987*** | ***0.43*** | ***0.606*** | <0.050 |
| Dissolved Metals Filtration Location | | - | - | n/a | FIELD | FIELD | - | FIELD | FIELD | FIELD | - |
| Aluminum (Al)-Dissolved | mg/L | 0.1 | - | 0.001 | 0.0068 | 0.0062 | 9% | <0.0010 | <0.0020 | <0.0020 | - |
| Antimony (Sb)-Dissolved | mg/L | - | - | 0.0001 | <0.00010 | <0.00010 | <DL | 0.00683 | 0.00396 | 0.00179 | - |
| Arsenic (As)-Dissolved | mg/L | 0.005 | 0.15 | 0.0001 | 0.00025 | 0.00023 | 8% | ***0.00709*** | ***0.00928*** | ***0.0066*** | - |
| Barium (Ba)-Dissolved | mg/L | - | - | 0.00005 | 0.0785 | 0.074 | 6% | 0.0108 | 0.0128 | 0.0112 | - |
| Beryllium (Be)-Dissolved | mg/L | - | - | 0.0001 | <0.00010 | <0.00010 | <DL | <0.00010 | <0.00020 | <0.00020 | - |
| Bismuth (Bi)-Dissolved | mg/L | - | - | 0.0005 | <0.00050 | <0.00050 | <DL | <0.00050 | <0.0010 | <0.0010 | - |
| Boron (B)-Dissolved | mg/L | - | - | 0.01 | <0.010 | <0.010 | <DL | <0.010 | <0.020 | <0.020 | - |
| Cadmium (Cd)-Dissolved | mg/L | 0.000033 | - | 0.00001 | 0.000023 | 0.000018 | 22% | ***0.00692*** | ***0.00327*** | ***0.00419*** | - |
| Calcium (Ca)-Dissolved | mg/L | - | - | 0.05 | 28.4 | 28.6 | 1% | 253 | 320 | 341 | - |
| Chromium (Cr)-Dissolved | mg/L | 0.0089 | - | 0.0001 | 0.0002 | <0.00010 | <DL | <0.00010 | <0.00020 | <0.00020 | - |
| Cobalt (Co)-Dissolved | mg/L | - | - | 0.0001 | <0.00010 | <0.00010 | <DL | <0.00010 | <0.00020 | <0.00020 | - |
| Copper (Cu)-Dissolved | mg/L | 0.002 | - | 0.0002 | 0.00095 | 0.00093 | 2% | ***0.0066*** | ***0.00306*** | 0.00186 | - |
| Iron (Fe)-Dissolved | mg/L | 0.3 | - | 0.01 | 0.012 | 0.013 | 8% | 0.02 | <0.010 | <0.010 | - |
| Lead (Pb)-Dissolved | mg/L | 0.003 | - | 0.00005 | <0.000050 | <0.000050 | <DL | <0.000050 | <0.00010 | <0.00010 | - |
| Lithium (Li)-Dissolved | mg/L | - | - | 0.0005 | <0.00050 | <0.00050 | <DL | 0.00781 | 0.0087 | 0.0089 | - |
| Magnesium (Mg)-Dissolved | mg/L | - | - | 0.1 | 9.53 | 9.6 | 1% | 62.2 | 84.2 | 87.3 | - |
| Manganese (Mn)-Dissolved | mg/L | - | - | 0.00005 | 0.0534 | 0.0504 | 6% | 0.0951 | 0.0396 | 0.172 | - |
| Mercury (Hg)-Dissolved | mg/L | 0.000026 | - | 0.00001 | <0.000010 | <0.000010 | <DL | <0.000010 | <0.000010 | <0.000010 | - |
| Molybdenum (Mo)-Dissolved | mg/L | 0.0073 | - | 0.00005 | 0.000368 | 0.000368 | 0% | 0.000173 | 0.00014 | <0.00010 | - |
| Nickel (Ni)-Dissolved | mg/L | 0.1 | - | 0.0005 | <0.00050 | <0.00050 | <DL | 0.00108 | <0.0010 | <0.0010 | - |
| Phosphorus (P)-Dissolved | mg/L | - | - | 0.05 | <0.050 | <0.050 | <DL | <0.050 | <0.050 | <0.050 | - |
| Potassium (K)-Dissolved | mg/L | - | - | 0.1 | 0.6 | 0.61 | 2% | 3.08 | 3.86 | 3.91 | - |
| Selenium (Se)-Dissolved | mg/L | 0.001 | - | 0.0001 | <0.00010 | <0.00010 | <DL | <0.00010 | <0.00020 | <0.00020 | - |
| Silicon (Si)-Dissolved | mg/L | - | - | 0.05 | 6 | 6.03 | 1% | 5.52 | 3.63 | 3.76 | - |
| Silver (Ag)-Dissolved | mg/L | 0.0001 | - | 0.00001 | <0.000010 | <0.000010 | <DL | <0.000010 | <0.000020 | <0.000020 | - |
| Sodium (Na)-Dissolved | mg/L | - | - | 0.05 | 2.72 | 2.57 | 6% | 10.6 | 12.1 | 14.6 | - |
| Strontium (Sr)-Dissolved | mg/L | - | - | 0.0002 | 0.312 | 0.307 | 2% | 0.957 | 1.07 | 1.13 | - |
| Sulfur (S)-Dissolved | mg/L | - | - | 0.5 | 6.62 | 6.55 | 1% | 204 | 305 | 318 | - |
| Thallium (Tl)-Dissolved | mg/L | 0.0008 | - | 0.00001 | <0.000010 | <0.000010 | <DL | 0.000072 | 0.00006 | 0.000052 | - |
| Tin (Sn)-Dissolved | mg/L | - | - | 0.0001 | <0.00010 | <0.00010 | <DL | <0.00010 | <0.00020 | <0.00020 | - |
| Titanium (Ti)-Dissolved | mg/L | - | - | 0.01 | <0.010 | <0.010 | <DL | <0.010 | <0.020 | <0.020 | - |
| Uranium (U)-Dissolved | mg/L | 0.015 | - | 0.00001 | 0.00064 | 0.00064 | 0% | 0.00348 | 0.00416 | 0.00492 | - |
| Vanadium (V)-Dissolved | mg/L | - | - | 0.001 | <0.0010 | <0.0010 | <DL | <0.0010 | <0.0020 | <0.0020 | - |
| Zinc (Zn)-Dissolved | mg/L | 0.03 | - | 0.001 | <0.0010 | <0.0010 | <DL | ***1.0*** | ***0.432*** | ***0.609*** | - |

**Applied Guidelines: 'Federal CCME Canadian Environmental Quality Guidelines (May 2014), CCME: Freshwater Aquatic Life**
**'Mount Nansen Effluent Discharge Standards**

| COLOUR KEY: |
|---|
| ***Exceeds CCME Guideline*** |
| ***Exceeds MN Effluent Discharge Standards*** |
| ***Exceeds both CCME and MN Standards*** |
| Data flag for Detection Limit Adjustment --> Please refer to the lab COA report and lab excel report for more info |
| Exceeds 10% difference threshold for QA/QC replicate samples. Note <DL = below detection limit |

*For those guidelines that are hardness dependent (Cd, Cu, Pb, Ni), the most conservative guideline has been applied. Same for guidelines that are pH and temperature dependent (Ammonia and Aluminum), unless otherwise noted.*

