Appendix G1

2016 Core Receiving Environment Monitoring Program

Final

Core Receiving Environment Monitoring Program 2016

Meadowbank Mine

Prepared for:

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Meadowbank Division
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- Gary Mann (Azimuth) – Gary was responsible for overall management, technical oversight and review of the CREMP.
- Eric Franz (Azimuth) – Eric was responsible for overall coordination and implementation (sampling, analysis/interpretation and reporting) of the CREMP.
- Brian Pyper (Azimuth Associate) – Brian conducted the statistical analyses and plotting for the trends assessment.

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ACRONYMS

Agnico	Agnico Eagle Mines Ltd.
AEMP	Aquatic Effects Monitoring Program
ANOVA	Analysis of variance
AWAR	All weather access road
BACI	Before/after control/impact
BACIP	Before/after control/impact Paired
BAP	Baker Lake – Akilahaarjuk Point
BBD	Baker Lake – barge dock
BES	Baker Lake – east shore
BPJ	Baker Lake – proposed jetty
CCME	Canadian Council of Ministers of the Environment
COC	Chain of custody
CREMP	Core Receiving Environment Monitoring Program
CRM	Certified reference material
DFO	Department of Fisheries and Oceans
DI	Deionized blank
DOC	Dissolved organic carbon
DQO	Data quality objective
EAS	Effects assessment strategy
EEM	Environmental effects monitoring
EB	Equipment blank
EIA	Environmental impact assessment
FEIS	Final Environmental Impact Statement
FF	Far-field
GPS	Global positioning system
HEPH	Heavy extractable petroleum hydrocarbons
ICP-MS	Inductively coupled plasma mass spectrometry
INUG	Inuggugayualik Lake
ISQG	Interim sediment Quality Guidelines
LCS	Laboratory control sample
LEPH	Light Extractable Petroleum Hydrocarbons
MDL	Method detection limit
MF	Mid-field
MMER	Metal Mining Effluent Regulations
NF	Near-field
NWB	Nunavut Water Board
PAG	Potentially acid Generating
PAHs	Polycyclic aromatic hydrocarbons

PDL	Pipedream Lake
PEL	Probable effect level
QA/QC	Quality assurance / quality control
REF	Reference
RPD	Relative percent difference
SEP	Sequential extraction procedure
SOP	Standard operating procedure
SQG	Sediment quality guidelines
SP	Second Portage Lake
TDS	Total dissolved solids
TE	Tehek Lake
TEFF	Tehek Lake Far-field
TIA	Tailings impoundment area
TKN	Total Kjeldahl nitrogen
TOC	Total organic carbon
TSF	Tailings Storage Facility (North and South Cells)
TSS	Total suspended solids
TPE, TPN, TPS	Third Portage Lake
UTM	Universal Transverse Mercator
WAL	Wally Lake

EXECUTIVE SUMMARY

The CREMP focuses on identifying changes in limnological parameters, water and sediment chemistry, or changes to primary (phytoplankton) and secondary (benthic invertebrate community) aquatic producers that may be associated with mine development activities. This is accomplished through temporal/spatial trend assessment that includes application of quantitative decision criteria (i.e., early warning "triggers" and action "thresholds") to facilitate immediate and objective decision-making regarding appropriate management actions. This information is integrated annually into the Aquatic Ecosystem Monitoring Program (AEMP) for holistic environmental management and decision making.

Meadowbank Study Lakes

CREMP monitoring started in 2006 and in-water mine development started in 2008. Key mine development activities that could result in changes to the aquatic receiving environment include: East Dike construction (2008), Bay-Goose Dike construction (2009-10), dewatering of lakes and impoundments (2009-11, 2013, 2014), effluent discharge (2012 to present), and general site-related mining activities that mostly generate dust (e.g., rock crushing, blasting, ore and waste hauling; 2008 to present). Key findings for 2016 are summarized in **Table ES-1**:

- *Water Chemistry* – As in the past, there were some statistically significant mine-related changes relative to baseline/reference conditions identified in 2016 at one or more near-field (NF) areas that exceeded their respective triggers: alkalinity (SP); conductivity (TPN, TPE, SP, WAL); hardness (TPN, TPE, SP, WAL); major cations (i.e., calcium, potassium, magnesium, and sodium [TPN, TPE, SP, WAL]); and TDS (TPN, TPE, SP, WAL). In the absence of effects-based thresholds (e.g., CCME water quality criteria) for these parameters, their triggers were set at the 95th percentile of baseline data. While these results represent mine-related changes, the observed concentrations are still relatively low and unlikely to adversely affect aquatic life. **These trends will be reviewed again in 2017**.
- *Sediment Chemistry* – Quantitative trigger analysis for sediment is based on coring results, which are conducted on a three-year cycle to coincide with MMER EEM field studies. This program is scheduled for completion in 2017. Grab samples submitted for analysis in 2016 showed similar concentrations to previous years based on visual comparison of the data. With the exception of chromium at TPE, none of the grab samples exceeded the trigger values in 2016. The 2016 chromium concentrations at TPE are lower than peak concentrations observed in 2014 and 2015. This "apparent" decrease may be an artifact of spatial variability within the sediment area, rather than an actual reduction in sediment chromium concentrations. Nonetheless, the 2016 results are within the range of concentrations reported in 2015. A few PAHs were detected in the composite sediment samples from SP (naphthalene), TPE (acenaphthylene, naphthalene), WAL (2-methylnaphthalene, naphthalene), and INUG (phenanthrene). These results are somewhat anomalous given that most PAHs have been measured below the MDL dating back to the start of the CREMP. The concentrations were all within 5-times the MDL, and the absolute concentrations are unlikely to pose risk to benthic invertebrates at the NF locations. PAH concentrations will be monitored in 2017, consistent with previous reporting cycles. **No additional studies are recommending beyond continued evaluation of the temporal trends in sediment metals concentrations in 2017 using BACI analysis of sediment core chemistry results. Sediment grab chemistry results will be monitored for PAHs as per the routine CREMP sediment sampling program.**

- *Phytoplankton Community* – There were no statistically significant ($p<0.1$) adverse effects (i.e., >20% reduction) to phytoplankton biomass or taxa richness at the NF study areas in 2016. Biomass and richness were lower at TPE relative to baseline/reference conditions, but the results were either not significant (biomass) or the effect size was less than the trigger value of 20% (taxa richness). **The trends in phytoplankton biomass and richness will be reviewed again in 2017.**
- *Benthic Invertebrate Community* – WAL had particularly high abundance in 2016 relative to previous years. There was an "apparent" reduction (>20%) in total abundance at TPE, when compared to INUG, but none of the results were statistically significant. Furthermore, when compared to previous years the results are well within the range of natural variability. In summary, there were no statistically significant short-term (i.e., past year) or longer-term (i.e., past two to four years) trends in reduced abundance or richness at the NF locations in 2016. **The trends in benthic invertebrate abundance and richness will be reviewed again in 2017.**

Baker Lake

CREMP monitoring at Baker Lake started in 2008. Key mine-related activities include barge/shipping traffic and general land-based activities associated with the tank farm area. No spills of fuels, hydrocarbons or any other materials were reported in the vicinity of the barge dock or jetty in 2016. There were no cases where water quality parameters exceeded the triggers in 2016. Overall, no changes in the aquatic receiving environment were observed that were attributable to Agnico's activities in Baker Lake, and as such, no follow-up management actions are required for 2017 beyond routine monitoring.

Table ES–1. Summary of key findings from the 2016 CREMP.

Variable Type & Variable	Magnitude[1]	Spatial Scale[2]	Causation[3]	Permanence[4]	Uncertainty[5]	Comments	Management Action[6]
Exposure - Limnology							
Oxygen	**0**	n/a	n/a	n/a	?	All stations - consistent with previous years	**0**
Temperature	**0**	n/a	n/a	n/a	?	All stations - consistent with previous years	**0**
Conductivity	**0**	Small	Low	n/a	???	Sp. conductivity readings at SP (January) and WAL (March) were elevated relative to historical conductivity readings in each lake. The results are highly uncertain because of possible issues with the probe. Conductivity readings for the rest of the year were within the normal historical range for each lake. No action required.	**0**
Exposure - Water Chemistry							
Conventionals	**1**	Large	High	Low	?	The following parameters (conventionals and nutrients) were elevated relative to reference/baseline conditions. However, concentrations suggest low potential for adverse effects: **Alkalinity** (SP); **Conductivity** (TPN, TPE, SP, WAL); **Hardness** (TPN, TPE, SP, WAL); **Ca/K/Mg/Na** (TPN, TPE, SP [not Na], WAL [not Na or K]); **TDS** (TPN, TPE, SP, WAL)	**1**
Nutrients	**0**	n/a	n/a	n/a	?	No trigger exceedances.	**0**
Total Metals	**0**	n/a	n/a	n/a	?	No trigger exceedances.	**0**
Dissolved Metals	**0**	n/a	n/a	n/a	?	No trigger exceedances.	**0**
Total Suspended Solids	**0**	n/a	n/a	n/a	?	No trigger exceedances.	**0**
Exposure - Sediment Chemistry							
Physical	**0**	n/a	n/a	n/a	?		**0**
Total Metals	**1**	Moderate	High	Moderate	??	Sediment chromium concentrations continue to exceed the trigger at TPE. Concentrations appear to be stabilizing based on the results from 2015 and 2016.	**1**
Organics	**0**	n/a	n/a	n/a	?	Acenaphthylene exceeded the threshold at TPE. The concentration at TPE was less than 5-times the MDL. Acenaphthylene is not considered a risk to the benthic invertebrate community at TPE.	**0**
Effects - Phytoplankton							
Chlorophyll-a*	**0**	n/a	n/a	n/a	?	Continued data quality issue for chlorophyll-a (temperature control in transit).	**0**
Total Biomass	**0**	n/a	n/a	n/a	?	No statistically significant adverse effects were detected in 2016.	**0**
Taxa Richness	**0**	n/a	n/a	n/a	?	16% lower richness was reported at TPE in 2016 relative to baseline/reference. The trigger for adverse effects to phytoplankton richness is a reduction of 20% or more.	**0**
Effects - Benthic Invertebrates							
Total Abundance	**0**	n/a	n/a	n/a	?	Decreased abundance at TPE relative to INUG in the past four years, but the differences are primarily driven by increased abundance at INUG while abundance at TPE has been relatively stable. None of the results are statistically significant.	**0**
Total Richness	**0**	n/a	n/a	n/a	?	Richness continues to track higher for most stations. The benthic communities are dominated by chironomids, and the relative proportion of major taxa remains stable at all stations.	**0**

Notes:

[1] **Magnitude Ratings (narrative in brackets used in the absence of specific triggers/thresholds):**

- **0 –** no exceedances of triggers or thresholds (or no apparent changes from baseline of concern)
- **1 –** early warning trigger exceeded (or change from baseline warranting concern)
- **2 –** threshold exceeded (or change from baseline exceeding magnitude of concern)

[2] **Spatial Scale Ratings:**

- n/a – no magnitude of effect, therefore not evaluated
- Small – localized scale
- Moderate – sub-basin to basin scale
- Large – basin to whole lake scale

[3] **Causation Ratings:**

- n/a – no magnitude of effect, therefore not evaluated
- Low – no evidence for a mine-related source
- Moderate – some likelihood of a mine-related source
- High – the source of the problem is very likely to be mine-related

[4] **Permanence Ratings:**

- n/a – no magnitude of effect, therefore not evaluated
- Low – rapidly reversible (e.g., months to years)
- Moderate – slowly reversible (e.g., years to decades)
- High – largely irreversible (e.g., decades +)

[5] **Uncertainty Ratings:**

- ? – low uncertainty
- ?? – moderate uncertainty
- ??? – high uncertainty

[6] **Management Actions:**

- **0 –** no action beyond routine CREMP monitoring
- **1 –** continued trend monitoring in 2017
- **2 –** active follow-up with more detailed quantitative assessment in 2017

1. INTRODUCTION

1.1. Background

Agnico Eagle Mines Ltd.'s Meadowbank Mine is situated approximately 75 km north of the hamlet of Baker Lake, Nunavut. The Aquatic Effects Management Program (AEMP; Azimuth, 2005a [updated 2015a]) was developed to address issues identified during the Environmental Impact Assessment (EIA) process that could potentially impact the aquatic receiving environments surrounding the development. Building from earlier baseline monitoring (Azimuth, 2005b), the 2005 AEMP described the general monitoring strategy designed to detect impacts to the aquatic environment. This strategy relied on two primary components (discussed further in **Section 1.3**): the core monitoring program and targeted studies. Monitoring following the 2005 AEMP strategy has been implemented as follows:

- 2006 and 2007 – The core monitoring program was implemented over two complete cycles (Azimuth, 2008a, 2008b) prior to construction of the mine (i.e., baseline conditions).
- 2008 – 2016 – Mine construction started in 2008, with dike construction activities occurring directly in the receiving environment. Core receiving environment monitoring (Azimuth, 2009c, 2010a, 2011b, 2012a, 2013, 2014, 2015c, 2016, this report) was complemented by targeted studies on dike construction monitoring (Azimuth, 2009a, 2010b; Agnico, 2011), the potential effects of total suspended solids (Azimuth, 2009a, 2010c, 2011a, 2012b) on water quality and benthic invertebrate communities in affected waterbodies, and most recently a sediment chromium bioavailability and toxicity study (Azimuth, 2016).

> **<u>"AEMP" Terminology</u>**
>
> The term "AEMP" was first used in the 2005 report *Aquatic Effects Management Program* (Azimuth, 2005a), which described the rationale, framework, strategy, methods, and scope of receiving environment monitoring for the Meadowbank Mine. Receiving environment monitoring conducted in 2006 and 2007 use this term in the annual report titles.
>
> The Nunavut Water Board A License, issued in 2008 and renewed in 2015, defines "AEMP" as the "Aquatic Effects Monitoring Program"; annual receiving environment monitoring reports since 2008 reflect this subtle change.
>
> Agnico has a number of monitoring programs (e.g., effluent monitoring, ground water monitoring, air quality monitoring) relevant to tracking potential changes to the aquatic receiving environment surrounding the Meadowbank Mine. One of the requirements of the original Nunavut Water Board (NWB) A License was to revise the AEMP to consider the results of all these programs; a restructured AEMP was submitted in December 2012 (Azimuth, 2012c). Previously, the term "AEMP" was essentially synonymous with receiving environment monitoring. However, given the AEMP's broadened scope, more specific terminology is needed to minimize confusion. To that end, we use the following terms in this report:
>
> **CREMP** – refers to the "core receiving environment monitoring program"; this is synonymous with "core monitoring program". While this term was first used for the 2009 annual report, it is meant to encompass the entire core receiving environment monitoring program since 2006. Program details were recently documented in the *CREMP: 2015 Plan Update* (Azimuth, 2015b).
>
> **2005 AEMP** – refers to the original AEMP, which served as the plan for the CREMP until the *CREMP Design Document 2012* (Azimuth, 2012d).
>
> **AEMP** – is used generically when not referring to either of the first two definitions.

Agnico, in consultation with regulators, completed two ongoing initiatives in 2012:

- The restructured Aquatic Effects Management Program (AEMP) (Azimuth, 2012c), now serves as an overarching 'umbrella' strategy that conceptually provides an opportunity to integrate results of individual, but related, monitoring programs in accordance with the original NWB Type A water license requirements. In 2012, Agncio completed the AEMP synthesis document which systematically evaluated the results of individual monitoring programs, developed a site specific conceptual model to evaluate stressors, transport medias and receptors of concern (see **Section 2.4** for more details), and integrated the results of numerous monitoring programs into a management response framework.

- The Core Receiving Environment Monitoring Program (CREMP): Design Document 2012 (Azimuth, 2012d). This document reviewed all historic monitoring CREMP data, presented the trigger/threshold derivation process (see Section 1.5 for description of triggers/thresholds), determined trigger/threshold values for individual parameters and established the experimental design to optimize the program. The resulting triggers/thresholds and experimental design changes have been integrated into the 2012 CREMP report.

As per the recommendations of the 2012 CREMP (Azimuth, 2013), water quality triggers/thresholds were updated in 2013, with minor updates in 2014 to include more recent monitoring data (i.e., in the case of triggers based on the 95th percentile of reference/baseline conditions), to reflect new thresholds (e.g., adopted from other jurisdictions where not covered by CCME), or to add field pH triggers. Current program details were recently documented in the *CREMP: 2015 Plan Update* (Azimuth, 2015b)

This CREMP monitoring report documents the methods and results of aquatic receiving environment monitoring activities undertaken during 2016. As in previous years, this report integrates accumulated results since 2006 to facilitate the identification of changes in limnology or water chemistry parameters, sediment chemistry, phytoplankton biomass and benthic community structure associated with mine-related activities at Meadowbank Mine or in Baker Lake.

1.2. Environmental Setting

Understanding the environmental setting of the project lakes is integral to understanding the design of the CREMP. The Meadowbank project lakes are situated in the barren-ground central Arctic region of Nunavut within an area of continuous permafrost. These are headwater ultra-oligotrophic/oligotrophic (nutrient poor and unproductive) lakes, situated on the watershed boundary that separates two main drainages – the Arctic and Hudson Bay drainages. Only a few hundred meters to the north of Second and Third Portage lakes is the divide between water that flows north to the Arctic Ocean (via the Meadowbank and Back River system) or to Chesterfield Inlet and Hudson Bay (via the Quoich River system).

The landscape consists of rolling hills and relief with low-growing vegetative cover and poor soil development. Numerous lakes are interspersed among boulder fields, eskers and bedrock outcrops, with indistinct and complex drainages. The main lakes in the Meadowbank project area include: Third Portage Lake (TP), Second Portage Lake (SP), Tehek Lake (TE), and the Vault Lake system – Vault, Wally (WAL) and Drilltrail lakes. As is common of headwater lakes, all of the project lakes have small drainage areas relative to the surface area of the lakes themselves. Local inflow from surrounding terrain is the predominant influence on water movement within the system. Small channels connect the project area lakes, although there is little flow between lakes except during freshet and possibly none during winter months. Movement by fish between lakes is also rare, as populations remain quite isolated from one another. The ice-free season on these lakes is short, with ice break-up in late-June to mid-July and ice-up beginning in late September or early October. Maximum ice thickness is at least 2 m by March/April.

Overall, the Meadowbank project lakes support healthy communities of plankton, benthos and fish that are typical of oligotrophic Arctic lakes (Azimuth, 2005b). Biological productivity of the lakes is limited by nutrient availability, cold water and a short growing season.

1.3. Core Monitoring Program (CREMP) Objectives

The 2005 AEMP framework (Azimuth, 2005a) presented a receiving environment monitoring strategy consisting of two components:

- *Core Monitoring Program (CREMP)* - was tailored based on our understanding of mine construction, operation and infrastructure (e.g., dikes, effluents, stream crossings, roads, etc.) and has been developed to detect mine-related effects at temporal and spatial scales that are ecologically relevant. The program was expanded to include Baker Lake in 2008. The program was updated based on the recommendations of the *CREMP: Design Document 2012* (Azimuth, 2012d) and more recently, described in detail in the *CREMP: 2015 Plan Update* (Azimuth, 2015b).
- *Targeted Monitoring Program* – targeted studies are specific studies that typically have narrower temporal or spatial bounds or are designed to address specific questions related to particular components of mine development during construction or operation (i.e., they are not routinely conducted). These are integrated with and are complementary to the core monitoring design. Examples include dike construction monitoring (e.g., Azimuth, 2009a) and the total suspended solids (TSS) effects assessment studies (EAS) (e.g., Azimuth, 2009b). Following a recommendation from the 2014 CREMP report (Azimuth, 2015c), a targeted study was conducted in 2015 to investigate the toxicity and bioavailability of chromium in sediments from TPE (Azimuth, 2016).

<u>CREMP Sampling Area Categorization</u>

Tracking spatial and temporal differences related to mining activities relied on categorizing areas using two factors:

• *Area Type* – this concept relates to an area's spatial proximity to the planned mine development, whether built or not; categories include near-field, mid-field, far-field, and reference (see text for more details).

• *Area Status* – this concept is temporal and has two levels: control (not exposed to mine-related activity) or impact (exposed to mine-related activity. The term "impact" is taken from the BACI statistical study design approach and does not mean that an actual impact has taken place; rather, it designates a time period when potential mine-related impacts may occur for an area.

For example, the status of baseline (i.e., pre-construction) monitoring conducted at all areas, regardless of category, would be "control". This status would change to "impact" once construction activities started that had the potential to affect an area (e.g., SP changed from control to impact status in August 2008 with the onset of construction for the East Dike; TE followed suit based on actual exposure to TSS from that event). WAL (a near-field lake) was still "control" status in early 2013, but changed to "impact" in July when construction activities were initiated for the Vault deposit.

Together, area categorization by type and status provide a logical framework to facilitate the identification of real mining-related changes (as opposed to natural regional changes due to climate or other factors) to the aquatic receiving environment (described in **Section 1.5**).

The study design is based on a before-after-control-impact (BACI) approach (see text box), but has also incorporated the concept of gradients in exposure. To this end, the 2016 program consisted of 13 sampling areas (see **Figure 1.3–1** to **Figure 1.3–3**), each categorized into one of the four[1] main types of areas described below:

- *Near-field (NF) areas* – Areas are situated in close proximity to the development (planned or constructed), in particular, near dikes, dewatering discharge, and proposed effluent sources (**Figure 1.3–1** to **Figure 1.3–3**). These areas provide the first line of early-warning for introductions of stressors into the receiving environment. In the Meadowbank study lakes, these areas include: Third Portage Lake North (TPN), Third Portage Lake East (TPE), Second Portage (SP), and Wally Lake (WAL; note that planned mining activity started there in July 2013).

  For Baker Lake, there are two NF areas, one targeting the hamlet's barge landing area (Baker Barge Dock [BBD]) and the other Agnico's fuel storage facility (Baker Proposed Jetty [BPJ]).

- *Mid-field (MF) area* – This area designation was added in 2011 to be consistent with the area categorizations used in the *CREMP: Design Document 2012* (Azimuth, 2012d) and includes Tehek Lake (TE) and Third Portage Lake South (TPS). TE is adjacent to the inlet from Second Portage Lake (**Figure 1.3–1**) and was exposed to elevated TSS during construction of the East Dike in 2008, prompting the addition of a new far-field area (Tehek far-field) in 2009. Consequently, MF designation is more accurate for TE. TPS was initially envisioned as an internal reference area in the 2005 AEMP. However, given the connectivity to TPN and the slight changes in hardness-related parameters, it is more appropriately considered a MF area. That said, given the degree (i.e., relatively minor) and nature (i.e., limited to certain non-metal parameters only) of the observed changes and the termination of discharges to TPN, TPS should still be appropriate as a reference area for EEM water quality monitoring.

  Beginning in 2016, sampling frequency and monitoring components are determined based on the results from the previous monitoring cycle at the NF areas. This new sampling approach is discussed in full in **Section 2.2.3**.

- *Far-field (FF) area* – The intent of this area is to monitor water and sediment quality downstream of project infrastructure to provide insights into the spatial extent of any effects observed at the near-field areas. The Tehek far-field (TEFF) area is a key location that will ultimately determine whether or not contaminants are detectable downstream of the entire mine development. Lake waters from Second and Third Portage Lakes and the Vault Lakes (Vault, Wally, Drilltrail) meet at the southern end of Second Portage Lake and discharge via a single channel into Tehek Lake (**Figure 1.3–1**). Monitoring the water and sediment quality and the health of the benthic invertebrate community in the basin adjoining the discharge point from Second Portage Lake will help determine if any effects identified at SP are extending into TE and beyond into TEFF.

  Similar to the MF areas, the sampling frequency and monitoring components at TEFF are determined based on conclusions from the previous monitoring cycle at the MF areas, specifically TE. This new sampling approach for the TEFF is discussed in full in **Section 2.2.3**.

- *Reference (Ref) areas* – By definition, reference areas are sufficiently removed from the mine that they are presumed to be unaffected by any infrastructure (roads, dikes, runways) and point sources (aerial and aquatic) associated with mine development. Inuggugayualik Lake (INUG) and

[1] Note that three main area types were initially envisioned in the 2005 AEMP: NF, FF and Ref. However, area designations were modified during the CREMP design review (Azimuth, 2012d) to more accurately reflect the realities of potential exposure to mine-related activities following dike construction; a mid-field (MF) category was added that includes Tehek Lake (TE) and Third Portage Lake South (TPS).

Pipedream Lake (PDL) are external reference areas chosen for the purposes of making comparisons with the project lakes (EVS, 1999; Azimuth, 2005b). Monitoring of reference areas is important in order to distinguish between possible mine-related changes in water quality or ecological parameters and natural changes, unrelated to the mine. The reference areas are situated about 16 km west at INUG and 12 km northwest at PDL of the mine site (**Figure 1.3–1** and **Figure 1.3–2**). They are both headwater lakes and flow north into the Arctic Ocean. Despite the different drainage basin, both these lakes satisfy the requirements of an external reference lake from a physical/chemical perspective because they are at similar in latitude, have similar geology, relief and climate, do not have any significant inflows and has generally similar limnological features, water chemistry and aquatic biological community structure to the project lakes (Azimuth, 2005b). Pipedream Lake, added to the CREMP in 2009, was originally investigated as a candidate reference area in 1998 (EVS, 1999) from a fisheries perspective.

For Baker Lake, an internal reference area is located several kilometers to the east of the hamlet along the north shore of the lake (Baker Akilahaarjuk Point [BAP]) and a second reference area was added in 2011 based on a recommendation from additional analysis and interpretation of the historical Baker Lake data, which is located on the same shoreline, east of BPJ and west of BAP (Baker East Shore [BES]; see **Figure 1.3–3**).

Thus, the core monitoring program is intended to detect changes and help define the extent (both spatially and temporally) of any adverse effects. Information on the status of each site (i.e., control or impact designation as per the text box) is provided in **Section 1.4**.

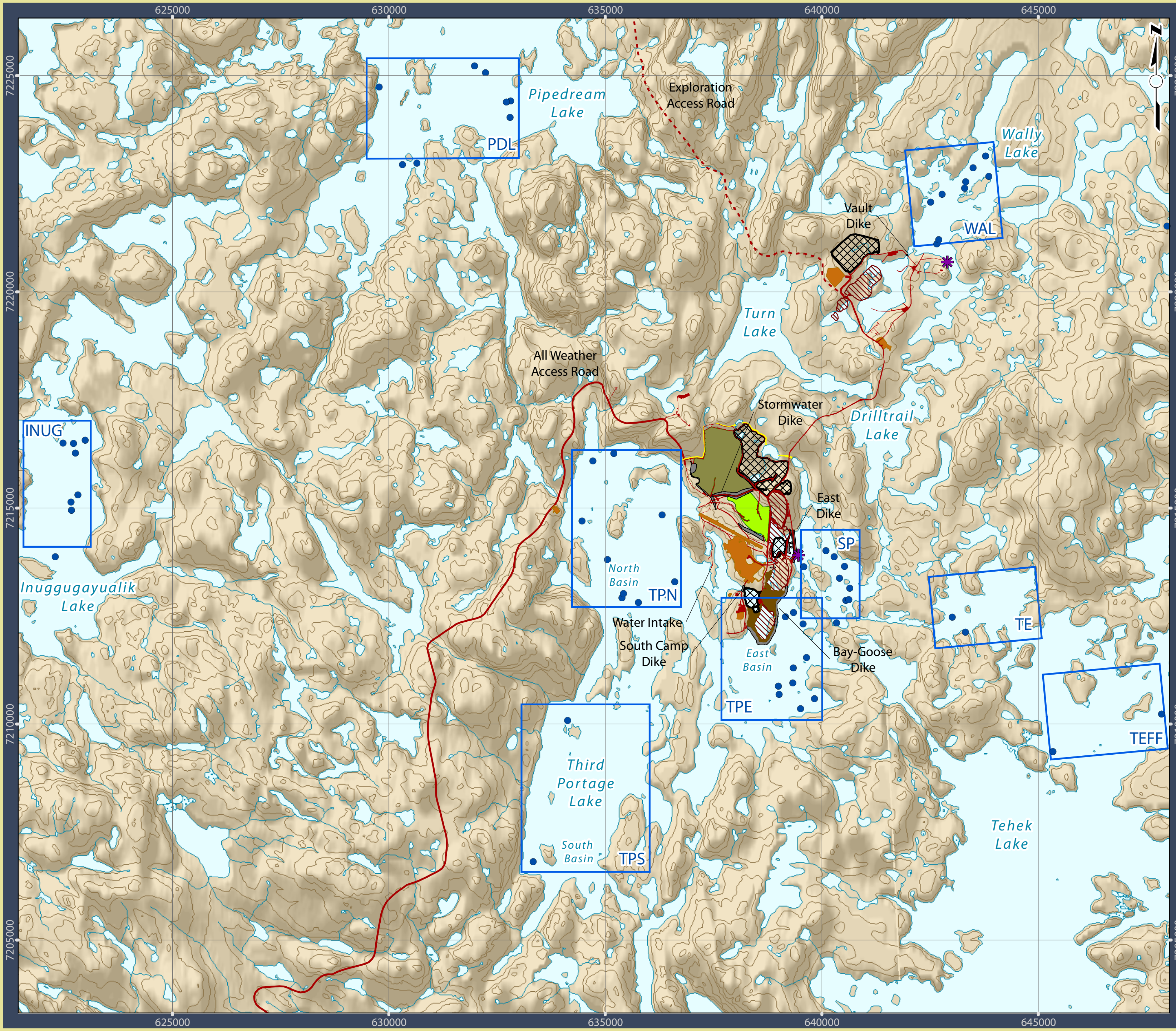

Figure 1.3-1: Meadowbank Water Quality Monitoring Stations - 2016

Legend

- Water Sampling Point
- Water Sampling Area
- All Weather Access Road
- Exploration Access Road

Mine Features

- Diffuser
- Facilities
- Road
- Dike
- Diversion Ditch
- Waste Dump
- Pit
- Dewatered Lake
- South Cell Tailings Storage Facility
- North Cell Tailings Storage Facility

Area of Detail

0 1 2 3

Kilometres

Projection: UTM Zone 14 NAD83

Data Sources:
Natural Resources Canada, GeoBase®
National Topographic Database
Agnico-Eagle Mines Limited.
Azimuth Consulting Group Inc.

Meadowbank Gold Project

Prepared for: AGNICO EAGLE

By: CASLYS CONSULTING

January 27, 2017

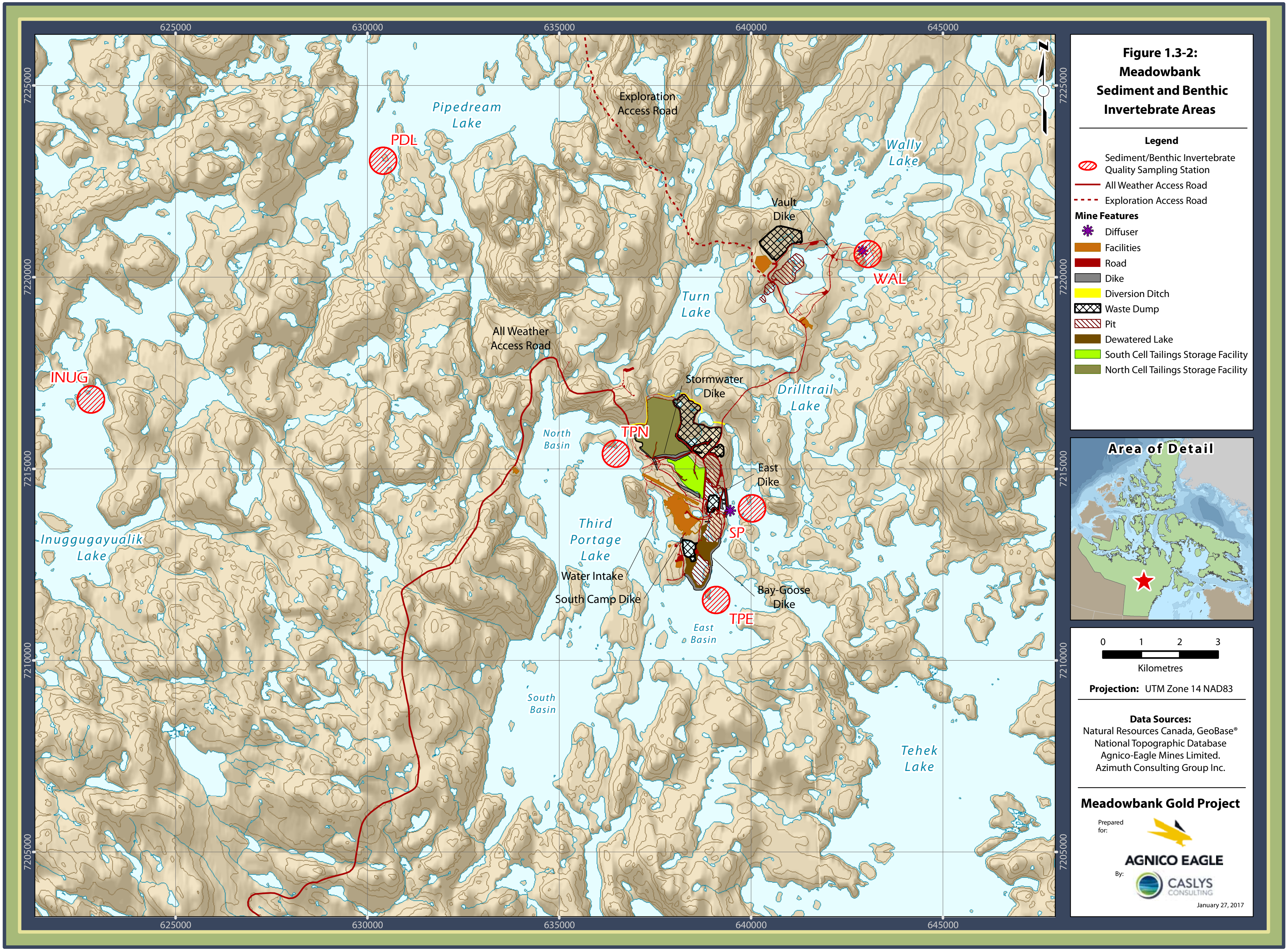

Figure 1.3-2: Meadowbank Sediment and Benthic Invertebrate Areas

Legend

- Water Sampling Point
- Sediment/Benthic Invertebrate Quality Sampling Station
- All Weather Access Road
- Exploration Access Road

0 5 10 15

Kilometres

Projection: UTM Zone 14 NAD83

Data Sources:
Natural Resources Canada, GeoBase®
National Topographic Database
Agnico-Eagle Mines Limited.
Azimuth Consulting Group Inc.

Figure 1.3-3: Baker Lake Water, Sediment, and Benthic Invertebrate Sampling Area - 2016

Meadowbank Gold Project

Prepared for: AGNICO EAGLE

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January 30, 2017

1.4. Meadowbank Mine Development and Operation

The construction phase of the Meadowbank Mine officially started in June 2008, upon receipt of the NWB A Water License (2AM-MEA0815; renewed to 2AM-MEA1525 in 2015) for the project. The Fisheries and Oceans Canada (DFO) *Fisheries Act* Authorization (NU-03-0191) for the project was issued on July 30, 2008, thus allowing the start of in-water construction activities. Key mine-related activities (e.g., site construction, dike construction, dewatering, effluent discharge, general site-related activity, barge traffic in Baker Lake (**Figure 1.4–1**; information provided by Agnico), and related changes observed in the receiving environment are described by year in **Table 1.4–1**.

The onset of construction activities in proximity to a CREMP monitoring area formally ends the baseline phase and changes the status of that area from "control" to "impact" (not necessarily meaning that there is an impact or effect [i.e., either positive or negative]; only that there is the potential for mining-related changes that may occur at that area after that time). Status changes are also important for any statistical analyses, as they dictate how data are grouped when assessing potential trends (see **Section 1.5**). Note that the end of the baseline phase is specific to each area. For example, TPE would have still be in the baseline phase in August 2008 (it is up gradient of Second Portage Lake), but not in August 2009 due to dike construction activities. The lack of baseline monitoring at the Baker Lake areas means that the status of areas does not change over time (i.e., near-field areas are "impact" and reference areas are "control"). The status of all CREMP areas since monitoring started is provided in **Table 1.4–2**.

Table 1.4–1. Chronology of mine development and operational activities and associated receiving environment overview.

Year	Major Mine-Related Activities	Receiving Environment Overview
2008	● Major in-water construction activities included the East Dike (located in Second Portage Lake) and the Western Channel Dike (located between Third Portage Lake and Second Portage Lake); the closest CREMP sampling area to these activities was the Second Portage Lake area (SP). ● Other site-related activities included rock crushing, road building, pit blasting, ground preparation, and infrastructure construction. ● Barge traffic increases in Baker Lake to support construction.	● As described in detail elsewhere (Azimuth, 2009a; 2009b), East Dike construction led to a sedimentation event that extended through Second Portage Lake (SP) to Tehek Lake (TE). The potential impact of construction-related sediment releases to the aquatic environment was the focus of the four-year EAS study (Azimuth, 2009b, 2010d, 2011a, 2012c).
2009	● Dewatering discharges (i.e., impounded Second Portage Lake water with TSS) were directed primarily into the north basin of Third Portage Lake (TPN), but also into Second Portage Lake (March to July and Oct to Dec, 2009). ● Bay-Goose Dike construction started in late July 2009. ● Most of the site preparation and road infrastructure was completed in 2009. ● North Portage Pit was the primary focus of blasting and mine operations. ● Barge traffic increases in Baker Lake.	● Despite a number of precautions, storm winds broke the Bay-Goose Dike turbidity barrier containment system, leading to another sedimentation event in late August. ● Elevated TSS (and other parameters) was primarily restricted to east basin of Third Portage Lake (TPE) and to a minor extent into SP and TE. The implications of the release were assessed in the EAS study (see above).
2010	● Bay-Goose Dike construction completed using additional mitigation measures. ● Mine officially opened on 27 Feb 2010, marking the start of the operations period. ● Pit development focused on North Portage and South Portage pits. ● Waste rock to rock storage facility (RSF). Tailings to impoundment area (TIA). Contact water from operations not discharged to receiving environment. ● Dewatering of SP impoundment to TPN continued, with discharge now subject to MMER. ● Barge traffic increases in Baker Lake.	● Bay-Goose Dike construction leads to less-pronounced sedimentation event in TPE and extends through SP to TE; EAS studies continue. ● TPN (dewatering) TSS concentrations generally consistent with baseline conditions.
2011	● Mining operations focus on North Portage and South Portage pits. ● Waste rock to rock storage facility (RSF). Tailings to impoundment area (TIA). ● Construction activities limited to mine footprint. ● Dewatering of SP and TPE to TPN continued, with treatment added to reduce fine sediment and turbidity. ● Barge traffic stabilizes in Baker Lake.	● TPN focus of routine EEM study - no mine-related effects detected (Azimuth, 2012e). ● TPN TSS concentrations consistent with baseline. ● The TSS EAS targeting dike construction sedimentation events completed.
2012	● SP and TPE dewatering discharges to TPN finished by spring. Diffuser installed and effluent (mix of residual Bay-Goose water, contact water, East Dike seepage and run-off) discharge to TPN commences; treatment (for fine sediment, turbidity) continues. ● North cell non-contact water diversion ditches completed in August (intercepting run-off prior to the tailings and waste rock areas and diverting to NP2 and Dogleg ponds). ● Vault access road constructed and site preparation activities for the Vault Pit and Vault Dike commence. ● Barge traffic remains stable in Baker Lake; 200-L diesel spill occurs, but cleaned up successfully.	● TPN TSS concentrations generally consistent with baseline. ● Minor mine-related trends identified for a number of water chemistry parameters at near-field areas: conductivity, sulphate and total dissolved solids. ● Spill-related monitoring show no traces of hydrocarbons in Baker Lake.
2013	● Effluent discharge to TPN continued. ● Fishout activity in Vault lake was completed. ● Vault lake was dewatered into Wally Lake (ongoing) and did not require TSS treatment. ● Minor construction modifications to north cell diversion ditches completed. ● Completion of the Airstrip extension (18m) into Third Portage Lake in March. ● Seepage from Rock Storage Facility (ST-16) through the road into NP2 identified (additional monitoring in NP2 to evaluate near-shore water quality).	● TPN TSS concentrations consistent with baseline. ● Minor mine-related trends identified for a number of water chemistry parameters at near-field areas: alkalinity, conductivity, calcium and total dissolved solids. ● TPE sediment chromium concentrations were elevated above trigger value; better spatial coverage needed to reduce uncertainty in 2014.

Table 1.4–1. Chronology of mine development and operational activities and associated receiving environment overview.

Year	Major Mine-Related Activities	Receiving Environment Overview
2014	● Effluent discharge to TPN from the Portage Attenuation Pond occurred only from June 10 to July 5. Discharge to TPN is now complete. The former Portage Attenuation Pond has now become the South Cell for tailings deposition. ● EEM Cycle 2 Study Design was conducted at the end of August through the beginning of September (no TPN discharge at this time). ● Vault Dewatering into Wally Lake from June 20 to 29 (now complete); discharge from Vault Attenuation Pond into Wally Lake from July 24 to August 14. No TSS treatment for Vault Discharge. ● New discharge into Second Portage Lake during all of 2014 (except from May 3 to July 28): two seepage collection points (North and South) are situated on west side of the East Dike to collect seepage through dike from SP. Water is pumped from both collection points, which are connected together before discharging back into Second Portage Lake through a diffuser. No TSS treatment for East Dike Discharge. ● No seepage water from Rock Storage Facility (ST-16) reaching the NP2 Lake in 2014. ● Commercial mining in Vault Pit started at the beginning of 2014. No major construction or modifications in 2014.	● Minor mine-related trends identified for a number of water chemistry parameters at near-field areas: conductivity, hardness, Ca/Mg/K/Na and total dissolved solids. ● Temporal trend in TPE sediment chromium confirmed in coring study; targeted study recommended for 2015.
2015	● No discharge to TPN was done in 2015 ● Vault discharge to Wally from July 7th to September 10th. No TSS treatement needed. ● East dike (North-South) discharge to SP all year except from June 16th to August 10th. Discharge was stopped for increasing TSS levels as no treatment is available for this location. The discharge from East Dike that was not directed to 2PL was discharged in the Portage Pit and then pumped to the South Cell TSF (Tailings Storage Facility). ● No seepage water from Rock Storage Facility to NP-2. Monitoring ongoing. ● HCMP work completed for TP, SP and Dogleg lakes and at water crossing R02 along the AWAR. ● One incident of elevated TSS from Vault road culverts to NP-1, early june, during freshet. Barriers installed. No impacts observed to Dogleg Lake.	● Minor mine-related trends identified for a number of water chemistry parameters at near-field areas: conductivity, hardness, Ca/Mg/K/Na and total dissolved solids. Parameters with effects-based thresholds (e.g., CCME water quality criteria) were below their respective trigger values in 2016. ● Targeted sediment bioavailability and toxicity testing was completed at TPE. Toxicity test results on *Chironomus dilutus* and *Hyalella azteca,* combined with sequential extraction tests on the sediment, indicated current chromium concentrations at TPE are unlike to adversely affect the benthic invertebrate community. Continued monitoring was recommended for 2016, but addition target studies were not recommended for 2016. ● Phytoplankton and benthic invertebrate community results for the impact stations were within the range of reference/baseline conditions.
2016	● No discharge to TPN was done in 2016 ● Vault discharge to Wally from June to September. No TSS treatement needed. ● East dike (North-South) discharge to SP all year. ● No seepage water from Rock Storage Facility to NP-2. Monitoring ongoing. ● Phaser lake dewatering - August 26th to September 10th and September 15th to October 4th ● Phaser Lake fishout from August 13th to 31st and September 10th to 25th ● No Goose Pit reflooding activities ● Pit E and pushback assessment ● Mining focused on Vault Pit and Pit A ● Amaruq exploration road construction (km 25 at end of 2016)	● CREMP monitoring results reported herein. ● See Summary in **Table 4.1-1**.

Table 1.4–2. Status of all CREMP sampling areas since the beginning of monitoring.

	Meadowbank Areas									Baker Lake Areas			
	REF	**REF**	**NF**	**NF**	**NF**	**NF**	**MF**	**MF**	**FF**	**REF**	**REF**	**NF**	**NF**
Year	**INUG**	**PDL**	**TPN**	**SP**	**TPE**	**WAL**	**TPS**	**TE**	**TEFF**	BAP	BES	BBD	BPJ
2006	C		C	C	C	C	C	C					
2007	C		C	C	C	C	C	C					
2008	C		C	I (Aug)	C	C	C	I (Aug)		C		I	I
2009	C	C	I (Mar)	I	I (Aug)	C	C	I	C	C		I	I
2010	C	C	I	I	I	C	C	I	C	C		I	I
2011	C	C	I	I	I	C	C	I	C	C	C	I	I
2012	C	C	I	I	I	C	C	I	C	C	C	I	I
2013	C	C	I	I	I	I (Jul)	C	I	C	C	C	I	I
2014	C	C	I	I	I	I	C	I	C	C	C	I	I
2015	C	C	I	I	I	I	C	I	C	C	C	I	I
2016	C	C	I	I	I	I	C	I	C	C	C	I	I

Notes:

Area designations:

C=Control; I=Impact; REF=reference (in grey shading); NF=near-field (in blue shading); MF=mid-field (in pink shading); FF=far-field (in teal shading); Blank denotes that the area was not part of the monitoring program that year.

Area IDs:

INUG=Inuggugayualik Lake;

PDL=Pipedream Lake

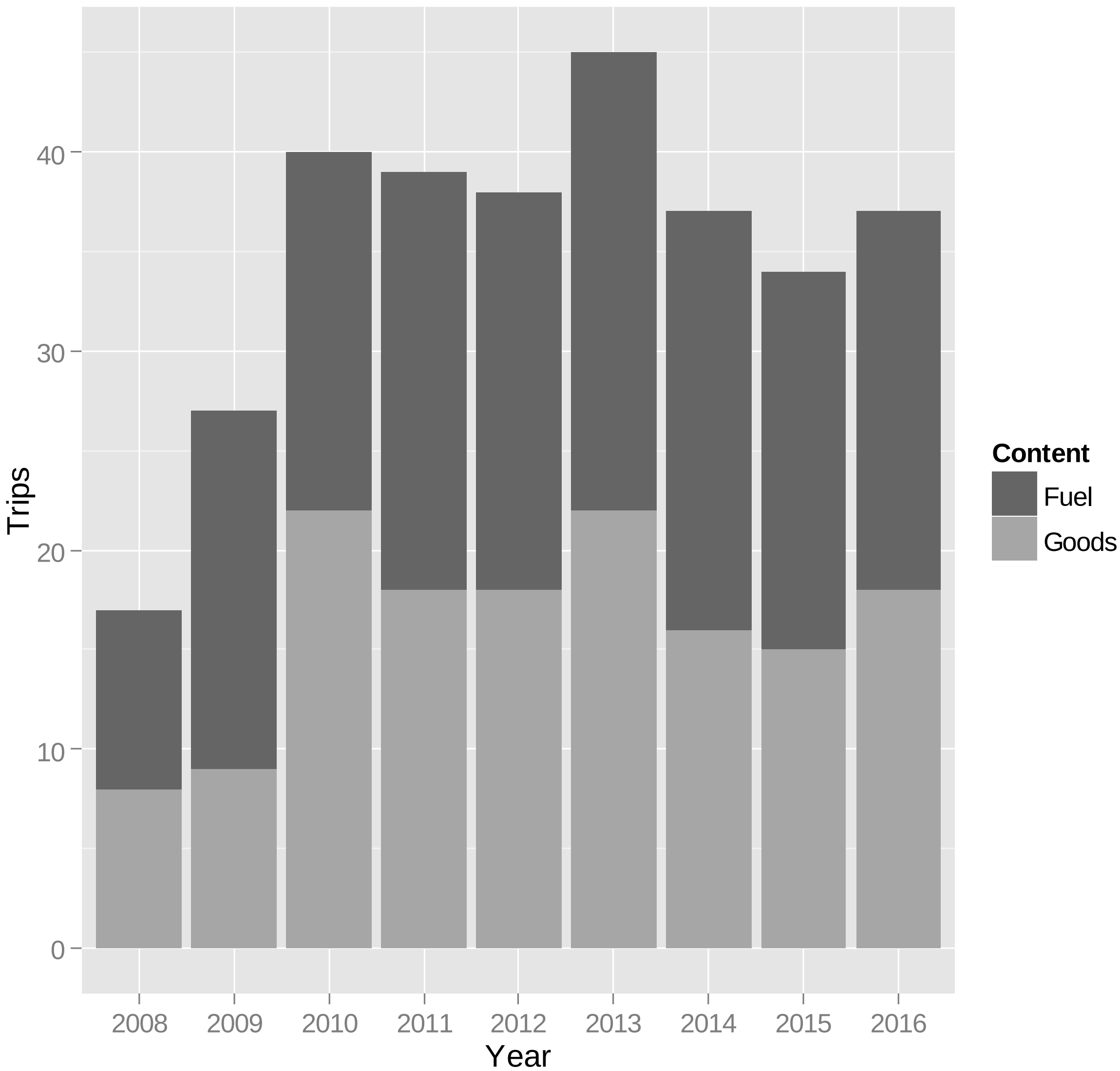
TPN, TPE, TPS=Third Portage Lake - North, East, South basins

SP=Second Portage Lake; WAL=Wally Lake;

TE, TEFF=Tehek Lake – Mid-field and Far-field;

BAP, BES, BBD, BPJ=Baker Lake - Akilahaarjuk Point, East Shore, Barge Dock, Proposed Jetty.

Figure 1.4–1. Barge traffic (number of trips/year) arriving in Baker Lake from Chesterfield Inlet since 2008.



1.5. Approach

CREMP reporting changed substantially starting in 2011 with a stronger focus on assessing potential temporal and spatial trends in the data related to mining activity. To this end, greater emphasis is placed on identifying changes to support the AEMP and ultimately the environmental management process, rather than on providing a detailed description of the annual results in isolation. To that end, this CREMP report applies numerical decision criteria (i.e., triggers and thresholds) to assess the magnitude of change in CREMP monitoring variables.

The 2012 AEMP (Azimuth, 2012c) described a two-tiered approach for decision criteria at Meadowbank based on 'trigger' and 'threshold' level concentrations (**Figure 1.5–1**). Trigger values are typically lower or more conservative than threshold values. These are defined as:

- *Triggers* are early warning criteria that may lead to action. Exceedance of a trigger value does not necessarily imply that an adverse effect may be expected. The triggers may be based on absolute numbers (e.g., an increases half-way from baseline to an identified effects threshold) or statistical criteria (e.g., statistically significant trend that predicts exceedances of a threshold within 3 years).
- *Thresholds* are legal requirements, regulatory guidelines (e.g., CCME), or other discrete benchmarks, below which unacceptable adverse effects are not expected and above which adverse effects may occur. If effects-based thresholds do not exist or are not warranted for a particular variable, then early warning triggers will be developed *without* thresholds. In such cases, if triggers are exceeded then the implications of such exceedances can only be understood through the integration of results from other AEMP monitoring programs, or, if important information gaps still exist, through focused studies (e.g., risk assessment).

Thus, comparison of the data to trigger values is the initial analytical focus; only if trigger values are exceeded, are data then compared to the applicable thresholds.

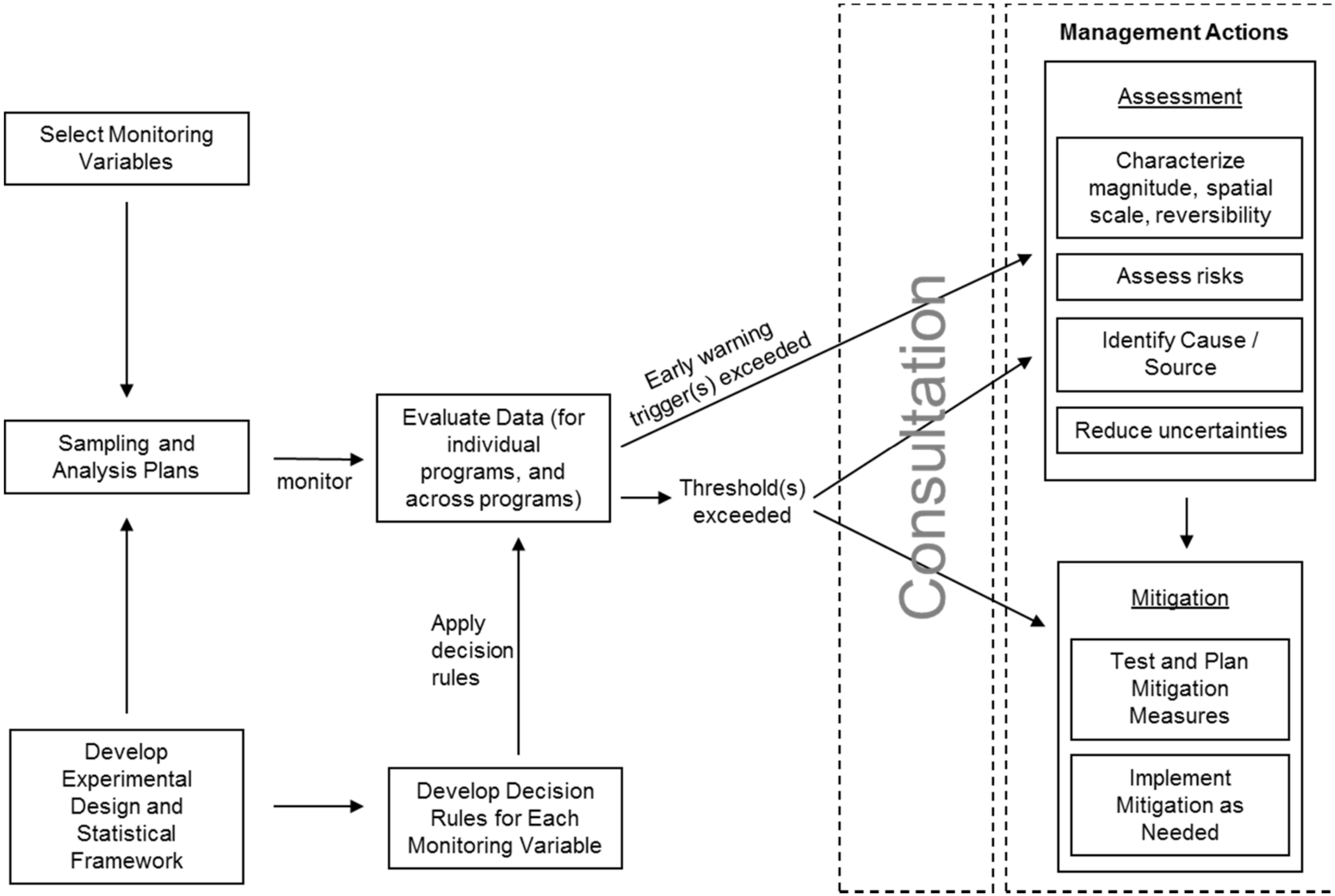
Details regarding the derivation of trigger and threshold values for the CREMP are presented in the *CREMP: Design Document 2012* (Azimuth, 2012d). The application of trigger/threshold values complements the spatial-temporal trends assessment initiated in the 2011 CREMP (Azimuth, 2012a), which used trend plots (each showing monitoring results since 2006) to identify patterns of change consistent with one or more of the mining activities described in **Section 1.4**.

The general rationale for conducting the trend assessment followed these principles:

1. *Establish Expected Conditions* – Control data (i.e., combination of baseline (i.e., pre-mining) data from impact areas and data from remote reference or control areas; see **Table 1.4–2**) were examined to set expectations for a parameter (e.g., water or sediment metal concentration, etc.) in the absence of mining activity. Baseline data were used to infer relative spatial differences (e.g., between a NF and Ref area) and reference data were used to infer regional temporal changes (e.g., the regional decrease in benthic community abundance between 2009 and 2010).
2. *Compare Patterns of Change* – With expected conditions in mind, impact data (i.e., data collected at NF and MF areas after the onset of mining-related activity in proximity to an area; see **Table 1.4–2**) were assessed visually for spatial-temporal patterns (e.g., short-term [in any year] spikes [rapid rises that return to baseline] or longer-term trends [gradual or rapid increases that persist]) matching mining activity (e.g., rise in TSS concentrations at SP in August 2008). Where observed, the spatial and temporal extent and magnitude of the changes were characterized (i.e., do they extend to MF or FF areas, and if so, at what magnitude/duration?).

3. *Provide Context for Magnitude of Change* – As discussed above, site-specific triggers and thresholds were used to provide some context for observed changes to CREMP monitoring parameters. In addition, where applicable and available, results of target studies (e.g., TSS EAS studies) were used to help interpret changes in biological parameters and endpoints.
4. *Identify Parameters for Management* – Identify parameters requiring management action on one of two levels: continued trend monitoring (i.e., to follow low magnitude or weak trends), or active follow-up with more detailed quantitative assessment (i.e., a targeted study to address a potential concern). This process will emphasize issues or concerns present in this year's CREMP results.

Figure 1.5–1. Management response plan for the Meadowbank Mine AEMP.



2. METHODS

2.1. Overview

The *CREMP: 2015 Plan Update* (Azimuth, 2015b) provides detailed documentation of the Meadowbank CREMP. The document describes the CREMP study design and methods, and integrates a number of changes from the previous CREMP plan (Azimuth, 2010d), including those stemming from the NWB Type A Water License renewal process. In an effort to streamline the annual report and reduce redundancy, aspects of the CREMP study design presented in the *CREMP: 2015 Plan Update* are not repeated herein. Readers looking for detailed information on the aspects of the study design such as sampling methods, QA/QC protocols and procedures, and data evaluation criteria are referred to Azimuth (2015b). An overview of the routine CREMP study is provided below.

2.2. Routine CREMP

2.2.1. Sampling Areas

A summary of monitoring events for 2016 CREMP is presented in **Table 2.2–1**. Sampling locations for water and phytoplankton were selected randomly[2] from within their respective lake basins (**Figure 1.3–1**). Sediment grab samples for chemistry and benthic invertebrate community analyses were collected from the established areas (i.e., depositional zones between 6.5 m and 9 m) in each basin/lake (**Figure 1.3–2**). Global Positioning System (GPS) Universal Transverse Mercator (UTM) coordinates (in NAD 83) for all monitoring components are shown in **Table 2.2–2** for each sampling area.

2.2.2. Sampling Components and Methods

Water quality, sediment quality (grabs only), phytoplankton community, and benthic invertebrate community were monitored in the 2016 program. Sampling was undertaken according to established SOPs included in the *CREMP: 2015 Plan Update* (Azimuth, 2015b).

Samples from the 2016 CREMP were sent to the laboratories listed below for analysis.

- Water and sediment chemistry – ALS Laboratories (Burnaby, British Columbia)
- Phytoplankton taxonomy – Plankton R Us Inc. (Winnipeg, Manitoba)
- Benthic invertebrate taxonomy – ZEAS Inc. (Nobleton, Ontario)

2.2.3. Sampling Effort and Frequency Assessment

The new results-driven sampling strategy that was developed as part of the *CREMP: 2015 Plan Update* (Azimuth, 2015b) was implemented for the first time 2016. The objective of this new strategy is to increase the overall efficiency of the CREMP by maintaining monitoring intensity in the areas most likely to be affected by mining-related activities (i.e., NF areas), while potentially reducing monitoring intensity at MF and FF areas depending on the water quality results observed at up-gradient areas. The annual decision framework presented in the *CREMP: 2015 Plan Update* (Azimuth, 2015b; **Figure 2.2–1** [below]) applies to MF and FF areas at Meadowbank[3] (i.e., MF area TE (which is paired with upstream NF areas

[2] Target locations for sampling were randomly pre-determined by bounding the sample areas and using a random number generator to select coordinates within those bounds. Coordinates were then recorded in MapSource and in the hand-held GPS units (NAD 83) before going out into the field.

[3] This framework does not apply to the Baker Lake areas as there are no MF or FF areas in Baker Lake.

TPE, SP, and WAL), MF area TPS (which is paired with NF area TPN), and to FF area TEFF (paired with upstream MF area TE). As per the normal CREMP data analysis process, NF results are evaluated on an annual basis (i.e., with CREMP reporting due at the end of March following each monitoring year), with the NF results (i.e., for "Year") dictating the monitoring requirements for the MF area in the subsequent year (i.e., "Year +1"). The Year +1 NF and MF results are used as the basis to determine the MF and FF monitoring requirements for Year +2, and so on. While the full CREMP program will be conducted at each NF area each year, the specific monitoring requirements for the MF and FF areas vary based on the NF and MF results, respectively. Below are the various outcomes of the CREMP data analysis and associated program requirements for MF and FF areas in the following year (see Azimuth, 2015b for more details, including a worked example of the strategy):

- *No changes identified* – no statistical changes above any trigger values. No further sampling required.
- *Minor changes identified* – statistically significant changes exceeding the early warning trigger values for parameters without effects-based threshold values (i.e., trigger values are based on the 95th percentile of the baseline distribution). Spot sampling through-ice is required to determine if changes extend to MF area (or to FF if such changes are seen at an MF area), but no further sampling is needed that year at the MF or FF areas unless moderate changes (see below) are identified at those areas.
- *Moderate changes identified* – statistically significant changes exceeding the early warning trigger values for parameters with effects-based thresholds (e.g., CCME water quality guidelines for water chemistry parameters). Full CREMP water sampling (all events) is required to determine if changes extend to MF area (or to FF if such changes are seen at an MF area).
- *Major changes identified* – statistically significant changes exceeding the effects-based threshold values. Full CREMP program (i.e., including sediment and biological components) is required to determine if changes extend to MF area (or to FF if such changes are seen at an MF area).

Minor changes were identified in the 2015 CREMP (Azimuth, 2016). Specifically, there were a few parameters with trigger exceedances, but none of the parameters have effects-based thresholds. As per the approach outlined above, the absence of threshold exceedances at NF areas justified a pared-down monitoring program at MF (TPS and TE) and FF (TEFF) areas in 2016. Water sampling through-ice was completed (at NF, MF and FF areas) in April 2016. Additional water sampling at MF or FF areas during the open-water season in 2016 was deemed unnecessary as no effects-based thresholds were exceeded (i.e., further sampling at the MF and FF areas was suspended for the year as trigger exceedances were limited to non-threshold parameters only (see **Section 3.1.2** for details).

Figure 2.2–1. Annual results-based sampling strategy rules for mid-field and far-field sampling areas.

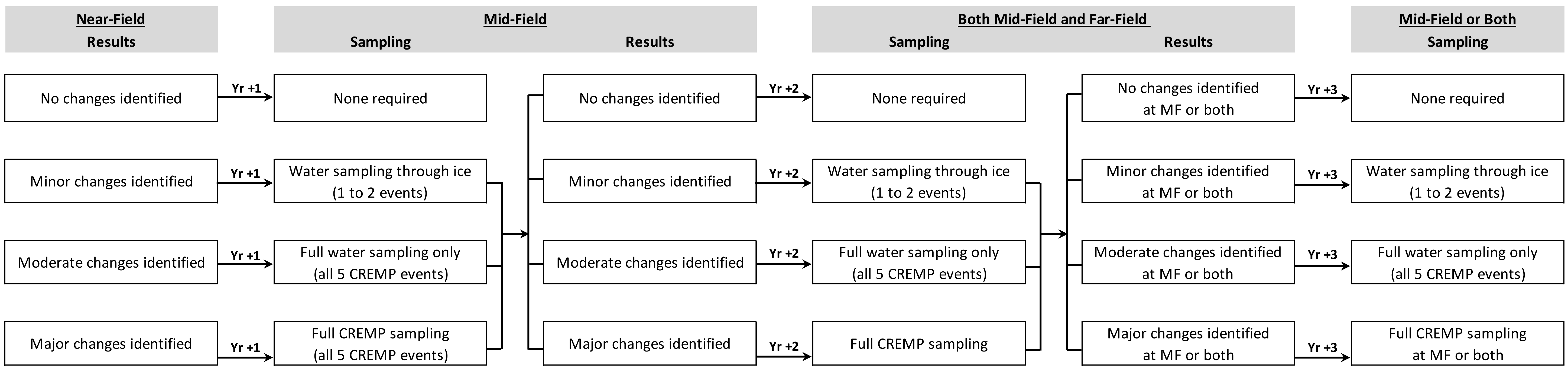


Table 2.2–1. CREMP sampling summary, Meadowbank study lakes and Baker Lake, 2016.

Sampling Month	Sampling Crew	Monitoring Conditions	Monitoring Components	Meadowbank Areas									Baker Areas			
				INUG	PDL	TPN	SP	TPE	WAL	TPS	TE	TEFF	BAP	BES	BBD	BPJ
				REF	REF	NF	NF	NF	NF	MF	MF	FF	REF	REF	NF	NF
January	AEM	Ice	L			✓	✓	✓	✓							
February	AEM	Ice	L			✓	✓	✓	✓							
March	AEM	Ice	L			✓	✓	✓	✓							
April	AEM	Ice	L,W,P	✓	✓	✓	✓	✓	✓	✓	✓	✓				
May	AEM	Ice														
June		***Ice not safe***														
July	AEM	Open-water	L,W,P	✓	✓	✓	✓	✓	✓				✓		✓	✓
August	Azimuth	Open-water	L,W,P	✓	✓	✓	✓	✓	✓				✓		✓	✓
			B,S,C*	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓
September	AEM	Open-water	L,W,P	✓	✓	✓	✓	✓	✓				✓		✓	✓
October		***Ice not safe***														
November	AEM	Ice	L,W,P	x	x	✓	✓	✓	✓							
December	AEM	Ice	L			✓	✓	✓	✓							

Notes:

Components:

L=Limnology; W=Water chemistry; P=Phytoplankton; B=Benthic invertebrates; S=Sediment grab chemistry; C=Sediment coring chemistry. *Sediment coring is conducted to match the timing of EEM field studies program (i.e., in 2014, 2017, 2020…).

✓ = monitoring components were collected.

x = monitoring components were scheduled but not collected due to equipment issues. Refer to **Section 3.1.6** for more details.

Area designations:

C=Control; I=Impact; REF=reference (in grey shading); NF=near-field (in blue shading); MF=mid-field (in pink shading); FF=far-field (in teal shading); Blank denotes that the area was not part of the monitoring program that year.

Area IDs:

INUG=Inuggugayualik Lake;
PDL=Pipedream Lake
TPN, TPE, TPS=Third Portage Lake - North, East, South basins
SP=Second Portage Lake; WAL=Wally Lake;
TE, TEFF=Tehek Lake – Mid-field and Far-field;
BAP, BES, BBD, BPJ=Baker Lake - Akilahaarjuk Point, East Shore, Barge Dock, Proposed Jetty.

Table 2.2–2. CREMP sampling location coordinates (GPS, UTM, NAD83), Meadowbank study lakes and Baker Lake, 2016.

Lake	Area Type[1]	**Water & Phytoplankton** (monthly)					**Benthos & Sediment Grabs** (August)					
		Area-Replicate[2]	Date	Zone	Easting	Northing	Area-Replicate[2]	Sample Type[3]	Depth (m)	Zone	Easting	Northing
Inugugayualik	Ref	INUG-78-S	15-Apr-16	14W	622668	7214948	INUG-1	B & C	7.6	14W	622823	7216829
		INUG-79-S	15-Apr-16	14W	622713	7216494	INUG-2	B & C	7.8	14W	622748	7216816
		INUG-80-S	18-Jul-16	14W	622290	7213879	INUG-3	B & C	7.2	14W	622789	7216799
		INUG-81-S	18-Jul-16	14W	622981	7216570	INUG-4	B & C	8.4	14W	622685	7216818
		INUG-82-S	7-Aug-16	14W	622654	7215139	INUG-5	B & C	8.9	14W	622681	7216792
		INUG-83-S	7-Aug-16	14W	622469	7216502	INUG-COMP	C				
		INUG-84-S	7-Sep-16	14W	622755	7216270						
		INUG-85-S	7-Sep-16	14W	622812	7215300						
		INUG-78-S*	November									
		INUG-79-S*	November									
Pipedream	Ref	PDL-43-S	16-Apr-16	14W	632817	7224422	PDL-1	B & C	7.3	14W	630536	7222977
		PDL-44-S	16-Apr-16	14W	632232	7225074	PDL-2	B & C	7.2	14W	630570	7222981
		PDL-45-S	19-Jul-16	14W	630310	7222944	PDL-3	B & C	7.0	14W	630593	7222996
		PDL-46-S	19-Jul-16	14W	632714	7224398	PDL-4	B & C	7.8	14W	630613	7223014
		PDL-47-S	6-Aug-16	14W	630646	7222979	PDL-5	B & C	7.6	14W	630621	7223043
		PDL-48-S	6-Aug-16	14W	629772	7224745	PDL-COMP	C				
		PDL-49-S	8-Sep-16	14W	631977	7225233						
		PDL-50-S	8-Sep-16	14W	632797	7224037						
		PDL-51-S*	November									
		PDL-52-S*	November									
Third Portage	NF	TPE-90-S	20-Apr-16	14W	639328	7210957	TPE-1	B & C	9.0	14W	639151	7211733
		TPE-91-S	20-Apr-16	14W	639567	7212322	TPE-2	B & C	7.8	14W	639158	7211672
		TPE-92-S	12-Jul-16	14W	639511	7210360	TPE-3	B & C	8.1	14W	639129	7211575
		TPE-93-S	12-Jul-16	14W	639648	7211539	TPE-4	B & C	8.4	14W	639089	7211527
		TPE-94-S	5-Aug-16	14W	639341	7211297	TPE-5	B & C	8.4	14W	639052	7211488
		TPE-95-S	5-Aug-16	14W	639346	7212579	TPE-COMP	C				
		TPE-96-S	11-Sep-16	14W	639012	7210692						
		TPE-97-S	11-Sep-16	14W	639832	7210591						
		TPE-98-S	27-Nov-16	14W	638995	7210884						
		TPE-99-S	27-Nov-16	14W	639159	7212481						
	NF	TPN-90-S	17-Apr-16	14W	635760	7212811	TPN-1	B & C	8.9	14W	636334	7215507
		TPN-91-S	17-Apr-16	14W	635195	7216260	TPN-2	B & C	9.2	14W	636356	7215520
		TPN-92-S	20-Jul-16	14W	634462	7214699	TPN-3	B & C	9.2	14W	636379	7215530
		TPN-93-S	20-Jul-16	14W	636604	7213293	TPN-4	B & C	6.8	14W	636392	7215550
		TPN-94-S	5-Aug-16	14W	635384	7212920	TPN-5	B & C	8.2	14W	636424	7215509
		TPN-95-S	5-Aug-16	14W	634710	7216091	TPN-COMP	C				
		TPN-96-S	4-Sep-16	14W	635046	7213810						
		TPN-97-S	4-Sep-16	14W	635419	7213027						
		TPN-98-S	30-Nov-16	14W	636312	7214842						
		TPN-99-S	30-Nov-16	14W	636432	7212984						
	MF	TPS-55-S	21-Apr-16	14W	634125	7210087	NC					
		TPS-56-S	21-Apr-16	14W	633329	7206818						
Second Portage	NF	SP-90-S	14-Apr-16	14W	640338	7212340	SP-1	B & C	7.8	14W	639994	7214070
		SP-91-S	14-Apr-16	14W	640408	7213374	SP-2	B & C	8.2	14W	640029	7214101
		SP-92-S	8-Jul-16	14W	639583	7213646	SP-3	B & C	7.8	14W	640057	7214144
		SP-93-S	8-Jul-16	14W	610306	7213566	SP-4	B & C	7.5	14W	640068	7214175
		SP-94-S	3-Aug-16	14W	640555	7212862	SP-5	B & C	6.9	14W	640057	7214196
		SP-95-S	3-Aug-16	14W	640096	7214009	SP-COMP	C				
		SP-96-S	5-Sep-16	14W	640649	7213144						
		SP-97-S	5-Sep-16	14W	640526	7213648						
		SP-98-S	25-Nov-16	14W	640624	7212883						
		SP-99-S	25-Nov-16	14W	640287	7213875						
Tehek	MF	TE-90-S	25-Apr-16	15W	360486	7211949	NC					
		TE-91-S	25-Apr-16	15W	360209	7212324						
	FF	TEFF-43-S	25-Apr-16	15W	364816	7209637	NC					
		TEFF-44-S	25-Apr-16	15W	362227	7209002						
Wally	NF	WAL-59-S	18-Apr-16	15W	360677	7220947	WAL-1	B & C	8.6	15W	360907	7220491
		WAL-60-S	18-Apr-16	15W	362021	7222391	WAL-2	B & C	9.2	15W	360934	7220454
		WAL-61-S	10-Jul-16	15W	361434	7222176	WAL-3	B & C	8.2	15W	360907	7220467
		WAL-62-S	10-Jul-16	15W	366010	7220853	WAL-4	B & C	6.8	15W	360917	7220433
		WAL-63-S	5-Aug-16	15W	360908	7222091	WAL-5	B & C	7.3	15W	360950	7220395
		WAL-64-S	5-Aug-16	15W	361477	7222326	WAL-COMP	C				
		WAL-65-S	4-Sep-16	15W	360728	7221045						
		WAL-66-S	4-Sep-16	15W	361991	7222871						
		WAL-67-S	30-Nov-16	15W	361678	7222629						
		WAL-68-S	30-Nov-16	15W	360628	7221930						

Table 2.2–2. CREMP sampling location coordinates (GPS, UTM, NAD83), Meadowbank study lakes and Baker Lake, 2016.

Lake	Area Type[1]	Water & Phytoplankton (monthly)					Benthos & Sediment Grabs (August)					
		Area-Replicate[2]	Date	Zone	Easting	Northing	Area-Replicate[2]	Sample Type[3]	Depth (m)	Zone	Easting	Northing
Baker	Ref	BAP-43-S	22-Jul-16	15W	364352	7130768	BAP-1	B & C	7.6	15W	363970	7131221
		BAP-44-S	22-Jul-16	15W	363395	7130893	BAP-2	B & C	7.1	15W	364045	7131196
		BAP-45-S	8-Aug-16	15W	363638	7131008	BAP-3	B & C	8.0	15W	364076	7131157
		BAP-46-S	8-Aug-16	15W	363500	7131164	BAP-4	B & C	7.8	15W	364136	7131144
		BAP-47-S	2-Sep-16	15W	363226	7131224	BAP-5	B & C	8.2	15W	364142	7131075
		BAP-48-S	2-Sep-16	15W	363653	7131174	BAP-COMP	C				
	Ref	NC					BES-1	B & C	7.8	15W	361221	7132410
							BES-2	B & C	9.0	15W	361251	7132386
							BES-3	B & C	8.9	15W	361291	7132362
							BES-4	B & C	8.0	15W	361354	7132352
							BES-5	B & C	8.3	15W	361435	7132299
							BES-COMP	C				
	NF	BBD-43-S	22-Jul-16	14W	644012	7135101	BBD-1	B & C	8.2	14W	644539	7135312
		BBD-44-S	22-Jul-16	14W	644790	7134891	BBD-2	B & C	8.2	14W	644594	7135288
		BBD-45-S	10-Aug-16	14W	643977	7135354	BBD-3	B & C	8.0	14W	644453	7135339
		BBD-46-S	10-Aug-16	14W	644564	7135335	BBD-4	B & C	8.9	14W	644502	7135312
		BBD-47-S	3-Sep-16	14W	644570	7135139	BBD-5	B & C	7.9	14W	644565	7135308
		BBD-48-S	3-Sep-16	14W	644230	7135119	BBD-COMP	C				
	NF	BPJ-43-S	22-Jul-16	15W	357073	7133932	BPJ-1	B & C	8.1	15W	357267	7134110
		BPJ-44-S	22-Jul-16	15W	356504	7133875	BPJ-2	B & C	8.2	15W	357243	7134125
		BPJ-45-S	10-Aug-16	15W	357237	7134004	BPJ-3	B & C	8.7	15W	357221	7134127
		BPJ-46-S	10-Aug-16	15W	357423	7133747	BPJ-4	B & C	8.5	15W	357100	7134202
		BPJ-47-S	3-Sep-16	15W	357003	7134143	BPJ-5	B & C	8.6	15W	357040	7134219
		BPJ-48-S	3-Sep-16	15W	357393	7134035	BPJ-COMP	C				

Notes:

[1] Area types: NF=near-field; MF=mid-field; FF=far-field; Ref=reference.

[2] Area IDs are as follows: TPE,TPN,TPS=Third Portage Lake - East, North, South basins; SP=Second Portage Lake; TE,TEFF=Tehek Lake - Farfield; INUG=Inuggugayualik Lake; WAL=Wally Lake; PDL=Pipedream Lake; BBD,BPJ,BES,BAP=Baker Lake - Barge Dock, Proposed Jetty, East Shore, Akilahaarjuk Point.
NC=water or sediment not collected as per the study design.
* Samples not collected due to equipment-related issues.

[3] Sample types: B=Benthos; C=chemistry.
Comp = composite sample of all 5 replicate samples from each area.

2.3. Quality Assurance / Quality Control

The objective of quality assurance and quality control (QA/QC) is to assure that the chemical and biological data collected are representative of the material or populations being sampled, are of known quality, have sufficient laboratory precision to be highly repeatable, are properly documented, and are scientifically defensible. Data quality was assured throughout the collection and analysis of samples using specified standardized procedures, by the employment of laboratories that have been certified for all applicable methods, and by staffing the program with experienced technicians.

An overview of the QA/QC program for each component is provided below; refer to the 2015 CREMP plan (Azimuth, 2015b) update for a complete description.

2.3.1. Water

Laboratory QC

There are five main components of the water chemistry laboratory QC program to assess analytical precision, bias, and completeness:

- *Sample Integrity* – documentation of any abnormal conditions for a sample/batch of samples. This represents the first step in the QC assessment where samples may be flagged for reliability/usability. Results are flagged as potentially unreliable for one of three reasons: (1) samples were damaged during transport, (2) the temperature inside the cooler was above 10°C when received by the laboratory, or (3) the recommend hold-time was exceeded prior to analysis.
- *Laboratory Duplicate* – a new aliquot from the same sample is analyzed from the start in the same manner as the original aliquot taken from the bottle/jar. The difference between the two analyses is a measure of the variability associated with duplicate analyses of the same sample in the laboratory.
- *Laboratory Control Sample (LCS)*[4] – a well-characterized sample of known analytes and concentration. A reference material (i.e., certified reference material) containing certified amounts of target analytes, may be used as an LCS. Percent recovery of the target analytes in the LCS is compared to established control limits and assists in determining whether the methodology is in control and whether the laboratory is capable of making accurate and precise measurements at the required reporting limit.
- *Method Blank (MB)* – an analyte-free matrix (e.g., water) subjected to the entire analytical process to demonstrate that the analytical system itself does not introduce contamination.
- *Matrix Spike (MS) / Matrix Duplicate (MD)* – a known amount of a compound similar chemically to the target analyte is added to samples to ascertain any matrix effects on recoveries and to determine the accuracy and precision of the method in this matrix.

Laboratory QC results are included in each laboratory report for CREMP water quality samples. The ALS analytical reports are presented in **Appendix F**.

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[4] Descriptions of the various QC sample types are found on the ALS Environmental website (Link)

Field QA/QC

The standard QA procedures included thoroughly flushing the flexible tubing and pump to prevent cross-contamination between areas and thoroughly rinsing the sample containers with site water prior to sample collection. Field QC procedures include collection and/or analysis of field duplicates, travel blanks, and equipment blanks. Data quality objectives (DQOs) for each QA/QC sample type are discussed below.

Data Quality Objectives

Duplicate Samples – Quality control results of the laboratory and field duplicates are assessed by measuring the relative percent difference (RPD) between original and duplicate measurements as measure of precision by the laboratory and the magnitude of variability between original and field duplicate samples, respectively. The equation used to calculate a RPD is:

$$RPD = \frac{(A - B)}{(\frac{A + B}{2})} x\ 100$$

where: A = analytical result; B = duplicate result[5].

Laboratory duplicate DQOs are parameter-specific and depend on the concentration in the sample[6]. For most parameters including metals, anions, and nutrients, the DQO is an RPD of less than 20% when the concentration is greater than 10-times the MDL. For parameters with concentrations less than 10-times the MDL, the DQO is a difference in concentration between the original and duplicate samples of less than 2-times the MDL. The DQOs for field duplicates is RPDs less than 50% when concentrations exceed 10-times the MDL. RPD values may be either positive or negative, and ideally should provide a mix of the two, clustered around zero. RPDs are not calculated for cases where one of the samples (i.e., either A or B above) is below detection and the other is not.

Blanks (Travel, Field, Equipment) – Results from both the equipment and travel blanks are examined for detectable concentrations of any of the parameters measured; no parameter in either blank should exceed laboratory method detection limits (MDLs). If an analyte is detected in a blank, the results for the batch of samples submitted with the blank are compared with the measured concentration in the blank; results that are less than 5-times the detected analyte concentration in the equipment blank are flagged to examine the potential for cross-contamination to affect the results[7]. Results carried forward in the QA/QC assessment are given either a cautionary flag or an unreliable flag. Cautionary flags are applied to sample results if the analyte was detected in the blank, but the effect of potential cross-contamination is considered minor (e.g., the concentration in the equipment blank is a small percentage of the concentration in the samples). Unreliable data flags are applied to water quality results that are anomalous or unrepresentative of the water quality (e.g., elevated metals concentrations in a sample that are not observed in other replicate sample(s) collected during the same event). The "cautionary" and "unreliable" data flags are provided for clarity on which results should be excluded from decision making.

[5] RPD values are not calculated when one of the analytical results is below the MDL.

[6] The list of DQOs for each water quality parameter is provided in Azimuth (2015b; Appendix A, Table 2).

[7] This approach is consistent with how ALS flags unreliable results for the laboratory method blanks.

2.3.2. Sediment

Laboratory QC

Laboratory duplicates were analyzed for sediment chemistry parameters similar to water chemistry parameters. The full list of laboratory DQOs for each parameter are presented in the SOP appended to the *CREMP: 2015 Plan Update* (Azimuth, 2015b).

Field QA/QC

Field QA consisted of taking care between sampling areas, by rinsing and cleaning the sampling gear for sediment grabs (Petite Ponar grab, stainless steel compositing bowls and spoons) and sediment cores (corer and spatula) using site water and phosphate-free cleaning detergent, avoids the possibility of cross-contamination. Field QC measures included collection and analysis of the following:

- *Filter Swipe* – Metals analysis of an ashless filter (QA/QC Filter) that was swiped over the pre-cleaned bowl at four sampling areas to assess the cleaning procedures. The significance of any metal detected on this filter was evaluated by comparing this amount to the measured concentrations in the sediment samples. Where comparisons were required, the concentration of metals originating from any equipment was estimated by dividing the amount detected on the filter (weight) by: the surface area of 2 Petite Ponar grabs (assuming a thickness of 3 cm was collected from each), that was multiplied by the density of sediment (assumed to be 2 g/cm^3).
- *Field Duplicate* – Five duplicate sediment grab samples were collected for the 2016 program. The DQO for field duplicate samples is based on an RPD of 50% for concentrations that are greater than 10-times the MDL.

2.3.3. Biota

Standard procedures were used to collect phytoplankton and benthic invertebrate samples (Azimuth, 2015b). Sampling gear was thoroughly rinsed between sampling areas to ensure that there was no inadvertent introduction (i.e., cross-contamination) of biota from one area to another.

Laboratory QC

Phytoplankton – As a measure of laboratory QA/QC on the enumeration method replicate counts were performed on 10% of the samples. Replicate samples were chosen at random and processed at different times from the original analysis to reduce biases. The laboratory replicate is a new aliquot (10 mL) from the sample jar and is counted from the start in the same manner as the original aliquot (10 mL) taken from the jar.

Benthic Invertebrates – ZEAS re-sorts and re-counts approximately 10% of the samples, targeting greater than 90% recovery between the original and re-sorted sample.

Field QA/QC

Phytoplankton – Field duplicates were collected for phytoplankton during each sampling event (i.e., monthly) in coordination with water sample duplicates and were taken in order to assess sampling variability and sample homogeneity. A RPD of 50% for total density and biomass concentrations is considered acceptable.

Benthic Invertebrates – Field replicates (5 per area) were collected for benthos to determine natural variability and heterogeneity. Replicates were collected at least 20 m apart from one another, within the defined sampling areas.

2.4. Data Evaluation Criteria

The specific methods used to apply triggers/thresholds in the evaluation of CREMP monitoring parameters varied by study component; details are presented in the following sections. As discussed in **Section 1.5**, the evaluation process focused on comparisons to early warning triggers; only when triggers were exceeded were monitoring results compared to thresholds. Consequently, methods for applying numerical decision criteria focus on triggers only, but apply equally to threshold values.

A comprehensive review of the data evaluation methods/approach was completed in the *CREMP: 2015 Plan Update* (Azimuth, 2015b). The data evaluation process is summarized by component in the following sections.

2.4.1. Water Chemistry

Water quality data collected in 2016 were evaluated against triggers and thresholds consistent with the existing framework outlined in the *CREMP: 2015 Plan Update* (Azimuth, 2015b). Formal comparison of the water quality data for decision-making purposes was done by comparing the yearly mean[8] parameter concentrations to the trigger values developed separately for the Meadowbank projects lakes, Wally Lake, and Baker Lake areas. Those parameters where the yearly mean was equal to or exceeded the trigger value were formally tested using a one-tailed test of the null hypothesis[9] (significance level of $p=0.05$) according to the framework outlined below for Meadowbank and Baker Lake areas.

- *Meadowbank Project Lakes* – A Before-After-Control-Impact (BACI) statistical framework was applied. The BACI model is "paired" (i.e., BACIP) when multiple "before" and "after" events are available. In the BACI model, INUG is used as the reference ("control") area, and the other areas are tested as exposure ("impact") areas. Both PDL and TEFF are excluded as control areas in the BACI analysis because neither area was sampled in the "before" period between 2006 and 2008. True "pre-impact" data (i.e., when both INUG and the test area had "control" ("C") status; see **Table 1.4–2**) were used for the "before" data. Only events when both INUG and the test area were sampled in 2016 were used as the "after" data.
- *Baker Lake* – Baker Lake areas were designated as "control" (BAP) or "impact" (BPJ and BBD) when sampling started in 2008 (i.e., there was no detailed baseline sampling was conducted for Baker Lake; see **Table 1.4–2**), so there are no true "pre-impact" "before" data. While a spatial "CI" design could be used to test for differences between reference "control" and exposure "impact" areas, the design does not allow for distinguishing natural differences between areas from development-related changes. Given that no development-related changes had been identified to date, all years of data up to and including 2015 were considered in the "before" period while the 2016 results were considered "after" period data (i.e., allowing the more robust BACI analysis). Thus, the BACI analyses specifically looked at changes in 2016 at the two "impact" areas relative to previous years.

In addition to the trigger/threshold evaluation, annual CREMP water chemistry data were also compared to the maximum whole-lake average water quality modelling predictions for Third Portage, Second Portage, and Wally Lakes made during the environmental assessment process (Cumberland, 2005). While

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[8] Yearly means were calculated by first calculating the monthly mean for each parameter per area, then calculating the yearly mean on an area-specific basis. Values that were less than the MDL were conservatively set to the MDL.

[9] The null hypothesis is "test" area concentrations either did not change or decreased. The alternative hypothesis is that they increased.

direct comparisons were made, the difference in spatial focus (i.e., the CREMP at the basin scale and the water quality model at the whole-lake scale) warrants caution interpreting any differences. To that end, the assessment criteria outlined in the Final Environmental Impact Statement (FEIS; Cumberland, 2005) for defining the predicted magnitude of impacts to water quality will be used to provide the appropriate context for interpreting the screening results as follows:

- *Negligible*: water quality concentrations are similar to baseline
- *Low*: concentrations are < 1x the CCME WQG
- *Medium*: concentrations are between 1 and 10-times the CCME guidelines
- *High*: concentrations are less than MMER but greater than 10-times the CCME guidelines
- *Very High*: concentrations exceed MMER standards

2.4.2. Sediment Chemistry

Statistical comparison of sediment chemistry data against trigger values is completed in years when sediment cores are collected. In years when only sediment grabs are collected, such as 2016, the approach to describing trends is purely visual.

2.4.3. Phytoplankton

Phytoplankton triggers and thresholds are set to relative changes (increases or decreases of 20% and 50%, respectively) in total biomass and species richness at test areas using the BACI framework[10] (Azimuth, 2012d). The evaluation procedure was analogous to that used for water chemistry, except that area means for 2016 were not directly comparable to triggers (i.e., since the triggers/thresholds are based on the relative change over time in a parameter rather than on a finite value), so the process started with the BACI testing. Two-tailed tests of the null hypothesis (i.e., that test areas experienced no relative change up or down) were conducted with a significance level of p=0.1.

2.4.4. Benthic Invertebrates

Similar to phytoplankton, triggers and thresholds were set to relative changes (decreases of 20% and 50%, respectively) in total biomass and species richness at test areas using the BACI framework. Statistical power increases with consideration of more "after" period years (Note: benthic invertebrates are sampled yearly in August); consequently, BACI analyses were conducted on four "after" data period lengths: one year (2016 only), two years (2015-2016), three years (2014-2016), and four years (2013-2016). One-tailed tests of the null hypothesis were conducted with a significance level of p=0.1[11].

Similar to water chemistry (**Section 2.4.1**), there is no baseline benthic community data for Baker Lake, so there are no true "pre-impact" "before" data. While a spatial "CI" design could be used to test for differences between reference "control" and exposure "impact" areas, the design does not allow for distinguishing natural differences between areas from development-related changes. Rather, since no development-related changes had been identified to date, the temporal scenarios for Baker Lake used all

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[10] BACI framework involves paired monthly sampling events at "control" [INUG or BAP] and "impact" [i.e., NF or MF areas] areas over two periods ["before" and "after"], with "months" as the unit for temporal replication).

[11] The null hypothesis is "test" area measures (total biomass and species richness) either did not change or increased. The alternative hypothesis is that they decreased. Despite this BACI being conducted as a one-tailed test, the p value was left at 0.1 to help improve statistical power for the benthic invertebrate endpoints.

the data (i.e., 2016 was compared to 2008-2015; 2015/2016 was compared to 2008-2014…and so on). Thus, the series of comparisons provides a more robust means to identify temporal changes due to mining-related activities in Baker Lake.

3. RESULTS AND DISCUSSION

The QA/QC results for the 2016 CREMP program are presented and discussed in **Section 3.1**. Results of the 2016 CREMP program are presented and discussed separately for the Meadowbank project lakes (**Section 3.2**) and Baker Lake (**Section 3.3**). The Meadowbank and Baker Lake sections are subdivided by study component (e.g., limnology, water chemistry, etc.) with the discussion organized into the following sub-headings:

- *General Observations* – This provides a synopsis of expected conditions in the absence of mining-related activities (i.e., based on baseline and reference data [i.e., "control" status data; see textbox in **Section 1.3** and text in **Section 1.4**]).
- *Temporal and Spatial Trend Interpretation* – This (1) describes the types of changes that could be expected in relation to mining activity, specific to the parameters in question; (2) identifies trends in parameters that are associated with mining-related activities; (3) provides context for the magnitude of observed changes relative to trigger and threshold value; and (4) identifies parameters requiring management action on two levels: a) continued trend monitoring in 2017 (i.e., to follow low magnitude or weak trends), or b) active follow-up with more detailed quantitative assessment in 2017 (i.e., a targeted study to address a potential concern).

3.1. QA/QC

QA/QC procedures consisted of a combination of careful field collection and sample handling, the collection of field duplicate samples and the analysis of laboratory replicates and standard reference materials. A discussion of sample shipping and handling procedures is provided upfront, followed by a discussion of the results pertaining to the various CREMP components.

3.1.1. Sample Shipping and Handling

Refinement of the shipping and handling protocols implemented in 2014 has resulted in a marked improvement in the frequency of 1) water samples exceeding the recommended hold-times for analysis and 2) sample temperatures outside the optimal range during transport. There were few issues with shipping and handling of samples sent to various laboratories in 2016; however, the remote location of Meadowbank continues to present a challenge with getting samples to ALS within the recommended hold-time for analysis of some parameters. The distance between Meadowbank and ALS in Burnaby[12] also has implications on the temperature of samples upon arrival. Temperatures inside the coolers were routinely above 20°C during the summer months. The impact on data quality for the majority of the analytes is likely negligible given the samples are preserved in the field (where appropriate). Chlorophyll-a is the one parameter where there is a greater level of uncertainty regarding the effect of thawing on data integrity. Freezing is also periodically an issue for samples shipped during the winter. In November, the glass containers for DOC, TOC, and mercury analysis for some samples broke as a result of freezing during transport (**Table 3.1–1**). In these cases, an aliquot was taken from either the conventional or TSS/TDS bottle, preserved, and analyzed accordingly.

[12] In 2013, the cargo flight routing changed due to the introduction of the 737 combo (passenger and cargo) jet which is direct from Val D'Or, Quebec to Meadowbank. In the past, samples were sent to ALS Winnipeg, MB, through Thompson, MB, (which was a former cargo hub for Agnico).

3.1.2. Water Chemistry

Field duplicates, laboratory duplicates, and blank samples were analyzed as part of the QA/QC program in each of the five sampling events in 2016. Results of the QA/QC analysis are discussed below, along with a discussion on the implications of the QA/QC assessment on the sample results from 2016.

- **Travel Blanks** – One travel blank was analyzed for the August sampling event. The full suite of parameters (excluding dissolved metals) was analyzed. All analytes in the travel blank were below the MDL (**Table 3.1–2**). Travel blanks were not submitted with the other sampling events; however, de-ionized (DI) water blanks were analyzed for each event and provide a measure of DI water quality and laboratory analytical variability.
- **Deionized Blanks** – The goal of these blanks is to test the quality of the DI water batch and/or variability in laboratory analytical methods. One DI blank with the full suite of analyses was submitted for each event (except July [no dissolved metals]). The November DI blank had detectable concentrations of total and dissolved aluminum and dissolved tin slightly above their respective MDLs (**Table 3.1–2**). Dissolved aluminum and tin were not detected in the corresponding equipment blank (EB) for November.
- **Equipment Blanks** – Several parameters were again detected in at least one of the equipment blanks submitted in 2016 (**Table 3.1–2**). With the exception of dissolved barium in November, all the analytes listed below were detected at concentrations less than 10-times the MDL. The implication of these detectable concentrations on interpretation of the water quality data are discussed at the end of this section.

Fraction	Parameter	Months				
		Apr	Jul	Aug	Sep	Nov
Unfiltered	Nitrite (as N)			○		
	Aluminum		○			○
	Barium				○	○
	Calcium		○		○	
	Lead		○			○
	Manganese					○
	Silicon	○			○	
	Strontium		○		○	
Filtered	Aluminum		○		○	
	Arsenic					○
	Barium		○	○	○	●
	Calcium		○			○
	Copper		○			
	Manganese			○	○	
	Sodium		○			
	Strontium		○			○
	Zinc		○			○
	DOC		○			

Notes:

○ < 10-times the MDL

● >10-times the MDL

- **Field Duplicates** – The target frequency of duplicate sample collection is approximately 10% of the total number of samples. There were a total of 9 duplicates collected in 2016, corresponding to 10.7% of the total number of water samples (84) collected at the Meadowbank and Baker Lake areas. Two field duplicates were collected in each event with the exception of November where only one was collected (**Table 3.1–3**). The field duplicate samples showed a high level of consistency with the original samples. Of the over 900 paired RPD comparisons in 2016, there were only 5 instances where the RPD exceeded 50%, and none of these samples had original and duplicate concentrations greater than 10-times the MDL.
- **Laboratory Duplicates** – These samples, conducted randomly as part of the laboratory's internal QA/QC program, showed a high degree of consistency and precision. There were no instances where the laboratory DQOs was exceeded in 2016 (**Table 3.1–1**).

Summary

The field and laboratory duplicate analyses showed a high degree of similarity in 2016. The few exceedances of the established DQOs represent much less than 1% of the total for QA samples and parameters measured. When comparing results for a large number of parameters, many of which are near detection limits, simple odds dictate that a few parameters will exceed DQOs due to laboratory variability (i.e., a false positive). Overall, there was no pattern in the nature of the exceedances that indicates a bias of specific parameters one way or another.

A new water pump was put in commission for the CREMP program in 2016, and silicon tubing is now swapped out with greater frequency during each annual campaign. Both of these changes were made in 2016 to address issues identified in 2015 CREMP report. Despite using a new pump and changing the tubing more frequently, results from EB samples analyzed in 2016 still indicate cross-contamination is a potential issue, either from the equipment, the environment where the blanks are collected, and/or the sampling method. The blanks have typically been collected back at the Environment Office for convenience. To test whether dust in the Environment Office is a potential source of cross-contamination, Azimuth staff collected the April EB at the Environment Office and the August EB in the boat while out on Baker Lake. The results show the April EB had the fewest detectable parameters despite being collected at the Environment Office where contamination from dust is more likely compared to out in the boat. The EB samples from July, September, and November were collected at the Environment Office as well, and indicate that conditions in the office are not always favorable for blank collection.

The equipment, particularly the filters, appears to be another potential source of metals to the EB samples. Waterra brand filters are currently used for the CREMP. One filter is typically used to collect approximately 10 water samples before it is discarded. There is no set guidance from Waterra on how often to change out the filters; rather, they instruct practitioners to make decisions on a site-specific basis. Given the ultra-oligotrophic/oligotrophic nature of the lakes in the vicinity of Meadowbank, and the high-capacity of the filters, collecting multiple samples from each filter was considered acceptable. To avoid cross-contamination among sampling locations, filters are well-flushed prior to collecting samples (Azimuth, 2015b). Overall, the results are inconclusive as to the exact source of cross-contamination. In light of the uncertainty, the following improvements to the EB collection are recommended for the 2017 CREMP:

1. Switch from Waterra brand filters to Voss SingleSample® high capacity disposable filters[13]. The technical specifications for the Voss filters indicate lower limits of detection (LoD) compared to Waterra filters. For several metals that have been detected in the EBs, including barium, manganese, and lead, the Voss filter LoD is less than the Waterra certified LoD. Several metals have LoD above the ALS MDLs for this project. The implication is that there may be some potential for cross-contamination from the Voss filters as well. Overall, the Voss filters have a longer list of metals with LoD below the ALS MDLs compared with Waterra filters.
2. Refine the SOP for collecting EB samples, with an emphasis on minimizing the potential for dust contamination.

The implication of possible cross-contamination on interpretation of the 2016 water quality data was evaluated by comparing the sample concentrations with the equipment blank results from the same event[14]. Sample results in **Table 3.2–1** (Meadowbank) and **Table 3.3–1** (Baker) were given a cautionary flagged using underlining (e.g., <u>0.001</u>) to indicate that the measured concentration was less than 5-times the concentration detected in the equipment blank. Of the analytes detected in the equipment blanks, aluminum (total and dissolved) was routinely given a "cautionary" flag because the concentrations were consistently within 5-times the MDL, meaning there is potential for cross-contamination to bias the sample results higher. Cautionary flags were also applied infrequently to some samples with detectable concentrations of arsenic, barium, copper, lead, manganese, and zinc. Analysis of the water quality data relative to the triggers and thresholds was done on the entire data set, including the cautionary flagged data. Importantly, none of the aforementioned parameters exceeded the triggers values in 2016, indicating that any potential cross-contamination is unlikely to bias interpretation of the water quality analysis.

3.1.3. Sediment Grab Chemistry

Sediment QA/QC results for the grab samples are presented in **Table 3.1–4** (metals) and **Table 3.1–5** (hydrocarbons and PAHs) discussed below:

- **Field Duplicates** – Five field duplicates were collected in 2016. Among the 5 duplicate samples, only four analytes exceeded the RPD DQO of 50% (2 for sand, 1 for arsenic, and 1 for manganese). Slight exceedances of the 50% RPD DQO between field duplicates are common in sediment. There were no field duplicate DQO exceedances for the hydrocarbon and PAH analyses in 2016.
- **Laboratory Duplicates** – There were no cases where the RPD value exceeded the parameter-specific DQOs listed in **Table 3.1–4** (metals) and **Table 3.1–5** (hydrocarbons and PAHs). These results confirm that sediments were well homogenized in the field and that the laboratory processing methods were consistent between sub-samples.
- **Filter Swipes** – 5 filter swipes were conducted on sediment grab equipment after washing with soap and rinsing with deionized water. Swipes were analyzed for total metals in units of µg/filter. A number of parameters were detected on the filter swipes used in 2015, so the swipe protocol was changed in 2016 to use gauze moistened with dilute nitric acid provided by ALS. Dilute nitric acid has the potential to mobilize metals from the sampling equipment (e.g., ponar, stainless steel bowls,

[13] The supplier of filters for this project switched from Voss to Waterra filters in 2014. At the time, the supplier indicated the technical specifications were identical between the two filter brands.

[14] If more than one equipment blank was submitted for a given event, the maximum detected concentration was compared against the samples results.

spoons), meaning the swipe results represent a worst-case scenario for cross-contamination. There were a few analytes that were detected in the 2016 swipes, namely barium, chromium, iron, manganese, and zinc. Iron and zinc were the only two analytes where the measured concentration was greater than 10-times the MDL (n=5 for iron, n=2 for zinc; **Table 3.1–4**). The implication of these detected parameters was evaluated by determining the incremental influence of the swipe concentrations relative to the sediment chemistry results. Chromium was estimated to contribute approximately 2% to actual measured sediment metals concentrations. All the other parameters were estimated at less than 1% of measured sediment metals concentrations. The potential for meaningful cross-contamination is considered negligible and DQOs were considered to be fully met.

3.1.4. Phytoplankton

Two field duplicate samples were collected for each sampling event with the exception of November where only one was collected. The field duplicates and laboratory QC duplicates were analyzed for the RPD in total density and total biomass between the original sample and the duplicate. RPD values were also calculated for the major taxa groups, but these results are not relied on for QC purposes because of the tendency for small differences in abundance/biomass between the original and the duplicate to cause large differences in the RPD. Thus, we evaluate the quality of these data based on total density and total biomass both for field and laboratory duplicates.

Results of the RPD analysis for all these parameters are presented in **Table 3.1–6** (field) and **Table 3.1–7** (laboratory) and are discussed below:

- **Field Duplicates** – Total density, total biomass, total richness, and Simpson's diversity endpoints were all well below the 50% RPD DQO for the field duplicate samples in 2016.
- **Laboratory Duplicates** – Duplicate re-counts were conducted on approximately 10% of the samples. No DQO exceedances were observed for the total density and total biomass endpoints.
- **Overall** – The 2016 results met the DQOs for this project. Total density and biomass did not differ in one direction or another for the field and the laboratory duplicates, indicating a lack of bias.

3.1.5. Benthic Invertebrates

Laboratory replicate counts were performed on 10% of all benthic samples. Replicate samples were chosen at random and processed at different times from the original analysis to reduce bias. Percent recovery was above 98% in all re-sorted samples, with an average percent recovery of approximately 99% (**Table 3.1–8**). These results suggest that the majority of individual are recovered by the taxonomist during enumeration. As in previous years, the reference collection of benthic taxa for this project has been maintained.

3.1.6. QA/QC Summary

Below is a summary of field and sample QA/QC results for the 2016 CREMP program:

- Deviations from the proposed sampling plan:
    - o Reference areas INUG and PDL were not sampled in November (limnology, water chemistry, and phytoplankton) due to equipment issues with the tundra buggy and safety concerns.
- Field duplicate water samples were collected at a frequency of 10.7% in 2016.

- Laboratory QA/QC analyses (blanks, duplicates, certified reference material) were performed in accordance with ALS's DQO's.
- Blanks (DI and EB) were submitted with in every sampling event. EB results suggest there is the potential for dust in the Environment Office to cross-contaminate the EB samples. The inline water filters from Waterra may also be a potential source of some dissolved metals in the EB. Overall, the potential cross-contamination effect (bias) on interpretation of the data was considered negligible.
- A travel blanks was submitted for the August sampling event.
- Lost, damaged, and or compromised data:
    - Shipping – temperatures inside the coolers continue exceed 20°C upon arrival at ALS for the summer sampling events (July and August). The effect on preserved samples is considered negligible, but for chlorophyll-a samples the increase in temperature means samples may arrive thawed. Keeping the chlorophyll-a samples frozen is a recurring challenge for this program given the logistics of shipping samples from Nunavut to Vancouver in a timely fashion. A few glass bottles broke due to freezing when shipping the November sampling event. The analyses (DOC, TOC, and Hg) were done on samples from the unpreserved conventionals or TSS/TDS 1L bottles.
    - Limnology (DO) – there are missing results for some stations in March, April, and November due to issues with the probes related to cold weather data collection.
    - Limnology (Specific Conductance) – there are missing results for some stations in September and November due to intermittent readings.
    - Blanks – the July DI blank are missing ammonia, TKN, phosphorus (P)-Total, TOC, and dissolved metals. The September DI blank and EB are missing ammonia, TKN, phosphorus (P)-Total, DOC, and TOC.
    - Sample IDs – there were a few instances where the labels on the samples containers sent to ALS did not match the sample IDs on the CoC. In all cases the discrepancies were traceable and corrected.

Table 3.1–1. Laboratory QA/QC summary for the 2016 CREMP water and sediment quality program.

								Laboratory QC Summary									
					Sample Integrity			Detection Limits		Laboratory Duplicates		Method Blanks		Matrix Spike		LCS / CRM	
Event	Lab ID	Analytes	Date sampled	Date received	Observations	Temperature (°C)	Hold-time Exceedances	Parameters	Qualifier	Parameters	Qualifier	Parameters	Qualifier	Parameters	Qualifier	Parameters	Qualifier
April	L1759774		April 14 - 17	25-Apr-16	Discrepency between bottle label ID and CoC ID.	13, 13	TDS, TSS, Turbidity, pH, Diss O-PO4, Nitrate, Nitrite, TDP	None		None		Alkalinity-Total Ca-Total	B	None		None	
	L1762620		April 18 - 21	2-May-16	None	14, 15	TDS, TSS, Turbidity, pH, alkalinity, Diss O-PO4, Nitrate, Nitrite, TDP	TDS	DL (10 mg/L) for some samples	None		Zn-Dissolved	MB-LOR	None		None	
	L1763257		April 25	3-May-16	None	14, 18	TDS, TSS, Turbidity, pH, Diss O-PO4, Nitrate, Nitrite, TDP	None		None		None		None		None	
	L1772459		April 14 - 25	20-May-16	None	3	Chl-A	None		None		None		n/a		None	
July	L1801106	Conventionals	July 8 - 12	20-Jul-16	Discrepency between bottle label ID and CoC ID.	22	TDS, TSS, Turbidity, pH, Diss O-PO4, Nitrate, Nitrite, TDP	None		None		None		n/a		None	
	L1801137	Metals, cyanides, TOC, DOC, Nutrients	July 8 - 12	20-Jul-16	Discrepency between bottle label ID and CoC ID.	22	None	None		None		None		None		None	
	L1803270	Metals, cyanides, TOC, DOC, Nutrients	July 18 - 20	25-Jul-16	TPN-92-S diss. Hg vial broke during transport	20, 21	TDS, TSS, Turbidity, pH, Diss O-PO4, Nitrate, Nitrite, TDP	None		None		Cr-Total	MB-LOR	None		None	
	L1808381	Metals, cyanides, TOC, DOC, Nutrients	22-Jul-16	4-Aug-16	None	20, 21	None	None		None		None		None		None	
	L1808402	Chl-a	July 8 - 22	4-Aug-16	None	19, 20	None	None		n/a		None		n/a		None	
	L1808438	Conventionals	22-Jul-16	4-Aug-16	Discrepency between bottle label ID and CoC ID.	19, 20	TDS, TSS, Turbidity, pH, Diss O-PO4, Nitrate, Nitrite, TDP	TDS, Br, Cl, F, Nitrate, Nitrite, SO_4	DLDS	None		None		None		None	
August	L1813371	Chl-a	Aug 3 - 10	15-Aug-16	AUG DUP-2 not received. Submitted with November samples	21	None	None		n/a		None		n/a		None	
	L1813394	Conventionals	Aug 8 - 10	15-Aug-16	None	21	Turbidity, pH, Diss O-PO4, Nitrate, Nitrite, TDP	TDS	DL (10 mg/L) for some samples	None		None		None		None	
	L1813406	Conventionals, metals, cyanides, TOC, DOC, Nutrients	Aug 3 - 7	15-Aug-16	Discrepency between CoC and bottles received	22	TDS, TSS, Turbidity, pH, Diss O-PO4, Nitrate, Nitrite, TDP	Cr-Total	DL raised for some samples	None		Cr-Total	MB-LOR	None		None	
	L1815622	Metals, cyanides, TOC, DOC, Nutrients	Aug 8 - 10	18-Aug-16	None	22, 22, 21	None	None		None		None		Ba, Na, Sr (Dissolved)	MS-B	None	
	L1815642	Sediment analyses	Aug 3 - 9	18-Aug-16	None	22, 22, 21	Moisture, EPHs, PAHs	TOC, EPHs, PAHs	DLHM for some samples	None		None		None		None	
September	L1827203	Metals, cyanides, TOC, DOC, Nutrients	September 2 - 6	12-Sep-16	None	18	None	None		None		None		None		None	
	L1828508	Conventionals	September 2 - 5	13-Sep-16	Discrepency between CoC and bottles received	16	TDS, TSS, Turbidity, pH, Diss O-PO4, Nitrate, Nitrite, TDP	TDS	DL (10 mg/L) for some samples	None		None		None		None	
	L1829511	Metals, cyanides, TOC, DOC, Nutrients	September 2 - 8	15-Sep-16	Discrepency between CoC and blank bottle labels	16, 16	None	None		None		None		None		None	

Table 3.1–1. Laboratory QA/QC summary for the 2016 CREMP water and sediment quality program.

								Laboratory QC Summary									
					Sample Integrity			Detection Limits		Laboratory Duplicates		Method Blanks		Matrix Spike		LCS / CRM	
Event	Lab ID	Analytes	Date sampled	Date received	Observations	Temperature (°C)	Hold-time Exceedances	Parameters	Qualifier	Parameters	Qualifier	Parameters	Qualifier	Parameters	Qualifier	Parameters	Qualifier
September	L1829521	Conventionals, chl-a	September 2 - 11	15-Sep-16	None	16, 16	TDS, TSS, Turbidity, pH, Diss O-PO4, Nitrate, Nitrite, TDP	None		None		None		None		None	
November	L1868891	Conventionals, metals, cyanides, TOC, DOC, Nutrients	November 25 - 30	12-Dec-16	Discrepency between CoC and blank bottle labels Broken TOC, DOC, and Hg bottles (frozen samples)	-0.5, 0.4, 0.9	TDS, TSS, Turbidity, pH, Diss O-PO4, Nitrate, Nitrite, TDP, cyanides	None		None		None		None		None	
	L1874802	Chl-a	November 25 - 30	30-Dec-16	AUG DUP-2 submitted with the November chl-a samples	2	Chl-A	None		n/a		None		n/a		None	
	L1874814	All parameters	25-Nov-16	30-Dec-16	Discrepency between date on bottles and CoC	9	Alkalinity, NH4, Br, Cl, Cond., Hg (diss. and tot.), DOC, F, SO4, TKN, TDS, TSS, Turbidity, pH, Diss O-PO4, TOC, Nitrate, Nitrite, TDP, Si, cyanides	None		n/a		None		n/a		None	

Notes:
Conventionals = analytes that are not preserved
Diss O-PO4 = dissolved orthophosphate
LCS / CRM = laboratory control sample / certified reference material
TDS = total dissolved solids
TDP = total dissolved phosphorus
TSS = total suspended solids

Laboratory QC qualifiers:
n/a = laboratory QC program not included as part of the analyses.
MB-LOR = Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.
B = Method Blank exceeds ALS DQO. All associated sample results are at least 5 times greater than blank levels and are considered reliable.
DLDS = Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
DLHM = Detection Limit Adjusted: Sample has high moisture content.
MS-B = Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Table 3.1–2. Laboratory detection limits, equipment blanks, and travel blanks for the 2016 CREMP water quality program.

											Equipment & Deionized Water Blanks			
Month	April		July		August		September		November		APR DI-1	APR EB-1	JUL DI-1	JUL EB-1
Analyte	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	15-Apr-16	15-Apr-16	20-Jul-16	20-Jul-16
Physical Tests														
Conductivity (µS/cm)	2	2	2	2	2	2	2	2	2	2	*<2.0*	*<2.0*	*<2.0*	*<2.0*
Hardness (mg/L)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	*<0.50*	*<0.50*	*<0.50*	*<0.50*
pH (Laboratory)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	5.44	5.42	5.22	5.17
Total Suspended Solids (mg/L)	1	1	1	1	1	1	1	1	1	1	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Total Dissolved Solids (mg/L)	3	10	3	15	3	10	3	10	3	3	*<3.0*	*<3.0*	*<3.0*	*<3.0*
Turbidity (NTU)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	*<0.10*	**0.12**	*<0.10*	**0.15**
Anions and Nutrients (mg/L)														
Alkalinity, Bicarbonate (as $CaCO_3$)	1	1	1	1	1	1	1	1	1	1	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Alkalinity, Carbonate (as $CaCO_3$)	1	1	1	1	1	1	1	1	1	1	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Alkalinity, Hydroxide (as CaCO3)	1	1	1	1	1	1	1	1	1	1	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Alkalinity, Total (as $CaCO_3$)	1	1	1	1	1	1	1	1	1	1	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Ammonia, Total (as N)	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	*<0.0050*	*<0.0050*		*<0.0050*
Bromide (Br)	0.05	0.05	0.05	0.25	0.05	0.05	0.05	0.05	0.05	0.05	*<0.050*	*<0.050*	*<0.050*	*<0.050*
Chloride (Cl)	0.1	0.1	0.1	0.5	0.1	0.1	0.1	0.1	0.1	0.1	*<0.10*	*<0.10*	*<0.10*	*<0.10*
Fluoride (F)	0.02	0.02	0.02	0.1	0.02	0.02	0.02	0.02	0.02	0.02	*<0.020*	*<0.020*	*<0.020*	*<0.020*
Nitrate (as N)	0.005	0.005	0.005	0.025	0.005	0.005	0.005	0.005	0.005	0.005	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*
Nitrite (as N)	0.001	0.001	0.001	0.005	0.001	0.001	0.001	0.001	0.001	0.001	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Total Kjeldahl Nitrogen	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	*<0.050*	*<0.050*		*<0.050*
Orthophosphate-Dissolved (as P)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Phosphorus (P)-Total Dissolved	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*
Phosphorus (P)-Total	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	*<0.0020*	*<0.0020*		*<0.0020*
Silicate (as SiO_2)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	*<0.50*	*<0.50*	*<0.50*	*<0.50*
Sulfate (SO_4)	0.3	0.3	0.3	1.5	0.3	0.3	0.3	0.3	0.3	0.3	*<0.30*	*<0.30*	*<0.30*	*<0.30*
Cyanides (mg/L)														
Total Cyanide	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Free Cyanide	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Organic / Inorganic Carbon (mg/L)														
Dissolved Organic Carbon	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	*<0.50*	*<0.50*	*<0.50*	**1.64**
Total Organic Carbon	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	*<0.50*	*<0.50*		*<0.50*
Plant Pigments (µg/L)														
Chlorophyll-a	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01				
Total Metals (mg/L)														
Aluminum	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	*<0.0030*	*<0.0030*	*<0.0030*	**0.0045**
Antimony	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Arsenic	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Barium	0.00005	0.00005	0.00005	0.00025	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	*<0.000050*	*<0.000050*	*<0.000050*	*<0.00025*
Beryllium	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*
Bismuth	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Boron	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Cadmium	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Calcium	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	*<0.050*	*<0.050*	*<0.050*	**0.113**
Chromium	0.0001	0.0001	0.0001	0.0001	0.0001	0.0004	0.0001	0.0001	0.0001	0.0001	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Cobalt	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Copper	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Iron	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Lead	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	*<0.000050*	*<0.000050*	*<0.000050*	**0.000058**
Lithium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Magnesium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	*<0.10*	*<0.10*	*<0.10*	*<0.10*
Manganese	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00020*
Mercury	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Molybdenum	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Nickel	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Phosphorus	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	*<0.050*	*<0.050*	*<0.050*	*<0.050*
Potassium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	*<0.10*	*<0.10*	*<0.10*	*<0.10*
Selenium	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Silicon	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	*<0.050*	**0.122**	*<0.050*	*<0.050*
Silver	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Sodium	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	*<0.050*	*<0.050*	*<0.050*	*<0.050*
Strontium	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	*<0.00020*	*<0.00020*	*<0.00020*	**0.00067**
Sulfur	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	*<0.50*	*<0.50*	*<0.50*	*<0.50*
Thallium	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Tin	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Titanium	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*
Uranium	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Vanadium	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Zinc	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*
Zirconium	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*
Dissolved Metals (mg/L)														
Aluminum	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	*<0.0010*	*<0.0010*		**0.0014**
Antimony	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	*<0.00010*	*<0.00010*		*<0.00010*
Arsenic	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	*<0.00010*	*<0.00010*		*<0.00010*
Barium	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	*<0.000050*	*<0.000050*		**0.000348**
Beryllium	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	*<0.000020*	*<0.000020*		*<0.000020*
Bismuth	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	*<0.000050*	*<0.000050*		*<0.000050*
Boron	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	*<0.010*	*<0.010*		*<0.010*
Cadmium	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	*<0.0000050*	*<0.0000050*		*<0.0000050*
Calcium	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	*<0.050*	*<0.050*		**0.167**
Chromium	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	*<0.00010*	*<0.00010*		*<0.00010*
Cobalt	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	*<0.00010*	*<0.00010*		*<0.00010*
Copper	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	*<0.00020*	*<0.00020*		**0.00024**
Iron	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	*<0.010*	*<0.010*		*<0.010*
Lead	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	*<0.000050*	*<0.000050*		*<0.000050*
Lithium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	*<0.0010*	*<0.0010*		*<0.0010*
Magnesium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	*<0.10*	*<0.10*		*<0.10*
Manganese	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	*<0.00010*	*<0.00010*		*<0.00010*
Mercury	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	*<0.0000050*	*<0.0000050*		*<0.0000050*
Molybdenum	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	*<0.000050*	*<0.000050*		*<0.000050*
Nickel	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	*<0.00050*	*<0.00050*		*<0.00050*
Phosphorus	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	*<0.050*	*<0.050*		*<0.050*
Potassium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	*<0.10*	*<0.10*		*<0.10*
Selenium	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	*<0.000050*	*<0.000050*		*<0.000050*
Silicon	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	*<0.050*	*<0.050*		*<0.050*
Silver	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	*<0.000010*	*<0.000010*		*<0.000010*
Sodium	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	*<0.050*	*<0.050*		**0.06**
Strontium	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	*<0.00020*	*<0.00020*		**0.00034**
Sulfur	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	*<0.50*	*<0.50*		*<0.50*
Thallium	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	*<0.000010*	*<0.000010*		*<0.000010*
Tin	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	*<0.00010*	*<0.00010*		*<0.00010*
Titanium	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	*<0.00030*	*<0.00030*		*<0.00030*
Uranium	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	*<0.000010*	*<0.000010*		*<0.000010*
Vanadium	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	*<0.00050*	*<0.00050*		*<0.00050*
Zinc	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	*<0.0010*	*<0.0010*		**0.0072**
Zirconium	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	*<0.00030*	*<0.00030*		*<0.00030*

Notes:

Bolded Equipment or Travel Blank values concentrations exceeds laboratory MDLs but < 10 x MDL.

Shaded Equipment or Travel Blank values concentrations is > 10 x MDL.

Italicized numbers are below detection limits.

Table 3.1–2. Laboratory detection limits, equipment blanks, and travel blanks for the 2016 CREMP water quality program.

Analyte	Month	Equipment & Deionized Water Blanks						Travel Blanks
		AUG DI-1 10-Aug-16	AUG EB-1 10-Aug-16	SEP DI-1 6-Sep-16	SEP EB-1 6-Sep-16	NOV DI-1 1-Dec-16	NOV EB-1 25-Nov-16	AUG TRAV-1
Physical Tests								
Conductivity (µS/cm)		*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*
Hardness (mg/L)		*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	**0.54**	*<0.50*
pH (Laboratory)		5.1	5.04	5.41	5.61	5.45	5.48	5.2
Total Suspended Solids (mg/L)		*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Total Dissolved Solids (mg/L)		*<3.0*	*<3.0*	*<3.0*	*<3.0*	*<3.0*	*<3.0*	*<3.0*
Turbidity (NTU)		*<0.10*	**0.13**	*<0.10*	**0.17**	*<0.10*	**0.12**	*<0.10*
Anions and Nutrients (mg/L)								
Alkalinity, Bicarbonate (as $CaCO_3$)		*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Alkalinity, Carbonate (as $CaCO_3$)		*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Alkalinity, Hydroxide (as CaCO3)		*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Alkalinity, Total (as $CaCO_3$)		*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Ammonia, Total (as N)		*<0.0050*	*<0.0050*			*<0.0050*	*<0.0050*	*<0.0050*
Bromide (Br)		*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*
Chloride (Cl)		*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*
Fluoride (F)		*<0.020*	*<0.020*	*<0.020*	*<0.020*	*<0.020*	*<0.020*	*<0.020*
Nitrate (as N)		*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*
Nitrite (as N)		*<0.0010*	**0.0023**	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Total Kjeldahl Nitrogen		*<0.050*	*<0.050*			*<0.050*	*<0.050*	*<0.050*
Orthophosphate-Dissolved (as P)		*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Phosphorus (P)-Total Dissolved		*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*
Phosphorus (P)-Total		*<0.0020*	*<0.0020*			*<0.0020*	*<0.0020*	*<0.0020*
Silicate (as SiO_2)		*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*
Sulfate (SO_4)		*<0.30*	*<0.30*	*<0.30*	*<0.30*	*<0.30*	*<0.30*	*<0.30*
Cyanides (mg/L)								
Total Cyanide		*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Free Cyanide		*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Organic / Inorganic Carbon (mg/L)								
Dissolved Organic Carbon		*<0.50*	*<0.50*			*<0.50*	*<0.50*	
Total Organic Carbon		*<0.50*	*<0.50*			*<0.50*	*<0.50*	*<0.50*
Plant Pigments (µg/L)								
Chlorophyll-a								
Total Metals (mg/L)								
Aluminum		*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	**0.0073**	**0.0066**	*<0.0030*
Antimony		*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Arsenic		*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Barium		*<0.000050*	*<0.000050*	*<0.000050*	**0.000137**	*<0.000050*	**0.000082**	*<0.000050*
Beryllium		*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*
Bismuth		*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Boron		*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Cadmium		*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Calcium		*<0.050*	*<0.050*	*<0.050*	**0.074**	*<0.050*	*<0.050*	*<0.050*
Chromium		*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Cobalt		*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Copper		*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Iron		*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Lead		*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	**0.000211**	*<0.000050*
Lithium		*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Magnesium		*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*
Manganese		*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	**0.0002**	*<0.00010*
Mercury		*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Molybdenum		*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Nickel		*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Phosphorus		*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*
Potassium		*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*
Selenium		*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Silicon		*<0.050*	*<0.050*	*<0.050*	**0.051**	*<0.050*	*<0.050*	*<0.050*
Silver		*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Sodium		*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*
Strontium		*<0.00020*	*<0.00020*	*<0.00020*	**0.00029**	*<0.00020*	*<0.00020*	*<0.00020*
Sulfur		*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*
Thallium		*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Tin		*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Titanium		*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*
Uranium		*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Vanadium		*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Zinc		*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*
Zirconium		*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*
Dissolved Metals (mg/L)								
Aluminum		*<0.0010*	*<0.0010*	*<0.0010*	**0.0019**	**0.0077**	*<0.0010*	
Antimony		*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	
Arsenic		*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	**0.0002**	
Barium		*<0.000050*	**0.000138**	*<0.000050*	**0.000098**	*<0.000050*	0.00067	
Beryllium		*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	
Bismuth		*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	
Boron		*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	
Cadmium		*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	
Calcium		*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	**0.217**	
Chromium		*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	
Cobalt		*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	
Copper		*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*	
Iron		*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	
Lead		*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	
Lithium		*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	
Magnesium		*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	
Manganese		*<0.00010*	**0.00013**	*<0.00010*	**0.00018**	*<0.00010*	*<0.00010*	
Mercury		*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	
Molybdenum		*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	
Nickel		*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	
Phosphorus		*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	
Potassium		*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	
Selenium		*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	
Silicon		*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	
Silver		*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	
Sodium		*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	
Strontium		*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*	**0.00148**	
Sulfur		*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	
Thallium		*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	
Tin		*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	**0.00011**	*<0.00010*	
Titanium		*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	
Uranium		*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	
Vanadium		*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	
Zinc		*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	**0.0012**	
Zirconium		*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	

Notes:

Bolded Equipment or Travel Blank values concentrations exceeds laboratory MDLs but < 10 x MDL.

Shaded Equipment or Travel Blank values concentrations is > 10 x MDL.

Italicized numbers are below detection limits.

Table 3.1–3. Field QA/QC summary for the 2016 CREMP water quality program.

Month	April							July			
	April MDLs	Third Portage Lake - East Basin			Third Portage Lake - South Basin			July MDLs	Third Portage Lake - East Basin		
Analyte		TPE-91-S	APR DUP-1	RPD	TPS-55-S	APR DUP-2	RPD		TPE-92-S	JUL DUP-1	RPD
Physical Tests											
Conductivity (µS/cm)	2	32.4	30.6	5.7	31.4	20.8	40.6	2	28.3	27.9	1.4
Hardness (mg/L)	0.5	13.80	13.80	0.0	11.20	11.10	0.9	0.5	9.57	9.60	-0.3
pH (Laboratory)	0.1	6.68	6.66	0.3	6.90	6.81	1.3	0.1	7.10	7.10	0.0
Total Suspended Solids (mg/L)	1	*<1.0*	*<1.0*		*<1.0*	*<1.0*		1	*<1.0*	*<1.0*	
Total Dissolved Solids (mg/L)	3	24.7	22.0	11.6	21.5	21.9	-1.8	3	17.0	17.6	-3.5
Turbidity (NTU)	0.1	0.12	0.12	0	0.11	0.11	0.0	0.1	0.26	0.33	-24
Anions and Nutrients (mg/L)											
Alkalinity, Bicarbonate (as $CaCO_3$)	1	6	6	6.7	8	6	27.0	1	7	7	4.5
Alkalinity, Carbonate (as $CaCO_3$)	1	*<1.0*	*<1.0*		*<1.0*	*<1.0*		1	*<1.0*	*<1.0*	
Alkalinity, Hydroxide (as CaCO3)	1	*<1.0*	*<1.0*		*<1.0*	*<1.0*		1	*<1.0*	*<1.0*	
Alkalinity, Total (as $CaCO_3$)	1	6	6	6.7	8	6	27.0	1	7	7	4.5
Ammonia, Total (as N)	0.005	0.0215	0.0221	-2.8	0.0186	0.0191	-2.7	0.005	*<0.0050*	*<0.0050*	
Bromide (Br)	0.05	*<0.050*	*<0.050*		*<0.050*	*<0.050*		0.05	*<0.050*	*<0.050*	
Chloride (Cl)	0.1	1.00	1.00	0.0	0.95	0.94	1.1	0.1	0.47	0.67	-35
Fluoride (F)	0.02	0.097	0.098	-1.0	0.084	0.083	1.2	0.02	0.051	0.073	-35
Nitrate (as N)	0.005	0.0346	0.0415	-18.1	0.0672	0.0661	1.7	0.005	0.0226	0.0319	-34.1
Nitrite (as N)	0.001	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		0.001	*<0.0010*	*<0.0010*	
Total Kjeldahl Nitrogen	0.05	0.111	0.110	0.9	0.231	0.102	**77.5**	0.05	0.1	0.12	-7.9
Orthophosphate-Dissolved (as P)	0.001	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		0.001	*<0.0010*	*<0.0010*	
Phosphorus (P)-Total Dissolved	0.002	*<0.0020*	*<0.0020*		*<0.0020*	*<0.0020*		0.002	*<0.0020*	*<0.0020*	
Phosphorus (P)-Total	0.002	*<0.0020*	*<0.0020*		*<0.0020*	*<0.0020*		0.002	*<0.0020*	0.0021	
Silicate (as SiO_2)	0.5	*<0.50*	*<0.50*		*<0.50*	*<0.50*		0.5	*<0.50*	*<0.50*	
Sulfate (SO_4)	0.3	6.37	6.37	0.0	6.06	6.00	1.0	0.3	2.82	4.25	-40.5
Cyanides (mg/L)											
Total Cyanide	0.001	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		0.001	*<0.0010*	*<0.0010*	
Free Cyanide	0.001	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		0.001	*<0.0010*	*<0.0010*	
Organic / Inorganic Carbon (mg/L)											
Dissolved Organic Carbon	0.5	1.83	1.55	16.6	1.46	1.46	0.0	0.5	1.28	1.35	-5.3
Total Organic Carbon	0.5	1.49	1.69	-13	1.53	1.63	-6.3	0.5	1.30	1.55	-17.5
Plant Pigments (µg/L)											
Chlorophyll-a	0.01	0.112	0.106	6	0.24	0.227	5.6	0.01	0.142	0.159	-11
Total Metals (mg/L)											
Aluminum	0.003	*<0.0030*	*<0.0030*		0.0034	*<0.0030*		0.003	0.0083	0.0101	-20
Antimony	0.0001	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		0.0001	*<0.00010*	*<0.00010*	
Arsenic	0.0001	0.00050	0.00050	0.0	0.00022	0.00019	14.6	0.0001	0.00034	0.00035	-3
Barium	0.00005	0.00405	0.00397	2.0	0.00372	0.00357	4.1	0.00005	0.00316	0.00331	-4.6
Beryllium	0.00002	*<0.000020*	*<0.000020*		*<0.000020*	*<0.000020*		0.00002	*<0.000020*	*<0.000020*	
Bismuth	0.00005	*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*		0.00005	*<0.000050*	*<0.000050*	
Boron	0.01	*<0.010*	*<0.010*		*<0.010*	*<0.010*		0.01	*<0.010*	*<0.010*	
Cadmium	0.000005	*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*		0.000005	*<0.0000050*	*<0.0000050*	
Calcium	0.05	3.40	3.42	-0.6	2.75	2.66	3.3	0.05	2.37	2.38	-0.4
Chromium	0.0001	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		0.0001	0.00011	*<0.00010*	
Cobalt	0.0001	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		0.0001	*<0.00010*	*<0.00010*	
Copper	0.0005	*<0.00050*	0.00058		*<0.00050*	*<0.00050*		0.0005	*<0.00050*	*<0.00050*	
Iron	0.01	*<0.010*	*<0.010*		*<0.010*	*<0.010*		0.01	0.017	0.02	-16
Lead	0.00005	*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*		0.00005	0.000065	0.000195	**-100.0**
Lithium	0.001	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		0.001	*<0.0010*	*<0.0010*	
Magnesium	0.1	1.28	1.29	-0.8	1.10	1.08	1.8	0.1	0.88	0.89	-1.1
Manganese	0.0001	0.00032	0.00031	3	0.00036	0.00033	8.7	0.0001	0.00322	0.00341	-6
Mercury	0.000005	*<0.0000050*	0.0000214		*<0.0000050*	0.0000172		0.000005	*<0.0000050*	*<0.0000050*	
Molybdenum	0.00005	0.000210	0.000215	-2.4	0.000204	0.000201	1.5	0.00005	0.000154	0.000142	8
Nickel	0.0005	0.00062	0.00059	5.0	0.00053	*<0.00050*		0.0005	0.00065	0.00068	-4.5
Phosphorus	0.05	*<0.050*	*<0.050*		*<0.050*	*<0.050*		0.05	*<0.050*	*<0.050*	
Potassium	0.1	0.74	0.73	1.4	0.64	0.64	0.0	0.1	0.57	0.54	5.4
Selenium	0.00005	*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*		0.00005	*<0.000050*	*<0.000050*	
Silicon	0.05	0.068	0.064	6.1	*<0.050*	*<0.050*		0.05	0.109	0.112	-2.7
Silver	0.00001	*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		0.00001	*<0.000010*	*<0.000010*	
Sodium	0.05	1.44	1.42	1.4	1.47	1.44	2.1	0.05	1.02	1.01	1.0
Strontium	0.0002	0.0147	0.0148	-0.7	0.0126	0.0123	2.4	0.0002	0.0108	0.0110	-1.8
Sulfur	0.5	1.99	2.02	-1.5	1.98	1.89	4.7	0.5	1.46	1.45	1
Thallium	0.00001	*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		0.00001	*<0.000010*	*<0.000010*	
Tin	0.0001	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		0.0001	*<0.00010*	*<0.00010*	
Titanium	0.0003	*<0.00030*	*<0.00030*		*<0.00030*	*<0.00030*		0.0003	*<0.00030*	*<0.00030*	
Uranium	0.00001	0.000049	0.000051	-4	0.000039	0.000039	0.0	0.00001	0.000051	0.000051	0
Vanadium	0.0005	*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*		0.0005	*<0.00050*	*<0.00050*	
Zinc	0.003	*<0.0030*	*<0.0030*		*<0.0030*	*<0.0030*		0.003	*<0.0030*	*<0.0030*	
Zirconium	0.0003	*<0.00030*	*<0.00030*		*<0.00030*	*<0.00030*		0.0003	*<0.00030*	*<0.00030*	
Dissolved Metals (mg/L)											
Aluminum	0.001	0.0010	0.0013	-26.1	0.0010	0.0039	**-118.4**	0.001	0.0026	0.0028	-7.4
Antimony	0.0001	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		0.0001	*<0.00010*	*<0.00010*	
Arsenic	0.0001	0.00049	0.00055	-11.5	0.00022	0.00021	4.7	0.0001	0.00031	0.00031	0.0
Barium	0.00005	0.00397	0.00416	-4.7	0.00360	0.00359	0.3	0.00005	0.00367	0.00308	17.5
Beryllium	0.00002	*<0.000020*	*<0.000020*		*<0.000020*	*<0.000020*		0.00002	*<0.000020*	*<0.000020*	
Bismuth	0.00005	*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*		0.00005	*<0.000050*	*<0.000050*	
Boron	0.01	*<0.010*	*<0.010*		*<0.010*	*<0.010*		0.01	*<0.010*	*<0.010*	
Cadmium	0.000005	*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*		0.000005	*<0.0000050*	*<0.0000050*	
Calcium	0.05	3.43	3.43	0.0	2.70	2.66	1.5	0.05	2.38	2.38	0.0
Chromium	0.0001	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		0.0001	*<0.00010*	*<0.00010*	
Cobalt	0.0001	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		0.0001	*<0.00010*	*<0.00010*	
Copper	0.0002	0.00040	0.00043	-7.2	0.00035	0.00034	2.9	0.0002	0.00063	0.00040	44.7
Iron	0.01	*<0.010*	*<0.010*		*<0.010*	*<0.010*		0.01	*<0.010*	*<0.010*	
Lead	0.00005	0.000099	*<0.000050*		0.000096	*<0.000050*		0.00005	*<0.000050*	*<0.000050*	
Lithium	0.001	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		0.001	*<0.0010*	*<0.0010*	
Magnesium	0.1	1.28	1.28	0.0	1.09	1.07	1.9	0.1	0.88	0.89	-1.1
Manganese	0.0001	0.00014	0.00015	-6.9	0.00015	0.00012	22.2	0.0001	0.00347	0.00299	15
Mercury	0.000005	*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*		0.000005	*<0.0000050*	*<0.0000050*	
Molybdenum	0.00005	0.000199	0.000195	2.0	0.000188	0.000186	1.1	0.00005	0.000119	0.000148	-22
Nickel	0.0005	0.00075	0.0007	6.9	*<0.00050*	*<0.00050*		0.0005	0.0008	0.00062	25.4
Phosphorus	0.05	*<0.050*	*<0.050*		*<0.050*	*<0.050*		0.05	*<0.050*	*<0.050*	
Potassium	0.1	0.70	0.69	1	0.61	0.61	0.0	0.1	0.57	0.55	3.6
Selenium	0.00005	*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*		0.00005	*<0.000050*	*<0.000050*	
Silicon	0.05	0.065	0.061	6.3	*<0.050*	*<0.050*		0.05	0.097	0.096	1.0
Silver	0.00001	*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		0.00001	*<0.000010*	*<0.000010*	
Sodium	0.05	1.28	1.45	-12.5	1.42	1.39	2.1	0.05	1.06	0.99	6.7
Strontium	0.0002	0.0145	0.01450	0.0	0.0122	0.01180	3.3	0.0002	0.0115	0.01100	4.4
Sulfur	0.5	2.01	2.04	-1.5	1.94	1.95	-0.5	0.5	1.45	1.43	1
Thallium	0.00001	*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		0.00001	*<0.000010*	*<0.000010*	
Tin	0.0001	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		0.0001	*<0.00010*	*<0.00010*	
Titanium	0.0003	*<0.00030*	*<0.00030*		*<0.00030*	*<0.00030*		0.0003	*<0.00030*	*<0.00030*	
Uranium	0.00001	0.000047	0.000045	4.3	0.000036	0.000036	0.0	0.00001	0.000037	0.000047	-24
Vanadium	0.0005	*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*		0.0005	*<0.00050*	*<0.00050*	
Zinc	0.001	*<0.0010*	0.0011		*<0.0010*	*<0.0010*		0.001	0.0018	*<0.0010*	
Zirconium	0.0003	*<0.00030*	*<0.00030*		*<0.00030*	*<0.00030*		0.0003	*<0.00030*	*<0.00030*	

Notes:

RPD = Relative Percent Difference (%) = ((original - duplicate) / (original + duplicate)/2) x 100.

RPDs are calculated when both samples are above detection.

The data quality objective (DQO) for field duplicates is an RPD < 50%.

Bolded RPDs	RPD values exceed 50% but < 10 x MDL.
Shaded RPD	RPD values exceed 50% and > 10 x MDL.

\- = no measurement

Italicized numbers are below detection limits.

Table 3.1–3. Field QA/QC summary for the 2016 CREMP water quality program.

Month	July			August						
	Third Portage Lake - North Basin			Aug MDLs	Third Portage Lake - North Basin			Baker Lake Barge Dock		
Analyte	**TPN-92-S**	**JUL DUP-2**	**RPD**		**TPN-95-S**	**AUG DUP-1**	**RPD**	**BBD-45-S**	**AUG DUP-2**	**RPD**
Physical Tests										
Conductivity (µS/cm)	28.4	26.7	6.2	2	26.7	27.1	-1.5	50.4	58.4	-14.7
Hardness (mg/L)	8.95	8.93	0.2	0.5	8.97	9.31	-3.7	13.5	13.1	3.0
pH (Laboratory)	6.64	6.64	0.0	0.1	6.87	6.94	-1.0	7.01	7.11	-1.4
Total Suspended Solids (mg/L)	*<1.0*	*<1.0*		1	*<1.0*	*<1.0*		*<1.0*	*<1.0*	
Total Dissolved Solids (mg/L)	18.1	19.8	-9.0	3	18.9	18.9	0.0	42.0	53.0	-23
Turbidity (NTU)	0.22	0.22	0	0.1	0.24	0.25	-4	0.40	0.41	-2
Anions and Nutrients (mg/L)										
Alkalinity, Bicarbonate (as $CaCO_3$)	6	6	3.3	1	6	6	0.0	8.8	9.1	-3.4
Alkalinity, Carbonate (as $CaCO_3$)	*<1.0*	*<1.0*		1	*<1.0*	*<1.0*		*<1.0*	*<1.0*	
Alkalinity, Hydroxide (as CaCO3)	*<1.0*	*<1.0*		1	*<1.0*	*<1.0*		*<1.0*	*<1.0*	
Alkalinity, Total (as $CaCO_3$)	6	6	3.3	1	6	6	0	8.8	9.1	-3.4
Ammonia, Total (as N)	*<0.0050*	*<0.0050*		0.005	*<0.0050*	*<0.0050*		0.02	0.006	**103.9**
Bromide (Br)	*<0.050*	*<0.050*		0.05	*<0.050*	*<0.050*		0.1	*<0.050*	
Chloride (Cl)	0.71	0.71	0.0	0.1	0.71	0.72	-1.4	7.95	9.26	-15
Fluoride (F)	0.064	0.063	1.6	0.02	0.066	0.065	2	0.051	0.051	0.0
Nitrate (as N)	0.0559	0.0560	-0.2	0.005	0.0458	0.0454	0.9	0.0211	0.0192	9
Nitrite (as N)	*<0.0010*	*<0.0010*		0.001	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*	
Total Kjeldahl Nitrogen	0.08	0.09	-6.1	0.05	0.11	0.12	-7.9	0.19	0.18	6.4
Orthophosphate-Dissolved (as P)	*<0.0010*	*<0.0010*		0.001	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*	
Phosphorus (P)-Total Dissolved	*<0.0020*	*<0.0020*		0.002	*<0.0020*	*<0.0020*		0.0	0.002	4.9
Phosphorus (P)-Total	*<0.0020*	*<0.0020*		0.002	0.0023	*<0.0020*		0.0	0.0	3.9
Silicate (as SiO_2)	*<0.50*	*<0.50*		0.5	*<0.50*	*<0.50*		*<0.50*	*<0.50*	
Sulfate (SO_4)	4.57	4.57	0.0	0.3	4.57	4.56	0.2	1.51	1.70	-11.8
Cyanides (mg/L)										
Total Cyanide	*<0.0010*	*<0.0010*		0.001	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*	
Free Cyanide	*<0.0010*	*<0.0010*		0.001	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*	
Organic / Inorganic Carbon (mg/L)										
Dissolved Organic Carbon	1.27	1.13	11.7	0.5	1.28	1.06	18.8	3.58	3.49	3
Total Organic Carbon	1.18	1.24	-5.0	0.5	1.32	1.35	-2	3.66	3.79	-3.5
Plant Pigments (µg/L)										
Chlorophyll-a	0.171	0.192	-12	0.01	0.638	0.608	4.8	1.210	1.020	17.0
Total Metals (mg/L)										
Aluminum	0.0052	0.0065	-22.2	0.003	0.0059	0.0057	3	0.0154	0.0133	14.6
Antimony	*<0.00010*	*<0.00010*		0.0001	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*	
Arsenic	0.00017	0.00019	-11.1	0.0001	0.00019	0.00019	0.0	0.00013	0.00013	0.0
Barium	0.00271	0.00287	-5.7	0.00005	0.00318	0.00325	-2.2	0.01970	0.01950	1.0
Beryllium	*<0.000020*	*<0.000020*		0.00002	*<0.000020*	*<0.000020*		*<0.000020*	*<0.000020*	
Bismuth	*<0.000050*	*<0.000050*		0.00005	*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*	
Boron	*<0.010*	*<0.010*		0.01	*<0.010*	*<0.010*		*<0.010*	*<0.010*	
Cadmium	*<0.0000050*	*<0.0000050*		0.000005	*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*	
Calcium	2.12	2.22	-4.6	0.05	2.20	2.17	1.4	2.67	2.63	1.5
Chromium	*<0.00010*	0.00011		0.0001	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*	
Cobalt	*<0.00010*	*<0.00010*		0.0001	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*	
Copper	*<0.00050*	0.00071		0.0005	*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*	
Iron	*<0.010*	0.011		0.01	*<0.010*	*<0.010*		0.0	0.0	0.0
Lead	*<0.000050*	*<0.000050*		0.00005	*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*	
Lithium	*<0.0010*	*<0.0010*		0.001	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*	
Magnesium	0.83	0.87	-4.7	0.1	0.90	0.88	2.2	1.56	1.58	-1.3
Manganese	0.00191	0.00203	-6.1	0.0001	0.00161	0.00171	-6.0	0.00615	0.00618	-0.5
Mercury	*<0.0000050*	*<0.0000050*		0.000005	*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*	
Molybdenum	0.000173	0.000180	-4.0	0.00005	0.000158	0.000154	3	0.00005	*<0.000050*	
Nickel	*<0.00050*	0.00479		0.0005	*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*	
Phosphorus	*<0.050*	*<0.050*		0.05	*<0.050*	*<0.050*		*<0.050*	*<0.050*	
Potassium	0.47	0.49	-4.2	0.1	0.54	0.52	3.8	0.52	0.56	-7.4
Selenium	*<0.000050*	*<0.000050*		0.00005	*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*	
Silicon	0.061	0.064	-4.8	0.05	0.055	0.055	0	0.239	0.235	1.7
Silver	*<0.000010*	*<0.000010*		0.00001	*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*	
Sodium	1.11	1.16	-4.4	0.05	1.19	1.22	-2.5	4.16	4.65	-11.1
Strontium	0.0101	0.0105	-3.9	0.0002	0.0103	0.0102	1.0	0.0201	0.0202	-0.5
Sulfur	1.59	1.66	-4.3	0.5	1.73	1.67	3.5	0.63	0.67	-6
Thallium	*<0.000010*	*<0.000010*		0.00001	*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*	
Tin	*<0.00010*	*<0.00010*		0.0001	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*	
Titanium	*<0.00030*	*<0.00030*		0.0003	*<0.00030*	*<0.00030*		*<0.00030*	*<0.00030*	
Uranium	0.000036	0.000038	-5.4	0.00001	0.000037	0.000037	0.0	0.000045	0.000045	0.0
Vanadium	*<0.00050*	*<0.00050*		0.0005	*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*	
Zinc	*<0.0030*	0.0041		0.003	*<0.0030*	*<0.0030*		*<0.0030*	*<0.0030*	
Zirconium	*<0.00030*	*<0.00030*		0.0003	*<0.00030*	*<0.00030*		*<0.00030*	*<0.00030*	
Dissolved Metals (mg/L)										
Aluminum	0.0022	0.0028	-24	0.001	0.0021	0.0022	-5	0.0054	0.0054	0.0
Antimony	*<0.00010*	*<0.00010*		0.0001	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*	
Arsenic	0.00016	0.00016	0.0	0.0001	0.00016	0.00019	-17	0.00011	*<0.00010*	
Barium	0.00287	0.00275	4.3	0.00005	0.00306	0.00311	-1.6	0.01960	0.01940	1.0
Beryllium	*<0.000020*	*<0.000020*		0.00002	*<0.000020*	*<0.000020*		*<0.000020*	*<0.000020*	
Bismuth	*<0.000050*	*<0.000050*		0.00005	*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*	
Boron	*<0.010*	*<0.010*		0.01	*<0.010*	*<0.010*		*<0.010*	*<0.010*	
Cadmium	*<0.0000050*	*<0.0000050*		0.000005	*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*	
Calcium	2.17	2.17	0.0	0.05	2.17	2.25	-3.6	2.69	2.65	1.5
Chromium	*<0.00010*	*<0.00010*		0.0001	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*	
Cobalt	*<0.00010*	*<0.00010*		0.0001	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*	
Copper	0.00034	0.00039	-13.7	0.0002	0.00032	0.00032	0.0	0.00025	0.00025	0
Iron	*<0.010*	*<0.010*		0.01	*<0.010*	*<0.010*		*<0.010*	0.0	
Lead	*<0.000050*	*<0.000050*		0.00005	*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*	
Lithium	*<0.0010*	*<0.0010*		0.001	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*	
Magnesium	0.86	0.85	1.2	0.1	0.86	0.90	-4.5	1.65	1.58	4.3
Manganese	0.00149	0.00149	0.0	0.0001	0.00080	0.00073	9.2	0.00102	0.00122	-17.9
Mercury	*<0.0000050*	*<0.0000050*		0.000005	*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*	
Molybdenum	0.000181	0.000144	22.8	0.00005	0.000147	0.000145	1.4	*<0.000050*	*<0.000050*	
Nickel	*<0.00050*	0.00058		0.0005	*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*	
Phosphorus	*<0.050*	*<0.050*		0.05	*<0.050*	*<0.050*		*<0.050*	*<0.050*	
Potassium	0.45	0.46	-2	0.1	0.43	0.47	-8.9	0.58	0.55	5.3
Selenium	*<0.000050*	*<0.000050*		0.00005	*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*	
Silicon	0.062	0.063	-1.6	0.05	*<0.050*	*<0.050*		0.2	0.206	-0.5
Silver	*<0.000010*	*<0.000010*		0.00001	*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*	
Sodium	1.17	1.14	2.6	0.05	1.19	1.21	-1.7	4.95	4.37	12.4
Strontium	0.0092	0.01030	-12	0.0002	0.0101	0.00999	1.1	0.02000	0.01970	1.5
Sulfur	1.62	1.64	-1	0.5	1.52	1.53	-0.7	0.66	0.62	6.3
Thallium	*<0.000010*	*<0.000010*		0.00001	*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*	
Tin	*<0.00010*	*<0.00010*		0.0001	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*	
Titanium	*<0.00030*	*<0.00030*		0.0003	*<0.00030*	*<0.00030*		*<0.00030*	*<0.00030*	
Uranium	0.000051	0.000034	40	0.00001	0.000031	0.000034	-9	0.000041	0.000040	2
Vanadium	*<0.00050*	*<0.00050*		0.0005	*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*	
Zinc	*<0.0010*	*<0.0010*		0.001	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*	
Zirconium	*<0.00030*	*<0.00030*		0.0003	*<0.00030*	*<0.00030*		*<0.00030*	*<0.00030*	

Notes:

RPD = Relative Percent Difference (%) = ((original - duplicate) / (original + duplicate)/2) x 100.

RPDs are calculated when both samples are above detection.

The data quality objective (DQO) for field duplicates is an RPD < 50%.

Bolded RPDs	RPD values exceed 50% but < 10 x MDL.
Shaded RPD	RPD values exceed 50% and > 10 x MDL.

- = no measurement

Italicized numbers are below detection limits.

Table 3.1–3. Field QA/QC summary for the 2016 CREMP water quality program.

Month	September							November			
	Sept MDLs	Third Portage Lake - North Basin			Second Portage Lake			Nov MDLs	Wally Lake		
Analyte		TPN-96-S	SEPT DUP-1	RPD	SP-97-S	SEPT DUP-2	RPD		WAL-67-S	NOV DUP-1	RPD
Physical Tests											
Conductivity (µS/cm)	2	26.6	27.1	-1.9	34.6	35.8	-3.4	2	44.5	45.2	-1.6
Hardness (mg/L)	0.5	8.35	8.53	-2.1	13.10	13.6	-3.7	0.5	18.80	18.50	1.6
pH (Laboratory)	0.1	7.02	7.00	0.3	7.25	7.27	-0.3	0.1	7.26	7.29	-0.4
Total Suspended Solids (mg/L)	1	*<1.0*	*<1.0*		*<1.0*	*<1.0*		1	*<1.0*	*<1.0*	
Total Dissolved Solids (mg/L)	3	20.1	18.9	6.2	24.6	24.6	0.0	3	29.5	32.0	-8.1
Turbidity (NTU)	0.1	0.25	0.27	-7.7	0.26	0.26	0	0.1	0.22	0.23	-4.4
Anions and Nutrients (mg/L)											
Alkalinity, Bicarbonate (as $CaCO_3$)	1	7	6	6	11	11	-0.9	1	14	14	-1.4
Alkalinity, Carbonate (as $CaCO_3$)	1	*<1.0*	*<1.0*		*<1.0*	*<1.0*		1	*<1.0*	*<1.0*	
Alkalinity, Hydroxide (as CaCO3)	1	*<1.0*	*<1.0*		*<1.0*	*<1.0*		1	*<1.0*	*<1.0*	
Alkalinity, Total (as $CaCO_3$)	1	7	6	6	11	11	-0.9	1	14	14	-1.4
Ammonia, Total (as N)	0.005	*<0.0050*	*<0.0050*		-			0.005	0.0150	0.0125	18.2
Bromide (Br)	0.05	*<0.050*	*<0.050*		*<0.050*	*<0.050*		0.05	*<0.050*	*<0.050*	
Chloride (Cl)	0.1	0.72	0.71	1	0.82	0.82	0	0.1	0.88	0.89	-1.1
Fluoride (F)	0.02	0.066	0.065	2	0.069	0.069	0.0	0.02	0.052	0.052	0.0
Nitrate (as N)	0.005	0.0373	0.0387	-3.7	*<0.0050*	*<0.0050*		0.005	0.0380	0.0389	-2.3
Nitrite (as N)	0.001	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		0.001	0.0013	*<0.0010*	
Total Kjeldahl Nitrogen	0.05	0.12	0.11	6.0	-			0.05	0.14	0.15	-2.8
Orthophosphate-Dissolved (as P)	0.001	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		0.001	*<0.0010*	*<0.0010*	
Phosphorus (P)-Total Dissolved	0.002	*<0.0020*	*<0.0020*		*<0.0020*	*<0.0020*		0.002	*<0.0020*	*<0.0020*	
Phosphorus (P)-Total	0.002	*<0.0020*	0.003		-			0.002	0.002	0.0021	-4.9
Silicate (as SiO_2)	0.5	*<0.50*	*<0.50*		*<0.50*	*<0.50*		0.5	0.68	0.7	-2.9
Sulfate (SO_4)	0.3	4.57	4.56	0.2	4.33	4.33	0.0	0.3	5.13	5.13	0.0
Cyanides (mg/L)											
Total Cyanide	0.001	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		0.001	*<0.0010*	*<0.0010*	
Free Cyanide	0.001	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		0.001	*<0.0010*	*<0.0010*	
Organic / Inorganic Carbon (mg/L)											
Dissolved Organic Carbon	1	1.45	1.30	10.9	-			0.5	1.67	2.06	-20.9
Total Organic Carbon	1	1.41	1.23	13.6	-			0.5	1.58	2.03	-24.9
Plant Pigments (µg/L)											
Chlorophyll-a	0.01	0.639	0.636	0.5	0.772	0.682	12.4	0.01	0.817	0.766	6.4
Total Metals (mg/L)											
Aluminum	0.003	0.0076	0.0063	19	0.0076	0.0098	-25	0.003	0.006	0.0055	8.7
Antimony	0.0001	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		0.0001	*<0.00010*	*<0.00010*	
Arsenic	0.0001	0.00019	0.00019	0.0	0.00026	0.00027	-4	0.0001	0.00024	0.00026	-8.0
Barium	0.00005	0.00309	0.00315	-1.9	0.00269	0.00262	2.6	0.00005	0.00233	0.00225	3.5
Beryllium	0.00002	*<0.000020*	*<0.000020*		*<0.000020*	*<0.000020*		0.00002	*<0.000020*	*<0.000020*	
Bismuth	0.00005	*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*		0.00005	*<0.000050*	*<0.000050*	
Boron	0.01	*<0.010*	*<0.010*		*<0.010*	*<0.010*		0.01	*<0.010*	*<0.010*	
Cadmium	0.000005	*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*		0.000005	*<0.0000050*	*<0.0000050*	
Calcium	0.05	2.19	2.21	-0.9	3.64	3.69	-1.4	0.05	5.14	5.04	2.0
Chromium	0.0001	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		0.0001	*<0.00010*	*<0.00010*	
Cobalt	0.0001	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		0.0001	*<0.00010*	*<0.00010*	
Copper	0.0005	*<0.00050*	*<0.00050*		0.00063	0.00074	-16.1	0.0005	0.00089	0.00082	8.2
Iron	0.01	*<0.010*	*<0.010*		0.023	0.017	30.0	0.01	0.01	0.011	-9.5
Lead	0.00005	*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*		0.00005	0.000071	*<0.000050*	
Lithium	0.001	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		0.001	*<0.0010*	*<0.0010*	
Magnesium	0.1	0.86	0.86	0.0	1.14	1.15	-0.9	0.1	1.35	1.37	-1.5
Manganese	0.0001	0.00152	0.00142	6.8	0.00167	0.00189	-12.4	0.0001	0.00161	0.00155	3.8
Mercury	0.000005	*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*		0.000005	*<0.0000050*	*<0.0000050*	
Molybdenum	0.00005	0.000173	0.000181	-4.5	0.000179	0.000179	0.0	0.00005	0.000369	0.000359	2.7
Nickel	0.0005	*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*		0.0005	*<0.00050*	*<0.00050*	
Phosphorus	0.05	*<0.050*	*<0.050*		*<0.050*	*<0.050*		0.05	*<0.050*	*<0.050*	
Potassium	0.1	0.55	0.52	5.6	0.53	0.50	6	0.1	0.50	0.51	-2.0
Selenium	0.00005	*<0.000050*	0.000058		*<0.000050*	*<0.000050*		0.00005	*<0.000050*	*<0.000050*	
Silicon	0.05	0.070	0.077	-9.5	0.206	0.204	1.0	0.05	0.287	0.347	-18.9
Silver	0.00001	*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		0.00001	*<0.000010*	*<0.000010*	
Sodium	0.05	1.21	1.25	-3.3	0.91	0.92	-1.1	0.05	0.64	0.64	1.3
Strontium	0.0002	0.0102	0.0103	-1.0	0.0178	0.0177	0.6	0.0002	0.0249	0.0248	0.4
Sulfur	0.5	1.55	1.54	0.6	1.53	1.51	1.3	0.5	1.70	1.61	5.4
Thallium	0.00001	*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		0.00001	*<0.000010*	*<0.000010*	
Tin	0.0001	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		0.0001	*<0.00010*	*<0.00010*	
Titanium	0.0003	*<0.00030*	*<0.00030*		*<0.00030*	*<0.00030*		0.0003	*<0.00030*	*<0.00030*	
Uranium	0.00001	0.000035	0.000036	-2.8	0.000046	0.000046	0	0.00001	0.000058	0.000056	3.5
Vanadium	0.0005	*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*		0.0005	*<0.00050*	*<0.00050*	
Zinc	0.003	*<0.0030*	*<0.0030*		*<0.0030*	*<0.0030*		0.003	*<0.0030*	*<0.0030*	
Zirconium	0.0003	*<0.00030*	*<0.00030*		*<0.00030*	*<0.00030*		0.0003	*<0.00030*	*<0.00030*	
Dissolved Metals (mg/L)											
Aluminum	0.001	0.0021	0.0023	-9	0.0020	0.0026	-26	0.001	0.0019	*<0.0010*	
Antimony	0.0001	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		0.0001	*<0.00010*	*<0.00010*	
Arsenic	0.0001	0.00014	0.00015	-7	0.00022	0.00024	-8.7	0.0001	0.00028	0.00026	7.4
Barium	0.00005	0.00312	0.00306	1.9	0.00255	0.00249	2.4	0.00005	0.00270	0.00251	7.3
Beryllium	0.00002	*<0.000020*	*<0.000020*		*<0.000020*	*<0.000020*		0.00002	*<0.000020*	*<0.000020*	
Bismuth	0.00005	*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*		0.00005	*<0.000050*	*<0.000050*	
Boron	0.01	*<0.010*	*<0.010*		*<0.010*	*<0.010*		0.01	*<0.010*	*<0.010*	
Cadmium	0.000005	*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*		0.000005	*<0.0000050*	*<0.0000050*	
Calcium	0.05	2.03	2.06	-1.5	3.49	3.60	-3.1	0.05	5.27	5.15	2.3
Chromium	0.0001	*<0.00010*	0.00029		*<0.00010*	*<0.00010*		0.0001	*<0.00010*	*<0.00010*	
Cobalt	0.0001	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		0.0001	*<0.00010*	*<0.00010*	
Copper	0.0002	0.00031	0.00033	-6	0.00054	0.00055	-2	0.0002	0.00072	0.00070	2.8
Iron	0.01	*<0.010*	*<0.010*		*<0.010*	*<0.010*		0.01	*<0.010*	*<0.010*	
Lead	0.00005	*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*		0.00005	*<0.000050*	*<0.000050*	
Lithium	0.001	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		0.001	*<0.0010*	*<0.0010*	
Magnesium	0.1	0.80	0.83	-3.7	1.07	1.11	-3.7	0.1	1.37	1.37	0.0
Manganese	0.0001	0.00043	0.00048	-11	0.00035	0.00035	0	0.0001	0.00097	0.00051	**62.2**
Mercury	0.000005	*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*		0.000005	*<0.0000050*	*<0.0000050*	
Molybdenum	0.00005	0.000163	0.000152	7.0	0.000171	0.000167	2.4	0.00005	0.000326	0.000320	1.9
Nickel	0.0005	*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*		0.0005	*<0.00050*	*<0.00050*	
Phosphorus	0.05	*<0.050*	*<0.050*		*<0.050*	*<0.050*		0.05	*<0.050*	*<0.050*	
Potassium	0.1	0.43	0.44	-2	0.43	0.47	-8.9	0.1	0.51	0.51	0.0
Selenium	0.00005	*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*		0.00005	*<0.000050*	*<0.000050*	
Silicon	0.05	*<0.050*	*<0.050*		0.149	0.158	-5.9	0.05	0.267	0.256	4.2
Silver	0.00001	*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		0.00001	*<0.000010*	*<0.000010*	
Sodium	0.05	1.16	1.15	0.9	0.85	0.85	0.1	0.05	0.67	0.65	2.1
Strontium	0.0002	0.0103	0.00972	5.8	0.0170	0.01700	0.0	0.0002	0.0275	0.02590	6.0
Sulfur	0.5	1.60	1.56	2.5	1.53	1.55	-1.3	0.5	1.72	1.54	11.0
Thallium	0.00001	*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		0.00001	*<0.000010*	*<0.000010*	
Tin	0.0001	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		0.0001	*<0.00010*	*<0.00010*	
Titanium	0.0003	*<0.00030*	*<0.00030*		*<0.00030*	*<0.00030*		0.0003	*<0.00030*	*<0.00030*	
Uranium	0.00001	0.000030	0.000029	3.4	0.000038	0.000037	3	0.00001	0.000052	0.000048	8.0
Vanadium	0.0005	*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*		0.0005	*<0.00050*	*<0.00050*	
Zinc	0.001	*<0.0010*	0.0012		*<0.0010*	*<0.0010*		0.001	*<0.0010*	*<0.0010*	
Zirconium	0.0003	*<0.00030*	*<0.00030*		*<0.00030*	*<0.00030*		0.0003	*<0.00030*	*<0.00030*	

Notes:

RPD = Relative Percent Difference (%) = ((original - duplicate) / (original + duplicate)/2) x 100.

RPDs are calculated when both samples are above detection.

The data quality objective (DQO) for field duplicates is an RPD < 50%.

Bolded RPDs	RPD values exceed 50% but < 10 x MDL.
Shaded RPD	RPD values exceed 50% and > 10 x MDL.

\- = no measurement

Italicized numbers are below detection limits.

Table 3.1–4. QA/QC data for metals analysis of sediment grab samples, Meadowbank study lakes and Baker Lake, 2016.

Analyte	Laboratory DQOs[1,2]	MDLs (mg/kg)	Field Duplicates[3]															
			Second Portage			Third Portage - East Basin			Pipedream			Baker Lake - East Shore			Baker Lake - Proposed Jetty		
			SP-2	DUP-1	RPD	TPE-1	DUP-2	RPD	PDL-5	DUP-3	RPD	BES-4	DUP-4	RPD	BPJ-4	DUP-5	RPD
			3-Aug-16		(%)	4-Aug-16		(%)	6-Aug-16		(%)	8-Aug-16		(%)	9-Aug-16		(%)
Physical & Organic Parameters																	
Moisture (%)	20	*0.25*	84.4	84.1	0.4	82.9	81.9	1.2	78.8	77.1	2.2	35.9	32.0	11	42.3	42.6	-0.7
pH	0.30	*0.10*	6.29	6.19	2	5.98	5.85	2.2	5.69	5.78	-1.6	7.59	7.42	2.3	6.41	6.42	-0.2
Total Organic Carbon (% dw)	30	*0.10*	3.91	3.78	3.4	3.25	3.23	0.6	2.08	2.10	-1	0.29	0.32	-7.9	0.48	0.47	1.3
Particle Size																	
% Gravel (>2mm)	5	*0.10*	*<0.10*	*<0.10*		*<0.10*	*<0.10*		*<0.10*	*<0.10*		*<0.10*	*<0.10*		*<0.10*	*<0.10*	
% Sand (2.00mm - 0.063mm)	5	*0.10*	1.57	3.01	-63	5.8	6.0	-3	6.6	13.3	-67.3	77.8	76.3	1.9	17.90	18.20	-2
% Silt (0.063mm - 4µm)	5	*0.10*	72.5	71.3	1.7	65.4	65.0	1	77.8	68.9	12.1	19.7	20.6	-4	67.6	67.0	0.9
% Clay (<4µm)	5	*0.10*	25.9	25.7	0.8	28.9	29.1	-1	15.6	17.8	-13.2	2.5	3.1	-20	14.5	14.8	-2.0
Total Metals (mg/kg dw)																	
Aluminum	40	*50*	26000	24500	5.9	25600	27300	-6.4	21100	20000	5.4	5270	4540	15	7380	9590	-26.0
Antimony	30	*0.10*	0.28	0.26	7	0.22	0.22	0	0.20	0.19	5	0.12	0.11	8.7	0.16	0.13	20.7
Arsenic	30	*0.100*	29.1	27.7	4.9	20.0	20.2	-1.0	22.8	21.1	7.7	2.9	2.8	3.5	5.5	10.8	-65.2
Barium	40	*0.50*	127	116	9	111	111	0	95	83	13.8	146	119	20.4	114	89	25.0
Beryllium	30	*0.10*	2.00	1.91	4.6	1.86	1.92	-3.2	1.09	1.06	3	0.29	0.27	7.1	0.36	0.44	-20.0
Bismuth	30	*0.20*	2.32	2.25	3.1	2.61	2.69	-3.0	0.93	0.94	-1.07	*<0.20*	*<0.20*		*<0.20*	0.24	
Boron	30	*5.00*	8.10	7.00		7.30	7.80		7.20	5.70		5.60	*<5.0*		6.80	7.70	
Cadmium	30	*0.020*	0.234	0.233	0	0.123	0.132	-7.1	0.115	0.105	9	0.029	0.026	11	0.057	0.059	-3.4
Calcium	30	*50*	2540	2380	6.5	2080	2100	-1.0	2090	1870	11.1	2040	1820	11.4	2400	2620	-9
Chromium	30	*0.50*	90.7	86.4	4.9	127	129	-2	139.0	129.0	7.5	16.3	15.7	3.8	17.5	22	-21.0
Cobalt	30	*0.10*	15.4	14.7	4.7	16.1	15.9	1.3	13.7	12.8	6.8	4.0	3.9	3.6	5.8	6.8	-15.9
Copper	30	*0.50*	70.3	67.1	4.7	59.1	58.8	0.5	45.5	42.8	6.1	3.7	3.8	-1.1	8.0	9.6	-18.3
Iron	30	*50*	65800	62800	4.7	47400	47200	0.4	36600	34400	6.2	11700	11100	5	14600	18600	-24.1
Lead	40	*0.50*	22.7	22.0	3.1	22.6	23.6	-4.3	14.6	14.4	1.4	4.0	4.0	0.3	7.8	10.1	-26.3
Lithium	30	*2.0*	45.8	45.4	1	54.0	56.2	-4	29.4	30.1	-2	7.8	7.9	-1	10.9	13.2	-19
Magnesium	30	*20*	10000	9590	4.2	10700	11100	-3.7	10700	10400	2.8	3280	3140	4.4	4340	5180	-17.6
Manganese	30	*1.0*	3140	2970	5.6	1250	1220	2.4	367	345	6.2	437	417	5	287	558	-64.1
Mercury	40	*0.0050*	0.0346	0.0337	3	0.0235	0.0203	14.6	0.0098	0.0093	5	0.0052	0.0050	4	0.0087	0.0084	3.5
Molybdenum	40	*0.10*	6.23	5.97	4.3	4.53	4.40	2.9	2.93	2.80	4.5	0.41	0.43	-4.8	0.97	1.02	-5.0
Nickel	30	*0.50*	69.3	65.7	5.3	67.3	69.3	-2.9	82.9	77.9	6.2	9.9	9.54	3.9	11.4	13	-16.1
Phosphorus	30	*50*	561	512	9.1	458	451	1.5	552	518	6.4	620	596	3.9	860	967	-12
Potassium	40	*100*	4400	4150	5.8	4620	4720	-2.1	2960	2650	11.1	1180	960	21	1480	1810	-20
Selenium	30	*0.20*	0.61	0.59	3.3	0.47	0.50	-6.2	0.30	0.27	10.53	*<0.20*	*<0.20*		*<0.20*	*<0.20*	
Silver	40	*0.10*	0.19	0.18	5.41	*<0.10*	*<0.10*		*<0.10*	*<0.10*		*<0.10*	*<0.10*		*<0.10*	*<0.10*	
Sodium	40	*50*	196	182	7.4	174	180	-3.4	154	100	42.5	101	81	22	134	214	-46
Strontium	40	*0.50*	21.1	19.5	7.9	17.3	17.8	-2.8	23.6	19.2	20.6	36.9	27.6	28.8	38.4	47.0	-20
Thallium	30	*0.050*	0.375	0.351	7	0.385	0.408	-5.8	0.189	0.180	5	*<0.050*	*<0.050*		0.076	0.082	-7.6
Tin	40	*2.0*	*<2.0*	*<2.0*		*<2.0*	*<2.0*		*<2.0*	*<2.0*		*<2.0*	*<2.0*		*<2.0*	*<2.0*	
Titanium	40	*1.0*	733	666	10	880	852	3.2	572	474	18.7	325	225	36	343	387	-12
Uranium	30	*0.050*	20.1	19.4	3.5	19.3	20.8	-7.5	8.9	8.9	-0.6	1.0	1.2	-16.5	2.2	2.2	-0.5
Vanadium	30	*0.20*	40.3	38.7	4.1	45.5	46.5	-2.2	39.1	36.1	8.0	17.6	16.3	8	23.7	25.6	-7.7
Zinc	30	*2.0*	109.0	105.0	3.7	106.0	105.0	0.9	81.6	75.8	7.4	19.6	18.7	5	30.0	36.1	-18.5
Zirconium	30	*1.0*	2.7	2.7		4.1	4.3		1.8	2.0		2.8	2.3		4.8	7.3	

Notes:

[1] Laboratory data quality objectives (DQOs) for moisture, TOC, and metals are expressed as the relative percent difference (RPD) .

[2] The laboratory DQOs for pH and particle size are the absolute difference between the original sample and laboratory duplicate.

[3] The DQO for field duplicates is an RPD of < 50%.

RPD (%) = ((original - duplicate) / (original + duplicate)/2) x 100.

RPDs have not been calculated for cases where one of the samples is below detection and the other is not and in cases where both are below detection. RPD has been left blank.

Bold RPDs	values exceed the DQOs, but concentrations are < 10 x MDL.
Shaded RPDs	values exceed the DQOs, and concentrations are > 10 x MDL.
Bold Filter Swipe	value is > MDL, but < 10 x MDL.
Shaded Filter Swipe	value > 10x MDL.

Field Dup' samples are homogenization duplicates - the original and duplicate samples were split from the same homogenized bowl of sediment.

Italicized numbers are below detection limits.

Table 3.1–4. QA/QC data for metals analysis of sediment grab samples, Meadowbank study lakes and Baker Lake, 2016.

Analyte	Laboratory DQOs[1,2]	MDLs (mg/kg)	Laboratory Duplicates: Various Samples Original August	Laboratory Duplicate	RPD (%)	Various Samples Original August	Laboratory Duplicate	RPD (%)	Various Samples Original August	Laboratory Duplicate	RPD (%)	Various Samples Original August	Laboratory Duplicate	RPD (%)
Physical & Organic Parameters														
Moisture (%)	20	*0.25*	24.1	24.9	-3.3	84.4	82.9	1.8	48	48.8	-1.7	84.4	84.2	0.2
pH	0.30	*0.10*	5.85	5.85	0.0	6.67	6.67	0.0	5.97	5.98	0.01			
Total Organic Carbon (% dw)	30	*0.10*												
Particle Size														
% Gravel (>2mm)	5	*0.10*	3.98	3.98	0.00	*<0.10*	*<0.10*		*<0.10*	*<0.10*				
% Sand (2.00mm - 0.063mm)	5	*0.10*	49.9	51.20	1.3	7.08	7.46	0.4	40.6	40.5	0.1			
% Silt (0.063mm - 4µm)	5	*0.10*	24.8	24.1	1	77.2	80.1	2.9	50.9	51.1	0.2			
% Clay (<4µm)	5	*0.10*	21.4	20.8	0.6	15.7	12.5	3.2	8.44	8.36	0.1			
Total Metals (mg/kg dw)														
Aluminum	40	*50*	19600	18900	3.6	23400	24400	-4.2	4280	3760	12.9			
Antimony	30	*0.10*	0.2	0.21	-4.9	0.27	0.28	-3.6	*<0.10*	*<0.10*				
Arsenic	30	*0.100*	13.2	12.9	2	65.8	67	-1.8	3.12	2.78	11.5			
Barium	40	*0.50*	88.5	83	6.4	121	124	-2.4	44.2	34.6	24.4			
Beryllium	30	*0.10*	0.96	0.91	5.3	2.09	2.13	-1.9	0.19	0.17	11.1			
Bismuth	30	*0.20*	0.84	0.83	1.2	2.27	2.32	-2.2	*<0.20*	*<0.20*				
Boron	30	*5.00*	7.2	6.4	11.8	6.4	7.8	-19.7	*<5.0*	*<5.0*				
Cadmium	30	*0.020*	0.1	0.097	3.0	0.291	0.294	-1.0	0.022	*<0.020*				
Calcium	30	*50*	2260	2130	5.9	2290	2360	-3.0	1290	1060	19.6			
Chromium	30	*0.50*	129	124	4.0	78.2	79.6	-1.8	9.43	7.45	23.5			
Cobalt	30	*0.10*	11.7	11.4	2.6	14.6	14.7	-0.7	3.28	2.82	15.1			
Copper	30	*0.50*	41.8	40.3	3.7	76.1	75.7	0.5	3.65	2.96	20.9			
Iron	30	*50*	29400	28600	2.8	85100	85900	-0.9	9040	8070	11.3			
Lead	40	*0.50*	13.4	12.9	3.8	21.7	22	-1.4	3.55	3.04	15.5			
Lithium	30	*2.0*	28.2	27.4	3	42.1	43.1	-2.3	7.2	6.3	13.3			
Magnesium	30	*20*	10100	9910	1.9	8680	8890	-2.4	3000	2530	17.0			
Manganese	30	*1.0*	298	290	2.7	1360	1370	-0.7	140	121	14.6			
Mercury	40	*0.0050*	0.0101	0.01	1.0	0.0289	0.0289	0.0	*<0.0050*	*<0.0050*				
Molybdenum	40	*0.10*	2.33	2.23	4.4	11.1	11.2	-0.9	0.27	0.26	4			
Nickel	30	*0.50*	76.1	73.8	3.1	59.4	60	-1.0	6.54	5.6	15.5			
Phosphorus	30	*50*	444	424	4.6	639	667	-4.3	406	331	20.4			
Potassium	40	*100*	2900	2730	6.0	4060	4320	-6.2	670	580	14.4			
Selenium	30	*0.20*	0.24	0.22	8.7	0.78	0.77	1.3	*<0.20*	*<0.20*				
Silver	40	*0.10*	*<0.10*	*<0.10*		0.19	0.2	-5.1	*<0.10*	*<0.10*				
Sodium	40	*50*	138	148	-7	183	214	-15.6	57	60	-5			
Strontium	40	*0.50*	25.1	23.3	7.4	19.3	20.3	-5.1	23.6	20.5	14.1			
Thallium	30	*0.050*	0.187	0.18	3.8	0.364	0.367	-0.8	*<0.050*	*<0.050*				
Tin	40	*2.0*	*<2.0*	*<2.0*		*<2.0*	*<2.0*		*<2.0*	*<2.0*				
Titanium	40	*1.0*	588	532	10.0	595	690	-14.8	196	157	22.1			
Uranium	30	*0.050*	8.29	8.08	2.6	20.6	21.4	-3.8	0.67	0.617	8.2			
Vanadium	30	*0.20*	36.6	35.1	4	38.1	39.2	-2.8	11.6	10	14.8			
Zinc	30	*2.0*	75.1	73.2	2.6	117	119	-1.7	17.7	15.4	13.9			
Zirconium	30	*1.0*	2.1	2.2	-4.7	2.8	2.3	19.6	2.8	2.5				

Analyte	Swipe MDLs (mg)	Equipment Swipes: SWIPE-1 FILTER 5-Aug-16	SWIPE-2 FILTER 5-Aug-16	SWIPE-3 FILTER 7-Aug-16	SWIPE-4 FILTER 8-Aug-16	SWIPE-5 FILTER 9-Aug-16
		TOTAL METALS (mg)				
Aluminum	0.010	*<0.020*	*<0.020*	*<0.020*	*<0.020*	*<0.020*
Antimony	0.010	*<0.020*	*<0.020*	*<0.020*	*<0.020*	*<0.020*
Arsenic	0.010	*<0.020*	*<0.020*	*<0.020*	*<0.020*	*<0.020*
Barium	0.00050	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	**0.00120**
Beryllium	0.00030	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Bismuth	0.010	*<0.020*	*<0.020*	*<0.020*	*<0.020*	*<0.020*
Boron						
Cadmium	0.00050	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Calcium	0.050	*<0.20*	*<0.20*	*<0.20*	*<0.20*	*<0.20*
Chromium	0.0010	**0.0037**	**0.0024**	**0.0043**	**0.0028**	**0.0045**
Cobalt	0.00050	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Copper	0.00050	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Iron	0.0020	0.0290	0.0270	0.0330	0.0250	0.0380
Lead	0.0030	*<0.0040*	*<0.0040*	*<0.0040*	*<0.0040*	*<0.0040*
Lithium	0.00050	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Magnesium	0.0050	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*
Manganese	0.00030	**0.00056**	*<0.00050*	**0.00055**	*<0.00050*	**0.00102**
Mercury						
Molybdenum	0.0020	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*
Nickel	0.0030	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*
Phosphorus	0.020	*<0.030*	*<0.030*	*<0.030*	*<0.030*	*<0.030*
Potassium	0.10	*<0.20*	*<0.20*	*<0.20*	*<0.20*	*<0.20*
Selenium	0.010	*<0.020*	*<0.020*	*<0.020*	*<0.020*	*<0.020*
Silver	0.00050	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Sodium	0.10	*<0.40*	*<0.40*	*<0.40*	*<0.40*	*<0.40*
Strontium	0.00030	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Thallium	0.010	*<0.020*	*<0.020*	*<0.020*	*<0.020*	*<0.020*
Tin	0.0020	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*
Titanium	0.00050	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Uranium						
Vanadium	0.0020	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*
Zinc	0.00030	0.00332	0.00371	**0.00053**	**0.00083**	**0.00163**
Zirconium						

Notes:

1 Laboratory data quality objectives (DQOs) for moisture, TOC, and metals are expressed as the relative percent difference (RPD) .

2 The laboratory DQOs for pH and particle size are the absolute difference between the original sample and laboratory duplicate.

3 The DQO for field duplicates is an RPD of < 50%.

RPD (%) = ((original - duplicate) / (original + duplicate)/2) x 100.

RPDs have not been calculated for cases where one of the samples is below detection and the other is not and in cases where both are below detection. RPD has been left blank.

Bold RPDs values exceed the DQOs, but concentrations are < 10 x MDL.

Shaded RPDs values exceed the DQOs, and concentrations are > 10 x MDL.

Bold Filter Swipe value is > MDL, but < 10 x MDL.

Shaded Filter Swipe value > 10x MDL.

Field Dup' samples are homogenization duplicates - the original and duplicate samples were split from the same homogenized bowl of sediment.

Italicized numbers are below detection limits.

Table 3.1–5. QA/QC data for hydrocarbon and PAH analysis of sediment grab samples, Meadowbank study lakes and Baker Lake, 2016.

			Field Duplicates[3] Inuggugayualik Lake			Laboratory Duplicates Various Lakes		
Analyte	Laboratory DQOs[1,2]	MDLs	INUG	COMP DUP-1	RPD (%)	Original August	Laboratory Duplicate	RPD (%)
Physical Parameters								
Moisture (%)		*0.25*	84.6	82.9	2.0			
Aggregate Organics (mg/kg)								
Mineral Oil and Grease		*500*	600.0	*<500*		*<500*	*<500*	
Hydrocarbons (mg/kg)								
EPH10-19	40	*200*	*<560*	*<520*		*<200*	*<200*	
EPH19-32	40	*200*	*<560*	*<520*		*<200*	*<200*	
LEPH		*200*	*<560*	*<520*				
HEPH		*200*	*<560*	*<520*				
Polycyclic Aromatic Hydrocarbons (mg/kg)								
Acenaphthene	50	*0.0050*	*<0.020*	*<0.0050*		*<0.0050*	*<0.0050*	
Acenaphthylene	50	*0.0050*	*<0.020*	*<0.0050*		*<0.0050*	*<0.0050*	
Anthracene	50	*0.0040*	*<0.020*	*<0.0040*		*<0.0040*	*<0.0040*	
Benzo(a)anthracene	50	*0.010*	*<0.020*	*<0.010*		*<0.010*	*<0.010*	
Benzo(a)pyrene	50	*0.010*	*<0.020*	*<0.010*		*<0.010*	*<0.010*	
Benzo(b)fluoranthene	50	*0.010*	*<0.020*	*<0.010*		*<0.010*	*<0.010*	
Benzo(b+j+k)fluoranthene	50	*0.015*	*<0.028*	*<0.015*		*<0.010*	*<0.010*	
Benzo(g,h,i)perylene	50	*0.010*	*<0.020*	*<0.010*		*<0.010*	*<0.010*	
Benzo(k)fluoranthene	50	*0.010*	*<0.020*	*<0.010*		*<0.010*	*<0.010*	
Chrysene	50	*0.010*	*<0.020*	*<0.010*		*<0.0050*	*<0.0050*	
Dibenz(a,h)anthracene	50	*0.0050*	*<0.020*	*<0.0050*		*<0.010*	*<0.010*	
Fluoranthene	50	*0.010*	*<0.020*	*<0.010*		*<0.010*	*<0.010*	
Fluorene	50	*0.010*	*<0.020*	*<0.010*		*<0.010*	*<0.010*	
Indeno(1,2,3-c,d)pyrene	50	*0.010*	*<0.020*	*<0.010*		*<0.010*	*<0.010*	
2-Methylnaphthalene	50	*0.010*	*<0.020*	*<0.010*		*<0.010*	*<0.010*	
Naphthalene	50	*0.010*	*<0.020*	*<0.010*		*<0.010*	*<0.010*	
Phenanthrene	50	*0.010*	0.0290	*<0.010*		*<0.010*	*<0.010*	
Pyrene	50	*0.010*	*<0.020*	*<0.010*				
d10-Acenaphthene (%)	50		82.3	94.8	-14.1			
d12-Chrysene (%)	50		94.1	90.6	3.8			
d8-Naphthalene (%)	50		75.9	90.9	-18.0			
d10-Phenanthrene (%)	50		88.5	91.0	-2.8			
B(a)P Total Potency Equivalent	50	*0.020*	*<0.024*	*<0.020*				
IACR (CCME)	50	*0.15*	*<0.24*	*<0.15*				

Notes:

[1] Laboratory data quality objectives are expressed as the relative percent difference (RPD).

[2] Laboratory duplicate analyses were not completed for Mineral Oil and Grease, LEPHs, or HEPHs.

[3] The DQO for field duplicates is an RPD of < 50%.

RPD (%) = ((original - duplicate) / (original + duplicate)/2) x 100.

RPDs have not been calculated for cases where one of the samples is below detection and the other is not and in cases where both are below detection. RPD has been left blank.

Bold RPDs values exceed the DQOs, but concentrations are < 10 x MDL.

Shaded RPDs values exceed the DQOs, and concentrations are > 10 x MDL.

Field Dup' samples are homogenization duplicates - the original and duplicate samples were split from the same homogenized bowl of sediment.

Italicized numbers are below detection limits.

Table 3.1–6. Field QA/QC data for phytoplankton, Meadowbank study lakes and Baker Lake, 2016.

Sampling Event	Field QA	Phytoplankton Biomass (mg/m^3)							Taxa Richness
		Cyanophyte	Chlorophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	**Total**	
April	TPE-91	0	0	18	1	5.2	0	24	14
	DUP - 1	0	1.3	17	2.4	8.8	0	30	16
	RPD (%)		-111	4	-124	-52		-21	-13
April	TPS-55	0	1.1	36	2.0	13	11	63	17
	DUP - 2	0	2.8	28	1.9	9.0	11	53	19
	RPD (%)	NA	-87	25.4	2	36	-2	17	-11.1
July	TPE-92	0	7.6	90	14	7.7	17	136	31
	DUP - 1	0	4.3	80	8.8	2.2	11	106	34
	RPD (%)	NA	56	12	45	111	46	25	-9.2
July	TPN-92	0	2.1	147	8.7	18	69	245	34
	DUP - 2	0	1.5	133	8.4	15	34	192	32
	RPD (%)		34	10	3	17	68	24	6.1
August	TPN-95	0	0	90	22	26	32	171	26
	DUP - 1	0	1.2	167	15	15	11	210	34
	RPD (%)		-112	-59	37	53	96	-20	-27
August	BBD-45	0	5.1	145	48	34	3.1	235	37
	DUP - 2	2.5	6.2	170	30	52	9.5	270	43
	RPD (%)	NA	-19	-16	46	-44	-101	-14	-15.0
September	TPN-96	0	3.6	173	24	6.6	14	221	32
	DUP - 1	0	5.1	183	11	15	38	252	36
	RPD (%)		-35	-6	76.6	-76	-91	-13.2	-11.8
September	SP-97	1	14	197	22	21	25	279	40
	DUP - 2	0	9.5	172	15	17	17	231	38
	RPD (%)	17	36	14	36	23	38	19	5.1
November	WAL-67	0	3.6	41	6.9	4.2	2.3	58	18
	DUP - 1	0	1.5	47	6.0	5.6	2.4	62	21
	RPD (%)		80	-14	14	-28	-4	-8.0	-15.4

Notes:

RPD = Relative Percent Difference (%) = ((original - duplicate) / (original + duplicate)/2) x 100.

Bolded RPD values exceed 50%.

RPDs have not been calculated for cases where one or both of the samples is "0".

Table 3.1–6. Field QA/QC data for phytoplankton, Meadowbank study lakes and Baker Lake, 2016.

Sampling Event	Field QA	Phytoplankton Density (cells/L)							Simpson's Diversity
		Cyanophyte	Chlorophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	**Total**	
April	TPE-91	0	28,369	393,617	15,284	26,023	0	463,293	0.77
	DUP - 1	0	60,284	390,071	17,931	47,499	0	515,785	0.79
	RPD (%)		-72	1	-15.9	-58		-11	-3.6
April	TPS-55	0	117,021	680,851	108,083	79,014	1,100	986,070	0.78
	DUP - 2	400	110,629	634,752	113,575	56,938	1,200	917,494	0.79
	RPD (%)	NA	6	7	-5	32	-8.7	7.2	-1.5
July	TPE-92	400	122,528	1,415,448	189,384	38,720	29,736	1,796,216	0.74
	DUP - 1	0	129,712	1,106,336	205,152	8,184	2,000	1,451,384	0.77
	RPD (%)	NA	-6	25	-8	130	175	21	-4.8
July	TPN-92	0	237,272	1,423,232	147,880	98,592	60,888	1,967,864	0.82
	DUP - 2	0	36,920	1,504,256	224,504	146,880	8,000	1,920,560	0.78
	RPD (%)		146	-6	-41	-39	154	2.4	4.8
August	TPN-95	0	21,552	1,243,632	332,464	167,432	25,952	1,791,032	0.81
	DUP - 1	0	72,040	1,626,184	450,608	104,176	16,968	2,269,976	0.81
	RPD (%)		-108	-27	-30.2	47	42	-23.6	-0.1
August	BBD-45	0	222,904	1,593,864	227,400	212,936	200	2,257,304	0.90
	DUP - 2	57,472	186,984	1,538,992	182,544	326,280	1,800	2,294,072	0.89
	RPD (%)	NA	18	4	22	-42.0	-160	-1.6	0.7
September	TPN-96	0	136,896	1,356,192	618,640	52,088	2,200	2,166,016	0.83
	DUP - 1	0	231,088	1,449,184	433,856	96,392	5,400	2,215,920	0.86
	RPD (%)		-51	-6.6	35	-60	-84	-2.3	-3.1
September	SP-97	2,200	431,240	2,407,040	548,400	127,728	11,384	3,527,992	0.87
	DUP - 2	1,800	231,088	1,905,560	354,032	98,392	30,536	2,621,408	0.87
	RPD (%)	20	60	23	43	26	-91	29	-0.6
November	WAL-67	0	74,668	419,040	178,213	19,331	100	691,351	0.75
	DUP - 1	0	39,407	454,101	108,991	17,284	100	619,883	0.70
	RPD (%)		61.8	-8.0	48	11	0	11	7.1

Notes:

RPD = Relative Percent Difference (%) = ((original - duplicate) / (original + duplicate)/2) x 100.

Bolded RPD values exceed 50%.

RPDs have not been calculated for cases where one or both of the samples is "0".

Table 3.1–7. Laboratory QA/QC data for phytoplankton, Meadowbank study lakes and Baker Lake, 2016.

Sampling Event	Laboratory QA	Phytoplankton Biomass (mg/m^3)							Taxa Richness
		Cyanophyte	Chlorophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	**Total**	
April	INUG-79	0.02	0.49	24.76	0.44	6.0	0.92	32.58	17
	Lab Dup	0.00	0.80	22.91	0.87	7.4	2.1	34.02	16
	RPD (%)	NA	-47.5	7.8	-66.1	-21	-77	-4.3	6.1
April	TPN-90	0.00	0.28	22.56	1.0	15.46	6.3	45.58	13
	Lab Dup	0.00	0.31	21.31	1.4	10.59	6.5	40.10	14
	RPD (%)		-10.3	5.7	-31.8	37	-3.6	12.8	-7.4
July	TPE-93	0.07	1.1	45.34	5.4	4.8	14.22	70.93	24
	Lab Dup	0.00	1.0	39.72	4.2	3.1	13.33	61.40	25
	RPD (%)	NA	9.2	13	25	42	6.5	14	-4.1
July	TPN-92	0.00	2.1	147.17	8.7	18.10	68.51	244.58	34
	Lab Dup	0.00	1.7	154.34	8.6	21.43	64.81	250.86	32
	RPD (%)		23	-4.8	1	-17	5.6	-2.5	6.1
August	PDL-47	5.4	6.5	91.11	15.19	7.6	12.08	137.92	36
	Lab Dup	5.0	2.9	94.97	10.69	6.5	15.92	136.02	37
	RPD (%)	6.7	76	-4.2	34.8	16.2	-27	1.4	-2.7
August	BPJ-45	0.07	3.5	140.61	58.74	59.45	11.55	273.95	41
	Lab Dup	0.00	3.8	127.69	57.74	53.49	15.53	258.25	41
	RPD (%)	NA	-7	9.6	2	10.6	-29	5.9	0.0
September	BPJ-47	0.00	13.50	164.76	24.91	47.54	27.28	277.99	34
	Lab Dup	0.00	2.3	155.42	26.01	50.89	28.70	263.29	34
	RPD (%)		142	6	-4.3	-6.8	-5.1	5.4	0
September	TPE-97	0.86	23.06	59.38	18.79	12.95	6.9	121.90	31
	Lab Dup	1.5	17.72	57.01	18.66	14.48	5.0	114.36	30
	RPD (%)	-53	26	4.1	1	-11	31	6.4	3.3
November	SP-99	0.00	0.49	39.10	3.9	2.8	0.00	46.30	17
	Lab Dup	0.00	0.21	41.49	5.3	1.3	2.4	50.63	17
	RPD (%)		80	-5.9	-30	73	NA	-8.9	0.0

Notes:

RPD = Relative Percent Difference (%) = ((original - duplicate) / (original + duplicate)/2) x 100.

Bolded RPD values exceed 25%.

RPDs have not been calculated for cases where one or both of the samples is "0".

Table 3.1–7. Laboratory QA/QC data for phytoplankton, Meadowbank study lakes and Baker Lake, 2016.

Sampling Event	Laboratory QA	Phytoplankton Density (cells/L)						Total
		Cyanophyte	Chlorophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	
April	INUG-79	100	117,021	375,987	7,092	32,715	100	533,015
	Lab Dup	0	152,482	368,794	22,177	33,315	300	577,068
	RPD (%)	NA	-26	1.9	-103	-1.8	-100	-7.9
April	TPN-90	0	10,638	418,440	42,653	76,768	600	549,099
	Lab Dup	0	10,638	421,986	67,676	54,692	700	555,692
	RPD (%)		0.0	-0.8	-45	34	-15	-1.2
July	TPE-93	200	71,840	754,520	73,440	22,952	2,000	924,952
	Lab Dup	0	50,288	733,168	80,624	8,784	1,600	874,464
	RPD (%)	NA	35	2.9	-9.3	89.3	22	5.6
July	TPN-92	0	237,272	1,423,232	147,880	98,592	60,888	1,967,864
	Lab Dup	0	193,968	1,559,928	185,400	113,960	75,256	2,128,512
	RPD (%)		20	-9.2	-23	-14.5	-21	-7.8
August	PDL-47	54,704	94,192	867,880	167,048	43,704	29,336	1,256,864
	Lab Dup	41,336	65,056	939,120	107,976	43,504	29,736	1,226,728
	RPD (%)	28	37	-7.9	43.0	0.5	-1.4	2.4
August	BPJ-45	200	57,872	1,425,832	214,264	364,000	8,984	2,071,152
	Lab Dup	0	58,072	1,339,024	182,728	306,928	8,784	1,895,536
	RPD (%)	NA	-0.3	6.3	15.9	17.0	2	8.9
September	BPJ-47	0	266,608	1,718,392	120,072	360,600	23,352	2,489,024
	Lab Dup	0	122,528	1,580,896	129,056	388,736	30,536	2,251,752
	RPD (%)		74	8.3	-7	-8	-26.7	10.0
September	TPE-97	4,200	855,096	886,032	627,608	41,120	400	2,414,456
	Lab Dup	32,536	754,920	914,368	663,328	42,120	800	2,408,072
	RPD (%)	-154	12	-3	-5.5	-2	-67	0.3
November	SP-99	0	17,931	433,024	62,084	18,131	0	531,169
	Lab Dup	0	7,192	447,209	91,553	7,292	100	553,346
	RPD (%)		85	-3.2	-38	85	NA	-4.1

Notes:

RPD = Relative Percent Difference (%) = ((original - duplicate) / (original + duplicate)/2) x 100.

Bolded RPD values exceed 25%.

RPDs have not been calculated for cases where one or both of the samples is "0".

Table 3.1–8. Percent recovery of benthic invertebrate samples, Meadowbank study lakes and Baker Lake, August 2016

Area-Replicate	Number of Organisms Recovered	Number of Organisms in Re-sort	Percent Recovery
BES-4	126	129	97.7%
BPJ-5	147	149	98.7%
PDL-4	69	70	98.6%
SP-1	71	71	100%
WAL-5	644	644	100%
		Average % Recovery	99.0%

Notes:
All samples were sorted in their entirety.
Pupae were not counted toward total number of taxa unless they were the sole representative of their taxa group.

Immatures were not counted toward total number of taxa unless they were the sole representative of their taxa group.

3.2. Meadowbank Study Lakes

3.2.1. Limnology

3.2.1.1. General Observations

The ice-free season on the Meadowbank study lakes is very short. Ice break-up usually occurs during mid- to late-June; ice begins to form again on the lakes beginning in late September or early October, with complete ice cover by late October. Maximum ice thickness is about 2 m and occurs in March/April, increasing the concentration of some ions, such as chloride, in the water near the ice-water interface. This phenomenon is due to cryo-concentration where ice formation excludes certain ions and increases their concentration in the water column (Wetzel, 1983). Because the lakes are ice covered for most of the year, gas exchange with the atmosphere is limited, although oxygen concentrations usually remain high under the ice because of the low rates of biological activity and decomposition of organic material (processes that consume oxygen from the water). Historically, during winter there is typically a slight negative thermal stratification with near 0°C water near the ice-water interface, increasing to 3°C to 5 °C at depth.

During open water conditions, maximum water temperatures may reach 14°C in summer with little evidence of thermal stratification, except for brief periods of time (days) and typically only a 4°C to 5°C temperature difference. Winds blow near constantly and at high speeds, maintaining uniform temperature and high oxygen profiles in the water column in all lakes due to vertical mixing. This also ensures that the distribution of phytoplankton and to a lesser extent, zooplankton is vertically more uniform.

3.2.1.2. Temporal and Spatial Trend Interpretation

Temperature and Oxygen

Depth profiles for temperature, dissolved oxygen, and conductivity are conducted during each monitoring event. Limnology data, when compared to previous monitoring data, provides an initial assessment of whether conditions are changing within a sampling area that may require additional follow-up investigation. Water temperatures at a depth of 3 m are shown in **Figure 3.2–1** for the Meadowbank project lakes since 2006.

The 2016 vertical temperature profiles are characteristic of the typical thermal regime of these lakes (**Figure 3.2–2** through **Figure 3.2–10**). Winter temperature profiles for the through-ice events show a slight negative thermal stratification with water temperatures near 0°C at the ice-water interface, increasing to typically between 2°C and 3.5°C at depth. Oxygen concentrations in winter generally decrease slightly with increasing depth, with occasional values measured above theoretical limits of air saturation[15] (14.6 mg/L at 0°C). Oxygen concentrations in all basins are greater than 5 mg/L, and usually greater than 10 mg/L even at the lowest depths, despite nearly nine months of ice cover.

The project lakes typically turn over by mid-July, leading to a well-mixed water column with uniform temperature and high oxygen concentrations. Water temperatures warm rapidly to reach maximum temperatures of around 15°C by late July and into August. Deeper lakes and basins, such as TPN and

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[15] Photosynthesis occurring under ice can lead to DO results exceeding theoretical air saturation limits. This is due to photosynthesis producing pure oxygen, as opposed to the approximate oxygen content of 21% in air.

INUG, are typically 2˚C to 3˚C colder than the shallower locations WAL and SP. Temperatures in 2016 were moderate and typical of historical temperature patterns (**Figure 3.2–1**). Vertical stratification in water temperature, which occasionally establishes after extended periods of calm, windless conditions, was noted at WAL and TPE in July 2016 (**Figure 3.2–6**). Water temperatures at all other locations in July were generally uniform throughout the water column.

In September, water temperatures cooled to below 5˚C but remained un-stratified. With vertical mixing, oxygen concentrations are high and fully saturated (**Figure 3.2–7**). While the values jumped around slightly, no vertical stratification was observed. The November sampling event was generally well mixed and un-stratified for DO and conductivity despite ice-cover on all the lakes (**Figure 3.2–8**).

The seasonal patterns in water temperature and oxygen concentrations observed in 2016 were typical of this area of the Arctic and similar to what has been observed in previous years. There were no differences in these patterns between the control lakes INUG and PDL and the NF and MF monitoring areas.

Conductivity

Field conductivity is discussed here as an indicator of stratification in the water column. From a monitoring perspective, uniform conductivity provides confidence that the water column is well-mixed and that a water chemistry sample will be representative. In contrast, variable conductivity may indicate the presence of water with different chemical properties (e.g., mining effluent), so profiling is useful to identify these situations and adjust sample collection if necessary to ensure that the different water masses are properly characterized. Oligotrophic systems with low dissolved solids and ions (Ca, Na, Cl, Mg, etc.) typically register conductivity measurements of less than 50 µS/cm. At the Meadowbank study lakes, conductivity is usually uniform in concentration from top to bottom at impact and reference lakes. While the overall range in conductivity is similar between ice-on (5 – 50 µS/cm) and ice-off (5 – 35 µS/cm) months, the conductivities in ice-off months are generally lower, consistent with cryo-concentration during progressive ice formation during winter months.

In 2016, field conductivity was generally uniform in concentration through the water column among the various samples that were collected. Minor vertical differences due to cryo-concentration were observed during winter, with no apparent differences between reference and near-field areas and fairly uniform profiles during the open water period (**Figure 3.2–6** to **Figure 3.2–8**). There were, however, two limnology profiles with conductivity readings outside the typical range, one at SP in January (**Figure 3.2–2**) and one at WAL in March (**Figure 3.2–4**). Both SP and WAL have diffusers that discharge water from near-by mine operations. The limnology profiles at SP and WAL were taken in close proximity to the diffusers in each lake. At SP the conductivity in January was between 135-150 µS/cm, and mine staff confirmed that water was discharged from the East Dike Seepage to SP all year. In the case of WAL, there is greater uncertainty about the reliability of the readings. The March conductivity readings were between 450 and >1000 µS/cm, well outside the typical range for WAL. Agnico confirmed that there was no discharge to WAL from the Vault Attenuation Pond in March. Without a clear source of possible loading to WAL, it seems likely that the results are anomalous and indicative of issues with probe. There were issues with both the DO and temperature probes as well at WAL in March, providing additional evidence that conductivity readings should be considered unreliable.

Temperature, DO, and specific conductance readings from 2016 are largely within the range of historical values, with the exception of some anomalous conductivity results attributed to technical issues with the water quality meter. As outlined in the *CREMP: 2015 Plan Update* (Azimuth, 2015b), additional water chemistry sampling is recommended in situations where there appear to be anomalous *in situ* measurements and the water quality meter/probes are operating correctly. The acceptable range of values for temperature, DO, and conductivity was established for the NF areas, but only for the open water events (Azimuth, 2015b; Appendix A Table 3). The rules around contingency water sampling will be reviewed in 2017 prior to the first water sampling event. First, the normal range of temperature, DO, and conductivity measurements at each water sampling area will be reviewed for the through-ice and open water seasons. These "normal" ranges of temperature, DO, and conductivity will be used to set relevant thresholds to simplify decision making for determining when to collect contingency water samples.

Figure 3.2–1. Mean monthly field-measured temperature (°C) at 3 m depth from 2006 – 2016, Meadowbank study lakes.

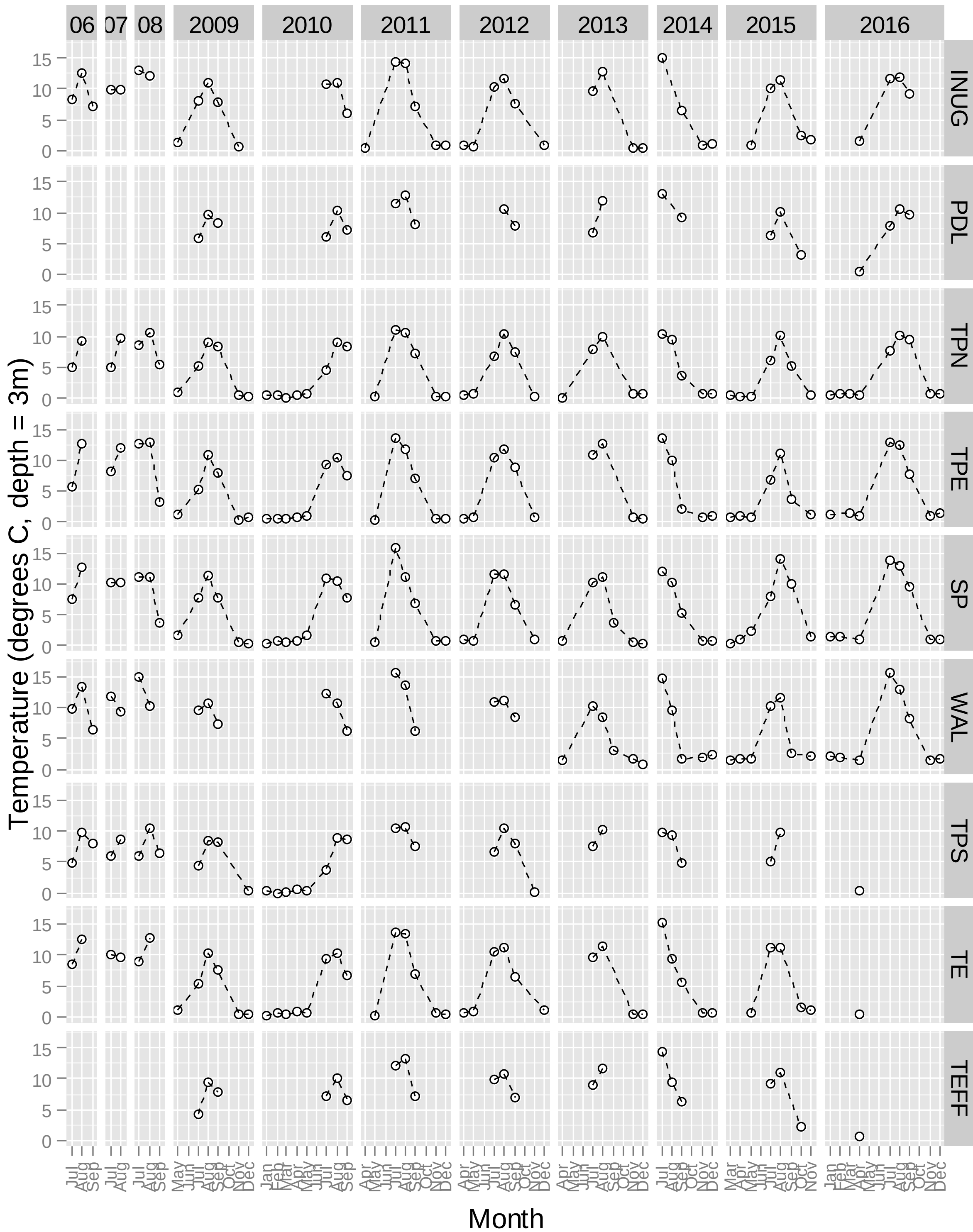

Figure 3.2–2. Field-measured temperature (°C), conductivity (µS/cm) and dissolved oxygen (mg/L) profiles for January, 2016.

Note: The specific conductivity measurements for SP were considered unreliable. The recorded values are labelled but not shown in the figure.

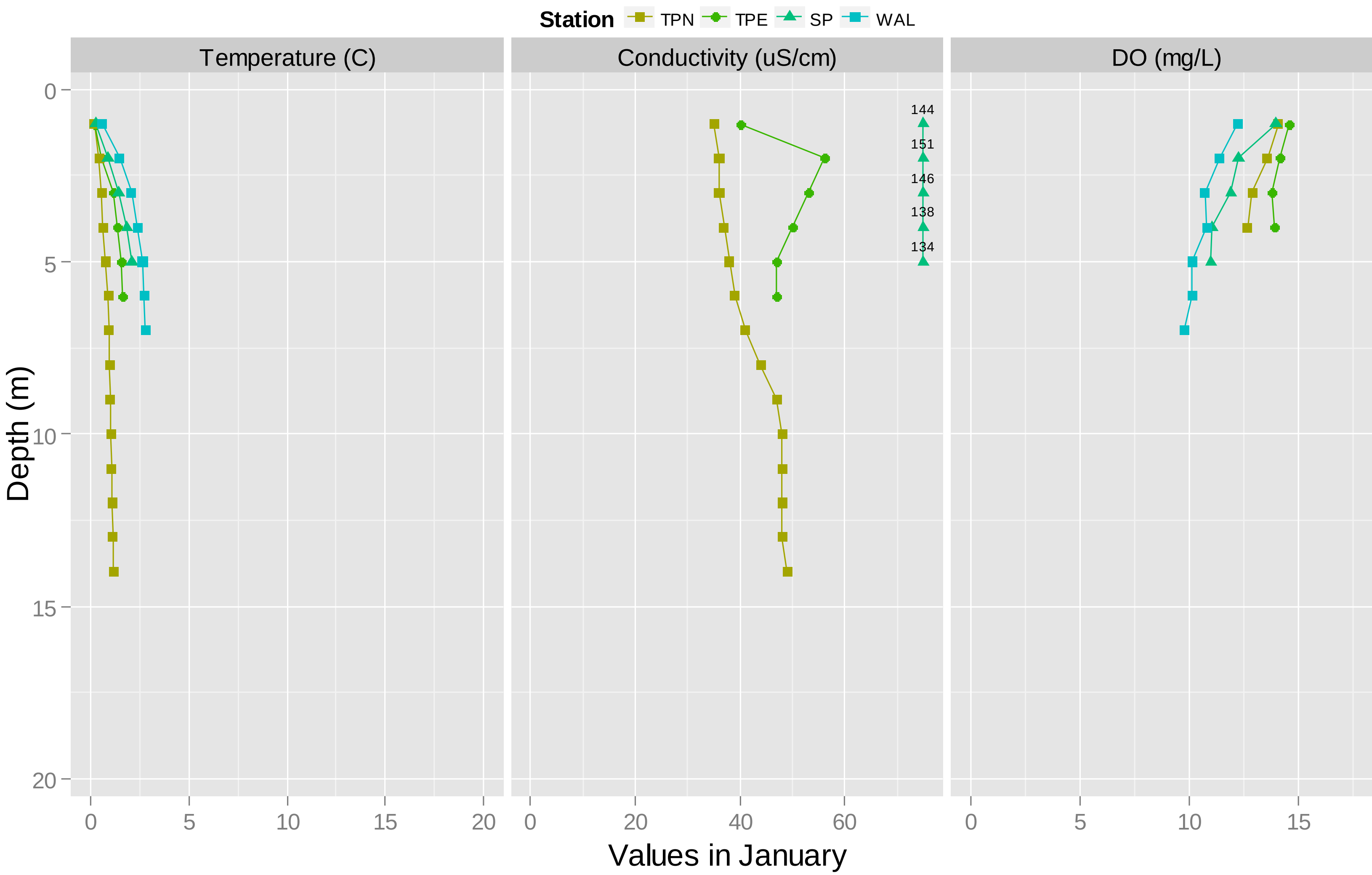

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Figure 3.2–3. Field-measured temperature (°C), conductivity (µS/cm) and dissolved oxygen (mg/L) profiles for February, 2016.

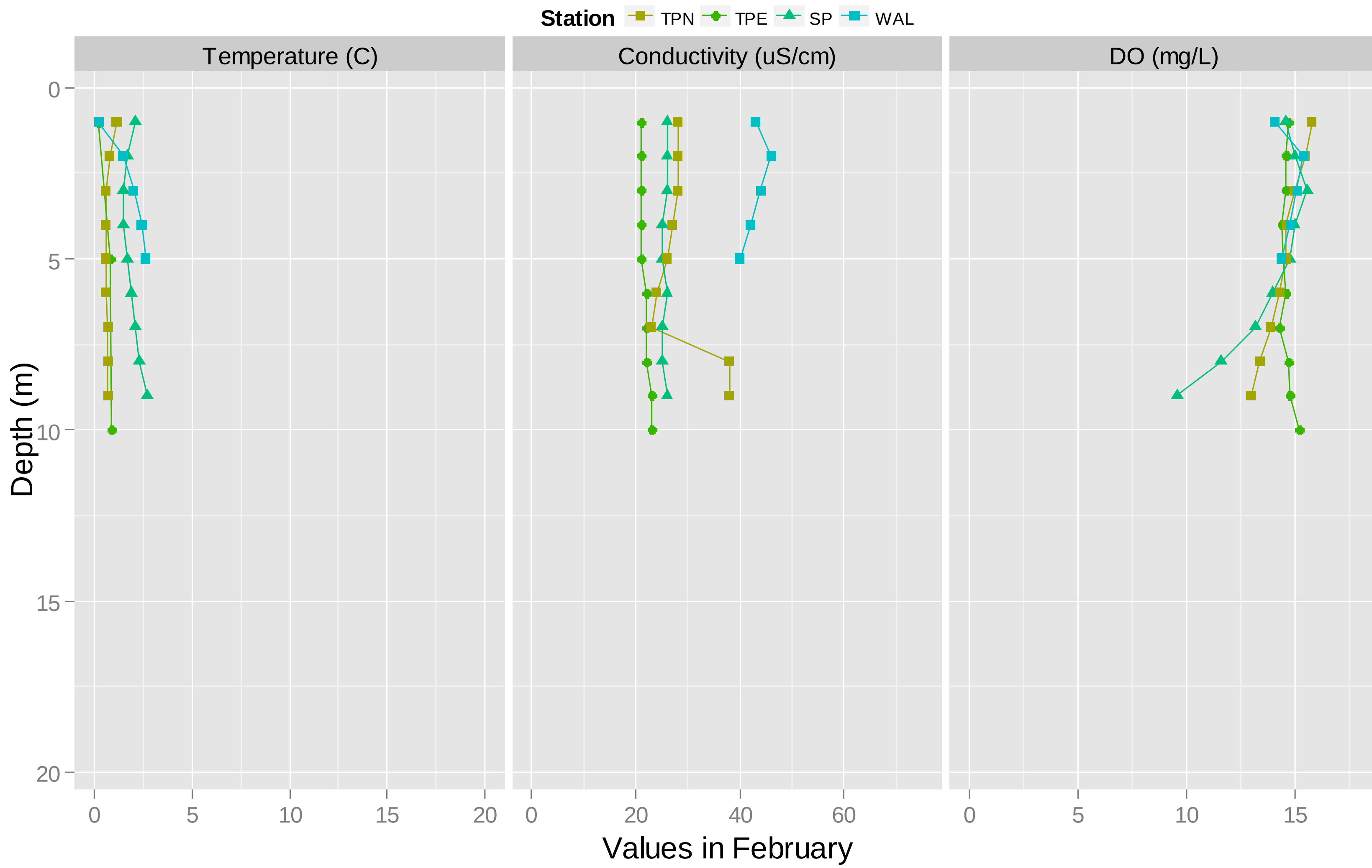


Figure 3.2–4. Field-measured temperature (°C), conductivity (µS/cm) and dissolved oxygen (mg/L) profiles for March, 2016.

Note: The specific conductivity measurements for WAL were considered unreliable. The recorded values are labelled but not shown in the figure.

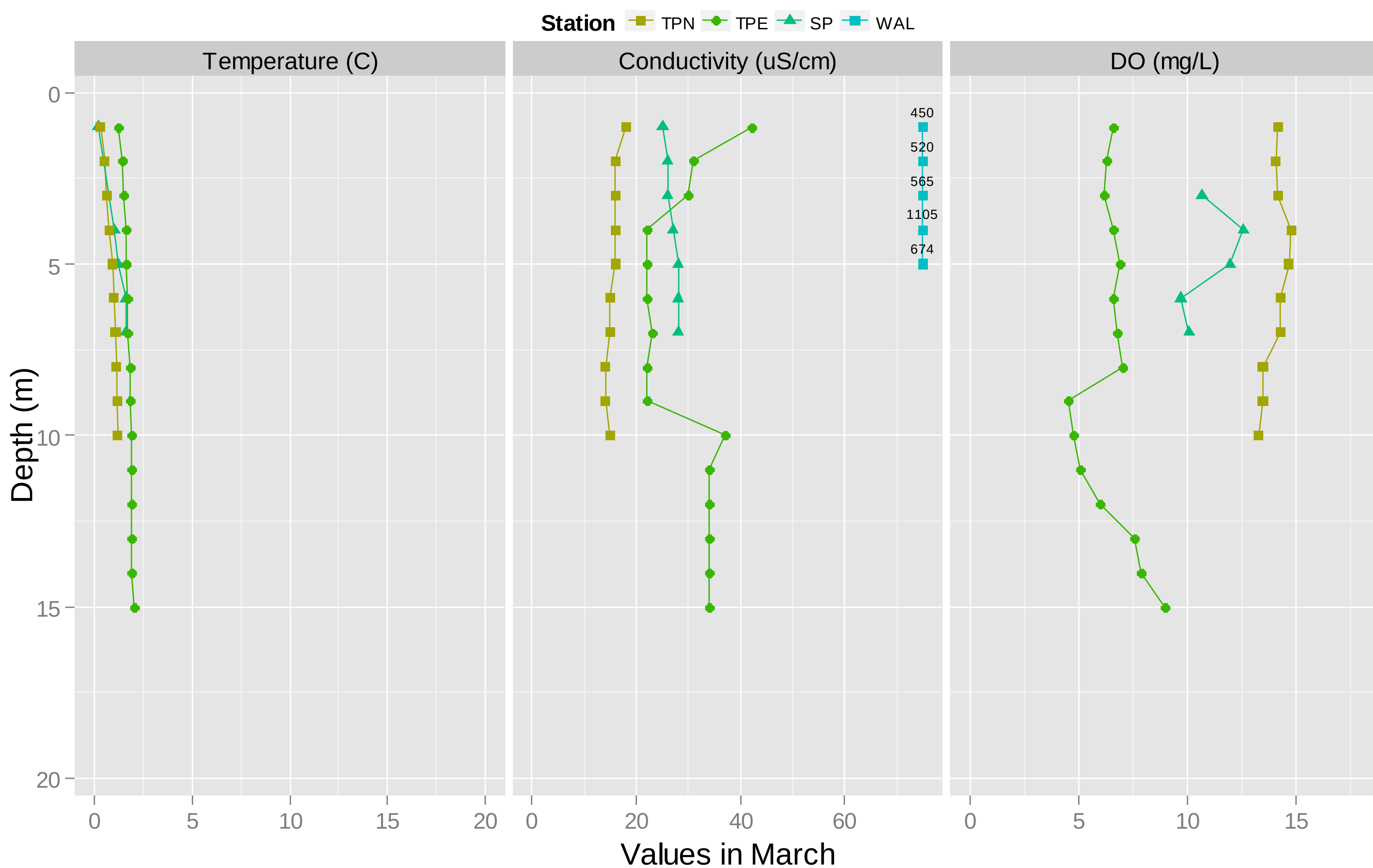


Figure 3.2–5. Field-measured temperature (°C), conductivity (µS/cm) and dissolved oxygen (mg/L) profiles for April, 2016.

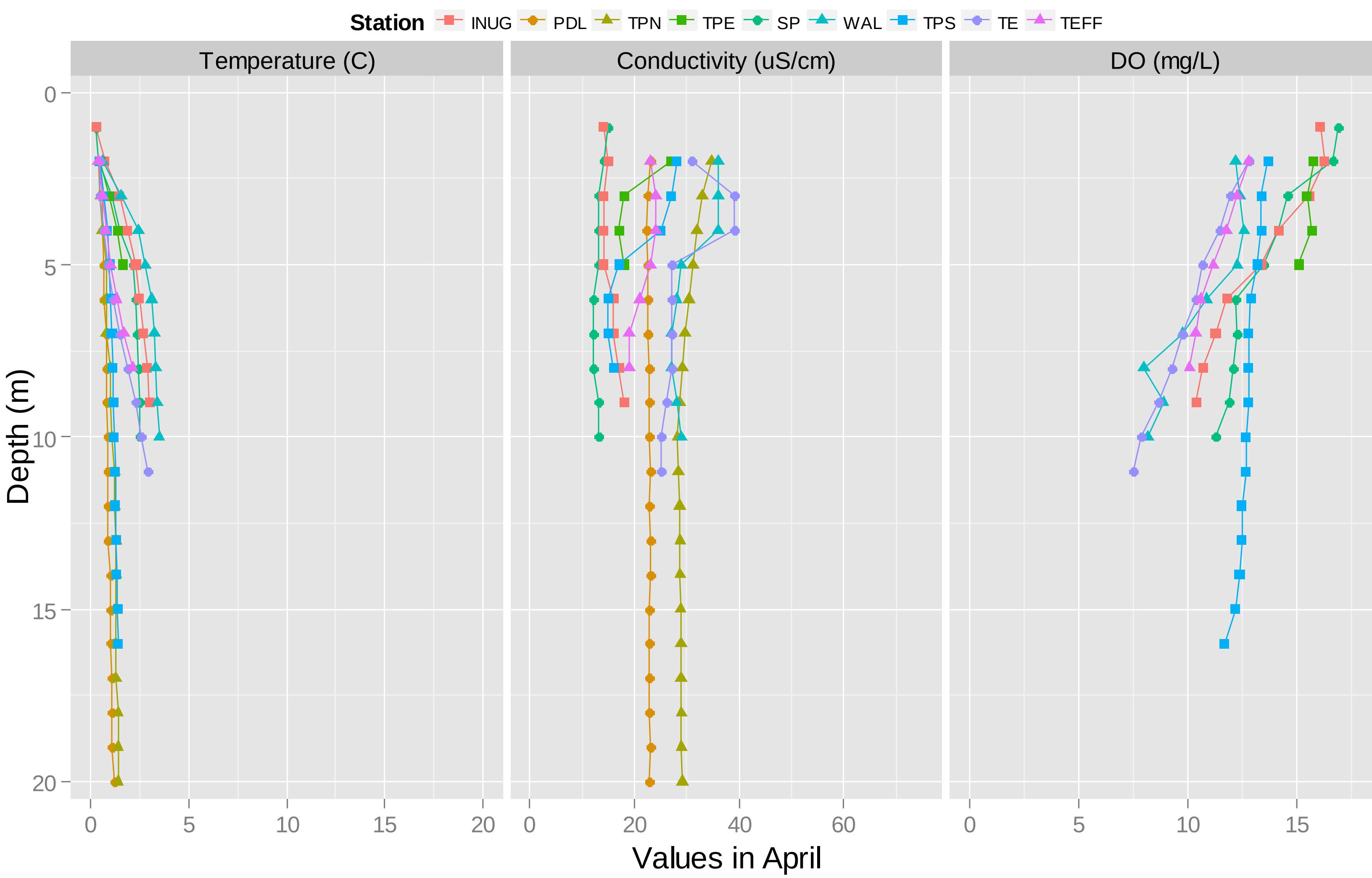


Figure 3.2–6. Field-measured temperature (°C), conductivity (µS/cm) and dissolved oxygen (mg/L) profiles for July, 2016.

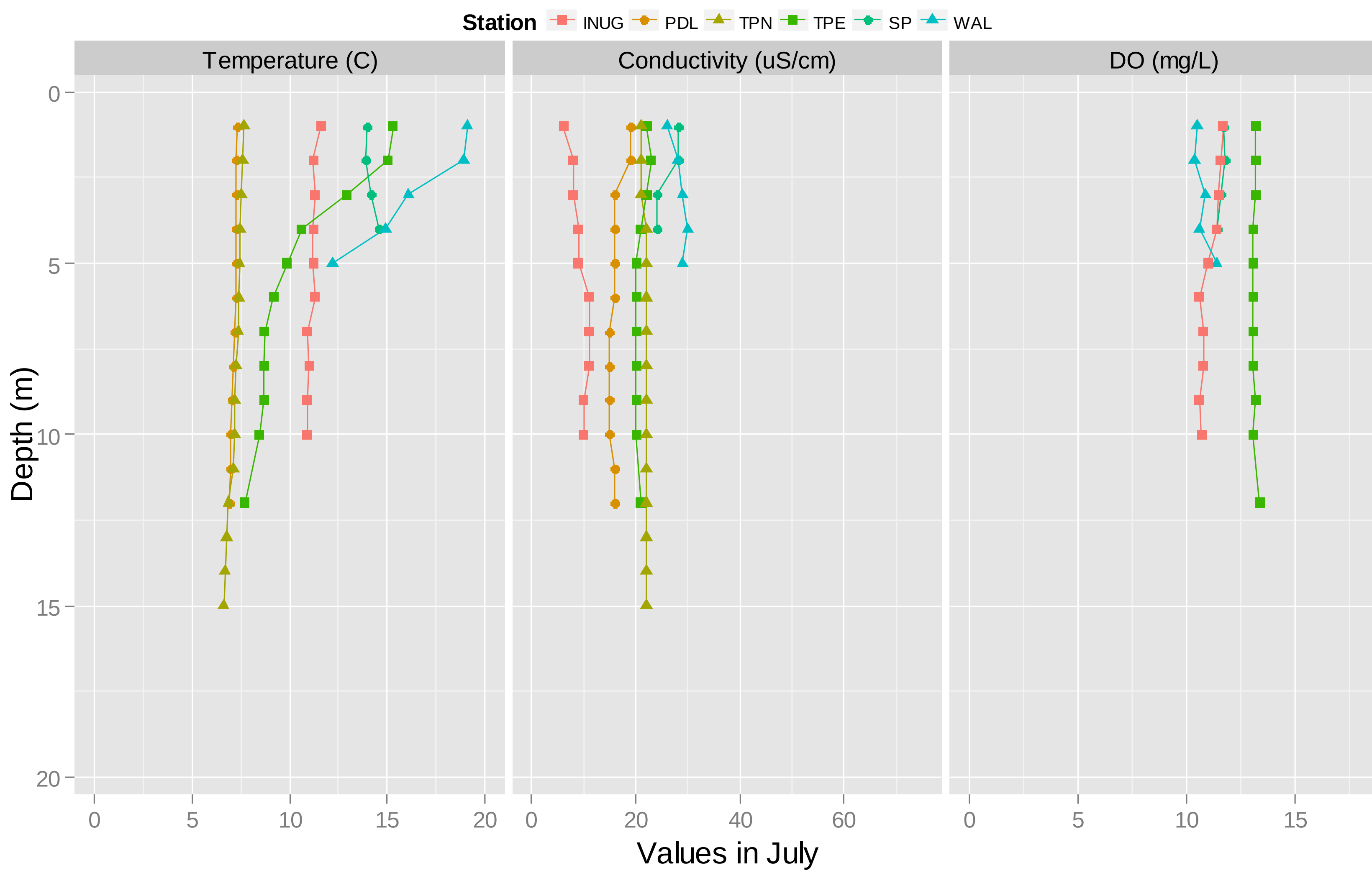


Figure 3.2–7. Field-measured temperature (°C), conductivity (µS/cm) and dissolved oxygen (mg/L) profiles for August, 2016.

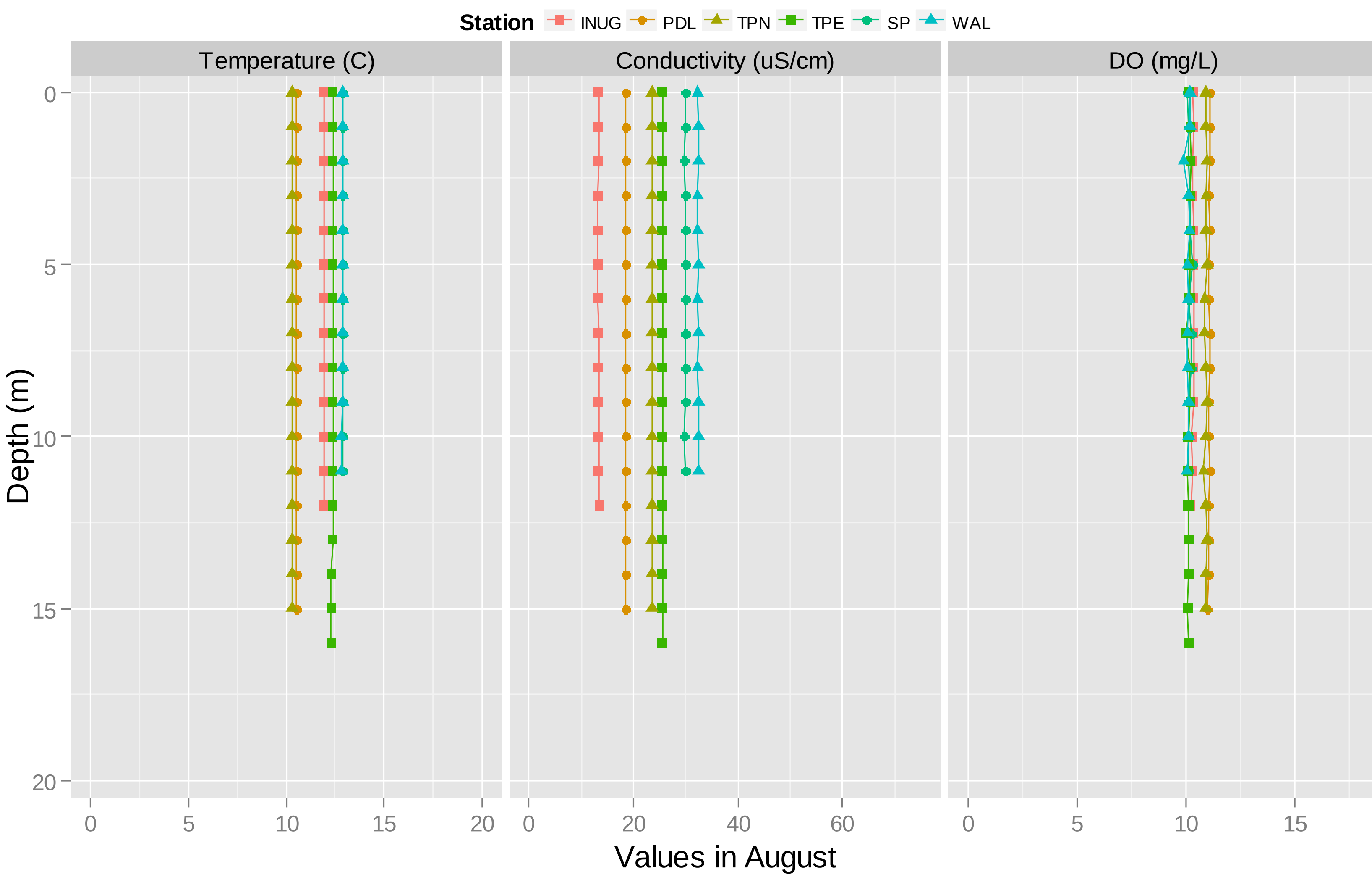


Figure 3.2–8. Field-measured temperature (°C), conductivity (µS/cm) and dissolved oxygen (mg/L) profiles for September, 2016.

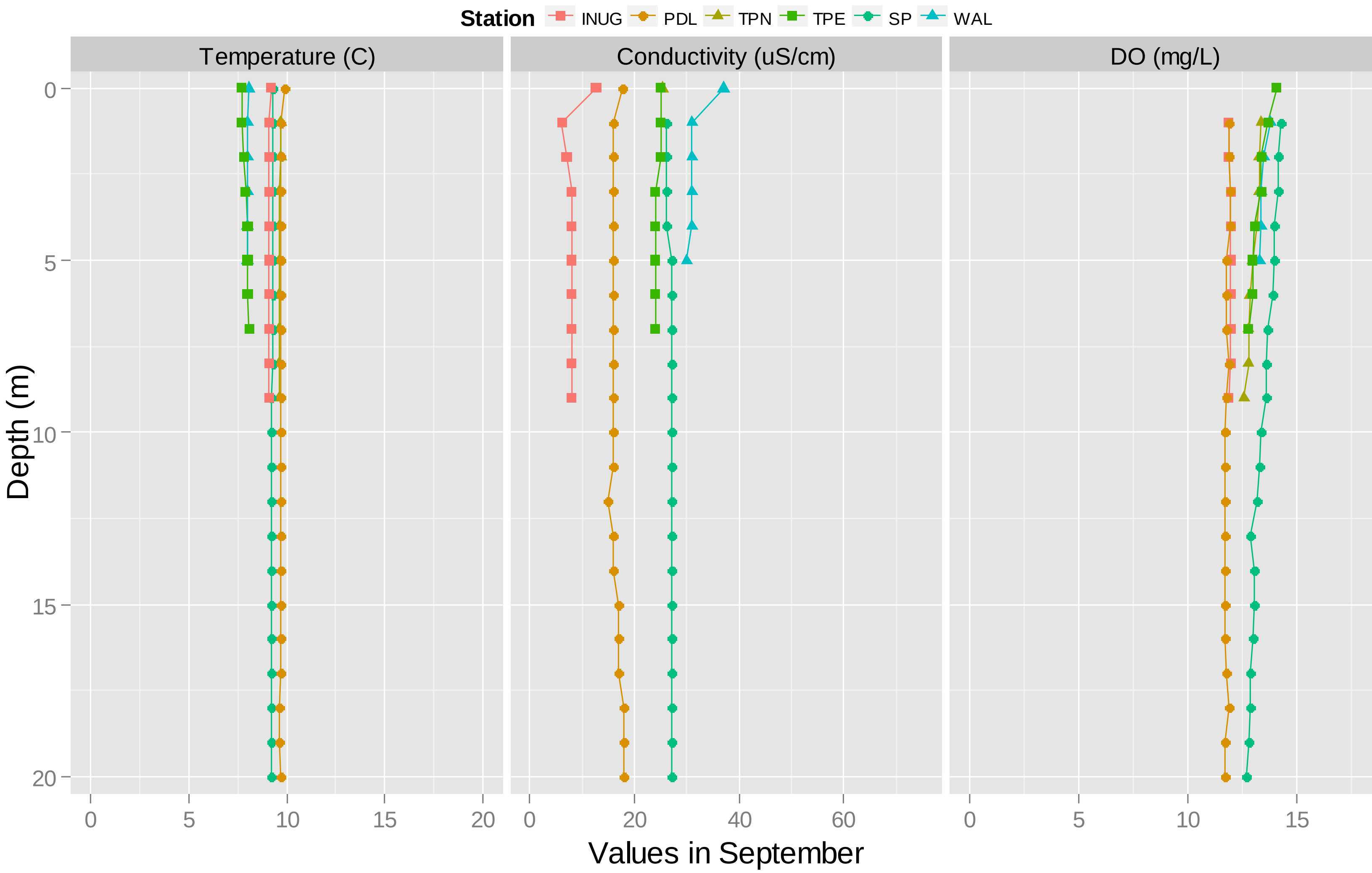


Figure 3.2–9. Field-measured temperature (°C), conductivity (µS/cm) and dissolved oxygen (mg/L) profiles for November, 2016.

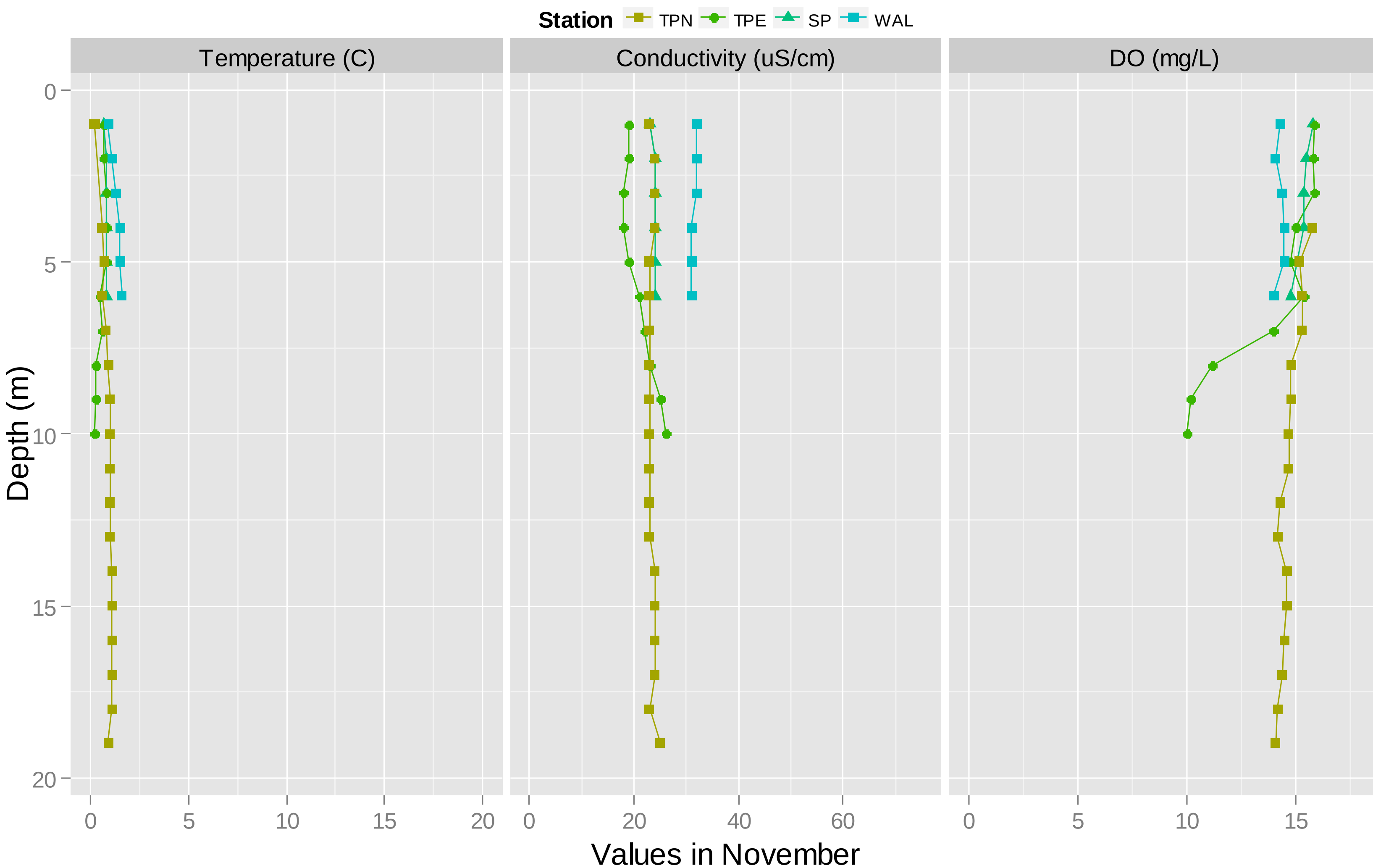
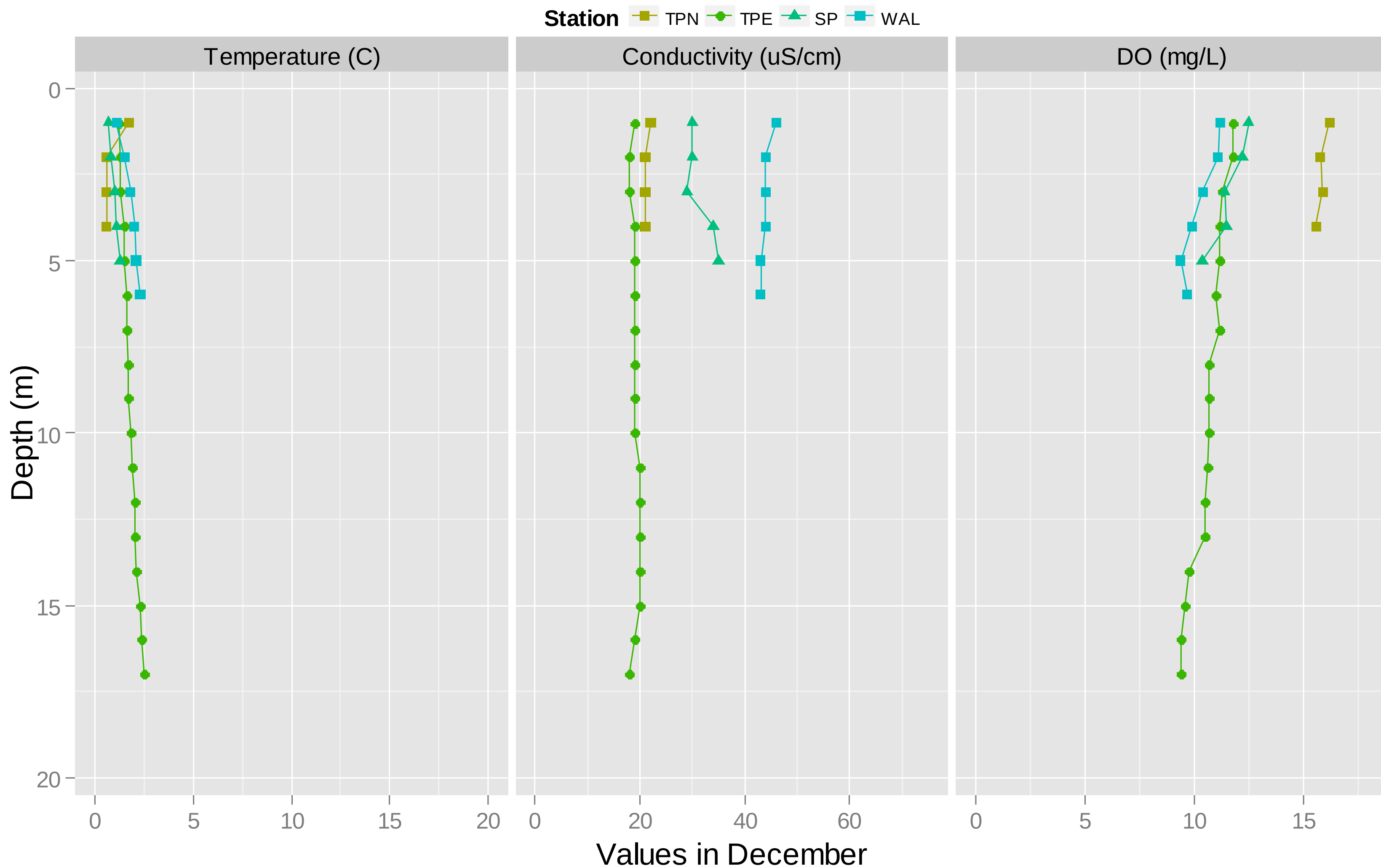


Figure 3.2–10. Field-measured temperature (°C), conductivity (μS/cm) and dissolved oxygen (mg/L) profiles for December, 2016.



3.2.2. Water Chemistry

3.2.2.1. General Observations

The general conditions affecting water quality in this region were described in **Section 3.2**. Key points to recall are:

- The Meadowbank study lakes are generally nutrient-poor, thermally un-stratified and well-mixed with uniform temperature and oxygen profiles with no winter anoxia beneath an ice cover.
- The Meadowbank study lakes are headwater lakes, so there are no significant natural sources of nutrients or sediment introduced to these lakes, save only local runoff that contributes little nutrient enrichment, but sustains these aquatic ecosystems. Many chemical parameters in water have been typically below laboratory detection limits (MDLs) since formal baseline monitoring started in 2006[16].

3.2.2.2. Temporal and Spatial Trend Interpretation

2016 water quality data from the Meadowbank project lakes (NF locations only) were screened against site-specific trigger and threshold values in **Table 3.2–1** and against FEIS model predictions in **Table 3.2–5** to **Table 3.2–7** for Third Portage Lake, Second Portage Lake, and Wally Lake, respectively. The results are discussed below from a spatial and temporal trend perspective when relevant. Implications for the 2016 monitoring program are discussed at the end of this section.

CREMP monitoring results since 2006 were used to assess temporal and spatial trends related to mining activities. The general rationale for assessing these trends was discussed in **Section 1.5**; the process was tailored slightly for water chemistry, as described below.

As previously discussed, many water quality parameters had concentrations that were routinely below laboratory MDLs, thus providing little insight into the assessment of mine-related changes to water quality. To streamline the interpretation process, a conservative three-step screening process was used to identify parameters for inclusion into the formal trend assessment (the results are summarized in **Table 3.2–2**):

1. *Overall Detection Frequency* – Only those water quality parameters that exceeded MDLs in at least 10% of the samples were included in this discussion. Because the project lakes are ultra-oligotrophic, it is normal for many parameters to routinely be below MDLs. In 2016, just over half (53%) of parameters measured exceeded MDLs at least 10% of the time. These parameters are included in this discussion.
2. Control-*Impact Detection Frequency Comparison* – To avoid screening out infrequently detected parameters that were detected more often in association with mining activities, the proportion of samples exceeding MDLs between "control" and "impact" samples were compared. The intent of this screen was to identify parameters with <10% detection frequency (i.e., those screened out above) for which there were detection frequency changes potentially associated with mining activity (i.e., where the proportion of detected values increased by 0.1 or more). No parameters were added back into the trend assessment based on this second screening level.

[16] While formal baseline water quality monitoring started in 2006, reconnaissance baseline monitoring started in the mid-1990s and served as the foundation for designing the formal monitoring program.

3. *Apparent Detection Pattern Matching Mining Activity* – To avoid screening out infrequently detected parameters that may be associated with mining activities (see **Section 1.4**), trend plots were used to identify parameters with measured values associated with periods/locations of known mining activities. Where such patterns were observed or where parameters were measured at greater than 5-times the MDL at near-field sampling areas in at least one event, these parameters were added back into the trend assessment process. Given that no such patterns have been observed since 2008 East Dike construction and no major activities have taken place on site in 2016, no parameters were added back into the trend assessment process based on this screen.

Parameters that were retained in the analysis are shown in **Figure 3.2–12** to **Figure 3.2–50**. Samples shown in these figures were collected from a depth of 3 meters. The red dashed line in each of these water chemistry figures is the trigger value specific to the parameter and area (i.e., Meadowbank lakes, Wally Lake, and Baker Lake each have their own trigger values). All parameters not retained for the trend assessment were assumed to have no spatial or temporal trends related to mining activities or to natural variability and were excluded from further consideration (although plots for these parameters are included for reference in **Appendix A1**).

Historical trend assessment results related to each of the mining activities are discussed at length in the 2012 CREMP report (Azimuth, 2013). Water chemistry parameters for which the 2016 means for Meadowbank study lakes exceeded their respective trigger values are presented in **Table 3.2–3**. For each parameter/area that exceeded the trigger, formal statistical testing of the observed result was conducted using the BACI statistical model (one-tailed; looking for uni-directional changes only). In this analysis, the model interaction term (or BACI effect term) represents the change at the test area relative to baseline after accounting for natural temporal changes (i.e., temporal changes at the reference area); for simplicity, changes are noted "relative to baseline/reference" conditions. Results are provided in **Table 3.2–4**; key results (i.e., those parameter/area combinations where the 2016 results were statistically different [$p<0.05$[17]]) were as follows:

- *Laboratory Conductivity/Hardness* – TPN, TPE, SP, and WAL showed an increase relative to baseline/reference conditions. Conductivity is a composite variable that responds positively to increasing concentrations of ionic compounds (e.g., chlorides, sulphates, carbonates, sodium, magnesium, calcium, potassium and metallic ions). The observed change, therefore, is indicative of changes in its underlying compounds (e.g., see ionic compounds below for additional context).
- *Ionic* Compounds *(Calcium, Magnesium, Potassium, Sodium)* – TPN, TPE, and SP showed an increase (relative to baseline/reference) in all of these major ions; WAL showed increases in calcium and magnesium. Concentrations at these NF areas have typically been <6 mg/L (calcium), <2 mg/L (magnesium), < 1.5 mg/L (sodium), and <1 mg/L (potassium). Slight increases of these ionic compounds in the Meadowbank study lakes are unlikely to adversely affect biota.
- *TDS* – TPN, TPE, and SP showed an increase relative to baseline/reference conditions. Similar to conductivity, TDS is a composite variable based on the combined amount of all inorganic and organic substances contained in a sample. The current TDS discharge limit in the water use license (2AM-MEA1525) is 1,400 mg/L for both the maximum average concentration and

[17] Results in the same targeted statistical power (0.9) as using p<0.1 for a two-tailed test.

maximum allowable grab sample concentration[18]. Weber-Scannell and Duffy (2007) reviewed TDS toxicity to aquatic life. While they recommend deriving ion-specific limits for aquatic life (i.e., rather than for TDS), none of the literature studies they compiled showed effects at TDS concentrations less than 250 mg/L and they report mean TDS in the world's rivers of approximately 120 mg/L. There are no federal water quality guidelines for TDS in Canada or the US. In Alaska, TDS may not exceed 500 mg/L without a special permit and 1000 mg/L at any time (ADEC, 2012). A TDS receiving environment benchmark 500 mg/L was adopted at Diavik (WLWB, 2013). Thus, these changes leading to TDS concentrations on the order of 15 to 45 mg/L are very low and not of concern.

- *Alkalinity* – SP showed an increase in bicarbonate and total alkalinity in 2016 relative to baseline/reference conditions. Bicarbonate (HCO_3^-) comprised 100% of the total alkalinity faction, typical of surface water with pH in the range of 6.5 to 9. Bicarbonate alkalinity at SP has consistently exceeded the trigger dating back to 2011, and in 2016 was 11.1 mg/L, similar to the concentration reported in 2015 of 11.5 mg/L. The temporal trend of slightly increasing alkalinity relative to baseline/reference conditions is unlikely to adversely affect biota at SP.

It is important to note that total and dissolved metals concentrations were consistently low or below their respective MDLs at the NF, MF, and FF locations (**Table 3.2–1**) and that none of these parameters have ever exceeded trigger or threshold values. In 2016, the same metals were measured above laboratory detection limits (MDLs) as in 2015. This is important to note in relation to ongoing discharges to the receiving environment (e.g., discharge from Vault attenuation pond to Wally Lake [June – September] and discharge of East Dike seepage to Second Portage Lake [during all of 2016]). Refer to **Section 1.4** and **Table 1.4–1** for more details on major mine-related activities in 2016.

The CREMP continues to detect changes in some general water quality parameters that appear to be related to mining activity. These changes are also reflected in higher concentrations of some parameters when compared to the model predictions in FEIS. The FEIS water quality predictions are estimates of change water quality in Third Portage Lake, Second Portage Lake, and Wally Lake assuming different mixing scenarios and loading estimates from water releases and dike leaching. The model for Third Portage Lake includes treated water release from the project in year's 1 to 4 and long-term loading of metals from the Bay-Goose dike material. The Second Portage Lake water quality model includes loading of parameters from the Third Portage and East dikes and inflow from Third Portage and Wally lakes. The water quality model for Wally incorporates long-term loadings from the Vault dike and effluent releases from the Vault Attenuation pond. At the time the FEIS was issued, the CWQG for cadmium was lower than the MDL for the baseline data. A thorough review of the ecological significance of the predicted cadmium concentrations was presented in the FEIS, and the probability of cadmium causing toxicity was considered "extremely low" (Cumberland, 2005). Arsenic was also predicted to exceed the CWQGs in Wally Lake. Similar to cadmium, the MDL was equal to the guideline (i.e., 0.005 mg/L). The models were considered conservative because the MDLs were used as the baseline concentrations. The current MDLs for arsenic and cadmium are 0.0001 mg/L and 0.000005 mg/L, respectively. All of the samples collected in 2016 from Third Portage, Second Portage, and Wally Lakes were below the MDL for cadmium. In the case of arsenic at Wally, the concentrations are below the trigger value, and well below the CCME water quality guideline of 0.005 mg/L. Overall, the FEIS predicted the magnitude of potential effect on water

[18] The discharge limit applies to effluent from the Vault Attenuation Pond at Monitoring Station ST-10 (directed to Wally Lake through the Wally Outfall Diffuser).

quality in each of the lakes as "low[19]" (see **Section 2.4.1** for more details on the decision criteria for effect magnitude).

The same list of parameters that exceed the Meadowbank trigger values typically exceed the concentrations predicted in the FEIS, namely ionic compounds (calcium and magnesium), hardness, and total alkalinity. Chloride, fluoride, nitrate (as N), and sulphate also exceed the FEIS predictions for Third Portage Lake, Second Portage Lake, and Wally Lake in some samples. Most metals are below the predicted concentrations for Third Portage Lake (**Table 3.2–5**), Second Portage Lake (**Table 3.2–6**), and Wally Lake (**Table 3.2–7**) with the exception of isolated instances of aluminum, iron, and manganese. Strontium consistently exceeded the model predictions in all three lakes, but importantly did not exceed the trigger (95th percentile of baseline) indicating current strontium concentrations are representative of pre-development conditions. It is important to point out that none of the above parameters that exceed the trigger values or FEIS model predictions have trigger values that were set in the context of effects-based threshold values (e.g., CCME water quality guidelines). Thus, CREMP water quality results are consistent with the "low" significance (i.e., <1x CCME WQG) rating applied to model predictions in the FEIS (Cumberland, 2005).

