Appendix G6

Report: *2013 Core Receiving Environment Monitoring Program*

FINAL

Core Receiving Environment Monitoring Program 2013

Meadowbank Mine

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Appendix J. ALS Laboratory Reports, 2013

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- Gary Mann (Azimuth) – Gary was responsible for overall management of this project. He also provided oversight and logistical support for the field crew, collaborated on approach development and implementation of the trends assessment, and authored and reviewed the CREMP report.
- Maggie McConnell (Azimuth) – Maggie was responsible for coordinating in data interpretation and reporting.
- Laura Bekar (Azimuth) – Laura assisted in the logistics supporting the field monitoring.
- Eric Franz (Azimuth) – Eric was responsible for overall coordination of the CREMP. He organized and led the CREMP field monitoring program, coordinated data collation and report review.
- Randy Baker (Azimuth) – Randy collaborated on approach development and implementation of the trends assessment, and reviewed the CREMP report.
- Brian Pyper (Azimuth Associate) – Brian conducted the statistical analyses and plotting for the trends assessment.
- Morgan Finley (Azimuth) – Morgan was responsible for on-site logistics for and participation in the 2013 field monitoring program.

PROFESSIONAL LIABILITY STATEMENT

This report has been prepared by Azimuth Consulting Group Partnership (Azimuth; managing partner Azimuth Consulting Group Inc.), for the use of Agnico-Eagle Mines Ltd. (AEM), who has been party to the development of the scope of work for this project and understands its limitations. The extent to which previous investigations were relied on is detailed in the report.

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ACRONYMS

AEM – Agnico Eagle Mines Ltd.

AEMP – Aquatic Effects Monitoring Program

ANOVA – Analysis of Variance

AWPAR – All Weather Private Access Road

BACI – Before/After Control/Impact

BACIP - Before/After Control/Impact Paired

BAER – Baseline Aquatic Ecosystem Report

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

DOC – Dissolved Organic Carbon

DQO – Data Quality Objective

EAS – Effects Assessment Strategy

EEM – Environmental Effects Monitoring

EIA – Environmental Impact Assessment

FF – Far Field

GPS – Global Positioning System

HEPH – Heavy Extractable Petroleum Hydrocarbons

INUG – Inuggugayualik Lake

ISQG – Interim Sediment Quality Guidelines

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

SOP – Standard Operating Procedure

SQG – Sediment Quality Guidelines

SP – Second Portage Lake

TE – Tehek Lake

TEFF – Tehek Lake Farfield

TIA – Tailings Impoundment Area

TKN – Total Kjeldahl Nitrogen

TOC – Total Organic Carbon

TSS – Total Suspended Solids

TPE, TPN, TPS – Third Portage Lake – East, North, and South Basins

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 the application of a temporal/spatial trend assessment that includes application of quantitative decision criteria (i.e., early warning "triggers" and action "thresholds"; some of which were updated in 2013) 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[1]

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 2013 are summarized in **Table ES-1**:

- *Water Chemistry* – There were some statistically significant mine-related changes identified in 2013 at one or more near-field (NF) areas: total and bicarbonate alkalinity (SP), conductivity (SP, TPE & TPN), calcium (TPE) and TDS (SP & TPE) were elevated above their respective trigger values with statistically significant changes at one or more NF areas relative to baseline/reference conditions. These triggers were set at the 95th percentile of baseline data using an approach that evaluates a statistically significant trend as compared to baseline data, and were not derived from effects-based thresholds (e.g., CCME water quality criteria). While these results represent mine-related changes, the observed concentrations are still relatively low and unlikely to adversely affect aquatic life. **These trends need to be reviewed again in 2014**.
- *Sediment Chemistry* – Quantitative trigger analysis for sediment is based on coring results, which are scheduled to coincide with MMER EEM field studies (i.e., every three years); the next program will take place in 2014. Notwithstanding, visual trend analysis was conducted in 2013. The increasing trend in chromium concentrations in TPE continued in 2013 and exceeded the trigger value. **A follow-up study is recommended in 2014** to confirm the nature of the trend (i.e., reduce residual uncertainty regarding the possibility of the results being due to a spatial trend).

[1] Notes: SP = Second Portage Lake; TPN = Third Portage North; TPS = Third Portage South; TPE = Third Portage East; TE = Tehek Lake.

- *Phytoplankton Community* – Statistically significant increases in total biomass (TPN, TPE, SP, TE & WAL) and taxa richness (TPN) were seen in 2013 relative to baseline/reference conditions. However, this apparent increase is due to a relative decrease in biomass at reference area INUG not an absolute increase at the near-field and mid-field areas, where results are fairly consistent with historical trends at those areas. **While not apparently mine related, these trends should be watched again in 2014**.
- *Benthic Invertebrate Community* – While the majority of near-field and mid-field areas showed apparent reductions in abundance and taxa richness relative to baseline/reference conditions, the only statistically significant adverse effect was a decrease (-46%) in abundance at far-field TEFF over the last three years combined. However, these results appear to be due to historically high abundance and taxa richness at reference area INUG, rather than absolute decreases at the near-field, mid-field or far-field areas, which generally tracked within baseline ranges. **While these trends are not mine related, they should be watched in 2014**.

Baker Lake

CREMP monitoring 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 occurred in the vicinity of the barge dock and jetty in 2013. No changes in the aquatic receiving environment were observed that were attributable to AEM's activities in Baker Lake. No follow-up management actions are required for 2014.

Table ES-1. Summary of key findings from the 2013 CREMP, Meadowbank Mine.

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	?		**0**	
Temperature	**0**	n/a	n/a	n/a	?		**0**	
Conductivity	**0**	n/a	n/a	n/a	?		**0**	
Exposure - Water Chemistry								
Conventionals	**1**	Large	High	Low	?	Alkalinity (SP), conductivity (TPN, TPE, SP), calcium (TPE), and TDS (TPE, SP) are elevated relative to baseline; concentrations suggest low potential for adverse effects.	**1**	
Nutrients	**0**	n/a	n/a	n/a	?		**0**	
Total Metals	**0**	n/a	n/a	n/a	?		**0**	
Dissolved Metals	**0**	n/a	n/a	n/a	?		**0**	
Total Suspended Solids	**0**	n/a	n/a	n/a	?		**0**	
Exposure - Sediment Chemistry								
Physical	**0**	n/a	n/a	n/a	?		**0**	
Total Metals	**1**	Moderate	Moderate	Moderate	??	Chromium (TPE); apparent temporal trend	**1**	**
Organics	**0**	n/a	n/a	n/a	?		**0**	
Effects - Phytoplankton								
Chlorophyll-*a* *	**0**	*	*	*	?		**0**	
Total Biomass	**2**	Large	Low	Low	??	>50% higher (TPN, TPE, SP, TE, WAL); due to relative decrease at reference (INUG)	**1**	
Species Richness	**1**	Moderate	Moderate	Low	??	>20% higher at TPN; due to relative decrease at reference (INUG)	**1**	
Effects - Benthic Invertebrates								
Total Abundance	**0**	n/a	n/a	n/a	?	Apparent "decreases" (most stations); due to increase at reference (INUG)	**1**	
Total Richness	**0**	n/a	n/a	n/a	?		**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
1 – continued trend monitoring in 2014
2 – active follow-up with more detailed quantitative assessment in 2014

*Data quality issue is being addressed (chlorophyll-*a*)
** Targeted study recommended; see text for detail.

1. INTRODUCTION

1.1. Background

Agnico-Eagle Mines (AEM) Ltd.'s Meadowbank Mine is situated approximately 75 km north of the hamlet of Baker Lake, Nunavut. The Aquatic Effects Management Program (AEMP, 2005) 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 (BAER, 2005), 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 – 2012 – Mine construction started in 2008, with dike construction activities occurring directly in the receiving environment. Core receiving environment monitoring (Azimuth, 2009c, 2010a, 2011b, 2012a, this report) was complemented by targeted studies directed towards effects of dike construction

"AEMP" Terminology

The term "AEMP" was first used in the 2005 report *Aquatic Effects Management Program*, 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, defines "AEMP" as the "Aquatic Effects Monitoring Program"; annual receiving environment monitoring reports since 2008 reflect this subtle change.

AEM 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 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.

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.

(Azimuth, 2009a, 2010b; AEM, 2011) and associated effects related to the effects of total suspended solids (TSS) on water quality and benthic community in affected waterbodies (Azimuth, 2009b, 2010c, 2011a, 2012b).

AEM, 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 NWB Type A water license requirements. In 2012, AEM 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 this 2012 CREMP report.

As per the recommendations of the 2012 CREMP (Azimuth, 2013), water quality triggers/thresholds were updated in 2013 (**Appendix A**) to include more recent monitoring data (i.e., in the case of triggers based on the 95th percentile of reference/baseline conditions) or to reflect new thresholds (e.g., adopted from other jurisdictions where not covered by CCME).

This CREMP monitoring report documents the methods and results of aquatic receiving environment monitoring activities undertaken during 2013. As in previous years, this report integrates accumulated results since 2006 to facilitate the identification of changes in limnological 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 (BAER, 2005). 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 (AEMP, 2005) 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).
- *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).

Starting in 2009, CREMP limnological and water quality sampling was expanded, to be conducted on a monthly basis throughout the year where ice conditions permitted. Consequently, sampling was also undertaken in May, November, December (2009) and January–April (2010) in addition to the routine July, August and September sampling (requirements of the Type A water license).

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 2012 program consisted of 13 sampling areas (see **Figures 1.3-1 to 1.3-3**), each categorized into one of the four[2] 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 (**Figures 1.3-1 to 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

CREMP Sampling Area Categorization

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

- *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).

- *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**).

[2] 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).

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 AEM'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 review (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 Farfield) 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 possibility for exposure to a large-scale event, it is more appropriately considered a MF area. This change in categorization does not necessarily prevent the use of TPS data to make inferences regarding regional conditions (i.e., as long as its status is "control" [see text box above and **Section 1.4**] it remains relevant as an internal reference area), but it does mean that such use would need to be cognizant as discussed in **Section 1.5**.
- *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 Farfield (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.
- *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 Pipedream Lake (PDL) are external reference areas chosen for the purposes of making comparisons with the project lakes (EVS, 1999; BAER, 2005). 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 (**Figures 1.3-1 and 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 (BAER, 2005). 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**.

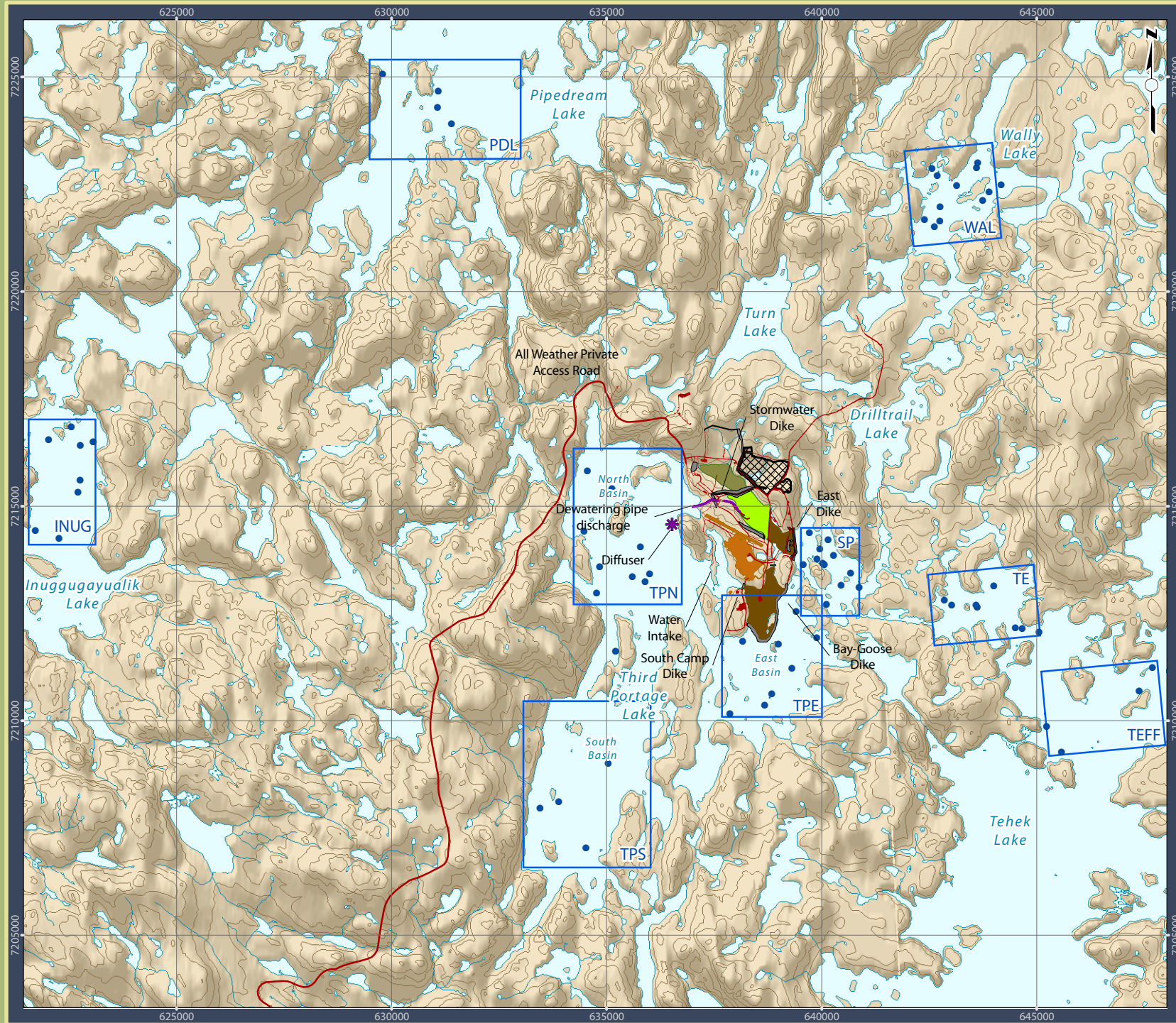


Figure 1.3-1: Water Quality Monitoring Areas and Sampling Stations - 2013

Legend

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

Mine Features

- Diffuser
- Dewatering Pipe Discharge
- Facilities
- Road
- Dike
- Waste Dump
- Dewatered Lake
- Portage Attenuation Facility
- 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

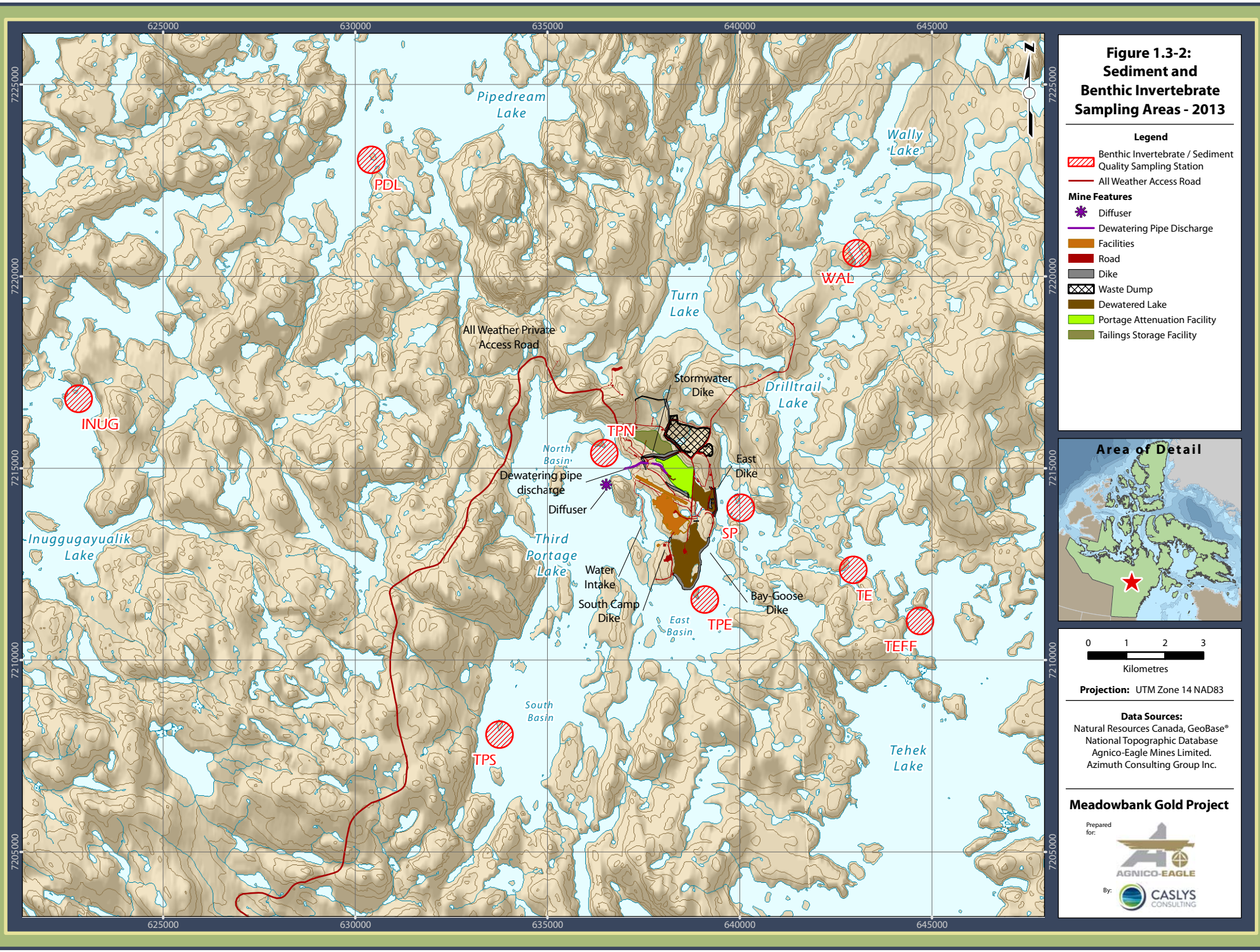


Figure 1.3-2: Sediment and Benthic Invertebrate Sampling Areas - 2013

Legend

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

Mine Features

- Diffuser
- Dewatering Pipe Discharge
- Facilities
- Road
- Dike
- Waste Dump
- Dewatered Lake
- Portage Attenuation Facility
- 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

625000
650000
675000
700000
725000
7200000
7175000
7150000
7125000
7100000
N
Meadowbank Mine Site
Tehek Lake
Whitehills Lake
Baker Lake
Baker Lake
Baker Barge Dock (BBD)
Baker Proposed Jetty (BPJ)
Baker East Shore (BES)
Baker Akilahaarjuk Point (BAP)
Baker Lake
0 2.5 5 7.5
Kilometres
Area of Detail
Legend
Water Sampling Point
Baker Lake Benthic Invertebrate/ Sediment Quality Sampling Station
All Weather 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 - 2013
Meadowbank Gold Project
Prepared for:
AGNICO-EAGLE
By:
CASLYS CONSULTING

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) 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 AEM) and related changes observed in the receiving environment are described by year in **Table 1.4-1**.

As discussed in the text box in **Section 1.3**, 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.

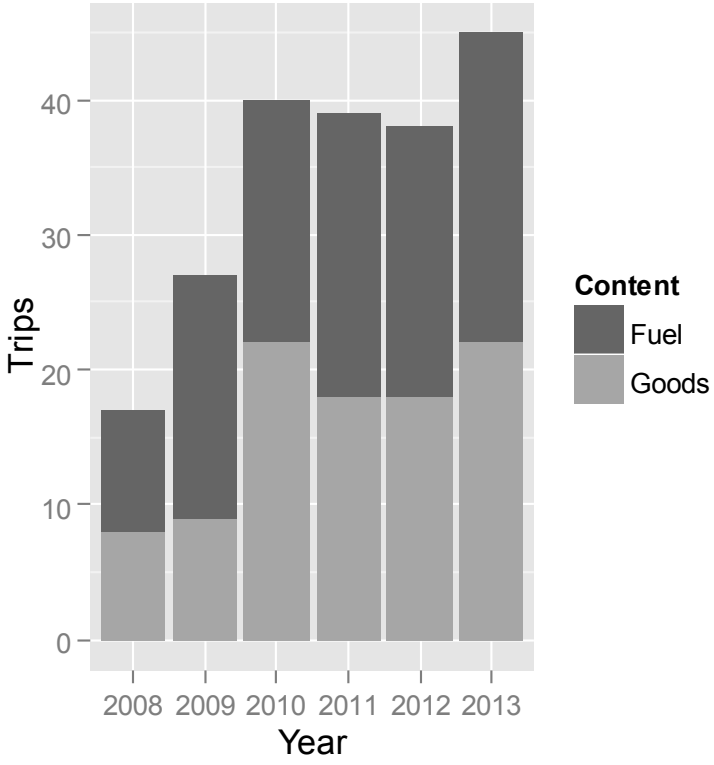
Year	Major Mine-Related Activities	Receiving Environment Overview
2008	Major in-water construction activities for 2008 included the East Dike (located in Second Portage Lake) and the Western Channel Dike (located between Third Portage Lake and Second Portage Lake); the closest CREMP sampling area to 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 to Tehek Lake. The potential impact of construction-related sediment releases to the aquatic environment was the focus of the four-year EAS study (Azimuth, 2009b, 2010c, 2011a, 2012b).
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 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. Pit development focused on North Portage and South Portage pits. Mine officially opened on 27 Feb 2010, marking the started of the operations period. 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 occurs 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 continues. North cell non-contact water diversion 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. Dewatering and fishout activity in Vault lake was completed. Vault lake was dewatered into WAL and did not require TSS treatment. Minor construction modifications to north cell diversion ditch 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) (Golder, 2014).	CREMP monitoring results presented herein.

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

	Meadowbank Sampling 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

Notes:
Area designations: C = Control; I = Impact; REF = reference; NF = near-field; MF = mid-field; FF = far-field; Blank denotes that the area was not part of the monitoring program that year.

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 2012 results in isolation. Building on last year's changes to the CREMP data evaluation process, 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 less conservative than threshold values. These are defined as:

- *Triggers* are early warning criteria that may lead to action. Exceedence 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 exceedences 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 exceedences 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).

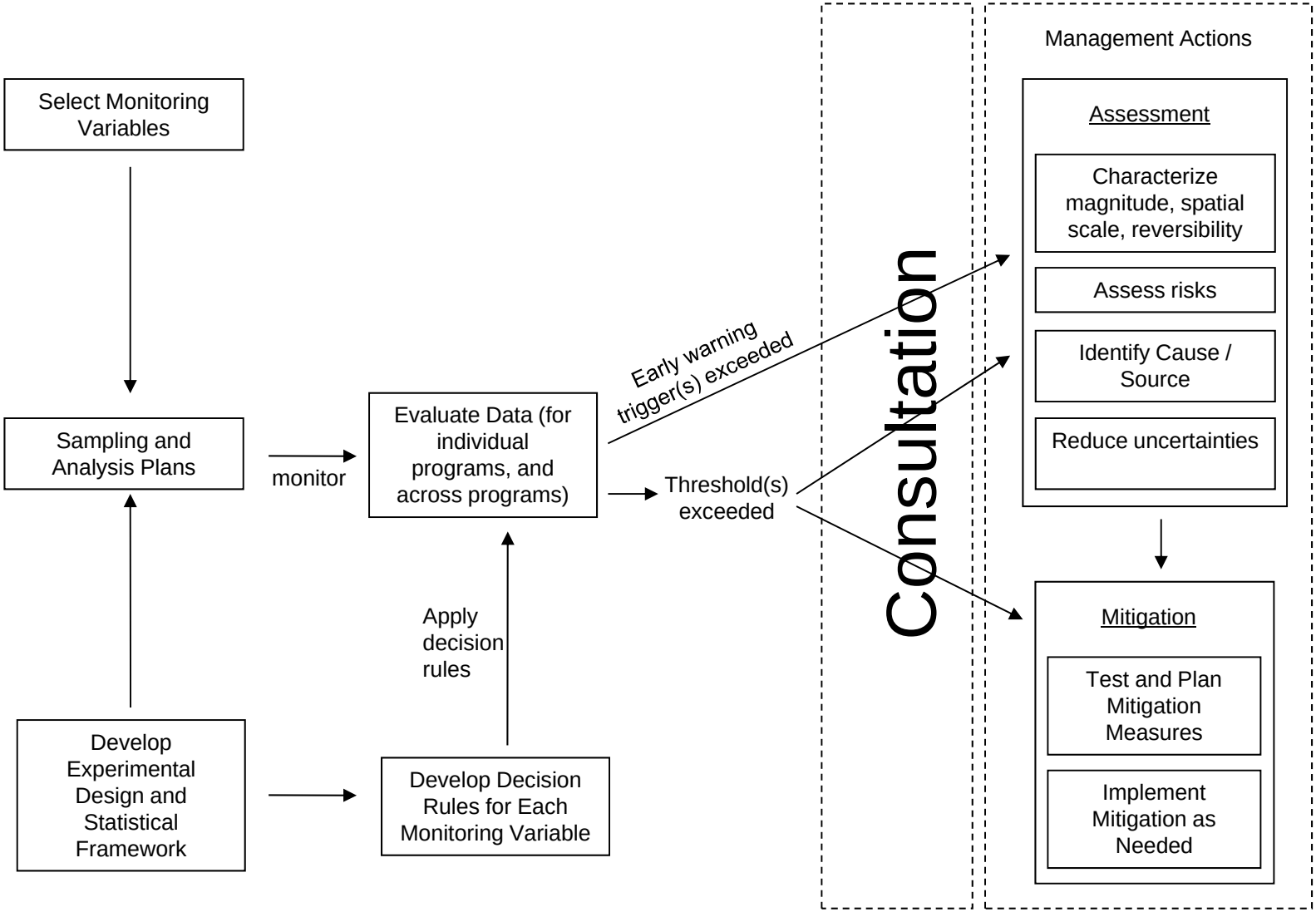
Thus, comparison of the data to trigger values is the initial analytical focus; only if trigger values are exceeded, are data then compared to the applicable thresholds.

Details regarding the derivation of trigger and threshold values for the CREMP are presented in the *Core Receiving Environment Monitoring Program (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

A summary of monitoring events for 2013 CREMP is presented in **Table 2.2-1**. Sampling locations for water and phytoplankton were selected randomly[3] from within their respective lake basins (**Figure 1.3-1**). 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. Sampling Methods

Sampling for the 2013 CREMP program was undertaken according to the SOPs listed in **Appendix B** and **Appendix C** for:

- Limnology (**Appendix B**)
- Water chemistry and phytoplankton (**Appendix B**)
- Sediment chemistry (**Appendix C**)
- Benthic invertebrates (**Appendix C**)

Each SOP includes general information on the sampling locations and timing of field collections, as well as detailed information on:

- the location and timing of sampling,
- pre-trip planning,
- field collection materials,
- quality assurance / quality control protocols,
- step-by-step instructions on sample collection,
- bottle requirements and list of parameters,
- sample preservation, and
- sample handling and transportation.

[3] 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.

Table 2.2-1. CREMP sampling summary, Meadowbank study lakes and Baker Lake, 2013.

Sampling Event	Sampling Crew	Conditions	Components	Meadowbank									Baker			
				TPN	TPE	TPS	SP	TE	TEFF	WAL	INUG	PDL	BBD	BPJ	BAP	BES
January	AEM	Ice	L	×	×	×	×									
February	AEM	Ice	L	×	×	×	×									
March	AEM	Ice	L	×	×	×	×									
Apr 18-20	AEM	Ice	L,W,P	✓	×		✓	×		✓	×					
Jul 15-21	AEM	Open	L,W,P	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Aug 22-30	Azi	Open	L,W,P	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
			B, S	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sep 15-18	AEM	Open	L,W,P	×	×	×	✓	×	×	✓	×	×				
Nov 24-30	AEM	Ice	L,W,P	✓	✓		✓	✓		✓	✓					
Dec 8-22	AEM	Ice	L,W,P	✓	✓		✓	✓		✓	✓					

Notes:
L = Limnology
W = Water chemistry
P = Phytoplankton
B = Benthos
S = Sediment
✓ = samples collected
× = areas and components that were not collected, but were scheduled for sampling

Table 2.2-2. CREMP sampling location coordinates (GPS, UTM, NAD83), Meadowbank study lakes and Baker Lake, 2013.

Lake	Area-Replicate ID[1]	Area Type[2]	Water & Phytoplankton (monthly)			Benthos & Sediment Grabs (August)				
			Date	Zone & Easting	Northing	Area-Replicate	Sample Type[3]	Depth (m)[4]	Easting	Northing
Third Portage	TPE-60	NF	July	14W 639310	7211225	TPE-1	B & C	7.4	14W 639036	7211520
	TPE-61		July	14W 637862	7210161	TPE-2	B & C	7.2	14W 639062	7211526
	TPE-62		August	14W 638842	7210630	TPE-3	B & C	7.5	14W 639114	7211563
	TPE-63		August	14W 638164	7211863	TPE-4	B & C	7.5	14W 639087	7211555
	TPE-66		November	14W 638672	7210376	TPE-5	B & C	8.8	14W 639052	7211497
	TPE-67		November	14W 638996	7211783	TPE-COMP	C	Comp	Comp	Comp
	TPE-68		December	14W 639890	7211938					
	TPE-69		December	14W 639411	7212550					
	TPN-58	NF	April	14W 635209	7211629	TPN-1	B & C	8.0	14W 636374	7215540
	TPN-59		April	14W 636000	7213419	TPN-2	B & C	7.5	14W 636411	7215532
	TPN-60		July	14W 634475	7214427	TPN-3	B & C	9.4	14W 636588	7215408
	TPN-61		July	14W 635786	7214049	TPN-4	B & C	8.6	14W 636633	7215488
	TPN-62		August	14W 635896	7213251	TPN-5	B & C	7.7	14W 636595	7215607
	TPN-63		August	14W 634765	7212985	TPN-COMP	C	Comp	Comp	Comp
	TPN-66		November	14W 635601	7213351					
	TPN-67		November	14W 635128	7215412					
	TPN-68		December	14W 634548	7215830					
	TPN-69		December	14W 634837	7213583					
	TPS-39	MF	July	14W 633884	7208112	TPS-1	B & C	9.0	14W 633579	7208155
	TPS-40		July	14W 633451	7207971	TPS-2	B & C	8.0	14W 633628	7208092
	TPS-41		August	14W 634519	7207038	TPS-3	B & C	8.3	14W 633654	7208035
	TPS-42		August	14W 635037	7209004	TPS-4	B & C	8.5	14W 633684	7207995
						TPS-5	B & C	7.0	14W 633740	7208022
						TPS-COMP	C	Comp	Comp	Comp
Second Portage	SP-58	NF	April	14W 639961	7213998	SP-1	B & C	8.0	14W 639982	7214063
	SP-59		April	14W 640027	7213677	SP-2	B & C	8.1	14W 640018	7214100
	SP-60		July	14W 639713	7214379	SP-3	B & C	8.8	14W 640053	7214126
	SP-61		July	14W 640872	7213105	SP-4	B & C	7.4	14W 640059	7214165
	SP-62		August	14W 640280	7213856	SP-5	B & C	7.0	14W 640067	7214207
	SP-63		August	14W 640680	7213440	SP-COMP	C	Comp	Comp	Comp
	SP-64		September	14W 640062	7213640					
	SP-65		September	14W 640110	7212722					
	SP-66		November	14W 640457	7213162					
	SP-67		November	14W 639895	7213784					
	SP-68		December	14W 639575	7213640					
	SP-69		December	14W 640155	7214215					
Tehek	TE-60	MF	July	15W 361832	7211847	TE-1	B & C	7.4	15W 359997	7212179
	TE-61		July	15W 361267	7212890	TE-2	B & C	9.3	15W 360012	7212214
	TE-62		August	15W 360243	7212536	TE-3	B & C	8.6	15W 360064	7212233
	TE-63		August	15W 360833	7212437	TE-4	B & C	8.0	15W 360072	7212250
	TE-66		November	15W 360085	7212679	TE-5	B & C	6.7	15W 360084	7212267
	TE-67		November	15W 360810	7212492	TE-COMP	C	Comp	Comp	Comp
	TE-68		December	15W 362206	7211721					
	TE-69		December	15W 361674	7211879					
	TEFF-27	FF	July	15W 364757	7210651	TEFF-1	B & C	8.6	15W 361882	7210758
	TEFF-28		July	15W 364394	7210144	TEFF-2	B & C	7.4	15W 361841	7210723
	TEFF-29		August	15W 362172	7209523	TEFF-3	B & C	8.5	15W 361804	7210685
	TEFF-30		August	15W 362465	7208896	TEFF-4	B & C	8.7	15W 361763	7210658
						TEFF-5	B & C	7.0	15W 361629	7210630
						TEFF-COMP	C	Comp	Comp	Comp

Table 2.2-2. CREMP sampling location coordinates (GPS, UTM, NAD83), Meadowbank study lakes and Baker Lake, 2013.

Lake	Area-Replicate ID[1]	Area Type[2]	Water & Phytoplankton (monthly)			Benthos & Sediment Grabs (August)				
			Date	Zone & Easting	Northing	Area-Replicate	Sample Type[3]	Depth (m)[4]	Easting	Northing
Innugugayualik	INUG-48	Ref	July	14W 622756	7215607	INUG-1	B & C	7.9	14W 622925	7216891
	INUG-49		July	14W 622761	7216428	INUG-2	B & C	8.4	14W 622837	7216820
	INUG-50		August	14W 621712	7214440	INUG-3	B & C	6.5	14W 622798	7216860
	INUG-51		August	14W 622709	7215333	INUG-4	B & C	7.5	14W 622757	7216813
	INUG-54		November	14W 622262	7214246	INUG-5	B & C	8.3	14W 622750	7216791
	INUG-55		November	14W 622021	7216547	INUG-COMP	C	Comp	Comp	Comp
	INUG-56		December	14W 623059	7216498					
	INUG-57		December	14W 622549	7216850					
Wally	WAL-27	NF	April	15W 361285	7222268	WAL-1	B & C	8.0	15W 360878	7220487
	WAL-28		April	15W 361787	7222625	WAL-2	B & C	9.0	15W 360926	7220470
	WAL-29		July	15W 360853	7221799	WAL-3	B & C	6.5	15W 360919	7220430
	WAL-30		July	15W 362321	7222181	WAL-4	B & C	9.2	15W 360949	7220412
	WAL-31		August	15W 360470	7221548	WAL-5	B & C	8.4	15W 360984	7220369
	WAL-32		August	15W 361859	7221866	WAL-COMP	C	Comp	Comp	Comp
	WAL-33		September	15W 360859	7222541					
	WAL-34		September	15W 362023	7222044					
	WAL-35		November	15W 361824	7222750					
	WAL-36		November	15W 360818	7221481					
	WAL-37		December	15W 360756	7222715					
	WAL-38		December	15W 360676	7221355					
Pipedream	PDL-27	Ref	July	14W 629786	7225081	PDL-1	B & C	8.6	14W 630703	7222959
	PDL-28		July	14W 631086	7224670	PDL-2	B & C	6.6	14W 630601	7223022
	PDL-29		August	14W 631389	7223910	PDL-3	B & C	6.8	14W 630574	7222988
	PDL-30		August	14W 631068	7224301	PDL-4	B & C	7.0	14W 630677	7223013
						PDL-5	B & C	7.3	14W 630670	7223060
						PDL-COMP	C	Comp	Comp	Comp
Baker	BBD-27	NF	July	14W 644263	7135306	BBD-1	B & C	8.4	14W 644395	7135347
	BBD-28		July	14W 644659	7135297	BBD-2	B & C	8.9	14W 644477	7135301
	BBD-29		August	14W 644424	7135116	BBD-3	B & C	7.0	14W 644551	7135311
	BBD-30		August	14W 643906	7135236	BBD-4	B & C	7.5	14W 644591	7135303
						BBD-5	B & C	7.3	14W 644625	7135298
						BBD-COMP	C	Comp	Comp	Comp
	BPJ-27	NF	July	15W 356985	7134044	BPJ-1	B & C	7.9	15W 357032	7134226
	BPJ-28		July	15W 356784	7134069	BPJ-2	B & C	8.5	15W 357046	7134210
	BPJ-29		August	15W 357191	7134160	BPJ-3	B & C	9.0	15W 357081	7134202
	BPJ-30		August	15W 357336	7134090	BPJ-4	B & C	7.8	15W 357197	7134154
						BPJ-5	B & C	7.7	15W 357224	7134141
						BPJ-COMP	C	Comp	Comp	Comp
	BES	Ref	NA			BES-1	B & C	7.0	15W 361233	7132408
						BES-2	B & C	7.2	15W 361267	7132387
						BES-3	B & C	8.2	15W 361300	7132362
						BES-4	B & C	8.3	15W 361329	7132353
						BES-5	B & C	8.8	15W 361358	7132333
						BES-COMP	C	Comp	Comp	Comp
	BAP-27	Ref	July	15W 363130	7131250	BAP-1	B & C	8.3	15W 363967	7131216
	BAP-28		July	15W 363724	7131039	BAP-2	B & C	7.7	15W 364013	7131191
	BAP-29		August	15W 363908	7131063	BAP-3	B & C	8.6	15W 364052	7131168
	BAP-30		August	15W 363420	7131026	BAP-4	B & C	8.6	15W 364982	7131146
						BAP-5	B & C	9.1	15W 364110	7131135
						BAP-COMP	C	Comp	Comp	Comp

Notes:

[1] 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.

[2] Area types are as follows: NF = near-field; MF = mid-field; FF = far-field; Ref.= reference.

[3] Sample types are as follows: B = Benthos; C = chemistry.

[4] 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.

Laboratory QA/QC – Data Quality Objectives (DQOs) are numerically definable measures of analytical precision and completeness. Analytical precision is a measurement of the variability associated with duplicate analyses of the same sample in the laboratory. The laboratory duplicate is a new aliquot from the sample bottle/jar and is analyzed from the start in the same manner as the original aliquot taken from the bottle/jar. Also, Certified Reference Materials (CRM) are always included as part of routine laboratory QA/QC. The full list of laboratory DQOs for each parameter are presented in **Appendix B** (Table 1).

Field QA/QC: Water Sampling – Field QA/QC standards during water sampling were maintained for every sample. The standard QA/QC 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 QA procedures include collection and/or analysis of the following:

- Field Duplicate Samples – An independent collection of water samples at the same time and location as the original, as a measure of consistency in sampling methodology and heterogeneity of chemical parameters at discrete locations. The number of field duplicates taken is approximately 10% of original samples.
- Travel Blank – Laboratory supplied bottles of distilled water that are transported to site, carried back and forth into the field and returned to the laboratory, unopened, to test for inadvertent contamination during the transport and field sampling process.
- Equipment Blank – At the beginning or end of a field sampling episode, after routine rinsing of the pump and tubing, distilled water is run through the equipment and placed in sampling bottles for analysis of a wide suite of parameters (e.g., metals, nutrients, and conventionals). This blank tests for possible cross-contamination of samples from the water sampling 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 MDLs.

Quality assurance results of the laboratory and field duplicates were 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:

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

where: A = analytical result; B = duplicate result.

The DQOs for this project were:

- Laboratory Duplicate = 25% RPD for concentrations that exceed 10x the method detection limit (MDL).
- Field Duplicate = 50% RPD for concentrations that exceed 10 x MDL.

RPD values may be either positive or negative, and ideally should provide a mix of the two, clustered around zero. Consistently positive or negative values may indicate a bias. Large variations in RPD values are often observed between duplicate samples when the concentrations of analytes are very low and approaching the detection limit. The reason for this is apparent if one considers duplicate samples with concentrations of an analyte of 0.0005 and 0.0007 mg/L. In absolute terms, the concentration difference between the two is only 0.0002 mg/L, a very tiny amount; however, the RPD value is 33.3%. This may sometimes lead to a belief that the level of precision is less than it actually is. 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.

Field QA/QC: Sediment and Sediment Core Sampling – Field QA/QC standards during sediment sampling consisted of the following:

- 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, avoided the possibility of cross-contamination.
- 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).

- Eight (sediment grab) and 13 (sediment core) field duplicate samples were collected in the immediate vicinity of original samples from randomly selected locations as a test of consistency in field methodology and to characterize heterogeneity of sediment chemistry within discrete areas. The DQO for field duplicate samples is based on an RPD of 50% for concentrations that are >10 x MDL.

Field and Laboratory QA/QC: Biota Sampling – Standard procedures were used to collect biota samples. All 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.

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 density and biomass concentrations is considered acceptable.

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.

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.

ZEAS incorporates the following set of QA/QC procedures in all benthic projects undertaken by the company to ensure the generation of high quality and reliable data:

- Samples were logged upon arrival, inspected, and enumerated;
- Samples were checked for proper preservation;
- Samples were stained to facilitate sorting;
- Taxonomic identifications were based on the most updated and widely used keys;
- 10% of the samples were re-sorted, and re-counted, targeting >90% recovery;
- Precision and accuracy estimates were calculated;
- A voucher collection was compiled;

- Sorted sediments and debris were re-preserved in 10% formalin and are retained for up to three months. For samples subject to subsampling, sorted and unsorted fractions were re-preserved separately.

2.4. Data Evaluation Criteria

The specific methods used to apply triggers/thresholds in the evaluation of CREMP monitoring parameters varied by variable group; 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.

It is important to note that trigger values (and threshold values) may be exceeded for reasons unrelated to mining activity. For example, trigger values for parameters derived in the absence of effects-based thresholds (or where such thresholds were already exceeded prior to mine development) were set at the 95th percentile of the background data; we would expect 5% of values to exceed triggers naturally, in the absence of any mine-related changes. Thus, to avoid making false positive errors (i.e., characterizing a change or difference as mine-related when it is not), when triggers were exceeded we compared the observed pattern of change to our expectations of a mine-related effect (e.g., we would generally expect to see a gradient with NF>MF>FF); where a pattern was absent (e.g., an increase only seen at a FF area), the observed change was inferred as unrelated to mining activity. Thus, it is important to realize that trigger exceedences do not necessarily mean that mine-related changes have occurred. Rather, they highlight cases that should be looked at more closely to determine the most plausible.

2.4.1. Water Chemistry

As discussed in the *Core Receiving Environment Monitoring Program (CREMP): Design Document 2012* (Azimuth, 2012d), while monthly mean values were compared to trigger values to identify short-term, episodic exceedences in water chemistry parameters, formal application of the trigger for decision-making purposes was to the yearly mean for each sampling area (i.e., area means calculated from two to three through-ice monitoring events and three to four open water monitoring events; termed “2012 mean”).

The hierarchical process for water chemistry variables was as follows (implemented separately for Meadowbank Project Lakes and Baker Lake, for which triggers were independently derived [Azimuth, 2012d]):

1. *Computation of Yearly Means* – monthly means calculated first for each parameter, then yearly means on an area-specific (i.e., lake or basin-specific) basis. Note that values < MDL were conservatively set equal to the MDL.

2. *Comparisons of Yearly Means to Triggers* – yearly means for each sampling area were compared to the triggers to identify all cases for which the mean equaled or exceeded the trigger.
3. *Statistical Testing of Yearly Means Exceeding Triggers* – cases where the yearly means exceeded the triggers were formally tested using statistical analyses; this process was conducted different for Meadowbank Project Lakes and Baker Lake:

   Meadowbank Project Lakes

   - Before-After-Control-Impact statistical framework with multiple paired "before" and "after" period events (BACIP) was applied (see Azimuth, 2012d for details).
   - INUG was used as the reference ("control") area; the other areas were tested as exposure ("impact") areas. PDL nor TEFF could be utilized as controls for BACIP as no data exists 2006 – 2008 for these areas. Instead, these areas are used to compare reference and exposure area data patterns.
   - 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; the 2013 data (only events when both INUG and the test area were sampled) were used as the "after" data.
   - All data were log-transformed (natural logs). Thus, the exponent of the BACI interaction term coefficient provides the proportional change in 2013 relative to the "before" period.
   - One-tailed tests of the null hypothesis (i.e., that test areas experienced no relative change) were conducted; the alternative hypothesis was a relative increase in a parameter at the test area.

   Baker Lake (where different from above)

   - Baker Lake areas were designated as "control" or "impact" 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. Rather, since no development-related changes had been identified to date, all years of data up to and including 2012 were considered "before" and the 2013 data as "after" period data (i.e., allowing the more robust BACIP analysis). Thus, while the trend plots were used to assess temporal trends at the "impact"

areas since monitoring started, the BACIP analyses specifically looked at changes in 2013 at the two "impact" areas relative to previous years.

- The Akilahaarjuk Point (BAP) area was used as the reference "control" area.

2.4.2. Sediment Chemistry

As discussed in the *Core Receiving Environment Monitoring Program (CREMP): Design Document 2012* (Azimuth, 2012d), the sediment core samples were used to screen against trigger values. Methods, which did not vary between the Meadowbank Project Lakes and Baker Lake, were as follows:

1. *Computation of Yearly Means* – the 2012 sediment coring data were used to calculate means for each parameter at each sampling area. Note that values < MDL were conservatively set equal to the MDL.
2. *Comparisons of Yearly Means to Triggers* – yearly means for core samples from each sampling area were compared to the triggers to identify all cases for which the mean equaled or exceeded the trigger.
3. *Statistical Testing of Yearly Means Exceeding Triggers* – cases where the yearly means exceeded the triggers were formally tested using statistical analyses. Unlike water chemistry, as sediment concentrations are not expected to vary annually due to climatic changes, a "before" – "after" (BA) analysis was used to test for temporal differences at each exposure "impact" area. Sediment is inherently much more variable than water however, and greater natural variability is to be expected.

2.4.3. Phytoplankton

As discussed in the *Core Receiving Environment Monitoring Program (CREMP): Design Document 2012* (Azimuth, 2012d), triggers and thresholds were set to relative changes (increases or decreases of 20% and 50%, respectively) in total biomass and species richness at test areas using the BACIP framework (i.e., 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). The evaluation procedure was analogous to that used for water chemistry, except that area means for 2012 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 BACIP testing. Two-tailed tests of the null hypothesis (i.e., that test areas experienced no relative change up or down) were conducted.

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. As discussed in the *Core Receiving Environment Monitoring Program (CREMP): Design Document 2012* (Azimuth, 2012d), statistical power increased with consideration of more "after" period years (Note: benthic invertebrates are sampled yearly in August). Consequently, BACI analyses (analogous to phytoplankton, except that unit of temporal replication was "years" instead of "months") were conducted on three "after" data period lengths: one year (2012 only), two years (2011-2012) and three years (2010-2012).

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 the data (i.e., 2013 was compared to 2008 – 2012; 2013/2012 was compared to 2008 – 2011…and so on).

3. RESULTS AND DISCUSSION

Following the review of QA/QC results (**Section 3.1**), the remainder of this section presents results and discussion for each study component. The latter sections (**Sections 3.2 through 3.6**), are subdivided by study area (i.e., Meadowbank study lakes and Baker Lake), have been structured in a consistent manner with the general rationale used for the trend assessment, and include:

- *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 2014 (i.e., to follow low magnitude or weak trends), or b) active follow-up with more detailed quantitative assessment in 2014 (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 sample shipping and handling concerns is contained in **Section 3.1.1**. Results of the QA/QC analyses are presented in **Tables 3.1-1 to 3.1-6** for water chemistry (field and lab), sediment grab chemistry, phytoplankton (field and lab) and benthos, respectively.

3.1.1. Sample Shipping and Handling

Although it is not the first time shipping has hampered CREMP QA/QC, the frequency of compromised results seemed to increase in 2013 while shipping samples from the mine site (through Val D'Or, Quebec) to ALS Vancouver. As a result, a thorough review of the shipping and handling chain of custody was conducted in response to a number of instances of samples being compromised during the 2013 CREMP program. From a program implementation perspective, the objective of this assessment was to provide AEM with details of where data quality issues are arising in the course of sample shipping and analysis with the goal of improving shipping and handling procedures. In consultation with ALS, the following two issues were singled out for more detailed examination:

- Hold-time exceedences, and
- Sample handling and storage concerns.

3.1.1.1. Hold-time Exceedences

As part of each analytical report prepared by ALS, the laboratory identifies parameters within each sample that exceed recommended hold-times for sample analysis (refer to Table 1 in **Appendix B**). For the 2013 CREMP program, the hold-time exceedences were related to unpreserved samples that are to be stored at 4°C in the time between collection and analysis. These include physical test measurements of the water samples and analysis of some anions and nutrients. The most commonly flagged parameters for hold-time exceedences are parameters with three-day hold-times, which were:

- Colour
- Turbidity
- Nitrate
- Nitrite
- Ortho-phosphate (dissolved as P)

Other parameters that were flagged for hold-time exceedences in each sampling event in 2013 were TDS and TSS (7 day hold-times), and alkalinity measurements (14 day hold-time) in samples collected in April, September, November, and December. Metals (total and dissolved), TOC, DOC, and chlorophyll-*a* analyses were all achieved within the recommended hold-times.

The remote location of the mine poses inherent challenges to shipping samples to ALS Vancouver within the hold-times. 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 AEM). In 2013, samples were shipped from Val D'Or by ground or air on rush to ALS. ALS does not provide information on the reliability of data that exceeds the recommended hold-times, nor does a hold-time exceedence necessarily infer the loss of sample integrity. Rather, the QC process is simply a way of identifying that the potential exists for loss of sample integrity and less reliable data. The final assessment of the usability of the data was made on a sample-by-sample basis, and the results were interpreted within the context of the reliability of the data.

3.1.1.2. Sample Transport

A review of the COC forms identified some QC issues with the shipping process that produces less reliable data in 2013. In particular, the apparent lack of temperature control

during shipping resulted in significant changes in temperature within the coolers. Two potential negative outcomes of the lack of temperature control are:

1. Thawing of frozen chlorophyll-*a* samples, and
2. Broken bottles due to samples freezing (i.e., TOC and DOC).

For samples that were shipped in April, July, August, and September, the coolers arrived at the laboratory with internal temperatures ranging from 11.8°C (April) to 21.2°C (July). The concern for these shipments is that the chlorophyll-*a* samples may have thawed in during transport from Val d'Or, Quebec to Burnaby, British Columbia. ALS only reports the internal temperature of the coolers, not whether the filters arrived in a frozen state. Consequently, the chlorophyll-*a* sample integrity was inferred from the ALS cooler temperature reading that is reported on the COC. Although these samples may have thawed, they were kept in the dark which would help to interfere with any further growth on the filters. For these sampling events, the data flagged as being potentially less reliable when interpreting the trends in chlorophyll-*a* between years.

The lack of temperature control also resulted in some samples freezing during the November and December shipments. As a result, several of the glass bottles containing water for TOC and DOC analysis broke, resulting in loss of the samples. Laboratory staff notified Azimuth staff that this had occurred, and advised that an aliquot from the corresponding unpreserved 1L conventional bottles could be taken and preserved to make up for the samples that were destroyed.

3.1.2. Water Chemistry

For water samples during each of the six events, one or two field duplicates, one or two laboratory duplicates, one or two equipment blanks and one travel blank were analyzed for all water parameters. The September sampling event did not have a field duplicate, but only 4 site samples were collected during that event. As a result, a total of 8 field duplicates, 9 laboratory duplicates, 7 equipment blanks, and 2 travel blanks were each analyzed for 22 conventional parameters as well as 32 total and 32 dissolved metals. Although there were some exceedences of the established DQOs, these exceedences 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 error (i.e., a false positive). There was no pattern in the nature of the exceedences that indicates a bias of specific parameters one way or another. The results of the RPD analysis for all these parameters are presented in **Table 3.1-1** (Field) and **Table 3.1-2** (Laboratory) and discussed below:

- **Field Duplicates** – Overall, these samples showed a high level of consistency with the original samples. There were only 10 cases (out of >600 cases) where the

RPD exceeded 50% (excluding the November field duplicate). Of these 10 cases, only three had original and duplicate values greater than 10 x MDL (i.e., chlorophyll-*a* in July and, hardness and calcium in December). In the November field duplicate there were several RPDs exceeding 50%; these exceedences appear to be a sampling error[4].

- **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 four cases where RPDs exceeded 25% but in all cases these were < 10 x MDL. Consequently, DQOs were met in all samples.
- **Equipment Blanks** – In 2013 there were multiple detectable parameters in equipment blank samples, all were < 10 x MDL. The increased number of parameters detected in the blank samples appears to be due to an issue with the blank sample collection methodology and not related to an actual contamination issue. For 2014 sampling, we will ensure that field crews have all the required equipment and a good understanding of the procedures around collecting these blank samples.
- **Travel Blanks** – There were two cases where parameters were detectable and one of these (ammonia) was above just >10 x MDL.
- **Overall** – The frequency of DQO exceedences represent a small fraction of the total number of samples and parameters that were measured for QA/QC purposes (i.e., <1%). While there was a pattern of exceedence in a single field duplicate which cannot be definitively explained, there were no apparent patterns in exceedences of parameters suggesting that there was no trend towards higher or lower results in replicate samples. As such, the measured concentrations are considered usable but some are flagged to be interpreted with caution as a result of exceedences of multiple parameters in a duplication sample as well as detectable concentrations in equipment blanks.

3.1.3. Sediment Grab Chemistry

Sediment QA/QC results are presented in **Table 3.1-3** and discussed below:

- **Field Duplicates** – Overall, the eight sediment grab field duplicate samples showed a high level of consistency with the original samples. There were only

[4] The November field duplicate had a number of parameters that had RPDs exceeding 50%. The number and size of differences between the original and the duplicate indicate that these water samples are not similar, despite being collected from the same location during the same event. We believe that these differences are due to incorrect sample labeling and not due to natural variation in the water. Never-the-less, caution should be used when interpreting the November water chemistry results.

four cases, two for particle size analyses and two for total antimony, where the RPD exceeded 50% (i.e., field dup-5, -6, and -8). In three of the four cases, the values were < 10 x MDL. These differences demonstrate the heterogeneous nature of sediment grab samples, even within a spatially small area.

- **Laboratory Duplicates** – The RPD value exceeded the DQO of 25% in one sediment grab lab duplicate sample for antimony, though the result was < 10 x MDL. This result confirms that sediments were, for the most part, well homogenized in the field prior to placement in jars.
- **Filter Swipes** – filter swipes were conducted on sediment grabs equipment only and were analyzed for total metals in units of µg/filter. While the majority of parameters tested were below the MDL, a few metals were detected, however, some of these elements are commonly found in water (e.g., calcium, magnesium). In addition, the incremental influence of the measured amounts (of those that were > 10 x MDL) was estimated to be less than 0.01% of actual measured sediment concentrations in all cases. Consequently, the potential for meaningful cross-contamination is considered negligible and DQOs were considered to be fully met.

3.1.4. Phytoplankton

For phytoplankton, during each event between one and three field duplicates and laboratory duplicates were analyzed for density and biomass (total and for each major phytoplankton group). Similar to water chemistry, the results for phytoplankton QA/QC had a number of exceedences of the established DQOs. However, where density or biomass of a particular phytoplankton group is very small (i.e., about 1% of total), small differences in that metric between the original and the duplicate can cause very 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.

For both field and laboratory duplicates RPDs for *total* density and *total* biomass consistently met the DQOs (i.e., < 50% for field, < 25% for laboratory).

Results of the RPD analysis for all these parameters are presented in **Table 3.1-4** (Field) and **Table 3.1-5** (Laboratory) and are discussed below:

- **Field Duplicates** – RPDs for *total* density and *total* biomass consistently met the DQOs (i.e., < 50%). RPD values were also always much less than 50% for number of species and Simpson's diversity. Within-taxa variability of the field duplicates was high.
- **Laboratory Duplicates** – Duplicate re-counts were conducted on 10% of the samples analyzed. RPDs for *total* density and *total* biomass consistently met the

DQOs (i.e., < 25%). Similar to field duplicates, laboratory duplicates showed high within-taxa variability.

- **Overall** – Taken on a taxa basis, the results illustrate the inherently large difference in composition because of the relatively small number of plankters enumerated relative to the very large number of plankters present in the sample. However, total density and biomass did not differ in one direction or another for laboratory duplicates.

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. Of the re-sorted samples, 3/48 (6.3%), 0/46 (0%), 2/69 (2.9%), 1/60 (1.7%), 0/58 (0%), 5/183 (2.7%), and 3/164 (1.8%) of organisms were missed (**Table 3.1-6**), with an overall omission rate of about 2.2%. These results suggest that the vast majority of animals observed in benthic samples by the taxonomist were recovered. A reference collection of benthic taxa has been compiled.

3.1.6. QA/QC Summary

Below is a summary of field and sample QA/QC results for the 2013 CREMP program:

- Deviations from the proposed sampling plan:
    - Through-ice limnology profiling was not completed at TPE, TPN, TPS, and SP in January, February, or March due to safety concerns around ice-augering at depths greater 5 feet.
    - April sampling at TPE, TE, and INUG was not completed due to safety concerns similar to above.
    - The lack of helicopter availability on site (the result of early completion of the exploration program) in September meant that sampling was not conducted at remote locations: TE, TEFF, INUG, and PDL. A decision was made to cancel most of the remainder of the program (TPE, TPN, TPS, and Baker Lake) for September; it was decided that there would be no added value in collecting samples from impact areas without having a paired reference area sample (INUG). A second winter sampling event (i.e., December 2013) was added to make up for the lost event.
- Equipment flush samples collected for every sampling event.
- Travel blank samples only collected during the August sampling event.
- Field duplicate samples collected for at least every 10 samples collected for each sampling event, with the exception of September for water chemistry as only 4

samples were collected. One phytoplankton sample duplicate was missed during the August event.

- Laboratory duplicates performed on 10% of samples received by the laboratory and reported for each dataset.
- Lost, damaged, and or compromised data:
    - The chlorophyll-*a* sample for TE-62-S (August) was recorded on the ALS COC, but not documented as being in the shipment that arrived at ALS. No result available.
    - Coolers arriving at ALS for the April, July, August, and September water sampling events were not kept cool during shipping. Chlorophyll-*a* samples from these events may have been compromised.
    - Chlorophyll-*a* results initially reported in the August laboratory data assumed that 1L of water had been filtered. The reports were reissued with results based on filtering 500 mL of water, consistent with other chlorophyll-*a* results.
    - Some samples shipped in November and December froze during transport from Meadowbank to ALS in Burnaby, BC. This resulted in several broken glass bottles for TOC and DOC (i.e., the only parameters in glass bottles). Subsamples were taken at ALS from the 1L bottle (conventionals; unpreserved) and preserved/filtered where appropriate. Below is a list of affected samples that were flagged in the analysis:
        - November (Report L1402362):
            - SP-66-S (TOC)
            - TPE-66-S (TOC)
            - TE-67-S (TOC)
        - December (Report L1406897)
            - SP-69-S (TOC)
            - CREMP DEC EB-1 (TOC)
            - CREMP DEC DUP 1 (DOC)
            - TPE-69-S (DOC)

Table 3.1-1. Field QA/QC data for water parameters, Meadowbank study lakes and Baker Lake, 2013.

		Third Portage Lake			Wally Lake			Baker Lake			Innugugayualik Lake			Third Portage Lake		
		TPN-59	APR DUP-1	RPD	WAL-30	JULY DUP-1	RPD	BAP-28	JULY DUP-2	RPD	INUG-50	AUG DUP-1	RPD	TPN-63	AUG DUP-3	RPD
ANALYTE	**MDLs**	18-Apr-13	18-Apr-13	%	19-Jul-13	19-Jul-13	%	20-Jul-13	20-Jul-13	%	23-Aug-13	23-Aug-13	%	26-Aug-13	26-Aug-13	%
CONVENTIONAL PARAMETERS																
Physical Tests																
Conductivity (µS/cm)	2.0	26.3	26.3	0	39.6	31.4	23	71.3	71.3	0	14.3	14.3	0	23.4	23.4	0
Hardness (mg/L)	0.50	9.47	9.32	1.6	12.50	12.50	0	14.30	14.50	-1.4	5.38	5.30	1.5	7.91	7.98	-0.9
pH	0.10	6.86	6.94	-1.2	7.93	7.56	4.8	7.30	7.30	0.0	6.75	6.64	1.6	7.08	7.05	0
Total Suspended Solids (mg/L)	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 (mg/L)	3.0	17.0	14.6	15	19.0	22.7	-18	39.0	45.3	-15	13.8	14.3	-3.6	17.6	17.8	-1.1
Turbidity (NTU)	0.10	0.15	0.12	22	0.26	0.32	-21	0.47	0.48	-2.1	0.28	0.28	0	0.27	0.23	16
Anions and Nutrients (mg/L)																
Alkalinity, Bicarbonate (as $CaCO_3$)	2.0	6.4	6.4	0	10.3	10.3	0	9.2	8.7	5.6	5.4	4.9	10	5.4	5.4	0
Alkalinity, Carbonate (as $CaCO_3$)	2.0	*<2.0*	*<2.0*		*<2.0*	*<2.0*		*<2.0*	*<2.0*		*<2.0*	*<2.0*		*<2.0*	*<2.0*	
Alkalinity, Hydroxide (as CaCO3)	2.0	*<2.0*	*<2.0*		*<2.0*	*<2.0*		*<2.0*	*<2.0*		*<2.0*	*<2.0*		*<2.0*	*<2.0*	
Alkalinity, Total (as $CaCO_3$)	2.0	6.4	6.4	0	10.3	10.3	0	9.2	8.7	5.6	5.4	4.9	10	5.4	5.4	0
Ammonia, Total (as N)	0.0050	0.0208	0.0188	10	*<0.005*	*<0.005*		*<0.005*	*<0.005*		*<0.005*	0.0249		*<0.005*	0.0052	
Bromide (Br)	0.050	*<0.05*	*<0.05*		*<0.05*	*<0.05*		0.06	0.061	-1.7	*<0.05*	*<0.05*		*<0.05*	*<0.05*	
Chloride (Cl)	0.10	0.74	0.73	1.4	0.49	0.49	0	14.00	13.90	0.7	0.66	0.66	0	0.64	0.63	1.6
Nitrate (as N)	0.0050	0.0664	0.0662	0	*<0.005*	*<0.005*		0.0320	0.0314	1.9	*<0.005*	*<0.005*		0.0476	0.0484	-1.7
Nitrite (as N)	0.0010	*<0.001*	0.0011		*<0.001*	*<0.001*		*<0.001*	*<0.001*		*<0.001*	*<0.001*		0.0012	*<0.001*	
Total Kjeldahl Nitrogen	0.050	0.112	0.126	-12	0.142	0.138	2.9	0.211	0.209	1.0	0.157	0.142	10	0.139	0.133	4.4
Orthophosphate (as P)	0.0010	*<0.001*	*<0.001*		*<0.001*	*<0.001*		*<0.001*	*<0.001*		*<0.001*	*<0.001*		*<0.001*	*<0.001*	
Total Phosphate (as P)	0.0020	*<0.002*	*<0.002*		0.0034	0.0034	0	0.0046	0.0048	-4.3	0.003	0.0033	-10	*<0.002*	*<0.002*	
Silicate (as SiO_2)	0.50	*<0.5*	*<0.5*		0.72	0.69	4.3	*<0.5*	*<0.5*		*<0.5*	*<0.5*		*<0.5*	*<0.5*	
Sulfate (SO_4)	0.50	4.53	4.49	0.9	2.51	2.51	0	2.50	2.50	0	0.85	0.85	0	3.89	3.93	-1.0
Organic / Inorganic Carbon (mg/L)																
Dissolved Organic Carbon	0.50	2.14	2.58	-19	2.85	2.95	-3.4	3.30	3.31	0	1.95	1.76	10	1.42	1.43	-0.7
Total Organic Carbon	0.50	1.66	2.08	-22	2.77	2.51	10	3.17	3.60	-13	2.05	1.76	15	1.39	1.36	2.2
Plant Pigments (ug/L)																
Chlorophyll-a	0.010	*<0.01*	*<0.01*		0.261	0.294	-12	0.245	0.454	-60	0.168	0.133	23	0.22	0.195	12
TOTAL METALS (mg/L)																
Aluminum	0.0030	*<0.0030*	*<0.0030*		0.007	0.0072	-2.8	0.0241	0.023	4.7	0.0081	0.0067	19	0.005	0.0056	-11
Antimony	0.00010	*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*	
Arsenic	0.00010	0.00022	0.00020	10	0.00024	0.00021	13	0.00016	0.00013	21	*<0.0001*	*<0.0001*		0.00019	0.00018	5.4
Barium	0.000050	0.00325	0.00318	2.2	0.00196	0.00185	5.8	0.01720	0.01660	3.6	0.00177	0.00175	1.1	0.00270	0.00308	-13
Beryllium	0.00010	*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*	
Bismuth	0.00050	*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*	
Boron	0.010	*<0.01*	*<0.01*		*<0.01*	*<0.01*		*<0.01*	*<0.01*		*<0.01*	*<0.01*		*<0.01*	*<0.01*	
Cadmium	0.000010	*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*	
Calcium	0.050	2.24	2.18	2.7	3.33	3.23	3.0	2.68	2.66	0.7	1.12	1.12	0	1.99	2.08	-4.4
Chromium	0.00010	*<0.0001*	*<0.0001*		0.00011	0.00011	0	0.00027	0.00013	**70**	0.00011	0.0001	10	*<0.0001*	*<0.0001*	
Copper	0.00050	*<0.0005*	*<0.0005*		0.00095	0.00101	-6.1	0.00056	*<0.0005*		0.00054	*<0.0005*		*<0.0005*	*<0.0005*	
Iron	0.010	*<0.01*	*<0.01*		0.02	0.02	0	0.033	0.029	13	0.018	0.014	25	*<0.01*	*<0.01*	
Lead	0.000050	*<0.00005*	*<0.00005*		*<0.00005*	*<0.00005*		*<0.00005*	*<0.00005*		*<0.00005*	*<0.00005*		*<0.00005*	*<0.00005*	
Lithium	0.00050	0.00088	0.00087	1.1	*<0.0005*	*<0.0005*		0.00066	0.00054	20	*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*	
Magnesium	0.10	0.90	0.88	2.2	0.99	0.96	3.1	1.90	1.86	2.1	0.69	0.68	1.5	0.81	0.82	-1.2
Manganese	0.000050	0.00202	0.00203	0	0.00161	0.00157	2.5	0.00397	0.00390	1.8	0.00207	0.00195	6.0	0.00253	0.00261	-3.1
Mercury	0.000010	*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*	
Molybdenum	0.000050	0.000221	0.000225	-1.8	0.000083	0.000085	-2.4	0.000080	0.000064	22	*<0.00005*	*<0.00005*		0.000183	0.000187	-2.2
Nickel	0.00050	*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*		*<0.0005*	0.00051	
Phosphorus	0.050	*<0.05*	*<0.05*		*<0.05*	*<0.05*		*<0.05*	*<0.05*		*<0.05*	*<0.05*		*<0.05*	*<0.05*	

Table 3.1-1. Field QA/QC data for water parameters, Meadowbank study lakes and Baker Lake, 2013.

		Third Portage Lake			Wally Lake			Baker Lake			Innugugayualik Lake			Third Portage Lake		
		TPN-59	APR DUP-1	RPD	WAL-30	JULY DUP-1	RPD	BAP-28	JULY DUP-2	RPD	INUG-50	AUG DUP-1	RPD	TPN-63	AUG DUP-3	RPD
ANALYTE	**MDLs**	18-Apr-13	18-Apr-13	%	19-Jul-13	19-Jul-13	%	20-Jul-13	20-Jul-13	%	23-Aug-13	23-Aug-13	%	26-Aug-13	26-Aug-13	%
Potassium	0.050	0.51	0.51	0	0.40	0.39	2.5	0.71	0.70	1.4	0.37	0.37	0	0.47	0.48	-2.1
Selenium	0.00010	*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*	
Silicon	0.050	0.068	0.077	-12	0.325	0.317	2.5	0.230	0.228	0.9	0.138	0.132	4.4	0.054	0.059	-8.8
Sodium	0.050	1.07	1.03	3.8	0.48	0.45	5.2	7.26	7.21	0.7	0.52	0.52	0	0.99	1.01	-2.0
Strontium	0.00020	0.0104	0.0106	-1.9	0.0165	0.0159	3.7	0.0215	0.0211	1.9	0.0064	0.0064	0.8	0.0095	0.0098	-3.8
Sulfur	0.50	1.57	1.46	7.3	0.88	0.85	3.5	0.96	0.89	7.6	*<0.5*	*<0.5*		1.32	1.39	-5.2
Thallium	0.000010	*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*	
Tin	0.00010	*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*	
Titanium	0.010	*<0.01*	*<0.01*		*<0.01*	*<0.01*		*<0.01*	*<0.01*		*<0.01*	*<0.01*		*<0.01*	*<0.01*	
Uranium	0.000010	0.000048	0.000050	-4.1	0.000043	0.000044	-2.3	0.000050	0.000050	0	0.000046	0.000046	0	0.000042	0.000044	-4.7
Vanadium	0.0010	*<0.001*	*<0.001*		*<0.001*	*<0.001*		*<0.001*	*<0.001*		*<0.001*	*<0.001*		*<0.001*	*<0.001*	
Zinc	0.0030	*<0.0030*	*<0.0030*		*<0.0030*	*<0.0030*		*<0.0030*	*<0.0030*		*<0.0030*	*<0.0030*		*<0.0030*	*<0.0030*	
DISSOLVED METALS (mg/L)																
Aluminum	0.0010	0.0014	0.0017	-19	0.0025	0.0028	-11	0.0050	0.0052	-3.9	0.0021	0.0019	10	0.0020	0.0025	-22
Antimony	0.00010	*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*	
Arsenic	0.00010	0.00018	0.00018	0	0.00021	0.00021	0	0.00012	*<0.0001*		*<0.0001*	*<0.0001*		0.00016	0.00015	6.5
Barium	0.000050	0.00327	0.00339	-3.6	0.00190	0.00179	6.0	0.01700	0.01720	-1.2	0.00173	0.00166	4.1	0.00269	0.00267	0.7
Beryllium	0.00010	*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*	
Bismuth	0.00050	*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*	
Boron	0.010	*<0.01*	*<0.01*		*<0.01*	*<0.01*		*<0.01*	*<0.01*		*<0.01*	*<0.01*		*<0.01*	*<0.01*	
Cadmium	0.000010	*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*	
Calcium	0.050	2.28	2.24	1.8	3.38	3.37	0	2.67	2.70	-1.1	1.07	1.05	1.9	1.90	1.91	-0.5
Chromium	0.00010	*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		0.00016	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*	
Copper	0.00020	0.00039	0.00038	2.6	0.00083	0.00079	4.9	0.00036	0.00033	8.7	0.00034	0.00035	-2.9	0.00038	0.00035	8.2
Iron	0.010	*<0.01*	*<0.01*		*<0.01*	*<0.01*		*<0.01*	*<0.01*		*<0.01*	*<0.01*		*<0.01*	*<0.01*	
Lead	0.000050	*<0.00005*	*<0.00005*		*<0.00005*	*<0.00005*		*<0.00005*	*<0.00005*		*<0.00005*	*<0.00005*		*<0.00005*	*<0.00005*	
Lithium	0.00050	0.00083	0.00075	10	*<0.0005*	*<0.0005*		0.00058	0.00066	-13	*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*	
Magnesium	0.10	0.92	0.91	1.1	0.99	0.99	0	1.85	1.87	-1.1	0.66	0.65	1.5	0.77	0.78	-1.3
Manganese	0.000050	0.00171	0.00164	4.2	0.00077	0.00074	4.2	0.00232	0.00252	-8.3	0.00043	0.00039	11	0.00172	0.00178	-3.4
Mercury	0.000010	*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*	
Molybdenum	0.000050	0.000209	0.000201	3.9	0.000074	0.000079	-6.5	0.000067	*<0.00005*		*<0.00005*	*<0.00005*		0.000172	0.000164	4.8
Nickel	0.00050	*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*	
Phosphorus	0.050	*<0.05*	*<0.05*		*<0.05*	*<0.05*		*<0.05*	*<0.05*		*<0.05*	*<0.05*		*<0.05*	*<0.05*	
Potassium	0.050	0.53	0.54	-1.9	0.39	0.38	2.6	0.69	0.70	-1.4	0.33	0.33	0	0.43	0.43	0
Selenium	0.00010	*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*	
Silicon	0.050	0.067	0.082	-20	0.328	0.320	2.5	0.186	0.190	-2.1	0.122	0.121	0.8	*<0.05*	0.051	
Sodium	0.050	1.09	1.08	0.9	0.48	0.47	1.9	7.04	7.35	-4.3	0.50	0.50	-0.8	0.94	0.96	-1.7
Strontium	0.00020	0.0105	0.00996	5.3	0.0160	0.01570	1.9	0.0207	0.02040	1.5	0.0060	0.00631	-5.0	0.0095	0.00946	0
Sulfur	0.50	1.54	1.50	2.6	0.87	0.89	-2.3	0.95	0.90	5.4	*<0.5*	*<0.5*		1.26	1.29	-2.4
Thallium	0.000010	*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*	
Tin	0.00010	*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*	
Titanium	0.010	*<0.01*	*<0.01*		*<0.01*	*<0.01*		*<0.01*	*<0.01*		*<0.01*	*<0.01*		*<0.01*	*<0.01*	
Uranium	0.000010	0.000045	0.000046	-2.2	0.000038	0.000039	-2.6	0.000041	0.000039	5.0	0.000035	0.000038	-8.2	0.000035	0.000035	0
Vanadium	0.0010	*<0.001*	*<0.001*		*<0.001*	*<0.001*		*<0.001*	*<0.001*		*<0.001*	*<0.001*		*<0.001*	*<0.001*	
Zinc	0.0010	*<0.001*	*<0.001*		*<0.001*	*<0.001*		*<0.001*	*<0.001*		*<0.001*	*<0.001*		*<0.001*	*<0.001*	

Notes:

RPD = Relative Percent Difference (%) = ((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.

Bolded RPDs values exceed 50% but < 10 x MDL.

Shaded RPD values exceed 50% and > 10 x MDL.

Bolded Equipment Blank values exceed laboratory MDLs but < 10 x MDL.

Shaded Equipment Blank values > 10 x MDL.

- = no measurement

Table 3.1-1. Field QA/QC data for water parameters, Meadowbank study lakes and Baker Lake, 2013.

		Baker Lake			Third Portage Lake			Third Portage Lake			Equipment Blanks						
		BAP-29	AUG DUP-2	RPD	TPE-67	NOV DUP-1	RPD	TPE-68	DEC DUP-1	RPD	APR EB-1	JUL-EB1	AUG-EB1	AUG-EB2	SEPT EB-1	NOV EB-1	DEC EB-1
ANALYTE	**MDLs**	30-Aug-13	30-Aug-13	%	26-Nov-13	26-Nov-13	%	09-Dec-13	09-Dec-13	%	17-Apr-13	17-Jul-13	25-Aug-13	30-Aug-13	15-Sep-13	24-Nov-13	08-Dec-13
CONVENTIONAL PARAMETERS																	
Physical Tests																	
Conductivity (µS/cm)	2.0	101.0	101.0	0	28.1	28.4	-1.1	30.4	30.7	-1.0	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*
Hardness (mg/L)	0.50	16.50	16.60	-0.6	5.76	10.5	-58	4.17	7.70	-59	*<0.5*	*<0.5*	*<0.5*	*<0.5*	**0.89**	*<0.5*	*<0.5*
pH	0.10	7.68	7.40	3.7	7.56	7.42	1.9	7.12	7.09	0	5.98	5.82	6.00	5.55	5.75	6.07	6.07
Total Suspended Solids (mg/L)	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 (mg/L)	3.0	60	61.3	-2.0	23.7	21.0	12	15.4	17.6	-13	*<3.0*	*<10*	*<3.0*	*<3.0*	*<3.0*	*<3.0*	*<3.0*
Turbidity (NTU)	0.10	0.23	0.26	-12	0.37	0.28	28	0.19	0.19	0	*<0.1*	**0.10**	*<0.1*	*<0.1*	*<0.1*	**0.13**	*<0.1*
Anions and Nutrients (mg/L)																	
Alkalinity, Bicarbonate (as $CaCO_3$)	2.0	6.9	9.3	-30	7.6	7.5	1.3	9.0	8.7	3.4	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*
Alkalinity, Carbonate (as $CaCO_3$)	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*
Alkalinity, Hydroxide (as CaCO3)	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*
Alkalinity, Total (as $CaCO_3$)	2.0	6.9	9.3	-30	7.6	7.5	1.3	9.0	8.7	3.4	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*
Ammonia, Total (as N)	0.0050	0.0053	0.0183	**-110**	0.0059	0.0085	-36	0.0087	0.0381	**-126**	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*
Bromide (Br)	0.050	0.079	0.079	0	*<0.05*	*<0.05*		*<0.05*	*<0.05*		*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*
Chloride (Cl)	0.10	22.00	22.00	0	0.68	0.67	1.5	0.72	0.72	0	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*
Nitrate (as N)	0.0050	0.0259	0.0263	-1.5	0.0127	0.0131	-3.1	0.0138	0.0134	2.9	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*
Nitrite (as N)	0.0010	*<0.001*	*<0.001*		*<0.001*	*<0.001*		*<0.001*	*<0.001*		*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Total Kjeldahl Nitrogen	0.050	0.15	0.163	-11	0.056	0.090	-47	0.108	0.139	-25	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*
Orthophosphate (as P)	0.0010	*<0.001*	*<0.001*		*<0.001*	*<0.001*		*<0.001*	*<0.001*		*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Total Phosphate (as P)	0.0020	0.0036	0.0040	-11	*<0.002*	*<0.002*		*<0.002*	*<0.002*		*<0.002*	*<0.002*	*<0.002*	*<0.002*	*<0.002*	*<0.002*	*<0.002*
Silicate (as SiO_2)	0.50	*<0.50*	*<0.5*		*<0.5*	*<0.5*		*<0.5*	*<0.5*		*<0.5*	*<0.5*	*<0.5*	*<0.5*	*<0.5*	*<0.5*	*<0.5*
Sulfate (SO_4)	0.50	3.62	3.62	0	4.05	4.01	1.0	4.33	4.35	0	*<0.5*	*<0.5*	*<0.5*	*<0.5*	*<0.5*	*<0.5*	*<0.5*
Organic / Inorganic Carbon (mg/L)																	
Dissolved Organic Carbon	0.50	3.1	3.06	2.3	1.65	1.31	23	1.68	1.35	22	**1.25**	**1.08**	*<0.5*	*<0.5*	**2.34**	**1.57**	**1.31**
Total Organic Carbon	0.50	3.0	2.98	0.7	1.20	1.07	11	1.26	1.51	-18	**1.01**	*<0.5*	*<0.5*	*<0.5*	*<0.5*	*<0.5*	**0.71**
Plant Pigments (ug/L)																	
Chlorophyll-a	0.010	0.47	0.444	5.9	0.114	0.434	-117	0.279	0.186	40	-	-	-	-	*<0.01*	-	-
TOTAL METALS (mg/L)																	
Aluminum	0.0030	0.0100	0.0105	-4.9	0.006	0.0044	31	0.0037	0.0042	-13	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*
Antimony	0.00010	*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Arsenic	0.00010	0.0001	0.00015	-6.9	0.00051	0.00028	**58**	0.00032	0.00025	25	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Barium	0.000050	0.0174	0.01780	-2.3	0.00280	0.00156	57	0.00172	0.00129	29	**0.00048**	**0.00010**	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	**0.00017**
Beryllium	0.00010	*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Bismuth	0.00050	*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*
Boron	0.010	*<0.01*	*<0.01*		*<0.01*	*<0.01*		*<0.01*	*<0.01*		*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*
Cadmium	0.000010	*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	**0.00004**
Calcium	0.050	2.83	2.79	1.4	2.45	1.36	57	1.44	1.17	21	**0.153**	**0.058**	*<0.05*	*<0.05*	**0.082**	*<0.05*	**0.474**
Chromium	0.00010	*<0.0001*	*<0.0001*		0.00016	*<0.0001*		0.0001	0.00013	-26	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Copper	0.00050	*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*
Iron	0.010	0.01	0.012	15	0.011	*<0.01*		*<0.01*	*<0.01*		*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*
Lead	0.000050	*<0.00005*	*<0.00005*		*<0.00005*	*<0.00005*		*<0.00005*	*<0.00005*		*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	**0.00007**	*<0.00005*	**0.00038**
Lithium	0.00050	0.0010	0.00106	-7.8	*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*
Magnesium	0.10	2.41	2.44	-1.2	0.87	0.49	**56**	0.51	0.41	22	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*
Manganese	0.000050	0.00187	0.00187	0	0.00122	0.00072	51	0.00071	0.00052	29	*<0.00005*	**0.00007**	**0.00005**	*<0.00005*	**0.00006**	*<0.00005*	**0.00029**
Mercury	0.000010	*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*
Molybdenum	0.000050	0.000074	0.000057	26	0.000178	0.000109	48	0.000113	0.000082	32	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*
Nickel	0.00050	*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*
Phosphorus	0.050	*<0.05*	*<0.05*		*<0.05*	*<0.05*		*<0.05*	*<0.05*		*<0.05*	*<0.30*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*

Table 3.1-1. Field QA/QC data for water parameters, Meadowbank study lakes and Baker Lake, 2013.

		Baker Lake			Third Portage Lake			Third Portage Lake			Equipment Blanks						
		BAP-29	AUG DUP-2	RPD	TPE-67	NOV DUP-1	RPD	TPE-68	DEC DUP-1	RPD	APR EB-1	JUL-EB1	AUG-EB1	AUG-EB2	SEPT EB-1	NOV EB-1	DEC EB-1
ANALYTE	**MDLs**	30-Aug-13	30-Aug-13	%	26-Nov-13	26-Nov-13	%	09-Dec-13	09-Dec-13	%	17-Apr-13	17-Jul-13	25-Aug-13	30-Aug-13	15-Sep-13	24-Nov-13	08-Dec-13
Potassium	0.050	0.95	0.97	-2.1	0.48	0.26	**59**	0.27	0.24	12	*<0.1*	*<0.05*	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*
Selenium	0.00010	*<0.0001*	*<0.0001*		0.00012	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Silicon	0.050	0.18	0.177	-0.6	0.065	*<0.05*		*<0.05*	*<0.05*		*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*
Sodium	0.050	11.50	11.40	0.9	0.83	0.45	**59**	0.49	0.39	22	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*
Strontium	0.00020	0.0243	0.0246	-1.2	0.0102	0.0058	56	0.0063	0.0050	24	*<0.0002*	*<0.0002*	*<0.0002*	*<0.0002*	**0.00029**	*<0.0002*	**0.00060**
Sulfur	0.50	1.23	1.24	-0.8	1.21	0.69	**55**	0.72	0.57	23	*<0.5*	-	*<0.5*	*<0.5*	*<0.5*	*<0.5*	*<0.5*
Thallium	0.000010	*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*
Tin	0.00010	*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Titanium	0.010	*<0.01*	*<0.01*		*<0.01*	*<0.01*		*<0.01*	*<0.01*		*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*
Uranium	0.000010	0.000045	0.000046	-2.2	0.000047	0.000027	**54**	0.000028	0.000023	20	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*
Vanadium	0.0010	*<0.001*	*<0.001*		*<0.001*	*<0.001*		*<0.001*	*<0.001*		*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Zinc	0.0030	*<0.0030*	*<0.0030*		*<0.0030*	*<0.0030*		*<0.0030*	*<0.0030*		*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	**0.0035**	*<0.0030*
DISSOLVED METALS (mg/L)																	
Aluminum	0.0010	0.0041	0.0047	-14	*<0.001*	0.0012		*<0.001*	0.0027		*<0.001*	*<0.001*	*<0.001*	*<0.001*	**0.0011**	*<0.001*	*<0.001*
Antimony	0.00010	*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Arsenic	0.00010	0.00012	0.00012	0	0.00029	0.00052	**-57**	0.00021	0.00031	-38	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Barium	0.000050	0.0182	0.01720	5.6	0.00167	0.00288	-53	0.00128	0.00199	-43	**0.0005**	**0.00017**	*<0.00005*	**0.00009**	**0.00023**	*<0.00005*	*<0.00005*
Beryllium	0.00010	*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Bismuth	0.00050	*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*
Boron	0.010	*<0.01*	*<0.01*		*<0.01*	*<0.01*		*<0.01*	*<0.01*		*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*
Cadmium	0.000010	*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*		*<0.00001*	0.000019		**0.00010**	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	**0.00002**
Calcium	0.050	2.76	2.75	0.4	1.45	2.65	-59	1.06	2.11	-66	**0.147**	**0.108**	*<0.05*	*<0.05*	**0.357**	*<0.05*	*<0.05*
Chromium	0.00010	*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Copper	0.00020	0.00029	0.00030	-3.4	*<0.0002*	0.00034		*<0.0002*	0.00034		*<0.0002*	**0.00041**	*<0.0002*	*<0.0002*	*<0.0002*	*<0.0002*	*<0.0002*
Iron	0.010	*<0.01*	*<0.01*		*<0.01*	*<0.01*		*<0.01*	*<0.01*		*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*
Lead	0.000050	*<0.00005*	*<0.00005*		*<0.00005*	*<0.00005*		*<0.00005*	0.000114		**0.00014**	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*
Lithium	0.00050	0.0012	0.00104	11	*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*
Magnesium	0.10	2.34	2.36	-0.9	0.52	0.93	**-57**	0.37	0.59	-46	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*
Manganese	0.000050	0.0005	0.00044	7.1	0.00009	0.00024	**-93**	0.00014	0.00036	**-88**	*<0.00005*	**0.00018**	*<0.00005*	**0.00007**	**0.00008**	*<0.00005*	*<0.00005*
Mercury	0.000010	*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*
Molybdenum	0.000050	0.0001	0.000057	-5.4	0.000097	0.000186	**-63**	0.000078	0.000129	-49	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*
Nickel	0.00050	*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*		*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*
Phosphorus	0.050	*<0.05*	*<0.05*		*<0.05*	*<0.05*		*<0.05*	*<0.05*		*<0.05*	*<0.30*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*
Potassium	0.050	0.88	0.87	1.1	0.28	0.51	-58	0.19	0.34	**-57**	*<0.1*	*<0.05*	*<0.1*	*<0.1*	*<0.1*	*<0.1*	*<0.1*
Selenium	0.00010	*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Silicon	0.050	0.158	0.160	-1.3	*<0.05*	0.065		*<0.05*	*<0.05*		*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*
Sodium	0.050	11.40	11.20	1.8	0.48	0.87	-59	0.35	0.59	**-50**	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*
Strontium	0.00020	0.0246	0.02350	4.6	0.0059	0.01070	-58	0.0047	0.00782	-49	*<0.0002*	**0.00034**	*<0.0002*	*<0.0002*	**0.00168**	*<0.0002*	*<0.0002*
Sulfur	0.50	1.22	1.19	2.5	0.69	1.28	**-60**	*<0.5*	0.87		*<0.5*	-	*<0.5*	*<0.5*	*<0.5*	*<0.5*	*<0.5*
Thallium	0.000010	*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*		*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*
Tin	0.00010	*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*		*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Titanium	0.010	*<0.01*	*<0.01*		*<0.01*	*<0.01*		*<0.01*	*<0.01*		*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*
Uranium	0.000010	0.000041	0.000041	0	0.000026	0.000043	**-49**	0.000017	0.000029	**-52**	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*
Vanadium	0.0010	*<0.001*	*<0.001*		*<0.001*	*<0.001*		*<0.001*	*<0.001*		*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Zinc	0.0010	*<0.001*	*<0.001*		*<0.001*	*<0.001*		*<0.001*	0.0011		**0.0029**	**0.0015**	*<0.001*	*<0.001*	*<0.001*	*<0.001*	**0.0011**

Notes:

RPD = Relative Percent Difference (%) = ((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.

Bolded RPDs values exceed 50% but < 10 x MDL.

Shaded RPD values exceed 50% and > 10 x MDL.

Bolded Equipment Blank values exceed laboratory MDLs but < 10 x MDL.

Shaded Equipment Blank values > 10 x MDL.

- = no measurement

Table 3.1-2. Laboratory QA/QC data for water parameters, Meadowbank study lakes and Baker Lake, 2013.

		Various Lakes			Various Lakes			Various Lakes			Various Lakes			Various Lakes		
Analyte	**MDLs**	**Original** April	**Laboratory Duplicate**	**RPD** %	**Original** July	**Laboratory Duplicate**	**RPD** %	**Original** July	**Laboratory Duplicate**	**RPD** %	**Original** August	**Laboratory Duplicate**	**RPD** %	**Original** August	**Laboratory Duplicate**	**RPD** %
CONVENTIONAL PARAMETERS																
Physical Tests																
Conductivity (µS/cm)	2.0	-	-	-	20	20.2	-1.0	27.4	27.5	0	25.4	25.2	0.8	101	101	0
Hardness (mg/L)	0.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pH	0.10	-	-	-	6.72	6.73	-0.1	7.33	7.33	0	7.21	7.22	-0.1	7.4	7.35	0.7
Total Suspended Solids (mg/L)	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids (mg/L)	3.0	27.7	26.4	4.8	-	-	-	19	21.5	-12	13.8	13.3	3.7	-	-	-
Turbidity (NTU)	0.10	-	-	-	-	-	-	0.26	0.26	0	0.23	0.24	-4.3	-	-	-
Anions and Nutrients (mg/L)																
Alkalinity, Bicarbonate (as $CaCO_3$)	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Alkalinity, Carbonate (as $CaCO_3$)	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Alkalinity, Hydroxide (as CaCO3)	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Alkalinity, Total (as $CaCO_3$)	2.0	-	-	-	-	-	-	8.7	8.9	-2.3	5.4	4.7	14	9.4	9.1	3.2
Ammonia, Total (as N)	0.0050	-	-	-	-	-	-	*<0.0050*	*<0.0050*		*<0.0050*	*<0.0050*		0.0107	0.0106	0.9
Bromide (Br)	0.050	-	-	-	*<0.050*	*<0.050*		*<0.050*	*<0.050*		*<0.050*	*<0.050*		-	-	-
Chloride (Cl)	0.10	-	-	-	0.58	0.57	1.7	0.57	0.57	0	0.58	0.57	1.7	-	-	-
Nitrate (as N)	0.0050	-	-	-	*<0.0050*	*<0.0050*		0.0073	0.0071	2.8	*<0.0050*	*<0.0050*		-	-	-
Nitrite (as N)	0.0010	-	-	-	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		-	-	-
Total Kjeldahl Nitrogen	0.050	-	-	-	-	-	-	-	-	-	0.133	0.137	-3.0	-	-	-
Orthophosphate (as P)	0.0010	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		-	-	-
Total Phosphate (as P)	0.0020	-	-	-	*<0.0020*	*<0.0020*		0.0034	0.0033	3.0	*<0.0020*	*<0.0020*		0.0035	0.0033	5.9
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*	
Sulfate (SO_4)	0.50	-	-	-	2.37	2.37	0	3.2	3.2	0	1.56	1.56	0	-	-	-
Organic / Inorganic Carbon (mg/L)																
Dissolved Organic Carbon	0.50	2.17	2.11	2.8	1.84	1.8	2.2	1.83	1.78	2.8	1.65	1.66	-0.6	3.51	3.46	1.4
Total Organic Carbon	0.50	2.30	2.28	0.9	2.17	1.99	8.7	1.92	1.88	2.1	1.64	1.48	10	3.02	3.29	-8.6
Plant Pigments (ug/L)																
Chlorophyll-a	0.010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL METALS (mg/L)																
Aluminum	0.0030	-	-	-	-	-	-	0.0096	0.0086	11	0.0045	0.0048	-6.5	-	-	-
Antimony	0.00010	-	-	-	-	-	-	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		-	-	-
Arsenic	0.00010	-	-	-	-	-	-	0.00026	0.00025	3.9	0.00014	0.00014	0	-	-	-
Barium	0.000050	-	-	-	-	-	-	0.0019	0.0018	5.4	0.00189	0.00185	2.1	-	-	-
Beryllium	0.00010	-	-	-	-	-	-	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		-	-	-
Bismuth	0.00050	-	-	-	-	-	-	*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*		-	-	-
Boron	0.010	-	-	-	-	-	-	*<0.010*	*<0.010*		*<0.010*	*<0.010*		-	-	-
Cadmium	0.000010	-	-	-	-	-	-	*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		-	-	-
Calcium	0.050	-	-	-	-	-	-	3.42	3.32	3.0	2.22	2.21	0	-	-	-
Chromium	0.00010	-	-	-	-	-	-	0.00012	0.0001	18	0.00011	*<0.00010*		-	-	-
Copper	0.00050	-	-	-	-	-	-	0.00088	0.00089	-1.1	*<0.00050*	*<0.00050*		-	-	-
Iron	0.010	-	-	-	-	-	-	0.023	0.022	4.4	*<0.010*	*<0.010*		-	-	-
Lead	0.000050	-	-	-	-	-	-	*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*		-	-	-
Lithium	0.00050	-	-	-	-	-	-	*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*		-	-	-
Magnesium	0.10	-	-	-	-	-	-	1.02	0.99	3.0	0.78	0.77	1.3	-	-	-
Manganese	0.000050	-	-	-	-	-	-	0.00194	0.0019	2.1	0.00111	0.00107	3.7	-	-	-
Mercury	0.000010	-	-	-	-	-	-	-	-	-	*<0.000010*	*<0.000010*		-	-	-
Molybdenum	0.000050	-	-	-	-	-	-	0.000094	0.000088	6.6	*<0.000050*	*<0.000050*		-	-	-
Nickel	0.00050	-	-	-	-	-	-	*<0.00050*	0.00052		0.00061	0.00061	0	-	-	-
Phosphorus	0.050	-	-	-	-	-	-	*<0.050*	*<0.050*		*<0.050*	*<0.050*		-	-	-

Table 3.1-2. Laboratory QA/QC data for water parameters, Meadowbank study lakes and Baker Lake, 2013.

		Various Lakes			Various Lakes			Various Lakes			Various Lakes			Various Lakes		
Analyte	**MDLs**	**Original** April	**Laboratory Duplicate**	**RPD** %	**Original** July	**Laboratory Duplicate**	**RPD** %	**Original** July	**Laboratory Duplicate**	**RPD** %	**Original** August	**Laboratory Duplicate**	**RPD** %	**Original** August	**Laboratory Duplicate**	**RPD** %
Potassium	0.050	-	-	-	-	-	-	0.4	0.4	0	0.32	0.32	0	-	-	-
Selenium	0.00010	-	-	-	-	-	-	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		-	-	-
Silicon	0.050	-	-	-	-	-	-	0.331	0.325	1.8	0.156	0.149	4.6	-	-	-
Sodium	0.050	-	-	-	-	-	-	0.481	0.468	2.7	0.459	0.471	-2.6	-	-	-
Strontium	0.00020	-	-	-	-	-	-	0.0171	0.0165	3.6	0.0093	0.00925	0.5	-	-	-
Sulfur	0.50	-	-	-	-	-	-	0.91	0.89	2.2	0.55	0.55	0	-	-	-
Thallium	0.000010	-	-	-	-	-	-	*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		-	-	-
Tin	0.00010	-	-	-	-	-	-	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		-	-	-
Titanium	0.010	-	-	-	-	-	-	*<0.010*	*<0.010*		*<0.010*	*<0.010*		-	-	-
Uranium	0.000010	-	-	-	-	-	-	0.000044	0.000046	-4.4	0.000024	0.000025	-4.1	-	-	-
Vanadium	0.0010	-	-	-	-	-	-	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		-	-	-
Zinc	0.0030	-	-	-	-	-	-	*<0.0030*	*<0.0030*		*<0.0030*	*<0.0030*		-	-	-
DISSOLVED METALS (mg/L)																
Aluminum	0.0010	0.0013	0.0018	**-32**	-	-	-	0.0025	0.0024	4.1	0.0023	0.0022	4.4	0.005	0.0048	4.1
Antimony	0.00010	*<0.00010*	*<0.00010*		-	-	-	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*	
Arsenic	0.00010	0.00064	0.00064	0	-	-	-	0.00021	0.00021	0	0.00015	0.00017	-13	0.00012	0.00011	8.7
Barium	0.000050	0.00453	0.0046	-1.5	-	-	-	0.0019	0.00181	4.9	0.00284	0.00276	2.9	0.0173	0.0183	-5.6
Beryllium	0.00010	*<0.00010*	*<0.00010*		-	-	-	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*	
Bismuth	0.00050	*<0.00050*	*<0.00050*		-	-	-	*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*	
Boron	0.010	*<0.010*	*<0.010*		-	-	-	*<0.010*	*<0.010*		*<0.010*	*<0.010*		*<0.010*	*<0.010*	
Cadmium	0.000010	*<0.000010*	*<0.000010*		-	-	-	*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*	
Calcium	0.050	3.87	3.83	1.0	1.92	1.89	1.6	3.38	3.43	-1.5	1.87	1.86	0.5	2.98	2.97	0.3
Chromium	0.00010	*<0.00010*	*<0.00010*		-	-	-	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*	
Copper	0.00020	0.0006	0.00065	-8.0	-	-	-	0.00083	0.00082	1.2	0.00033	0.00035	-5.9	0.00032	0.00031	3.2
Iron	0.010	*<0.010*	*<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*		*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*	
Lithium	0.00050	0.00126	0.0008	**45**	-	-	-	*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*		0.00108	0.00108	0
Magnesium	0.10	1.42	1.40	1.4	0.73	0.73	0	0.99	1.01	-2.0	0.76	0.77	-1.3	2.93	2.94	-0.3
Manganese	0.000050	0.000338	0.000335	0.9	-	-	-	0.000773	0.00074	4.4	0.00135	0.00141	-4.3	0.000507	0.000504	0.6
Mercury	0.000010	*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*	
Molybdenum	0.000050	0.000262	0.000242	7.9	-	-	-	0.000074	0.000069	7.0	0.000182	0.000174	4.5	0.000064	0.000061	4.8
Nickel	0.00050	0.00055	0.0006	-8.7	-	-	-	*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*	
Phosphorus	0.050	*<0.050*	*<0.050*		*<0.30*	*<0.30*		*<0.050*	*<0.050*		*<0.050*	*<0.050*		*<0.050*	*<0.050*	
Potassium	0.050	0.78	0.77	1.3	-	-	-	0.39	0.39	0	0.42	0.44	-4.7	1.07	1.09	-1.9
Selenium	0.00010	*<0.00010*	*<0.00010*		-	-	-	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*	
Silicon	0.050	0.152	0.149	2.0	0.164	0.163	0.6	0.328	0.331	-0.9	0.051	*<0.050*		0.181	0.183	-1.1
Sodium	0.050	1.21	1.27	-4.8	-	-	-	0.478	0.479	-0.2	0.923	0.936	-1.4	15.9	15.6	1.9
Strontium	0.00020	0.0179	0.0168	6.3	-	-	-	0.016	0.0158	1.3	0.0094	0.00939	0.1	0.0267	0.0264	1.1
Sulfur	0.50	1.82	1.80	1.1	-	-	-	0.87	0.87	0	1.26	1.24	1.6	1.59	1.55	2.5
Thallium	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*	
Titanium	0.010	*<0.010*	*<0.010*		*<0.010*	*<0.010*		*<0.010*	*<0.010*		*<0.010*	*<0.010*		*<0.010*	*<0.010*	
Uranium	0.000010	0.000065	0.000068	-4.5	-	-	-	0.000038	0.000038	0	0.000032	0.000032	0	0.000044	0.00004	10
Vanadium	0.0010	*<0.0010*	*<0.0010*		-	-	-	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*	
Zinc	0.0010	*<0.0010*	*<0.0010*		-	-	-	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*	

Notes:

RPD = Relative Percent Difference (%) = ((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.

Bolded RPD values exceed 25% but < 10 x MDL.

Shaded RPD values exceed 25% and > 10 x MDL.

Bolded Travel Blank values exceed laboratory MDLs but < 10 x MDL.

Shaded Travel Blank values > 10 x MDL.

- = no measurement

Table 3.1-2. Laboratory QA/QC data for water parameters, Meadowbank study lakes and Baker Lake, 2013.

		Various Lakes			Various Lakes			Various Lakes			Various Lakes			Travel Blanks	
Analyte	**MDLs**	**Original** September	**Laboratory Duplicate**	**RPD** %	**Original** November	**Laboratory Duplicate**	**RPD** %	**Original** December	**Laboratory Duplicate**	**RPD** %	**Original** December	**Laboratory Duplicate**	**RPD** %	**AUG TRAV-1**	**AUG TRAV-2**
CONVENTIONAL PARAMETERS															
Physical Tests															
Conductivity (µS/cm)	2.0	-	-	-	-	-	-	34.3	34	0.9	-	-	-	*<2.0*	*<2.0*
Hardness (mg/L)	0.50	-	-	-	-	-	-	-	-	-	-	-	-	*<0.5*	*<0.5*
pH	0.10	-	-	-	6.6	6.66	-0.9	7.37	7.35	0	-	-	-	6.03	5.82
Total Suspended Solids (mg/L)	1.0	-	-	-	-	-	-	-	-	-	-	-	-	*<1.0*	*<1.0*
Total Dissolved Solids (mg/L)	3.0	-	-	-	23.7	23	3.0	19.2	20.2	-5.1	-	-	-	*<3.0*	*<3.0*
Turbidity (NTU)	0.10	-	-	-	0.27	0.27	0	0.18	0.18	0	-	-	-	*<0.1*	*<0.1*
Anions and Nutrients (mg/L)															
Alkalinity, Bicarbonate (as $CaCO_3$)	2.0	-	-	-	-	-	-	-	-	-	-	-	-	*<2.0*	*<2.0*
Alkalinity, Carbonate (as $CaCO_3$)	2.0	-	-	-	-	-	-	-	-	-	-	-	-	*<2.0*	*<2.0*
Alkalinity, Hydroxide (as CaCO3)	2.0	-	-	-	-	-	-	-	-	-	-	-	-	*<2.0*	*<2.0*
Alkalinity, Total (as $CaCO_3$)	2.0	-	-	-	-	-	-	-	-	-	-	-	-	*<2.0*	*<2.0*
Ammonia, Total (as N)	0.0050	-	-	-	0.0068	0.0063	7.6	0.0083	0.0089	-7.0	-	-	-	*<0.005*	0.054
Bromide (Br)	0.050	-	-	-	*<0.050*	*<0.050*		*<0.050*	*<0.050*		-	-	-	*<0.05*	*<0.05*
Chloride (Cl)	0.10	-	-	-	0.67	0.67	0	0.63	0.64	-1.6	-	-	-	*<0.1*	*<0.1*
Nitrate (as N)	0.0050	-	-	-	0.0131	0.0129	1.5	*<0.0050*	*<0.0050*		-	-	-	*<0.005*	*<0.005*
Nitrite (as N)	0.0010	-	-	-	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		-	-	-	*<0.001*	*<0.001*
Total Kjeldahl Nitrogen	0.050	0.162	0.161	0.6	0.109	0.099	10	0.121	0.121	0	0.090	0.093	-3.3	**0.122**	*<0.05*
Orthophosphate (as P)	0.0010	-	-	-	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		-	-	-	*<0.001*	*<0.001*
Total Phosphate (as P)	0.0020	-	-	-	*<0.0020*	*<0.0020*		0.0022	*<0.0020*		0.0021	0.0021	0	*<0.002*	*<0.002*
Silicate (as SiO_2)	0.50	-	-	-	*<0.50*	*<0.50*		*<0.50*	*<0.50*		1.19	1.14	4.3	*<0.5*	*<0.5*
Sulfate (SO_4)	0.50	-	-	-	4.01	4	0.2	3.66	3.67	0	-	-	-	*<0.5*	*<0.5*
Organic / Inorganic Carbon (mg/L)															
Dissolved Organic Carbon	0.50	1.75	1.74	0.6	2.57	2.73	-6.0	2.14	1.84	15	2.37	2.38	-0.4	-	-
Total Organic Carbon	0.50	1.69	1.68	0.6	*<0.50*	0.64					2.18	2.05	6.1	*<0.5*	*<0.5*
Plant Pigments (ug/L)															
Chlorophyll-a	0.010	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL METALS (mg/L)															
Aluminum	0.0030	-	-	-	0.0059	0.0085	**-36**	-	-	-	-	-	-	*<0.0030*	*<0.0030*
Antimony	0.00010	-	-	-	*<0.00010*	*<0.00010*		-	-	-	-	-	-	*<0.0001*	*<0.0001*
Arsenic	0.00010	-	-	-	0.00025	0.00026	-3.9	-	-	-	-	-	-	*<0.0001*	*<0.0001*
Barium	0.000050	-	-	-	0.00259	0.00256	1.2	-	-	-	-	-	-	*<0.00005*	*<0.00005*
Beryllium	0.00010	-	-	-	*<0.00010*	*<0.00010*		-	-	-	-	-	-	*<0.0001*	*<0.0001*
Bismuth	0.00050	-	-	-	*<0.00050*	*<0.00050*		-	-	-	-	-	-	*<0.0005*	*<0.0005*
Boron	0.010	-	-	-	*<0.010*	*<0.010*		-	-	-	-	-	-	*<0.01*	*<0.01*
Cadmium	0.000010	-	-	-	0.000046	0.00006	**-26**	-	-	-	-	-	-	*<0.00001*	*<0.00001*
Calcium	0.050	-	-	-	3.52	3.56	-1.1	-	-	-	-	-	-	*<0.05*	*<0.05*
Chromium	0.00010	-	-	-	0.00016	0.00018	-12	-	-	-	-	-	-	*<0.0001*	*<0.0001*
Copper	0.00050	-	-	-	0.00072	0.0010	**-33**	-	-	-	-	-	-	*<0.0005*	*<0.0005*
Iron	0.010	-	-	-	0.013	0.016	-21	-	-	-	-	-	-	*<0.01*	*<0.01*
Lead	0.000050	-	-	-	0.000667	0.000644	3.5	-	-	-	-	-	-	*<0.00005*	*<0.00005*
Lithium	0.00050	-	-	-	*<0.00050*	*<0.00050*		-	-	-	-	-	-	*<0.0005*	*<0.0005*
Magnesium	0.10	-	-	-	1.14	1.16	-1.7	-	-	-	-	-	-	*<0.1*	*<0.1*
Manganese	0.000050	-	-	-	0.000937	0.000974	-3.9	-	-	-	-	-	-	*<0.00005*	*<0.00005*
Mercury	0.000010	-	-	-	*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		-	-	-	*<0.00001*	*<0.00001*
Molybdenum	0.000050	-	-	-	0.000141	0.00014	0.7	-	-	-	-	-	-	*<0.00005*	*<0.00005*
Nickel	0.00050	-	-	-	*<0.00050*	*<0.00050*		-	-	-	-	-	-	*<0.0005*	*<0.0005*
Phosphorus	0.050	-	-	-	*<0.050*	*<0.050*		-	-	-	-	-	-	*<0.05*	*<0.05*

Table 3.1-2. Laboratory QA/QC data for water parameters, Meadowbank study lakes and Baker Lake, 2013.

		Various Lakes			Various Lakes			Various Lakes			Various Lakes			Travel Blanks	
Analyte	**MDLs**	**Original** September	**Laboratory Duplicate**	**RPD** %	**Original** November	**Laboratory Duplicate**	**RPD** %	**Original** December	**Laboratory Duplicate**	**RPD** %	**Original** December	**Laboratory Duplicate**	**RPD** %	**AUG TRAV-1**	**AUG TRAV-2**
Potassium	0.050	-	-	-	0.51	0.5	2.0	-	-	-	-	-	-	*<0.1*	*<0.1*
Selenium	0.00010	-	-	-	*<0.00010*	*<0.00010*		-	-	-	-	-	-	*<0.0001*	*<0.0001*
Silicon	0.050	-	-	-	0.18	0.183	-1.7	-	-	-	-	-	-	*<0.05*	*<0.05*
Sodium	0.050	-	-	-	0.699	0.712	-1.8	-	-	-	-	-	-	*<0.05*	*<0.05*
Strontium	0.00020	-	-	-	0.0152	0.0154	-1.3	-	-	-	-	-	-	*<0.0002*	*<0.0002*
Sulfur	0.50	-	-	-	1.27	1.25	1.6	-	-	-	-	-	-	*<0.5*	*<0.5*
Thallium	0.000010	-	-	-	*<0.000010*	*<0.000010*		-	-	-	-	-	-	*<0.00001*	*<0.00001*
Tin	0.00010	-	-	-	*<0.00010*	*<0.00010*		-	-	-	-	-	-	*<0.0001*	*<0.0001*
Titanium	0.010	-	-	-	*<0.010*	*<0.010*		-	-	-	-	-	-	*<0.01*	*<0.01*
Uranium	0.000010	-	-	-	0.000038	0.000038	0	-	-	-	-	-	-	*<0.00001*	*<0.00001*
Vanadium	0.0010	-	-	-	*<0.0010*	*<0.0010*		-	-	-	-	-	-	*<0.001*	*<0.001*
Zinc	0.0030	-	-	-	*<0.0030*	*<0.0030*		-	-	-	-	-	-	*<0.0030*	*<0.0030*
DISSOLVED METALS (mg/L)															
Aluminum	0.0010	0.0014	0.0014	0	0.0012	0.0013	-8.0	-	-	-	0.0022	0.0024	-8.7	-	-
Antimony	0.00010	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		-	-	-	*<0.00010*	*<0.00010*		-	-
Arsenic	0.00010	0.00024	0.00023	4.3	0.00052	0.00053	-1.9	-	-	-	*<0.00010*	*<0.00010*		-	-
Barium	0.000050	0.00162	0.00164	-1.2	0.00288	0.00298	-3.4	-	-	-	0.00175	0.00179	-2.3	-	-
Beryllium	0.00010	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		-	-	-	*<0.00010*	*<0.00010*		-	-
Bismuth	0.00050	*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*		-	-	-	*<0.00050*	*<0.00050*		-	-
Boron	0.010	*<0.010*	*<0.010*		*<0.010*	*<0.010*		-	-	-	*<0.010*	*<0.010*		-	-
Cadmium	0.000010	*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		-	-	-	0.000014	0.000013	7.4	-	-
Calcium	0.050	3.83	3.79	1.0	2.65	2.61	1.5	-	-	-	1.19	1.17	1.7	-	-
Chromium	0.00010	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		-	-	-	*<0.00010*	*<0.00010*		-	-
Copper	0.00020	0.00072	0.00072	0	0.00034	0.00035	-2.9	-	-	-	0.00032	0.00033	-3.1	-	-
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*		-	-	-	*<0.000050*	*<0.000050*		-	-
Lithium	0.00050	*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*		-	-	-	0.00057	0.00054	5.4	-	-
Magnesium	0.10	1.13	1.12	0.9	0.93	0.93	0	-	-	-	0.71	0.7	1.4	-	-
Manganese	0.000050	0.00045	0.000433	3.9	0.000241	0.000201	18	-	-	-	0.000243	0.000292	-18	-	-
Mercury	0.000010	*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		-	-	-	*<0.000010*	*<0.000010*		-	-
Molybdenum	0.000050	0.000119	0.000121	-1.7	0.000186	0.00018	3.3	-	-	-	*<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	0.050	0.42	0.4	4.9	0.51	0.53	-3.8	-	-	-	0.39	0.39	0	-	-
Selenium	0.00010	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		-	-	-	*<0.00010*	*<0.00010*		-	-
Silicon	0.050	0.373	0.371	0.5	0.065	0.066	-1.5	-	-	-	0.112	0.108	3.6	-	-
Sodium	0.050	0.552	0.559	-1.3	0.869	0.869	0	-	-	-	0.557	0.57	-2.3	-	-
Strontium	0.00020	0.0176	0.0174	1.1	0.0107	0.0108	-0.9	-	-	-	0.00612	0.00621	-1.5	-	-
Sulfur	0.50	1.05	1.08	-2.8	1.28	1.27	0.8	-	-	-	*<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	0.010	*<0.010*	*<0.010*		*<0.010*	*<0.010*		-	-	-	*<0.010*	*<0.010*		-	-
Uranium	0.000010	0.00003	0.000037	-21	0.000043	0.000042	2.4	-	-	-	0.000036	0.000033	8.7	-	-
Vanadium	0.0010	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		-	-	-	*<0.0010*	*<0.0010*		-	-
Zinc	0.0010	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		-	-	-	*<0.0010*	*<0.0010*		-	-

Notes:

RPD = Relative Percent Difference (%) = ((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.

Bolded RPD values exceed 25% but < 10 x MDL.

Shaded RPD values exceed 25% and > 10 x MDL.

Bolded Travel Blank values exceed laboratory MDLs but < 10 x MDL.

Shaded Travel Blank values > 10 x MDL.

- = no measurement

Table 3.1-3. QA/QC data for sediment grab parameters, Meadowbank study lakes and Baker Lake, August 2013.

		Innugugayualik Lake			Wally Lake			Tehek Lake			Second Portage Lake			Baker Lake			Baker Lake			Third Portage Lake		
		INUG-1	Field Dup-1	RPD	WAL-1	Field Dup-2	RPD	TEFF-1	Field Dup-3	RPD	SP-2	Field Dup-4	RPD	BPJ-2	Field Dup-5	RPD	BES-3	Field Dup-6	RPD	TPS-2	Field Dup-7	RPD
Analyte	**MDLs**	23-Aug-13	23-Aug-13	(%)	26-Aug-13	26-Aug-13	(%)	24-Aug-13	24-Aug-13	(%)	25-Aug-13	25-Aug-13	(%)	29-Aug-13	29-Aug-13	(%)	30-Aug-13	30-Aug-13	(%)	27-Aug-13	27-Aug-13	(%)
CONVENTIONAL PARAMETERS																						
Physical & Organic Parameters																						
Moisture (%)	*0.25*	86.5	85.7	0.9	91.0	91.3	-0.3	86.7	86.6	0.1	86.2	86.4	-0.2	48.0	42.6	12	37.3	38.0	-1.9	84.7	83.9	0.9
pH	*0.10*	5.82	5.82	0	6.50	6.60	-1.5	6.12	6.13	-0.2	6.08	6.18	-1.6	6.52	7.21	-10	7.02	7.51	-6.7	5.88	5.86	0.3
Total Organic Carbon (% dw)	*0.10*	4.49	4.33	3.6	9.12	9.26	-1.5	4.05	4.37	-7.6	4.58	4.67	-1.9	0.51	0.59	-15	0.34	0.32	6.1	4.32	4.36	-0.9
Particle Size																						
% Gravel (>2mm)	*0.10*	*<0.10*	*<0.10*		*<0.10*	*<0.10*		*<0.10*	*<0.10*		*<0.10*	*<0.10*		*<0.10*	0.15		0.19	4.64	**-184**	*<0.10*	*<0.10*	
% Sand (2.00mm - 0.063mm)	*0.10*	2.48	1.90	26	1.38	2.07	-40	1.28	1.31	-2.3	1.76	1.26	33	45.0	43.8	2.7	67.4	63.6	5.8	2.65	2.88	-8.3
% Silt (0.063mm - 4µm)	*0.10*	78.9	85.7	-8.3	87.5	90.5	-3.4	67.7	75.1	-10	73.7	83.8	-13	48.9	50.5	-3.2	27.9	28.0	-0.4	68.7	79.7	-15
% Clay (<4µm)	*0.10*	18.6	12.4	40	11.2	7.48	40	31.0	23.6	27	24.6	14.9	49	5.99	5.48	8.9	4.51	3.76	18	28.7	17.4	49
Total Metals (mg/kg dw)																						
Aluminum	*50*	18100	18200	-0.6	20400	22200	-8.5	25300	25000	1.2	21900	23900	-8.7	7950	7290	8.7	6220	5890	5.5	19800	26900	-30
Antimony	*0.10*	0.18	0.21	-15	0.45	0.41	9.3	0.19	0.19	0	0.27	0.31	-14	0.12	0.28	**-80**	0.13	0.14	-7.4	0.19	0.27	-35
Arsenic	*0.050*	228	229	-0.4	61.4	63.1	-2.7	12.3	12.4	-0.8	37.9	39.0	-2.9	16.0	16.0	0	3.53	3.24	8.6	13.2	18.0	-31
Barium	*0.50*	138	133	3.7	121	123	-1.6	121	121	0	144	146	-1.4	104	106	-1.9	98.3	97.7	0.6	80.1	115	-36
Beryllium	*0.20*	1.24	1.18	5.0	1.68	1.79	-6.3	2.14	2.08	2.8	1.67	1.76	-5.2	0.35	0.34	2.9	0.32	0.33	-3.1	1.15	1.69	-38
Bismuth	*0.20*	1.02	1.02	0	2.09	2.13	-1.9	1.95	1.95	0	1.94	2.02	-4.0	*<0.20*	*<0.20*		*<0.20*	*<0.20*		1.23	1.86	-41
Cadmium	*0.050*	0.245	0.248	-1.2	0.533	0.534	-0.2	0.168	0.155	8.0	0.274	0.298	-8.4	0.072	0.084	-15	*<0.050*	*<0.050*		0.156	0.221	-34
Calcium	*50*	1810	1840	-1.6	3920	4190	-6.7	2110	2090	1.0	2530	2600	-2.7	2270	2280	-0.4	2400	2340	2.5	1400	1950	-33
Chromium	*0.50*	92.6	91.2	1.5	60.8	61.3	-0.8	60.4	60.4	0	85.6	90.3	-5.3	19.9	18.5	7.3	17.2	16.9	1.8	91.7	128	-33
Cobalt	*0.10*	14.8	14.7	0.7	10.1	10.2	-1.0	13.3	13.0	2.3	21.0	21.4	-1.9	6.05	6.12	-1.2	4.45	4.33	2.7	12.8	18.0	-34
Copper	*0.50*	43.6	43.3	0.7	162	165	-1.8	55.9	54.7	2.2	63.5	66.2	-4.2	7.17	8.45	-16	4.89	4.63	5.5	52.3	72.0	-32
Iron	*50*	124000	125000	-0.8	47400	48000	-1.3	41900	41700	0.5	80000	84000	-4.9	20500	19700	4.0	14000	13500	3.6	25000	35000	-33
Lead	*0.50*	12.5	12.6	-0.8	35.5	36.1	-1.7	21.6	21.4	0.9	19.8	20.5	-3.5	8.38	9.43	-12	5.40	5.67	-4.9	15.7	22.6	-36
Lithium	*5.0*	21.7	20.8	4.2	31.8	36.5	-14	51.7	51.7	0	36.5	37.8	-3.5	10.2	9.4	8.2	8.8	8.4	4.7	28.6	40.1	-33
Magnesium	*20*	7910	7860	0.6	7550	7660	-1.4	8800	8640	1.8	8730	9130	-4.5	4310	4090	5.2	3560	3530	0.8	7400	10600	-36
Manganese	*1.0*	2710	2440	10	431	429	0.5	2110	2070	1.9	7150	7280	-1.8	2870	3070	-6.7	304	290	4.7	609	839	-32
Mercury	*0.0050*	0.0292	0.0305	-4.4	0.0807	0.0700	14	0.0206	0.0208	-1.0	0.0355	0.0368	-3.6	0.0110	0.0097	13	0.0056	0.0050	11	0.0158	0.0182	-14
Molybdenum	*0.50*	9.03	8.82	2.4	12.8	13.6	-6.1	4.87	4.66	4.4	6.66	6.61	0.8	1.73	1.80	-4.0	*<0.50*	*<0.50*		3.02	4.17	-32
Nickel	*0.50*	84.1	82.0	2.5	58.6	59.5	-1.5	40.1	40.7	-1.5	78.2	81.9	-4.6	12.3	11.6	5.9	9.70	9.81	-1.1	57.8	80.6	-33
Phosphorus	*50*	3430	3560	-3.7	804	860	-6.7	469	493	-5.0	593	614	-3.5	807	794	1.6	728	750	-3.0	391	522	-29
Potassium	*100*	2800	2890	-3.2	3370	3560	-5.5	4620	4680	-1.3	3850	4090	-6.0	1470	1260	15	1270	1200	5.7	3110	4210	-30
Selenium	*0.20*	0.80	0.78	2.5	1.23	1.23	0	0.75	0.73	2.7	0.92	0.99	-7.3	*<0.20*	*<0.20*		*<0.20*	*<0.20*		0.59	0.87	-38
Silver	*0.10*	0.16	0.16	0	0.68	0.67	1.5	*<0.10*	*<0.10*		0.18	0.20	-11	*<0.10*	*<0.10*		*<0.10*	*<0.10*		0.12	0.17	-34
Sodium	*100*	140	160	-13	160	190	-17	190	200	-5.1	170	190	-11	130	120	8.0	*<100*	*<100*		140	170	-19
Strontium	*0.50*	23.0	23.2	-0.9	25.8	29.0	-12	19.6	19.5	0.5	21.7	22.7	-4.5	49.3	44.1	11	39.6	39.0	1.5	13.3	18.0	-30
Thallium	*0.050*	0.201	0.198	1.5	0.317	0.328	-3.4	0.434	0.425	2.1	0.339	0.348	-2.6	0.065	0.063	3.1	0.050	0.053	-5.8	0.224	0.320	-35
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	*1.0*	435	454	-4.3	528	609	-14	855	903	-5.5	662	763	-14	390	327	18	354	330	7.0	560	750	-29
Uranium	*0.050*	14.1	14.2	-0.7	17.4	18.1	-3.9	25.2	24.6	2.4	16.4	17.0	-3.6	1.60	1.54	3.8	1.34	1.36	-1.5	13.9	20.9	-40
Vanadium	*0.20*	30.8	30.5	1.0	32.4	33.1	-2.1	39.0	38.0	2.6	36.7	37.9	-3.2	24.7	22.2	11	20.2	20.2	0	32.6	45.4	-33
Zinc	*1.0*	85.5	83.7	2.1	130	128	1.6	112	108	3.6	107	112	-4.6	34.4	36.8	-6.7	23.7	23.2	2.1	77.8	108	-33

Notes:

RPD = Relative Percent Difference (%) = ((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.

Bolded RPD values exceed 25% (lab duplicates) or 50% (field duplicates) but < 10 x MDL.

Shaded RPD values exceed 25% (lab duplicates) or 50% (field duplicates) and > 10 x MDL.

Bolded Filter Swipe values exceed laboratory MDLs but < 10 x MDL.

Shaded Filter Swipe values > 10 x MDL.

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

"-" = no measurement

Table 3.1-3. QA/QC data for sediment grab parameters, Meadowbank study lakes and Baker Lake, August 2013.

		Third Portage Lake			Various Lakes			Various Lakes			Various Lakes			Various Lakes										
		TPN-1	Field Dup-8	RPD	Original	Laboratory Duplicate	RPD	Original	Laboratory Duplicate	RPD	Original	Laboratory Duplicate	RPD	Original	Laboratory Duplicate	RPD		Swipe-1 FILTER	Swipe-2 FILTER	Swipe-3 FILTER	Swipe-4 FILTER	Swipe-5 FILTER	Swipe-6 FILTER	Swipe-7 FILTER	Swipe-8 FILTER
Analyte	**MDLs**	28-Aug-13	28-Aug-13	(%)	August		(%)	August		(%)	August		(%)	August		(%)		23-Aug-13	26-Aug-13	24-Aug-13	25-Aug-13	29-Aug-13	30-Aug-13	27-Aug-13	28-Aug-13
CONVENTIONAL PARAMETERS																								
Physical & Organic Parameters																								
Moisture (%)	*0.25*	79.0	78.2	1.0	88.7	88.3	0.5	81.6	82.7	-1.3	86.5	87.4	-1.0	54.7	50.6	7.8		-	-	-	-	-	-	-	-
pH	*0.10*	5.87	6.60	-12	6.77	6.94	-2.5	6.17	6.12	0.8	8.05	8.05	0	6.9	6.1	12		-	-	-	-	-	-	-	-
Total Organic Carbon (% dw)	*0.10*	2.75	2.64	4.1	4.02	4.08	-1.5	4.19	4.17	0.5	1.92	1.91	0.5	5.7	5.68	0.4		-	-	-	-	-	-	-	-
Particle Size																								
% Gravel (>2mm)	*0.10*	*<0.10*	*<0.10*		9.67	11.4	-16	17.7	15	17	2.92	3.19	-8.8	-	-	-		-	-	-	-	-	-	-	-
% Sand (2.00mm - 0.063mm)	*0.10*	31.0	30.2	2.6	*<0.10*	*<0.10*		*<0.10*	*<0.10*		*<0.10*	*<0.10*		-	-	-		-	-	-	-	-	-	-	-
% Silt (0.063mm - 4µm)	*0.10*	51.3	61.1	-17	2.05	2.39	-15	2.15	2.09	2.8	77	76.2	1.0	-	-	-		-	-	-	-	-	-	-	-
% Clay (<4µm)	*0.10*	17.8	8.75	68	88.3	86.2	2.4	80.1	82.9	-3.4	20.1	20.6	-2.5	-	-	-		-	-	-	-	-	-	-	-
Total Metals (mg/kg dw)																	**MDLs (ug)**				**TOTAL METALS (ug)**				
Aluminum	*50*	15900	17100	-7.3	24900	23600	5.4	25000	24300	2.8	4890	5190	-6.0	15100	17100	-12	20	*<20*	*<20*	*<20*	*<20*	*<20*	*<20*	*<20*	*<20*
Antimony	*0.10*	0.15	0.28	**-60**	0.23	0.23	0	0.24	0.24	0	0.13	3.02	**-183**	0.17	0.18	-5.7	20	*<20*	*<20*	*<20*	*<20*	*<20*	*<20*	*<20*	*<20*
Arsenic	*0.050*	9.17	10.4	-13	17.2	16.6	3.6	41.3	40	3.2	3.1	3.12	-0.6	14.2	16	-12	20	*<20*	*<20*	*<20*	*<20*	*<20*	*<20*	*<20*	*<20*
Barium	*0.50*	58.1	69.1	-17	140	137	2.2	129	124	4.0	163	170	-4.2	71.4	66.3	7.4	1.0	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Beryllium	*0.20*	0.94	1.03	-9.1	1.69	1.62	4.2	2.02	1.93	4.6	0.3	0.28	6.9	0.77	0.88	-13	0.50	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*
Bismuth	*0.20*	0.93	1.08	-15	2.28	2.23	2.2	2.32	2.17	6.7	*<0.20*	*<0.20*		0.82	0.99	-19	20	*<20*	*<20*	*<20*	*<20*	*<20*	*<20*	*<20*	*<20*
Cadmium	*0.050*	0.079	0.082	-3.7	0.623	0.656	-5.2	0.234	0.245	-4.6	*<0.050*	*<0.050*		0.091	0.096	-5.3	1.0	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Calcium	*50*	1440	1710	-17	2190	2030	7.6	2210	2200	0.5	2170	2190	-0.9	1800	1510	18	5.0	51.8	54.7	**46.4**	57.3	**45.0**	**35.4**	**40.3**	**35.5**
Chromium	*0.50*	102	112	-9.3	114	114	0	81.2	78.8	3.0	16.8	16.1	4.3	90.5	103	-13	2.0	**3.7**	**3.6**	**4.6**	**2.3**	*<2.0*	**2.7**	*<2.0*	**2.2**
Cobalt	*0.10*	8.37	9.29	-10	16.5	16.4	0.6	17.2	16.8	2.4	4.1	4.11	-0.2	9.46	10.9	-14	1.0	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Copper	*0.50*	40.2	45.5	-12	50.9	51.9	-1.9	74.9	72.7	3.0	3.89	4.56	-16	29.7	34.4	-15	1.0	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Iron	*50*	22300	24800	-11	41400	40900	1.2	79900	77500	3.0	12200	12600	-3.2	26900	31300	-15	3.0	42.3	35.4	42.9	**23.8**	**20.8**	**18.7**	**16.5**	**23.7**
Lead	*0.50*	12.8	15.0	-16	26.2	20.8	23	21.1	20.5	2.9	4.37	4.27	2.3	11.5	13.8	-18	5.0	*<5.0*	*<5.0*	*<5.0*	*<5.0*	*<5.0*	*<5.0*	*<5.0*	*<5.0*
Lithium	*5.0*	24.9	27.3	-9.2	46.1	40.8	12	42	40.4	3.9	8.4	7.7	8.7	21.8	26.1	-18	1.0	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Magnesium	*20*	7190	8370	-15	9390	9450	-0.6	9080	9140	-0.7	3300	3300	0	6870	8040	-16	10	**24**	**20**	**20**	**23**	**25**	**17**	**12**	**15**
Manganese	*1.0*	253	291	-14	4150	4360	-4.9	1780	1790	-0.6	631	644	-2.0	596	685	-14	0.50	**1.06**	**0.70**	**1.61**	**0.67**	**1.76**	**0.50**	*<0.50*	**0.73**
Mercury	*0.0050*	0.0110	0.0129	-16	0.018	0.0184	-2.2	0.0302	0.0275	9.4	*<0.0050*	*<0.0050*		0.0105	0.0116	-10	0.010	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Molybdenum	*0.50*	1.81	2.04	-12	3.82	3.6	5.9	7.8	7.63	2.2	0.68	*<0.50*		2.2	2.55	-15	3.0	*<3.0*	*<3.0*	*<3.0*	*<3.0*	*<3.0*	*<3.0*	*<3.0*	*<3.0*
Nickel	*0.50*	49.5	55.1	-11	164	166	-1.2	63.9	62.6	2.1	9.69	9.52	1.8	45.2	52.8	-16	5.0	*<5.0*	*<5.0*	*<5.0*	*<5.0*	*<5.0*	*<5.0*	*<5.0*	*<5.0*
Phosphorus	*50*	481	552	-14	425	433	-1.9	714	703	1.6	672	719	-6.8	323	391	-19	30	*<30*	*<30*	*<30*	*<30*	*<30*	*<30*	*<30*	*<30*
Potassium	*100*	2270	2540	-11	4310	4130	4.3	4510	4430	1.8	970	1060	-8.9	2280	2430	-6.4	200	*<200*	*<200*	*<200*	*<200*	*<200*	*<200*	*<200*	*<200*
Selenium	*0.20*	0.44	0.41	7.1	0.83	0.83	0	0.95	0.96	-1.0	*<0.20*	*<0.20*		0.49	0.57	-15	20	*<20*	*<20*	*<20*	*<20*	*<20*	*<20*	*<20*	*<20*
Silver	*0.10*	*<0.10*	*<0.10*		*<0.10*	*<0.10*		0.15	0.15	0	*<0.10*	*<0.10*		*<0.10*	*<0.10*		1.0	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Sodium	*100*	*<100*	120		180	180	0	210	180	15	*<100*	*<100*		130	110	17	200	*<200*	*<200*	*<200*	*<200*	**220**	*<200*	*<200*	*<200*
Strontium	*0.50*	13.4	15.0	-11	18.4	17	7.9	20.5	20.2	1.5	31.5	34.8	-10	15.6	13.6	14	0.50	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*
Thallium	*0.050*	0.163	0.195	-18	0.513	0.514	-0.2	0.388	0.369	5.0	0.051	0.052	-1.9	0.158	0.193	-20	20	*<20*	*<20*	*<20*	*<20*	*<20*	*<20*	*<20*	*<20*
Tin	*2.0*	*<2.0*	*<2.0*		13.5	*<2.0*		*<2.0*	*<2.0*		*<2.0*	*<2.0*		*<2.0*	*<2.0*		3.0	**3.2**	*<3.0*	*<3.0*	*<3.0*	*<3.0*	*<3.0*	*<3.0*	*<3.0*
Titanium	*1.0*	480	505	-5.1	807	757	6.4	830	820	1.2	284	312	-9.4	497	507	-2.0	1.0	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Uranium	*0.050*	11.4	12.7	-11	15.6	15.5	0.6	19.6	19.1	2.6	1.03	1.03	0	9.15	10.9	-17									
Vanadium	*0.20*	27.5	30.2	-9.4	40.2	39.4	2.0	40.5	39.2	3.3	17.3	18	-4.0	26.2	29.6	-12	3.0	*<3.0*	*<3.0*	*<3.0*	*<3.0*	*<3.0*	*<3.0*	*<3.0*	*<3.0*
Zinc	*1.0*	61.6	69.3	-12	119	118	0.8	119	115	3.4	21.6	21.8	-0.9	62.1	69.6	-11	0.50	**1.19**	*<0.50*	**0.63**	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*

Notes:

RPD = Relative Percent Difference (%) = ((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.

Bolded RPD values exceed 25% (lab duplicates) or 50% (field duplicates) but < 10 x MDL.

Shaded RPD values exceed 25% (lab duplicates) or 50% (field duplicates) and > 10 x MDL.

Bolded Filter Swipe values exceed laboratory MDLs but < 10 x MDL.

Shaded Filter Swipe values > 10 x MDL.

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

"-" = no measurement

Table 3.1-4. Field QA/QC data for phytoplankton, Meadowbank study lakes and Baker Lake, 2013.

Field QA	Phytoplankton Density (cells/L)							Total
	Cyanophyte	Chlorophyte	Euglenophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	
TPN-59	3546	6300	0	212766	18231	1800	600	243243
APR DUP-1	3546	5100	0	216312	25423	2700	1100	254181
RPD (%)	0	21		-1.7	-33	-40	**-59**	-4
WAL-30	200	123328	0	1793016	100592	104376	600	2122112
JUL DUP-1	0	130312	0	1950664	101192	98392	8184	2288744
RPD (%)	NA	-5.5		-8.4	-0.6	5.9	**-173**	-8
BAP-28	0	50288	0	806808	132760	74656	9584	1074096
JUL DUP-2	0	57672	0	838744	85440	30552	3000	1015408
RPD (%)		-14		-3.9	43	**84**	**105**	6
TPN-61	0	28936	0	1246664	195768	8984	3200	1483552
JUL DUP-3	0	43304	0	1564760	107376	31536	2600	1749576
RPD (%)		-40		-23	**58**	**-111**	21	-16
INUG-50	44504	511864	0	1806184	98392	166232	7784	2634960
AUG DUP-1	1800	463176	0	1685256	104976	80224	21952	2357384
RPD (%)	**184**	10		6.9	-6.5	**70**	**-95**	11
BAP-29	0	215920	0	1423232	122992	246872	1400	2010416
AUG DUP-2	14368	567536	0	669112	59504	98192	400	1409112
RPD (%)	NA	**-90**		**72**	**70**	**86**	**111**	35
TPN-63	400	79624	0	1510440	744352	110960	32736	2478512
AUG DUP-3	0	195568	0	1520024	665128	37520	4800	2423040
RPD (%)	NA	**-84**		-0.6	11	**99**	**149**	2
TPE-67	100	10838	0	397963	111529	27423	400	548253
NOV DUP-1	1900	87206	0	487616	60838	11338	1000	649898
RPD (%)	**-180**	**-156**		-20	**59**	**83**	**-86**	-17
TPE-68	100	18831	0	634952	298826	37461	100	990270
DEC DUP-1	900	28469	0	834034	564584	10692	100	1438778
RPD (%)	**-160**	-41		-27	**-62**	**111**	0	-37

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". RPD has been left blank.

Table 3.1-4. Field QA/QC data for phytoplankton, Meadowbank study lakes and Baker Lake, 2013.