**Table E-3. Summary of Water Quality Results for the December 15-16, 2014 Trip.**

| Analyte | Units | CCME-WATER-F-AL | Mount Nansen Effluent Discharge Standards | Sample ID<br>WQ Site ID<br>Date Sampled<br>Detection Limit | 0455-141216-Travel-Blank<br>TRAVEL BLANK<br>n/a | 0455-141216-Field-Blank<br>FIELD BLANK<br>16-Dec-14 |
|---|---|---|---|---|---|---|
| Temperature (in-situ) | °C | - | - | - | - | - |
| Specific Conductivity (in-situ) | µS/cm | - | - | - | - | - |
| pH (in-situ) | pH | 6.5 - 9.0 | 6.0 - 8.5 | - | - | - |
| Turbidity (In-situ) | NTU | - | - | - | - | - |
| Dissolved Oxygen (in-situ - Pit only) | 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 | ***5.39*** | ***5.39*** |
| 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 | <0.0050 | <0.0050 |
| Nitrite (as N) | mg/L | 0.06 | - | 0.001 | <0.0010 | <0.0010 |
| Sulfate (SO4) | mg/L | - | - | 0.5 | <0.30 | <0.30 |
| 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 | 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 | 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-3. Summary of Water Quality Results for the December 15-16, 2014 Trip.**

| Analyte | Units | CCME-WATER-F-AL | Mount Nansen Effluent Discharge Standards | Sample ID<br>WQ Site ID<br>Date Sampled<br>Detection Limit | 0455-141216-Travel-Blank<br>TRAVEL BLANK<br>n/a | 0455-141216-Field-Blank<br>FIELD BLANK<br>16-Dec-14 |
|---|---|---|---|---|---|---|
| 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 | 0.1 | - | 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 | 0.003 | - | 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 | 0.0073 | - | 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 |

**Applied Guidelines: 'Federal CCME Canadian Environmental Quality Guidelines (May 2014), CCME: Freshwater Aquatic Life**
**'Mount Nansen Effluent Discharge Standards**

| COLOUR KEY: |
|---|
| ***Exceeds CCME Guideline*** |
| ***Exceeds MN Effluent Discharge Standards*** |
| ***Exceeds both CCME and MN Standards*** |
| Data flag for Detection Limit Adjustment --> Please refer to the lab COA report and lab excel report for more info |
| Exceeds 10% difference threshold for QA/QC replicate samples. Note <DL = below detection limit |

*For those guidelines that are hardness dependent (Cd, Cu, Pb, Ni), the most conservative guideline has been applied. Same for guidelines that are pH and temperature dependent (Ammonia and Aluminum), unless otherwise noted.*

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# APPENDIX F. METEOROLOGICAL DATA

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## Table F-1. Mount Nansen Daily Average Meteorological Data (October 1 to December 31, 2014).

| Date | Air Temperature (°C) | | | Ground Temperature (°C) | | | Rain (mm) | Snow Depth (cm) | Wind Direction (degrees) | Wind Speed (m/s) | | Radiative Fluxes (W/m^2) | | | Relative Humidity (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Min | Max | Mean | Max | Min | Mean | Max | Max | | Max Gust | Mean | Mean SW | Mean LW | Mean Net | |
| 01-Oct-14 | -6.5 | -0.8 | -4.3 | -0.2 | -3.9 | -2.1 | 0.3 | 8.9 | 265 | 4.3 | 2.5 | 35.7 | -54.8 | -19.1 | 76.2 |
| 02-Oct-14 | -6.4 | -2.1 | -4.5 | -0.5 | -4.4 | -2.6 | 0 | 5.8 | 111 | 4.6 | 2.4 | 38.8 | -47.9 | -9.1 | 79.1 |
| 03-Oct-14 | -4.8 | 1.7 | -2.4 | 0.3 | -2.2 | -1.0 | 0.7 | 7.5 | 67 | 5.0 | 3.6 | 7.9 | -4.4 | 3.6 | 93.2 |
| 04-Oct-14 | 0.6 | 5.2 | 3.0 | 1.6 | -1.0 | 0.4 | 0.7 | 12.7 | 198 | 5.6 | 3.6 | 32.5 | -44.7 | -12.1 | 70.3 |