In the absence of available thresholds, trigger values for these substances were set at the 95th percentile of baseline data (i.e., in the absence of any mine-related inputs, 5% of the samples would be expected to exceed the trigger). Consequently, the BACI model results reported above only indicate that statistically significant changes have been detected relative to baseline/reference conditions. Available information suggests that the observed concentrations of these parameters are well below levels of concern. As in the past, it is recommended that these trends continue to be monitored in 2017.

Pursuant to the new assessment strategy for MF and FF areas outlined in the *CREMP: 2015 Plan Update* (Azimuth, 2015b), formal analysis of the trigger/threshold exceedances in 2016 was applied to the decision criteria outlined in **Section 2.2.3** to determine the level of effort and frequency of sampling required at the MF and FF areas in 2017. The assessment strategy uses the water quality assessment results from current year (in this case 2016) to inform sampling at MF and FF areas the following year (i.e., 2017). The data were analyzed starting from the "Year +1" step of the flow chart where results from the NF areas are used to inform sampling at both MF and FF locations in 2017 (**Figure 3.2–11**).

Trigger/threshold screening results are presented in **Table 3.2–8** according to their corresponding degree of change (i.e., no trigger exceedance, minor changes, moderate changes, and major changes). The outcome of the assessment for sampling at NF, MF and FF areas in 2017 is summarized below:

- *Near-field (TPE, TPN, SP, and WAL)*: Trigger exceedances were documented for parameters without effects-based thresholds (e.g., conductivity, hardness, and cations). The full program will be completed at the NF locations in 2017 as well as at both reference areas (INUG and PDL).
- *Mid-field and Far-field (TE, TPS, and TEFF)*: One through-ice sampling event was completed at the MF and FF areas in 2016. Some parameters without effects-based thresholds exceeded trigger values at TPS, TE, and TEFF in the April 2016 samples, but all of the metals were below their respective trigger values in 2016. For this reason, additional sampling during the open water

[19] Low magnitude effect on water quality was applied in the FEIS if predicted parameter concentrations remain below CWQGs for the protection of aquatic life (and project specific guidelines), but remain above baseline values (Cumberland, 2005). Even though cadmium was predicted to exceed the CWQG, the magnitude was considered low based on several considerations including over-estimation of the actual concentrations (i.e., using the MDL as the baseline concentration) and a thorough examination of chronic toxicity data available at the time the FEIS was issued (Cumberland, 2005).

period in 2016 was deemed unnecessary. Formal BACI analysis of the results was not completed given the new sampling and analysis framework. Given there were no trigger exceedances for parameters with effects-based thresholds at the NF stations in 2016, a minimum of one (but ideally two) through-ice sampling events at the MF and FF areas are recommended in 2017 to verify there are no exceedances of effects-based thresholds. No other sampling (e.g., sediment chemistry or benthic invertebrate community) is required at MF and FF areas in 2017.

Figure 3.2–11. Flow chart showing sampling effort and frequency assessment results for mid-field and far-field sampling in 2017.

Near-Field Results 2016 CREMP		**Mid-Field and Far-Field Plan for 2017 (TPS, TE, TEFF)**
No changes identified	Yr +1 →	None required
Minor changes identified	Yr +1 →	Water sampling through ice (1 to 2 events)
Moderate changes identified	Yr +1 →	Full water sampling only (all 5 CREMP events)
Major changes identified	Yr +1 →	Full CREMP sampling (all 5 CREMP events)

Notes:
Blue-shaded cells show the linkage between 2016 CREMP results and the sampling effort and frequency for mid-field and far-field areas in 2017.

Table 3.2–1. Water quality results from the 2016 CREMP, Meadowbank study lakes.

Lake and Station					Third Portage Lake East Basin (TPE)									
Area-Replicate ID	**CCME (2012)**	**Trigger[2]**			TPE-90-S	TPE-91-S	TPE-92-S	TPE-93-S	TPE-94-S	TPE-95-S	TPE-96-S	TPE-97-S	TPE-98-S	TPE-99-S
Depth (m)					3	3	3	3	3	3	3	3	3	3
Date	**Guideline[1]**	**Meadowbank**	**Wally Lake**	**Threshold[2]**	20-Apr-16	20-Apr-16	12-Jul-16	12-Jul-16	5-Aug-16	5-Aug-16	11-Sep-16	11-Sep-16	27-Nov-16	27-Nov-16
Field Measurements (Surface)														
Temperature (°C)					0.5	0.4	16.0	15.3	12.3	12.4	7.7	7.9	0.9	0.8
Specific Conductivity (µS/cm)					27	32	25	22	26	26	25	26	20	18
Dissolved Oxygen (mg/L)					15.80	15.6	11.2	13.20	10.21	10.18	14.1	13.6	16.00	15.90
pH	6.5 - 9.0	6.50 - 7.94	6.75 - 8.17	6.5 - 9.0	7.16	7.34	7.40	7.22	7.11	7.13	7.58	7.42	7.13	7.23
Physical Tests (mg/L)														
Conductivity (µS/cm)		23.5	36.6		**33.4**	**32.4**	**28.3**	**29.4**	**29.3**	**29.4**	**28.7**	**27.9**	**30.9**	**30.3**
Hardness		8.5	16.7		**14.0**	**13.8**	**9.6**	**10.0**	**10.7**	**10.5**	**9.7**	**9.8**	**10.4**	**10.2**
pH (Laboratory)	6.5 - 9.0	6.50 - 7.94	6.75 - 8.17	6.5 - 9.0	6.91	6.68	7.10	7.13	7.02	7.00	7.04	7.03	7.11	7.11
Total Suspended Solids		3.0	3.0	5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Dissolved Solids		18.0	25.3		**23**	**25**	17	**18**	**23**	**22**	**22**	**21**	**25**	**23**
Turbidity (NTU)					0.12	0.12	0.26	0.30	0.27	0.28	0.29	0.39	0.25	0.23
Anions and Nutrients (mg/L)														
Alkalinity - Bicarbonate		8.6	17.8		8.3	6.2	6.8	7.2	7.4	7.5	7.4	7.4	7.8	7.6
Alkalinity - Carbonate		4	4		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity - Hydroxide					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity - Total		8.5	17.8		8.3	6.2	6.8	7.2	7.4	7.5	7.4	7.4	7.8	7.6
Ammonia (as N)[3]	***equation***	0.065	0.067	0.126	0.022	0.022	<0.0050	<0.0050	<0.0050	0.005	<0.0050	<0.0050	0.007	0.007
Bromide					<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride	120	60.28	60.2	120	1.00	1.00	0.47	0.48	0.68	0.67	0.71	0.70	0.76	0.74
Fluoride	0.120				0.10	0.10	0.05	0.05	0.07	0.07	0.08	0.08	0.08	0.08
Nitrate (as N)	3.0	1.50	1.50	3	0.0488	0.0346	0.0226	0.0241	0.0144	0.0147	<0.0050	<0.0050	0.0084	<0.0050
Nitrite (as N)	0.060	0.031	0.031	0.060	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen		0.170	0.163		0.11	0.11	0.11	0.10	0.11	0.11	0.09	0.10	0.10	0.11
Ortho Phosphate (as P)		0.002	0.002		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Phosphorus (P)-Total Diss.					<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Phosphorus (P)-Total	0.0040	0.0060	0.0067	0.004	<0.0020	<0.0020	<0.0020	0.0028	<0.0020	0.0027	<0.0020	0.0023	<0.0020	<0.0020
Silicate (as SiO_2)		1.0	1.08		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Sulphate (SO_4)		64.7	65.2	128	6.38	6.37	2.82	2.92	4.40	4.40	4.52	4.52	4.90	4.75
Cyanides (mg/L)														
Total Cyanide					<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Free Cyanide	0.005				<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon (mg/L)														
Dissolved Organic Carbon		2.60	3.21		1.53	1.83	1.28	1.37	1.35	1.29	1.10	1.21	1.54	1.56
Total Organic Carbon		2.79	4.11		1.40	1.49	1.30	1.21	1.14	1.33	1.18	1.34	1.66	1.53
Plant Pigments (µg/L)														
Chlorophyll-*a*					0.06	0.11	0.14	0.16	0.63	0.68	0.44	0.43	0.49	0.30
Total Metals (mg/L)														
Aluminum[3]	***equation***	0.054	0.053	0.100	<0.0030	<0.0030	0.0083	0.0107	0.0080	0.0075	0.0093	0.0112	0.0067	0.0058
Antimony		0.0101	0.0100	0.020	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	0.0050	0.00255	0.0026	0.005	0.0005	0.0005	0.0003	0.0004	0.0006	0.0005	0.0005	0.0005	0.0003	0.0003
Barium		0.50	0.50	1	0.0044	0.0041	0.0032	0.0033	0.0032	0.0033	0.0032	0.0031	0.0028	0.0027
Beryllium		0.0027	0.0027	0.0053	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Bismuth					<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	1.5	0.76	0.76	1.5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium[3]	***equation***	0.000025	0.000025	0.000040	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium		2.15	4.88		**3.45**	**3.40**	**2.37**	**2.47**	**2.59**	**2.57**	**2.51**	**2.51**	**2.56**	**2.58**
Chromium[4]	0.001	0.00056	0.00055	0.001	<0.00010	<0.00010	0.0001	<0.00010	<0.00020	<0.00020	<0.00010	<0.00010	<0.00010	<0.00010
Cobalt					<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper[3]	***equation***	0.00124	0.00149	0.002	<0.00050	<0.00050	<0.00050	<0.00050	0.0006	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Iron	0.3	0.155	0.157	0.3	<0.010	<0.010	0.017	0.016	0.015	0.015	0.011	0.014	<0.010	<0.010
Lead[3]	***equation***	0.000525	0.000525	0.001	<0.000050	<0.000050	0.00007	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.00010	<0.000050
Lithium		0.048	0.048	0.096	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium		0.83	1.36		**1.30**	**1.28**	**0.88**	**0.91**	**0.96**	**0.96**	**0.94**	**0.95**	**0.88**	**0.90**
Manganese[3]		0.3157	0.3300	***equation***	0.0003	0.0003	0.0032	0.0030	0.0016	0.0016	0.0012	0.0012	0.0007	0.0007
Mercury	0.000026	0.000018	0.000018	0.000026	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum	0.073	0.0365	0.0370	0.073	0.0002	0.0002	0.0002	0.0001	0.0002	0.0002	0.0002	0.0001	0.0002	0.0002
Nickel[3]	***equation***	0.0127	0.0130	0.025	0.0007	0.0006	0.0007	0.0007	<0.00050	0.0005	0.0005	0.0005	0.0005	0.0005
Phosphorus					<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium		0.50	0.59		**0.74**	**0.74**	**0.57**	**0.57**	**0.57**	**0.56**	0.47	0.48	0.48	0.49
Selenium	0.001	0.00055	0.00055	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon					0.07	0.07	0.11	0.11	0.06	0.07	0.09	0.10	0.08	0.06
Silver	0.0001				<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium		0.975	0.72		**1.47**	**1.44**	**1.02**	**1.03**	**1.11**	**1.11**	**1.19**	**1.17**	**1.03**	**1.02**
Strontium		0.0279	0.0330	0.049	0.0151	0.0147	0.0108	0.0112	0.0112	0.0111	0.0121	0.0117	0.0115	0.0115
Sulfur					2.04	1.99	1.46	1.48	1.65	1.62	1.61	1.69	1.56	1.53
Thallium	0.0008	0.00041	0.00041	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin		0.0002	0.0002		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium		1.00	1.00	2	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	0.00033	<0.00030	<0.00030
Uranium	0.015	0.0075	0.0075	0.015	0.000048	0.000049	0.000051	0.000054	0.000049	0.000051	0.000045	0.000045	0.000039	0.000039
Vanadium		0.0035	0.0035	0.006	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc[3]	0.030	0.0063	0.0106	***equation***	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0056	<0.0030	<0.0030	<0.0030
Zirconium					<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Dissolved Metals (mg/L)														
Aluminum[3]		0.0263	0.0260	0.05	0.0012	0.0010	0.0026	0.0031	0.0024	0.0026	0.0025	0.0026	0.0013	0.0013
Antimony		0.0101	0.0100	0.020	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic		0.0026	0.0026	0.005	0.0005	0.0005	0.0003	0.0004	0.0005	0.0005	0.0004	0.0004	0.0003	0.0003
Barium		0.5010	0.5000	1	0.0043	0.0040	0.0037	0.0033	0.0032	0.0032	0.0031	0.0031	0.0029	0.0027
Beryllium		0.0027	0.0027	0.0053	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Bismuth					<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron		0.76	0.76	1.5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium		0.000025	0.000025	0.00004	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium					3.47	3.43	2.38	2.50	2.64	2.62	2.40	2.41	2.62	2.57
Chromium		0.00055	0.00055	0.001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Cobalt					<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper		0.00119	0.00148	0.002	0.00041	0.00040	0.00063	0.00040	0.00035	0.0003	0.00037	0.00036	0.00031	0.00030
Iron		0.155	0.155	0.3	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Lead		0.000525	0.000525	0.001	<0.000050	0.00010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium		0.048	0.048	0.096	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium					1.29	1.28	0.88	0.91	0.99	0.97	0.91	0.91	0.93	0.91
Manganese[3]		0.315	0.330	***equation***	0.0001	0.0001	0.0035	0.0026	0.0007	0.0007	0.0004	0.0004	<0.00010	<0.00010
Mercury		0.000018	0.000018	0.000026	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum		0.037	0.037	0.073	0.0002	0.0002	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001
Nickel		0.013	0.013	0.025	0.0006	0.0008	0.0008	0.0006	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Phosphorus					<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium					0.68	0.70	0.57	0.56	0.49	0.46	0.45	0.47	0.52	0.50
Selenium		0.00055	0.00055	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon					0.07	0.07	0.10	0.10	0.06	0.06	<0.050	<0.050	<0.050	<0.050
Silver					<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium					1.42	1.28	1.06	1.04	1.09	1.11	1.15	1.16	1.07	1.03
Strontium		0.028	0.033	0.049	0.0146	0.0145	0.0115	0.0113	0.0107	0.0111	0.0114	0.0116	0.0114	0.0111
Sulfur					2.04	2.01	1.45	1.48	1.50	1.48	1.59	1.58	1.42	1.42
Thallium		0.00041	0.00041	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin		0.0002	0.0002		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00	<0.00010	<0.00010	<0.00010
Titanium		1.01	1.00	2	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Uranium		0.0075	0.0075	0.015	0.00004	0.00005	0.00004	0.00005	0.00004	0.00004	0.00004	0.00004	0.00003	0.00003
Vanadium		0.0035	0.0035	0.006	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc[3]		0.0053	0.0096	***equation***	<0.0010	<0.0010	0.002	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zirconium					<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030

Notes:

1 CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life, 1999, updated up to 2015.

2 Trigger and threshold values were developed in *CREMP Design Document 2012* (Azimuth, 2012d). A number of thresholds were derived from methods (or sources) other than CCME guidelines. Refer to the *CREMP: 2015 Plan Update* (Azimuth, 2015a) for more details.

3 "***equation***" means that CCME guidelines (or thresholds) are calculated based on an equation which is either pH or hardness dependent. The ammonia and aluminum (t & d) guidelines vary with pH; the cadmium, copper, lead, manganese, nickel and zinc guidelines vary with hardness.

4 Chromium CCME guideline is for Cr VI.

123 Bolded concentrations exceed the trigger value.

123 Bolded and shaded concentrations also exceed the threshold value.

Italicized numbers are below detection limits.

underline = results were given a cautionary flag in the QC assessment (refer to **Section 3.1.2** for details)

~~strikethrough~~ = results flagged as unreliable in the QC assessment

Table 3.2–1. Water quality results from the 2016 CREMP, Meadowbank study lakes.

Lake and Station					Third Portage Lake North Basin (TPN)									
Area-Replicate ID					TPN-90-S	TPN-91-S	TPN-92-S	TPN-93-S	TPN-94-S	TPN-95-S	TPN-96-S	TPN-97-S	TPN-98-S	TPN-99-S
Depth (m)	**CCME (2012)**	**Trigger[2]**			3	3	3	3	3	3	3	3	3	3
Date	**Guideline[1]**	**Meadowbank**	**Wally Lake**	**Threshold[2]**	17-Apr-16	17-Apr-16	20-Jul-16	20-Jul-16	5-Aug-16	5-Aug-16	4-Sep-16	4-Sep-16	30-Nov-16	30-Nov-16
Field Measurements (Surface)														
Temperature (°C)					0.2	0.4	8.3	7.7	9.8	10.3	9.7	9.5	0.7	0.6
Specific Conductivity (µS/cm)					34.5	34.7	26	21	23	24	25.4	25.5	15	24
Dissolved Oxygen (mg/L)					~~25.0~~	~~25.7~~	na	na	11.16	10.92	13.4	14.5	16.6	15.8
pH	6.5 - 9.0	6.50 - 7.94	6.75 - 8.17	6.5 - 9.0	7.54	6.68	7.50	7.24	6.96	7.05	7.48	7.43	6.81	6.86
Physical Tests (mg/L)														
Conductivity (µS/cm)		23.5	36.6		**34.5**	**34.9**	**28.4**	**26.7**	**27.2**	**26.7**	**26.6**	**26.4**	**28.4**	**27.9**
Hardness		8.5	16.7		**10.9**	**11.2**	**9.0**	**8.9**	**9.2**	**9.0**	8.4	**8.6**	**11.2**	**8.9**
pH (Laboratory)	6.5 - 9.0	6.50 - 7.94	6.75 - 8.17	6.5 - 9.0	6.93	6.94	6.64	6.61	6.88	6.87	7.02	7.02	7.04	7.04
Total Suspended Solids		3.0	3.0	5.0	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Total Dissolved Solids		18.0	25.3		**21**	**22**	**18**	**20**	**19**	**19**	**20**	**20**	**23**	**22**
Turbidity (NTU)					0.13	0.12	0.22	0.22	0.18	0.24	0.25	0.26	0.21	0.24
Anions and Nutrients (mg/L)														
Alkalinity - Bicarbonate		8.6	17.8		7.1	7.0	6.2	5.7	6.0	6.1	6.6	6.2	**9.8**	5.9
Alkalinity - Carbonate		4	4		*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Alkalinity - Hydroxide					*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Alkalinity - Total		8.5	17.8		7.1	7.0	6.2	5.7	6.0	6.1	6.6	6.2	**9.8**	5.9
Ammonia (as N)[3]	***equation***	0.065	0.067	0.126	0.020	0.019	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	0.006	0.007
Bromide					*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*
Chloride	120	60.28	60.2	120	0.92	0.94	0.71	0.70	0.71	0.71	0.72	0.71	0.78	0.78
Fluoride	0.120				0.08	0.08	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.07
Nitrate (as N)	3.0	1.50	1.50	3	0.0669	0.0700	0.0559	0.0574	0.0485	0.0458	0.0373	0.0375	0.0322	0.0326
Nitrite (as N)	0.060	0.031	0.031	0.060	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Total Kjeldahl Nitrogen		0.170	0.163		0.109	0.116	0.08	0.09	0.11	0.11	0.12	0.12	0.10	0.11
Ortho Phosphate (as P)		0.002	0.002		*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Phosphorus (P)-Total Diss.					*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*
Phosphorus (P)-Total	0.0040	0.0060	0.0067	0.004	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	0.0023	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*
Silicate (as SiO_2)		1.0	1.08		*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*
Sulphate (SO_4)		64.7	65.2	128	5.98	6.03	4.57	4.56	4.56	4.57	4.57	4.56	4.86	4.83
Cyanides (mg/L)														
Total Cyanide					*<0.0010*	0.0023	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Free Cyanide	0.005				*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Organic / Inorganic Carbon (mg/L)														
Dissolved Organic Carbon		2.60	3.21		1.48	1.47	1.27	1.10	1.17	1.28	1.45	1.32	1.67	1.53
Total Organic Carbon		2.79	4.11		1.51	1.76	1.18	1.25	1.41	1.32	1.41	1.29	1.58	1.41
Plant Pigments (µg/L)														
Chlorophyll-*a*					0.25	0.50	0.17	0.16	0.69	0.64	0.64	0.61	0.75	1.12
Total Metals (mg/L)														
Aluminum[3]	***equation***	0.054	0.053	0.100	0.0050	*<0.0030*	0.0052	0.0047	0.0051	0.0059	0.0076	0.0058	0.0054	0.0049
Antimony		0.0101	0.0100	0.020	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Arsenic	0.0050	0.00255	0.0026	0.005	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Barium		0.50	0.50	1	0.0036	0.0037	0.0027	0.0028	0.0032	0.0032	0.0031	0.0031	0.0029	0.0028
Beryllium		0.0027	0.0027	0.0053	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*
Bismuth					*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Boron	1.5	0.76	0.76	1.5	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Cadmium[3]	***equation***	0.000025	0.000025	0.000040	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Calcium		2.15	4.88		**2.78**	**2.73**	2.12	2.13	**2.16**	**2.20**	**2.19**	**2.18**	**2.18**	2.11
Chromium[4]	0.001	0.00056	0.00055	0.001	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Cobalt					*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Copper[3]	***equation***	0.00124	0.00149	0.002	*<0.00050*	*<0.00050*	*<0.00050*	**0.0013**	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Iron	0.3	0.155	0.157	0.3	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Lead[3]	***equation***	0.000525	0.000525	0.001	0.00008	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Lithium		0.048	0.048	0.096	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Magnesium		0.83	1.36		**1.12**	**1.12**	**0.83**	**0.84**	**0.88**	**0.90**	**0.86**	**0.84**	**0.83**	0.81
Manganese[3]		0.3157	0.3300	***equation***	0.0006	0.0004	0.0019	0.0018	0.0016	0.0016	0.0015	0.0016	0.0009	0.0010
Mercury	0.000026	0.000018	0.000018	0.000026	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Molybdenum	0.073	0.0365	0.0370	0.073	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Nickel[3]	***equation***	0.0127	0.0130	0.025	*<0.00050*	0.0005	*<0.00050*	0.0005	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	0.0006
Phosphorus					*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*
Potassium		0.50	0.59		**0.71**	**0.69**	0.47	0.46	**0.55**	**0.54**	**0.55**	**0.54**	0.48	0.47
Selenium	0.001	0.00055	0.00055	0.001	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Silicon					*<0.050*	*<0.050*	0.06	0.07	0.05	0.06	0.07	0.08	0.08	0.05
Silver	0.0001				*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Sodium		0.975	0.72		**1.41**	**1.43**	**1.11**	**1.12**	**1.17**	**1.19**	**1.21**	**1.20**	**1.09**	**1.06**
Strontium		0.0279	0.0330	0.049	0.0132	0.0133	0.0101	0.0099	0.0101	0.0103	0.0102	0.0101	0.0100	0.0097
Sulfur					1.93	1.92	1.59	1.61	1.66	1.73	1.55	1.66	1.59	1.57
Thallium	0.0008	0.00041	0.00041	0.0008	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Tin		0.0002	0.0002		*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Titanium		1.00	1.00	2	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*
Uranium	0.015	0.0075	0.0075	0.015	0.000041	0.000042	0.000036	0.000036	0.000040	0.000037	0.000035	0.000036	0.000034	0.000034
Vanadium		0.0035	0.0035	0.006	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Zinc[3]	0.030	0.0063	0.0106	***equation***	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*
Zirconium					*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*
Dissolved Metals (mg/L)														
Aluminum[3]		0.0263	0.0260	0.05	0.0010	0.0012	0.0022	0.0019	0.0019	0.0021	0.0021	0.0021	0.0014	0.0012
Antimony		0.0101	0.0100	0.020	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Arsenic		0.0026	0.0026	0.005	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001	0.0002	0.0002	0.0002
Barium		0.5010	0.5000	1	0.0035	0.0036	0.0029	0.0028	0.0032	0.0031	0.0031	0.0030	0.0031	0.0028
Beryllium		0.0027	0.0027	0.0053	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*
Bismuth					*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Boron		0.76	0.76	1.5	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Cadmium		0.000025	0.000025	0.00004	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Calcium					2.64	2.73	2.17	2.16	2.22	2.17	2.03	2.07	2.93	2.21
Chromium		0.00055	0.00055	0.001	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Cobalt					*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Copper		0.00119	0.00148	0.002	0.00037	0.00035	0.00034	0.00044	0.00032	0.00032	0.00031	0.00037	0.00028	0.00027
Iron		0.155	0.155	0.3	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Lead		0.000525	0.000525	0.001	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Lithium		0.048	0.048	0.096	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Magnesium					1.06	1.07	0.86	0.85	0.88	0.86	0.80	0.82	0.94	0.82
Manganese[3]		0.315	0.330	***equation***	*<0.00010*	0.0001	0.0015	0.0014	0.0008	0.0008	0.0004	0.0005	0.0010	*<0.00010*
Mercury		0.000018	0.000018	0.000026	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Molybdenum		0.037	0.037	0.073	0.0002	0.0002	0.0002	0.0002	0.0001	0.0001	0.0002	0.0002	0.0002	0.0001
Nickel		0.013	0.013	0.025	*<0.00050*	*<0.00050*	*<0.00050*	0.0006	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Phosphorus					*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*
Potassium					0.59	0.61	0.45	0.45	0.54	0.43	0.43	0.47	0.52	0.48
Selenium		0.00055	0.00055	0.001	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Silicon					*<0.050*	*<0.050*	0.06	0.06	0.05	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*
Silver					*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Sodium					1.35	1.40	1.17	1.14	1.16	1.19	1.16	1.15	1.25	1.07
Strontium		0.028	0.033	0.049	0.0128	0.0123	0.0092	0.0101	0.0098	0.0101	0.0103	0.0098	0.0217	0.0100
Sulfur					1.89	1.95	1.62	1.60	1.59	1.52	1.60	1.62	1.68	1.58
Thallium		0.00041	0.00041	0.0008	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Tin		0.0002	0.0002		*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Titanium		1.01	1.00	2	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*
Uranium		0.0075	0.0075	0.015	0.00004	0.00004	0.00005	0.00004	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003
Vanadium		0.0035	0.0035	0.006	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Zinc[3]		0.0053	0.0096	***equation***	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	0.002	*<0.0010*	*<0.0010*
Zirconium					*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*

Notes:

1 CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life, 1999, updated up to 2015.

2 Trigger and threshold values were developed in *CREMP Design Document 2012* (Azimuth, 2012d). A number of thresholds were derived from methods (or sources) other than CCME guidelines. Refer to the *CREMP: 2015 Plan Update* (Azimuth, 2015a) for more details.

3 "***equation***" means that CCME guidelines (or thresholds) are calculated based on an equation which is either pH or hardness dependent. The ammonia and aluminum (t & d) guidelines vary with pH; the cadmium, copper, lead, manganese, nickel and zinc guidelines vary with hardness.

4 Chromium CCME guideline is for Cr VI.

123 Bolded concentrations exceed the trigger value.

123 Bolded and shaded concentrations also exceed the threshold value.

Italicized numbers are below detection limits.

underline = results were given a cautionary flag in the QC assessment (refer to **Section 3.1.2** for details)

~~strikethrough~~ = results flagged as unreliable in the QC assessment

Table 3.2–1. Water quality results from the 2016 CREMP, Meadowbank study lakes.

Lake and Station					Third Portage Lake South Basin (TPS)		Second Portage Lake (SP)									
Area-Replicate ID	CCME (2012)	Trigger[2]			TPS-55-S	TPS-56-S	SP-90-S	SP-91-S	SP-92-S	SP-93-S	SP-94-S	SP-95-S	SP-96-S	SP-97-S	SP-98-S	SP-99-S
Depth (m)					3	3	3	3	3	3	3	3	3	3	3	3
Date	Guideline[1]	Meadowbank	Wally Lake	Threshold[2]	21-Apr-16	21-Apr-16	14-Apr-16	14-Apr-16	8-Jul-16	8-Jul-16	3-Aug-16	3-Aug-16	5-Sep-16	5-Sep-16	25-Nov-16	25-Nov-16
Field Measurements (Surface)																
Temperature (°C)					0.5	0.2	0.5	0.3	14.0	13.7	12.9	13.0	9.3	9.3	1.0	0.8
Specific Conductivity (µS/cm)					28	41.9	18	15	28	30	30	30	25	26	28	24
Dissolved Oxygen (mg/L)					13.7	14.5	16.7	16.9	11.7	11.40	10.05	10.14	13.2	14.3	14	15.4
pH	6.5 - 9.0	6.50 - 7.94	6.75 - 8.17	6.5 - 9.0	7.44	7.27	7.68	7.60	7.55	7.74	7.17	7.30	**8.09**	7.70	6.97	7.03
Physical Tests (mg/L)																
Conductivity (µS/cm)		23.5	36.6		**31.4**	**36.3**	**44.4**	**43.9**	**36.8**	**34.7**	**35.6**	**34.8**	**34.5**	**34.6**	**40.1**	**38.0**
Hardness		8.5	16.7		**11.2**	**11.4**	**16.8**	**16.7**	**13.5**	**14.0**	**14.5**	**14.4**	**13.7**	**13.1**	**15.0**	**14.3**
pH (Laboratory)	6.5 - 9.0	6.50 - 7.94	6.75 - 8.17	6.5 - 9.0	6.90	6.67	7.04	7.02	7.12	7.16	7.13	7.13	7.26	7.25	7.28	7.29
Total Suspended Solids		3.0	3.0	5.0	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Total Dissolved Solids		18.0	25.3		**22**	**20**	**29.1**	**27.0**	**23.7**	**22.3**	**22**	**23**	**25**	**25**	**29**	**30**
Turbidity (NTU)					0.11	0.12	0.12	0.14	0.34	0.36	0.26	0.27	0.26	0.26	0.22	0.23
Anions and Nutrients (mg/L)																
Alkalinity - Bicarbonate		8.6	17.8		8.0	**10.3**	**12.3**	**11.9**	**10.1**	**10.2**	**11.1**	**9.9**	**11.1**	**11.0**	**12.0**	**11.3**
Alkalinity - Carbonate		4	4		*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Alkalinity - Hydroxide					*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Alkalinity - Total		8.5	17.8		8.0	**10.3**	**12.3**	**11.9**	**10.1**	**10.2**	**11.1**	**9.9**	**11.1**	**11.0**	**12.0**	**11.3**
Ammonia (as N)[3]	***equation***	0.065	0.067	0.126	0.019	0.022	0.019	0.021	*<0.0050*	*<0.0050*	*<0.0050*	0.017	*<0.0050*	-	0.006	0.006
Bromide					*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*
Chloride	120	60.28	60.2	120	0.95	1.00	1.01	1.00	0.84	0.85	0.82	0.82	0.82	0.82	0.93	0.91
Fluoride	0.120				0.08	0.09	0.09	0.09	0.07	0.06	0.07	0.07	0.07	0.07	0.07	0.07
Nitrate (as N)	3.0	1.50	1.50	3	0.0672	0.0714	0.0363	0.0316	0.0229	0.0183	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*
Nitrite (as N)	0.060	0.031	0.031	0.060	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Total Kjeldahl Nitrogen		0.170	0.163		**0.23**	0.11	0.17	0.13	0.11	0.12	0.11	0.14	0.15	-	0.12	0.11
Ortho Phosphate (as P)		0.002	0.002		*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Phosphorus (P)-Total Diss.					*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*
Phosphorus (P)-Total	0.0040	0.0060	0.0067	0.004	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	0.0022	0.0020	*<0.0020*	*<0.0020*	0.0021	-	*<0.0020*	*<0.0020*
Silicate (as SiO_2)		1.0	1.08		*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	0.57	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*
Sulphate (SO_4)		64.7	65.2	128	6.06	6.27	5.89	5.94	4.43	4.30	4.22	4.29	4.34	4.33	4.98	4.91
Cyanides (mg/L)																
Total Cyanide					*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Free Cyanide	0.005				*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Organic / Inorganic Carbon (mg/L)																
Dissolved Organic Carbon		2.60	3.21		1.46	1.50	2.02	1.94	1.72	1.68	1.96	1.47	1.57	-	1.76	1.94
Total Organic Carbon		2.79	4.11		1.53	1.43	1.85	2.11	1.77	1.61	1.68	1.69	1.56	-	1.80	1.77
Plant Pigments (µg/L)																
Chlorophyll-*a*					0.24	0.30	0.12	0.15	0.27	0.26	0.56	0.63	0.77	0.77	0.51	0.57
Total Metals (mg/L)																
Aluminum[3]	***equation***	0.054	0.053	0.100	0.0034	0.0032	*<0.0030*	0.0035	0.0178	0.0156	0.0087	0.0089	0.0083	0.0076	0.0056	0.0051
Antimony		0.0101	0.0100	0.020	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Arsenic	0.0050	0.00255	0.0026	0.005	0.0002	0.0002	0.0003	0.0004	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002	0.0002
Barium		0.50	0.50	1	0.0037	0.0038	0.0037	0.0038	0.0032	0.0029	0.0028	0.0029	0.0026	0.0027	0.0025	0.0025
Beryllium		0.0027	0.0027	0.0053	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*
Bismuth					*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Boron	1.5	0.76	0.76	1.5	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Cadmium[3]	***equation***	0.000025	0.000025	0.000040	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Calcium		2.15	4.88		**2.75**	**2.76**	**4.23**	**4.24**	**3.48**	**3.59**	**3.76**	**3.63**	**3.79**	**3.64**	**4.10**	**3.80**
Chromium[4]	0.001	0.00056	0.00055	0.001	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	0.0001	0.0001	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Cobalt					*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Copper[3]	***equation***	0.00124	0.00149	0.002	*<0.00050*	0.0006	0.0006	0.0010	0.0007	0.0007	0.0007	0.0007	0.0006	0.0006	0.0007	0.0006
Iron	0.3	0.155	0.157	0.3	*<0.010*	*<0.010*	*<0.010*	*<0.010*	0.040	0.031	0.021	0.020	0.020	0.023	*<0.010*	*<0.010*
Lead[3]	***equation***	0.000525	0.000525	0.001	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	0.00006	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Lithium		0.048	0.048	0.096	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Magnesium		0.83	1.36		**1.10**	**1.12**	**1.44**	**1.45**	**1.12**	**1.13**	**1.19**	**1.17**	**1.19**	**1.14**	**1.25**	**1.16**
Manganese[3]		0.3157	0.3300	***equation***	0.0004	0.0004	0.0003	0.0005	0.0028	0.0027	0.0019	0.0018	0.0017	0.0017	0.0008	0.0008
Mercury	0.000026	0.000018	0.000018	0.000026	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Molybdenum	0.073	0.0365	0.0370	0.073	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Nickel[3]	***equation***	0.0127	0.0130	0.025	0.0005	0.0005	*<0.00050*	*<0.00050*	0.0006	0.0005	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Phosphorus					*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*
Potassium		0.50	0.59		**0.64**	**0.68**	**0.72**	**0.75**	**0.59**	**0.55**	**0.54**	**0.56**	**0.53**	**0.53**	**0.52**	**0.51**
Selenium	0.001	0.00055	0.00055	0.001	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Silicon					*<0.050*	0.05	0.19	0.17	0.24	0.26	0.20	0.18	0.22	0.21	0.23	0.18
Silver	0.0001				*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Sodium		0.975	0.72		**1.47**	**1.49**	**1.19**	**1.24**	0.87	0.80	0.83	0.88	0.89	0.91	0.84	0.86
Strontium		0.0279	0.0330	0.049	0.0126	0.0130	0.0196	0.0193	0.0163	0.0175	0.0173	0.0170	0.0171	0.0178	0.0191	0.0176
Sulfur					1.98	2.03	1.89	1.94	1.52	1.48	1.65	1.63	1.58	1.53	1.61	1.65
Thallium	0.0008	0.00041	0.00041	0.0008	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Tin		0.0002	0.0002		*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Titanium		1.00	1.00	2	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	0.00031	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*
Uranium	0.015	0.0075	0.0075	0.015	0.000039	0.000042	0.000048	0.000052	0.000059	0.000058	0.000050	0.000052	0.000044	0.000046	0.000043	0.000040
Vanadium		0.0035	0.0035	0.006	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Zinc[3]	0.030	0.0063	0.0106	***equation***	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*
Zirconium					*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*
Dissolved Metals (mg/L)																
Aluminum[3]		0.0263	0.0260	0.05	0.0010	0.0013	0.0012	0.0013	0.0033	0.0033	0.0027	0.0028	0.0020	0.0020	0.0014	0.0012
Antimony		0.0101	0.0100	0.020	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Arsenic		0.0026	0.0026	0.005	0.0002	0.0002	0.0003	0.0003	0.0003	0.0002	0.0003	0.0003	0.0002	0.0002	0.0002	0.0002
Barium		0.5010	0.5000	1	0.0036	0.0036	0.0037	0.0037	0.0031	0.0028	0.0027	0.0028	0.0026	0.0026	0.0023	0.0025
Beryllium		0.0027	0.0027	0.0053	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*
Bismuth					*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Boron		0.76	0.76	1.5	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Cadmium		0.000025	0.000025	0.00004	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Calcium					2.70	2.75	4.37	4.33	3.53	3.71	3.80	3.78	3.61	3.49	4.12	3.84
Chromium		0.00055	0.00055	0.001	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Cobalt					*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Copper		0.00119	0.00148	0.002	0.00035	0.00038	0.00056	0.00054	0.00057	0.00064	0.00059	0.00058	0.00056	0.00054	0.00054	0.00049
Iron		0.155	0.155	0.3	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Lead		0.000525	0.000525	0.001	0.00010	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	0.00005
Lithium		0.048	0.048	0.096	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Magnesium					1.09	1.10	1.44	1.43	1.13	1.15	1.21	1.20	1.13	1.07	1.15	1.14
Manganese[3]		0.315	0.330	***equation***	0.0002	0.0002	*<0.00010*	0.0001	0.0017	0.0019	0.0006	0.0006	0.0003	0.0004	*<0.00010*	0.0001
Mercury		0.000018	0.000018	0.000026	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Molybdenum		0.037	0.037	0.073	0.0002	0.0002	0.0002	0.0002	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Nickel		0.013	0.013	0.025	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Phosphorus					*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*
Potassium					0.61	0.62	0.68	0.70	0.60	0.55	0.50	0.47	0.47	0.43	0.49	0.52
Selenium		0.00055	0.00055	0.001	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Silicon					*<0.050*	*<0.050*	0.18	0.16	0.22	0.25	0.19	0.17	0.16	0.15	0.17	0.14
Silver					*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Sodium					1.42	1.28	1.21	1.22	0.88	0.79	0.83	0.87	0.84	0.85	0.78	0.87
Strontium		0.028	0.033	0.049	0.0122	0.0124	0.0193	0.0186	0.0163	0.0175	0.0168	0.0164	0.0170	0.0170	0.0188	0.0174
Sulfur					1.94	2.00	1.94	1.94	1.51	1.45	1.45	1.48	1.55	1.53	1.60	1.47
Thallium		0.00041	0.00041	0.0008	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Tin		0.0002	0.0002		*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Titanium		1.01	1.00	2	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*
Uranium		0.0075	0.0075	0.015	0.00004	0.00004	0.00004	0.00005	0.00005	0.00005	0.00005	0.00004	0.00004	0.00004	0.00004	0.00004
Vanadium		0.0035	0.0035	0.006	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Zinc[3]		0.0053	0.0096	***equation***	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Zirconium					*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*

Notes:

1 CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life, 1999, updated up to 2015.

2 Trigger and threshold values were developed in *CREMP Design Document 2012* (Azimuth, 2012d). A number of thresholds were derived from methods (or sources) other than CCME guidelines. Refer to the *CREMP: 2015 Plan Update* (Azimuth, 2015a) for more details.

3 "***equation***" means that CCME guidelines (or thresholds) are calculated based on an equation which is either pH or hardness dependent. The ammonia and aluminum (t & d) guidelines vary with pH; the cadmium, copper, lead, manganese, nickel and zinc guidelines vary with hardness.

4 Chromium CCME guideline is for Cr VI.

123 Bolded concentrations exceed the trigger value.

123 Bolded and shaded concentrations also exceed the threshold value.

Italicized numbers are below detection limits.

underline = results were given a cautionary flag in the QC assessment (refer to **Section 3.1.2** for details)

~~strikethrough~~ = results flagged as unreliable in the QC assessment

Table 3.2–1. Water quality results from the 2016 CREMP, Meadowbank study lakes.

Lake and Station					**Tehek Lake (TE)**		**Tehek Lake Far-field (TEFF)**		**Inuggugayualik Lake (INUG)**							
Area-Replicate ID					TE-90-S	TE-91-S	TEFF-43-S	TEFF-44-S	INUG-78-S	INUG-79-S	INUG-80-S	INUG-81-S	INUG-82-S	INUG-83-S	INUG-84-S	INUG-85-S
Depth (m)	**CCME (2012)**	**Trigger[2]**			3	3	3	3	3	3	3	3	3	3	3	3
Date	**Guideline[1]**	**Meadowbank**	**Wally Lake**	**Threshold[2]**	25-Apr-16	25-Apr-16	25-Apr-16	25-Apr-16	15-Apr-16	15-Apr-16	18-Jul-16	18-Jul-16	7-Aug-16	7-Aug-16	7-Sep-16	7-Sep-16
Field Measurements (Surface)																
Temperature (°C)					0.5	0.4	0.4	0.4	0.3	0.3	13.7	11.6	11.9	11.9	9.2	9.3
Specific Conductivity (µS/cm)					31	32	28	23	14	17	9	6	13	13	12.6	12.6
Dissolved Oxygen (mg/L)					12.8	15.5	14.40	12.80	16.1	17.1	9.9	11.7	10.33	10.14	11.9	13.2
pH	6.5 - 9.0	6.50 - 7.94	6.75 - 8.17	6.5 - 9.0	6.98	6.97	7.22	7.07	7.16	7.23	7.69	7.76	6.63	6.81	7.41	7.37
Physical Tests (mg/L)																
Conductivity (µS/cm)		23.5	36.6		**42.3**	**34.8**	22.8	**25.4**	20.1	20.5	16.2	15.9	15.0	15.4	15.1	15.3
Hardness		8.5	16.7		**16.1**	**12.5**	7.6	**8.9**	7.2	7.4	5.5	5.6	5.8	5.7	5.4	5.4
pH (Laboratory)	6.5 - 9.0	6.50 - 7.94	6.75 - 8.17	6.5 - 9.0	6.92	6.89	6.71	6.78	6.79	6.78	6.79	6.79	6.78	6.80	6.87	6.83
Total Suspended Solids		3.0	3.0	5.0	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Total Dissolved Solids		18.0	25.3		**25**	**21**	15	14	16	15	14	14	11	13	14	15
Turbidity (NTU)					0.13	0.21	0.15	0.13	0.14	0.16	0.40	0.38	0.32	0.34	0.31	0.31
Anions and Nutrients (mg/L)																
Alkalinity - Bicarbonate		8.6	17.8		**11.3**	**9.4**	6.0	6.8	6.2	6.5	4.8	4.6	5.0	5.0	5.2	5.2
Alkalinity - Carbonate		4	4		*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Alkalinity - Hydroxide					*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Alkalinity - Total		8.5	17.8		**11.3**	**9.4**	6.0	6.8	6.2	6.5	4.8	4.6	5.0	5.0	5.2	5.2
Ammonia (as N)[3]	***equation***	0.065	0.067	0.126	0.013	0.014	0.010	0.012	0.019	0.016	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*
Bromide					*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*
Chloride	120	60.28	60.2	120	1.20	1.13	0.94	0.96	0.95	0.97	0.70	0.71	0.72	0.72	0.76	0.75
Fluoride	0.120				0.10	0.10	0.08	0.08	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.06
Nitrate (as N)	3.0	1.50	1.50	3	0.0264	0.0204	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*
Nitrite (as N)	0.060	0.031	0.031	0.060	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Total Kjeldahl Nitrogen		0.170	0.163		0.11	0.11	0.09	0.09	0.15	0.15	0.11	0.10	0.12	0.12	*<0.050*	0.12
Ortho Phosphate (as P)		0.002	0.002		*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Phosphorus (P)-Total Diss.					*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*
Phosphorus (P)-Total	0.0040	0.0060	0.0067	0.004	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	0.0021	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	0.0023	0.0021
Silicate (as SiO_2)		1.0	1.08		*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*
Sulphate (SO_4)		64.7	65.2	128	5.63	4.49	2.96	3.22	1.13	1.16	0.80	0.81	0.81	0.81	0.84	0.83
Cyanides (mg/L)																
Total Cyanide					*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Free Cyanide	0.005				*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Organic / Inorganic Carbon (mg/L)																
Dissolved Organic Carbon		2.60	3.21		1.93	1.89	1.67	1.66	2.05	2.27	2.13	1.92	1.69	1.69	1.71	1.79
Total Organic Carbon		2.79	4.11		1.99	1.88	1.65	1.58	2.03	2.13	2.05	1.96	1.85	1.87	1.52	1.71
Plant Pigments (µg/L)																
Chlorophyll-*a*					-	-	0.22	0.18	0.24	0.26	0.26	0.27	0.39	0.42	0.45	0.49
Total Metals (mg/L)																
Aluminum[3]	***equation***	0.054	0.053	0.100	*<0.0030*	0.0085	*<0.0030*	*<0.0030*	*<0.0030*	0.0039	0.0113	0.0105	0.0099	0.0086	0.0100	0.0094
Antimony		0.0101	0.0100	0.020	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Arsenic	0.0050	0.00255	0.0026	0.005	0.0003	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Barium		0.50	0.50	1	0.0041	0.0039	0.0031	0.0031	0.0021	0.0023	0.0019	0.0019	0.0021	0.0019	0.0019	0.0019
Beryllium		0.0027	0.0027	0.0053	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*
Bismuth					*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Boron	1.5	0.76	0.76	1.5	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Cadmium[3]	***equation***	0.000025	0.000025	0.000040	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Calcium		2.15	4.88		**4.01**	**3.14**	1.76	2.03	1.43	1.45	1.09	1.10	1.12	1.09	1.14	1.08
Chromium[4]	0.001	0.00056	0.00055	0.001	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	0.0001	0.0001	*<0.00010*	*<0.00010*	*<0.00010*	0.0001
Cobalt					*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Copper[3]	***equation***	0.00124	0.00149	0.002	0.0006	0.0006	*<0.00050*	*<0.00050*	*<0.00050*	0.0005	0.0007	0.0005	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Iron	0.3	0.155	0.157	0.3	*<0.010*	0.015	*<0.010*	*<0.010*	*<0.010*	*<0.010*	0.029	0.020	0.015	0.016	0.026	0.015
Lead[3]	***equation***	0.000525	0.000525	0.001	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Lithium		0.048	0.048	0.096	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Magnesium		0.83	1.36		**1.45**	**1.22**	0.78	**0.86**	**0.91**	**0.92**	0.65	0.66	0.69	0.67	0.70	0.67
Manganese[3]		0.3157	0.3300	***equation***	0.0005	0.0010	0.0004	0.0005	0.0006	0.0006	0.0060	0.0066	0.0028	0.0028	0.0021	0.0020
Mercury	0.000026	0.000018	0.000018	0.000026	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Molybdenum	0.073	0.0365	0.0370	0.073	0.0001	0.0001	*<0.000050*	0.0001	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Nickel[3]	***equation***	0.0127	0.0130	0.025	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	0.0065	*<0.00050*	0.0005	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Phosphorus					*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*
Potassium		0.50	0.59		**0.78**	**0.73**	**0.56**	**0.63**	**0.53**	**0.55**	0.37	0.37	0.40	0.39	0.39	0.33
Selenium	0.001	0.00055	0.00055	0.001	*<0.000050*	*<0.000050*	*<0.000050*	0.00007	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Silicon					0.23	0.22	0.12	0.14	0.13	0.14	0.14	0.15	0.13	0.12	0.18	0.16
Silver	0.0001				*<0.000010*	*<0.000010*	*<0.000010*	0.00005	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Sodium		0.975	0.72		**1.20**	**1.01**	0.80	0.85	0.68	0.72	0.56	0.57	0.58	0.57	0.60	0.63
Strontium		0.0279	0.0330	0.049	0.0181	0.0149	0.0093	0.0110	0.0084	0.0080	0.0063	0.0064	0.0063	0.0063	0.0066	0.0067
Sulfur					1.96	1.53	1.00	1.12	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*
Thallium	0.0008	0.00041	0.00041	0.0008	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Tin		0.0002	0.0002		*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Titanium		1.00	1.00	2	*<0.00030*	0.00031	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*
Uranium	0.015	0.0075	0.0075	0.015	0.000052	0.000057	0.000041	0.000045	0.000047	0.000044	0.000048	0.000050	0.000046	0.000048	0.000042	0.000045
Vanadium		0.0035	0.0035	0.006	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Zinc[3]	0.030	0.0063	0.0106	***equation***	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*
Zirconium					*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*
Dissolved Metals (mg/L)																
Aluminum[3]		0.0263	0.0260	0.05	0.0010	0.0013	0.0011	0.0012	0.0020	0.0014	0.0038	0.0129	0.0027	0.0029	0.0027	0.0028
Antimony		0.0101	0.0100	0.020	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Arsenic		0.0026	0.0026	0.005	0.0002	0.0002	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Barium		0.5010	0.5000	1	0.0041	0.0038	0.0030	0.0033	0.0021	0.0022	0.0019	0.0018	0.0020	0.0019	0.0018	0.0018
Beryllium		0.0027	0.0027	0.0053	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*
Bismuth					*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Boron		0.76	0.76	1.5	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Cadmium		0.000025	0.000025	0.00004	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Calcium					4.06	3.06	1.74	2.08	1.43	1.47	1.12	1.13	1.15	1.14	1.06	1.08
Chromium		0.00055	0.00055	0.001	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Cobalt					*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Copper		0.00119	0.00148	0.002	0.00051	0.00043	0.00026	0.00030	0.00036	0.00035	0.00030	0.00033	0.00029	0.00031	0.00032	0.00033
Iron		0.155	0.155	0.3	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Lead		0.000525	0.000525	0.001	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Lithium		0.048	0.048	0.096	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Magnesium					1.44	1.18	0.78	0.89	0.88	0.90	0.66	0.68	0.71	0.69	0.66	0.66
Manganese[3]		0.315	0.330	***equation***	0.0003	0.0003	0.0002	0.0002	0.0002	0.0002	0.0034	0.0034	0.0002	0.0002	0.0004	0.0002
Mercury		0.000018	0.000018	0.000026	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Molybdenum		0.037	0.037	0.073	0.0001	0.0001	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Nickel		0.013	0.013	0.025	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Phosphorus					*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*
Potassium					0.73	0.69	0.55	0.60	0.47	0.48	0.37	0.40	0.36	0.35	0.37	0.41
Selenium		0.00055	0.00055	0.001	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Silicon					0.23	0.20	0.12	0.14	0.12	0.13	0.14	0.14	0.12	0.12	0.11	0.11
Silver					*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Sodium					1.17	1.02	0.79	0.83	0.68	0.70	0.57	0.56	0.58	0.59	0.60	0.59
Strontium		0.028	0.033	0.049	0.0178	0.0143	0.0092	0.0105	0.0077	0.0082	0.0063	0.0064	0.0063	0.0061	0.0063	0.0063
Sulfur					1.94	1.47	0.98	1.06	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*
Thallium		0.00041	0.00041	0.0008	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Tin		0.0002	0.0002		*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Titanium		1.01	1.00	2	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*
Uranium		0.0075	0.0075	0.015	0.00005	0.00005	0.00004	0.00004	0.00004	0.00004	0.00004	0.00004	0.00004	0.00004	0.00003	0.00003
Vanadium		0.0035	0.0035	0.006	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Zinc[3]		0.0053	0.0096	***equation***	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Zirconium					*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*

Notes:

1 CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life, 1999, updated up to 2015.

2 Trigger and threshold values were developed in *CREMP Design Document 2012* (Azimuth, 2012d). A number of thresholds were derived from methods (or sources) other than CCME guidelines. Refer to the *CREMP: 2015 Plan Update* (Azimuth, 2015a) for more details.

3 "***equation***" means that CCME guidelines (or thresholds) are calculated based on an equation which is either pH or hardness dependent. The ammonia and aluminum (t & d) guidelines vary with pH; the cadmium, copper, lead, manganese, nickel and zinc guidelines vary with hardness.

4 Chromium CCME guideline is for Cr VI.

123	Bolded concentrations exceed the trigger value.
123	Bolded and shaded concentrations also exceed the threshold value.

Italicized numbers are below detection limits.

underline = results were given a cautionary flag in the QC assessment (refer to **Section 3.1.2** for details)

~~strikethrough~~ = results flagged as unreliable in the QC assessment

Table 3.2–1. Water quality results from the 2016 CREMP, Meadowbank study lakes.

Lake and Station					**Pipedream Lake (PDL)**							
Area-Replicate ID	**CCME (2012)**	**Trigger[2]**			PDL-43-S	PDL-44-S	PDL-45-S	PDL-46-S	PDL-47-S	PDL-48-S	PDL-49-S	PDL-50-S
Depth (m)					3	3	3	3	3	3	3	3
Date	**Guideline[1]**	**Meadowbank**	**Wally Lake**	**Threshold[2]**	16-Apr-16	16-Apr-16	19-Jul-16	19-Jul-16	6-Aug-16	6-Aug-16	8-Sep-16	8-Sep-16
Field Measurements (Surface)												
Temperature (°C)					0.1	0.5	8.5	7.3	10.6	10.5	9.9	9.9
Specific Conductivity (µS/cm)					28.6	23	15	19	19	18	18	18
Dissolved Oxygen (mg/L)					~~40.51~~	~~33.92~~	na	na	10.94	11.11	11.9	12.2
pH	6.5 - 9.0	6.50 - 7.94	6.75 - 8.17	6.5 - 9.0	6.60	7.00	7.71	7.40	7.03	6.88	7.59	7.61
Physical Tests (mg/L)												
Conductivity (µS/cm)		23.5	36.6		**24.5**	**23.7**	21.3	21.5	21.9	21.2	20.7	21.0
Hardness		8.5	16.7		**9.6**	**9.5**	**8.6**	**8.6**	**8.8**	**9.1**	8.3	8.4
pH (Laboratory)	6.5 - 9.0	6.50 - 7.94	6.75 - 8.17	6.5 - 9.0	6.96	6.99	6.87	6.89	7.01	7.03	7.07	7.07
Total Suspended Solids		3.0	3.0	5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Dissolved Solids		18.0	25.3		18	18	17	16	17	17	17	**18**
Turbidity (NTU)					0.12	0.13	0.25	0.22	0.24	0.24	~~0.26~~	~~0.22~~
Anions and Nutrients (mg/L)												
Alkalinity - Bicarbonate		8.6	17.8		7.8	7.5	7.2	7.2	7.7	7.1	7.6	7.7
Alkalinity - Carbonate		4	4		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity - Hydroxide					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity - Total		8.5	17.8		7.8	7.5	7.2	7.2	7.7	7.1	7.6	7.7
Ammonia (as N)[3]	***equation***	0.065	0.067	0.126	0.012	0.012	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Bromide					<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride	120	60.28	60.2	120	0.68	0.65	0.58	0.58	0.59	0.59	0.61	0.61
Fluoride	0.120				0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Nitrate (as N)	3.0	1.50	1.50	3	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrite (as N)	0.060	0.031	0.031	0.060	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen		0.170	0.163		0.101	0.107	0.10	0.09	0.11	0.11	<0.050	0.09
Ortho Phosphate (as P)		0.002	0.002		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Phosphorus (P)-Total Diss.					<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Phosphorus (P)-Total	0.0040	0.0060	0.0067	0.004	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0021	0.0023
Silicate (as SiO_2)		1.0	1.08		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Sulphate (SO_4)		64.7	65.2	128	1.83	1.76	1.53	1.55	1.55	1.56	1.59	1.59
Cyanides (mg/L)												
Total Cyanide					<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Free Cyanide	0.005				<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon (mg/L)												
Dissolved Organic Carbon		2.60	3.21		1.73	1.52	1.64	1.49	1.54	1.25	1.36	1.48
Total Organic Carbon		2.79	4.11		1.65	1.68	1.54	1.51	1.67	1.53	1.38	1.47
Plant Pigments (µg/L)												
Chlorophyll-*a*					0.33	0.27	0.25	0.28	0.44	0.44	0.49	0.45
Total Metals (mg/L)												
Aluminum[3]	***equation***	0.054	0.053	0.100	<0.0030	<0.0030	0.0057	0.0047	0.0467	0.0049	0.0074	0.0061
Antimony		0.0101	0.0100	0.020	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	0.0050	0.00255	0.0026	0.005	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Barium		0.50	0.50	1	0.0021	0.0020	0.0018	0.0018	0.0025	0.0021	0.0021	0.0022
Beryllium		0.0027	0.0027	0.0053	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Bismuth					<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	1.5	0.76	0.76	1.5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium[3]	***equation***	0.000025	0.000025	0.000040	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium		2.15	4.88		**2.49**	**2.39**	**2.15**	**2.19**	**2.22**	**2.29**	**2.20**	**2.17**
Chromium[4]	0.001	0.00056	0.00055	0.001	<0.00010	<0.00010	0.0001	<0.00010	<0.00040	<0.00020	0.0001	<0.00010
Cobalt					<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper[3]	***equation***	0.00124	0.00149	0.002	0.0006	<0.00050	0.0006	0.0006	**0.0016**	0.0005	0.0008	<0.00050
Iron	0.3	0.155	0.157	0.3	<0.010	<0.010	0.011	0.011	0.081	<0.010	<0.010	<0.010
Lead[3]	***equation***	0.000525	0.000525	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium		0.048	0.048	0.096	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium		0.83	1.36		**0.89**	**0.85**	0.75	0.75	0.81	0.79	0.77	0.77
Manganese[3]		0.3157	0.3300	***equation***	0.0006	0.0006	0.0025	0.0020	0.0021	0.0016	0.0016	0.0016
Mercury	0.000026	0.000018	0.000018	0.000026	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum	0.073	0.0365	0.0370	0.073	0.0001	<0.000050	0.0001	<0.000050	0.0001	0.0001	<0.000050	<0.000050
Nickel[3]	***equation***	0.0127	0.0130	0.025	0.0006	0.0006	0.0007	0.0006	0.0008	0.0007	0.0103	0.0007
Phosphorus					<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium		0.50	0.59		0.43	0.39	0.33	0.36	0.38	0.37	0.33	0.30
Selenium	0.001	0.00055	0.00055	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon					0.12	0.12	0.13	0.13	0.19	0.12	0.15	0.15
Silver	0.0001				<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium		0.975	0.72		0.53	0.51	0.51	0.50	0.53	0.52	0.53	0.53
Strontium		0.0279	0.0330	0.049	0.0105	0.0099	0.0088	0.0090	0.0091	0.0092	0.0095	0.0095
Sulfur					0.64	0.59	0.61	0.62	0.64	0.63	0.65	0.62
Thallium	0.0008	0.00041	0.00041	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin		0.0002	0.0002		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium		1.00	1.00	2	<0.00030	<0.00030	<0.00030	<0.00030	0.00150	<0.00030	<0.00030	<0.00030
Uranium	0.015	0.0075	0.0075	0.015	0.000021	0.000022	0.000024	0.000024	0.000037	0.000024	0.000023	0.000022
Vanadium		0.0035	0.0035	0.006	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc[3]	0.030	0.0063	0.0106	***equation***	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Zirconium					<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Dissolved Metals (mg/L)												
Aluminum[3]		0.0263	0.0260	0.05	<0.0010	<0.0010	0.0020	0.0024	0.0021	0.0018	0.0021	0.0020
Antimony		0.0101	0.0100	0.020	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic		0.0026	0.0026	0.005	0.0001	0.0002	0.0001	0.0001	0.0002	0.0001	0.0002	0.0001
Barium		0.5010	0.5000	1	0.0020	0.0020	0.0019	0.0019	0.0021	0.0021	0.0021	0.0021
Beryllium		0.0027	0.0027	0.0053	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Bismuth					<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron		0.76	0.76	1.5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium		0.000025	0.000025	0.00004	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium					2.44	2.43	2.20	2.20	2.24	2.30	2.11	2.13
Chromium		0.00055	0.00055	0.001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Cobalt					<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper		0.00119	0.00148	0.002	0.00038	0.00036	0.00041	0.00039	0.00041	0.00039	0.00040	0.00041
Iron		0.155	0.155	0.3	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Lead		0.000525	0.000525	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium		0.048	0.048	0.096	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium					0.85	0.83	0.76	0.77	0.78	0.81	0.75	0.75
Manganese[3]		0.315	0.330	***equation***	<0.00010	<0.00010	0.0015	0.0011	0.0006	0.0007	0.0002	0.0002
Mercury		0.000018	0.000018	0.000026	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum		0.037	0.037	0.073	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel		0.013	0.013	0.025	<0.00050	<0.00050	0.0009	0.0006	0.0006	0.0006	0.0006	0.0006
Phosphorus					<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium					0.37	0.38	0.34	0.34	0.30	0.33	0.34	0.33
Selenium		0.00055	0.00055	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon					0.11	0.11	0.13	0.12	0.12	0.12	0.10	0.10
Silver					<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium					0.52	0.51	0.50	0.50	0.52	0.52	0.52	0.51
Strontium		0.028	0.033	0.049	0.0099	0.0096	0.0090	0.0091	0.0088	0.0089	0.0091	0.0090
Sulfur					0.60	0.62	0.57	0.59	0.56	0.56	0.60	0.62
Thallium		0.00041	0.00041	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin		0.0002	0.0002		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium		1.01	1.00	2	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Uranium		0.0075	0.0075	0.015	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002
Vanadium		0.0035	0.0035	0.006	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc[3]		0.0053	0.0096	***equation***	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zirconium					<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030

Notes:

1 CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life, 1999, updated up to 2015.

2 Trigger and threshold values were developed in *CREMP Design Document 2012* (Azimuth, 2012d). A number of thresholds were derived from methods (or sources) other than CCME guidelines. Refer to the *CREMP: 2015 Plan Update* (Azimuth, 2015a) for more details.

3 "***equation***" means that CCME guidelines (or thresholds) are calculated based on an equation which is either pH or hardness dependent. The ammonia and aluminum (t & d) guidelines vary with pH; the cadmium, copper, lead, manganese, nickel and zinc guidelines vary with hardness.

4 Chromium CCME guideline is for Cr VI.

123 Bolded concentrations exceed the trigger value.

123 Bolded and shaded concentrations also exceed the threshold value.

Italicized numbers are below detection limits.

underline = results were given a cautionary flag in the QC assessment (refer to **Section 3.1.2** for details)

~~strikethrough~~ = results flagged as unreliable in the QC assessment

Table 3.2–1. Water quality results from the 2016 CREMP, Meadowbank study lakes.

Lake and Station					Wally Lake (WAL)									
Area-Replicate ID	**CCME (2012)**	**Trigger[2]**			WAL-59-S	WAL-60-S	WAL-61-S	WAL-62-S	WAL-63-S	WAL-64-S	WAL-65-S	WAL-66-S	WAL-67-S	WAL-68-S
Depth (m)					3	3	3	3	3	3	3	3	3	3
Date	**Guideline[1]**	**Meadowbank**	**Wally Lake**	**Threshold[2]**	18-Apr-16	18-Apr-16	10-Jul-16	10-Jul-16	5-Aug-16	5-Aug-16	4-Sep-16	4-Sep-06	30-Nov-16	30-Nov-16
Field Measurements (Surface)														
Temperature (°C)					0.6	0.6	19.1	17.2	12.9	12.9	8.1	8.6	1.3	1.5
Specific Conductivity (μS/cm)					29	36	26	20	32.3	32	37	31	32	17
Dissolved Oxygen (mg/L)					15.3	12.2	10.5	11.10	10.21	10.14	13.8	13.4	14.4	14.6
pH	6.5 - 9.0	6.50 - 7.94	6.75 - 8.17	6.5 - 9.0	7.22	7.31	7.45	7.53	7.41	7.48	7.68	7.74	6.92	6.98
Physical Tests (mg/L)														
Conductivity (μS/cm)		23.5	36.6		**62.7**	**51.9**	33.7	33.7	**40.4**	35.6	**39.4**	**38.1**	**44.5**	**46.1**
Hardness		8.5	16.7		**26.0**	**21.8**	14.4	14.2	16.1	16.0	15.8	15.6	**18.8**	**18.5**
pH (Laboratory)	6.5 - 9.0	6.50 - 7.94	6.75 - 8.17	6.5 - 9.0	6.97	6.94	7.24	7.26	7.20	7.17	7.30	7.32	7.26	7.30
Total Suspended Solids		3.0	3.0	5.0	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Total Dissolved Solids		18.0	25.3		**44**	**32**	23	22	**26**	**26**	**31**	**30**	**30**	**32**
Turbidity (NTU)					0.13	0.14	0.33	0.34	0.28	0.36	0.34	0.33	0.22	0.23
Anions and Nutrients (mg/L)														
Alkalinity - Bicarbonate		8.6	17.8		**22.0**	16.7	11.2	10.5	12.1	11.6	13.5	11.1	14.0	13.9
Alkalinity - Carbonate		4	4		*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Alkalinity - Hydroxide					*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Alkalinity - Total		8.5	17.8		**22.0**	16.7	11.2	10.5	12.1	11.6	13.5	11.1	14.0	13.9
Ammonia (as N)[3]	***equation***	0.065	0.067	0.126	0.034	0.021	*<0.0050*	*<0.0050*	0.005	*<0.0050*	*<0.0050*	*<0.0050*	0.015	0.016
Bromide					*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*
Chloride	120	60.28	60.2	120	1.29	1.04	0.66	0.63	0.70	0.69	0.78	0.77	0.88	0.94
Fluoride	0.120				0.07	0.06	0.05	0.04	0.05	0.05	0.05	0.05	0.05	0.05
Nitrate (as N)	3.0	1.50	1.50	3	0.0817	0.0511	*<0.0050*	*<0.0050*	0.0229	0.0126	0.0272	0.0172	0.0380	0.0651
Nitrite (as N)	0.060	0.031	0.031	0.060	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	0.001	*<0.0010*
Total Kjeldahl Nitrogen		0.170	0.163		**0.170**	0.146	0.14	0.16	0.14	0.14	**0.18**	**0.17**	0.14	0.16
Ortho Phosphate (as P)		0.002	0.002		*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Phosphorus (P)-Total Diss.					*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*
Phosphorus (P)-Total	0.0040	0.0060	0.0067	0.004	*<0.0020*	*<0.0020*	0.0028	0.0024	0.0022	0.0022	0.0024	0.0027	0.0020	*<0.0020*
Silicate (as SiO_2)		1.0	1.08		**1.15**	1.04	0.73	0.62	0.55	0.55	0.52	0.56	0.68	0.68
Sulphate (SO_4)		64.7	65.2	128	6.85	5.53	3.34	3.32	3.82	3.66	4.38	4.25	5.13	5.67
Cyanides (mg/L)														
Total Cyanide					*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Free Cyanide	0.005				*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Organic / Inorganic Carbon (mg/L)														
Dissolved Organic Carbon		2.60	3.21		2.56	2.36	1.92	2.01	2.11	2.06	1.89	1.98	1.67	1.53
Total Organic Carbon		2.79	4.11		2.96	2.41	2.17	1.99	2.25	2.11	2.00	2.51	1.58	1.41
Plant Pigments (μg/L)														
Chlorophyll-*a*					0.08	0.13	0.42	0.41	0.79	0.78	0.82	1.04	0.82	0.78
Total Metals (mg/L)														
Aluminum[3]	***equation***	0.054	0.053	0.100	*<0.0030*	*<0.0030*	0.0133	0.0130	0.0067	0.0077	0.0068	0.0074	0.0060	0.0057
Antimony		0.0101	0.0100	0.020	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Arsenic	0.0050	0.00255	0.0026	0.005	0.0004	0.0003	0.0002	0.0002	0.0003	0.0003	0.0003	0.0003	0.0002	0.0003
Barium		0.50	0.50	1	0.0040	0.0031	0.0025	0.0023	0.0024	0.0023	0.0024	0.0024	0.0023	0.0024
Beryllium		0.0027	0.0027	0.0053	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*
Bismuth					*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Boron	1.5	0.76	0.76	1.5	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Cadmium[3]	***equation***	0.000025	0.000025	0.000040	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Calcium		2.15	4.88		**7.22**	**5.93**	3.92	3.89	4.28	4.15	4.57	4.59	**5.14**	**5.22**
Chromium[4]	0.001	0.00056	0.00055	0.001	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Cobalt					*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Copper[3]	***equation***	0.00124	0.00149	0.002	0.0012	0.0010	0.0009	0.0009	0.0009	0.0011	0.0010	0.0010	0.0009	0.0008
Iron	0.3	0.155	0.157	0.3	*<0.010*	*<0.010*	0.029	0.029	0.020	0.019	0.021	0.021	0.010	0.011
Lead[3]	***equation***	0.000525	0.000525	0.001	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	0.00007	*<0.000050*
Lithium		0.048	0.048	0.096	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Magnesium		0.83	1.36		**2.14**	**1.76**	1.15	1.11	1.24	1.22	1.28	1.30	1.35	**1.38**
Manganese[3]		0.3157	0.3300	***equation***	0.0011	0.0008	0.0043	0.0025	0.0019	0.0019	0.0021	0.0024	0.0016	0.0016
Mercury	0.000026	0.000018	0.000018	0.000026	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Molybdenum	0.073	0.0365	0.0370	0.073	0.0004	0.0003	0.0002	0.0002	0.0003	0.0002	0.0003	0.0003	0.0004	0.0004
Nickel[3]	***equation***	0.0127	0.0130	0.025	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Phosphorus					*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*
Potassium		0.50	0.59		**0.84**	**0.69**	0.50	0.45	0.50	0.49	0.54	0.53	0.50	0.51
Selenium	0.001	0.00055	0.00055	0.001	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Silicon					0.50	0.45	0.33	0.29	0.27	0.28	0.29	0.33	0.29	0.29
Silver	0.0001				*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Sodium		0.975	0.72		**0.99**	**0.80**	0.58	0.54	0.63	0.61	0.69	0.68	0.64	0.64
Strontium		0.0279	0.0330	0.049	**0.0354**	0.0285	0.0200	0.0197	0.0221	0.0199	0.0228	0.0230	0.0249	0.0258
Sulfur					2.23	1.80	1.19	1.14	1.48	1.40	1.50	1.45	1.70	1.87
Thallium	0.0008	0.00041	0.00041	0.0008	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Tin		0.0002	0.0002		*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Titanium		1.00	1.00	2	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*
Uranium	0.015	0.0075	0.0075	0.015	0.000057	0.000043	0.000051	0.000056	0.000060	0.000050	0.000058	0.000056	0.000058	0.000072
Vanadium		0.0035	0.0035	0.006	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Zinc[3]	0.030	0.0063	0.0106	***equation***	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*
Zirconium					*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*
Dissolved Metals (mg/L)														
Aluminum[3]		0.0263	0.0260	0.05	0.0010	*<0.0010*	0.0035	0.0042	0.0030	0.0024	0.0023	0.0023	0.0019	0.0014
Antimony		0.0101	0.0100	0.020	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Arsenic		0.0026	0.0026	0.005	0.0003	0.0003	0.0002	0.0002	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Barium		0.5010	0.5000	1	0.0040	0.0031	0.0023	0.0022	0.0024	0.0023	0.0022	0.0022	0.0027	0.0029
Beryllium		0.0027	0.0027	0.0053	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*
Bismuth					*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Boron		0.76	0.76	1.5	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Cadmium		0.000025	0.000025	0.00004	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Calcium					7.05	5.89	3.88	3.87	4.35	4.30	4.30	4.26	5.27	5.15
Chromium		0.00055	0.00055	0.001	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Cobalt					*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Copper		0.00119	0.00148	0.002	0.00104	0.00086	0.00077	0.00087	0.00082	0.00081	0.00083	0.00080	0.00072	0.00068
Iron		0.155	0.155	0.3	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Lead		0.000525	0.000525	0.001	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Lithium		0.048	0.048	0.096	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Magnesium					2.05	1.73	1.13	1.10	1.28	1.27	1.23	1.20	1.37	1.36
Manganese[3]		0.315	0.330	***equation***	0.0004	0.0002	0.0028	0.0015	0.0004	0.0004	0.0004	0.0004	0.0010	0.0005
Mercury		0.000018	0.000018	0.000026	*<0.0000050*	0.00	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Molybdenum		0.037	0.037	0.073	0.0003	0.0003	0.0001	0.0001	0.0002	0.0002	0.0003	0.0003	0.0003	0.0004
Nickel		0.013	0.013	0.025	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Phosphorus					*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*
Potassium					0.73	0.63	0.48	0.52	0.44	0.44	0.47	0.43	0.51	0.50
Selenium		0.00055	0.00055	0.001	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Silicon					0.49	0.44	0.32	0.27	0.27	0.29	0.26	0.25	0.27	0.25
Silver					*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Sodium					0.95	0.79	0.57	0.54	0.61	0.61	0.65	0.65	0.67	0.63
Strontium		0.028	0.033	0.049	**0.0338**	0.0275	0.0195	0.0195	0.0210	0.0207	0.0221	0.0220	0.0275	0.0251
Sulfur					2.18	1.66	1.13	1.15	1.31	1.25	1.56	1.48	1.72	1.69
Thallium		0.00041	0.00041	0.0008	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Tin		0.0002	0.0002		*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Titanium		1.01	1.00	2	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*
Uranium		0.0075	0.0075	0.015	0.00005	0.00003	0.00004	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00006
Vanadium		0.0035	0.0035	0.006	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Zinc[3]		0.0053	0.0096	***equation***	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	0.001	*<0.0010*	*<0.0010*	*<0.0010*
Zirconium					*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*

Notes:

1 CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life, 1999, updated up to 2015.

2 Trigger and threshold values were developed in *CREMP Design Document 2012* (Azimuth, 2012d). A number of thresholds were derived from methods (or sources) other than CCME guidelines. Refer to the *CREMP: 2015 Plan Update* (Azimuth, 2015a) for more details.

3 "***equation***" means that CCME guidelines (or thresholds) are calculated based on an equation which is either pH or hardness dependent. The ammonia and aluminum (t & d) guidelines vary with pH; the cadmium, copper, lead, manganese, nickel and zinc guidelines vary with hardness.

4 Chromium CCME guideline is for Cr VI.

123 Bolded concentrations exceed the trigger value.

123 Bolded and shaded concentrations also exceed the threshold value.

Italicized numbers are below detection limits.

underline = results were given a cautionary flag in the QC assessment (refer to **Section 3.1.2** for details)

~~strikethrough~~ = results flagged as unreliable in the QC assessment

Table 3.2–2. Screening process for water quality parameters, Meadowbank study lakes 2016.

CONVENTIONALS

Screening Level	1	2	3
Screening Rule[1]	>DL ≥ 10% frequency	C-I > 0.1 frequency	Pattern = Activity
Conductivity	Figure 3.2-12		
Hardness	Figure 3.2-13		
pH -Field	Figure 3.2-14		
pH -Lab	Figure 3.2-15		
TSS	Figure 3.2-16		
TDS	Figure 3.2-17		
B-Alkalinity	Figure 3.2-18		
C-Alkalinity*	No	No	No
T-Alkalinity	Figure 3.2-19		
Ammonia-N	Figure 3.2-20		
Chloride	Figure 3.2-21		
Nitrate-N	Figure 3.2-22		
Nitrite-N*	No	No	No
TKN	Figure 3.2-23		
T-phosphorous	Figure 3.2-24		
Ortho-phosphate*	No	No	No
Reactive silica	Figure 3.2-25		
Sulphate	Figure 3.2-26		
DOC	Figure 3.2-27		
TOC	Figure 3.2-28		
T-Cyanide*	No	No	No
Free Cyanide*	No	No	No

TOTAL METALS

Screening Level	1	2	3
Screening Rule[1]	>DL ≥ 10% frequency	C-I > 0.1 frequency	Pattern = Activity
Aluminum	Figure 3.2-29		
Antimony*	No	No	No
Arsenic	Figure 3.2-30		
Barium	Figure 3.2-31		
Beryllium*	No	No	No
Boron*	No	No	No
Cadmium*	No	No	No
Calcium	Figure 3.2-32		
Chromium	Figure 3.2-33		
Copper	Figure 3.2-34		
Iron	Figure 3.2-35		
Lead*	No	No	No
Lithium*	No	No	No
Magnesium	Figure 3.2-36		
Manganese	Figure 3.2-37		
Mercury*	No	No	No
Molybdenum	Figure 3.2-38		
Nickel*	No	No	No
Potassium	Figure 3.2-39		
Selenium*	No	No	No
Sodium	Figure 3.2-40		
Strontium	Figure 3.2-41		
Thallium*	No	No	No
Tin*	No	No	No
Titanium*	No	No	No
Uranium	Figure 3.2-42		
Vanadium*	No	No	No
Zinc*	No	No	No

DISSOLVED METALS

Screening Level	1	2	3
Screening Rule[1]	>DL ≥ 10% frequency	C-I > 0.1 frequency	Pattern = Activity
Aluminum	Figure 3.2-43		
Antimony*	No	No	No
Arsenic	Figure 3.2-44		
Barium	Figure 3.2-45		
Beryllium*	No	No	No
Boron*	No	No	No
Cadmium*	No	No	No
Chromium*	No	No	No
Copper	Figure 3.2-46		
Iron*	No	No	No
Lead*	No	No	No
Lithium*	No	No	No
Manganese	Figure 3.2-47		
Mercury*	No	No	No
Molybdenum	Figure 3.2-48		
Nickel*	No	No	No
Selenium*	No	No	No
Strontium	Figure 3.2-49		
Thallium*	No	No	No
Tin*	No	No	No
Titanium*	No	No	No
Uranium	Figure 3.2-50		
Vanadium*	No	No	No
Zinc*	No	No	No

Notes:

* Plots for these parameters are presented in **Appendix A1**.

[1] See text for further detail.

Table 3.2–3. Water quality variables at the NF[1] Meadowbank areas for which 2016 mean concentration exceeded the trigger.

Parameter	Trigger	PDL	TPN	TPE	SP
		REF	NF	NF	NF
Bicarb. alkalinity	8.56				11.09
Conductivity	23.51		28.77	30	37.74
Hardness	8.49	8.88	9.51	10.87	14.6
Calcium	2.15	2.26	2.28	2.7	3.83
Potassium	0.5		0.55	0.57	0.58
Magnesium	0.83		0.9	1	1.22
Sodium	0.98		1.2	1.16	
Total alkalinity	8.55				11.09
TDS	18		20.42	21.84	25.49

Parameter	Trigger	WAL
		NF
Conductivity	36.6	42.6
Hardness	16.7	17.7
Calcium	4.9	4.9
Magnesium	1.4	1.4
TDS	25.3	29.5

Notes:

[1] MF (TPS and TE) and FF (TEFF) areas were only sampled in April, and were excluded from the formal BACI analysis in 2016 according to the approach outline in **Section 2.2.3**.

Reported mean values are all in units of mg/L with the exception of conductivity (µS/cm).

No cases of trigger exceedances at INUG in 2016.

REF = reference; NF = near-field; MF = mid-field; FF = far-field

Table 3.2–4. Results of BACI tests for selected water variables at Meadowbank areas in 2016.

Variable	Test Area	n(B)	n(A)	Estimate	SE	P-value[1]	Proportional Change		
							Exp(Est.)	LCI	UCI
Bicarb. alkalinity	SP	5	4	0.338	0.043	**0.000**	1.40	1.27	1.55
Conductivity	TPN	6	4	0.555	0.013	**0.000**	1.74	1.69	1.80
	TPE	8	4	0.571	0.048	**0.000**	1.77	1.59	1.97
	SP	5	4	0.385	0.021	**0.000**	1.47	1.40	1.55
	WAL	18	5	0.177	0.070	**0.010**	1.19	1.03	1.38
Hardness	TPN	6	4	0.472	0.014	**0.000**	1.60	1.55	1.65
	TPE	8	4	0.611	0.047	**0.000**	1.84	1.66	2.04
	SP	5	4	0.382	0.027	**0.000**	1.46	1.37	1.56
	WAL	18	5	0.247	0.061	**0.000**	1.28	1.13	1.45
Calcium	TPN	6	4	0.550	0.012	**0.000**	1.73	1.69	1.78
	TPE	8	4	0.674	0.049	**0.000**	1.96	1.76	2.19
	SP	5	4	0.408	0.035	**0.000**	1.50	1.38	1.63
	WAL	18	5	0.219	0.042	**0.000**	1.25	1.14	1.36
Potassium	TPN	6	4	0.307	0.041	**0.000**	1.36	1.24	1.49
	TPE	8	4	0.347	0.024	**0.000**	1.41	1.34	1.49
	SP	5	4	0.365	0.035	**0.000**	1.44	1.33	1.56
Magnesium	TPN	6	4	0.416	0.016	**0.000**	1.52	1.46	1.57
	TPE	8	4	0.508	0.046	**0.000**	1.66	1.50	1.84
	SP	5	4	0.338	0.024	**0.000**	1.40	1.33	1.48
	WAL	18	5	0.219	0.039	**0.000**	1.25	1.15	1.35
Sodium	TPN	6	4	0.696	0.013	**0.000**	2.01	1.95	2.07
	TPE	8	4	0.661	0.019	**0.000**	1.94	1.86	2.02
Total alkalinity	SP	5	4	0.338	0.043	**0.000**	1.40	1.27	1.55
TDS	TPN	6	4	0.289	0.072	**0.002**	1.33	1.13	1.58
	TPE	8	4	0.402	0.070	**0.000**	1.49	1.28	1.75
	SP	5	4	0.462	0.082	**0.000**	1.59	1.31	1.93
	WAL	18	5	0.089	0.149	0.279	1.09	0.80	1.49

Notes:
[1] **Bolded** values are p-values < 0.05
Test area = area compared to control (INUG)
n(B) = number of months in the "before" period
n(A) = number of months in the "after" period (i.e., in 2016)
Estimate = BACI model estimate of the 2016 change in mean for log-transformed data
SE = standard error of the estimate
P-value = one-tailed test of the null hypothesis of no change or a decrease in mean (opposite for a pH lower trigger)
Exp(Est.) = estimated proportional change
LCI = lower 95% confidence interval; UCI = upper 95% confidence interval

Table 3.2–5. Water quality results from Third Portage Lake in 2016 compared against predicted concentrations in the FEIS.

Lake and Station		Simulated Maximum Whole Lake Concentration (mg/L) Third Portage Lake[2]				Third Portage Lake East Basin (TPE)										Third Portage Lake North Basin (TPN)			
Area-Replicate ID	CCME (2012) Guideline[1]	Upper Mixing Estimate (169 Mm^3)		Mid-range Mixing Estimate (92 Mm^3)		TPE-90-S	TPE-91-S	TPE-92-S	TPE-93-S	TPE-94-S	TPE-95-S	TPE-96-S	TPE-97-S	TPE-98-S	TPE-99-S	TPN-90-S	TPN-91-S	TPN-92-S	TPN-93-S
Depth (m)		Without Dike Leaching	With Dike Leaching	Without Dike Leaching	With Dike Leaching	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Date						20-Apr-16	20-Apr-16	12-Jul-16	12-Jul-16	5-Aug-16	5-Aug-16	11-Sep-16	11-Sep-16	27-Nov-16	27-Nov-16	17-Apr-16	17-Apr-16	20-Jul-16	20-Jul-16
Field Measurements (Surface)																			
Temperature (°C)						0.5	0.4	16.0	15.3	12.3	12.4	7.7	7.9	0.9	0.8	0.2	0.4	8.3	7.7
Specific Conductivity (µS/cm)						27	32	25	22	26	26	25	26	20	18	34.5	34.7	~~26~~	~~21~~
Dissolved Oxygen (mg/L)						15.80	15.6	11.2	13.20	10.21	10.18	14.1	13.6	16.00	15.90	25	25.7	na	na
pH	6.5 - 9.0					7.16	7.34	7.40	7.22	7.11	7.13	7.58	7.42	7.13	7.23	7.54	6.68	7.50	7.24
Physical Tests (mg/L)																			
Conductivity (µS/cm)						33.4	32	28	29	29	29	29	28	31	30	35	35	28	27
Hardness		5.7	6.0	6.0	6.4	14.0	13.8	9.6	10.0	10.7	10.5	9.7	9.8	10.4	10.2	10.9	11.2	9.0	8.9
pH (Laboratory)	6.5 - 9.0					6.91	6.68	7.10	7.13	7.02	7.00	7.04	7.03	7.11	7.11	6.93	6.94	6.64	6.61
Total Suspended Solids						<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Dissolved Solids						23	25	17	18	23	22	22	21	25	23	21	22	18	20
Turbidity (NTU)						0.12	0.12	0.26	0.30	0.27	0.28	0.29	0.39	0.25	0.23	0.13	0.12	0.22	0.22
Anions and Nutrients (mg/L)																			
Alkalinity - Bicarbonate						8	6	7	7	7	8	7	7	8	8	7	7	6	6
Alkalinity - Carbonate						<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity - Hydroxide						<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity - Total		4.13	4.14	4.23	4.24	8	6	7	7	7	8	7	7	8	8	7	7	6	6
Ammonia (as N)[3]	equation	0.0333	0.0333	0.0497	0.0497	0.022	0.022	<0.0050	<0.0050	<0.0050	0.005	<0.0050	<0.0050	0.007	0.007	0.020	0.019	<0.0050	<0.0050
Bromide						<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride	120	0.8	0.8	1.0	1.1	1.00	1.00	0.47	0.48	0.68	0.67	0.71	0.70	0.76	0.74	0.92	0.94	0.71	0.70
Fluoride	0.120	0.07	0.08	0.07	0.09	0.10	0.10	0.05	0.05	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.06	0.06
Nitrate (as N)	3.0	0.0351	0.0363	0.0569	0.0588	0.0488	0.0346	0.0226	0.0241	0.0144	0.0147	<0.0050	<0.0050	0.0084	<0.0050	0.067	0.070	0.0559	0.0574
Nitrite (as N)	0.060					<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen						0.11	0.11	0.11	0.10	0.11	0.11	0.09	0.10	0.10	0.11	0.109	0.116	0.08	0.09
Ortho Phosphate (as P)		0.0022	0.0022	0.0024	0.0024	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Phosphorus (P)-Total Diss.						<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Phosphorus (P)-Total	0.0040	0.0027	0.0029	0.0032	0.0035	<0.0020	<0.0020	<0.0020	0.0028	<0.0020	0.0027	<0.0020	0.0023	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Silicate (as SiO_2)						<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Sulphate (SO_4)		1.7	1.7	2.0	2.0	6.38	6.37	2.82	2.92	4.40	4.40	4.52	4.52	4.90	4.75	5.98	6.03	4.57	4.56
Cyanides (mg/L)																			
Total Cyanide		0	0	0	0	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0023	<0.0010	<0.0010
Free Cyanide	0.005					<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon (mg/L)																			
Dissolved Organic Carbon						1.53	1.83	1.28	1.37	1.35	1.29	1.10	1.21	1.54	1.56	1.48	1.47	1.27	1.10
Total Organic Carbon						1.40	1.49	1.30	1.21	1.14	1.33	1.18	1.34	1.66	1.53	1.51	1.76	1.18	1.25
Plant Pigments (ug/L)																			
Chlorophyll-*a*						0.06	0.11	0.14	0.16	0.63	0.68	0.44	0.43	0.49	0.30	0.25	0.50	0.17	0.16
Total Metals (mg/L)																			
Aluminum[3]	equation	0.007	0.009	0.007	0.01	<0.0030	<0.0030	0.0083	0.0107	0.0080	0.0075	0.0093	0.0112	0.0067	0.0058	0.0050	<0.0030	0.0052	0.0047
Antimony		0.00056	0.00057	0.0006	0.00062	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	0.0050	0.00062	0.00062	0.00072	0.00072	0.0005	0.0005	0.0003	0.0004	0.0006	0.0005	0.0005	0.0005	0.0003	0.0003	0.0002	0.0002	0.0002	0.0002
Barium		0.02	0.022	0.02	0.023	0.0044	0.0041	0.0032	0.0033	0.0032	0.0033	0.0032	0.0031	0.0028	0.0027	0.0036	0.0037	0.0027	0.0028
Beryllium		0.001	0.001	0.001	0.001	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Bismuth		0.102	0.102	0.104	0.104	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	1.5	0.00001	0.00001	0.00001	0.00001	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium[3]	equation	<0.000051	<0.000051	<0.000052	<0.000052	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium		1.3	1.4	1.5	1.5	3.45	3.40	2.37	2.47	2.59	2.57	2.51	2.51	2.56	2.58	2.78	2.73	2.12	2.13
Chromium[4]	0.001	0.001	0.001	0.001	0.001	<0.00010	<0.00010	0.0001	<0.00010	<0.00020	<0.00020	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Cobalt		0.004	0.0013	0.0004	0.0017	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper[3]	equation	0.0012	0.0012	0.0013	0.0013	<0.00050	<0.00050	<0.00050	<0.00050	0.0006	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.0013
Iron	0.3	0.03	0.03	0.03	0.03	<0.010	<0.010	0.02	0.02	0.02	0.02	0.01	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Lead[3]	equation	0.0006	0.0006	0.0006	0.0007	<0.000050	<0.000050	0.00007	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.00010	<0.000050	0.00008	<0.000050	<0.000050	<0.000050
Lithium		0.005	0.005	0.005	0.005	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium		0.6	0.6	0.6	0.7	1.30	1.28	0.88	0.91	0.96	0.96	0.94	0.95	0.88	0.90	1.12	1.12	0.83	0.84
Manganese[3]		0.009	0.052	0.015	0.072	0.0003	0.0003	0.0032	0.0030	0.0016	0.0016	0.0012	0.0012	0.0007	0.0007	0.0006	0.0004	0.0019	0.0018
Mercury	0.000026	0.00005	0.00005	0.00005	0.00005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum	0.073	0.001	0.001	0.001	0.001	0.0002	0.0002	0.0002	0.0001	0.0002	0.0002	0.0002	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Nickel[3]	equation	0.0016	0.0016	0.002	0.0021	0.0007	0.0006	0.0007	0.0007	<0.00050	0.0005	0.0005	0.0005	0.0005	0.0005	<0.00050	0.0005	<0.00050	0.0005
Phosphorus						<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium		2	2.1	2	2.1	0.74	0.74	0.57	0.57	0.57	0.56	0.47	0.48	0.48	0.49	0.71	0.69	0.47	0.46
Selenium	0.001	0.001	0.001	0.001	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon		0.01	0.08	0.02	0.12	0.07	0.07	0.11	0.11	0.06	0.07	0.09	0.10	0.08	0.06	<0.050	<0.050	0.06	0.07
Silver	0.0001	0.00002	0.00002	0.00002	0.00002	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium		2	2	2	2.1	1.47	1.44	1.02	1.03	1.11	1.11	1.19	1.17	1.03	1.02	1.41	1.43	1.11	1.12
Strontium		0.002	0.005	0.004	0.007	0.0151	0.0147	0.0108	0.0112	0.0112	0.0111	0.0121	0.0117	0.0115	0.0115	0.0132	0.0133	0.0101	0.0099
Sulfur						2.04	1.99	1.46	1.48	1.65	1.62	1.61	1.69	1.56	1.53	1.93	1.92	1.59	1.61

Table 3.2–5. Water quality results from Third Portage Lake in 2016 compared against predicted concentrations in the FEIS.

Lake and Station		Simulated Maximum Whole Lake Concentration (mg/L) Third Portage Lake[2]				Third Portage Lake East Basin (TPE)										Third Portage Lake North Basin (TPN)			
		Upper Mixing Estimate (169 Mm^3)		Mid-range Mixing Estimate (92 Mm^3)															
Area-Replicate ID	**CCME (2012) Guideline[1]**					TPE-90-S	TPE-91-S	TPE-92-S	TPE-93-S	TPE-94-S	TPE-95-S	TPE-96-S	TPE-97-S	TPE-98-S	TPE-99-S	TPN-90-S	TPN-91-S	TPN-92-S	TPN-93-S
Depth (m)		Without Dike Leaching	With Dike Leaching	Without Dike Leaching	With Dike Leaching	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Date						20-Apr-16	20-Apr-16	12-Jul-16	12-Jul-16	5-Aug-16	5-Aug-16	11-Sep-16	11-Sep-16	27-Nov-16	27-Nov-16	17-Apr-16	17-Apr-16	20-Jul-16	20-Jul-16
Thallium	0.0008	0.0002	0.0002	0.0002	0.0002	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Tin						*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Titanium						*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	0.00033	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*
Uranium	0.015	0.0002	0.0002	0.0002	0.0003	0.000048	0.000049	0.000051	0.000054	0.000049	0.000051	0.000045	0.000045	0.000039	0.000039	0.000041	0.000042	0.000036	0.000036
Vanadium		0.03	0.03	0.03	0.03	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Zinc[3]	0.030	0.011	0.011	0.015	0.015	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	0.0056	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*
Zirconium						*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*

Notes:

1 CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life, 1999, updated up to 2016.

2 Whole lake data are given for a range of mixing conditions, representing lower and upper mixing estimate for the north basin discharge location. The model includes treated water releases from the project (Years 1 to 4), and long-term substance loading due to leaching from the Bay-Goose dike (Cumberland, 2005).

3 "***equation***" means that CCME guidelines (or thresholds) are calculated based on an equation which is either pH or hardness dependent. The ammonia and aluminum (t & d) guidelines vary with pH; the cadmium, copper, lead, manganese, nickel and zinc guidelines vary with hardness.

4 Chromium CCME guideline is for Cr VI.

Formatting for indicating the parameters that exceed the model predictions in the FEIS:

Mid-range Mixing Estimate (92 Mm^3):

- ***Bold italicized*** = concentrations exceed the prediction "With Dike Leaching."
- *Italicized* = concentrations exceed the prediction "Without Dike Leaching."

Upper-range Mixing Estimate (169 Mm^3):

- Bordered cells = concentrations exceed the prediction "With Dike Leaching."
- Shaded cells = concentrations exceed the prediction "Without Dike Leaching."

Italicized numbers are below detection limits.

Table 3.2–5. Water quality results from Third Portage Lake in 2016 compared against predicted concentrations in the FEIS.

Lake and Station		Simulated Maximum Whole Lake Concentration (mg/L) Third Portage Lake[2]				Third Portage Lake North Basin (TPN)						Third Portage Lake South Basin (TPS)	
		Upper Mixing Estimate (169 Mm^3)		Mid-range Mixing Estimate (92 Mm^3)									
Area-Replicate ID	CCME (2012) Guideline[1]					TPN-94-S	TPN-95-S	TPN-96-S	TPN-97-S	TPN-98-S	TPN-99-S	TPS-55-S	TPS-56-S
Depth (m)		Without Dike Leaching	With Dike Leaching	Without Dike Leaching	With Dike Leaching	3	3	3	3	3	3	3	3
Date						5-Aug-16	5-Aug-16	4-Sep-16	4-Sep-16	30-Nov-16	30-Nov-16	21-Apr-16	21-Apr-16
Field Measurements (Surface)													
Temperature (°C)						9.8	10.3	9.7	9.5	0.7	0.6	0.5	0.2
Specific Conductivity (µS/cm)						23	24	25.4	25.5	15	24	~~28~~	~~41.9~~
Dissolved Oxygen (mg/L)						11.16	10.92	13.4	14.5	16.6	15.8	13.7	14.5
pH	6.5 - 9.0					6.96	7.05	7.48	7.43	6.81	6.86	7.44	7.27
Physical Tests (mg/L)													
Conductivity (µS/cm)						27	27	27	26	28	28	31	36
Hardness		5.7	6.0	6.0	6.4	***9.2***	***9.0***	***8.4***	***8.6***	***11.2***	***8.9***	***11.2***	***11.4***
pH (Laboratory)	6.5 - 9.0					6.88	6.87	7.02	7.02	7.04	7.04	6.90	6.67
Total Suspended Solids						<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Dissolved Solids						19	19	20	20	23	22	22	20
Turbidity (NTU)						0.18	0.24	0.25	0.26	0.21	0.24	0.11	0.12
Anions and Nutrients (mg/L)													
Alkalinity - Bicarbonate						6	6	7	6	10	6	8	10
Alkalinity - Carbonate						<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity - Hydroxide						<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity - Total		4.13	4.14	4.23	4.24	***6***	***6***	***7***	***6***	***10***	***6***	***8***	***10***
Ammonia (as N)[3]	***equation***	0.0333	0.0333	0.0497	0.0497	<0.0050	<0.0050	<0.0050	<0.0050	0.006	0.007	0.019	0.022
Bromide						<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride	120	0.8	0.8	1.0	1.1	0.71	0.71	0.72	0.71	0.78	0.78	0.95	1.00
Fluoride	0.120	0.07	0.08	0.07	0.09	0.07	0.07	0.07	0.07	0.07	0.07	*0.08*	*0.09*
Nitrate (as N)	3.0	0.0351	0.0363	0.0569	0.0588	0.0485	0.0458	0.0373	0.0375	0.0322	0.0326	***0.0672***	***0.0714***
Nitrite (as N)	0.060					<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen						0.11	0.11	0.12	0.12	0.10	0.11	0.23	0.11
Ortho Phosphate (as P)		0.0022	0.0022	0.0024	0.0024	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Phosphorus (P)-Total Diss.						<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Phosphorus (P)-Total	0.0040	0.0027	0.0029	0.0032	0.0035	<0.0020	0.0023	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Silicate (as SiO_2)						<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Sulphate (SO_4)		1.7	1.7	2.0	2.0	***4.56***	***4.57***	***4.57***	***4.56***	***4.86***	***4.83***	***6.06***	***6.27***
Cyanides (mg/L)													
Total Cyanide		0	0	0	0	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Free Cyanide	0.005					<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon (mg/L)													
Dissolved Organic Carbon						1.17	1.28	1.45	1.32	1.67	1.53	1.46	1.50
Total Organic Carbon						1.41	1.32	1.41	1.29	1.58	1.41	1.53	1.43
Plant Pigments (ug/L)													
Chlorophyll-*a*						0.69	0.64	0.64	0.61	0.75	1.12	0.24	0.30
Total Metals (mg/L)													
Aluminum[3]	***equation***	0.007	0.009	0.007	0.01	0.0051	0.0059	*0.0076*	0.0058	0.0054	0.0049	0.0034	0.0032
Antimony		0.00056	0.00057	0.0006	0.00062	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	0.0050	0.00062	0.00062	0.00072	0.00072	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Barium		0.02	0.022	0.02	0.023	0.0032	0.0032	0.0031	0.0031	0.0029	0.0028	0.0037	0.0038
Beryllium		0.001	0.001	0.001	0.001	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Bismuth		0.102	0.102	0.104	0.104	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	1.5	0.00001	0.00001	0.00001	0.00001	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium[3]	***equation***	<0.000051	<0.000051	<0.000052	<0.000052	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium		1.3	1.4	1.5	1.5	***2.16***	***2.20***	***2.19***	***2.18***	***2.18***	***2.11***	***2.75***	***2.76***
Chromium[4]	0.001	0.001	0.001	0.001	0.001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Cobalt		0.004	0.0013	0.0004	0.0017	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper[3]	***equation***	0.0012	0.0012	0.0013	0.0013	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.0006
Iron	0.3	0.03	0.03	0.03	0.03	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Lead[3]	***equation***	0.0006	0.0006	0.0006	0.0007	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium		0.005	0.005	0.005	0.005	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium		0.6	0.6	0.6	0.7	***0.88***	***0.90***	***0.86***	***0.84***	***0.83***	***0.81***	***1.10***	***1.12***
Manganese[3]		0.009	0.052	0.015	0.072	0.0016	0.0016	0.0015	0.0016	0.0009	0.0010	0.0004	0.0004
Mercury	0.000026	0.00005	0.00005	0.00005	0.00005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum	0.073	0.001	0.001	0.001	0.001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Nickel[3]	***equation***	0.0016	0.0016	0.002	0.0021	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.0006	0.0005	0.0005
Phosphorus						<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium		2	2.1	2	2.1	0.55	0.54	0.55	0.54	0.48	0.47	0.64	0.68
Selenium	0.001	0.001	0.001	0.001	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon		0.01	0.08	0.02	0.12	*0.05*	*0.06*	*0.07*	*0.08*	*0.08*	*0.05*	<0.050	*0.05*
Silver	0.0001	0.00002	0.00002	0.00002	0.00002	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium		2	2	2	2.1	1.17	1.19	1.21	1.20	1.09	1.06	1.47	1.49
Strontium		0.002	0.005	0.004	0.007	***0.0101***	***0.0103***	***0.0102***	***0.0101***	***0.0100***	***0.0097***	***0.0126***	***0.0130***
Sulfur						1.66	1.73	1.55	1.66	1.59	1.57	1.98	2.03

Table 3.2–5. Water quality results from Third Portage Lake in 2016 compared against predicted concentrations in the FEIS.

Lake and Station		Simulated Maximum Whole Lake Concentration (mg/L) Third Portage Lake[2]				Third Portage Lake North Basin (TPN)						Third Portage Lake South Basin (TPS)	
Area-Replicate ID	CCME (2012) Guideline[1]	Upper Mixing Estimate (169 Mm^3)		Mid-range Mixing Estimate (92 Mm^3)		TPN-94-S	TPN-95-S	TPN-96-S	TPN-97-S	TPN-98-S	TPN-99-S	TPS-55-S	TPS-56-S
Depth (m)		Without Dike Leaching	With Dike Leaching	Without Dike Leaching	With Dike Leaching	3	3	3	3	3	3	3	3
Date						5-Aug-16	5-Aug-16	4-Sep-16	4-Sep-16	30-Nov-16	30-Nov-16	21-Apr-16	21-Apr-16
Thallium	0.0008	0.0002	0.0002	0.0002	0.0002	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Tin						*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Titanium						*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*
Uranium	0.015	0.0002	0.0002	0.0002	0.0003	0.000040	0.000037	0.000035	0.000036	0.000034	0.000034	0.000039	0.000042
Vanadium		0.03	0.03	0.03	0.03	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Zinc[3]	0.030	0.011	0.011	0.015	0.015	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*
Zirconium						*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*

Notes:

1 CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life, 1999, updated up to 2016.

2 Whole lake data are given for a range of mixing conditions, representing lower and upper mixing estimate for the north basin discharge location. The model includes treated water releases from the project (Years 1 to 4), and long-term substance loading due to leaching from the Bay-Goose dike (Cumberland, 2005).

3 "***equation***" means that CCME guidelines (or thresholds) are calculated based on an equation which is either pH or hardness dependent. The ammonia and aluminum (t & d) guidelines vary with pH; the cadmium, copper, lead, manganese, nickel and zinc guidelines vary with hardness.

4 Chromium CCME guideline is for Cr VI.

Formatting for indicating the parameters that exceed the model predictions in the FEIS:

Mid-range Mixing Estimate (92 Mm^3):

- ***Bold italicized*** = concentrations exceed the prediction "With Dike Leaching."
- *Italicized* = concentrations exceed the prediction "Without Dike Leaching."

Upper-range Mixing Estimate (169 Mm^3):

- Bordered cells = concentrations exceed the prediction "With Dike Leaching."
- Shaded cells = concentrations exceed the prediction "Without Dike Leaching."

Italicized numbers are below detection limits.

Table 3.2–6. Water quality results from Second Portage Lake in 2016 compared against predicted concentrations in the FEIS.

Lake and Station		Simulated Maximum Whole Lake Concentration (mg/L) Second Portage Lake[2]				Second Portage Lake (SP)									
		Upper Mixing Estimate (169 Mm^3)		Mid-range Mixing Estimate (92 Mm^3)											
Area-Replicate ID	CCME (2012) Guideline[1]					SP-90-S	SP-91-S	SP-92-S	SP-93-S	SP-94-S	SP-95-S	SP-96-S	SP-97-S	SP-98-S	SP-99-S
Depth (m)		Without Dike Leaching	With Dike Leaching	Without Dike Leaching	With Dike Leaching	3	3	3	3	3	3	3	3	3	3
Date						14-Apr-16	14-Apr-16	8-Jul-16	8-Jul-16	3-Aug-16	3-Aug-16	5-Sep-16	5-Sep-16	25-Nov-16	25-Nov-16
Field Measurements (Surface)															
Temperature (°C)						0.5	0.3	14.0	13.7	12.9	13.0	9.3	9.3	1.0	0.8
Specific Conductivity (µS/cm)						18	15	28	30	30	30	~~25~~	~~26~~	28	24
Dissolved Oxygen (mg/L)						16.7	16.9	11.7	11.40	10.05	10.14	13.2	14.3	14	15.4
pH	6.5 - 9.0					7.68	7.60	7.55	7.74	7.17	7.30	8.09	7.70	6.97	7.03
Physical Tests (mg/L)															
Conductivity (µS/cm)						44	44	37	35	36	35	35	35	40	38
Hardness		8.9	8.9	8.9	8.9	16.8	16.7	13.5	14.0	14.5	14.4	13.7	13.1	15.0	14.3
pH (Laboratory)	6.5 - 9.0					7.04	7.02	7.12	7.16	7.13	7.13	7.26	7.25	7.28	7.29
Total Suspended Solids						<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Dissolved Solids						29	27	24	22	22	23	25	25	29	30
Turbidity (NTU)						0.12	0.14	0.34	0.36	0.26	0.27	0.26	0.26	0.22	0.23
Anions and Nutrients (mg/L)															
Alkalinity - Bicarbonate						12	12	10	10	11	10	11	11	12	11
Alkalinity - Carbonate						<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity - Hydroxide						<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity - Total		7.0	7.0	7.0	7.0	12	12	10	10	11	10	11	11	12	11
Ammonia (as N)[3]	equation	0.025	0.025	0.031	0.031	0.019	0.021	<0.0050	<0.0050	<0.0050	0.017	<0.0050	-	0.006	0.006
Bromide						<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride	120	0.7	0.7	0.8	0.8	1.01	1.00	0.84	0.85	0.82	0.82	0.82	0.82	0.93	0.91
Fluoride	0.120	0.07	0.071	0.07	0.071	0.09	0.09	0.07	0.06	0.07	0.07	0.07	0.07	0.07	0.07
Nitrate (as N)	3.0	0.017	0.017	0.025	0.025	0.0363	0.0316	0.0229	0.0183	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrite (as N)	0.060					<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen						0.17	0.13	0.11	0.12	0.11	0.14	0.15	-	0.12	0.11
Ortho Phosphate (as P)		0.003	0.003	0.003	0.003	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Phosphorus (P)-Total Diss.						<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Phosphorus (P)-Total	0.0040	0.003	0.003	0.0031	0.0031	<0.0020	<0.0020	0.0022	0.0020	<0.0020	<0.0020	0.0021	-	<0.0020	<0.0020
Silicate (as SiO_2)						<0.50	<0.50	<0.50	0.57	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Sulphate (SO_4)		2.8	2.8	2.8	2.8	5.89	5.94	4.43	4.30	4.22	4.29	4.34	4.33	4.98	4.91
Cyanides (mg/L)															
Total Cyanide		0	0	0	0	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Free Cyanide	0.005					<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon (mg/L)															
Dissolved Organic Carbon						2.02	1.94	1.72	1.68	1.96	1.47	1.57	-	1.76	1.94
Total Organic Carbon						1.85	2.11	1.77	1.61	1.68	1.69	1.56	-	1.80	1.77
Plant Pigments (ug/L)															
Chlorophyll-*a*						0.12	0.15	0.27	0.26	0.56	0.63	0.77	0.77	0.51	0.57
Total Metals (mg/L)															
Aluminum[3]	equation	0.007	0.007	0.007	0.007	<0.0030	0.0035	0.0178	0.0156	0.0087	0.0089	0.0083	0.0076	0.0056	0.0051
Antimony		0.0005	0.0005	0.0005	0.0005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	0.0050	0.0005	0.0005	0.0006	0.0006	0.0003	0.0004	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002	0.0002
Barium		0.02	0.02	0.02	0.02	0.0037	0.0038	0.0032	0.0029	0.0028	0.0029	0.0026	0.0027	0.0025	0.0025
Beryllium		0.001	0.001	0.001	0.001	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Bismuth		0.1	0.1	0.1	0.1	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	1.5	0.00001	0.00001	0.00001	0.00001	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium[3]	equation	<0.000050	<0.000050	<0.000051	<0.000051	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium		2.3	2.3	2.3	2.3	4.23	4.24	3.48	3.59	3.76	3.63	3.79	3.64	4.10	3.80
Chromium[4]	0.001	0.001	0.001	0.001	0.001	<0.00010	<0.00010	0.0001	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Cobalt		0.0003	0.0004	0.0003	0.0004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper[3]	equation	0.0011	0.0011	0.0011	0.0011	0.0006	0.0010	0.0007	0.0007	0.0007	0.0007	0.0006	0.0006	0.0007	0.0006
Iron	0.3	0.03	0.03	0.03	0.03	<0.010	<0.010	0.04	0.03	0.02	0.02	0.02	0.02	<0.010	<0.010
Lead[3]	equation	0.0009	0.0009	0.0009	0.0009	<0.000050	<0.000050	0.00006	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium		0.005	0.005	0.005	0.005	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium		0.8	0.8	0.8	0.8	1.44	1.45	1.12	1.13	1.19	1.17	1.19	1.14	1.25	1.16
Manganese[3]		0.0044	0.0067	0.0066	0.0089	0.0003	0.0005	0.0028	0.0027	0.0019	0.0018	0.0017	0.0017	0.0008	0.0008
Mercury	0.000026	0.00005	0.00005	0.00005	0.00005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum	0.073	0.001	0.001	0.001	0.001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Nickel[3]	equation	0.001	0.001	0.001	0.001	<0.00050	<0.00050	0.0006	0.0005	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Phosphorus						<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium		2	2	2	2	0.72	0.75	0.59	0.55	0.54	0.56	0.53	0.53	0.52	0.51
Selenium	0.001	0.001	0.001	0.001	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050

Table 3.2–6. Water quality results from Second Portage Lake in 2016 compared against predicted concentrations in the FEIS.

Lake and Station		Simulated Maximum Whole Lake Concentration (mg/L) Second Portage Lake[2]				Second Portage Lake (SP)									
		Upper Mixing Estimate (169 Mm³)		Mid-range Mixing Estimate (92 Mm³)											
Area-Replicate ID	CCME (2012)					SP-90-S	SP-91-S	SP-92-S	SP-93-S	SP-94-S	SP-95-S	SP-96-S	SP-97-S	SP-98-S	SP-99-S
Depth (m)	Guideline[1]	Without Dike	With Dike	Without Dike	With Dike	3	3	3	3	3	3	3	3	3	3
Date		Leaching	Leaching	Leaching	Leaching	14-Apr-16	14-Apr-16	8-Jul-16	8-Jul-16	3-Aug-16	3-Aug-16	5-Sep-16	5-Sep-16	25-Nov-16	25-Nov-16
Silicon		0.01	0.01	0.01	0.01	***0.19***	***0.17***	***0.24***	***0.26***	***0.20***	***0.18***	***0.22***	***0.21***	***0.23***	***0.18***
Silver	0.0001	0.00001	0.00001	0.00001	0.00001	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Sodium		2	2	2	2	1.19	1.24	0.87	0.80	0.83	0.88	0.89	0.91	0.84	0.86
Strontium		0.8	0.8	0.8	0.8	0.0196	0.0193	0.0163	0.0175	0.0173	0.0170	0.0171	0.0178	0.0191	0.0176
Sulfur						1.89	1.94	1.52	1.48	1.65	1.63	1.58	1.53	1.61	1.65
Thallium	0.0008	0.0002	0.0002	0.0002	0.0002	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Tin						*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Titanium						*<0.00030*	*<0.00030*	*<0.00030*	0.00031	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*
Uranium	0.015	0.0002	0.0002	0.0002	0.0002	0.000048	0.000052	0.000059	0.000058	0.000050	0.000052	0.000044	0.000046	0.000043	0.000040
Vanadium		0.03	0.03	0.03	0.03	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Zinc[3]	0.030	0.007	0.007	0.009	0.009	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*

Notes:

[1] CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life, 1999, updated up to 2016.

[2] The Second Portage Lake water quality model includes substance loading from the Third Portage and East dikes and inflow from Third Portage and Wally lakes. Changes in water quality in Second Portage Lake were modelled for two different mixing scenarios of water releases into Third Portage Lake (Cumberland, 2005).

[3] "***equation***" means that CCME guidelines (or thresholds) are calculated based on an equation which is either pH or hardness dependent. The ammonia and aluminum (t & d) guidelines vary with pH; the cadmium, copper, lead, manganese, nickel and zinc guidelines vary with hardness.

[4] Chromium CCME guideline is for Cr VI.

Formatting for indicating the parameters that exceed the model predictions in the FEIS:

Mid-range Mixing Estimate (92 Mm³):

- ***Bold italicized*** = concentrations exceed the prediction "With Dike Leaching."
- **Bold** = concentrations exceed the prediction "Without Dike Leaching."

Upper-range Mixing Estimate (169 Mm³):

- Bordered cells = concentrations exceed the prediction "With Dike Leaching."
- Shaded cells = concentrations exceed the prediction "Without Dike Leaching."

Italicized numbers are below detection limits.

Table 3.2–7. Water quality results from Wally Lake in 2016 compared against predicted concentrations in the FEIS.

Lake and Station		Simulated Maximum Whole Lake Concentration (mg/L) Wally Lake[2]		Wally Lake (WAL)									
Area-Replicate ID Depth (m) Date	CCME (2012) Guideline[1]	Without Dike Leaching	With Dike Leaching	WAL-59-S 3 18-Apr-16	WAL-60-S 3 18-Apr-16	WAL-61-S 3 10-Jul-16	WAL-62-S 3 10-Jul-16	WAL-63-S 3 5-Aug-16	WAL-64-S 3 5-Aug-16	WAL-65-S 3 4-Sep-16	WAL-66-S 3 4-Sep-06	WAL-67-S 3 30-Nov-16	WAL-68-S 3 30-Nov-16
Field Measurements (Surface)													
Temperature (°C)				0.6	0.6	19.1	17.2	12.9	12.9	8.1	8.6	1.3	1.5
Specific Conductivity (µS/cm)				29	36	~~26~~	20	32.3	32	~~37~~	31	32	17
Dissolved Oxygen (mg/L)				15.3	12.2	10.5	11.10	10.21	10.14	13.8	13.4	14.4	14.6
pH	6.5 - 9.0			7.22	7.31	7.45	7.53	7.41	7.48	7.68	7.74	6.92	6.98
Physical Tests (mg/L)													
Conductivity (µS/cm)				63	52	34	34	40	36	39	38	45	46
Hardness		17.2	17.2	***26.0***	***21.8***	14.4	14.2	16.1	16.0	15.8	15.6	***18.8***	***18.5***
pH (Laboratory)	6.5 - 9.0			6.97	6.94	7.24	7.26	7.20	7.17	7.30	7.32	7.26	7.30
Total Suspended Solids				<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Dissolved Solids				44	32	23	22	26	26	31	30	30	32
Turbidity (NTU)				0.13	0.14	0.33	0.34	0.28	0.36	0.34	0.33	0.22	0.23
Anions and Nutrients (mg/L)													
Alkalinity - Bicarbonate				22	17	11	11	12	12	14	11	14	14
Alkalinity - Carbonate				<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity - Hydroxide				<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity - Total		13.24	13.34	***22***	***17***	11	11	12	12	***14***	11	***14***	***14***
Ammonia (as N)[3]	***equation***	0.089	0.089	0.034	0.021	<0.0050	<0.0050	0.005	<0.0050	<0.0050	<0.0050	0.015	0.016
Bromide				<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride	120	0.7	0.7	***1.29***	***1.04***	0.66	0.63	0.70	0.69	***0.78***	***0.77***	***0.88***	***0.94***
Fluoride	0.120	0.05	0.05	***0.07***	***0.06***	0.05	0.04	0.05	0.05	***0.05***	***0.05***	***0.05***	***0.05***
Nitrate (as N)	3.0	0.102	0.102	0.0817	0.0511	<0.0050	<0.0050	0.0229	0.0126	0.0272	0.0172	0.0380	0.0651
Nitrite (as N)	0.060			<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	<0.0010
Total Kjeldahl Nitrogen				0.170	0.146	0.14	0.16	0.14	0.14	0.18	0.17	0.14	0.16
Ortho Phosphate (as P)		0.003	0.003	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Phosphorus (P)-Total Diss.				<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Phosphorus (P)-Total	0.0040	0.0039	0.004	<0.0020	<0.0020	0.0028	0.0024	0.0022	0.0022	0.0024	0.0027	0.0020	<0.0020
Silicate (as SiO_2)				1.15	1.04	0.73	0.62	0.55	0.55	0.52	0.56	0.68	0.68
Sulphate (SO_4)		5.3	5.3	***6.85***	***5.53***	3.34	3.32	3.82	3.66	4.38	4.25	5.13	***5.67***
Cyanides (mg/L)													
Total Cyanide		0	0	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Free Cyanide	0.005			<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon (mg/L)													
Dissolved Organic Carbon				2.56	2.36	1.92	2.01	2.11	2.06	1.89	1.98	1.67	1.53
Total Organic Carbon				2.96	2.41	2.17	1.99	2.25	2.11	2.00	2.51	1.58	1.41
Plant Pigments (uGu/L)													
Chlorophyll-*a*				0.08	0.13	0.42	0.41	0.79	0.78	0.82	1.04	0.82	0.78
Total Metals (mg/L)													
Aluminum[3]	***equation***	0.012	0.013	<0.0030	<0.0030	***0.0133***	**0.0130**	0.0067	0.0077	0.0068	0.0074	0.0060	0.0057
Antimony		0.0009	0.0009	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	0.0050	0.005	0.006	0.0004	0.0003	0.0002	0.0002	0.0003	0.0003	0.0003	0.0003	0.0002	0.0003
Barium		0.02	0.02	0.0040	0.0031	0.0025	0.0023	0.0024	0.0023	0.0024	0.0024	0.0023	0.0024
Beryllium		0.001	0.001	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Bismuth		0.1	0.1	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	1.5	0.00001	0.00001	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium[3]	***equation***	0.00018	0.00019	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium		4.7	4.7	***7.22***	***5.93***	3.92	3.89	4.28	4.15	4.57	4.59	***5.14***	***5.22***
Chromium[4]	0.001	0.001	0.001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Cobalt		0.0003	0.0003	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper[3]	***equation***	0.002	0.002	0.0012	0.0010	0.0009	0.0009	0.0009	0.0011	0.0010	0.0010	0.0009	0.0008
Iron	0.3	0.03	0.03	<0.010	<0.010	0.03	0.03	0.02	0.02	0.02	0.02	0.01	0.01
Lead[3]	***equation***	0.0007	0.0007	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.00007	<0.000050
Lithium		0.005	0.005	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010

Table 3.2–7. Water quality results from Wally Lake in 2016 compared against predicted concentrations in the FEIS.

Lake and Station		**Simulated Maximum Whole Lake Concentration (mg/L)**		**Wally Lake (WAL)**									
		Wally Lake[2]											
Area-Replicate ID	**CCME (2012) Guideline[1]**	Without Dike Leaching	With Dike Leaching	WAL-59-S	WAL-60-S	WAL-61-S	WAL-62-S	WAL-63-S	WAL-64-S	WAL-65-S	WAL-66-S	WAL-67-S	WAL-68-S
Depth (m)				3	3	3	3	3	3	3	3	3	3
Date				18-Apr-16	18-Apr-16	10-Jul-16	10-Jul-16	5-Aug-16	5-Aug-16	4-Sep-16	4-Sep-06	30-Nov-16	30-Nov-16
Magnesium		1.3	1.3	***2.14***	***1.76***	1.15	1.11	1.24	1.22	1.28	1.30	***1.35***	***1.38***
Manganese[3]		0.002	0.002	0.0011	0.0008	***0.0043***	***0.0025***	0.0019	0.0019	***0.0021***	***0.0024***	0.0016	0.0016
Mercury	0.000026	0.0001	0.0001	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Molybdenum	0.073	0.002	0.002	0.0004	0.0003	0.0002	0.0002	0.0003	0.0002	0.0003	0.0003	0.0004	0.0004
Nickel[3]	***equation***	0.001	0.001	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Phosphorus				*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*
Potassium		2	2	0.84	0.69	0.50	0.45	0.50	0.49	0.54	0.53	0.50	0.51
Selenium	0.001	0.001	0.001	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Silicon		0.04	0.04	***0.50***	***0.45***	***0.33***	***0.29***	***0.27***	***0.28***	***0.29***	***0.33***	***0.29***	***0.29***
Silver	0.0001	0.00002	0.00002	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Sodium		2	2	0.99	0.80	0.58	0.54	0.63	0.61	0.69	0.68	0.64	0.64
Strontium				0.0354	0.0285	0.0200	0.0197	0.0221	0.0199	0.0228	0.0230	0.0249	0.0258
Sulfur				2.23	1.80	1.19	1.14	1.48	1.40	1.50	1.45	1.70	1.87
Thallium	0.0008	0.0002	0.0002	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Tin				*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Titanium				*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*
Uranium	0.015	0.0007	0.0007	0.000057	0.000043	0.000051	0.000056	0.000060	0.000050	0.000058	0.000056	0.000058	0.000072
Vanadium		0.03	0.03	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Zinc[3]	0.030	0.013	0.013	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*

Notes:

[1] CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life, 1999, updated up to 2016.

[2] Preliminary modelling of whole lake water quality in the receiving environment water bodies incorporates long-term loadings from the Vault dike and effluent releases from the Vault Attenuation pond (Cumberland, 2005).

[3] "***equation***" means that CCME guidelines (or thresholds) are calculated based on an equation which is either pH or hardness dependent. The ammonia and aluminum (t & d) guidelines vary with pH; the cadmium, copper, lead, manganese, nickel and zinc guidelines vary with hardness.

[4] Chromium CCME guideline is for Cr VI.

Formatting for indicating the parameters that exceed the model predictions in the FEIS:

- ***Bold italicized*** = concentrations exceed the prediction "With Dike Leaching."
- **Bold** = concentrations exceed the prediction "Without Dike Leaching."

Table 3.2–8. Sampling effort and frequency assessment results for the 2017 CREMP.

Areas	Designation	Triggers Exceeded?	Minor Changes		Moderate Changes		Major Changes		Plan for 2017
		Yes/No	Yes/No	Parameters	Yes/No	Parameters	Yes/No	Parameters	
Sampling Strategy for Reference Areas									
INUG	Ref	No	No	-	No	-	No	-	Full CREMP (reference area)
PDL	Ref	Yes	Yes	Hard., Ca	No	-	No	-	Full CREMP (reference area)
Sampling Strategy for TE and TEFF									
TPE	NF	Yes	Yes	Cond., Hard., Ca, K, Mg, Na, TDS	No	-	No	-	Full CREMP (near-field area)
SP	NF	Yes	Yes	Cond., Hard., Ca, K, Mg, Alkalinity (HCO_3 & Total), TDS	No	-	No	-	Full CREMP (near-field area)
WAL	NF	Yes	Yes	Cond., Hard., Ca, Mg, TDS	No	-	No	-	Full CREMP (near-field area)
TE	MF	NA	NA	-	No	-	No	-	Limnology and water sampling see **Table 4.2-1** for schedule
TEFF	FF	NA	NA	-	No	-	No	-	Limnology and water sampling see **Table 4.2-1** for schedule
Sampling Strategy for TPS									
TPN	NF	Yes	Yes	Cond., Hard., Ca, K, Mg, Na, TDS	No	-	No	-	Full CREMP (near-field area)
TPS	MF	NA	NA	-	No	-	No	-	Limnology and water sampling see **Table 4.2-1** for schedule

Notes:

Minor exceedance of the early warning trigger values for parameters without effects-based threshold values.
Moderate exceedance of the early warning trigger values for parameters with effects-based thresholds.
Major exceedance of the effects-based threshold values.
NA MF and/or FF stations were not assessed using the formal BACI analysis in the current CREMP year.

Figure 3.2–12. Laboratory-measured conductivity (µS/cm) in water samples from Meadowbank study lakes since 2006.

Note: Laboratory-measured conductivity data from 2014 should be interpreted with caution, particularly at low concentrations (See Azimuth [2015c] for more detail).

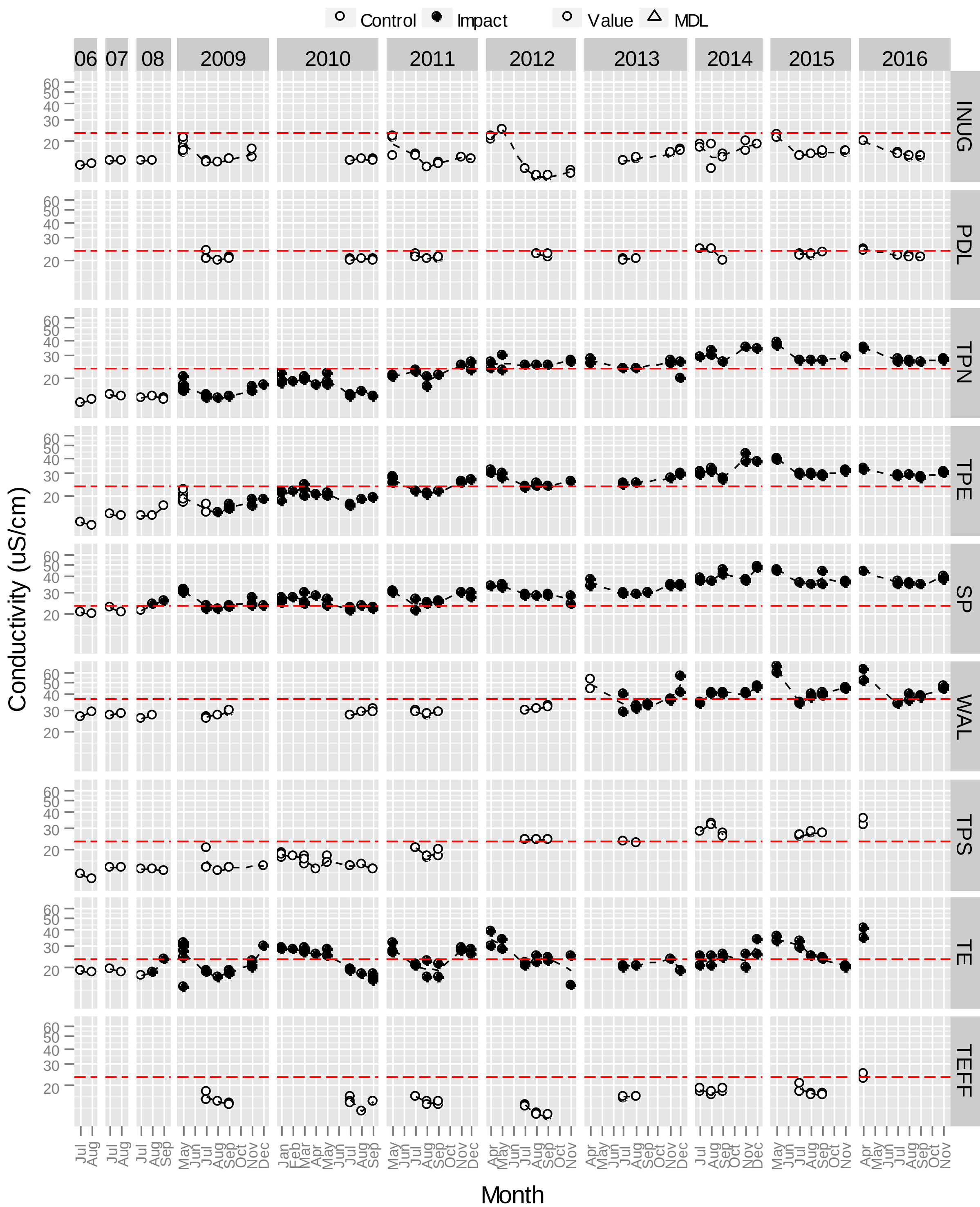


Figure 3.2–13. Hardness (mg/L) in water samples from Meadowbank study lakes since 2006.

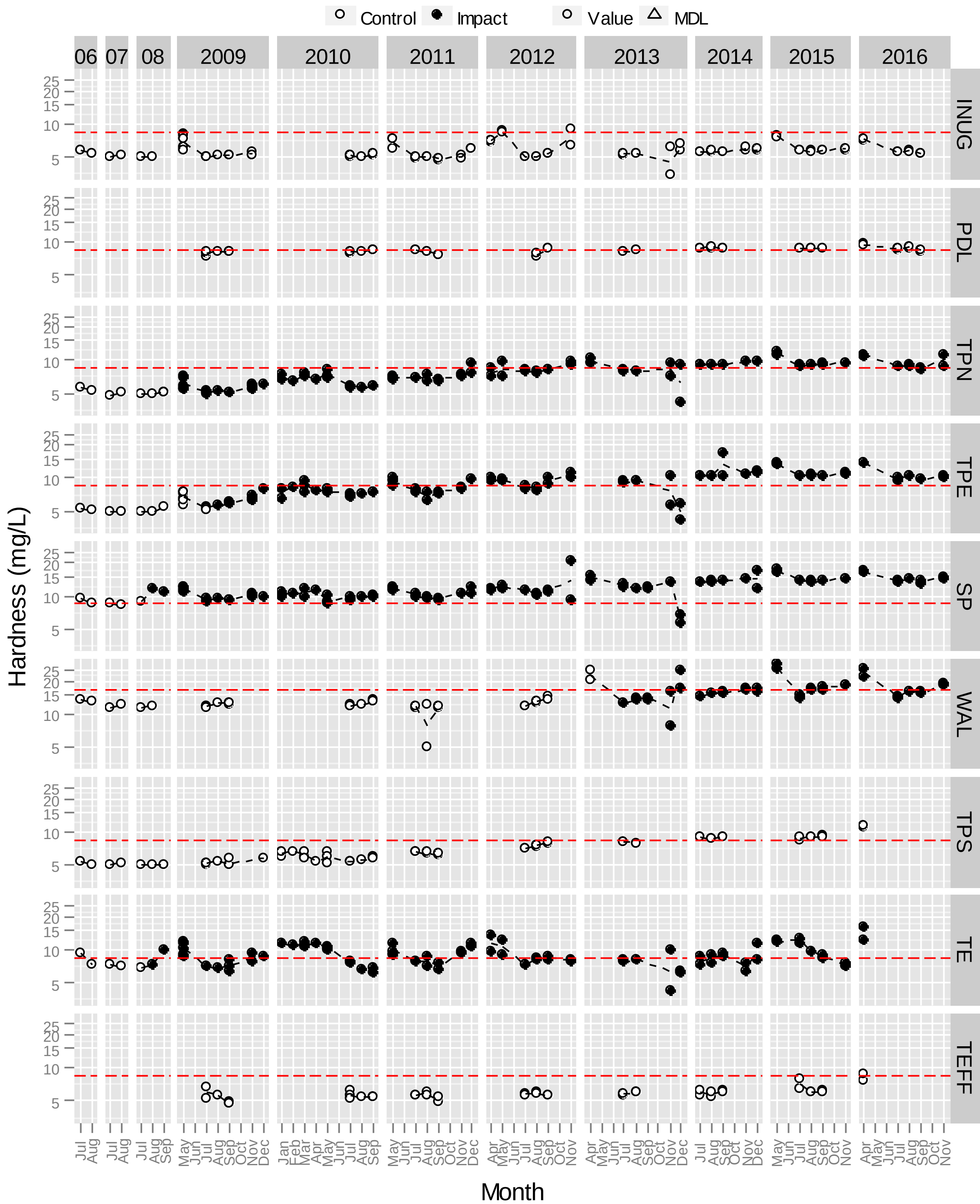


Figure 3.2–14. Field-measured pH in water samples from Meadowbank study lakes since 2006.

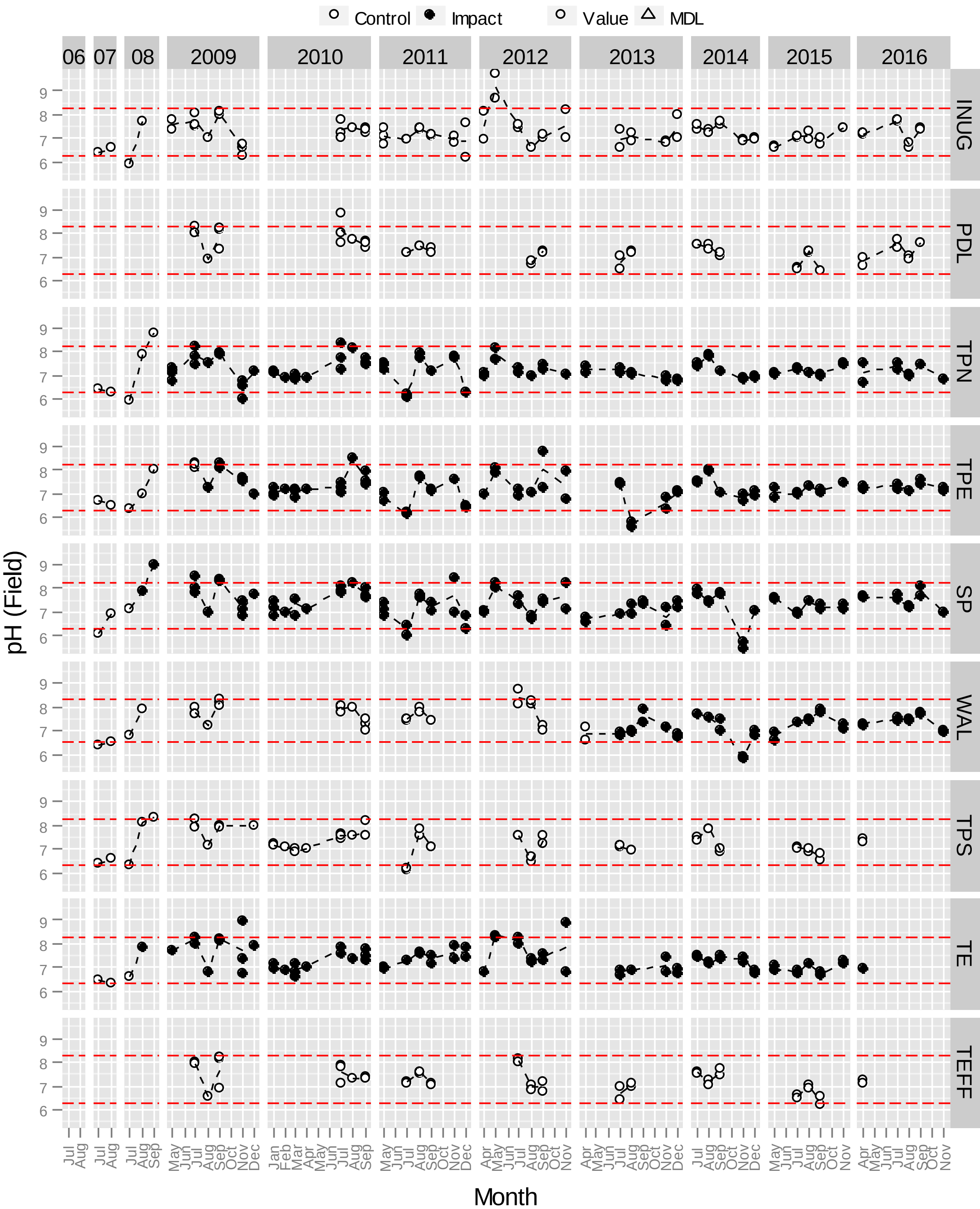


Figure 3.2–15. Laboratory-measured pH in water samples from Meadowbank study lakes since 2006.

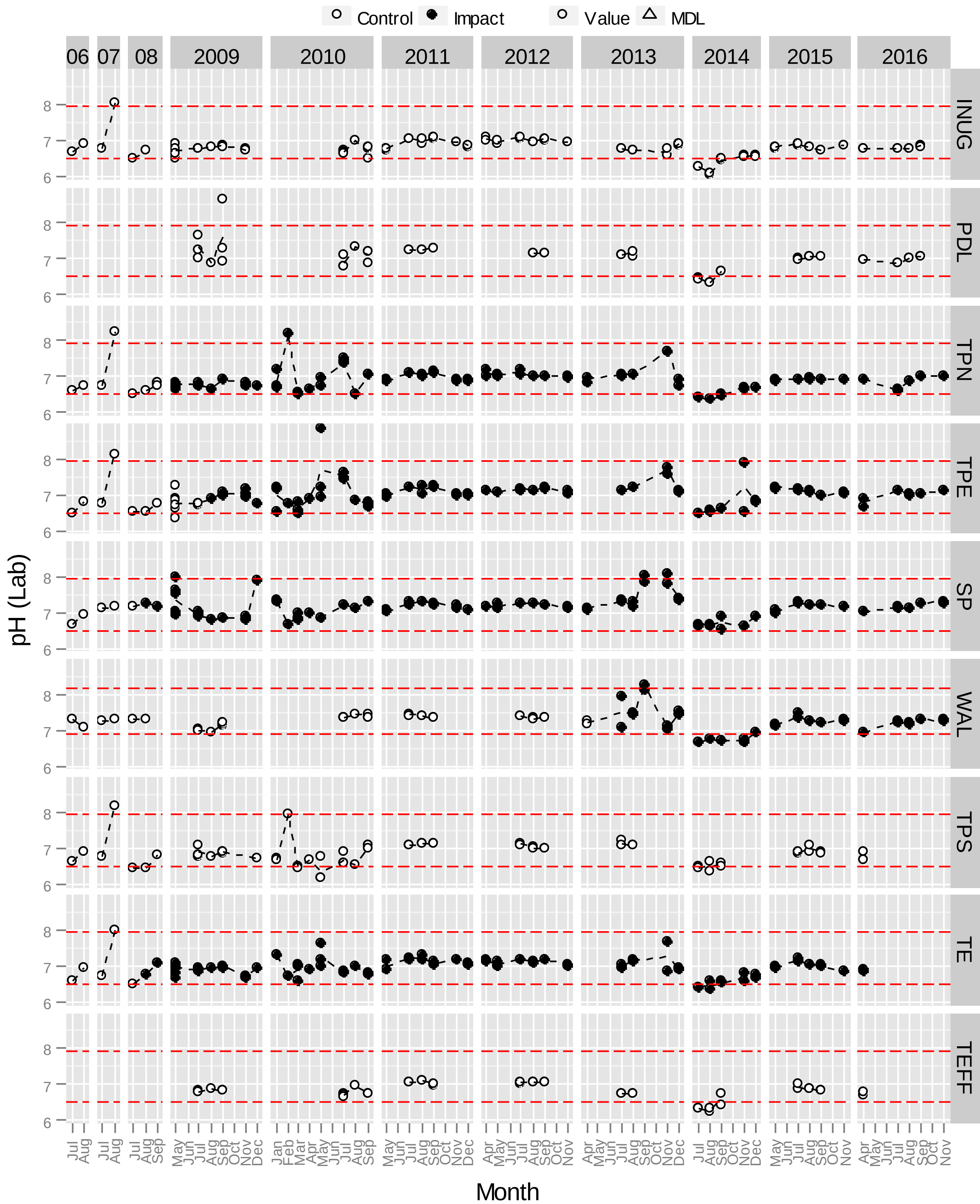


Figure 3.2–16. Total Suspended Solids (TSS; mg/L) in water samples from Meadowbank study lakes since 2006.

Note: TSS data from 2014 were excluded due to data quality issues (See Azimuth [2015c] for more detail).

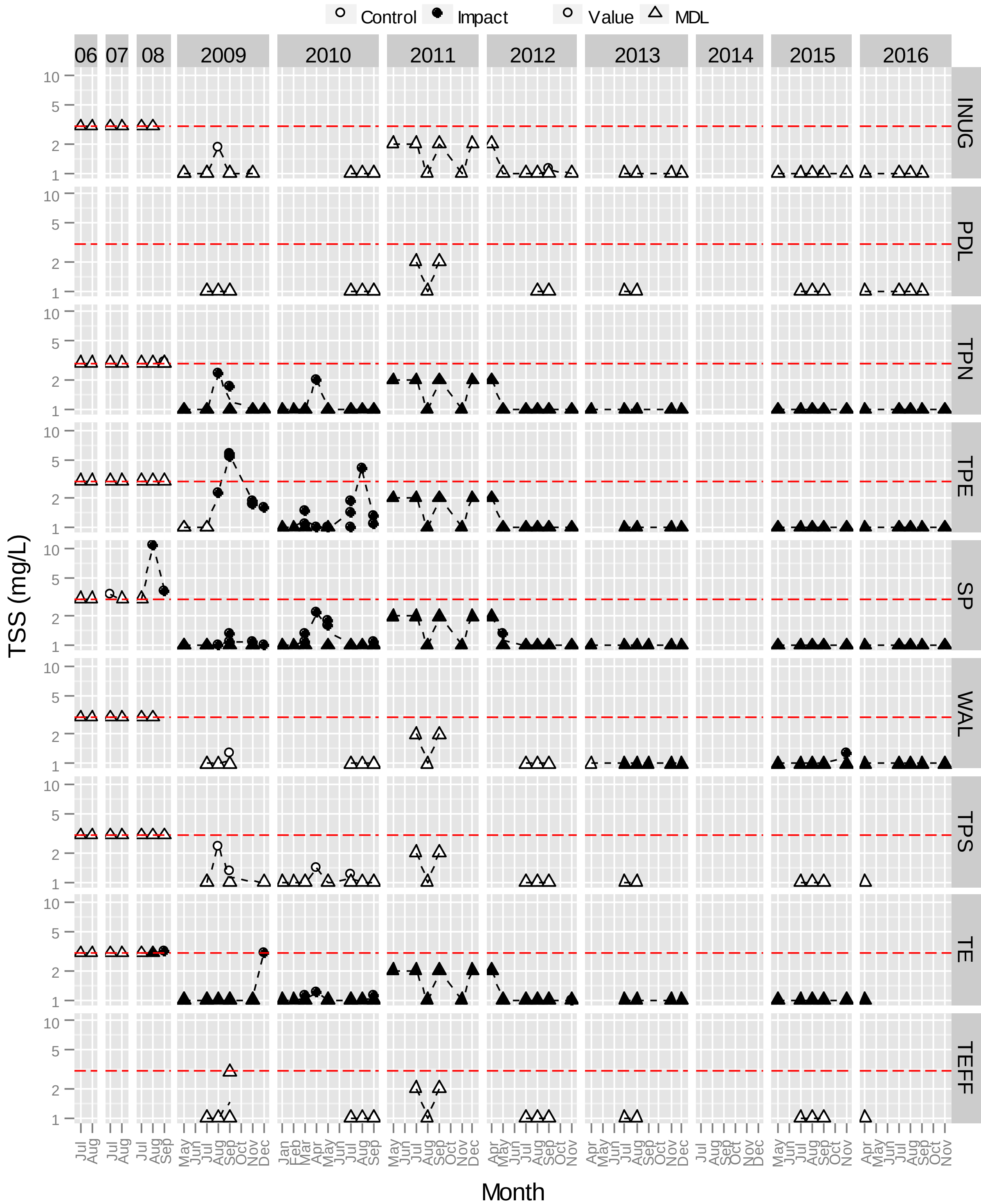


Figure 3.2–17. Total Dissolved Solids (TDS; mg/L) in water samples from Meadowbank study lakes since 2006.

Note: TDS data from 2014 were excluded due to data quality issues (See Azimuth [2015c] for more detail).

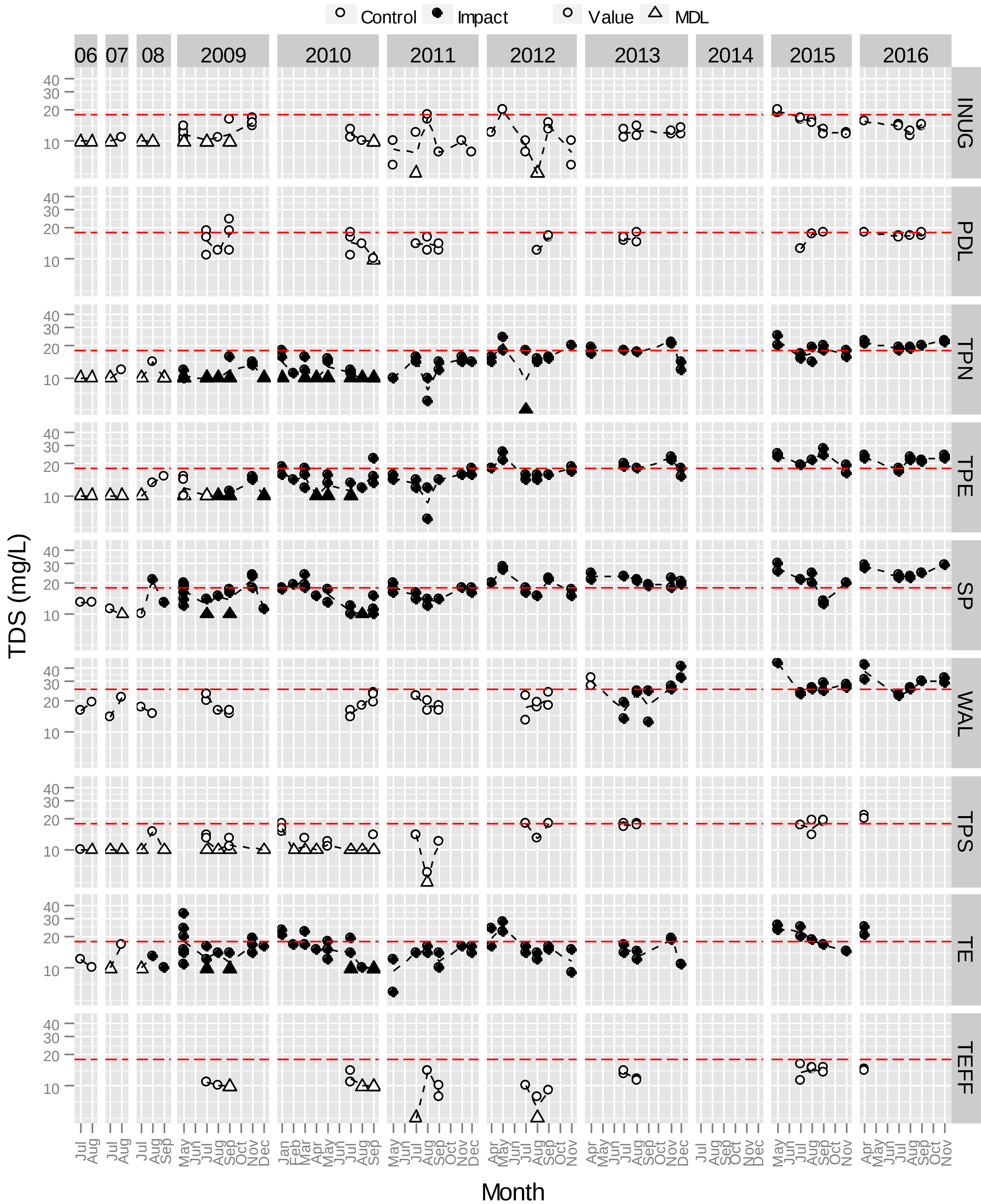


Figure 3.2–18. Bicarbonate Alkalinity (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: Bicarbonate alkalinity data from 2014 were excluded due to data quality issues (see Azimuth [2015c] for more detail).

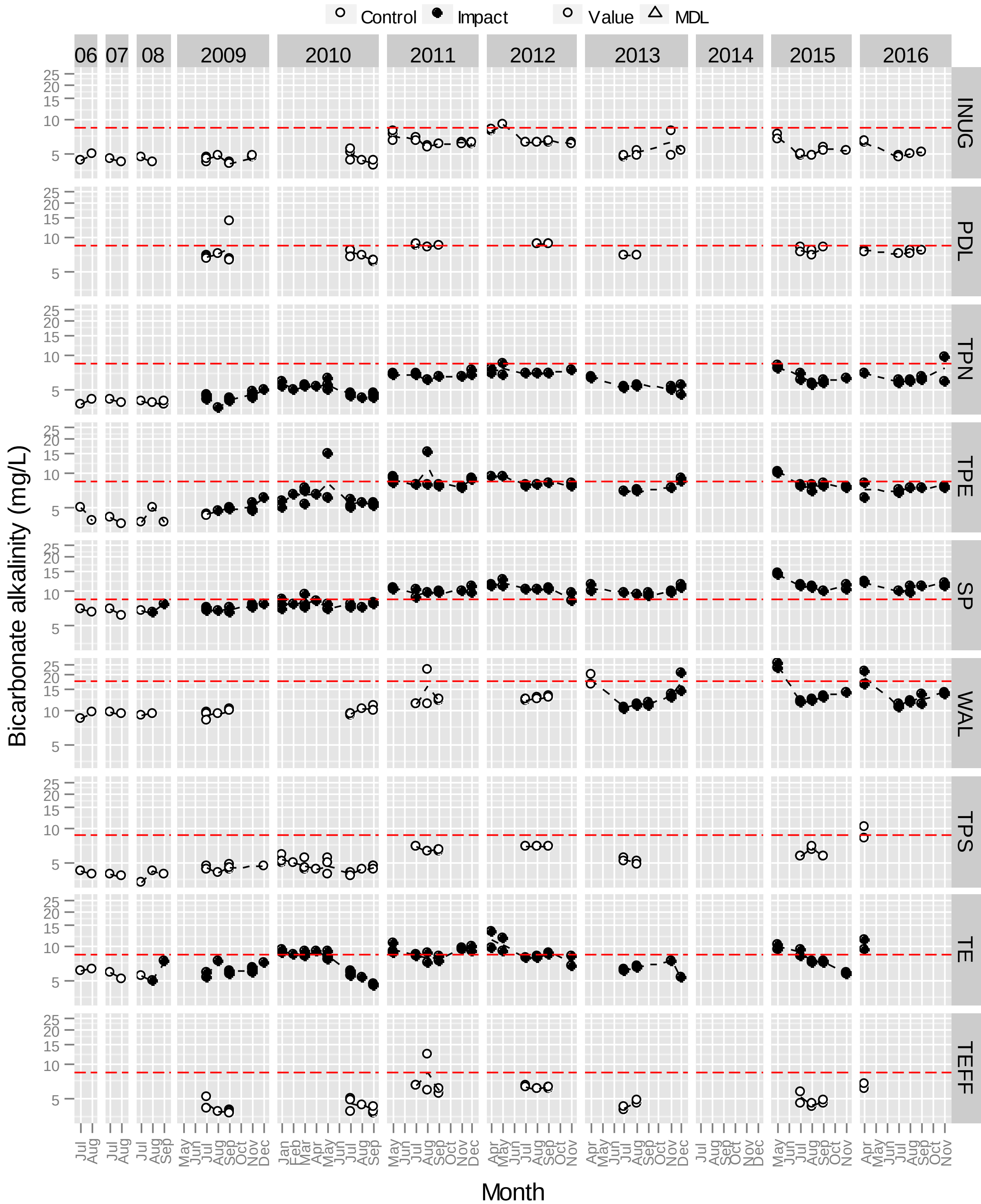


Figure 3.2–19. Total Alkalinity (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: Total alkalinity data from 2014 were excluded due to data quality issues (See Azimuth [2015c] for more detail).

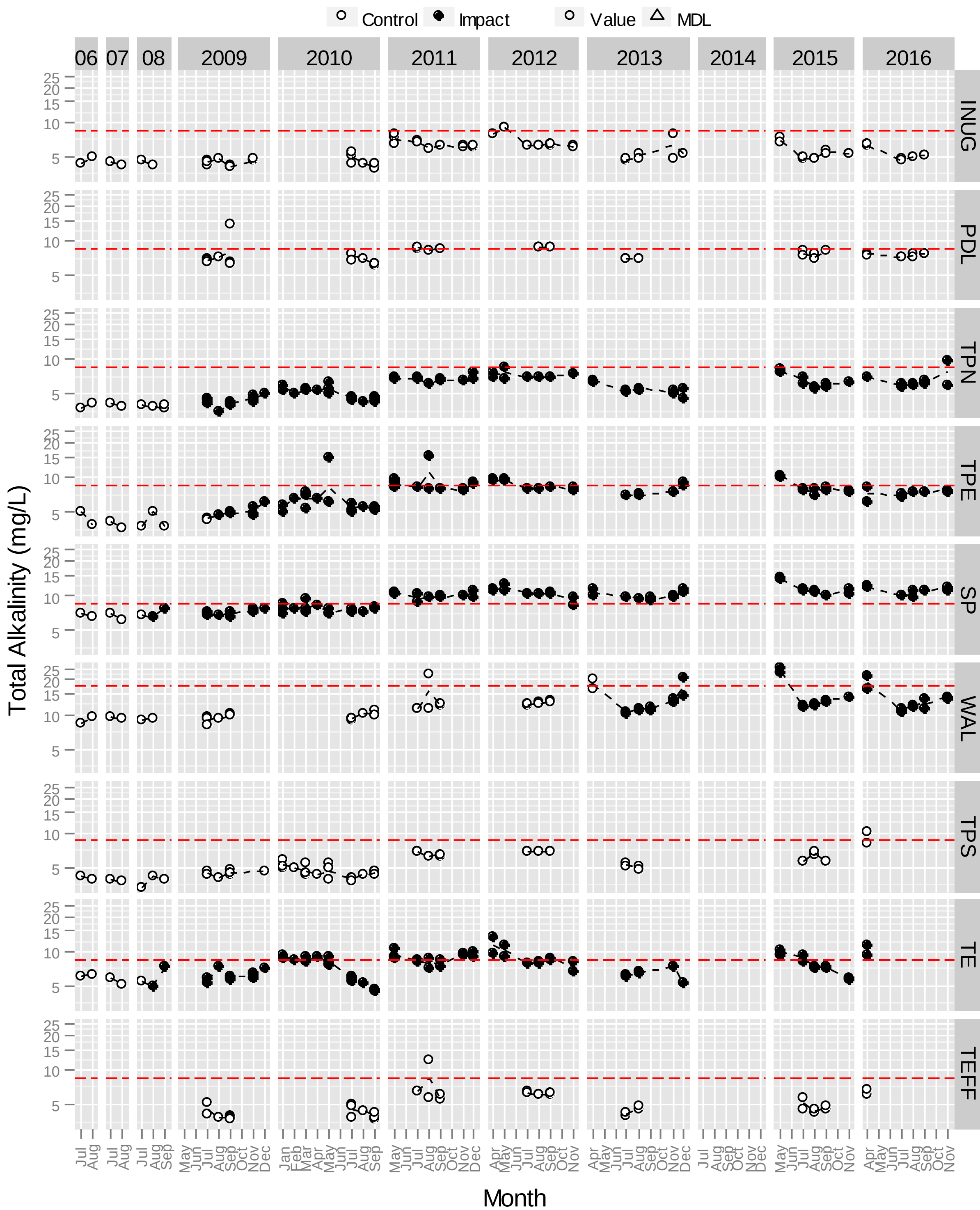


Figure 3.2–20. Ammonia-N (mg/L) in water samples from Meadowbank study lakes since 2006.

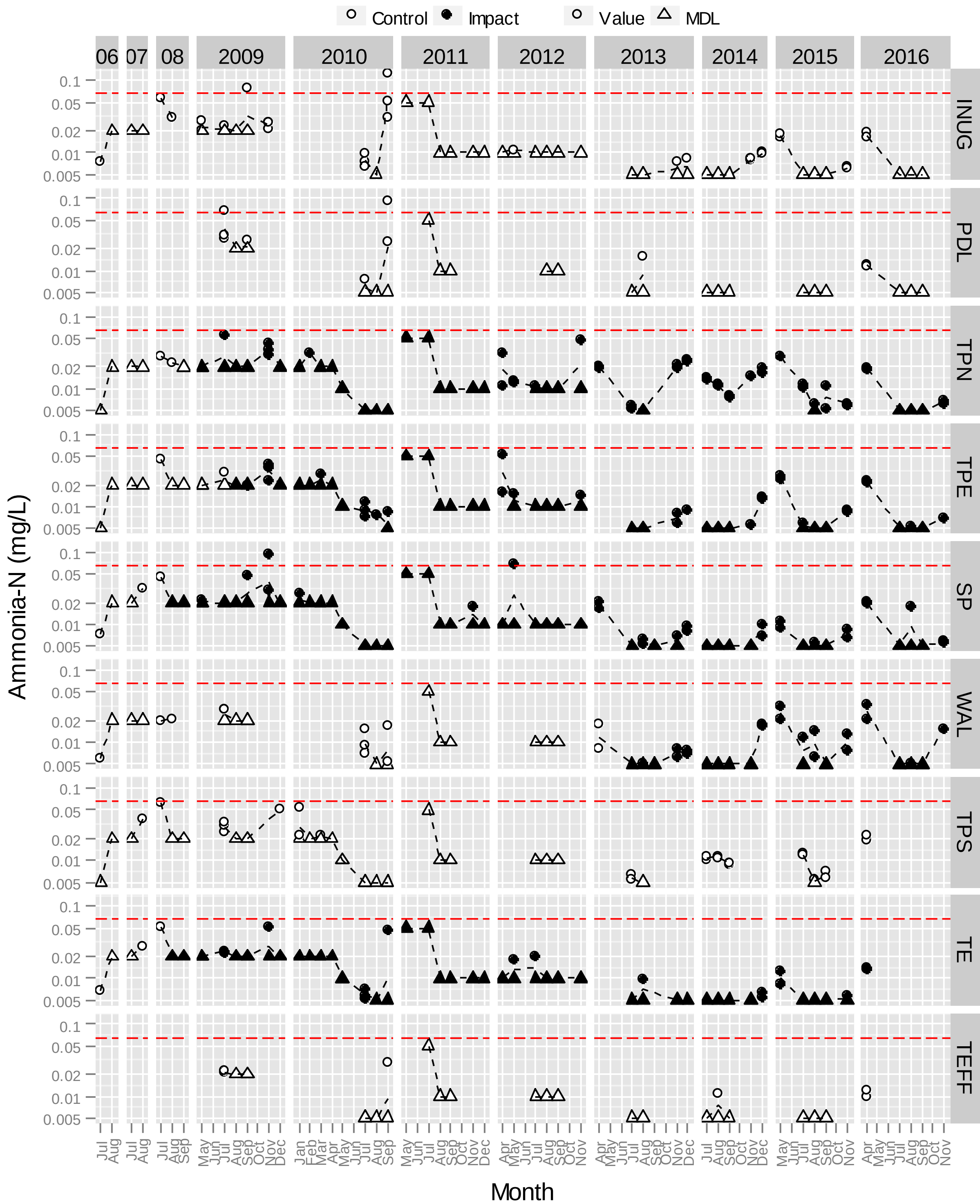


Figure 3.2–21. Chloride (mg/L) in water samples from Meadowbank study lakes since 2006.

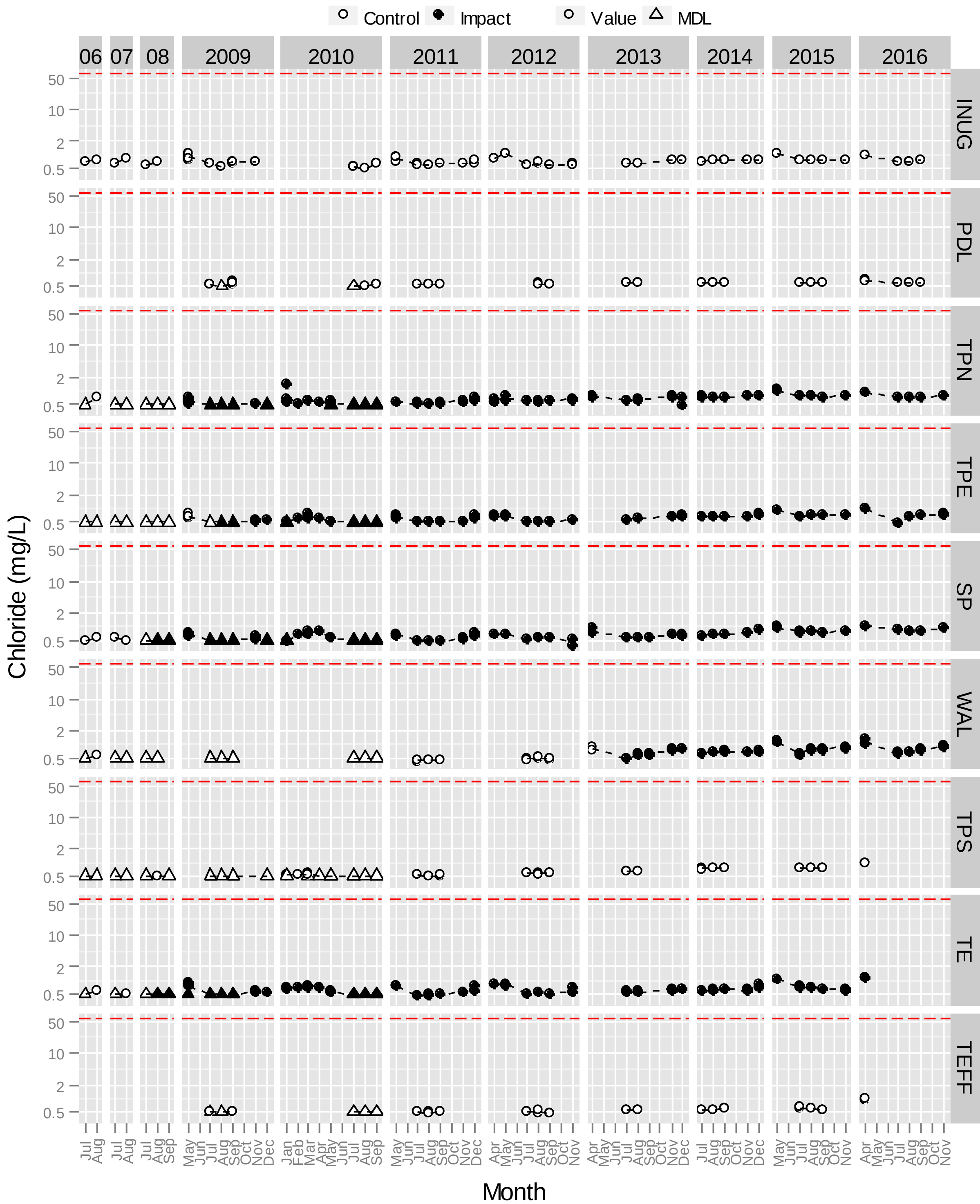


Figure 3.2–22. Nitrate-N (mg/L) in water samples from Meadowbank study lakes since 2006.

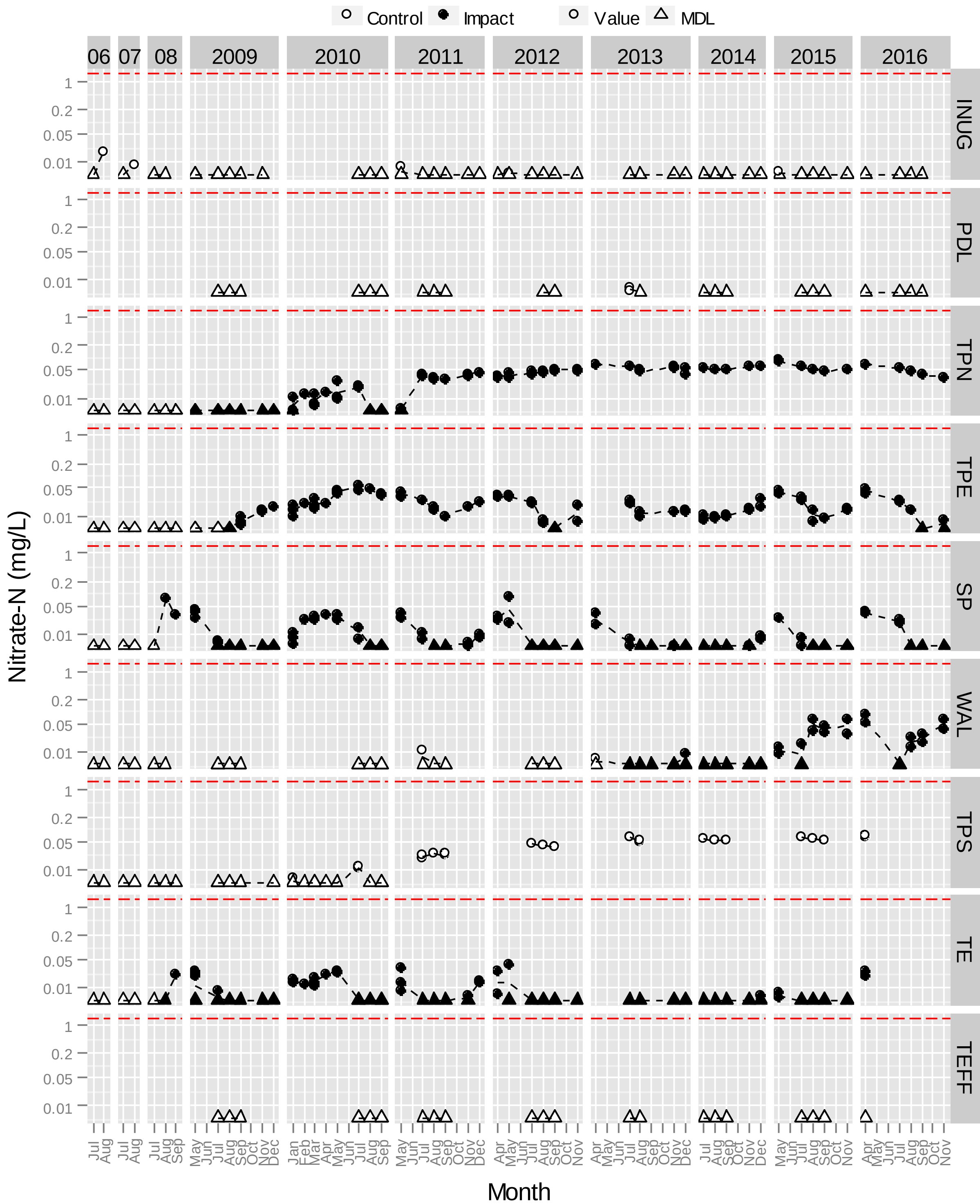


Figure 3.2–23. Total Kjeldahl Nitrogen (TKN; mg/L) in water samples from Meadowbank study lakes since 2006.

Note: TKN data from 2014 were excluded due to data quality issues (See Azimuth [2015c] for more detail).

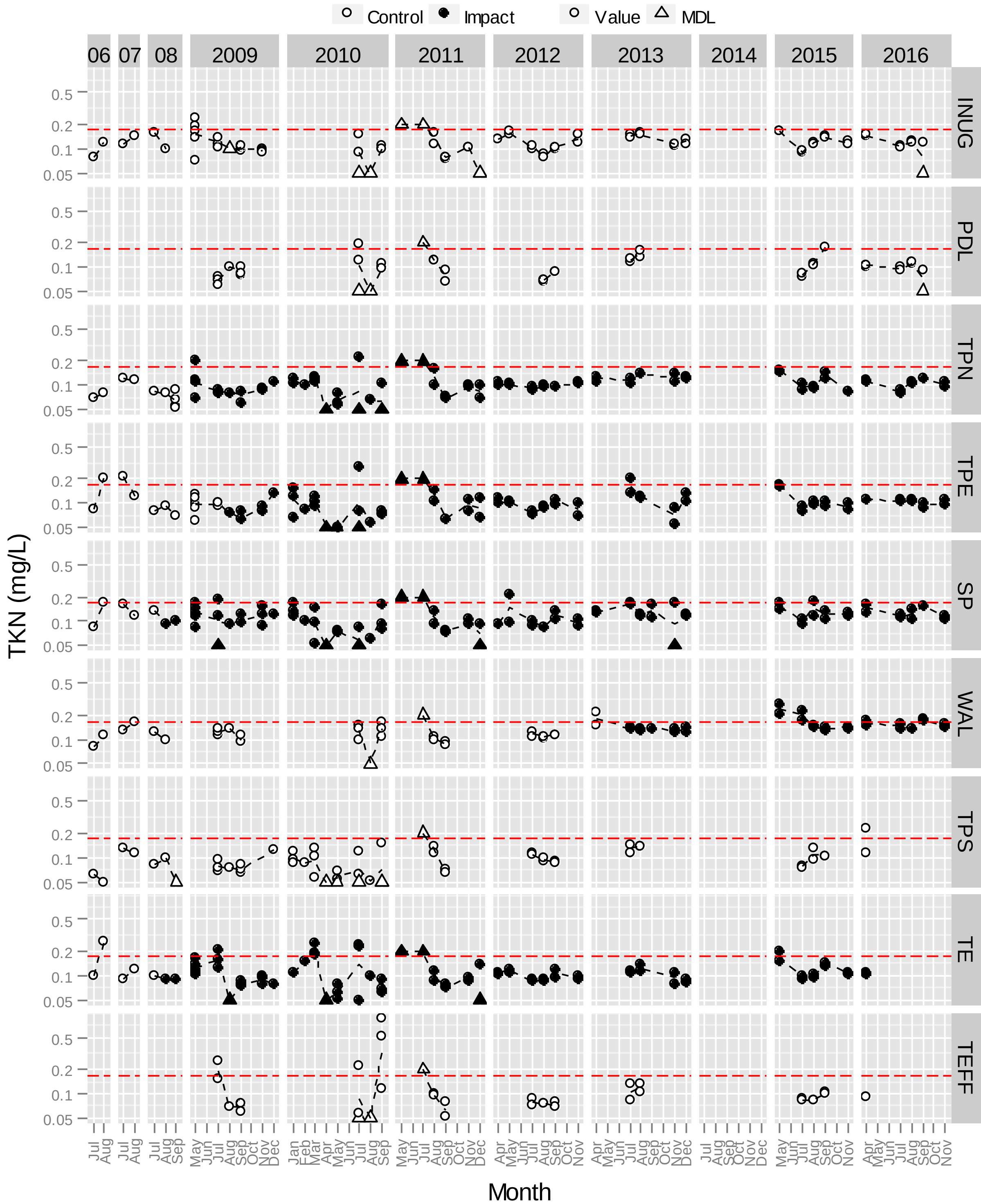


Figure 3.2–24. Total Phosphorus (mg/L) in water samples from Meadowbank study lakes since 2006.

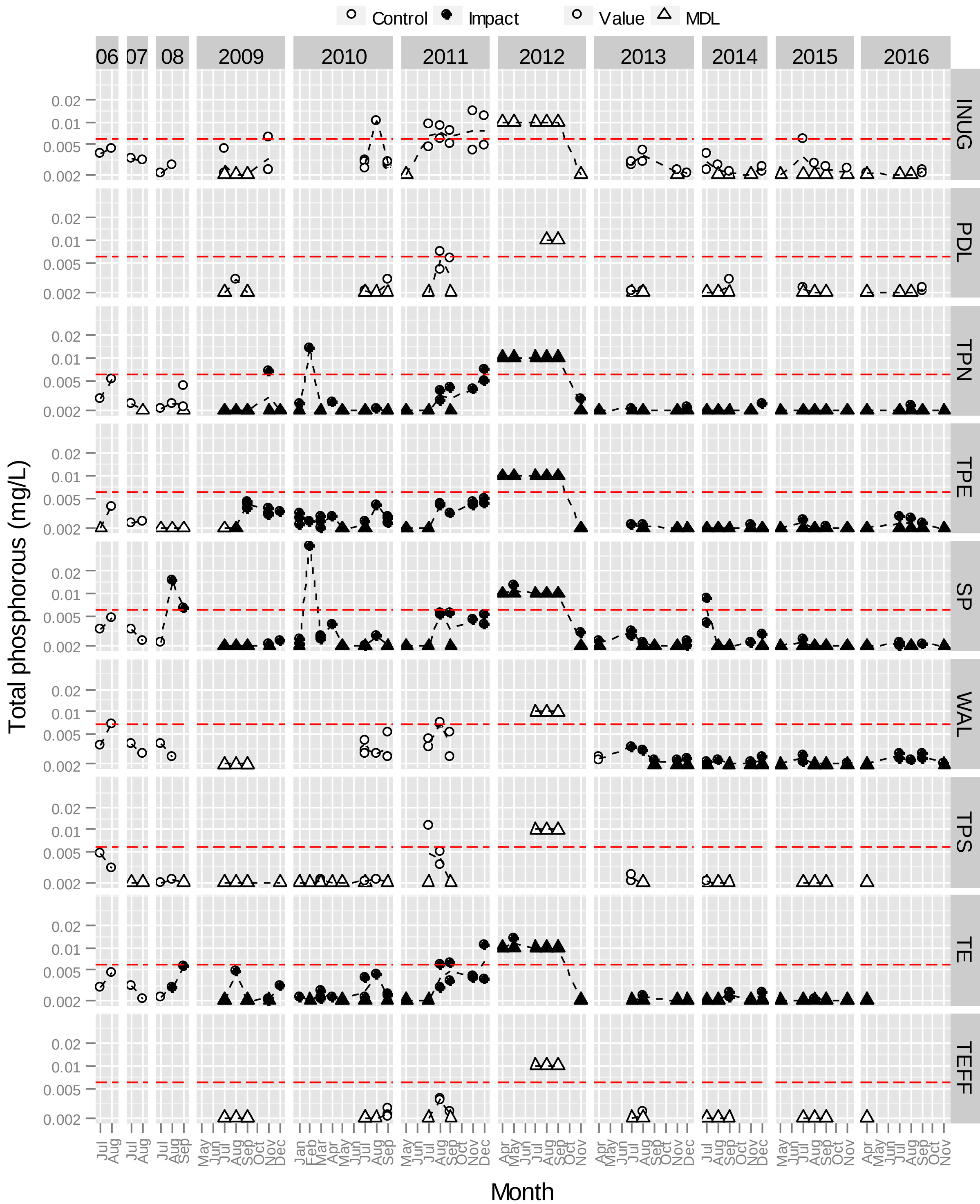


Figure 3.2–25. Reactive Silica (mg/L) in water samples from Meadowbank study lakes since 2006.

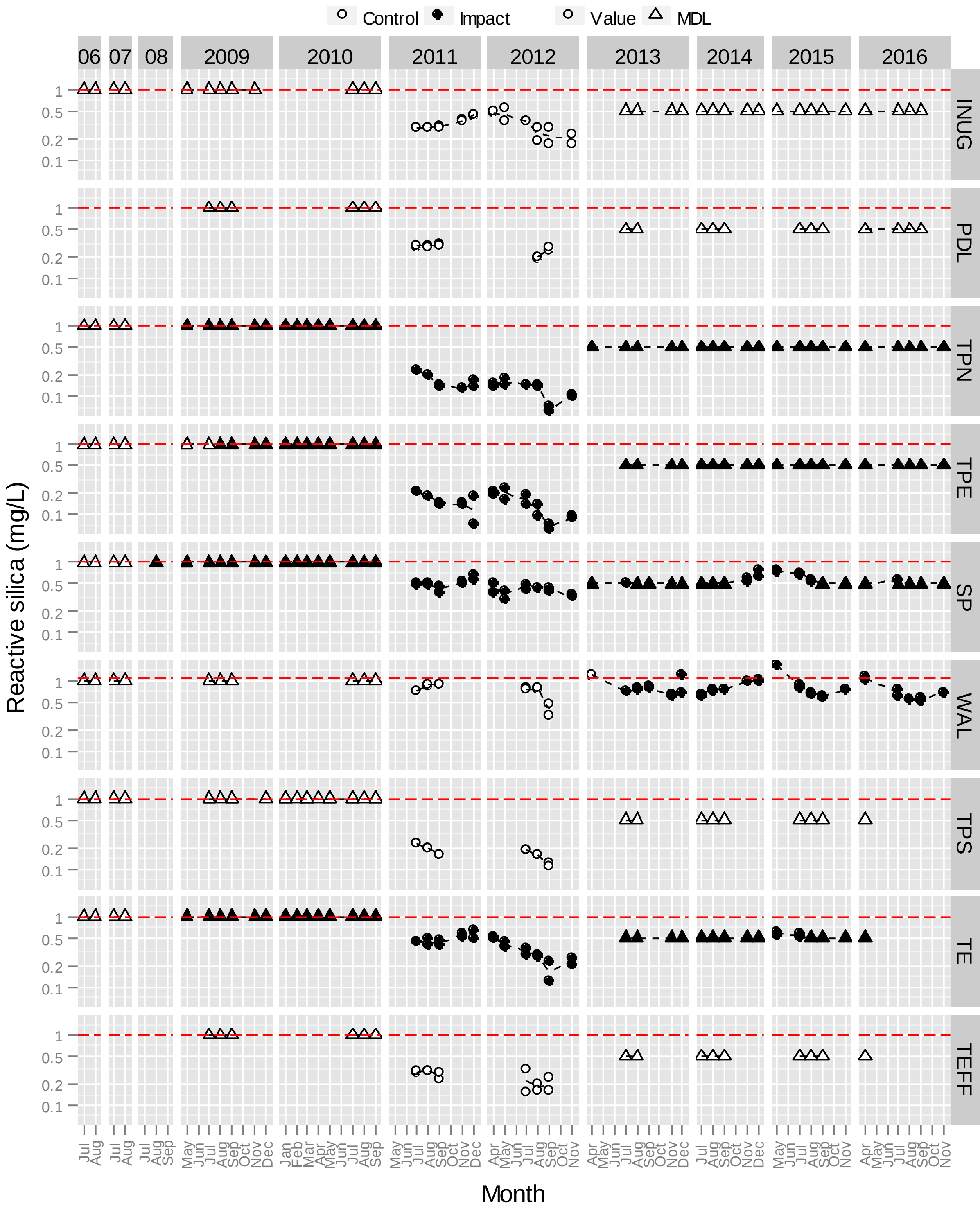


Figure 3.2–26. Sulphate (mg/L) in water samples from Meadowbank study lakes since 2006.

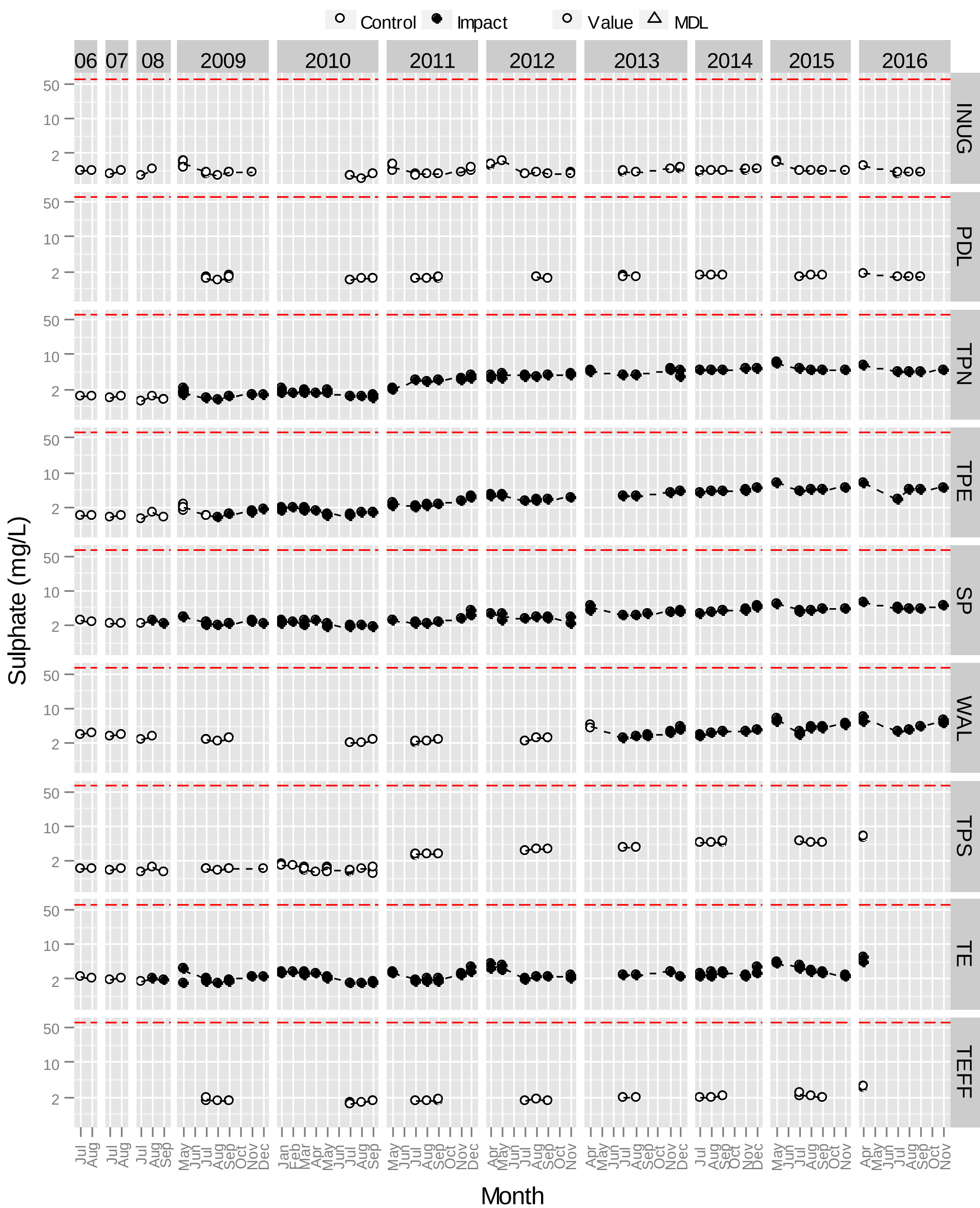


Figure 3.2–27. Dissolved Organic Carbon (DOC; mg/L) in water samples from Meadowbank study lakes since 2006.

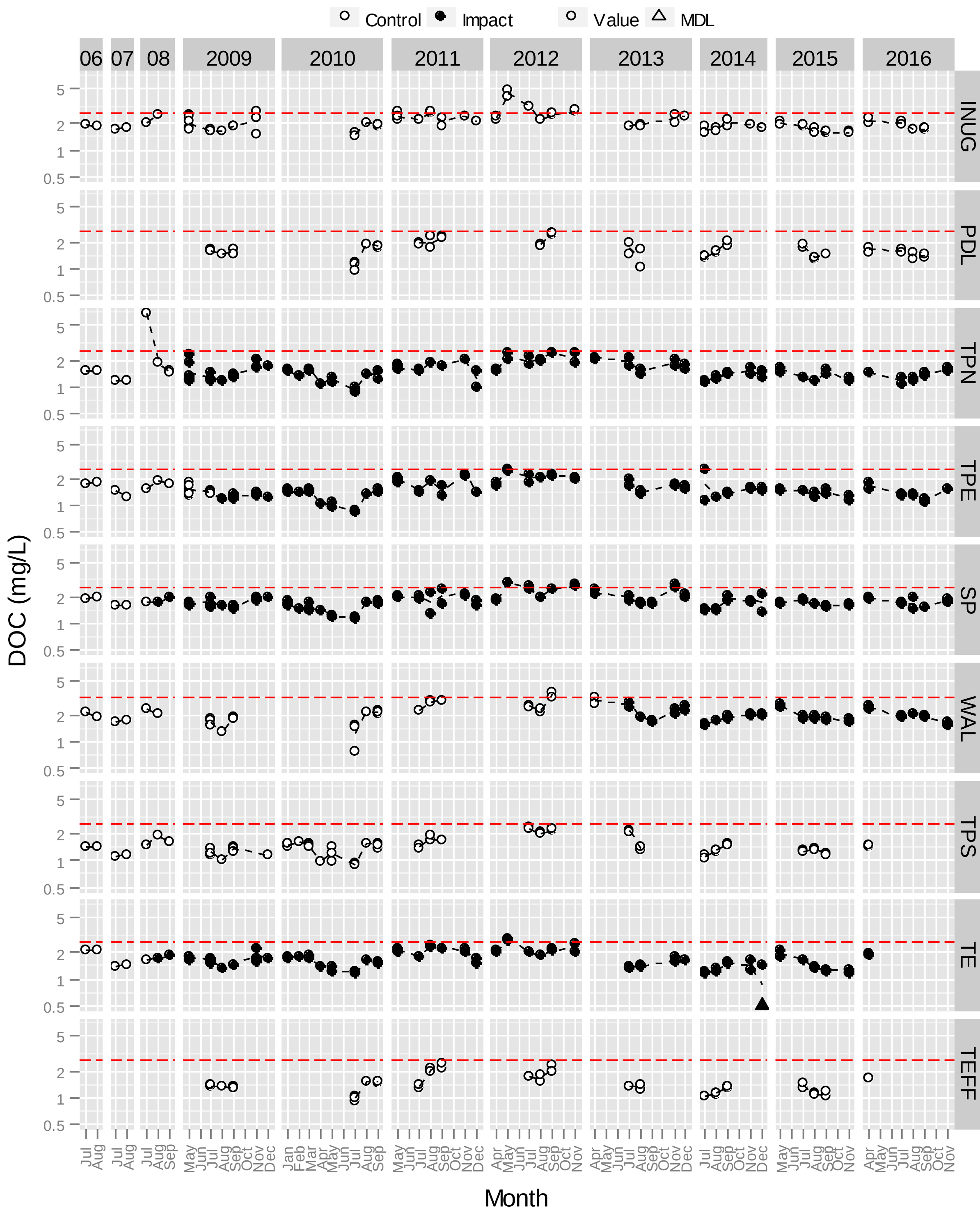


Figure 3.2–28. Total Organic Carbon (TOC; mg/L) in water samples from Meadowbank study lakes since 2006.

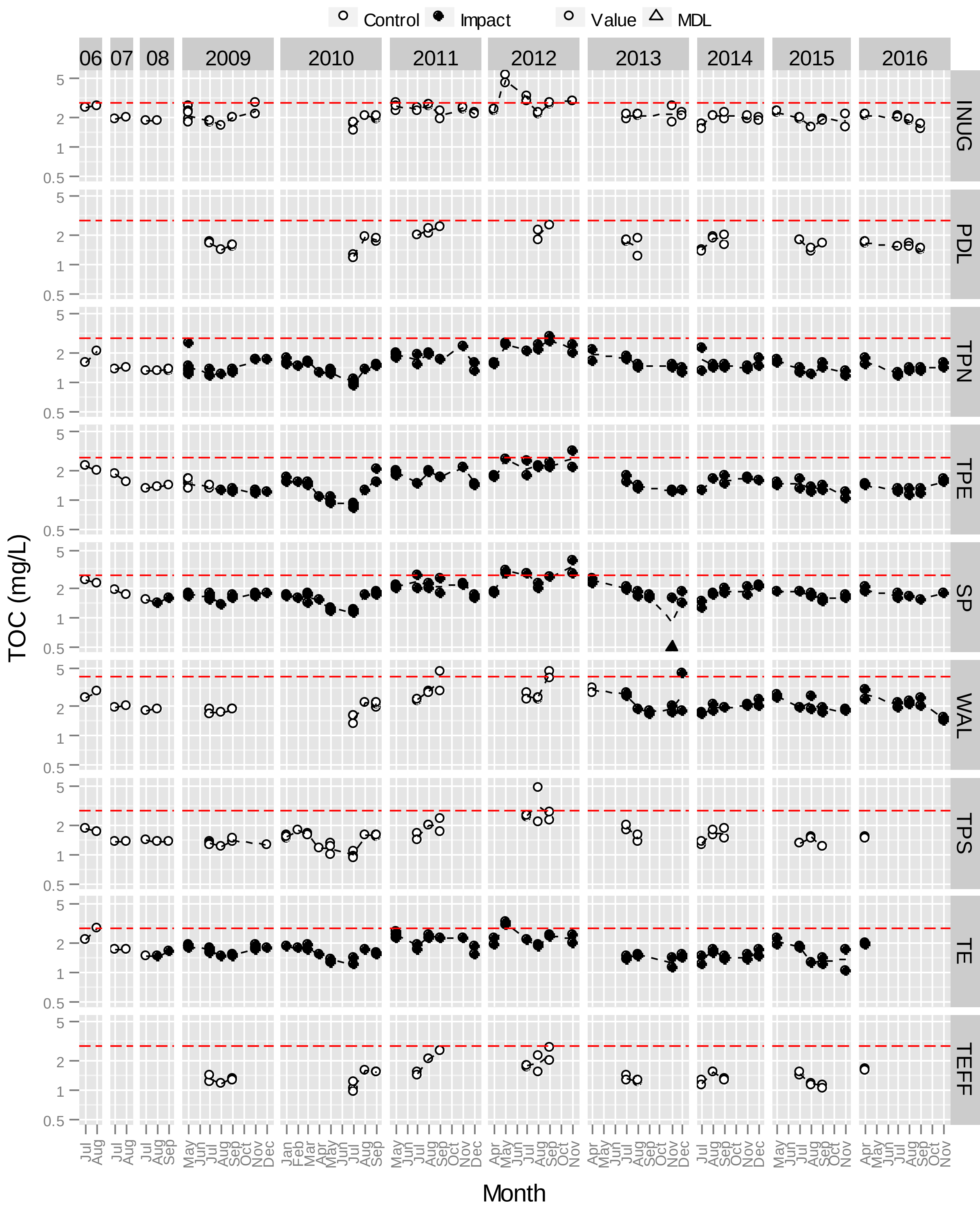


Figure 3.2–29. Total Aluminum (mg/L) in water samples from Meadowbank study lakes since 2006.

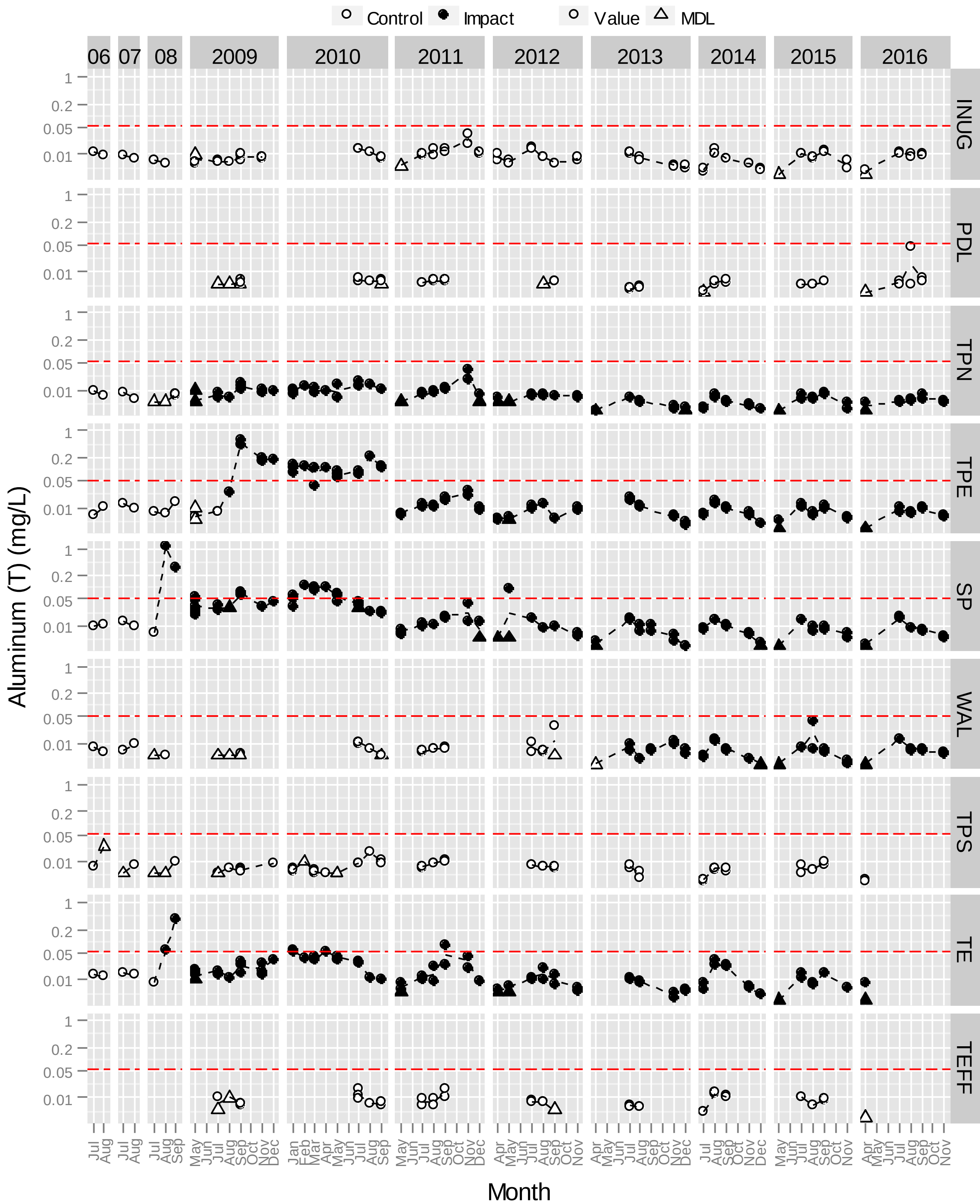


Figure 3.2–30. Total Arsenic (mg/L) in water samples from Meadowbank study lakes since 2006.

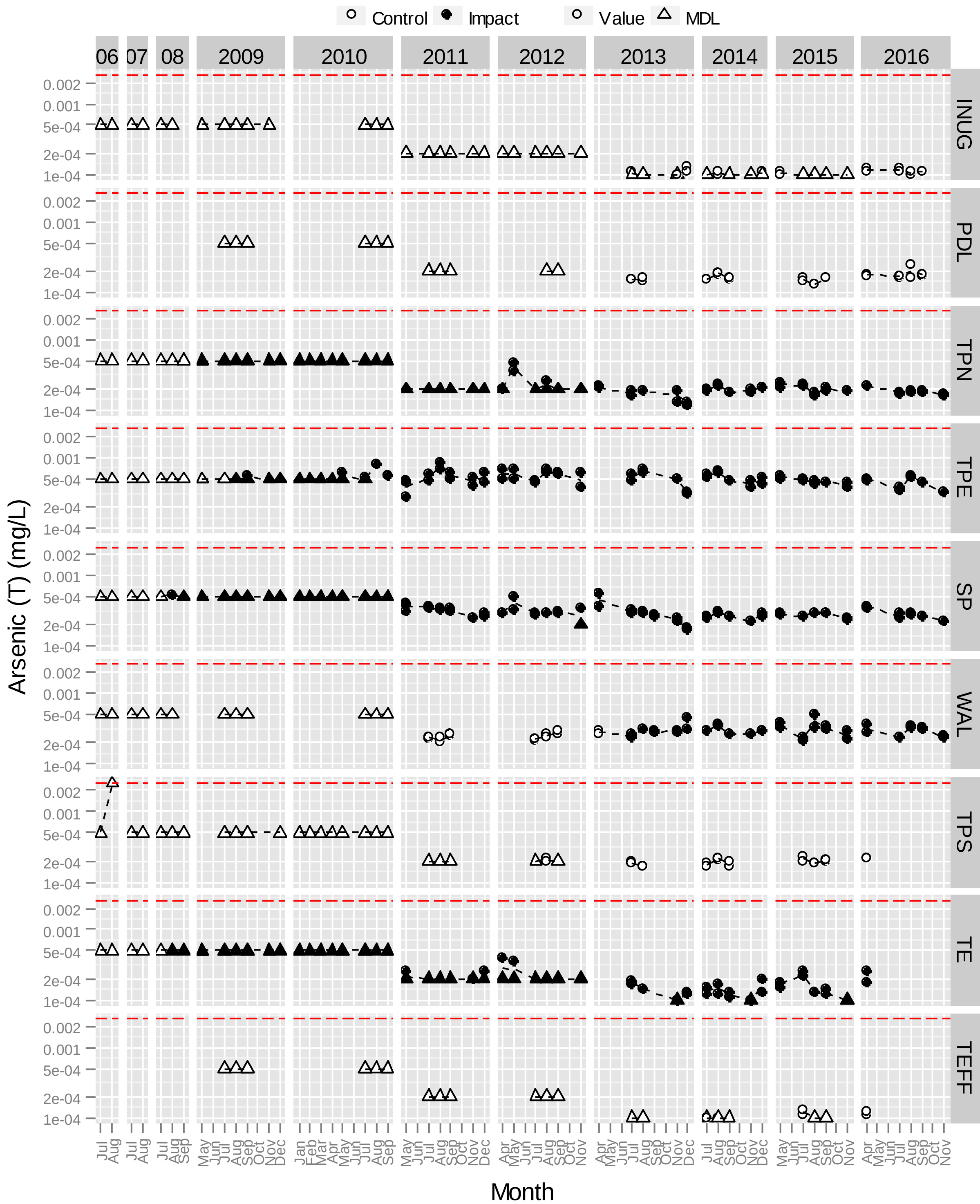


Figure 3.2–31. Total Barium (mg/L) in water samples from Meadowbank study lakes since 2006.

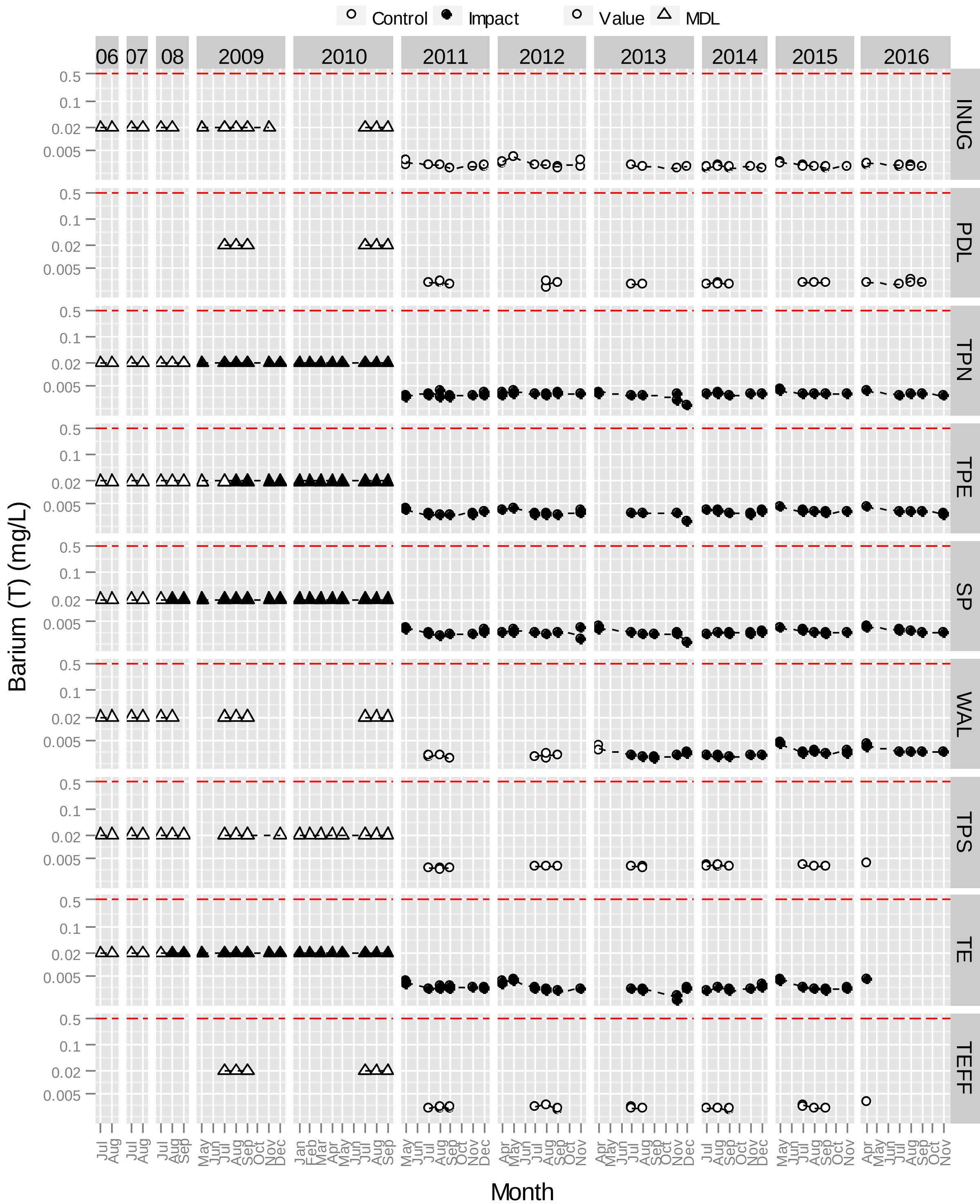


Figure 3.2–32. Total Calcium (mg/L) in water samples from Meadowbank study lakes since 2006.

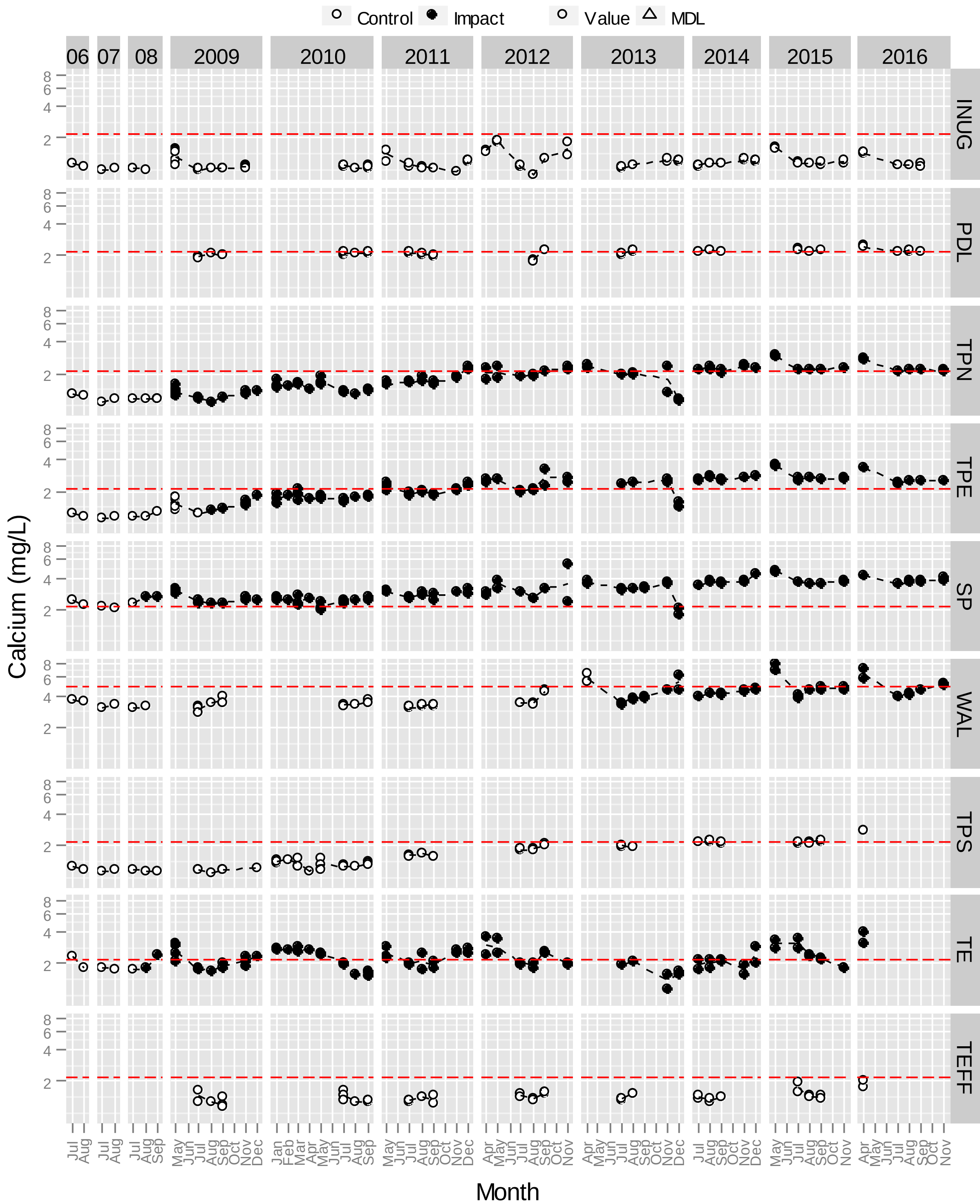


Figure 3.2–33. Total Chromium (mg/L) in water samples from Meadowbank study lakes since 2006.

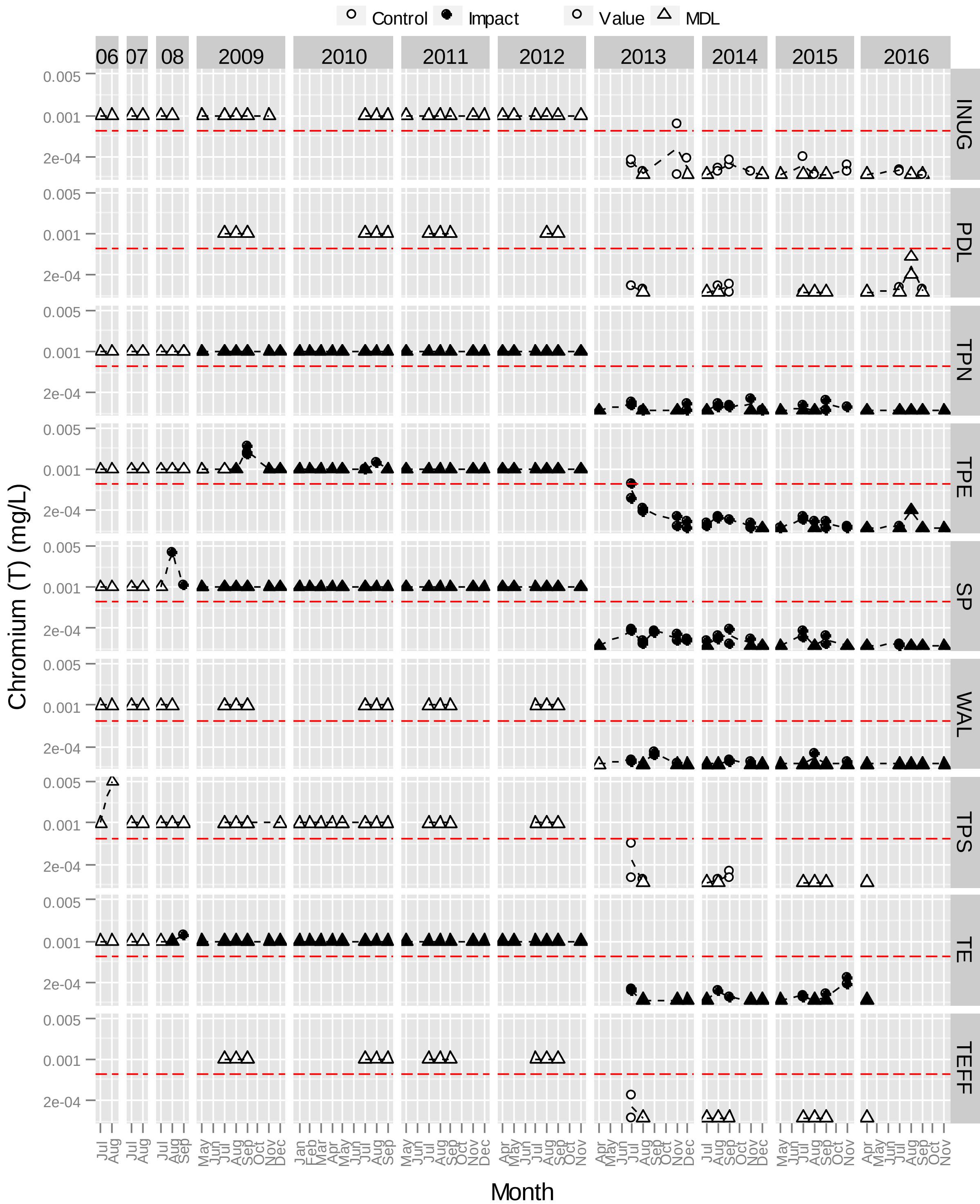


Figure 3.2–34. Total Copper (mg/L) in water samples from Meadowbank study lakes since 2006.

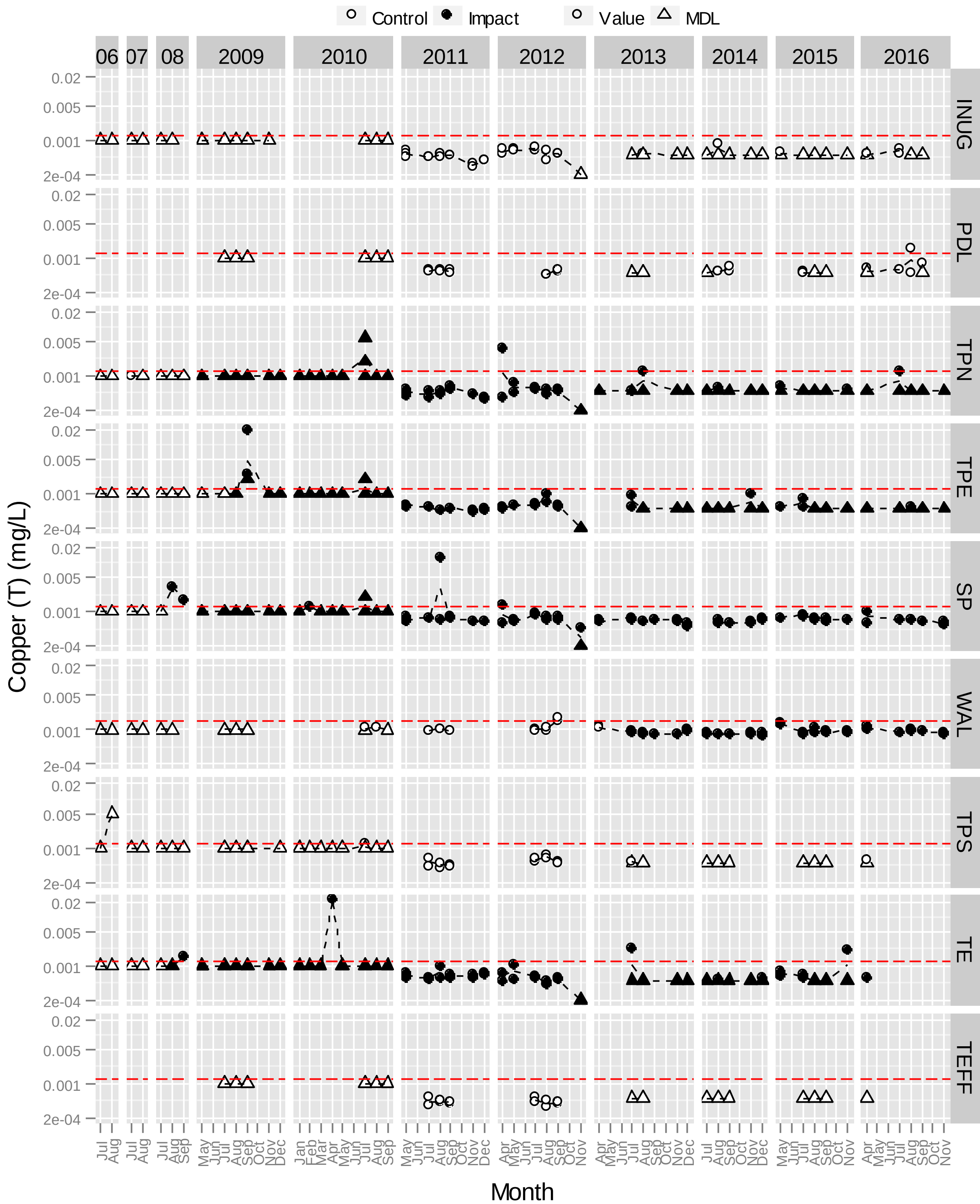


Figure 3.2–35. Total Iron (mg/L) in water samples from Meadowbank study lakes since 2006.

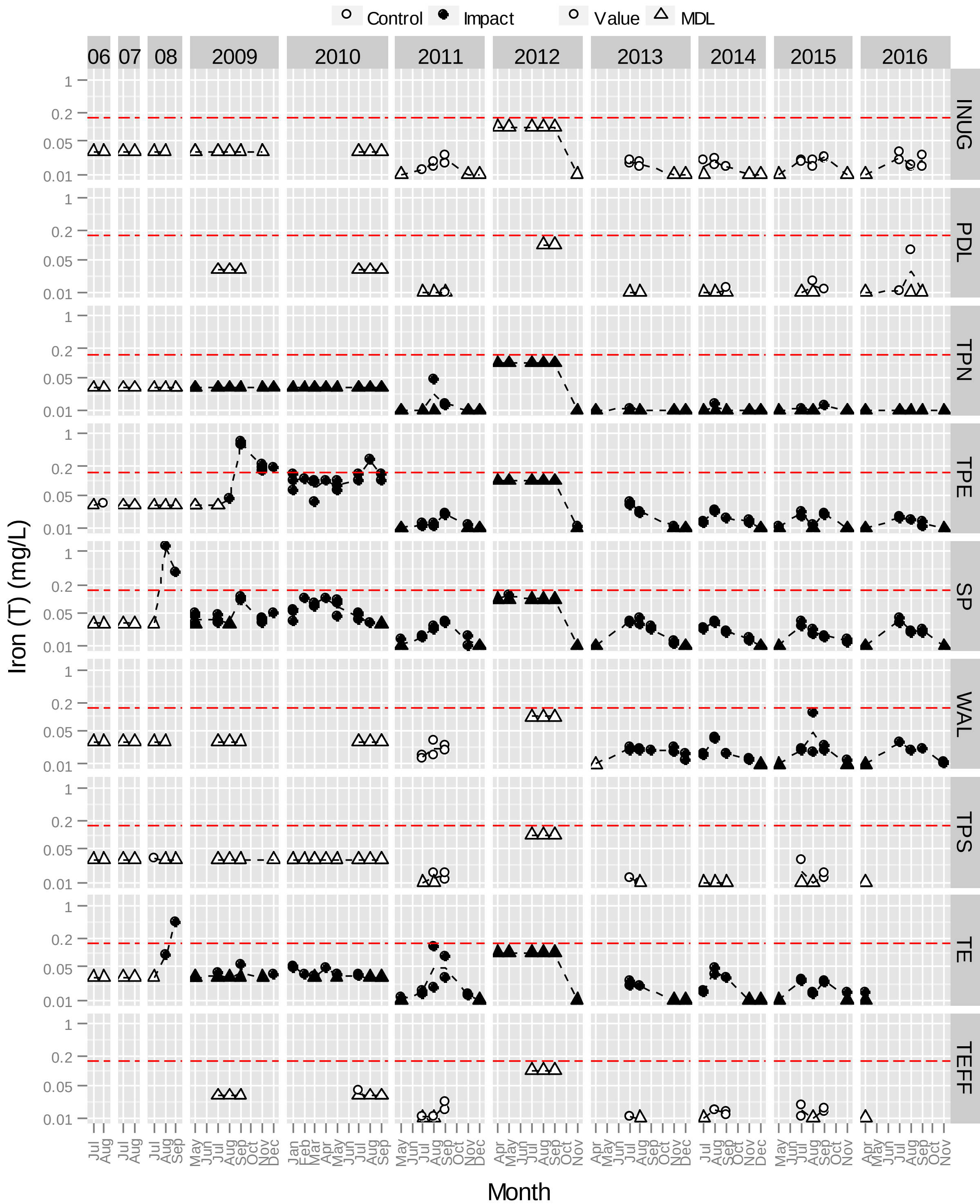


Figure 3.2–36. Total Magnesium (mg/L) in water samples from Meadowbank study lakes since 2006.

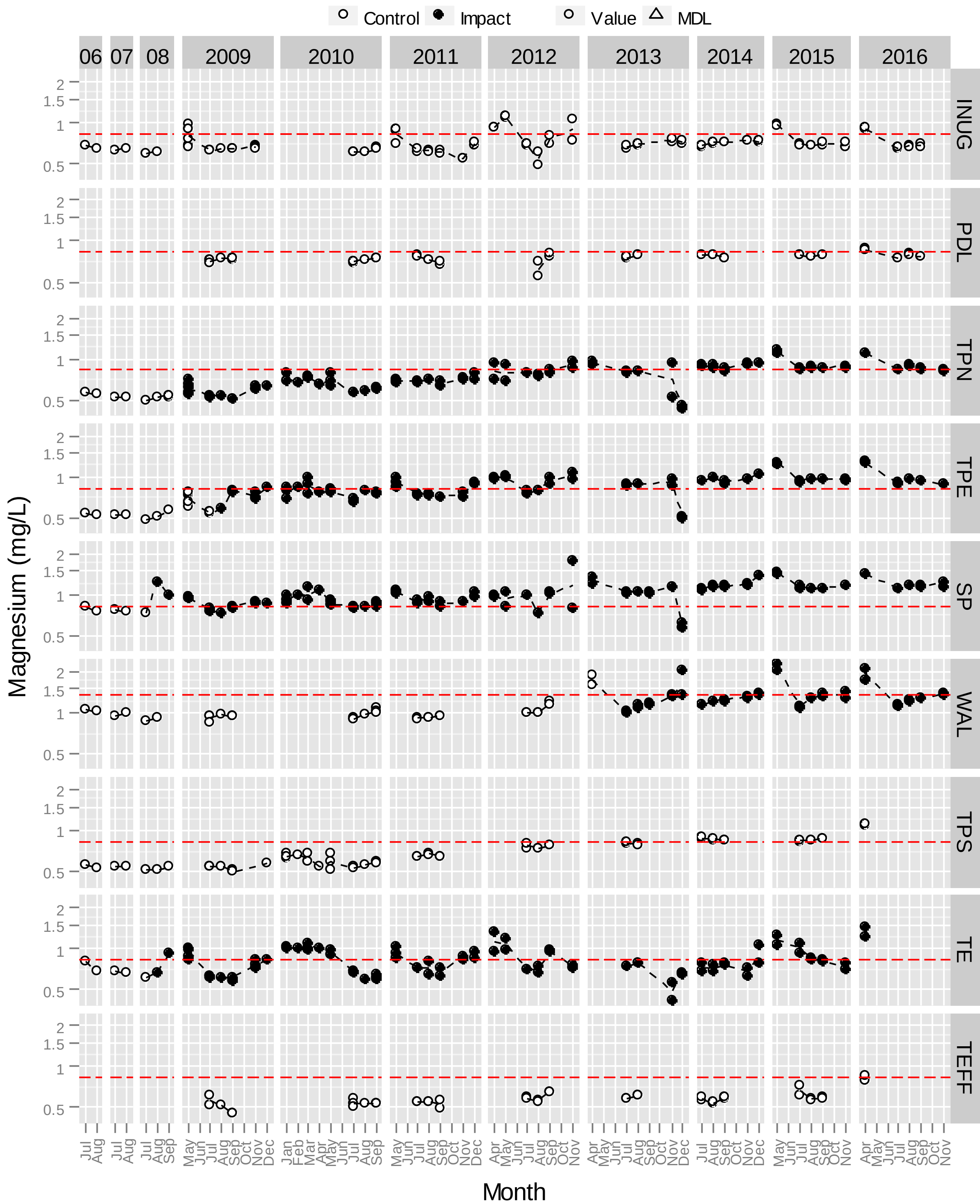


Figure 3.2–37. Total Manganese (mg/L) in water samples from Meadowbank study lakes since 2006.

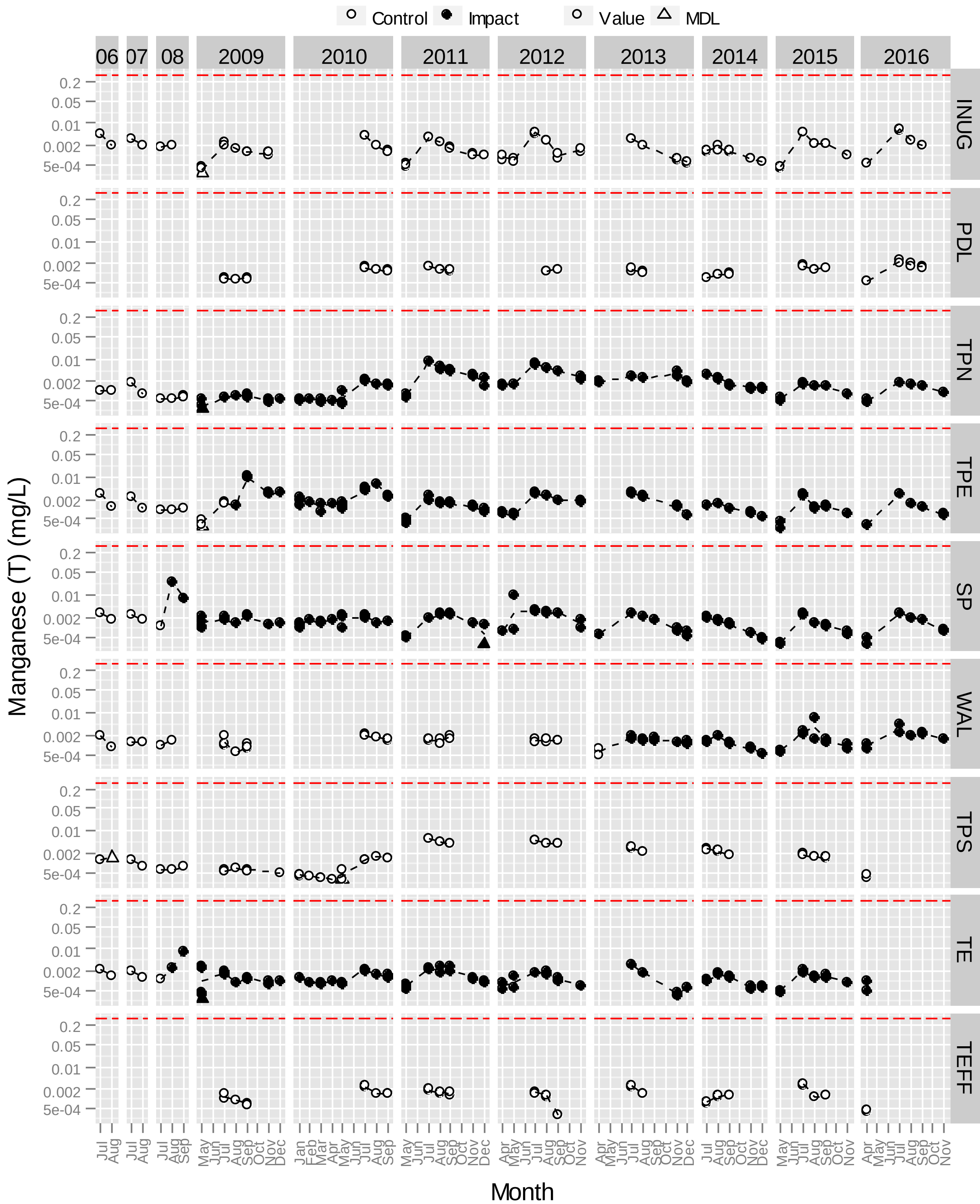


Figure 3.2–38. Total Molybdenum (mg/L) in water samples from Meadowbank study lakes since 2006.

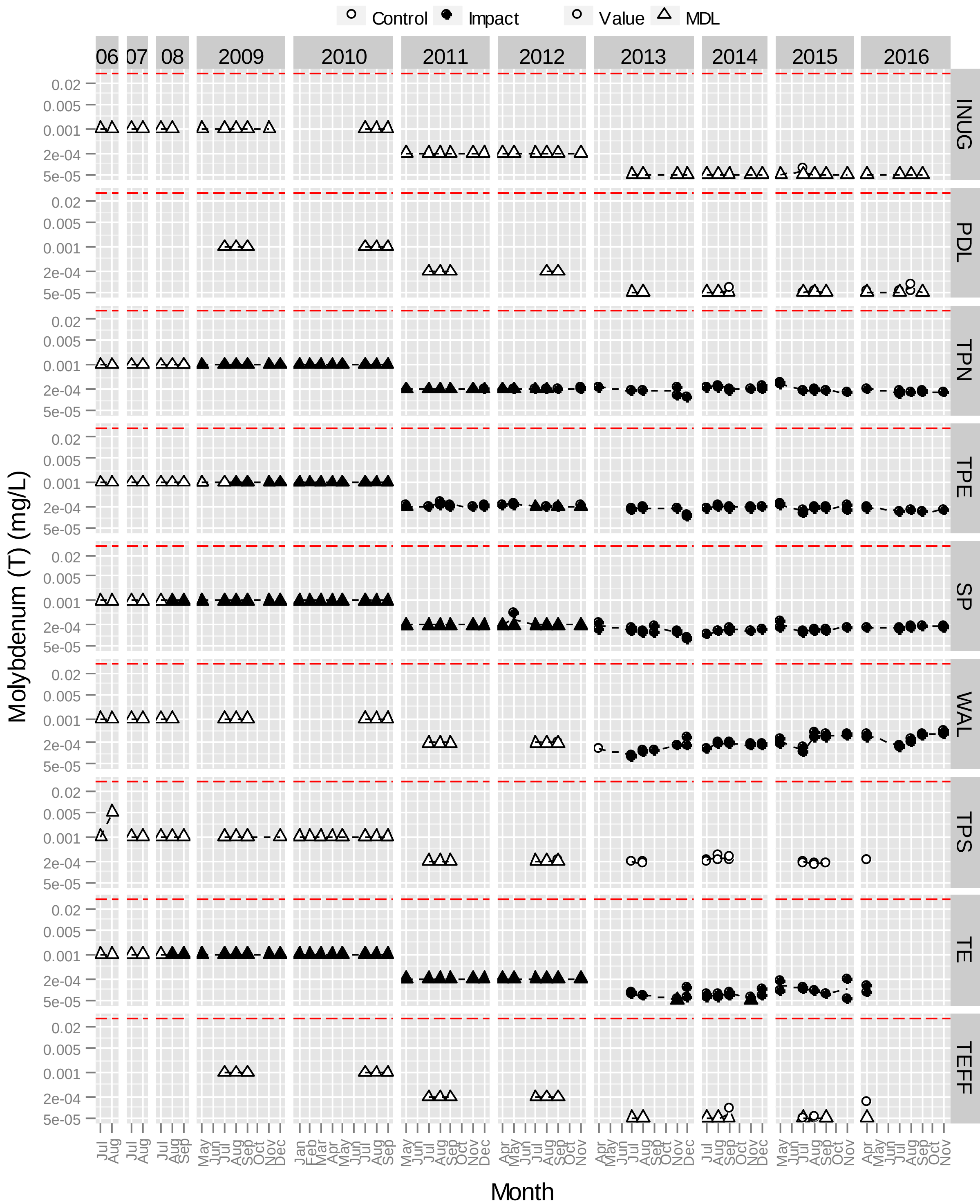


Figure 3.2–39. Total Potassium (mg/L) in water samples from Meadowbank study lakes since 2006.

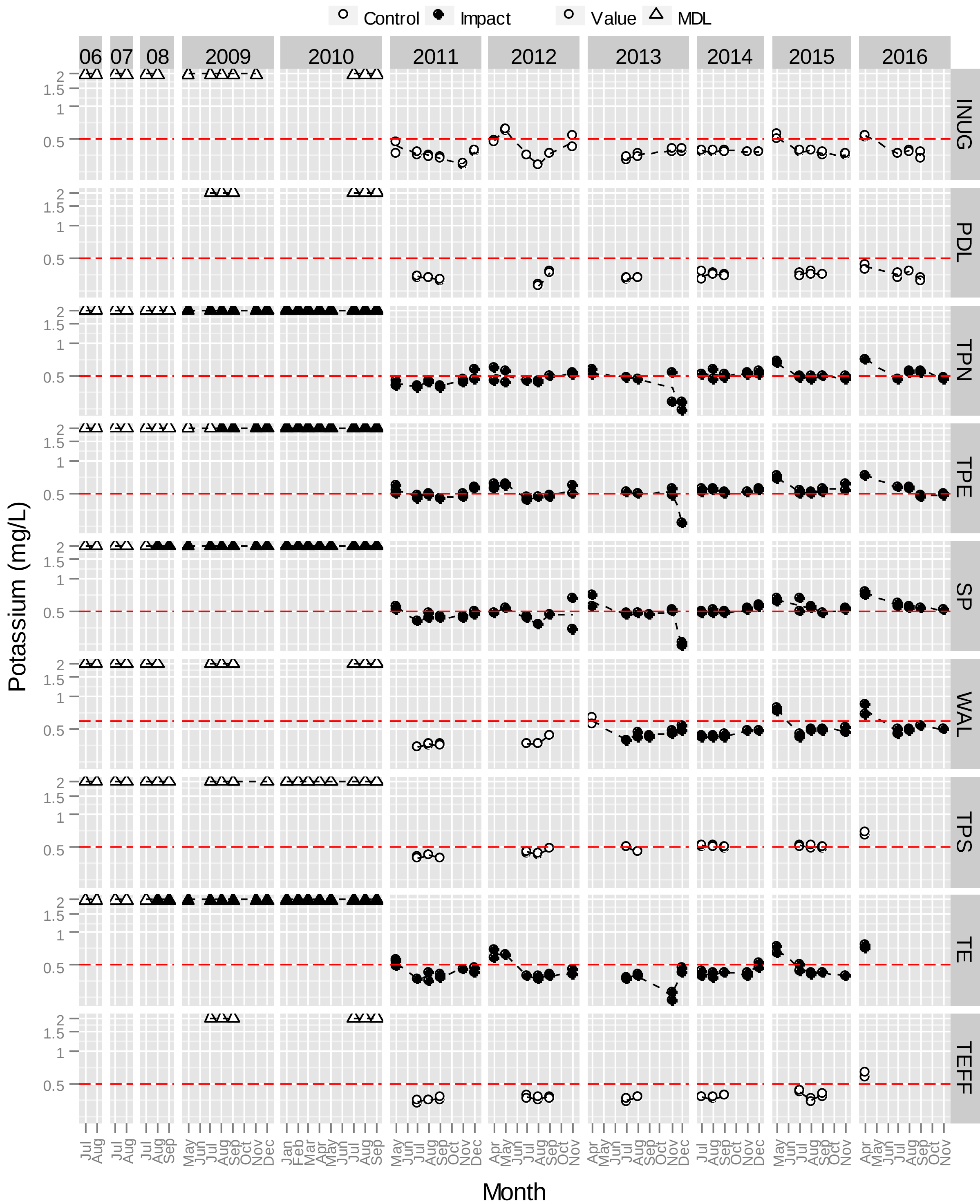


Figure 3.2–40. Total Sodium (mg/L) in water samples from Meadowbank study lakes since 2006.

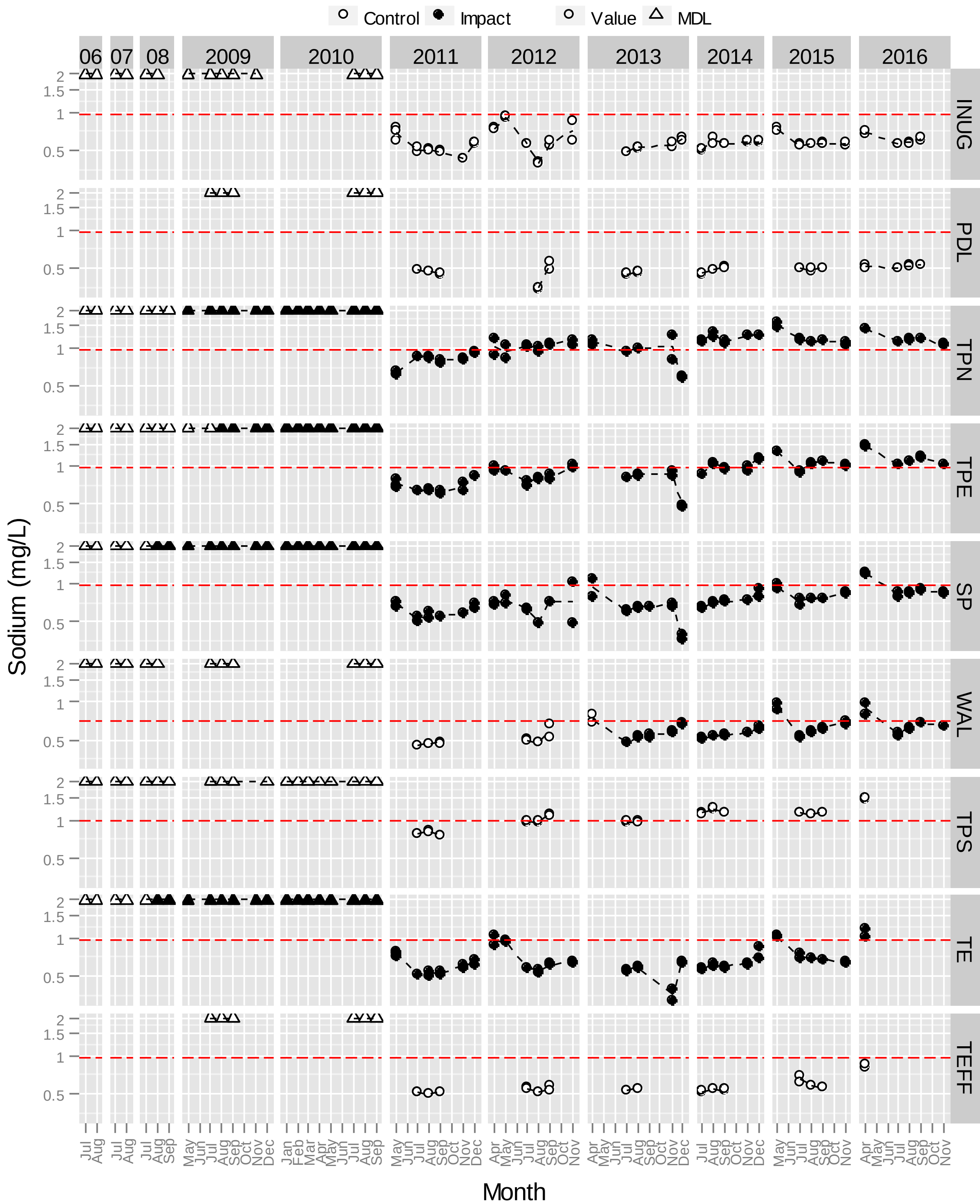


Figure 3.2–41. Total Strontium (mg/L) in water samples from Meadowbank study lakes since 2006.

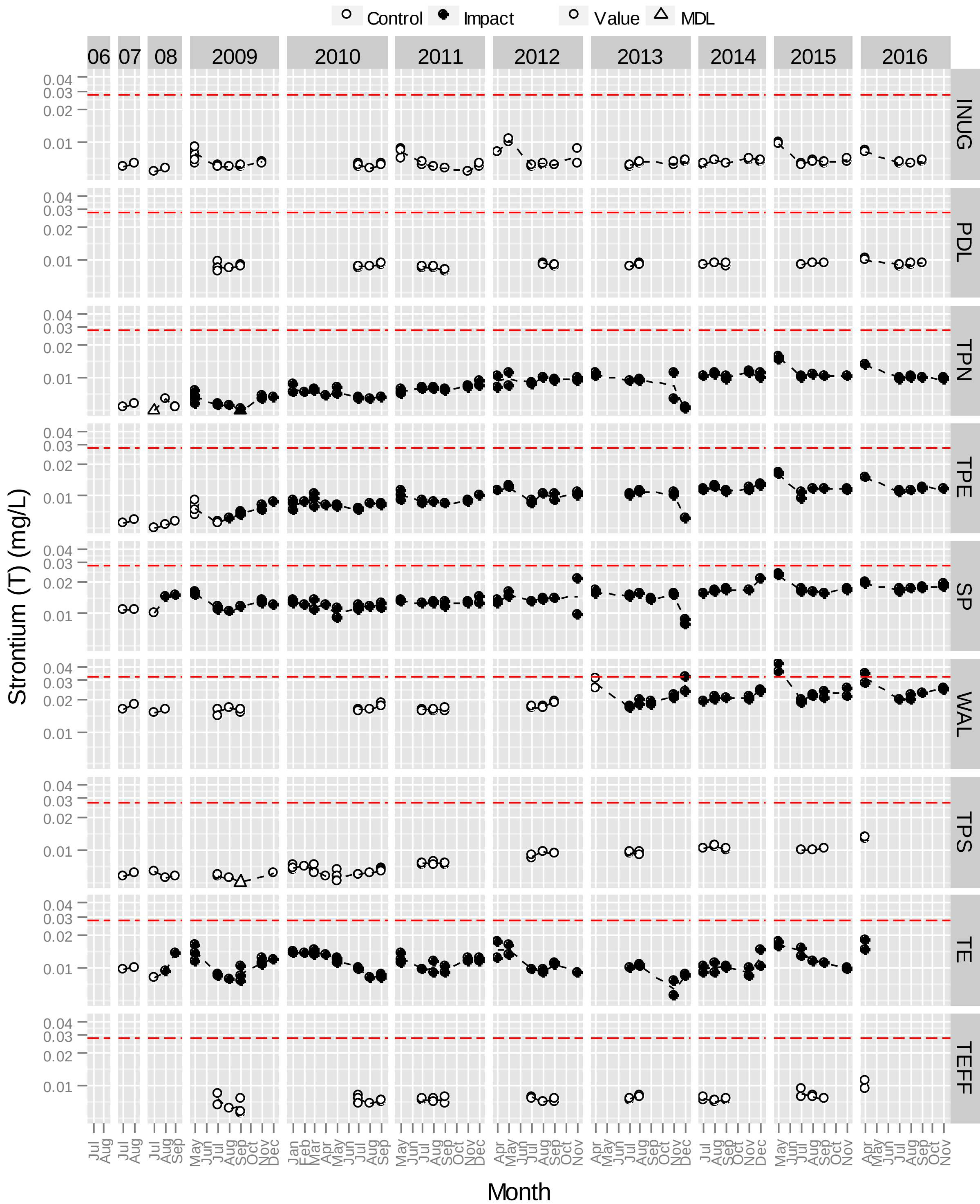


Figure 3.2–42. Total Uranium (mg/L) in water samples from Meadowbank study lakes since 2006.

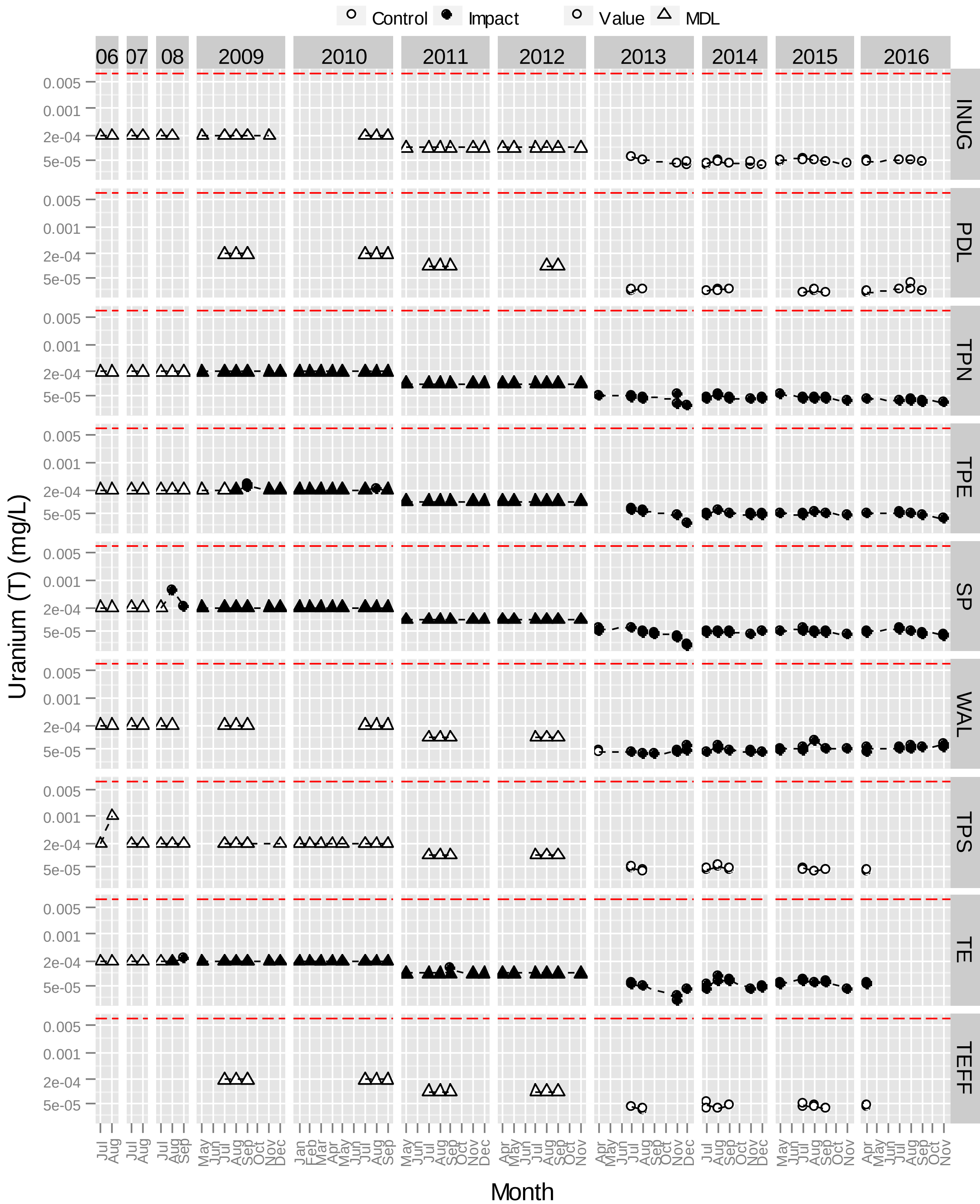


Figure 3.2–43. Dissolved Aluminum (mg/L) in water samples from Meadowbank study lakes since 2006.

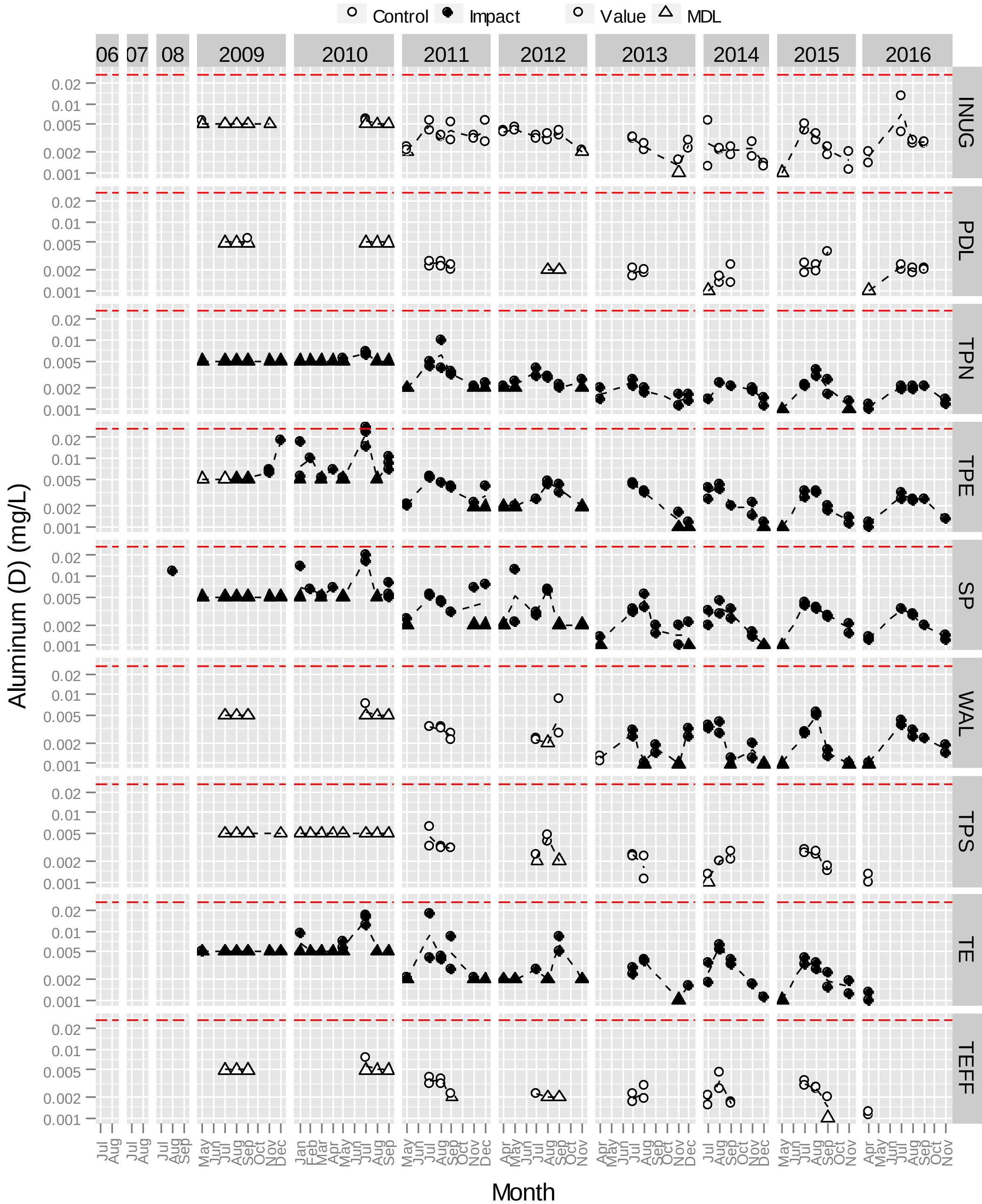


Figure 3.2–44. Dissolved Arsenic (mg/L) in water samples from Meadowbank study lakes since 2006.

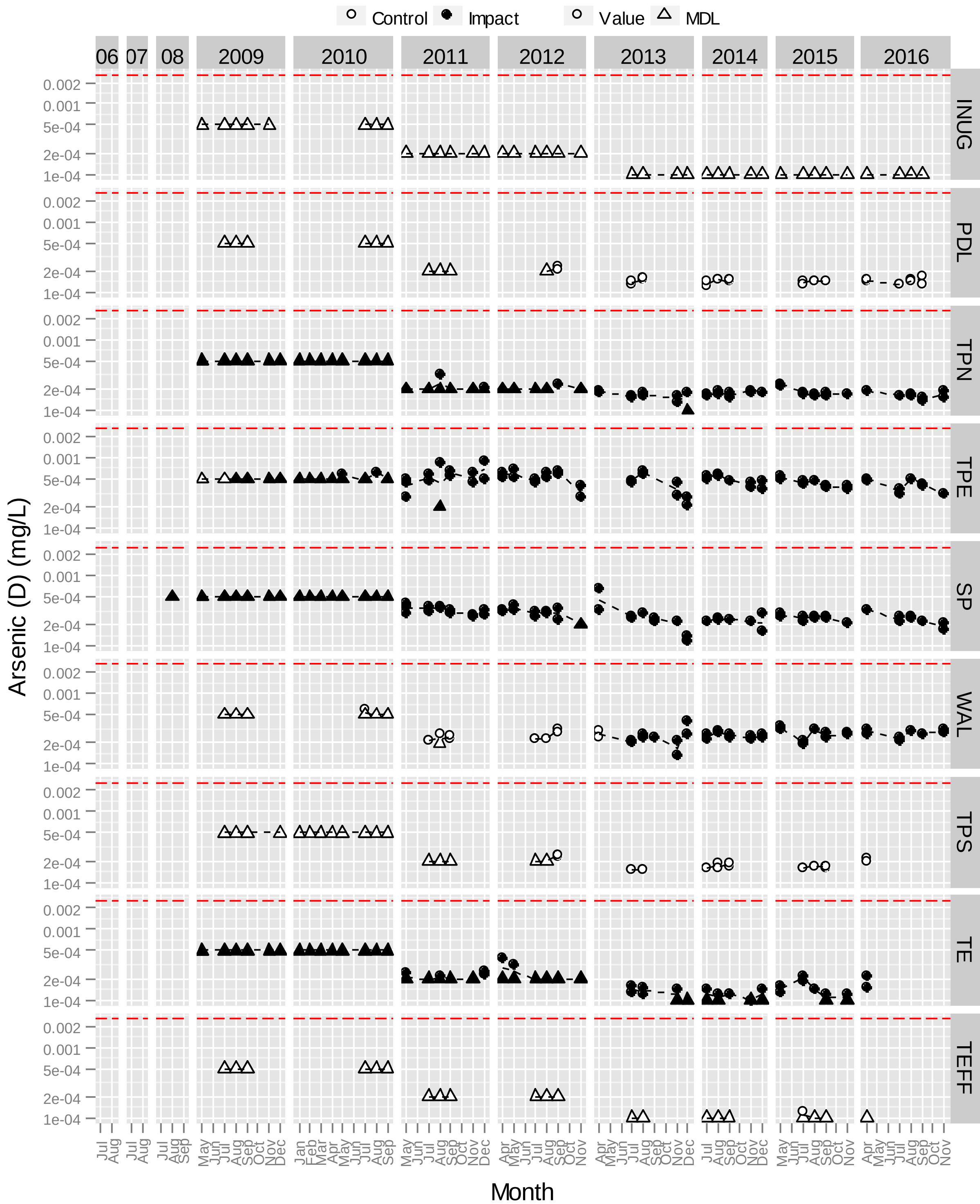


Figure 3.2–45. Dissolved Barium (mg/L) in water samples from Meadowbank study lakes since 2006.

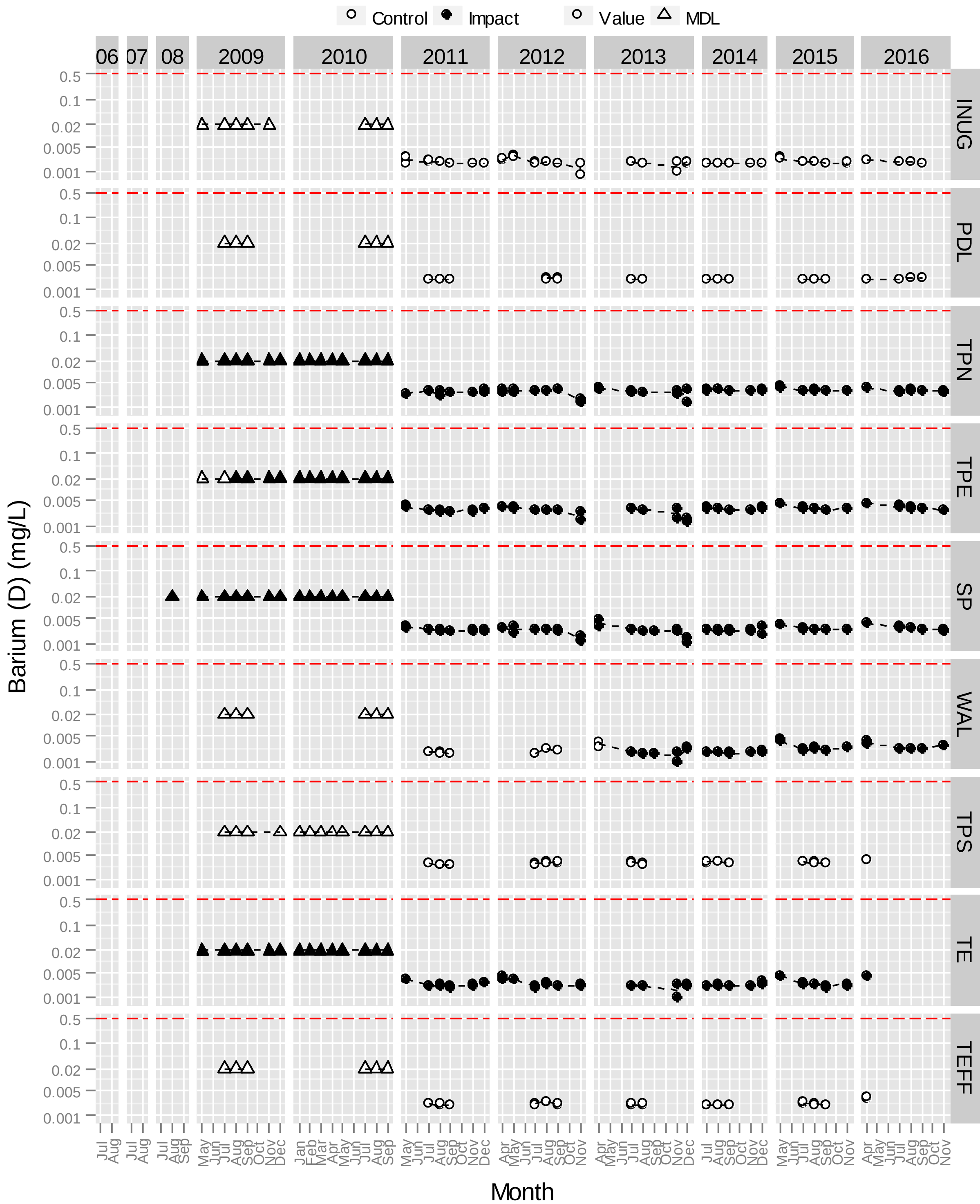


Figure 3.2–46. Dissolved Copper (mg/L) in water samples from Meadowbank study lakes since 2006.