Field QA	Phytoplankton Biomass (mg/m^3)							Total	Other	
	Cyanophyte	Chlorophyte	Euglenophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate		# Species	Simp.Div.
TPN-59	0.18	0.71	0.00	8.51	1.47	2.26	0.86	13.99	17	0.65
APR DUP-1	0.24	0.54	0.00	8.93	1.64	3.17	1.55	16.07	17	0.73
RPD (%)	-29	27		-4.8	-11	-34	**-58**	-14	0	-12
WAL-30	0.13	4.24	0.00	188.90	16.86	13.09	9.99	233.20	35	0.83
JUL DUP-1	0.00	3.95	0.00	208.26	9.08	14.13	18.87	254.29	34	0.83
RPD (%)	NA	7.1		-10	**60**	-7.7	**-62**	-9	2.9	0
BAP-28	0.00	2.07	0.00	59.28	45.49	23.19	23.89	153.93	31	0.82
JUL DUP-2	0.00	2.25	0.00	96.75	12.60	16.30	27.90	155.80	34	0.86
RPD (%)		-8.3		-48	**113**	35	-15	-1	-9.2	-4.1
TPN-61	0.00	1.55	0.00	144.77	17.62	3.58	14.70	182.22	27	0.85
JUL DUP-3	0.00	2.22	0.00	185.92	16.72	7.03	19.14	231.04	30	0.80
RPD (%)		-36		-25	5.3	**-65**	-26	-24	-11	6.0
INUG-50	2.45	9.45	0.00	109.45	6.35	14.57	4.94	147.21	36	0.82
AUG DUP-1	0.45	8.70	0.00	130.39	7.10	7.46	8.60	162.70	36	0.85
RPD (%)	**138**	8.2		-17	-11	**65**	**-54**	-10	0	-3.4
BAP-29	0.00	9.26	0.00	98.75	28.42	41.24	8.08	185.75	39	0.83
AUG DUP-2	0.50	12.59	0.00	53.97	11.81	17.57	2.08	98.53	35	0.89
RPD (%)	NA	-30		**59**	**83**	**80**	**118**	**61**	10.8	-7.6
TPN-63	0.11	1.05	0.00	141.45	46.62	8.80	30.12	228.15	34	0.88
AUG DUP-3	0.00	5.40	0.00	168.22	39.77	4.36	11.24	228.99	32	0.89
RPD (%)	NA	**-135**		-17	16	**68**	**91**	0	6.1	-0.4
TPE-67	0.02	0.23	0.00	42.06	5.94	6.07	3.68	58.00	19	0.83
NOV DUP-1	0.30	3.16	0.00	49.63	4.26	1.67	4.31	63.33	20	0.80
RPD (%)	**-177**	**-173**		-17	33	**114**	-16	-9	-5.1	4.7
TPE-68	0.02	1.08	0.00	46.43	15.60	5.00	2.50	70.63	28	0.86
DEC DUP-1	0.27	0.94	0.00	62.80	24.01	4.87	0.78	93.67	25	0.83
RPD (%)	**-169**	13		-30	-42	2.8	**105**	-28	11	2.9

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". RPD has been left blank.

Table 3.1-5. Laboratory QA/QC data for phytoplankton, Meadowbank study lakes and Baker Lake, 2013.

Laboratory QA	Phytoplankton Density (cells/L)							Total
	Cyanophyte	Chlorophyte	Euglenophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	
WAL-27	0	19131	0	887025	35915	111883	1400	1055353
APR REP-1	0	23077	0	890471	21331	98199	1000	1034077
RPD (%)		-19		0	**51**	13	**33**	2
SP-60	800	215720	0	1699624	483744	81440	800	2482128
JUL REP-1	800	230088	0	2360752	431256	89824	200	3112920
RPD (%)	0	-6.4		**-33**	11	-10	**120**	-23
WAL-29	1200	151864	0	2074592	94408	112760	8384	2443208
JUL REP-2	1800	144680	0	2018120	142496	105776	8384	2421256
RPD (%)	**-40**	4.8		2.8	**-41**	6.4	0	1
BBD-28	200	79024	0	1194344	137544	116560	1800	1529472
JUL REP-3	0	79024	0	1223280	151712	115560	1600	1571176
RPD (%)	NA	0		-2.4	-10	0.9	12	-3
TEFF-29	1000	223704	0	1525808	116344	87008	10384	1964248
AUG REP-1	1000	223304	0	1468736	123528	65456	10384	1892408
RPD (%)	0	0		3.8	-6.0	**28**	0	4
SP-63	152664	273192	0	1358376	211952	162048	1800	2160032
AUG REP-2	29936	294944	0	1552744	196584	205952	8984	2289144
RPD (%)	**134**	-7.7		-13	7.5	-24	**-133**	-6
WAL-32	287360	375168	0	1720176	412488	68256	10784	2874232
AUG REP-3	258624	310112	0	1654720	448008	83624	3400	2758488
RPD (%)	11	19		3.9	-8.3	-20	**104**	4
TPE-66	100	54192	0	412948	115529	51345	100	634214
NOV REP-1	200	10838	0	394317	93899	17384	400	517038
RPD (%)	**-67**	**133**		4.6	21	**99**	**-120**	20
TPE-68	100	18831	0	634952	298826	37461	100	990270
DEC REP-1	200	11538	0	588753	309865	44653	0	955009
RPD (%)	**-67**	**48**		7.6	-3.6	-18	NA	4

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". RPD has been left blank.

Table 3.1-5. Laboratory QA/QC data for phytoplankton, Meadowbank study lakes and Baker Lake, 2013.

Laboratory QA	Phytoplankton Biomass (mg/m^3)							Total	Other	
	Cyanophyte	Chlorophyte	Euglenophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate		# Species	Simp.Div.
WAL-27	0.00	0.92	0.00	41.78	4.40	20.86	5.19	73.15	24	0.70
APR REP-1	0.00	1.20	0.00	43.86	3.03	19.86	1.60	69.54	25	0.72
RPD (%)		**-26**		-4.9	**37**	4.9	**106**	5	-4.1	-2.8
SP-60	0.55	4.02	0.00	154.57	27.22	21.08	7.71	215.14	34	0.84
JUL REP-1	0.61	6.39	0.00	185.35	27.58	23.92	2.80	246.65	32	0.73
RPD (%)	-11	**-46**		-18	-1.3	-13	**93**	-14	6.1	14
WAL-29	0.76	5.52	0.00	234.74	8.04	16.27	24.43	289.75	35	0.82
JUL REP-2	1.15	5.28	0.00	236.12	12.81	16.56	20.39	292.31	33	0.82
RPD (%)	**-40**	4.4		-0.6	**-46**	-1.8	18	-1	5.9	0
BBD-28	0.16	2.75	0.00	84.79	32.74	24.47	22.12	167.02	32	0.81
JUL REP-3	0.00	1.83	0.00	81.65	26.39	22.67	16.92	149.46	32	0.81
RPD (%)	NA	**40**		3.8	21	7.6	**27**	11	0	0
TEFF-29	0.92	5.00	0.00	102.86	9.19	5.35	18.77	142.09	34	0.83
AUG REP-1	0.40	4.60	0.00	89.58	9.20	4.20	16.70	124.68	31	0.81
RPD (%)	**80**	8.3		14	-0.2	24	12	13	9.2	2.6
SP-63	48.25	6.19	0.00	68.41	24.57	25.90	17.32	190.63	32	0.85
AUG REP-2	1.17	6.04	0.00	116.07	29.55	32.20	10.50	195.53	34	0.84
RPD (%)	**191**	2.5		**-52**	-18	-22	**49**	-3	-6.1	0.5
WAL-32	13.71	8.60	0.00	147.28	28.14	8.06	17.16	222.96	35	0.87
AUG REP-3	12.34	7.70	0.00	140.82	33.34	10.23	13.09	217.51	35	0.88
RPD (%)	11	11		4.5	-17	-24	**27**	2	0	-1.0
TPE-66	0.01	0.89	0.00	47.54	8.56	8.96	0.11	66.08	23	0.83
NOV REP-1	0.03	0.23	0.00	40.53	4.40	5.42	2.87	53.48	21	0.81
RPD (%)	**-91**	**118**		16	**64**	**49**	**-186**	21	9.1	2.7
TPE-68	0.02	1.08	0.00	46.43	15.60	5.00	2.50	70.63	28	0.86
DEC REP-1	0.05	0.91	0.00	48.19	15.45	5.19	0.00	69.79	26	0.86
RPD (%)	**-67**	17		-3.7	1.0	-3.7	NA	1	7.4	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". RPD has been left blank.

Table 3.1-6. Percent recovery of benthic invertebrate samples, Meadowbank study lakes and Baker Lake, August 2013.

Area-Replicate	Number of Organisms Recovered	Number of Organisms in Re-sort	Percent Recovery
BBD-3	45	48	93.8%
TEFF-1	46	46	100.0%
BPJ-1	67	69	97.1%
INUG-3	59	60	98.3%
TPN-2	58	58	100.0%
TPS-5	178	183	97.3%
BES-2	161	164	98.2%
		Average % Recovery	97.8%

Notes:
All sixty-five samples were sorted in their entirety.

3.2. Limnology

3.2.1. Meadowbank Study Lakes

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^{o}C water near the ice-water interface, increasing to 3^{o}C to 5^{o}C at depth.

During open water conditions, maximum water temperatures may reach 14^{o}C in summer with little evidence of thermal stratification, except for brief periods of time (days) and typically only a 4^{o}C to 5^{o}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 3 m depth for all project lakes since 2006 are depicted in **Figure 3.2-8**.

The 2013 vertical temperature profiles are characteristic of the typical thermal regime of these lakes (**Figures 3.2-1 through 3.2-6**). Winter temperature profiles (April, **Figure 3.2-1**) show a slight negative thermal stratification with water temperatures near 0^{o}C at the ice-water interface, increasing to no more than 3^{o}C at depth. Oxygen concentrations in winter generally decrease slightly with increasing depth. 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.

Once the ice is off by mid-July, all the lakes turn over completely, with uniform temperature and high oxygen concentrations and saturation. Water temperatures warm rapidly to reach maximum temperatures of at least 14^{o}C by late July and into August. Deeper basins, such as TPS, are typically 2^{o}C to 3^{o}C colder than the shallower basins. Temperatures in 2013 were moderate and typical of historically temperature patterns (**Figure 3.2-2**). No vertical stratification was recorded during summer months in 2013, either because sampling did not occur during a period of calm, windless conditions or that calm conditions did not persist long enough for stratification to become established (**Figures 3.2-2 and 3.2-3**).

In September, water temperatures cooled to below 5^{o}C but remained un-stratified until freeze-up. With vertical mixing, oxygen concentrations are high and fully saturated (**Figure 3.2-4**). While the values jumped around slightly, no vertical stratification was observed.

In November and December, once thick ice has formed similar stratification patterns and data value ranges as those observed earlier in the year (April). This includes increasing water temperature and decreasing oxygen concentration with lowering depth. Water temperature is at its seasonal low of < 3^{o}C (**Figures 3.2-5 and 3.2-6**).

The seasonal patterns in water temperature and oxygen concentrations observed in 2013 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 near- and mid-field monitoring areas.

Conductivity

Although technically a 'water chemistry' parameter (it is also included in **Section 3.3**), conductivity is discussed here as an indicator of change in the water column to facilitate review by the reader. 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 2013, conductivity was uniform in concentration through the water column, providing further evidence of a complete vertical mixing, consistent with results of temperature and oxygen. Minor vertical differences due to cyro-concentration were observed when expected (winter: **Figures 3.2-1, 3.2-5, 3.2-6**), with no differences between reference and

near-field areas and uniform profiles during the open water period (**Figures 3.2-2 to 3.2-4**).

3.2.2. Baker Lake

Throughout this discussion, the following abbreviations will be used for each lake area/basin: Baker Lake –Barge Dock, –Proposed Jetty (no longer a proposed jetty, but near to the Meadowbank Spudd Barge), –East Shore, –Akilahaarjuk Point (BBD, BPJ, BES, and BAP). Limnology surveys were conducted in July and August.

3.2.2.1. General Observations

Baker Lake is a very large lake with much greater wind fetch than 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 (>12 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. Nearshore areas of the three routine monitoring areas of Baker Lake in 2013 show relatively low concentrations of these parameters across all areas and events, suggesting that deep, higher conductivity water was influential during these sampling events.

As described below (and in **Section 3.3**), 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. Consequently, we identified a need to better characterize Baker Lake limnology at depth. Therefore, in August 2012, in addition to the limnology data collected at the water areas in Baker Lake, a deep limnology survey was conducted along transects into Baker Lake offshore of Baker Lake water sampling locations. 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).

3.2.2.2. Temporal and Spatial Trend Interpretation

The major mine-related activity that occurs in this area is seasonal barge traffic, which begins around mid-August and may continue through September. 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 study lakes except that water temperatures are cooler, reaching no more than 11^{o}C in mid-summer, are generally un-stratified because of the large, cold water volume and large fetch of Baker Lake (**Figure 3.2-7, Figure 3.2-8**).

In August 2013 conductivity was very consistent at both the impact sites (BBD and BPJ) and the reference site (BAP) throughout the depth profile (**Figure 3.2-7**); however, it was much higher than measured in July at these sites, reaching between 100 – 125 uS/cm in August, compared to 20 – 50 uS/cm measured in July.

Overall, the general pattern of temperature and conductivity in Baker Lake was similar in 2013 as in previous monitoring periods (**Figure 3.2-7**). Occasional elevations in conductivity and related parameters is 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.

Figure 3.2-1. Field-measured temperature (°C), conductivity (µS/cm) and dissolved oxygen (mg/L) profiles for April, 2013.

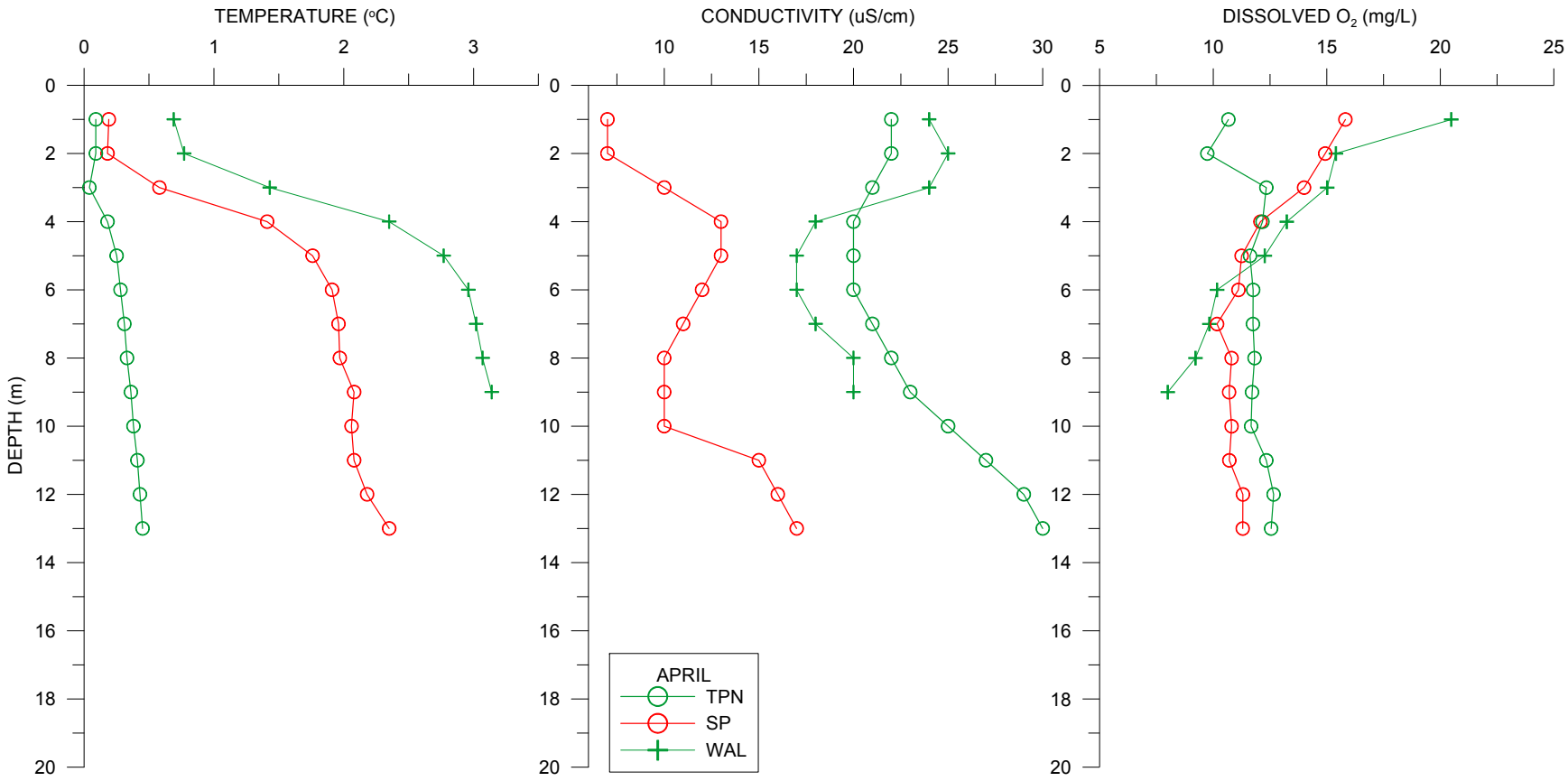


Figure 3.2-2. Field-measured temperature (°C), conductivity (µS/cm) and dissolved oxygen (mg/L) profiles for July, 2013.

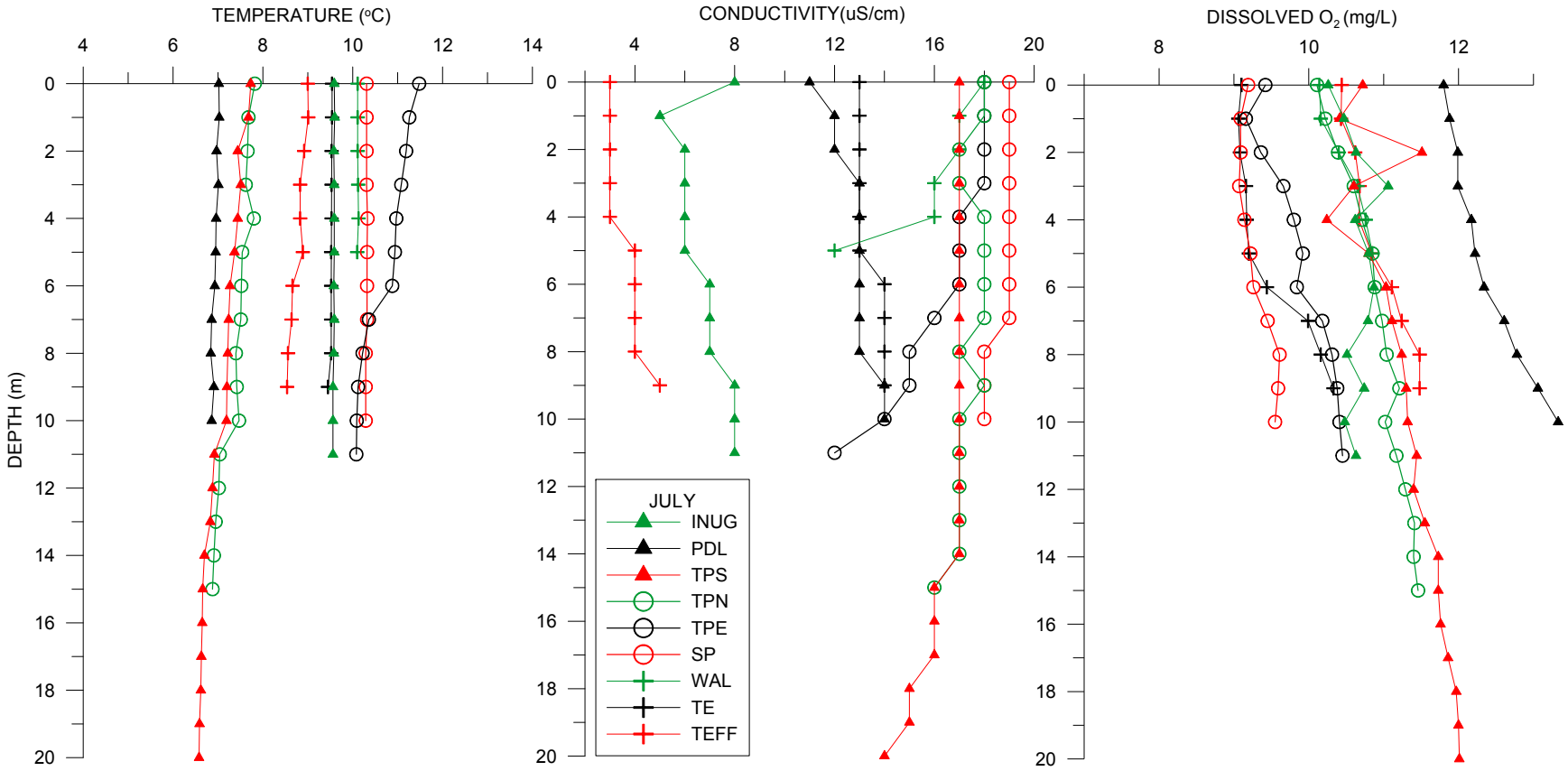


Figure 3.2-3. Field-measured temperature (°C), conductivity (µS/cm) and dissolved oxygen (mg/L) profiles for August, 2013.

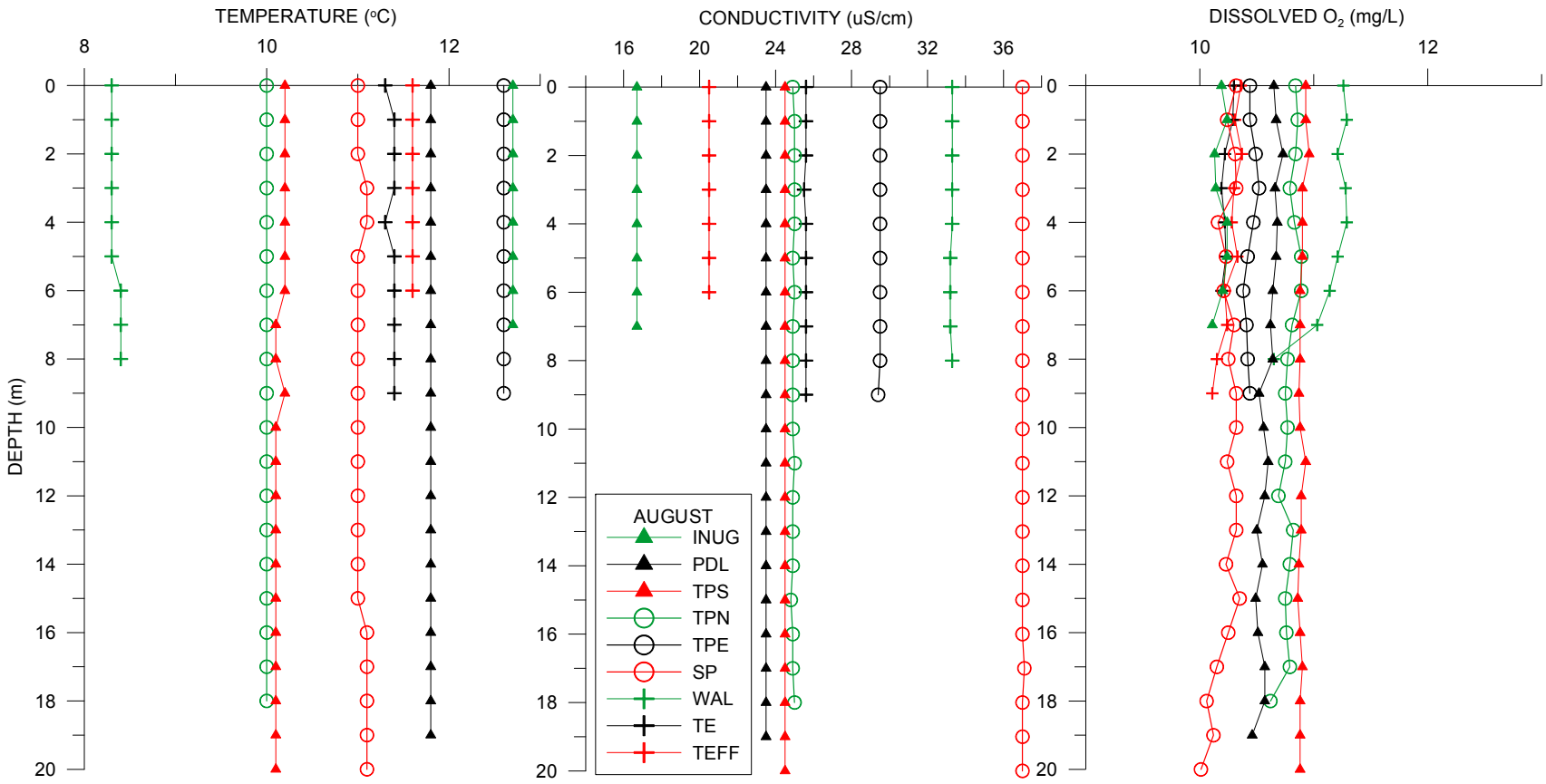


Figure 3.2-4. Field-measured temperature (°C), conductivity (µS/cm) and dissolved oxygen (mg/L) profiles for September, 2013.

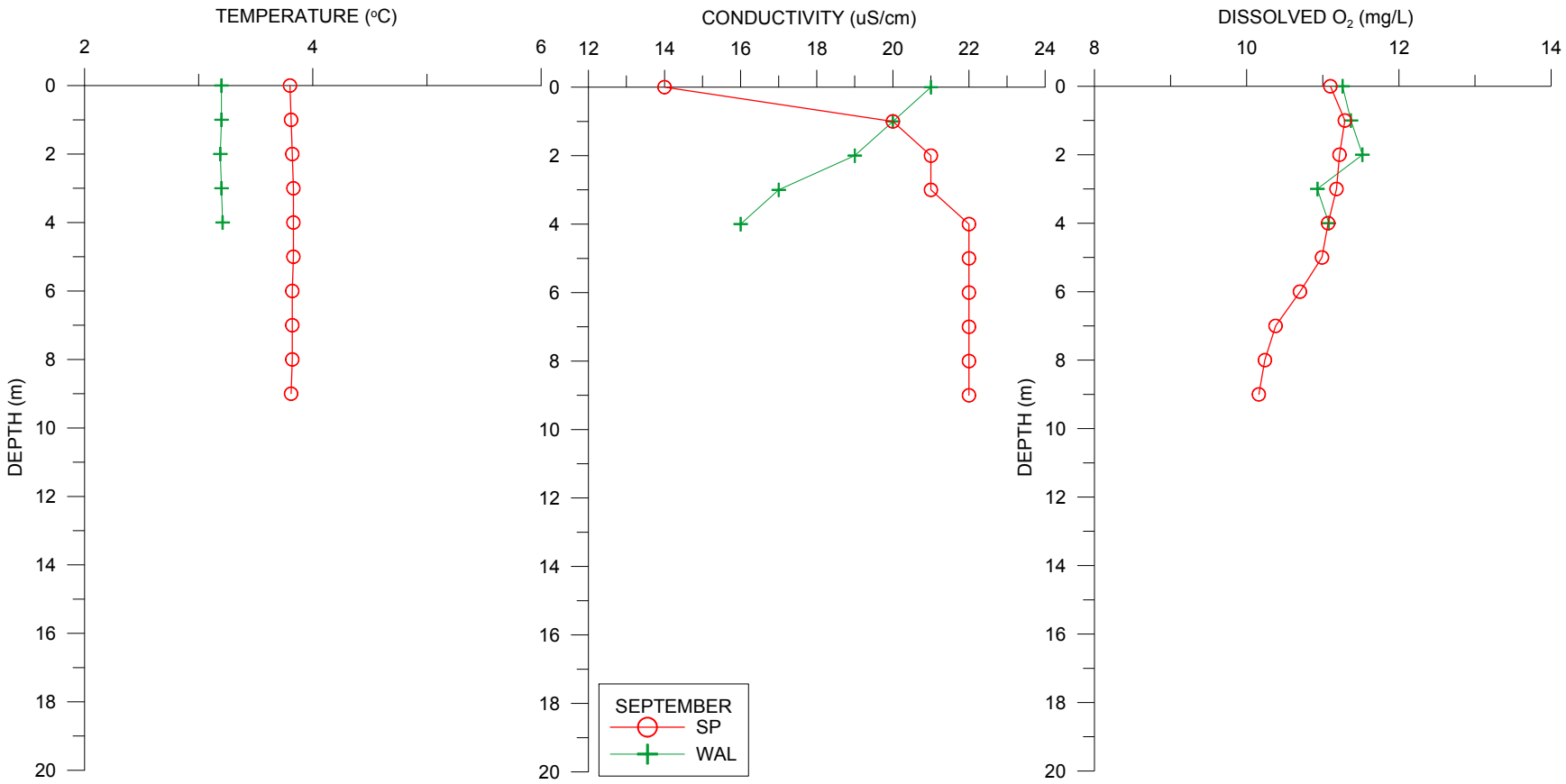


Figure 3.2-5. Field-measured temperature (°C), conductivity (µS/cm) and dissolved oxygen (mg/L) profiles for November, 2013.

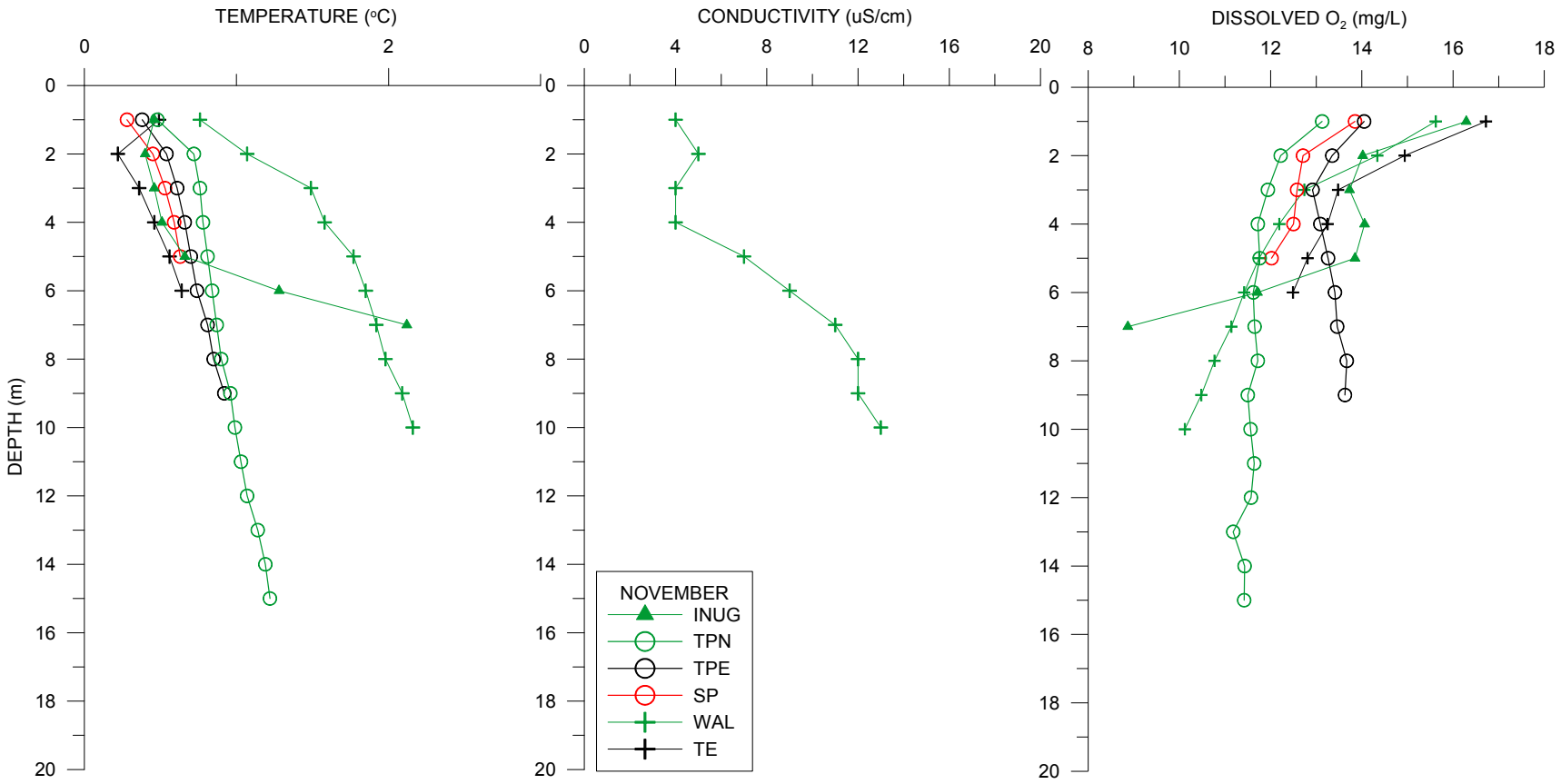


Figure 3.2-6. Field-measured temperature (°C), conductivity (µS/cm) and dissolved oxygen (mg/L) profiles for December, 2013.

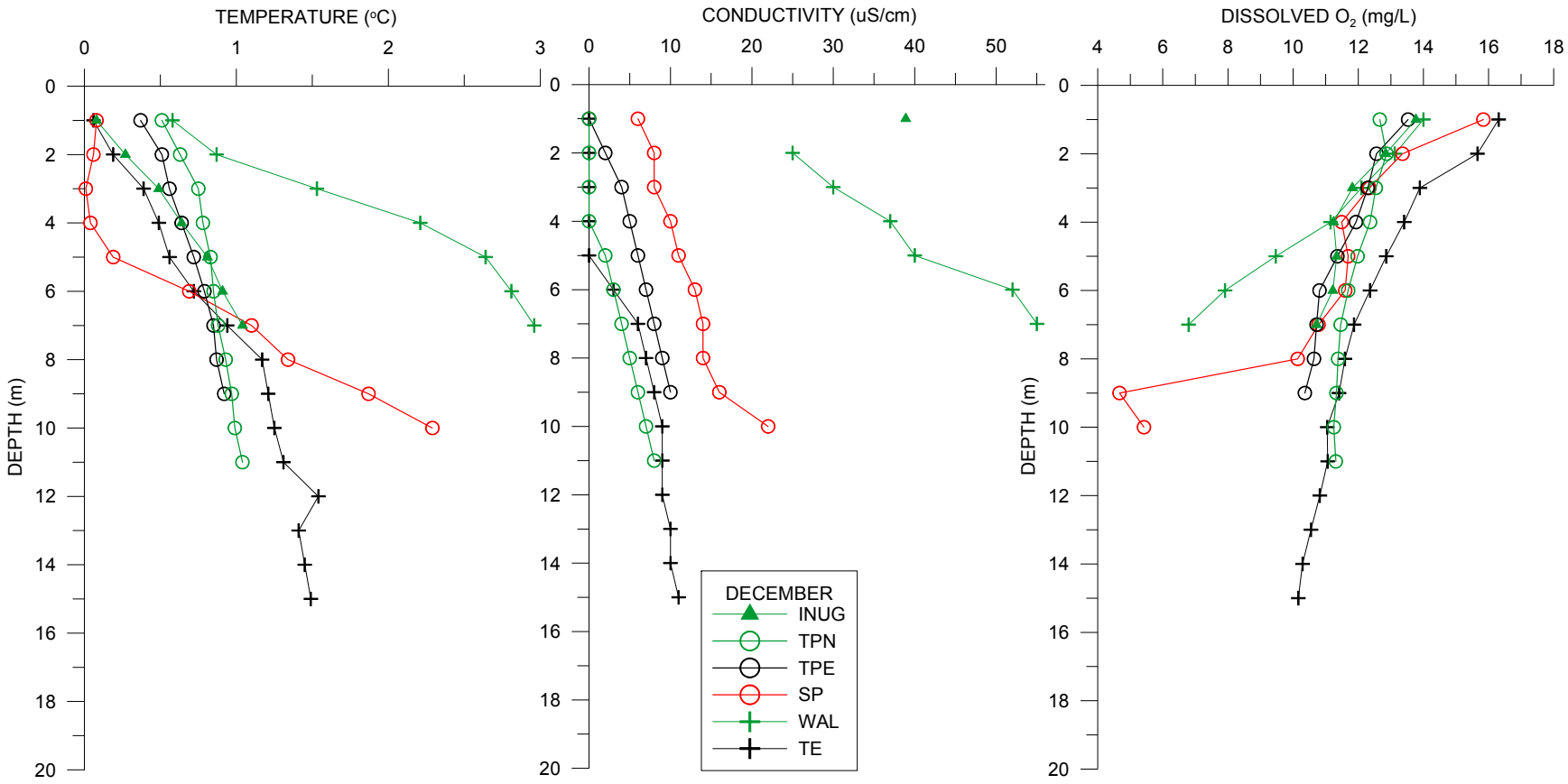


Figure 3.2-7. Field-measured temperature (°C), conductivity (µS/cm) and dissolved oxygen (mg/L) profiles in Baker Lake for July and August, 2013.

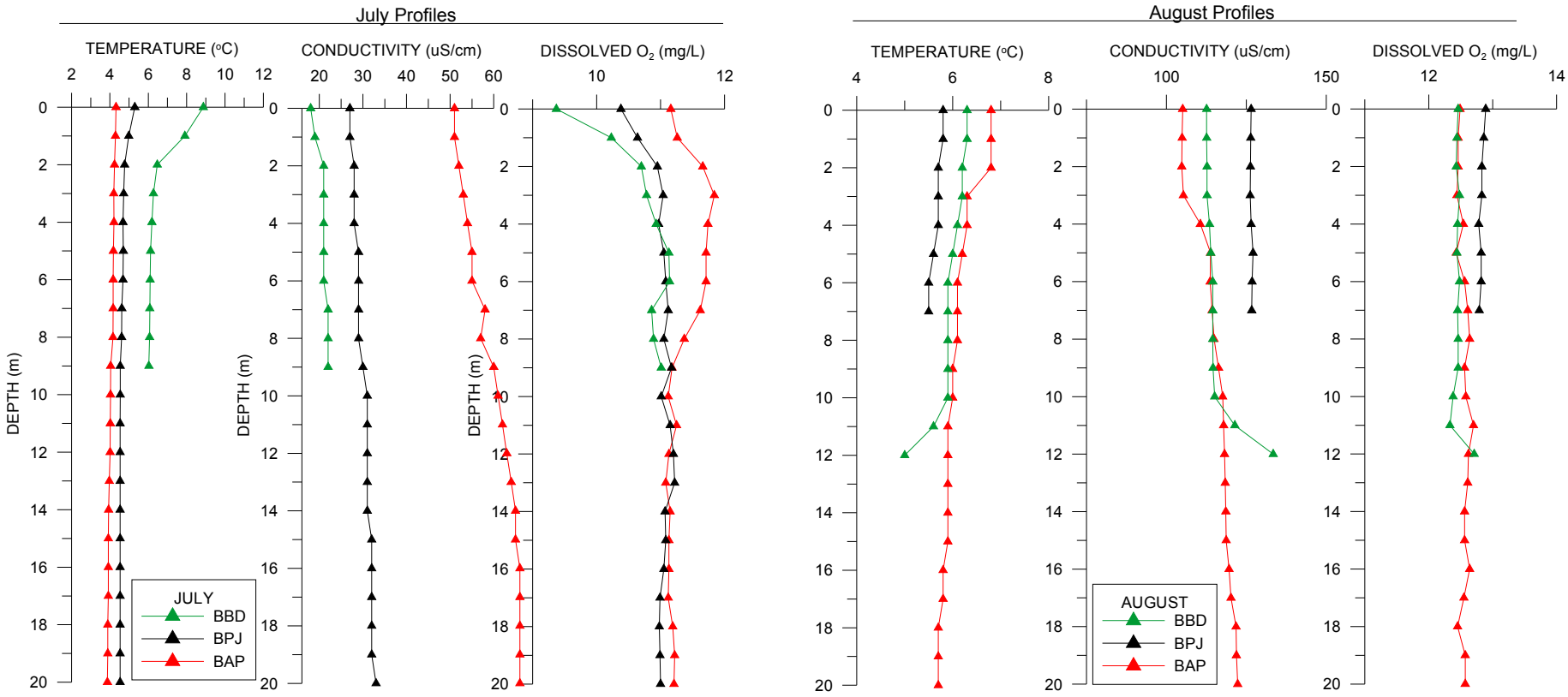
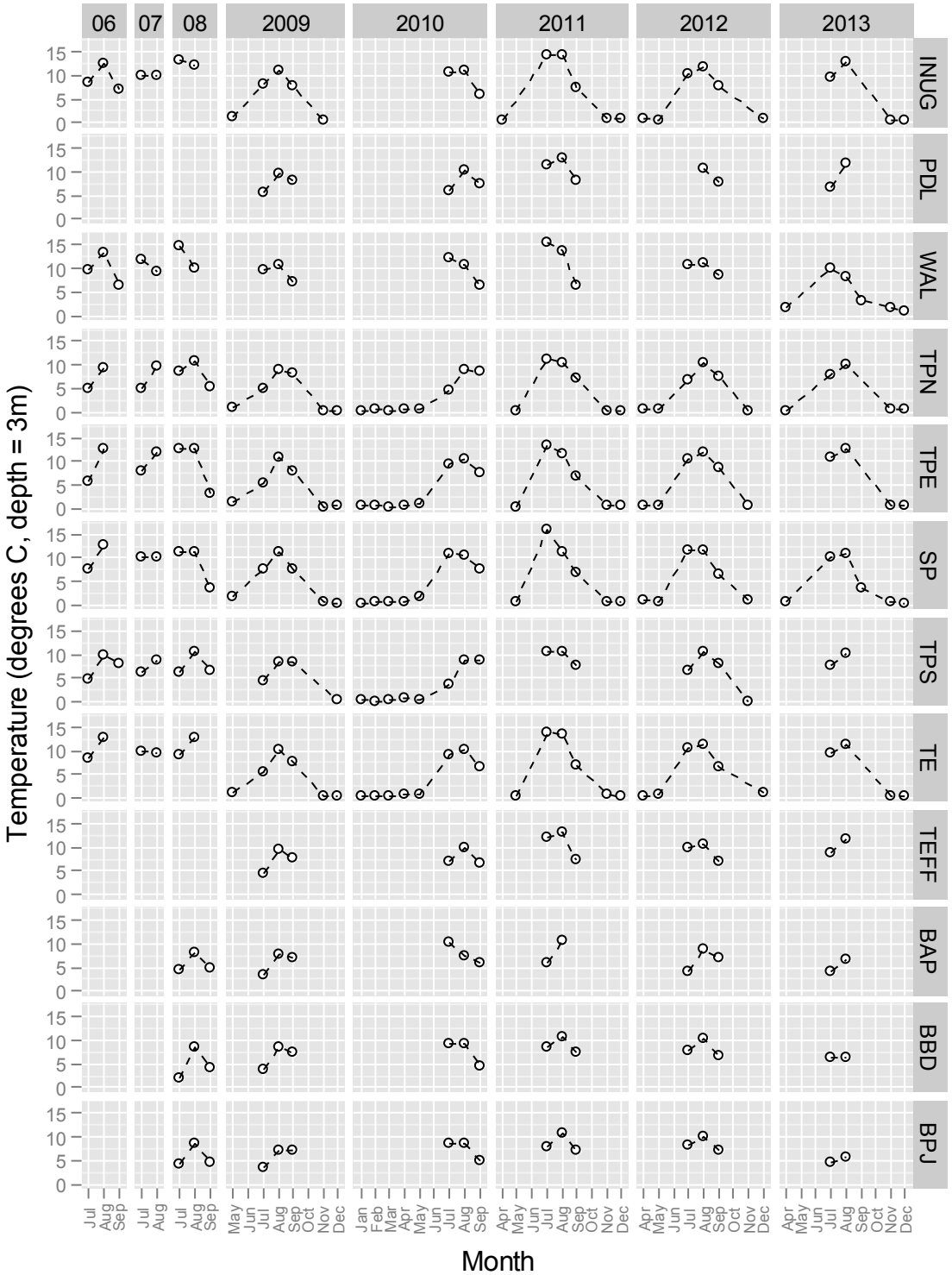


Figure 3.2-8. Mean monthly field-measured temperature (°C) at 3 m depth from 2006 – 2013, Meadowbank study lakes and Baker Lake.



3.3. Water Chemistry

3.3.1. Meadowbank Study Lakes

3.3.1.1. 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 unstratified 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[5].

3.3.1.2. Temporal and Spatial Trend Interpretation

Results for conventional water quality parameters, nutrients and metals for 2013 are presented in **Table 3.3-1**; they are discussed, where relevant from a spatial and temporal trend perspective.

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 3.3-2**):

1. *Overall Detection Frequency* - Only those water quality parameters that exceeded MDLs in at least 10% of the samples were included in this discussion.

[5] 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.

Because the project lakes are ultra-oligotrophic, it is normal for many parameters to routinely be below MDLs. In fact just over half (54%) of parameters measured exceeded MDLs at least 10% of the time and are included in this discussion.

2. *Control-Impact Detection Frequency Comparison* – In order 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 screen.
3. *Apparent Detection Pattern Matching Mining Activity* – In order 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, 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 2013, no parameters were added back into the trend assessment process based on this screen.

All parameters retained are shown in **Figures 3.3-1 through 3.3-38**. All parameters in these figures were measured from a depth of 3 meters for all areas and events. 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 (plots for these parameters are included for reference in **Appendix E**).

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 2013 means for Meadowbank study lakes exceeded their respective trigger values (see **Appendix A** for updated derivation details) are presented in **Table 3.3-3**.

For each parameter/area combination highlighted in **Table 3.3-3**, formal statistical testing of the observed result was conducted using the BACIP statistical model (see **Section 2.4.1** for more details). In this analysis, the model interaction term (or BACIP 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 3.3-4**; key results (i.e., those parameter/area combinations where the 2013 results were statistically different) were as follows:

- *Total & Bicarbonate alkalinity* – SP showed an increase (for both parameters) relative to baseline/reference conditions. Mean alkalinity concentrations at SP have been > trigger since 2011. Alkalinity is a measure of the capacity of water to neutralize (buffer) acid inputs. Low alkalinity waters are more prone to acidification than high alkalinity waters, so a minimum concentration of 20 mg/L as $CaCO_3$ is generally recommended (e.g., USEPA, BCMOE) to minimize the chances of reducing pH to levels harmful to aquatic life. Given that most the project lakes would be classified as sensitive to acid inputs, the slight increases to date would serve to provide further buffering capacity without adversely affecting aquatic life.
- *Laboratory Conductivity* – TPN, TPE, and SP 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., calcium, see below).
- *Calcium* – TPE showed an increase (relative to baseline/reference) in calcium. Despite this increase, concentrations in TPE have always been <4 mg/L (i.e., still low). Modest increases of calcium (similar to alkalinity) in the Meadowbank study lakes will serve to provide additional buffering capacity against potential adverse effects of acidification.
- *TDS* – 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. 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 benchmark of 500 mg/L (WLWB 2013) has recently been adopted at Diavik. Thus, these changes (leading to TDS concentrations on the order of 15 to 25 mg/L at TPE and SP) are not a concern at this time.

Total and dissolved metals concentrations were consistently low or undetectable among the study lakes (**Table 3.3-1**). The only total metals measured above laboratory detection limits (MDLs) were consistent with 2012 results. This is important to note in relation to the reported seepage from the Rock Storage Facility (RSF) into the drainage that includes ponds NP2, NP1 and dogleg pond (Golder, 2014). Despite elevated metals and cyanide found in the seepage (ST-16) and in pond NP2, no changes in water chemistry were noted at SP, which has an ephemeral hydraulic connection from Dogleg pond, NP1 (Dogleg north) and NP2 (Golder, 2014).

Similar to what was reported in 2012, the CREMP is detecting changes in some general water quality parameters that appear to be related to mining activity. However, it is important to point out that none of the above parameters have trigger values that were set in the context of effects-based threshold values (e.g., CCME water quality guidelines). Rather, in the absence of available thresholds, the trigger values for these substances were set at the 95th percentile of baseline data. Consequently, the BACIP model results reported above only indicate that statistically significant changes have been detected. 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 2014.

3.3.2. Baker Lake

3.3.2.1. General Observations

Baker Lake is a large lake, very exposed along the north-south axis to 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, that depending on wind speed and direction, can influence water chemistry parameters (conductivity, salts, dissolved solids). 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 2013 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 3.3.1.2** 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 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 3.3-5** 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. In fact just over half (57%) of parameters measured exceeded MDLs at least 10% of the time and are included in this discussion.
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). Only total lead was found to have an increased detection frequency in impact samples relative to control samples.

All parameters retained are shown in **Figures 3.3-39 through 3.3-80**. All parameters in these figures were measured from a depth of 3 meters for all areas and events. 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 barge activities or to natural variability and were excluded from further consideration (plots for these parameters are included for reference in **Appendix E**).

Historical trend assessment results related to barge activities are discussed at greater length in the 2012 CREMP report (Azimuth, 2013). There were no exceedences of trigger values for water chemistry parameters at Baker Lake in 2013 (see **Appendix A** for updated derivation details).

Thus, despite the increase in barge traffic seen over the past five years (**Figure 1.4-1**), there were no obvious changes to water quality that could be attributed to that activity. This is not surprising given 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. Consequently, there are no follow-up measures for management in 2014.

Table 3.3-1. Conventional water chemistry and total and dissolved metals (mg/L), Meadowbank study lakes and Baker Lake, 2013.

Lake					Third Portage Lake															
Station					East Basin (TPE)								North Basin (TPN)							
Area-Replicate ID	CCME (2012)	Trigger[2]		Threshold[2]	TPE-60	TPE-61	TPE-62	TPE-63	TPE-66	TPE-67	TPE-68	TPE-69	TPN-58	TPN-59	TPN-60	TPN-61	TPN-62	TPN-63	TPN-66	TPN-67	TPN-68	TPN-69
Depth (m)	Guideline[1]				3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Date		Meadowbank	Baker Lake		21-Jul-13	21-Jul-13	22-Aug-13	22-Aug-13	26-Nov-13	26-Nov-13	09-Dec-13	09-Dec-13	18-Apr-13	18-Apr-13	21-Jul-13	21-Jul-13	26-Aug-13	26-Aug-13	26-Nov-13	26-Nov-13	10-Dec-13	10-Dec-13
CONVENTIONAL PARAMETERS																				
Physical Tests (mg/L)																				
Conductivity (µS/cm)		23.5	494.5		**25.0**	**24.4**	**25.3**	**25.4**	**28.1**	**28.1**	**30.4**	**29.5**	**28.3**	**26.3**	**23.6**	**23.7**	23.4	23.4	**26.0**	**28.0**	20.0	**26.6**
Hardness		8.5	41.2		**9.47**	**9.06**	**9.40**	**9.37**	**10.40**	5.76	4.17	5.91	**10.30**	**9.47**	8.08	8.18	8.04	7.91	7.18	**9.56**	4.14	**9.26**
pH	6.5 - 9.0	6.50 - 7.94	6.74 - 8.12	6.5 - 9.0	7.13	7.13	7.20	7.21	7.74	7.56	7.12	7.06	6.97	6.86	7.04	7.06	7.05	7.08	7.72	7.72	6.75	6.91
Total Suspended Solids		3	3	5	*<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*	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Total Dissolved Solids		18	208		**20**	**19**	**18**	**18**	**22**	**24**	15	**18**	**19**	17	**18**	**18**	18	18	**21**	**22**	12	14
Turbidity (NTU)					0.58	0.51	0.34	0.37	0.36	0.37	0.19	0.26	0.11	0.15	0.22	0.24	0.23	0.27	0.18	0.27	0.16	0.15
Anions and Nutrients (mg/L)																				
Alkalinity - Bicarbonate		8.6	10.6		7.1	7.0	7.2	7.0	7.5	7.6	**9.0**	8.5	6.6	6.4	5.3	5.2	5.6	5.4	5.0	5.3	4.6	5.6
Alkalinity - Carbonate		4	4		*<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*
Alkalinity - Hydroxide					*<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*
Alkalinity - Total		8.5	10.6		7.1	7.0	7.2	7.0	7.5	7.6	**9.0**	8.5	6.6	6.4	5.3	5.2	5.6	5.4	5.0	5.3	4.6	5.6
Ammonia (as N)[3]	***equation***	0.065	0.067	0.126	*<0.005*	*<0.005*	*<0.005*	*<0.005*	0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.01	*<0.005*	*<0.005*	0.02	0.02	0.03	0.02
Bromide					*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*
Chloride	120	60.28	95.7	120	0.58	0.58	0.59	0.59	0.68	0.68	0.72	0.68	0.79	0.74	0.62	0.62	0.63	0.64	0.71	0.78	0.47	0.72
Nitrate (as N)	3.0	1.50	1.51	3	0.0237	0.0212	0.0097	0.0132	0.0134	0.0127	0.0138	0.0132	0.0682	0.0664	0.0607	0.0634	0.0490	0.0476	0.0563	0.0609	0.0374	0.0557
Nitrite (as N)	0.060	0.0305	0.0305	0.06	*<0.001*	0.0012	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	0.0016	*<0.001*	*<0.001*	0.0016	0.0016	0.0012	0.0014	0.0016	*<0.001*	0.0015
Total Kjeldahl Nitrogen		0.170	0.214		**0.21**	0.13	0.13	0.12	0.09	0.06	0.11	0.13	0.13	0.11	0.11	0.12	0.14	0.14	0.11	0.14	0.13	0.12
Ortho Phosphate (as P)		0.002	0.002		*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	0.0014	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Total Phosphate (as P)	0.0040	0.0060	0.0096	0.004	0.0022	0.0022	*<0.002*	0.0022	*<0.002*	*<0.002*	*<0.002*	*<0.002*	*<0.002*	*<0.002*	0.0021	*<0.002*	*<0.002*	*<0.002*	*<0.002*	*<0.002*	0.0022	*<0.002*
Silicate (as SiO_2)		1	1		*<0.50*	*<5.0*	*<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*	*<0.50*	*<0.50*
Sulphate (SO_4)		64.71	65.92	128	3.31	3.29	3.41	3.46	4.01	4.05	4.33	4.15	4.82	4.53	3.88	3.88	3.93	3.89	4.76	5.21	3.46	4.89
Organic / Inorganic Carbon (mg/L)																						
Dissolved Organic Carbon		2.60	4.05		2.0	1.7	1.3	1.4	1.8	1.7	1.7	1.5	2.1	2.1	2.2	1.7	1.6	1.4	1.7	2.1	1.8	1.6
Total Organic Carbon		2.79	4.25		1.8	1.5	1.3	1.4	1.3	1.2	1.3	1.3	2.2	1.7	1.9	1.7	1.5	1.4	1.5	1.4	1.4	1.3
Plant Pigments (ug/L)																						
Chlorophyll-a					0.34	0.43	0.22	0.31	0.34	0.11	0.28	0.21	*<0.01*	*<0.01*	0.08	0.14	0.23	0.22	0.44	0.59	0.09	0.10
TOTAL METALS (mg/L)																						
Aluminum[3]	***equation***	0.054	0.056	0.100	0.0187	0.0166	0.0105	0.0120	0.0065	0.0060	0.0037	0.0046	0.0031	*<0.0030*	0.0065	0.0065	0.0055	0.0050	0.0033	0.0039	0.0037	*<0.0030*
Antimony		0.0101	0.0101	0.020	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Arsenic	0.0050	0.00255	0.00257	0.005	0.0006	0.0005	0.0007	0.0006	0.0005	0.0005	0.0003	0.0003	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001	0.0002	0.0001	0.0001
Barium		0.501	0.509	1	0.0029	0.0028	0.0028	0.0028	0.0029	0.0028	0.0017	0.0017	0.0034	0.0033	0.0029	0.0029	0.0028	0.0027	0.0021	0.0033	0.0016	0.0015
Beryllium		0.0027	0.0027	0.0053	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Bismuth					*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*
Boron	1.5	0.755	0.756	1.5	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*
Cadmium[3]	***equation***	0.000025	0.000025	0.000040	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	0.00002	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	0.00001	*<0.00001*
Calcium		2.1	4.5		**2.40**	**2.35**	**2.49**	**2.46**	**2.62**	**2.45**	1.44	1.59	**2.41**	**2.24**	1.95	1.97	2.04	1.99	1.34	**2.35**	1.17	1.12
Chromium[4]	0.001	0.00056	0.00056	0.001	**0.0006**	0.0003	0.0002	0.0002	0.0001	0.0002	0.0001	0.0001	*<0.0001*	*<0.0001*	0.0001	0.0001	0.0001	*<0.0001*	*<0.0001*	*<0.0001*	0.0001	0.0001
Copper[3]	***equation***	0.00124	0.00125	0.002	0.0005	0.0010	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	0.0005	*<0.0005*	**0.0013**	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*
Iron	0.3	0.155	0.160	0.3	0.04	0.03	0.02	0.02	*<0.01*	0.01	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	0.01	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*
Lead[3]	***equation***	0.000525	0.000525	0.001	*<0.00005*	0.00005	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	0.00007	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	0.00009	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*
Lithium		0.048	0.048	0.096	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	0.0008	0.0009	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*
Magnesium		0.8	7.4		**0.89**	**0.87**	**0.90**	**0.90**	**0.96**	**0.87**	0.51	0.50	**0.97**	**0.90**	0.80	0.81	0.82	0.81	0.53	**0.94**	0.43	0.45
Manganese[3]		0.3157	0.3400	***equation***	0.0036	0.0031	0.0026	0.0025	0.0013	0.0012	0.0007	0.0007	0.0019	0.0020	0.0028	0.0029	0.0026	0.0025	0.0028	0.0043	0.0020	0.0020
Mercury	0.000026	0.000018	0.000018	0.000026	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*
Molybdenum	0.073	0.0365	0.0365	0.073	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001	0.0002	0.0001	0.0001
Nickel[3]	***equation***	0.0127	0.0128	0.025	0.0008	0.0007	0.0005	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	0.0006	0.0005	*<0.0005*	*<0.0005*	*<0.0005*	0.0005	*<0.0005*	*<0.0005*
Phosphorus					*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*
Potassium		0.5	2.4		**0.51**	**0.52**	0.49	0.50	**0.55**	0.48	0.27	0.27	**0.56**	**0.51**	0.48	0.48	0.46	0.47	0.28	**0.54**	0.24	0.28
Selenium	0.001	0.00055	0.00055	0.001	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	0.00012	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Silicon					0.13	0.13	0.09	0.09	0.06	0.07	*<0.05*	*<0.05*	0.07	0.07	0.09	0.08	0.06	0.05	*<0.05*	*<0.05*	*<0.05*	*<0.05*
Sodium		0.975	54.0		0.81	0.82	0.85	0.86	0.92	0.83	0.49	0.48	**1.16**	**1.07**	0.93	0.96	**0.98**	**0.99**	0.81	**1.27**	0.58	0.60
Strontium		0.0279	0.0564	0.049	0.0105	0.0103	0.0111	0.0109	0.0110	0.0102	0.0063	0.0062	0.0111	0.0104	0.0093	0.0094	0.0097	0.0095	0.0063	0.0110	0.0052	0.0053

Table 3.3-1. Conventional water chemistry and total and dissolved metals (mg/L), Meadowbank study lakes and Baker Lake, 2013.

Lake					Third Portage Lake																
Station					East Basin (TPE)								North Basin (TPN)								
Area-Replicate ID	CCME (2012)	Trigger[2]		Threshold[2]	TPE-60	TPE-61	TPE-62	TPE-63	TPE-66	TPE-67	TPE-68	TPE-69	TPN-58	TPN-59	TPN-60	TPN-61	TPN-62	TPN-63	TPN-66	TPN-67	TPN-68	TPN-69
Depth (m)	Guideline[1]				3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Date		Meadowbank	Baker Lake		21-Jul-13	21-Jul-13	22-Aug-13	22-Aug-13	26-Nov-13	26-Nov-13	09-Dec-13	09-Dec-13	18-Apr-13	18-Apr-13	21-Jul-13	21-Jul-13	26-Aug-13	26-Aug-13	26-Nov-13	26-Nov-13	10-Dec-13	10-Dec-13
Sulfur		1.18	1.14	1.18	1.19	1.34	1.21	0.72	0.68	1.63	1.57	1.31	1.35	1.37	1.32	1.01	1.85	0.82	0.89		
Thallium	0.0008	0.00041	0.00041	0.0008	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*
Tin		0.0002	0.0002		*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Titanium		1.00	1.00	2	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*
Uranium	0.015	0.0075	0.0075	0.015	0.000065	0.000062	0.000056	0.000059	0.000046	0.000047	0.000028	0.000029	0.000052	0.000048	0.000050	0.000047	0.000045	0.000042	0.000031	0.000055	0.000027	0.000028
Vanadium		0.0035	0.0035	0.006	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Zinc[3]	0.030	0.0063	0.0132	***equation***	*<0.0030*	0.0046	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*
DISSOLVED METALS (mg/L)																						
Aluminum[3]		0.0263	0.0274	0.05	0.0041	0.0045	0.0031	0.0033	0.0016	*<0.001*	*<0.001*	0.0012	0.0020	0.0014	0.0027	0.0022	0.0017	0.0020	0.0011	0.0016	0.0013	0.0016
Antimony		0.0101	0.0101	0.020	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Arsenic		0.0026	0.0026	0.005	0.0005	0.0005	0.0006	0.0006	0.0005	0.0003	0.0002	0.0003	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001	0.0002	*<0.0001*	0.0002
Barium		0.5010	0.5089	1	0.0029	0.0029	0.0026	0.0027	0.0029	0.0017	0.0013	0.0016	0.0036	0.0033	0.0029	0.0028	0.0028	0.0027	0.0023	0.0031	0.0014	0.0032
Beryllium		0.0027	0.0027	0.0053	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Bismuth					*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*
Boron		0.755	0.755	1.5	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*
Cadmium		0.000025	0.000025	0.00004	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	0.000018	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*
Calcium					2.38	2.27	2.38	2.36	2.60	1.45	1.06	1.58	2.48	2.28	1.94	1.96	1.94	1.90	1.75	2.30	1.07	2.26
Chromium		0.00055	0.00055	0.001	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	0.00	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Copper		0.00119	0.00116	0.002	0.00041	0.00043	0.00036	0.00038	0.00036	*<0.0002*	*<0.0002*	0.00020	0.00043	0.00039	0.00038	0.00039	0.00035	0.00038	0.00026	0.00031	*<0.0002*	0.00041
Iron		0.155	0.155	0.3	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*
Lead		0.000525	0.000525	0.001	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	0.00	*<0.00005*	*<0.00005*	*<0.00005*
Lithium		0.048	0.048	0.096	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	0.0008	0.0008	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*
Magnesium					0.85	0.82	0.84	0.84	0.95	0.52	0.37	0.48	1.00	0.92	0.79	0.80	0.78	0.77	0.68	0.93	0.36	0.88
Manganese[3]		0.3152	0.3391	***equation***	0.0024	0.0020	0.0011	0.0011	0.0003	0.0001	0.0001	0.0002	0.0019	0.0017	0.0021	0.0022	0.0017	0.0017	0.0026	0.0036	0.0015	0.0037
Mercury		0.000018	0.000018	0.000026	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*
Molybdenum		0.0366	0.0365	0.073	0.0002	0.0001	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001	0.0002
Nickel		0.0128	0.0128	0.025	0.0006	0.0006	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	0.0005	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	0.0015
Phosphorus					*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*
Potassium					0.49	0.48	0.43	0.45	0.55	0.28	0.19	0.26	0.59	0.53	0.47	0.47	0.42	0.43	0.38	0.52	0.21	0.53
Selenium		0.00055	0.00055	0.001	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Silicon					0.10	0.11	0.07	0.07	0.05	*<0.05*	*<0.05*	*<0.05*	0.08	0.07	0.09	0.08	0.05	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*
Sodium					0.77	0.80	0.80	0.81	0.93	0.48	0.35	0.46	1.12	1.09	0.91	0.96	0.95	0.94	0.91	1.23	0.50	1.23
Strontium		0.0280	0.0492	0.049	0.0101	0.0096	0.0106	0.0105	0.0109	0.0059	0.0047	0.0059	0.0111	0.0105	0.0089	0.0089	0.0092	0.0095	0.0080	0.0105	0.0044	0.0107
Sulfur					1.13	1.10	1.11	1.12	1.32	0.69	*<0.50*	0.66	1.68	1.54	1.28	1.35	1.29	1.26	1.32	1.74	0.69	1.85
Thallium		0.0004	0.0004	0.0008	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*
Tin		0.0002	0.0002		*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Titanium		1.01	1.01	2	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*
Uranium		0.0075	0.0075	0.015	0.00006	0.00005	0.00004	0.00005	0.00004	0.00003	0.00002	0.00002	0.00005	0.00005	0.00004	0.00005	0.00004	0.00004	0.00003	0.00004	0.00002	0.00005
Vanadium		0.0035	0.0035	0.006	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Zinc[3]		0.005	0.012	***equation***	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	0.001	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	0.001	*<0.001*

Notes:

[1]CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life, 1999, updated up to 2014.

[2]Trigger and threshold values were developed in "CREMP Design Document 2012" (Azimuth, 2012).
A number of thresholds were derived from methods (or sources) other than CCME guidelines - see **Appendix A** for 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.

Table 3.3-1. Conventional water chemistry and total and dissolved metals (mg/L), Meadowbank study lakes and Baker Lake, 2013.

Lake					Third Portage Lake				Second Portage Lake (SP)											
Station					South Basin (TPS)															
Area-Replicate ID	CCME (2012)	Trigger[2]		Threshold[2]	TPS-39	TPS-40	TPS-41	TPS-42	SP-58	SP-59	SP-60	SP-61	SP-62	SP-63	SP-64	SP-65	SP-66	SP-67	SP-68	SP-69
Depth (m)					3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Date	Guideline[1]	Meadowbank	Baker Lake		21-Jul-13	21-Jul-13	26-Aug-13	26-Aug-13	19-Apr-13	19-Apr-13	19-Jul-13	19-Jul-13	24-Aug-13	24-Aug-13	18-Sep-13	18-Sep-13	24-Nov-13	24-Nov-13	08-Dec-13	08-Dec-13
CONVENTIONAL PARAMETERS																				
Physical Tests (mg/L)																				
Conductivity (µS/cm)		23.5	494.5		**23.6**	**23.6**	23.0	23.0	**37.8**	**33.2**	**29.2**	**28.7**	**28.8**	**28.8**	**29.9**	**29.8**	**33.1**	**34.2**	**33.2**	**34.3**
Hardness		8.5	41.2		8.08	8.16	7.79	7.78	**15.50**	**13.90**	**12.80**	**12.30**	**11.90**	**11.90**	**12.00**	**11.90**	**13.40**	**13.30**	5.76	6.70
pH	6.5 - 9.0	6.50 - 7.94	6.74 - 8.12	6.5 - 9.0	7.22	7.09	7.07	7.08	7.09	7.14	7.34	7.30	7.18	7.29	7.83	**8.04**	7.81	**8.07**	7.40	7.37
Total Suspended Solids		3	3	5	*<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*	*<1.0*	*<1.0*
Total Dissolved Solids		18	208		18	17	18	18	**25**	**21**	**23**	**23**	**21**	**20**	**18**	**19**	**22**	17	**19**	**20**
Turbidity (NTU)					0.25	0.28	0.23	0.24	0.22	0.19	0.44	0.47	0.28	0.25	0.27	0.31	0.27	0.23	0.18	0.17
Anions and Nutrients (mg/L)																				
Alkalinity - Bicarbonate		8.6	10.6		5.4	5.2	5.1	4.8	**11.5**	**10.2**	**9.8**	**9.8**	**9.5**	**9.6**	**9.9**	**9.3**	**10.0**	**9.7**	**10.7**	**11.7**
Alkalinity - Carbonate		4	4		*<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*
Alkalinity - Hydroxide					*<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*
Alkalinity - Total		8.5	10.6		5.4	5.2	5.1	4.8	**11.5**	**10.2**	**9.8**	**9.8**	**9.5**	**9.6**	**9.9**	**9.3**	**10.0**	**9.7**	**10.7**	**11.7**
Ammonia (as N)[3]	***equation***	0.065	0.067	0.126	0.01	0.01	*<0.005*	*<0.005*	0.02	0.02	*<0.005*	*<0.005*	0.01	0.01	*<0.005*	*<0.005*	*<0.005*	0.01	0.01	0.01
Bromide					*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*
Chloride	120	60.28	95.7	120	0.62	0.62	0.62	0.62	0.93	0.74	0.57	0.56	0.57	0.57	0.58	0.59	0.65	0.69	0.63	0.67
Nitrate (as N)	3.0	1.50	1.51	3	0.0652	0.0647	0.0499	0.0517	0.0319	0.0176	0.0073	0.0052	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	0.0052	*<0.005*	*<0.005*
Nitrite (as N)	0.060	0.0305	0.0305	0.06	0.0023	0.0018	0.0010	0.0016	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Total Kjeldahl Nitrogen		0.170	0.214		0.14	0.12	0.13	0.14	0.13	0.13	0.17	0.16	0.12	0.12	0.11	0.16	*<0.05*	**0.17**	0.12	0.12
Ortho Phosphate (as P)		0.002	0.002		*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Total Phosphate (as P)	0.0040	0.0060	0.0096	0.004	0.0021	0.0025	*<0.002*	*<0.002*	*<0.002*	0.0024	0.0032	0.0028	0.0022	*<0.002*	*<0.002*	*<0.002*	*<0.002*	*<0.002*	0.0023	0.0020
Silicate (as SiO_2)		1	1		*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	0.51	0.52	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*
Sulphate (SO_4)		64.71	65.92	128	3.86	3.86	3.83	3.83	5.07	4.07	3.20	3.14	3.18	3.19	3.34	3.36	3.63	3.62	3.66	3.82
Organic / Inorganic Carbon (mg/L)																				
Dissolved Organic Carbon		2.60	4.05		2.2	2.1	1.3	1.4	2.4	2.2	1.8	2.1	1.7	1.7	1.8	1.7	2.6	**2.8**	2.0	2.1
Total Organic Carbon		2.79	4.25		1.8	2.0	1.3	1.6	2.6	2.3	1.9	2.1	1.9	1.6	1.6	1.7	*<0.50*	1.6	1.4	1.9
Plant Pigments (ug/L)																				
Chlorophyll-a					0.26	0.17	0.15	0.28	*<0.01*	0.06	0.29	0.58	0.24	0.31	*<0.01*	*<0.01*	0.28	0.51	0.29	0.27
TOTAL METALS (mg/L)																				
Aluminum[3]	***equation***	0.054	0.056	0.100	0.0067	0.0081	0.0058	0.0040	0.0041	*<0.0030*	0.0142	0.0161	0.0112	0.0073	0.0072	0.0114	0.0041	0.0059	0.0031	0.0032
Antimony		0.0101	0.0101	0.020	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Arsenic	0.0050	0.00255	0.00257	0.005	0.0002	0.0002	0.0002	0.0002	0.0006	0.0004	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002	0.0003	0.0002	0.0002
Barium		0.501	0.509	1	0.0030	0.0031	0.0029	0.0028	0.0041	0.0031	0.0027	0.0026	0.0024	0.0024	0.0024	0.0023	0.0024	0.0026	0.0015	0.0014
Beryllium		0.0027	0.0027	0.0053	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Bismuth					*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*
Boron	1.5	0.755	0.756	1.5	0.01	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*
Cadmium[3]	***equation***	0.000025	0.000025	0.000040	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	**0.000037**	**0.000046**	*<0.00001*	*<0.00001*
Calcium		2.1	4.5		1.97	1.99	1.95	1.92	**3.83**	**3.56**	**3.11**	**3.22**	**3.20**	**3.22**	**3.24**	**3.16**	**3.60**	**3.52**	2.03	1.79
Chromium[4]	0.001	0.00056	0.00056	0.001	0.0005	0.0001	0.0001	*<0.0001*	*<0.0001*	*<0.0001*	0.0002	0.0002	0.0001	0.0001	0.0002	0.0002	0.0001	0.0002	0.0001	0.0001
Copper[3]	***equation***	0.00124	0.00125	0.002	*<0.0005*	0.0005	*<0.0005*	*<0.0005*	0.0007	0.0006	0.0007	0.0008	0.0007	0.0006	0.0007	0.0007	0.0007	0.0007	0.0005	0.0006
Iron	0.3	0.155	0.160	0.3	0.01	0.01	0.01	*<0.01*	*<0.01*	*<0.01*	0.03	0.03	0.03	0.04	0.02	0.03	0.01	0.01	*<0.01*	*<0.01*
Lead[3]	***equation***	0.000525	0.000525	0.001	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	0.00005	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	**0.00067**	0.00006	0.00011
Lithium		0.048	0.048	0.096	*<0.0005*	*<0.0005*	0.0005	*<0.0005*	0.0008	0.0008	*<0.0005*	*<0.0005*	0.0005	0.0006	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*
Magnesium		0.8	7.4		0.81	0.82	0.80	0.79	**1.37**	**1.20**	**1.03**	**1.05**	**1.04**	**1.05**	**1.06**	**1.03**	**1.15**	**1.14**	0.62	0.57
Manganese[3]	***equation***	0.3157	0.3400	***equation***	0.0030	0.0030	0.0023	0.0022	0.0006	0.0006	0.0028	0.0028	0.0022	0.0023	0.0017	0.0017	0.0008	0.0009	0.0005	0.0008
Mercury	0.000026	0.000018	0.000018	0.000026	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*
Molybdenum	0.073	0.0365	0.0365	0.073	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001
Nickel[3]	***equation***	0.0127	0.0128	0.025	0.0006	0.0006	0.0005	*<0.0005*	0.0005	*<0.0005*	0.0006	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	**0.0515**
Phosphorus					*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*
Potassium		0.5	2.4		0.50	0.50	0.46	0.46	**0.70**	**0.56**	0.48	0.47	0.48	0.48	0.47	0.47	0.50	**0.51**	0.26	0.24
Selenium	0.001	0.00055	0.00055	0.001	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Silicon					0.09	0.09	0.06	0.06	0.18	0.24	0.24	0.26	0.20	0.20	0.18	0.17	0.22	0.18	0.12	0.09
Sodium		0.975	54.0		0.96	0.97	**0.98**	0.95	**1.09**	0.80	0.61	0.62	0.65	0.66	0.66	0.67	0.67	0.70	0.39	0.37
Strontium		0.0279	0.0564	0.049	0.0092	0.0095	0.0095	0.0090	0.0166	0.0155	0.0143	0.0148	0.0153	0.0153	0.0133	0.0138	0.0156	0.0152	0.0089	0.0079

Table 3.3-1. Conventional water chemistry and total and dissolved metals (mg/L), Meadowbank study lakes and Baker Lake, 2013.

Lake					Third Portage Lake				Second Portage Lake (SP)											
Station					South Basin (TPS)															
Area-Replicate ID		Trigger[2]			TPS-39	TPS-40	TPS-41	TPS-42	SP-58	SP-59	SP-60	SP-61	SP-62	SP-63	SP-64	SP-65	SP-66	SP-67	SP-68	SP-69
Depth (m)					3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Date	CCME (2012) Guideline[1]	Meadowbank	Baker Lake	Threshold[2]	21-Jul-13	21-Jul-13	26-Aug-13	26-Aug-13	19-Apr-13	19-Apr-13	19-Jul-13	19-Jul-13	24-Aug-13	24-Aug-13	18-Sep-13	18-Sep-13	24-Nov-13	24-Nov-13	08-Dec-13	08-Dec-13
Sulfur					1.32	1.40	1.32	1.28	1.69	1.32	1.10	1.12	1.10	1.10	1.19	1.22	1.26	1.27	0.70	0.66
Thallium	0.0008	0.00041	0.00041	0.0008	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*
Tin		0.0002	0.0002		*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Titanium		1.00	1.00	2	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*
Uranium	0.015	0.0075	0.0075	0.015	0.000049	0.000050	0.000045	0.000040	0.000063	0.000049	0.000059	0.000061	0.000051	0.000048	0.000047	0.000042	0.000035	0.000038	0.000024	0.000022
Vanadium		0.0035	0.0035	0.006	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Zinc[3]	0.030	0.0063	0.0132	***equation***	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	0.0043	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*
DISSOLVED METALS (mg/L)																				
Aluminum[3]		0.0263	0.0274	0.05	0.0025	0.0024	0.0023	0.0011	0.0013	*<0.001*	0.0033	0.0031	0.0036	0.0055	0.0015	0.0019	0.0010	0.0020	*<0.001*	0.0022
Antimony		0.0101	0.0101	0.020	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Arsenic		0.0026	0.0026	0.005	0.0002	0.0002	0.0002	0.0002	0.0006	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002	0.0003	0.0002	0.0002	0.0001	0.0001
Barium		0.5010	0.5089	1	0.0032	0.0029	0.0028	0.0027	0.0045	0.0030	0.0025	0.0025	0.0023	0.0023	0.0023	0.0022	0.0022	0.0024	0.0011	0.0014
Beryllium		0.0027	0.0027	0.0053	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Bismuth					*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*
Boron		0.755	0.755	1.5	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*
Cadmium		0.000025	0.000025	0.00004	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	**0.000059**	*<0.00001*	0.000011
Calcium					1.94	1.95	1.87	1.87	3.87	3.55	3.44	3.20	3.10	3.12	3.13	3.08	3.50	3.47	1.55	1.77
Chromium		0.00055	0.00055	0.001	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Copper		0.00119	0.00116	0.002	0.00039	0.00038	0.00033	0.00033	0.00060	0.00058	0.00061	0.00069	0.00058	0.00061	0.00058	0.00058	0.00054	0.00060	0.00033	0.00034
Iron		0.155	0.155	0.3	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	0.02	0.02	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*
Lead		0.000525	0.000525	0.001	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	0.00018
Lithium		0.048	0.048	0.096	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	0.0013	0.0008	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*
Magnesium					0.79	0.80	0.76	0.76	1.42	1.21	1.02	1.05	1.00	1.01	1.01	1.01	1.13	1.12	0.46	0.55
Manganese[3]		0.3152	0.3391	***equation***	0.0022	0.0022	0.0014	0.0013	0.0003	0.0001	0.0016	0.0014	0.0017	0.0016	0.0007	0.0006	0.0001	0.0002	0.0001	0.0002
Mercury		0.000018	0.000018	0.000026	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*
Molybdenum		0.0366	0.0365	0.073	0.0002	0.0002	0.0002	0.0002	0.0003	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Nickel		0.0128	0.0128	0.025	*<0.0005*	0.0006	*<0.0005*	*<0.0005*	0.0006	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*
Phosphorus					*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*
Potassium					0.46	0.49	0.42	0.44	0.78	0.56	0.46	0.45	0.44	0.44	0.45	0.44	0.46	0.48	0.18	0.24
Selenium		0.00055	0.00055	0.001	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Silicon					0.09	0.08	0.05	0.05	0.15	0.22	0.23	0.24	0.19	0.20	0.17	0.16	0.21	0.16	0.08	0.09
Sodium					0.92	0.90	0.92	0.92	1.21	0.80	0.62	0.62	0.64	0.63	0.64	0.66	0.67	0.69	0.31	0.38
Strontium		0.0280	0.0492	0.049	0.0089	0.0089	0.0094	0.0088	0.0179	0.0154	0.0140	0.0141	0.0147	0.0153	0.0135	0.0125	0.0153	0.0147	0.0066	0.0080
Sulfur					1.28	1.34	1.26	1.25	1.82	1.38	1.08	1.08	1.04	1.04	1.13	1.19	1.17	1.16	0.51	0.62
Thallium		0.0004	0.0004	0.0008	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*
Tin		0.0002	0.0002		*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Titanium		1.01	1.01	2	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*
Uranium		0.0075	0.0075	0.015	0.00004	0.00004	0.00003	0.00003	0.00007	0.00004	0.00005	0.00005	0.00005	0.00004	0.00003	0.00003	0.00003	0.00003	0.00001	0.00002
Vanadium		0.0035	0.0035	0.006	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Zinc[3]		0.005	0.012	***equation***	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	0.001

Notes:

[1]CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life, 1999, updated up to 2014.

[2]Trigger and threshold values were developed in "CREMP Design Document 2012" (Azimuth, 2012).
A number of thresholds were derived from methods (or sources) other than CCME guidelines - see **Appendix A** for 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.

Table 3.3-1. Conventional water chemistry and total and dissolved metals (mg/L), Meadowbank study lakes and Baker Lake, 2013.

Lake					Tehek Lake												Inuggugayualik Lake (INUG)							
Station					Tehek (TE)								Tehek Farfield (TEFF)											
Area-Replicate ID		Trigger[2]		Threshold[2]	TE-60	TE-61	TE-62	TE-63	TE-66	TE-67	TE-68	TE-69	TEFF-27	TEFF-28	TEFF-29	TEFF-30	INUG-48	INUG-49	INUG-50	INUG-51	INUG-54	INUG-55	INUG-56	INUG-57
Depth (m)	CCME (2012)				3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Date	Guideline[1]	Meadowbank	Baker Lake		15-Jul-13	15-Jul-13	24-Aug-13	24-Aug-13	28-Nov-13	28-Nov-13	22-Dec-13	22-Dec-13	15-Jul-13	15-Jul-13	24-Aug-13	24-Aug-13	16-Jul-13	16-Jul-13	23-Aug-13	23-Aug-13	30-Nov-13	30-Nov-13	19-Dec-13	19-Dec-13
CONVENTIONAL PARAMETERS																								
Physical Tests (mg/L)																								
Conductivity (µS/cm)		23.5	494.5		20.4	20.9	20.8	20.6	**23.6**	23.2	19.3	19.0	16.1	16.5	16.4	16.4	14.1	14.1	14.3	15.0	15.8	16.4	17.4	16.9
Hardness		8.5	41.2		7.78	8.05	8.08	8.03	4.26	**9.98**	6.51	6.30	5.60	5.89	6.07	5.97	5.32	5.35	5.38	5.42	3.51	6.13	5.87	6.54
pH	6.5 - 9.0	6.50 - 7.94	6.74 - 8.12	6.5 - 9.0	6.94	7.05	7.15	7.17	7.69	6.85	6.93	6.94	6.72	6.75	6.73	6.75	6.77	6.80	6.75	6.75	6.60	6.80	6.89	6.91
Total Suspended Solids		3	3	5	*<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*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Total Dissolved Solids		18	208		14	17	12	14	**19**	**19**	11	11	13	14	12	11	13	11	14	11	12	12	12	14
Turbidity (NTU)					0.60	0.38	0.40	0.30	0.28	0.20	0.19	0.17	0.26	0.28	0.25	0.25	0.33	0.34	0.28	0.26	0.36	0.20	0.16	0.20
Anions and Nutrients (mg/L)																								
Alkalinity - Bicarbonate		8.6	10.6		6.1	6.3	6.6	6.4	7.3	7.4	5.3	5.4	4.0	4.3	4.6	4.8	4.6	4.8	5.4	4.9	8.0	4.8	5.4	5.3
Alkalinity - Carbonate		4	4		*<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*
Alkalinity - Hydroxide					*<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*
Alkalinity - Total		8.5	10.6		6.1	6.3	6.6	6.4	7.3	7.4	5.3	5.4	4.0	4.3	4.6	4.8	4.6	4.8	5.4	4.9	8.0	4.8	5.4	5.3
Ammonia (as N)[3]	***equation***	0.065	0.067	0.126	*<0.005*	*<0.005*	0.01	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	0.01	*<0.005*	0.01	*<0.005*
Bromide					*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*
Chloride	120	60.28	95.7	120	0.58	0.56	0.57	0.56	0.67	0.60	0.62	0.62	0.57	0.57	0.54	0.54	0.65	0.65	0.66	0.66	0.73	0.75	0.73	0.74
Nitrate (as N)	3.0	1.50	1.51	3	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*
Nitrite (as N)	0.060	0.0305	0.0305	0.06	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Total Kjeldahl Nitrogen		0.170	0.214		0.11	0.11	0.14	0.11	0.11	0.08	0.09	0.08	0.13	0.08	0.13	0.11	0.15	0.14	0.16	0.15	0.11	0.12	0.13	0.12
Ortho Phosphate (as P)		0.002	0.002		*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Total Phosphate (as P)	0.0040	0.0060	0.0096	0.004	*<0.002*	*<0.002*	*<0.002*	0.0023	*<0.002*	*<0.002*	*<0.002*	*<0.002*	*<0.002*	*<0.002*	0.0024	*<0.002*	0.0026	0.0029	0.0030	**0.0041**	*<0.002*	0.0023	0.0021	0.0021
Silicate (as SiO_2)		1	1		*<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*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*
Sulphate (SO_4)		64.71	65.92	128	2.37	2.40	2.39	2.36	2.82	2.75	2.29	2.25	1.89	1.95	1.98	1.98	0.85	0.87	0.85	0.85	0.94	0.98	0.99	1.01
Organic / Inorganic Carbon (mg/L)																								
Dissolved Organic Carbon		2.60	4.05		1.4	1.4	1.4	1.4	1.6	1.8	1.7	1.6	1.3	1.4	1.2	1.4	1.9	1.8	2.0	1.9	2.1	2.6	2.4	2.4
Total Organic Carbon		2.79	4.25		1.3	1.5	1.5	1.5	1.4	1.1	1.4	1.5	1.4	1.2	1.2	1.2	1.9	2.2	2.1	2.1	1.7	2.6	2.2	2.1
Plant Pigments (ug/L)																								
Chlorophyll-a					0.25	0.47	-	0.10	0.76	0.31	0.42	0.24	0.21	0.12	0.09	0.10	0.29	0.49	0.17	0.16	0.48	0.67	0.11	0.16
TOTAL METALS (mg/L)																								
Aluminum[3]	***equation***	0.054	0.056	0.100	0.0107	0.0113	0.0087	0.0093	0.0035	0.0045	0.0059	0.0052	0.0065	0.0061	0.0058	0.0060	0.0099	0.0114	0.0081	0.0068	0.0053	0.0047	0.0045	0.0052
Antimony		0.0101	0.0101	0.020	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Arsenic	0.0050	0.00255	0.00257	0.005	0.0002	0.0002	0.0001	0.0001	*<0.0001*	0.0001	0.0001	0.0001	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	0.0001	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	0.0001	0.0001	0.0001
Barium		0.501	0.509	1	0.0023	0.0022	0.0021	0.0022	0.0012	0.0015	0.0023	0.0026	0.0022	0.0022	0.0020	0.0020	0.0019	0.0020	0.0018	0.0019	0.0017	0.0017	0.0018	0.0019
Beryllium		0.0027	0.0027	0.0053	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Bismuth					*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*
Boron	1.5	0.755	0.756	1.5	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*
Cadmium[3]	***equation***	0.000025	0.000025	0.000040	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	0.00002	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	0.00001	0.00001
Calcium		2.1	4.5		1.92	1.93	2.11	2.10	1.14	1.58	1.68	1.59	1.34	1.36	1.51	1.52	1.02	1.06	1.12	1.12	1.19	1.25	1.20	1.21
Chromium[4]	0.001	0.00056	0.00056	0.001	0.0001	0.0002	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	0.0002	0.0001	*<0.0001*	*<0.0001*	0.0002	0.0002	0.0001	*<0.0001*	0.0001	**0.0007**	*<0.0001*	0.0002
Copper[3]	***equation***	0.00124	0.00125	0.002	*<0.0005*	**0.0023**	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	0.0005	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*
Iron	0.3	0.155	0.160	0.3	0.02	0.03	0.02	0.02	*<0.01*	*<0.01*	*<0.01*	*<0.01*	0.01	0.01	*<0.01*	*<0.01*	0.02	0.02	0.02	0.02	*<0.01*	*<0.01*	*<0.01*	*<0.01*
Lead[3]	***equation***	0.000525	0.000525	0.001	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*
Lithium		0.048	0.048	0.096	*<0.0005*	*<0.0005*	*<0.0005*	0.0006	*<0.0005*	*<0.0005*	*<0.0005*	0.0006	*<0.0005*	*<0.0005*	0.0007	0.0005	*<0.0005*	*<0.0005*	*<0.0005*	0.0005	*<0.0005*	*<0.0005*	0.0006	0.0005
Magnesium		0.8	7.4		0.75	0.74	0.78	0.78	0.42	0.56	0.67	0.64	0.58	0.59	0.62	0.62	0.64	0.68	0.69	0.70	0.72	0.76	0.70	0.74
Manganese[3]		0.3157	0.3400	***equation***	0.0031	0.0032	0.0019	0.0018	0.0003	0.0004	0.0006	0.0006	0.0024	0.0027	0.0014	0.0014	0.0033	0.0034	0.0021	0.0021	0.0007	0.0008	0.0006	0.0007
Mercury	0.000026	0.000018	0.000018	0.000026	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*
Molybdenum	0.073	0.0365	0.0365	0.073	0.0001	0.0001	0.0001	0.0001	*<0.00005*	0.0001	0.0001	0.0001	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*
Nickel[3]	***equation***	0.0127	0.0128	0.025	*<0.0005*	0.0010	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	0.0005	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*
Phosphorus					*<0.30*	*<0.30*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.30*	*<0.30*	*<0.05*	*<0.05*	*<0.30*	*<0.30*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*
Potassium		0.5	2.4		0.38	0.38	0.41	0.40	0.24	0.28	0.48	0.43	0.34	0.36	0.38	0.38	0.33	0.35	0.37	0.35	0.39	0.42	0.39	0.42
Selenium	0.001	0.00055	0.00055	0.001	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Silicon					0.18	0.18	0.19	0.19	0.08	0.11	0.13	0.13	0.13	0.13	0.14	0.14	0.16	0.17	0.14	0.14	0.12	0.11	0.11	0.13
Sodium		0.975	54.0		0.57	0.55	0.59	0.58	0.32	0.39	0.65	0.64	0.53	0.54	0.55	0.55	0.48	0.48	0.52	0.53	0.53	0.58	0.63	0.60
Strontium		0.0279	0.0564	0.049	0.0100	0.0100	0.0104	0.0106	0.0054	0.0074	0.0086	0.0085	0.0073	0.0077	0.0082	0.0080	0.0059	0.0061	0.0064	0.0066	0.0061	0.0066	0.0065	0.0067

Table 3.3-1. Conventional water chemistry and total and dissolved metals (mg/L), Meadowbank study lakes and Baker Lake, 2013.

Lake					Tehek Lake												Inuggugayualik Lake (INUG)							
Station					Tehek (TE)								Tehek Farfield (TEFF)											
Area-Replicate ID		Trigger[2]		Threshold[2]	TE-60	TE-61	TE-62	TE-63	TE-66	TE-67	TE-68	TE-69	TEFF-27	TEFF-28	TEFF-29	TEFF-30	INUG-48	INUG-49	INUG-50	INUG-51	INUG-54	INUG-55	INUG-56	INUG-57
Depth (m)	CCME (2012)				3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Date	Guideline[1]	Meadowbank	Baker Lake		15-Jul-13	15-Jul-13	24-Aug-13	24-Aug-13	28-Nov-13	28-Nov-13	22-Dec-13	22-Dec-13	15-Jul-13	15-Jul-13	24-Aug-13	24-Aug-13	16-Jul-13	16-Jul-13	23-Aug-13	23-Aug-13	30-Nov-13	30-Nov-13	19-Dec-13	19-Dec-13
Sulfur							0.82	0.82	*<0.50*	0.58	0.84	0.85			0.66	0.67			*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*
Thallium	0.0008	0.00041	0.00041	0.0008	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*
Tin		0.0002	0.0002		*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Titanium		1.00	1.00	2	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*
Uranium	0.015	0.0075	0.0075	0.015	0.000054	0.000057	0.000049	0.000046	0.000021	0.000027	0.000039	0.000039	0.000040	0.000042	0.000034	0.000036	0.000057	0.000059	0.000046	0.000046	0.000039	0.000040	0.000037	0.000042
Vanadium		0.0035	0.0035	0.006	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Zinc[3]	0.030	0.0063	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*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*
DISSOLVED METALS (mg/L)																								
Aluminum[3]		0.0263	0.0274	0.05	0.0023	0.0029	0.0039	0.0036	*<0.001*	*<0.001*	0.0016	0.0016	0.0017	0.0022	0.0019	0.0030	0.0031	0.0032	0.0021	0.0026	*<0.001*	0.0015	0.0022	0.0029
Antimony		0.0101	0.0101	0.020	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Arsenic		0.0026	0.0026	0.005	0.0001	0.0002	0.0002	0.0001	*<0.0001*	0.0001	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Barium		0.5010	0.5089	1	0.0022	0.0022	0.0020	0.0021	0.0010	0.0024	0.0021	0.0022	0.0020	0.0020	0.0020	0.0020	0.0019	0.0019	0.0017	0.0017	0.0010	0.0018	0.0018	0.0019
Beryllium		0.0027	0.0027	0.0053	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Bismuth					*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*
Boron		0.755	0.755	1.5	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*
Cadmium		0.000025	0.000025	0.00004	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	0.000011	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	0.000014	*<0.00001*
Calcium					1.92	2.00	2.02	2.01	1.06	2.52	1.55	1.50	1.31	1.40	1.46	1.44	1.05	1.06	1.07	1.08	0.70	1.23	1.19	1.32
Chromium		0.00055	0.00055	0.001	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	0.00
Copper		0.00119	0.00116	0.002	0.00041	0.00041	0.00039	0.00041	*<0.0002*	0.00042	0.00026	0.00030	0.00053	0.00048	0.00029	0.00028	0.00041	0.00036	0.00034	0.00039	*<0.0002*	0.00031	0.00032	0.00035
Iron		0.155	0.155	0.3	*<0.01*	*<0.01*	0.01	0.01	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*
Lead		0.000525	0.000525	0.001	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	0.00	*<0.00005*	0.00	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*
Lithium		0.048	0.048	0.096	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	0.0005	*<0.0005*	0.0005	*<0.0005*	*<0.0005*	0.0005	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	0.0006	*<0.0005*
Magnesium					0.73	0.74	0.74	0.74	0.39	0.90	0.64	0.62	0.56	0.58	0.59	0.58	0.65	0.66	0.66	0.66	0.43	0.74	0.71	0.79
Manganese[3]		0.3152	0.3391	***equation***	0.0018	0.0018	0.0012	0.0012	*<0.00005*	0.0001	0.0002	0.0002	0.0016	0.0018	0.0005	0.0010	0.0017	0.0017	0.0004	0.0005	*<0.00005*	*<0.00005*	0.0002	0.0004
Mercury		0.000018	0.000018	0.000026	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*
Molybdenum		0.0366	0.0365	0.073	0.0001	0.0001	0.0001	0.0001	*<0.00005*	0.0001	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*
Nickel		0.0128	0.0128	0.025	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*
Phosphorus					*<0.30*	*<0.30*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.30*	*<0.30*	*<0.05*	*<0.05*	*<0.30*	*<0.30*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*
Potassium					0.37	0.37	0.37	0.37	0.20	0.46	0.39	0.40	0.35	0.35	0.35	0.34	0.34	0.34	0.33	0.32	0.23	0.39	0.39	0.45
Selenium		0.00055	0.00055	0.001	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Silicon					0.16	0.17	0.18	0.17	0.07	0.16	0.12	0.12	0.12	0.13	0.13	0.13	0.15	0.15	0.12	0.13	0.06	0.11	0.11	0.13
Sodium					0.55	0.55	0.58	0.57	0.29	0.64	0.59	0.61	0.53	0.53	0.53	0.53	0.48	0.48	0.50	0.50	0.30	0.56	0.56	0.59
Strontium		0.0280	0.0492	0.049	0.0094	0.0098	0.0102	0.0101	0.0049	0.0117	0.0081	0.0081	0.0071	0.0073	0.0078	0.0074	0.0058	0.0057	0.0060	0.0062	0.0038	0.0065	0.0061	0.0068
Sulfur							0.76	0.76	*<0.50*	0.97	0.72	0.71			0.62	0.64			*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*
Thallium		0.0004	0.0004	0.0008	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*
Tin		0.0002	0.0002		*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Titanium		1.01	1.01	2	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*
Uranium		0.0075	0.0075	0.015	0.00005	0.00005	0.00004	0.00004	0.00001	0.00004	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00005	0.00005	0.00004	0.00004	0.00002	0.00003	0.00004	0.00004
Vanadium		0.0035	0.0035	0.006	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Zinc[3]		0.005	0.012	***equation***	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	0.001	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*

Notes:

[1]CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life, 1999, updated up to 2014.

[2]Trigger and threshold values were developed in "CREMP Design Document 2012" (Azimuth, 2012).
A number of thresholds were derived from methods (or sources) other than CCME guidelines - see **Appendix A** for 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.

Table 3.3-1. Conventional water chemistry and total and dissolved metals (mg/L), Meadowbank study lakes and Baker Lake, 2013.

Lake					Pipedream Lake (PDL)				Wally Lake (WAL)												
Station					PDL-27	PDL-28	PDL-29	PDL-30	WAL-27	WAL-28	WAL-29	WAL-30	WAL-31	WAL-32	WAL-33	WAL-34	WAL-35	WAL-36	WAL-37	WAL-38
Area-Replicate ID		Trigger[2]		Threshold[2]	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Depth (m)	CCME (2012)				16-Jul-13	16-Jul-13	23-Aug-13	23-Aug-13	20-Apr-13	20-Apr-13	19-Jul-13	19-Jul-13	26-Aug-13	26-Aug-13	15-Sep-13	15-Sep-13	28-Nov-13	28-Nov-13	22-Dec-13	22-Dec-13
Date	Guideline[1]	Meadowbank	Baker Lake																	
CONVENTIONAL PARAMETERS																				
Physical Tests (mg/L)																				
Conductivity (µS/cm)		23.5	494.5		20.0	20.1	20.2	20.2	**52.2**	**43.4**	**28.7**	**39.6**	**32.6**	**30.9**	**33.5**	**32.2**	**35.9**	**37.0**	**55.4**	**41.1**
Hardness		8.5	41.2		8.33	8.31	8.40	8.39	**25.30**	**20.40**	**12.70**	**12.50**	**13.80**	**13.30**	**14.20**	**13.50**	**16.00**	7.82	**25.40**	**16.90**
pH	6.5 - 9.0	6.50 - 7.94	6.74 - 8.12	6.5 - 9.0	7.12	7.09	7.08	7.18	7.26	7.17	7.08	7.93	7.50	7.44	**8.28**	**8.14**	7.13	7.04	7.54	7.46
Total Suspended Solids		3	3	5	*<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*	*<1.0*	*<1.0*
Total Dissolved Solids		18	208		16	15	15	**18**	**33**	**28**	14	**19**	**24**	**24**	**25**	13	**26**	**27**	**42**	**33**
Turbidity (NTU)					0.21	0.20	0.22	0.21	0.27	0.12	0.29	0.26	0.23	0.35	0.30	0.34	0.30	0.38	0.22	0.27
Anions and Nutrients (mg/L)																				
Alkalinity - Bicarbonate		8.6	10.6		6.9	6.9	7.0	7.0	**20.5**	**16.4**	**10.5**	**10.3**	**11.3**	**11.0**	**11.6**	**10.9**	**12.9**	**13.6**	**21.3**	**14.5**
Alkalinity - Carbonate		4	4		*<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*
Alkalinity - Hydroxide					*<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*
Alkalinity - Total		8.5	10.6		6.9	6.9	7.0	7.0	**20.5**	**16.4**	**10.5**	**10.3**	**11.3**	**11.0**	**11.6**	**10.9**	**12.9**	**13.6**	**21.3**	**14.5**
Ammonia (as N)[3]	***equation***	0.065	0.067	0.126	*<0.005*	*<0.005*	*<0.005*	0.02	0.01	0.02	*<0.005*	*<0.005*	*<0.005*	0.01	*<0.005*	*<0.005*	0.01	0.01	0.01	0.01
Bromide					*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*
Chloride	120	60.28	95.7	120	0.59	0.59	0.58	0.59	0.89	0.73	0.49	0.49	0.62	0.56	0.62	0.60	0.75	0.78	0.83	0.83
Nitrate (as N)	3.0	1.50	1.51	3	0.0054	0.0065	*<0.005*	*<0.005*	0.0068	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	0.0088	*<0.005*
Nitrite (as N)	0.060	0.0305	0.0305	0.06	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Total Kjeldahl Nitrogen		0.170	0.214		0.13	0.12	0.13	0.16	**0.22**	0.15	0.14	0.14	0.14	0.13	0.14	0.13	0.13	0.14	0.14	0.12
Ortho Phosphate (as P)		0.002	0.002		*<0.001*	*<0.001*	*<0.001*	*<0.001*	0.0010	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Total Phosphate (as P)	0.0040	0.0060	0.0096	0.004	0.0021	*<0.002*	0.0021	*<0.002*	0.0025	0.0022	0.0033	0.0034	0.0030	0.0031	*<0.002*	0.0023	0.0023	*<0.002*	0.0024	*<0.002*
Silicate (as SiO_2)		1	1		*<0.50*	*<0.50*	*<0.50*	*<0.50*	**1.14**	**1.23**	0.71	0.72	0.75	0.77	0.82	0.79	0.59	0.63	**1.19**	0.68
Sulphate (SO_4)		64.71	65.92	128	1.59	1.63	1.56	1.56	4.64	3.86	2.51	2.51	2.71	2.66	2.86	2.80	3.22	3.37	4.15	3.63
Organic / Inorganic Carbon (mg/L)																				
Dissolved Organic Carbon		2.60	4.05		2.0	1.5	1.7	1.1	**3.2**	**2.7**	2.5	**2.9**	1.9	1.9	1.8	1.7	2.4	2.1	**2.6**	2.3
Total Organic Carbon		2.79	4.25		1.8	1.7	1.9	1.2	**3.2**	**2.8**	2.6	2.8	1.9	1.9	1.7	1.8	1.8	2.1	**4.4**	1.8
Plant Pigments (ug/L)																				
Chlorophyll-a					0.70	0.29	0.15	0.20	*<0.01*	*<0.01*	0.14	0.26	0.23	0.19	*<0.01*	0.23	0.45	0.62	0.46	0.37
TOTAL METALS (mg/L)																				
Aluminum[3]	***equation***	0.054	0.056	0.100	0.0038	0.0035	0.0045	0.0041	*<0.0030*	*<0.0030*	0.0096	0.0070	0.0043	0.0040	0.0067	0.0078	0.0100	0.0116	0.0054	0.0078
Antimony		0.0101	0.0101	0.020	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Arsenic	0.0050	0.00255	0.00257	0.005	0.0002	0.0002	0.0001	0.0002	0.0003	0.0003	0.0003	0.0002	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0005	0.0003
Barium		0.501	0.509	1	0.0019	0.0019	0.0019	0.0019	0.0035	0.0027	0.0019	0.0020	0.0018	0.0018	0.0017	0.0017	0.0020	0.0021	0.0024	0.0022
Beryllium		0.0027	0.0027	0.0053	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Bismuth					*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*
Boron	1.5	0.755	0.756	1.5	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*
Cadmium[3]	***equation***	0.000025	0.000025	0.000040	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	**0.000085**	*<0.00001*
Calcium		2.1	4.5		2.13	2.03	**2.22**	**2.26**	**6.48**	**5.47**	**3.42**	**3.33**	**3.84**	**3.67**	**3.98**	**3.87**	**4.48**	**4.55**	**6.37**	**4.61**
Chromium[4]	0.001	0.00056	0.00056	0.001	0.0001	0.0001	0.0001	*<0.0001*	*<0.0001*	*<0.0001*	0.0001	0.0001	*<0.0001*	*<0.0001*	0.0002	0.0001	0.0001	*<0.0001*	*<0.0001*	*<0.0001*
Copper[3]	***equation***	0.00124	0.00125	0.002	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	0.0012	0.0011	0.0009	0.0010	0.0009	0.0008	0.0008	0.0008	0.0008	0.0008	0.0010	0.0009
Iron	0.3	0.155	0.160	0.3	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.02
Lead[3]	***equation***	0.000525	0.000525	0.001	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	0.00011	*<0.00005*	*<0.00005*	*<0.00005*	0.00008	**0.00067**
Lithium		0.048	0.048	0.096	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	0.0009	0.0008	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*
Magnesium		0.8	7.4		0.76	0.74	0.78	0.80	**1.91**	**1.62**	**1.02**	**0.99**	**1.14**	**1.10**	**1.19**	**1.14**	**1.31**	**1.34**	**2.06**	**1.35**
Manganese[3]		0.3157	0.3400	***equation***	0.0015	0.0011	0.0011	0.0011	0.0007	0.0005	0.0019	0.0016	0.0014	0.0015	0.0015	0.0018	0.0013	0.0012	0.0014	0.0011
Mercury	0.000026	0.000018	0.000018	0.000026	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*
Molybdenum	0.073	0.0365	0.0365	0.073	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0003	0.0002
Nickel[3]	***equation***	0.0127	0.0128	0.025	0.0007	0.0007	0.0006	0.0006	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	0.0006	*<0.0005*	*<0.0005*	*<0.0005*
Phosphorus					*<0.30*	*<0.30*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*
Potassium		0.5	2.4		0.32	0.32	0.32	0.32	**0.65**	**0.56**	0.40	0.40	0.47	0.43	0.44	0.43	0.46	0.49	**0.53**	0.49
Selenium	0.001	0.00055	0.00055	0.001	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Silicon					0.16	0.14	0.16	0.15	0.72	0.61	0.33	0.33	0.38	0.39	0.40	0.40	0.40	0.40	0.66	0.41
Sodium		0.975	54.0		0.45	0.44	0.46	0.47	0.79	0.68	0.48	0.48	0.53	0.52	0.53	0.56	0.57	0.59	0.69	0.66
Strontium		0.0279	0.0564	0.049	0.0089	0.0088	0.0093	0.0091	**0.0311**	0.0253	0.0171	0.0165	0.0200	0.0182	0.0189	0.0179	0.0207	0.0224	**0.0321**	0.0234

Table 3.3-1. Conventional water chemistry and total and dissolved metals (mg/L), Meadowbank study lakes and Baker Lake, 2013.

Lake					Pipedream Lake (PDL)				Wally Lake (WAL)											
Station		Trigger[2]		Threshold[2]	PDL-27	PDL-28	PDL-29	PDL-30	WAL-27	WAL-28	WAL-29	WAL-30	WAL-31	WAL-32	WAL-33	WAL-34	WAL-35	WAL-36	WAL-37	WAL-38
Area-Replicate ID					3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Depth (m)	CCME (2012)																			
Date	Guideline[1]	Meadowbank	Baker Lake		16-Jul-13	16-Jul-13	23-Aug-13	23-Aug-13	20-Apr-13	20-Apr-13	19-Jul-13	19-Jul-13	26-Aug-13	26-Aug-13	15-Sep-13	15-Sep-13	28-Nov-13	28-Nov-13	22-Dec-13	22-Dec-13
Sulfur							0.55	0.56	1.57	1.36	0.91	0.88	0.95	0.93	1.11	1.11	1.09	1.19	1.44	1.25
Thallium	0.0008	0.00041	0.00041	0.0008	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*
Tin		0.0002	0.0002		*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Titanium		1.00	1.00	2	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*
Uranium	0.015	0.0075	0.0075	0.015	0.000025	0.000022	0.000024	0.000024	0.000045	0.000043	0.000044	0.000043	0.000040	0.000037	0.000037	0.000040	0.000043	0.000046	0.000063	0.000045
Vanadium		0.0035	0.0035	0.006	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Zinc[3]	0.030	0.0063	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*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*
DISSOLVED METALS (mg/L)																				
Aluminum[3]		0.0263	0.0274	0.05	0.0021	0.0016	0.0018	0.0020	0.0013	0.0011	0.0030	0.0025	0.0010	*<0.001*	0.0014	0.0019	*<0.001*	*<0.001*	0.0024	0.0033
Antimony		0.0101	0.0101	0.020	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Arsenic		0.0026	0.0026	0.005	0.0001	0.0001	0.0002	0.0002	0.0003	0.0002	0.0002	0.0002	0.0002	0.0003	0.0002	0.0002	0.0002	0.0001	0.0004	0.0003
Barium		0.5010	0.5089	1	0.0019	0.0020	0.0019	0.0019	0.0035	0.0026	0.0018	0.0019	0.0017	0.0017	0.0016	0.0017	0.0019	0.0010	0.0025	0.0022
Beryllium		0.0027	0.0027	0.0053	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Bismuth					*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*
Boron		0.755	0.755	1.5	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*
Cadmium		0.000025	0.000025	0.00004	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	0.000014	0.000011
Calcium					2.10	2.09	2.16	2.13	6.81	5.51	3.42	3.38	3.75	3.59	3.83	3.65	4.33	2.10	6.66	4.56
Chromium		0.00055	0.00055	0.001	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Copper		0.00119	0.00116	0.002	0.00046	0.00046	0.00047	0.00042	0.00116	0.00093	0.00078	0.00083	0.00077	0.00076	0.00072	0.00074	0.00073	0.00048	0.00095	0.00084
Iron		0.155	0.155	0.3	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*
Lead		0.000525	0.000525	0.001	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	0.00008	*<0.00005*
Lithium		0.048	0.048	0.096	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	0.0013	0.0007	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	0.0006
Magnesium					0.75	0.75	0.73	0.75	2.01	1.62	1.01	0.99	1.09	1.06	1.13	1.07	1.26	0.62	2.14	1.34
Manganese[3]		0.3152	0.3391	***equation***	0.0009	0.0008	0.0003	0.0003	0.0002	0.0001	0.0008	0.0008	0.0003	0.0004	0.0005	0.0003	*<0.00005*	*<0.00005*	0.0007	0.0005
Mercury		0.000018	0.000018	0.000026	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*
Molybdenum		0.0366	0.0365	0.073	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0003	0.0002
Nickel		0.0128	0.0128	0.025	0.0007	0.0007	0.0006	0.0006	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*
Phosphorus					*<0.30*	*<0.30*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*
Potassium					0.32	0.32	0.30	0.31	0.68	0.55	0.38	0.39	0.42	0.40	0.42	0.38	0.45	0.22	0.54	0.46
Selenium		0.00055	0.00055	0.001	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Silicon					0.16	0.15	0.15	0.15	0.75	0.62	0.32	0.33	0.37	0.38	0.37	0.37	0.37	0.18	0.68	0.40
Sodium					0.45	0.44	0.46	0.45	0.81	0.65	0.47	0.48	0.52	0.51	0.55	0.52	0.55	0.27	0.68	0.65
Strontium		0.0280	0.0492	0.049	0.0084	0.0085	0.0089	0.0090	**0.0349**	0.0244	0.0159	0.0160	0.0194	0.0183	0.0176	0.0173	0.0202	0.0100	**0.0308**	0.0226
Sulfur							0.50	0.53	1.58	1.32	0.89	0.87	0.92	0.89	1.05	1.01	1.11	*<0.50*	1.42	1.19
Thallium		0.0004	0.0004	0.0008	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*
Tin		0.0002	0.0002		*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Titanium		1.01	1.01	2	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*
Uranium		0.0075	0.0075	0.015	0.00002	0.00002	0.00002	0.00002	0.00004	0.00004	0.00004	0.00004	0.00003	0.00003	0.00003	0.00003	0.00003	0.00002	0.00006	0.00005
Vanadium		0.0035	0.0035	0.006	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Zinc[3]		0.005	0.012	***equation***	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	0.001	*<0.001*	*<0.001*	*<0.001*

Notes:

[1]CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life, 1999, updated up to 2014.

[2]Trigger and threshold values were developed in "CREMP Design Document 2012" (Azimuth, 2012).
A number of thresholds were derived from methods (or sources) other than CCME guidelines - see **Appendix A** for 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.

Table 3.3-1. Conventional water chemistry and total and dissolved metals (mg/L), Meadowbank study lakes and Baker Lake, 2013.

Lake					Baker Lake											
Station					Akilahaarjuk Point (BAP)				Barge Dock (BBD)				Proposed Jetty (BPJ)			
Area-Replicate ID		Trigger[2]			BAP-27	BAP-28	BAP-29	BAP-30	BBD-27	BBD-28	BBD-29	BBD-30	BPJ-27	BPJ-28	BPJ-29	BPJ-30
Depth (m)	CCME (2012)				3	3	3	3	3	3	3	3	3	3	3	3
Date	Guideline[1]	Meadowbank	Baker Lake	Threshold[2]	20-Jul-13	20-Jul-13	30-Aug-13	30-Aug-13	20-Jul-13	20-Jul-13	30-Aug-13	30-Aug-13	20-Jul-13	20-Jul-13	30-Aug-13	30-Aug-13
CONVENTIONAL PARAMETERS																
Physical Tests (mg/L)																
Conductivity (µS/cm)		23.5	494.5		64.1	71.3	101.0	110.0	27.4	27.8	119.0	118.0	34.7	34.7	132.0	131.0
Hardness		8.5	41.2		13.90	14.30	16.50	17.40	10.30	10.20	18.70	18.10	11.10	10.90	19.30	19.50
pH	6.5 - 9.0	6.50 - 7.94	6.74 - 8.12	6.5 - 9.0	7.32	7.30	7.68	7.58	7.33	7.32	7.91	7.77	7.33	7.32	7.49	7.43
Total Suspended Solids		3	3	5	*<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	208		42	39	60	65	24	24	70	67	26	27	78	77
Turbidity (NTU)					0.47	0.47	0.23	0.24	0.44	0.57	0.24	0.24	0.48	0.46	0.23	0.22
Anions and Nutrients (mg/L)																
Alkalinity - Bicarbonate		8.6	10.6		8.9	9.2	6.9	9.3	8.4	8.5	9.5	9.6	8.4	8.5	9.4	9.4
Alkalinity - Carbonate		4	4		*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*
Alkalinity - Hydroxide					*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*
Alkalinity - Total		8.5	10.6		8.9	9.2	6.9	9.3	8.4	8.5	9.5	9.6	8.4	8.5	9.4	9.4
Ammonia (as N)[3]	***equation***	0.065	0.067	0.126	0.01	*<0.005*	0.01	0.01	*<0.005*	*<0.005*	0.01	0.01	*<0.005*	*<0.005*	0.01	0.01
Bromide					*<0.05*	0.06	0.08	0.09	*<0.05*	*<0.05*	0.10	0.10	*<0.05*	*<0.05*	0.11	0.11
Chloride	120	60.28	95.7	120	12.10	14.00	22.00	24.50	2.22	2.30	27.00	26.80	4.15	4.12	30.70	30.30
Nitrate (as N)	3.0	1.50	1.51	3	0.0303	0.0320	0.0259	0.0278	0.0174	0.0175	0.0334	0.0333	0.0235	0.0246	0.0346	0.0369
Nitrite (as N)	0.060	0.0305	0.0305	0.06	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Total Kjeldahl Nitrogen		0.170	0.214		**0.34**	0.21	0.15	0.15	0.21	**0.21**	0.17	0.16	0.21	**0.25**	0.15	0.14
Ortho Phosphate (as P)		0.002	0.002		*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Total Phosphate (as P)	0.0040	0.0060	0.0096	0.004	**0.0047**	**0.0046**	0.0036	0.0035	**0.0051**	**0.0054**	**0.0046**	**0.0041**	**0.0047**	**0.0050**	0.0035	0.0035
Silicate (as SiO_2)		1	1		*<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)		64.71	65.92	128	2.23	2.50	3.62	3.97	0.83	0.84	4.32	4.30	1.11	1.10	4.86	4.81
Organic / Inorganic Carbon (mg/L)																
Dissolved Organic Carbon		2.60	4.05		3.6	3.3	3.1	3.0	3.9	3.8	3.5	3.2	3.9	3.9	2.9	2.9
Total Organic Carbon		2.79	4.25		4.0	3.2	3.0	3.0	3.6	3.5	3.0	3.1	3.6	3.5	3.2	3.1
Plant Pigments (ug/L)																
Chlorophyll-a					0.69	0.25	0.47	0.43	0.41	0.34	0.25	0.33	0.85	0.64	0.20	0.19
TOTAL METALS (mg/L)																
Aluminum[3]	***equation***	0.054	0.056	0.100	0.0285	0.0241	0.0100	0.0110	0.0261	0.0237	0.0127	0.0115	0.0298	0.0306	0.0125	0.0119
Antimony		0.0101	0.0101	0.020	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Arsenic	0.0050	0.00255	0.00257	0.005	0.0001	0.0002	0.0001	0.0002	0.0002	0.0001	0.0002	0.0002	0.0001	0.0001	0.0002	0.0002
Barium		0.501	0.509	1	0.0170	0.0172	0.0174	0.0168	0.0167	0.0173	0.0174	0.0177	0.0165	0.0166	0.0178	0.0178
Beryllium		0.0027	0.0027	0.0053	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Bismuth					*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*
Boron	1.5	0.755	0.756	1.5	*<0.01*	*<0.01*	*<0.01*	0.01	*<0.01*	*<0.01*	*<0.01*	0.01	*<0.01*	*<0.01*	0.01	0.01
Cadmium[3]	***equation***	0.000025	0.000025	0.000040	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*
Calcium		2.1	4.5		2.63	2.68	2.83	2.90	2.40	2.39	2.92	2.90	2.40	2.38	3.04	3.02
Chromium[4]	0.001	0.00056	0.00056	0.001	0.0002	0.0003	*<0.0001*	*<0.0001*	0.0002	0.0001	*<0.0001*	*<0.0001*	0.0002	0.0001	0.0002	*<0.0001*
Copper[3]	***equation***	0.00124	0.00125	0.002	0.0007	0.0006	*<0.0005*	*<0.0005*	0.0006	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	0.0006	*<0.0005*
Iron	0.3	0.155	0.160	0.3	0.04	0.03	0.01	0.01	0.04	0.03	0.02	0.02	0.03	0.03	0.06	0.01
Lead[3]	***equation***	0.000525	0.000525	0.001	0.00007	*<0.00005*	*<0.00005*	*<0.00005*	0.00007	*<0.00005*	*<0.00005*	*<0.00005*	0.00007	*<0.00005*	*<0.00005*	*<0.00005*
Lithium		0.048	0.048	0.096	0.0006	0.0007	0.0010	0.0010	0.0007	0.0009	0.0008	0.0009	0.0006	0.0005	0.0010	0.0011
Magnesium		0.8	7.4		1.75	1.90	2.41	2.63	1.11	1.09	2.72	2.71	1.20	1.20	3.04	2.99
Manganese[3]		0.3157	0.3400	***equation***	0.0041	0.0040	0.0019	0.0018	0.0046	0.0044	0.0021	0.0023	0.0042	0.0042	0.0022	0.0018
Mercury	0.000026	0.000018	0.000018	0.000026	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*
Molybdenum	0.073	0.0365	0.0365	0.073	0.0001	0.0001	0.0001	0.0001	0.0001	*<0.00005*	0.0001	0.0001	0.0001	*<0.00005*	0.0001	0.0001
Nickel[3]	***equation***	0.0127	0.0128	0.025	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*
Phosphorus					*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*
Potassium		0.5	2.4		0.68	0.71	0.95	1.02	0.46	0.47	1.08	1.07	0.50	0.50	1.18	1.16
Selenium	0.001	0.00055	0.00055	0.001	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	0.00010	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Silicon					0.24	0.23	0.18	0.19	0.23	0.21	0.20	0.20	0.22	0.24	0.20	0.20
Sodium		0.975	54.0		6.31	7.26	11.50	12.10	1.21	1.22	13.60	13.70	2.14	2.14	15.70	15.80
Strontium		0.0279	0.0564	0.049	0.0208	0.0215	0.0243	0.0260	0.0168	0.0170	0.0264	0.0263	0.0171	0.0169	0.0284	0.0274

Table 3.3-1. Conventional water chemistry and total and dissolved metals (mg/L), Meadowbank study lakes and Baker Lake, 2013.

Lake					Baker Lake											
Station					Akilahaarjuk Point (BAP)				Barge Dock (BBD)				Proposed Jetty (BPJ)			
Area-Replicate ID		Trigger[2]			BAP-27	BAP-28	BAP-29	BAP-30	BBD-27	BBD-28	BBD-29	BBD-30	BPJ-27	BPJ-28	BPJ-29	BPJ-30
Depth (m)	CCME (2012)			Threshold[2]	3	3	3	3	3	3	3	3	3	3	3	3
Date	Guideline[1]	Meadowbank	Baker Lake		20-Jul-13	20-Jul-13	30-Aug-13	30-Aug-13	20-Jul-13	20-Jul-13	30-Aug-13	30-Aug-13	20-Jul-13	20-Jul-13	30-Aug-13	30-Aug-13
Sulfur					0.81	0.96	1.23	1.38	*<0.50*	*<0.50*	1.42	1.42	*<0.50*	*<0.50*	1.62	1.61
Thallium	0.0008	0.00041	0.00041	0.0008	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*
Tin		0.0002	0.0002		*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Titanium		1.00	1.00	2	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*
Uranium	0.015	0.0075	0.0075	0.015	0.000043	0.000050	0.000045	0.000048	0.000047	0.000037	0.000047	0.000044	0.000043	0.000042	0.000050	0.000048
Vanadium		0.0035	0.0035	0.006	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Zinc[3]	0.030	0.0063	0.0132	***equation***	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	0.0069	*<0.0030*	*<0.0030*	*<0.0030*
DISSOLVED METALS (mg/L)																
Aluminum[3]		0.0263	0.0274	0.05	0.0052	0.0050	0.0041	0.0060	0.0047	0.0044	0.0045	0.0063	0.0049	0.0044	0.0048	0.0050
Antimony		0.0101	0.0101	0.020	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Arsenic		0.0026	0.0026	0.005	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Barium		0.5010	0.5089	1	0.0171	0.0170	0.0182	0.0177	0.0168	0.0163	0.0180	0.0185	0.0170	0.0164	0.0177	0.0173
Beryllium		0.0027	0.0027	0.0053	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Bismuth					*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*
Boron		0.755	0.755	1.5	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*
Cadmium		0.000025	0.000025	0.00004	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*
Calcium					2.65	2.67	2.76	2.84	2.37	2.34	2.96	2.92	2.46	2.41	2.96	2.98
Chromium		0.00055	0.00055	0.001	*<0.0001*	0.00	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Copper		0.00119	0.00116	0.002	0.00038	0.00036	0.00029	0.00030	0.00034	0.00034	0.00032	0.00059	0.00035	0.00029	0.00044	0.00032
Iron		0.155	0.155	0.3	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*
Lead		0.000525	0.000525	0.001	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*	*<0.00005*
Lithium		0.048	0.048	0.096	0.0007	0.0006	0.0012	0.0008	0.0010	0.0006	0.0010	0.0011	0.0007	0.0007	0.0010	0.0011
Magnesium					1.77	1.85	2.34	2.51	1.06	1.05	2.74	2.63	1.21	1.18	2.89	2.93
Manganese[3]		0.3152	0.3391	***equation***	0.0025	0.0023	0.0005	0.0005	0.0027	0.0028	0.0008	0.0009	0.0024	0.0023	0.0006	0.0005
Mercury		0.000018	0.000018	0.000026	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*
Molybdenum		0.0366	0.0365	0.073	*<0.00005*	0.0001	0.0001	0.0001	0.0001	*<0.00005*	0.0001	0.0001	*<0.00005*	*<0.00005*	0.0001	0.0001
Nickel		0.0128	0.0128	0.025	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*
Phosphorus					*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*	*<0.05*
Potassium					0.66	0.69	0.88	0.93	0.43	0.43	1.01	0.95	0.47	0.45	1.05	1.07
Selenium		0.00055	0.00055	0.001	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Silicon					0.19	0.19	0.16	0.17	0.17	0.16	0.19	0.18	0.18	0.17	0.18	0.18
Sodium					6.52	7.04	11.40	12.40	1.18	1.18	13.90	13.90	2.21	2.21	15.40	15.90
Strontium		0.0280	0.0492	0.049	0.0198	0.0207	0.0246	0.0247	0.0171	0.0160	0.0256	0.0256	0.0166	0.0166	0.0275	0.0267
Sulfur					0.82	0.95	1.22	1.30	*<0.50*	*<0.50*	1.44	1.43	*<0.50*	*<0.50*	1.59	1.59
Thallium		0.0004	0.0004	0.0008	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*	*<0.00001*
Tin		0.0002	0.0002		*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*	*<0.0001*
Titanium		1.01	1.01	2	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*
Uranium		0.0075	0.0075	0.015	0.00004	0.00004	0.00004	0.00004	0.00004	0.00004	0.00004	0.00004	0.00004	0.00004	0.00004	0.00004
Vanadium		0.0035	0.0035	0.006	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Zinc[3]		0.005	0.012	***equation***	*<0.001*	*<0.001*	*<0.001*	*<0.001*	0.002	*<0.001*	*<0.001*	0.001	*<0.001*	*<0.001*	*<0.001*	*<0.001*

Notes:

[1]CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life, 1999, updated up to 2014.

[2]Trigger and threshold values were developed in "CREMP Design Document 2012" (Azimuth, 2012).
A number of thresholds were derived from methods (or sources) other than CCME guidelines - see **Appendix A** for 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.

Table 3.3-2. Screening process for water quality parameters, Meadowbank study lakes.

CONVENTIONALS				TOTAL METALS				DISSOLVED METALS			
Screening Level	**1**	**2**	**3**	**Screening Level**	**1**	**2**	**3**	**Screening Level**	**1**	**2**	**3**
Screening Rule[1]	**>DL ≥ 10% frequency**	**C-I > 0.1 frequency**	**Pattern = Activity**	**Screening Rule[1]**	**>DL ≥ 10% frequency**	**C-I > 0.1 frequency**	**Pattern = Activity**	**Screening Rule[1]**	**>DL ≥ 10% frequency**	**C-I > 0.1 frequency**	**Pattern = Activity**
Conductivity	Figure 3.3-1			Aluminum	Figure 3.3-17			Aluminum	Figure 3.3-31		
Hardness	Figure 3.3-2			Antimony			*	Antimony			*
pH	Figure 3.3-3			Arsenic	Figure 3.3-18			Arsenic	Figure 3.3-32		
TSS	Figure 3.3-4			Barium	Figure 3.3-19			Barium	Figure 3.3-33		
TDS	Figure 3.3-5			Beryllium			*	Beryllium			*
B-Alkalinity	Figure 3.3-6			Boron			*	Boron			*
C-Alkalinity			*	Cadmium			*	Cadmium			*
T-Alkalinity	Figure 3.3-7			Calcium	Figure 3.3-20			Chromium			*
Ammonia-N	Figure 3.3-8			Chromium			*	Copper	Figure 3.3-34		
Chloride	Figure 3.3-9			Copper	Figure 3.3-21			Iron			*
Nitrate-N	Figure 3.3-10			Iron	Figure 3.3-22			Lead			*
Nitrite-N			*	Lead			*	Lithium			*
TKN	Figure 3.3-11			Lithium			*	Manganese	Figure 3.3-35		
T-phosphorous	Figure 3.3-12			Magnesium	Figure 3.3-23			Mercury			*
Ortho-phosphate			*	Manganese	Figure 3.3-24			Molybdenum	Figure 3.3-36		
Reactive silica	Figure 3.3-13			Mercury			*	Nickel			*
Sulphate	Figure 3.3-14			Molybdenum	Figure 3.3-25			Selenium			*
DOC	Figure 3.3-15			Nickel			*	Strontium	Figure 3.3-37		
TOC	Figure 3.3-16			Potassium	Figure 3.3-26			Thallium			*
				Selenium			*	Tin			*
				Sodium	Figure 3.3-27			Titanium			*
				Strontium	Figure 3.3-28			Uranium	Figure 3.3-38		
				Thallium			*	Vanadium			*
				Tin			*	Zinc			*
				Titanium	Figure 3.3-29						
				Uranium	Figure 3.3-30						
				Vanadium			*				
				Zinc			*				

Notes: [1] See text for further detail; * Plots for these parameters are presented in **Appendix E**.

Table 3.3-3. Water variables for which 2013 means exceeded triggers for Meadowbank areas.

		Meadowbank Study Lakes								
		REF	REF	NF	NF	NF	NF	MF	MF	FF
Parameter Measured	**Trigger**	**INUG**	**PDL**	**TPN**	**SP**	**TPE**	**WAL**	**TPS**	**TE**	**TEFF**
Bicarbonate alkalinity	8.6	-	-	-	10.1	-	-	-	-	-
Conductivity	23.5	-	-	24.9	31.8	27.0	38.5	-	-	-
Hardness	8.5	-	-	-	11.8	-	-	-	-	-
Calcium	2.1	-	2.2	-	3.1	2.2	-	-	-	-
Magnesium	0.8	-	-	-	1.0	-	-	-	-	-
Total alkalinity	8.5	-	-	-	10.1	-	-	-	-	-
TDS	18	-	-	-	20.8	19.4	25.5	-	-	-

Notes:
REF = reference; NF = near-field; MF = mid-field; FF = far-field;
Reported mean values are all in units of mg/L with the exception of conductivity (uS/cm).
"-" denotes that the mean value does not exceed the trigger;
note that trigger values are different for Wally Lake (WAL): 36.6 for conductivity and 25.3 for TDS.

Table 3.3-4. Results of BACI tests for selected water variables and Meadowbank areas.

Parameter Measured	Test Station	n(B)	n(A)	Estimate	SE	P-value*	Proportional Change		
							Exp(Est.)	LCI	UCI
Bicarbonate alkalinity	SP	5	4	0.249	0.090	**0.014**	1.28	1.04	1.59
Conductivity	TPN	6	4	0.454	0.056	**0.000**	1.57	1.38	1.79
	TPE	8	4	0.540	0.046	**0.000**	1.72	1.55	1.9
	SP	5	4	0.278	0.023	**0.000**	1.32	1.25	1.39
	WAL	18	4	0.118	0.076	0.068	1.13	0.96	1.32
Hardness	SP	5	4	0.164	0.189	0.206	1.18	0.75	1.84
Calcium	TPE	8	4	0.503	0.104	**0.000**	1.65	1.31	2.09
	SP	5	4	0.165	0.138	0.136	1.18	0.85	1.64
Magnesium	SP	5	4	0.095	0.140	0.258	1.1	0.79	1.53
Total alkalinity	SP	5	4	0.249	0.090	**0.014**	1.28	1.04	1.59
TDS	TPE	8	4	0.424	0.071	**0.000**	1.53	1.3	1.79
	SP	5	4	0.417	0.074	**0.000**	1.52	1.27	1.81
	WAL	18	4	0.125	0.171	0.236	1.13	0.79	1.62

Notes:
Test station = station 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 2013);
Estimate = BACI model estimate of the 2013 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; ***Bolded values** are statistically significant results;
Exp(Est.) = estimated proportional change (i.e., exp[Estimate]);
LCI = lower 95% confidence interval; **UCI** = upper 95% confidence interval.

Table 3.3-5. Screening process for water quality parameters, Baker Lake.

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 3.3-39		Aluminum	Figure 3.3-56		Aluminum	Figure 3.3-72	
Hardness	Figure 3.3-40		Antimony		*	Antimony		*
pH	Figure 3.3-41		Arsenic	Figure 3.3-57		Arsenic	Figure 3.3-73	
TSS	Figure 3.3-42		Barium	Figure 3.3-58		Barium	Figure 3.3-74	
TDS	Figure 3.3-43		Beryllium		*	Beryllium		*
B-Alkalinity	Figure 3.3-44		Boron		*	Boron		*
C-Alkalinity		*	Cadmium		*	Cadmium		*
T-Alkalinity	Figure 3.3-45		Calcium	Figure 3.3-59		Chromium		*
Ammonia-N	Figure 3.3-46		Chromium		*	Copper	Figure 3.3-75	
Chloride	Figure 3.3-47		Copper	Figure 3.3-60		Iron		*
Nitrate-N	Figure 3.3-48		Iron	Figure 3.3-61		Lead		*
Nitrite-N		*	Lead		Figure 3.3-62	Lithium	Figure 3.3-76	
TKN	Figure 3.3-49		Lithium	Figure 3.3-63		Manganese	Figure 3.3-77	
T-phosphorous	Figure 3.3-50		Magnesium	Figure 3.3-64		Mercury		*
Ortho-phosphate	Figure 3.3-51		Manganese	Figure 3.3-65		Molybdenum	Figure 3.3-78	
Reactive silica	Figure 3.3-52		Mercury		*	Nickel		*
Sulphate	Figure 3.3-53		Molybdenum	Figure 3.3-66		Selenium		*
DOC	Figure 3.3-54		Nickel		*	Strontium	Figure 3.3-79	
TOC	Figure 3.3-55		Potassium	Figure 3.3-67		Thallium		*
			Selenium		*	Tin		*
			Sodium	Figure 3.3-68		Titanium		*
			Strontium	Figure 3.3-69		Uranium	Figure 3.3-80	
			Thallium		*	Vanadium		*
			Tin		*	Zinc		*
			Titanium	Figure 3.3-70				
			Uranium	Figure 3.3-71				
			Vanadium		*			
			Zinc		*			

Notes: [1] See text for further detail; * Plots for these parameters are presented in **Appendix E**.

Figure 3.3-1. Laboratory-measured conductivity (µS/cm) in water samples from Meadowbank study lakes since 2006.

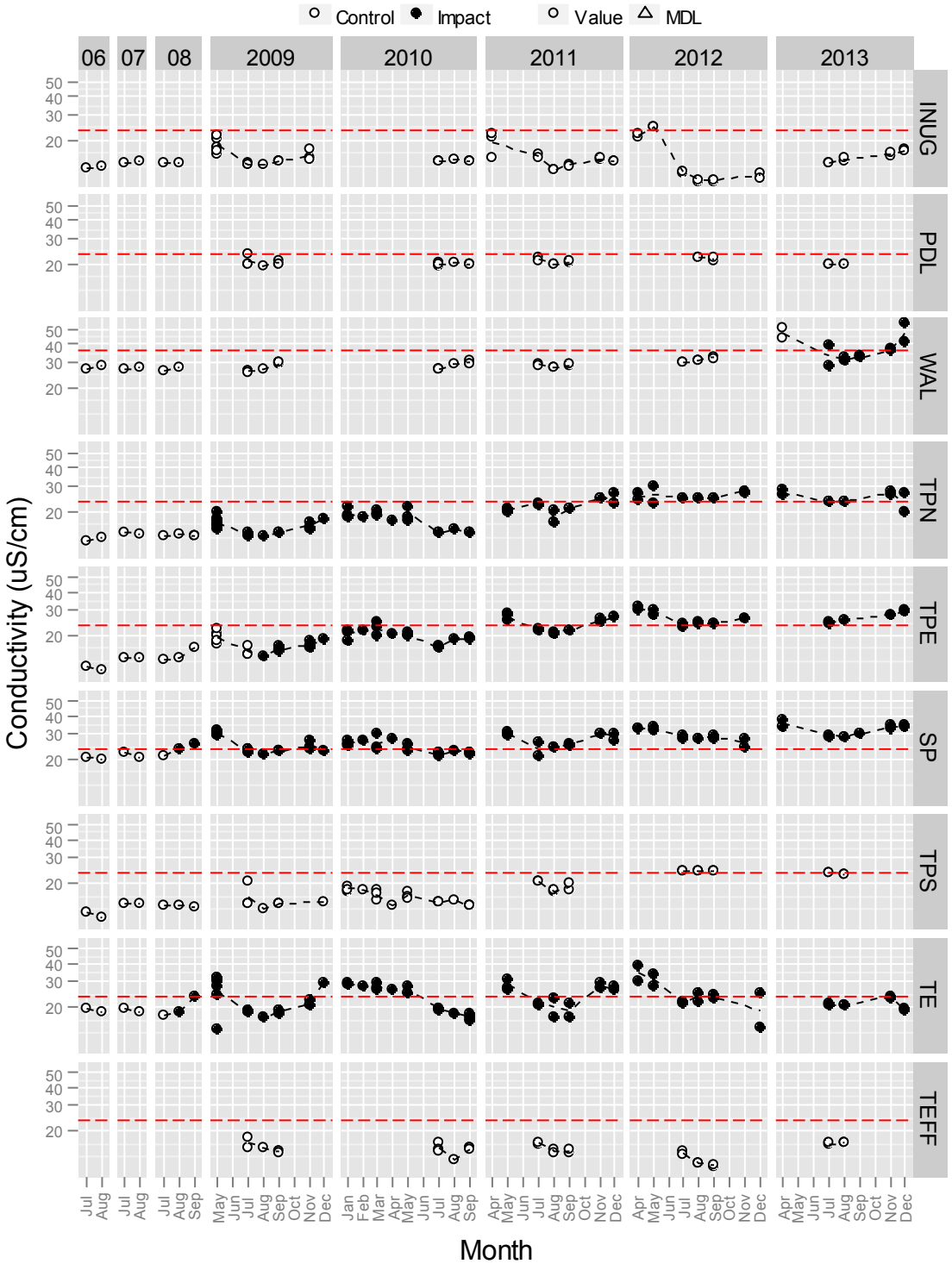


Figure 3.3-2. Hardness (mg/L) in water samples from Meadowbank study lakes since 2006.