| 05-Oct-14 | -0.9 | 3.8 | 1.3 | 1.3 | -1.1 | 0.0 | 0.2 | 6.8 | 145 | 7.4 | 4.9 | 10.2 | -31.6 | -21.5 | 77.2 |
| 06-Oct-14 | -6.6 | -0.9 | -3.8 | -0.7 | -2.6 | -1.4 | 0 | 8.3 | 247 | 4.3 | 1.8 | -3.3 | 2.9 | -0.4 | 85.2 |
| 07-Oct-14 | -9.4 | -5.5 | -7.5 | -1.5 | -4.0 | -2.9 | 0 | 13.4 | 254 | 2.5 | 1.4 | 8.3 | 1.7 | 10.1 | 78.8 |
| 08-Oct-14 | -9.7 | -4.7 | -8.1 | -1.9 | -4.5 | -3.2 | 0.4 | 11.9 | 76 | 3.0 | 1.7 | 25.8 | -20.2 | 5.6 | 85.1 |
| 09-Oct-14 | -8.2 | -2.1 | -6.4 | -1.2 | -4.5 | -3.2 | 0 | 11.1 | 47 | 6.3 | 3.7 | 5.4 | -21.3 | -16.0 | 94.0 |
| 10-Oct-14 | -2.1 | 7.9 | 3.0 | 2.8 | -1.2 | 0.7 | 1.9 | 11.3 | 146 | 6.8 | 3.6 | 37.4 | -25.5 | 12.0 | 82.4 |
| 11-Oct-14 | 1.6 | 6.9 | 3.5 | 2.9 | -0.9 | 0.5 | 0 | 7.9 | 182 | 6.0 | 2.9 | 34.4 | -47.8 | -13.3 | 74.7 |
| 12-Oct-14 | 1.4 | 5.2 | 2.8 | 2.5 | -0.8 | 0.6 | 0 | 7.0 | 153 | 3.7 | 2.2 | 37.0 | -32.4 | 4.6 | 67.0 |
| 13-Oct-14 | 0.6 | 2.1 | 1.2 | 1.1 | 0.2 | 0.5 | 0.3 | 6.9 | 43 | 6.0 | 4.1 | 17.1 | -11.7 | 5.4 | 85.7 |
| 14-Oct-14 | -3.7 | 0.9 | -1.1 | 0.4 | -1.6 | -0.5 | 0 | 7.4 | 36 | 6.3 | 3.8 | 12.6 | -17.1 | -4.6 | 86.4 |
| 15-Oct-14 | -4.7 | -2.0 | -3.1 | -0.5 | -2.0 | -1.2 | 0 | 8.8 | 69 | 3.6 | 2.3 | 7.1 | -0.4 | 6.7 | 94.9 |
| 16-Oct-14 | -3.2 | 1.8 | -1.1 | 0.9 | -2.2 | -0.8 | 1.4 | 8.3 | 92 | 3.1 | 1.3 | 29.1 | -3.0 | 26.0 | 86.9 |
| 17-Oct-14 | -3.2 | 0.1 | -1.7 | 0.2 | -3.1 | -1.5 | 0 | 8.3 | 64 | 4.2 | 2.3 | 20.3 | -21.3 | -1.0 | 85.3 |
| 18-Oct-14 | -4.9 | -2.8 | -3.6 | -1.1 | -3.7 | -2.2 | 0 | 8.6 | 57 | 4.5 | 2.8 | 11.6 | -23.1 | -11.6 | 88.2 |
| 19-Oct-14 | -4.3 | 0.0 | -1.7 | 0.0 | -2.2 | -0.9 | 0.4 | 9.9 | 45 | 6.5 | 3.4 | 8.0 | -4.5 | 3.5 | 97.1 |
| 20-Oct-14 | -2.1 | 2.6 | -0.2 | 0.5 | -1.7 | -0.6 | 0.6 | 10.3 | 158 | 5.9 | 2.2 | 24.7 | -22.8 | 1.9 | 88.6 |
| 21-Oct-14 | -4.0 | 0.7 | -1.7 | -0.2 | -3.9 | -2.1 | 0 | 10.1 | 147 | 4.9 | 2.6 | 33.9 | -57.9 | -24.1 | 79.4 |
| 22-Oct-14 | -2.2 | -1.0 | -1.7 | -0.4 | -2.0 | -1.0 | 0.1 | 13.4 | 41 | 4.3 | 3.0 | 6.3 | -8.4 | -2.1 | 92.0 |
| 23-Oct-14 | -3.6 | -1.3 | -2.4 | -0.7 | -2.0 | -1.1 | 0 | 13.3 | 194 | 2.0 | 0.9 | 8.4 | -10.7 | -2.3 | 92.8 |
| 24-Oct-14 | -6.1 | -3.0 | -4.5 | -1.7 | -5.4 | -2.9 | 0 | 12.9 | 195 | 2.2 | 0.9 | 17.5 | -23.7 | -6.1 | 90.2 |
| 25-Oct-14 | -8.3 | -4.3 | -6.3 | -2.5 | -5.7 | -4.0 | 0 | 12.9 | 93 | 1.4 | 0.7 | 5.0 | -1.7 | 3.3 | 92.8 |
| 26-Oct-14 | -8.9 | -6.1 | -7.0 | -2.6 | -4.2 | -3.3 | 0 | 13.3 | 212 | 1.5 | 0.8 | 3.5 | -1.1 | 2.4 | 94.7 |
| 27-Oct-14 | -13.0 | -7.2 | -10.3 | -4.2 | -8.4 | -6.7 | 0 | 14.1 | 142 | 1.8 | 0.6 | 41.7 | 0.0 | 41.7 | 90.3 |
| 28-Oct-14 | -13.6 | -8.1 | -10.2 | -5.9 | -8.6 | -7.1 | 0 | 14.6 | 44 | 5.7 | 3.1 | 45.2 | -0.1 | 45.1 | 87.7 |
| 29-Oct-14 | -8.6 | -3.6 | -6.4 | -3.7 | -5.9 | -4.9 | 0 | 13.9 | 124 | 4.9 | 1.7 | 20.5 | 2.7 | 23.2 | 89.4 |
| 30-Oct-14 | -5.0 | -3.3 | -4.1 | -2.2 | -5.5 | -3.3 | 0 | 19.8 | 66 | 5.5 | 3.2 | -0.2 | 0.9 | 0.7 | 92.6 |
| 31-Oct-14 | -9.6 | -4.0 | -7.1 | -2.2 | -4.9 | -3.7 | 0 | 19.3 | 150 | 3.3 | 1.6 | 39.1 | 4.1 | 43.1 | 90.2 |
| 01-Nov-14 | -7.4 | -3.6 | -5.8 | -2.4 | -4.6 | -3.5 | 0 | 20.0 | 38 | 3.4 | 2.2 | -0.8 | 0.7 | 0.0 | 91.2 |
| 02-Nov-14 | -4.2 | -0.6 | -3.1 | -2.1 | -4.2 | -3.3 | 0.6 | 19.7 | 133 | 1.9 | 0.8 | 28.7 | 9.0 | 37.7 | 81.5 |
| 03-Nov-14 | -6.3 | -1.6 | -4.5 | -3.0 | -4.1 | -3.8 | 0.1 | 19.5 | 164 | 5.3 | 2.5 | 18.5 | -19.8 | -1.3 | 77.2 |
| 04-Nov-14 | -8.4 | -5.6 | -7.4 | -2.9 | -4.3 | -3.5 | 0 | 24.2 | 97 | 5.8 | 2.6 | 8.0 | -7.9 | 0.1 | 88.8 |
| 05-Nov-14 | -8.6 | -2.8 | -6.1 | -2.7 | -4.7 | -3.7 | 0 | 23.4 | 146 | 5.0 | 1.6 | 28.2 | 4.6 | 32.8 | 86.9 |