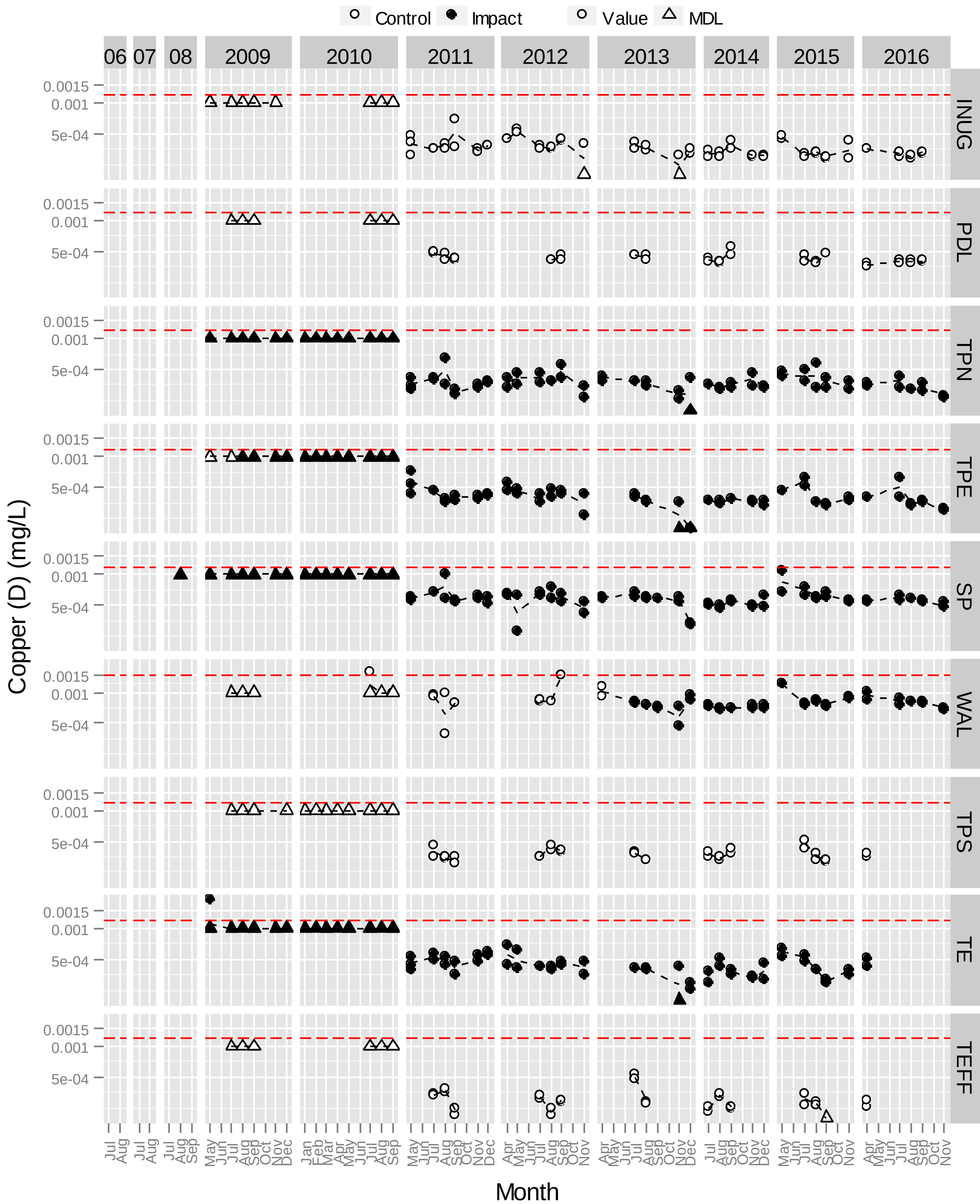


Figure 3.2–47. Dissolved Manganese (mg/L) in water samples from Meadowbank study lakes since 2006.

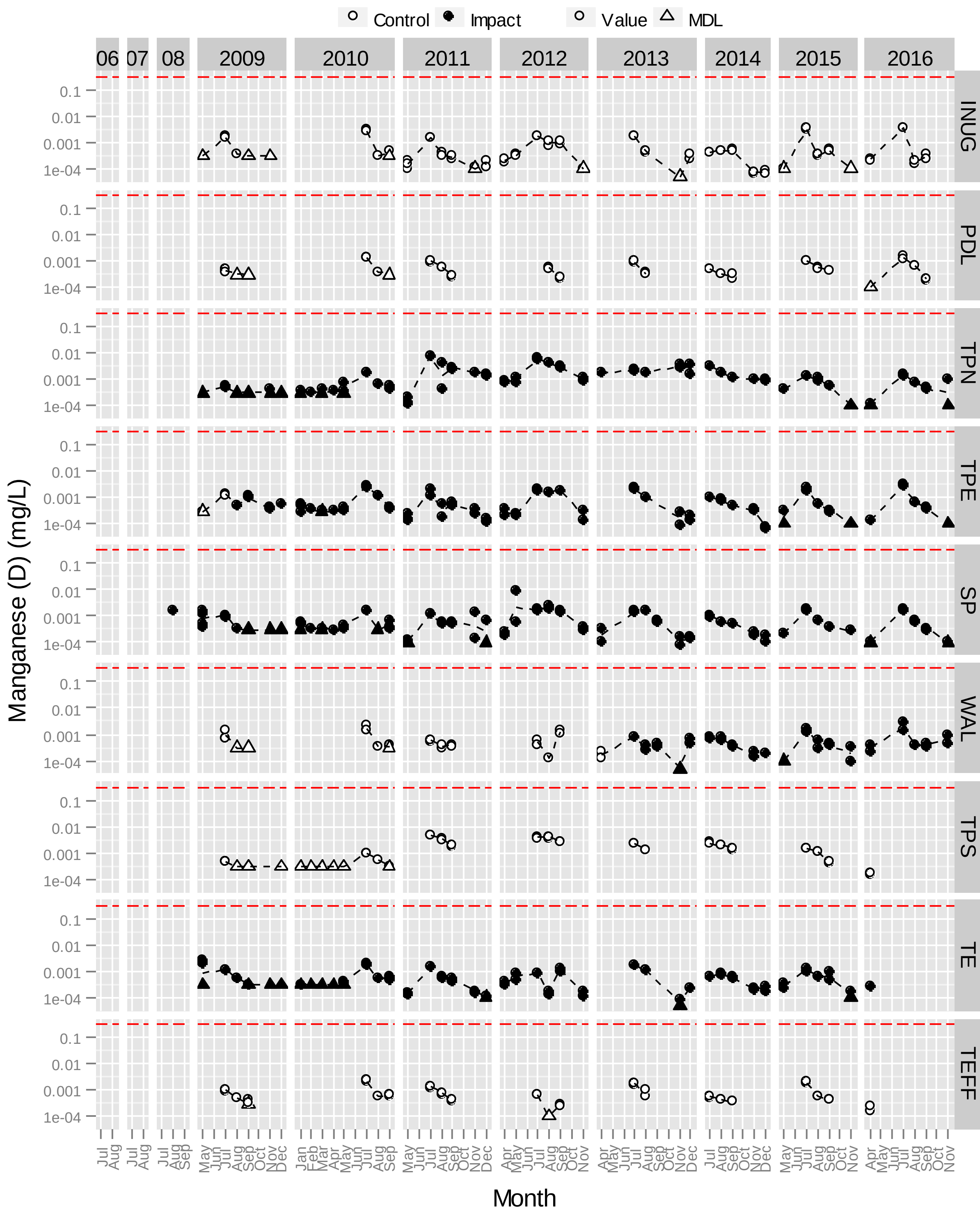


Figure 3.2–48. Dissolved Molybdenum (mg/L) in water samples from Meadowbank study lakes since 2006.

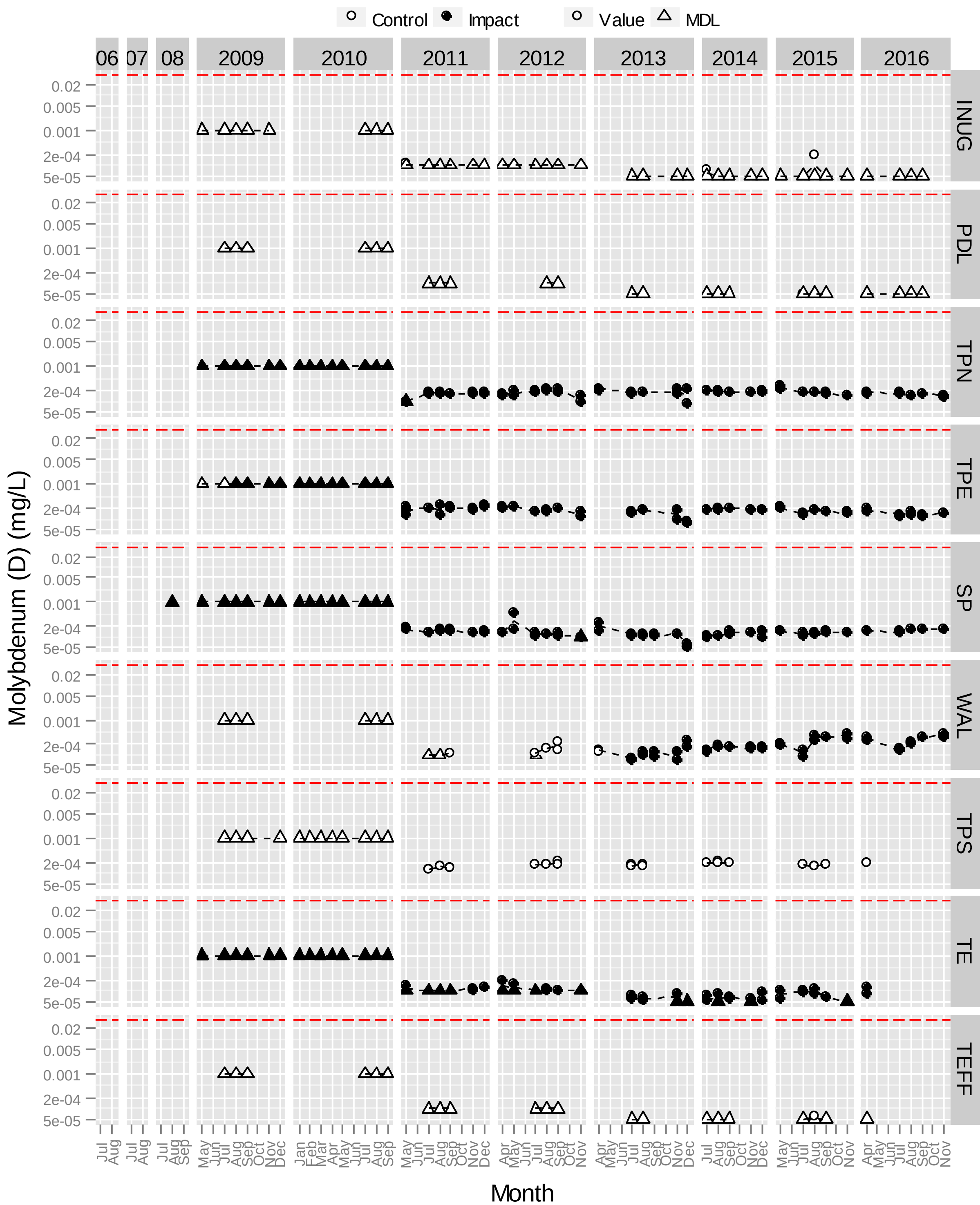


Figure 3.2–49. Dissolved Strontium (mg/L) in water samples from Meadowbank study lakes since 2006.

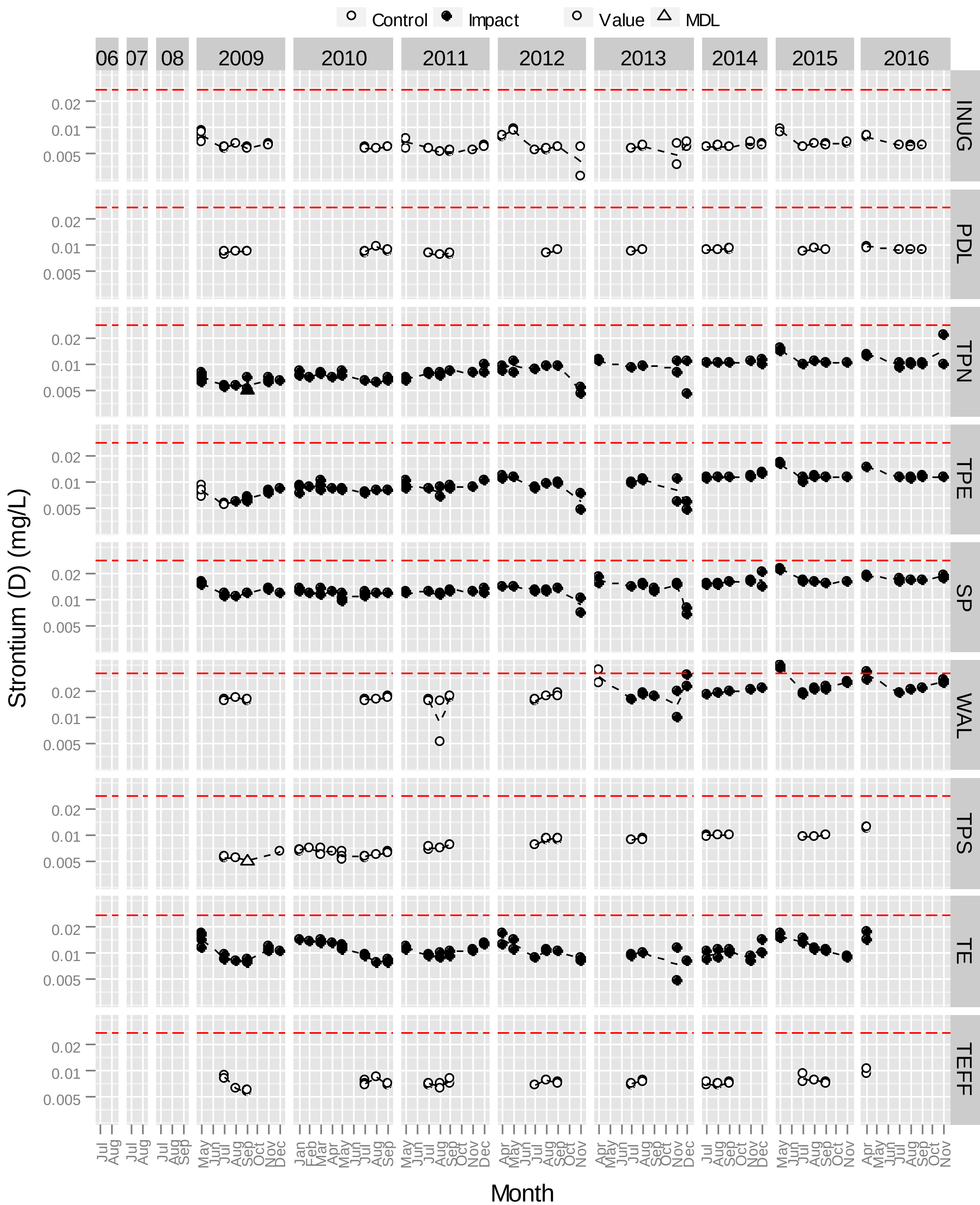
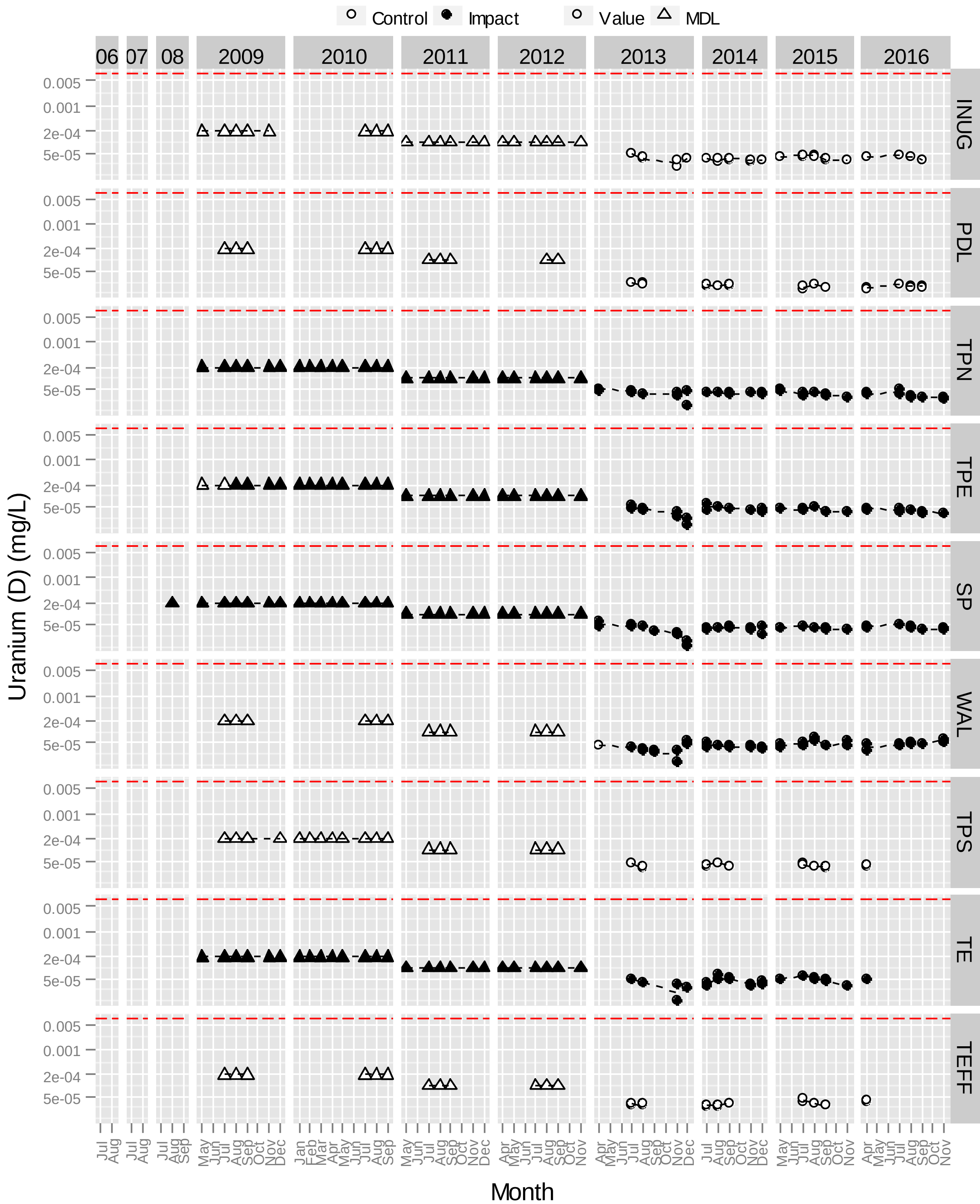


Figure 3.2–50. Dissolved Uranium (mg/L) in water samples from Meadowbank study lakes since 2006.



3.2.3. Sediment Chemistry

3.2.3.1. General Observations

Natural sedimentation rates are considered low, due to the headwater nature of the watersheds and the lack of any substantial riverine or tributary inflow. Thus, very little sediment is carried into the lakes besides what may drain off of the nearby tundra during spring run-off or heavy rain events, or from dust deposition. There are, however, a number of mine-site activities that can generate dust and potentially increase the net deposition into project lakes.

Based on historical bulk sampling of sediment using grab samples, we have observed reasonably large, within-basin or within-lake differences in surface sediment (i.e., top 3 – 5 cm) concentrations for a variety of metals, indicative of natural spatial heterogeneity driven by localized mineralization. There are a number of processes that can affect the pattern of metals distribution to sediments, including differential deposition of different grain size materials according to wind direction and speed, water depth, water currents, basin morphometry, bioturbation (i.e., vertical mixing of sediment by burrowing insect larvae) and patchy, heterogeneous distribution of metals in mineralized areas. Grain size has a very large influence on metals concentrations – all else equal, the more coarse the grain size (i.e., sandier), the lower the metals concentrations. As such, our sediment programs target low energy, depositional areas that are dominated by silt/clay sediment in areas of similar depth (6 – 10 m), where grain size tends to be finer and more consistent.

Sediment chemistry samples have been collected using grab samplers (targeting top 3 - 5 cm) or coring devices (targeting top 1.5 cm). Grab samples are used every year to characterize the chemical and physical conditions of sediments paired with the benthic invertebrate community samples. While grab samples can provide insights into temporal changes in sediment chemistry, core samples are a more sensitive tool and are used in the CREMP to formally test for changes in sediment chemistry related to mining. Core samples are collected every three years, and now match the timing of environmental effects monitoring studies required under the *Metal Mining Effluent Regulations*. Below is an overview of the various sediment coring programs at Meadowbank dating back to baseline sampling in 2008:

- 2008 – Baseline coring was conducted in July 2008 prior to onset of East Dike construction to characterize baseline surface metals concentrations at all monitoring areas.
- 2009 – The 2009 coring program was implemented to monitor potential changes to surface sediment chemistry that may have occurred as a result of the East Dike sedimentation event in August 2008. The 2009 study was conducted only at SP, TE, TPE, and INUG. TPE and INUG were used as the reference areas for SP and TE.
- 2010 to 2013 – The 2010 to 2013 sediment grab sampling programs covered all NF, MF, and FF Meadowbank study lakes as well as the reference areas INUG and PDL. Sediment coring was completed as part of the 2012 program.
- 2014 – The 2014 program covered all Meadowbank study lakes sampling areas and reference areas. Note that the 2014 program was advanced a year ahead to align with EEM program. Additional sampling was completed at TPE in 2014 to help assess whether the apparent changes in sediment chromium concentrations were related to spatially biased sampling or were a real temporal trend. Two zones in TPE were targeted for coring: the zone sampled initially in 2008 and 2009 (prior to dike construction; TPE-B) and the zone sampled in 2010 (TPE). Results from this analysis helped inform the design of the targeted chromium bioavailability study conducted at TPE in 2015.

- 2015 – The routine 2015 sediment sampling program was limited to the NF study lakes in accordance with the new approach outlined in the *CREMP: 2015 Plan Update* (Azimuth, 2015b). In addition to routine sampling, a targeted bioavailability and toxicity testing program was completed on sediments from TPE to provide more information on whether the apparent increase in chromium concentrations is adversely affecting the benthic invertebrate community. Sediment grab samples were collected from two zones in TPE and from the reference areas. Samples were analyzed for total metals and other conventional parameters as per the routine CREMP program, as well as sequential extraction testing to determine the bioavailability of sediment chromium. Bulk sediment was sent to a toxicity testing laboratory where two tests were run using *Chironomus dilutus* and *Hyalella azteca*.

Sediment sampling in 2016 was limited to grab sampling at the Meadowbank study lakes, synoptic with the benthic invertebrate community sampling locations (**Figure 1.3–2**).

3.2.3.2. Temporal and Spatial Trend Interpretation

The 2016 sediment grab chemistry data are screened against site-specific triggers/thresholds in **Table 3.2–9** (metals, particle size, TOC) and **Table 3.2–10** (hydrocarbons and PAHs).

To help with interpretation of long-term temporal and spatial trends, concentrations of individual metals have been plotted in **Figure 3.2–52** to **Figure 3.2–59.** Metals concentrations are shown by area/basin for the different sampling methods (grab [data points] vs core samples [box and whisker plots]). The red dashed line in each of sediment metals figures is the trigger value specific to the parameter and area (i.e., Meadowbank lakes, and Baker Lake each have their own trigger values). The box and whisker plots illustrate the statistical distribution of core samples within each area. Data interpretation for the box and whisker plots is as follows:

- The horizontal line inside the box represents the median concentration
- The upper and lower margins of the box represent the upper (75th) and lower (25th) percentile concentrations, respectively (the "interquartile" range)
- The vertical lines represent maximum and/or minimum concentrations (provided at least one value falls outside the box but within 1.5 times the interquartile range)
- 'x's that occur beyond the maximum or minimum lines represent concentrations that are greater than 1.5 times the interquartile distance and indicate 'outlier' concentrations that are real, but don't fit within the distribution of the rest of the data, for whatever reason.

Below is a summary of the trigger exceedances by exposure area for the 2016 grab samples (i.e., based on visual observations only; formal statistical testing of triggers is limited to core samples only):

- **Third Portage Lake** – Chromium was the only metal that exceeded the trigger values in 2016. The trigger value was exceeded in three replicate samples in TPE, with a mean concentration of 121 mg/kg (**Table 3.2–9**). By comparison, chromium concentrations at PDL averaged 131 mg/kg (range = 121 – 139 mg/kg). Temporally, the concentrations at TPE in 2016 are within the range reported between 2012 and 2015 (**Figure 3.2–55**). A slight decrease in chromium concentrations is apparent when comparing the results from 2016 to those from 2014 and 2015.

  Most hydrocarbons and PAH analytes were below the MDLs in sediment at TPN and TPE with the exception of acenaphthylene at TPE (0.0063 mg/kg) and naphthalene (0.018 mg/kg). The CCME

ISQG for acenaphthylene is 0.00587 mg/kg, slightly above the ALS MDL of 0.005 mg/kg. Naphthalene was below the CCME ISQG[20]. The low magnitude of exceedance of the acenaphthylene ISQG does not merit further investigation beyond routine monitoring as part of the 2017 CREMP program.

- **Second Portage Lake** – One sample had an exceedance of the trigger value for zinc. This result is consistent with historical data and there is no evidence of temporal trends of increasing metals concentrations in Second Portage Lake.

  Naphthalene was detected in the composite sample from SP in 2016, but the concentration was below the CCME ISQG.

- **Wally Lake** – Copper (n=3) and lead (n=3) exceeded the trigger values in 2016. One sample exceeded the threshold for lead (i.e., CCME ISQG) of 35 mg/kg. These results are consistent with baseline conditions and are therefore not related to mining activity. Furthermore, based on visual evidence presented in the figures, no temporal trends of increasing concentrations were observed for these metals in Wally Lake.

  Naphthalene and 2-methylnaphthalene were detected in the composite sample from WAL in 2016, but the concentration was below the CCME ISQG.

With the exception of chromium at TPE, visual examination of the chemistry plots shows no evidence of increasing concentrations of key metals in any of the project lakes between 2008 and 2016. A change in chromium was first noticed in TPE in 2009 when coring results showed an "increase" in concentrations despite samples being collected in July prior to the onset of Bay-Goose Dike construction (which started early August 2009; **Figure 3.2–55**). Chromium continues to exceed the trigger value at TPE, but the 2016 results are lower than peak concentrations observed in 2014 and 2015. This "apparent" decrease may be an artifact of spatial variability within the sediment area, rather than an actual reduction in sediment chromium concentrations. Nonetheless, the 2016 results are within the range of concentrations reported in 2015 when sediment toxicity testing and sequential extraction analysis was completed. Both lines of evidence pointed to the sediments being non-toxic to benthic species (*C. dilutus* and *H. azteca*). Refer to the CREMP 2015 report (Azimuth, 2016) for more information on the sediment toxicity and sequential extraction tests completed as part of the targeted chromium bioavailability study at TPE.

One point to highlight is the detection of acenaphthylene, naphthalene and 2-methylnaphthalene in some of the NF samples in 2016. Phenanthrene was also detected at the reference area INUG in 2016. Hydrocarbons have rarely been detected in sediment samples from the Meadowbank project lakes. Sporadic detections of naphthalene were previously noted at WAL in 2009 (when the lake was still considered in "before" period) and at TPN in 2013. All other PAHs have measured below their respective MDLs dating back to 2008 when sediment was first collected for analysis of PAHs and hydrocarbons. All of the instances of detection were less than 5-times the MDL, and caution should be taken when interpreting results near the MDL. The fact that PAHs were measured at reference and exposure areas suggests the results are false-positives rather than "real" indications of increases in sediment PAH concentrations related to activities at the mine. Nonetheless, PAH concentrations will be closely monitored in sediment samples collected in 2017.

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[20] Canadian ISQGs and PELs for PAHs in freshwater and marine sediments were developed using a modification of the National Status and Trends Program (NSTP) approach as described in CCME (1995). Marine ISQGs (and PELs) for acenaphthylene and naphthalene were provisionally adopted for freshwater (CCME, 1999)

Routine on-going monitoring of the sediment chemistry at TPE (and other NF areas) is recommended in 2017. Formal statistical testing of the sediment core chemistry results against triggers/threshold is scheduled for 2017.

Table 3.2–9. Conventional sediment grab chemistry, particle size, and total metals (mg/kg), Meadowbank study lakes, 2016.

Lake & Basin	Screening Criteria			Third Portage Lake – East Basin					Third Portage Lake – North Basin					Second Portage Lake				
Area-Replicate ID	CCME[1]	Meadowbank[2]		TPE-1	TPE-2	TPE-3	TPE-4	TPE-5	TPN-1	TPN-2	TPN-3	TPN-4	TPN-5	SP-1	SP-2	SP-3	SP-4	SP-5
Date	ISQG	Trigger	Threshold	4-Aug-16	4-Aug-16	4-Aug-16	4-Aug-16	4-Aug-16	4-Aug-16	4-Aug-16	4-Aug-16	4-Aug-16	4-Aug-16	3-Aug-16	3-Aug-16	3-Aug-16	3-Aug-16	3-Aug-16
Physical & Organic Parameters																		
Moisture (%)				82.9	78.2	88.2	84.7	86.4	49.0	39.6	82.9	60.6	44.5	84.3	84.4	85	84.4	85.6
pH				5.98	6.22	6.23	6.4	6.3	6.33	6.07	6	6	5.99	6.05	6.29	6.22	6.08	5.97
Total Organic Carbon (% dw)				3.25	1.77	3.8	3.39	3.69	0.589	0.398	3.45	1.03	0.648	3.85	3.91	3.67	3.87	4.22
Particle Size																		
% Gravel (>2mm)				*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	3.98	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*
% Sand (2.00mm - 0.063mm)				5.78	16.5	1.59	1.59	2.13	52.7	49.9	23.6	63.1	34.5	1.87	1.57	1.23	1.22	0.97
% Silt (0.063mm - 4µm)				65.4	54.2	68.6	67.5	69.6	31.4	24.8	59.5	29	41.9	73	72.5	71.2	69.2	75.7
% Clay (<4µm)				28.9	29.3	29.8	30.9	28.3	15.9	21.4	17	7.9	23.6	25.1	25.9	27.6	29.6	23.3
Total Metals (mg/kg dw)																		
Aluminum				25600	24400	23600	23000	23100	12600	13100	15700	10400	15500	22400	26000	27500	27700	23400
Antimony				0.22	0.16	0.27	0.23	0.24	*<0.10*	*<0.10*	0.2	0.10	0.11	0.26	0.28	0.26	0.29	0.27
Arsenic*	5.9	120.0		20	17.5	20.2	16.6	20.8	6.36	5.49	14.9	10	16.4	39.8	29.1	26.7	40.8	65.8
Barium				111	113	114	119	108	50.2	62	65.6	41.7	70.4	116	127	127	133	121
Beryllium				1.86	1.72	1.78	1.76	1.69	0.57	0.62	1.04	0.62	0.86	1.75	2	2.17	2.46	2.09
Bismuth				2.61	2.29	2.37	2.36	2.26	0.55	0.58	1.05	0.64	0.82	2.03	2.32	2.46	2.64	2.27
Boron				7.3	5.5	7.4	7.5	7.6	*<5.0*	*<5.0*	5.9	*<5.0*	*<5.0*	7.2	8.10	7.7	8.1	6.4
Cadmium*	0.6	1.10		0.123	0.13	0.274	0.305	0.182	0.068	0.049	0.128	0.057	0.06	0.236	0.234	0.253	0.292	0.291
Calcium				2080	1680	2390	2120	2230	1200	1120	1690	1010	1150	2400	2540	2300	2470	2290
Chromium*	37.3	114.3		**127**	101	**135**	113	**130**	67.8	60	113	76.3	78.9	85.6	90.7	90	89	78.2
Cobalt				16.1	14.5	16.3	15.4	16.2	8.88	8	10.2	7.72	10.5	15.5	15.4	16.6	18.9	14.6
Copper*	35.7	126.0		59.1	52	53.7	51.3	49.5	16.7	16.9	47.2	27.1	28.8	61.7	70.3	78.6	87.4	76.1
Iron				47400	45200	47000	40100	50400	21500	22100	30800	21600	31700	85800	65800	64900	73900	85100
Lead	35	32.5	35	22.6	20.4	21.6	21.4	20.3	7.41	8.32	14.9	8.69	11.7	20.4	22.7	23	24.8	21.7
Lithium				54	57.4	46.9	46.8	44.5	28.2	33.3	27	19.5	36.3	39.3	45.8	47.2	49.4	42.1
Magnesium				10700	10200	10300	9420	9980	6990	6570	7800	5630	7750	8820	10000	10000	9990	8680
Manganese				1250	1120	1770	2220	1840	324	390	362	325	468	3610	3140	1680	1490	1360
Mercury	0.17	0.104	0.17	0.0235	0.0151	0.0266	0.0234	0.0257	0.0058	0.006	0.0202	0.0097	0.0081	0.0341	0.0346	0.028	0.0282	0.0289
Molybdenum				4.53	4.52	4.93	4.53	4.30	1.78	1.71	2.87	1.56	3.93	7.22	6.23	7.21	8.48	11.1
Nickel				67.3	61.8	86.3	86.9	68.6	49.3	50	57.1	37.2	51.5	64.4	69.3	69.4	72.4	59.4
Phosphorus				458	318	453	420	421	194	142	621	331	278	570	561	534	660	639
Potassium				4620	4560	4220	4230	4220	2040	2650	2430	1520	2840	3780	4400	4600	4800	4060
Selenium				0.47	0.33	0.81	0.74	0.87	*<0.20*	*<0.20*	0.5	*<0.20*	*<0.20*	0.69	0.61	0.53	0.65	0.78
Silver				*<0.10*	*<0.10*	0.11	*<0.10*	0.18	*<0.10*	*<0.10*	0.14	*<0.10*	*<0.10*	0.2	0.19	0.11	0.12	0.19
Sodium				174	164	200	187	185	86	176	131	79	149	175	196	179	213	183
Strontium				17.3	15.6	18.9	18	18.3	11	12.6	14.6	9.49	11.4	19.4	21.1	19.9	21.2	19.3
Thallium				0.385	0.388	0.405	0.442	0.364	0.157	0.189	0.182	0.12	0.213	0.325	0.375	0.389	0.418	0.364
Tin				*<2.0*	*<2.0*	*<2.0*	*<2.0*	3.3	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*
Titanium				880	954	782	804	794	617	677	430	341	699	656	733	751	753	595
Uranium				19.3	18.8	16.8	16.6	15.7	5.72	5.82	13.2	7.47	10.7	16.9	20.1	22.4	24.5	20.6
Vanadium				45.5	43.6	42.4	40.5	41.4	24.4	24.9	30.6	21.3	30.9	35.4	40.3	42.6	44.4	38.1
Zinc*	123	121.3		106	104	104	102	95.6	55	59.4	68.4	43.6	68.3	95.7	109	118	**133**	117
Zirconium				4.1	5.6	3.4	3	3.1	8.2	10.8	1.8	1.2	6.5	2.2	2.7	3.3	3	2.8

Notes:

[1] CCME (Canadian Council of Ministers of the Environment) Canadian Sediment Quality Guidelines for the Protection of Aquatic Life, 1999, updated in 2002. ISQG = Interim freshwater Sediment Quality Guideline.

[2] Trigger and threshold values were developed in the *CREMP Design Document 2012* (Azimuth, 2012d).

Thresholds are set equal to CCME ISQG guidelines, where available.

* CCME guideline not used as threshold value because threshold value would be lower than trigger value.

123 Bolded concentrations exceed the trigger value.

123 Bolded and shaded concentrations also exceed the threshold value.

Italicized numbers are below detection limits.

Table 3.2–9. Conventional sediment grab chemistry, particle size, and total metals (mg/kg), Meadowbank study lakes, 2016.

Lake & Basin	Screening Criteria			Wally Lake					Inuggugayualik Lake					Pipedream Lake				
Area-Replicate ID	**CCME[1]**	**Meadowbank[2]**		**WAL-1**	**WAL-2**	**WAL-3**	**WAL-4**	**WAL-5**	**INUG-1**	**INUG-2**	**INUG-3**	**INUG-4**	**INUG-5**	**PDL-1**	**PDL-2**	**PDL-3**	**PDL-4**	**PDL-5**
Date	**ISQG**	**Trigger**	**Threshold**	5-Aug-16	5-Aug-16	5-Aug-16	5-Aug-16	5-Aug-16	7-Aug-16	7-Aug-16	7-Aug-16	7-Aug-16	7-Aug-16	6-Aug-16	6-Aug-16	6-Aug-16	6-Aug-16	6-Aug-16
Physical & Organic Parameters																		
Moisture (%)				92.3	92.2	91.4	88	87.2	82.5	83.9	83	84.2	82.4	76.7	80.0	78.8	76.7	78.8
pH				6.68	6.43	6.64	6.57	6.61	5.64	5.35	5.51	5.48	5.21	5.85	5.77	5.79	5.68	5.69
Total Organic Carbon (% dw)				9.04	12.4	9.01	6.63	6.1	3.42	4.02	3.27	4.21	3.66	1.91	2.67	2.13	2.35	2.08
Particle Size																		
% Gravel (>2mm)				*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*
% Sand (2.00mm - 0.063mm)				4.14	2.14	2.65	5.02	7.04	1.59	2.59	2.34	1.12	1.12	12.5	7.61	7.08	7.71	6.6
% Silt (0.063mm - 4µm)				79.3	86.1	87.1	82.9	79.9	75.5	78.4	76.4	75.4	75.9	70.4	77.1	77.2	77.5	77.8
% Clay (<4µm)				16.6	11.80	10.2	12.1	13.1	23	19	21.3	23.5	23	17.1	15.3	15.7	14.8	15.6
Total Metals (mg/kg dw)																		
Aluminum				19500	14100	19100	21000	18300	22800	21000	21900	21900	24800	19600	18200	20300	19200	21100
Antimony				0.48	0.37	0.45	0.46	0.35	0.16	0.18	0.17	0.19	0.2	0.2	0.26	0.21	0.19	0.2
Arsenic*	5.9	120.0		28.2	29.8	46.9	19.6	21.2	81.1	83.9	21.3	11.3	69.1	13.2	56.3	13.1	9.53	22.8
Barium				117	86.3	119	132	106	115	120	110	126	147	88.5	82.6	86.8	92.1	95.1
Beryllium				1.56	1.21	1.62	1.75	1.52	1.43	1.4	1.46	1.44	1.64	0.96	0.94	1.01	0.92	1.09
Bismuth				1.91	1.42	2.06	2.25	1.94	1.27	1.26	1.29	1.22	1.33	0.84	0.84	0.9	0.82	0.93
Boron				12	13.5	12.7	8.5	8.2	7.2	7.1	6.4	7.4	9.9	7.2	6.5	7	6.00	7.2
Cadmium*	0.6	1.10		0.55	0.416	0.505	0.758	0.403	0.148	0.25	0.175	0.298	0.272	0.100	0.149	0.09	0.126	0.115
Calcium				4650	4450	4890	3980	4060	1910	1770	1650	1850	2270	2260	2170	2320	2170	2090
Chromium*	37.3	114.3		57.4	44.3	58.2	62.4	56.2	111	105	108	107	**120**	**129**	**121**	**137**	**128**	**139**
Cobalt				9.23	8.08	9.48	9.12	8.23	11.9	13.4	12.4	11.4	12.7	11.7	12.7	11.8	10.9	13.7
Copper*	35.7	126.0		**149**	109	**155**	**161**	120	47.2	46.2	47.7	46.5	51.9	41.8	42.2	43.8	41.1	45.5
Iron				29200	24900	39600	29300	28600	71500	78600	45800	34400	66800	29400	45800	32200	26900	36600
Lead	35	32.5	35	**34.2**	28.2	**34.9**	**37.6**	30.4	14	14.8	14.3	14.1	14.8	13.4	14.2	14.4	14.1	14.6
Lithium				35.6	27.3	34.6	43.3	39.4	28.7	26.7	29.5	29.6	30.6	28.2	25.1	29	27.8	29.4
Magnesium				7780	5910	7240	8170	7490	9900	9100	9630	9670	10300	10100	9620	10900	10500	10700
Manganese				308	297	343	300	311	857	1000	911	489	685	298	526	347	304	367
Mercury	0.17	0.104	0.17	0.0778	0.0933	0.0835	0.0465	0.0446	0.0237	0.03	0.023	0.0287	0.0267	0.0101	0.0149	0.011	0.0117	0.0098
Molybdenum				7.8	6.95	11	6.27	5.85	4.94	5.89	2.99	3.41	6.6	2.33	4.04	1.49	1.31	2.93
Nickel				55.7	45.9	53.8	59.3	48.8	71.5	82.7	76.7	88.4	87.8	76.1	74.2	77	77.4	82.9
Phosphorus				706	898	792	569	622	2220	2040	1380	915	1880	444	790	653	502	552
Potassium				3310	2780	3480	3790	3310	3480	3150	3240	3290	4150	2900	2620	2940	2730	2960
Selenium				0.79	0.77	1.01	0.83	0.66	0.56	0.56	0.57	0.53	0.7	0.24	0.47	0.36	0.31	0.30
Silver				0.7	0.53	0.73	0.56	0.42	0.17	0.19	0.17	0.23	0.22	*<0.10*	0.15	0.15	0.21	*<0.10*
Sodium				200	177	204	176	178	163	145	179	166	245	138	139	144	128	154
Strontium				29.3	28	30.2	27.6	27.5	23.6	21.3	21.6	21.5	29.6	25.1	22.3	25.6	22.2	23.6
Thallium				0.311	0.25	0.327	0.332	0.295	0.208	0.226	0.218	0.238	0.258	0.187	0.176	0.192	0.181	0.189
Tin				*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*
Titanium				534	410	526	646	626	561	499	558	521	681	588	497	613	544	572
Uranium				15.9	12.1	17.8	18	14.7	17.1	16.8	17.7	17.1	18.3	8.29	7.79	8.39	7.8	8.89
Vanadium				30.8	23.1	31.2	34.1	30.6	37.1	34.8	36	34.8	41.1	36.6	34.4	38.7	35.9	39.1
Zinc*	123	121.3		118	94	116	115	99.2	80.9	86.9	80.2	90.7	97.3	75.1	71	74.6	73.1	81.6
Zirconium				3.8	3.8	3.7	4.2	3.2	3.3	2.4	4	2.8	4	2.1	2	2.5	2	1.8

Notes:

1 CCME (Canadian Council of Ministers of the Environment) Canadian Sediment Quality Guidelines for the
Protection of Aquatic Life, 1999, updated in 2002. ISQG = Interim freshwater Sediment Quality Guideline.

2 Trigger and threshold values were developed in the *CREMP Design Document 2012* (Azimuth, 2012d).
Thresholds are set equal to CCME ISQG guidelines, where available.

* CCME guideline not used as threshold value because threshold value would be lower than trigger value.

123 Bolded concentrations exceed the trigger value.

123 Bolded and shaded concentrations also exceed the threshold value.

Italicized numbers are below detection limits.

Table 3.2–10. Hydrocarbon and PAH results for composite sediment grabs at Meadowbank study lakes, 2016.

Lake	**CCME (2002) Guidelines[1]**	**Third Portage Lake**		**Second Portage**	**Wally**	**Inuggugayualik**	**Pipedream**
Area ID		**TPE**	**TPN**	**SP**	**WAL**	**INUG**	**PDL**
Date	**ISQG**	4-Aug-16	4-Aug-16	3-Aug-16	5-Aug-16	7-Aug-16	6-Aug-16
Physical Parameters							
Moisture (%)		85.7	56.9	85.3	90.0	84.6	75.7
Aggregate Organics (mg/kg)							
Mineral Oil and Grease		2600	*<500*	700	3700	600	*<500*
Hydrocarbons (mg/kg)							
EPH10-19		*<780*	*<220*	*<740*	*<1000*	*<560*	*<400*
EPH19-32		*<780*	*<220*	*<740*	*<1000*	*<560*	*<400*
LEPH		*<780*	*<220*	*<740*	*<1000*	*<560*	*<400*
HEPH		*<780*	*<220*	*<740*	*<1000*	*<560*	*<400*
Polycyclic Aromatic Hydrocarbons (mg/kg)							
Acenaphthene	0.00671	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.020*	*<0.0050*
Acenaphthylene	0.00587	**0.0063**	*<0.0050*	*<0.0050*	*<0.0050*	*<0.020*	*<0.0050*
Anthracene	0.0469	*<0.0060*	*<0.0040*	*<0.0040*	*<0.0040*	*<0.020*	*<0.0040*
Benzo(a)anthracene	0.0317	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.020*	*<0.010*
Benzo(a)pyrene	0.0319	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.020*	*<0.010*
Benzo(b)fluoranthene		*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.020*	*<0.010*
Benzo(b+j+k)fluoranthene		*<0.015*	*<0.015*	*<0.015*	*<0.015*	*<0.028*	*<0.015*
Benzo(g,h,i)perylene		*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.020*	*<0.010*
Benzo(k)fluoranthene		*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.020*	*<0.010*
Chrysene	0.0571	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.020*	*<0.010*
Dibenz(a,h)anthracene	0.00622	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.020*	*<0.0050*
Fluoranthene	0.111	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.020*	*<0.010*
Fluorene	0.0212	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.020*	*<0.010*
Indeno(1,2,3-c,d)pyrene		*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.020*	*<0.010*
2-Methylnaphthalene	0.0202	*<0.010*	*<0.010*	*<0.010*	0.011	*<0.020*	*<0.010*
Naphthalene	0.0346	0.018	*<0.010*	0.017	0.023	*<0.020*	*<0.010*
Phenanthrene	0.0419	*<0.010*	*<0.010*	*<0.010*	*<0.010*	0.029	*<0.010*
Pyrene	0.053	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.020*	*<0.010*
d10-Acenaphthene (%)		106.5	97.9	92.8	98.4	82.3	74.4
d12-Chrysene (%)		100.2	091.7	86.8	091.2	94.1	093.4
d8-Naphthalene (%)		100.1	97.4	92.4	97.7	75.9	70.4
d10-Phenanthrene (%)		98.9	93.0	89.0	090.8	88.5	084.0
B(a)P Total Potency Equivalent		*<0.020*	*<0.020*	*<0.020*	*<0.020*	*<0.024*	*<0.020*
IACR (CCME)		*<0.15*	*<0.15*	*<0.15*	*<0.15*	*<0.24*	*<0.15*

Notes:

[1] CCME (Canadian Council of Ministers of the Environment) Canadian Sediment Quality Guidelines for the Protection of Aquatic Life, 1999, updated in 2002.

ISQG = Interim freshwater Sediment Quality Guideline

Bolded concentrations exceed the ISQG guideline.

Italicized numbers are below detection limits.

Figure 3.2–51. Sediment grain size composition in sediment samples from Meadowbank study lakes since 2008.

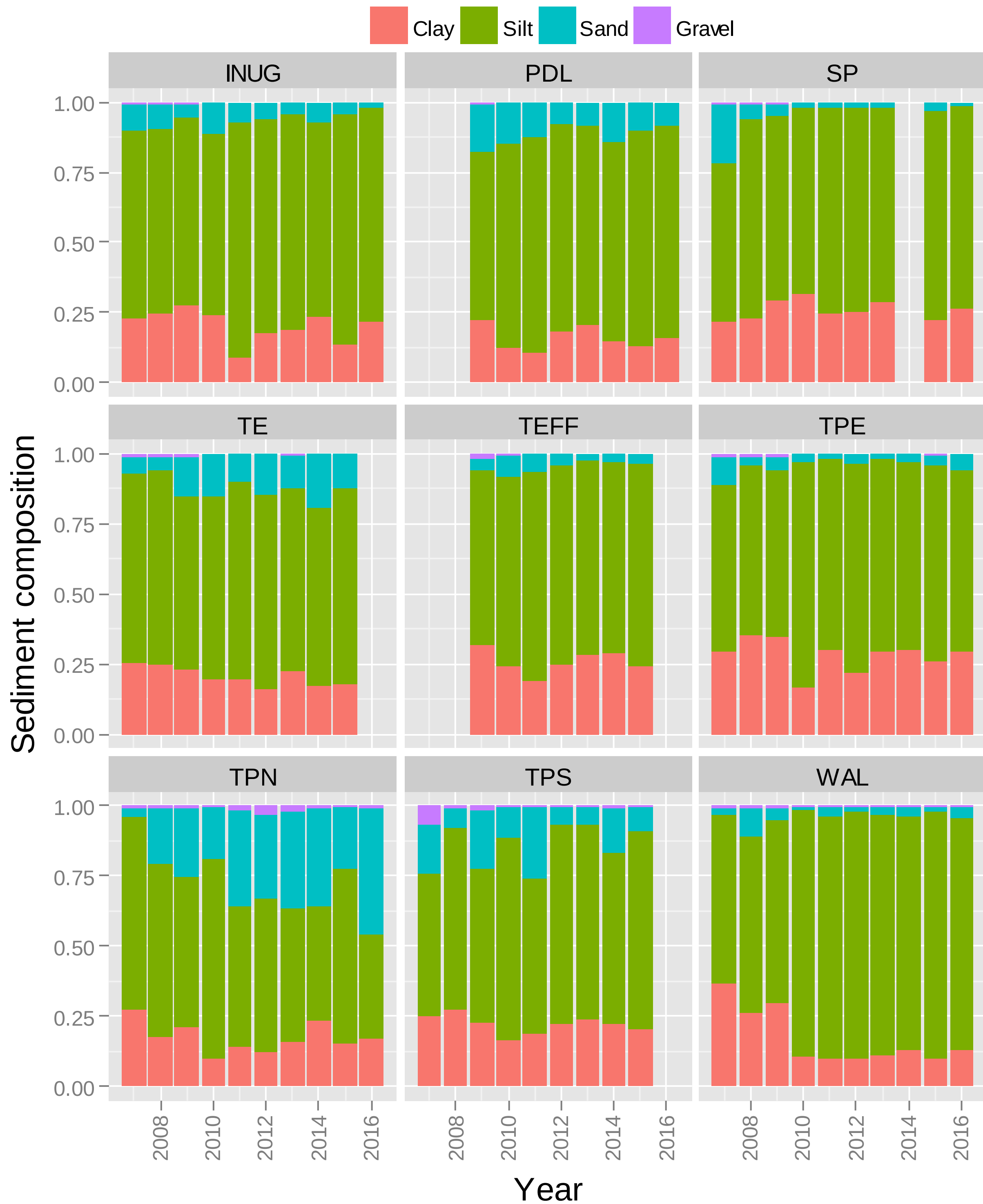


Figure 3.2–52. Total Aluminum (mg/kg) in sediment samples (grabs & cores) from Meadowbank study lakes since 2006.

Note: Grab samples = dots; Core samples = box and whisker

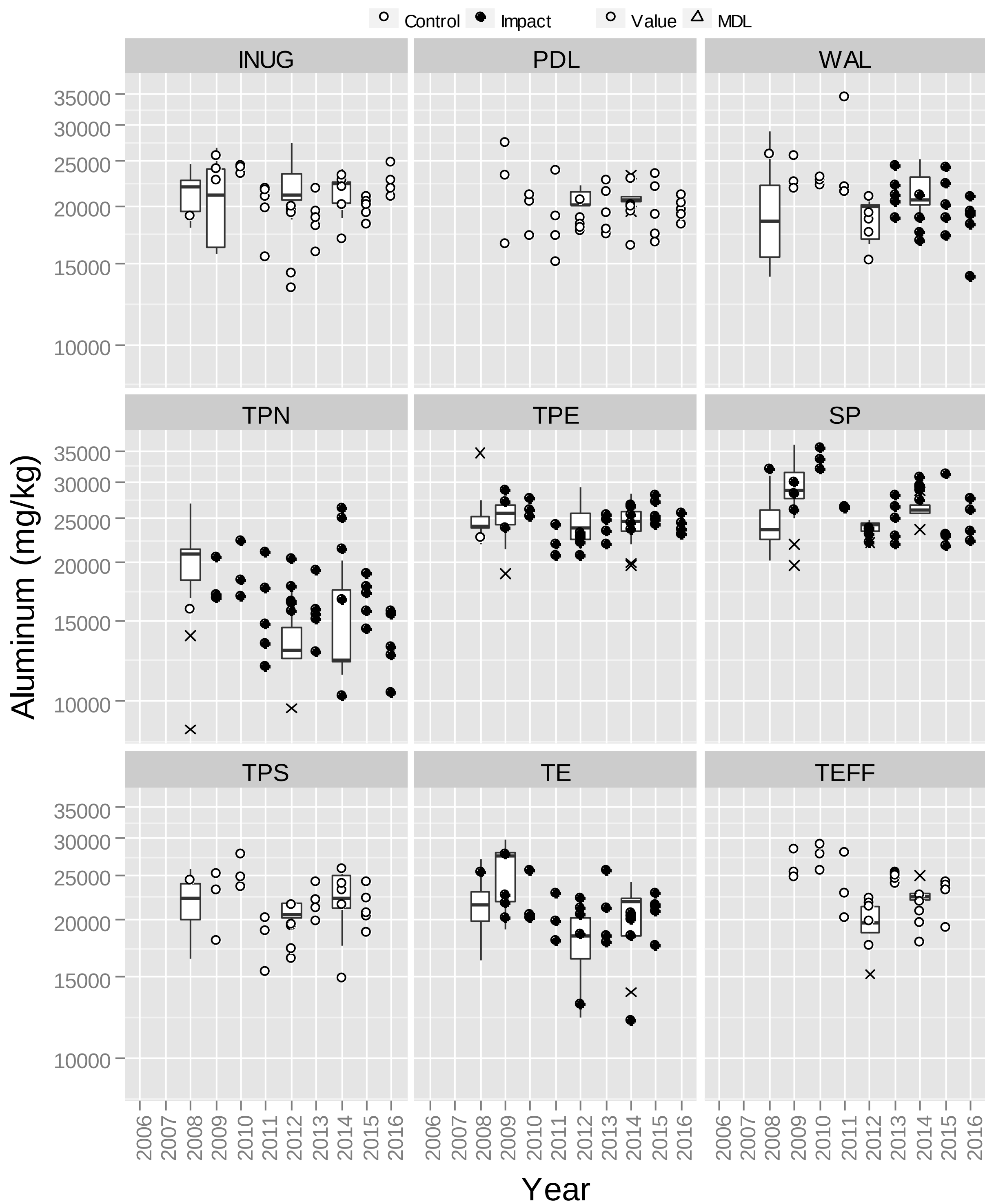


Figure 3.2–53. Total Arsenic (mg/kg) in sediment samples (grabs & cores) from Meadowbank study lakes since 2006.

Note: The red dashed line represents the trigger value. Grab samples = dots; Core samples = box and whisker.

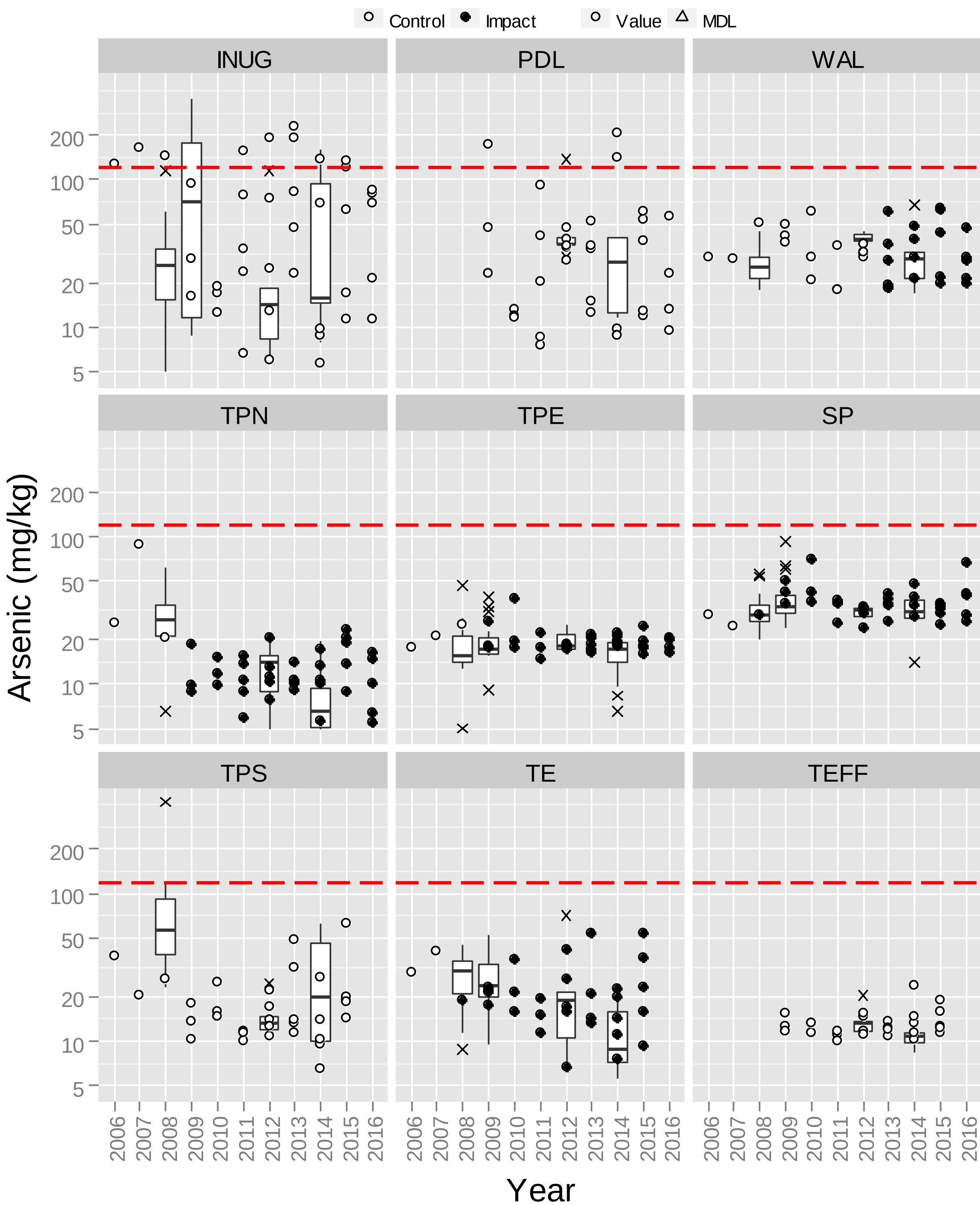


Figure 3.2–54. Total Cadmium (mg/kg) in sediment samples (grabs & cores) from Meadowbank study lakes since 2006.

Note: The red dashed line represents the trigger value. Grab samples = dots; Core samples = box and whisker.

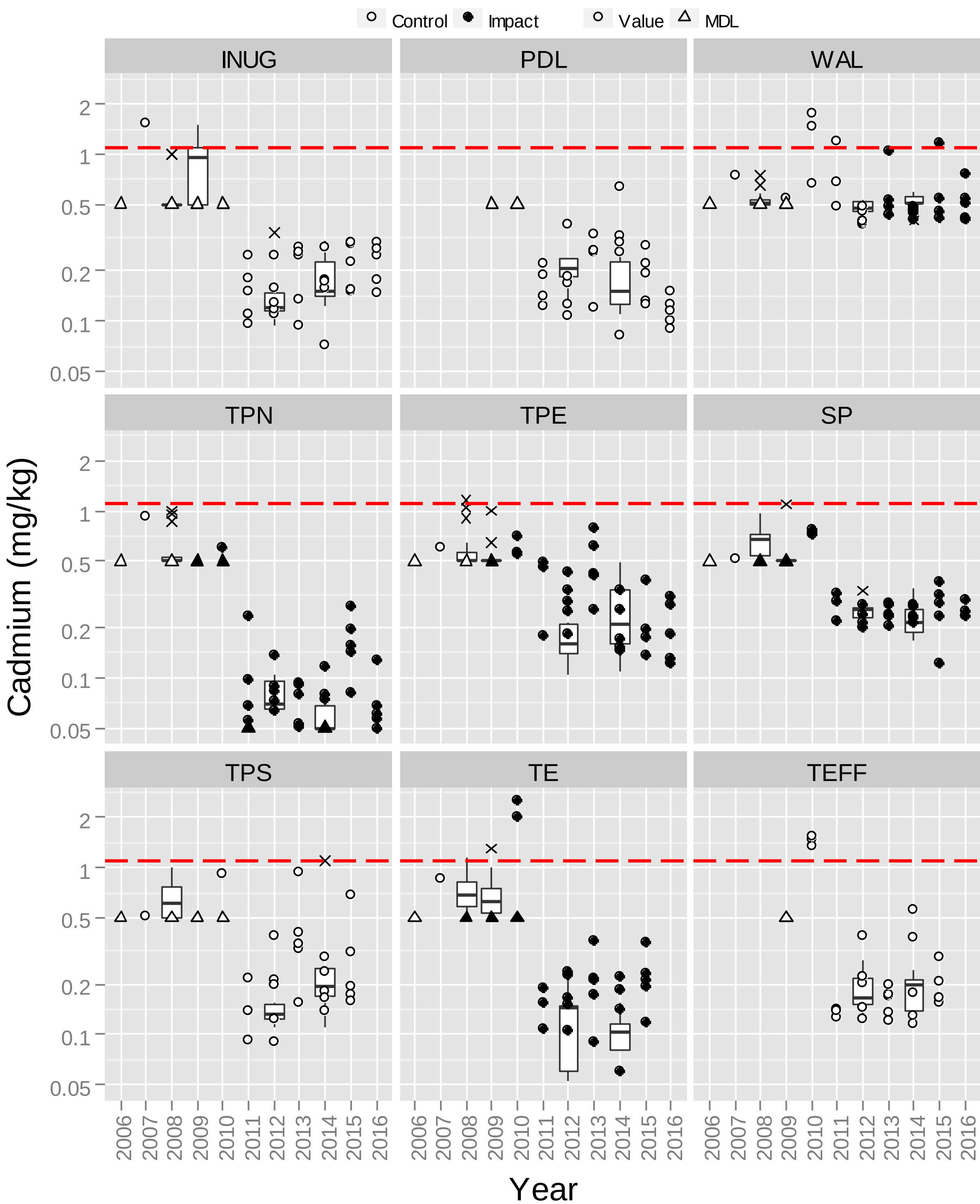


Figure 3.2–55. Total Chromium (mg/kg) in sediment samples (grabs & cores) from Meadowbank study lakes since 2006.

Note: The red dashed line represents the trigger value. Grab samples = dots; Core samples = box and whisker.

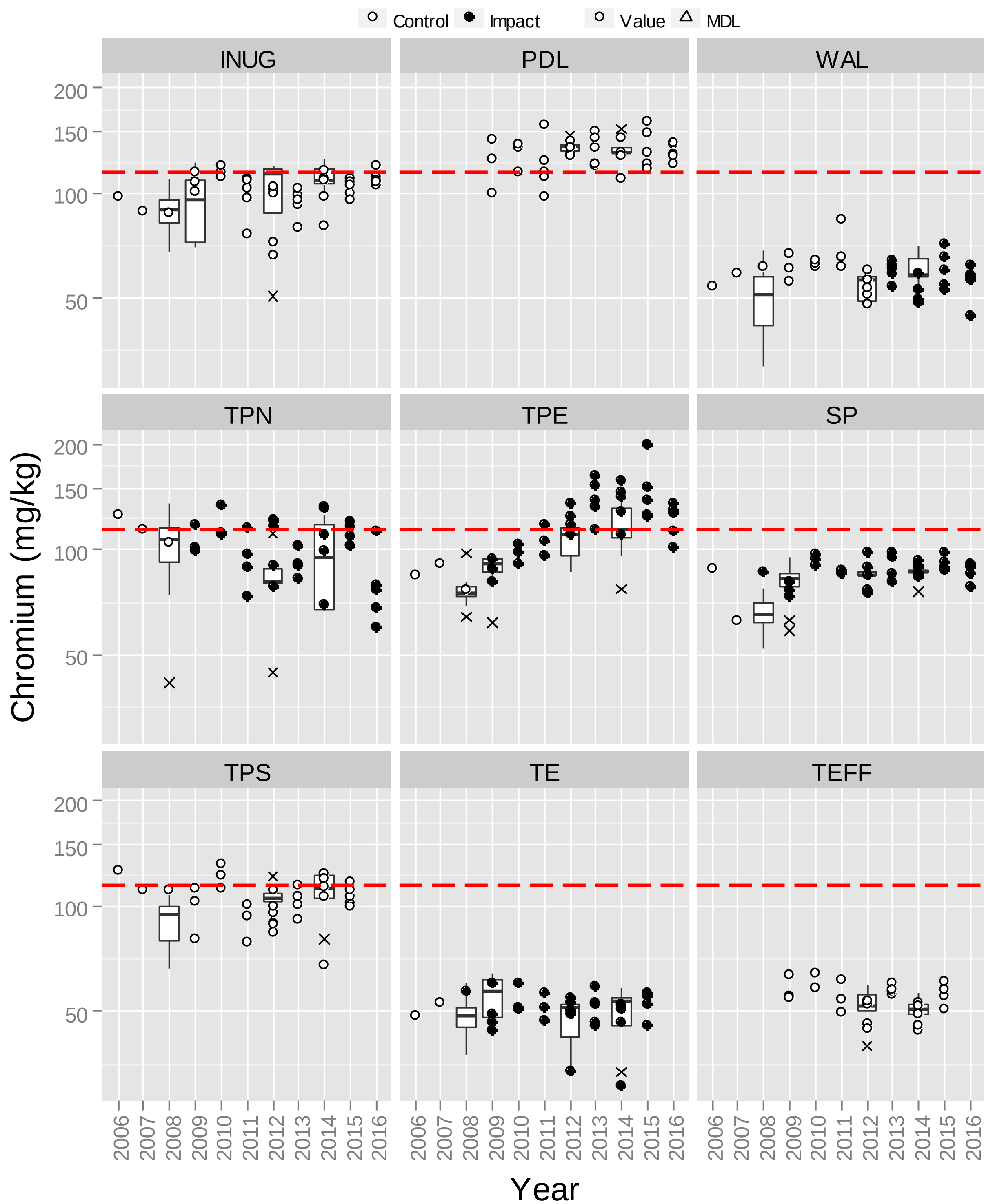


Figure 3.2–56. Total Copper (mg/kg) in sediment samples (grabs & cores) from Meadowbank study lakes since 2006.

Note: The red dashed line represents the trigger value. Grab samples = dots; Core samples = box and whisker.

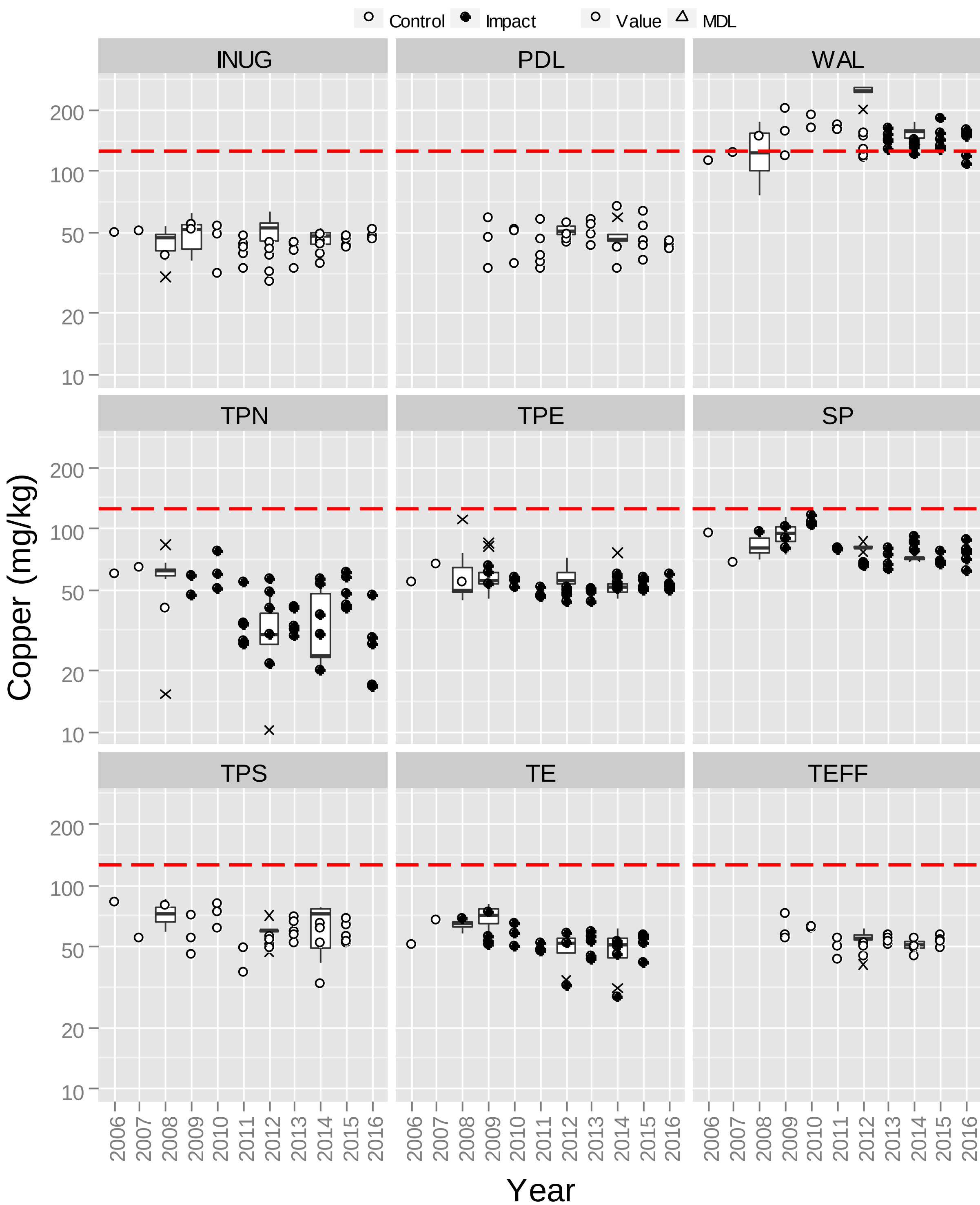


Figure 3.2–57. Total Lead (mg/kg) in sediment samples (grabs & cores) from Meadowbank study lakes since 2006.

Note: The red dashed line represents the trigger value. Grab samples = dots; Core samples = box and whisker.

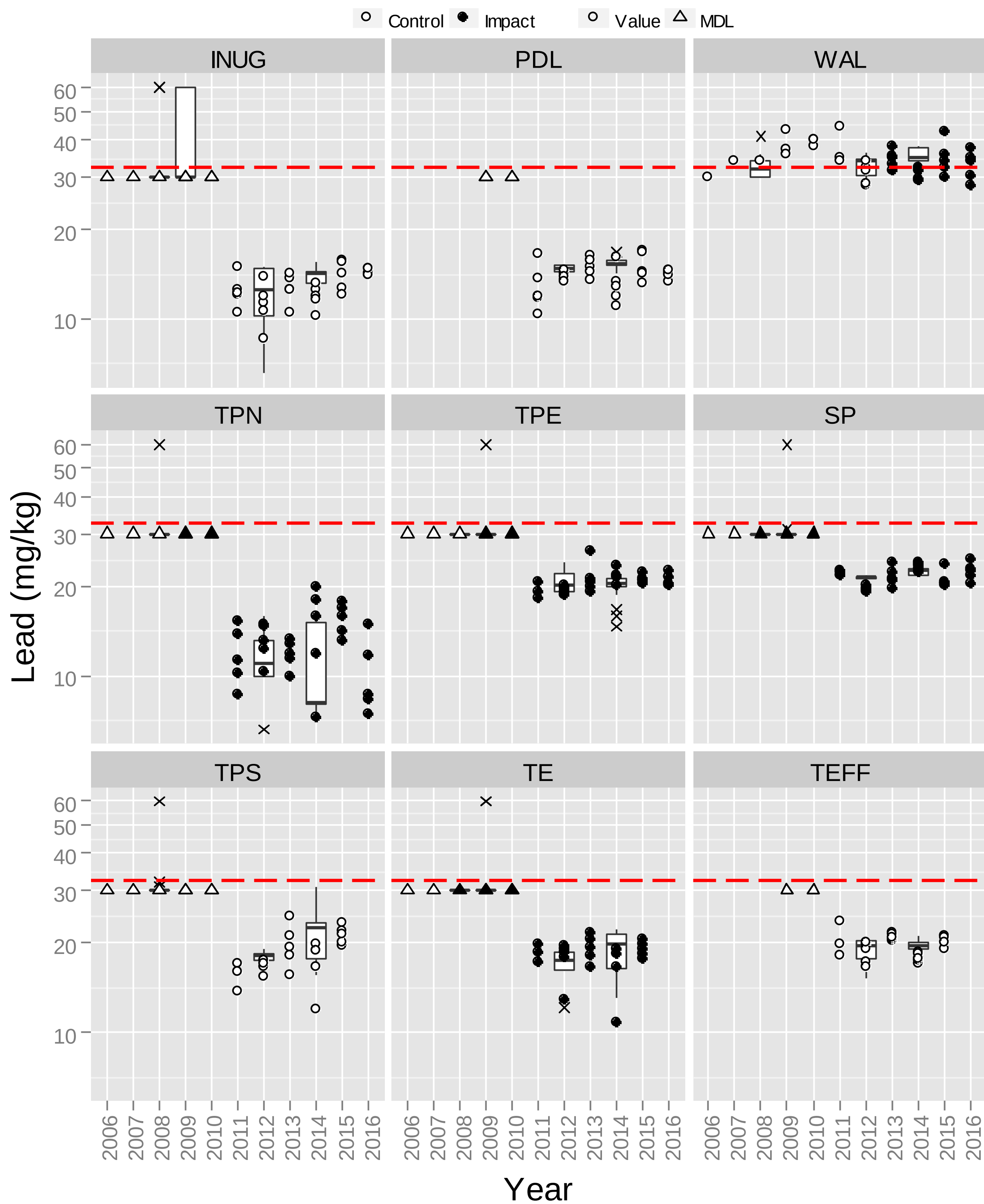


Figure 3.2–58. Total Mercury (mg/kg) in sediment samples (grabs & cores) from Meadowbank study lakes since 2006.

Note: The red dashed line represents the trigger value. Grab samples = dots; Core samples = box and whisker.

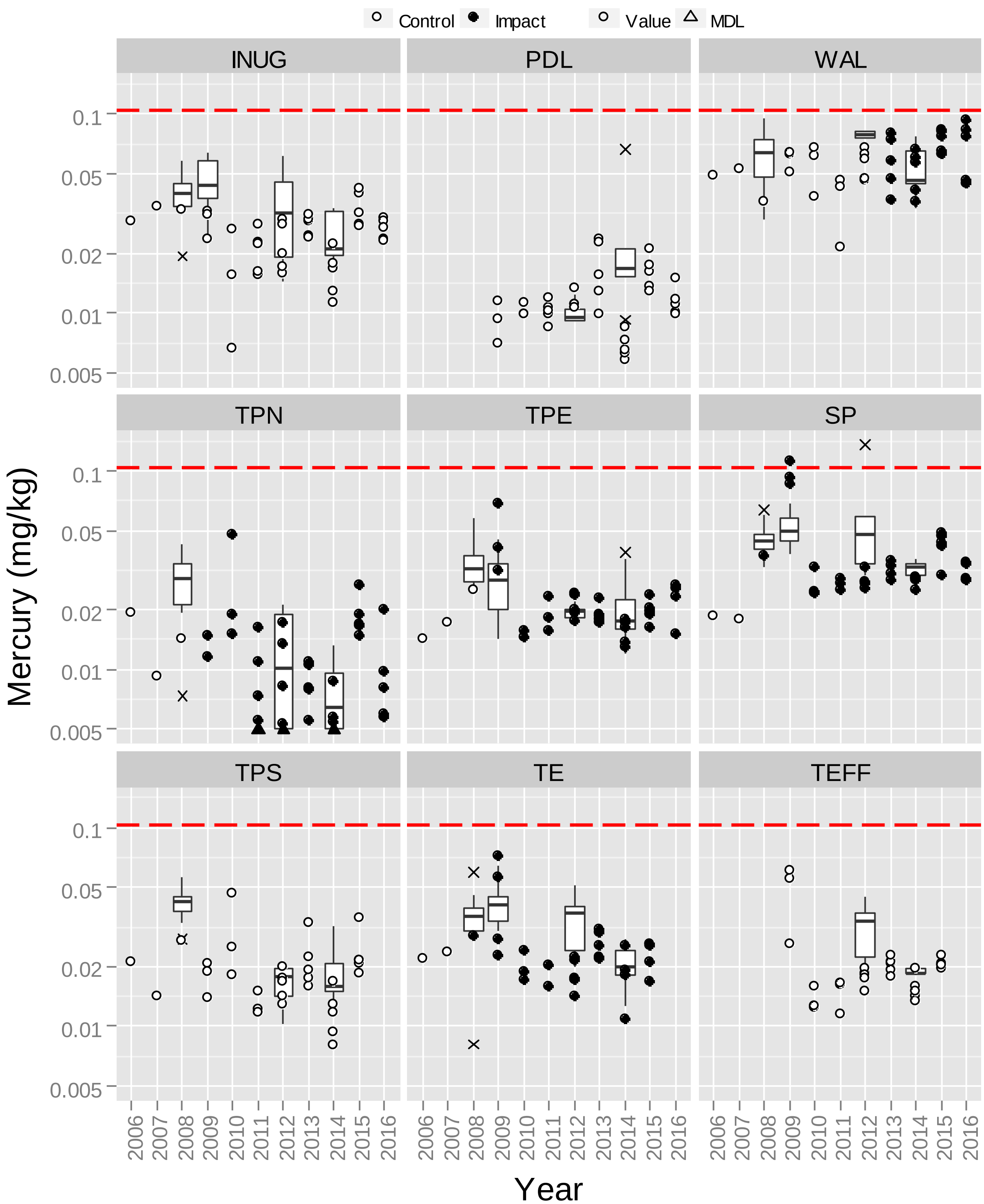
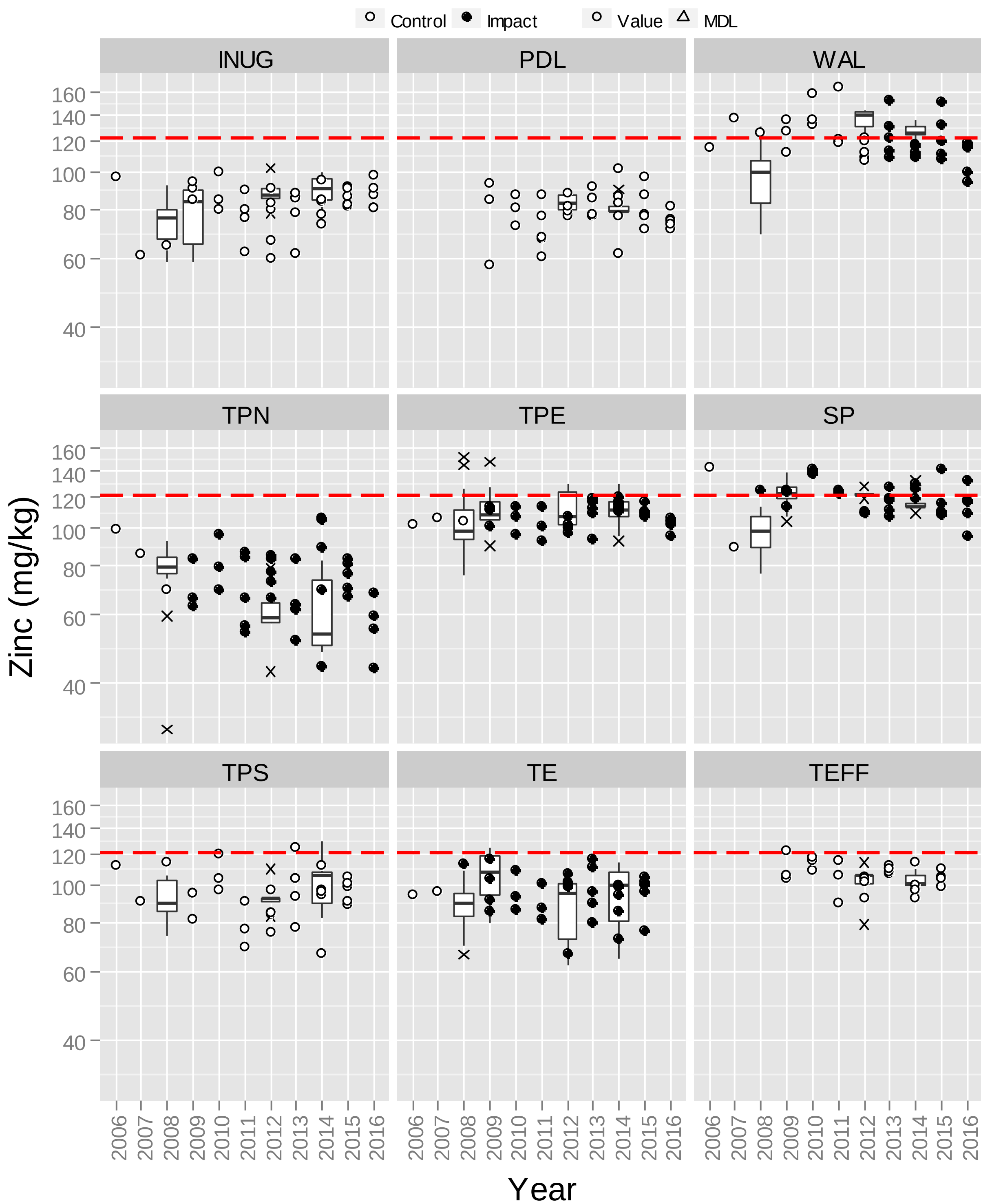


Figure 3.2–59. Total Zinc (mg/kg) in sediment samples (grabs & cores) from Meadowbank study lakes since 2006.

Note: The red dashed line represents the trigger value. Grab samples = dots; Core samples = box and whisker.



3.2.4. Phytoplankton

3.2.4.1. General Observations

The diversity in types and sizes of phytoplankton is large and their abundance is great, typically exceeding 1 million individuals per litre with a total biomass of approximately 200 mg/m^3 in summer. Six major taxonomic groups of phytoplankton are present in the study lakes, namely blue-green algae (Cyanophyta), green algae (Chlorophyta), golden-brown algae (Chrysophyta), Diatom, Cryptophyta and Dinoflagellata. Chrysophytes (golden-brown algae) are small, usually unicellular phytoplankton that are consistently the most numerous taxonomic group in the Meadowbank area lakes. Chrysophytes also dominate biomass in all project lakes, typically representing 65% or more of total phytoplankton biomass in summer samples, with smaller proportions (usually <10% each) of the other five major groups. The dominant chrysophyte genera for the Meadowbank lakes are *Chrysococcus*, *Kephyrion*, *Chrysochromulina, Dinobryon* and *Chrysolkos*. Dominant genera for the other groups were *Oocystis* for chlorophytes, *Planktolyngbya* for cyanophytes, *Cyclotella* for diatoms, *Rhodomonas* and *Cryptomonas* for cryptophytes, and *Gymnodinium* and *Peridinium* for dinoflagellates (Azimuth, 2012a, 2011b, 2010a, 2009c, 2008a, and 2008b).

Mean phytoplankton biomass in the Meadowbank area lakes typically ranges from 100 to 250 mg/m^3 during summer with diminishing biomass in fall through winter. This range in biomass is typical for oligotrophic, central Arctic Canadian lakes. Biomass estimates from lakes sampled in the 1980's in the Kiggavik area generally ranged between 100 and 300 mg/m^3 (McKee et al., 1989). Other studies on arctic lake phytoplankton communities have reported similar ranges of phytoplankton biomass at Snap Lake (266 mg/m^3; De Beers, 2002), Char Lake (166 mg/m^3, Kalff et al., 1975), and Spring Lake (120 mg/m^3, Welch et al., 1989).

3.2.4.2. Temporal and Spatial Trend Interpretation

The approach to identify potential mine-related impacts involves visually searching for general temporal-spatial patterns that might be associated with mine-related activities (see **Section 1.5** for details), augmented by statistical analyses of 2016 data to test for changes relative to baseline/reference conditions using the BACI model (see **Section 2.4.3** for details).

The primary metrics used in the assessment were chlorophyll-a concentration (a surrogate for overall primary productivity), total biomass (mg/m^3), relative biomass of major taxonomic groups, and species richness (total # species). Biomass, and not abundance, was examined because the two tend to be reasonably well correlated and ultimately, biomass is a much better approximation of actual lake productivity or food available to zooplankton. The BACI statistical testing focused on total biomass and species richness as these reflect ecologically relevant aspects of the phytoplankton community (i.e., total mass of community and community composition, respectively); effect sizes of interest are 20% and 50%.

The expected response patterns in phytoplankton biomass and species richness is dictated by the nature of the physical and/or chemical changes caused by mine-related activities. For example, dike construction or dewatering may introduce turbidity, leading to a reduction in phytoplankton biomass/diversity. In contrast, introduction of other substances such as nitrogen nutrients associated with blasting by-products could increase primary production, so we are looking for both reductions and increases (i.e., two-tailed statistical tests) in phytoplankton-related metrics coinciding with mining activities (i.e., focusing primarily on data for SP, TPE, TPN, and WAL).

One consideration with phytoplankton data is the high natural variability of control data. This potentially confounding "noise" effect can make it difficult to identify mining-related influences or "signals" at impact areas, unless the latter are quite large.

Density and biomass results for phytoplankton samples collected from the Meadowbank study lakes are provided in **Table 3.2–11** (a presence/absence species matrix is provided in **Appendix B**). The 2012 CREMP (Azimuth, 2013) provides a detailed description of historical trends in phytoplankton-related metrics; this report emphasizes results for 2016. Trend data for chlorophyll-a, total biomass, major taxa composition, and species richness are presented in **Figure 3.2–60** to **Figure 3.2–64**. Plots for all other phytoplankton metrics are presented in **Appendix C1**. The results for the BACI model statistical tests of the 2016 results against baseline/reference conditions for total biomass and species richness are provided in **Table 3.2–12**; Key results are described below:

- *Chlorophyll-a* – Concentrations in the reference area samples ranged between 0.2 and 0.5 µg/L in summer months, reflecting the oligotrophic, nutrient poor condition of these lakes; a trend that has not changed over time. The seasonal pattern of chlorophyll-a concentrations among reference and exposure areas was similar in 2016, with higher concentrations observed at all locations during the fall through-ice sampling event in November relative to the open-water events. Despite some variability, chlorophyll-a concentrations have remained consistent since 2006 (**Figure 3.2–60**).
- *Total Biomass* – Biomass results followed the same seasonal trends as previous years with highest biomass reported in the summer months (July) compared to fall/winter. Peak summer phytoplankton biomass at the reference areas was between 220 and 330 mg/m^3 at INUG while PDL was approximately 250 mg/m^3. These results are consistent with the range observed in previous years for the reference areas (**Figure 3.2–62**). Biomass at the exposure areas in the summer months was generally in the range of 150 to 250 mg/m^3, consistent with results from previous years. Winter under-ice biomass is naturally very low at all locations in all years it has been measured, and the same pattern was noted in 2016. There was an apparent reduction of 21% in phytoplankton biomass at TPE in 2016 relative to baseline/reference conditions, but the result was not statistically significant (**Table 3.2–12**).
- *Major Taxa Composition* – Chrysophytes tend to dominate in all open-water months, a pattern that has been consistent since monitoring began in 2006 (**Figure 3.2–63**).
- *Species Richness* – Seasonal profiles in species richness were similar in shape to total biomass, with an increase from low diversity in under-ice months (INUG; 17 to 25 taxa) to peak diversity of between approximately 30 and 40 taxa during the open water season (**Table 3.2–11**). The seasonal pattern of species richness at the exposure areas was similar to the reference areas and consistent with previous years (**Figure 3.2–64**). A statistically significant reduction (16%; p=0.006) in species composition was noted at TPE in 2016 relative to INUG, but the effect size was below the 20% trigger level. The change at TPE was most strongly influenced by differences between INUG and TPE in July, which were largely absent by August. The study design has high power to detect relatively small changes in species composition despite because species counts for INUG and TPE are well correlated.

The phytoplankton community taxa biomass and taxa richness data from 2016 are generally similar to previous years and within the range of historical baseline/reference conditions. These results continue to show that any minor changes to water quality as a result of mining activities (e.g., increased concentrations of some major ions relative to baseline/reference) are not resulting in persistent and adverse changes to the phytoplankton communities in the Meadowbank exposure lakes.

Table 3.2–13. Phytoplankton density (cells/L), biomass (mg/m^3), and diversity by major taxa group, Meadowbank study lakes, 2016.

Area-Replicate	Date	Phytoplankton Biomass (mg/m^3)							Taxa Richness	Simpson's Diversity
		Cyanophyte	Chlorophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	**TOTAL**		
Inuggugayualik Lake										
INUG-78	15-Apr-16	0	1.2	15	1.0	9.9	2.9	30	16	0.75
INUG-79	15-Apr-16	0.0	0.5	25	0.4	6.0	0.9	33	17	0.64
INUG-80	18-Jul-16	0	5.1	179	13	12	17	226	39	0.86
INUG-81	18-Jul-16	0	4.7	266	14	28	16	329	41	0.85
INUG-82	7-Aug-16	0.6	6.7	108	17	24	12	168	38	0.91
INUG-83	7-Aug-16	0.1	9.2	186	7.7	28	11	242	38	0.92
INUG-84	7-Sep-16	1.3	8.0	196	6.4	18	7.8	237	38	0.83
INUG-85	7-Sep-16	0.6	14	167	6.9	5.9	0.9	195	40	0.90
Percent Density or Biomass		***0.18***	***5.0***	***84***	***3.1***	***5.4***	***2.0***			
Pipedream Lake										
PDL-43	16-Apr-16	0.8	0.4	31	0.2	20	3.8	56	17	0.73
PDL-44	16-Apr-16	0.3	0.1	39	0.0	10	15	65	14	0.62
PDL-45	19-Jul-16	2.8	1.9	155	19	21	46	246	35	0.77
PDL-46	19-Jul-16	2.5	0.8	160	12	11	39	225	33	0.78
PDL-47	6-Aug-16	5.4	6.5	91	15	7.6	12	138	36	0.88
PDL-48	6-Aug-16	3.4	7.0	97	17	5.3	3.8	133	30	0.85
PDL-49	8-Sep-16	9.9	5.0	129	8.3	3.3	6.2	161	32	0.89
PDL-50	8-Sep-16	12	9.3	81	16	5.5	18	141	35	0.90
Percent Density or Biomass		***3.2***	***2.7***	***67***	***7.5***	***7.3***	***12***			
Third Portage Lake - East Basin										
TPE-90	20-Apr-16	0	2.7	18	0.3	4.3	1.0	27	13	0.75
TPE-91	20-Apr-16	0	0.4	18	0.6	5.2	0.00	24	14	0.77
TPE-92	12-Jul-16	0.1	7.6	90	14	7.7	17	136	31	0.74
TPE-93	12-Jul-16	0.1	1.1	45	5.4	4.8	14	71	24	0.78
TPE-94	5-Aug-16	0.1	6.7	146	29	20	13	214	35	0.82
TPE-95	5-Aug-16	0.00	6.3	69	26	13	13	127	30	0.79
TPE-96	11-Sep-16	0.4	30	68	28	11	2.3	139	31	0.87
TPE-97	11-Sep-16	0.9	23	59	19	13	6.9	122	31	0.87
TPE-98	27-Nov-16	0.00	11	51	23	6.9	14	106	20	0.61
TPE-99	27-Nov-16	0.3	9.1	57	16	8.0	4.7	95	20	0.71
Percent Density or Biomass		***0.18***	***16***	***51***	***19***	***8.3***	***6.1***			

Table 3.2–13. Phytoplankton density (cells/L), biomass (mg/m^3), and diversity by major taxa group, Meadowbank study lakes, 2016.

Area-Replicate	Date	Phytoplankton Density (cells/L)						
		Cyanophyte	Chlorophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	**TOTAL**
Inuggugayualik Lake								
INUG-78	15-Apr-16	0	117,121	258,865	37,261	57,538	500	471,285
INUG-79	15-Apr-16	100	117,021	375,987	7,092	32,715	100	533,015
INUG-80	18-Jul-16	0	202,552	1,394,528	155,564	88,208	1,200	1,842,052
INUG-81	18-Jul-16	0	101,576	2,184,184	276,592	183,400	22,152	2,767,904
INUG-82	7-Aug-16	7,984	266,608	1,078,400	95,792	187,384	1,000	1,637,168
INUG-83	7-Aug-16	200	333,464	1,749,112	116,144	224,304	14,968	2,438,192
INUG-84	7-Sep-16	17,168	195,368	1,863,856	188,184	151,264	8,384	2,424,224
INUG-85	7-Sep-16	9,184	353,416	1,591,664	224,104	57,672	400	2,236,440
Percent Density or Biomass		***0.24***	***12***	***73***	***7.7***	***6.8***	***0.34***	
Pipedream Lake								
PDL-43	16-Apr-16	7,346	74,568	471,631	3,546	118,121	200	675,413
PDL-44	16-Apr-16	2,100	31,915	457,547	100	48,199	1,000	540,861
PDL-45	19-Jul-16	9,800	86,808	2,245,008	263,824	126,328	27,352	2,759,120
PDL-46	19-Jul-16	7,600	65,056	1,630,384	176,016	81,224	12,184	1,972,464
PDL-47	6-Aug-16	54,704	94,192	867,880	167,048	43,704	29,336	1,256,864
PDL-48	6-Aug-16	10,000	115,144	795,640	198,368	37,320	600	1,157,072
PDL-49	8-Sep-16	42,600	159,248	1,081,800	216,720	36,320	14,368	1,551,056
PDL-50	8-Sep-16	44,600	253,040	1,023,928	225,504	51,488	22,352	1,620,912
Percent Density or Biomass		***1.5***	***7.6***	***74***	***11***	***4.7***	***0.93***	
Third Portage Lake - East Basin								
TPE-90	20-Apr-16	0	35,661	432,624	17,731	22,077	200	508,292
TPE-91	20-Apr-16	0	28,369	393,617	15,284	26,023	0	463,293
TPE-92	12-Jul-16	400	122,528	1,415,448	189,384	38,720	29,736	1,796,216
TPE-93	12-Jul-16	200	71,840	754,520	73,440	22,952	2,000	924,952
TPE-94	5-Aug-16	600	295,144	1,831,920	868,696	146,880	15,968	3,159,208
TPE-95	5-Aug-16	0	216,520	969,840	749,152	81,024	8,784	2,025,320
TPE-96	11-Sep-16	2,400	1,063,432	849,712	863,880	26,552	7,184	2,813,160
TPE-97	11-Sep-16	4,200	855,096	886,032	627,608	41,120	400	2,414,456
TPE-98	27-Nov-16	0	237,072	365,800	1,035,096	30,736	600	1,669,304
TPE-99	27-Nov-16	7,184	179,800	513,664	740,552	44,304	200	1,485,704
Percent Density or Biomass		***<0.1***	***18***	***49***	***30***	***2.8***	***0.38***	

Table 3.2–13. Phytoplankton density (cells/L), biomass (mg/m^3), and diversity by major taxa group, Meadowbank study lakes, 2016.

Area-Replicate	Date	Phytoplankton Biomass (mg/m^3)							Taxa Richness	Simpson's Diversity
		Cyanophyte	Chlorophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	**TOTAL**		
Third Portage Lake - North Basin										
TPN-90	17-Apr-16	0	0.3	23	1.0	15	6.3	46	13	0.75
TPN-91	17-Apr-16	0	0.6	25	1.3	24	7.9	60	17	0.75
TPN-92	20-Jul-16	0	2.1	147	8.7	18	69	245	34	0.82
TPN-93	20-Jul-16	0	2.0	113	6.8	10	35	167	30	0.80
TPN-94	5-Aug-16	0.00	2.5	89	8.0	19	8.2	126	32	0.81
TPN-95	5-Aug-16	0	0.3	90	22	26	32	171	26	0.81
TPN-96	4-Sep-16	0	3.6	173	24	6.6	14	221	32	0.83
TPN-97	4-Sep-16	0	3.3	170	42	9.7	24	249	34	0.86
TPN-98	30-Nov-16	0.00	2.6	27	14	1.7	2.4	47	17	0.70
TPN-99	30-Nov-16	0.00	1.1	22	13	2.2	3.4	42	17	0.65
Percent Density or Biomass		***<0.1***	***1.9***	***70***	***17***	***3.6***	***7.9***			
Third Portage Lake - South Basin										
TPS-55	21-Apr-16	0	1.1	36	2.0	13	11	63	17	0.78
TPS-56	21-Apr-16	0	1.7	27	1.5	20	4.4	54	18	0.79
Percent Density or Biomass		***<0.1***	***2.4***	***53***	***3.0***	***28***	***13***			
Second Portage Lake										
SP-90	14-Apr-16	0	0.4	19	0.6	6.9	6.7	33	19	0.70
SP-91	14-Apr-16	0	0.4	14	0.5	13	0.8	29	16	0.74
SP-92	8-Jul-16	0	3.0	88	2.5	6.0	11	111	30	0.70
SP-93	8-Jul-16	0	6.5	131	3.1	20	5.3	165	33	0.74
SP-94	3-Aug-16	0.1	9.2	110	32	22	1.6	176	35	0.86
SP-95	3-Aug-16	0.1	9.9	134	39	15	18	218	35	0.88
SP-96	5-Sep-16	0.5	11	198	19	25	28	282	43	0.89
SP-97	5-Sep-16	0.6	14	197	22	21	25	279	40	0.87
SP-98	25-Nov-16	0	1.1	30	4.3	3.2	0.00	38	15	0.58
SP-99	25-Nov-16	0	0.5	39	3.9	2.8	0.00	46	17	0.63
Percent Density or Biomass		***<0.1***	***4.0***	***72***	***7.7***	***8.1***	***8.2***			
Tehek Lake										
TE-90	25-Apr-16	0	0.1	26	1.2	21	8.4	57	16	0.70
TE-91	25-Apr-16	0	0.1	19	0.5	23	9.7	53	17	0.75
Percent Density or Biomass		***<0.1***	***0.20***	***41***	***1.6***	***40***	***17***			

Table 3.2–13. Phytoplankton density (cells/L), biomass (mg/m^3), and diversity by major taxa group, Meadowbank study lakes, 2016.

Area-Replicate	Date	Phytoplankton Density (cells/L)						
		Cyanophyte	Chlorophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	**TOTAL**
Third Portage Lake - North Basin								
TPN-90	17-Apr-16	0	10,638	418,440	42,653	76,768	600	549,099
TPN-91	17-Apr-16	0	56,738	478,824	44,553	140,098	7,692	727,904
TPN-92	20-Jul-16	0	237,272	1,423,232	147,880	98,592	60,888	1,967,864
TPN-93	20-Jul-16	0	100,976	1,200,928	240,072	93,792	34,336	1,670,104
TPN-94	5-Aug-16	0	72,840	1,295,120	240,472	137,296	8,384	1,754,112
TPN-95	5-Aug-16	0	21,552	1,243,632	332,464	167,432	25,952	1,791,032
TPN-96	4-Sep-16	0	136,896	1,356,192	618,640	52,088	2,200	2,166,016
TPN-97	4-Sep-16	0	194,568	1,211,712	970,856	66,656	3,000	2,446,792
TPN-98	30-Nov-16	0	42,653	277,596	391,371	10,938	100	722,658
TPN-99	30-Nov-16	0	17,731	242,435	416,594	14,584	200	691,543
Percent Density or Biomass		***<0.1***	***6.2***	***63***	***24***	***5.9***	***0.99***	
Third Portage Lake - South Basin								
TPS-55	21-Apr-16	0	117,021	680,851	108,083	79,014	1,100	986,070
TPS-56	21-Apr-16	0	99,691	535,561	82,960	121,867	500	840,580
Percent Density or Biomass		***<0.1***	***12***	***67***	***10***	***11***	***<0.1***	
Second Portage Lake								
SP-90	14-Apr-16	0	24,823	269,604	21,577	46,199	600	362,802
SP-91	14-Apr-16	0	10,738	308,611	3,946	62,384	400	386,079
SP-92	8-Jul-16	0	79,824	1,236,048	92,008	23,752	8,384	1,440,016
SP-93	8-Jul-16	0	238,472	1,739,328	45,120	99,192	1,000	2,123,112
SP-94	3-Aug-16	600	374,568	1,286,936	765,720	120,344	600	2,548,768
SP-95	3-Aug-16	400	546,184	1,544,760	885,664	69,056	1,400	3,047,464
SP-96	5-Sep-16	2,000	424,056	2,213,872	382,768	108,976	11,384	3,143,056
SP-97	5-Sep-16	2,200	431,240	2,407,040	548,400	127,728	11,384	3,527,992
SP-98	25-Nov-16	0	14,484	571,022	103,937	5,646	0	695,090
SP-99	25-Nov-16	0	17,931	433,024	62,084	18,131	0	531,169
Percent Density or Biomass		***<0.1***	***12***	***67***	***16***	***3.8***	***0.20***	
Tehek Lake								
TE-90	25-Apr-16	0	24,823	326,241	26,223	86,260	1,300	464,847
TE-91	25-Apr-16	0	28,369	287,234	4,046	126,314	1,100	447,063
Percent Density or Biomass		***<0.1***	***5.8***	***67***	***3.3***	***23***	***0.26***	

Table 3.2–13. Phytoplankton density (cells/L), biomass (mg/m^3), and diversity by major taxa group, Meadowbank study lakes, 2016.

Area-Replicate	Date	Phytoplankton Biomass (mg/m^3)							Taxa Richness	Simpson's Diversity
		Cyanophyte	Chlorophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	TOTAL		
Tehek Lake - Far-field										
TEFF-43	25-Apr-16	0.0	0.4	24	2.8	7.6	1.5	36	19	0.71
TEFF-44	25-Apr-16	0	0.3	20	1.0	19	6.2	46	17	0.83
Percent Density or Biomass		***<0.1***	***0.77***	***53***	***4.5***	***33***	***9.4***			
Wally Lake										
WAL-59	18-Apr-16	0	0.1	9.5	0.8	5.2	0.2	16	16	0.80
WAL-60	18-Apr-16	0	0.2	18	0.6	17	0.00	35	16	0.78
WAL-61	10-Jul-16	4.5	9.0	191	13	59	6.6	284	40	0.85
WAL-62	10-Jul-16	0	4.6	178	8.5	22	9.1	221	37	0.82
WAL-63	5-Aug-16	0.0	27	118	11	34	8.1	198	38	0.90
WAL-64	5-Aug-16	1.4	34	112	17	25	11	200	37	0.88
WAL-65	4-Sep-16	0.2	22	177	53	44	20	316	44	0.89
WAL-66	4-Sep-16	0	17	232	25	58	16	348	44	0.87
WAL-67	30-Nov-16	0	3.6	41	6.9	4.2	2.3	58	18	0.75
WAL-68	30-Nov-16	0	3.1	37	5.8	6.4	2.4	54	19	0.76
Percent Density or Biomass		***0.36***	***5.9***	***63***	***12***	***15***	***5.2***			
All 2016 Locations Relative Density or Biomass (%)		***0.58***	***4.4***	***67***	***8.7***	***11***	***8.4***			

Table 3.2–13. Phytoplankton density (cells/L), biomass (mg/m^3), and diversity by major taxa group, Meadowbank study lakes, 2016.

Area-Replicate	Date	Phytoplankton Density (cells/L)						
		Cyanophyte	Chlorophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	**TOTAL**
Tehek Lake - Far-field								
TEFF-43	25-Apr-16	300	3,746	471,631	72,322	46,499	3,546	598,045
TEFF-44	25-Apr-16	0	25,023	315,603	25,123	114,675	7,492	487,916
Percent Density or Biomass		***<0.1***	***2.6***	***72***	***9.0***	***15***	***1.0***	
Wally Lake								
WAL-59	18-Apr-16	0	3,546	170,213	10,192	28,869	100	212,920
WAL-60	18-Apr-16	0	28,469	347,518	22,577	74,422	0	472,985
WAL-61	10-Jul-16	35,920	366,984	2,314,648	128,976	240,304	800	3,087,632
WAL-62	10-Jul-16	0	252,640	2,444,360	72,904	98,592	7,784	2,876,280
WAL-63	5-Aug-16	0	956,672	1,487,888	195,968	199,568	1,200	2,841,296
WAL-64	5-Aug-16	14,568	1,444,984	1,365,960	384,552	141,096	8,184	3,359,344
WAL-65	4-Sep-16	1,400	589,888	1,732,944	1,025,944	175,448	30,136	3,555,760
WAL-66	4-Sep-16	0	635,992	2,543,352	543,216	192,632	9,584	3,924,776
WAL-67	30-Nov-16	0	74,668	419,040	178,213	19,331	100	691,351
WAL-68	30-Nov-16	0	95,945	362,202	131,014	27,423	100	616,683
Percent Density or Biomass		***0.24***	***21***	***61***	***12***	***5.5***	***0.27***	
All 2016 Locations Relative Density or Biomass (%)		***0.28***	***13***	***64***	***17***	***5.3***	***0.47***	

Table 3.2–12. Results of BACI test for phytoplankton variables at Meadowbank areas.

Parameter Measured	Test Area	n(B)	n(A)	Estimate	SE	P-value*	Effect size (%)		
							ES	LCI	UCI
Total biomass	TPN	7	4	0.35	0.21	0.133	42	-12	130
	TPE	8	4	-0.24	0.18	0.206	-21	-47	17
	SP	6	4	0.1	0.22	0.669	10	-33	83
	WAL	19	4	0.1	0.21	0.651	10	-29	70
Species	TPN	7	4	0.02	0.06	0.726	2	-11	18
	TPE	8	4	-0.18	0.05	**0.006**	-16	-26	-6
	SP	6	4	0.05	0.07	0.486	5	-10	22
	WAL	19	4	-0.02	0.06	0.731	-2	-14	12

Notes:

* **Bolded** values are P-values < 0.1

Shaded cells indicate negative effect sizes (reductions) of 20% or more

Test area = area compared to control (INUG)

n(B) = number of months in the "before" period

n(A) = number of months in the "after" period (i.e., in 2016)

Estimate = BACI model estimate of the 2016 change in mean for log-transformed data

SE = standard error of the estimate

P-value = two-tailed test of the null hypothesis of no change

ES = estimated effect size (i.e., 100%*(exp[Estimate]-1))

LCI = lower 95% confidence interval; UCI = upper 95% confidence interval

Figure 3.2–60. Chlorophyll-a (µg/L) in water samples from Meadowbank study lakes since 2006.

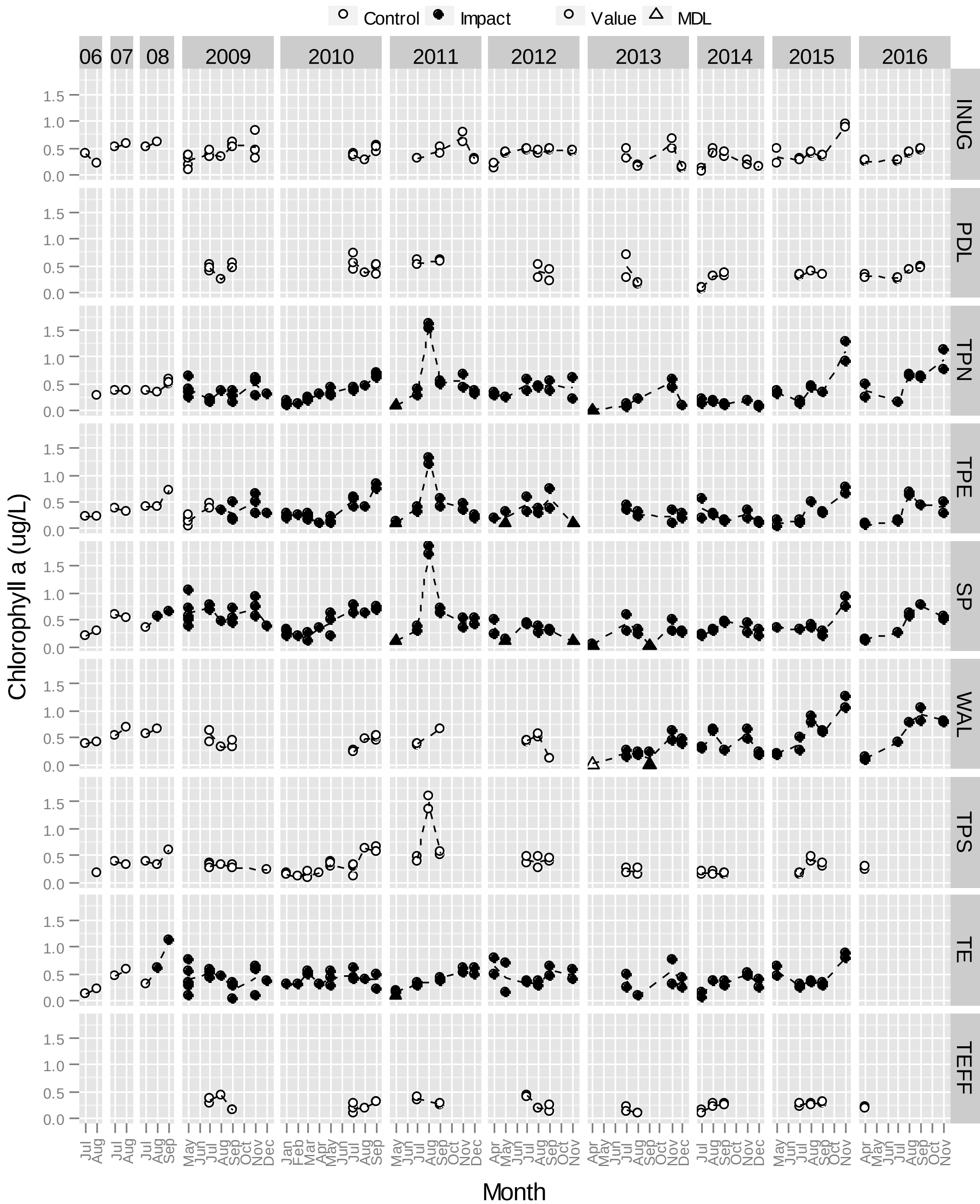


Figure 3.2–61. Total phytoplankton biomass (mg/m^3) from Meadowbank study lakes since 2006.

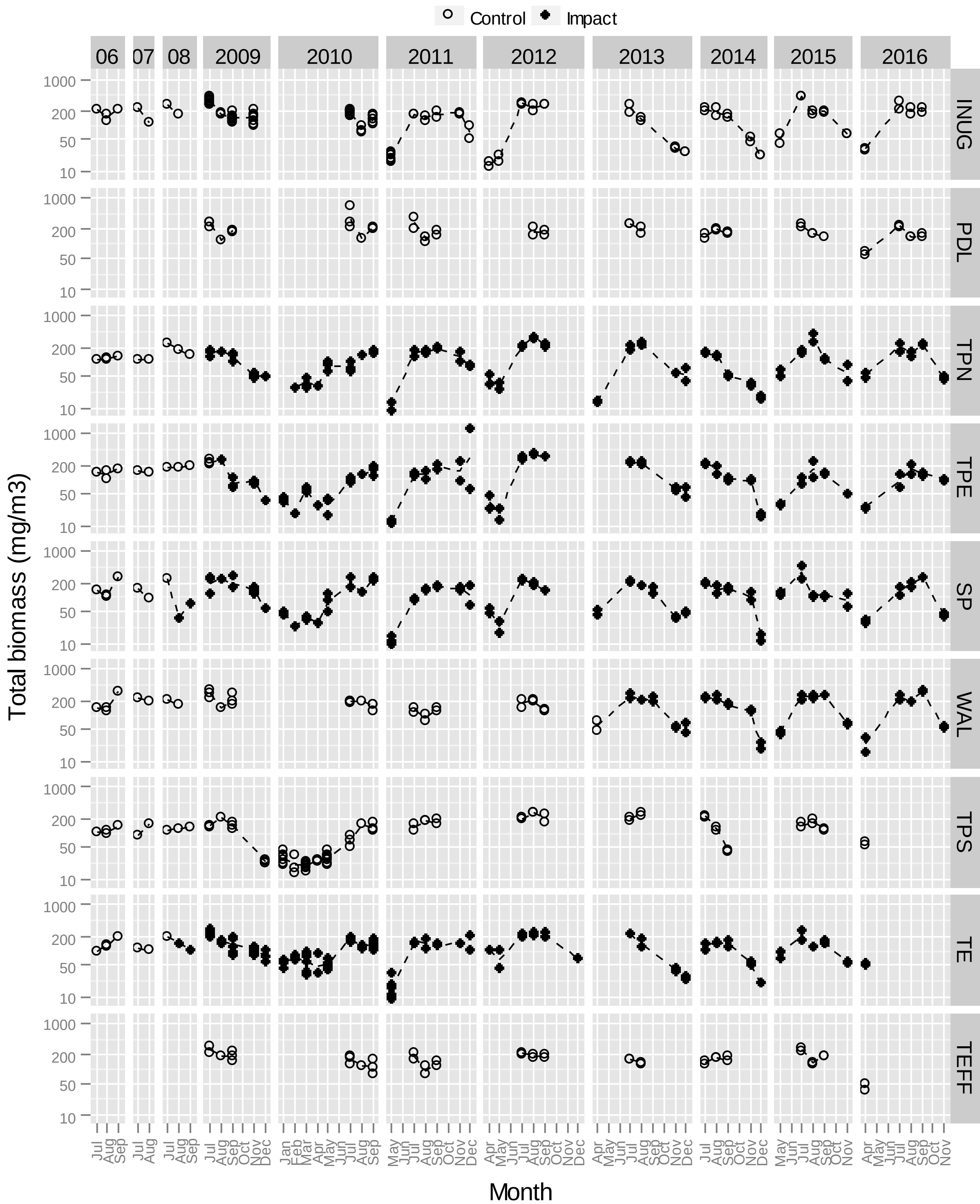


Figure 3.2–62. Phytoplankton biomass (mg/m^3) by major taxa group from Meadowbank study lakes since 2006.

Figure 3.2–63. Relative phytoplankton biomass by major taxa group from Meadowbank study lakes since 2006.

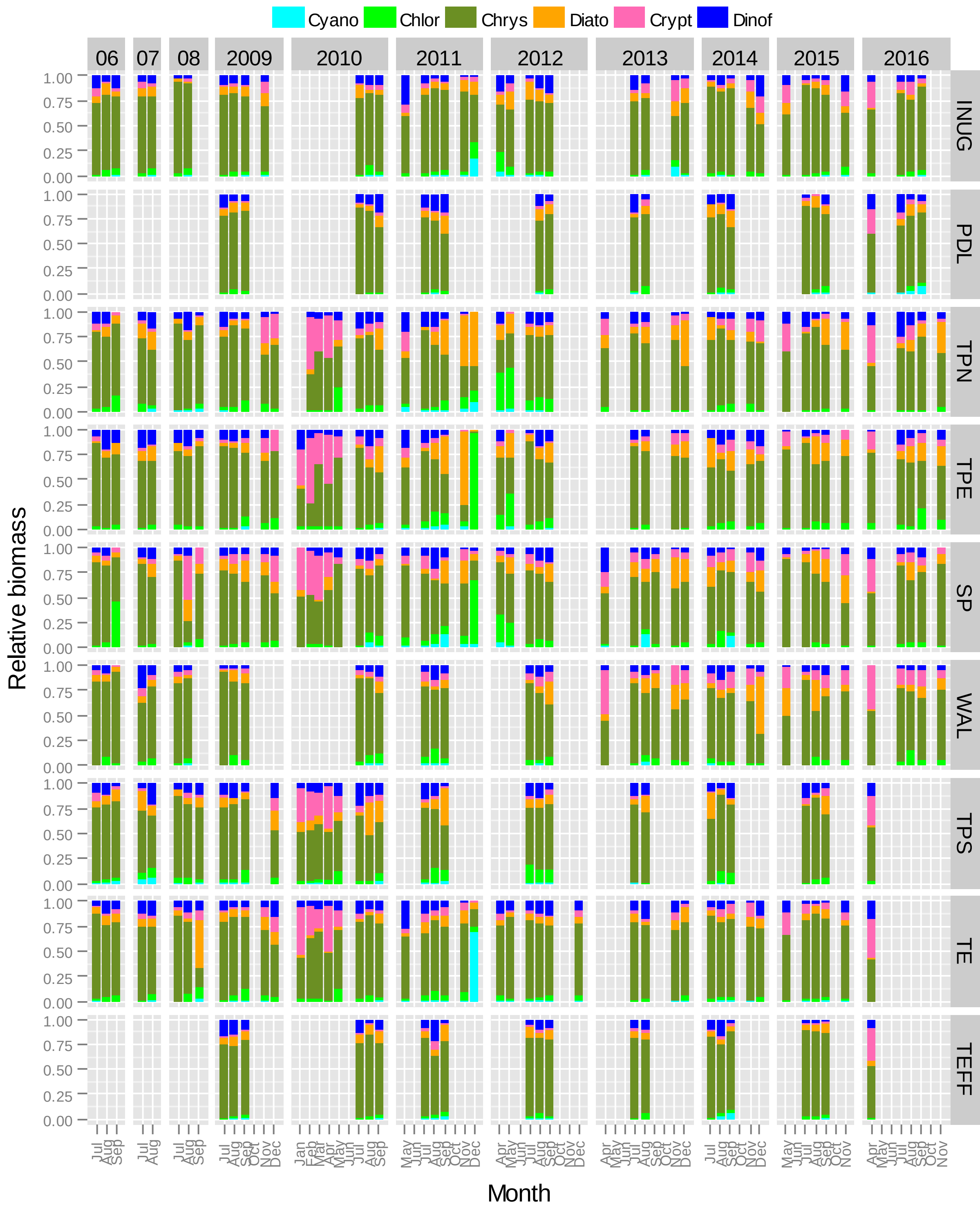
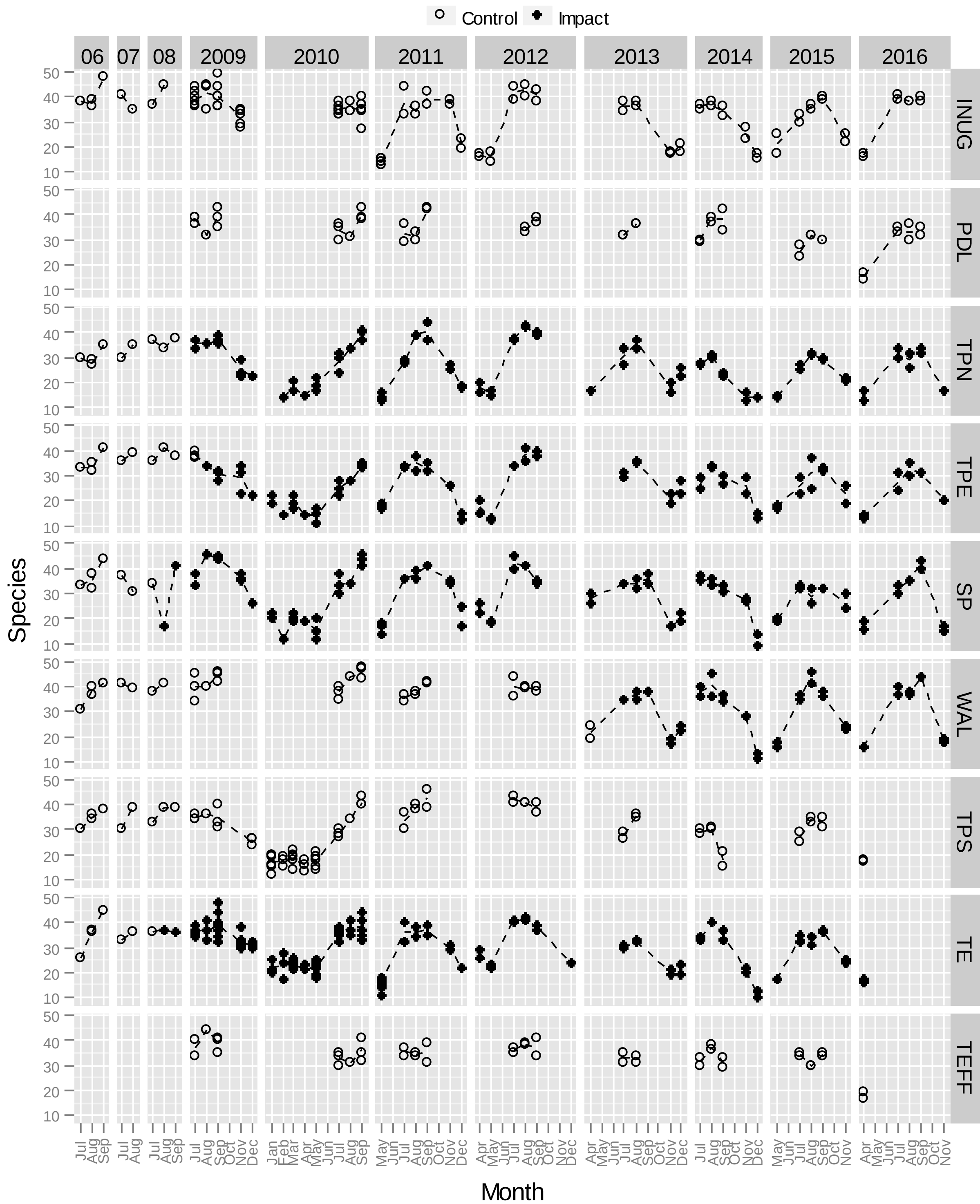


Figure 3.2–64. Phytoplankton species richness from Meadowbank study lakes since 2006.



3.2.5. Benthic Invertebrates

3.2.5.1. General Observations

The abundance and species composition of benthic invertebrates are strongly affected by water depth, substrate size and organic carbon. Other physical factors, such as water temperature, can influence larval development rates and ultimately timing of hatching for insect larvae. Consequently, even if sampling can be conducted simultaneously in all lakes (which is not practical), this would still not overcome differential timing of hatching of particular species between lakes. This is partly overcome in the CREMP by sampling during late fall, after the emergence of most groups, but is still a source of some variability.

Benthic invertebrate communities in the Meadowbank study lakes are typically characterized by relatively few taxa and low abundance. Abundance is generally less than 2,000 organisms/m^2 and is often less than 1,000 organisms/m^2 among both reference and exposure areas (e.g., **Figure 3.2–65**). Despite abundance generally being low at the study lakes, values above 5,000 organisms/m^2 are not uncommon for the area, and in a few cases estimates of abundance have exceeded 10,000 organisms/m^2 (e.g., WAL in 2006 and again in 2016). Importantly, there can be substantial temporal variability within areas, as shown by the range in abundance values at TPE and WAL between 2006 and 2008 (**Figure 3.2–65**).

Taxa richness typically ranged from 8 to 12 for most area-year combinations (**Figure 3.2–69**). Typical of most Arctic lakes, the benthic invertebrate community has been dominated by the aquatic larval stages of insects, especially chironomids (Family Chironomidae), both in terms of abundance and taxa richness (e.g., **Figure 3.2–67** and **Figure 3.2–70**). The next most abundant group was Mollusca (clams) especially, *Cyclocalyx / Neopisidium*, genera of the family Sphaeriidae (fingernail clams). Oligochaete worms were also relatively abundant in the lake sediments; generally, at least one oligochaete taxon was present at most area/year combinations.

3.2.5.2. Temporal and Spatial Trend Interpretation

Benthic invertebrate abundance and richness results from the reference (INUG and PDL) and NF (TPE, TPN, SP, and WAL) Meadowbank study lakes in 2016 are summarized in **Table 3.2–13** by major taxa group (i.e., Insecta, Mollusca, Oligochaeta, and other taxa[21]). Raw data are provided in **Appendix D** showing the organism counts by taxa for each of the replicate samples collected in 2016.

Time-series plots showing abundance and richness endpoints are presented in **Figure 3.2–65** to **Figure 3.2–70**. Below are descriptions of the endpoints based on Environment Canada guidance (EEM, 2011):

- *Total abundance* – the number of individual organisms per m^2, this metric is a measure of community density.
- *Total richness* – the number of different taxa (identified to the lowest practical taxonomic level, usually species) per grab.
- *Major taxa group abundance* – similar to total abundance, but broken down by major taxa group.
- *Major taxa group relative abundance* – proportional abundance of each major taxa group.
- *Major taxa group richness* – similar to total richness, but broken down by major taxa group.
- *Major taxa group relative richness* – proportional richness of each major taxa group.

[21] "Other taxa" includes flatworms (Turbellaria) and arthropods (Acalyptonotidae, Hygrobatidae, Lebertiidae, Oxidae, and O. Notostraca).

Other benthic invertebrate community results presented in **Appendix E**, but not discussed in detail include time-series plots of abundance and richness within each major taxa group, Simpson's Diversity[22] and Bray-Curtis Index values[23].

The identification of potential mine-related impacts generally involved visually examining the data for spatial/temporal patterns that matched mine-related events. Visual examination of the data was further supported with statistical analyses of the 2016 data to test for changes relative to baseline/reference conditions using the BACI model (see **Section 2.4.4** for details). The BACI comparisons involved looking at longer-term trends (i.e., up to four-year trends) and focused only on benthic invertebrate abundance and taxa richness. Details regarding historical trends (e.g., related to sedimentation events) are discussed in the 2011 CREMP (Azimuth, 2012a) and the 2011 EAS (Azimuth, 2012b). This report focuses on the 2016 results and trends over the last four years (i.e., dating back to 2013), similar to the approach taken in recent CREMP reports (Azimuth, 2014; Azimuth 2015c). BACI model results for benthic invertebrate abundance and richness are presented in **Table 3.2–14** and **Table 3.2–15**, respectively. Key results are described below:

- *Total abundance* – INUG and PDL were slightly more abundant in 2016 relative to 2015, with overall abundance within the range of previously-reported results. In the case of WAL, abundances among the 5 replicate samples were the highest reported thus far in the program (**Figure 3.2–65**). Average abundance at WAL in 2016 was nearly 16,000 organisms/m^2 (**Table 3.2–13**). The large increase in abundance occurred mainly in the genus *Corynocera* and *Tanytarsus* (family Chironomidae). High abundance was previously reported at WAL in 2006, indicating the potential for large annual variability in Wally Lake. Abundance at TPE was generally similar to results from 2013 to 2015, with abundance ranging between approximately 1,000 and 2,200 organisms/m^2. Abundance at SP and TPN were both lower in 2016 compared to 2015, but relative to previous years, total abundance in both lakes is either higher than the baseline period (SP) or similar to the baseline period (TPN).

  The trend of continued increases in total abundance at INUG in 2016 resulted in an apparent decrease in relative abundance at TPE (57%) and SP (21%) in the BACI analysis, although none of the results were statistically significant (**Table 3.2–14**). The same observation for TPE was also noted in the after periods 2013-2016, 2014-2016, and 2015-2016 when comparatively high abundance at INUG resulted in apparent decreases in benthic invertebrate productivity at TPE (**Table 3.2–15**). It's important to note while these "differences" are being identified in the BACI analysis, absolute abundance at TPE has been consistent over the past 4 years. Overall, none of the NF areas show a consistent decreasing trend in invertebrate abundance that could be attributable to mining activity.

- *Major taxa group abundance and relative abundance* – Insects were the dominant taxa group followed by molluscs (**Figure 3.2–66** and **Figure 3.2–67**). While there were no apparent trends in composition changes related to mining, it is notable that most peaks (or valleys) in total abundance over the years appear to be driven by changes in abundance of insects

[22] Simpson's Diversity takes into account both the abundance patterns and taxa richness of the community based on the proportion of individuals that each taxa contributes to total abundance.

[23] Bray-Curtis Index is a distance coefficient (based on comparison of a site to one or more [pooled] reference sites) that ranges between 0 (both identical) to 1 (completely different). The index measures the percentage of difference between sites.

(predominantly chironomids). Notable examples of this are WAL in 2006, TPS in 2015, and WAL in 2016.

- *Taxa richness* – Taxa richness was either higher in 2016 relative to previous years, or within the range of taxa reported in more recent monitoring cycles (i.e., since 2013; **Figure 3.2–68**). Taxa numbers averaged between 11 (PDL) and 16 taxa (INUG) in 2016 (**Table 3.2–13**). Richness was highest at INUG, WAL, and SP in 2016 compared to all years dating back to 2006. Relatively high taxa richness was noted at TPN (2nd highest) and TPE (4th highest) relative to all preceding years. The BACI results showed no statistically significant decreases in richness at NF areas in 2016 or the longer term 2, 3 and 4-yr after periods (**Table 3.2–15**). Despite some within-year variability in taxa richness, the NF areas show either stable or slightly increasing taxa richness.
- *Major taxa group richness and relative richness* – Similar to abundance, insects were dominant in terms of absolute and proportional (generally over 50%) richness, followed by molluscs (~10 to 20%) (**Figure 3.2–69** and **Figure 3.2–70**). There were no apparent trends in composition related to mining.

The benthic invertebrate metrics (total abundance and taxa richness) for the NF and reference areas were generally within the range reported for previous years. The benthic invertebrate community was particularly abundant at WAL in 2016. Despite the noticeable increase in 2016, the abundance results are close to the upper limit of previously reported at WAL in 2006, suggesting there is considerable annual variability in abundance in this lake. The BACI analysis has noted decreased abundance at TPE relative to INUG in the past four years, but the differences are primarily driven by increased abundance at INUG while abundance at TPE has been relatively stable. Importantly, the diversity of the benthic invertebrate community at TPE is consistent with previous CREMP years, indicating the benthic community at TPE remains functionally diverse. In summary, no mine-related effects to the benthic invertebrate communities in the Meadowbank project lakes were observed in 2016.

Table 3.2–13. Benthic invertebrate abundance (#/m^2) and richness (# taxa) by major taxa group, Meadowbank study lakes, 2016.

Area-Replicate	Date	Depth (m)	Abundance (#/m^2)					Richness (# taxa)					Simpson's Diversity	Bray-Curtis Index
			Oligochaetes	Insects	Molluscs	Other Taxa[1]	Total	Oligochaetes	Insects	Molluscs	Other Taxa[1]	Total		
Inuggugayualik Lake														
INUG-1	7-Aug-16	7.6	0	652	457	43	1152	0	10	3	1	14	0.96	0.47
INUG-2	7-Aug-16	7.8	22	1174	783	22	2000	1	9	3	1	14	0.95	0.36
INUG-3	7-Aug-16	7.2	22	1239	435	65	1761	1	12	3	1	17	0.95	0.36
INUG-4	7-Aug-16	8.4	43	2804	674	152	3674	2	10	3	3	18	0.88	0.36
INUG-5	7-Aug-16	8.9	22	2370	304	43	2739	1	10	3	2	16	0.90	0.37
Area Mean			***22***	***1648***	***530***	***65***	***2265***	***1***	***10***	***3***	***2***	***16***	***0.93***	***0.38***
Pipedream Lake														
PDL-1	6-Aug-16	7.3	43	826	348	22	1239	2	4	2	1	9	0.77	0.62
PDL-2	6-Aug-16	7.2	109	1804	370	22	2304	2	5	2	1	10	0.54	0.59
PDL-3	6-Aug-16	7.0	22	978	457	0	1457	1	12	2	0	15	0.83	0.47
PDL-4	6-Aug-16	7.8	22	783	543	0	1348	1	10	2	0	13	0.91	0.46
PDL-5	6-Aug-16	7.6	0	630	239	0	870	0	5	1	0	6	0.80	0.57
Area Mean			***39***	***1004***	***391***	***9***	***1443***	***1***	***7***	***2***	***0***	***11***	***0.77***	***0.54***
Second Portage Lake														
SP-1	3-Aug-16	7.8	22	761	413	217	1413	1	10	1	3	15	0.95	0.65
SP-2	3-Aug-16	8.2	0	804	370	65	1239	0	10	2	2	14	0.94	0.59
SP-3	3-Aug-16	7.8	65	1022	717	22	1826	3	12	2	1	18	0.97	0.52
SP-4	3-Aug-16	7.5	22	609	543	65	1239	1	8	2	3	14	0.96	0.59
SP-5	3-Aug-16	6.9	65	804	500	87	1457	2	9	2	2	15	0.97	0.50
Area Mean			***35***	***800***	***509***	***91***	***1435***	***1***	***10***	***2***	***2***	***15***	***0.96***	***0.57***
Third Portage Lake - East Basin														
TPE-1	4-Aug-16	9	87	1370	478	22	1957	2	10	1	1	14	0.93	0.57
TPE-2	4-Aug-16	7.8	87	1413	435	22	1957	2	10	1	1	14	0.93	0.60
TPE-3	4-Aug-16	8.1	43	3457	522	0	4022	1	9	1	0	11	0.82	0.72
TPE-4	4-Aug-16	8.4	87	2457	761	65	3370	2	11	1	1	15	0.91	0.66
TPE-5	4-Aug-16	8.4	22	2739	457	22	3239	1	12	1	1	15	0.86	0.69
Area Mean			***65***	***2287***	***530***	***26***	***2909***	***2***	***10***	***1***	***1***	***14***	***0.89***	***0.65***
Third Portage Lake - North Basin														
TPN-1	4-Aug-16	8.9	0	1000	65	0	1065	0	9	1	0	10	0.90	0.55
TPN-2	4-Aug-16	9.2	22	1848	43	0	1913	1	10	1	0	12	0.90	0.67
TPN-3	4-Aug-16	9.2	65	1783	326	22	2196	1	13	1	1	16	0.91	0.51
TPN-4	4-Aug-16	6.8	43	1717	65	22	1848	1	12	1	1	15	0.89	0.56
TPN-5	4-Aug-16	8.2	22	1478	196	0	1696	1	8	1	0	10	0.86	0.47
Area Mean			***30***	***1565***	***139***	***9***	***1743***	***1***	***8***	***1***	***0***	***13***	***0.89***	***0.55***
Wally Lake														
WAL-1	5-Aug-16	8.6	0	15500	478	109	16087	0	8	2	3	13	0.37	0.63
WAL-2	5-Aug-16	9.2	152	30043	1022	196	31413	2	9	2	3	16	0.60	0.89
WAL-3	5-Aug-16	8.2	0	9196	783	174	10152	0	8	2	3	13	0.49	0.66
WAL-4	5-Aug-16	6.8	22	7739	717	152	8630	1	9	2	3	15	0.65	0.62
WAL-5	5-Aug-16	7.3	22	12413	565	283	13283	1	10	2	3	16	0.51	0.62
Area Mean			***39***	***14978***	***713***	***183***	***15913***	***1***	***9***	***2***	***3***	***15***	***0.52***	***0.68***

Notes:

[1] "Other taxa" includes flatworms (Turbellaria) and arthropods (Acalyptonotidae, Hygrobatidae, Lebertiidae, Oxidae, and O. Notostraca).

Table 3.2–14. Results of BACI tests for benthic invertebrate abundance at Meadowbank areas.

After Period	Test Area	n(B)	n(A)	Estimate	SE	P-value*	Effect size (%)		
							ES	LCI	UCI
2016	TPN	2	1	-0.18	0.47	0.39	-16.1	-99.8	30933
	TPE	3	1	-0.84	0.67	0.17	-56.6	-97.5	666.3
	SP	2	1	-0.24	0.27	0.27	-21.1	-97.6	2479.9
	WAL	7	1	1.07	0.98	0.84	191	-73.8	3132.3
2015-16	TPN	2	2	0.24	0.41	0.69	26.5	-78.6	648
	TPE	3	2	-0.71	0.44	0.10	-51	-87.9	97.5
	SP	2	2	0.04	0.29	0.55	3.8	-69.6	254.7
	WAL	7	2	0.08	0.84	0.54	8.2	-85.2	690.1
2014-16	TPN	2	3	0.00	0.51	0.50	0	-80.4	409.9
	TPE	3	3	-0.35	0.51	0.27	-29.5	-82.8	189.1
	SP	2	3	0.58	0.58	0.81	78.5	-71.4	1014.5
	WAL	7	3	0.19	0.70	0.61	21.4	-75.7	506.4
2013-16	TPN	2	4	-0.08	0.44	0.44	-7.3	-72.3	210.7
	TPE	3	4	-0.51	0.47	0.16	-40	-82	99.4
	SP	2	4	0.51	0.51	0.82	66.4	-59.1	577.1
	WAL	7	4	-0.15	0.65	0.41	-13.6	-80	273.4

Notes:

* **Bolded** values are P-values < 0.1

Shaded cells indicate negative effect sizes (reductions) of 20% or more

Test area = area compared to control (INUG)

n(B) = number of years in the “before” period

n(A) = number of years in the “after” period

Estimate = BACI model estimate of the after-period change in mean for log-transformed data

SE = standard error of the estimate

P-value = one-tailed test of the null hypothesis of no change or an increase in mean

ES = estimated effect size (i.e., 100%*(exp[Estimate]-1))

LCI = lower 95% confidence interval; UCI = upper 95% confidence interval

Table 3.2–15. Results of BACI tests for benthic invertebrate taxa richness at Meadowbank areas.

After Period	Test Area	n(B)	n(A)	Estimate	SE	P-value*	Effect size (%)		
							ES	LCI	UCI
2016	TPN	2	1	0.18	0.24	0.70	19.4	-94.1	2319.7
	TPE	3	1	-0.06	0.14	0.35	-6.2	-48.6	71.1
	SP	2	1	0.32	0.22	0.81	38	-91	2023.7
	WAL	7	1	0.02	0.31	0.52	1.7	-52.2	116.5
2015-16	TPN	2	2	0.22	0.18	0.83	25	-43	174.3
	TPE	3	2	0.07	0.14	0.68	7.3	-30.6	65.9
	SP	2	2	0.35	0.14	0.93	41.7	-23.8	163.5
	WAL	7	2	-0.04	0.23	0.43	-4.2	-43.8	63.3
2014-16	TPN	2	3	0.13	0.19	0.72	13.4	-38.5	109
	TPE	3	3	0.12	0.12	0.82	13.1	-19	58
	SP	2	3	0.48	0.19	0.96	62.3	-11.5	197.6
	WAL	7	3	0.06	0.19	0.61	5.6	-32	64
2013-16	TPN	2	4	0.14	0.17	0.78	15.5	-27.6	84.3
	TPE	3	4	0.09	0.11	0.77	9.1	-17.9	45
	SP	2	4	0.39	0.22	0.92	47.5	-20.5	173.5
	WAL	7	4	-0.03	0.18	0.43	-3.2	-34.9	44

Notes:

*** Bolded** values are P-values < 0.1

Shaded cells indicate negative effect sizes (reductions) of 20% or more

Test area = area compared to control (INUG)

n(B) = number of years in the "before" period

n(A) = number of years in the "after" period

Estimate = BACI model estimate of the after-period change in mean for log-transformed data

SE = standard error of the estimate

P-value = one-tailed test of the null hypothesis of no change or an increase in mean

ES = estimated effect size (i.e., 100%*(exp[Estimate]-1))

LCI = lower 95% confidence interval; UCI = upper 95% confidence interval

Figure 3.2–65. Benthic invertebrate total abundance (#/m^2) from Meadowbank study lakes since 2006.

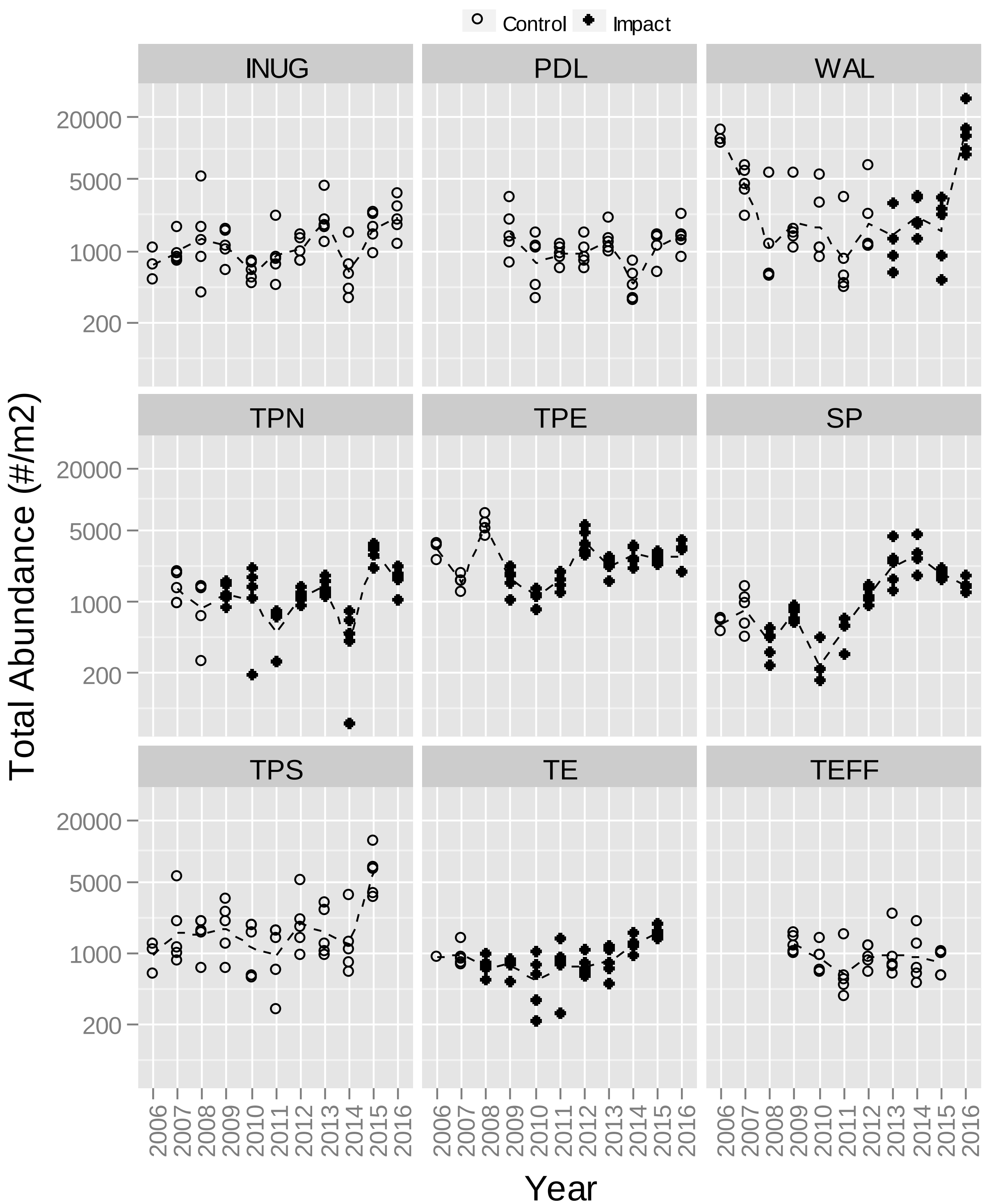


Figure 3.2–66. Benthic invertebrate abundance (#/m²) by major taxa group from Meadowbank study lakes since 2006.

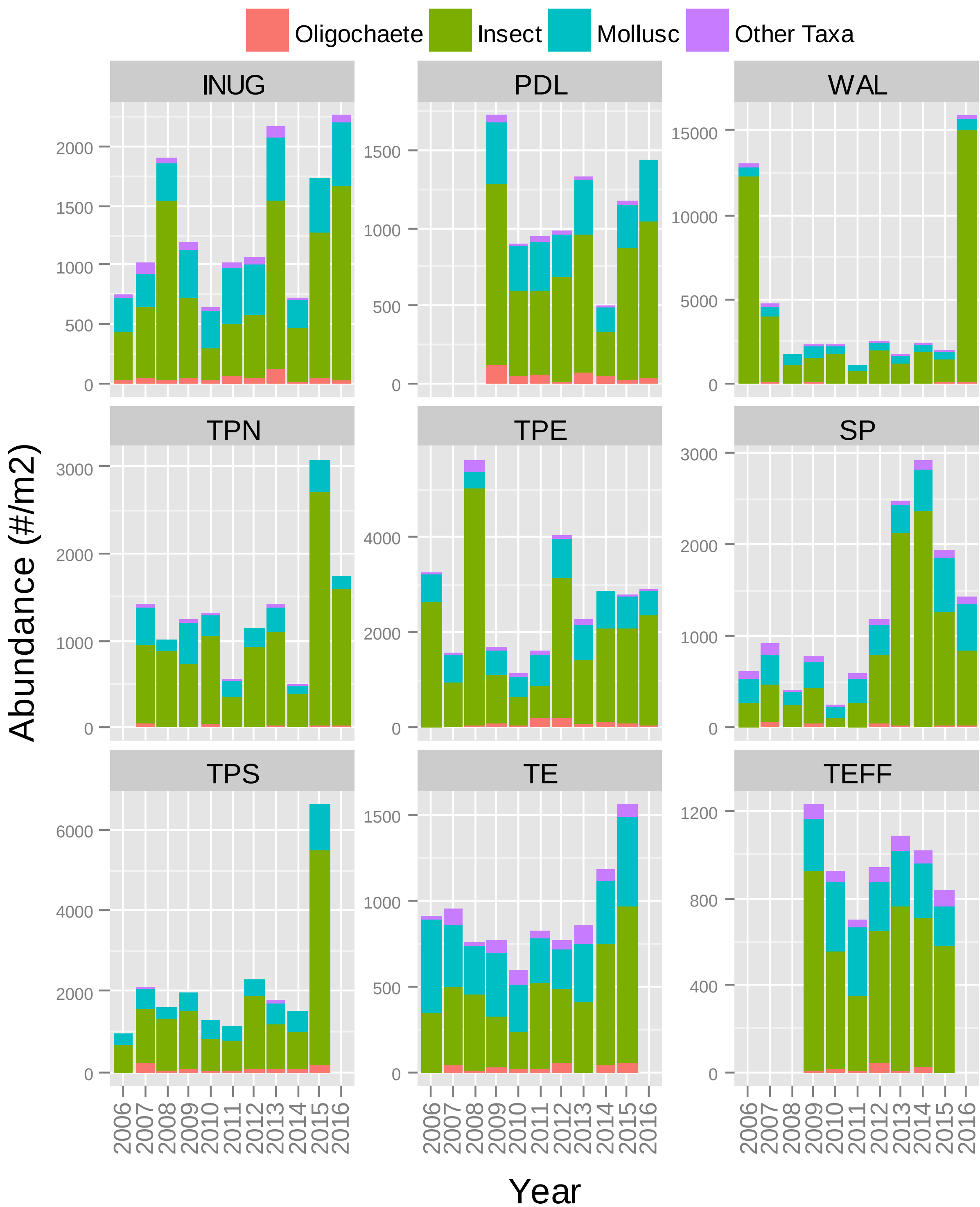


Figure 3.2–67. Benthic invertebrate relative abundance by major taxa group from Meadowbank study lakes since 2006.

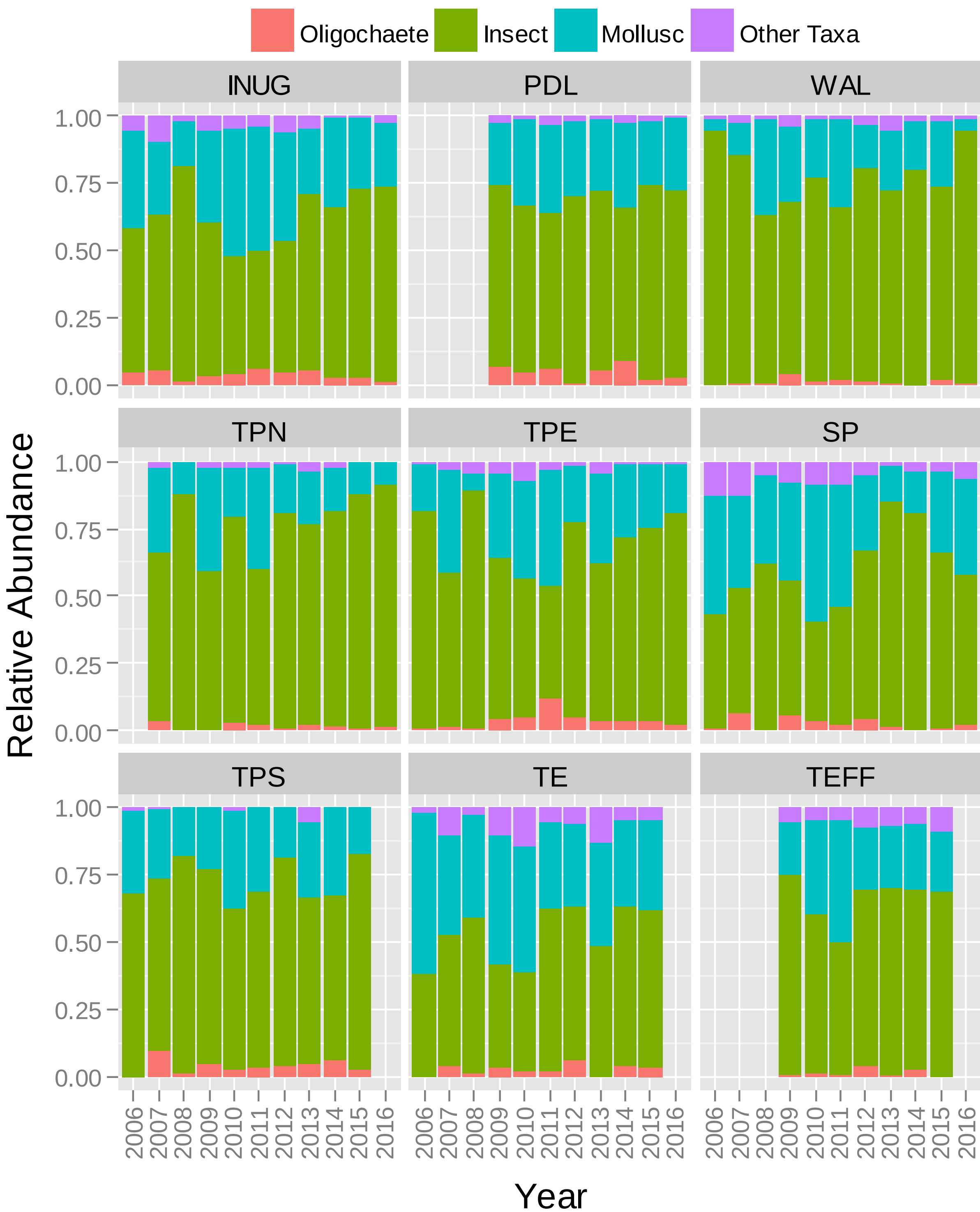


Figure 3.2–68. Benthic invertebrate total richness (# taxa) from Meadowbank study lakes since 2006.

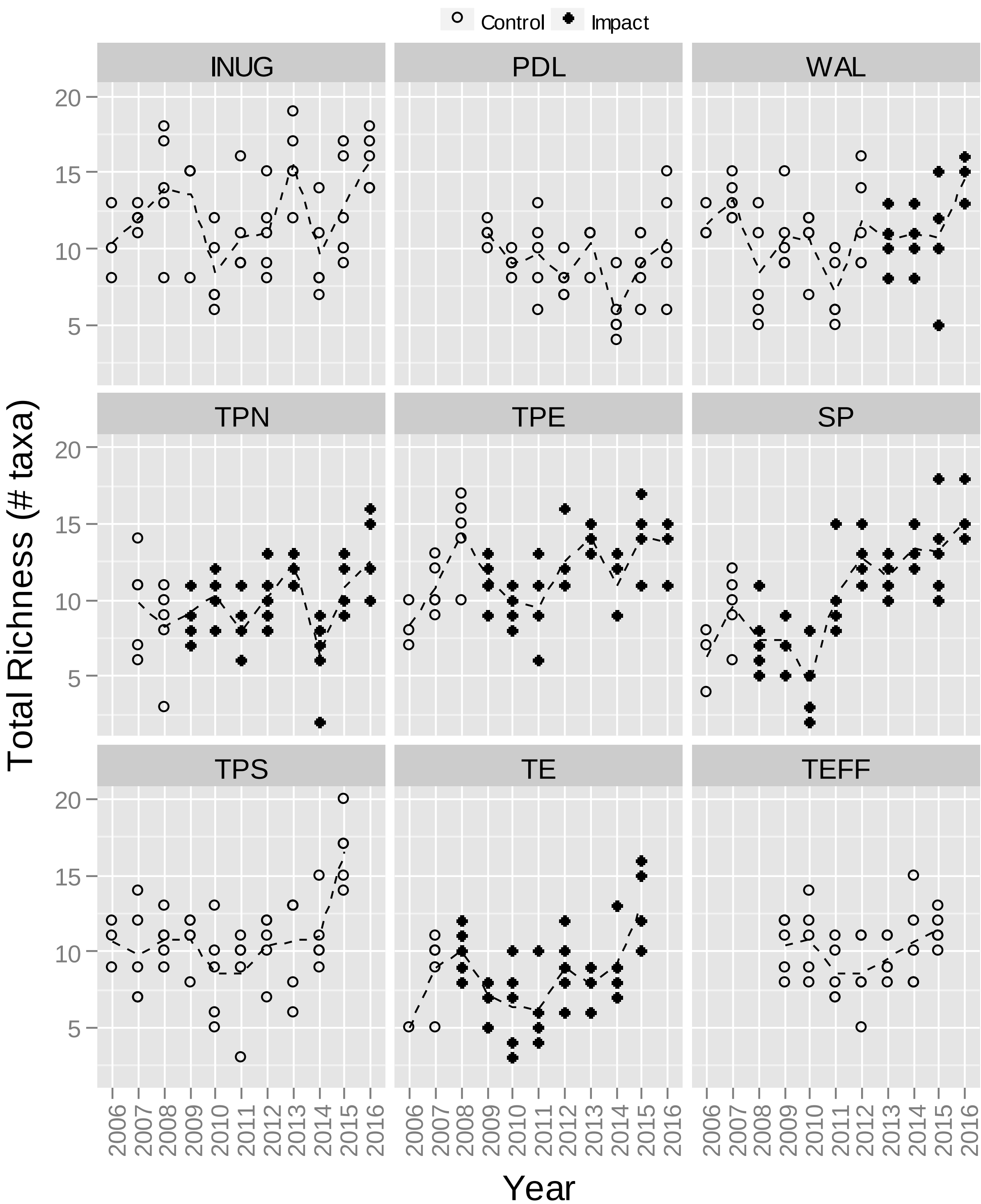


Figure 3.2–69. Benthic invertebrate richness (# taxa) by major taxa group from Meadowbank study lakes since 2006.

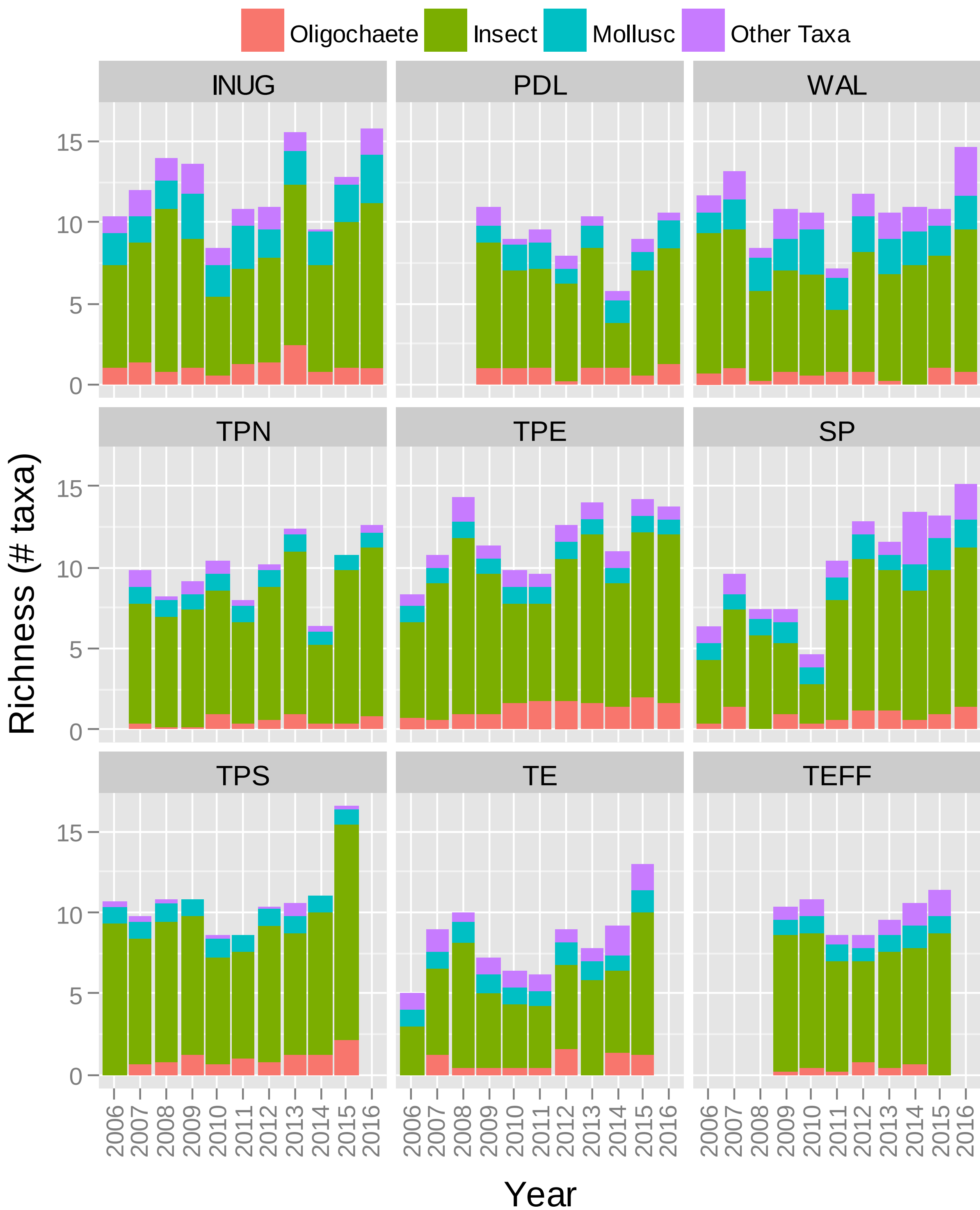
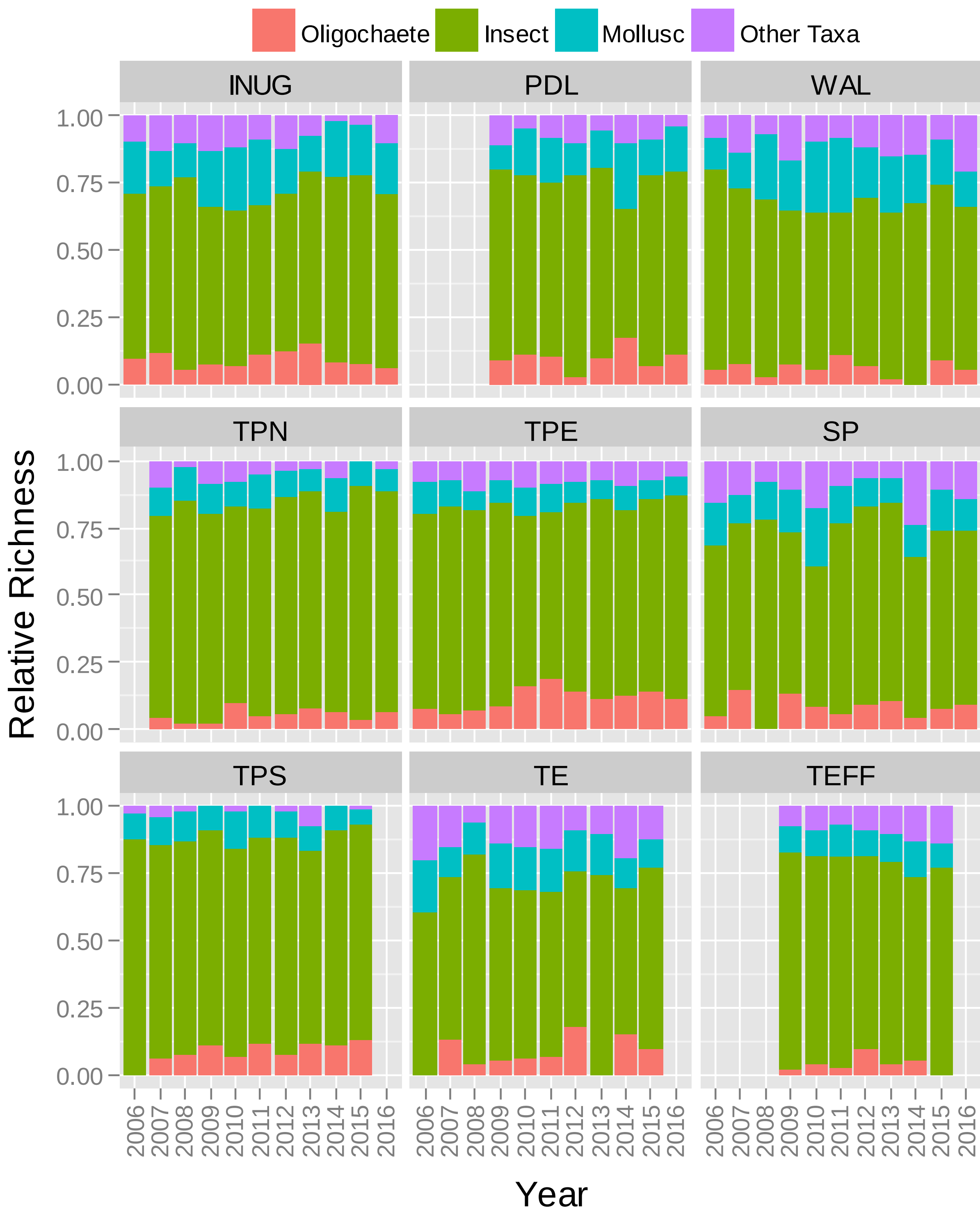


Figure 3.2–70. Benthic invertebrate relative richness by major taxa group from Meadowbank study lakes since 2006.



3.3. Baker Lake

Throughout this discussion, the following abbreviations will be used for each lake area/basin:

- BBD – Baker Lake Barge Dock,
- BPJ – Baker Lake Proposed Jetty (no longer a proposed jetty, but located adjacent to Agnico's fuel storage area and the Meadowbank Spud Barge),
- BES – Bake Lake East Shore (sediment chemistry/benthic invertebrates only),
- BAP – Bake Lake Akilahaarjuk Point

The full CREMP program was completed at all Baker Lake areas in 2016. Limnology, water chemistry, and phytoplankton sampling was completed in July, August, and September. Sediment and benthic invertebrate sampling was completed in August.

3.3.1. Limnology

3.3.1.1. General Observations

Baker Lake is a large lake with much greater wind fetch than the Meadowbank lakes and a unique limnology, due partly to its proximity to tidally influenced Chesterfield Inlet, influence of the Thelon River and deep water that is naturally elevated in dissolved solids. These natural complexities interact, leading to the "competing" influences of less-saline Thelon River water and more-saline Baker Lake water. Timing of sampling relative to freshet on the Thelon River, coupled with shifts in north/south wind speed and direction lead to variable degrees of horizontal and vertical mixing of the water column. When sampling near to the north shore, these factors may combine to confound the detection of potential changes in water quality related to barge activity, with the "signal" getting lost in the "noise" of natural variability in this dynamic location.

The following parameters are associated with more-saline or higher conductivity water that appears to be present in deep water (>10-15 m) and demonstrates considerable fluctuations within and between years. These include conductivity, hardness, calcium, chloride, magnesium, sodium and TDS. Other parameters also have a high level of natural variability and appear to be correlated with the above parameters in Baker Lake and include ammonia, nitrate, TKN, total phosphorus, sulphate and TOC/DOC.

As described below (and in **Section 3.3.2**), sampling results to date show marked differences in certain parameters (e.g., total dissolved solids and ancillary parameters such as water hardness, alkalinity and some nutrients) associated with hard (e.g., slightly brackish) water. Variability related to these factors potentially confounds the identification of development-related effects on local limnology and water quality. A deep limnology survey was conducted in August 2012 to better characterize Baker Lake limnology at depth. All parameters measured (temperature, conductivity, dissolved oxygen, pH, total dissolved solids and salinity) showed a strong and abrupt stratification from 8 - 12 m depth at areas BBD 1 and 2, and BPJ. For example, conductivity increased from <20 µS/cm in shallow, near-shore water, to >200 µS/cm between 8 and 12 m depth, depending on location. Conductivity remained uniformly high to the maximum depth sampled (40 m).

3.3.1.2. Temporal and Spatial Trend Interpretation

The major mine-related activity that occurs in this area is seasonal barge traffic during the summer months when Baker Lake is ice-free. It should also be noted that the Hamlet of Baker Lake's sewage lagoons and landfill are situated in a watershed that discharges seasonally into Baker Lake between BBD and BPJ. Locally, propeller wash may cause vertical mixing in very discrete areas when there is active traffic. Otherwise (with the exception of spills etc.), there are no other activities with the potential to alter limnological parameters. There has been no influence on shoreline development, volume or any other feature of Baker Lake itself.

At Baker Lake, limnological conditions are similar to the Meadowbank study lakes except that water temperatures are cooler, typically reaching no more than 10°C in mid-summer (**Figure 3.3–1**). Some thermal stratification is evident in Baker Lake, particularly in July and August. In September, all locations were well mixed (~10°C) and thermally un-stratified because of the large, cold water volume and large fetch of Baker Lake (**Figure 3.3–2**).

As described above in the 2012 deep limnology profiling at Baker Lake, conductivity can show a strong and abrupt stratification. Overall, the general pattern of temperature and conductivity in Baker Lake was similar in 2016 as in previous monitoring periods (**Figure 3.3–2**)[24]. Occasional elevations in conductivity and related parameters are due to the heterogeneity of surface waters related to the natural phenomena of wind driven currents, vertical mixing of deeper, higher conductivity water and influence of the Thelon River.

[24] There are no conductivity measurements for the September event due to technical issues with the conductivity probe.

Figure 3.3–1. Mean monthly field-measured temperature (°C) at 3 m depth from 2008 – 2016, Baker Lake.

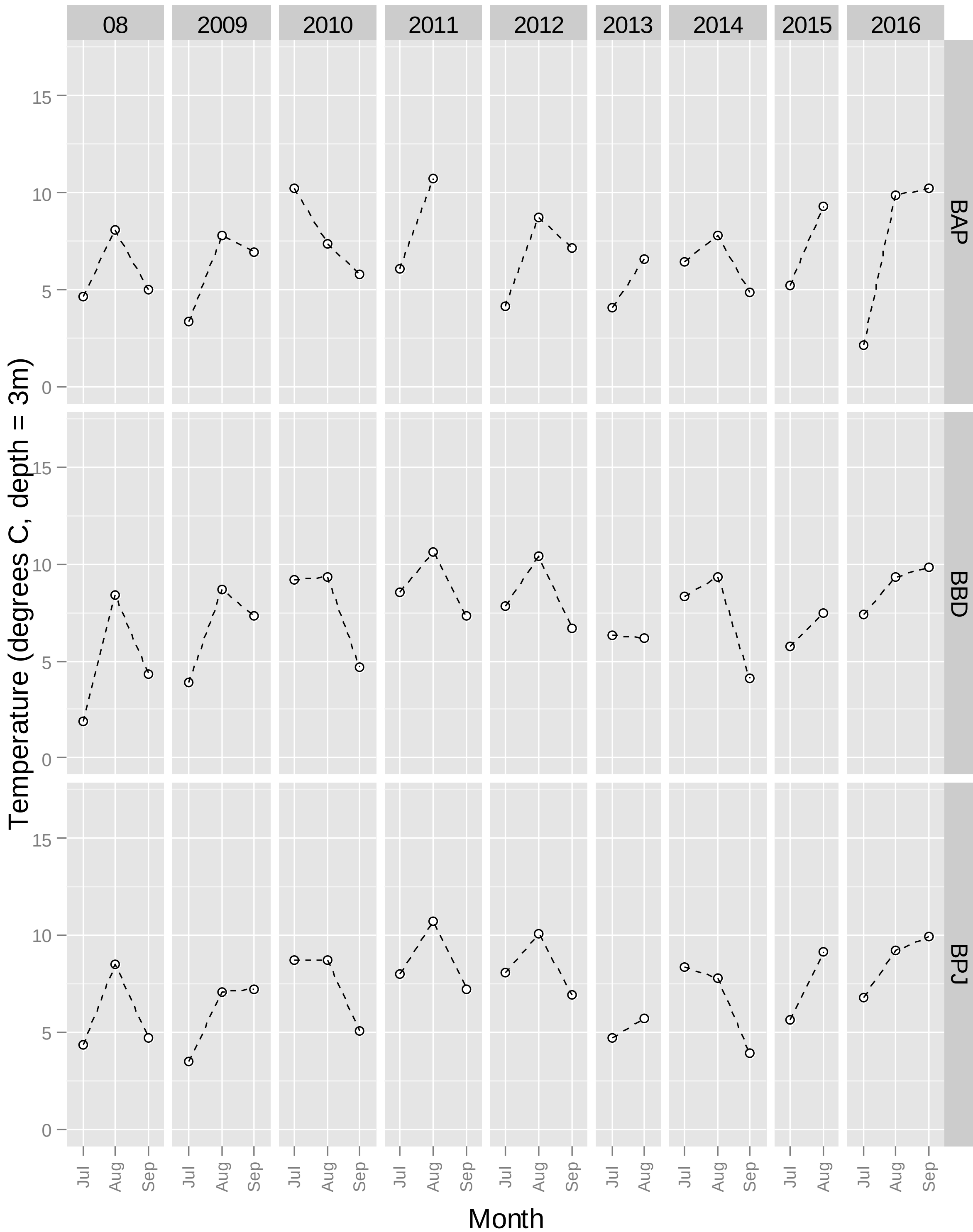


Figure 3.3–2. Field-measured temperature (°C) and conductivity (µS/cm) profiles in Baker Lake, July 2016.

Note: Dissolved oxygen data were not collected due to issues with the water quality instrument.

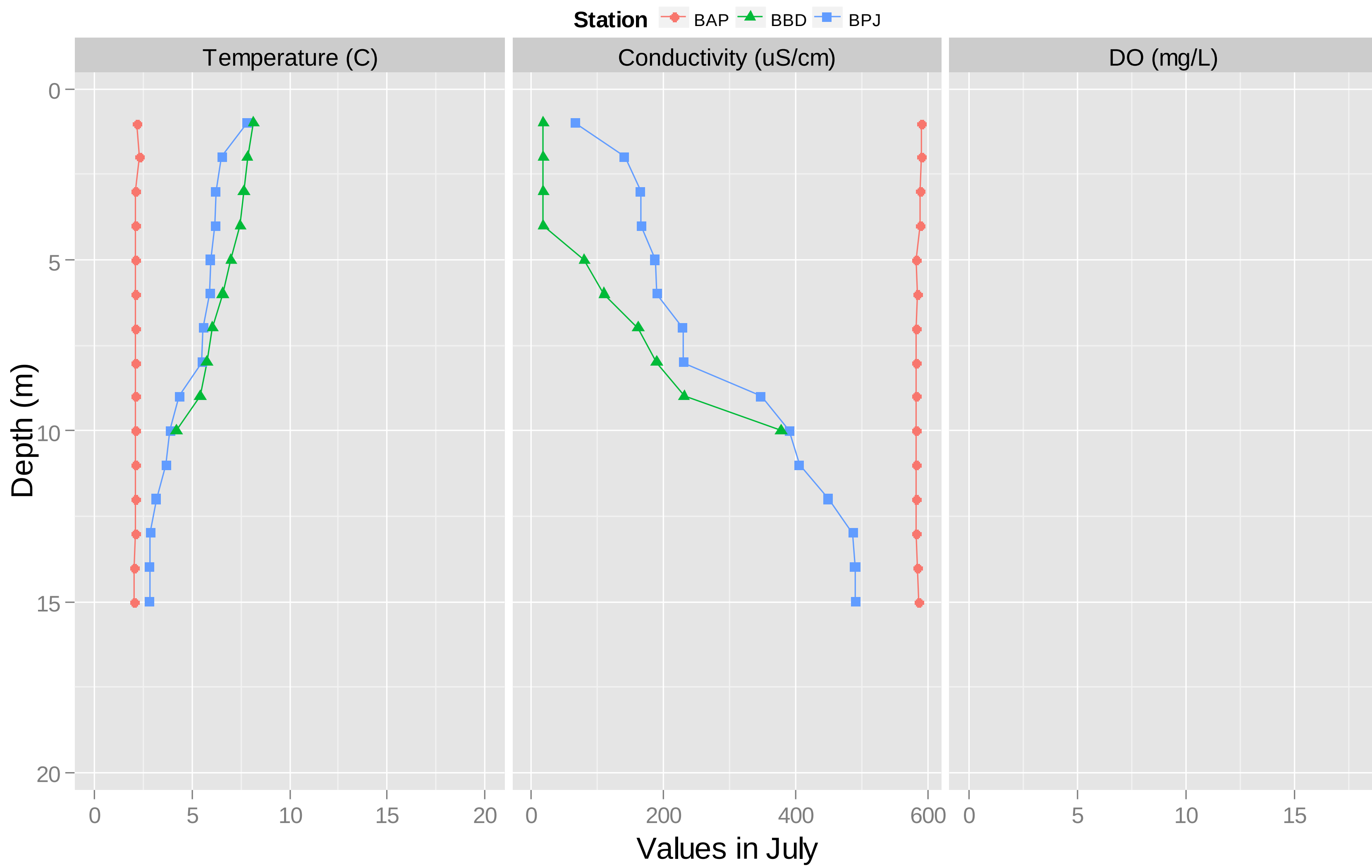


Figure 3.3–3. Field-measured temperature (°C), conductivity (µS/cm) and dissolved oxygen (mg/L) profiles in Baker Lake, August 2016.

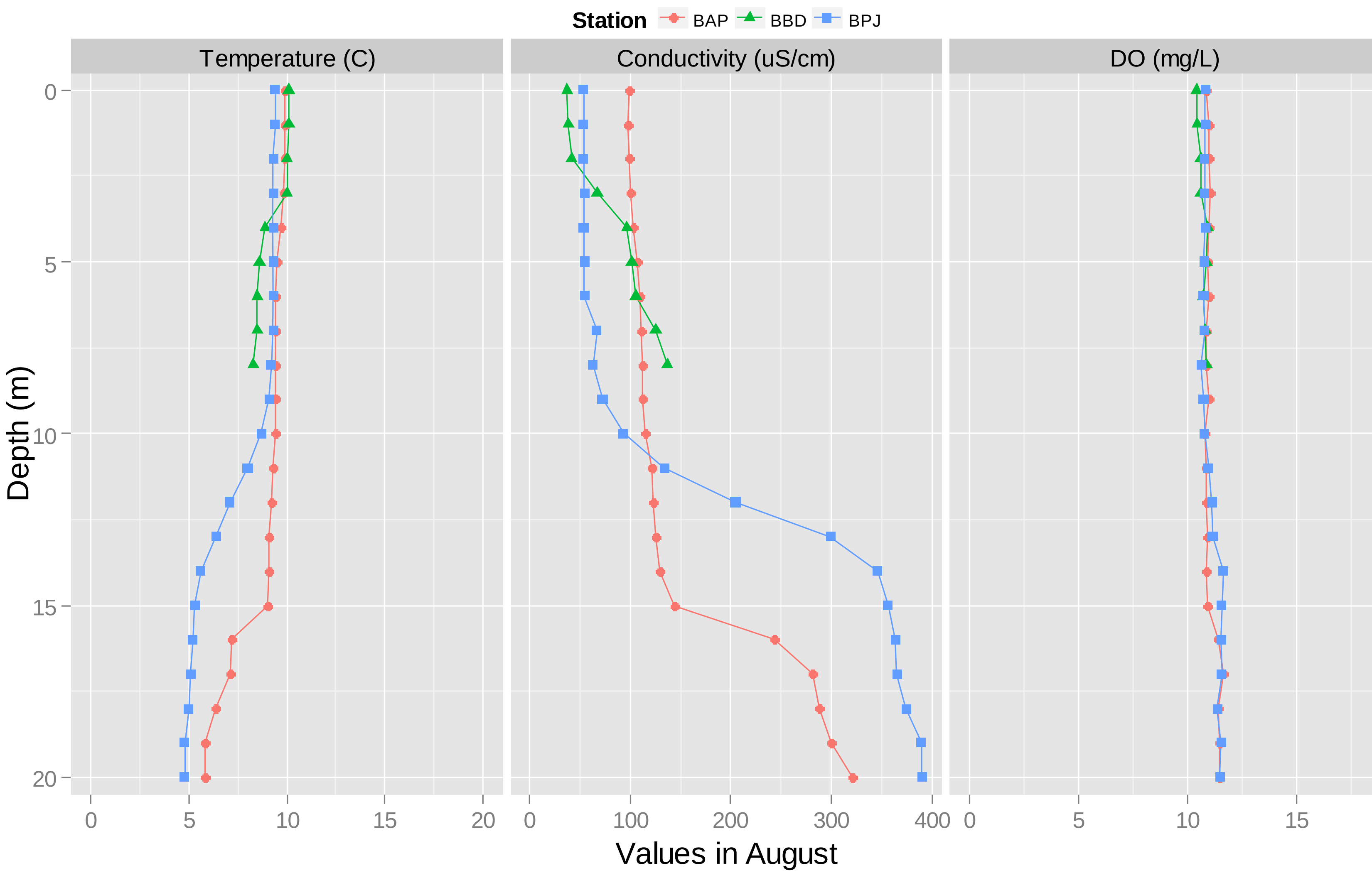
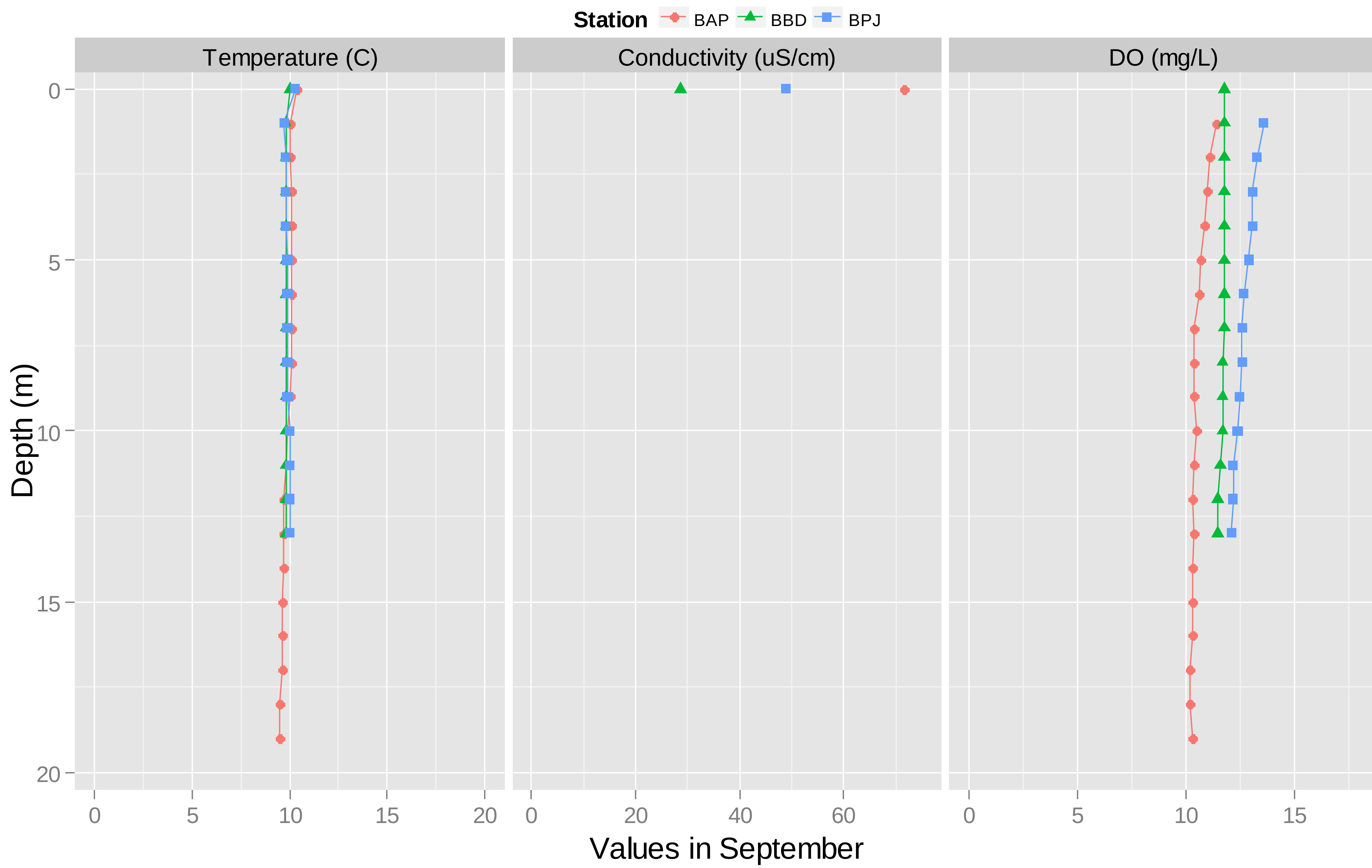


Figure 3.3–4. Field-measured temperature (°C), conductivity (µS/cm) and dissolved oxygen (mg/L) profiles in Baker Lake, September 2016.

Note: Specific conductivity readings were only taken at the surface because of technical issues with water quality instrument.



3.3.2. Water Chemistry

3.3.2.1. General Observations

Baker Lake is very large and exposed along the north-south axis to high wind and wind-generated currents. Monitoring areas along the north shore also have the added complexity of a large river (Thelon River) that discharges into Baker Lake at its western end, and possibly a residual deep-water brackish layer. Depending on wind speed and direction, water from this deeper layer can influence water chemistry parameters (conductivity, salts, and dissolved solids) in surface waters. Consequently, there can be pronounced spatial (horizontal and vertical) and temporal variability in certain parameters. Despite this variability, many parameters in the Baker Lake samples were also typically below laboratory MDLs.

3.3.2.2. Temporal and Spatial Trend Interpretation

Results for conventional water quality parameters, nutrients and metals for 2016 are presented in **Table 3.3–1**; they are discussed, where relevant from a spatial and temporal trend perspective.

CREMP monitoring results since 2008 were used to assess temporal and spatial trends related to mining activities. The general rationale for assessing these trends was discussed in **Section 1.5**; the process was tailored slightly for water chemistry, as described below.

As discussed in **Section 3.2.2** for Meadowbank study lakes, most water quality parameters in Baker Lake were routinely below laboratory MDLs. Thus, detection of changes to water quality related to barge activity (or related to potential non-mining inputs from the Hamlet of Baker Lake's sewage lagoons and landfill, which are situated in a watershed that discharges seasonally into Baker Lake between BBD and BPJ) would be relatively easy to detect, notwithstanding the confounding influence of elevated conductivity, dissolved salts and TDS depending on limnological conditions. Similar to Meadowbank, starting with the parameters listed in **Table 3.3–1**, a conservative two-step screening process was used to identify parameters for inclusion into the formal trend assessment (the results are summarized in **Table 3.3–2** with figure number references for all parameters that were screened in):

1. *Overall Detection Frequency* - Only those water quality parameters that exceeded MDLs in at least 10% of the samples were included in this discussion. Because this lake is ultra-oligotrophic, it is normal for many parameters to routinely be below MDLs.
2. *Control-Impact Detection Frequency Comparison* – In order to avoid screening out infrequently detected parameters that were detected more often in association with barge activities, the proportion of samples exceeding MDLs between "control" and "impact" samples were compared; the intent of this screen was to identify parameters with <5% detection frequency (i.e., those screened out above) for which there were detection frequency changes potentially associated with mining activity (i.e., where the proportion of detected values increased by 0.05 or more).

All routine parameters, anions and nutrients, and metal (total and dissolved) retained based on the two-step screening process are shown in **Figure 3.3–5** to **Figure 3.3–49**. The samples were collected from a depth of 3 meters for all areas and events, consistent with the SOP. The red dashed line in each of these water chemistry figures is the trigger value specific to Baker Lake. All parameters not retained for the trend assessment were assumed to have no spatial or temporal trends related to barge activities or to natural variability and were excluded from further consideration (plots for these parameters are included for reference in **Appendix A2**).

There were no instances of the mean concentrations exceeding the trigger values at any of the exposure areas in 2016. There were isolated threshold exceedances of chloride and strontium (total and dissolved) at the reference area BAP in July that coincide with elevated conductivity (>600 µS/cm). Other than two isolated trigger exceedances for TKN (one each at BBD and BPJ), all water quality parameters were below the trigger values in 2016 (**Table 3.3–1**). Barge traffic over the past few years (**Figure 1.4–1**) is not adversely affecting water quality at the exposure areas. This is not surprising given that there were no reported spills in 2016 and that any effects to the water column from prop wash would be ephemeral and would clear quickly with no lingering effects to the water column. There are no follow-up measures for management in 2017 beyond routine CREMP monitoring.

Table 3.3–1. Water quality results from the 2016 CREMP, Baker Lake

Lake and Station				Baker Lake											
				Akilahaarjuk Point (BAP)						Barge Dock (BBD)					
Area-Replicate ID				BAP-43-S	BAP-44-S	BAP-45-S	BAP-46-S	BAP-47-S	BAP-48-S	BBD-43-S	BBD-44-S	BBD-45-S	BBD-46-S	BBD-47-S	BBD-48-S
Depth (m)		Trigger[2]		3	3	3	3	3	3	3	3	3	3	3	3
Date	CCME Guideline[1]	Baker Lake	Threshold[2]	22-Jul-16	22-Jul-16	8-Aug-16	8-Aug-16	2-Sep-16	2-Sep-16	22-Jul-16	22-Jul-16	10-Aug-16	10-Aug-16	3-Sep-16	3-Sep-16
Field Measurements (Surface)															
Temperature (°C)				2.2	2.3	9.9	9.9	10.4	10.4	8.2	7.9	10.1	9.4	10.2	10.0
Specific Conductivity (µS/cm)				591	576	98.4	106.2	71.6	89	18	41	37.1	70.9	26.8	28.6
Dissolved Oxygen (mg/L)				na	na	10.88	10.76	11.4	10.5	na	na	10.42	10.67	12.9	11.8
pH	6.5 - 9.0	6.74 - 8.12	6.5 - 9.0	7.20	7.50	7.03	7.08	7.30	7.43	**8.16**	8.12	6.93	6.92	7.38	7.34
Physical Tests (mg/L)															
Conductivity (µS/cm)		494.5		**704**	**639**	124	122	73.2	94.9	27.5	105	50	116	27.9	32.1
Hardness		41.2		**68.1**	**62.7**	18.8	19.3	14.1	15.8	10.7	16.8	13.5	17.5	10.1	10.5
pH (Laboratory)	6.5 - 9.0	6.74 - 8.12	6.5 - 9.0	6.74	6.79	7.02	7.01	7.11	7.08	6.81	6.81	7.01	6.98	7.14	7.11
Total Suspended Solids		3.0	5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.5	<1.0	<1.0	<1.0	<1.0	<1.0
Total Dissolved Solids		208		**399**	**357**	106	81	71	63	32	94	42	97	23	22
Turbidity (NTU)				0.29	0.28	0.41	0.45	0.34	0.30	0.20	0.27	0.40	0.42	0.34	0.37
Anions and Nutrients (mg/L)															
Alkalinity - Bicarbonate		10.6		10.3	10.1	9.1	8.6	8.6	8.6	9.0	9.4	8.8	8.9	8.9	9.2
Alkalinity - Carbonate		4		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity - Hydroxide				<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity - Total		10.6		10.3	10.1	9.1	8.6	8.6	8.6	9.0	9.4	8.8	8.9	8.9	9.2
Ammonia (as N)[3]	***equation***	0.067	0.126	<0.0050	<0.0050	0.01	0.01	<0.0050	<0.0050	<0.0050	<0.0050	0.02	0.01	<0.0050	<0.0050
Bromide				0.67	0.59	0.12	0.09	0.06	0.08	<0.050	0.09	0.06	0.10	<0.050	<0.050
Chloride	120	95.7	120	**189**	**168**	28	27	15	20	2	23	8	26	2	3
Fluoride	0.120			<0.10	0.07	0.05	0.05	0.05	0.05	0.05	0.06	0.05	0.05	0.05	0.05
Nitrate (as N)	3.0	1.51	3	0.0710	0.0634	0.0191	0.0187	0.0167	0.0167	0.0233	0.0289	0.0211	0.0227	0.0180	0.0170
Nitrite (as N)	0.060	0.031	0.060	<0.0050	<0.0010	<0.0010	0.002	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen		0.214		0.16	0.16	0.17	**0.22**	0.21	0.21	0.18	0.21	0.19	0.17	**0.22**	0.20
Ortho Phosphate (as P)		0.002		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Phosphorus (P)-Total Diss.				<0.0020	<0.0020	0.0021	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0021	<0.0020	<0.0020	<0.0020
Phosphorus (P)-Total	0.0040	0.0096	0.004	<0.0020	<0.0020	0.0045	0.0045	0.0045	0.0045	0.0029	<0.0020	0.0026	<0.0020	0.0060	0.0044
Silicate (as SiO_2)		1.0		0.66	0.68	<0.50	<0.50	<0.50	<0.50	0.63	0.62	<0.50	<0.50	<0.50	<0.50
Sulphate (SO_4)		65.92	128	26.20	24.40	4.29	4.22	2.37	3.22	0.71	3.67	1.51	4.07	0.67	0.83
Cyanides (mg/L)															
Total Cyanide				<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Free Cyanide	0.005			<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon (mg/L)															
Dissolved Organic Carbon		4.05		2.89	3.06	3.53	3.53	3.34	3.18	3.38	3.45	3.58	3.61	3.34	3.63
Total Organic Carbon		4.25		2.94	3.06	3.47	3.95	3.49	3.30	3.56	3.45	3.66	3.45	3.44	3.40
Plant Pigments (µg/L)															
Chlorophyll-*a*				0.16	0.20	1.32	1.30	1.79	1.75	1.07	0.93	1.21	1.28	1.02	1.06
Total Metals (mg/L)															
Aluminum[3]	***equation***	0.056	0.100	0.0109	0.0110	0.0171	0.0151	0.0148	0.0137	0.0275	0.0213	0.0154	0.0172	0.0180	0.0208
Antimony		0.0101	0.020	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	0.0050	0.00257	0.005	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0002	0.0001	0.0001
Barium		0.51	1	0.0206	0.0203	0.0198	0.0194	0.0205	0.0200	0.0218	0.0212	0.0197	0.0196	0.0218	0.0219
Beryllium		0.0027	0.0053	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Bismuth				<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	1.5	0.76	1.5	0.05	0.04	<0.010	0.01	<0.010	<0.010	<0.010	0.01	<0.010	0.01	<0.010	<0.010
Cadmium[3]	***equation***	0.000025	0.000040	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium		4.50		**6.57**	**6.11**	3.06	3.07	2.68	2.81	2.60	3.16	2.67	3.00	2.43	2.42
Chromium[4]	0.001	0.00056	0.001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Cobalt				<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper[3]	***equation***	0.00125	0.002	0.0005	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.0006	<0.00050	<0.00050	<0.00050	<0.00050
Iron	0.3	0.160	0.3	0.02	0.02	0.03	0.03	0.03	0.02	0.05	0.04	0.03	0.04	0.03	0.03
Lead[3]	***equation***	0.000525	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium		0.048	0.096	0.0025	0.0019	<0.0010	<0.0010	<0.0010	0.0010	<0.0010	0.0012	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium		7.44		**13.40**	**12.10**	2.80	2.86	1.95	2.30	1.17	2.86	1.56	2.69	1.17	1.18
Manganese[3]		0.3400	***equation***	0.0083	0.0091	0.0053	0.0052	0.0031	0.0031	0.0071	0.0115	0.0062	0.0070	0.0030	0.0032
Mercury	0.000026	0.000018	0.000026	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum	0.073	0.0365	0.073	0.0002	0.0002	0.0001	0.0001	<0.000050	0.0001	<0.000050	0.0001	0.0001	0.0001	<0.000050	<0.000050
Nickel[3]	***equation***	0.0128	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Phosphorus				<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium		2.43		**4.33**	**3.89**	0.96	0.95	0.75	0.89	0.44	0.97	0.52	0.89	0.41	0.44
Selenium	0.001	0.00055	0.001	<0.000050	<0.000050	<0.000050	<0.000050	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.00006
Silicon				0.26	0.25	0.23	0.22	0.23	0.22	0.29	0.26	0.24	0.24	0.21	0.21
Silver	0.0001			<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium		54.0		**106**	**87.1**	13.4	14.1	8.0	11.3	0.9	15.7	4.2	13.1	1.2	1.4
Strontium		0.0564	0.049	**0.091**	**0.083**	0.025	0.026	0.021	0.024	0.018	0.028	0.020	0.027	0.017	0.017
Sulfur				8.93	8.11	1.53	1.55	0.84	1.11	<0.50	1.49	0.63	1.45	<0.50	<0.50
Thallium	0.0008	0.00041	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin		0.0002		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium		1.00	2	<0.00030	0.00030	<0.00030	<0.00030	<0.00030	<0.00030	0.00042	0.00044	<0.00030	0.00032	<0.00030	0.00063
Uranium	0.015	0.0075	0.015	0.00006	0.00006	0.00004	0.00004	0.00004	0.00004	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Vanadium		0.0035	0.006	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc[3]	0.030	0.0132	***equation***	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Zirconium				<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Dissolved Metals (mg/L)															
Aluminum[3]		0.0274	0.05	0.0023	0.0029	0.0047	0.0046	0.0064	0.0084	0.0061	0.0062	0.0054	0.0056	0.0072	0.0077
Antimony		0.0101	0.020	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic		0.0026	0.005	0.0001	0.0001	0.0001	0.0001	0.0001	<0.00010	0.0001	0.0001	0.0001	0.0001	<0.00010	0.0001
Barium		0.5089	1	0.0202	0.0199	0.0192	0.0192	0.0198	0.0198	0.0200	0.0203	0.0196	0.0197	0.0204	0.0203
Beryllium		0.0027	0.0053	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Bismuth				<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron		0.76	1.5	0.04	0.04	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium		0.000025	0.00004	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050		<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium				6.26	5.95	3.01	3.09	2.53	2.63	2.48	2.87	2.69	2.95	2.25	2.32
Chromium		0.00055	0.001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Cobalt				<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper		0.00116	0.002	0.00027	0.00031	0.00026	0.00027	0.00026	0.00031	0.00027	0.00032	0.00025	0.00026	0.00026	0.00025
Iron		0.155	0.3	<0.010	<0.010	<0.010	<0.010	0.01	0.01	0.01	0.02	<0.010	<0.010	0.01	0.01
Lead		0.000525	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium		0.048	0.096	0.0024	0.0022	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium				12.70	11.60	2.74	2.80	1.89	2.23	1.11	2.34	1.65	2.46	1.08	1.13
Manganese[3]		0.339	***equation***	0.0072	0.0072	0.0004	0.0005	0.0004	0.0006	0.0019	0.0057	0.0010	0.0010	0.0007	0.0008
Mercury		0.000018	0.000026	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum		0.037	0.073	0.0002	0.0001	0.0001	0.0001	<0.000050	0.0001	<0.000050	0.0001	<0.000050	0.0001	<0.000050	<0.000050
Nickel		0.013	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Phosphorus				<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium				4.04	3.69	0.89	0.93	0.65	0.77	0.40	0.77	0.58	0.81	0.38	0.39
Selenium		0.00055	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon				0.23	0.23	0.21	0.20	0.16	0.17	0.23	0.24	0.21	0.21	0.14	0.14
Silver				<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium				105.00	91.90	13.00	13.40	7.70	11.40	0.76	11.70	4.95	11.30	1.11	1.45
Strontium		0.049	0.049	**0.0894**	**0.0817**	0.0263	0.0262	0.0208	0.0236	0.0177	0.0253	0.0200	0.0248	0.0162	0.0167
Sulfur				8.69	7.82	1.47	1.48	0.85	1.18	<0.50	1.16	0.66	1.26	<0.50	<0.50
Thallium		0.00041	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin		0.0002		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium		1.01	2	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Uranium		0.0075	0.015	0.00005	0.00005	0.00004	0.00004	0.00004	0.00004	0.00004	0.00004	0.00004	0.00004	0.00004	0.00004
Vanadium		0.0035	0.006	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc[3]		0.0122	***equation***	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.004	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010
Zirconium				<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030

Notes:

1 CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life, 1999, updated up to 2015.

2 Trigger and threshold values were developed in *CREMP Design Document 2012* (Azimuth, 2012d).

A number of thresholds were derived from methods (or sources) other than CCME guidelines. Refer to the *CREMP: 2015 Plan Update* (Azimuth, 2015a) for more details.

3 "***equation***" means that CCME guidelines (or thresholds) are calculated based on an equation which is either pH or hardness dependent. The ammonia and aluminum (t & d) guidelines vary with pH; the cadmium, copper, lead, manganese, nickel and zinc guidelines vary with hardness.

4 Chromium CCME guideline is for Cr VI.

123 Bolded concentrations exceed the trigger value.

123 Bolded and shaded concentrations also exceed the threshold value.

Italicized numbers are below detection limits.

underline = results were given a cautionary flag in the QC assessment (refer to **Section 3.1.2** for details)

~~strikethrough~~ = results flagged as unreliable in the QC assessment

Table 3.3–1. Water quality results from the 2016 CREMP, Baker Lake

Lake and Station				Baker Lake					
				Proposed Jetty (BPJ)					
Area-Replicate ID				BPJ-43-S	BPJ-44-S	BPJ-45-S	BPJ-46-S	BPJ-47-S	BPJ-48-S
Depth (m)		Trigger[2]		3	3	3	3	3	3
Date	CCME Guideline[1]	Baker Lake	Threshold[2]	22-Jul-16	22-Jul-16	10-Aug-16	10-Aug-16	3-Sep-16	3-Sep-16
Field Measurements (Surface)									
Temperature (°C)				7.7	7.8	9.2	9.4	10.3	10.3
Specific Conductivity (µS/cm)				78	67	64.4	53.6	48.8	55
Dissolved Oxygen (mg/L)				na	na	10.79	10.83	13.6	13
pH	6.5 - 9.0	6.74 - 8.12	6.5 - 9.0	7.30	7.38	6.87	6.89	7.38	7.36
Physical Tests (mg/L)									
Conductivity (µS/cm)		494.5		134	230	70.5	58.0	50.5	53.9
Hardness		41.2		20.1	29.0	14.8	13.6	11.9	12.6
pH (Laboratory)	6.5 - 9.0	6.74 - 8.12	6.5 - 9.0	6.81	6.82	7.00	7.00	7.10	7.11
Total Suspended Solids		3.0	5.0	*<1.0*	1.0	1.0	*<1.0*	*<1.0*	*<1.0*
Total Dissolved Solids		208		112	169	62	64	38	38
Turbidity (NTU)				0.34	0.31	0.51	0.47	0.30	0.32
Anions and Nutrients (mg/L)									
Alkalinity - Bicarbonate		10.6		9.5	9.7	8.4	8.8	8.8	8.7
Alkalinity - Carbonate		4		*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Alkalinity - Hydroxide				*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Alkalinity - Total		10.6		9.5	9.7	8.4	8.8	8.8	8.7
Ammonia (as N)[3]	***equation***	0.067	0.126	0.01	0.01	0.01	*<0.0050*	*<0.0050*	*<0.0050*
Bromide				0.11	0.21	0.05	0.06	*<0.050*	*<0.050*
Chloride	120	95.7	120	30	57	13	10	8	10
Fluoride	0.120			0.06	0.06	0.05	0.05	0.05	0.05
Nitrate (as N)	3.0	1.51	3	0.0299	0.0368	0.0208	0.0233	0.0197	0.0185
Nitrite (as N)	0.060	0.031	0.060	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Total Kjeldahl Nitrogen		0.214		0.17	0.17	0.16	0.17	**0.22**	0.21
Ortho Phosphate (as P)		0.002		*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Phosphorus (P)-Total Diss.				*<0.0020*	*<0.0020*	0.0025	0.0027	*<0.0020*	*<0.0020*
Phosphorus (P)-Total	0.0040	0.0096	0.004	0.0021	*<0.0020*	0.0043	0.0028	0.0069	0.0046
Silicate (as SiO_2)		1.0		0.64	0.62	*<0.50*	*<0.50*	*<0.50*	*<0.50*
Sulphate (SO_4)		65.92	128	4.76	8.50	2.29	1.83	1.50	1.66
Cyanides (mg/L)									
Total Cyanide				*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Free Cyanide	0.005			*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Organic / Inorganic Carbon (mg/L)									
Dissolved Organic Carbon		4.05		3.48	3.24	3.55	3.57	3.42	3.43
Total Organic Carbon		4.25		3.33	3.24	3.59	3.80	3.65	3.45
Plant Pigments (µg/L)									
Chlorophyll-*a*				0.90	0.64	1.39	1.19	1.41	1.48
Total Metals (mg/L)									
Aluminum[3]	***equation***	0.056	0.100	0.0188	0.0176	0.0177	0.0167	0.0158	0.0170
Antimony		0.0101	0.020	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Arsenic	0.0050	0.00257	0.005	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001
Barium		0.51	1	0.0208	0.0207	0.0197	0.0191	0.0211	0.0207
Beryllium		0.0027	0.0053	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*
Bismuth				*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Boron	1.5	0.76	1.5	0.01	0.02	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Cadmium[3]	***equation***	0.000025	0.000040	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Calcium		4.50		3.23	3.84	2.75	2.49	2.54	2.55
Chromium[4]	0.001	0.00056	0.001	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Cobalt				*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Copper[3]	***equation***	0.00125	0.002	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Iron	0.3	0.160	0.3	0.04	0.04	0.04	0.03	0.02	0.03
Lead[3]	***equation***	0.000525	0.001	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Lithium		0.048	0.096	0.0012	0.0014	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Magnesium		7.44		3.06	4.97	1.91	1.56	1.55	1.65
Manganese[3]		0.3400	***equation***	0.0095	0.0118	0.0061	0.0059	0.0030	0.0030
Mercury	0.000026	0.000018	0.000026	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Molybdenum	0.073	0.0365	0.073	0.0001	0.0001	0.0001	0.0001	*<0.000050*	*<0.000050*
Nickel[3]	***equation***	0.0128	0.025	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Phosphorus				*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*
Potassium		2.43		1.02	1.65	0.66	0.55	0.58	0.65
Selenium	0.001	0.00055	0.001	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	0.00006	*<0.000050*
Silicon				0.26	0.26	0.25	0.22	0.21	0.23
Silver	0.0001			*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Sodium		54.0		17.3	33.1	7.0	5.0	4.7	5.3
Strontium		0.0564	0.049	0.030	0.041	0.022	0.020	0.019	0.020
Sulfur				1.62	2.91	0.88	0.70	0.57	0.63
Thallium	0.0008	0.00041	0.0008	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Tin		0.0002		*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Titanium		1.00	2	0.00031	0.00035	0.00033	*<0.00030*	*<0.00030*	*<0.00030*
Uranium	0.015	0.0075	0.015	0.00005	0.00005	0.00005	0.00004	0.00004	0.00004
Vanadium		0.0035	0.006	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Zinc[3]	0.030	0.0132	***equation***	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*
Zirconium				*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*
Dissolved Metals (mg/L)									
Aluminum[3]		0.0274	0.05	0.0057	0.0046	0.0052	0.0054	0.0065	0.0068
Antimony		0.0101	0.020	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Arsenic		0.0026	0.005	*<0.00010*	0.0001	0.0001	0.0001	0.0001	*<0.00010*
Barium		0.5089	1	0.0199	0.0206	0.0210	0.0193	0.0197	0.0198
Beryllium		0.0027	0.0053	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*	*<0.000020*
Bismuth				*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Boron		0.76	1.5	0.01	0.02	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Cadmium		0.000025	0.00004	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Calcium				3.12	3.70	2.76	2.68	2.36	2.44
Chromium		0.00055	0.001	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Cobalt				*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Copper		0.00116	0.002	0.00023	0.00025	0.00026	0.00028	0.00023	0.00025
Iron		0.155	0.3	0.01	*<0.010*	0.01	0.01	0.01	0.01
Lead		0.000525	0.001	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	0.00012
Lithium		0.048	0.096	0.0011	0.0013	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Magnesium				3.00	4.79	1.91	1.69	1.46	1.58
Manganese[3]		0.339	***equation***	0.0052	0.0076	0.0006	0.0007	0.0005	0.0006
Mercury		0.000018	0.000026	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Molybdenum		0.037	0.073	0.0001	0.0001	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Nickel		0.013	0.025	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Phosphorus				*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*
Potassium				0.98	1.55	0.65	0.59	0.51	0.56
Selenium		0.00055	0.001	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Silicon				0.23	0.22	0.22	0.21	0.16	0.16
Silver				*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Sodium				17.30	32.60	7.07	5.33	4.29	4.85
Strontium		0.049	0.049	0.0291	0.0403	0.0217	0.0204	0.0184	0.0187
Sulfur				1.61	2.89	0.84	0.71	0.57	0.64
Thallium		0.00041	0.0008	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Tin		0.0002		*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Titanium		1.01	2	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*
Uranium		0.0075	0.015	0.00004	0.00004	0.00004	0.00004	0.00004	0.00004
Vanadium		0.0035	0.006	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Zinc[3]		0.0122	***equation***	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Zirconium				*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*

Notes:

[1] CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life, 1999, updated up to 2015.

[2] Trigger and threshold values were developed in *CREMP Design Document 2012* (Azimuth, 2012d).

A number of thresholds were derived from methods (or sources) other than CCME guidelines. Refer to the *CREMP: 2015 Plan Update* (Azimuth, 2015a) for more details.

[3] "***equation***" means that CCME guidelines (or thresholds) are calculated based on an equation which is either pH or hardness dependent. The ammonia and aluminum (t & d) guidelines vary with pH; the cadmium, copper, lead, manganese, nickel and zinc guidelines vary with hardness.

[4] Chromium CCME guideline is for Cr VI.

123 Bolded concentrations exceed the trigger value.

123 Bolded and shaded concentrations also exceed the threshold v

Italicized numbers are below detection limits.

underline = results were given a cautionary flag in the QC assessment (refer to **Section 3.1.2** for detail

~~strikethrough~~ = results flagged as unreliable in the QC assessment

Table 3.3–2. Screening process for water quality parameters, Baker Lake 2016.

CONVENTIONALS			TOTAL METALS			DISSOLVED METALS		
Screening Level	**1**	**2**	**Screening Level**	**1**	**2**	**Screening Level**	**1**	**2**
Screening Rule[1]	**>DL ≥ 10% frequency**	**C-I > 0.05 frequency**	**Screening Rule**[1]	**>DL ≥ 10% frequency**	**C-I > 0.05 frequency**	**Screening Rule**[1]	**>DL ≥ 10% frequency**	**C-I > 0.05 frequency**
Conductivity	Figure 3.3-5		Aluminum	Figure 3.3-23		Aluminum	Figure 3.3-40	
Hardness	Figure 3.3-6		Antimony*	No	No	Antimony*	No	No
pH -Field	Figure 3.3-7		Arsenic	Figure 3.3-24		Arsenic	Figure 3.3-41	
pH -Lab	Figure 3.3-8		Barium	Figure 3.3-25		Barium	Figure 3.3-42	
TSS	Figure 3.3-9		Beryllium*	No	No	Beryllium*	No	No
TDS	Figure 3.3-10		Boron	Figure 3.3-26		Boron	Figure 3.3-43	
B-Alkalinity	Figure 3.3-11		Cadmium*	No	No	Cadmium*	No	No
C-Alkalinity*	No	No	Calcium	Figure 3.3-27		Chromium*	No	No
T-Alkalinity	Figure 3.3-12		Chromium	Figure 3.3-28		Copper	Figure 3.3-44	
Ammonia-N	Figure 3.3-13		Copper	Figure 3.3-29		Iron*	No	No
Chloride	Figure 3.3-14		Iron	Figure 3.3-30		Lead*	No	No
Nitrate-N	Figure 3.3-15		Lead	No	No	Lithium	Figure 3.3-45	
Nitrite-N*	No	No	Lithium	Figure 3.3-31		Manganese	Figure 3.3-46	
TKN	Figure 3.3-16		Magnesium	Figure 3.3-32		Mercury*	No	No
T-phosphorous	Figure 3.3-17		Manganese	Figure 3.3-33		Molybdenum	Figure 3.3-47	
Ortho-phosphate	Figure 3.3-18		Mercury*	No	No	Nickel*	No	No
Reactive silica	Figure 3.3-19		Molybdenum	Figure 3.3-34		Selenium*	No	No
Sulphate	Figure 3.3-20		Nickel*	No	No	Strontium	Figure 3.3-48	
DOC	Figure 3.3-21		Potassium	Figure 3.3-35		Thallium*	No	No
TOC	Figure 3.3-22		Selenium*	No	No	Tin*	No	No
T-Cyanide*	No	No	Sodium	Figure 3.3-36		Titanium*	No	No
Free Cyanide*	No	No	Strontium	Figure 3.3-37		Uranium	Figure 3.3-49	
			Thallium*	No	No	Vanadium*	No	No
			Tin*	No	No	Zinc*	No	No
			Titanium	Figure 3.3-38				
			Uranium	Figure 3.3-39				
			Vanadium*	No	No			
			Zinc*	No	No			

Notes:

* Plots for these parameters are presented in **Appendix A2**.

[1] See text for further detail.

Figure 3.3–5. Laboratory-measured conductivity (µS/cm) in water samples from Baker Lake since 2008.

Note: Laboratory-measured conductivity data from 2014 should be interpreted with caution, particularly at low concentrations (see Azimuth, 2015c for details).

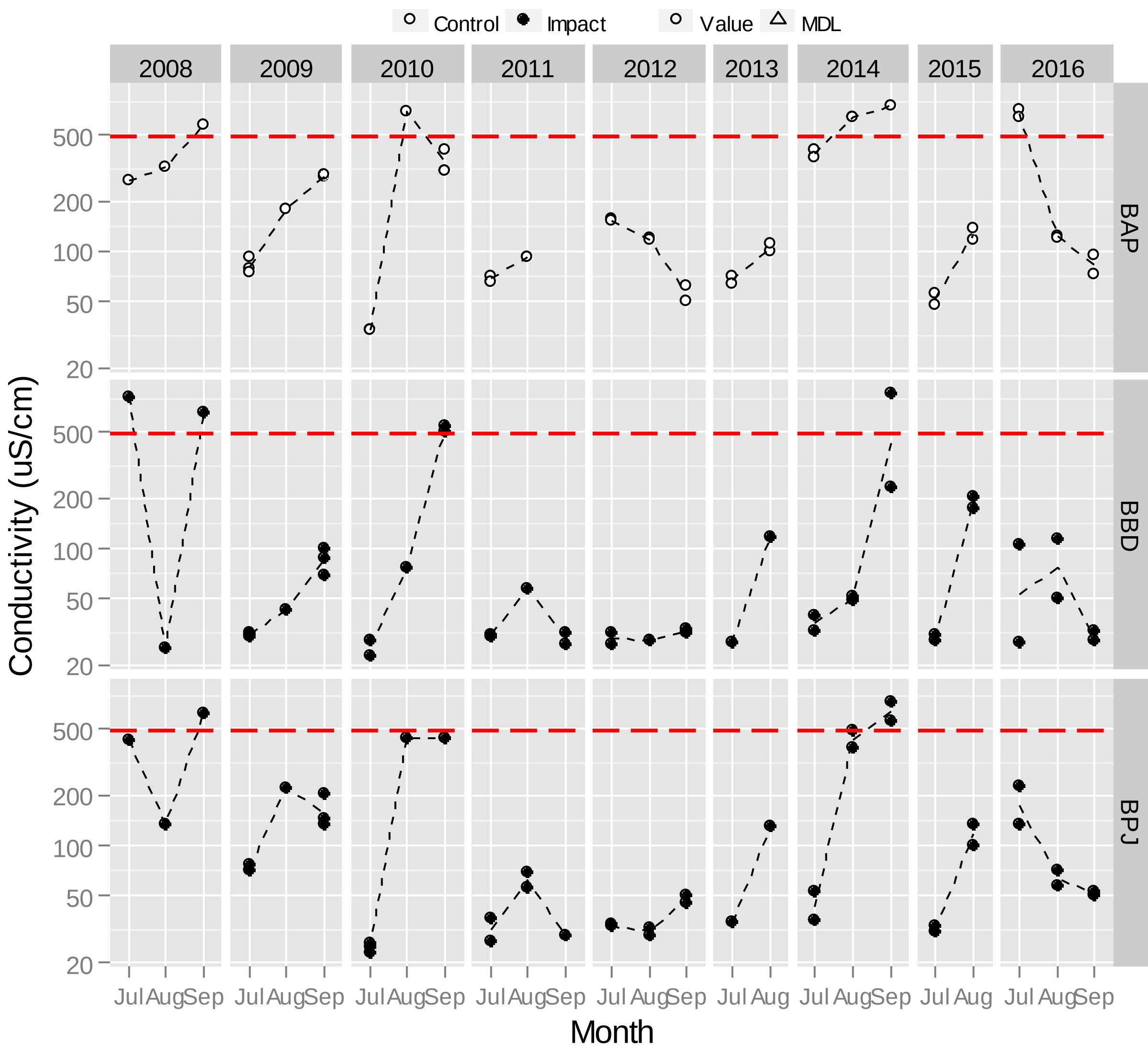


Figure 3.3–6. Hardness (mg/L) in water samples from Baker Lake since 2008.

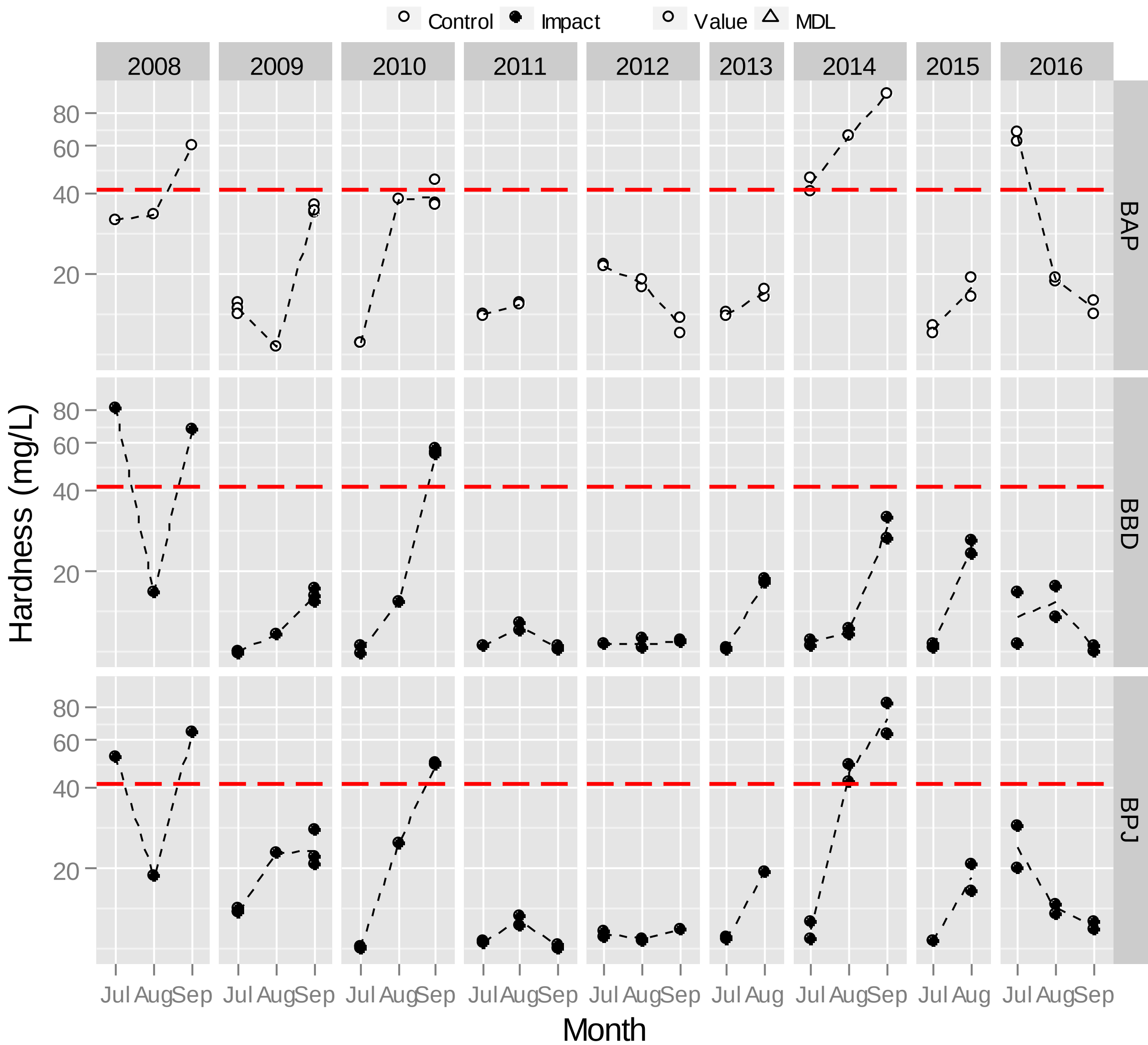


Figure 3.3–7. Field-measured pH in water samples from Baker Lake since 2008.

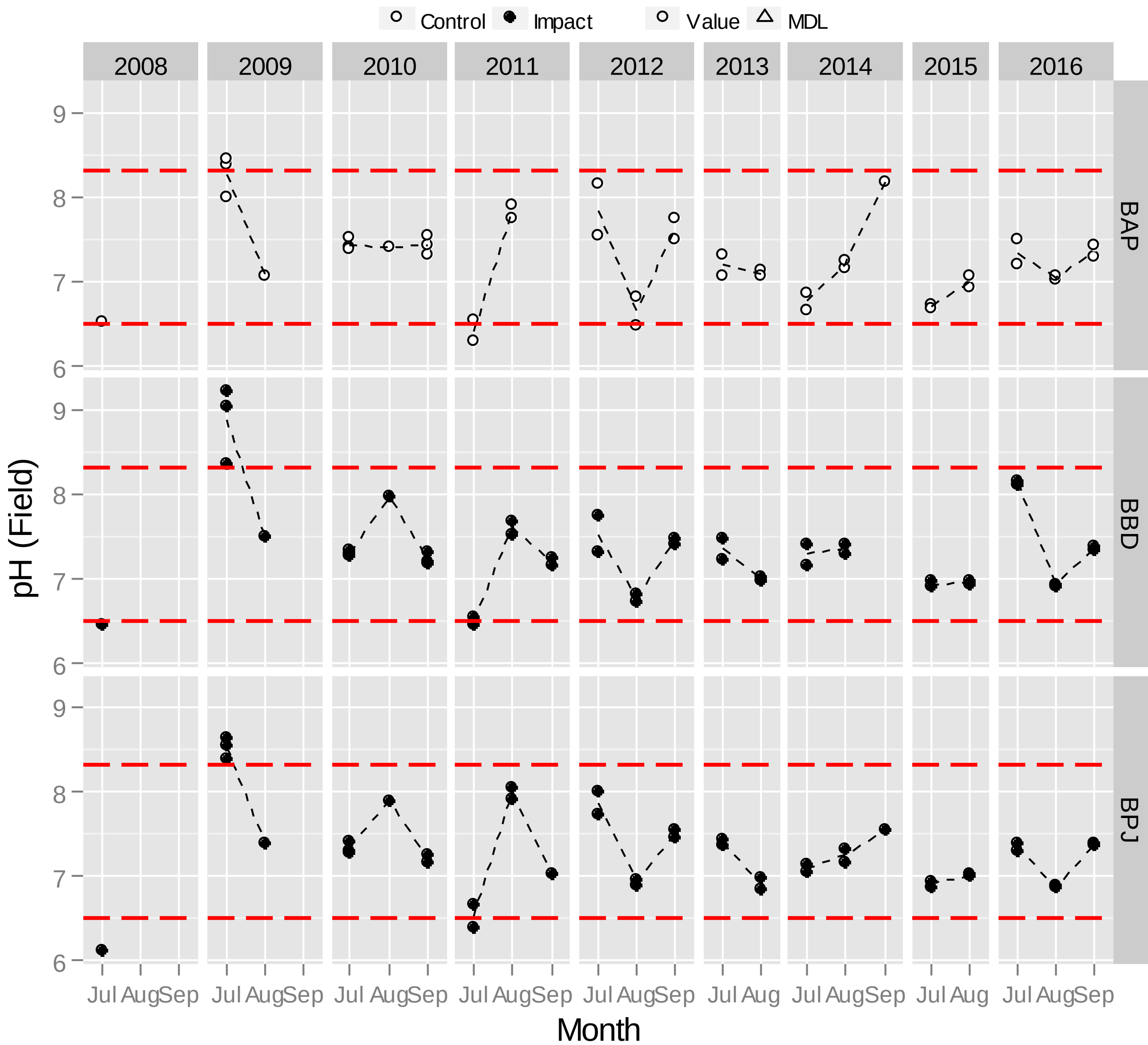


Figure 3.3–8. Laboratory-measured pH in water samples from Baker Lake since 2008.

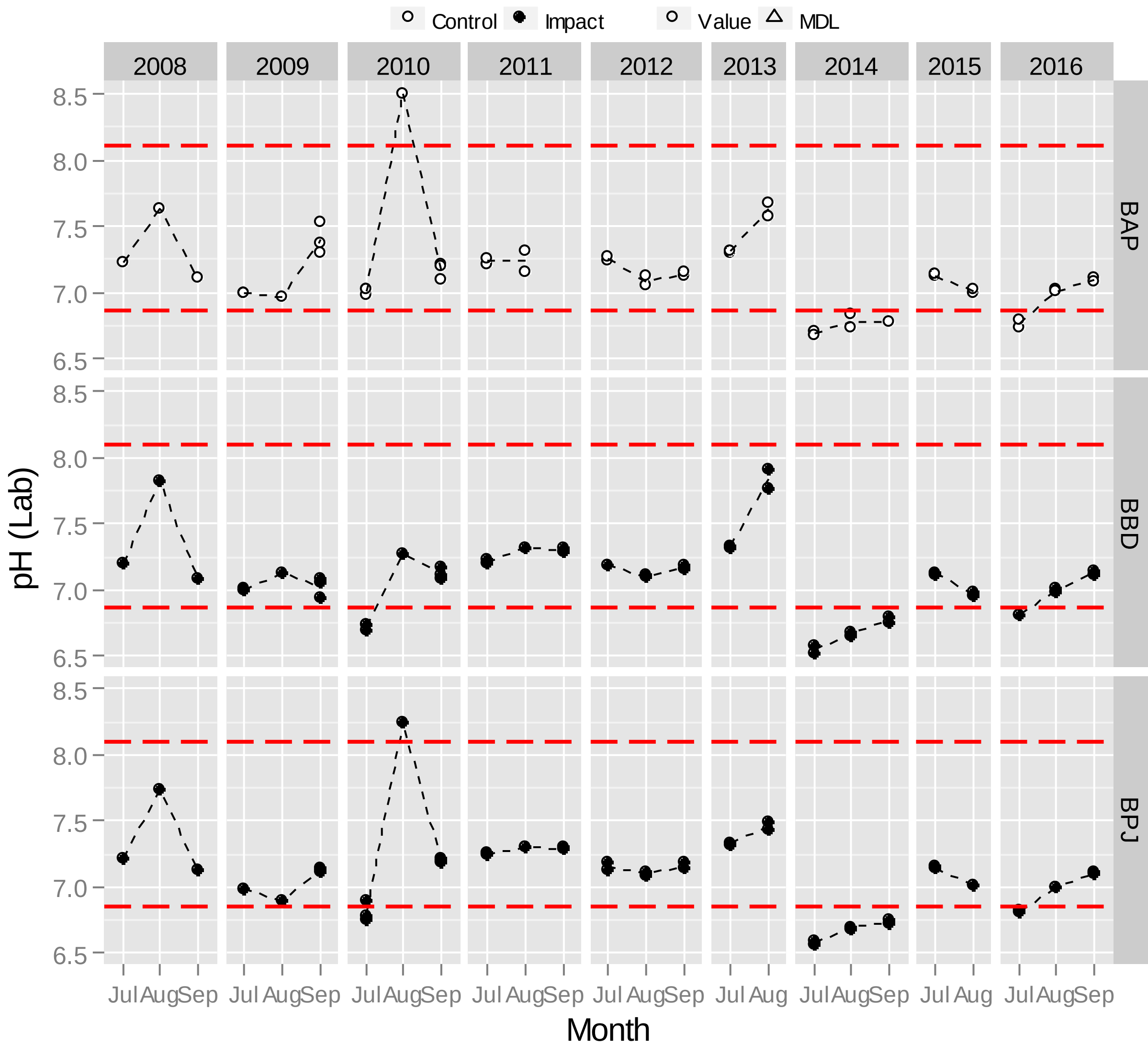


Figure 3.3–9. Total Suspended Solids (TSS; mg/L) in water samples from Baker Lake since 2008.

Note: TSS data from 2014 were excluded due to data quality issues (see Azimuth, 2015c for more detail).

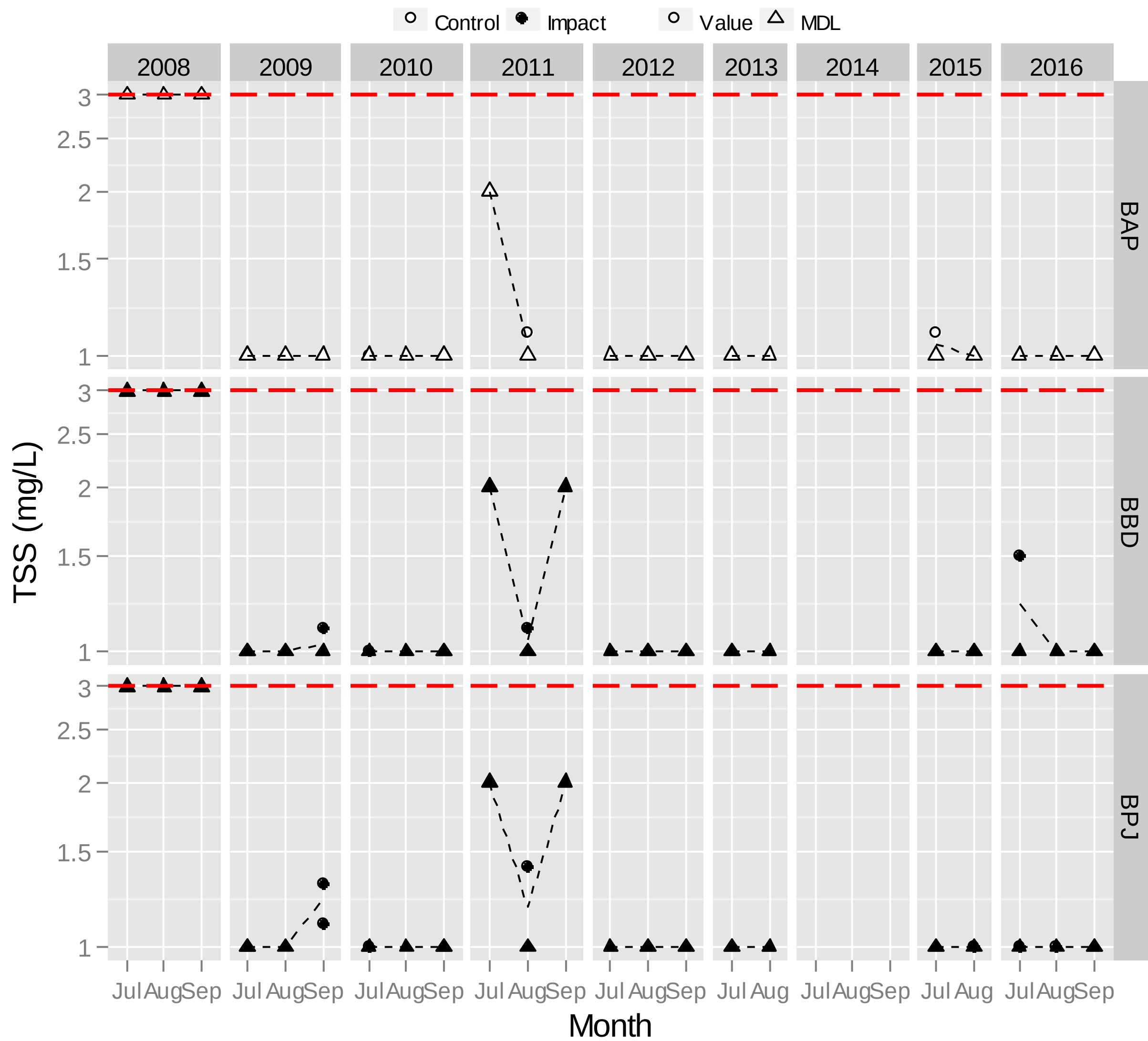


Figure 3.3–10. Total Dissolved Solids (TDS; mg/L) in water samples from Baker Lake since 2008.

Note: TDS data from 2014 were excluded due to data quality issues (see Azimuth, 2015c for more detail).

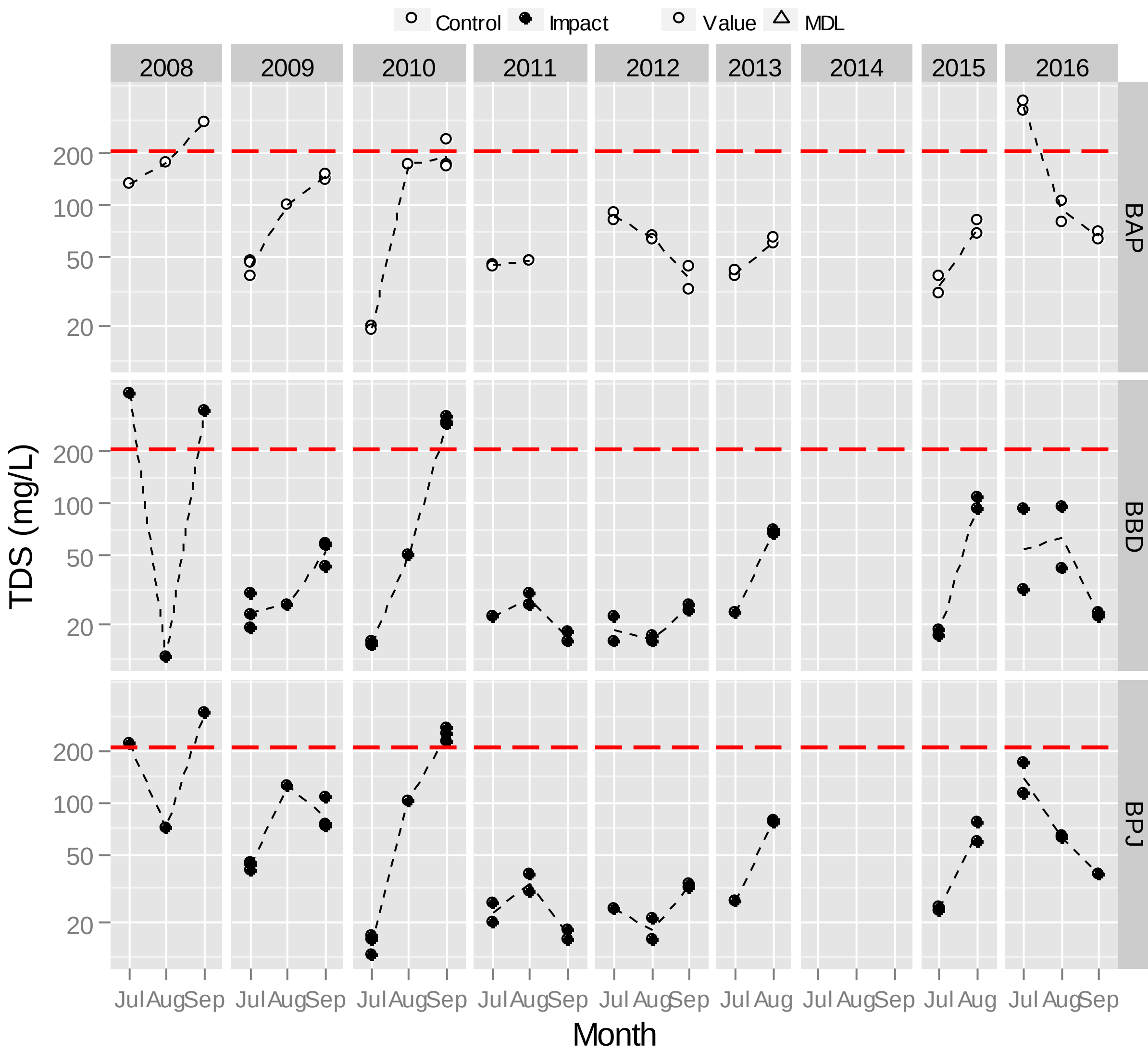


Figure 3.3–11. Bicarbonate Alkalinity (mg/L) in water samples from Baker Lake since 2008.

Note: Bicarbonate alkalinity data from 2014 were excluded due to data quality issues (see Azimuth, 2015c for more detail).

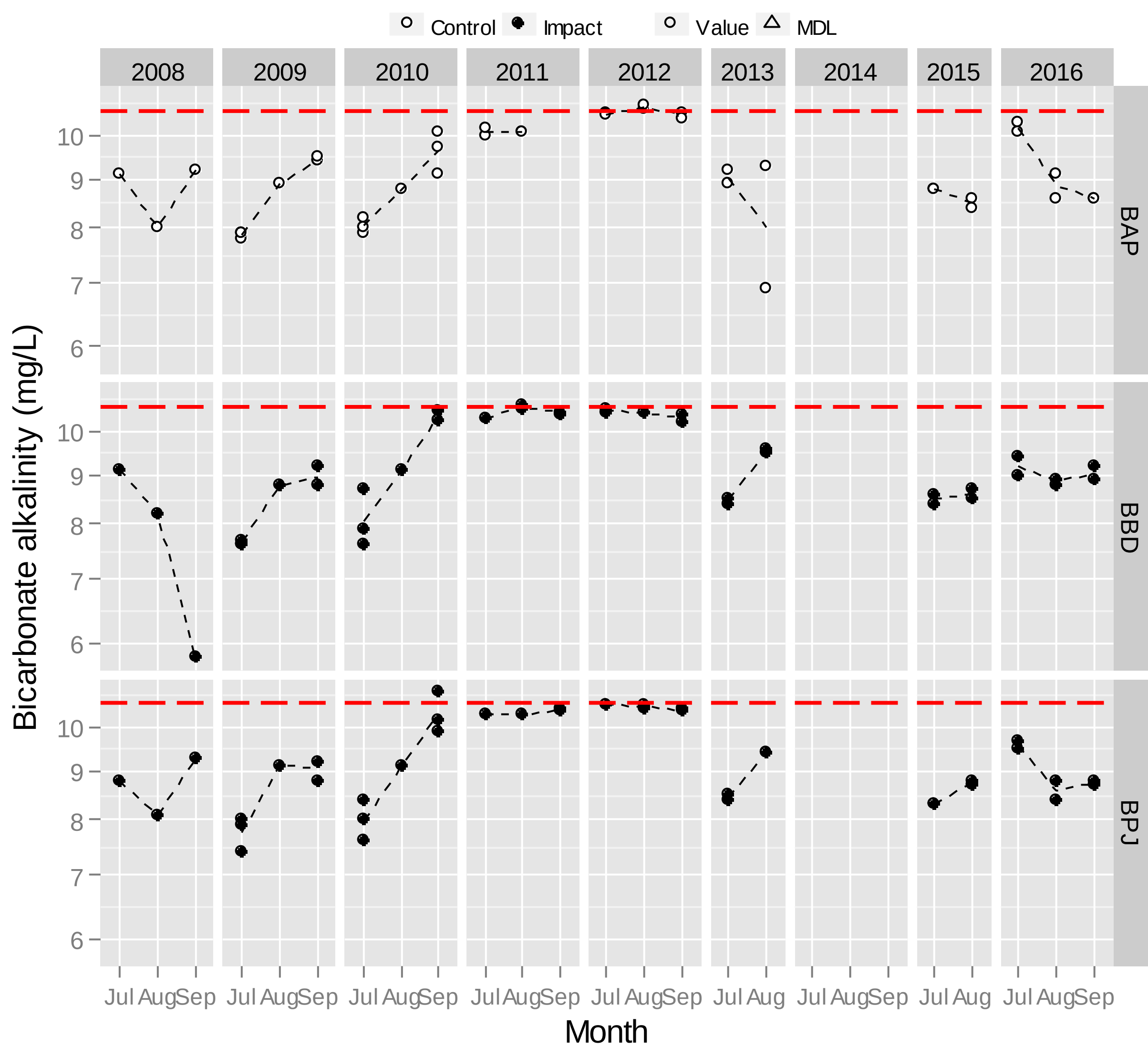


Figure 3.3–12. Total Alkalinity (mg/L) in water samples from Baker Lake since 2008.

Note: Total alkalinity data from 2014 were excluded due to data quality issues (see Azimuth, 2015c for more detail).

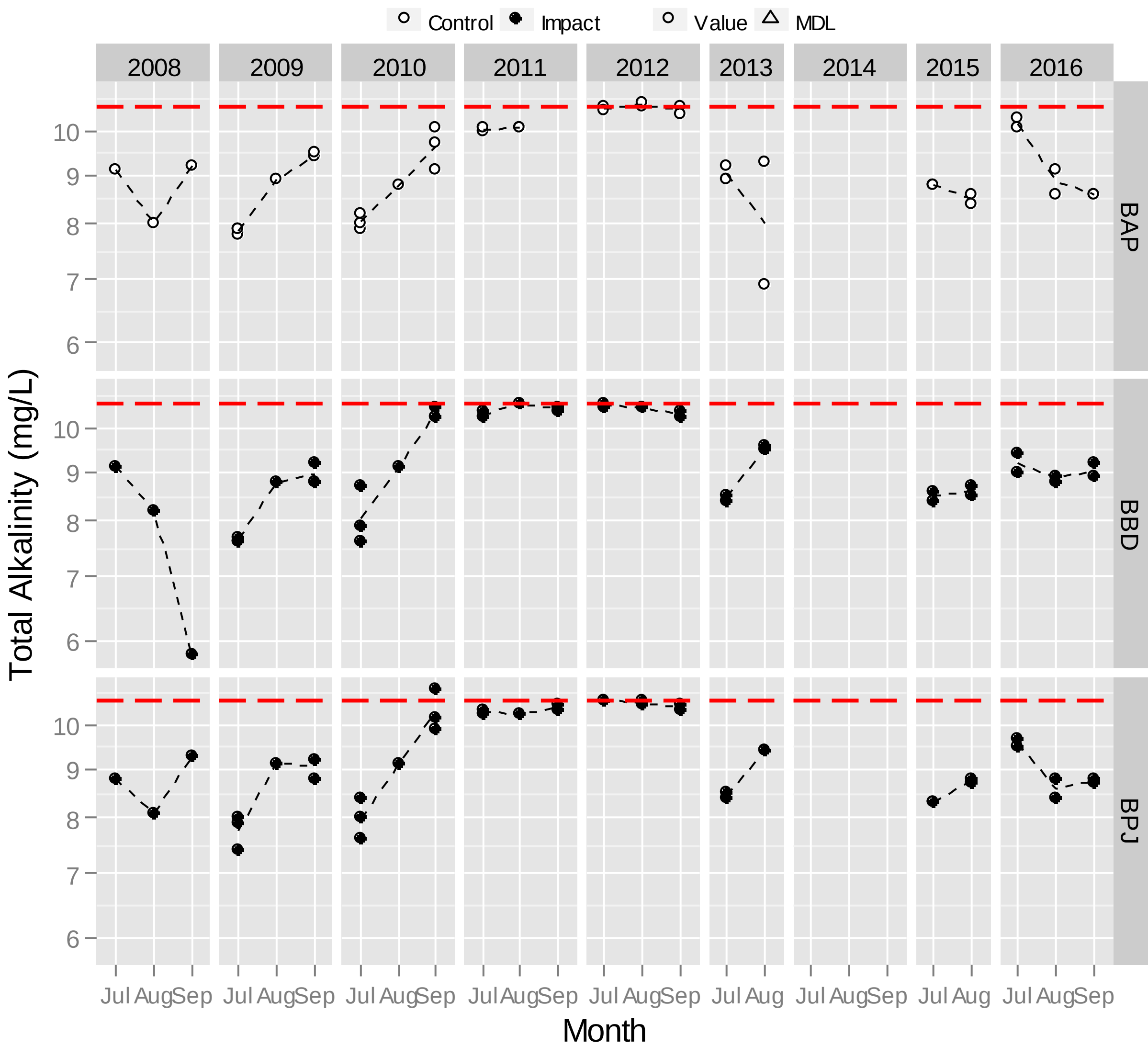


Figure 3.3–13. Ammonia-N (mg/L) in water samples from Baker Lake since 2008.

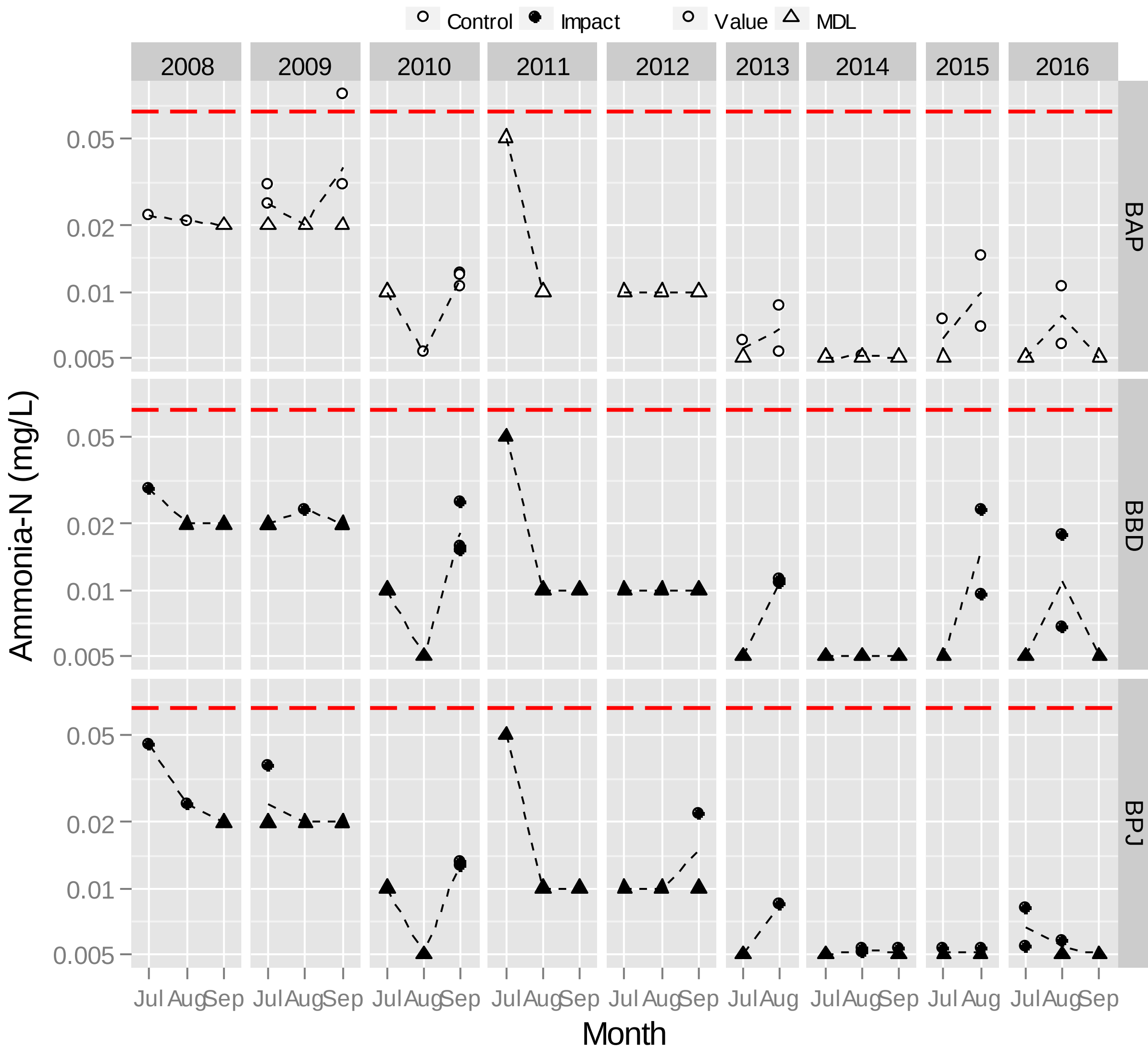


Figure 3.3–14. Chloride (mg/L) in water samples from Baker Lake since 2008.

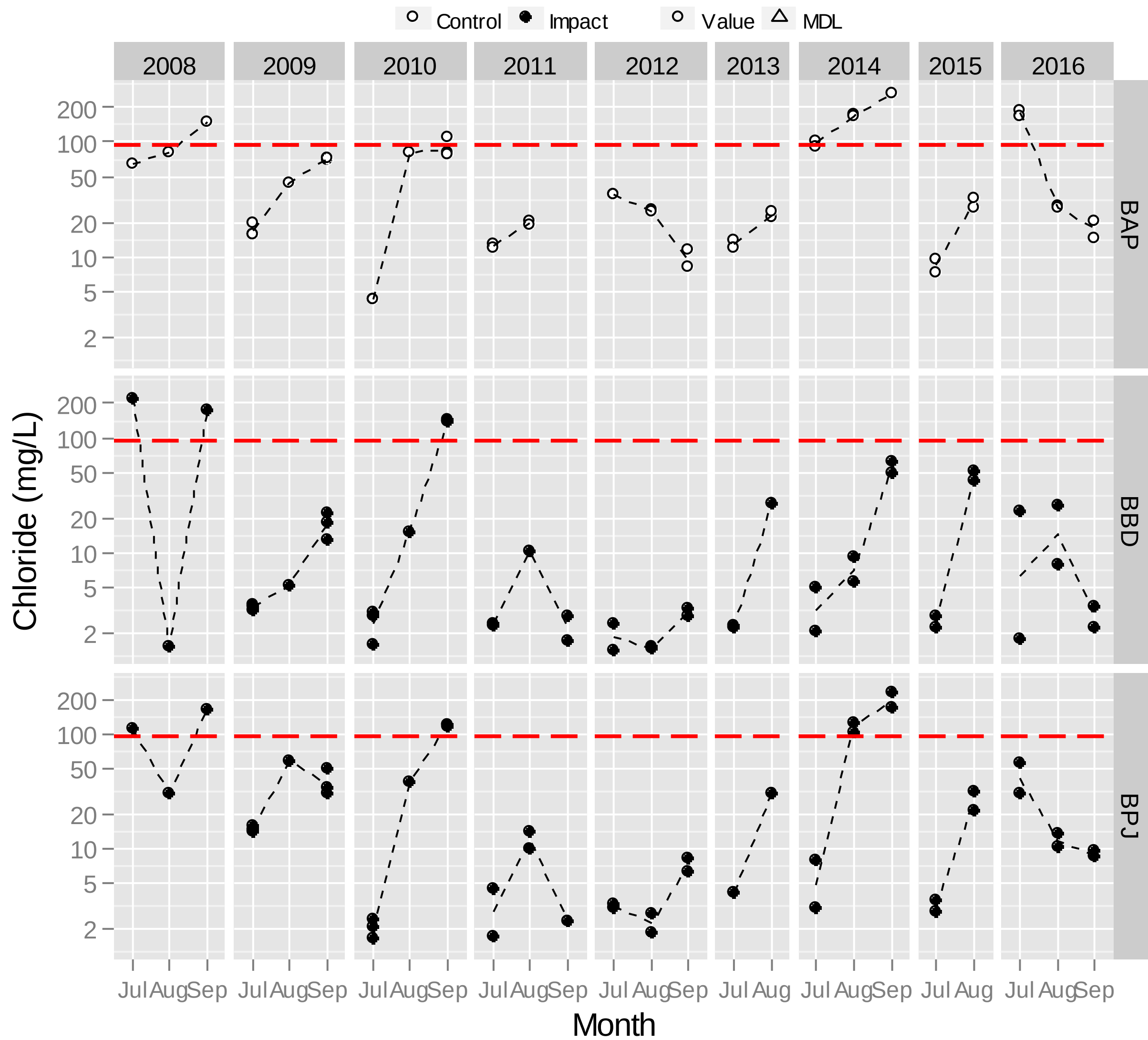


Figure 3.3–15. Nitrate-N (mg/L) in water samples from Baker Lake since 2008.