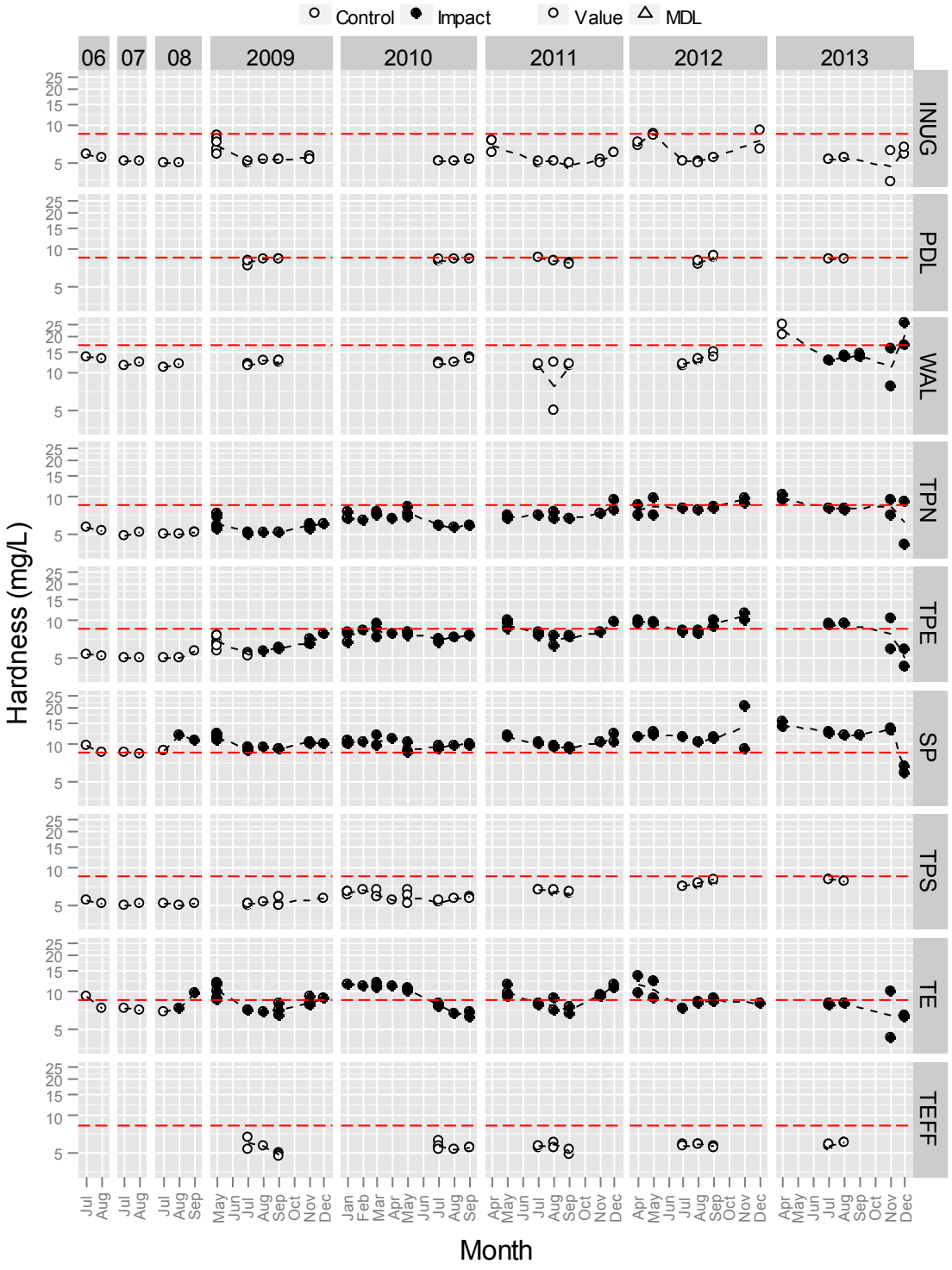


Figure 3.3-3. Laboratory-measured pH in water samples from Meadowbank study lakes since 2006.

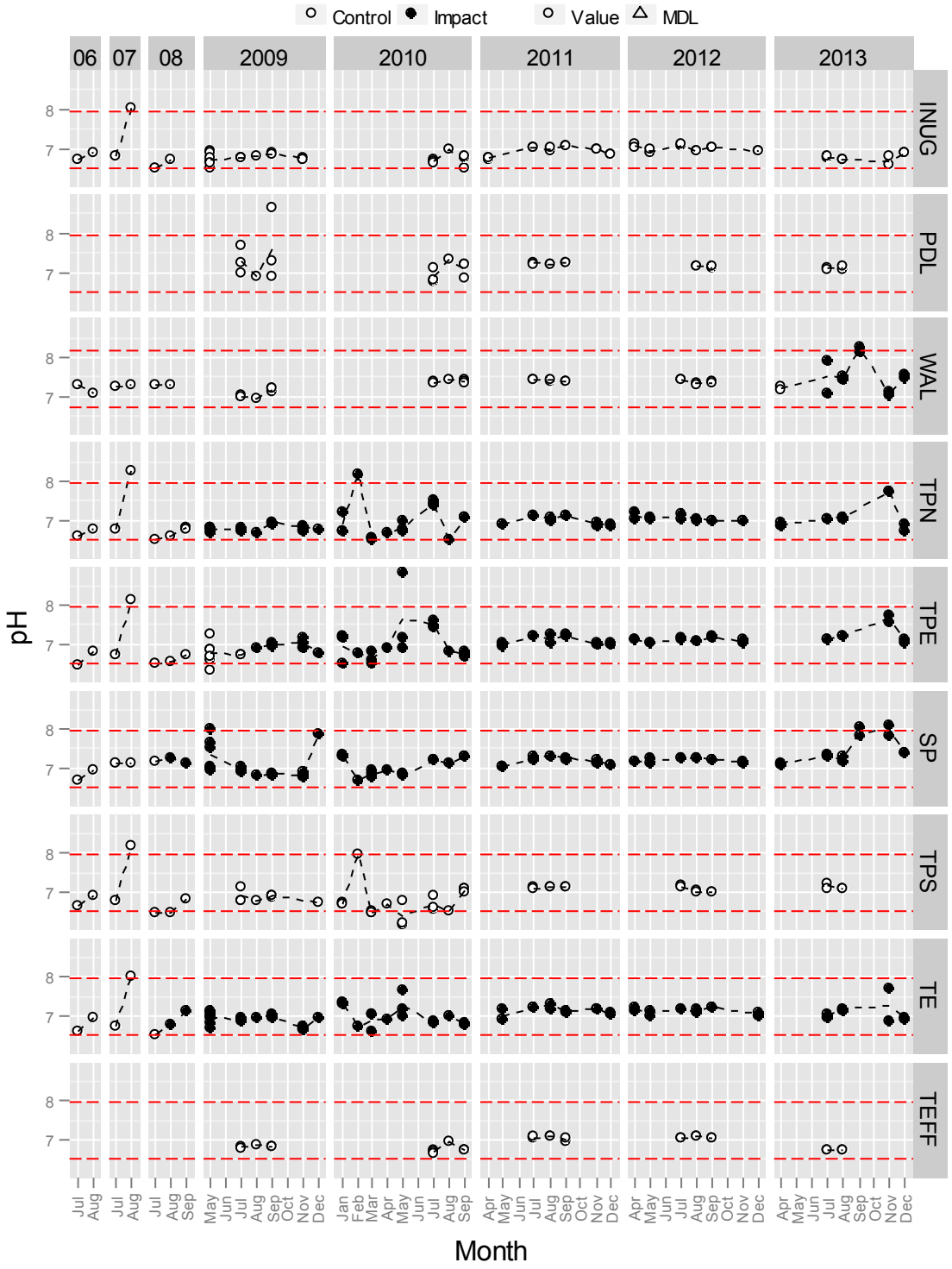


Figure 3.3-4. Total Suspended Solids (TSS; mg/L) in water samples from Meadowbank study lakes since 2006.

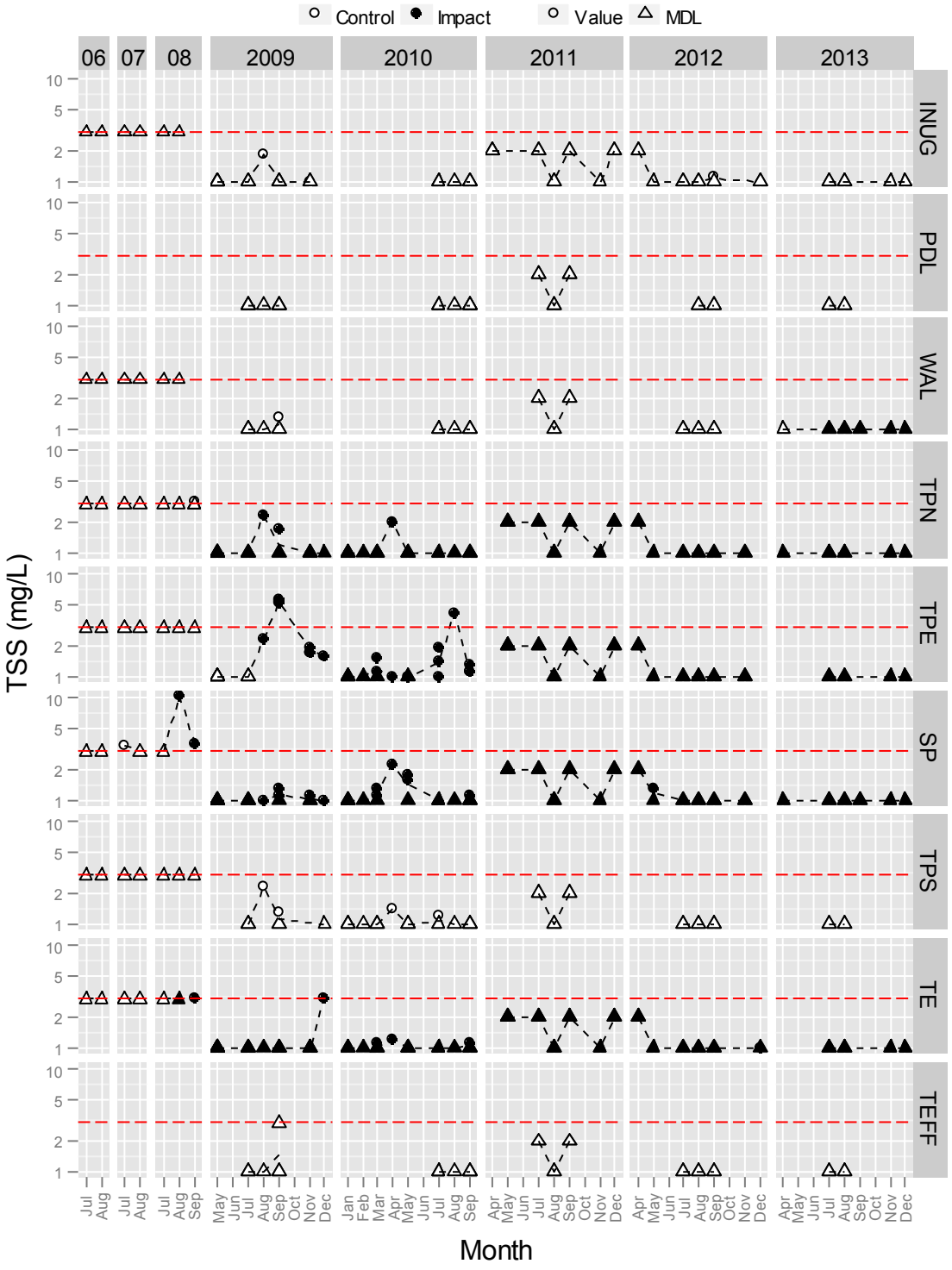


Figure 3.3-5. Total Dissolved Solids (TDS; mg/L) in water samples from Meadowbank study lakes since 2006.

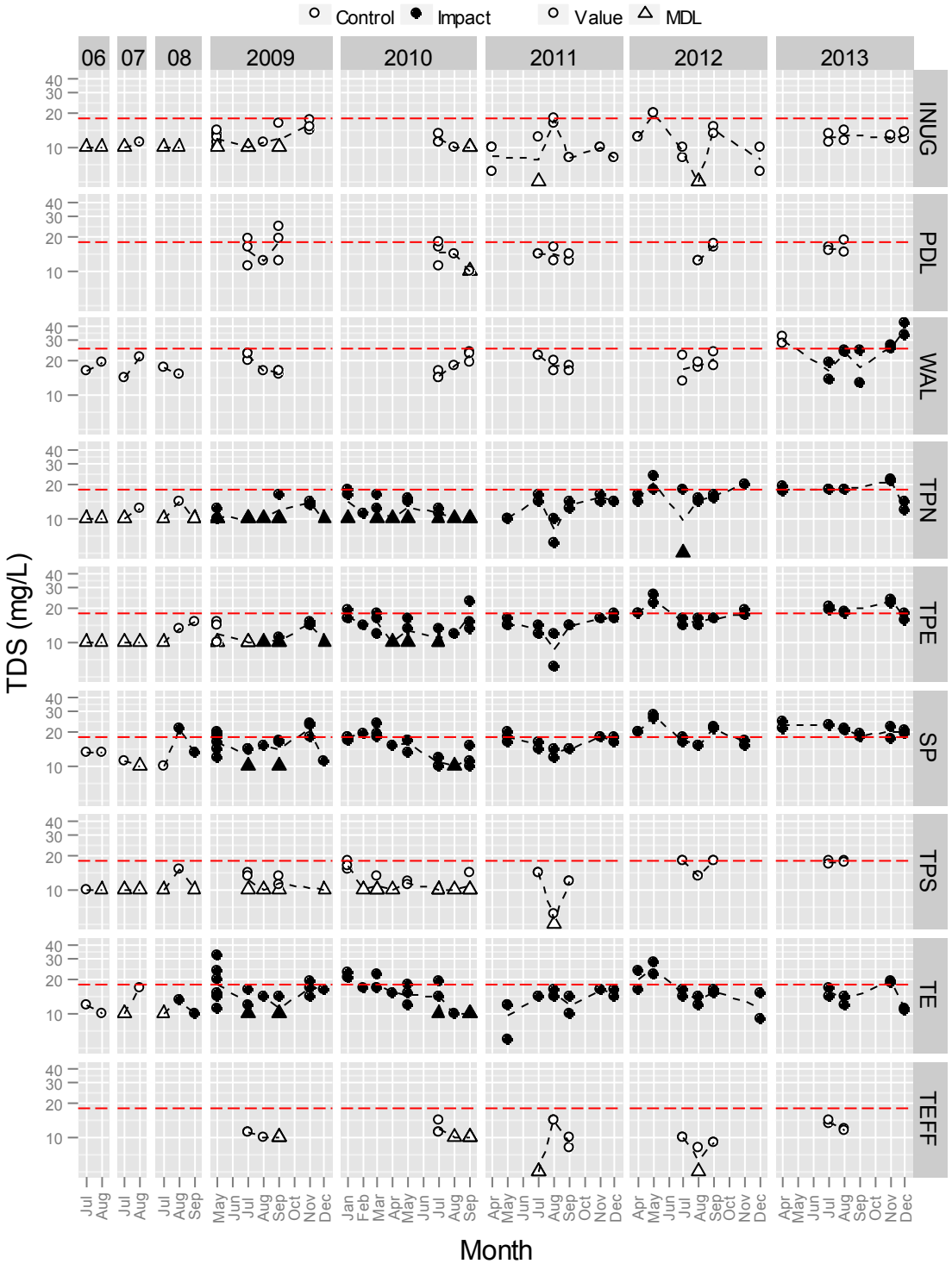


Figure 3.3-6. Bicarbonate Alkalinity (mg/L) in water samples from Meadowbank study lakes since 2006.

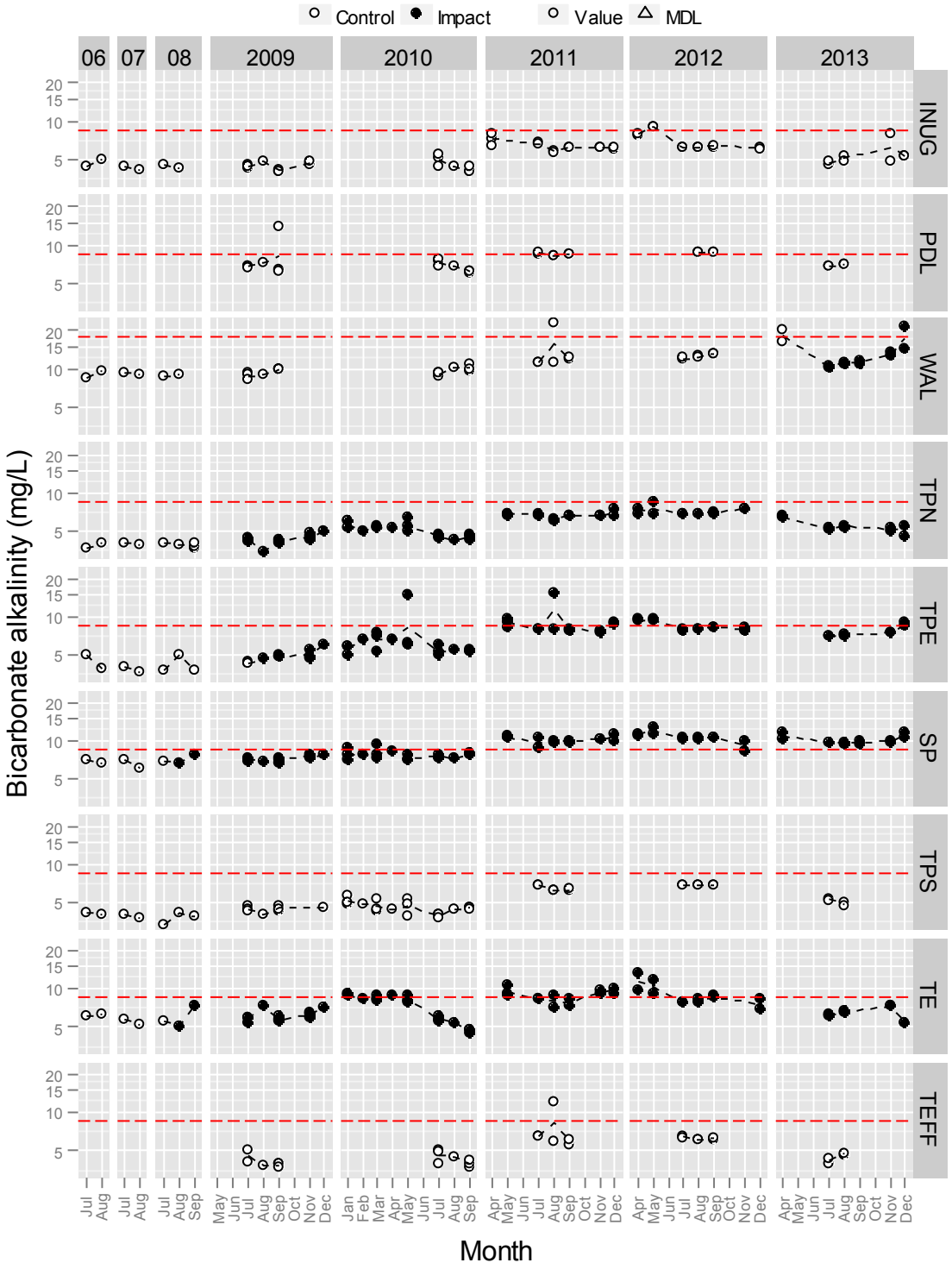


Figure 3.3-7. Total Alkalinity (mg/L) in water samples from Meadowbank study lakes since 2006.

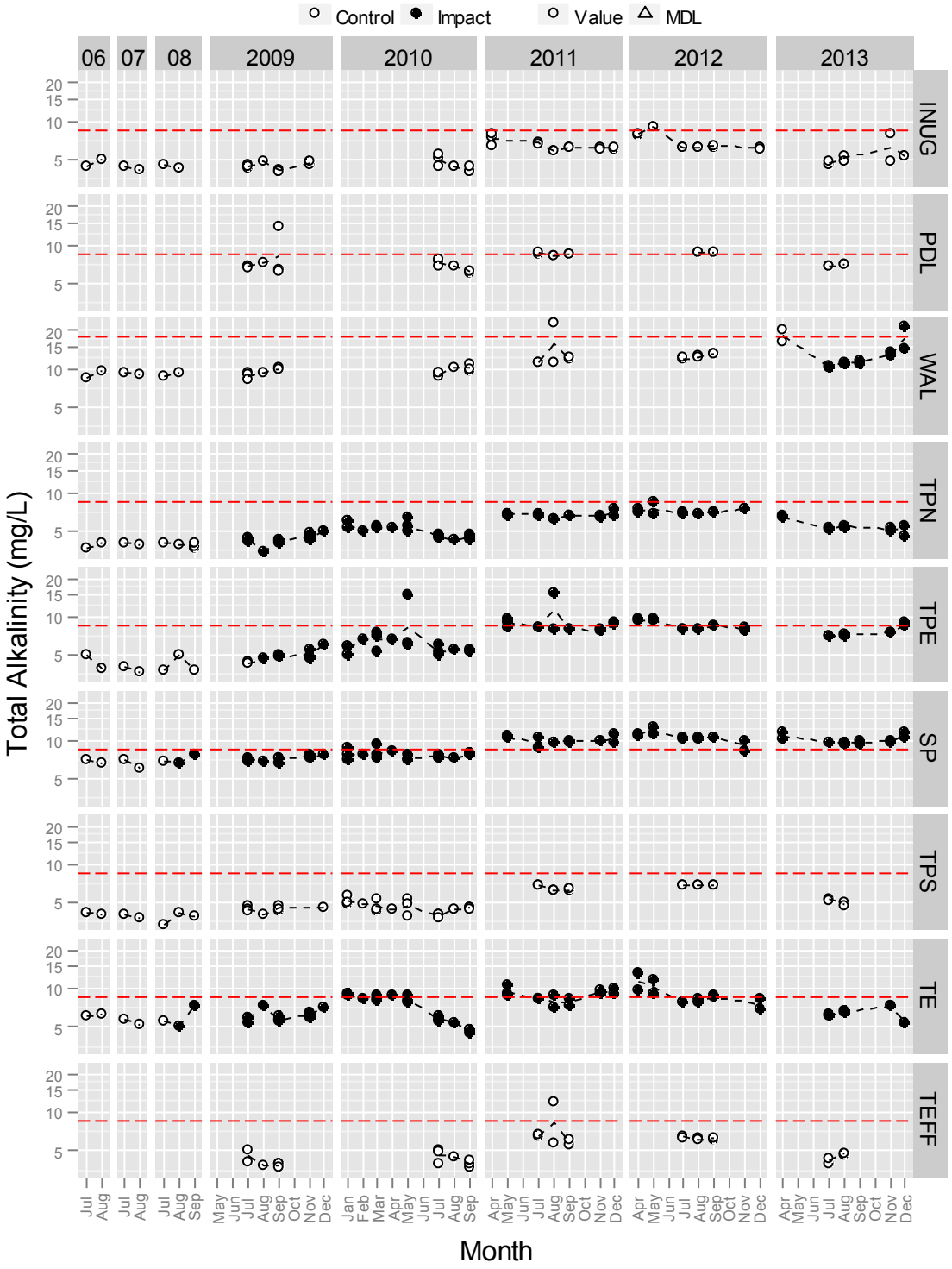


Figure 3.3-8. Ammonia-N (mg/L) in water samples from Meadowbank study lakes since 2006.

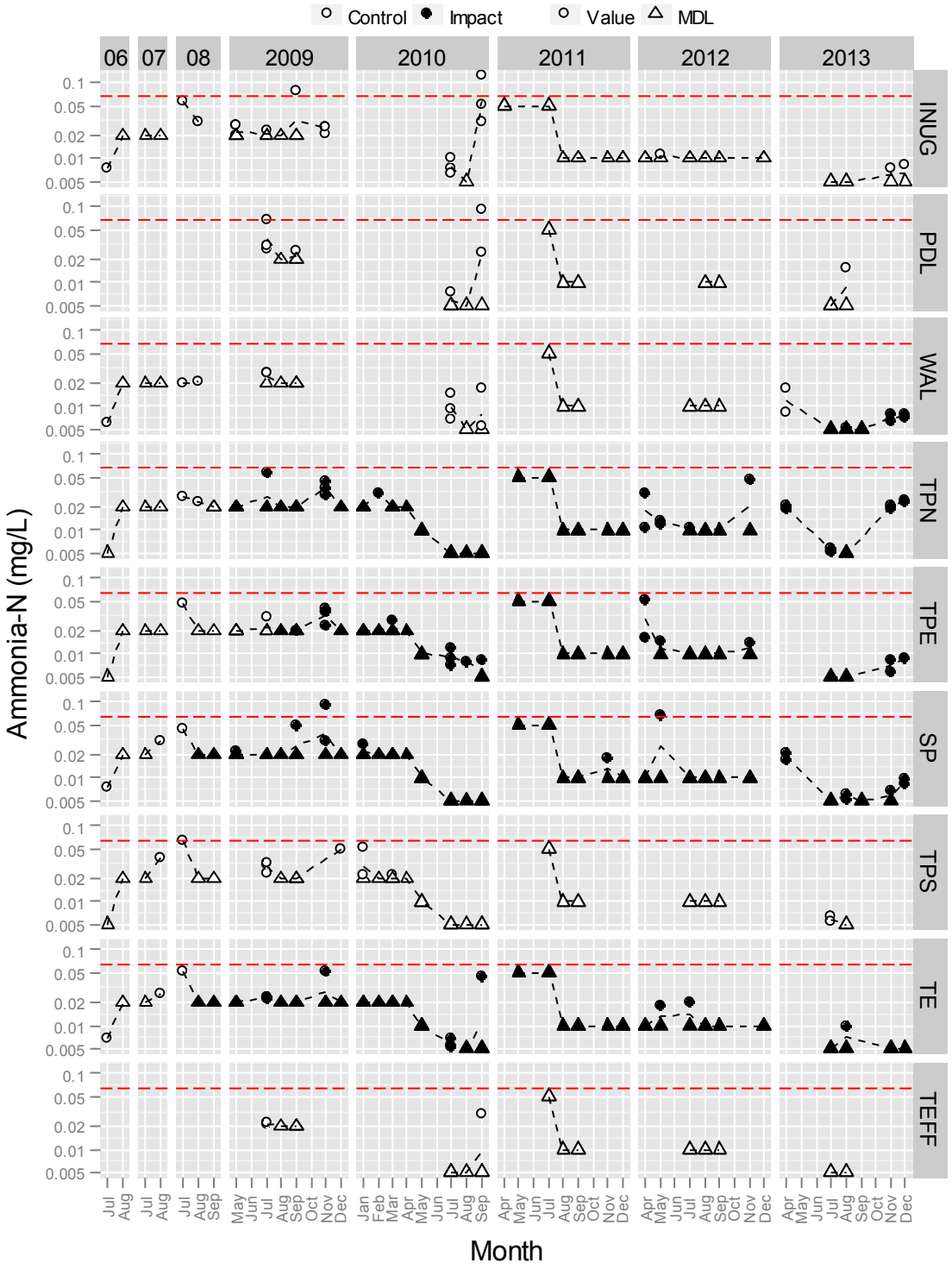


Figure 3.3-9. Chloride (mg/L) in water samples from Meadowbank study lakes since 2006.

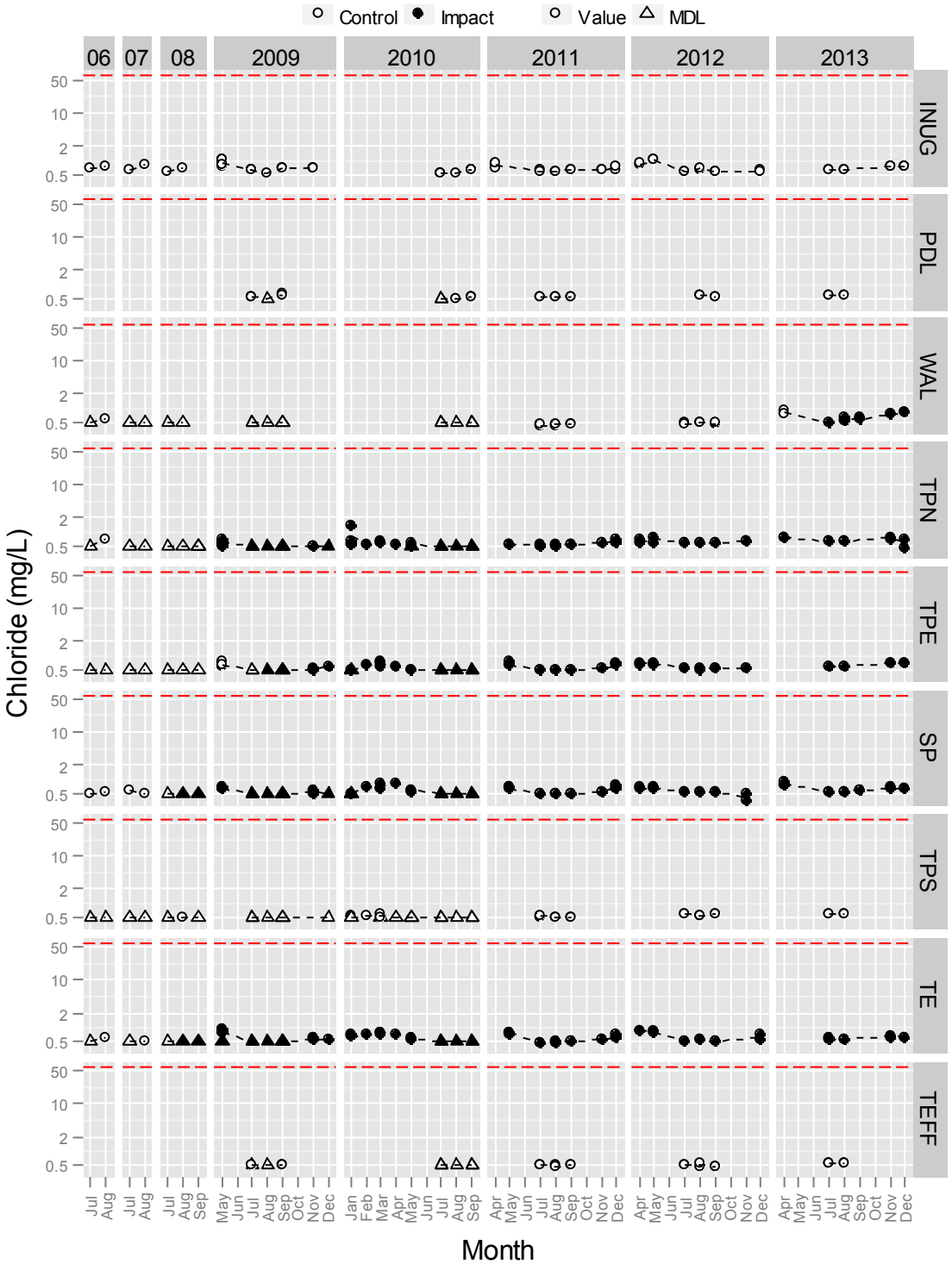


Figure 3.3-10. Nitrate-N (mg/L) in water samples from Meadowbank study lakes since 2006.

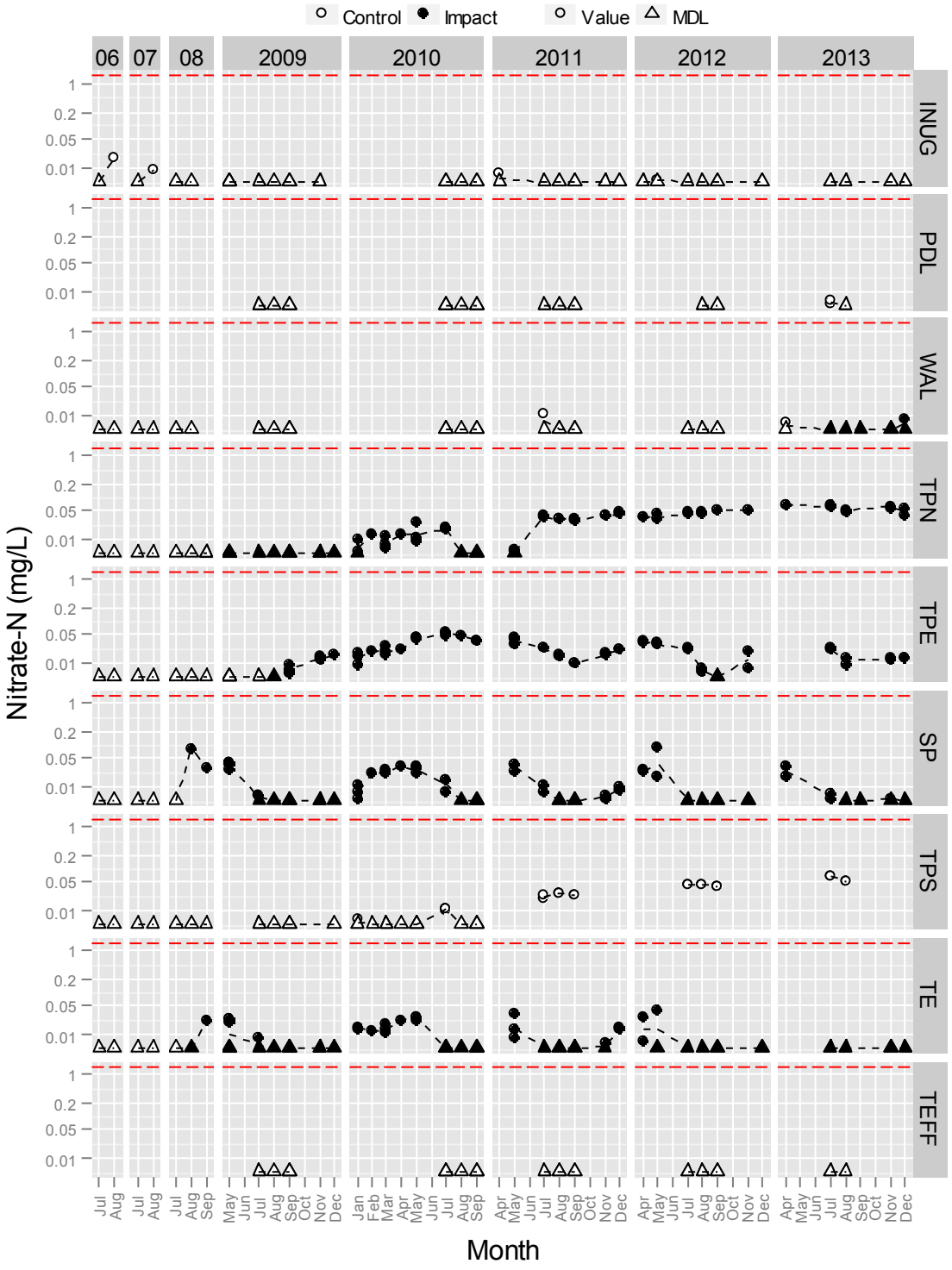


Figure 3.3-11. Total Kjeldahl Nitrogen (TKN; mg/L) in water samples from Meadowbank study lakes since 2006.

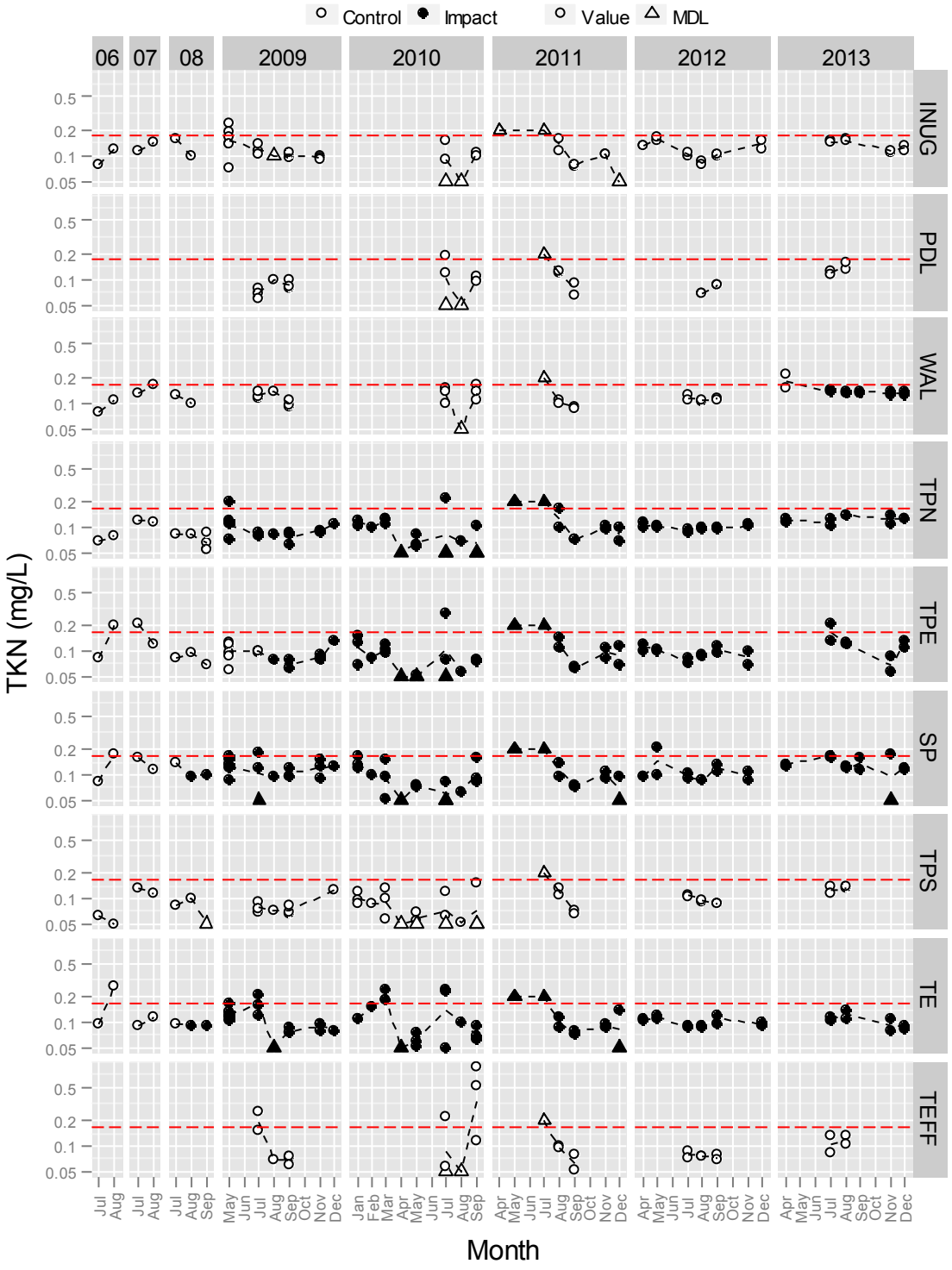


Figure 3.3-12. Total Phosphorus (mg/L) in water samples from Meadowbank study lakes since 2006.

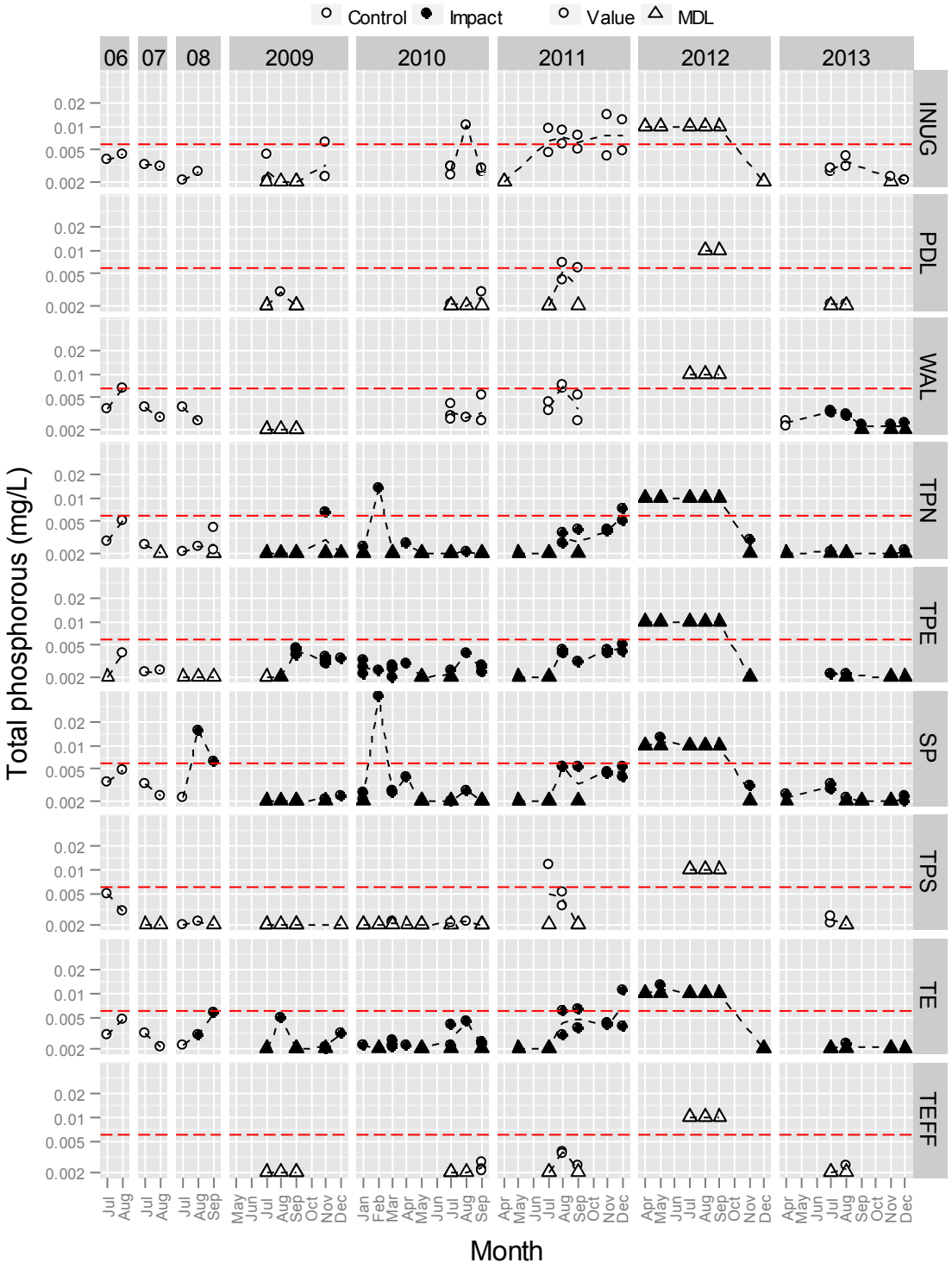


Figure 3.3-13. Reactive Silica (mg/L) in water samples from Meadowbank study lakes since 2006.

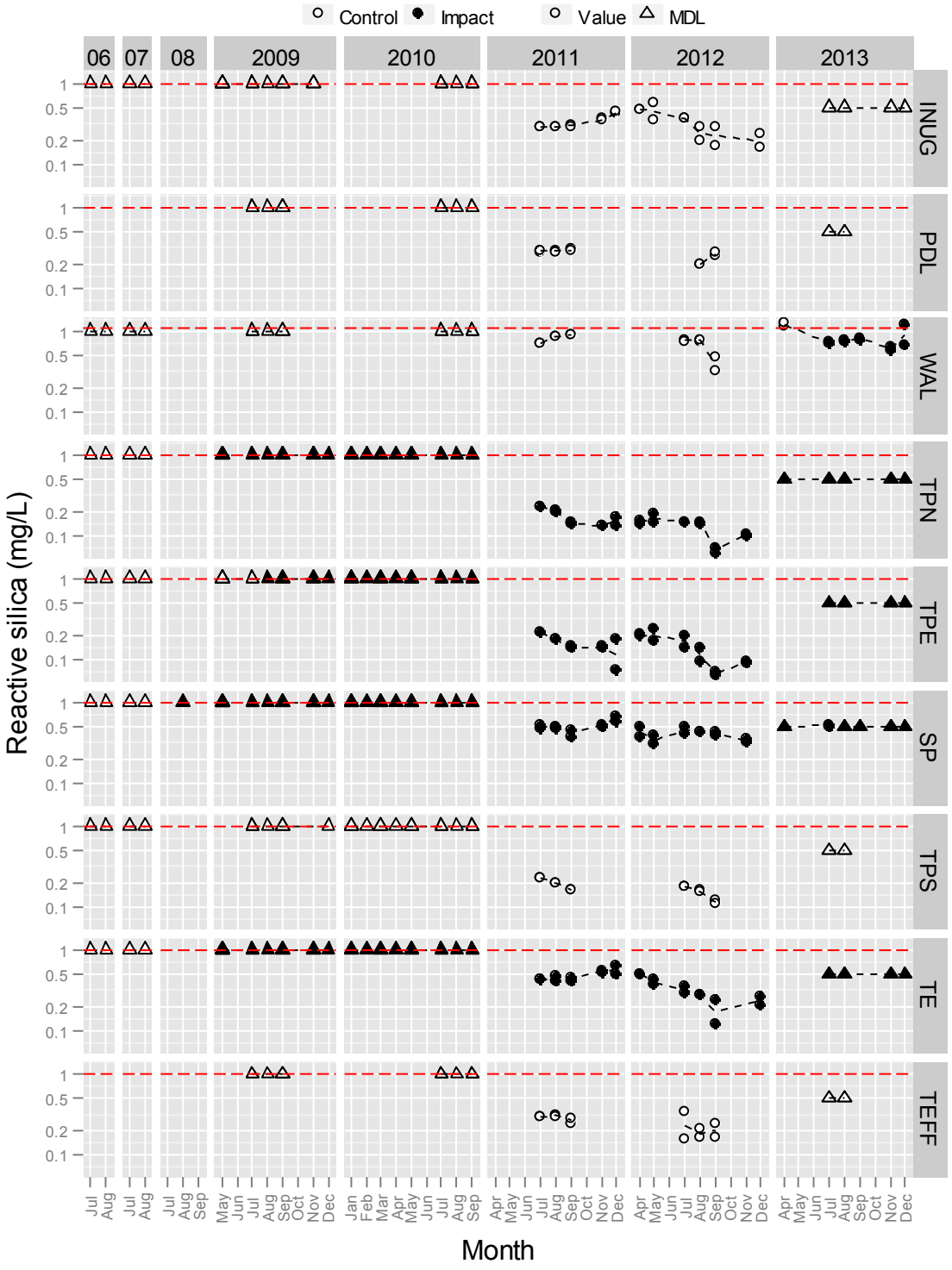


Figure 3.3-14. Sulphate (mg/L) in water samples from Meadowbank study lakes since 2006.

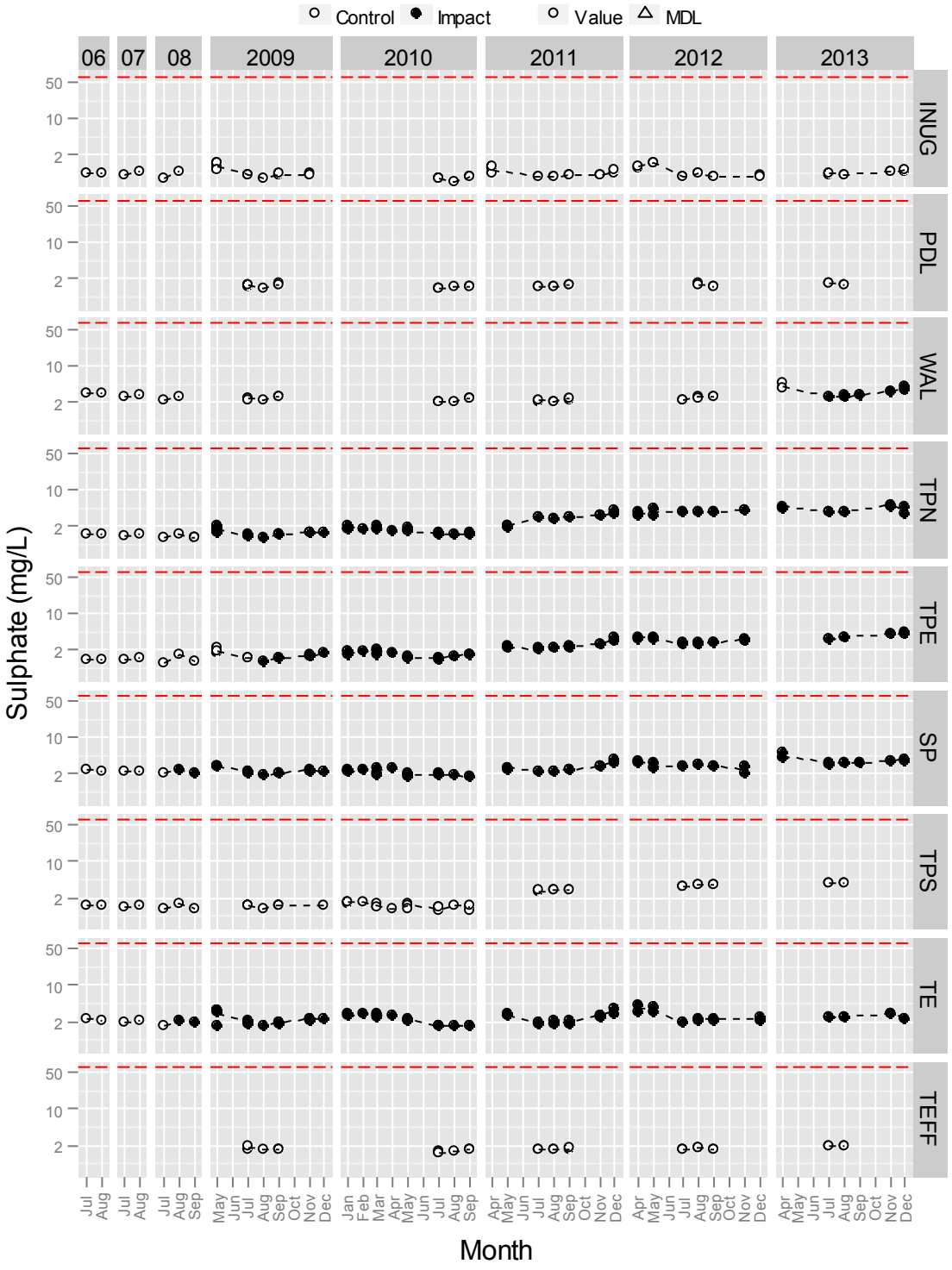


Figure 3.3-15. Dissolved Organic Carbon (DOC; mg/L) in water samples from Meadowbank study lakes since 2006.

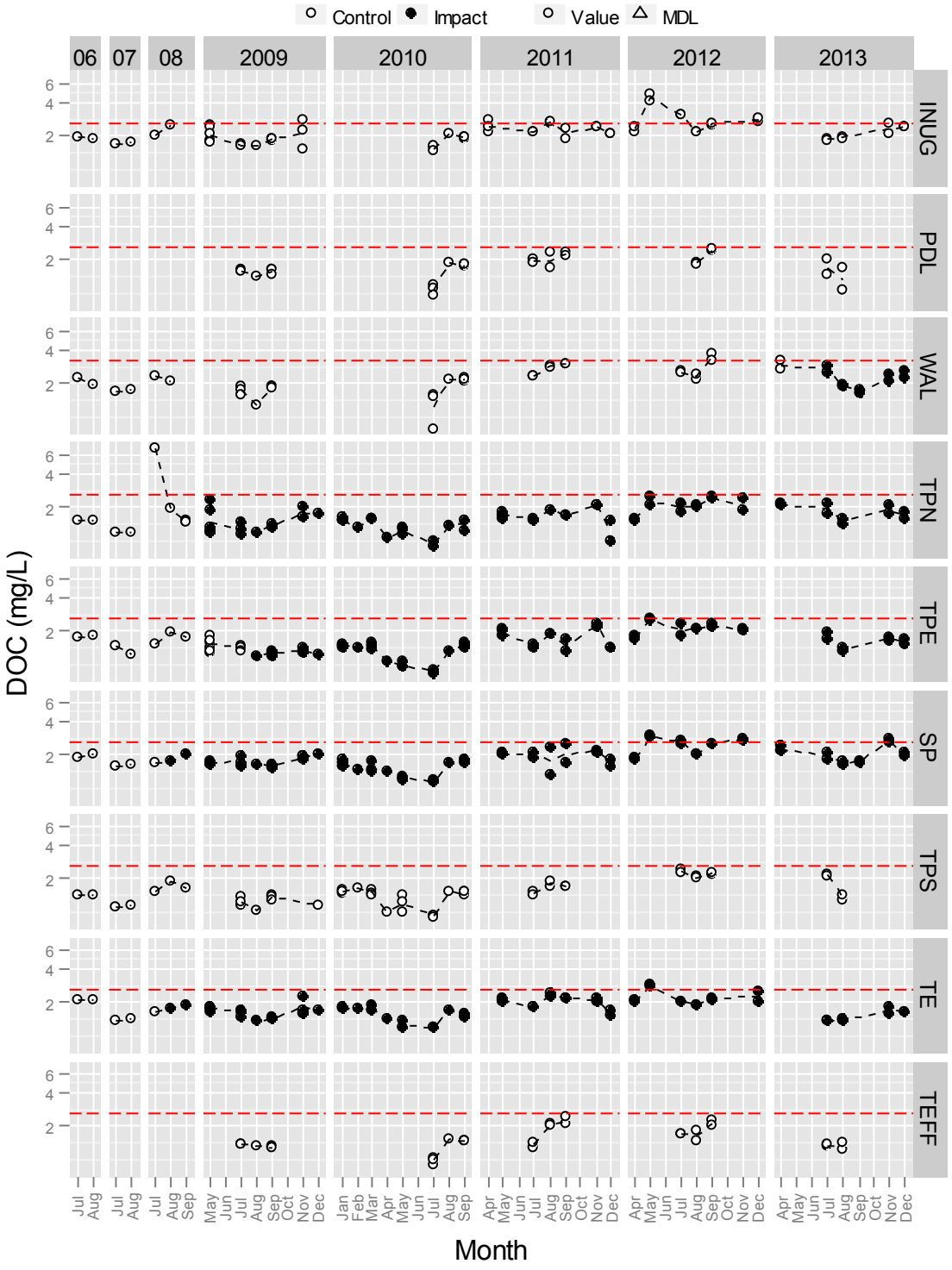


Figure 3.3-16. Total Organic Carbon (TOC; mg/L) in water samples from Meadowbank study lakes since 2006.

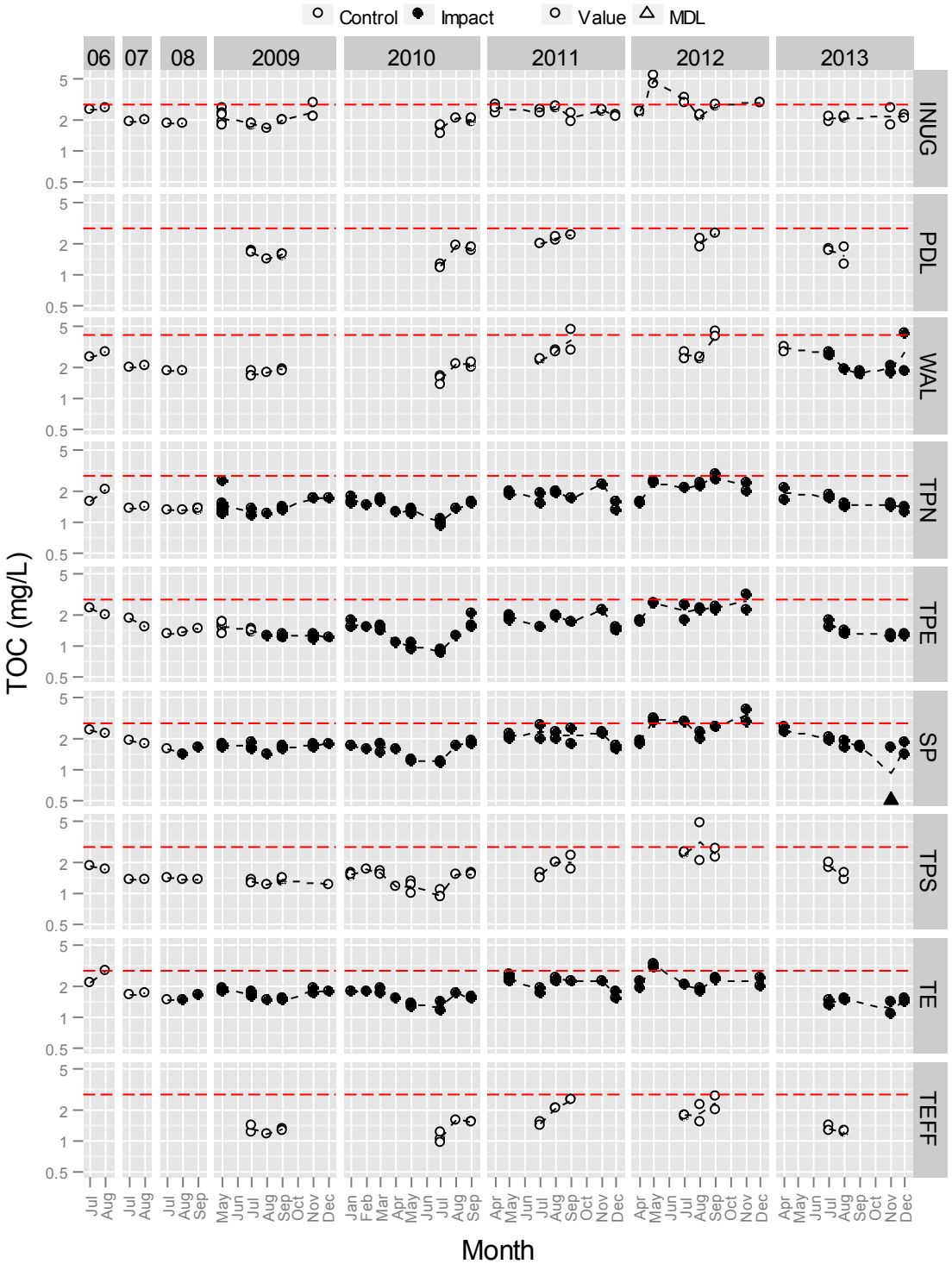


Figure 3.3-17. Total Aluminum (mg/L) in water samples from Meadowbank study lakes since 2006.

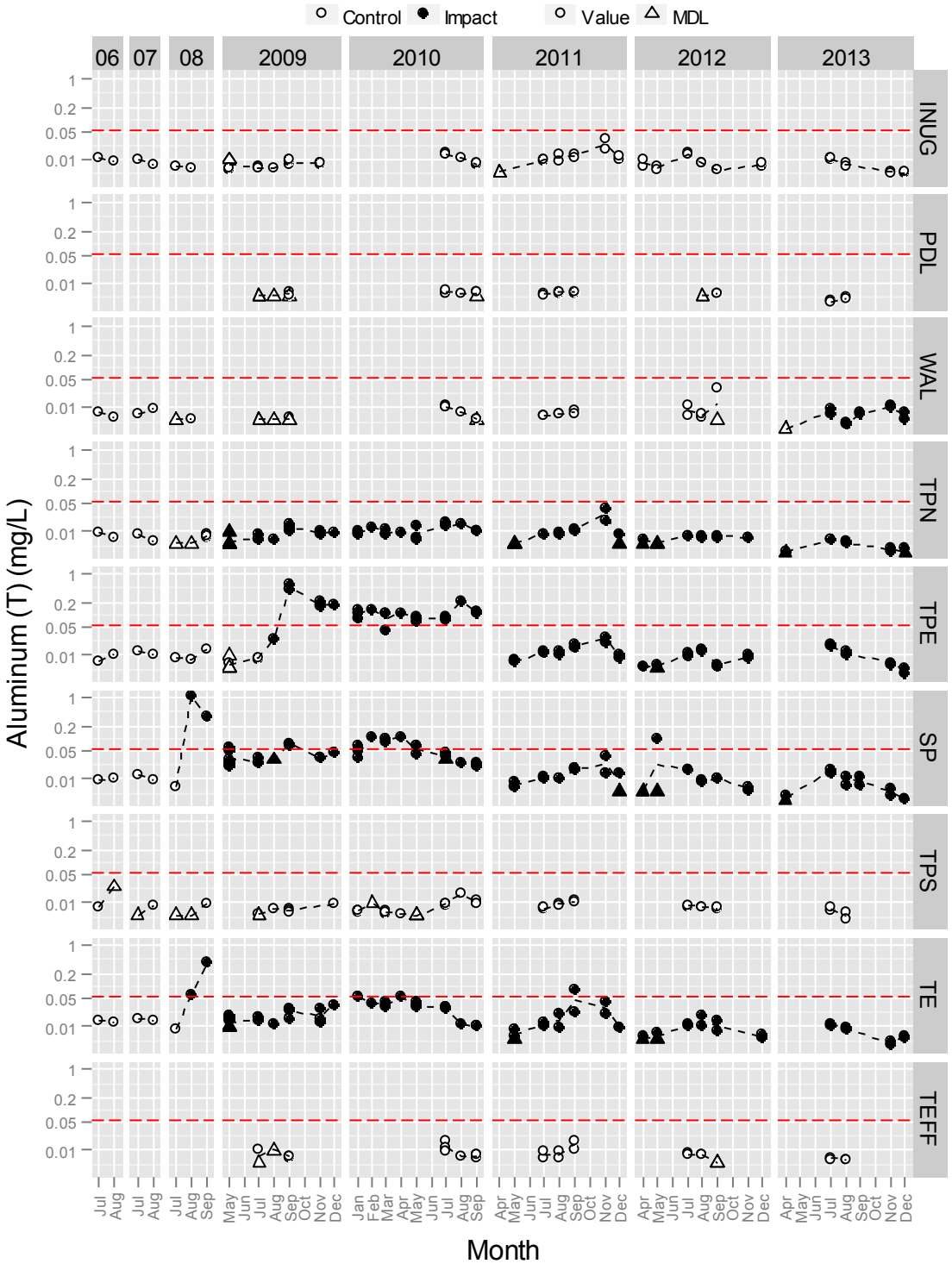


Figure 3.3-18. Total Arsenic (mg/L) in water samples from Meadowbank study lakes since 2006.

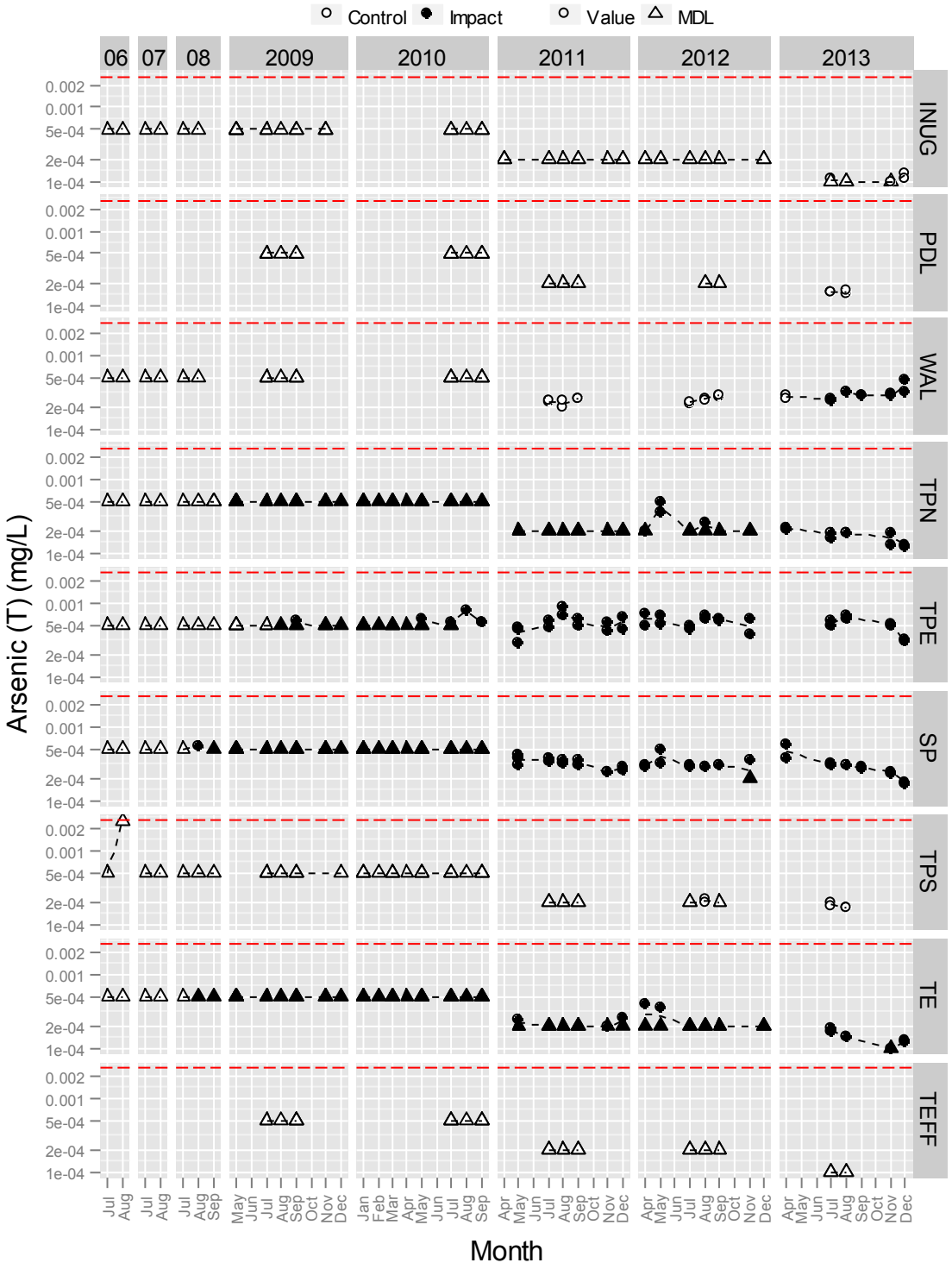


Figure 3.3-19. Total Barium (mg/L) in water samples from Meadowbank study lakes since 2006.

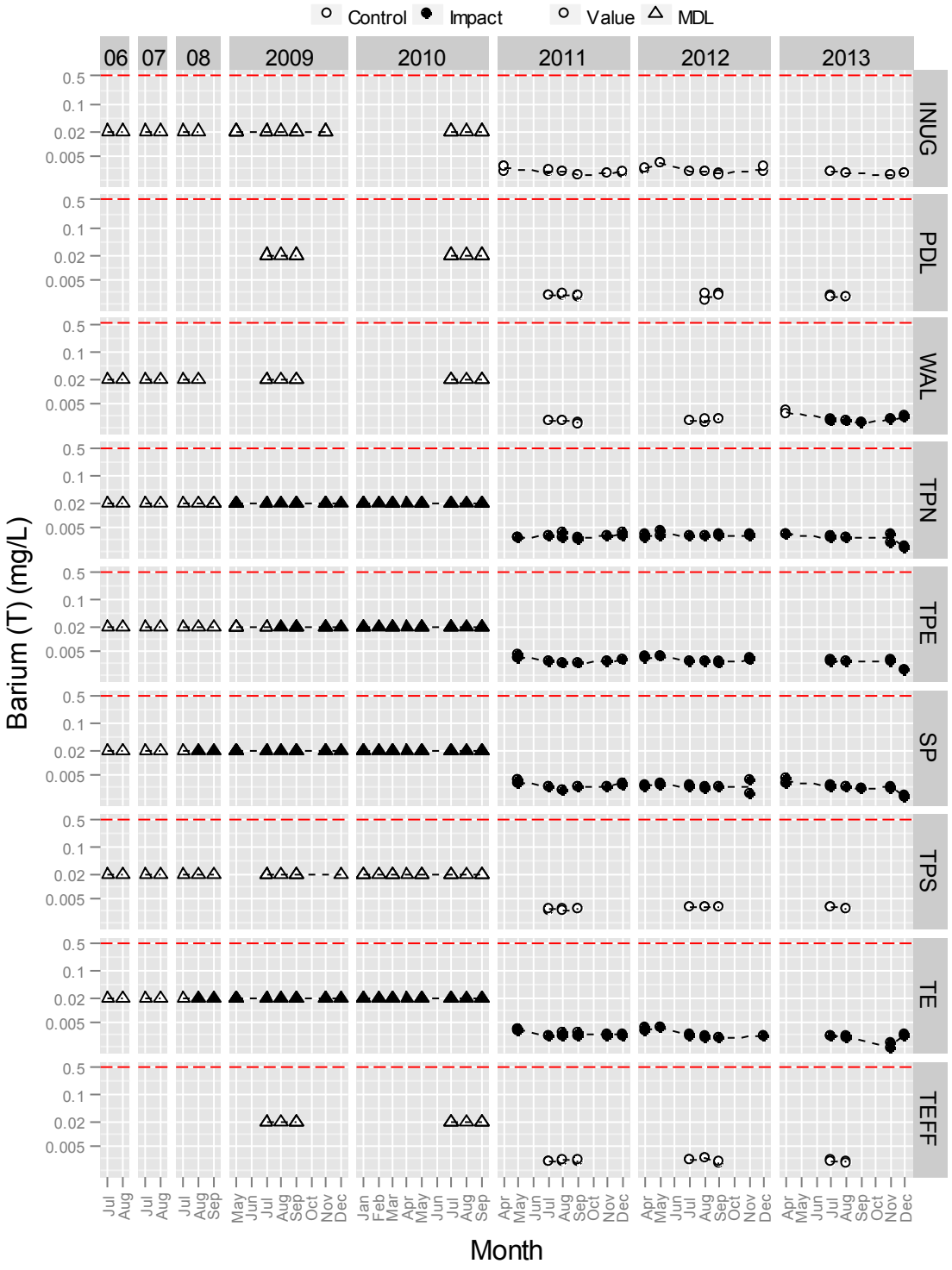


Figure 3.3-20. Total Calcium (mg/L) in water samples from Meadowbank study lakes since 2006.

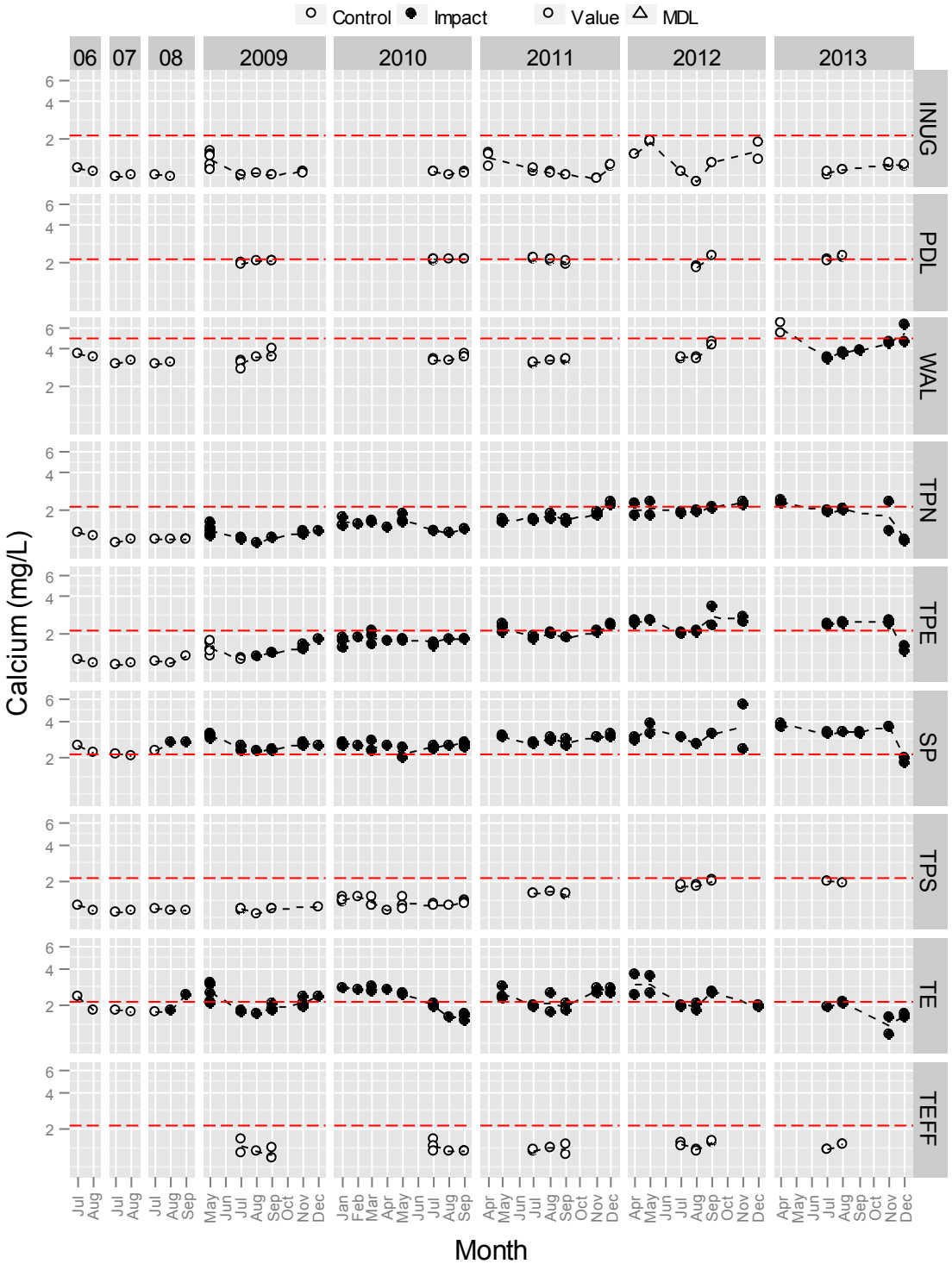


Figure 3.3-21. Total Copper (mg/L) in water samples from Meadowbank study lakes since 2006.

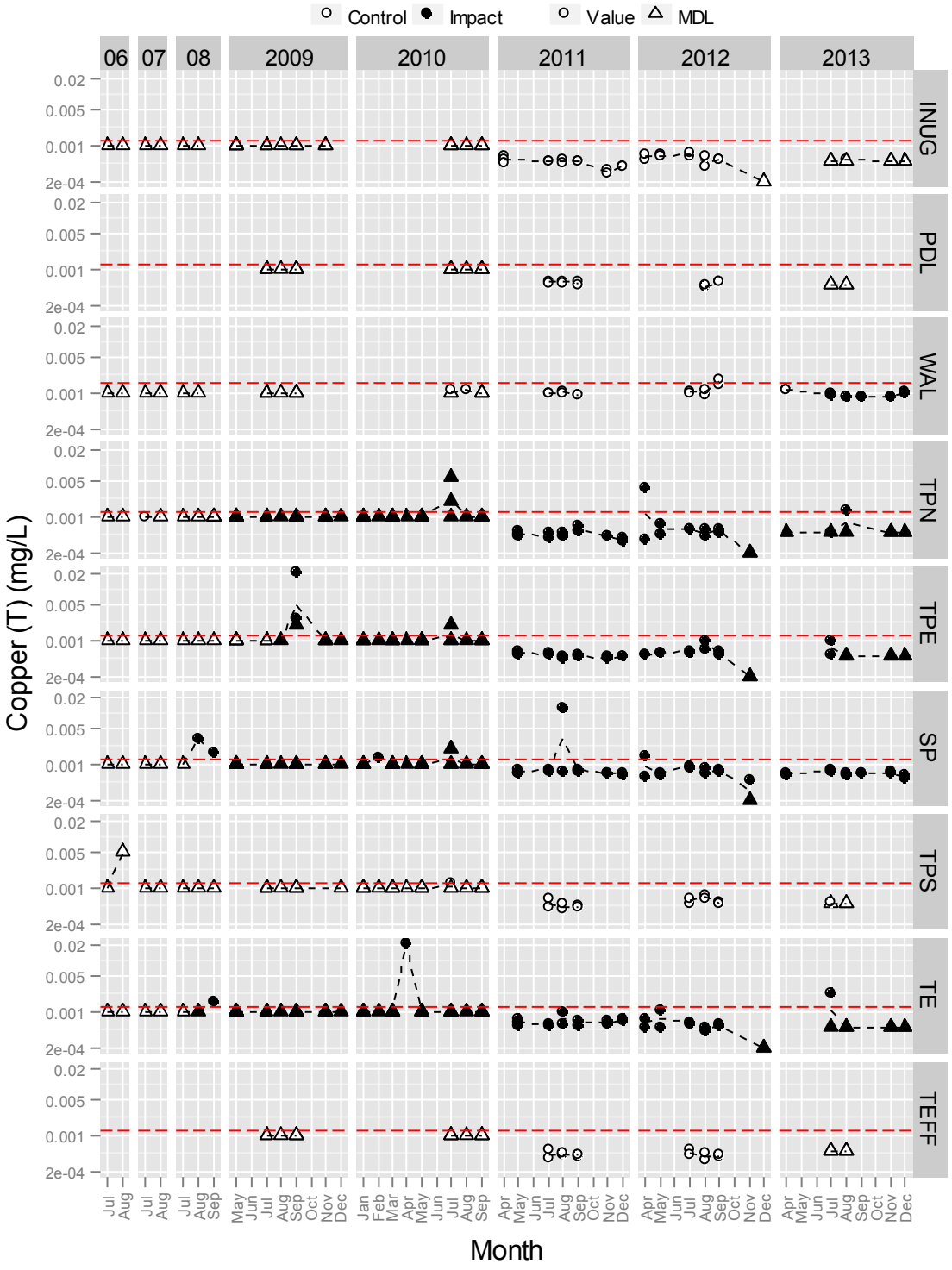


Figure 3.3-22. Total Iron (mg/L) in water samples from Meadowbank study lakes since 2006.

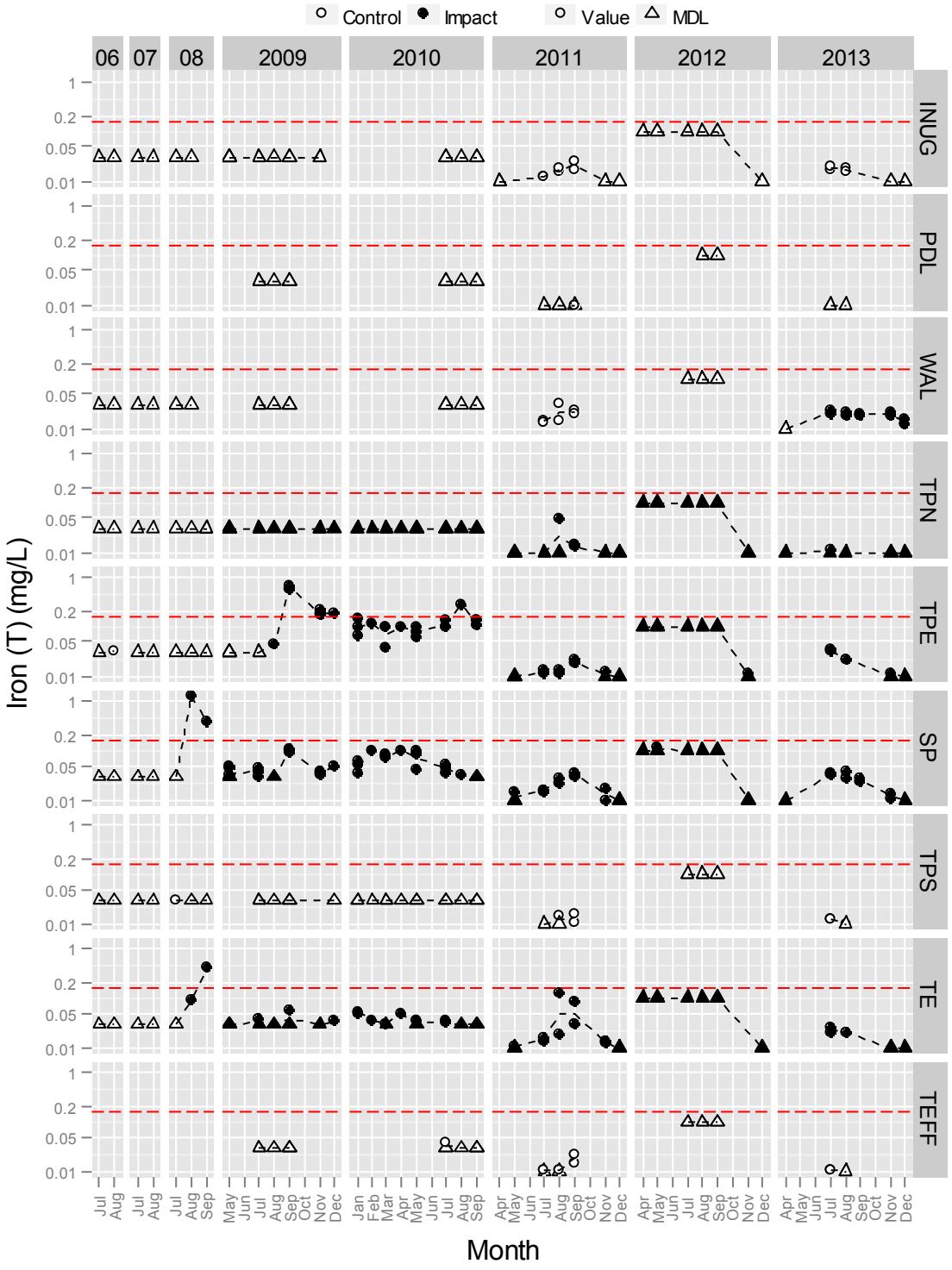


Figure 3.3-23. Total Magnesium (mg/L) in water samples from Meadowbank study lakes since 2006.

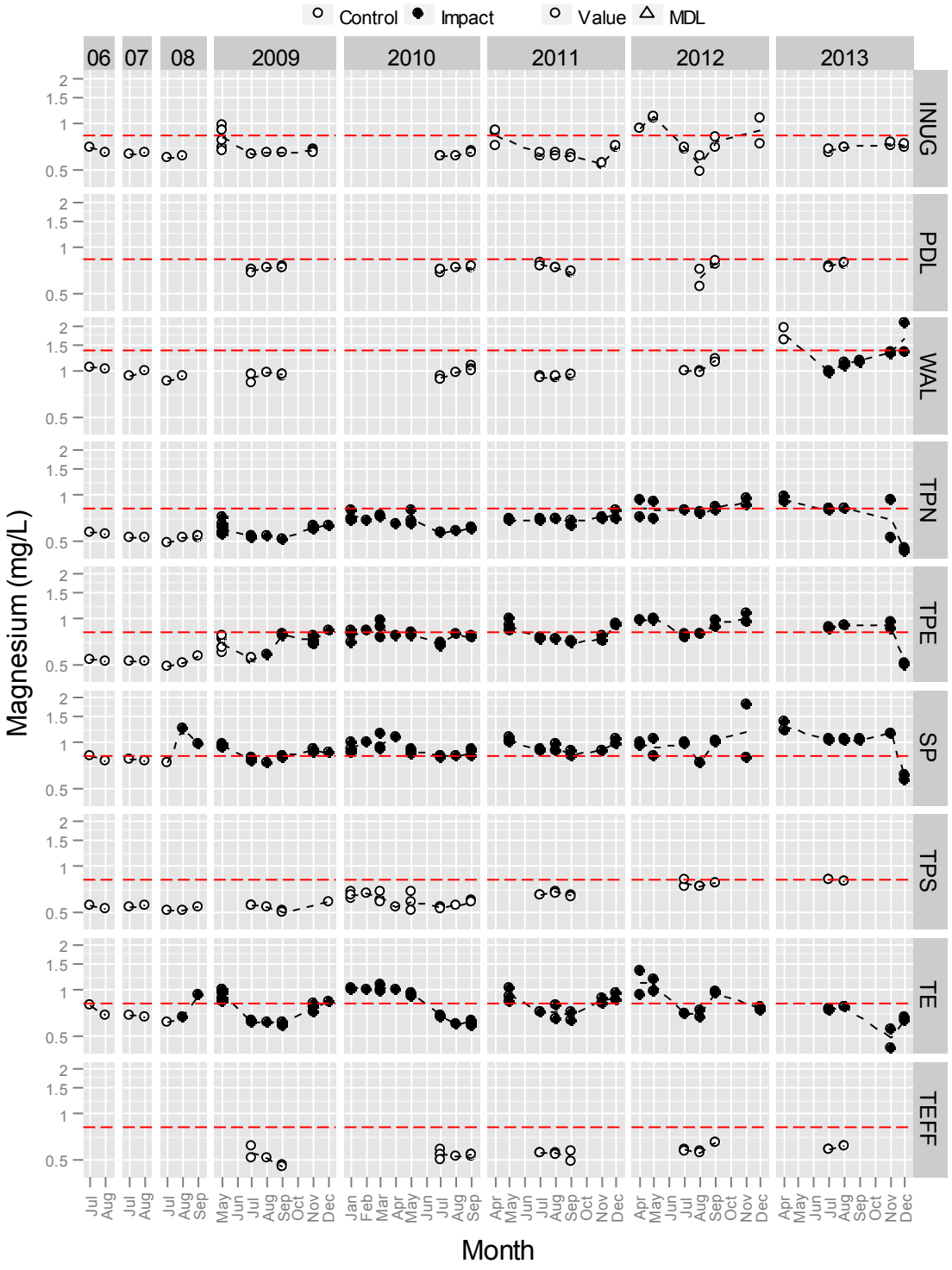


Figure 3.3-24. Total Manganese (mg/L) in water samples from Meadowbank study lakes since 2006.

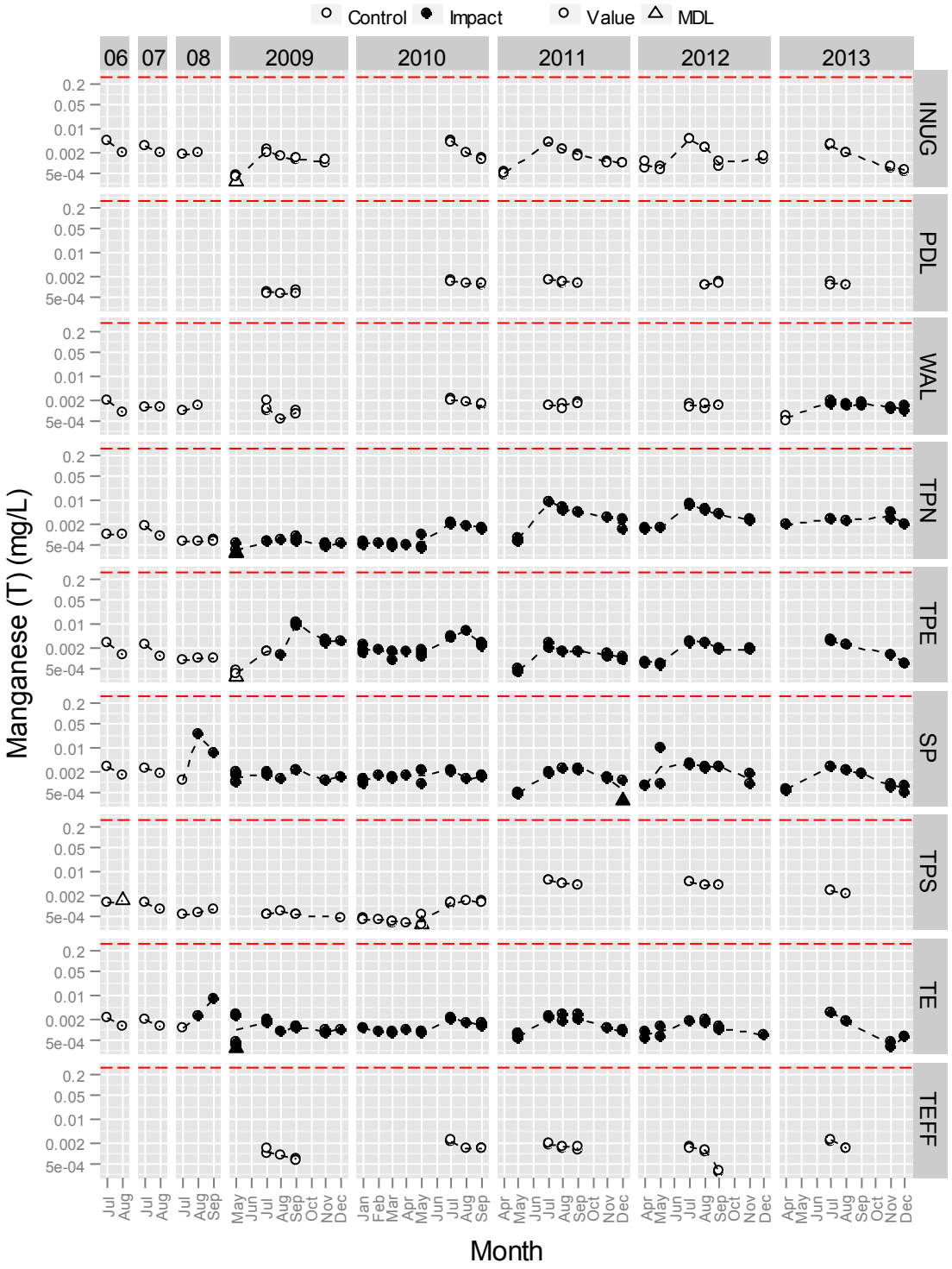


Figure 3.3-25. Total Molybdenum (mg/L) in water samples from Meadowbank study lakes since 2006.

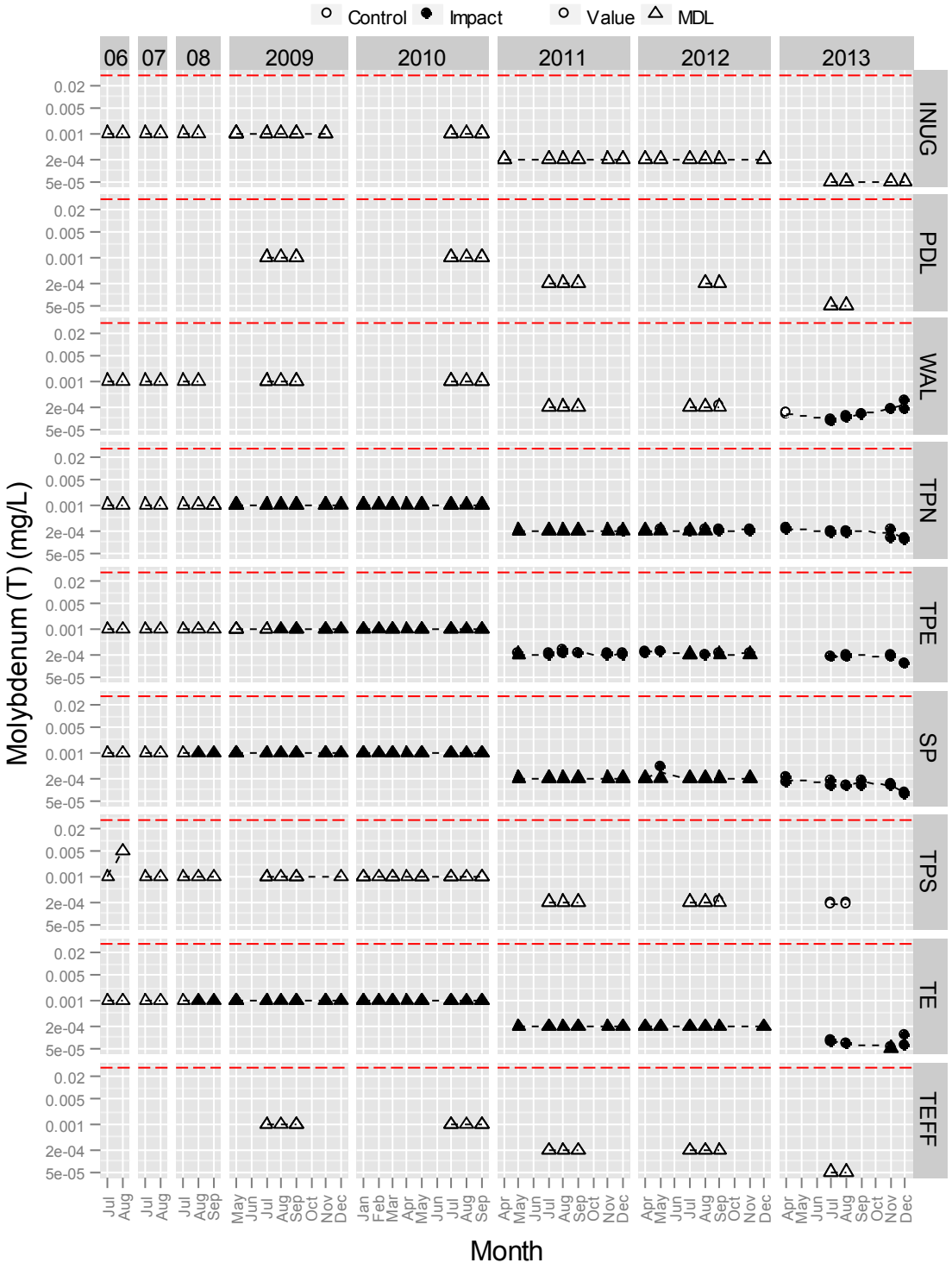


Figure 3.3-26. Total Potassium (mg/L) in water samples from Meadowbank study lakes since 2006.

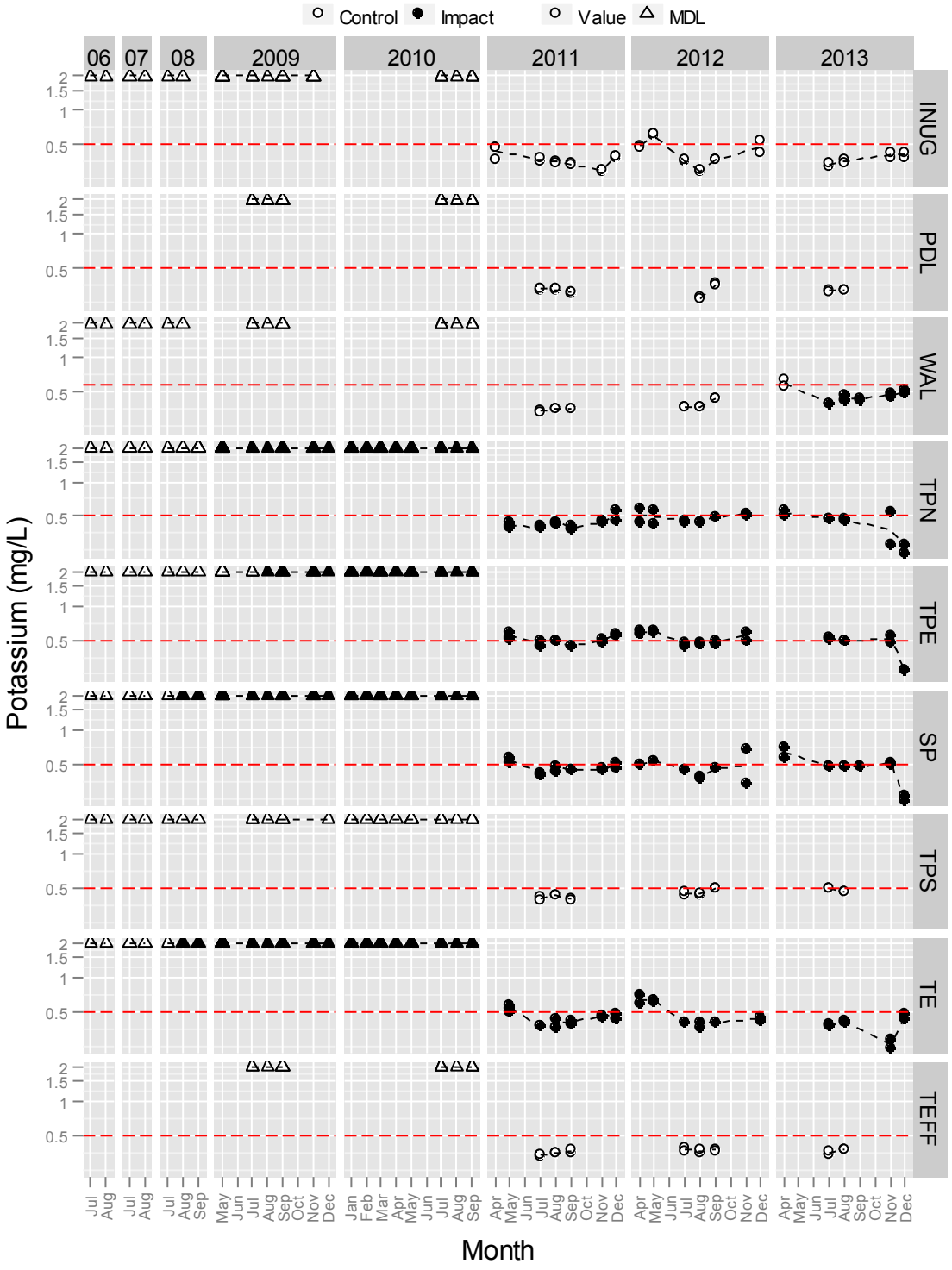


Figure 3.3-27. Total Sodium (mg/L) in water samples from Meadowbank study lakes since 2006.

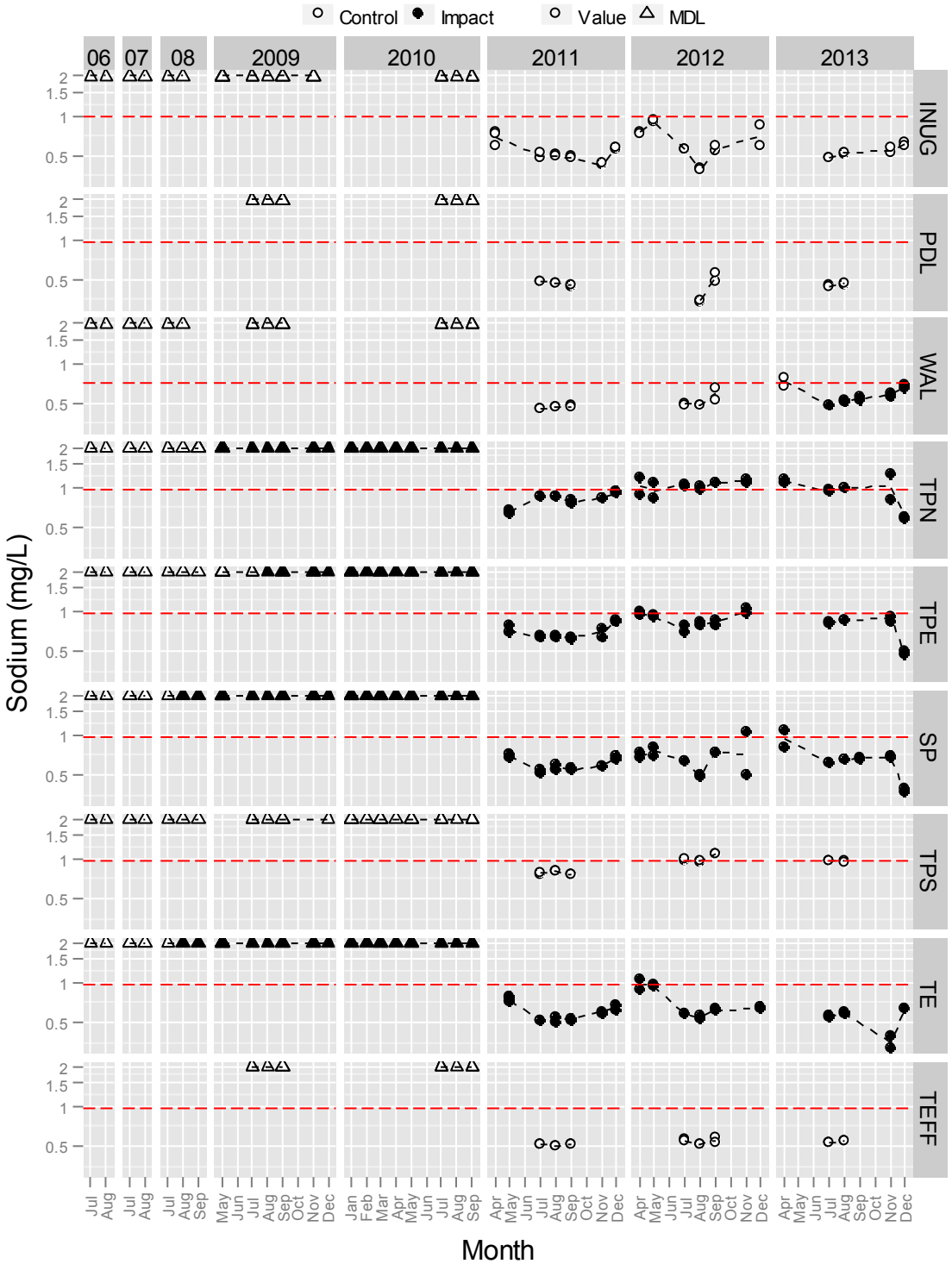


Figure 3.3-28. Total Strontium (mg/L) in water samples from Meadowbank study lakes since 2006.

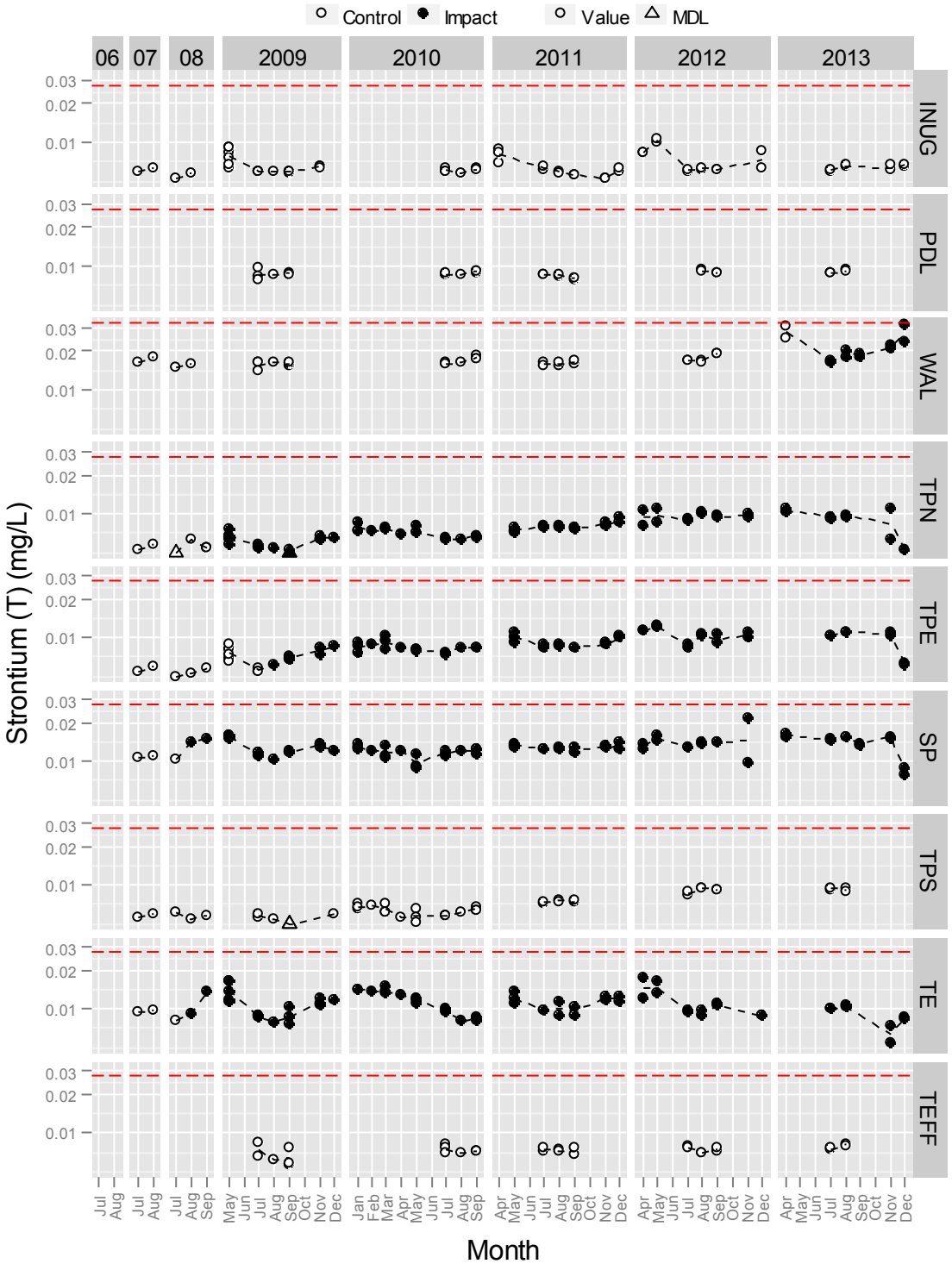


Figure 3.3-29. Total Titanium (mg/L) in water samples from Meadowbank study lakes since 2006.

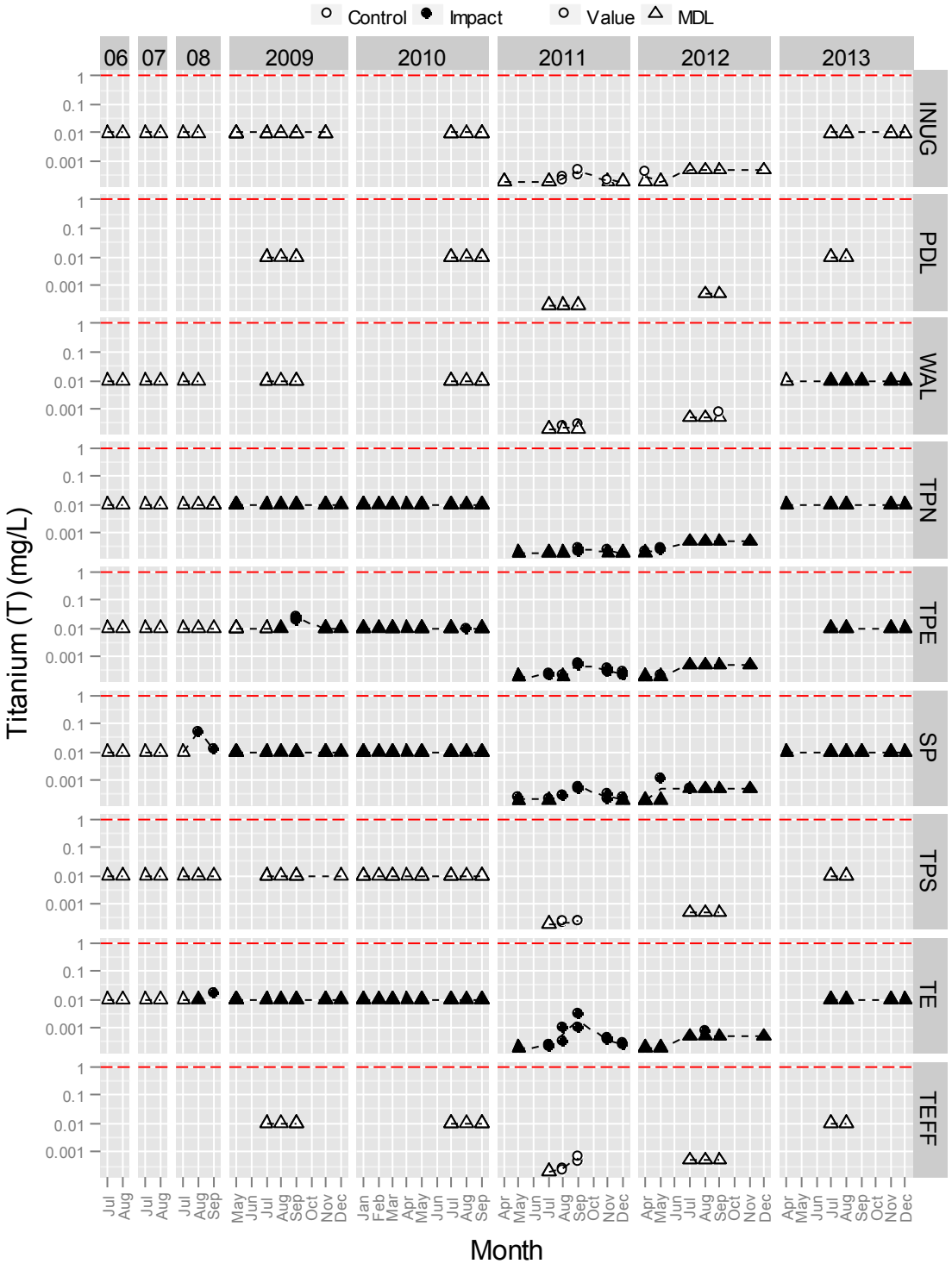


Figure 3.3-30. Total Uranium (mg/L) in water samples from Meadowbank study lakes since 2006.

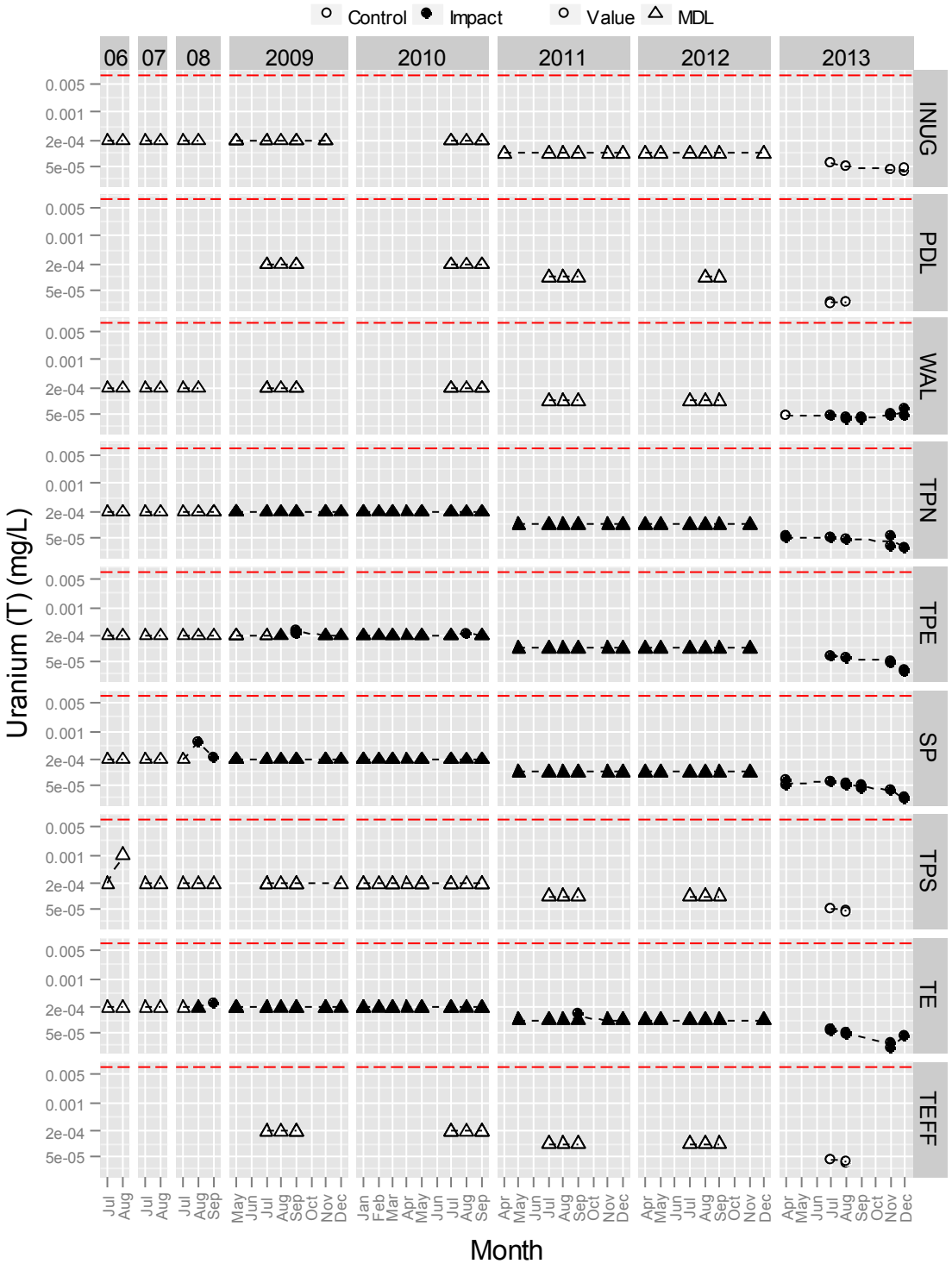


Figure 3.3-31. Dissolved Aluminum (mg/L) in water samples from Meadowbank study lakes since 2006.

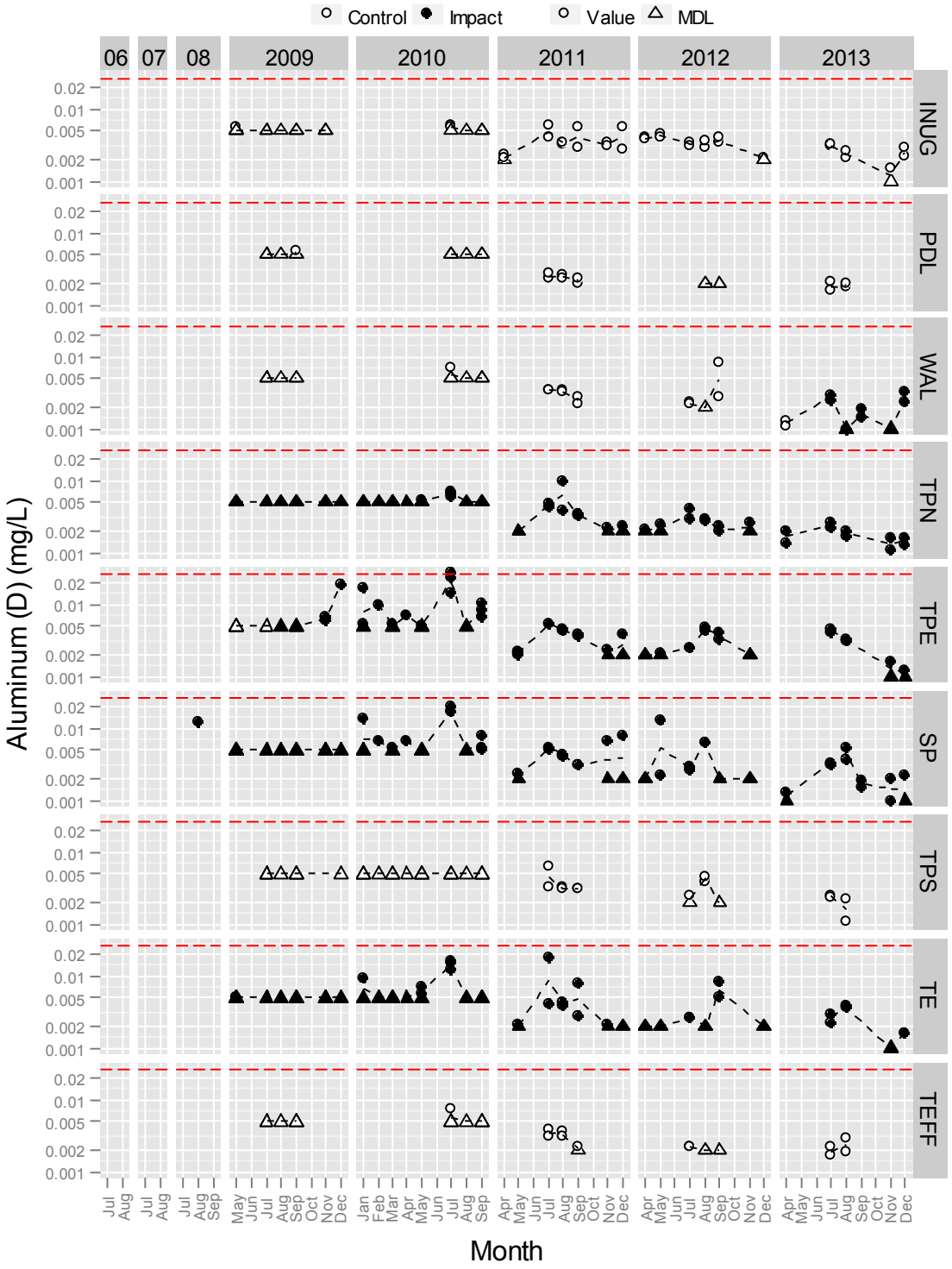


Figure 3.3-32. Dissolved Arsenic (mg/L) in water samples from Meadowbank study lakes since 2006.

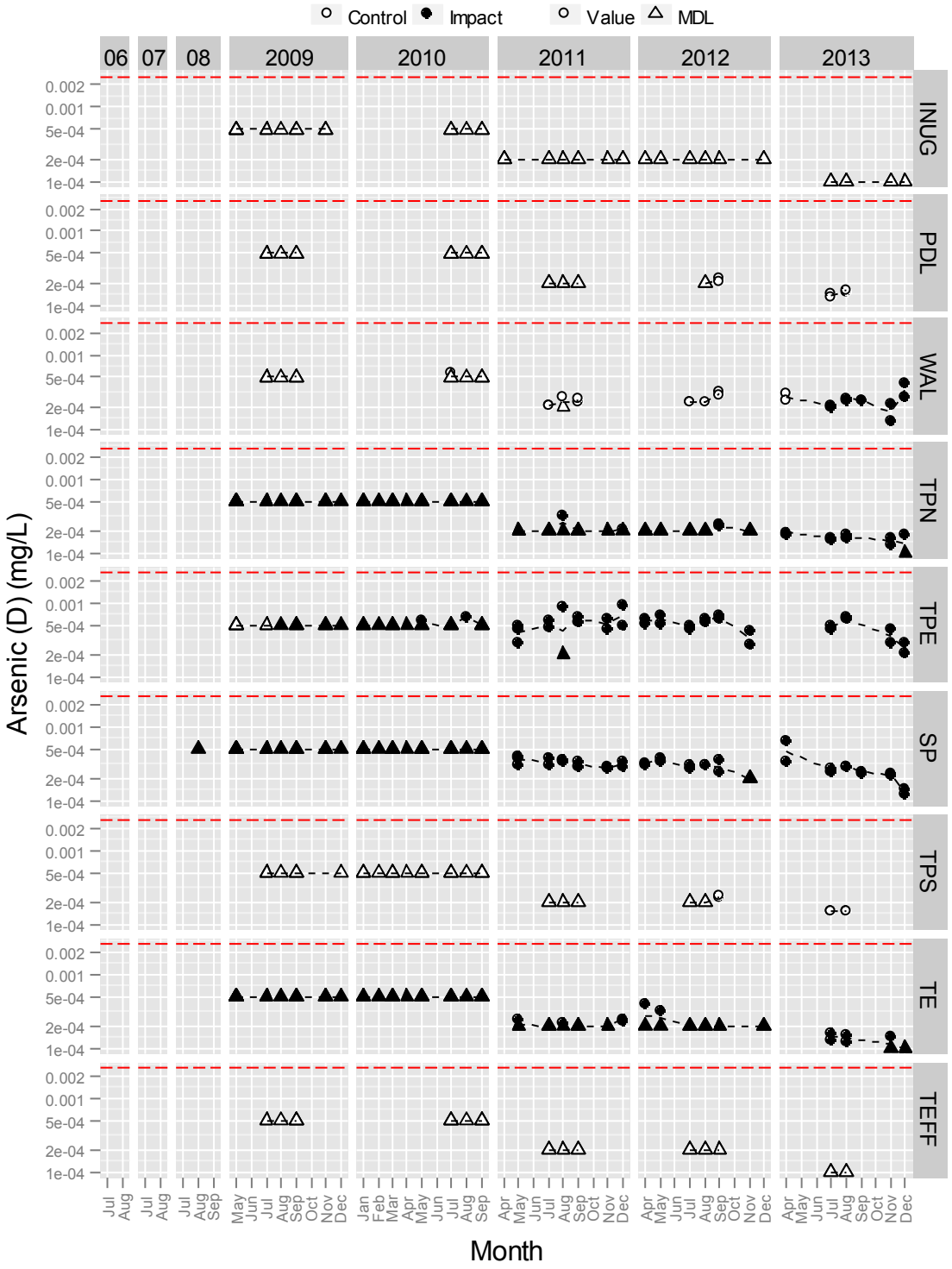


Figure 3.3-33. Dissolved Barium (mg/L) in water samples from Meadowbank study lakes since 2006.

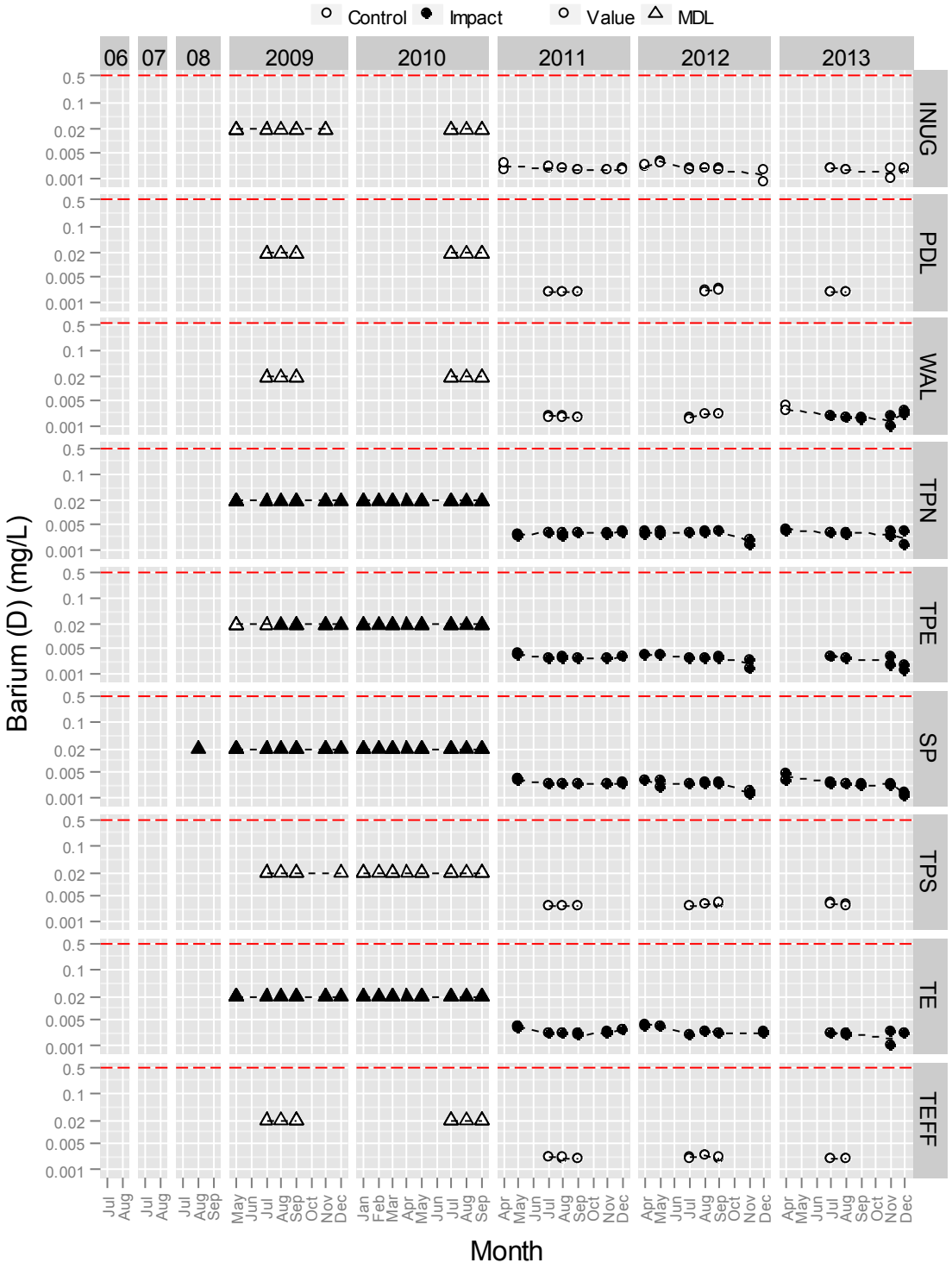


Figure 3.3-34. Dissolved Copper (mg/L) in water samples from Meadowbank study lakes since 2006.

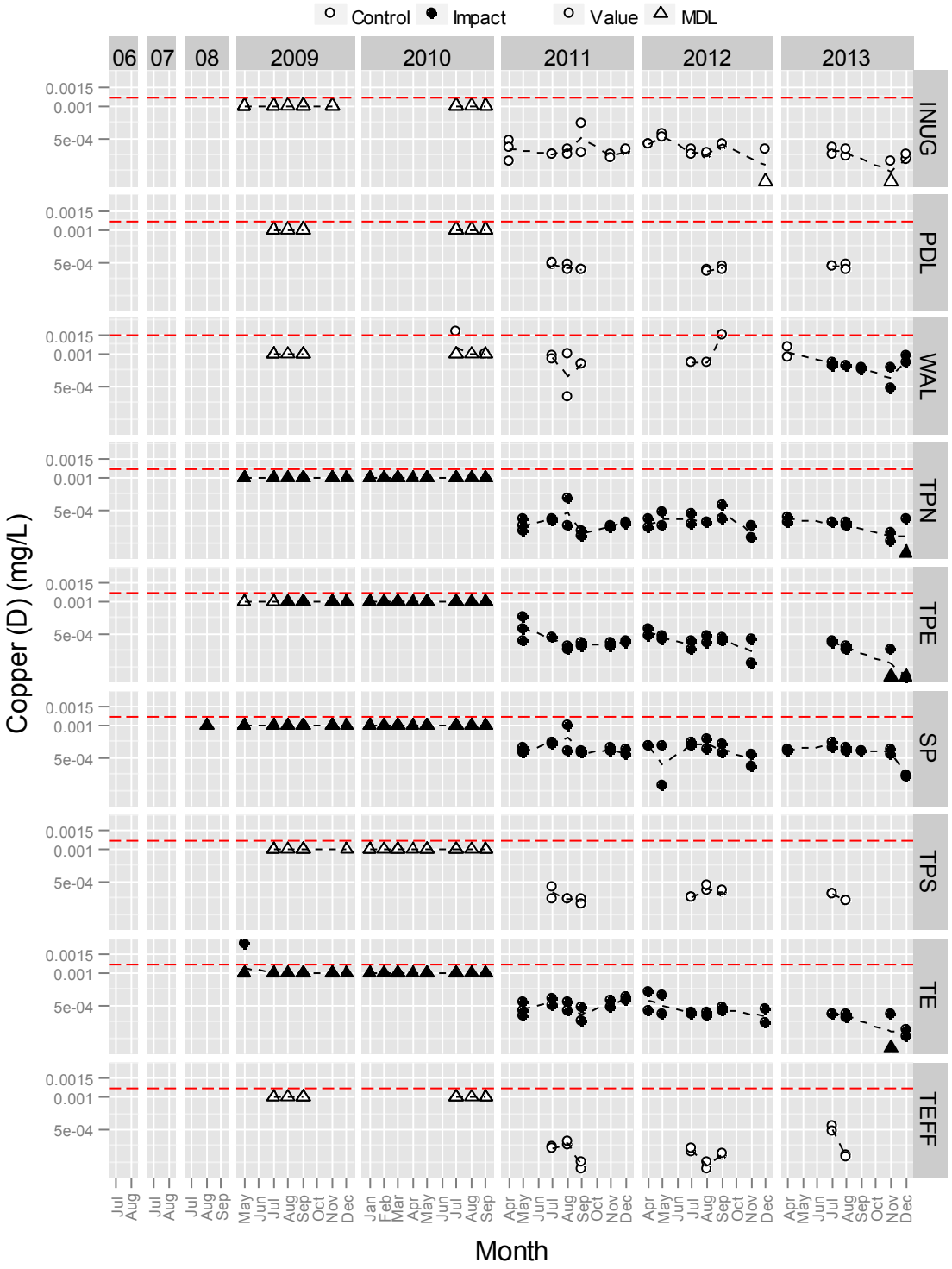


Figure 3.3-35. Dissolved Manganese (mg/L) in water samples from Meadowbank study lakes since 2006.

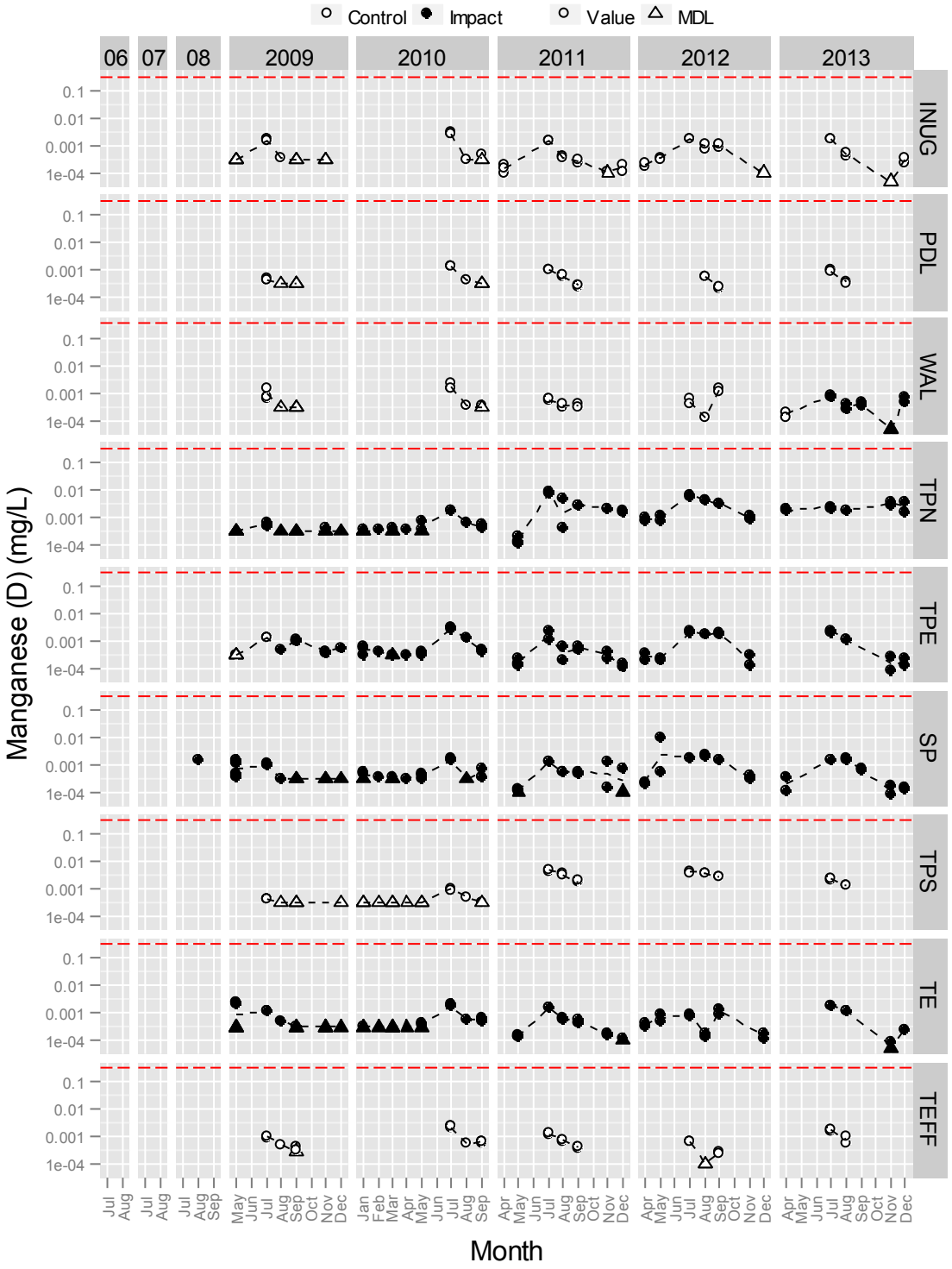


Figure 3.3-36. Dissolved Molybdenum (mg/L) in water samples from Meadowbank study lakes since 2006.