| Date | Air Temperature (°C) | | | Ground Temperature (°C) | | | Rain (mm) | Snow Depth (cm) | Wind Direction (degrees) | Wind Speed (m/s) | | Radiative Fluxes (W/m^2) | | | Relative Humidity (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Min | Max | Mean | Max | Min | Mean | Max | Max | | Max Gust | Mean | Mean SW | Mean LW | Mean Net | |
| 06-Nov-14 | -9.6 | -7.2 | -8.3 | -3.3 | -4.1 | -3.7 | 0 | 22.0 | 57 | 6.6 | 2.8 | 3.6 | 0.9 | 4.5 | 91.9 |
| 07-Nov-14 | -9.8 | -6.2 | -8.0 | -2.7 | -3.9 | -3.4 | 0 | 21.1 | 52 | 2.5 | 1.8 | 2.0 | -0.3 | 1.7 | 94.6 |
| 08-Nov-14 | -7.3 | -1.4 | -4.9 | -3.0 | -4.1 | -3.7 | 0.2 | 21.3 | 116 | 2.5 | 0.7 | 27.8 | -0.6 | 27.2 | 93.4 |
| 09-Nov-14 | -6.7 | -2.1 | -5.1 | -2.8 | -4.5 | -3.9 | 0 | 21.8 | 180 | 3.3 | 1.8 | 36.8 | 3.0 | 39.9 | 86.1 |
| 10-Nov-14 | -7.2 | -3.4 | -5.5 | -3.0 | -4.2 | -3.7 | 0 | 21.8 | 153 | 2.5 | 0.8 | 8.8 | 7.4 | 16.2 | 85.9 |
| 11-Nov-14 | -8.1 | -4.2 | -6.0 | -3.3 | -4.4 | -3.9 | 0 | 22.0 | 73 | 4.1 | 2.7 | 16.6 | -9.3 | 7.2 | 84.3 |
| 12-Nov-14 | -7.2 | -4.4 | -6.3 | -3.6 | -4.8 | -4.2 | 0 | 22.3 | 34 | 4.1 | 2.9 | 6.5 | -50.2 | -43.7 | 69.2 |
| 13-Nov-14 | -8.2 | -2.7 | -6.1 | -4.0 | -5.8 | -5.1 | 0 | 22.3 | 100 | 3.4 | 1.2 | 5.8 | -46.2 | -40.4 | 56.1 |
| 14-Nov-14 | -8.3 | -1.6 | -5.5 | -4.7 | -6.5 | -5.8 | 0 | 22.4 | 115 | 1.6 | 0.4 | 5.2 | -44.3 | -39.1 | 49.2 |
| 15-Nov-14 | -6.1 | 0.8 | -1.9 | -3.6 | -6.3 | -4.7 | 0.1 | 22.9 | 214 | 3.2 | 2.0 | 4.5 | -49.2 | -44.7 | 35.1 |
| 16-Nov-14 | -2.6 | 1.2 | -1.2 | -3.2 | -5.0 | -4.0 | 0 | 22.6 | 217 | 4.3 | 2.0 | 2.0 | -42.9 | -40.8 | 32.5 |
| 17-Nov-14 | -4.1 | 0.2 | -2.3 | -3.0 | -4.6 | -3.7 | 0 | 21.4 | 218 | 3.2 | 1.6 | 11.5 | -47.0 | -35.5 | 79.2 |
| 18-Nov-14 | -5.1 | -1.7 | -3.9 | -3.2 | -4.7 | -3.8 | 0 | 22.1 | 56 | 5.4 | 3.9 | 1.7 | -33.6 | -31.9 | 83.2 |
| 19-Nov-14 | -3.9 | 0.2 | -1.7 | -1.7 | -3.6 | -2.3 | 0 | 22.1 | 193 | 3.7 | 1.8 | 1.4 | -22.8 | -21.5 | 86.9 |
| 20-Nov-14 | -7.1 | -1.5 | -4.5 | -3.6 | -5.8 | -5.0 | 0 | 22.6 | 96 | 4.6 | 1.4 | 13.5 | -37.7 | -24.2 | 72.8 |
| 21-Nov-14 | -11.7 | -7.1 | -10.1 | -5.4 | -8.0 | -6.6 | 0 | 27.5 | 39 | 5.4 | 4.7 | 1.3 | -24.3 | -23.0 | 80.2 |
| 22-Nov-14 | -12.8 | -10.4 | -11.7 | -4.2 | -5.4 | -4.7 | 0 | 29.8 | 100 | 3.3 | 0.6 | -1.9 | 3.0 | 1.1 | 91.6 |
| 23-Nov-14 | -13.6 | -8.0 | -11.0 | -4.6 | -5.4 | -5.0 | 0 | 29.4 | 168 | 1.8 | 0.5 | -0.8 | 4.6 | 3.8 | 91.4 |
| 24-Nov-14 | -14.1 | -7.6 | -10.0 | -5.0 | -6.5 | -5.6 | 0 | 28.1 | 165 | 1.3 | 0.1 | -1.9 | 3.8 | 1.9 | 90.0 |
| 25-Nov-14 | -13.6 | -6.1 | -10.7 | -5.1 | -6.5 | -6.0 | 0 | 28.0 | 194 | 0.8 | 0.4 | 3.1 | 3.8 | 6.9 | 87.0 |
| 26-Nov-14 | -14.7 | -9.3 | -11.2 | -4.4 | -5.6 | -4.9 | 0 | 28.6 | 228 | 2.6 | 0.8 | -1.0 | 2.5 | 1.5 | 86.2 |
| 27-Nov-14 | -20.1 | -14.1 | -16.9 | -5.5 | -9.1 | -7.4 | 0 | 28.5 | 210 | 2.4 | 0.3 | -0.1 | 10.9 | 10.8 | 79.4 |
| 28-Nov-14 | -20.5 | -14.5 | -18.1 | -7.7 | -9.4 | -8.5 | 0 | 28.7 | 203 | 4.2 | 1.4 | 12.1 | -13.0 | -1.0 | 55.0 |
| 29-Nov-14 | -18.4 | -12.1 | -14.5 | -6.0 | -8.4 | -6.9 | 0 | 28.9 | 190 | 1.8 | 0.7 | 0.8 | -15.5 | -14.7 | 75.4 |
| 30-Nov-14 | -15.3 | -12.3 | -14.1 | -5.8 | -6.7 | -6.1 | 0 | 30.3 | 200 | 3.7 | 1.5 | -1.6 | 4.4 | 2.9 | 84.5 |
| 01-Dec-14 | -16.3 | -12.5 | -14.2 | -6.2 | -7.3 | -6.7 | 0 | 29.6 | 241 | 3.0 | 1.8 | -2.6 | 7.4 | 4.8 | 80.6 |
| 02-Dec-14 | -12.9 | -4.0 | -7.8 | -3.8 | -6.2 | -4.6 | 0 | 30.7 | 242 | 4.2 | 2.1 | -2.4 | 5.8 | 3.3 | 84.9 |
| 03-Dec-14 | -11.0 | -3.8 | -7.6 | -3.6 | -5.7 | -4.6 | 0 | 30.5 | 243 | 4.2 | 1.7 | -1.9 | 15.7 | 13.8 | 76.5 |
| 04-Dec-14 | -11.4 | -8.8 | -10.5 | -5.6 | -6.4 | -5.9 | 0 | 30.6 | 204 | 2.6 | 1.0 | -1.4 | 14.3 | 12.9 | 70.1 |
| 05-Dec-14 | -11.7 | -8.3 | -9.5 | -5.6 | -6.6 | -6.2 | 0 | 30.1 | 141 | 2.7 | 0.5 | -1.7 | -1.3 | -3.0 | 46.8 |
| 06-Dec-14 | -13.6 | -10.9 | -12.3 | -5.7 | -6.5 | -6.0 | 0 | 31.7 | 95 | 3.6 | 1.8 | 0.8 | -15.1 | -14.3 | 73.0 |
| 07-Dec-14 | -11.3 | -4.7 | -6.2 | -3.8 | -5.8 | -4.7 | 0 | 30.1 | 127 | 5.0 | 2.5 | -0.3 | -28.6 | -28.9 | 88.1 |
| 08-Dec-14 | -5.4 | -2.7 | -4.1 | -2.7 | -3.8 | -3.5 | 0 | 33.6 | 34 | 3.9 | 3.1 | -0.4 | -26.6 | -27.0 | 92.7 |
| 09-Dec-14 | -3.9 | -2.6 | -3.2 | -2.2 | -2.7 | -2.4 | 0 | 37.6 | 50 | 3.4 | 2.5 | 0.0 | -8.2 | -8.2 | 96.2 |
| 10-Dec-14 | -7.5 | -3.9 | -6.6 | -2.2 | -2.4 | -2.3 | 0 | 38.1 | 125 | 2.0 | 0.8 | -1.0 | 0.3 | -0.8 | 95.9 |
| 11-Dec-14 | -9.2 | -5.9 | -7.8 | -2.3 | -2.6 | -2.4 | 0 | 37.6 | 86 | 2.4 | 1.1 | -1.1 | 0.2 | -1.0 | 94.4 |
| 12-Dec-14 | -12.4 | -8.5 | -10.3 | -2.6 | -3.8 | -3.0 | 0 | 37.0 | 195 | 1.2 | 0.4 | -3.5 | 3.8 | 0.3 | 93.1 |
| 13-Dec-14 | -10.3 | -5.8 | -7.9 | -3.6 | -3.9 | -3.8 | 0 | 36.3 | 190 | 2.3 | 1.2 | -5.2 | 4.0 | -1.2 | 90.8 |