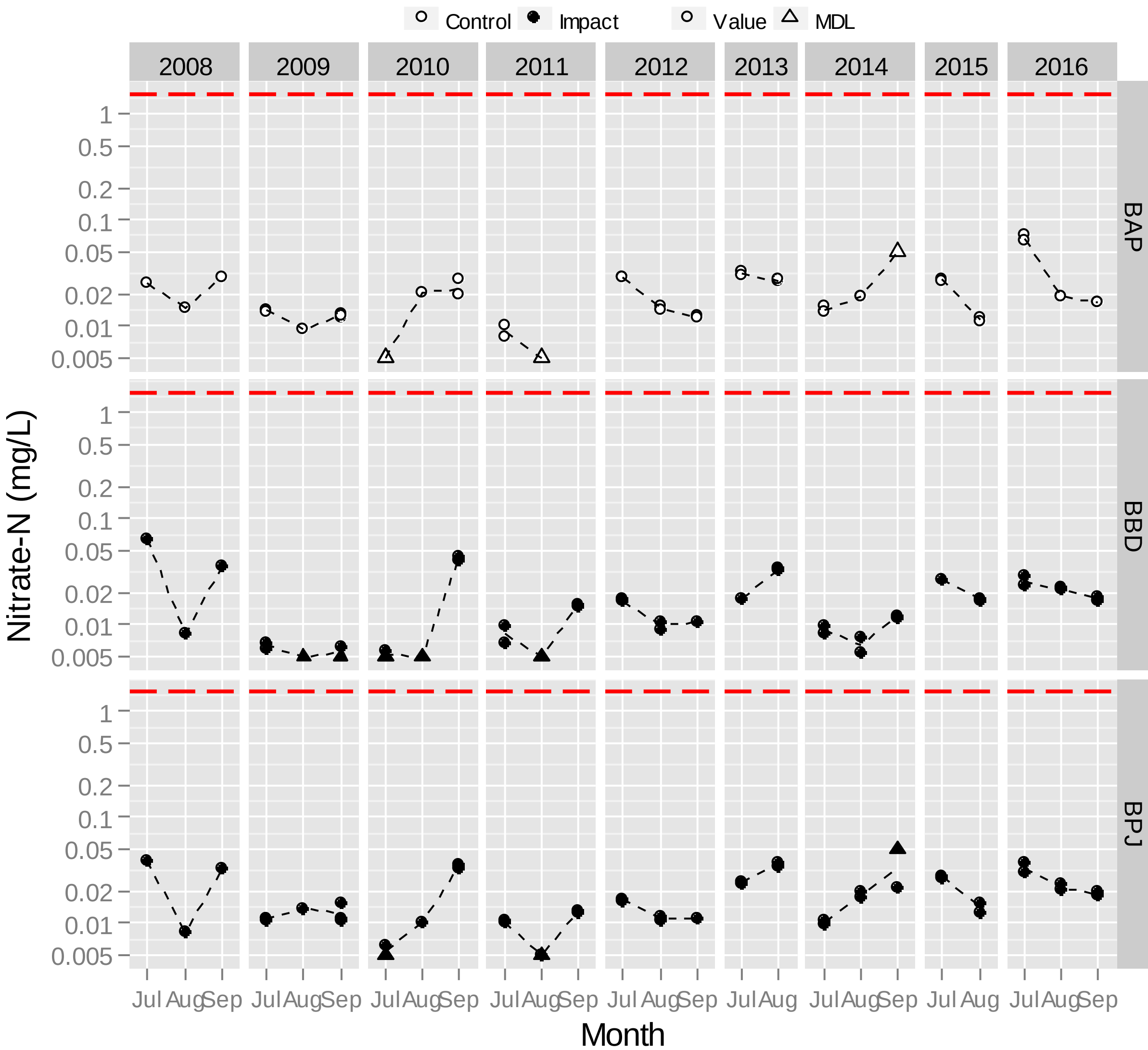


Figure 3.3–16. Total Kjeldahl Nitrogen (TKN; mg/L) in water samples from Baker Lake since 2008.

Note: TKN alkalinity data from 2014 were excluded due to data quality issues (see Azimuth, 2015c for more detail).

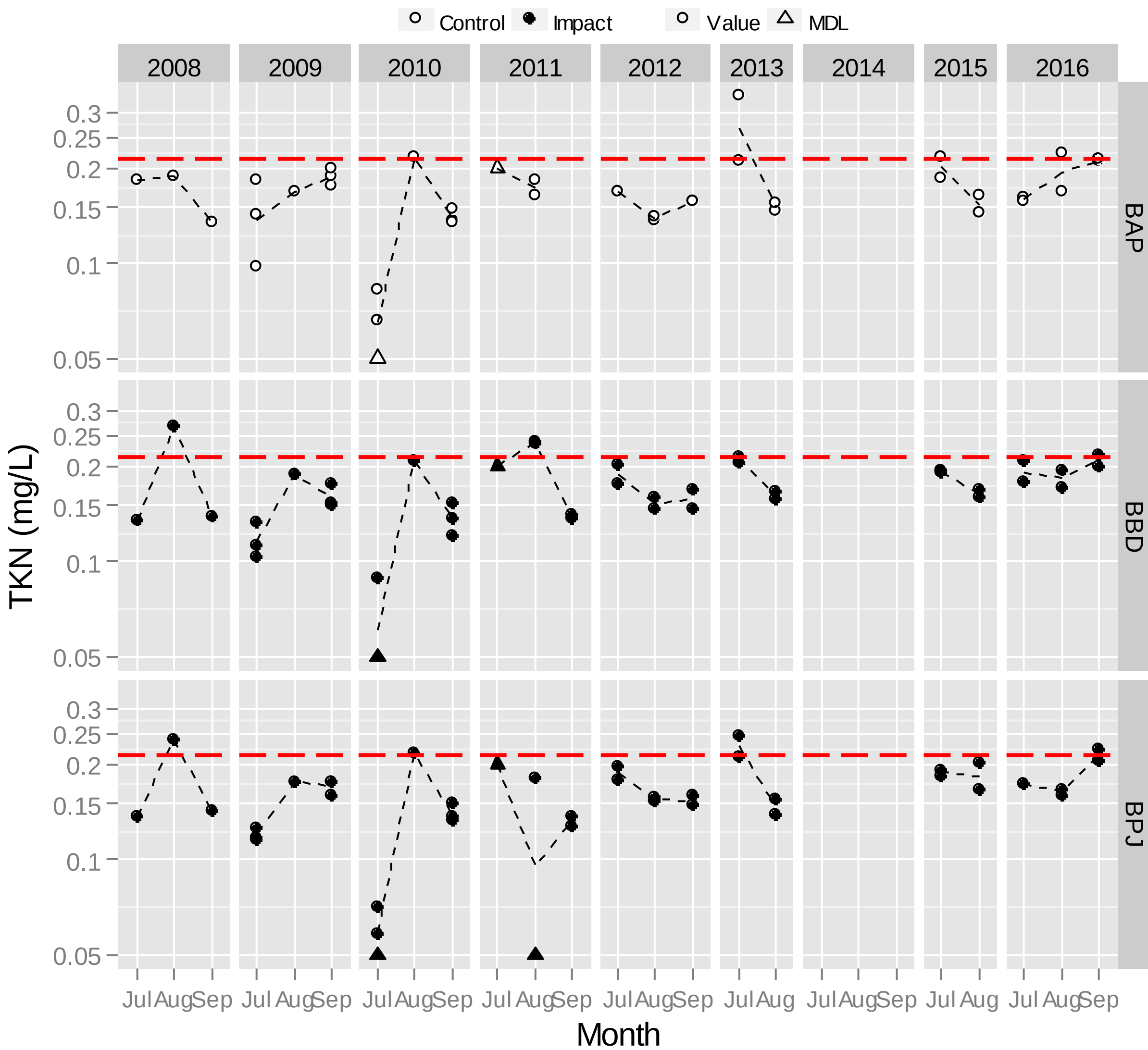


Figure 3.3–17. Total Phosphorus (mg/L) in water samples from Baker Lake since 2008.

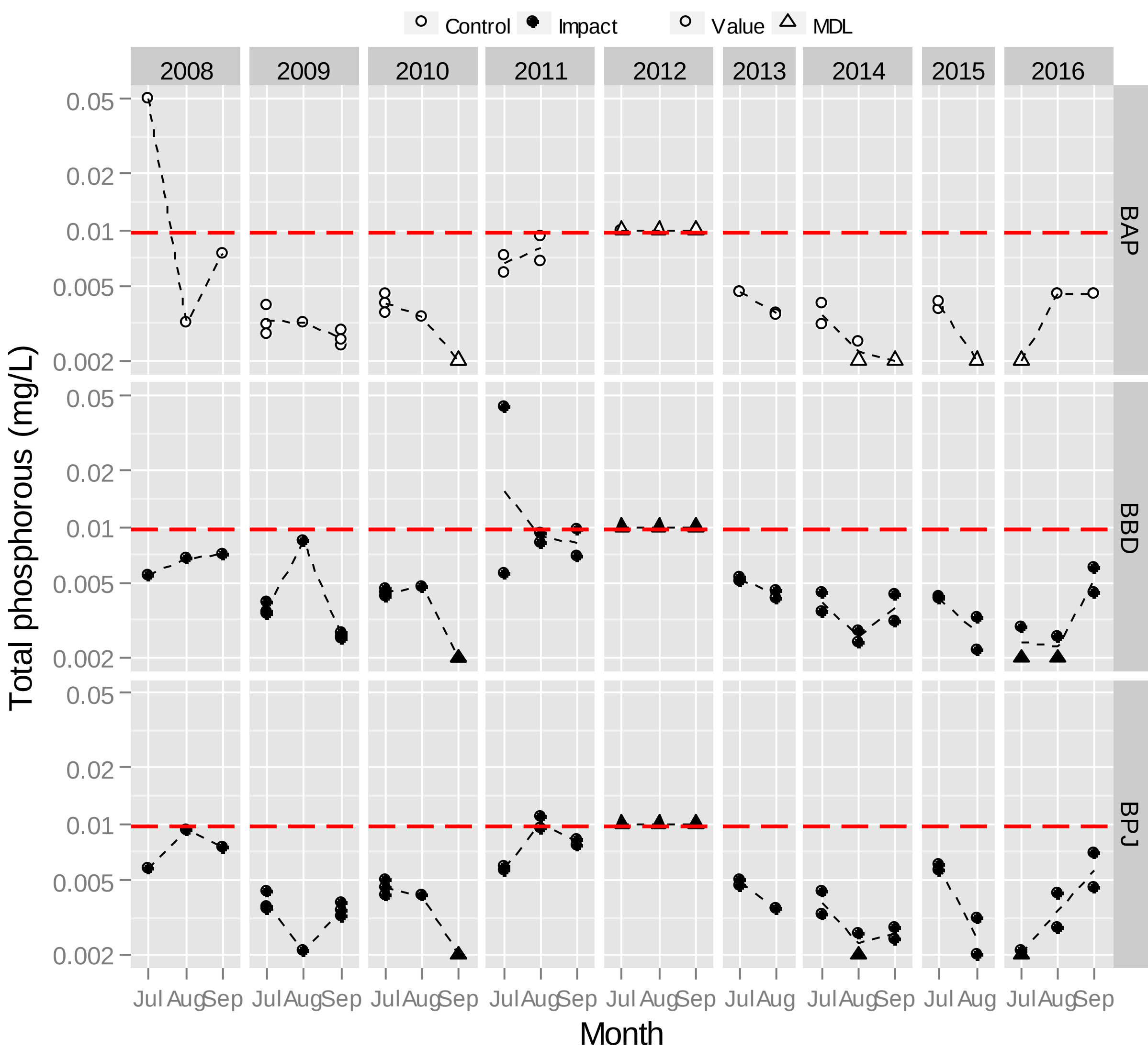


Figure 3.3–18. Total Ortho-phosphate (mg/L) in water samples from Baker Lake since 2008.

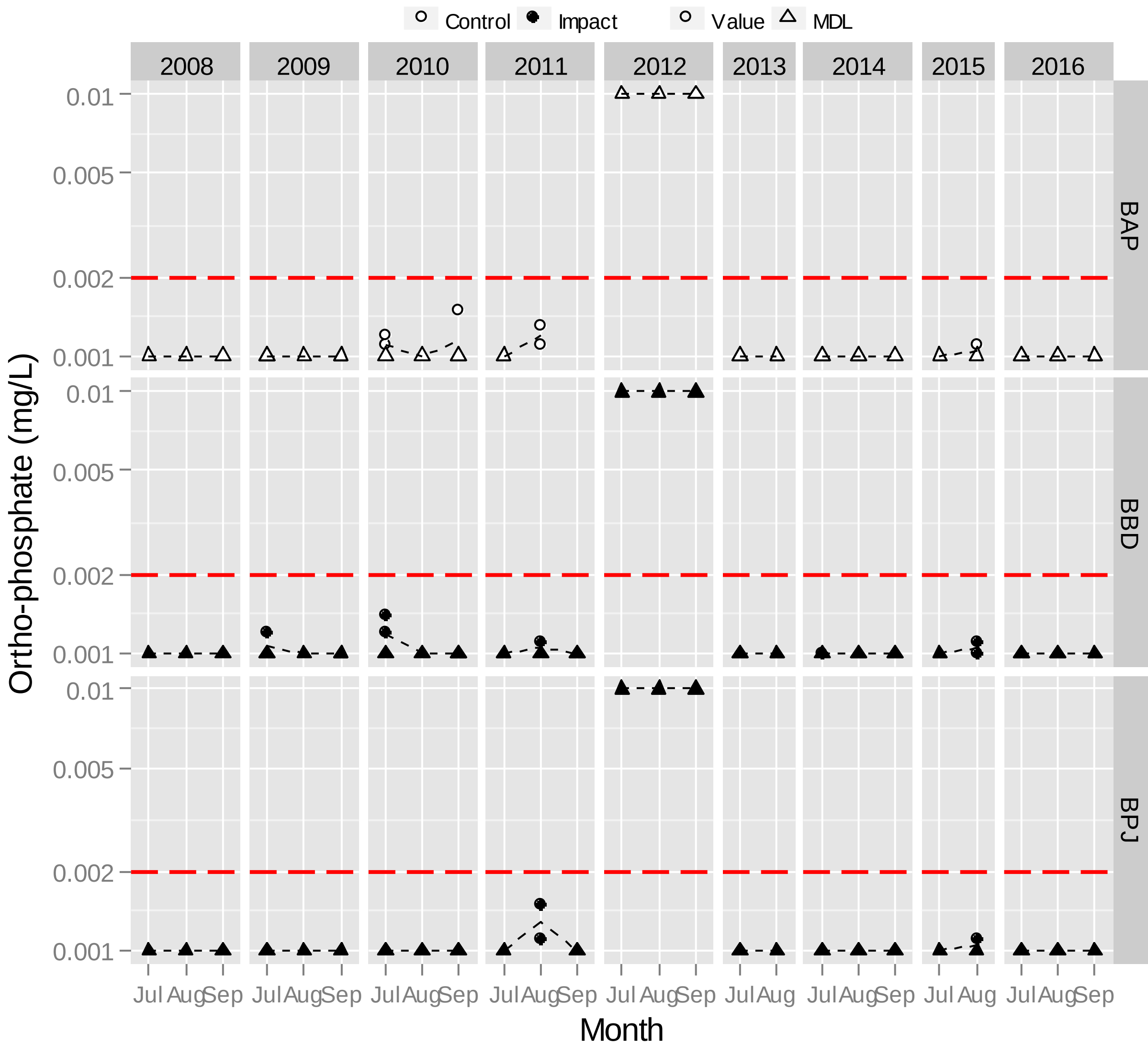


Figure 3.3–19. Reactive Silica (mg/L) in water samples from Baker Lake since 2008.

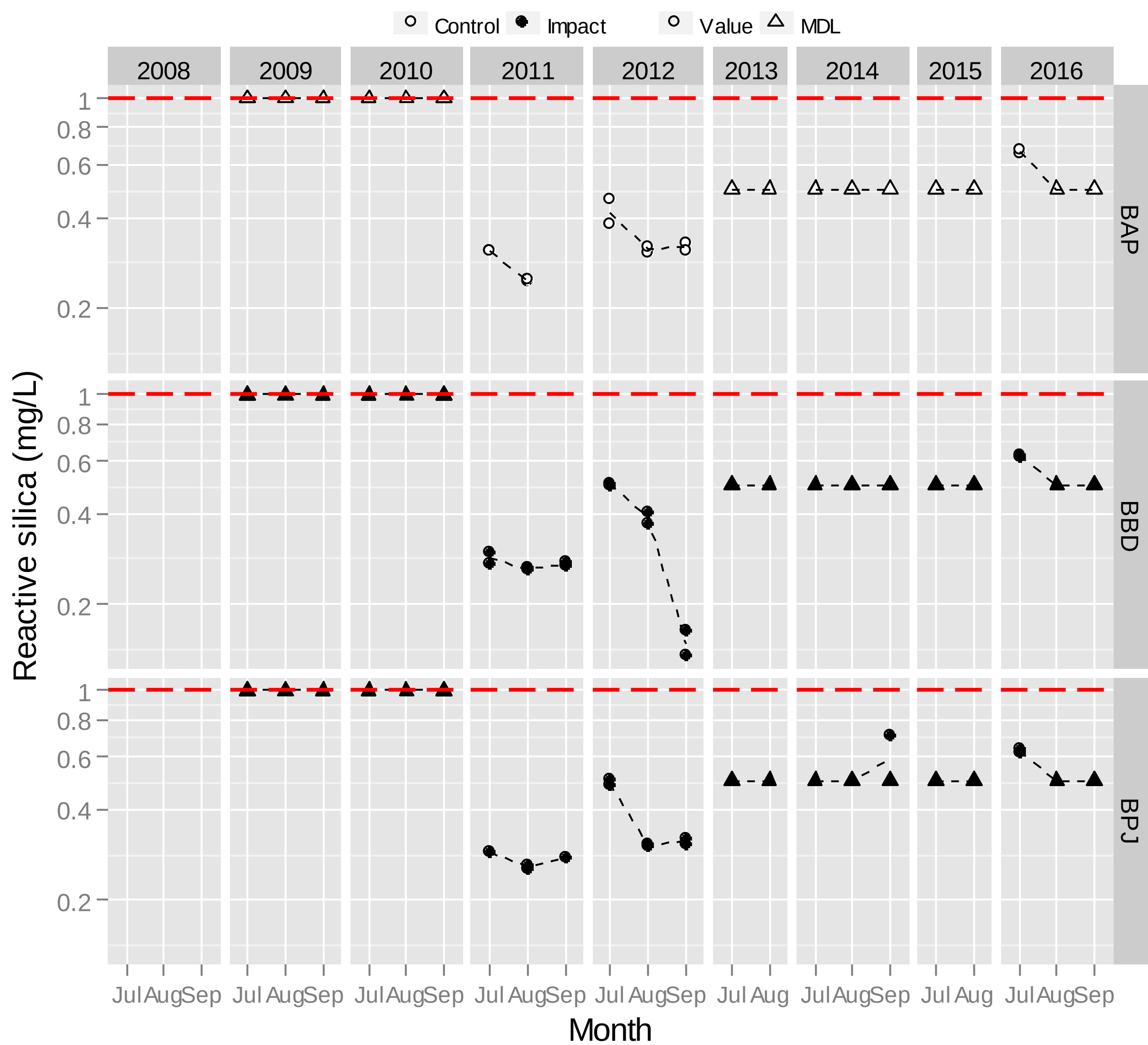


Figure 3.3–20. Sulphate (mg/L) in water samples from Baker Lake since 2008.

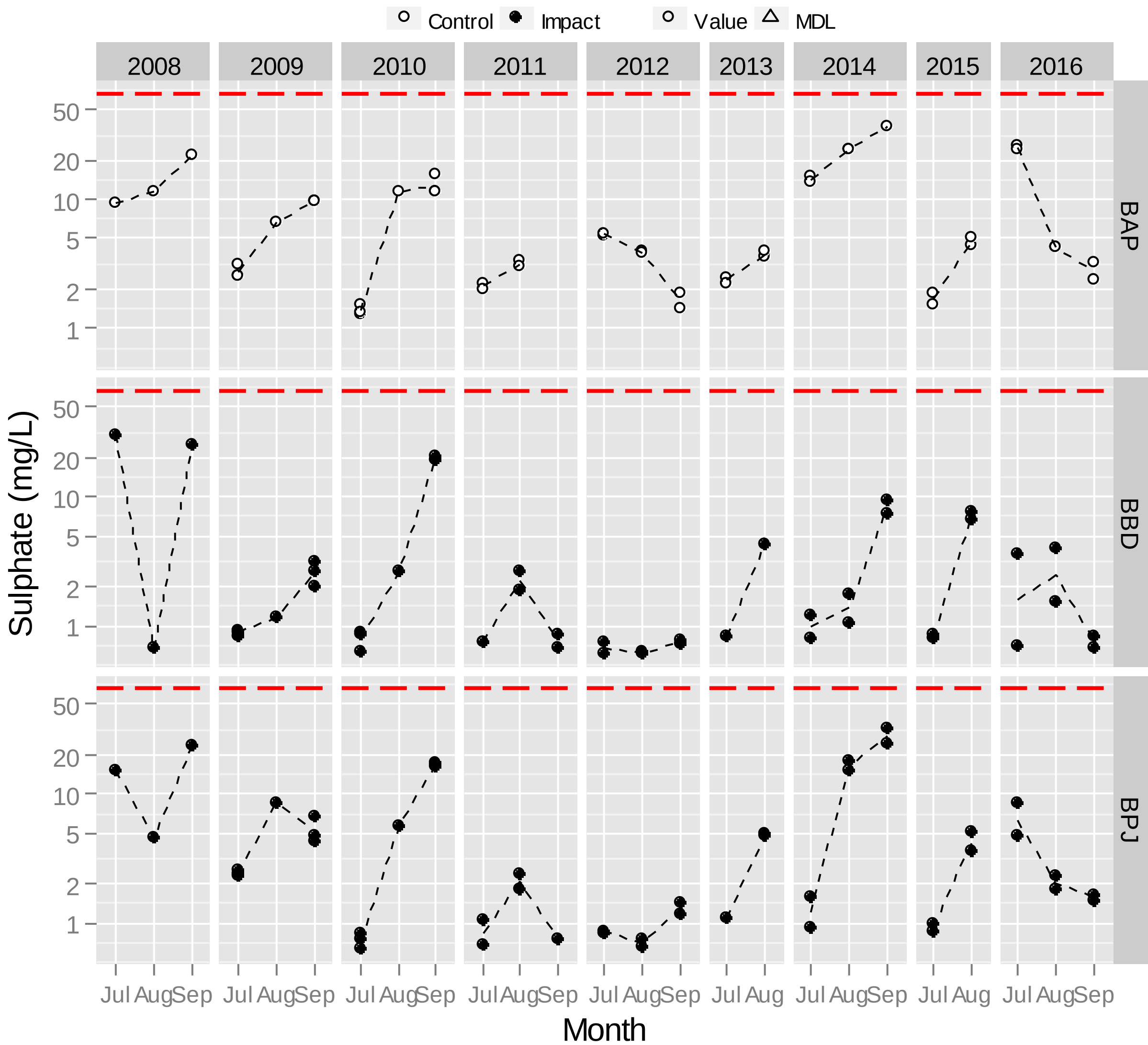


Figure 3.3–21. Dissolved Organic Carbon (DOC; mg/L) in water samples from Baker Lake since 2008.

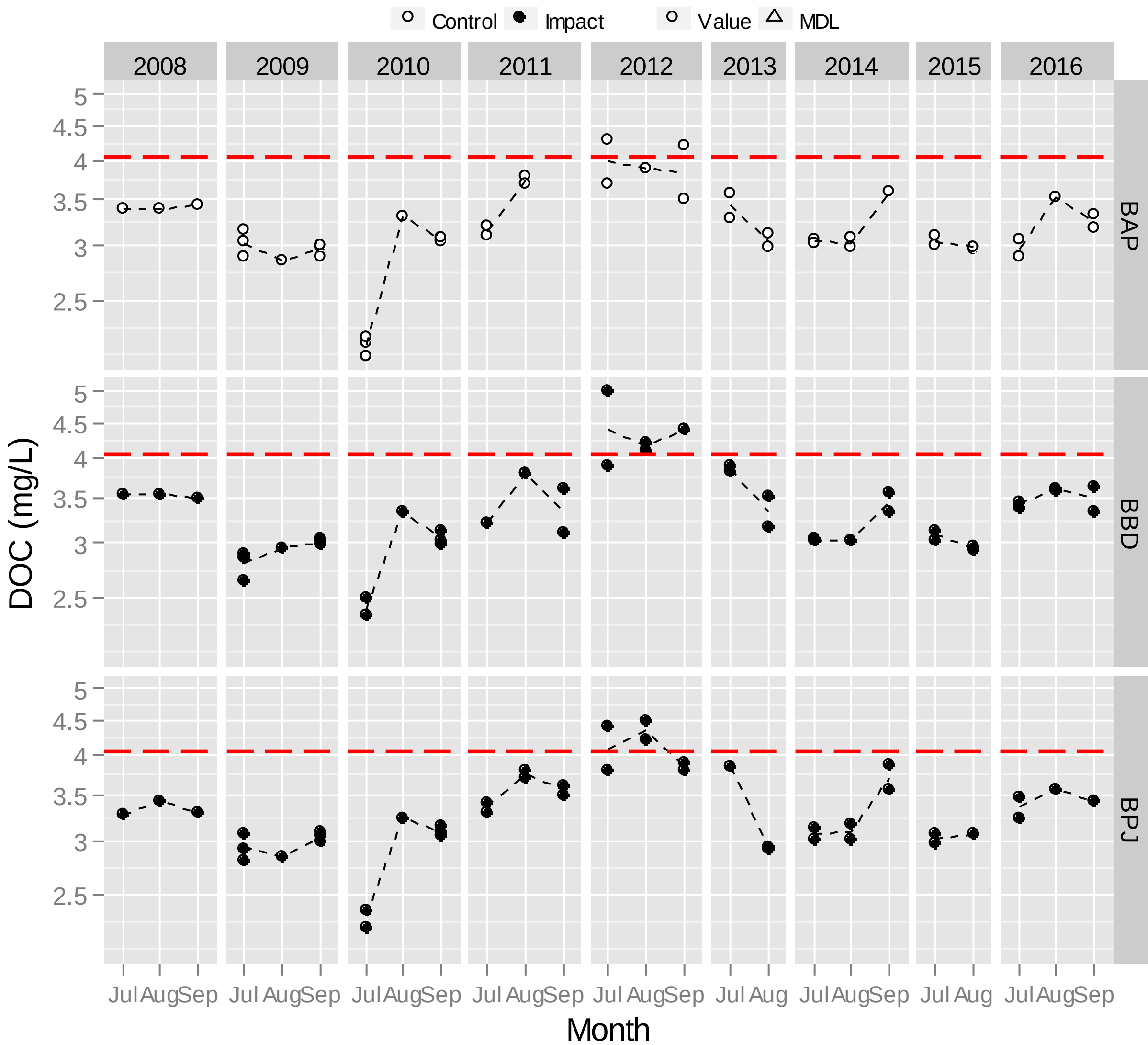


Figure 3.3–22. Total Organic Carbon (TOC; mg/L) in water samples from Baker Lake since 2008.

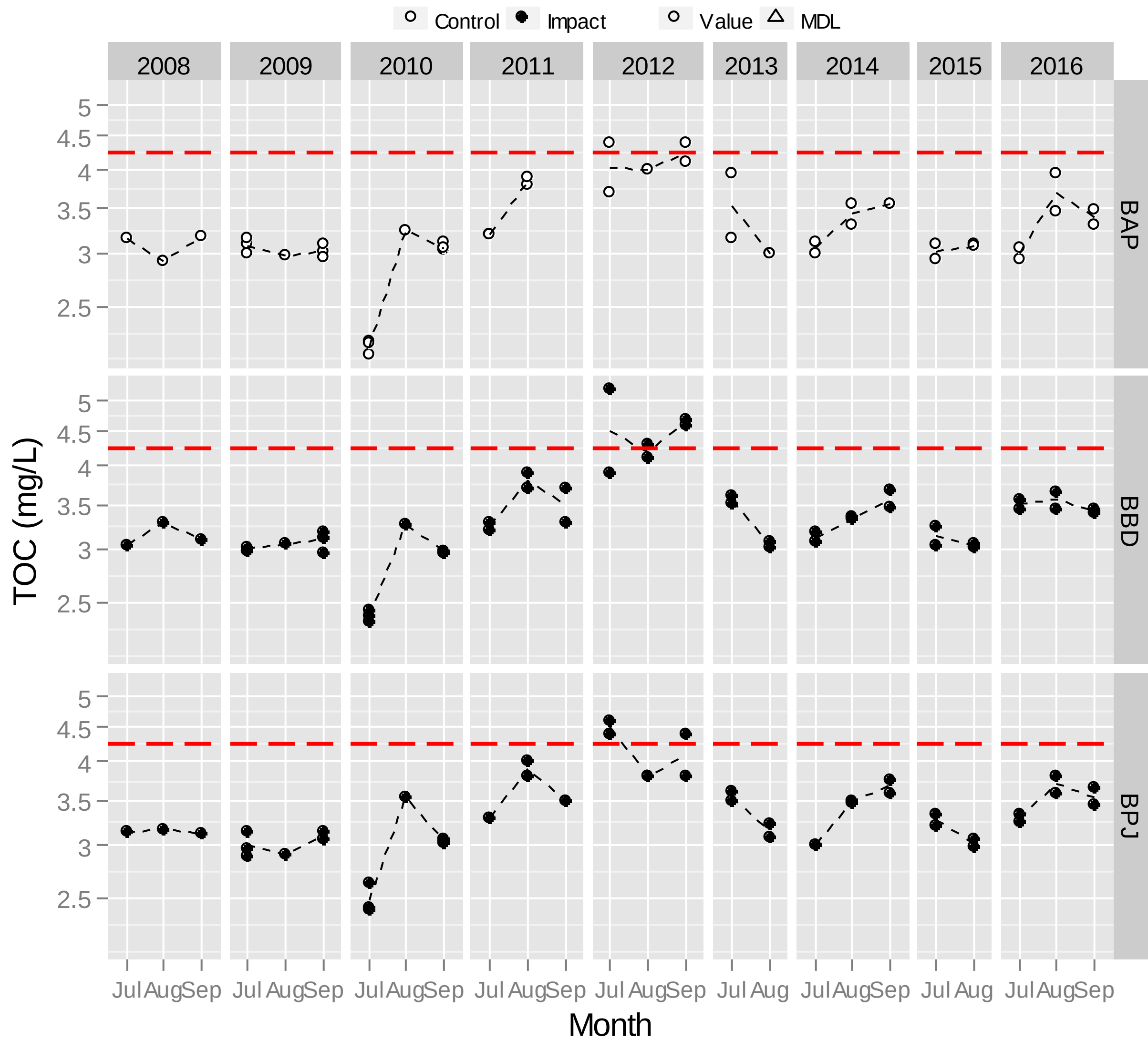


Figure 3.3–23. Total Aluminum (mg/L) in water samples from Baker Lake since 2008.

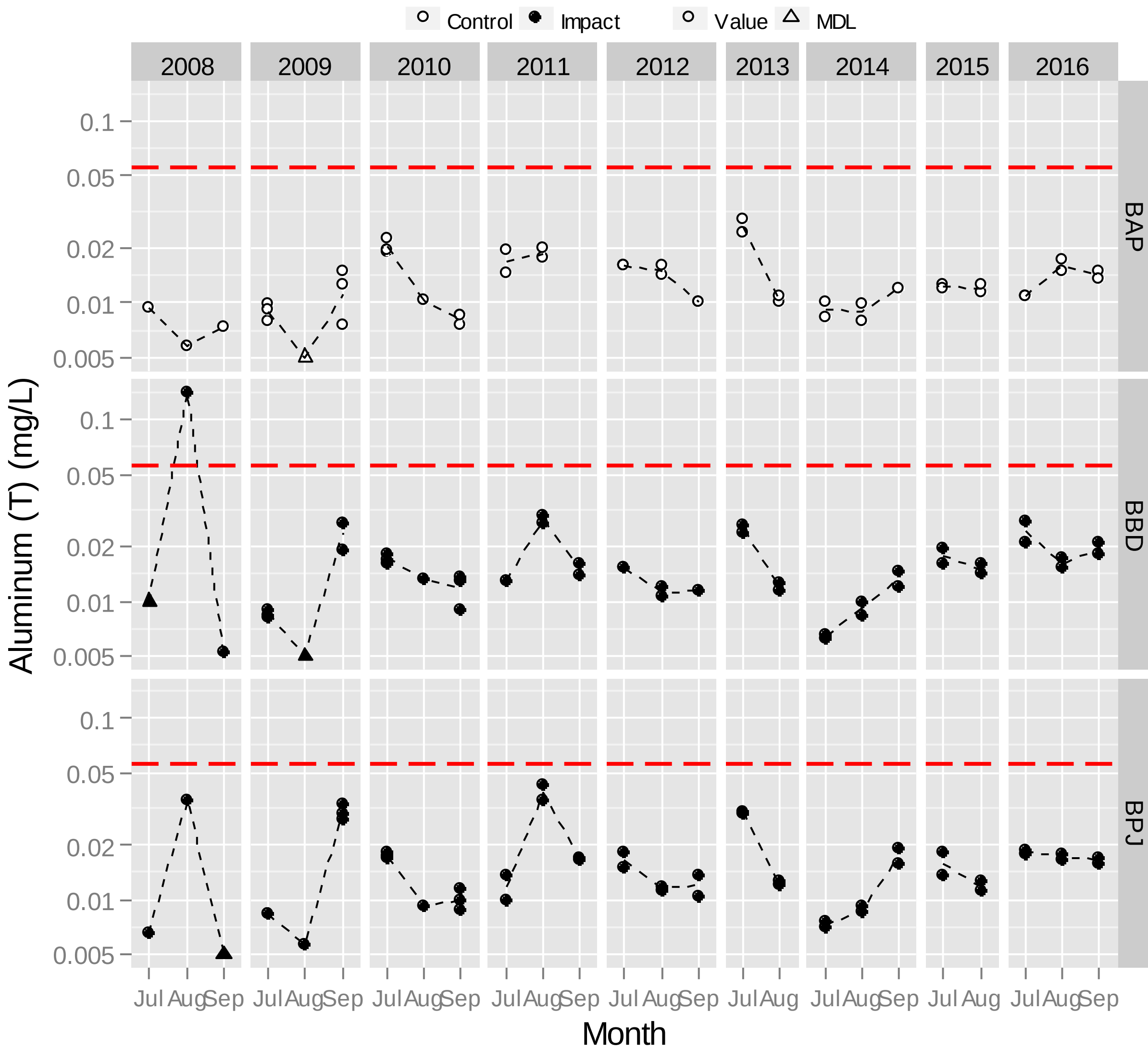


Figure 3.3–24. Total Arsenic (mg/L) in water samples from Baker Lake since 2008.

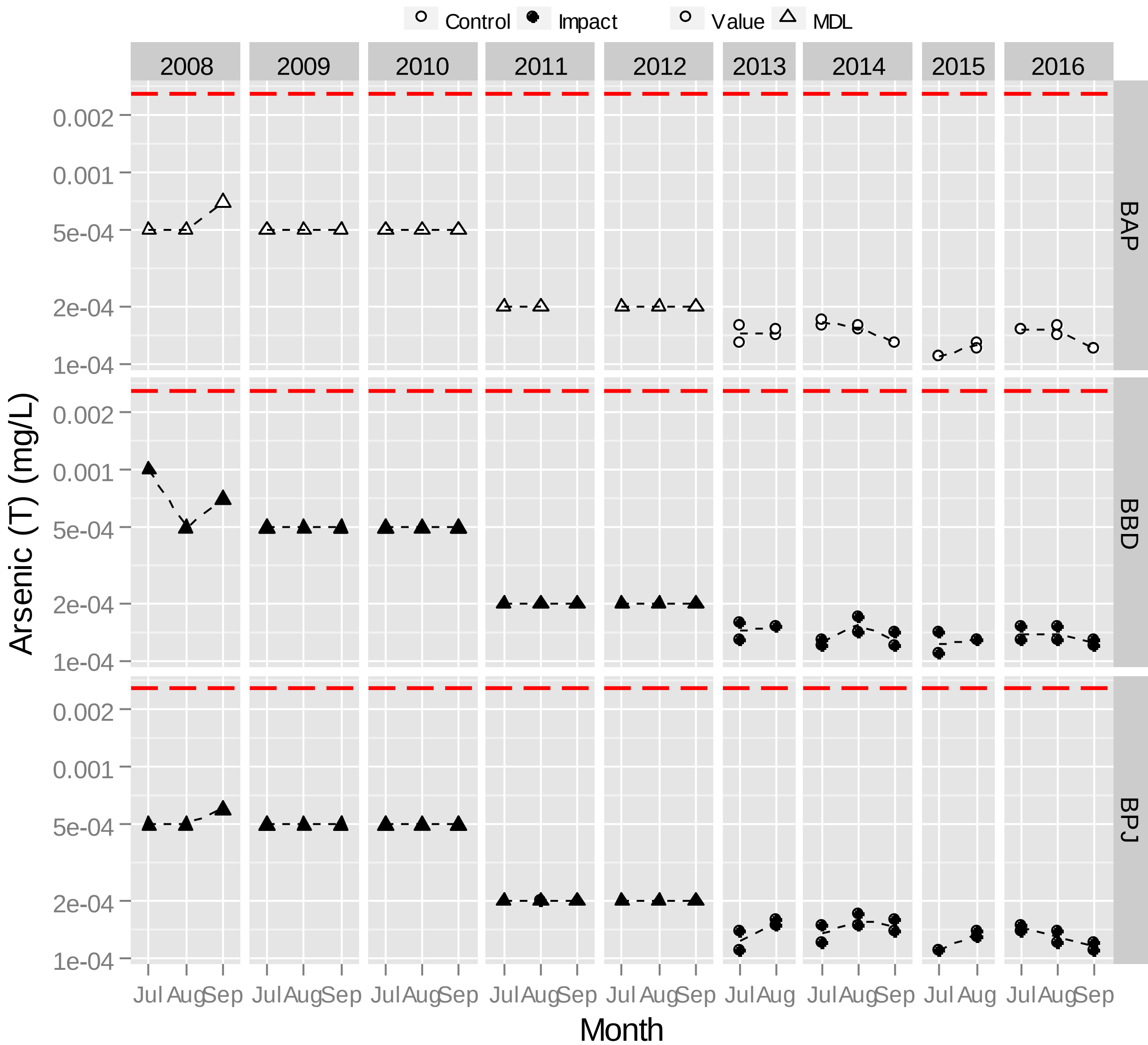


Figure 3.3–25. Total Barium (mg/L) in water samples from Baker Lake since 2008.

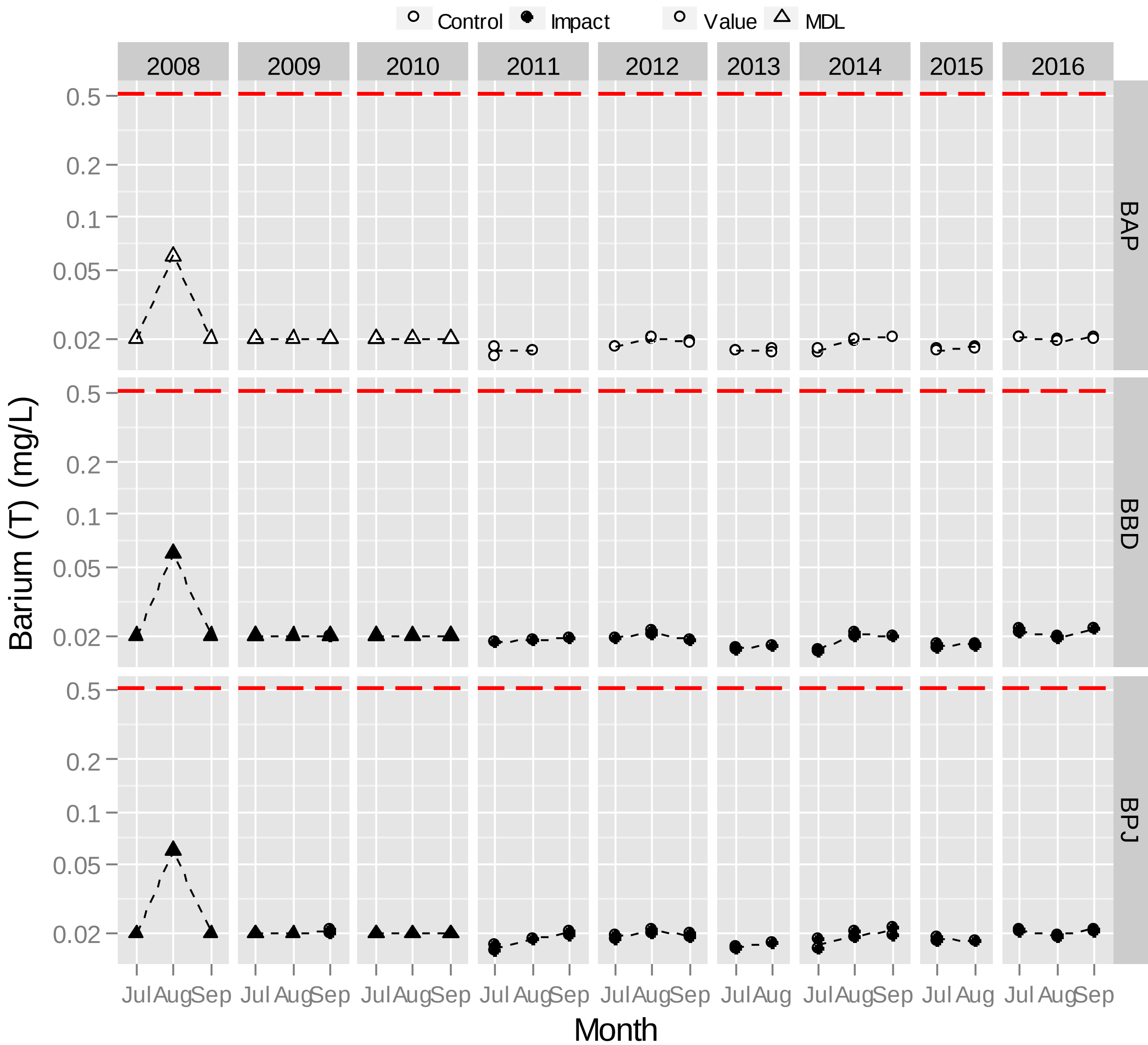


Figure 3.3–26. Total (mg/L) Boron in water samples from Baker Lake since 2008.

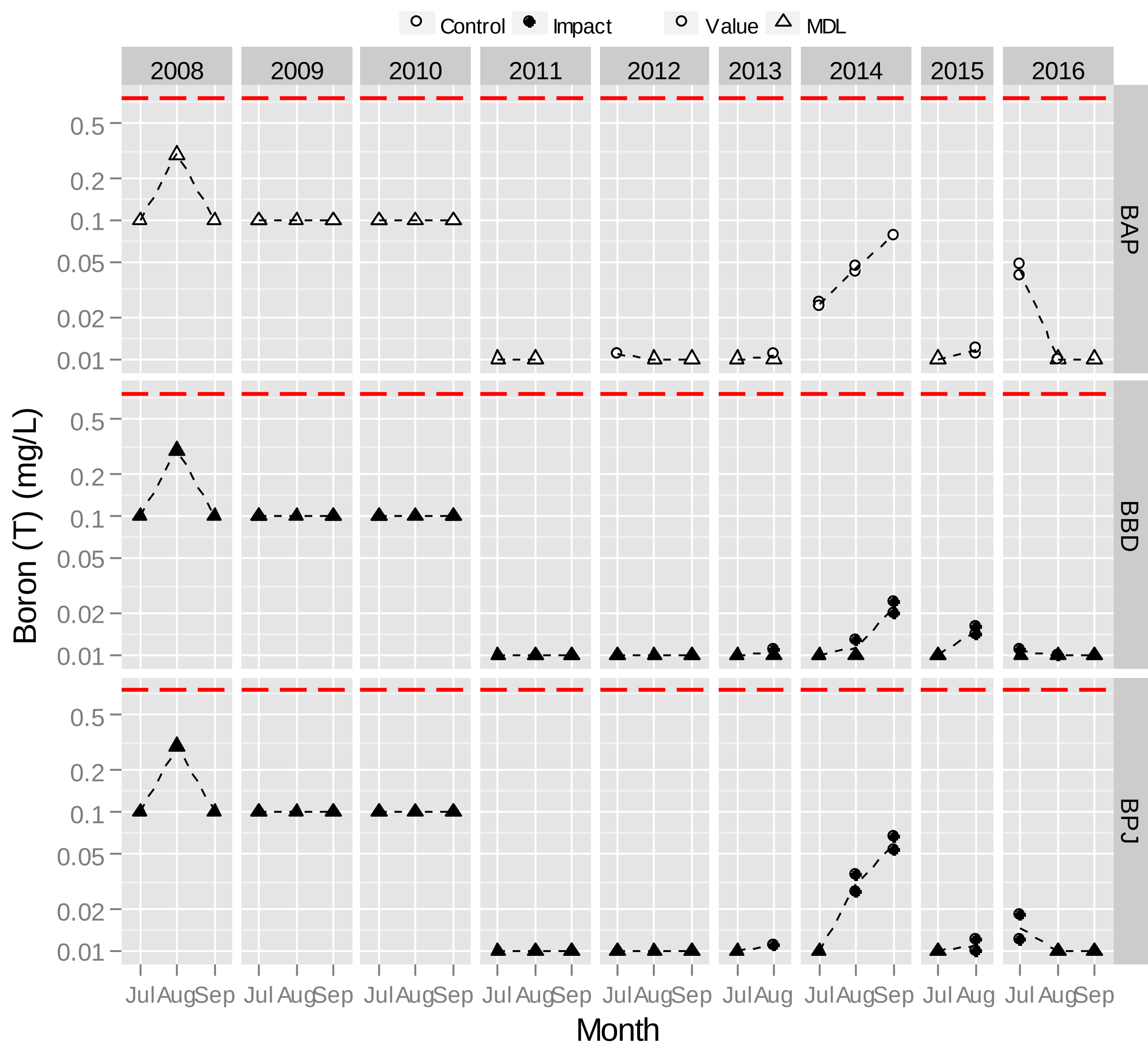


Figure 3.3–27. Total Calcium (mg/L) in water samples from Baker Lake since 2008.

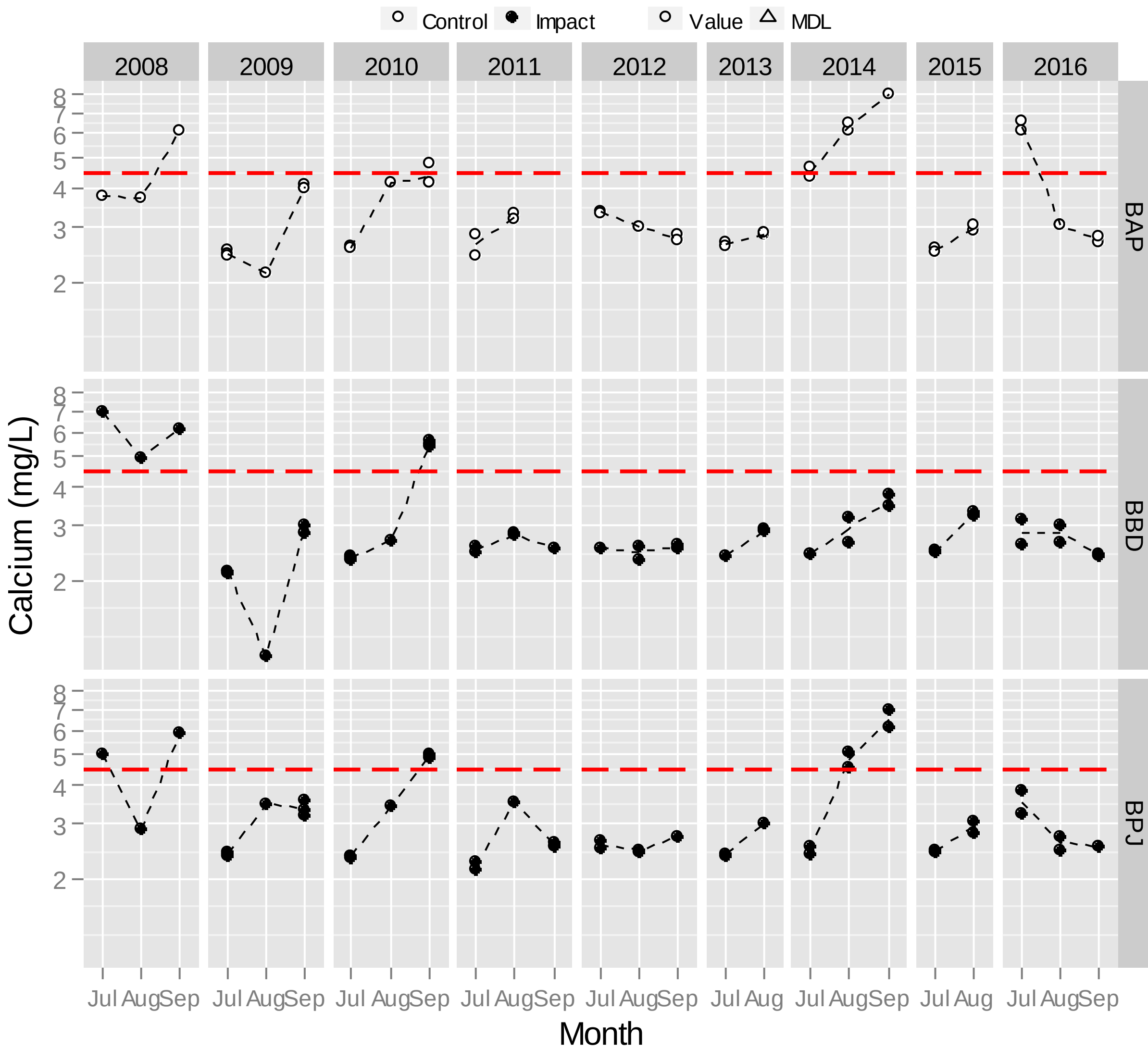


Figure 3.3–28. Total Chromium (mg/L) in water samples from Baker Lake since 2008.

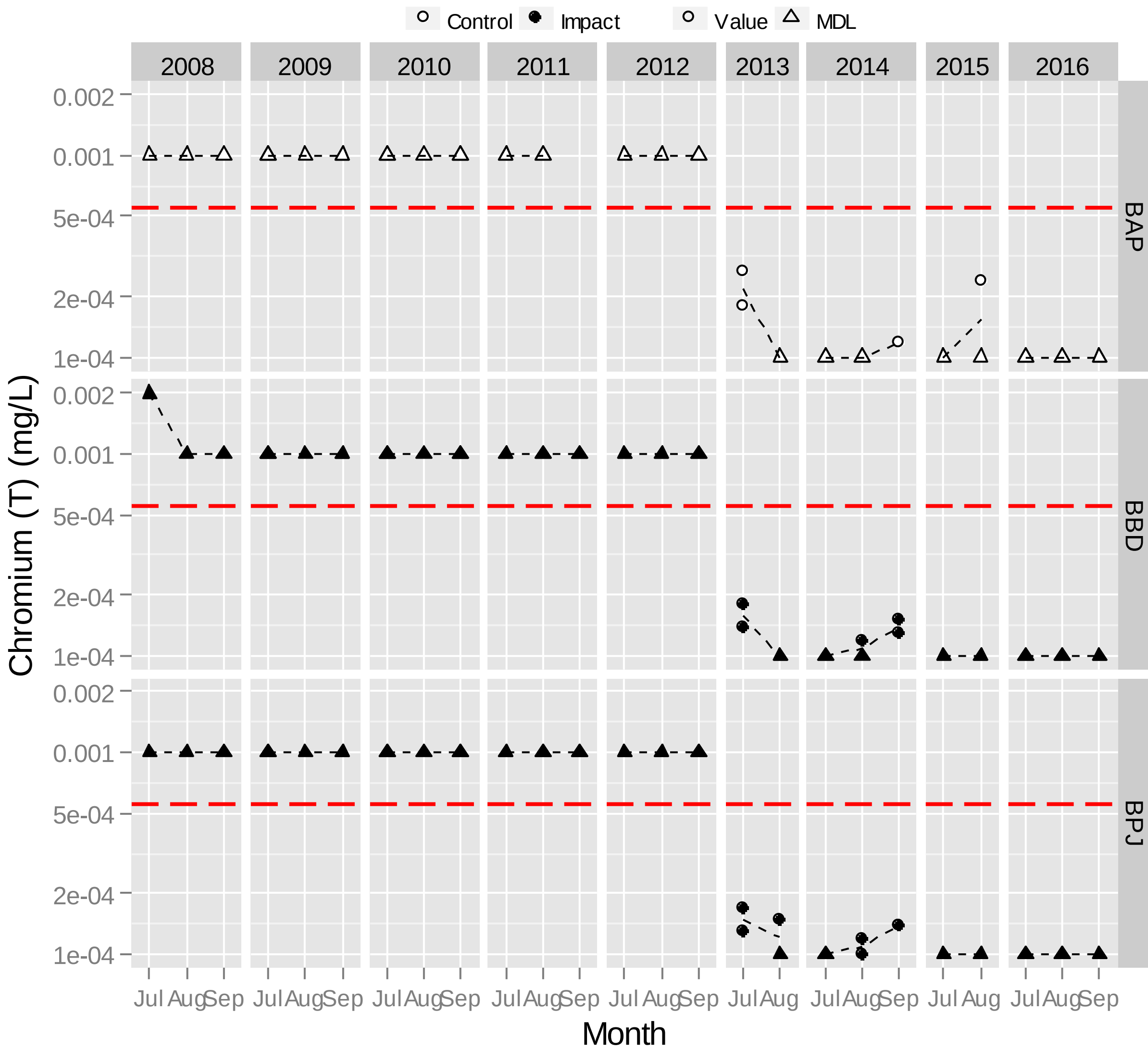


Figure 3.3–29. Total Copper (mg/L) in water samples from Baker Lake since 2008.

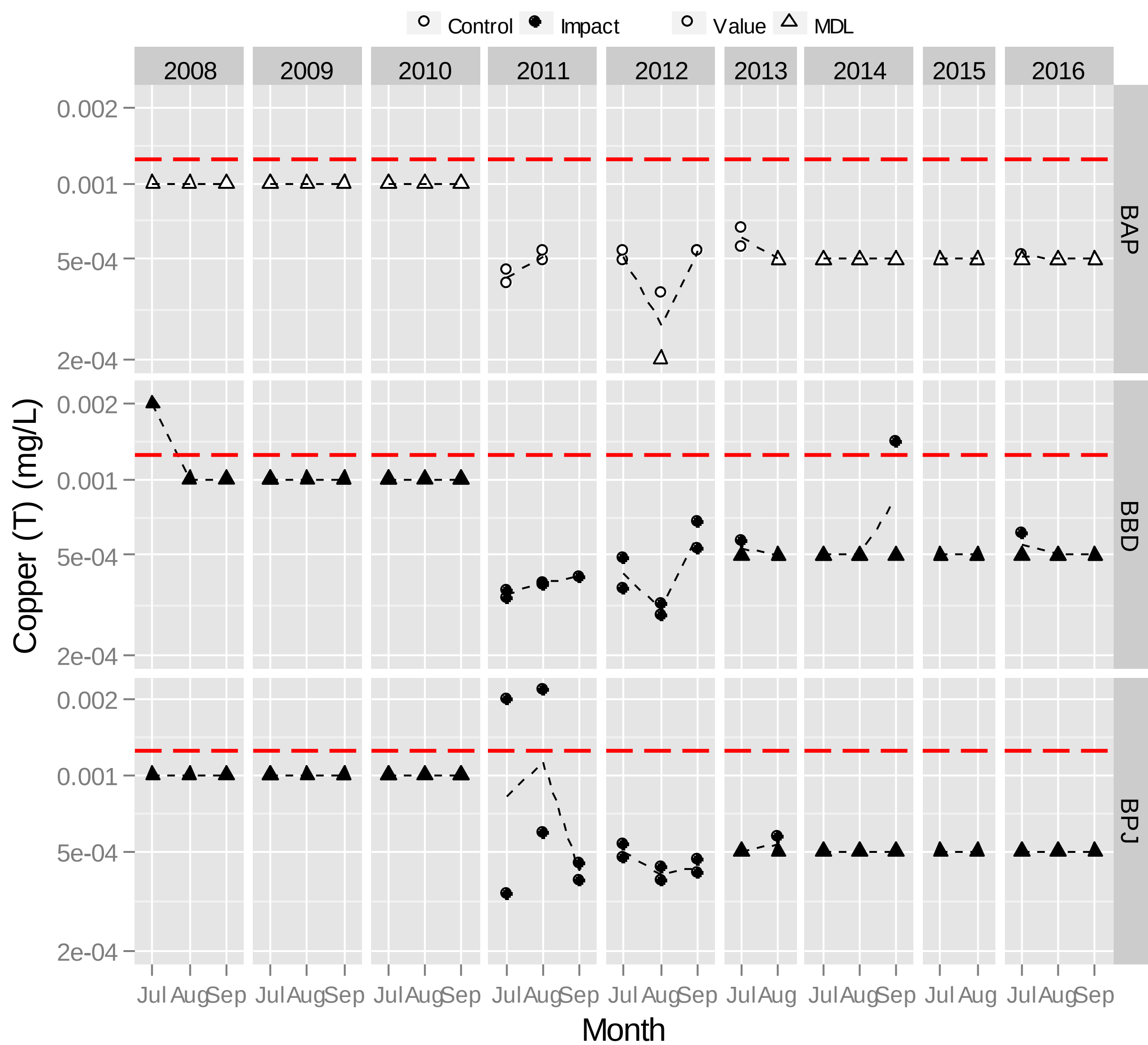


Figure 3.3–30. Total Iron (mg/L) in water samples from Baker Lake since 2008.

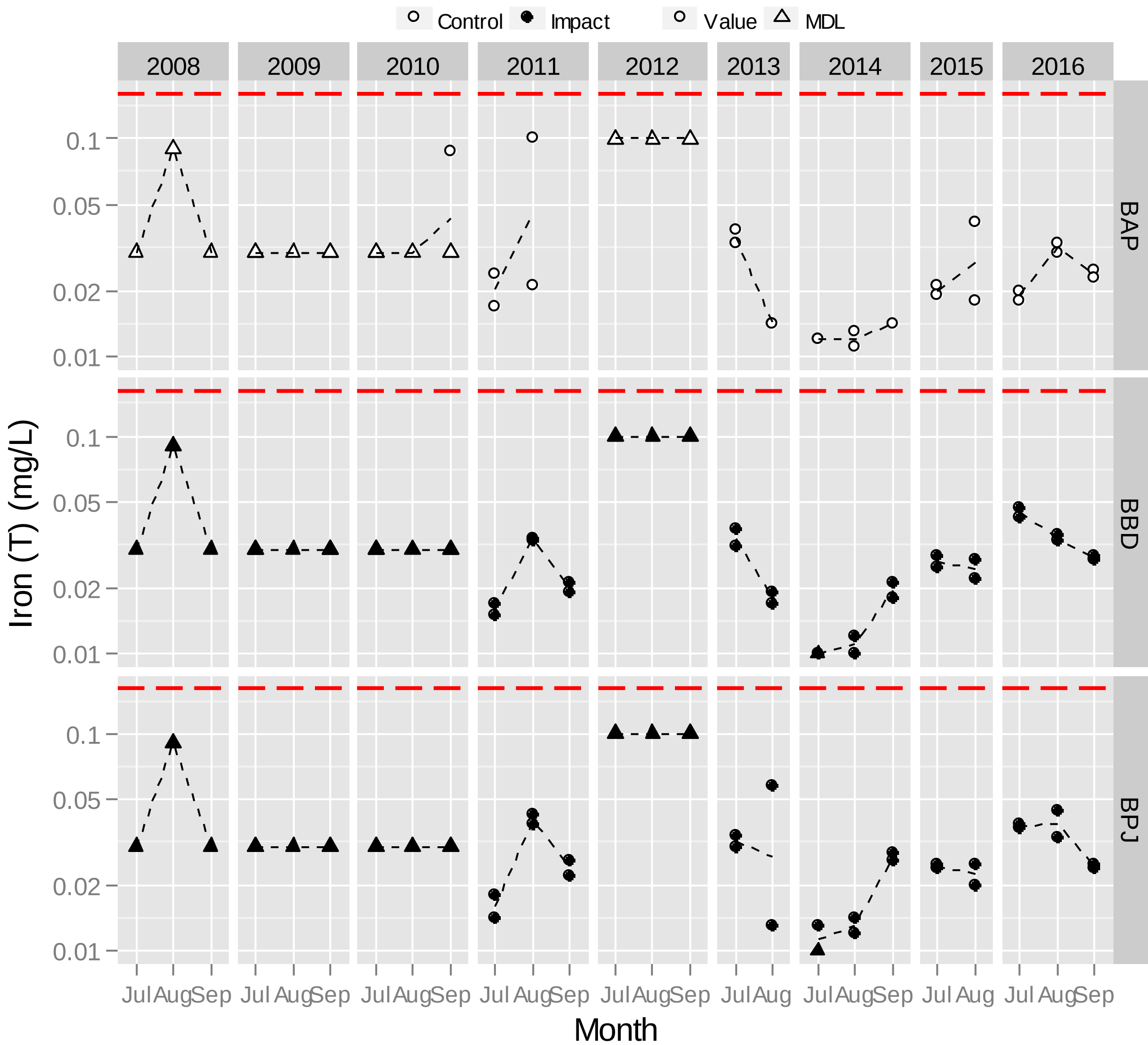


Figure 3.3–31. Total Lithium (mg/L) in water samples from Baker Lake since 2008.

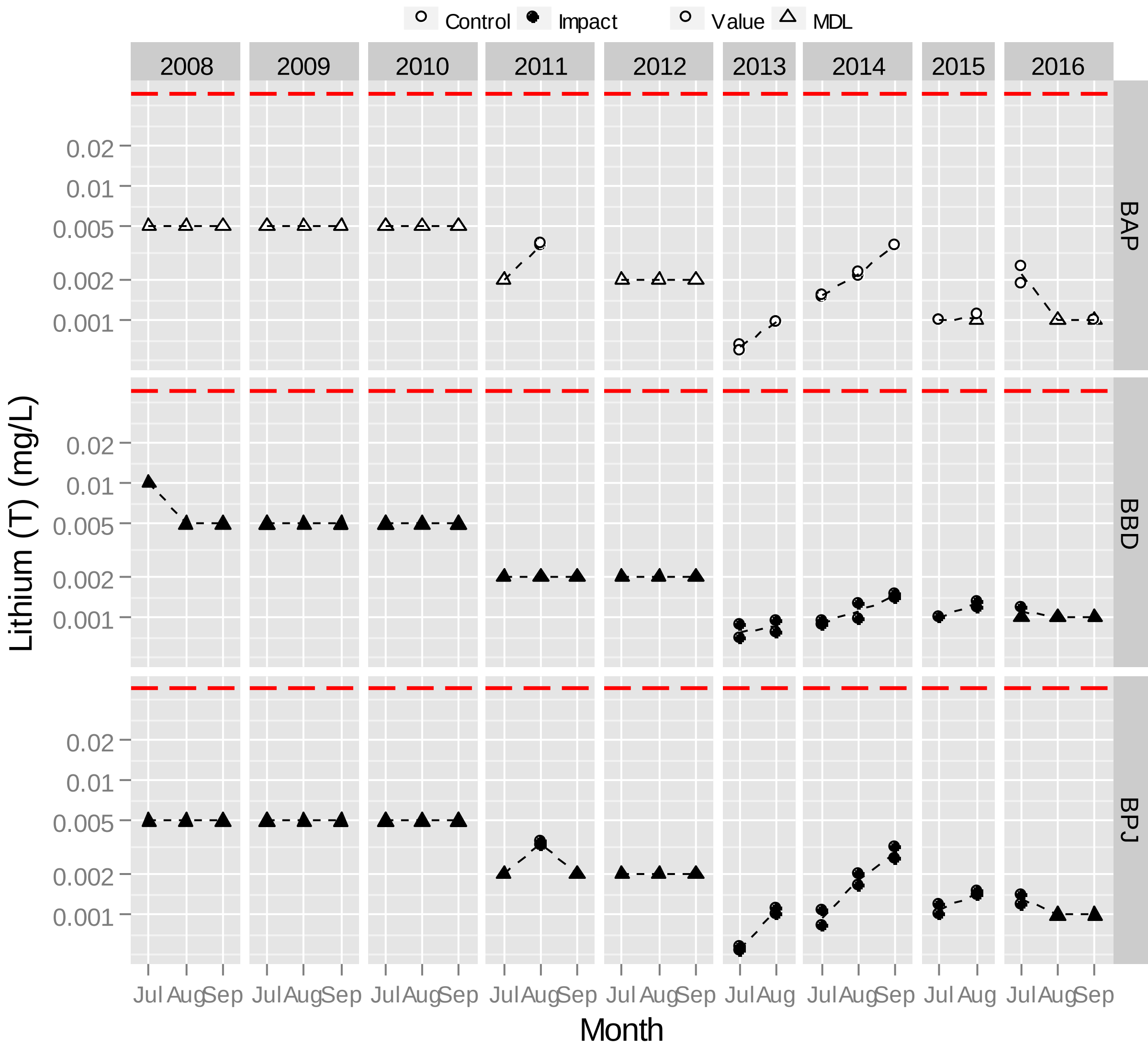


Figure 3.3–32. Total Magnesium (mg/L) in water samples from Baker Lake since 2008.

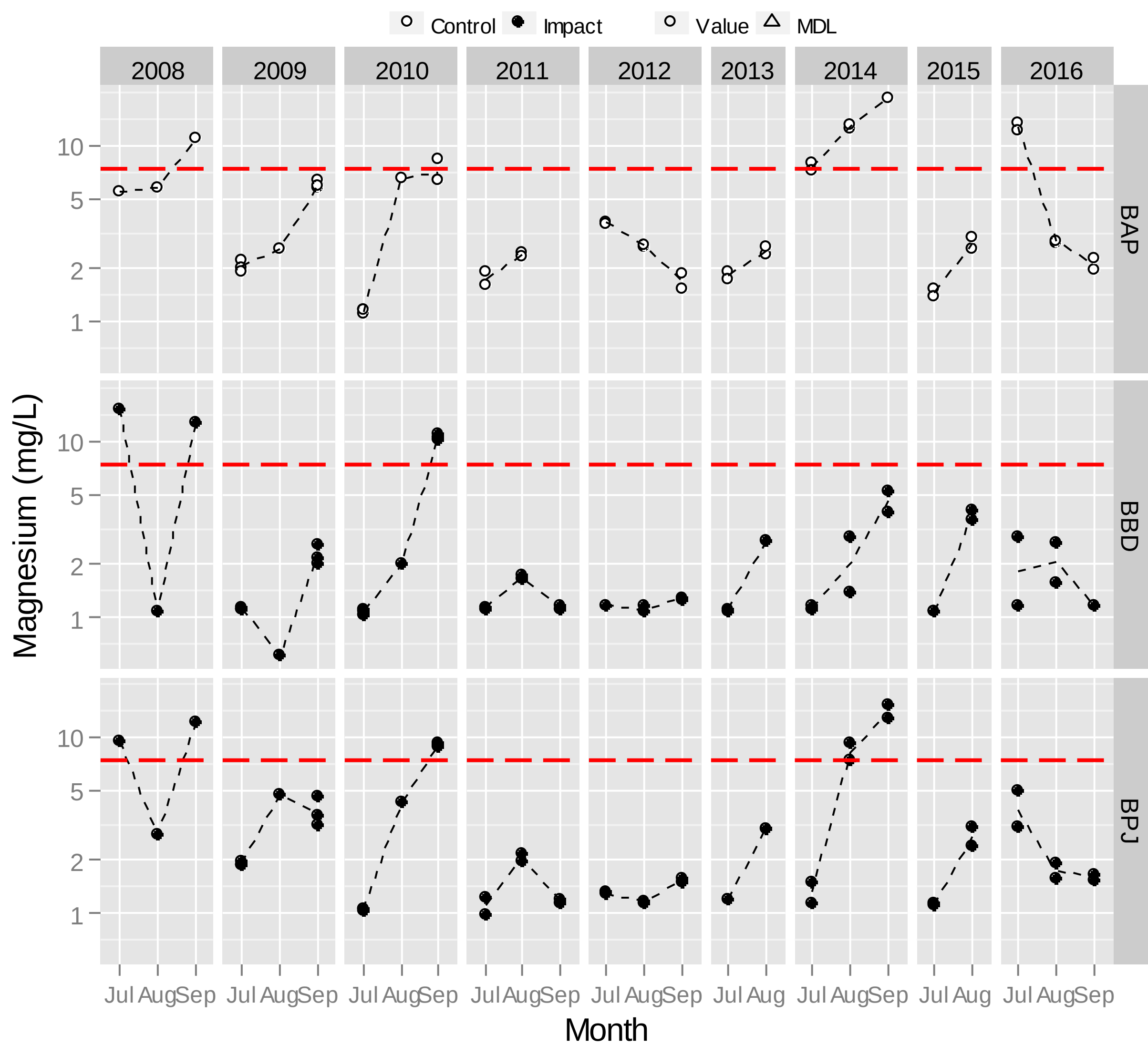


Figure 3.3–33. Total Manganese (mg/L) in water samples from Baker Lake since 2008.

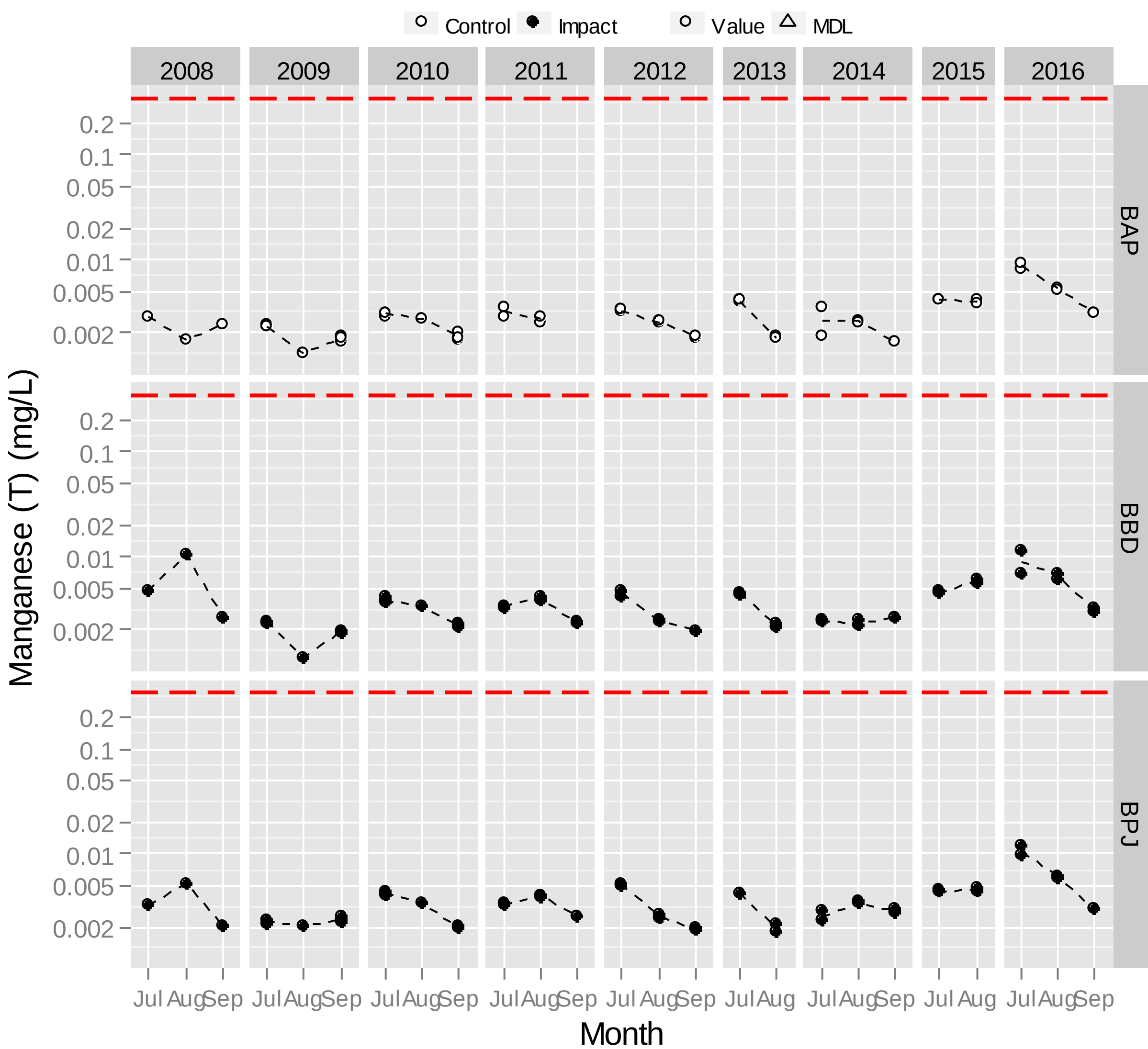


Figure 3.3–34. Total Molybdenum (mg/L) in water samples from Baker Lake since 2008.

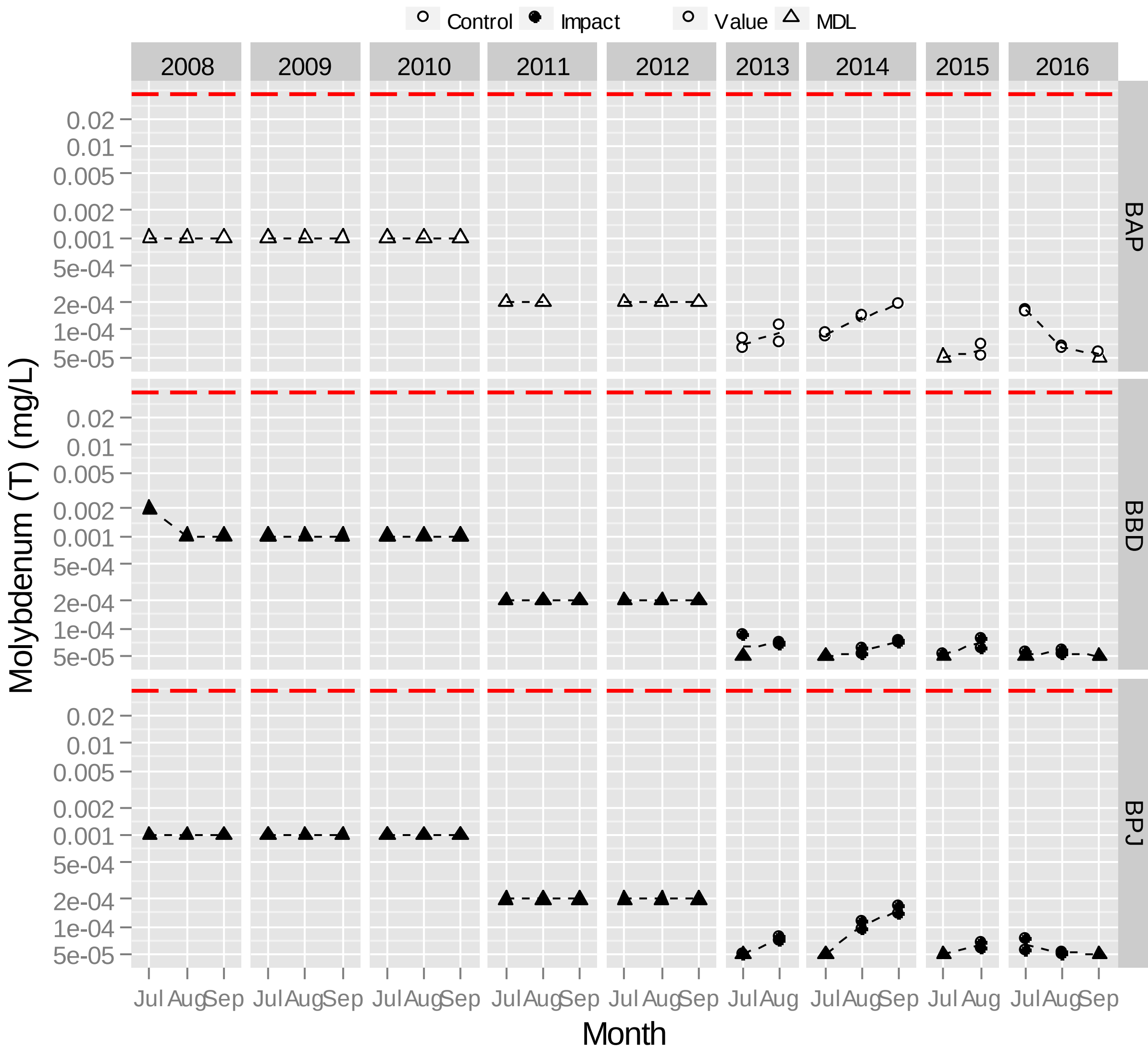


Figure 3.3–35. Total Potassium (mg/L) in water samples from Baker Lake since 2008.

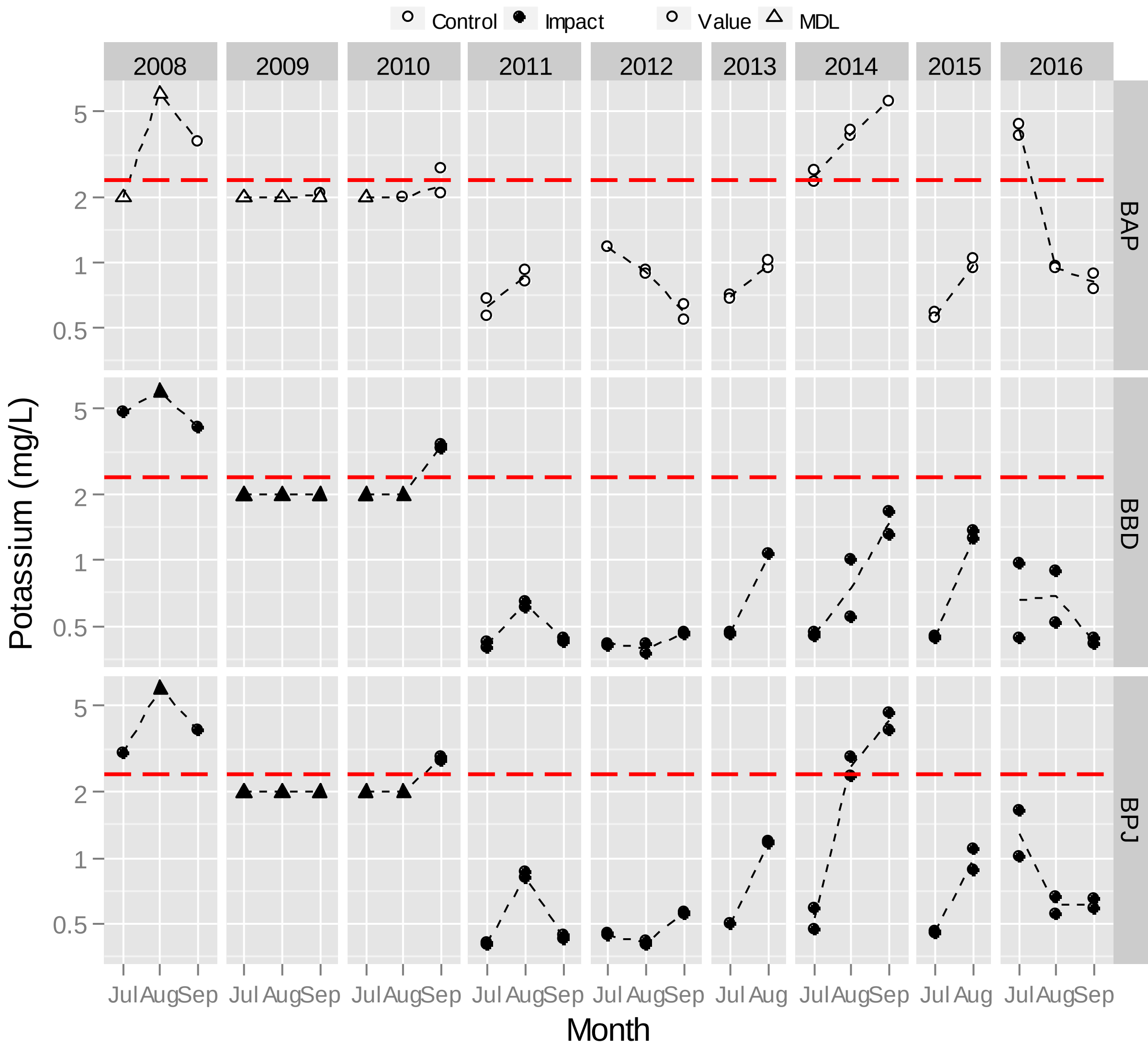


Figure 3.3–36. Total Sodium (mg/L) in water samples from Baker Lake since 2008.

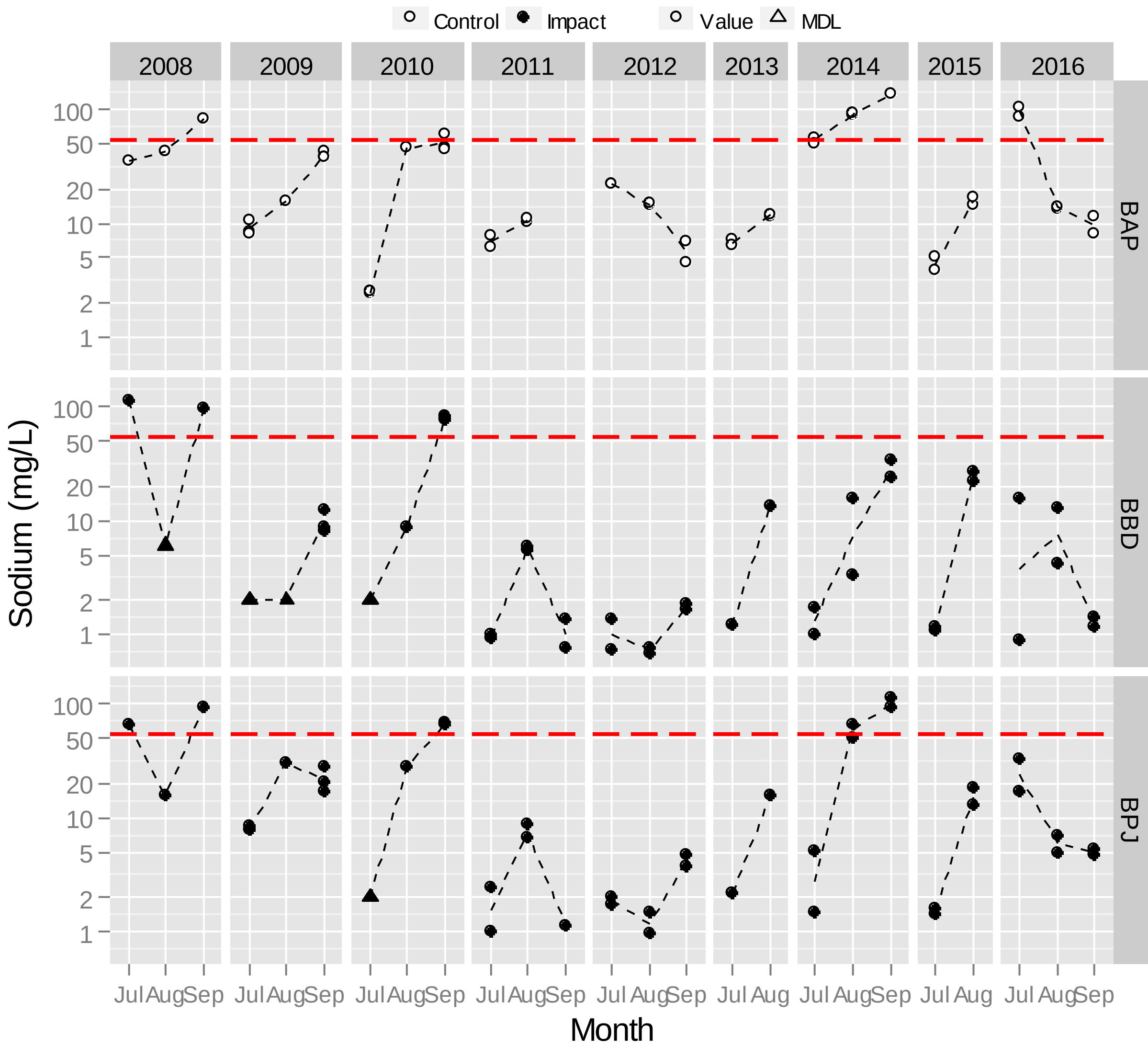


Figure 3.3–37. Total Strontium (mg/L) in water samples from Baker Lake since 2008.

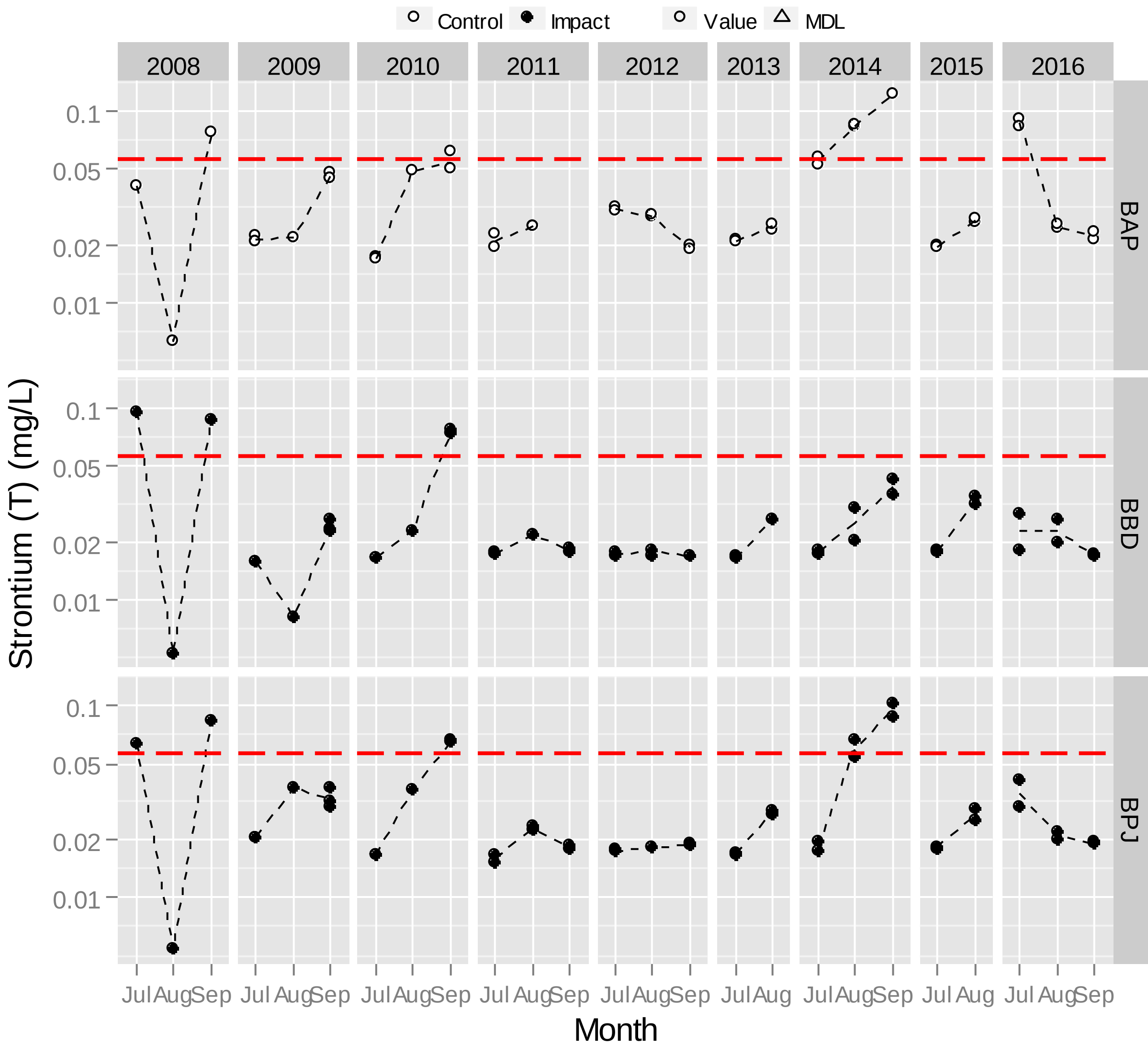


Figure 3.3–38. Total Titanium (mg/L) in water samples from Baker Lake since 2008.

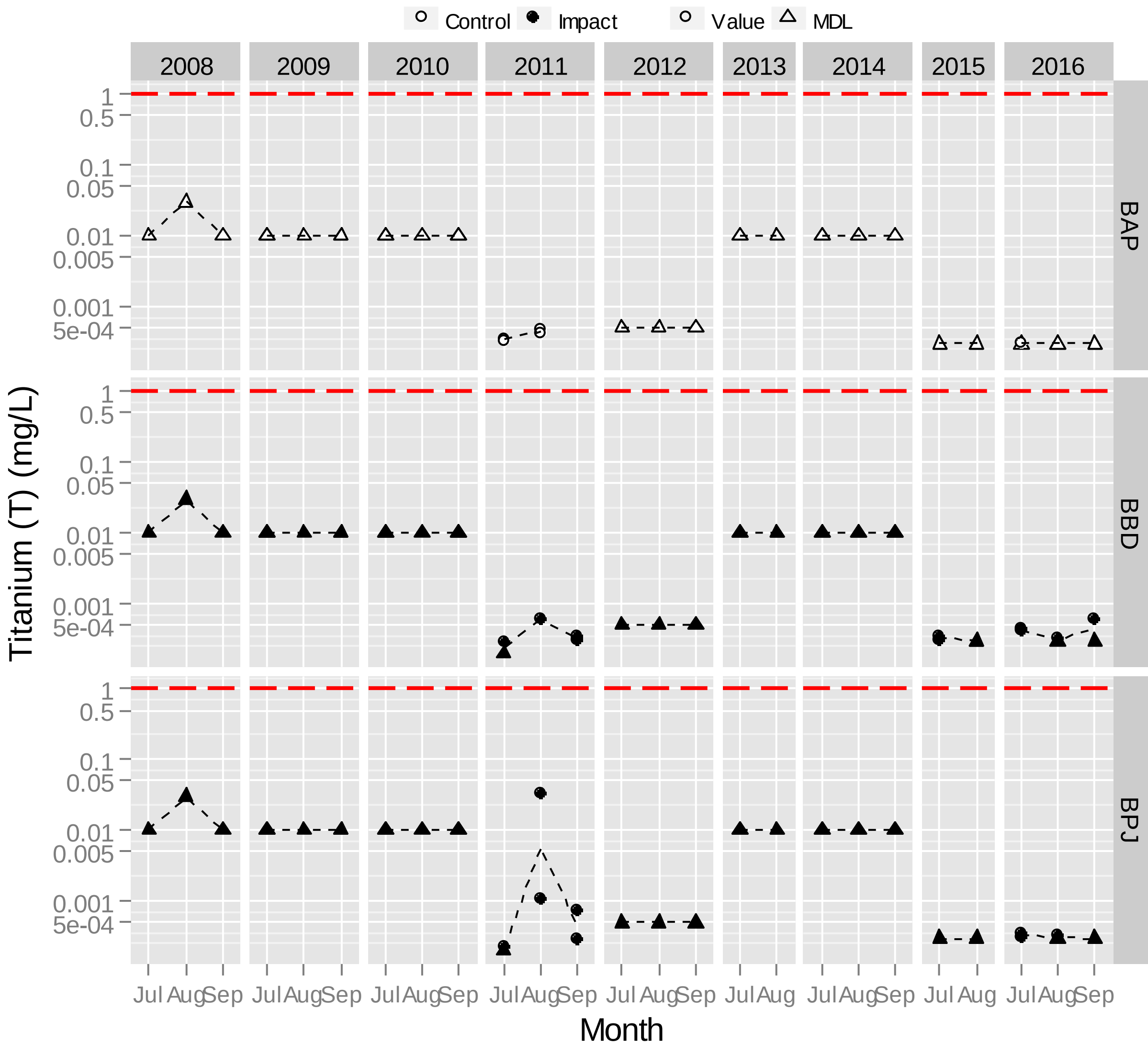


Figure 3.3–39. Total Uranium (mg/L) in water samples from Baker Lake since 2008.

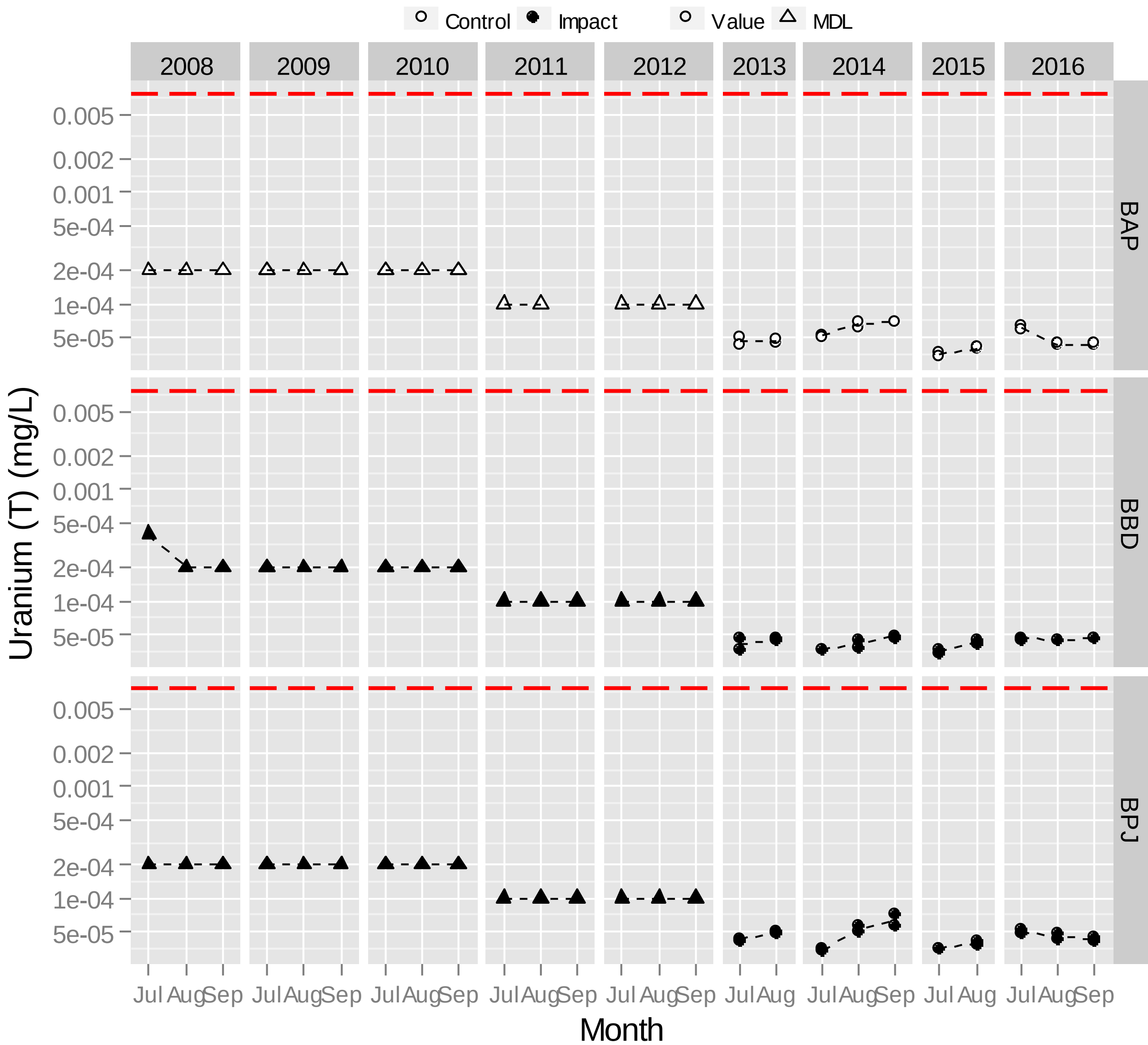


Figure 3.3–40. Dissolved Aluminum (mg/L) in water samples from Baker Lake since 2008.

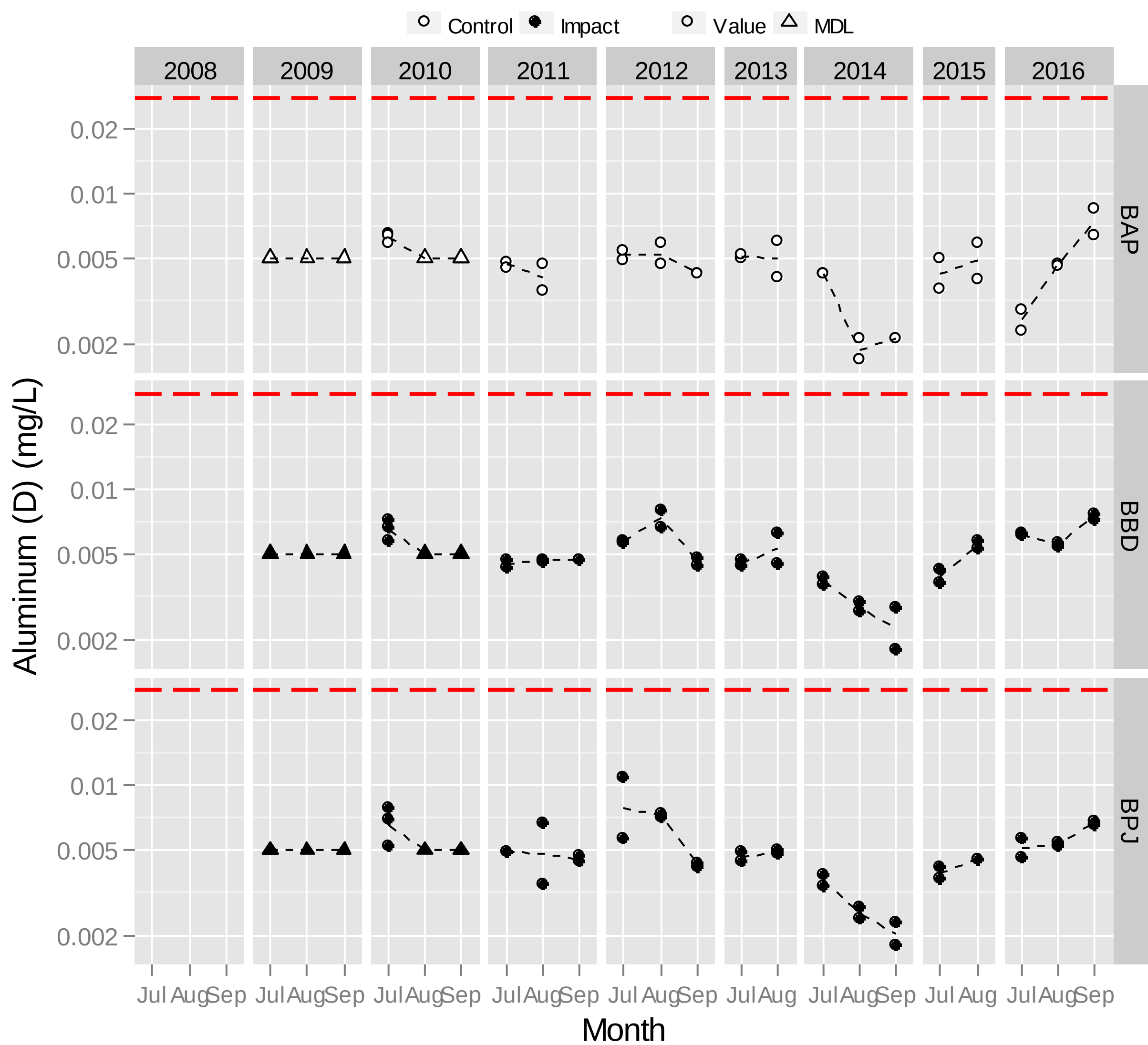


Figure 3.3–41. Dissolved Arsenic (mg/L) in water samples from Baker Lake since 2008.

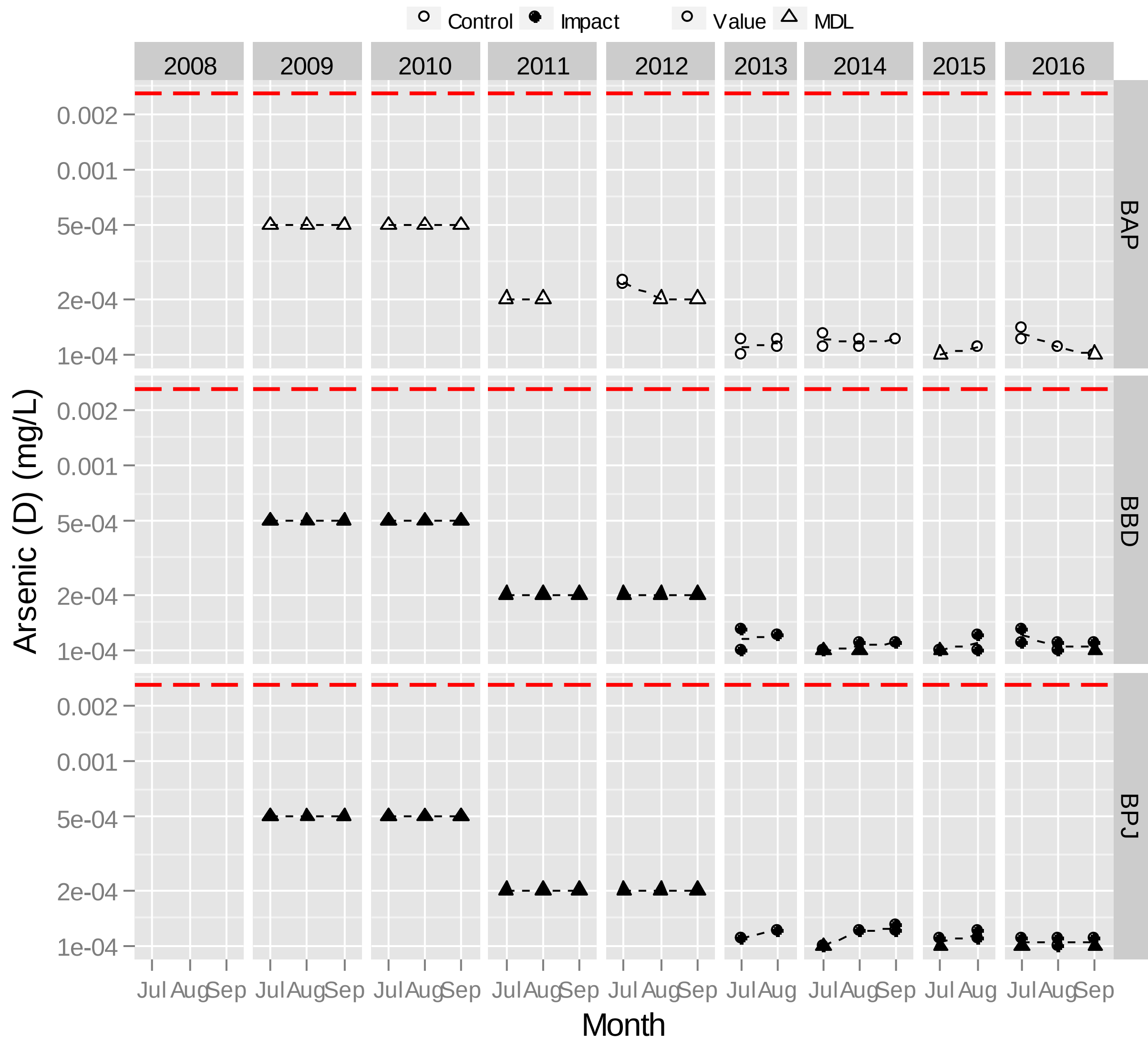


Figure 3.3–42. Dissolved Barium (mg/L) in water samples from Baker Lake since 2008.

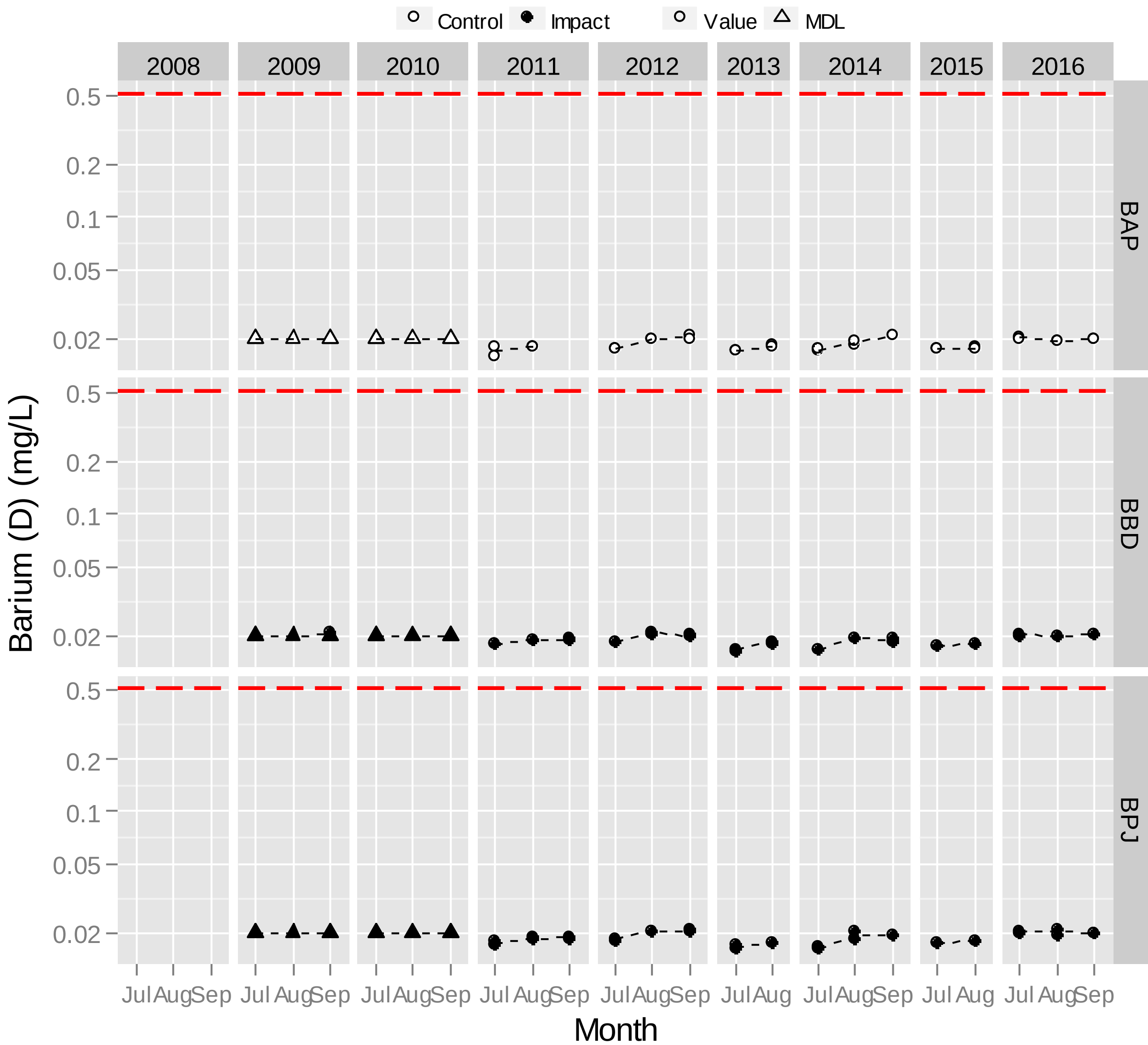


Figure 3.3–43. Dissolved Boron (mg/L) in water samples from Baker Lake since 2008.

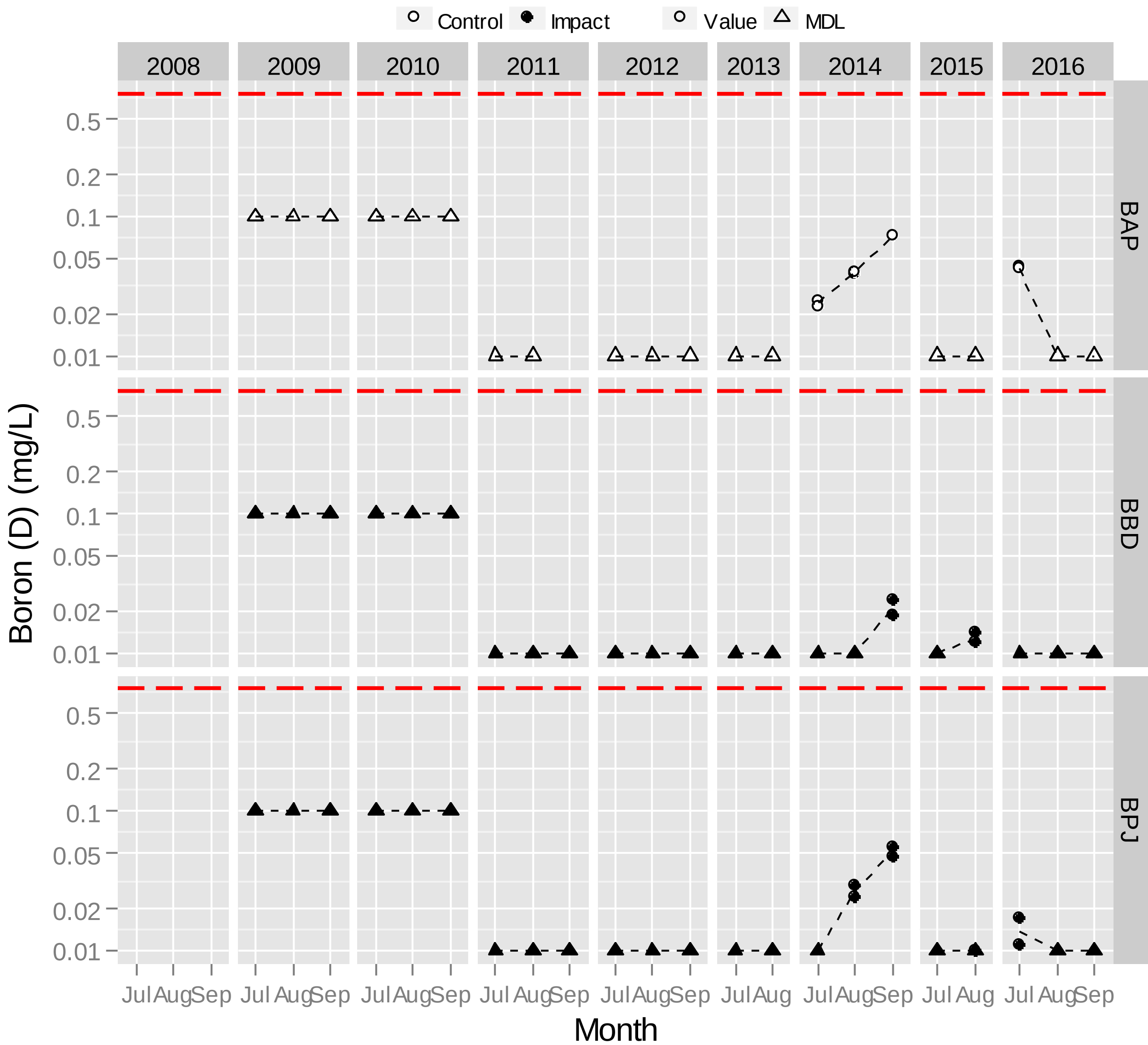


Figure 3.3–44. Dissolved Copper (mg/L) in water samples from Baker Lake since 2008.

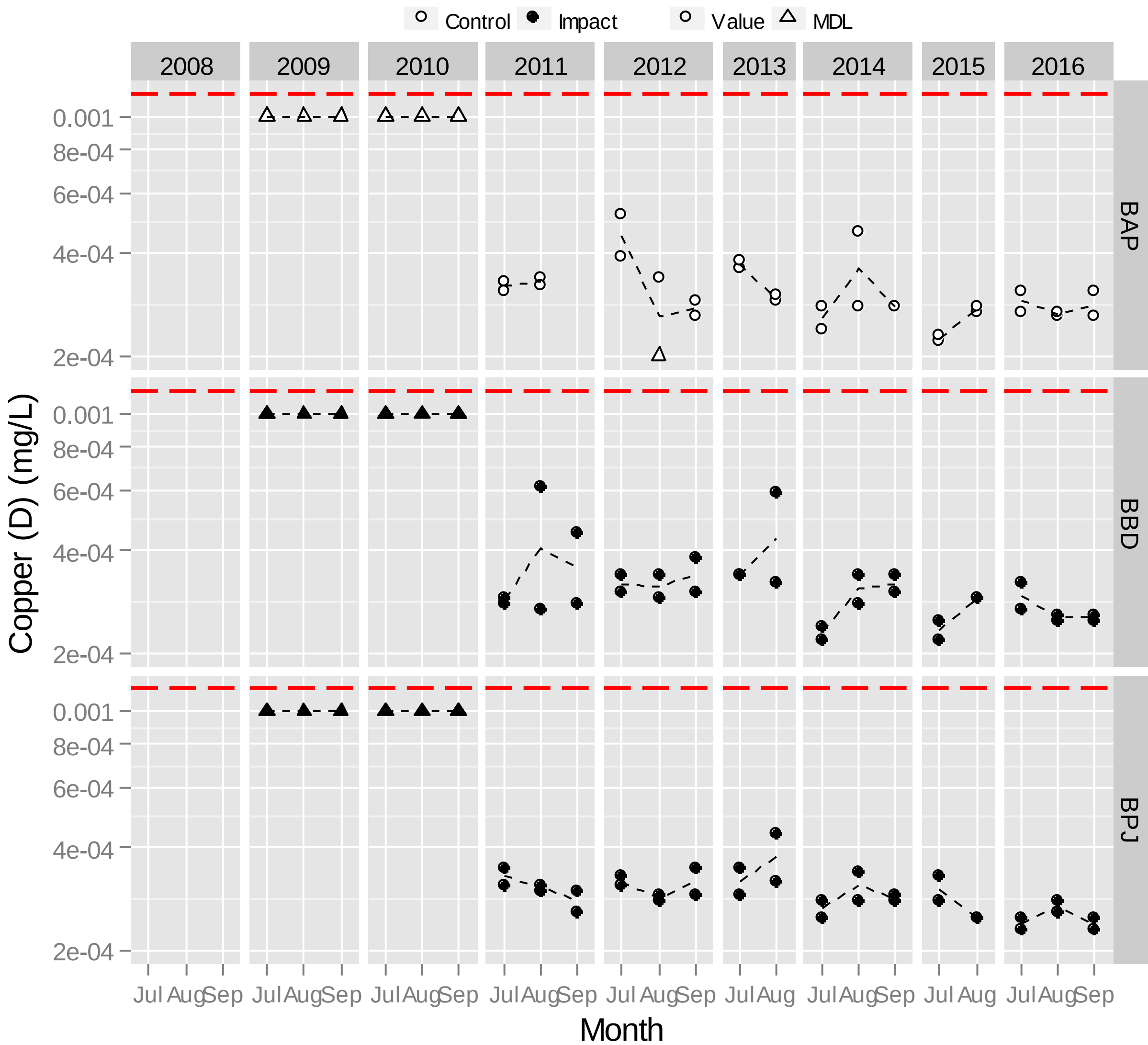


Figure 3.3–45. Dissolved Lithium (mg/L) in water samples from Baker Lake since 2008.

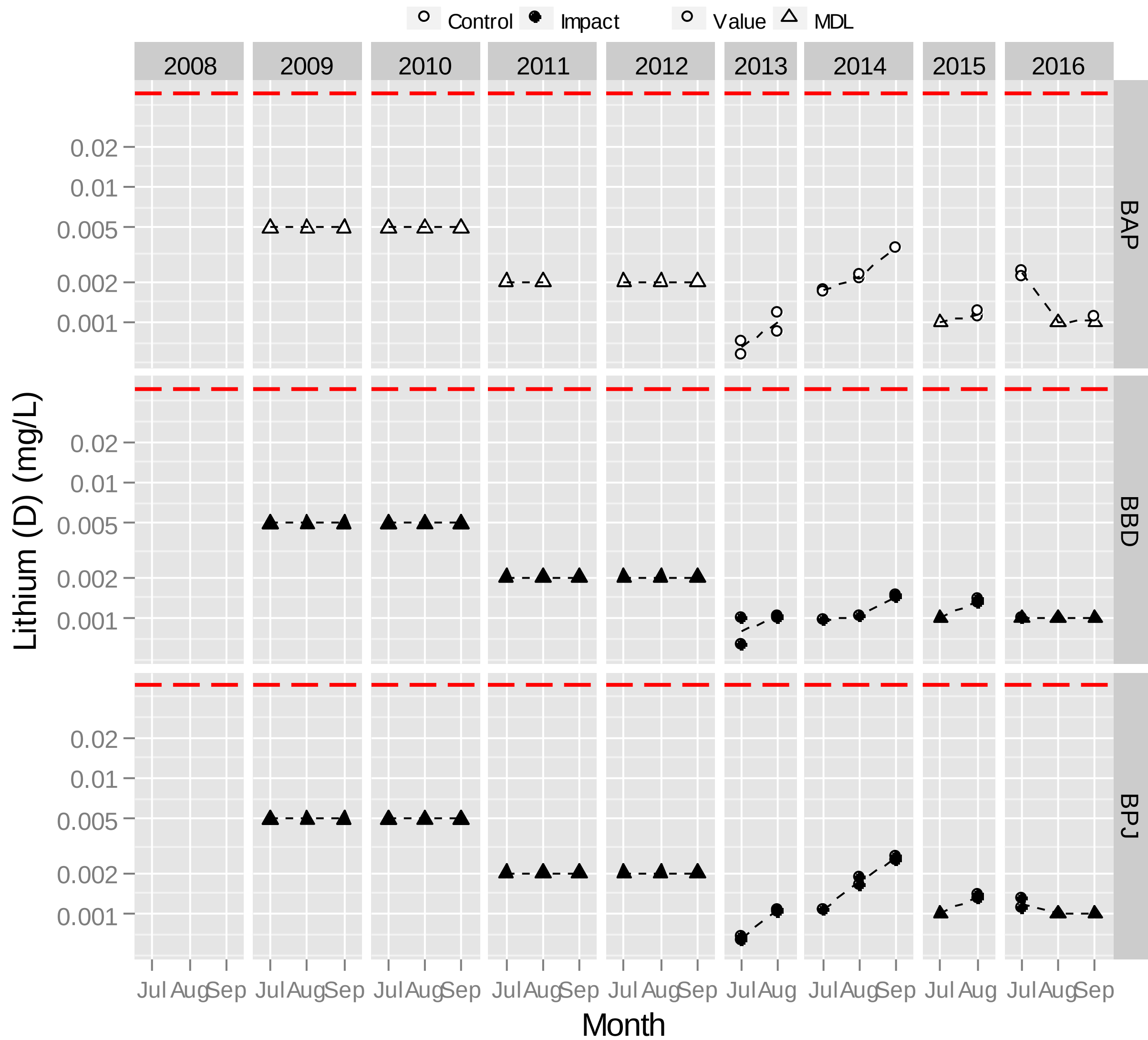


Figure 3.3–46. Dissolved Manganese (mg/L) in water samples from Baker Lake since 2008.

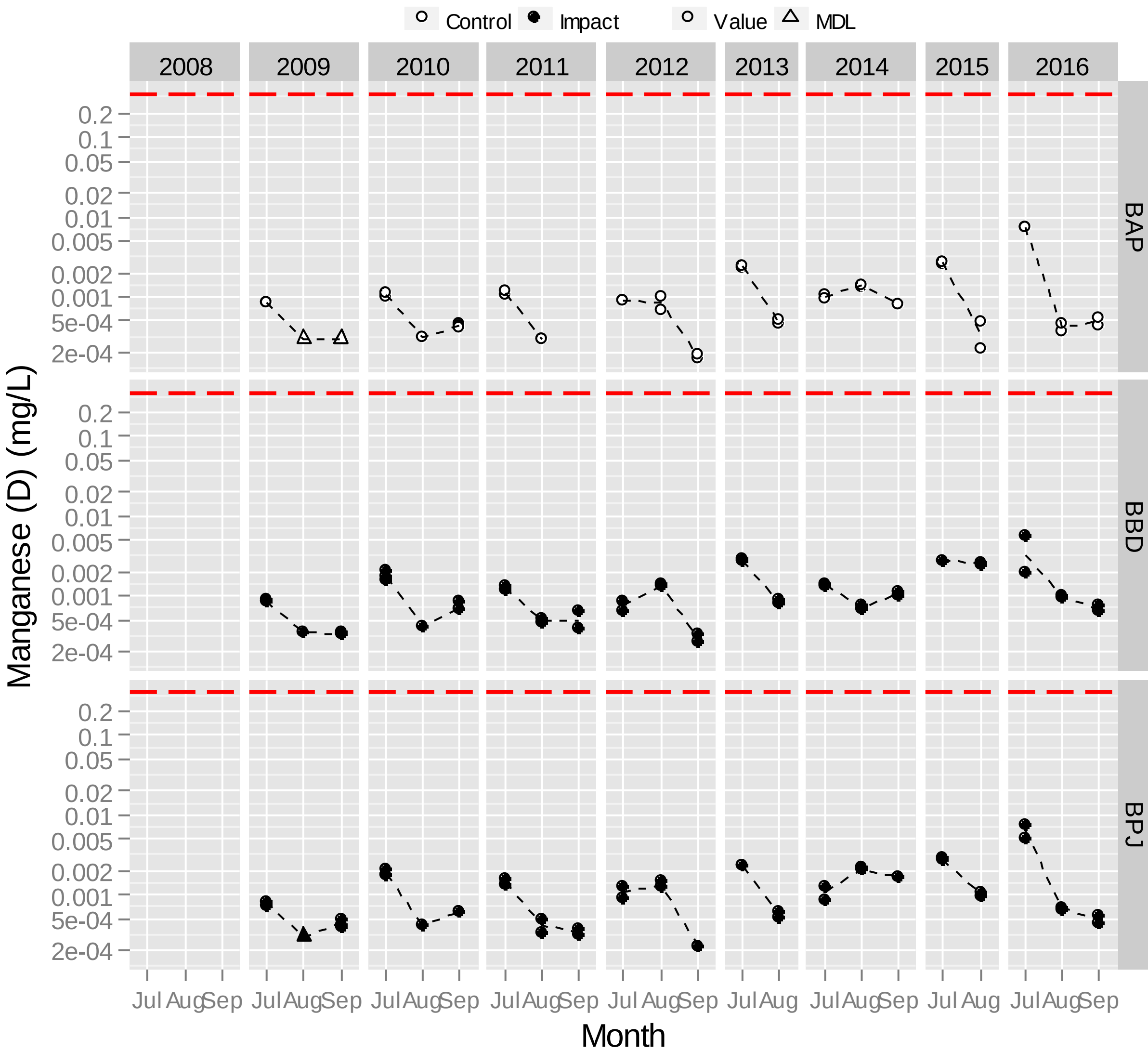


Figure 3.3–47. Dissolved Molybdenum (mg/L) in water samples from Baker Lake since 2008.

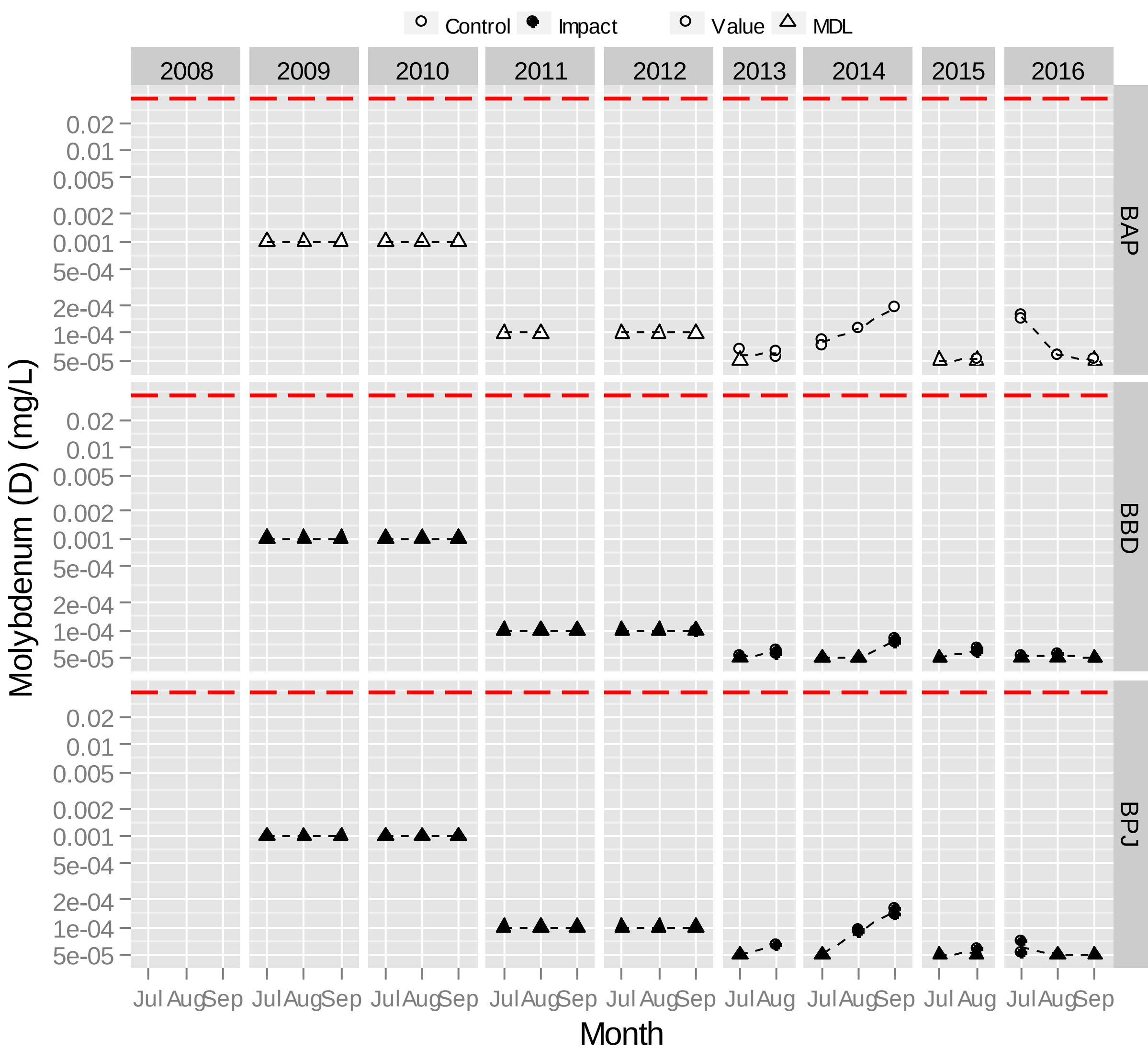


Figure 3.3–48. Dissolved Strontium (mg/L) in water samples from Baker Lake since 2008.

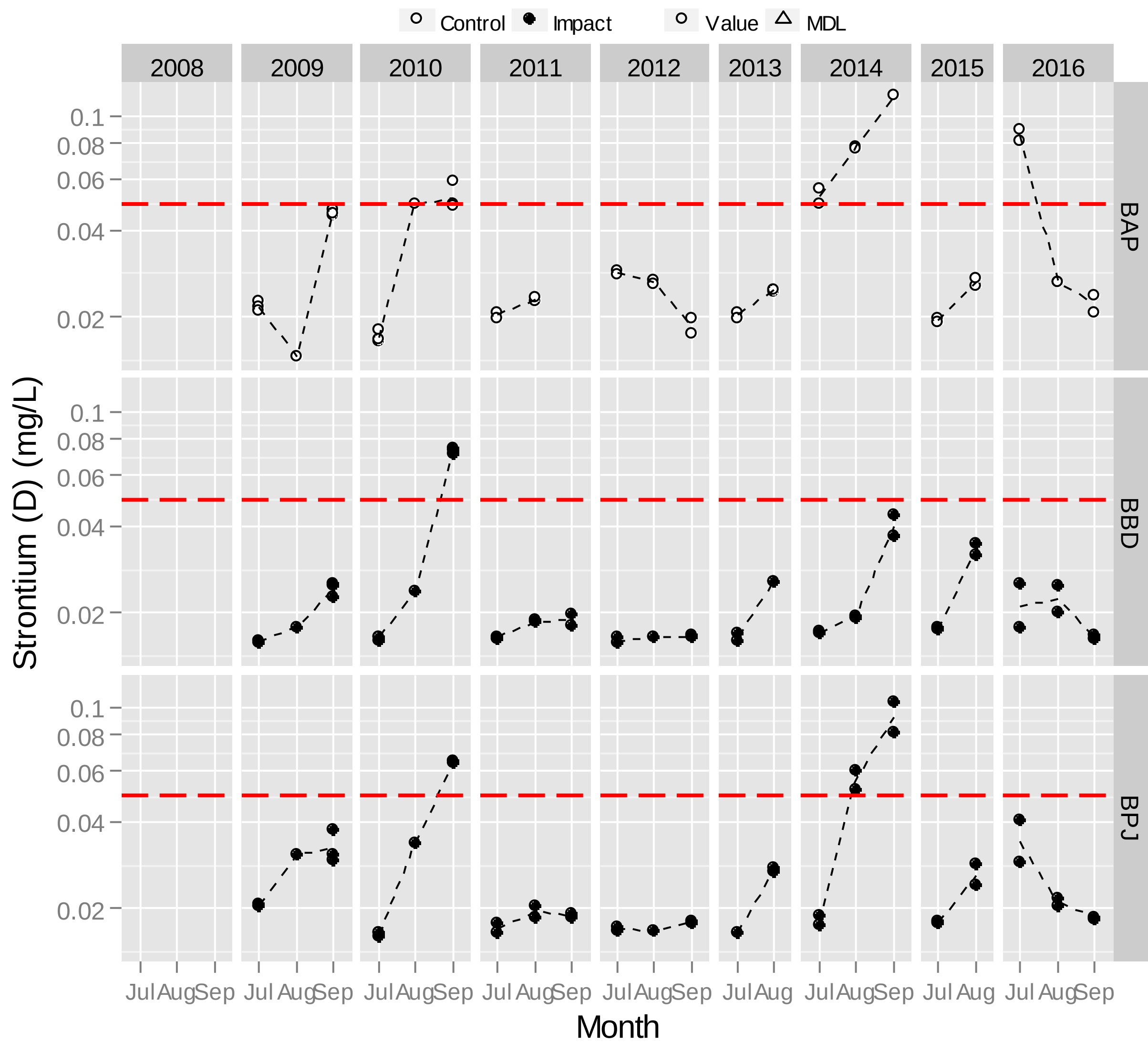
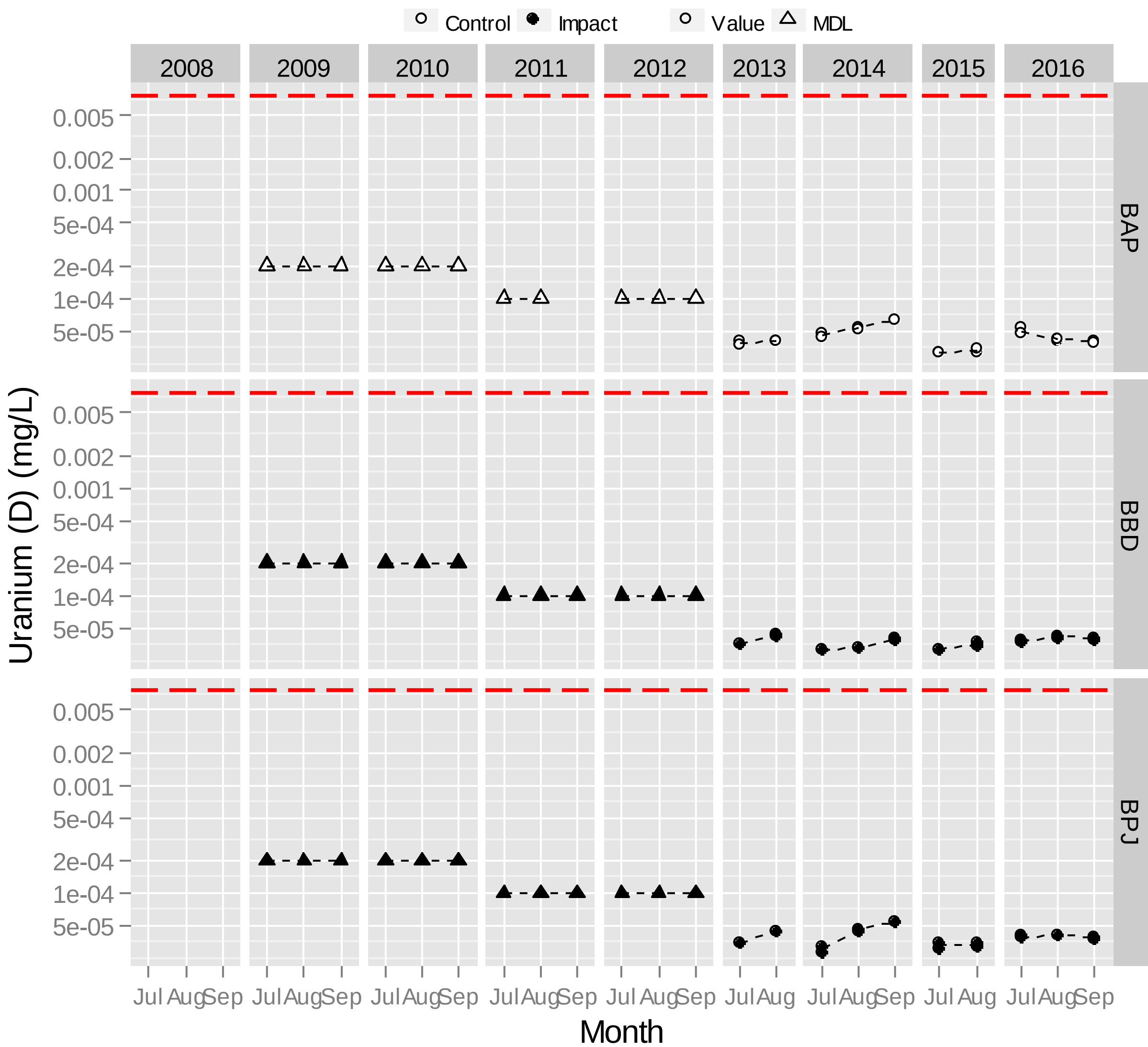


Figure 3.3–49. Dissolved Uranium (mg/L) in water samples from Baker Lake since 2008.



3.3.3. Sediment Chemistry

3.3.3.1. General Observations

Baker Lake has multiple confounding influences that potentially affect water quality (including potential inputs from the Hamlet of Baker Lake's sewage lagoons and landfill, which are situated in a watershed that discharges seasonally into Baker Lake between BBD and BPJ). Shipping-related influence on sediment metals concentrations would be limited to disturbance of bottom sediments from ship propeller wash and possibly from contaminant introductions (e.g., discharges, leaks, or spills); no spills were reported in 2016. Note that the red dashed line in each of sediment metals figures is the trigger value specific to the parameter and area (i.e., Meadowbank lakes, and Baker Lake each have their own trigger values).

The 2016 sediment and benthic invertebrate sampling program at BPJ in 2016 occurred on the same day (August 9th) that a tug boat was operating to dislodge an empty container barge that was partially beached on shore. Three of the five replicate stations were located east of the spud barge area, outside of the zone where prop wash had noticeably disturbed the sediment. Replicate station four was located closest to where the tug boat was operating. Qualitative observations of the sediment grabs taken when sampling suggested the surficial layer of sediment had been disturbed, although the grain size distribution at this location was similar relative to previous years. From a chemistry perspective, the disturbance of the sediment layer is inconsequential for this year's analysis (i.e., no BACI sediment analyses in 2016). Nonetheless, the chemistry results at replicate station four should be interpreted in light of physical disturbance.

3.3.3.2. Temporal and Spatial Trend Interpretation

Patterns in metals concentrations within and between areas have been quite consistent since monitoring began in 2008. In general, metals concentrations have not appeared to have changed or trended higher or lower over time regardless of area. Metals concentrations at the exposure area BPJ are uniformly higher than the control/reference areas BAP and BES, likely due to the higher percentage of fine particles (i.e., silt and clay) compared to the other locations (**Figure 3.3–50**). In 2016, impact area BPJ percent silt and clay comprised between approximately 30% and 80% of the particle size distribution among the five replicate stations. Replicate four had the lowest concentrations of metals relative to the other replicate samples despite similar particle size distributions compared to replicates 1, 2, and 3 (**Table 3.3–3**). Propeller wash from the tug boat likely disturbed the surficial layer of sediment, and may have removed the fine sediment layer (1-2 cm) with higher metals concentrations along with a large portion of the benthic invertebrate community (see **Section 3.3.5**).

Concentrations of aluminum, arsenic, chromium, copper, lead, mercury, and zinc in grab (all years, including 2016) and core (previous years only) samples are shown in **Figure 3.3–51** to **Figure 3.3–58**, respectively. The concentrations measured in 2016 are in the range of previously reported concentrations for each area/analyte combination. Arsenic exceeded the trigger value in four of the five replicates at BPJ in 2016 (**Figure 3.3–52**). Arsenic concentrations at BPJ have consistently exceeded the trigger (8.3 mg/kg) since monitoring started in 2008. Importantly, there is no indication that concentrations of arsenic are increasing, which implies that the arsenic trigger is not appropriate for this area of Baker Lake. As in previous years, concentrations of hydrocarbons and PAH's in the composite sediment samples were below their respective MDL's at the reference and exposure areas (**Table 3.3–4**).

There continues to be no evidence of any barge-related impacts to sediment metals or organics concentrations at impact areas in Baker Lake. The majority of the influence of barge traffic would be disturbance and re-settling of existing sediment particles. Although sediment grain size is inherently different between exposure and reference areas, there was no pattern of change for any metal over time that would suggest metals contamination, such as from loss of paint from the hulls of barges.

Table 3.3–3. Conventional sediment grab chemistry, particle size, and total metals (mg/kg), Baker Lake, 2016.

Lake & Basin	Screening Criteria			Baker Lake																			
				Barge Dock					Proposed Jetty					Akilahaarjuk Point					East Shore				
Area-Replicate ID	**CCME[1]**	**Baker Laker[2]**		**BBD-1**	**BBD-2**	**BBD-3**	**BBD-4**	**BBD-5**	**BPJ-1**	**BPJ-2**	**BPJ-3**	**BPJ-4**	**BPJ-5**	**BAP-1**	**BAP-2**	**BAP-3**	**BAP-4**	**BAP-5**	**BES-1**	**BES-2**	**BES-3**	**BES-4**	**BES-5**
Date	**ISQG**	**Trigger**	**Threshold**	9-Aug-16	9-Aug-16	9-Aug-16	9-Aug-16	9-Aug-16	9-Aug-16	9-Aug-16	9-Aug-16	9-Aug-16	9-Aug-16	8-Aug-16	8-Aug-16	8-Aug-16	8-Aug-16	8-Aug-16	8-Aug-16	8-Aug-16	8-Aug-16	8-Aug-16	8-Aug-16
Physical & Organic Parameters																							
Moisture (%)				39.2	17.6	18.4	19.2	37.7	49.9	48	50.6	42.3	36.9	22.9	29.5	33.4	24.6	24.1	40.2	43.2	44.1	35.9	31.5
pH				6.36	6.67	6.76	6.52	6.42	6.8	6.77	6.63	6.41	7.2	6.82	6.38	5.97	6.72	6.58	7.10	6.69	6.71	7.59	7.49
Total Organic Carbon (% dw)				0.561	0.17	0.214	0.117	0.474	0.675	0.639	0.664	0.475	0.32	0.179	0.223	0.364	0.113	0.093	0.48	0.545	0.475	0.293	0.291
Particle Size																							
% Gravel (>2mm)				*<0.10*	0.53	*<0.10*	0.43	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	1.06
% Sand (2.00mm - 0.063mm)				40.6	85	96.2	88.8	62.1	16.4	21.5	22.8	17.9	71.7	82	80.6	72.0	87.3	91.6	62.8	45.6	57.5	77.8	78.5
% Silt (0.063mm - 4µm)				50.9	13.1	3.5	9.35	32.1	70.7	66.7	63.8	67.6	23.1	16.6	17.3	24.9	11.7	8.1	32.3	48.0	37.0	19.7	18.2
% Clay (<4µm)				8.44	1.42	0.3	1.42	5.8	12.9	11.8	13.4	14.5	5.15	1.4	2.13	3.16	0.95	0.31	4.84	6.36	5.46	2.53	2.29
Total Metals (mg/kg dw)																							
Aluminum				4910	4280	3350	3700	6250	9930	9440	9910	7380	9670	3890	4480	6100	3600	3170	6420	7580	7200	5270	5170
Antimony				*<0.10*	*<0.10*	*<0.10*	*<0.10*	0.14	0.14	0.13	0.14	0.16	0.13	0.12	0.14	0.15	0.14	0.14	0.14	0.14	0.15	0.12	0.13
Arsenic*	5.9	8.3		**8.65**	3.12	2.47	2.95	6.69	**25.1**	**22.8**	**37.5**	5.49	**10.4**	4.18	2.96	4.01	2.16	1.89	3.89	4.88	6.78	2.87	2.79
Barium				80.5	44.2	27.6	33.9	90.3	126	118	134	114	87.7	367	476	426	269	341	146	108	135	146	140
Beryllium				0.25	0.19	0.14	0.17	0.31	0.44	0.43	0.46	0.36	0.45	0.26	0.3	0.36	0.26	0.24	0.36	0.4	0.38	0.29	0.28
Bismuth				*<0.20*	*<0.20*	*<0.20*	*<0.20*	*<0.20*	0.23	0.22	0.24	*<0.20*	0.24	*<0.20*	*<0.20*	*<0.20*	*<0.20*	*<0.20*	*<0.20*	*<0.20*	*<0.20*	*<0.20*	*<0.20*
Boron				*<5.0*	*<5.0*	*<5.0*	*<5.0*	5.6	8.8	8.3	7.7	6.8	8	5.2	5.9	7.1	5.3	*<5.0*	6.3	7.1	7.5	5.6	5.5
Cadmium	0.6	0.55	0.6	0.048	0.022	*<0.020*	*<0.020*	0.043	0.09	0.084	0.084	0.057	0.058	*<0.020*	0.023	0.034	*<0.020*	*<0.020*	0.041	0.048	0.04	0.029	0.029
Calcium				1570	1290	889	1040	1910	2870	2820	2690	2400	2630	1960	2350	2320	1410	1820	2220	2380	2380	2040	2090
Chromium	37.3	27.0	37.3	11.5	9.4	7	7.66	13.7	22	21.2	22.5	17.5	21.7	13.3	14.9	21.6	12.9	12.0	18.8	21.8	20.7	16.3	16.4
Cobalt				4.31	3.28	2.71	2.98	5.18	7.48	7.21	8.26	5.77	6.89	3.13	3.33	4.26	2.97	2.74	5.08	5.86	5.41	4.01	4
Copper	35.7	20.5	35.7	4.25	3.65	2.37	3.93	6.56	9.61	9.22	11	7.99	9.58	2.98	3.56	6.84	3.24	2.36	5.18	6.84	5.87	3.72	3.65
Iron				13300	9040	7260	8520	13500	23400	23100	27700	14600	18200	11700	13100	15300	10400	11700	13800	15900	15800	11700	12100
Lead	35	32.5	35	5.25	3.55	2.27	3.09	6.13	10.1	9.79	10.7	7.75	10	3.55	4.22	5.3	3.05	3.1	5.57	7.13	6.25	4	3.96
Lithium				7.1	7.2	6	6.5	9.6	12.1	11.5	13.0	10.9	13.00	5.90	6.40	8.8	5.80	5.20	9.4	10.5	9.9	7.8	7.6
Magnesium				2950	3000	2550	2510	3740	5080	4860	5420	4340	5330	2350	2490	3300	2280	2070	3900	4480	4130	3280	3260
Manganese				1930	140	117	122	297	1340	1480	1640	287	548	142	106	145	93	87.2	575	1160	984	437	316
Mercury	0.17	0.088	0.17	0.0066	*<0.0050*	*<0.0050*	*<0.0050*	0.006	0.0124	0.0121	0.0102	0.0087	0.0055	*<0.0050*	*<0.0050*	0.0055	*<0.0050*	*<0.0050*	0.0081	0.0117	0.0095	0.0052	*<0.0050*
Molybdenum				1.38	0.27	0.23	0.34	0.99	1.44	1.6	2.08	0.97	1.1	0.39	0.35	0.46	0.29	0.26	0.57	0.78	0.91	0.41	0.85
Nickel				7.8	6.54	5.61	6.1	9.32	13.8	13.5	14.9	11.4	13.7	7.6	7.96	12	7.53	6.7	11.5	12.9	12.3	9.9	9.87
Phosphorus				528	406	292	344	749	1210	1120	1550	860	938	615	725	686	442	609	695	761	792	620	623
Potassium				930	670	490	600	1180	2020	1850	1800	1480	1820	1030	1150	1530	970	820	1380	1620	1630	1180	1150
Selenium				*<0.20*	*<0.20*	*<0.20*	*<0.20*	*<0.20*	*<0.20*	*<0.20*	*<0.20*	*<0.20*	*<0.20*	*<0.20*	*<0.20*	*<0.20*	*<0.20*	*<0.20*	*<0.20*	*<0.20*	*<0.20*	*<0.20*	*<0.20*
Silver				*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*
Sodium				109	57	*<50*	*<50*	101	258	231	209	134	199	67	86	139	59	55	165	209	187	101	81
Strontium				35.8	23.6	19.6	21	32.8	56.5	55.2	49.8	38.4	48.5	43.3	47.1	48.1	39.5	38.7	39.8	56.9	44.6	36.9	37.3
Thallium				0.053	*<0.050*	*<0.050*	*<0.050*	0.057	0.084	0.077	0.083	0.076	0.08	*<0.050*	*<0.050*	0.069	*<0.050*	*<0.050*	0.067	0.075	0.07	*<0.050*	*<0.050*
Tin				*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*
Titanium				268	196	133	163	281	456	446	385	343	411	267	320	369	200	222	334	346	377	325	338
Uranium				1.07	0.67	0.448	0.616	1.72	2.01	1.94	2.28	2.19	2.19	1.04	1.13	1.67	0.853	0.889	1.43	1.79	1.48	0.975	1.02
Vanadium				15.9	11.6	9.11	10.7	20.5	25.6	25.1	27.2	23.7	26.7	16.9	20.5	23.3	15.8	17.5	20.5	23.2	21.9	17.6	18.7
Zinc	123	73.6	123	20.9	17.7	14.1	16.1	25.9	39.7	37.4	41.8	30.0	36.1	14.4	16.3	22.4	13.2	11.9	25.2	29.7	26.9	19.6	19.3
Zirconium				2.9	2.8	2.5	2.9	4.2	4.4	4.1	4.4	4.8	7.5	4.6	5.4	6	5.3	5	2.6	2.3	2.8	2.8	3.5

Notes:

[1] CCME (Canadian Council of Ministers of the Environment) Canadian Sediment Quality Guidelines for the Protection of Aquatic Life, 1999, updated in 2002. ISQG = Interim freshwater Sediment Quality Guideline.

[2] Trigger and threshold values were developed in the *CREMP Design Document 2012* (Azimuth, 2012d).
Thresholds are set equal to CCME ISQG guidelines, where available.

* CCME guideline not used as threshold value because threshold value would be lower than trigger value.

123 Bolded concentrations exceed the trigger value.

123 Bolded and shaded concentrations also exceed the threshold value.

Italicized numbers are below detection limits.

Table 3.3–4 Hydrocarbon and PAH results from composite sediment grabs at Baker Lake, 2016.

Lake	CCME (2002) Guidelines[1]	Baker Lake			
Area ID		BBD	BPJ	BAP	BES
Date	ISQG	9-Aug-16	9-Aug-16	8-Aug-16	8-Aug-16
Physical Parameters					
Moisture (%)		25.3	44.2	25.4	37.9
Aggregate Organics (mg/kg)					
Mineral Oil and Grease		*<500*	*<500*	*<500*	*<500*
Hydrocarbons (mg/kg)					
EPH10-19		*<200*	*<200*	*<200*	*<200*
EPH19-32		*<200*	*<200*	*<200*	*<200*
LEPH		*<200*	*<200*	*<200*	*<200*
HEPH		*<200*	*<200*	*<200*	*<200*
Polycyclic Aromatic Hydrocarbons (mg/kg)					
Acenaphthene	0.00671	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*
Acenaphthylene	0.00587	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*
Anthracene	0.0469	*<0.0040*	*<0.0040*	*<0.0040*	*<0.0040*
Benzo(a)anthracene	0.0317	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Benzo(a)pyrene	0.0319	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Benzo(b)fluoranthene		*<0.010*	*<0.010*	*<0.010*	*<0.010*
Benzo(b+j+k)fluoranthene		*<0.015*	*<0.015*	*<0.015*	*<0.015*
Benzo(g,h,i)perylene		*<0.010*	*<0.010*	*<0.010*	*<0.010*
Benzo(k)fluoranthene		*<0.010*	*<0.010*	*<0.010*	*<0.010*
Chrysene	0.0571	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Dibenz(a,h)anthracene	0.00622	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*
Fluoranthene	0.111	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Fluorene	0.0212	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Indeno(1,2,3-c,d)pyrene		*<0.010*	*<0.010*	*<0.010*	*<0.010*
2-Methylnaphthalene	0.0202	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Naphthalene	0.0346	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Phenanthrene	0.0419	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Pyrene	0.053	*<0.010*	*<0.010*	*<0.010*	*<0.010*
d10-Acenaphthene (%)		97.5	96.3	79.5	92.4
d12-Chrysene (%)		091.8	093.8	091.9	091.8
d8-Naphthalene (%)		92.1	91.3	77.9	88.6
d10-Phenanthrene (%)		91.3	091.8	83.7	90.0
B(a)P Total Potency Equivalent		*<0.020*	*<0.020*	*<0.020*	*<0.020*
IACR (CCME)		*<0.15*	*<0.15*	*<0.15*	*<0.15*

Notes:

[1] CCME (Canadian Council of Ministers of the Environment) Canadian Sediment Quality Guidelines for the Protection of Aquatic Life, 1999, updated in 2002.

ISQG = Interim freshwater Sediment Quality Guideline

Bolded concentrations exceed the ISQG guideline.

Italicized numbers are below detection limits.

Figure 3.3–50. Sediment grain size composition in sediment samples from Baker Lake since 2008.

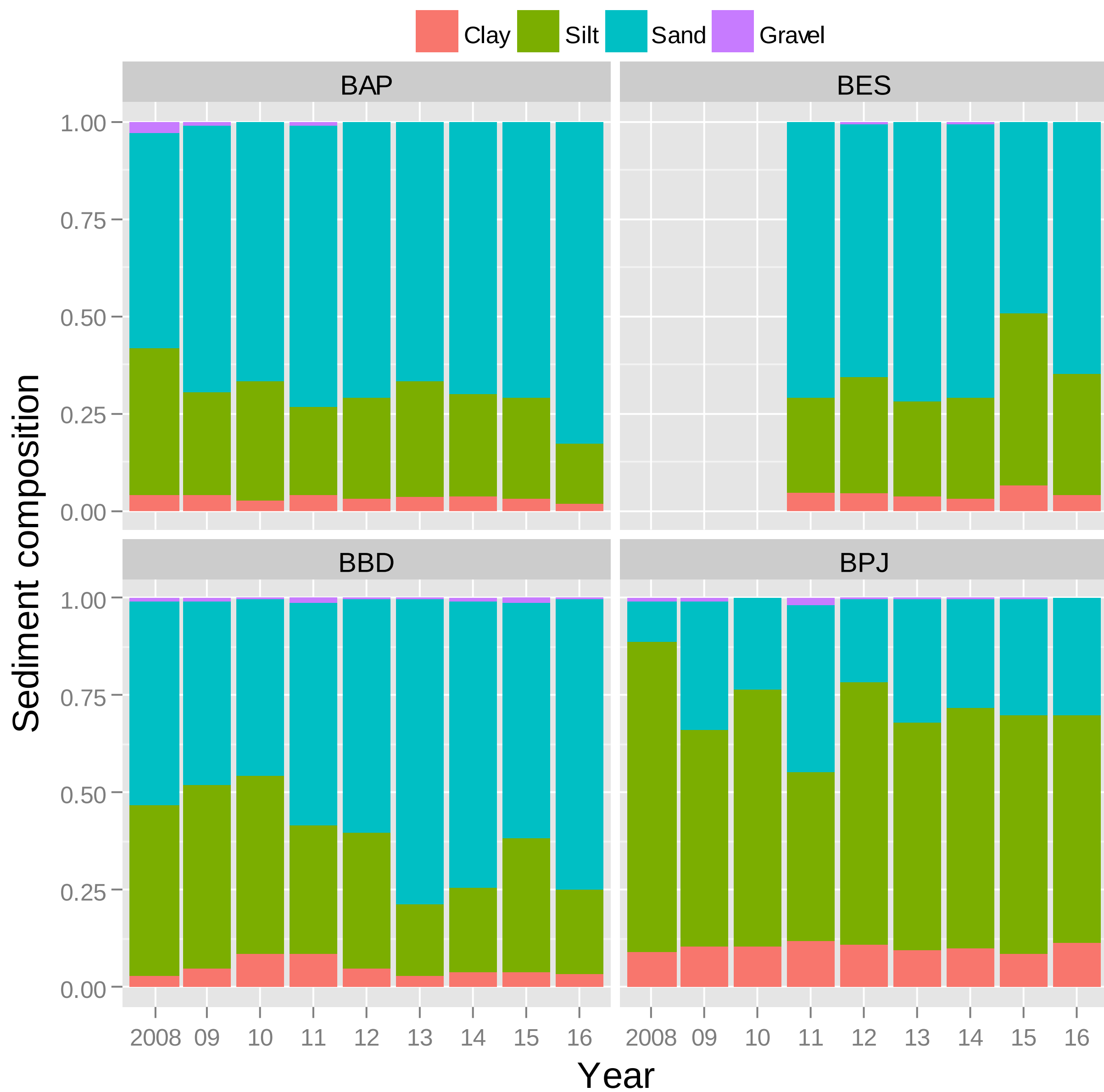


Figure 3.3–51. Total Aluminum (mg/kg) in sediment samples (grabs & cores) from Baker Lake since 2008.

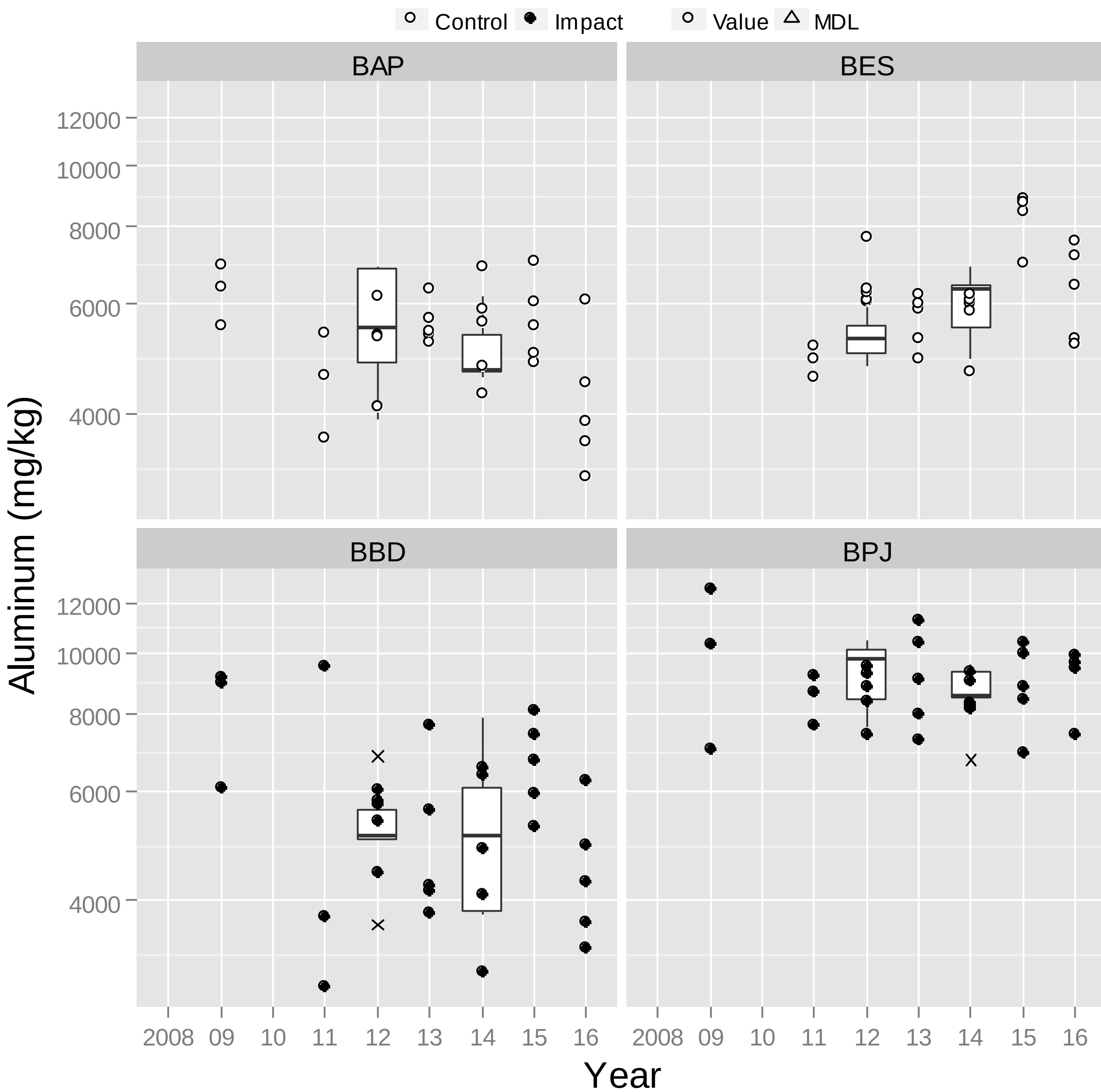


Figure 3.3–52. Total Arsenic (mg/kg) in sediment samples (grabs & cores) from Baker Lake since 2008.

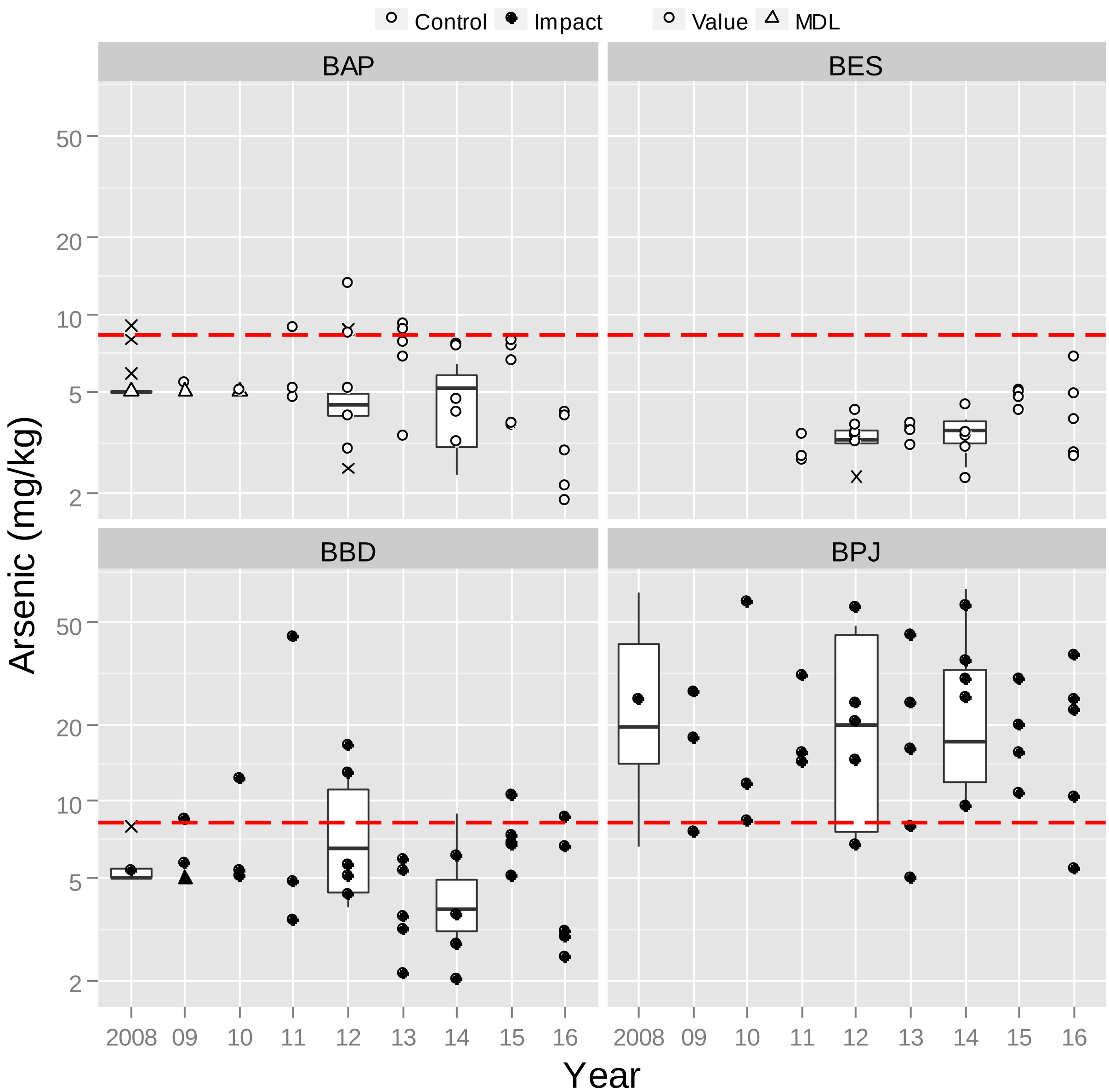


Figure 3.3–53. Total Cadmium (mg/kg) in sediment samples (grabs & cores) from Baker Lake since 2008.

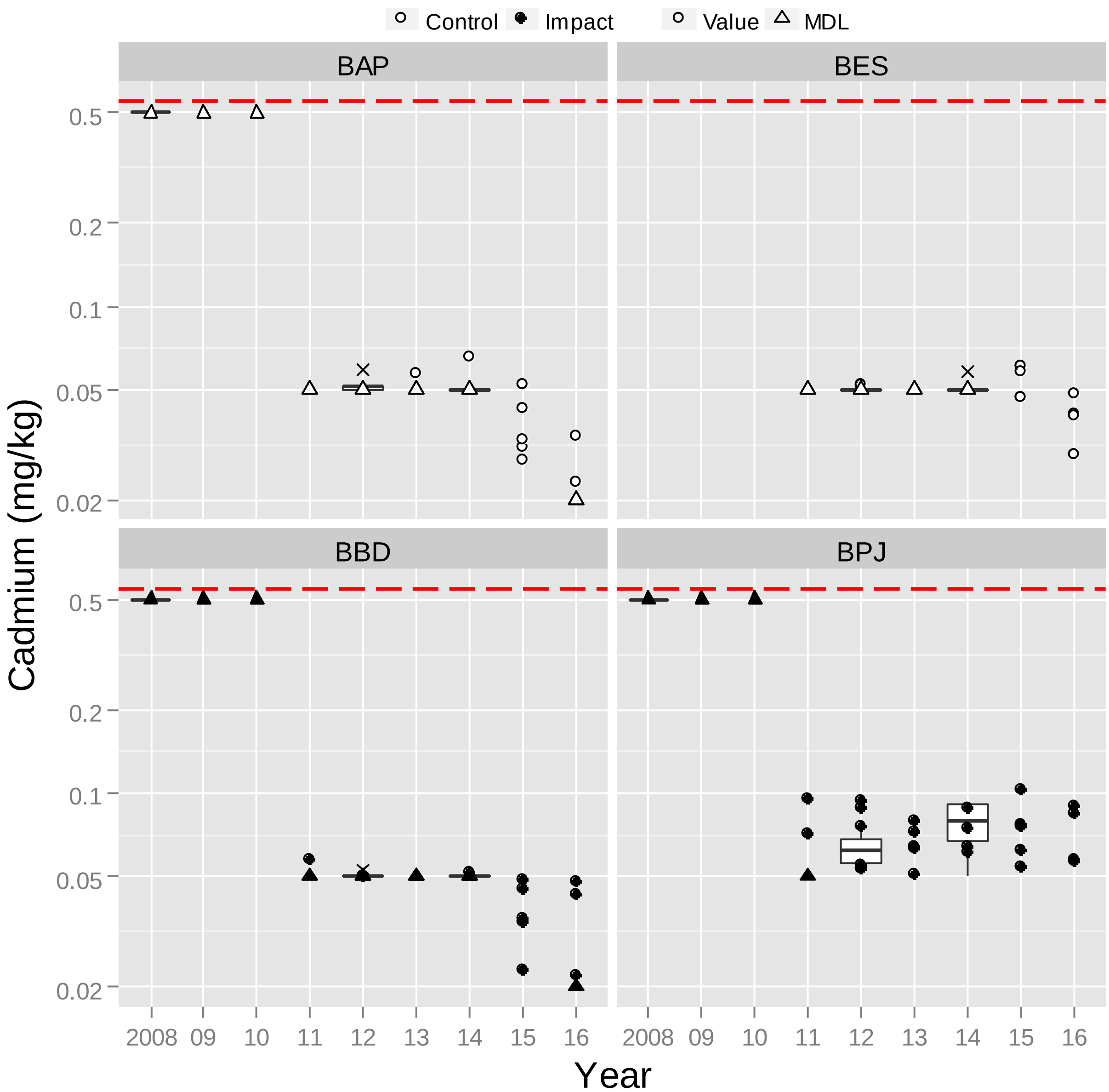


Figure 3.3–54. Total Chromium (mg/kg) in sediment samples (grabs & cores) from Baker Lake since 2008.

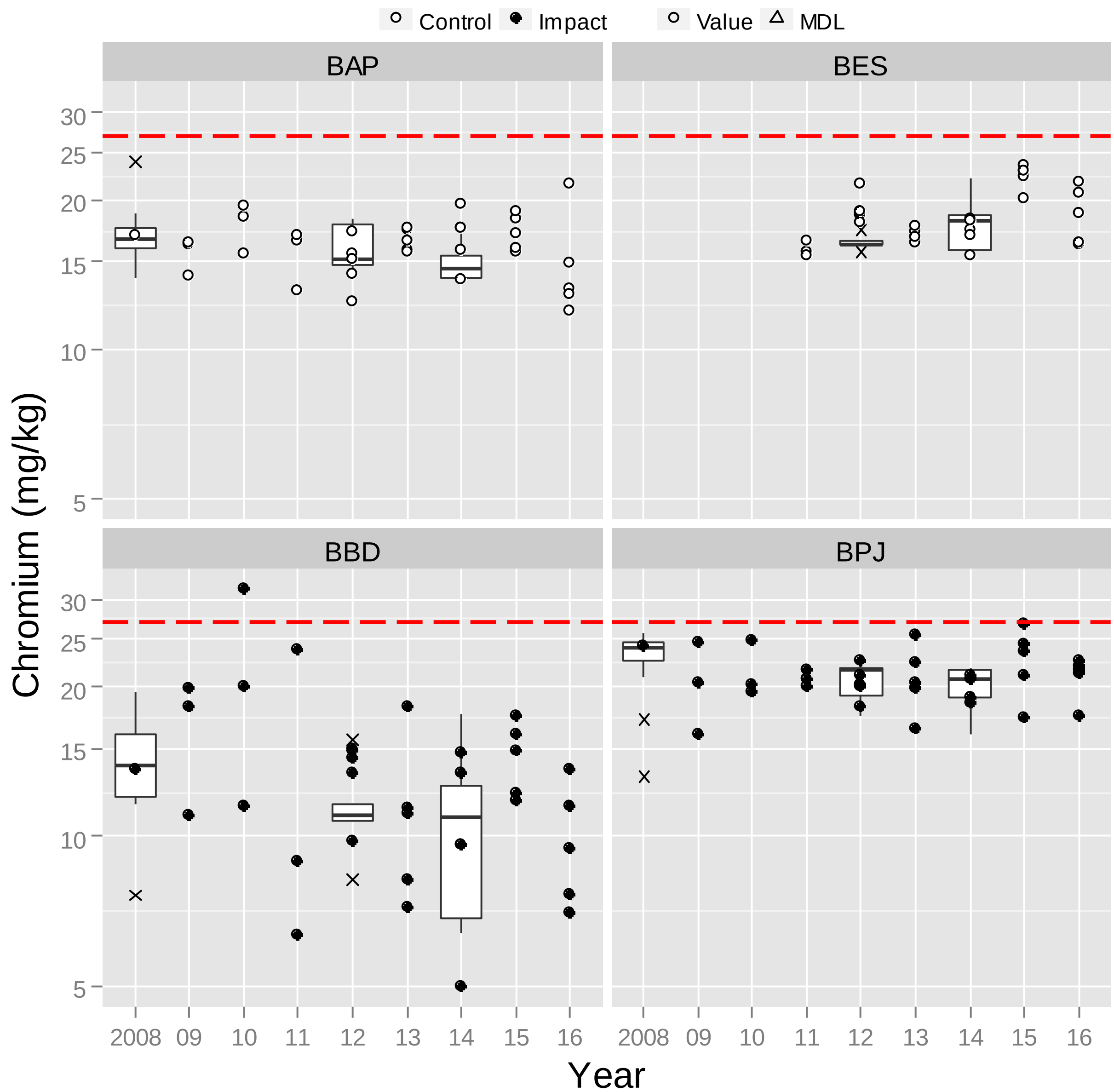


Figure 3.3–55. Total Copper (mg/kg) in sediment samples (grabs & cores) from Baker Lake since 2008.

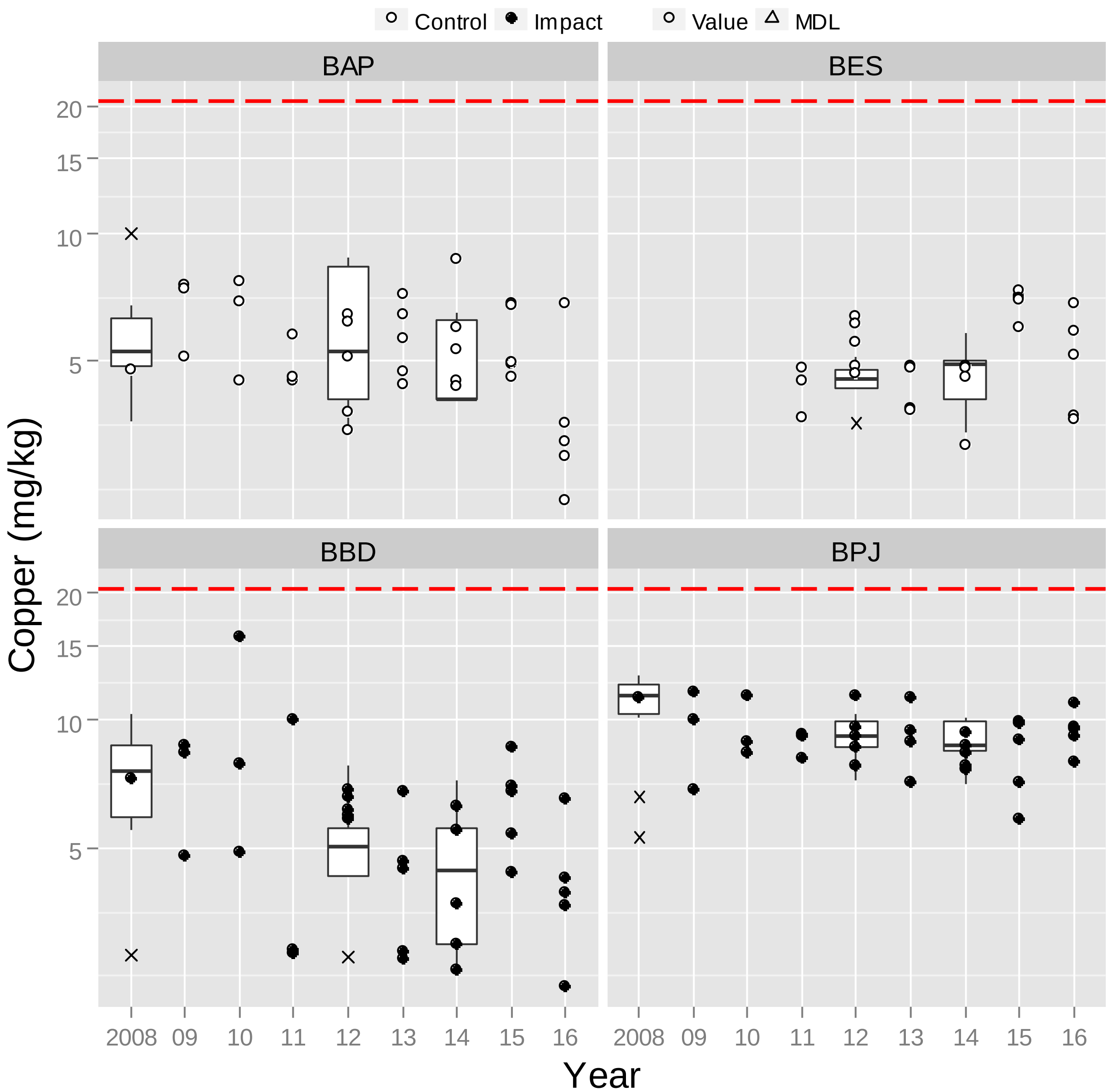


Figure 3.3–56. Total Lead (mg/kg) in sediment samples (grabs & cores) from Baker Lake since 2008.

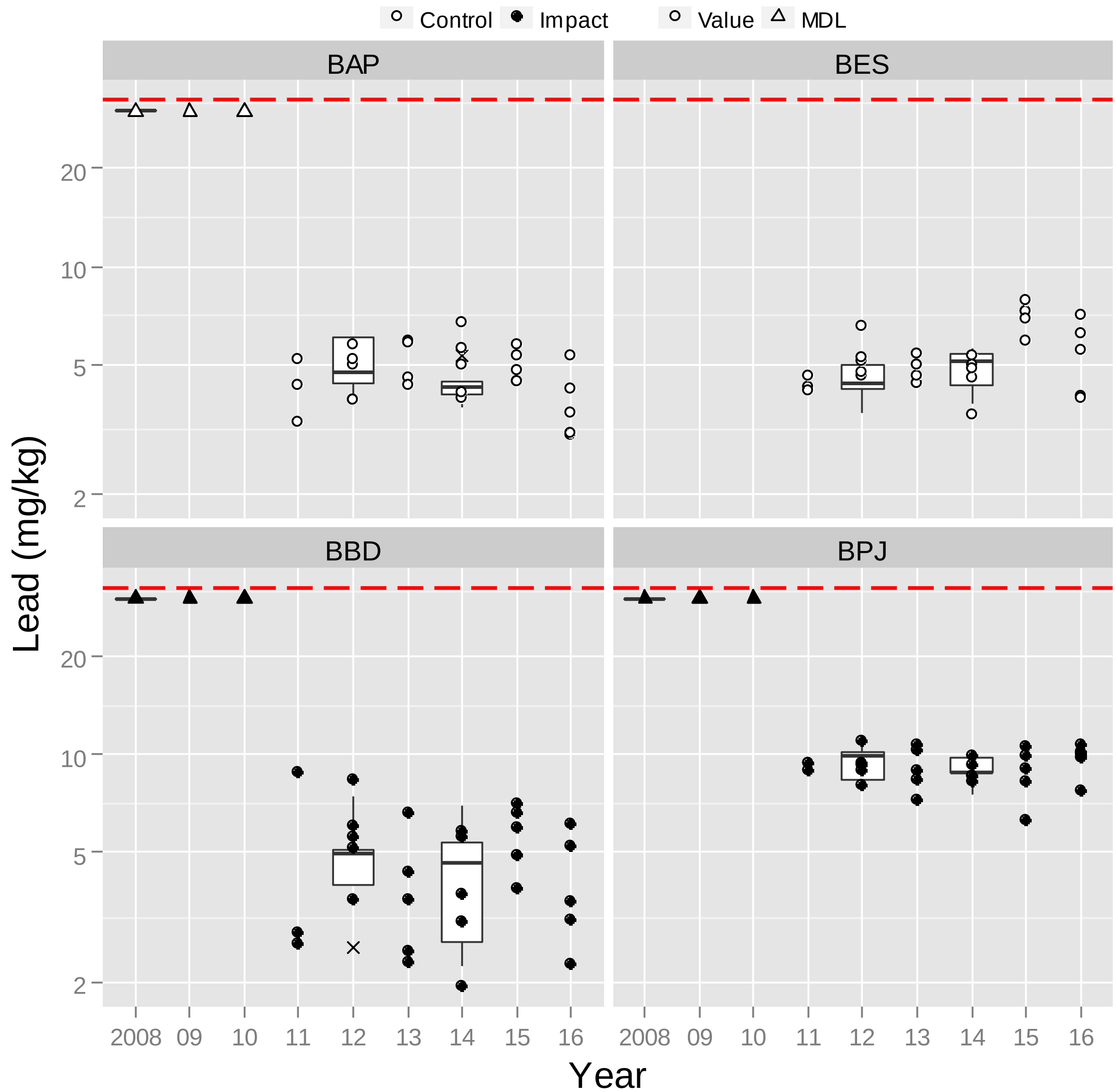


Figure 3.3–57. Total Mercury (mg/kg) in sediment samples (grabs & cores) from Baker Lake since 2008.

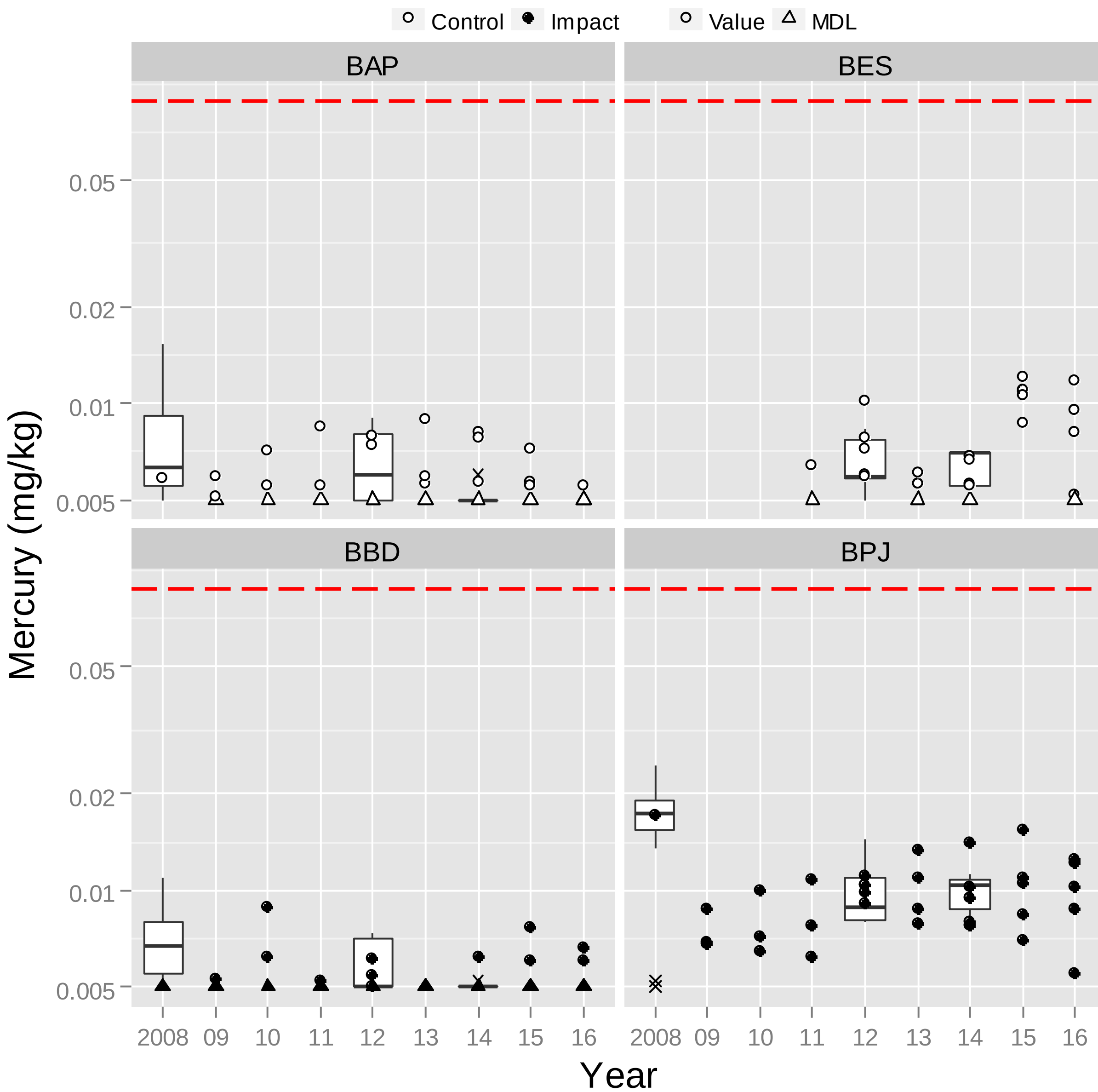
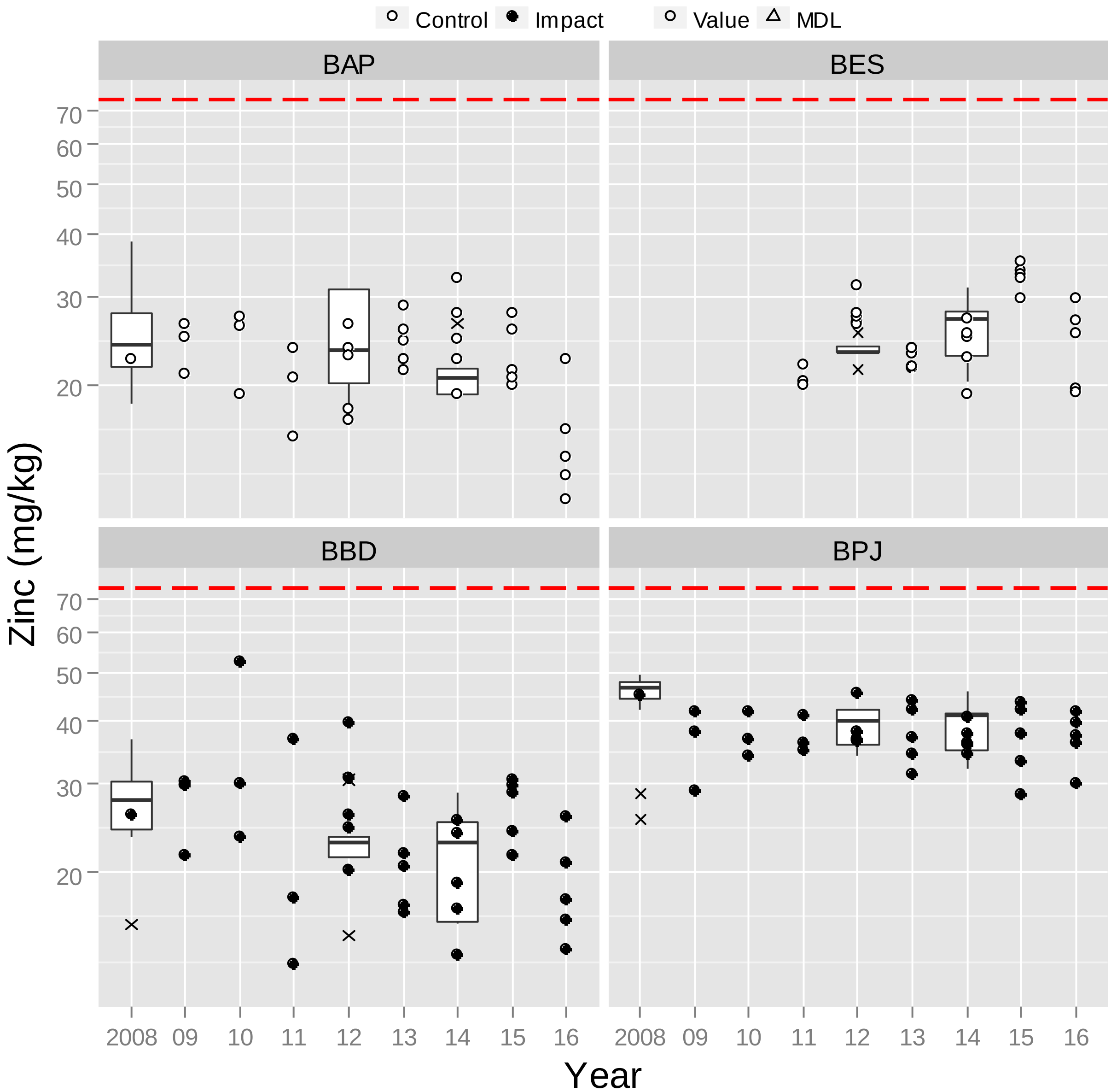


Figure 3.3–58. Total Zinc (mg/kg) in sediment samples (grabs & cores) from Baker Lake since 2008.



3.3.4. Phytoplankton

3.3.4.1. General Observations

The phytoplankton community of Baker Lake is relatively similar to the Meadowbank Lakes despite some seasonal differences in water quality due to the competing influences of less saline water from the Thelon River and more saline water from the deeper portion of Baker Lake (see **Section 3.3.1**). Taxonomic composition and biomass in Baker Lake were similar to the Meadowbank study lakes, with chrysophytes (e.g., *Chrysococcus*, *Kephyrion*, *Dinobryon*) comprising the dominant taxonomic group since monitoring began in 2008. Cryptophytes and diatoms typically comprise the second and third most abundant groups in Baker Lake as shown in **Figure 3.3–61**. Mean summer phytoplankton biomass in Baker Lake is generally similar to the Meadowbank lakes, reaching a maximum of between 200 to 300 mg/m^3.

3.3.4.2. Temporal and Spatial Trend Interpretation

No winter/spring sampling has been conducted at Baker Lake areas so interpretations are limited to summer open water period (which coincides with barge activity). Because of the large size of Baker Lake, it is unlikely that barge traffic (in the absence of a fuel or chemical spill) could influence whole-lake phytoplankton community.

The 2016 density and biomass results for phytoplankton are provided in **Table 3.3–5**. The results for the BACI model statistical tests of the 2016 results against baseline/reference conditions are provided in **Table 3.3–6**. Effect sizes are 20% for the trigger and 50% for the threshold.

Major findings at Baker Lake areas for chlorophyll-a, biomass, species richness and major taxa group composition are as follows:

- *Chlorophyll-a* – Concentrations at reference area BAP historically range between 0.4 to 1 µg/L (**Figure 3.3–59**). July concentrations were slightly lower at BAP in 2016 relative to previous years, measuring 0.16 and 0.2 µg/L. The temperature data from July limnology profile at BAP suggests the ice had just recently come off in the vicinity of BAP, which may have delayed the onset of phytoplankton community development. By August all three areas had similar chlorophyll-a concentrations of between 1.2 and 1.3 µg/L. Overall, range and pattern of chlorophyll-a concentrations for three Baker Lake areas were similar relative to previous years.
- *Total biomass* – Lower biomass was noted at BAP in July 2016, which is consistent with the lower chlorophyll-a concentrations discussed above. By August, phytoplankton biomass at BAP was within the range of previously-reported values (**Figure 3.3–60**). The only statistically significant change in the BACI analysis in 2016 was a 37% increase in biomass at BPJ (**Table 3.3–6**), which was driven, in part, by the large differences seen in the July event. While TKN slightly exceeded the trigger in one sample at BPJ in September, biomass was similar between BJP and the reference area BAP that month. Looking at the historical trends, the apparent increase at BJP in 2016 is due to the lowest total biomass ever measured at BAP in the July event. As discussed for chlorophyll-a, the temperature profile shows that BAP was physically different than the other two areas, probably due to recent ice out or a related natural process. Overall, phytoplankton biomass in Baker Lake continues to show consistent patterns of seasonal change, with absolute biomass estimates at the exposure areas remaining within the range of previously-reported values.
- *Major taxa composition* – there were no apparent differences in relative composition of phytoplankton communities between BAP and impact areas BBD and BPJ in 2016 (**Figure 3.3–62**). Chrysophytes are the dominant taxa in terms of biomass at the reference and exposure

areas, making up ~60% of the total phytoplankton biomass in each area. Diatoms, cryptophytes, and chlorophytes comprise the remaining ~40% (**Table 3.3–5**).

- *Species richness* – Taxa richness, like biomass, was within the range previously noted for the exposure and reference areas (**Figure 3.3–63**). Seasonal trends of lower richness in July relative to August and September were again observed in the 2016 monitoring cycle. There were no statistically significant changes in species richness for 2016 relative to previous years and the BAP reference.

The apparent increase in phytoplankton biomass observed at BPJ in 2016 was likely driven by natural limnological processes causing lower biomass at the reference area BAP. Phytoplankton biomass will continue to be monitored for potential temporal trends, but no follow-up measures are recommended other than routine monitoring for 2017.

Table 3.3–5. Phytoplankton density (cells/L), biomass (mg/m^3), and diversity by major taxa group, Baker Lake, 2016.

Area-Replicate	Date	Phytoplankton Biomass (mg/m^3)								Taxa Richness	Simpson's Diversity
		Cyanophyte	Chlorophyte	Euglenophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	TOTAL		
Baker Akilahaarjuk Point											
BAP-43	22-Jul-16	0	3.7	0	49	20.04	3	20.92	96	32	0.81
BAP-44	22-Jul-16	1	2.4	0	60	14.05	14	18.33	110	34	0.84
BAP-45	8-Aug-16	0	8.8	0	185	59.40	45	8.79	308	47	0.87
BAP-46	8-Aug-16	0	6.5	0	192	37.32	23	8.64	268	34	0.83
BAP-47	2-Sep-16	0	10.3	0	174	35.68	30	13.88	264	40	0.86
BAP-48	2-Sep-16	0	4.8	0	142	36.45	45	26.40	255	35	0.86
Percent Density or Biomass		***0.16***	***2.8***	***<0.1***	***62***	***16***	***12***	***7.5***			
Baker Barge Dock											
BBD-43	22-Jul-16	0	8.0	0	181	37.75	53.2	22.33	302	35	0.89
BBD-44	22-Jul-16	0	5.7	0	143	15.57	30	17.61	212	33	0.85
BBD-45	10-Aug-16	0	5.1	0	145	47.89	34	3.12	235	37	0.90
BBD-46	10-Aug-16	0	9.1	1.3	151	66.07	64	8.10	300	40	0.90
BBD-47	3-Sep-16	0	7.0	0	80	25.60	31	22.24	166	37	0.78
BBD-48	3-Sep-16	0	5	0	86	31.25	26	19.13	168	39	0.81
Percent Density or Biomass		***<0.1***	***2.9***	***<0.1***	***57***	***16***	***17***	***6.7***			
Baker Proposed Jetty											
BPJ-43	22-Jul-16	1	2.8	0	162	28.99	20	31.43	246	38	0.89
BPJ-44	22-Jul-16	0	4.2	0	112	42.48	29	19.62	208	38	0.86
BPJ-45	10-Aug-16	0	3.5	0	141	58.74	59	11.55	274	41	0.87
BPJ-46	10-Aug-16	1	8.1	0	209	73.29	48	4.17	343	47	0.87
BPJ-47	3-Sep-16	0	13.5	0	165	24.91	48	27.28	278	34	0.82
BPJ-48	3-Sep-16	0	5.1	0	156	32.86	24	35.17	253	40	0.79
Percent Density or Biomass		***0.17***	***2.3***	***<0.1***	***59***	***16***	***14***	***8.1***			
All 2016 Locations Relative Density or Biomass (%)		***0.12***	***2.6***	***<0.1***	***59***	***16***	***15***	***7.4***			

Table 3.3–5. Phytoplankton density (cells/L), biomass (mg/m^3), and diversity by major taxa group, Baker Lake, 2016.

Area-Replicate	Date	Phytoplankton Density (cells/L)							
		Cyanophyte	Chlorophyte	Euglenophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	**TOTAL**
Baker Akilahaarjuk Point									
BAP-43	22-Jul-16	400	93,592	0	632,592	75,256	15,168	9,584	826,592
BAP-44	22-Jul-16	8,984	65,056	0	647,360	64,872	94,792	2,600	883,664
BAP-45	8-Aug-16	1,400	194,168	0	1,808,784	210,680	375,568	1,600	2,592,200
BAP-46	8-Aug-16	600	114,944	0	1,760,696	232,384	202,952	1,200	2,312,776
BAP-47	2-Sep-16	0	388,136	0	2,102,928	192,944	223,704	8,584	2,916,296
BAP-48	2-Sep-16	800	258,624	0	1,710,408	188,376	345,832	9,584	2,513,624
Percent Density or Biomass		***0.10***	***9.3***	***<0.1***	***72***	***8.0***	***10***	***0.28***	
Baker Barge Dock									
BBD-43	22-Jul-16	0	229,888	0	1,942,880	95,840	398,120	10,784	2,677,512
BBD-44	22-Jul-16	0	107,760	0	1,519,824	46,320	216,720	8,984	1,899,608
BBD-45	10-Aug-16	0	222,904	0	1,593,864	227,400	212,936	200	2,257,304
BBD-46	10-Aug-16	400	223,104	200	1,422,048	286,520	375,984	8,584	2,316,840
BBD-47	3-Sep-16	400	107,760	0	1,546,760	98,688	199,768	22,952	1,976,328
BBD-48	3-Sep-16	0	136,896	0	1,253,216	88,304	176,416	8,384	1,663,216
Percent Density or Biomass		***<0.1***	***8.0***	***<0.1***	***73***	***6.6***	***12***	***0.47***	
Baker Proposed Jetty									
BPJ-43	22-Jul-16	29,136	93,592	0	1,592,464	100,408	146,080	10,784	1,972,464
BPJ-44	22-Jul-16	600	65,456	0	1,583,080	127,560	169,632	2,600	1,948,928
BPJ-45	10-Aug-16	200	57,872	0	1,425,832	214,264	364,000	8,984	2,071,152
BPJ-46	10-Aug-16	200	230,088	0	1,890,808	271,832	294,360	600	2,687,888
BPJ-47	3-Sep-16	0	266,608	0	1,718,392	120,072	360,600	23,352	2,489,024
BPJ-48	3-Sep-16	0	287,960	0	2,015,720	123,272	181,000	17,168	2,625,120
Percent Density or Biomass		***0.22***	***7.3***	***<0.1***	***74***	***6.9***	***11***	***0.46***	
All 2016 Locations Relative Density or Biomass (%)		***0.11***	***8.1***	***<0.1***	***73***	***7.2***	***11***	***0.41***	

Table 3.3–6. Results of BACI tests for phytoplankton variables at Baker Lake areas.

Parameter Measured	Test Area	n(B)	n(A)	Estimate	SE	P-value*	Effect size (%)		
							ES	LCI	UCI
Total biomass	BBD	21	3	0.14	0.22	0.541	15	-27	81
	BPJ	21	3	0.32	0.17	**0.078**	37	-4	96
Species	BBD	21	3	-0.03	0.05	0.555	-3	-13	8
	BPJ	21	3	0.03	0.05	0.51	3	-7	14

Notes:
* **Bolded** values are P-values < 0.1
Shaded cells indicate negative effect sizes (reductions) of 20% or more
Test area = area compared to control (BAP)
n(B) = number of months in the "before" period
n(A) = number of months in the "after" period (i.e., in 2016)
Estimate = BACI model estimate of the 2016 change in mean for log-transformed data
SE = standard error of the estimate
P-value = two-tailed test of the null hypothesis of no change
ES = estimated effect size (i.e., 100%*(exp[Estimate]-1))
LCI = lower 95% confidence interval; UCI = upper 95% confidence interval

Figure 3.3–59. Chlorophyll-a (µg/L) in water samples from Baker Lake since 2008.

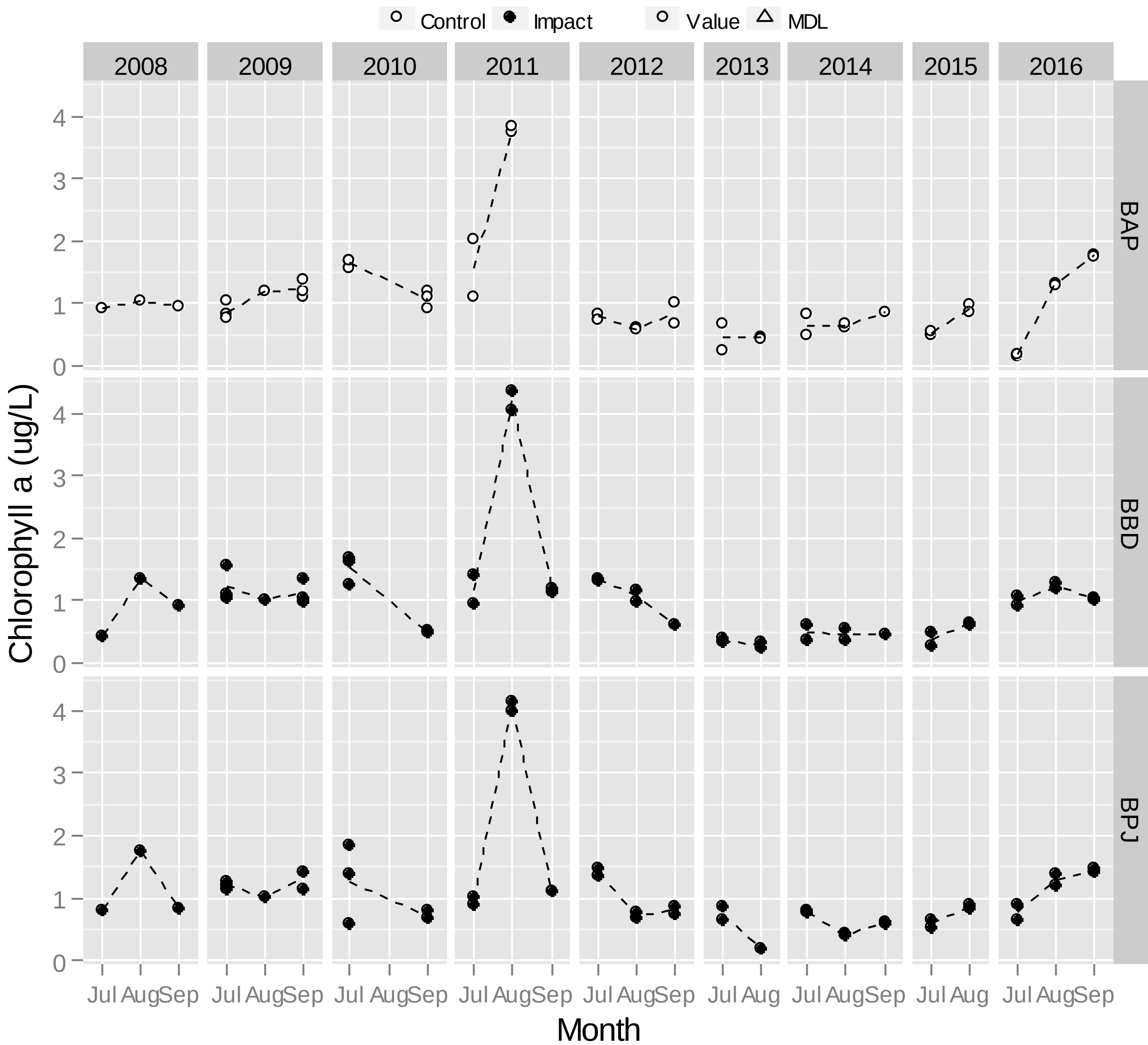


Figure 3.3–60. Total phytoplankton biomass (mg/m^3) from Baker Lake since 2008.

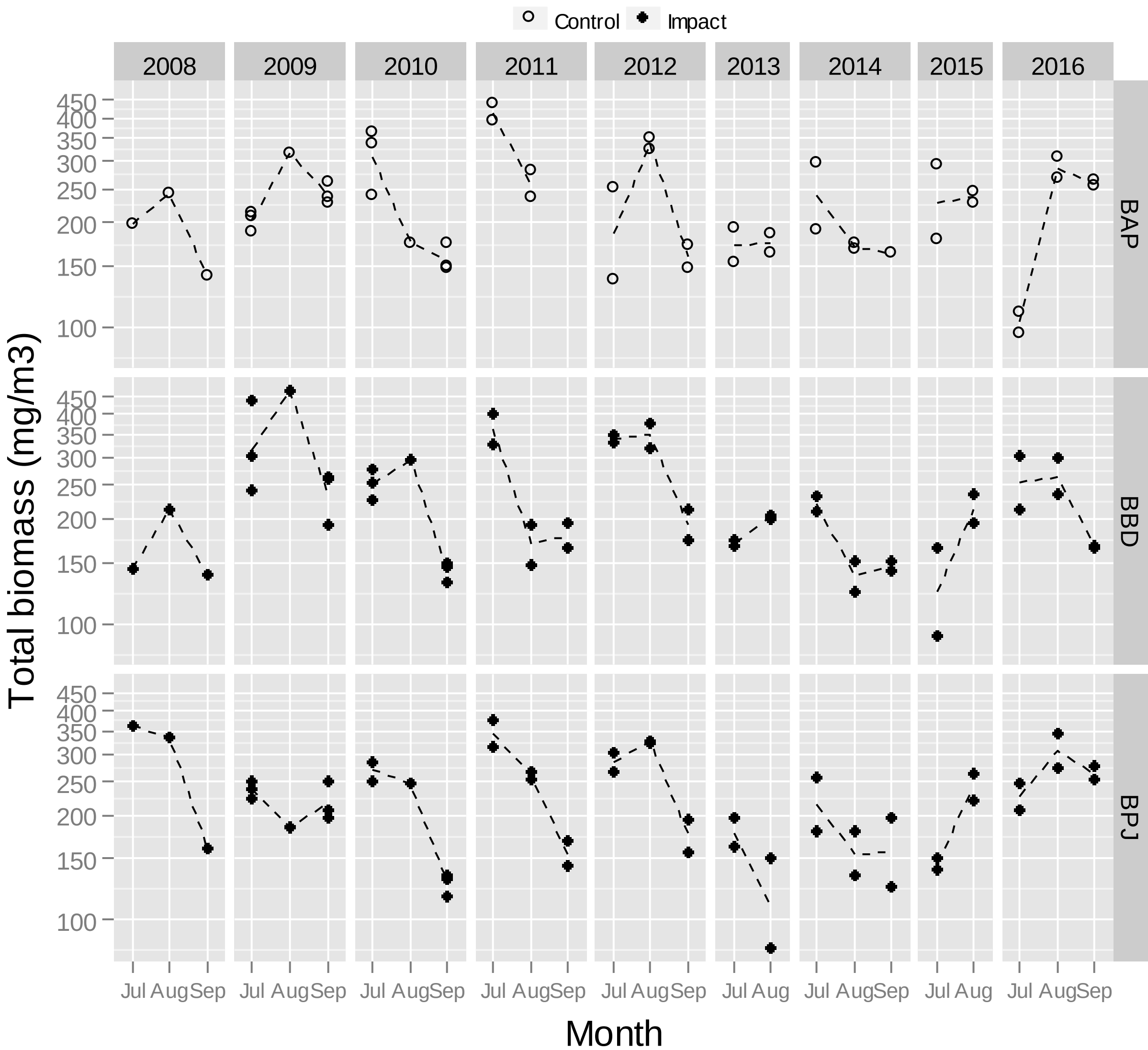


Figure 3.3–61. Phytoplankton biomass (mg/m^3) by major taxa group from Baker Lake since 2008.

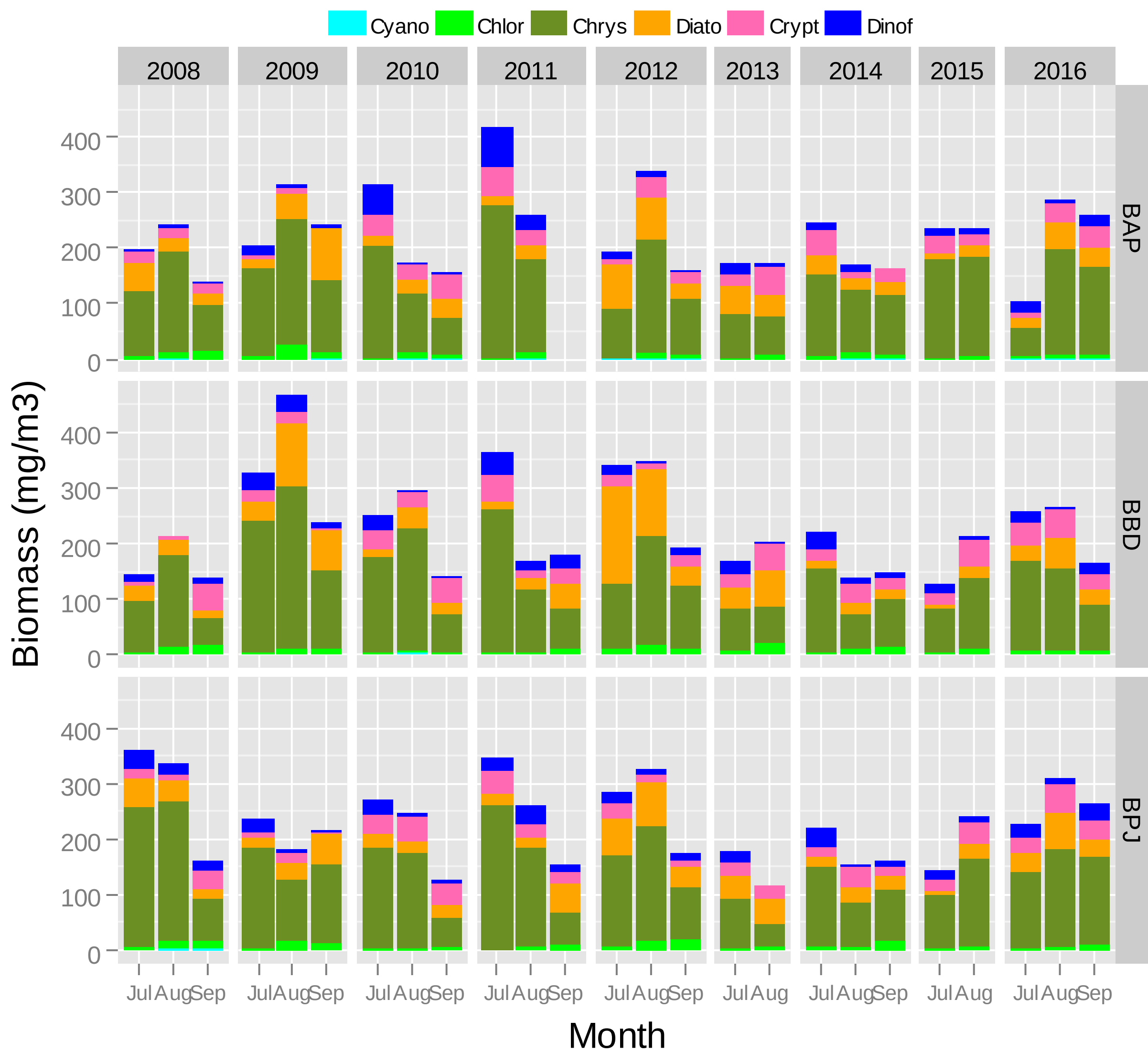


Figure 3.3–62. Phytoplankton relative biomass by major taxa group from Baker Lake since 2008.

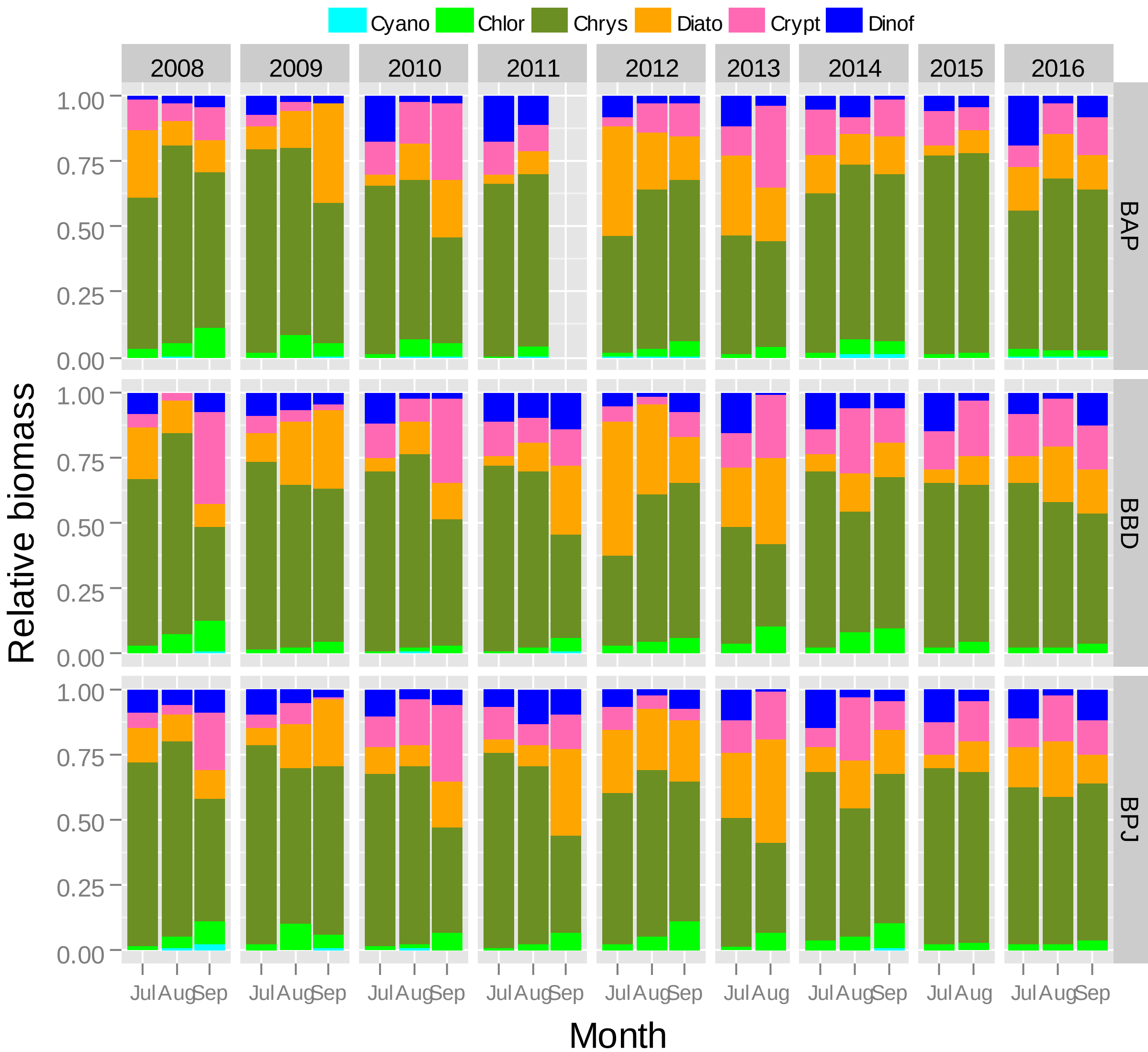
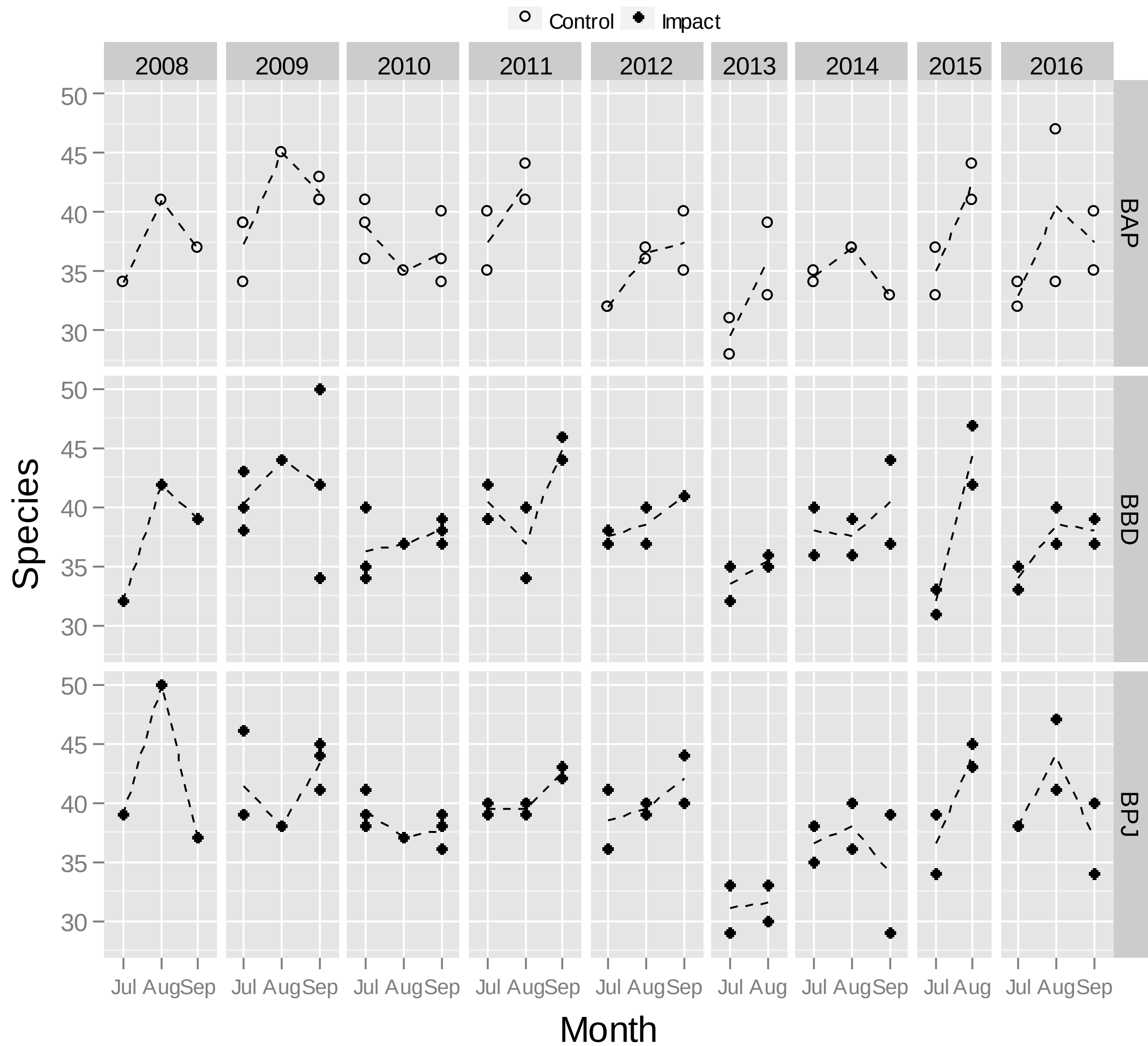


Figure 3.3–63. Phytoplankton species richness from Baker Lake since 2008.



3.3.5. Benthic Invertebrates

3.3.5.1. General Observations

Benthic invertebrates have been collected from Baker Lake annually in August since 2008. Baker Lake was added to the core program to ensure that monitoring was also in place to track activities in that area related primarily to barge traffic and shipping. There are two near-field impact areas, one targeting the hamlet's barge landing area (BBD) and the other Agnico's fuel storage facility (BPJ). The initial (since 2008) reference area (BAP) is several kilometers to the east of the hamlet along the north shore of the lake. A second reference area (BES) was added in 2011 to provide a broader perspective for temporal patterns in benthic community structure.

Abundance and species composition of benthic invertebrate communities at Baker Lake are strongly affected by a variety of parameters, including grain size, water depth and sediment organic content (as discussed in **Section 3.2.5.1**). Investigations in the Meadowbank lakes and Baker Lake have targeted areas of similar depth and grain size (i.e., dominated by silt/clay with a small [<5%] sand fraction). Unlike the Meadowbank study lakes, sediment grain size in Baker Lake has tended to be more variable and less predictable at all locations, with consistently coarser grain size (more sandy) than observed in Meadowbank lakes (see the 2016 results in **Table 3.3–3** as an example of the variability within, and between areas). Higher sand content is typically associated with a lower TOC concentration, which in turn influences the type of benthic community.

Similar to Meadowbank study lakes, the Baker Lake benthic community is generally characterized by relatively low abundance and taxa richness. Benthic invertebrate community abundance at Baker Lake often exceeds 5,000 organisms/m^2 (**Figure 3.3–64**), which is higher than typically-reported benthic invertebrate abundance at the Meadowbank study area lakes (**Figure 3.2–65**). Annual variability was sometimes high, as seen for example at BBD (e.g., from 2008 to 2009). There have also been fairly consistent spatial differences in abundance among areas (e.g., BBD and BPJ have generally had lower abundance than BAP). Taxa richness historically ranged from 8 to 12 in exposure areas and from approximately 12 to 22 in reference areas, although considerable within-station variability in taxa richness has been documented, particularly at the exposure areas BBD and BPJ (e.g., **Figure 3.3–67**).

The benthic invertebrate community in Baker Lake is dominated by the aquatic larval stages of insects, especially chironomids (Family Chironomidae), both in terms of abundance (**Figure 3.3–65** and **Figure 3.3–66**) and taxa richness (**Figure 3.3–68** and **Figure 3.3–69**). The next most abundant group is typically Mollusca (clams) especially, *Cyclocalyx/Neopisidium*, genera of the family Sphaeriidae (fingernail clams). Oligochaete worms can also be relatively abundant in the lake sediments, possibly because of higher sand content; generally, at least one oligochaete taxon was present at most area/year combinations.

3.3.5.2. Temporal and Spatial Trend Interpretation

Abundance and richness results from 2016 are shown in **Table 3.3–7**. Details regarding historical trends are discussed in the 2011 CREMP (Azimuth, 2012a). This report focuses on the 2016 results and trends over the last four years. BACI model results are presented in **Table 3.3–8** (abundance) and **Table 3.3–9** (richness). Key results are described below:

- *Total abundance* – Mean 2016 abundance was generally similar to previous years at all Baker Lake areas (**Figure 3.3–64**). One sample collected from BPJ had substantially low abundance compared to the other four replicates. The low abundance was attributed to propeller wash from the tug boat that was working to pull the barge off the shore just prior to sample collection. Mean abundance for replicates 1, 2, 3, and 5 was 3,348 organisms/m^2. In contrast, abundance at replicate 4 was 130 organisms/m^2. The BACI analysis was run with and without the low abundance values at BPJ-4 to determine the effect on the analysis. Including BPJ-4 in the BACI analysis had no effect on the overall interpretation of whether there is an adverse effect on benthic invertebrate abundance at BPJ. Overall, the BACI analysis shows moderate increases in abundance at the exposure areas relative to the reference areas for 2016, as well as for the 2-, 3-, and 4-year "after" periods (**Table 3.3–8**). In summary, there is no indication that barge traffic is having an adverse effect on benthic invertebrate community abundance at the exposure areas in Baker Lake.

- *Major taxa group abundance and relative abundance* – As discussed previously, the benthic invertebrate communities at reference and impact areas in Baker Lake are comprised primarily of chironomid larvae. However, the relative proportion of different taxa is markedly different for the impact areas BBD and BPJ compared to reference are BAP (apart from 2008; **Figure 3.3–65** and **Figure 3.3–66**). Since 2009, between approximately 25 to 60% of individuals at BAP have been oligochaetes, compared to less than 10% at the impact areas and reference area BES (which was added in 2011 to provide a reference area with more similar characteristics to the exposure areas). As was the case in 2015, the dominant oligochaete taxa in terms of density at BAP in 2016 were from the Naididae subfamilies Rhyacodrilinae (*Rhyacodrilus sp*) and Tubificinae (see **Appendix D**). *Rhyacodrilus sp* were identified in at least two replicate samples from BES, BBD, and BPJ, but at lower abundances. The differences observed in major taxa composition between the two reference areas is completely natural.
- *Taxa richness* – Mean taxa richness was high across all Baker Lake areas in 2016 (**Figure 3.3–67**). Geometric means for total richness were the highest among all years for BES and second highest at BAP, BBD, and BPJ. Consequently, the BACI model results showed positive, yet uncertain (p>0.1), effects sizes for total richness in 2016 and the two-year, 3-year, and 4-year time periods (**Table 3.3–9**).
- *Major taxa group richness and relative richness* – From a taxa richness perspective, impact areas BBD and BPJ appear reasonably similar to both reference areas (BES and BAP), with insects dominating the communities (**Figure 3.3–68** and **Figure 3.3–69**). There were no apparent trends in species composition, indicating the barge operations are not adversely affecting the community.

Monitoring results to date have been variable across the sites. A detailed discussion on early trends is presented in the 2012 CREMP (Azimuth, 2013). At present there is no evidence that development-related activities are adversely affecting the benthic invertebrate community, especially in light of no apparent barge-related effects to water quality and sediment chemistry.

Table 3.3–7. Benthic invertebrate abundance (#/m^2) and richness (# taxa) by major taxa group, Baker Lake, 2016.

Area-Replicate	Date	Depth (m)	Abundance (#/m^2) Oligochaetes	Insects	Molluscs	Other Taxa[1]	Total	Richness (# taxa) Oligochaetes	Insects	Molluscs	Other Taxa[1]	Total	Simpson's Diversity	Bray-Curtis Index
Baker Akilahaarjuk Point														
BAP-1	8-Aug-16	7.6	1674	2413	326	152	4565	4	15	2	2	23	0.88	0.36
BAP-2	8-Aug-16	7.1	2891	3652	457	261	7261	5	15	2	4	26	0.90	0.34
BAP-3	8-Aug-16	8.0	1326	978	326	174	2804	4	13	2	3	22	0.93	0.40
BAP-4	8-Aug-16	7.8	3522	3391	87	65	7065	3	14	1	2	20	0.88	0.40
BAP-5	8-Aug-16	8.2	1348	3065	674	109	5196	4	16	2	4	26	0.91	0.44
Area Mean			***2152***	***2700***	***374***	***152***	***5378***	***4***	***15***	***2***	***3***	***23***	***0.90***	***0.39***
Baker Barge Dock														
BBD-1	9-Aug-16	8.2	196	4565	87	0	4848	1	12	1	0	14	0.64	0.57
BBD-2	9-Aug-16	8.2	196	3326	217	0	3739	2	11	2	0	15	0.44	0.62
BBD-3	9-Aug-16	8	0	739	0	22	761	0	9	0	1	10	0.81	0.78
BBD-4	9-Aug-16	8.9	65	717	0	0	783	1	11	0	0	12	0.89	0.79
BBD-5	9-Aug-16	7.9	65	4435	87	130	4717	2	17	2	3	24	0.84	0.53
Area Mean			***104***	***2757***	***78***	***30***	***2970***	***1***	***12***	***1***	***1***	***15***	***0.73***	***0.66***
Baker East Shore														
BES-1	8-Aug-16	7.8	87	1717	152	152	2109	2	12	2	2	18	0.92	0.54
BES-2	8-Aug-16	9	196	2870	109	196	3370	2	16	2	4	24	0.94	0.51
BES-3	8-Aug-16	8.9	217	2478	152	261	3109	2	12	2	2	18	0.93	0.54
BES-4	8-Aug-16	8	130	2065	196	348	2739	2	14	1	3	20	0.92	0.51
BES-5	8-Aug-16	8.3	109	1717	326	87	2239	2	12	1	2	17	0.91	0.59
Area Mean			***148***	***2170***	***187***	***209***	***2713***	***2***	***13***	***2***	***3***	***19***	***0.92***	***0.54***
Baker Proposed Jetty														
BPJ-1	9-Aug-16	8.1	22	3391	152	261	3826	1	13	2	2	18	0.88	0.61
BPJ-2	9-Aug-16	8.2	0	3304	43	239	3587	0	14	1	3	18	0.90	0.54
BPJ-3	9-Aug-16	8.7	22	2370	22	348	2761	1	16	1	1	19	0.90	0.64
BPJ-4*	9-Aug-16	8.5	0	109	0	22	130	0	3	0	1	4	0.93	0.97
BPJ-5	9-Aug-16	8.6	217	2826	22	152	3217	2	15	1	2	20	0.93	0.54
Area Mean			***52***	***2400***	***48***	***204***	***2704***	***1***	***12***	***1***	***2***	***16***	***0.91***	***0.66***

Notes:

[1] "Other taxa" includes flatworms (Turbellaria) and arthropods (Acalyptonotidae, Hygrobatidae, Lebertiidae, Oxidae, and O. Notostraca).

* Low benthic invertebrate abundance and richness is attributed to physical disturbance caused by propeller wash from a tug boat that was operating to pull the barge off shore.

Table 3.3–8. Results of BACI tests for benthic invertebrate abundance at Baker Lake areas.

After Period	Test Area	n(B)	n(A)	Estimate	SE	P-value*	Effect size (%)		
							ES	LCI	UCI
2016	BBD	8	1	0.03	1.22	0.51	3	-94	1726
	BPJ	8	1	0.66	0.97	0.74	93	-80	1808
2015-2016	BBD	7	2	0.41	0.88	0.67	50	-81	1108
	BPJ	7	2	0.67	0.71	0.81	95	-64	951
2014-2016	BBD	6	3	0.04	0.74	0.52	4	-82	506
	BPJ	6	3	0.43	0.65	0.74	53	-67	608
2013-2016	BBD	5	4	0.25	0.68	0.64	29	-74	544
	BPJ	5	4	0.36	0.62	0.71	44	-67	520

Table 3.3–9. Results of BACI tests for benthic invertebrate taxa richness at Baker Lake areas.

After Period	Test Area	n(B)	n(A)	Estimate	SE	P-value*	Effect size (%)		
							ES	LCI	UCI
2016	BBD	8	1	0.10	0.33	0.62	11	-49	140
	BPJ	8	1	0.19	0.37	0.69	21	-49	190
2015-2016	BBD	7	2	0.15	0.24	0.72	16	-35	107
	BPJ	7	2	0.18	0.28	0.74	20	-37	131
2014-2016	BBD	6	3	0.11	0.22	0.68	11	-33	86
	BPJ	6	3	0.27	0.23	0.86	31	-24	125
2013-2016	BBD	5	4	0.15	0.20	0.75	16	-28	86
	BPJ	5	4	0.27	0.22	0.87	31	-21	118

Notes:

* **Bolded** values are P-values < 0.1

Shaded cells indicate negative effect sizes (reductions) of 20% or more

Test area = area compared to control (BAP)
n(B) = number of years in the "before" period

n(A) = number of years in the "after" period

Estimate = BACI model estimate of the after-period change in mean for log-transformed data

SE = standard error of the estimate

P-value = one-tailed test of the null hypothesis of no change or an increase in mean

ES = estimated effect size (i.e., 100%*(exp[Estimate]-1))
LCI = lower 95% confidence interval; UCI = upper 95% confidence interval

Figure 3.3–64. Benthic invertebrate total abundance (#/m^2) from Baker Lake since 2008.

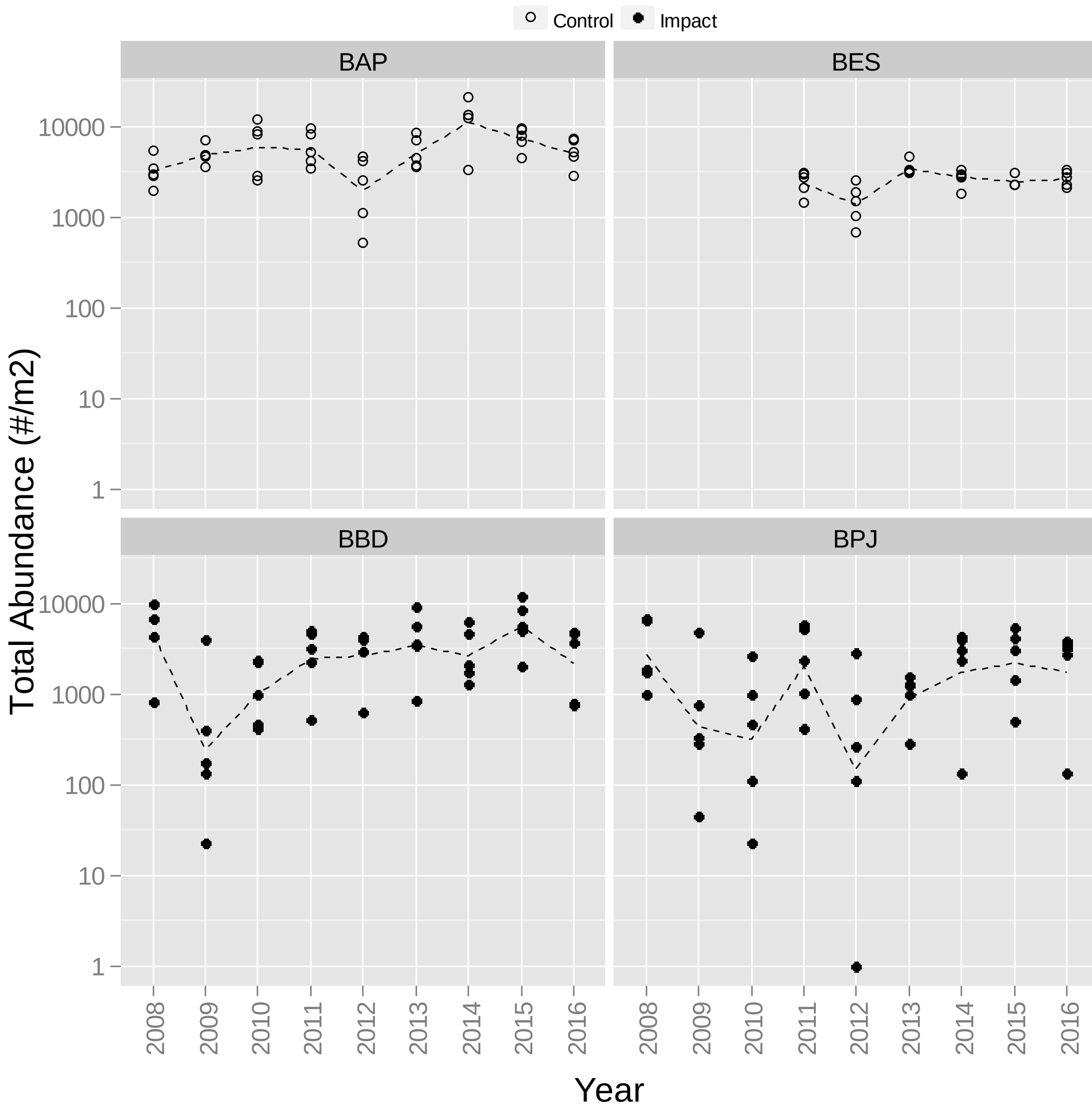


Figure 3.3–65. Benthic invertebrate abundance (#/m^2) by major taxa group from Baker Lake since 2008.

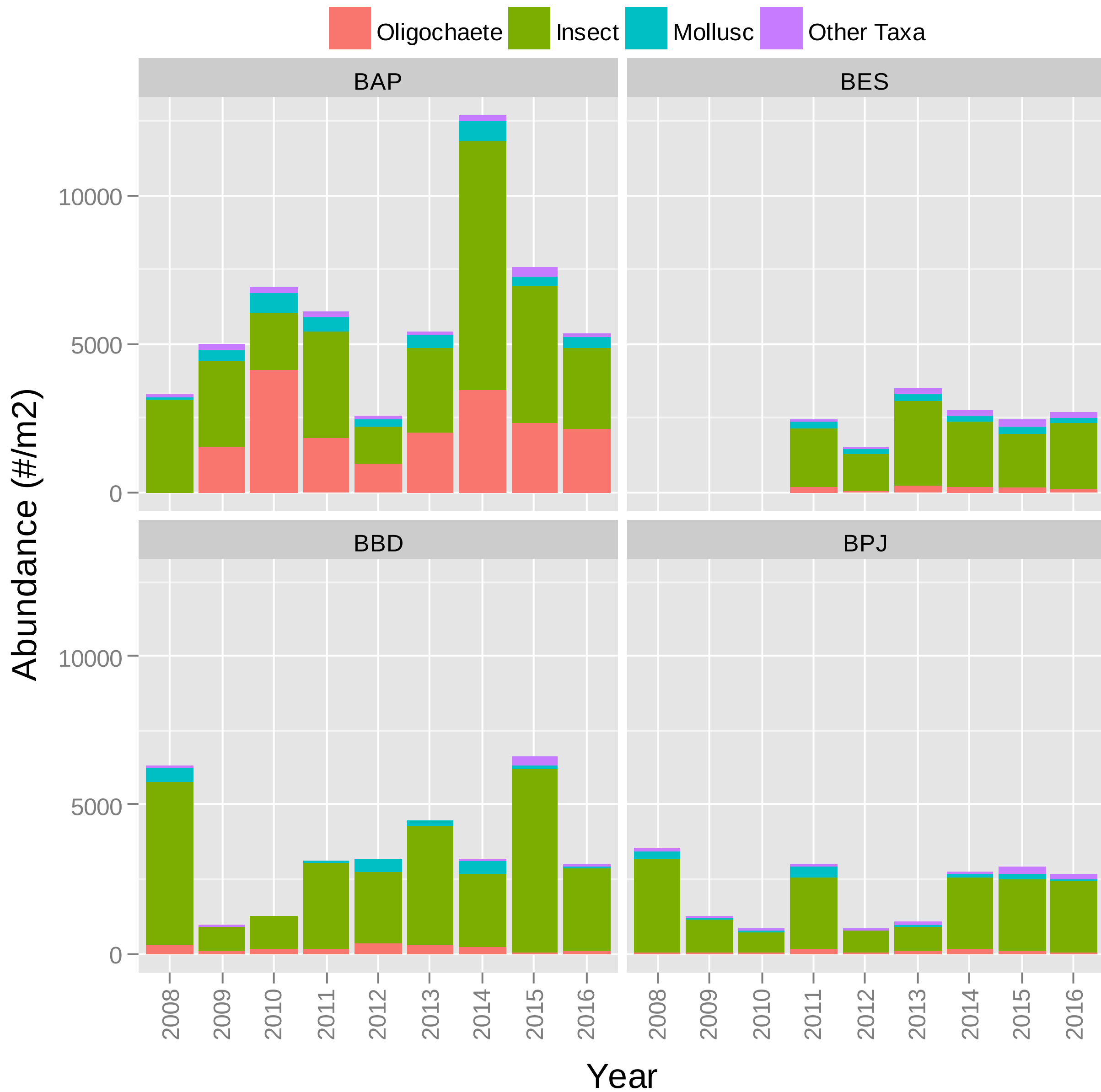


Figure 3.3–66. Benthic Invertebrate relative abundance by major taxa group from Baker Lake since 2008.

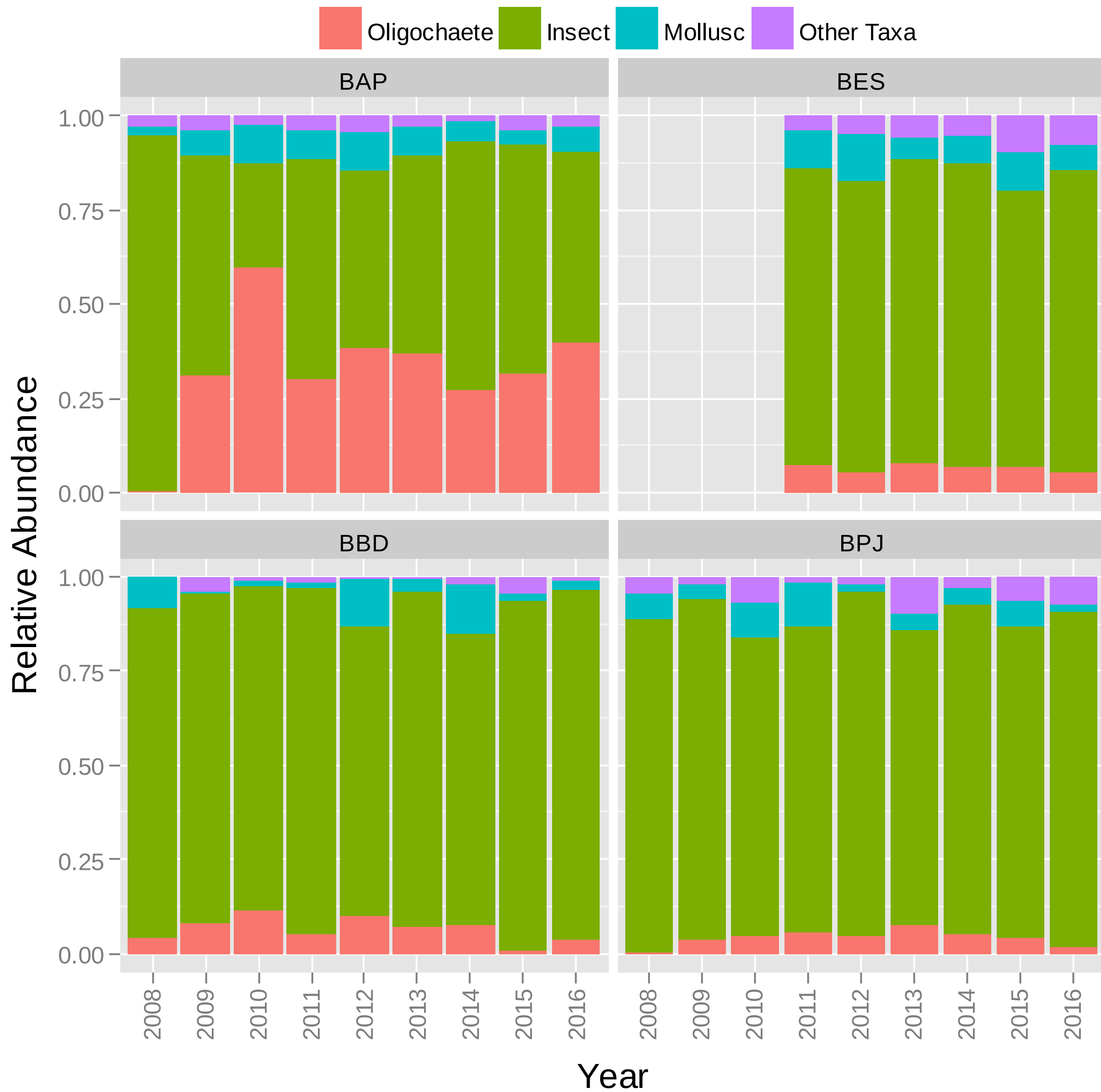


Figure 3.3–67. Benthic invertebrate total richness (# taxa) from Baker Lake since 2008.

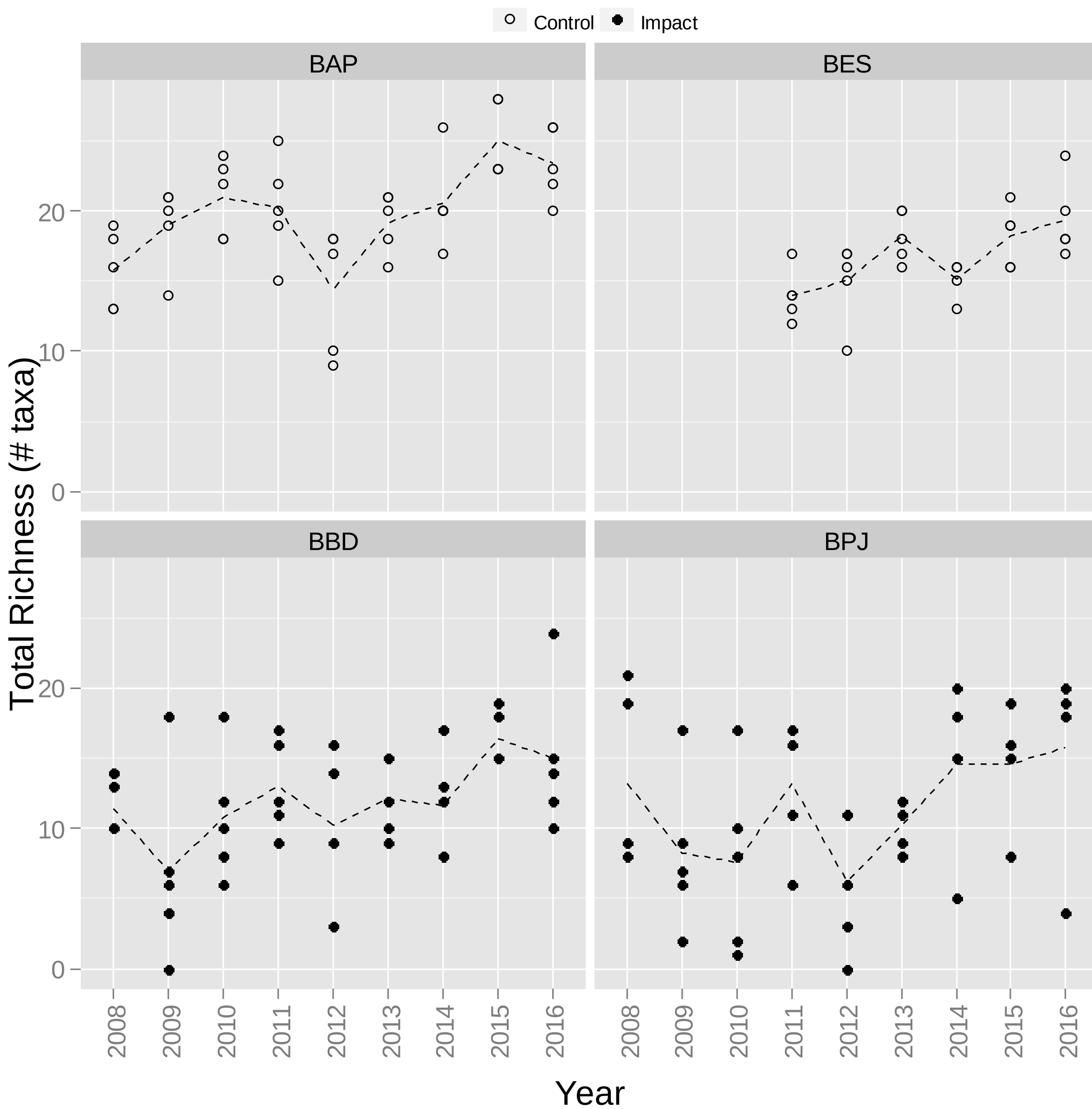


Figure 3.3–68. Benthic invertebrate richness (# taxa) by major taxa group from Baker Lake since 2008.

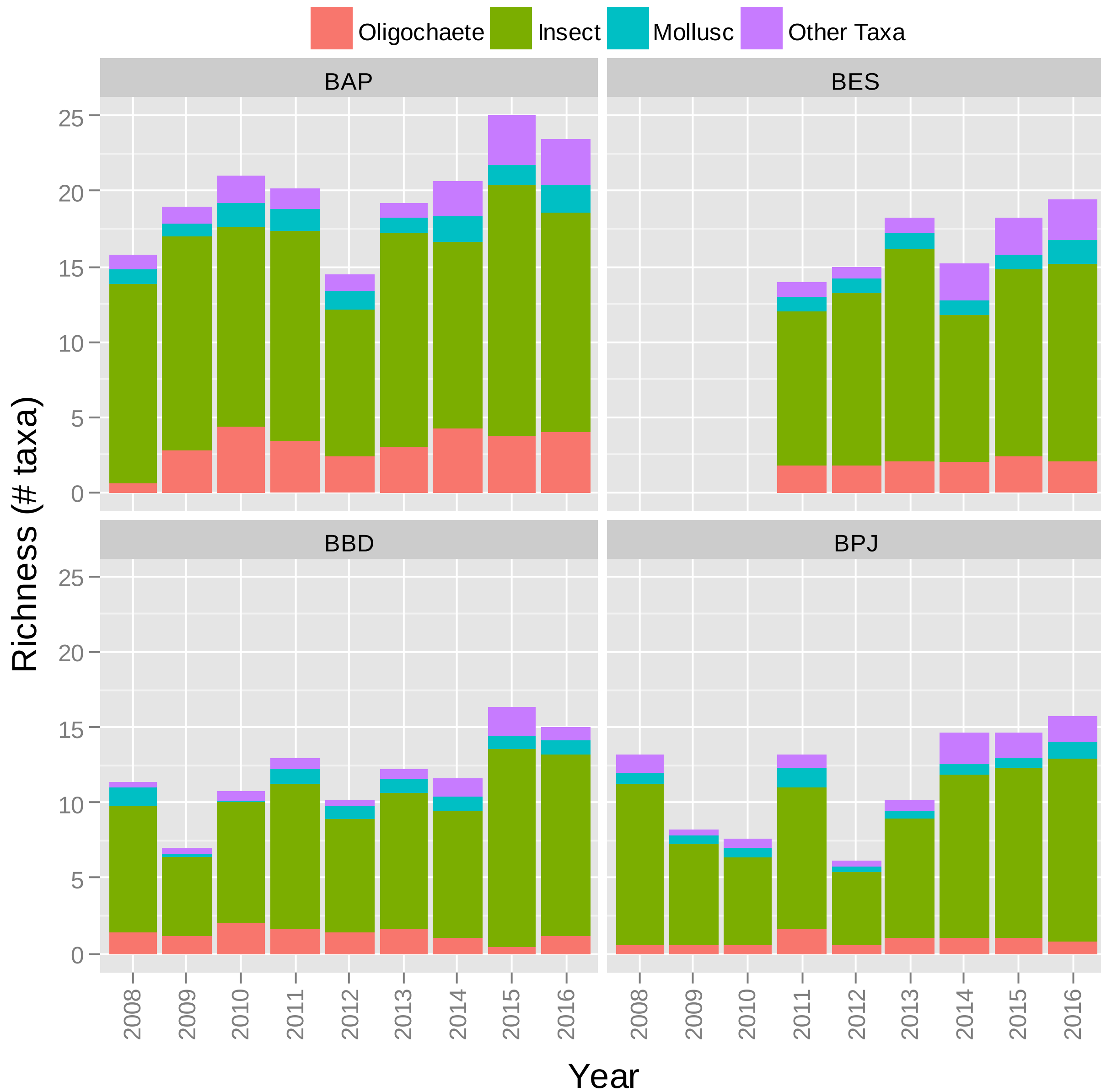
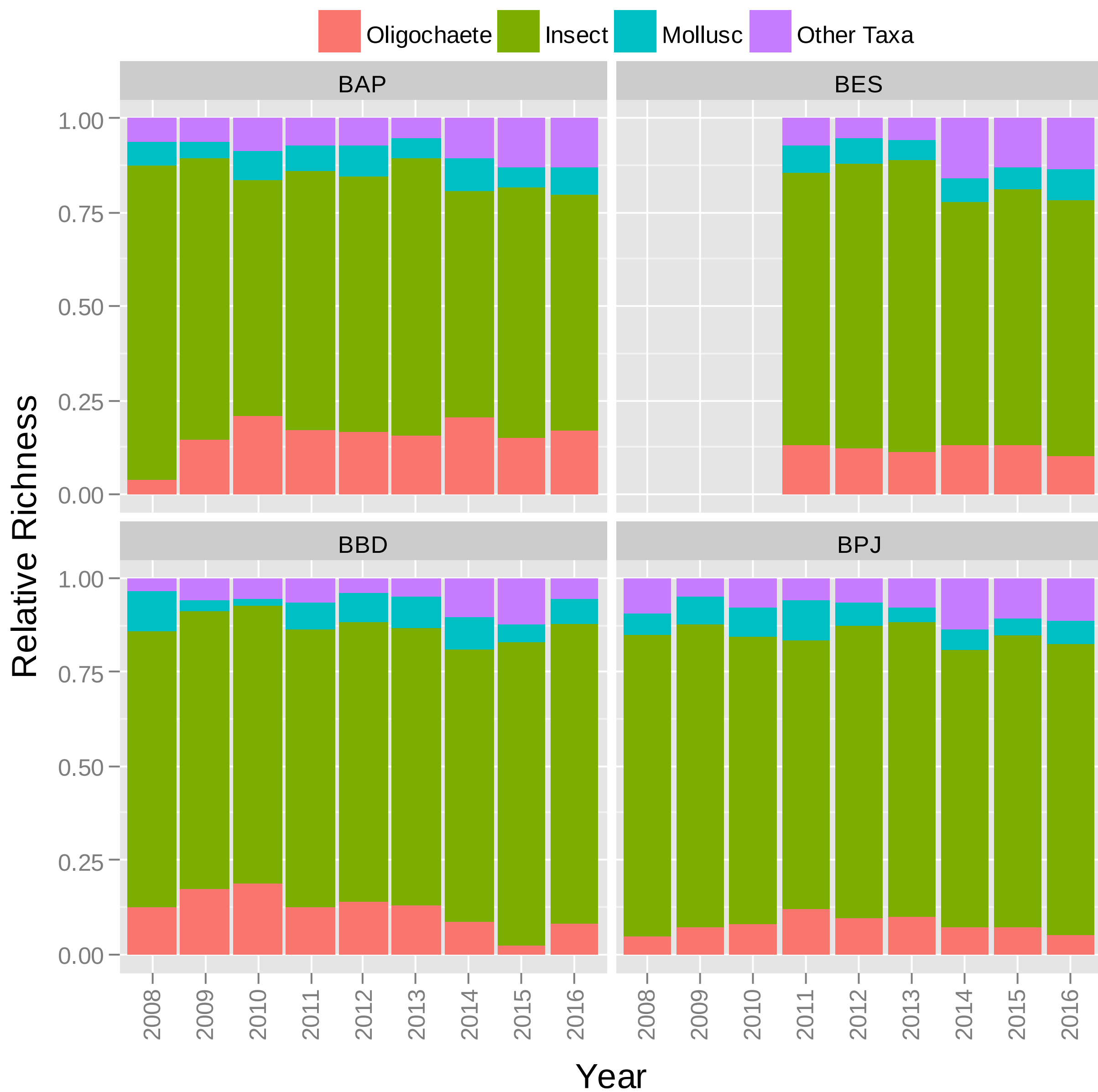


Figure 3.3–69. Benthic invertebrate relative richness by major taxa group from Baker Lake since 2008.



4. SUMMARY AND IMPLICATIONS FOR MANAGEMENT

4.1. Summary of the 2016 CREMP Program

The CREMP focuses on identifying changes in limnological parameters, water and sediment chemistry, or changes to primary (phytoplankton) and secondary (benthic invertebrate community) aquatic producers that may be associated with mine development activities. This is accomplished through the application of a temporal/spatial trend assessment that includes application of quantitative decision criteria (i.e., early warning "triggers" and action "thresholds") to facilitate immediate and objective decision-making regarding appropriate management actions. This information is integrated annually into the Aquatic Ecosystem Monitoring Program (AEMP) for holistic environmental management and decision making.