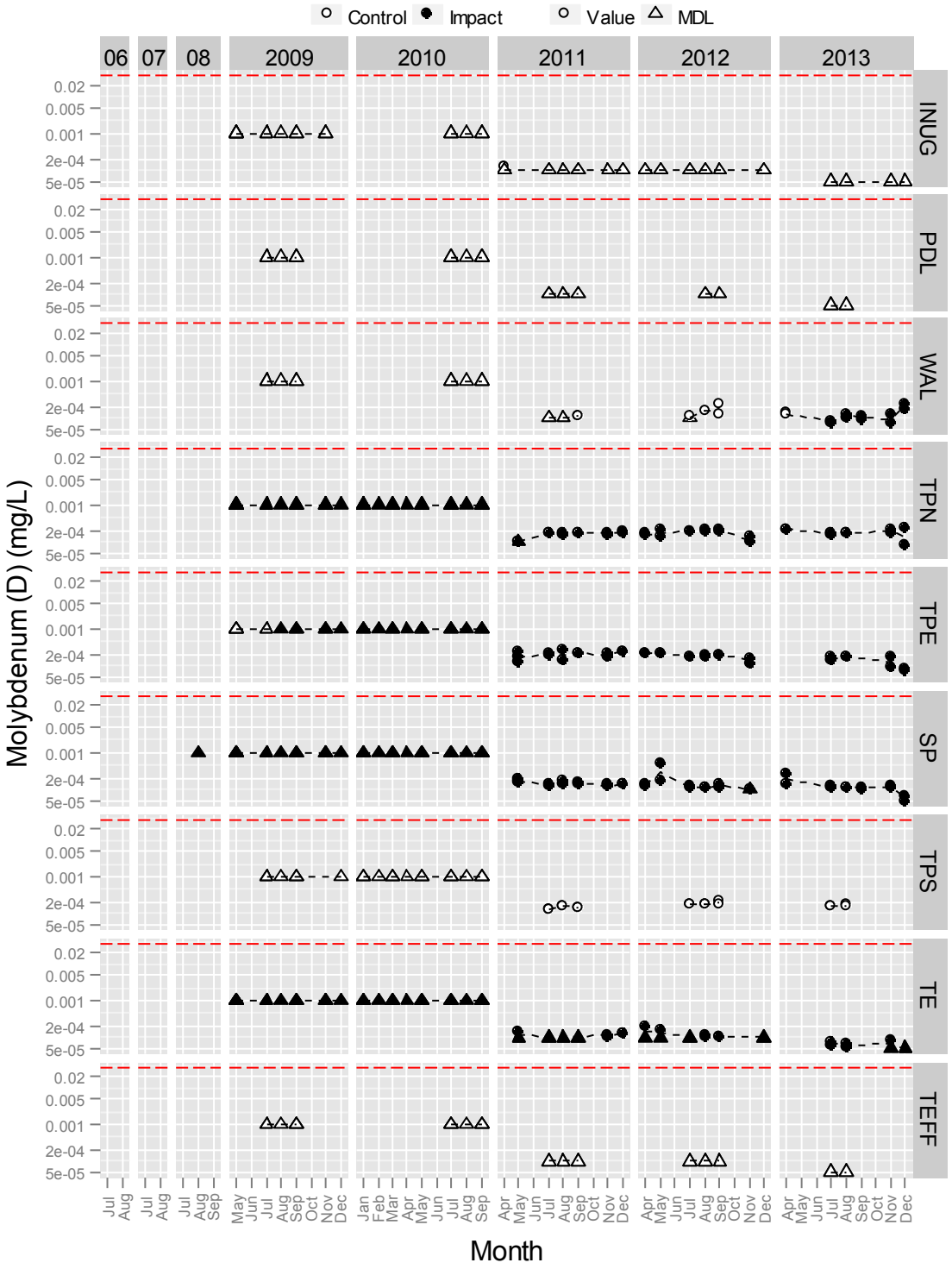


Figure 3.3-37. Dissolved Strontium (mg/L) in water samples from Meadowbank study lakes since 2006.

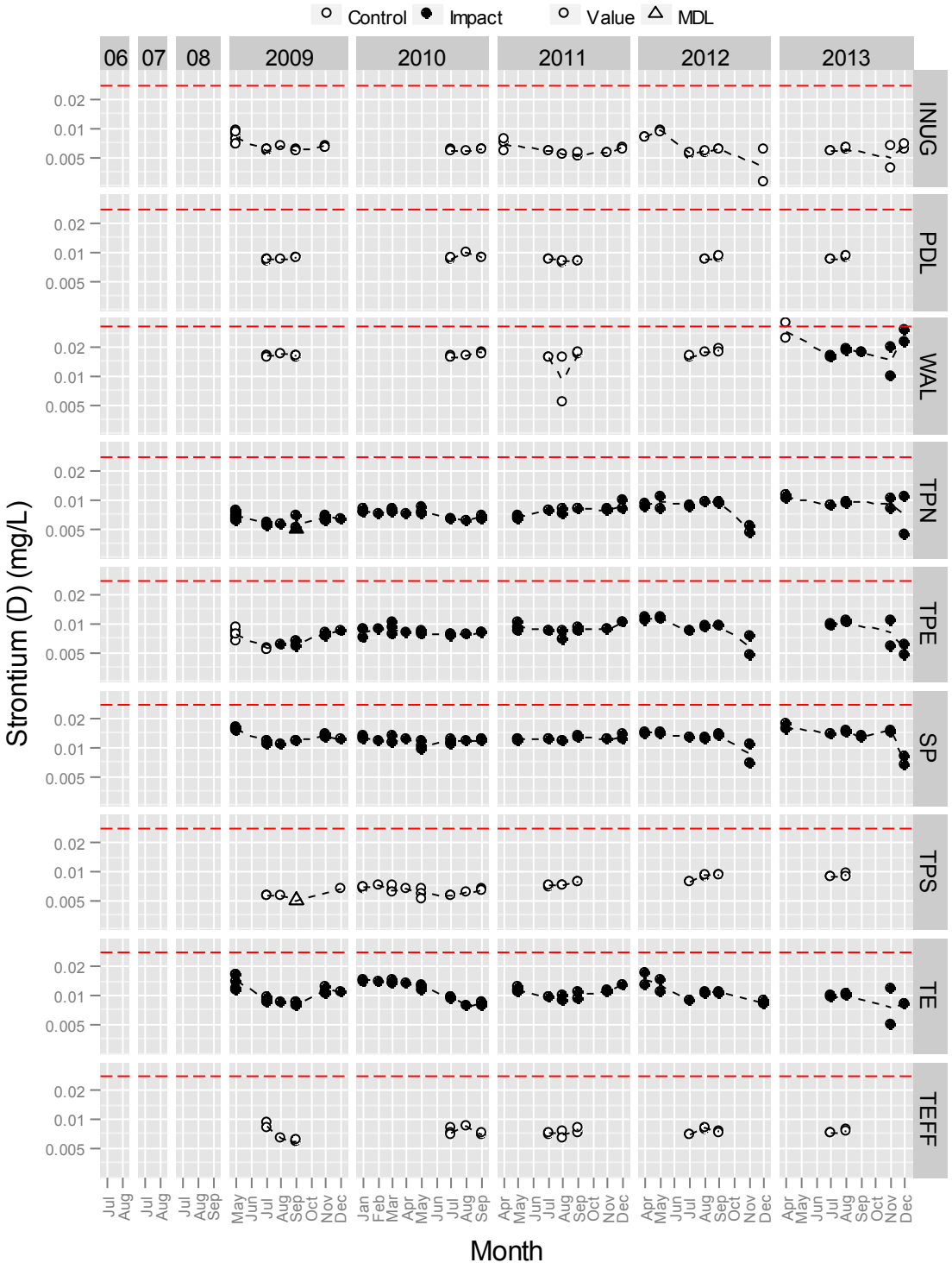


Figure 3.3-38. Dissolved Uranium (mg/L) in water samples from Meadowbank study lakes since 2006.

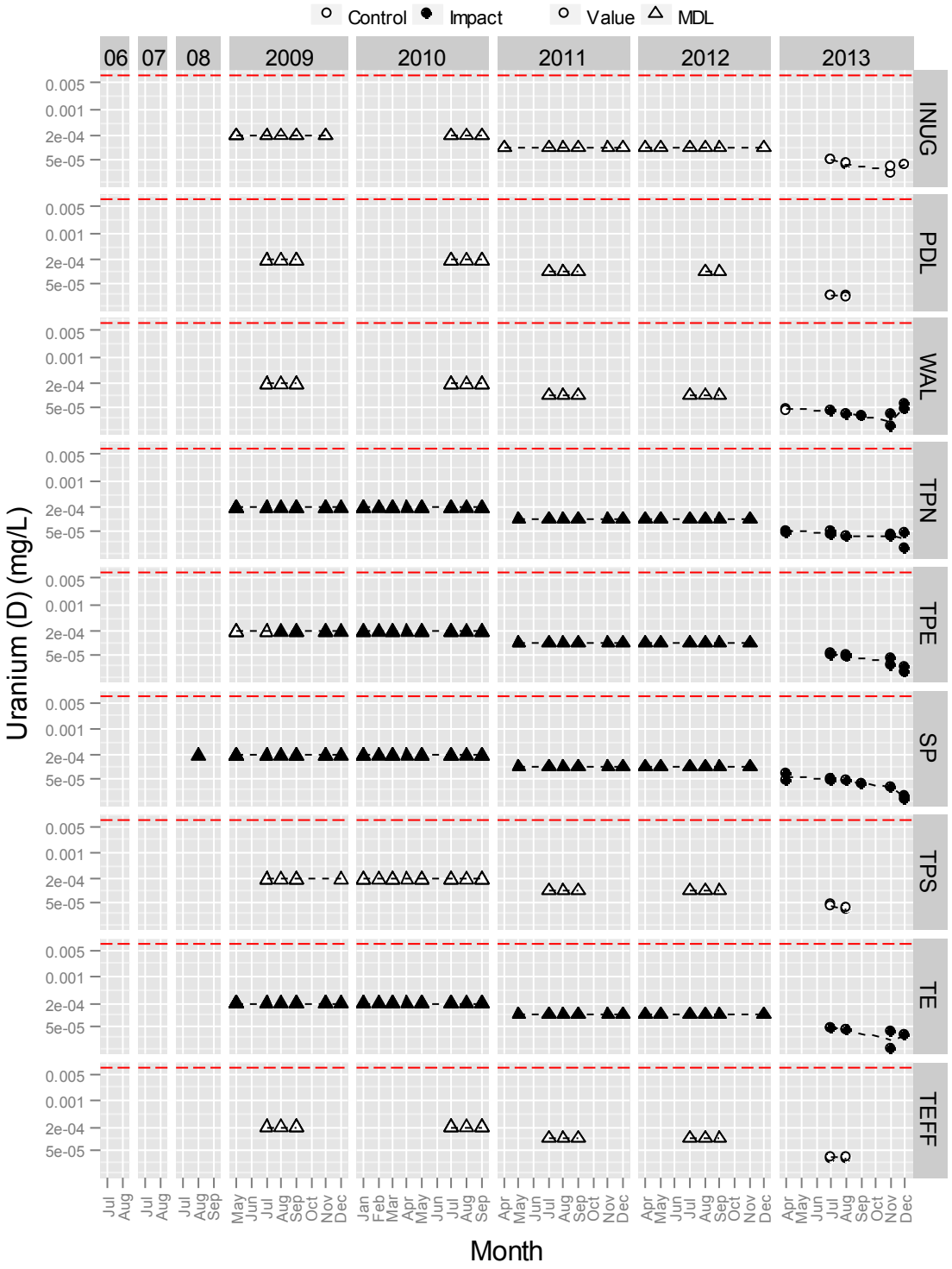


Figure 3.3-39. Laboratory-measured conductivity (µS/cm) in water samples from Baker Lake since 2008.

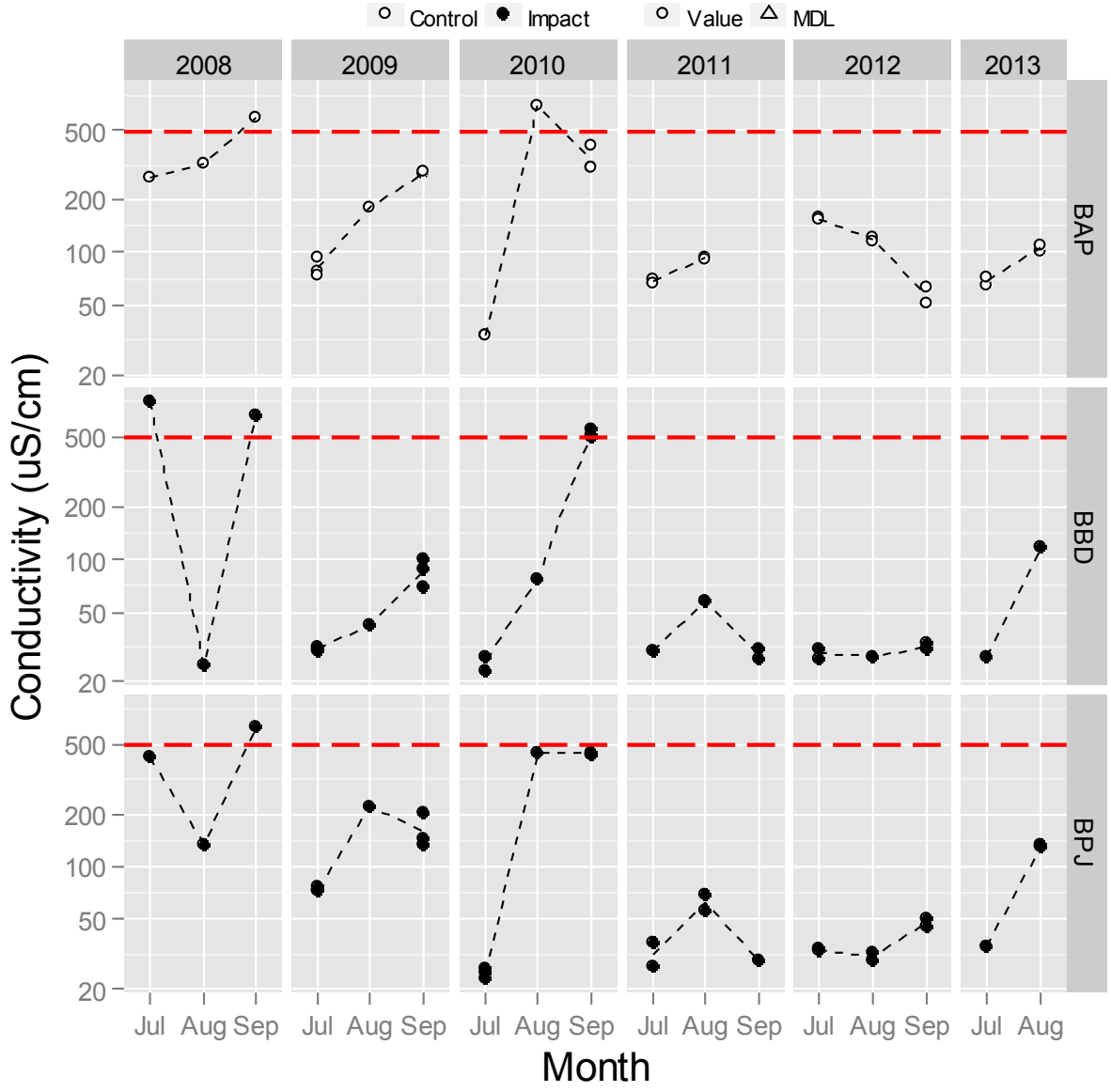


Figure 3.3-40. Hardness (mg/L) in water samples from Baker Lake since 2008.

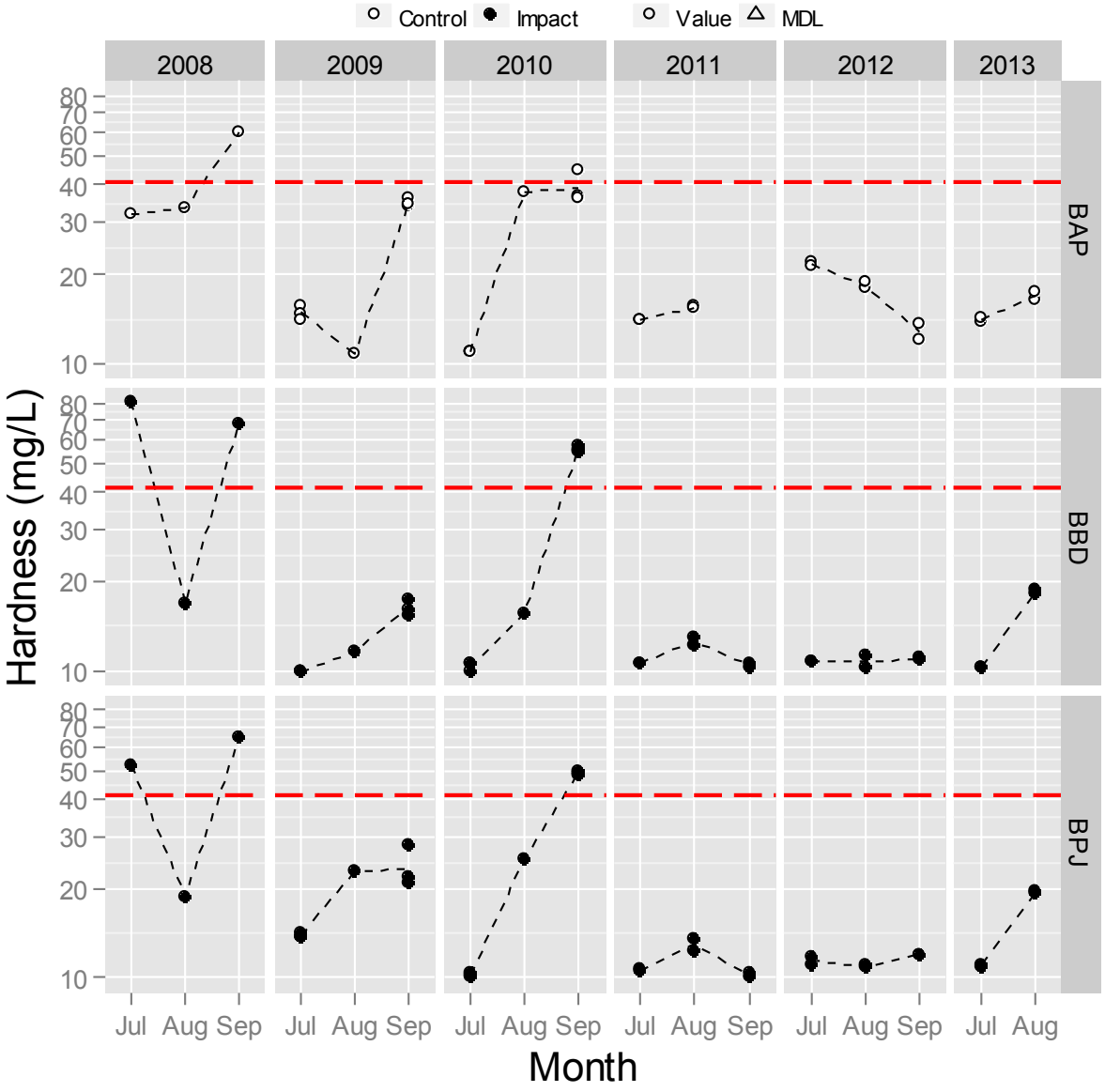


Figure 3.3-41. Laboratory-measured pH in water samples from Baker Lake since 2008.

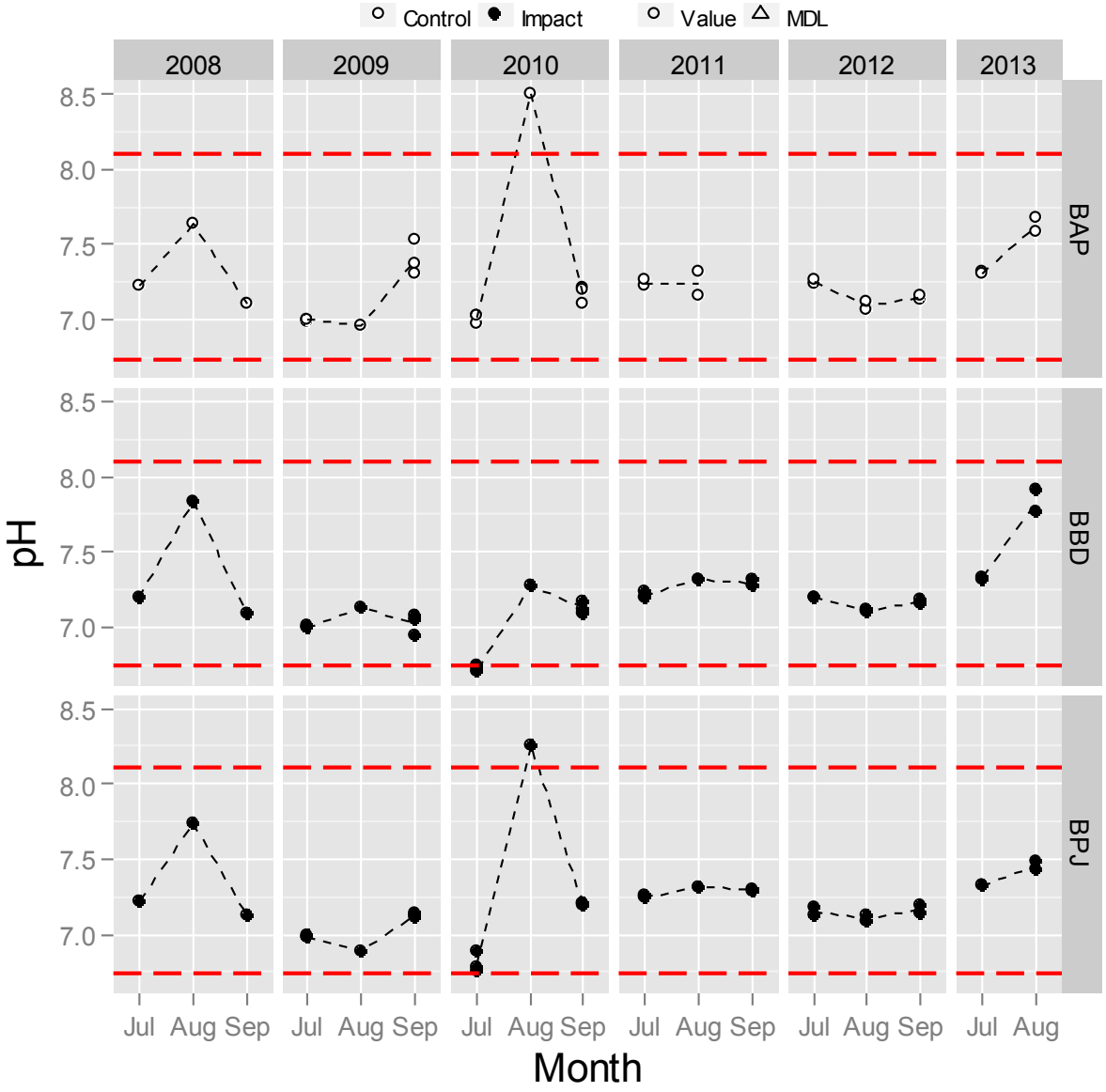


Figure 3.3-42. Total Suspended Solids (TSS; mg/L) in water samples from Baker Lake since 2008.

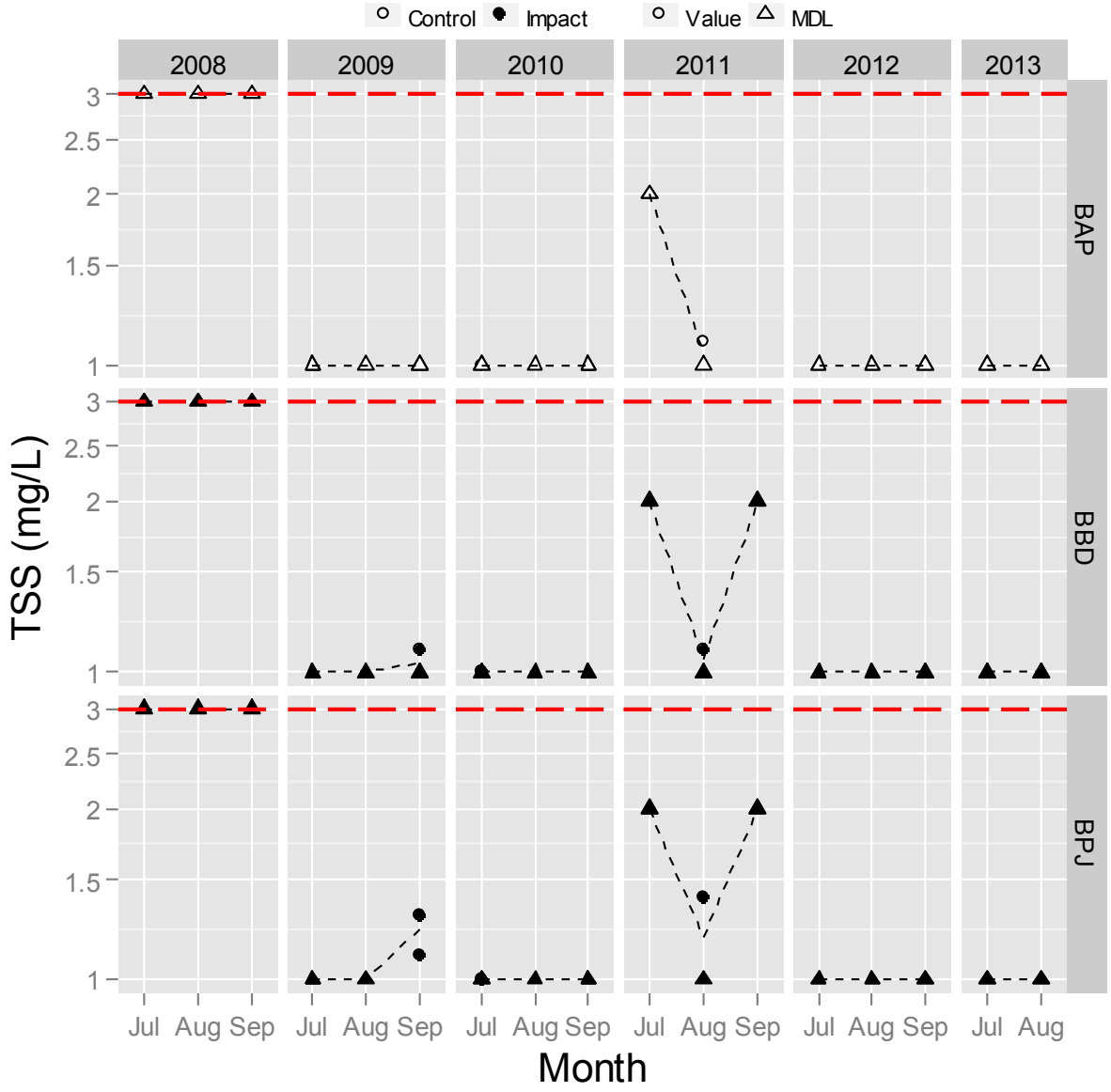


Figure 3.3-43. Total Dissolved Solids (TDS; mg/L) in water samples from Baker Lake since 2008.

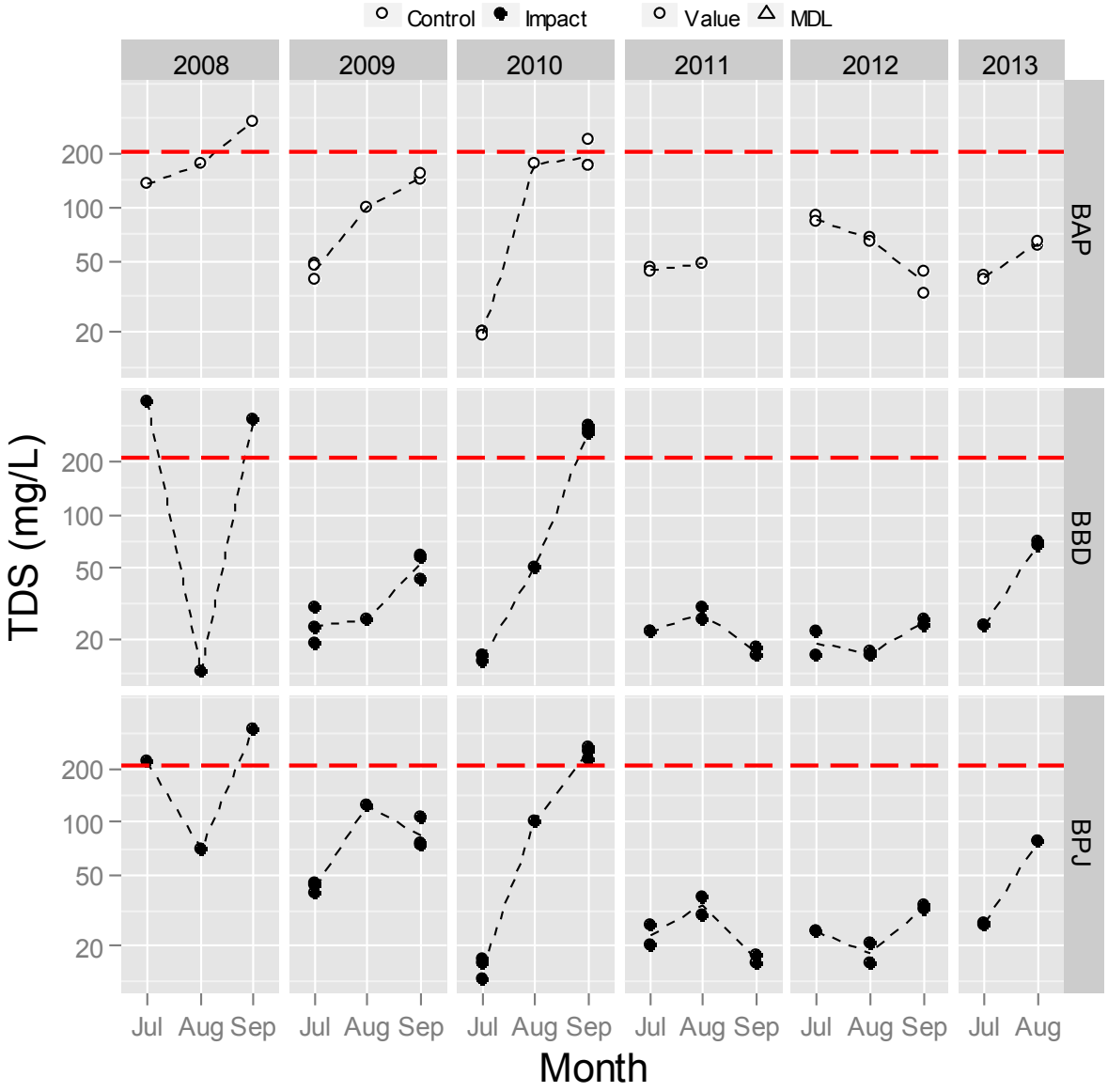


Figure 3.3-44. Bicarbonate Alkalinity (mg/L) in water samples from Baker Lake since 2008.

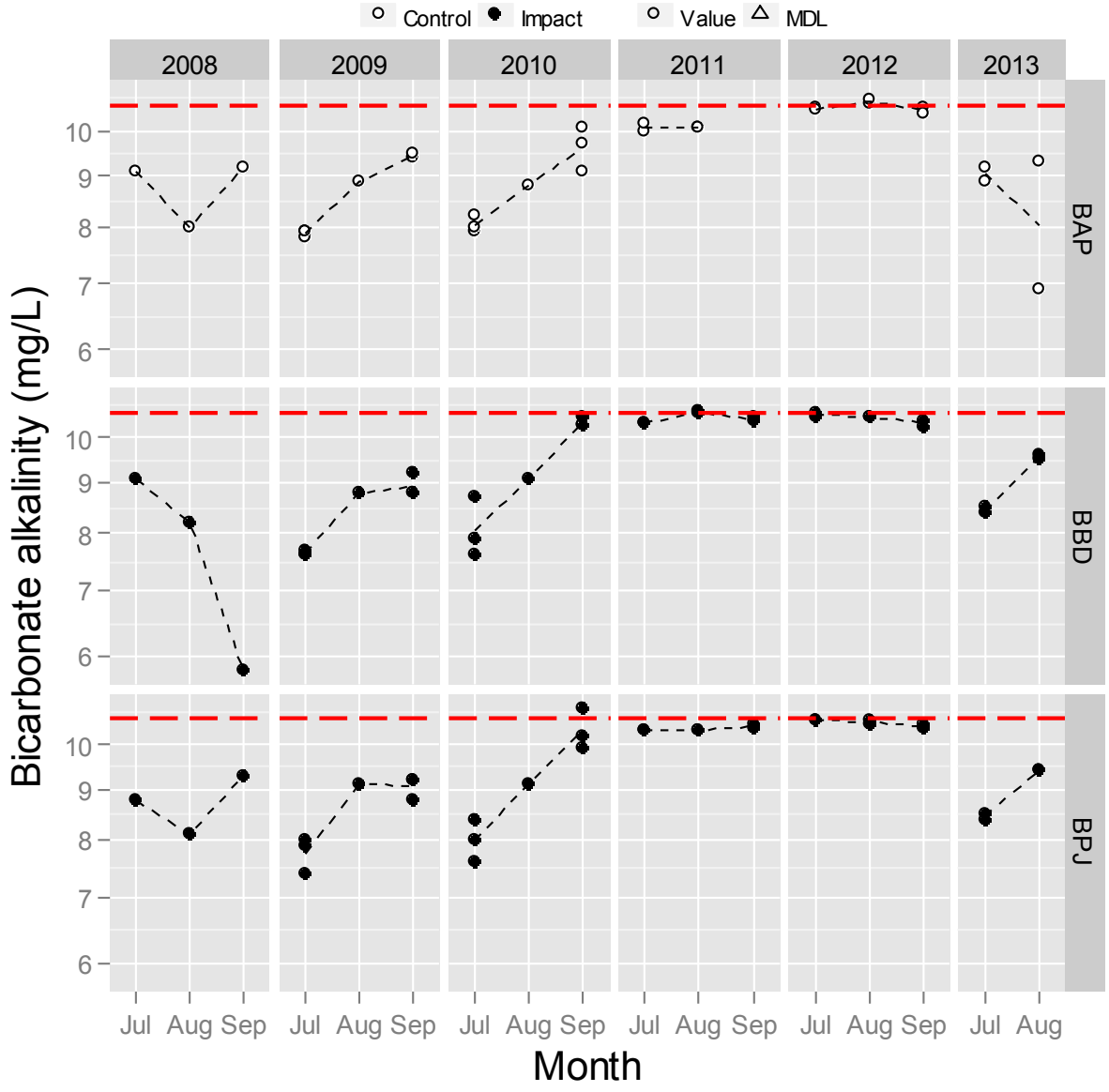


Figure 3.3-45. Total Alkalinity (mg/L) in water samples from Baker Lake since 2008.

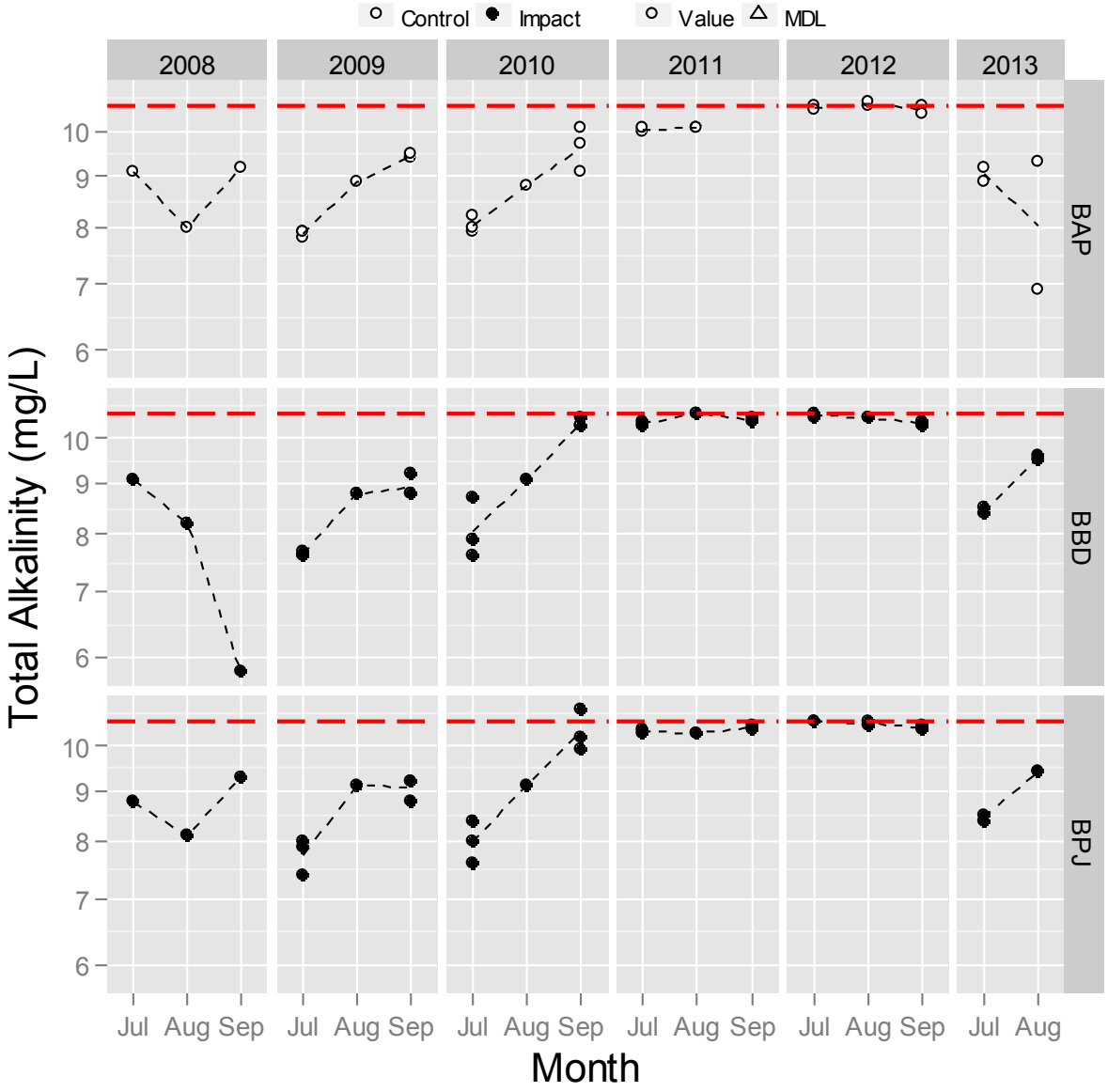


Figure 3.3-46. Ammonia-N (mg/L) in water samples from Baker Lake since 2008.

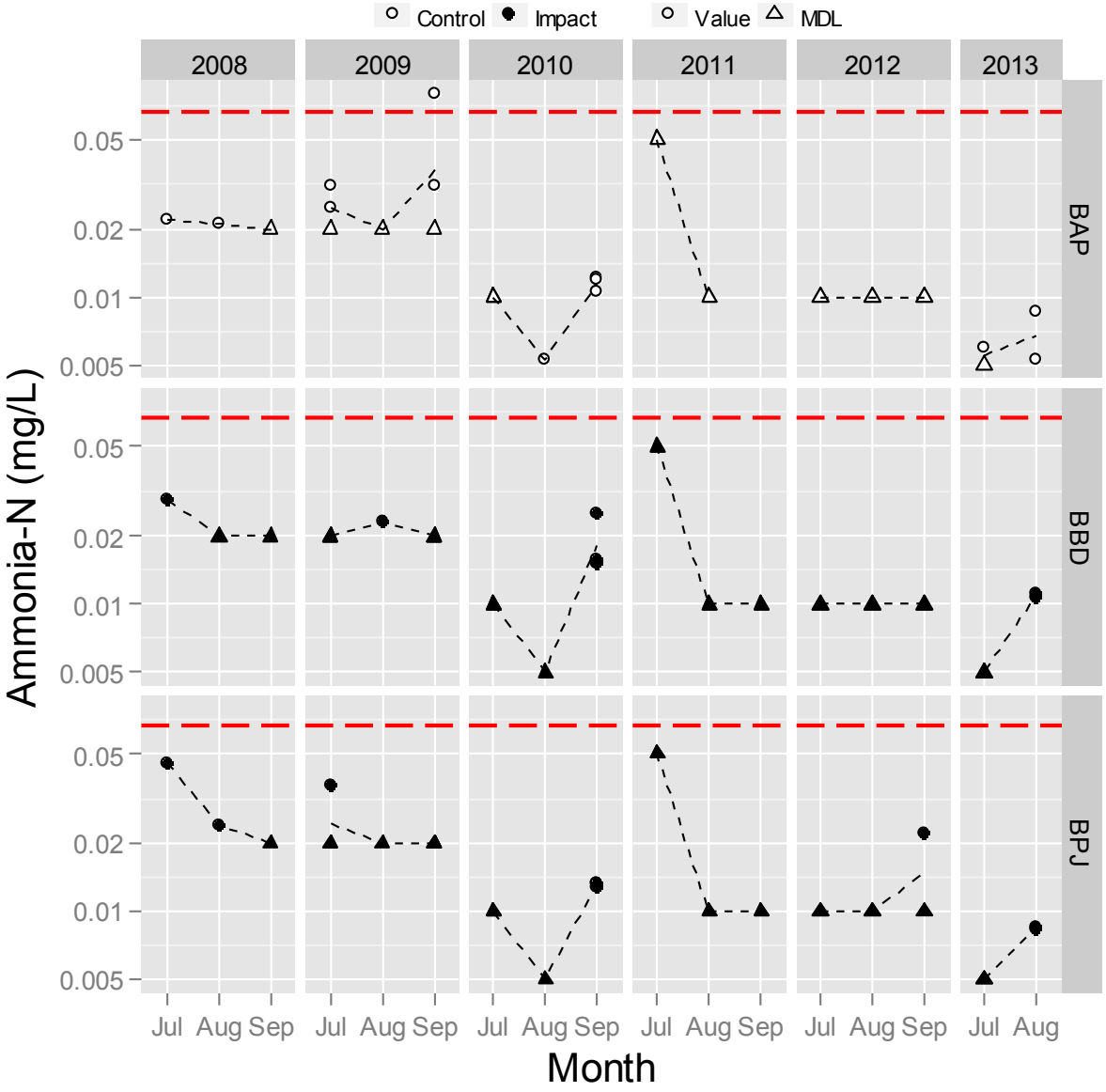


Figure 3.3-47. Chloride (mg/L) in water samples from Baker Lake since 2008.

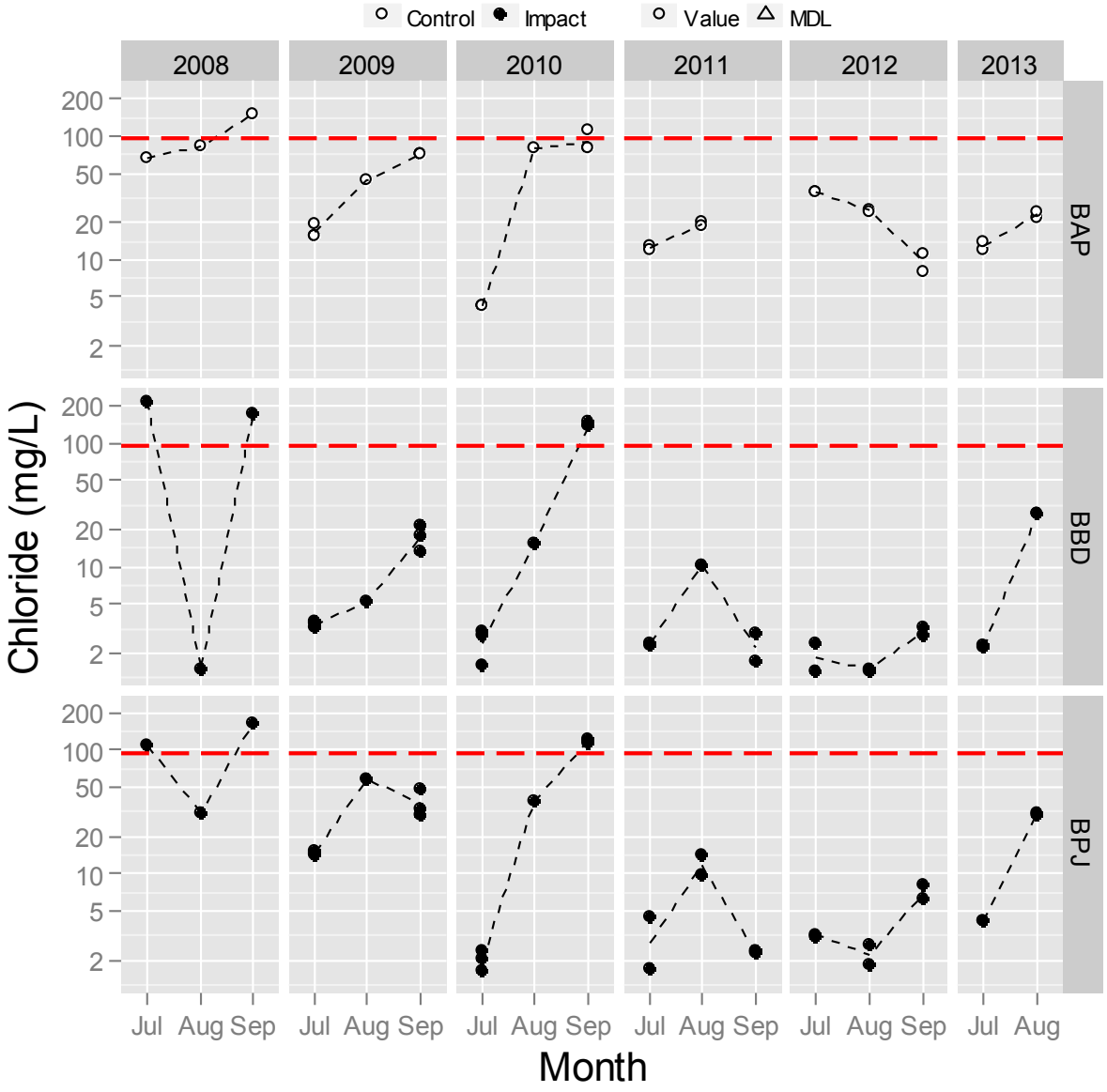


Figure 3.3-48. Nitrate-N (mg/L) in water samples from Baker Lake since 2008.

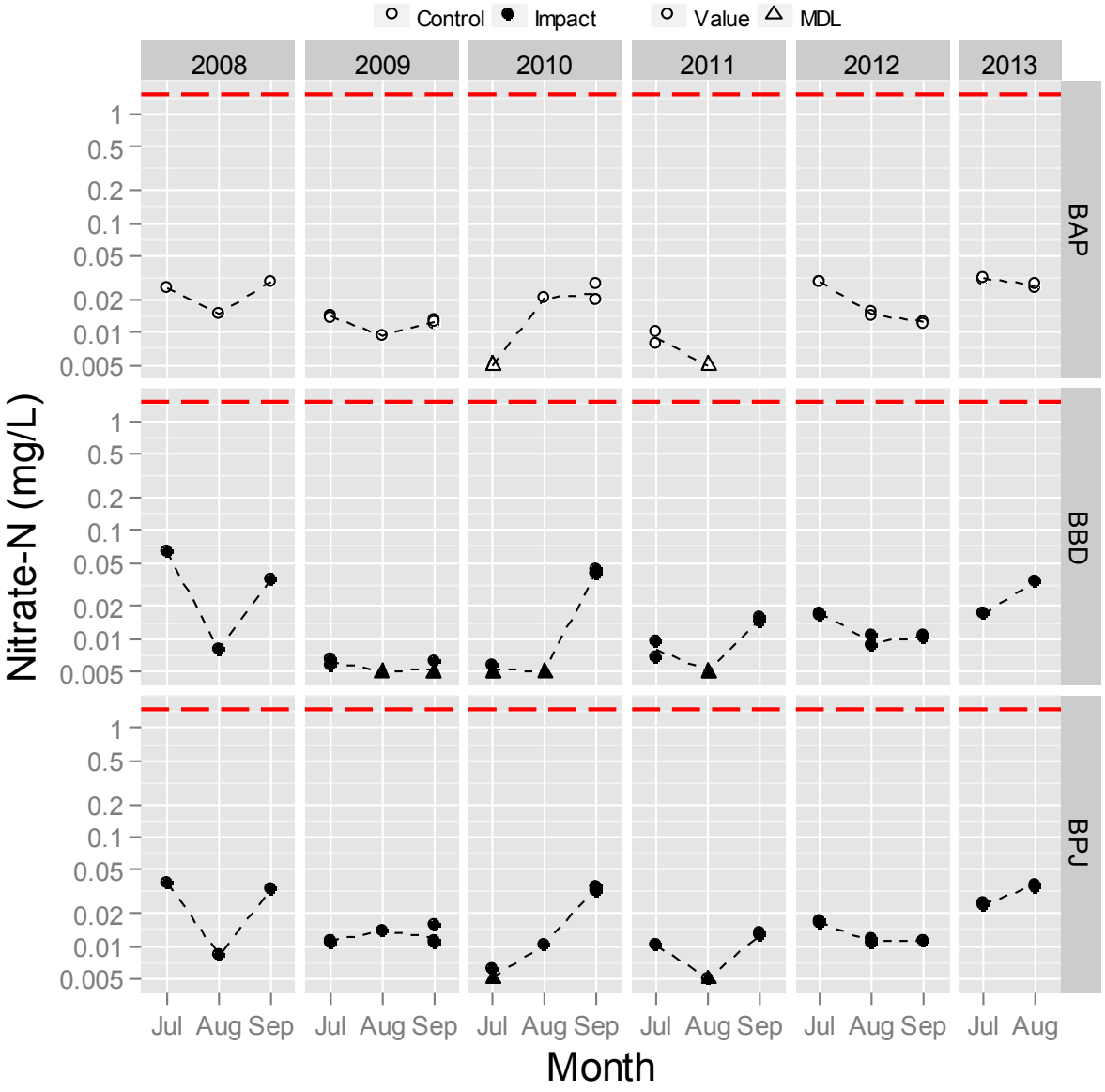


Figure 3.3-49. Total Kjeldahl Nitrogen (TKN; mg/L) in water samples from Baker Lake since 2008.

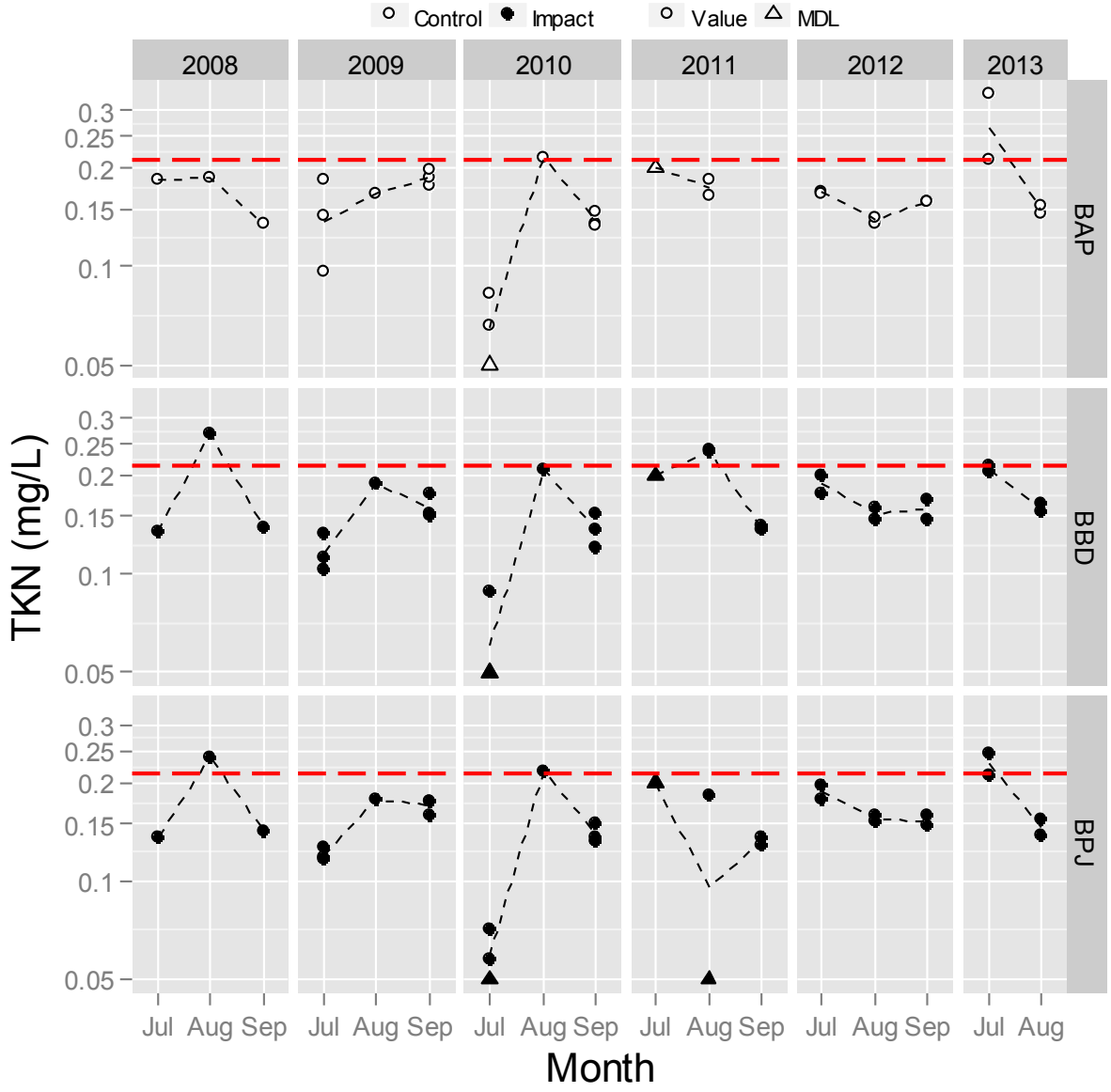


Figure 3.3-50. Total Phosphorus (mg/L) in water samples from Baker Lake since 2008.

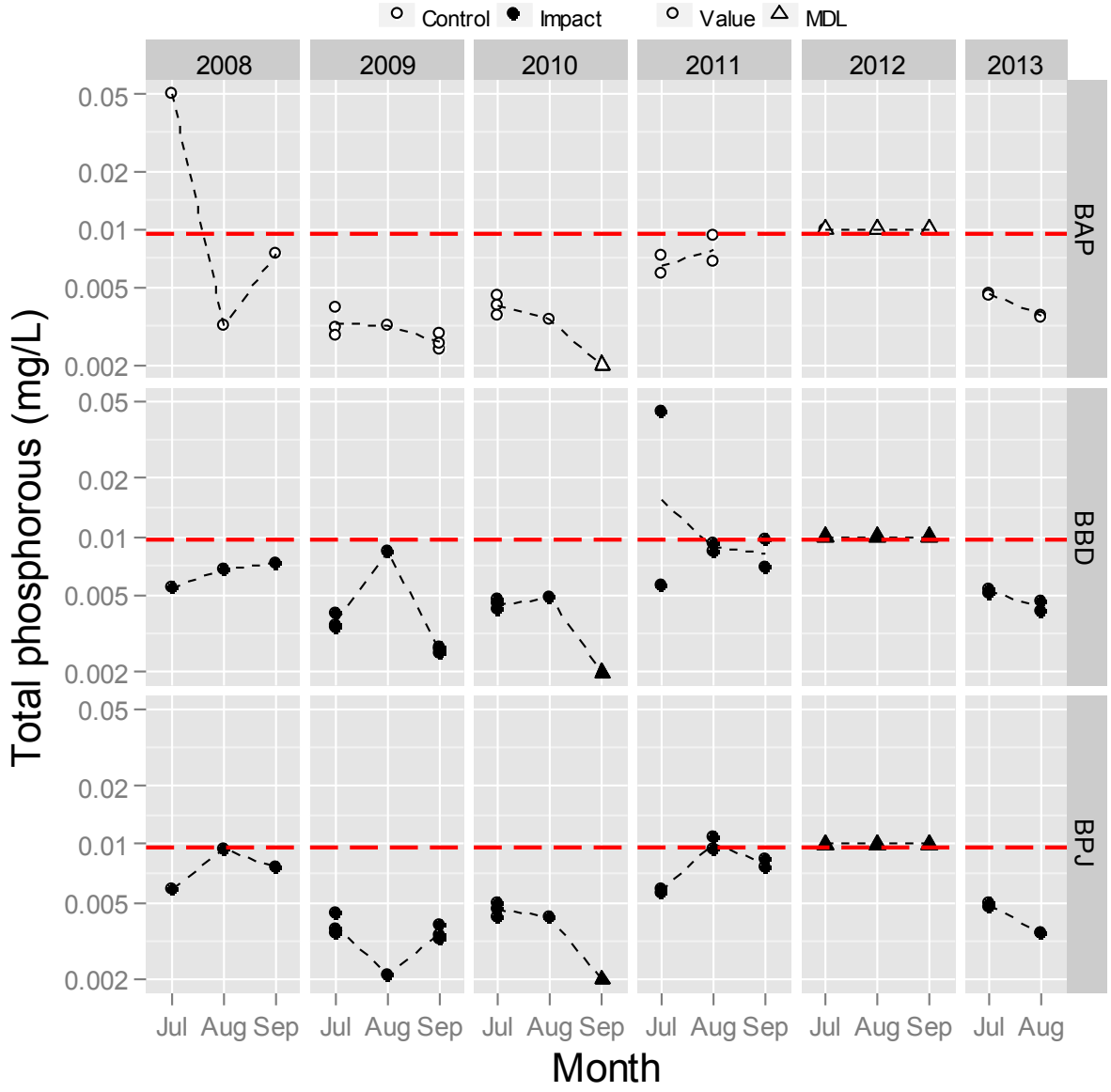


Figure 3.3-51. Total Ortho-phosphate (mg/L) in water samples from Baker Lake since 2008.

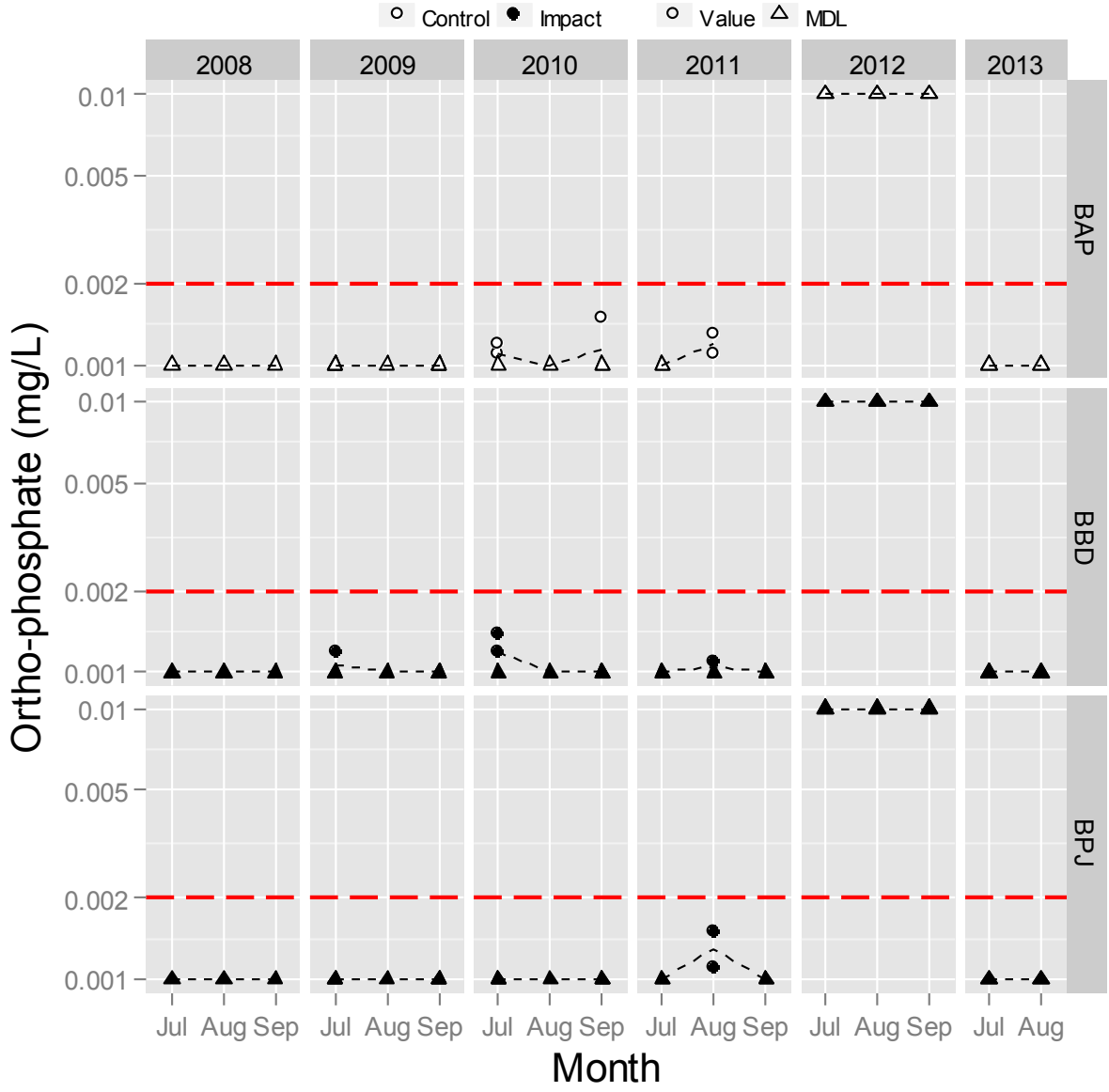


Figure 3.3-52. Reactive Silica (mg/L) in water samples from Baker Lake since 2008.

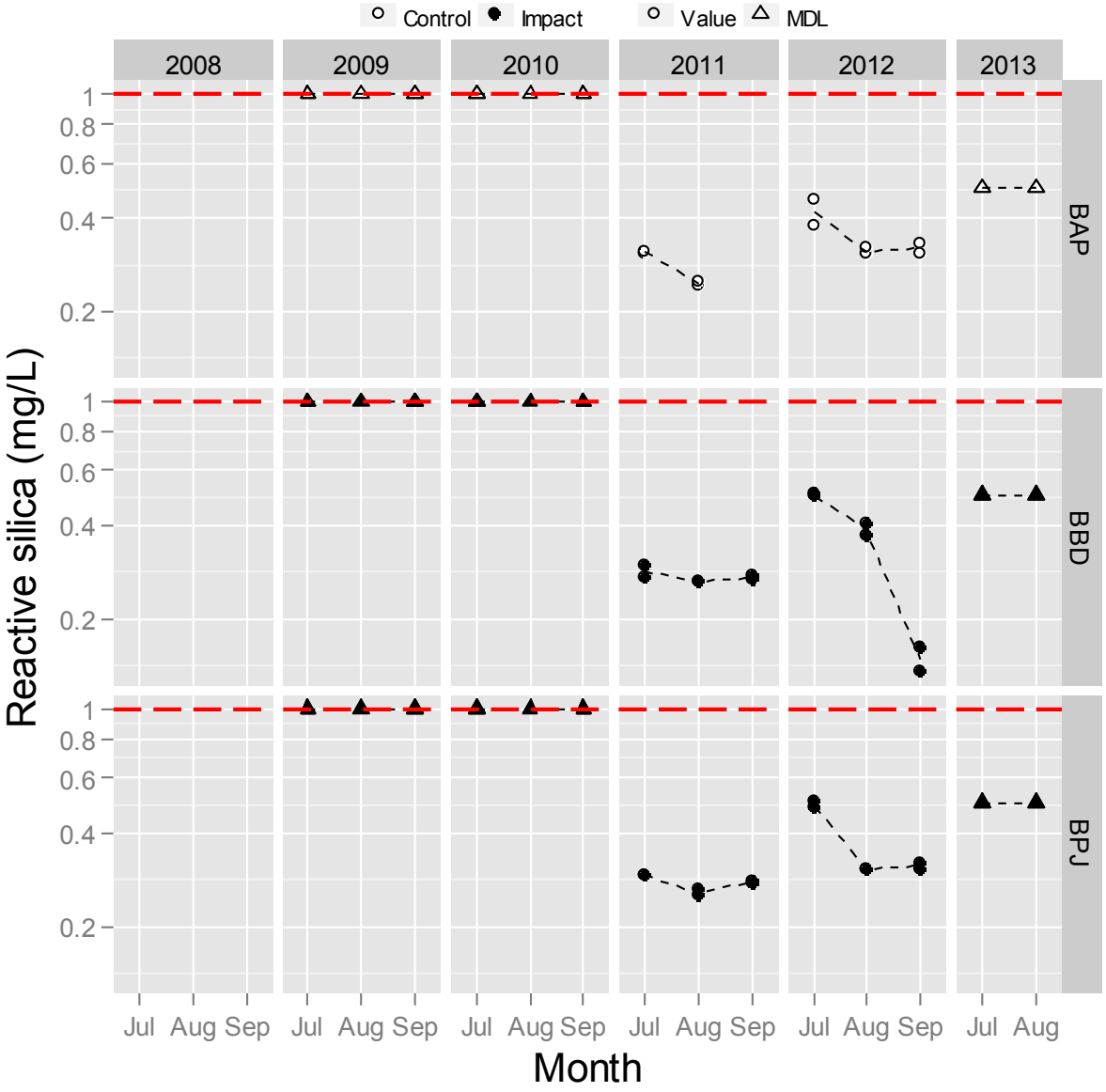


Figure 3.3-53. Sulphate (mg/L) in water samples from Baker Lake since 2008.

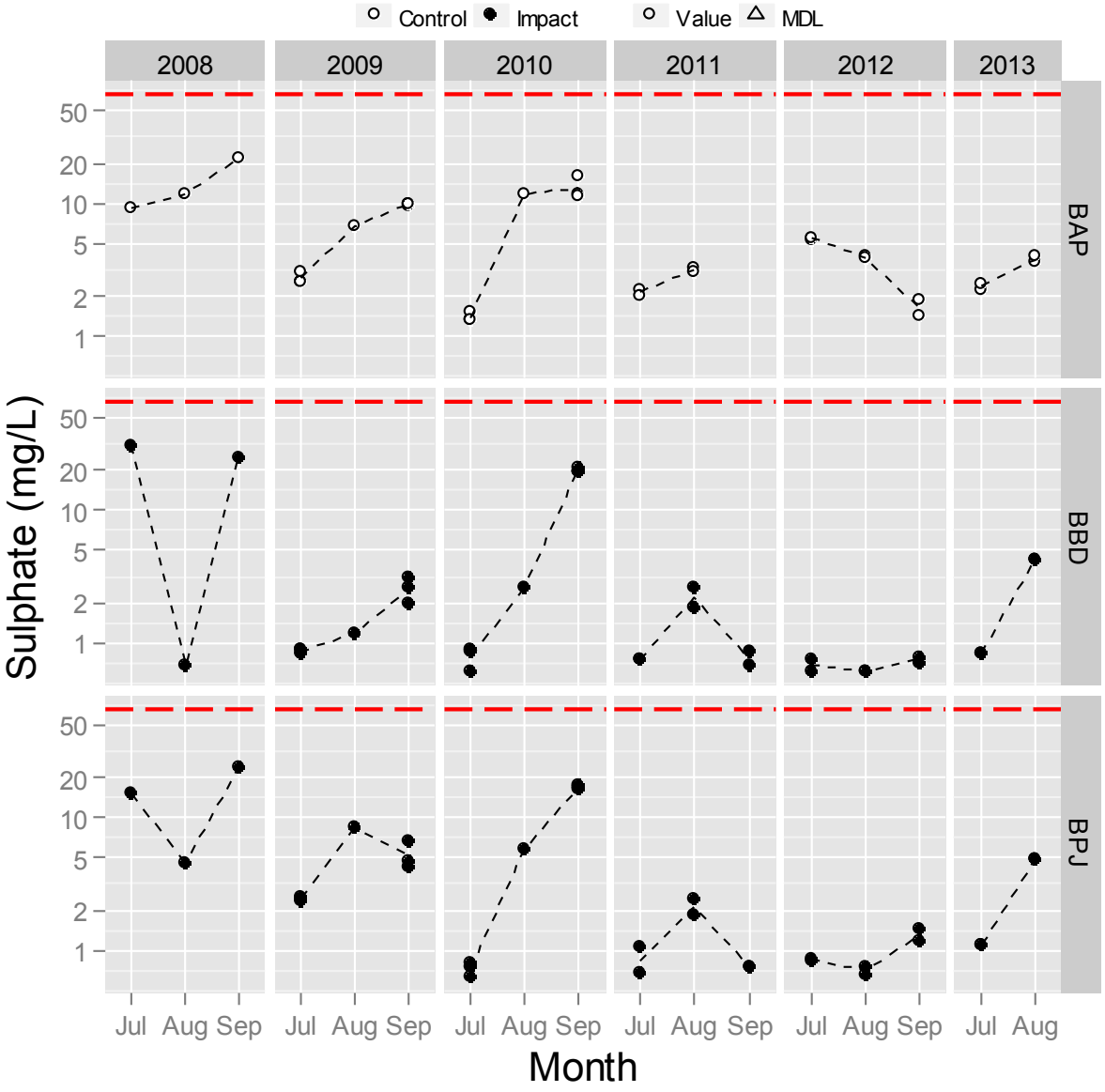


Figure 3.3-54. Dissolved Organic Carbon (DOC; mg/L) in water samples from Baker Lake since 2008.

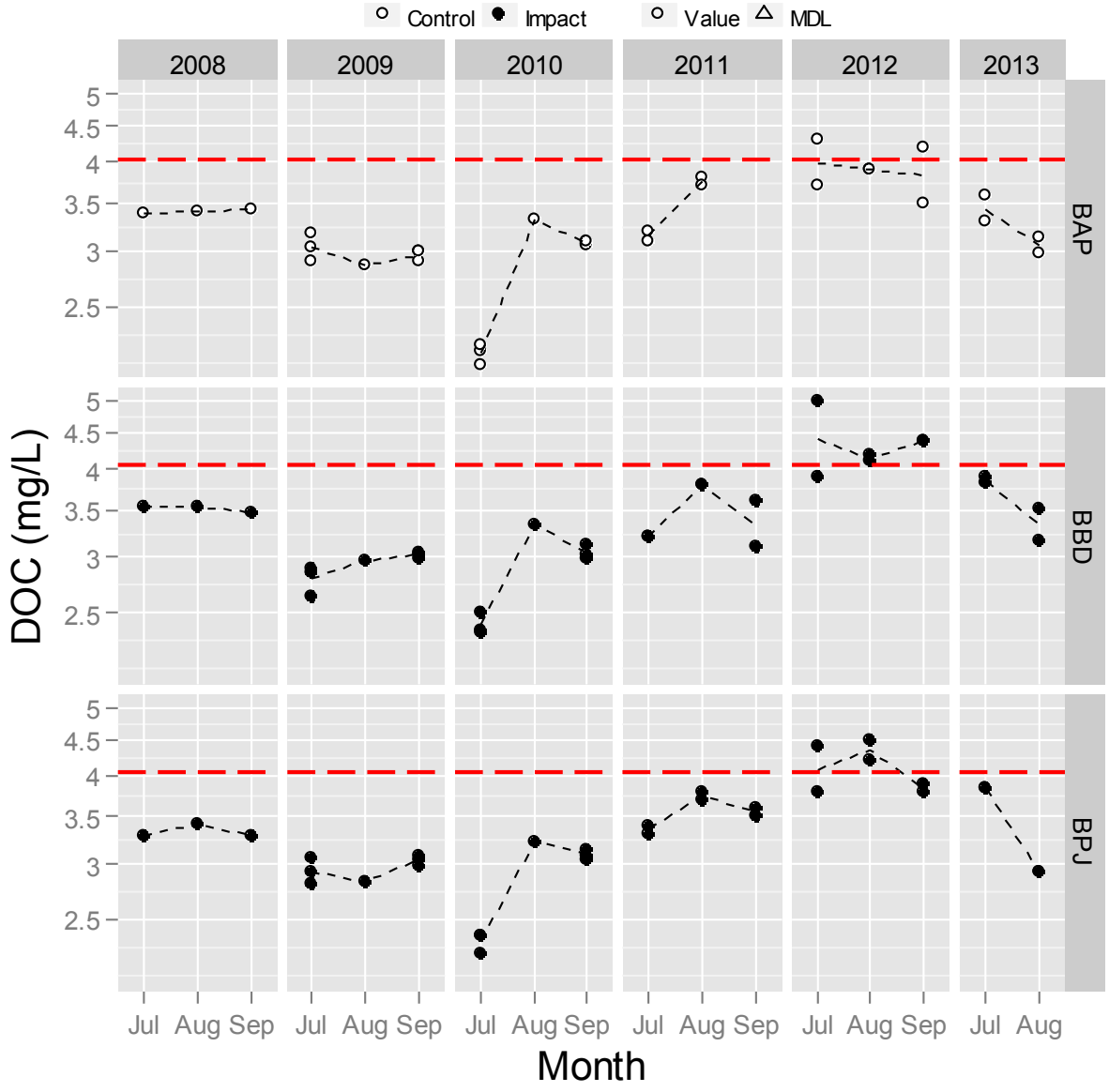


Figure 3.3-55. Total Organic Carbon (TOC; mg/L) in water samples from Baker Lake since 2008.

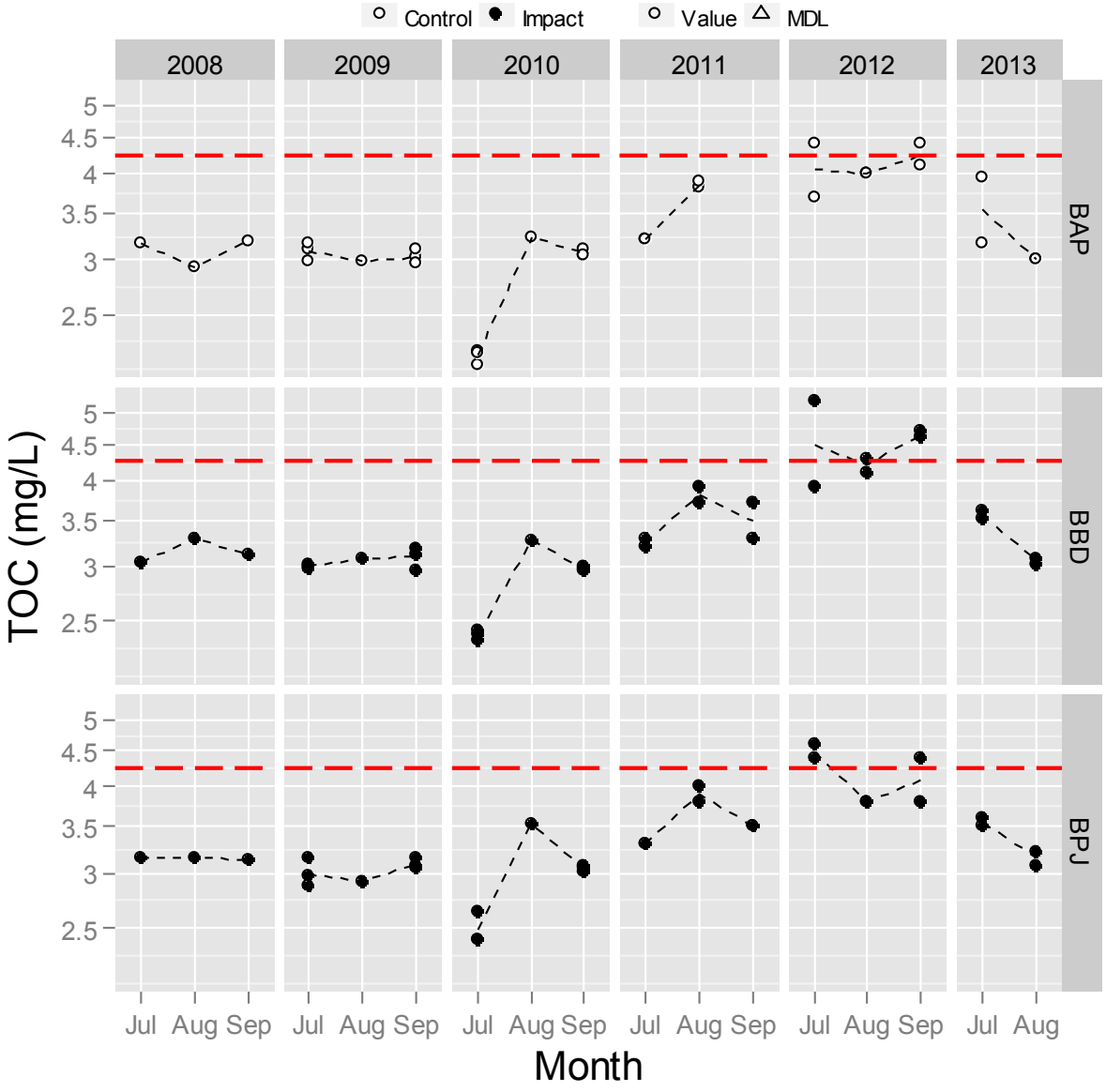


Figure 3.3-56. Total Aluminum (mg/L) in water samples from Baker Lake since 2008.

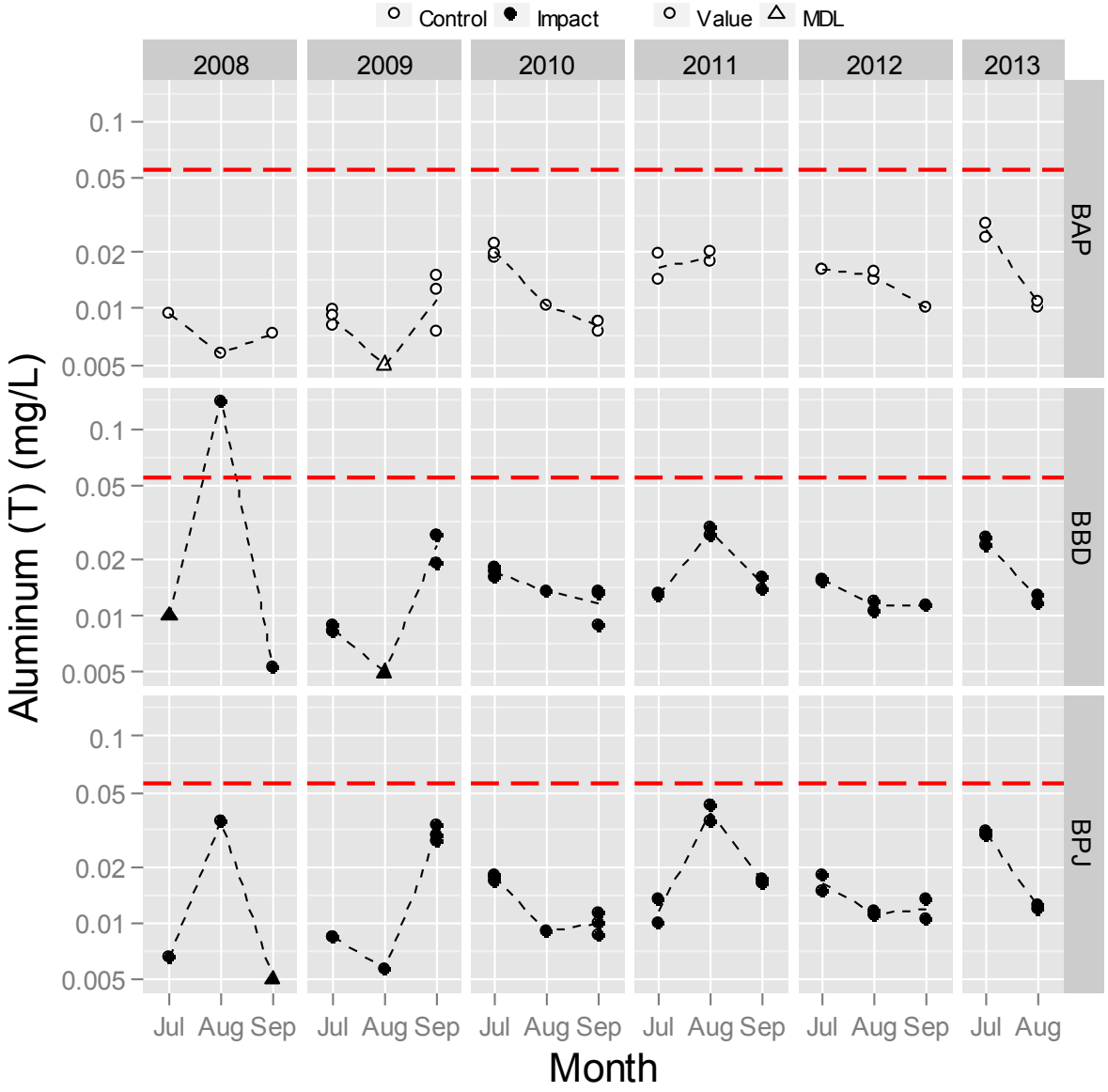


Figure 3.3-57. Total Arsenic (mg/L) in water samples from Baker Lake since 2008.

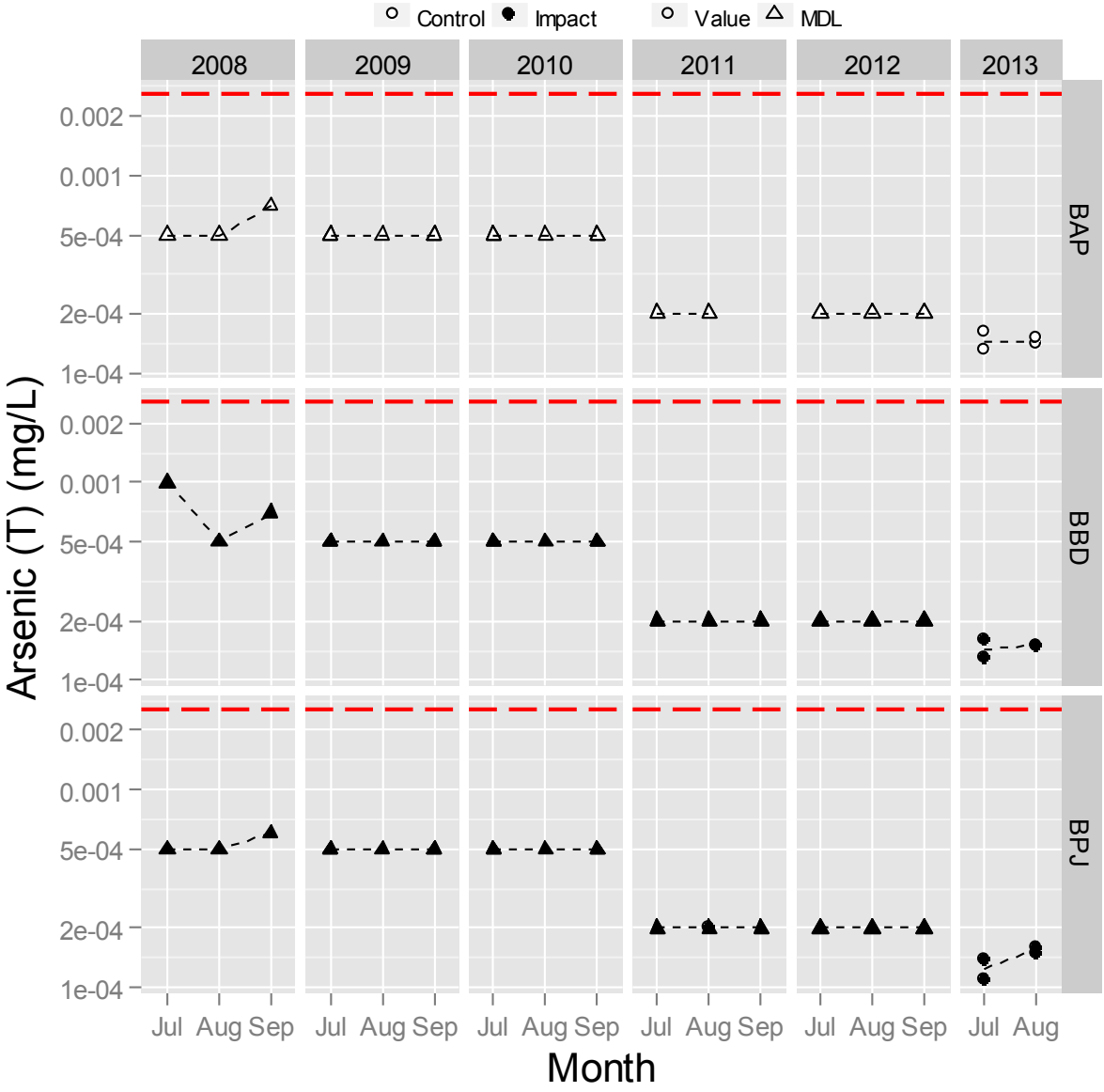


Figure 3.3-58. Total Barium (mg/L) in water samples from Baker Lake since 2008.

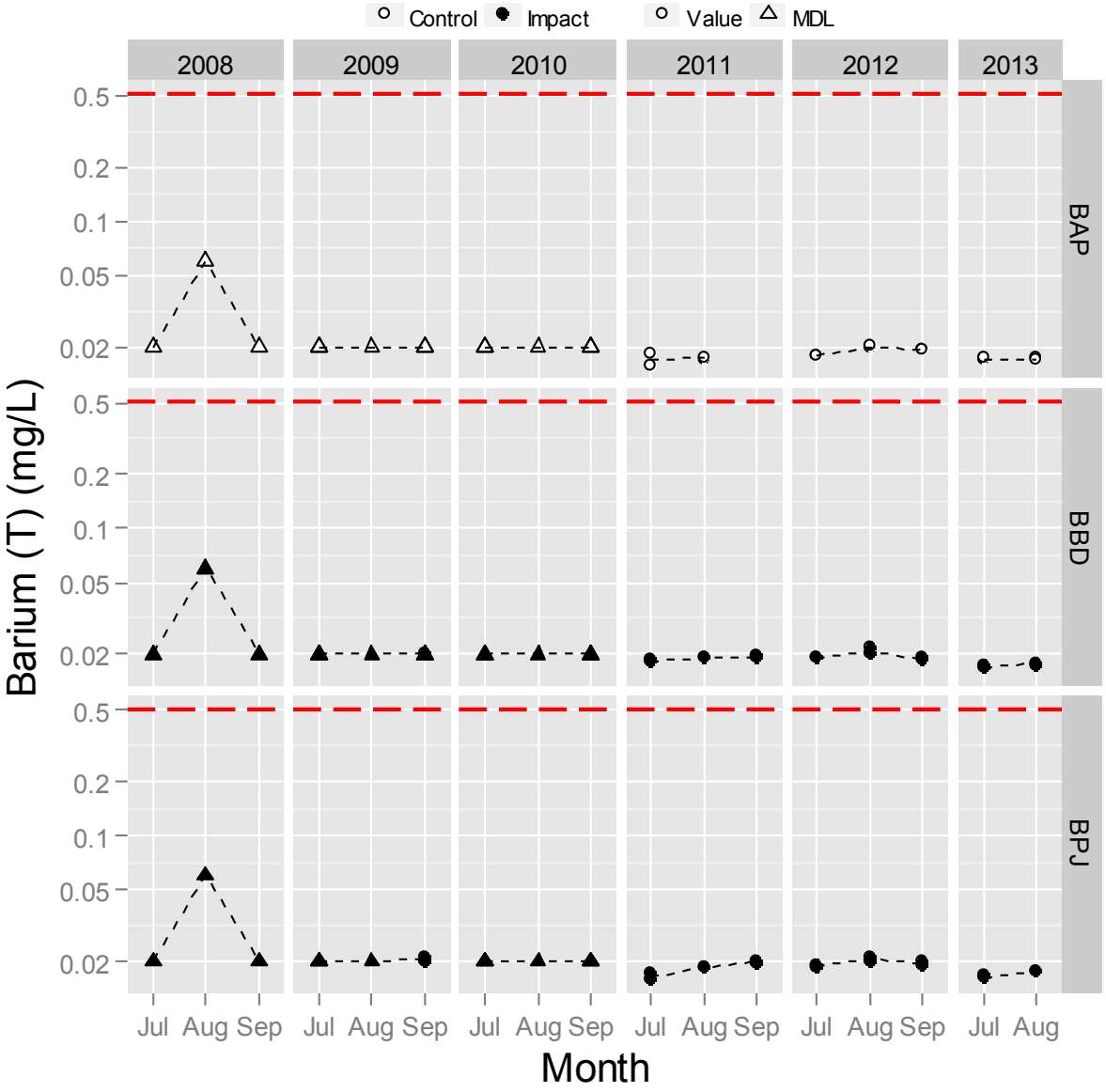


Figure 3.3-59. Total Calcium (mg/L) in water samples from Baker Lake since 2008.

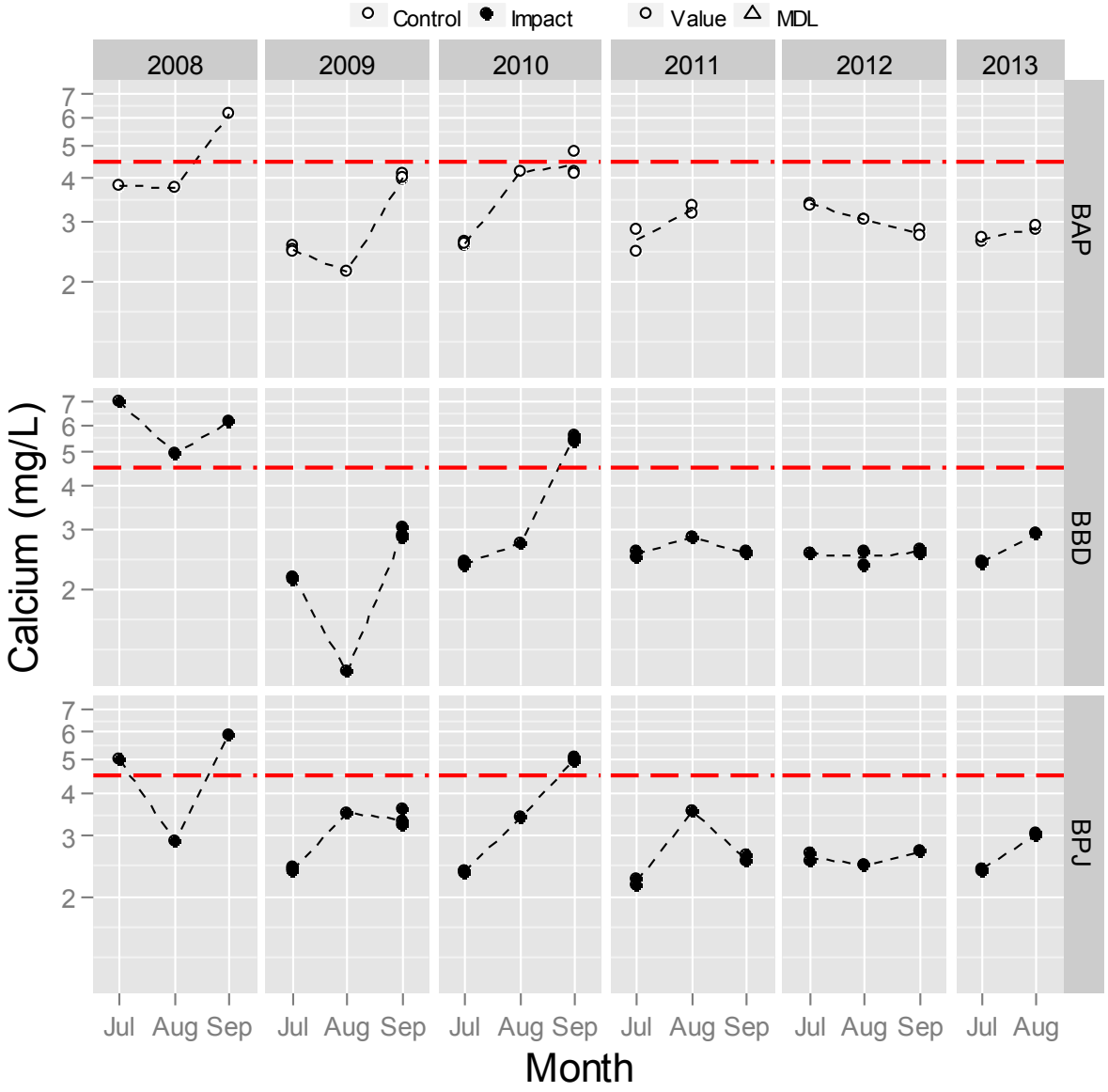


Figure 3.3-60. Total Copper (mg/L) in water samples from Baker Lake since 2008.

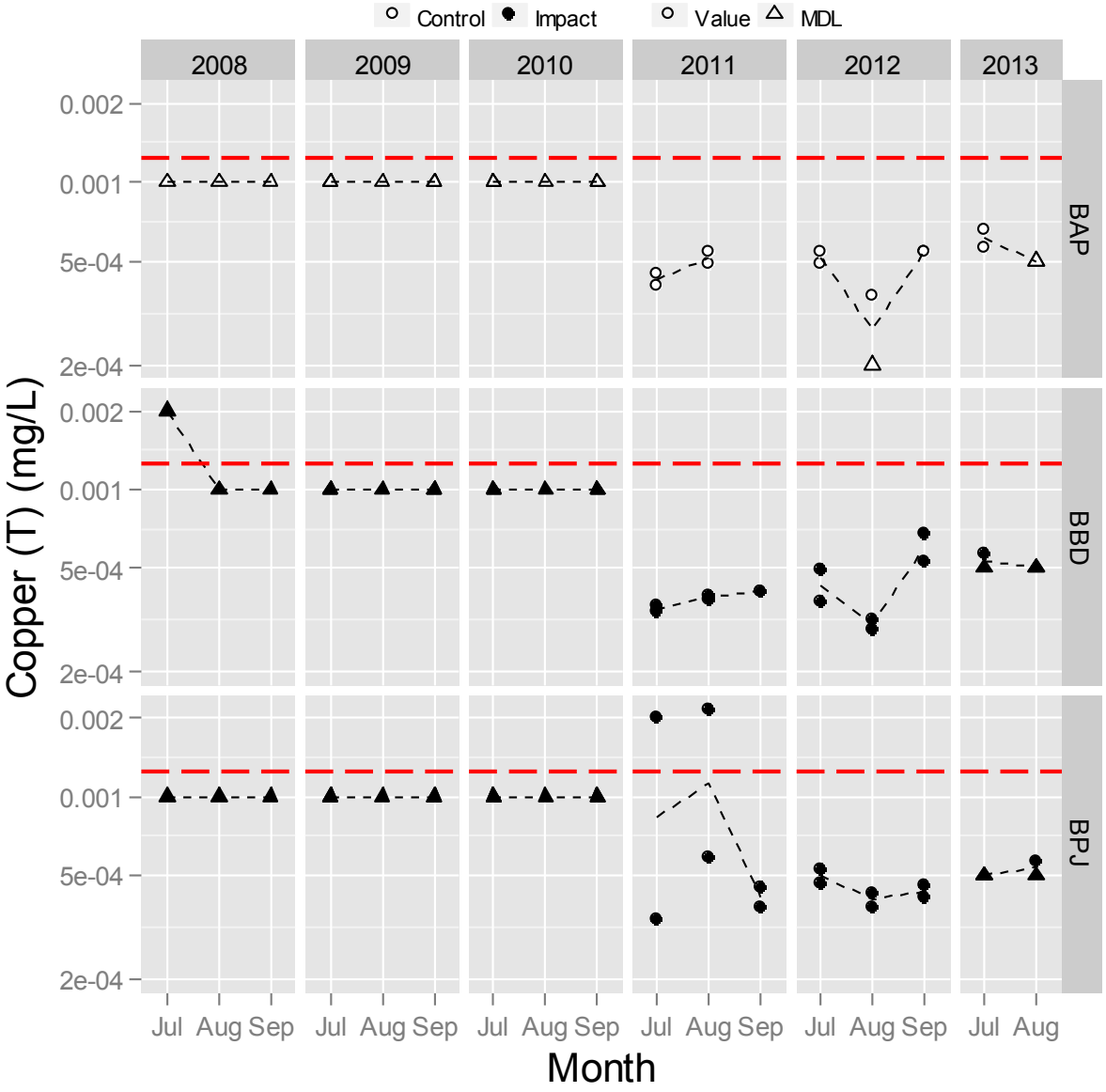


Figure 3.3-61. Total Iron (mg/L) in water samples from Baker Lake since 2008.

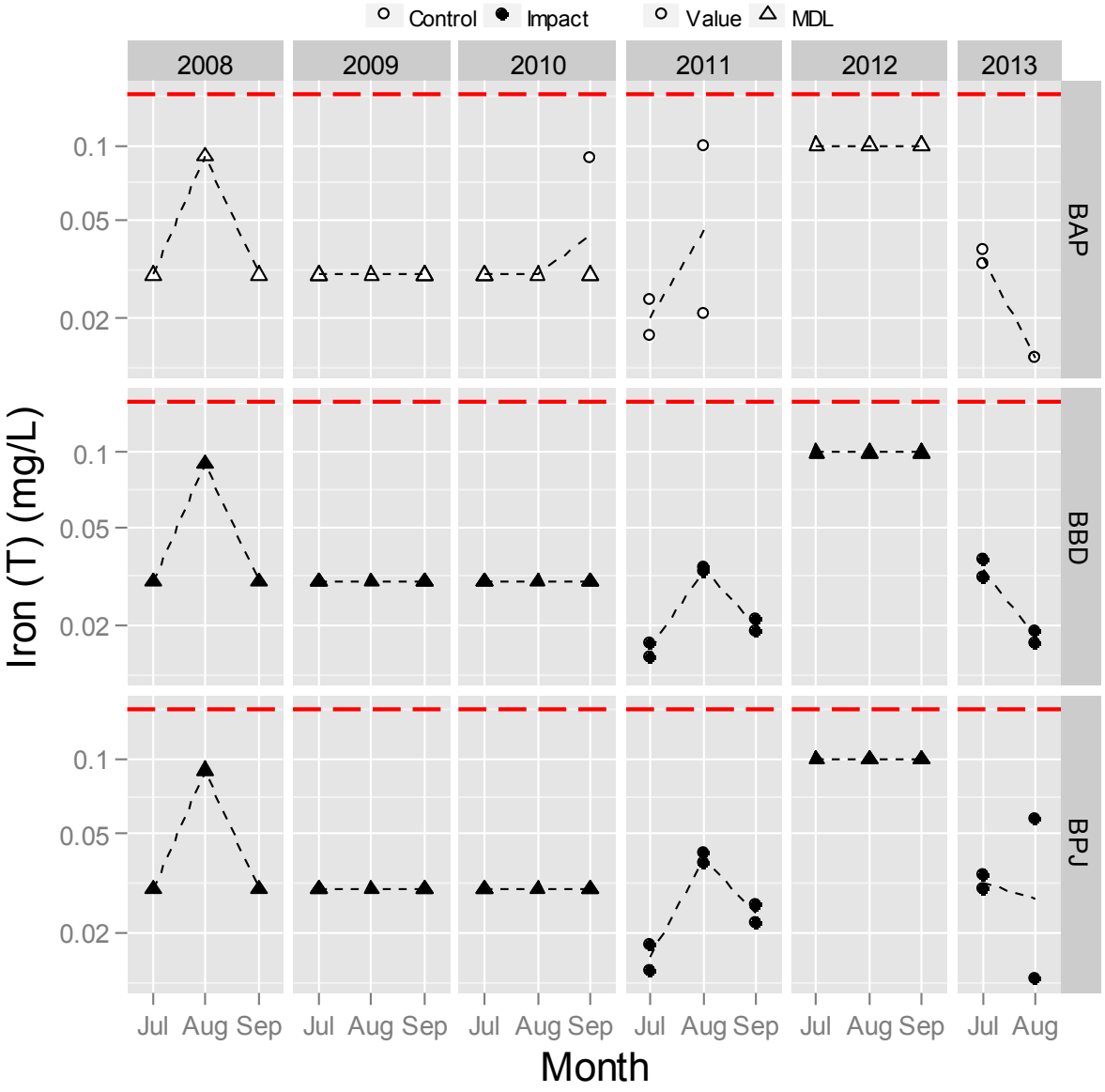


Figure 3.3-62. Total Lead (mg/L) in water samples from Baker Lake since 2008.

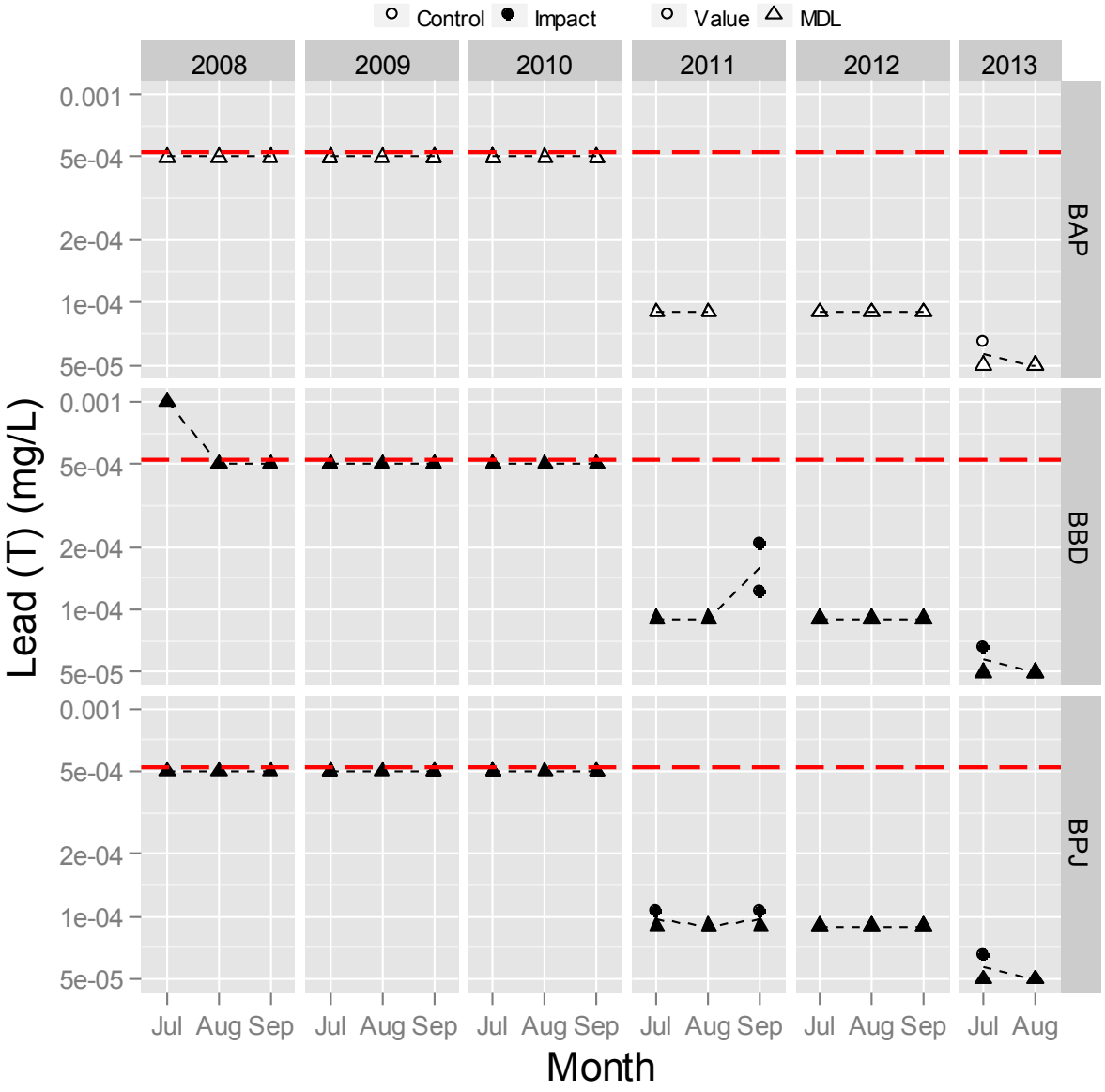


Figure 3.3-63. Total Lithium (mg/L) in water samples from Baker Lake since 2008.

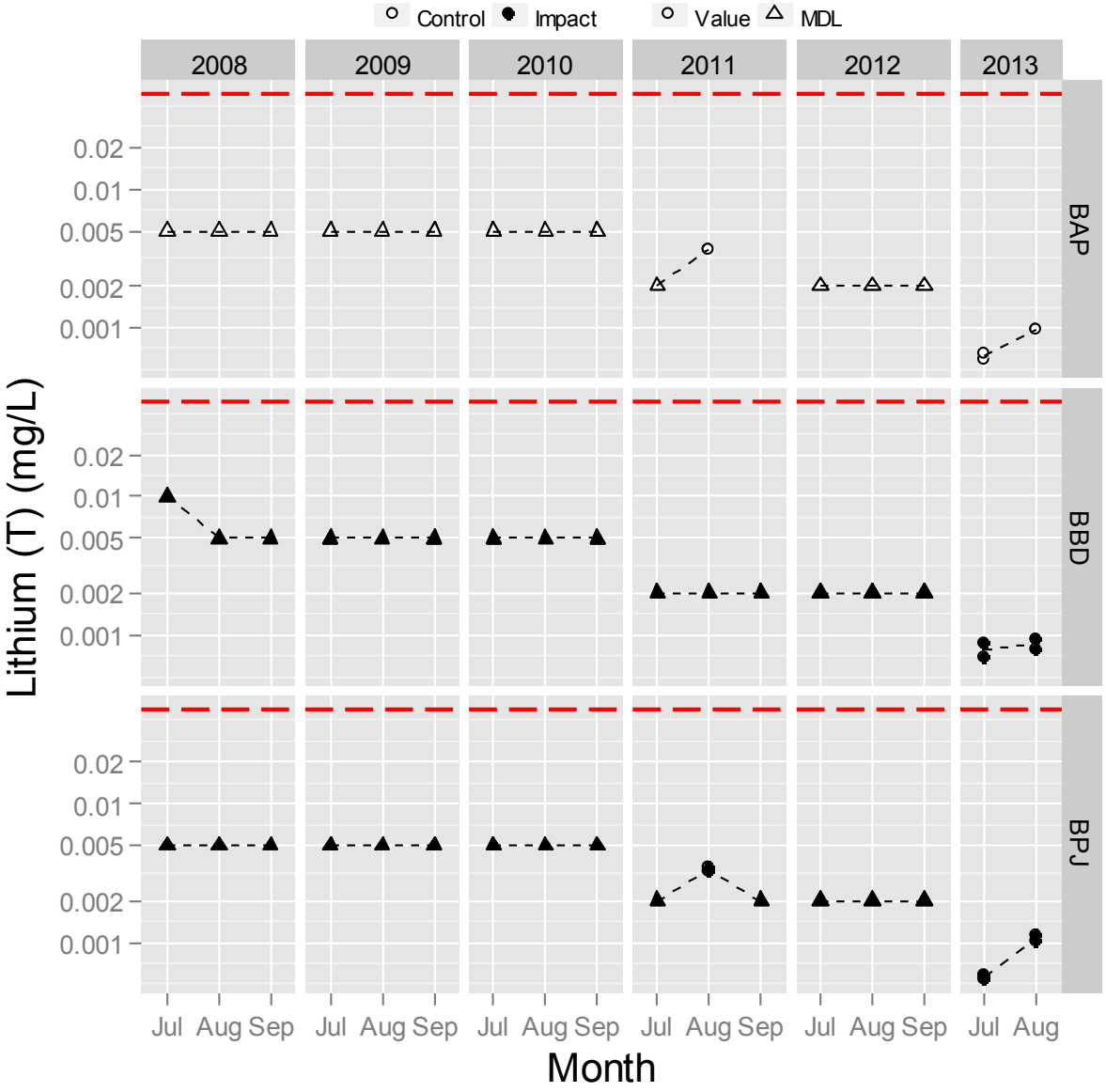


Figure 3.3-64. Total Magnesium (mg/L) in water samples from Baker Lake since 2008.

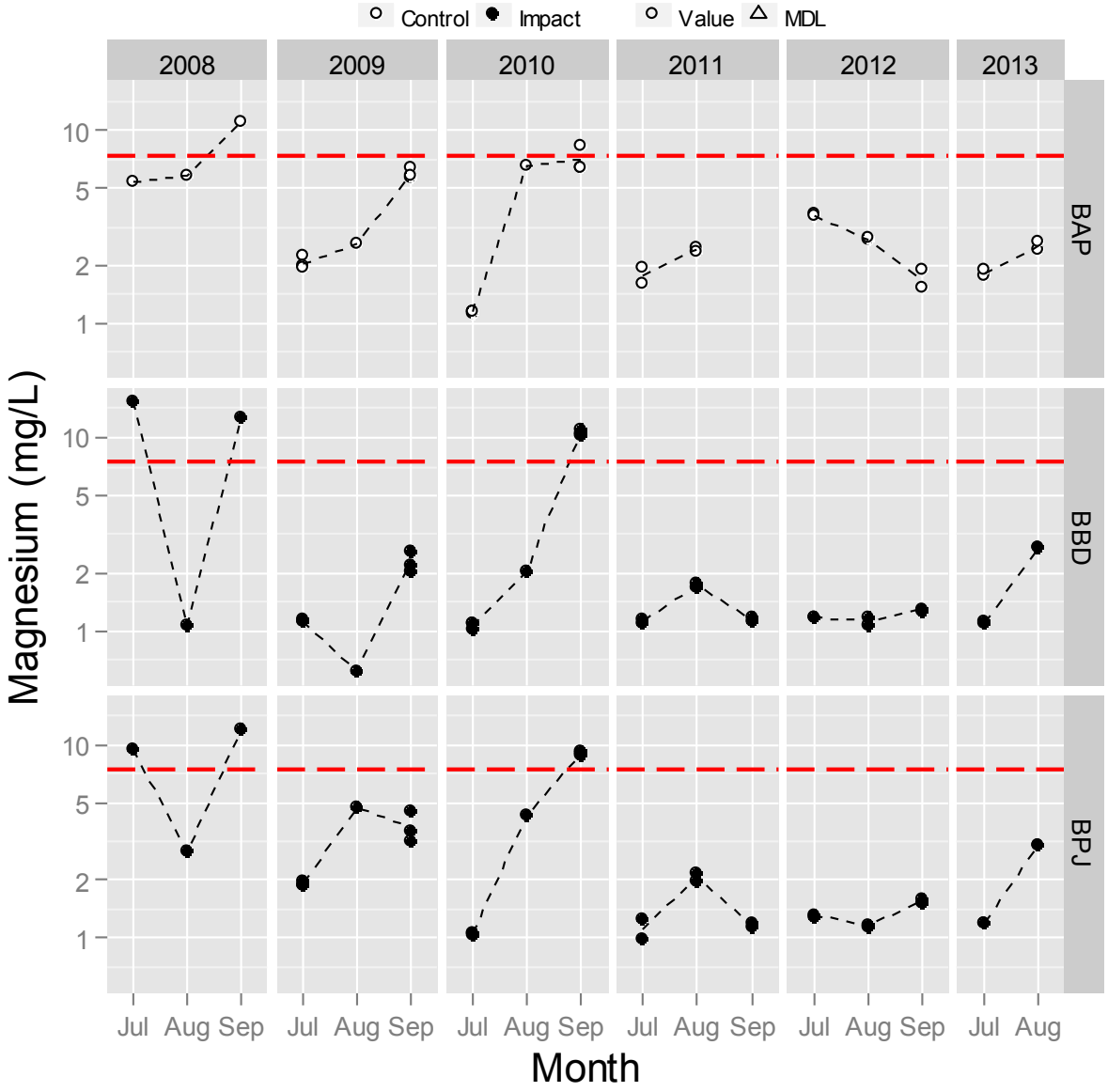


Figure 3.3-65. Total Manganese (mg/L) in water samples from Baker Lake since 2008.

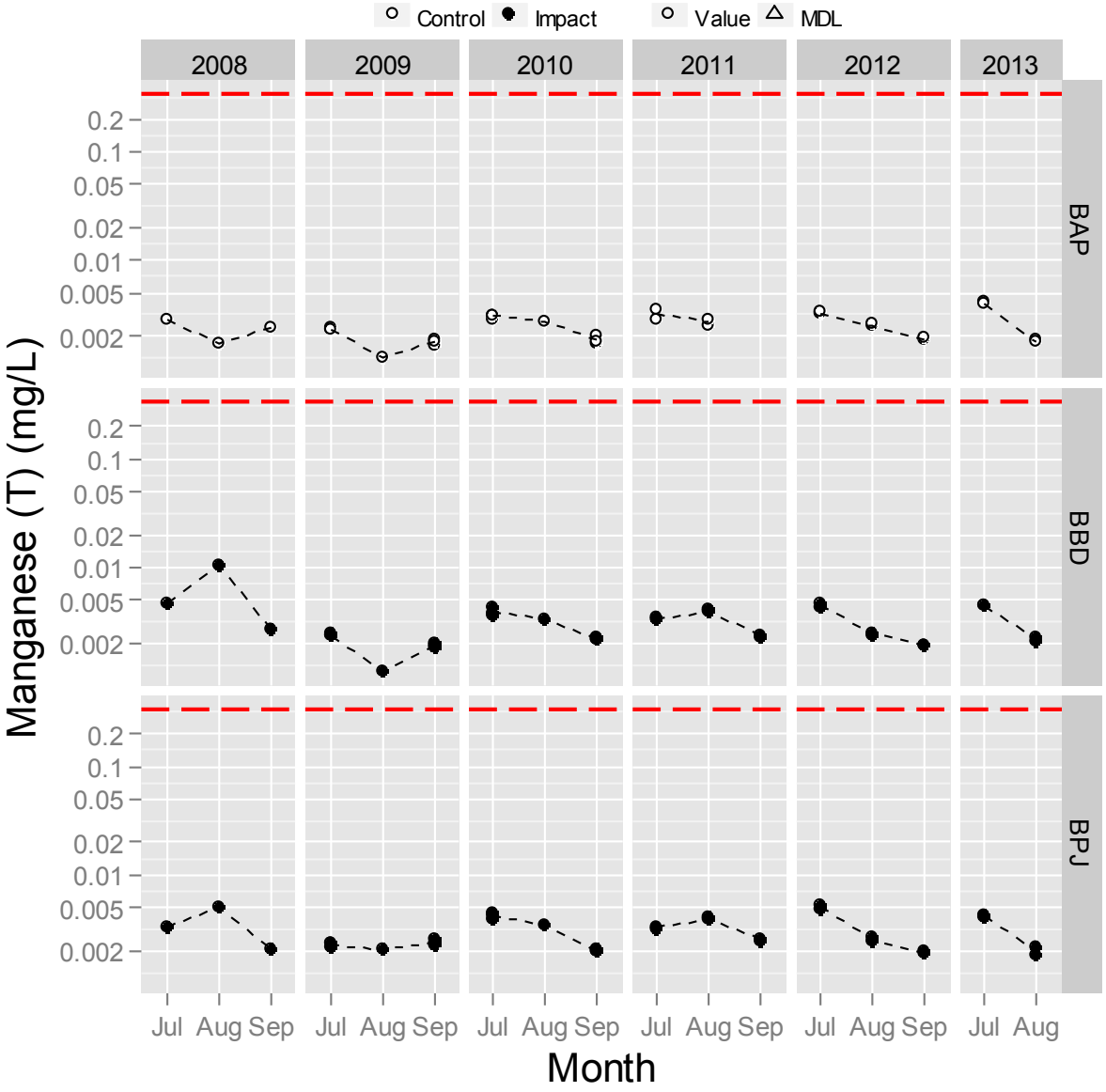


Figure 3.3-66. Total Molybdenum (mg/L) in water samples from Baker Lake since 2008.

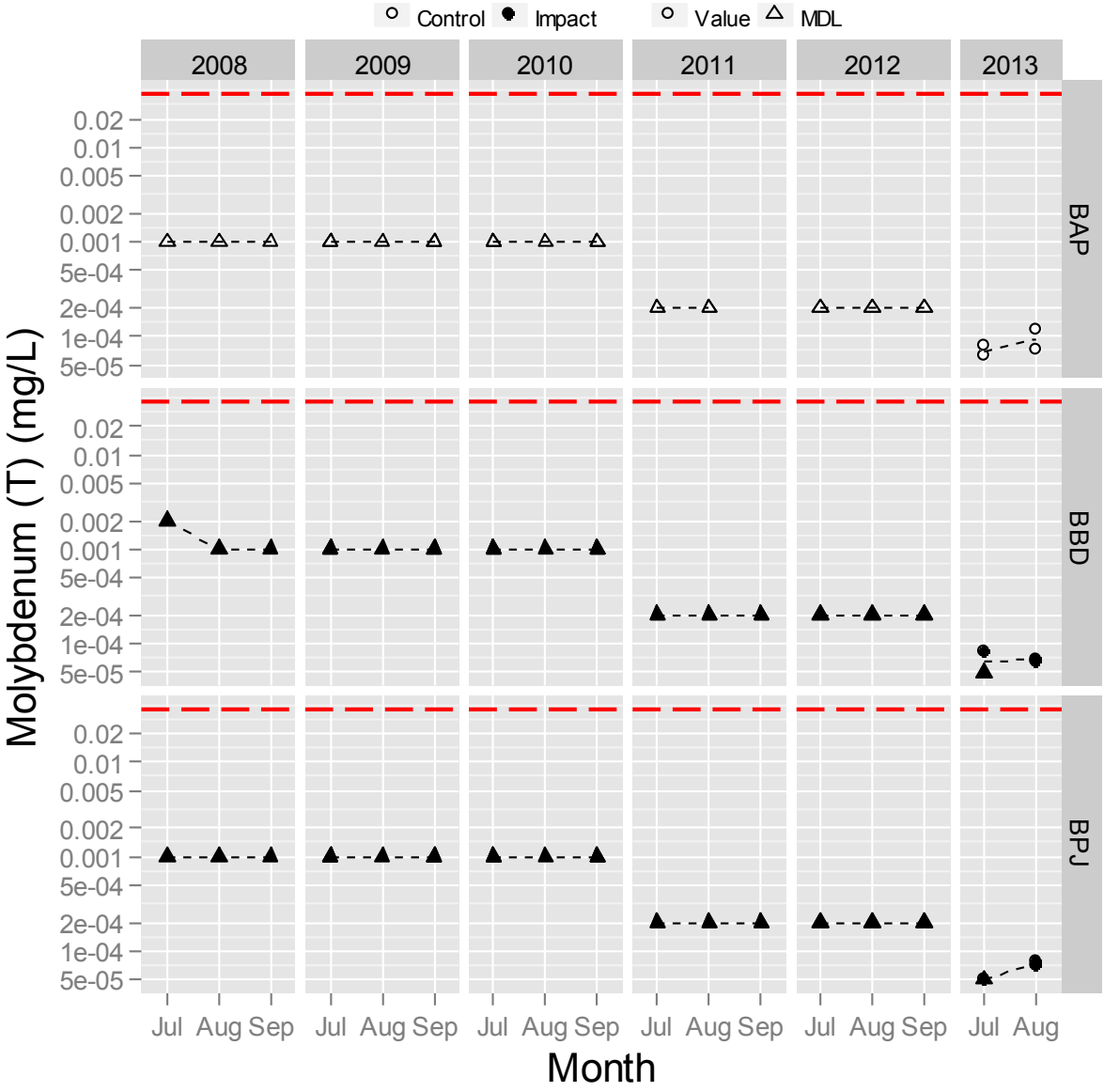


Figure 3.3-67. Total Potassium (mg/L) in water samples from Baker Lake since 2008.

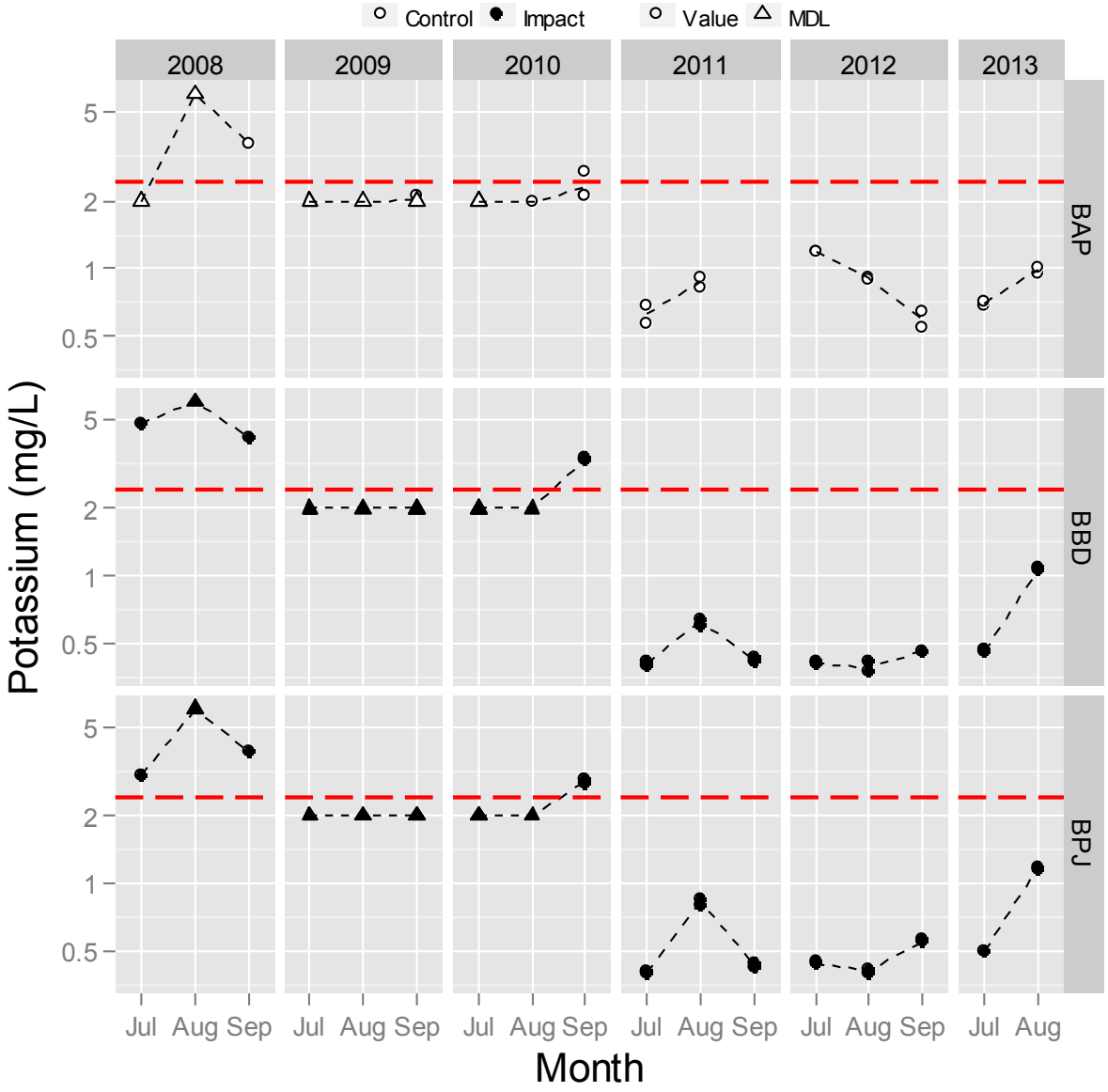


Figure 3.3-68. Total Sodium (mg/L) in water samples from Baker Lake since 2008.

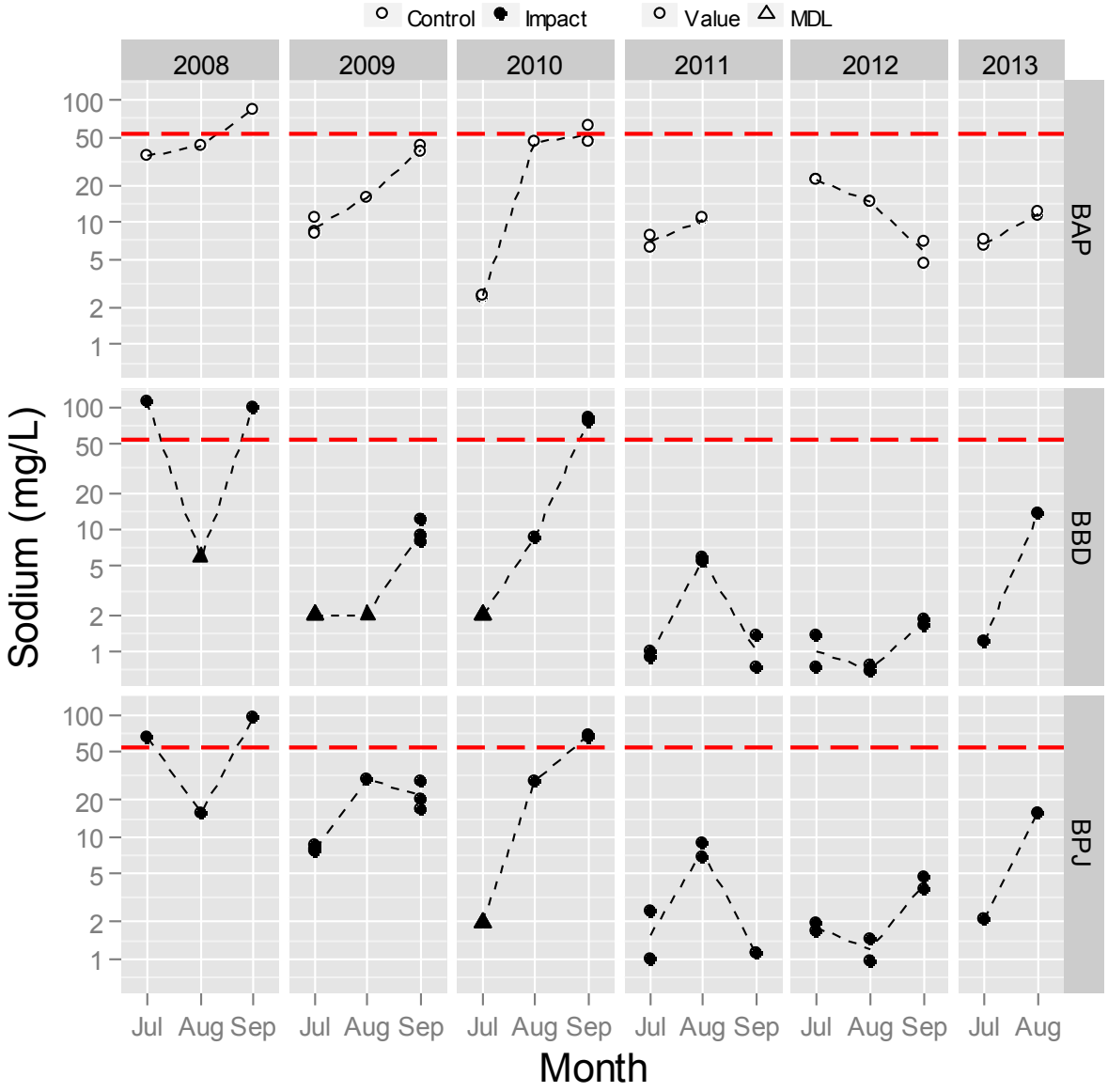


Figure 3.3-69. Total Strontium (mg/L) in water samples from Baker Lake since 2008.

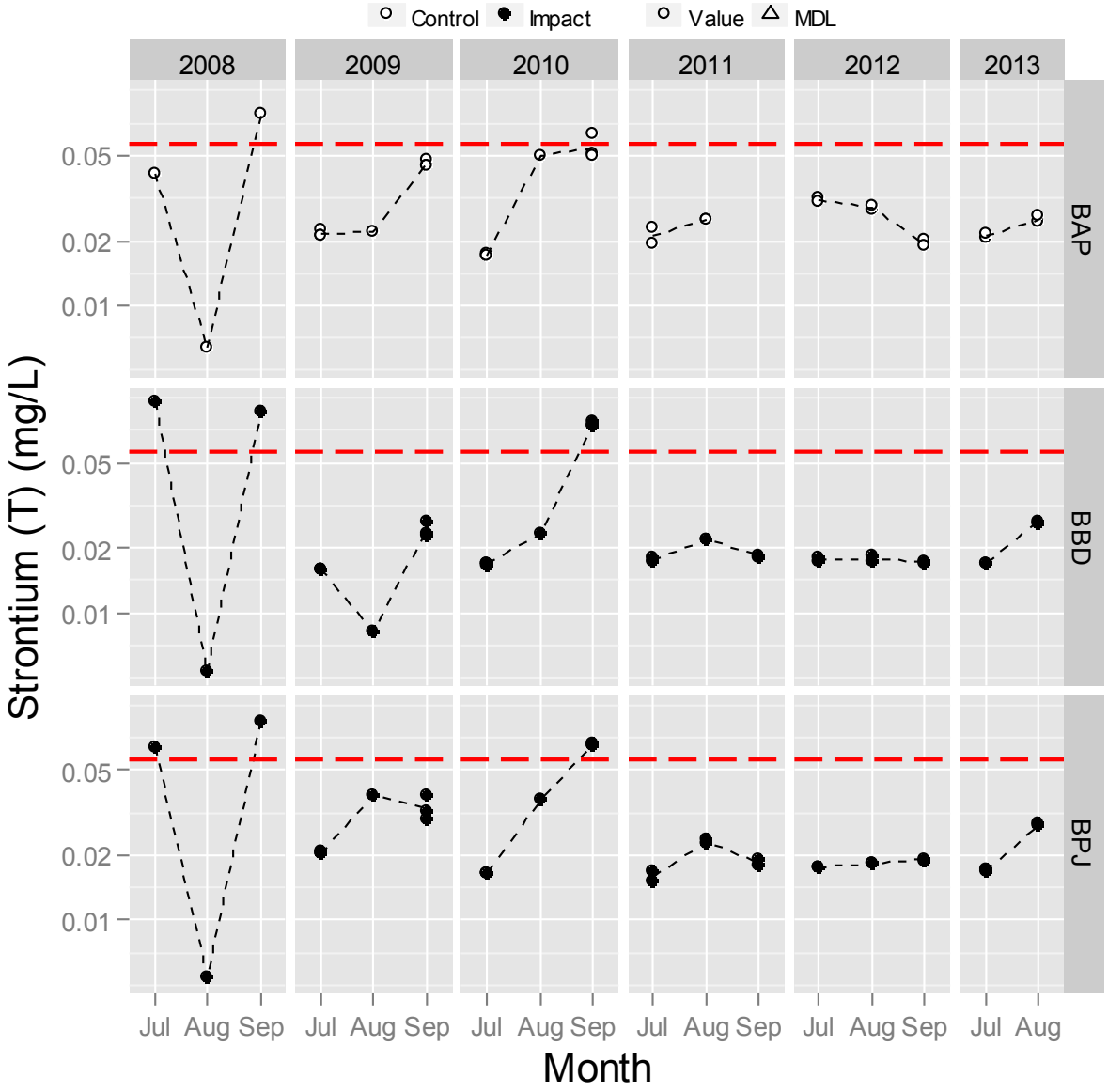


Figure 3.3-70. Total Titanium (mg/L) in water samples from Baker Lake since 2008.

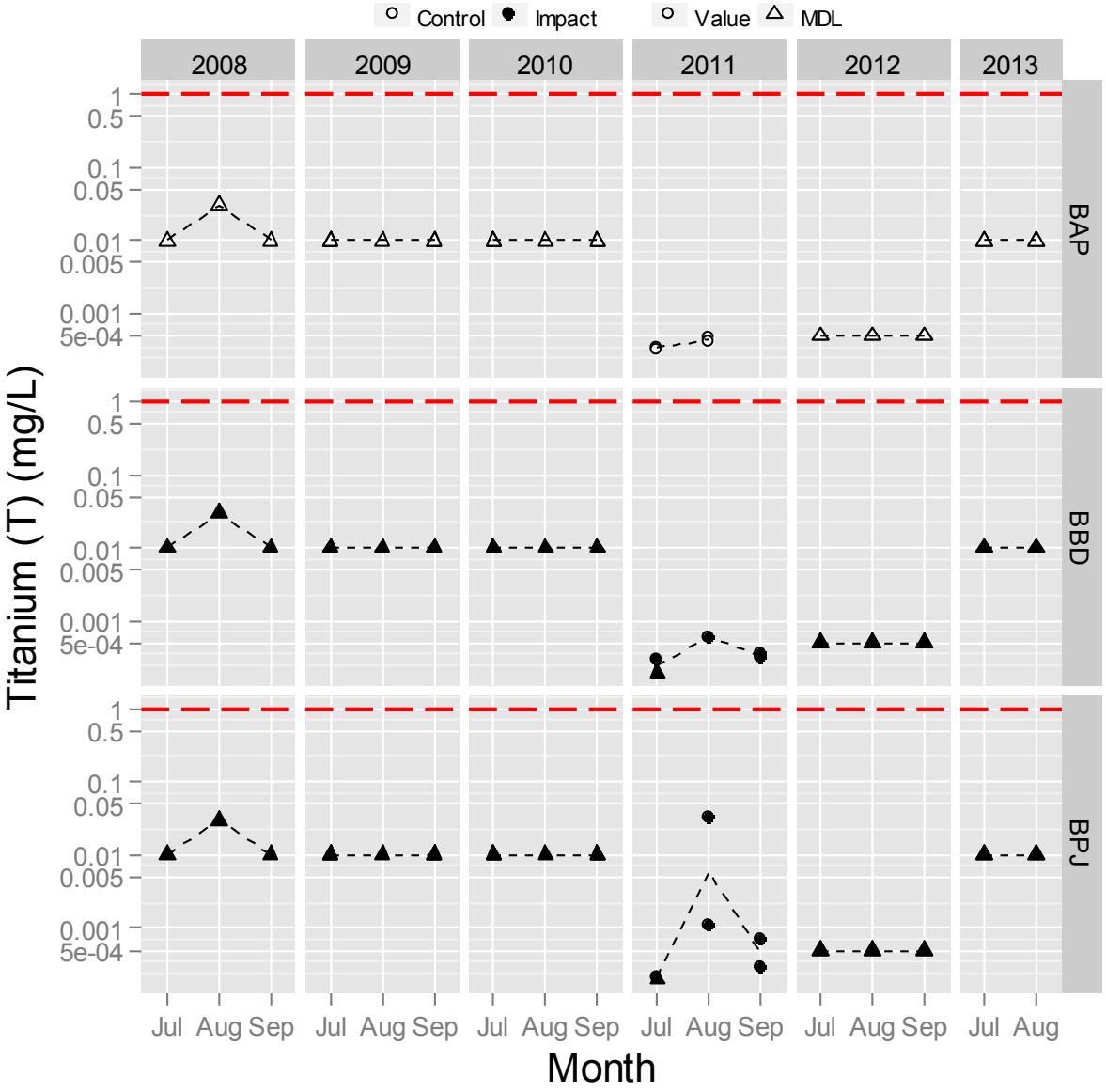


Figure 3.3-71. Total Uranium (mg/L) in water samples from Baker Lake since 2008.