| Date | Air Temperature (°C) | | | Ground Temperature (°C) | | | Rain (mm) | Snow Depth (cm) | Wind Direction (degrees) | Wind Speed (m/s) | | Radiative Fluxes (W/m^2) | | | Relative Humidity (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Min | Max | Mean | Max | Min | Mean | Max | Max | | Max Gust | Mean | Mean SW | Mean LW | Mean Net | |
| 14-Dec-14 | -7.5 | -3.7 | -5.3 | -2.8 | -3.8 | -3.3 | 0 | 36.1 | 92 | 3.4 | 2.1 | -2.3 | 4.4 | 2.1 | 87.5 |
| 15-Dec-14 | -4.6 | -1.9 | -3.0 | -2.5 | -2.8 | -2.6 | 0 | 35.8 | 136 | 6.2 | 2.7 | 0.3 | 9.1 | 9.4 | 83.6 |
| 16-Dec-14 | -6.3 | -3.4 | -4.5 | -2.7 | -3.4 | -3.0 | 0 | 35.8 | 137 | 2.2 | 1.3 | -3.1 | 14.3 | 11.2 | 78.8 |
| 17-Dec-14 | -8.3 | -4.1 | -6.7 | -3.3 | -3.6 | -3.5 | 0 | 35.7 | 245 | 4.1 | 2.8 | -1.8 | -15.7 | -17.5 | 79.2 |
| 18-Dec-14 | -11.0 | -8.1 | -9.3 | -3.6 | -4.5 | -4.0 | 0 | 36.1 | 87 | 5.4 | 3.2 | 4.2 | -57.5 | -53.3 | 82.5 |
| 19-Dec-14 | -12.3 | -10.2 | -11.2 | -3.8 | -4.5 | -4.1 | 0 | 41.3 | 43 | 4.7 | 3.7 | -0.3 | -16.3 | -16.6 | 86.8 |
| 20-Dec-14 | -11.2 | -7.9 | -9.5 | -3.5 | -3.9 | -3.7 | 0 | 41.0 | 43 | 6.1 | 4.6 | -1.3 | -11.9 | -13.1 | 89.2 |
| 21-Dec-14 | -9.2 | -7.5 | -8.2 | -3.3 | -3.5 | -3.4 | 0 | 40.3 | 100 | 4.3 | 2.1 | 2.4 | -27.9 | -25.5 | 91.1 |
| 22-Dec-14 | -8.6 | -4.2 | -5.8 | -3.0 | -3.5 | -3.2 | 0 | 40.7 | 253 | 3.7 | 2.7 | 1.2 | -26.8 | -25.7 | 87.4 |
| 23-Dec-14 | -10.5 | -5.5 | -8.0 | -3.2 | -3.9 | -3.6 | 0 | 40.0 | 123 | 2.7 | 1.4 | 3.3 | -30.8 | -27.5 | 86.9 |
| 24-Dec-14 | -13.2 | -9.4 | -11.5 | -3.7 | -4.2 | -3.8 | 0 | 39.5 | 145 | 2.8 | 1.0 | -0.7 | -7.2 | -7.9 | 90.3 |
| 25-Dec-14 | -12.7 | -7.5 | -10.0 | -4.2 | -4.5 | -4.3 | 0 | 39.7 | 227 | 5.3 | 2.1 | 6.8 | -8.2 | -1.4 | 83.9 |
| 26-Dec-14 | -8.2 | -5.5 | -6.6 | -3.3 | -4.2 | -3.7 | 0 | 41.7 | 230 | 3.4 | 1.8 | -2.6 | -0.3 | -2.9 | 80.2 |
| 27-Dec-14 | -13.0 | -8.2 | -10.6 | -3.3 | -4.4 | -3.9 | 0 | 41.8 | 274 | 3.2 | 2.0 | 2.3 | 12.8 | 15.1 | 80.3 |
| 28-Dec-14 | -15.9 | -12.3 | -15.0 | -4.4 | -5.4 | -5.0 | 0 | 41.6 | 124 | 3.7 | 1.9 | -1.6 | 8.0 | 6.4 | 72.9 |
| 29-Dec-14 | -14.9 | -6.0 | -9.9 | -4.2 | -5.5 | -5.0 | 0 | 41.8 | 180 | 3.7 | 2.6 | -2.0 | -2.6 | -4.6 | 48.3 |
| 30-Dec-14 | -6.1 | -1.6 | -3.8 | -3.2 | -4.2 | -3.8 | 0 | 41.6 | 238 | 4.3 | 2.9 | -0.7 | -24.7 | -25.4 | 55.5 |
| 31-Dec-14 | -3.7 | 0.7 | -1.3 | -2.6 | -3.2 | -2.8 | 0 | 41.5 | 269 | 4.8 | 2.4 | -0.9 | -34.4 | -35.3 | 70.2 |