Meadowbank Study Lakes

CREMP monitoring started in 2006 and in-water mine development started in 2008. Key mine development activities that could result in changes to the aquatic receiving environment include: East Dike construction (2008), Bay-Goose Dike construction (2009-10), dewatering of both lakes and impoundments (2009-11, 2013), effluent discharge (2012 to present), and general site-related mining activities that mostly generate dust (e.g., rock crushing, blasting, ore and waste hauling; 2008 to present). Key findings for 2016 are summarized in **Table 4.1–1**:

- *Water Chemistry* – As in the past, there were some statistically significant mine-related changes relative to baseline/reference conditions identified in 2016 at one or more near-field (NF) areas that exceeded their respective triggers: alkalinity (SP); conductivity (TPN, TPE, SP, WAL); hardness (TPN, TPE, SP, WAL); major cations (i.e., calcium, potassium, magnesium, and sodium [TPN, TPE, SP, WAL]); and TDS (TPN, TPE, SP, WAL). In the absence of effects-based thresholds (e.g., CCME water quality criteria) for these parameters, their triggers were set at the 95th percentile of baseline data. While these results represent mine-related changes, the observed concentrations are still relatively low and unlikely to adversely affect aquatic life. There were not trigger exceedances for any nutrients or metals in 2016. **The trends in water chemistry will be reviewed again in 2017**.
- *Sediment Chemistry* – Quantitative trigger analysis for sediment is based on coring results, which are conducted on a three-year cycle to coincide with MMER EEM field studies. Sediment coring is planned for 2017. Grab samples submitted for analysis in 2016 showed similar metals concentrations compared to previous years. With the exception of chromium at TPE, none of the grab samples exceeded the trigger values in 2016. Targeted bioavailability and toxicity testing was done on sediment from TPE in 2015 to determine the potential for chromium to cause adverse effects to benthic invertebrates. There was no indication that concentrations in 2015 posed risks to the benthic community at TPE, and in 2016 the sediment chromium concentrations were similar to those reported in 2015. **No additional studies are recommending beyond continued evaluation of the temporal trends in sediment metals concentrations in 2017 using BACI analysis of sediment core chemistry results. Sediment PAH concentrations will be monitored as per the routine CREMP sediment sampling program**.
- *Phytoplankton Community* – There were no statistically significant ($p<0.1$) adverse effects (i.e., >20% reduction) to phytoplankton biomass or taxa richness at the NF study areas in 2016. Biomass and richness were lower at TPE relative to baseline/reference conditions, but the results were either not significant (biomass) or the effect size was less than the trigger value of 20%

(taxa richness). **The trends in phytoplankton biomass and richness will be reviewed again in 2017.**

- *Benthic Invertebrate Community* – WAL had particularly high abundance in 2016 relative to previous years. There was an "apparent" reduction (>20%) in total abundance at TPE, when compared to INUG, but none of the results were statistically significant. Furthermore, when compared to previous years the results are well within the range of natural variability. In summary, there were no statistically significant short-term (i.e., past year) or longer-term (i.e., past two to four years) trends in reduced abundance or richness at the NF locations in 2016. **The trends in benthic invertebrate abundance and richness will be reviewed again in 2017.**

Baker Lake

CREMP monitoring at Baker Lake started in 2008. Key mine-related activities include barge/shipping traffic and general land-based activities associated with the tank farm area. No spills of fuels, hydrocarbons or any other materials were reported in the vicinity of the barge dock or jetty in 2016. There were no cases where water quality parameters exceeded the triggers in 2016. Overall, no changes in the aquatic receiving environment were observed that were attributable to Agnico's activities in Baker Lake, and as such, no follow-up management actions are required for 2017 beyond routine monitoring.

Table ES–1. Summary of key findings from the 2016 CREMP.

Variable Type & Variable	Magnitude[1]	Spatial Scale[2]	Causation[3]	Permanence[4]	Uncertainty[5]	Comments	Management Action[6]
Exposure - Limnology							
Oxygen	**0**	n/a	n/a	n/a	?	All stations - consistent with previous years	**0**
Temperature	**0**	n/a	n/a	n/a	?	All stations - consistent with previous years	**0**
Conductivity	**0**	Small	Low	n/a	???	Sp. conductivity readings at SP (January) and WAL (March) were elevated relative to historical conductivity readings in each lake. The results are highly uncertain because of possible issues with the probe. Conductivity readings for the rest of the year were within the normal historical range for each lake. No action required.	**0**
Exposure - Water Chemistry							
Conventionals	**1**	Large	High	Low	?	The following parameters (conventionals and nutrients) were elevated relative to reference/baseline conditions. However, concentrations suggest low potential for adverse effects: **Alkalinity** (SP); **Conductivity** (TPN, TPE, SP, WAL); **Hardness** (TPN, TPE, SP, WAL); **Ca/K/Mg/Na** (TPN, TPE, SP [not Na], WAL [not Na or K]); **TDS** (TPN, TPE, SP, WAL)	**1**
Nutrients	**0**	n/a	n/a	n/a	?	No trigger exceedances.	**0**
Total Metals	**0**	n/a	n/a	n/a	?	No trigger exceedances.	**0**
Dissolved Metals	**0**	n/a	n/a	n/a	?	No trigger exceedances.	**0**
Total Suspended Solids	**0**	n/a	n/a	n/a	?	No trigger exceedances.	**0**
Exposure - Sediment Chemistry							
Physical	**0**	n/a	n/a	n/a	?		**0**
Total Metals	**1**	Moderate	High	Moderate	??	Sediment chromium concentrations continue to exceed the trigger at TPE. Concentrations appear to be stabilizing based on the results from 2015 and 2016.	**1**
Organics	**0**	n/a	n/a	n/a	?	Acenaphthylene exceeded the threshold at TPE. The concentration at TPE was less than 5-times the MDL. Acenaphthylene is not considered likely to pose a risk to the benthic invertebrate community at TPE.	**0**
Effects - Phytoplankton							
Chlorophyll-a*	**0**	n/a	n/a	n/a	?	Continued data quality issue for chlorophyll-a (temperature control in transit).	**0**
Total Biomass	**0**	n/a	n/a	n/a	?	No statistically significant adverse effects were detected in 2016.	**0**
Taxa Richness	**0**	n/a	n/a	n/a	?	16% lower richness was reported at TPE in 2016 relative to baseline/reference. The trigger for adverse effects to phytoplankton richness is a reduction of 20% or more.	**0**
Effects - Benthic Invertebrates							
Total Abundance	**0**	n/a	n/a	n/a	?	Decreased abundance at TPE relative to INUG in the past four years, but the differences are primarily driven by increased abundance at INUG while abundance at TPE has been relatively stable. None of the results are statistically significant.	**0**
Total Richness	**0**	n/a	n/a	n/a	?	Richness continues to track higher for most stations. The benthic communities are dominated by chironomids, and the relative proportion of major taxa remains stable at all stations.	**0**

Notes:

[1] **Magnitude Ratings (narrative in brackets used in the absence of specific triggers/thresholds):**
- **0 –** no exceedances of triggers or thresholds (or no apparent changes from baseline of concern)
- **1 –** early warning trigger exceeded (or change from baseline warranting concern)
- **2 –** threshold exceeded (or change from baseline exceeding magnitude of concern)

[2] **Spatial Scale Ratings:**
- n/a – no magnitude of effect, therefore not evaluated
- Small – localized scale
- Moderate – sub-basin to basin scale
- Large – basin to whole lake scale

[3] **Causation Ratings:**
- n/a – no magnitude of effect, therefore not evaluated
- Low – no evidence for a mine-related source
- Moderate – some likelihood of a mine-related source
- High – the source of the problem is very likely to be mine-related

[4] **Permanence Ratings:**
- n/a – no magnitude of effect, therefore not evaluated
- Low – rapidly reversible (e.g., months to years)
- Moderate – slowly reversible (e.g., years to decades)
- High – largely irreversible (e.g., decades +)

[5] **Uncertainty Ratings:**
- ? – low uncertainty
- ?? – moderate uncertainty
- ??? – high uncertainty

[6] **Management Actions:**
- **0 –** no action beyond routine CREMP monitoring
- **1 –** continued trend monitoring in 2017
- **2 –** active follow-up with more detailed quantitative assessment in 2017

4.2. Monitoring Components for 2017

The current status of the rationale, framework, strategy, methods, triggers/thresholds, and scope of the CREMP were documented in the *CREMP: 2015 Plan Update* (Azimuth, 2015b). A key aspect of the updated plan was the design of the new results-based sampling strategy outlined in **Section 2.2.3** to improve program efficiency at the mid-field and far-field Meadowbank areas when warranted. The current program for 2017 is summarized in **Table 4.2–1**. Based on the outcome of the water quality screening results at NF and MF areas in the context of this new assessment framework (**Section 3.2.2.2**), the full CREMP program (through ice and open water) is limited to the NF areas in 2017. A shift in the timing of the through-ice sampling events is proposed for 2017 where both through-ice events are scheduled for the spring (i.e., March and May). Shifting away from late season sampling in November means the all the analytical results will be delivered earlier in Q4, which will speed up reporting timelines. Also, in the event that equipment issues or weather issues hamper sampling in either March or May, November can serve as a backup option to complete five full water sampling events. Through-ice limnology and water chemistry sampling at TPS, TE, and TEFF is planned for a minimum of one, but ideally two events in 2017 depending on ice conditions. In addition, contingency water samples may need to be collected during the limnology-only through ice sampling event(s) at the NF areas if anomalous *in-situ* limnology results are observed.

The other notable recommendation for the 2017 CREMP program involves switching from Waterra to Voss inline filters for collecting water for analysis of dissolved parameters. Refer to **Section 3.1.2** for more information.

Table 4.2–1. Monitoring components planned for 2016 CREMP.

Project Lake	Area ID	Through-Ice						Open-Water			Through-Ice		
		Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Reference Areas													
Inuggugayualik	**INUG**			Limno[1] Water Phyto		Limno[1] Water Phyto	**Ice not safe**	Limno[1] Water Phyto	Limno[1] Water Phyto Sed Benthos	Limno[1] Water Phyto	**Ice not safe**		
Pipedream	**PDL**						**Ice not safe**	Limno[1] Water Phyto	Limno[1] Water Phyto Sed Benthos	Limno[1] Water Phyto	**Ice not safe**		
Near-Field Areas													
Third Portage	**TPE**	Limno[2]	Limno[2]	Limno[1] Water Phyto	Limno[2]	Limno[1] Water Phyto	**Ice not safe**	Limno[1] Water Phyto	Limno[1] Water Phyto Sed Benthos	Limno[1] Water Phyto	**Ice not safe**	Limno[2]	Limno[2]
Third Portage	**TPN**	Limno[2]	Limno[2]	Limno[1] Water Phyto	Limno[2]	Limno[1] Water Phyto	**Ice not safe**	Limno[1] Water Phyto	Limno[1] Water Phyto Sed Benthos	Limno[1] Water Phyto	**Ice not safe**	Limno[2]	Limno[2]
Second Portage	**SP**	Limno[2]	Limno[2]	Limno[1] Water Phyto	Limno[2]	Limno[1] Water Phyto	**Ice not safe**	Limno[1] Water Phyto	Limno[1] Water Phyto Sed Benthos	Limno[1] Water Phyto	**Ice not safe**	Limno[2]	Limno[2]
Wally	**WAL**	Limno[2]	Limno[2]	Limno[1] Water Phyto	Limno[2]	Limno[1] Water Phyto	**Ice not safe**	Limno[1] Water Phyto	Limno[1] Water Phyto Sed Benthos	Limno[1] Water Phyto	**Ice not safe**	Limno[2]	Limno[2]
Mid-Field Areas													
Third Portage	**TPS**			Limno[3] Water		Limno[3] Water	**Ice not safe**				**Ice not safe**		
Tehek	**TE**			Limno[3] Water		Limno[3] Water	**Ice not safe**				**Ice not safe**		
Far-Field Areas													
Tehek	**TEFF**			Limno[3] Water		Limno[3] Water	**Ice not safe**				**Ice not safe**		

Table 4.2–1. Monitoring components planned for 2016 CREMP.

Project Lake	Area ID	Through-Ice						Open-Water			Through-Ice		
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Baker Lake	BBD						**Ice not safe**	Limno[1] Water Phyto	Limno[1] Water Phyto Sed Benthos	Limno[1] Water Phyto	**Ice not safe**		
Baker Lake	BPJ						**Ice not safe**	Limno[1] Water Phyto	Limno[1] Water Phyto Sed Benthos	Limno[1] Water Phyto	**Ice not safe**		
Baker Lake	BAP						**Ice not safe**	Limno[1] Water Phyto	Limno[1] Water Phyto Sed Benthos	Limno[1] Water Phyto	**Ice not safe**		
Baker Lake	BES						**Ice not safe**		Sed Benthos		**Ice not safe**		

Notes:

Limno[1]: 2 depth profiles per sampling event per year.

Limno[2]: 1 limno depth profile should be collected at key near-field areas (TPN, TPE, SP, and WAL) to reduce uncertainty regarding the potential occurrence of changes over winter; water chemistry will also be collected if profiling shows unusual results.

Limno[3]: 2 depth profiles for a minimum of 1, but ideally 2 sampling events per year at mid-field and far-field stations (paired with sample timing at INUG).

Water: 2 replicate samples from 3m depth; same locations as limno.

Phyto: 2 replicate samples from 3m depth; same locations as limno.

Sed: 1 composite for organics (LEPH, HEPH, PAH(low), Mineral Oil and Grease); 5 replicates for physical (TOC, Grain Size, Moisture); 10 replicate cores.

Benthos: 5 replicate samples (2 grab composite/sample); same locations as sediment.

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APPENDICES

APPENDIX A

Water Quality Parameter Plots

APPENDIX A1

Meadowbank Water Quality Plots 2006 – 2016

LIST OF FIGURES – APPENDIX A1

Note on the water quality plots: the red dashed line represents the trigger value for each parameter.

Figure A1–1. Carbonate Alkalinity (mg/L) in water samples from Meadowbank study lakes since 2006.

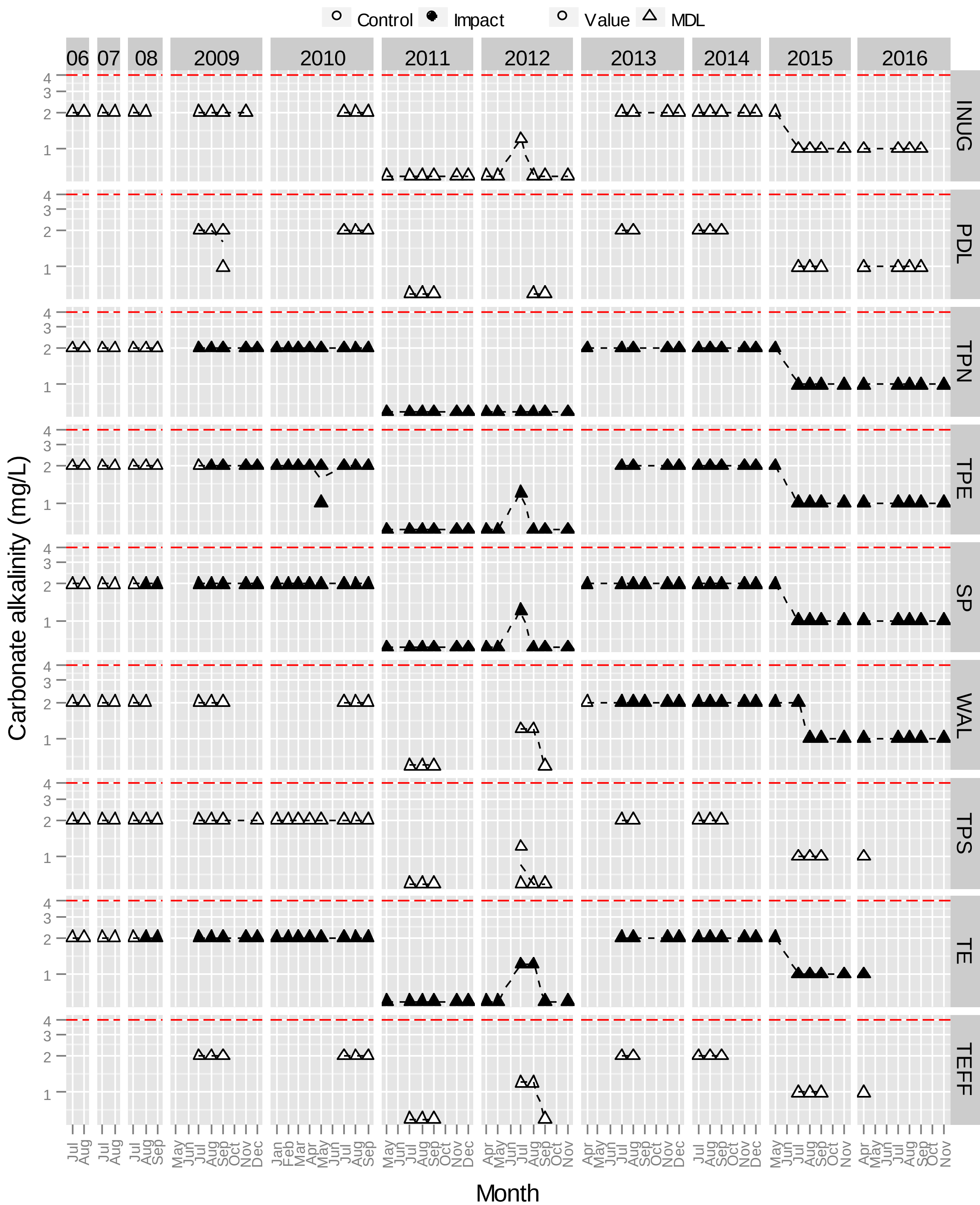


Figure A1–2. Nitrite-N (mg/L) in water samples from Meadowbank study lakes since 2006.

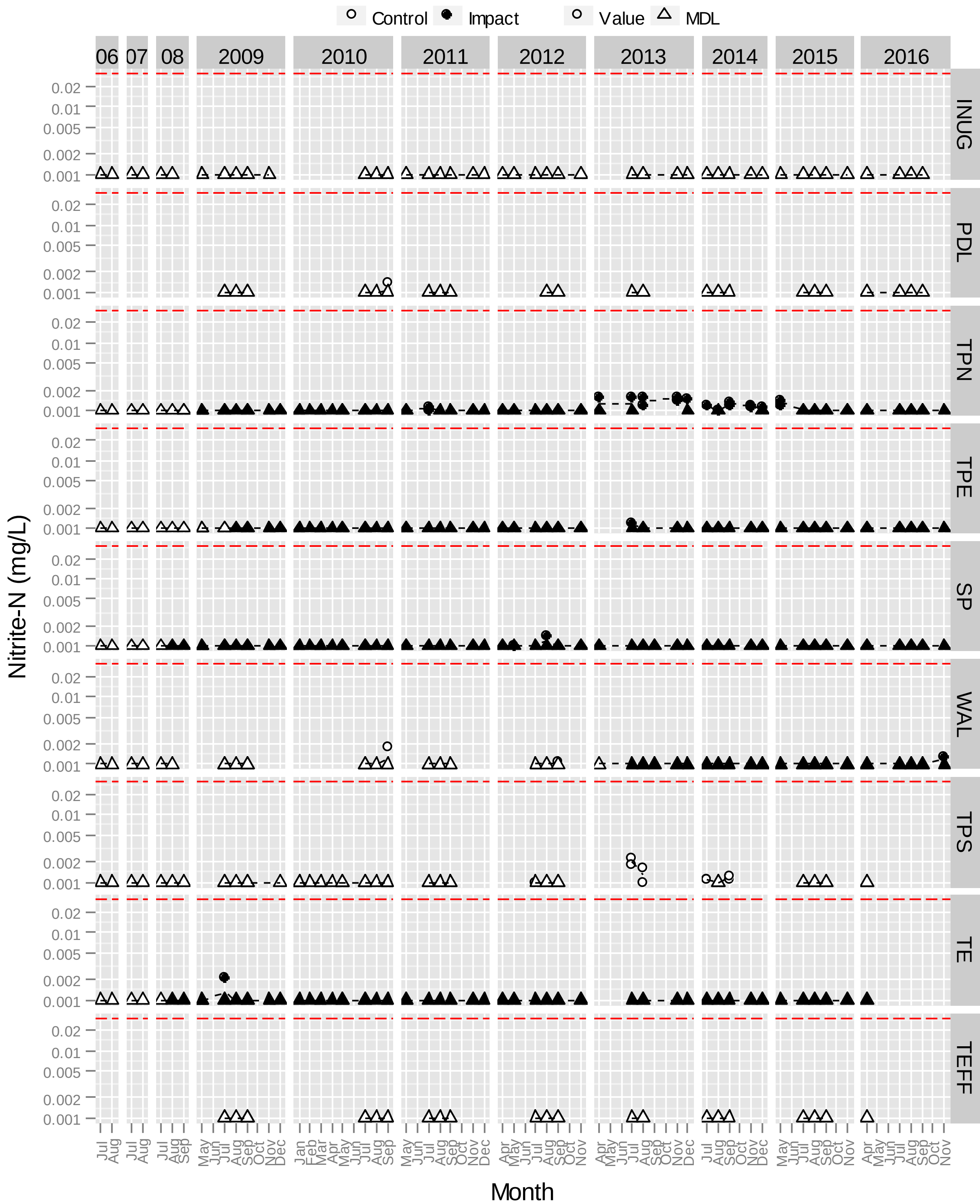


Figure A1–3. Orthophosphate (mg/L) in water samples from Meadowbank study lakes since 2006.

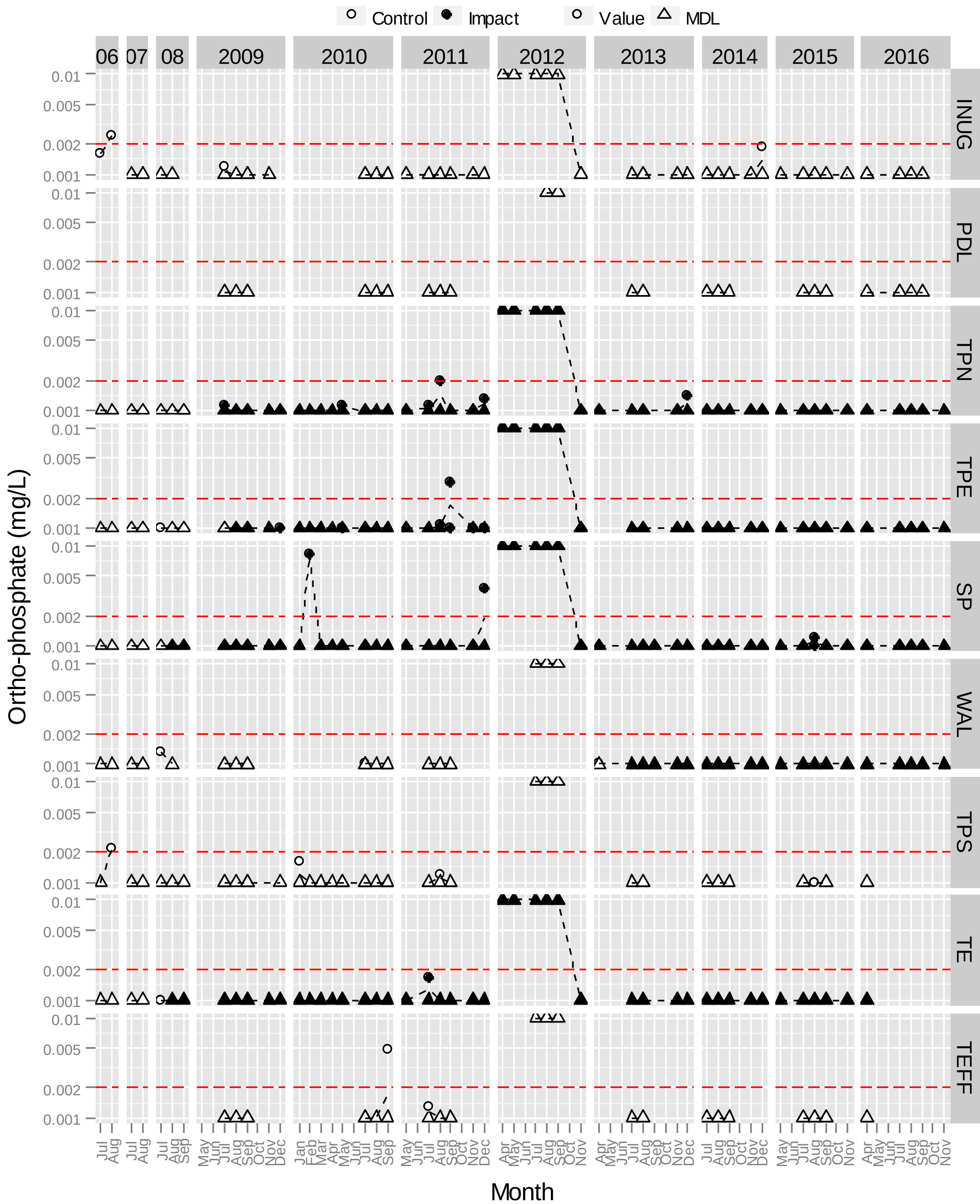


Figure A1–4. Total Cyanide (mg/L) in water samples from Meadowbank study lakes since 2014.

Note: No trigger for total cyanide. Detection limit lowered from 0.005 mg/L in 2014 to 0.001 mg/L in 2015.

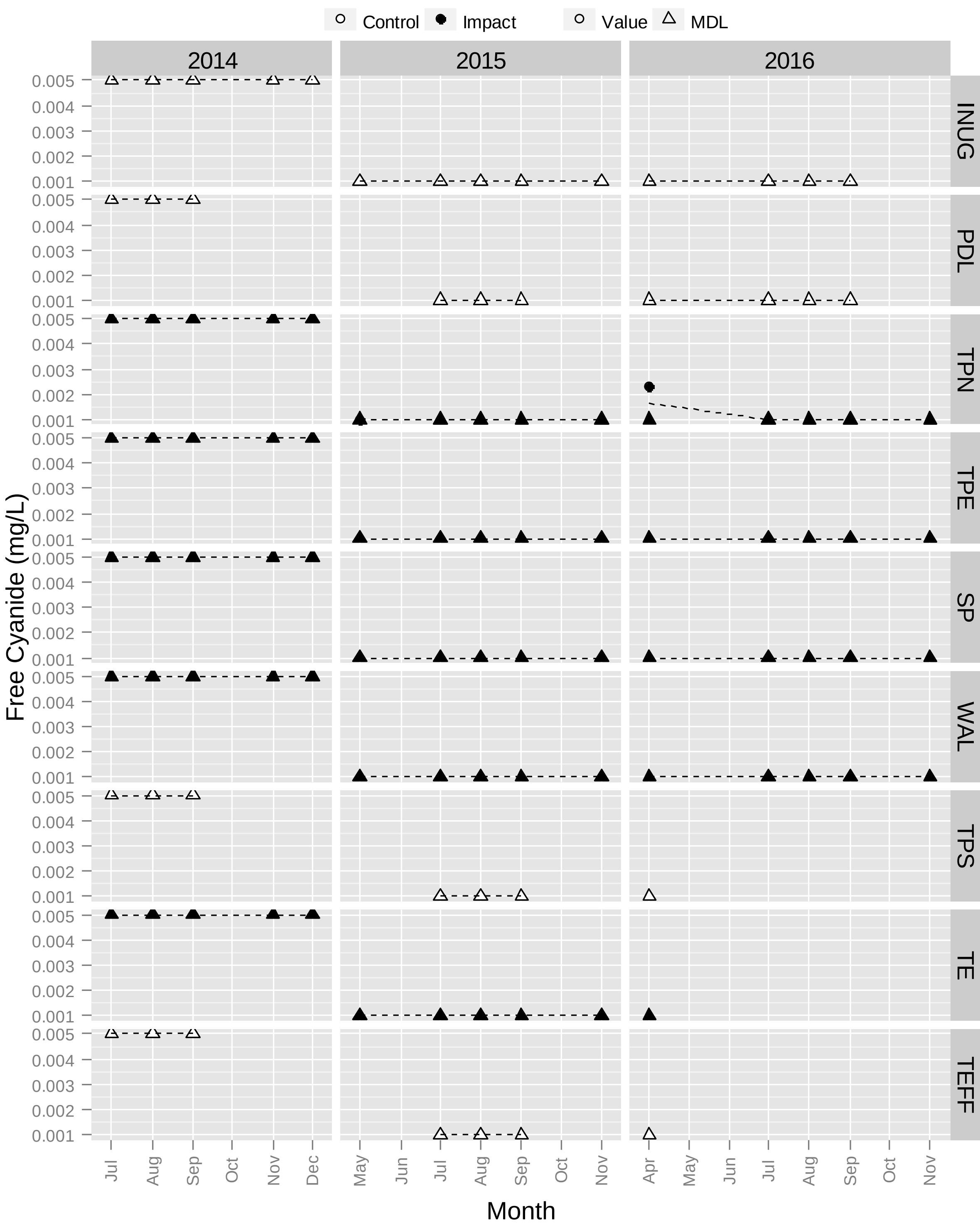


Figure A1–5. Free Cyanide (mg/L) in water samples from Meadowbank study lakes since 2014.

Note: No trigger for free cyanide. Detection limit lowered from 0.005 mg/L in 2014 to 0.001 mg/L in 2015.

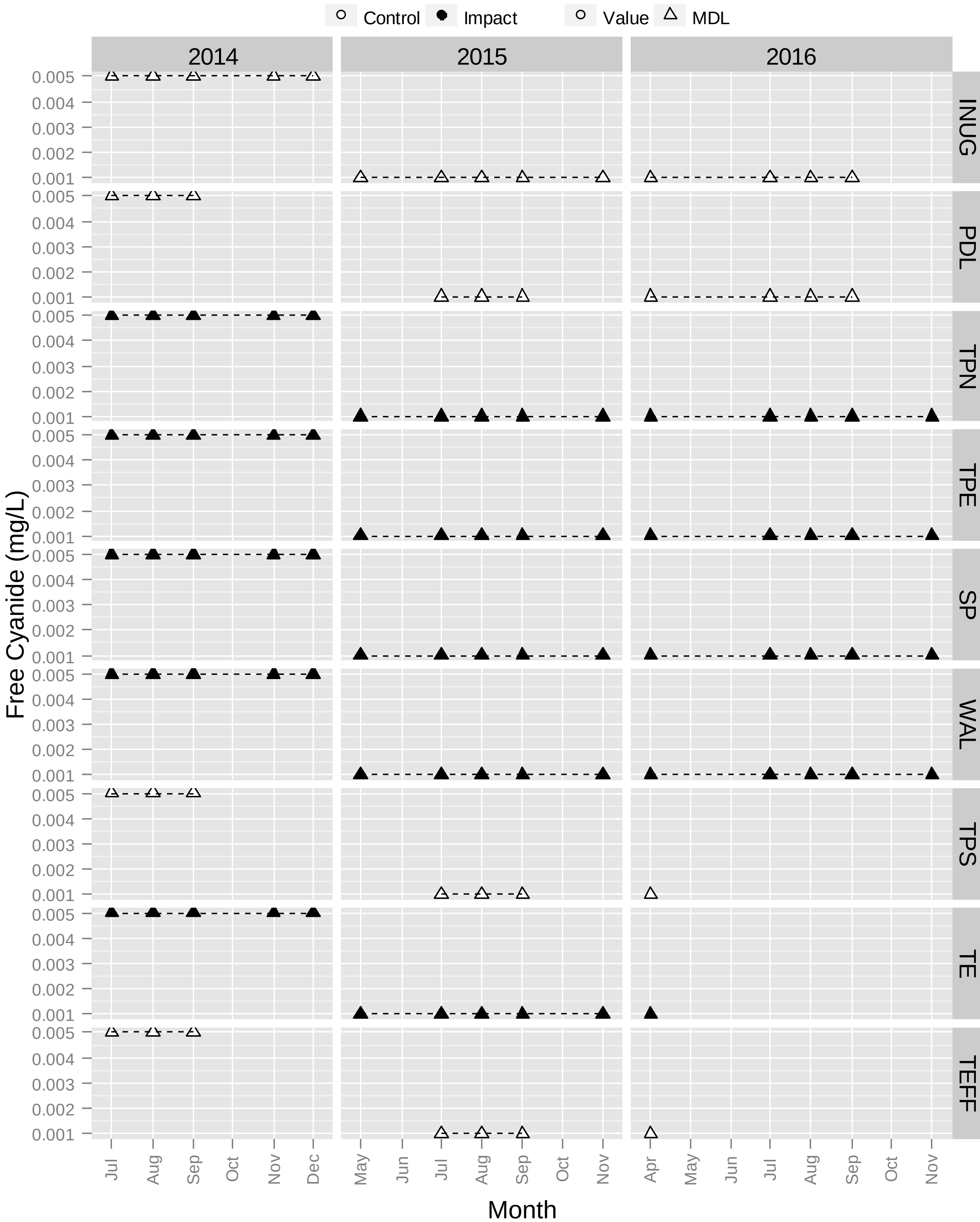


Figure A1–6. Total antimony (mg/L) in water samples from Meadowbank study lakes since 2006.

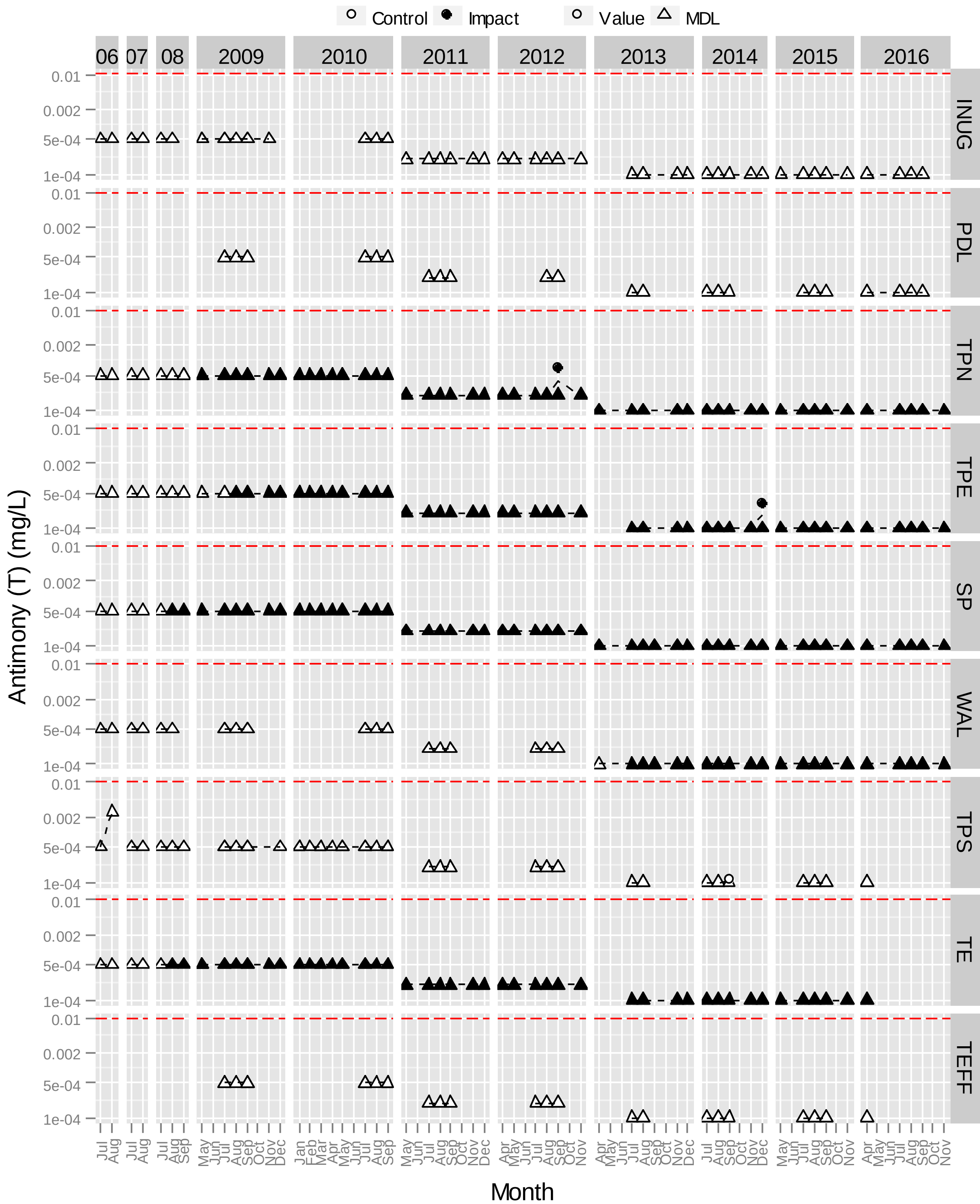


Figure A1–7. Total Beryllium (mg/L) in water samples from Meadowbank study lakes since 2006.

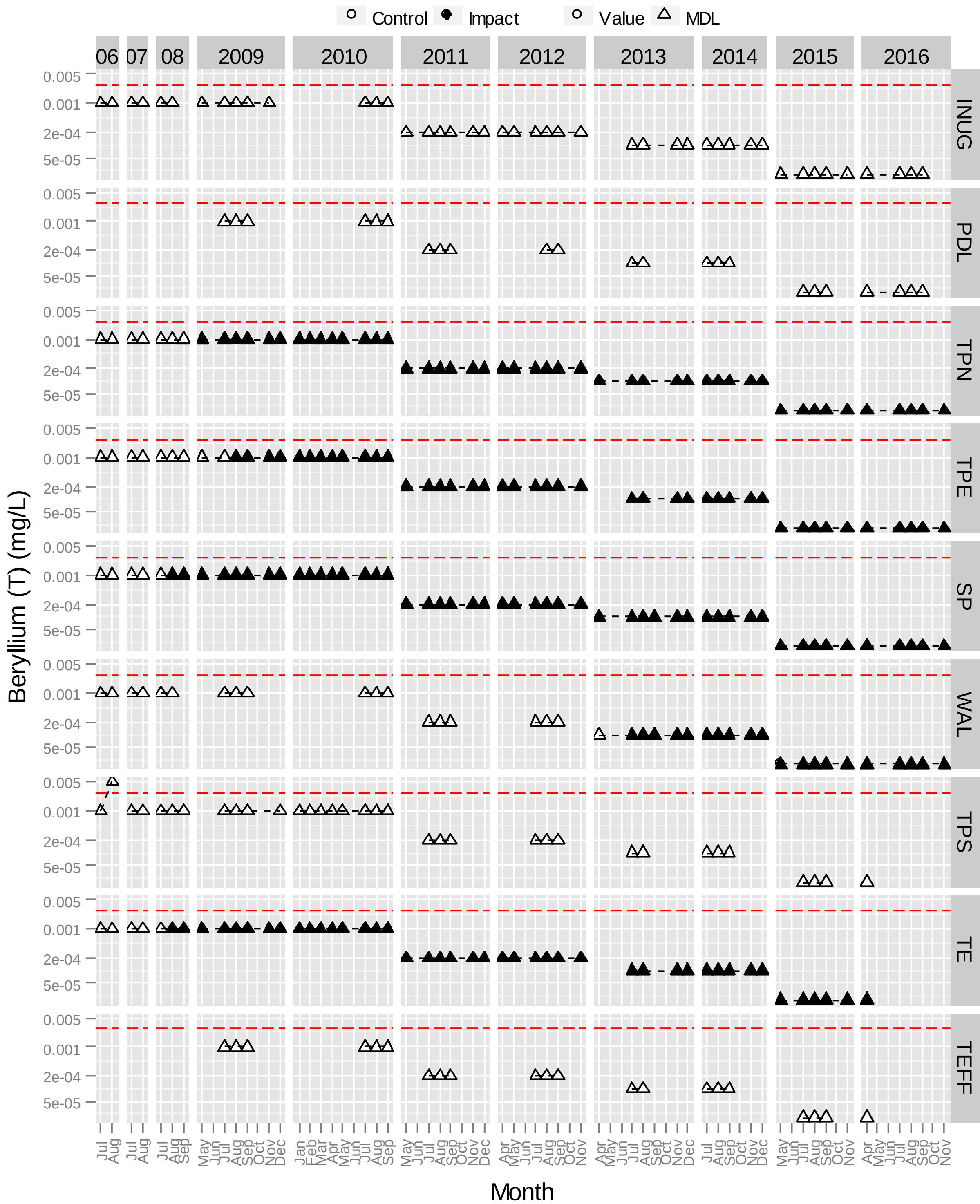


Figure A1–8. Total Boron (mg/L) in water samples from Meadowbank study lakes since 2006.

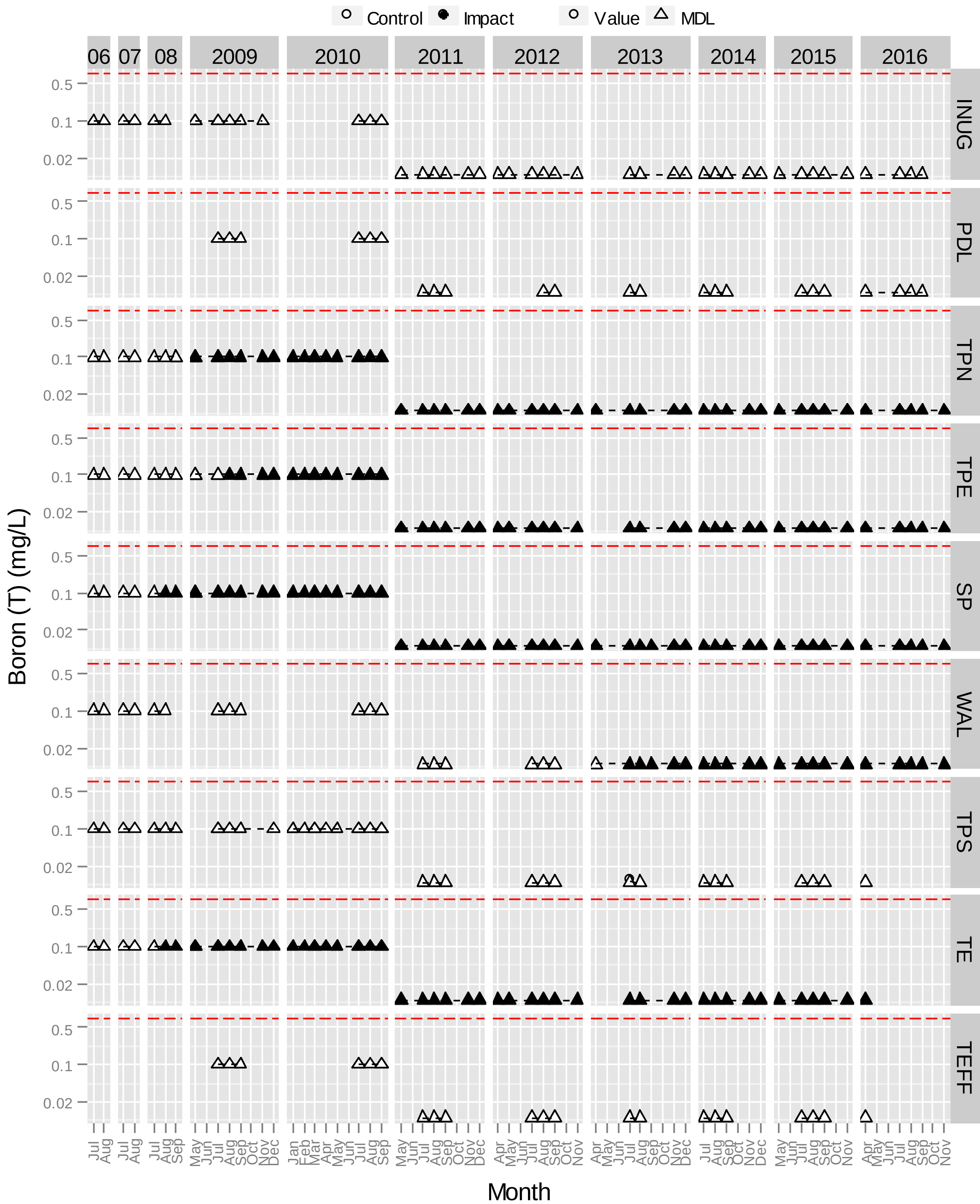


Figure A1–9. Total Cadmium (mg/L) in water samples from Meadowbank study lakes since 2006.

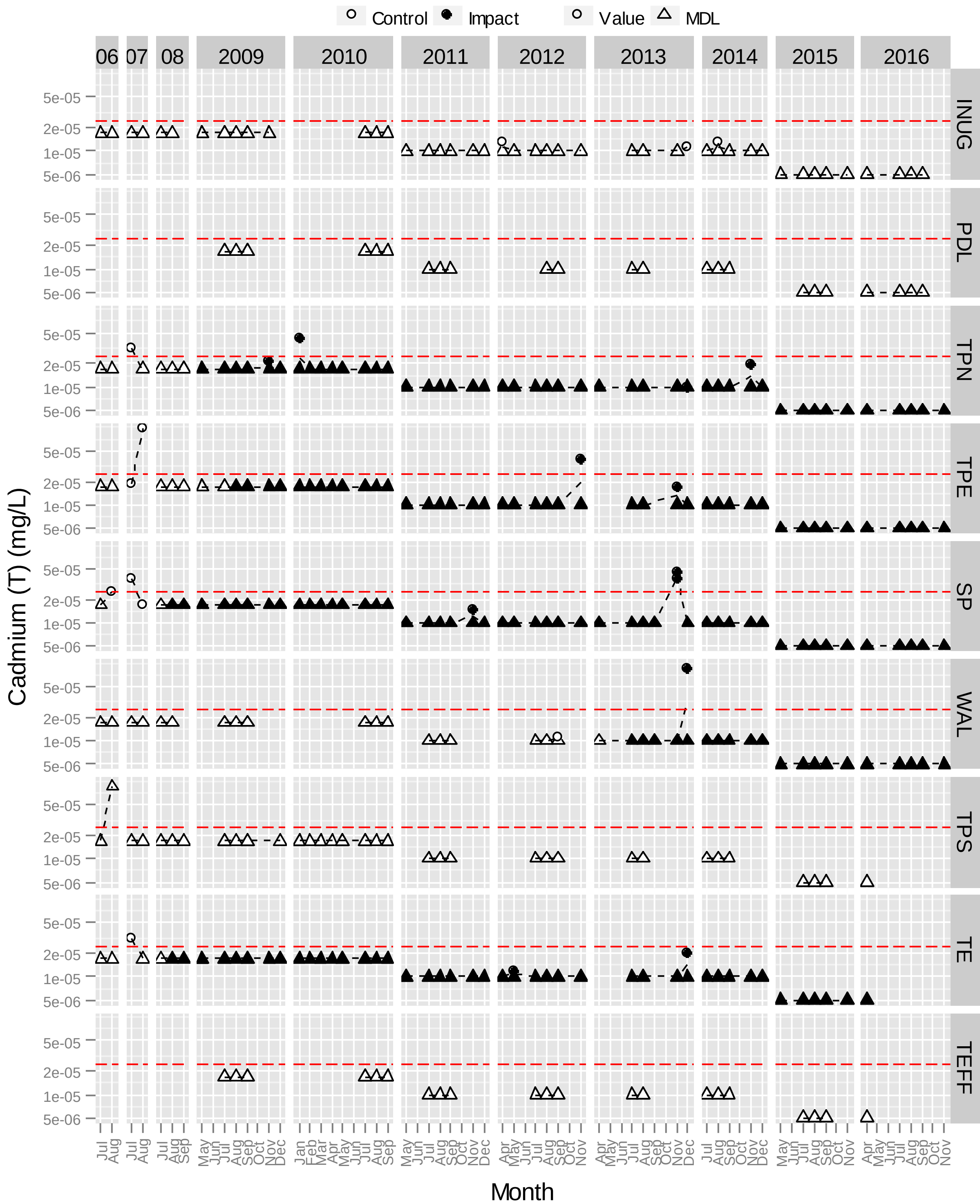


Figure A1–10. Total Lead (mg/L) in water samples from Meadowbank study lakes since 2006.

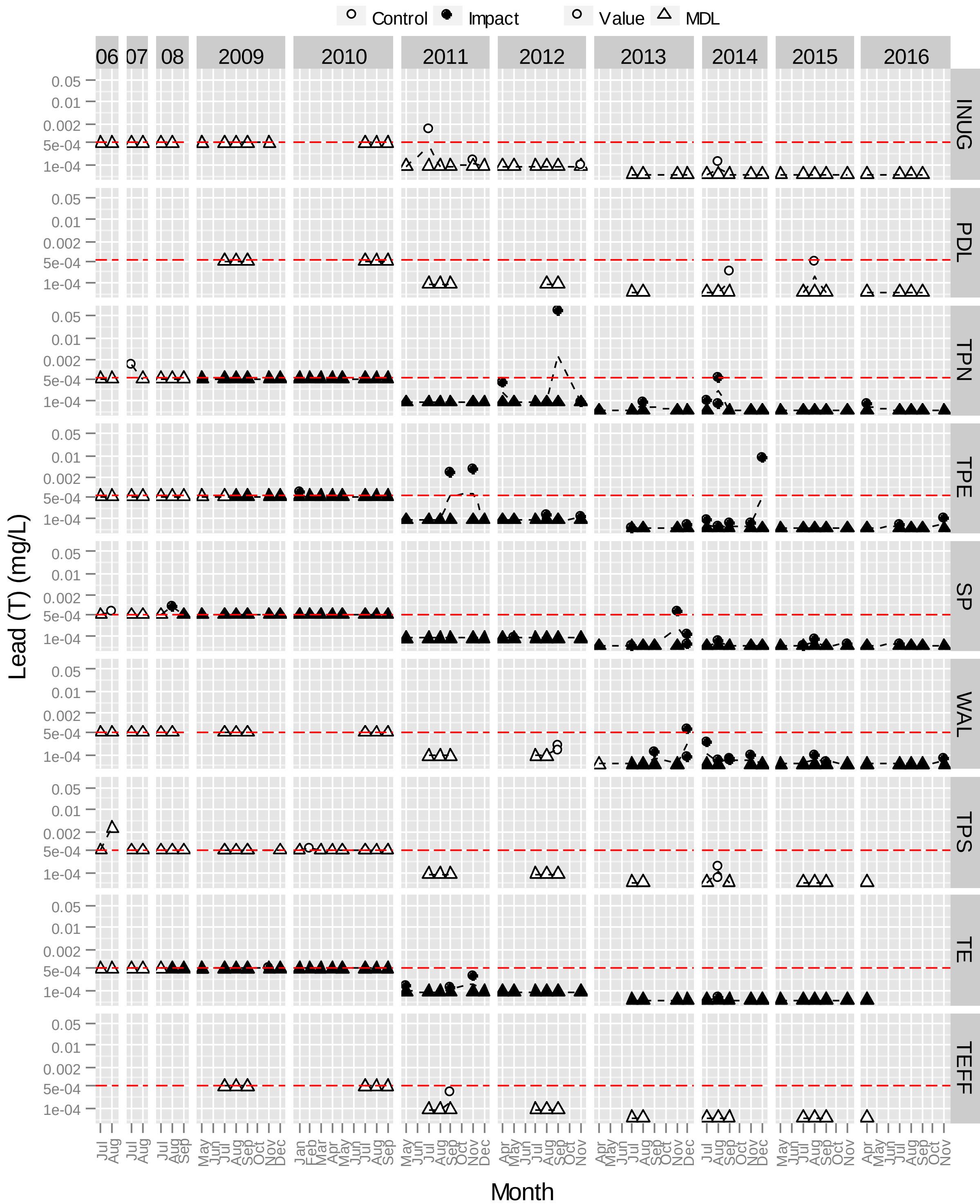


Figure A1–11. Total Lithium (mg/L) in water samples from Meadowbank study lakes since 2006.

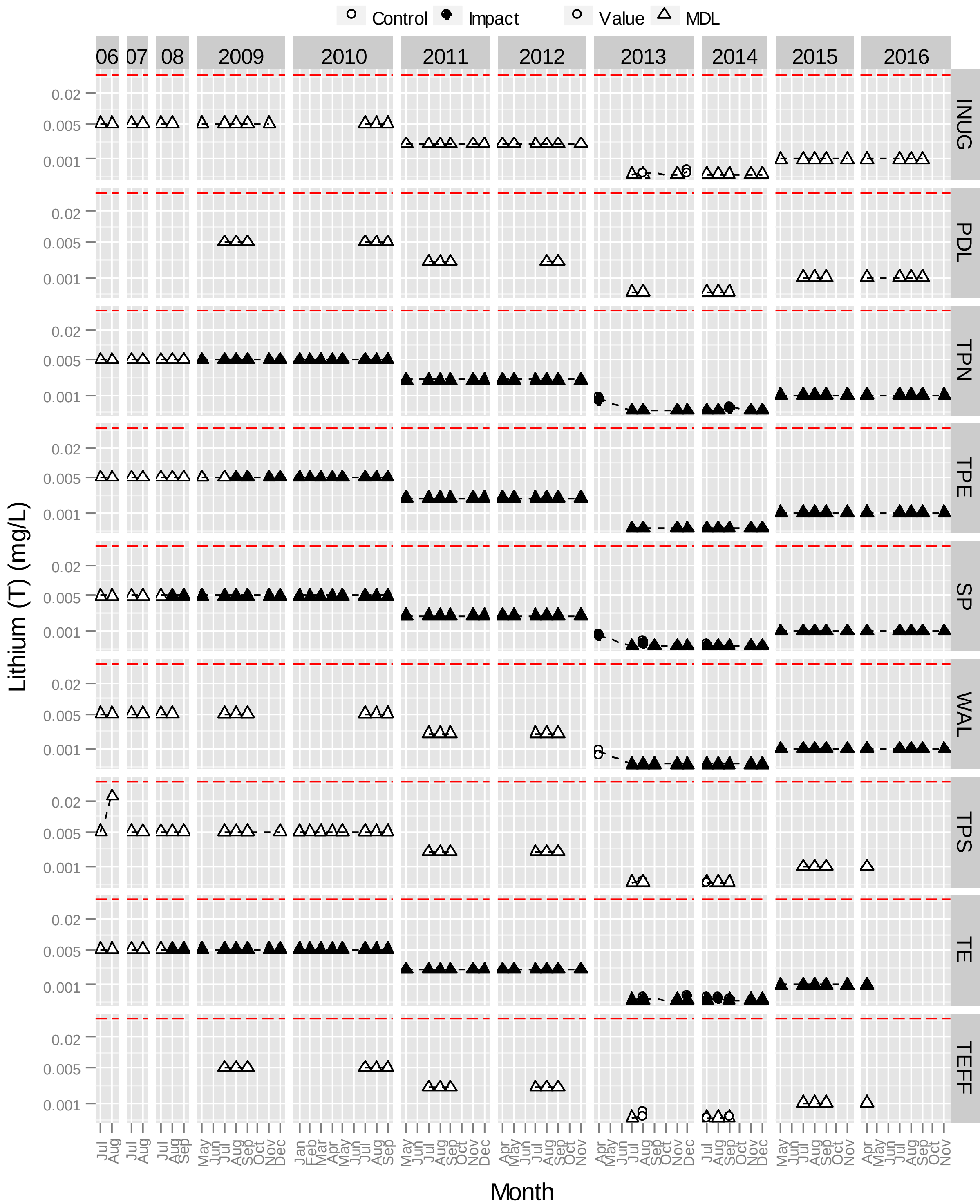


Figure A1–12. Total Mercury (mg/L) in water samples from Meadowbank study lakes since 2006.

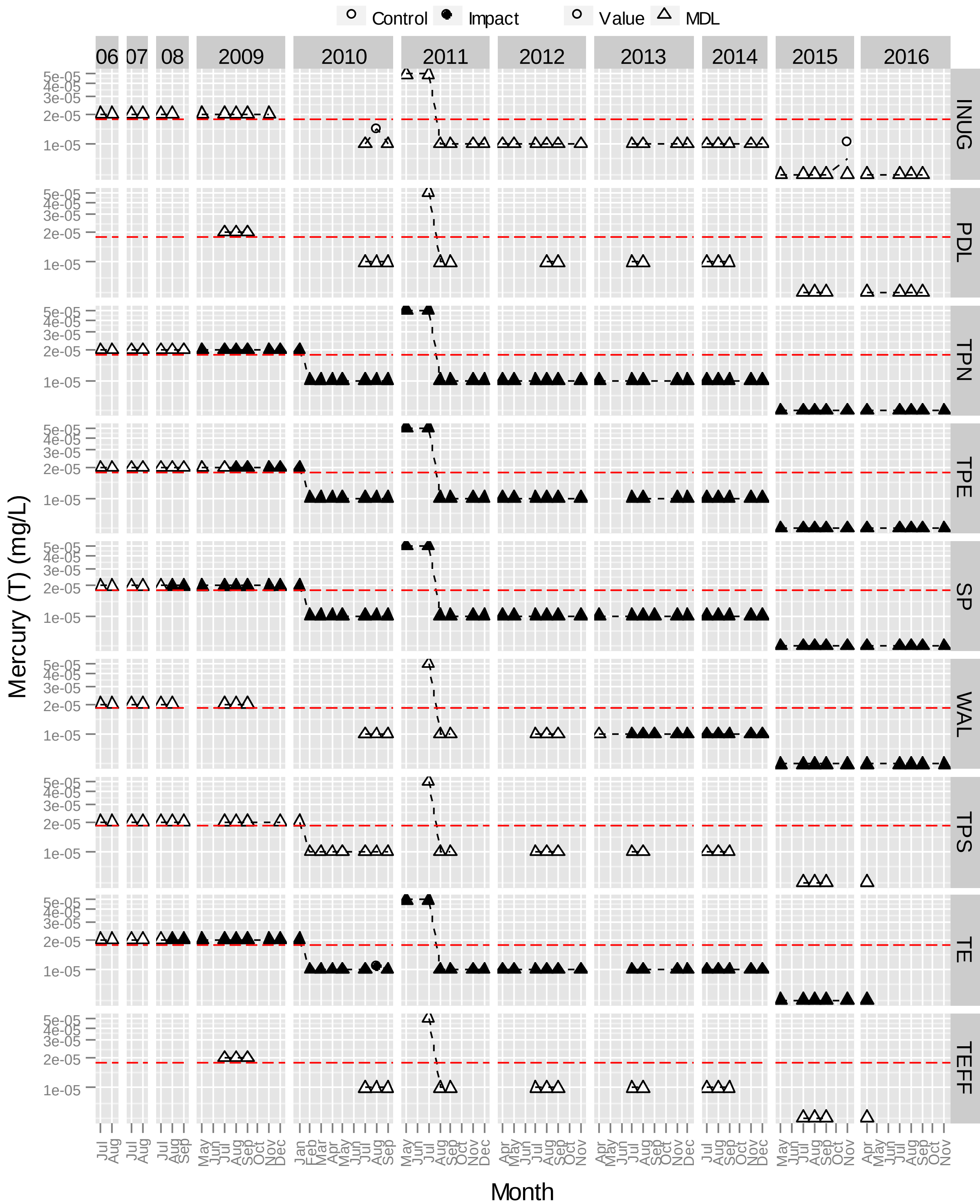


Figure A1–13. Total Nickel (mg/L) in water samples from Meadowbank study lakes since 2006.

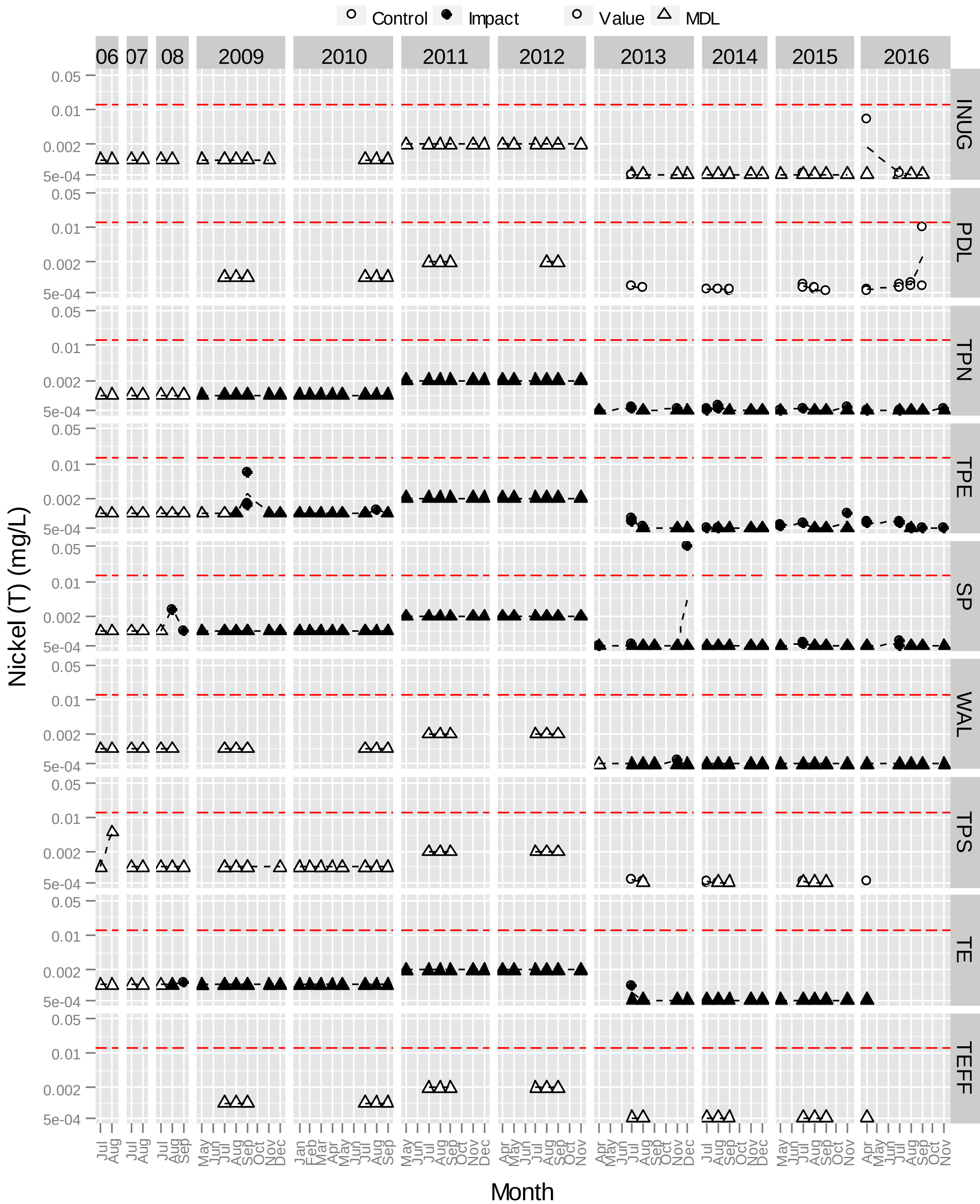


Figure A1–14. Total Selenium (mg/L) in water samples from Meadowbank study lakes since 2006.

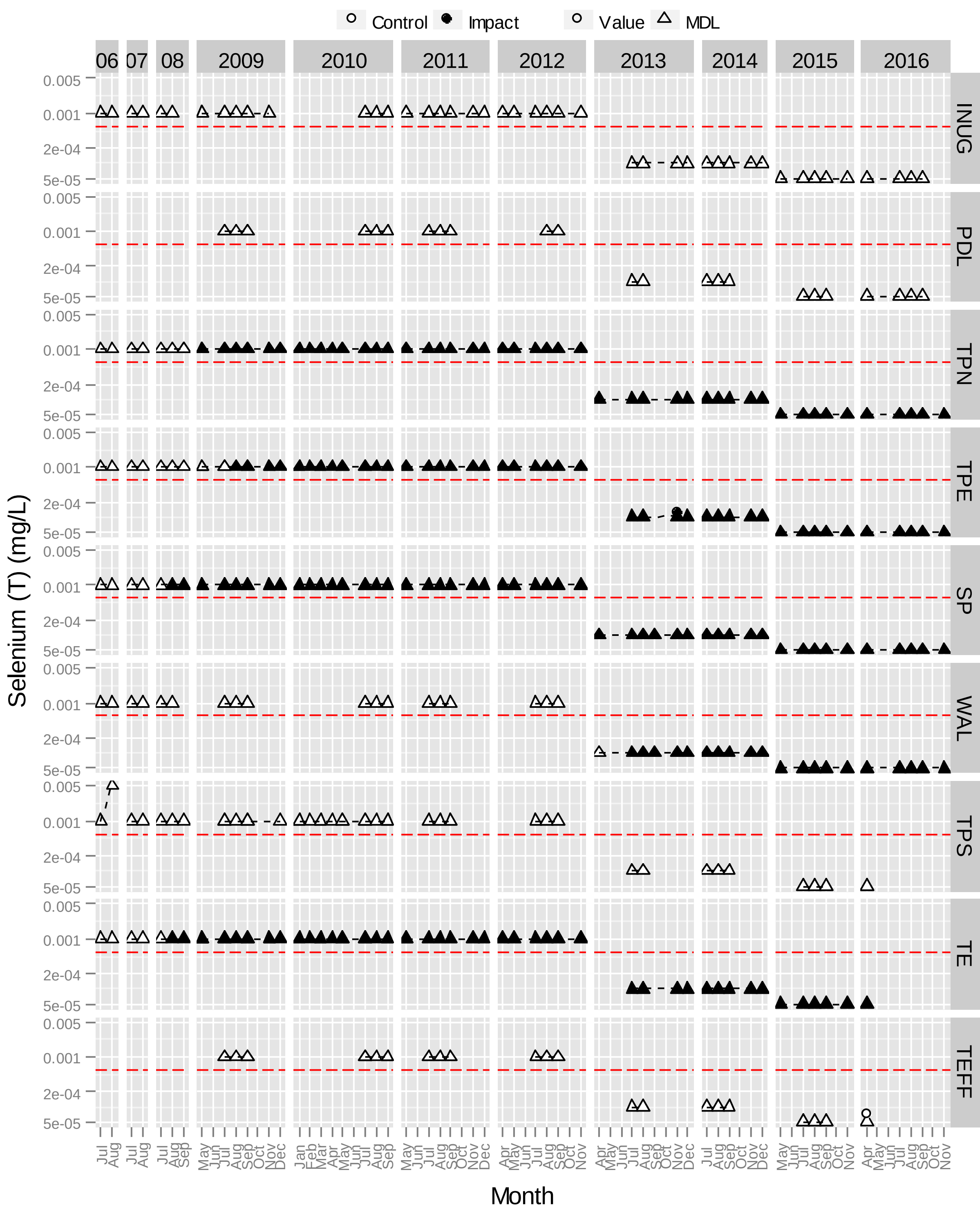


Figure A1–15. Total Thallium (mg/L) in water samples from Meadowbank study lakes since 2006.

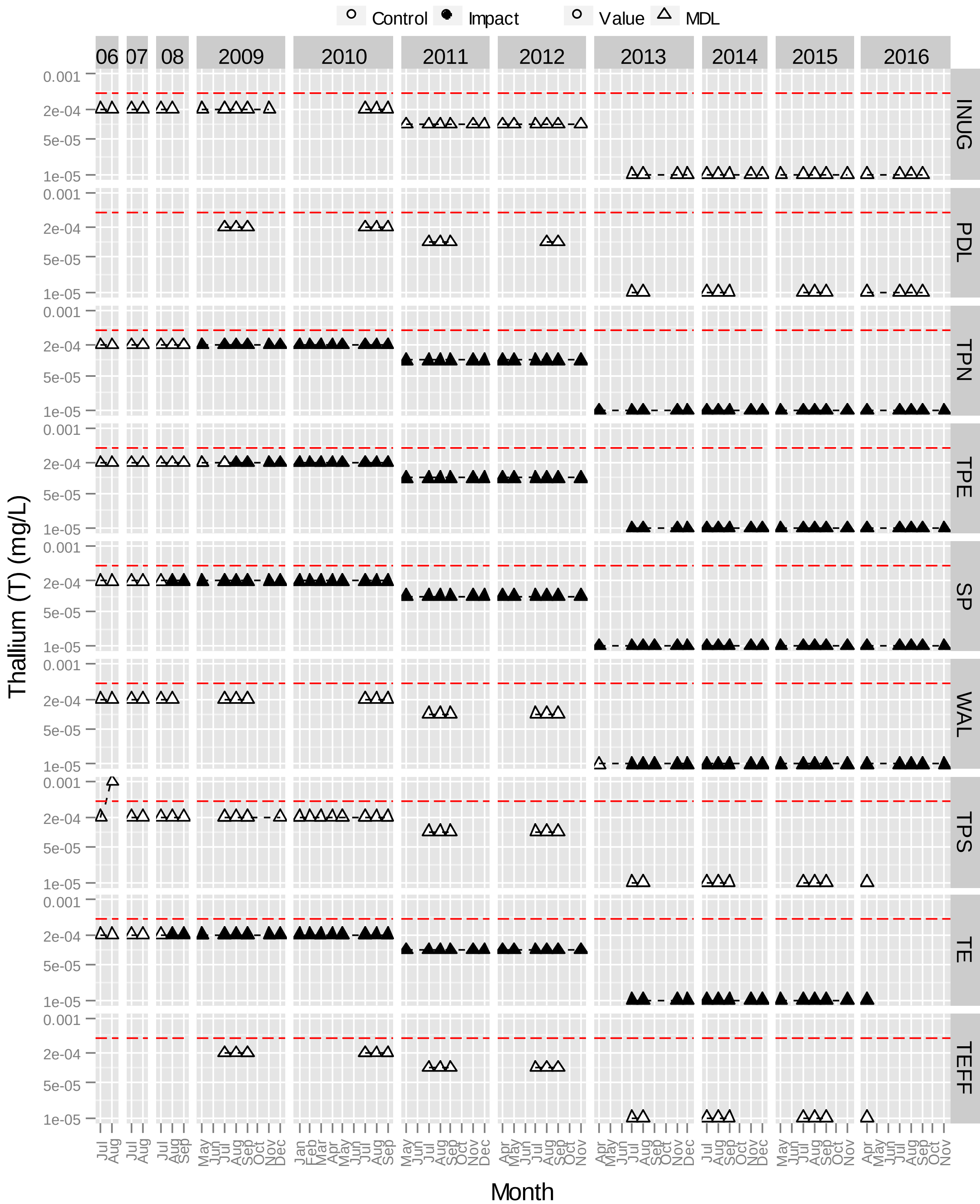


Figure A1–16. Total Tin (mg/L) in water samples from Meadowbank study lakes since 2006.

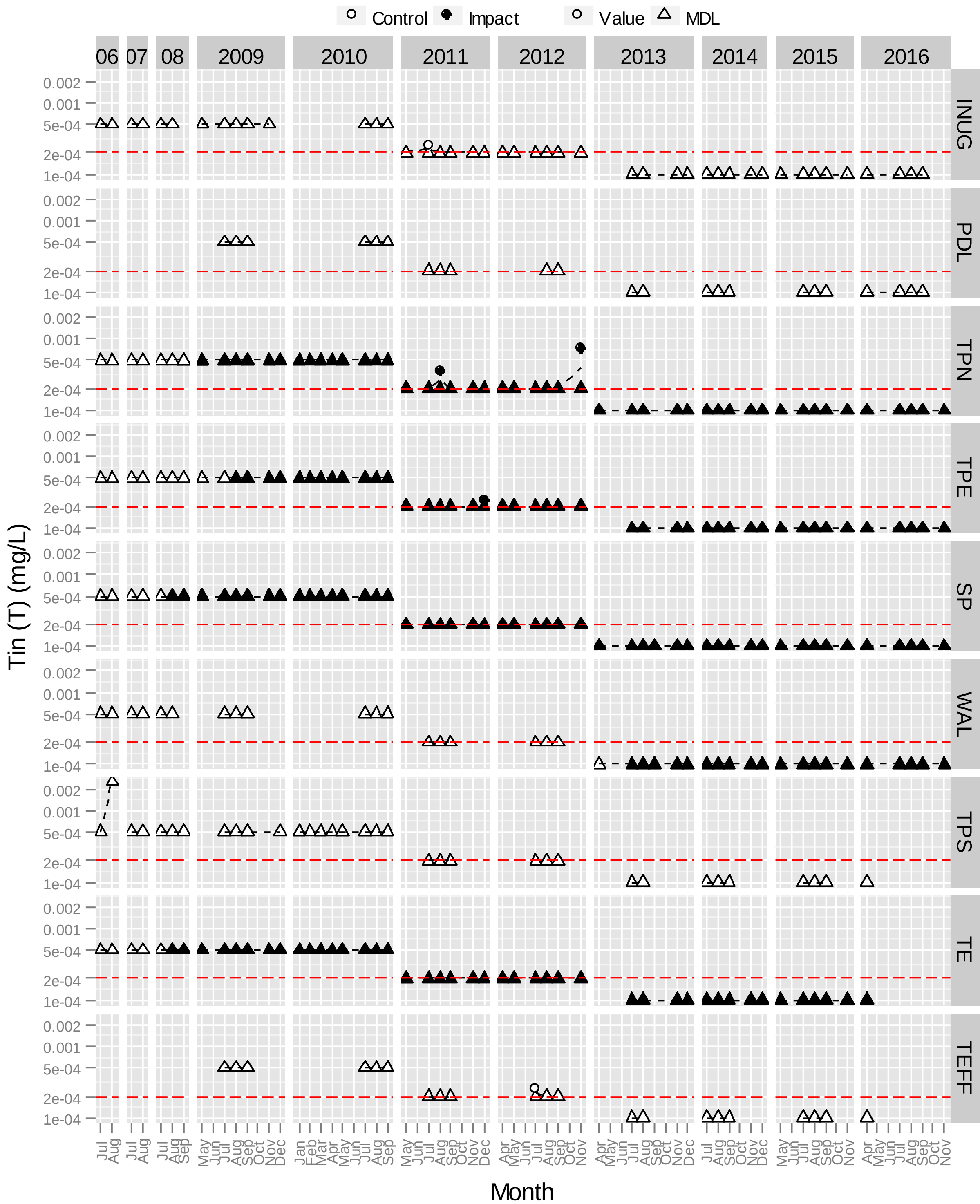


Figure A1–17. Total Titanium (mg/L) in water samples from Meadowbank study lakes since 2006.

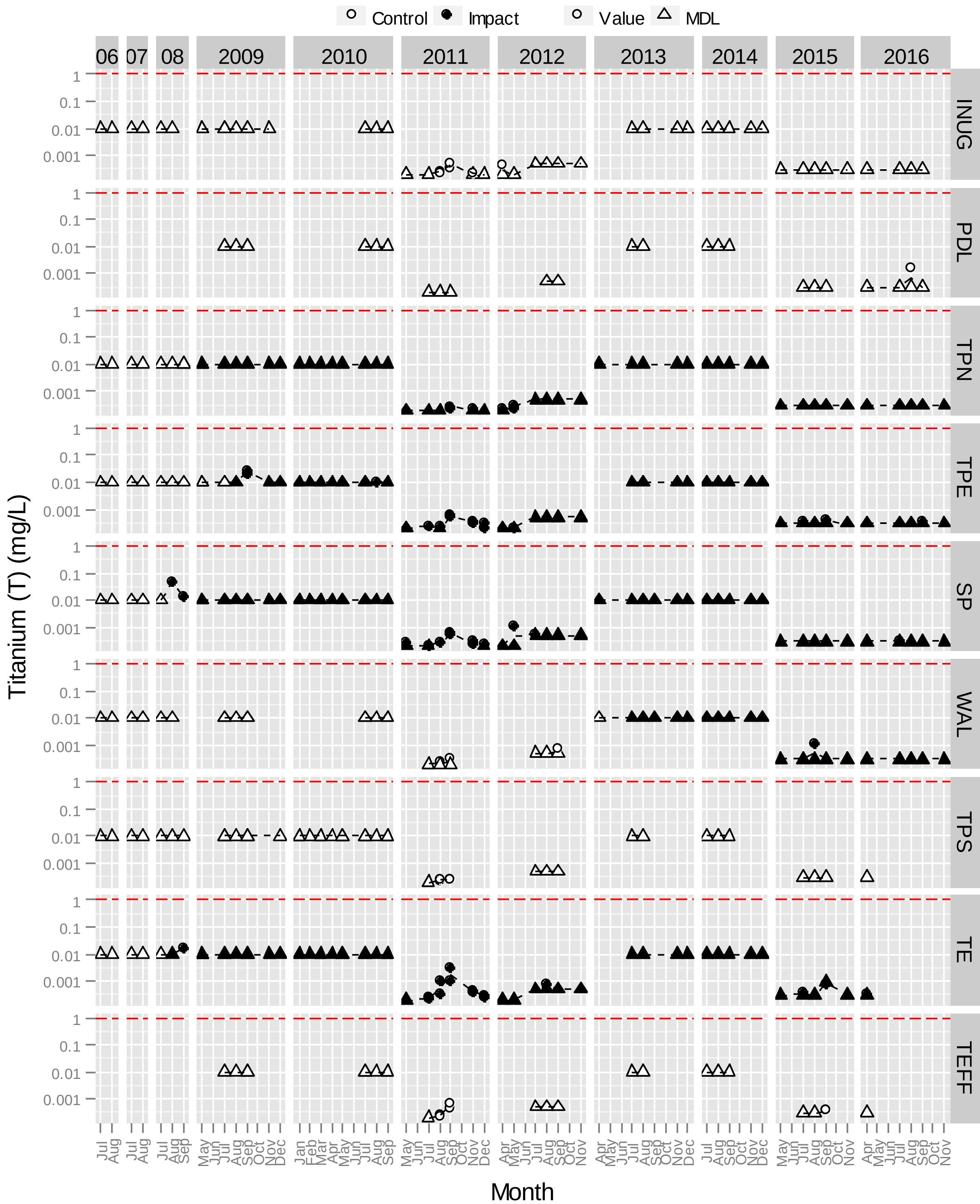


Figure A1–18. Total Vanadium (mg/L) in water samples from Meadowbank study lakes since 2006.

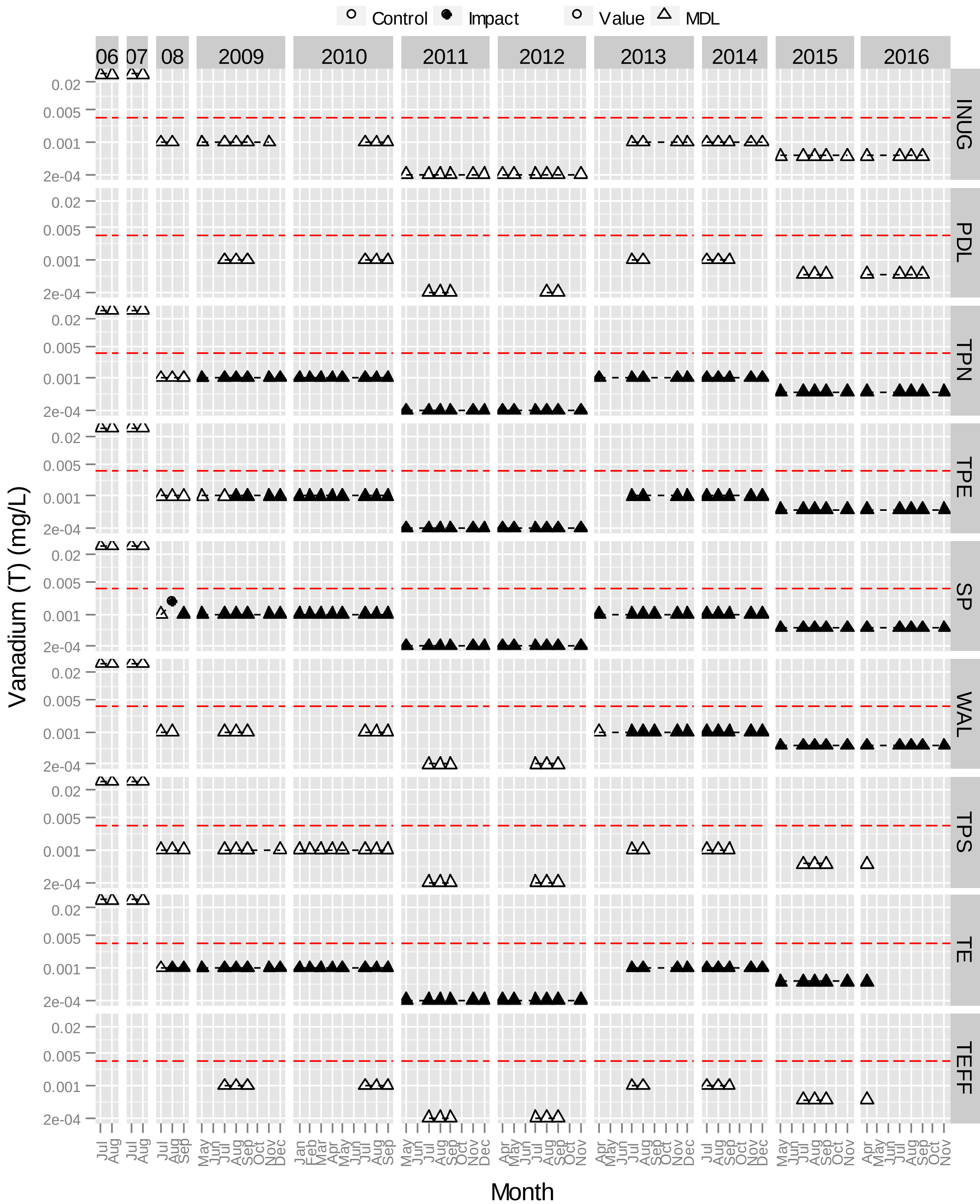


Figure A1–19. Total Zinc (mg/L) in water samples from Meadowbank study lakes since 2006.

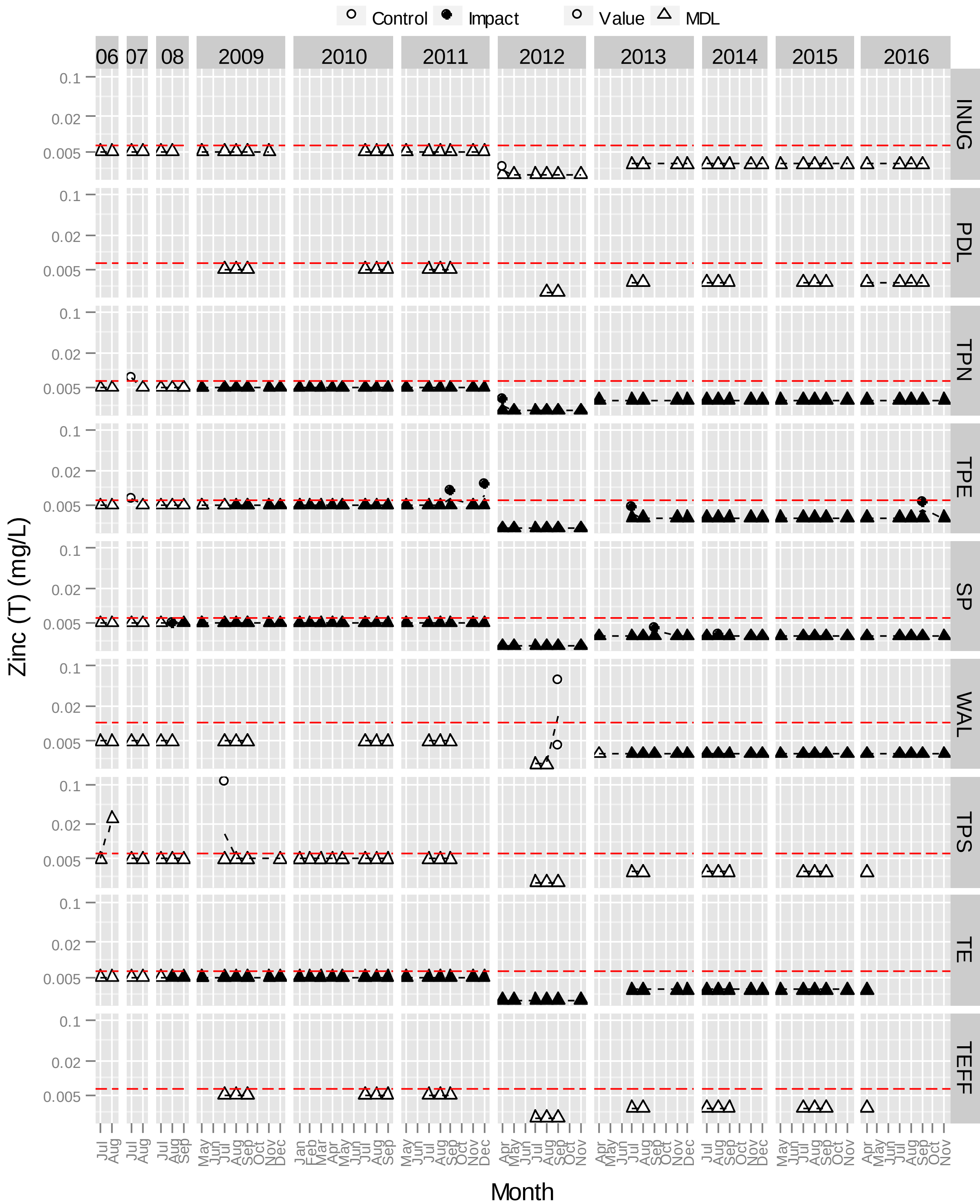


Figure A1–20. Dissolved Antimony (mg/L) in water samples from Meadowbank study lakes since 2006.

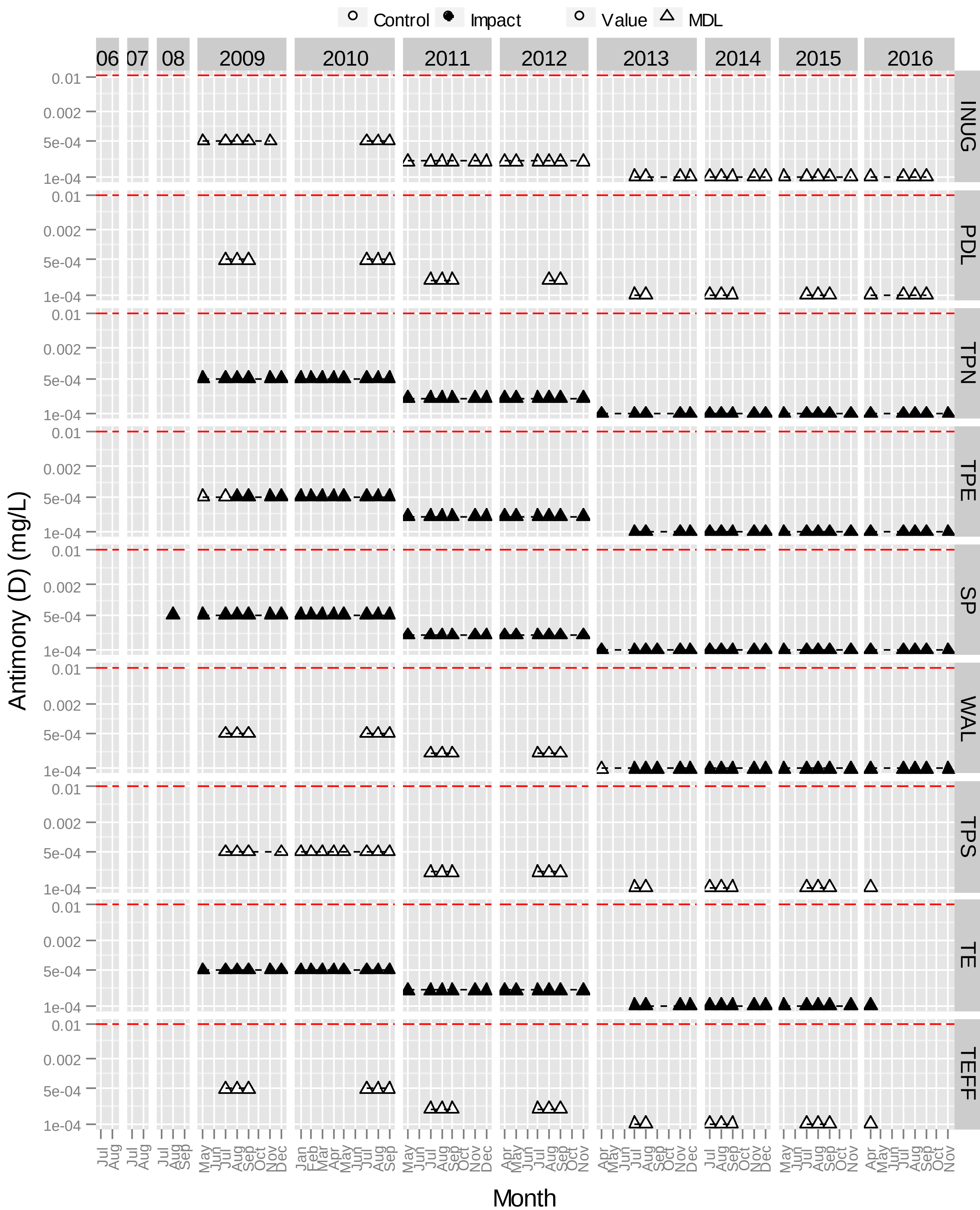


Figure A1–21. Dissolved Beryllium (mg/L) in water samples from Meadowbank study lakes since 2006.

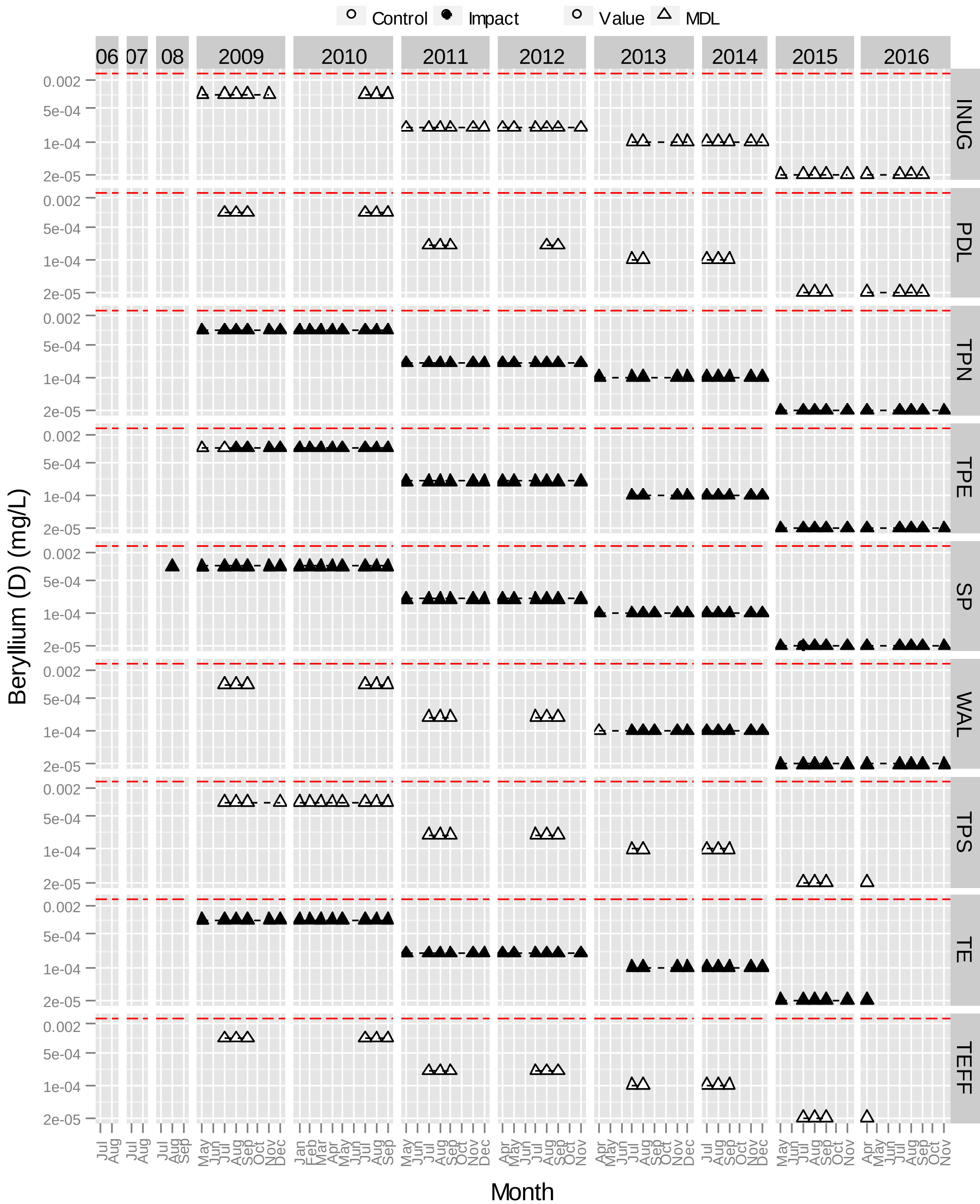


Figure A1–22. Dissolved Boron (mg/L) in water samples from Meadowbank study lakes since 2006.

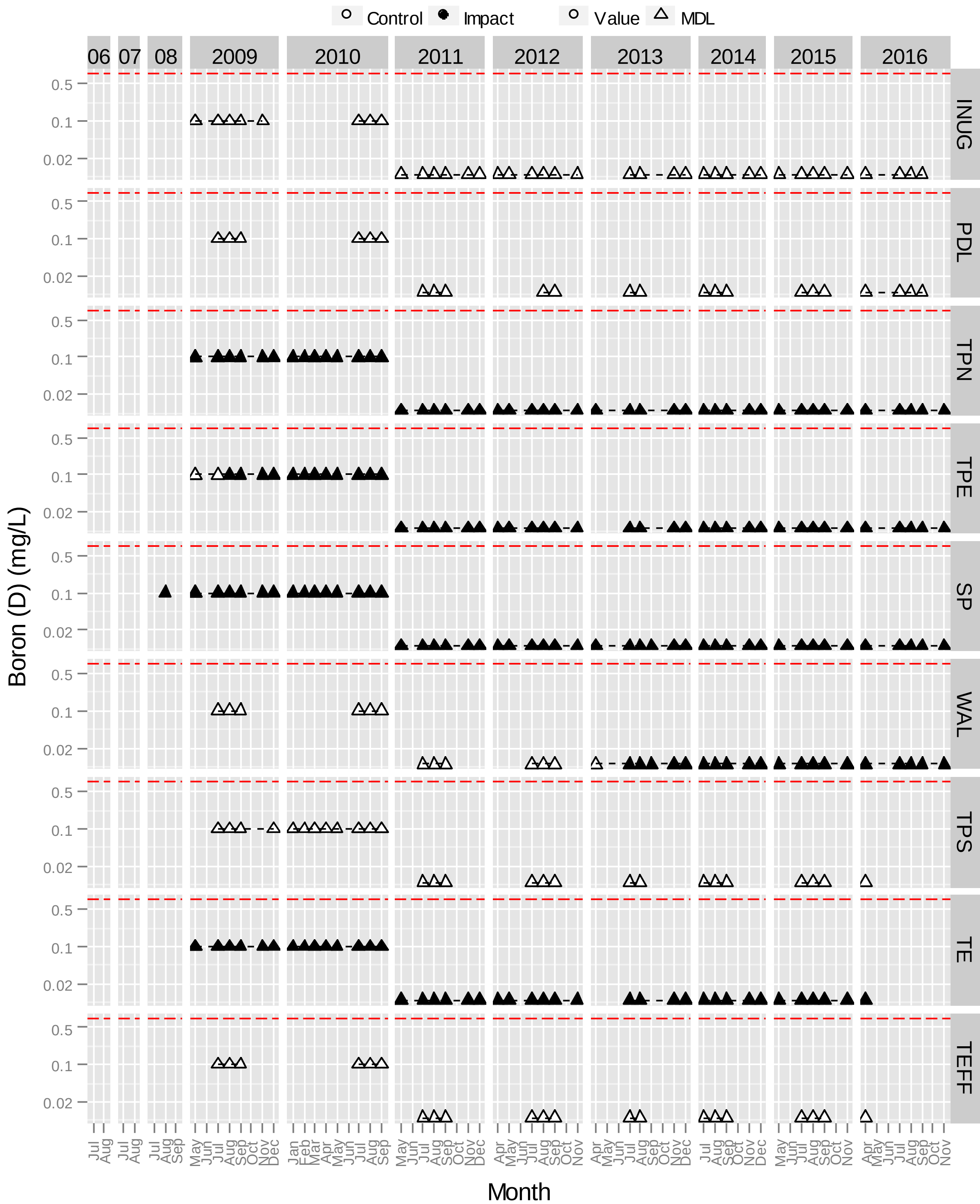


Figure A1–23. Dissolved Cadmium (mg/L) in water samples from Meadowbank study lakes since 2006.

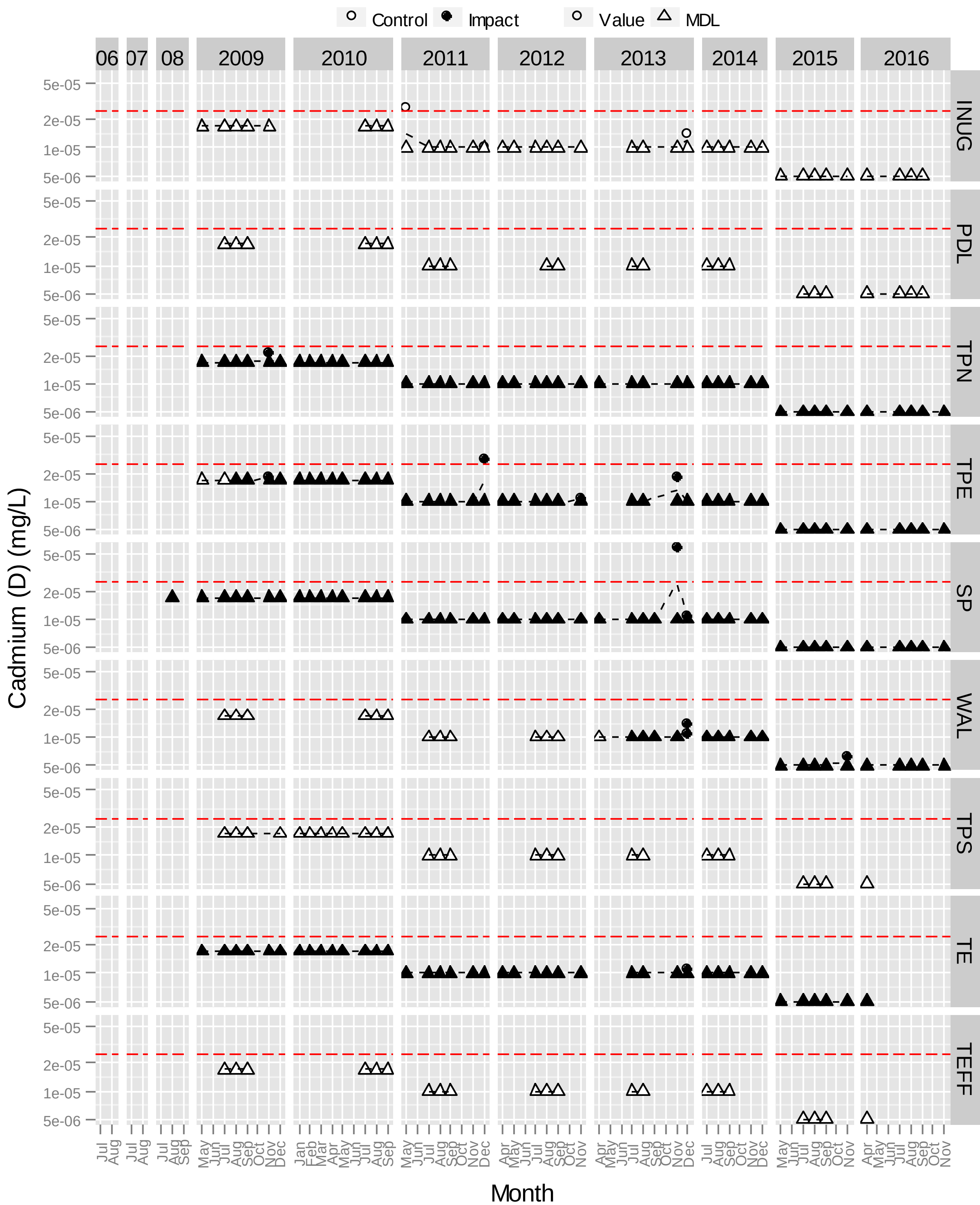


Figure A1–24. Dissolved Chromium (mg/L) in water samples from Meadowbank study lakes since 2006.

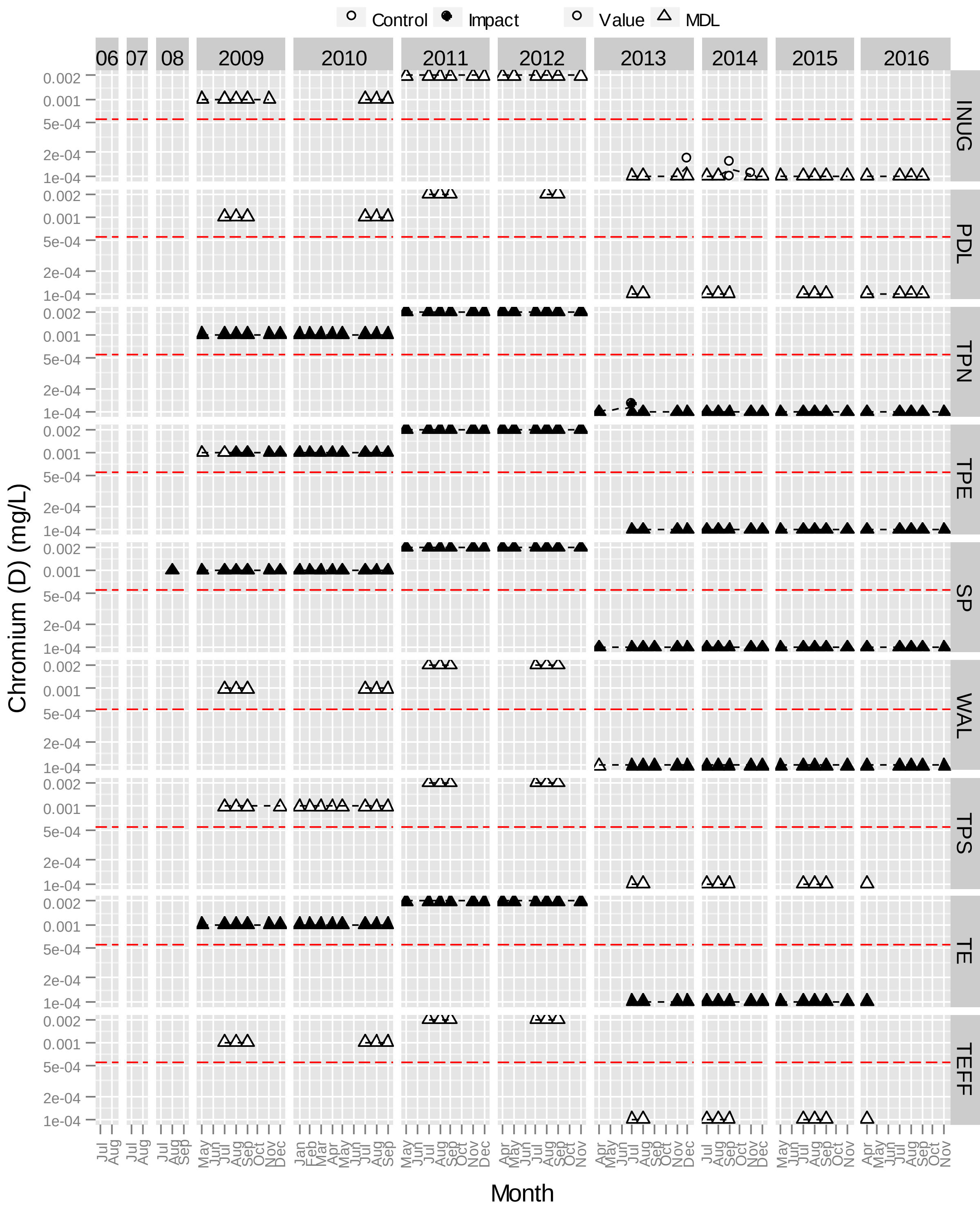


Figure A1–25. Dissolved Iron (mg/L) in water samples from Meadowbank study lakes since 2006.

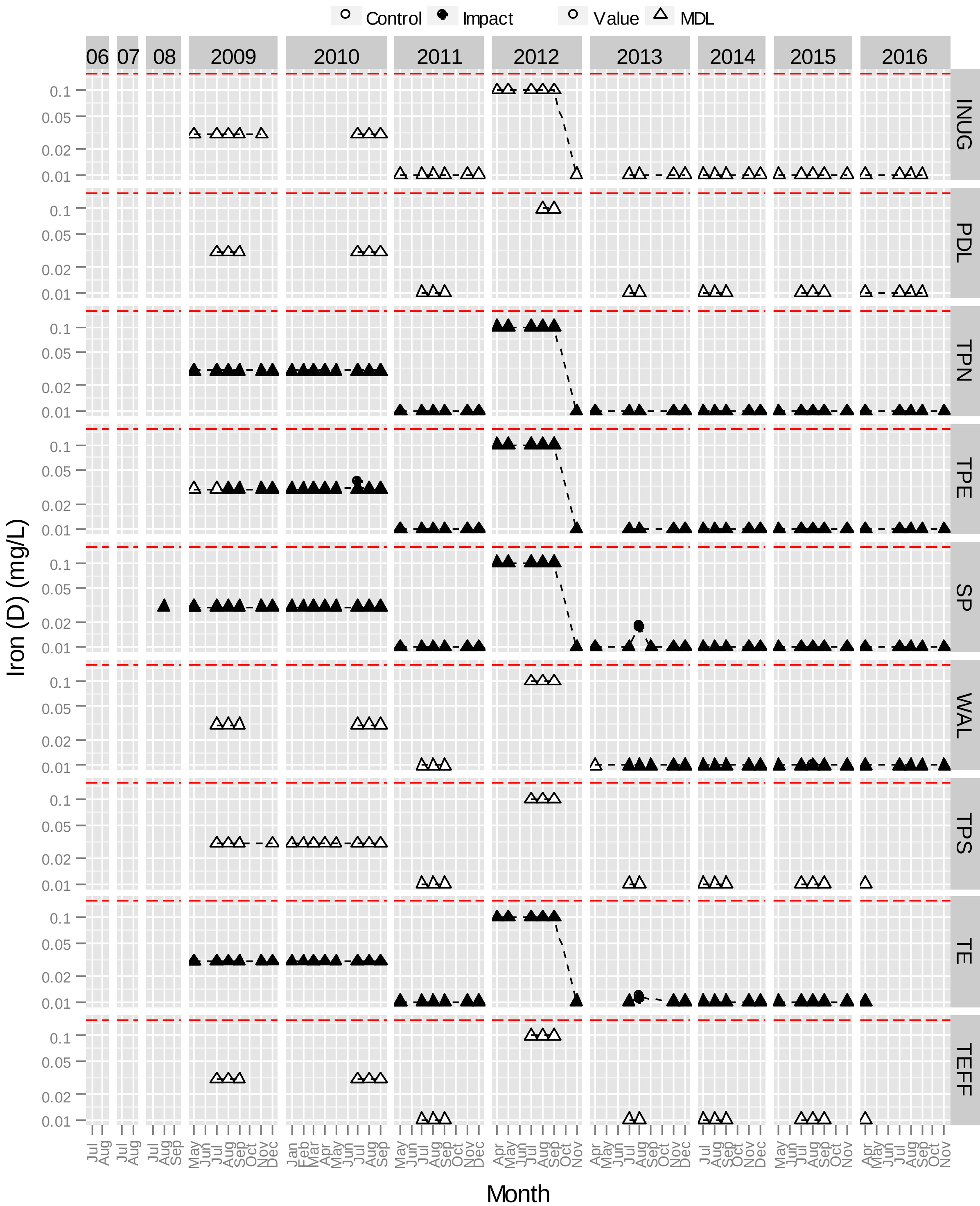


Figure A1–26. Dissolved Lead (mg/L) in water samples from Meadowbank study lakes since 2006.

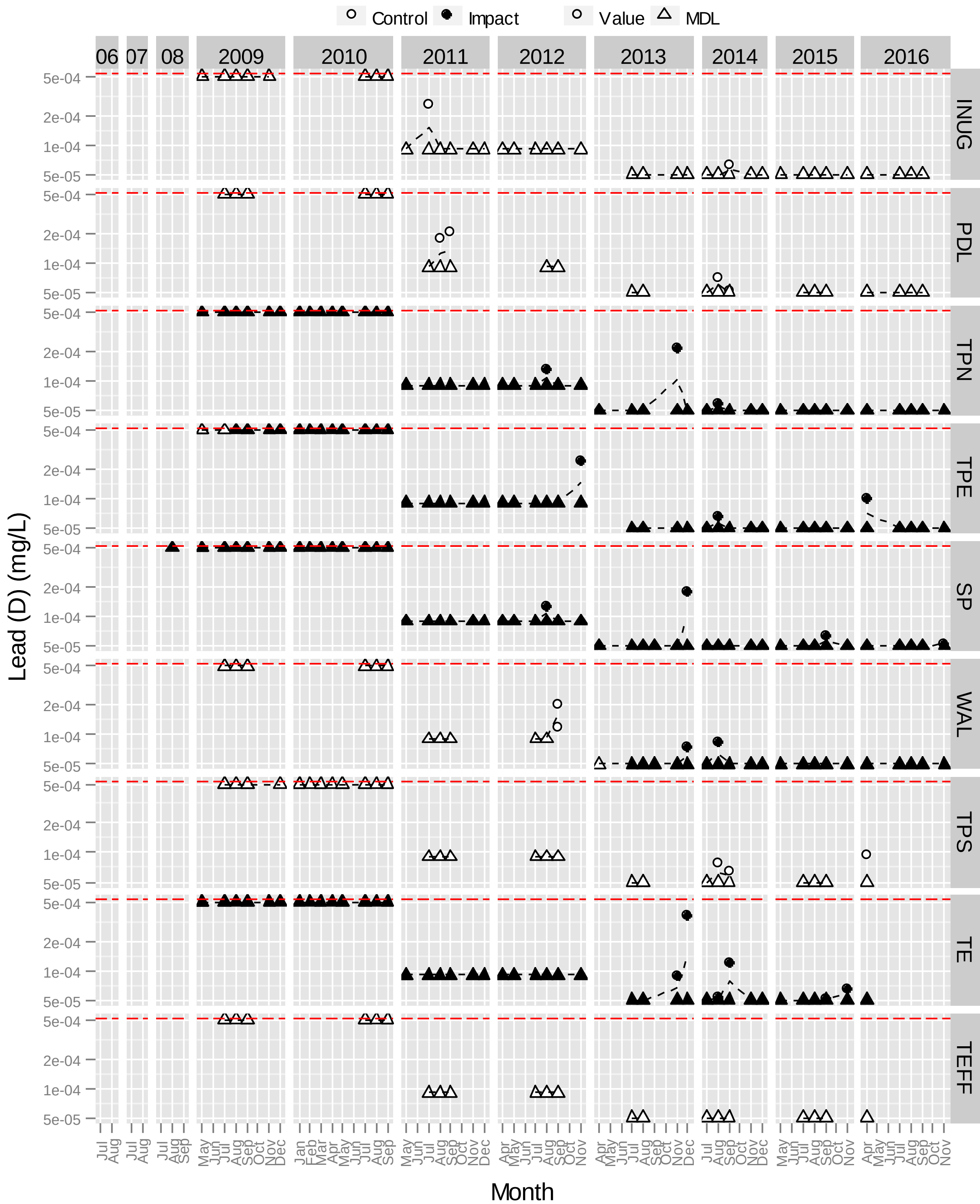


Figure A1–27. Dissolved Lithium (mg/L) in water samples from Meadowbank study lakes since 2006.

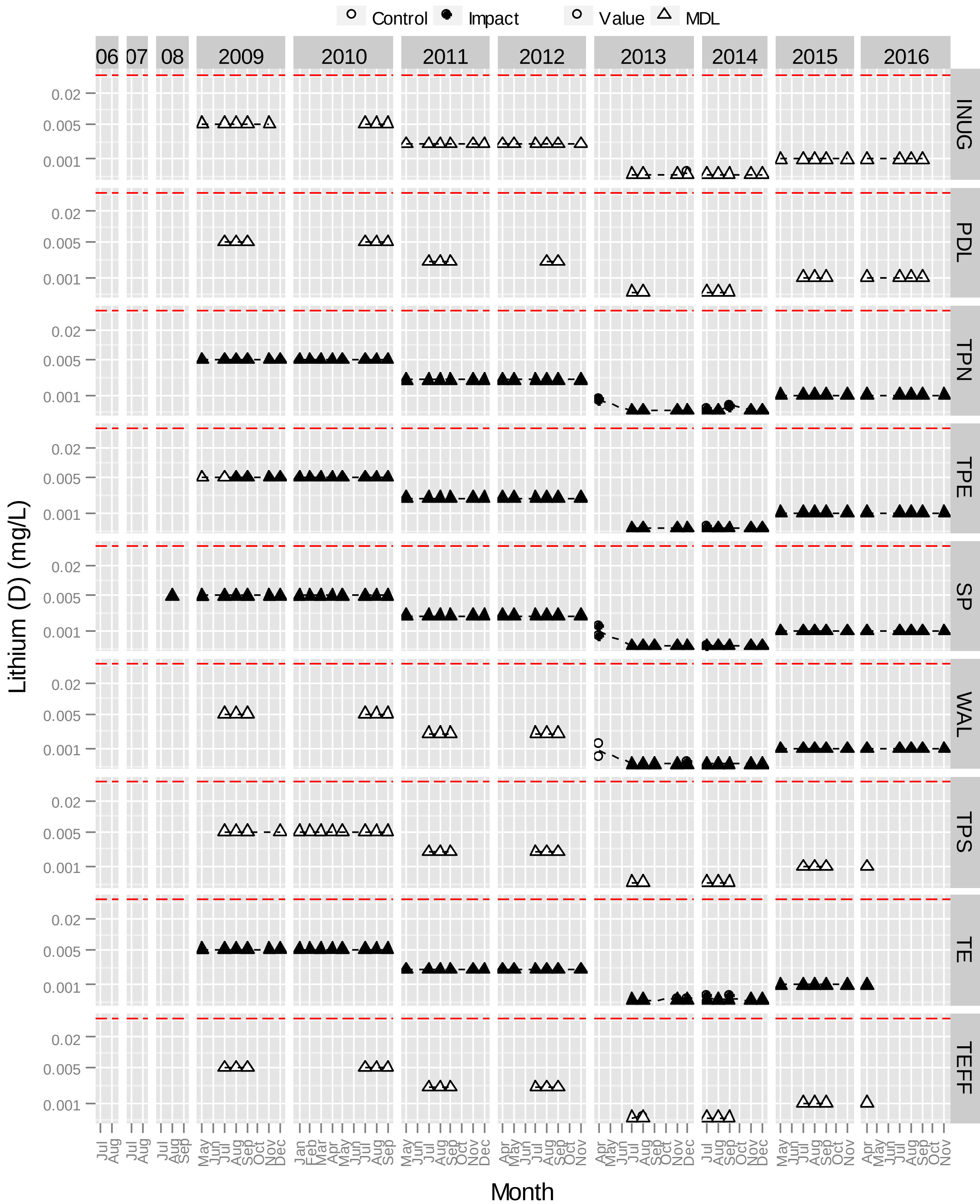


Figure A1–28. Dissolved Mercury (mg/L) in water samples from Meadowbank study lakes since 2006.

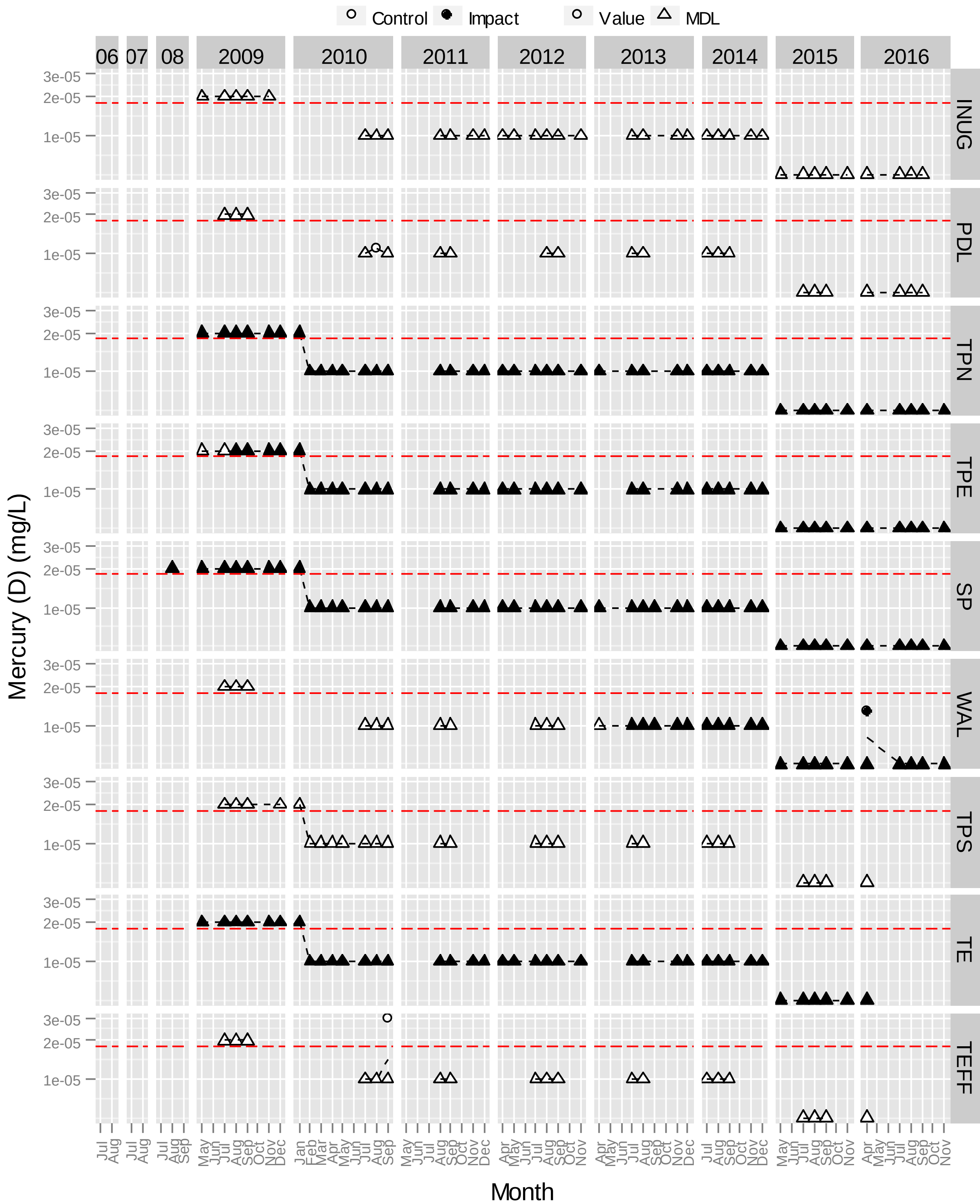


Figure A1–29. Dissolved Nickel (mg/L) in water samples from Meadowbank study lakes since 2006.

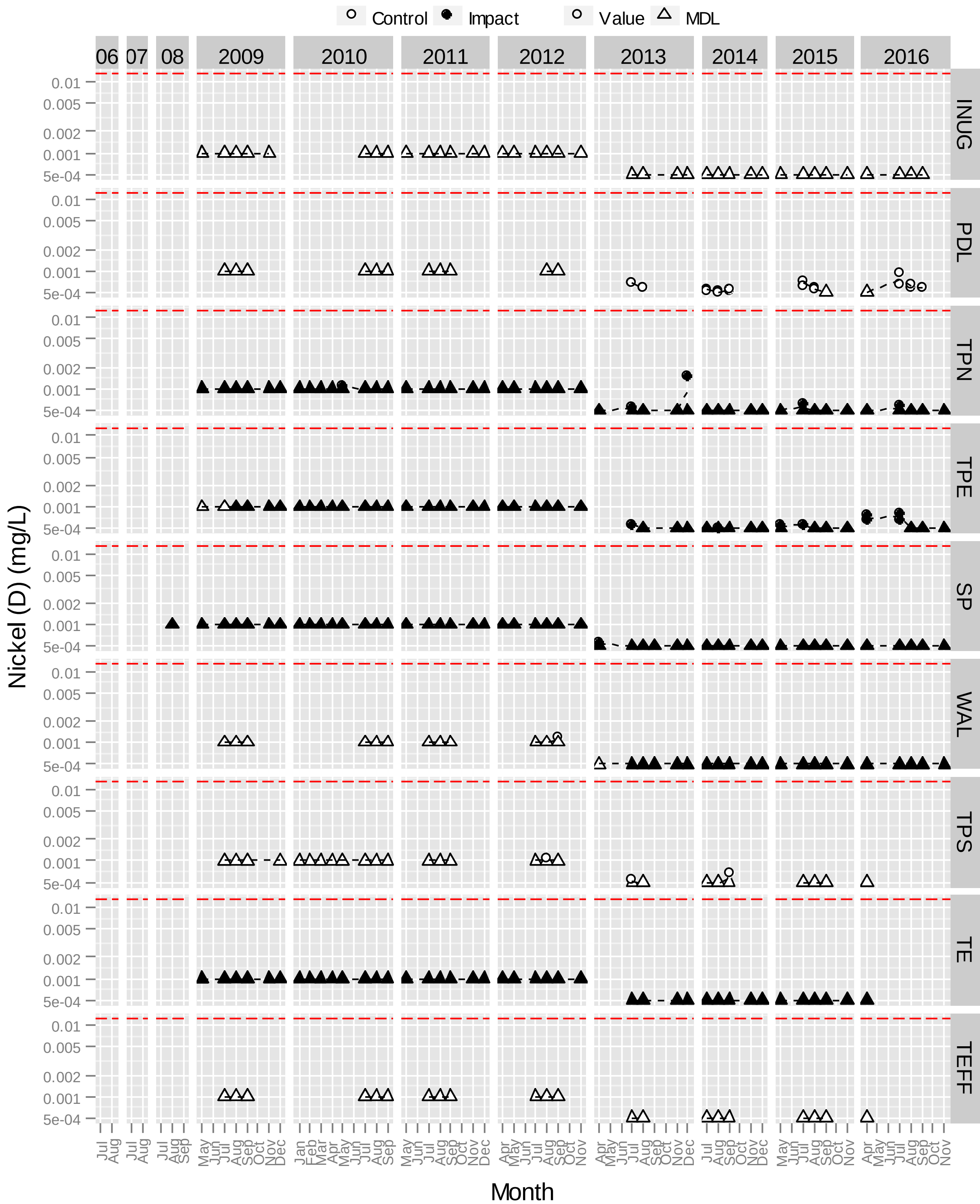


Figure A1–30. Dissolved Selenium (mg/L) in water samples from Meadowbank study lakes since 2006.

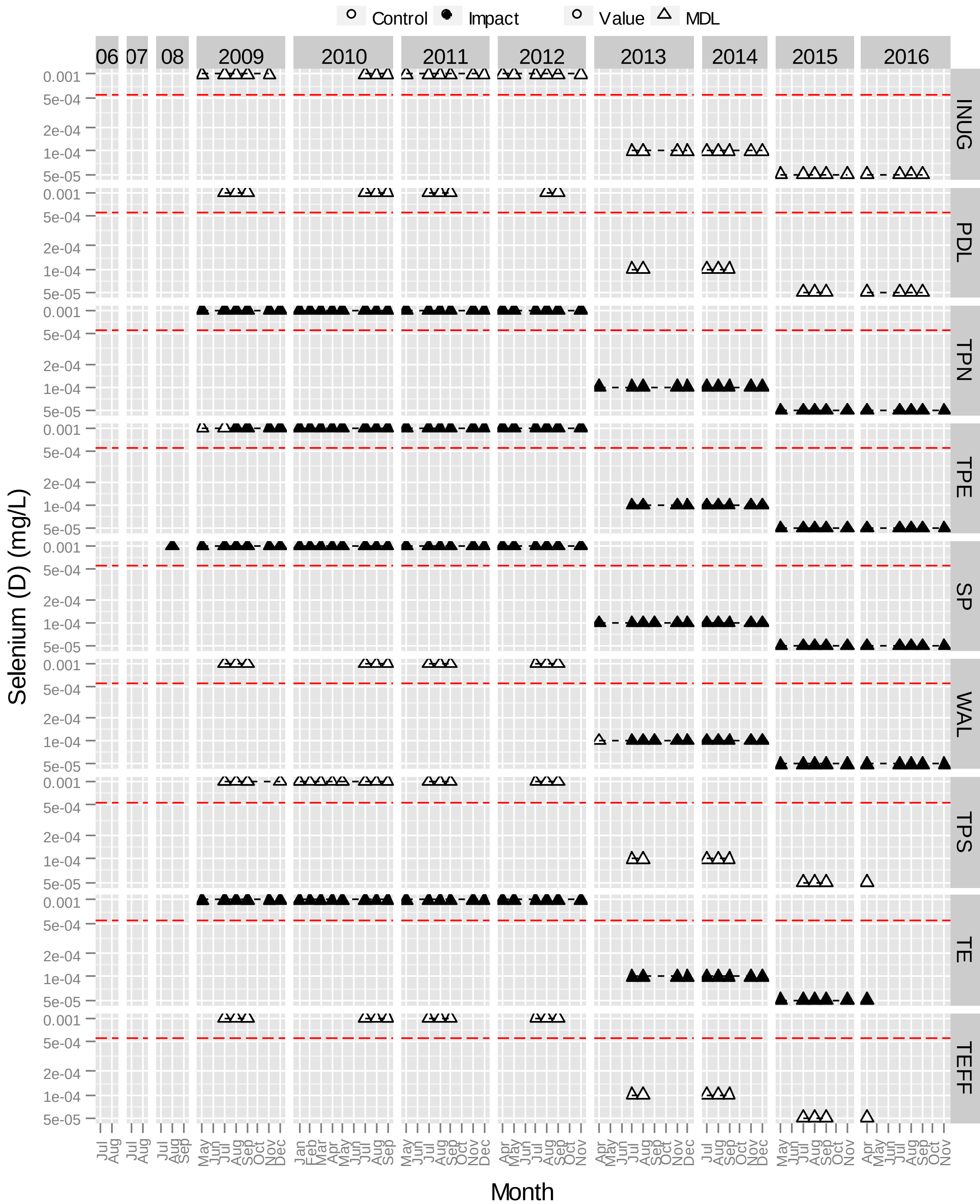


Figure A1–31. Dissolved Thallium (mg/L) in water samples from Meadowbank study lakes since 2006.

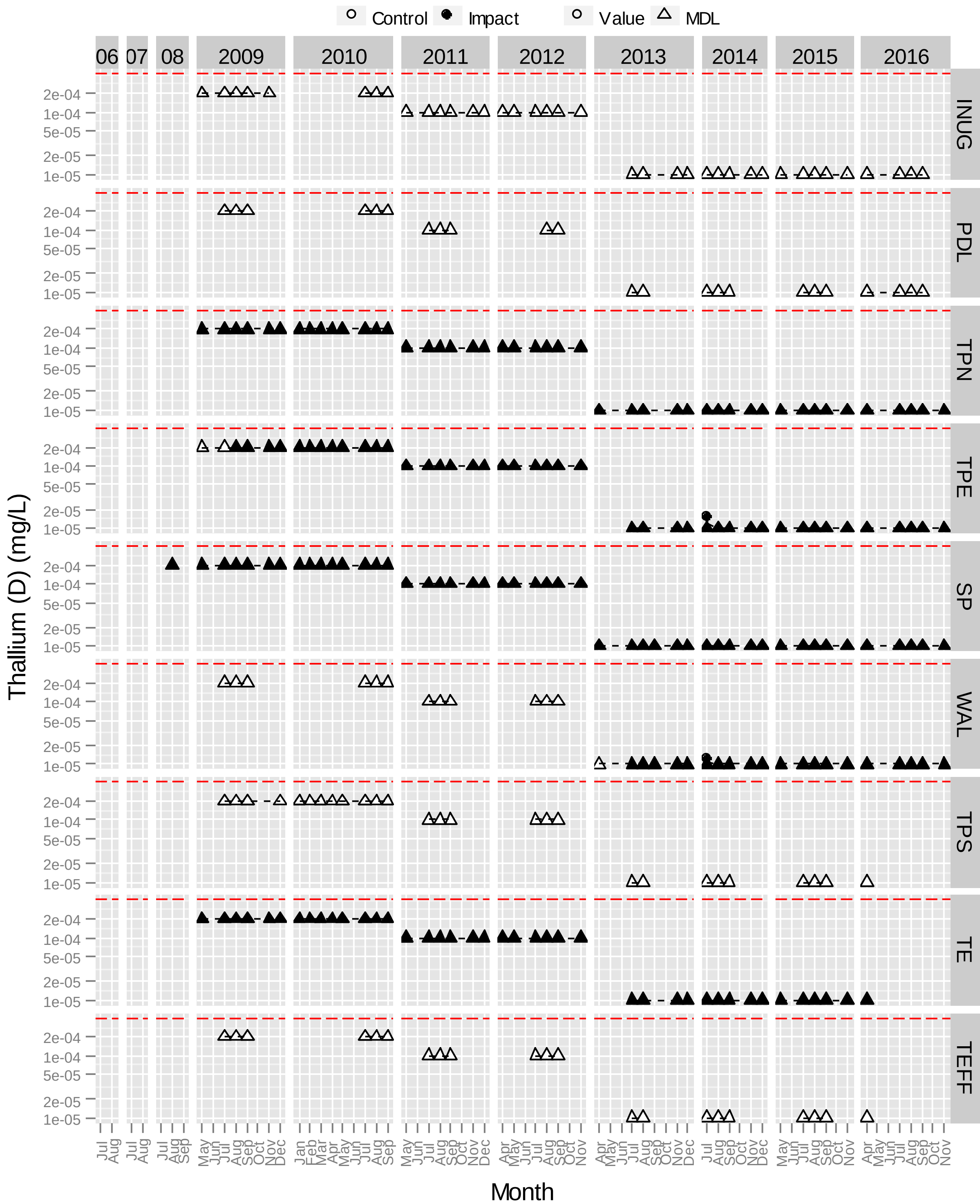


Figure A1–32. Dissolved Tin (mg/L) in water samples from Meadowbank study lakes since 2006.

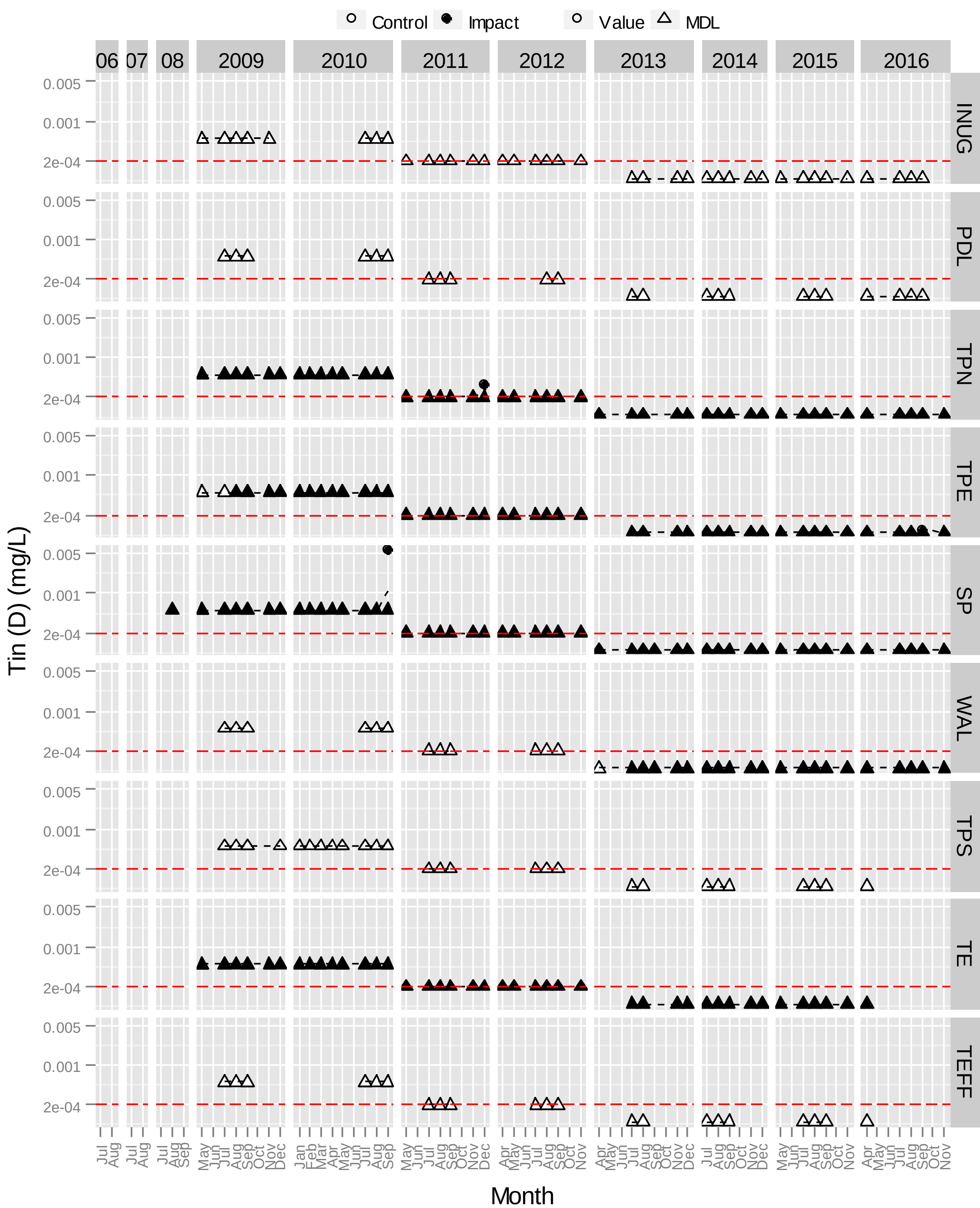


Figure A1–33. Dissolved Titanium (mg/L) in water samples from Meadowbank study lakes since 2006.

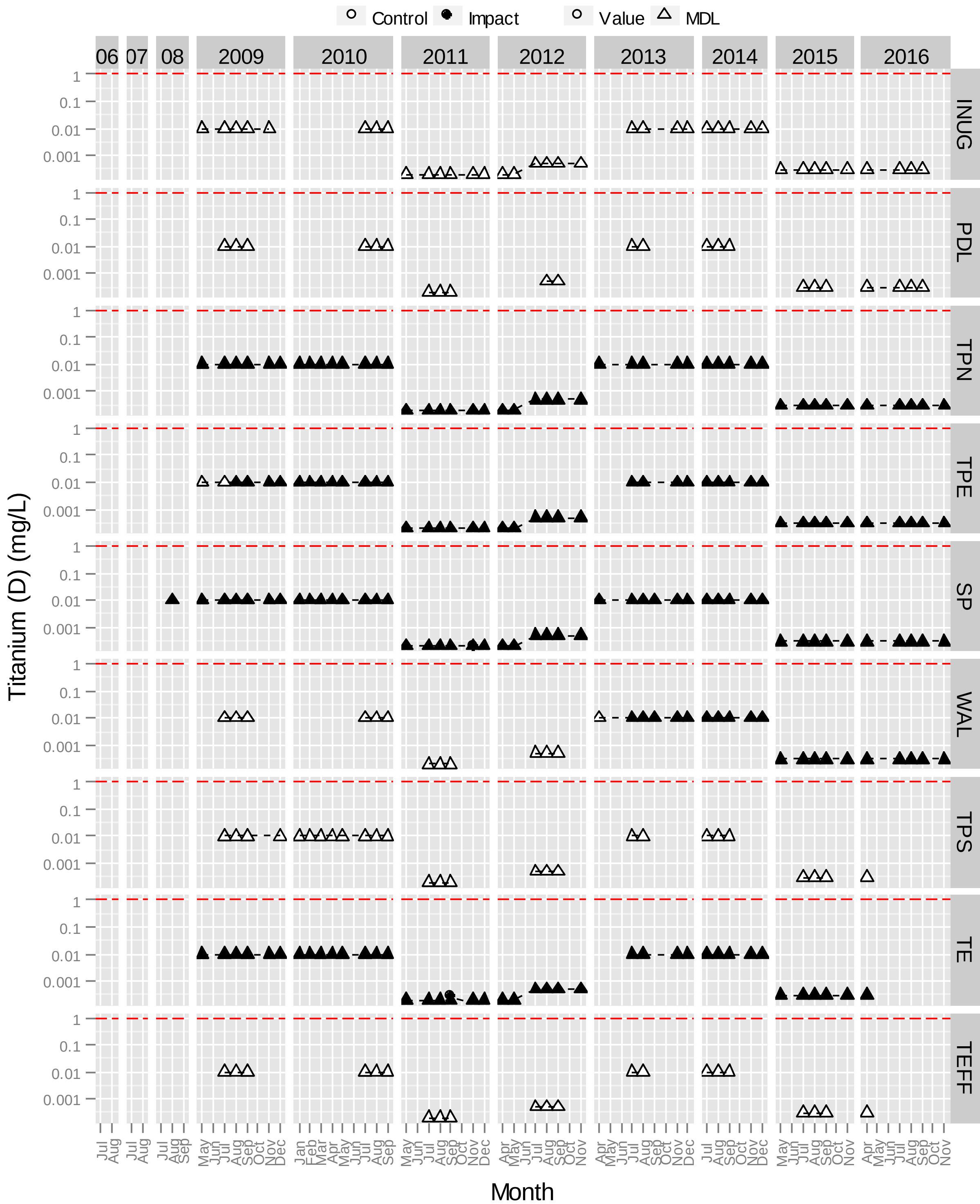


Figure A1–34. Dissolved Vanadium (mg/L) in water samples from Meadowbank study lakes since 2006.

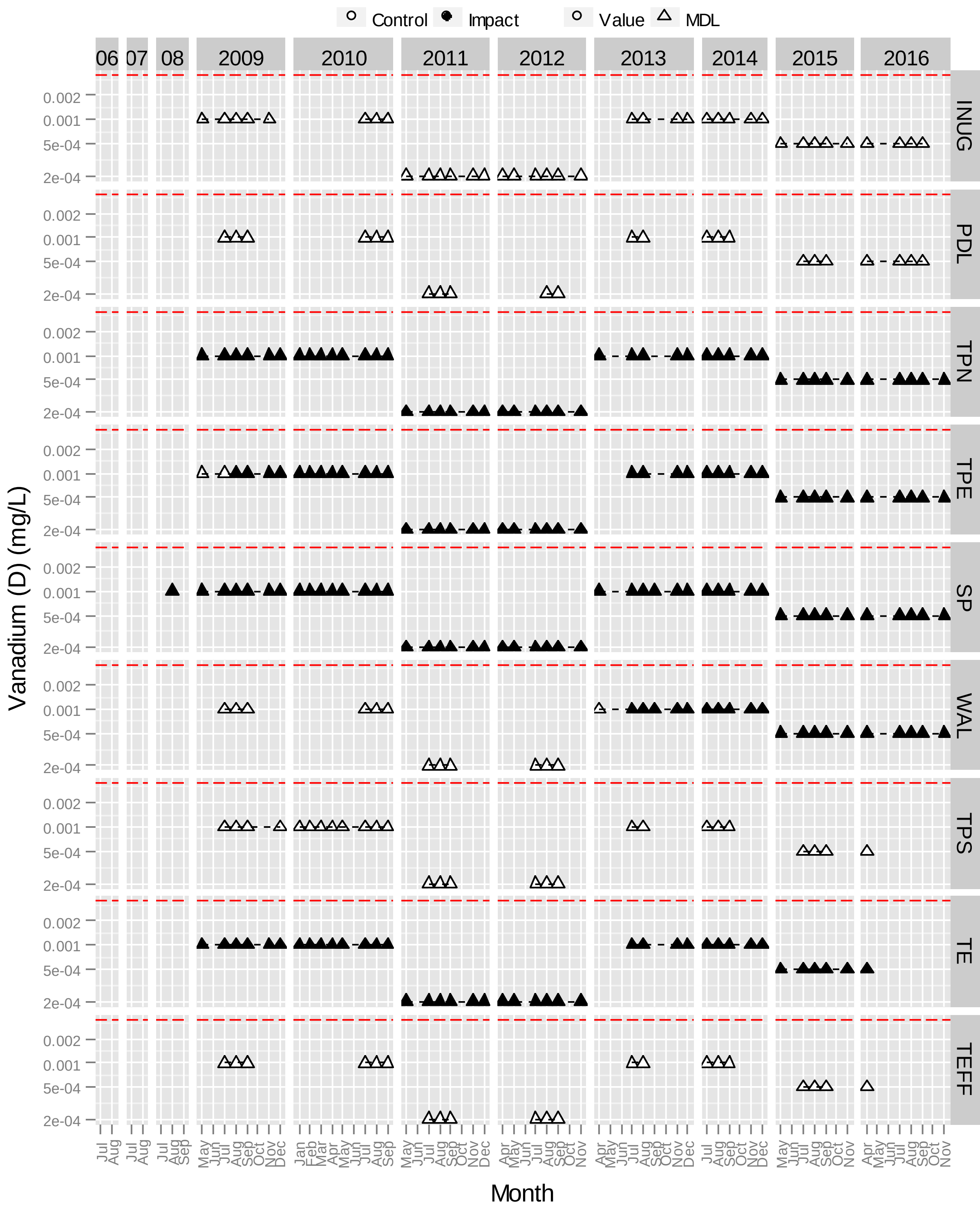
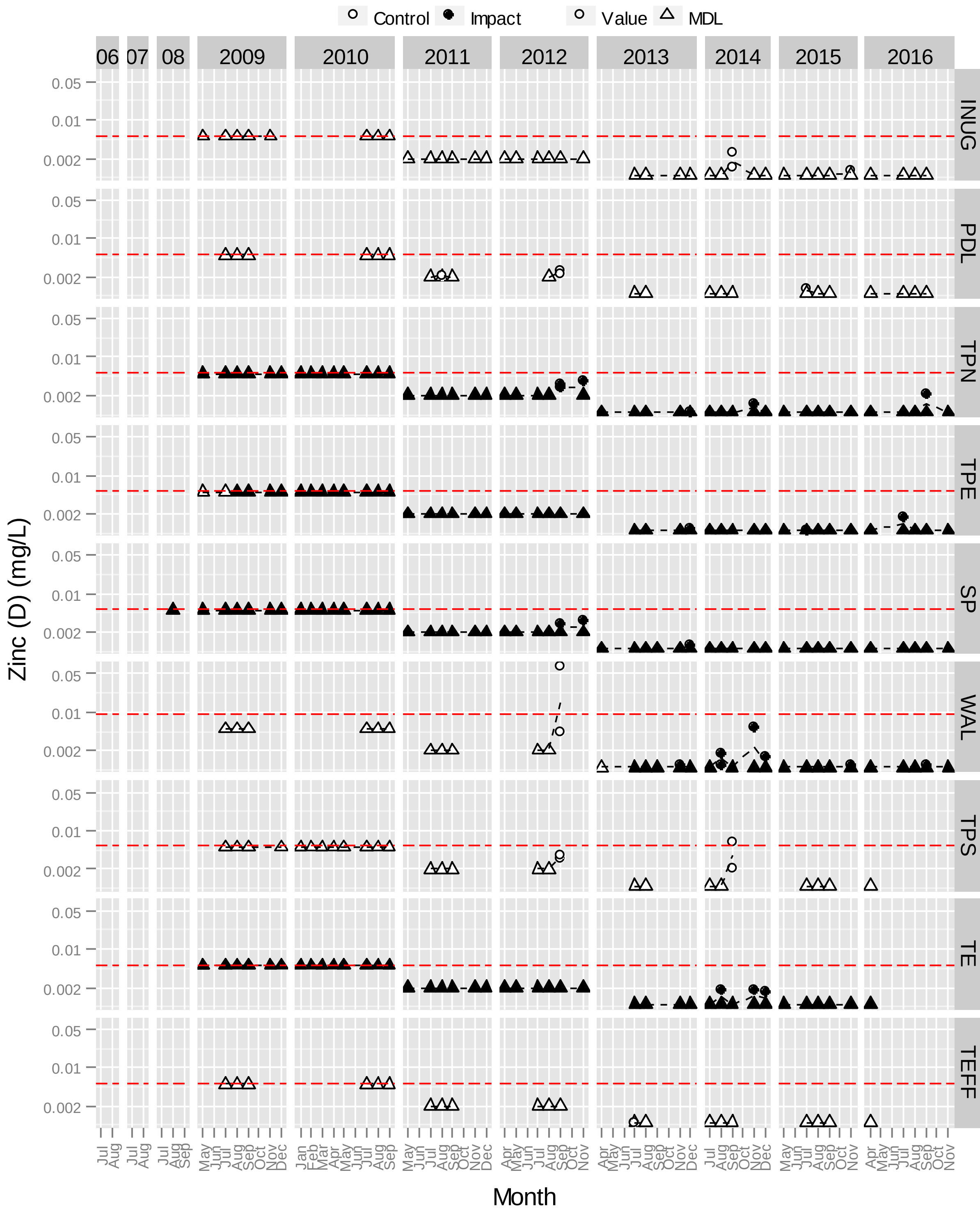


Figure A1–35. Dissolved Zinc (mg/L) in water samples from Meadowbank study lakes since 2006.



APPENDIX A2

Baker Lake Water Quality Plots 2008 – 2016

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Figure A2–1. Carbonate Alkalinity (mg/L) in water samples from Baker Lake since 2008.

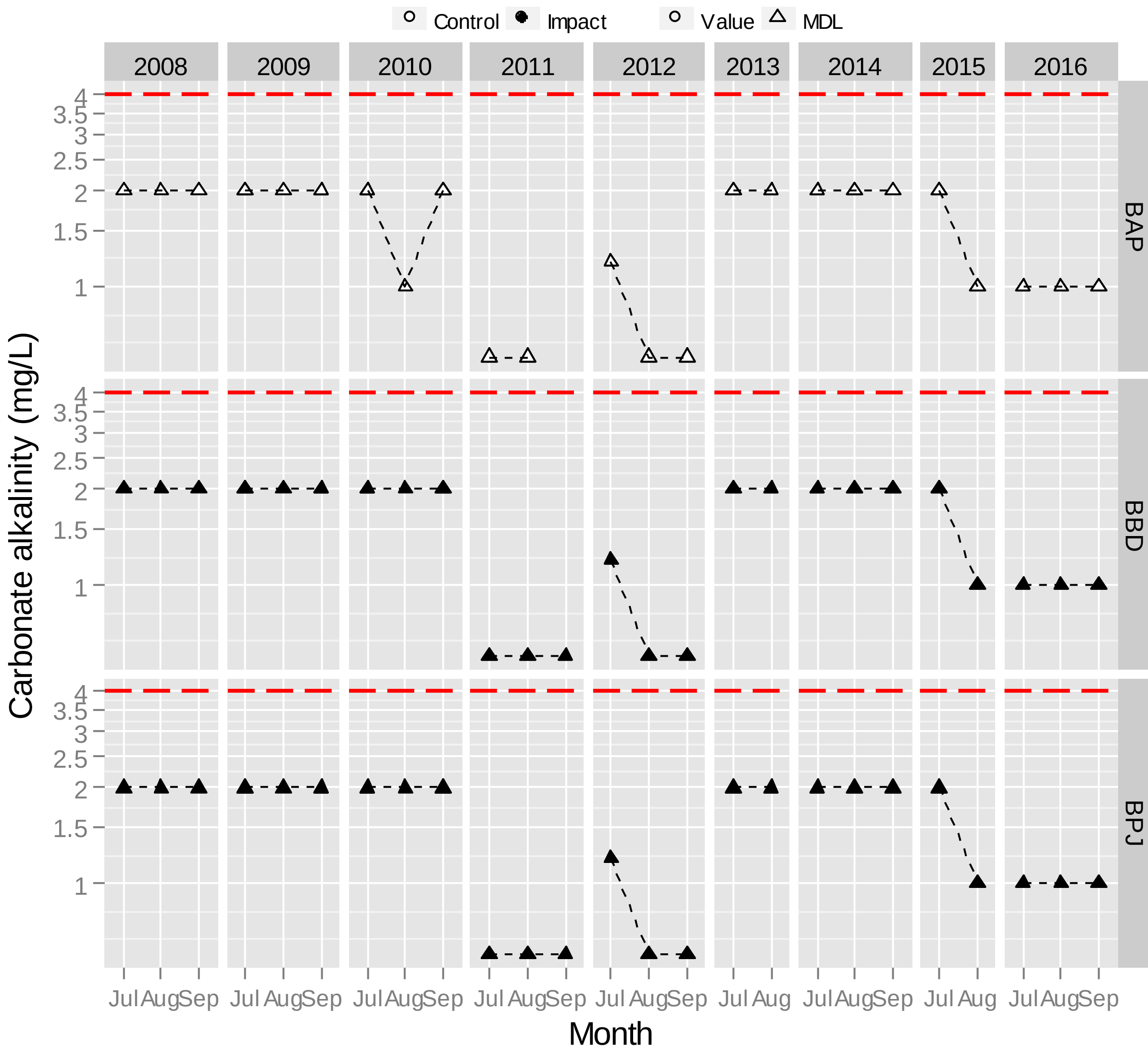


Figure A2–2. Nitrite-N (mg/L) in water samples from Baker Lake since 2008.

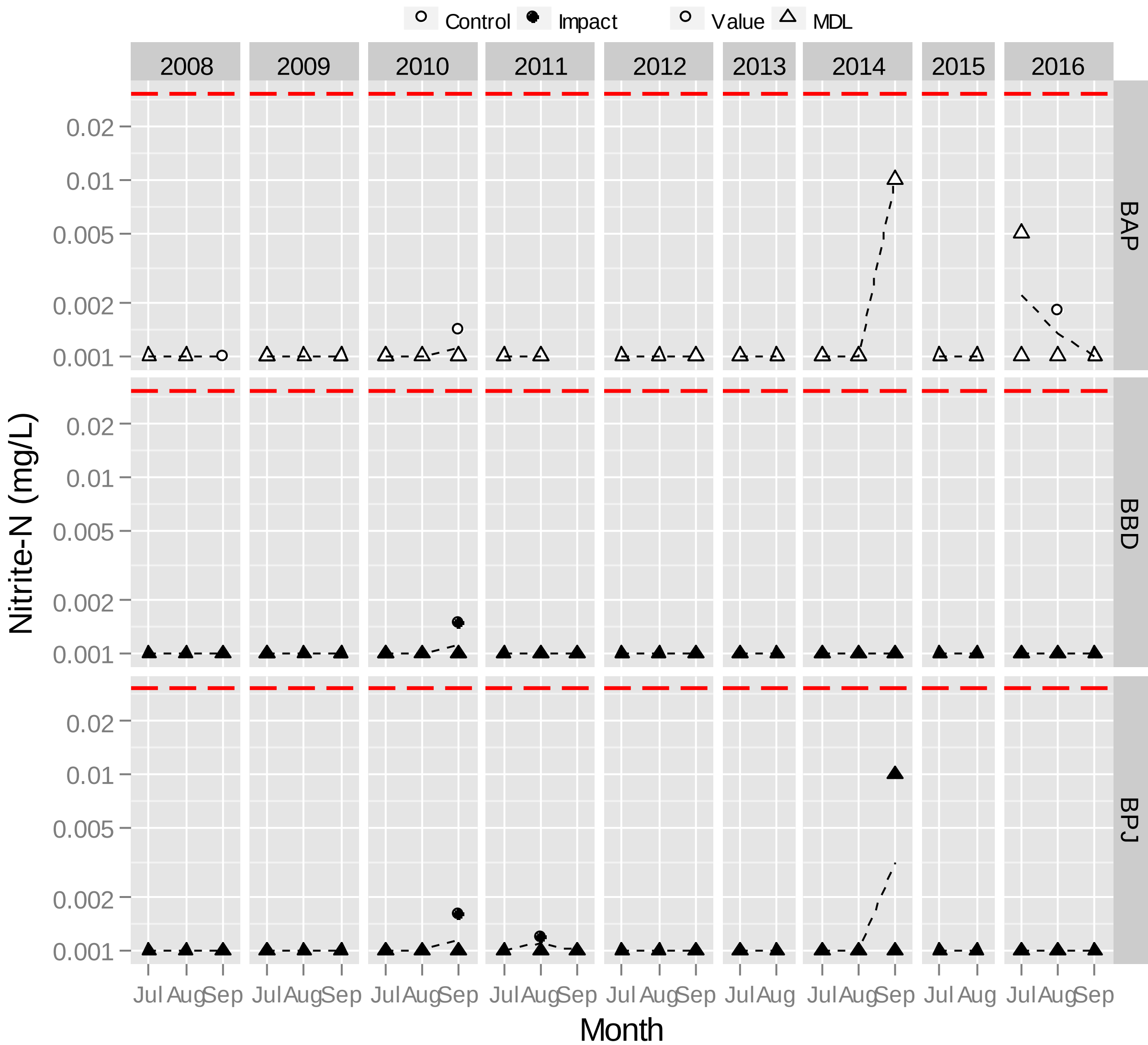


Figure A2–3. Total Cyanide (mg/L) in water samples from Baker Lake since 2014.

Note: No trigger for total cyanide. Detection limit lowered from 0.005 mg/L in 2014 to 0.001 mg/L in 2015.

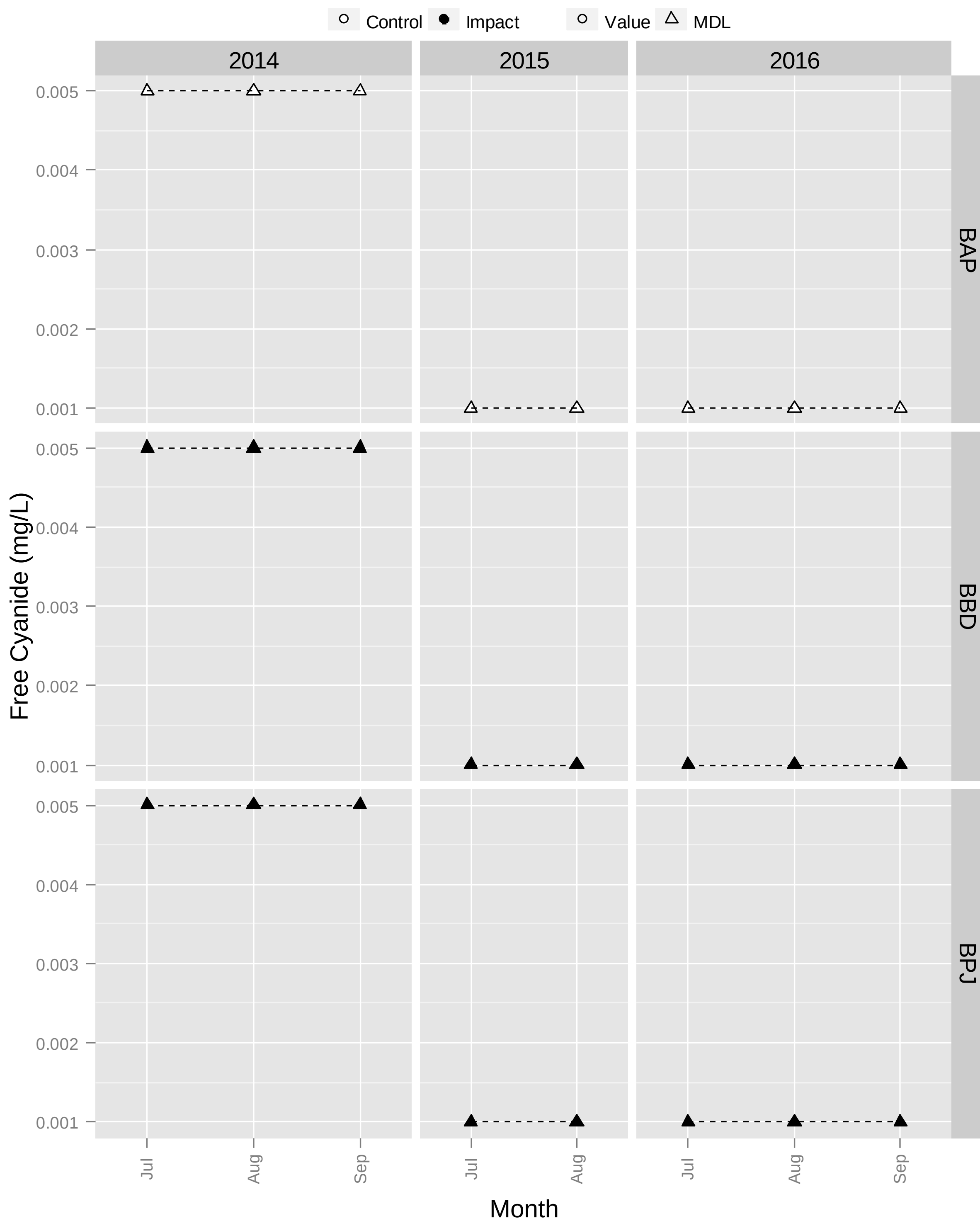


Figure A2–4. Free Cyanide (mg/L) in water samples from Baker Lake since 2014.

Note: No trigger for free cyanide. Detection limit lowered from 0.005 mg/L in 2014 to 0.001 mg/L in 2015.

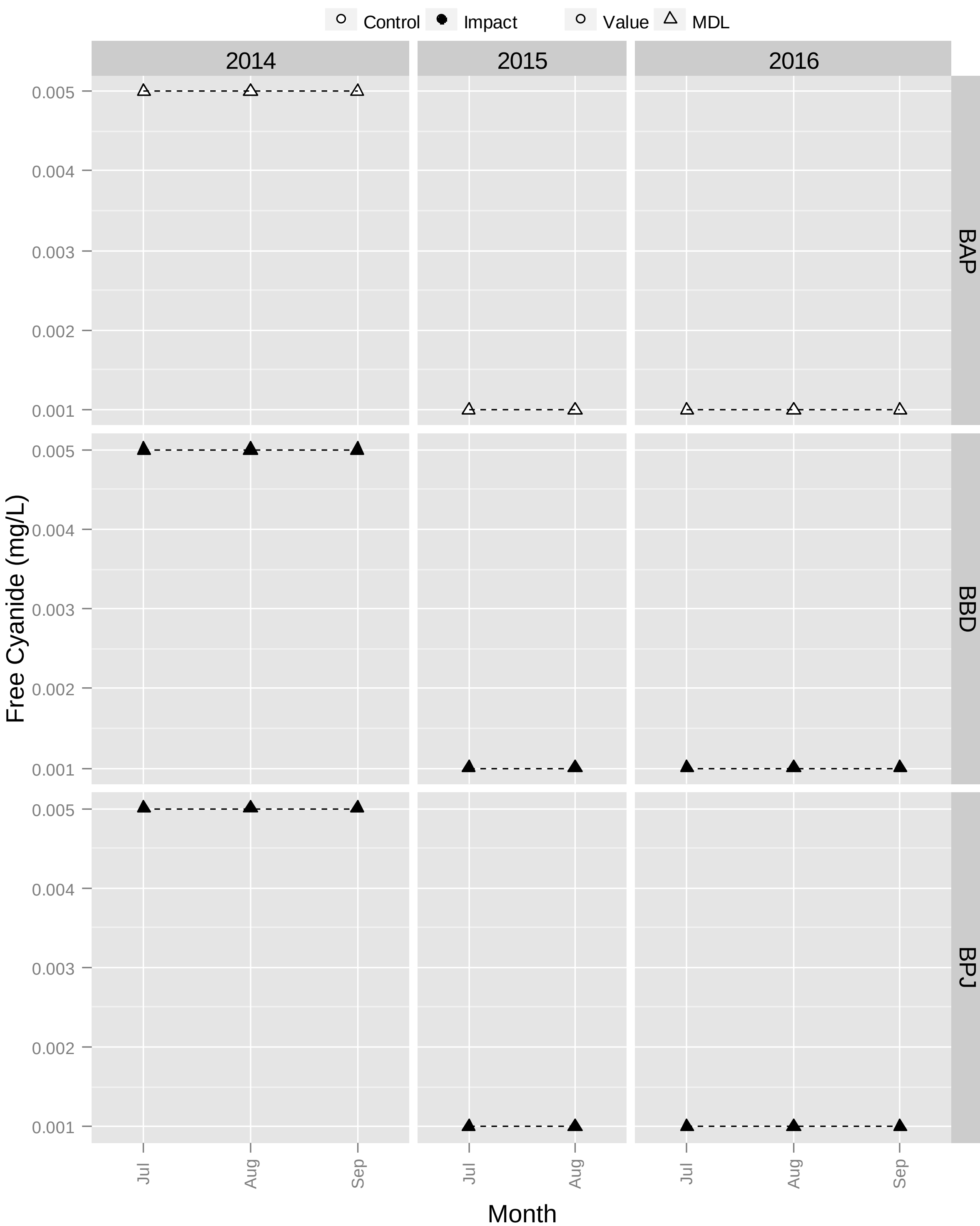


Figure A2–5. Total Antimony (mg/L) in water samples from Baker Lake since 2008.

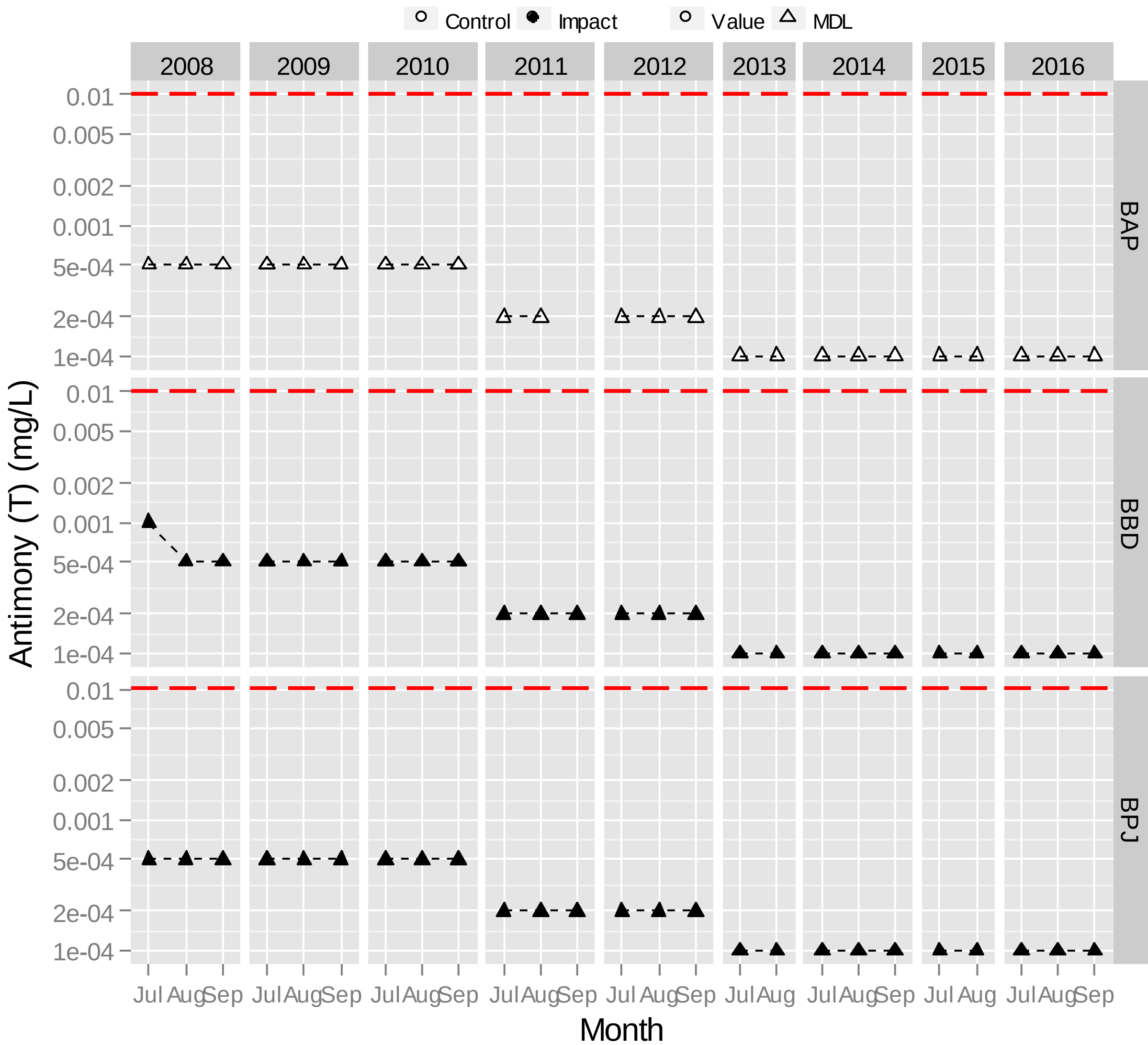


Figure A2–6. Total Beryllium (mg/L) in water samples from Baker Lake since 2008.

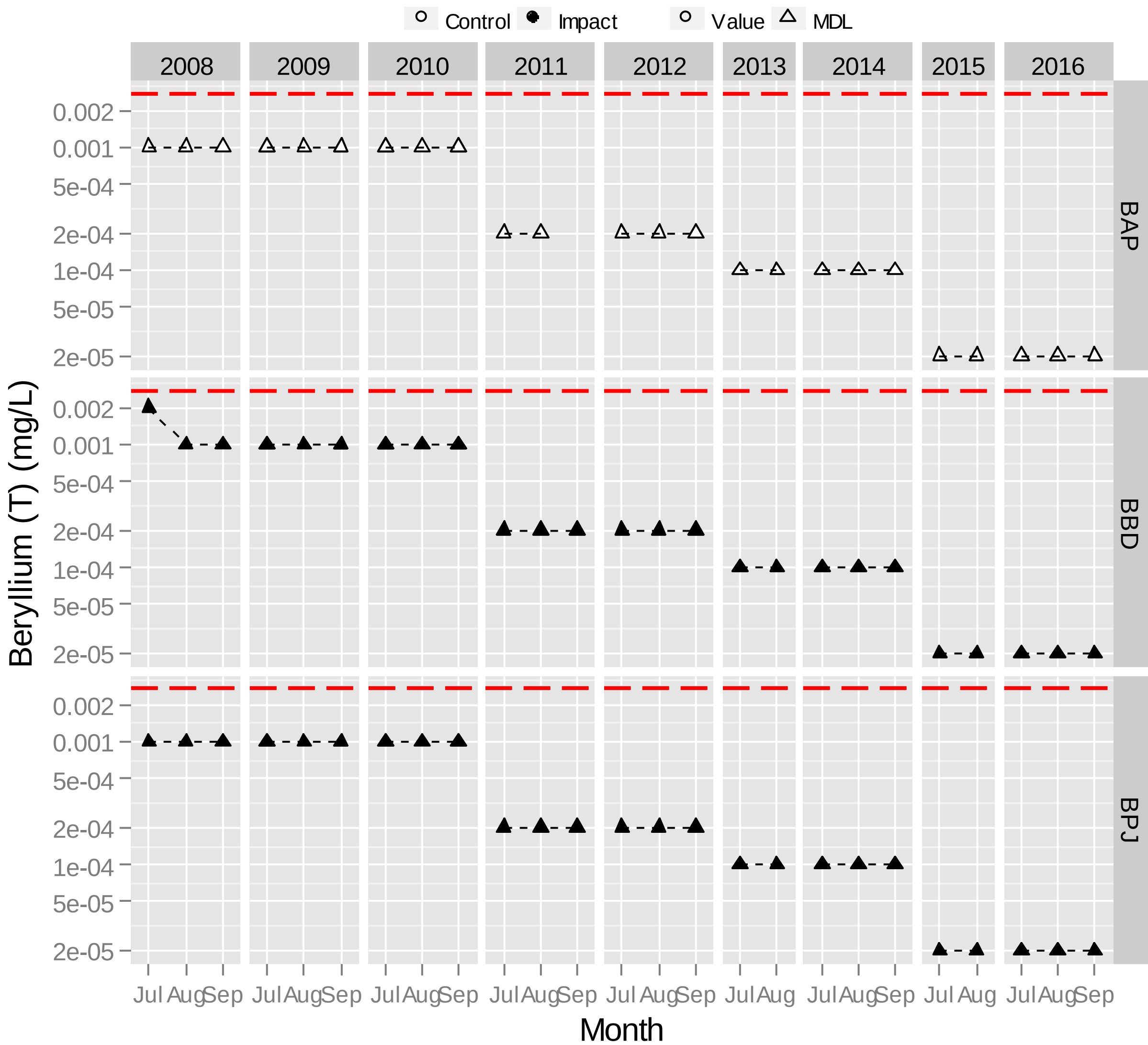


Figure A2–7. Total Cadmium (mg/L) in water samples from Baker Lake since 2008.

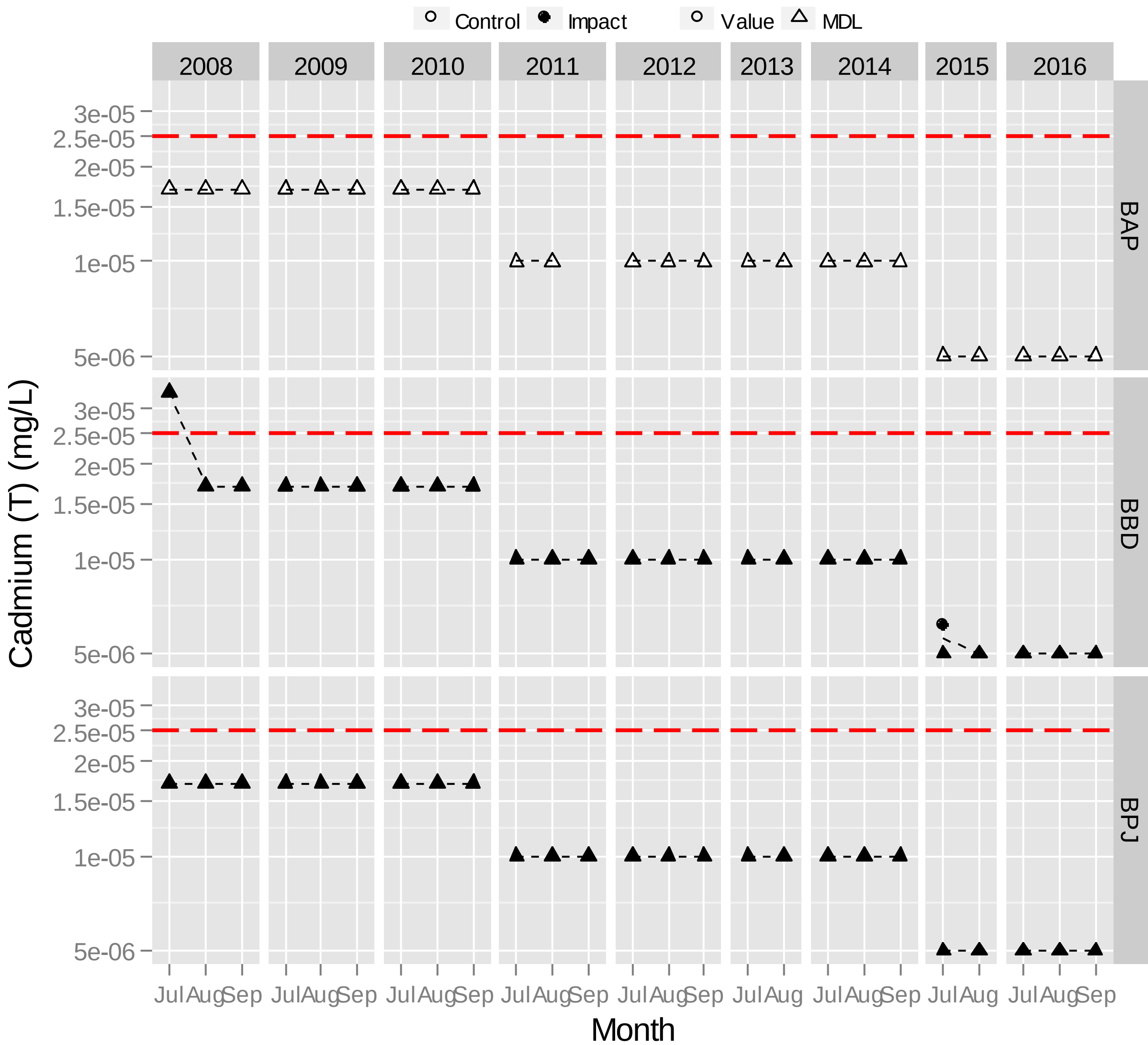


Figure A2–8. Total Lead (mg/L) in water samples from Baker Lake since 2008.

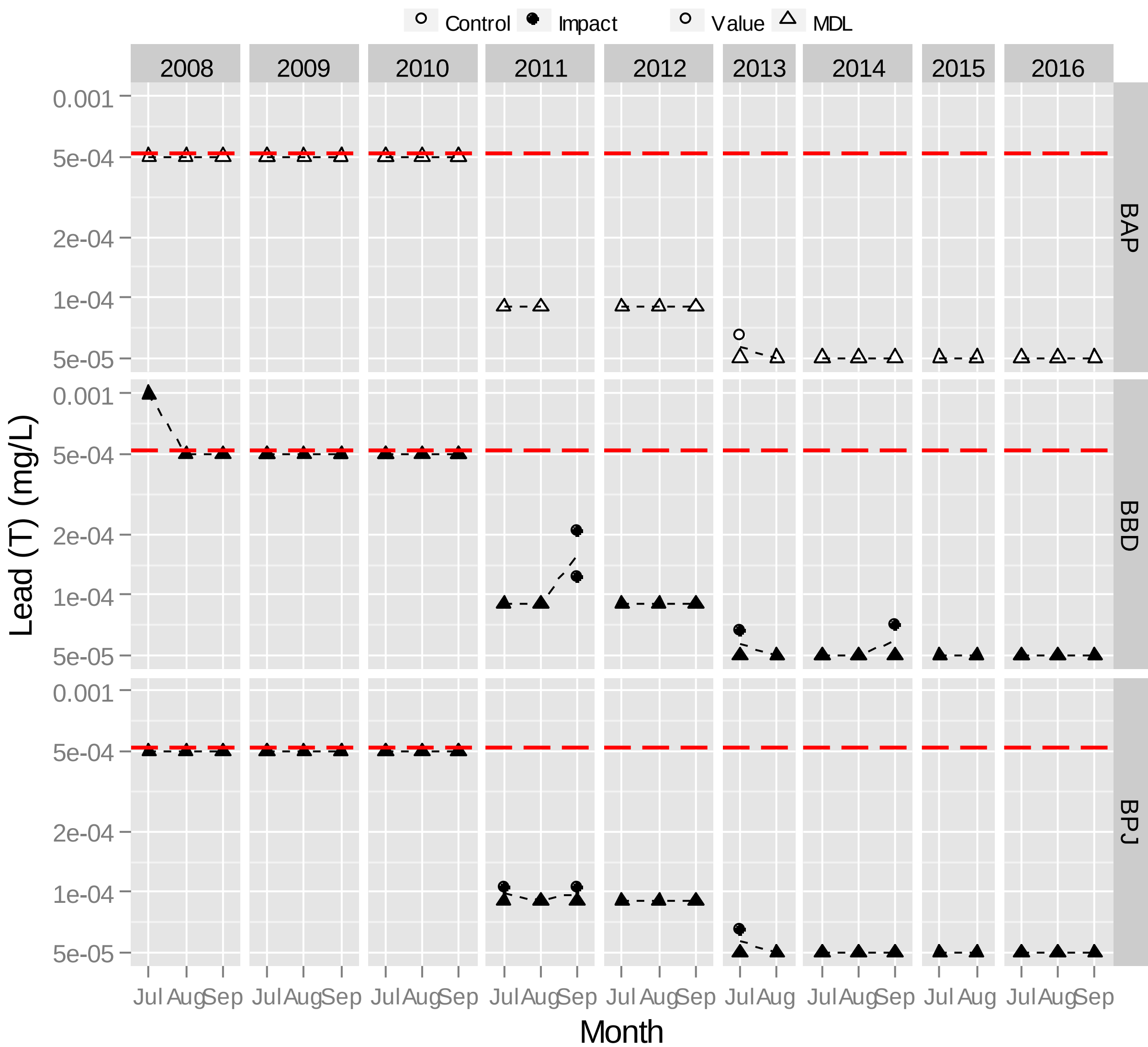


Figure A2–9. Total Mercury (mg/L) in water samples from Baker Lake since 2008.

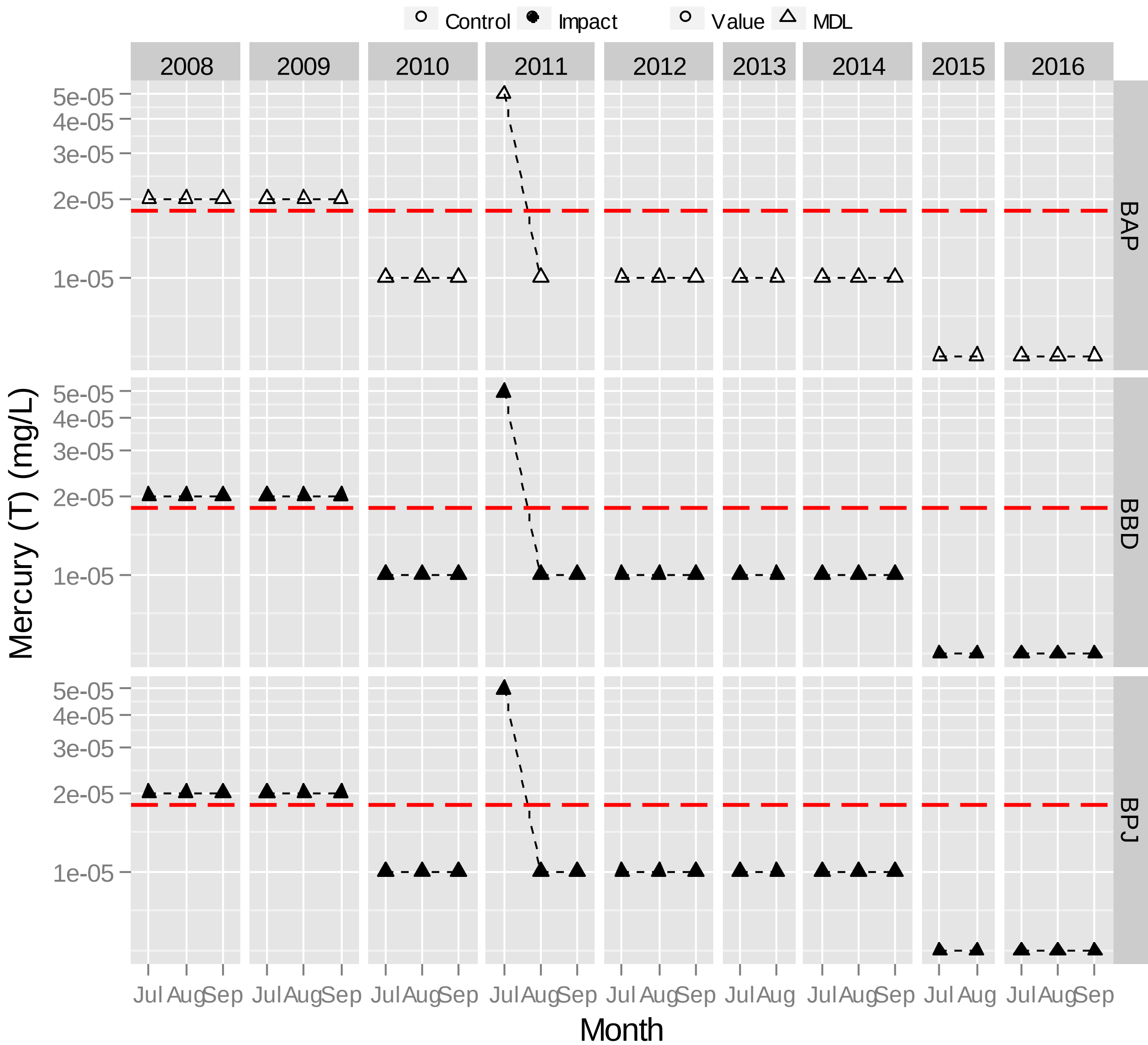


Figure A2–10. Total Nickel (mg/L) in water samples from Baker Lake since 2008.

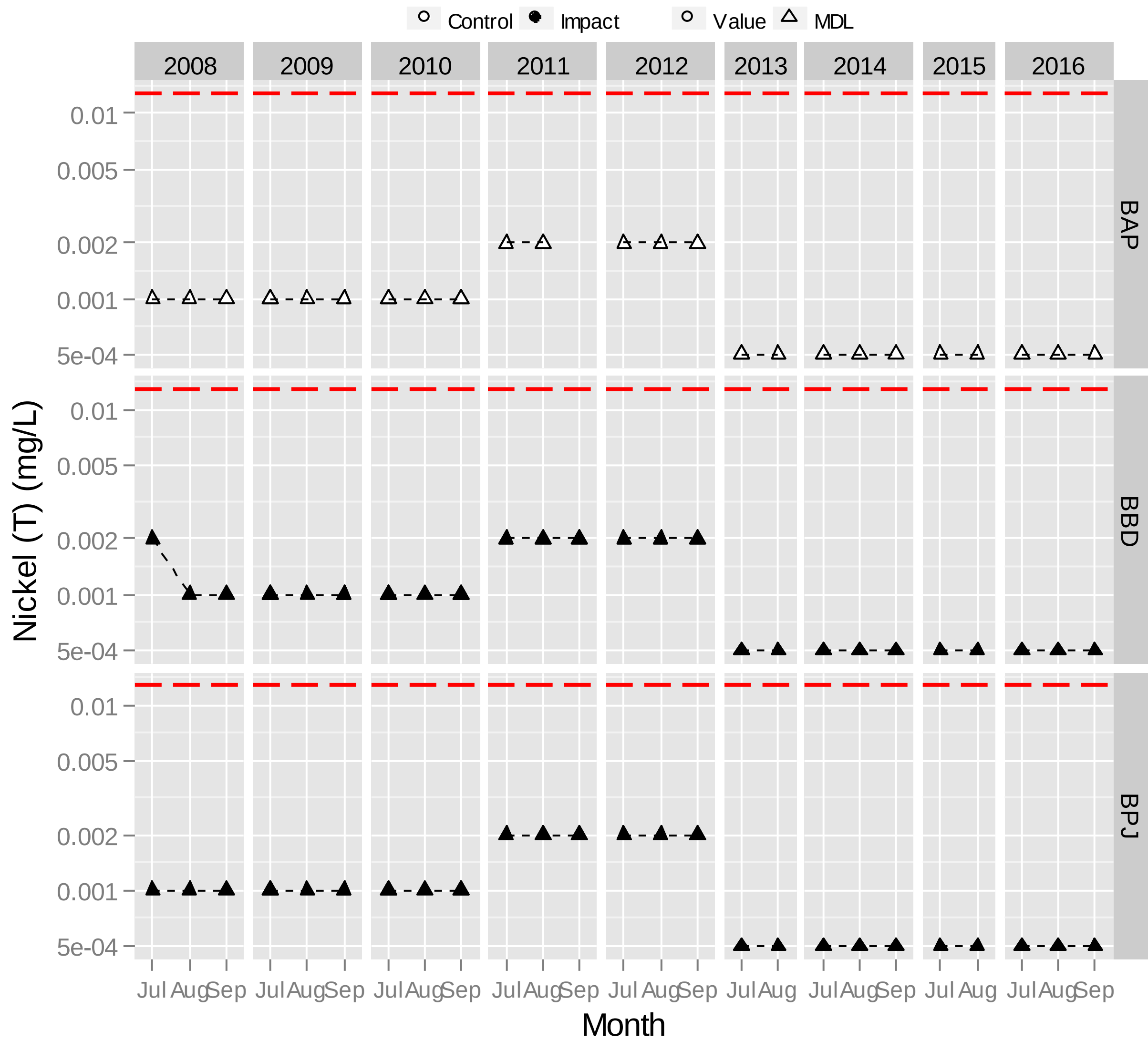


Figure A2–11. Total Selenium (mg/L) in water samples from Baker Lake since 2008.

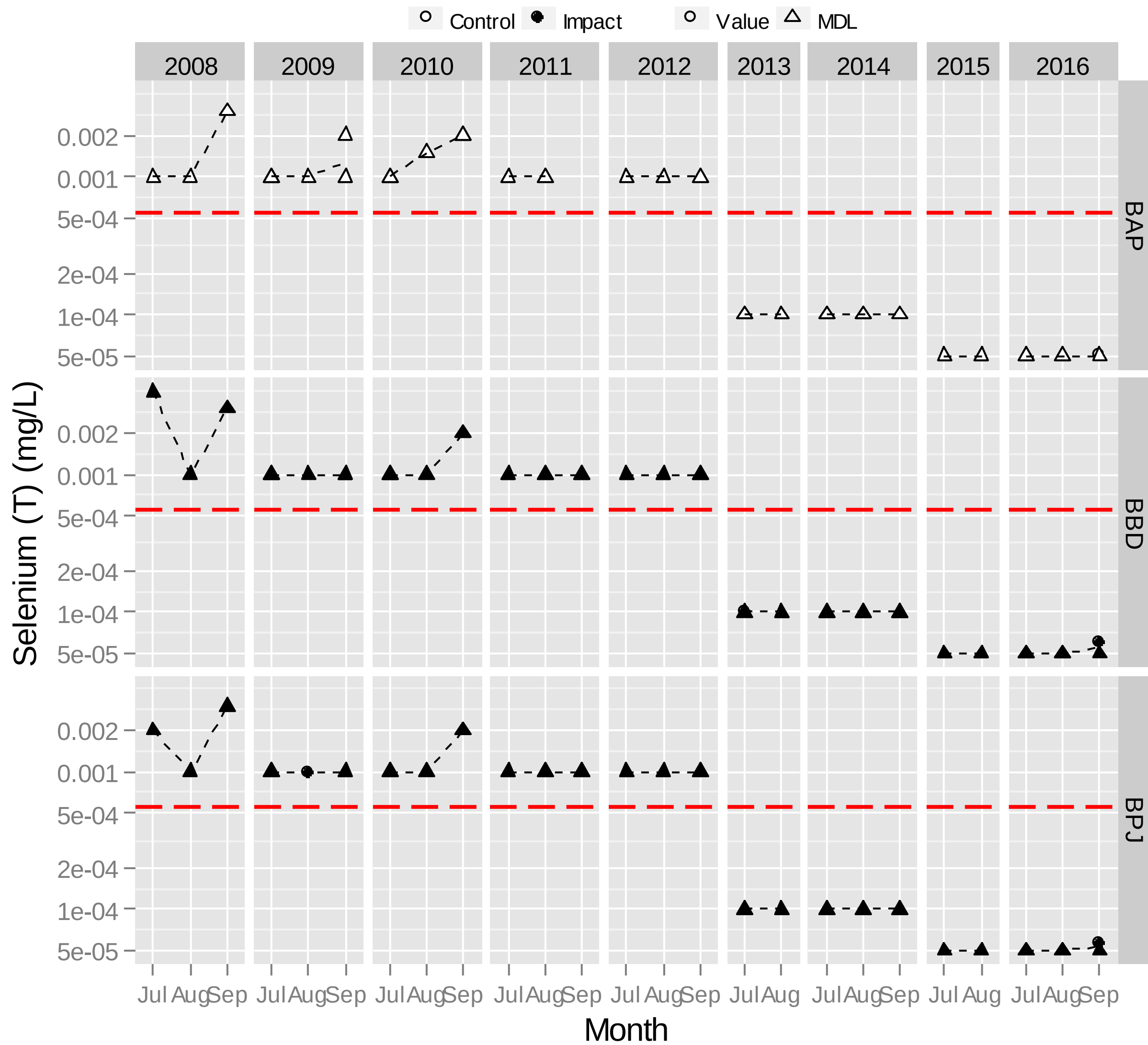


Figure A2–12. Total Thallium (mg/L) in water samples from Baker Lake since 2008.

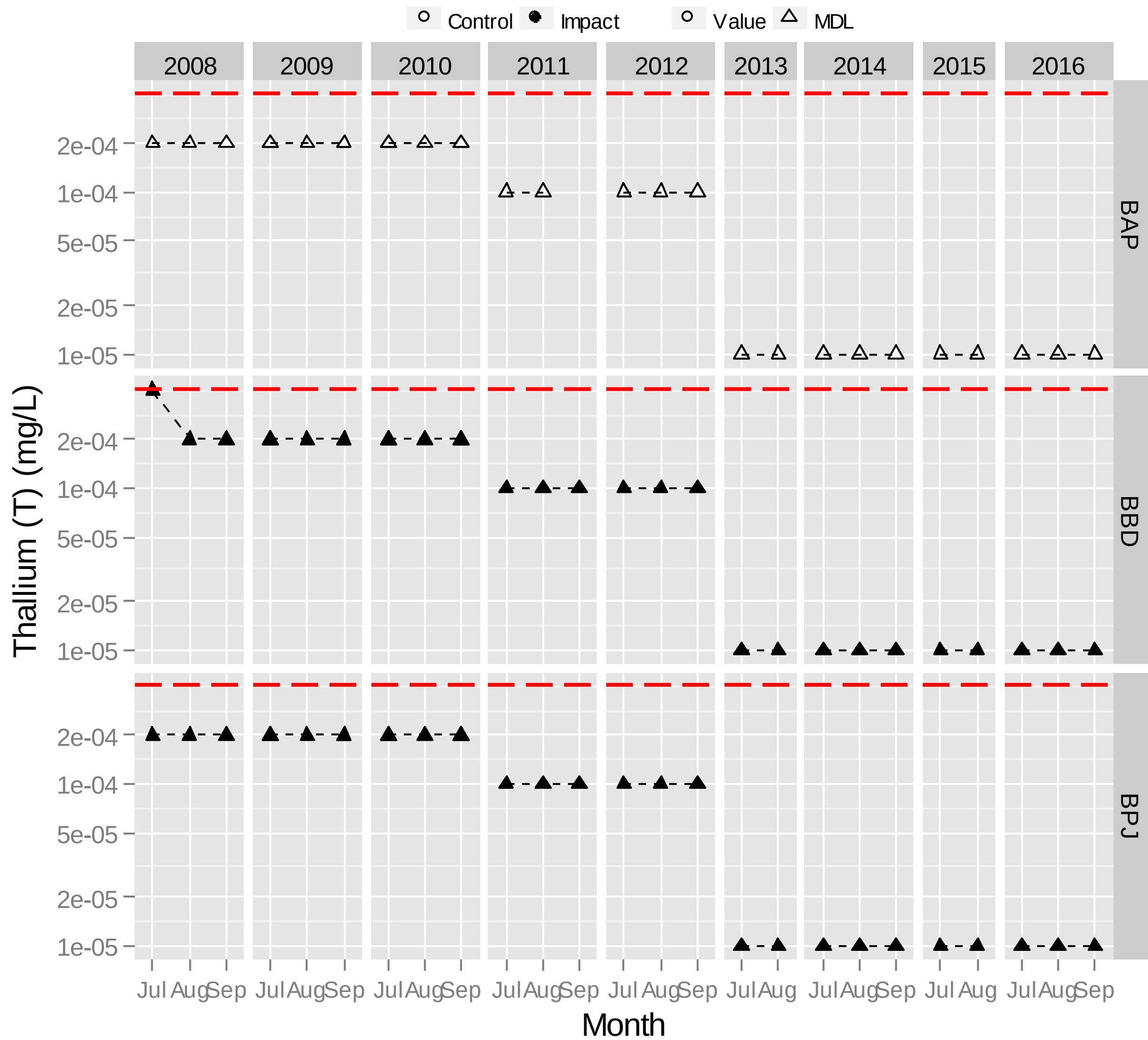


Figure A2–13. Total Tin (mg/L) in water samples from Baker Lake since 2008.

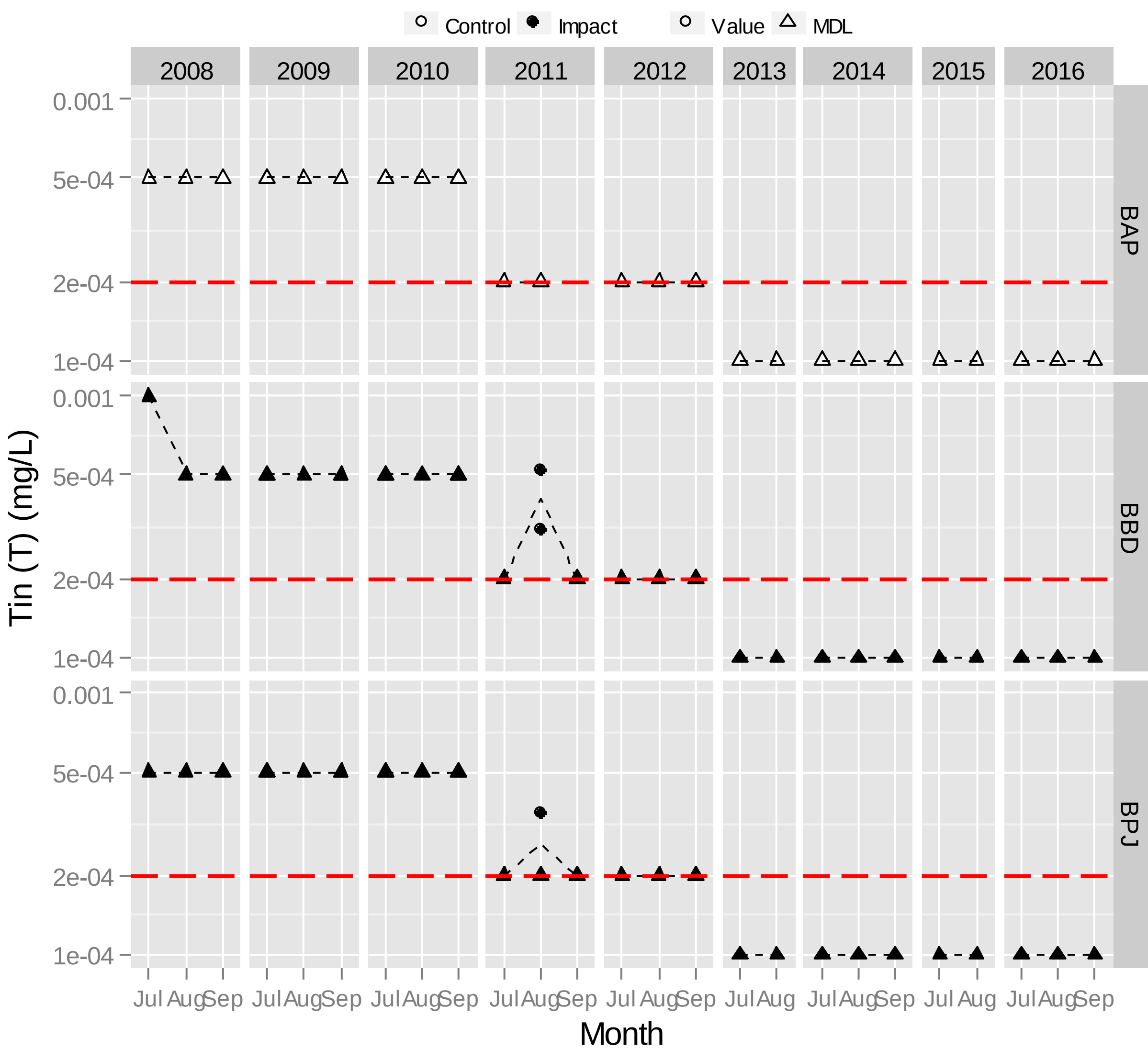


Figure A2–14. Total Vanadium (mg/L) in water samples from Baker Lake since 2008.

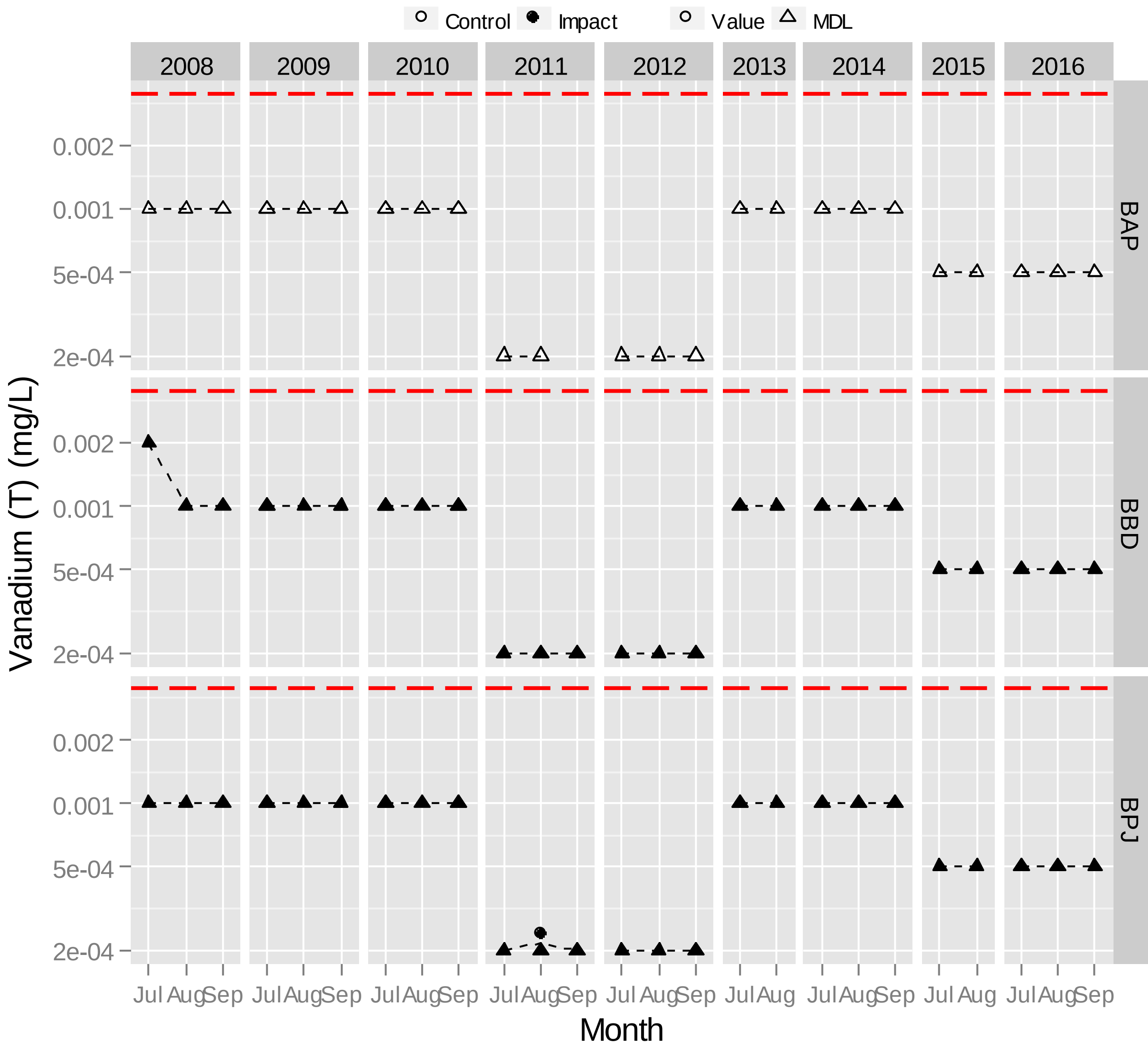


Figure A2–15. Total Zinc (mg/L) in water samples from Baker Lake since 2008.

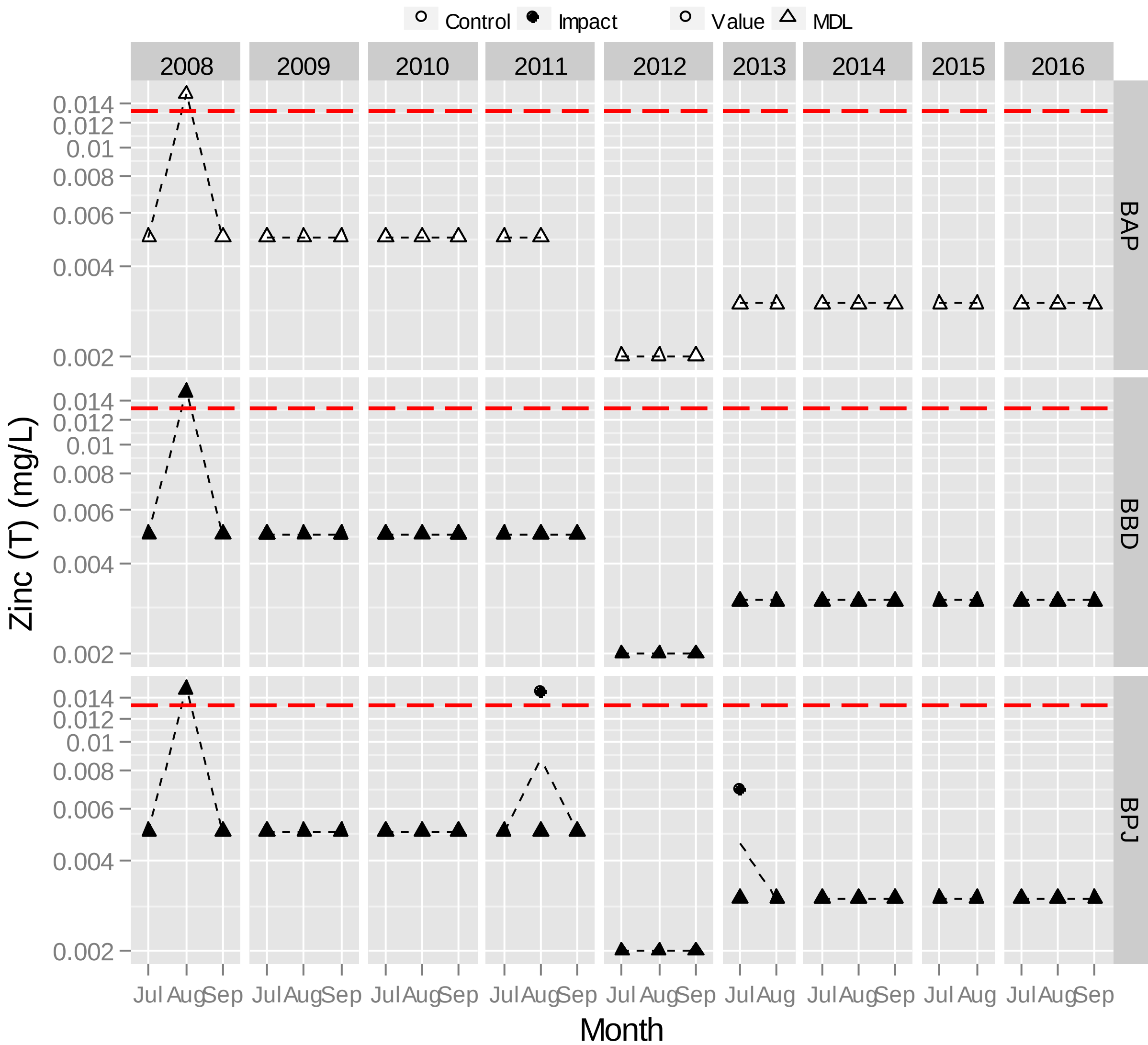


Figure A2–16. Dissolved Antimony (mg/L) in water samples from Baker Lake since 2008.

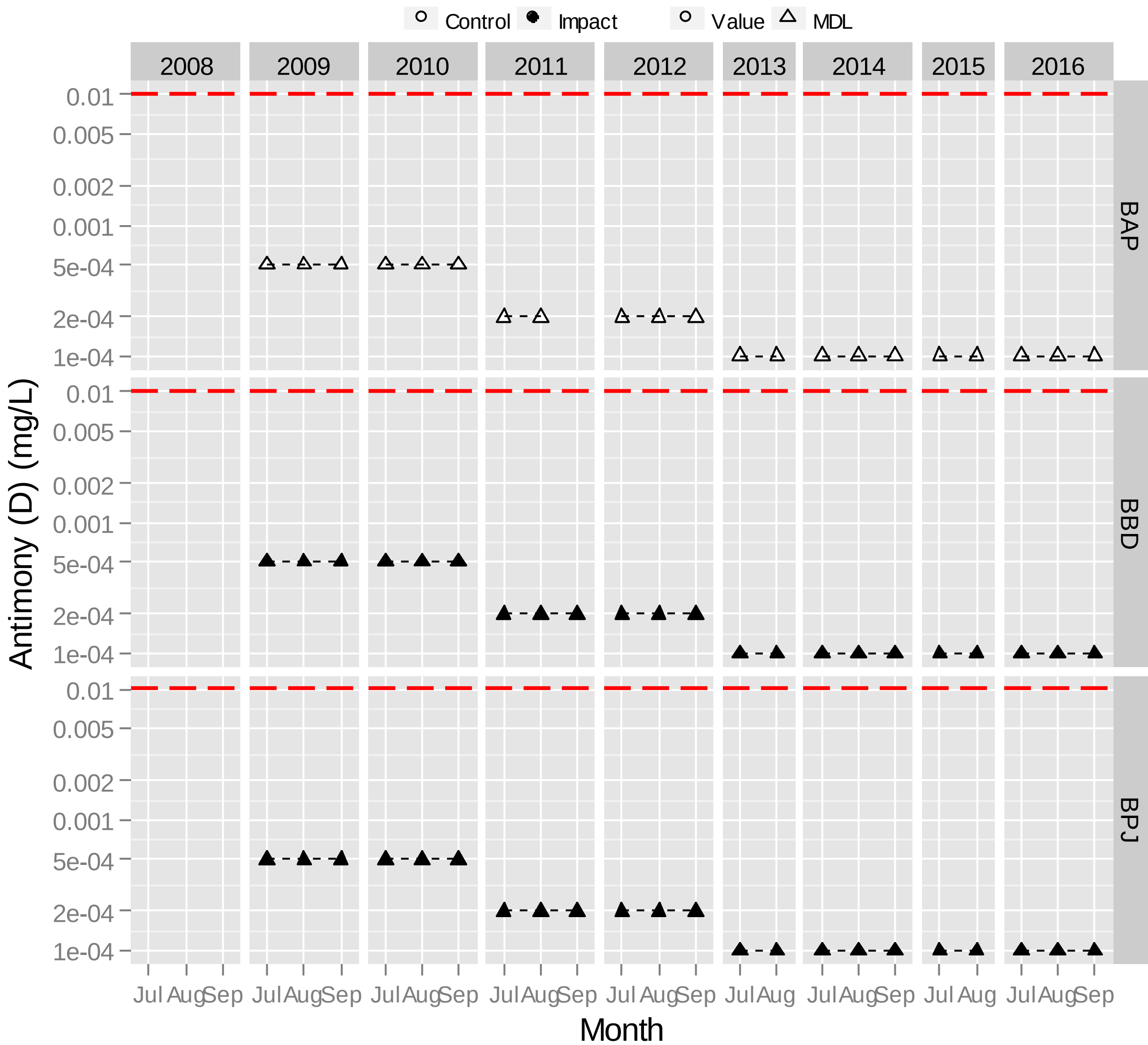


Figure A2–17. Dissolved Beryllium (mg/L) in water samples from Baker Lake since 2008.

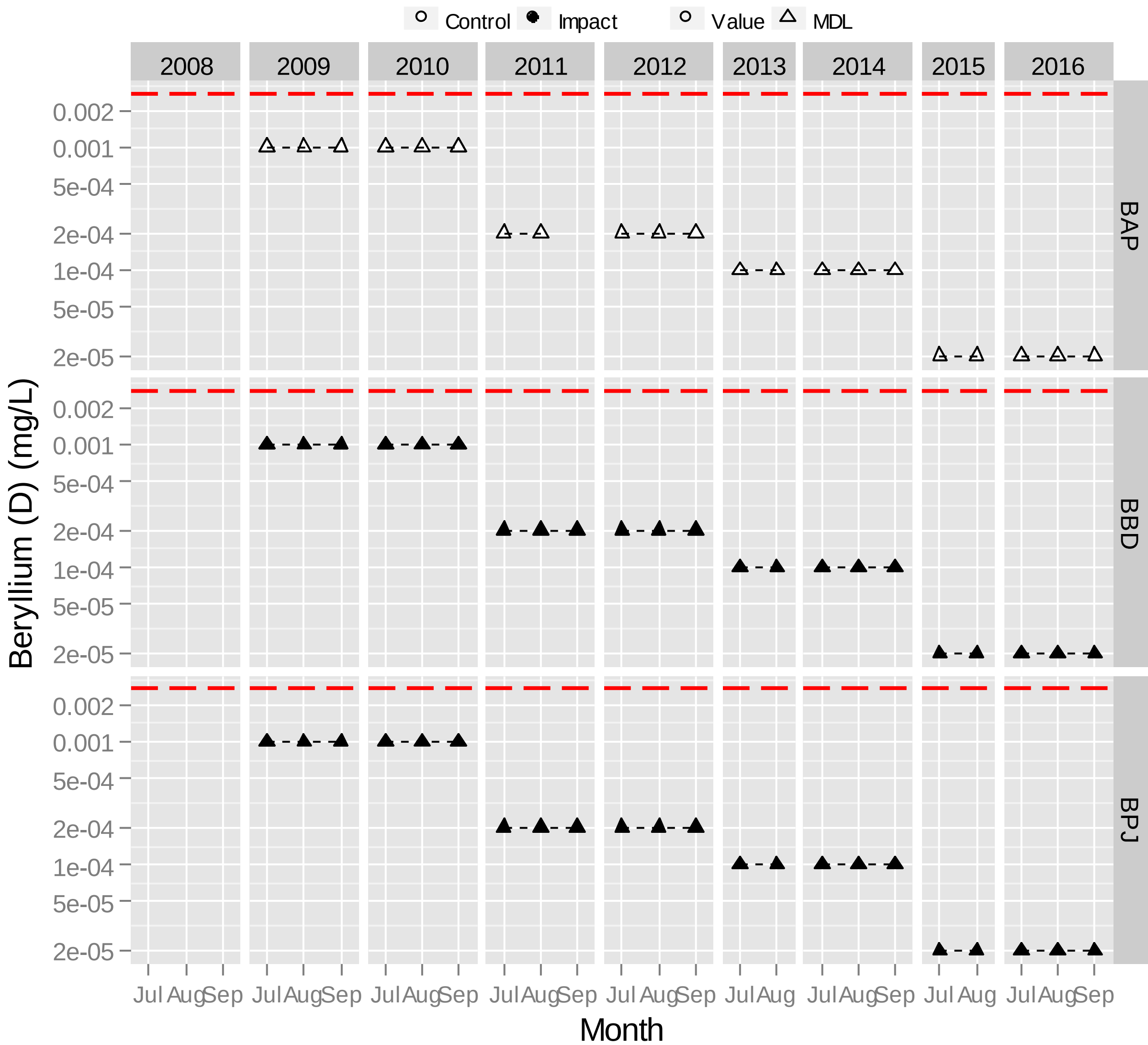


Figure A2–18. Dissolved Cadmium (mg/L) in water samples from Baker Lake since 2008.

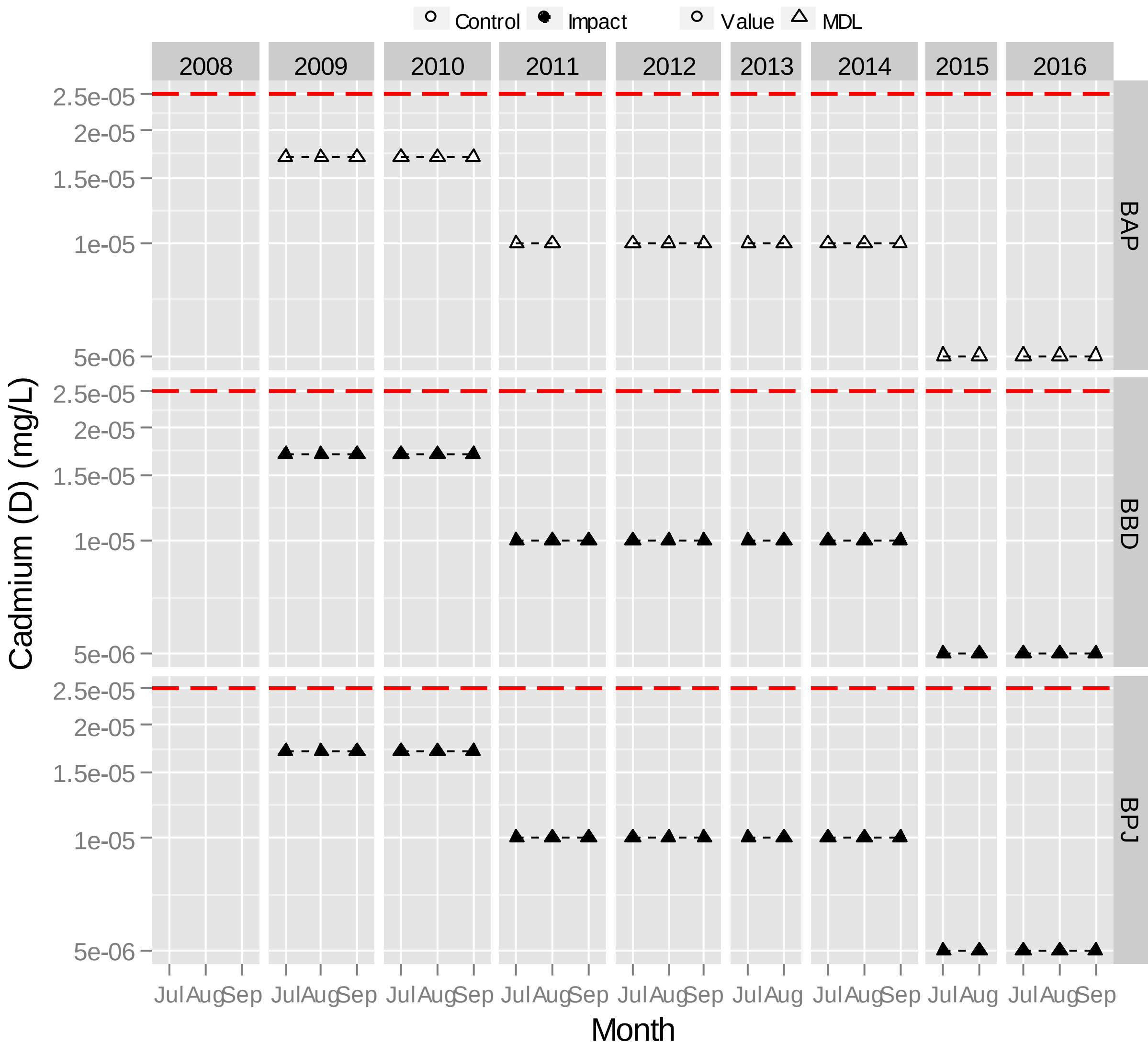


Figure A2–19. Dissolved Chromium (mg/L) in water samples from Baker Lake since 2008.

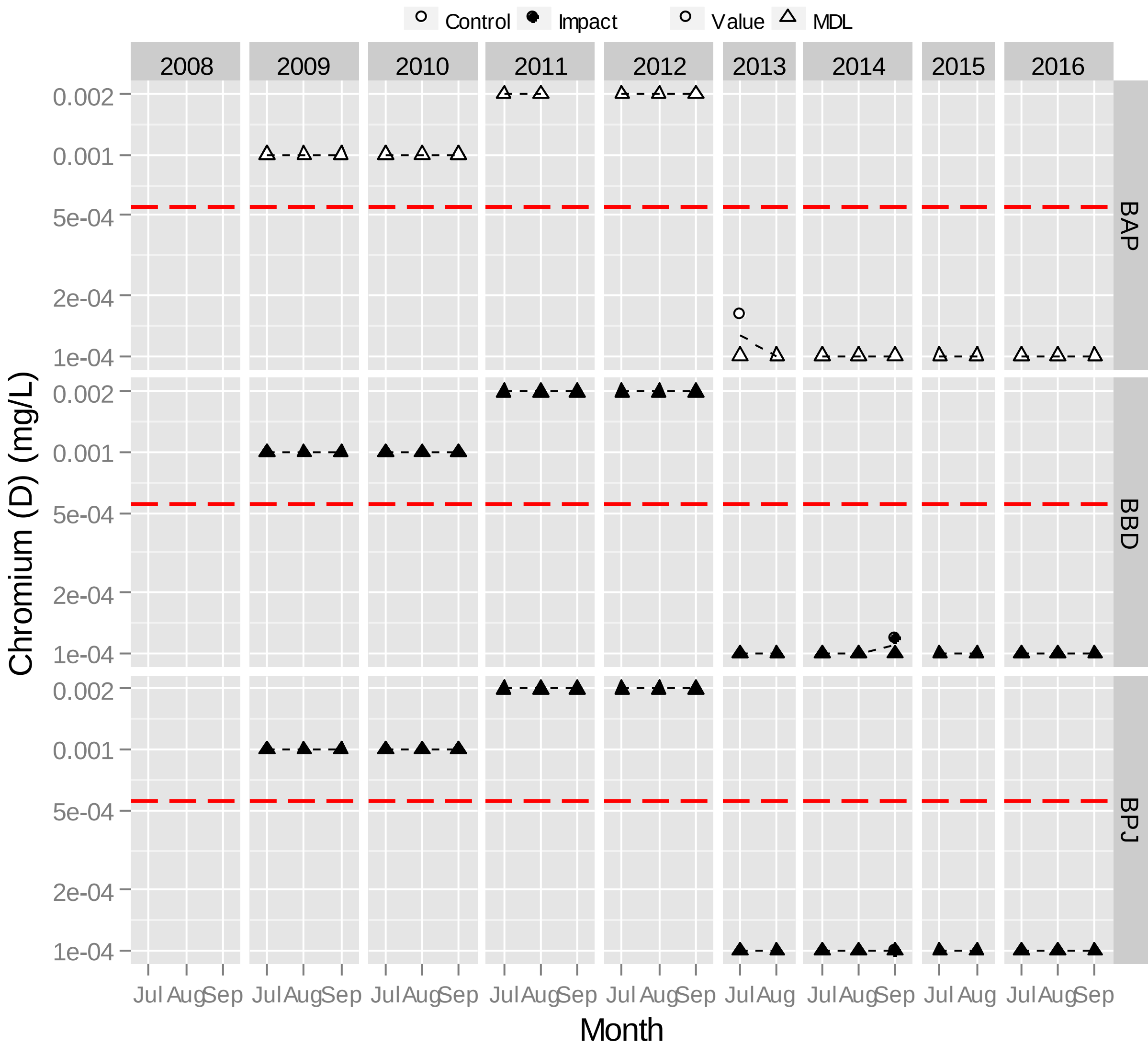


Figure A2–20. Dissolved Iron (mg/L) in water samples from Baker Lake since 2008.

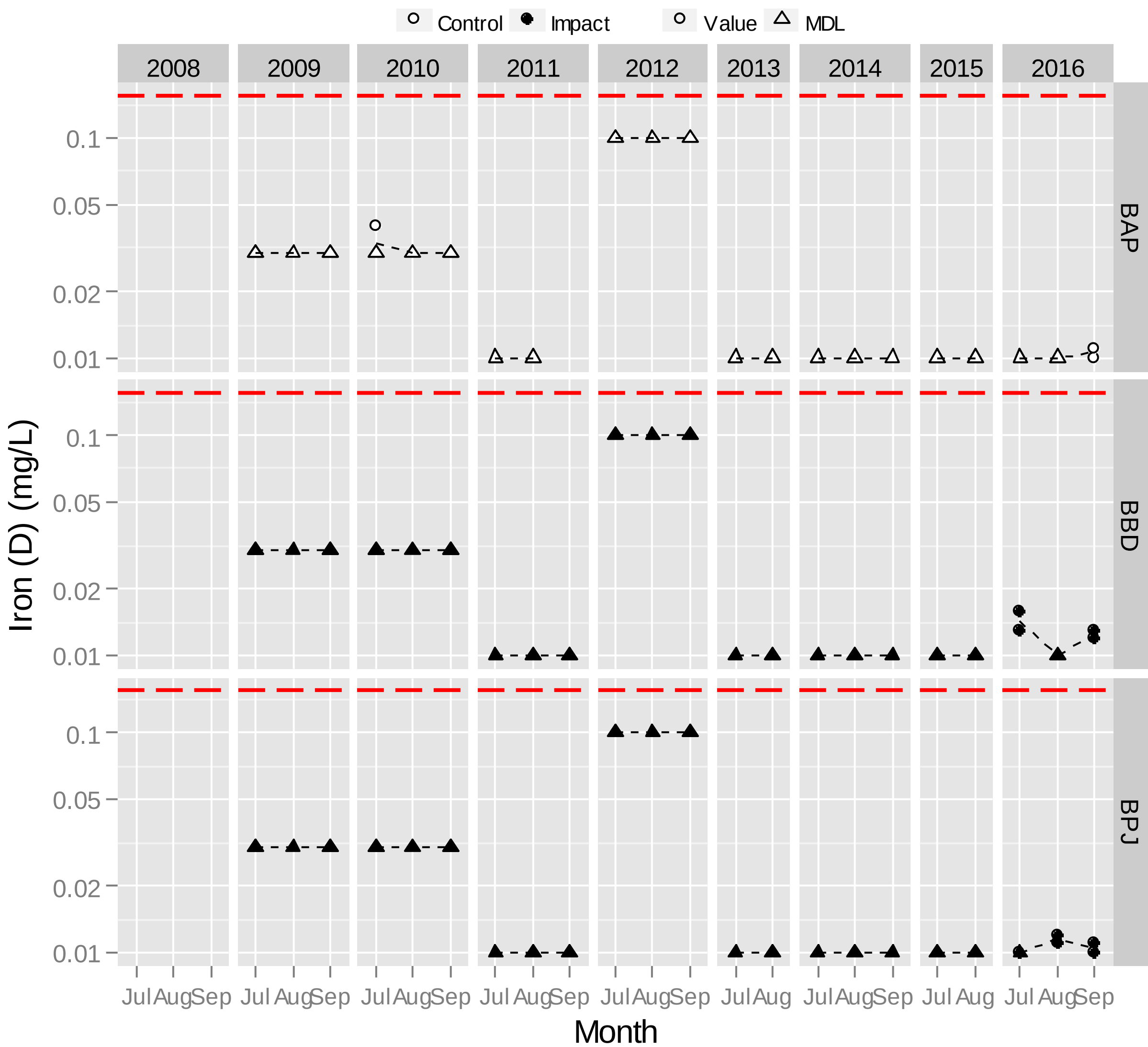


Figure A2–21. Dissolved Lead (mg/L) in water samples from Baker Lake since 2008.

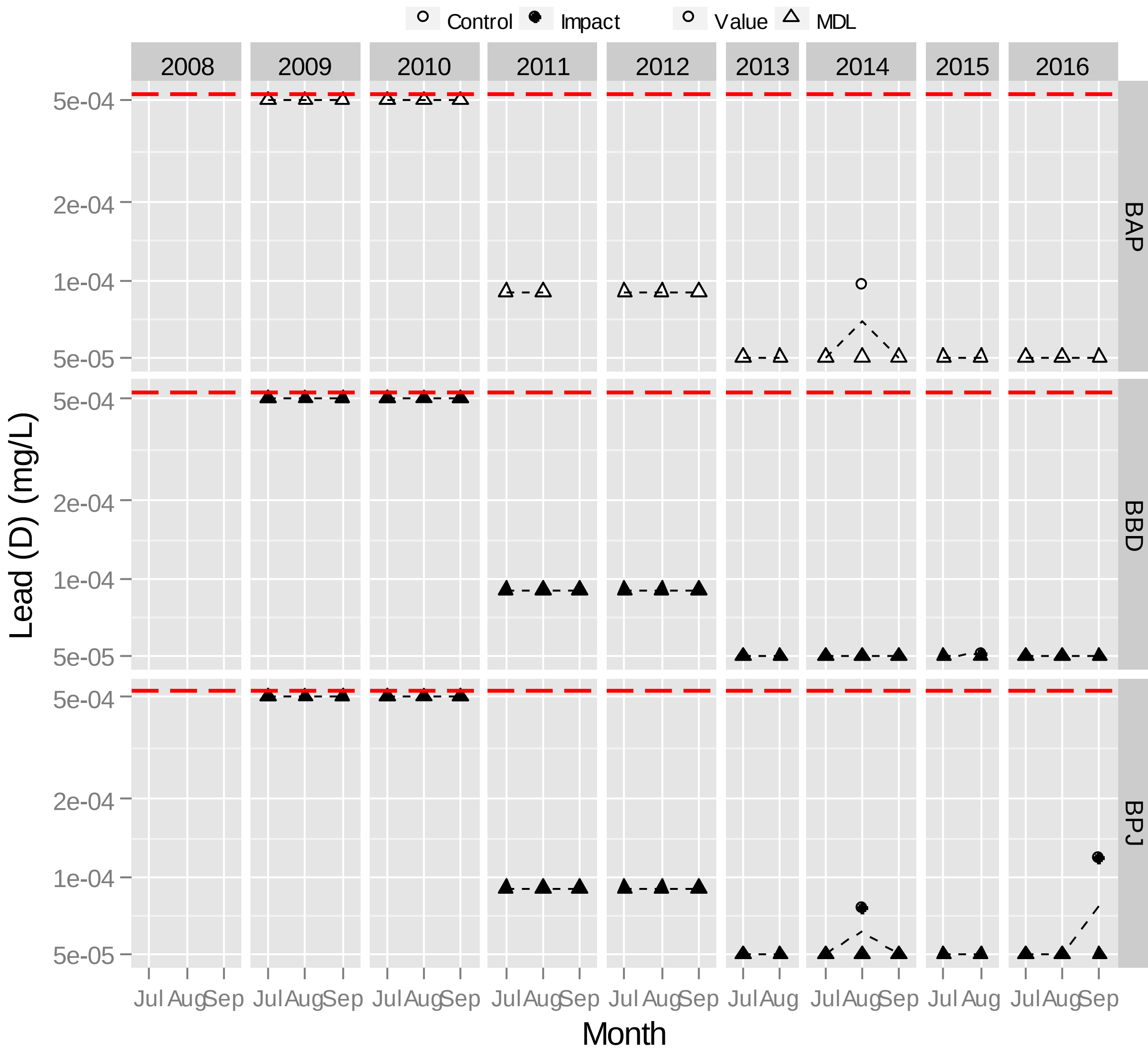


Figure A2–22. Dissolved Mercury (mg/L) in water samples from Baker Lake since 2008.

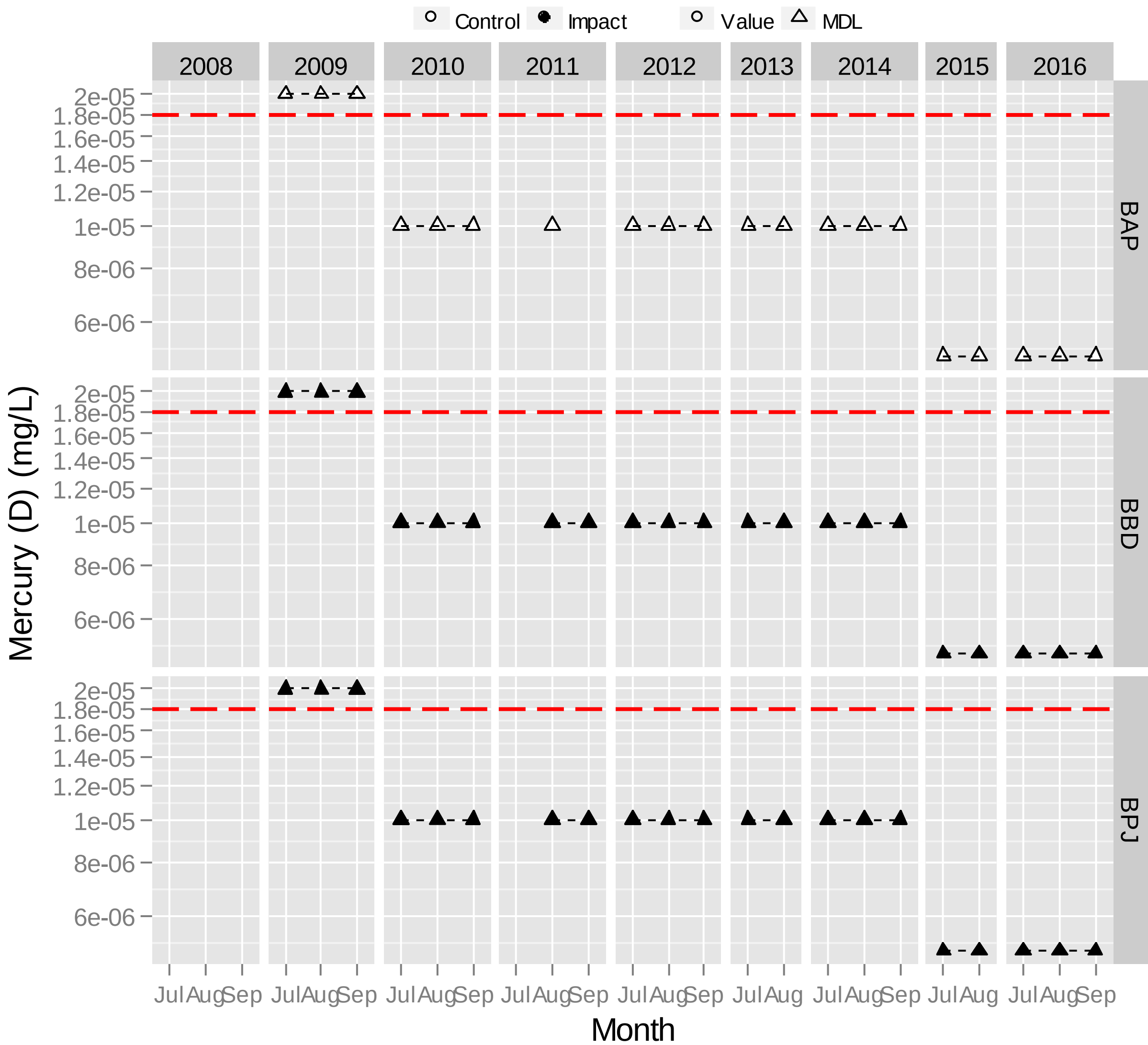


Figure A2–23. Dissolved Nickel (mg/L) in water samples from Baker Lake since 2008.

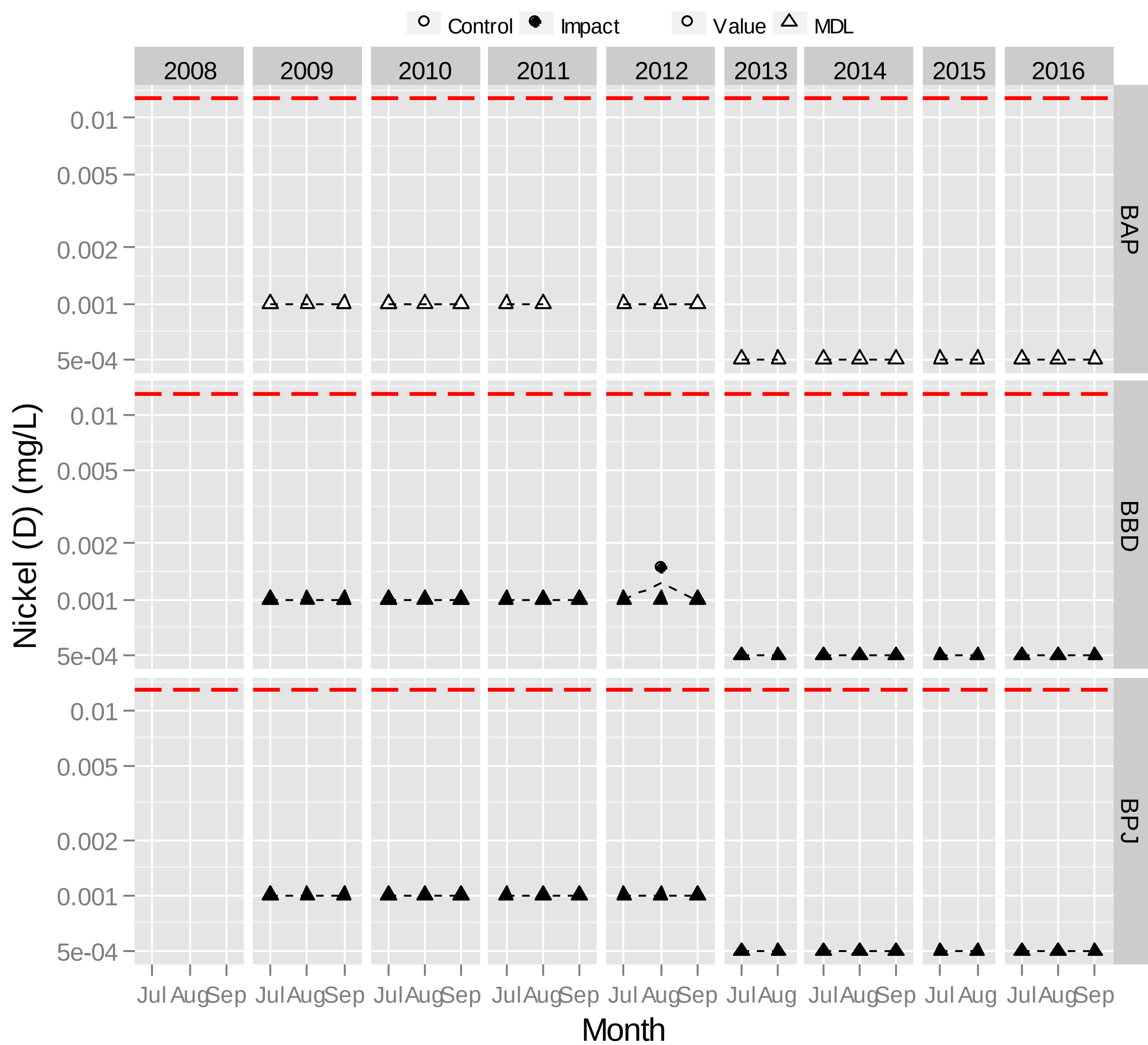


Figure A2–24. Dissolved Selenium (mg/L) in water samples from Baker Lake since 2008.

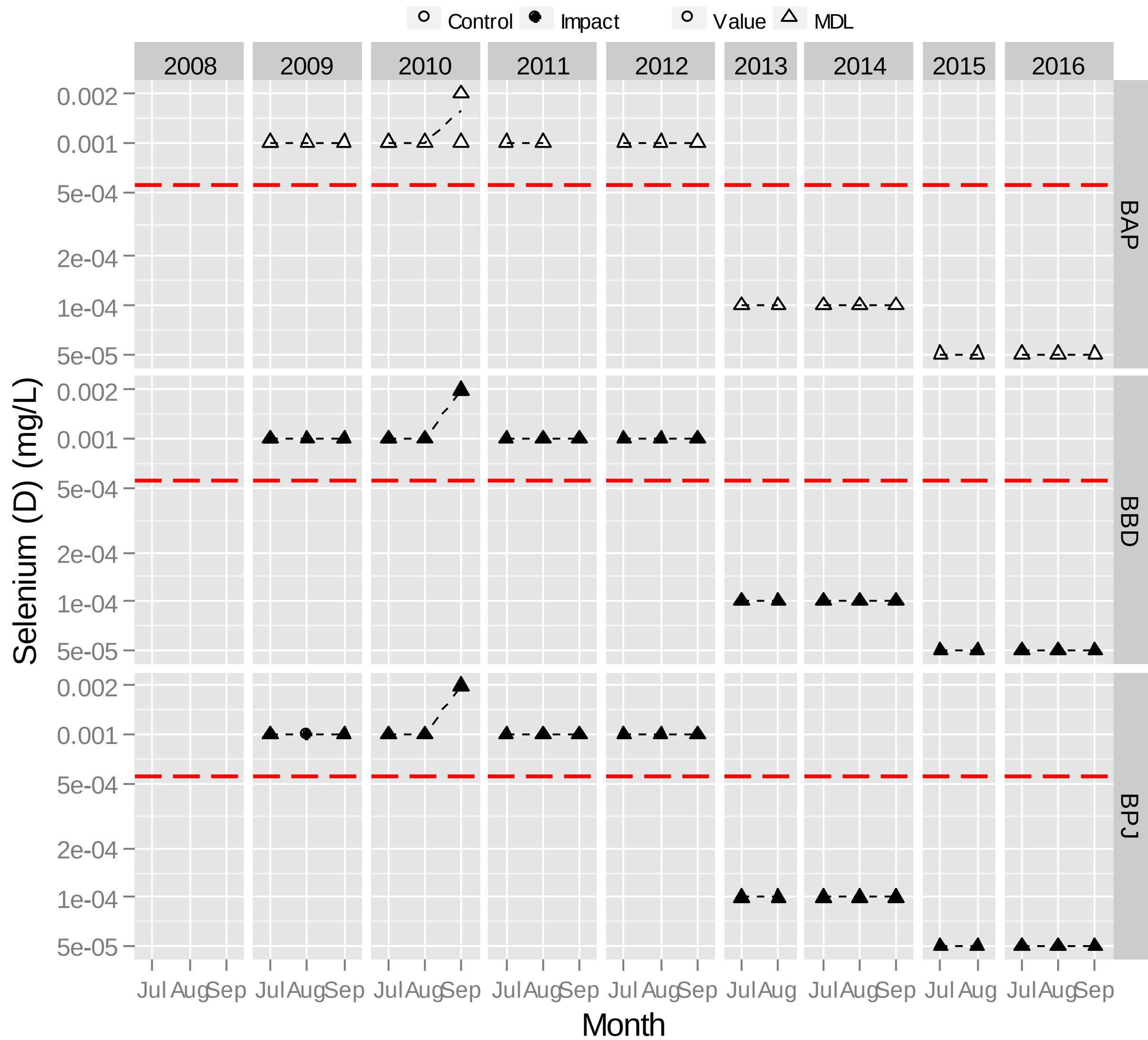


Figure A2–25. Dissolved Thallium (mg/L) in water samples from Baker Lake since 2008.

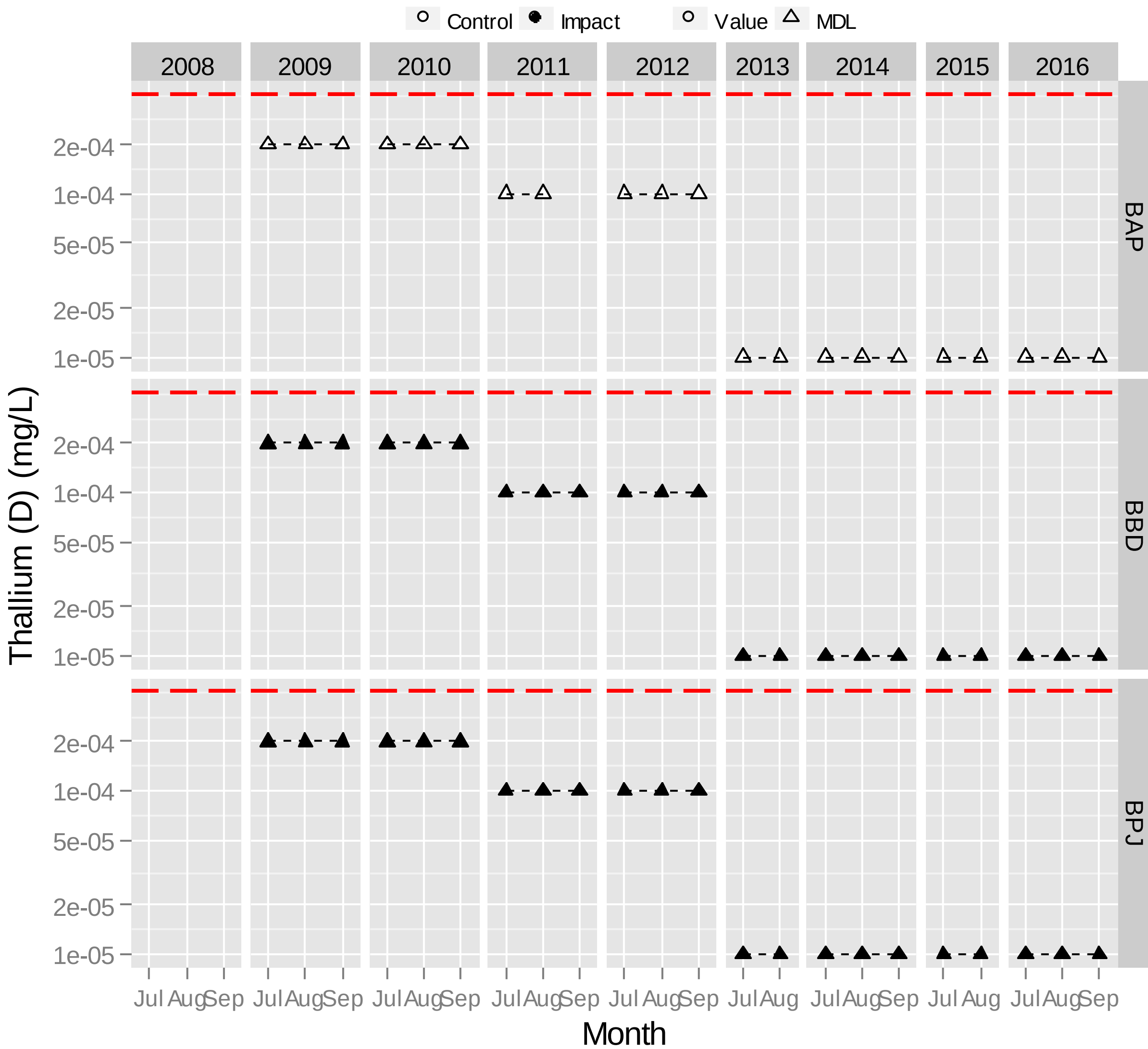


Figure A2–26. Dissolved Tin (mg/L) in water samples from Baker Lake since 2008.

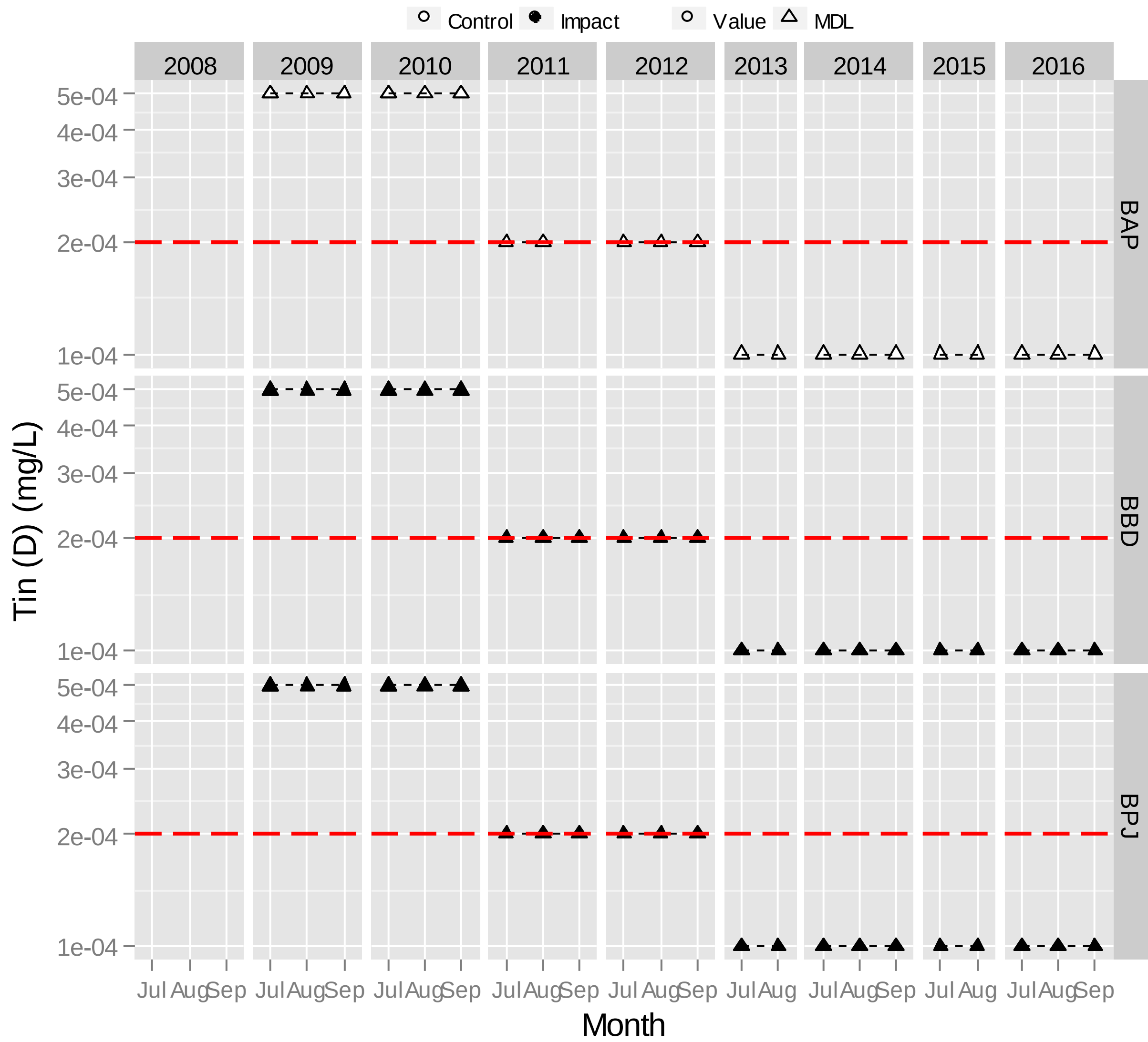


Figure A2–27. Dissolved Titanium (mg/L) in water samples from Baker Lake since 2008.

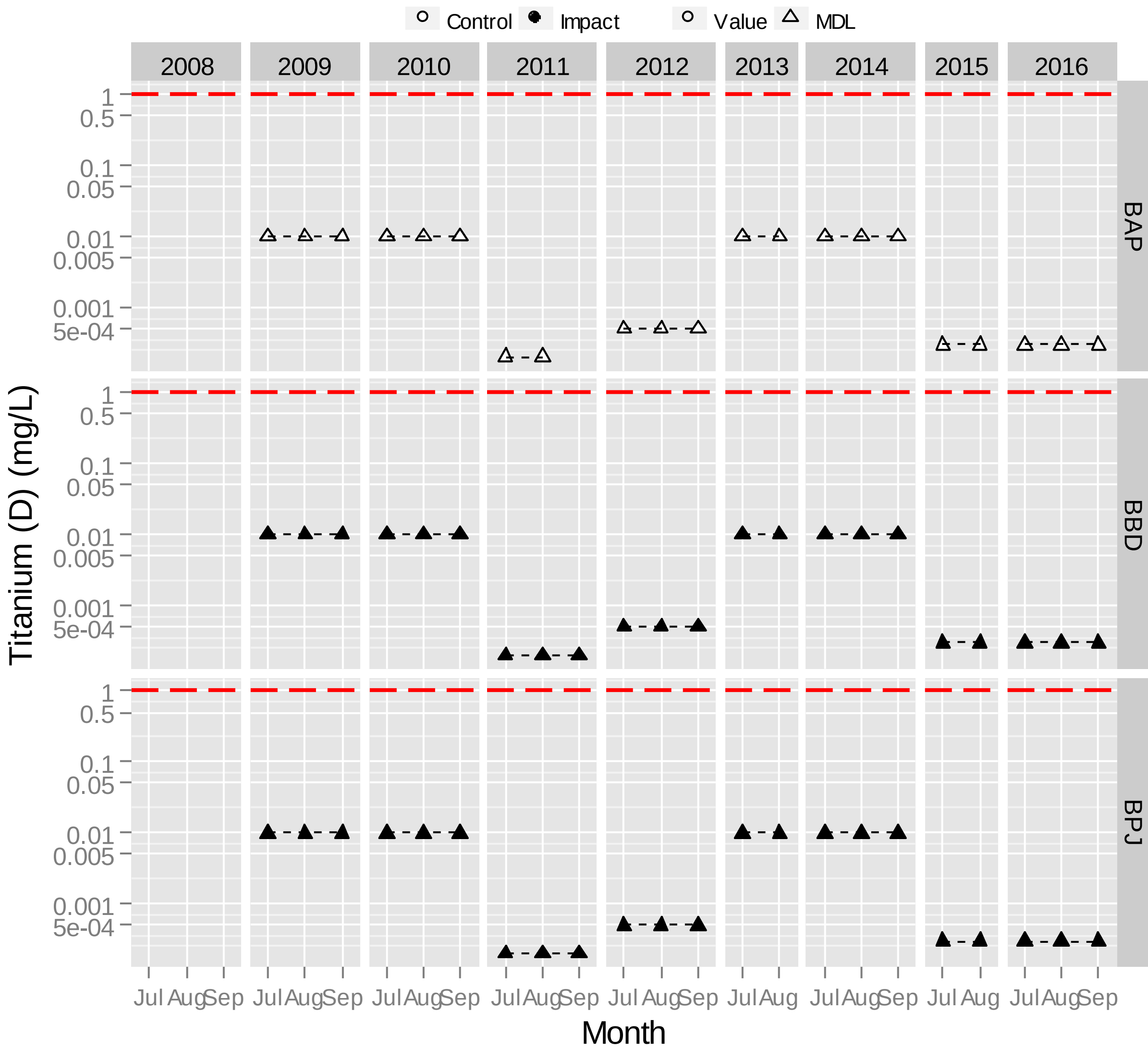


Figure A2–28. Dissolved Vanadium (mg/L) in water samples from Baker Lake since 2008.