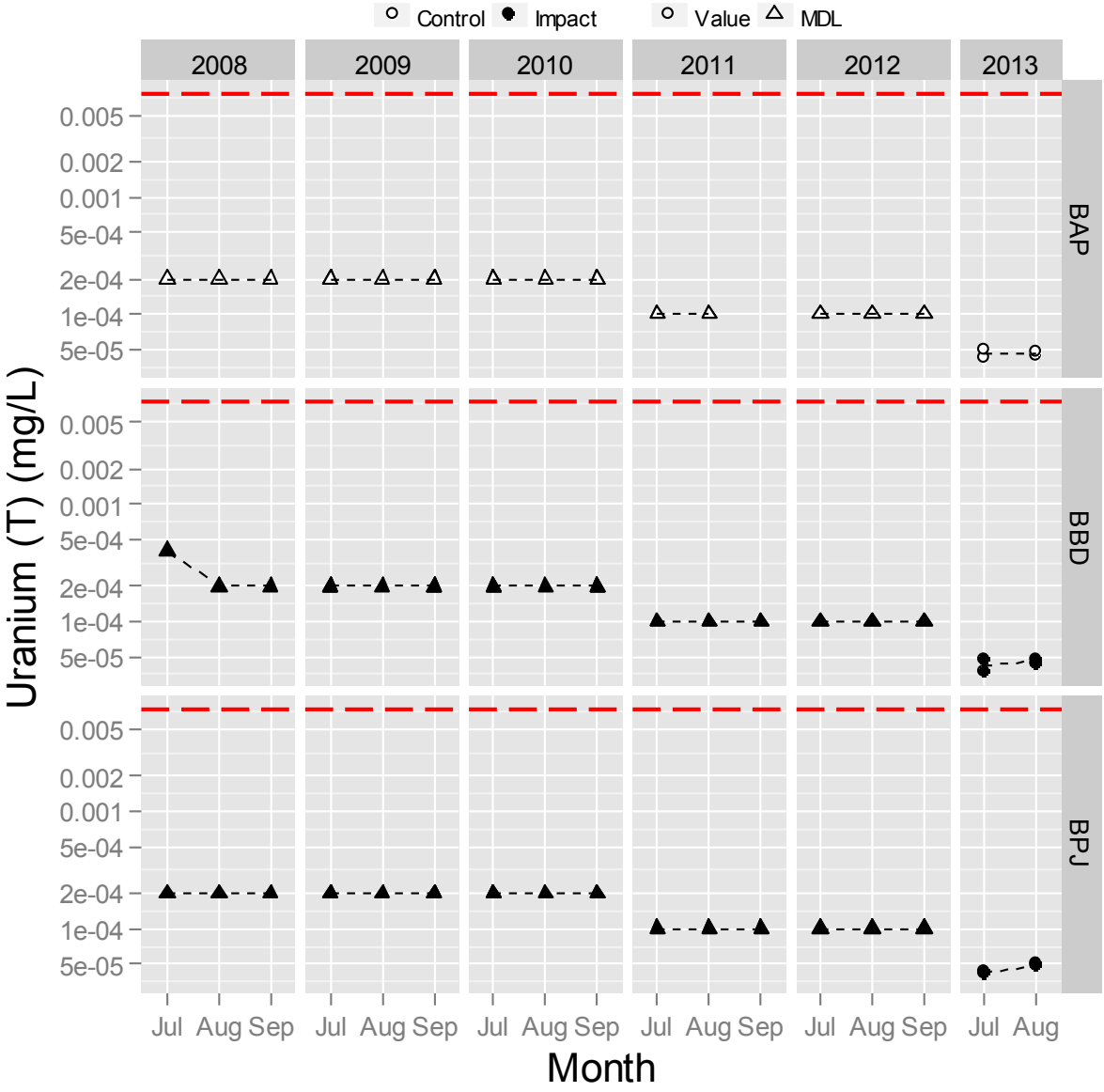


Figure 3.3-72. Dissolved Aluminum (mg/L) in water samples from Baker Lake since 2008.

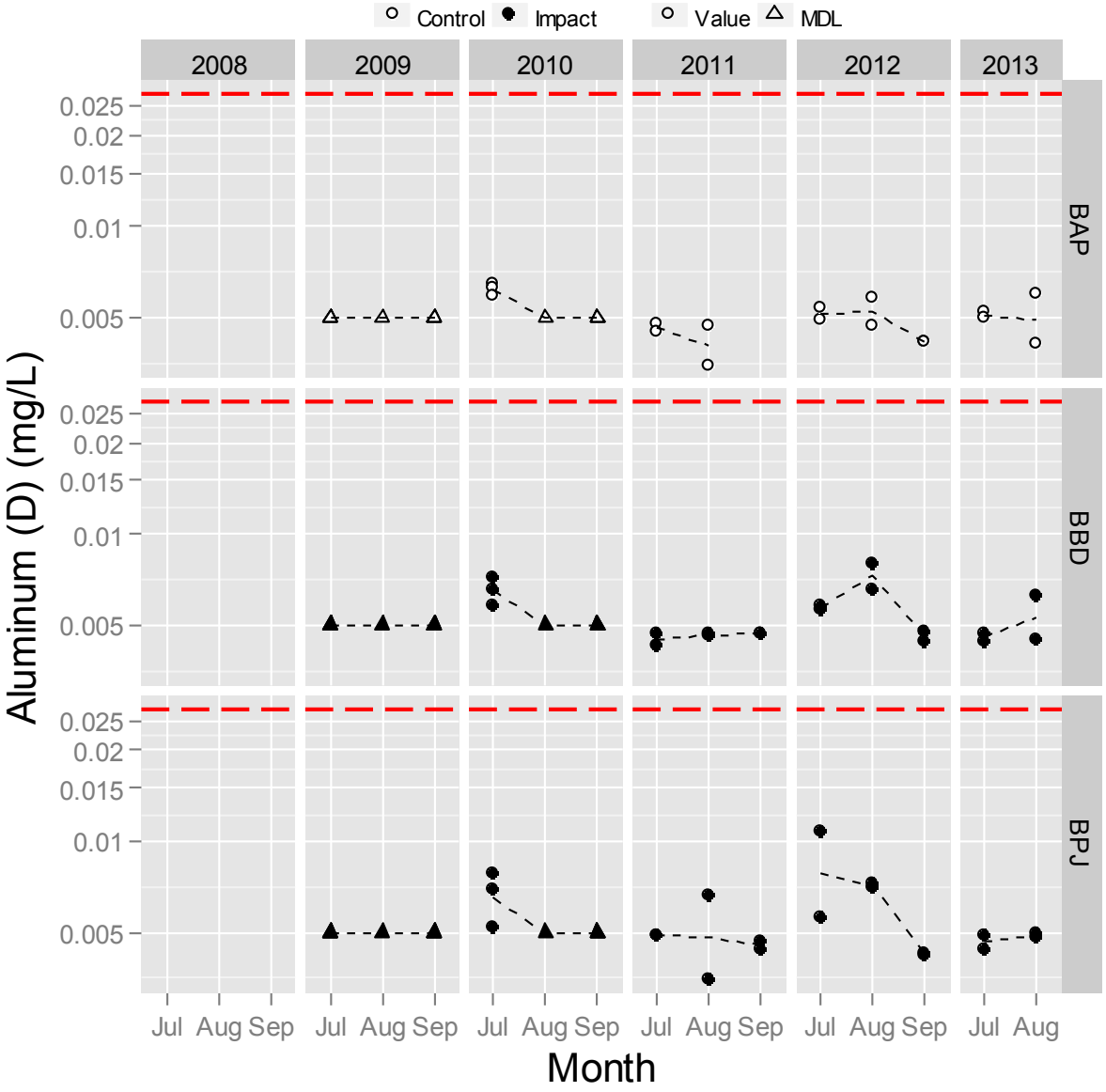


Figure 3.3-73. Dissolved Arsenic (mg/L) in water samples from Baker Lake since 2008.

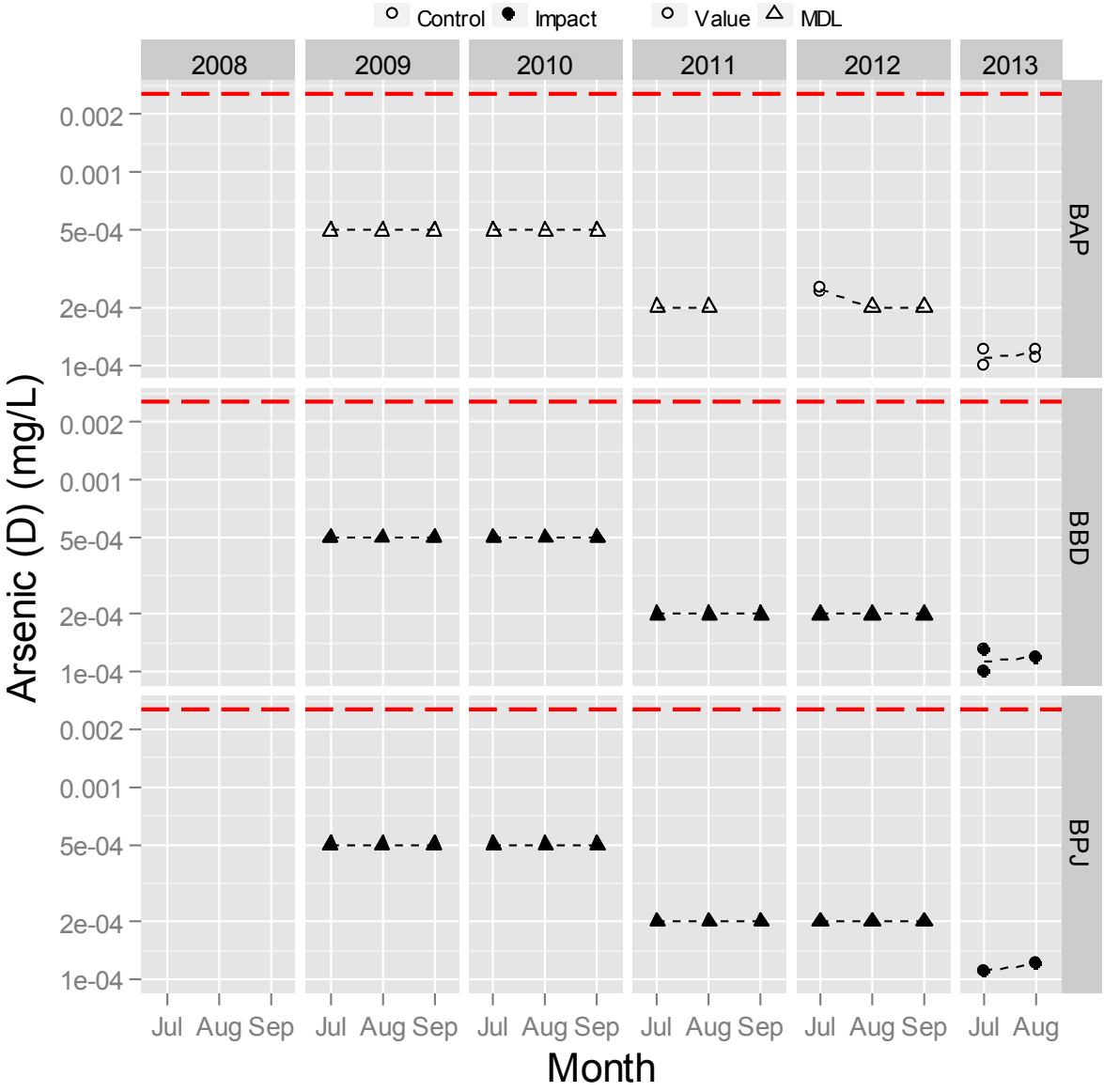


Figure 3.3-74. Dissolved Barium (mg/L) in water samples from Baker Lake since 2008.

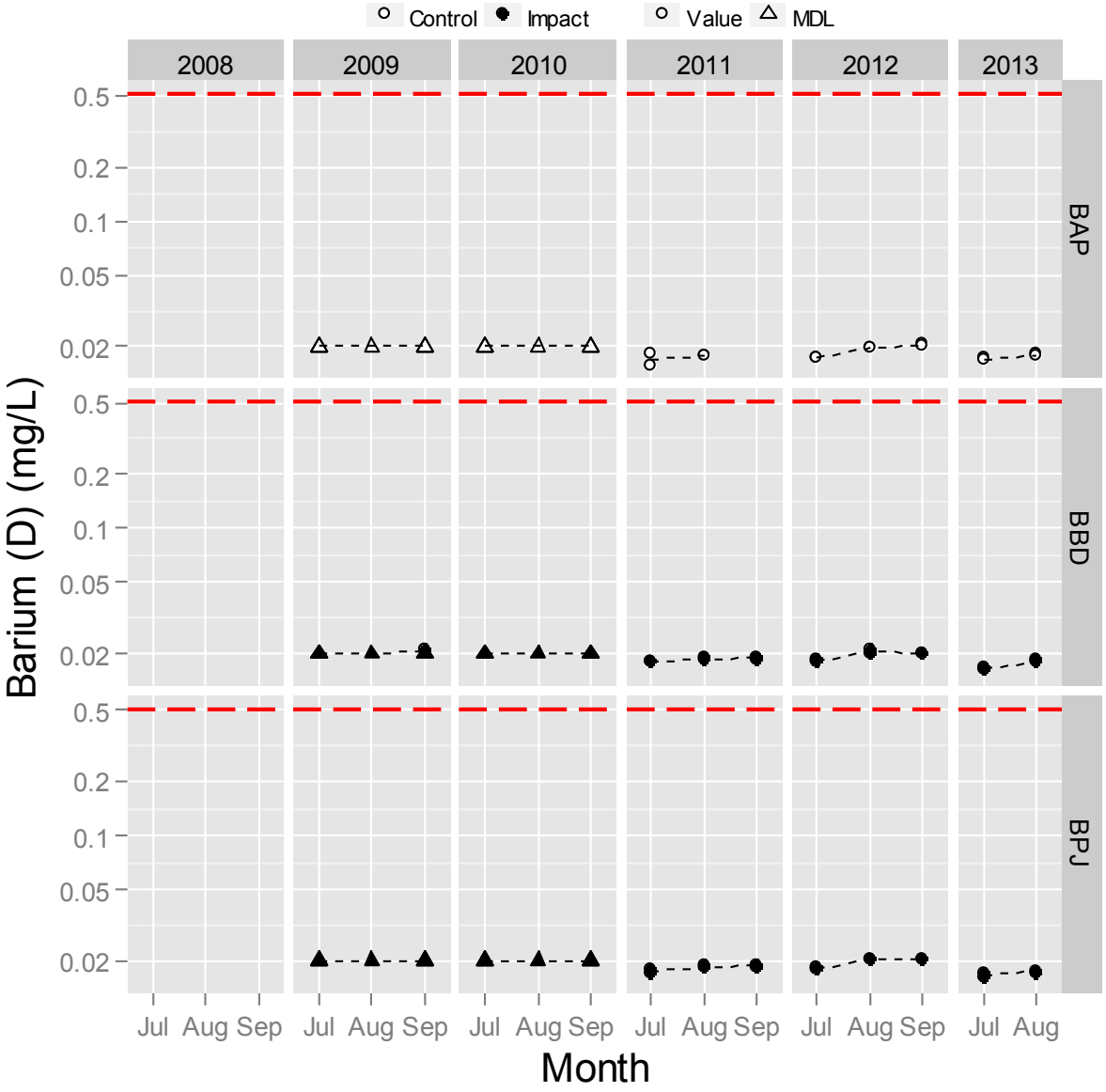


Figure 3.3-75. Dissolved Copper (mg/L) in water samples from Baker Lake since 2008.

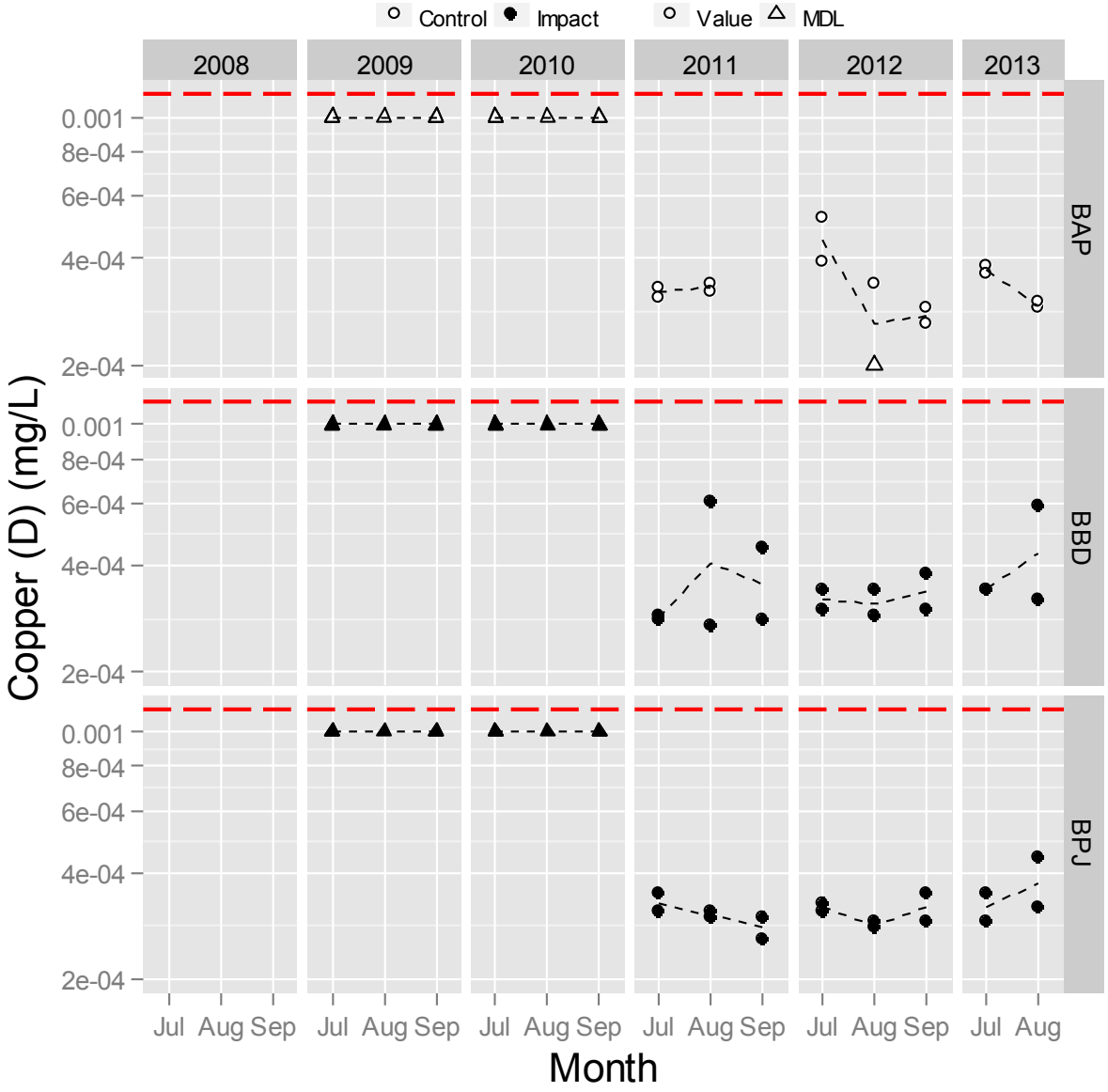


Figure 3.3-76. Dissolved Lithium (mg/L) in water samples from Baker Lake since 2008.

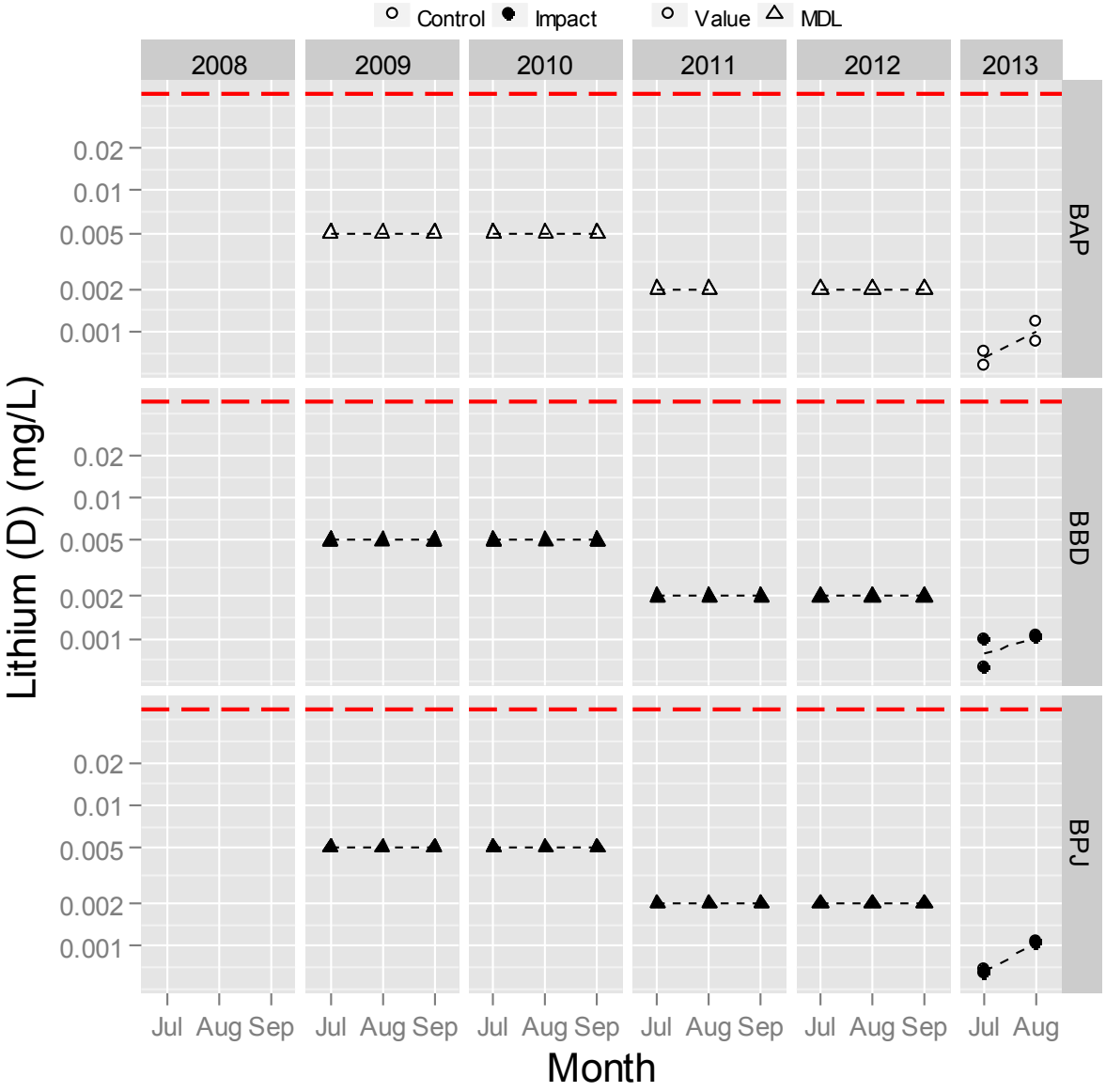


Figure 3.3-77. Dissolved Manganese (mg/L) in water samples from Baker Lake since 2008.

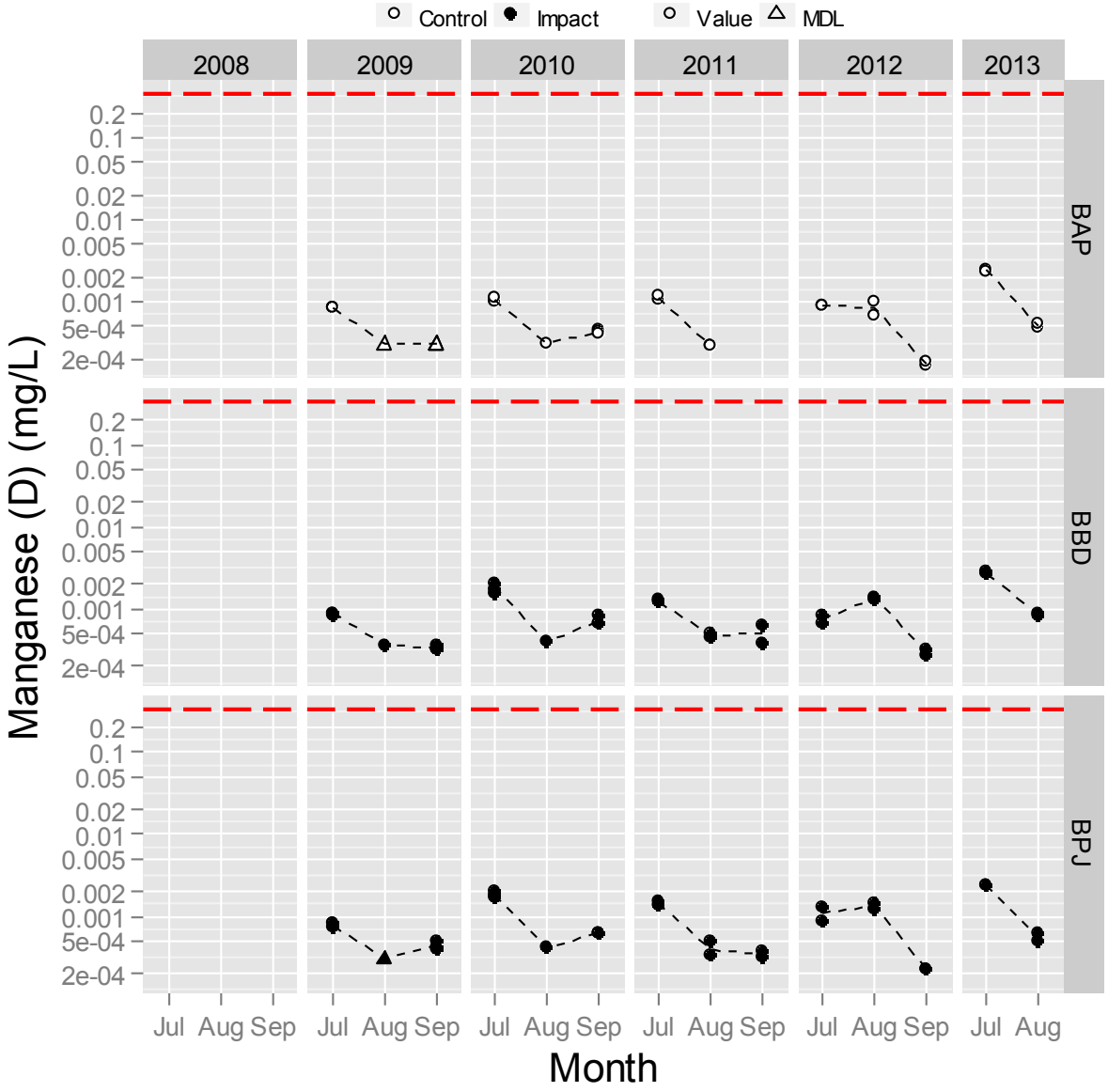


Figure 3.3-78. Dissolved Molybdenum (mg/L) in water samples from Baker Lake since 2008.

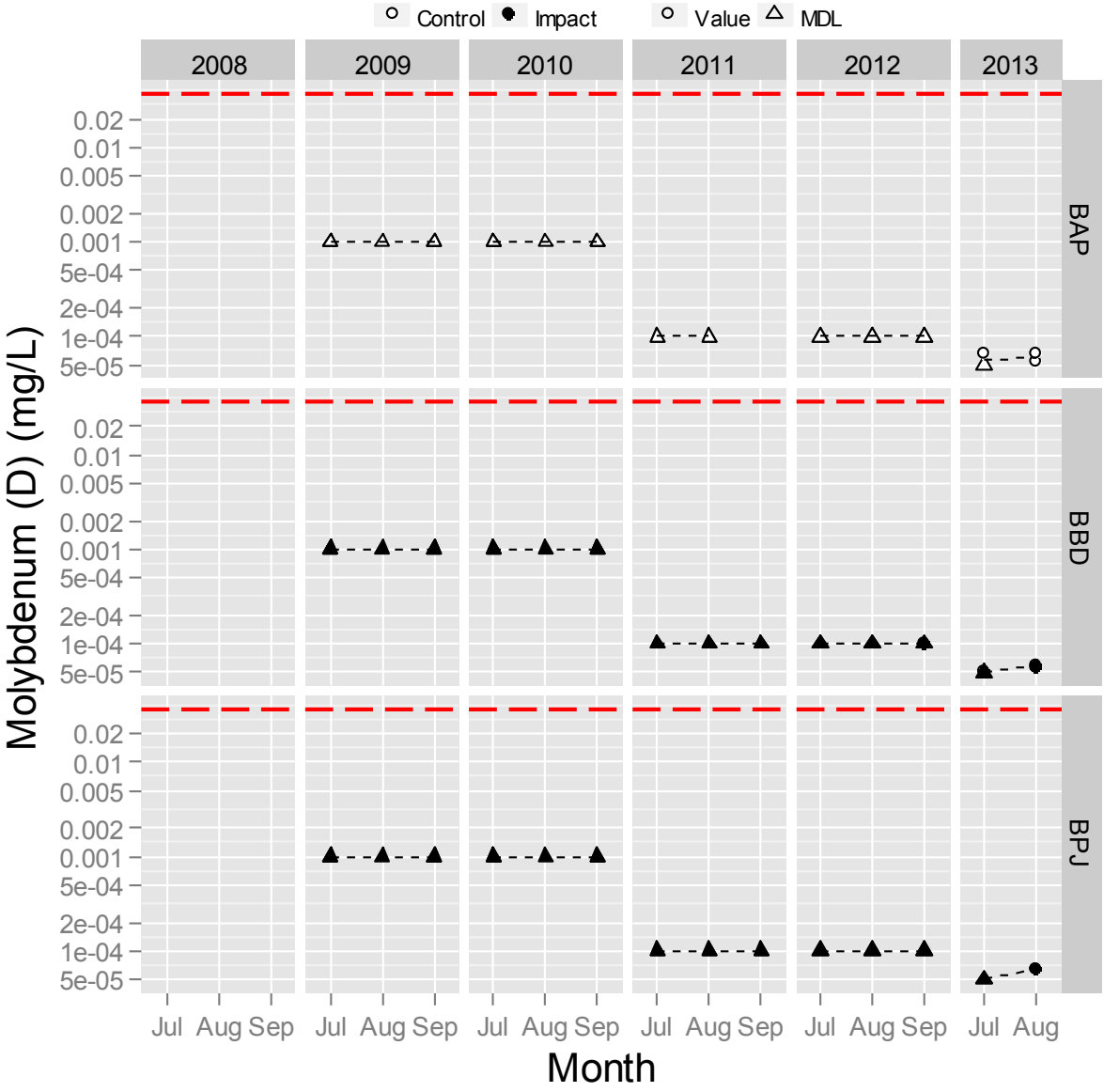


Figure 3.3-79. Dissolved Strontium (mg/L) in water samples from Baker Lake since 2008.

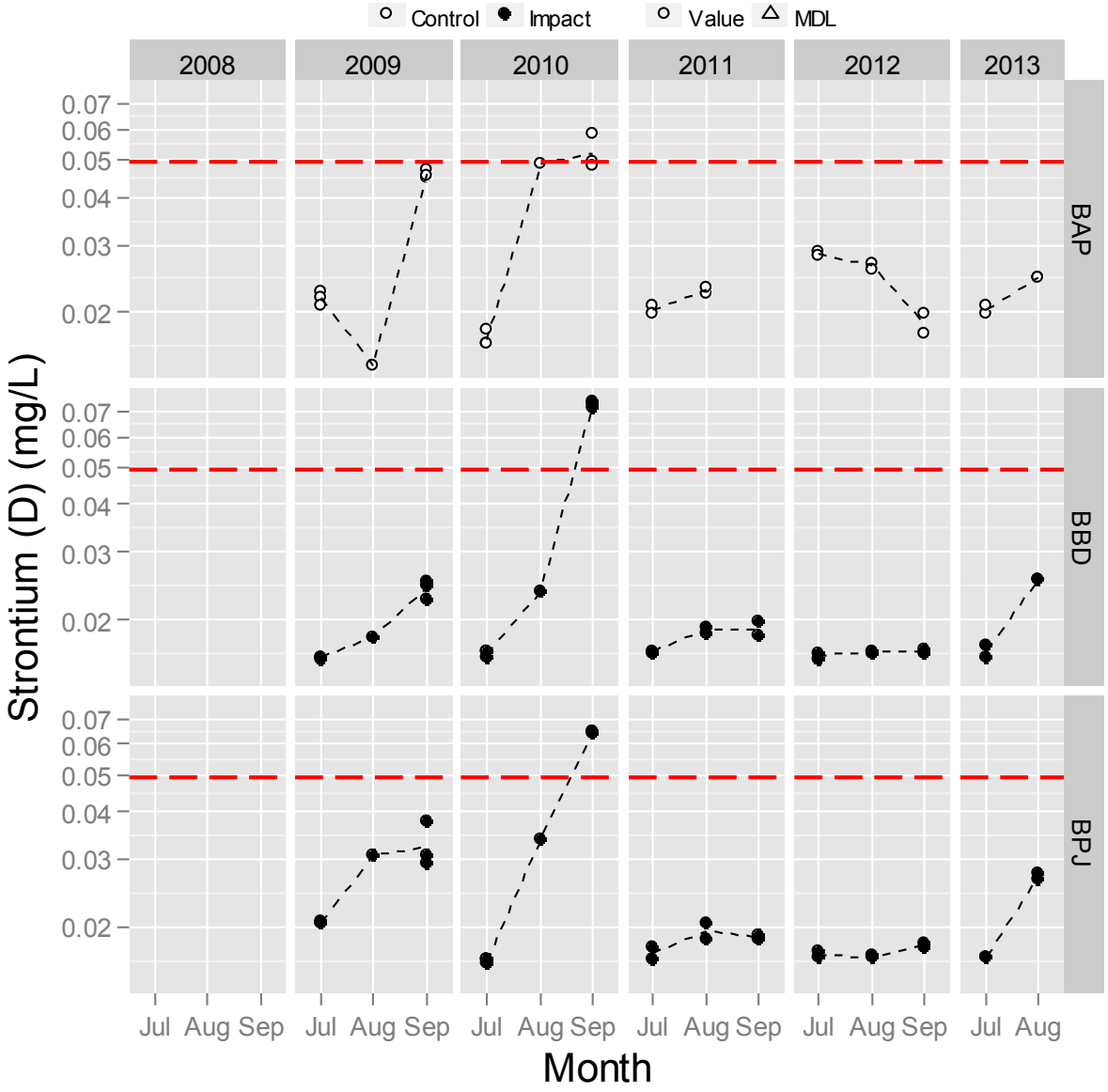
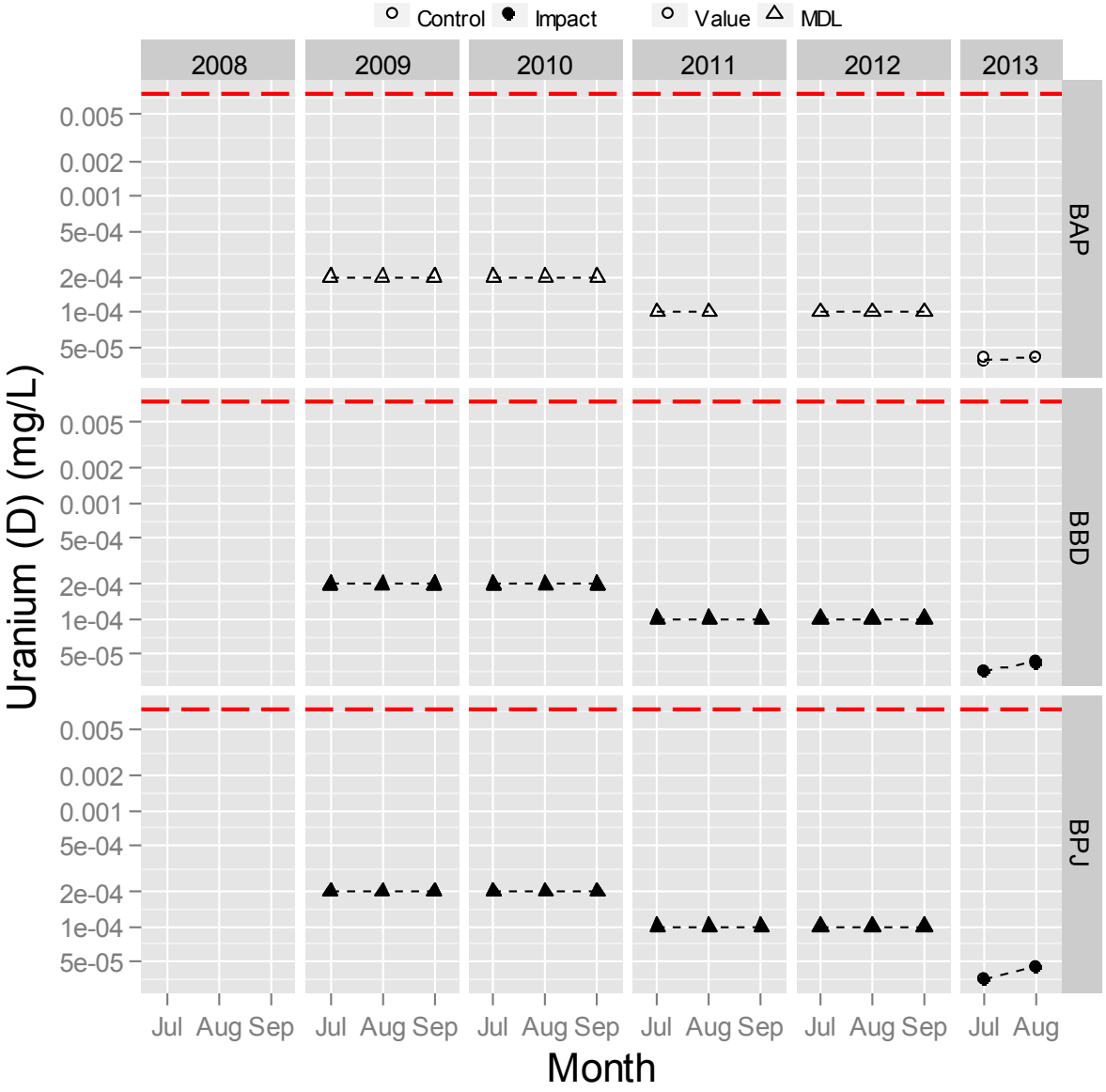


Figure 3.3-80. Dissolved Uranium (mg/L) in water samples from Baker Lake since 2008.



3.4. Sediment Chemistry

3.4.1. Meadowbank Study Lakes

3.4.1.1. General Observations

The natural volume or rate of introduction of particulate materials into the Meadowbank study lakes is low. Because none of the study lakes receives any substantial riverine or tributary inflow, very little sediment is carried into the lakes besides what may drain off of the nearby tundra, or is deposited as dust in rain and snowfall. There are a number of mine-site activities however, that can generate dust, possibly increasing net deposition into project lakes in excess of natural rates.

Based on historical bulk sampling of sediment using grab samples, we have observed reasonably large differences in surface sediment (i.e., top 3 – 5 cm) concentrations for a variety of metals. Although one might intuitively believe that because of the slow net depositional rate of sediments in these lakes, metal concentrations might be more uniform or homogeneous, this is not the case. 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. Sediment coring studies were conducted within each major basin in 2008 (to characterize baseline conditions), 2009 (to monitor changes in sediment chemistry in a subset of basins as part of the EAS following East Dike construction; Azimuth, 2010c) and 2012, further illustrate the magnitude of natural heterogeneity in metals concentrations in the top 1 cm of sediment.

Finally, the degree to which sediments metals concentrations may vary, independent of mine-related activities, include the historical (pre-mine) sedimentation patterns, mineralization areas, bioturbation and different grain size distribution. Grain size has a very large influence on metals concentrations – the more coarse the grain size (i.e., sandier), the lower the metals concentrations. Thus, our sediment programs have attempted to target 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 (**Figure 3.4-1**).

3.4.1.2. Temporal and Spatial Trend Interpretation

To help with interpretation of long-term temporal and spatial trends, concentrations of individual metals have been plotted (**Figures 3.4-2 to 3.4-9**) over time within areas and depict bulk-sediment (i.e., open or closed circles [control versus impact data, respectively] collected using a grab sampler) and surface sediment (i.e., box and whisker plots using a sediment core device). 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 (top 1 cm only) 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 (75^{th}) and lower (25^{th}) percentile concentrations, respectively
- 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.

Coring was conducted initially in July 2008 (i.e., prior to onset of East Dike construction) to characterize baseline surface metals concentrations at all monitoring areas. As noted above, the 2009 study monitored 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, with the last two areas serving as reference areas for SP and TE. The 2012 program covered all Meadowbank study lakes sampling areas as well as reference areas. There was no coring program in 2013; coring is planned for August 2014.

Sediment metals concentrations can naturally be highly variable in mineralized areas, making detection of mine-related events difficult using grab samples (i.e., given the small amount of sediment introduced to the surface layer relative to the volume of sediment sampled from the bottom by the grab). Consequently, while grab data provide insights into sediment chemistry as a result of long-term historical deposition, coring data is much more sensitive and appropriate for assessing changes related to mining activity. Furthermore, given the low sedimentation rates for this region, there is no expectation for inter-annual changes in sediment chemistry due to natural factors; variability seen in the grab data over time in control data is likely due to intra-area spatial heterogeneity (or to laboratory variability or error).

As discussed above (see **Section 1.5**), our approach to identify potential mine-related impacts involved visually searching for temporal/spatial patterns associated with mining activities. In years when sediment cores are collected, the core chemistry results are compared to site-specific triggers/thresholds and cases where means exceed triggers are formally tested using a before-after (BA) statistical model. This year, in the absence of coring data, our approach to describing trends will be visual.

Trend plots for sediment chemistry parameters (including comparison to trigger values) are provided in **Figures 3.4-2 through 3.4-9**. The 2013 sediment chemistry data are screened against site-specific triggers/thresholds in **Table 3.4-1** (metals – grabs), and **Table 3.4-2** (organics - grabs).

While there were a few trigger values exceeded at impact areas (e.g., copper [WAL], chromium [TPN] and zinc [SP, WAL], each were within the range of baseline conditions), there were no anomalous temporal/spatial patterns observed in 2013 for any sediment contaminants except chromium at TPE (**Figure 3.4-5**). Based on the 2012 coring results, last year's CREMP (Azimuth, 2013) identified a temporal trend in chromium concentrations at TPE and flagged it as a trend to watch for 2013. At that time, chromium concentrations in the core samples were near, but did not exceed (based on statistical testing) the trigger value of 114 mg/kg dw.

Historical results show considerable natural differences in sediment chromium concentrations among lakes (**Figure 3.4-5**), with concentrations at PDL and TPS at or above the trigger value. 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); those results suggested spatial heterogeneity in chromium concentrations within TPE (i.e., the results were attributed to inadvertent spatial bias in sampling). However, the increasing concentrations observed since then (**Figure 3.4-5**) suggest a temporal trend. The spatial compilation of all CREMP monitoring results in TPE since 2006 (**Figure 3.4-10**) is not conclusive, as there is evidence of both spatial heterogeneity and temporal variability. Interestingly, chromium concentrations in water (in **Appendix E** due to scarcity of measured concentrations; detection limits were reduced in 2013) at TPE were similar to INUG, with some measured total concentrations near the trigger value but no detectable dissolved concentrations; however, there are too few measured values to put much weight on those results. Given the continued trend in sediment chromium concentrations in 2013 and that the results now exceed the trigger value, we recommend the following targeted study to assess the situation:

- *Confirmation of trend* – A coring study is currently planned for 2014 to coincide with this year's EEM program. The program for TPE should be expanded to target: (1) the zone sampled prior to dike construction in 2008 and 2009 (i.e., the western zone in **Figure 3.4-10**), and (2) the eastern zone sampled since 2010. Given the uncertainty regarding spatial heterogeneity, each zone should include 10 stations. This component of the program should verify whether the observed trend is spatial or temporal.
- *Assessment of ecological relevance* – Following the East Dike sedimentation event in 2008, where elevated metals (including chromium) concentrations were observed in SP, a targeted study was initiated in 2010 to assess metals bioavailability (Azimuth, 2011a). This included sequential extraction analyses and

toxicity testing. While the results verified low metals bioavailability in SP, chromium concentrations were lower there than are currently observed in TPE. Depending on the results of the coring study, a metals bioavailability study in TPE may be warranted. As discussed in **Section 3.6**, there are no apparent adverse trends in benthic invertebrate community density or taxa richness at TPE.

Summary

The only anomalous temporal/spatial pattern observed in 2013 was for chromium in TPE sediment, where this year's grab sample results exceeded the trigger value and are consistent with an increasing temporal trend since 2009. As discussed in **Section 3.6**, the benthic invertebrate community at TPE appears healthy and consistent with baseline conditions. Given the 2013 results, the recommended management action is to follow-up with a targeted coring study to verify the trend (i.e., reduce residual uncertainty) in 2014. The results of the coring study will be used to determine whether any further studies are needed.

3.4.2. Baker Lake

3.4.2.1. General Observations

As discussed earlier, Baker Lake has multiple confounding influences that potentially affect water quality. 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). Other possible contaminant sources would be spills; there were none reported in 2013. 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).

Sediment grain size, which is known to affect sediment chemistry, is a confounding factor in this case as the BAP reference area is generally more sandy, with less silt/clay (**Table 3.4-1 and Figure 3.4-11**). Typically, the more coarse the grain size (i.e., sandier), the lower the metal concentration. Despite our attempt to target areas that are dominated by silt/clay sediment in areas of similar depth (6 – 10 m), this was not always possible.

3.4.2.2. Temporal and Spatial Trend Interpretation

Patterns in metals concentrations within and between areas were 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. Concentrations at exposure or impact areas are uniformly higher than at control / reference areas because of grain size. In 2013, impact area BPJ percent silt/clay was 68% with about 30% sand. At the second impact area, BBD, and the reference areas BAP and BES, sand dominated

grain size distribution (78%, 67% and 71%) with a much smaller fraction of silt/clay in the sediment (about 20 – 30 %) (**Table 3.4-1 and Figure 3.4-11**).

Aluminum, arsenic, chromium, copper, and zinc concentrations at impact areas were reasonably variable, sometimes ranging over an order of magnitude between minimum and maximum concentrations with a similar range in values for all metals between BBD and BPJ (but always higher concentrations at BPJ) (**Figures 3.4-12, 3.4-13, 3.4-15, 3.4-16, and 3.4-19**). Concentrations of the same metals were about 50% lower at the reference areas and were less variable over time with a narrower range in concentration between minimum and maximum values again, likely due to larger grain size. Similar to 2012, the only grab sample mean to exceed a trigger was arsenic at BPJ.

Cadmium and mercury were consistently at or just above laboratory MDLs (**Figures 3.4-14, and 3.4-18**). When MDLs were lowered for these metals (and for lead; **Figure 3.4-17**) in 2011, concentrations were about an order of magnitude lower and similar across all areas.

Summary

There is no evidence of 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 (including the newly added BES area), 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 3.4-1. Conventional sediment grab chemistry, partical size, and total metals (mg/kg), Meadowbank study lakes and Baker Lake, August 2013.

Lake & Basin	CCME (2002)					Third Portage Lake				
						East Basin					North Basin				
Area-Replicate ID	Guideline[1]	Trigger[2]		Threshold[2]		TPE-1	TPE-2	TPE-3	TPE-4	TPE-5	TPN-1	TPN-2	TPN-3	TPN-4	TPN-5
Date	ISQG	Meadowbank	Baker Lake	Meadowbank	Baker Lake	27-Aug-13	27-Aug-13	27-Aug-13	27-Aug-13	27-Aug-13	28-Aug-13	28-Aug-13	28-Aug-13	28-Aug-13	28-Aug-13
Physical & Organic Parameters															
Moisture (%)						86.7	87.5	85.3	87.3	86.5	79.0	80.3	60.5	60.2	80.1
pH						6.54	6.77	6.88	6.80	7.60	5.87	5.69	5.81	6.32	6.90
Total Organic Carbon (% dw)						4.02	3.82	3.84	4.06	4.42	2.75	2.00	1.00	1.15	2.68
Particle Size															
% Gravel (>2mm)						*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	9.30	0.37	*<0.10*
% Sand (2.00mm - 0.063mm)						2.07	2.04	1.28	1.57	1.93	31.0	39.7	40.5	45.0	15.6
% Silt (0.063mm - 4µm)						68.7	67.0	67.5	68.4	70.1	51.3	46.9	36.2	39.4	65.4
% Clay (<4µm)						29.3	30.9	31.2	30.1	28.0	17.8	13.4	14.1	15.3	19.1
Total Metals (mg/kg dw)															
Aluminum						21900	24900	25400	25500	23500	15900	12800	15500	19200	15100
Antimony						0.25	0.23	0.26	0.24	0.26	0.15	0.13	0.13	0.15	0.17
Arsenic*	5.9	120.0	8.3			16.4	17.2	21.6	18.8	20.8	9.17	10.0	10.6	14.1	14.2
Barium						103	140	127	133	138	58.1	49.1	57.0	80.2	71.4
Beryllium						1.48	1.69	1.73	1.62	1.54	0.94	0.75	0.81	1.00	0.77
Bismuth						1.80	2.28	2.15	2.17	2.02	0.93	0.73	0.89	1.11	0.82
Cadmium*	0.6	1.10	0.55		0.6	0.257	0.623	0.425	0.411	0.785	0.079	0.053	0.051	0.093	0.091
Calcium						2780	2190	2320	2420	2300	1440	1110	1030	1600	1800
Chromium*	37.3	114.3	27.0		37.3	**132**	114	**162**	**139**	**152**	102	82.5	91.0	102	90.5
Cobalt						15.1	16.5	19.2	16.9	18.2	8.37	7.56	9.53	12.5	9.46
Copper*	35.7	126.0	20.5		35.7	43.4	50.9	50.9	49.0	49.9	40.2	31.5	33.0	41.4	29.7
Iron						40500	41400	47800	45200	44100	22300	22500	26600	31400	26900
Lead	35	32.5	32.5	35	35	19.2	26.2	20.6	19.9	21.1	12.8	10.0	11.8	13.3	11.5
Lithium						36.4	46.1	43.2	41.8	39.7	24.9	20.5	27.1	34.6	21.8
Magnesium						9120	9390	10700	10400	10300	7190	6270	7360	8970	6870
Manganese						2580	4150	3410	3480	6630	253	311	412	690	596
Mercury	0.17	0.104	0.088	0.17	0.17	0.0188	0.0180	0.0185	0.0172	0.0230	0.0110	0.0080	0.0055	0.0081	0.0105
Molybdenum						4.27	3.82	4.45	3.88	4.14	1.81	1.62	1.74	2.32	2.20
Nickel						93.6	164	120	125	204	49.5	40.4	46.7	59.4	45.2
Phosphorus						384	425	432	457	435	481	380	309	312	323
Potassium						3830	4310	4150	4070	3770	2270	1870	2220	3040	2280
Selenium						0.76	0.83	0.92	0.89	0.84	0.44	0.30	0.22	0.26	0.49
Silver						*<0.10*	*<0.10*	0.12	0.13	0.19	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*
Sodium						250	180	160	170	160	*<100*	*<100*	*<100*	120	130
Strontium						20.5	18.4	18.4	19.3	18.0	13.4	10.8	10.8	16.4	15.6
Thallium						0.321	0.513	0.430	0.433	0.504	0.163	0.131	0.166	0.206	0.158
Tin						3.3	13.5	*<2.0*	*<2.0*	2.0	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*
Titanium						760	807	765	796	682	480	412	540	704	497
Uranium						12.3	15.6	14.8	14.9	13.5	11.4	9.10	11.3	13.3	9.15
Vanadium						37.6	40.2	43.0	41.3	40.0	27.5	23.1	27.9	33.4	26.2
Zinc*	123	121.3	73.6		123	93.7	119	109	112	117	61.6	51.6	63.5	83.6	62.1

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 "CREMP Design Document 2012" (Azimuth, 2012). 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 3.4-1. Conventional sediment grab chemistry, partical size, and total metals (mg/kg), Meadowbank study lakes and Baker Lake, August 2013.

Lake & Basin	CCME (2002)					South Basin					Second Portage Lake				
Area-Replicate ID	Guideline[1]	Trigger[2]		Threshold[2]		TPS-1	TPS-2	TPS-3	TPS-4	TPS-5	SP-1	SP-2	SP-3	SP-4	SP-5
Date	ISQG	Meadowbank	Baker Lake	Meadowbank	Baker Lake	27-Aug-13	27-Aug-13	27-Aug-13	27-Aug-13	27-Aug-13	25-Aug-13	25-Aug-13	25-Aug-13	25-Aug-13	25-Aug-13
Physical & Organic Parameters															
Moisture (%)						85.8	84.7	83.6	87.0	85.0	85.0	86.2	86.4	85.8	86.2
pH						5.99	5.88	5.55	6.13	5.56	6.17	6.08	6.44	6.37	6.27
Total Organic Carbon (% dw)						4.55	4.32	3.92	5.70	4.57	3.93	4.58	3.95	4.53	4.03
Particle Size															
% Gravel (>2mm)						*<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)						2.85	2.65	12.2	3.79	12.7	1.49	1.76	1.40	1.67	2.04
% Silt (0.063mm - 4µm)						70.3	68.7	61.7	75.6	69.1	69.7	73.7	68.4	71.4	65.1
% Clay (<4µm)						26.9	28.7	26.1	20.6	18.2	28.8	24.6	30.2	26.9	32.9
Total Metals (mg/kg dw)															
Aluminum						24100	19800	22000	22000	21200	25000	21900	26500	22900	28000
Antimony						0.25	0.19	0.22	0.29	0.20	0.24	0.27	0.24	0.25	0.26
Arsenic*	5.9	120.0	8.3			31.5	13.2	13.9	48.9	11.3	41.3	37.9	26.5	35.0	34.2
Barium						108	80.1	102	142	97.5	129	144	126	135	129
Beryllium						1.52	1.15	1.38	1.45	1.31	2.02	1.67	1.96	1.80	2.21
Bismuth						1.59	1.23	1.39	1.52	1.25	2.32	1.94	2.44	2.11	2.58
Cadmium*	0.6	1.10	0.55		0.6	0.323	0.156	0.405	0.942	0.347	0.234	0.274	0.203	0.280	0.240
Calcium						1860	1400	1790	1940	1900	2210	2530	2280	2420	2390
Chromium*	37.3	114.3	27.0		37.3	**115**	91.7	106	106	101	81.2	85.6	85.8	94.7	98.5
Cobalt						19.3	12.8	16.1	41.5	11.2	17.2	21.0	15.8	17.6	16.2
Copper*	35.7	126.0	20.5		35.7	70.1	52.3	59.0	65.8	57.5	74.9	63.5	74.5	67.0	79.9
Iron						46300	25000	27800	73700	26000	79900	80000	58500	78000	58100
Lead	35	32.5	32.5	35	35	21.0	15.7	19.3	24.5	18.2	21.1	19.8	22.3	20.9	24.1
Lithium						34.5	28.6	34.3	31.1	30.8	42.0	36.5	44.1	37.7	50.3
Magnesium						9470	7400	8980	8390	8950	9080	8730	9880	9370	10200
Manganese						1270	609	758	3690	336	1780	7150	2160	3930	1710
Mercury	0.17	0.104	0.088	0.17	0.17	0.0222	0.0158	0.0175	0.0333	0.0193	0.0302	0.0355	0.0302	0.0337	0.0284
Molybdenum						5.96	3.02	2.89	6.36	2.75	7.80	6.66	5.75	6.88	6.78
Nickel						79.0	57.8	78.1	145	69.7	63.9	78.2	62.6	74.0	69.8
Phosphorus						473	391	361	966	472	714	593	591	572	528
Potassium						3800	3110	3710	3550	3360	4510	3850	4720	3970	4640
Selenium						1.00	0.59	0.62	1.06	0.86	0.95	0.92	0.82	0.89	0.72
Silver						0.19	0.12	0.14	0.24	0.18	0.15	0.18	0.11	0.17	0.11
Sodium						160	140	180	190	160	210	170	210	170	170
Strontium						16.9	13.3	16.6	17.8	16.1	20.5	21.7	20.8	20.8	20.9
Thallium						0.295	0.224	0.288	0.426	0.258	0.388	0.339	0.385	0.360	0.398
Tin						*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*
Titanium						635	560	725	635	690	830	662	817	699	778
Uranium						18.6	13.9	16.5	17.2	16.7	19.6	16.4	20.8	17.7	23.0
Vanadium						40.0	32.6	38.7	37.6	36.1	40.5	36.7	42.6	38.9	45.6
Zinc*	123	121.3	73.6		123	104	77.8	104	**124**	93.7	119	107	118	111	**127**

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 "CREMP Design Document 2012" (Azimuth, 2012). 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 3.4-1. Conventional sediment grab chemistry, partical size, and total metals (mg/kg), Meadowbank study lakes and Baker Lake, August 2013.

Lake & Basin	CCME (2002)					Tehek Lake					Tehek Farfield				
Area-Replicate ID	Guideline[1]	Trigger[2]		Threshold[2]		TE-1	TE-2	TE-3	TE-4	TE-5	TEFF-1	TEFF-2	TEFF-3	TEFF-4	TEFF-5
Date	ISQG	Meadowbank	Baker Lake	Meadowbank	Baker Lake	24-Aug-13	24-Aug-13	24-Aug-13	24-Aug-13	24-Aug-13	24-Aug-13	24-Aug-13	24-Aug-13	24-Aug-13	24-Aug-13
Physical & Organic Parameters															
Moisture (%)						77.3	80.2	82.0	85.1	84.6	86.7	86.5	86.6	88.0	85.9
pH						5.49	6.02	6.32	6.04	5.95	6.12	6.32	6.19	6.24	6.34
Total Organic Carbon (% dw)						2.54	2.64	3.01	3.96	3.12	4.05	4.19	3.74	4.42	3.73
Particle Size															
% Gravel (>2mm)						0.15	1.57	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*
% Sand (2.00mm - 0.063mm)						22.3	23.7	8.07	3.50	2.78	1.28	2.87	1.80	1.62	2.96
% Silt (0.063mm - 4µm)						60.5	56.6	66.9	70.9	68.8	67.7	67.5	67.6	68.8	75.4
% Clay (<4µm)						17.0	18.2	25.1	25.6	28.4	31.0	29.6	30.6	29.6	21.7
Total Metals (mg/kg dw)															
Aluminum						18500	17900	21200	21100	25500	25300	23900	25200	24500	24900
Antimony						0.15	0.13	0.18	0.21	0.18	0.19	0.16	0.16	0.22	0.15
Arsenic*	5.9	120.0	8.3			13.3	14.2	21.2	53.8	20.7	12.3	10.8	13.6	12.2	12.0
Barium						95.6	82.1	112	132	132	121	117	119	118	113
Beryllium						1.59	1.51	1.78	1.83	2.10	2.14	1.86	1.95	1.84	1.92
Bismuth						1.69	1.60	1.95	1.97	2.21	1.95	1.81	1.90	1.94	1.88
Cadmium*	0.6	1.10	0.55		0.6	0.173	0.091	0.215	0.362	0.214	0.168	0.172	0.135	0.200	0.122
Calcium						1940	1910	1900	2040	2150	2110	1960	1890	2050	1970
Chromium*	37.3	114.3	27.0		37.3	46.7	45.4	52.8	52.6	59.0	60.4	55.9	57.4	56.9	57.7
Cobalt						8.40	8.78	13.0	11.6	14.8	13.3	11.8	13.4	13.1	12.9
Copper*	35.7	126.0	20.5		35.7	44.5	42.9	52.8	55.8	59.4	55.9	51.4	57.0	55.4	53.4
Iron						37000	54700	75500	88500	64500	41900	39900	51800	43100	42600
Lead	35	32.5	32.5	35	35	18.1	16.6	19.4	20.7	21.7	21.6	20.4	20.6	21.4	20.9
Lithium						36.3	34.5	38.6	39.7	46.6	51.7	46.8	47.7	45.2	53.7
Magnesium						7220	6810	7520	7690	8790	8800	8180	8660	8520	8360
Manganese						452	844	3620	2620	5260	2110	1640	3130	2500	1680
Mercury	0.17	0.104	0.088	0.17	0.17	0.0220	0.0254	0.0294	0.0310	0.0223	0.0206	0.0211	0.0190	0.0226	0.0179
Molybdenum						3.82	5.87	7.45	11.9	8.68	4.87	4.36	5.33	4.54	4.52
Nickel						34.6	29.9	41.8	54.3	53.8	40.1	40.9	38.9	42.2	38.0
Phosphorus						801	554	554	1490	542	469	617	536	503	543
Potassium						3570	3360	3910	3820	4470	4620	4360	4560	4500	4600
Selenium						0.56	0.71	0.84	0.87	0.83	0.75	0.83	0.78	0.85	0.73
Silver						0.13	0.12	0.13	0.20	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*
Sodium						150	140	170	170	200	190	200	190	210	230
Strontium						16.4	14.8	16.7	18.2	19.2	19.6	18.6	18.3	18.8	19.1
Thallium						0.305	0.271	0.335	0.363	0.396	0.434	0.386	0.405	0.422	0.403
Tin						*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	2.4	*<2.0*	2.3	*<2.0*
Titanium						848	746	817	760	896	855	833	812	810	878
Uranium						16.6	15.2	18.9	18.8	22.2	25.2	22.5	24.8	23.9	23.8
Vanadium						30.2	28.3	32.9	33.0	38.1	39.0	36.1	37.8	37.0	38.4
Zinc*	123	121.3	73.6		123	90.0	80.1	96.3	111	116	112	107	108	110	110

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 "CREMP Design Document 2012" (Azimuth, 2012). 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 3.4-1. Conventional sediment grab chemistry, partical size, and total metals (mg/kg), Meadowbank study lakes and Baker Lake, August 2013.

Lake & Basin	CCME (2002)					Inuggugayualik Lake					Wally Lake				
Area-Replicate ID	Guideline[1]	Trigger[2]		Threshold[2]		INUG-1	INUG-2	INUG-3	INUG-4	INUG-5	WAL-1	WAL-2	WAL-3	WAL-4	WAL-5
Date	ISQG	Meadowbank	Baker Lake	Meadowbank	Baker Lake	23-Aug-13	23-Aug-13	23-Aug-13	23-Aug-13	23-Aug-13	26-Aug-13	26-Aug-13	26-Aug-13	26-Aug-13	26-Aug-13
Physical & Organic Parameters															
Moisture (%)						86.5	85.9	85.5	84.9	84.2	91.0	88.4	88.7	90.5	89.7
pH						5.82	5.48	5.30	5.79	5.97	6.50	6.80	6.69	6.65	6.82
Total Organic Carbon (% dw)						4.49	4.47	4.00	4.47	3.96	9.12	6.51	5.80	8.98	8.00
Particle Size															
% Gravel (>2mm)						*<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)						2.48	2.89	10.9	3.73	2.15	1.38	3.00	6.07	2.05	2.45
% Silt (0.063mm - 4µm)						78.9	78.2	73.5	74.2	80.1	87.5	81.6	84.9	88.3	88.0
% Clay (<4µm)						18.6	19.0	15.6	22.1	17.7	11.2	15.4	9.08	9.67	9.57
Total Metals (mg/kg dw)															
Aluminum						18100	19500	18900	21900	15900	20400	24500	22200	21200	18900
Antimony						0.18	0.17	0.15	0.17	0.13	0.45	0.66	0.36	0.39	0.39
Arsenic*	5.9	120.0	8.3			**228**	82.1	47.3	22.8	**193**	61.4	18.2	19.3	36.3	28.4
Barium						138	127	93.2	120	86.2	121	157	118	117	102
Beryllium						1.24	1.29	1.14	1.32	1.00	1.68	1.73	1.59	1.62	1.42
Bismuth						1.02	1.15	1.08	1.16	0.92	2.09	2.45	2.25	2.10	1.91
Cadmium*	0.6	1.10	0.55		0.6	0.245	0.274	0.134	0.260	0.093	0.533	1.04	0.482	0.436	0.434
Calcium						1810	1770	1640	1980	1600	3920	3950	3480	4430	3890
Chromium*	37.3	114.3	27.0		37.3	92.6	98.5	95.2	103	79.1	60.8	64.3	61.8	58.7	54.2
Cobalt						14.8	14.8	11.2	14.3	14.2	10.1	10.7	8.53	9.38	8.63
Copper*	35.7	126.0	20.5		35.7	43.6	44.7	40.9	44.9	33.4	**162**	**150**	**141**	**143**	**129**
Iron						124000	89100	58300	52400	162000	47400	28200	27600	36400	30400
Lead	35	32.5	32.5	35	35	12.5	13.7	12.6	14.2	10.5	**35.5**	**38.3**	**33.2**	**34.7**	31.5
Lithium						21.7	23.0	21.6	24.5	19.5	31.8	43.3	39.0	33.6	32.9
Magnesium						7910	8480	8180	8940	7040	7550	9150	8210	7690	7450
Manganese						2710	1940	644	1350	1930	431	366	305	379	343
Mercury	0.17	0.104	0.088	0.17	0.17	0.0292	0.0295	0.0242	0.0311	0.0241	0.0807	0.0473	0.0368	0.0745	0.0583
Molybdenum						9.03	5.64	5.64	3.72	13.7	12.8	6.49	5.72	8.78	6.54
Nickel						84.1	85.0	62.8	85.4	49.8	58.6	65.0	54.1	54.4	50.2
Phosphorus						3430	2300	942	994	1460	804	617	460	722	633
Potassium						2800	3040	3010	3270	2490	3370	4230	3650	3480	3230
Selenium						0.80	0.76	0.66	0.73	0.71	1.23	1.25	0.91	1.03	0.91
Silver						0.16	0.18	0.11	0.16	0.12	0.68	0.62	0.43	0.56	0.53
Sodium						140	140	160	170	130	160	170	160	170	180
Strontium						23.0	23.6	22.4	25.0	19.9	25.8	27.1	25.1	28.6	26.0
Thallium						0.201	0.215	0.185	0.217	0.146	0.317	0.401	0.319	0.315	0.294
Tin						*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*
Titanium						435	487	544	557	426	528	815	714	597	622
Uranium						14.1	15.4	14.0	16.0	11.8	17.4	24.4	16.4	16.1	15.5
Vanadium						30.8	33.0	32.6	35.1	26.8	32.4	35.6	33.2	31.6	29.4
Zinc*	123	121.3	73.6		123	85.5	85.4	78.4	88.0	61.4	**130**	**152**	113	**122**	109

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 "CREMP Design Document 2012" (Azimuth, 2012). Thresholds are set equal to CCME ISQG guidelines, where available.

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123 **Bolded concentrations exceed the trigger value.**

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

Italicized numbers are below detection limits.

Table 3.4-1. Conventional sediment grab chemistry, partical size, and total metals (mg/kg), Meadowbank study lakes and Baker Lake, August 2013.

Lake & Basin	CCME (2002)					Pipedream Lake					Baker Lake				
											Barge Dock				
Area-Replicate ID	Guideline[1]	Trigger[2]		Threshold[2]		PDL-1	PDL-2	PDL-3	PDL-4	PDL-5	BBD-1	BBD-2	BBD-3	BBD-4	BBD-5
Date	ISQG	Meadowbank	Baker Lake	Meadowbank	Baker Lake	23-Aug-13	23-Aug-13	23-Aug-13	23-Aug-13	23-Aug-13	29-Aug-13	29-Aug-13	29-Aug-13	29-Aug-13	29-Aug-13
Physical & Organic Parameters															
Moisture (%)						82.5	84.9	84.7	71.9	80.6	35.8	20.7	35.5	28.6	49.2
pH						6.23	5.65	5.72	6.40	6.37	6.30	6.41	6.70	7.05	6.63
Total Organic Carbon (% dw)						3.14	4.44	3.64	1.92	2.67	0.29	*<0.10*	0.23	*<0.10*	0.18
Particle Size															
% Gravel (>2mm)						*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	0.14	0.51	0.62	0.14	0.35
% Sand (2.00mm - 0.063mm)						6.94	10.2	10.6	7.40	5.37	74.9	93.8	46.4	91.2	85.9
% Silt (0.063mm - 4µm)						73.1	73.4	73.4	68.4	69.1	22.2	5.35	44.4	7.85	12.5
% Clay (<4µm)						20.0	16.4	16.0	24.2	25.6	2.75	0.35	8.57	0.81	1.25
Total Metals (mg/kg dw)															
Aluminum						19400	17400	17800	22800	21500	5600	4160	7660	3830	4240
Antimony						0.25	0.27	0.23	0.24	0.28	*<0.10*	*<0.10*	0.14	*<0.10*	*<0.10*
Arsenic*	5.9	120.0	8.3			34.2	15.1	12.6	51.8	35.9	5.89	3.57	5.40	2.12	3.14
Barium						83.8	85.4	89.7	105	88.1	61.6	30.9	68.8	30.9	49.4
Beryllium						0.99	0.88	0.90	1.08	1.07	0.26	*<0.20*	0.36	*<0.20*	*<0.20*
Bismuth						0.95	0.77	0.78	1.08	1.09	*<0.20*	*<0.20*	*<0.20*	*<0.20*	*<0.20*
Cadmium*	0.6	1.10	0.55		0.6	0.120	0.260	0.266	0.334	0.119	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*
Calcium						2170	2360	2120	1960	2070	1730	1010	2530	1040	1280
Chromium*	37.3	114.3	27.0		37.3	**134**	**120**	**121**	**150**	**144**	11.1	8.17	18.3	7.22	11.4
Cobalt						16.9	11.0	10.9	20.7	18.0	3.80	2.80	5.45	2.91	3.57
Copper*	35.7	126.0	20.5		35.7	48.6	43.0	43.0	58.2	54.9	4.65	2.85	6.81	2.74	4.46
Iron						40300	27600	25300	33900	41600	11500	9750	13900	6720	9500
Lead	35	32.5	32.5	35	35	14.9	14.5	13.5	16.4	15.7	4.36	2.50	6.61	2.29	3.57
Lithium						24.1	23.9	25.0	31.3	28.7	8.3	6.3	10.3	6.3	6.7
Magnesium						10300	9530	9580	11700	10900	3310	2750	3930	2600	2960
Manganese						1090	274	274	2300	1010	230	128	291	184	192
Mercury	0.17	0.104	0.088	0.17	0.17	0.0235	0.0225	0.0154	0.0099	0.0128	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*
Molybdenum						2.75	2.40	2.31	4.75	3.15	*<0.50*	2.12	1.14	*<0.50*	*<0.50*
Nickel						82.0	82.2	79.8	127	89.5	7.59	6.42	10.3	6.00	7.26
Phosphorus						512	488	462	463	494	477	342	764	277	413
Potassium						2680	2380	2330	3050	2850	910	630	1570	550	670
Selenium						0.46	0.52	0.46	*<0.20*	0.36	*<0.20*	*<0.20*	*<0.20*	*<0.20*	*<0.20*
Silver						*<0.10*	0.22	0.20	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*
Sodium						120	110	*<100*	*<100*	100	*<100*	*<100*	120	*<100*	*<100*
Strontium						22.9	22.1	20.0	23.3	22.0	34.4	24.9	44.8	25.0	24.4
Thallium						0.186	0.177	0.168	0.253	0.194	*<0.050*	*<0.050*	0.065	*<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*
Titanium						476	514	495	612	489	276	195	426	196	206
Uranium						9.07	7.57	7.57	11.4	10.5	0.851	0.514	2.23	0.441	0.679
Vanadium						36.2	32.5	33.0	41.9	39.0	15.0	10.7	22.8	10.1	12.8
Zinc*	123	121.3	73.6		123	76.8	76.8	77.7	91.2	85.3	21.9	17.3	28.3	16.6	20.5

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 "CREMP Design Document 2012" (Azimuth, 2012). 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 3.4-1. Conventional sediment grab chemistry, partical size, and total metals (mg/kg), Meadowbank study lakes and Baker Lake, August 2013.

Lake & Basin	CCME (2002)					Baker Lake									
						Proposed Jetty					Akilahaarjuk Point				
Area-Replicate ID	Guideline[1]	Trigger[2]		Threshold[2]		BPJ-1	BPJ-2	BPJ-3	BPJ-4	BPJ-5	BAP-1	BAP-2	BAP-3	BAP-4	BAP-5
Date	ISQG	Meadowbank	Baker Lake	Meadowbank	Baker Lake	29-Aug-13	29-Aug-13	29-Aug-13	29-Aug-13	29-Aug-13	30-Aug-13	30-Aug-13	30-Aug-13	30-Aug-13	30-Aug-13
Physical & Organic Parameters															
Moisture (%)						43.3	48.0	51.4	44.7	54.7	38.0	40.4	36.8	54.7	42.2
pH						6.61	6.52	6.61	6.17	6.48	6.94	6.19	6.25	5.85	6.26
Total Organic Carbon (% dw)						0.42	0.51	0.54	0.48	0.63	0.36	0.53	0.37	0.86	0.59
Particle Size															
% Gravel (>2mm)						*<0.10*	*<0.10*	*<0.10*	*<0.10*	1.81	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*
% Sand (2.00mm - 0.063mm)						46.9	45.0	22.1	16.3	27.1	73.5	72.2	71.4	53.8	62.9
% Silt (0.063mm - 4µm)						46.9	48.9	68.7	67.9	61.2	23.8	24.8	25.9	41.1	32.2
% Clay (<4µm)						6.19	5.99	9.16	15.8	9.87	2.71	3.00	2.76	5.14	4.85
Total Metals (mg/kg dw)															
Aluminum						7260	7950	10400	11300	9060	5360	5710	5210	6360	5420
Antimony						0.10	0.12	0.14	0.16	0.16	0.14	0.15	0.13	0.16	0.21
Arsenic*	5.9	120.0	8.3			5.05	**16.0**	**24.2**	8.03	**44.9**	6.83	**9.19**	**8.82**	7.82	3.38
Barium						75.3	104	133	90.6	142	425	340	387	296	284
Beryllium						0.33	0.35	0.45	0.51	0.40	0.33	0.36	0.31	0.37	0.33
Bismuth						*<0.20*	*<0.20*	0.23	0.25	0.22	*<0.20*	*<0.20*	*<0.20*	*<0.20*	*<0.20*
Cadmium*	0.6	1.10	0.55		0.6	0.051	0.072	0.080	0.064	0.063	*<0.050*	*<0.050*	*<0.050*	0.057	*<0.050*
Calcium						2180	2270	2920	3150	2710	2270	2090	2250	2250	2160
Chromium*	37.3	114.3	27.0		37.3	16.4	19.9	22.4	25.4	20.4	15.9	17.4	15.7	17.5	16.6
Cobalt						5.56	6.05	7.24	7.35	7.72	4.27	4.30	3.75	4.76	4.28
Copper*	35.7	126.0	20.5		35.7	7.16	7.17	9.51	11.3	8.88	4.72	5.65	4.41	7.16	6.44
Iron						15000	20500	22100	18900	29800	13500	13600	14600	15400	12900
Lead	35	32.5	32.5	35	35	7.21	8.38	10.3	10.7	8.91	4.53	5.93	4.35	5.84	5.82
Lithium						8.9	10.2	12.1	13.8	10.4	8.1	9.0	8.0	9.9	8.3
Magnesium						3970	4310	5260	5510	4700	3100	3370	2960	3600	3260
Manganese						1580	2870	2520	432	2310	439	180	195	188	131
Mercury	0.17	0.104	0.088	0.17	0.17	0.0079	0.0110	0.0133	0.0079	0.0087	*<0.0050*	0.0056	*<0.0050*	0.0089	0.0059
Molybdenum						0.87	1.73	1.46	0.90	2.65	0.77	*<0.50*	0.53	0.63	*<0.50*
Nickel						10.9	12.3	14.1	14.9	13.0	9.47	10.3	8.80	10.5	9.75
Phosphorus						640	807	1060	941	1680	681	738	716	694	682
Potassium						1320	1470	2000	2220	1770	1200	1380	1170	1480	1270
Selenium						*<0.20*	*<0.20*	*<0.20*	0.21	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*
Sodium						140	130	230	200	150	*<100*	*<100*	*<100*	110	*<100*
Strontium						44.1	49.3	59.7	60.7	51.5	45.2	47.6	45.7	42.9	38.3
Thallium						0.057	0.065	0.079	0.091	0.070	0.058	0.062	0.054	0.072	0.067
Tin						*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*
Titanium						374	390	496	548	425	326	319	324	349	285
Uranium						1.48	1.60	1.99	2.49	2.04	1.47	1.34	1.22	1.67	1.57
Vanadium						20.9	24.7	26.5	30.2	25.4	19.3	19.6	20.0	22.5	20.5
Zinc*	123	121.3	73.6		123	31.3	34.4	42.1	43.8	37.0	22.4	24.5	21.4	28.6	25.7

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 "CREMP Design Document 2012" (Azimuth, 2012). 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 3.4-1. Conventional sediment grab chemistry, partical size, and total metals (mg/kg), Meadowbank study lakes and Baker Lake, August 2013.

Lake & Basin	CCME (2002)					Baker Lake				
						East Shore				
Area-Replicate ID	Guideline[1]	Trigger[2]		Threshold[2]		BES-1	BES-2	BES-3	BES-4	BES-5
Date	ISQG	Meadowbank	Baker Lake	Meadowbank	Baker Lake	30-Aug-13	30-Aug-13	30-Aug-13	30-Aug-13	30-Aug-13
Physical & Organic Parameters										
Moisture (%)						38.8	38.4	37.3	46.6	42.3
pH						8.05	7.78	7.02	6.95	6.79
Total Organic Carbon (% dw)						0.36	0.30	0.34	0.43	0.41
Particle Size										
% Gravel (>2mm)						*<0.10*	0.37	0.19	*<0.10*	*<0.10*
% Sand (2.00mm - 0.063mm)						77.0	78.2	67.4	74.1	62.1
% Silt (0.063mm - 4µm)						20.1	18.7	27.9	22.8	32.8
% Clay (<4µm)						2.92	2.68	4.51	3.09	5.11
Total Metals (mg/kg dw)										
Aluminum						4890	5270	6220	5880	6020
Antimony						0.13	0.15	0.13	0.13	0.13
Arsenic*	5.9	120.0	8.3			3.10	3.63	3.53	3.78	3.54
Barium						163	151	98.3	137	92.8
Beryllium						0.30	0.30	0.32	0.32	0.34
Bismuth						*<0.20*	*<0.20*	*<0.20*	*<0.20*	*<0.20*
Cadmium*	0.6	1.10	0.55		0.6	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*
Calcium						2170	2240	2400	2180	2090
Chromium*	37.3	114.3	27.0		37.3	16.8	16.4	17.2	17.7	16.8
Cobalt						4.10	4.09	4.45	4.48	4.66
Copper*	35.7	126.0	20.5		35.7	3.89	3.83	4.89	4.84	4.82
Iron						12200	13900	14000	13100	13100
Lead	35	32.5	32.5	35	35	4.37	4.36	5.40	4.63	5.00
Lithium						8.4	8.6	8.8	8.8	8.3
Magnesium						3300	3410	3560	3600	3570
Manganese						631	662	304	548	397
Mercury	0.17	0.104	0.088	0.17	0.17	*<0.0050*	*<0.0050*	0.0056	0.0056	0.0061
Molybdenum						0.68	0.55	*<0.50*	0.56	*<0.50*
Nickel						9.69	10.2	9.70	10.4	10.4
Phosphorus						672	740	728	615	585
Potassium						970	1050	1270	1230	1250
Selenium						*<0.20*	*<0.20*	*<0.20*	*<0.20*	*<0.20*
Silver						*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*
Sodium						*<100*	*<100*	*<100*	*<100*	*<100*
Strontium						31.5	35.3	39.6	38.9	36.9
Thallium						0.051	*<0.050*	0.050	0.056	0.058
Tin						*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*
Titanium						284	325	354	335	331
Uranium						1.03	1.08	1.34	1.14	1.24
Vanadium						17.3	19.8	20.2	18.8	19.1
Zinc*	123	121.3	73.6		123	21.6	21.7	23.7	23.1	23.7

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 "CREMP Design Document 2012" (Azimuth, 2012). 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 3.4-2. Composite sediment grab hydrocarbons and PAHs, Meadowbank study lakes and Baker Lake, August 2013.

Lake	CCME (2002) Guidelines[1]	Third Portage Lake			Second Portage	Tehek	Tehek Farfield	Inuggugayualik	Wally	Pipedream	Baker Lake			
Area ID		TPE	TPN	TPS	SP	TE	TEFF	INUG	WAL	PDL	BBD	BPJ	BAP	BES
Date	ISQG	27-Aug-13	28-Aug-13	27-Aug-13	25-Aug-13	24-Aug-13	24-Aug-13	23-Aug-13	26-Aug-13	23-Aug-13	29-Aug-13	29-Aug-13	30-Aug-13	30-Aug-13
Physical Parameters														
Moisture (%)		86.9	74.5	85.5	86.6	81.6	87.1	85.9	89.9	81.5	29.1	53.0	42.1	42.5
Aggregate Organics (mg/kg)														
Mineral Oil and Grease		*<1800*	*<850*	*<1600*	*<1700*	*<2300*	*<1300*	*<1700*	*<2100*	*<1200*	*<500*	*<500*	*<500*	*<500*
Hydrocarbons (mg/kg)														
EPH10-19		*<640*	*<320*	*<640*	*<600*	*<400*	*<560*	*<560*	*<740*	*<440*	*<200*	*<200*	*<200*	*<200*
EPH19-32		*<640*	*<320*	*<640*	*<600*	*<400*	*<560*	*<560*	*<740*	*<440*	*<200*	*<200*	*<200*	*<200*
LEPH		*<640*	*<320*	*<640*	*<600*	*<400*	*<560*	*<560*	*<740*	*<440*	*<200*	*<200*	*<200*	*<200*
HEPH		*<640*	*<320*	*<640*	*<600*	*<400*	*<560*	*<560*	*<740*	*<440*	*<200*	*<200*	*<200*	*<200*
Polycyclic Aromatic Hydrocarbons (mg/kg)														
Acenaphthene	0.00671	*<0.010*	*<0.0050*	*<0.010*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*
Acenaphthylene	0.00587	*<0.010*	*<0.0050*	*<0.010*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*
Anthracene	0.0469	*<0.0080*	*<0.0040*	*<0.0080*	*<0.0040*	*<0.0040*	*<0.0040*	*<0.0040*	*<0.0040*	*<0.0040*	*<0.0040*	*<0.0040*	*<0.0040*	*<0.0040*
Benzo(a)anthracene	0.0317	*<0.020*	*<0.010*	*<0.020*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Benzo(a)pyrene	0.0319	*<0.020*	*<0.010*	*<0.020*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	0.012	*<0.010*	*<0.010*
Benzo(b)fluoranthene		*<0.020*	*<0.010*	*<0.020*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	0.017	*<0.010*	*<0.010*
Benzo(b+j+k)fluoranthene		*<0.028*	*<0.015*	*<0.028*	*<0.015*	*<0.015*	*<0.015*	*<0.015*	*<0.015*	*<0.015*	*<0.015*	0.017	*<0.015*	*<0.015*
Benzo(g,h,i)perylene		*<0.020*	*<0.010*	*<0.020*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Benzo(k)fluoranthene		*<0.020*	*<0.010*	*<0.020*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Chrysene	0.0571	*<0.020*	*<0.010*	*<0.020*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	0.010	*<0.010*	*<0.010*
Dibenz(a,h)anthracene	0.00622	*<0.010*	*<0.0050*	*<0.010*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*
Fluoranthene	0.111	*<0.020*	*<0.010*	*<0.020*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Fluorene	0.0212	*<0.020*	*<0.010*	*<0.020*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Indeno(1,2,3-c,d)pyrene		*<0.020*	*<0.010*	*<0.020*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*
2-Methylnaphthalene	0.0202	*<0.020*	*<0.010*	*<0.020*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Naphthalene	0.0346	*<0.020*	0.022	*<0.020*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Phenanthrene	0.0419	*<0.020*	*<0.010*	*<0.020*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Pyrene	0.053	*<0.020*	*<0.010*	*<0.020*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*

Notes:

[1]CCME (Canadian Council of Ministers of the Environment) Canadian Sediment Quality Guidelines for the Protection of Aquatic Life, 1999, updated in 200

ISQG = Interim freshwater Sediment Quality Guideline

Bolded concentrations exceed the ISQG guideline.

Italicized numbers are below detection limits.

Figure 3.4-1. Sediment grain size composition in sediment samples from Meadowbank study lakes since 2008.

Figure 3.4-2. Total Aluminum (mg/kg) in sediment samples (grabs & cores) from Meadowbank study lakes since 2006.

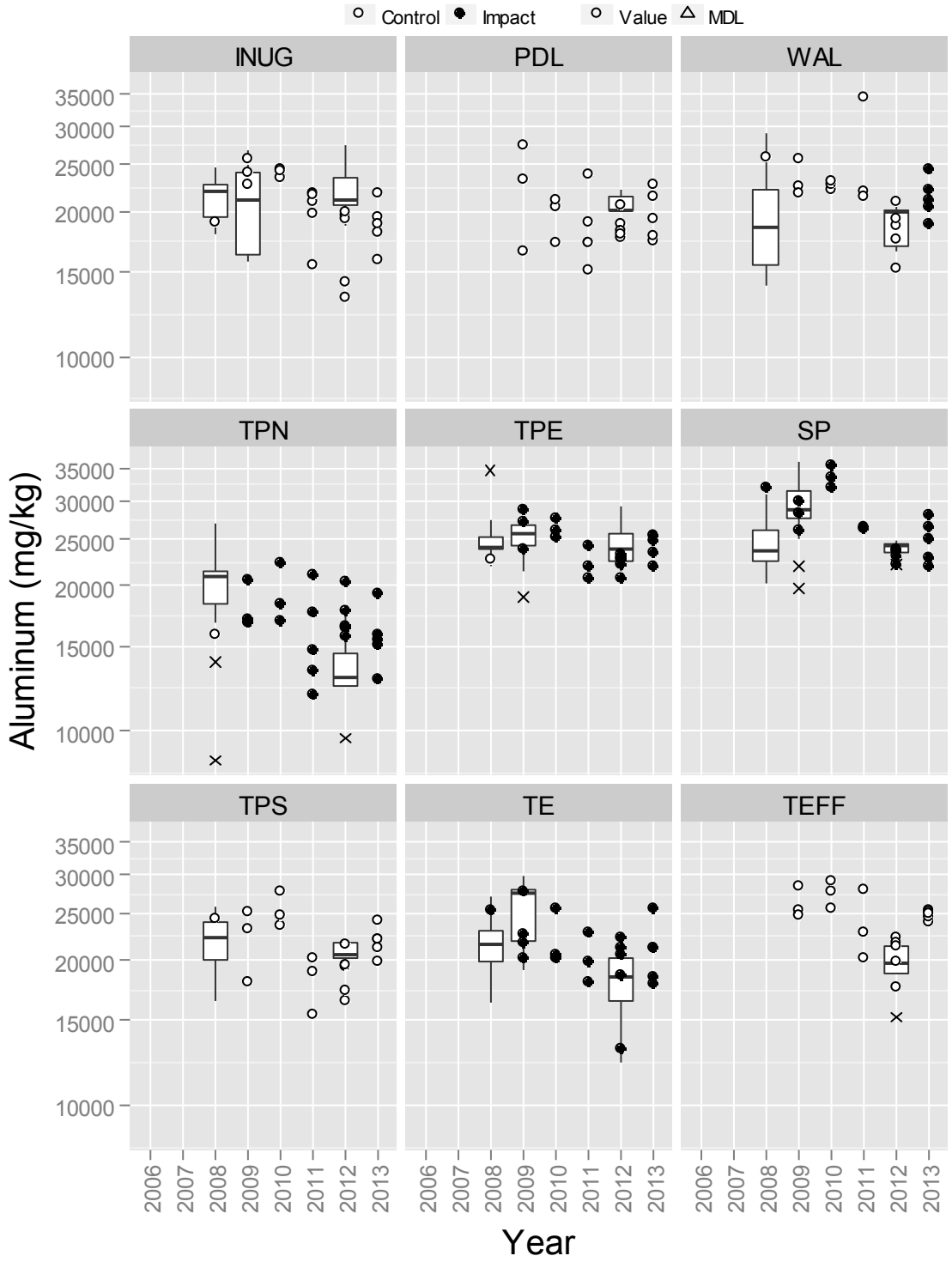


Figure 3.4-3. Total Arsenic (mg/kg) in sediment samples (grabs & cores) from Meadowbank study lakes since 2006.

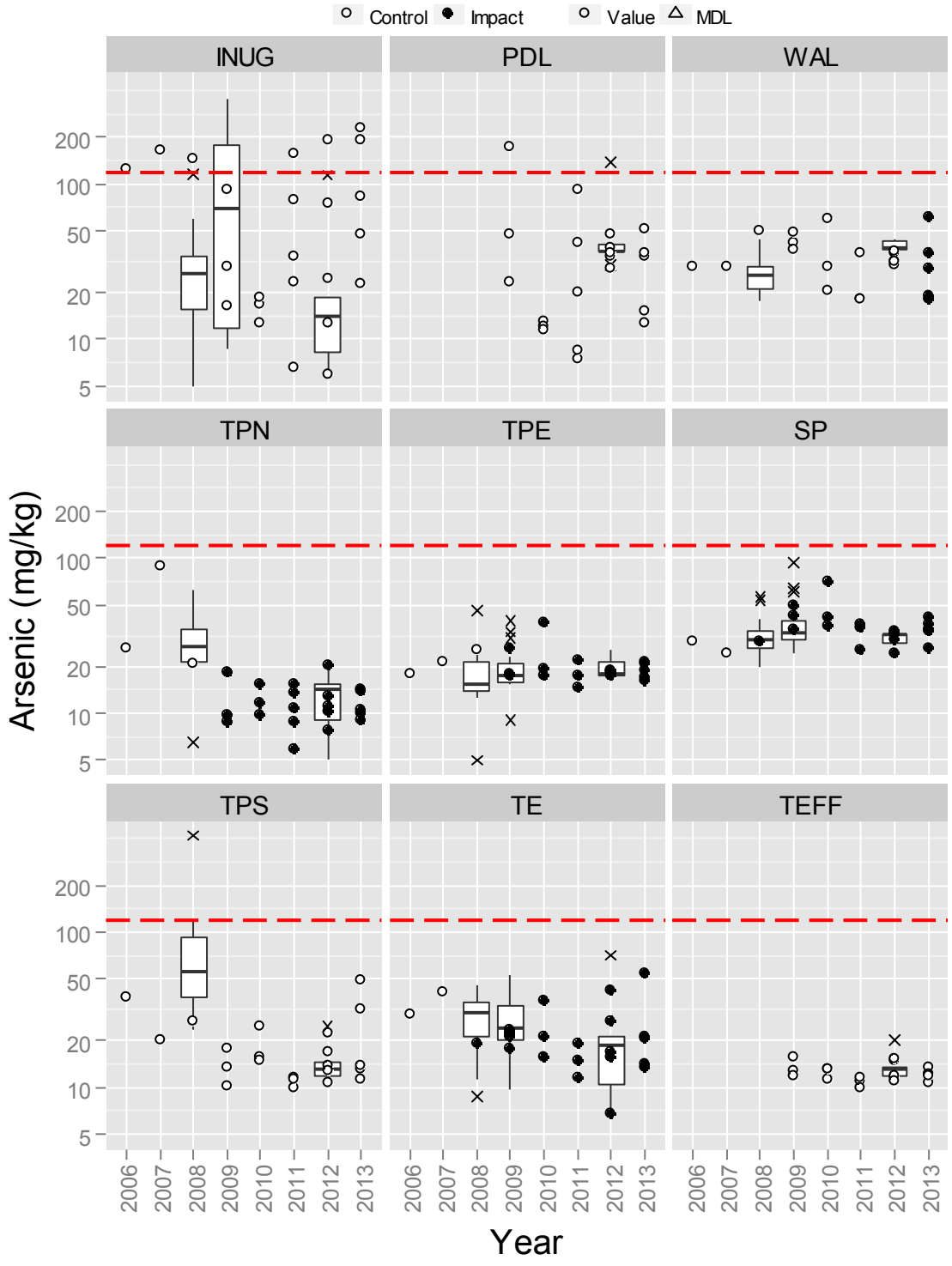


Figure 3.4-4. Total Cadmium (mg/kg) in sediment samples (grabs & cores) from Meadowbank study lakes since 2006.

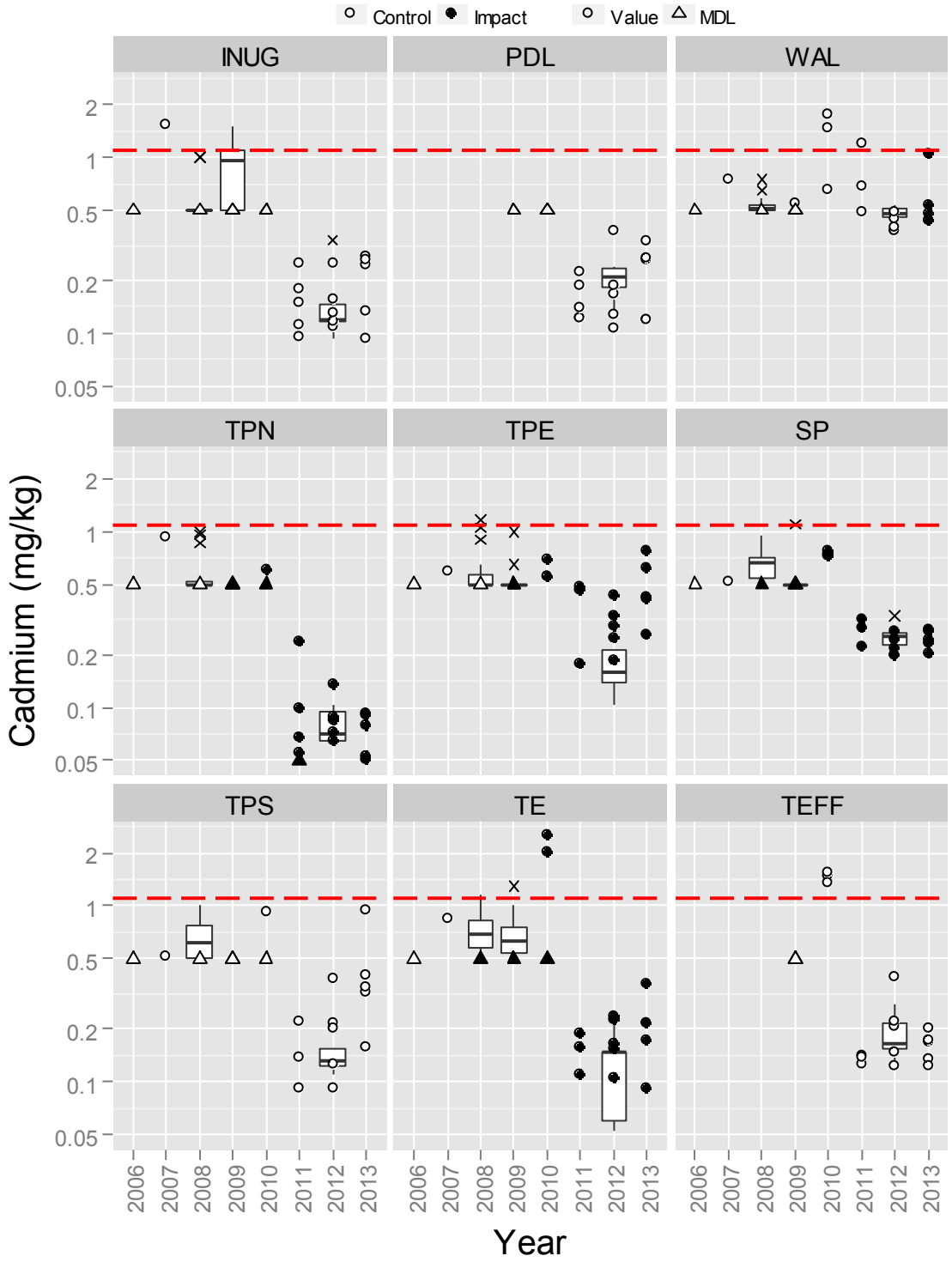


Figure 3.4-5. Total Chromium (mg/kg) in sediment samples (grabs & cores) from Meadowbank study lakes since 2006.

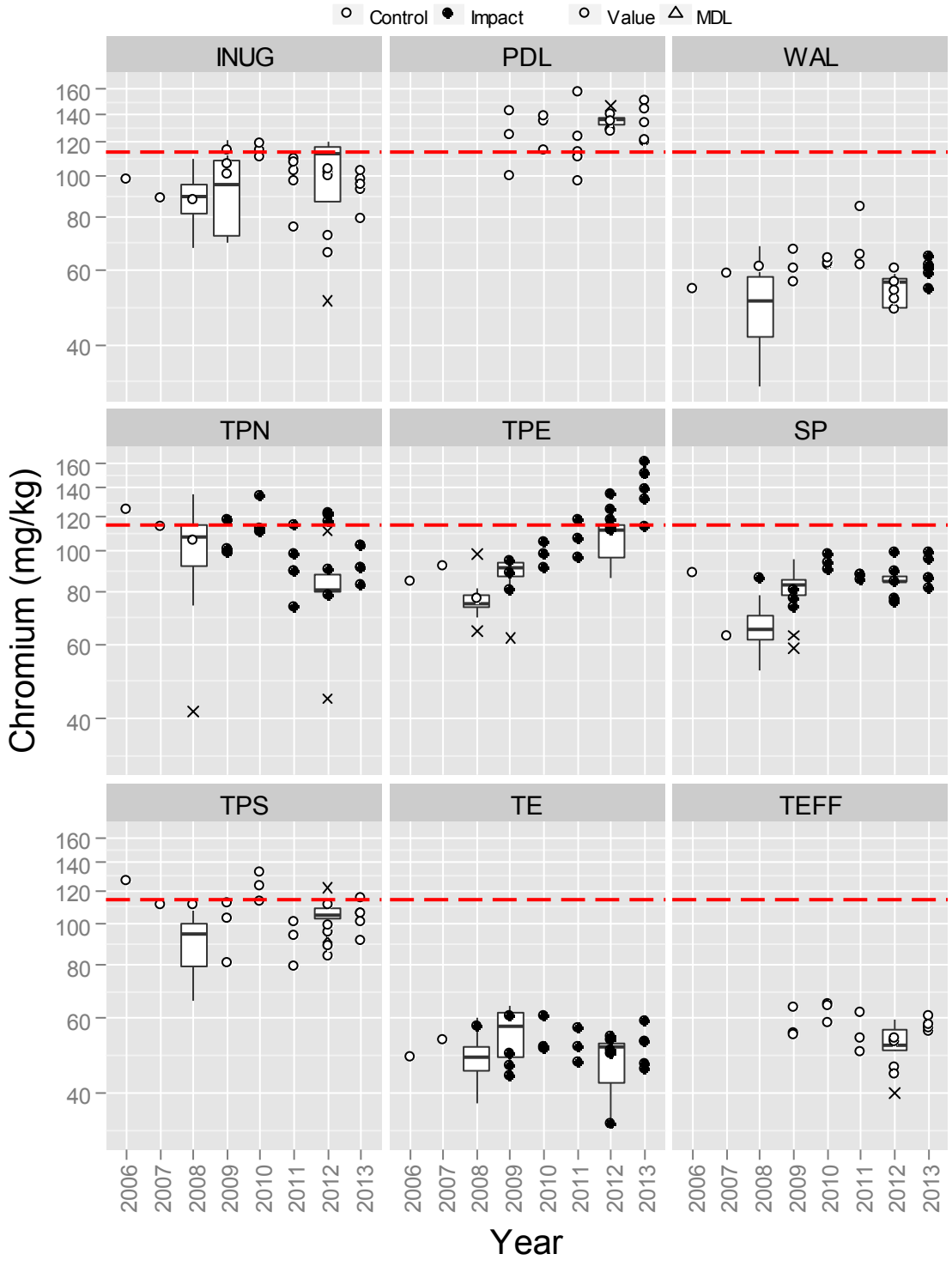


Figure 3.4-6. Total Copper (mg/kg) in sediment samples (grabs & cores) from Meadowbank study lakes since 2006.

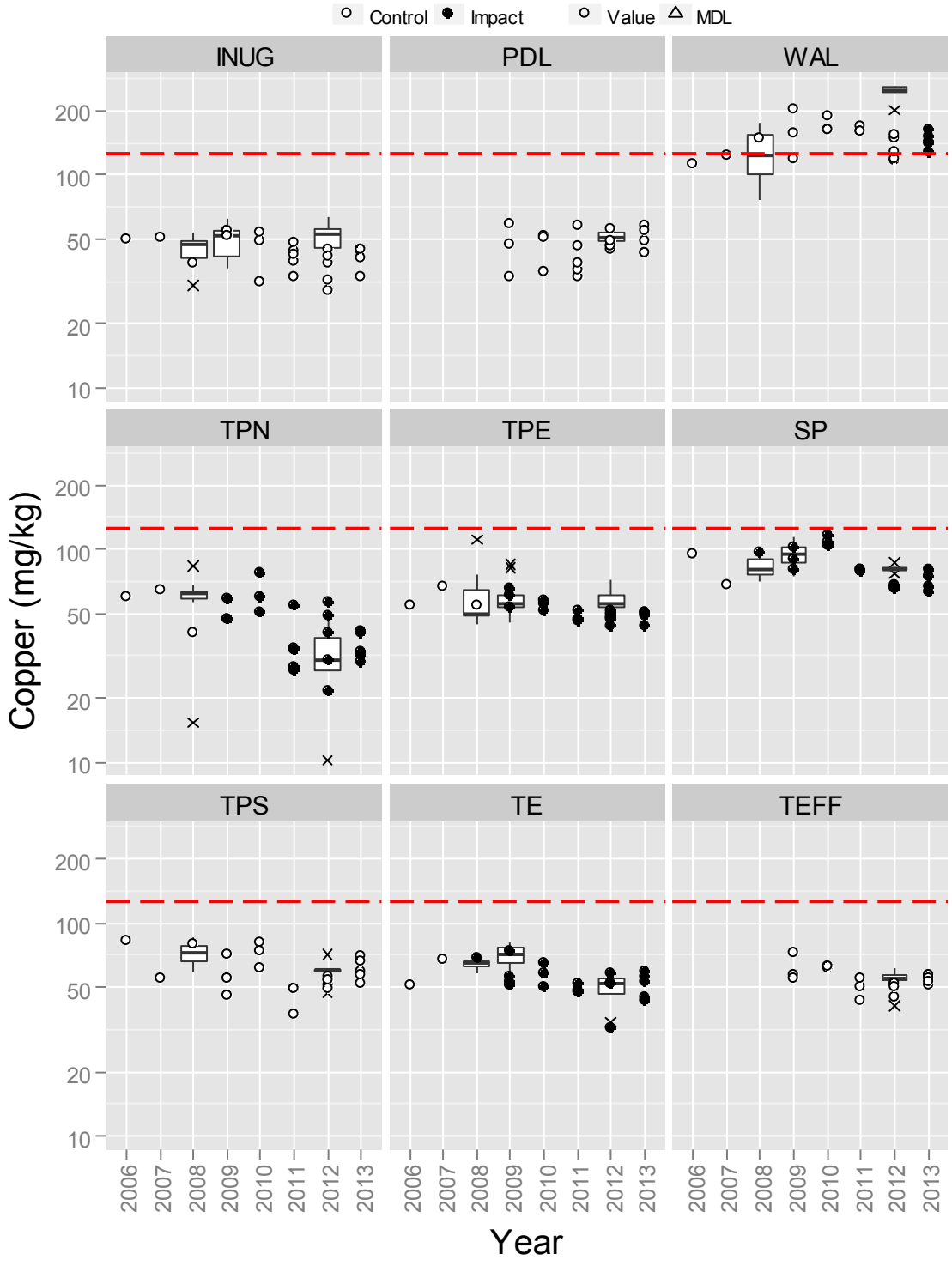


Figure 3.4-7. Total Lead (mg/kg) in sediment samples (grabs & cores) from Meadowbank study lakes since 2006.

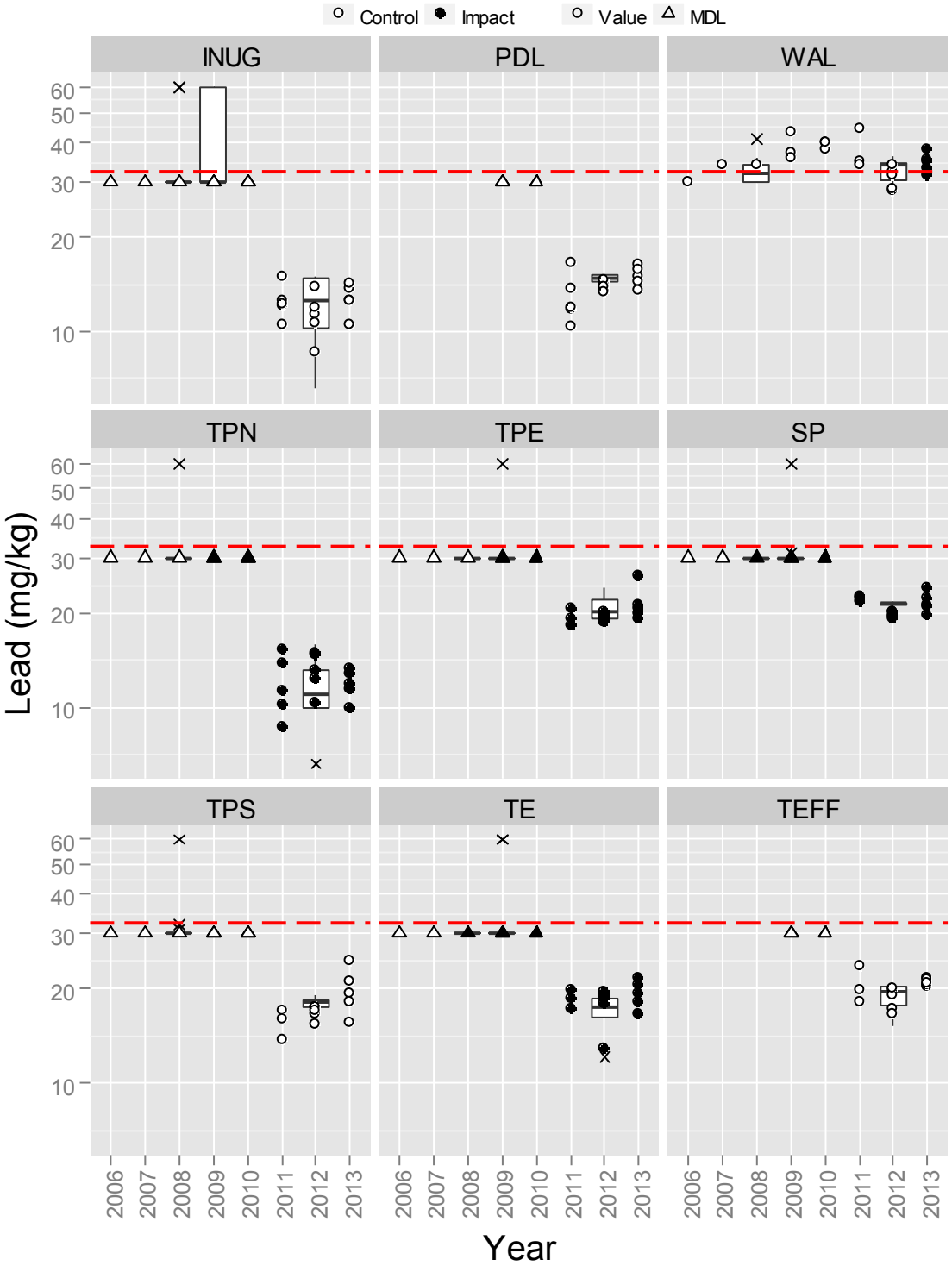


Figure 3.4-8. Total Mercury (mg/kg) in sediment samples (grabs & cores) from Meadowbank study lakes since 2006.

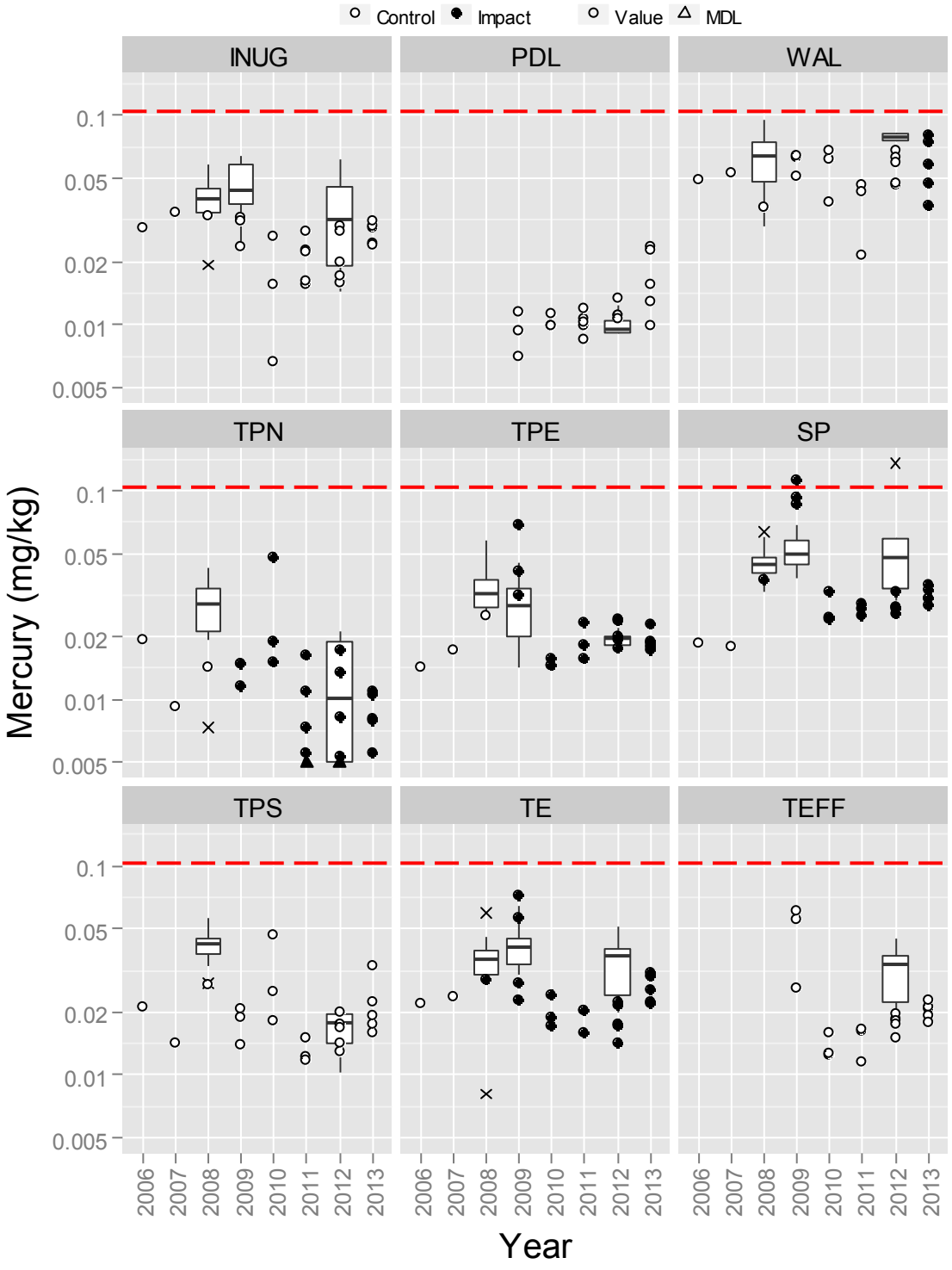


Figure 3.4-9. Total Zinc (mg/kg) in sediment samples (grabs & cores) from Meadowbank study lakes since 2006.

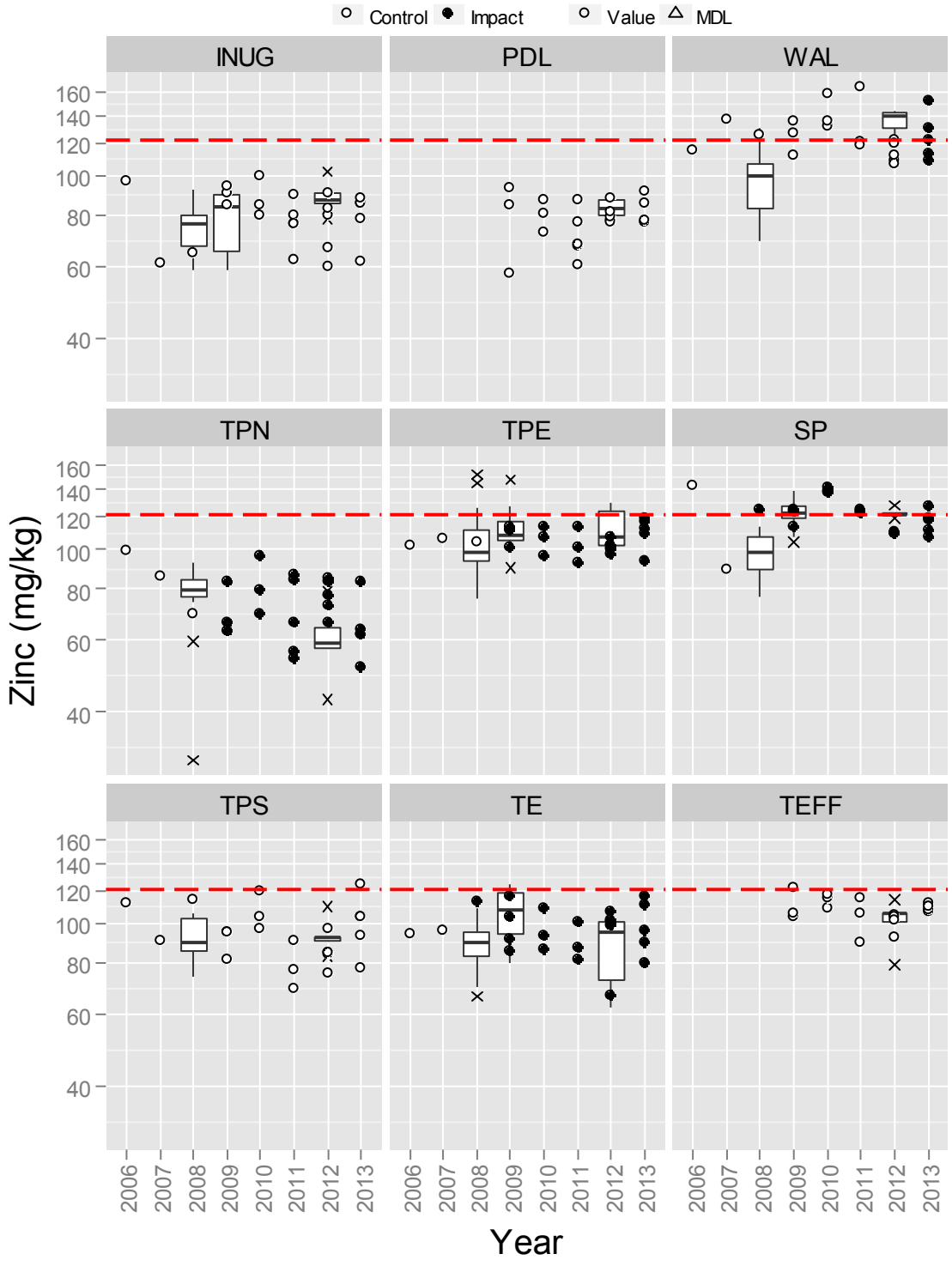


Figure 3.4-10. Spatial assessment of total chromium in Third Portage – East Basin (TPE) sediments, 2006-2013.

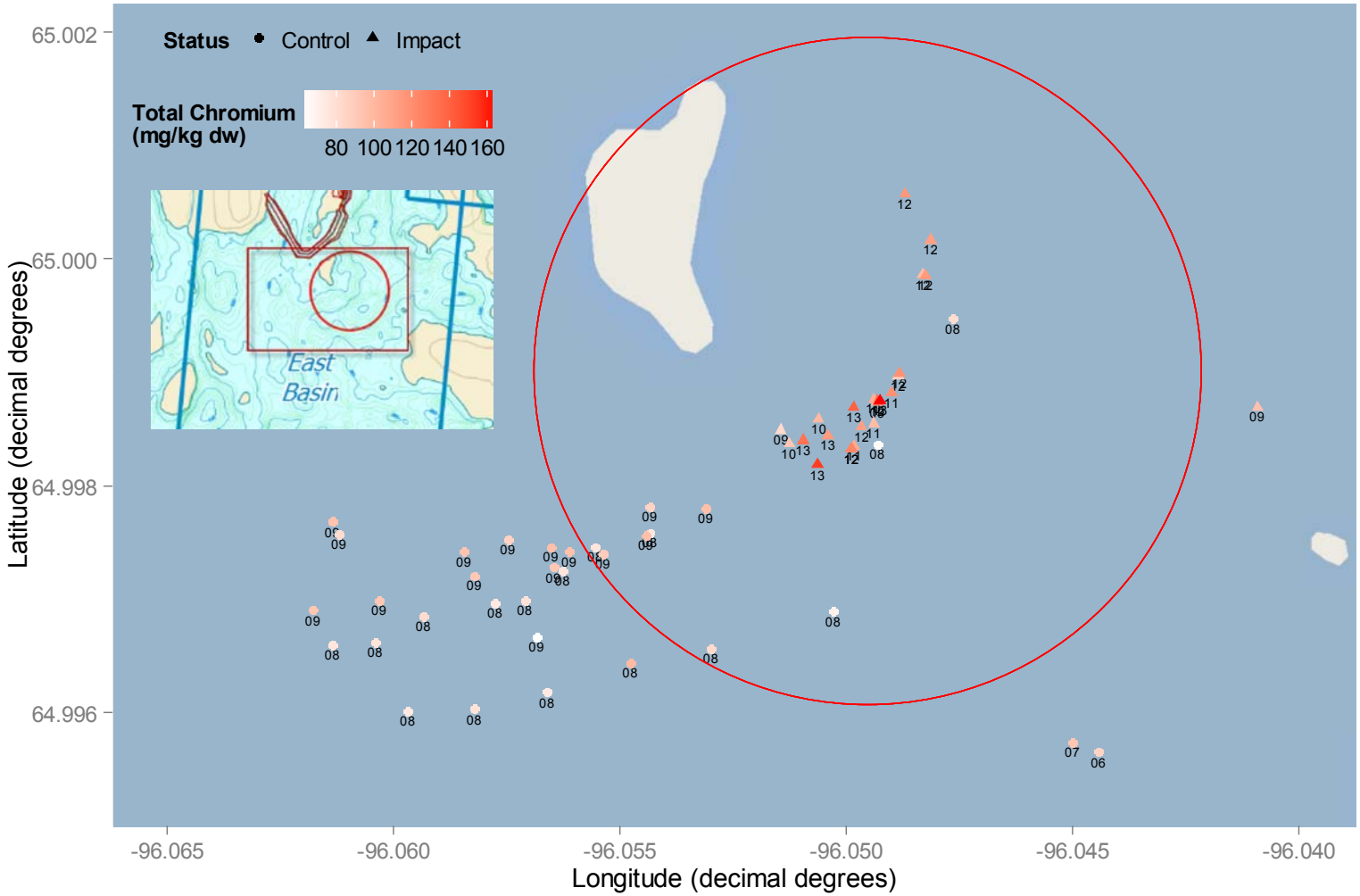


Figure 3.4-11. Sediment grain size composition in sediment samples from Baker Lake since 2008.

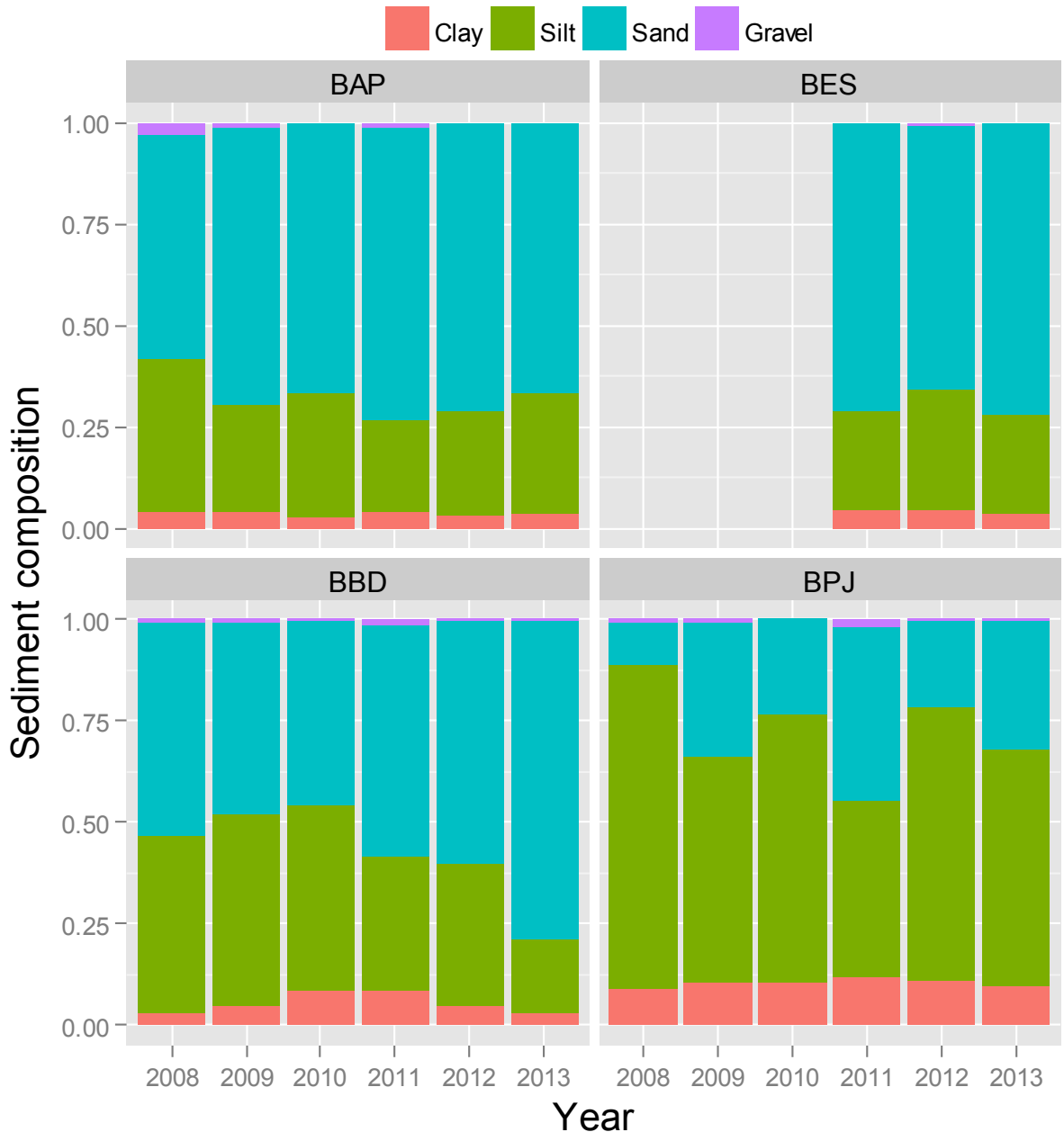


Figure 3.4-12. Total Aluminum (mg/kg) in sediment samples (grabs & cores) from Baker Lake since 2008.

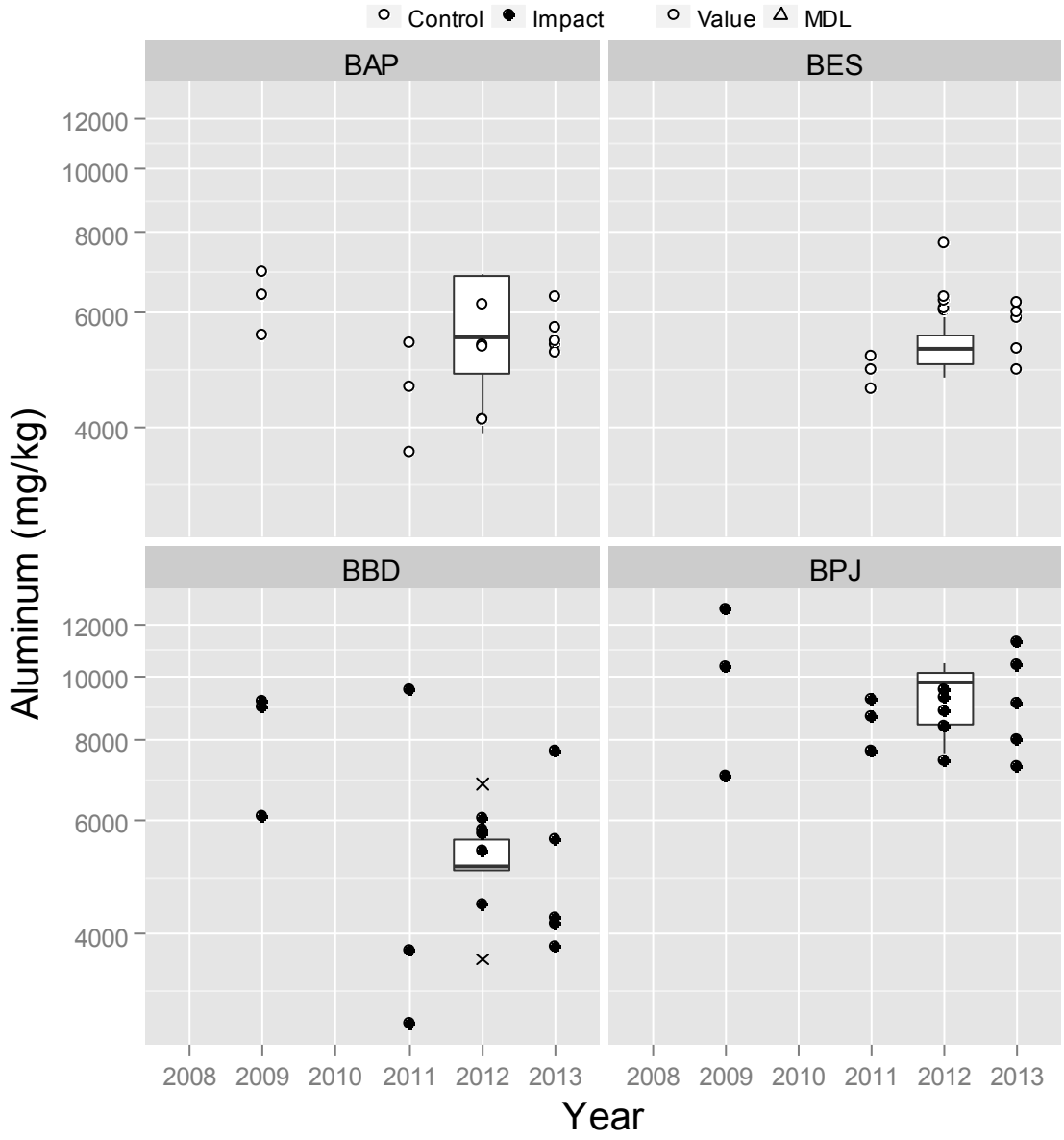


Figure 3.4-13. Total Arsenic (mg/kg) in sediment samples (grabs & cores) from Baker Lake since 2008.

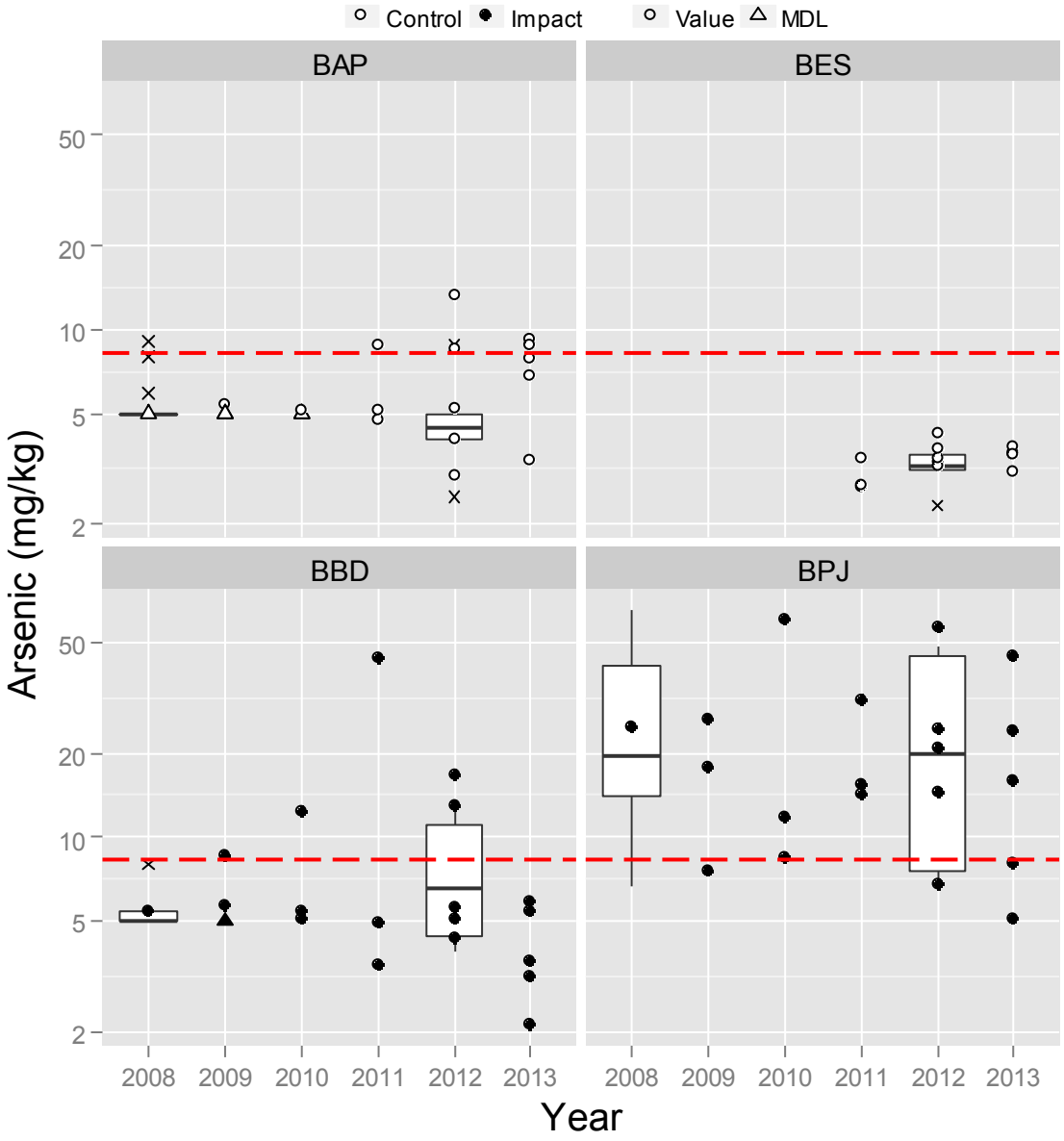


Figure 3.4-14. Total Cadmium (mg/kg) in sediment samples (grabs & cores) from Baker Lake since 2008.

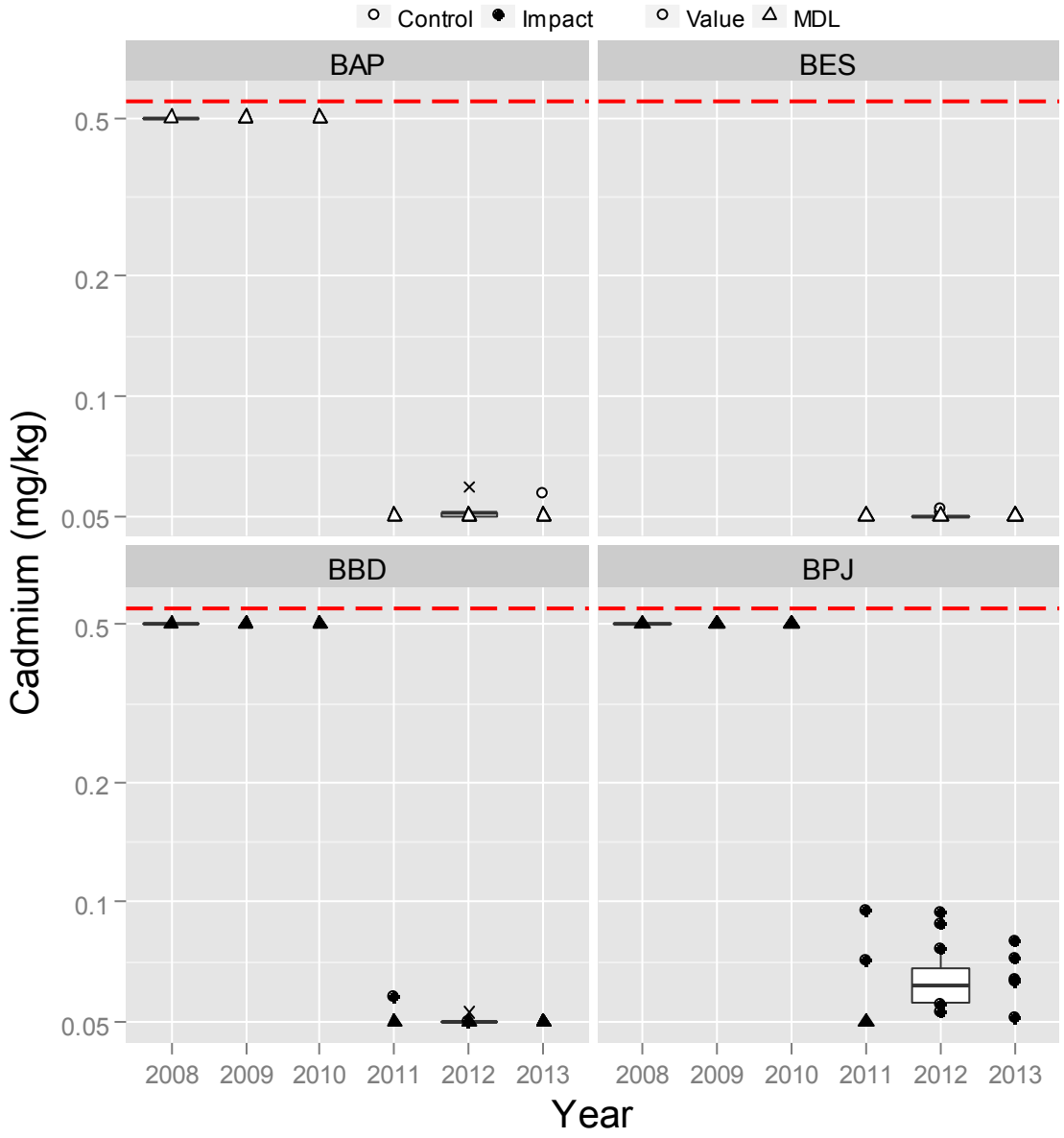


Figure 3.4-15. Total Chromium (mg/kg) in sediment samples (grabs & cores) from Baker Lake since 2008.