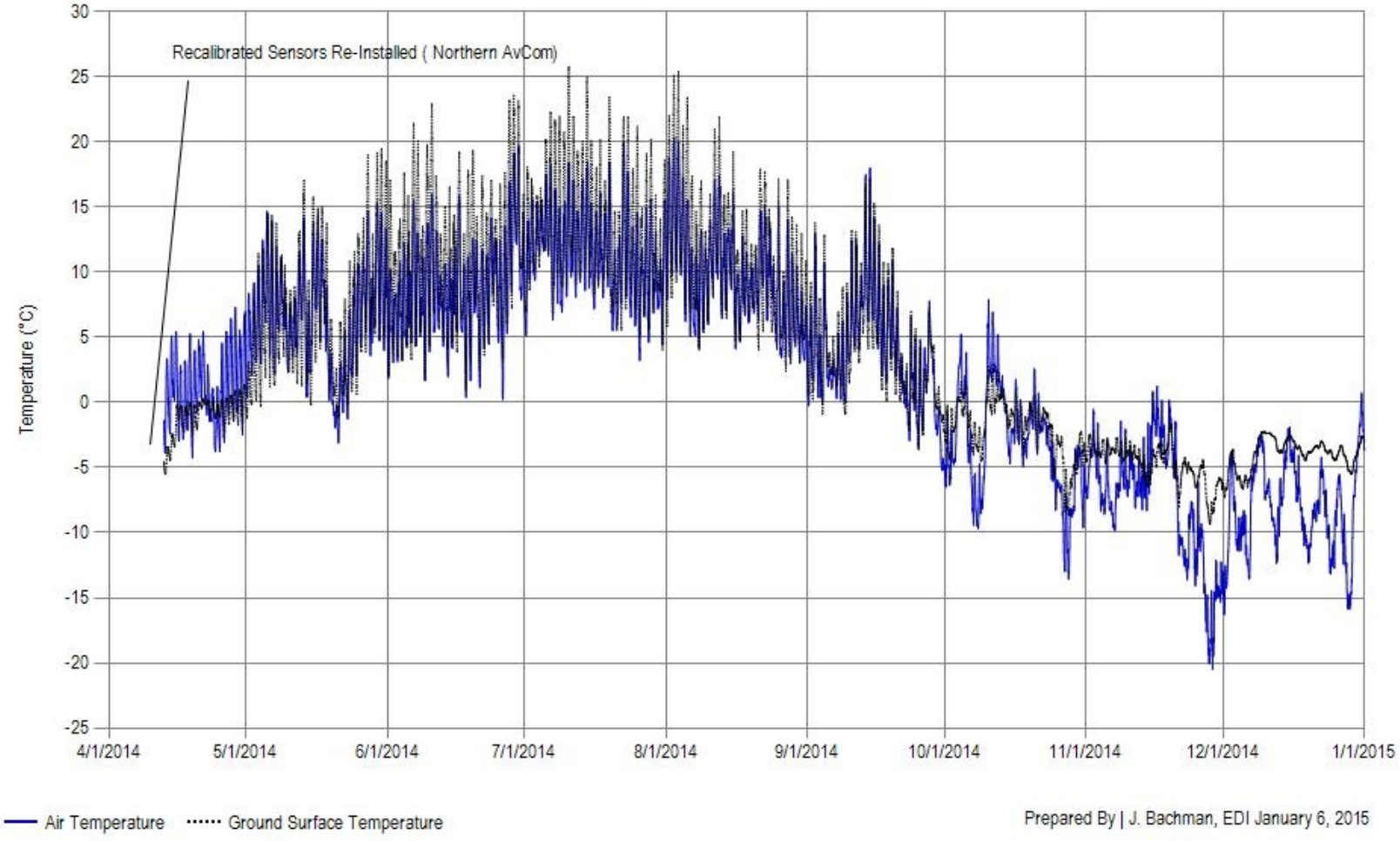


**Figure F-1. Mount Nansen mean hourly air and ground temperature, April 1 to December 31, 2014.**

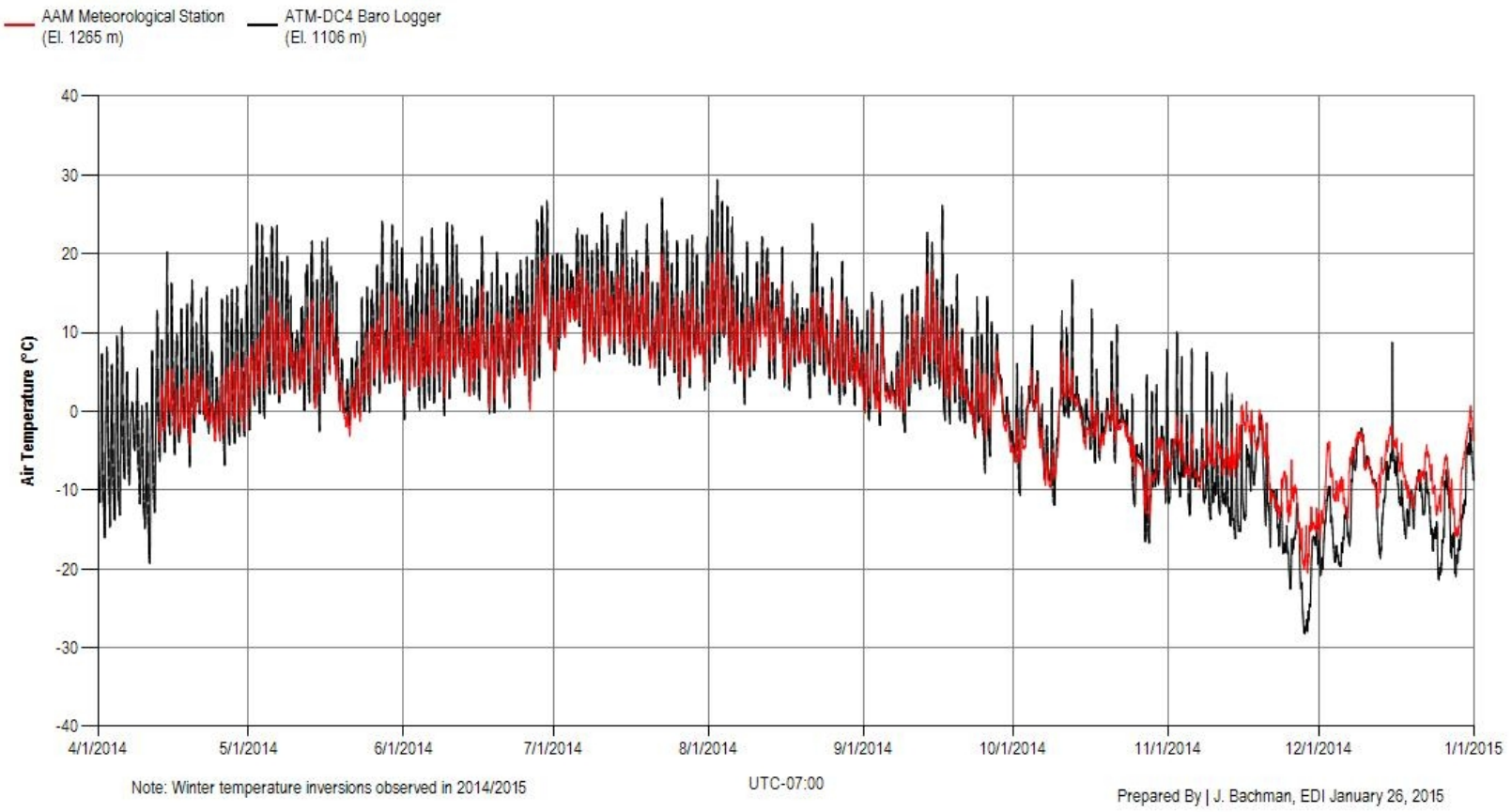


**Figure F-2. Mount Nansen mean hourly air temperature compared for the ATM-ROAD AAM station and the ATM-DC-4 station, April 1 to December 31, 2014.**