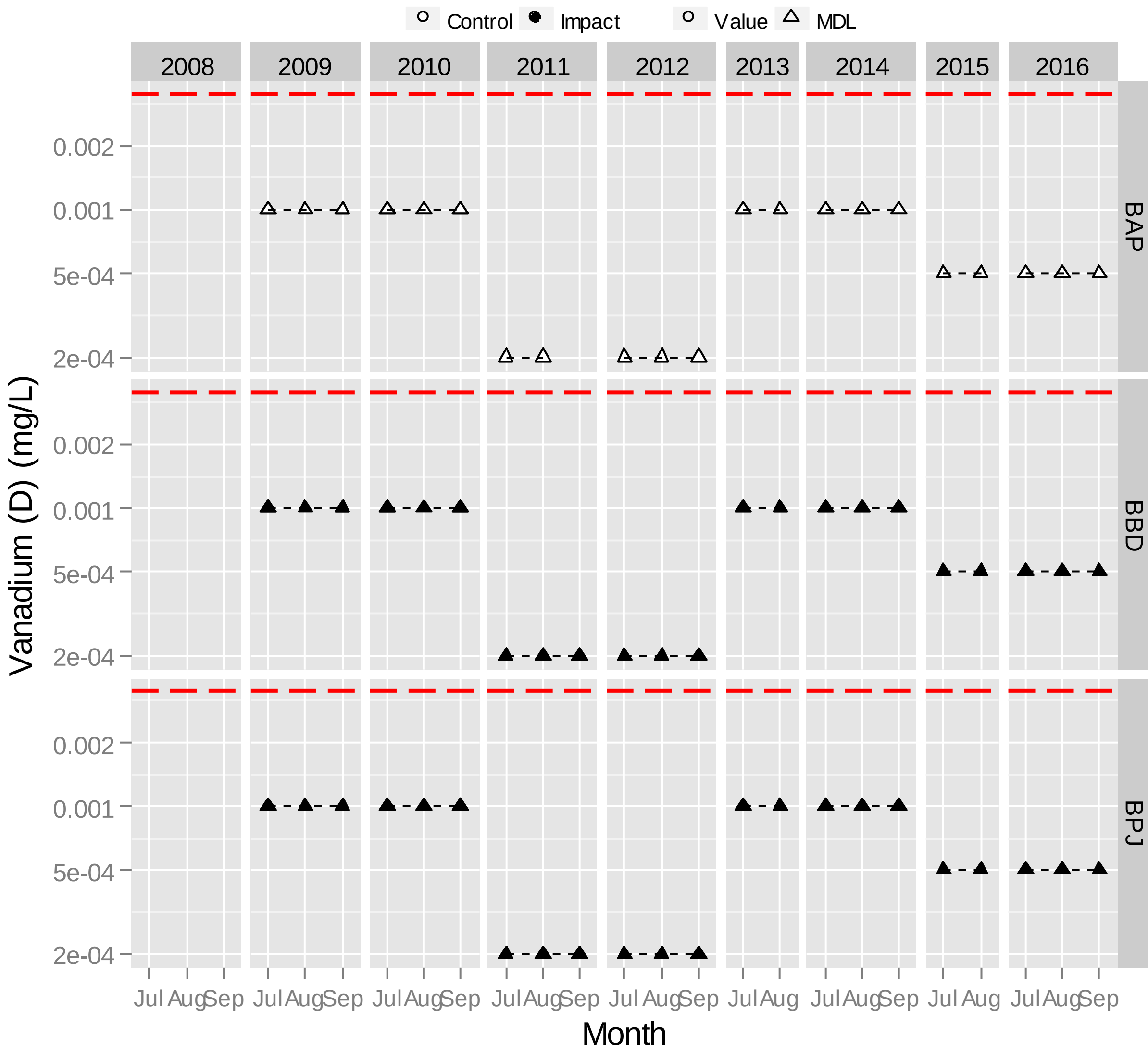
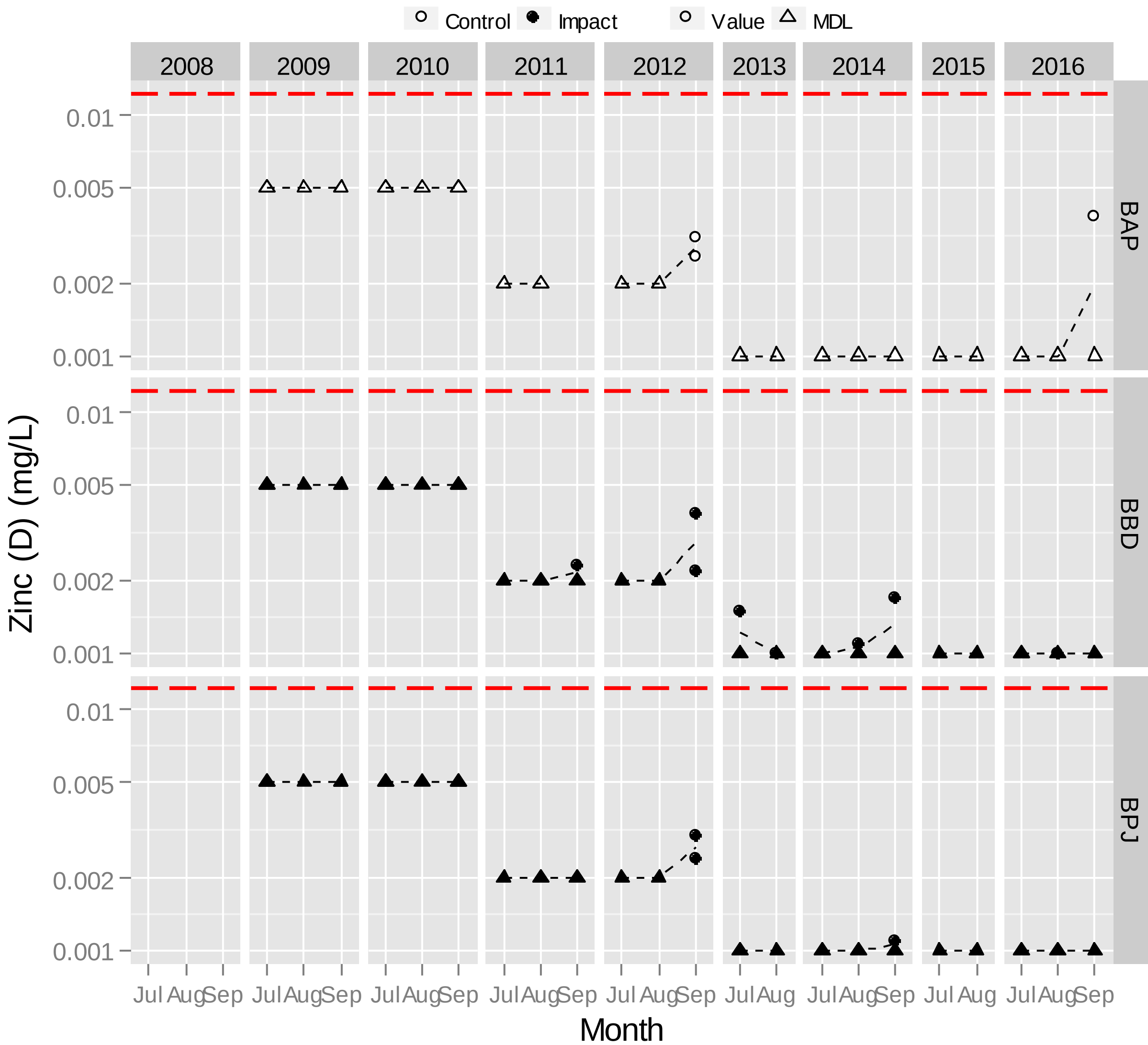


Figure A2–29. Dissolved Zinc (mg/L) in water samples from Baker Lake since 2008.



APPENDIX B

Phytoplankton Raw Data, Meadowbank Study Lakes and Baker Lake, 2016

Appendix B. Presence (+) / Absence (-) matrix of phytoplankton species in Meadowbank study lakes and Baker Lake, 2016.

	Area-Replicate ID	BAP-43S	BAP-44S	BAP-45S	BAP-46S	BAP-47S	BAP-48S	BBD-43S	BBD-44S	BBD-45S	BBD-46S	BBD-47S
Code	Species Name	22-Jul-16	22-Jul-16	8-Aug-16	8-Aug-16	2-Sep-16	2-Sep-16	22-Jul-16	22-Jul-16	10-Aug-16	10-Aug-16	3-Sep-16
	Cyanophyte											
1008	*Aphanocapsa sp.*	-	-	-	-	-	-	-	-	-	-	-
1012	*Aphanothece sp.*	-	-	-	-	-	-	-	-	-	-	-
1014	*Chroococcus limneticus Lemmermann*	-	-	-	-	-	-	-	-	-	-	-
1054	*Planktolyngbya limnetica*	+	+	+	+	-	+	-	-	-	+	-
1073	*Snowella sp*	-	-	-	-	-	-	-	-	-	-	+
1077	*Pseudoanabaena sp.*	-	+	-	-	-	-	-	-	-	-	-
1089	*Cyanodictyon sp.*	-	-	-	-	-	-	-	-	-	-	-
1129	*Planktothrix*	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	Chlorophyte											
2100	*Pyramidomonas tetrarhynchus Schmarda*	-	-	-	-	-	-	-	-	+	-	-
2101	*Carteria spp.*	-	+	-	-	-	-	-	-	-	-	-
2105	*Chlamydomonas spp.*	-	-	+	+	+	+	+	-	-	+	+
2107	*Chlorogonium maximum Skuja*	-	+	-	-	-	-	-	-	-	-	-
2112	*Sphaerocystis schroeteri Chodat*	-	-	+	-	+	+	-	-	+	-	+
2121	*Oocystis lacustris Chodat*	+	+	+	-	-	-	-	-	-	-	+
2126	*Chodatella sp.*	-	-	-	-	-	-	-	-	-	-	-
2137	*Dictyosphaerium simplex Sukja*	+	+	+	-	-	+	+	+	+	+	+
2138	*Monoraphidium komarkovae (Nyg.) Komarkova-Legnerova*	-	-	-	-	+	+	-	-	-	-	+
2143	*Monoraphidium minutum (Nag.) Komarkova-Legnerova*	-	-	-	-	-	-	-	-	-	-	-
2145	*Crucigenia quadrata Morr.*	-	-	+	-	+	+	-	-	-	-	-
2164	*Quadrigula closterioides (Bohl.) Printz*	-	-	-	-	-	-	-	-	-	-	-
2167	*Elakatothrix gelatinosa Willen*	-	-	+	-	+	-	-	-	-	+	-
2169	*Planctonema lauterbornii Schmidle*	-	-	-	-	-	-	-	-	-	-	-
2178	*Cosmarium sp.*	-	-	-	-	+	-	-	-	-	-	-
2182	*Euastrum spp.*	-	-	+	-	-	-	-	-	-	-	-
2186	*Xanthidium sp.*	-	-	-	-	-	-	-	-	-	-	-
2187	*Staurodesmus extensus (Andersson) Teiling*	-	-	-	-	-	-	-	-	-	-	-
2191	*Staurodesmus cuspidatus (Brebisson and Ralfs) Teiling*	-	-	-	-	-	-	-	-	-	-	-
2193	*Staurodesmus paradoxum Meyen*	-	-	-	-	-	-	-	-	-	-	-
2195	*Staurodesmus bullardii G.M. Smith*	-	-	-	-	-	-	-	-	-	-	-
2199	*Spondylosium planum (Wolle) W. and G.S. West*	-	-	+	-	-	+	-	-	-	-	-
2204	*Ankyra judai (G.M. Smith) Fott*	-	-	-	-	+	-	-	-	-	-	+
2205	*Mougeotia sp.*	-	-	-	-	-	-	-	-	-	+	-
2206	*Botryococcus braunii Kutzing*	-	-	-	-	-	-	-	-	-	+	-
2215	*Tetraedron caudatum (Corda) Hansgrig*	-	-	+	+	+	+	-	-	-	+	+
2235	*Ankistrodesmus spiralis Lemmermann*	+	+	+	+	+	-	+	+	+	+	-
2247	*Oocystis gigas Archer*	+	-	-	-	-	-	-	-	-	-	-
2252	*Scenedesmus acutus Chodat*	-	-	-	-	+	+	-	-	-	-	+
2509	*Scenedesmus ecornis*	-	-	-	-	-	-	+	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	Euglenophyte											
3301	*Euglena acus Ehrenberg*	-	-	-	-	-	-	-	-	-	+	-
		-	-	-	-	-	-	-	-	-	-	-
	Chrysophyte											
4351	*Small chrysophyceae*	+	+	+	+	+	+	+	+	+	+	+
4352	*Large chrysophyceae*	+	+	+	+	+	+	+	+	+	+	+
4355	*Chrysochromulina parva Lackey*	+	+	+	+	+	+	+	+	+	+	+
4357	*Chrysococcus sp.*	+	+	+	+	+	+	+	+	+	+	+
4358	*Chrysostephanospaera globulifera Scherffel*	-	-	-	-	-	-	+	-	-	+	-
4361	*Kephyrion boreale Skuja*	-	-	-	-	+	-	-	-	-	-	-
4362	*Kephyrion sp.*	+	+	+	+	+	+	+	+	+	+	+
4363	*Spiniferomonas sirrata****************	-	+	-	-	-	+	+	-	+	+	+
4364	*Mallomonas caudata Ivanov*	-	-	+	+	-	-	-	-	-	-	-
4367	*Mallomonas duerrschmidtiae Siver, Hamer and Kling*	-	-	-	-	-	-	-	-	-	-	-
4368	*Mallomonas crassisquama (Asmund) Fott*	+	-	+	+	+	+	+	+	+	+	+
4370	*Mallomonas akrokomos Asmund and Kristiansen*	-	-	-	-	+	+	+	-	-	-	+
4372	*Mallomonas tonsurata Teiling and Krieger*	-	-	-	-	-	-	-	-	-	-	-
4375	*Synura sphagnicola Korschikow*	+	+	+	-	-	-	+	-	+	-	-
4378	*Dinobryon borgei Lemmermann*	+	+	+	+	+	+	+	+	+	+	-
4380	*Dinobryon suecicum Lemmermann*	-	-	-	-	-	-	-	-	-	-	-
4381	*Dinobryon mucronutom Nygaard*	-	-	-	-	-	-	-	-	-	-	-
4383	*Dinobryon bavaricum Imhof*	-	-	+	+	+	+	+	+	+	+	+
4384	*Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger*	-	-	-	-	-	-	-	-	-	-	-
4388	*Dinobryon sertularia Ehrenberg*	+	+	+	+	+	+	+	+	+	+	+
4390	*Dinobryon sociale Ehrenberg*	-	+	+	+	+	+	+	+	+	+	-
4394	*Epiphyxis sp.*	-	-	-	-	-	-	-	-	-	-	-
4396	*Chrysolkos skuja (Nauwerck) Willen*	+	+	+	+	+	+	+	+	+	+	-
4400	*Ochromonas sp.*	-	+	+	+	+	+	-	-	-	+	-
4401	*Uroglena volvox Ehrenberg*	+	-	+	+	-	-	+	+	+	+	-
4403	*Chrysosphaerella longispina Lauterborn*	-	-	-	-	-	-	-	-	-	-	-
4411	*Bitrichia chodatii (Reverdin) Chodat*	-	-	-	-	-	-	-	-	+	-	-
4413	*Chrysochromulina laurentiana Kling*	+	+	+	+	+	+	+	+	+	+	+
4414	*Stichogloea spp.*	-	+	+	-	+	-	-	-	-	-	-
4415	*Bicoeca lacustris Clark*	-	-	-	-	-	-	-	-	-	-	+
4418	*Salpingoeca frequentissima (Zach.) Lemmermann*	+	+	+	+	+	+	+	+	+	+	+
4436	*Dinobryon attenatum Hill*	-	-	+	-	+	-	+	+	+	-	-
4437	*Pteridomonas sp.*	-	-	+	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	Diatoms											
5500	*Aulacoseira granulata (Ehrenberg) Simonsen*	+	+	+	+	-	-	+	+	+	+	+
5507	*Cyclotella stelligera Cleve and Grunow*	+	+	+	+	+	+	+	+	+	+	+
5508	*Cyclotella pseudostelligera*	-	-	-	-	-	-	-	-	+	-	-
5509	*Cyclotella ocellata Pant.*	+	-	-	-	-	-	-	-	-	-	-
5511	*Rhizosolenia eriense H.L. Smith*	-	+	+	+	+	+	+	+	+	+	+
5513	*Tabellaria fenestrata (Lyngbye) Kutzing*	-	-	+	+	+	+	-	-	+	+	+
5514	*Tabellaria flocculsa (Roth) Kutzing*	+	-	+	-	+	-	-	+	+	-	+
5515	*Fragilaria crotonensis Kitton*	-	-	-	-	-	-	-	-	-	-	-
5518	*Synedra acus Kutzing*	+	+	+	+	+	-	+	+	+	+	+
5523	*Synedra ulna (Nitzsch) Ehrenberg*	-	-	-	-	-	-	-	-	-	-	-
5524	*Asterionella formosa Hassall*	+	+	+	+	+	+	+	+	+	+	+
5540	*Aulacoseira italica v subarctica (O. Muller) Simonsen*	-	-	+	+	-	-	-	+	-	-	-
5551	*Cyclotella michiganiana Skvortzow*	+	+	+	+	+	+	+	+	+	+	+
5720	*Cyclotella bodanica Eulenst.*	-	-	-	-	-	-	-	-	-	-	-
5768	*Nitzschia linearis W. Smith*	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	Crytophyte											
6554	*Rhodomonas minuta Skuja*	+	+	+	+	+	+	+	+	+	+	+
6558	*Cryptomonas erosa Ehrenberg*	+	+	+	+	+	+	+	+	+	+	+
6562	*Cryptomonas reflexa (Marsson) Skuja*	-	-	-	-	-	-	-	-	-	+	-
6565	*Cryptomonas rostratiformis Skuja*	-	-	-	-	-	-	-	+	+	-	+
6568	*Katablepharis ovalis Skuja*	+	-	+	+	+	+	+	+	+	+	+
		-	-	-	-	-	-	-	-	-	-	-
	Dinoflagellates											
7631	*Gymnodinium helveticum Penard*	-	-	-	-	-	-	-	-	-	-	+
7632	*Gymnodinium sp.*	+	+	+	-	+	+	+	+	+	+	+
7635	*Peridinium willei Huitfeldt-Kaas*	-	-	-	-	-	-	-	-	-	-	-
7639	*Peridinium pusillum (Penard) Lemmermann*	+	+	+	+	+	+	+	+	-	+	+
7641	*Peridinium aciculiferum Lemmermann*	+	+	+	+	-	-	+	+	-	-	-
	Taxa Richness per Sample	**31**	**33**	**46**	**33**	**40**	**35**	**35**	**32**	**36**	**39**	**37**

Appendix B. Presence (+) / Absence (-) matrix of phytoplankton species in Meadowbank study lakes and Baker Lake, 2016.

	Area-Replicate ID	BBD-48S	BPJ-43S	BPJ-44S	BPJ-45S	BPJ-46S	BPJ-47S	BPJ-48S	INUG-78S	INUG-79S	INUG-80S	INUG-81S
Code	*Species Name*	3-Sep-16	22-Jul-16	22-Jul-16	10-Aug-16	10-Aug-16	3-Sep-16	3-Sep-16	15-Apr-16	15-Apr-16	18-Jul-16	18-Jul-16
	Cyanophyte											
1008	*Aphanocapsa sp.*	-	-	-	-	-	-	-	-	-	-	-
1012	*Aphanothece sp.*	-	-	-	-	-	-	-	-	-	-	-
1014	*Chroococcus limneticus Lemmermann*	-	+	-	-	-	-	-	-	-	-	-
1054	*Planktolyngbya limnetica*	-	+	+	+	-	-	-	-	+	-	-
1073	*Snowella sp*	-	-	-	-	-	-	-	-	-	-	-
1077	*Pseudoanabaena sp.*	-	-	-	-	-	-	-	-	-	-	-
1089	*Cyanodictyon sp.*	-	-	-	-	-	-	-	-	-	-	-
1129	*Planktothrix*	-	-	-	-	+	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	Chlorophyte											
2100	*Pyramidomonas tetrarhynchus Schmarda*	-	-	-	-	-	-	-	-	-	-	-
2101	*Carteria spp.*	-	-	-	-	-	-	-	-	-	-	-
2105	*Chlamydomonas spp.*	-	-	-	+	+	-	+	+	-	+	-
2107	*Chlorogonium maximum Skuja*	-	-	-	-	-	-	-	-	-	-	-
2112	*Sphaerocystis schroeteri Chodat*	+	-	-	-	-	-	+	-	-	+	+
2121	*Oocystis lacustris Chodat*	-	-	-	-	+	+	-	-	-	+	+
2126	*Chodatella sp.*	+	-	-	-	-	-	-	-	-	-	-
2137	*Dictyosphaerium simplex Sukja*	+	+	-	-	+	+	+	+	+	-	-
2138	*Monoraphidium komarkovae (Nyg.) Komarkova-Legnerova*	+	-	-	-	-	+	+	-	-	-	-
2143	*Monoraphidium minutum (Nag.) Komarkova-Legnerova*	-	-	-	-	+	-	-	-	-	-	+
2145	*Crucigenia quadrata Morr.*	-	+	-	-	-	-	-	-	-	-	-
2164	*Quadrigula closterioides (Bohl.) Printz*	-	-	-	-	-	-	-	-	-	-	-
2167	*Elakatothrix gelatinosa Willen*	-	-	-	-	+	+	+	+	-	+	+
2169	*Planctonema lauterbornii Schmidle*	-	-	-	-	-	-	-	-	-	-	-
2178	*Cosmarium sp.*	-	-	-	-	-	-	-	-	-	-	-
2182	*Euastrum spp.*	+	-	-	-	-	-	-	-	-	-	+
2186	*Xanthidium sp.*	-	-	-	-	-	-	-	-	-	+	+
2187	*Staurodesmus extensus (Andersson) Teiling*	-	+	-	-	-	+	-	-	-	+	+
2191	*Staurodesmus cuspidatus (Brebisson and Ralfs) Teiling*	-	-	-	-	-	-	-	-	-	-	-
2193	*Staurodesmus paradoxum Meyen*	+	-	-	-	-	-	-	-	-	+	-
2195	*Staurodesmus bullardii G.M. Smith*	-	-	-	-	-	-	-	-	-	-	-
2199	*Spondylosium planum (Wolle) W. and G.S. West*	-	-	-	-	+	-	-	-	-	-	-
2204	*Ankyra judai (G.M. Smith) Fott*	+	-	-	-	-	-	-	-	-	-	-
2205	*Mougeotia sp.*	-	-	-	-	-	-	-	-	-	-	-
2206	*Botryococcus braunii Kutzing*	-	-	+	+	+	-	+	+	-	+	-
2215	*Tetraedron caudatum (Corda) Hansgrig*	+	-	+	+	+	-	+	-	-	-	-
2235	*Ankistrodesmus spiralis Lemmermann*	-	+	+	+	+	+	+	-	-	+	-
2247	*Oocystis gigas Archer*	-	-	-	-	-	-	-	-	-	-	+
2252	*Scenedesmus acutus Chodat*	+	-	-	-	-	-	+	-	-	-	-
2509	*Scenedesmus ecornis*	-	+	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	Euglenophyte											
3301	*Euglena acus Ehrenberg*	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	Chrysophyte											
4351	*Small chrysophyceae*	+	+	+	+	+	+	+	+	+	+	+
4352	*Large chrysophyceae*	+	+	+	+	+	+	+	+	+	+	+
4355	*Chrysochromulina parva Lackey*	+	+	+	+	+	+	+	-	-	+	+
4357	*Chrysococcus sp.*	+	+	+	+	+	+	+	+	+	+	+
4358	*Chrysostephanospaera globulifera Scherffel*	-	-	+	-	+	-	-	-	-	-	-
4361	*Kephyrion boreale Skuja*	-	-	-	+	+	+	+	-	+	-	-
4362	*Kephyrion sp.*	+	+	+	+	+	+	+	+	-	+	+
4363	*Spiniferomonas sirrata*****************	-	+	-	+	+	+	+	-	-	-	+
4364	*Mallomonas caudata Ivanov*	-	-	+	-	-	-	-	-	-	-	-
4367	*Mallomonas duerrschmidtiae Siver, Hamer and Kling*	-	-	-	-	-	-	-	-	-	-	-
4368	*Mallomonas crassisquama (Asmund) Fott*	+	+	+	+	+	+	+	-	+	+	+
4370	*Mallomonas akrokomos Asmund and Kristiansen*	+	-	-	-	-	+	+	-	-	-	-
4372	*Mallomonas tonsurata Teiling and Krieger*	-	-	-	-	+	-	-	-	-	+	-
4375	*Synura sphagnicola Korschikow*	+	-	+	-	+	-	-	-	-	-	-
4378	*Dinobryon borgei Lemmermann*	+	+	+	+	+	-	+	-	-	+	+
4380	*Dinobryon suecicum Lemmermann*	-	-	-	-	-	-	-	-	-	-	+
4381	*Dinobryon mucronutom Nygaard*	-	-	-	-	-	-	-	-	-	-	+
4383	*Dinobryon bavaricum Imhof*	+	-	+	+	+	+	+	-	-	+	+
4384	*Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger*	-	-	-	+	-	+	-	-	-	+	+
4388	*Dinobryon sertularia Ehrenberg*	+	+	+	+	+	+	+	-	-	+	+
4390	*Dinobryon sociale Ehrenberg*	-	+	+	+	+	+	+	-	+	+	+
4394	*Epiphyxis sp.*	-	-	-	-	-	-	-	-	-	-	-
4396	*Chrysolkos skuja (Nauwerck) Willen*	+	+	+	+	+	-	-	-	-	-	+
4400	*Ochromonas sp.*	+	-	+	+	-	-	-	+	+	-	-
4401	*Uroglena volvox Ehrenberg*	-	+	+	+	+	-	-	-	-	+	+
4403	*Chrysosphaerella longispina Lauterborn*	-	+	-	-	-	-	-	-	-	-	-
4411	*Bitrichia chodatii (Reverdin) Chodat*	+	-	-	-	-	-	+	-	-	+	+
4413	*Chrysochromulina laurentiana Kling*	+	+	+	+	+	+	+	-	+	+	+
4414	*Stichogloea spp.*	-	+	-	-	+	-	-	-	-	+	+
4415	*Bicoeca lacustris Clark*	-	-	-	-	-	-	-	-	-	-	-
4418	*Salpingoeca frequentissima (Zach.) Lemmermann*	+	+	+	+	+	+	+	+	+	-	+
4436	*Dinobryon attenatum Hill*	-	-	+	+	+	-	-	-	-	-	-
4437	*Pteridomonas sp.*	-	+	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	Diatoms											
5500	*Aulacoseira granulata (Ehrenberg) Simonsen*	+	+	+	+	+	+	+	-	-	-	-
5507	*Cyclotella stelligera Cleve and Grunow*	+	+	+	+	+	+	+	-	-	+	+
5508	*Cyclotella pseudostelligera*	-	-	-	-	-	-	-	-	-	-	-
5509	*Cyclotella ocellata Pant.*	-	-	+	-	-	-	+	-	+	+	-
5511	*Rhizosolenia eriense H.L. Smith*	+	+	+	+	+	+	+	-	-	+	+
5513	*Tabellaria fenestrata (Lyngbye) Kutzing*	+	+	-	+	-	+	+	-	-	+	+
5514	*Tabellaria flocculsa (Roth) Kutzing*	+	-	-	+	+	+	-	-	-	+	-
5515	*Fragilaria crotonensis Kitton*	-	-	-	+	+	-	+	-	-	-	-
5518	*Synedra acus Kutzing*	+	+	+	+	+	+	+	+	-	+	+
5523	*Synedra ulna (Nitzsch) Ehrenberg*	-	-	-	-	-	-	-	-	-	+	-
5524	*Asterionella formosa Hassall*	+	+	+	+	+	+	+	-	-	-	-
5540	*Aulacoseira italica v subarctica (O. Muller) Simonsen*	-	-	-	-	+	-	-	-	-	-	-
5551	*Cyclotella michiganiana Skvortzow*	+	+	+	+	+	+	+	+	+	+	+
5720	*Cyclotella bodanica Eulenst.*	-	-	-	-	-	-	-	-	-	-	-
5768	*Nitzschia linearis W. Smith*	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	Crytophyte											
6554	*Rhodomonas minuta Skuja*	+	+	+	+	+	+	+	+	+	+	+
6558	*Cryptomonas erosa Ehrenberg*	+	+	+	+	+	+	+	+	+	+	+
6562	*Cryptomonas reflexa (Marsson) Skuja*	-	+	+	-	-	-	-	-	-	-	+
6565	*Cryptomonas rostratiformis Skuja*	-	-	+	+	+	-	-	-	-	-	+
6568	*Katablepharis ovalis Skuja*	+	+	+	+	+	+	+	+	+	+	+
		-	-	-	-	-	-	-	-	-	-	-
	Dinoflagellates											
7631	*Gymnodinium helveticum Penard*	+	-	-	-	-	-	-	-	-	-	+
7632	*Gymnodinium sp.*	+	+	+	+	-	+	+	+	+	+	+
7635	*Peridinium willei Huitfeldt-Kaas*	-	-	-	-	-	-	-	-	-	+	-
7639	*Peridinium pusillum (Penard) Lemmermann*	+	+	+	+	+	+	+	-	-	+	+
7641	*Peridinium aciculiferum Lemmermann*	-	+	+	+	+	-	+	-	-	-	-
	Taxa Richness per Sample	**39**	**38**	**38**	**40**	**46**	**34**	**40** **0**	**16**	**17**	**39**	**41**

Appendix B. Presence (+) / Absence (-) matrix of phytoplankton species in Meadowbank study lakes and Baker Lake, 2016.

	Area-Replicate ID	INUG-82S	INUG-83S	INUG-84S	INUG-85S	PDL-43S	PDL-44S	PDL-45S	PDL-46S	PDL-47S	PDL-48S	PDL-49S
Code	Species Name	7-Aug-16	7-Aug-16	7-Sep-16	7-Sep-16	16-Apr-16	16-Apr-16	19-Jul-16	19-Jul-16	6-Aug-16	6-Aug-16	8-Sep-16
	Cyanophyte											
1008	*Aphanocapsa sp.*	-	-	-	-	-	-	-	-	-	-	-
1012	*Aphanothece sp.*	+	-	+	-	+	-	-	-	-	-	-
1014	*Chroococcus limneticus Lemmermann*	-	-	-	-	-	-	-	-	+	-	-
1054	*Planktolyngbya limnetica*	+	+	+	+	+	+	+	+	+	+	+
1073	*Snowella sp*	-	-	-	-	-	-	-	-	-	-	-
1077	*Pseudoanabaena sp.*	-	-	-	-	-	-	-	-	-	-	-
1089	*Cyanodictyon sp.*	-	-	-	+	-	-	-	-	-	-	-
1129	*Planktothrix*	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	Chlorophyte											
2100	*Pyramidomonas tetrarhynchus Schmarda*	-	-	+	+	-	-	-	-	-	-	-
2101	*Carteria spp.*	-	-	-	-	-	-	-	-	-	-	-
2105	*Chlamydomonas spp.*	+	-	+	+	+	-	-	-	-	+	-
2107	*Chlorogonium maximum Skuja*	-	-	-	-	-	-	-	-	-	-	-
2112	*Sphaerocystis schroeteri Chodat*	+	+	+	+	-	-	-	+	-	-	+
2121	*Oocystis lacustris Chodat*	+	+	-	+	-	-	+	-	-	-	+
2126	*Chodatella sp.*	-	-	-	-	-	-	-	-	-	-	-
2137	*Dictyosphaerium simplex Sukja*	-	-	+	+	+	+	+	-	-	-	-
2138	*Monoraphidium komarkovae (Nyg.) Komarkova-Legnerova*	-	-	+	+	-	-	-	-	-	-	+
2143	*Monoraphidium minutum (Nag.) Komarkova-Legnerova*	-	-	-	-	-	-	-	-	+	+	-
2145	*Crucigenia quadrata Morr.*	-	-	-	-	-	-	-	+	-	-	-
2164	*Quadrigula closterioides (Bohl.) Printz*	-	-	-	-	-	-	-	-	-	-	-
2167	*Elakatothrix gelatinosa Willen*	+	+	+	+	-	-	-	-	+	-	+
2169	*Planctonema lauterbornii Schmidle*	-	-	-	-	-	-	-	-	+	+	-
2178	*Cosmarium sp.*	-	+	+	-	-	-	-	-	-	-	-
2182	*Euastrum spp.*	-	-	-	-	-	-	-	-	-	-	-
2186	*Xanthidium sp.*	-	-	-	-	-	-	-	-	-	-	-
2187	*Staurodesmus extensus (Andersson) Teiling*	+	+	-	+	+	-	+	+	+	+	+
2191	*Staurodesmus cuspidatus (Brebisson and Ralfs) Teiling*	-	-	-	-	-	-	-	-	-	-	-
2193	*Staurodesmus paradoxum Meyen*	-	-	-	-	-	-	-	-	-	-	-
2195	*Staurodesmus bullardii G.M. Smith*	-	-	-	-	-	-	-	-	-	-	-
2199	*Spondylosium planum (Wolle) W. and G.S. West*	+	-	-	-	-	-	-	-	-	+	+
2204	*Ankyra judai (G.M. Smith) Fott*	-	-	-	-	-	-	-	-	-	-	-
2205	*Mougeotia sp.*	-	-	-	+	-	-	-	-	-	-	-
2206	*Botryococcus braunii Kutzing*	-	+	+	+	-	-	+	-	+	-	+
2215	*Tetraedron caudatum (Corda) Hansgrig*	-	-	-	+	-	-	+	+	+	+	-
2235	*Ankistrodesmus spiralis Lemmermann*	-	-	-	-	-	-	+	+	+	+	+
2247	*Oocystis gigas Archer*	+	+	-	-	-	-	-	-	-	-	-
2252	*Scenedesmus acutus Chodat*	-	-	-	-	-	-	-	-	-	-	-
2509	*Scenedesmus ecornis*	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	Euglenophyte											
3301	*Euglena acus Ehrenberg*	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	Chrysophyte											
4351	*Small chrysophyceae*	+	+	+	+	+	+	+	+	+	+	+
4352	*Large chrysophyceae*	+	+	+	+	+	+	+	+	+	+	+
4355	*Chrysochromulina parva Lackey*	+	+	-	+	-	-	-	+	+	-	+
4357	*Chrysococcus sp.*	+	+	+	+	+	+	+	+	+	+	+
4358	*Chrysostephanospaera globulifera Scherffel*	-	-	-	-	-	-	-	-	-	+	+
4361	*Kephyrion boreale Skuja*	-	-	+	+	-	-	-	-	-	-	+
4362	*Kephyrion sp.*	+	+	+	+	+	+	+	+	+	+	+
4363	*Spiniferomonas sirrata*****************	+	-	+	+	-	-	+	+	+	-	-
4364	*Mallomonas caudata Ivanov*	-	-	-	-	-	-	-	-	-	-	-
4367	*Mallomonas duerrschmidtiae Siver, Hamer and Kling*	-	-	+	-	-	-	-	-	-	-	-
4368	*Mallomonas crassisquama (Asmund) Fott*	-	-	-	-	-	-	-	+	-	-	-
4370	*Mallomonas akrokomos Asmund and Kristiansen*	-	+	-	-	-	-	-	-	-	-	-
4372	*Mallomonas tonsurata Teiling and Krieger*	-	-	-	-	-	-	-	-	-	-	-
4375	*Synura sphagnicola Korschikow*	-	-	-	-	-	-	-	-	-	-	-
4378	*Dinobryon borgei Lemmermann*	+	+	+	+	-	-	+	+	+	+	-
4380	*Dinobryon suecicum Lemmermann*	-	-	-	-	-	-	-	-	-	-	-
4381	*Dinobryon mucronutom Nygaard*	-	+	+	+	-	-	+	-	+	-	+
4383	*Dinobryon bavaricum Imhof*	+	+	+	+	-	-	+	+	+	+	+
4384	*Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger*	-	+	+	+	-	-	-	-	-	-	-
4388	*Dinobryon sertularia Ehrenberg*	+	+	+	+	-	-	+	+	+	+	+
4390	*Dinobryon sociale Ehrenberg*	+	+	+	+	+	+	+	+	+	+	-
4394	*Epiphyxis sp.*	+	-	+	+	-	-	-	-	+	-	-
4396	*Chrysolkos skuja (Nauwerck) Willen*	+	+	+	+	-	-	+	+	+	+	+
4400	*Ochromonas sp.*	+	-	-	-	-	-	-	+	-	-	-
4401	*Uroglena volvox Ehrenberg*	+	+	-	-	-	-	-	-	-	-	-
4403	*Chrysosphaerella longispina Lauterborn*	-	-	-	-	-	-	-	-	-	-	-
4411	*Bitrichia chodatii (Reverdin) Chodat*	-	+	+	+	-	-	-	-	-	+	-
4413	*Chrysochromulina laurentiana Kling*	+	+	+	+	-	-	+	+	+	+	+
4414	*Stichogloea spp.*	+	+	+	+	-	-	+	+	+	-	+
4415	*Bicoeca lacustris Clark*	-	-	-	-	-	-	-	-	-	-	-
4418	*Salpingoeca frequentissima (Zach.) Lemmermann*	+	+	-	-	+	+	+	-	-	-	+
4436	*Dinobryon attenatum Hill*	-	-	-	-	-	-	-	-	-	-	-
4437	*Pteridomonas sp.*	-	+	-	-	-	-	-	-	-	-	+
		-	-	-	-	-	-	-	-	-	-	-
	Diatoms											
5500	*Aulacoseira granulata (Ehrenberg) Simonsen*	-	-	-	-	-	-	-	-	-	-	-
5507	*Cyclotella stelligera Cleve and Grunow*	+	+	+	+	-	-	+	+	+	+	-
5508	*Cyclotella pseudostelligera*	+	-	-	-	-	-	-	-	-	-	-
5509	*Cyclotella ocellata Pant.*	+	+	-	-	-	-	+	+	+	+	+
5511	*Rhizosolenia eriense H.L. Smith*	+	-	+	+	+	-	+	+	+	+	+
5513	*Tabellaria fenestrata (Lyngbye) Kutzing*	-	-	-	-	-	-	-	-	-	-	-
5514	*Tabellaria flocculsa (Roth) Kutzing*	-	-	+	+	-	-	-	-	+	-	-
5515	*Fragilaria crotonensis Kitton*	-	-	-	-	-	-	-	-	-	-	-
5518	*Synedra acus Kutzing*	+	+	+	+	-	+	+	+	+	+	+
5523	*Synedra ulna (Nitzsch) Ehrenberg*	-	-	-	-	-	-	-	-	-	-	-
5524	*Asterionella formosa Hassall*	-	-	-	-	-	-	-	-	-	-	-
5540	*Aulacoseira italica v subarctica (O. Muller) Simonsen*	-	-	-	-	-	-	-	-	-	-	-
5551	*Cyclotella michiganiana Skvortzow*	+	+	+	+	-	-	+	+	+	+	+
5720	*Cyclotella bodanica Eulenst.*	-	-	-	-	-	-	+	+	+	-	-
5768	*Nitzschia linearis W. Smith*	-	+	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	Crytophyte											
6554	*Rhodomonas minuta Skuja*	+	+	+	+	+	+	+	+	+	+	+
6558	*Cryptomonas erosa Ehrenberg*	+	+	+	+	+	+	+	+	+	+	+
6562	*Cryptomonas reflexa (Marsson) Skuja*	+	+	-	-	-	-	+	-	-	-	-
6565	*Cryptomonas rostratiformis Skuja*	-	-	-	-	+	-	+	-	+	-	-
6568	*Katablepharis ovalis Skuja*	+	+	+	+	-	+	+	+	-	+	+
		-	-	-	-	-	-	-	-	-	-	-
	Dinoflagellates											
7631	*Gymnodinium helveticum Penard*	-	-	-	-	-	+	-	-	-	-	-
7632	*Gymnodinium sp.*	+	+	+	-	+	+	+	+	+	+	+
7635	*Peridinium willei Huitfeldt-Kaas*	-	-	-	-	+	-	-	-	-	-	-
7639	*Peridinium pusillum (Penard) Lemmermann*	+	+	+	+	-	-	+	+	+	+	-
7641	*Peridinium aciculiferum Lemmermann*	-	-	-	-	-	-	+	+	-	-	-
	Taxa Richness per Sample	**38**	**38**	**38**	**40**	**17**	**14**	**35**	**33**	**36**	**30**	**32**

Appendix B. Presence (+) / Absence (-) matrix of phytoplankton species in Meadowbank study lakes and Baker Lake, 2016.

Code	Species Name / *Area-Replicate ID*	PDL-50S 8-Sep-16	SP-90S 14-Apr-16	SP-91S 14-Apr-16	SP-92S 8-Jul-16	SP-93S 8-Jul-16	SP-94S 3-Aug-16	SP-95S 3-Aug-16	SP-96S 5-Sep-16	SP-97S 5-Sep-16	SP-98S 25-Nov-16	SP-99S 25-Nov-16
	Cyanophyte											
1008	*Aphanocapsa sp.*	-	-	-	-	-	-	-	-	-	-	-
1012	*Aphanothece sp.*	-	-	-	-	-	-	-	-	-	-	-
1014	*Chroococcus limneticus Lemmermann*	-	-	-	-	-	-	-	-	-	-	-
1054	*Planktolyngbya limnetica*	+	-	-	-	-	+	+	+	+	-	-
1073	*Snowella sp*	-	-	-	-	-	-	-	-	-	-	-
1077	*Pseudoanabaena sp.*	-	-	-	-	-	-	-	-	-	-	-
1089	*Cyanodictyon sp.*	-	-	-	-	-	-	-	-	-	-	-
1129	*Planktothrix*	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	Chlorophyte											
2100	*Pyramidomonas tetrarhynchus Schmarda*	+	-	-	-	-	-	-	-	-	-	-
2101	*Carteria spp.*	-	-	-	-	-	-	-	-	-	-	-
2105	*Chlamydomonas spp.*	+	-	-	+	-	-	+	+	-	-	-
2107	*Chlorogonium maximum Skuja*	-	-	-	-	-	-	-	-	-	-	-
2112	*Sphaerocystis schroeteri Chodat*	-	-	-	-	+	-	-	+	+	-	-
2121	*Oocystis lacustris Chodat*	+	-	-	+	+	+	+	+	+	-	-
2126	*Chodatella sp.*	-	-	-	-	-	-	-	-	-	-	-
2137	*Dictyosphaerium simplex Sukja*	-	+	+	-	+	+	+	+	+	-	-
2138	*Monoraphidium komarkovae (Nyg.) Komarkova-Legnerova*	+	+	+	-	-	-	-	+	+	-	-
2143	*Monoraphidium minutum (Nag.) Komarkova-Legnerova*	-	-	-	-	-	-	-	+	-	-	-
2145	*Crucigenia quadrata Morr.*	-	-	-	-	-	-	+	+	-	-	-
2164	*Quadrigula closterioides (Bohl.) Printz*	-	-	-	-	-	-	-	-	-	-	-
2167	*Elakatothrix gelatinosa Willen*	+	-	-	-	+	+	+	-	+	-	+
2169	*Planctonema lauterbornii Schmidle*	-	-	-	-	-	-	+	-	-	-	-
2178	*Cosmarium sp.*	-	-	-	-	-	-	-	-	-	-	-
2182	*Euastrum spp.*	+	-	-	-	-	-	-	-	-	-	-
2186	*Xanthidium sp.*	-	-	-	-	-	-	-	-	-	-	-
2187	*Staurodesmus extensus (Andersson) Teiling*	+	-	-	+	+	-	-	-	-	-	+
2191	*Staurodesmus cuspidatus (Brebisson and Ralfs) Teiling*	-	-	-	-	-	-	-	-	-	-	-
2193	*Staurodesmus paradoxum Meyen*	-	-	-	-	-	-	-	-	-	-	-
2195	*Staurodesmus bullardii G.M. Smith*	-	-	-	+	-	-	-	-	-	-	-
2199	*Spondylosium planum (Wolle) W. and G.S. West*	+	-	-	-	-	+	+	+	-	-	-
2204	*Ankyra judai (G.M. Smith) Fott*	-	-	-	-	-	-	-	-	-	-	-
2205	*Mougeotia sp.*	-	-	-	-	+	-	-	-	-	-	-
2206	*Botryococcus braunii Kutzing*	-	-	+	-	+	+	-	+	+	+	+
2215	*Tetraedron caudatum (Corda) Hansgrig*	+	-	-	+	+	+	+	+	+	-	-
2235	*Ankistrodesmus spiralis Lemmermann*	+	-	-	+	+	+	+	+	+	+	-
2247	*Oocystis gigas Archer*	-	-	-	+	+	+	+	-	-	-	-
2252	*Scenedesmus acutus Chodat*	-	-	-	-	-	-	-	-	-	-	-
2509	*Scenedesmus ecornis*	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	Euglenophyte											
3301	*Euglena acus Ehrenberg*	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	Chrysophyte											
4351	*Small chrysophyceae*	+	+	+	+	+	+	+	+	+	+	+
4352	*Large chrysophyceae*	+	+	+	+	+	+	+	+	+	-	+
4355	*Chrysochromulina parva Lackey*	+	-	-	+	-	-	-	+	+	-	+
4357	*Chrysococcus sp.*	+	+	+	+	+	+	+	+	+	+	-
4358	*Chrysostephanospaera globulifera Scherffel*	-	-	-	-	-	+	-	+	+	-	-
4361	*Kephyrion boreale Skuja*	-	-	-	-	+	+	-	-	+	-	-
4362	*Kephyrion sp.*	+	+	+	+	+	+	+	+	+	+	+
4363	*Spiniferomonas sirrata******************	-	-	+	+	-	-	+	+	+	-	-
4364	*Mallomonas caudata Ivanov*	-	-	-	-	-	-	-	-	-	-	-
4367	*Mallomonas duerrschmidtiae Siver, Hamer and Kling*	-	-	-	-	-	-	-	-	-	-	-
4368	*Mallomonas crassisquama (Asmund) Fott*	-	+	-	-	+	+	-	+	-	-	-
4370	*Mallomonas akrokomos Asmund and Kristiansen*	-	-	-	-	-	-	-	-	-	-	-
4372	*Mallomonas tonsurata Teiling and Krieger*	-	-	-	-	-	-	-	-	-	-	-
4375	*Synura sphagnicola Korschikow*	-	-	-	-	-	-	-	-	-	-	-
4378	*Dinobryon borgei Lemmermann*	+	-	-	+	+	+	+	+	+	-	-
4380	*Dinobryon suecicum Lemmermann*	-	-	-	-	-	-	-	-	-	-	-
4381	*Dinobryon mucronutom Nygaard*	+	-	-	-	-	+	+	+	+	-	-
4383	*Dinobryon bavaricum Imhof*	+	-	-	-	-	-	-	+	+	-	-
4384	*Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger*	-	-	-	-	-	-	-	-	-	-	-
4388	*Dinobryon sertularia Ehrenberg*	+	-	-	+	+	+	+	+	+	-	-
4390	*Dinobryon sociale Ehrenberg*	+	+	-	+	+	+	+	+	-	+	+
4394	*Epiphyxis sp.*	-	-	-	+	-	-	-	+	+	-	-
4396	*Chrysolkos skuja (Nauwerck) Willen*	-	-	-	+	+	+	+	-	+	+	-
4400	*Ochromonas sp.*	-	-	+	-	-	-	-	+	-	-	-
4401	*Uroglena volvox Ehrenberg*	-	-	-	-	-	-	-	-	-	-	-
4403	*Chrysosphaerella longispina Lauterborn*	-	-	-	-	-	-	-	-	-	-	-
4411	*Bitrichia chodatii (Reverdin) Chodat*	+	-	-	-	-	-	-	-	+	-	-
4413	*Chrysochromulina laurentiana Kling*	+	+	-	+	+	+	+	+	+	-	+
4414	*Stichogloea spp.*	+	-	-	+	+	+	+	+	+	-	-
4415	*Bicoeca lacustris Clark*	-	-	-	-	-	-	-	-	-	-	-
4418	*Salpingoeca frequentissima (Zach.) Lemmermann*	-	+	+	-	+	+	-	+	+	+	-
4436	*Dinobryon attenatum Hill*	-	-	-	-	-	-	-	-	-	-	-
4437	*Pteridomonas sp.*	-	-	-	+	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	Diatoms											
5500	*Aulacoseira granulata (Ehrenberg) Simonsen*	-	-	-	-	-	-	-	-	-	-	-
5507	*Cyclotella stelligera Cleve and Grunow*	+	+	+	-	+	+	+	+	+	+	+
5508	*Cyclotella pseudostelligera*	-	-	-	-	-	-	-	-	-	-	-
5509	*Cyclotella ocellata Pant.*	+	-	-	-	-	+	+	-	-	+	+
5511	*Rhizosolenia eriense H.L. Smith*	+	-	-	-	-	-	-	+	+	-	-
5513	*Tabellaria fenestrata (Lyngbye) Kutzing*	-	-	-	-	-	-	-	-	-	-	-
5514	*Tabellaria flocculsa (Roth) Kutzing*	-	-	-	-	+	+	-	+	+	-	-
5515	*Fragilaria crotonensis Kitton*	-	-	-	-	-	-	-	-	-	-	-
5518	*Synedra acus Kutzing*	+	+	-	+	+	+	+	+	+	+	+
5523	*Synedra ulna (Nitzsch) Ehrenberg*	-	-	-	-	-	-	-	-	-	+	+
5524	*Asterionella formosa Hassall*	-	-	-	-	-	-	-	-	-	-	-
5540	*Aulacoseira italica v subarctica (O. Muller) Simonsen*	-	-	-	-	-	-	-	-	-	-	-
5551	*Cyclotella michiganiana Skvortzow*	+	+	+	+	+	+	+	+	+	+	+
5720	*Cyclotella bodanica Eulenst.*	-	-	-	-	-	+	+	+	+	-	-
5768	*Nitzschia linearis W. Smith*	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	Crytophyte											
6554	*Rhodomonas minuta Skuja*	+	+	+	+	+	+	+	+	+	+	+
6558	*Cryptomonas erosa Ehrenberg*	+	+	+	+	+	+	+	+	+	+	+
6562	*Cryptomonas reflexa (Marsson) Skuja*	-	-	-	-	-	-	+	+	+	-	-
6565	*Cryptomonas rostratiformis Skuja*	-	-	-	+	+	+	+	+	+	-	-
6568	*Katablepharis ovalis Skuja*	+	+	+	+	+	+	-	+	+	-	+
		-	-	-	-	-	-	-	-	-	-	-
	Dinoflagellates											
7631	*Gymnodinium helveticum Penard*	+	-	-	+	-	-	+	-	-	-	-
7632	*Gymnodinium sp.*	+	+	-	+	+	-	+	+	+	-	-
7635	*Peridinium willei Huitfeldt-Kaas*	-	+	-	-	-	-	-	-	-	-	-
7639	*Peridinium pusillum (Penard) Lemmermann*	+	+	+	+	+	+	+	+	+	-	-
7641	*Peridinium aciculiferum Lemmermann*	-	-	-	-	-	-	-	-	-	-	-
	Taxa Richness per Sample	**35**	**19**	**16**	**30**	**33**	**35**	**35**	**43**	**40**	**15**	**17**

Appendix B. Presence (+) / Absence (-) matrix of phytoplankton species in Meadowbank study lakes and Baker Lake, 2016.

	Area-Replicate ID	TE-90S	TE-91S	TEFF-43S	TEFF-44S	TPE-90S	TPE-91S	TPE-92S	TPE-93S	TPE-94S	TPE-95S	TPE-96S
Code	*Species Name*	25-Apr-16	25-Apr-16	25-Apr-16	25-Apr-16	20-Apr-16	20-Apr-16	12-Jul-16	12-Jul-16	5-Aug-16	5-Aug-16	11-Sep-16
	Cyanophyte											
1008	*Aphanocapsa sp.*	-	-	-	-	-	-	-	-	-	-	-
1012	*Aphanothece sp.*	-	-	-	-	-	-	-	-	-	-	-
1014	*Chroococcus limneticus Lemmermann*	-	-	-	-	-	-	-	-	-	-	-
1054	*Planktolyngbya limnetica*	-	-	+	-	-	-	+	+	+	-	+
1073	*Snowella sp*	-	-	-	-	-	-	-	-	-	-	-
1077	*Pseudoanabaena sp.*	-	-	-	-	-	-	-	-	-	-	-
1089	*Cyanodictyon sp.*	-	-	-	-	-	-	-	-	-	-	-
1129	*Planktothrix*	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	Chlorophyte											
2100	*Pyramidomonas tetrarhynchus Schmarda*	-	-	-	-	-	-	-	-	-	-	-
2101	*Carteria spp.*	-	-	-	-	-	-	-	-	-	-	-
2105	*Chlamydomonas spp.*	-	-	+	-	+	-	+	-	+	+	-
2107	*Chlorogonium maximum Skuja*	-	-	-	-	-	-	-	-	-	-	-
2112	*Sphaerocystis schroeteri Chodat*	-	-	-	-	-	-	-	-	+	-	+
2121	*Oocystis lacustris Chodat*	-	-	-	-	-	-	-	+	-	+	+
2126	*Chodatella sp.*	-	-	-	-	-	-	-	-	-	-	-
2137	*Dictyosphaerium simplex Sukja*	+	+	-	+	-	+	-	-	+	-	+
2138	*Monoraphidium komarkovae (Nyg.) Komarkova-Legnerova*	-	-	-	-	+	+	-	-	-	-	+
2143	*Monoraphidium minutum (Nag.) Komarkova-Legnerova*	-	-	-	-	-	-	-	-	+	-	-
2145	*Crucigenia quadrata Morr.*	-	-	-	-	-	-	-	-	-	-	-
2164	*Quadrigula closterioides (Bohl.) Printz*	-	-	-	-	-	-	-	-	-	-	-
2167	*Elakatothrix gelatinosa Willen*	-	-	-	-	-	-	+	-	+	+	+
2169	*Planctonema lauterbornii Schmidle*	-	-	-	-	-	-	-	-	-	-	-
2178	*Cosmarium sp.*	-	-	-	-	-	-	-	-	-	-	-
2182	*Euastrum spp.*	-	-	-	-	-	-	-	-	-	-	-
2186	*Xanthidium sp.*	-	-	-	-	-	-	-	-	-	+	-
2187	*Staurodesmus extensus (Andersson) Teiling*	-	-	+	+	-	-	-	-	-	-	+
2191	*Staurodesmus cuspidatus (Brebisson and Ralfs) Teiling*	-	-	-	-	-	-	-	-	-	-	-
2193	*Staurodesmus paradoxum Meyen*	-	-	-	-	-	-	+	-	-	-	-
2195	*Staurodesmus bullardii G.M. Smith*	-	-	-	-	-	-	-	-	-	-	-
2199	*Spondylosium planum (Wolle) W. and G.S. West*	-	-	-	-	-	-	-	-	-	+	-
2204	*Ankyra judai (G.M. Smith) Fott*	-	-	-	-	-	-	-	-	-	-	-
2205	*Mougeotia sp.*	-	-	-	-	-	-	-	-	-	-	-
2206	*Botryococcus braunii Kutzing*	-	-	+	+	+	-	-	-	+	+	-
2215	*Tetraedron caudatum (Corda) Hansgrig*	-	-	-	-	-	-	+	+	+	+	+
2235	*Ankistrodesmus spiralis Lemmermann*	-	-	-	-	-	-	+	+	+	+	-
2247	*Oocystis gigas Archer*	-	-	-	-	-	-	+	-	+	-	-
2252	*Scenedesmus acutus Chodat*	-	-	-	-	-	-	-	-	-	-	-
2509	*Scenedesmus ecornis*	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	Euglenophyte											
3301	*Euglena acus Ehrenberg*	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	Chrysophyte											
4351	*Small chrysophyceae*	+	+	+	+	+	+	+	+	+	+	+
4352	*Large chrysophyceae*	+	+	+	+	+	+	+	+	+	+	+
4355	*Chrysochromulina parva Lackey*	-	-	-	-	-	-	+	-	-	-	+
4357	*Chrysococcus sp.*	+	+	+	+	+	+	+	+	+	+	+
4358	*Chrysostephanospaera globulifera Scherffel*	-	-	-	-	-	+	-	-	+	-	-
4361	*Kephyrion boreale Skuja*	-	-	-	-	-	-	-	-	-	-	+
4362	*Kephyrion sp.*	+	+	+	+	+	-	+	+	+	+	+
4363	*Spiniferomonas sirrata*****************	-	-	+	-	-	-	-	-	+	-	+
4364	*Mallomonas caudata Ivanov*	-	-	-	-	-	-	-	-	-	-	-
4367	*Mallomonas duerrschmidtiae Siver, Hamer and Kling*	-	-	-	-	-	-	-	-	-	-	-
4368	*Mallomonas crassisquama (Asmund) Fott*	-	-	-	-	-	-	-	-	-	-	-
4370	*Mallomonas akrokomos Asmund and Kristiansen*	-	-	-	-	-	-	-	-	-	-	-
4372	*Mallomonas tonsurata Teiling and Krieger*	-	-	-	-	-	-	-	-	-	-	-
4375	*Synura sphagnicola Korschikow*	-	-	-	-	-	-	-	-	-	-	-
4378	*Dinobryon borgei Lemmermann*	-	-	-	-	-	-	+	-	+	+	-
4380	*Dinobryon suecicum Lemmermann*	-	-	-	-	-	-	-	-	-	-	-
4381	*Dinobryon mucronutom Nygaard*	-	-	-	-	-	-	+	-	+	-	+
4383	*Dinobryon bavaricum Imhof*	-	-	-	-	-	-	-	+	-	-	+
4384	*Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger*	-	-	-	-	-	-	-	-	-	-	-
4388	*Dinobryon sertularia Ehrenberg*	-	-	-	-	-	-	+	+	+	+	+
4390	*Dinobryon sociale Ehrenberg*	-	-	-	-	-	-	+	+	+	+	+
4394	*Epiphyxis sp.*	-	-	-	-	-	-	+	-	+	+	-
4396	*Chrysolkos skuja (Nauwerck) Willen*	-	+	+	+	-	+	+	+	+	+	-
4400	*Ochromonas sp.*	-	-	+	+	-	-	-	-	-	-	-
4401	*Uroglena volvox Ehrenberg*	-	-	-	-	-	-	+	-	-	-	+
4403	*Chrysosphaerella longispina Lauterborn*	-	-	-	-	-	-	-	-	-	-	-
4411	*Bitrichia chodatii (Reverdin) Chodat*	-	-	-	-	-	-	-	-	-	-	-
4413	*Chrysochromulina laurentiana Kling*	+	-	-	-	-	-	+	+	+	+	+
4414	*Stichogloea spp.*	-	-	-	-	-	-	-	+	+	-	-
4415	*Bicoeca lacustris Clark*	-	-	-	-	-	-	-	-	-	-	-
4418	*Salpingoeca frequentissima (Zach.) Lemmermann*	+	+	+	+	+	+	-	-	-	-	-
4436	*Dinobryon attenatum Hill*	-	+	-	-	-	-	-	-	-	-	-
4437	*Pteridomonas sp.*	-	-	-	-	-	-	-	-	+	+	-
		-	-	-	-	-	-	-	-	-	-	-
	Diatoms											
5500	*Aulacoseira granulata (Ehrenberg) Simonsen*	-	-	-	-	-	-	-	-	-	-	-
5507	*Cyclotella stelligera Cleve and Grunow*	-	-	-	+	-	+	+	+	-	+	+
5508	*Cyclotella pseudostelligera*	-	-	-	-	-	-	+	-	-	-	-
5509	*Cyclotella ocellata Pant.*	+	+	-	+	-	-	+	+	+	+	+
5511	*Rhizosolenia eriense H.L. Smith*	+	-	+	-	-	-	-	-	-	-	-
5513	*Tabellaria fenestrata (Lyngbye) Kutzing*	-	-	+	-	-	-	-	-	-	-	-
5514	*Tabellaria flocculsa (Roth) Kutzing*	-	-	-	-	-	-	-	-	+	-	-
5515	*Fragilaria crotonensis Kitton*	-	-	-	-	-	-	-	-	-	-	-
5518	*Synedra acus Kutzing*	+	+	+	+	-	+	+	+	+	+	+
5523	*Synedra ulna (Nitzsch) Ehrenberg*	-	-	-	-	-	-	-	+	-	-	-
5524	*Asterionella formosa Hassall*	-	-	-	-	-	-	-	-	-	-	+
5540	*Aulacoseira italica v subarctica (O. Muller) Simonsen*	-	-	-	-	-	-	-	-	-	-	-
5551	*Cyclotella michiganiana Skvortzow*	+	-	+	+	+	+	+	+	+	+	+
5720	*Cyclotella bodanica Eulenst.*	-	-	-	-	-	-	-	-	-	-	-
5768	*Nitzschia linearis W. Smith*	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	Crytophyte											
6554	*Rhodomonas minuta Skuja*	+	+	+	+	+	+	+	+	+	+	+
6558	*Cryptomonas erosa Ehrenberg*	+	+	+	+	+	+	+	+	+	+	+
6562	*Cryptomonas reflexa (Marsson) Skuja*	-	-	-	-	-	-	-	-	-	-	-
6565	*Cryptomonas rostratiformis Skuja*	-	-	-	-	-	-	+	-	+	+	+
6568	*Katablepharis ovalis Skuja*	-	+	-	-	-	+	+	+	+	+	+
		-	-	-	-	-	-	-	-	-	-	-
	Dinoflagellates											
7631	*Gymnodinium helveticum Penard*	-	+	-	-	-	-	-	-	-	+	-
7632	*Gymnodinium sp.*	+	+	+	+	+	-	+	+	+	+	+
7635	*Peridinium willei Huitfeldt-Kaas*	+	+	-	-	-	-	-	-	-	-	-
7639	*Peridinium pusillum (Penard) Lemmermann*	+	+	-	-	+	-	+	+	+	+	-
7641	*Peridinium aciculiferum Lemmermann*	-	-	-	-	-	-	-	-	-	-	-
	Taxa Richness per Sample	**16**	**17**	**19**	**17**	**13**	**14**	**31**	**24**	**35**	**30**	**31**

Appendix B. Presence (+) / Absence (-) matrix of phytoplankton species in Meadowbank study lakes and Baker Lake, 2016.

	Area-Replicate ID	TPE-97S	TPE-98S	TPE-99S	TPN-90S	TPN-91S	TPN-92S	TPN-93S	TPN-94S	TPN-95S	TPN-96S	TPN-97S
Code	*Species Name*	11-Sep-16	27-Nov-16	27-Nov-16	17-Apr-16	17-Apr-16	20-Jul-16	20-Jul-16	5-Aug-16	5-Aug-16	4-Sep-16	4-Sep-16
	Cyanophyte											
1008	*Aphanocapsa sp.*	-	-	-	-	-	-	-	-	-	-	-
1012	*Aphanothece sp.*	-	-	+	-	-	-	-	-	-	-	-
1014	*Chroococcus limneticus Lemmermann*	-	-	-	-	-	-	-	-	-	-	-
1054	*Planktolyngbya limnetica*	+	-	-	-	-	-	-	-	-	-	-
1073	*Snowella sp*	-	-	-	-	-	-	-	-	-	-	-
1077	*Pseudoanabaena sp.*	-	-	-	-	-	-	-	-	-	-	-
1089	*Cyanodictyon sp.*	-	-	-	-	-	-	-	-	-	-	-
1129	*Planktothrix*	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	Chlorophyte											
2100	*Pyramidomonas tetrarhynchus Schmarda*	-	-	-	-	-	-	-	-	-	-	-
2101	*Carteria spp.*	-	-	-	-	-	-	-	-	-	-	-
2105	*Chlamydomonas spp.*	-	+	+	-	-	+	+	-	+	+	-
2107	*Chlorogonium maximum Skuja*	-	-	-	-	-	-	-	-	-	-	-
2112	*Sphaerocystis schroeteri Chodat*	+	-	-	+	-	+	+	+	-	+	+
2121	*Oocystis lacustris Chodat*	+	+	+	-	-	+	-	-	+	-	+
2126	*Chodatella sp.*	-	-	-	-	-	-	-	-	-	-	-
2137	*Dictyosphaerium simplex Sukja*	+	-	-	+	+	+	-	-	-	-	+
2138	*Monoraphidium komarkovae (Nyg.) Komarkova-Legnerova*	+	-	-	-	-	-	-	-	-	+	+
2143	*Monoraphidium minutum (Nag.) Komarkova-Legnerova*	-	-	-	-	-	-	-	-	-	-	-
2145	*Crucigenia quadrata Morr.*	-	-	-	-	-	-	-	-	-	-	-
2164	*Quadrigula closterioides (Bohl.) Printz*	-	-	-	-	-	-	-	-	-	-	-
2167	*Elakatothrix gelatinosa Willen*	-	+	+	-	+	-	-	+	-	+	+
2169	*Planctonema lauterbornii Schmidle*	-	-	-	-	-	-	-	-	-	-	-
2178	*Cosmarium sp.*	-	-	-	-	-	-	-	-	-	-	-
2182	*Euastrum spp.*	-	-	-	-	-	-	-	-	-	-	-
2186	*Xanthidium sp.*	-	-	-	-	-	-	-	-	-	-	-
2187	*Staurodesmus extensus (Andersson) Teiling*	+	-	-	-	-	-	-	-	-	-	+
2191	*Staurodesmus cuspidatus (Brebisson and Ralfs) Teiling*	-	-	-	-	-	-	-	-	-	-	-
2193	*Staurodesmus paradoxum Meyen*	-	-	-	-	-	-	-	-	-	-	-
2195	*Staurodesmus bullardii G.M. Smith*	-	-	-	-	-	-	-	-	-	-	-
2199	*Spondylosium planum (Wolle) W. and G.S. West*	-	-	-	-	-	-	+	-	-	-	-
2204	*Ankyra judai (G.M. Smith) Fott*	-	-	-	-	-	-	-	-	-	-	-
2205	*Mougeotia sp.*	-	-	-	-	-	-	-	+	-	-	-
2206	*Botryococcus braunii Kutzing*	-	-	+	-	-	+	+	+	-	+	+
2215	*Tetraedron caudatum (Corda) Hansgrig*	+	+	-	-	-	+	+	+	+	+	+
2235	*Ankistrodesmus spiralis Lemmermann*	-	+	+	-	-	-	+	+	-	-	-
2247	*Oocystis gigas Archer*	-	-	-	-	-	-	-	+	-	-	-
2252	*Scenedesmus acutus Chodat*	-	-	-	-	-	-	-	-	-	-	-
2509	*Scenedesmus ecornis*	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	Euglenophyte											
3301	*Euglena acus Ehrenberg*	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	Chrysophyte											
4351	*Small chrysophyceae*	+	+	+	+	+	+	+	+	+	+	+
4352	*Large chrysophyceae*	+	+	-	+	+	+	+	+	+	+	+
4355	*Chrysochromulina parva Lackey*	+	-	-	-	-	+	+	-	+	-	+
4357	*Chrysococcus sp.*	+	+	+	+	+	+	+	+	+	+	+
4358	*Chrysostephanospaera globulifera Scherffel*	-	-	-	-	-	+	-	-	+	+	-
4361	*Kephyrion boreale Skuja*	-	-	-	-	-	+	+	+	-	+	+
4362	*Kephyrion sp.*	+	+	+	+	+	+	+	+	+	+	+
4363	*Spiniferomonas sirrata****************	+	-	-	-	-	+	+	+	-	-	-
4364	*Mallomonas caudata Ivanov*	-	-	-	-	-	-	-	-	-	-	-
4367	*Mallomonas duerrschmidtiae Siver, Hamer and Kling*	-	-	-	-	-	-	-	-	-	-	-
4368	*Mallomonas crassisquama (Asmund) Fott*	-	+	-	-	-	-	-	-	-	-	-
4370	*Mallomonas akrokomos Asmund and Kristiansen*	-	-	-	-	-	-	-	-	-	-	-
4372	*Mallomonas tonsurata Teiling and Krieger*	-	-	-	-	-	-	-	-	-	-	-
4375	*Synura sphagnicola Korschikow*	-	-	-	-	-	-	-	-	-	-	-
4378	*Dinobryon borgei Lemmermann*	-	-	+	-	-	+	+	+	-	+	+
4380	*Dinobryon suecicum Lemmermann*	-	-	-	-	-	-	-	-	-	-	-
4381	*Dinobryon mucronutom Nygaard*	+	-	-	-	-	-	+	-	-	+	+
4383	*Dinobryon bavaricum Imhof*	+	-	-	-	-	-	-	-	-	+	+
4384	*Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger*	-	-	-	-	-	-	-	+	-	-	-
4388	*Dinobryon sertularia Ehrenberg*	+	-	-	-	+	+	+	+	+	+	+
4390	*Dinobryon sociale Ehrenberg*	-	+	+	-	-	+	+	+	+	+	-
4394	*Epiphyxis sp.*	+	-	-	-	-	-	-	-	-	+	+
4396	*Chrysolkos skuja (Nauwerck) Willen*	+	-	-	-	+	+	+	+	-	+	+
4400	*Ochromonas sp.*	-	-	-	-	-	-	-	-	-	-	-
4401	*Uroglena volvox Ehrenberg*	-	-	-	-	-	+	+	+	-	-	-
4403	*Chrysosphaerella longispina Lauterborn*	-	-	-	-	-	-	-	-	-	-	-
4411	*Bitrichia chodatii (Reverdin) Chodat*	+	-	-	-	-	-	-	-	-	-	-
4413	*Chrysochromulina laurentiana Kling*	+	+	+	+	+	+	+	+	+	+	+
4414	*Stichogloea spp.*	+	-	-	-	-	-	-	-	+	+	+
4415	*Bicoeca lacustris Clark*	-	-	-	-	-	-	-	-	-	-	-
4418	*Salpingoeca frequentissima (Zach.) Lemmermann*	-	+	+	+	+	-	-	-	-	-	+
4436	*Dinobryon attenatum Hill*	-	-	-	-	-	+	-	+	-	+	-
4437	*Pteridomonas sp.*	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	Diatoms											
5500	*Aulacoseira granulata (Ehrenberg) Simonsen*	-	-	-	-	-	-	-	-	-	-	-
5507	*Cyclotella stelligera Cleve and Grunow*	+	+	+	-	+	+	+	+	-	+	+
5508	*Cyclotella pseudostelligera*	-	-	-	-	-	-	-	-	-	-	-
5509	*Cyclotella ocellata Pant.*	+	+	+	-	-	+	-	+	+	+	+
5511	*Rhizosolenia eriense H.L. Smith*	-	-	-	-	-	-	+	-	-	-	-
5513	*Tabellaria fenestrata (Lyngbye) Kutzing*	-	-	-	-	-	-	-	-	-	-	-
5514	*Tabellaria flocculsa (Roth) Kutzing*	+	-	-	+	-	+	-	-	-	-	-
5515	*Fragilaria crotonensis Kitton*	-	-	-	-	-	-	-	-	-	-	-
5518	*Synedra acus Kutzing*	+	+	+	-	+	+	+	+	+	+	+
5523	*Synedra ulna (Nitzsch) Ehrenberg*	-	-	-	-	-	-	-	-	-	-	-
5524	*Asterionella formosa Hassall*	-	-	-	-	-	-	-	-	+	-	-
5540	*Aulacoseira italica v subarctica (O. Muller) Simonsen*	-	-	-	-	-	-	-	-	-	-	-
5551	*Cyclotella michiganiana Skvortzow*	+	+	+	+	+	+	+	+	+	+	+
5720	*Cyclotella bodanica Eulenst.*	-	-	-	-	-	-	-	-	-	-	-
5768	*Nitzschia linearis W. Smith*	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	Crytophyte											
6554	*Rhodomonas minuta Skuja*	+	+	+	+	+	+	+	+	+	+	+
6558	*Cryptomonas erosa Ehrenberg*	+	+	+	+	+	+	+	+	+	+	+
6562	*Cryptomonas reflexa (Marsson) Skuja*	-	-	-	-	-	-	-	-	-	-	-
6565	*Cryptomonas rostratiformis Skuja*	+	-	-	-	-	+	+	+	+	+	+
6568	*Katablepharis ovalis Skuja*	-	-	-	-	-	+	+	+	+	+	+
		-	-	-	-	-	-	-	-	-	-	-
	Dinoflagellates											
7631	*Gymnodinium helveticum Penard*	+	+	+	-	-	+	-	-	+	-	+
7632	*Gymnodinium sp.*	+	-	-	+	+	+	+	+	+	+	+
7635	*Peridinium willei Huitfeldt-Kaas*	-	-	-	-	-	-	-	-	+	-	-
7639	*Peridinium pusillum (Penard) Lemmermann*	-	-	-	-	+	+	+	+	+	+	+
7641	*Peridinium aciculiferum Lemmermann*	-	-	-	-	-	+	-	+	+	-	-
	Taxa Richness per Sample	**31**	**20**	**20**	**13**	**17**	**34**	**30**	**32**	**26**	**32**	**34**

Appendix B. Presence (+) / Absence (-) matrix of phytoplankton species in Meadowbank study lakes and Baker Lake, 2016.

	Area-Replicate ID	TPN-98S	TPN-99S	TPS-55S	TPS-56S	WAL-59S	WAL-60S	WAL-61S	WAL-62S	WAL-63S	WAL-64S	WAL-65S
Code	Species Name	30-Nov-16	30-Nov-16	21-Apr-16	21-Apr-16	18-Apr-16	18-Apr-16	10-Jul-16	10-Jul-16	5-Aug-16	5-Aug-16	4-Sep-16
	Cyanophyte											
1008	*Aphanocapsa sp.*	-	-	-	-	-	-	+	-	-	+	-
1012	*Aphanothece sp.*	-	-	-	-	-	-	-	-	-	-	-
1014	*Chroococcus limneticus Lemmermann*	-	-	-	-	-	-	-	-	-	-	-
1054	*Planktolyngbya limnetica*	-	-	-	-	-	-	-	-	-	+	+
1073	*Snowella sp*	-	-	-	-	-	-	-	-	-	-	-
1077	*Pseudoanabaena sp.*	-	-	-	-	-	-	-	-	-	-	-
1089	*Cyanodictyon sp.*	-	-	-	-	-	-	-	-	-	-	-
1129	*Planktothrix*	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	Chlorophyte											
2100	*Pyramidomonas tetrarhynchus Schmarda*	-	-	-	-	-	+	-	-	-	-	-
2101	*Carteria spp.*	-	-	-	-	-	-	-	-	-	-	-
2105	*Chlamydomonas spp.*	-	-	+	-	+	-	+	+	+	+	+
2107	*Chlorogonium maximum Skuja*	-	-	-	-	-	-	-	-	-	-	-
2112	*Sphaerocystis schroeteri Chodat*	-	-	-	-	-	-	+	-	+	+	-
2121	*Oocystis lacustris Chodat*	+	+	-	-	-	-	-	+	+	+	+
2126	*Chodatella sp.*	-	-	-	-	-	-	-	-	-	-	-
2137	*Dictyosphaerium simplex Sukja*	-	-	+	+	-	+	+	+	+	+	+
2138	*Monoraphidium komarkovae (Nyg.) Komarkova-Legnerova*	-	-	+	+	-	-	-	-	-	-	+
2143	*Monoraphidium minutum (Nag.) Komarkova-Legnerova*	-	-	-	-	-	-	-	-	-	+	+
2145	*Crucigenia quadrata Morr.*	-	-	-	-	-	-	-	-	-	+	-
2164	*Quadrigula closterioides (Bohl.) Printz*	-	-	-	-	-	-	-	-	-	-	-
2167	*Elakatothrix gelatinosa Willen*	+	-	+	+	-	-	+	-	+	+	+
2169	*Planctonema lauterbornii Schmidle*	-	-	-	-	-	-	-	-	+	-	-
2178	*Cosmarium sp.*	-	-	-	-	-	-	+	-	+	+	-
2182	*Euastrum spp.*	-	-	-	-	-	-	-	+	-	-	-
2186	*Xanthidium sp.*	-	-	-	-	-	-	-	-	-	-	-
2187	*Staurodesmus extensus (Andersson) Teiling*	+	-	-	-	-	-	-	-	+	+	+
2191	*Staurodesmus cuspidatus (Brebisson and Ralfs) Teiling*	-	-	-	-	-	-	-	-	-	-	+
2193	*Staurodesmus paradoxum Meyen*	-	-	-	-	-	-	-	-	-	-	-
2195	*Staurodesmus bullardii G.M. Smith*	-	-	-	-	-	-	-	-	-	-	-
2199	*Spondylosium planum (Wolle) W. and G.S. West*	-	-	-	-	-	-	+	+	-	-	+
2204	*Ankyra judai (G.M. Smith) Fott*	-	-	-	-	-	-	-	-	-	-	-
2205	*Mougeotia sp.*	-	-	-	-	-	-	-	-	-	-	-
2206	*Botryococcus braunii Kutzing*	-	-	-	+	-	-	+	+	+	-	+
2215	*Tetraedron caudatum (Corda) Hansgrig*	-	-	-	-	-	+	+	+	+	+	+
2235	*Ankistrodesmus spiralis Lemmermann*	+	+	-	-	-	-	+	-	+	+	+
2247	*Oocystis gigas Archer*	-	-	-	-	-	-	-	+	-	-	-
2252	*Scenedesmus acutus Chodat*	-	-	-	-	-	-	-	-	-	-	-
2509	*Scenedesmus ecornis*	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	Euglenophyte											
3301	*Euglena acus Ehrenberg*	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	Chrysophyte											
4351	*Small chrysophyceae*	+	+	+	+	+	+	+	+	+	+	+
4352	*Large chrysophyceae*	+	-	+	+	+	+	+	+	+	+	+
4355	*Chrysochromulina parva Lackey*	-	-	-	-	-	-	+	+	+	-	+
4357	*Chrysococcus sp.*	+	+	+	+	+	+	+	+	+	+	+
4358	*Chrysostephanospaera globulifera Scherffel*	-	-	-	-	-	-	+	-	+	+	+
4361	*Kephyrion boreale Skuja*	-	-	-	-	-	-	+	-	-	-	+
4362	*Kephyrion sp.*	+	+	+	+	+	+	+	+	+	+	+
4363	*Spiniferomonas sirrata****************	-	-	-	-	-	-	+	+	+	-	+
4364	*Mallomonas caudata Ivanov*	-	-	-	-	-	-	-	+	-	-	-
4367	*Mallomonas duerrschmidtiae Siver, Hamer and Kling*	-	-	-	-	-	-	-	-	-	-	-
4368	*Mallomonas crassisquama (Asmund) Fott*	-	-	-	+	-	-	-	+	+	+	+
4370	*Mallomonas akrokomos Asmund and Kristiansen*	-	-	-	-	-	-	-	-	-	-	-
4372	*Mallomonas tonsurata Teiling and Krieger*	-	-	-	-	-	-	-	-	-	-	-
4375	*Synura sphagnicola Korschikow*	-	-	-	-	-	-	-	-	-	-	-
4378	*Dinobryon borgei Lemmermann*	-	+	-	-	-	-	+	+	+	+	+
4380	*Dinobryon suecicum Lemmermann*	-	-	-	-	-	-	-	-	-	-	-
4381	*Dinobryon mucronutom Nygaard*	-	-	-	-	-	-	+	+	+	+	+
4383	*Dinobryon bavaricum Imhof*	-	-	-	-	-	-	+	+	+	+	+
4384	*Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger*	-	-	-	-	-	-	-	-	-	-	-
4388	*Dinobryon sertularia Ehrenberg*	+	+	-	-	-	-	+	+	+	+	-
4390	*Dinobryon sociale Ehrenberg*	+	+	+	-	-	-	+	+	+	+	+
4394	*Epiphyxis sp.*	-	-	-	-	-	-	+	+	-	-	+
4396	*Chrysolkos skuja (Nauwerck) Willen*	-	+	+	+	+	-	+	+	-	-	+
4400	*Ochromonas sp.*	-	-	-	+	+	+	-	-	-	-	-
4401	*Uroglena volvox Ehrenberg*	-	-	-	-	-	-	+	+	+	+	-
4403	*Chrysosphaerella longispina Lauterborn*	-	-	-	-	-	-	-	-	-	-	-
4411	*Bitrichia chodatii (Reverdin) Chodat*	-	-	-	-	-	-	-	-	-	-	-
4413	*Chrysochromulina laurentiana Kling*	-	-	-	-	-	-	+	+	+	+	+
4414	*Stichogloea spp.*	-	-	-	-	-	-	-	-	+	-	+
4415	*Bicoeca lacustris Clark*	-	-	-	-	-	-	-	-	-	-	-
4418	*Salpingoeca frequentissima (Zach.) Lemmermann*	-	-	+	+	+	+	-	-	-	-	+
4436	*Dinobryon attenatum Hill*	-	-	-	-	-	-	-	-	-	-	-
4437	*Pteridomonas sp.*	-	-	-	-	-	-	+	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	Diatoms											
5500	*Aulacoseira granulata (Ehrenberg) Simonsen*	-	-	-	-	-	-	-	-	-	-	-
5507	*Cyclotella stelligera Cleve and Grunow*	-	-	-	-	-	-	+	+	+	+	+
5508	*Cyclotella pseudostelligera*	-	-	-	-	-	-	-	-	-	-	-
5509	*Cyclotella ocellata Pant.*	+	+	-	-	+	-	+	+	+	+	+
5511	*Rhizosolenia eriense H.L. Smith*	-	-	-	-	-	-	+	+	-	-	+
5513	*Tabellaria fenestrata (Lyngbye) Kutzing*	-	-	-	-	-	-	-	-	-	-	-
5514	*Tabellaria flocculsa (Roth) Kutzing*	-	-	-	-	-	-	-	-	-	-	+
5515	*Fragilaria crotonensis Kitton*	-	-	-	-	-	-	-	-	-	-	-
5518	*Synedra acus Kutzing*	+	+	+	+	+	+	+	+	+	+	+
5523	*Synedra ulna (Nitzsch) Ehrenberg*	+	+	-	-	-	-	-	+	-	-	-
5524	*Asterionella formosa Hassall*	-	-	-	-	+	+	-	-	-	-	-
5540	*Aulacoseira italica v subarctica (O. Muller) Simonsen*	-	-	-	-	-	-	-	-	-	-	-
5551	*Cyclotella michiganiana Skvortzow*	+	+	+	+	+	+	+	-	+	+	+
5720	*Cyclotella bodanica Eulenst.*	-	-	-	-	-	-	+	-	+	+	-
5768	*Nitzschia linearis W. Smith*	-	-	-	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-	-	-	-
	Crytophyte											
6554	*Rhodomonas minuta Skuja*	+	+	+	+	+	+	+	+	+	+	+
6558	*Cryptomonas erosa Ehrenberg*	+	+	+	+	+	+	+	+	+	+	+
6562	*Cryptomonas reflexa (Marsson) Skuja*	-	-	-	-	-	-	-	-	-	-	+
6565	*Cryptomonas rostratiformis Skuja*	-	-	-	-	+	+	+	+	+	+	+
6568	*Katablepharis ovalis Skuja*	-	-	-	-	-	+	+	+	+	+	+
		-	-	-	-	-	-	-	-	-	-	-
	Dinoflagellates											
7631	*Gymnodinium helveticum Penard*	+	-	-	-	-	-	-	-	-	-	-
7632	*Gymnodinium sp.*	-	+	+	+	-	-	+	+	+	+	+
7635	*Peridinium willei Huitfeldt-Kaas*	-	+	-	-	-	-	-	-	-	-	-
7639	*Peridinium pusillum (Penard) Lemmermann*	-	-	+	+	+	-	+	+	+	+	+
7641	*Peridinium aciculiferum Lemmermann*	-	-	-	-	-	-	-	+	-	-	-
	Taxa Richness per Sample	**17**	**17**	**17**	**18**	**16**	**16**	**40**	**37**	**38**	**37**	**44**

Appendix B. Presence (+) / Absence (-) matrix of phytoplankton species in Meadowbank study lakes and Baker Lake, 2016.

Code	Species Name (Area-Replicate ID)	WAL-66S 4-Sep-16	WAL-67S 30-Nov-16	WAL-68S 30-Nov-16
	Cyanophyte			
1008	*Aphanocapsa sp.*	-	-	-
1012	*Aphanothece sp.*	-	-	-
1014	*Chroococcus limneticus Lemmermann*	-	-	-
1054	*Planktolyngbya limnetica*	-	-	-
1073	*Snowella sp*	-	-	-
1077	*Pseudoanabaena sp.*	-	-	-
1089	*Cyanodictyon sp.*	-	-	-
1129	*Planktothrix*	-	-	-
		-	-	-
	Chlorophyte			
2100	*Pyramidomonas tetrarhynchus Schmarda*	-	-	-
2101	*Carteria spp.*	-	-	-
2105	*Chlamydomonas spp.*	+	-	-
2107	*Chlorogonium maximum Skuja*	-	-	-
2112	*Sphaerocystis schroeteri Chodat*	+	+	+
2121	*Oocystis lacustris Chodat*	+	+	+
2126	*Chodatella sp.*	-	-	-
2137	*Dictyosphaerium simplex Sukja*	+	-	-
2138	*Monoraphidium komarkovae (Nyg.) Komarkova-Legnerova*	+	-	-
2143	*Monoraphidium minutum (Nag.) Komarkova-Legnerova*	+	-	-
2145	*Crucigenia quadrata Morr.*	-	-	-
2164	*Quadrigula closterioides (Bohl.) Printz*	+	-	-
2167	*Elakatothrix gelatinosa Willen*	-	-	-
2169	*Planctonema lauterbornii Schmidle*	-	-	-
2178	*Cosmarium sp.*	+	-	-
2182	*Euastrum spp.*	+	-	-
2186	*Xanthidium sp.*	-	-	-
2187	*Staurodesmus extensus (Andersson) Teiling*	+	-	-
2191	*Staurodesmus cuspidatus (Brebisson and Ralfs) Teiling*	-	-	-
2193	*Staurodesmus paradoxum Meyen*	-	-	-
2195	*Staurodesmus bullardii G.M. Smith*	-	-	-
2199	*Spondylosium planum (Wolle) W. and G.S. West*	+	-	-
2204	*Ankyra judai (G.M. Smith) Fott*	-	-	-
2205	*Mougeotia sp.*	-	-	-
2206	*Botryococcus braunii Kutzing*	+	+	+
2215	*Tetraedron caudatum (Corda) Hansgrig*	+	-	-
2235	*Ankistrodesmus spiralis Lemmermann*	+	+	+
2247	*Oocystis gigas Archer*	-	-	-
2252	*Scenedesmus acutus Chodat*	-	-	-
2509	*Scenedesmus ecornis*	-	-	-
		-	-	-
	Euglenophyte			
3301	*Euglena acus Ehrenberg*	-	-	-
		-	-	-
	Chrysophyte			
4351	*Small chrysophyceae*	+	+	+
4352	*Large chrysophyceae*	+	+	-
4355	*Chrysochromulina parva Lackey*	+	-	-
4357	*Chrysococcus sp.*	+	+	+
4358	*Chrysostephanospaera globulifera Scherffel*	-	-	-
4361	*Kephyrion boreale Skuja*	-	-	+
4362	*Kephyrion sp.*	+	-	-
4363	*Spiniferomonas sirrata****************	+	-	-
4364	*Mallomonas caudata Ivanov*	-	-	-
4367	*Mallomonas duerrschmidtiae Siver, Hamer and Kling*	-	-	-
4368	*Mallomonas crassisquama (Asmund) Fott*	+	-	+
4370	*Mallomonas akrokomos Asmund and Kristiansen*	-	-	-
4372	*Mallomonas tonsurata Teiling and Krieger*	-	-	-
4375	*Synura sphagnicola Korschikow*	-	-	-
4378	*Dinobryon borgei Lemmermann*	+	-	-
4380	*Dinobryon suecicum Lemmermann*	-	-	-
4381	*Dinobryon mucronutom Nygaard*	+	-	-
4383	*Dinobryon bavaricum Imhof*	+	-	-
4384	*Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger*	-	-	-
4388	*Dinobryon sertularia Ehrenberg*	-	-	-
4390	*Dinobryon sociale Ehrenberg*	+	+	+
4394	*Epiphyxis sp.*	+	-	-
4396	*Chrysolkos skuja (Nauwerck) Willen*	+	-	-
4400	*Ochromonas sp.*	-	-	-
4401	*Uroglena volvox Ehrenberg*	-	-	-
4403	*Chrysosphaerella longispina Lauterborn*	-	-	-
4411	*Bitrichia chodatii (Reverdin) Chodat*	+	-	-
4413	*Chrysochromulina laurentiana Kling*	+	+	+
4414	*Stichogloea spp.*	+	-	-
4415	*Bicoeca lacustris Clark*	-	-	-
4418	*Salpingoeca frequentissima (Zach.) Lemmermann*	+	+	+
4436	*Dinobryon attenatum Hill*	-	-	-
4437	*Pteridomonas sp.*	-	-	-
		-	-	-
	Diatoms			
5500	*Aulacoseira granulata (Ehrenberg) Simonsen*	-	-	-
5507	*Cyclotella stelligera Cleve and Grunow*	+	+	+
5508	*Cyclotella pseudostelligera*	-	-	-
5509	*Cyclotella ocellata Pant.*	+	+	+
5511	*Rhizosolenia eriense H.L. Smith*	+	-	+
5513	*Tabellaria fenestrata (Lyngbye) Kutzing*	-	-	-
5514	*Tabellaria flocculsa (Roth) Kutzing*	+	-	-
5515	*Fragilaria crotonensis Kitton*	-	-	-
5518	*Synedra acus Kutzing*	+	+	+
5523	*Synedra ulna (Nitzsch) Ehrenberg*	-	+	-
5524	*Asterionella formosa Hassall*	-	-	-
5540	*Aulacoseira italica v subarctica (O. Muller) Simonsen*	-	-	-
5551	*Cyclotella michiganiana Skvortzow*	+	+	+
5720	*Cyclotella bodanica Eulenst.*	-	-	-
5768	*Nitzschia linearis W. Smith*	-	-	-
		-	-	-
	Crytophyte			
6554	*Rhodomonas minuta Skuja*	+	+	+
6558	*Cryptomonas erosa Ehrenberg*	+	+	+
6562	*Cryptomonas reflexa (Marsson) Skuja*	+	-	-
6565	*Cryptomonas rostratiformis Skuja*	+	-	-
6568	*Katablepharis ovalis Skuja*	+	-	-
		-	-	-
	Dinoflagellates			
7631	*Gymnodinium helveticum Penard*	-	-	+
7632	*Gymnodinium sp.*	+	-	-
7635	*Peridinium willei Huitfeldt-Kaas*	-	+	-
7639	*Peridinium pusillum (Penard) Lemmermann*	+	-	-
7641	*Peridinium aciculiferum Lemmermann*	-	-	-
	Taxa Richness per Sample	**44**	**18**	**19**

APPENDIX C

Phytoplankton Plots

APPENDIX C1

Meadowbank Phytoplankton Plots 2006 – 2016

LIST OF FIGURES – APPENDIX C1

Figure C1–1. Total phytoplankton density (cells/L) from Meadowbank study lakes since 2006.

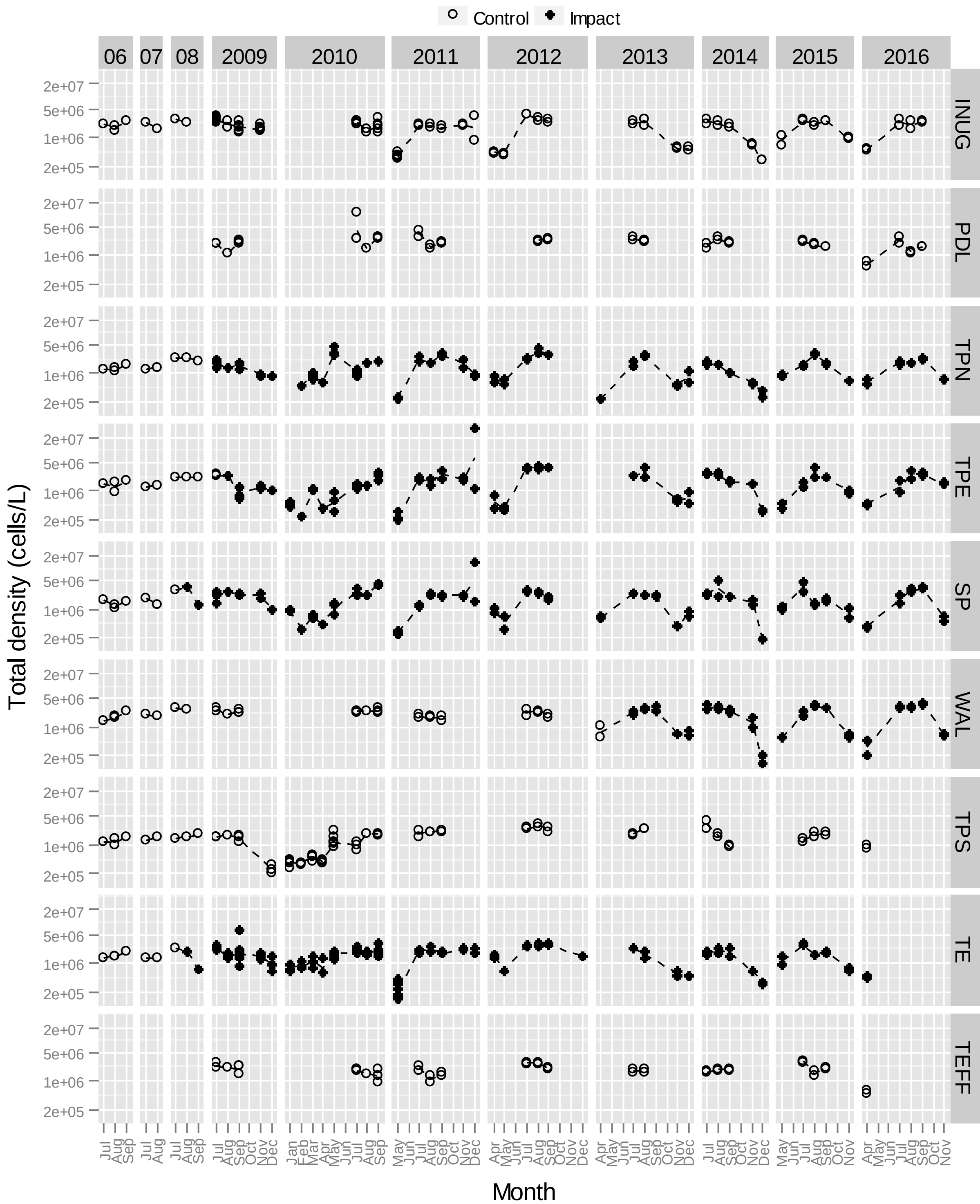


Figure C1–2. Cyanophyte biomass (mg/m^3) from Meadowbank study lakes since 2006.

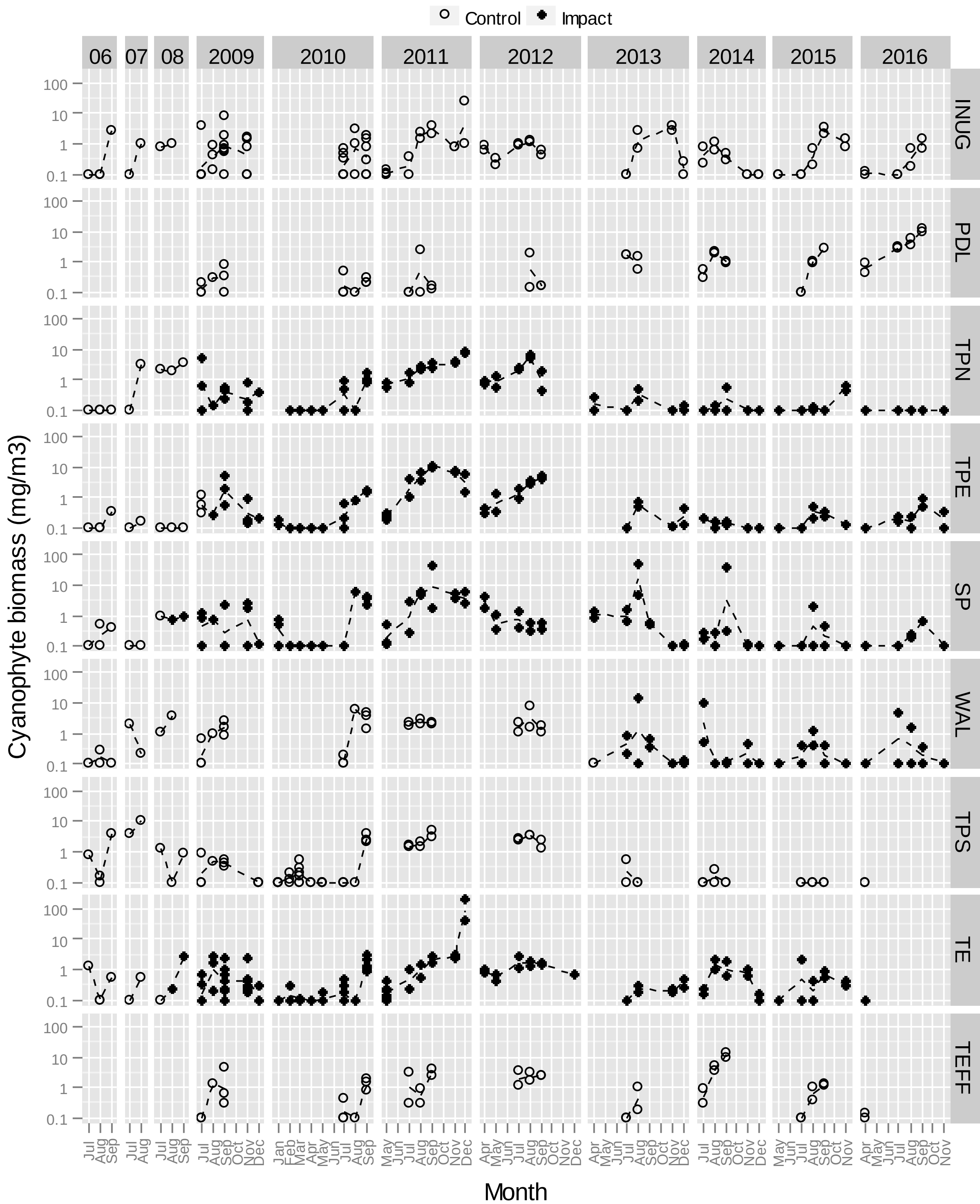


Figure C1–3. Chlorophyte biomass (mg/m^3) from Meadowbank study lakes since 2006.

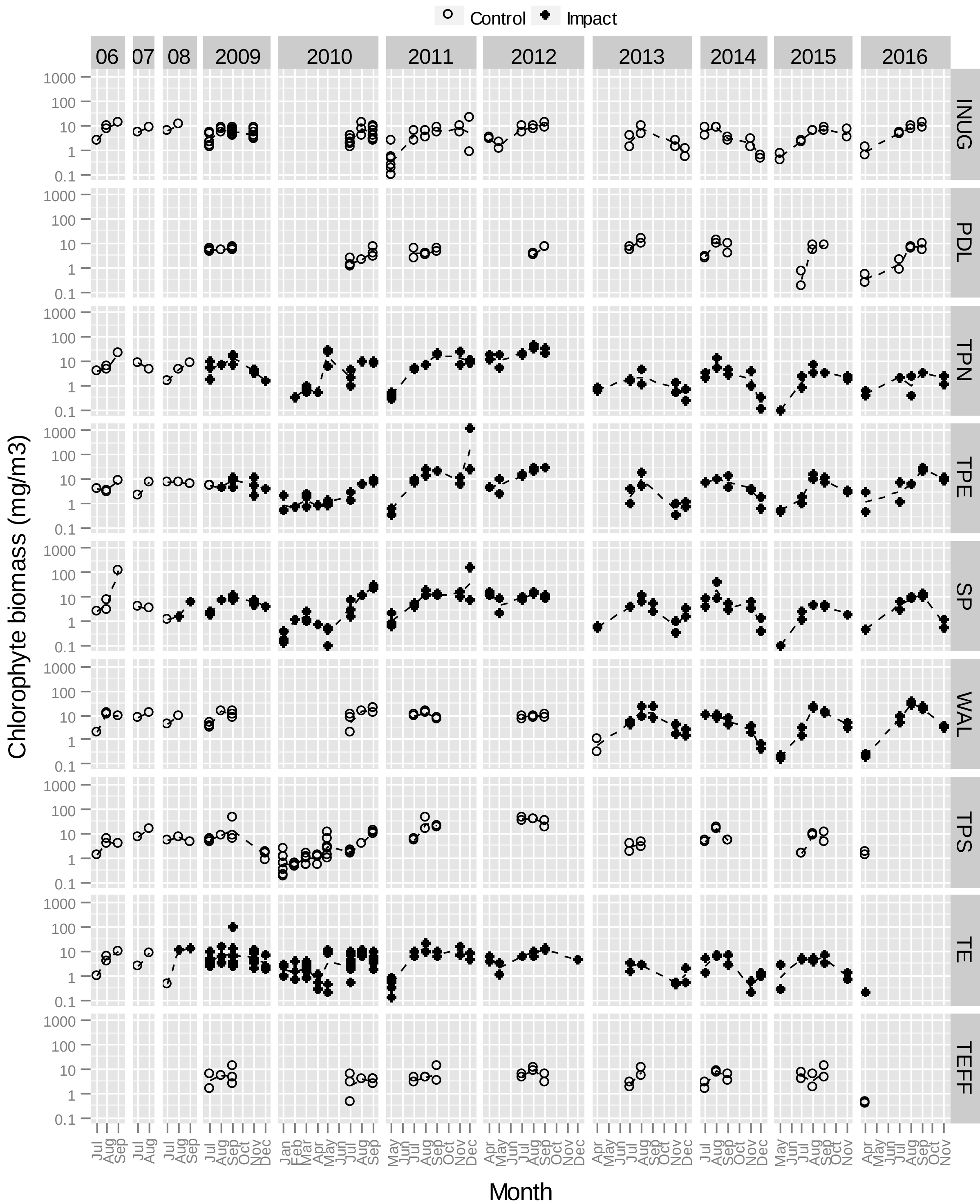


Figure C1–4. Chrysophyte biomass (mg/m^3) from Meadowbank study lakes since 2006.

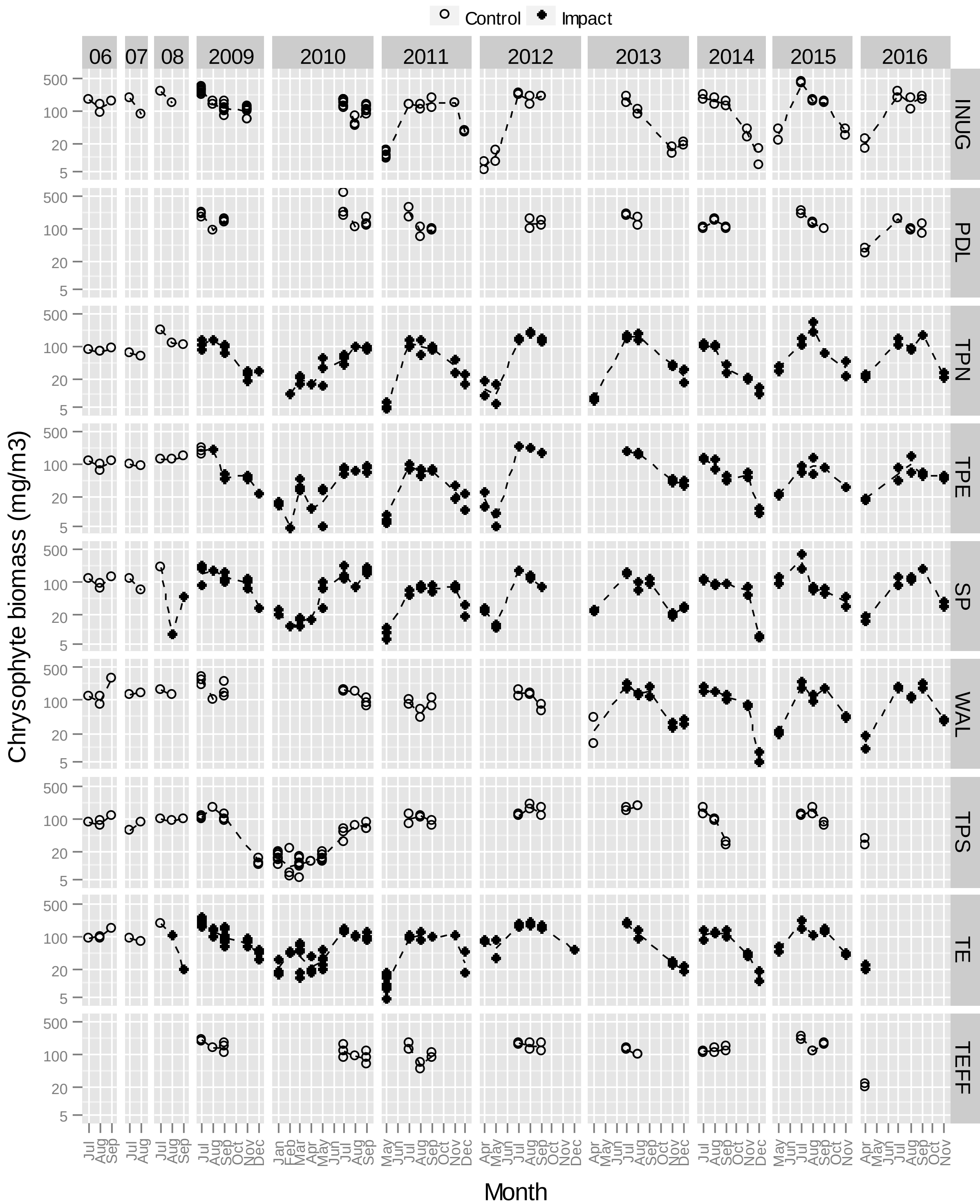


Figure C1–5. Diatom biomass (mg/m^3) from Meadowbank study lakes since 2006.

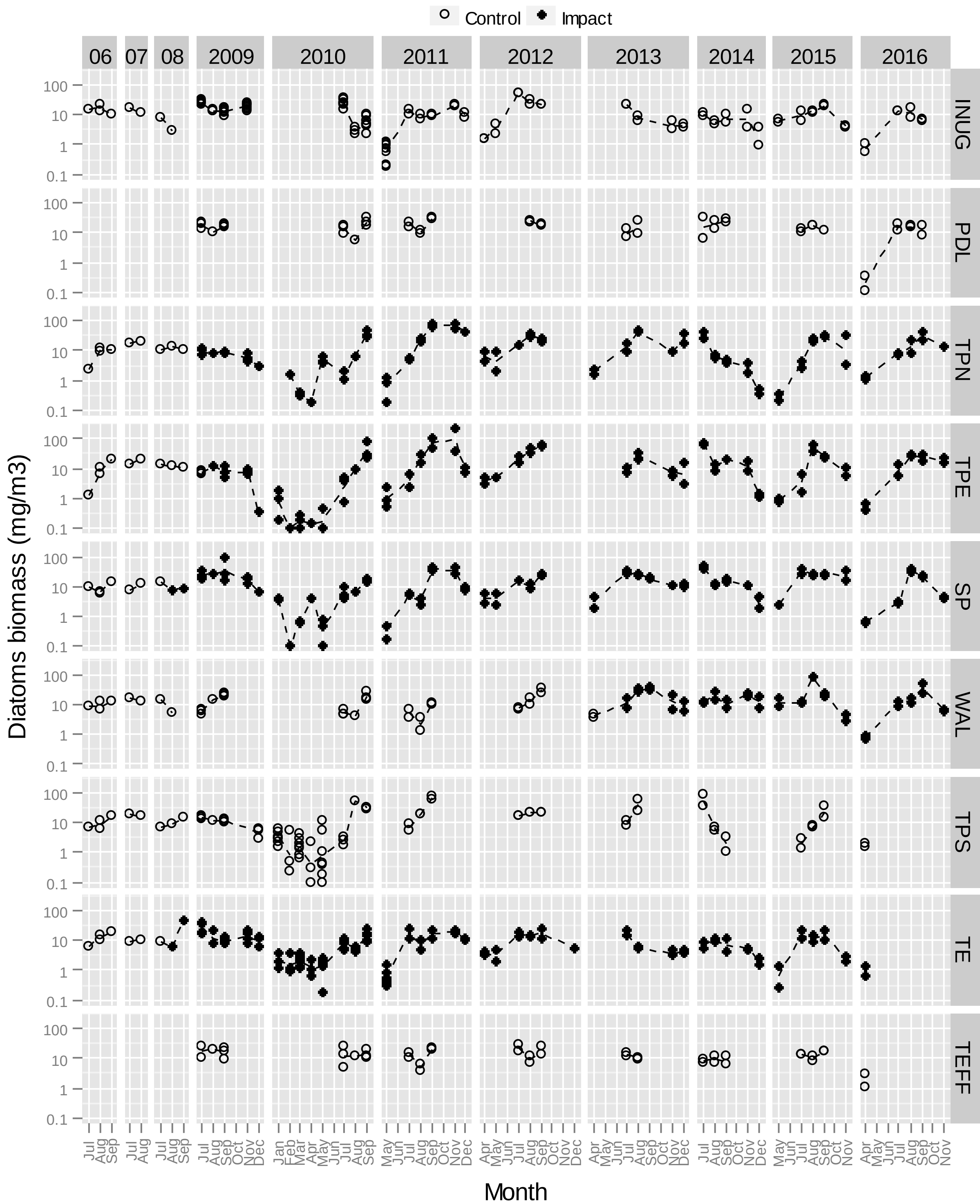


Figure C1–6. Cryptophyte biomass (mg/m³) from Meadowbank study lakes since 2006.

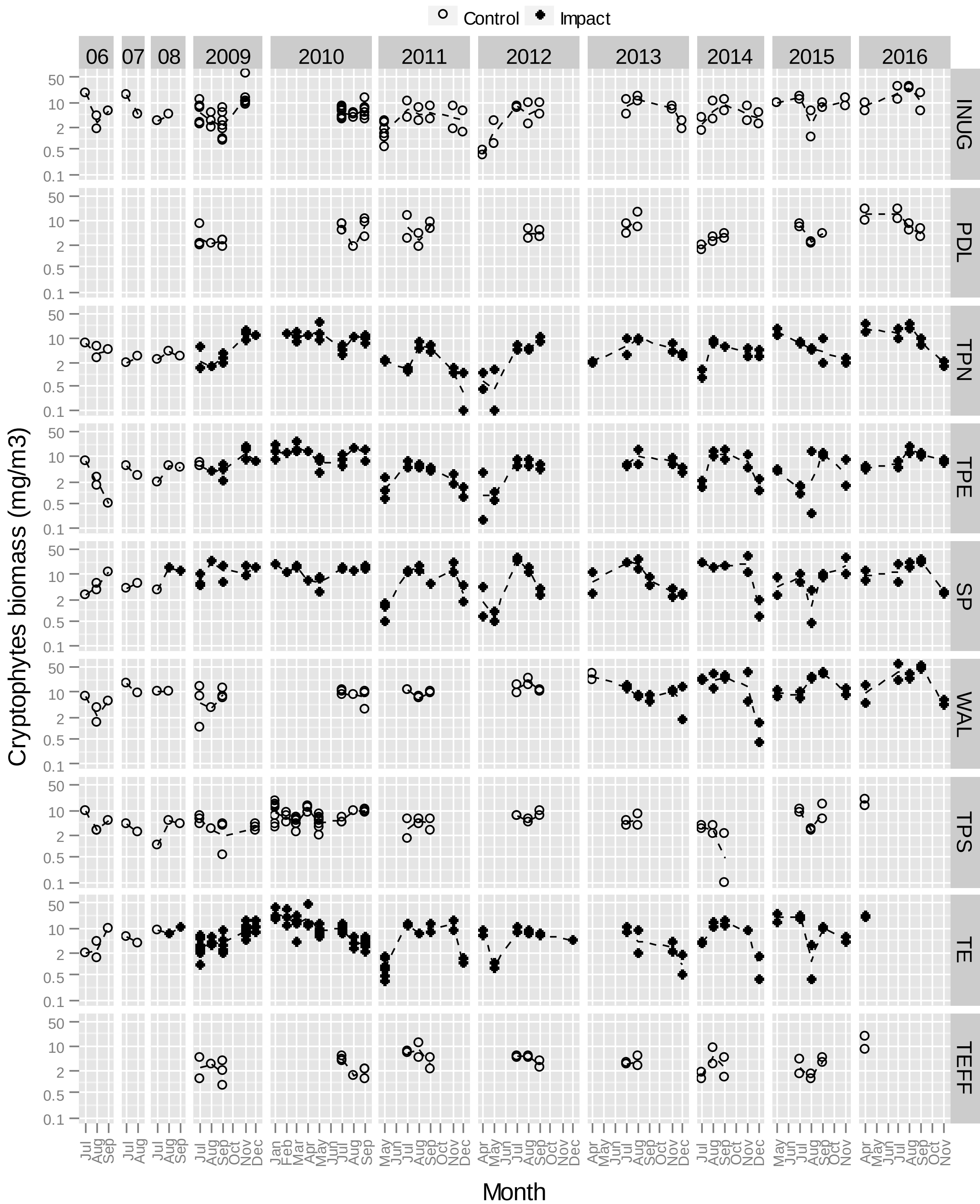


Figure C1–7. Dinoflagellate biomass (mg/m³) from Meadowbank study lakes since 2006.

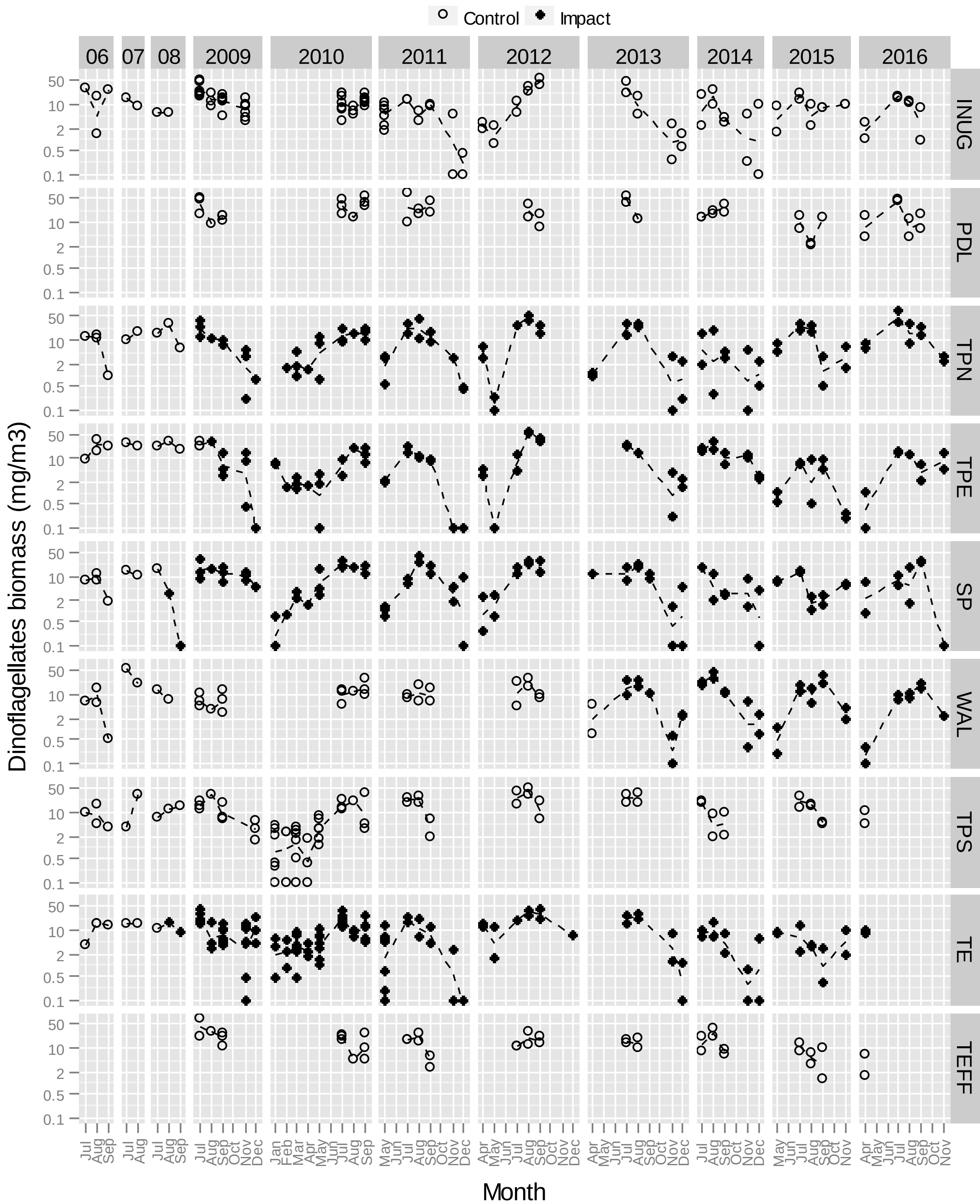


Figure C1–8. Phytoplankton density (cells/L) by major taxa group from Meadowbank study lakes since 2006.

Figure C1–9. Relative phytoplankton density by major taxa group from Meadowbank study lakes since 2006.

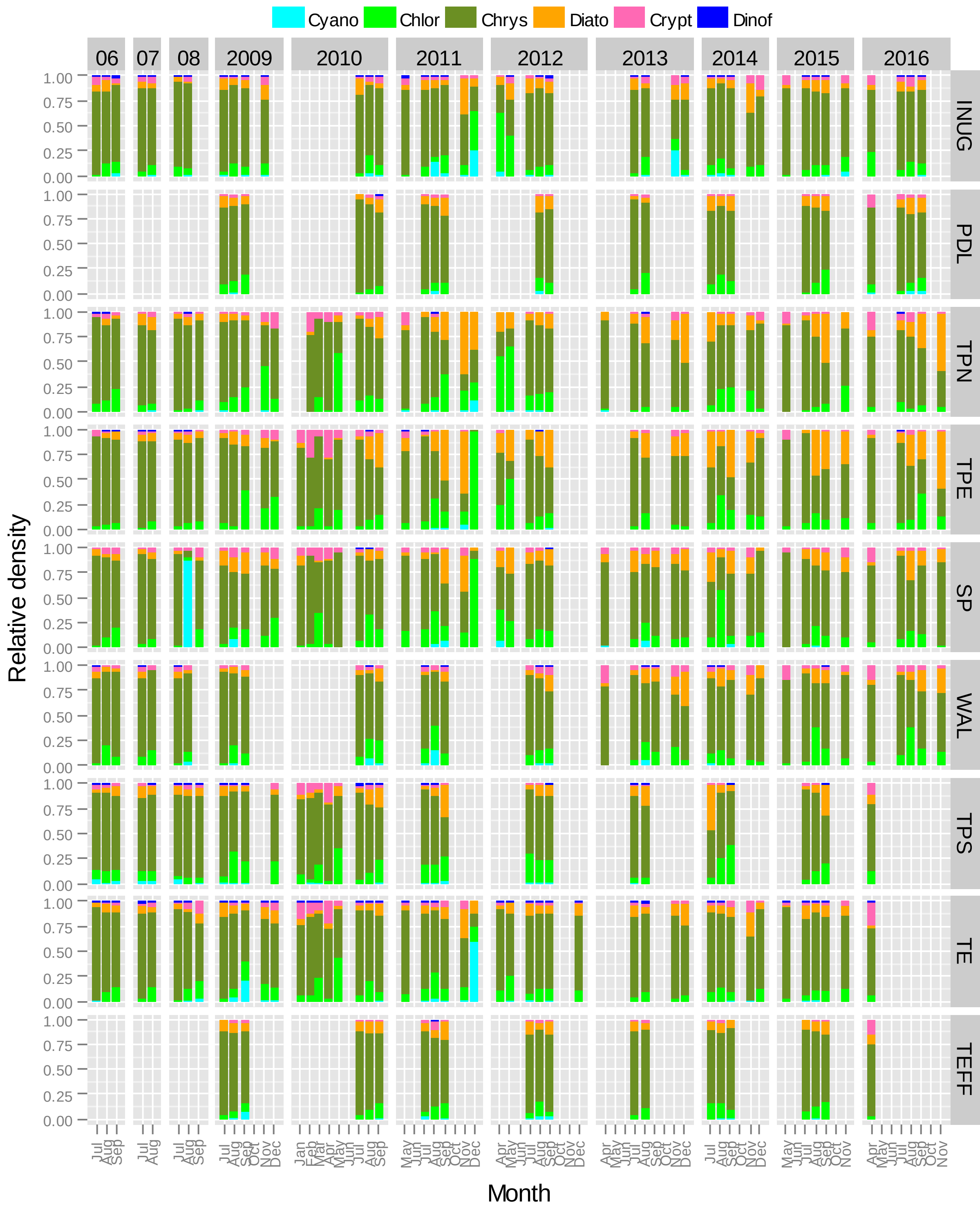


Figure C1–10. Cyanophyte density (cells/L) from Meadowbank study lakes since 2006.

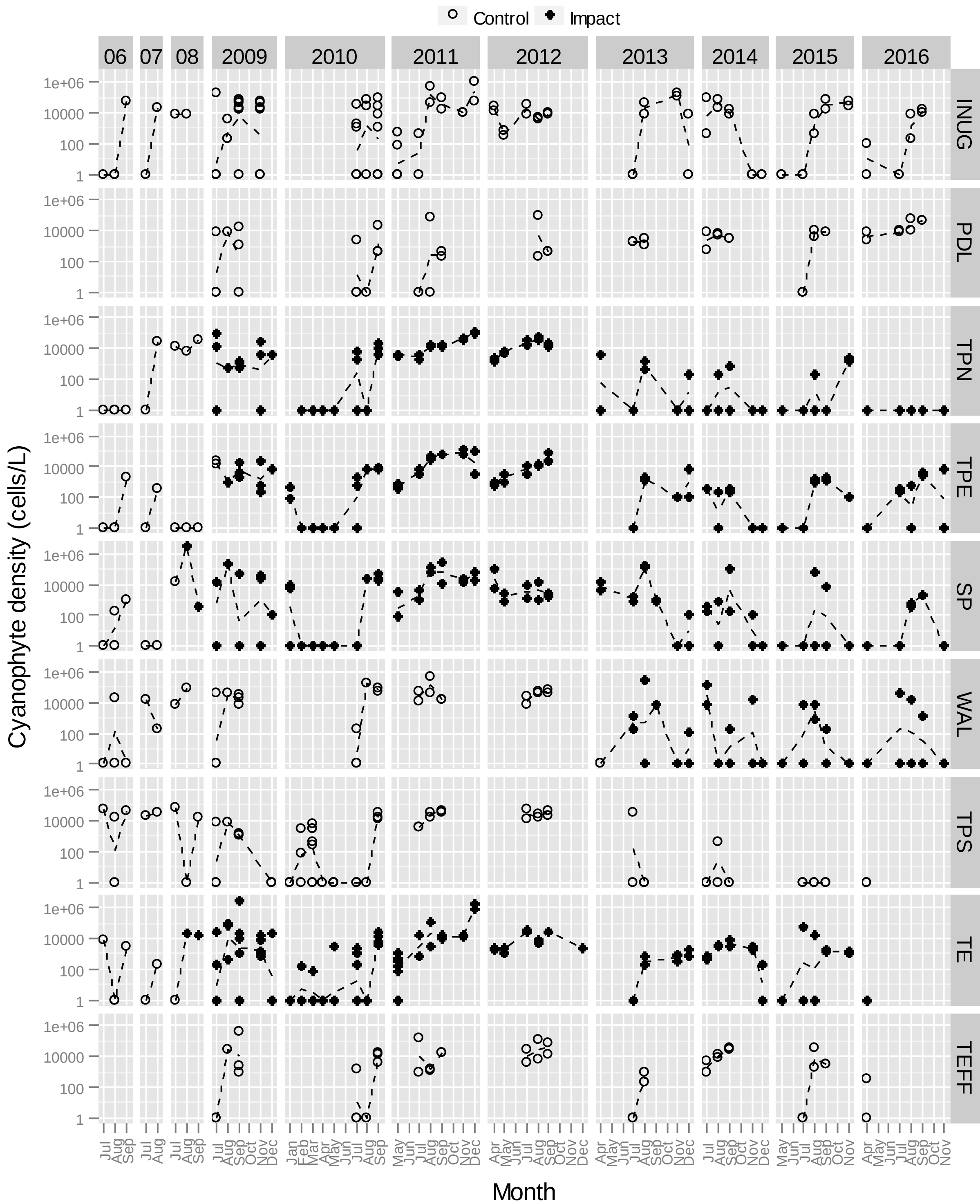


Figure C1–11. Chlorophyte density (cells/L) from Meadowbank study lakes since 2006.

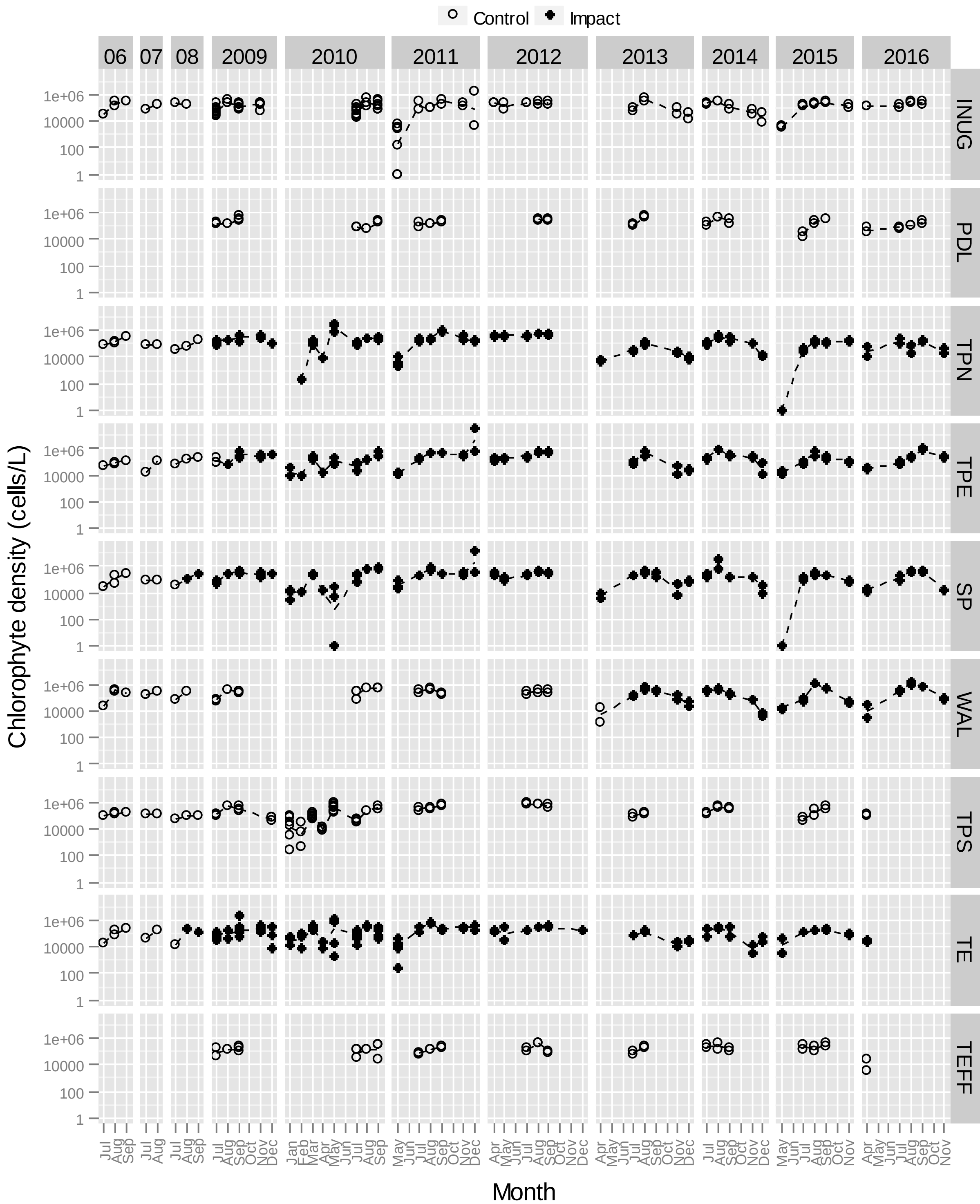


Figure C1–12. Chrysophyte density (cells/L) from Meadowbank study lakes since 2006.

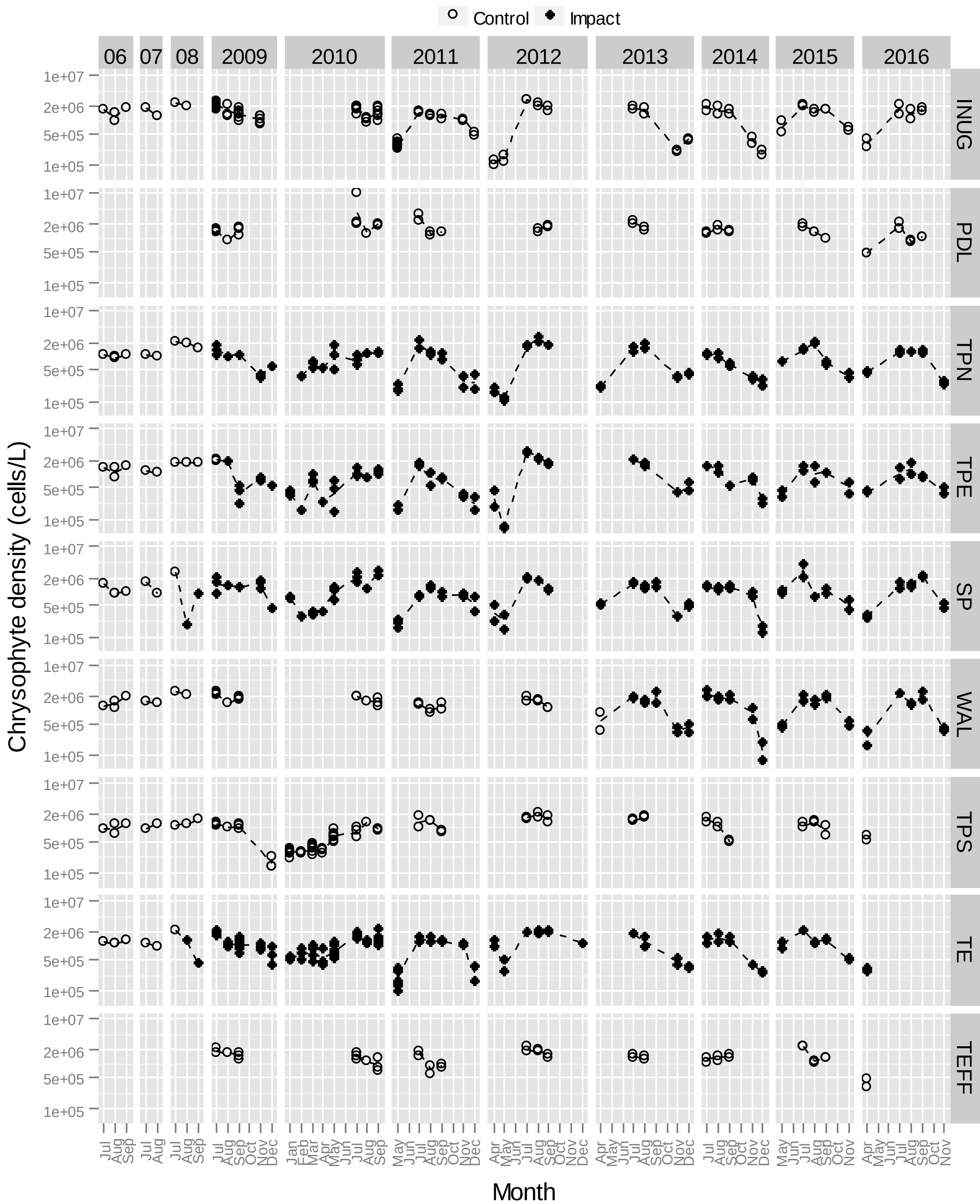


Figure C1–13. Diatom density (cells/L) from Meadowbank study lakes since 2006.

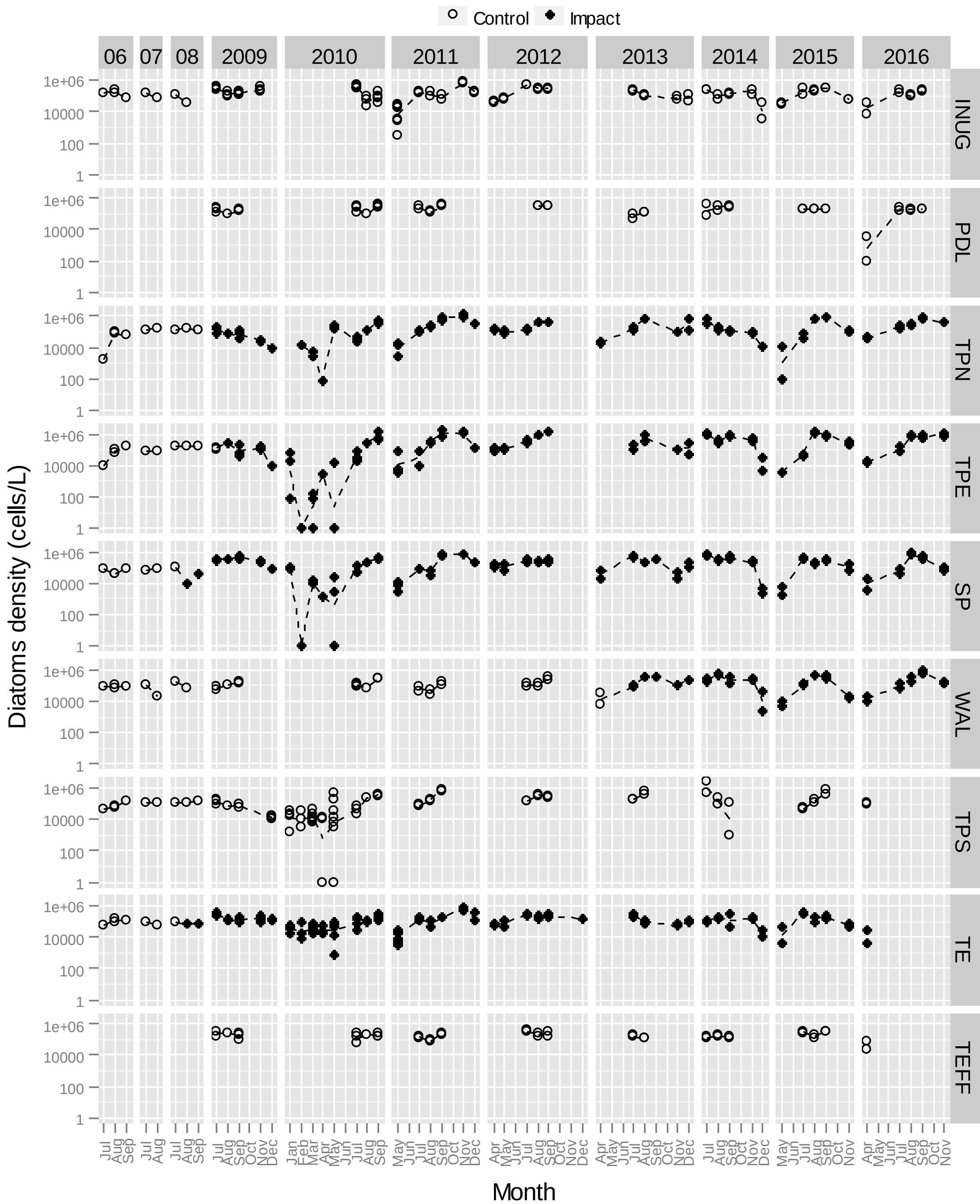


Figure C1–14. Cryptophytes density (cells/L) from Meadowbank study lakes since 2006.

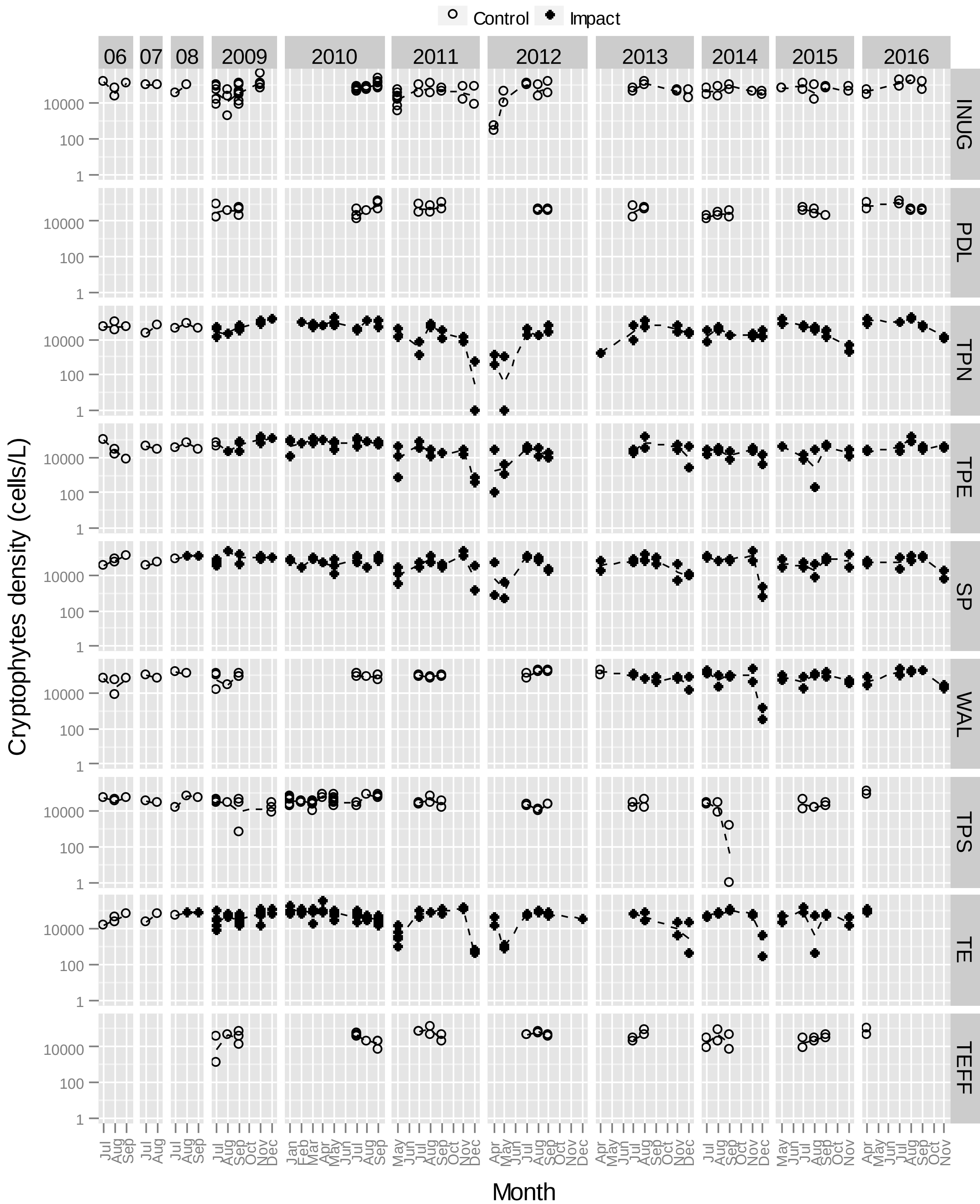


Figure C1–15. Dinoflagellates density (cells/L) from Meadowbank study lakes since 2006.

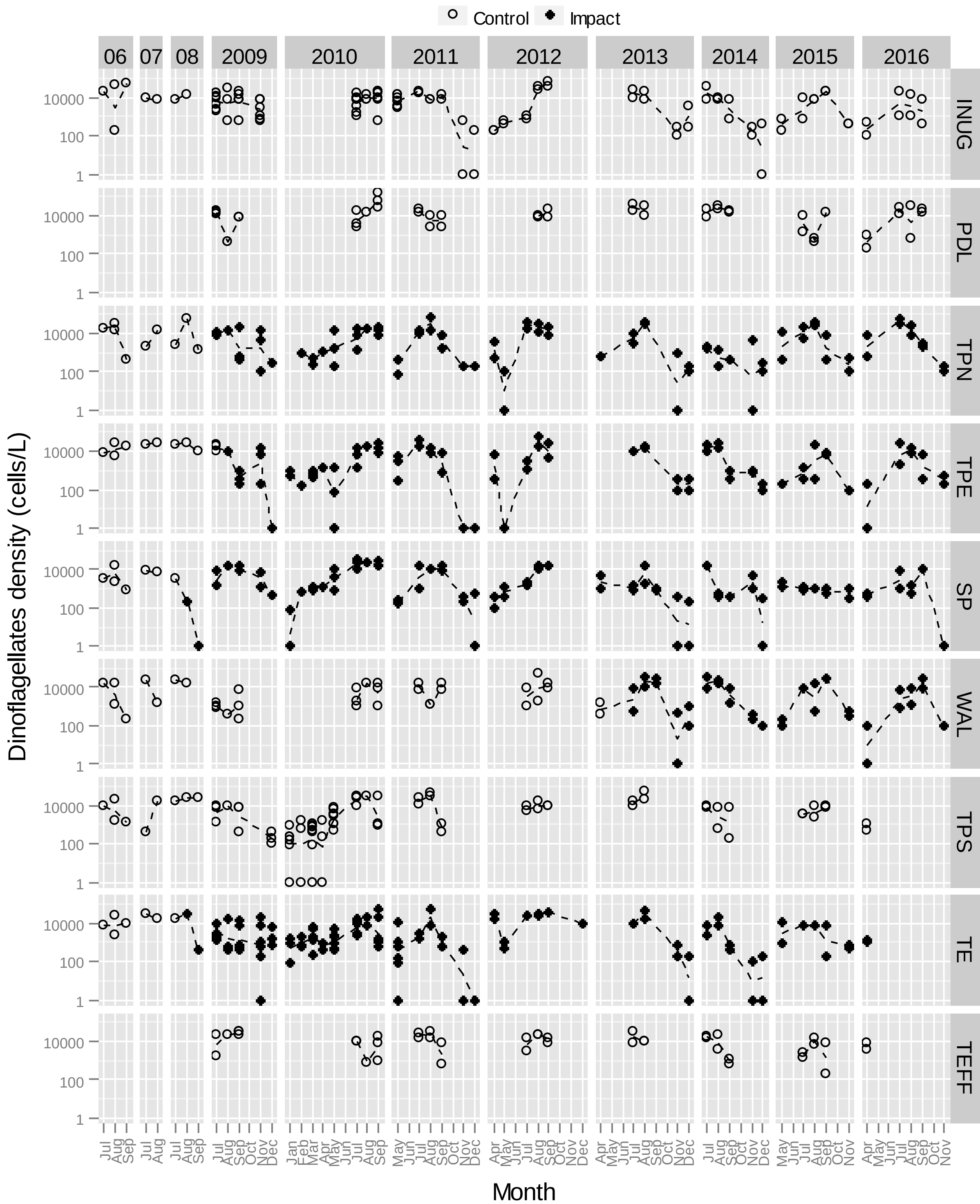
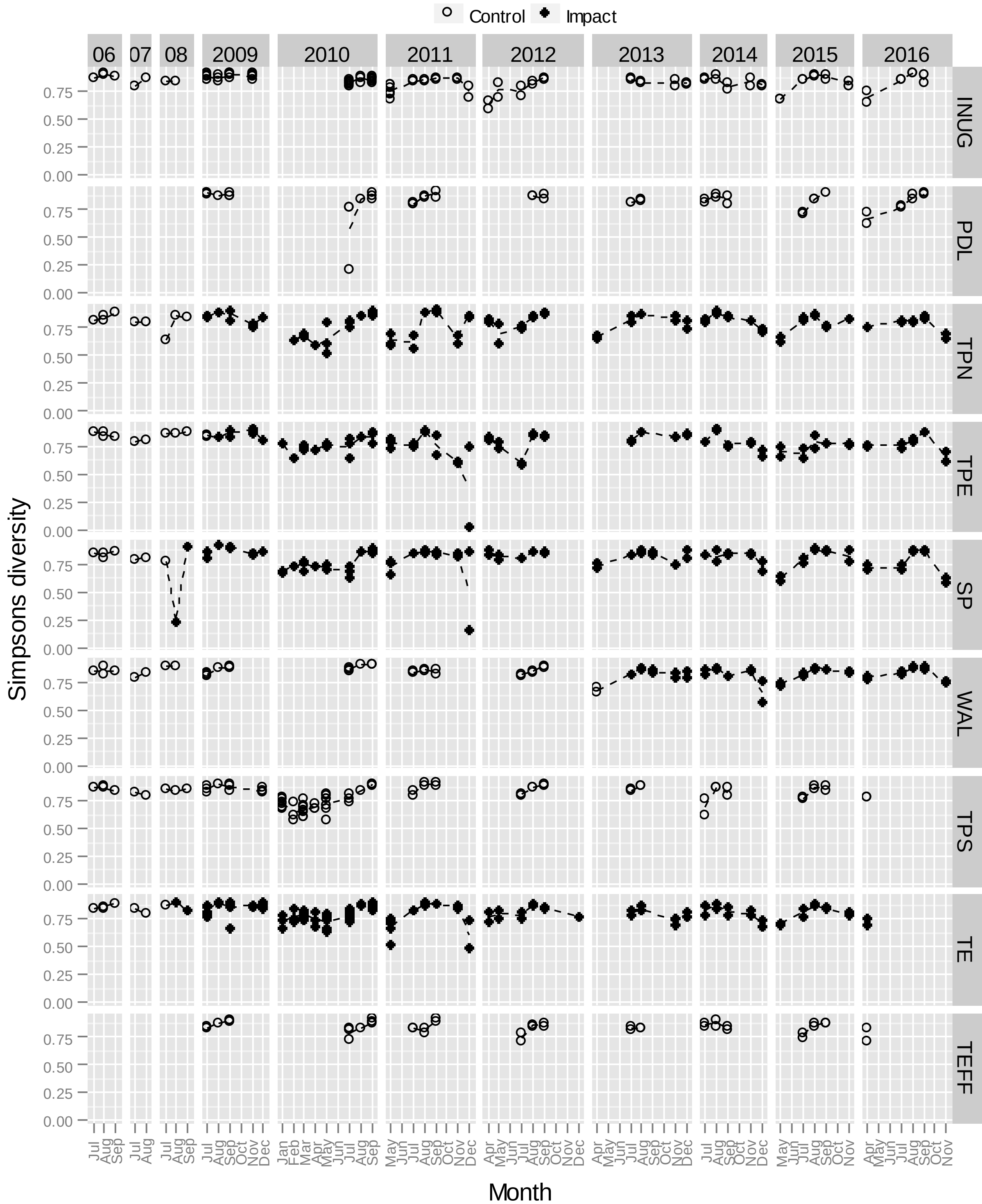


Figure C1–16. Simpson's Diversity for the phytoplankton community from Meadowbank study lakes since 2006.



APPENDIX C2

Baker Lake Phytoplankton Plots 2008 – 2016

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Figure C2–1. Total phytoplankton density (cells/L) from Baker Lake since 2008.

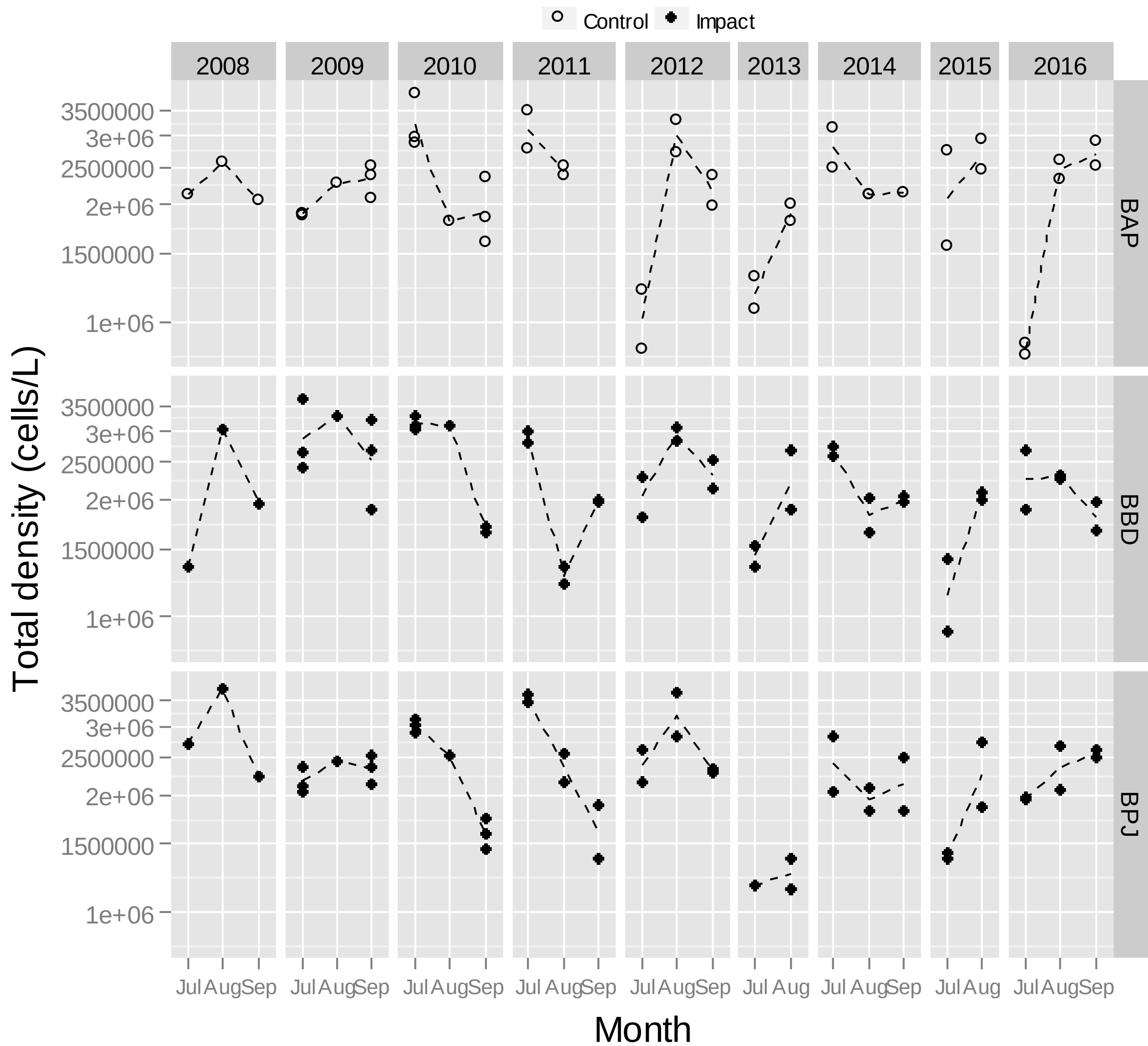


Figure C2–2. Cyanophyte biomass (mg/m^3) from Baker Lake since 2008.

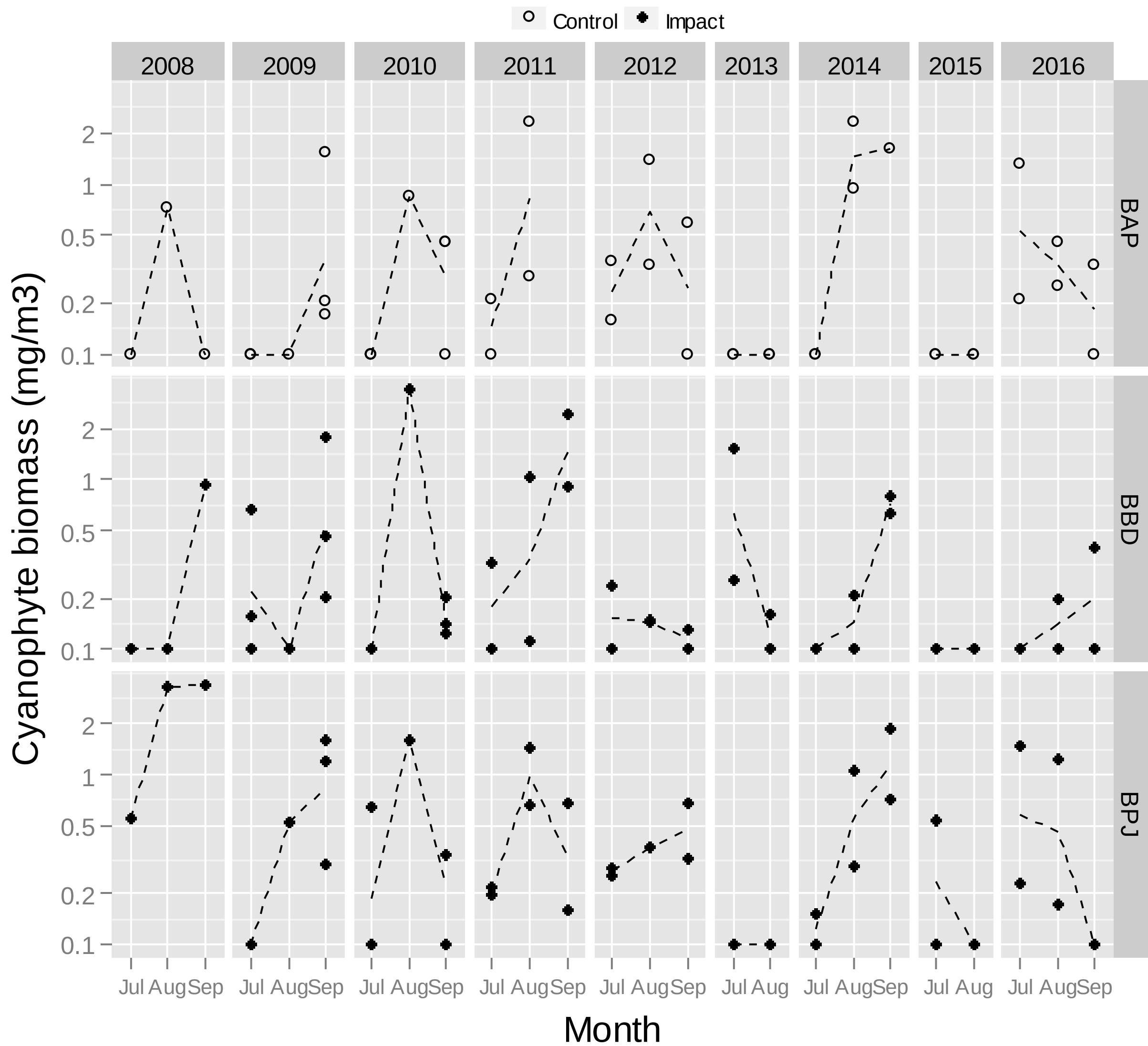


Figure C2–3. Chlorophyte biomass (mg/m³) from Baker Lake since 2008.

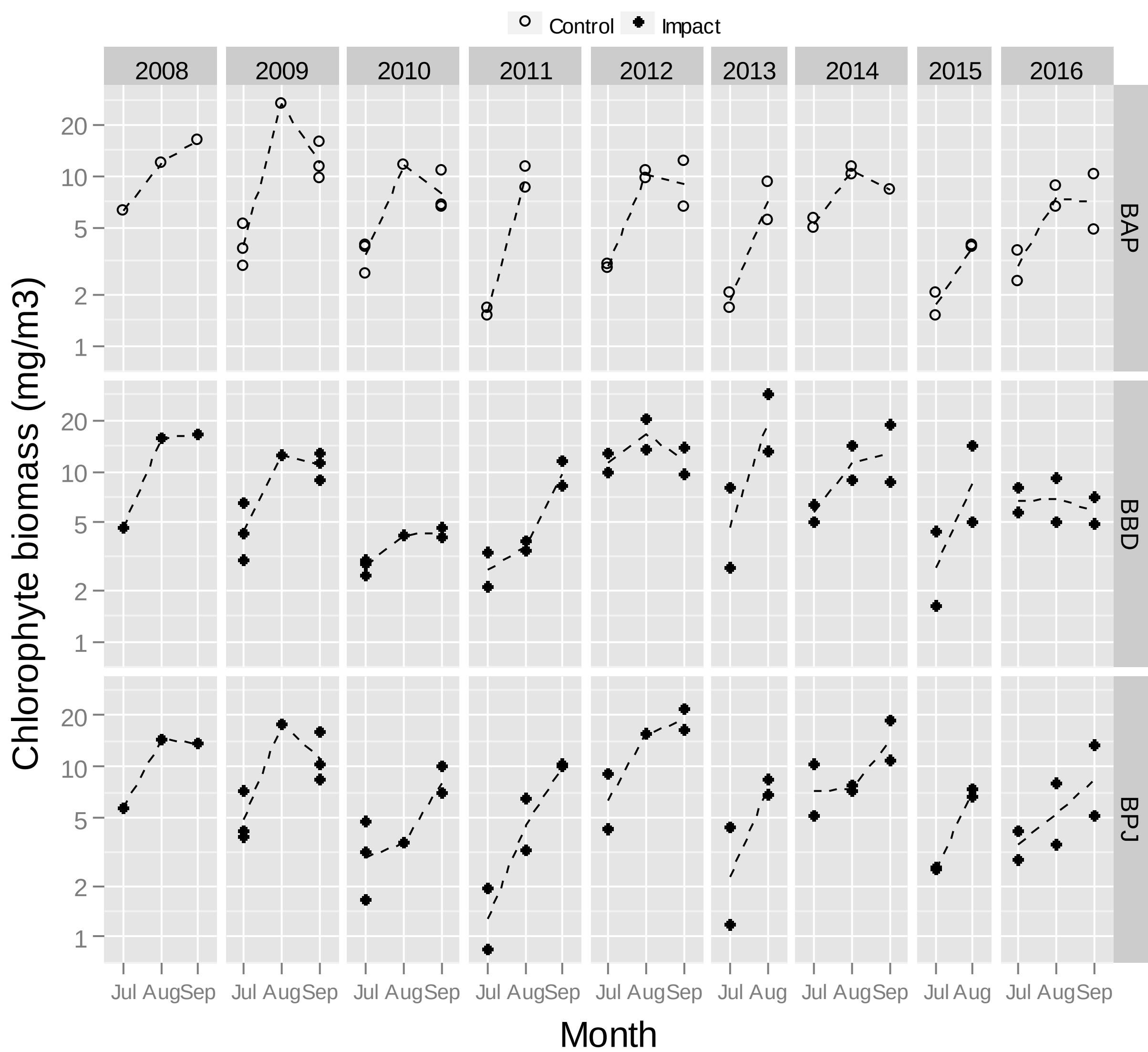


Figure C2–4. Chrysophyte biomass (mg/m^3) from Baker Lake since 2008.

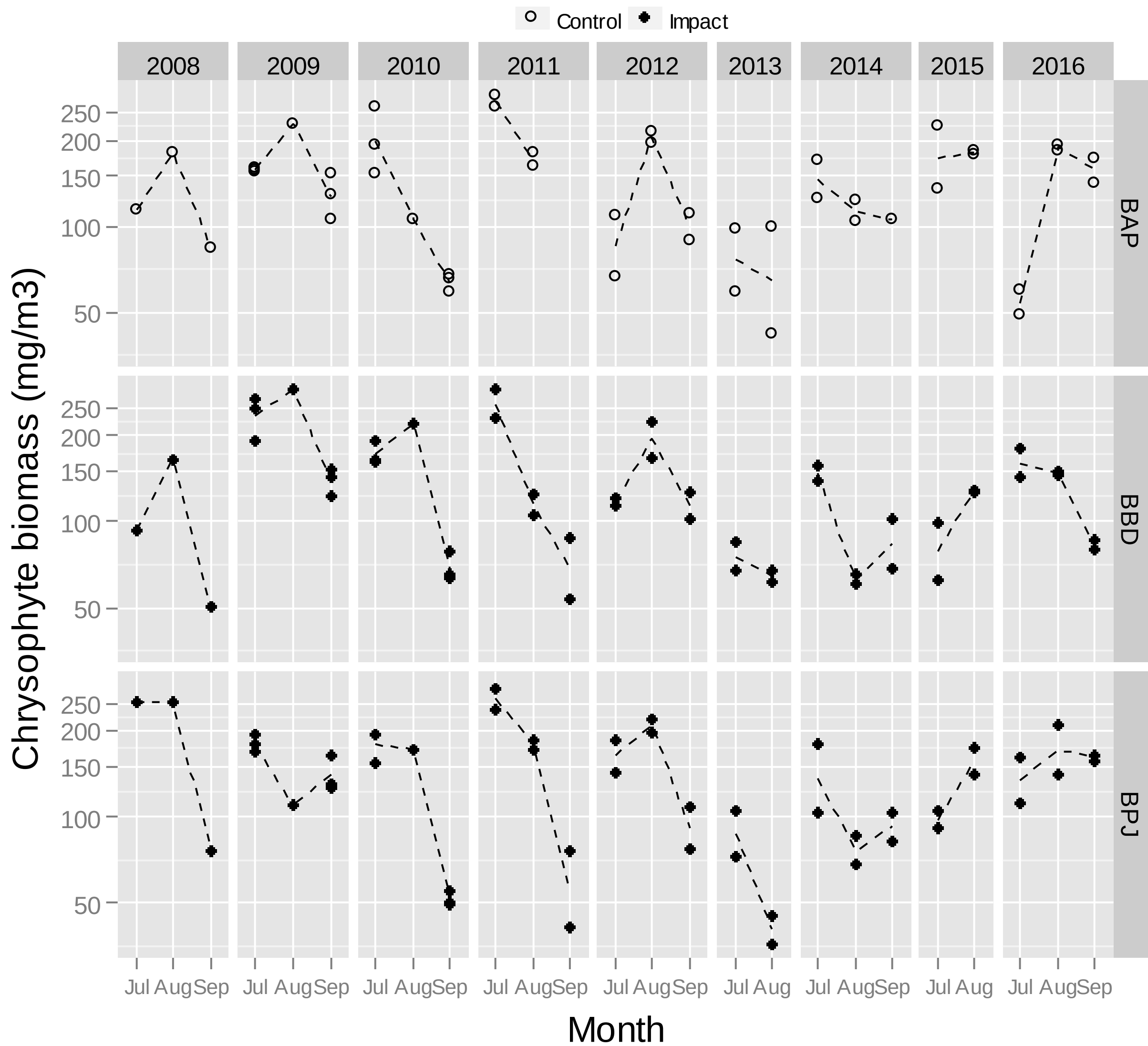


Figure C2–5. Diatom biomass (mg/m^3) from Baker Lake since 2008.

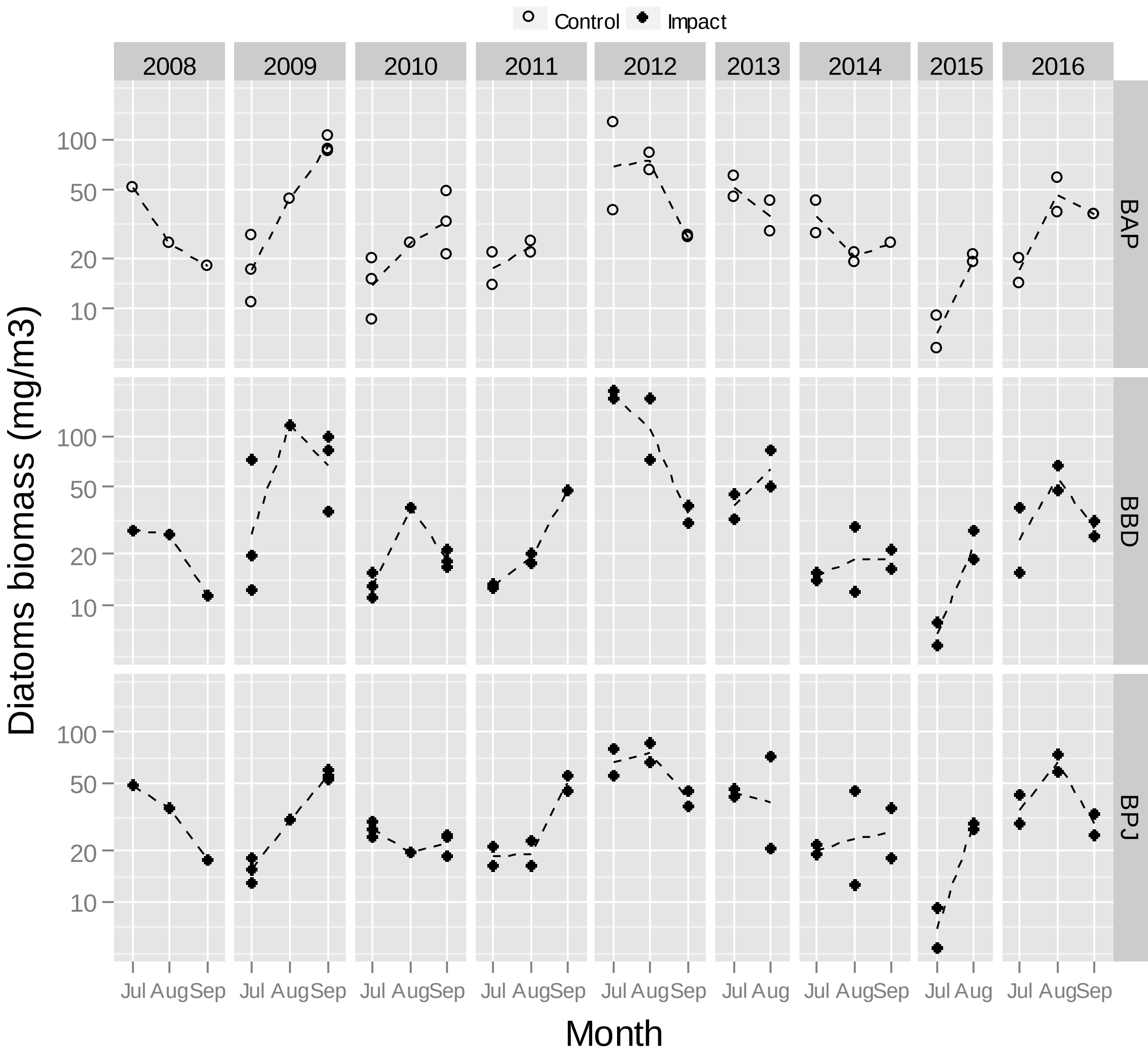


Figure C2–6. Cryptophyte biomass (mg/m^3) from Baker Lake since 2008.

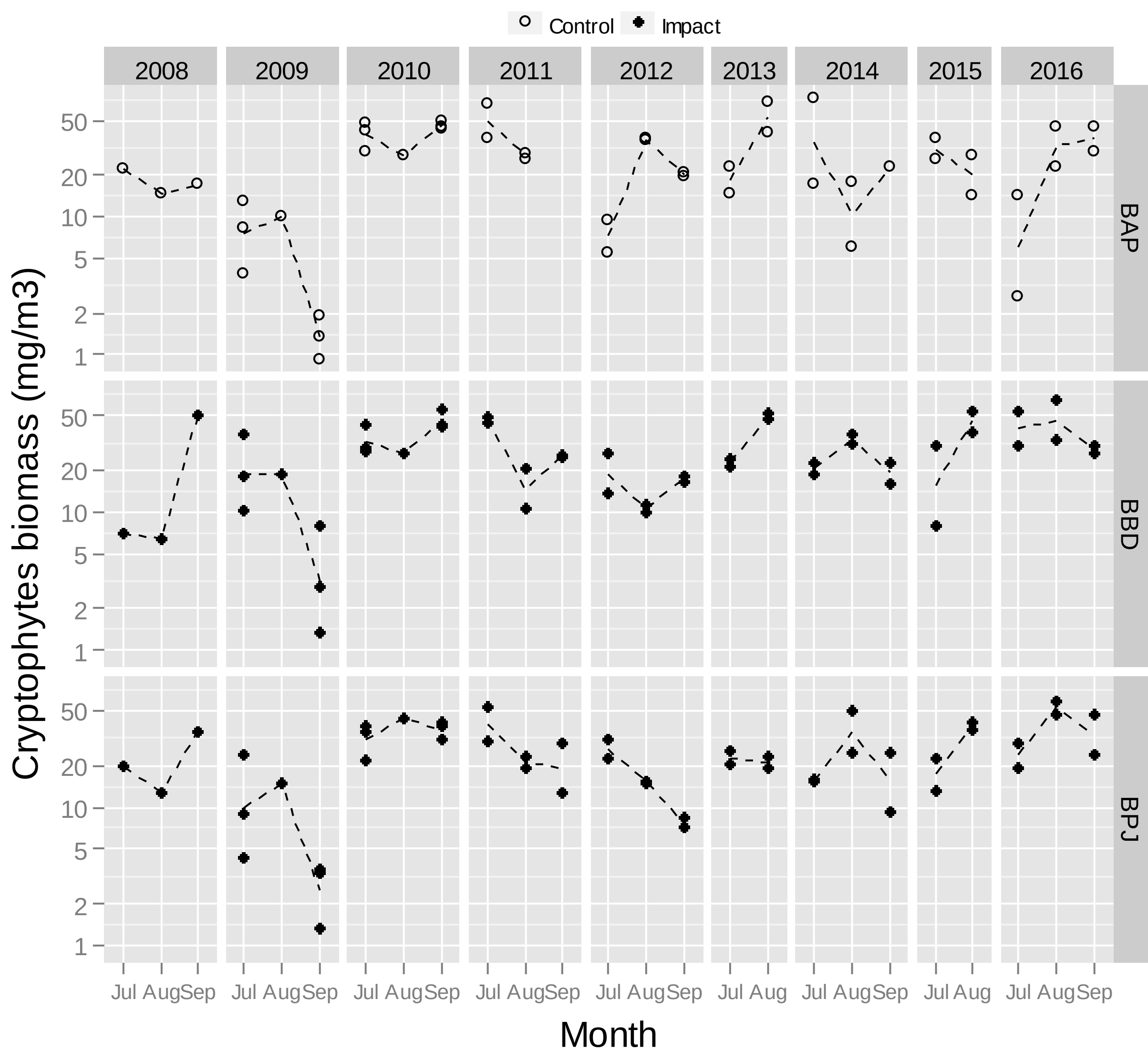


Figure C2–7. Dinoflagellate biomass (mg/m^3) from Baker Lake since 2008.

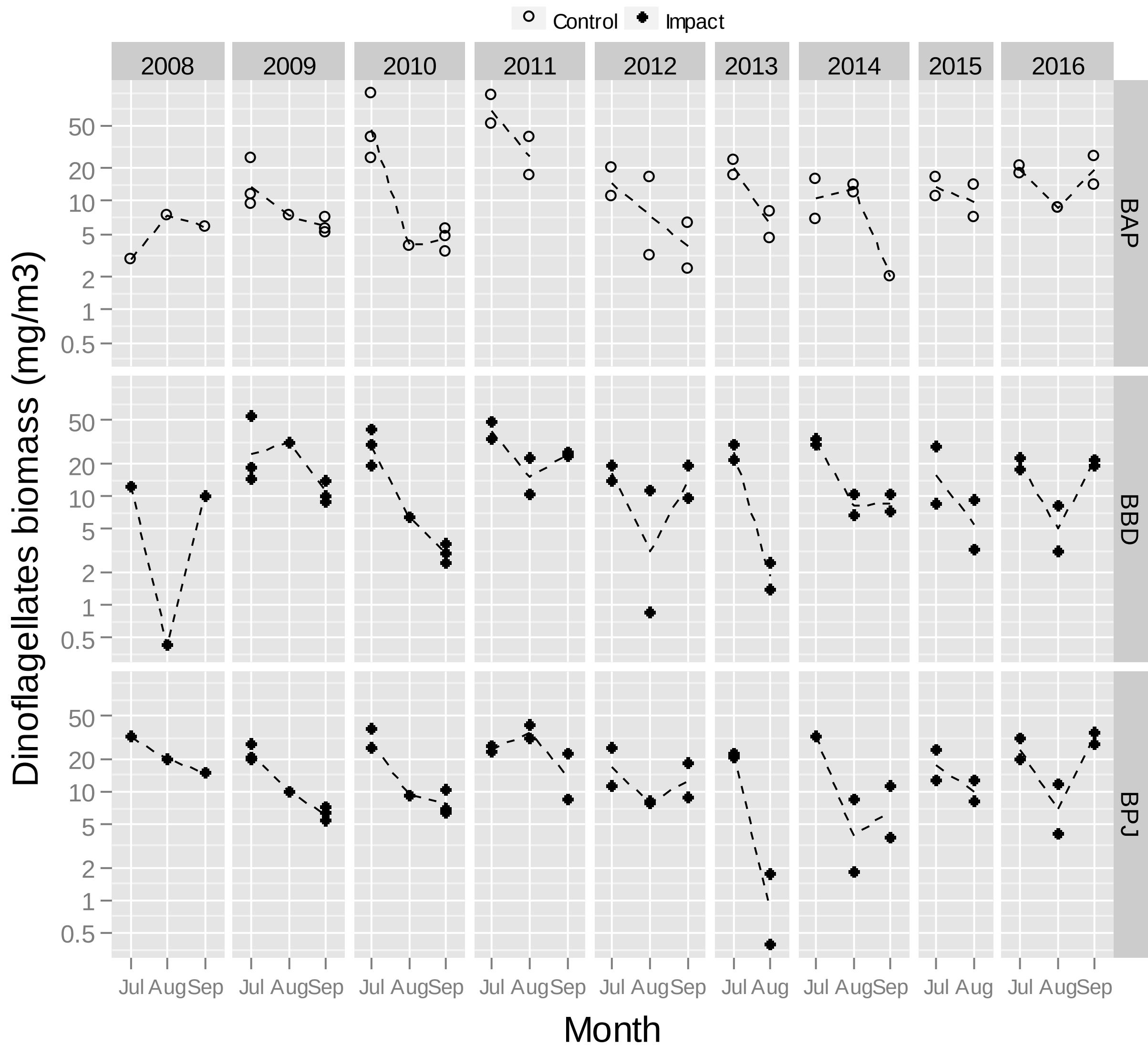


Figure C2–8. Phytoplankton density (cells/L) by major taxa group from Baker Lake since 2008.

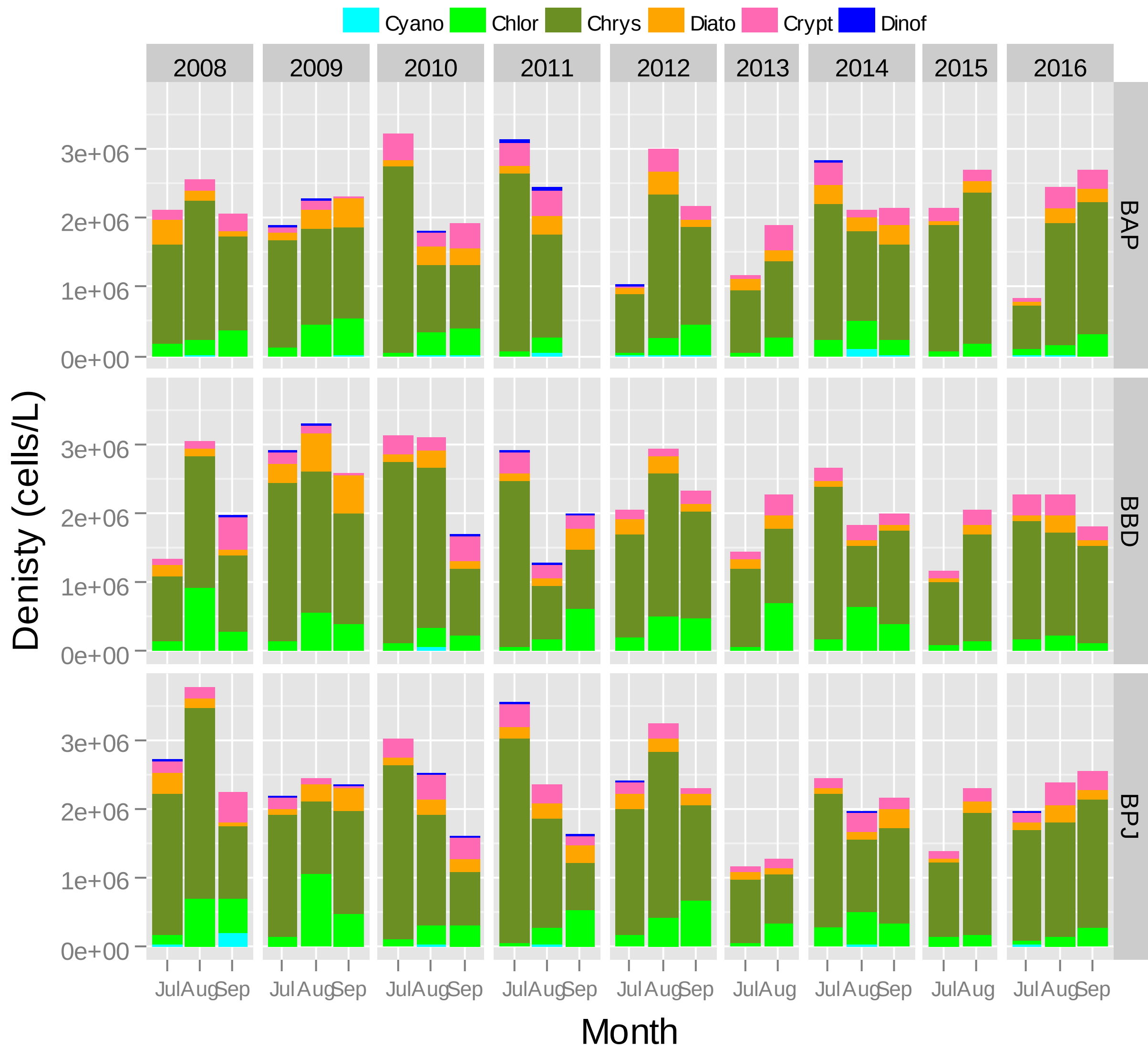


Figure C2‒9. Relative phytoplankton density by major taxa group from Baker Lake since 2008.

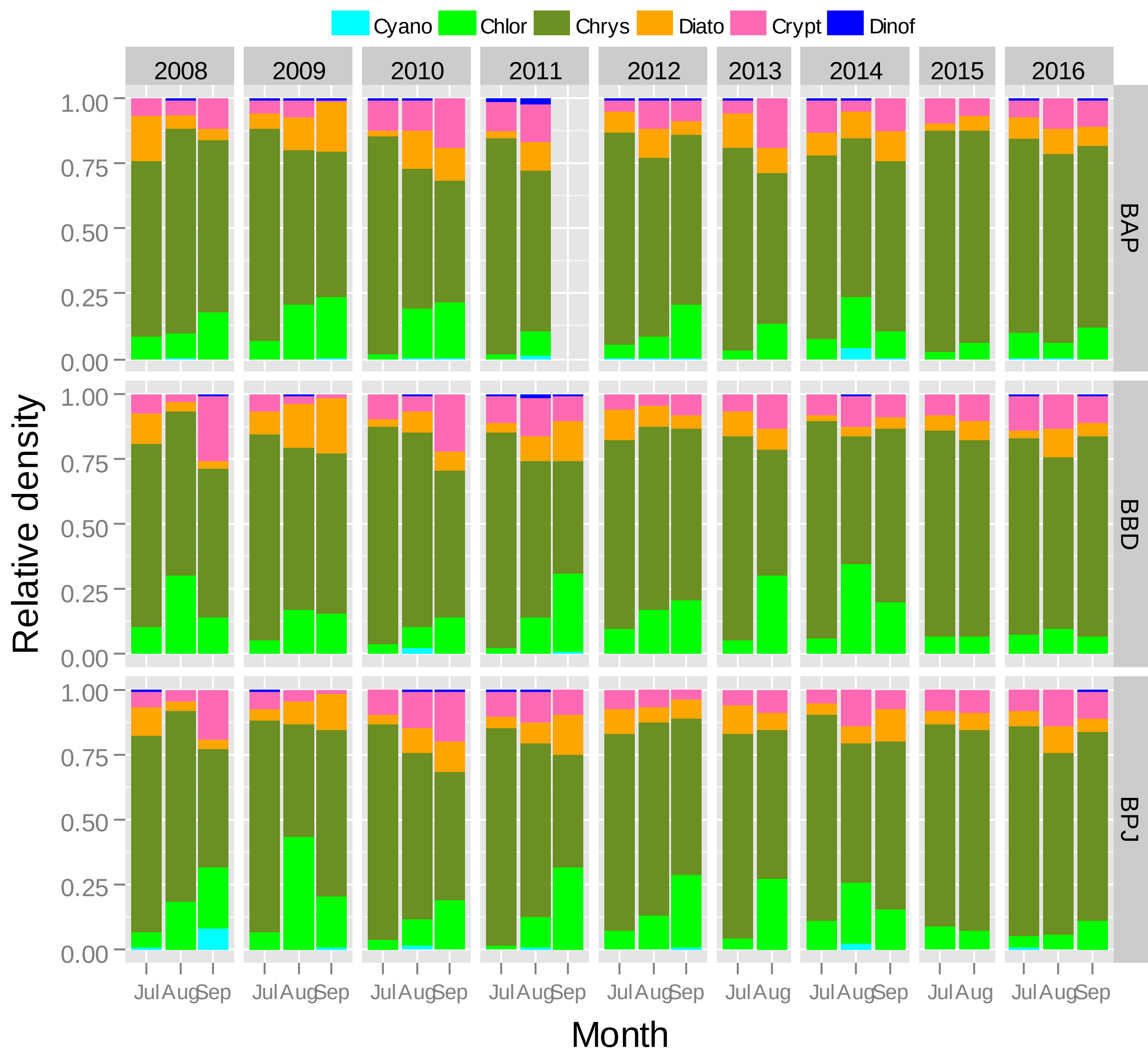


Figure C2–10. Cyanophyte density (cells/L) from Baker Lake since 2008.

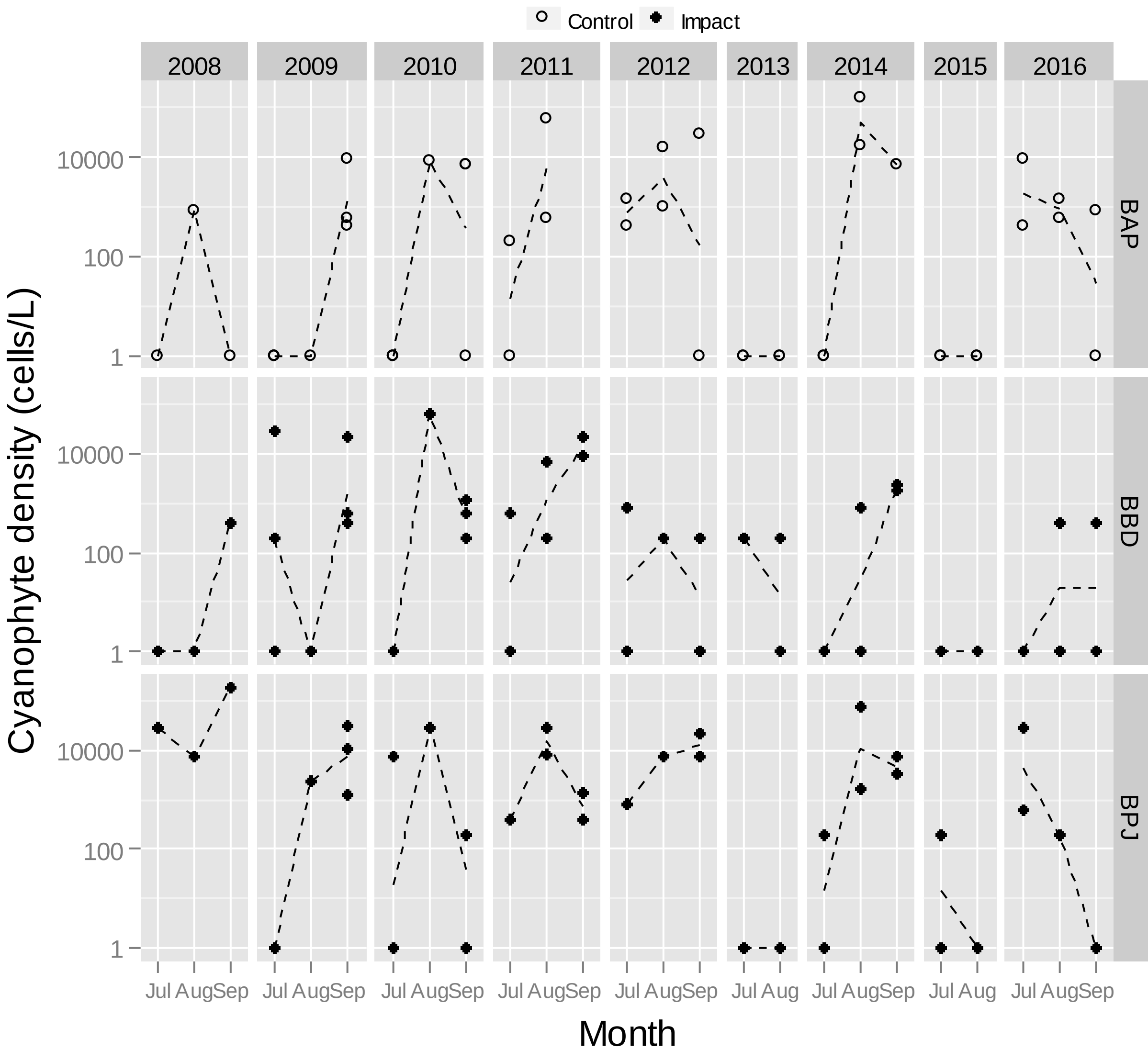


Figure C2–11. Chlorophyte density (cells/L) from Baker Lake since 2008.

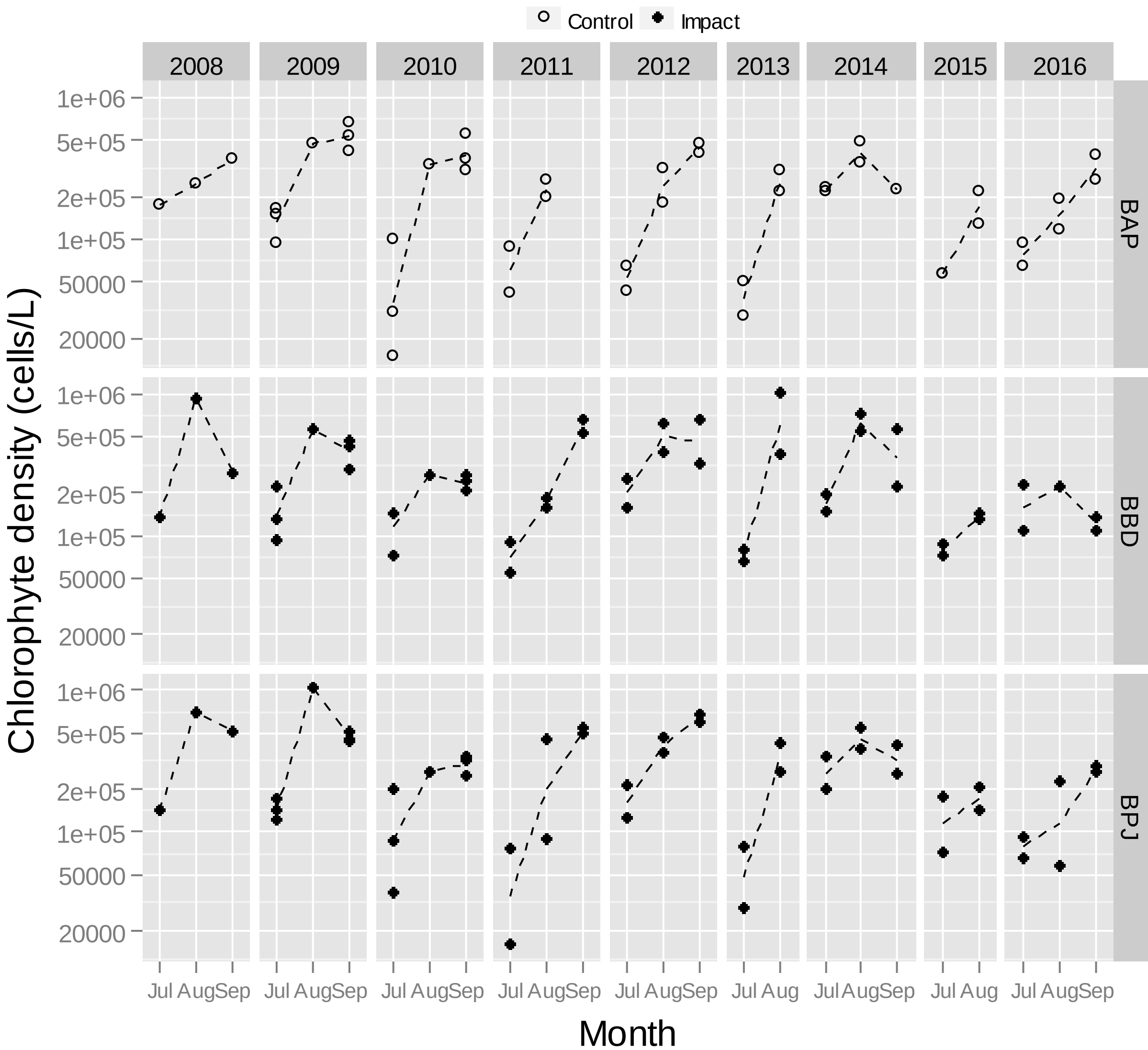


Figure C2–12. Chrysophyte density (cells/L) from Baker Lake since 2008.

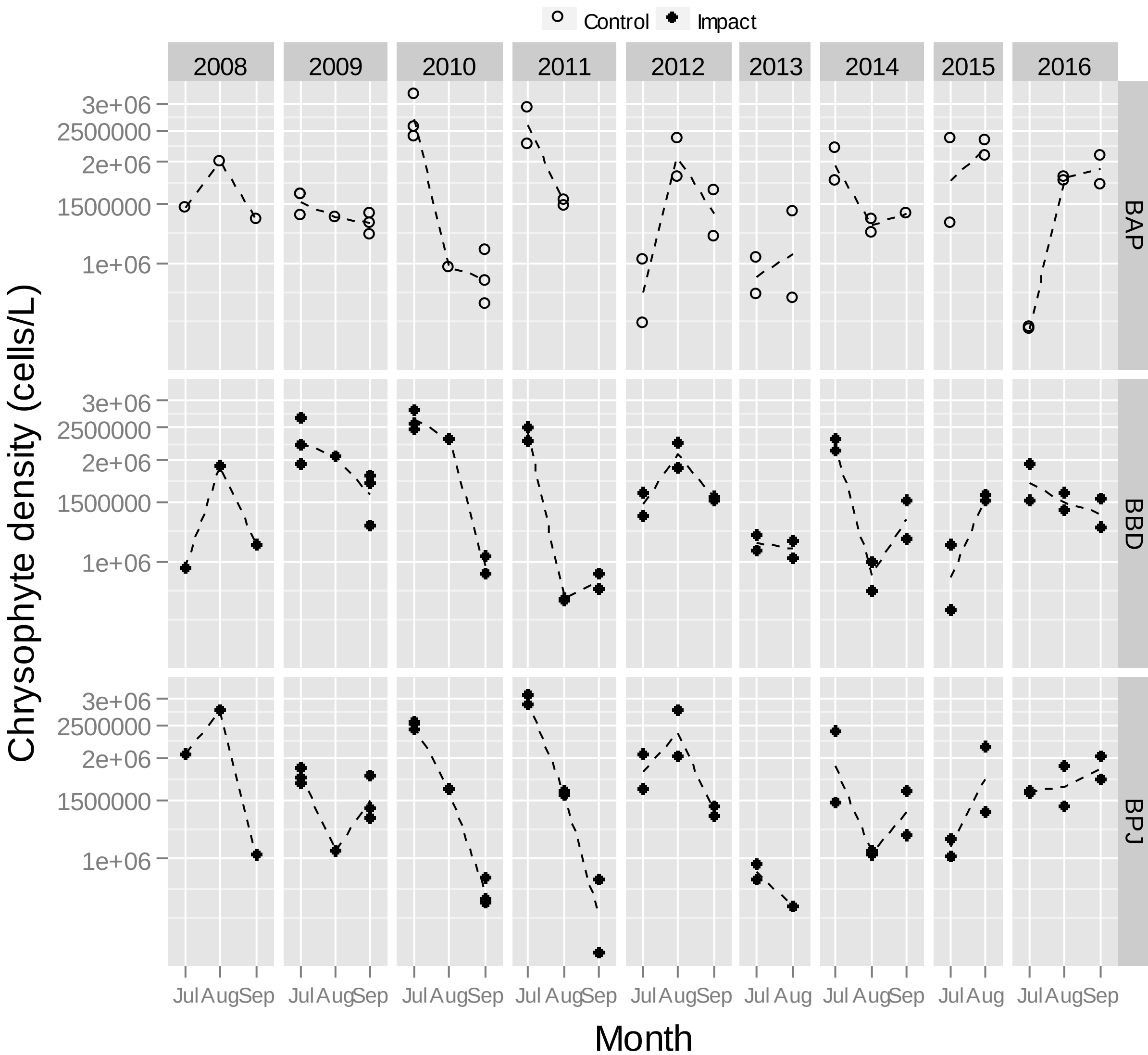


Figure C2–13. Diatom density (cells/L) from Baker Lake since 2008.

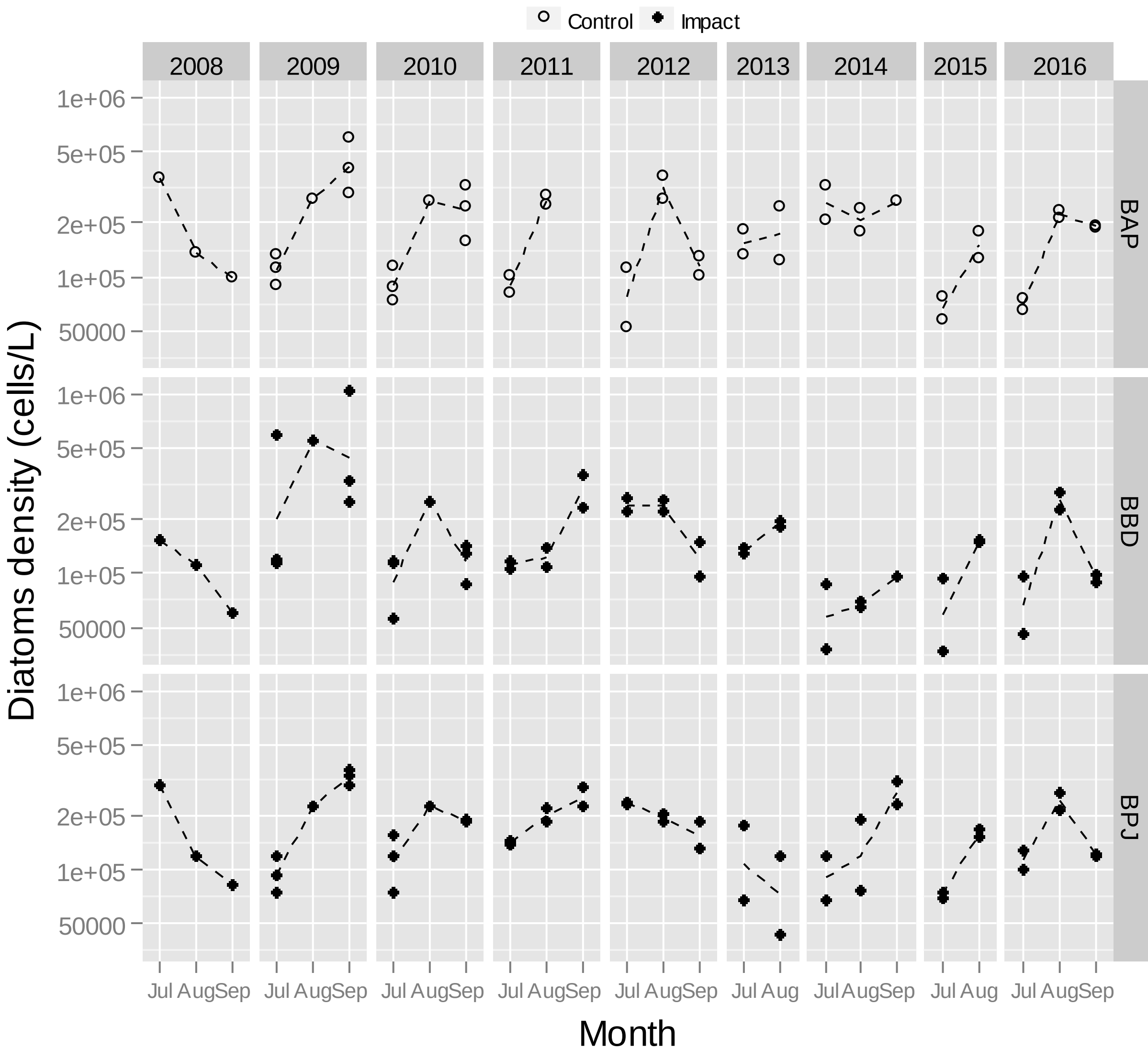


Figure C2–14. Cryptophytes density (cells/L) from Baker Lake since 2008.

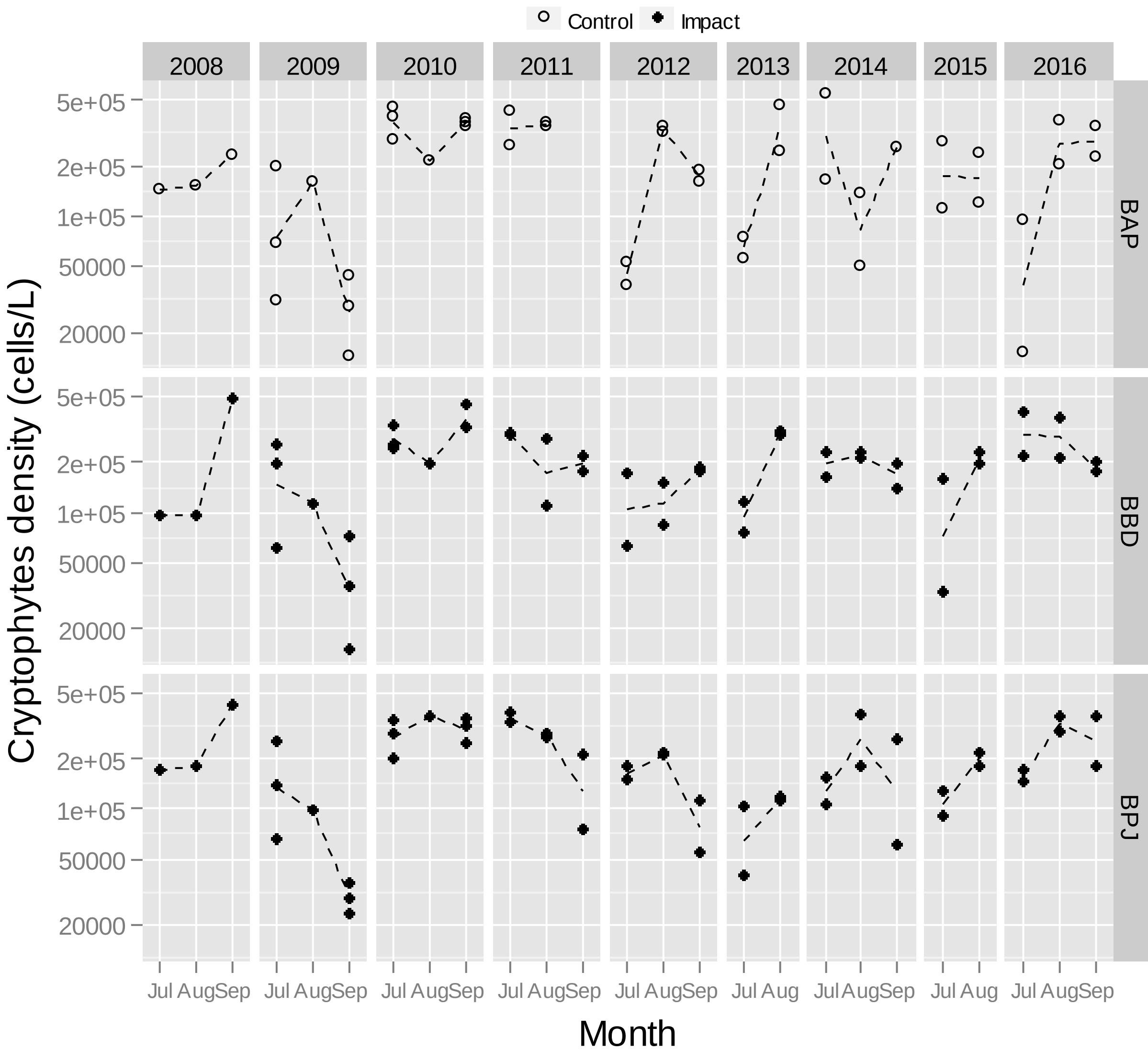


Figure C2–15. Dinoflagellates density (cells/L) from Baker Lake since 2008.

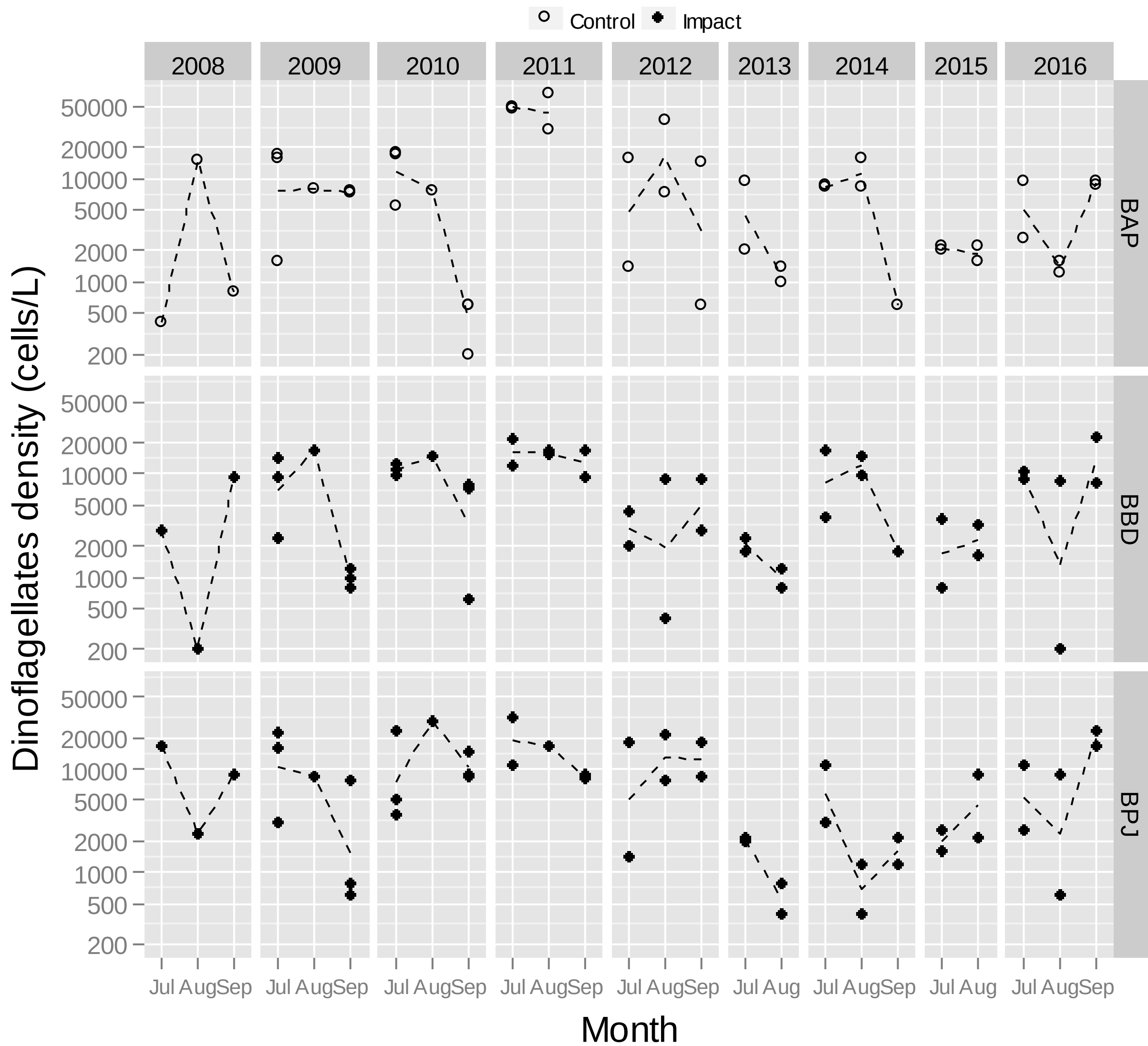
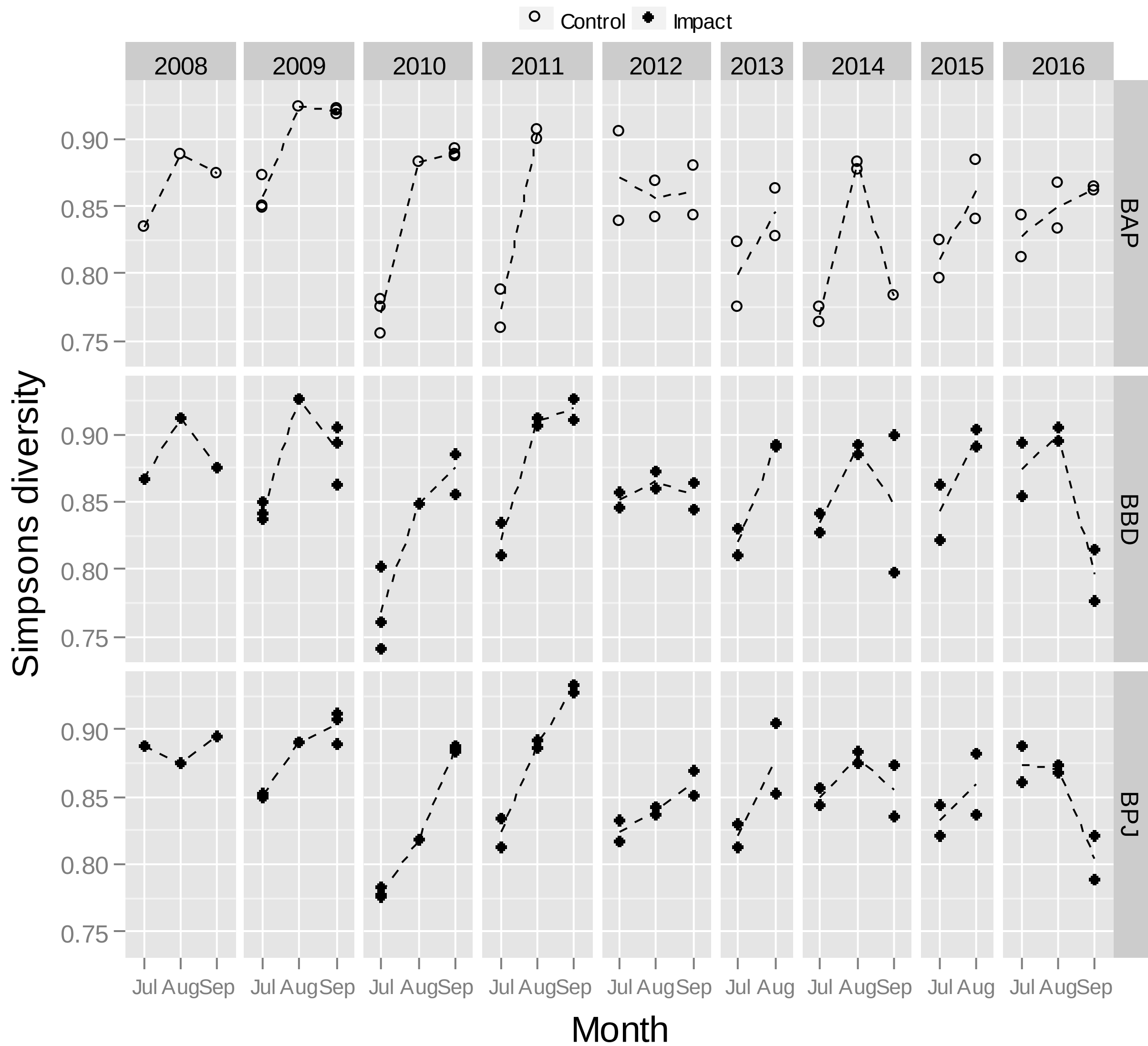


Figure C2–16. Simpson's Diversity for the phytoplankton community from Baker Lake since 2008.



APPENDIX D

Benthic Invertebrate Raw Data, Meadowbank Study Lakes and Baker Lake, 2016

Appendix D. Benthic Invertebrate Raw Data, Meadowbank Study Lakes and Baker Lake, 2016.

Location	Baker Akilahaarjuk Point					Baker Barge Dock					Baker East Shore				
Station	**BAP**					**BBD**					**BES**				
Replicate	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Baker or Meadowbank?	Baker	Baker	Baker	Baker	Baker	Baker	Baker	Baker	Baker	Baker	Baker	Baker	Baker	Baker	Baker
DepthOfSample (m)	7.6	7.1	8	7.8	8.2	8.2	8.2	8	8.9	7.9	7.8	9	8.9	8	8.3
# Grabs/sample	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Mesh Size (µm)	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Date	8-Aug-16	8-Aug-16	8-Aug-16	8-Aug-16	8-Aug-16	9-Aug-16	9-Aug-16	9-Aug-16	9-Aug-16	9-Aug-16	8-Aug-16	8-Aug-16	8-Aug-16	8-Aug-16	8-Aug-16
ROUNDWORMS															
P. Nemata	11	14	24	6	5	3	1	2	-	2	7	7	10	3	4
FLATWORMS															
P. Platyhelminthes															
Cl. Turbellaria															
indeterminate	-	3	1	-	-	-	-	-	-	-	-	1	-	-	-
ANNELIDS															
P. Annelida															
WORMS															
Cl. Oligochaeta															
F. Enchytraeidae	4	7	-	-	3	-	1	-	-	-	1	8	6	2	1
F. Naididae															
S.F. Naidinae															
Nais	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
S.F. Tubificinae															
Limnodrilus hoffmeisteri	-	-	-	8	-	-	-	-	1	-	-	-	-	-	-
Tasserkidrilus americanus	-	7	9	-	3	-	-	-	-	-	-	-	-	-	-
immatures with hair chaetae	4	26	12	73	-	-	-	-	-	-	-	-	-	-	-
immatures without hair chaetae	11	7	3	8	19	-	-	-	2	-	-	-	-	-	-
S.F. Rhyacodrilinae															
Rhyacodrilus coccineus	12	20	15	41	6	-	-	-	-	-	-	-	-	-	-
Rhyacodrilus montana	46	46	19	32	31	9	8	-	-	-	3	1	4	4	4
F. Lumbriculidae															
Lumbriculus	-	20	3	-	-	-	-	-	-	1	-	-	-	-	-
ARTHROPODS															
P. Arthropoda															
MITES															
Cl. Arachnida															
O. Acarina															
indeterminate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Acalyptonotidae															
Acalyptonotus	3	-	2	-	1	-	-	-	-	-	-	3	4	3	1
F. Hygrobatidae															
Hygrobates	-	3	-	-	1	-	-	-	-	2	2	1	-	3	-
F. Lebertiidae															
Lebertia	4	5	5	1	2	-	-	1	-	3	5	4	8	10	3
F. Oxidae															
Oxus	-	1	-	2	-	-	-	-	-	1	-	-	-	-	-
SEED SHRIMPS															
Cl. Ostracoda	2	15	2	4	4	2	4	3	2	6	-	-	1	-	2
TADPOLE SHRIMP															
O. Notostraca															
Lepidurus arcticus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WATER SCUDS															
O. Amphipoda															
F. Gammaracanthidae															
Gammaracanthus aestuariorum	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
INSECTS															
Cl. Insecta															
CADDISFLIES															
O. Trichoptera															
F. Apataniidae															
Apatania	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-
F. Limnephilidae															
Grensia praeterita	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TRUE FLIES															
O. Diptera															
MIDGES															
F. Chironomidae															
chironomid pupae	15	12	12	15	36	19	5	13	8	22	15	15	19	21	26
S.F. Chironominae															
Cladotanytarsus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Constempellina	2	18	1	5	2	2	3	-	1	4	7	12	6	4	8
Corynocera ambigua	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Corynocera ?oliveri	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cryptotendipes	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Dicrotendipes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Micropsectra	-	-	-	15	-	6	-	1	1	9	-	-	-	2	-
Microtendipes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Parachironomus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paracladopelma	4	4	1	7	5	2	1	2	5	2	-	2	1	1	2
Paratanytarsus	16	11	2	8	30	-	1	-	-	-	-	12	5	13	2
Polypedilum	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sergentia	-	-	-	-	-	2	-	-	-	2	-	-	-	-	-
Stempellinella	-	-	3	-	-	-	-	-	-	-	-	6	-	-	1
Stictochironomus	50	82	8	59	31	129	128	8	7	73	-	-	-	1	-
Tanytarsus	2	-	1	22	5	6	2	-	1	-	5	12	14	-	5
S.F. Diamesinae															
Pagastia	-	-	-	-	-	-	-	2	-	4	-	-	-	-	-
Protanypus	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-
Potthastia	1	3	-	-	2	-	-	1	-	-	-	2	1	-	-
Pseudodiamesa	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-
S.F. Orthocladiinae															
Abiskomyia	5	15	1	11	3	28	3	-	4	11	17	21	19	20	10
Cricotopus/Orthocladius	1	2	-	-	1	-	-	-	-	-	-	2	-	-	-
Heterotrissocladius	-	2	3	6	-	2	1	3	1	9	4	5	13	4	6
Hydrobaenus	-	2	-	1	1	-	-	-	-	4	-	-	-	-	-
Mesocricotopus	1	2	3	1	3	-	-	-	1	-	8	10	14	5	5
Nanocladius	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paracladius	2	-	-	1	-	-	1	-	-	2	7	10	8	10	4
Parakiefferiella	-	2	-	1	1	-	-	1	-	-	2	-	-	-	-
Psectrocladius	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
Pseudosmittia	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
Zalutschia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Orthocladiinae *Genus "Greenland"*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
indeterminate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S.F. Prodiamesinae															
Monodiamesa	3	2	5	1	11	2	4	1	1	32	8	10	8	6	3
S.F. Tanypodinae															
Ablabesmyia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Procladius	4	4	1	3	-	4	1	2	2	4	1	3	3	3	1
Thienemannimyia complex	2	-	1	-	4	-	-	-	-	17	-	-	-	-	-
F. Empididae															
Neoplasta	2	4	2	-	-	7	2	-	-	-	2	4	-	3	-
Wiedemannia	-	-	-	-	-	1	-	-	1	1	1	1	1	1	3
pupae	-	2	1	-	3	-	1	-	-	3	1	4	2	-	3
F. Tipulidae															
Tipula	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
MOLLUSCS															
P. Mollusca															
SNAILS															
Cl. Gastropoda															
F. Planorbidae															
Gyraulus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Valvatidae															
Valvata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLAMS															
Cl. Bivalvia															
F. Sphaeriidae															
Cyclocalyx/Neopisidium	9	5	8	4	13	4	8	-	-	1	6	4	6	9	15
Cyclocalyx	6	16	7	-	18	-	2	-	-	3	1	1	1	-	-
Sphaerium nitidum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Richness - totals [1]															
Total	23	26	22	20	26	14	15	10	12	24	18	24	18	20	17
Oligochaete	4	5	4	3	4	1	2	0	1	2	2	2	2	2	2
Insect	15	15	13	14	16	12	11	9	11	17	12	16	12	14	12
Mollusc	2	2	2	1	2	1	2	0	0	2	2	2	2	1	1
Other[3]	2	4	3	2	4	0	0	1	0	3	2	4	2	3	2
Abundance (raw) - totals [2]															
Total	210	334	129	325	239	223	172	35	36	217	97	155	143	126	103
Oligochaete	77	133	61	162	62	9	9	0	3	3	4	9	10	6	5
Insect	111	168	45	156	141	210	153	34	33	204	79	132	114	95	79
Mollusc	15	21	15	4	31	4	10	0	0	4	7	5	7	9	15
Other[3]	7	12	8	3	5	0	0	1	0	6	7	9	12	16	4
Abundance - totals (#/m^2)															
Total	4565	7261	2804	7065	5196	4848	3739	761	783	4717	2109	3370	3109	2739	2239
Oligochaete	1674	2891	1326	3522	1348	196	196	0	65	65	87	196	217	130	109
Insect	2413	3652	978	3391	3065	4565	3326	739	717	4435	1717	2870	2478	2065	1717
Mollusc	326	457	326	87	674	87	217	0	0	87	152	109	152	196	326
Other[3]	152	261	174	65	109	0	0	22	0	130	152	196	261	348	87

Notes:

[1] Richness totals exclude P. Nemata and Cl. Ostracoda, pupae and indeterminates (Acarina). Pupae are included in the richness totals if no other life stages are present in the replicate sample.

[2] Abundance totals exclude P. Nemata and Cl. Ostracoda.
Raw abundance from two grabs (grab area = 0.023 m^2).

[3] Other taxa = Cl. Turbellaria, F. Acalyptonotidae, F. Hygrobatidae, F. Lebertiidae, F. Oxidae, and O. Notostraca.

Appendix D. Benthic Invertebrate Raw Data, Meadowbank Study Lakes and Baker Lake, 2016.

Location	Baker Proposed Jetty					Inuggugayualik Lake					Pipedream Lake				
Station	**BPJ**					**INUG**					**PDL**				
Replicate	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Baker or Meadowbank?	Baker	Baker	Baker	Baker	Baker	Meadowbank	Meadowbank	Meadowbank	Meadowbank	Meadowbank	Meadowbank	Meadowbank	Meadowbank	Meadowbank	Meadowbank
DepthOfSample (m)	8.1	8.2	8.7	8.5	8.6	7.6	7.8	7.2	8.4	8.9	7.3	7.2	7	7.8	7.6
# Grabs/sample	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Mesh Size (µm)	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Date	9-Aug-16	9-Aug-16	9-Aug-16	9-Aug-16	9-Aug-16	7-Aug-16	7-Aug-16	7-Aug-16	7-Aug-16	7-Aug-16	6-Aug-16	6-Aug-16	6-Aug-16	6-Aug-16	6-Aug-16
ROUNDWORMS															
P. Nemata	15	11	13	1	1	1	3	3	-	2	-	2	1	6	-
FLATWORMS															
P. Platyhelminthes															
Cl. Turbellaria															
indeterminate	2	-	-	-	-	-	-	-	4	-	-	-	-	-	-
ANNELIDS															
P. Annelida															
WORMS															
Cl. Oligochaeta															
F. Enchytraeidae	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-
F. Naididae															
S.F. Naidinae															
Nais	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S.F. Tubificinae															
Limnodrilus hoffmeisteri	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tasserkidrilus americanus	-	-	-	-	-	-	-	-	-	-	-	2	-	1	-
immatures with hair chaetae	-	-	-	-	-	-	-	1	-	-	1	1	-	-	-
immatures without hair chaetae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S.F. Rhyacodrilinae															
Rhyacodrilus coccineus	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-
Rhyacodrilus montana	1	-	1	-	6	-	-	-	-	-	-	-	-	-	-
F. Lumbriculidae															
Lumbriculus	-	-	-	-	-	-	-	-	1	1	1	2	1	-	-
ARTHROPODS															
P. Arthropoda															
MITES															
Cl. Arachnida															
O. Acarina															
indeterminate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Acalyptonotidae															
Acalyptonotus	-	2	-	-	-	-	-	-	-	-	-	1	-	-	-
F. Hygrobatidae															
Hygrobates	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-
F. Lebertiidae															
Lebertia	10	8	16	-	6	-	-	-	-	-	-	-	-	-	-
F. Oxidae															
Oxus	-	-	-	1	1	2	1	3	1	1	-	-	-	-	-
SEED SHRIMPS															
Cl. Ostracoda	8	6	3	-	-	-	2	2	2	1	1	-	1	2	7
TADPOLE SHRIMP															
O. Notostraca															
Lepidurus arcticus	-	-	-	-	-	-	-	-	2	1	-	-	-	-	-
WATER SCUDS															
O. Amphipoda															
F. Gammaracanthidae															
Gammaracanthus aestuariorum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
INSECTS															
Cl. Insecta															
CADDISFLIES															
O. Trichoptera															
F. Apataniidae															
Apatania	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
F. Limnephilidae															
Grensia praeterita	-	-	-	-	-	-	1	-	-	-	-	2	-	1	-
TRUE FLIES															
O. Diptera															
MIDGES															
F. Chironomidae															
chironomid pupae	37	35	24	1	13	7	6	4	15	21	1	-	-	-	1
S.F. Chironominae															
Cladotanytarsus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Constempellina	3	9	4	-	2	-	-	-	-	-	-	-	-	-	-
Corynocera ambigua	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Corynocera ?oliveri	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cryptotendipes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dicrotendipes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Micropsectra	34	13	11	-	6	5	11	5	15	18	-	-	1	-	-
Microtendipes	-	-	-	-	-	3	14	5	18	17	-	-	-	-	-
Parachironomus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paracladopelma	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paratanytarsus	-	-	-	-	-	-	4	9	2	2	-	-	1	-	-
Polypedilum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sergentia	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Stempellinella	-	-	-	-	-	1	2	2	7	-	-	-	-	-	-
Stictochironomus	14	20	3	1	24	1	-	10	50	17	27	72	27	18	17
Tanytarsus	-	7	7	-	19	2	5	4	9	17	-	-	1	-	-
S.F. Diamesinae															
Pagastia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Protanypus	-	3	2	-	-	1	-	1	-	2	1	-	1	1	-
Potthastia	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-
Pseudodiamesa	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
S.F. Orthocladiinae															
Abiskomyia	10	14	5	-	8	-	-	-	-	-	-	-	-	2	-
Cricotopus/Orthocladius	-	4	-	1	9	-	-	-	-	-	-	-	-	-	-
Heterotrissocladius	26	21	19	-	8	3	1	1	1	2	-	-	-	1	1
Hydrobaenus	1	2	-	-	-	-	-	-	-	-	-	-	1	-	-
Mesocricotopus	4	3	2	-	6	-	-	-	-	-	-	-	-	-	-
Nanocladius	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paracladius	7	14	16	-	-	-	-	1	-	-	-	-	-	-	-
Parakiefferiella	-	-	1	-	3	-	-	-	-	-	-	-	-	-	-
Psectrocladius	-	-	-	-	-	1	-	2	1	3	-	-	2	-	-
Pseudosmittia	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Zalutschia	-	-	-	-	-	-	1	-	-	-	3	-	1	4	1
Orthocladiinae *Genus "Greenland"*	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-
indeterminate	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
S.F. Prodiamesinae															
Monodiamesa	2	1	3	-	3	-	-	2	1	1	-	1	-	1	2
S.F. Tanypodinae															
Ablabesmyia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Procladius	14	3	5	-	10	5	9	10	10	9	6	6	7	6	7
Thienemannimyia complex	2	-	2	-	1	-	-	-	-	-	-	-	1	1	-
F. Empididae															
Neoplasta	1	2	2	-	2	-	-	-	-	-	-	-	-	-	-
Wiedemannia	1	-	1	2	11	-	-	-	-	-	-	-	-	-	-
pupae	-	1	1	-	2	-	-	-	-	-	-	-	-	-	-
F. Tipulidae															
Tipula	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MOLLUSCS															
P. Mollusca															
SNAILS															
Cl. Gastropoda															
F. Planorbidae															
Gyraulus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Valvatidae															
Valvata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLAMS															
Cl. Bivalvia															
F. Sphaeriidae															
Cyclocalyx/Neopisidium	6	2	1	-	1	13	26	16	19	9	4	15	19	17	11
Cyclocalyx	1	-	-	-	-	4	3	3	5	2	12	2	2	8	-
Sphaerium nitidum	-	-	-	-	-	4	7	1	7	3	-	-	-	-	-
Richness - totals [1]															
Total	18	18	19	4	20	14	14	17	18	16	9	10	15	13	6
Oligochaete	1	0	1	0	2	0	1	1	2	1	2	2	1	1	0
Insect	13	14	16	3	15	10	9	12	10	10	4	5	12	10	5
Mollusc	2	1	1	0	1	3	3	3	3	3	2	2	2	2	1
Other[3]	2	3	1	1	2	1	1	1	3	2	1	1	0	0	0
Abundance (raw) - totals [2]															
Total	176	165	127	6	148	53	92	81	169	126	57	106	67	62	40
Oligochaete	1	0	1	0	10	0	1	1	2	1	2	5	1	1	0
Insect	156	152	109	5	130	30	54	57	129	109	38	83	45	36	29
Mollusc	7	2	1	0	1	21	36	20	31	14	16	17	21	25	11
Other[3]	12	11	16	1	7	2	1	3	7	2	1	1	0	0	0
Abundance - totals (#/m^2)															
Total	3826	3587	2761	130	3217	1152	2000	1761	3674	2739	1239	2304	1457	1348	870
Oligochaete	22	0	22	0	217	0	22	22	43	22	43	109	22	22	0
Insect	3391	3304	2370	109	2826	652	1174	1239	2804	2370	826	1804	978	783	630
Mollusc	152	43	22	0	22	457	783	435	674	304	348	370	457	543	239
Other[3]	261	239	348	22	152	43	22	65	152	43	22	22	0	0	0

Notes:

[1] Richness totals exclude P. Nemata and Cl. Ostracoda, pupae and indeterminates (Acarina). Pupae are included in the richness totals if no other life stages are present in the replicate sample.

[2] Abundance totals exclude P. Nemata and Cl. Ostracoda.

Raw abundance from two grabs (grab area = 0.023 m^2).

[3] Other taxa = Cl. Turbellaria, F. Acalyptonotidae, F. Hygrobatidae, F. Lebertiidae, F. Oxidae, and O. Notostraca.

Appendix D. Benthic Invertebrate Raw Data, Meadowbank Study Lakes and Baker Lake, 2016.

Location	Second Portage Lake					Third Portage Lake - East Basin					Third Portage Lake - North Basin				
Station	**SP**					**TPE**					**TPN**				
Replicate	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Baker or Meadowbank?	Meadowbank	Meadowbank	Meadowbank	Meadowbank	Meadowbank	Meadowbank	Meadowbank	Meadowbank	Meadowbank	Meadowbank	Meadowbank	Meadowbank	Meadowbank	Meadowbank	Meadowbank
DepthOfSample (m)	7.8	8.2	7.8	7.5	6.9	9	7.8	8.1	8.4	8.4	8.9	9.2	9.2	6.8	8.2
# Grabs/sample	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Mesh Size (µm)	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Date	3-Aug-16	3-Aug-16	3-Aug-16	3-Aug-16	3-Aug-16	4-Aug-16	4-Aug-16	4-Aug-16	4-Aug-16	4-Aug-16	4-Aug-16	4-Aug-16	4-Aug-16	4-Aug-16	4-Aug-16
ROUNDWORMS															
P. Nemata	-	1	3	2	1	4	15	6	3	4	1	2	1	1	1
FLATWORMS															
P. Platyhelminthes															
Cl. Turbellaria															
indeterminate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANNELIDS															
P. Annelida															
WORMS															
Cl. Oligochaeta															
F. Enchytraeidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Naididae															
S.F. Naidinae															
Nais	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S.F. Tubificinae															
Limnodrilus hoffmeisteri	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tasserkidrilus americanus	-	-	1	-	-	-	-	-	-	-	-	-	1	-	-
immatures with hair chaetae	1	-	-	1	2	-	-	-	-	-	-	-	2	-	-
immatures without hair chaetae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S.F. Rhyacodrilinae															
Rhyacodrilus coccineus	-	-	1	-	-	2	1	2	3	1	-	-	-	-	-
Rhyacodrilus montana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Lumbriculidae															
Lumbriculus	-	-	1	-	1	2	3	-	1	-	-	1	-	2	1
ARTHROPODS															
P. Arthropoda															
MITES															
Cl. Arachnida															
O. Acarina															
indeterminate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Acalyptonotidae															
Acalyptonotus	2	2	-	1	-	1	-	-	3	-	-	-	1	1	-
F. Hygrobatidae															
Hygrobates	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-
F. Lebertiidae															
Lebertia	2	-	-	1	-	-	-	-	-	-	-	-	-	-	-
F. Oxidae															
Oxus	6	1	1	1	3	-	-	-	-	1	-	-	-	-	-
SEED SHRIMPS															
Cl. Ostracoda	6	4	2	2	9	13	43	42	36	59	3	12	7	2	3
TADPOLE SHRIMP															
O. Notostraca															
Lepidurus arcticus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WATER SCUDS															
O. Amphipoda															
F. Gammaracanthidae															
Gammaracanthus aestuariorum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
INSECTS															
Cl. Insecta															
CADDISFLIES															
O. Trichoptera															
F. Apataniidae															
Apatania	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
F. Limnephilidae															
Grensia praeterita	-	-	-	-	2	-	-	-	-	-	1	1	2	-	-
TRUE FLIES															
O. Diptera															
MIDGES															
F. Chironomidae															
chironomid pupae	1	-	4	1	2	5	1	6	3	3	5	9	6	5	15
S.F. Chironominae															
Cladotanytarsus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Constempellina	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Corynocera ambigua	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Corynocera ?oliveri	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cryptotendipes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dicrotendipes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Micropsectra	-	3	-	-	4	9	13	8	28	5	10	16	23	20	19
Microtendipes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Parachironomus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paracladopelma	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paratanytarsus	-	-	-	-	-	9	11	70	28	46	2	12	2	10	1
Polypedilum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sergentia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stempellinella	1	3	7	4	3	-	-	-	-	-	-	-	3	-	-
Stictochironomus	2	4	6	2	6	-	3	2	6	4	8	4	4	13	17
Tanytarsus	2	1	3	1	2	3	1	1	-	7	4	8	13	4	5
S.F. Diamesinae															
Pagastia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Protanypus	-	-	1	-	-	1	-	-	1	-	-	-	1	-	-
Potthastia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pseudodiamesa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S.F. Orthocladiinae															
Abiskomyia	6	11	6	8	4	12	13	14	6	10	-	-	-	-	-
Cricotopus/Orthocladius	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heterotrissocladius	5	3	1	-	2	6	4	15	24	23	7	6	12	11	4
Hydrobaenus	-	1	1	-	-	-	-	-	-	-	3	8	4	4	2
Mesocricotopus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nanocladius	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Paracladius	2	-	1	-	-	1	1	-	3	3	-	-	-	-	-
Parakiefferiella	-	1	1	-	-	-	-	-	-	1	-	-	-	1	-
Psectrocladius	-	-	-	2	-	1	3	5	1	-	3	3	3	1	1
Pseudosmittia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zalutschia	-	-	5	1	-	-	-	-	-	-	-	-	3	1	-
Orthocladiinae *Genus "Greenland"*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
indeterminate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S.F. Prodiamesinae															
Monodiamesa	2	2	2	1	5	-	-	-	1	-	-	-	-	1	-
S.F. Tanypodinae															
Ablabesmyia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Procladius	12	8	9	8	7	15	3	21	9	9	-	8	5	5	4
Thienemannimyia complex	1	-	-	-	-	1	12	17	3	13	3	10	1	3	-
F. Empididae															
Neoplasta	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wiedemannia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pupae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Tipulidae															
Tipula	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MOLLUSCS															
P. Mollusca															
SNAILS															
Cl. Gastropoda															
F. Planorbidae															
Gyraulus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F. Valvatidae															
Valvata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLAMS															
Cl. Bivalvia															
F. Sphaeriidae															
Cyclocalyx/Neopisidium	19	14	28	22	20	22	20	24	35	21	3	2	15	3	9
Cyclocalyx	-	3	5	3	3	-	-	-	-	-	-	-	-	-	-
Sphaerium nitidum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Richness - totals [1]															
Total	15	14	18	14	15	14	14	11	15	15	10	12	16	15	10
Oligochaete	1	0	3	1	2	2	2	1	2	1	0	1	1	1	1
Insect	10	10	12	8	9	10	10	9	11	12	9	10	13	12	8
Mollusc	1	2	2	2	2	1	1	1	1	1	1	1	1	1	1
Other[3]	3	2	1	3	2	1	1	0	1	1	0	0	1	1	0
Abundance (raw) - totals [2]															
Total	65	57	84	57	67	90	90	185	155	149	49	88	101	85	78
Oligochaete	1	0	3	1	3	4	4	2	4	1	0	1	3	2	1
Insect	35	37	47	28	37	63	65	159	113	126	46	85	82	79	68
Mollusc	19	17	33	25	23	22	20	24	35	21	3	2	15	3	9
Other[3]	10	3	1	3	4	1	1	0	3	1	0	0	1	1	0
Abundance - totals (#/m^2)															
Total	1413	1239	1826	1239	1457	1957	1957	4022	3370	3239	1065	1913	2196	1848	1696
Oligochaete	22	0	65	22	65	87	87	43	87	22	0	22	65	43	22
Insect	761	804	1022	609	804	1370	1413	3457	2457	2739	1000	1848	1783	1717	1478
Mollusc	413	370	717	543	500	478	435	522	761	457	65	43	326	65	196
Other[3]	217	65	22	65	87	22	22	0	65	22	0	0	22	22	0

Notes:

[1] Richness totals exclude P. Nemata and Cl. Ostracoda, pupae and indeterminates (Acarina). Pupae are included in the richness totals if no other life stages are present in the replicate sample.

[2] Abundance totals exclude P. Nemata and Cl. Ostracoda.

Raw abundance from two grabs (grab area = 0.023 m^2).

[3] Other taxa = Cl. Turbellaria, F. Acalyptonotidae, F. Hygrobatidae, F. Lebertiidae, F. Oxidae, and O. Notostraca.

Appendix D. Benthic Invertebrate Raw Data, Meadowbank Study Lakes and Baker Lake, 2016.

Location	Wally Lake				
Station	**WAL**				
Replicate	1	2	3	4	5
Baker or Meadowbank?	Meadowbank	Meadowbank	Meadowbank	Meadowbank	Meadowbank
DepthOfSample (m)	8.6	9.2	8.2	6.8	7.3
# Grabs/sample	2	2	2	2	2
Mesh Size (µm)	500	500	500	500	500
Date	5-Aug-16	5-Aug-16	5-Aug-16	5-Aug-16	5-Aug-16
ROUNDWORMS					
P. Nemata	4	-	6	2	7
FLATWORMS					
P. Platyhelminthes					
Cl. Turbellaria					
indeterminate	2	-	5	3	8
ANNELIDS					
P. Annelida					
WORMS					
Cl. Oligochaeta					
F. Enchytraeidae	-	-	-	-	-
F. Naididae					
S.F. Naidinae					
Nais	-	-	-	-	-
S.F. Tubificinae					
Limnodrilus hoffmeisteri	-	-	-	-	-
Tasserkidrilus americanus	-	-	-	-	-
immatures with hair chaetae	-	-	-	-	-
immatures without hair chaetae	-	-	-	-	-
S.F. Rhyacodrilinae					
Rhyacodrilus coccineus	-	1	-	-	-
Rhyacodrilus montana	-	-	-	-	-
F. Lumbriculidae					
Lumbriculus	-	6	-	1	1
ARTHROPODS					
P. Arthropoda					
MITES					
Cl. Arachnida					
O. Acarina					
indeterminate	-	-	-	-	-
F. Acalyptonotidae					
Acalyptonotus	2	5	2	-	3
F. Hygrobatidae					
Hygrobates	-	-	-	-	-
F. Lebertiidae					
Lebertia	1	2	-	2	2
F. Oxidae					
Oxus	-	2	1	2	-
SEED SHRIMPS					
Cl. Ostracoda	9	19	9	17	26
TADPOLE SHRIMP					
O. Notostraca					
Lepidurus arcticus	-	-	-	-	-
WATER SCUDS					
O. Amphipoda					
F. Gammaracanthidae					
Gammaracanthus aestuariorum	-	-	-	-	-
INSECTS					
Cl. Insecta					
CADDISFLIES					
O. Trichoptera					
F. Apataniidae					
Apatania	-	-	-	-	-
F. Limnephilidae					
Grensia praeterita	-	1	-	-	1
TRUE FLIES					
O. Diptera					
MIDGES					
F. Chironomidae					
chironomid pupae	1	30	1	1	3
S.F. Chironominae					
Cladotanytarsus	-	-	-	-	-
Constempellina	-	-	-	-	-
Corynocera ambigua	35	134	31	32	52
Corynocera ?oliveri	584	827	330	224	423
Cryptotendipes	-	-	-	-	-
Dicrotendipes	-	-	-	-	7
Micropsectra	-	-	-	-	-
Microtendipes	-	-	-	-	-
Parachironomus	-	-	-	-	-
Paracladopelma	-	-	-	-	-
Paratanytarsus	4	7	2	2	6
Polypedilum	-	-	-	-	-
Sergentia	-	1	-	-	-
Stempellinella	-	-	-	-	-
Stictochironomus	19	-	6	19	27
Tanytarsus	35	366	38	59	40
S.F. Diamesinae					
Pagastia	-	-	-	-	-
Protanypus	-	-	-	-	-
Potthastia	-	-	-	-	-
Pseudodiamesa	-	-	-	-	-
S.F. Orthocladiinae					
Abiskomyia	-	-	-	-	-
Cricotopus/Orthocladius	-	-	-	-	-
Heterotrissocladius	-	4	-	-	-
Hydrobaenus	-	-	-	-	-
Mesocricotopus	-	-	-	-	-
Nanocladius	-	-	-	-	-
Paracladius	-	-	-	-	-
Parakiefferiella	-	-	-	-	-
Psectrocladius	-	1	2	2	-
Pseudosmittia	-	-	-	-	-
Zalutschia	-	-	-	-	-
Orthocladiinae *Genus "Greenland"*	-	-	-	-	-
indeterminate	-	-	-	-	-
S.F. Prodiamesinae					
Monodiamesa	15	-	4	2	3
S.F. Tanypodinae					
Ablabesmyia	8	-	-	-	3
Procladius	12	11	9	13	6
Thienemannimyia complex	-	-	-	2	-
F. Empididae					
Neoplasta	-	-	-	-	-
Wiedemannia	-	-	-	-	-
pupae	-	-	-	-	-
F. Tipulidae					
Tipula	-	-	-	-	-
MOLLUSCS					
P. Mollusca					
SNAILS					
Cl. Gastropoda					
F. Planorbidae					
Gyraulus	-	-	-	-	-
F. Valvatidae					
Valvata	-	-	-	-	-
CLAMS					
Cl. Bivalvia					
F. Sphaeriidae					
Cyclocalyx/Neopisidium	15	21	23	27	22
Cyclocalyx	7	26	13	6	4
Sphaerium nitidum	-	-	-	-	-
Richness - totals [1]					
Total	13	16	13	15	16
Oligochaete	0	2	0	1	1
Insect	8	9	8	9	10
Mollusc	2	2	2	2	2
Other[3]	3	3	3	3	3
Abundance (raw) - totals [2]					
Total	740	1445	467	397	611
Oligochaete	0	7	0	1	1
Insect	713	1382	423	356	571
Mollusc	22	47	36	33	26
Other[3]	5	9	8	7	13
Abundance - totals (#/m^2)					
Total	16087	31413	10152	8630	13283
Oligochaete	0	152	0	22	22
Insect	15500	30043	9196	7739	12413
Mollusc	478	1022	783	717	565
Other[3]	109	196	174	152	283

Notes:

[1] Richness totals exclude P. Nemata and Cl. Ostracoda, pupae and indeterminates (Acarina). Pupae are included in the richness totals if no other life stages are present in the replicate sample.

[2] Abundance totals exclude P. Nemata and Cl. Ostracoda.

Raw abundance from two grabs (grab area = 0.023 m^2).

[3] Other taxa = Cl. Turbellaria, F. Acalyptonotidae, F. Hygrobatidae, F. Lebertiidae, F. Oxidae, and O. Notostraca.

APPENDIX E

Benthic Invertebrate Plots

APPENDIX E1

Meadowbank Benthic Invertebrate Plots 2006 – 2016

LIST OF FIGURES – APPENDIX E1

Figure E1–1. Oligochaete abundance (#/m^2) from Meadowbank study lakes since 2006.

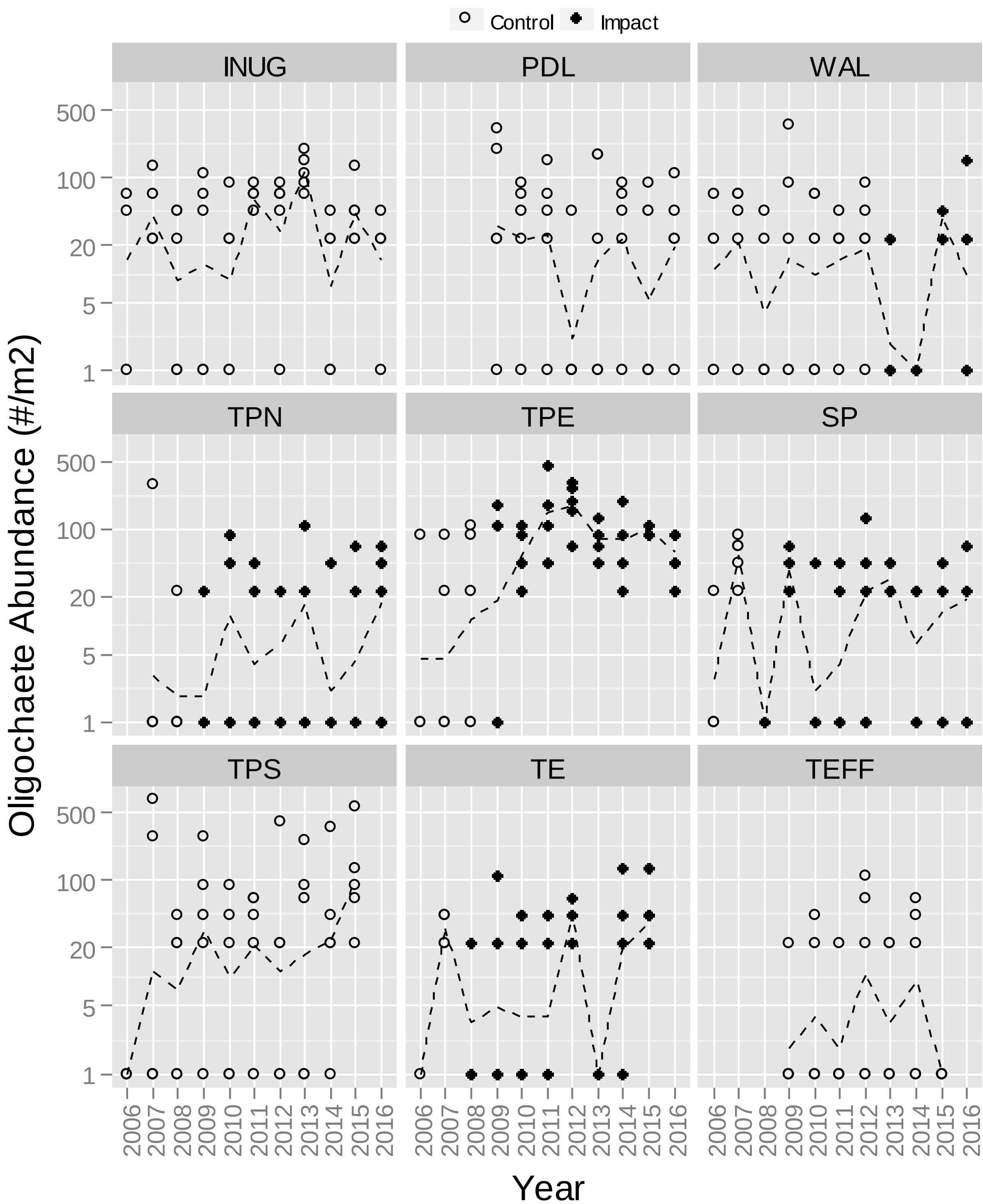


Figure E1–2. Insect abundance (#/m^2) from Meadowbank study lakes since 2006.

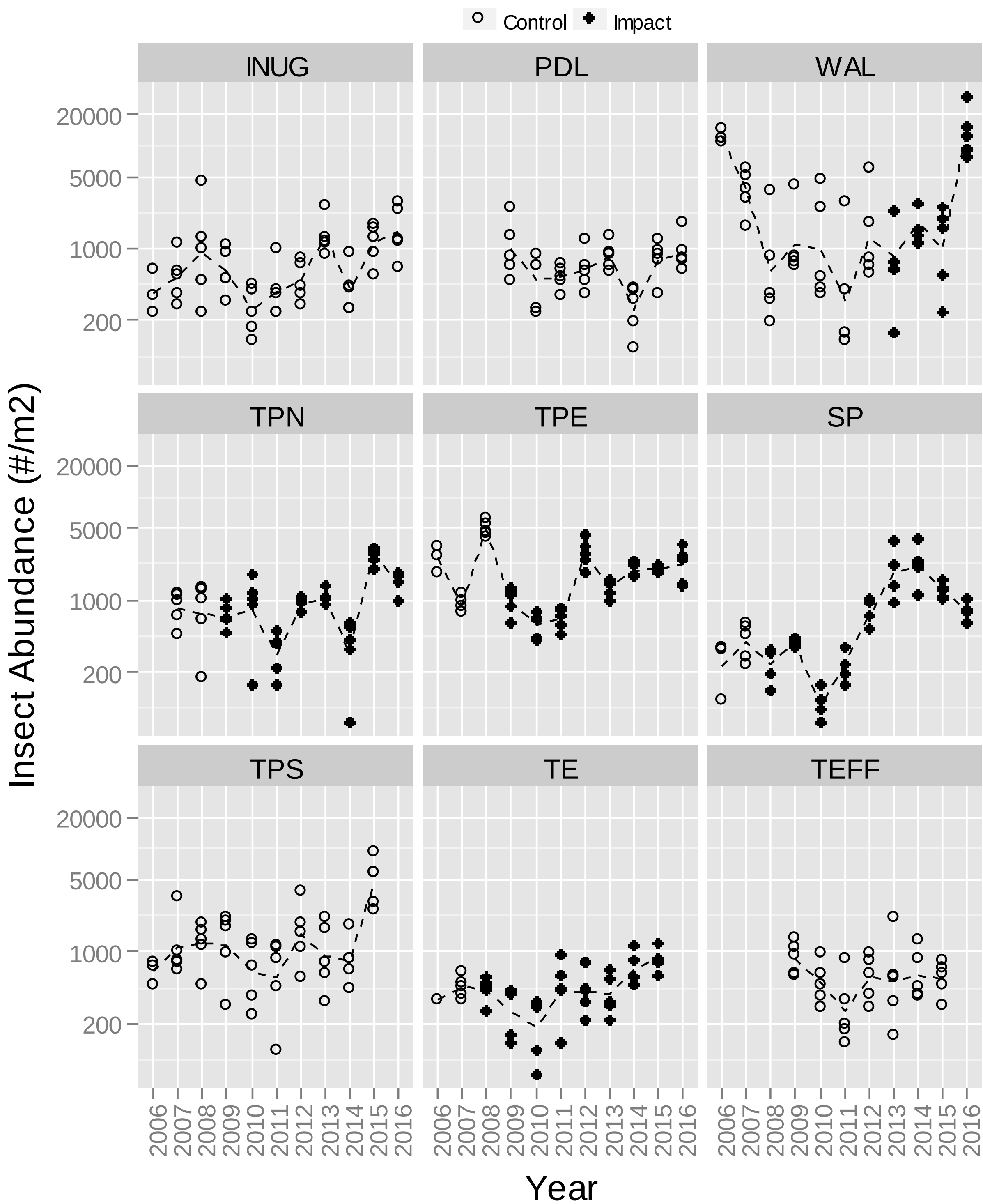


Figure E1–3. Mollusc abundance (#/m^2) from Meadowbank study lakes since 2006.

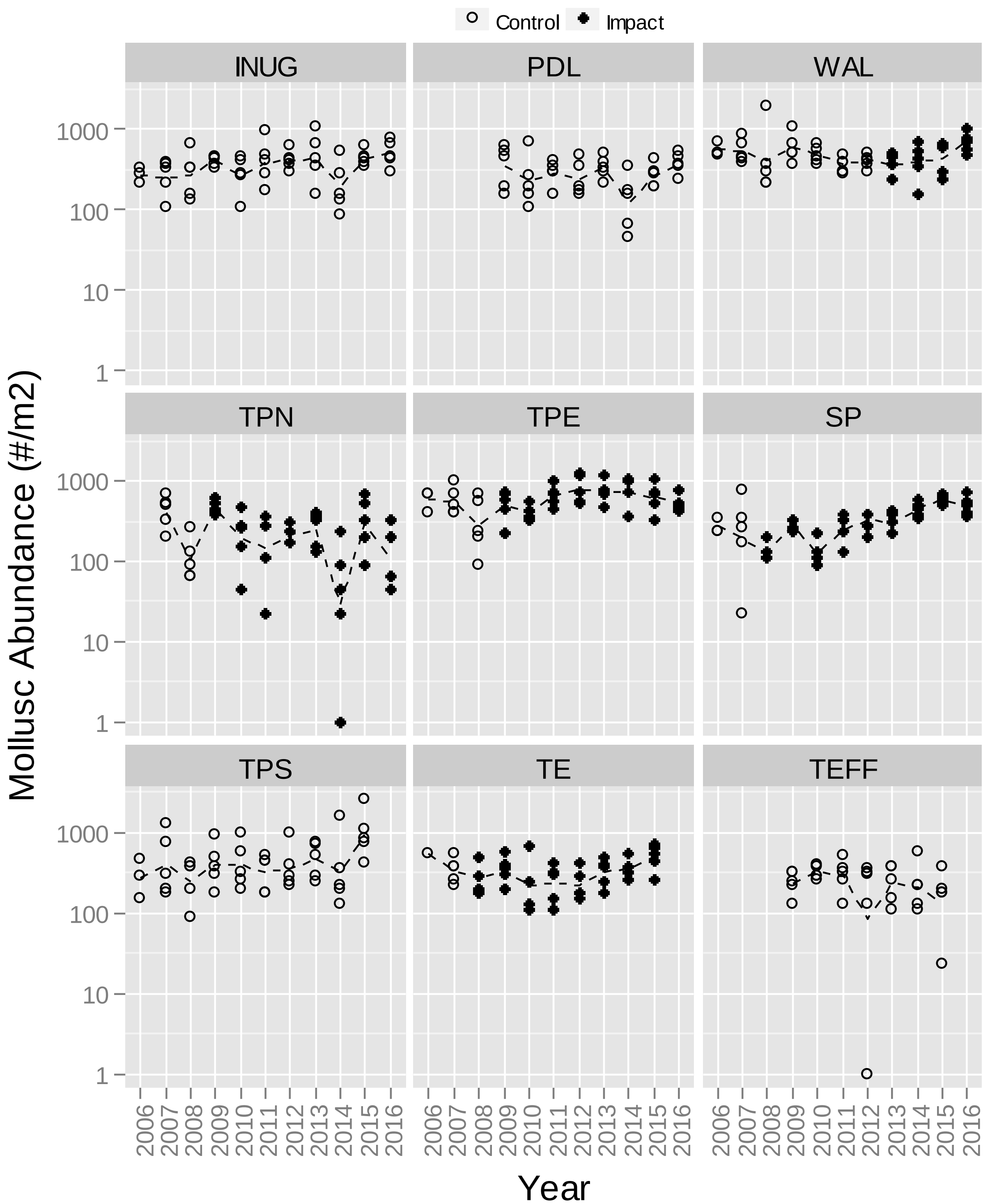


Figure E1–4. Other taxa abundance (#/m^2) from Meadowbank study lakes since 2006.

Note: "Other taxa" includes flatworms (Turbellaria) and arthropods (Acalyptonotidae, Hygrobatidae, Lebertiidae, Oxidae, and O. Notostraca).