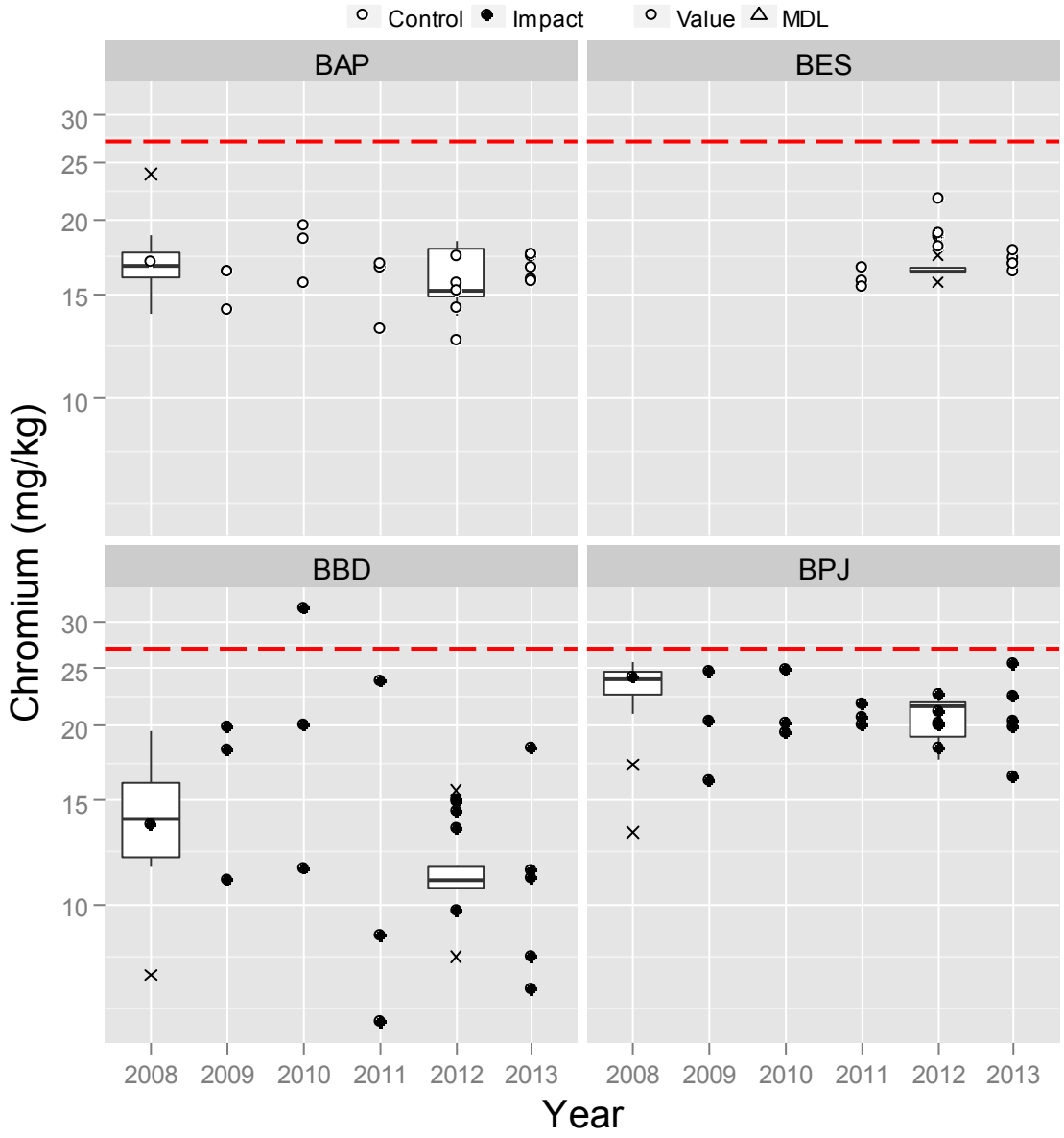


Figure 3.4-16. Total Copper (mg/kg) in sediment samples (grabs & cores) from Baker Lake since 2008.

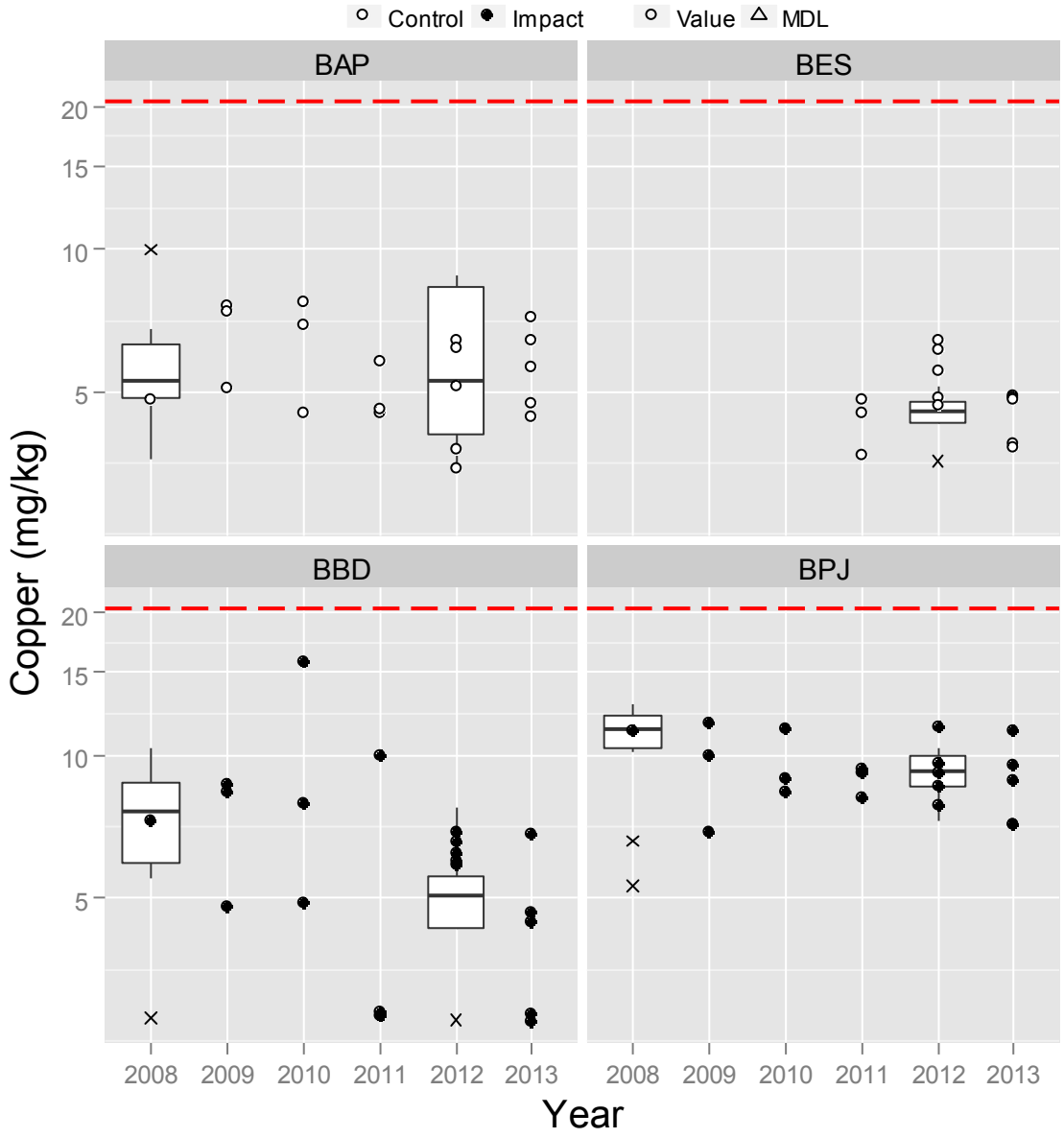


Figure 3.4-17. Total Lead (mg/kg) in sediment samples (grabs & cores) from Baker Lake since 2008.

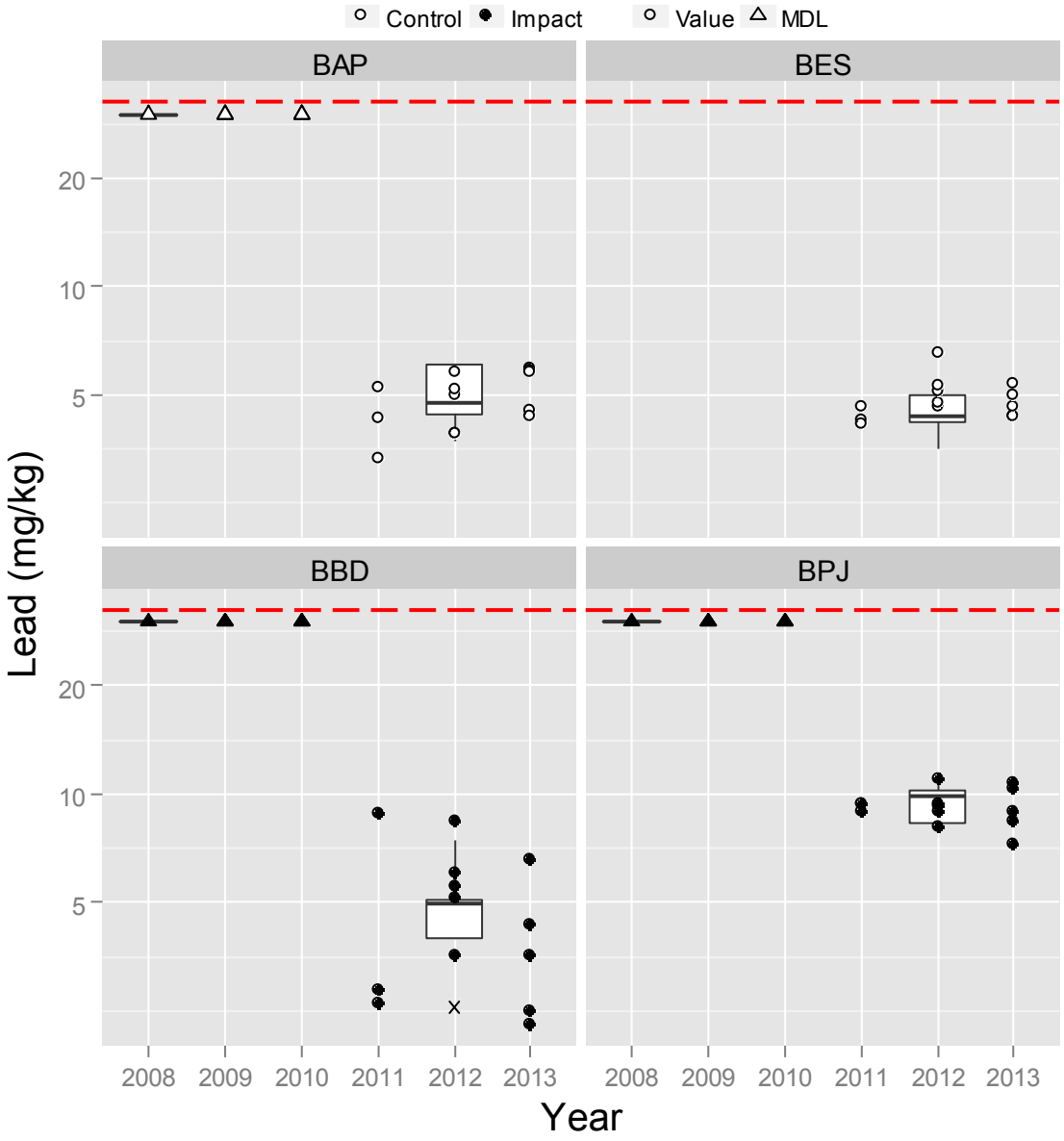


Figure 3.4-18. Total Mercury (mg/kg) in sediment samples (grabs & cores) from Baker Lake since 2008.

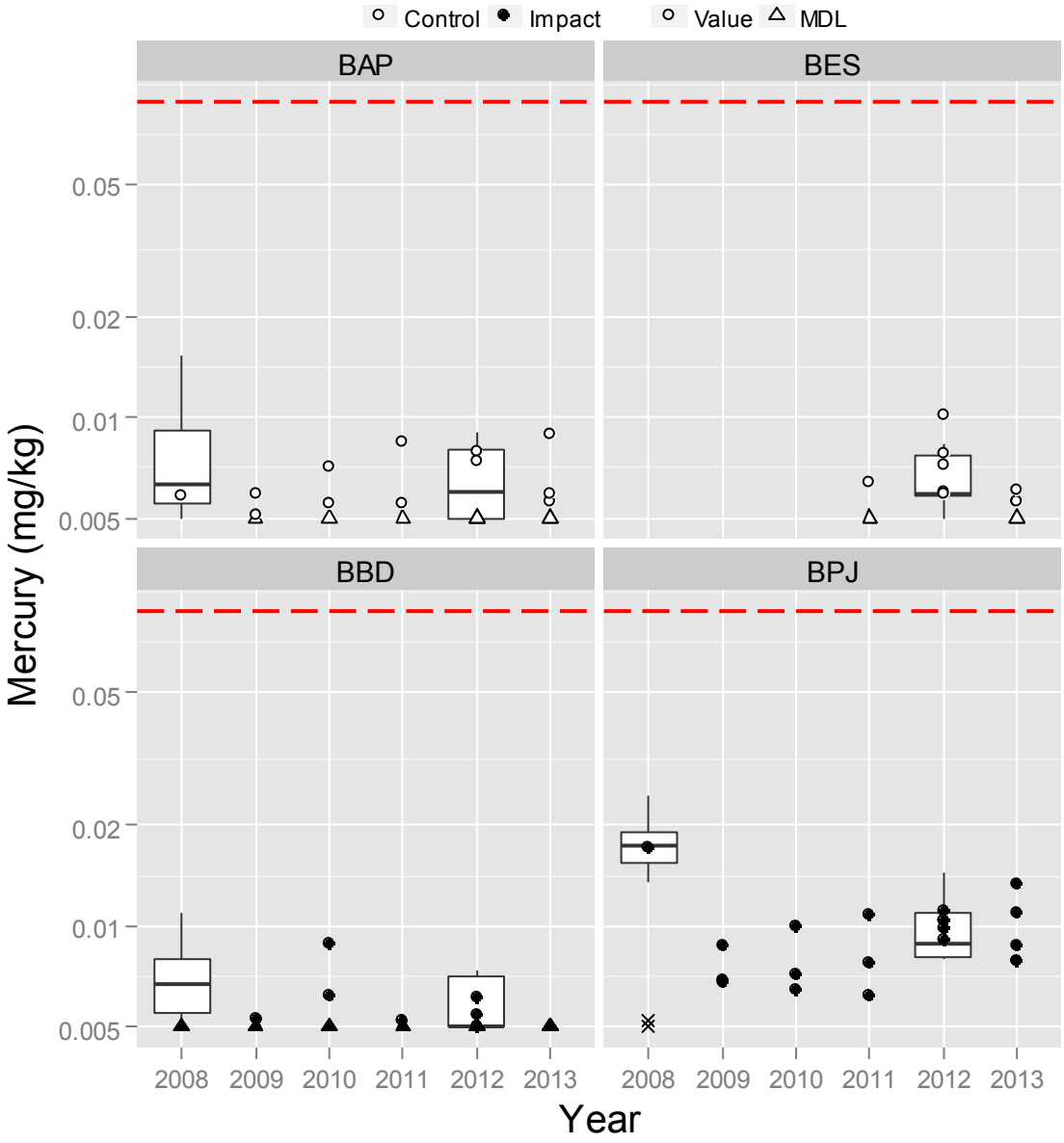
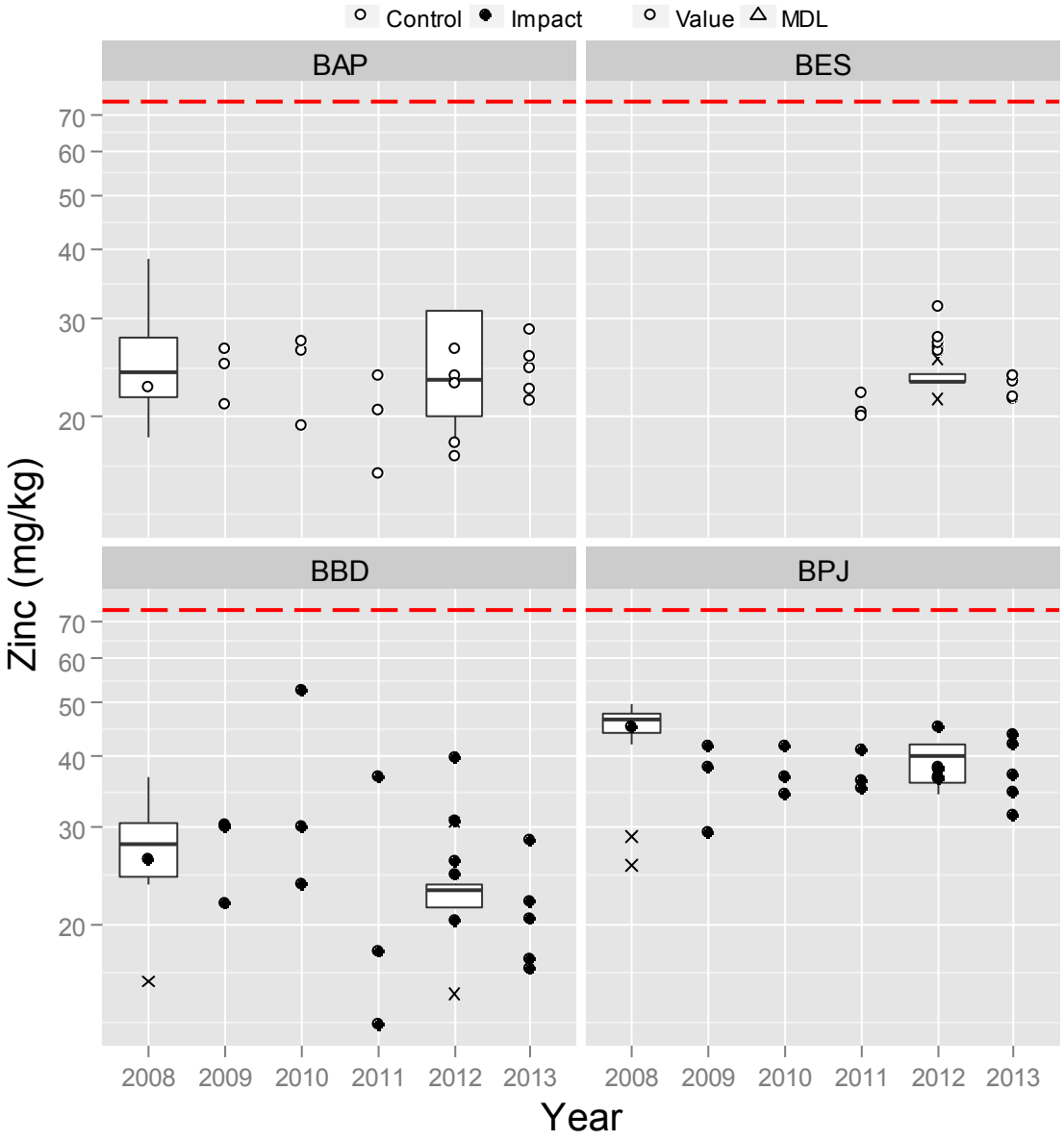


Figure 3.4-19. Total Zinc (mg/kg) in sediment samples (grabs & cores) from Baker Lake since 2008.



3.5. Phytoplankton

3.5.1. Meadowbank Study Lakes

3.5.1.1. 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 sp.* for chlorophytes, *Planktolyngbya sp.* for cyanophytes, *Cyclotella sp.* for diatoms, *Rhodomonas sp.* and *Cryptomonas sp.* for cryptophytes, and *Gymnodinium sp*. and *Peridinium sp.* for dinoflagellates (Azimuth, 2012a, 2011b, 2010a, 2009c, 2008a, and 2008b).

Mean phytoplankton biomass in the Meadowbank area lakes typically ranges from 100 to 200 mg/m^3 during summer with diminishing biomass in fall through winter. This range in biomass is fairly typical for oligotrophic, central Arctic Canadian lakes. For example, some nearby lakes such as Snap Lake (266 mg/m^3; De Beers, 2002), Kiggavik lakes (125 mg/m^3; McKee et al., 1989), Char, Spring and Saqvaqjuac lakes, not far from Baker Lake ranged up to 166 mg/m^3, 120 mg/m^3 and 130 mg/m^3 respectively (Kalff et al., 1975; Welch et al., 1989).

3.5.1.2. Temporal and Spatial Trend Interpretation

As previously discussed, our approach to identify potential mine-related impacts involved 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 2013 data to test for changes relative to baseline/reference conditions using the BACIP model (see **Section 2.4.3** for details).

The primary metrics upon which we based our general 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 or diversity (total # species). We chose to examine biomass and not abundance because the two tend to be

reasonably well correlated and ultimately, biomass is a much better approximation of actual production or food available to zooplankton. The BACIP 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 in phytoplankton-related metrics coinciding with mining activities (i.e., focusing primarily on data for SP, TPE and TPN).

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.

The 2013 density and biomass results for phytoplankton are provided in **Table 3.5-1** (a presence/absence species matrix is provided in **Appendix F**). The 2012 CREMP (Azimuth, 2013) provides a detailed description of historical trends in phytoplankton-related metrics; this report emphasizes results for 2013. Trend data for chlorophyll-*a*, total biomass, major taxa composition, and species richness are presented in **Figures 3.5-1 through 5** (plots for all other phytoplankton metrics are presented in **Appendix G**). The results for the BACIP model statistical tests of the 2013 results against baseline/reference conditions for total biomass and species richness are provided in **Table 3.5-2**; Key results are described below:

- *Chlorophyll-a* – concentrations at most reference areas ranged between 0.2 and 0.7 µg/L in spring and summer months. These concentrations have remained fairly consistent since 2006 (**Figure 3.5-1**). No anomalous spatial/temporal trends were evident for near-field areas in 2013, although results need to be viewed cautiously due to the sample transport data quality issue (see **Section 3.1.1.2** for details). In the worst-case, this would cause chlorophyll-*a* concentration to increase above what is typical and this has not been seen.
- *Total Biomass* – At reference areas, peak summer phytoplankton biomass was approximately 200 mg/m^3 at INUG, TEFF, and PDL, which is consistent with the range in concentrations observed in previous years (**Figure 3.5-2**). Winter under-ice biomass is very low at all locations in all years it has been measured. Total biomass in 2013 was higher at the NF and MF areas, with statistically significant increases relative to baseline/reference conditions seen at TPN (118%), TPE (104%), SP (58%), TE (48%), and WAL (74%) (**Table 3.5-2**). These large

positive effects are primarily due to a relative decrease in biomass at the reference area INUG (i.e., the "increase" was identified primarily in relative rather than absolute terms; seen best in **Figure 3.5-3**). While the trend appears related to high variability at the INUG reference area, the trend should be watched in 2014.

- *Major Taxa Composition* – All areas are dominated by chrysophytes in all open-water months where biomass is in excess of 25 mg/m^3, a pattern that has been consistent since monitoring began in 2006 (**Figure 3.5-4**). No major differences were noted for 2013.
- *Species Richness* – At reference areas, seasonal profiles in species richness were similar in shape to total biomass, with an increase from low diversity (~15-20 species) in under-ice months (when and where measured) to peak diversity (~35 – 40 species) in summer during open water (**Figure 3.5-5**). In 2013, there was a significant increase in the annual mean species richness at TPN (25%) relative to baseline/reference conditions (**Table 3.5-2**). Again, as seen in **Figure 3.5-5**, this result appears to be driven by reduced diversity at INUG rather by an actual increase at TPN. This trend should be watched in 2014.

In summary, the statistically significant relative increases in mean total biomass in 2013 at the near-field areas TPN, TPE, SP, TE and WAL and species richness at TPN were due to decreases at INUG in 2013 rather than absolute increases at the impact areas, where results were consistent with historical trends. Notwithstanding, these trends should be closely monitored in 2014.

3.5.2. Baker Lake

3.5.2.1. General Observations

The phytoplankton community of Baker Lake is relatively similar to the Meadowbank Lakes by virtue of the fact that they are situated within roughly the same geographical region. Similar to the study lakes, taxonomic composition and biomass are comparable as chrysophytes (golden-brown algae) have consistently been the numerous taxonomic group in Baker Lake since monitoring began in 2008, with similar dominant taxa (e.g., *Chrysococcus*, *Kephyrion*, *Dinobryon*). However, Cryptophytes and Diatoms were the next most abundant groups in Baker Lake, each comprising about 20 - 25% of abundance, followed by dinoflagellates. This group was slightly less represented in Baker Lake relative to the study lakes because of the large size of Baker Lake. Given that dinoflagellates tend to be more sessile and associated with hard substrates and shorelines, the lack of this habitat limited their relative abundance and biomass.

Mean summer phytoplankton biomass in Baker Lake is generally similar to or higher than the Meadowbank lakes, typically reaching a maximum of about 200 to 400 mg/m^3.

3.5.2.2. 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 does coincide 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 2013 density and biomass results for phytoplankton are provided in **Table 3.5-3**. The results for the BACIP model statistical tests of the 2013 results against baseline/reference conditions are provided in **Table 3.5-4**; effect sizes of interest are 20% and 50%.

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 typically range from <1 to 2 µg/L (**Figure 3.5-6**). While a decreasing trend is apparent at all areas over the last two years, the results should be interpreted cautiously due to the data quality issue related to sample transport in 2013 (see **Section 3.1.1.2**).
- *Total biomass* – phytoplankton biomass was generally lower in 2013 than in previous years (**Figure 3.5-7**). BPJ showed a 22% decrease relative to reference area (BAP) performance, although the change was not statistically significant (**Table 3.5-4**).
- *Major taxa composition* – there were no apparent differences in relative composition of phytoplankton communities between BAP and impact areas BBD and BPJ in 2013 (**Figures 3.5-8 and 3.5-9**).
- *Species richness* – similar to total biomass, taxa richness was lower at all areas in 2013 than in previous years (**Figure 3.5-10**). There were no statistically significant changes in species richness for 2013 relative to previous years and the BAP reference.

Summary

Some minor (non-significant) changes were observed in 2013 relative to previous years. Given that no major changes in water quality occurred, these patterns are most likely natural.

Table 3.5-1. Phytoplankton density (cells/L), biomass (mg/m^3), and diversity by major taxa group, Meadowbank study lakes, 2013.

Area-Replicate	Date	Phytoplankton Density (cells/L)						
		Cyanophyte	Chlorophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	**TOTAL**
TPE-60	21-Jul-13	0	57672	2088176	101192	24352	11184	2282576
TPE-61	21-Jul-13	0	115144	2058640	209352	16768	10784	2410688
TPE-62	22-Aug-13	1200	712016	1726376	1029160	142296	16368	3627416
TPE-63	22-Aug-13	1800	273392	1523224	385968	32336	17168	2233888
TPE-66	26-Nov-13	100	54192	412948	115529	51345	100	634214
TPE-67	26-Nov-13	100	10838	397963	111529	27423	400	548253
TPE-68	09-Dec-13	100	18831	634952	298826	37461	100	990270
TPE-69	09-Dec-13	7392	28369	425632	47453	2700	400	511946
TPN-58	18-Apr-13	0	4800	209320	22277	1700	700	238797
TPN-59	18-Apr-13	3546	6300	212766	18231	1800	600	243243
TPN-60	21-Jul-13	0	36920	1698872	132112	67256	10384	1945544
TPN-61	21-Jul-13	0	28936	1246664	195768	8984	3200	1483552
TPN-62	26-Aug-13	1400	130512	1878824	630208	50304	42520	2733768
TPN-63	26-Aug-13	400	79624	1510440	744352	110960	32736	2478512
TPN-66	26-Nov-13	0	29869	339880	104691	65530	0	539969
TPN-67	26-Nov-13	0	17931	366848	93953	28869	900	508500
TPN-68	10-Dec-13	0	7192	398463	144298	26323	200	576476
TPN-69	10-Dec-13	200	11438	424286	682805	19931	100	1138760
TPS-39	21-Jul-13	28736	72440	1572928	173616	15968	17168	1880856
TPS-40	21-Jul-13	0	129712	1394128	210936	30336	9784	1774896
TPS-41	26-Aug-13	0	158848	1762880	428256	41120	19368	2410472
TPS-42	26-Aug-13	0	130112	1795016	595288	16968	49704	2587088
SP-58	19-Apr-13	14184	10492	549946	22477	18131	4546	619775
SP-59	19-Apr-13	4246	4100	505746	73522	59238	1100	647952
SP-60	19-Jul-13	800	215720	1699624	483744	81440	800	2482128
SP-61	19-Jul-13	1800	187184	1505456	578936	46920	1400	2321696
SP-62	24-Aug-13	129512	517448	1200128	218136	70056	16168	2151448
SP-63	24-Aug-13	152664	273192	1358376	211952	162048	1800	2160032
SP-64	18-Sep-13	800	137096	1618600	340464	45904	1000	2143864
SP-65	18-Sep-13	1000	323680	1273168	347248	89408	800	2035304
SP-66	24-Nov-13	0	53292	301419	20784	5246	0	380741
SP-67	24-Nov-13	0	7392	280542	58892	39607	400	386833
SP-68	08-Dec-13	100	95745	475477	116029	12238	200	699790
SP-69	08-Dec-13	0	60284	588753	231850	9192	0	890079
TE-60	15-Jul-13	0	86408	1821168	336264	66256	10384	2320480
TE-61	15-Jul-13	0	86208	1868856	206352	69056	8984	2239456
TE-62	24-Aug-13	600	129912	1553344	76440	88808	46304	1895408
TE-63	24-Aug-13	200	173016	1000576	117744	28936	17968	1338440
TE-66	28-Nov-13	800	10838	536561	68776	4946	200	622121
TE-67	28-Nov-13	300	21277	384179	59638	26623	800	492816
TE-68	22-Dec-13	1600	21577	351864	88853	21977	200	486070
TE-69	22-Dec-13	700	32715	324095	118021	400	0	475931
TEFF-27	15-Jul-13	0	100776	1650136	160848	29536	30536	1971832
TEFF-28	15-Jul-13	0	57672	1383928	185200	22352	8584	1657736
TEFF-29	24-Aug-13	1000	223704	1525808	116344	87008	10384	1964248
TEFF-30	24-Aug-13	200	179800	1295320	138696	43504	9184	1666704

Table 3.5-1. Phytoplankton density (cells/L), biomass (mg/m^3), and diversity by major taxa group, Meadowbank study lakes, 2013.

Area-Replicate	Date	Phytoplankton Density (cells/L)						
		Cyanophyte	Chlorophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	**TOTAL**
INUG-48	16-Jul-13	0	101976	1998168	273808	44504	9784	2428240
INUG-49	16-Jul-13	0	50888	1739744	217336	69256	26152	2103376
INUG-50	23-Aug-13	44504	511864	1806184	98392	166232	7784	2634960
INUG-51	23-Aug-13	8384	274592	1310488	111560	115144	22752	1842920
INUG-54	30-Nov-13	170213	31915	221558	61184	44253	100	529223
INUG-55	30-Nov-13	109929	92199	203528	91553	58738	300	556246
INUG-56	19-Dec-13	7092	14784	367048	118621	57138	3546	568230
INUG-57	19-Dec-13	0	39007	388625	51245	21477	300	500654
PDL-27	16-Jul-13	1800	129712	2144832	44120	16368	17968	2354800
PDL-28	16-Jul-13	2000	108160	2447960	107176	73040	37520	2775856
PDL-29	23-Aug-13	3400	510864	1506056	131912	51888	8984	2213104
PDL-30	23-Aug-13	1200	419472	1682072	136512	59272	29136	2327664
WAL-27	20-Apr-13	0	19131	887025	35915	111883	1400	1055353
WAL-28	20-Apr-13	0	1400	361902	5746	182505	400	551953
WAL-29	19-Jul-13	1200	151864	2074592	94408	112760	8384	2443208
WAL-30	19-Jul-13	200	123328	1793016	100592	104376	600	2122112
WAL-31	26-Aug-13	0	669512	1489088	395136	68056	37320	2659112
WAL-32	26-Aug-13	287360	375168	1720176	412488	68256	10784	2874232
WAL-33	15-Sep-13	7984	424856	1441000	401136	39320	28936	2343232
WAL-34	15-Sep-13	7184	317496	2508816	363416	89408	15168	3301488
WAL-35	28-Nov-13	0	71222	412548	114037	74022	500	672329
WAL-36	28-Nov-13	0	170213	307072	126167	66930	0	670382
WAL-37	22-Dec-13	0	21377	468685	260519	88460	1000	840041
WAL-38	22-Dec-13	100	49645	330787	238497	14784	100	633914
Relative Density or Biomass (%)		**0.9**	**9.0**	**72**	**14**	**3.4**	**0.6**	

Table 3.5-1. Phytoplankton density (cells/L), biomass (mg/m^3), and diversity by major taxa group, Meadowbank study lakes, 2013.

Area-Replicate	Date	Phytoplankton Biomass (mg/m^3)							Other	
		Cyanophyte	Chlorophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	**TOTAL**	# Species	Simp.Div.
TPE-60	21-Jul-13	0.00	0.92	190.44	7.25	6.06	22.54	227.21	29	0.79
TPE-61	21-Jul-13	0.00	3.95	195.02	10.91	5.23	25.96	241.08	31	0.81
TPE-62	22-Aug-13	0.39	18.82	178.31	31.71	16.16	15.20	260.59	36	0.88
TPE-63	22-Aug-13	0.62	5.36	165.65	19.47	6.00	14.98	212.08	35	0.88
TPE-66	26-Nov-13	0.01	0.89	47.54	8.56	8.96	0.11	66.08	23	0.83
TPE-67	26-Nov-13	0.02	0.23	42.06	5.94	6.07	3.68	58.00	19	0.83
TPE-68	09-Dec-13	0.02	1.08	46.43	15.60	5.00	2.50	70.63	28	0.86
TPE-69	09-Dec-13	0.35	0.66	34.67	2.92	3.65	1.40	43.65	23	0.85
TPN-58	18-Apr-13	0.00	0.49	7.29	2.35	2.06	1.09	13.27	17	0.68
TPN-59	18-Apr-13	0.18	0.71	8.51	1.47	2.26	0.86	13.99	17	0.65
TPN-60	21-Jul-13	0.00	1.74	168.73	9.33	9.80	30.25	219.85	34	0.80
TPN-61	21-Jul-13	0.00	1.55	144.77	17.62	3.58	14.70	182.22	27	0.85
TPN-62	26-Aug-13	0.42	4.55	191.85	41.92	10.24	23.67	272.65	37	0.88
TPN-63	26-Aug-13	0.11	1.05	141.45	46.62	8.80	30.12	228.15	34	0.88
TPN-66	26-Nov-13	0.00	1.22	38.53	8.73	7.40	0.00	55.88	16	0.85
TPN-67	26-Nov-13	0.00	0.43	41.78	8.91	4.10	3.39	58.61	20	0.82
TPN-68	10-Dec-13	0.00	0.16	17.26	16.48	3.16	2.51	39.56	23	0.82
TPN-69	10-Dec-13	0.05	0.69	33.26	37.03	3.91	0.11	75.05	26	0.75
TPS-39	21-Jul-13	0.46	1.65	169.81	7.99	3.81	33.29	217.01	29	0.85
TPS-40	21-Jul-13	0.00	3.85	145.85	11.29	5.04	19.02	185.05	26	0.84
TPS-41	26-Aug-13	0.00	2.81	182.37	24.46	7.49	19.82	236.95	36	0.88
TPS-42	26-Aug-13	0.00	3.98	184.94	59.36	3.63	35.53	287.44	35	0.88
SP-58	19-Apr-13	1.22	0.55	23.51	1.73	2.96	12.39	42.35	26	0.76
SP-59	19-Apr-13	0.69	0.45	25.94	4.73	10.95	11.51	54.27	30	0.72
SP-60	19-Jul-13	0.55	4.02	154.57	27.22	21.08	7.71	215.14	34	0.84
SP-61	19-Jul-13	1.45	3.92	160.77	36.38	20.93	18.35	241.81	34	0.83
SP-62	24-Aug-13	4.80	12.82	106.67	25.86	14.82	23.14	188.11	36	0.88
SP-63	24-Aug-13	48.25	6.19	68.41	24.57	25.90	17.32	190.63	32	0.85
SP-64	18-Sep-13	0.43	2.50	91.02	18.66	5.12	8.54	126.27	38	0.83
SP-65	18-Sep-13	0.51	5.23	118.26	19.86	8.46	12.33	164.64	34	0.87
SP-66	24-Nov-13	0.00	0.92	23.22	11.34	2.41	0.00	37.89	17	0.74
SP-67	24-Nov-13	0.00	0.27	19.17	10.55	4.03	1.24	35.26	17	0.75
SP-68	08-Dec-13	0.02	1.47	27.39	11.88	2.50	4.81	48.07	22	0.88
SP-69	08-Dec-13	0.00	3.62	30.62	9.89	2.96	0.00	47.09	19	0.81
TE-60	15-Jul-13	0.00	1.49	183.09	21.08	7.83	26.36	239.85	31	0.78
TE-61	15-Jul-13	0.00	3.14	197.52	15.28	11.23	15.73	242.89	30	0.82
TE-62	24-Aug-13	0.20	2.64	140.09	5.75	8.68	29.63	186.99	33	0.83
TE-63	24-Aug-13	0.07	2.93	91.06	5.58	1.99	21.38	123.00	32	0.87
TE-66	28-Nov-13	0.13	0.34	29.62	3.02	2.16	1.13	36.40	21	0.69
TE-67	28-Nov-13	0.07	0.45	25.84	4.85	4.09	7.85	43.16	19	0.76
TE-68	22-Dec-13	0.36	0.44	18.18	3.66	1.81	1.08	25.53	23	0.77
TE-69	22-Dec-13	0.17	1.99	22.39	4.75	0.41	0.00	29.70	19	0.82
TEFF-27	15-Jul-13	0.00	2.95	133.17	11.37	3.19	16.51	167.19	35	0.81
TEFF-28	15-Jul-13	0.00	1.72	123.74	14.84	2.91	14.39	157.59	31	0.84
TEFF-29	24-Aug-13	0.92	5.00	102.86	9.19	5.35	18.77	142.09	34	0.83
TEFF-30	24-Aug-13	0.07	11.55	95.54	10.90	2.69	10.24	130.98	31	0.83

Table 3.5-1. Phytoplankton density (cells/L), biomass (mg/m^3), and diversity by major taxa group, Meadowbank study lakes, 2013.

Area-Replicate	Date	Phytoplankton Biomass (mg/m^3)							Other	
		Cyanophyte	Chlorophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	**TOTAL**	# Species	Simp.Div.
INUG-48	16-Jul-13	0.00	3.52	147.38	21.17	4.59	20.34	197.00	38	0.87
INUG-49	16-Jul-13	0.00	1.17	202.24	21.58	12.11	46.15	283.24	34	0.86
INUG-50	23-Aug-13	2.45	9.45	109.45	6.35	14.57	4.94	147.21	36	0.82
INUG-51	23-Aug-13	0.63	4.74	86.07	8.70	10.28	16.85	127.26	38	0.83
INUG-54	30-Nov-13	3.91	1.28	16.49	3.08	6.22	0.16	31.14	17	0.80
INUG-55	30-Nov-13	2.53	2.30	12.60	5.81	7.85	2.76	33.84	18	0.86
INUG-56	19-Dec-13	0.17	0.39	18.17	4.48	3.04	1.31	27.56	21	0.83
INUG-57	19-Dec-13	0.00	1.03	20.80	3.57	1.69	0.48	27.57	18	0.81
PDL-27	16-Jul-13	1.66	4.96	184.01	6.99	4.06	54.82	256.51	32	0.81
PDL-28	16-Jul-13	1.67	7.00	196.26	13.22	8.20	38.46	264.81	32	0.82
PDL-29	23-Aug-13	1.31	9.99	118.59	9.11	16.62	12.44	168.06	36	0.85
PDL-30	23-Aug-13	0.42	16.19	167.66	25.62	6.42	12.19	228.50	36	0.83
WAL-27	20-Apr-13	0.00	0.92	41.78	4.40	20.86	5.19	73.15	24	0.70
WAL-28	20-Apr-13	0.00	0.19	12.09	3.51	31.53	0.66	47.98	19	0.66
WAL-29	19-Jul-13	0.76	5.52	234.74	8.04	16.27	24.43	289.75	35	0.82
WAL-30	19-Jul-13	0.13	4.24	188.90	16.86	13.09	9.99	233.20	35	0.83
WAL-31	26-Aug-13	0.00	23.78	132.10	36.42	7.45	24.32	224.07	38	0.88
WAL-32	26-Aug-13	13.71	8.60	147.28	28.14	8.06	17.16	222.96	35	0.87
WAL-33	15-Sep-13	0.55	23.46	122.71	32.57	5.44	10.80	195.54	38	0.87
WAL-34	15-Sep-13	0.25	7.31	195.27	38.92	8.21	10.92	260.88	38	0.83
WAL-35	28-Nov-13	0.00	1.48	25.69	21.07	11.16	0.53	59.93	17	0.79
WAL-36	28-Nov-13	0.00	4.20	34.59	6.87	10.62	0.00	56.29	19	0.84
WAL-37	22-Dec-13	0.00	1.26	39.15	12.35	13.74	2.36	68.86	24	0.84
WAL-38	22-Dec-13	0.04	2.70	31.85	5.61	1.59	2.65	44.44	22	0.79
Relative Density or Biomass (%)		**1.0**	**2.9**	**71**	**11**	**5.6**	**9.2**			

Table 3.5-2. Results of BACI test for phytoplankton variables at Meadowbank areas.

Parameter Measured	Test Station	n(B)	n(A)	Estimate	SE	P-value*	Effect size (%)		
							ES	LCI	UCI
Total biomass	TPN	7	4	0.78	0.21	**0.006**	118	34	254
	TPE	8	4	0.71	0.16	**0.001**	104	43	191
	SP	6	4	0.46	0.17	**0.025**	58	8	131
	TPS	19	2	0.50	0.35	0.177	64	-22	244
	TE	6	4	0.39	0.13	**0.018**	48	9	100
	TEFF	12	2	-0.06	0.2	0.785	-5	-39	46
	WAL	19	4	0.55	0.21	**0.014**	74	13	167
Species	TPN	7	4	0.22	0.09	**0.043**	25	1	54
	TPE	8	4	0.12	0.08	0.173	13	-6	37
	SP	6	4	0.07	0.05	0.176	7	-4	19
	TPS	19	2	-0.09	0.10	0.369	-9	-25	12
	TE	6	4	0.09	0.09	0.377	9	-12	36
	TEFF	12	2	-0.06	0.07	0.401	-6	-19	10
	WAL	19	4	0.01	0.06	0.924	1	-12	15

Notes:
Test station = station 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 2013);
Estimate = BACI model estimate of the 2013 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;
***Bolded values** are statistically significant results;
ES = estimated effect size (i.e., 100%*(exp[Estimate]-1));
LCI = lower 95% confidence interval; **UCI** = upper 95% confidence interval
Shading indicates a negative effect size (reduction) of 20% or greater.

Table 3.5-3. Phytoplankton density (cells/L), biomass (mg/m^3), and diversity by major taxa group, Baker Lake, 2013.

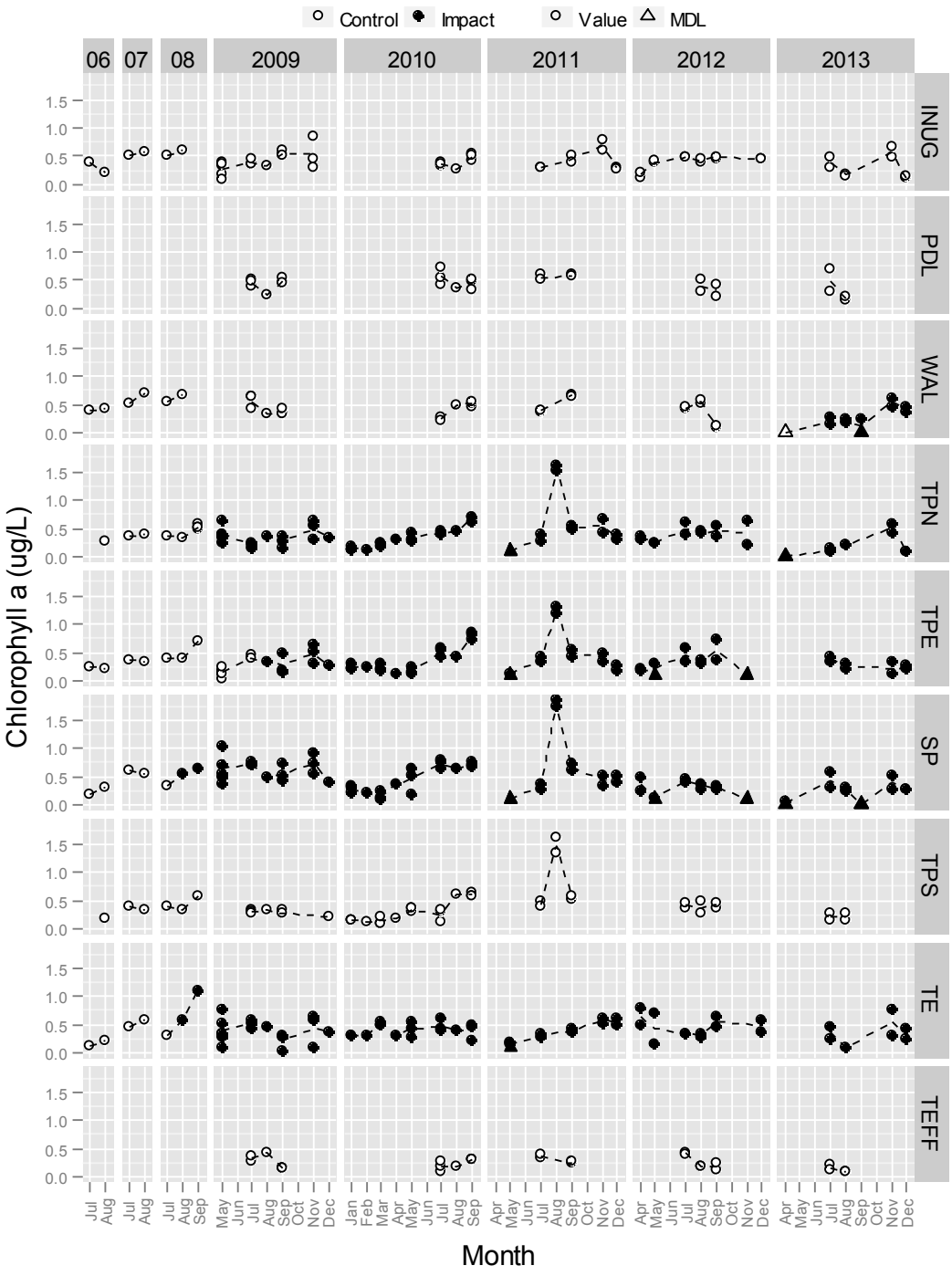
Area-Replicate	Date	Phytoplankton Density (cells/L)							Phytoplankton Biomass (mg/m^3)							Other	
		Cyanophyte	Chlorophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	**TOTAL**	Cyanophyte	Chlorophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	**TOTAL**	# Species	Simp.Div.
BAP-27	20-Jul-13	0	28936	1031912	181464	56088	2000	1300400	0.00	1.65	98.43	60.32	14.89	17.17	192.46	28	0.78
BAP-28	20-Jul-13	0	50288	806808	132760	74656	9584	1074096	0.00	2.07	59.28	45.49	23.19	23.89	153.93	31	0.82
BAP-29	30-Aug-13	0	215920	1423232	122992	246872	1400	2010416	0.00	9.26	98.75	28.42	41.24	8.08	185.75	39	0.83
BAP-30	30-Aug-13	0	301728	790640	243936	466976	1000	1804280	0.00	5.45	42.07	43.25	68.10	4.56	163.43	33	0.86
BBD-27	20-Jul-13	200	65856	1074016	129576	75056	2400	1347104	1.44	7.95	67.22	45.59	21.41	29.78	173.38	35	0.83
BBD-28	20-Jul-13	200	79024	1194344	137544	116560	1800	1529472	0.16	2.75	84.79	32.74	24.47	22.12	167.02	32	0.81
BBD-29	30-Aug-13	200	1020128	1156824	183864	311328	1200	2673544	0.06	28.54	66.99	50.53	51.27	1.39	198.77	36	0.89
BBD-30	30-Aug-13	0	374168	1020328	195264	295760	800	1886320	0.00	13.14	61.57	81.29	47.29	2.44	205.73	35	0.89
BPJ-27	20-Jul-13	0	28936	965856	67520	104792	2200	1169304	0.00	1.17	104.92	41.95	25.82	22.16	196.02	29	0.81
BPJ-28	20-Jul-13	0	79224	872464	175080	39936	2000	1168704	0.00	4.40	72.27	45.62	20.35	20.37	163.00	33	0.83
BPJ-29	30-Aug-13	0	423856	718400	119624	116960	800	1379640	0.00	8.50	45.23	71.59	22.99	1.76	150.08	30	0.90
BPJ-30	30-Aug-13	0	266008	725984	43736	112160	400	1148288	0.00	6.89	35.80	20.52	19.33	0.39	82.93	33	0.85
Relative Density or Biomass (%)		**0.003**	**16**	**64**	**9.4**	**11**	**0.1**		**0.1**	**4.5**	**41**	**28**	**19**	**7.6**			

Table 3.5-4. Results of BACI tests for phytoplankton variables at Baker Lake areas.

Parameter Measured	Test Station	n(B)	n(A)	Estimate	SE	P-value*	Effect size (%)		
							ES	LCI	UCI
Total biomass	BBD	14	2	-0.01	0.24	0.98	-1	-40	65
	BPJ	14	2	-0.25	0.20	0.24	-22	-50	20
Species	BBD	14	2	0.03	0.06	0.60	3	-10	18
	BPJ	14	2	-0.10	0.06	0.14	-9	-21	4

Notes:
Test station = station 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 2013);
Estimate = BACI model estimate of the 2013 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;
***Bolded values** are statistically significant results;
ES = estimated effect size (i.e., 100%*(exp[Estimate]-1));
LCI = lower 95% confidence interval; **UCI** = upper 95% confidence interval
Shading indicates a negative effect size (reduction) of 20% or greater.

Figure 3.5-1. Chlorophyll-*a* (µg/L) in water samples from Meadowbank study lakes since 2006.



*__Note__: Chlorophyll-*a* data from 2013 were potentially compromised due to sample transport issues (see **Section 3.1.1.2**).

Figure 3.5-2. Total phytoplankton biomass (mg/m3) from Meadowbank study lakes since 2006.

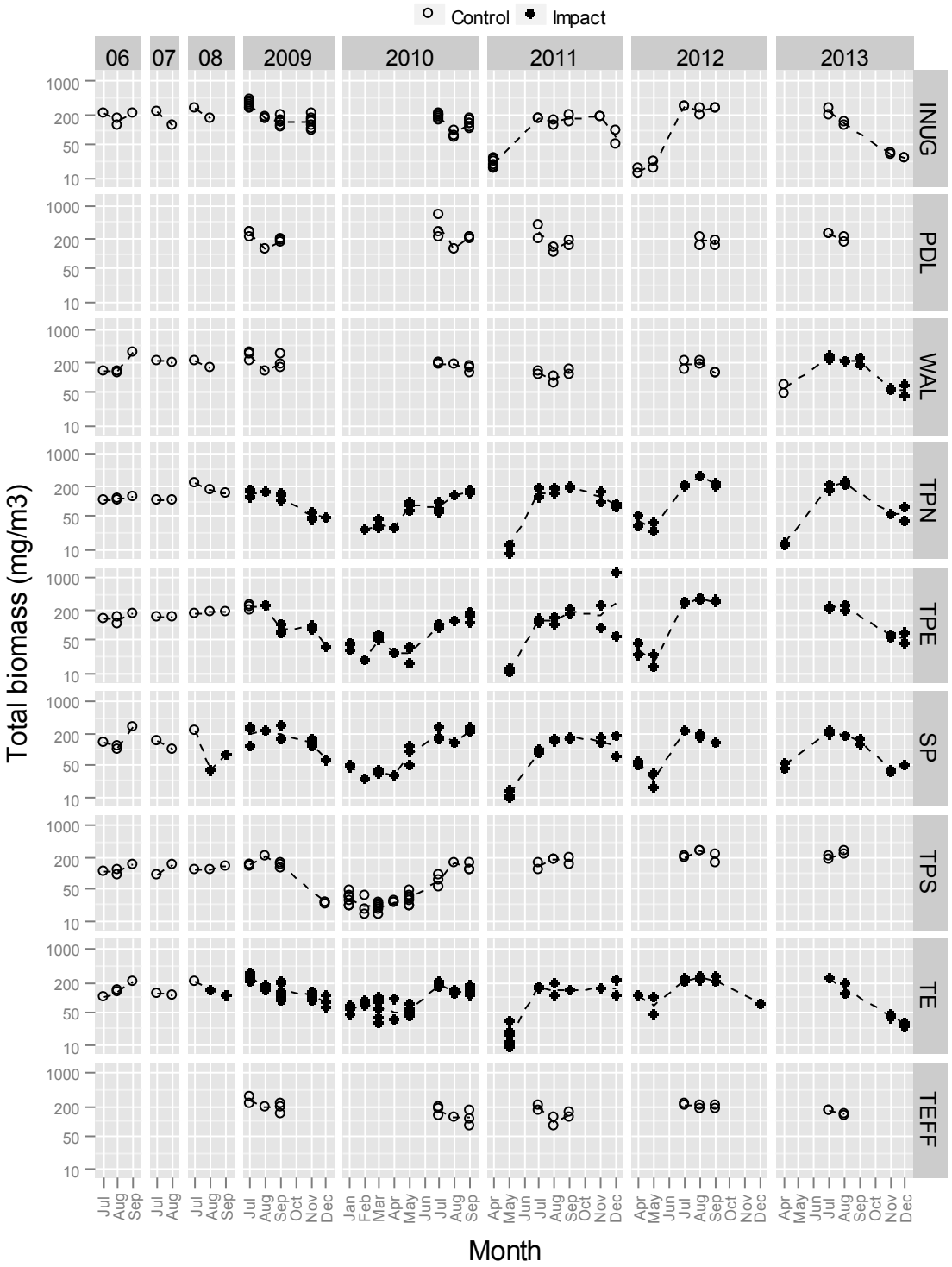


Figure 3.5-3. Phytoplankton biomass (mg/m^3) by major taxa group from Meadowbank study lakes since 2006.

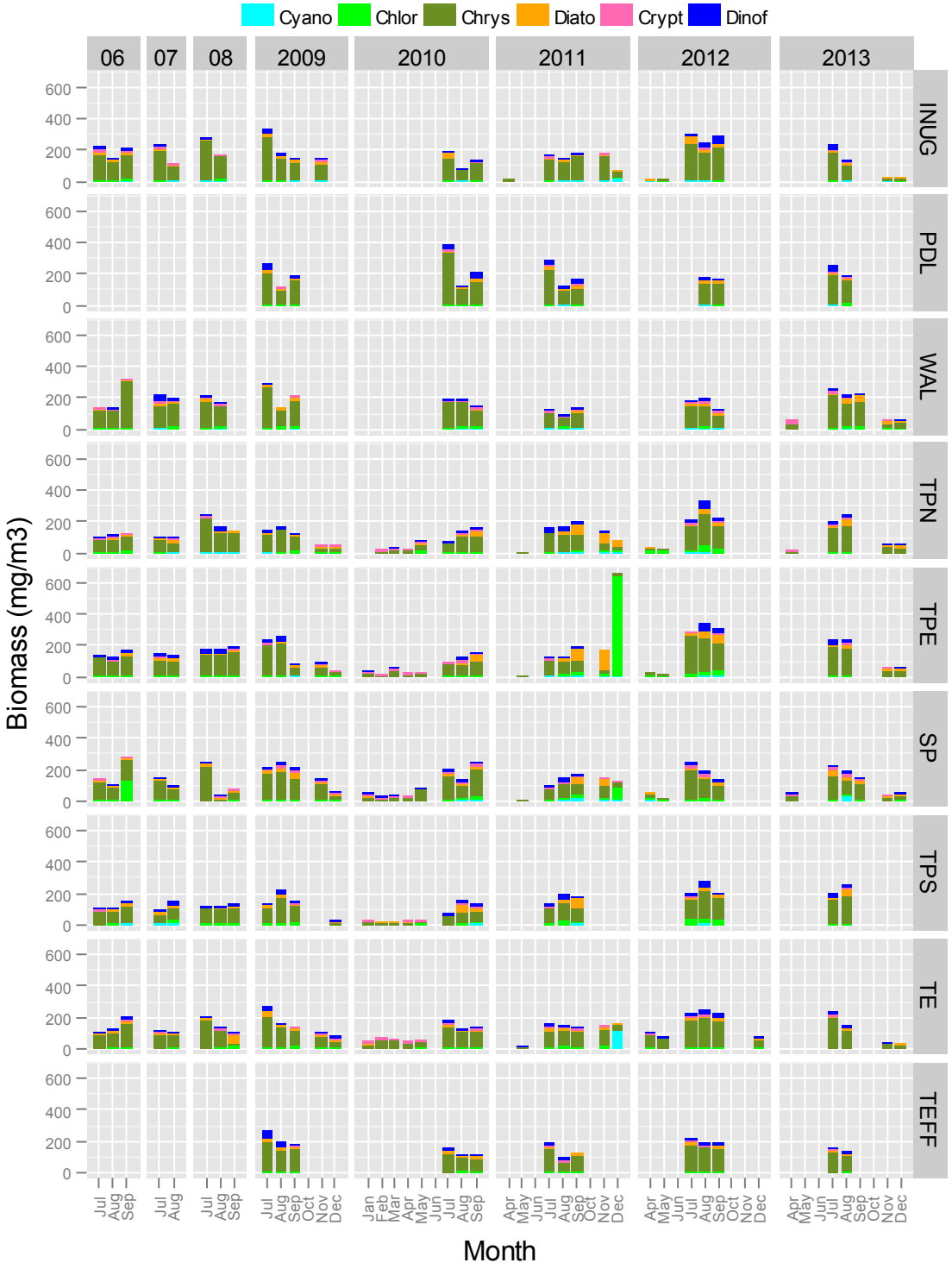


Figure 3.5-4. Phytoplankton relative biomass by major taxa group from Meadowbank study lakes since 2006.

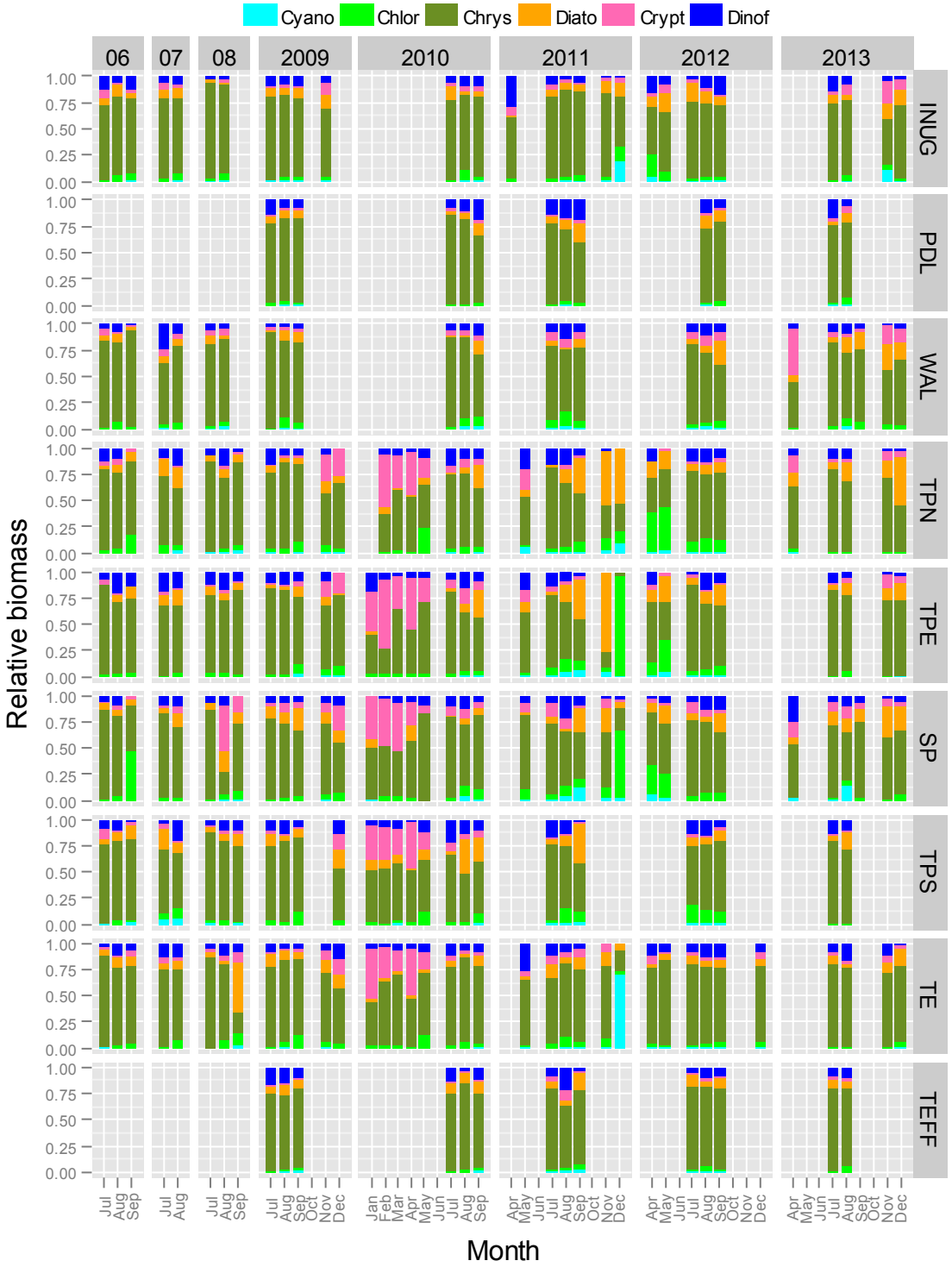


Figure 3.5-5. Phytoplankton species richness from Meadowbank study lakes since 2006.

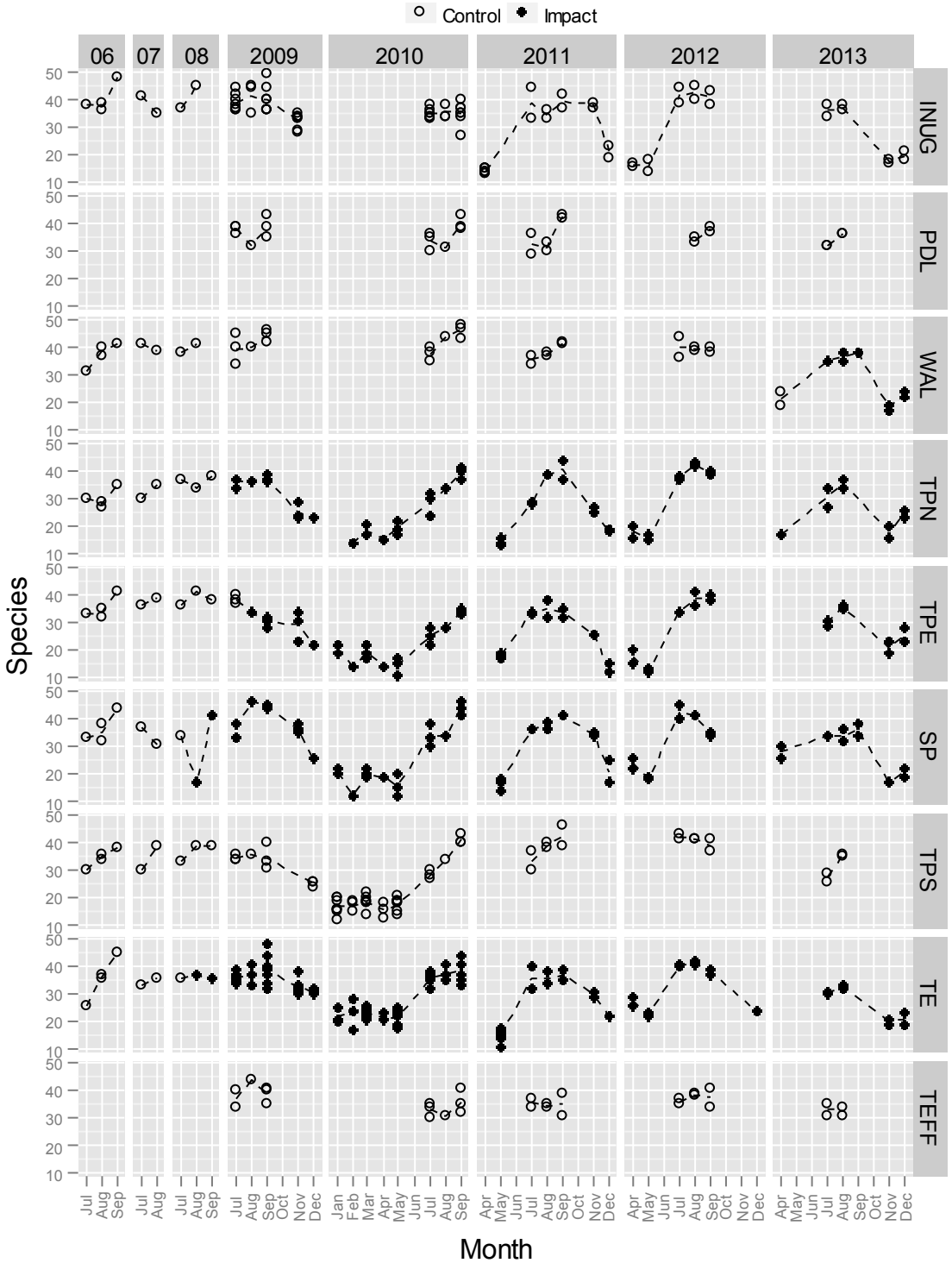
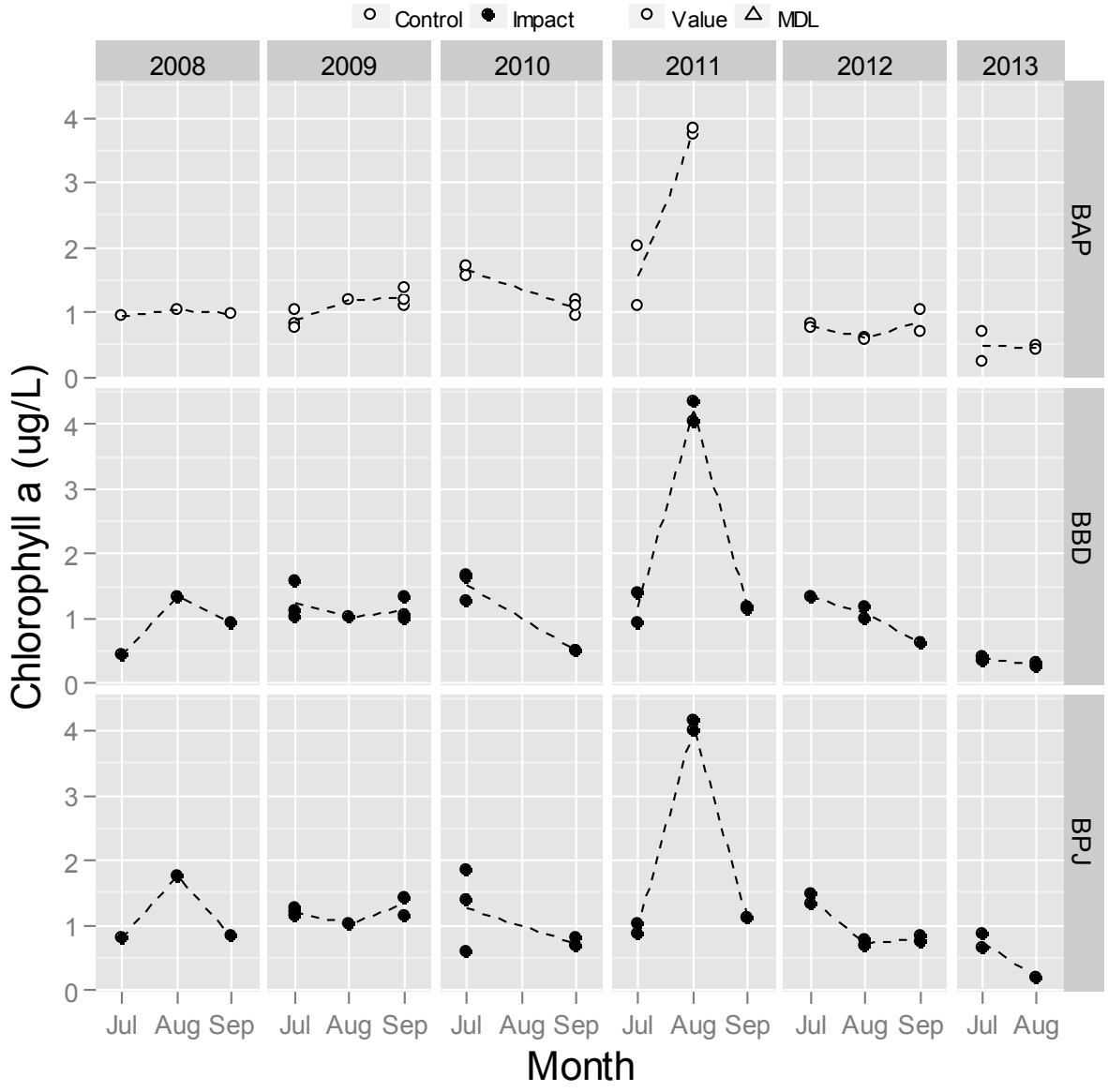


Figure 3.5-6. Chlorophyll-*a* (µg/L) in water samples from Baker Lake since 2008.



*__Note__: Chlorophyll-*a* data from 2013 were potentially compromised due to sample transport issues (see **Section 3.1.1.2**).

Figure 3.5-7. Total phytoplankton biomass (mg/m^3) from Baker Lake since 2008.

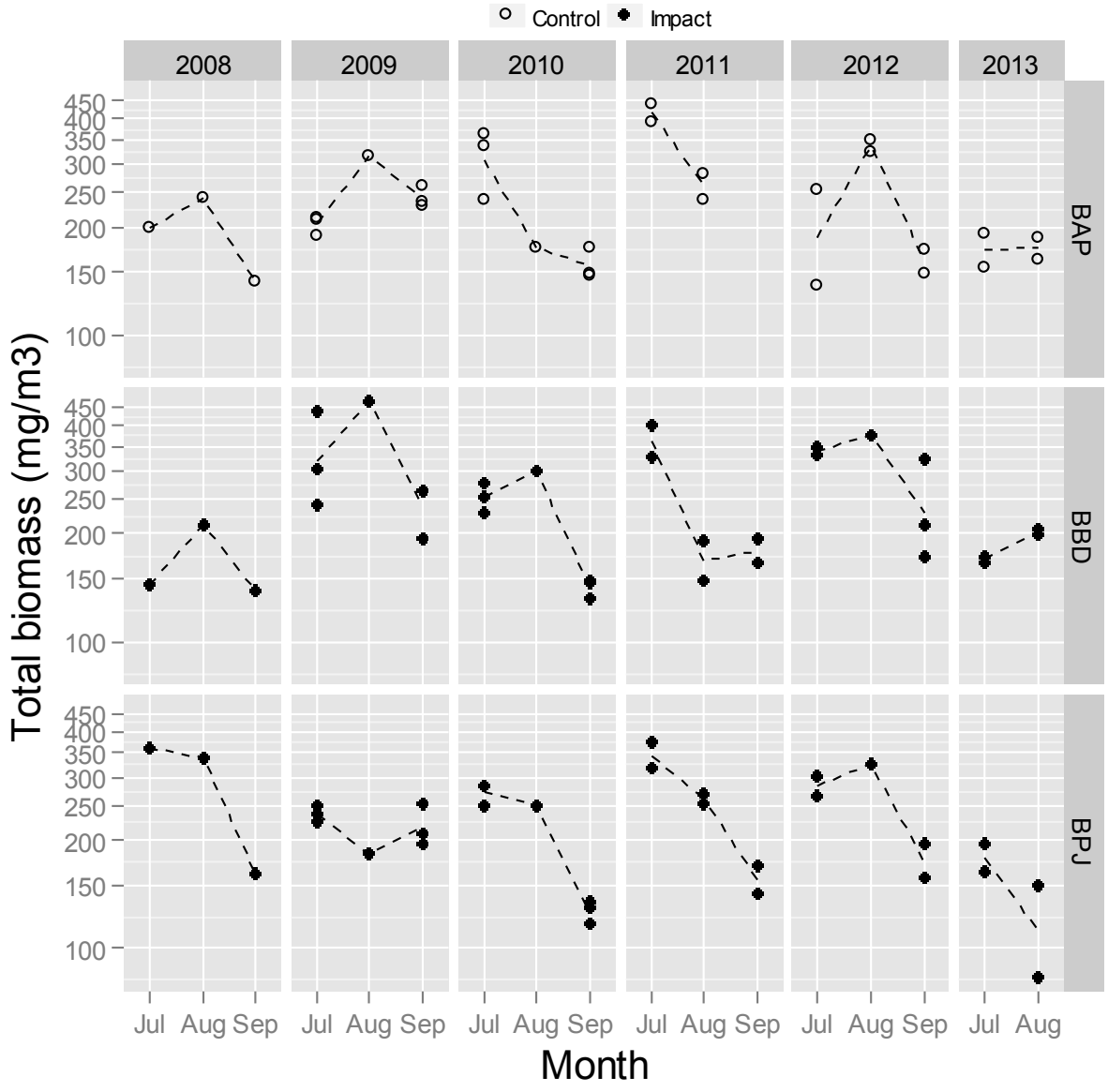


Figure 3.5-8. Phytoplankton biomass (mg/m^3) by major taxa group from Baker Lake since 2008.

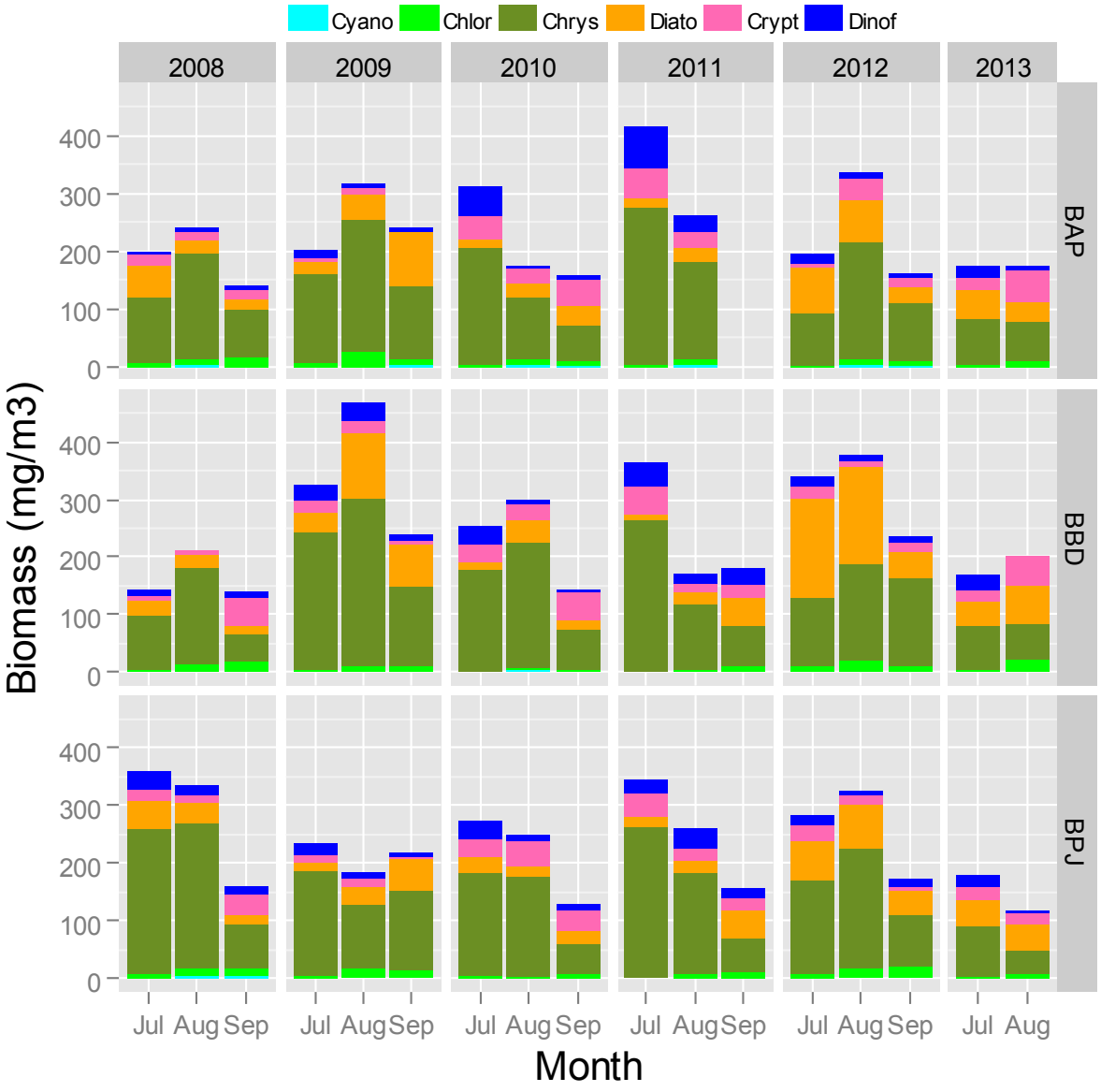


Figure 3.5-9. Phytoplankton relative biomass by major taxa group from Baker Lake since 2008.

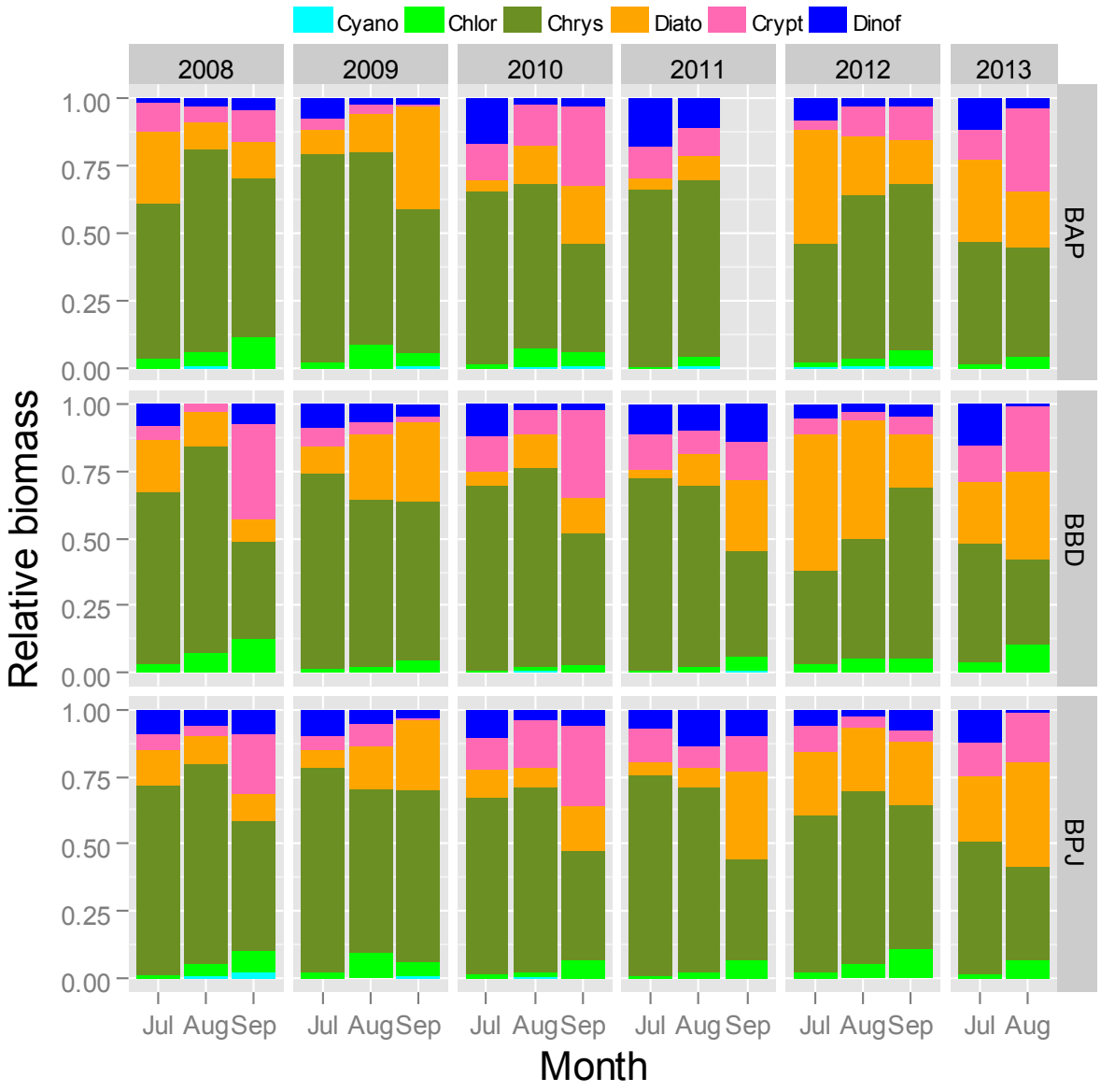
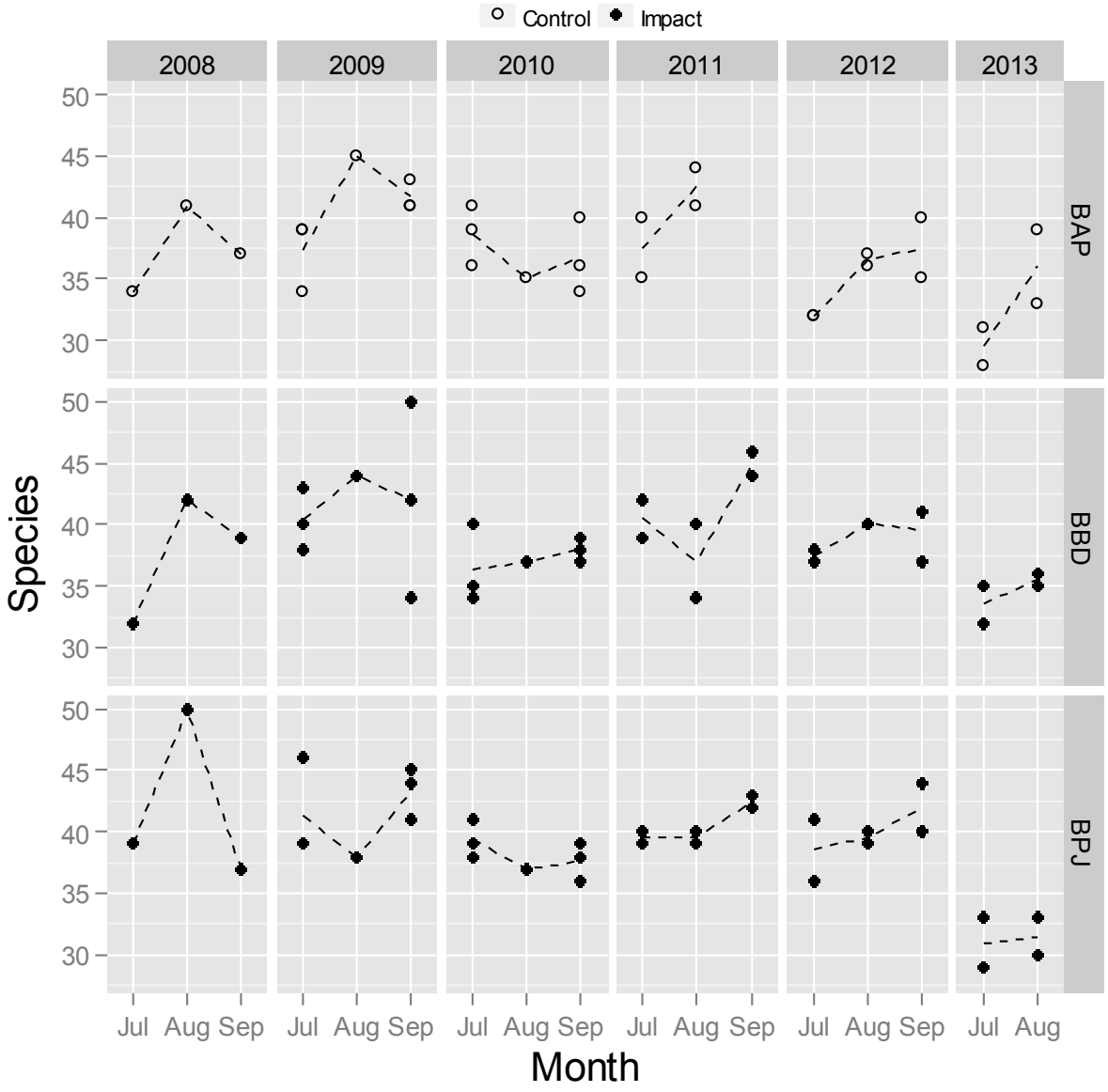


Figure 3.5-10. Phytoplankton species richness from Baker Lake since 2008.



3.6. Benthic Invertebrates

3.6.1. Meadowbank Study Lakes

3.6.1.1. *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.

Low productivity and low nutrient cycling result in a benthic community characterized by low abundance and relatively low taxa richness. Benthos abundance was typically less than 2,000 organisms/m^2 and was often less than 1,000 organisms/m^2 (e.g., **Figures 3.6-1 and 3.6-2**). Annual variability was sometimes high and spatially discrete, as seen at WAL (e.g., all years) and TPE (e.g., 2006 to 2008). There have also been fairly consistent spatial differences in abundance among lakes. For example, biomass in SP and TE is lower than the other lakes and WAL higher since baseline monitoring (2006 to 2007). Taxa richness typically ranged from 8 to 12 for most area-year combinations (e.g., **Figures 3.6-4 and 3.6-5**).

Typical of most Arctic lakes, the benthic invertebrate community has been generally dominated by the aquatic larval stages of insects, especially chironomids (Family Chironomidae), both in terms of abundance and taxa richness (e.g., **Figures 3.6-2, 3.6-3, 3.6-5, and 3.6-6**). The next most abundant group was typically 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. Epibenthic insects such as mayflies and stoneflies are not common in the project lakes.

3.6.1.2. *Temporal and Spatial Trend Interpretation*

The 2013 results are summarized in **Tables 3.6-1** (Meadowbank) and **Table 3.6-2** (Baker Lake) (raw data are provided in **Appendix H**), and included in the time series graphs (**Figures 3.6-1 to 3.6-12**) that target the following endpoints (descriptions 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.

Other endpoints that are presented in **Appendix I** but not discussed in detail in the text are:

- *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.
- *Bray-Curtis Index* – 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.

As discussed in **Sections 1.4 and 1.5**, the identification of potential mine-related impacts generally involved visually examining the data for spatial/temporal patterns that matched mine-related events (see **Section 1.4** for details). This was augmented by conducting statistical analyses of the 2013 data to test for changes relative to baseline/reference conditions using the BACI model (see **Section 2.4.4** for details); this included 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 2013 results and trends over the last four years. BACI model results for benthic invertebrate abundance and richness are presented in **Tables 3.6-3 and 3.6-4**, respectively. Key results are described below:

- *Total abundance* – Mean abundance at reference area INUG was higher (nearly double; **Figure 3.6-1**) than observed historically. Despite total abundance at all near-field and mid-field areas tracking within or higher than baseline ranges, the BACI results (i.e., comparing actual to expected based on reference/baseline conditions; **Table 3.6-3**) showed large apparent "decreases" (ranging from -26 to

-69%) relative to reference/baseline conditions at all areas except SP (which also had higher than ever abundance). However, the only statistically significant change (single year or longer term) identified was for far-field TEFF (apparent change of -46% over the last three years), which actually increased in absolute abundance during that time. While these overall results appear to be driven by anomalous reference area results in 2013 (i.e., they do not appear related to mining activities), the trends should be monitored in 2014.

- *Major taxa group abundance and relative abundance* – As expected, insects dominated across areas, followed by molluscs (**Figures 3.6-2 and 3.6-3**). While there were no apparent trends in composition changes related to mining, it is notable that most peaks in total abundance over the years appear to be driven by increases in insects (predominantly chironomids).
- *Taxa richness* – Similar to total abundance, mean taxa richness at reference area INUG was higher than ever and approximately 50% higher than seen over the last three years (**Figure 3.6-4**). Despite the high richness seen at INUG, the BACI results (**Table 3.6-4**) showed no decreases in richness at near-field areas (TPN, TPE and SP), which highlights good years for those areas too. The apparent "decreases" (-21 to -30%) seen in the BACI results for the mid-field and far-field areas were not statistically significant and were due to the relative increase at INUG in 2013 (i.e., all impact areas tracking within or above historical baseline ranges). No significant longer-term trends were identified.
- *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%) (**Figures 3.6-5 and 3.6-6**). There were no apparent trends in composition related to mining.

In summary, apparent "decreases" in total abundance were identified for most areas in 2013 due to anomalously high abundance at reference area INUG. Given that total abundance in all areas was tracking with their respective baseline ranges and that no associated decreases (apparent or absolute) in taxa richness were observed at near-field areas (TPN, TPE, SP) during this period, these results are unlikely due to mining activity.

3.6.2. Baker Lake

3.6.2.1. *General Observations*

As discussed in **Section 3.6.1.1**, the abundance and species composition of benthic invertebrates is strongly affected by a variety of parameters, the most important of which are grain size, water depth and organic content of the sediment. Investigations in the Meadowbank lakes and Baker Lake have attempted to target areas of similar depth and

grain size (i.e., dominated by silt/clay with a small [<5%] sand fraction). However, in Baker Lake, sediment grain size has tended to be more variable and less predictable according to depth and grain size at all locations is consistently larger, with a higher sand fraction than observed in Meadowbank lakes. Higher sand content is also typically associated with a lower TOC concentration and a different benthic community. However, this area of Baker Lake appears to be naturally quite sandy, so this represents the 'typical' condition and this is what was sampled. For perspective, the reference areas BAP and BES sediment contain about 60 – 70% sand, while the impact areas at BBD (50 – 65% sand) and BPJ (10 – 40% sand) have a smaller sand component and relatively more silt-clay.

Similar to Meadowbank study lakes, the Baker Lake benthic community is characterized by relatively low abundance and taxa richness. Benthos abundance was typically around 5,000 organisms/m^2, which is higher than typical numbers (~2,000/m^2) in Meadowbank (e.g., **Figures 3.6-7 and 3.6-8)**. 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 typically ranged from 6 to 12 in exposure areas and from about 12 to 22 in reference areas (e.g., **Figures 3.6-10 and 3.6-11**).

Typical of most Arctic lakes, the benthic invertebrate community has been generally dominated by the aquatic larval stages of insects, especially chironomids (Family Chironomidae), both in terms of abundance and taxa richness (**Figures 3.6-8, 3.6-9, 3.6-11 and 3.6-12**). The next most abundant group was typically Mollusca (clams) especially, *Cyclocalyx / Neopisidium*, genera of the family Sphaeriidae (fingernail clams). Oligochaete worms were also relatively abundant in the lake sediments, possibly because of the sandier grain size sediment; generally, at least one oligochaete taxon was present at most area/year combinations.

3.6.2.2. *Temporal and Spatial Trend Interpretation*

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 AEM'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.

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 2013 results and trends over the last four years. BACI model (see **Section**

2.4.4) results for benthic invertebrate abundance and richness are presented in **Tables 3.6-5 and 3.6-6**, respectively. Key results are described below:

- *Total abundance* – Mean abundance at all areas was higher in 2013 than in earlier years (**Figure 3.6-7**). BACI model results (**Table 3.6-5**) showed either positive effect sizes or minimal decreases relative to predicted reference area performance in 2013. While the three-year trend showed an apparent increase of 64% at BPJ, the four-year trend was an apparent reduction (-36%) in abundance. The result was driven by 2010, where two of the BPJ replicates had very low abundance. Although variability is high, no apparent decreasing trend is evident at impact areas BBD or BPJ since 2008.
- *Major taxa group abundance and relative abundance* – Impact areas BBD and BPJ are dominated by insects and the taxonomic community is different than BAP (apart from 2008; **Figures 3.6-8 and 3.6-9**). Since 2009, between approximately 25 to 60% of individuals at BAP have been oligochaetes, compared to <10% at the other areas. Notwithstanding, compositional patterns have been fairly consistent within each area over the years suggesting no development-related changes.
- *Taxa richness* – Similar to total abundance, mean taxa richness at all areas in 2013 was higher than in 2012 (**Figure 3.6-10**). The only apparent decreases in richness in the BACI model results (**Table 3.6-6**) was the four-year trend for BPJ, which showed a modest drop (-15%, but not statistically significant and below the 20% trigger). Thus, although variable, no apparent decreasing trends are evident at impact areas BBD or BPJ since 2008.
- *Major taxa group richness and relative richness* – From a taxa richness perspective, impact areas BBD and BPJ appear reasonably similar to both reference area (BES and BAP), with insects dominating the communities (**Figures 3.6-11 and 3.6-12**). There were no apparent trends in composition related to mining.

Monitoring results to date have been variable across the sites. A detailed discussion on early trends is presented in the 2012 CREMP (Azimuth, 2013). Overall, it is difficult to attribute any of the observed patterns to development-related activities, especially in light of no apparent barge-related effects to water quality and sediment chemistry.

Table 3.6-1. Benthic invertebrate abundance (#/m^2) and richness (# taxa) by major taxa group, Meadowbank study lakes, August 2013.

Area-Replicate	Date	Depth (m)	Total Abundance (#/m^2)				Total	Total Richness (# taxa)				Total
			Oligochaetes	Insects	Molluscs	Other Taxa		Oligochaetes	Insects	Molluscs	Other Taxa	
Inuggugayualik Lake												
INUG-1	23-Aug-13	7.9	65	1261	348	65	1739	2	10	1	2	15
INUG-2	23-Aug-13	8.4	109	1152	674	65	2000	1	10	3	2	16
INUG-3	23-Aug-13	6.5	152	891	152	0	1196	2	9	1	0	12
INUG-4	23-Aug-13	7.5	196	2609	1065	391	4261	2	11	3	2	18
INUG-5	23-Aug-13	8.3	87	1174	435	0	1696	3	10	2	0	15
	Area Mean		***122***	***1417***	***535***	***104***	***2178***	***2***	***10***	***2***	***1***	***15***
Pipedream Lake												
PDL-1	23-Aug-13	8.6	22	696	304	22	1043	1	8	1	1	11
PDL-2	23-Aug-13	6.6	174	609	217	0	1000	1	7	2	0	10
PDL-3	23-Aug-13	6.8	174	1348	500	43	2065	1	6	2	1	10
PDL-4	23-Aug-13	7	0	913	391	0	1304	0	7	1	0	8
PDL-5	23-Aug-13	7.3	0	870	326	22	1217	0	9	1	1	11
	Area Mean		***74***	***887***	***348***	***17***	***1326***	***1***	***7***	***1***	***1***	***10***
Second Portage Lake												
SP-1	25-Aug-13	8	43	2174	391	43	2652	0	7	1	1	9
SP-2	25-Aug-13	8.1	22	3783	435	65	4304	1	10	1	1	13
SP-3	25-Aug-13	8.8	22	1370	217	87	1696	0	9	1	1	11
SP-4	25-Aug-13	7.4	43	2174	217	0	2435	1	9	1	0	11
SP-5	25-Aug-13	7	22	935	304	43	1304	0	8	1	1	10
	Area Mean		***30***	***2087***	***313***	***48***	***2478***	***0***	***9***	***1***	***1***	***11***
Tehek Lake												
TE-1	24-Aug-13	7.4	0	304	391	22	717	0	7	1	1	9
TE-2	24-Aug-13	9.3	0	674	370	130	1174	0	6	1	1	8
TE-3	24-Aug-13	8.6	0	217	239	43	500	0	4	1	1	6
TE-4	24-Aug-13	8	0	543	174	370	1087	0	6	1	1	8
TE-5	24-Aug-13	6.7	0	326	478	0	804	0	6	2	0	8
	Area Mean		***0***	***413***	***330***	***113***	***857***	***0***	***6***	***1***	***1***	***8***

Table 3.6-1. Benthic invertebrate abundance (#/m^2) and richness (# taxa) by major taxa group, Meadowbank study lakes, August 2013.

Area-Replicate	Date	Depth (m)	Total Abundance (#/m^2)				Total	Total Richness (# taxa)				Total
			Oligochaetes	Insects	Molluscs	Other Taxa		Oligochaetes	Insects	Molluscs	Other Taxa	
Tehek Lake - Farfield												
TEFF-1	24-Aug-13	8.6	0	326	370	43	739	0	7	1	1	9
TEFF-2	24-Aug-13	7.4	22	2152	109	109	2391	1	8	1	1	11
TEFF-3	24-Aug-13	8.5	0	587	261	65	913	0	6	1	1	8
TEFF-4	24-Aug-13	8.7	0	565	152	65	783	0	9	1	1	11
TEFF-5	24-Aug-13	7	22	152	370	87	630	1	6	1	1	9
	Area Mean		***9***	***757***	***252***	***74***	***1091***	***0***	***7***	***1***	***1***	***10***
Third Portage Lake - East Basin												
TPE-1	27-Aug-13	7.4	43	1152	783	261	2239	1	11	1	1	14
TPE-2	27-Aug-13	7.2	87	1500	696	22	2304	2	11	1	1	15
TPE-3	27-Aug-13	7.5	130	1587	696	109	2522	2	11	1	1	15
TPE-4	27-Aug-13	7.5	65	1435	1196	22	2717	1	10	1	1	13
TPE-5	27-Aug-13	8.8	87	978	478	65	1609	2	9	1	1	13
	Area Mean		***83***	***1330***	***770***	***96***	***2278***	***2***	***10***	***1***	***1***	***14***
Third Portage Lake - North Basin												
TPN-1	28-Aug-13	8	22	1391	370	0	1783	1	11	1	0	13
TPN-2	28-Aug-13	7.5	109	891	130	0	1130	2	10	1	0	13
TPN-3	28-Aug-13	9.4	22	1087	152	0	1261	1	10	1	0	12
TPN-4	28-Aug-13	8.6	0	913	413	22	1348	0	11	1	1	13
TPN-5	28-Aug-13	7.7	22	1022	326	239	1609	1	8	1	1	11
	Area Mean		***35***	***1061***	***278***	***52***	***1426***	***1***	***10***	***1***	***0***	***12***
Third Portage Lake - South Basin												
TPS-1	27-Aug-13	9	65	609	522	43	1239	1	10	1	1	13
TPS-2	27-Aug-13	8	0	326	283	348	957	0	6	1	1	8
TPS-3	27-Aug-13	8.3	0	783	239	0	1022	0	5	1	0	6
TPS-4	27-Aug-13	8.5	87	1674	761	87	2609	1	9	1	1	12
TPS-5	27-Aug-13	7	261	2152	696	22	3130	2	8	1	1	12
	Area Mean		***83***	***1109***	***500***	***100***	***1791***	***1***	***8***	***1***	***1***	***10***
Wally Lake												
WAL-1	26-Aug-13	8	0	761	457	109	1326	0	7	2	1	10
WAL-2	26-Aug-13	9	22	152	370	65	609	1	3	3	1	8
WAL-3	26-Aug-13	6.5	0	630	239	43	913	0	7	2	2	11
WAL-4	26-Aug-13	9.2	0	2348	500	109	2957	0	7	2	2	11
WAL-5	26-Aug-13	8.4	0	2348	370	174	2891	0	9	2	2	13
	Area Mean		***4***	***1248***	***387***	***100***	***1739***	***0***	***7***	***2***	***2***	***11***

Table 3.6-2. Benthic invertebrate abundance (#/m^2) and richness (# taxa) by major taxa group, Baker Lake, August 2013.

Area-Replicate	Date	Depth (m)	Total Abundance (#/m^2)				Total	Total Richness (# taxa)				Total
			Oligochaetes	Insects	Molluscs	Other Taxa		Oligochaetes	Insects	Molluscs	Other Taxa	
Baker Akilahaarjuk Point												
BAP-1	30-Aug-13	8.3	696	2565	109	130	3500	3	16	1	1	21
BAP-2	30-Aug-13	7.7	2804	4739	739	196	8478	2	12	1	1	16
BAP-3	30-Aug-13	8.6	1739	2304	239	109	4391	3	15	1	1	20
BAP-4	30-Aug-13	8.6	1652	1652	348	109	3761	3	16	1	1	21
BAP-5	30-Aug-13	9.1	3109	3022	717	174	7022	4	12	1	1	18
	Area Mean		***2000***	***2857***	***430***	***143***	***5430***	***3***	***14***	***1***	***1***	***19***
Baker Barge Dock												
BBD-1	29-Aug-13	8.4	261	8304	413	0	8978	1	8	1	0	10
BBD-2	29-Aug-13	8.9	804	2674	22	0	3500	3	5	1	0	9
BBD-3	29-Aug-13	7	0	804	0	43	848	0	11	0	1	12
BBD-4	29-Aug-13	7.5	130	3152	43	43	3370	2	11	1	1	15
BBD-5	29-Aug-13	7.3	348	5043	239	65	5696	2	10	2	1	15
	Area Mean		***309***	***3996***	***143***	***30***	***4478***	***2***	***9***	***1***	***1***	***12***
Baker East Shore												
BES-1	30-Aug-13	7	261	2609	152	239	3261	3	15	1	1	20
BES-2	30-Aug-13	7.2	543	2457	0	196	3196	3	14	0	1	18
BES-3	30-Aug-13	8.2	196	2696	196	152	3239	2	13	1	1	17
BES-4	30-Aug-13	8.3	326	3696	478	196	4696	2	15	2	1	20
BES-5	30-Aug-13	8.8	0	2717	196	174	3087	0	14	1	1	16
	Area Mean		***265***	***2835***	***204***	***191***	***3496***	***2***	***14***	***1***	***1***	***18***
Baker Proposed Jetty												
BPJ-1	29-Aug-13	7.9	196	761	196	130	1283	1	8	1	1	11
BPJ-2	29-Aug-13	8.5	130	978	0	130	1239	2	6	0	1	9
BPJ-3	29-Aug-13	9	22	217	43	0	283	1	6	1	0	8
BPJ-4	29-Aug-13	7.8	0	913	0	87	1000	0	10	0	1	11
BPJ-5	29-Aug-13	7.7	43	1304	0	174	1522	1	10	0	1	12
	Area Mean		***78***	***835***	***48***	***104***	***1065***	***1***	***8***	***0***	***1***	***10***

Table 3.6-3. Results of BACI tests for benthic invertebrate abundance at Meadowbank areas.

After Period	Test Station	n(B)	n(A)	Estimate	SE	P-value*	Effect size (%)		
							ES	LCI	UCI
2013	TPN	2	1	-0.30	0.47	0.32	-26	-100	27274
	TPE	3	1	-0.99	0.67	0.14	-63	-98	555
	SP	2	1	0.30	0.32	0.74	35	-98	7563
	TPS	7	1	-0.60	0.37	0.08	-45	-78	37
	TE	2	1	-0.94	0.29	0.09	-61	-99	1405
	TEFF	4	1	-0.71	0.33	0.06	-51	-83	43
	WAL	7	1	-1.16	0.98	0.14	-69	-97	247
2012-13	TPN	2	2	-0.09	0.43	0.43	-8	-85	480
	TPE	3	2	-0.40	0.62	0.28	-33	-91	376
	SP	2	2	0.28	0.24	0.82	33	-52	266
	TPS	6	2	-0.13	0.29	0.33	-12	-57	79
	TE	2	2	-0.67	0.34	0.09	-49	-88	124
	TEFF	3	2	-0.44	0.35	0.15	-36	-79	94
2011-13	TPN	2	3	-0.24	0.37	0.29	-21	-76	159
	TPE	3	3	-0.44	0.49	0.21	-36	-83	148
	SP	2	3	0.09	0.27	0.62	10	-54	161
	TPS	5	3	-0.24	0.26	0.20	-21	-58	49
	TE	2	3	-0.53	0.33	0.11	-41	-79	70
	TEFF	2	3	-0.61	0.23	**0.04**	-46	-74	13
2010-13	TPN	2	4	-0.04	0.42	0.46	-4	-70	208
	TPE	3	4	-0.46	0.41	0.15	-37	-78	79
	SP	2	4	-0.13	0.41	0.38	-12	-72	172
	TPS	4	4	-0.07	0.26	0.39	-7	-51	74
	TE	2	4	-0.44	0.30	0.11	-36	-72	49
	TEFF	1	4	-0.29	0.50	0.30	-25	-85	269

Notes:
Test station = station compared to control (INUG);
n(B) = number of months in the "before" period;
n(A) = number of months 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 a decrease in mean;
***Bolded values** are statistically significant results;
ES = estimated effect size (i.e., 100%*(exp[Estimate]-1));
LCI = lower 95% confidence interval; **UCI** = upper 95% confidence interval
Shading indicates a negative effect size (reduction) of 20% or greater.

Table 3.6-4. Results of BACI tests for benthic invertebrate species richness at Meadowbank areas.

After Period	Test Station	n(B)	n(A)	Estimate	SE	P-value*	Effect size (%)		
							ES	LCI	UCI
2013	TPN	2	1	0.21	0.23	0.73	23	-93	2155
	TPE	3	1	0.00	0.13	0.49	0	-44	78
	SP	2	1	0.03	0.18	0.55	3	-90	921
	TPS	7	1	-0.27	0.18	0.09	-24	-52	20
	TE	2	1	-0.24	0.19	0.22	-21	-93	835
	TEFF	4	1	-0.35	0.27	0.14	-30	-70	64
	WAL	7	1	-0.28	0.31	0.20	-24	-64	61
2012-13	TPN	2	2	0.28	0.18	0.87	32	-38	183
	TPE	3	2	0.12	0.13	0.79	13	-26	72
	SP	2	2	0.31	0.28	0.80	36	-59	354
	TPS	6	2	-0.07	0.14	0.33	-6	-34	33
	TE	2	2	-0.03	0.25	0.46	-3	-67	183
	TEFF	3	2	-0.29	0.23	0.15	-25	-64	54
2011-13	TPN	2	3	0.23	0.16	0.88	26	-24	109
	TPE	3	3	0.07	0.12	0.70	7	-23	48
	SP	2	3	0.32	0.22	0.88	37	-31	174
	TPS	5	3	-0.10	0.13	0.25	-9	-34	25
	TE	2	3	-0.07	0.19	0.38	-6	-50	74
	TEFF	2	3	-0.30	0.22	0.13	-26	-63	48
2010-13	TPN	2	4	0.33	0.20	0.91	39	-20	143
	TPE	3	4	0.11	0.11	0.82	12	-17	50
	SP	2	4	0.16	0.30	0.69	18	-49	173
	TPS	4	4	-0.01	0.13	0.47	-1	-27	35
	TE	2	4	-0.03	0.19	0.44	-3	-42	64
	TEFF	1	4	0.10	0.31	0.61	10	-59	198

Notes:
Test station = station compared to control (INUG);
n(B) = number of months in the "before" period;
n(A) = number of months 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 a decrease in mean;
***Bolded values** are statistically significant results;
ES = estimated effect size (i.e., 100%*(exp[Estimate]-1));
LCI = lower 95% confidence interval; **UCI** = upper 95% confidence interval
Shading indicates a negative effect size (reduction) of 20% or greater.

Table 3.6-5. Results of BACI tests for benthic invertebrate abundance at Baker Lake areas.

After Period	Test Station	n(B)	n(A)	Estimate	SE	P-value*	Effect size (%)		
							ES	LCI	UCI
2013	BBD	5	1	0.60	1.37	0.66	81	-96	8134
	BPJ	5	1	-0.14	1.18	0.46	-13	-97	2227
2012-13	BBD	4	2	1.26	1.04	0.85	254	-80	6225
	BPJ	4	2	0.13	0.92	0.55	14	-91	1357
2011-13	BBD	3	3	1.15	0.95	0.85	216	-77	4317
	BPJ	3	3	0.49	0.87	0.70	64	-85	1727
2010-13	BBD	2	4	0.64	1.08	0.71	90	-91	3736
	BPJ	2	4	-0.45	0.92	0.32	-36	-95	727

See notes below **Table 3.6-6**.

Table 3.6-6. Results of BACI tests for benthic invertebrate species richness at Baker Lake areas.

After Period	Test Station	n(B)	n(A)	Estimate	SE	P-value*	Effect size (%)		
							ES	LCI	UCI
2013	BBD	5	1	0.17	0.43	0.65	19	-64	288
	BPJ	5	1	0.14	0.49	0.61	16	-70	348
2012-13	BBD	4	2	0.25	0.32	0.76	29	-47	216
	BPJ	4	2	0.15	0.39	0.64	16	-61	246
2011-13	BBD	3	3	0.33	0.28	0.85	39	-36	205
	BPJ	3	3	0.33	0.35	0.80	38	-47	263
2010-13	BBD	2	4	0.30	0.30	0.82	36	-41	212
	BPJ	2	4	-0.17	0.39	0.35	-15	-72	153

Notes:
One BPJ replicate sample (i.e., one out of 5 from 2012) was removed for these analyses due to the absence of benthic invertebrates in the sample.
Test station = station compared to control (BAP);
n(B) = number of months in the "before" period;
n(A) = number of months 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 a decrease in mean;
***Bolded values** are statistically significant results;
ES = estimated effect size (i.e., 100%*(exp[Estimate]-1));
LCI = lower 95% confidence interval; **UCI** = upper 95% confidence interval
Shading indicates a negative effect size (reduction) of 20% or greater.

Figure 3.6-1. Benthic invertebrate total abundance (#/m^2) from Meadowbank study lakes since 2006.

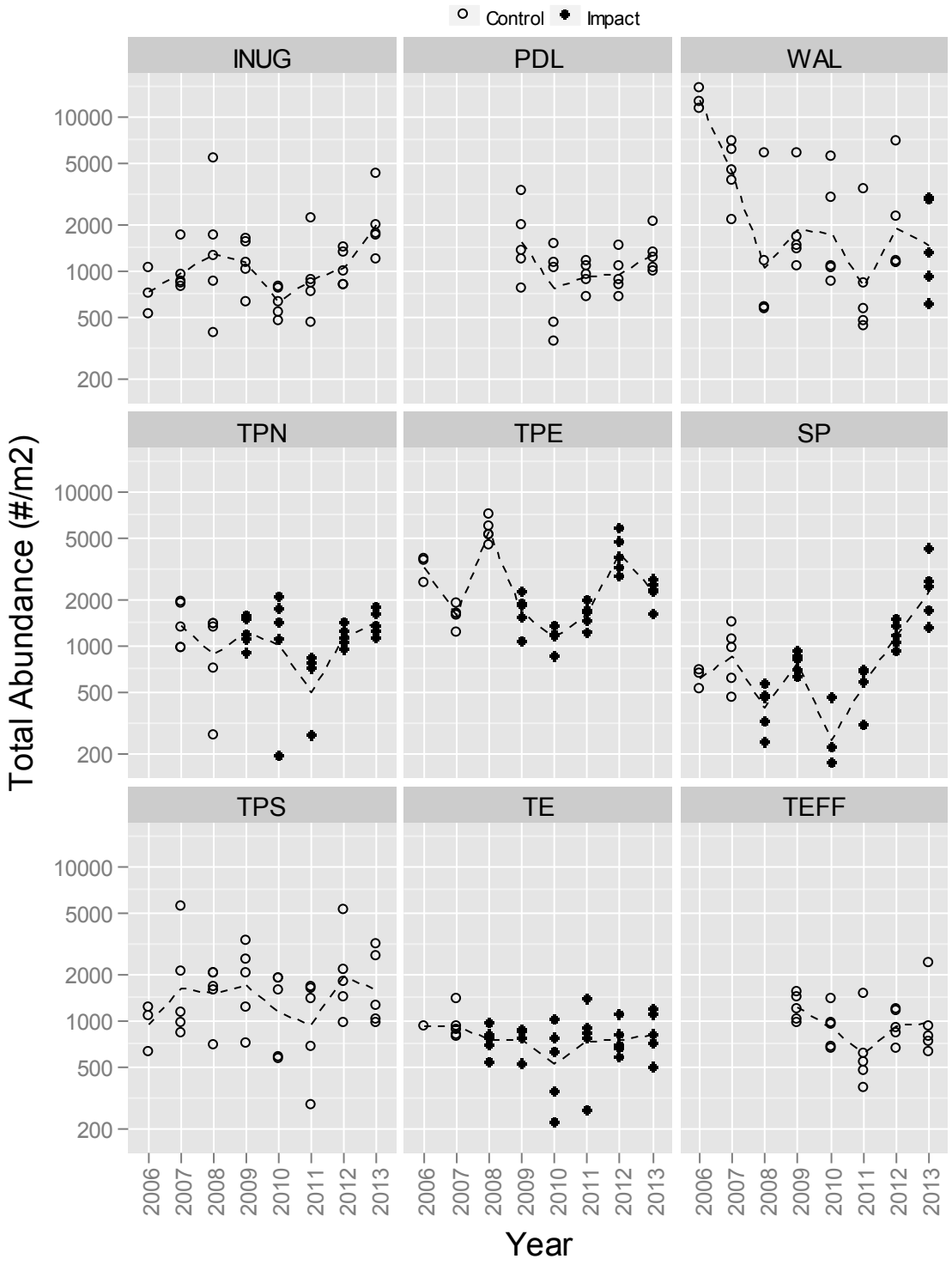


Figure 3.6-2. Benthic invertebrate abundance (#/m^2) by major taxa group from Meadowbank study lakes since 2006.

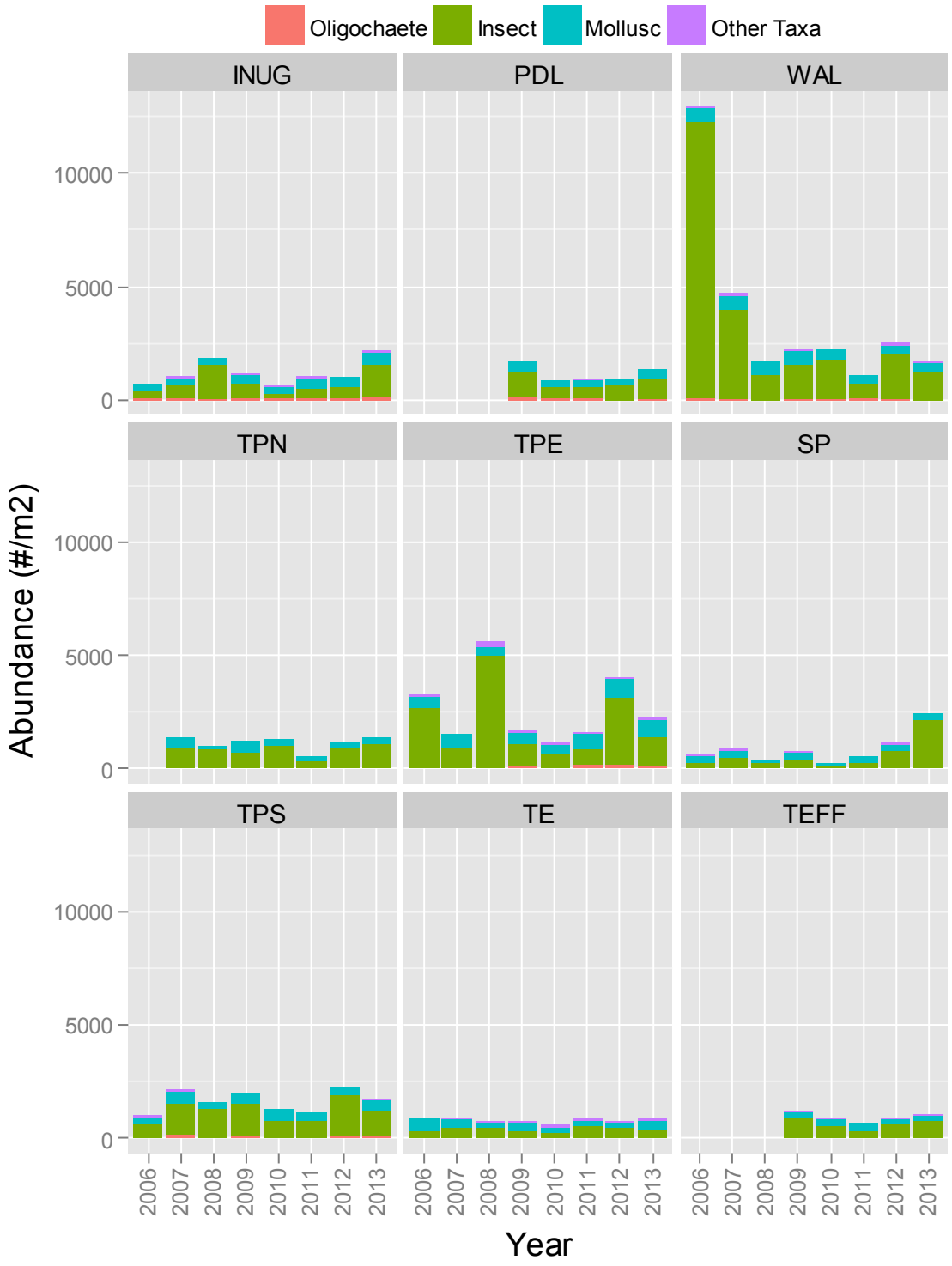


Figure 3.6-3. Benthic invertebrate relative abundance by major taxa group from Meadowbank study lakes since 2006.

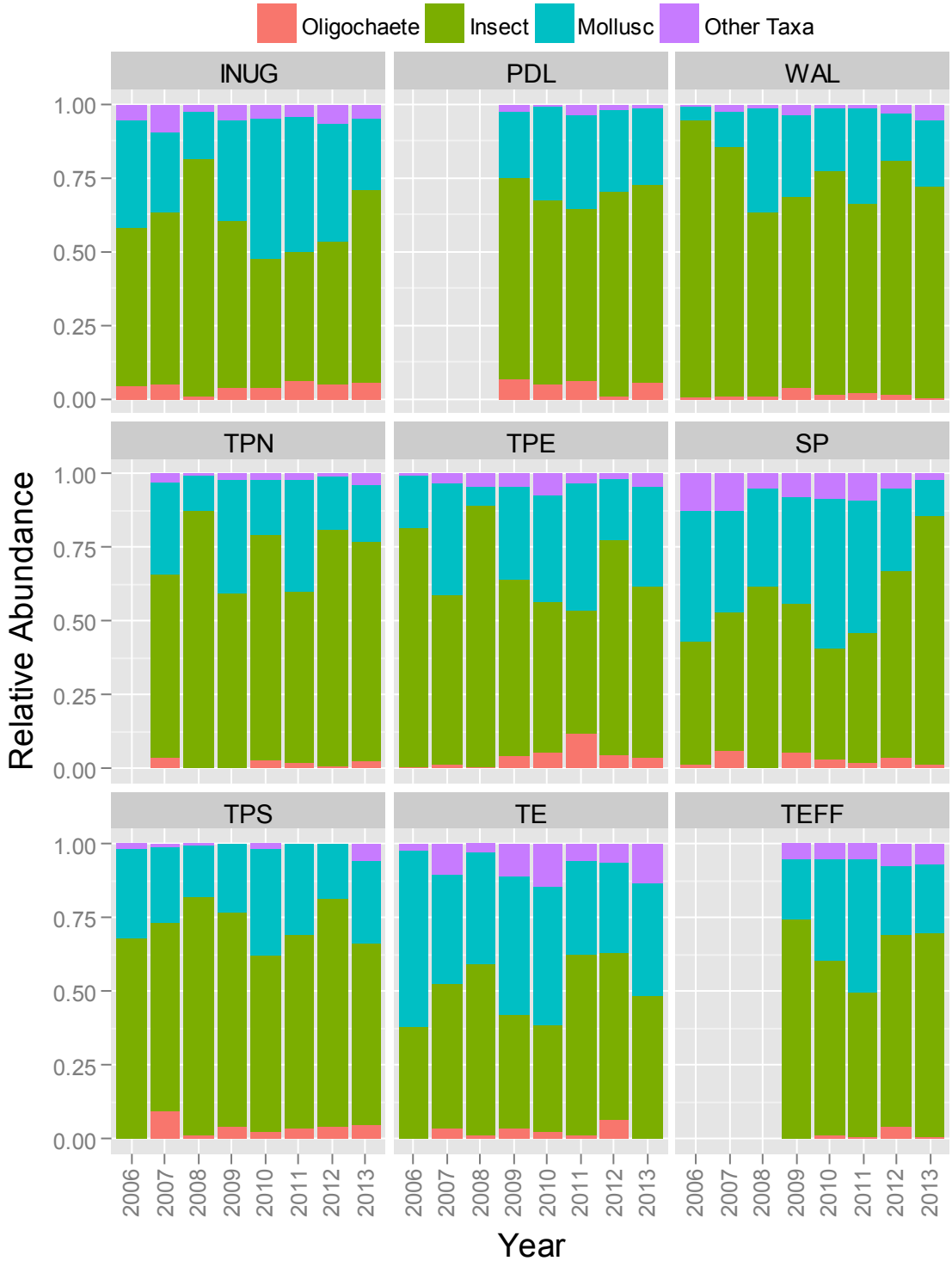


Figure 3.6-4. Benthic invertebrate total richness (# taxa) from Meadowbank study lakes since 2006.

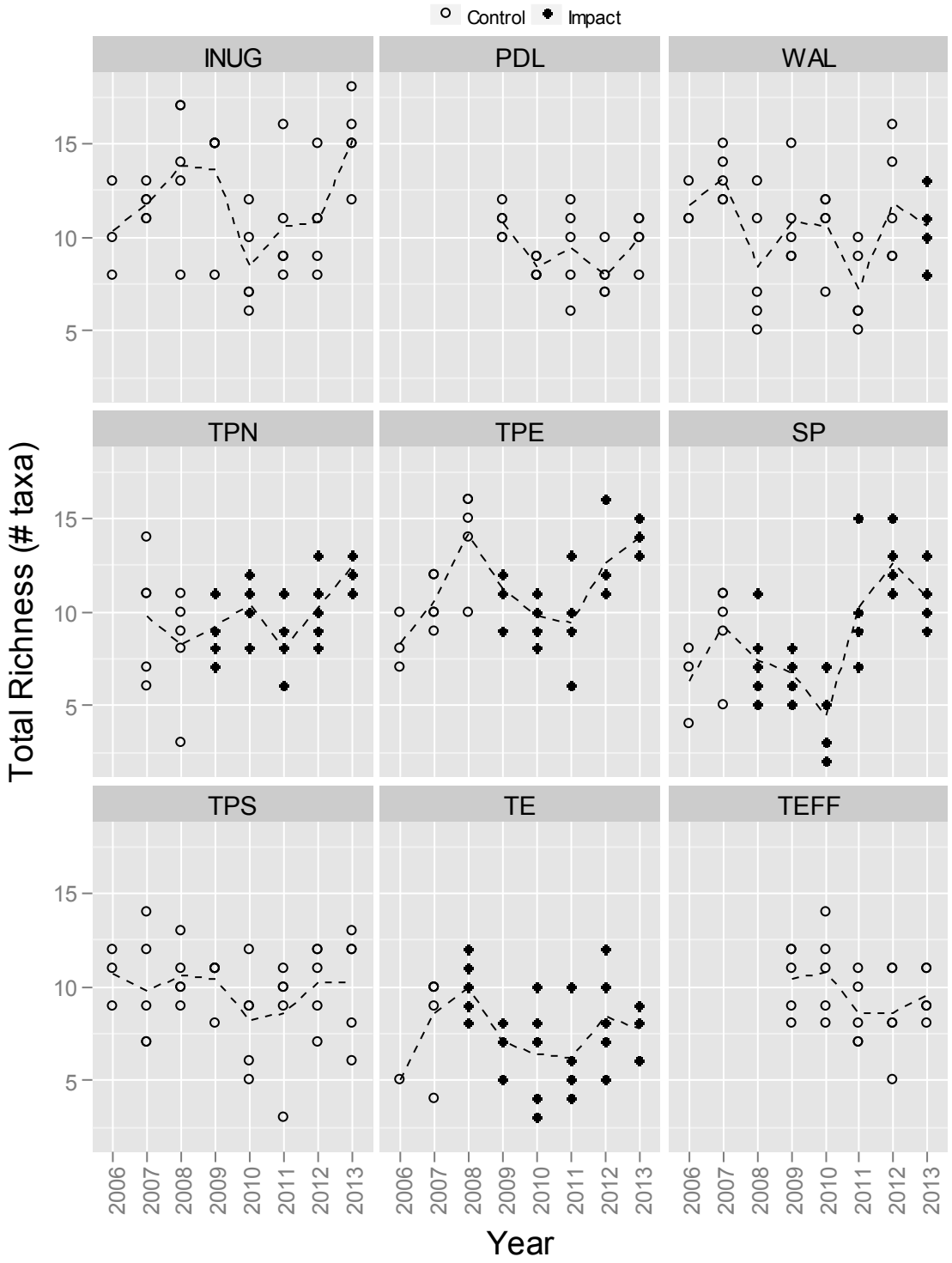


Figure 3.6-5. Benthic invertebrate richness (# taxa) by major taxa group from Meadowbank study lakes since 2006.

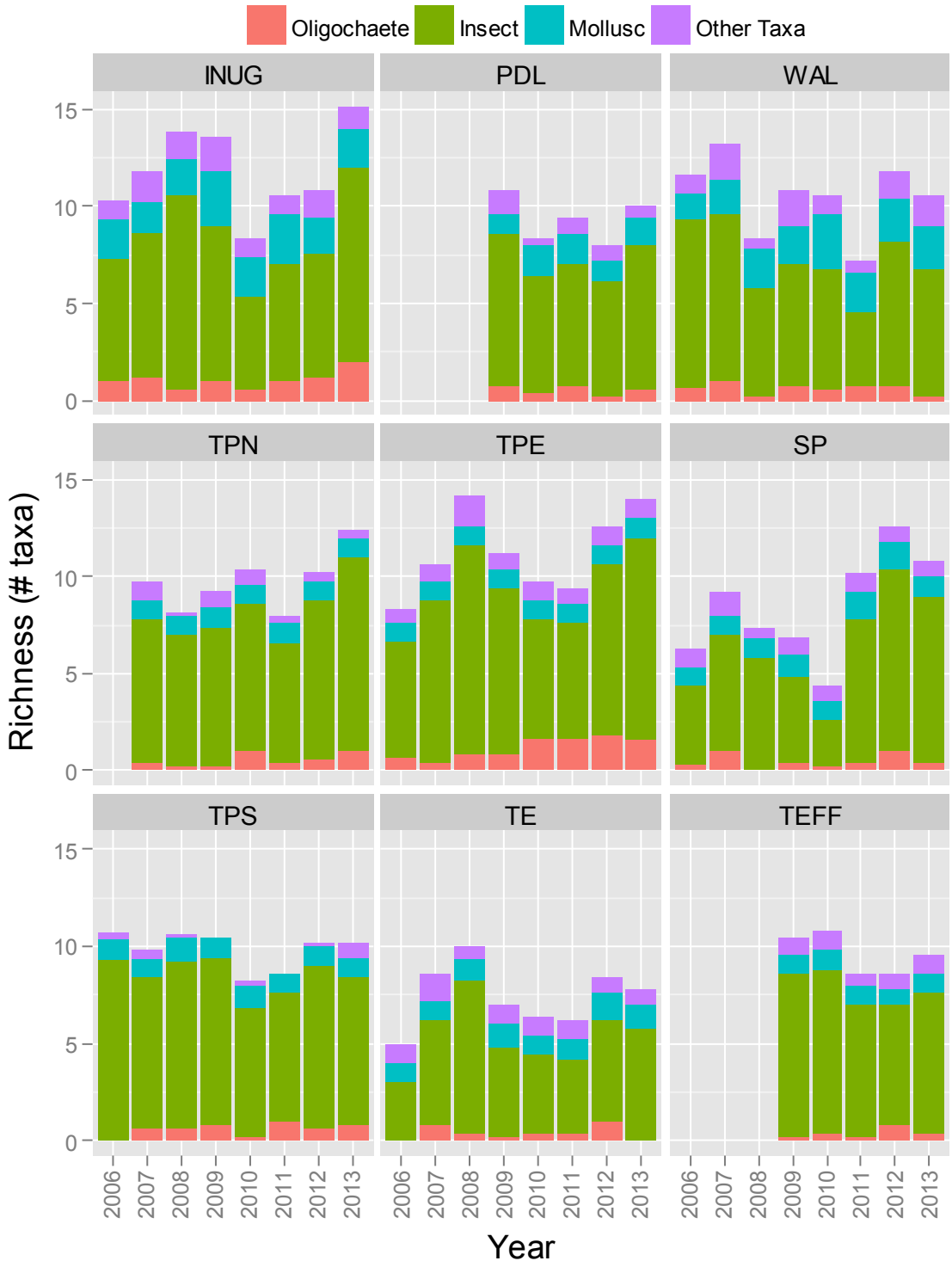


Figure 3.6-6. Benthic invertebrate relative richness by major taxa group from Meadowbank study lakes since 2006.

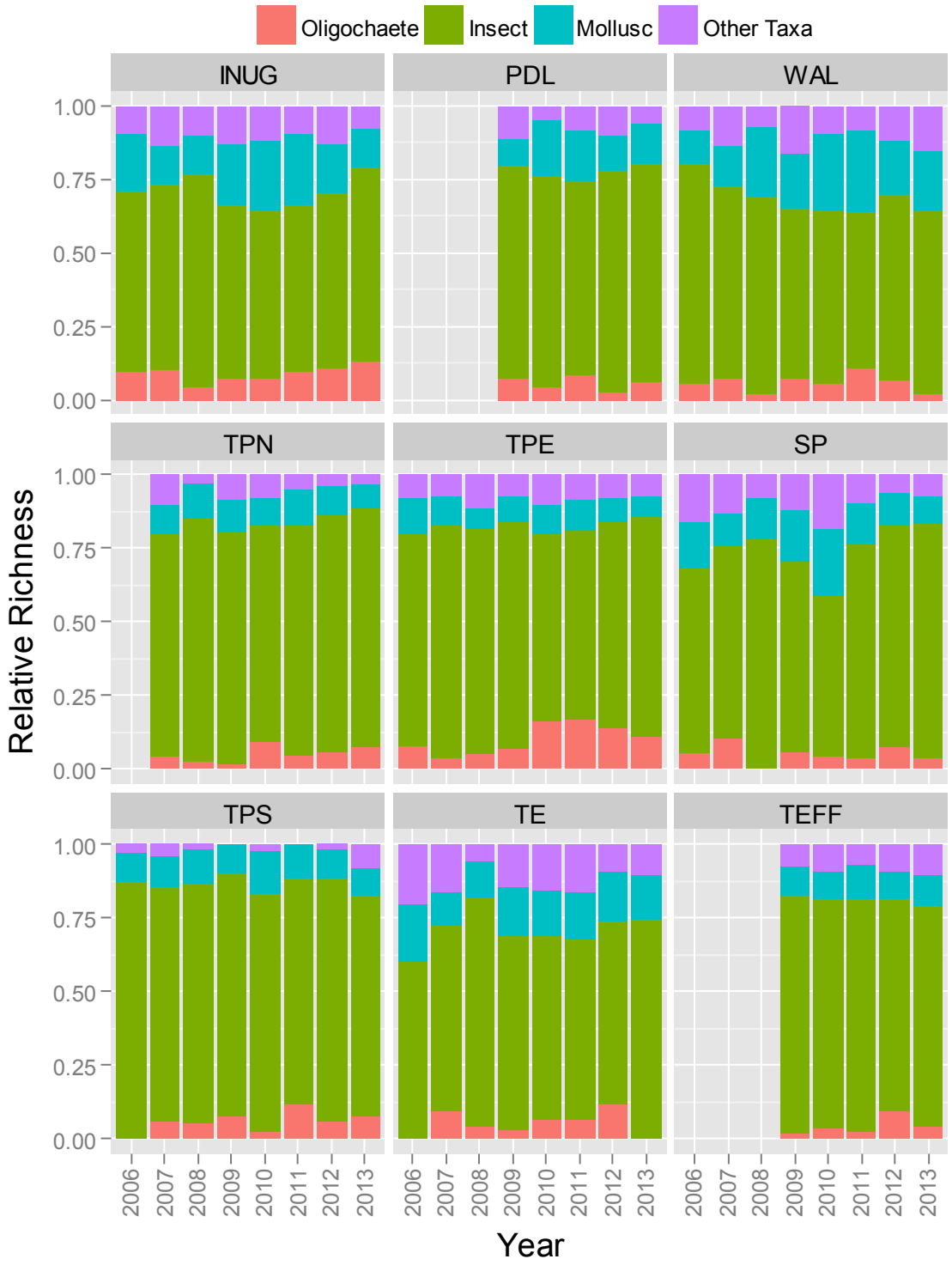
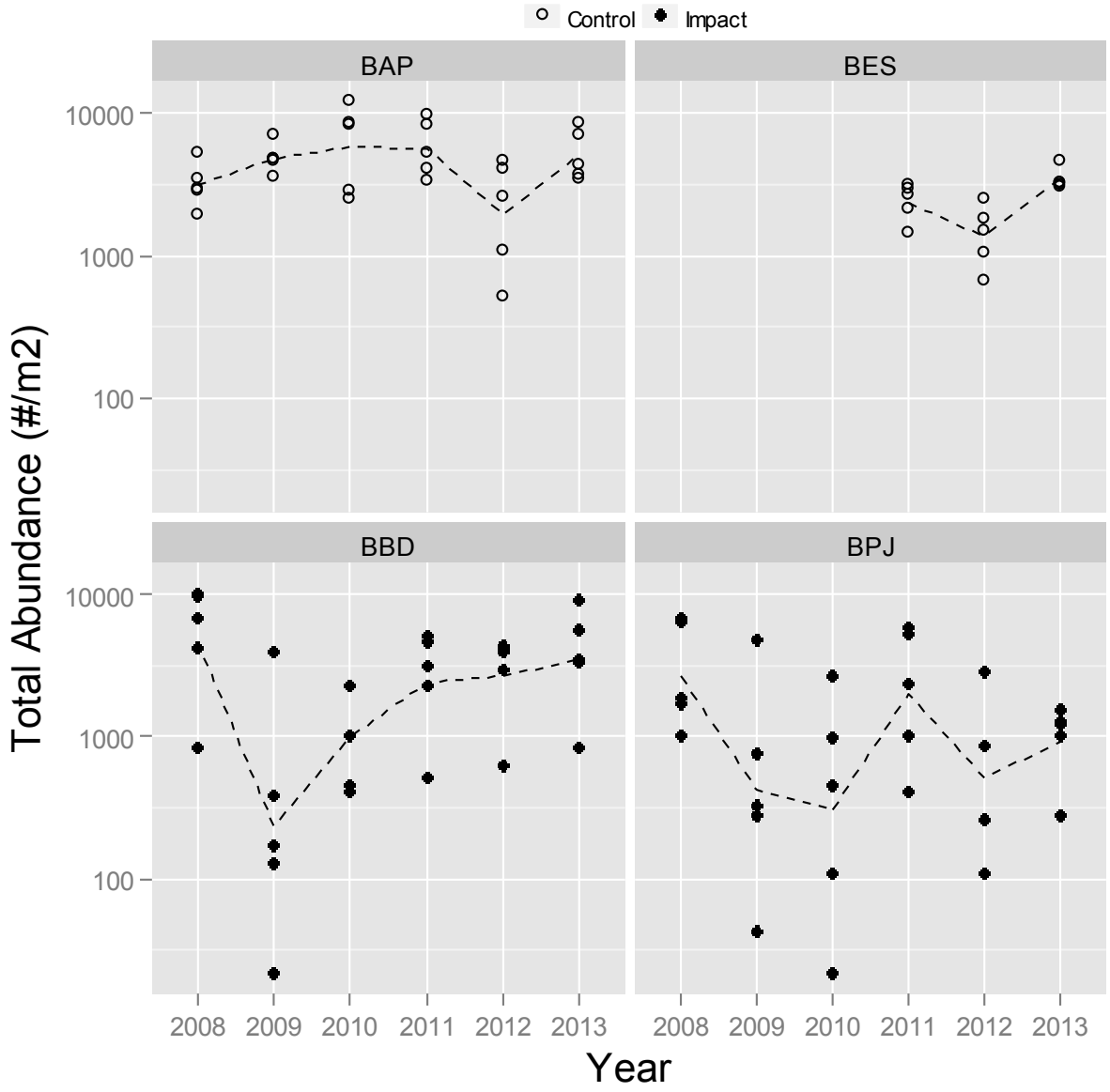
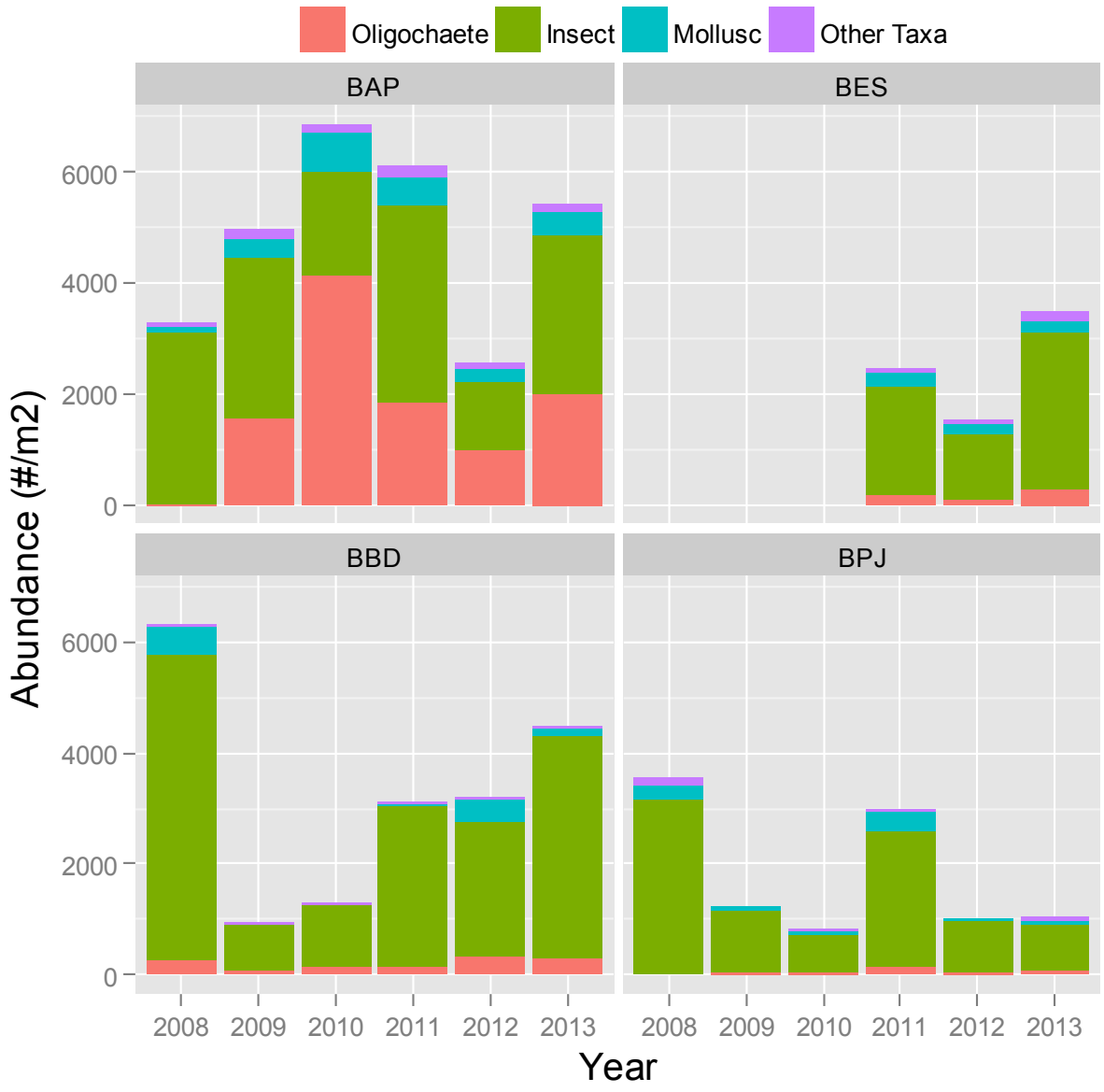


Figure 3.6-7. Benthic invertebrate total abundance (#/m^2) from Baker Lake since 2008.