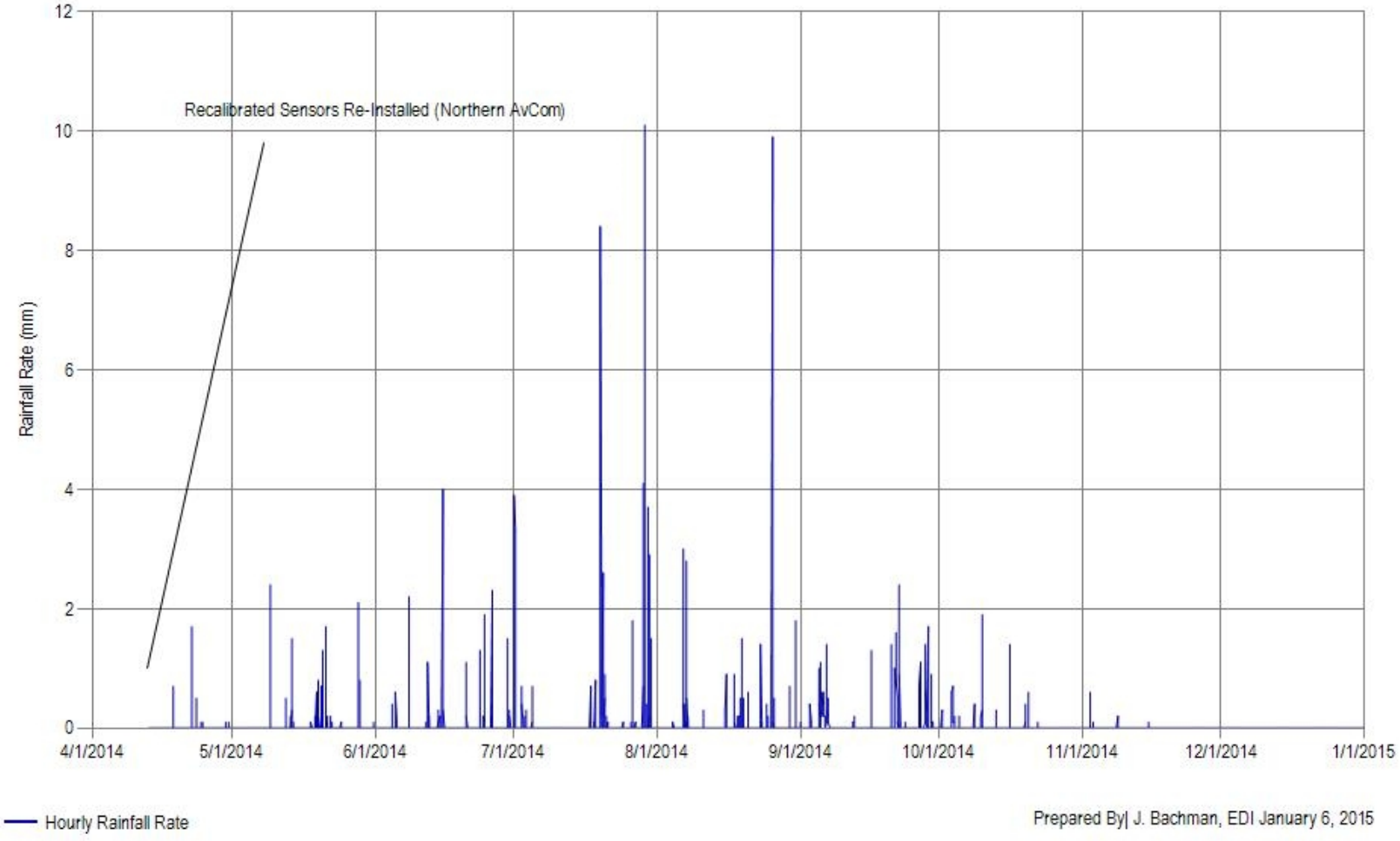


**Figure F-3. Mount Nansen cumulative hourly precipitation as rainfall, April 1 to December 31, 2014.**

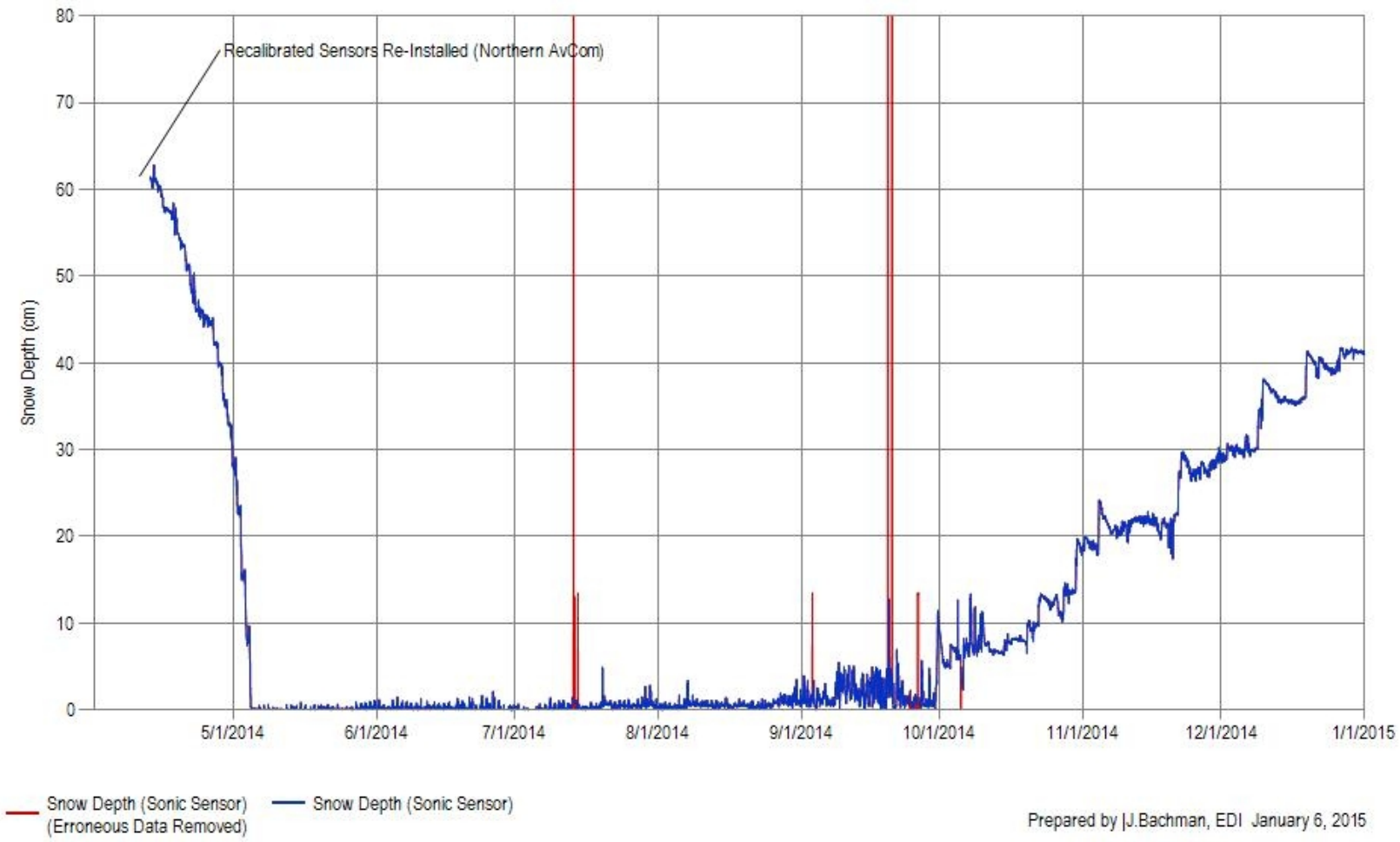


**Figure F-4. Mount Nansen cumulative daily snow depth, April 1 to December 31, 2014.**

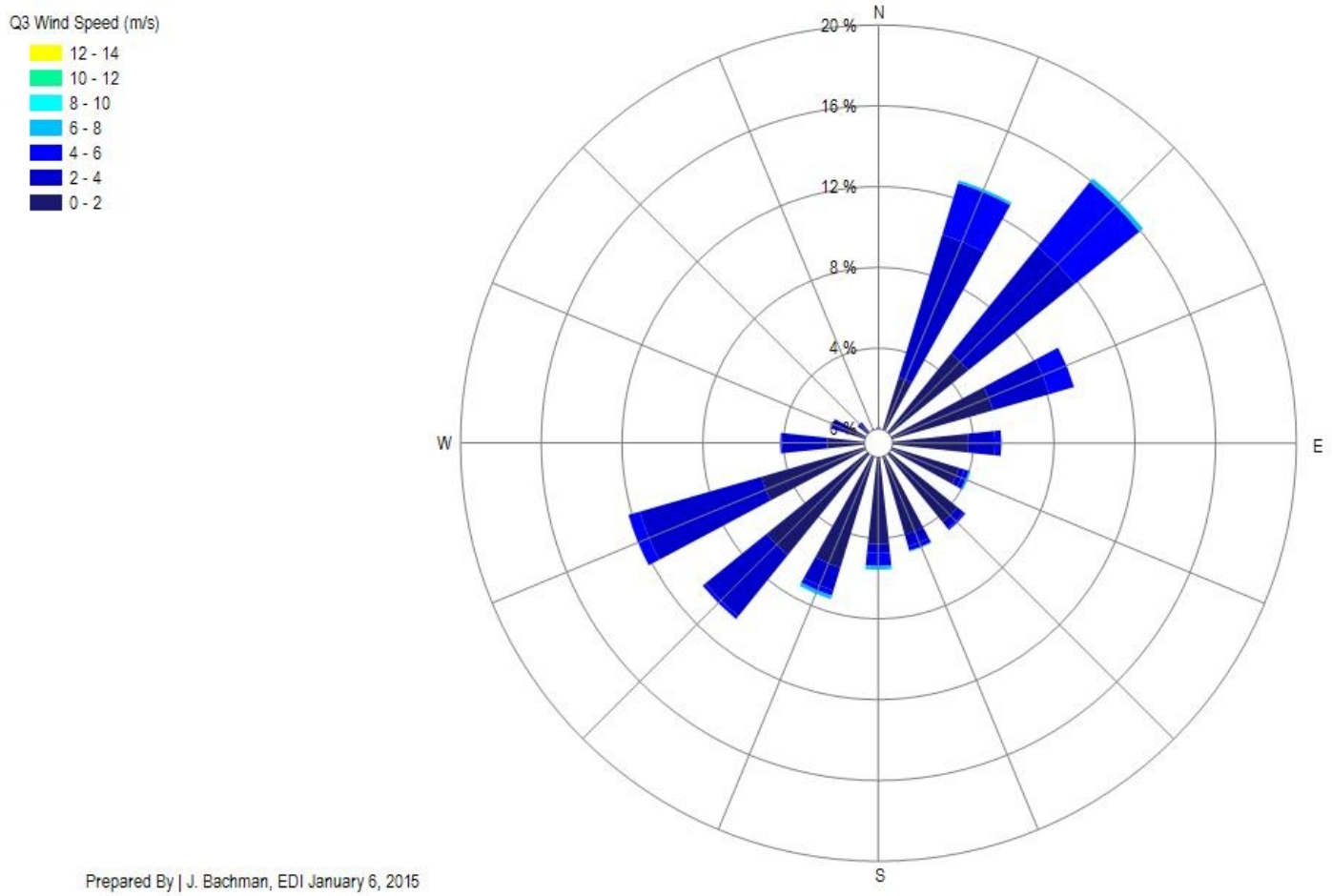


**Figure F-5. Mount Nansen mean hourly wind speed (m/s) and direction (wind rose diagram), October 1 to December 31, 2014.**