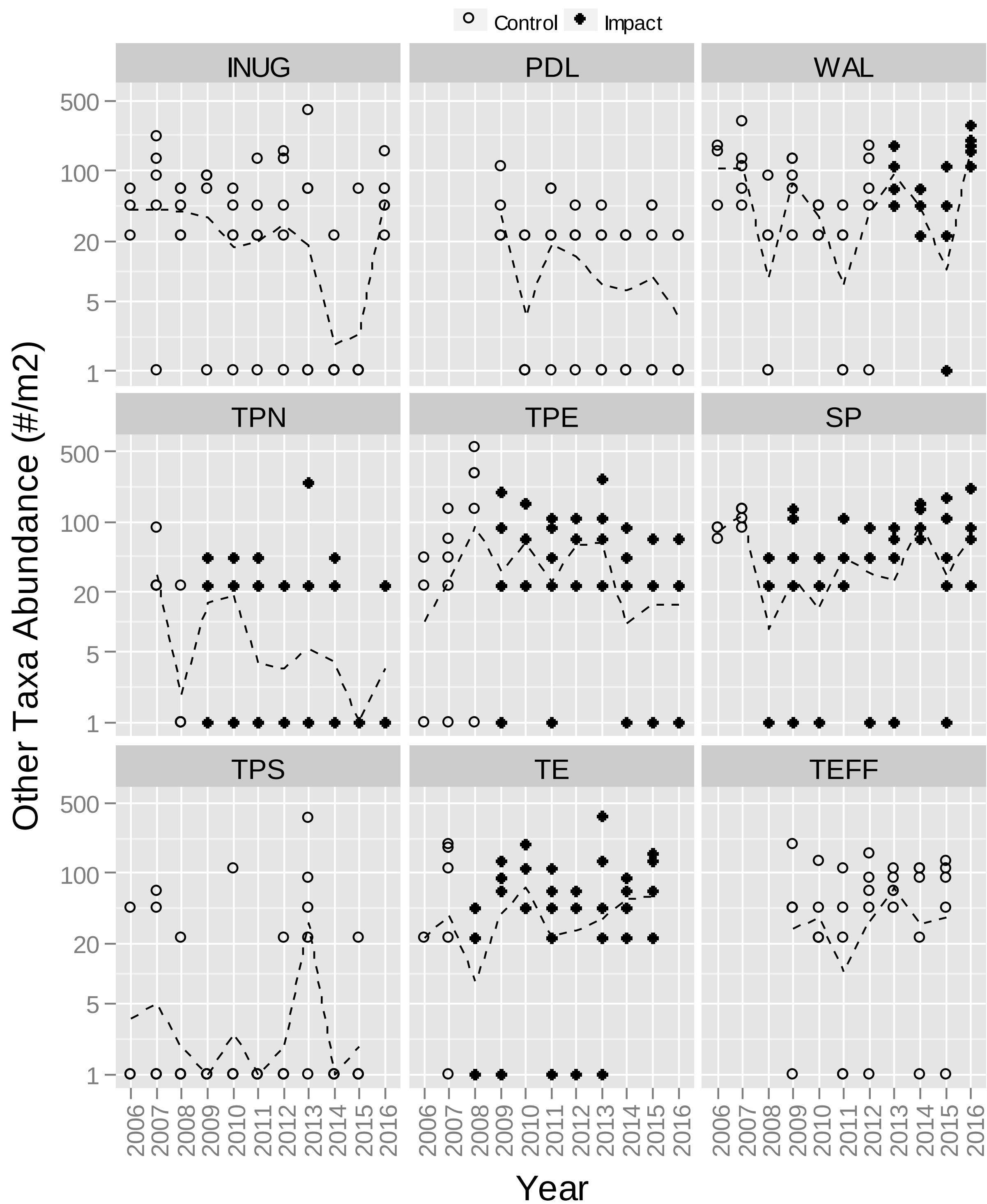


Figure E1–5. Oligochaete richness (# of taxa) from Meadowbank study lakes since 2006.

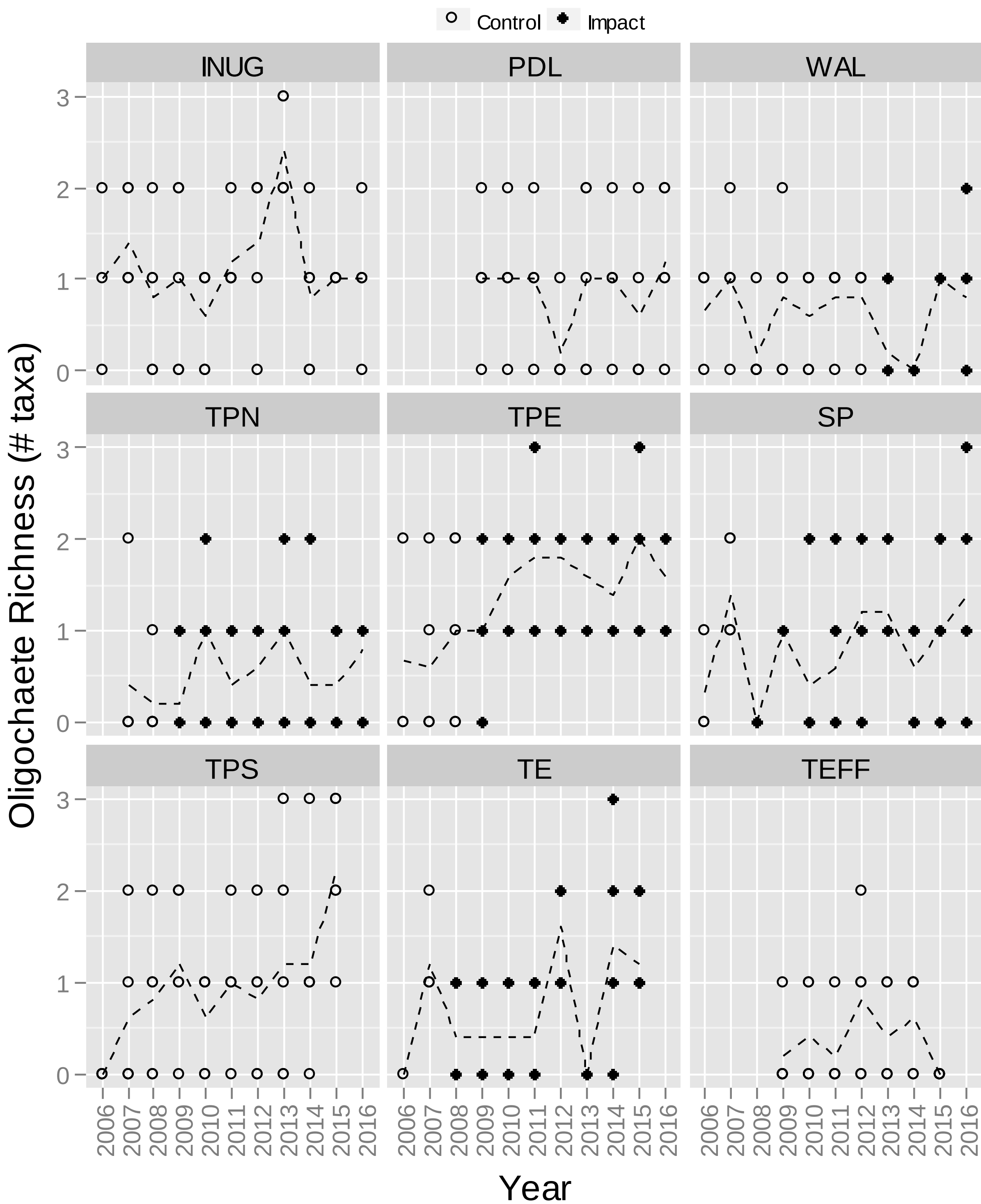


Figure E1–6. Insect richness (# of taxa) from Meadowbank study lakes since 2006.

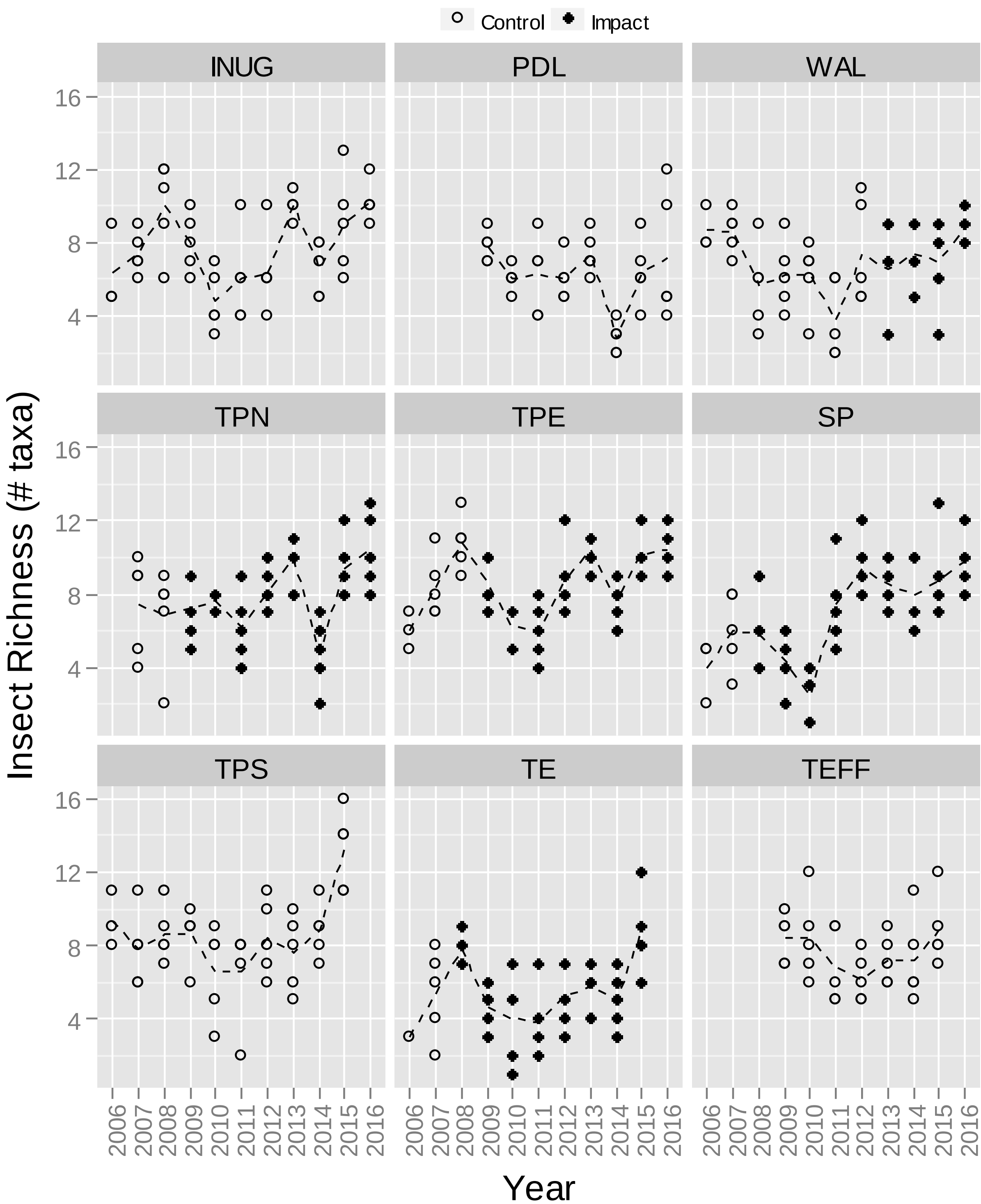


Figure E1–7. Mollusc richness (# of taxa) from Meadowbank study lakes since 2006.

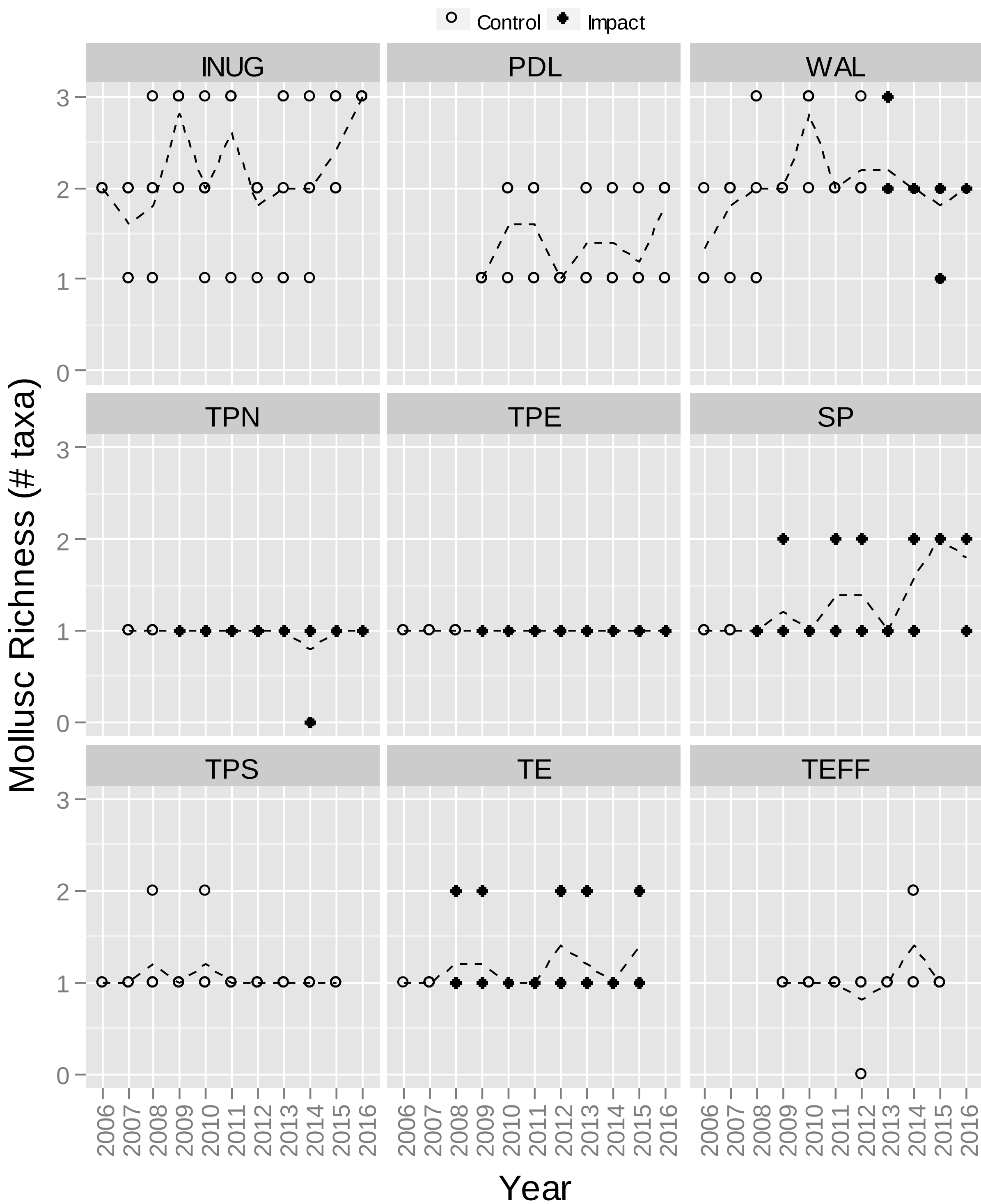


Figure E1–8. Other taxa richness (# of taxa) from Meadowbank study lakes since 2006.

Note: "Other taxa" includes flatworms (Turbellaria) and arthropods (Acalyptonotidae, Hygrobatidae, Lebertiidae, Oxidae, and O. Notostraca).

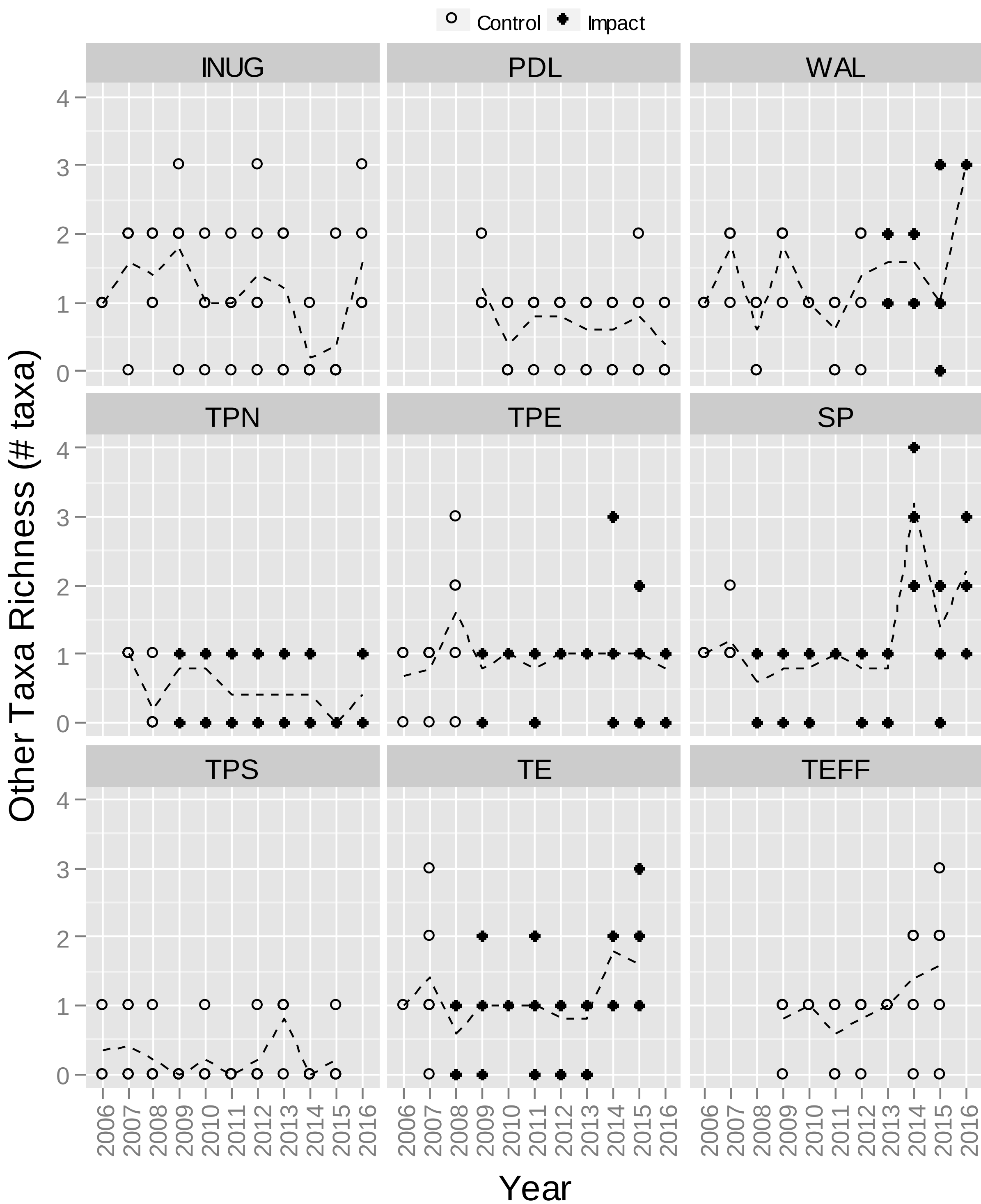


Figure E1–9. Simpson's Diversity for the benthic invertebrate community at the Meadowbank study lakes since 2006.

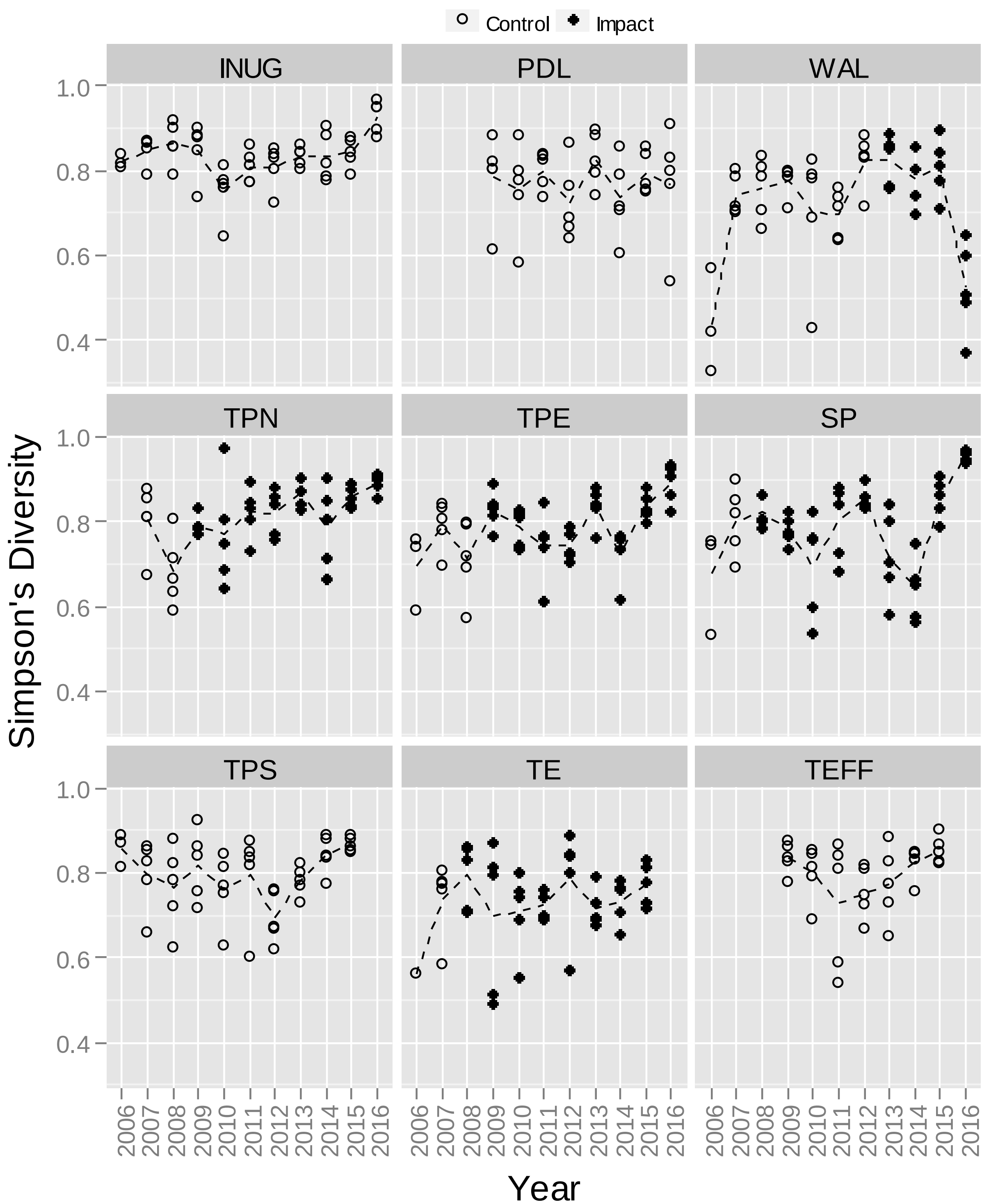
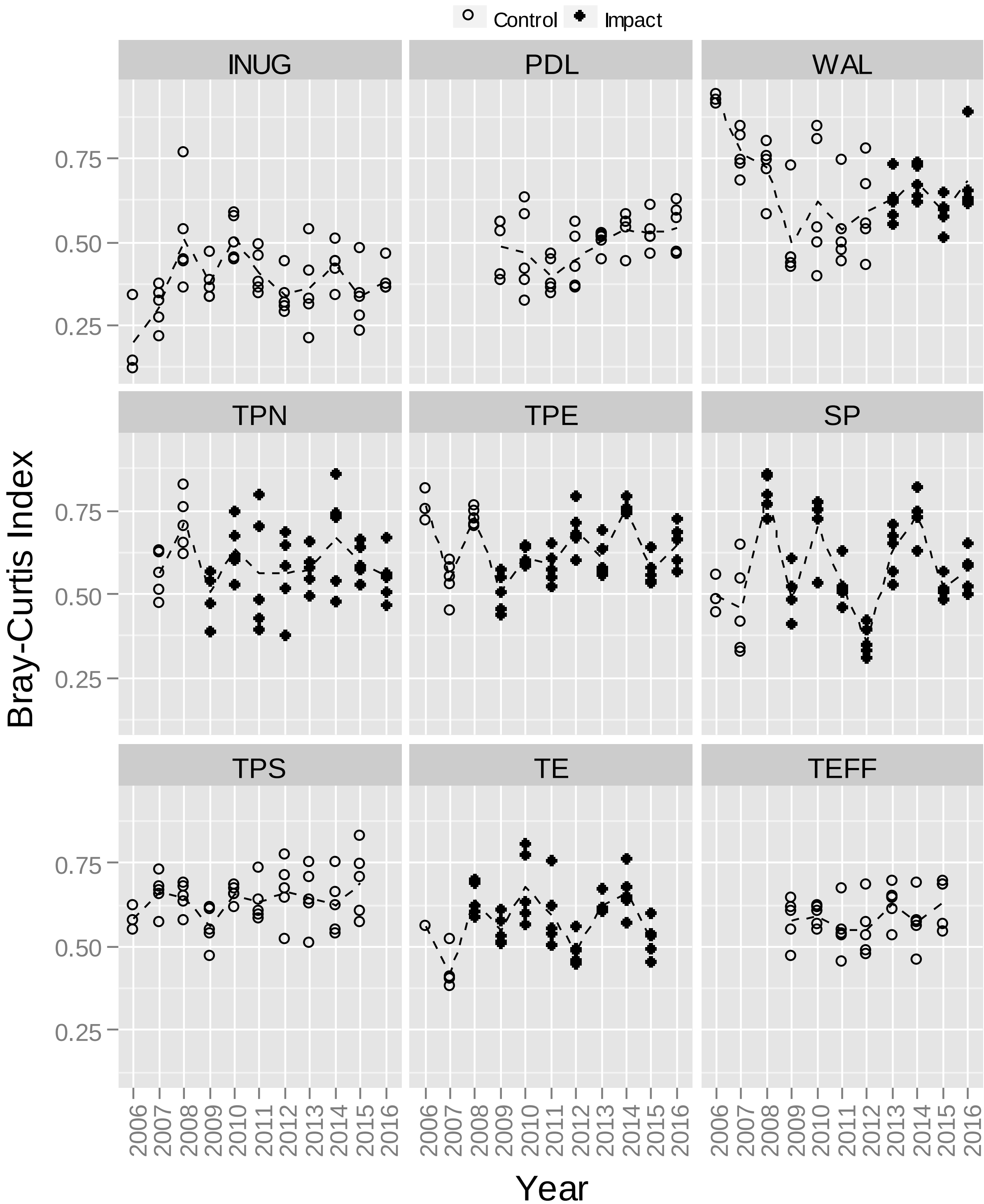


Figure E1–10. Bray-Curtis Index for the benthic invertebrate community at the Meadowbank study lakes since 2006.



APPENDIX E2

Baker Lake Benthic Invertebrate Plots 2006 – 2016

LIST OF FIGURES – APPENDIX E2

Figure E2–1. Oligochaete abundance (#/m^2) from Baker Lake since 2008.

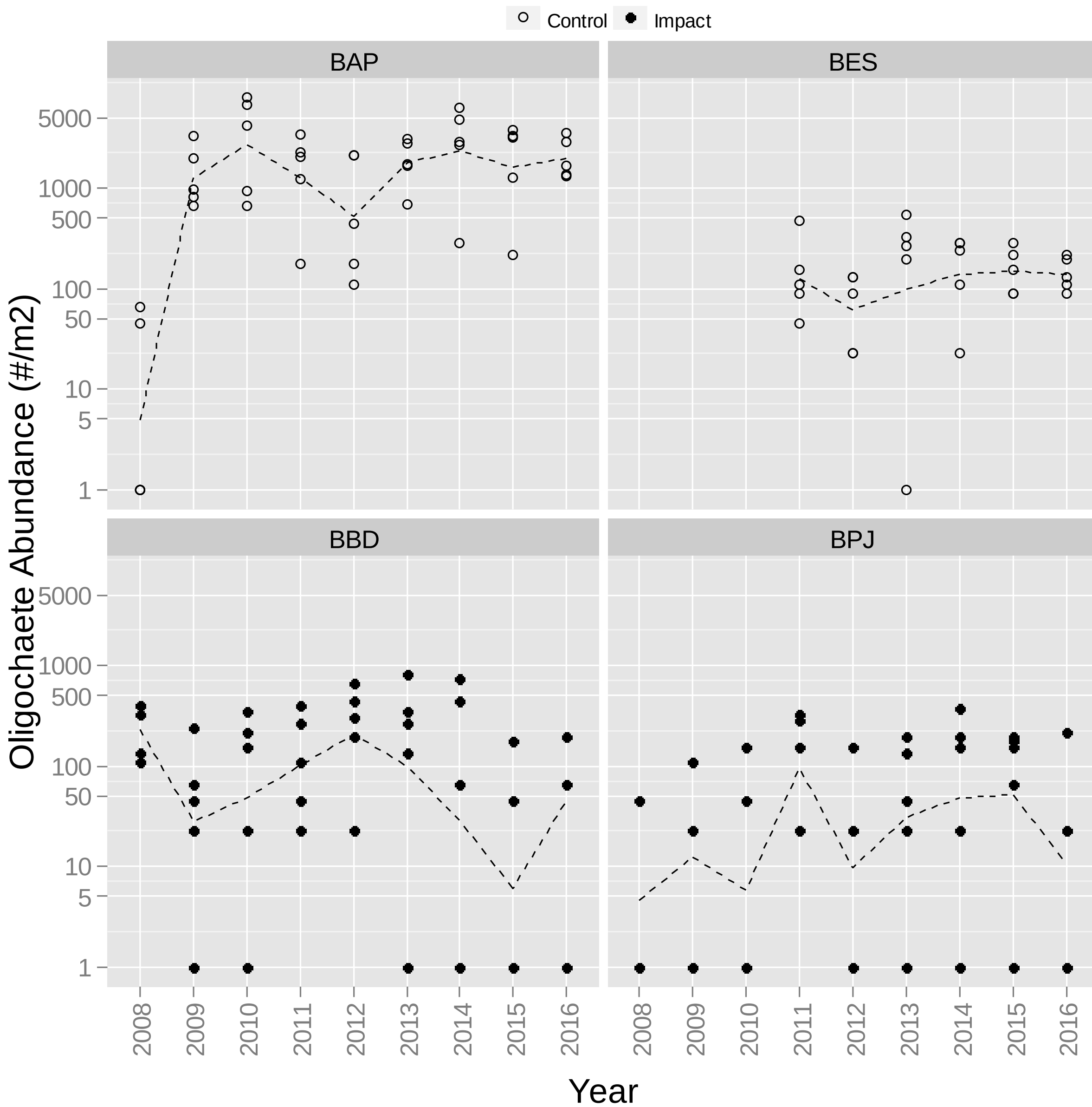


Figure E2–2. Insect abundance (#/m²) from Baker Lake since 2008.

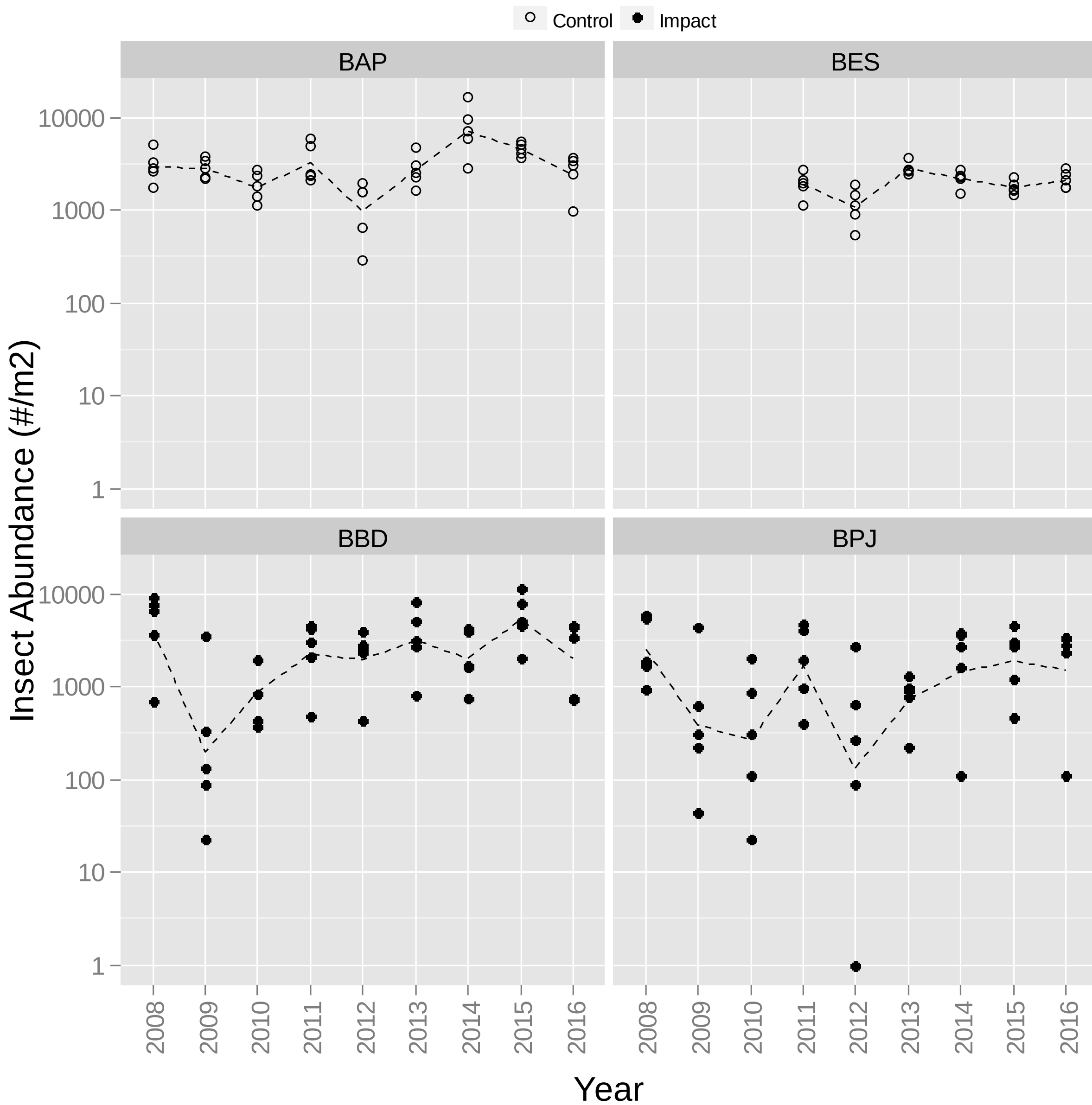


Figure E2–3. Mollusc abundance (#/m^2) from Baker Lake since 2008.

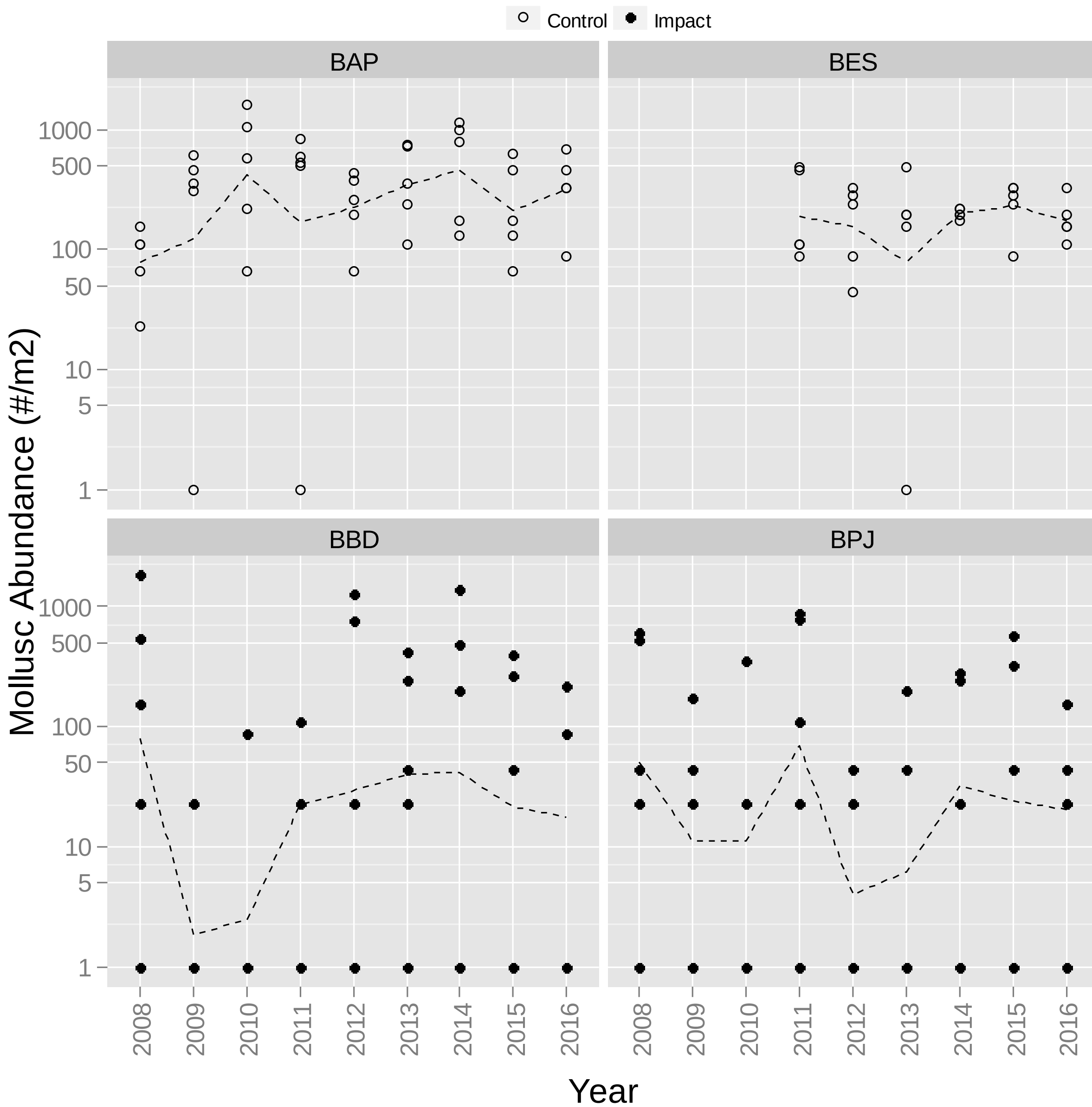


Figure E2–4. Other taxa abundance (#/m^2) from Baker Lake since 2008.

Note: "Other taxa" includes flatworms (Turbellaria) and arthropods (Acalyptonotidae, Hygrobatidae, Lebertiidae, Oxidae, and O. Notostraca).

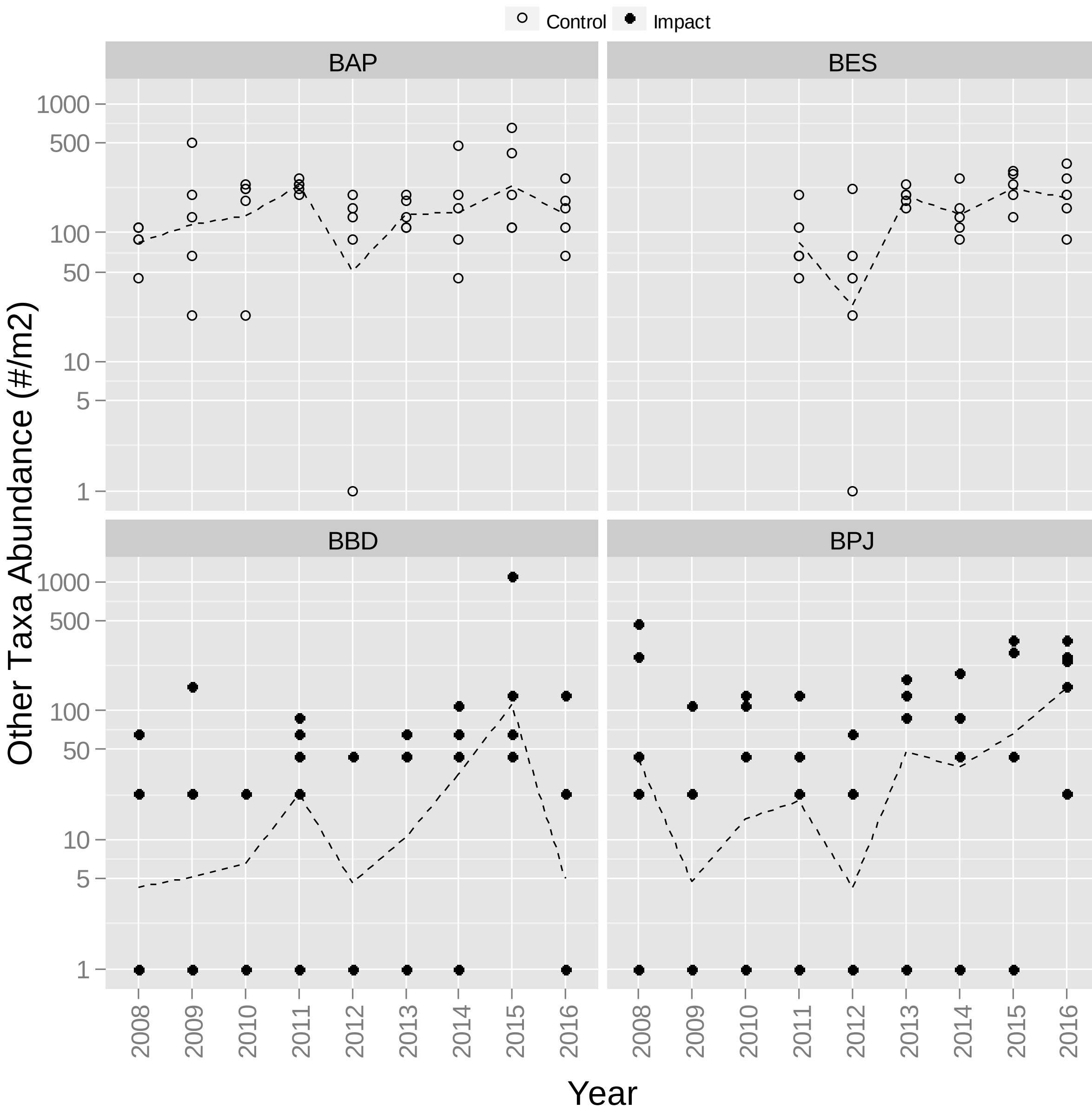


Figure E2–5. Oligochaete richness (# of taxa) from Baker Lake since 2008.

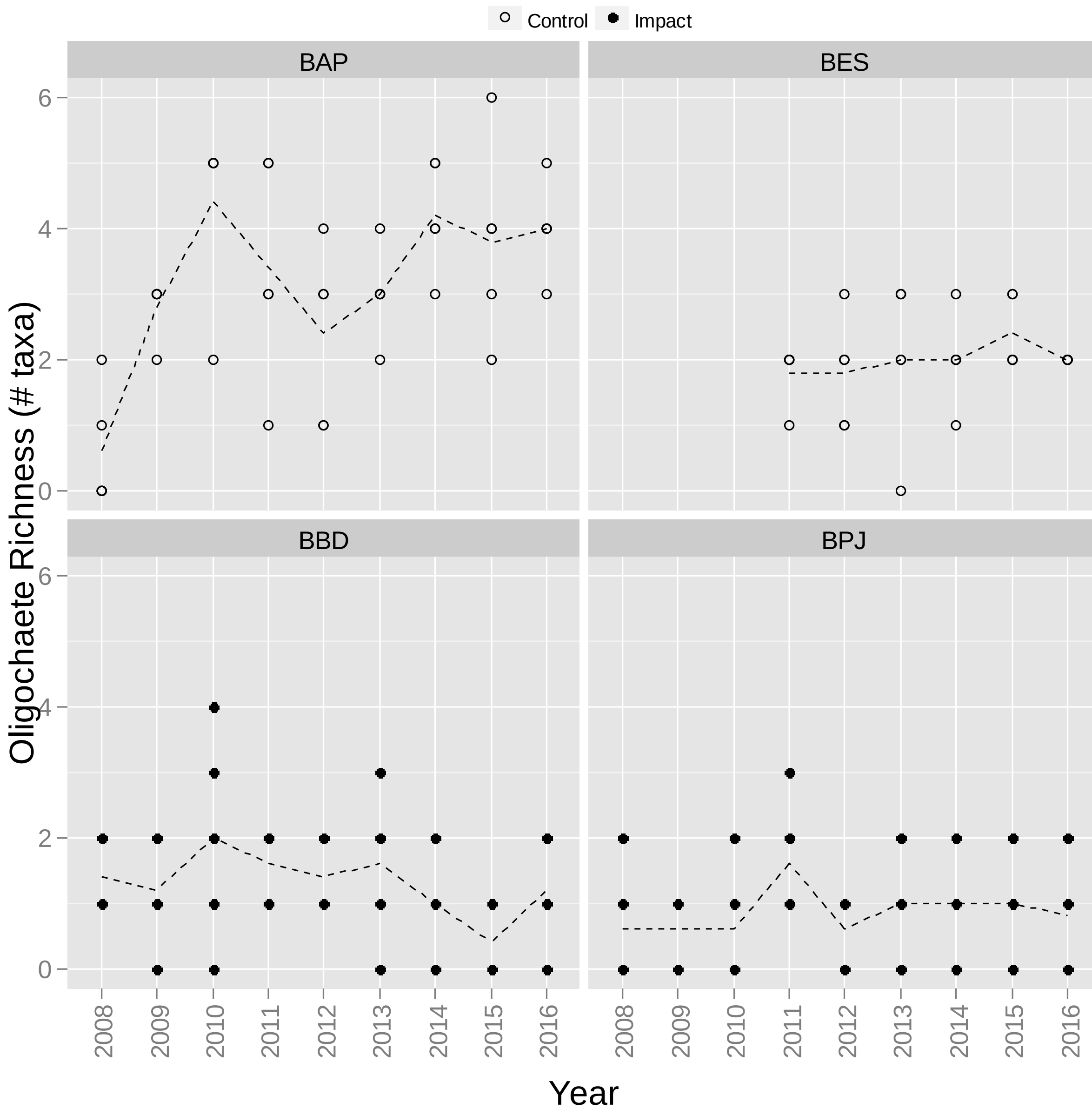


Figure E2–6. Insect richness (# of taxa) from Baker Lake since 2008.

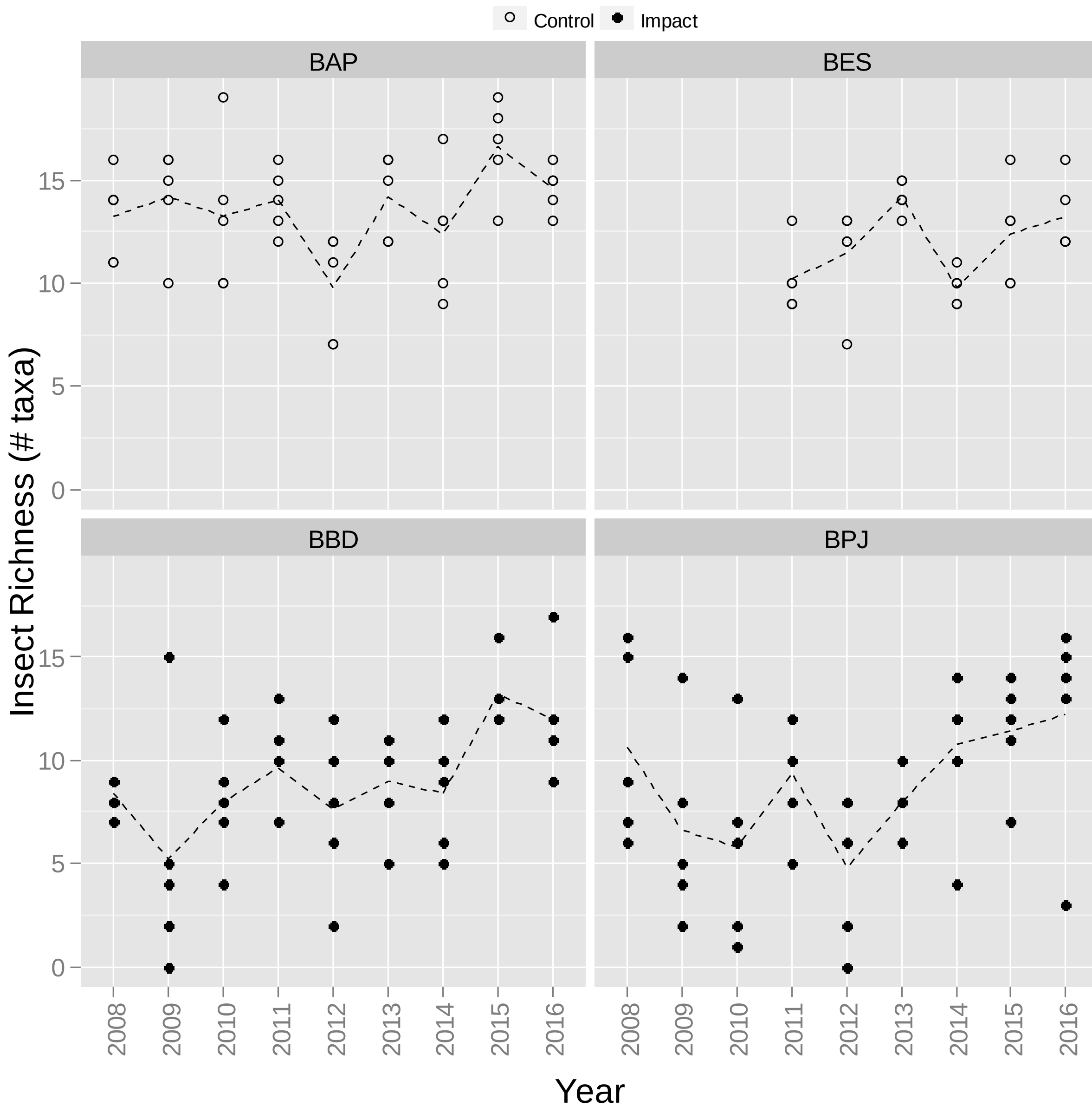


Figure E2–7. Mollusc richness (# of taxa) from Baker Lake since 2008.

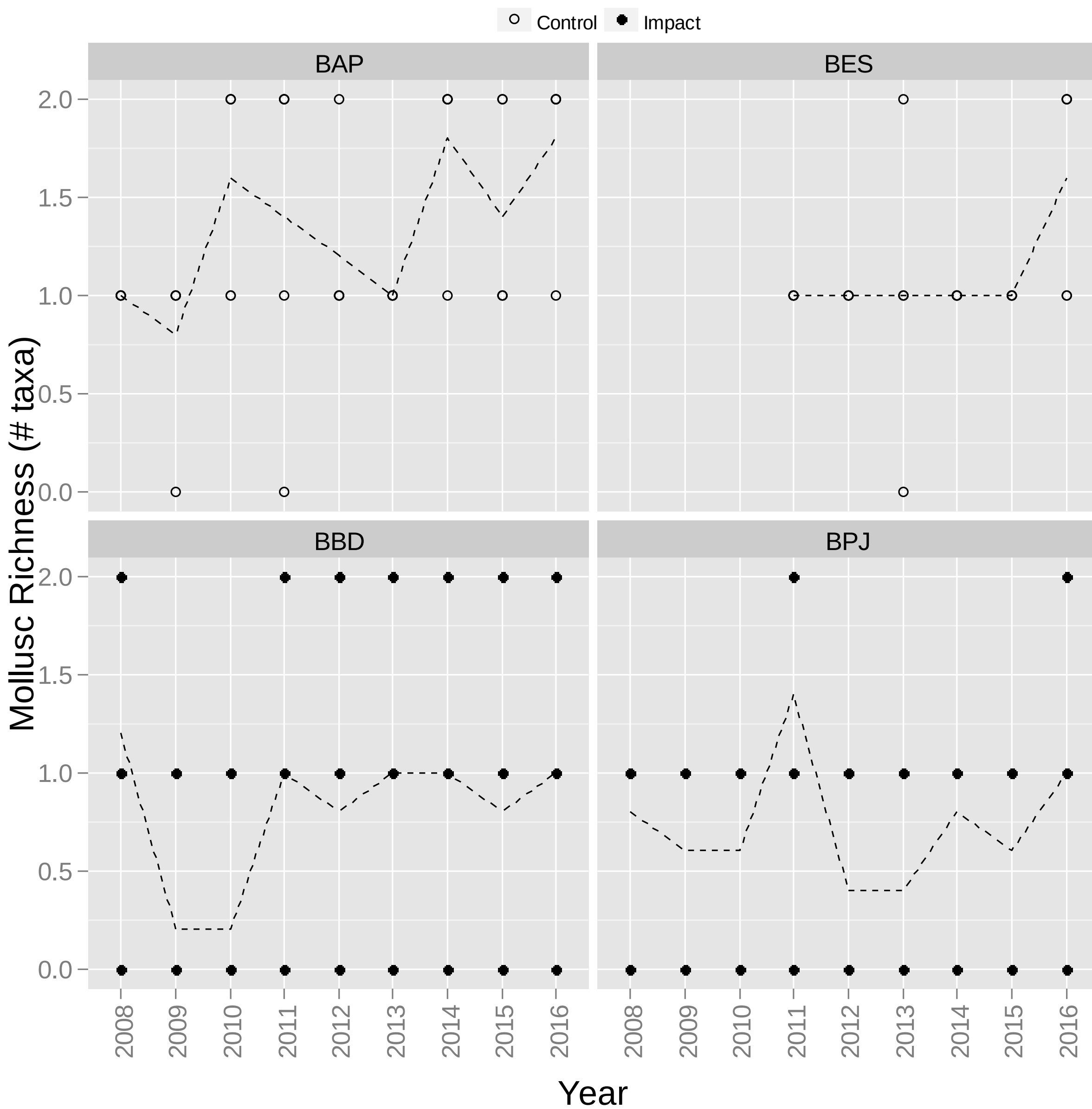


Figure E2–8. Other taxa richness (# of taxa) from Baker Lake since 2008.

Note: "Other taxa" includes flatworms (Turbellaria) and arthropods (Acalyptonotidae, Hygrobatidae, Lebertiidae, Oxidae, and O. Notostraca).

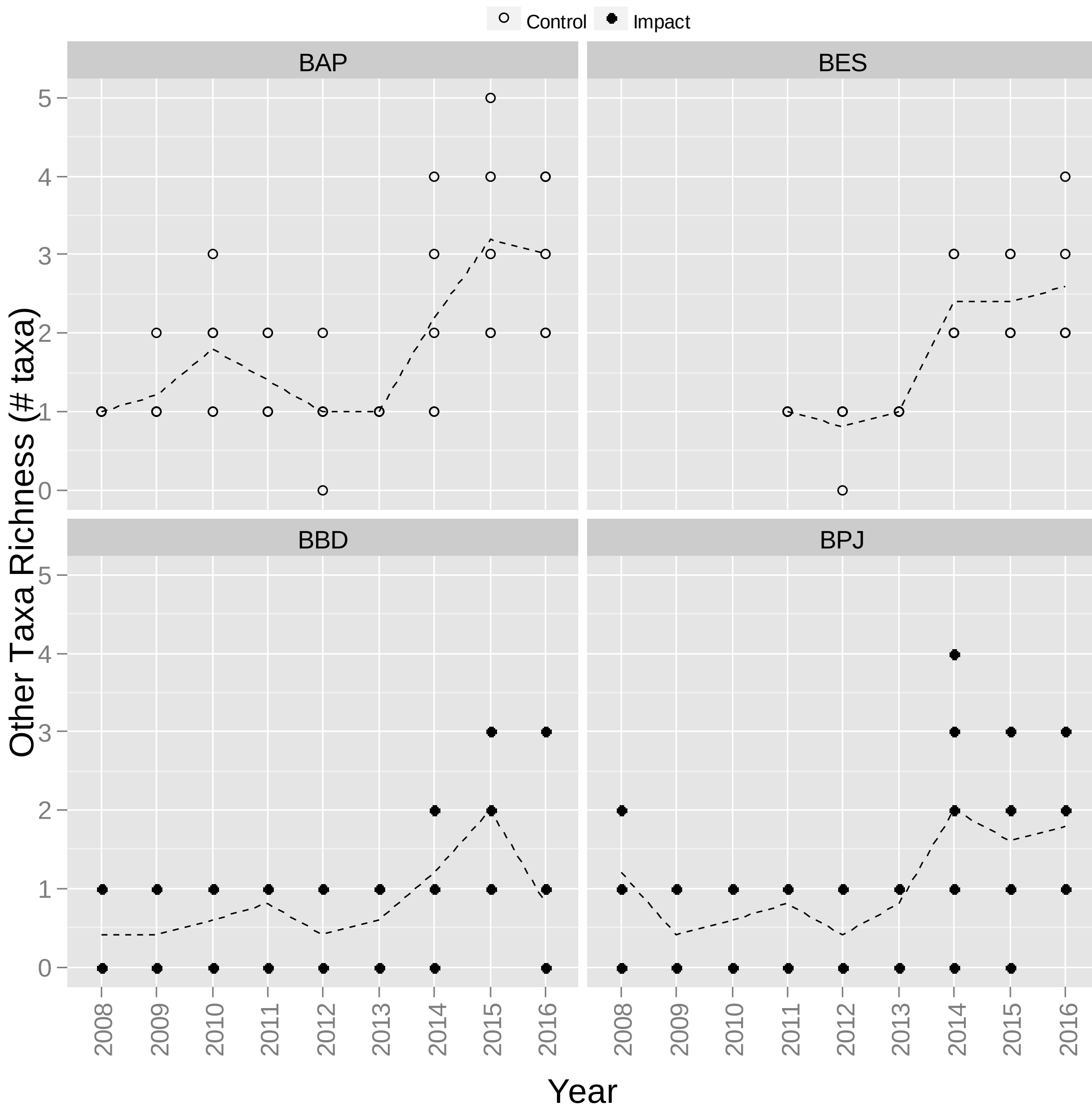


Figure E2–9. Simpson's Diversity for the benthic invertebrate community at Baker Lake since 2006.

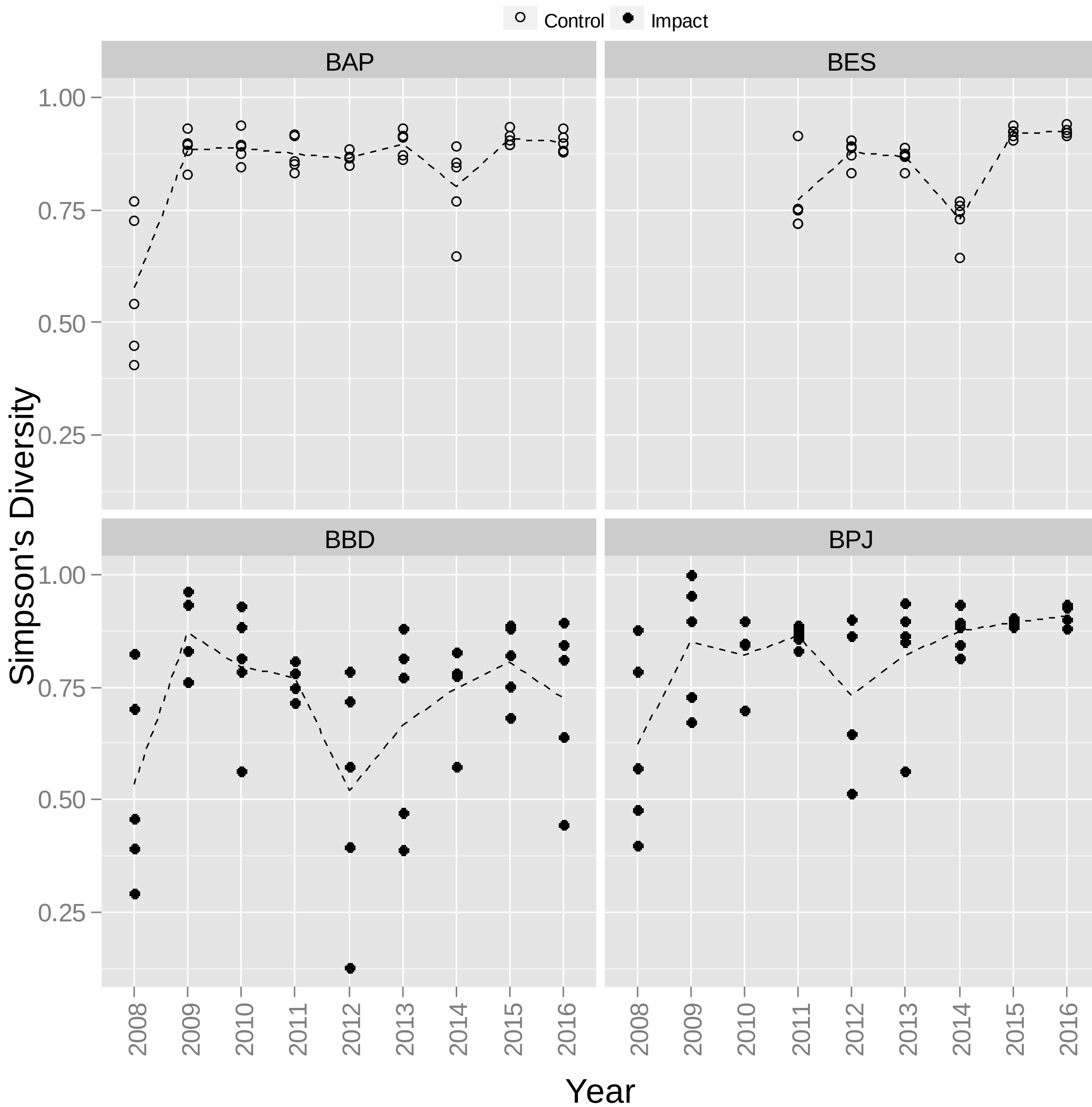
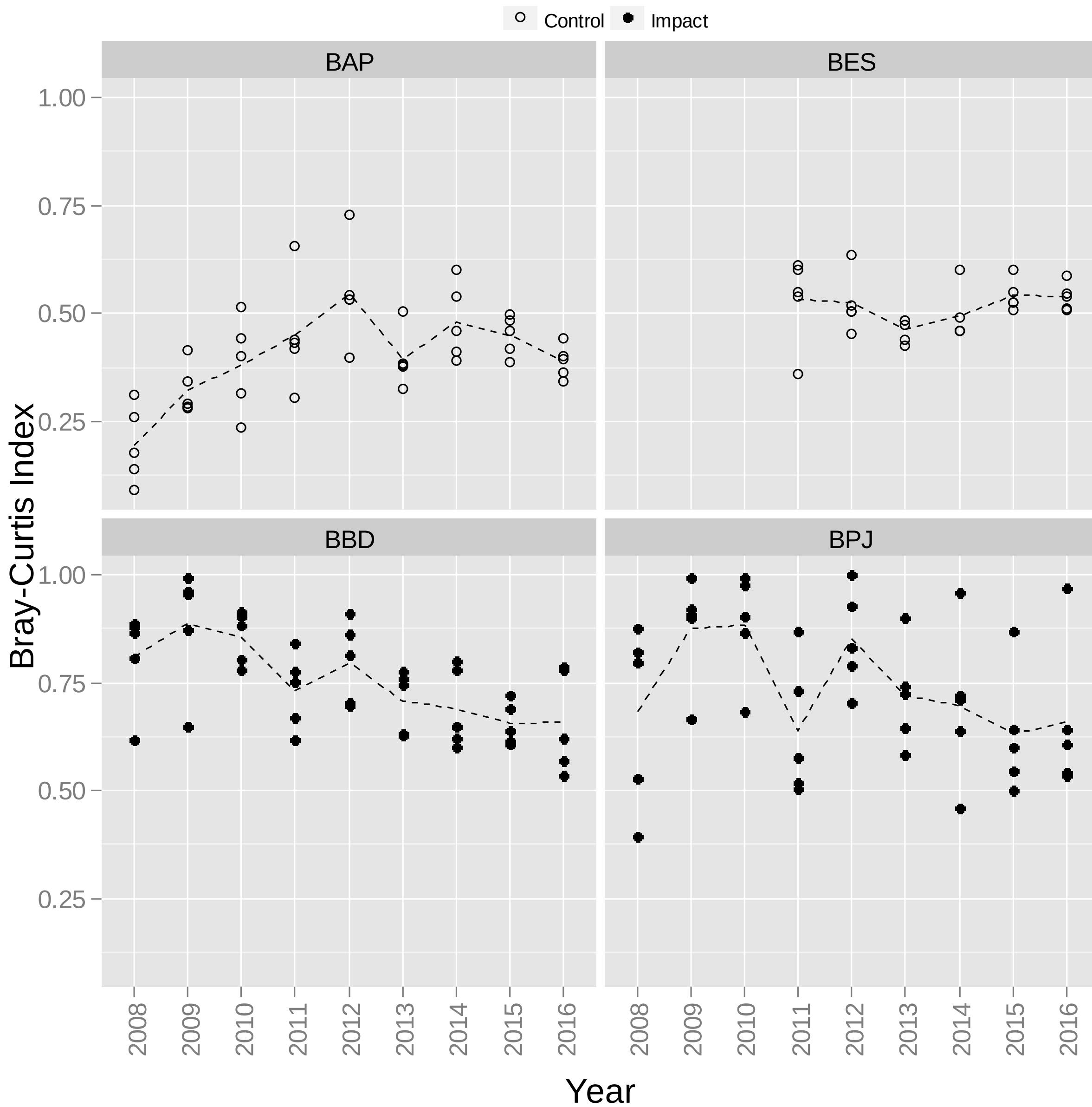


Figure E2–10. Bray-Curtis Index for the benthic invertebrate community at Baker Lake since 2008.



APPENDIX F

ALS Laboratory Reports, 2016

AZIMUTH CONSULTING GROUP INC.
ATTN: Eric Franz
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 25-APR-16
Report Date: 02-MAY-16 17:07 (MT)
Version: FINAL

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1759774
Project P.O. #: NOT SUBMITTED
Job Reference: CREMP MEADOWBANK SURFACEWATER
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1759774-1	L1759774-2	L1759774-3	L1759774-4	L1759774-5
	Description	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE
	Sampled Date	14-APR-16	14-APR-16	15-APR-16	15-APR-16	15-APR-16
	Sampled Time	15:00	16:10	09:50	10:50	16:00
	Client ID	SP-90-S	SP-91-S	INUG-79-S	INUG-78-S	APR CREMP DI-1
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	44.4	43.9	20.5	20.1	<2.0
	Hardness (as CaCO3) (mg/L)	16.8	16.7	7.38	7.19	<0.50
	pH (pH)	7.04	7.02	6.78	6.79	5.44
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Total Dissolved Solids (mg/L)	29.1	27.0	15.4	15.5	<3.0
	Turbidity (NTU)	0.12	0.14	0.16	0.14	<0.10
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	12.3	11.9	6.5	6.2	<1.0
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	12.3	11.9	6.5	6.2	<1.0
	Ammonia, Total (as N) (mg/L)	0.0193	0.0207	0.0164	0.0189	<0.0050
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	1.01	1.00	0.97	0.95	<0.10
	Fluoride (F) (mg/L)	0.085	0.086	0.073	0.073	<0.020
	Nitrate (as N) (mg/L)	0.0363	0.0316	<0.0050	<0.0050	<0.0050
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	0.165	0.131	0.148	0.145	<0.050
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Phosphorus (P)-Total (mg/L)	<0.0020	<0.0020	<0.0020	0.0021	<0.0020
	Silicate (as SiO2) (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Sulfate (SO4) (mg/L)	5.89	5.94	1.16	1.13	<0.30
Cyanides	Cyanide, Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Cyanide, Free (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	2.02	1.94	2.27	2.05	<0.50
	Total Organic Carbon (mg/L)	1.85	2.11	2.13	2.03	<0.50
Total Metals	Aluminum (Al)-Total (mg/L)	<0.0030	0.0035	0.0039	<0.0030	<0.0030
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00034	0.00037	0.00011	0.00012	<0.00010
	Barium (Ba)-Total (mg/L)	0.00366	0.00378	0.00230	0.00207	<0.000050
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Total (mg/L)	4.23	4.24	1.45	1.43	<0.050
	Chromium (Cr)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1759774-6	L1759774-7	L1759774-8	L1759774-9	L1759774-10
	Description	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE
	Sampled Date	15-APR-16	16-APR-16	16-APR-16	17-APR-16	17-APR-16
	Sampled Time	16:30	10:15	12:30	09:00	10:25
	Client ID	APR CREMP EB-1	PDL-43-S	PDL-44-S	TPN-91-S	TPN-90-S
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	<2.0	24.5	23.7	34.9	34.5
	Hardness (as CaCO3) (mg/L)	<0.50	9.61	9.50	11.2	10.9
	pH (pH)	5.42	6.96	6.99	6.94	6.93
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Total Dissolved Solids (mg/L)	<3.0	17.8	17.8	22.2	20.8
	Turbidity (NTU)	0.12	0.12	0.13	0.12	0.13
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	<1.0	7.8	7.5	7.0	7.1
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	<1.0	7.8	7.5	7.0	7.1
	Ammonia, Total (as N) (mg/L)	<0.0050	0.0123	0.0115	0.0187	0.0197
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	<0.10	0.68	0.65	0.94	0.92
	Fluoride (F) (mg/L)	<0.020	0.042	0.041	0.079	0.078
	Nitrate (as N) (mg/L)	<0.0050	<0.0050	<0.0050	0.0700	0.0669
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	<0.050	0.101	0.107	0.116	0.109
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Phosphorus (P)-Total (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Silicate (as SiO2) (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Sulfate (SO4) (mg/L)	<0.30	1.83	1.76	6.03	5.98
Cyanides	Cyanide, Total (mg/L)	<0.0010	<0.0010	<0.0010	0.0023	<0.0010
	Cyanide, Free (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	<0.50	1.73	1.52	1.47	1.48
	Total Organic Carbon (mg/L)	<0.50	1.65	1.68	1.76	1.51
Total Metals	Aluminum (Al)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	0.0050
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	<0.00010	0.00018	0.00017	0.00022	0.00022
	Barium (Ba)-Total (mg/L)	<0.000050	0.00210	0.00198	0.00367	0.00363
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Total (mg/L)	<0.050	2.49	2.39	2.73	2.78
	Chromium (Cr)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1759774-1	L1759774-2	L1759774-3	L1759774-4	L1759774-5
	Description	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE
	Sampled Date	14-APR-16	14-APR-16	15-APR-16	15-APR-16	15-APR-16
	Sampled Time	15:00	16:10	09:50	10:50	16:00
	Client ID	SP-90-S	SP-91-S	INUG-79-S	INUG-78-S	APR CREMP DI-1
Grouping	**Analyte**					
WATER						
Total Metals	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Total (mg/L)	0.00061	0.00104	0.00051	<0.00050	<0.00050
	Iron (Fe)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)-Total (mg/L)	1.44	1.45	0.92	0.91	<0.10
	Manganese (Mn)-Total (mg/L)	0.00031	0.00046	0.00059	0.00056	<0.00010
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	0.000170	0.000175	<0.000050	<0.000050	<0.000050
	Nickel (Ni)-Total (mg/L)	<0.00050	<0.00050	0.00645	<0.00050	<0.00050
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	0.72	0.75	0.55	0.53	<0.10
	Selenium (Se)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)-Total (mg/L)	0.191	0.171	0.137	0.129	<0.050
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	1.19	1.24	0.723	0.678	<0.050
	Strontium (Sr)-Total (mg/L)	0.0196	0.0193	0.00800	0.00842	<0.00020
	Sulfur (S)-Total (mg/L)	1.89	1.94	<0.50	<0.50	<0.50
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Total (mg/L)	0.000048	0.000052	0.000044	0.000047	<0.000010
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0012	0.0013	0.0014	0.0020	<0.0010
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00033	0.00033	<0.00010	<0.00010	<0.00010
	Barium (Ba)-Dissolved (mg/L)	0.00370	0.00368	0.00216	0.00211	<0.000050
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Dissolved (mg/L)	4.37	4.33	1.47	1.43	<0.050
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1759774-6	L1759774-7	L1759774-8	L1759774-9	L1759774-10
	Description	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE
	Sampled Date	15-APR-16	16-APR-16	16-APR-16	17-APR-16	17-APR-16
	Sampled Time	16:30	10:15	12:30	09:00	10:25
	Client ID	APR CREMP EB-1	PDL-43-S	PDL-44-S	TPN-91-S	TPN-90-S
WATER						
Total Metals	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Total (mg/L)	<0.00050	0.00060	<0.00050	<0.00050	<0.00050
	Iron (Fe)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	0.000084
	Lithium (Li)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)-Total (mg/L)	<0.10	0.89	0.85	1.12	1.12
	Manganese (Mn)-Total (mg/L)	<0.00010	0.00055	0.00058	0.00044	0.00056
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	<0.000050	0.000053	<0.000050	0.000192	0.000195
	Nickel (Ni)-Total (mg/L)	<0.00050	0.00059	0.00055	0.00051	<0.00050
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	<0.10	0.43	0.39	0.69	0.71
	Selenium (Se)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)-Total (mg/L)	RRV 0.122	0.120	0.116	<0.050	<0.050
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	<0.050	0.532	0.505	1.43	1.41
	Strontium (Sr)-Total (mg/L)	<0.00020	0.0105	0.00989	0.0133	0.0132
	Sulfur (S)-Total (mg/L)	<0.50	0.64	0.59	1.92	1.93
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Total (mg/L)	<0.000010	0.000021	0.000022	0.000042	0.000041
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	0.0012	0.0010
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	<0.00010	0.00014	0.00015	0.00019	0.00019
	Barium (Ba)-Dissolved (mg/L)	<0.000050	0.00203	0.00196	0.00359	0.00349
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Dissolved (mg/L)	<0.050	2.44	2.43	2.73	2.64
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		L1759774-1	L1759774-2	L1759774-3	L1759774-4	L1759774-5
	Sample ID	L1759774-1	L1759774-2	L1759774-3	L1759774-4	L1759774-5
	Description	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE
	Sampled Date	14-APR-16	14-APR-16	15-APR-16	15-APR-16	15-APR-16
	Sampled Time	15:00	16:10	09:50	10:50	16:00
	Client ID	SP-90-S	SP-91-S	INUG-79-S	INUG-78-S	APR CREMP DI-1
Grouping	**Analyte**					
WATER						
Dissolved Metals	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Dissolved (mg/L)	0.00056	0.00054	0.00035	0.00036	<0.00020
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)-Dissolved (mg/L)	1.44	1.43	0.90	0.88	<0.10
	Manganese (Mn)-Dissolved (mg/L)	<0.00010	0.00010	0.00020	0.00024	<0.00010
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	0.000158	0.000153	<0.000050	<0.000050	<0.000050
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	0.68	0.70	0.48	0.47	<0.10
	Selenium (Se)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)-Dissolved (mg/L)	0.182	0.162	0.129	0.122	<0.050
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	1.21	1.22	0.699	0.675	<0.050
	Strontium (Sr)-Dissolved (mg/L)	0.0193	0.0186	0.00815	0.00768	<0.00020
	Sulfur (S)-Dissolved (mg/L)	1.94	1.94	<0.50	<0.50	<0.50
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Dissolved (mg/L)	0.000043	0.000047	0.000040	0.000039	<0.000010
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1759774-6	L1759774-7	L1759774-8	L1759774-9	L1759774-10
	Description	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE
	Sampled Date	15-APR-16	16-APR-16	16-APR-16	17-APR-16	17-APR-16
	Sampled Time	16:30	10:15	12:30	09:00	10:25
	Client ID	APR CREMP EB-1	PDL-43-S	PDL-44-S	TPN-91-S	TPN-90-S
WATER						
Dissolved Metals	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Dissolved (mg/L)	<0.00020	0.00038	0.00036	0.00035	0.00037
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)-Dissolved (mg/L)	<0.10	0.85	0.83	1.07	1.06
	Manganese (Mn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	0.00012	<0.00010
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	0.000170	0.000188
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	<0.10	0.37	0.38	0.61	0.59
	Selenium (Se)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)-Dissolved (mg/L)	<0.050	0.112	0.111	<0.050	<0.050
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	<0.050	0.518	0.509	1.40	1.35
	Strontium (Sr)-Dissolved (mg/L)	<0.00020	0.00994	0.00955	0.0123	0.0128
	Sulfur (S)-Dissolved (mg/L)	<0.50	0.60	0.62	1.95	1.89
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Dissolved (mg/L)	<0.000010	0.000018	0.000016	0.000035	0.000039
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Alkalinity, Total (as CaCO3)	B	L1759774-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Method Blank	Calcium (Ca)-Total	B	L1759774-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Aluminum (Al)-Dissolved	DLA	L1759774-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Antimony (Sb)-Dissolved	DLA	L1759774-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Arsenic (As)-Dissolved	DLA	L1759774-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Bismuth (Bi)-Dissolved	DLA	L1759774-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Cadmium (Cd)-Dissolved	DLA	L1759774-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Chromium (Cr)-Dissolved	DLA	L1759774-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Cobalt (Co)-Dissolved	DLA	L1759774-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Copper (Cu)-Dissolved	DLA	L1759774-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Lead (Pb)-Dissolved	DLA	L1759774-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Nickel (Ni)-Dissolved	DLA	L1759774-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Selenium (Se)-Dissolved	DLA	L1759774-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Silver (Ag)-Dissolved	DLA	L1759774-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Thallium (Tl)-Dissolved	DLA	L1759774-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Tin (Sn)-Dissolved	DLA	L1759774-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Titanium (Ti)-Dissolved	DLA	L1759774-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Vanadium (V)-Dissolved	DLA	L1759774-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Zinc (Zn)-Dissolved	DLA	L1759774-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Zirconium (Zr)-Dissolved	DLA	L1759774-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Total Kjeldahl Nitrogen	MS-B	L1759774-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Ammonia, Total (as N)	MS-B	L1759774-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Total Organic Carbon	MS-B	L1759774-10, -4, -5, -6, -7, -8, -9
Matrix Spike	Dissolved Organic Carbon	MS-B	L1759774-10, -4, -5, -6, -7, -8, -9

Qualifiers for Individual Parameters Listed:

Qualifier	Description
B	Method Blank exceeds ALS DQO. All associated sample results are at least 5 times greater than blank levels and are considered reliable.
DLA	Detection Limit adjusted for required dilution
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

ALS Test Code	Matrix	Test Description	Method Reference**
BE-D-L-CCMS-VA	Water	Diss. Be (low) in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

ALS Test Code	Matrix	Test Description	Method Reference**
BE-T-L-CCMS-VA	Water	Total Be (Low) in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

ALS Test Code	Matrix	Test Description	Method Reference**
BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ALS Test Code	Matrix	Test Description	Method Reference**
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.

ALS Test Code	Matrix	Test Description	Method Reference**
CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)

Reference Information

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

CL-L-IC-N-VA Water Chloride in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

CN-FREE-L-CFA-VA Water Low Level Free Cyanide in water by CFA ASTM 7237

This analysis is carried out using procedures adapted from ASTM Method 7237 "Free Cyanide with Flow Injection Analysis (FIA) Utilizing Gas Diffusion Separation and Amperometric Detection". Free cyanide is determined by in-line gas diffusion at pH 6 with final determination by colourimetric analysis.

CN-T-L-CFA-VA Water Low Level Total Cyanide in water by CFA ISO 14403:2002

This analysis is carried out using procedures adapted from ISO Method 14403:2002 "Determination of Total Cyanide using Flow Analysis (FIA and CFA)". Total or strong acid dissociable (SAD) cyanide is determined by in-line UV digestion along with sample distillation and final determination by colourimetric analysis. Method Limitation: This method is susceptible to interference from thiocyanate (SCN). If SCN is present in the sample, there could be a positive interference with this method, but it would be less than 1% and could be as low as zero.

EC-PCT-VA Water Conductivity (Automated) APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

F-IC-N-VA Water Fluoride in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

HARDNESS-CALC-VA Water Hardness APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-D-CVAA-VA Water Diss. Mercury in Water by CVAAS or CVAFS APHA 3030B/EPA 1631E (mod)

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

HG-T-CVAA-VA Water Total Mercury in Water by CVAAS or CVAFS EPA 1631E (mod)

Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

MET-D-CCMS-VA Water Dissolved Metals in Water by CRC ICPMS APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-DIS-LOW-ICP-VA Water Dissolved Metals in Water by ICPOES EPA 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

MET-T-CCMS-VA Water Total Metals in Water by CRC ICPMS EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-TOT-LOW-ICP-VA Water Total Metals in Water by ICPOES EPA 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

NH3-F-VA Water Ammonia in Water by Fluorescence APHA 4500 NH3-NITROGEN (AMMONIA)

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NH3-F-VA Water Ammonia in Water by Fluorescence J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-VA Water Nitrite in Water by IC (Low Level) EPA 300.1 (mod)

Reference Information

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-VA Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-PRES-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

P-TD-COL-VA Water Total Dissolved P in Water by Colour APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H "pH Value"

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PO4-DO-COL-VA Water Diss. Orthophosphate in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

S-DIS-ICP-VA Water Dissolved Sulfur in Water by ICPOES EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

S-TOT-ICP-VA Water Total Sulfur in Water by ICPOES EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

SILICATE-COL-VA Water Silicate by Colourimetric analysis APHA 4500-SiO2 E.

This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.

SO4-IC-N-VA Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-LOW-VA Water Low Level TDS (3.0mg/L) by Gravimetric APHA 2540C

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total dissolved solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TKN-F-VA Water TKN in Water by Fluorescence APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-LOW-VA Water Total Suspended Solids by Grav. (1 mg/L) APHA 2540D

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.
Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis

Reference Information

methods are available for these types of samples.

TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 "Turbidity"

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Short Holding Time

- *Rush Processing*

ALS En

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC # ____________

Report To		Report Format / Distribution		Service Requested (Rush for routine analysis subject to availability)
Company:	Azimuth Consulting Group	☐ Standard ☐ Other		◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Eric Franz	☐ PDF ☐ Excel ☐ Digital ☐ Fax		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1:	efranz@azimuthgroup.ca	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6K2G8	Email 2:	gmann@azimuthgroup.ca	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax:	Email 3:	ryan.vanengen@agnicoeagle.com	**Analysis Request**
Invoice To	Same as Report ? ☑ Yes ☐ No	**Client / Project Information**		Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	CREMP Meadowbank Surfacewater	
Company:		PO / AFE:		
Contact:		LSD:		
Address:				
Phone:	Fax:	Quote #:	Q39503	
[redacted] Lab Work Order # (lab use only) [redacted]		ALS Contact:	Sampler:	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TOC, Ammonia, TKN, Total P (P)	DOC (F/P)	T-CN (Low), Free CN (Low) (P)	Total mercury (P)	Dissolved mercury (F/P)	Total Metals (P)	Dissolved Metals (F/P)						Number of Containers
[redacted]	SP-90-S	14-Apr-16	15:00	Surface Water	X	X	X	X	X	X	X						7
[redacted]	SP-91-S	14-Apr-16	16:10	Surface Water	X	X	X	X	X	X	X						7
[redacted]	INUG-79-S	15-Apr-16	9:50	Surface Water	X	X	X	X	X	X	X						7
[redacted]	INUG-78-S	15-Apr-16	10:50	Surface Water	X	X	X	X	X	X	X						7
[redacted]	APR CREMP DI-1	15-Apr-16	16:00	Surface Water	X	X	X	X	X	X	X						7
[redacted]	APR CREMP EB-1	15-Apr-16	16:30	Surface Water	X	X	X	X	X	X	X						7
[redacted]	PDL-43-S	16-Apr-16	10:15	Surface Water	X	X	X	X	X	X	X						7
[redacted]	PDL-44-S	16-Apr-16	12:30	Surface Water	X	X	X	X	X	X	X						7
[redacted]	TPN-91-S	17-Apr-16	9:00	Surface Water	X	X	X	X	X	X	X						7
[redacted]	TPN-90-S	17-Apr-16	10:25	Surface Water	X	X	X	X	X	X	X						7
[redacted]																	
[redacted]																	

L1759774-COFC

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Tom Thomson	[redacted]15	9:00	Jem	25 Apr	11:33	13,13 °C				

2016-04-16

ALS Environmental

Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

COC #

Report To		Report Format / Distribution	Service Requested (Rush for routine analysis subject to availability)
Company:	Azimuth Consulting Group	☐ Standard ☐ Other	◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Eric Franz	☐ PDF ☐ Excel ☐ Digital ☐ Fax	○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1: efranz@azimuthgroup.ca	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6K2G8	Email 2: gmann@azimuthgroup.ca	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax:	Email 3: ryan.vanengen@agnicoeagle.com	Analysis Request
Invoice To	Same as Report ? ☑ Yes ☐ No	Client / Project Information	Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #: CREMP Meadowbank Surfacewater	
Company:		PO / AFE:	
Contact:		LSD:	
Address:			
Phone:	Fax:	Quote #: Q39503	
Lab Work Order # (lab use only)		ALS Contact: Sampler:	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Conventionals** see notes	TSS-Low, TDS-Low	Number of Containers
	SP-90-S	14-Apr-16	15:00	Surface Water	X	X	2
	SP-91-S	14-Apr-16	16:10	Surface Water	X	X	2
	INUG-79-S	15-Apr-16	9:50	Surface Water	X	X	2
	INUG-78-S	15-Apr-16	10:50	Surface Water	X	X	2
	APR CREMP DI-1	15-Apr-16	16:00	Surface Water	X	X	2
	APR CREMP EB-1	15-Apr-16	16:30	Surface Water	X	X	2
	PDL-43-S	16-Apr-16	10:15	Surface Water	X	X	2
	PDL-44-S	16-Apr-16	12:30	Surface Water	X	X	2
	TPN-91-S	17-Apr-16	9:00	Surface Water	X	X	2
	TPN-90-S	17-Apr-16	10:25	Surface Water	X	X	2

L1759774-COFC

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

**Conventionals includes: Alk Species, pH, EC, Turbidity, Conductivity, Anions (F, NO2, NO3, Br, SO4), low-level Chloride, Silicate, TD-P, and Ortho-PO4.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Tom Thomson	~~[illegible]5~~ 2016-04-18	9:00				°C				

AZIMUTH CONSULTING GROUP INC.
ATTN: Eric Franz
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 02-MAY-16
Report Date: 09-MAY-16 16:04 (MT)
Version: FINAL

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1762620

Project P.O. #: NOT SUBMITTED
Job Reference: CREMP MEADOWBANK SURFACEWATER
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1762620-1	L1762620-2	L1762620-3	L1762620-4	L1762620-5
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	18-APR-16	18-APR-16	20-APR-16	20-APR-16	20-APR-16
	Sampled Time	14:50	15:29	15:28	15:28	16:00
	Client ID	WAL-60-S	WAL-59-S	TPE-91-S	APR CREMP DUP 1	TPE-90-S
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	51.9	62.7	32.4	30.6	33.4
	Hardness (as CaCO3) (mg/L)	21.8	26.0	13.8	13.8	14.0
	pH (pH)	6.94	6.97	6.68	6.66	6.91
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Total Dissolved Solids (mg/L)	32	44	24.7	22.0	22.7
	Turbidity (NTU)	0.14	0.13	0.12	0.12	0.12
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	16.7	22.0	6.2	5.8	8.3
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	16.7	22.0	6.2	5.8	8.3
	Ammonia, Total (as N) (mg/L)	0.0208	0.0337	0.0215	0.0221	0.0223
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	1.04	1.29	1.00	1.00	1.00
	Fluoride (F) (mg/L)	0.064	0.073	0.097	0.098	0.096
	Nitrate (as N) (mg/L)	0.0511	0.0817	0.0346	0.0415	0.0488
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	0.146	0.170	0.111	0.110	0.111
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Phosphorus (P)-Total (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Silicate (as SiO2) (mg/L)	1.04	1.15	<0.50	<0.50	<0.50
	Sulfate (SO4) (mg/L)	5.53	6.85	6.37	6.37	6.38
Cyanides	Cyanide, Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Cyanide, Free (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	2.36	2.56	1.83	1.55	1.53
	Total Organic Carbon (mg/L)	2.41	2.96	1.49	1.69	1.40
Total Metals	Aluminum (Al)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00028	0.00036	0.00050	0.00050	0.00048
	Barium (Ba)-Total (mg/L)	0.00312	0.00402	0.00405	0.00397	0.00435
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Total (mg/L)	5.93	7.22	3.40	3.42	3.45
	Chromium (Cr)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1762620-6	L1762620-7	L1762620-8		
	Description	Surface Water	Surface Water	Surface Water		
	Sampled Date	21-APR-16	21-APR-16	21-APR-16		
	Sampled Time	10:35	10:35	15:49		
	Client ID	TPS-55-S	APR CREMP DUP2	TPS-56-S		
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	31.4	20.8	36.3		
	Hardness (as CaCO3) (mg/L)	11.2	11.1	11.4		
	pH (pH)	6.90	6.81	6.67		
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0		
	Total Dissolved Solids (mg/L)	21.5	21.9	20.1		
	Turbidity (NTU)	0.11	0.11	0.12		
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	8.0	6.1	10.3		
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0		
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0		
	Alkalinity, Total (as CaCO3) (mg/L)	8.0	6.1	10.3		
	Ammonia, Total (as N) (mg/L)	0.0186	0.0191	0.0224		
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050		
	Chloride (Cl) (mg/L)	0.95	0.94	1.00		
	Fluoride (F) (mg/L)	0.084	0.083	0.086		
	Nitrate (as N) (mg/L)	0.0672	0.0661	0.0714		
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010		
	Total Kjeldahl Nitrogen (mg/L)	0.231	0.102	0.113		
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	<0.0010		
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020	<0.0020	<0.0020		
	Phosphorus (P)-Total (mg/L)	<0.0020	<0.0020	<0.0020		
	Silicate (as SiO2) (mg/L)	<0.50	<0.50	<0.50		
	Sulfate (SO4) (mg/L)	6.06	6.00	6.27		
Cyanides	Cyanide, Total (mg/L)	<0.0010	<0.0010	<0.0010		
	Cyanide, Free (mg/L)	<0.0010	<0.0010	<0.0010		
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	1.46	1.46	1.50		
	Total Organic Carbon (mg/L)	1.53	1.63	1.43		
Total Metals	Aluminum (Al)-Total (mg/L)	0.0034	<0.0030	0.0032		
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010		
	Arsenic (As)-Total (mg/L)	0.00022	0.00019	0.00022		
	Barium (Ba)-Total (mg/L)	0.00372	0.00357	0.00381		
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020		
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050		
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010		
	Cadmium (Cd)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050		
	Calcium (Ca)-Total (mg/L)	2.75	2.66	2.76		
	Chromium (Cr)-Total (mg/L)	<0.00010	<0.00010	<0.00010		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1762620-1	L1762620-2	L1762620-3	L1762620-4	L1762620-5
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	18-APR-16	18-APR-16	20-APR-16	20-APR-16	20-APR-16
	Sampled Time	14:50	15:29	15:28	15:28	16:00
	Client ID	WAL-60-S	WAL-59-S	TPE-91-S	APR CREMP DUP 1	TPE-90-S
Grouping	**Analyte**					
WATER						
Total Metals	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Total (mg/L)	0.00100	0.00120	<0.00050	0.00058	<0.00050
	Iron (Fe)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)-Total (mg/L)	1.76	2.14	1.28	1.29	1.30
	Manganese (Mn)-Total (mg/L)	0.00078	0.00111	0.00032	0.00031	0.00032
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	0.0000214	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	0.000282	0.000366	0.000210	0.000215	0.000182
	Nickel (Ni)-Total (mg/L)	<0.00050	<0.00050	0.00062	0.00059	0.00067
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	0.69	0.84	0.74	0.73	0.74
	Selenium (Se)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)-Total (mg/L)	0.448	0.496	0.068	0.064	0.074
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	0.801	0.986	1.44	1.42	1.47
	Strontium (Sr)-Total (mg/L)	0.0285	0.0354	0.0147	0.0148	0.0151
	Sulfur (S)-Total (mg/L)	1.80	2.23	1.99	2.02	2.04
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Total (mg/L)	0.000043	0.000057	0.000049	0.000051	0.000048
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	LAB	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	<0.0010	0.0010	0.0010	0.0013	0.0012
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00027	0.00031	0.00049	0.00055	0.00048
	Barium (Ba)-Dissolved (mg/L)	0.00313	0.00402	0.00397	0.00416	0.00434
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Dissolved (mg/L)	5.89	7.05	3.43	3.43	3.47
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1762620-6	L1762620-7	L1762620-8		
	Description	Surface Water	Surface Water	Surface Water		
	Sampled Date	21-APR-16	21-APR-16	21-APR-16		
	Sampled Time	10:35	10:35	15:49		
	Client ID	TPS-55-S	APR CREMP DUP2	TPS-56-S		
Grouping	**Analyte**					
WATER						
Total Metals	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010		
	Copper (Cu)-Total (mg/L)	<0.00050	<0.00050	0.00055		
	Iron (Fe)-Total (mg/L)	<0.010	<0.010	<0.010		
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050		
	Lithium (Li)-Total (mg/L)	<0.0010	<0.0010	<0.0010		
	Magnesium (Mg)-Total (mg/L)	1.10	1.08	1.12		
	Manganese (Mn)-Total (mg/L)	0.00036	0.00033	0.00044		
	Mercury (Hg)-Total (mg/L)	<0.0000050	0.0000172	<0.0000050		
	Molybdenum (Mo)-Total (mg/L)	0.000204	0.000201	0.000224		
	Nickel (Ni)-Total (mg/L)	0.00053	<0.00050	0.00052		
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050		
	Potassium (K)-Total (mg/L)	0.64	0.64	0.68		
	Selenium (Se)-Total (mg/L)	<0.000050	<0.000050	<0.000050		
	Silicon (Si)-Total (mg/L)	<0.050	<0.050	0.051		
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010		
	Sodium (Na)-Total (mg/L)	1.47	1.44	1.49		
	Strontium (Sr)-Total (mg/L)	0.0126	0.0123	0.0130		
	Sulfur (S)-Total (mg/L)	1.98	1.89	2.03		
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010		
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010		
	Titanium (Ti)-Total (mg/L)	<0.00030	<0.00030	<0.00030		
	Uranium (U)-Total (mg/L)	0.000039	0.000039	0.000042		
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050		
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030		
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.00030		
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD		
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD		
	Aluminum (Al)-Dissolved (mg/L)	0.0010	0.0039	0.0013		
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Arsenic (As)-Dissolved (mg/L)	0.00022	0.00021	0.00020		
	Barium (Ba)-Dissolved (mg/L)	0.00360	0.00359	0.00357		
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020		
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050		
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010		
	Cadmium (Cd)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050		
	Calcium (Ca)-Dissolved (mg/L)	2.70	2.66	2.75		
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1762620-1	L1762620-2	L1762620-3	L1762620-4	L1762620-5
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	18-APR-16	18-APR-16	20-APR-16	20-APR-16	20-APR-16
	Sampled Time	14:50	15:29	15:28	15:28	16:00
	Client ID	WAL-60-S	WAL-59-S	TPE-91-S	APR CREMP DUP 1	TPE-90-S
Grouping	**Analyte**					
WATER						
Dissolved Metals	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Dissolved (mg/L)	0.00086	0.00104	0.00040	0.00043	0.00041
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	0.000099	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)-Dissolved (mg/L)	1.73	2.05	1.28	1.28	1.29
	Manganese (Mn)-Dissolved (mg/L)	0.00021	0.00037	0.00014	0.00015	0.00014
	Mercury (Hg)-Dissolved (mg/L)	0.0000129	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	0.000275	0.000319	0.000199	0.000195	0.000165
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	<0.00050	0.00075	0.00070	0.00064
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	0.63	0.73	0.70	0.69	0.68
	Selenium (Se)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)-Dissolved (mg/L)	0.439	0.488	0.065	0.061	0.069
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	0.786	0.947	1.28	1.45	1.42
	Strontium (Sr)-Dissolved (mg/L)	0.0275	0.0338	0.0145	0.0145	0.0146
	Sulfur (S)-Dissolved (mg/L)	1.66	2.18	2.01	2.04	2.04
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Dissolved (mg/L)	0.000031	0.000048	0.000047	0.000045	0.000042
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	0.0011	<0.0010
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1762620-6	L1762620-7	L1762620-8		
	Description	Surface Water	Surface Water	Surface Water		
	Sampled Date	21-APR-16	21-APR-16	21-APR-16		
	Sampled Time	10:35	10:35	15:49		
	Client ID	TPS-55-S	APR CREMP DUP2	TPS-56-S		
Grouping	**Analyte**					
WATER						
Dissolved Metals	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Copper (Cu)-Dissolved (mg/L)	0.00035	0.00034	0.00038		
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010		
	Lead (Pb)-Dissolved (mg/L)	0.000096	<0.000050	<0.000050		
	Lithium (Li)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010		
	Magnesium (Mg)-Dissolved (mg/L)	1.09	1.07	1.10		
	Manganese (Mn)-Dissolved (mg/L)	0.00015	0.00012	0.00016		
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050		
	Molybdenum (Mo)-Dissolved (mg/L)	0.000188	0.000186	0.000184		
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050		
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050		
	Potassium (K)-Dissolved (mg/L)	0.61	0.61	0.62		
	Selenium (Se)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050		
	Silicon (Si)-Dissolved (mg/L)	<0.050	<0.050	<0.050		
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010		
	Sodium (Na)-Dissolved (mg/L)	1.42	1.39	1.28		
	Strontium (Sr)-Dissolved (mg/L)	0.0122	0.0118	0.0124		
	Sulfur (S)-Dissolved (mg/L)	1.94	1.95	2.00		
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010		
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030		
	Uranium (U)-Dissolved (mg/L)	0.000036	0.000036	0.000038		
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050		
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010		
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Nitrite (as N)	DLDS	L1762620-1, -2, -3, -4, -5, -6, -7, -8
Method Blank	Zinc (Zn)-Dissolved	MB-LOR	L1762620-1
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1762620-2, -3, -4, -5, -6, -7, -8
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1762620-2, -3, -4, -5, -6, -7, -8

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

ALS Test Code	Matrix	Test Description	Method Reference**
BE-D-L-CCMS-VA	Water	Diss. Be (low) in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

ALS Test Code	Matrix	Test Description	Method Reference**
BE-T-L-CCMS-VA	Water	Total Be (Low) in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

ALS Test Code	Matrix	Test Description	Method Reference**
BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ALS Test Code	Matrix	Test Description	Method Reference**
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.

ALS Test Code	Matrix	Test Description	Method Reference**
CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

ALS Test Code	Matrix	Test Description	Method Reference**
CL-L-IC-N-VA	Water	Chloride in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ALS Test Code	Matrix	Test Description	Method Reference**
CN-FREE-L-CFA-VA	Water	Low Level Free Cyanide in water by CFA	ASTM 7237

This analysis is carried out using procedures adapted from ASTM Method 7237 "Free Cyanide with Flow Injection Analysis (FIA) Utilizing Gas Diffusion Separation and Amperometric Detection". Free cyanide is determined by in-line gas diffusion at pH 6 with final determination by colourimetric analysis.

ALS Test Code	Matrix	Test Description	Method Reference**
CN-T-L-CFA-VA	Water	Low Level Total Cyanide in water by CFA	ISO 14403:2002

This analysis is carried out using procedures adapted from ISO Method 14403:2002 "Determination of Total Cyanide using Flow Analysis (FIA and CFA)". Total or strong acid dissociable (SAD) cyanide is determined by in-line UV digestion along with sample distillation and final determination by colourimetric analysis. Method Limitation: This method is susceptible to interference from thiocyanate (SCN). If SCN is present in the sample, there could be a positive interference with this method, but it would be less than 1% and could be as low as zero.

ALS Test Code	Matrix	Test Description	Method Reference**
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

ALS Test Code	Matrix	Test Description	Method Reference**
F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

ALS Test Code	Matrix	Test Description	Method Reference**
HARDNESS-CALC-VA	Water	Hardness	APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in $CaCO_3$ equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

ALS Test Code	Matrix	Test Description	Method Reference**
HG-D-CVAA-VA	Water	Diss. Mercury in Water by CVAAS or CVAFS	APHA 3030B/EPA 1631E (mod)

Reference Information

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

HG-T-CVAA-VA Water Total Mercury in Water by CVAAS or CVAFS EPA 1631E (mod)

Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

MET-D-CCMS-VA Water Dissolved Metals in Water by CRC ICPMS APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-DIS-LOW-ICP-VA Water Dissolved Metals in Water by ICPOES EPA 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

MET-T-CCMS-VA Water Total Metals in Water by CRC ICPMS EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-TOT-LOW-ICP-VA Water Total Metals in Water by ICPOES EPA 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

NH3-F-VA Water Ammonia in Water by Fluorescence APHA 4500 NH3-NITROGEN (AMMONIA)

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NH3-F-VA Water Ammonia in Water by Fluorescence J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-VA Water Nitrite in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-VA Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-PRES-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

P-TD-COL-VA Water Total Dissolved P in Water by Colour APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H "pH Value"

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PO4-DO-COL-VA Water Diss. Orthophosphate in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Reference Information

S-DIS-ICP-VA Water Dissolved Sulfur in Water by ICPOES EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

S-TOT-ICP-VA Water Total Sulfur in Water by ICPOES EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

SILICATE-COL-VA Water Silicate by Colourimetric analysis APHA 4500-SiO2 E.

This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.

SO4-IC-N-VA Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-LOW-VA Water Low Level TDS (3.0mg/L) by Gravimetric APHA 2540C

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total dissolved solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TKN-F-VA Water TKN in Water by Fluorescence APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-LOW-VA Water Total Suspended Solids by Grav. (1 mg/L) APHA 2540D

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.
Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

TURBIDITY-VA Water Turbidity by Meter APHA 2130 "Turbidity"

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

TURBIDITY-VA Water Turbidity by Meter APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Short Holding Time

Rush Processing

ALS

Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

COC # ____________

Report To	
Company:	Azimuth Consulting Group
Contact:	Eric Franz
Address:	218-2902 West Broadway
	Vancouver, BC V6K2G8
Phone:	604-730-1220 Fax:
Invoice To	Same as Report ? ☑ Yes ☐ No
Hardcopy of Invoice with Report?	☐ Yes ☑ No
Company:	
Contact:	
Address:	
Phone:	

Report Format / Distribution	
☐ Standard ☐ Other	
☐ PDF ☐ Excel ☐ Digital ☐ Fax	
Email 1:	efranz@azimuthgroup.ca
Email 2:	gmann@azimuthgroup.ca
Email 3:	ryan.vanengen@agnicoeagle.com
Client / Project Information	
Job #:	CREMP Meadowbank Surfacewater
PO / AFE:	
LSD:	
Quote #:	Q39503
ALS Contact:	Sampler:

Service Requested (Rush for routine analysis subject to availability)

- ◉ Regular (Standard Turnaround Times - Business Days)
- ○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
- ○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
- ○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request

Please indicate below Filtered, Preserved or both (F, P, F/P)

L1762620-COFC

Sample #	Sample (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Conventionals** see notes	TSS-Low, TDS-Low	Number of Containers
[redacted]				Surface Water	X	X	2
[redacted]	WAL-60-S	18-Apr-16	14:50	Surface Water	X	X	2
[redacted]	WAL-59-S	18-Apr-16	15:29	Surface Water	X	X	2
	TPE-91-S	20-Apr-16	15:28	Surface Water	X	X	2
	APR CREMP DUP 1	20-Apr-16	15:28	Surface Water	X	X	2
	TPE-90-S	20-Apr-16	16:00	Surface Water	X	X	2
	TPS-55-S	21-Apr-16	10:35	Surface Water	X	X	2
	APR CREMP DUP 2	21-Apr-16	10:35	Surface Water	X	X	2
	TPS-56-S	21-Apr-16	15:49	Surface Water	X	X	2

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

**Conventionals includes: Alk Species, pH, EC, Turbidity, Conductivity, Anions (F, NO2, NO3, Br, SO4), low-level Chloride, Silicate, TD-P, and Ortho-PO4.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Tom Thomson	25-Apr-16	9:00	Jean	2 May	8:40	14+15 °C				

ALS Environmental

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC # ____________

Report To	
Company:	Azimuth Consulting Group
Contact:	Eric Franz
Address:	218-2902 West Broadway
	Vancouver, BC V6K2G8
Phone:	604-730-1220 Fax:
Invoice To	Same as Report ? ☑ Yes ☐ No
Hardcopy of Invoice with Report?	☐ Yes ☑ No
Company:	
Contact:	
Address:	
Phone:	
Lab Work Order # (lab use only)	L1762620-COFC

Report Format / Distribution	
☐ Standard ☐ Other	
☐ PDF ☐ Excel ☐ Digital ☐ Fax	
Email 1:	efranz@azimuthgroup.ca
Email 2:	gmann@azimuthgroup.ca
Email 3:	ryan.vanengen@agnicoeagle.com
Client / Project Information	
Job #:	CREMP Meadowbank Surfacewater
PO / AFE:	
LSD:	
Quote #:	Q39503
ALS Contact:	Sampler:

Service Requested (Rush for routine analysis subject to availability)
- ◉ Regular (Standard Turnaround Times - Business Days)
- ○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
- ○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
- ○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request
Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TOC, Ammonia, TKN, Total P (P)	DOC (F/P)	T-CN (Low), Free CN (Low) (P)	Total mercury (P)	Dissolved mercury (F/P)	Total Metals (P)	Dissolved Metals (F/P)	Number of Containers
	WAL-60-S	18-Apr-16	14:50	Surface Water	X	X	X	X	X	X	X	7
	WAL-59-S	18-Apr-16	15:29	Surface Water	X	X	X	X	X	X	X	7
	TPE-91-S	20-Apr-16	15:28	Surface Water	X	X	X	X	X	X	X	7
	APR CREMP DUP 1	20-Apr-16	15:28	Surface Water	X	X	X	X	X	X	X	7
	TPE-90-S	20-Apr-16	16:00	Surface Water	X	X	X	X	X	X	X	7
	TPS-55-S	21-Apr-16	10:35	Surface Water	X	X	X	X	X	X	X	7
	APR CREMP DUP 2	21-Apr-16	10:35	Surface Water	X	X	X	X	X	X	X	7
	TPS-56-S	21-Apr-16	15:49	Surface Water	X	X	X	X	X	X	X	7

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Tom Thomson	25-Apr-16	9:00				°C				

AZIMUTH CONSULTING GROUP INC.
ATTN: Eric Franz
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 03-MAY-16
Report Date: 13-JUN-16 12:47 (MT)
Version: FINAL REV. 2

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1763257
Project P.O. #: NOT SUBMITTED
Job Reference: CREMP MEADOWBANK SURFACEWATER
C of C Numbers:
Legal Site Desc:

Comments:
13-JUN-2016 This result replaces the previous version and contains re-analysis results for Total Metals for sample ALS ID 2.

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1763257-1	L1763257-2	L1763257-3	L1763257-4
	Description	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	25-APR-16	25-APR-16	25-APR-16	25-APR-16
	Sampled Time	12:50	14:06	15:09	15:45
	Client ID	TEFF_43-S	TEFF-44-S	TE-90-S	TE-91-S
Grouping	**Analyte**				
WATER					
Physical Tests	Conductivity (uS/cm)	22.8	25.4	42.3	34.8
	Hardness (as CaCO3) (mg/L)	7.56	8.87	16.1	12.5
	pH (pH)	6.71	6.78	6.92	6.89
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0
	Total Dissolved Solids (mg/L)	14.8	14.1	24.6	21.0
	Turbidity (NTU)	0.15	0.13	0.13	0.21
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	6.0	6.8	11.3	9.4
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	6.0	6.8	11.3	9.4
	Ammonia, Total (as N) (mg/L)	0.0097	0.0123	0.0134	0.0137
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	0.94	0.96	1.20	1.13
	Fluoride (F) (mg/L)	0.079	0.082	0.102	0.099
	Nitrate (as N) (mg/L)	<0.0050	<0.0050	0.0264	0.0204
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	0.090	0.089	0.108	0.105
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020
	Phosphorus (P)-Total (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020
	Silicate (as SiO2) (mg/L)	<0.50	<0.50	<0.50	<0.50
	Sulfate (SO4) (mg/L)	2.96	3.22	5.63	4.49
Cyanides	Cyanide, Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010
	Cyanide, Free (mg/L)	<0.0010 HTD	<0.0010 HTD	<0.0010 HTD	<0.0010 HTD
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	1.67	1.66	1.93	1.89
	Total Organic Carbon (mg/L)	1.65	1.58	1.99	1.88
Total Metals	Aluminum (Al)-Total (mg/L)	<0.0030	<0.0030	<0.0030	0.0085
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00011	0.00012	0.00026	0.00018
	Barium (Ba)-Total (mg/L)	0.00305	0.00310	0.00414	0.00390
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Total (mg/L)	1.76	2.03	4.01	3.14
	Chromium (Cr)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1763257-1	L1763257-2	L1763257-3	L1763257-4
	Description	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	25-APR-16	25-APR-16	25-APR-16	25-APR-16
	Sampled Time	12:50	14:06	15:09	15:45
	Client ID	TEFF_43-S	TEFF-44-S	TE-90-S	TE-91-S
WATER					
Total Metals	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Total (mg/L)	<0.00050	<0.00050	0.00059	0.00059
	Iron (Fe)-Total (mg/L)	<0.010	<0.010	<0.010	0.015
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)-Total (mg/L)	0.78	0.86	1.45	1.22
	Manganese (Mn)-Total (mg/L)	0.00041	0.00047	0.00051	0.00098
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	<0.000050	0.000141	0.000132	0.000087
	Nickel (Ni)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	0.56	0.63	0.78	0.73
	Selenium (Se)-Total (mg/L)	<0.000050	0.000071	<0.000050	<0.000050
	Silicon (Si)-Total (mg/L)	0.116	0.139	0.229	0.218
	Silver (Ag)-Total (mg/L)	<0.000010	0.000046	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	0.796	0.849	1.20	1.01
	Strontium (Sr)-Total (mg/L)	0.00934	0.0110	0.0181	0.0149
	Sulfur (S)-Total (mg/L)	1.00	1.12	1.96	1.53
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	<0.00030	<0.00030	<0.00030	0.00031
	Uranium (U)-Total (mg/L)	0.000041	0.000045	0.000052	0.000057
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0011	0.0012	0.0010	0.0013
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	<0.00010	<0.00010	0.00022	0.00015
	Barium (Ba)-Dissolved (mg/L)	0.00301	0.00328	0.00405	0.00380
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Dissolved (mg/L)	1.74	2.08	4.06	3.06
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1763257-1	L1763257-2	L1763257-3	L1763257-4	
	Description	Surface Water	Surface Water	Surface Water	Surface Water	
	Sampled Date	25-APR-16	25-APR-16	25-APR-16	25-APR-16	
	Sampled Time	12:50	14:06	15:09	15:45	
	Client ID	TEFF_43-S	TEFF-44-S	TE-90-S	TE-91-S	
Grouping	**Analyte**					
WATER						
Dissolved Metals	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Copper (Cu)-Dissolved (mg/L)	0.00026	0.00030	0.00051	0.00043	
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	
	Lithium (Li)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	
	Magnesium (Mg)-Dissolved (mg/L)	0.78	0.89	1.44	1.18	
	Manganese (Mn)-Dissolved (mg/L)	0.00016	0.00023	0.00025	0.00025	
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	
	Molybdenum (Mo)-Dissolved (mg/L)	<0.000050	<0.000050	0.000131	0.000085	
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	
	Potassium (K)-Dissolved (mg/L)	0.55	0.60	0.73	0.69	
	Selenium (Se)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	
	Silicon (Si)-Dissolved (mg/L)	0.116	0.144	0.225	0.199	
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Sodium (Na)-Dissolved (mg/L)	0.792	0.830	1.17	1.02	
	Strontium (Sr)-Dissolved (mg/L)	0.00920	0.0105	0.0178	0.0143	
	Sulfur (S)-Dissolved (mg/L)	0.98	1.06	1.94	1.47	
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	
	Uranium (U)-Dissolved (mg/L)	0.000037	0.000038	0.000047	0.000046	
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Alkalinity, Total (as CaCO3)	B	L1763257-1, -2, -3, -4
Duplicate	Bromide (Br)	DLDS	L1763257-1, -2, -3, -4
Duplicate	Fluoride (F)	DLDS	L1763257-1, -2, -3, -4
Duplicate	Nitrite (as N)	DLDS	L1763257-1, -2, -3, -4
Duplicate	Nitrate (as N)	DLDS	L1763257-1, -2, -3, -4
Duplicate	Bromide (Br)	DLDS	L1763257-1, -2, -3, -4
Duplicate	Fluoride (F)	DLDS	L1763257-1, -2, -3, -4
Duplicate	Nitrite (as N)	DLDS	L1763257-1, -2, -3, -4
Duplicate	Fluoride (F)	DLDS	L1763257-1, -2, -3, -4
Duplicate	Nitrite (as N)	DLDS	L1763257-1, -2, -3, -4
Duplicate	Nitrite (as N)	DLDS	L1763257-1, -2, -3, -4
Duplicate	Nitrate (as N)	DLDS	L1763257-1, -2, -3, -4
Duplicate	Fluoride (F)	DLDS	L1763257-1, -2, -3, -4
Duplicate	Nitrite (as N)	DLDS	L1763257-1, -2, -3, -4
Duplicate	Cadmium (Cd)-Dissolved	DLM	L1763257-1, -2, -3, -4
Duplicate	Dissolved Organic Carbon	HTP	L1763257-1, -2, -3, -4
Matrix Spike	Phosphorus (P)-Total	MS-B	L1763257-1, -2, -3, -4
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1763257-1, -2, -3, -4
Matrix Spike	Boron (B)-Dissolved	MS-B	L1763257-1, -2, -3, -4
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1763257-1, -2, -3, -4
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1763257-1, -2, -3, -4
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1763257-1, -2, -3, -4
Matrix Spike	Sodium (Na)-Total	MS-B	L1763257-1, -2, -3, -4
Matrix Spike	Strontium (Sr)-Total	MS-B	L1763257-1, -2, -3, -4
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1763257-1, -2, -3, -4
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1763257-1, -2, -3, -4
Matrix Spike	Molybdenum (Mo)-Dissolved	MS-B	L1763257-1, -2, -3, -4
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1763257-1, -2, -3, -4
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1763257-1, -2, -3, -4
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1763257-1, -2, -3, -4
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1763257-1, -2, -3, -4

Qualifiers for Individual Parameters Listed:

Qualifier	Description
B	Method Blank exceeds ALS DQO. All associated sample results are at least 5 times greater than blank levels and are considered reliable.
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
HTD	Hold time exceeded for re-analysis or dilution, but initial testing was conducted within hold time.
HTP	Sample preparation or preservation hold time was exceeded.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

ALS Test Code	Matrix	Test Description	Method Reference**
BE-D-L-CCMS-VA	Water	Diss. Be (low) in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

ALS Test Code	Matrix	Test Description	Method Reference**
BE-T-L-CCMS-VA	Water	Total Be (Low) in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Reference Information

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.

CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

CL-L-IC-N-VA	Water	Chloride in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

CN-FREE-L-CFA-VA	Water	Low Level Free Cyanide in water by CFA	ASTM 7237

This analysis is carried out using procedures adapted from ASTM Method 7237 "Free Cyanide with Flow Injection Analysis (FIA) Utilizing Gas Diffusion Separation and Amperometric Detection". Free cyanide is determined by in-line gas diffusion at pH 6 with final determination by colourimetric analysis.

CN-T-L-CFA-VA	Water	Low Level Total Cyanide in water by CFA	ISO 14403:2002

This analysis is carried out using procedures adapted from ISO Method 14403:2002 "Determination of Total Cyanide using Flow Analysis (FIA and CFA)". Total or strong acid dissociable (SAD) cyanide is determined by in-line UV digestion along with sample distillation and final determination by colourimetric analysis. Method Limitation: This method is susceptible to interference from thiocyanate (SCN). If SCN is present in the sample, there could be a positive interference with this method, but it would be less than 1% and could be as low as zero.

EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

HARDNESS-CALC-VA	Water	Hardness	APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in $CaCO_3$ equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-D-CVAA-VA	Water	Diss. Mercury in Water by CVAAS or CVAFS	APHA 3030B/EPA 1631E (mod)

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

HG-T-CVAA-VA	Water	Total Mercury in Water by CVAAS or CVAFS	EPA 1631E (mod)

Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-DIS-LOW-ICP-VA	Water	Dissolved Metals in Water by ICPOES	EPA 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-TOT-LOW-ICP-VA	Water	Total Metals in Water by ICPOES	EPA 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method

Reference Information

6010B).

NH3-F-VA	Water	Ammonia in Water by Fluorescence	APHA 4500 NH3-NITROGEN (AMMONIA)

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-PRES-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

P-TD-COL-VA	Water	Total Dissolved P in Water by Colour	APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

PH-PCT-VA	Water	pH by Meter (Automated)	APHA 4500-H "pH Value"

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PH-PCT-VA	Water	pH by Meter (Automated)	APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PO4-DO-COL-VA	Water	Diss. Orthophosphate in Water by Colour	APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

S-DIS-ICP-VA	Water	Dissolved Sulfur in Water by ICPOES	EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

S-TOT-ICP-VA	Water	Total Sulfur in Water by ICPOES	EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

SILICATE-COL-VA	Water	Silicate by Colourimetric analysis	APHA 4500-SiO2 E.

This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.

SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

Reference Information

TDS-LOW-VA Water Low Level TDS (3.0mg/L) by Gravimetric APHA 2540C

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total dissolved solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TKN-F-VA Water TKN in Water by Fluorescence APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-LOW-VA Water Total Suspended Solids by Grav. (1 mg/L) APHA 2540D

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.
Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

TURBIDITY-VA Water Turbidity by Meter APHA 2130 "Turbidity"

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

TURBIDITY-VA Water Turbidity by Meter APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Short Holding Time

Rush Processing

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC #

Report To		**Report Format / Distribution**		**Service Requested** (Rush for routine analysis subject to availability)
Company:	Azimuth Consulting Group	☐ Standard ☐ Other		◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Eric Franz	☐ PDF ☐ Excel ☐ Digital ☐ Fax		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1:	efranz@azimuthgroup.ca	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6K2G8	Email 2:	gmann@azimuthgroup.ca	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax:	Email 3:	ryan.vanengen@agnicoeagle.com	**Analysis Request**
Invoice To	Same as Report ? ☑ Yes ☐ No	**Client / Project Information**		Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	CREMP Meadowbank Surfacewater	
Company:		PO / AFE:		
Contact:		LSD:		
Address:				
Phone:	Fax:	Quote #:	Q39503	
Lab Work Order # (lab use only)		ALS Contact:	Sampler:	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Conventionals** see notes	TSS-Low, TDS-Low	Number of Containers
	TEFF-43-S	25-Apr-16	12:50	Surface Water	X	X	2
	TEFF-44-S	25-Apr-16	14:06	Surface Water	X	X	2
	TE-90-S	25-Apr-16	15:09	Surface Water	X	X	2
	TE-91-S	25-Apr-16	15:45	Surface Water	X	X	2

L1763257-COFC

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

**Conventionals includes: Alk Species, pH, EC, Turbidity, Conductivity, Anions (F, NO2, NO3, Br, SO4), low-level Chloride, Silicate, TD-P, and Ortho-PO4.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by: Tom Thomson	Date (dd-mmm-yy) 26-Apr-16	Time (hh-mm) 9:00	Received by: Jeor	Date: 3 May	Time: 8:50	Temperature: 18, 19 °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC #

ALS • *Rush Processing*

Report To	
Company:	Azimuth Consulting Group
Contact:	Eric Franz
Address:	218-2902 West Broadway
	Vancouver, BC V6K2G8
Phone:	604-730-1220 Fax:
Invoice To	Same as Report ? ☑ Yes ☐ No
Hardcopy of Invoice with Report?	☐ Yes ☑ No
Company:	
Contact:	
Address:	
Phone:	Fax:
Lab Work Order # (lab use only)	

Report Format / Distribution	
☐ Standard ☐ Other	
☐ PDF ☐ Excel ☐ Digital ☐ Fax	
Email 1:	efranz@azimuthgroup.ca
Email 2:	gmann@azimuthgroup.ca
Email 3:	ryan.vanengen@agnicoeagle.com
Client / Project Information	
Job #:	CREMP Meadowbank Surfacewater
PO / AFE:	
LSD:	
Quote #:	Q39503
ALS Contact:	Sampler:

Service Requested (Rush for routine analysis subject to availability)

- ◉ Regular (Standard Turnaround Times - Business Days)
- ○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
- ○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
- ○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request

Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TOC, Ammonia, TKN, Total P (P)	DOC (F/P)	T-CN (Low), Free CN (Low) (P)	Total mercury (P)	Dissolved mercury (F/P)	Total Metals (P)	Dissolved Metals (F/P)	Number of Containers
	TEFF-43-S	25-Apr-16	12:50	Surface Water	X	X	X	X	X	X	X	7
	TEFF-44-S	25-Apr-16	14:06	Surface Water	X	X	X	X	X	X	X	7
	TE-90-S	25-Apr-16	15:09	Surface Water	X	X	X	X	X	X	X	7
	TE-91-S	25-Apr-16	15:45	Surface Water	X	X	X	X	X	X	X	7

L1763257-COFC

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Tom Thomson	26-Apr-16	9:00	Jen	3 May	8:50	18,14 °C				

AZIMUTH CONSULTING GROUP INC.
ATTN: Eric Franz
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 20-MAY-16
Report Date: 01-JUN-16 09:07 (MT)
Version: FINAL

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1772459

Project P.O. #: NOT SUBMITTED
Job Reference: CREMP MEADOWBANK SURFACEWATER
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1772459-1	L1772459-2	L1772459-3	L1772459-4	L1772459-5
		Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
		Sampled Date	14-APR-16	14-APR-16	15-APR-16	15-APR-16	16-APR-16
		Sampled Time	15:00	16:10	09:50	10:50	10:15
		Client ID	SP-90-S	SP-91-S	INUG-79-S	INUG-78-S	PDL-43-S
Grouping	**Analyte**						
FILTER							
Plant Pigments	Chlorophyll a (ug/L)		0.118	0.147	0.258	0.244	0.328

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1772459-6	L1772459-7	L1772459-8	L1772459-9	L1772459-10
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	16-APR-16	17-APR-16	17-APR-16	18-APR-16	18-APR-16
	Sampled Time	12:30	09:00	10:25	14:50	15:29
	Client ID	PDL-44-S	TPN-91-S	TPN-90-S	WAL-60-S	WAL-59-S
Grouping	**Analyte**					
FILTER						
Plant Pigments	Chlorophyll a (ug/L)	0.271	0.504	0.248	0.131	0.084

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1772459-11	L1772459-12	L1772459-13	L1772459-14	L1772459-15
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	20-APR-16	20-APR-16	20-APR-16	21-APR-16	21-APR-16
	Sampled Time	15:28	15:28	16:00	10:35	10:35
	Client ID	TPE-91-S	APR CREMP DUP1	TPE-90-S	TPS-55-S	APR CREMP DUP 2
Grouping	**Analyte**					
FILTER						
Plant Pigments	Chlorophyll a (ug/L)	0.112	0.106	0.062	0.240	0.227

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1772459-16	L1772459-17	L1772459-18		
	Description	Surface Water	Surface Water	Surface Water		
	Sampled Date	21-APR-16	25-APR-16	25-APR-16		
	Sampled Time	15:49	12:50	14:06		
	Client ID	TPS-56-S	TEFF-43-S	TEFF-44-S		
Grouping	**Analyte**					
FILTER						
Plant Pigments	Chlorophyll a (ug/L)	0.304	0.222	0.184		

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CHLOROA-F-VA	Filter	Chlorophyll a by Fluorometer (Filter)	EPA 445.0

This analysis is done using procedures modified from EPA Method 445.0. Chlorophyll-a is determined by a routine acetone extraction followed with analysis by fluorometry using the non-acidification procedure. This method is not subject to interferences from chlorophyll b.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS
Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

ALS Enviro L1772459-COFC

Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

COC #

Page 1 of 2

Report To			
Company:	Azimuth Consulting Group		
Contact:	Eric Franz		
Address:	218-2902 West Broadway		
	Vancouver, BC V6K2G8		
Phone:	604-730-1220	Fax:	
Invoice To	Same as Report ?	☑ Yes	☐ No
Hardcopy of Invoice with Report?		☐ Yes	☑ No
Company:			
Contact:			
Address:			
Phone:		Fax:	
Lab Work Order # (lab use only)			

Report Format / Distribution			
☐ Standard	☐ Other		
☐ PDF	☐ Excel	☐ Digital	☐ Fax
Email 1:	efranz@azimuthgroup.ca		
Email 2:	gmann@azimuthgroup.ca		
Email 3:	ryan.vanengen@agnicoeagle.com		
Client / Project Information			
Job #:	CREMP Meadowbank Surfacewater		
PO / AFE:			
LSD:			
Quote #:	Q39503		
ALS Contact:		**Sampler:**	

Service Requested (Rush for routine analysis subject to availability)

- ◉ Regular (Standard Turnaround Times - Business Days)
- ○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
- ○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
- ○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request

Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Chlorophyll A												Number of Containers
	SP-90-S	14-Apr-16	15:00	Surface Water	X												1
	SP-91-S	14-Apr-16	16:10	Surface Water	X												1
	INUG-79-S	15-Apr-16	9:50	Surface Water	X												1
	INUG-78-S	15-Apr-16	10:50	Surface Water	X												1
	PDL-43-S	16-Apr-16	10:15	Surface Water	X												1
	PDL-44-S	16-Apr-16	12:30	Surface Water	X												1
	TPN-91-S	17-Apr-16	9:00	Surface Water	X												1
	TPN-90-S	17-Apr-16	10:25	Surface Water	X												1
	WAL-60-S	18-Apr-16	14:50	Surface Water	X												1
	WAL-59-S	18-Apr-16	15:29	Surface Water	X												1
	TPE-91-S	20-Apr-16	15:28	Surface Water	X												1
	APR CREMP DUP 1	20-Apr-16	15:28	Surface Water	X												1
	TPE-90-S	20-Apr-16	16:00	Surface Water	X												1

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

**Conventionals includes: Alk Species, pH, EC, Turbidity, Conductivity, Anions (F, NO2, NO3, Br, SO4), low-level Chloride, Silicate, TD-P, and Ortho-PO4.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Tom Thomson	~~[illegible]~~	7:30	Lady	May 20	8:30AM	3 °C				

2016-05-17

ALS Envi[illegible]

L1772459-COFC

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC #

Report To	
Company:	Azimuth Consulting Group
Contact:	Eric Franz
Address:	218-2902 West Broadway Vancouver, BC V6K2G8
Phone:	604-730-1220 Fax:
Invoice To	Same as Report ? ☑ Yes ☐ No
Hardcopy of Invoice with Report?	☐ Yes ☑ No
Company:	
Contact:	
Address:	
Phone:	Fax:
Lab Work Order # (lab use only)	

Report Format / Distribution	
☐ Standard ☐ Other	
☐ PDF ☐ Excel ☐ Digital ☐ Fax	
Email 1:	efranz@azimuthgroup.ca
Email 2:	gmann@azimuthgroup.ca
Email 3:	ryan.vanengen@agnicoeagle.com
Client / Project Information	
Job #:	CREMP Meadowbank Surfacewater
PO / AFE:	
LSD:	
Quote #:	Q39503
ALS Contact:	Sampler:

Service Requested (Rush for routine analysis subject to availability)
◉ Regular (Standard Turnaround Times - Business Days)
○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request

Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Chlorophyll A	Number of Containers
	TPS-55-S	21-Apr-16	10:35	Surface Water	X	1
	APR CREMP DUP 2	21-Apr-16	10:35	Surface Water	X	1
	TPS-56-S	21-Apr-16	15:49	Surface Water	X	1
	TEFF-43-S	25-Apr-16	12:50	Surface Water	X	1
	TEFF-44-S	25-Apr-16	14:06	Surface Water	X	1
	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~	~~Surface Water~~	~~X~~	~~[illegible]~~
	~~[illegible]~~	~~[illegible]~~	~~[illegible]~~	~~Surface Water~~	~~X~~	~~[illegible]~~

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

**Conventionals includes: Alk Species, pH, EC, Turbidity, Conductivity, Anions (F, NO2, NO3, Br, SO4), low-level Chloride, Silicate, TD-P, and Ortho-PO4.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by: Tom Thomson	Date (dd-mmm-yy) ~~[illegible]~~5	Time (hh-mm) 7:30	Received by: lady	Date: May 20	Time: 8:30Am	Temperature: 3 °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

2016-05-17

AZIMUTH CONSULTING GROUP INC.
ATTN: Eric Franz
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 20-JUL-16
Report Date: 27-JUL-16 15:52 (MT)
Version: FINAL

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1801106

Project P.O. #: NOT SUBMITTED
Job Reference: CREMP MEADOWBANK SURFACEWATER
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1801106-1 SURFACE WATE 08-JUL-16 14:00 JUL SP-92	L1801106-2 SURFACE WATE 08-JUL-16 14:30 JUL SP-93	L1801106-3 SURFACE WATE 10-JUL-16 13:55 JUL WAL-61	L1801106-4 SURFACE WATE 10-JUL-16 14:42 JUL WAL-62	L1801106-5 SURFACE WATE 12-JUL-16 14:45 JUL TPE-92
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	36.8	34.7	33.7	33.7	28.3
	pH (pH)	7.12	7.16	7.24	7.26	7.10
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Total Dissolved Solids (mg/L)	23.7	22.3	22.5	22.4	17.0
	Turbidity (NTU)	0.34	0.36	0.33	0.34	0.26
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	10.1	10.2	11.2	10.5	6.8
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	10.1	10.2	11.2	10.5	6.8
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	0.84	0.85	0.66	0.63	0.47
	Fluoride (F) (mg/L)	0.066	0.064	0.046	0.043	0.051
	Nitrate (as N) (mg/L)	0.0229	0.0183	<0.0050	<0.0050	0.0226
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Silicate (as SiO2) (mg/L)	<0.50	0.57	0.73	0.62	<0.50
	Sulfate (SO4) (mg/L)	4.43	4.30	3.34	3.32	2.82

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1801106-6	L1801106-7			
	Description	SURFACE WATE	SURFACE WATE			
	Sampled Date	12-JUL-16	12-JUL-16			
	Sampled Time	14:53	14:45			
	Client ID	JUL TPE-93	JUL DUP-1			
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	29.4	27.9			
	pH (pH)	7.13	7.10			
	Total Suspended Solids (mg/L)	<1.0	<1.0			
	Total Dissolved Solids (mg/L)	18.4	17.6			
	Turbidity (NTU)	0.30	0.33			
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	7.2	6.5			
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0			
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0			
	Alkalinity, Total (as CaCO3) (mg/L)	7.2	6.5			
	Bromide (Br) (mg/L)	<0.050	<0.050			
	Chloride (Cl) (mg/L)	0.48	0.67			
	Fluoride (F) (mg/L)	0.051	0.073			
	Nitrate (as N) (mg/L)	0.0241	0.0319			
	Nitrite (as N) (mg/L)	<0.0010	<0.0010			
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010			
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020	<0.0020			
	Silicate (as SiO2) (mg/L)	<0.50	<0.50			
	Sulfate (SO4) (mg/L)	2.92	4.25			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Fluoride (F)	DLDS	L1801106-1, -2, -3, -4, -5, -6, -7
Duplicate	Nitrite (as N)	DLDS	L1801106-1, -2, -3, -4, -5, -6, -7
Duplicate	Nitrate (as N)	DLDS	L1801106-1, -2, -3, -4, -5, -6, -7

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

CL-L-IC-N-VA	Water	Chloride in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-TD-COL-VA	Water	Total Dissolved P in Water by Colour	APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

PH-PCT-VA	Water	pH by Meter (Automated)	APHA 4500-H "pH Value"

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PH-PCT-VA	Water	pH by Meter (Automated)	APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PO4-DO-COL-VA	Water	Diss. Orthophosphate in Water by Colour	APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

SILICATE-COL-VA	Water	Silicate by Colourimetric analysis	APHA 4500-SiO2 E.

This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.

SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-LOW-VA	Water	Low Level TDS (3.0mg/L) by Gravimetric	APHA 2540C

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total dissolved solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TSS-LOW-VA	Water	Total Suspended Solids by Grav. (1 mg/L)	APHA 2540D

Reference Information

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.
Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 "Turbidity"

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

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Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Short Holding Time

Rush Processing

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC #

Page 1 of 1

Report To		Report Format / Distribution		Service Requested (Rush for routine analysis subject to availability)
Company:	Azimuth Consulting Group	☐ Standard ☐ Other		◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Eric Franz	☐ PDF ☐ Excel ☐ Digital ☐ Fax		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1:	efranz@azimuthgroup.ca	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6K2G8	Email 2:	gmann@azimuthgroup.ca	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax:	Email 3:	ryan.vanengen@agnicoeagle.com	**Analysis Request**
Invoice To	Same as Report ? ☑ Yes ☐ No	**Client / Project Information**		Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	CREMP Meadowbank Surfacewater	
Company:		PO / AFE:		
Contact:		LSD:		
Address:				
Phone:	Fax:	Quote #:	Q39503	
Lab Work Order # (lab use only)		ALS Contact:	Sampler:	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Conventionals** see notes	TSS-Low, TDS-Low	Number of Containers
[redacted]	JUL SP-92	08-Jul-16	14:00	Surface Water	X	X	2
[redacted]	JUL SP-93	08-Jul-16	14:30	Surface Water	X	X	2
[redacted]	JUL WAL-61	10-Jul-16	13:55	Surface Water	X	X	2
[redacted]	JUL WAL-62	10-Jul-16	14:42	Surface Water	X	X	2
[redacted]	JUL TPE-92	12-Jul-16	14:45	Surface Water	X	X	
[redacted]	JUL TPE-92	12-Jul-16	14:53	Surface Water	X	X	
[redacted]	JUL DUP-1	12-Jul-16	14:45	Surface Water	X	X	

L1801106-COFC

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

**Conventionals includes: Alk Species, pH, EC, Turbidity, Conductivity, Anions (F, NO2, NO3, Br, SO4), low-level Chloride, Silicate, TD-P, and Ortho-PO4.

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Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
	13-Jul-06	7:30	Sarah	July 20	11:30	22 °C				

AZIMUTH CONSULTING GROUP INC.
ATTN: Eric Franz
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 20-JUL-16
Report Date: 29-JUL-16 15:41 (MT)
Version: FINAL

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1801137

Project P.O. #: NOT SUBMITTED
Job Reference: CREMP MEADOWBANK SURFACEWATER
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1801137-1	L1801137-2	L1801137-3	L1801137-4	L1801137-5
	Description	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE
	Sampled Date	08-JUL-16	08-JUL-16	10-JUL-16	10-JUL-16	12-JUL-16
	Sampled Time	14:00	14:30	01:55	14:42	14:45
	Client ID	JUL SP-92	JUL SP-93	JUL WALL-61	JUL WALL-62	JUL TPE-92
Grouping	**Analyte**					
WATER						
Physical Tests	Hardness (as CaCO3) (mg/L)	13.5	14.0	14.4	14.2	9.57
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (mg/L)	0.113	0.122	0.138	0.157	0.110
	Phosphorus (P)-Total (mg/L)	0.0022	0.0020	0.0028	0.0024	<0.0020
Cyanides	Cyanide, Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Cyanide, Free (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	1.72	1.68	1.92	2.01	1.28
	Total Organic Carbon (mg/L)	1.77	1.61	2.17	1.99	1.30
Total Metals	Aluminum (Al)-Total (mg/L)	0.0178	0.0156	0.0133	0.0130	0.0083
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00029	0.00025	0.00024	0.00024	0.00034
	Barium (Ba)-Total (mg/L)	0.00318	0.00287	0.00247	0.00233	0.00316
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Total (mg/L)	3.48	3.59	3.92	3.89	2.37
	Chromium (Cr)-Total (mg/L)	0.00011	0.00010	<0.00010	<0.00010	0.00011
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Total (mg/L)	0.00067	0.00072	0.00089	0.00090	<0.00050
	Iron (Fe)-Total (mg/L)	0.040	0.031	0.029	0.029	0.017
	Lead (Pb)-Total (mg/L)	0.000060	<0.000050	<0.000050	<0.000050	0.000065
	Lithium (Li)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)-Total (mg/L)	1.12	1.13	1.15	1.11	0.88
	Manganese (Mn)-Total (mg/L)	0.00279	0.00267	0.00427	0.00248	0.00322
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	0.000170	0.000158	0.000155	0.000178	0.000154
	Nickel (Ni)-Total (mg/L)	0.00062	0.00052	<0.00050	<0.00050	0.00065
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	0.59	0.55	0.50	0.45	0.57
	Selenium (Se)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)-Total (mg/L)	0.244	0.260	0.330	0.285	0.109
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	0.873	0.796	0.579	0.543	1.02
	Strontium (Sr)-Total (mg/L)	0.0163	0.0175	0.0200	0.0197	0.0108
	Sulfur (S)-Total (mg/L)	1.52	1.48	1.19	1.14	1.46

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1801137-6	L1801137-7			
	Description	SURFACE WATE	SURFACE WATE			
	Sampled Date	12-JUL-16	12-JUL-16			
	Sampled Time	14:53	14:45			
	Client ID	JUL TPE-93	JUL DUP-1			
Grouping	**Analyte**					
WATER						
Physical Tests	Hardness (as CaCO3) (mg/L)	10.0	9.60			
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050			
	Total Kjeldahl Nitrogen (mg/L)	0.104	0.119			
	Phosphorus (P)-Total (mg/L)	0.0028	0.0021			
Cyanides	Cyanide, Total (mg/L)	<0.0010	<0.0010			
	Cyanide, Free (mg/L)	<0.0010	<0.0010			
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	1.37	1.35			
	Total Organic Carbon (mg/L)	1.21	1.55			
Total Metals	Aluminum (Al)-Total (mg/L)	0.0107	0.0101			
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010			
	Arsenic (As)-Total (mg/L)	0.00039	0.00035			
	Barium (Ba)-Total (mg/L)	0.00327	0.00331			
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020			
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050			
	Boron (B)-Total (mg/L)	<0.010	<0.010			
	Cadmium (Cd)-Total (mg/L)	<0.0000050	<0.0000050			
	Calcium (Ca)-Total (mg/L)	2.47	2.38			
	Chromium (Cr)-Total (mg/L)	<0.00010	<0.00010			
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010			
	Copper (Cu)-Total (mg/L)	<0.00050	<0.00050			
	Iron (Fe)-Total (mg/L)	0.016	0.020			
	Lead (Pb)-Total (mg/L)	<0.000050	0.000195			
	Lithium (Li)-Total (mg/L)	<0.0010	<0.0010			
	Magnesium (Mg)-Total (mg/L)	0.91	0.89			
	Manganese (Mn)-Total (mg/L)	0.00295	0.00341			
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050			
	Molybdenum (Mo)-Total (mg/L)	0.000146	0.000142			
	Nickel (Ni)-Total (mg/L)	0.00069	0.00068			
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050			
	Potassium (K)-Total (mg/L)	0.57	0.54			
	Selenium (Se)-Total (mg/L)	<0.000050	<0.000050			
	Silicon (Si)-Total (mg/L)	0.109	0.112			
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010			
	Sodium (Na)-Total (mg/L)	1.03	1.01			
	Strontium (Sr)-Total (mg/L)	0.0112	0.0110			
	Sulfur (S)-Total (mg/L)	1.48	1.45			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1801137-1	L1801137-2	L1801137-3	L1801137-4	L1801137-5
	Description	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE
	Sampled Date	08-JUL-16	08-JUL-16	10-JUL-16	10-JUL-16	12-JUL-16
	Sampled Time	14:00	14:30	01:55	14:42	14:45
	Client ID	JUL SP-92	JUL SP-93	JUL WALL-61	JUL WALL-62	JUL TPE-92
Grouping	**Analyte**					
WATER						
Total Metals	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	<0.00030	0.00031	<0.00030	<0.00030	<0.00030
	Uranium (U)-Total (mg/L)	0.000059	0.000058	0.000051	0.000056	0.000051
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0033	0.0033	0.0035	0.0042	0.0026
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00027	0.00022	0.00021	0.00024	0.00031
	Barium (Ba)-Dissolved (mg/L)	0.00305	0.00275	0.00228	0.00223	0.00367
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Dissolved (mg/L)	3.53	3.71	3.88	3.87	2.38
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Dissolved (mg/L)	0.00057	0.00064	0.00077	0.00087	0.00063
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)-Dissolved (mg/L)	1.13	1.15	1.13	1.10	0.88
	Manganese (Mn)-Dissolved (mg/L)	0.00174	0.00186	0.00277	0.00150	0.00347
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	0.000144	0.000138	0.000130	0.000146	0.000119
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	0.00080
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	0.60	0.55	0.48	0.52	0.57
	Selenium (Se)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)-Dissolved (mg/L)	0.218	0.254	0.318	0.273	0.097
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	0.879	0.793	0.572	0.544	1.06
	Strontium (Sr)-Dissolved (mg/L)	0.0163	0.0175	0.0195	0.0195	0.0115
	Sulfur (S)-Dissolved (mg/L)	1.51	1.45	1.13	1.15	1.45

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1801137-6	L1801137-7			
	Description	SURFACE WATE	SURFACE WATE			
	Sampled Date	12-JUL-16	12-JUL-16			
	Sampled Time	14:53	14:45			
	Client ID	JUL TPE-93	JUL DUP-1			
Grouping	**Analyte**					
WATER						
Total Metals	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010			
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010			
	Titanium (Ti)-Total (mg/L)	<0.00030	<0.00030			
	Uranium (U)-Total (mg/L)	0.000054	0.000051			
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050			
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030			
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030			
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD			
	Dissolved Metals Filtration Location	FIELD	FIELD			
	Aluminum (Al)-Dissolved (mg/L)	0.0031	0.0028			
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010			
	Arsenic (As)-Dissolved (mg/L)	0.00037	0.00031			
	Barium (Ba)-Dissolved (mg/L)	0.00331	0.00308			
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020			
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050			
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010			
	Cadmium (Cd)-Dissolved (mg/L)	<0.0000050	<0.0000050			
	Calcium (Ca)-Dissolved (mg/L)	2.50	2.38			
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010			
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010			
	Copper (Cu)-Dissolved (mg/L)	0.00040	0.00040			
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010			
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050			
	Lithium (Li)-Dissolved (mg/L)	<0.0010	<0.0010			
	Magnesium (Mg)-Dissolved (mg/L)	0.91	0.89			
	Manganese (Mn)-Dissolved (mg/L)	0.00263	0.00299			
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050			
	Molybdenum (Mo)-Dissolved (mg/L)	0.000135	0.000148			
	Nickel (Ni)-Dissolved (mg/L)	0.00064	0.00062			
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050			
	Potassium (K)-Dissolved (mg/L)	0.56	0.55			
	Selenium (Se)-Dissolved (mg/L)	<0.000050	<0.000050			
	Silicon (Si)-Dissolved (mg/L)	0.097	0.096			
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010			
	Sodium (Na)-Dissolved (mg/L)	1.04	0.991			
	Strontium (Sr)-Dissolved (mg/L)	0.0113	0.0110			
	Sulfur (S)-Dissolved (mg/L)	1.48	1.43			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1801137-1	L1801137-2	L1801137-3	L1801137-4	L1801137-5
	Description	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE
	Sampled Date	08-JUL-16	08-JUL-16	10-JUL-16	10-JUL-16	12-JUL-16
	Sampled Time	14:00	14:30	01:55	14:42	14:45
	Client ID	JUL SP-92	JUL SP-93	JUL WALL-61	JUL WALL-62	JUL TPE-92
Grouping	**Analyte**					
WATER						
Dissolved Metals	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Dissolved (mg/L)	0.000052	0.000052	0.000043	0.000046	0.000037
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	0.0018
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1801137-6	L1801137-7			
	Description	SURFACE WATE	SURFACE WATE			
	Sampled Date	12-JUL-16	12-JUL-16			
	Sampled Time	14:53	14:45			
	Client ID	JUL TPE-93	JUL DUP-1			
Grouping	**Analyte**					
WATER						
Dissolved Metals	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010			
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010			
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030			
	Uranium (U)-Dissolved (mg/L)	0.000048	0.000047			
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050			
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010			
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Beryllium (Be)-Total	DLA	L1801137-1, -2, -3, -4, -5, -6, -7
Duplicate	Aluminum (Al)-Total	DLA	L1801137-1, -2, -3, -4, -5, -6, -7
Duplicate	Bismuth (Bi)-Total	DLA	L1801137-1, -2, -3, -4, -5, -6, -7
Duplicate	Chromium (Cr)-Total	DLA	L1801137-1, -2, -3, -4, -5, -6, -7
Duplicate	Silver (Ag)-Total	DLA	L1801137-1, -2, -3, -4, -5, -6, -7
Duplicate	Thallium (Tl)-Total	DLA	L1801137-1, -2, -3, -4, -5, -6, -7
Duplicate	Tin (Sn)-Total	DLA	L1801137-1, -2, -3, -4, -5, -6, -7
Duplicate	Titanium (Ti)-Total	DLA	L1801137-1, -2, -3, -4, -5, -6, -7
Duplicate	Vanadium (V)-Total	DLA	L1801137-1, -2, -3, -4, -5, -6, -7
Duplicate	Zinc (Zn)-Total	DLA	L1801137-1, -2, -3, -4, -5, -6, -7
Duplicate	Zirconium (Zr)-Total	DLA	L1801137-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Phosphorus (P)-Total	MS-B	L1801137-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1801137-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1801137-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Aluminum (Al)-Dissolved	MS-B	L1801137-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1801137-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1801137-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1801137-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1801137-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1801137-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1801137-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1801137-1, -2, -3, -4, -5, -6, -7

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BE-D-L-CCMS-VA	Water	Diss. Be (low) in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

BE-T-L-CCMS-VA	Water	Total Be (Low) in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.

CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

CN-FREE-L-CFA-VA	Water	Low Level Free Cyanide in water by CFA	ASTM 7237

This analysis is carried out using procedures adapted from ASTM Method 7237 "Free Cyanide with Flow Injection Analysis (FIA) Utilizing Gas Diffusion Separation and Amperometric Detection". Free cyanide is determined by in-line gas diffusion at pH 6 with final determination by colourimetric analysis.

CN-T-L-CFA-VA	Water	Low Level Total Cyanide in water by CFA	ISO 14403:2002

This analysis is carried out using procedures adapted from ISO Method 14403:2002 "Determination of Total Cyanide using Flow Analysis (FIA and CFA)". Total or strong acid dissociable (SAD) cyanide is determined by in-line UV digestion along with sample distillation and final determination by colourimetric analysis. Method Limitation: This method is susceptible to interference from thiocyanate (SCN). If SCN is present in the sample, there could be a positive interference with this method, but it would be less than 1% and could be as low as zero.

HARDNESS-CALC-VA	Water	Hardness	APHA 2340B

Reference Information

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-D-CVAA-VA	Water	Diss. Mercury in Water by CVAAS or CVAFS	APHA 3030B/EPA 1631E (mod)

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

HG-T-CVAA-VA	Water	Total Mercury in Water by CVAAS or CVAFS	EPA 1631E (mod)

Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-DIS-LOW-ICP-VA	Water	Dissolved Metals in Water by ICPOES	EPA 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-TOT-LOW-ICP-VA	Water	Total Metals in Water by ICPOES	EPA 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

NH3-F-VA	Water	Ammonia in Water by Fluorescence	APHA 4500 NH3-NITROGEN (AMMONIA)

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

P-T-PRES-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

S-DIS-ICP-VA	Water	Dissolved Sulfur in Water by ICPOES	EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

S-TOT-ICP-VA	Water	Total Sulfur in Water by ICPOES	EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

TKN-F-VA	Water	TKN in Water by Fluorescence	APHA 4500-NORG D.

Reference Information

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

L1801137-COFC

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC #

Page 1 of 1

Report To		Report Format / Distribution		Service Requested (Rush for routine analysis subject to availability)
Company:	Azimuth Consulting Group	☐ Standard ☐ Other		◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Eric Franz	☐ PDF ☐ Excel ☐ Digital ☐ Fax		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1:	efranz@azimuthgroup.ca	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6K2G8	Email 2:	gmann@azimuthgroup.ca	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax:	Email 3:	ryan.vanengen@agnicoeagle.com	**Analysis Request**
Invoice To	Same as Report ? ☑ Yes ☐ No	**Client / Project Information**		Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	CREMP Meadowbank Surfacewater	
Company:		PO / AFE:		
Contact:		LSD:		
Address:				
Phone:	Fax:	Quote #:	Q39503	
Lab Work Order # (lab use only)		ALS Contact:	Sampler:	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TOC, Ammonia, TKN, Total P (P)	DOC (F/P)	T-CN (Low), Free CN (Low) (P)	Total mercury (P)	Dissolved mercury (F/P)	Total Metals (P)	Dissolved Metals (F/P)						Number of Containers
	JUL SP-92	08-Jul-16	14:00	Surface Water	X	X	X	X	X	X	X						7
	JUL SP-93	08-Jul-16	14:30	Surface Water	X	X	X	X	X	X	X						7
	JUL WAL-61	10-Jul-16	13:55	Surface Water	X	X	X	X	X	X	X						7
	JUL WAL-62	10-Jul-16	14:42	Surface Water	X	X	X	X	X	X	X						7
	JUL TPE-92	12-Jul-16	14:45	Surface Water	X	X	X	X	X	X	X						
	JUL TPE-92	12-Jul-16	14:53	Surface Water	X	X	X	X	X	X	X						
	JUL DUP-1	12-Jul-16	14:45	Surface Water	X	X	X	X	X	X	X						

Short Holding Time

• *Rush Processing* (A)

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy) 12-Jul-16	Time (hh-mm) 7:30	Received by: Sarah	Date: July 20	Time: 11:30	Temperature: 22 °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

AZIMUTH CONSULTING GROUP INC.
ATTN: Eric Franz
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 25-JUL-16
Report Date: 09-AUG-16 14:56 (MT)
Version: FINAL

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1803270

Project P.O. #:	NOT SUBMITTED
Job Reference:	CREMP MEADOWBANK SURFACEWATER
C of C Numbers:	
Legal Site Desc:	

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1803270-1 Surface Water 18-JUL-16 14:21 INUG-80-S	L1803270-2 Surface Water 18-JUL-16 14:52 INUG-81-S	L1803270-3 Surface Water 19-JUL-16 08:31 PDL-46-S	L1803270-4 Surface Water 19-JUL-16 09:11 PDL-45-S	L1803270-5 Surface Water 20-JUL-16 14:00 TPN-92-S
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	16.2	15.9	21.5	21.3	28.4
	Hardness (as CaCO3) (mg/L)	5.53	5.60	8.64	8.63	8.95
	pH (pH)	6.79	6.79	6.89	6.87	6.64
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Total Dissolved Solids (mg/L)	14.3	13.9	16.3	17.0	18.1
	Turbidity (NTU)	0.40	0.38	0.22	0.25	0.22
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	4.8	4.6	7.2	7.2	6.2
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	4.8	4.6	7.2	7.2	6.2
	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	0.70	0.71	0.58	0.58	0.71
	Fluoride (F) (mg/L)	0.059	0.058	0.038	0.038	0.064
	Nitrate (as N) (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	0.0559
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	0.111	0.104	0.093	0.098	0.080
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Phosphorus (P)-Total (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Silicate (as SiO2) (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Sulfate (SO4) (mg/L)	0.80	0.81	1.55	1.53	4.57
Cyanides	Cyanide, Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Cyanide, Free (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	2.13	1.92	1.49	1.64	1.27
	Total Organic Carbon (mg/L)	2.05	1.96	1.51	1.54	1.18
Total Metals	Aluminum (Al)-Total (mg/L)	0.0113	0.0105	0.0047	0.0057	0.0052
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00012	0.00011	0.00017	0.00016	0.00017
	Barium (Ba)-Total (mg/L)	0.00193	0.00194	0.00182	0.00180	0.00271
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Total (mg/L)	1.09	1.10	2.19	2.15	2.12
	Chromium (Cr)-Total (mg/L)	0.00012	0.00011	<0.00010	0.00012	<0.00010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1803270-6 Surface Water 20-JUL-16 14:00 JUL-DUP-2	L1803270-7 Surface Water 20-JUL-16 14:40 TPN-93-S	L1803270-8 Surface Water 20-JUL-16 16:00 JUL-DI-1	L1803270-9 Surface Water 20-JUL-16 16:30 JUL-EB-1	
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	26.7	26.7	<2.0	<2.0	
	Hardness (as CaCO3) (mg/L)	8.93	8.90	<0.50	<0.50	
	pH (pH)	6.64	6.61	5.22	5.17	
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	
	Total Dissolved Solids (mg/L)	19.8	19.6	<3.0	<3.0	
	Turbidity (NTU)	0.22	0.22	<0.10	0.15	
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	6.0	5.7	<1.0	<1.0	
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	
	Alkalinity, Total (as CaCO3) (mg/L)	6.0	5.7	<1.0	<1.0	
	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050		<0.0050	
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	
	Chloride (Cl) (mg/L)	0.71	0.70	<0.10	<0.10	
	Fluoride (F) (mg/L)	0.063	0.064	<0.020	<0.020	
	Nitrate (as N) (mg/L)	0.0560	0.0574	<0.0050	<0.0050	
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	
	Total Kjeldahl Nitrogen (mg/L)	0.085	0.089		<0.050	
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	
	Phosphorus (P)-Total (mg/L)	<0.0020	<0.0020		<0.0020	
	Silicate (as SiO2) (mg/L)	<0.50	<0.50	<0.50	<0.50	
	Sulfate (SO4) (mg/L)	4.57	4.56	<0.30	<0.30	
Cyanides	Cyanide, Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	
	Cyanide, Free (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	1.13	1.10	<0.50	RRV 1.64	
	Total Organic Carbon (mg/L)	1.24	1.25		<0.50	
Total Metals	Aluminum (Al)-Total (mg/L)	0.0065	0.0047	<0.0030	0.0045	
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Arsenic (As)-Total (mg/L)	0.00019	0.00018	<0.00010	<0.00010	
	Barium (Ba)-Total (mg/L)	0.00287	0.00277	<0.000050	DLB <0.00025	
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	
	Cadmium (Cd)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	
	Calcium (Ca)-Total (mg/L)	2.22	2.13	<0.050	RRV 0.113	
	Chromium (Cr)-Total (mg/L)	0.00011	<0.00010	<0.00010	<0.00010	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1803270-1	L1803270-2	L1803270-3	L1803270-4	L1803270-5
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	18-JUL-16	18-JUL-16	19-JUL-16	19-JUL-16	20-JUL-16
	Sampled Time	14:21	14:52	08:31	09:11	14:00
	Client ID	INUG-80-S	INUG-81-S	PDL-46-S	PDL-45-S	TPN-92-S
Grouping	**Analyte**					
WATER						
Total Metals	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Total (mg/L)	0.00069	0.00053	0.00059	0.00058	<0.00050
	Iron (Fe)-Total (mg/L)	0.029	0.020	0.011	0.011	<0.010
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)-Total (mg/L)	0.65	0.66	0.75	0.75	0.83
	Manganese (Mn)-Total (mg/L)	0.00599	0.00662	0.00199	0.00250	0.00191
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	<0.000050	<0.000050	<0.000050	0.000053	0.000173
	Nickel (Ni)-Total (mg/L)	<0.00050	0.00053	0.00064	0.00073	<0.00050
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	0.37	0.37	0.36	0.33	0.47
	Selenium (Se)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)-Total (mg/L)	0.143	0.146	0.128	0.128	0.061
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	0.557	0.565	0.496	0.506	1.11
	Strontium (Sr)-Total (mg/L)	0.00632	0.00644	0.00903	0.00882	0.0101
	Sulfur (S)-Total (mg/L)	<0.50	<0.50	0.62	0.61	1.59
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Total (mg/L)	0.000048	0.000050	0.000024	0.000024	0.000036
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0038	0.0129	0.0024	0.0020	0.0022
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	<0.00010	<0.00010	0.00013	0.00013	0.00016
	Barium (Ba)-Dissolved (mg/L)	0.00190	0.00183	0.00186	0.00189	0.00287
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Dissolved (mg/L)	1.12	1.13	2.20	2.20	2.17
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		L1803270-6	L1803270-7	L1803270-8	L1803270-9
	Sample ID	L1803270-6	L1803270-7	L1803270-8	L1803270-9
	Description	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	20-JUL-16	20-JUL-16	20-JUL-16	20-JUL-16
	Sampled Time	14:00	14:40	16:00	16:30
	Client ID	JUL-DUP-2	TPN-93-S	JUL-DI-1	JUL-EB-1
Grouping	**Analyte**				
WATER					
Total Metals	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Total (mg/L)	0.00071	0.00128	<0.00050	<0.00050
	Iron (Fe)-Total (mg/L)	0.011	<0.010	<0.010	<0.010
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	0.000058
	Lithium (Li)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)-Total (mg/L)	0.87	0.84	<0.10	<0.10
	Manganese (Mn)-Total (mg/L)	0.00203	0.00181	<0.00010	DLB <0.00020
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	0.000180	0.000150	<0.000050	<0.000050
	Nickel (Ni)-Total (mg/L)	0.00479	0.00050	<0.00050	<0.00050
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	0.49	0.46	<0.10	<0.10
	Selenium (Se)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)-Total (mg/L)	0.064	0.068	<0.050	<0.050
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	1.16	1.12	<0.050	<0.050
	Strontium (Sr)-Total (mg/L)	0.0105	0.00987	<0.00020	0.00067
	Sulfur (S)-Total (mg/L)	1.66	1.61	<0.50	<0.50
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Total (mg/L)	0.000038	0.000036	<0.000010	<0.000010
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)	0.0041	<0.0030	<0.0030	<0.0030
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD		FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD		FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0028	0.0019		0.0014
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010		<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00016	0.00016		<0.00010
	Barium (Ba)-Dissolved (mg/L)	0.00275	0.00276		0.000348
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020		<0.000020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050		<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010		<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.0000050	<0.0000050		<0.0000050
	Calcium (Ca)-Dissolved (mg/L)	2.17	2.16		RRV 0.167
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010		<0.00010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	Sample ID	L1803270-1	L1803270-2	L1803270-3	L1803270-4	L1803270-5
		Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
		Sampled Date	18-JUL-16	18-JUL-16	19-JUL-16	19-JUL-16	20-JUL-16
		Sampled Time	14:21	14:52	08:31	09:11	14:00
		Client ID	INUG-80-S	INUG-81-S	PDL-46-S	PDL-45-S	TPN-92-S
WATER							
Dissolved Metals	Cobalt (Co)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Dissolved (mg/L)		0.00030	0.00033	0.00039	0.00041	0.00034
	Iron (Fe)-Dissolved (mg/L)		<0.010	<0.010	<0.010	<0.010	<0.010
	Lead (Pb)-Dissolved (mg/L)		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)-Dissolved (mg/L)		0.66	0.68	0.77	0.76	0.86
	Manganese (Mn)-Dissolved (mg/L)		0.00342	0.00344	0.00113	0.00145	0.00149
	Mercury (Hg)-Dissolved (mg/L)		<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)		<0.000050	<0.000050	<0.000050	<0.000050	0.000181
	Nickel (Ni)-Dissolved (mg/L)		<0.00050	<0.00050	0.00063	0.00091	<0.00050
	Phosphorus (P)-Dissolved (mg/L)		<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)		0.37	0.40	0.34	0.34	0.45
	Selenium (Se)-Dissolved (mg/L)		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)-Dissolved (mg/L)		0.135	0.140	0.120	0.126	0.062
	Silver (Ag)-Dissolved (mg/L)		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)		0.571	0.561	0.502	0.495	1.17
	Strontium (Sr)-Dissolved (mg/L)		0.00628	0.00638	0.00910	0.00903	0.00917
	Sulfur (S)-Dissolved (mg/L)		<0.50	<0.50	0.59	0.57	1.62
	Thallium (Tl)-Dissolved (mg/L)		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Dissolved (mg/L)		0.000042	0.000044	0.000022	0.000021	0.000051
	Vanadium (V)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zirconium (Zr)-Dissolved (mg/L)		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1803270-6	L1803270-7	L1803270-8	L1803270-9	
	Description	Surface Water	Surface Water	Surface Water	Surface Water	
	Sampled Date	20-JUL-16	20-JUL-16	20-JUL-16	20-JUL-16	
	Sampled Time	14:00	14:40	16:00	16:30	
	Client ID	JUL-DUP-2	TPN-93-S	JUL-DI-1	JUL-EB-1	
Grouping	**Analyte**					
WATER						
Dissolved Metals	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010		<0.00010	
	Copper (Cu)-Dissolved (mg/L)	0.00039	0.00044		0.00024	
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010		<0.010	
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050		<0.000050	
	Lithium (Li)-Dissolved (mg/L)	<0.0010	<0.0010		<0.0010	
	Magnesium (Mg)-Dissolved (mg/L)	0.85	0.85		<0.10	
	Manganese (Mn)-Dissolved (mg/L)	0.00149	0.00142		<0.00010	
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050		<0.0000050	
	Molybdenum (Mo)-Dissolved (mg/L)	0.000144	0.000159		<0.000050	
	Nickel (Ni)-Dissolved (mg/L)	0.00058	0.00058		<0.00050	
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050		<0.050	
	Potassium (K)-Dissolved (mg/L)	0.46	0.45		<0.10	
	Selenium (Se)-Dissolved (mg/L)	<0.000050	<0.000050		<0.000050	
	Silicon (Si)-Dissolved (mg/L)	0.063	0.063		<0.050	
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010		<0.000010	
	Sodium (Na)-Dissolved (mg/L)	1.14	1.14		0.060	
	Strontium (Sr)-Dissolved (mg/L)	0.0103	0.0101		0.00034	
	Sulfur (S)-Dissolved (mg/L)	1.64	1.60		<0.50	
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010		<0.000010	
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010		<0.00010	
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030		<0.00030	
	Uranium (U)-Dissolved (mg/L)	0.000034	0.000035		<0.000010	
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050		<0.00050	
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010		0.0072	
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030		<0.00030	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

Qualifiers for Individual Samples Listed:

Sample Number	Client Sample ID	Qualifier	Description
L1803270-5	TPN-92-S	WSMD	Water sample(s) for dissolved mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low.

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Bromide (Br)	DLDS	L1803270-1, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Bromide (Br)	DLDS	L1803270-1, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Antimony (Sb)-Dissolved	DLM	L1803270-1, -2, -3, -4, -5, -6, -7, -9
Duplicate	Arsenic (As)-Dissolved	DLM	L1803270-1, -2, -3, -4, -5, -6, -7, -9
Duplicate	Bismuth (Bi)-Dissolved	DLM	L1803270-1, -2, -3, -4, -5, -6, -7, -9
Duplicate	Boron (B)-Dissolved	DLM	L1803270-1, -2, -3, -4, -5, -6, -7, -9
Duplicate	Chromium (Cr)-Dissolved	DLM	L1803270-1, -2, -3, -4, -5, -6, -7, -9
Duplicate	Cobalt (Co)-Dissolved	DLM	L1803270-1, -2, -3, -4, -5, -6, -7, -9
Duplicate	Copper (Cu)-Dissolved	DLM	L1803270-1, -2, -3, -4, -5, -6, -7, -9
Duplicate	Silver (Ag)-Dissolved	DLM	L1803270-1, -2, -3, -4, -5, -6, -7, -9
Duplicate	Thallium (Tl)-Dissolved	DLM	L1803270-1, -2, -3, -4, -5, -6, -7, -9
Duplicate	Tin (Sn)-Dissolved	DLM	L1803270-1, -2, -3, -4, -5, -6, -7, -9
Duplicate	Titanium (Ti)-Dissolved	DLM	L1803270-1, -2, -3, -4, -5, -6, -7, -9
Duplicate	Vanadium (V)-Dissolved	DLM	L1803270-1, -2, -3, -4, -5, -6, -7, -9
Duplicate	Zinc (Zn)-Dissolved	DLM	L1803270-1, -2, -3, -4, -5, -6, -7, -9
Duplicate	Zirconium (Zr)-Dissolved	DLM	L1803270-1, -2, -3, -4, -5, -6, -7, -9
Method Blank	Chromium (Cr)-Total	MB-LOR	L1803270-1, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1803270-1, -2, -3, -4, -5, -6, -7, -9
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1803270-1, -2, -3, -4, -5, -6, -7, -9
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1803270-1, -2, -3, -4, -5, -6, -7, -9
Matrix Spike	Phosphorus (P)-Total	MS-B	L1803270-3, -4, -5, -6, -7, -9
Matrix Spike	Nitrate (as N)	MS-B	L1803270-1, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Total Organic Carbon	MS-B	L1803270-1
Matrix Spike	Dissolved Organic Carbon	MS-B	L1803270-1
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1803270-1, -2, -3, -4, -5, -6, -7, -9
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1803270-1, -2, -3, -4, -5, -6, -7, -9
Matrix Spike	Uranium (U)-Dissolved	MS-B	L1803270-1, -2, -3, -4, -5, -6, -7, -9
Matrix Spike	Total Organic Carbon	MS-B	L1803270-2, -3, -4, -5, -6
Matrix Spike	Dissolved Organic Carbon	MS-B	L1803270-8
Matrix Spike	Dissolved Organic Carbon	MS-B	L1803270-7, -9

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLB	Detection Limit Raised. Analyte detected at comparable level in Method Blank.
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

BE-D-L-CCMS-VA	Water	Diss. Be (low) in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Reference Information

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

BE-T-L-CCMS-VA Water Total Be (Low) in Water by CRC ICPMS EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

BR-L-IC-N-VA Water Bromide in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

CARBONS-DOC-VA Water Dissolved organic carbon by combustion APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.

CARBONS-TOC-VA Water Total organic carbon by combustion APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

CL-L-IC-N-VA Water Chloride in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

CN-FREE-L-CFA-VA Water Low Level Free Cyanide in water by CFA ASTM 7237

This analysis is carried out using procedures adapted from ASTM Method 7237 "Free Cyanide with Flow Injection Analysis (FIA) Utilizing Gas Diffusion Separation and Amperometric Detection". Free cyanide is determined by in-line gas diffusion at pH 6 with final determination by colourimetric analysis.

CN-T-L-CFA-VA Water Low Level Total Cyanide in water by CFA ISO 14403:2002

This analysis is carried out using procedures adapted from ISO Method 14403:2002 "Determination of Total Cyanide using Flow Analysis (FIA and CFA)". Total or strong acid dissociable (SAD) cyanide is determined by in-line UV digestion along with sample distillation and final determination by colourimetric analysis. Method Limitation: This method is susceptible to interference from thiocyanate (SCN). If SCN is present in the sample, there could be a positive interference with this method, but it would be less than 1% and could be as low as zero.

EC-PCT-VA Water Conductivity (Automated) APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

F-IC-N-VA Water Fluoride in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

HARDNESS-CALC-VA Water Hardness APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-D-CVAA-VA Water Diss. Mercury in Water by CVAAS or CVAFS APHA 3030B/EPA 1631E (mod)

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

HG-T-CVAA-VA Water Total Mercury in Water by CVAAS or CVAFS EPA 1631E (mod)

Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

MET-D-CCMS-VA Water Dissolved Metals in Water by CRC ICPMS APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-DIS-LOW-ICP-VA Water Dissolved Metals in Water by ICPOES EPA 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

MET-T-CCMS-VA Water Total Metals in Water by CRC ICPMS EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-TOT-LOW-ICP-VA Water Total Metals in Water by ICPOES EPA 3005A/6010B

Reference Information

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

NH3-F-VA	Water	Ammonia in Water by Fluorescence	APHA 4500 NH3-NITROGEN (AMMONIA)

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-PRES-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

P-TD-COL-VA	Water	Total Dissolved P in Water by Colour	APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

PH-PCT-VA	Water	pH by Meter (Automated)	APHA 4500-H "pH Value"

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PH-PCT-VA	Water	pH by Meter (Automated)	APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PO4-DO-COL-VA	Water	Diss. Orthophosphate in Water by Colour	APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

S-DIS-ICP-VA	Water	Dissolved Sulfur in Water by ICPOES	EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

S-TOT-ICP-VA	Water	Total Sulfur in Water by ICPOES	EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

SILICATE-COL-VA	Water	Silicate by Colourimetric analysis	APHA 4500-SiO2 E.

This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.

Reference Information

SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-LOW-VA	Water	Low Level TDS (3.0mg/L) by Gravimetric	APHA 2540C

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total dissolved solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TKN-F-VA	Water	TKN in Water by Fluorescence	APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-LOW-VA	Water	Total Suspended Solids by Grav. (1 mg/L)	APHA 2540D

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.
Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 "Turbidity"

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS
Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

ALS Environmental

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC # ______________

Page 1 of 1

Report To					
Company:	Azimuth Consulting Group				
Contact:	Eric Franz				
Address:	218-2902 West Broadway				
	Vancouver, BC V6K2G8				
Phone:	604-730-1220	Fax:			
Invoice To	Same as Report ?	☑ Yes	☐ No		
Hardcopy of Invoice with Report?		☐ Yes	☑ No		
Company:					
Contact:					
Address:					
Phone:					
Lab Work Order # (lab use only)	L1803270-COFC				

Report Format / Distribution			
☐ Standard	☐ Other		
☐ PDF	☐ Excel	☐ Digital	☐ Fax
Email 1:	efranz@azimuthgroup.ca		
Email 2:	gmann@azimuthgroup.ca		
Email 3:	ryan.vanengen@agnicoeagle.com		
Client / Project Information			
Job #:	CREMP Meadowbank Surfacewater		
PO / AFE:			
LSD:			
Quote #:	Q39503		
ALS Contact:		Sampler:	

Service Requested (Rush for routine analysis subject to availability)
◉ Regular (Standard Turnaround Times - Business Days)
○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request

Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TOC, Ammonia, TKN, Total P (P)	DOC (F/P)	T-CN (Low), Free CN (Low) (P)	Total mercury (P)	Dissolved mercury (F/P)	Total Metals (P)	Dissolved Metals (F/P)						Number of Containers
	INUG-80-S	18-Jul-16	14:21	Surface Water	X	X	X	X	X	X	X						7
	INUG-81-S	18-Jul-16	14:52	Surface Water	X	X	X	X	X	X	X						7
	PDL-46-S	19-Jul-16	8:31	Surface Water	X	X	X	X	X	X	X						7
	PDL-45-S	19-Jul-16	9:11	Surface Water	X	X	X	X	X	X	X						7
	TPN-92-S	20-Jul-16	14:00	Surface Water	X	X	X	X	X	X	X						7
	JUL-DUP-2	20-Jul-16	14:00	Surface Water	X	X	X	X	X	X	X						7
	TPN-93-S	20-Jul-16	14:40	Surface Water	X	X	X	X	X	X	X						7
	JUL-DI-1	20-Jul-16	16:00	Surface Water		X	X	X		X							5
	JUL-EB-1	20-Jul-16	16:30	Surface Water	X	X	X	X	X	X	X						7

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Tom T	21-Jul-16	7:30	SHAYAN	JULY.25	1115	20,21 °C				

GENF 20.00 Front

ALS Environmental

Chain of Custody / Analytical Request Form
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www.alsglobal.com

COC # ______

Page 1 of 1

Report To	
Company:	Azimuth Consulting Group
Contact:	Eric Franz
Address:	218-2902 West Broadway
	Vancouver, BC V6K2G8
Phone:	604-730-1220 Fax:
Invoice To	Same as Report ? ☑ Yes ☐ No
Hardcopy of Invoice with Report?	☐ Yes ☑ No
Company:	
Contact:	
Address:	
Phone:	
[redacted] Lab Work Ord [redacted] (lab use onl	L1803270-COFC

Report Format / Distribution	
☐ Standard ☐ Other	
☐ PDF ☐ Excel ☐ Digital ☐ Fax	
Email 1:	efranz@azimuthgroup.ca
Email 2:	gmann@azimuthgroup.ca
Email 3:	ryan.vanengen@agnicoeagle.com
Client / Project Information	
Job #:	CREMP Meadowbank Surfacewater
PO / AFE:	
LSD:	
uote #:	Q39503
LS ontact:	**Sampler:**

Service Requested (Rush for routine analysis subject to availability)

- ◉ Regular (Standard Turnaround Times - Business Days)
- ○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
- ○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
- ○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request

Please indicate below Filtered, Preserved or both (F, P, F/P)

[redacted] Sample # [redacted]	(This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Conventionals** see notes	TSS-Low, TDS-Low											Number of Containers
[redacted]	INUG-80-S	18-Jul-16	14:21	Surface Water	X	X											2
[redacted]	INUG-81-S	18-Jul-16	14:52	Surface Water	X	X											2
[redacted]	PDL-46-S	19-Jul-16	8:31	Surface Water	X	X											2
[redacted]	PDL-45-S	19-Jul-16	9:11	Surface Water	X	X											2
[redacted]	TPN-92-S	20-Jul-16	14:00	Surface Water	X	X											2
[redacted]	JUL-DUP-2	20-Jul-16	14:00	Surface Water	X	X											2
[redacted]	TPN-93-S	20-Jul-16	14:40	Surface Water	X	X											2
[redacted]	JUL-DI-1	20-Jul-16	16:00	Surface Water	X	X											2
[redacted]	JUL-EB-1	20-Jul-16	16:30	Surface Water	X	X											2
[redacted]																	
[redacted]																	
[redacted]																	

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

**Conventionals includes: Alk Species, pH, EC, Turbidity, Conductivity, Anions (F, NO2, NO3, Br, SO4), low-level Chloride, Silicate, TD-P, and Ortho-PO4.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

[redacted] SHIPMENT RELEASE (client use) [redacted]			[redacted] SHIPMENT RECEPTION (lab use only) [redacted]				[redacted] SHIPMENT VERIFICATION (lab use only) [redacted]			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Tom T	21-Jul-16	7:30	SHAYAN	JULY.25	1115	20,21 °C				

AZIMUTH CONSULTING GROUP INC.
ATTN: Eric Franz
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 04-AUG-16
Report Date: 16-AUG-16 19:00 (MT)
Version: FINAL

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1808381

Project P.O. #: NOT SUBMITTED
Job Reference: CREMP MEADOWBANK SURFACEWATER
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1808381-1	L1808381-2	L1808381-3	L1808381-4	L1808381-5
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	22-JUL-16	22-JUL-16	22-JUL-16	22-JUL-16	22-JUL-16
	Sampled Time	12:40	12:15	11:30	11:50	11:00
	Client ID	BAP-43-S	BAP-44-S	BBD-43-S	BBD-44-S	BPJ-43-S
Grouping	**Analyte**					
WATER						
Physical Tests	Hardness (as CaCO3) (mg/L)	68.1	62.7	10.7	16.8	20.1
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	0.0054
	Total Kjeldahl Nitrogen (mg/L)	0.162	0.156	0.178	0.207	0.173
	Phosphorus (P)-Total (mg/L)	<0.0020	<0.0020	0.0029	<0.0020	0.0021
Cyanides	Cyanide, Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Cyanide, Free (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	2.89	3.06	3.38	3.45	3.48
	Total Organic Carbon (mg/L)	2.94	3.06	3.56	3.45	3.33
Total Metals	Aluminum (Al)-Total (mg/L)	0.0109	0.0110	0.0275	0.0213	0.0188
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00015	0.00015	0.00013	0.00015	0.00014
	Barium (Ba)-Total (mg/L)	0.0206	0.0203	0.0218	0.0212	0.0208
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	0.049	0.040	<0.010	0.011	0.012
	Cadmium (Cd)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Total (mg/L)	6.57	6.11	2.60	3.16	3.23
	Chromium (Cr)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Total (mg/L)	0.00052	<0.00050	<0.00050	0.00061	<0.00050
	Iron (Fe)-Total (mg/L)	0.020	0.018	0.047	0.042	0.038
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Total (mg/L)	0.0025	0.0019	<0.0010	0.0012	0.0012
	Magnesium (Mg)-Total (mg/L)	13.4	12.1	1.17	2.86	3.06
	Manganese (Mn)-Total (mg/L)	0.00829	0.00914	0.00705	0.0115	0.00954
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	0.000165	0.000160	<0.000050	0.000055	0.000056
	Nickel (Ni)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	4.33	3.89	0.44	0.97	1.02
	Selenium (Se)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)-Total (mg/L)	0.258	0.254	0.286	0.258	0.257
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	106	87.1	0.893	15.7	17.3
	Strontium (Sr)-Total (mg/L)	0.0913	0.0831	0.0184	0.0284	0.0298
	Sulfur (S)-Total (mg/L)	8.93	8.11	<0.50	1.49	1.62

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1808381-6				
	Description	Surface Water				
	Sampled Date	22-JUL-16				
	Sampled Time	10:30				
	Client ID	BPJ-44-S				
Grouping	**Analyte**					
WATER						
Physical Tests	Hardness (as CaCO3) (mg/L)	29.0				
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	0.0082				
	Total Kjeldahl Nitrogen (mg/L)	0.173				
	Phosphorus (P)-Total (mg/L)	<0.0020				
Cyanides	Cyanide, Total (mg/L)	<0.0010				
	Cyanide, Free (mg/L)	<0.0010				
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	3.24				
	Total Organic Carbon (mg/L)	3.24				
Total Metals	Aluminum (Al)-Total (mg/L)	0.0176				
	Antimony (Sb)-Total (mg/L)	<0.00010				
	Arsenic (As)-Total (mg/L)	0.00015				
	Barium (Ba)-Total (mg/L)	0.0207				
	Beryllium (Be)-Total (mg/L)	<0.000020				
	Bismuth (Bi)-Total (mg/L)	<0.000050				
	Boron (B)-Total (mg/L)	0.018				
	Cadmium (Cd)-Total (mg/L)	<0.0000050				
	Calcium (Ca)-Total (mg/L)	3.84				
	Chromium (Cr)-Total (mg/L)	<0.00010				
	Cobalt (Co)-Total (mg/L)	<0.00010				
	Copper (Cu)-Total (mg/L)	<0.00050				
	Iron (Fe)-Total (mg/L)	0.037				
	Lead (Pb)-Total (mg/L)	<0.000050				
	Lithium (Li)-Total (mg/L)	0.0014				
	Magnesium (Mg)-Total (mg/L)	4.97				
	Manganese (Mn)-Total (mg/L)	0.0118				
	Mercury (Hg)-Total (mg/L)	<0.0000050				
	Molybdenum (Mo)-Total (mg/L)	0.000074				
	Nickel (Ni)-Total (mg/L)	<0.00050				
	Phosphorus (P)-Total (mg/L)	<0.050				
	Potassium (K)-Total (mg/L)	1.65				
	Selenium (Se)-Total (mg/L)	<0.000050				
	Silicon (Si)-Total (mg/L)	0.256				
	Silver (Ag)-Total (mg/L)	<0.000010				
	Sodium (Na)-Total (mg/L)	33.1				
	Strontium (Sr)-Total (mg/L)	0.0409				
	Sulfur (S)-Total (mg/L)	2.91				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1808381-1	L1808381-2	L1808381-3	L1808381-4	L1808381-5
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	22-JUL-16	22-JUL-16	22-JUL-16	22-JUL-16	22-JUL-16
	Sampled Time	12:40	12:15	11:30	11:50	11:00
	Client ID	BAP-43-S	BAP-44-S	BBD-43-S	BBD-44-S	BPJ-43-S
Grouping	**Analyte**					
WATER						
Total Metals	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	<0.00030	0.00030	0.00042	0.00044	0.00031
	Uranium (U)-Total (mg/L)	0.000064	0.000058	0.000045	0.000047	0.000048
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	LAB	LAB	LAB	LAB	LAB
	Aluminum (Al)-Dissolved (mg/L)	0.0023	0.0029	0.0061	0.0062	0.0057
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00014	0.00012	0.00011	0.00013	<0.00010
	Barium (Ba)-Dissolved (mg/L)	0.0202	0.0199	0.0200	0.0203	0.0199
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	0.044	0.042	<0.010	<0.010	0.011
	Cadmium (Cd)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Dissolved (mg/L)	6.26	5.95	2.48	2.87	3.12
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Dissolved (mg/L)	0.00027	0.00031	0.00027	0.00032	0.00023
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	0.013	0.016	0.010
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	0.0024	0.0022	<0.0010	0.0010	0.0011
	Magnesium (Mg)-Dissolved (mg/L)	12.7	11.6	1.11	2.34	3.00
	Manganese (Mn)-Dissolved (mg/L)	0.00724	0.00720	0.00191	0.00565	0.00518
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	0.000161	0.000143	<0.000050	0.000053	0.000052
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	4.04	3.69	0.40	0.77	0.98
	Selenium (Se)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)-Dissolved (mg/L)	0.232	0.229	0.228	0.235	0.234
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	105	91.9	0.757	11.7	17.3
	Strontium (Sr)-Dissolved (mg/L)	0.0894	0.0817	0.0177	0.0253	0.0291
	Sulfur (S)-Dissolved (mg/L)	8.69	7.82	<0.50	1.16	1.61

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1808381-6				
	Description	Surface Water				
	Sampled Date	22-JUL-16				
	Sampled Time	10:30				
	Client ID	BPJ-44-S				
Grouping	**Analyte**					
WATER						
Total Metals	Thallium (Tl)-Total (mg/L)	<0.000010				
	Tin (Sn)-Total (mg/L)	<0.00010				
	Titanium (Ti)-Total (mg/L)	0.00035				
	Uranium (U)-Total (mg/L)	0.000052				
	Vanadium (V)-Total (mg/L)	<0.00050				
	Zinc (Zn)-Total (mg/L)	<0.0030				
	Zirconium (Zr)-Total (mg/L)	<0.00030				
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD				
	Dissolved Metals Filtration Location	LAB				
	Aluminum (Al)-Dissolved (mg/L)	0.0046				
	Antimony (Sb)-Dissolved (mg/L)	<0.00010				
	Arsenic (As)-Dissolved (mg/L)	0.00011				
	Barium (Ba)-Dissolved (mg/L)	0.0206				
	Beryllium (Be)-Dissolved (mg/L)	<0.000020				
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050				
	Boron (B)-Dissolved (mg/L)	0.017				
	Cadmium (Cd)-Dissolved (mg/L)	<0.0000050				
	Calcium (Ca)-Dissolved (mg/L)	3.70				
	Chromium (Cr)-Dissolved (mg/L)	<0.00010				
	Cobalt (Co)-Dissolved (mg/L)	<0.00010				
	Copper (Cu)-Dissolved (mg/L)	0.00025				
	Iron (Fe)-Dissolved (mg/L)	<0.010				
	Lead (Pb)-Dissolved (mg/L)	<0.000050				
	Lithium (Li)-Dissolved (mg/L)	0.0013				
	Magnesium (Mg)-Dissolved (mg/L)	4.79				
	Manganese (Mn)-Dissolved (mg/L)	0.00762				
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050				
	Molybdenum (Mo)-Dissolved (mg/L)	0.000070				
	Nickel (Ni)-Dissolved (mg/L)	<0.00050				
	Phosphorus (P)-Dissolved (mg/L)	<0.050				
	Potassium (K)-Dissolved (mg/L)	1.55				
	Selenium (Se)-Dissolved (mg/L)	<0.000050				
	Silicon (Si)-Dissolved (mg/L)	0.223				
	Silver (Ag)-Dissolved (mg/L)	<0.000010				
	Sodium (Na)-Dissolved (mg/L)	32.6				
	Strontium (Sr)-Dissolved (mg/L)	0.0403				
	Sulfur (S)-Dissolved (mg/L)	2.89				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1808381-1	L1808381-2	L1808381-3	L1808381-4	L1808381-5
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	22-JUL-16	22-JUL-16	22-JUL-16	22-JUL-16	22-JUL-16
	Sampled Time	12:40	12:15	11:30	11:50	11:00
	Client ID	BAP-43-S	BAP-44-S	BBD-43-S	BBD-44-S	BPJ-43-S
Grouping	**Analyte**					
WATER						
Dissolved Metals	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Dissolved (mg/L)	0.000053	0.000047	0.000038	0.000037	0.000039
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1808381-6				
	Description	Surface Water				
	Sampled Date	22-JUL-16				
	Sampled Time	10:30				
	Client ID	BPJ-44-S				
Grouping	**Analyte**					
WATER						
Dissolved Metals	Thallium (Tl)-Dissolved (mg/L)	<0.000010				
	Tin (Sn)-Dissolved (mg/L)	<0.00010				
	Titanium (Ti)-Dissolved (mg/L)	<0.00030				
	Uranium (U)-Dissolved (mg/L)	0.000040				
	Vanadium (V)-Dissolved (mg/L)	<0.00050				
	Zinc (Zn)-Dissolved (mg/L)	<0.0010				
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Aluminum (Al)-Dissolved	MS-B	L1808381-1, -2, -3, -4, -5, -6
Matrix Spike	Cadmium (Cd)-Dissolved	MS-B	L1808381-1, -2, -3, -4, -5, -6
Matrix Spike	Cobalt (Co)-Dissolved	MS-B	L1808381-1, -2, -3, -4, -5, -6
Matrix Spike	Copper (Cu)-Dissolved	MS-B	L1808381-1, -2, -3, -4, -5, -6
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1808381-1, -2, -3, -4, -5, -6
Matrix Spike	Nickel (Ni)-Dissolved	MS-B	L1808381-1, -2, -3, -4, -5, -6
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1808381-1, -2, -3, -4, -5, -6
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1808381-1, -2, -3, -4, -5, -6
Matrix Spike	Uranium (U)-Dissolved	MS-B	L1808381-1, -2, -3, -4, -5, -6
Matrix Spike	Zinc (Zn)-Dissolved	MS-B	L1808381-1, -2, -3, -4, -5, -6

Qualifiers for Individual Parameters Listed:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BE-D-L-CCMS-VA	Water	Diss. Be (low) in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

BE-T-L-CCMS-VA	Water	Total Be (Low) in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.

CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

CN-FREE-L-CFA-VA	Water	Low Level Free Cyanide in water by CFA	ASTM 7237

This analysis is carried out using procedures adapted from ASTM Method 7237 "Free Cyanide with Flow Injection Analysis (FIA) Utilizing Gas Diffusion Separation and Amperometric Detection". Free cyanide is determined by in-line gas diffusion at pH 6 with final determination by colourimetric analysis.

CN-T-L-CFA-VA	Water	Low Level Total Cyanide in water by CFA	ISO 14403:2002

This analysis is carried out using procedures adapted from ISO Method 14403:2002 "Determination of Total Cyanide using Flow Analysis (FIA and CFA)". Total or strong acid dissociable (SAD) cyanide is determined by in-line UV digestion along with sample distillation and final determination by colourimetric analysis. Method Limitation: This method is susceptible to interference from thiocyanate (SCN). If SCN is present in the sample, there could be a positive interference with this method, but it would be less than 1% and could be as low as zero.

HARDNESS-CALC-VA	Water	Hardness	APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in $CaCO_3$ equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-D-CVAA-VA	Water	Diss. Mercury in Water by CVAAS or CVAFS	APHA 3030B/EPA 1631E (mod)

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

HG-T-CVAA-VA	Water	Total Mercury in Water by CVAAS or CVAFS	EPA 1631E (mod)

Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-DIS-LOW-ICP-VA	Water	Dissolved Metals in Water by ICPOES	EPA 3005A/6010B

Reference Information

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-TOT-LOW-ICP-VA	Water	Total Metals in Water by ICPOES	EPA 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

NH3-F-VA	Water	Ammonia in Water by Fluorescence	APHA 4500 NH3-NITROGEN (AMMONIA)

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

P-T-PRES-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

S-DIS-ICP-VA	Water	Dissolved Sulfur in Water by ICPOES	EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

S-TOT-ICP-VA	Water	Total Sulfur in Water by ICPOES	EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

TKN-F-VA	Water	TKN in Water by Fluorescence	APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

ALS Environmental

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC # ______

Page 1 of 1

Report To		Report Format / Distribution	
Company:	Azimuth Consulting Group	☐ Standard ☐ Other	
Contact:	Eric Franz	☐ PDF ☐ Excel ☐ Digital ☐ Fax	
Address:	218-2902 West Broadway	Email 1:	efranz@azimuthgroup.ca
	Vancouver, BC V6K2G8	Email 2:	gmann@azimuthgroup.ca
Phone:	604-730-1220 Fax:	Email 3:	ryan.vanengen@agnicoeagle.com
Invoice To	Same as Report ? ☑ Yes ☐ No	**Client / Project Information**	
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	CREMP Meadowbank Surfacewater
Company:		PO / AFE:	
Contact:		LSD:	
Address:			
Phone:	Fax:	Quote #:	Q39503
Lab Work Order # (lab use only)		ALS Contact:	Sampler:

Service Requested (Rush for routine analysis subject to availability)

- ◉ Regular (Standard Turnaround Times - Business Days)
- ○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
- ○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
- ○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request

Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TOC, Ammonia, TKN, Total P (P)	DOC (F/P)	T-CN (Low), Free CN (Low) (P)	Total mercury (P)	Dissolved mercury (F/P)	Total Metals (P)	Dissolved Metals (F/P)						Number of Containers
	BAP-43-S	22-Jul-16	12:40	Surface Water	X	X	X	X	X	X	X						7
	BAP-44-S	22-Jul-16	12:15	Surface Water	X	X	X	X	X	X	X						7
	BBD-43-S	22-Jul-16	11:30	Surface Water	X	X	X	X	X	X	X						7
	BBD-44-S	22-Jul-16	11:50	Surface Water	X	X	X	X	X	X	X						7
	BPJ-43-S	22-Jul-16	11:00	Surface Water	X	X	X	X	X	X	X						7
	BPJ-44-S	22-Jul-16	10:30	Surface Water	X	X	X	X	X	X	X						7

L1808381-COFC

Short Holding Time

● *Rush Processing*

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by: Jamie K	Date (dd-mmm-yy) 25-Jul-16	Time (hh-mm) 8:30	Received by: Sarah	Date: Aug 4	Time: 11:20	Temperature: 20/21 °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

GENF 20.00 Front

AZIMUTH CONSULTING GROUP INC.
ATTN: Eric Franz
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 04-AUG-16
Report Date: 10-AUG-16 13:50 (MT)
Version: FINAL

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1808402

Project P.O. #: NOT SUBMITTED
Job Reference: CREMP MEADOWBANK SURFACEWATER
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1808402-1	L1808402-2	L1808402-3	L1808402-4	L1808402-5
	Description	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE
	Sampled Date	22-JUL-16	22-JUL-16	22-JUL-16	22-JUL-16	22-JUL-16
	Sampled Time					
	Client ID	BAP-43-S	BAP-44-S	BBD-43-S	BBD-44-S	BPJ-43-S
Grouping	**Analyte**					
FILTER						
Plant Pigments	Chlorophyll a (ug/L)	0.158	0.195	1.07	0.929	0.903

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1808402-6	L1808402-7	L1808402-8	L1808402-9	L1808402-10
		Description	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE
		Sampled Date	22-JUL-16	12-JUL-16	12-JUL-16	18-JUL-16	18-JUL-16
		Sampled Time					
		Client ID	BPJ-44-S	TPE-92-S	TPE-93-S	INNUG-80-S	INNUG-81-S
Grouping	**Analyte**						
FILTER							
Plant Pigments	Chlorophyll a (ug/L)		0.640	0.142	0.156	0.257	0.271

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1808402-11	L1808402-12	L1808402-13	L1808402-14	L1808402-15
		Description	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE
		Sampled Date	20-JUL-16	20-JUL-16	19-JUL-16	19-JUL-16	08-JUL-16
		Sampled Time					
		Client ID	TPN-92-S	TPN-93-S	PDL-45-S	PDL-46-S	SP-92-S
Grouping	**Analyte**						
FILTER							
Plant Pigments	Chlorophyll a (ug/L)		0.171	0.163	0.254	0.276	0.265

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1808402-16	L1808402-17	L1808402-18	L1808402-19	L1808402-20
		Description	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE
		Sampled Date	08-JUL-16	10-JUL-16	10-JUL-16		
		Sampled Time					
		Client ID	SP-93-92-S	WAL-61-S	WAL-62-S	JUL-DUP-1	JUL-DUP-2
Grouping	**Analyte**						
FILTER							
Plant Pigments	Chlorophyll a (ug/L)		0.258	0.423	0.410	0.159	0.192

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CHLOROA-F-VA	Filter	Chlorophyll a by Fluorometer (Filter)	EPA 445.0

This analysis is done using procedures modified from EPA Method 445.0. Chlorophyll-a is determined by a routine acetone extraction followed with analysis by fluorometry using the non-acidification procedure. This method is not subject to interferences from chlorophyll b.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Short Holding Time

Rush Processing

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC # ____________

Report To	
Company:	Azimuth Consulting Group
Contact:	Eric Franz
Address:	218-2902 West Broadway
	Vancouver, BC V6K2G8
Phone:	604-730-1220 Fax:
Invoice To	Same as Report ? ☑ Yes ☐ No
Hardcopy of Invoice with Report?	☐ Yes ☑ No
Company:	
Contact:	
Address:	
Phone:	Fax:
Lab Work Order # (lab use only)	[redacted]

Report Format / Distribution	
☐ Standard ☐ Other	
☐ PDF ☐ Excel ☐ Digital ☐ Fax	
Email 1:	efranz@azimuthgroup.ca
Email 2:	gmann@azimuthgroup.ca
Email 3:	ryan.vanengen@agnicoeagle.com
Client / Project Information	
Job #:	CREMP Meadowbank Surfacewater
PO / AFE:	
LSD:	
Quote #:	Q39503
ALS Contact:	Sampler:

Service Requested (Rush for routine analysis subject to availability)

- ◉ Regular (Standard Turnaround Times - Business Days)
- ○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
- ○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
- ○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request

Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Chloro A (F)	Number of Containers
[redacted]	BAP-43-S	22-Jul-16		Surface Water	x	1
[redacted]	BAP-44-S	22-Jul-16		Surface Water	x	1
[redacted]	BBD-43-S	22-Jul-16		Surface Water	x	1
[redacted]	BBD-44-S	22-Jul-16		Surface Water	x	1
[redacted]	BPJ-43-S	22-Jul-16		Surface Water	x	1
[redacted]	BPJ-44-S	22-Jul-16		Surface Water	x	1
[redacted]	TPE-92-S	12-Jul-16		Surface Water	x	1
[redacted]	TPE-93-S	12-Jul-16		Surface Water	x	1
[redacted]	INNUG-80-S	18-Jul-16		Surface Water	x	1
[redacted]	INNUG-81-S	18-Jul-16		Surface Water	x	1
[redacted]	TPN-92-S	20-Jul-16		Surface Water	x	1
[redacted]	TPN-93-S	20-Jul-16		Surface Water	x	1
[redacted]	PDL-45-S	19-Jul-16		Surface Water	x	1
[redacted]	PDL-46-S	19-Jul-16		Surface Water	x	1
[redacted]	SP-92-S	08-Jul-16		Surface Water	x	1
[redacted]	SP-93-92-S	08-Jul-16		Surface Water	x	1
[redacted]	WAL-61-S	10-Jul-16		Surface Water	x	1
[redacted]	WAL-62-S	10-Jul-16		Surface Water	x	1
[redacted]	JUL-DUP-1			Surface Water	x	1
[redacted]	JUL-DUP-2			Surface Water	x	1

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by: Jamie K	Date (dd-mmm-yy) 25-Jul-16	Time (hh-mm) 8:30	Received by: HMC	Date: Aug 4	Time: 11:15	Temperature: 19/20 °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

GENF 20.00 Front

L1808402-COFC

AZIMUTH CONSULTING GROUP INC.
ATTN: Eric Franz
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 04-AUG-16
Report Date: 11-AUG-16 10:27 (MT)
Version: FINAL

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1808438

Project P.O. #: NOT SUBMITTED
Job Reference: CREMP MEADOWBANK SURFACEWATER
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1808438-1	L1808438-2	L1808438-3	L1808438-4	L1808438-5
	Description	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE
	Sampled Date	22-JUL-16	22-JUL-16	22-JUL-16	22-JUL-16	22-JUL-16
	Sampled Time	12:40	12:15	11:30	11:50	11:00
	Client ID	BAP-43-S	BAP-44-S	BBD-43-S	BBD-44-S	BPJ-43-S
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	704	639	27.5	105	134
	pH (pH)	6.74	6.79	6.81	6.81	6.81
	Total Suspended Solids (mg/L)	<1.0	<1.0	1.5	<1.0	<1.0
	Total Dissolved Solids (mg/L)	399	357	31.8	94	112
	Turbidity (NTU)	0.29	0.28	0.20	0.27	0.34
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	10.3	10.1	9.0	9.4	9.5
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	10.3	10.1	9.0	9.4	9.5
	Bromide (Br) (mg/L)	0.67	0.592	<0.050	0.090	0.112
	Chloride (Cl) (mg/L)	189	168	1.75	22.7	30.4
	Fluoride (F) (mg/L)	<0.10 DLDS	0.073	0.054	0.055	0.058
	Nitrate (as N) (mg/L)	0.071	0.0634	0.0233	0.0289	0.0299
	Nitrite (as N) (mg/L)	<0.0050 DLDS	<0.0010	<0.0010	<0.0010	<0.0010
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Silicate (as SiO2) (mg/L)	0.66	0.68	0.63	0.62	0.64
	Sulfate (SO4) (mg/L)	26.2	24.4	0.71	3.67	4.76

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1808438-6					
	Description	SURFACE WATE					
	Sampled Date	22-JUL-16					
	Sampled Time	10:30					
	Client ID	BPJ-44-S					
Grouping	**Analyte**						
WATER							
Physical Tests	Conductivity (uS/cm)	230					
	pH (pH)	6.82					
	Total Suspended Solids (mg/L)	1.0					
	Total Dissolved Solids (mg/L)	169					
	Turbidity (NTU)	0.31					
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	9.7					
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0					
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0					
	Alkalinity, Total (as CaCO3) (mg/L)	9.7					
	Bromide (Br) (mg/L)	0.207					
	Chloride (Cl) (mg/L)	56.6					
	Fluoride (F) (mg/L)	0.061					
	Nitrate (as N) (mg/L)	0.0368					
	Nitrite (as N) (mg/L)	<0.0010					
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010					
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020					
	Silicate (as SiO2) (mg/L)	0.62					
	Sulfate (SO4) (mg/L)	8.50					

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Fluoride (F)	DLDS	L1808438-1, -2, -3, -4, -5, -6

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

BR-L-IC-N-VA Water Bromide in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

CL-L-IC-N-VA Water Chloride in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

EC-PCT-VA Water Conductivity (Automated) APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

F-IC-N-VA Water Fluoride in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO2-L-IC-N-VA Water Nitrite in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-VA Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-TD-COL-VA Water Total Dissolved P in Water by Colour APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H "pH Value"

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PO4-DO-COL-VA Water Diss. Orthophosphate in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

SILICATE-COL-VA Water Silicate by Colourimetric analysis APHA 4500-SiO2 E.

This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.

SO4-IC-N-VA Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-LOW-VA Water Low Level TDS (3.0mg/L) by Gravimetric APHA 2540C

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total dissolved solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TSS-LOW-VA Water Total Suspended Solids by Grav. (1 mg/L) APHA 2540D

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.
Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis

Reference Information

methods are available for these types of samples.

TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 "Turbidity"

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Short Holding Time

● *Rush Processing*

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC #

Page 1 of 1

Report To		Report Format / Distribution		Service Requested (Rush for routine analysis subject to availability)
Company:	Azimuth Consulting Group	☐ Standard ☐ Other		◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Eric Franz	☐ PDF ☐ Excel ☐ Digital ☐ Fax		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1:	efranz@azimuthgroup.ca	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6K2G8	Email 2:	gmann@azimuthgroup.ca	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax:	Email 3:	ryan.vanengen@agnicoeagle.com	Analysis Request
Invoice To	Same as Report ? ☑ Yes ☐ No	Client / Project Information		Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	CREMP Meadowbank Surfacewater	
Company:		PO / AFE:		
Contact:		LSD:		
Address:				
Phone:	Fax:	Quote #:	Q39503	
Lab Work Order # (lab use only)		ALS Contact:	Sampler:	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Conventionals** see notes	TSS-Low, TDS-Low											Number of Containers
	BAP-43-S	22-Jul-16	12:40	Surface Water	X	X											2
	BAP-44-S	22-Jul-16	12:15	Surface Water	X	X											2
	BBD-43-S	22-Jul-16	11:30	Surface Water	X	X											2
	BBD-44-S	22-Jul-16	11:50	Surface Water	X	X											2
	BPJ-43-S	22-Jul-16	11:00	Surface Water	X	X											2
	BPJ-43-S	22-Jul-16	10:30	Surface Water	X	X											2
																	2
																	2
																	2

L1808438-COFC

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

**Conventionals includes: Alk Species, pH, EC, Turbidity, Conductivity, Anions (F, NO2, NO3, Br, SO4), low-level Chloride, Silicate, TD-P, and Ortho-PO4.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by: Jamie K	Date (dd-mmm-yy) 25-Jul-16	Time (hh-mm) 8:30	Received by: Hmc	Date: Aug 4	Time: 11:15	Temperature: 19/20°C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

AZIMUTH CONSULTING GROUP INC.
ATTN: Eric Franz
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 15-AUG-16
Report Date: 24-AUG-16 13:25 (MT)
Version: FINAL

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1813371

Project P.O. #: NOT SUBMITTED
Job Reference: CREMP MEADOWBANK SURFACEWATER
C of C Numbers: 1, 2
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1813371-1	L1813371-2	L1813371-3	L1813371-4	L1813371-5
	Description	other	other	other	other	other
	Sampled Date	03-AUG-16	03-AUG-16	05-AUG-16	05-AUG-16	05-AUG-16
	Sampled Time	12:14	12:45	09:15	08:30	10:00
	Client ID	SP-94	SP-95	TPN-94	TPN-95	TPE-94
Grouping	**Analyte**					
FILTER						
Plant Pigments	Chlorophyll a (ug/L)	0.563	0.632	0.685	0.638	0.627

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1813371-6	L1813371-7	L1813371-8	L1813371-9	L1813371-10
	Description	other	other	other	other	other
	Sampled Date	05-AUG-16	05-AUG-16	05-AUG-16	06-AUG-16	06-AUG-16
	Sampled Time	10:30	16:45	17:20	15:15	14:30
	Client ID	TPE-95	WAL-63	WAL-64	PDL-47	PDL-48
Grouping	**Analyte**					
FILTER						
Plant Pigments	Chlorophyll a (ug/L)	0.683	0.791	0.779	0.439	0.443

ALS ENVIRONMENTAL ANALYTICAL REPORT

		L1813371-11	L1813371-12	L1813371-13	L1813371-14	L1813371-15
	Sample ID	L1813371-11	L1813371-12	L1813371-13	L1813371-14	L1813371-15
	Description	other	other	other	other	other
	Sampled Date	07-AUG-16	07-AUG-16		08-AUG-16	08-AUG-16
	Sampled Time	08:30	09:00		14:30	15:00
	Client ID	INUG-82	INUG-83	AUG DUP-1	BAP-45	BAP-46
Grouping	**Analyte**					
FILTER						
Plant Pigments	Chlorophyll a (ug/L)	0.385	0.420	0.608	1.32	1.30

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1813371-16	L1813371-17	L1813371-18	L1813371-19	
	Description	other	other	other	other	
	Sampled Date	10-AUG-16	10-AUG-16	10-AUG-16	10-AUG-16	
	Sampled Time	08:30	09:30	10:15	10:45	
	Client ID	BBD-45	BBD-46	BPJ-45	BPJ-46	
Grouping	**Analyte**					
FILTER						
Plant Pigments	Chlorophyll a (ug/L)	1.21	1.28	1.39	1.19	

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CHLOROA-F-VA	Filter	Chlorophyll a by Fluorometer (Filter)	EPA 445.0

This analysis is done using procedures modified from EPA Method 445.0. Chlorophyll-a is determined by a routine acetone extraction followed with analysis by fluorometry using the non-acidification procedure. This method is not subject to interferences from chlorophyll b.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

1 2

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Short Holding Time

● *Rush Processing*

Chain of Custody / Analytical Req
Canada Toll Free: 1 800 668
www.alsglobal.com

L1813371-COFC

Report To		Report Format / Distribution	
Company:	Azimuth Consulting Group	☑ Standard ☐ Other	
Contact:	Eric Franz	☑ PDF ☑ Excel ☐ Digital ☐ Fax	
Address:	218-2902 West Broadway	Email 1:	efranz@azimuthgroup.ca
	Vancouver, BC V6K2G8	Email 2:	gmann@azimuthgroup.ca
Phone:	604-730-1220 Fax:	Email 3:	ryan.vanengen@agnicoeagle.com
Invoice To	Same as Report ? ☑ Yes ☐ No	Client / Project Information	
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	CREMP Meadowbank Surfacewater
Company:		PO / AFE:	
Contact:		LSD:	
Address:			
Phone:	Fax:	Quote #:	Q39503
Lab Work Order # (lab use only)	L1813371	ALS Contact: Brent Mack	Sampler: Eric Franz

Service Requested (Rush for routine analysis subject to availability)

- ◉ Regular (Standard Turnaround Times - Business Days)
- ○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
- ○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
- ○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request

Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Chlorophyll 'a'	Number of Containers
	SP-94	03-Aug-16	12:14	Other	X	1
	SP-95	03-Aug-16	12:45	Other	X	1
	TPN-94	05-Aug-16	9:15	Other	X	1
	TPN-95	05-Aug-16	8:30	Other	X	1
	TPE-94	05-Aug-16	10:00	Other	X	1
	TPE-95	05-Aug-16	10:30	Other	X	1
	WAL-63	05-Aug-16	16:45	Other	X	1
	WAL-64	05-Aug-16	17:20	Other	X	1
	PDL-47	06-Aug-16	15:15	Other	X	1
	PDL-48	06-Aug-16	14:30	Other	X	1
	INUG-82	07-Aug-16	8:30	Other	X	1
	INUG-83	07-Aug-16	9:00	Other	X	1

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Filtered 500 mL of water for the chlorophyll-a sampels

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Eric Franz	11-Aug-16	9:15	HMC	Aug15/16	11:15	21 °C				

Short Holding Time

- *Rush Processing*

Chain of Custody / Analytical Req
Canada Toll Free: 1 800 668
www.alsglobal.com

L1813371-COFC

Report To		Report Format / Distribution		Service Requested (Rush for routine analysis subject to availability)
Company:	Azimuth Consulting Group	☑ Standard ☐ Other		◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Eric Franz	☑ PDF ☑ Excel ☐ Digital ☐ Fax		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1:	efranz@azimuthgroup.ca	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6K2G8	Email 2:	gmann@azimuthgroup.ca	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax:	Email 3:	ryan.vanengen@agnicoeagle.com	Analysis Request
Invoice To	Same as Report ? ☑ Yes ☐ No	Client / Project Information		Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	CREMP Meadowbank Surfacewater	
Company:		PO / AFE:		
Contact:		LSD:		
Address:				
Phone:	Fax:	Quote #:	Q39503	
Lab Work Order # (lab use only)		ALS Contact: Brent Mack	Sampler: Eric Franz	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Chlorophyll 'a'											Number of Containers
	AUG DUP-1	-	-	Other	X											1
	BAP-45	08-Aug-16	14:30	Other	X											1
	BAP-46	08-Aug-16	15:00	Other	X											1
	BBD-45	10-Aug-16	8:30	Other	X											1
	BBD-46	10-Aug-16	9:30	Other	X											1
	BPJ-45	10-Aug-16	10:15	Other	X											1
	BPJ-46	10-Aug-16	10:45	Other	X											1
	AUG DUP-2	-	-	Other	X											1

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Filtered 500 mL of water for the chlorophyll-a sampels

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by: HMC	Date: Aug 15/16	Time: 11:15	Temperature: 2(°C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

AZIMUTH CONSULTING GROUP INC.
ATTN: Eric Franz
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 15-AUG-16
Report Date: 23-AUG-16 17:17 (MT)
Version: FINAL

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1813394

Project P.O. #:	NOT SUBMITTED
Job Reference:	CREMP MEADOWBANK SURFACEWATER
C of C Numbers:	1
Legal Site Desc:	

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1813394-1	L1813394-2	L1813394-3	L1813394-4	L1813394-5
	Description	surface water	surface water	surface water	surface water	surface water
	Sampled Date	08-AUG-16	08-AUG-16	10-AUG-16	10-AUG-16	10-AUG-16
	Sampled Time	14:30	15:00	08:30	09:30	10:15
	Client ID	BAP-45	BAP-46	BBD-45	BBD-46	BPJ-45
WATER						
Physical Tests	Conductivity (uS/cm)	124	122	50.4	116	70.5
	pH (pH)	7.02	7.01	7.01	6.98	7.00
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	1.0
	Total Dissolved Solids (mg/L)	106	81	42	97	62
	Turbidity (NTU)	0.41	0.45	0.40	0.42	0.51
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	9.1	8.6	8.8	8.9	8.4
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	9.1	8.6	8.8	8.9	8.4
	Bromide (Br) (mg/L)	0.118	0.094	0.057	0.102	0.051
	Chloride (Cl) (mg/L)	27.5	26.9	7.95	26.0	13.4
	Fluoride (F) (mg/L)	0.053	0.053	0.051	0.053	0.050
	Nitrate (as N) (mg/L)	0.0191	0.0187	0.0211	0.0227	0.0208
	Nitrite (as N) (mg/L)	<0.0010	0.0018	<0.0010	<0.0010	<0.0010
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Phosphorus (P)-Total Dissolved (mg/L)	0.0021	<0.0020	0.0021	<0.0020	0.0025
	Silicate (as SiO2) (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Sulfate (SO4) (mg/L)	4.29	4.22	1.51	4.07	2.29

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1813394-6	L1813394-7	L1813394-8	L1813394-9	L1813394-10
	Description	surface water	surface water	surface water	surface water	surface water
	Sampled Date	10-AUG-16	10-AUG-16	10-AUG-16		
	Sampled Time	10:45	11:20	19:30		
	Client ID	BPJ-46	AUG EB-1	AUG D1-1	AUG TRAV-1	AUG DUP-2
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	58.0	<2.0	<2.0	<2.0	58.4
	pH (pH)	7.00	5.04	5.10	5.20	7.11
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Total Dissolved Solids (mg/L)	64	<3.0	<3.0	<3.0	53
	Turbidity (NTU)	0.47	0.13	<0.10	<0.10	0.41
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	8.8	<1.0	<1.0	<1.0	9.1
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	8.8	<1.0	<1.0	<1.0	9.1
	Bromide (Br) (mg/L)	0.060	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	10.2	<0.10	<0.10	<0.10	9.26
	Fluoride (F) (mg/L)	0.050	<0.020	<0.020	<0.020	0.051
	Nitrate (as N) (mg/L)	0.0233	<0.0050	<0.0050	<0.0050	0.0192
	Nitrite (as N) (mg/L)	<0.0010	0.0023	<0.0010	<0.0010	<0.0010
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Phosphorus (P)-Total Dissolved (mg/L)	0.0027	<0.0020	<0.0020	<0.0020	0.0020
	Silicate (as SiO2) (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Sulfate (SO4) (mg/L)	1.83	<0.30	<0.30	<0.30	1.70

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

CL-L-IC-N-VA	Water	Chloride in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-TD-COL-VA	Water	Total Dissolved P in Water by Colour	APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

PH-PCT-VA	Water	pH by Meter (Automated)	APHA 4500-H "pH Value"

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PH-PCT-VA	Water	pH by Meter (Automated)	APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PO4-DO-COL-VA	Water	Diss. Orthophosphate in Water by Colour	APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

SILICATE-COL-VA	Water	Silicate by Colourimetric analysis	APHA 4500-SiO2 E.

This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.

SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-LOW-VA	Water	Low Level TDS (3.0mg/L) by Gravimetric	APHA 2540C

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total dissolved solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TSS-LOW-VA	Water	Total Suspended Solids by Grav. (1 mg/L)	APHA 2540D

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.
Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 "Turbidity"

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 Turbidity

Reference Information

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

1

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Short Holding Time

● *Rush Processing*

Chain of Custody /
Canada Toll F
www.

L1813394-COFC

COC # ____________

Report To	
Company:	Azimuth Consulting Group
Contact:	Eric Franz
Address:	218-2902 West Broadway
	Vancouver, BC V6K2G8
Phone:	604-730-1220 Fax:
Invoice To	Same as Report ? ☑ Yes ☐ No
Hardcopy of Invoice with Report?	☐ Yes ☑ No
Company:	
Contact:	
Address:	
Phone:	Fax:
Lab Work Order # (lab use only)	L1813394

Report Format / Distribution	
☑ Standard ☐ Other	
☑ PDF ☑ Excel ☐ Digital ☐ Fax	
Email 1:	efranz@azimuthgroup.ca
Email 2:	grhann@azimuthgroup.ca
Email 3:	ryan.vanengen@agnicoeagle.com
Client / Project Information	
Job #:	CREMP Meadowbank Surfacewater
PO / AFE:	
LSD:	
Quote #:	Q39503
ALS Contact:	Brent Mack
Sampler:	Eric Franz

Service Requested (Rush for routine analysis subject to availability)

- ◉ Regular (Standard Turnaround Times - Business Days)
- ○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
- ○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
- ○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request

Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Conventionals** see notes	TSS-Low, TDS-Low	Number of Containers
1	BAP-45	08-Aug-16	14:30	Surface Water	X	X	2
2	BAP-46	08-Aug-16	15:00	Surface Water	X	X	2
3	BBD-45	10-Aug-16	8:30	Surface Water	X	X	2
4	BBD-46	10-Aug-16	9:30	Surface Water	X	X	2
5	BPJ-45	10-Aug-16	10:15	Surface Water	X	X	2
6	BPJ-46	10-Aug-16	10:45	Surface Water	X	X	2
7	AUG EB-1	10-Aug-16	11:20	Surface Water	X	X	2
8	AUG DI-1	10-Aug-16	19:30	Surface Water	X	X	2
9	AUG TRAV-1	-	-	Surface Water	X	X	2
10	AUG DUP-2	-	-	Surface Water	X	X	2

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

**Conventionals includes: Alk Species, pH, EC, Turbidity, Conductivity, Anions (F, NO2, NO3, Br, SO4), low-level Chloride, Silicate, TD-P, and Ortho-PO4.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Eric Franz	11-Aug-16	9:10	HMC	Aug15/16	11:15	21 °C				

AZIMUTH CONSULTING GROUP INC.
ATTN: Eric Franz
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 15-AUG-16
Report Date: 24-AUG-16 12:26 (MT)
Version: FINAL

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1813406

Project P.O. #: NOT SUBMITTED
Job Reference: CREMP MEADOWBANK SURFACEWATER
C of C Numbers: 1, 2
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1813406-1	L1813406-2	L1813406-3	L1813406-4	L1813406-5
	Description	surface water	surface water	surface water	surface water	surface water
	Sampled Date	03-AUG-16	03-AUG-16	05-AUG-16	05-AUG-16	05-AUG-16
	Sampled Time	12:14	12:45	09:15	08:30	10:00
	Client ID	SP-94	SP-95	TPN-94	TPN-95	TPE-94
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	35.6	34.8	27.2	26.7	29.3
	Hardness (as CaCO3) (mg/L)	14.5	14.4	9.16	8.97	10.7
	pH (pH)	7.13	7.13	6.88	6.87	7.02
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Total Dissolved Solids (mg/L)	22.3	22.8	19.3	18.9	23.3
	Turbidity (NTU)	0.26	0.27	0.18	0.24	0.27
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	11.1	9.9	6.0	6.1	7.4
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	11.1	9.9	6.0	6.1	7.4
	Ammonia, Total (as N) (mg/L)	<0.0050	0.0174	<0.0050	<0.0050	<0.0050
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	0.82	0.82	0.71	0.71	0.68
	Fluoride (F) (mg/L)	0.065	0.065	0.065	0.066	0.072
	Nitrate (as N) (mg/L)	<0.0050	<0.0050	0.0485	0.0458	0.0144
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	0.106	0.140	0.106	0.110	0.108
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Phosphorus (P)-Total (mg/L)	<0.0020	<0.0020	<0.0020	0.0023	<0.0020
	Silicate (as SiO2) (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Sulfate (SO4) (mg/L)	4.22	4.29	4.56	4.57	4.40
Cyanides	Cyanide, Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Cyanide, Free (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	1.96	1.47	1.17	1.28	1.35
	Total Organic Carbon (mg/L)	1.68	1.69	1.41	1.32 M	1.14
Total Metals	Aluminum (Al)-Total (mg/L)	0.0087	0.0089	0.0051	0.0059	0.0080
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00028	0.00029	0.00018	0.00019	0.00055
	Barium (Ba)-Total (mg/L)	0.00279	0.00289	0.00321	0.00318	0.00317
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Total (mg/L)	3.76	3.63	2.16	2.20	2.59
	Chromium (Cr)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00020 DLB

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1813406-6	L1813406-7	L1813406-8	L1813406-9	L1813406-10
	Description	surface water	surface water	surface water	surface water	surface water
	Sampled Date	05-AUG-16	05-AUG-16	05-AUG-16	06-AUG-16	06-AUG-16
	Sampled Time	10:30	16:45	17:20	15:15	14:30
	Client ID	TPE-95	WAL-63	WAL-64	PDL-47	PDL-48
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	29.4	40.4	35.6	21.9	21.2
	Hardness (as CaCO3) (mg/L)	10.5	16.1	16.0	8.82	9.10
	pH (pH)	7.00	7.20	7.17	7.01	7.03
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Total Dissolved Solids (mg/L)	22.2	26.0	25.7	16.6	17.1
	Turbidity (NTU)	0.28	0.28	0.36	0.24	0.24
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	7.5	12.1	11.6	7.7	7.1
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	7.5	12.1	11.6	7.7	7.1
	Ammonia, Total (as N) (mg/L)	0.0052	0.0052	<0.0050	<0.0050	<0.0050
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	0.67	0.70	0.69	0.59	0.59
	Fluoride (F) (mg/L)	0.072	0.047	0.049	0.039	0.039
	Nitrate (as N) (mg/L)	0.0147	0.0229	0.0126	<0.0050	<0.0050
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	0.109	0.139	0.139	0.109	0.114
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Phosphorus (P)-Total (mg/L)	0.0027	0.0022	0.0022	<0.0020	<0.0020
	Silicate (as SiO2) (mg/L)	<0.50	0.55	0.55	<0.50	<0.50
	Sulfate (SO4) (mg/L)	4.40	3.82	3.66	1.55	1.56
Cyanides	Cyanide, Total (mg/L)	<0.0010	<0.0010	<0.0010	HTD <0.0010	HTD <0.0010
	Cyanide, Free (mg/L)	<0.0010	<0.0010	<0.0010	HTD <0.0010	HTD <0.0010
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	1.29	2.11	2.06	1.54	1.25
	Total Organic Carbon (mg/L)	1.33	2.25	2.11	1.67	1.53
Total Metals	Aluminum (Al)-Total (mg/L)	0.0075	0.0067	0.0077	0.0467	0.0049
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00053	0.00034	0.00033	0.00024	0.00016
	Barium (Ba)-Total (mg/L)	0.00325	0.00241	0.00233	0.00245	0.00213
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Total (mg/L)	2.57	4.28	4.15	2.22	2.29
	Chromium (Cr)-Total (mg/L)	DLB <0.00020	<0.00010	<0.00010	DLB <0.00040	DLB <0.00020

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID / Description / Sampled Date / Sampled Time / Client ID	L1813406-11 surface water 07-AUG-16 08:30 INUG-82	L1813406-12 surface water 07-AUG-16 09:00 INUG-83	L1813406-13 surface water AUG DUP-1		
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	15.0	15.4	27.1		
	Hardness (as CaCO3) (mg/L)	5.78	5.67	9.31		
	pH (pH)	6.78	6.80	6.94		
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0		
	Total Dissolved Solids (mg/L)	11.3	12.6	18.9		
	Turbidity (NTU)	0.32	0.34	0.25		
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	5.0	5.0	6.1		
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0		
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0		
	Alkalinity, Total (as CaCO3) (mg/L)	5.0	5.0	6.1		
	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	<0.0050		
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050		
	Chloride (Cl) (mg/L)	0.72	0.72	0.72		
	Fluoride (F) (mg/L)	0.061	0.060	0.065		
	Nitrate (as N) (mg/L)	<0.0050	<0.0050	0.0454		
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010		
	Total Kjeldahl Nitrogen (mg/L)	0.124	0.120	0.119		
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	<0.0010		
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020	<0.0020	<0.0020		
	Phosphorus (P)-Total (mg/L)	<0.0020	<0.0020	<0.0020		
	Silicate (as SiO2) (mg/L)	<0.50	<0.50	<0.50		
	Sulfate (SO4) (mg/L)	0.81	0.81	4.56		
Cyanides	Cyanide, Total (mg/L)	HTD <0.0010	HTD <0.0010	<0.0010		
	Cyanide, Free (mg/L)	HTD <0.0010	HTD <0.0010	<0.0010		
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	1.69	1.69	1.06		
	Total Organic Carbon (mg/L)	1.85	1.87	1.35		
Total Metals	Aluminum (Al)-Total (mg/L)	0.0099	0.0086	0.0057		
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010		
	Arsenic (As)-Total (mg/L)	0.00010	0.00011	0.00019		
	Barium (Ba)-Total (mg/L)	0.00206	0.00191	0.00325		
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020		
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050		
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010		
	Cadmium (Cd)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050		
	Calcium (Ca)-Total (mg/L)	1.12	1.09	2.17		
	Chromium (Cr)-Total (mg/L)	<0.00010	<0.00010	<0.00010		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		L1813406-1	L1813406-2	L1813406-3	L1813406-4	L1813406-5
	Sample ID	L1813406-1	L1813406-2	L1813406-3	L1813406-4	L1813406-5
	Description	surface water	surface water	surface water	surface water	surface water
	Sampled Date	03-AUG-16	03-AUG-16	05-AUG-16	05-AUG-16	05-AUG-16
	Sampled Time	12:14	12:45	09:15	08:30	10:00
	Client ID	SP-94	SP-95	TPN-94	TPN-95	TPE-94
Grouping	**Analyte**					
WATER						
Total Metals	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Total (mg/L)	0.00068	0.00070	<0.00050	<0.00050	0.00055
	Iron (Fe)-Total (mg/L)	0.021	0.020	<0.010	<0.010	0.015
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)-Total (mg/L)	1.19	1.17	0.88	0.90	0.96
	Manganese (Mn)-Total (mg/L)	0.00187	0.00184	0.00163	0.00161	0.00157
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	0.000179	0.000169	0.000157	0.000158	0.000157
	Nickel (Ni)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	0.54	0.56	0.55	0.54	0.57
	Selenium (Se)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)-Total (mg/L)	0.197	0.181	0.052	0.055	0.062
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	0.832	0.880	1.17	1.19	1.11
	Strontium (Sr)-Total (mg/L)	0.0173	0.0170	0.0101	0.0103	0.0112
	Sulfur (S)-Total (mg/L)	1.65	1.63	1.66	1.73	1.65
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Total (mg/L)	0.000050	0.000052	0.000040	0.000037	0.000049
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0027	0.0028	0.0019	0.0021	0.0024
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00025	0.00027	0.00017	0.00016	0.00050
	Barium (Ba)-Dissolved (mg/L)	0.00274	0.00284	0.00315	0.00306	0.00315
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Dissolved (mg/L)	3.80	3.78	2.22	2.17	2.64
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

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	Sample ID	L1813406-6	L1813406-7	L1813406-8	L1813406-9	L1813406-10
	Description	surface water	surface water	surface water	surface water	surface water
	Sampled Date	05-AUG-16	05-AUG-16	05-AUG-16	06-AUG-16	06-AUG-16
	Sampled Time	10:30	16:45	17:20	15:15	14:30
	Client ID	TPE-95	WAL-63	WAL-64	PDL-47	PDL-48
Grouping	**Analyte**					
WATER						
Total Metals	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Total (mg/L)	<0.00050	0.00094	0.00106	0.00162	0.00050
	Iron (Fe)-Total (mg/L)	0.015	0.020	0.019	0.081	<0.010
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)-Total (mg/L)	0.96	1.24	1.22	0.81	0.79
	Manganese (Mn)-Total (mg/L)	0.00155	0.00190	0.00189	0.00210	0.00161
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	0.000166	0.000267	0.000218	0.000053	0.000085
	Nickel (Ni)-Total (mg/L)	0.00051	<0.00050	<0.00050	0.00076	0.00065
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	0.56	0.50	0.49	0.38	0.37
	Selenium (Se)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)-Total (mg/L)	0.067	0.274	0.278	0.185	0.118
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	1.11	0.633	0.610	0.528	0.515
	Strontium (Sr)-Total (mg/L)	0.0111	0.0221	0.0199	0.00911	0.00920
	Sulfur (S)-Total (mg/L)	1.62	1.48	1.40	0.64	0.63
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	<0.00030	<0.00030	<0.00030	0.00150	<0.00030
	Uranium (U)-Total (mg/L)	0.000051	0.000060	0.000050	0.000037	0.000024
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0026	0.0030	0.0024	0.0021	0.0018
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00049	0.00030	0.00030	0.00015	0.00014
	Barium (Ba)-Dissolved (mg/L)	0.00321	0.00238	0.00231	0.00208	0.00208
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Dissolved (mg/L)	2.62	4.35	4.30	2.24	2.30
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1813406-11	L1813406-12	L1813406-13		
	Description	surface water	surface water	surface water		
	Sampled Date	07-AUG-16	07-AUG-16			
	Sampled Time	08:30	09:00			
	Client ID	INUG-82	INUG-83	AUG DUP-1		
Grouping	**Analyte**					
WATER						
Total Metals	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010		
	Copper (Cu)-Total (mg/L)	<0.00050	<0.00050	<0.00050		
	Iron (Fe)-Total (mg/L)	0.015	0.016	<0.010		
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050		
	Lithium (Li)-Total (mg/L)	<0.0010	<0.0010	<0.0010		
	Magnesium (Mg)-Total (mg/L)	0.69	0.67	0.88		
	Manganese (Mn)-Total (mg/L)	0.00279	0.00275	0.00171		
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050		
	Molybdenum (Mo)-Total (mg/L)	<0.000050	<0.000050	0.000154		
	Nickel (Ni)-Total (mg/L)	<0.00050	<0.00050	<0.00050		
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050		
	Potassium (K)-Total (mg/L)	0.40	0.39	0.52		
	Selenium (Se)-Total (mg/L)	<0.000050	<0.000050	<0.000050		
	Silicon (Si)-Total (mg/L)	0.128	0.124	0.055		
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010		
	Sodium (Na)-Total (mg/L)	0.583	0.569	1.22		
	Strontium (Sr)-Total (mg/L)	0.00627	0.00630	0.0102		
	Sulfur (S)-Total (mg/L)	<0.50	<0.50	1.67		
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010		
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010		
	Titanium (Ti)-Total (mg/L)	<0.00030	<0.00030	<0.00030		
	Uranium (U)-Total (mg/L)	0.000046	0.000048	0.000037		
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050		
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030		
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.00030		
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD		
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD		
	Aluminum (Al)-Dissolved (mg/L)	0.0027	0.0029	0.0022		
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Arsenic (As)-Dissolved (mg/L)	<0.00010	<0.00010	0.00019		
	Barium (Ba)-Dissolved (mg/L)	0.00197	0.00192	0.00311		
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020		
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050		
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010		
	Cadmium (Cd)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050		
	Calcium (Ca)-Dissolved (mg/L)	1.15	1.14	2.25		
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1813406-1	L1813406-2	L1813406-3	L1813406-4	L1813406-5
	Description	surface water	surface water	surface water	surface water	surface water
	Sampled Date	03-AUG-16	03-AUG-16	05-AUG-16	05-AUG-16	05-AUG-16
	Sampled Time	12:14	12:45	09:15	08:30	10:00
	Client ID	SP-94	SP-95	TPN-94	TPN-95	TPE-94
Grouping	**Analyte**					
WATER						
Dissolved Metals	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Dissolved (mg/L)	0.00059	0.00058	0.00032	0.00032	0.00035
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)-Dissolved (mg/L)	1.21	1.20	0.88	0.86	0.99
	Manganese (Mn)-Dissolved (mg/L)	0.00057	0.00064	0.00077	0.00080	0.00072
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	0.000164	0.000176	0.000142	0.000147	0.000140
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	0.50	0.47	0.54	0.43	0.49
	Selenium (Se)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)-Dissolved (mg/L)	0.187	0.169	0.051	<0.050	0.060
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	0.833	0.867	1.16	1.19	1.09
	Strontium (Sr)-Dissolved (mg/L)	0.0168	0.0164	0.00984	0.0101	0.0107
	Sulfur (S)-Dissolved (mg/L)	1.45	1.48	1.59	1.52	1.50
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Dissolved (mg/L)	0.000045	0.000042	0.000032	0.000031	0.000040
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1813406-6	L1813406-7	L1813406-8	L1813406-9	L1813406-10
	Description	surface water	surface water	surface water	surface water	surface water
	Sampled Date	05-AUG-16	05-AUG-16	05-AUG-16	06-AUG-16	06-AUG-16
	Sampled Time	10:30	16:45	17:20	15:15	14:30
	Client ID	TPE-95	WAL-63	WAL-64	PDL-47	PDL-48
Grouping	**Analyte**					
WATER						
Dissolved Metals	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Dissolved (mg/L)	0.00034	0.00082	0.00081	0.00041	0.00039
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)-Dissolved (mg/L)	0.97	1.28	1.27	0.78	0.81
	Manganese (Mn)-Dissolved (mg/L)	0.00070	0.00041	0.00037	0.00061	0.00069
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	0.000161	0.000231	0.000209	<0.000050	<0.000050
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	0.00059	0.00064
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	0.46	0.44	0.44	0.30	0.33
	Selenium (Se)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)-Dissolved (mg/L)	0.058	0.266	0.285	0.116	0.116
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	1.11	0.614	0.613	0.516	0.522
	Strontium (Sr)-Dissolved (mg/L)	0.0111	0.0210	0.0207	0.00883	0.00892
	Sulfur (S)-Dissolved (mg/L)	1.48	1.31	1.25	0.56	0.56
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Dissolved (mg/L)	0.000042	0.000050	0.000048	0.000019	0.000018
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1813406-11	L1813406-12	L1813406-13		
	Description	surface water	surface water	surface water		
	Sampled Date	07-AUG-16	07-AUG-16			
	Sampled Time	08:30	09:00			
	Client ID	INUG-82	INUG-83	AUG DUP-1		
Grouping	**Analyte**					
WATER						
Dissolved Metals	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Copper (Cu)-Dissolved (mg/L)	0.00029	0.00031	0.00032		
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010		
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050		
	Lithium (Li)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010		
	Magnesium (Mg)-Dissolved (mg/L)	0.71	0.69	0.90		
	Manganese (Mn)-Dissolved (mg/L)	0.00016	0.00020	0.00073		
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050		
	Molybdenum (Mo)-Dissolved (mg/L)	<0.000050	<0.000050	0.000145		
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050		
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050		
	Potassium (K)-Dissolved (mg/L)	0.36	0.35	0.47		
	Selenium (Se)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050		
	Silicon (Si)-Dissolved (mg/L)	0.123	0.121	<0.050		
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010		
	Sodium (Na)-Dissolved (mg/L)	0.584	0.587	1.21		
	Strontium (Sr)-Dissolved (mg/L)	0.00627	0.00607	0.00999		
	Sulfur (S)-Dissolved (mg/L)	<0.50	<0.50	1.53		
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010		
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030		
	Uranium (U)-Dissolved (mg/L)	0.000040	0.000039	0.000034		
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050		
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010		
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Chromium (Cr)-Total	DLB	L1813406-1, -10, -11, -12, -13, -2, -3, -4, -5, -6, -7, -8, -9
Method Blank	Chromium (Cr)-Total	MB-LOR	L1813406-1, -10, -11, -12, -13, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Total Organic Carbon	MS-B	L1813406-1, -2
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1813406-1, -10, -11, -12, -13, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1813406-1, -10, -11, -12, -13, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Aluminum (Al)-Dissolved	MS-B	L1813406-1, -10, -11, -12, -13, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1813406-1, -10, -11, -12, -13, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1813406-1, -10, -11, -12, -13, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1813406-1, -10, -11, -12, -13, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Antimony (Sb)-Dissolved	MS-B	L1813406-1, -10, -11, -12, -13, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Arsenic (As)-Dissolved	MS-B	L1813406-1, -10, -11, -12, -13, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Nickel (Ni)-Dissolved	MS-B	L1813406-1, -10, -11, -12, -13, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1813406-1, -10, -11, -12, -13, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1813406-1, -10, -11, -12, -13, -2, -3, -4, -5, -6, -7, -8, -9

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLB	Detection Limit Raised. Analyte detected at comparable level in Method Blank.
HTD	Hold time exceeded for re-analysis or dilution, but initial testing was conducted within hold time.
M	A peak has been manually integrated.
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

BE-D-L-CCMS-VA	Water	Diss. Be (low) in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

BE-T-L-CCMS-VA	Water	Total Be (Low) in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.

CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

CL-L-IC-N-VA	Water	Chloride in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

CN-FREE-L-CFA-VA	Water	Low Level Free Cyanide in water by CFA	ASTM 7237

This analysis is carried out using procedures adapted from ASTM Method 7237 "Free Cyanide with Flow Injection Analysis (FIA) Utilizing Gas Diffusion Separation and Amperometric Detection". Free cyanide is determined by in-line gas diffusion at pH 6 with final determination by colourimetric analysis.

CN-T-L-CFA-VA	Water	Low Level Total Cyanide in water by CFA	ISO 14403:2002

This analysis is carried out using procedures adapted from ISO Method 14403:2002 "Determination of Total Cyanide using Flow Analysis (FIA and CFA)". Total or strong acid dissociable (SAD) cyanide is determined by in-line UV digestion along with sample distillation and final determination by

Reference Information

colourimetric analysis. Method Limitation: This method is susceptible to interference from thiocyanate (SCN). If SCN is present in the sample, there could be a positive interference with this method, but it would be less than 1% and could be as low as zero.

EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

HARDNESS-CALC-VA	Water	Hardness	APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-D-CVAA-VA	Water	Diss. Mercury in Water by CVAAS or CVAFS	APHA 3030B/EPA 1631E (mod)

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

HG-T-CVAA-VA	Water	Total Mercury in Water by CVAAS or CVAFS	EPA 1631E (mod)

Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-DIS-LOW-ICP-VA	Water	Dissolved Metals in Water by ICPOES	EPA 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-TOT-LOW-ICP-VA	Water	Total Metals in Water by ICPOES	EPA 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

NH3-F-VA	Water	Ammonia in Water by Fluorescence	APHA 4500 NH3-NITROGEN (AMMONIA)

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-PRES-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

P-TD-COL-VA	Water	Total Dissolved P in Water by Colour	APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

PH-PCT-VA	Water	pH by Meter (Automated)	APHA 4500-H "pH Value"

Reference Information

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PH-PCT-VA	Water	pH by Meter (Automated)	APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PO4-DO-COL-VA	Water	Diss. Orthophosphate in Water by Colour	APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

S-DIS-ICP-VA	Water	Dissolved Sulfur in Water by ICPOES	EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

S-TOT-ICP-VA	Water	Total Sulfur in Water by ICPOES	EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

SILICATE-COL-VA	Water	Silicate by Colourimetric analysis	APHA 4500-SiO2 E.

This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.

SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-LOW-VA	Water	Low Level TDS (3.0mg/L) by Gravimetric	APHA 2540C

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total dissolved solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TKN-F-VA	Water	TKN in Water by Fluorescence	APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-LOW-VA	Water	Total Suspended Solids by Grav. (1 mg/L)	APHA 2540D

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.
Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 "Turbidity"

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Reference Information

Chain of Custody Numbers:

1 2

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Short Holding Time

• *Rush Processing*

Chain of Custody / Analytical
Canada Toll Free: 1 800
www.alsglobal.co

L1813406-COFC

COC #

Report To	
Company:	Azimuth Consulting Group
Contact:	Eric Franz
Address:	218-2902 West Broadway
	Vancouver, BC V6K2G8
Phone:	604-730-1220 Fax:
Invoice To	Same as Report ? ☑ Yes ☐ No
Hardcopy of Invoice with Report?	☐ Yes ☑ No
Company:	
Contact:	
Address:	
Phone:	Fax:
Lab Work Order # (lab use only)	L1813406

Report Format / Distribution	
☑ Standard ☐ Other	
☑ PDF ☑ Excel ☐ Digital ☐ Fax	
Email 1:	efranz@azimuthgroup.ca
Email 2:	gmann@azimuthgroup.ca
Email 3:	ryan.vanengen@agnicoeagle.com
Client / Project Information	
Job #:	CREMP Meadowbank Surfacewater
PO / AFE:	
LSD:	
Quote #:	Q39503
ALS Contact:	Brent Mack
Sampler:	Eric Franz

Service Requested (Rush for routine analysis subject to availability)
- ◉ Regular (Standard Turnaround Times - Business Days)
- ○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
- ○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
- ○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request
Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Conventionals** see notes	TSS-Low, TDS-Low	Number of Containers
1	SP-94	03-Aug-16	12:14	Surface Water	X	X	2
2	SP-95	03-Aug-16	12:45	Surface Water	X	X	2
3	TPN-94	05-Aug-16	9:15	Surface Water	X	X	2
4	TPN-95	05-Aug-16	8:30	Surface Water	X	X	2
5	TPE-94	05-Aug-16	10:00	Surface Water	X	X	2
6	TPE-95	05-Aug-16	10:30	Surface Water	X	X	2
7	WAL-63	05-Aug-16	16:45	Surface Water	X	X	2
8	WAL-64	05-Aug-16	17:20	Surface Water	X	X	2
9	PDL-47	06-Aug-16	15:15	Surface Water	X	X	2
10	PDL-48	06-Aug-16	14:30	Surface Water	X	X	2
11	INUG-82	07-Aug-16	8:30	Surface Water	X	X	2
12	INUG-83	07-Aug-16	9:00	Surface Water	X	X	2

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

**Conventionals includes: Alk Species, pH, EC, Turbidity, Conductivity, Anions (F, NO2, NO3, Br, SO4), low-level Chloride, Silicate, TD-P, and Ortho-PO4.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by: E. Franz	Date (dd-mmm-yy) 07-Aug-16	Time (hh-mm) 18:00	Received by: UMC	Date: Aug 15/16	Time: 11:15	Temperature: 22 °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

GENF 20.00 Front

Short Holding Time

- *Rush Processing*

Chain of Custody / Analytical
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L1813406-COFC

)C #

Page 2 of 2

Report To		Report Format / Distribution		Service Requested (Rush for routine analysis subject to availability)
Company:	Azimuth Consulting Group	☑ Standard ☐ Other		◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Eric Franz	☑ PDF ☑ Excel ☐ Digital ☐ Fax		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1:	efranz@azimuthgroup.ca	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6K2G8	Email 2:	gmann@azimuthgroup.ca	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax:	Email 3:	ryan.vanengen@agnicoeagle.com	**Analysis Request**
Invoice To	Same as Report ? ☑ Yes ☐ No	Client / Project Information		Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	CREMP Meadowbank Surfacewater	
Company:		PO / AFE:		
Contact:		LSD:		
Address:				
Phone:	Fax:	Quote #:	Q39503	
Lab Work Order # (lab use only)		ALS Contact:	Brent Mack	Sampler: Eric Franz

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Conventionals** see notes	TSS-Low, TDS-Low											Number of Containers
	AUG DUP-1	-	-	Surface Water	X	X											2

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

**Conventionals includes: Alk Species, pH, EC, Turbidity, Conductivity, Anions (F, NO2, NO3, Br, SO4), low-level Chloride, Silicate, TD-P, and Ortho-PO4.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by: HMC	Date: Aug15/16	Time: 15:15	Temperature: 22 °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

AZIMUTH CONSULTING GROUP INC.
ATTN: Eric Franz
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 18-AUG-16
Report Date: 29-AUG-16 17:26 (MT)
Version: FINAL

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1815622

Project P.O. #:	NOT SUBMITTED
Job Reference:	CREMP MEADOWBANK SURFACE WATER
C of C Numbers:	1
Legal Site Desc:	

Comments:

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1815622-1	L1815622-2	L1815622-3	L1815622-4	L1815622-5
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	08-AUG-16	08-AUG-16	10-AUG-16	10-AUG-16	10-AUG-16
	Sampled Time	14:30	15:00	08:30	09:30	10:15
	Client ID	BAP-45	BAP-46	BBD-45	BBD-46	BPJ-45
Grouping	**Analyte**					
WATER						
Physical Tests	Hardness (as CaCO3) (mg/L)	18.8	19.3	13.5	17.5	14.8
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	0.0057	0.0106	0.0177	0.0068	0.0058
	Total Kjeldahl Nitrogen (mg/L)	0.168	0.221	0.194	0.171	0.159
	Phosphorus (P)-Total (mg/L)	0.0045	0.0045	0.0026	<0.0020	0.0043
Cyanides	Cyanide, Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Cyanide, Free (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	3.53	3.53	3.58	3.61	3.55
	Total Organic Carbon (mg/L)	3.47	3.95	3.66	3.45	3.59
Total Metals	Aluminum (Al)-Total (mg/L)	0.0171	0.0151	0.0154	0.0172	0.0177
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00016	0.00014	0.00013	0.00015	0.00014
	Barium (Ba)-Total (mg/L)	0.0198	0.0194	0.0197	0.0196	0.0197
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	<0.010	0.010	<0.010	0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Total (mg/L)	3.06	3.07	2.67	3.00	2.75
	Chromium (Cr)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Iron (Fe)-Total (mg/L)	0.033	0.030	0.033	0.035	0.044
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)-Total (mg/L)	2.80	2.86	1.56	2.69	1.91
	Manganese (Mn)-Total (mg/L)	0.00531	0.00519	0.00615	0.00695	0.00613
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	0.000067	0.000062	0.000053	0.000057	0.000052
	Nickel (Ni)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	0.96	0.95	0.52	0.89	0.66
	Selenium (Se)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)-Total (mg/L)	0.231	0.223	0.239	0.241	0.245
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	13.4	14.1	4.16	13.1	6.95
	Strontium (Sr)-Total (mg/L)	0.0247	0.0256	0.0201	0.0266	0.0220
	Sulfur (S)-Total (mg/L)	1.53	1.55	0.63	1.45	0.88

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1815622-6	L1815622-7	L1815622-8	L1815622-9	L1815622-10
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	10-AUG-16	10-AUG-16	10-AUG-16		
	Sampled Time	10:45	11:20	19:30		
	Client ID	BPJ-46	AUG-EB-1	AUG DI-1	AUG TRAV-1	AUG DUP-2
WATER						
Physical Tests	Hardness (as CaCO3) (mg/L)	13.6	<0.50	<0.50	<0.50 HTC	13.1
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	0.0056
	Total Kjeldahl Nitrogen (mg/L)	0.167	<0.050	<0.050	<0.050	0.182
	Phosphorus (P)-Total (mg/L)	0.0028	<0.0020	<0.0020	<0.0020	0.0025
Cyanides	Cyanide, Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Cyanide, Free (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	3.57	<0.50	<0.50		3.49
	Total Organic Carbon (mg/L)	3.80	<0.50	<0.50	<0.50	3.79
Total Metals	Aluminum (Al)-Total (mg/L)	0.0167	<0.0030	<0.0030	<0.0030	0.0133
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00012	<0.00010	<0.00010	<0.00010	0.00013
	Barium (Ba)-Total (mg/L)	0.0191	<0.000050	<0.000050	<0.000050	0.0195
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Total (mg/L)	2.49	<0.050	<0.050	<0.050	2.63
	Chromium (Cr)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Iron (Fe)-Total (mg/L)	0.033	<0.010	<0.010	<0.010	0.033
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)-Total (mg/L)	1.56	<0.10	<0.10	<0.10	1.58
	Manganese (Mn)-Total (mg/L)	0.00589	<0.00010	<0.00010	<0.00010	0.00618
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	0.000051	<0.000050	<0.000050	<0.000050	<0.000050
	Nickel (Ni)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	0.55	<0.10	<0.10	<0.10	0.56
	Selenium (Se)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)-Total (mg/L)	0.223	<0.050	<0.050	<0.050	0.235
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	5.00	<0.050	<0.050	<0.050	4.65
	Strontium (Sr)-Total (mg/L)	0.0203	<0.00020	<0.00020	<0.00020	0.0202
	Sulfur (S)-Total (mg/L)	0.70	<0.50	<0.50	<0.50	0.67

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1815622-1	L1815622-2	L1815622-3	L1815622-4	L1815622-5
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	08-AUG-16	08-AUG-16	10-AUG-16	10-AUG-16	10-AUG-16
	Sampled Time	14:30	15:00	08:30	09:30	10:15
	Client ID	BAP-45	BAP-46	BBD-45	BBD-46	BPJ-45
WATER						
Total Metals	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	<0.00030	<0.00030	<0.00030	0.00032	0.00033
	Uranium (U)-Total (mg/L)	0.000043	0.000044	0.000045	0.000045	0.000048
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0047	0.0046	0.0054	0.0056	0.0052
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00011	0.00011	0.00011	0.00010	0.00011
	Barium (Ba)-Dissolved (mg/L)	0.0192	0.0192	0.0196	0.0197	0.0210
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Dissolved (mg/L)	3.01	3.09	2.69	2.95	2.76
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Dissolved (mg/L)	0.00026	0.00027	0.00025	0.00026	0.00026
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	0.012
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)-Dissolved (mg/L)	2.74	2.80	1.65	2.46	1.91
	Manganese (Mn)-Dissolved (mg/L)	0.00037	0.00046	0.00102	0.00096	0.00064
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	0.000057	0.000057	<0.000050	0.000056	<0.000050
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	0.89	0.93	0.58	0.81	0.65
	Selenium (Se)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)-Dissolved (mg/L)	0.205	0.202	0.205	0.212	0.217
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	13.0	13.4	4.95	11.3	7.07
	Strontium (Sr)-Dissolved (mg/L)	0.0263	0.0262	0.0200	0.0248	0.0217
	Sulfur (S)-Dissolved (mg/L)	1.47	1.48	0.66	1.26	0.84

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1815622-6	L1815622-7	L1815622-8	L1815622-9	L1815622-10
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	10-AUG-16	10-AUG-16	10-AUG-16		
	Sampled Time	10:45	11:20	19:30		
	Client ID	BPJ-46	AUG-EB-1	AUG DI-1	AUG TRAV-1	AUG DUP-2
Grouping	**Analyte**					
WATER						
Total Metals	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Total (mg/L)	0.000043	<0.000010	<0.000010	<0.000010	0.000045
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD		FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD		FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0054	<0.0010	<0.0010		0.0054
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00010	<0.00010	<0.00010		<0.00010
	Barium (Ba)-Dissolved (mg/L)	0.0193	0.000138 RRV	<0.000050		0.0194
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020		<0.000020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050		<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010		<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050		<0.0000050
	Calcium (Ca)-Dissolved (mg/L)	2.68	<0.050	<0.050		2.65
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		<0.00010
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		<0.00010
	Copper (Cu)-Dissolved (mg/L)	0.00028	<0.00020	<0.00020		0.00025
	Iron (Fe)-Dissolved (mg/L)	0.011	<0.010	<0.010		0.011
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050		<0.000050
	Lithium (Li)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010		<0.0010
	Magnesium (Mg)-Dissolved (mg/L)	1.69	<0.10	<0.10		1.58
	Manganese (Mn)-Dissolved (mg/L)	0.00070	0.00013 RRV	<0.00010		0.00122
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050		<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050		<0.000050
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050		<0.00050
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050		<0.050
	Potassium (K)-Dissolved (mg/L)	0.59	<0.10	<0.10		0.55
	Selenium (Se)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050		<0.000050
	Silicon (Si)-Dissolved (mg/L)	0.214	<0.050	<0.050		0.206
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010		<0.000010
	Sodium (Na)-Dissolved (mg/L)	5.33	<0.050	<0.050		4.37
	Strontium (Sr)-Dissolved (mg/L)	0.0204	<0.00020	<0.00020		0.0197
	Sulfur (S)-Dissolved (mg/L)	0.71	<0.50	<0.50		0.62

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1815622-1	L1815622-2	L1815622-3	L1815622-4	L1815622-5
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	08-AUG-16	08-AUG-16	10-AUG-16	10-AUG-16	10-AUG-16
	Sampled Time	14:30	15:00	08:30	09:30	10:15
	Client ID	BAP-45	BAP-46	BBD-45	BBD-46	BPJ-45
Grouping	**Analyte**					
WATER						
Dissolved Metals	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Dissolved (mg/L)	0.000041	0.000042	0.000041	0.000042	0.000041
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	0.0010	<0.0010
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1815622-6	L1815622-7	L1815622-8	L1815622-9	L1815622-10
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	10-AUG-16	10-AUG-16	10-AUG-16		
	Sampled Time	10:45	11:20	19:30		
	Client ID	BPJ-46	AUG-EB-1	AUG DI-1	AUG TRAV-1	AUG DUP-2
Grouping	**Analyte**					
WATER						
Dissolved Metals	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010		<0.000010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030		<0.00030
	Uranium (U)-Dissolved (mg/L)	0.000041	<0.000010	<0.000010		0.000040
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050		<0.00050
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010		<0.0010
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030		<0.00030

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1815622-1, -10, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1815622-1, -10, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1815622-1, -10, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1815622-1, -10, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1815622-1, -10, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Uranium (U)-Dissolved	MS-B	L1815622-1, -10, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Sodium (Na)-Total	MS-B	L1815622-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Strontium (Sr)-Total	MS-B	L1815622-1, -10, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1815622-1, -10, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1815622-1, -10, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1815622-1, -10, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1815622-1, -10, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1815622-1, -10, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1815622-1, -10, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Boron (B)-Dissolved	MS-B	L1815622-1, -10, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1815622-1, -10, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1815622-1, -10, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Uranium (U)-Dissolved	MS-B	L1815622-1, -10, -2, -3, -4, -5, -6, -7, -8

Qualifiers for Individual Parameters Listed:

Qualifier	Description
HTC	Hardness was calculated from Total Ca and/or Mg concentrations and may be biased high (dissolved Ca/Mg results unavailable).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BE-D-L-CCMS-VA	Water	Diss. Be (low) in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

BE-T-L-CCMS-VA	Water	Total Be (Low) in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.

CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

CN-FREE-L-CFA-VA	Water	Low Level Free Cyanide in water by CFA	ASTM 7237

This analysis is carried out using procedures adapted from ASTM Method 7237 "Free Cyanide with Flow Injection Analysis (FIA) Utilizing Gas Diffusion Separation and Amperometric Detection". Free cyanide is determined by in-line gas diffusion at pH 6 with final determination by colourimetric analysis.