*One BPJ sample out of five was removed from analysis in 2012 due to the absence of benthic invertebrates in the sample.

Figure 3.6-8. Benthic invertebrate abundance (#/m^2) by major taxa group from Baker Lake since 2008.

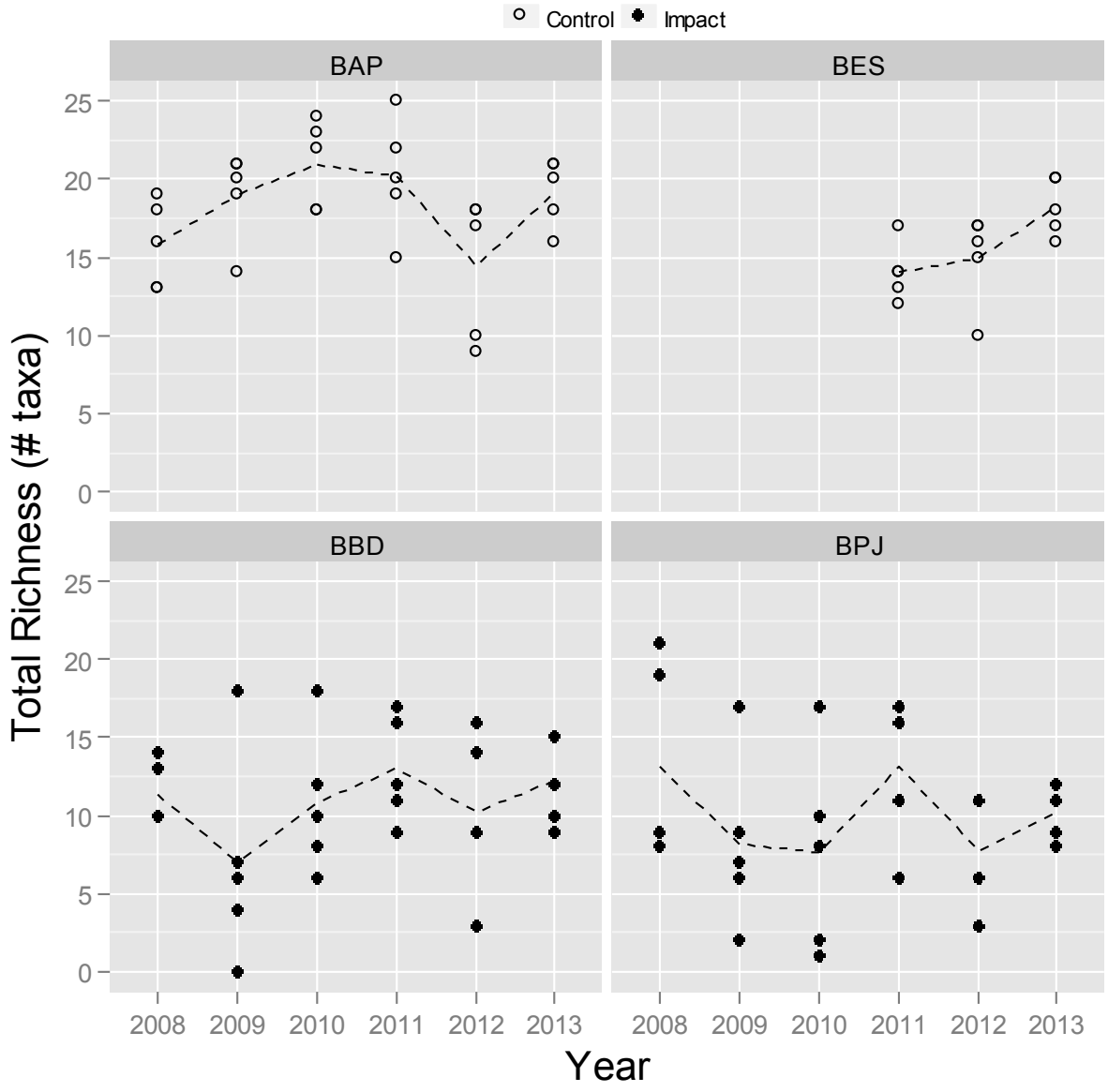


*One BPJ sample out of five was removed from analysis in 2012 due to the absence of benthic invertebrates in the sample.

Figure 3.6-9. Benthic Invertebrate relative abundance by major taxa group from Baker Lake since 2008.

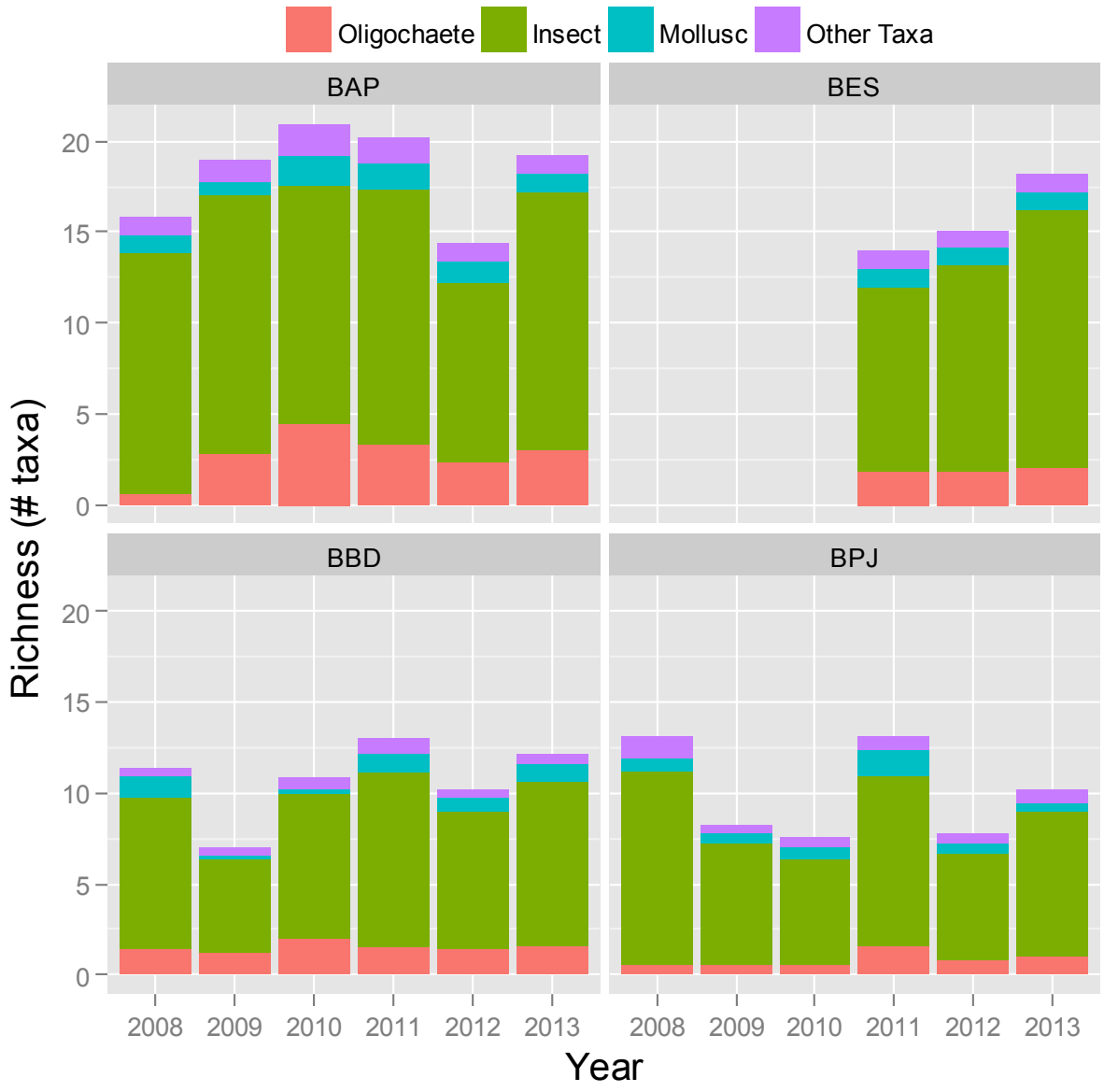
*One BPJ sample out of five was removed from analysis in 2012 due to the absence of benthic invertebrates in the sample.

Figure 3.6-10. Benthic invertebrate total richness (# taxa) from Baker Lake since 2008.



*One BPJ sample out of five was removed from analysis in 2012 due to the absence of benthic invertebrates in the sample.

Figure 3.6-11. Benthic invertebrate richness (# taxa) by major taxa group from Baker Lake since 2008.



*One BPJ sample out of five was removed from analysis in 2012 due to the absence of benthic invertebrates in the sample.

Figure 3.6-12. Benthic invertebrate relative richness by major taxa group from Baker Lake since 2008.

*One BPJ sample out of five was removed from analysis in 2012 due to the absence of benthic invertebrates in the sample.

4. SUMMARY AND IMPLICATIONS FOR MANAGEMENT

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"; some of which were updated in 2013) 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[6]

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 2013 are summarized in **Table 4-1**:

- *Water Chemistry* – There were some statistically significant mine-related changes identified in 2013 at one or more near-field (NF) areas: total and bicarbonate alkalinity (SP), conductivity (SP, TPE & TPN), calcium (TPE) and TDS (SP & TPE) were elevated above their respective trigger values with statistically significant changes at one or more NF areas relative to baseline/reference conditions. These triggers were set at the 95th percentile of baseline data using an approach that evaluates a statistically significant trend as compared to baseline data, and were not derived from effects-based thresholds (e.g., CCME water quality criteria). While these results represent mine-related changes, the observed concentrations are still relatively low and unlikely to adversely affect aquatic life. **These trends need to be reviewed again in 2014**.
- *Sediment Chemistry* – Quantitative trigger analysis for sediment is based on coring results, which are scheduled to coincide with MMER EEM field studies (i.e., every three years); the next program will take place in 2014. Notwithstanding, visual trend analysis was conducted in 2013. The increasing trend in chromium concentrations in TPE continued in 2013 and exceeded the

[6] Notes: SP = Second Portage Lake; TPN = Third Portage North; TPS = Third Portage South; TPE = Third Portage East; TE = Tehek Lake.

trigger value. **A follow-up study is recommended in 2014** to confirm the nature of the trend (i.e., reduce residual uncertainty regarding the possibility of the results being due to a spatial trend).

- *Phytoplankton Community* – Statistically significant increases in total biomass (TPN, TPE, SP, TE & WAL) and taxa richness (TPN) were seen in 2013 relative to baseline/reference conditions. However, this apparent increase is due to a relative decrease in biomass at reference area INUG not an absolute increase at the near-field and mid-field areas, where results are fairly consistent with historical trends at those areas. **While not apparently mine related, these trends should be watched again in 2014**.
- *Benthic Invertebrate Community* – While the majority of near-field and mid-field areas showed apparent reductions in abundance and taxa richness relative to baseline/reference conditions, the only statistically significant adverse effect was a decrease (-46%) in abundance at far-field TEFF over the last three years combined. However, these results appear to be due to historically high abundance and taxa richness at reference area INUG, rather than absolute decreases at the near-field, mid-field or far-field areas, which generally tracked within baseline ranges. **While these trends are not mine related, they should be watched in 2014**.

Baker Lake

CREMP monitoring 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 occurred in the vicinity of the barge dock and jetty in 2013. No changes in the aquatic receiving environment were observed that were attributable to AEM's activities in Baker Lake. No follow-up management actions are required for 2014.

Table 4-1. Summary of key findings from the 2013 CREMP, Meadowbank Mine.

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	?		**0**	
Temperature	**0**	n/a	n/a	n/a	?		**0**	
Conductivity	**0**	n/a	n/a	n/a	?		**0**	
Exposure - Water Chemistry								
Conventionals	**1**	Large	High	Low	?	Alkalinity (SP), conductivity (TPN, TPE, SP), calcium (TPE), and TDS (TPE, SP) are elevated relative to baseline; concentrations suggest low potential for adverse effects.	**1**	
Nutrients	**0**	n/a	n/a	n/a	?		**0**	
Total Metals	**0**	n/a	n/a	n/a	?		**0**	
Dissolved Metals	**0**	n/a	n/a	n/a	?		**0**	
Total Suspended Solids	**0**	n/a	n/a	n/a	?		**0**	
Exposure - Sediment Chemistry								
Physical	**0**	n/a	n/a	n/a	?		**0**	
Total Metals	**1**	Moderate	Moderate	Moderate	??	Chromium (TPE); apparent temporal trend	**1**	**
Organics	**0**	n/a	n/a	n/a	?		**0**	
Effects - Phytoplankton								
Chlorophyll-*a* *	**0**	*	*	*	?		**0**	
Total Biomass	**2**	Large	Low	Low	??	>50% higher (TPN, TPE, SP, TE, WAL); due to relative decrease at reference (INUG)	**1**	
Species Richness	**1**	Moderate	Moderate	Low	??	>20% higher at TPN; due to relative decrease at reference (INUG)	**1**	
Effects - Benthic Invertebrates								
Total Abundance	**0**	n/a	n/a	n/a	?	Apparent "decreases" (most stations); due to increase at reference (INUG)	**1**	
Total Richness	**0**	n/a	n/a	n/a	?		**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
1 – continued trend monitoring in 2014
2 – active follow-up with more detailed quantitative assessment in 2014

*Data quality issue is being addressed (chlorophyll-*a*)
** Targeted study recommended; see text for detail.

5. MONITORING COMPONENTS FOR 2014

As discussed in **Section 1**, the rationale, framework, strategy, methods, and scope of receiving environment (now referred to as *Core Receiving Environment Monitoring Program* or "CREMP") monitoring for the Meadowbank Mine were documented in the 2005 AEMP (AEMP, 2005). The CREMP has been implemented every year since 2006, with some modifications (e.g., lake sampling area additions, parameter deletions/additions, sampling frequency and intensity) to improve the program or to comply with regulatory requirements. In 2011, an update report was submitted to document changes to the program made since the 2005 AEMP and present details on sampling and analysis (Azimuth, 2010g). AEM commissioned Azimuth to begin a thorough review of the historical data to ensure that the CREMP design would be able to detect potential mine-related impacts and would address most the requirements of the NWB A License. The 2012 CREMP design report (Azimuth 2012d) details the latest CREMP monitoring program which ensures adequate detection of mine-related impacts (in a timely manner) as part of AEM's integrated adaptive management framework. The current program for 2014 is summarized in **Table 5-1**.

Table 5-1. Monitoring components planned for 2014 CREMP.

Project Lake	Area ID	Through-Ice						Open-Water			Through-Ice		
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Third Portage	TPE	Limno[1]	Limno[1]	Limno[1]	Limno Water Phyto	Limno Water Phyto	Ice not safe	Limno Water Phyto	Limno Water Phyto Sed Coring Benthos	Limno Water Phyto	Ice not safe	Limno Water Phyto	Limno[1]
	TPN	Limno[1]	Limno[1]	Limno[1]	Limno Water Phyto	Limno Water Phyto	Ice not safe	Limno Water Phyto	Limno Water Phyto Sed Coring Benthos	Limno Water Phyto	Ice not safe	Limno Water Phyto	Limno[1]
	TPS	Limno[1]	Limno[1]	Limno[1]			Ice not safe	Limno Water Phyto	Limno Water Phyto Sed Coring Benthos	Limno Water Phyto	Ice not safe		Limno[1]
Second Portage	SP	Limno[1]	Limno[1]	Limno[1]	Limno Water Phyto	Limno Water Phyto	Ice not safe	Limno Water Phyto	Limno Water Phyto Sed Coring Benthos	Limno Water Phyto	Ice not safe	Limno Water Phyto	Limno[1]
Tehek	TE				Limno Water Phyto	Limno Water Phyto	Ice not safe	Limno Water Phyto	Limno Water Phyto Sed Coring Benthos	Limno Water Phyto	Ice not safe	Limno Water Phyto	
Tehek	TEFF						Ice not safe	Limno Water Phyto	Limno Water Phyto Sed Coring Benthos	Limno Water Phyto	Ice not safe		
Inuggugayualik	INUG				Limno Water Phyto	Limno Water Phyto	Ice not safe	Limno Water Phyto	Limno Water Phyto Sed Coring Benthos	Limno Water Phyto	Ice not safe	Limno Water Phyto	
Wally	WAL				Limno Water Phyto	Limno Water Phyto	Ice not safe	Limno Water Phyto	Limno Water Phyto Sed Coring Benthos	Limno Water Phyto	Ice not safe	Limno Water Phyto	
Pipedream	PDL						Ice not safe	Limno Water Phyto	Limno Water Phyto Sed Coring Benthos	Limno Water Phyto	Ice not safe		

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[2] Water Phyto	Limno[2] Water Phyto Sed Coring Benthos	Limno[2] Water Phyto	Ice not safe		
	BPJ						Ice not safe	Limno[2] Water Phyto	Limno[2] Water Phyto Sed Coring Benthos	Limno[2] Water Phyto	Ice not safe		
	BAP						Ice not safe	Limno[2] Water Phyto	Limno[2] Water Phyto Sed Coring Benthos	Limno[2] Water Phyto	Ice not safe		
	BES						Ice not safe	Limno[2]	Limno[2] Sed Coring Benthos	Limno[2]	Ice not safe		

Notes:

Limno: 2 depth profiles for 6 (or 3) events per year.

Limno[1]: 1 depth profile for 4 events per year; water chemistry will also be collected if profiling shows unusual results.

Limno[2]: 2 depth profiles for 3 events per year; also including deeper profiles to investigate potential marine influence.

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).

Coring: 10 replicate sediment core samples (+1 duplicate) for metals and TOC.

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

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APPENDICES

APPENDIX A

UPDATED THRESHOLD AND TRIGGER DEVELOPMENT FOR CREMP WATER PARAMETERS

THRESHOLDS AND TRIGGERS

Data – The data used to develop triggers were the standard control ("baseline") samples – duplicates and depth replicates were excluded as they are pseudo-replicates of standard samples. All baseline samples through December 2013 were used. The number of baseline samples collected for each system was 204 for Meadowbank, 34 for Wally, and 31 for Baker (total = 269). The development of triggers was based on baseline data specific to each system (Meadowbank, Wally, and Baker).

Methods – The main text has described the rationale and approach for development of thresholds and triggers. There were three basic methods of trigger development as follows:

1. When a threshold (e.g., CCME guideline) was established, the trigger was set as the maximum of either (a) the value halfway between the baseline median and the threshold ("Method A"), or (b) the 95th percentile of the baseline data ("Method B").
2. When a threshold was not established, the trigger was set equal to the maximum of either the 95th percentile of the baseline data ("Method B") or two times the current detection limit ("Method C").

Medians and 95th percentiles were chosen as metrics rather than means, standard deviations, or maximums, because the former are generally robust to skewed distributions and potential outliers. When required, robust methods were used to estimate medians and 95th percentiles to account for values below detection limits (i.e., censored data; Helsel 2012). The analytical procedures for a given variable were as follows. First, all data reported detection limits greater than the maximum observed value were removed (such values contain no information regarding summary statistics of the data distribution; Helsel 2012). Next, classical estimates of medians and 95th percentiles were computed if possible (i.e., when there was the required number of observations exceeding detection limits). When there was insufficient data to compute a classical estimate, the median and/or 95th percentile were estimated using the robust "Regression on Order Statistics" (ROS) method as recommended by Helsel (2012) and implemented in the function "cenros" in the R package NADA. However, Helsel (2012) suggests that estimates of summary statistics such as the median are typically unreliable when more than 80% of the observations are censored (below detection limits). Thus, ROS estimates were only used when at least 20% of the observations were above detection limits. When a threshold was established but there was no viable estimate of the median, the current detection limit was used in "Method A" above. When a threshold was not established and there was no viable estimate of the 95th percentile, "Method C" was used.

There were special considerations for several variables, specifically t-Al, t-Cd, t-Mn, t-Zn, d-Al, ammonia-N, t-P, pH and TSS. These cases are explained in detail below.

Results – Thresholds and triggers are summarized in **Tables 1-3** for total metals, dissolved metals, and nutrients/conventionals. Thresholds were established for 54 variables based on

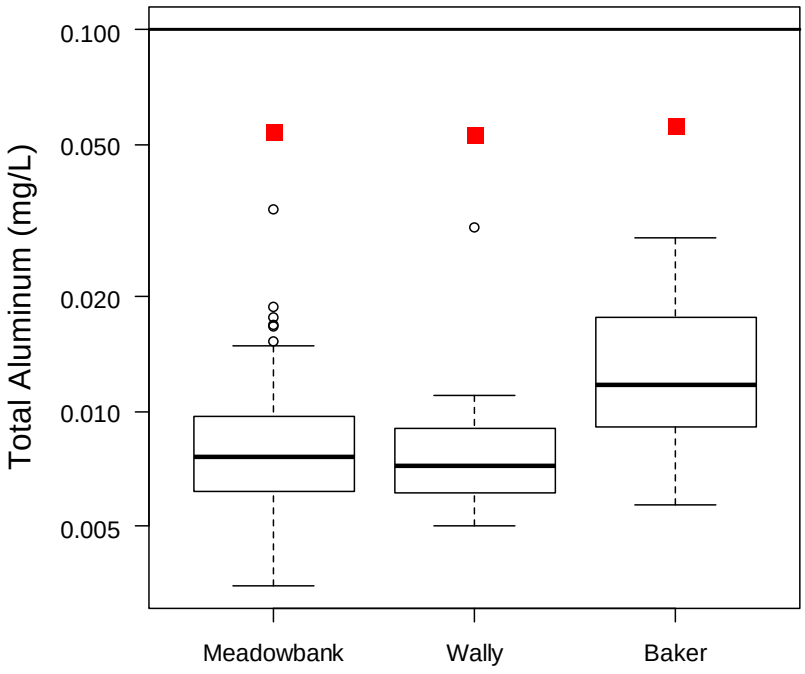
water-quality guidelines (**Table 4**). In most cases, the threshold was equal to a given guideline, but there were exceptions for a few variables as discussed below. Note that in cases where a water quality guideline exists but Method B was used for trigger development (i.e., cases where baseline data already exceed the guideline for > 5% of cases), it is possible for the trigger to equal or exceed the guideline (e.g., this occurs for total phosphorus, the lower pH trigger for Meadowbank, and the Baker triggers for total and dissolved strontium). In such cases, the guideline is reported as the threshold but is not used as a criterion for action; rather, the trigger is the only criterion for action as is the case for variables lacking water quality guidelines.

There are three variables (t-Cu, t-Pb, t-Ni) for which the water quality guidelines are specific to water hardness ranges below 82, 60, and 60 mg/L $CaCO_3$, respectively. Hardness levels for Meadowbank, Wally, and Baker samples were consistently below 60 mg/L $CaCO_3$. For example, as reported in **Table 3**, the 95^{th} percentiles for hardness were 8.5, 16.7, and 41.2 for Meadowbank, Wally, and Baker samples, respectively. Thus for these three variables, the guidelines associated with low hardness ranges were used as thresholds.

Special Cases – There were several variables that warranted special consideration in the development of thresholds and/or triggers. These are discussed in the following pages.

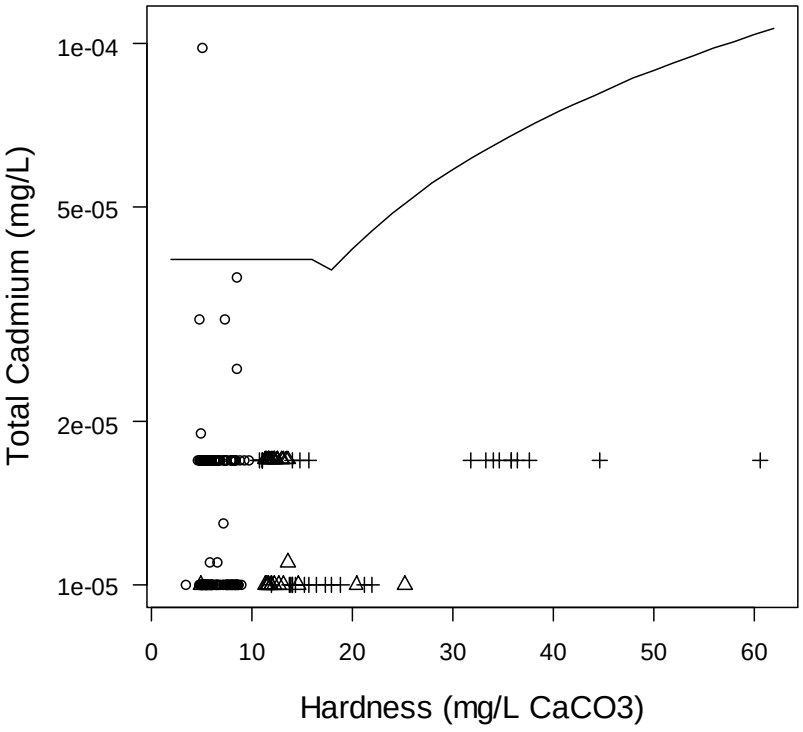
Total aluminum -- The CCME guideline for t-Al in water is 0.005 mg/L when pH < 6.5, and 0.1 mg/L when pH ≥ 6.5. Across baseline samples for Meadowbank/Wally/Baker (n = 269), there were only 9 cases of pH < 6.5 (two for station TPE, six for TPS, and one for INUG), of which only three were below pH = 6.47 (values = 6.18, 6.20, and 6.34). For these nine samples, only four t-Al measurements were above the current DL (0.005 mg/L), with a maximum value of 0.0076 mg/L.

Given the strong tendency for pH to equal or exceed 6.5 across baseline samples, the CCME guideline of 0.1 mg/L was adopted as the threshold for t-Al (**Table 1**). Triggers were computed for each system based on Method A (**Table 1**). For example, across the 204 Meadowbank samples, the median t-Al was 0.007 mg/L and the 95th percentile was 0.014 mg/L (**Table 1**). Based on Method A, the value halfway between the median t-Al and the threshold is 0.054 mg/L (i.e., [0.1 – 0.007]/2 = 0.054), which is larger than the 95% percentile (Method B), and thus the proposed trigger for Meadowbank t-Al is 0.054 mg/L. Similar trigger values were computed for Wally and Baker (**Table 1**). As an example, the following figure shows box-plots of t-Al values (> DL; in log scale) for each of Meadowbank/Wally/Baker, as well as the guideline (solid line) and proposed triggers (solid red squares).



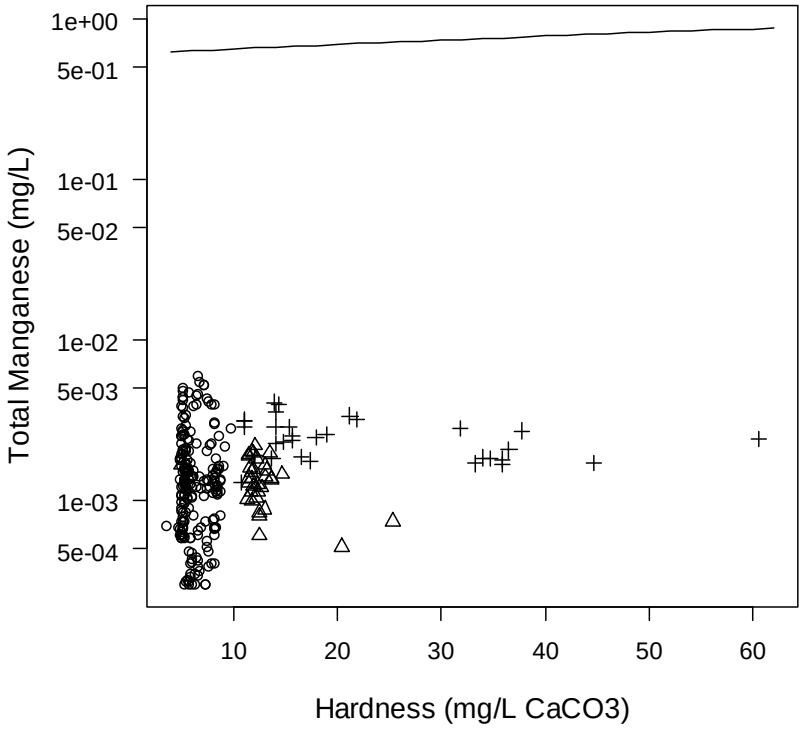
Total cadmium -- The hardness-dependent CCME guideline for t-Cd (mg/L) is 0.00004 when water hardness (mg/L $CaCO_3$) is less than 17.0, and equal to $0.001*10^{0.83*\log10(H)-2.46}$ (where H = hardness) when water hardness is ≥ 17.0 and ≤ 280. The relationship is illustrated in the figure below (solid curve) across the range of baseline observations of hardness for Meadowbank (circles), Wally (triangles), and Baker ("+"). Note that baseline measurements of t-Cd exceeded detection limits for only 10 of 204 Meadowbank samples and one of 34 Wally samples, and just one measure exceeded the CCME guideline (station TPE, hardness = 5.05, t-Cd = 0.000098 mg/L).

For simplicity, we propose a single t-Cd trigger applicable to all three systems (**Table 1**). The median sample values of hardness for Meadowbank (5.7), Wally (12.2), and Baker (16.5) were all less than 17.0 mg/L $CaCO_3$, and hence, the CCME guideline of 0.00004 mg/L was set as the threshold for each system. Because there were insufficient data to compute medians or 95th percentiles, the trigger was computed via Method A using the current detection limit (i.e., halfway between 0.00001 and 0.00004), providing a trigger value of 0.000025 (**Table 1**).



Total manganese -- There is no CCME water quality guideline for t-Mn. The hardness-dependent BC MOE guideline for t-Mn (mg/L) is 0.0044*H + 0.605, where H = hardness (mg/L $CaCO_3$). This guideline is based on numerous studies for fish, invertebrates and plants. The relationship is illustrated in the figure below (solid curve) across the range of baseline observations of hardness for Meadowbank (circles), Wally (triangles), and Baker ("+"). The guideline greatly exceeds observed t-Mn values for all samples.

For simplicity, we propose a single t-Mn trigger for each system. To compute the t-Mn trigger, we first computed the guidelines corresponding to the median values of hardness observed for Meadowbank samples (median hardness = 5.70, t-Mn guideline = 0.63), Wally samples (median hardness = 12.2, t-Mn guideline = 0.66), and Baker samples (median hardness = 16.5, t-Mn guideline = 0.68). The corresponding lake-specific triggers for t-Mn (using Method A) are 0.32 for Meadowbank, 0.33 for Wally, and 0.34 for Baker (**Table 1**).

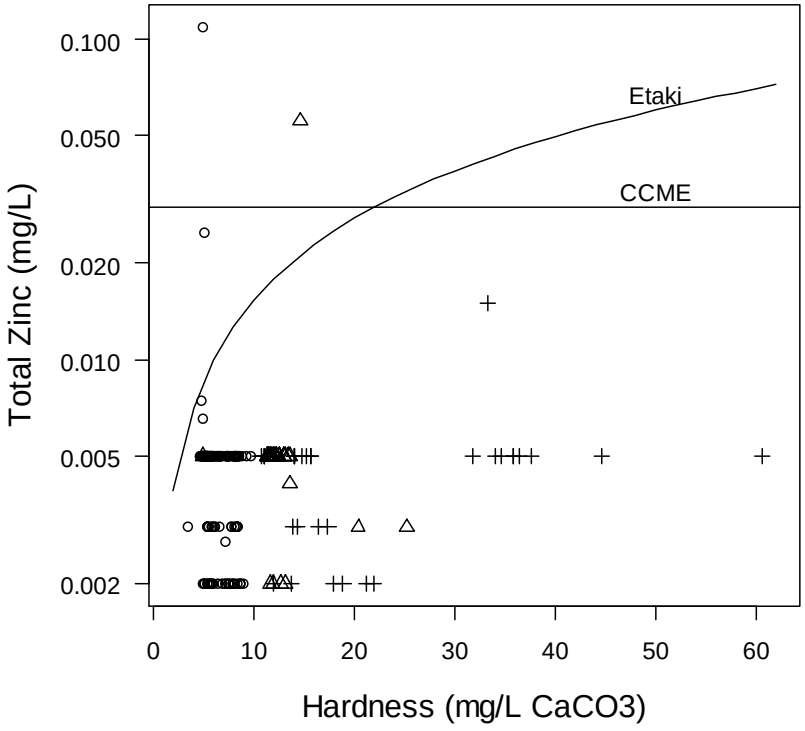


Total zinc -- The CCME water quality guideline for Zn is 0.030 mg/L. However, this guideline does not take into account hardness, and zinc toxicity is known to be hardness-dependent. An assessment for Ekati by EVS (2004) compiled data on species applicable to oligotrophic systems with low hardness, and developed a chronic benchmark for that was hardness dependent. The Ekati benchmark, denoted HC_5, represents the concentration of t-Zn at which 95% of species are likely to be protected against chronic effects (EVS 2004):

Hardness (mg/L CaCO3)	t-Zn level (HC_5) (mg/L)
5	0.0085
10	0.0153
15	0.0216
20	0.0276
25	0.0334
30	0.0389
35	0.0444
40	0.0497
45	0.0549
50	0.0600
55	0.0651
60	0.0700
65	0.0750
70	0.0798
75	0.0846
80	0.0894

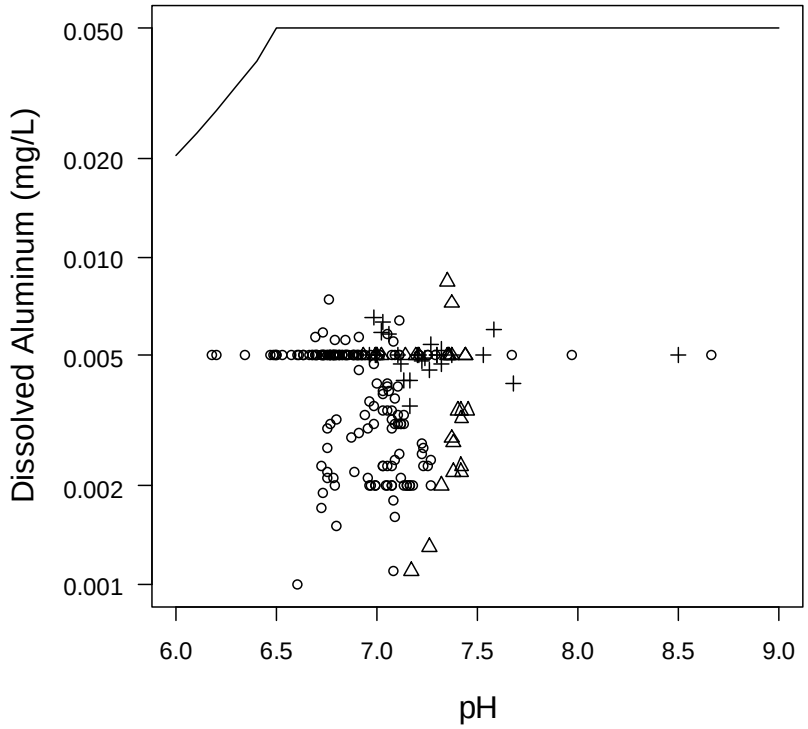
To express benchmarks as a continuous relationship, we fit a power function to the hardness-HC_5 data, which provided a near-perfect fit: t-Zn (HC_5) in mg/L $= 0.00217*H^{0.8486}$, where H = hardness (mg/L $CaCO_3$). This relationship is illustrated in the figure below (solid curve) across the range of baseline observations of hardness for Meadowbank (circles), Wally (triangles), and Baker ("+"). Note that the Ekati t-Zn benchmark is lower than the CCME guideline of 0.03 mg/L for hardness less than about 23. Only six of 269 baseline measurements of t-Zn have exceeded detection limits (four for Meadowbank, including the anomalous high value of t-Zn = 0.109 mg/L that occurred for station TPS in July 2009, and two for Wally).

As for t-Mn, we propose a single t-Zn trigger for each system. First, we computed the t-Zn benchmark (HC_5) corresponding to the median values of hardness observed for Meadowbank samples (median hardness = 5.70, t-Zn benchmark = 0.0095), Wally samples (median hardness = 12.2, t-Zn benchmark = 0.0181), and Baker samples (median hardness = 16.5, t-Zn benchmark = 0.0234). The corresponding lake-specific triggers for t-Zn (using Method A with the current DL = 0.003 mg/L) are 0.006 for Meadowbank, 0.011 for Wally, and 0.013 for Baker (**Table 1**).


0.100
0.050
0.020
0.010
0.005
0.002
Total Zinc (mg/L)
Etaki
CCME
0
10
20
30
40
50
60
Hardness (mg/L CaCO3)

Dissolved aluminum – There is no CCME guideline for d-Al in water. However, a pH-dependent water quality guideline for d-Al (mg/L) has been developed by BC MOE for protection of freshwater aquatic life. For pH < 6.5, the guideline is as follows: $d\text{-}Al = e^{(1.6-3.327*pH + 0.402*K)}$ where $K = pH^2$. For pH ≥ 6.5, the guideline is 0.05 mg/L. This relationship is illustrated in the figure below (solid curve) across the range of baseline observations of pH for Meadowbank (circles), Wally (triangles), and Baker ("+"). The BC MOE guideline greatly exceeds all observed values of d-Al.

Again, we propose a single d-Al trigger for each system. Based on the median pH observed for Meadowbank (6.89), Wally (7.35), and Baker (7.21), the corresponding BC MOE guideline for d-Al is 0.05 mg/L in each case. As documented in **Table 2**, the proposed triggers for d-Al (based on Method A and ROS estimates for median d-Al) are 0.026 for Meadowbank, 0.026 for Wally, and 0.027 for Baker.



Ammonia-N -- The CCME guideline for total ammonia in freshwater is pH and temperature dependent, with more stringent guidelines applying at higher pH and higher temperature. The proposed threshold for Ammonia-N (Meadowbank and Baker) was conservatively derived using two discrete CCME guidelines corresponding to specific pH and temperature values. Note that the maximum pH among baseline data for Meadowbank/Wally/Baker is 8.66, while maximum temperatures in the lakes are around 16 to 18 degrees. The two CCME guidelines that span these maximum (i.e., worst-case) conditions are as follows: (1) total ammonia = 0.239 mg/L for pH = 8.5 and temperature = 15 degrees; and (2) total ammonia = 0.067 mg/L for pH = 9.0 and temperature = 20 degrees. The mid-point of these two values is 0.153 mg/L, which when converted from total ammonia to total ammonia as N is 0.126 mg/L.

Thus, the proposed threshold for ammonia-N is 0.126 mg/L. Application of this threshold provided trigger values of 0.065, 0.067, and 0.067 mg/L respectively for Meadowbank, Wally, and Baker (**Table 3**). Only at extreme pH and temperature would this trigger potentially exceed the CCME guideline. Whenever the trigger is exceeded, the concentrations of ammonia-N should be compared to the CCME guideline based on the specific pH and field temperature of each sample.

Total P -- The CCME does not specify a particular guideline for total phosphorus, but instead establishes a guidance framework for site-specific application. Under that framework, the specification for ultra-oligotrophic lakes is for total-P of <0.004 mg/L. The framework notes that up to a 50% increase in total-P over baseline is generally considered acceptable. Regardless, the 95th percentiles for Total-P exceeded 0.004 mg/L for both Meadowbank samples and Baker samples (**Table 3**). Consequently, the proposed lake-specific triggers were set equal to these 95th percentiles (Method B, **Table 3**).

pH -- The CCME guideline for pH in freshwater is a range from 6.5 to 9.0. Thus, for pH, there is both an upper threshold (9.0) and a lower threshold (6.5), with associated upper and lower triggers (**Table 3**). In the case of Meadowbank data, the lower trigger was based on Method B because the 5th percentile of the baseline data was equal to the lower threshold of 6.50 (**Table 3**).

TSS -- For water bodies with low natural TSS, the CCME guideline is a maximum increase of 25 mg/L over background for short periods (e.g., 24h) and a maximum increase of 5 mg/L over background for longer periods (e.g., 24h to 30 days). If we conservatively assume a background TSS of 0 mg/L, then thresholds of 25 mg/L and 5 mg/L would apply for short-term and long-term exposures, respectively. However, because sampling occurs only at most once per month, it will be unknown whether a given TSS measure is a short-term (< 24 h) or longer term (> 24 h) phenomenon. We therefore propose a TSS trigger based on the lower threshold of 5 mg/L, which thereby addresses both short and long durations. The resulting triggers, based on Method A, were 3.0 mg/L for all three systems (**Table 3**).

Table 1. Total metals: summary of trigger values for Meadowbank, Wally, and Baker stations.

Notes: For each variable, thresholds (guidelines) are shown if applicable (see text for discussion); DL = current detection limit; N = sample measurements; >DL = number of measurements above DL; Med = median if estimable; P95 = 95th percentile if estimable; M = method used to determine the trigger, where A = halfway from median (or DL if median not estimable) to threshold, B = 95th percentile, and C = 2*DL.

			Meadowbank						Wally						Baker					
Variable	Threshold	DL	N	>DL	Med	P95	Trigger	M	N	>DL	Med	P95	Trigger	M	N	>DL	Med	P95	Trigger	M
Aluminum (T)	0.1	0.003	204	169	0.007	0.014	0.054	A	34	23	0.006	0.011	0.053	A	31	30	0.011	0.023	0.056	A
Antimony (T)	0.02	0.0001	204	0	NA	NA	0.010	A	34	0	NA	NA	0.010	A	31	0	NA	NA	0.010	A
Arsenic (T)	0.005	0.0001	204	14	NA	NA	0.0026	A	34	14	0.00025	0.00029	0.0026	A	31	4	0.00015	NA	0.0026	A
Barium (T)	1.0	0.00005	204	79	0.0021	0.0030	0.50	A	34	14	0.0019	0.0030	0.50	A	31	14	0.0177	0.0196	0.51	A
Beryllium (T)	0.0053	0.0001	204	0	NA	NA	0.0027	A	34	0	NA	NA	0.0027	A	31	0	NA	NA	0.0027	A
Boron (T)	1.5	0.01	204	1	NA	NA	0.76	A	34	0	NA	NA	0.76	A	31	3	0.011	0.011	0.76	A
Cadmium (T)	0.00004	0.00001	204	10	NA	NA	0.000025	A	34	1	NA	NA	0.000025	A	31	0	NA	NA	0.000025	A
Chromium (T)	0.001	0.0001	204	14	0.00011	0.00046	0.00056	A	34	0	NA	NA	0.00055	A	31	2	NA	NA	0.00055	A
Copper (T)	0.002	0.0005	204	61	0.00047	0.00068	0.00124	A	34	16	0.00098	0.00129	0.00149	A	31	11	0.00049	0.00060	0.00125	A
Iron (T)	0.3	0.01	204	26	NA	NA	0.155	A	34	6	0.015	0.025	0.157	A	31	9	0.020	0.063	0.160	A
Lead (T)	0.001	0.00005	204	7	NA	NA	0.00053	A	34	2	NA	0.00015	0.00053	A	31	1	NA	NA	0.00053	A
Lithium (T)	0.096	0.0005	204	6	0.00042	0.00063	0.048	A	34	2	0.00085	NA	0.048	A	31	6	0.0010	0.0036	0.048	A
Manganese (T)	See text	0.00005	204	198	0.0013	0.0043	0.316	A	34	34	0.0014	0.0020	0.330	A	31	31	0.0024	0.0038	0.340	A
Mercury (T)	0.000026	0.00001	204	1	NA	NA	0.000018	A	34	0	NA	NA	0.000018	A	31	0	NA	NA	0.000018	A
Molybdenum (T)	0.073	0.00005	204	5	NA	NA	0.037	A	34	3	0.00013	0.00019	0.037	A	31	4	0.00008	NA	0.037	A
Nickel (T)	0.025	0.0005	204	8	0.0005	0.0007	0.013	A	34	0	NA	NA	0.013	A	31	0	NA	NA	0.013	A
Selenium (T)	0.001	0.0001	204	0	NA	NA	0.00055	A	34	0	NA	NA	0.00055	A	31	0	NA	NA	0.00055	A
Strontium (T)	0.049	0.0002	192	188	0.0068	0.0095	0.028	A	32	32	0.016	0.022	0.033	A	31	31	0.025	0.056	0.056	B
Thallium (T)	0.0008	0.00001	204	0	NA	NA	0.00041	A	34	0	NA	NA	0.00041	A	31	0	NA	NA	0.00041	A
Tin (T)		0.0001	204	2	NA	NA	0.0002	C	34	0	NA	NA	0.0002	C	31	0	NA	NA	0.0002	C
Titanium (T)	2.0	0.01	204	14	0.00016	0.00044	1.0	A	34	3	0.00013	0.00049	1.0	A	31	4	0.00038	NA	1.0	A
Uranium (T)	0.015	0.00001	204	20	0.00004	0.00006	0.0075	A	34	2	0.00004	NA	0.0075	A	31	4	0.00005	NA	0.0075	A
Vanadium (T)	0.006	0.001	204	0	NA	NA	0.0035	A	34	0	NA	NA	0.0035	A	31	0	NA	NA	0.0035	A
Zinc (T)	See text	0.003	204	4	NA	NA	0.0063	A	34	2	NA	NA	0.0106	A	31	0	NA	NA	0.0132	A

Table 2. Dissolved metals: summary of trigger values for Meadowbank, Wally, and Baker stations.

Notes: For each variable, thresholds (guidelines) are shown if applicable (see text for discussion); DL = current detection limit; N = sample measurements; >DL = number of measurements above DL; Med = median if estimable; P95 = 95th percentile if estimable; M = method used to determine the trigger, where A = halfway from median (or DL if median not estimable) to threshold, B = 95th percentile, and C = 2*DL.

			Meadowbank						**Wally**						**Baker**					
Variable	Threshold	DL	N	>DL	Med	P95	Trigger	M	N	>DL	Med	P95	Trigger	M	N	>DL	Med	P95	Trigger	M
Aluminum (D)	0.05	0.001	164	69	0.003	0.005	0.026	A	27	13	0.003	0.006	0.026	A	28	17	0.005	0.006	0.027	A
Antimony (D)	0.02	0.0001	164	0	NA	NA	0.010	A	27	0	NA	NA	0.010	A	28	0	NA	NA	0.010	A
Arsenic (D)	0.005	0.0001	164	12	NA	NA	0.0026	A	27	13	0.00024	0.00034	0.0026	A	28	6	0.00012	0.00024	0.0026	A
Barium (D)	1.0	0.00005	164	79	0.0020	0.0029	0.50	A	27	13	0.0018	0.0030	0.50	A	28	14	0.0178	0.0200	0.51	A
Beryllium (D)	0.0053	0.0001	164	0	NA	NA	0.0027	A	27	0	NA	NA	0.0027	A	28	0	NA	NA	0.0027	A
Boron (D)	1.5	0.01	164	0	NA	NA	0.76	A	27	0	NA	NA	0.76	A	28	0	NA	NA	0.76	A
Cadmium (D)	0.00004	0.00001	164	3	NA	NA	0.000025	A	27	0	NA	NA	0.000025	A	28	0	NA	NA	0.000025	A
Chromium (D)	0.001	0.0001	164	1	NA	NA	0.00055	A	27	0	NA	NA	0.00055	A	28	1	NA	NA	0.00055	A
Copper (D)	0.002	0.0002	164	77	0.00038	0.00049	0.00119	A	27	15	0.00087	0.00148	0.00148	B	28	13	0.00033	0.00044	0.00116	A
Iron (D)	0.3	0.01	164	0	NA	NA	0.155	A	27	0	NA	NA	0.155	A	28	1	NA	NA	0.155	A
Lead (D)	0.001	0.00005	164	3	NA	NA	0.00053	A	27	2	NA	0.00015	0.000525	A	28	0	NA	NA	0.000525	A
Lithium (D)	0.096	0.0005	164	2	NA	0.00053	0.048	A	27	2	0.00099	NA	0.048	A	28	4	0.0008	NA	0.048	A
Manganese (D)	See text	0.00005	164	114	0.0004	0.0029	0.315	A	27	22	0.0004	0.0015	0.330	A	28	24	0.0006	0.0019	0.339	A
Mercury (D)	0.000026	0.00001	153	2	NA	NA	0.000018	A	25	0	NA	NA	0.000018	A	26	0	NA	NA	0.000018	A
Molybdenum (D)	0.073	0.00005	164	17	0.00010	0.00018	0.037	A	27	8	0.00011	0.00019	0.037	A	28	3	0.00006	NA	0.037	A
Nickel (D)	0.025	0.0005	164	6	NA	NA	0.013	A	27	1	NA	NA	0.013	A	28	0	NA	NA	0.013	A
Selenium (D)	0.001	0.0001	164	0	NA	NA	0.00055	A	27	0	NA	NA	0.00055	A	28	0	NA	NA	0.00055	A
Strontium (D)	0.049	0.002	164	161	0.0069	0.0090	0.028	A	27	27	0.016	0.023	0.033	A	28	28	0.023	0.049	0.049	B
Thallium (D)	0.0008	0.00001	164	0	NA	NA	0.00041	A	27	0	NA	NA	0.00041	A	28	0	NA	NA	0.00041	A
Tin (D)		0.0001	164	0	NA	NA	0.0002	C	27	0	NA	NA	0.0002	C	28	0	NA	NA	0.0002	C
Titanium (D)	2.0	0.01	164	0	NA	NA	1.0	A	27	0	NA	NA	1.0	A	28	0	NA	NA	1.0	A
Uranium (D)	0.015	0.00001	164	20	0.00003	0.00005	0.0075	A	27	2	0.00004	NA	0.0075	A	28	4	0.00004	NA	0.0075	A
Vanadium (D)	0.006	0.001	164	0	NA	NA	0.0035	A	27	0	NA	NA	0.0035	A	28	0	NA	NA	0.0035	A
Zinc (D)	See text	0.001	164	6	NA	0.0021	0.0053	A	27	2	NA	NA	0.0096	A	28	2	NA	0.0028	0.0122	A

Table 3. Nutrients and conventional parameters: summary of trigger values for Meadowbank, Wally, and Baker stations.

Notes: For each variable, thresholds (guidelines) are shown if applicable (see text for discussion); DL = current detection limit; N = sample measurements; >DL = number of measurements above DL; Med = median if estimable; P95 = 95th percentile if estimable; M = method used to determine the trigger, where A = halfway from median (or DL if median not estimable) to threshold, B = 95th percentile, and C = 2*DL.

			Meadowbank						**Wally**						**Baker**					
Variable	Threshold	DL	N	>DL	Med	P95	Trigger	M	N	>DL	Med	P95	Trigger	M	N	>DL	Med	P95	Trigger	M
Ammonia-N	0.126	0.005	204	52	0.005	0.046	0.065	A	34	12	0.007	0.024	0.067	A	31	13	0.007	0.031	0.067	A
TKN		0.05	204	178	0.097	0.170	0.170	B	34	31	0.111	0.163	0.163	B	31	28	0.157	0.214	0.214	B
Nitrate-N	3.0	0.005	204	26	NA	0.025	1.503	A	34	2	NA	NA	1.503	A	31	26	0.014	0.030	1.507	A
Nitrite-N	0.06	0.001	204	6	NA	NA	0.031	A	34	2	NA	NA	0.031	A	31	2	NA	NA	0.031	A
Ortho-phosphate		0.001	192	10	NA	0.0010	0.0020	C	34	3	NA	0.0010	0.0020	C	31	5	0.0007	0.0013	0.0020	C
T. phosphorous	0.004	0.002	192	84	0.0019	0.0060	0.0060	B	34	21	0.0028	0.0067	0.0067	B	31	23	0.0036	0.0096	0.0096	B
TOC		0.5	204	204	1.74	2.79	2.79	B	34	34	2.18	4.11	4.11	B	31	31	3.16	4.25	4.25	B
DOC		0.5	204	204	1.70	2.60	2.60	B	34	34	2.20	3.21	3.21	B	31	31	3.17	4.05	4.05	B
Reactive silica		0.5	185	56	0.28	0.44	1.00	C	32	14	0.74	1.08	1.08	B	28	10	0.31	0.42	1.00	C
Bicarb. alkalinity		2.0	192	192	5.2	8.6	8.6	B	34	34	10.0	17.8	17.8	B	31	31	9.3	10.6	10.6	B
Chloride	120	0.1	204	141	0.550	0.809	60.3	A	34	15	0.469	0.639	60.2	A	31	31	24.4	95.7	95.7	B
Carb. alkalinity		2.0	192	0	NA	NA	4.0	C	34	0	NA	NA	4.0	C	31	0	NA	NA	4.0	C
Conductivity		2.0	204	204	15.2	23.5	23.5	B	34	34	28.7	36.6	36.6	B	31	31	110.0	494.5	494.5	B
Hardness		0.5	204	204	5.7	8.5	8.5	B	34	34	12.2	16.7	16.7	B	31	31	16.5	41.2	41.2	B
Calcium		0.5	204	204	1.30	2.15	2.15	B	34	34	3.34	4.88	4.88	B	31	31	3.02	4.50	4.50	B
Potassium		0.1	204	79	0.37	0.50	0.50	B	34	14	0.37	0.59	0.59	B	31	20	0.93	2.43	2.43	B
Magnesium		0.1	204	204	0.64	0.83	0.83	B	34	34	0.96	1.36	1.36	B	31	31	2.61	7.44	7.44	B
Sodium		0.05	204	79	0.55	0.98	0.98	B	34	14	0.48	0.72	0.72	B	31	31	12.1	54.0	54.0	B
Sulphate	128	0.5	204	204	1.42	2.83	64.7	A	34	34	2.34	3.38	65.2	A	31	31	3.84	13.80	65.9	A
pH (Upper)	9.0	0.1	204	204	6.89	7.27	7.94	A	34	34	7.35	7.44	8.17	A	31	31	7.21	7.66	8.11	A
pH (Lower)	6.5	0.1	204	204	6.89	6.50[a]	6.50	B	34	34	7.35	7.00[a]	6.75	A	31	31	7.21	6.99[a]	6.74	A
Total Alkalinity		2.0	192	192	5.20	8.55	8.55	B	34	34	10.0	17.8	17.8	B	31	31	9.3	10.6	10.6	B
TDS		3.0	204	134	11.0	18.0	18.0	B	34	34	18.0	25.3	25.3	B	31	31	64.0	208.0	208.0	B
TSS	5.0	1.0	204	9	NA	NA	3.00	A	34	1	NA	NA	3.00	A	31	2	NA	NA	3.00	A

[a] For pH (Lower), the 5th percentile is reported.

Table 4. Summary of thresholds for water variables.

Variable	Source	Description of guidelines
t-Aluminum (Al)	CCME	The CCME guideline for t-Al in water is 0.005 mg/L when pH < 6.5, and 0.1 mg/L when pH ≥ 6.5. See text for details.
t-Arsenic (As) **d-Arsenic	CCME	The CCME water quality guideline (aquatic life) for t-As is 0.005 mg/L.
t-Boron (B) **d-Boron	BC MOE	There is no CCME guideline for t-B. However, the BC Ministry of Environment (BC MOE, www.env.gov.bc.ca) guideline for freshwater aquatic life is 1.2 mg/L.
t-Cadmium (Cd) **d-Cadmium	CCME	The hardness-dependent CCME guideline for t-Cd (mg/L) is 0.00004 mg/L when hardness > 0 to < 17 mg/L $CaCO_3$ and is $0.001*10^{0.83*\log(H)-2.46}$ where H = hardness (mg/L $CaCO_3$) when hardness is >= 17 to <= 280 mg/L $CaCO_3$. For hardness > 280 mg/L $CaCO_3$, the guideline is 0.00037 mg/L.
t-Chromium (Cr) **d-Chromium	CCME	The CCME guideline for hexavalent chromium (the most common form in surface waters) is 0.001 mg/L.
t-Copper (Cu) **d-Copper	CCME	The CCME guideline for t-Cu is 0.002 mg/L for hardness < 82 mg/L $CaCO_3$.
t-Iron (Fe) **d-Iron	CCME	The CCME guideline for t-Fe is 0.3 mg/L.
t-Lead (Pb) **d-Lead	CCME	The CCME guideline for t-Pb is 0.001 mg/L for hardness < 60 mg/L $CaCO_3$.
t-Manganese (Mn) **d-Manganese	BC MOE	There is no CCME guideline for t-Mn in water. The hardness-dependent BC MOE guideline for t-Mn in mg/L is 0.0044*H + 0.605, where H = hardness (mg/L $CaCO_3$). See text for details.
t-Mercury (Hg) **d-Mercury	CCME	The CCME guideline for total inorganic mercury is 26 ng/L (0.00026 mg/L).
t-Molybdenum (Mo) **d-Molybdenum	CCME	The CCME guideline for t-Mo in water is 0.073 mg/L.
t-Nickel (Ni) **d-Nickel	CCME	The CCME guideline for t-Ni is 0.025 mg/L for hardness < 60 mg/L $CaCO_3$.
t-Selenium (Se) **d-Selenium	CCME	The CCME guideline for t-Se in water is 0.001 mg/L.
t-Thallium (Tl) **d-Thallium	CCME	The CCME water quality guideline for t-Tl is 0.0008 mg/L.

t-Zinc (Zn) **d-Zinc	CCME Ekati	The CCME water quality guideline for t-Zn is 0.030 mg/L. However, this guideline does not take into account hardness, and zinc toxicity is known to be hardness-dependent. An assessment for Ekati by EVS (2004) compiled data on species applicable to oligotrophic systems with low hardness, and developed a chronic benchmark for t-Zn that was hardness dependent. See text for details.
d-Aluminum (Al)	BC MOE	A pH-dependent water quality guideline for d-Al (mg/L) has been developed by BC MOE for protection of freshwater aquatic life when pH <6.5 as follows: d-Al = $e^{(1.6-3.327*pH + 0.402*K)}$ where K = pH^2. For pH >= 6.5 the guideline is 0.05 mg/L See text for details.
Ammonia-N	CCME	The CCME guidelines for total ammonia in freshwater are pH and temperature dependent, with more stringent guidelines applying at higher pH and higher temperature. See text for details.
Nitrate-N	CCME	The CCME guideline for NO3-N is 2.9 mg/L.
Nitrite-N	CCME	The CCME guideline for nitrite-N is 0.06 mg/L.
t-Phosphorous (P)	CCME	The CCME does not specify a particular guideline for t-P, but instead establishes a guidance framework for site-specific application. See text for details.
pH	CCME	The CCME guideline for pH is a range from 6.5 to 9.0. See text for details.
TSS	CCME	For water bodies with low natural TSS, the CCME guideline is a maximum increase of 25 mg/L over background for short periods (e.g., 24h) and 5 mg/L for longer periods (e.g., 24h to 30 days). See text for details.

****** where thresholds for total metals were developed, those thresholds were also applied to dissolved metal parameters.

APPENDIX B

STANDARD OPERATING PROCEDURE (SOP) FOR CREMP WATER & PHYTOPLANKTON SAMPLING

Standard Operating Procedure
Meadowbank Project Lakes & Baker Lake
CREMP Water & Phytoplankton Sampling 2013

GENERAL:

Project Coordinator:
Laura Bekar
Azimuth Consulting Group
218-2902 West Broadway
Vancouver, BC, V6K 2G8
Telephone: 604-730-1220
Email: lbekar@azimuthgroup.ca

In case of **emergency**, contact Laura Bekar (cell [redacted]) or Gary Mann (cell [redacted]).
Azimuth office telephone number 604-730-1220.

LOCATION AND TIMING FOR FIELD ACTIVITIES:

Twelve (12) sampling stations have been chosen for water quality monitoring in the Meadowbank project lakes and Baker Lake:

Twelve (12) sampling stations have been chosen for water quality monitoring in the Meadowbank project lakes and Baker Lake:

Meadowbank Lakes

- Third Portage Lake – North Basin (TPN)
- Third Portage Lake – East Basin (TPE)
- Second Portage Lake (SP)
- Tehek Lake (TE)
- Inuggugayualik Lake (INUG)
- Tehek Lake – Far-field (TEFF)
- Third Portage Lake – South Basin (TPS)
- Wally Lake (WAL)
- Pipedream Lake (PDL)

Baker Lakes

- Baker Lake – Barge Dock (BBD)
- Baker Lake – Proposed Jetty (BPJ)
- Baker Lake – Akilahaarjuk Point (BAP)

Water sampling activities are scheduled roughly once a month for 6 months, including winter ice sampling. The first 5 stations listed above plus Wally (TPN, TPE, SP, TE, INUG, WAL) are sampled through the ice in April, May, and November. All of the above stations are sampled during open water in July, August, and September. Sampling will not be conducted in June and October because of thin ice conditions. Check the monthly water sampling schedule to confirm which samples are to be collected where, BEFORE going into the field.

All samples are collected from **3 m below the water surface**, which is indicated by "-S" at the end of the sample ID (S=Surface). **Two** target sample locations for each station listed above have been randomly pre-determined from within their respective lake basins and recorded in MapSource (version 6.15.11) and in the hand-held GPS units (NAD 83). Confirm before going into the field.

MONTHLY CREMP WATER CHEMISTRY & PHYTOPLANKTON SAMPLING:

1. Prior to leaving camp gather the appropriate type and number of sampling vessels and acid vials for preservation. Prepare appropriate labels for containers, affix them to the appropriate bottle (see below), and wrap label with packing tape. Use the following information:
   - Azimuth company name
   - Station abbreviation (e.g. TPE-36-S, INUG-24-S)
   - Date of sample collection
   - Parameters to be measured from individual bottle (TOC, total metals, etc.)

2. Gather **field collection materials**:
   In the boat:
   - Field collection data forms, pencils, waterproof markers & clipboard
   - GPS unit, batteries
   - Water pump & 12V battery
   - Tubing (4 meter length and 1 meter length) & weight (& extra C-clamps and cable ties)
   - In-line filter and a spare
   - YSI meter, batteries
   - Secchi disk
   - Hand held pH meter, batteries
   - Depth meter, batteries
   - Rope
   - Sampling gloves
   - Field sample bottles & preservatives (per sample):
     - 2 – 1 L plastic (TSS-low and Conventionals)
     - 1 – 250 mL amber glass (TKN, Ammonia, TOC)
     - 1 – 125 ml amber glass (DOC)
     - 2 – 250 mL plastic (total & dissolved metals, including total & dissolved Hg)
     - 2 – 250 mL plastic (chlorophyll)
     - 1 – 50 mL vial for phytoplankton
     - 2 vials sulfuric acid
     - 2 vials nitric acid
     - 1 syringe & Lugol's solution
   - Extra sample bottles in case of breakage or loss
   - QA/QC field duplicate sampling containers & preservatives (same as above).
   - Take one set of Travel Blank bottles into the field and transport and treat as other samples. Note that the Travel Blank bottles are not to be opened and no preservatives added.

In camp:

- Hand pump, filters, tweezers, and black 15 mL plastic tubes (from ALS) for chlorophyll-a
- De-ionized water for rinsing equipment and collected field equipment blank
- Coolers (for storing and shipping samples)
- Ice packs (for shipping samples to laboratories)
- Address labels for coolers
- Chain-of-custody forms
- Large Ziploc bags (for sending chain-of-custody form in cooler)
- Packing tape (for affixing labels to sampling containers & sealing cooler)

Table 1 lists the specific bottles to be filled, and **Table 2** lists the parameters to be measured and preservatives required for each. Affix the labels to the sampling containers and then prior to shipping, wrap packing tape around the labels to ensure a waterproof seal.

3. For **QAQC** purposes three kinds of samples are required:

Field duplicate: All parameters measured in the original sample are measured in the field duplicate. The sampling station is selected at random and labeled as station CREMP [month] DUP-1, -2, -3, -4, etc. Prepare the QAQC labels and affix to the sampling containers, as described in step 2.

Travel blank: These are to be carried into the field and treated like the other sampling vessels except that the bottles are not to be opened or anything added to them. Ship back to the lab, each set with different shipment.

Equipment blank: To collect an equipment blank, set up the water sampling equipment as if a routine sample was to be collected except that the incurrent and excurrent hoses are placed into the same opening of a container (find an empty and CLEAN container, large enough for >4L; pour 4L of ***de-ionized water sent from ALS laboratories*** into the clean container). Pump for 2 minutes (just like in the field) to flush site water from the equipment (also attach the filter to flush for 30 seconds). Flush and discard 4L, this time with the excurrent hose placed in sink or empty bucket. Now with fresh DI water from ALS, fill all bottles listed in the above table (except for chlorophyll and phytoplankton). Preserve and treat as other samples, including filtering where necessary. Label as station CREMP [month] EB-1, -2, -3, -4, etc.

4. Before and during sampling fill in the requested information on the field data form; complete one field data form in its entirety for each sampling station and sampling event. Forms are made of waterproof paper; print all information on the form using a lead pencil or a write-in-the-rain pen.

5. With the aid of a GPS unit, navigate the boat to the sampling station using the UTM coordinates (in NAD 83) provided. Approach the station from downstream of the wind direction. In windy conditions, anchor the boat upstream of the station and drift back; it is not necessary to anchor the boat in calm conditions providing the boat remains in the same position. Do not allow the anchor to drag through the sampling station. Record the **UTM coordinates** on the field data form.

6. Measure **water depth** at the sampling station using the 'Hawkeye' hand-held depth meter (or transom-mounted lowrance). Hold the meter in the water, facing the lake bottom, until the meter measures the depth. Record this information on the field data form. If you are in water that is too shallow (i.e., **must have at least 5 meters depth**), move to deeper water near the assigned station.

7. Measure the light attenuation at the sampling station using the **Secchi disk**. Lower the disk into the water, on the shady side of the boat, so that you can no longer see it. Slowly raise the disk to the point that you can see it and measure this depth using the markings on the disk rope.

8. Measure the pH of the water at the sampling station using the **pH meter** (unless the YSI includes this parameter). Hold the probe portion of the meter in the lake until the meter measures the pH. Record this information on the field data form.

9. Calibrate the YSI probe prior to going into the field; confirm elevation (m) of sampling environment. Check the DO calibration (adjust barometric pressure based on airport data) but also check the DO membrane (it may need to be replaced). At Meadowbank DO readings should be about 8 – 12mg/L; if meter is reading much lower/higher than this, membrane likely needs to be replaced. Keep a calibration log which includes date and time, type of calibration, results, and troubleshooting.

10. Lower the **YSI probe** into the lake to just below the water surface level. Measure the temperature (^{o}C), specific conductance (i.e., temperature corrected) (uS/cm) and dissolved oxygen concentration (mg/L) in the water and record on the field data form. Lower the meter to a depth of 1 m and record the field measurements. Allow the concentrations on the meter to stabilize for 10 to 15 seconds before recording the concentrations. Continue recording the field measurements at **1 m depth intervals** until you reach the whole metre mark above the lake bottom (i.e. if the lake depth is 9.3 meters, record field measurements up to a depth of 9 meters).

11. Set up the **water pump** in the boat; attach the tubing to the pump using the C-clamps and attach the 12-V battery. Attach the 4 meter length of tubing to the intake valve, and the 1 meter length to the output valve. Attach the plastic coated ball weight to the end of the 4 meter length of tubing. Lower the 4 meter length of tubing into the water to ***3 meters depth*** and place the 1 meter length of tubing over the edge of the boat. Run the pump for ***2 minutes*** to flush the sampling device.

12. For each sampling station, **fill** the required **pre-labeled sampling containers** with water from the 1 meter length of tubing.

13. Dissolved metals and dissolved organic carbon samples are to be collected with an in-line high capacity filter with 0.45 um pore size. After all unfiltered samples have been collected, disconnect the battery from the pump and fix the filter onto the end of the discharge hose. Re-connect the pump and allow the water to discharge and flush through the filter for 15 – 20 seconds. Direct filtered water into the DOC and dissolved metals (and dissolved Hg) bottles. Flow from the hose can be controlled by pinching the incurrent end of the tube (***not the excurrent***). Once filtered samples have been collected remove the filter and place into a plastic or zip-loc bag for re-use. In the Meadowbank environment where the amount of suspended solids is typically low, filters can be re-used for up to 10 samples. Remember to use the same filter when collecting equipment blank samples, not a new filter.

14. **Add the specified preservatives** to the appropriate sampling containers (according to the information on the labels and table in step 2), seal and mix thoroughly by turning upside down and then upright a number of times.

15. To collect a phytoplankton sample, add site water from appropriate depth (i.e., 3 m) into the 50 mL vial provided. Make sure that site information is appropriately labeled on the jar. In the field or the lab, add a few drops of Lugol's solution to the sample so that it has the color of weak tea.

16. Back in the office, to process the chlorophyll-a sample, use the hand-held pump apparatus and filters. Using the tweezers, place an ashless filter paper on the screen in the water filter apparatus, then screw the two sections together and attach the hand-held vacuum pump. **Filter 500 mL of water** through the water filter apparatus. After filtering remove the filter with clean tweezers, place the filter in the 15 mL black plastic tube. Place the plastic tube into the **freezer**. Mark on the field collection data sheet the volume of water filtered.

17. Until ready for shipping, the water samples are stored **chilled** in a refrigerator in camp, if space is available. The filter for chlorophyll-a analysis must be **frozen**; store this bag in a deep freezer in the camp. Bottles should be put in plastic bubble bags prior to storage on ice to protect the labels from water damage. The phytoplankton samples are stored at **room temperature**.

18. If this sampling station is selected as the QAQC **field duplicate**, collect a second set of water samples, fill the pre-labeled sampling containers, including the phytoplankton vial (repeat step 11-15) and collect a second filtered chlorophyll-a sample (step 16). Record which sampling station the QAQC samples are collected from on the appropriate field data form.

19. Fill out a **chain-of-custody** form for the water samples and filters being sent to **ALS Environmental**. The COC form must be completed carefully and in its entirety to ensure proper analysis. This includes listing all of the specific conventional parameters (see table in step 2), Azimuth and ALS contact names, and checking off all of the specific boxes for requested analyses. The ALS laboratory quote number must be printed on the COC form to ensure proper billing.

    A **digital COC** form is most commonly used; this form can be filled out in advance to ensure accuracy and efficiency and amended in the field as required. Note that using a digital copy of the COC requires printing 2 copies of the document in the field (one for the laboratory, one for Azimuth). Any questions regarding the COC form should be directed to the Azimuth project coordinator – Laura Bekar. Put the completed COC form in a sealed ziploc plastic bag in a cooler with the water samples.

20. Fill out a **chain-of-custody** form for the phytoplankton samples being sent to **Plankton R Us Inc.**, Winnipeg, MB. Complete all of the required fields and then put the form in a sealed ziploc plastic bag in the cooler with the phytoplankton samples.

PACKAGING & SHIPPING SAMPLES:

1. Ensure all **water samples** are **sealed** securely. Prior to shipping, it is advisable to wrap the label of each sample bottle with clear tape to make sure that the label does not come off during shipping and handling. Dry the water bottle and wrap with tape. **Pack** water sampling containers upright in coolers with ice packs, and packing material, to ensure samples do not spill or break during transport. Ideal storage and transport temperature is 4°.

2. Ensure the COC form is enclosed and then seal the cooler(s). **Label the cooler**(s) with the following address:

ALS Environmental
8081 Lougheed Hwy
Burnaby, BC
V5A 1W9
Attn: Brent Mack
604-253-4188

Hold-times for the various parameters are specified in **Table 2**, and shipping options should take into account minimizing the time samples are in transit to minimize the hold-times and reduce the potential for sample integrity issues as a result of coolers being stored at uncontrolled temperatures.

3. Ensure **phytoplankton samples** are **sealed** securely and **pack** in a cooler with packing material to ensure samples do not break during transport. It is not necessary to keep samples cool.

4. Ensure the COC form is enclosed and then seal the cooler. **Label the cooler** with the following address:

   Plankton R Us Inc.
   Dave Findlay
   39 Alburg Drive
   Winnipeg, MB
   R2N 1M1
   Tel: 204-254-7952

5. **Ship** the water **samples** to ALS Environmental as quickly as possible. Ship the phytoplankton samples to Dave Findlay at the end of each month or event.

6. Send completed **COC forms** and **field data forms** to Azimuth Consulting Group, attention the project coordinator – Laura Bekar.

Table 1. Samples collected as part of the CREMP water monitoring program.

				Field Collected			Lab-Prepared
Jar Type	**Label As:**	**Field Filtered**	**Preservation/ Storage**	**Station**	**Field Duplicate**	**Equipment Blank**	**Travel Blank**
1 L plastic	Conventionals	No	None/ refrigerate	Yes	Yes	Yes	Yes
1 L plastic	TSS-Low	No	None/ refrigerate	Yes	Yes	Yes	Yes
250 mL amber glass	Ammonia, TKN, TOC	No	1 vial sulfuric acid/ refrigerate	Yes	Yes	Yes	Yes
125 mL amber glass	DOC	Yes	1 vial sulfuric acid/ refrigerate	Yes	Yes	Yes	Yes
125 mL plastic	Total Metals	No	1 vial nitric acid/ refrigerate	Yes	Yes	Yes	Yes
125 mL plastic	Dissolved Metals	Yes	1 vial nitric acid/ refrigerate	Yes	Yes	Yes	Yes
Filter (500 mL water)	Chlorophyll-*a*	Yes[1]	place in black 15 mL tube/freeze	Yes	Yes	No	No
50 mL glass vial	Phytoplankton[1]	No	1.5 to 2 mL of Lugol's solution	Yes	Yes	No	No

For details on the analysis of individual parameters, see **Table 2.**

[1] The chlorophyll-*a* water sample is an unfiltered sample (500 mL) that is then filtered with a hand-pump at the field office.

Table 2. Water chemistry parameters and ALS laboratory data quality objectives.

Parameter	Target D.L.	Units	Accuracy [1] DQO	Matrix Spike [2] DQO	Precision [3] (RPD) DQO	Hold Times	Bottle Required	Volume Required	Filter (Yes/No)	Preservative	Method Reference
Water - Physical Tests											
Colour, True	5	CU	85-115%	n/a	20%	2 / 3 days	Plastic	1.0 L	No	None	BCMOE Colour Single Wavelength
Conductivity	2	µS/cm	90-110%	n/a	10%	28 days	Plastic	1.0 L	No	None	APHA 2510 Auto. Conduc.
Hardness (as $CaCO_3$)	0.5	S/c	75-125%	65-135%	25%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	APHA 2340B
pH	0.1	mg/L	± 0.10 pH units	n/a	± 0.20 pH units	0.25 hours	Plastic	1.0 L	No	None	APHA 4500-H pH Value
Total Dissolved Solids	10	pH	85-115%	n/a	20%	7 days	Plastic	1.0 L	No	None	APHA 2540 C - GRAVIMETRIC
Total Suspended Solids	3	mg/L	85-115%	n/a	20%	7 days	Plastic	1.0 L	No	None	APHA 2540 D - GRAVIMETRIC
Turbidity	0.1	mg/L NTU	85-115%	n/a	15%	2 / 3 days	Plastic	1.0 L	No	None	APHA 2130 Turbidity
Water - Anions and Nutrients											
Alkalinity, Bicarbonate (as $CaCO_3$)	2	mg/L	85-115%	n/a	20%	14 days	Plastic	1.0 L	No	None	EPA 310.2 OR APHA 2320
Alkalinity, Carbonate (as $CaCO_3$)	2	mg/L	85-115%	n/a	20%	14 days	Plastic	1.0 L	No	None	EPA 310.2 OR APHA 2320
Alkalinity, Hydroxide (as $CaCO_3$)	2	mg/L	85-115%	n/a	20%	14 days	Plastic	1.0 L	No	None	EPA 310.2 OR APHA 2320
Alkalinity, Total (as $CaCO_3$)	2	mg/L	85-115%	n/a	20%	14 days	Plastic	1.0 L	No	None	EPA 310.2 OR APHA 2320
Ammonia, Total (as N)	0.005	mg/L	85-115%	75-125%	20%	28 days	Amber Glass	250 ml	No	H_2SO_4	J. ENV. MONIT.,2005,7,37-42,RSC
Anion Sum	0.1										APHA 1030E
Bromide (Br)	0.05	mg/L	85-115%	75-125%	20%	28 days	Plastic	1.0 L	No	None	APHA 4110 B.
Cation - Anion Balance	-100										APHA 1030E
Cation Sum	0.1										APHA 1030E
Chloride (Cl)	0.5	mg/L	85-115%	75-125%	20%	28 days	Plastic	1.0 L	No	None	APHA 4110 B.
Computed Conductivity	0.2	uS/cm	90-110%	n/a	10%						APHA 1030E
Fluoride (F)	0.02	mg/L	85-115%	75-125%	20%	28 days	Plastic	1.0 L	No	None	APHA 4110 B.
Ion Balance	-100										APHA 1030E
Nitrate (as N)	0.005	mg/L	85-115%	75-125%	20%	2 / 3 days	Plastic	1.0 L	No	None	EPA 300.0
Nitrite (as N)	0.001	mg/L	85-115%	75-125%	20%	2 / 3 days	Plastic	1.0 L	No	None	EPA 300.0
Orthophosphate-Dissolved (as P)	0.001	mg/L	80-120%	70-130%	20%	2 / 3 days	Plastic	1.0 L	No	None	APHA 4500-P Phosphorous
Phosphorus (P)-Total	0.003	mg/L	80-120%	70-130%	20%	28 days	Plastic	1.0 L	No	None	APHA 4500-P Phosphorous
Phosphorus (P)-Total Dissolved	0.003	mg/L	80-120%	70-130%	20%	28 days	Plastic	1.0 L	No	None	APHA 4500-P Phosphorous
Sulfate (SO_4)	0.5	mg/L	85-115%	75-125%	20%	28 days	Plastic	1.0 L	No	None	APHA 4110 B.
TDS (Calculated)	1		85-115%	n/a	20%	28 days	Plastic	1.0 L	No	None	APHA 1030E
Total Kjeldahl Nitrogen	0.05	mg/L	75-125%	70-130%	20%	10 days	Amber Glass	250 ml	No	H_2SO_4	APHA 4500-NORG D.
Water - Organic / Inorganic Carbon											
Dissolved Organic Carbon	0.5	mg/L	80-120%	70-130%	20%	28 days	Amber Glass	125 ml	Yes	H_2SO_4	APHA 5310 TOTAL ORGANIC CARBON
Total Organic Carbon	0.5	mg/L	80-120%	70-130%	20%	28 days	Amber Glass	125 ml	No	H_2SO_4	APHA 5310 TOTAL ORGANIC CARBON
Chlorophyll-*a*											
Chlorophyll-*a*	0.01	µg	+/- 20%	n/a	+/- 20%	28 days	Plastic	250ml	Footnote 4	Footnote 4	EPA Method 445.0
Water - Total Metals											
Aluminum (Al)-Total	0.003	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	No	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Antimony (Sb)-Total	0.0001	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	No	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Arsenic (As)-Total	0.0001	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	No	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Barium (Ba)-Total	0.00005	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	No	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Beryllium (Be)-Total	0.0001	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	No	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Bismuth (Bi)-Total	0.0005	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	No	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Boron (B)-Total	0.01	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	No	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Cadmium (Cd)-Total	0.00001	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	No	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Calcium (Ca)-Total	0.05	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	No	HNO_3	EPA 3005A/6010B
Chromium (Cr)-Total	0.0001	mg/L	80-120%	70-130%	20%	30 days	Plastic, Verified	125 ml	No	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Cobalt (Co)-Total	0.0001	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	No	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Copper (Cu)-Total	0.0005	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	No	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Iron (Fe)-Total	0.01	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	No	HNO_3	EPA 3005A/6010B
Lead (Pb)-Total	0.00005	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	No	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Lithium (Li)-Total	0.0005	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	No	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Magnesium (Mg)-Total	0.1	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	No	HNO_3	EPA 3005A/6010B
Manganese (Mn)-Total	0.00005	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	No	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Mercury (Hg)-Total	0.00001	mg/L	80-120%	70-130%	20%	28 days	Plastic, Verified	125 ml	No	HNO_3	EPA 245.7
Molybdenum (Mo)-Total	0.00005	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	No	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Nickel (Ni)-Total	0.0005	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	No	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Phosphorus (P)-Total	0.05	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	No	HNO_3	EPA 3005A/6010B
Potassium (K)-Total	0.1	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	No	HNO_3	EPA 3005A/6010B

Table 2 (con't). Water chemistry parameters and ALS laboratory data quality objectives.

Parameter	Target D.L.	Units	Accuracy [1] DQO	Matrix Spike [2] DQO	Precision [3] (RPD) DQO	Hold Times	Bottle Required	Volume Required	Filter (Yes/No)	Preservative	Method Reference
Selenium (Se)-Total	0.0001	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	No	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Silicon (Si)-Total	0.05	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	No	HNO_3	EPA 3005A/6010B
Silver (Ag)-Total	0.00001	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	No	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Sodium (Na)-Total	0.05	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	No	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Strontium (Sr)-Total	0.0002	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	No	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Sulfur (S)-Total	0.5	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	No	HNO_3	EPA SW-846 3005A/6010B
Thallium (Tl)-Total	0.00001	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	No	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Tin (Sn)-Total	0.0001	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	No	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Titanium (Ti)-Total	0.01	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	No	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Uranium (U)-Total	0.00001	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	No	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Vanadium (V)-Total	0.001	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	No	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Zinc (Zn) - Total	0.003	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	No	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Water - Dissolved Metals											
Aluminum (Al)-Dissolved	0.001	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Antimony (Sb)-Dissolved	0.0001	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Arsenic (As)-Dissolved	0.0001	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Barium (Ba)-Dissolved	0.00005	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Beryllium (Be)-Dissolved	0.0001	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Bismuth (Bi)-Dissolved	0.0005	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Boron (B)-Dissolved	0.01	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Cadmium (Cd)-Dissolved	0.00001	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Calcium (Ca)-Dissolved	0.05	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	EPA 3005A/6010B
Chromium (Cr)-Dissolved	0.0001	mg/L	80-120%	70-130%	20%	30 days	Plastic, Verified	125 ml	Yes	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Cobalt (Co)-Dissolved	0.0001	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Copper (Cu)-Dissolved	0.0002	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Iron (Fe)-Dissolved	0.01	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	EPA 3005A/6010B
Lead (Pb)-Dissolved	0.00005	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Lithium (Li)-Dissolved	0.0005	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Magnesium (Mg)-Dissolved	0.1	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	EPA 3005A/6010B
Manganese (Mn)-Dissolved	0.00005	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Mercury (Hg)-Dissolved	0.00001	mg/L	80-120%	70-130%	20%	28 days	Plastic, Verified	125 ml	Yes	HNO_3	EPA SW-846 3005A & EPA 245.7
Molybdenum (Mo)-Dissolved	0.00005	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Nickel (Ni)-Dissolved	0.0005	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Phosphorus (P)-Dissolved	0.05	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	EPA 3005A/6010B
Potassium (K)-Dissolved	0.1	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	EPA 3005A/6010B
Selenium (Se)-Dissolved	0.0001	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Silicon (Si)-Dissolved	0.05	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	EPA 3005A/6010B
Silver (Ag)-Dissolved	0.00001	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Sodium (Na)-Dissolved	0.05	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Strontium (Sr)-Dissolved	0.0002	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Sulfur (S)-Dissolved	0.5	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	EPA SW-846 3005A/6010B
Thallium (Tl)-Dissolved	0.00001	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Tin (Sn)-Dissolved	0.0001	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Titanium (Ti)-Dissolved	0.01	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Uranium (U)-Dissolved	0.00001	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Vanadium (V)-Dissolved	0.001	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	APHA 3030 B&E / EPA SW-846 6020A
Zinc (Zn) - Dissolved	0.001	mg/L	80-120%	70-130%	20%	6 months	Plastic, Verified	125 ml	Yes	HNO_3	APHA 3030 B&E / EPA SW-846 6020A

Note: All bottles should be kept cool from sampling to lab receiving. If possible, Dissolved Metals should be filtered and preserved as soon as possible.

[1] Accuracy is measured as Percent Difference from True Value or Certified Target for Reference Materials and/or Method Analyte Spikes and Surrogates where applicable. For Matrix Spikes, accuracy is measured as the measured amount minus the sample background amount divided by the spiked amount. For low level results the accuracy objective is for the measured result to lie within +/- 1 times the LOR from the target.

[2] Matrix Spike (MS) recovery, expressed as a percentage is defined as:
100 * {[(Measured Concentration) - (Background Analyte Concentration in Sample)] ÷ (Spike Concentration)}
High analyte background may prevent accurate determination of MS recovery. MS recoveries are not calculated or evaluated when the spiked amount is less than the background analyte concentration in the sample.

[3] Precision is measured as the absolute value of Relative Percent Difference (RPD) for Laboratory Duplicate Samples. RPD = |(Result2 - Result1) / Mean| * 100. For low level results, the precision objective is for the difference of the two results to be less than 2 times the LOR.

[4] Wrap bottle with aluminum foil. If filtered, place filter in 15 mL black plastic tube provided by ALS.

APPENDIX C

STANDARD OPERATING PROCEDURE (SOP) FOR CREMP BENTHOS & SEDIMENT SAMPLING

Standard Operating Procedure
Meadowbank Project Lakes & Baker Lake
CREMP Benthos & Sediment Sampling 2013

GENERAL:

Project Coordinator:
Eric Franz
Azimuth Consulting Group
218-2902 West Broadway
Vancouver, BC, V6K 2G8
Telephone: 604-730-1220
Email: lbekar@azimuthgroup.ca

In case of **emergency**, contact Eric Franz (cell [redacted]) or Gary Mann (cell [redacted]). Azimuth office telephone number 604-730-1220.

LOCATION AND TIMING FOR FIELD ACTIVITIES:

Thirteen (13) sampling stations have been chosen for benthos and sediment quality monitoring in the Meadowbank project lakes. These stations (with their corresponding abbreviation) are:

- Third Portage Lake – North Basin (TPN)
- Third Portage Lake – East Basin (TPE)
- Second Portage Lake (SP)
- Tehek Lake (TE)
- Inuggugayualik Lake (INUG)

- Tehek Lake – Far-field (TEFF)
- Third Portage Lake – South Basin (TPS)
- Wally Lake (WAL)
- Pipedream Lake (PDL)

- Baker Lake – Barge Dock (BBD)
- Baker Lake – Proposed Jetty (BPJ)
- Baker Lake – Akilahaarjuk Point (BAP)
- Baker Lake – East Shore (BES)

Field activities are scheduled for once per year, in **mid/late August**. The **target water depth** at each sampling station is approximately **8 meters +/- 1.5 m**.

BENTHOS & SEDIMENT CHEMISTRY SAMPLING:

1. Gather **field collection materials**:
   In the boat:
   - Field collection data forms, waterproof paper, pencils, waterproof markers & clipboard

- GPS unit, batteries
- Depth meter, batteries
- pH meter, batteries
- Rope
- Petite Ponar grab and rope
- 500 micron sieve bag
- 3 stainless steel bowls
- 2 stainless steel spoons
- Liquinox detergent and dish cleaning brush
- Plastic squirt bottle
- Sampling gloves
- Safety glasses
- Field sample jars & preservatives (per sampling station):
  - 11 – 125 mL glass jars (sediment samples : 2 jars for 5 reps; 1 jar for composite)
  - 5 – 500 mL plastic jars (benthos: 1 jar for each rep)
- QA/QC field duplicate sediment jars
- Ashless filter paper & tweezers; 1-125 mL glass jar

In camp:

- Formalin (10% of pure Formaldehyde)
- Labels for sampling containers
- Coolers, action packers (for storing and shipping samples)
- Ice packs (for shipping sediment samples to lab)
- Address labels for coolers
- Chain-of-custody forms
- Large Ziploc bags (for sending chain-of-custody form in coolers)
- Electrical tape (for sealing benthos jars)
- Packing tape (for affixing labels to sediment sample containers & sealing coolers)

2. Before going into the field, **label the lids** of all sampling containers using a permanent waterproof marker. After sampling, prepare appropriate labels for containers and affix them when bottles are dry enough to stick to. Use the following information:
   - Azimuth company name
   - Station abbreviation (e.g. TPE-1, INUG-3)
   - Date of sample collection
   - Parameters to be measured from individual jar (5 x 125 mL – total metals, pH, moisture; 5 x 125 mL – grain size (PSA), TOC; 1 x 125 mL – PAHs, LEPHs & HEPHs, Mineral Oil & Grease.

   Affix the labels to the sediment jars and then wrap packing tape around the labels to ensure a waterproof seal.

   For the **benthos containers**, print the following information directly onto both the jar and jar lid using a permanent waterproof marker:
   - Azimuth company name
   - Station abbreviation (e.g. TPE, INUG) and replicate number (e.g. TPE-1, TPE-2); there are a total of 5 replicates per sampling station
   - Date of sample collection

Prepare **internal labels** for each of the benthos containers. On a small piece of waterproof paper, write, using a lead pencil, the station abbreviation and replicate number (e.g. TPE-1). If no waterproof paper is available, use regular paper. Store the labels in their corresponding sampling container.

3. For **QAQC** purposes, sediment samples are collected in duplicate from 8 replicate station every sampling event (DUP + Swipe). All parameters measured in the original sample are measured in the field duplicate. The sampling station is selected randomly from the 65 replicate stations, and labeled as station DUP (or Swipe). Prepare the QAQC labels and affix to the sediment jars, as described in step 2. And label one new 125 mL glass jars with the Azimuth company name, date, QAQC filter and total metals for each swipe sample.

4. A 100% formalin solution is equivalent to a solution of 37% formaldehyde. The **target formalin concentration** in each of the sampling containers is 10%. A neutral buffered formalin solution is achieved by adding a sufficient amount of calcium carbonate powder or pellets to render the solution pH neutral (pH = 7.0). Borax powder may be substituted for calcium carbonate powder if necessary.

   Transport Canada allows the free transport of formalin at concentrations less than 25% formaldehyde. Consequently, the formalin transported up to Meadowbank will be diluted in half (18.5% formaldehyde / 50% formalin solution).

   To **prepare** the **neutral buffered formalin**, add a small amount of calcium carbonate powder or pellets to the 50% formalin solution, seal the container and shake until mixed. Check the pH of the solution using the pH pen. Continue adding the powder/pellets until the pH of the solution reaches approximately 7.0. Store at room temperature until ready to use. Only prepare the required volume of neutral buffered formalin for that sampling event. Buffered formalin will not store for long periods of time.

   Follow all **safety precautions** when preparing the formalin solution. Formalin is a carcinogen and irritant. Wear sampling gloves and safety glasses when mixing the solution and prepare the solution in a well ventilated area.

5. Before and during the benthos and sediment sampling fill in the requested information on the **field data form**; complete one field data form in its entirety for each sampling station and sampling event. Forms are made of waterproof paper; **print** all information on the form using a **pencil** or write-in-the-rain pen.

6. With the aid of a GPS unit, **navigate the boat** to the sampling station using the UTM coordinates (in NAD 83) provided. Approach the station from downstream of the wind direction. In windy conditions, anchor the boat upstream of the station and drift back; it is not necessary to anchor the boat in calm conditions providing the boat remains within a 50 meter radius of the position. Do not allow the anchor to drag through the sampling station. Record the UTM coordinates on the field data form.

7. Measure the **water depth** at the sampling station. It is recommended to use a transom mounted sonar to first “view” each rep location looking for a smooth, relatively flat lake bottom. Record the

depth information on the field data form. Ensure sample depth is within the target (8 meters +/- 1.5 m).

8. Begin collecting the benthos samples. Collecting the sediment first would disturb the benthic community.

9. Ensure the rope is securely attached to the **Ponar**. Rinse the Ponar grab, 3 stainless steel bowls and a spoon with lake water. **Wash** each of these items with liquinox soap by scrubbing with the dish cleaning brush and then thoroughly rinse with lake water. Put aside two stainless steel bowls and spoon until later (step 18) and ready the largest stainless bowl for the Ponar.

10. Lower the **Ponar** to within 1 meter of the bottom of the lake. Lower the Ponar very slowly over the last meter and allow the rope to go slack. Raise the Ponar to the edge of the boat and check the grab for **acceptability**. The grab is acceptable if the sample:
    - does not contain large foreign objects;
    - has adequate penetration depth (i.e., 10-15 centimeters though in some locations if the substrate is particularly hard it may be necessary to accept smaller grabs);
    - is not overfilled (sediment surface must not be touching the top of the Ponar, though in reality there will be occasions when the Ponar is full, careful judgment is required to determine if the grab is too full);
    - did not leak (there is overlying water present in Ponar); and
    - is undisturbed (sediment surface relatively flat).

    Once the grab is deemed acceptable, open the Ponar jaws and drop the sample into the large stainless steel bowl. Rinse the ponar with squirt bottles to make sure all of the material is in the bowl. Gently pour the contents of the bowl into the 500 micron sieve bag.

11. **Sieve the sample** in the lake water until only the benthic organisms and coarse materials remain. Care must be taken to ensure the benthic organisms are not damaged or crushed. Do not disturb the sample to the point that it is splashing out of the sieve. Do not forcibly push materials through the sieve; gently massage apart any small clay balls. Rinse off any pieces of larger plant material or rocks in the sample and discard.

12. **Flush** the **remaining sample** in the bottom of the sieve into the pre-labeled plastic sampling container (i.e. station-1 jar). A plastic squirt bottle filled with lake water is useful for this purpose.

13. **Repeat steps 10-12**, flushing the sample into the same pre-labeled plastic sampling container (i.e., station-1 jar). Ensure the sample is collected in an area not previously disturbed by the Ponar. The two independent grabs (per replicate) are composited to increase the surface area sampled.

14. **Rinse the sieve** bag to clear out any debris in the screen. To rinse, hold the sieve upside down and raise and lower the sieve into the water.

15. Refer to step 18. At this point while you are still at the first rep you can also collect the Ponar grabs for the sediment chemistry composite.

16. **Repeat steps 10-14** four more times; there must be a separation of ***20 meters*** or more from other replicate stations. Prior to collecting the next REP, clean ponar and both bowls with liquinox and

scrub brush, rinse with lake water. Record the depth and GPS coordinates of each replicate station on the field data form. Put the samples from each replicate in pre-labeled station replicate jars 2 through 5. In total, 10 Ponar grabs will be collected for benthos collection, two grabs per replicate.

17. Ensure internal labels are in each sample container. Shake the formalin to ensure all of the calcium carbonate powder is in solution. **Add** a sufficient volume of **formalin** to each sampling container to make a corresponding formalin solution of approximately 10%. Volumes of formalin are added by 'eye' (for a 10% solution, a ratio of 4 parts water and 1 part 50% formalin solution). Overall, there must be enough liquid in the jar to cover the entire sample. Seal the sample container securely and gently roll the container to mix the sample and formalin solution. Do not shake the sample container; this will crush the benthic organisms inside.

18. Begin collecting the sediment samples. Lower the **Ponar** to within 1 meter of the bottom of the lake, in an area not previously disturbed by the Ponar. Lower the Ponar very slowly over the last meter and allow the rope to go slack. Raise the Ponar to the edge of the boat and check the grab for **acceptability** (see step 10 for criteria).

19. Once the grab is deemed acceptable, open the top of the Ponar and remove any overlying water. Using the pre-cleaned stainless steel spoon, scoop out the **top 3-5 centimeters** of **sediment** and place in the pre-cleaned stainless steel bowl. Empty the remainder of the grab sample into a bucket in the boat, not directly into the lake, to ensure the area is not disturbed.

20. **Repeat steps 18 and 19** one more time, placing the sediment into the bowl with the other sediment sample(s).

21. **Homogenize** the sediment samples in the stainless steel bowl (by stirring with the spoon) until the sediment is thoroughly mixed. Scoop the sediment into pre-labeled sediment sampling containers. **Fill the jars** to the top and seal securely.

22. Add one level-scoop of sediment from the sediment chemistry bowl to the last, clean, stainless bowl. This process is completed at each rep until there are 5 good scoops (one from each rep) in the "composite" bowl. Homogenize thoroughly and fill 1 x 125 mL jar for analysis (LEPHs&HEPHs, MOG, and PAHS). Be sure label ID includes "COMP" (e.g., TPE-COMP).

23. If this station is selected as the QAQC **field duplicate**, using the tweezers and a set of clean sampling gloves, **swipe** the stainless steel bowl and spoon with one piece of ashless **filter paper** (or a "ghost wipe") and store in the pre-labeled 125 mL glass jar. Collect the duplicate sediment sample from the same sediment collected in steps 18-20. Fill the sampling containers labeled as station DUP. Record that the QAQC samples were collected from this sampling station on the field data form.

24. **Complete** the **field data form**, including a description of the sediment (grain size, consistency, colour, presence of biota, sheen, unusual appearance) and the sampling effort (equipment failure, control of vertical descent of sampler) required to collect the benthos and sediment samples.

25. **Rinse** out the Ponar, stainless steel bowl and spoon with lake water. Dump the sediment and water from the plastic bin into the lake.

26. Until ready for shipping, store the sediment samples and QAQC filter paper **chilled** (on ice) in a cooler or in a refrigerator in camp, if space is available. The sediment sampling containers may be put in plastic bags prior to storage on ice to further protect the labels from water damage. Benthos samples are stored in a cooler or action packer at **room temperature**.

27. Fill out a **chain-of-custody** form for the sediment samples being sent to **ALS Environmental**. The COC form must be completed carefully and in its entirety to ensure proper analysis. This includes listing all of the specific parameters to be analyzed (see step 2), Azimuth and ALS contact names, and checking off all of the specific boxes for requested analyses. The ALS laboratory quote number must be printed on the COC form to ensure proper billing.

    A **digital COC** form is most commonly used; this form can be filled out in advance to ensure accuracy and efficiency and amended in the field as required. However, using a digital copy of the COC requires printing 2 copies of the document in the field (one for the laboratory, one for Azimuth). Any questions regarding the COC form should be directed to the Azimuth project coordinator – Laura Bekar. Put the completed COC form in a sealed ziploc plastic bag in the cooler with the samples.

28. Fill out a **chain-of-custody** form for the benthos samples being sent to **Zaranko Environmental Assessment Services** (ZEAS). Complete all of the required fields and then put the form in a sealed ziploc plastic bag in the cooler with the benthos samples.

PACKAGING & SHIPPING SAMPLES:

1. Ensure all **sediment samples** are **sealed** securely. **Pack** sediment sampling containers upright in a cooler with ice packs, and packing material, to ensure containers do not break during transport. (Ideal storage and transport temperature is 4°C).

2. Ensure the COC form is enclosed and then seal the cooler(s). **Label the cooler**(s) with the following address:

    ALS Environmental
    101-8081 Lougheed Hwy.
    Burnaby, BC, Canada
    V5A 1W9
    Tel: 604-253-4188
    Attention: Brent Mack

3. Ensure **benthos samples** are **sealed** securely. Wrap electrical tape around the edge of the lids to ensure a tight seal. **Pack** benthos sampling containers upright in a cooler or action packer; ensure the cooler/action packer is well packed so the jars are not able to move around.

4. Ensure the COC form is enclosed and then seal the cooler(s). **Label the cooler**(s) with the following address:

    Zaranko Environmental Assessment Services (ZEAS)
    36 McCutcheon Avenue
    P.O. Box 1045

Nobleton, ON
L0G 1N0
Tel: 905-859-7976

5. **Ship** the sediment **samples** to ALS Environmental as quickly as possible. Ship the benthos samples to ZEAS when convenient. Coordinate shipping with the camp manager.

6. Send completed **COC forms** and **field data forms** to **Azimuth** Consulting Group, attention the project coordinator – Laura Bekar.

APPENDIX D

STANDARD OPERATING PROCEDURE (SOP) FOR CREMP SEDIMENT CORE SAMPLING [FROM 2012]

Technical Memorandum

Date: July, 2012

To:

cc:

From:

RE: Meadowbank Mine: CREMP Sediment Coring Terms of Reference

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This technical memorandum lays out the terms of reference for 2012 sediment coring.

Objective:

The main objectives for 2012 are:

1. Characterization of spatial variability in sediment chemistry – Previous sediment sampling of the Meadowbank project lakes was conducted to characterize baseline conditions within discrete areas of the near-field, far-field and reference CREMP stations. This information will help determine the needs of future sampling events (e.g., sample size needed to detect specified effect size with known statistical power) to allow detection of potential mine-related changes to surface sediment chemistry.
2. Define very near-surface chemistry – Coring, unlike traditional tools such as a Petit Ponar, allows for precise and small depth ranges to be sampled. The corer will be used to sample the top 1.0 cm of sediment to define near-surface chemistry.

Sediment Coring Program:

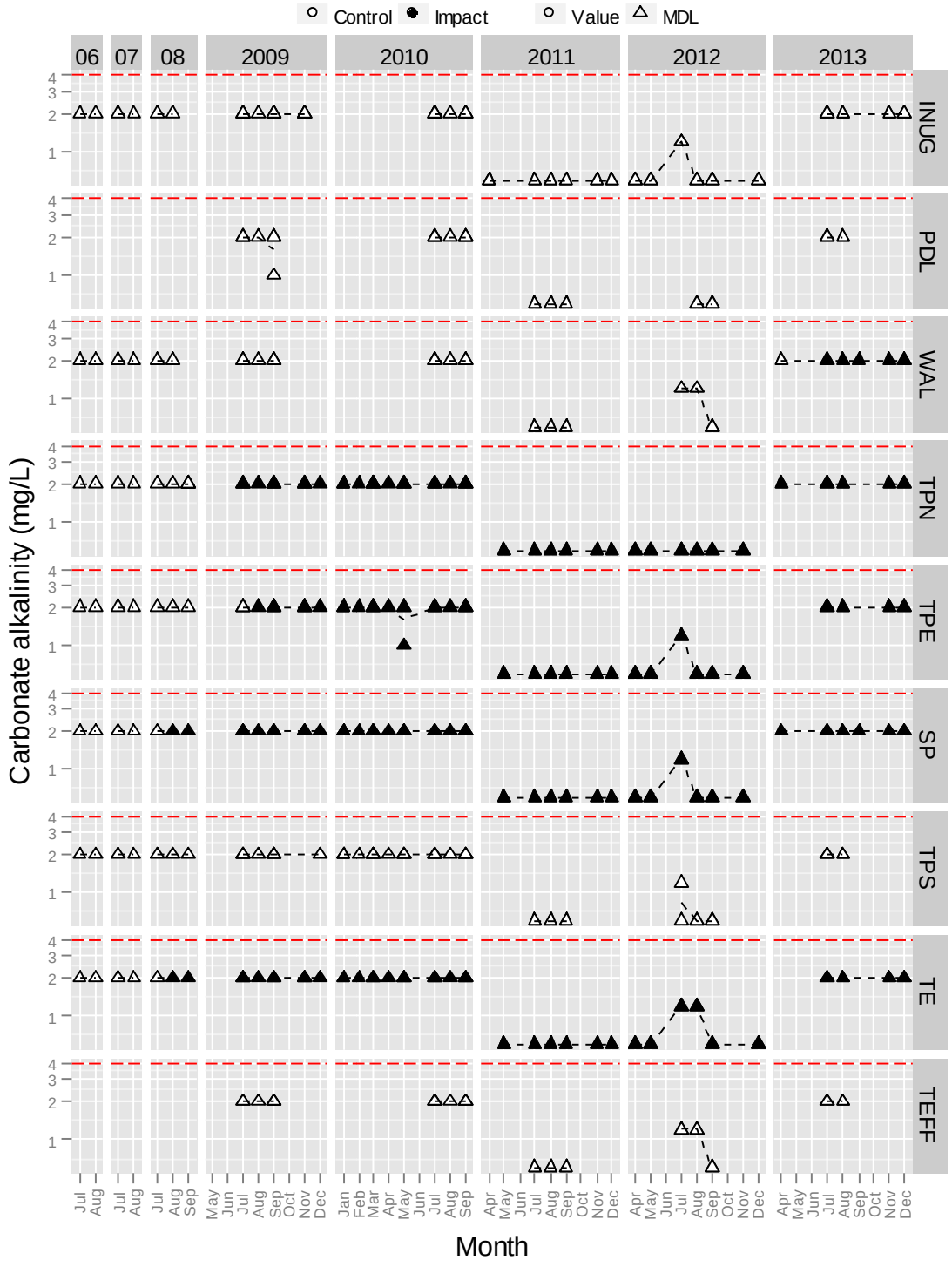
An average top 1.5cm of sediment chemistry at all CREMP stations will be characterized using sediment cores. Note that this complements, rather than replaces, the grab samples (top 3 to 5 cm) collected synoptically with benthic community samples in late August. This is in addition to the traditional composite sample using the petite Ponar grab. Ten (10) independent cores are to be collected from each of the stations. Cores will be collected within a 250 m radius around the center of each sampling area. The intent is to collect cores over a wide area, targeting depths of 6.5-9.5 m to match benthos sampling within the basin being sampled. The protocol for collecting sediment cores is as follows:

1. Core sampling is conducted prior to benthic sampling and will most often be paired with benthic sampling reps. Consideration can be given to identifying core sample locations prior to field collections.

2. If conditions are windy, anchor the boat. If calm, anchoring is not necessary. Survey the area to be sampled with the sonar to determine bottom type.
3. Deploy the corer from the boat and try to ensure that the core barrel is perpendicular with the surface before penetration. Depending on results, the corer can free-fall from 1 m above the surface. Avoid sampling over steep gradient slopes or over coarse grain substrate.
4. When the boat is anchored, deploy the corer from the boat and lower it when the boat has reached its furthest point in its swing to the right. This will be an odd numbered core. For the second core wait until the boat swings to the left, check the GPS to make sure this is around 5 m from the first core. This core will be an even numbered core. Cores can be taken from new locations each time and do not need to be at the exact same location as the other benthos work.
5. Raise the core to just below the water surface and cap prior to bringing above the water to ensure sediment is not lost out the bottom.
6. Check to make sure that the surface of the core is intact and is not mixed or disturbed and that the overlying water is clear. Record water depth and UTM location (NAD 83) of all successful core samples.
7. Process the core on the boat. Decant overlying water and collect only the top 1.5 cm of sediment.
8. Place the entire 1.5 cm slice into a 125 mL glass jar. Discard the remaining core sample.
9. Label the jars as per CREMP protocol (e.g., TE-x) but with a suffix indicating a core sample (e.g., TE-SC-01 to TE-SC-10).
10. Fill in the data sheet and record any observations about the core sample such as presence of varves, distinct changes in color, grain size, or any other unusual features.
11. Repeat the procedure above until all 10 core samples have been collected, randomly covering the general area depicted on the map.
12. Randomly from one of the 10 coring locations, take a duplicate core (independent deployment of corer) for QAQC purposes.
13. All core samples are to be analysed for total metals, pH and total organic carbon. Fill in CoCs as necessary.
14. Hold on ice or in the refrigerator until shipping to ALS, Vancouver.