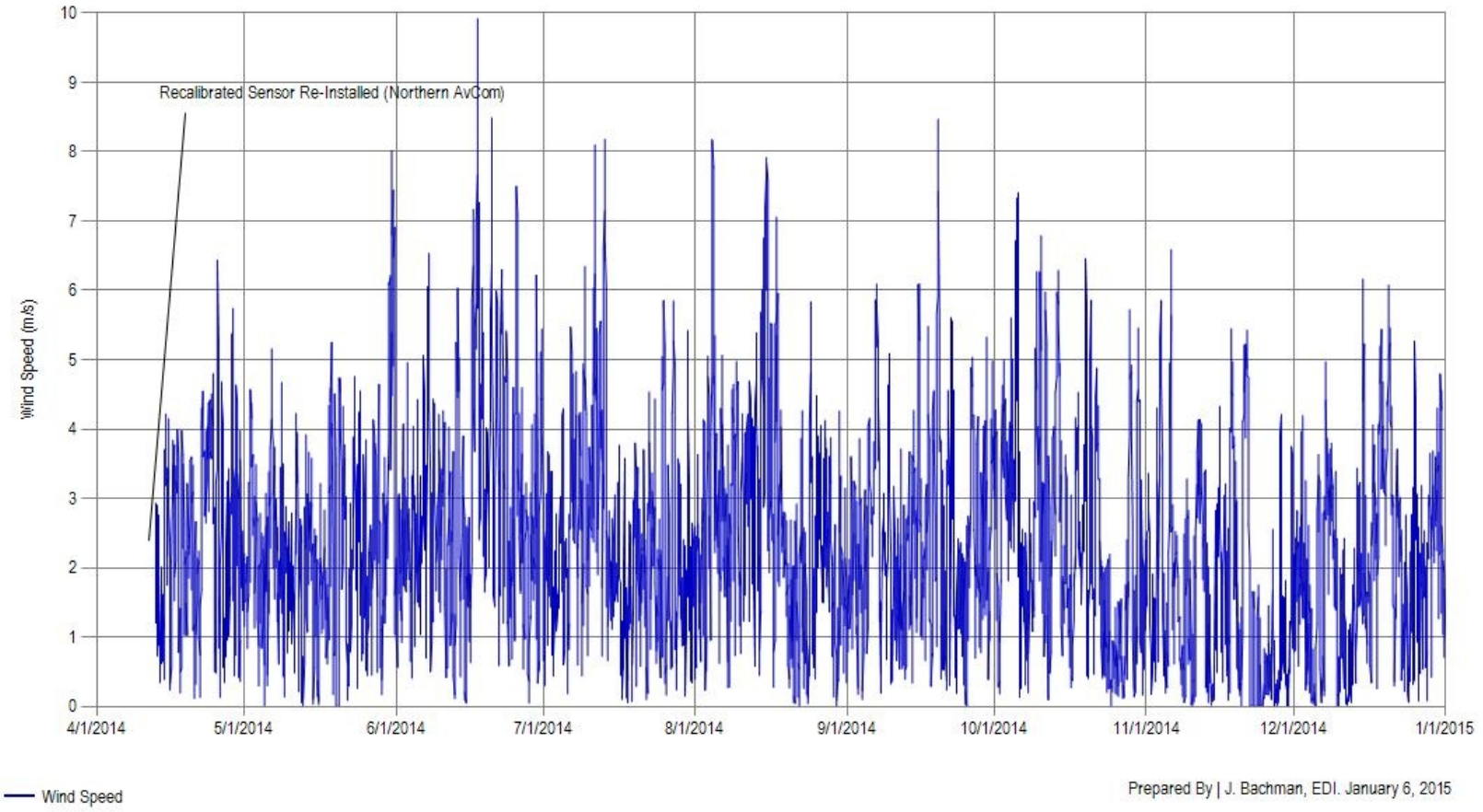


**Figure F-6. Mount Nansen mean hourly wind speed, April 1 to December 31, 2014.**

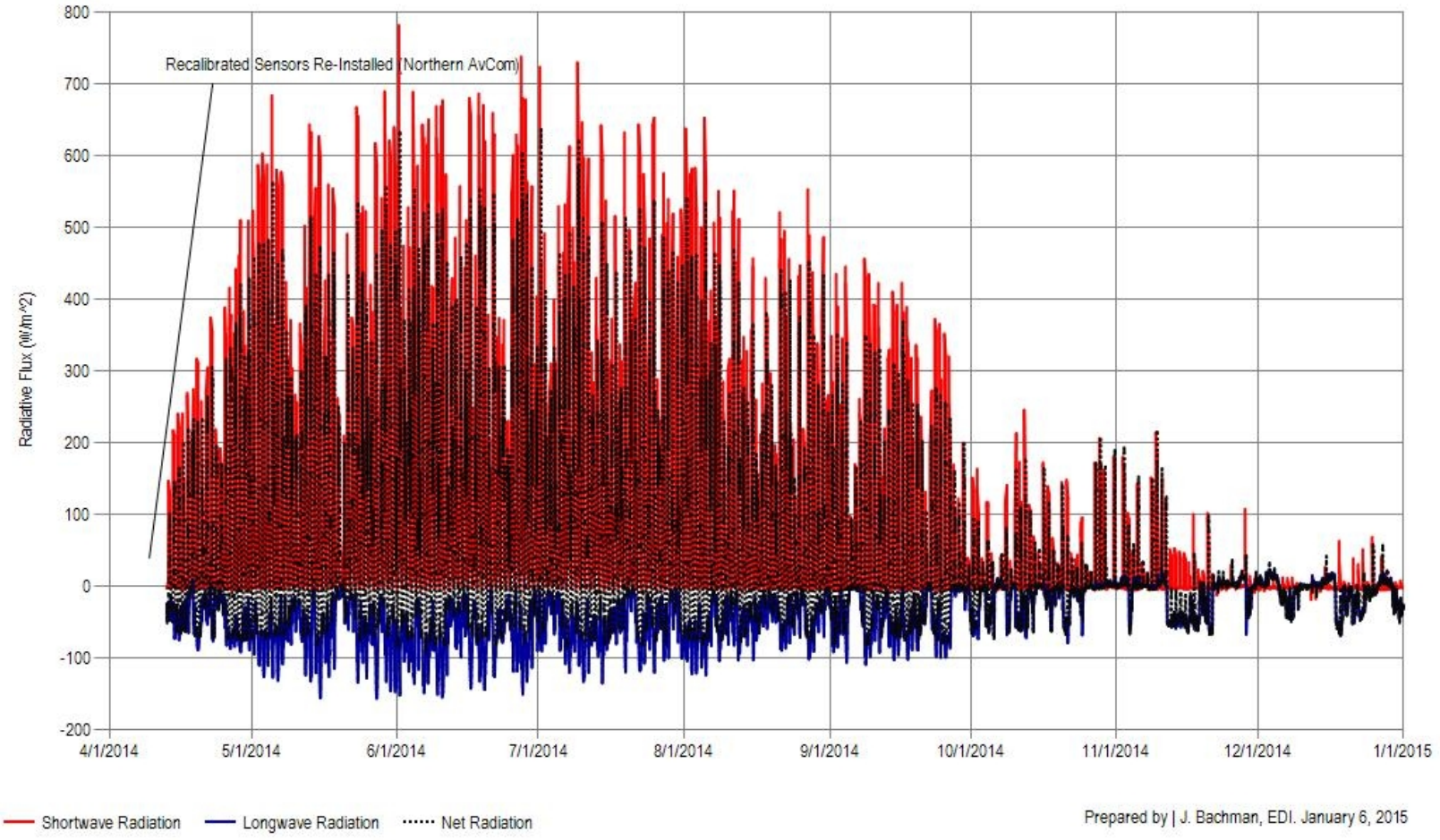


**Figure F-7. Mount Nansen mean hourly net shortwave, longwave and total radiation, April 1 to September 30, 2014.**

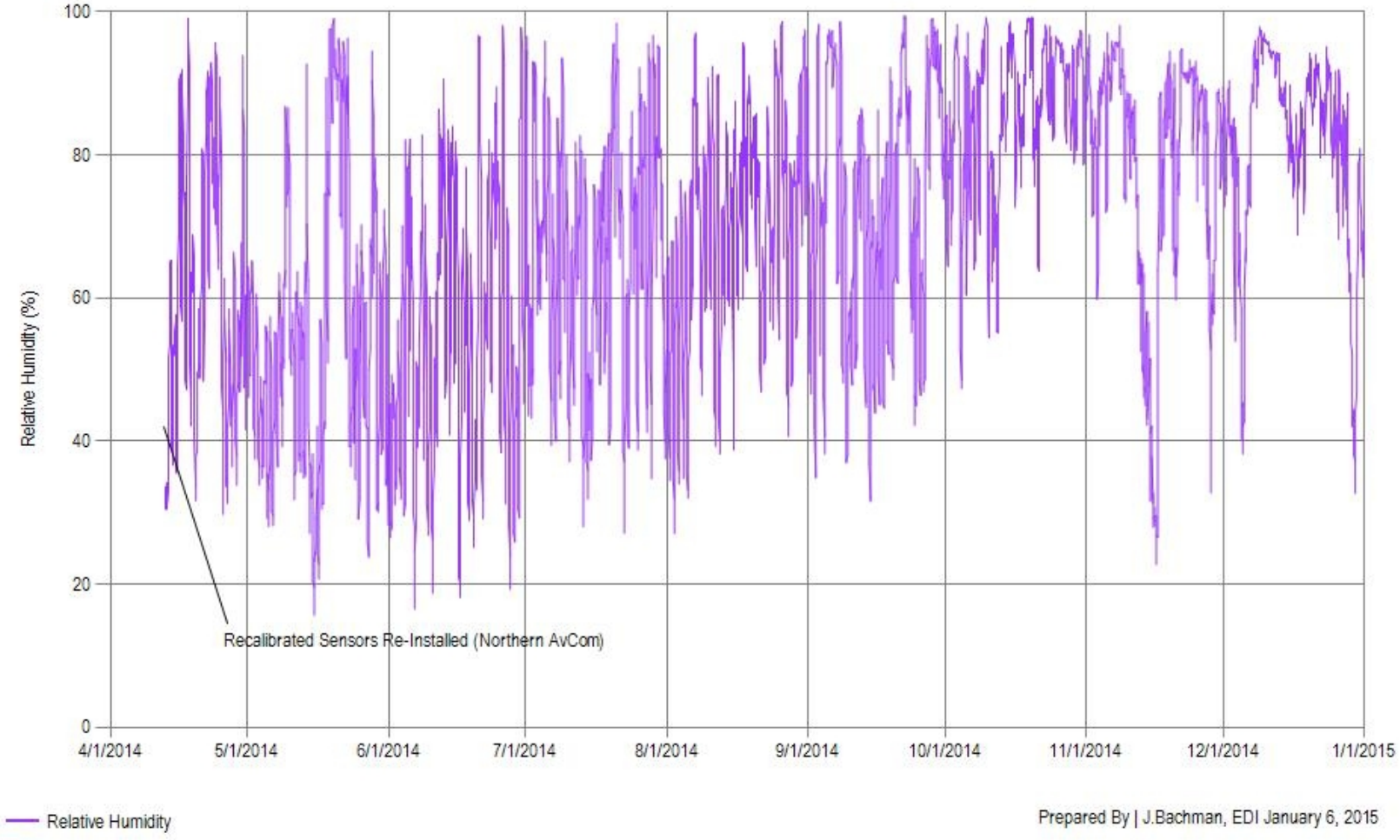


**Figure F-8. Mount Nansen mean hourly relative humidity, April 1 to September 30, 2014.**

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