CN-T-L-CFA-VA	Water	Low Level Total Cyanide in water by CFA	ISO 14403:2002

This analysis is carried out using procedures adapted from ISO Method 14403:2002 "Determination of Total Cyanide using Flow Analysis (FIA and CFA)". Total or strong acid dissociable (SAD) cyanide is determined by in-line UV digestion along with sample distillation and final determination by colourimetric analysis. Method Limitation: This method is susceptible to interference from thiocyanate (SCN). If SCN is present in the sample, there could be a positive interference with this method, but it would be less than 1% and could be as low as zero.

HARDNESS-CALC-VA	Water	Hardness	APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-D-CVAA-VA	Water	Diss. Mercury in Water by CVAAS or CVAFS	APHA 3030B/EPA 1631E (mod)

Reference Information

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

HG-T-CVAA-VA	Water	Total Mercury in Water by CVAAS or CVAFS	EPA 1631E (mod)

Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-DIS-LOW-ICP-VA	Water	Dissolved Metals in Water by ICPOES	EPA 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-TOT-LOW-ICP-VA	Water	Total Metals in Water by ICPOES	EPA 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

NH3-F-VA	Water	Ammonia in Water by Fluorescence	APHA 4500 NH3-NITROGEN (AMMONIA)

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

P-T-PRES-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

S-DIS-ICP-VA	Water	Dissolved Sulfur in Water by ICPOES	EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

S-TOT-ICP-VA	Water	Total Sulfur in Water by ICPOES	EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

TKN-F-VA	Water	TKN in Water by Fluorescence	APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

Reference Information

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

1

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

ALS Environmental

Chain of Custody (COC) / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

L1815622-COFC

COC # ____________

Page 1 of 1

Report To		Report Format / Distribution	
Company:	Azimuth Consulting Group	☑ Standard ☐ Other	
Contact:	Eric Franz	☑ PDF ☑ Excel ☐ Digital ☐ Fax	
Address:	218-2902 West Broadway	Email 1:	efranz@azimuthgroup.ca
	Vancouver, BC V6K2G8	Email 2:	gmann@azimuthgroup.ca
Phone:	604-730-1220 Fax:	Email 3:	ryan.vanengen@agnicoeagle.com
Invoice To	Same as Report ? ☑ Yes ☐ No	Client / Project Information	
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	CREMP Meadowbank Surfacewater
Company:		PO / AFE:	
Contact:		LSD:	
Address:			
Phone:	Fax:	Quote #:	Q39503
Lab Work Order # (lab use only)	L1815622	ALS Contact: Brent Mack	Sampler: Eric Franz

Service Requested (Rush for routine analysis subject to availability)

- ◉ Regular (Standard Turnaround Times - Business Days)
- ○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
- ○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
- ○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request

Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TOC, Ammonia, TKN, Total P (P)	DOC (F/P)	T-CN (Low), Free CN (Low) (P)	Total mercury (P)	Dissolved mercury (F/P)	Total Metals (P)	Dissolved Metals (F/P)	Number of Containers
1	BAP-45	08-Aug-16	14:30	Surface Water	X	X	X	X	X	X	X	7
2	BAP-46	08-Aug-16	15:00	Surface Water	X	X	X	X	X	X	X	7
3	BBD-45	10-Aug-16	8:30	Surface Water	X	X	X	X	X	X	X	7
4	BBD-46	10-Aug-16	9:30	Surface Water	X	X	X	X	X	X	X	7
5	BPJ-45	10-Aug-16	10:15	Surface Water	X	X	X	X	X	X	X	7
6	BPJ-46	10-Aug-16	10:45	Surface Water	X	X	X	X	X	X	X	7
7	AUG EB-1	10-Aug-16	11:20	Surface Water	X	X	X	X	X	X	X	7
8	AUG DI-1	10-Aug-16	19:30	Surface Water	X	X	X	X	X	X	X	7
9	AUG TRAV-1	-	-	Surface Water	X		X	X		X		4
10	AUG DUP-2	-	-	Surface Water	X	X	X	X	X	X	X	7

Short H ding Time

Rush rocessing

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by: Eric Franz	Date (dd-mmm-yy) 11-Aug-16	Time (hh-mm) 9:10	Received by: Sarah	Date: Aug18/16	Time: 11am	Temperature: 22,22,2 °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

GENF 20.00 Front

AZIMUTH CONSULTING GROUP INC.
ATTN: Eric Franz
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 18-AUG-16
Report Date: 29-AUG-16 11:32 (MT)
Version: FINAL

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1815642

Project P.O. #:	NOT SUBMITTED
Job Reference:	CREMP MEADOWBANK SEDIMENT
C of C Numbers:	1, 2, 3, 4, 5, 6
Legal Site Desc:	

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1815642-1	L1815642-2	L1815642-3	L1815642-4	L1815642-5
		Description	Sediment	Sediment	Sediment	Sediment	Sediment
		Sampled Date	03-AUG-16	03-AUG-16	03-AUG-16	03-AUG-16	03-AUG-16
		Sampled Time					
		Client ID	SP-1	SP-2	SP-3	SP-4	SP-5
Grouping	**Analyte**						
SOIL							
Physical Tests	Moisture (%)		84.3	84.4	85.0	84.4	85.6
	pH (1:2 soil:water) (pH)		6.05	6.29	6.22	6.08	5.97
Particle Size	% Gravel (>2mm) (%)		<0.10	<0.10	<0.10	<0.10	<0.10
	% Sand (2.0mm - 0.063mm) (%)		1.87	1.57	1.23	1.22	0.97
	% Silt (0.063mm - 4um) (%)		73.0	72.5	71.2	69.2	75.7
	% Clay (<4um) (%)		25.1	25.9	27.6	29.6	23.3
	Texture		Silt loam	Silt loam	Silt loam	Silt loam	Silt loam
Organic / Inorganic Carbon	Total Organic Carbon (%)		3.85	3.91	3.67	3.87	4.22
Metals	Aluminum (Al) (mg/kg)		22400	26000	27500	27700	23400
	Antimony (Sb) (mg/kg)		0.26	0.28	0.26	0.29	0.27
	Arsenic (As) (mg/kg)		39.8	29.1	26.7	40.8	65.8
	Barium (Ba) (mg/kg)		116	127	127	133	121
	Beryllium (Be) (mg/kg)		1.75	2.00	2.17	2.46	2.09
	Bismuth (Bi) (mg/kg)		2.03	2.32	2.46	2.64	2.27
	Boron (B) (mg/kg)		7.2	8.1	7.7	8.1	6.4
	Cadmium (Cd) (mg/kg)		0.236	0.234	0.253	0.292	0.291
	Calcium (Ca) (mg/kg)		2400	2540	2300	2470	2290
	Chromium (Cr) (mg/kg)		85.6	90.7	90.0	89.0	78.2
	Cobalt (Co) (mg/kg)		15.5	15.4	16.6	18.9	14.6
	Copper (Cu) (mg/kg)		61.7	70.3	78.6	87.4	76.1
	Iron (Fe) (mg/kg)		85800	65800	64900	73900	85100
	Lead (Pb) (mg/kg)		20.4	22.7	23.0	24.8	21.7
	Lithium (Li) (mg/kg)		39.3	45.8	47.2	49.4	42.1
	Magnesium (Mg) (mg/kg)		8820	10000	10000	9990	8680
	Manganese (Mn) (mg/kg)		3610	3140	1680	1490	1360
	Mercury (Hg) (mg/kg)		0.0341	0.0346	0.0280	0.0282	0.0289
	Molybdenum (Mo) (mg/kg)		7.22	6.23	7.21	8.48	11.1
	Nickel (Ni) (mg/kg)		64.4	69.3	69.4	72.4	59.4
	Phosphorus (P) (mg/kg)		570	561	534	660	639
	Potassium (K) (mg/kg)		3780	4400	4600	4800	4060
	Selenium (Se) (mg/kg)		0.69	0.61	0.53	0.65	0.78
	Silver (Ag) (mg/kg)		0.20	0.19	0.11	0.12	0.19
	Sodium (Na) (mg/kg)		175	196	179	213	183
	Strontium (Sr) (mg/kg)		19.4	21.1	19.9	21.2	19.3
	Thallium (Tl) (mg/kg)		0.325	0.375	0.389	0.418	0.364
	Tin (Sn) (mg/kg)		<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)		656	733	751	753	595

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1815642-6	L1815642-7	L1815642-8	L1815642-9	L1815642-10
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	03-AUG-16	04-AUG-16	04-AUG-16	04-AUG-16	04-AUG-16
	Sampled Time					
	Client ID	SP-COMP	TPE-1	TPE-2	TPE-3	TPE-4
SOIL						
Physical Tests	Moisture (%)	85.3	82.9	78.2	88.2	84.7
	pH (1:2 soil:water) (pH)		5.98	6.22	6.23	6.40
Particle Size	% Gravel (>2mm) (%)		<0.10	<0.10	<0.10	<0.10
	% Sand (2.0mm - 0.063mm) (%)		5.78	16.5	1.59	1.59
	% Silt (0.063mm - 4um) (%)		65.4	54.2	68.6	67.5
	% Clay (<4um) (%)		28.9	29.3	29.8	30.9
	Texture		Silt loam	Silt loam	Silt loam	Silt loam
Organic / Inorganic Carbon	Total Organic Carbon (%)		3.25	1.77	3.80	3.39
Metals	Aluminum (Al) (mg/kg)		25600	24400	23600	23000
	Antimony (Sb) (mg/kg)		0.22	0.16	0.27	0.23
	Arsenic (As) (mg/kg)		20.0	17.5	20.2	16.6
	Barium (Ba) (mg/kg)		111	113	114	119
	Beryllium (Be) (mg/kg)		1.86	1.72	1.78	1.76
	Bismuth (Bi) (mg/kg)		2.61	2.29	2.37	2.36
	Boron (B) (mg/kg)		7.3	5.5	7.4	7.5
	Cadmium (Cd) (mg/kg)		0.123	0.130	0.274	0.305
	Calcium (Ca) (mg/kg)		2080	1680	2390	2120
	Chromium (Cr) (mg/kg)		127	101	135	113
	Cobalt (Co) (mg/kg)		16.1	14.5	16.3	15.4
	Copper (Cu) (mg/kg)		59.1	52.0	53.7	51.3
	Iron (Fe) (mg/kg)		47400	45200	47000	40100
	Lead (Pb) (mg/kg)		22.6	20.4	21.6	21.4
	Lithium (Li) (mg/kg)		54.0	57.4	46.9	46.8
	Magnesium (Mg) (mg/kg)		10700	10200	10300	9420
	Manganese (Mn) (mg/kg)		1250	1120	1770	2220
	Mercury (Hg) (mg/kg)		0.0235	0.0151	0.0266	0.0234
	Molybdenum (Mo) (mg/kg)		4.53	4.52	4.93	4.53
	Nickel (Ni) (mg/kg)		67.3	61.8	86.3	86.9
	Phosphorus (P) (mg/kg)		458	318	453	420
	Potassium (K) (mg/kg)		4620	4560	4220	4230
	Selenium (Se) (mg/kg)		0.47	0.33	0.81	0.74
	Silver (Ag) (mg/kg)		<0.10	<0.10	0.11	<0.10
	Sodium (Na) (mg/kg)		174	164	200	187
	Strontium (Sr) (mg/kg)		17.3	15.6	18.9	18.0
	Thallium (Tl) (mg/kg)		0.385	0.388	0.405	0.442
	Tin (Sn) (mg/kg)		<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)		880	954	782	804

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1815642-11	L1815642-12	L1815642-13	L1815642-14	L1815642-15
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	04-AUG-16	04-AUG-16	04-AUG-16	04-AUG-16	04-AUG-16
	Sampled Time					
	Client ID	TPE-5	TPE-COMP	TPN-1	TPN-2	TPN-3
SOIL						
Physical Tests	Moisture (%)	86.4	85.7	49.0	39.6	82.9
	pH (1:2 soil:water) (pH)	6.30		6.33	6.07	6.00
Particle Size	% Gravel (>2mm) (%)	<0.10		<0.10	3.98	<0.10
	% Sand (2.0mm - 0.063mm) (%)	2.13		52.7	49.9	23.6
	% Silt (0.063mm - 4um) (%)	69.6		31.4	24.8	59.5
	% Clay (<4um) (%)	28.3		15.9	21.4	17.0
	Texture	Silt loam		Sandy loam	Sandy loam	Silt loam
Organic / Inorganic Carbon	Total Organic Carbon (%)	3.69		0.589	0.398	3.45
Metals	Aluminum (Al) (mg/kg)	23100		12600	13100	15700
	Antimony (Sb) (mg/kg)	0.24		<0.10	<0.10	0.20
	Arsenic (As) (mg/kg)	20.8		6.36	5.49	14.9
	Barium (Ba) (mg/kg)	108		50.2	62.0	65.6
	Beryllium (Be) (mg/kg)	1.69		0.57	0.62	1.04
	Bismuth (Bi) (mg/kg)	2.26		0.55	0.58	1.05
	Boron (B) (mg/kg)	7.6		<5.0	<5.0	5.9
	Cadmium (Cd) (mg/kg)	0.182		0.068	0.049	0.128
	Calcium (Ca) (mg/kg)	2230		1200	1120	1690
	Chromium (Cr) (mg/kg)	130		67.8	60.0	113
	Cobalt (Co) (mg/kg)	16.2		8.88	8.00	10.2
	Copper (Cu) (mg/kg)	49.5		16.7	16.9	47.2
	Iron (Fe) (mg/kg)	50400		21500	22100	30800
	Lead (Pb) (mg/kg)	20.3		7.41	8.32	14.9
	Lithium (Li) (mg/kg)	44.5		28.2	33.3	27.0
	Magnesium (Mg) (mg/kg)	9980		6990	6570	7800
	Manganese (Mn) (mg/kg)	1840		324	390	362
	Mercury (Hg) (mg/kg)	0.0257		0.0058	0.0060	0.0202
	Molybdenum (Mo) (mg/kg)	4.30		1.78	1.71	2.87
	Nickel (Ni) (mg/kg)	68.6		49.3	50.0	57.1
	Phosphorus (P) (mg/kg)	421		194	142	621
	Potassium (K) (mg/kg)	4220		2040	2650	2430
	Selenium (Se) (mg/kg)	0.87		<0.20	<0.20	0.50
	Silver (Ag) (mg/kg)	0.18		<0.10	<0.10	0.14
	Sodium (Na) (mg/kg)	185		86	176	131
	Strontium (Sr) (mg/kg)	18.3		11.0	12.6	14.6
	Thallium (Tl) (mg/kg)	0.364		0.157	0.189	0.182
	Tin (Sn) (mg/kg)	3.3		<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	794		617	677	430

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1815642-16 Sediment 04-AUG-16 TPN-4	L1815642-17 Sediment 04-AUG-16 TPN-5	L1815642-18 Sediment 04-AUG-16 TPN-COMP	L1815642-19 Sediment 05-AUG-16 WAL-1	L1815642-20 Sediment 05-AUG-16 WAL-2
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	60.6	44.5	56.9	92.3	92.2
	pH (1:2 soil:water) (pH)	6.00	5.99		6.68	6.43
Particle Size	% Gravel (>2mm) (%)	<0.10	<0.10		<0.10	<0.10
	% Sand (2.0mm - 0.063mm) (%)	63.1	34.5		4.14	2.14
	% Silt (0.063mm - 4um) (%)	29.0	41.9		79.3	86.1
	% Clay (<4um) (%)	7.90	23.6		16.6	11.8
	Texture	Sandy loam	Loam		Silt loam	Silt
Organic / Inorganic Carbon	Total Organic Carbon (%)	1.03	0.648		9.04	12.4
Metals	Aluminum (Al) (mg/kg)	10400	15500		19500	14100
	Antimony (Sb) (mg/kg)	0.10	0.11		0.48	0.37
	Arsenic (As) (mg/kg)	10.0	16.4		28.2	29.8
	Barium (Ba) (mg/kg)	41.7	70.4		117	86.3
	Beryllium (Be) (mg/kg)	0.62	0.86		1.56	1.21
	Bismuth (Bi) (mg/kg)	0.64	0.82		1.91	1.42
	Boron (B) (mg/kg)	<5.0	<5.0		12.0	13.5
	Cadmium (Cd) (mg/kg)	0.057	0.060		0.550	0.416
	Calcium (Ca) (mg/kg)	1010	1150		4650	4450
	Chromium (Cr) (mg/kg)	76.3	78.9		57.4	44.3
	Cobalt (Co) (mg/kg)	7.72	10.5		9.23	8.08
	Copper (Cu) (mg/kg)	27.1	28.8		149	109
	Iron (Fe) (mg/kg)	21600	31700		29200	24900
	Lead (Pb) (mg/kg)	8.69	11.7		34.2	28.2
	Lithium (Li) (mg/kg)	19.5	36.3		35.6	27.3
	Magnesium (Mg) (mg/kg)	5630	7750		7780	5910
	Manganese (Mn) (mg/kg)	325	468		308	297
	Mercury (Hg) (mg/kg)	0.0097	0.0081		0.0778	0.0933
	Molybdenum (Mo) (mg/kg)	1.56	3.93		7.80	6.95
	Nickel (Ni) (mg/kg)	37.2	51.5		55.7	45.9
	Phosphorus (P) (mg/kg)	331	278		706	898
	Potassium (K) (mg/kg)	1520	2840		3310	2780
	Selenium (Se) (mg/kg)	<0.20	<0.20		0.79	0.77
	Silver (Ag) (mg/kg)	<0.10	<0.10		0.70	0.53
	Sodium (Na) (mg/kg)	79	149		200	177
	Strontium (Sr) (mg/kg)	9.49	11.4		29.3	28.0
	Thallium (Tl) (mg/kg)	0.120	0.213		0.311	0.250
	Tin (Sn) (mg/kg)	<2.0	<2.0		<2.0	<2.0
	Titanium (Ti) (mg/kg)	341	699		534	410

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1815642-21	L1815642-22	L1815642-23	L1815642-24	L1815642-25
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	05-AUG-16	05-AUG-16	05-AUG-16	05-AUG-16	07-AUG-16
	Sampled Time					
	Client ID	WAL-3	WAL-4	WAL-5	WAL-COMP	INUG-1
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	91.4	88.0	87.2	90.0	82.5
	pH (1:2 soil:water) (pH)	6.64	6.57	6.61		5.64
Particle Size	% Gravel (>2mm) (%)	<0.10	<0.10	<0.10		<0.10
	% Sand (2.0mm - 0.063mm) (%)	2.65	5.02	7.04		1.59
	% Silt (0.063mm - 4um) (%)	87.1	82.9	79.9		75.5
	% Clay (<4um) (%)	10.2	12.1	13.1		23.0
	Texture	Silt	Silt	Silt		Silt loam
Organic / Inorganic Carbon	Total Organic Carbon (%)	9.01	6.63	6.10		3.42
Metals	Aluminum (Al) (mg/kg)	19100	21000	18300		22800
	Antimony (Sb) (mg/kg)	0.45	0.46	0.35		0.16
	Arsenic (As) (mg/kg)	46.9	19.6	21.2		81.1
	Barium (Ba) (mg/kg)	119	132	106		115
	Beryllium (Be) (mg/kg)	1.62	1.75	1.52		1.43
	Bismuth (Bi) (mg/kg)	2.06	2.25	1.94		1.27
	Boron (B) (mg/kg)	12.7	8.5	8.2		7.2
	Cadmium (Cd) (mg/kg)	0.505	0.758	0.403		0.148
	Calcium (Ca) (mg/kg)	4890	3980	4060		1910
	Chromium (Cr) (mg/kg)	58.2	62.4	56.2		111
	Cobalt (Co) (mg/kg)	9.48	9.12	8.23		11.9
	Copper (Cu) (mg/kg)	155	161	120		47.2
	Iron (Fe) (mg/kg)	39600	29300	28600		71500
	Lead (Pb) (mg/kg)	34.9	37.6	30.4		14.0
	Lithium (Li) (mg/kg)	34.6	43.3	39.4		28.7
	Magnesium (Mg) (mg/kg)	7240	8170	7490		9900
	Manganese (Mn) (mg/kg)	343	300	311		857
	Mercury (Hg) (mg/kg)	0.0835	0.0465	0.0446		0.0237
	Molybdenum (Mo) (mg/kg)	11.0	6.27	5.85		4.94
	Nickel (Ni) (mg/kg)	53.8	59.3	48.8		71.5
	Phosphorus (P) (mg/kg)	792	569	622		2220
	Potassium (K) (mg/kg)	3480	3790	3310		3480
	Selenium (Se) (mg/kg)	1.01	0.83	0.66		0.56
	Silver (Ag) (mg/kg)	0.73	0.56	0.42		0.17
	Sodium (Na) (mg/kg)	204	176	178		163
	Strontium (Sr) (mg/kg)	30.2	27.6	27.5		23.6
	Thallium (Tl) (mg/kg)	0.327	0.332	0.295		0.208
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0		<2.0
	Titanium (Ti) (mg/kg)	526	646	626		561

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1815642-26	L1815642-27	L1815642-28	L1815642-29	L1815642-30
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	07-AUG-16	07-AUG-16	07-AUG-16	07-AUG-16	07-AUG-16
	Sampled Time					
	Client ID	INUG-2	INUG-3	INUG-4	INUG-5	INUG-COMP
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	83.9	83.0	84.2	82.4	84.6
	pH (1:2 soil:water) (pH)	5.35	5.51	5.48	5.21	
Particle Size	% Gravel (>2mm) (%)	<0.10	<0.10	<0.10	<0.10	
	% Sand (2.0mm - 0.063mm) (%)	2.59	2.34	1.12	1.12	
	% Silt (0.063mm - 4um) (%)	78.4	76.4	75.4	75.9	
	% Clay (<4um) (%)	19.0	21.3	23.5	23.0	
	Texture	Silt loam	Silt loam	Silt loam	Silt loam	
Organic / Inorganic Carbon	Total Organic Carbon (%)	4.02	3.27	4.21	3.66	
Metals	Aluminum (Al) (mg/kg)	21000	21900	21900	24800	
	Antimony (Sb) (mg/kg)	0.18	0.17	0.19	0.20	
	Arsenic (As) (mg/kg)	83.9	21.3	11.3	69.1	
	Barium (Ba) (mg/kg)	120	110	126	147	
	Beryllium (Be) (mg/kg)	1.40	1.46	1.44	1.64	
	Bismuth (Bi) (mg/kg)	1.26	1.29	1.22	1.33	
	Boron (B) (mg/kg)	7.1	6.4	7.4	9.9	
	Cadmium (Cd) (mg/kg)	0.250	0.175	0.298	0.272	
	Calcium (Ca) (mg/kg)	1770	1650	1850	2270	
	Chromium (Cr) (mg/kg)	105	108	107	120	
	Cobalt (Co) (mg/kg)	13.4	12.4	11.4	12.7	
	Copper (Cu) (mg/kg)	46.2	47.7	46.5	51.9	
	Iron (Fe) (mg/kg)	78600	45800	34400	66800	
	Lead (Pb) (mg/kg)	14.8	14.3	14.1	14.8	
	Lithium (Li) (mg/kg)	26.7	29.5	29.6	30.6	
	Magnesium (Mg) (mg/kg)	9100	9630	9670	10300	
	Manganese (Mn) (mg/kg)	1000	911	489	685	
	Mercury (Hg) (mg/kg)	0.0300	0.0232	0.0287	0.0267	
	Molybdenum (Mo) (mg/kg)	5.89	2.99	3.41	6.59	
	Nickel (Ni) (mg/kg)	82.7	76.7	88.4	87.8	
	Phosphorus (P) (mg/kg)	2040	1380	915	1880	
	Potassium (K) (mg/kg)	3150	3240	3290	4150	
	Selenium (Se) (mg/kg)	0.56	0.57	0.53	0.70	
	Silver (Ag) (mg/kg)	0.19	0.17	0.23	0.22	
	Sodium (Na) (mg/kg)	145	179	166	245	
	Strontium (Sr) (mg/kg)	21.3	21.6	21.5	29.6	
	Thallium (Tl) (mg/kg)	0.226	0.218	0.238	0.258	
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	
	Titanium (Ti) (mg/kg)	499	558	521	681	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1815642-31 Sediment 06-AUG-16 PDL-1	L1815642-32 Sediment 06-AUG-16 PDL-2	L1815642-33 Sediment 06-AUG-16 PDL-3	L1815642-34 Sediment 06-AUG-16 PDL-4	L1815642-35 Sediment 06-AUG-16 PDL-5
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	76.7	80.0	78.8	76.7	78.8
	pH (1:2 soil:water) (pH)	5.85	5.77	5.79	5.68	5.69
Particle Size	% Gravel (>2mm) (%)	<0.10	<0.10	<0.10	<0.10	<0.10
	% Sand (2.0mm - 0.063mm) (%)	12.5	7.61	7.08	7.71	6.60
	% Silt (0.063mm - 4um) (%)	70.4	77.1	77.2	77.5	77.8
	% Clay (<4um) (%)	17.1	15.3	15.7	14.8	15.6
	Texture	Silt loam	Silt	Silt	Silt	Silt
Organic / Inorganic Carbon	Total Organic Carbon (%)	1.91	2.67	2.13	2.35	2.08
Metals	Aluminum (Al) (mg/kg)	19600	18200	20300	19200	21100
	Antimony (Sb) (mg/kg)	0.20	0.26	0.21	0.19	0.20
	Arsenic (As) (mg/kg)	13.2	56.3	13.1	9.53	22.8
	Barium (Ba) (mg/kg)	88.5	82.6	86.8	92.1	95.1
	Beryllium (Be) (mg/kg)	0.96	0.94	1.01	0.92	1.09
	Bismuth (Bi) (mg/kg)	0.84	0.84	0.90	0.82	0.93
	Boron (B) (mg/kg)	7.2	6.5	7.0	6.0	7.2
	Cadmium (Cd) (mg/kg)	0.100	0.149	0.090	0.126	0.115
	Calcium (Ca) (mg/kg)	2260	2170	2320	2170	2090
	Chromium (Cr) (mg/kg)	129	121	137	128	139
	Cobalt (Co) (mg/kg)	11.7	12.7	11.8	10.9	13.7
	Copper (Cu) (mg/kg)	41.8	42.2	43.8	41.1	45.5
	Iron (Fe) (mg/kg)	29400	45800	32200	26900	36600
	Lead (Pb) (mg/kg)	13.4	14.2	14.4	14.1	14.6
	Lithium (Li) (mg/kg)	28.2	25.1	29.0	27.8	29.4
	Magnesium (Mg) (mg/kg)	10100	9620	10900	10500	10700
	Manganese (Mn) (mg/kg)	298	526	347	304	367
	Mercury (Hg) (mg/kg)	0.0101	0.0149	0.0110	0.0117	0.0098
	Molybdenum (Mo) (mg/kg)	2.33	4.04	1.49	1.31	2.93
	Nickel (Ni) (mg/kg)	76.1	74.2	77.0	77.4	82.9
	Phosphorus (P) (mg/kg)	444	790	653	502	552
	Potassium (K) (mg/kg)	2900	2620	2940	2730	2960
	Selenium (Se) (mg/kg)	0.24	0.47	0.36	0.31	0.30
	Silver (Ag) (mg/kg)	<0.10	0.15	0.15	0.21	<0.10
	Sodium (Na) (mg/kg)	138	139	144	128	154
	Strontium (Sr) (mg/kg)	25.1	22.3	25.6	22.2	23.6
	Thallium (Tl) (mg/kg)	0.187	0.176	0.192	0.181	0.189
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	588	497	613	544	572

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1815642-36	L1815642-37	L1815642-38	L1815642-39	L1815642-40
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	06-AUG-16	08-AUG-16	08-AUG-16	08-AUG-16	08-AUG-16
	Sampled Time					
	Client ID	PDL-COMP	BAP-1	BAP-2	BAP-3	BAP-4
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	75.7	22.9	29.5	33.4	24.6
	pH (1:2 soil:water) (pH)		6.82	6.38	5.97	6.72
Particle Size	% Gravel (>2mm) (%)		<0.10	<0.10	<0.10	<0.10
	% Sand (2.0mm - 0.063mm) (%)		82.0	80.6	72.0	87.3
	% Silt (0.063mm - 4um) (%)		16.6	17.3	24.9	11.7
	% Clay (<4um) (%)		1.40	2.13	3.16	0.95
	Texture		Sand	Sand	Loamy sand	Sand
Organic / Inorganic Carbon	Total Organic Carbon (%)		0.179	0.223	0.364	0.113
Metals	Aluminum (Al) (mg/kg)		3890	4480	6100	3600
	Antimony (Sb) (mg/kg)		0.12	0.14	0.15	0.14
	Arsenic (As) (mg/kg)		4.18	2.96	4.01	2.16
	Barium (Ba) (mg/kg)		367	476	426	269
	Beryllium (Be) (mg/kg)		0.26	0.30	0.36	0.26
	Bismuth (Bi) (mg/kg)		<0.20	<0.20	<0.20	<0.20
	Boron (B) (mg/kg)		5.2	5.9	7.1	5.3
	Cadmium (Cd) (mg/kg)		<0.020	0.023	0.034	<0.020
	Calcium (Ca) (mg/kg)		1960	2350	2320	1410
	Chromium (Cr) (mg/kg)		13.3	14.9	21.6	12.9
	Cobalt (Co) (mg/kg)		3.13	3.33	4.26	2.97
	Copper (Cu) (mg/kg)		2.98	3.56	6.84	3.24
	Iron (Fe) (mg/kg)		11700	13100	15300	10400
	Lead (Pb) (mg/kg)		3.55	4.22	5.30	3.05
	Lithium (Li) (mg/kg)		5.9	6.4	8.8	5.8
	Magnesium (Mg) (mg/kg)		2350	2490	3300	2280
	Manganese (Mn) (mg/kg)		142	106	145	93.0
	Mercury (Hg) (mg/kg)		<0.0050	<0.0050	0.0055	<0.0050
	Molybdenum (Mo) (mg/kg)		0.39	0.35	0.46	0.29
	Nickel (Ni) (mg/kg)		7.60	7.96	12.0	7.53
	Phosphorus (P) (mg/kg)		615	725	686	442
	Potassium (K) (mg/kg)		1030	1150	1530	970
	Selenium (Se) (mg/kg)		<0.20	<0.20	<0.20	<0.20
	Silver (Ag) (mg/kg)		<0.10	<0.10	<0.10	<0.10
	Sodium (Na) (mg/kg)		67	86	139	59
	Strontium (Sr) (mg/kg)		43.3	47.1	48.1	39.5
	Thallium (Tl) (mg/kg)		<0.050	<0.050	0.069	<0.050
	Tin (Sn) (mg/kg)		<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)		267	320	369	200

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1815642-41	L1815642-42	L1815642-43	L1815642-44	L1815642-45
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	08-AUG-16	08-AUG-16	08-AUG-16	08-AUG-16	08-AUG-16
	Sampled Time					
	Client ID	BAP-5	BAP-COMP	BES-1	BES-2	BES-3
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	24.1	25.4	40.2	43.2	44.1
	pH (1:2 soil:water) (pH)	6.58		7.10	6.69	6.71
Particle Size	% Gravel (>2mm) (%)	<0.10		<0.10	<0.10	<0.10
	% Sand (2.0mm - 0.063mm) (%)	91.6		62.8	45.6	57.5
	% Silt (0.063mm - 4um) (%)	8.10		32.3	48.0	37.0
	% Clay (<4um) (%)	0.31		4.84	6.36	5.46
	Texture	Sand		Sandy loam	Sandy loam	Sandy loam
Organic / Inorganic Carbon	Total Organic Carbon (%)	0.093		0.476	0.545	0.475
Metals	Aluminum (Al) (mg/kg)	3170		6420	7580	7200
	Antimony (Sb) (mg/kg)	0.14		0.14	0.14	0.15
	Arsenic (As) (mg/kg)	1.89		3.89	4.88	6.78
	Barium (Ba) (mg/kg)	341		146	108	135
	Beryllium (Be) (mg/kg)	0.24		0.36	0.40	0.38
	Bismuth (Bi) (mg/kg)	<0.20		<0.20	<0.20	<0.20
	Boron (B) (mg/kg)	<5.0		6.3	7.1	7.5
	Cadmium (Cd) (mg/kg)	<0.020		0.041	0.048	0.040
	Calcium (Ca) (mg/kg)	1820		2220	2380	2380
	Chromium (Cr) (mg/kg)	12.0		18.8	21.8	20.7
	Cobalt (Co) (mg/kg)	2.74		5.08	5.86	5.41
	Copper (Cu) (mg/kg)	2.36		5.18	6.84	5.87
	Iron (Fe) (mg/kg)	11700		13800	15900	15800
	Lead (Pb) (mg/kg)	3.10		5.57	7.13	6.25
	Lithium (Li) (mg/kg)	5.2		9.4	10.5	9.9
	Magnesium (Mg) (mg/kg)	2070		3900	4480	4130
	Manganese (Mn) (mg/kg)	87.2		575	1160	984
	Mercury (Hg) (mg/kg)	<0.0050		0.0081	0.0117	0.0095
	Molybdenum (Mo) (mg/kg)	0.26		0.57	0.78	0.91
	Nickel (Ni) (mg/kg)	6.70		11.5	12.9	12.3
	Phosphorus (P) (mg/kg)	609		695	761	792
	Potassium (K) (mg/kg)	820		1380	1620	1630
	Selenium (Se) (mg/kg)	<0.20		<0.20	<0.20	<0.20
	Silver (Ag) (mg/kg)	<0.10		<0.10	<0.10	<0.10
	Sodium (Na) (mg/kg)	55		165	209	187
	Strontium (Sr) (mg/kg)	38.7		39.8	56.9	44.6
	Thallium (Tl) (mg/kg)	<0.050		0.067	0.075	0.070
	Tin (Sn) (mg/kg)	<2.0		<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	222		334	346	377

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID / Description / Sampled Date / Sampled Time / Client ID	L1815642-46 Sediment 08-AUG-16 BES-4	L1815642-47 Sediment 08-AUG-16 BES-5	L1815642-48 Sediment 08-AUG-16 BES-COMP	L1815642-49 Sediment 09-AUG-16 BPJ-1	L1815642-50 Sediment 09-AUG-16 BPJ-2
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	35.9	31.5	37.9	49.9	48.0
	pH (1:2 soil:water) (pH)	7.59	7.49		6.80	6.77
Particle Size	% Gravel (>2mm) (%)	<0.10	1.06		<0.10	<0.10
	% Sand (2.0mm - 0.063mm) (%)	77.8	78.5		16.4	21.5
	% Silt (0.063mm - 4um) (%)	19.7	18.2		70.7	66.7
	% Clay (<4um) (%)	2.53	2.29		12.9	11.8
	Texture	Loamy sand	Loamy sand		Silt loam	Silt loam
Organic / Inorganic Carbon	Total Organic Carbon (%)	0.293	0.291		0.675	0.639
Metals	Aluminum (Al) (mg/kg)	5270	5170		9930	9440
	Antimony (Sb) (mg/kg)	0.12	0.13		0.14	0.13
	Arsenic (As) (mg/kg)	2.87	2.79		25.1	22.8
	Barium (Ba) (mg/kg)	146	140		126	118
	Beryllium (Be) (mg/kg)	0.29	0.28		0.44	0.43
	Bismuth (Bi) (mg/kg)	<0.20	<0.20		0.23	0.22
	Boron (B) (mg/kg)	5.6	5.5		8.8	8.3
	Cadmium (Cd) (mg/kg)	0.029	0.029		0.090	0.084
	Calcium (Ca) (mg/kg)	2040	2090		2870	2820
	Chromium (Cr) (mg/kg)	16.3	16.4		22.0	21.2
	Cobalt (Co) (mg/kg)	4.01	4.00		7.48	7.21
	Copper (Cu) (mg/kg)	3.72	3.65		9.61	9.22
	Iron (Fe) (mg/kg)	11700	12100		23400	23100
	Lead (Pb) (mg/kg)	4.00	3.96		10.1	9.79
	Lithium (Li) (mg/kg)	7.8	7.6		12.1	11.5
	Magnesium (Mg) (mg/kg)	3280	3260		5080	4860
	Manganese (Mn) (mg/kg)	437	316		1340	1480
	Mercury (Hg) (mg/kg)	0.0052	<0.0050		0.0124	0.0121
	Molybdenum (Mo) (mg/kg)	0.41	0.85		1.44	1.60
	Nickel (Ni) (mg/kg)	9.92	9.87		13.8	13.5
	Phosphorus (P) (mg/kg)	620	623		1210	1120
	Potassium (K) (mg/kg)	1180	1150		2020	1850
	Selenium (Se) (mg/kg)	<0.20	<0.20		<0.20	<0.20
	Silver (Ag) (mg/kg)	<0.10	<0.10		<0.10	<0.10
	Sodium (Na) (mg/kg)	101	81		258	231
	Strontium (Sr) (mg/kg)	36.9	37.3		56.5	55.2
	Thallium (Tl) (mg/kg)	<0.050	<0.050		0.084	0.077
	Tin (Sn) (mg/kg)	<2.0	<2.0		<2.0	<2.0
	Titanium (Ti) (mg/kg)	325	338		456	446

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1815642-51 Sediment 09-AUG-16 BPJ-3	L1815642-52 Sediment 09-AUG-16 BPJ-4	L1815642-53 Sediment 09-AUG-16 BPJ-5	L1815642-54 Sediment 09-AUG-16 BPJ-COMP	L1815642-55 Sediment 09-AUG-16 BBD-1
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	50.6	42.3	36.9	44.2	39.2
	pH (1:2 soil:water) (pH)	6.63	6.41	7.20		6.36
Particle Size	% Gravel (>2mm) (%)	<0.10	<0.10	<0.10		<0.10
	% Sand (2.0mm - 0.063mm) (%)	22.8	17.9	71.7		40.6
	% Silt (0.063mm - 4um) (%)	63.8	67.6	23.1		50.9
	% Clay (<4um) (%)	13.4	14.5	5.15		8.44
	Texture	Silt loam	Silt loam	Sandy loam		Sandy loam
Organic / Inorganic Carbon	Total Organic Carbon (%)	0.664	0.475	0.320		0.561
Metals	Aluminum (Al) (mg/kg)	9910	7380	9670		4910
	Antimony (Sb) (mg/kg)	0.14	0.16	0.13		<0.10
	Arsenic (As) (mg/kg)	37.5	5.49	10.4		8.65
	Barium (Ba) (mg/kg)	134	114	87.7		80.5
	Beryllium (Be) (mg/kg)	0.46	0.36	0.45		0.25
	Bismuth (Bi) (mg/kg)	0.24	<0.20	0.24		<0.20
	Boron (B) (mg/kg)	7.7	6.8	8.0		<5.0
	Cadmium (Cd) (mg/kg)	0.084	0.057	0.058		0.048
	Calcium (Ca) (mg/kg)	2690	2400	2630		1570
	Chromium (Cr) (mg/kg)	22.5	17.5	21.7		11.5
	Cobalt (Co) (mg/kg)	8.26	5.77	6.89		4.31
	Copper (Cu) (mg/kg)	11.0	7.99	9.58		4.25
	Iron (Fe) (mg/kg)	27700	14600	18200		13300
	Lead (Pb) (mg/kg)	10.7	7.75	10.0		5.25
	Lithium (Li) (mg/kg)	13.0	10.9	13.0		7.1
	Magnesium (Mg) (mg/kg)	5420	4340	5330		2950
	Manganese (Mn) (mg/kg)	1640	287	548		1930
	Mercury (Hg) (mg/kg)	0.0102	0.0087	0.0055		0.0066
	Molybdenum (Mo) (mg/kg)	2.08	0.97	1.10		1.38
	Nickel (Ni) (mg/kg)	14.9	11.4	13.7		7.75
	Phosphorus (P) (mg/kg)	1550	860	938		528
	Potassium (K) (mg/kg)	1800	1480	1820		930
	Selenium (Se) (mg/kg)	<0.20	<0.20	<0.20		<0.20
	Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10		<0.10
	Sodium (Na) (mg/kg)	209	134	199		109
	Strontium (Sr) (mg/kg)	49.8	38.4	48.5		35.8
	Thallium (Tl) (mg/kg)	0.083	0.076	0.080		0.053
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0		<2.0
	Titanium (Ti) (mg/kg)	385	343	411		268

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1815642-56	L1815642-57	L1815642-58	L1815642-59	L1815642-60
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	09-AUG-16	09-AUG-16	09-AUG-16	09-AUG-16	09-AUG-16
	Sampled Time					
	Client ID	BBD-2	BBD-3	BBD-4	BBD-5	BBD-COMP
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	17.6	18.4	19.2	37.7	25.3
	pH (1:2 soil:water) (pH)	6.67	6.76	6.52	6.42	
Particle Size	% Gravel (>2mm) (%)	0.53	<0.10	0.43	<0.10	
	% Sand (2.0mm - 0.063mm) (%)	85.0	96.2	88.8	62.1	
	% Silt (0.063mm - 4um) (%)	13.1	3.52	9.35	32.1	
	% Clay (<4um) (%)	1.42	0.30	1.42	5.80	
	Texture	Sand	Sand	Sand	Sandy loam	
Organic / Inorganic Carbon	Total Organic Carbon (%)	0.170	0.214	0.117	0.474	
Metals	Aluminum (Al) (mg/kg)	4280	3350	3700	6250	
	Antimony (Sb) (mg/kg)	<0.10	<0.10	<0.10	0.14	
	Arsenic (As) (mg/kg)	3.12	2.47	2.95	6.69	
	Barium (Ba) (mg/kg)	44.2	27.6	33.9	90.3	
	Beryllium (Be) (mg/kg)	0.19	0.14	0.17	0.31	
	Bismuth (Bi) (mg/kg)	<0.20	<0.20	<0.20	<0.20	
	Boron (B) (mg/kg)	<5.0	<5.0	<5.0	5.6	
	Cadmium (Cd) (mg/kg)	0.022	<0.020	<0.020	0.043	
	Calcium (Ca) (mg/kg)	1290	889	1040	1910	
	Chromium (Cr) (mg/kg)	9.43	7.00	7.66	13.7	
	Cobalt (Co) (mg/kg)	3.28	2.71	2.98	5.18	
	Copper (Cu) (mg/kg)	3.65	2.37	3.93	6.56	
	Iron (Fe) (mg/kg)	9040	7260	8520	13500	
	Lead (Pb) (mg/kg)	3.55	2.27	3.09	6.13	
	Lithium (Li) (mg/kg)	7.2	6.0	6.5	9.6	
	Magnesium (Mg) (mg/kg)	3000	2550	2510	3740	
	Manganese (Mn) (mg/kg)	140	117	122	297	
	Mercury (Hg) (mg/kg)	<0.0050	<0.0050	<0.0050	0.0060	
	Molybdenum (Mo) (mg/kg)	0.27	0.23	0.34	0.99	
	Nickel (Ni) (mg/kg)	6.54	5.61	6.07	9.32	
	Phosphorus (P) (mg/kg)	406	292	344	749	
	Potassium (K) (mg/kg)	670	490	600	1180	
	Selenium (Se) (mg/kg)	<0.20	<0.20	<0.20	<0.20	
	Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10	<0.10	
	Sodium (Na) (mg/kg)	57	<50	<50	101	
	Strontium (Sr) (mg/kg)	23.6	19.6	21.0	32.8	
	Thallium (Tl) (mg/kg)	<0.050	<0.050	<0.050	0.057	
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	
	Titanium (Ti) (mg/kg)	196	133	163	281	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1815642-61	L1815642-62	L1815642-63	L1815642-64	L1815642-65
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date					
	Sampled Time					
	Client ID	CREMP DUP-1	CREMP DUP-2	CREMP DUP-3	CREMP DUP-4	CREMP DUP-5
SOIL						
Physical Tests	Moisture (%)	84.1	81.9	77.1	32.0	42.6
	pH (1:2 soil:water) (pH)	6.19	5.85	5.78	7.42	6.42
Particle Size	% Gravel (>2mm) (%)	<0.10	<0.10	<0.10	<0.10	<0.10
	% Sand (2.0mm - 0.063mm) (%)	3.01	5.97	13.3	76.3	18.2
	% Silt (0.063mm - 4um) (%)	71.3	65.0	68.9	20.6	67.0
	% Clay (<4um) (%)	25.7	29.1	17.8	3.10	14.8
	Texture	Silt loam	Silt loam	Silt loam	Loamy sand	Silt loam
Organic / Inorganic Carbon	Total Organic Carbon (%)	3.78	3.23	2.10	0.317	0.469
Metals	Aluminum (Al) (mg/kg)	24500	27300	20000	4540	9590
	Antimony (Sb) (mg/kg)	0.26	0.22	0.19	0.11	0.13
	Arsenic (As) (mg/kg)	27.7	20.2	21.1	2.77	10.8
	Barium (Ba) (mg/kg)	116	111	82.8	119	88.7
	Beryllium (Be) (mg/kg)	1.91	1.92	1.06	0.27	0.44
	Bismuth (Bi) (mg/kg)	2.25	2.69	0.94	<0.20	0.24
	Boron (B) (mg/kg)	7.0	7.8	5.7	<5.0	7.7
	Cadmium (Cd) (mg/kg)	0.233	0.132	0.105	0.026	0.059
	Calcium (Ca) (mg/kg)	2380	2100	1870	1820	2620
	Chromium (Cr) (mg/kg)	86.4	129	129	15.7	21.6
	Cobalt (Co) (mg/kg)	14.7	15.9	12.8	3.87	6.77
	Copper (Cu) (mg/kg)	67.1	58.8	42.8	3.76	9.60
	Iron (Fe) (mg/kg)	62800	47200	34400	11100	18600
	Lead (Pb) (mg/kg)	22.0	23.6	14.4	3.99	10.1
	Lithium (Li) (mg/kg)	45.4	56.2	30.1	7.9	13.2
	Magnesium (Mg) (mg/kg)	9590	11100	10400	3140	5180
	Manganese (Mn) (mg/kg)	2970	1220	345	417	558
	Mercury (Hg) (mg/kg)	0.0337	0.0203	0.0093	0.0050	0.0084
	Molybdenum (Mo) (mg/kg)	5.97	4.40	2.80	0.43	1.02
	Nickel (Ni) (mg/kg)	65.7	69.3	77.9	9.54	13.4
	Phosphorus (P) (mg/kg)	512	451	518	596	967
	Potassium (K) (mg/kg)	4150	4720	2650	960	1810
	Selenium (Se) (mg/kg)	0.59	0.50	0.27	<0.20	<0.20
	Silver (Ag) (mg/kg)	0.18	<0.10	<0.10	<0.10	<0.10
	Sodium (Na) (mg/kg)	182	180	100	81	214
	Strontium (Sr) (mg/kg)	19.5	17.8	19.2	27.6	47.0
	Thallium (Tl) (mg/kg)	0.351	0.408	0.180	<0.050	0.082
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	666	852	474	225	387

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1815642-66				
	Description	Sediment				
	Sampled Date					
	Sampled Time					
	Client ID	CREMP DUP-COMP				
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	82.9				
	pH (1:2 soil:water) (pH)					
Particle Size	% Gravel (>2mm) (%)					
	% Sand (2.0mm - 0.063mm) (%)					
	% Silt (0.063mm - 4um) (%)					
	% Clay (<4um) (%)					
	Texture					
Organic / Inorganic Carbon	Total Organic Carbon (%)					
Metals	Aluminum (Al) (mg/kg)					
	Antimony (Sb) (mg/kg)					
	Arsenic (As) (mg/kg)					
	Barium (Ba) (mg/kg)					
	Beryllium (Be) (mg/kg)					
	Bismuth (Bi) (mg/kg)					
	Boron (B) (mg/kg)					
	Cadmium (Cd) (mg/kg)					
	Calcium (Ca) (mg/kg)					
	Chromium (Cr) (mg/kg)					
	Cobalt (Co) (mg/kg)					
	Copper (Cu) (mg/kg)					
	Iron (Fe) (mg/kg)					
	Lead (Pb) (mg/kg)					
	Lithium (Li) (mg/kg)					
	Magnesium (Mg) (mg/kg)					
	Manganese (Mn) (mg/kg)					
	Mercury (Hg) (mg/kg)					
	Molybdenum (Mo) (mg/kg)					
	Nickel (Ni) (mg/kg)					
	Phosphorus (P) (mg/kg)					
	Potassium (K) (mg/kg)					
	Selenium (Se) (mg/kg)					
	Silver (Ag) (mg/kg)					
	Sodium (Na) (mg/kg)					
	Strontium (Sr) (mg/kg)					
	Thallium (Tl) (mg/kg)					
	Tin (Sn) (mg/kg)					
	Titanium (Ti) (mg/kg)					

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1815642-1	L1815642-2	L1815642-3	L1815642-4	L1815642-5
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	03-AUG-16	03-AUG-16	03-AUG-16	03-AUG-16	03-AUG-16
	Sampled Time					
	Client ID	SP-1	SP-2	SP-3	SP-4	SP-5
Grouping	**Analyte**					
SOIL						
Metals	Uranium (U) (mg/kg)	16.9	20.1	22.4	24.5	20.6
	Vanadium (V) (mg/kg)	35.4	40.3	42.6	44.4	38.1
	Zinc (Zn) (mg/kg)	95.7	109	118	133	117
	Zirconium (Zr) (mg/kg)	2.2	2.7	3.3	3.0	2.8
Aggregate Organics	Mineral Oil and Grease (mg/kg)					
Hydrocarbons	EPH10-19 (mg/kg)					
	EPH19-32 (mg/kg)					
	LEPH (mg/kg)					
	HEPH (mg/kg)					
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)					
	Acenaphthylene (mg/kg)					
	Anthracene (mg/kg)					
	Benz(a)anthracene (mg/kg)					
	Benzo(a)pyrene (mg/kg)					
	Benzo(b)fluoranthene (mg/kg)					
	Benzo(b+j+k)fluoranthene (mg/kg)					
	Benzo(g,h,i)perylene (mg/kg)					
	Benzo(k)fluoranthene (mg/kg)					
	Chrysene (mg/kg)					
	Dibenz(a,h)anthracene (mg/kg)					
	Fluoranthene (mg/kg)					
	Fluorene (mg/kg)					
	Indeno(1,2,3-c,d)pyrene (mg/kg)					
	2-Methylnaphthalene (mg/kg)					
	Naphthalene (mg/kg)					
	Phenanthrene (mg/kg)					
	Pyrene (mg/kg)					
	Surrogate: Acenaphthene d10 (%)					
	Surrogate: Chrysene d12 (%)					
	Surrogate: Naphthalene d8 (%)					
	Surrogate: Phenanthrene d10 (%)					
	B(a)P Total Potency Equivalent (mg/kg)					
	IACR (CCME) (mg/kg)					

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1815642-6	L1815642-7	L1815642-8	L1815642-9	L1815642-10
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	03-AUG-16	04-AUG-16	04-AUG-16	04-AUG-16	04-AUG-16
	Sampled Time					
	Client ID	SP-COMP	TPE-1	TPE-2	TPE-3	TPE-4
Grouping	**Analyte**					
SOIL						
Metals	Uranium (U) (mg/kg)		19.3	18.8	16.8	16.6
	Vanadium (V) (mg/kg)		45.5	43.6	42.4	40.5
	Zinc (Zn) (mg/kg)		106	104	104	102
	Zirconium (Zr) (mg/kg)		4.1	5.6	3.4	3.0
Aggregate Organics	Mineral Oil and Grease (mg/kg)	670 DLHM				
Hydrocarbons	EPH10-19 (mg/kg)	<740 DLHM				
	EPH19-32 (mg/kg)	<740 DLHM				
	LEPH (mg/kg)	<740				
	HEPH (mg/kg)	<740				
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.0050				
	Acenaphthylene (mg/kg)	<0.0050				
	Anthracene (mg/kg)	<0.0040				
	Benz(a)anthracene (mg/kg)	<0.010				
	Benzo(a)pyrene (mg/kg)	<0.010				
	Benzo(b)fluoranthene (mg/kg)	<0.010				
	Benzo(b+j+k)fluoranthene (mg/kg)	<0.015				
	Benzo(g,h,i)perylene (mg/kg)	<0.010				
	Benzo(k)fluoranthene (mg/kg)	<0.010				
	Chrysene (mg/kg)	<0.010				
	Dibenz(a,h)anthracene (mg/kg)	<0.0050				
	Fluoranthene (mg/kg)	<0.010				
	Fluorene (mg/kg)	<0.010				
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.010				
	2-Methylnaphthalene (mg/kg)	<0.010				
	Naphthalene (mg/kg)	0.017				
	Phenanthrene (mg/kg)	<0.010				
	Pyrene (mg/kg)	<0.010				
	Surrogate: Acenaphthene d10 (%)	92.8				
	Surrogate: Chrysene d12 (%)	86.8				
	Surrogate: Naphthalene d8 (%)	92.4				
	Surrogate: Phenanthrene d10 (%)	89.0				
	B(a)P Total Potency Equivalent (mg/kg)	<0.020				
	IACR (CCME) (mg/kg)	<0.15				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID / Description / Sampled Date / Sampled Time / Client ID	L1815642-11 Sediment 04-AUG-16 TPE-5	L1815642-12 Sediment 04-AUG-16 TPE-COMP	L1815642-13 Sediment 04-AUG-16 TPN-1	L1815642-14 Sediment 04-AUG-16 TPN-2	L1815642-15 Sediment 04-AUG-16 TPN-3
Grouping	**Analyte**					
SOIL						
Metals	Uranium (U) (mg/kg)	15.7		5.72	5.82	13.2
	Vanadium (V) (mg/kg)	41.4		24.4	24.9	30.6
	Zinc (Zn) (mg/kg)	95.6		55.0	59.4	68.4
	Zirconium (Zr) (mg/kg)	3.1		8.2	10.8	1.8
Aggregate Organics	Mineral Oil and Grease (mg/kg)		2620 DLHM			
Hydrocarbons	EPH10-19 (mg/kg)		<780 DLHM			
	EPH19-32 (mg/kg)		<780 DLHM			
	LEPH (mg/kg)		<780			
	HEPH (mg/kg)		<780			
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)		<0.0050			
	Acenaphthylene (mg/kg)		0.0063			
	Anthracene (mg/kg)		<0.0060 DLCI			
	Benz(a)anthracene (mg/kg)		<0.010			
	Benzo(a)pyrene (mg/kg)		<0.010			
	Benzo(b)fluoranthene (mg/kg)		<0.010			
	Benzo(b+j+k)fluoranthene (mg/kg)		<0.015			
	Benzo(g,h,i)perylene (mg/kg)		<0.010			
	Benzo(k)fluoranthene (mg/kg)		<0.010			
	Chrysene (mg/kg)		<0.010			
	Dibenz(a,h)anthracene (mg/kg)		<0.0050			
	Fluoranthene (mg/kg)		<0.010			
	Fluorene (mg/kg)		<0.010			
	Indeno(1,2,3-c,d)pyrene (mg/kg)		<0.010			
	2-Methylnaphthalene (mg/kg)		<0.010			
	Naphthalene (mg/kg)		0.018			
	Phenanthrene (mg/kg)		<0.010			
	Pyrene (mg/kg)		<0.010			
	Surrogate: Acenaphthene d10 (%)		106.5			
	Surrogate: Chrysene d12 (%)		100.2			
	Surrogate: Naphthalene d8 (%)		100.1			
	Surrogate: Phenanthrene d10 (%)		98.9			
	B(a)P Total Potency Equivalent (mg/kg)		<0.020			
	IACR (CCME) (mg/kg)		<0.15			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1815642-16	L1815642-17	L1815642-18	L1815642-19	L1815642-20
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	04-AUG-16	04-AUG-16	04-AUG-16	05-AUG-16	05-AUG-16
	Sampled Time					
	Client ID	TPN-4	TPN-5	TPN-COMP	WAL-1	WAL-2
Grouping	**Analyte**					
SOIL						
Metals	Uranium (U) (mg/kg)	7.47	10.7		15.9	12.1
	Vanadium (V) (mg/kg)	21.3	30.9		30.8	23.1
	Zinc (Zn) (mg/kg)	43.6	68.3		118	94.0
	Zirconium (Zr) (mg/kg)	1.2	6.5		3.8	3.8
Aggregate Organics	Mineral Oil and Grease (mg/kg)			<500		
Hydrocarbons	EPH10-19 (mg/kg)			<220 DLHM		
	EPH19-32 (mg/kg)			<220 DLHM		
	LEPH (mg/kg)			<220		
	HEPH (mg/kg)			<220		
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)			<0.0050		
	Acenaphthylene (mg/kg)			<0.0050		
	Anthracene (mg/kg)			<0.0040		
	Benz(a)anthracene (mg/kg)			<0.010		
	Benzo(a)pyrene (mg/kg)			<0.010		
	Benzo(b)fluoranthene (mg/kg)			<0.010		
	Benzo(b+j+k)fluoranthene (mg/kg)			<0.015		
	Benzo(g,h,i)perylene (mg/kg)			<0.010		
	Benzo(k)fluoranthene (mg/kg)			<0.010		
	Chrysene (mg/kg)			<0.010		
	Dibenz(a,h)anthracene (mg/kg)			<0.0050		
	Fluoranthene (mg/kg)			<0.010		
	Fluorene (mg/kg)			<0.010		
	Indeno(1,2,3-c,d)pyrene (mg/kg)			<0.010		
	2-Methylnaphthalene (mg/kg)			<0.010		
	Naphthalene (mg/kg)			<0.010		
	Phenanthrene (mg/kg)			<0.010		
	Pyrene (mg/kg)			<0.010		
	Surrogate: Acenaphthene d10 (%)			97.9		
	Surrogate: Chrysene d12 (%)			91.7		
	Surrogate: Naphthalene d8 (%)			97.4		
	Surrogate: Phenanthrene d10 (%)			93.0		
	B(a)P Total Potency Equivalent (mg/kg)			<0.020		
	IACR (CCME) (mg/kg)			<0.15		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1815642-21	L1815642-22	L1815642-23	L1815642-24	L1815642-25
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	05-AUG-16	05-AUG-16	05-AUG-16	05-AUG-16	07-AUG-16
	Sampled Time					
	Client ID	WAL-3	WAL-4	WAL-5	WAL-COMP	INUG-1
Grouping	**Analyte**					
SOIL						
Metals	Uranium (U) (mg/kg)	17.8	18.0	14.7		17.1
	Vanadium (V) (mg/kg)	31.2	34.1	30.6		37.1
	Zinc (Zn) (mg/kg)	116	115	99.2		80.9
	Zirconium (Zr) (mg/kg)	3.7	4.2	3.2		3.3
Aggregate Organics	Mineral Oil and Grease (mg/kg)				DLHM 3690	
Hydrocarbons	EPH10-19 (mg/kg)				DLHM <1000	
	EPH19-32 (mg/kg)				DLHM <1000	
	LEPH (mg/kg)				<1000	
	HEPH (mg/kg)				<1000	
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)				<0.0050	
	Acenaphthylene (mg/kg)				<0.0050	
	Anthracene (mg/kg)				<0.0040	
	Benz(a)anthracene (mg/kg)				<0.010	
	Benzo(a)pyrene (mg/kg)				<0.010	
	Benzo(b)fluoranthene (mg/kg)				<0.010	
	Benzo(b+j+k)fluoranthene (mg/kg)				<0.015	
	Benzo(g,h,i)perylene (mg/kg)				<0.010	
	Benzo(k)fluoranthene (mg/kg)				<0.010	
	Chrysene (mg/kg)				<0.010	
	Dibenz(a,h)anthracene (mg/kg)				<0.0050	
	Fluoranthene (mg/kg)				<0.010	
	Fluorene (mg/kg)				<0.010	
	Indeno(1,2,3-c,d)pyrene (mg/kg)				<0.010	
	2-Methylnaphthalene (mg/kg)				0.011	
	Naphthalene (mg/kg)				0.023	
	Phenanthrene (mg/kg)				<0.010	
	Pyrene (mg/kg)				<0.010	
	Surrogate: Acenaphthene d10 (%)				98.4	
	Surrogate: Chrysene d12 (%)				91.2	
	Surrogate: Naphthalene d8 (%)				97.7	
	Surrogate: Phenanthrene d10 (%)				90.8	
	B(a)P Total Potency Equivalent (mg/kg)				<0.020	
	IACR (CCME) (mg/kg)				<0.15	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID / Description / Sampled Date / Sampled Time / Client ID		L1815642-26 Sediment 07-AUG-16 INUG-2	L1815642-27 Sediment 07-AUG-16 INUG-3	L1815642-28 Sediment 07-AUG-16 INUG-4	L1815642-29 Sediment 07-AUG-16 INUG-5	L1815642-30 Sediment 07-AUG-16 INUG-COMP
Grouping	**Analyte**					
SOIL						
Metals	Uranium (U) (mg/kg)	16.8	17.7	17.1	18.3	
	Vanadium (V) (mg/kg)	34.8	36.0	34.8	41.1	
	Zinc (Zn) (mg/kg)	86.9	80.2	90.7	97.3	
	Zirconium (Zr) (mg/kg)	2.4	4.0	2.8	4.0	
Aggregate Organics	Mineral Oil and Grease (mg/kg)					DLHM 600
Hydrocarbons	EPH10-19 (mg/kg)					DLHM <560
	EPH19-32 (mg/kg)					DLHM <560
	LEPH (mg/kg)					<560
	HEPH (mg/kg)					<560
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)					DLHM <0.020
	Acenaphthylene (mg/kg)					DLHM <0.020
	Anthracene (mg/kg)					DLHM <0.020
	Benz(a)anthracene (mg/kg)					DLHM <0.020
	Benzo(a)pyrene (mg/kg)					DLHM <0.020
	Benzo(b)fluoranthene (mg/kg)					DLHM <0.020
	Benzo(b+j+k)fluoranthene (mg/kg)					<0.028
	Benzo(g,h,i)perylene (mg/kg)					DLHM <0.020
	Benzo(k)fluoranthene (mg/kg)					DLHM <0.020
	Chrysene (mg/kg)					DLHM <0.020
	Dibenz(a,h)anthracene (mg/kg)					DLHM <0.020
	Fluoranthene (mg/kg)					DLHM <0.020
	Fluorene (mg/kg)					DLHM <0.020
	Indeno(1,2,3-c,d)pyrene (mg/kg)					DLHM <0.020
	2-Methylnaphthalene (mg/kg)					DLHM <0.020
	Naphthalene (mg/kg)					DLHM <0.020
	Phenanthrene (mg/kg)					0.029
	Pyrene (mg/kg)					DLHM <0.020
	Surrogate: Acenaphthene d10 (%)					82.3
	Surrogate: Chrysene d12 (%)					94.1
	Surrogate: Naphthalene d8 (%)					75.9
	Surrogate: Phenanthrene d10 (%)					88.5
	B(a)P Total Potency Equivalent (mg/kg)					<0.024
	IACR (CCME) (mg/kg)					<0.24

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1815642-31	L1815642-32	L1815642-33	L1815642-34	L1815642-35
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	06-AUG-16	06-AUG-16	06-AUG-16	06-AUG-16	06-AUG-16
	Sampled Time					
	Client ID	PDL-1	PDL-2	PDL-3	PDL-4	PDL-5
SOIL						
Metals	Uranium (U) (mg/kg)	8.29	7.79	8.39	7.80	8.89
	Vanadium (V) (mg/kg)	36.6	34.4	38.7	35.9	39.1
	Zinc (Zn) (mg/kg)	75.1	71.0	74.6	73.1	81.6
	Zirconium (Zr) (mg/kg)	2.1	2.0	2.5	2.0	1.8
Aggregate Organics	Mineral Oil and Grease (mg/kg)					
Hydrocarbons	EPH10-19 (mg/kg)					
	EPH19-32 (mg/kg)					
	LEPH (mg/kg)					
	HEPH (mg/kg)					
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)					
	Acenaphthylene (mg/kg)					
	Anthracene (mg/kg)					
	Benz(a)anthracene (mg/kg)					
	Benzo(a)pyrene (mg/kg)					
	Benzo(b)fluoranthene (mg/kg)					
	Benzo(b+j+k)fluoranthene (mg/kg)					
	Benzo(g,h,i)perylene (mg/kg)					
	Benzo(k)fluoranthene (mg/kg)					
	Chrysene (mg/kg)					
	Dibenz(a,h)anthracene (mg/kg)					
	Fluoranthene (mg/kg)					
	Fluorene (mg/kg)					
	Indeno(1,2,3-c,d)pyrene (mg/kg)					
	2-Methylnaphthalene (mg/kg)					
	Naphthalene (mg/kg)					
	Phenanthrene (mg/kg)					
	Pyrene (mg/kg)					
	Surrogate: Acenaphthene d10 (%)					
	Surrogate: Chrysene d12 (%)					
	Surrogate: Naphthalene d8 (%)					
	Surrogate: Phenanthrene d10 (%)					
	B(a)P Total Potency Equivalent (mg/kg)					
	IACR (CCME) (mg/kg)					

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1815642-36	L1815642-37	L1815642-38	L1815642-39	L1815642-40
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	06-AUG-16	08-AUG-16	08-AUG-16	08-AUG-16	08-AUG-16
	Sampled Time					
	Client ID	PDL-COMP	BAP-1	BAP-2	BAP-3	BAP-4
Grouping	**Analyte**					
SOIL						
Metals	Uranium (U) (mg/kg)		1.04	1.13	1.67	0.853
	Vanadium (V) (mg/kg)		16.9	20.5	23.3	15.8
	Zinc (Zn) (mg/kg)		14.4	16.3	22.4	13.2
	Zirconium (Zr) (mg/kg)		4.6	5.4	6.0	5.3
Aggregate Organics	Mineral Oil and Grease (mg/kg)	<500				
Hydrocarbons	EPH10-19 (mg/kg)	<400 DLHM				
	EPH19-32 (mg/kg)	<400 DLHM				
	LEPH (mg/kg)	<400				
	HEPH (mg/kg)	<400				
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.0050				
	Acenaphthylene (mg/kg)	<0.0050				
	Anthracene (mg/kg)	<0.0040				
	Benz(a)anthracene (mg/kg)	<0.010				
	Benzo(a)pyrene (mg/kg)	<0.010				
	Benzo(b)fluoranthene (mg/kg)	<0.010				
	Benzo(b+j+k)fluoranthene (mg/kg)	<0.015				
	Benzo(g,h,i)perylene (mg/kg)	<0.010				
	Benzo(k)fluoranthene (mg/kg)	<0.010				
	Chrysene (mg/kg)	<0.010				
	Dibenz(a,h)anthracene (mg/kg)	<0.0050				
	Fluoranthene (mg/kg)	<0.010				
	Fluorene (mg/kg)	<0.010				
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.010				
	2-Methylnaphthalene (mg/kg)	<0.010				
	Naphthalene (mg/kg)	<0.010				
	Phenanthrene (mg/kg)	<0.010				
	Pyrene (mg/kg)	<0.010				
	Surrogate: Acenaphthene d10 (%)	74.4				
	Surrogate: Chrysene d12 (%)	93.4				
	Surrogate: Naphthalene d8 (%)	70.4				
	Surrogate: Phenanthrene d10 (%)	84.0				
	B(a)P Total Potency Equivalent (mg/kg)	<0.020				
	IACR (CCME) (mg/kg)	<0.15				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1815642-41 Sediment 08-AUG-16 BAP-5	L1815642-42 Sediment 08-AUG-16 BAP-COMP	L1815642-43 Sediment 08-AUG-16 BES-1	L1815642-44 Sediment 08-AUG-16 BES-2	L1815642-45 Sediment 08-AUG-16 BES-3
Grouping	**Analyte**					
SOIL						
Metals	Uranium (U) (mg/kg)	0.889		1.43	1.79	1.48
	Vanadium (V) (mg/kg)	17.5		20.5	23.2	21.9
	Zinc (Zn) (mg/kg)	11.9		25.2	29.7	26.9
	Zirconium (Zr) (mg/kg)	5.0		2.6	2.3	2.8
Aggregate Organics	Mineral Oil and Grease (mg/kg)		<500			
Hydrocarbons	EPH10-19 (mg/kg)		<200			
	EPH19-32 (mg/kg)		<200			
	LEPH (mg/kg)		<200			
	HEPH (mg/kg)		<200			
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)		<0.0050			
	Acenaphthylene (mg/kg)		<0.0050			
	Anthracene (mg/kg)		<0.0040			
	Benz(a)anthracene (mg/kg)		<0.010			
	Benzo(a)pyrene (mg/kg)		<0.010			
	Benzo(b)fluoranthene (mg/kg)		<0.010			
	Benzo(b+j+k)fluoranthene (mg/kg)		<0.015			
	Benzo(g,h,i)perylene (mg/kg)		<0.010			
	Benzo(k)fluoranthene (mg/kg)		<0.010			
	Chrysene (mg/kg)		<0.010			
	Dibenz(a,h)anthracene (mg/kg)		<0.0050			
	Fluoranthene (mg/kg)		<0.010			
	Fluorene (mg/kg)		<0.010			
	Indeno(1,2,3-c,d)pyrene (mg/kg)		<0.010			
	2-Methylnaphthalene (mg/kg)		<0.010			
	Naphthalene (mg/kg)		<0.010			
	Phenanthrene (mg/kg)		<0.010			
	Pyrene (mg/kg)		<0.010			
	Surrogate: Acenaphthene d10 (%)		79.5			
	Surrogate: Chrysene d12 (%)		91.9			
	Surrogate: Naphthalene d8 (%)		77.9			
	Surrogate: Phenanthrene d10 (%)		83.7			
	B(a)P Total Potency Equivalent (mg/kg)		<0.020			
	IACR (CCME) (mg/kg)		<0.15			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1815642-46	L1815642-47	L1815642-48	L1815642-49	L1815642-50
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	08-AUG-16	08-AUG-16	08-AUG-16	09-AUG-16	09-AUG-16
	Sampled Time					
	Client ID	BES-4	BES-5	BES-COMP	BPJ-1	BPJ-2
Grouping	**Analyte**					
SOIL						
Metals	Uranium (U) (mg/kg)	0.975	1.02		2.01	1.94
	Vanadium (V) (mg/kg)	17.6	18.7		25.6	25.1
	Zinc (Zn) (mg/kg)	19.6	19.3		39.7	37.4
	Zirconium (Zr) (mg/kg)	2.8	3.5		4.4	4.1
Aggregate Organics	Mineral Oil and Grease (mg/kg)			<500		
Hydrocarbons	EPH10-19 (mg/kg)			<200		
	EPH19-32 (mg/kg)			<200		
	LEPH (mg/kg)			<200		
	HEPH (mg/kg)			<200		
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)			<0.0050		
	Acenaphthylene (mg/kg)			<0.0050		
	Anthracene (mg/kg)			<0.0040		
	Benz(a)anthracene (mg/kg)			<0.010		
	Benzo(a)pyrene (mg/kg)			<0.010		
	Benzo(b)fluoranthene (mg/kg)			<0.010		
	Benzo(b+j+k)fluoranthene (mg/kg)			<0.015		
	Benzo(g,h,i)perylene (mg/kg)			<0.010		
	Benzo(k)fluoranthene (mg/kg)			<0.010		
	Chrysene (mg/kg)			<0.010		
	Dibenz(a,h)anthracene (mg/kg)			<0.0050		
	Fluoranthene (mg/kg)			<0.010		
	Fluorene (mg/kg)			<0.010		
	Indeno(1,2,3-c,d)pyrene (mg/kg)			<0.010		
	2-Methylnaphthalene (mg/kg)			<0.010		
	Naphthalene (mg/kg)			<0.010		
	Phenanthrene (mg/kg)			<0.010		
	Pyrene (mg/kg)			<0.010		
	Surrogate: Acenaphthene d10 (%)			92.4		
	Surrogate: Chrysene d12 (%)			91.8		
	Surrogate: Naphthalene d8 (%)			88.6		
	Surrogate: Phenanthrene d10 (%)			90.0		
	B(a)P Total Potency Equivalent (mg/kg)			<0.020		
	IACR (CCME) (mg/kg)			<0.15		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1815642-51	L1815642-52	L1815642-53	L1815642-54	L1815642-55
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	09-AUG-16	09-AUG-16	09-AUG-16	09-AUG-16	09-AUG-16
	Sampled Time					
	Client ID	BPJ-3	BPJ-4	BPJ-5	BPJ-COMP	BBD-1
SOIL						
Metals	Uranium (U) (mg/kg)	2.28	2.19	2.19		1.07
	Vanadium (V) (mg/kg)	27.2	23.7	26.7		15.9
	Zinc (Zn) (mg/kg)	41.8	30.0	36.1		20.9
	Zirconium (Zr) (mg/kg)	4.4	4.8	7.5		2.9
Aggregate Organics	Mineral Oil and Grease (mg/kg)				<500	
Hydrocarbons	EPH10-19 (mg/kg)				<200	
	EPH19-32 (mg/kg)				<200	
	LEPH (mg/kg)				<200	
	HEPH (mg/kg)				<200	
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)				<0.0050	
	Acenaphthylene (mg/kg)				<0.0050	
	Anthracene (mg/kg)				<0.0040	
	Benz(a)anthracene (mg/kg)				<0.010	
	Benzo(a)pyrene (mg/kg)				<0.010	
	Benzo(b)fluoranthene (mg/kg)				<0.010	
	Benzo(b+j+k)fluoranthene (mg/kg)				<0.015	
	Benzo(g,h,i)perylene (mg/kg)				<0.010	
	Benzo(k)fluoranthene (mg/kg)				<0.010	
	Chrysene (mg/kg)				<0.010	
	Dibenz(a,h)anthracene (mg/kg)				<0.0050	
	Fluoranthene (mg/kg)				<0.010	
	Fluorene (mg/kg)				<0.010	
	Indeno(1,2,3-c,d)pyrene (mg/kg)				<0.010	
	2-Methylnaphthalene (mg/kg)				<0.010	
	Naphthalene (mg/kg)				<0.010	
	Phenanthrene (mg/kg)				<0.010	
	Pyrene (mg/kg)				<0.010	
	Surrogate: Acenaphthene d10 (%)				96.3	
	Surrogate: Chrysene d12 (%)				93.8	
	Surrogate: Naphthalene d8 (%)				91.3	
	Surrogate: Phenanthrene d10 (%)				91.8	
	B(a)P Total Potency Equivalent (mg/kg)				<0.020	
	IACR (CCME) (mg/kg)				<0.15	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1815642-56	L1815642-57	L1815642-58	L1815642-59	L1815642-60
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date	09-AUG-16	09-AUG-16	09-AUG-16	09-AUG-16	09-AUG-16
	Sampled Time					
	Client ID	BBD-2	BBD-3	BBD-4	BBD-5	BBD-COMP
Grouping	**Analyte**					
SOIL						
Metals	Uranium (U) (mg/kg)	0.670	0.448	0.616	1.72	
	Vanadium (V) (mg/kg)	11.6	9.11	10.7	20.5	
	Zinc (Zn) (mg/kg)	17.7	14.1	16.1	25.9	
	Zirconium (Zr) (mg/kg)	2.8	2.5	2.9	4.2	
Aggregate Organics	Mineral Oil and Grease (mg/kg)					<500
Hydrocarbons	EPH10-19 (mg/kg)					<200
	EPH19-32 (mg/kg)					<200
	LEPH (mg/kg)					<200
	HEPH (mg/kg)					<200
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)					<0.0050
	Acenaphthylene (mg/kg)					<0.0050
	Anthracene (mg/kg)					<0.0040
	Benz(a)anthracene (mg/kg)					<0.010
	Benzo(a)pyrene (mg/kg)					<0.010
	Benzo(b)fluoranthene (mg/kg)					<0.010
	Benzo(b+j+k)fluoranthene (mg/kg)					<0.015
	Benzo(g,h,i)perylene (mg/kg)					<0.010
	Benzo(k)fluoranthene (mg/kg)					<0.010
	Chrysene (mg/kg)					<0.010
	Dibenz(a,h)anthracene (mg/kg)					<0.0050
	Fluoranthene (mg/kg)					<0.010
	Fluorene (mg/kg)					<0.010
	Indeno(1,2,3-c,d)pyrene (mg/kg)					<0.010
	2-Methylnaphthalene (mg/kg)					<0.010
	Naphthalene (mg/kg)					<0.010
	Phenanthrene (mg/kg)					<0.010
	Pyrene (mg/kg)					<0.010
	Surrogate: Acenaphthene d10 (%)					97.5
	Surrogate: Chrysene d12 (%)					91.8
	Surrogate: Naphthalene d8 (%)					92.1
	Surrogate: Phenanthrene d10 (%)					91.3
	B(a)P Total Potency Equivalent (mg/kg)					<0.020
	IACR (CCME) (mg/kg)					<0.15

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1815642-61	L1815642-62	L1815642-63	L1815642-64	L1815642-65
	Description	Sediment	Sediment	Sediment	Sediment	Sediment
	Sampled Date					
	Sampled Time					
	Client ID	CREMP DUP-1	CREMP DUP-2	CREMP DUP-3	CREMP DUP-4	CREMP DUP-5
Grouping	**Analyte**					
SOIL						
Metals	Uranium (U) (mg/kg)	19.4	20.8	8.94	1.15	2.20
	Vanadium (V) (mg/kg)	38.7	46.5	36.1	16.3	25.6
	Zinc (Zn) (mg/kg)	105	105	75.8	18.7	36.1
	Zirconium (Zr) (mg/kg)	2.7	4.3	2.0	2.3	7.3
Aggregate Organics	Mineral Oil and Grease (mg/kg)					
Hydrocarbons	EPH10-19 (mg/kg)					
	EPH19-32 (mg/kg)					
	LEPH (mg/kg)					
	HEPH (mg/kg)					
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)					
	Acenaphthylene (mg/kg)					
	Anthracene (mg/kg)					
	Benz(a)anthracene (mg/kg)					
	Benzo(a)pyrene (mg/kg)					
	Benzo(b)fluoranthene (mg/kg)					
	Benzo(b+j+k)fluoranthene (mg/kg)					
	Benzo(g,h,i)perylene (mg/kg)					
	Benzo(k)fluoranthene (mg/kg)					
	Chrysene (mg/kg)					
	Dibenz(a,h)anthracene (mg/kg)					
	Fluoranthene (mg/kg)					
	Fluorene (mg/kg)					
	Indeno(1,2,3-c,d)pyrene (mg/kg)					
	2-Methylnaphthalene (mg/kg)					
	Naphthalene (mg/kg)					
	Phenanthrene (mg/kg)					
	Pyrene (mg/kg)					
	Surrogate: Acenaphthene d10 (%)					
	Surrogate: Chrysene d12 (%)					
	Surrogate: Naphthalene d8 (%)					
	Surrogate: Phenanthrene d10 (%)					
	B(a)P Total Potency Equivalent (mg/kg)					
	IACR (CCME) (mg/kg)					

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1815642-66				
	Description	Sediment				
	Sampled Date					
	Sampled Time					
	Client ID	CREMP DUP-COMP				
Grouping	**Analyte**					
SOIL						
Metals	Uranium (U) (mg/kg)					
	Vanadium (V) (mg/kg)					
	Zinc (Zn) (mg/kg)					
	Zirconium (Zr) (mg/kg)					
Aggregate Organics	Mineral Oil and Grease (mg/kg)	<500				
Hydrocarbons	EPH10-19 (mg/kg)	<520 DLHM				
	EPH19-32 (mg/kg)	<520 DLHM				
	LEPH (mg/kg)	<520				
	HEPH (mg/kg)	<520				
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.0050				
	Acenaphthylene (mg/kg)	<0.0050				
	Anthracene (mg/kg)	<0.0040				
	Benz(a)anthracene (mg/kg)	<0.010				
	Benzo(a)pyrene (mg/kg)	<0.010				
	Benzo(b)fluoranthene (mg/kg)	<0.010				
	Benzo(b+j+k)fluoranthene (mg/kg)	<0.015				
	Benzo(g,h,i)perylene (mg/kg)	<0.010				
	Benzo(k)fluoranthene (mg/kg)	<0.010				
	Chrysene (mg/kg)	<0.010				
	Dibenz(a,h)anthracene (mg/kg)	<0.0050				
	Fluoranthene (mg/kg)	<0.010				
	Fluorene (mg/kg)	<0.010				
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.010				
	2-Methylnaphthalene (mg/kg)	<0.010				
	Naphthalene (mg/kg)	<0.010				
	Phenanthrene (mg/kg)	<0.010				
	Pyrene (mg/kg)	<0.010				
	Surrogate: Acenaphthene d10 (%)	94.8				
	Surrogate: Chrysene d12 (%)	90.6				
	Surrogate: Naphthalene d8 (%)	90.9				
	Surrogate: Phenanthrene d10 (%)	91.0				
	B(a)P Total Potency Equivalent (mg/kg)	<0.020				
	IACR (CCME) (mg/kg)	<0.15				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		L1815642-67	L1815642-68	L1815642-69	L1815642-70	L1815642-71
	Sample ID	L1815642-67	L1815642-68	L1815642-69	L1815642-70	L1815642-71
	Description	Swab	Swab	Swab	Swab	Swab
	Sampled Date	05-AUG-16	05-AUG-16	07-AUG-16	08-AUG-16	09-AUG-16
	Sampled Time					
	Client ID	CREMP SWIPE-1	CREMP SWIPE-2	CREMP SWIPE-3	CREMP SWIPE-4	CREMP SWIPE-5
Grouping	**Analyte**					
SWAB						
Metals	Aluminum (Al)-Total (mg)	<0.020	<0.020	<0.020	<0.020	<0.020
	Antimony (Sb)-Total (mg)	<0.020	<0.020	<0.020	<0.020	<0.020
	Arsenic (As)-Total (mg)	<0.020	<0.020	<0.020	<0.020	<0.020
	Barium (Ba)-Total (mg)	<0.0010	<0.0010	<0.0010	<0.0010	0.0012
	Beryllium (Be)-Total (mg)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)-Total (mg)	<0.020	<0.020	<0.020	<0.020	<0.020
	Cadmium (Cd)-Total (mg)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Calcium (Ca)-Total (mg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Chromium (Cr)-Total (mg)	0.0037	0.0024	0.0043	0.0028	0.0045
	Cobalt (Co)-Total (mg)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Copper (Cu)-Total (mg)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Iron (Fe)-Total (mg)	0.029	0.027	0.033	0.025	0.038
	Lead (Pb)-Total (mg)	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
	Lithium (Li)-Total (mg)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)-Total (mg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Manganese (Mn)-Total (mg)	0.00056	<0.00050	0.00055	<0.00050	0.00102
	Molybdenum (Mo)-Total (mg)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Nickel (Ni)-Total (mg)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Phosphorus (P)-Total (mg)	<0.030	<0.030	<0.030	<0.030	<0.030
	Potassium (K)-Total (mg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Selenium (Se)-Total (mg)	<0.020	<0.020	<0.020	<0.020	<0.020
	Silver (Ag)-Total (mg)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Sodium (Na)-Total (mg)	<0.40	<0.40	<0.40	<0.40	<0.40
	Strontium (Sr)-Total (mg)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Thallium (Tl)-Total (mg)	<0.020	<0.020	<0.020	<0.020	<0.020
	Tin (Sn)-Total (mg)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Titanium (Ti)-Total (mg)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Vanadium (V)-Total (mg)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Zinc (Zn)-Total (mg)	0.00332	0.00371	0.00053	0.00083	0.00163

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

Qualifiers for Individual Samples Listed:

Sample Number	Client Sample ID	Qualifier	Description
L1815642-1	SP-1	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-10	TPE-4	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-11	TPE-5	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-12	TPE-COMP	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-13	TPN-1	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-14	TPN-2	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-15	TPN-3	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-16	TPN-4	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-17	TPN-5	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-18	TPN-COMP	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-19	WAL-1	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-2	SP-2	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-20	WAL-2	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-21	WAL-3	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-22	WAL-4	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-23	WAL-5	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-24	WAL-COMP	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-25	INUG-1	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-26	INUG-2	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-27	INUG-3	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-28	INUG-4	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-29	INUG-5	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-3	SP-3	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-30	INUG-COMP	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-31	PDL-1	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-32	PDL-2	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-33	PDL-3	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-34	PDL-4	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-35	PDL-5	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-4	SP-4	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-43	BES-1	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-44	BES-2	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-49	BPJ-1	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-5	SP-5	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-50	BPJ-2	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.

Reference Information

L1815642-51	BPJ-3	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-6	SP-COMP	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-61	CREMP DUP-1	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-62	CREMP DUP-2	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-63	CREMP DUP-3	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-7	TPE-1	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-8	TPE-2	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
L1815642-9	TPE-3	PSAL	Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Acenaphthene	DLCI	L1815642-36
Duplicate	Naphthalene	DLCI	L1815642-36
Duplicate	Calcium (Ca)	DUP-H	L1815642-10, -11, -13, -14, -15, -16, -17, -19, -20, -21, -22, -23, -7, -8, -9

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLCI	Detection Limit Raised: Chromatographic Interference due to co-elution.
DLHM	Detection Limit Adjusted: Sample has High Moisture Content
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
C-TIC-PCT-SK	Soil	Total Inorganic Carbon in Soil	CSSS (2008) P216-217

A known quantity of acetic acid is consumed by reaction with carbonates in the soil. The pH of the resulting solution is measured and compared against a standard curve relating pH to weight of carbonate.

C-TOC-CALC-SK	Soil	Total Organic Carbon Calculation	CSSS (2008) 21.2

Total Organic Carbon (TOC) is calculated by the difference between total carbon (TC) and total inorganic carbon. (TIC)

C-TOT-LECO-SK	Soil	Total Carbon by combustion method	SSSA (1996) P. 973-974

The sample is ignited in a combustion analyzer where carbon in the reduced CO2 gas is determined using a thermal conductivity detector.

EPH-TUMB-FID-VA	Soil	EPH in Solids by Tumbler and GCFID	BC MOE EPH GCFID

Analysis is in accordance with BC MOE Lab Manual method "Extractable Petroleum Hydrocarbons in Solids by GC/FID", v2.1, July 1999. Soil samples are extracted with a 1:1 mixture of hexane and acetone using a rotary extraction technique modified from EPA 3570 prior to gas chromatography with flame ionization detection (GC-FID). EPH results include Polycyclic Aromatic Hydrocarbons (PAH) and are therefore not equivalent to Light and Heavy Extractable Petroleum Hydrocarbons (LEPH/HEPH).

HG-200.2-CVAF-VA	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.

LEPH/HEPH-CALC-VA	Soil	LEPHs and HEPHs	BC MOE LABORATORY MANUAL (2005)

Light and Heavy Extractable Petroleum Hydrocarbons in Solids. These results are determined according to the British Columbia Ministry of Environment, Lands, and Parks Analytical Method for Contaminated Sites "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water". According to this method, LEPH and HEPH are calculated
by subtracting selected Polycyclic Aromatic Hydrocarbon results from Extractable Petroleum Hydrocarbon results. To calculate LEPH, the individual results for Naphthalene and Phenanthrene are subtracted from EPH(C10-19). To calculate HEPH, the individual results for Benz(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-c,d)pyrene, and Pyrene
are subtracted from EPH(C19-32). Analysis of Extractable Petroleum Hydrocarbons adheres to all prescribed elements of the BCMELP method "Extractable Petroleum Hydrocarbons in Solids by GC/FID" (Version 2.1, July 20, 1999).

MET-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CRC ICPMS.

Reference Information

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may be environmentally available. This method does not dissolve all silicate materials and may result in a partial extraction. depending on the sample matrix, for some metals, including, but not limited to Al, Ba, Be, Cr, Sr, Ti, Tl, and V.

MET-MG-ICP-VA Swab Metals in Swab by ICPOES NIOSH 7303/EPA 6010B

This analysis is carried out using procedures adapted from Method 7303 in the NIOSH Manual of Analytcial Methods (NMAM). The procedure involves a hot block digestion of the swab material, using a combination of nitric acid and hydrochloric acid. Instrumental analysis of the swab extract is by inductively coupled plasma - optical emission spectrophotometry (EPA 6010B).

MOISTURE-VA Soil Moisture content ASTM D2974-00 Method A

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six hours.

OGG-TUMB-SG-VA Soil Mineral Oil & Grease in Soil CCME PETROLEUM HYDROCARBONS-GRAVIMETRIC

This analysis is carried out in accordance with the "Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil - Tier 1 Method, Canadian Council of Ministers of the Environment, December 2000." A subsample of the sediment/soil is extracted with 1:1 hexane:acetone using a rotary extraction apparatus. The extract undergoes a silica-gel clean-up to remove polar compounds, and is analyzed gravimetrically. Mineral Oil and Grease is equivalent to fraction F4G of the Canada-wide Standard for Petroleum Hydrocarbons.

Accuracy target values for Reference Materials used in this method are derived from averages of long-term method performance, as certified values do not exist for the reported parameters.

PAH-TMB-H/A-MS-VA Soil PAH - Rotary Extraction (Hexane/Acetone) EPA 3570/8270

This analysis is carried out using procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846, Methods 3570 & 8270, published by the United States Environmental Protection Agency (EPA). The procedure uses a mechanical shaking technique to extract a subsample of the sediment/soil with a 1:1 mixture of hexane and acetone. The extract is then solvent exchanged to toluene. The final extract is analysed by capillary column gas chromatography with mass spectrometric detection (GC/MS). Surrogate recoveries may not be reported in cases where interferences from the sample matrix prevent accurate quantitation. Because the two isomers cannot be readily chromatographically separated, benzo(j)fluoranthene is reported as part of the benzo(b)fluoranthene parameter.

PH-1:2-VA Soil pH in Soil (1:2 Soil:Water Extraction) BC WLAP METHOD: PH, ELECTROMETRIC, SOIL

This analysis is carried out in accordance with procedures described in the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water. The pH of the solution is then measured using a standard pH probe.

PSA-PIPET+GRAVEL-SK Soil Particle size - Sieve and Pipette SSIR-51 METHOD 3.2.1

Particle size distribution is determined by a combination of techniques. Dry sieving is performed for coarse particles, wet sieving for sand particles and the pipette sedimentation method for clay particles.

Reference:

Burt, R. (2009). Soil Survey Field and Laboratory Methods Manual. Soil Survey Investigations Report No. 5. Method 3.2.1.2.2. United States Department of Agriculture Natural Resources Conservation Service.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

1	2	3	4	5
6				

Reference Information

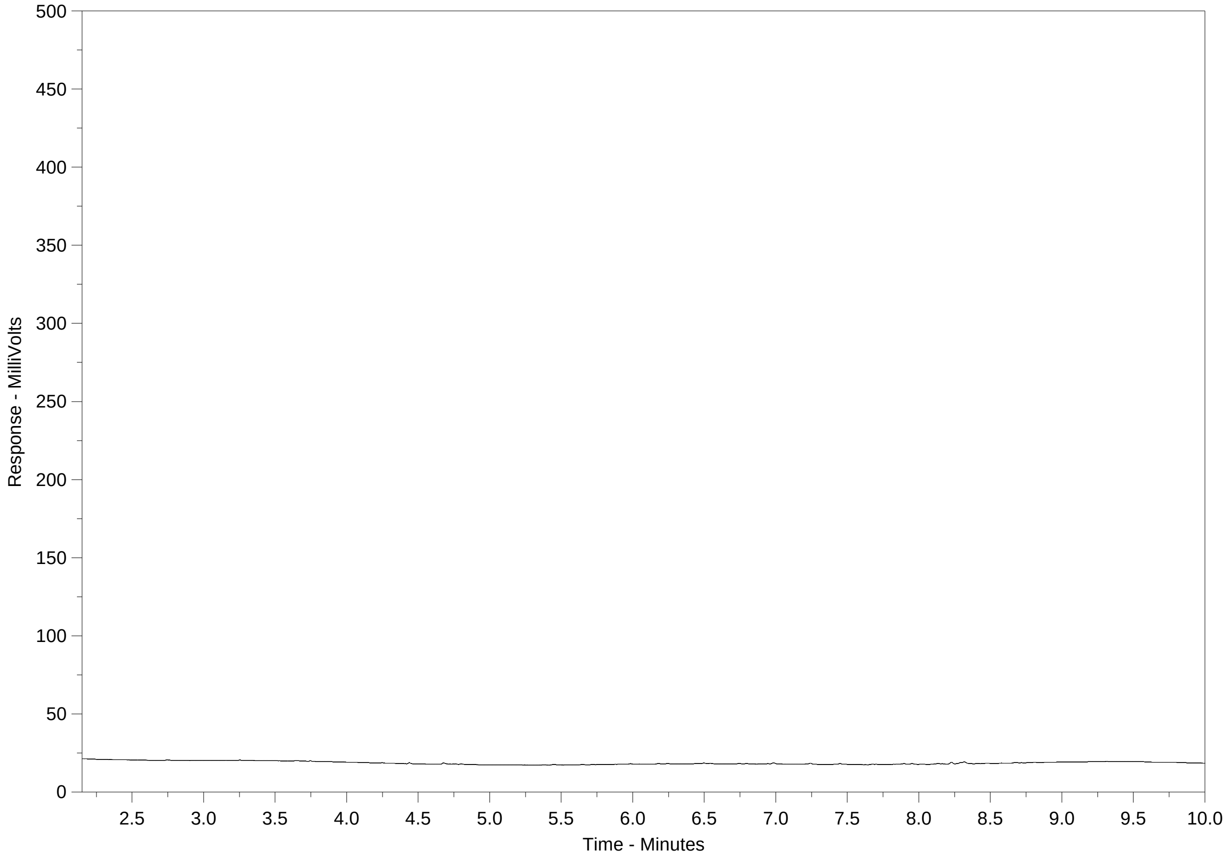
GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Hydrocarbon Distribution Report

ALS Sample ID: L1815642-6
Client Sample ID: SP-COMP



nC10	nC19	nC32
174°C	330°C	467°C
346°F	626°F	873°F
← Gasoline →	← Motor Oils / Lube Oils / Grease →	
← Diesel / Jet Fuels →		

The EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample. For further interpretation, a current library of reference products is available on www.alsglobal.com or upon request.

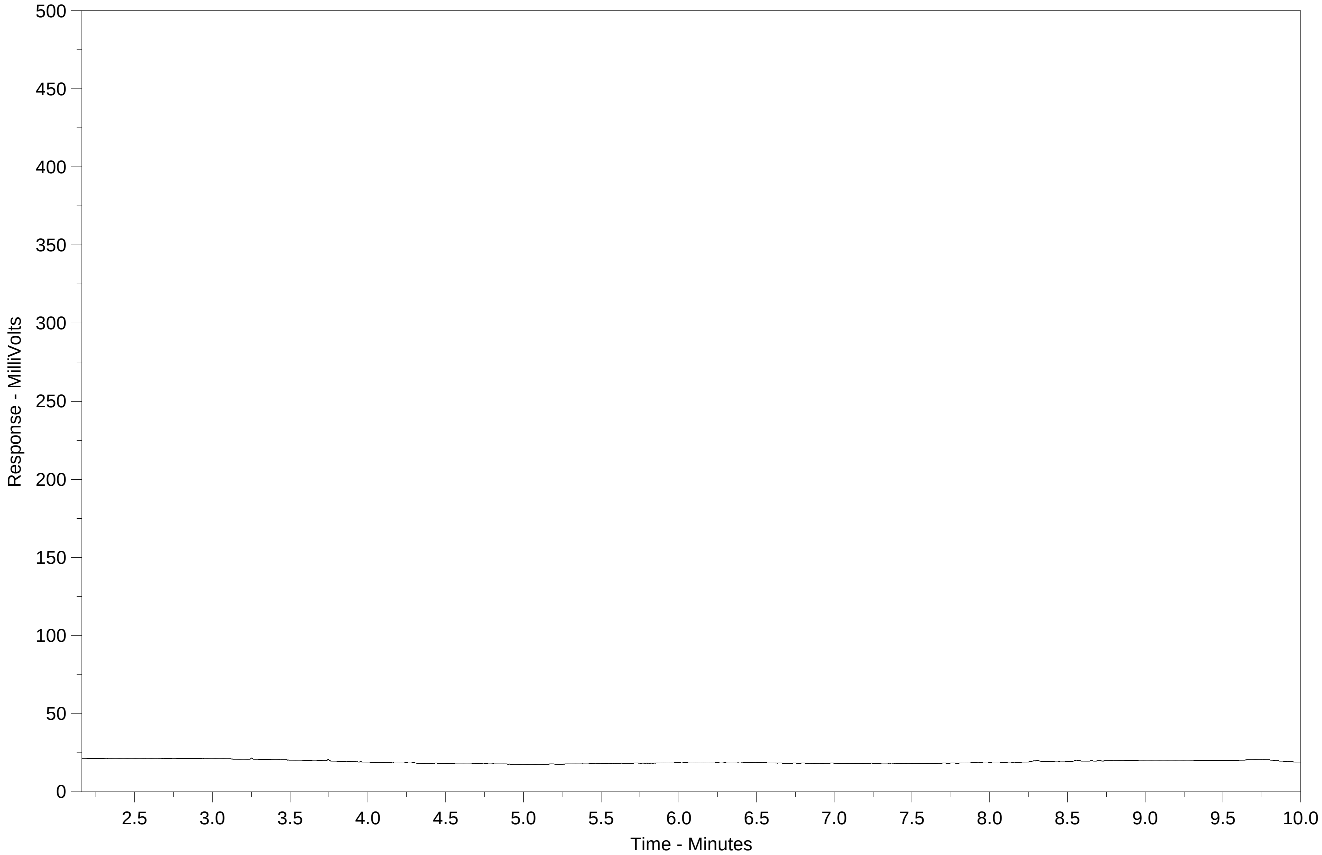
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the response scale at the left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Hydrocarbon Distribution Report

ALS Sample ID: L1815642-12
Client Sample ID: TPE-COMP



nC10	nC19	nC32
174°C 346°F	330°C 626°F	467°C 873°F
← Gasoline →	← Motor Oils / Lube Oils / Grease →	
← Diesel / Jet Fuels →		

The EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample. For further interpretation, a current library of reference products is available on www.alsglobal.com or upon request.

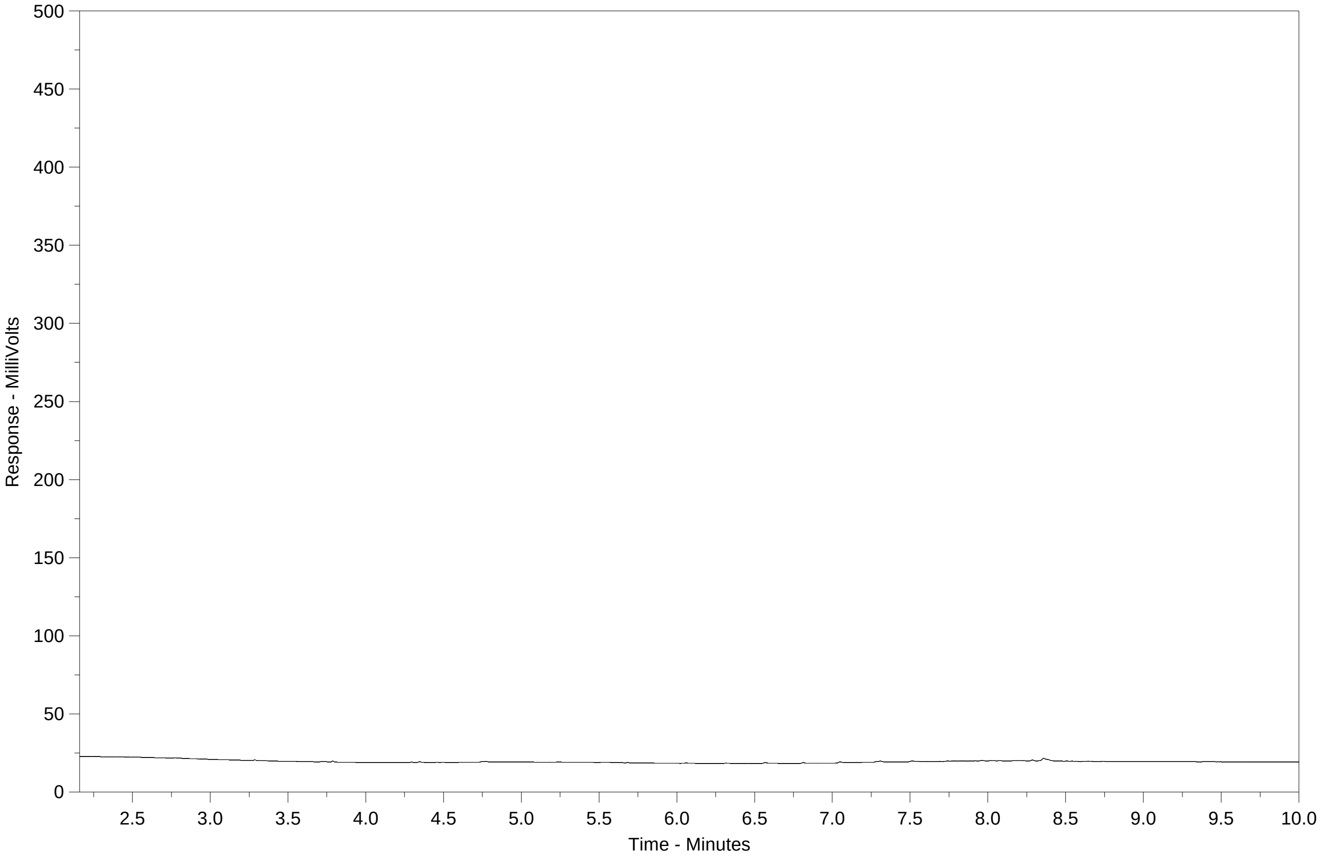
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the response scale at the left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Hydrocarbon Distribution Report

ALS Sample ID: L1815642-18
Client Sample ID: TPN-COMP



nC10	nC19	nC32
174°C	330°C	467°C
346°F	626°F	873°F
← Gasoline →	← Motor Oils / Lube Oils / Grease →	
← Diesel / Jet Fuels →		

The EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample. For further interpretation, a current library of reference products is available on www.alsglobal.com or upon request.

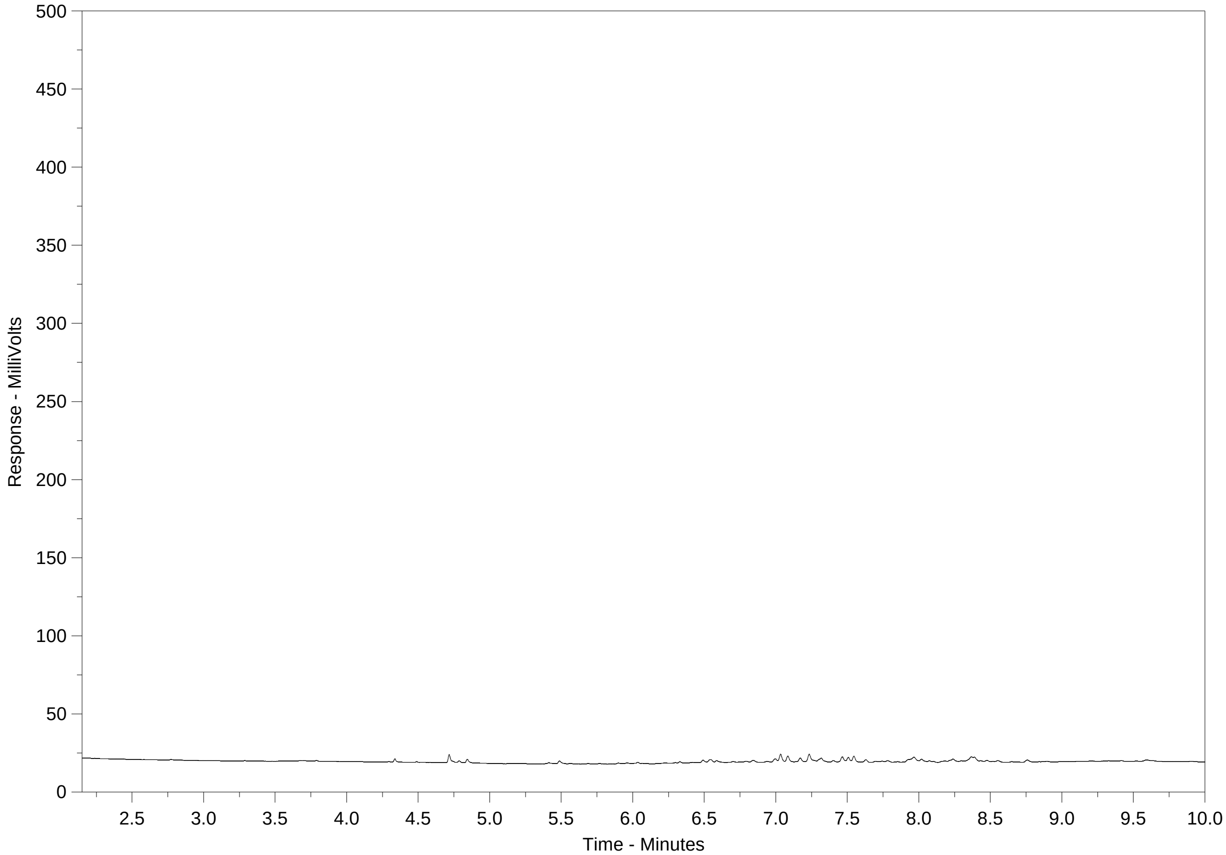
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the response scale at the left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Hydrocarbon Distribution Report

ALS Sample ID: L1815642-24
Client Sample ID: WAL-COMP



nC10	nC19	nC32
174°C 346°F	330°C 626°F	467°C 873°F
← Gasoline →	← Motor Oils / Lube Oils / Grease →	
← Diesel / Jet Fuels →		

The EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample. For further interpretation, a current library of reference products is available on www.alsglobal.com or upon request.

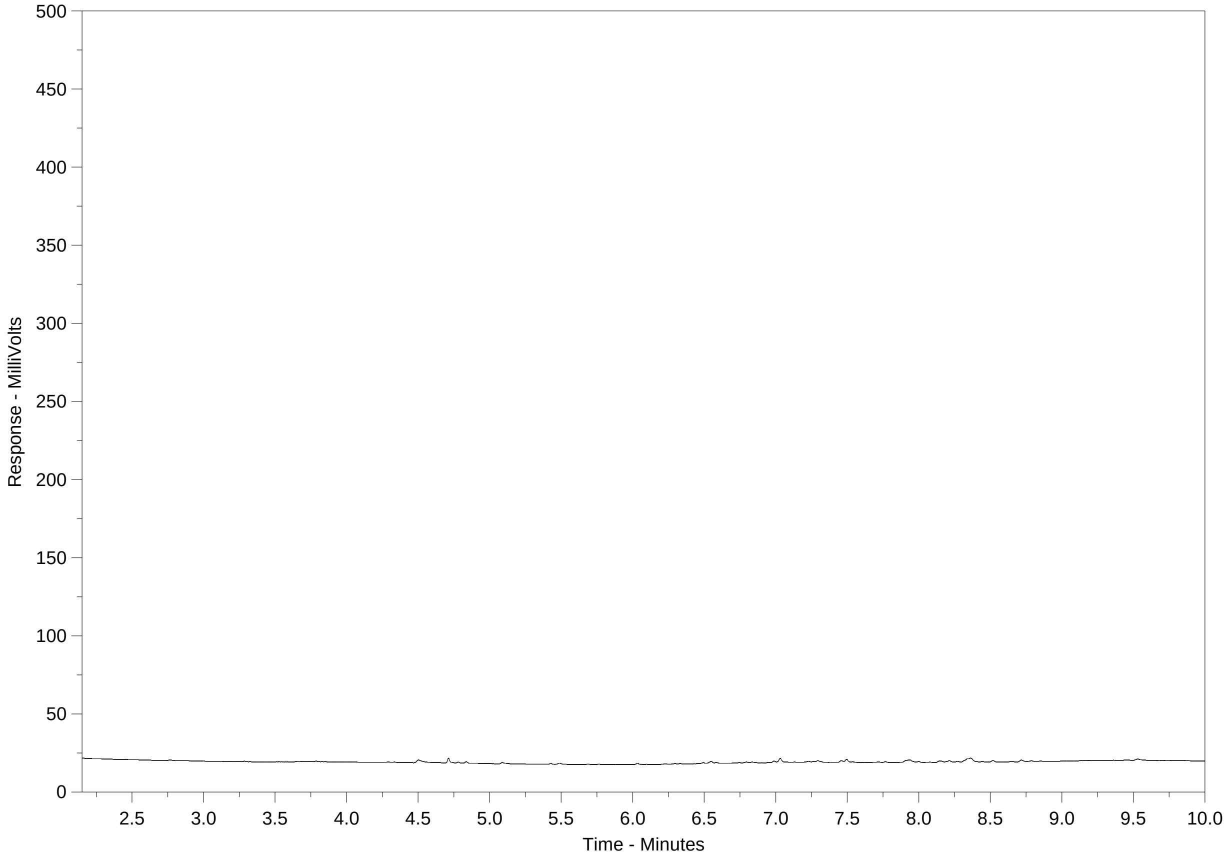
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the response scale at the left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Hydrocarbon Distribution Report

ALS Sample ID: L1815642-30
Client Sample ID: INUG-COMP



nC10	nC19	nC32
174°C 346°F	330°C 626°F	467°C 873°F
← Gasoline →	← Motor Oils / Lube Oils / Grease →	
← Diesel / Jet Fuels →		

The EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample. For further interpretation, a current library of reference products is available on www.alsglobal.com or upon request.

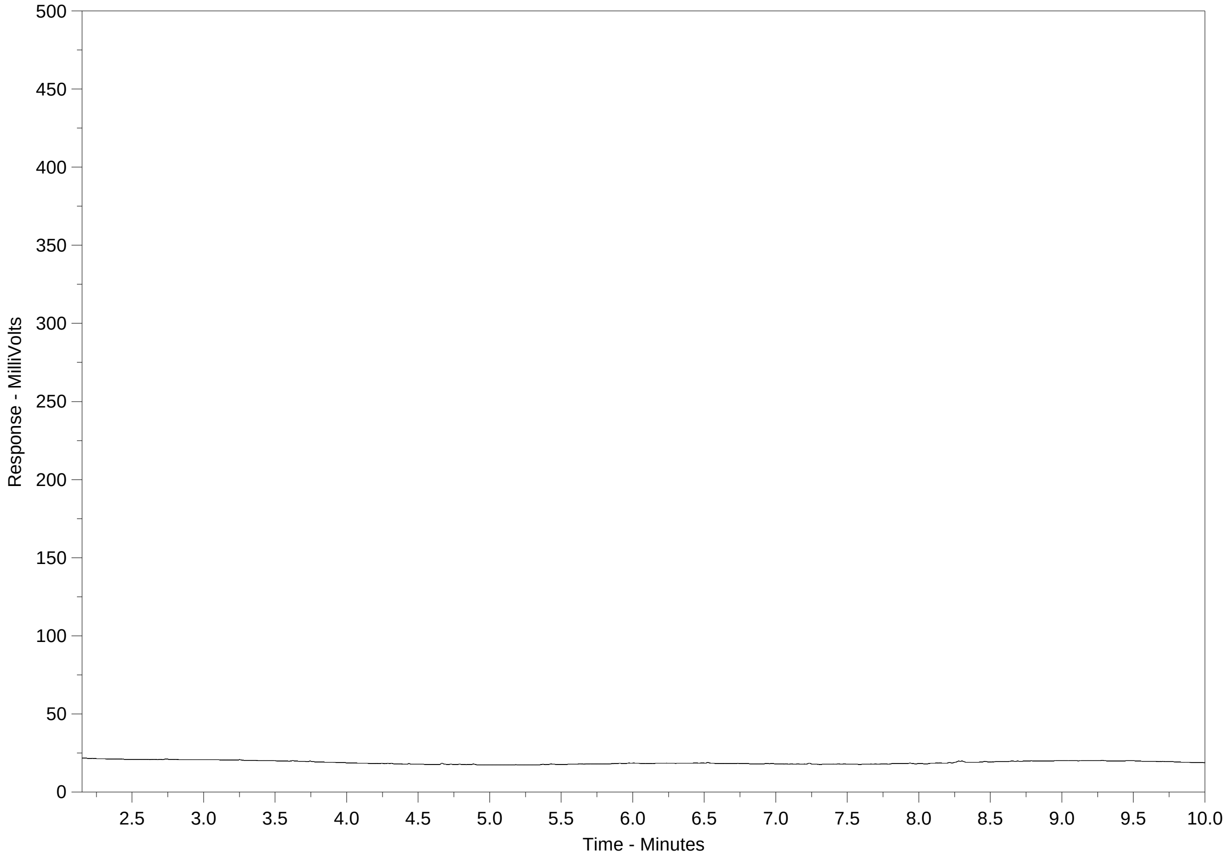
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the response scale at the left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Hydrocarbon Distribution Report

ALS Sample ID: L1815642-36
Client Sample ID: PDL-COMP



nC10	nC19	nC32
174°C 346°F	330°C 626°F	467°C 873°F
← Gasoline →	← Motor Oils / Lube Oils / Grease →	
← Diesel / Jet Fuels →		

The EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample. For further interpretation, a current library of reference products is available on www.alsglobal.com or upon request.

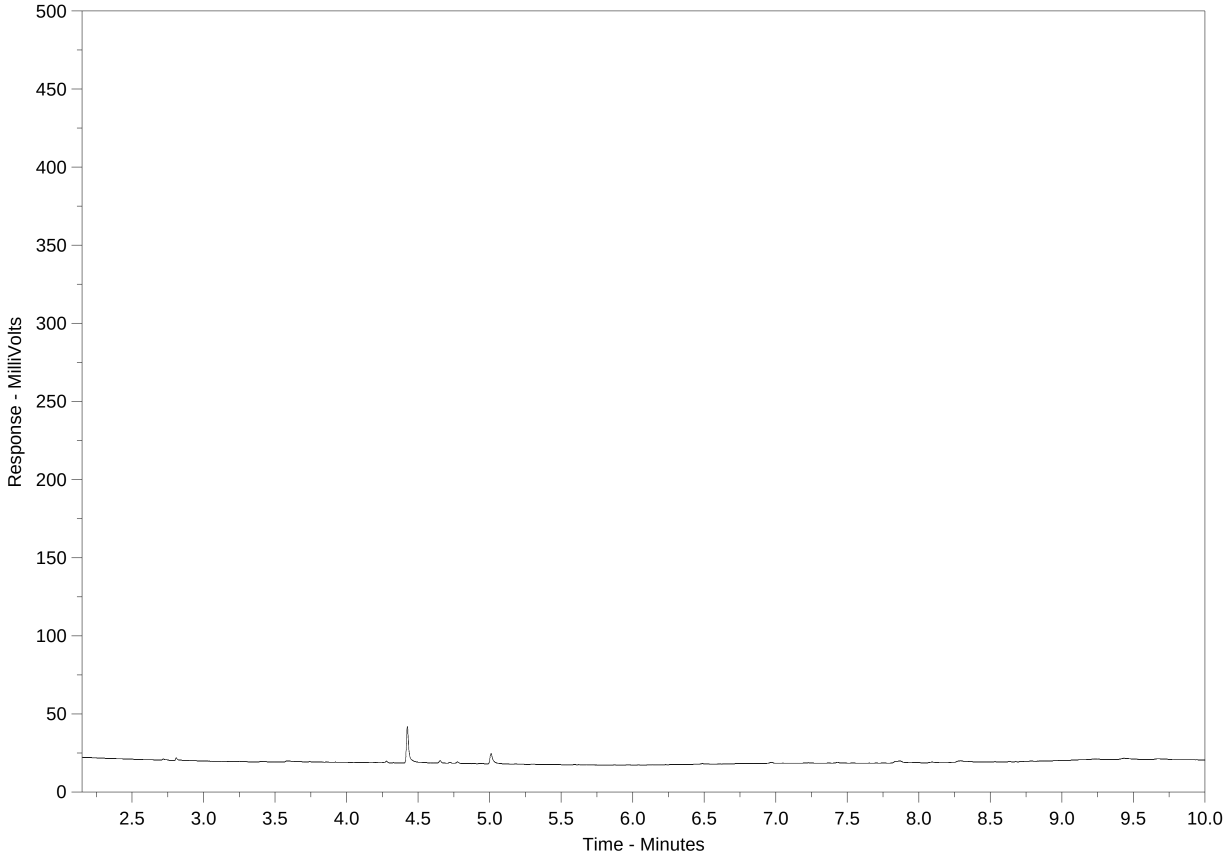
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the response scale at the left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Hydrocarbon Distribution Report

ALS Sample ID: L1815642-42
Client Sample ID: BAP-COMP



nC10	nC19	nC32
174°C 346°F	330°C 626°F	467°C 873°F

← Gasoline → ← Motor Oils / Lube Oils / Grease →
← Diesel / Jet Fuels →

The EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample. For further interpretation, a current library of reference products is available on www.alsglobal.com or upon request.

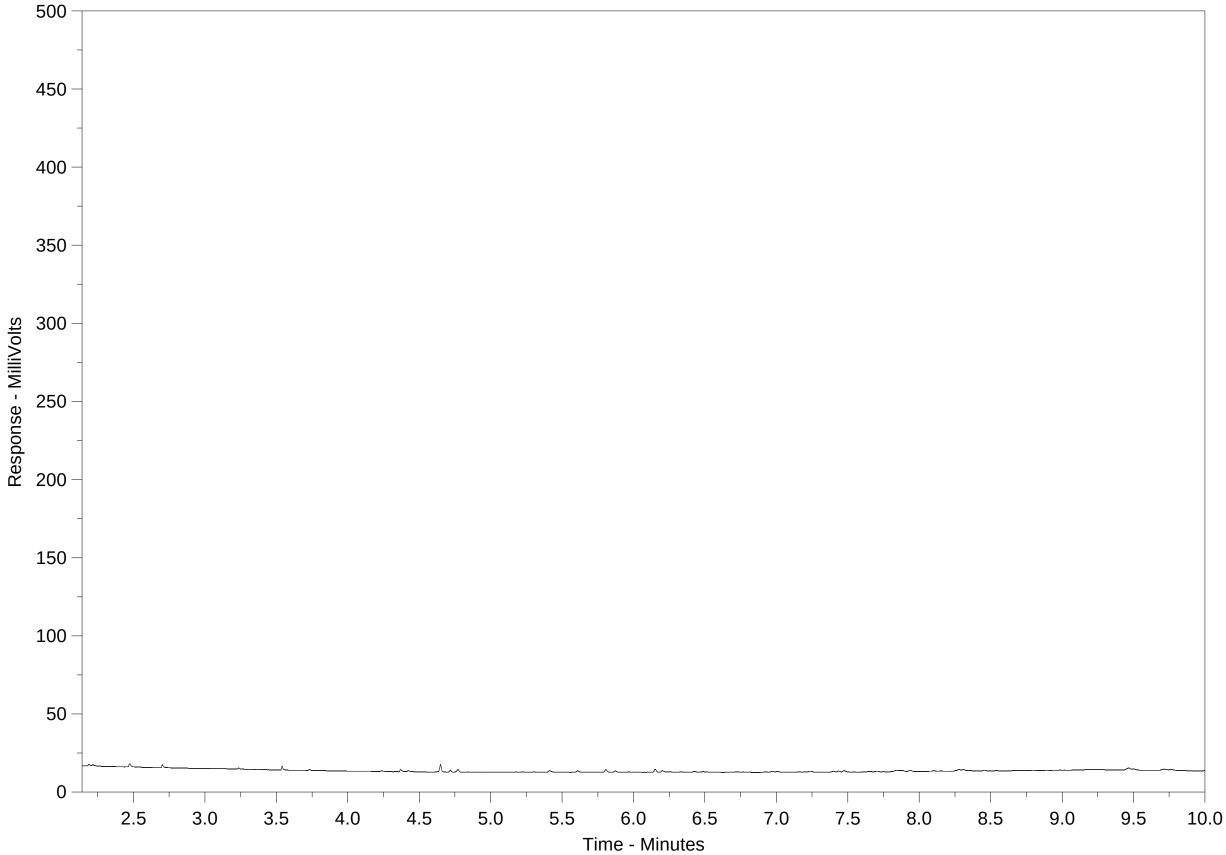
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the response scale at the left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Hydrocarbon Distribution Report

ALS Sample ID: L1815642-48
Client Sample ID: BES-COMP



nC10	nC19	nC32
174°C 346°F	330°C 626°F	467°C 873°F

← Gasoline → ← Motor Oils / Lube Oils / Grease →
← Diesel / Jet Fuels →

The EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample. For further interpretation, a current library of reference products is available on www.alsglobal.com or upon request.

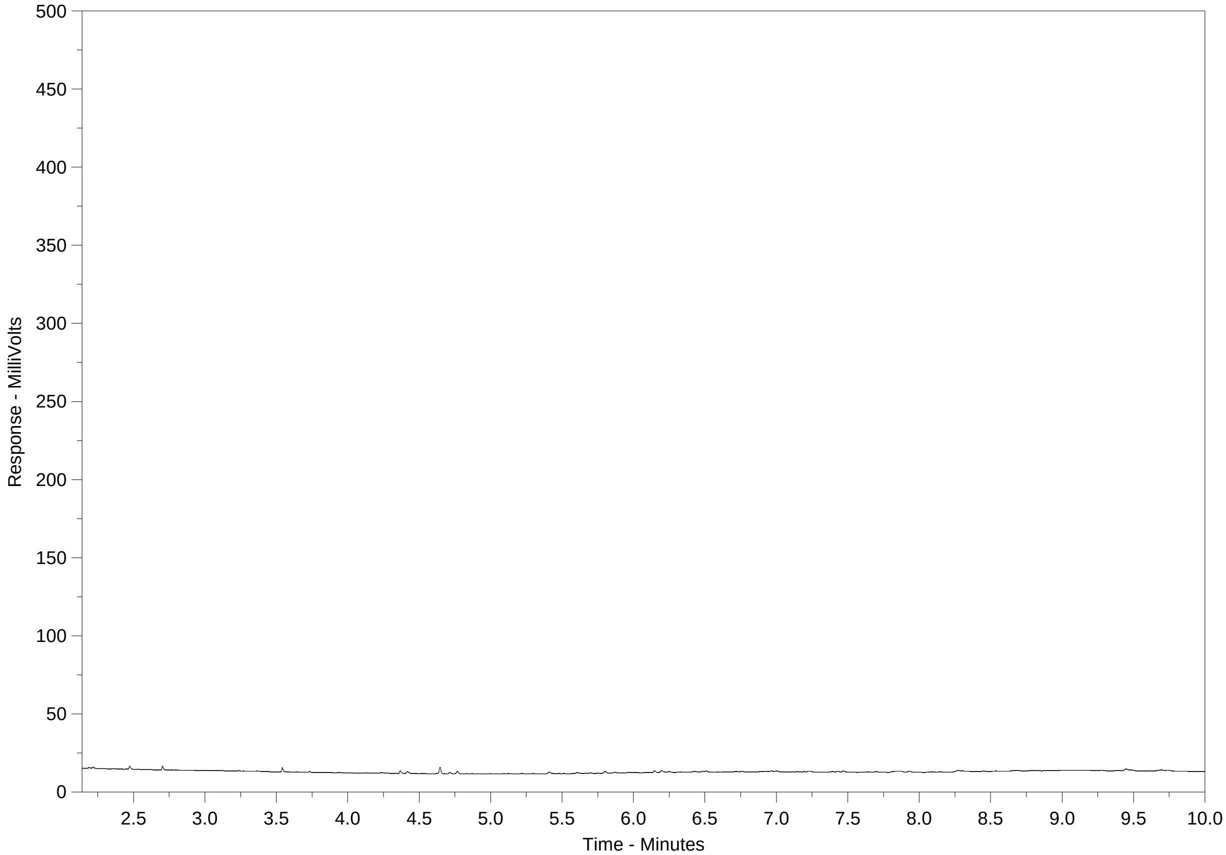
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the response scale at the left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Hydrocarbon Distribution Report

ALS Sample ID: WG2371804-5#L1815642-48
Client Sample ID: BES-COMP



nC10	nC19	nC32
174°C 346°F	330°C 626°F	467°C 873°F
← Gasoline →	← Motor Oils / Lube Oils / Grease →	
← Diesel / Jet Fuels →		

The EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample. For further interpretation, a current library of reference products is available on www.alsglobal.com or upon request.

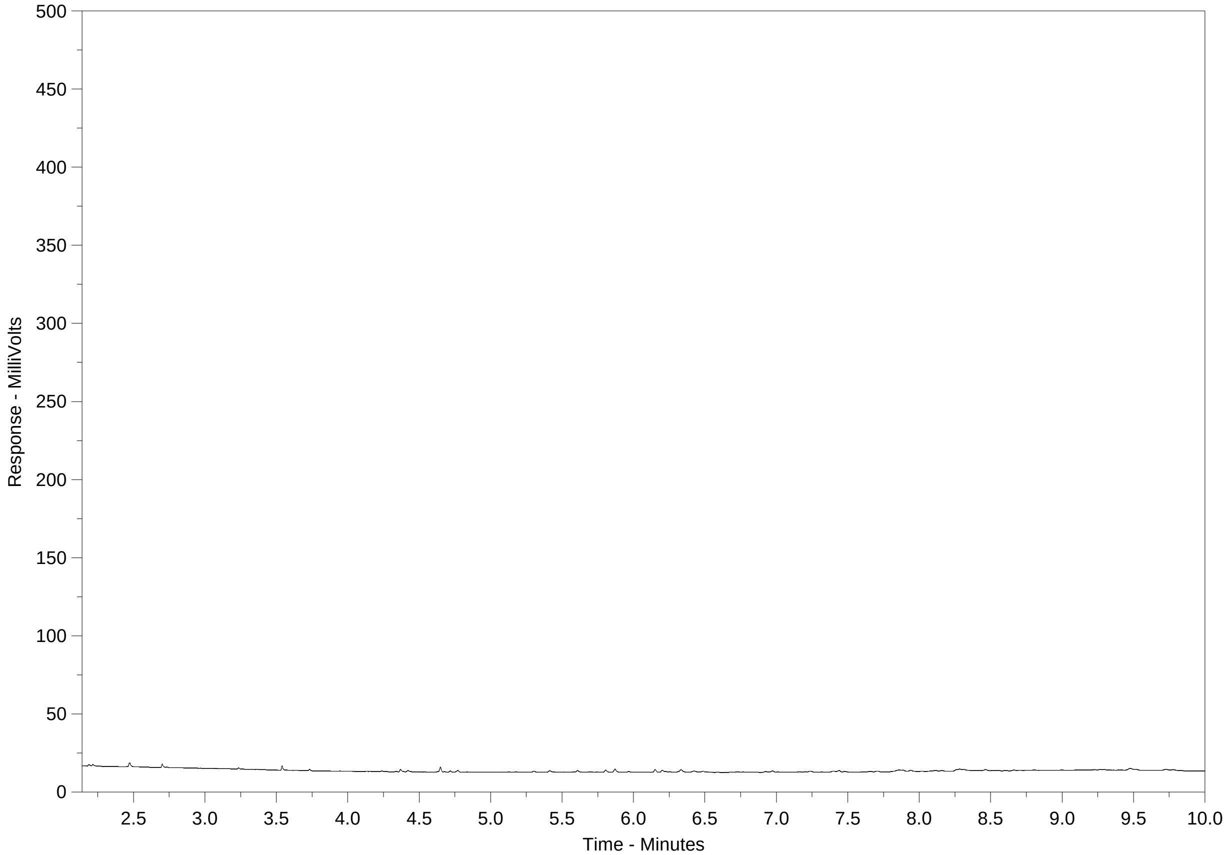
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the response scale at the left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Hydrocarbon Distribution Report

ALS Sample ID: L1815642-54
Client Sample ID: BPJ-COMP



nC10	nC19	nC32
174°C 346°F	330°C 626°F	467°C 873°F
← Gasoline →	← Motor Oils / Lube Oils / Grease →	
← Diesel / Jet Fuels →		

The EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample. For further interpretation, a current library of reference products is available on www.alsglobal.com or upon request.

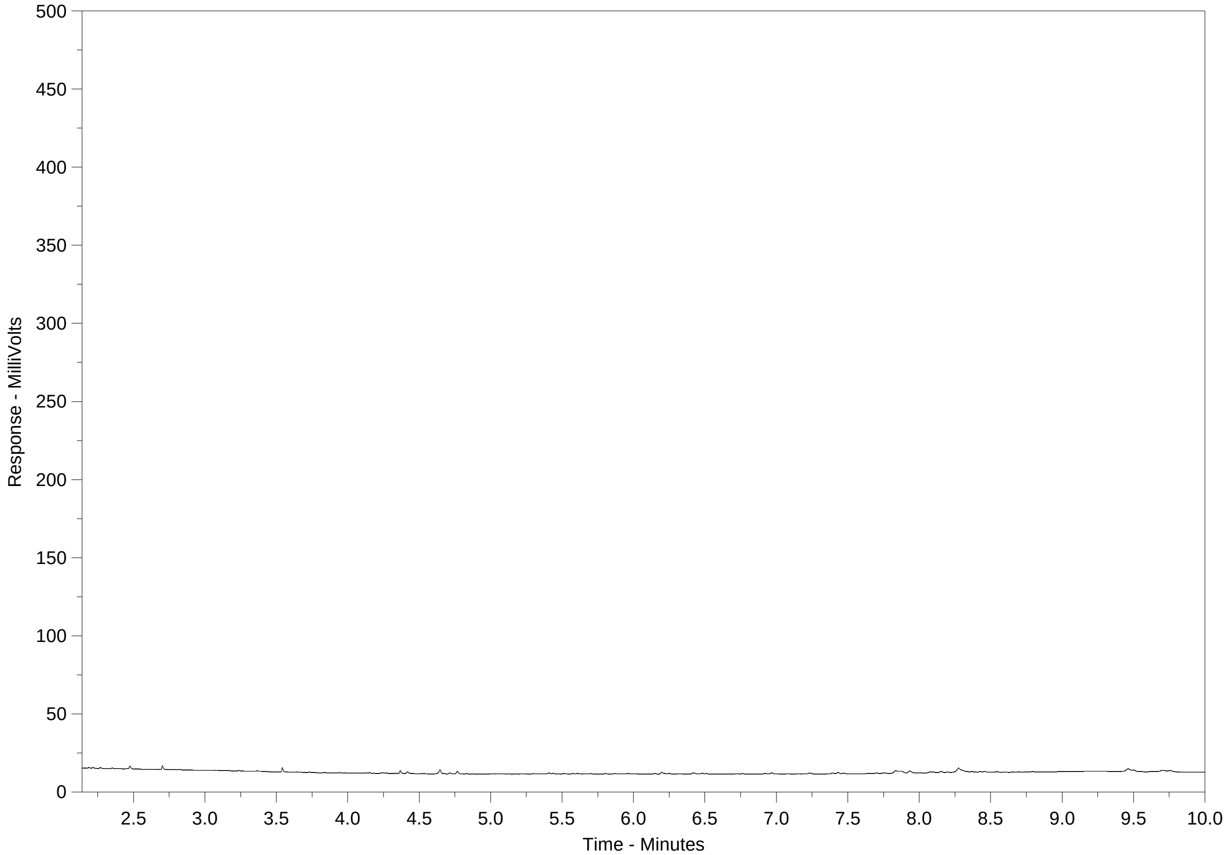
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the response scale at the left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Hydrocarbon Distribution Report

ALS Sample ID: L1815642-60
Client Sample ID: BBD-COMP



nC10	nC19	nC32
174°C 346°F	330°C 626°F	467°C 873°F
← Gasoline →	← Motor Oils / Lube Oils / Grease →	
← Diesel / Jet Fuels →		

The EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample. For further interpretation, a current library of reference products is available on www.alsglobal.com or upon request.

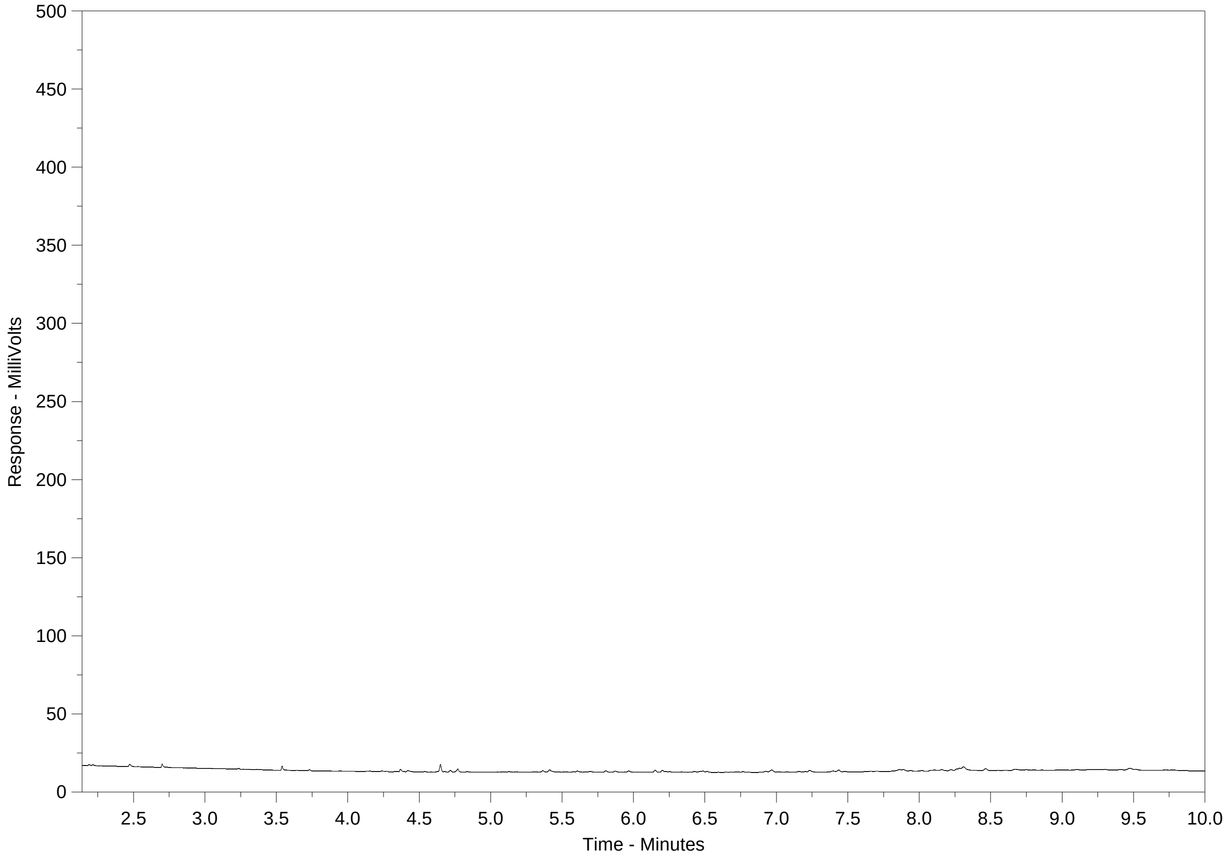
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the response scale at the left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

Hydrocarbon Distribution Report

ALS Sample ID: L1815642-66
Client Sample ID: CREMP DUP-COMP



nC10	nC19	nC32
174°C 346°F	330°C 626°F	467°C 873°F
← Gasoline →	← Motor Oils / Lube Oils / Grease →	
← Diesel / Jet Fuels →		

The EPH Hydrocarbon Distribution Report (HDR) is intended to assist you in characterizing hydrocarbon products that may be present in your sample. For further interpretation, a current library of reference products is available on www.alsglobal.com or upon request.

The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the response scale at the left.

A "-L-" in the sample ID denotes a low level sample. A "-S-" denotes a silica gel cleaned sample.

ALS Environmental

Chain of Custody (COC)

L1815642-COFC

COC #

Page 1 of 6

Report To	
Company:	Azimuth Consulting Group
Contact:	Eric Franz
Address:	218-2902 West Broadway
	Vancouver, BC V6K2G8
Phone:	604-730-1220 Fax:
Invoice To	Same as Report ? ☑ Yes ☐ No
Hardcopy of Invoice with Report?	☐ Yes ☑ No
Company:	
Contact:	
Address:	
Phone:	Fax:
Lab Work Order # (lab use only)	L1815642

Report Format	
☐ Standard ☐ Other	
☑ PDF ☑ Excel ☐ Digital ☐ Fax	
Email 1:	efranz@azimuthgroup.ca
Email 2:	gmann@azimuthgroup.ca
Email 3:	ryan.vanengen@agnicoeagle.com
Client / Project Information	
Job #:	CREMP Meadowbank Sediment
PO / AFE:	
LSD:	
Quote #:	Q38011
ALS Contact:	Brent Mack
Sampler:	Eric Franz

Service Requested (Rush for routine analysis subject to availability)

- ◉ Regular (Standard Turnaround Times - Business Days)
- ○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
- ○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
- ○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request

Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metals, pH, Moisture	TOC, Grain size	PAHs, LEPHs, HEPHs, MOG	Number of Containers
1	SP-1	03-AUG-16		Sediment	X	X		2
2	SP-2			Sediment	X	X		2
3	SP-3			Sediment	X	X		2
4	SP-4			Sediment	X	X		2
5	SP-5			Sediment	X	X		2
6	SP-COMP			Sediment			X	1
7	TPE-1	04-AUG-16		Sediment	X	X		2
8	TPE-2			Sediment	X	X		2
9	TPE-3			Sediment	X	X		2
10	TPE-4			Sediment	X	X		2
11	TPE-5			Sediment	X	X		2
12	TPE-COMP			Sediment			X	1

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Eric Franz	11-AUG-16	8:15	Sarah	Aug 19/16	11am	22,22,21 °C				

GENF 20.00 Front

ALS Environmental

Chain of C[...] Cana[...]

L1815642-COFC

COC #

Report To		Report Format /		Requested (Rush for routine analysis subject to availability)
Company:	Azimuth Consulting Group	☐ Standard ☐ Other		◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Eric Franz	☑ PDF ☑ Excel ☐ Digital ☐ Fax		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1:	efranz@azimuthgroup.ca	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6K2G8	Email 2:	gmann@azimuthgroup.ca	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax:	Email 3:	ryan.vanengen@agnicoeagle.com	Analysis Request
Invoice To	Same as Report ? ☑ Yes ☐ No	Client / Project Information		Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	CREMP Meadowbank Sediment	
Company:		PO / AFE:		
Contact:		LSD:		
Address:				
Phone:	Fax:	Quote #:	Q38011	
Lab Work Order # (lab use only)	L1815642	ALS Contact: Brent Mack	Sampler: Eric Franz	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metals, pH, Moisture	TOC, Grain size	PAHs, LEPHs, HEPHs, MOG	Number of Containers
13	TPN-1	04-AUG-16		Sediment	X	X		2
14	TPN-2	↓		Sediment	X	X		2
15	TPN-3			Sediment	X	X		2
16	TPN-4			Sediment	X	X		2
17	TPN-5			Sediment	X	X		2
18	TPN-COMP			Sediment			X	1
19	WAL-1	05-AUG-16		Sediment	X	X		2
20	WAL-2	↓		Sediment	X	X		2
21	WAL-3			Sediment	X	X		2
22	WAL-4			Sediment	X	X		2
23	WAL-5			Sediment	X	X		2
24	WAL-COMP			Sediment			X	1

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

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Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by: Eric Franz	Date (dd-mmm-yy)	Time (hh-mm)	Received by: Sarah	Date: Aug 18/16	Time: 11am	Temperature: 22, 22, 21 °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

GENF 20.00 Front

ALS Environmental

Chain of Custody
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www

L1815642-COFC

COC #

Report To		Report Format / Distribution		Service Requested (Rush for routine analysis subject to availability)
Company:	Azimuth Consulting Group	☐ Standard ☐ Other		◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Eric Franz	☑ PDF ☑ Excel ☐ Digital ☐ Fax		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1:	efranz@azimuthgroup.ca	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6K2G8	Email 2:	gmann@azimuthgroup.ca	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax:	Email 3:	ryan.vanengen@agnicoeagle.com	Analysis Request
Invoice To	Same as Report ? ☑ Yes ☐ No	Client / Project Information		Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	CREMP Meadowbank Sediment	
Company:		PO / AFE:		
Contact:		LSD:		
Address:				
Phone:	Fax:	Quote #:	Q38011	
Lab Work Order # (lab use only)	L1815642	ALS Contact: Brent Mack	Sampler: Eric Franz	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metals, pH, Moisture	TOC, Grain size	PAHs, LEPHs, HEPHs, MOG									Number of Containers
25	INUG-1	07-AUG-16		Sediment	X	X										2
26	INUG-2			Sediment	X	X										2
27	INUG-3			Sediment	X	X										2
28	INUG-4			Sediment	X	X										2
29	INUG-5			Sediment	X	X										2
30	INUG-COMP			Sediment			X									1
31	PDL-1	06-AUG-16		Sediment	X	X										2
32	PDL-2			Sediment	X	X										2
33	PDL-3			Sediment	X	X										2
34	PDL-4			Sediment	X	X										2
35	PDL-5			Sediment	X	X										2
36	PDL-COMP			Sediment			X									1

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

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SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by: Eric Franz	Date (dd-mmm-yy)	Time (hh-mm)	Received by: SE	Date: Ag 18/16	Time: 11am	Temperature: 22, 22, 21 °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

ALS Environmental

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Canada Toll Fr
www.als

L1815642-COFC

COC # ______

Report To		Report Format / Distribution		Service Requested (Rush for routine analysis subject to availability)
Company:	Azimuth Consulting Group	☐ Standard ☐ Other		◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Eric Franz	☑ PDF ☑ Excel ☐ Digital ☐ Fax		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1:	efranz@azimuthgroup.ca	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6K2G8	Email 2:	gmann@azimuthgroup.ca	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax:	Email 3:	ryan.vanengen@agnicoeagle.com	Analysis Request
Invoice To	Same as Report ? ☑ Yes ☐ No	Client / Project Information		Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	CREMP Meadowbank Sediment	
Company:		PO / AFE:		
Contact:		LSD:		
Address:				
Phone:	Fax:	Quote #:	Q38011	
Lab Work Order # (lab use only)	L1815642	ALS Contact: Brent Mack	Sampler: Eric Franz	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metals, pH, Moisture	TOC, Grain size	PAHs, LEPHs, HEPHs, MOG	Number of Containers
37	BAP-1	08-AUG-16		Sediment	X	X		2
38	BAP-2			Sediment	X	X		2
39	BAP-3			Sediment	X	X		2
40	BAP-4			Sediment	X	X		2
41	BAP-5			Sediment	X	X		2
42	BAP-COMP			Sediment			X	1
43	BES-1			Sediment	X	X		2
44	BES-2			Sediment	X	X		2
45	BES-3			Sediment	X	X		2
46	BES-4			Sediment	X	X		2
47	BES-5			Sediment	X	X		2
48	BES-COMP			Sediment			X	1

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

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Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by: Eric Franz	Date (dd-mmm-yy)	Time (hh-mm)	Received by: SG	Date: Aug 18/16	Time: 11am	Temperature: 22, 22, 21 °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

GENF 20.00 Front

Chain of Custody / Ar[illegible]
Canada Toll Fre[illegible]
www.als[illegible]

L1815642-COFC

COC #

ALS Environmental

Report To	
Company:	Azimuth Consulting Group
Contact:	Eric Franz
Address:	218-2902 West Broadway Vancouver, BC V6K2G8
Phone:	604-730-1220 Fax:
Invoice To	Same as Report ? ☑ Yes ☐ No
Hardcopy of Invoice with Report?	☐ Yes ☑ No
Company:	
Contact:	
Address:	
Phone:	Fax:
Lab Work Order # (lab use only)	L1815642

Report Format / Distribution	
☐ Standard ☐ Other	
☑ PDF ☑ Excel ☐ Digital ☐ Fax	
Email 1:	efranz@azimuthgroup.ca
Email 2:	gmann@azimuthgroup.ca
Email 3:	ryan.vanengen@agnicoeagle.com
Client / Project Information	
Job #:	CREMP Meadowbank Sediment
PO / AFE:	
LSD:	
Quote #:	Q38011
ALS Contact:	Brent Mack
Sampler:	Eric Franz

[illegible] (Rush for routine analysis subject to availability)
- ◉ Regular (Standard Turnaround Times - Business Days)
- ○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
- ○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
- ○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request
Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metals, pH, Moisture	TOC, Grain size	PAHs, LEPHs, HEPHs, MOG	Number of Containers
49	BPJ-1	09-AUG-16		Sediment	X	X		2
50	BPJ-2			Sediment	X	X		2
51	BPJ-3			Sediment	X	X		2
52	BPJ-4			Sediment	X	X		2
53	BPJ-5			Sediment	X	X		2
54	BPJ-COMP			Sediment			X	1
55	BBD-1			Sediment	X	X		2
56	BBD-2			Sediment	X	X		2
57	BBD-3			Sediment	X	X		2
58	BBD-4			Sediment	X	X		2
59	BBD-5			Sediment	X	X		2
60	BBD-COMP			Sediment			X	1

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by: Eric Franz	Date (dd-mmm-yy)	Time (hh-mm)	Received by: [illegible]	Date: Aug 13/16	Time: 9:11am	Temperature: 22, 22, 21 °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

ALS Environmental

Chain of Custody / An
Canada Toll Fre
www.alsg

L1815642-COFC

COC #

Report To		Report Format / Distribution		ush for routine analysis subject to availability)
Company:	Azimuth Consulting Group	☐ Standard ☐ Other		◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Eric Franz	☑ PDF ☑ Excel ☐ Digital ☐ Fax		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1:	efranz@azimuthgroup.ca	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6K2G8	Email 2:	gmann@azimuthgroup.ca	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax:	Email 3:	ryan.vanengen@agnicoeagle.com	**Analysis Request**
Invoice To	Same as Report ? ☑ Yes ☐ No	**Client / Project Information**		Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	CREMP Meadowbank Sediment	
Company:		PO / AFE:		
Contact:		LSD:		
Address:				
Phone:	Fax:	Quote #:	Q38011	
Lab Work Order # (lab use only)	L1815642	ALS Contact: Brent Mack	Sampler: Eric Franz	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metals, pH, Moisture	TOC, Grain size	PAHs, LEPHs, HEPHs, MOG	Total Metals									Number of Containers
61	CREMP DUP-1	–		Sediment	X	X											2
62	CREMP DUP-2	–		Sediment	X	X											2
63	CREMP DUP-3	–		Sediment	X	X											2
64	CREMP DUP-4	–		Sediment	X	X											2
65	CREMP DUP-5	–		Sediment	X	X											2
66	CREMP COMP DUP-1	—		Sediment			X										1
67	CREMP SWIPE-1	5-AUG-16		Sediment				X									1
68	CREMP SWIPE-2	5-AUG-16		Sediment				X									1
69	CREMP SWIPE-3	7-AUG-16		Sediment				X									1
70	CREMP SWIPE-4	8-AUG-16		Sediment				X									1
71	CREMP SWIPE-5	9-AUG-16		Sediment				X									1

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by: Eric Franz	Date (dd-mmm-yy)	Time (hh-mm)	Received by: 8E	Date: Aug 18, 2016	Time: 11am	Temperature: 22, 22, 21 °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

AZIMUTH CONSULTING GROUP INC.
ATTN: Eric Franz
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 12-SEP-16
Report Date: 23-SEP-16 13:36 (MT)
Version: FINAL

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1827203

Project P.O. #:	NOT SUBMITTED
Job Reference:	CREMP MEADOWBANK SURFACEWATER
C of C Numbers:	
Legal Site Desc:	

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1827203-1	L1827203-2	L1827203-3	L1827203-4	L1827203-5
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	02-SEP-16	02-SEP-16	03-SEP-16	03-SEP-16	03-SEP-16
	Sampled Time	17:27	16:05	07:31	07:55	08:48
	Client ID	BAP-48-S	BAP-47-S	BAJ-48-S	BAJ-47-S	BBD-47-S
Grouping	**Analyte**					
WATER						
Physical Tests	Hardness (as CaCO3) (mg/L)	15.8	14.1	12.6	11.9	10.1
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (mg/L)	0.212	0.210	0.205	0.222	0.216
	Phosphorus (P)-Total (mg/L)	0.0045	0.0045	0.0046	0.0069	0.0060
Cyanides	Cyanide, Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Cyanide, Free (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	3.18	3.34	3.43	3.42	3.34
	Total Organic Carbon (mg/L)	3.30	3.49	3.45	3.65	3.44
Total Metals	Aluminum (Al)-Total (mg/L)	0.0137	0.0148	0.0170	0.0158	0.0180
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00012	0.00012	0.00012	0.00011	0.00013
	Barium (Ba)-Total (mg/L)	0.0200	0.0205	0.0207	0.0211	0.0218
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Total (mg/L)	2.81	2.68	2.55	2.54	2.43
	Chromium (Cr)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Iron (Fe)-Total (mg/L)	0.023	0.025	0.025	0.024	0.027
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Total (mg/L)	0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)-Total (mg/L)	2.30	1.95	1.65	1.55	1.17
	Manganese (Mn)-Total (mg/L)	0.00307	0.00308	0.00303	0.00300	0.00303
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	0.000058	<0.000050	<0.000050	<0.000050	<0.000050
	Nickel (Ni)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	0.89	0.75	0.65	0.58	0.41
	Selenium (Se)-Total (mg/L)	<0.000050	0.000051	<0.000050	0.000056	<0.000050
	Silicon (Si)-Total (mg/L)	0.217	0.225	0.226	0.213	0.213
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	11.3	7.96	5.32	4.72	1.17
	Strontium (Sr)-Total (mg/L)	0.0237	0.0214	0.0196	0.0192	0.0172
	Sulfur (S)-Total (mg/L)	1.11	0.84	0.63	0.57	<0.50

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1827203-6	L1827203-7	L1827203-8	L1827203-9	L1827203-10
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	03-SEP-16	04-SEP-16	04-SEP-16	04-SEP-16	04-SEP-16
	Sampled Time	09:10	10:35	10:35	11:05	14:10
	Client ID	BBD-48-S	TPN-96-S	CREMP DUP-1	TPN-97-S	WAL-66-S
Grouping	**Analyte**					
WATER						
Physical Tests	Hardness (as CaCO3) (mg/L)	10.5	8.35	8.53	8.56	15.6
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (mg/L)	0.200	0.121	0.114	0.121	0.172
	Phosphorus (P)-Total (mg/L)	0.0044	<0.0020	0.0030	<0.0020	0.0027
Cyanides	Cyanide, Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Cyanide, Free (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	3.63	1.45	1.30	1.32	1.98
	Total Organic Carbon (mg/L)	3.40	1.41	1.23	1.29	2.51
Total Metals	Aluminum (Al)-Total (mg/L)	0.0208	0.0076	0.0063	0.0058	0.0074
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00012	0.00019	0.00019	0.00018	0.00031
	Barium (Ba)-Total (mg/L)	0.0219	0.00309	0.00315	0.00314	0.00237
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Total (mg/L)	2.42	2.19	2.21	2.18	4.59
	Chromium (Cr)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	0.00097
	Iron (Fe)-Total (mg/L)	0.028	<0.010	<0.010	<0.010	0.021
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)-Total (mg/L)	1.18	0.86	0.86	0.84	1.30
	Manganese (Mn)-Total (mg/L)	0.00321	0.00152	0.00142	0.00155	0.00240
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	<0.000050	0.000173	0.000181	0.000161	0.000321
	Nickel (Ni)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	0.44	0.55	0.52	0.54	0.53
	Selenium (Se)-Total (mg/L)	0.000060	<0.000050	0.000058	<0.000050	<0.000050
	Silicon (Si)-Total (mg/L)	0.213	0.070	0.077	0.083	0.326
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	1.41	1.21	1.25	1.20	0.681
	Strontium (Sr)-Total (mg/L)	0.0174	0.0102	0.0103	0.0101	0.0230
	Sulfur (S)-Total (mg/L)	<0.50	1.55	1.54	1.66	1.45

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1827203-11	L1827203-12	L1827203-13	L1827203-14	L1827203-15
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	04-SEP-16	05-SEP-16	05-SEP-16	05-SEP-16	06-SEP-16
	Sampled Time	15:15	13:52	14:38	14:38	17:00
	Client ID	WAL-65-S	SP-96-S	SP-97-S	CREMP DUP-2	CREMP EB-1
WATER						
Physical Tests	Hardness (as CaCO3) (mg/L)	15.8	13.7	13.1	13.6	<0.50
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050			
	Total Kjeldahl Nitrogen (mg/L)	0.177	0.152			
	Phosphorus (P)-Total (mg/L)	0.0024	0.0021			
Cyanides	Cyanide, Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Cyanide, Free (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	1.89	1.57			
	Total Organic Carbon (mg/L)	2.00	1.56			
Total Metals	Aluminum (Al)-Total (mg/L)	0.0068	0.0083	0.0076	0.0098	<0.0030
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00033	0.00027	0.00026	0.00027	<0.00010
	Barium (Ba)-Total (mg/L)	0.00238	0.00258	0.00269	0.00262	RRV 0.000137
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Total (mg/L)	4.57	3.79	3.64	3.69	0.074
	Chromium (Cr)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Total (mg/L)	0.00097	0.00062	0.00063	0.00074	<0.00050
	Iron (Fe)-Total (mg/L)	0.021	0.020	0.023	0.017	<0.010
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)-Total (mg/L)	1.28	1.19	1.14	1.15	<0.10
	Manganese (Mn)-Total (mg/L)	0.00210	0.00166	0.00167	0.00189	<0.00010
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	0.000343	0.000177	0.000179	0.000179	<0.000050
	Nickel (Ni)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	0.54	0.53	0.53	0.50	<0.10
	Selenium (Se)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)-Total (mg/L)	0.289	0.218	0.206	0.204	0.051
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	0.692	0.889	0.908	0.918	<0.050
	Strontium (Sr)-Total (mg/L)	0.0228	0.0171	0.0178	0.0177	RRV 0.00029
	Sulfur (S)-Total (mg/L)	1.50	1.58	1.53	1.51	<0.50

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1827203-16
	Description	Surface Water
	Sampled Date	06-SEP-16
	Sampled Time	17:15
	Client ID	CREMP DI-1
Grouping	**Analyte**	
WATER		
Physical Tests	Hardness (as CaCO3) (mg/L)	<0.50
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	
	Total Kjeldahl Nitrogen (mg/L)	
	Phosphorus (P)-Total (mg/L)	
Cyanides	Cyanide, Total (mg/L)	<0.0010
	Cyanide, Free (mg/L)	<0.0010
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	
	Total Organic Carbon (mg/L)	
Total Metals	Aluminum (Al)-Total (mg/L)	<0.0030
	Antimony (Sb)-Total (mg/L)	<0.00010
	Arsenic (As)-Total (mg/L)	<0.00010
	Barium (Ba)-Total (mg/L)	<0.000050
	Beryllium (Be)-Total (mg/L)	<0.000020
	Bismuth (Bi)-Total (mg/L)	<0.000050
	Boron (B)-Total (mg/L)	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.0000050
	Calcium (Ca)-Total (mg/L)	<0.050
	Chromium (Cr)-Total (mg/L)	<0.00010
	Cobalt (Co)-Total (mg/L)	<0.00010
	Copper (Cu)-Total (mg/L)	<0.00050
	Iron (Fe)-Total (mg/L)	<0.010
	Lead (Pb)-Total (mg/L)	<0.000050
	Lithium (Li)-Total (mg/L)	<0.0010
	Magnesium (Mg)-Total (mg/L)	<0.10
	Manganese (Mn)-Total (mg/L)	<0.00010
	Mercury (Hg)-Total (mg/L)	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	<0.000050
	Nickel (Ni)-Total (mg/L)	<0.00050
	Phosphorus (P)-Total (mg/L)	<0.050
	Potassium (K)-Total (mg/L)	<0.10
	Selenium (Se)-Total (mg/L)	<0.000050
	Silicon (Si)-Total (mg/L)	<0.050
	Silver (Ag)-Total (mg/L)	<0.000010
	Sodium (Na)-Total (mg/L)	<0.050
	Strontium (Sr)-Total (mg/L)	<0.00020
	Sulfur (S)-Total (mg/L)	<0.50

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1827203-1	L1827203-2	L1827203-3	L1827203-4	L1827203-5
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	02-SEP-16	02-SEP-16	03-SEP-16	03-SEP-16	03-SEP-16
	Sampled Time	17:27	16:05	07:31	07:55	08:48
	Client ID	BAP-48-S	BAP-47-S	BAJ-48-S	BAJ-47-S	BBD-47-S
Grouping	**Analyte**					
WATER						
Total Metals	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Total (mg/L)	0.000044	0.000042	0.000044	0.000042	0.000046
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0084	0.0064	0.0068	0.0065	0.0072
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	<0.00010	0.00010	<0.00010	0.00011	<0.00010
	Barium (Ba)-Dissolved (mg/L)	0.0198	0.0198	0.0198	0.0197	0.0204
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)		<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Dissolved (mg/L)	2.63	2.53	2.44	2.36	2.25
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Dissolved (mg/L)	0.00031	0.00026	0.00025	0.00023	0.00026
	Iron (Fe)-Dissolved (mg/L)	0.011	0.010	0.011	0.010	0.012
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	0.000118	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	0.0011	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)-Dissolved (mg/L)	2.23	1.89	1.58	1.46	1.08
	Manganese (Mn)-Dissolved (mg/L)	0.00055	0.00044	0.00055	0.00045	0.00065
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	0.000051	<0.000050	<0.000050	<0.000050	<0.000050
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	0.77	0.65	0.56	0.51	0.38
	Selenium (Se)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)-Dissolved (mg/L)	0.165	0.164	0.163	0.155	0.140
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	11.4	7.70	4.85	4.29	1.11
	Strontium (Sr)-Dissolved (mg/L)	0.0236	0.0208	0.0187	0.0184	0.0162
	Sulfur (S)-Dissolved (mg/L)	1.18	0.85	0.64	0.57	<0.50

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1827203-6	L1827203-7	L1827203-8	L1827203-9	L1827203-10
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	03-SEP-16	04-SEP-16	04-SEP-16	04-SEP-16	04-SEP-16
	Sampled Time	09:10	10:35	10:35	11:05	14:10
	Client ID	BBD-48-S	TPN-96-S	CREMP DUP-1	TPN-97-S	WAL-66-S
Grouping	**Analyte**					
WATER						
Total Metals	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	0.00063	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Total (mg/L)	0.000047	0.000035	0.000036	0.000036	0.000056
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0077	0.0021	0.0023	0.0021	0.0023
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00011	0.00014	0.00015	0.00015	0.00027
	Barium (Ba)-Dissolved (mg/L)	0.0203	0.00312	0.00306	0.00300	0.00221
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Dissolved (mg/L)	2.32	2.03	2.06	2.07	4.26
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010	0.00029	<0.00010	<0.00010
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Dissolved (mg/L)	0.00025	0.00031	0.00033	0.00037	0.00080
	Iron (Fe)-Dissolved (mg/L)	0.013	<0.010	<0.010	<0.010	<0.010
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)-Dissolved (mg/L)	1.13	0.80	0.83	0.82	1.20
	Manganese (Mn)-Dissolved (mg/L)	0.00075	0.00043	0.00048	0.00046	0.00036
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	<0.000050	0.000163	0.000152	0.000158	0.000309
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	0.39	0.43	0.44	0.47	0.43
	Selenium (Se)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)-Dissolved (mg/L)	0.137	<0.050	<0.050	<0.050	0.253
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	1.45	1.16	1.15	1.15	0.654
	Strontium (Sr)-Dissolved (mg/L)	0.0167	0.0103	0.00972	0.00983	0.0220
	Sulfur (S)-Dissolved (mg/L)	<0.50	1.60	1.56	1.62	1.48

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1827203-11	L1827203-12	L1827203-13	L1827203-14	L1827203-15
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	04-SEP-16	05-SEP-16	05-SEP-16	05-SEP-16	06-SEP-16
	Sampled Time	15:15	13:52	14:38	14:38	17:00
	Client ID	WAL-65-S	SP-96-S	SP-97-S	CREMP DUP-2	CREMP EB-1
WATER						
Total Metals	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Total (mg/L)	0.000058	0.000044	0.000046	0.000046	<0.000010
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0023	0.0020	0.0020	0.0026	0.0019 RRV
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00027	0.00023	0.00022	0.00024	<0.00010
	Barium (Ba)-Dissolved (mg/L)	0.00220	0.00257	0.00255	0.00249	0.000098 RRV
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Dissolved (mg/L)	4.30	3.61	3.49	3.60	<0.050
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Dissolved (mg/L)	0.00083	0.00056	0.00054	0.00055	<0.00020
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)-Dissolved (mg/L)	1.23	1.13	1.07	1.11	<0.10
	Manganese (Mn)-Dissolved (mg/L)	0.00044	0.00031	0.00035	0.00035	0.00018 RRV
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	0.000317	0.000174	0.000171	0.000167	<0.000050
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	0.47	0.47	0.43	0.47	<0.10
	Selenium (Se)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)-Dissolved (mg/L)	0.255	0.157	0.149	0.158	<0.050
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	0.651	0.840	0.848	0.847	<0.050
	Strontium (Sr)-Dissolved (mg/L)	0.0221	0.0170	0.0170	0.0170	<0.00020
	Sulfur (S)-Dissolved (mg/L)	1.56	1.55	1.53	1.55	<0.50

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID / Description / Sampled Date / Sampled Time / Client ID				
	Sample ID	L1827203-16				
	Description	Surface Water				
	Sampled Date	06-SEP-16				
	Sampled Time	17:15				
	Client ID	CREMP DI-1				
Grouping	**Analyte**					
WATER						
Total Metals	Thallium (Tl)-Total (mg/L)	<0.000010				
	Tin (Sn)-Total (mg/L)	<0.00010				
	Titanium (Ti)-Total (mg/L)	<0.00030				
	Uranium (U)-Total (mg/L)	<0.000010				
	Vanadium (V)-Total (mg/L)	<0.00050				
	Zinc (Zn)-Total (mg/L)	<0.0030				
	Zirconium (Zr)-Total (mg/L)	<0.00030				
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD				
	Dissolved Metals Filtration Location	FIELD				
	Aluminum (Al)-Dissolved (mg/L)	<0.0010				
	Antimony (Sb)-Dissolved (mg/L)	<0.00010				
	Arsenic (As)-Dissolved (mg/L)	<0.00010				
	Barium (Ba)-Dissolved (mg/L)	<0.000050				
	Beryllium (Be)-Dissolved (mg/L)	<0.000020				
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050				
	Boron (B)-Dissolved (mg/L)	<0.010				
	Cadmium (Cd)-Dissolved (mg/L)	<0.0000050				
	Calcium (Ca)-Dissolved (mg/L)	<0.050				
	Chromium (Cr)-Dissolved (mg/L)	<0.00010				
	Cobalt (Co)-Dissolved (mg/L)	<0.00010				
	Copper (Cu)-Dissolved (mg/L)	<0.00020				
	Iron (Fe)-Dissolved (mg/L)	<0.010				
	Lead (Pb)-Dissolved (mg/L)	<0.000050				
	Lithium (Li)-Dissolved (mg/L)	<0.0010				
	Magnesium (Mg)-Dissolved (mg/L)	<0.10				
	Manganese (Mn)-Dissolved (mg/L)	<0.00010				
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050				
	Molybdenum (Mo)-Dissolved (mg/L)	<0.000050				
	Nickel (Ni)-Dissolved (mg/L)	<0.00050				
	Phosphorus (P)-Dissolved (mg/L)	<0.050				
	Potassium (K)-Dissolved (mg/L)	<0.10				
	Selenium (Se)-Dissolved (mg/L)	<0.000050				
	Silicon (Si)-Dissolved (mg/L)	<0.050				
	Silver (Ag)-Dissolved (mg/L)	<0.000010				
	Sodium (Na)-Dissolved (mg/L)	<0.050				
	Strontium (Sr)-Dissolved (mg/L)	<0.00020				
	Sulfur (S)-Dissolved (mg/L)	<0.50				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1827203-1	L1827203-2	L1827203-3	L1827203-4	L1827203-5
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	02-SEP-16	02-SEP-16	03-SEP-16	03-SEP-16	03-SEP-16
	Sampled Time	17:27	16:05	07:31	07:55	08:48
	Client ID	BAP-48-S	BAP-47-S	BAJ-48-S	BAJ-47-S	BBD-47-S
Grouping	**Analyte**					
WATER						
Dissolved Metals	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Dissolved (mg/L)	0.000038	0.000041	0.000038	0.000039	0.000039
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	0.0038	<0.0010	<0.0010	<0.0010	<0.0010
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1827203-6	L1827203-7	L1827203-8	L1827203-9	L1827203-10
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	03-SEP-16	04-SEP-16	04-SEP-16	04-SEP-16	04-SEP-16
	Sampled Time	09:10	10:35	10:35	11:05	14:10
	Client ID	BBD-48-S	TPN-96-S	CREMP DUP-1	TPN-97-S	WAL-66-S
Grouping	**Analyte**					
WATER						
Dissolved Metals	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Dissolved (mg/L)	0.000041	0.000030	0.000029	0.000029	0.000046
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010	0.0012	0.0021	<0.0010
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1827203-11 Surface Water 04-SEP-16 15:15 WAL-65-S	L1827203-12 Surface Water 05-SEP-16 13:52 SP-96-S	L1827203-13 Surface Water 05-SEP-16 14:38 SP-97-S	L1827203-14 Surface Water 05-SEP-16 14:38 CREMP DUP-2	L1827203-15 Surface Water 06-SEP-16 17:00 CREMP EB-1
Grouping	**Analyte**					
WATER						
Dissolved Metals	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Dissolved (mg/L)	0.000048	0.000039	0.000038	0.000037	<0.000010
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	0.0011	<0.0010	<0.0010	<0.0010	<0.0010
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1827203-16				
	Description	Surface Water				
	Sampled Date	06-SEP-16				
	Sampled Time	17:15				
	Client ID	CREMP DI-1				
Grouping	**Analyte**					
WATER						
Dissolved Metals	Thallium (Tl)-Dissolved (mg/L)	<0.000010				
	Tin (Sn)-Dissolved (mg/L)	<0.00010				
	Titanium (Ti)-Dissolved (mg/L)	<0.00030				
	Uranium (U)-Dissolved (mg/L)	<0.000010				
	Vanadium (V)-Dissolved (mg/L)	<0.00050				
	Zinc (Zn)-Dissolved (mg/L)	<0.0010				
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

Qualifiers for Sample Submission Listed:

Qualifier	Description
WSMT	Water sample(s) for total mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low.
WSMD	Water sample(s) for dissolved mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low.

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Total Organic Carbon	MS-B	L1827203-11, -12
Matrix Spike	Total Organic Carbon	MS-B	L1827203-1

Qualifiers for Individual Parameters Listed:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BE-D-L-CCMS-VA	Water	Diss. Be (low) in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

BE-T-L-CCMS-VA	Water	Total Be (Low) in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.

CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

CN-FREE-L-CFA-VA	Water	Low Level Free Cyanide in water by CFA	ASTM 7237

This analysis is carried out using procedures adapted from ASTM Method 7237 "Free Cyanide with Flow Injection Analysis (FIA) Utilizing Gas Diffusion Separation and Amperometric Detection". Free cyanide is determined by in-line gas diffusion at pH 6 with final determination by colourimetric analysis.

CN-T-L-CFA-VA	Water	Low Level Total Cyanide in water by CFA	ISO 14403:2002

This analysis is carried out using procedures adapted from ISO Method 14403:2002 "Determination of Total Cyanide using Flow Analysis (FIA and CFA)". Total or strong acid dissociable (SAD) cyanide is determined by in-line UV digestion along with sample distillation and final determination by colourimetric analysis. Method Limitation: This method is susceptible to interference from thiocyanate (SCN). If SCN is present in the sample, there could be a positive interference with this method, but it would be less than 1% and could be as low as zero.

HARDNESS-CALC-VA	Water	Hardness	APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in $CaCO_3$ equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-D-CVAA-VA	Water	Diss. Mercury in Water by CVAAS or CVAFS	APHA 3030B/EPA 1631E (mod)

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

HG-T-CVAA-VA	Water	Total Mercury in Water by CVAAS or CVAFS	EPA 1631E (mod)

Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-DIS-LOW-ICP-VA	Water	Dissolved Metals in Water by ICPOES	EPA 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United

Reference Information

States Environmental Protection Agency (EPA). The procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

MET-T-CCMS-VA Water Total Metals in Water by CRC ICPMS EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-TOT-LOW-ICP-VA Water Total Metals in Water by ICPOES EPA 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

NH3-F-VA Water Ammonia in Water by Fluorescence APHA 4500 NH3-NITROGEN (AMMONIA)

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NH3-F-VA Water Ammonia in Water by Fluorescence J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

P-T-PRES-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

S-DIS-ICP-VA Water Dissolved Sulfur in Water by ICPOES EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

S-TOT-ICP-VA Water Total Sulfur in Water by ICPOES EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

TKN-F-VA Water TKN in Water by Fluorescence APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

ALS Environmental

Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

COC #

Report To	
Company:	Azimuth Consulting Group
Contact:	Eric Franz
Address:	218-2902 West Broadway
	Vancouver, BC V6K2G8
Phone:	604-730-1220 Fax:
Invoice To	Same as Report ? ☑ Yes ☐ No
Hardcopy of Invoice with Report?	☐ Yes ☑ No
Company:	
Contact:	
Address:	
Phone:	
[redacted] Lab Work (lab use	L1827203-COFC

Report Format / Distribution	
☐ Standard ☐ Other	
☐ PDF ☐ Excel ☐ Digital ☐ Fax	
Email 1:	efranz@azimuthgroup.ca
Email 2:	gmann@azimuthgroup.ca
Email 3:	ryan.vanengen@agnicoeagle.com
Client / Project Information	
Job #:	CREMP Meadowbank Surfacewater
PO / AFE:	
LSD:	
Quote #:	Q39503
ALS Contact:	Sampler:

Service Requested (Rush for routine analysis subject to availability)

- ◉ Regular (Standard Turnaround Times - Business Days)
- ○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
- ○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
- ○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request

Please indicate below Filtered, Preserved or both (F, P, F/P)

Short Holding Time

Rush Processing

[redacted] Sample # [redacted]	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Conventionals** see notes	TSS-Low, TDS-Low	Number of Containers
[redacted]	BAP-48-S	02-Sep-16	17:27	Surface Water	X	X	2
[redacted]	BAP-47-S	02-Sep-16	16:05	Surface Water	X	X	2
[redacted]	BPJ-48-S	03-Sep-16	7:31	Surface Water	X	X	2
[redacted]	BPJ-47-S	03-Sep-16	7:55	Surface Water	X	X	2
[redacted]	BBD-47-S	03-Sep-16	8:48	Surface Water	X	X	2
[redacted]	BBD-48-S	03-Sep-16	9:10	Surface Water	X	X	2
[redacted]	TPN-96-S	04-Sep-16	10:35	Surface Water	X	X	2
[redacted]	CREMP DUP 1	04-Sep-16	10:35	Surface Water	X	X	2
[redacted]	TPN-97-S	04-Sep-16	11:05	Surface Water	X	X	2
[redacted]	WAL-66-S	04-Sep-16	14:10	Surface Water	X	X	2
[redacted]	WAL-65-S	04-Sep-16	15:15	Surface Water	X	X	2
[redacted]							

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

**Conventionals includes: Alk Species, pH, EC, Turbidity, Conductivity, Anions (F, NO2, NO3, Br, SO4), low-level Chloride, Silicate, TD-P, and Ortho-PO4.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

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Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by: Tom T	Date (dd-mmm-yy) 6-Sep-16	Time (hh-mm) 9:00	Received by:	Date:	Time:	Temperature: 18 °C	Verified by: DJ	Date: Sep 12/16	Time: 11:45	Observations: Yes / No ? If Yes add SIF

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

ALS Environmental

COC #

Report To		Report Format / Distribution		Service Requested (Rush for routine analysis subject to availability)
Company:	Azimuth Consulting Group	☐ Standard ☐ Other		◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Eric Franz	☐ PDF ☐ Excel ☐ Digital ☐ Fax		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1:	efranz@azimuthgroup.ca	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6K2G8	Email 2:	gmann@azimuthgroup.ca	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax:	Email 3:	ryan.vanengen@agnicoeagle.com	Analysis Request
Invoice To	Same as Report ? ☑ Yes ☐ No	Client / Project Information		Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	CREMP Meadowbank Surfacewater	
Company:		PO / AFE:		
Contact:		LSD:		
Address:				
Phone:		Quote #:	Q39503	
Lab W[redacted] (lab [redacted]	L1827203-COFC	ALS Contact:	Sampler:	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Conventionals** see notes	TSS-Low, TDS-Low											Number of Containers
[redacted]	SP-96-S	05-Sep-16	13:52	Surface Water	X	X											2
[redacted]	SP-97-S	05-Sep-16	14:38	Surface Water	X	X											2
[redacted]	CREMP DUP 2	05-Sep-16	14:38	Surface Water	X	X											2
[redacted]	CREMP EB-1	06-Sep-16	17:00	Surface Water	X	X											2
[redacted]	CREMP DI-1	06-Sep-16	17:15	Surface Water	X	X											2

Short Holding Time

Rush Processing

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

**Conventionals includes: Alk Species, pH, EC, Turbidity, Conductivity, Anions (F, NO2, NO3, Br, SO4), low-level Chloride, Silicate, TD-P, and Ortho-PO4.

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Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Tom T	7-Sep-16	9:00				18 °C	DJ	Sep 12/16	1:45	

GENF 20.00 Front

ALS Environmental

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC # ______

Report To	
Company:	Azimuth Consulting Group
Contact:	Eric Franz
Address:	218-2902 West Broadway
	Vancouver, BC V6K2G8
Phone:	604-730-1220 Fax:
Invoice To	Same as Report ? ☑ Yes ☐ No
Hardcopy of Invoice with Report?	☐ Yes ☑ No
Company:	
Contact:	
Address:	
Phone:	
[redacted] Lab Work ([redacted] (lab use	L1827203-COFC

Report Format / Distribution	
☐ Standard ☐ Other	
☐ PDF ☐ Excel ☐ Digital ☐ Fax	
Email 1:	efranz@azimuthgroup.ca
Email 2:	gmann@azimuthgroup.ca
Email 3:	ryan.vanengen@agnicoeagle.com
Client / Project Information	
Job #:	CREMP Meadowbank Surfacewater
PO / AFE:	
LSD:	
Quote #:	Q39503
ALS Contact:	Sampler:

Service Requested (Rush for routine analysis subject to availability)

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Analysis Request

Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TOC, Ammonia, TKN, Total P (P)	DOC (F/P)	T-CN (Low), Free CN (Low) (P)	Total mercury (P)	Dissolved mercury (F/P)	Total Metals (P)	Dissolved Metals (F/P)						Number of Containers
[redacted]	BAP-48-S	02-Sep-16	17:27	Surface Water	X	X	X	X	X	X	X						7
[redacted]	BAP-47-S	02-Sep-16	16:05	Surface Water	X	X	X	X	X	X	X						7
[redacted]	BPJ-48-S	03-Sep-16	7:31	Surface Water	X	X	X	X	X	X	X						7
[redacted]	BPJ-47-S	03-Sep-16	7:55	Surface Water	X	X	X	X	X	X	X						7
[redacted]	BBD-47-S	03-Sep-16	8:48	Surface Water	X	X	X	X	X	X	X						7
[redacted]	BBD-48-S	03-Sep-16	9:10	Surface Water	X	X	X	X	X	X	X						7
[redacted]	TPN-96-S	04-Sep-16	10:35	Surface Water	X	X	X	X	X	X	X						7
[redacted]	CREMP DUP 1	04-Sep-16	10:35	Surface Water	X	X	X	X	X	X	X						7
[redacted]	TPN-97-S	04-Sep-16	11:05	Surface Water	X	X	X	X	X	X	X						7
[redacted]	WAL-66-S	04-Sep-16	14:10	Surface Water	X	X	X	X	X	X	X						7
[redacted]	WAL-65-S	04-Sep-16	15:15	Surface Water	X	X	X	X	X	X	X						7
[redacted]																	

Short Holding Time

Rush Processing

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

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Released by: Tom T	Date (dd-mmm-yy) 7-Sep-16	Time (hh-mm) 9:00	Received by:	Date:	Time:	Temperature: 18 °C	Verified by: DJ	Date: Sep 12/16	Time: 11:45	Observations: Yes / No ? If Yes add SIF

ALS Environmental

Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

COC # ____________

Page 2 of 2

Report To		Report Format / Distribution	
Company:	Azimuth Consulting Group	☐ Standard ☐ Other	
Contact:	Eric Franz	☐ PDF ☐ Excel ☐ Digital ☐ Fax	
Address:	218-2902 West Broadway	Email 1:	efranz@azimuthgroup.ca
	Vancouver, BC V6K2G8	Email 2:	gmann@azimuthgroup.ca
Phone:	604-730-1220 Fax:	Email 3:	ryan.vanengen@agnicoeagle.com
Invoice To	Same as Report ? ☑ Yes ☐ No	**Client / Project Information**	
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	CREMP Meadowbank Surfacewater
Company:		PO / AFE:	
Contact:		LSD:	
Address:			
Phone:		Quote #:	Q39503
[redacted] Lab Wor[redacted] (lab us	L1827203-COFC	ALS Contact:	Sampler:

Service Requested (Rush for routine analysis subject to availability)

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Analysis Request

Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TOC, Ammonia, TKN, Total P (P)	DOC (F/P)	T-CN (Low), Free CN (Low) (P)	Total mercury (P)	Dissolved mercury (F/P)	Total Metals (P)	Dissolved Metals (F/P)						Number of Containers
[redacted]	SP-96-S	05-Sep-16	13:52	Surface Water	X	X	X	X	X	X	X						7
[redacted]	SP-97-S	05-Sep-16	14:38	Surface Water	X	X	X	X	X	X	X						7
[redacted]	CREMP DUP 2	05-Sep-16	14:38	Surface Water	X	X	X	X	X	X	X						7
[redacted]	CREMP EB-1	06-Sep-16	17:00	Surface Water	X	X	X	X	X	X	X						7
[redacted]	CREMP DI-1	06-Sep-16	17:15	Surface Water	X	X	X	X	X	X	X						4
[redacted]																	

Short Holding Time

Rush Processing

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

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Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Tom T	7-Sep-16	9:00				18 °C	D	9/12/16	11:45	

GENF 20.00 Front

AZIMUTH CONSULTING GROUP INC.
ATTN: Eric Franz
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 13-SEP-16
Report Date: 20-SEP-16 16:13 (MT)
Version: FINAL

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1828508

Project P.O. #: NOT SUBMITTED
Job Reference: CREMP MEADOWBANK SURFACEWATER
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1828508-1	L1828508-2	L1828508-3	L1828508-4	L1828508-5
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	02-SEP-16	02-SEP-16	03-SEP-16	03-SEP-16	03-SEP-16
	Sampled Time	17:27	16:05	07:31	07:55	08:48
	Client ID	BAP-48-S	BAP-47-S	BPJ-48-S	BPJ-47-S	BBD-47-S
WATER						
Physical Tests	Conductivity (uS/cm)	94.9	73.2	53.9	50.5	27.9
	pH (pH)	7.11	7.08	7.11	7.10	7.14
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Total Dissolved Solids (mg/L)	71	63	38	38	23.3
	Turbidity (NTU)	0.34	0.30	0.32	0.30	0.34
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	8.6	8.6	8.7	8.8	8.9
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	8.6	8.6	8.7	8.8	8.9
	Bromide (Br) (mg/L)	0.076	0.056	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	20.4	14.5	9.50	8.40	2.25
	Fluoride (F) (mg/L)	0.051	0.050	0.049	0.048	0.047
	Nitrate (as N) (mg/L)	0.0167	0.0167	0.0185	0.0197	0.0180
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Silicate (as SiO2) (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Sulfate (SO4) (mg/L)	3.22	2.37	1.66	1.50	0.67

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1828508-6	L1828508-7	L1828508-8	L1828508-9	L1828508-10
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	03-SEP-16	04-SEP-16	04-SEP-16	04-SEP-16	04-SEP-16
	Sampled Time	09:10	10:35	10:35	11:05	14:10
	Client ID	BBD-48-S	TPN-96-S	CREMP DUP 1	TPN-97-S	WAL-66-S
WATER						
Physical Tests	Conductivity (uS/cm)	32.1	26.6	27.1	26.4	38.1
	pH (pH)	7.11	7.02	7.00	7.02	7.32
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Total Dissolved Solids (mg/L)	22.0	20.1	18.9	20.4	30.3
	Turbidity (NTU)	0.37	0.25	0.27	0.26	0.33
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	9.2	6.6	6.2	6.2	13.3
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	9.2	6.6	6.2	6.2	13.3
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	3.40	0.72	0.71	0.71	0.77
	Fluoride (F) (mg/L)	0.047	0.066	0.065	0.065	0.051
	Nitrate (as N) (mg/L)	0.0170	0.0373	0.0387	0.0375	0.0172
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Silicate (as SiO2) (mg/L)	<0.50	<0.50	<0.50	<0.50	0.56
	Sulfate (SO4) (mg/L)	0.83	4.57	4.56	4.56	4.25

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1828508-11	L1828508-12	L1828508-13	L1828508-14
	Description	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	04-SEP-16	05-SEP-16	05-SEP-16	05-SEP-16
	Sampled Time	15:15	13:52	14:38	14:38
	Client ID	WAL-65-S	SP-96-S	SP-97-S	CREMP DUP2
Grouping	**Analyte**				
WATER					
Physical Tests	Conductivity (uS/cm)	39.4	34.5	34.6	35.8
	pH (pH)	7.30	7.26	7.25	7.27
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0
	Total Dissolved Solids (mg/L)	30.6	24.8	24.6	24.6
	Turbidity (NTU)	0.34	0.26	0.26	0.26
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	13.5	11.1	11.0	11.1
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	13.5	11.1	11.0	11.1
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	0.78	0.82	0.82	0.82
	Fluoride (F) (mg/L)	0.052	0.068	0.069	0.069
	Nitrate (as N) (mg/L)	0.0272	<0.0050	<0.0050	<0.0050
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020
	Silicate (as SiO2) (mg/L)	0.52	<0.50	<0.50	<0.50
	Sulfate (SO4) (mg/L)	4.38	4.34	4.33	4.33

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Nitrate (as N)	MS-B	L1828508-1, -10, -11, -12, -13, -14, -2, -3, -4, -5, -6, -7, -8, -9

Qualifiers for Individual Parameters Listed:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

CL-L-IC-N-VA	Water	Chloride in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-TD-COL-VA	Water	Total Dissolved P in Water by Colour	APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

PH-PCT-VA	Water	pH by Meter (Automated)	APHA 4500-H "pH Value"

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PH-PCT-VA	Water	pH by Meter (Automated)	APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PO4-DO-COL-VA	Water	Diss. Orthophosphate in Water by Colour	APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

SILICATE-COL-VA	Water	Silicate by Colourimetric analysis	APHA 4500-SiO2 E.

This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.

SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-LOW-VA	Water	Low Level TDS (3.0mg/L) by Gravimetric	APHA 2540C

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total dissolved solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TSS-LOW-VA	Water	Total Suspended Solids by Grav. (1 mg/L)	APHA 2540D

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.

Reference Information

Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 "Turbidity"

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Short Holding Time
Rush Processing

ALS Environmental

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC #

Report To	
Company:	Azimuth Consulting Group
Contact:	Eric Franz
Address:	218-2902 West Broadway, Vancouver, BC V6K2G8
Phone:	604-730-1220 Fax:
Invoice To	Same as Report ? ☑ Yes ☐ No
Hardcopy of Invoice with Report?	☐ Yes ☑ No
Company:	
Contact:	
Address:	
Phone:	
Lab Work Order # (lab use only)	L1828508-COFC

Report Format / Distribution

☐ Standard ☐ Other
☐ PDF ☐ Excel ☐ Digital ☐ Fax

Email 1: efranz@azimuthgroup.ca
Email 2: gmann@azimuthgroup.ca
Email 3: ryan.vanengen@agnicoeagle.com

Client / Project Information

Job #: CREMP Meadowbank Surfacewater
PO / AFE:
LSD:
Quote #: Q39503
ALS Contact:
Sampler:

Service Requested (Rush for routine analysis subject to availability)

◉ Regular (Standard Turnaround Times - Business Days)
○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request

Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Conventionals** see notes	TSS-Low, TDS-Low	Number of Containers
	BAP-48-S	02-Sep-16	17:27	Surface Water	X	X	2
	BAP-47-S	02-Sep-16	16:05	Surface Water	X	X	2
	BPJ-48-S	03-Sep-16	7:31	Surface Water	X	X	2
	BPJ-47-S	03-Sep-16	7:55	Surface Water	X	X	2
	BBD-47-S	03-Sep-16	8:48	Surface Water	X	X	2
	BBD-48-S	03-Sep-16	9:10	Surface Water	X	X	2
	TPN-96-S	04-Sep-16	10:35	Surface Water	X	X	2
	CREMP DUP 1	04-Sep-16	10:35	Surface Water	X	X	2
	TPN-97-S	04-Sep-16	11:05	Surface Water	X	X	2
	WAL-66-S	04-Sep-16	14:10	Surface Water	X	X	2
	WAL-65-S	04-Sep-16	15:15	Surface Water	X	X	2

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

**Conventionals includes: Alk Species, pH, EC, Turbidity, Conductivity, Anions (F, NO2, NO3, Br, SO4), low-level Chloride, Silicate, TD-P, and Ortho-PO4.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Tom T	6-Sep-16	9:00		Sep13	1135	16 °C				

ALS Environmental

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC #

Report To	
Company:	Azimuth Consulting Group
Contact:	Eric Franz
Address:	218-2902 West Broadway
	Vancouver, BC V6K2G8
Phone:	604-730-1220 Fax:
Invoice To	Same as Report ? ☑ Yes ☐ No
Hardcopy of Invoice with Report?	☐ Yes ☑ No
Company:	
Contact:	
Address:	
Phone:	
Lab Work (lab use	L1828508-COFC

Report Format / Distribution	
☐ Standard ☐ Other	
☐ PDF ☐ Excel ☐ Digital ☐ Fax	
Email 1:	efranz@azimuthgroup.ca
Email 2:	gmann@azimuthgroup.ca
Email 3:	ryan.vanengen@agnicoeagle.com
Client / Project Information	
Job #:	CREMP Meadowbank Surfacewater
PO / AFE:	
LSD:	
Quote #:	Q39503
ALS Contact:	Sampler:

Service Requested (Rush for routine analysis subject to availability)
- ◉ Regular (Standard Turnaround Times - Business Days)
- ○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
- ○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
- ○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request
Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Conventionals** see notes	TSS-Low, TDS-Low											Number of Containers
	SP-96-S	05-Sep-16	13:52	Surface Water	X	X											2
	SP-97-S	05-Sep-16	14:38	Surface Water	X	X											2
	CREMP DUP 2	05-Sep-16	14:38	Surface Water	X	X											2
	CREMP EB-1	06-Sep-16	17:00	Surface Water	X	X											2
	CREMP DI-1	06-Sep-16	17:15	Surface Water	X	X											2

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

**Conventionals includes: Alk Species, pH, EC, Turbidity, Conductivity, Anions (F, NO2, NO3, Br, SO4), low-level Chloride, Silicate, TD-P, and Ortho-PO4.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Tom T	7-Sep-16	9:00	JC	13/9/16	11:35	16 °C				

WHITE - LABORATORY COPY

GENF 20.00 Front

AZIMUTH CONSULTING GROUP INC.
ATTN: Eric Franz
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 15-SEP-16
Report Date: 27-SEP-16 14:39 (MT)
Version: FINAL

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1829511

Project P.O. #: NOT SUBMITTED
Job Reference: CREMP MEADOWBANK SURFACEWATER
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1829511-17	L1829511-18	L1829511-19	L1829511-20	L1829511-21
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	07-SEP-16	07-SEP-16	08-SEP-16	08-SEP-16	08-SEP-16
	Sampled Time	10:53	11:30	09:18	09:47	09:05
	Client ID	INUG-85-S	INUG-84-S	PDL-49-S	PDL-50-S	TPE-97-S
Grouping	**Analyte**					
WATER						
Physical Tests	Hardness (as CaCO3) (mg/L)	5.41	5.36	8.34	8.39	9.77
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (mg/L)	0.122	<0.050	<0.050	0.093	0.103
	Phosphorus (P)-Total (mg/L)	0.0021	0.0023	0.0021	0.0023	0.0023
Cyanides	Cyanide, Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Cyanide, Free (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	1.79	1.71	1.36	1.48	1.21
	Total Organic Carbon (mg/L)	1.71	1.52	1.38	1.47	1.34
Total Metals	Aluminum (Al)-Total (mg/L)	0.0094	0.0100	0.0074	0.0061	0.0112
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00011	0.00011	0.00017	0.00018	0.00045
	Barium (Ba)-Total (mg/L)	0.00187	0.00185	0.00212	0.00215	0.00307
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Total (mg/L)	1.08	1.14	2.20	2.17	2.51
	Chromium (Cr)-Total (mg/L)	0.00010	<0.00010	0.00011	<0.00010	<0.00010
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Total (mg/L)	<0.00050	<0.00050	0.00080	<0.00050	<0.00050
	Iron (Fe)-Total (mg/L)	0.015	0.026	<0.010	<0.010	0.014
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)-Total (mg/L)	0.67	0.70	0.77	0.77	0.95
	Manganese (Mn)-Total (mg/L)	0.00203	0.00206	0.00157	0.00155	0.00120
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	0.000143
	Nickel (Ni)-Total (mg/L)	<0.00050	<0.00050	0.0103	0.00065	0.00051
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	0.33	0.39	0.33	0.30	0.48
	Selenium (Se)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)-Total (mg/L)	0.159	0.175	0.152	0.151	0.099
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	0.625	0.604	0.530	0.531	1.17
	Strontium (Sr)-Total (mg/L)	0.00668	0.00663	0.00945	0.00947	0.0117
	Sulfur (S)-Total (mg/L)	<0.50	<0.50	0.65	0.62	1.69

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1829511-22				
	Description	Surface Water				
	Sampled Date	08-SEP-16				
	Sampled Time	09:55				
	Client ID	TPE-96-S				
Grouping	**Analyte**					
WATER						
Physical Tests	Hardness (as CaCO3) (mg/L)	9.72				
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	<0.0050				
	Total Kjeldahl Nitrogen (mg/L)	0.086				
	Phosphorus (P)-Total (mg/L)	<0.0020				
Cyanides	Cyanide, Total (mg/L)	<0.0010				
	Cyanide, Free (mg/L)	<0.0010				
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	1.10				
	Total Organic Carbon (mg/L)	1.18				
Total Metals	Aluminum (Al)-Total (mg/L)	0.0093				
	Antimony (Sb)-Total (mg/L)	<0.00010				
	Arsenic (As)-Total (mg/L)	0.00045				
	Barium (Ba)-Total (mg/L)	0.00319				
	Beryllium (Be)-Total (mg/L)	<0.000020				
	Bismuth (Bi)-Total (mg/L)	<0.000050				
	Boron (B)-Total (mg/L)	<0.010				
	Cadmium (Cd)-Total (mg/L)	<0.0000050				
	Calcium (Ca)-Total (mg/L)	2.51				
	Chromium (Cr)-Total (mg/L)	<0.00010				
	Cobalt (Co)-Total (mg/L)	<0.00010				
	Copper (Cu)-Total (mg/L)	<0.00050				
	Iron (Fe)-Total (mg/L)	0.011				
	Lead (Pb)-Total (mg/L)	<0.000050				
	Lithium (Li)-Total (mg/L)	<0.0010				
	Magnesium (Mg)-Total (mg/L)	0.94				
	Manganese (Mn)-Total (mg/L)	0.00120				
	Mercury (Hg)-Total (mg/L)	<0.0000050				
	Molybdenum (Mo)-Total (mg/L)	0.000150				
	Nickel (Ni)-Total (mg/L)	0.00051				
	Phosphorus (P)-Total (mg/L)	<0.050				
	Potassium (K)-Total (mg/L)	0.47				
	Selenium (Se)-Total (mg/L)	<0.000050				
	Silicon (Si)-Total (mg/L)	0.087				
	Silver (Ag)-Total (mg/L)	<0.000010				
	Sodium (Na)-Total (mg/L)	1.19				
	Strontium (Sr)-Total (mg/L)	0.0121				
	Sulfur (S)-Total (mg/L)	1.61				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1829511-17	L1829511-18	L1829511-19	L1829511-20	L1829511-21
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	07-SEP-16	07-SEP-16	08-SEP-16	08-SEP-16	08-SEP-16
	Sampled Time	10:53	11:30	09:18	09:47	09:05
	Client ID	INUG-85-S	INUG-84-S	PDL-49-S	PDL-50-S	TPE-97-S
Grouping	**Analyte**					
WATER						
Total Metals	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	0.00033
	Uranium (U)-Total (mg/L)	0.000045	0.000042	0.000023	0.000022	0.000045
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0028	0.0027	0.0021	0.0020	0.0026
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	<0.00010	<0.00010	0.00017	0.00013	0.00041
	Barium (Ba)-Dissolved (mg/L)	0.00176	0.00177	0.00206	0.00208	0.00314
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Dissolved (mg/L)	1.08	1.06	2.11	2.13	2.41
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Dissolved (mg/L)	0.00033	0.00032	0.00040	0.00041	0.00036
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)-Dissolved (mg/L)	0.66	0.66	0.75	0.75	0.91
	Manganese (Mn)-Dissolved (mg/L)	0.00022	0.00036	0.00018	0.00021	0.00042
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	0.000125
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	<0.00050	0.00059	0.00058	<0.00050
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	0.41	0.37	0.34	0.33	0.47
	Selenium (Se)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)-Dissolved (mg/L)	0.112	0.107	0.103	0.102	<0.050
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	0.592	0.599	0.518	0.510	1.16
	Strontium (Sr)-Dissolved (mg/L)	0.00630	0.00631	0.00906	0.00899	0.0116
	Sulfur (S)-Dissolved (mg/L)	<0.50	<0.50	0.60	0.62	1.58

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1829511-22				
	Description	Surface Water				
	Sampled Date	08-SEP-16				
	Sampled Time	09:55				
	Client ID	TPE-96-S				
Grouping	**Analyte**					
WATER						
Total Metals	Thallium (Tl)-Total (mg/L)	<0.000010				
	Tin (Sn)-Total (mg/L)	<0.00010				
	Titanium (Ti)-Total (mg/L)	<0.00030				
	Uranium (U)-Total (mg/L)	0.000045				
	Vanadium (V)-Total (mg/L)	<0.00050				
	Zinc (Zn)-Total (mg/L)	0.0056				
	Zirconium (Zr)-Total (mg/L)	<0.00030				
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD				
	Dissolved Metals Filtration Location	FIELD				
	Aluminum (Al)-Dissolved (mg/L)	0.0025				
	Antimony (Sb)-Dissolved (mg/L)	<0.00010				
	Arsenic (As)-Dissolved (mg/L)	0.00043				
	Barium (Ba)-Dissolved (mg/L)	0.00314				
	Beryllium (Be)-Dissolved (mg/L)	<0.000020				
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050				
	Boron (B)-Dissolved (mg/L)	<0.010				
	Cadmium (Cd)-Dissolved (mg/L)	<0.0000050				
	Calcium (Ca)-Dissolved (mg/L)	2.40				
	Chromium (Cr)-Dissolved (mg/L)	<0.00010				
	Cobalt (Co)-Dissolved (mg/L)	<0.00010				
	Copper (Cu)-Dissolved (mg/L)	0.00037				
	Iron (Fe)-Dissolved (mg/L)	<0.010				
	Lead (Pb)-Dissolved (mg/L)	<0.000050				
	Lithium (Li)-Dissolved (mg/L)	<0.0010				
	Magnesium (Mg)-Dissolved (mg/L)	0.91				
	Manganese (Mn)-Dissolved (mg/L)	0.00036				
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050				
	Molybdenum (Mo)-Dissolved (mg/L)	0.000129				
	Nickel (Ni)-Dissolved (mg/L)	<0.00050				
	Phosphorus (P)-Dissolved (mg/L)	<0.050				
	Potassium (K)-Dissolved (mg/L)	0.45				
	Selenium (Se)-Dissolved (mg/L)	<0.000050				
	Silicon (Si)-Dissolved (mg/L)	<0.050				
	Silver (Ag)-Dissolved (mg/L)	<0.000010				
	Sodium (Na)-Dissolved (mg/L)	1.15				
	Strontium (Sr)-Dissolved (mg/L)	0.0114				
	Sulfur (S)-Dissolved (mg/L)	1.59				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1829511-17	L1829511-18	L1829511-19	L1829511-20	L1829511-21
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	07-SEP-16	07-SEP-16	08-SEP-16	08-SEP-16	08-SEP-16
	Sampled Time	10:53	11:30	09:18	09:47	09:05
	Client ID	INUG-85-S	INUG-84-S	PDL-49-S	PDL-50-S	TPE-97-S
Grouping	**Analyte**					
WATER						
Dissolved Metals	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Dissolved (mg/L)	0.000033	0.000032	0.000019	0.000018	0.000036
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1829511-22				
	Description	Surface Water				
	Sampled Date	08-SEP-16				
	Sampled Time	09:55				
	Client ID	TPE-96-S				
Grouping	**Analyte**					
WATER						
Dissolved Metals	Thallium (Tl)-Dissolved (mg/L)	<0.000010				
	Tin (Sn)-Dissolved (mg/L)	0.00011				
	Titanium (Ti)-Dissolved (mg/L)	<0.00030				
	Uranium (U)-Dissolved (mg/L)	0.000035				
	Vanadium (V)-Dissolved (mg/L)	<0.00050				
	Zinc (Zn)-Dissolved (mg/L)	<0.0010				
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Dissolved Organic Carbon	MS-B	L1829511-18, -19, -20, -21, -22
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1829511-17, -18, -19, -20, -21, -22
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1829511-17, -18, -19, -20, -21, -22
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1829511-17, -18, -19, -20, -21, -22
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1829511-17, -18, -19, -20, -21, -22
Matrix Spike	Boron (B)-Dissolved	MS-B	L1829511-17, -18, -19, -20, -21, -22
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1829511-17, -18, -19, -20, -21, -22
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1829511-17, -18, -19, -20, -21, -22
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1829511-17, -18, -19, -20, -21, -22
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1829511-17, -18, -19, -20, -21, -22
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1829511-17, -18, -19, -20, -21, -22
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1829511-17, -18, -19, -20, -21, -22
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1829511-17, -18, -19, -20, -21, -22
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1829511-17, -18, -19, -20, -21, -22
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1829511-17, -18, -19, -20, -21, -22
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1829511-17, -18, -19, -20, -21, -22
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1829511-17, -18, -19, -20, -21, -22
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1829511-17, -18, -19, -20, -21, -22
Matrix Spike	Silicon (Si)-Total	MS-B	L1829511-17, -18, -19, -20, -21, -22
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1829511-17, -18, -19, -20, -21, -22

Qualifiers for Individual Parameters Listed:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BE-D-L-CCMS-VA	Water	Diss. Be (low) in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

BE-T-L-CCMS-VA	Water	Total Be (Low) in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.

CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

CN-FREE-L-CFA-VA	Water	Low Level Free Cyanide in water by CFA	ASTM 7237

This analysis is carried out using procedures adapted from ASTM Method 7237 "Free Cyanide with Flow Injection Analysis (FIA) Utilizing Gas Diffusion Separation and Amperometric Detection". Free cyanide is determined by in-line gas diffusion at pH 6 with final determination by colourimetric analysis.

CN-T-L-CFA-VA	Water	Low Level Total Cyanide in water by CFA	ISO 14403:2002

This analysis is carried out using procedures adapted from ISO Method 14403:2002 "Determination of Total Cyanide using Flow Analysis (FIA and CFA)". Total or strong acid dissociable (SAD) cyanide is determined by in-line UV digestion along with sample distillation and final determination by colourimetric analysis. Method Limitation: This method is susceptible to interference from thiocyanate (SCN). If SCN is present in the sample, there could be a positive interference with this method, but it would be less than 1% and could be as low as zero.

HARDNESS-CALC-VA	Water	Hardness	APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-D-CVAA-VA	Water	Diss. Mercury in Water by CVAAS or CVAFS	APHA 3030B/EPA 1631E (mod)

Reference Information

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

HG-T-CVAA-VA	Water	Total Mercury in Water by CVAAS or CVAFS	EPA 1631E (mod)

Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-DIS-LOW-ICP-VA	Water	Dissolved Metals in Water by ICPOES	EPA 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-TOT-LOW-ICP-VA	Water	Total Metals in Water by ICPOES	EPA 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

NH3-F-VA	Water	Ammonia in Water by Fluorescence	APHA 4500 NH3-NITROGEN (AMMONIA)

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

P-T-PRES-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

S-DIS-ICP-VA	Water	Dissolved Sulfur in Water by ICPOES	EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

S-TOT-ICP-VA	Water	Total Sulfur in Water by ICPOES	EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

Method Limitation: This method will not give total sulfur results for all samples. Sulfide or other volatile forms of sulfur that may be present in submitted samples, is often lost during the sampling, preservation and analysis process. The data reported as total and/or dissolved sulfur represents all non-volatile forms of sulfur present in a particular sample.

TKN-F-VA	Water	TKN in Water by Fluorescence	APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

Reference Information

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

L1829511-COFC

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC # ______

Page 1 of 2

Report To		Report Format / Distribution		Service Requested (Rush for routine analysis subject to availability)
Company:	Azimuth Consulting Group	☐ Standard ☐ Other		◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Eric Franz	☐ PDF ☐ Excel ☐ Digital ☐ Fax		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1:	efranz@azimuthgroup.ca	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6K2G8	Email 2:	gmann@azimuthgroup.ca	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax:	Email 3:	ryan.vanengen@agnicoeagle.com	**Analysis Request**
Invoice To	Same as Report ? ☑ Yes ☐ No	Client / Project Information		Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	CREMP Meadowbank Surfacewater	
Company:		PO / AFE:		
Contact:		LSD:		
Address:				
Phone:	Fax:	Quote #:	Q39503	
Lab Work Order # (lab use only)	[redacted]	ALS Contact:	Sampler:	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TOC, Ammonia, TKN, Total P (P)	DOC (F/P)	T-CN (Low), Free CN (Low) (P)	Total mercury (P)	Dissolved mercury (F/P)	Total Metals (P)	Dissolved Metals (F/P)						Number of Containers
[redacted]	BAP-48-S	02-Sep-16	17:27	Surface Water	X	X	X	X	X	X	X						7
[redacted]	BAP-47-S	02-Sep-16	16:05	Surface Water	X	X	X	X	X	X	X						7
[redacted]	BPJ-48-S	03-Sep-16	7:31	Surface Water	X	X	X	X	X	X	X						7
[redacted]	BPJ-47-S	03-Sep-16	7:55	Surface Water	X	X	X	X	X	X	X						7
[redacted]	BBD-47-S	03-Sep-16	8:48	Surface Water	X	X	X	X	X	X	X						7
[redacted]	BBD-48-S	03-Sep-16	9:10	Surface Water	X	X	X	X	X	X	X						7
[redacted]	TPN-96-S	04-Sep-16	10:35	Surface Water	X	X	X	X	X	X	X						7
[redacted]	CREMP DUP 1	04-Sep-16	10:35	Surface Water	X	X	X	X	X	X	X						7
[redacted]	TPN-97-S	04-Sep-16	11:05	Surface Water	X	X	X	X	X	X	X						7
[redacted]	WAL-66-S	04-Sep-16	14:10	Surface Water	X	X	X	X	X	X	X						7
[redacted]	WAL-65-S	04-Sep-16	15:15	Surface Water	X	X	X	X	X	X	X						7
[redacted]																	

Short Holding Time
Rush Processing

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by: Tom T	Date (dd-mmm-yy) 7-Sep-16	Time (hh-mm) 9:00	Received by: SG	Date: Sept 8/16	Time: 8:30am	Temperature: 16,16 °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

L1829511-COFC

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC #

Report To		Report Format / Distribution		Service Requested (Rush for routine analysis subject to availability)
Company:	Azimuth Consulting Group	☐ Standard ☐ Other		◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Eric Franz	☐ PDF ☐ Excel ☐ Digital ☐ Fax		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1:	efranz@azimuthgroup.ca	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6K2G8	Email 2:	gmann@azimuthgroup.ca	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax:	Email 3:	ryan.vanengen@agnicoeagle.com	
Invoice To	Same as Report ? ☑ Yes ☐ No	Client / Project Information		
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	CREMP Meadowbank Surfacewater	
Company:		PO / AFE:		
Contact:		LSD:		
Address:				
Phone:	Fax:	Quote #:	Q39503	
Lab Work Order # (lab use only)	[redacted]	ALS Contact:	Sampler:	

Analysis Request — Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TOC, Ammonia, TKN, Total P (P)	DOC (F/P)	T-CN (Low), Free CN (Low) (P)	Total mercury (P)	Dissolved mercury (F/P)	Total Metals (P)	Dissolved Metals (F/P)						Number of Containers
[redacted]	SP-96-S	05-Sep-16	13:52	Surface Water	X	X	X	X	X	X	X						7
[redacted]	SP-97-S	05-Sep-16	14:38	Surface Water	X	X	X	X	X	X	X						7
[redacted]	CREMP DUP 2	05-Sep-16	14:38	Surface Water	X	X	X	X	X	X	X						7
[redacted]	CREMP EB-1	06-Sep-16	17:00	Surface Water	X	X	X	X	X	X	X						7
[redacted]	CREMP DI-1	06-Sep-16	17:15	Surface Water	X	X	X	X	X	X	X						7
[redacted]	INUG-85-S	07-Sep-16	10:53	Surface Water	X	X	X	X	X	X	X						7
[redacted]	INUG-84-S	07-Sep-16	11:30	Surface Water	X	X	X	X	X	X	X						7
[redacted]	PDL-49-S	08-Sep-16	9:18	Surface Water	X	X	X	X	X	X	X						7
[redacted]	PDL-50-S	08-Sep-16	9:47	Surface Water	X	X	X	X	X	X	X						7
[redacted]	TPE-97-S	11-Sep-16	9:05	Surface Water	X	X	X	X	X	X	X						7
[redacted]	TPE-96-S	11-Sep-16	9:55	Surface Water	X	X	X	X	X	X	X						7
[redacted]																	

Short Holding Time
Rush Processing

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

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Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Tom T	12-Sep-16	9:00	SS	Sept [illegible]/16	8:30am	16,16 °C				

AZIMUTH CONSULTING GROUP INC.
ATTN: Eric Franz
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 15-SEP-16
Report Date: 23-SEP-16 13:32 (MT)
Version: FINAL

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1829521

Project P.O. #: NOT SUBMITTED
Job Reference: CREMP MEADOWBANK SURFACEWATER
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1829521-1	L1829521-2	L1829521-3	L1829521-4	L1829521-5
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	02-SEP-16	02-SEP-16	03-SEP-16	03-SEP-16	03-SEP-16
	Sampled Time	17:27	16:05	07:31	07:55	08:48
	Client ID	BAP-48-S	BAP-47-S	BPJ-48-S	BPJ-47-S	BBD-47-S
Grouping	**Analyte**					
FILTER						
Plant Pigments	Chlorophyll a (ug/L)	1.75	1.79	1.48	1.41	1.02

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1829521-6	L1829521-7	L1829521-8	L1829521-9	L1829521-10
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	03-SEP-16	04-SEP-16	04-SEP-16	04-SEP-16	04-SEP-16
	Sampled Time	09:10	10:35	10:35	11:05	14:10
	Client ID	BBD-48-S	TPN-96-S	CREMP DUP 1	TPN-97-S	WAL-66-S
Grouping	**Analyte**					
FILTER						
Plant Pigments	Chlorophyll a (ug/L)	1.06	0.639	0.636	0.610	1.04

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1829521-11 Surface Water 04-SEP-16 15:15 WAL-65-S	L1829521-12 Surface Water 05-SEP-16 13:52 SP-96-S	L1829521-13 Surface Water 05-SEP-16 14:38 SP-97-S	L1829521-14 Surface Water 05-SEP-16 14:38 CREMP DUP 2	L1829521-17 Surface Water 07-SEP-16 10:53 INUG-85-S
Grouping	**Analyte**					
FILTER						
Plant Pigments	Chlorophyll a (ug/L)	0.819	0.771	0.772	0.682	0.488

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1829521-18	L1829521-19	L1829521-20	L1829521-21	L1829521-22
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	07-SEP-16	08-SEP-16	08-SEP-16	11-SEP-16	11-SEP-16
	Sampled Time	11:30	09:18	09:47	09:05	09:55
	Client ID	INUG-84-S	PDL-49-S	PDL-50-S	TPE-97-S	TPE-96-S
Grouping	**Analyte**					
FILTER						
Plant Pigments	Chlorophyll a (ug/L)	0.452	0.490	0.446	0.428	0.444

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1829521-15	L1829521-16	L1829521-17	L1829521-18	L1829521-19
	Description	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
	Sampled Date	06-SEP-16	06-SEP-16	07-SEP-16	07-SEP-16	08-SEP-16
	Sampled Time	17:00	17:15	10:53	11:30	09:18
	Client ID	CREMP EB-1	CREMP-DI-1	INUG-85-S	INUG-84-S	PDL-49-S
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	<2.0	<2.0	15.3	15.1	20.7
	pH (pH)	5.61	5.41	6.83	6.87	7.07
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Total Dissolved Solids (mg/L)	<3.0	<3.0	14.6	14.0	16.6
	Turbidity (NTU)	0.17	<0.10	0.31	0.31	0.26
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	<1.0	<1.0	5.2	5.2	7.6
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	<1.0	<1.0	5.2	5.2	7.6
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	<0.10	<0.10	0.75	0.76	0.61
	Fluoride (F) (mg/L)	<0.020	<0.020	0.064	0.063	0.037
	Nitrate (as N) (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Silicate (as SiO2) (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Sulfate (SO4) (mg/L)	<0.30	<0.30	0.83	0.84	1.59

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1829521-20 Surface Water 08-SEP-16 09:47 PDL-50-S	L1829521-21 Surface Water 11-SEP-16 09:05 TPE-97-S	L1829521-22 Surface Water 11-SEP-16 09:55 TPE-96-S		
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	21.0	27.9	28.7		
	pH (pH)	7.07	7.03	7.04		
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0		
	Total Dissolved Solids (mg/L)	18.2	21.1	21.9		
	Turbidity (NTU)	0.22	0.39	0.29		
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	7.7	7.4	7.4		
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0		
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0		
	Alkalinity, Total (as CaCO3) (mg/L)	7.7	7.4	7.4		
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050		
	Chloride (Cl) (mg/L)	0.61	0.71	0.70		
	Fluoride (F) (mg/L)	0.039	0.077	0.077		
	Nitrate (as N) (mg/L)	<0.0050	<0.0050	<0.0050		
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010		
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	<0.0010		
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020	<0.0020	<0.0020		
	Silicate (as SiO2) (mg/L)	<0.50	<0.50	<0.50		
	Sulfate (SO4) (mg/L)	1.59	4.52	4.52		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Nitrate (as N)	MS-B	L1829521-15, -16, -17, -18, -19, -20, -21, -22

Qualifiers for Individual Parameters Listed:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

CHLOROA-F-VA	Filter	Chlorophyll a by Fluorometer (Filter)	EPA 445.0

This analysis is done using procedures modified from EPA Method 445.0. Chlorophyll-a is determined by a routine acetone extraction followed with analysis by fluorometry using the non-acidification procedure. This method is not subject to interferences from chlorophyll b.

CL-L-IC-N-VA	Water	Chloride in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-TD-COL-VA	Water	Total Dissolved P in Water by Colour	APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

PH-PCT-VA	Water	pH by Meter (Automated)	APHA 4500-H "pH Value"

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PH-PCT-VA	Water	pH by Meter (Automated)	APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PO4-DO-COL-VA	Water	Diss. Orthophosphate in Water by Colour	APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

SILICATE-COL-VA	Water	Silicate by Colourimetric analysis	APHA 4500-SiO2 E.

This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.

SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-LOW-VA	Water	Low Level TDS (3.0mg/L) by Gravimetric	APHA 2540C

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total dissolved solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TSS-LOW-VA	Water	Total Suspended Solids by Grav. (1 mg/L)	APHA 2540D

Reference Information

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.
Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 "Turbidity"

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS
Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

ALS Environmental

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC # ____________

Report To		Report Format / Distribution		Service Requested (Rush for routine analysis subject to availability)
Company:	Azimuth Consulting Group	☐ Standard ☐ Other		◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Eric Franz	☐ PDF ☐ Excel ☐ Digital ☐ Fax		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1:	efranz@azimuthgroup.ca	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6K2G8	Email 2:	gmann@azimuthgroup.ca	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax:	Email 3:	ryan.vanengen@agnicoeagle.com	
Invoice To	Same as Report ? ☑ Yes ☐ No	Client / Project Information		
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	CREMP Meadowbank Surfacewater	
Company:		PO / AFE:		
Contact:		LSD:		
Address:				
Phone:	Fax:	Quote #:	Q39503	
[redacted] Lab Work Order # (lab use only)	[redacted]	ALS Contact:	Sampler:	

Analysis Request

Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Conventionals** see notes	TSS-Low, TDS-Low	Number of Containers
[redacted]	BAP-48-S	02-Sep-16	17:27	Surface Water	X	X	2
[redacted]	BAP-47-S	02-Sep-16	16:05	Surface Water	X	X	2
[redacted]	BPJ-48-S	03-Sep-16	7:31	Surface Water	X	X	2
[redacted]	BPJ-47-S	03-Sep-16	7:55	Surface Water	X	X	2
[redacted]	BBD-47-S	03-Sep-16	8:48	Surface Water	X	X	2
[redacted]	BBD-48-S	03-Sep-16	9:10	Surface Water	X	X	2
[redacted]	TPN-96-S	04-Sep-16	10:35	Surface Water	X	X	2
[redacted]	CREMP DUP 1	04-Sep-16	10:35	Surface Water	X	X	2
[redacted]	TPN-97-S	04-Sep-16	11:05	Surface Water	X	X	2
[redacted]	WAL-66-S	04-Sep-16	14:10	Surface Water	X	X	2
[redacted]	WAL-65-S	04-Sep-16	15:15	Surface Water	X	X	2
[redacted]							

L1829521-COFC

Short Holding Time
Rush Processing

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

**Conventionals includes: Alk Species, pH, EC, Turbidity, Conductivity, Anions (F, NO2, NO3, Br, SO4), low-level Chloride, Silicate, TD-P, and Ortho-PO4.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Tom T	6-Sep-16	9:00	SE	Sept 15/16	8:30am	16, 16 °C				

ALS Environmental

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC #

Report To	
Company:	Azimuth Consulting Group
Contact:	Eric Franz
Address:	218-2902 West Broadway
	Vancouver, BC V6K2G8
Phone:	604-730-1220 Fax:
Invoice To	Same as Report ? ☑ Yes ☐ No
Hardcopy of Invoice with Report?	☐ Yes ☑ No
Company:	
Contact:	
Address:	
Phone:	Fax:
[redacted] Lab Work Order # (lab use only)	[redacted]

Report Format / Distribution	
☐ Standard ☐ Other	
☐ PDF ☐ Excel ☐ Digital ☐ Fax	
Email 1:	efranz@azimuthgroup.ca
Email 2:	gmann@azimuthgroup.ca
Email 3:	ryan.vanengen@agnicoeagle.com
Client / Project Information	
Job #:	CREMP Meadowbank Surfacewater
PO / AFE:	
LSD:	
Quote #:	Q39503
ALS Contact:	Sampler:

Service Requested (Rush for routine analysis subject to availability)

- ◉ Regular (Standard Turnaround Times - Business Days)
- ○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
- ○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
- ○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request

Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Conventionals** see notes	TSS-Low, TDS-Low	Number of Containers
[redacted]	SP-96-S	05-Sep-16	13:52	Surface Water	X	X	2
[redacted]	SP-97-S	05-Sep-16	14:38	Surface Water	X	X	2
[redacted]	CREMP DUP 2	05-Sep-16	14:38	Surface Water	X	X	2
[redacted]	CREMP EB-1	06-Sep-16	17:00	Surface Water	X	X	2
[redacted]	CREMP DI-1	06-Sep-16	17:15	Surface Water	X	X	2
[redacted]	INUG-85-S	07-Sep-16	10:53	Surface Water	X	X	2
[redacted]	INUG-84-S	07-Sep-16	11:30	Surface Water	X	X	2
[redacted]	PDL-49-S	08-Sep-16	9:18	Surface Water	X	X	2
[redacted]	PDL-50-S	08-Sep-16	9:47	Surface Water	X	X	2
[redacted]	TPE-97-S	11-Sep-16	9:05	Surface Water	X	X	2
[redacted]	TPE-96-S	11-Sep-16	9:55	Surface Water	X	X	2
[redacted]							

L1829521-COFC

Short Holding Time
Rush Processing

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

**Conventionals includes: Alk Species, pH, EC, Turbidity, Conductivity, Anions (F, NO2, NO3, Br, SO4), low-level Chloride, Silicate, TD-P, and Ortho-PO4.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Tom T	12-Sep-16	9:00	SE	Sept 15/16	8:30am	16/16 °C				

AZIMUTH CONSULTING GROUP INC.
ATTN: Eric Franz
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 12-DEC-16
Report Date: 22-DEC-16 16:49 (MT)
Version: FINAL

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1868891

Project P.O. #: NOT SUBMITTED
Job Reference: CREMP MEADOWBANK SURFACEWATER
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1868891-1	L1868891-2	L1868891-3	L1868891-4	L1868891-5
	Description	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE
	Sampled Date	25-NOV-16	25-NOV-16	27-NOV-16	27-NOV-16	30-NOV-16
	Sampled Time	10:46	13:41	10:20	10:57	10:07
	Client ID	SP-98-S	SP-99-S	TPE-98-S	TPE-99-S	TPN-98-S
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	40.1	38.0	30.9	30.3	28.4
	Hardness (as CaCO3) (mg/L)	15.0	14.3	10.4	10.2	11.2
	pH (pH)	7.28	7.29	7.11	7.11	7.04
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Total Dissolved Solids (mg/L)	28.8	29.5	24.6	22.5	22.7
	Turbidity (NTU)	0.22	0.23	0.25	0.23	0.21
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	12.0	11.3	7.8	7.6	9.8
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	12.0	11.3	7.8	7.6	9.8
	Ammonia, Total (as N) (mg/L)	0.0059	0.0056	0.0067	0.0068	0.0060
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	0.93	0.91	0.76	0.74	0.78
	Fluoride (F) (mg/L)	0.071	0.072	0.077	0.079	0.068
	Nitrate (as N) (mg/L)	<0.0050	<0.0050	0.0084	<0.0050	0.0322
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	0.118	0.107	0.098	0.109	0.096
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Phosphorus (P)-Total (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Silicate (as SiO2) (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Sulfate (SO4) (mg/L)	4.98	4.91	4.90	4.75	4.86
Cyanides	Cyanide, Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Cyanide, Free (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	1.76	1.94	1.54	1.56	1.67
	Total Organic Carbon (mg/L)	1.80	1.77	1.66	1.53	1.58
Total Metals	Aluminum (Al)-Total (mg/L)	0.0056	0.0051	0.0067	0.0058	0.0054
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00022	0.00023	0.00032	0.00032	0.00017
	Barium (Ba)-Total (mg/L)	0.00250	0.00251	0.00279	0.00268	0.00285
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Total (mg/L)	4.10	3.80	2.56	2.58	2.18
	Chromium (Cr)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1868891-6	L1868891-7	L1868891-8	L1868891-9	L1868891-10
	Description	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE
	Sampled Date	30-NOV-16	30-NOV-16	30-NOV-16	30-NOV-16	01-DEC-16
	Sampled Time	10:49	14:25	14:25	15:06	07:15
	Client ID	TPN-99-S	WAL-67-S	NOV DUP-1	WAL-68-S	NOV DI-1
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	27.9	44.5	45.2	46.1	<2.0
	Hardness (as CaCO3) (mg/L)	8.90	18.8	18.5	18.5	<0.50
	pH (pH)	7.04	7.26	7.29	7.30	5.45
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Total Dissolved Solids (mg/L)	22.1	29.5	32.0	32.2	<3.0
	Turbidity (NTU)	0.24	0.22	0.23	0.23	<0.10
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	5.9	14.0	14.2	13.9	<1.0
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	5.9	14.0	14.2	13.9	<1.0
	Ammonia, Total (as N) (mg/L)	0.0068	0.0150	0.0125	0.0156	<0.0050
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	0.78	0.88	0.89	0.94	<0.10
	Fluoride (F) (mg/L)	0.068	0.052	0.052	0.052	<0.020
	Nitrate (as N) (mg/L)	0.0326	0.0380	0.0389	0.0651	<0.0050
	Nitrite (as N) (mg/L)	<0.0010	0.0013	<0.0010	<0.0010	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	0.110	0.141	0.145	0.159	<0.050
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Phosphorus (P)-Total (mg/L)	<0.0020	0.0020	0.0021	<0.0020	<0.0020
	Silicate (as SiO2) (mg/L)	<0.50	0.68	0.70	0.68	<0.50
	Sulfate (SO4) (mg/L)	4.83	5.13	5.13	5.67	<0.30
Cyanides	Cyanide, Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Cyanide, Free (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	1.53	2.29	2.06	1.81	<0.50
	Total Organic Carbon (mg/L)	1.41	2.06	2.03	1.98	<0.50
Total Metals	Aluminum (Al)-Total (mg/L)	0.0049	0.0060	0.0055	0.0057	RRV 0.0073
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00016	0.00024	0.00026	0.00025	<0.00010
	Barium (Ba)-Total (mg/L)	0.00276	0.00233	0.00225	0.00237	<0.000050
	Beryllium (Be)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Total (mg/L)	2.11	5.14	5.04	5.22	<0.050
	Chromium (Cr)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1868891-1	L1868891-2	L1868891-3	L1868891-4	L1868891-5
	Description	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE
	Sampled Date	25-NOV-16	25-NOV-16	27-NOV-16	27-NOV-16	30-NOV-16
	Sampled Time	10:46	13:41	10:20	10:57	10:07
	Client ID	SP-98-S	SP-99-S	TPE-98-S	TPE-99-S	TPN-98-S
Grouping	**Analyte**					
WATER						
Total Metals	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Total (mg/L)	0.00065	0.00057	<0.00050	<0.00050	<0.00050
	Iron (Fe)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	0.000100	<0.000050	<0.000050
	Lithium (Li)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)-Total (mg/L)	1.25	1.16	0.88	0.90	0.83
	Manganese (Mn)-Total (mg/L)	0.00081	0.00079	0.00066	0.00074	0.00093
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	0.000192	0.000176	0.000161	0.000165	0.000155
	Nickel (Ni)-Total (mg/L)	<0.00050	<0.00050	0.00051	0.00052	<0.00050
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	0.52	0.51	0.48	0.49	0.48
	Selenium (Se)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)-Total (mg/L)	0.226	0.180	0.075	0.063	0.082
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	0.839	0.862	1.03	1.02	1.09
	Strontium (Sr)-Total (mg/L)	0.0191	0.0176	0.0115	0.0115	0.0100
	Sulfur (S)-Total (mg/L)	1.61	1.65	1.56	1.53	1.59
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Total (mg/L)	0.000043	0.000040	0.000039	0.000039	0.000034
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0014	0.0012	0.0013	0.0013	0.0014
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00017	0.00021	0.00030	0.00031	0.00019
	Barium (Ba)-Dissolved (mg/L)	0.00234	0.00249	0.00285	0.00265	0.00307
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Dissolved (mg/L)	4.12	3.84	2.62	2.57	DTC 2.93
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1868891-6	L1868891-7	L1868891-8	L1868891-9	L1868891-10
	Description	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE
	Sampled Date	30-NOV-16	30-NOV-16	30-NOV-16	30-NOV-16	01-DEC-16
	Sampled Time	10:49	14:25	14:25	15:06	07:15
	Client ID	TPN-99-S	WAL-67-S	NOV DUP-1	WAL-68-S	NOV DI-1
Grouping	**Analyte**					
WATER						
Total Metals	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Total (mg/L)	<0.00050	0.00089	0.00082	0.00081	<0.00050
	Iron (Fe)-Total (mg/L)	<0.010	0.010	0.011	0.011	<0.010
	Lead (Pb)-Total (mg/L)	<0.000050	0.000071	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)-Total (mg/L)	0.81	1.35	1.37	1.38	<0.10
	Manganese (Mn)-Total (mg/L)	0.00097	0.00161	0.00155	0.00156	<0.00010
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)	0.000162	0.000369	0.000359	0.000440	<0.000050
	Nickel (Ni)-Total (mg/L)	0.00055	<0.00050	<0.00050	<0.00050	<0.00050
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	0.47	0.50	0.51	0.51	<0.10
	Selenium (Se)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)-Total (mg/L)	0.051	0.287	0.347	0.287	<0.050
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	1.06	0.643	0.635	0.637	<0.050
	Strontium (Sr)-Total (mg/L)	0.00971	0.0249	0.0248	0.0258	<0.00020
	Sulfur (S)-Total (mg/L)	1.57	1.70	1.61	1.87	<0.50
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Total (mg/L)	0.000034	0.000058	0.000056	0.000072	<0.000010
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0012	0.0019	<0.0010	0.0014	RRV 0.0077
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00015	0.00028	0.00026	0.00031	<0.00010
	Barium (Ba)-Dissolved (mg/L)	0.00278	0.00270	0.00251	0.00287	<0.000050
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)-Dissolved (mg/L)	2.21	5.27	5.15	5.15	<0.050
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1868891-1	L1868891-2	L1868891-3	L1868891-4	L1868891-5
	Description	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE
	Sampled Date	25-NOV-16	25-NOV-16	27-NOV-16	27-NOV-16	30-NOV-16
	Sampled Time	10:46	13:41	10:20	10:57	10:07
	Client ID	SP-98-S	SP-99-S	TPE-98-S	TPE-99-S	TPN-98-S
Grouping	**Analyte**					
WATER						
Dissolved Metals	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Dissolved (mg/L)	0.00054	0.00049	0.00031	0.00030	0.00028
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Lead (Pb)-Dissolved (mg/L)	<0.000050	0.000053	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)-Dissolved (mg/L)	1.15	1.14	0.93	0.91	0.94
	Manganese (Mn)-Dissolved (mg/L)	<0.00010	0.00011	<0.00010	<0.00010	0.00103
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	0.000170	0.000166	0.000149	0.000147	0.000150
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	0.49	0.52	0.52	0.50	0.52
	Selenium (Se)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)-Dissolved (mg/L)	0.167	0.144	<0.050	<0.050	<0.050
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	0.778	0.865	1.07	1.03	1.25
	Strontium (Sr)-Dissolved (mg/L)	0.0188	0.0174	0.0114	0.0111	0.0217 DTC
	Sulfur (S)-Dissolved (mg/L)	1.60	1.47	1.42	1.42	1.68
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Dissolved (mg/L)	0.000037	0.000041	0.000032	0.000032	0.000031
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1868891-6	L1868891-7	L1868891-8	L1868891-9	L1868891-10
	Description	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE
	Sampled Date	30-NOV-16	30-NOV-16	30-NOV-16	30-NOV-16	01-DEC-16
	Sampled Time	10:49	14:25	14:25	15:06	07:15
	Client ID	TPN-99-S	WAL-67-S	NOV DUP-1	WAL-68-S	NOV DI-1
Grouping	**Analyte**					
WATER						
Dissolved Metals	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Dissolved (mg/L)	0.00027	0.00072	0.00070	0.00068	<0.00020
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)-Dissolved (mg/L)	0.82	1.37	1.37	1.36	<0.10
	Manganese (Mn)-Dissolved (mg/L)	<0.00010	0.00097	0.00051	0.00048	<0.00010
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	0.000135	0.000326	0.000320	0.000385	<0.000050
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	0.48	0.51	0.51	0.50	<0.10
	Selenium (Se)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)-Dissolved (mg/L)	<0.050	0.267	0.256	0.250	<0.050
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	1.07	0.666	0.652	0.630	<0.050
	Strontium (Sr)-Dissolved (mg/L)	0.0100	0.0275	0.0259	0.0251	<0.00020
	Sulfur (S)-Dissolved (mg/L)	1.58	1.72	1.54	1.69	<0.50
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	RRV 0.00011
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)-Dissolved (mg/L)	0.000028	0.000052	0.000048	0.000062	<0.000010
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

Qualifiers for Individual Samples Listed:

Sample Number	Client Sample ID	Qualifier	Description
L1868891-5	TPN-98-S	WSMT	Water sample(s) for total mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low.
L1868891-8	NOV DUP-1	WSMT	Water sample(s) for total mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low.

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DTC	Dissolved concentration exceeds total. Results were confirmed by re-analysis.
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

BE-D-L-CCMS-VA	Water	Diss. Be (low) in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

BE-T-L-CCMS-VA	Water	Total Be (Low) in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.

CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

CL-L-IC-N-VA	Water	Chloride in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

CN-FREE-L-CFA-VA	Water	Low Level Free Cyanide in water by CFA	ASTM 7237

This analysis is carried out using procedures adapted from ASTM Method 7237 "Free Cyanide with Flow Injection Analysis (FIA) Utilizing Gas Diffusion Separation and Amperometric Detection". Free cyanide is determined by in-line gas diffusion at pH 6 with final determination by colourimetric analysis.

CN-T-L-CFA-VA	Water	Low Level Total Cyanide in water by CFA	ISO 14403:2002

This analysis is carried out using procedures adapted from ISO Method 14403:2002 "Determination of Total Cyanide using Flow Analysis (FIA and CFA)". Total or strong acid dissociable (SAD) cyanide is determined by in-line UV digestion along with sample distillation and final determination by colourimetric analysis. Method Limitation: This method is susceptible to interference from thiocyanate (SCN). If SCN is present in the sample, there could be a positive interference with this method, but it would be less than 1% and could be as low as zero.

EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

HARDNESS-CALC-VA	Water	Hardness	APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in $CaCO_3$ equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-D-CVAA-VA	Water	Diss. Mercury in Water by CVAAS or CVAFS	APHA 3030B/EPA 1631E (mod)

Reference Information

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

HG-T-CVAA-VA Water Total Mercury in Water by CVAAS or CVAFS EPA 1631E (mod)

Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

MET-D-CCMS-VA Water Dissolved Metals in Water by CRC ICPMS APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-T-CCMS-VA Water Total Metals in Water by CRC ICPMS EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

NH3-F-VA Water Ammonia in Water by Fluorescence APHA 4500 NH3-NITROGEN (AMMONIA)

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NH3-F-VA Water Ammonia in Water by Fluorescence J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-VA Water Nitrite in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-VA Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

P-TD-COL-VA Water Total Dissolved P in Water by Colour APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H "pH Value"

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PO4-DO-COL-VA Water Diss. Orthophosphate in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

SILICATE-COL-VA Water Silicate by Colourimetric analysis APHA 4500-SiO2 E.

This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.

SO4-IC-N-VA Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-LOW-VA Water Low Level TDS (3.0mg/L) by Gravimetric APHA 2540C

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total dissolved solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TKN-F-VA Water TKN in Water by Fluorescence APHA 4500-NORG D.

Reference Information

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-LOW-VA	Water	Total Suspended Solids by Grav. (1 mg/L)	APHA 2540D

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.
Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Short Holding Time

Rush Processing

ALS Environmental

Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

COC # ____________

Report To		Report Format / Distribution		Service Requested (Rush for routine analysis subject to availability)
Company:	Azimuth Consulting Group	☐ Standard ☐ Other		◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Eric Franz	☐ PDF ☐ Excel ☐ Digital ☐ Fax		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1:	efranz@azimuthgroup.ca	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6K2G8	Email 2:	gmann@azimuthgroup.ca	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax:	Email 3:	ryan.vanengen@agnicoeagle.com	**Analysis Request**
Invoice To	Same as Report ? ☑ Yes ☐ No	**Client / Project Information**		Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	CREMP Meadowbank Surfacewater	
Company:		PO / AFE:		
Contact:		LSD:		
Address:				
Phone:	Fax:	Quote #:	Q39503	
Lab Work Order # (lab use only)		ALS Contact:	Sampler:	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Conventionals** see notes	TSS-Low, TDS-Low	Number of Containers
	SP-98-S	25-Nov-16	10:46	Surface Water	X	X	2
	SP-99-S	25-Nov-16	13:41	Surface Water	X	X	2
	TPE-98-S	27-Nov-16	10:20	Surface Water	X	X	2
	TPE-99-S	27-Nov-16	10:57	Surface Water	X	X	2
	TPN-98-S	30-Nov-16	10:07	Surface Water	X	X	2
	TPN-99-S	30-Nov-16	10:49	Surface Water	X	X	2
	WAL-67-S	30-Nov-16	14:25	Surface Water	X	X	2
	NOV DUP-1	30-Nov-16	14:25	Surface Water	X	X	2
	WAL-68-S	30-Nov-16	15:06	Surface Water	X	X	2
	NOV DI-1	01-Dec-16	7:15	Surface Water	X	X	2

L1868891-COFC

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

**Conventionals includes: Alk Species, pH, EC, Turbidity, Conductivity, Anions (F, NO2, NO3, Br, SO4), low-level Chloride, Silicate, TD-P, and Ortho-PO4.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by: Tom T	Date (dd-mmm-yy) 1-Dec-16	Time (hh-mm) 8:00	Received by: JC.	Date: 12 Dec 16	Time: 11:05 Am	Temperature: -0.5, 0.4, 0.9 °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

ALS Environmental

Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

COC #

Report To			Report Format / Distribution		Service Requested (Rush for routine analysis subject to availability)
Company:	Azimuth Consulting Group		☐ Standard ☐ Other		◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Eric Franz		☐ PDF ☐ Excel ☐ Digital ☐ Fax		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway		Email 1:	efranz@azimuthgroup.ca	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6K2G8		Email 2:	gmann@azimuthgroup.ca	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220	Fax:	Email 3:	ryan.vanengen@agnicoeagle.com	
Invoice To	Same as Report ?	☑ Yes ☐ No	Client / Project Information		
Hardcopy of Invoice with Report?		☐ Yes ☑ No	Job #:	CREMP Meadowbank Surfacewater	
Company:			PO / AFE:		
Contact:			LSD:		
Address:					
Phone:		Fax:	Quote #:	Q39503	
Lab Work Order # (lab use only)			ALS Contact:	Sampler:	

Analysis Request

Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TOC, Ammonia, TKN, Total P (P)	DOC (F/P)	T-CN (Low), Free CN (Low) (P)	Total mercury (P)	Dissolved mercury (F/P)	Total Metals (P)	Dissolved Metals (F/P)	Number of Containers
[redacted]	SP-98-S	25-Nov-16	10:46	Surface Water	X	X	X	X	X	X	X	7
[redacted]	SP-99-S	25-Nov-16	13:41	Surface Water	X	X	X	X	X	X	X	7
[redacted]	TPE-98-S	27-Nov-16	10:20	Surface Water	X	X	X	X	X	X	X	7
[redacted]	TPE-99-S	27-Nov-16	10:57	Surface Water	X	X	X	X	X	X	X	7
	TPN-98-S	30-Nov-16	10:07	Surface Water	X	X	X	X	X	X	X	7
	TPN-99-S	30-Nov-16	10:49	Surface Water	X	X	X	X	X	X	X	7
	WAL-67-S	30-Nov-16	14:25	Surface Water	X	X	X	X	X	X	X	7
	NOV DUP-1	30-Nov-16	14:25	Surface Water	X	X	X	X	X	X	X	7
	WAL-68-S	30-Nov-16	15:06	Surface Water	X	X	X	X	X	X	X	7
	NOV DI-1	01-Dec-16	7:15	Surface Water	X	X	X	X	X	X	X	7

L1868891-COFC

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

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Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Tom T	1-Dec-16	8:00	JC	12Dec16	11:05AM	-0.5, 0.4, 0.9 °C				

AZIMUTH CONSULTING GROUP INC.
ATTN: Eric Franz
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 30-DEC-16
Report Date: 04-JAN-17 10:48 (MT)
Version: FINAL

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1874802

Project P.O. #: NOT SUBMITTED
Job Reference: CREMP MEADOWBANK SURFACEWATER
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1874802-1	L1874802-2	L1874802-3	L1874802-4	L1874802-5
	Description	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE
	Sampled Date	27-NOV-16	27-NOV-16	30-NOV-16	30-NOV-16	25-NOV-16
	Sampled Time					
	Client ID	TPE-98-S	TPE-99-S	TPN-98-S	TPN-99-S	SP-98-S
Grouping	**Analyte**					
FILTER						
Plant Pigments	Chlorophyll a (ug/L)	0.490	0.296	0.754	1.12	0.506

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1874802-6	L1874802-7	L1874802-8	L1874802-9	L1874802-10
		Description	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE	SURFACE WATE
		Sampled Date	25-NOV-16	30-NOV-16	30-NOV-16	30-NOV-16	31-AUG-16
		Sampled Time					
		Client ID	SP-99-S	WAL-67-S	WAL-68-S	NOV-DUP-1	AUG-DUP-2
Grouping	**Analyte**						
FILTER							
Plant Pigments	Chlorophyll a (ug/L)		0.566	0.817	0.775	0.766	1.02

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CHLOROA-F-VA	Filter	Chlorophyll a by Fluorometer (Filter)	EPA 445.0

This analysis is done using procedures modified from EPA Method 445.0. Chlorophyll-a is determined by a routine acetone extraction followed with analysis by fluorometry using the non-acidification procedure. This method is not subject to interferences from chlorophyll b.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

ALS Environmental

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC # ____________

Report To		**Report Format / Distribution**		**Service Requested** (Rush for routine analysis subject to availability)
Company:	Azimuth Consulting Group	☐ Standard ☐ Other		◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Eric Franz	☐ PDF ☐ Excel ☐ Digital ☐ Fax		◯ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1:	efranz@azimuthgroup.ca	◯ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6K2G8	Email 2:	gmann@azimuthgroup.ca	◯ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax:	Email 3:	ryan.vanengen@agnicoeagle.com	**Analysis Request**
Invoice To	Same as Report ? ☑ Yes ☐ No	**Client / Project Information**		Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	CREMP Meadowbank Surfacewater	F
Company:		PO / AFE:		
Contact:		LSD:		
Address:				
Phone:	Fax:	Quote #:	Q39503	
Lab Work Order # (lab use only)	[redacted]	ALS Contact:	Sampler:	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Chloro A	Number of Containers
[redacted]	TPE-98-S	27-11-16		Surface Water	X	1
[redacted]	TPE-99-S	27-11-16		Surface Water	X	1
[redacted]	TPN-98-S	30-11-16		Surface Water	X	1
[redacted]	TPN-99-S	30-11-16		Surface Water	X	1
[redacted]	SP-98-S	25-11-16		Surface Water	X	1
[redacted]	SP-99-S	25-11-16		Surface Water	X	1
[redacted]	WAL-67-S	30-11-16		Surface Water	X	1
[redacted]	WAL-68-S	30-11-16		Surface Water	X	1
[redacted]	NOV-DUP-1	30-11-16		Surface Water	X	1
[redacted]	AUG-DUP-2	31-Aug-16		Surface Water	X	1
[redacted]						

RUSH

Priority processing

L1874802-COFC

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Randy Schwandt	27-12-2016	8:00	JC	DEC 3 0 2016	8:20am	2 °C				

AZIMUTH CONSULTING GROUP INC.
ATTN: Eric Franz
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 30-DEC-16
Report Date: 16-JAN-17 12:30 (MT)
Version: FINAL

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1874814

Project P.O. #:	NOT SUBMITTED
Job Reference:	CREMP MEADOWBANK SURFACEWATER
C of C Numbers:	
Legal Site Desc:	

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1874814-1				
	Description	SURFACE WATE				
	Sampled Date	25-NOV-16				
	Sampled Time	10:46				
	Client ID	NOV EB-1				
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	<2.0				
	Hardness (as CaCO3) (mg/L)	0.54				
	pH (pH)	5.48				
	Total Suspended Solids (mg/L)	<1.0				
	Total Dissolved Solids (mg/L)	<3.0				
	Turbidity (NTU)	0.12				
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	<1.0				
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0				
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0				
	Alkalinity, Total (as CaCO3) (mg/L)	<1.0				
	Ammonia, Total (as N) (mg/L)	<0.0050				
	Bromide (Br) (mg/L)	<0.050				
	Chloride (Cl) (mg/L)	<0.10				
	Fluoride (F) (mg/L)	<0.020				
	Nitrate (as N) (mg/L)	<0.0050				
	Nitrite (as N) (mg/L)	<0.0010				
	Total Kjeldahl Nitrogen (mg/L)	<0.050				
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010				
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020				
	Phosphorus (P)-Total (mg/L)	<0.0020				
	Silicate (as SiO2) (mg/L)	<0.50				
	Sulfate (SO4) (mg/L)	<0.30				
Cyanides	Cyanide, Total (mg/L)	<0.0010				
	Cyanide, Free (mg/L)	<0.0010				
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	<0.50				
	Total Organic Carbon (mg/L)	<0.50				
Total Metals	Aluminum (Al)-Total (mg/L)	0.0066 RRV				
	Antimony (Sb)-Total (mg/L)	<0.00010				
	Arsenic (As)-Total (mg/L)	<0.00010				
	Barium (Ba)-Total (mg/L)	0.000082 RRV				
	Beryllium (Be)-Total (mg/L)	<0.000020				
	Bismuth (Bi)-Total (mg/L)	<0.000050				
	Boron (B)-Total (mg/L)	<0.010				
	Cadmium (Cd)-Total (mg/L)	<0.0000050				
	Calcium (Ca)-Total (mg/L)	<0.050				
	Chromium (Cr)-Total (mg/L)	<0.00010				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1874814-1				
	Description	SURFACE WATE				
	Sampled Date	25-NOV-16				
	Sampled Time	10:46				
	Client ID	NOV EB-1				
Grouping	**Analyte**					
WATER						
Total Metals	Cobalt (Co)-Total (mg/L)	<0.00010				
	Copper (Cu)-Total (mg/L)	<0.00050				
	Iron (Fe)-Total (mg/L)	<0.010				
	Lead (Pb)-Total (mg/L)	RRV 0.000211				
	Lithium (Li)-Total (mg/L)	<0.0010				
	Magnesium (Mg)-Total (mg/L)	<0.10				
	Manganese (Mn)-Total (mg/L)	RRV 0.00020				
	Mercury (Hg)-Total (mg/L)	<0.0000050				
	Molybdenum (Mo)-Total (mg/L)	<0.000050				
	Nickel (Ni)-Total (mg/L)	<0.00050				
	Phosphorus (P)-Total (mg/L)	<0.050				
	Potassium (K)-Total (mg/L)	<0.10				
	Selenium (Se)-Total (mg/L)	<0.000050				
	Silicon (Si)-Total (mg/L)	<0.050				
	Silver (Ag)-Total (mg/L)	<0.000010				
	Sodium (Na)-Total (mg/L)	<0.050				
	Strontium (Sr)-Total (mg/L)	<0.00020				
	Sulfur (S)-Total (mg/L)	<0.50				
	Thallium (Tl)-Total (mg/L)	<0.000010				
	Tin (Sn)-Total (mg/L)	<0.00010				
	Titanium (Ti)-Total (mg/L)	<0.00030				
	Uranium (U)-Total (mg/L)	<0.000010				
	Vanadium (V)-Total (mg/L)	<0.00050				
	Zinc (Zn)-Total (mg/L)	<0.0030				
	Zirconium (Zr)-Total (mg/L)	<0.00030				
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD				
	Dissolved Metals Filtration Location	FIELD				
	Aluminum (Al)-Dissolved (mg/L)	<0.0010				
	Antimony (Sb)-Dissolved (mg/L)	<0.00010				
	Arsenic (As)-Dissolved (mg/L)	RRV 0.00020				
	Barium (Ba)-Dissolved (mg/L)	RRV 0.000670				
	Beryllium (Be)-Dissolved (mg/L)	<0.000020				
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050				
	Boron (B)-Dissolved (mg/L)	<0.010				
	Cadmium (Cd)-Dissolved (mg/L)	<0.0000050				
	Calcium (Ca)-Dissolved (mg/L)	RRV 0.217				
	Chromium (Cr)-Dissolved (mg/L)	<0.00010				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1874814-1				
	Description	SURFACE WATE				
	Sampled Date	25-NOV-16				
	Sampled Time	10:46				
	Client ID	NOV EB-1				
Grouping	**Analyte**					
WATER						
Dissolved Metals	Cobalt (Co)-Dissolved (mg/L)	<0.00010				
	Copper (Cu)-Dissolved (mg/L)	<0.00020				
	Iron (Fe)-Dissolved (mg/L)	<0.010				
	Lead (Pb)-Dissolved (mg/L)	<0.000050				
	Lithium (Li)-Dissolved (mg/L)	<0.0010				
	Magnesium (Mg)-Dissolved (mg/L)	<0.10				
	Manganese (Mn)-Dissolved (mg/L)	<0.00010				
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050				
	Molybdenum (Mo)-Dissolved (mg/L)	<0.000050				
	Nickel (Ni)-Dissolved (mg/L)	<0.00050				
	Phosphorus (P)-Dissolved (mg/L)	<0.050				
	Potassium (K)-Dissolved (mg/L)	<0.10				
	Selenium (Se)-Dissolved (mg/L)	<0.000050				
	Silicon (Si)-Dissolved (mg/L)	<0.050				
	Silver (Ag)-Dissolved (mg/L)	<0.000010				
	Sodium (Na)-Dissolved (mg/L)	<0.050				
	Strontium (Sr)-Dissolved (mg/L)	0.00148 RRV				
	Sulfur (S)-Dissolved (mg/L)	<0.50				
	Thallium (Tl)-Dissolved (mg/L)	<0.000010				
	Tin (Sn)-Dissolved (mg/L)	<0.00010				
	Titanium (Ti)-Dissolved (mg/L)	<0.00030				
	Uranium (U)-Dissolved (mg/L)	<0.000010				
	Vanadium (V)-Dissolved (mg/L)	<0.00050				
	Zinc (Zn)-Dissolved (mg/L)	0.0012 RRV				
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Total Organic Carbon	MS-B	L1874814-1
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1874814-1
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1874814-1
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1874814-1
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1874814-1
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1874814-1
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1874814-1
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1874814-1
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1874814-1
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1874814-1
Matrix Spike	Molybdenum (Mo)-Dissolved	MS-B	L1874814-1
Matrix Spike	Potassium (K)-Dissolved	MS-B	L1874814-1
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1874814-1
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1874814-1
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1874814-1
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1874814-1
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1874814-1
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1874814-1
Matrix Spike	Phosphorus (P)-Total	MS-B	L1874814-1
Matrix Spike	Silicate (as SiO2)	MS-B	L1874814-1

Qualifiers for Individual Parameters Listed:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

BE-D-L-CCMS-VA	Water	Diss. Be (low) in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

BE-T-L-CCMS-VA	Water	Total Be (Low) in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.

CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

CL-L-IC-N-VA	Water	Chloride in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

CN-FREE-L-CFA-VA	Water	Low Level Free Cyanide in water by CFA	ASTM 7237

This analysis is carried out using procedures adapted from ASTM Method 7237 "Free Cyanide with Flow Injection Analysis (FIA) Utilizing Gas Diffusion Separation and Amperometric Detection". Free cyanide is determined by in-line gas diffusion at pH 6 with final determination by colourimetric analysis.

Reference Information

CN-T-L-CFA-VA Water Low Level Total Cyanide in water by CFA ISO 14403:2002

This analysis is carried out using procedures adapted from ISO Method 14403:2002 "Determination of Total Cyanide using Flow Analysis (FIA and CFA)". Total or strong acid dissociable (SAD) cyanide is determined by in-line UV digestion along with sample distillation and final determination by colourimetric analysis. Method Limitation: This method is susceptible to interference from thiocyanate (SCN). If SCN is present in the sample, there could be a positive interference with this method, but it would be less than 1% and could be as low as zero.

EC-PCT-VA Water Conductivity (Automated) APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

EC-SCREEN-VA Water Conductivity Screen (Internal Use Only) APHA 2510

Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.

F-IC-N-VA Water Fluoride in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

HARDNESS-CALC-VA Water Hardness APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in $CaCO_3$ equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-D-CVAA-VA Water Diss. Mercury in Water by CVAAS or CVAFS APHA 3030B/EPA 1631E (mod)

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

HG-T-CVAA-VA Water Total Mercury in Water by CVAAS or CVAFS EPA 1631E (mod)

Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

MET-D-CCMS-VA Water Dissolved Metals in Water by CRC ICPMS APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-T-CCMS-VA Water Total Metals in Water by CRC ICPMS EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

NH3-F-VA Water Ammonia in Water by Fluorescence APHA 4500 NH3-NITROGEN (AMMONIA)

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NH3-F-VA Water Ammonia in Water by Fluorescence J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-VA Water Nitrite in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-VA Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

P-TD-COL-VA Water Total Dissolved P in Water by Colour APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H "pH Value"

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H pH Value

Reference Information

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PO4-DO-COL-VA	Water	Diss. Orthophosphate in Water by Colour	APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

SILICATE-COL-VA	Water	Silicate by Colourimetric analysis	APHA 4500-SiO2 E.

This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.

SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-LOW-VA	Water	Low Level TDS (3.0mg/L) by Gravimetric	APHA 2540C

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total dissolved solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TKN-F-VA	Water	TKN in Water by Fluorescence	APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-LOW-VA	Water	Total Suspended Solids by Grav. (1 mg/L)	APHA 2540D

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.
Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS
Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

ALS Environmental

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC #

Report To		Report Format / Distribution		Service Requested (Rush for routine analysis subject to availability)
Company:	Azimuth Consulting Group	☐ Standard ☐ Other		◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Eric Franz	☐ PDF ☐ Excel ☐ Digital ☐ Fax		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1:	efranz@azimuthgroup.ca	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6K2G8	Email 2:	gmann@azimuthgroup.ca	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax:	Email 3:	ryan.vanengen@agnicoeagle.com	
Invoice To	Same as Report ? ☑ Yes ☐ No	Client / Project Information		
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	CREMP Meadowbank Surfacewater	
Company:		PO / AFE:		
Contact:		LSD:		
Address:				
Phone:	Fax:	Quote #:	Q39503	
Lab Work Order # (lab use only)		ALS Contact:	Sampler:	

Analysis Request — Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Conventionals** see notes	TSS-Low, TDS-Low	TOC, Ammonia, TKN, Total P	DOC	T-CN (Low), Free CN (Low)	Total mercury	Dissolved mercury	Total Metals	Dissolved Metals				Number of Containers
							P	F/P	P	P	F/P	P	F/P				
	NOV EB-1	25-Nov-16	10:46	Surface Water	X	X	X	X	X	X	X	X	X				9

L1874814-COFC

Short Holding Time
Rush Processing

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

**Conventionals includes: Alk Species, pH, EC, Turbidity, Conductivity, Anions (F, NO2, NO3, Br, SO4), low-level Chloride, Silicate, TD-P, and Ortho-PO4.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Randy Schwandt	26-Dec-16	8:00	JC	DEC 3 0 2016	8:20am	9 °C				