APPENDIX E

WATER QUALITY PARAMETER PLOTS 2006 – 2013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Carbonate alkalinity (mg/L)
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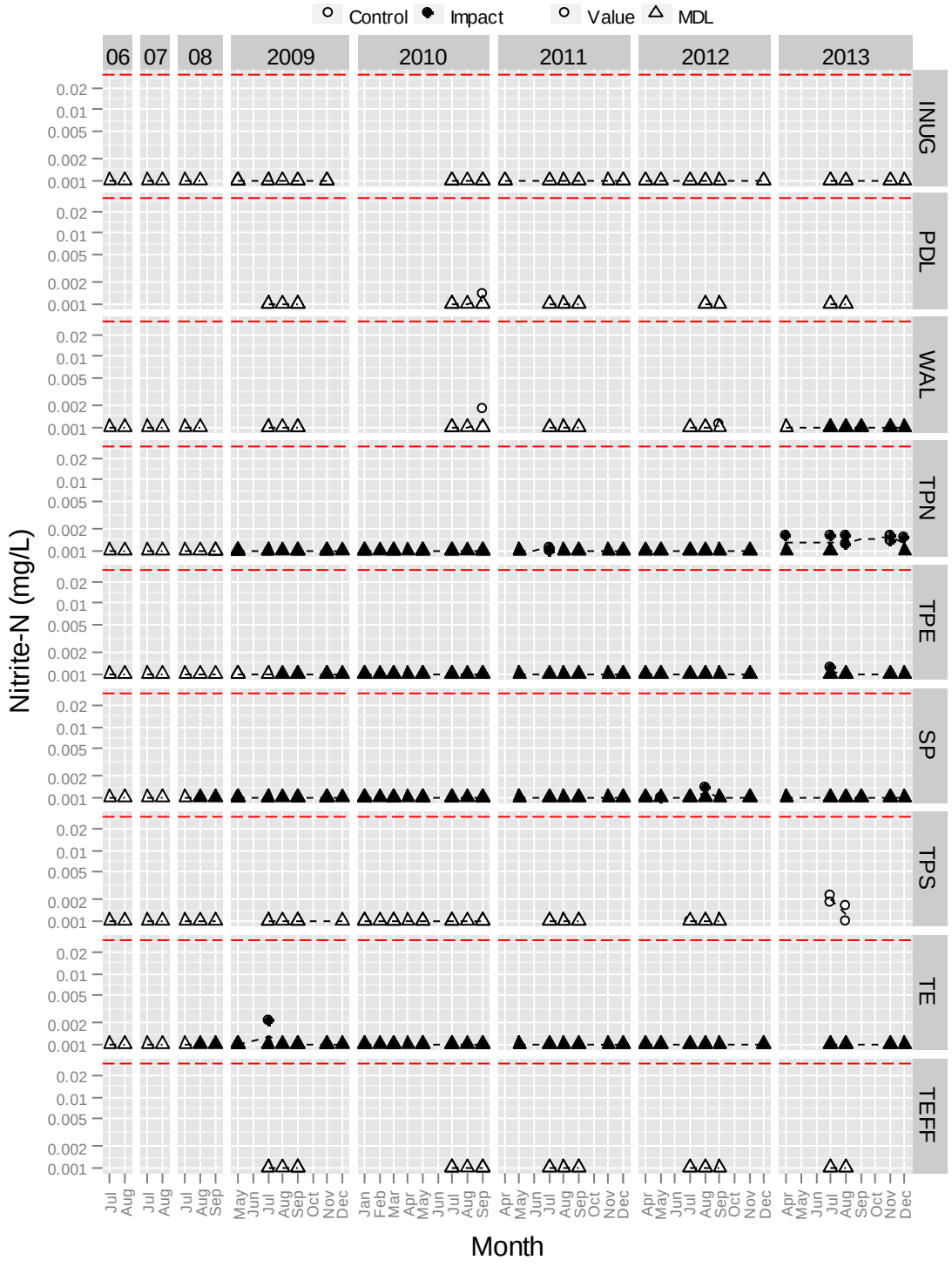
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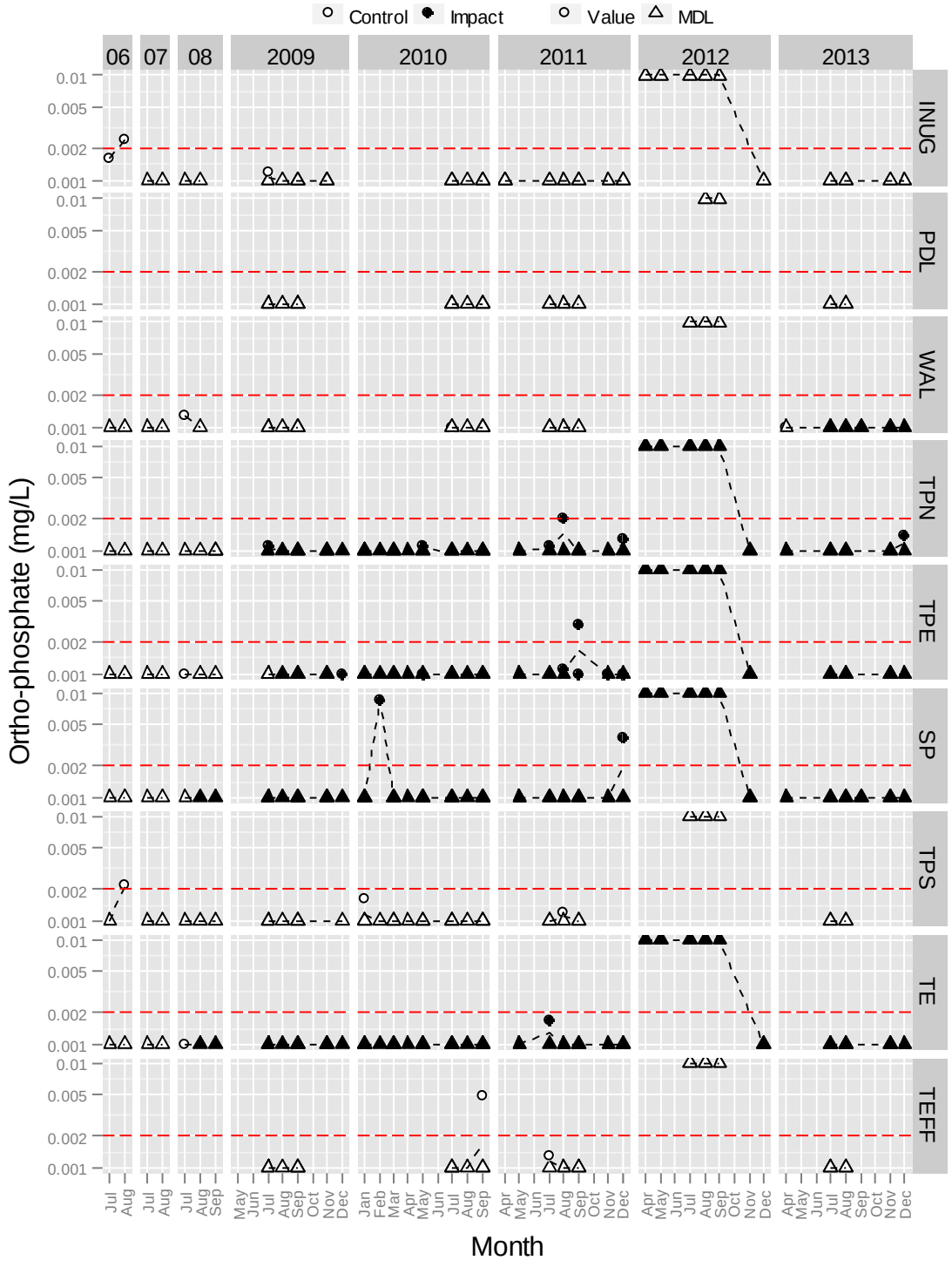
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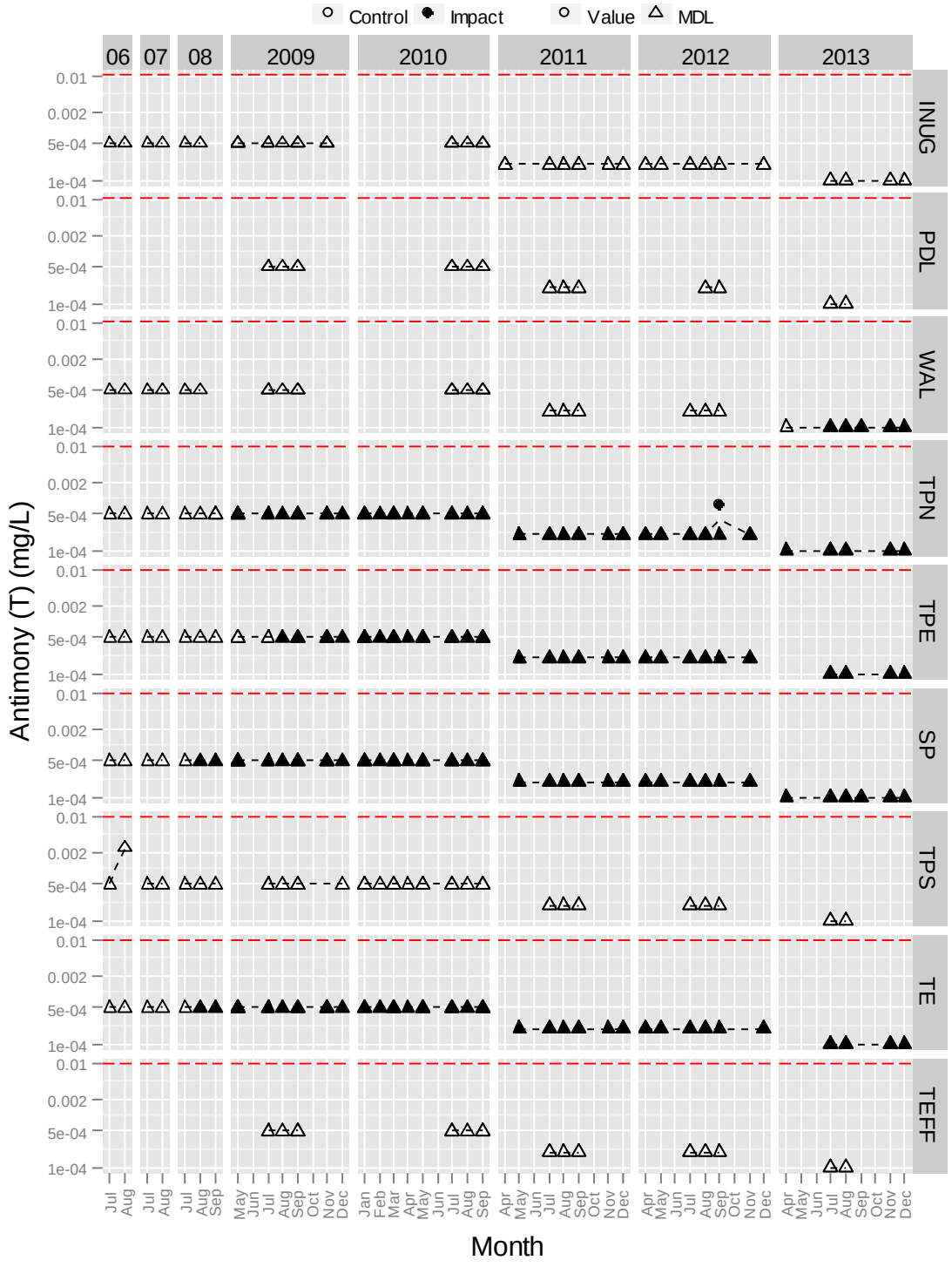
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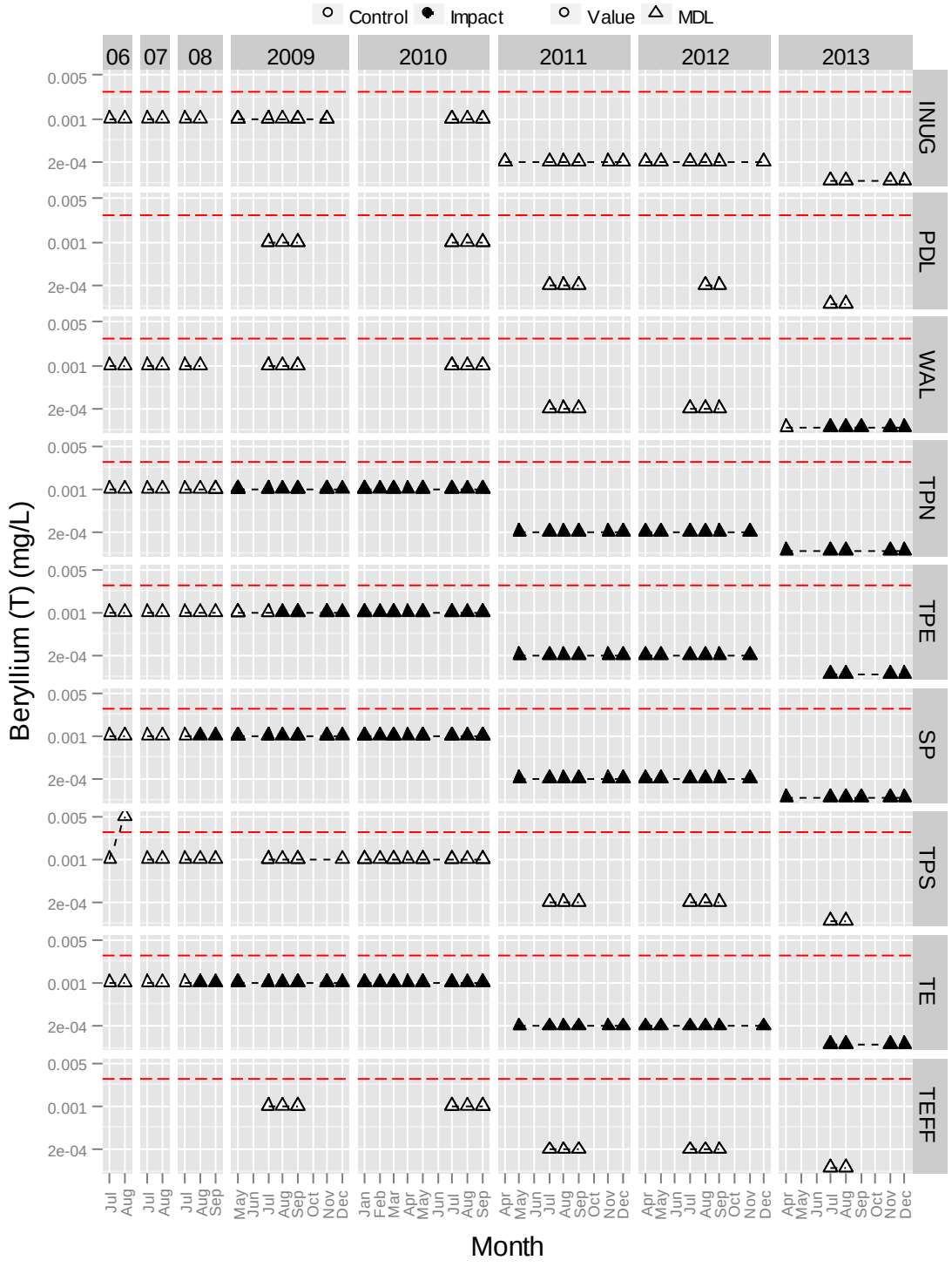
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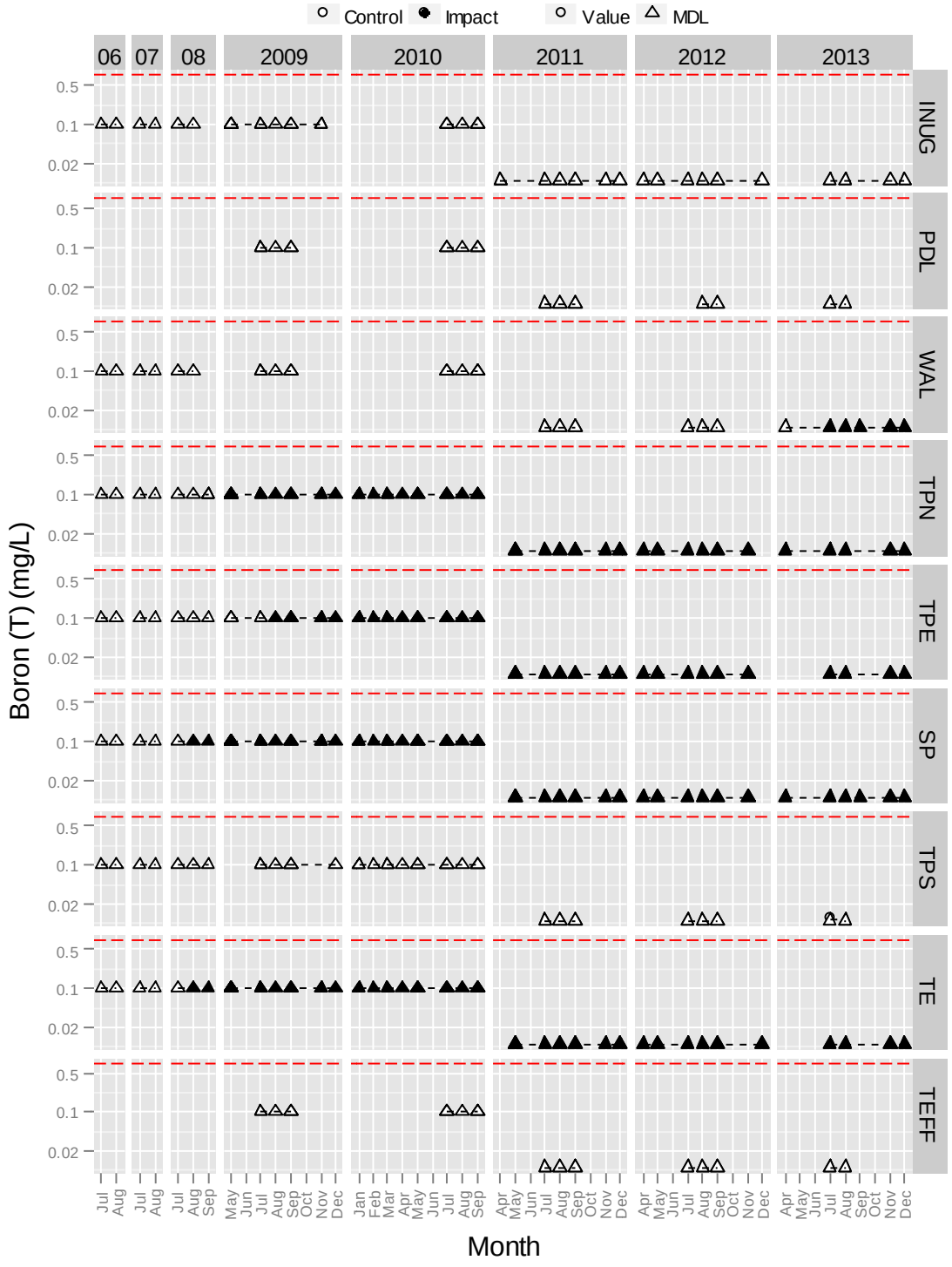
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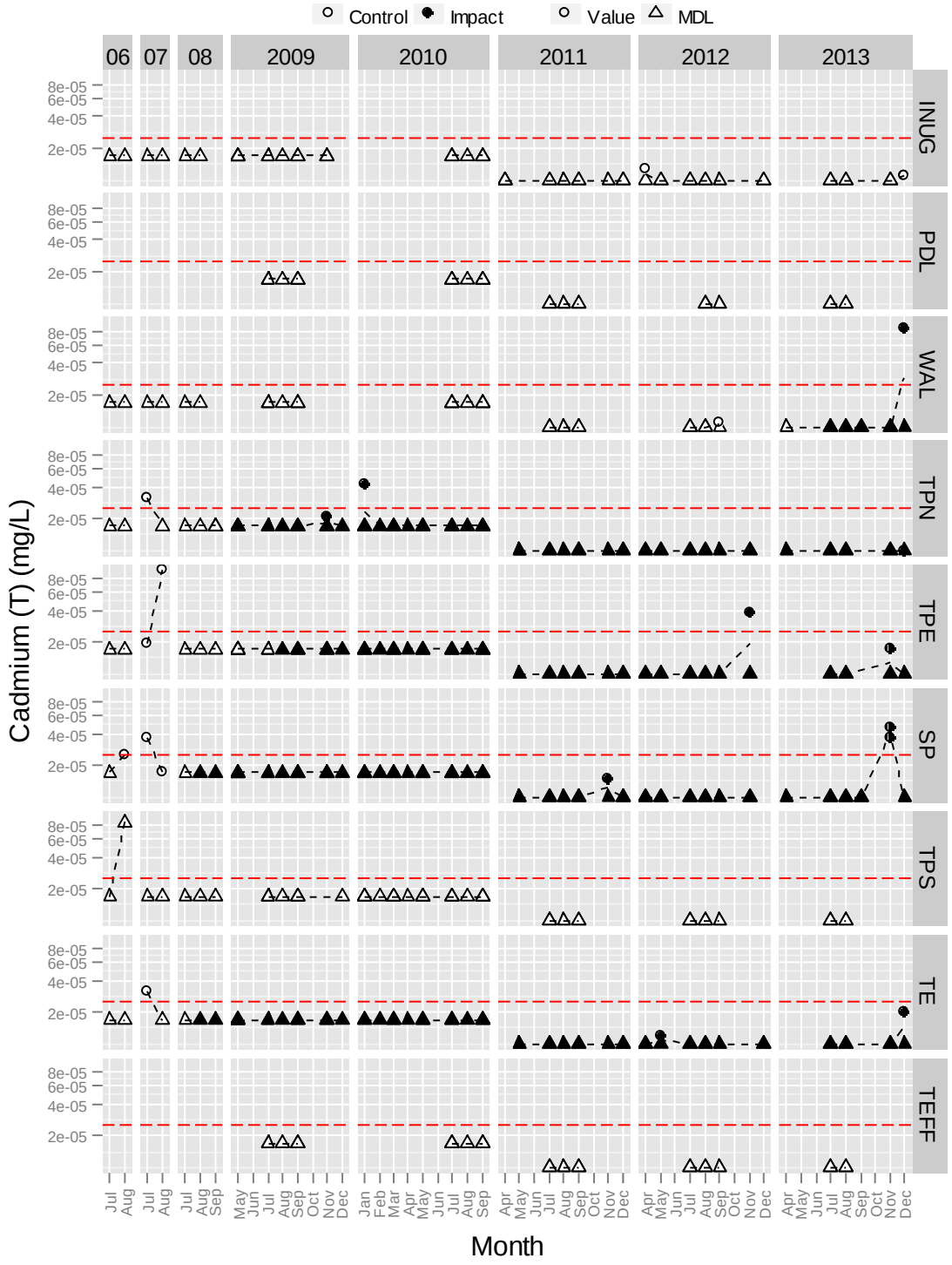
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Cadmium (T) (mg/L)
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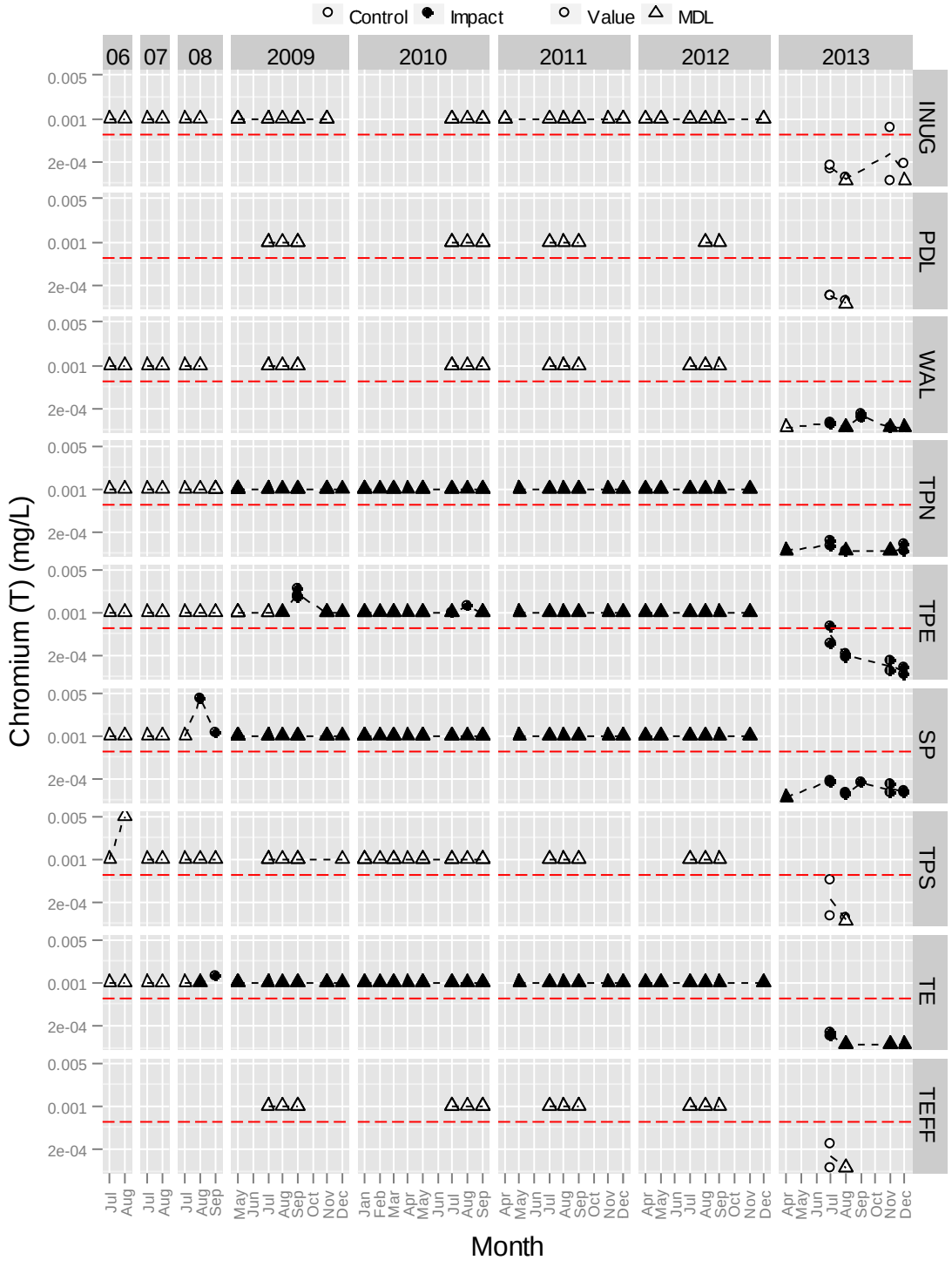
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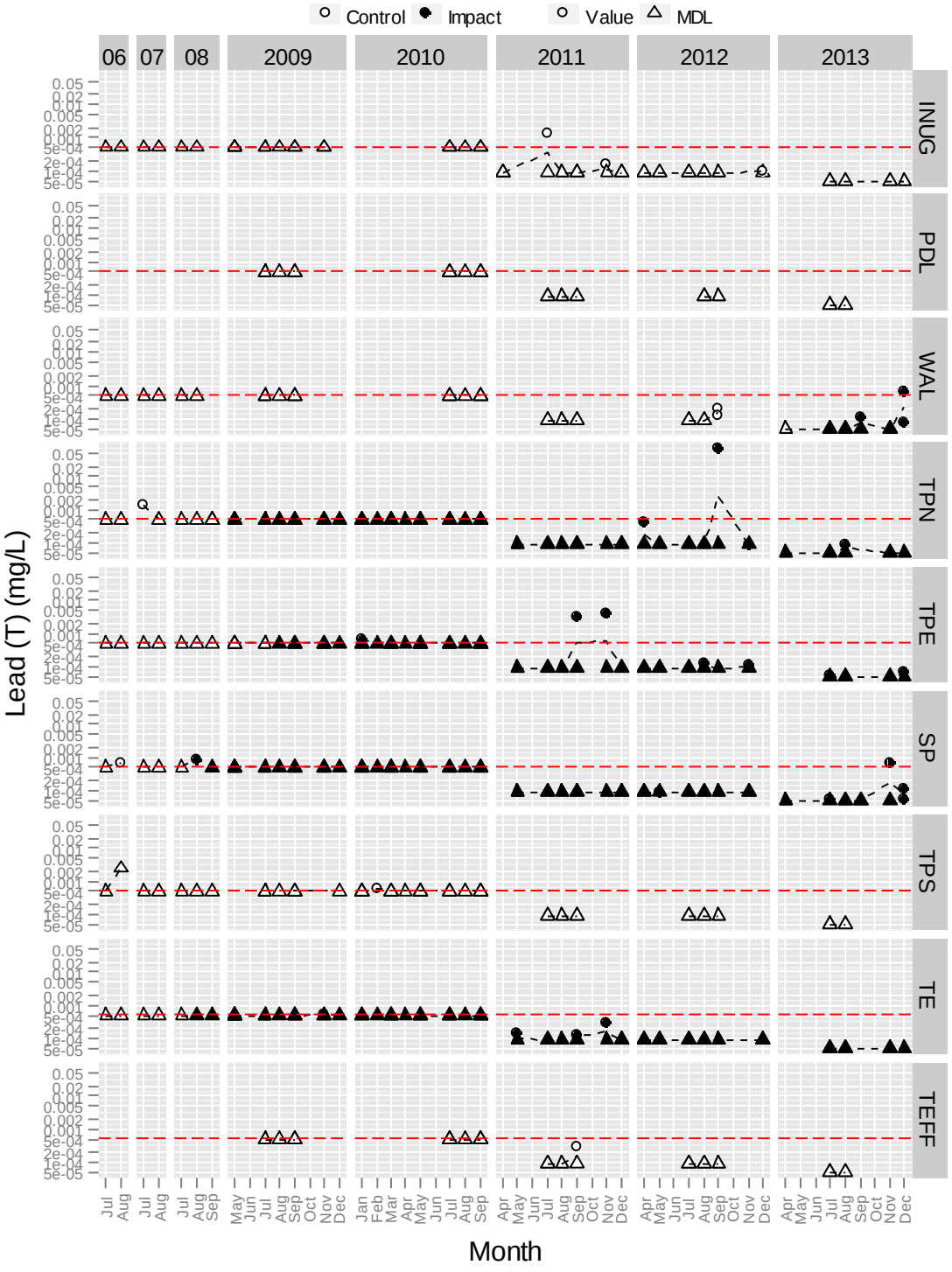
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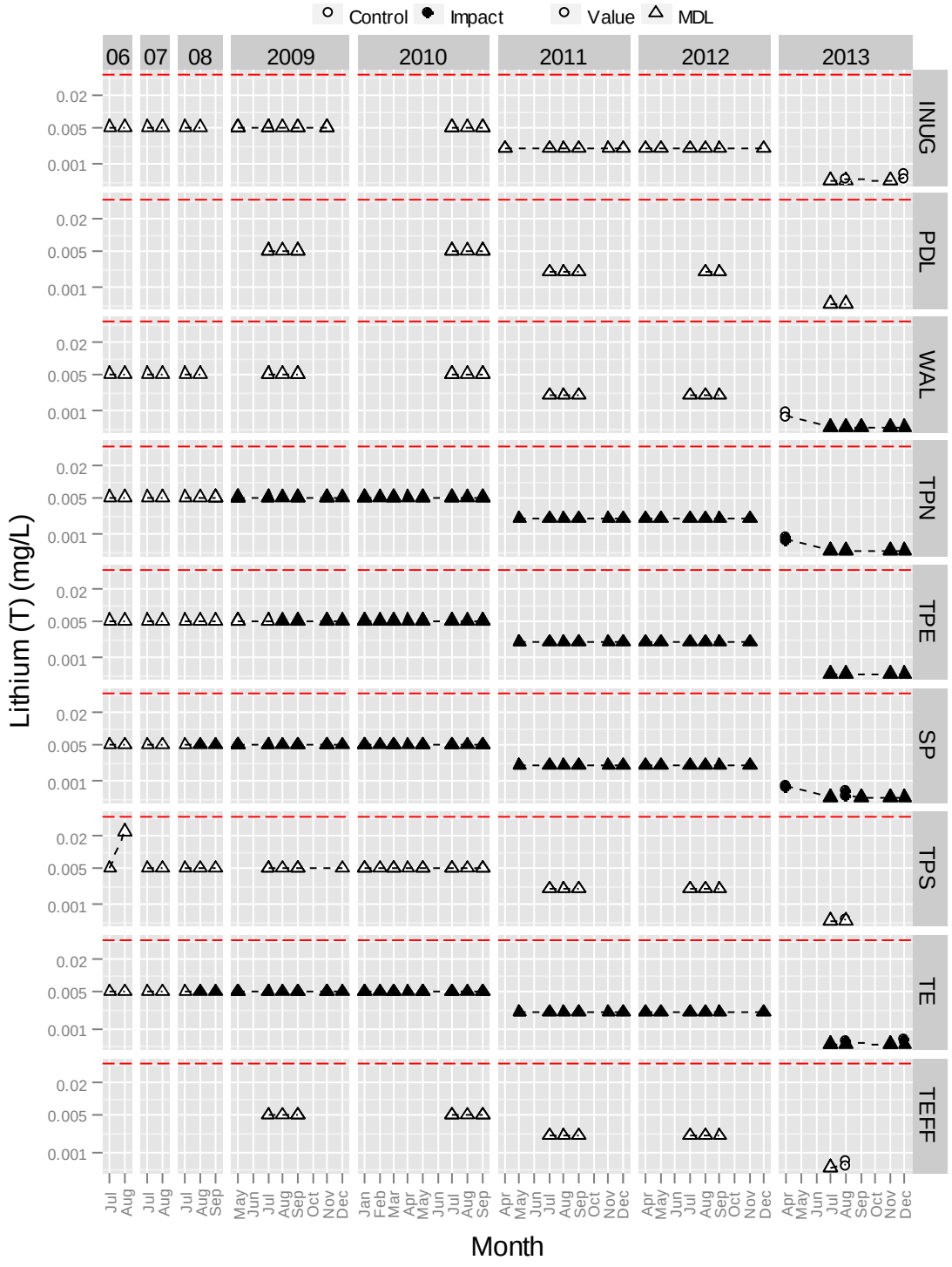
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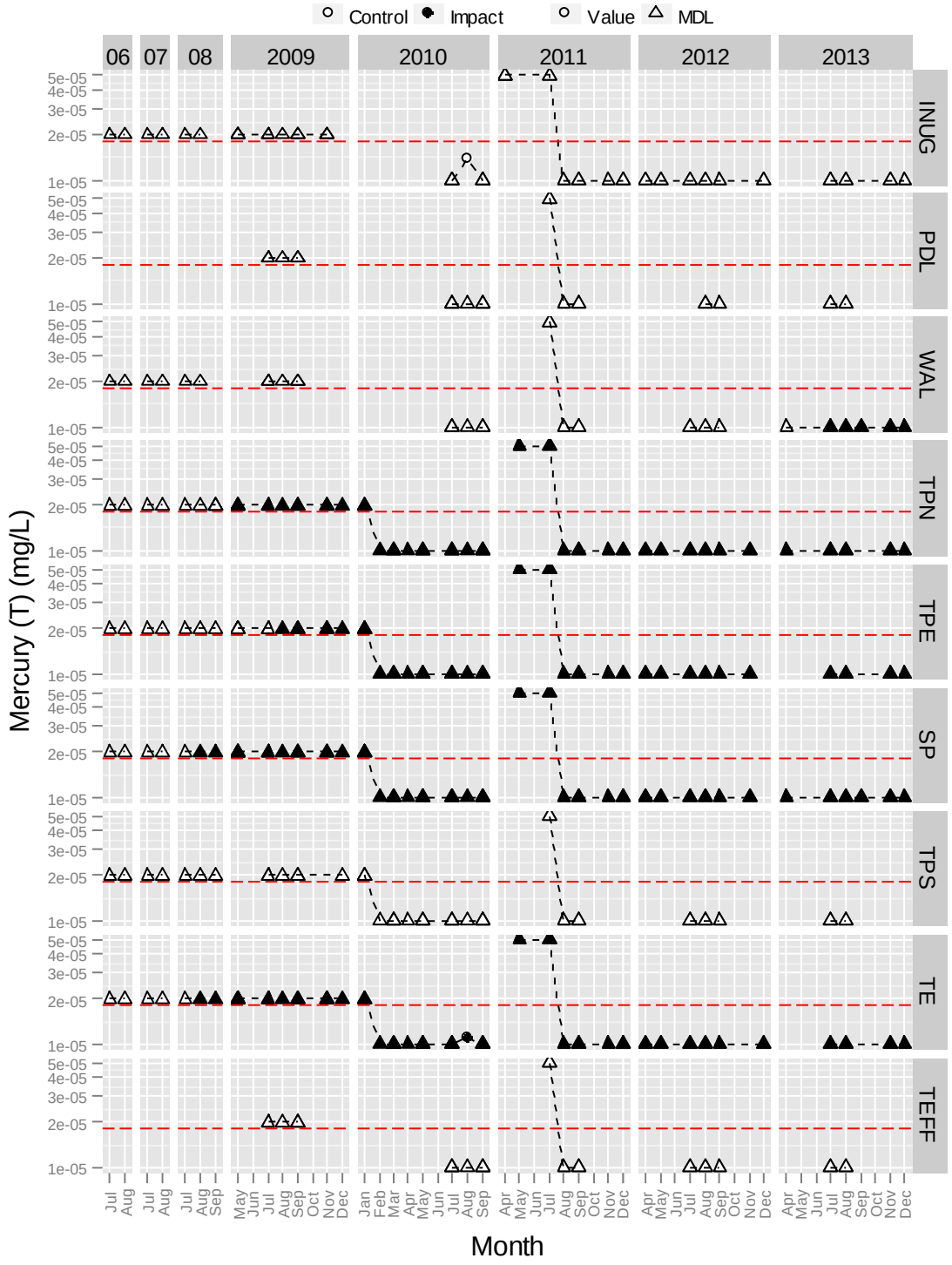
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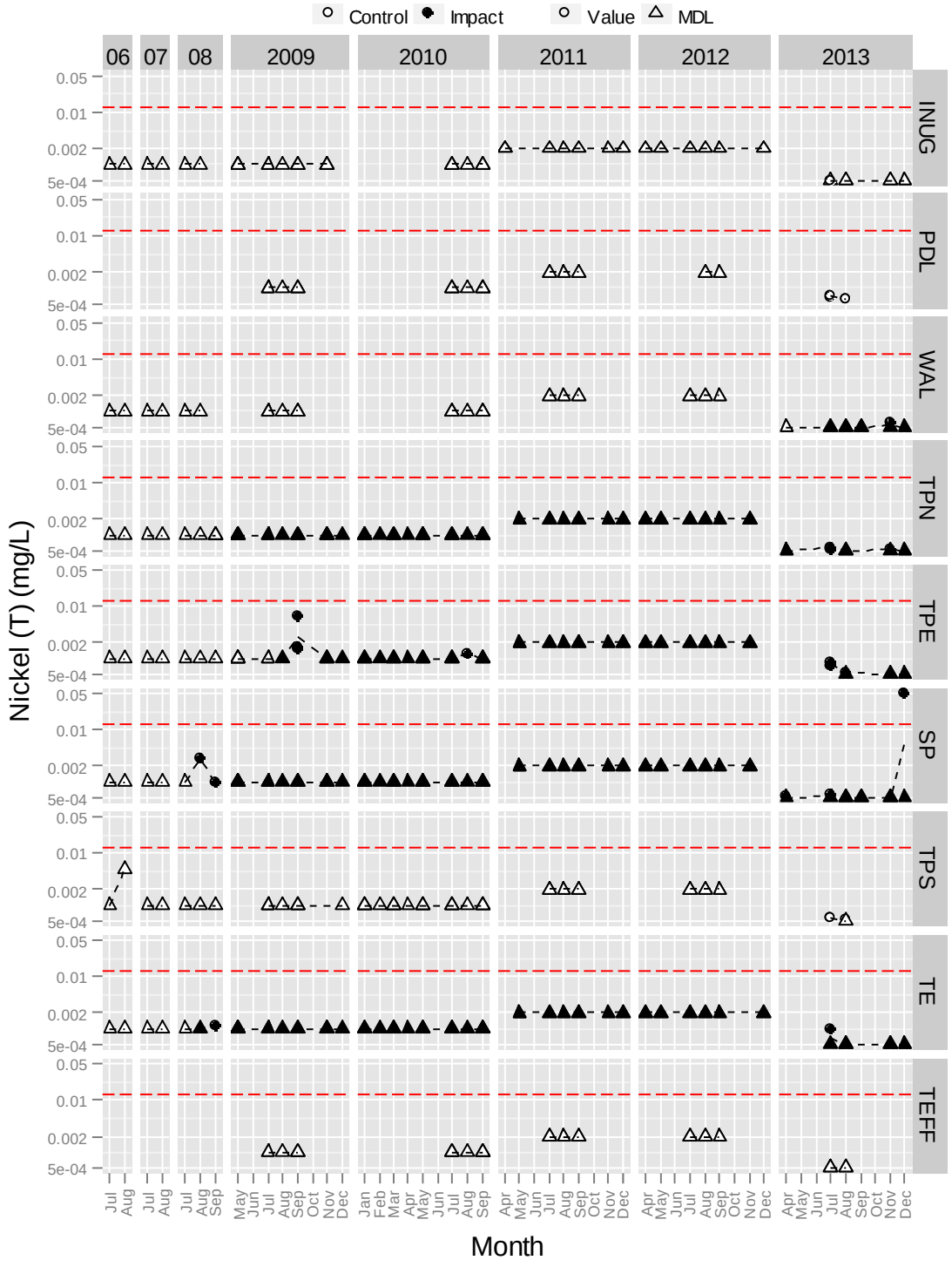
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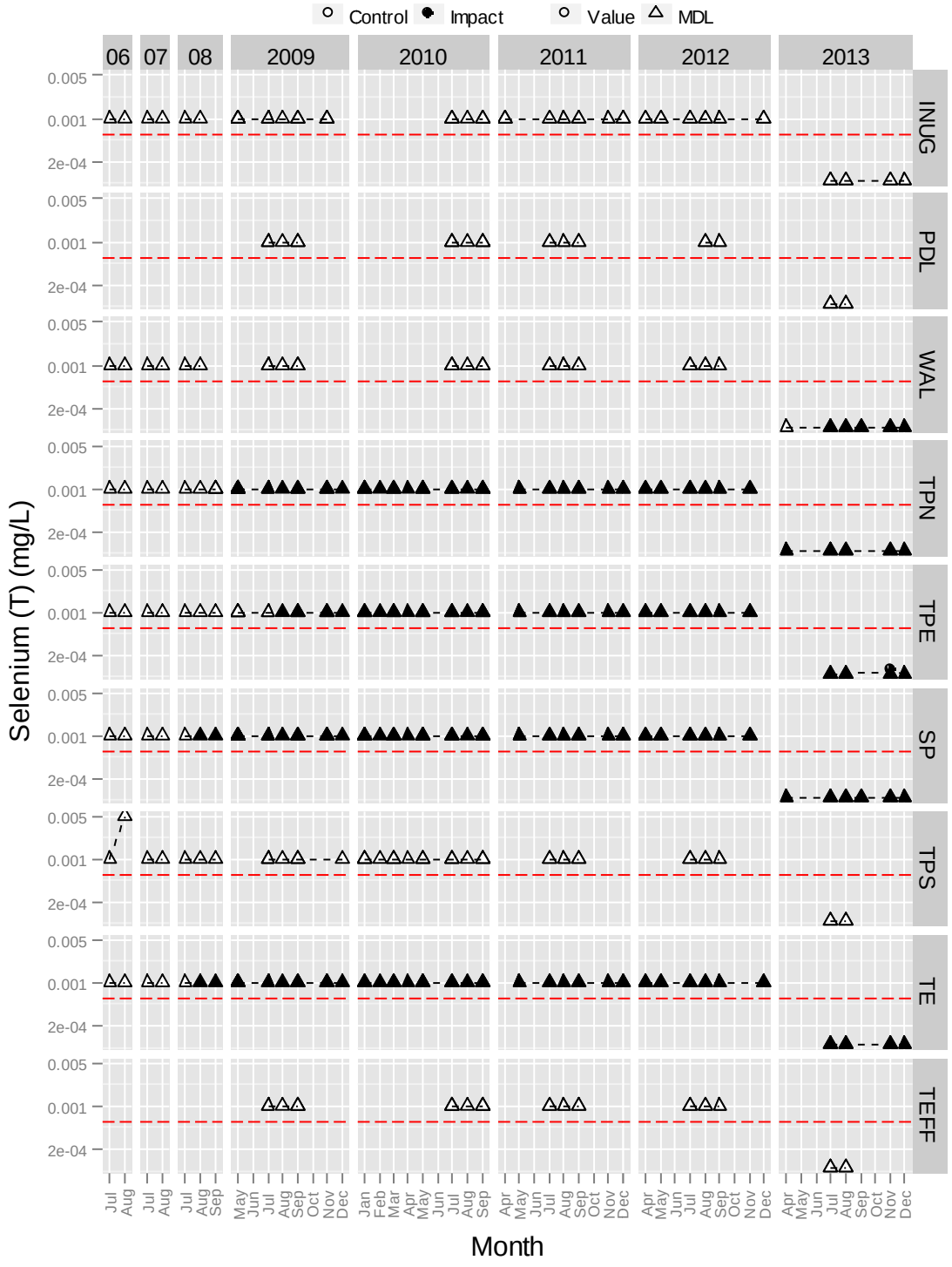
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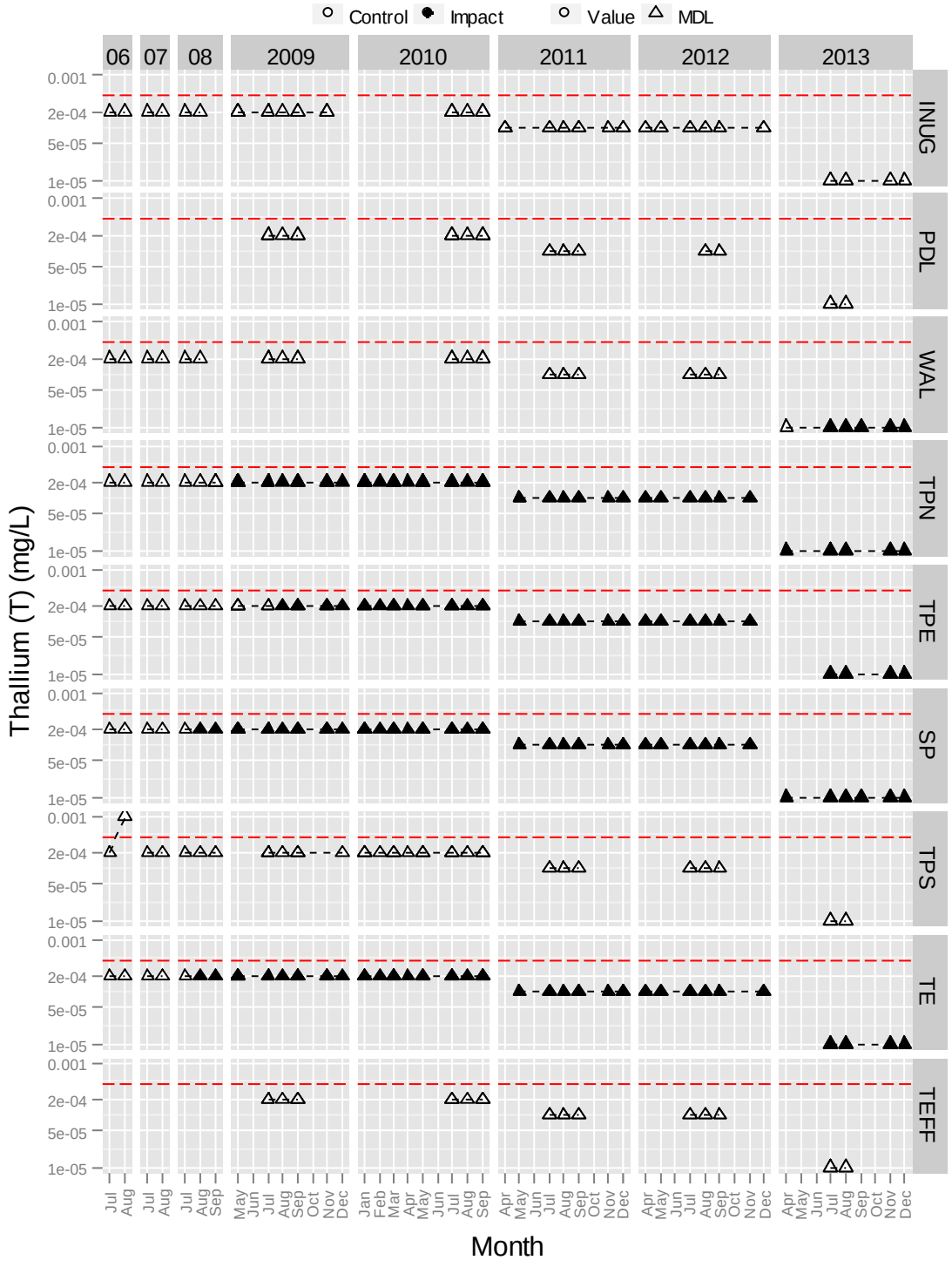
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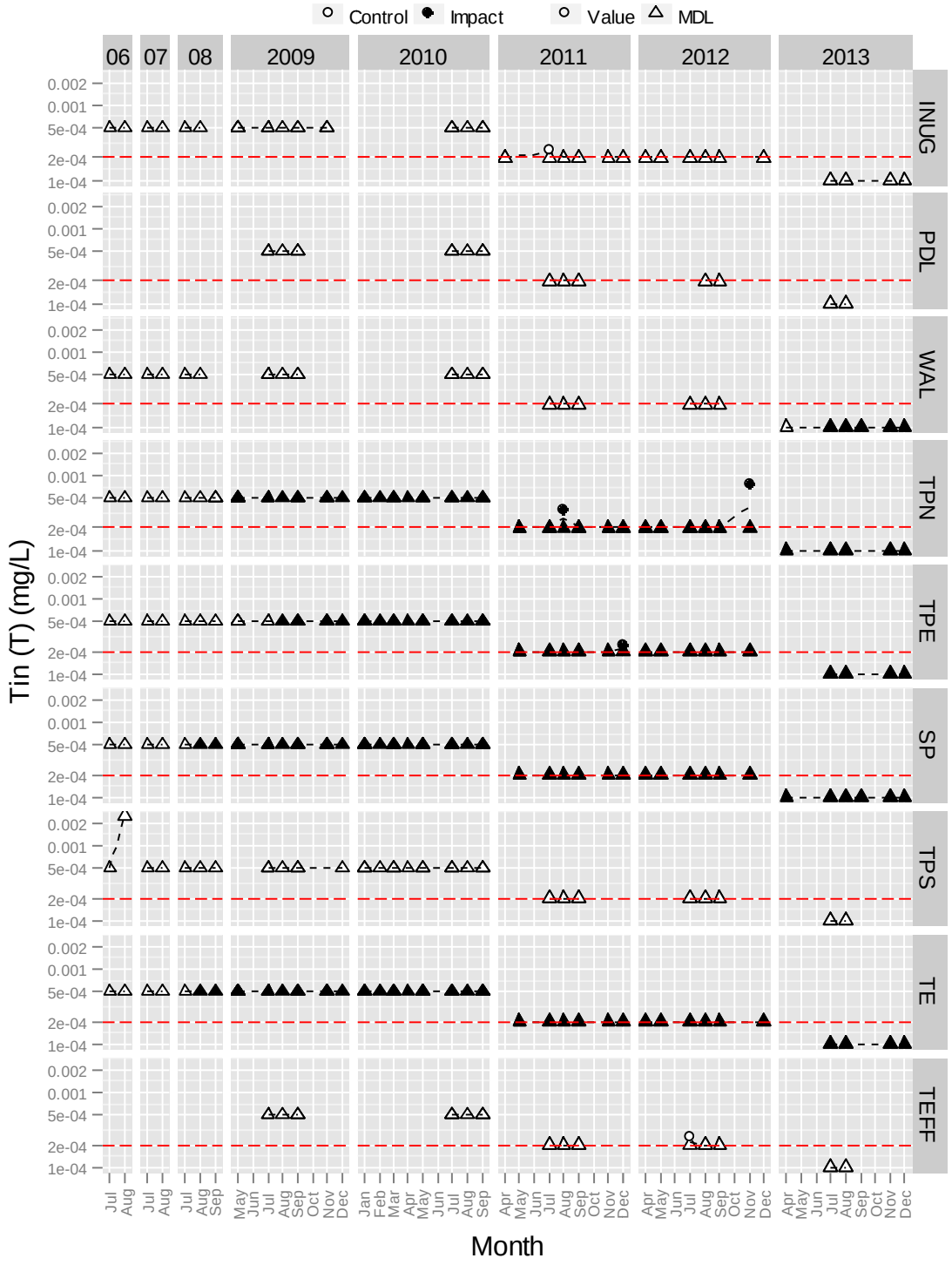
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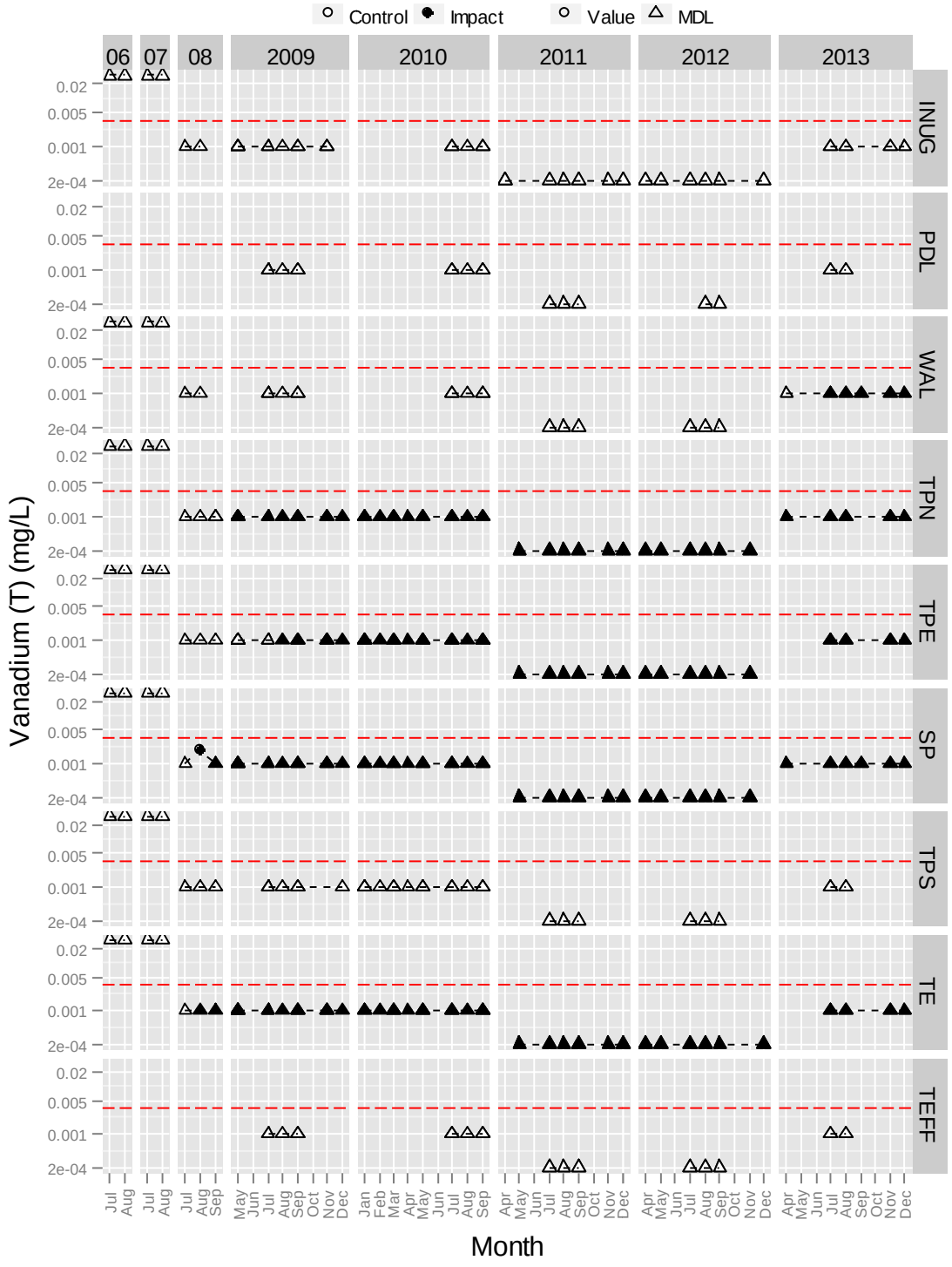
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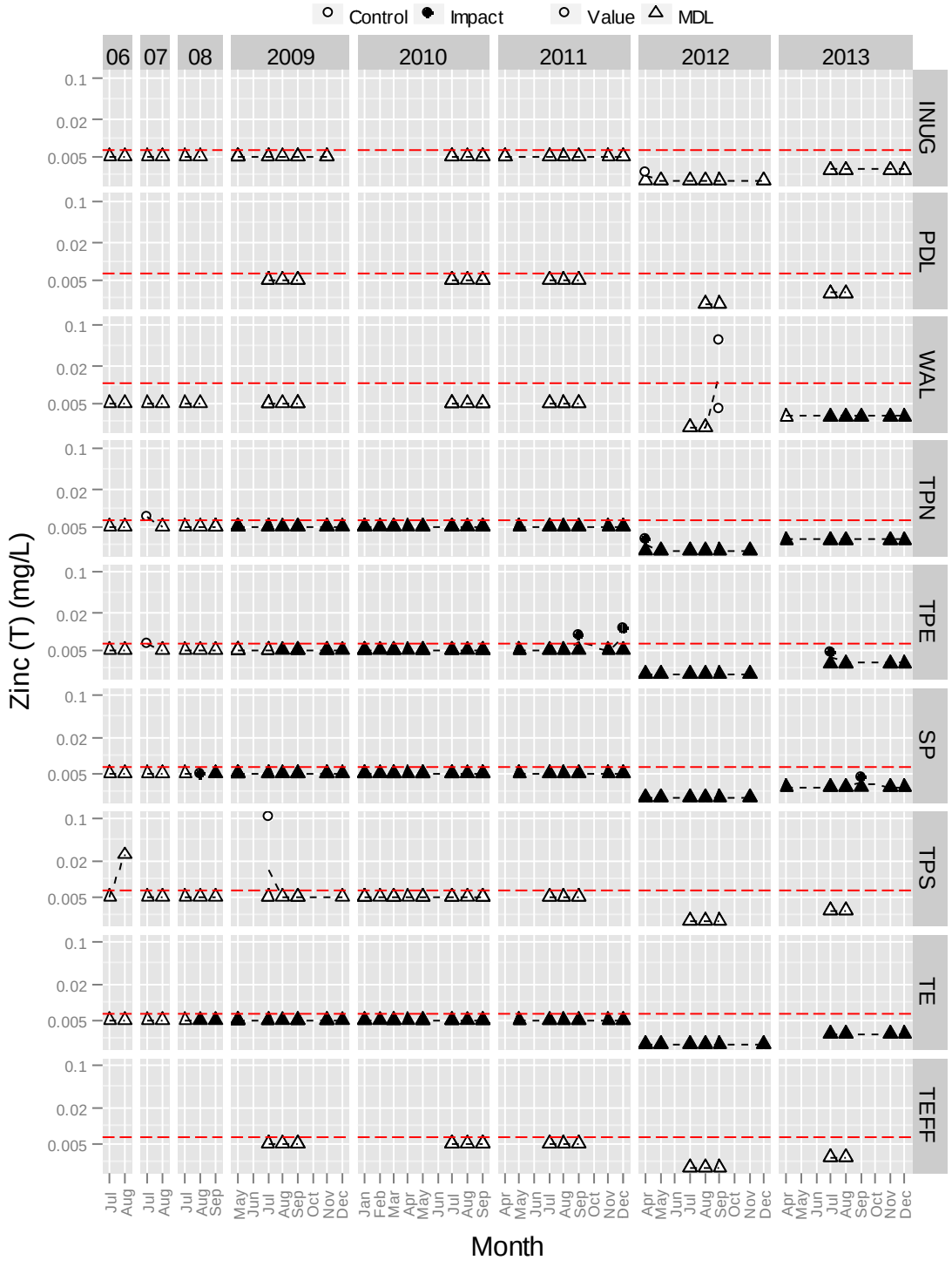
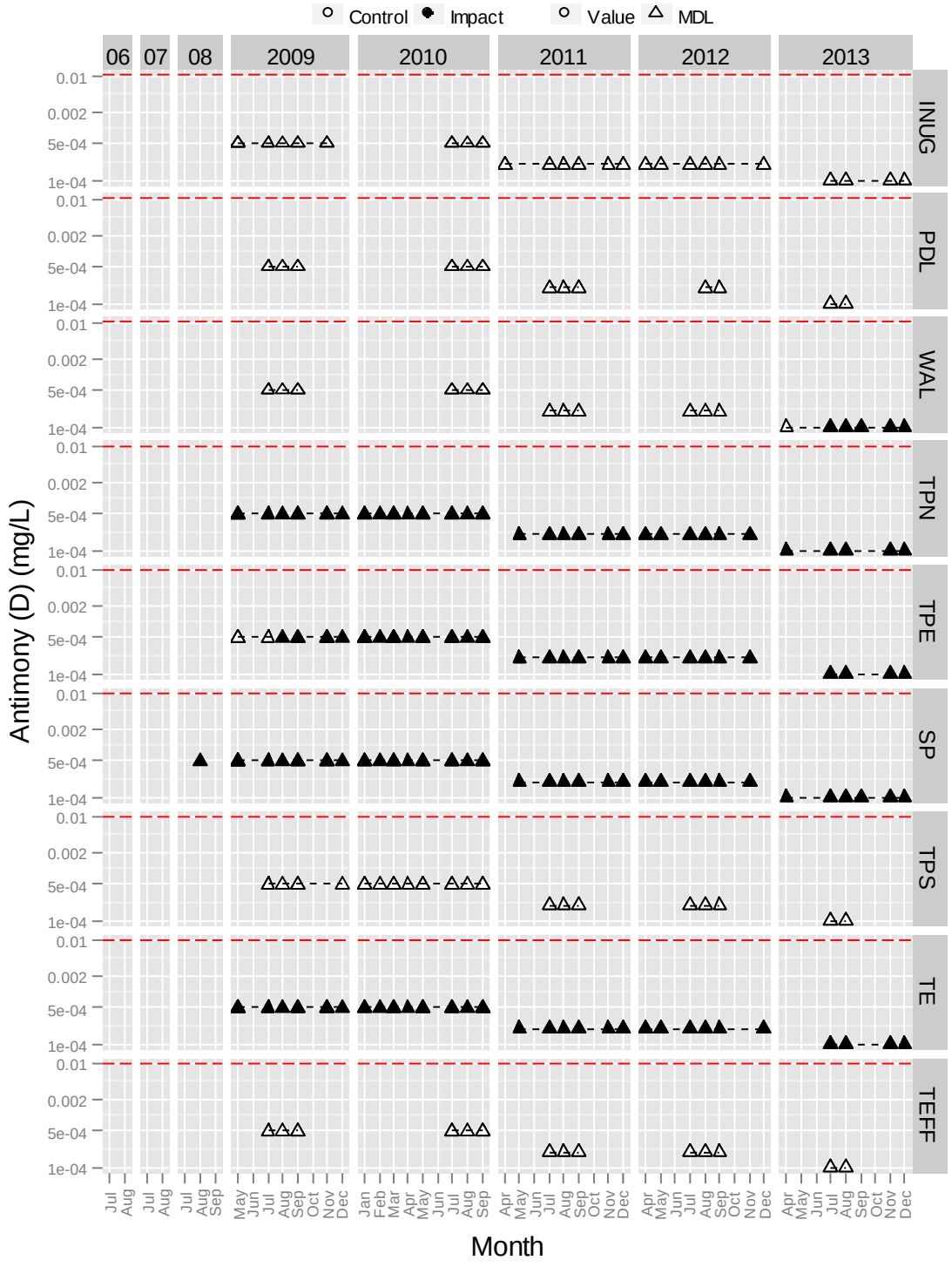
0.005
0.001
2e-04
Vanadium (T) (mg/L)
Jul
Aug
Sep
May
Jun
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Month


Control
Impact
Value
MDL
06
07
08
2009
2010
2011
2012
2013
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
0.1
0.02
0.005
Zinc (T) (mg/L)
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Month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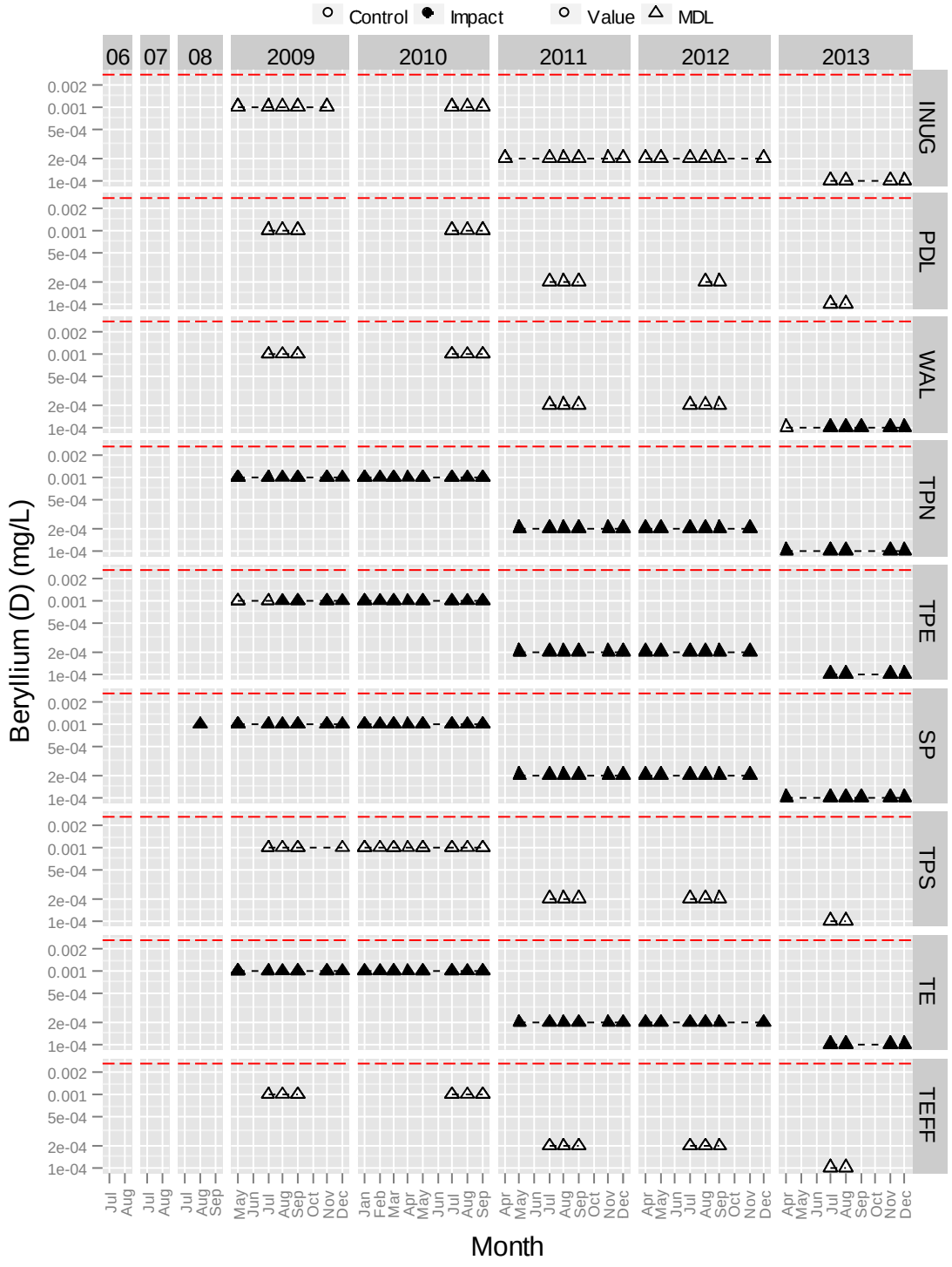
07
08
2009
2010
2011
2012
2013
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
0.01
0.002
5e-04
1e-04
Antimony (D) (mg/L)
Jul
Aug
Sep
May
Jun
Jan
Feb
Mar
Apr
Oct
Nov
Dec
Month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Value
MDL
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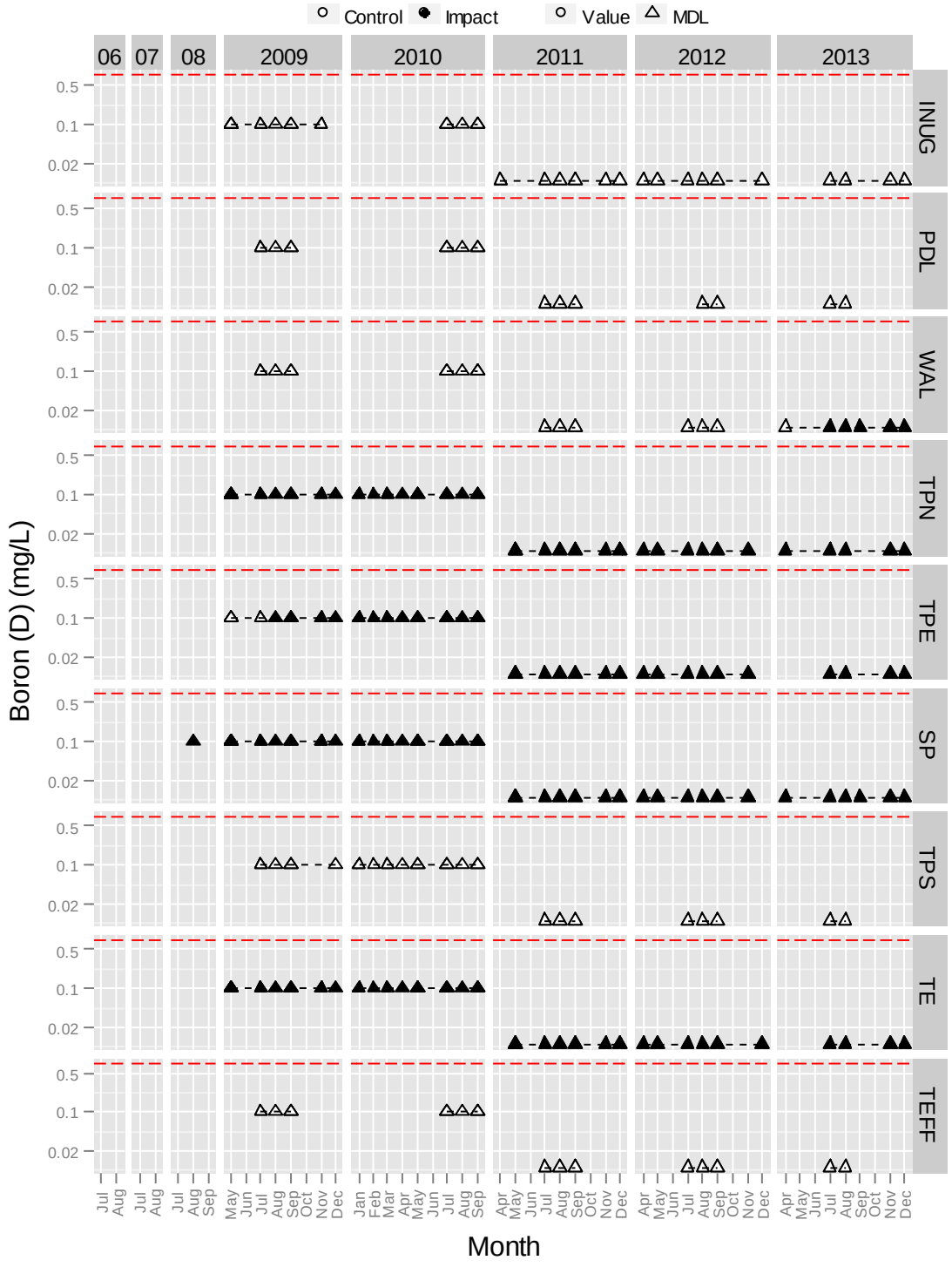
07
08
2009
2010
2011
2012
2013
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Beryllium (D) (mg/L)
0.002
0.001
5e-04
2e-04
1e-04
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Month


Control
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Value
MDL
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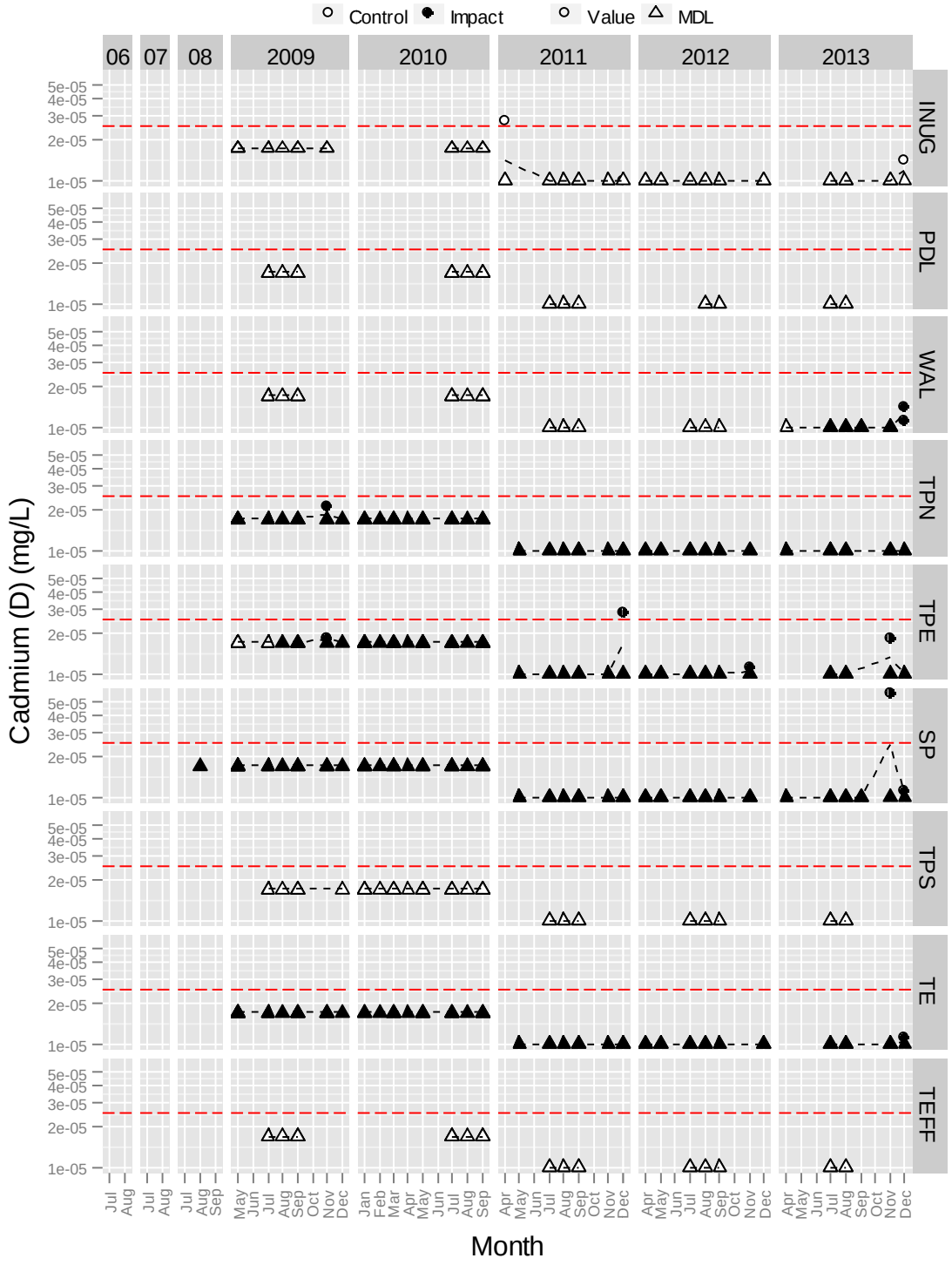
07
08
2009
2010
2011
2012
2013
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Boron (D) (mg/L)
0.5
0.1
0.02
Jul
Aug
Sep
May
Jun
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Month


Control
Impact
Value
MDL
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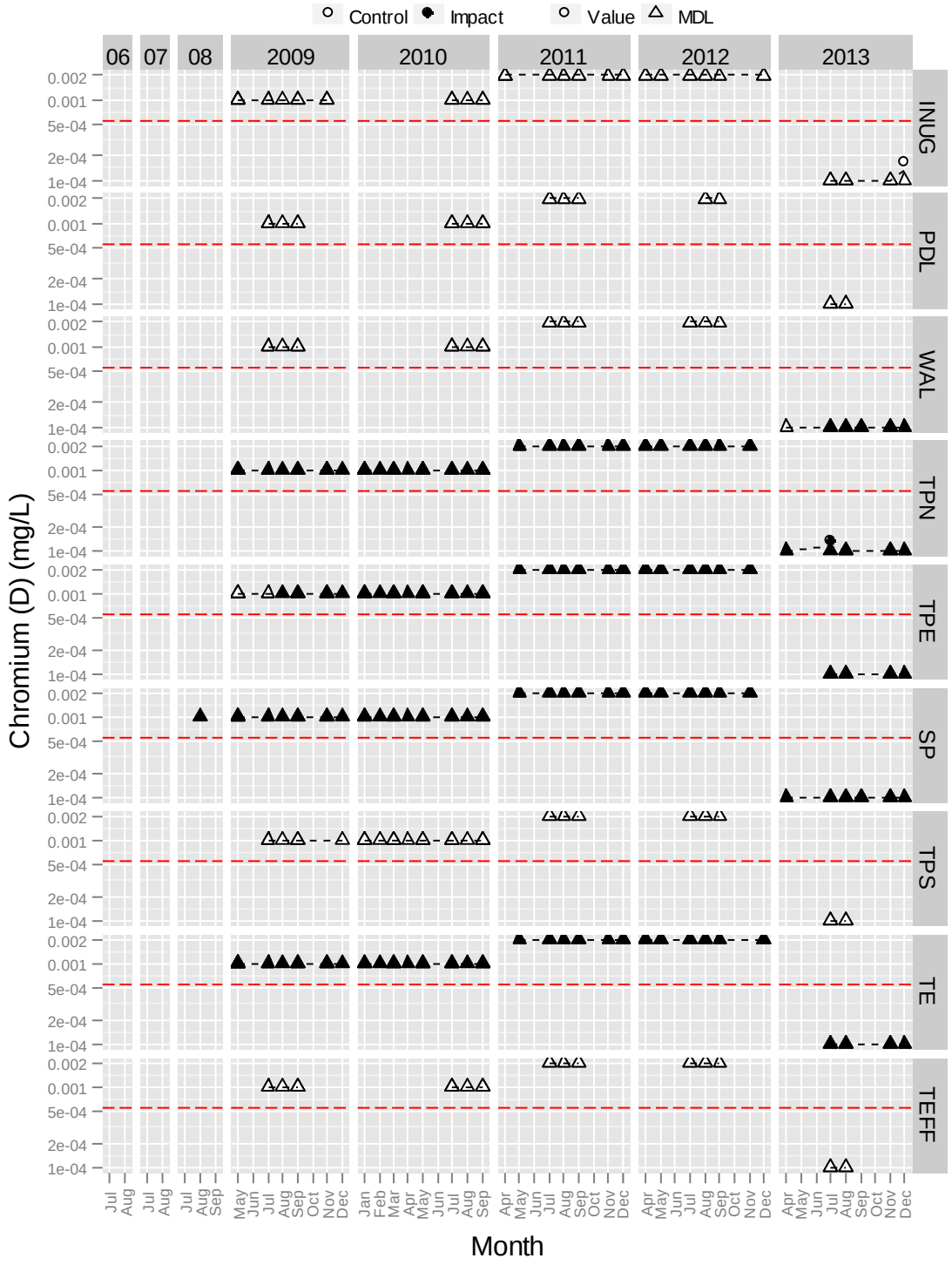
07
08
2009
2010
2011
2012
2013
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Cadmium (D) (mg/L)
5e-05
4e-05
3e-05
2e-05
1e-05
Jul
Aug
Sep
May
Jun
Jan
Feb
Mar
Apr
Oct
Nov
Dec
Month


Control
Impact
Value
MDL
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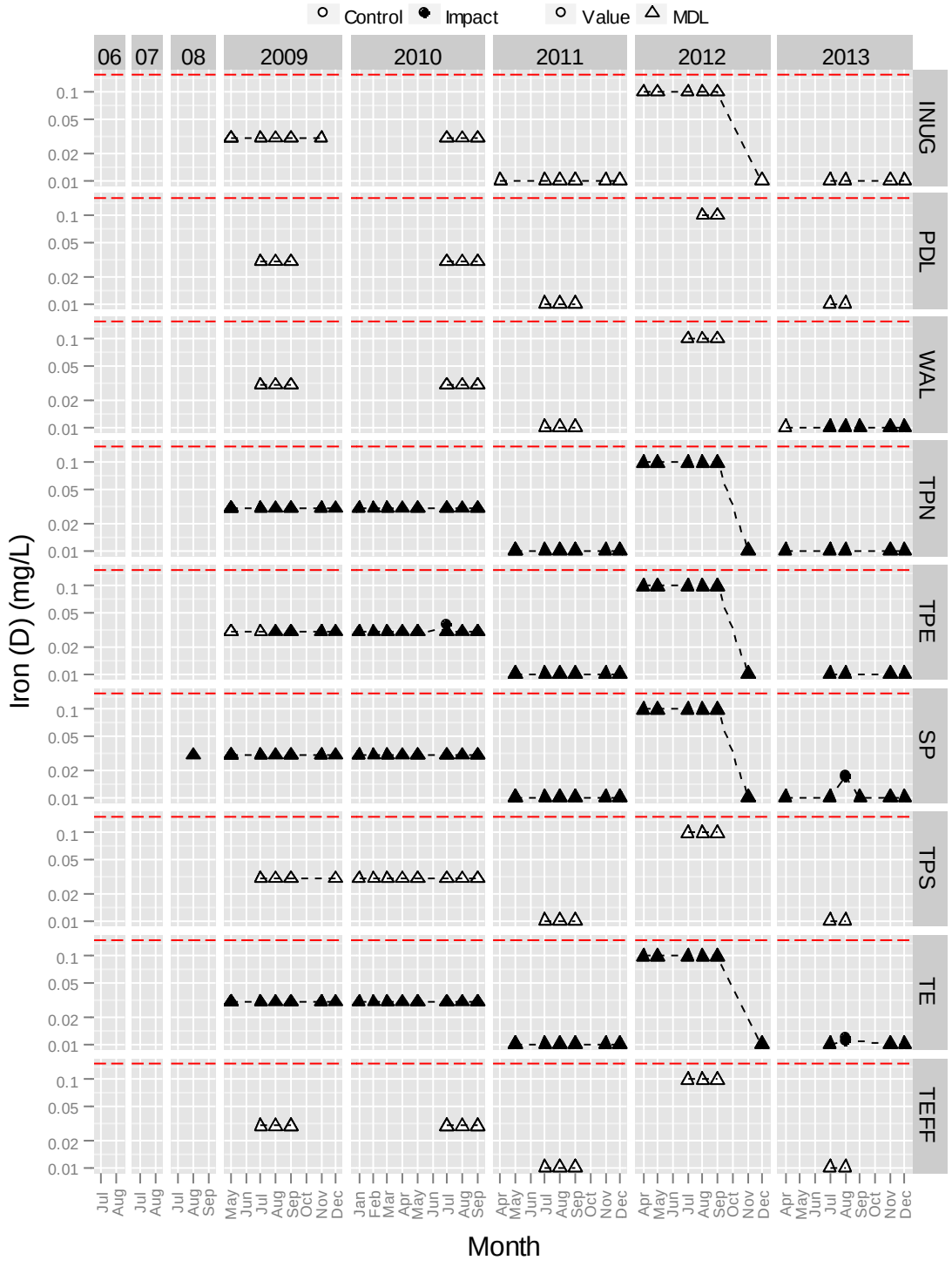
07
08
2009
2010
2011
2012
2013
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Chromium (D) (mg/L)
0.002
0.001
5e-04
2e-04
1e-04
Jul
Aug
Sep
May
Jun
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Month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Value
MDL
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07
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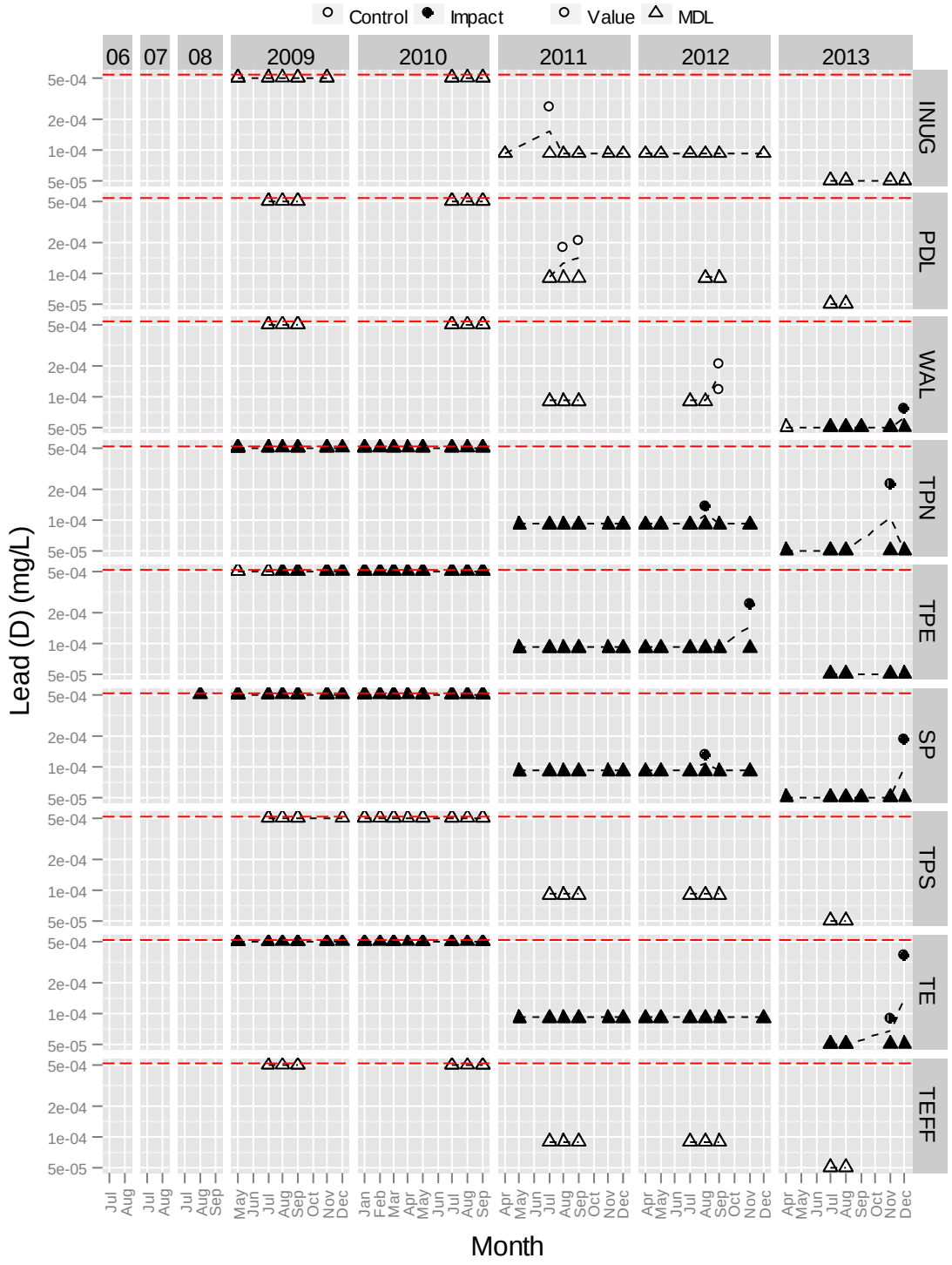
2009
2010
2011
2012
2013
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
0.1
0.05
0.02
0.01
Iron (D) (mg/L)
Jul
Aug
Sep
May
Jun
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Month


Control
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Value
MDL
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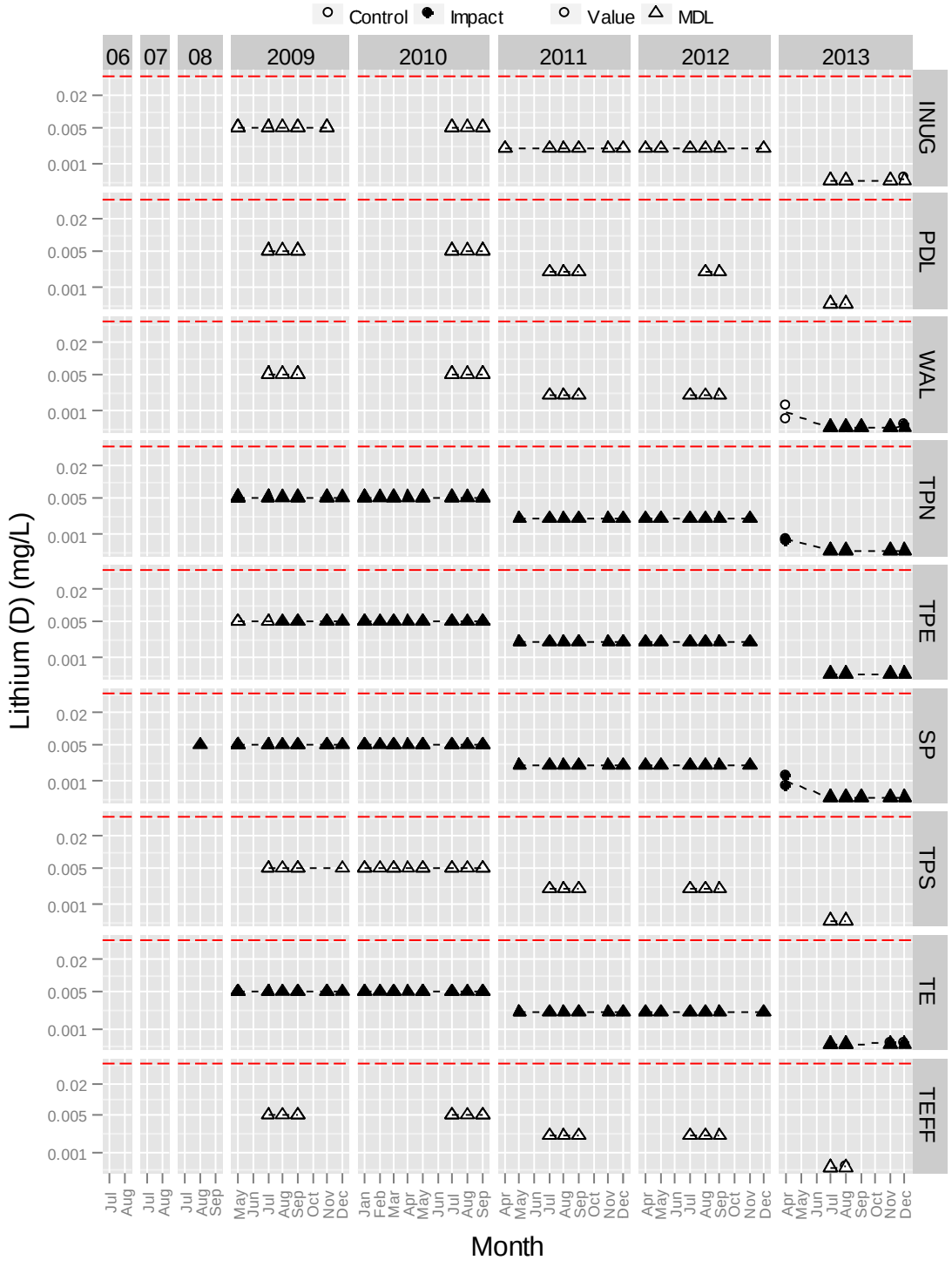
07
08
2009
2010
2011
2012
2013
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Lead (D) (mg/L)
5e-04
2e-04
1e-04
5e-05
Jul
Aug
Sep
May
Jun
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Month


Control
Impact
Value
MDL
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07
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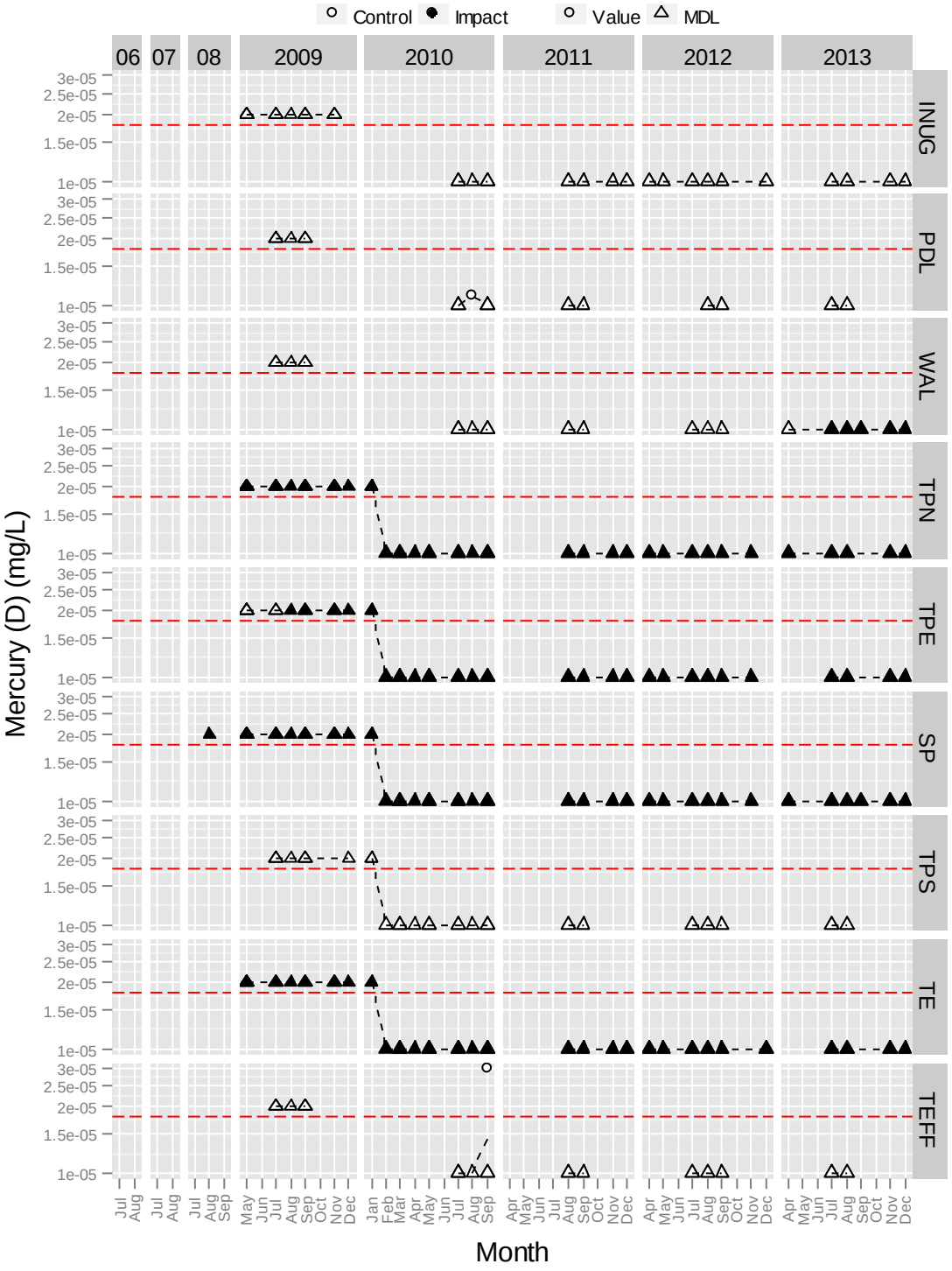
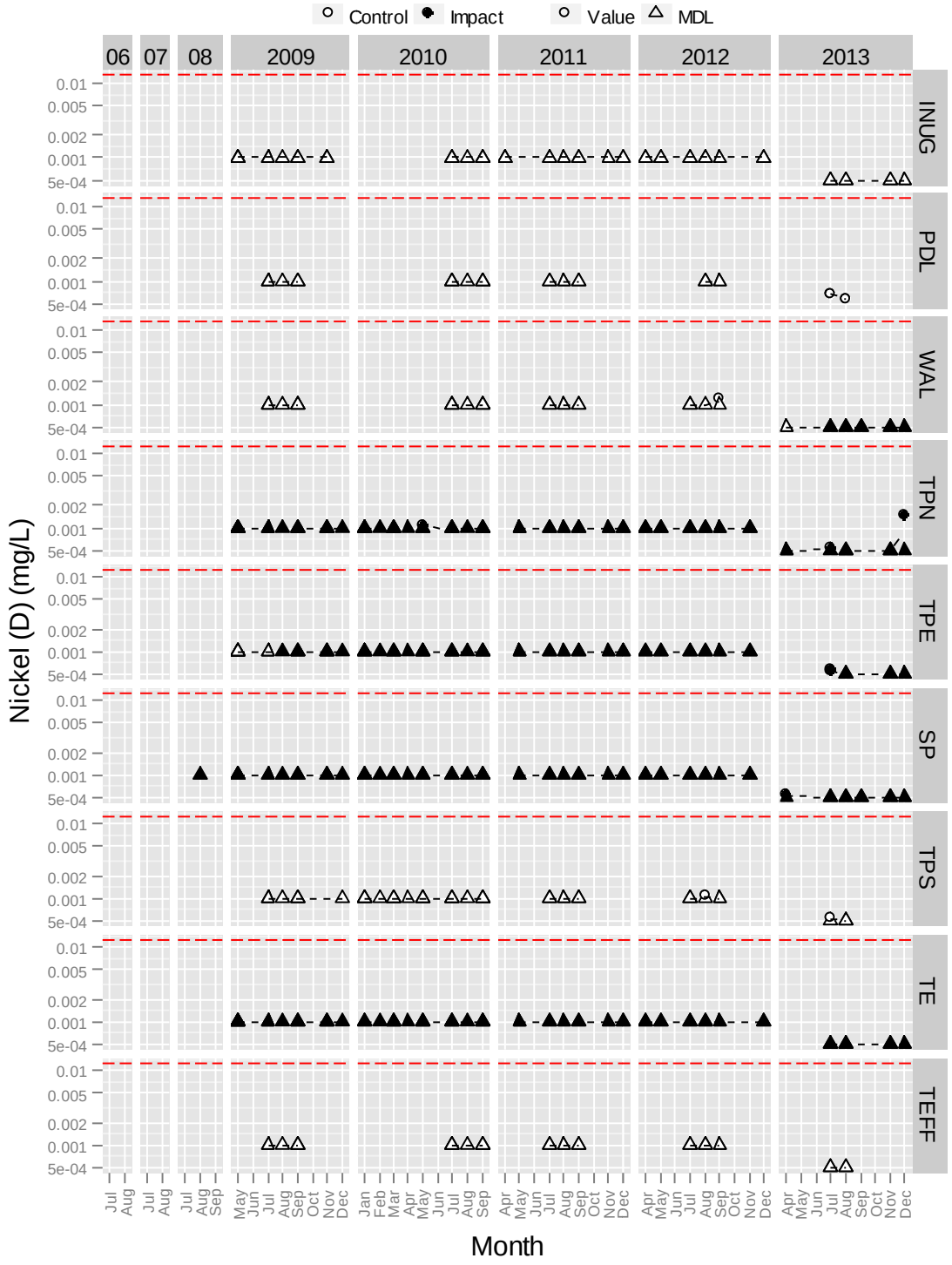
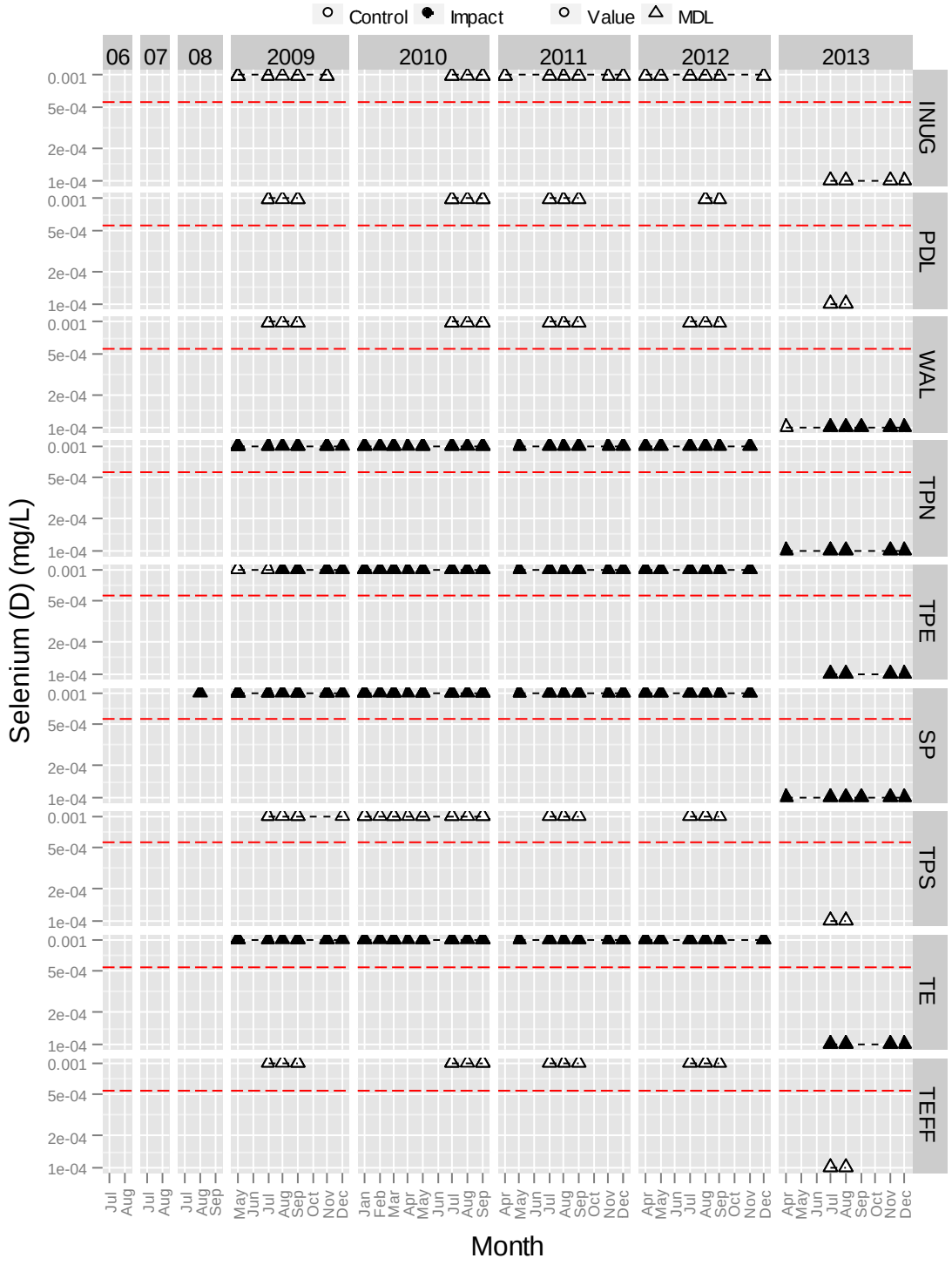
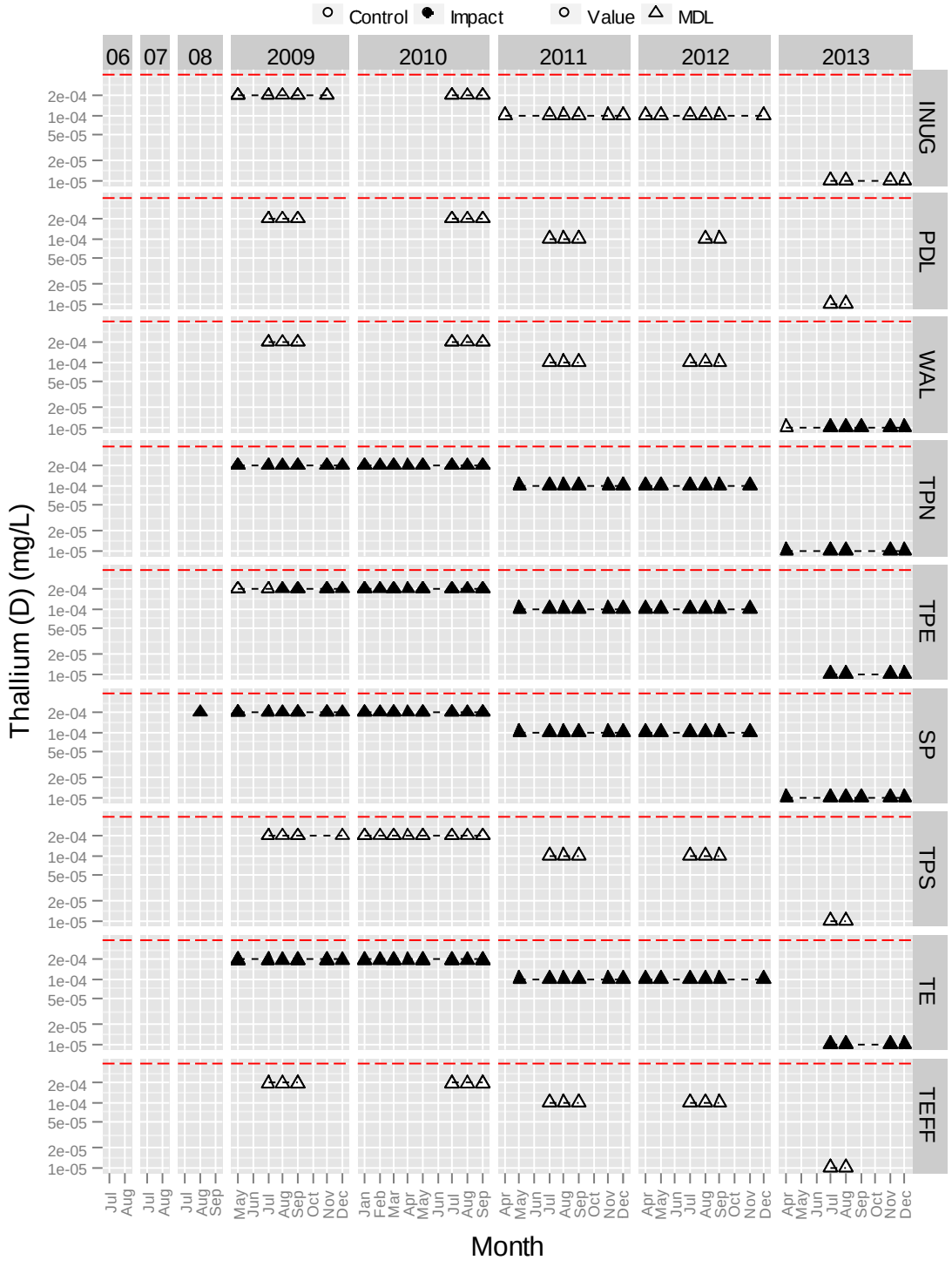
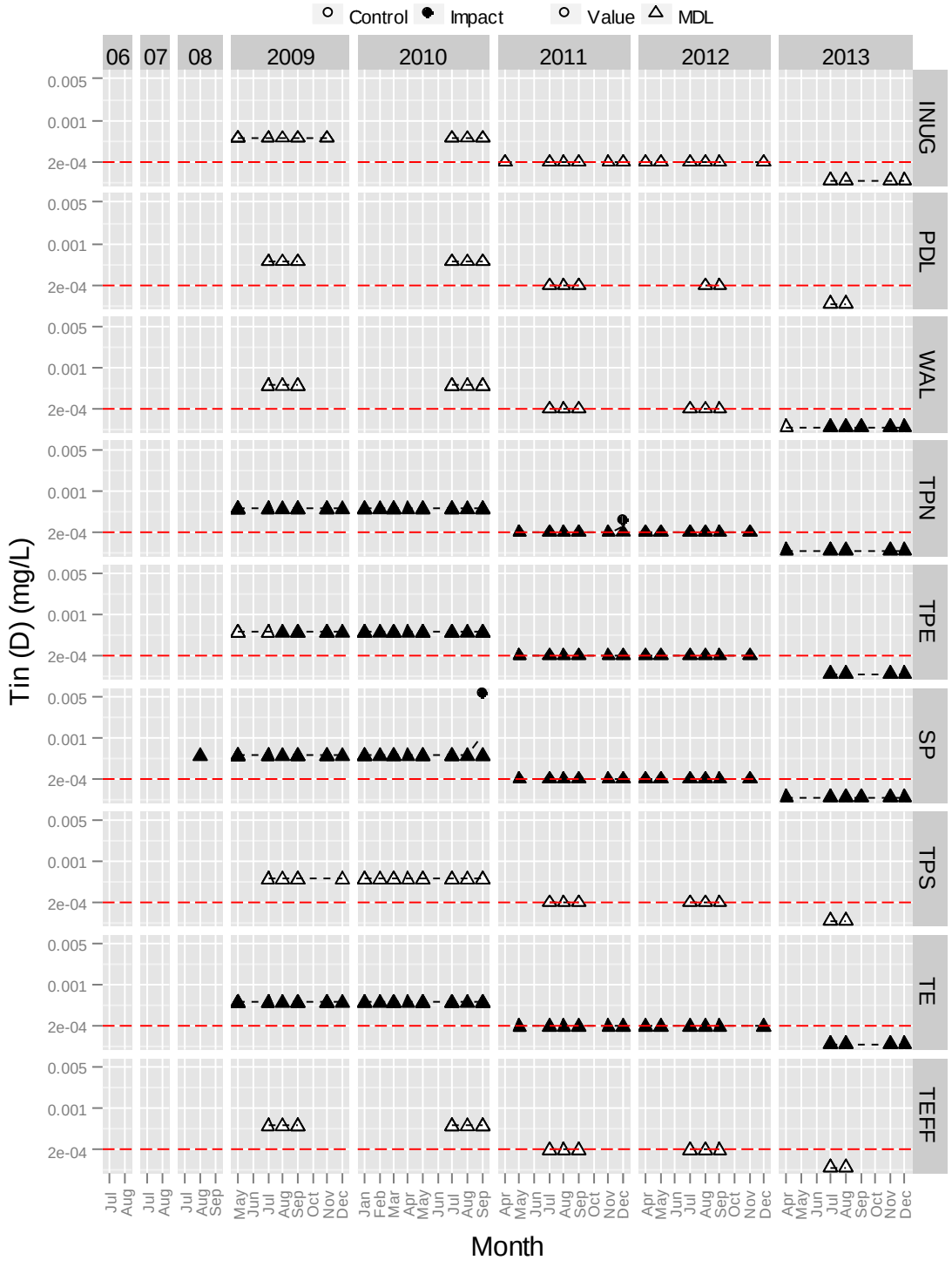
2009
2010
2011
2012
2013
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
0.02
0.005
0.001
Lithium (D) (mg/L)
Jul
Aug
Sep
May
Jun
Jan
Feb
Mar
Apr
Oct
Nov
Dec
Month

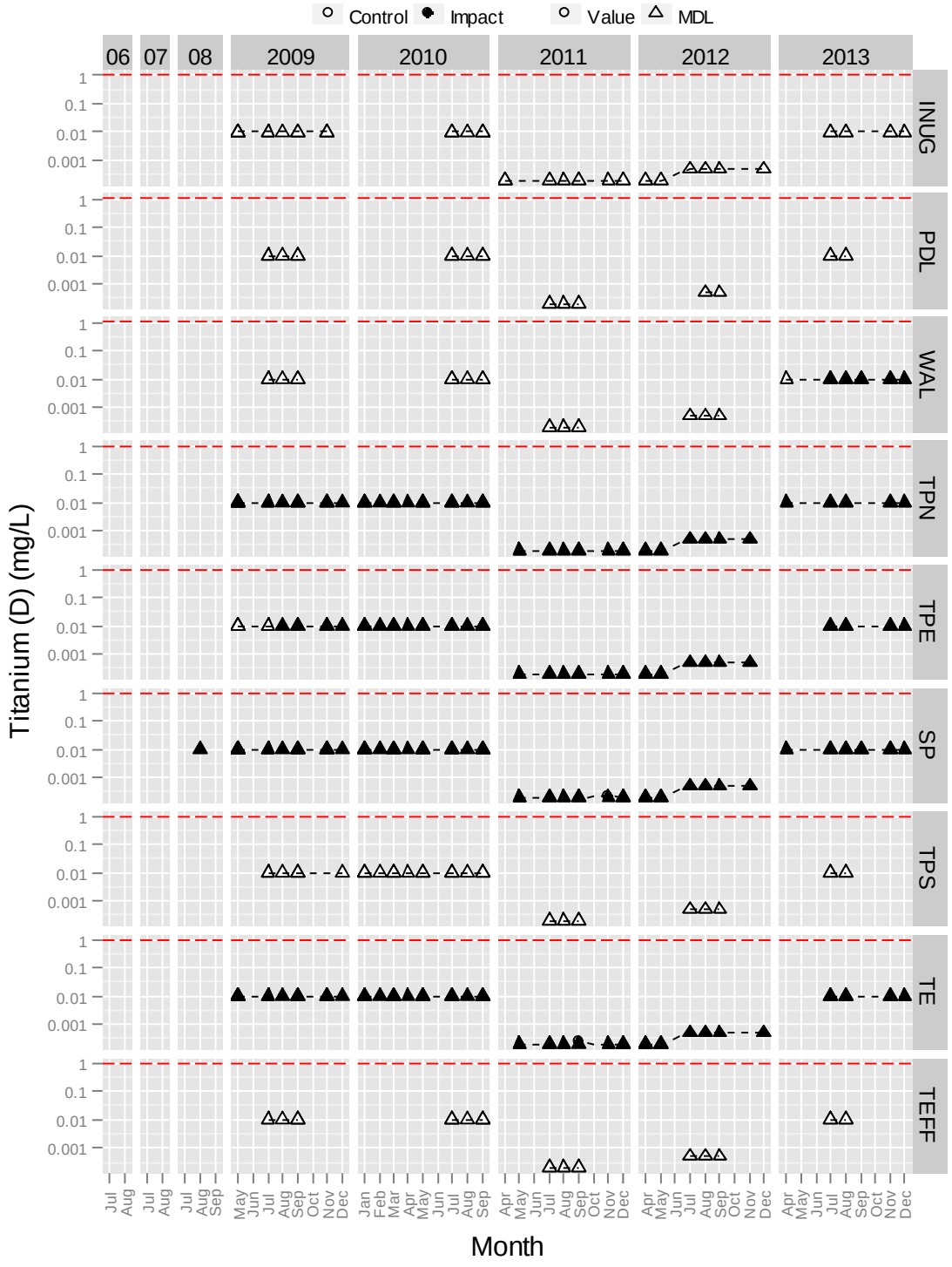

Control
Impact
Value
MDL
06
07
08
2009
2010
2011
2012
2013
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Mercury (D) (mg/L)
3e-05
2.5e-05
2e-05
1.5e-05
1e-05
Jul
Aug
Sep
May
Jun
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Month

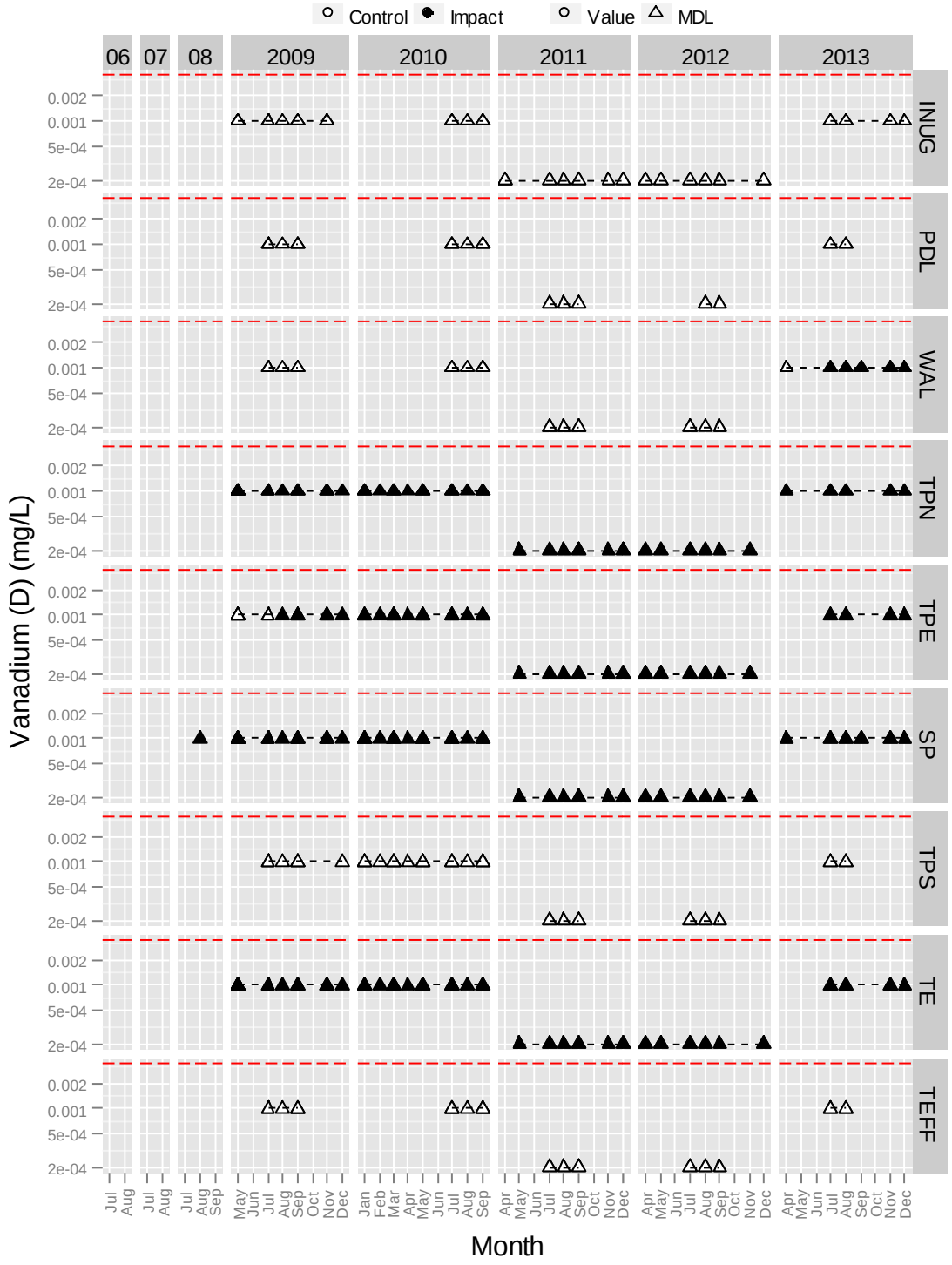

Control
Impact
Value
MDL
06
07
08
2009
2010
2011
2012
2013
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Nickel (D) (mg/L)
0.01
0.005
0.002
0.001
5e-04
Jul
Aug
Sep
May
Jun
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Month

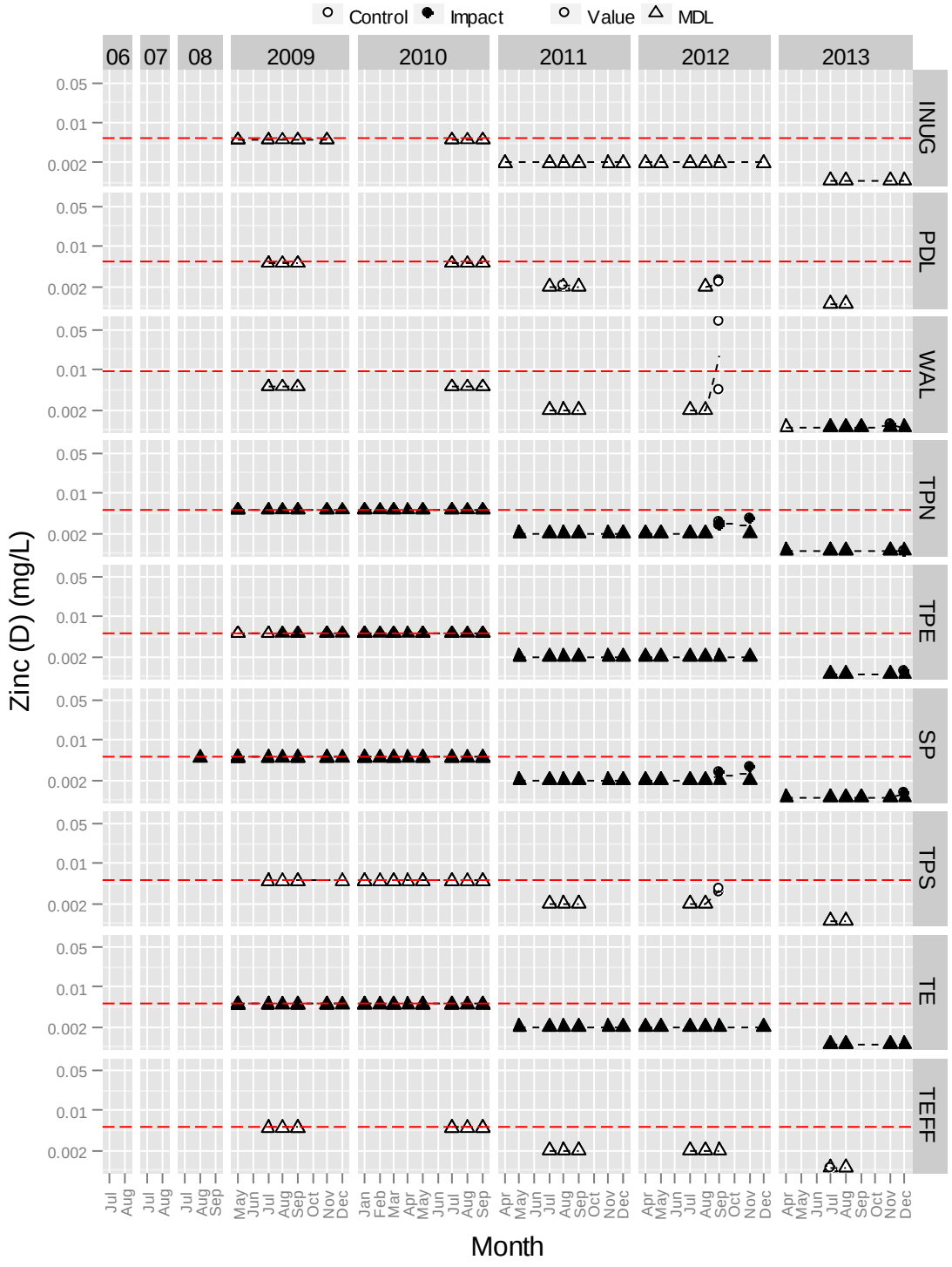

Control
Impact
Value
MDL
06
07
08
2009
2010
2011
2012
2013
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Selenium (D) (mg/L)
0.001
5e-04
2e-04
1e-04
Jul
Aug
Sep
May
Jun
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Month

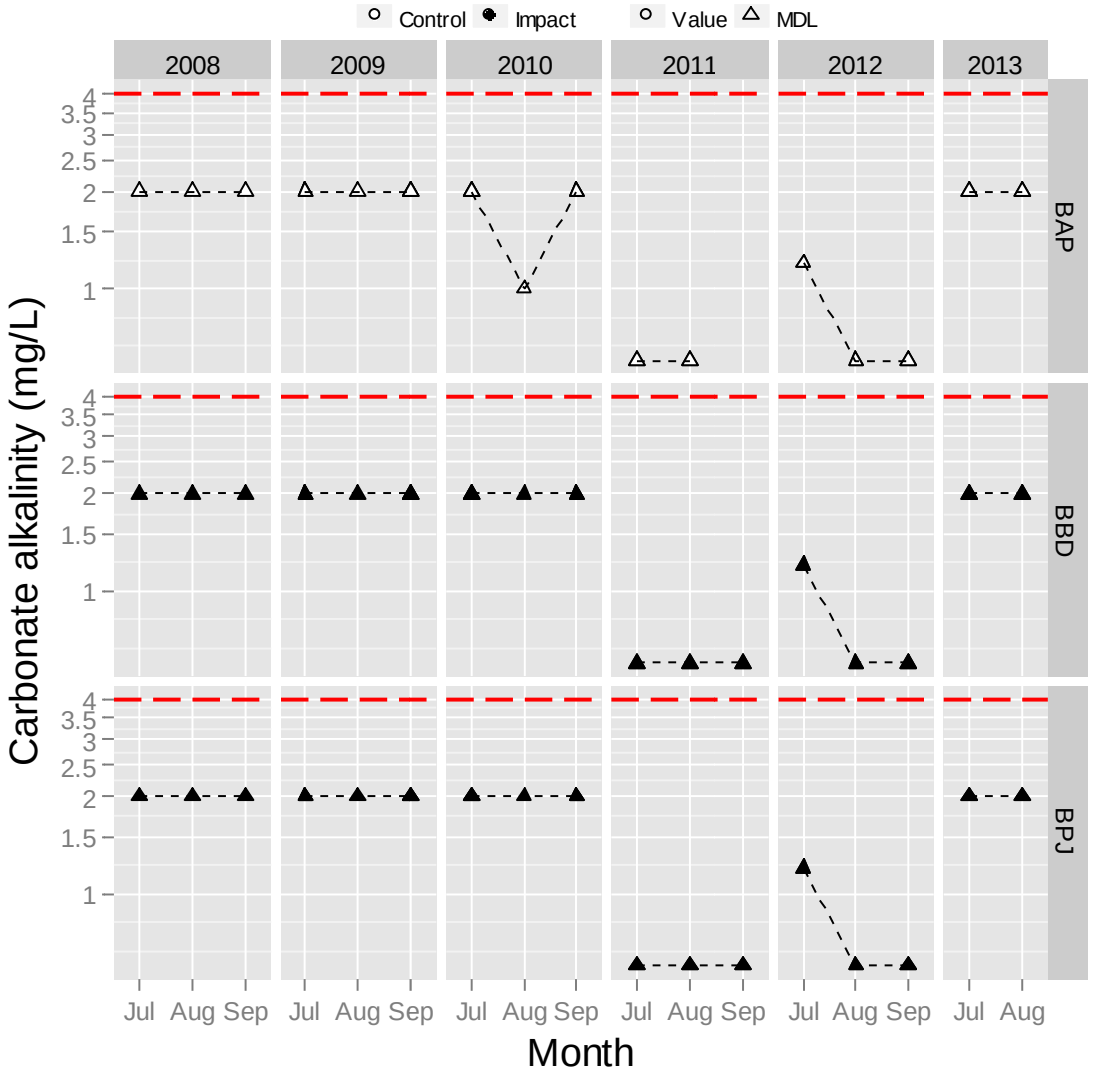

Control
Impact
Value
MDL
06
07
08
2009
2010
2011
2012
2013
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Thallium (D) (mg/L)
2e-04
1e-04
5e-05
2e-05
1e-05
Jul
Aug
Sep
May
Jun
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Month

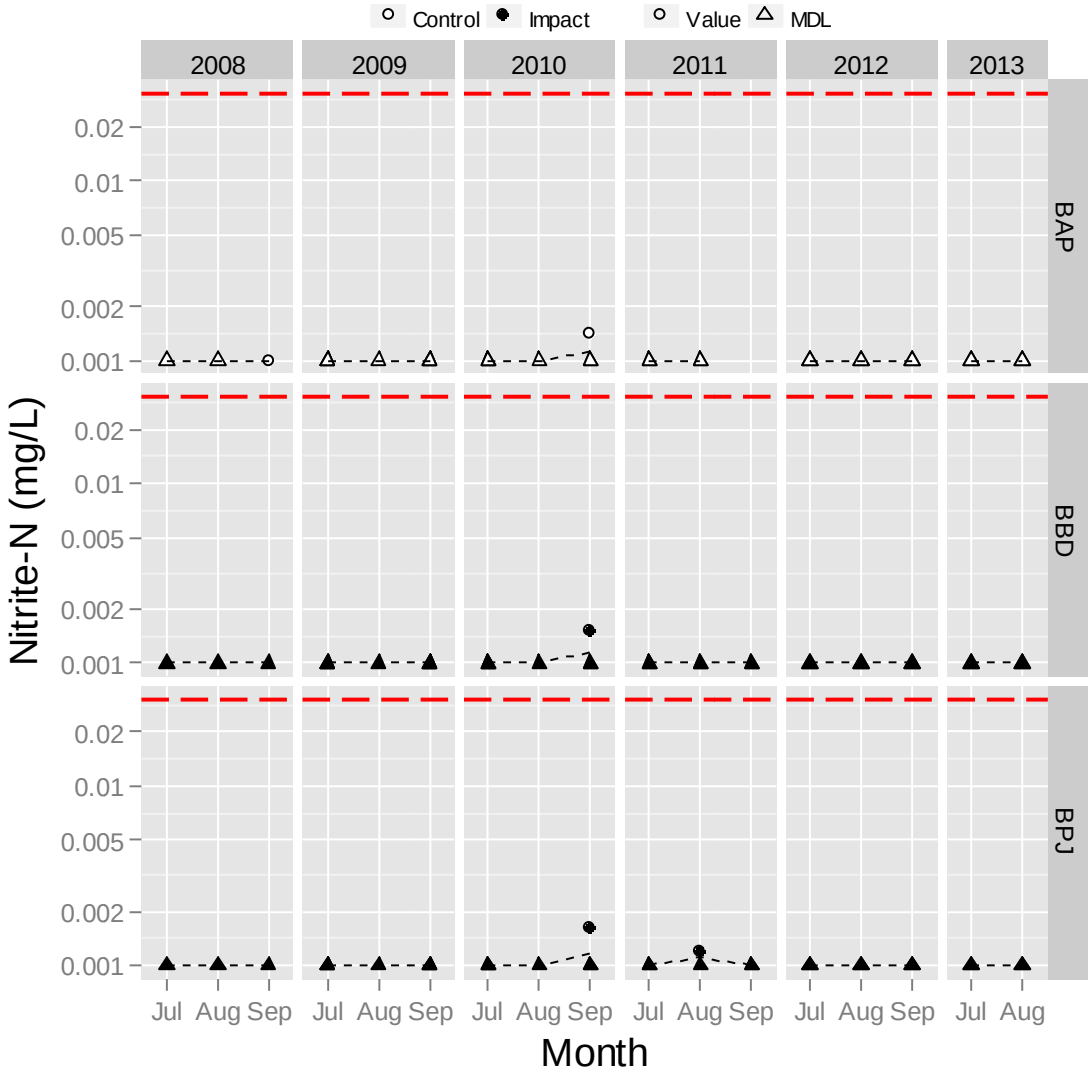

Control
Impact
Value
MDL
06
07
08
2009
2010
2011
2012
2013
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
0.005
0.001
2e-04
Tin (D) (mg/L)
Jul
Aug
Sep
May
Jun
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Month

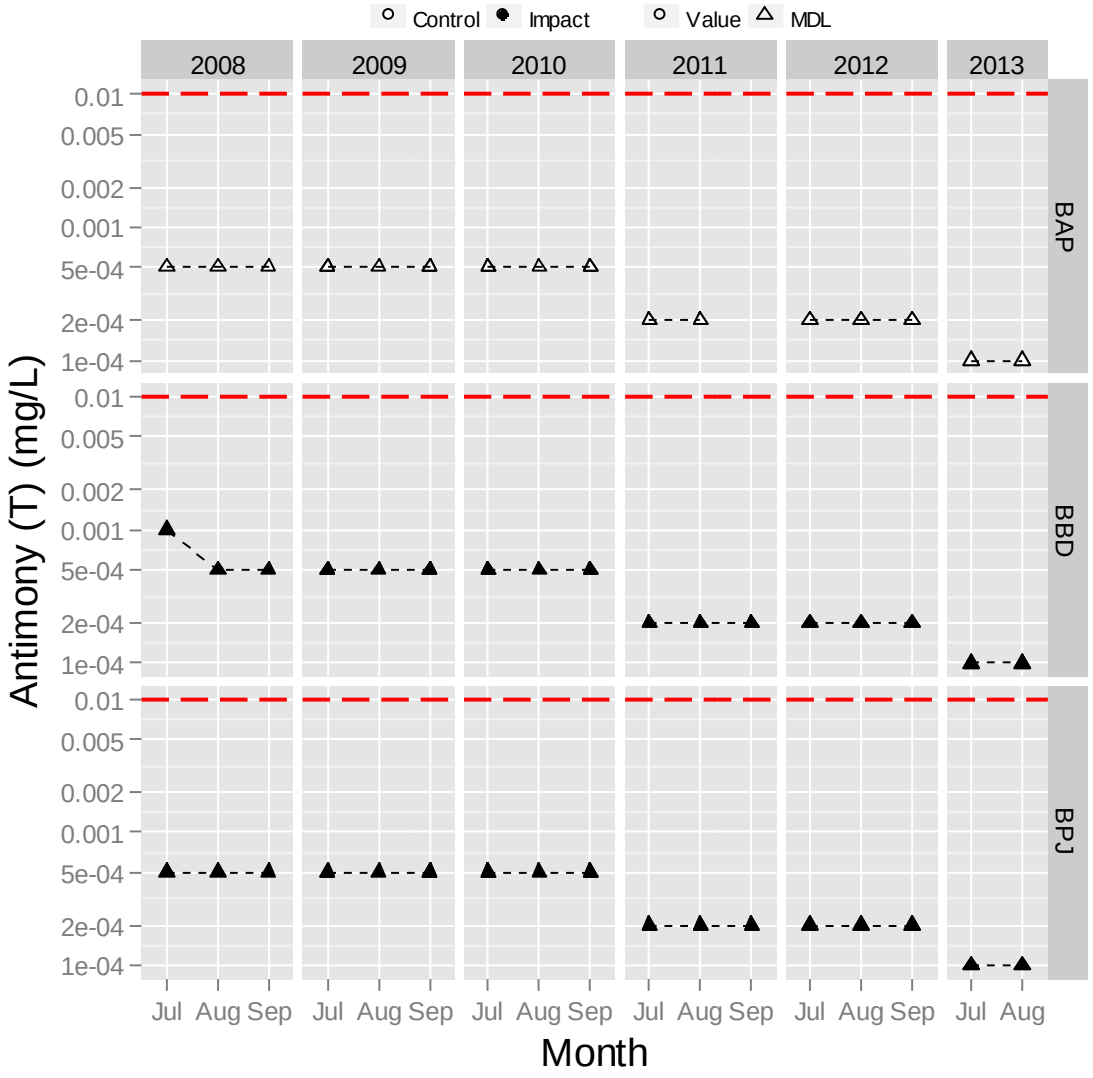

Control
Impact
Value
MDL
06
07
08
2009
2010
2011
2012
2013
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Titanium (D) (mg/L)
1
0.1
0.01
0.001
Jul
Aug
Sep
May
Jun
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Month

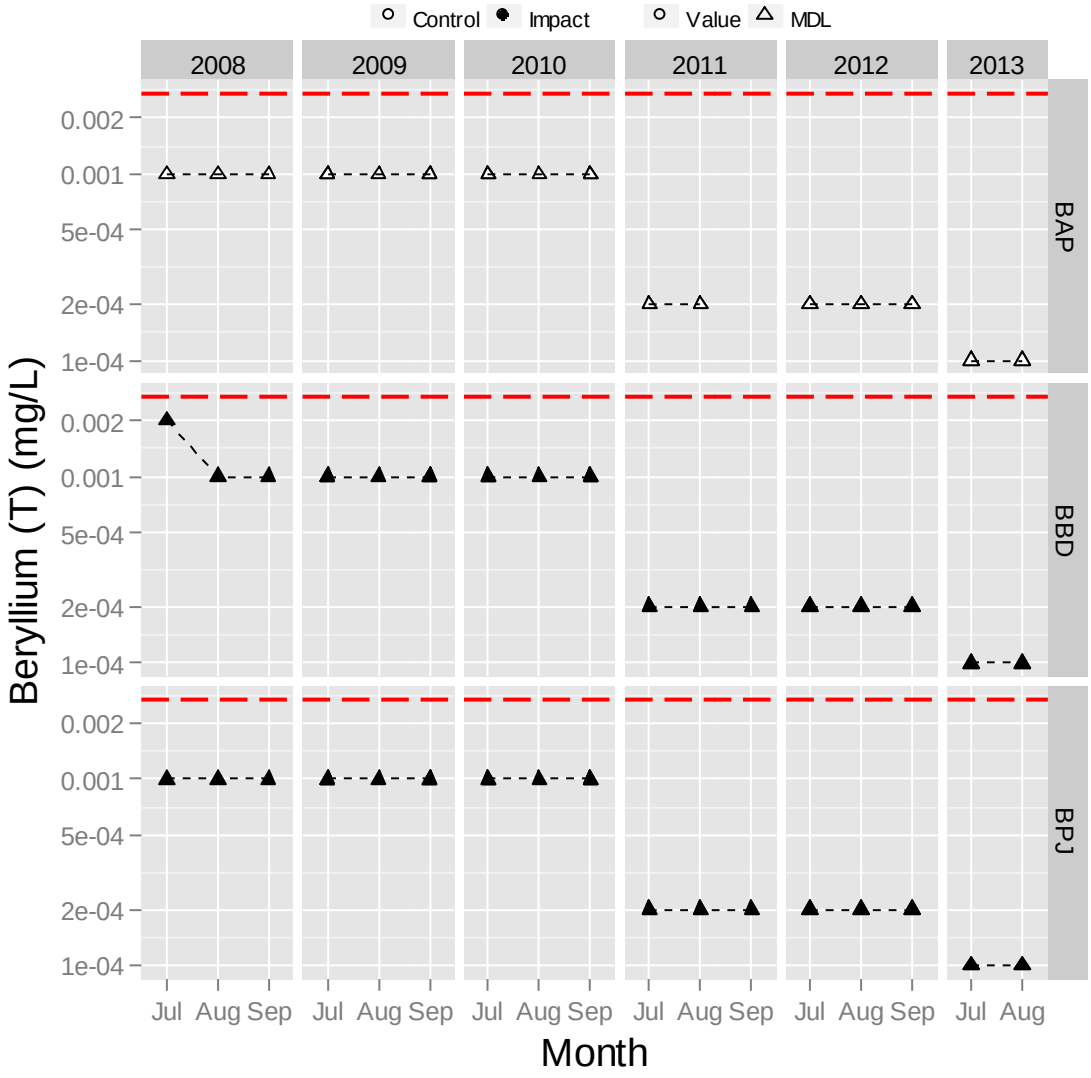

Control
Impact
Value
MDL
06
07
08
2009
2010
2011
2012
2013
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
0.002
0.001
5e-04
2e-04
Vanadium (D) (mg/L)
Jul
Aug
Sep
May
Jun
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Month

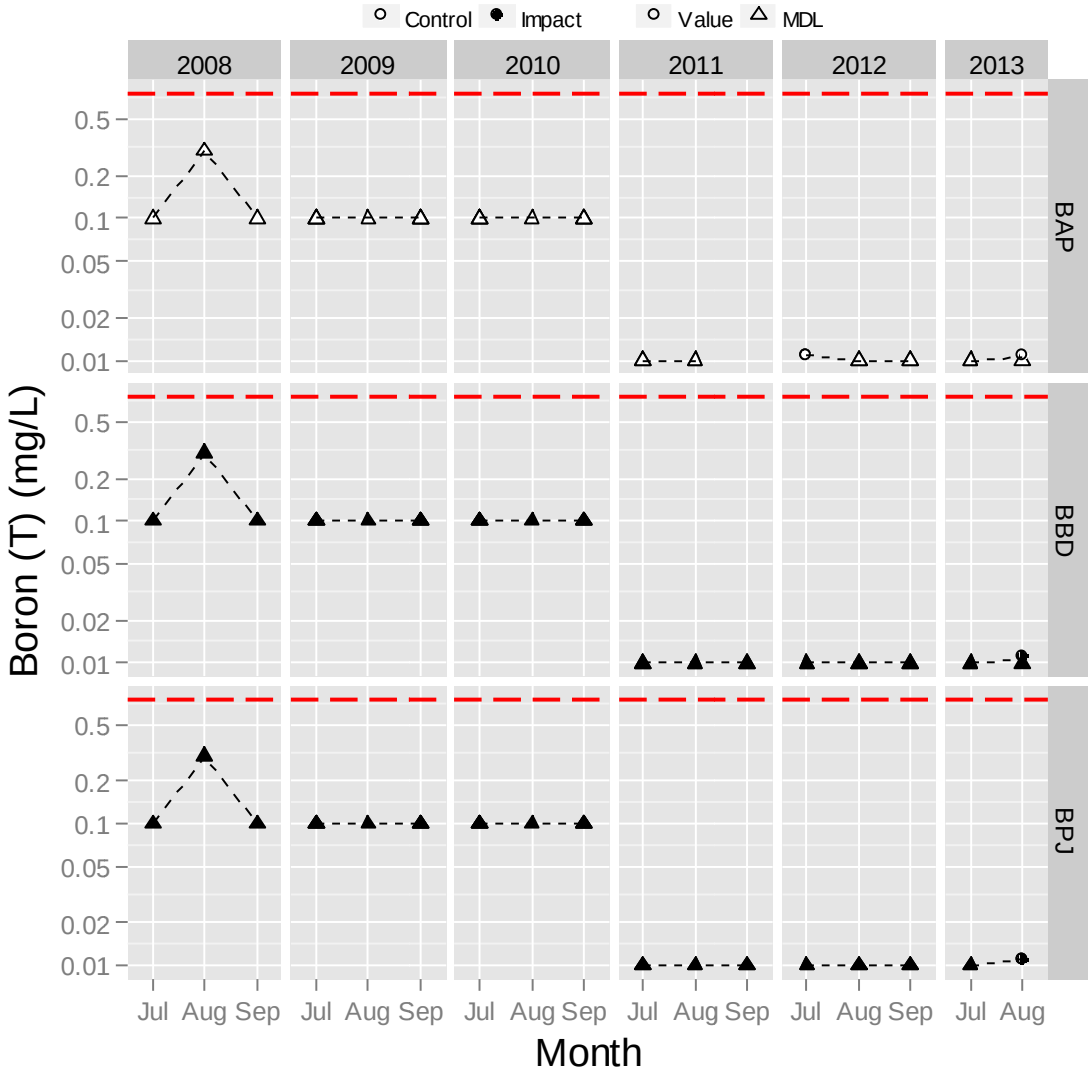

Control
Impact
Value
MDL
06
07
08
2009
2010
2011
2012
2013
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
0.05
0.01
0.002
Zinc (D) (mg/L)
Jul
Aug
Sep
May
Jun
Jan
Feb
Mar
Apr
Oct
Nov
Dec
Month

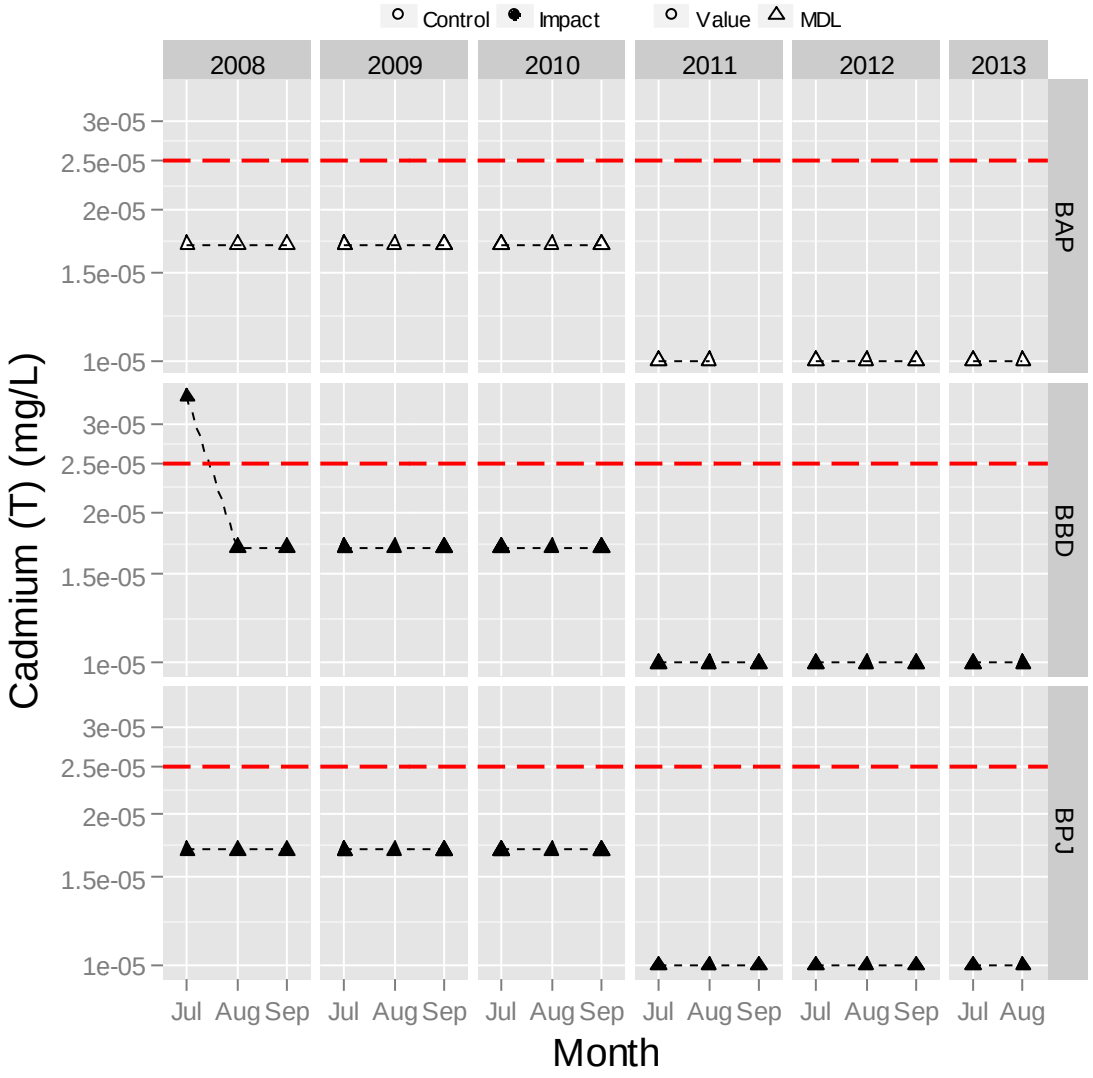

Control
Impact
Value
MDL
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
Carbonate alkalinity (mg/L)
4
3.5
3
2.5
2
1.5
1
Jul
Aug
Sep
Month

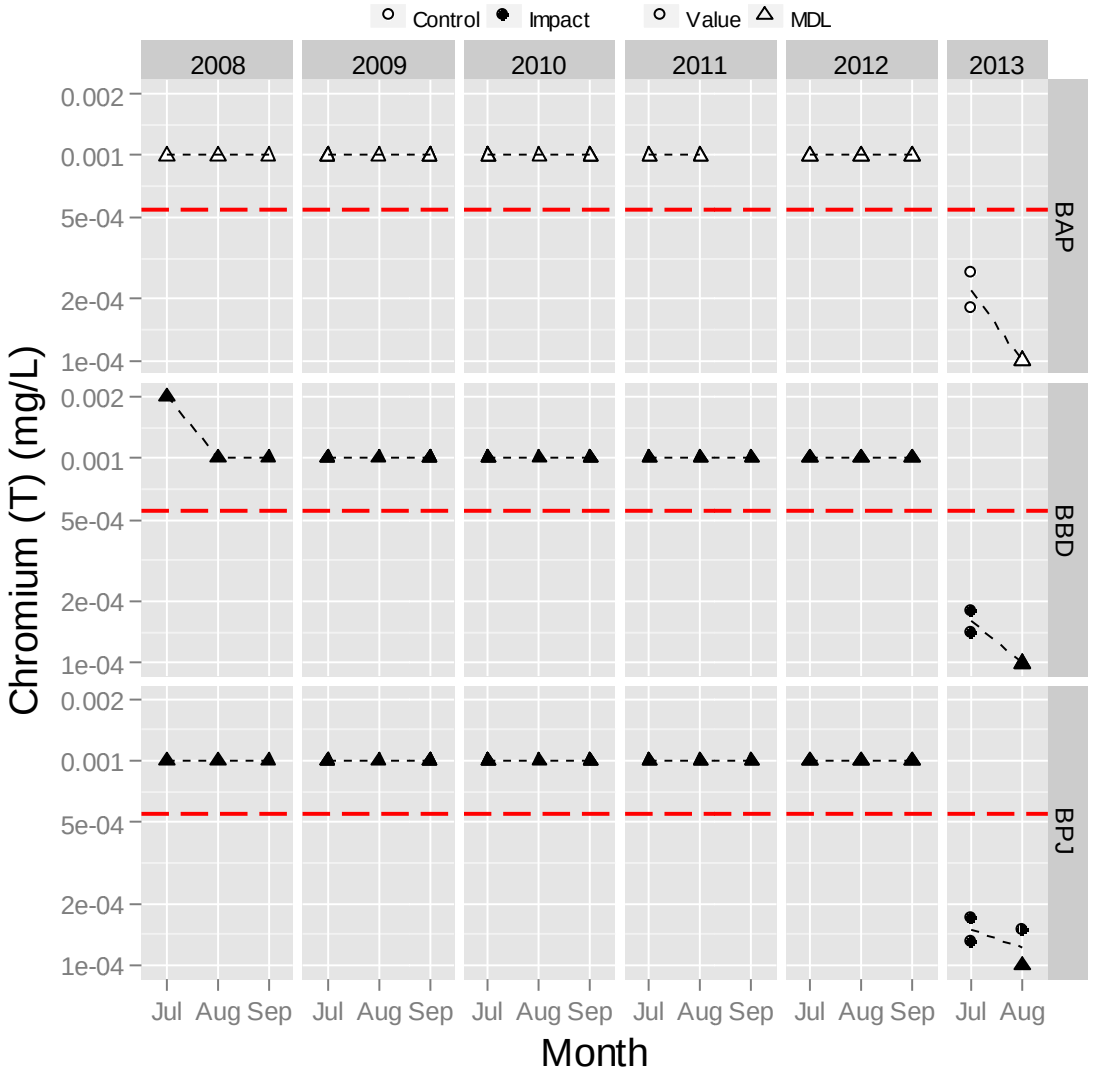

Control
Impact
Value
MDL
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
Nitrite-N (mg/L)
0.02
0.01
0.005
0.002
0.001
Jul
Aug
Sep
Month

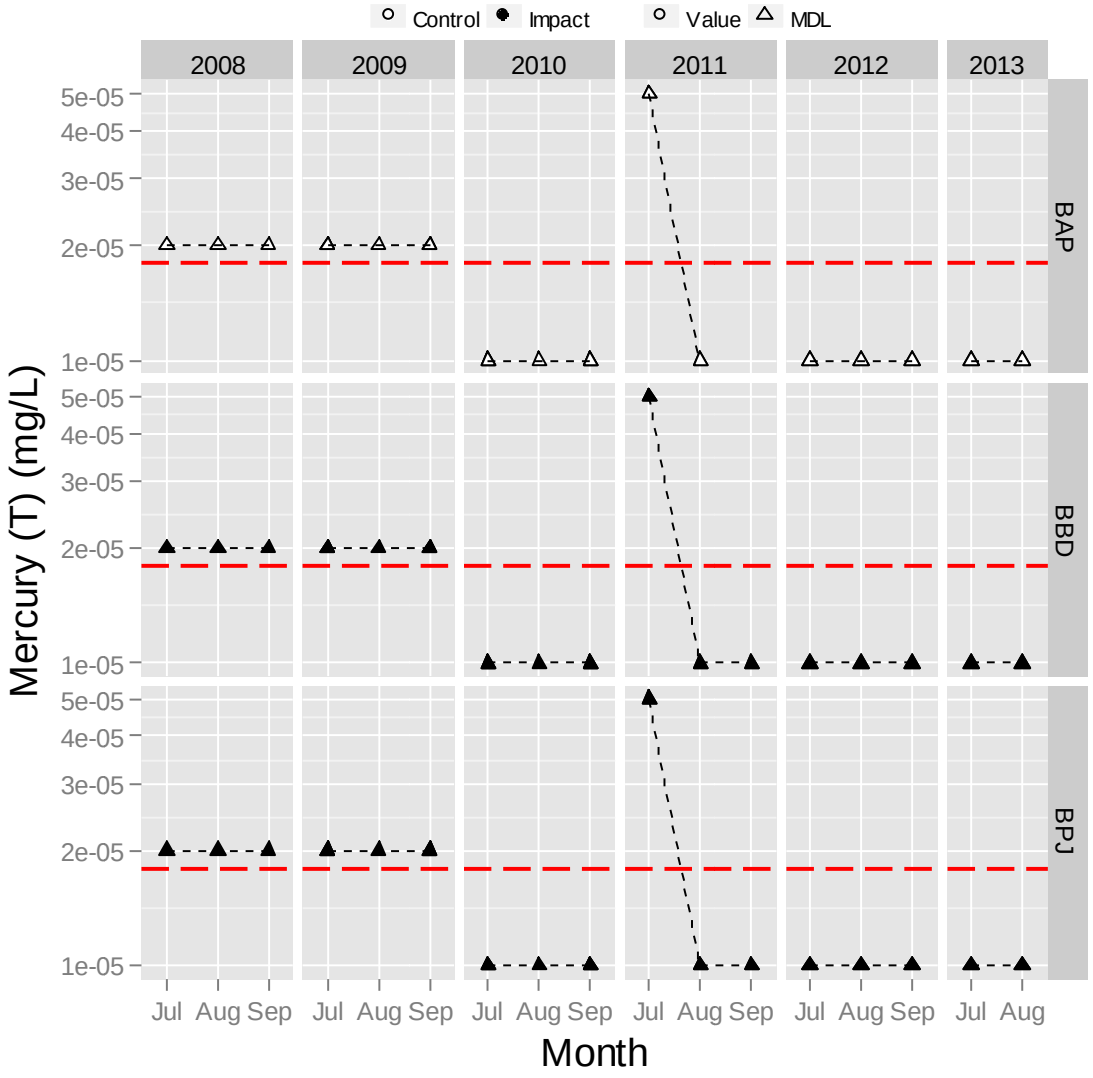

Control
Impact
Value
MDL
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
Antimony (T) (mg/L)
0.01
0.005
0.002
0.001
5e-04
2e-04
1e-04
Jul
Aug
Sep
Month

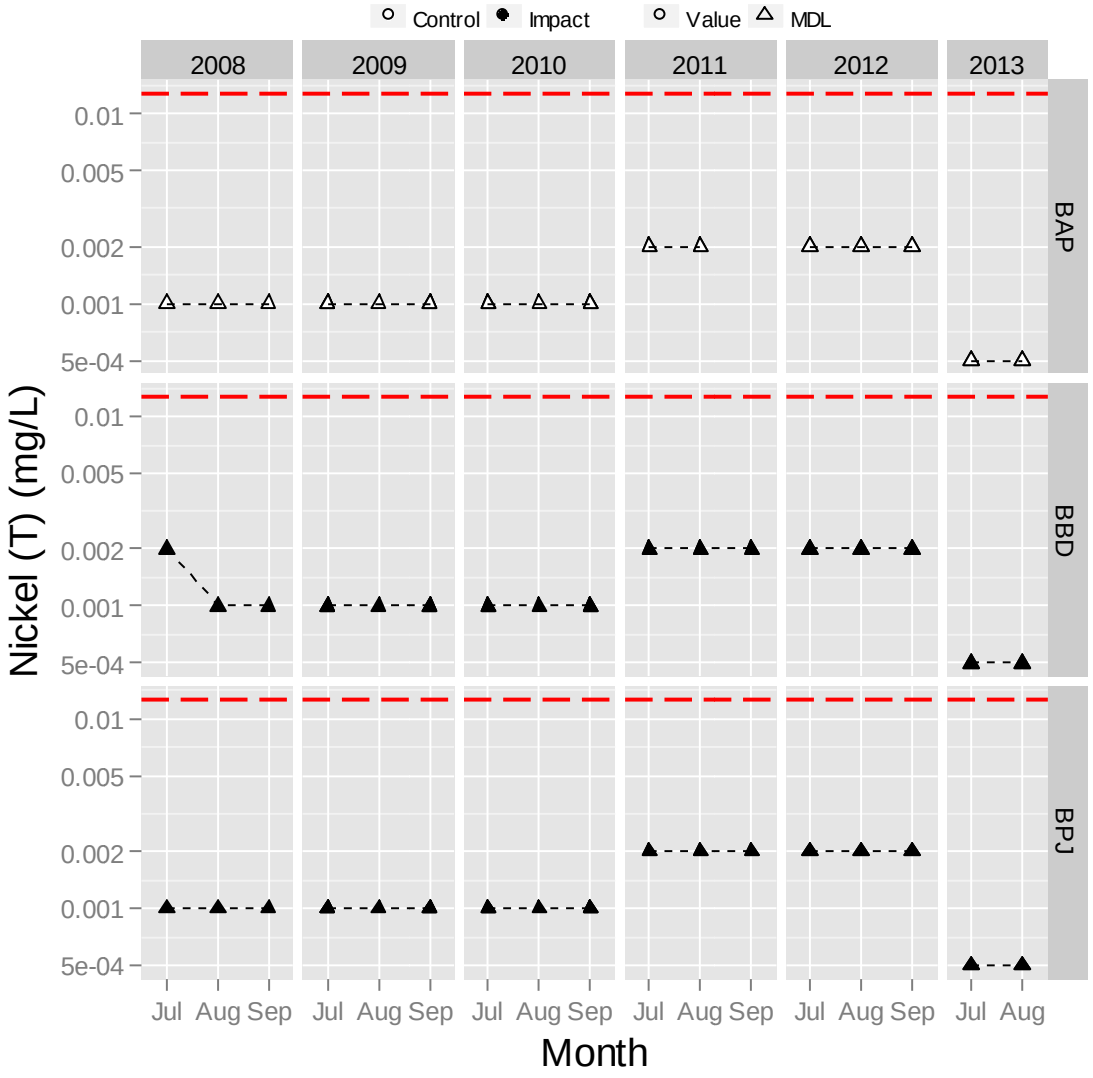

Control
Impact
Value
MDL
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
Beryllium (T) (mg/L)
0.002
0.001
5e-04
2e-04
1e-04
Jul
Aug
Sep
Month

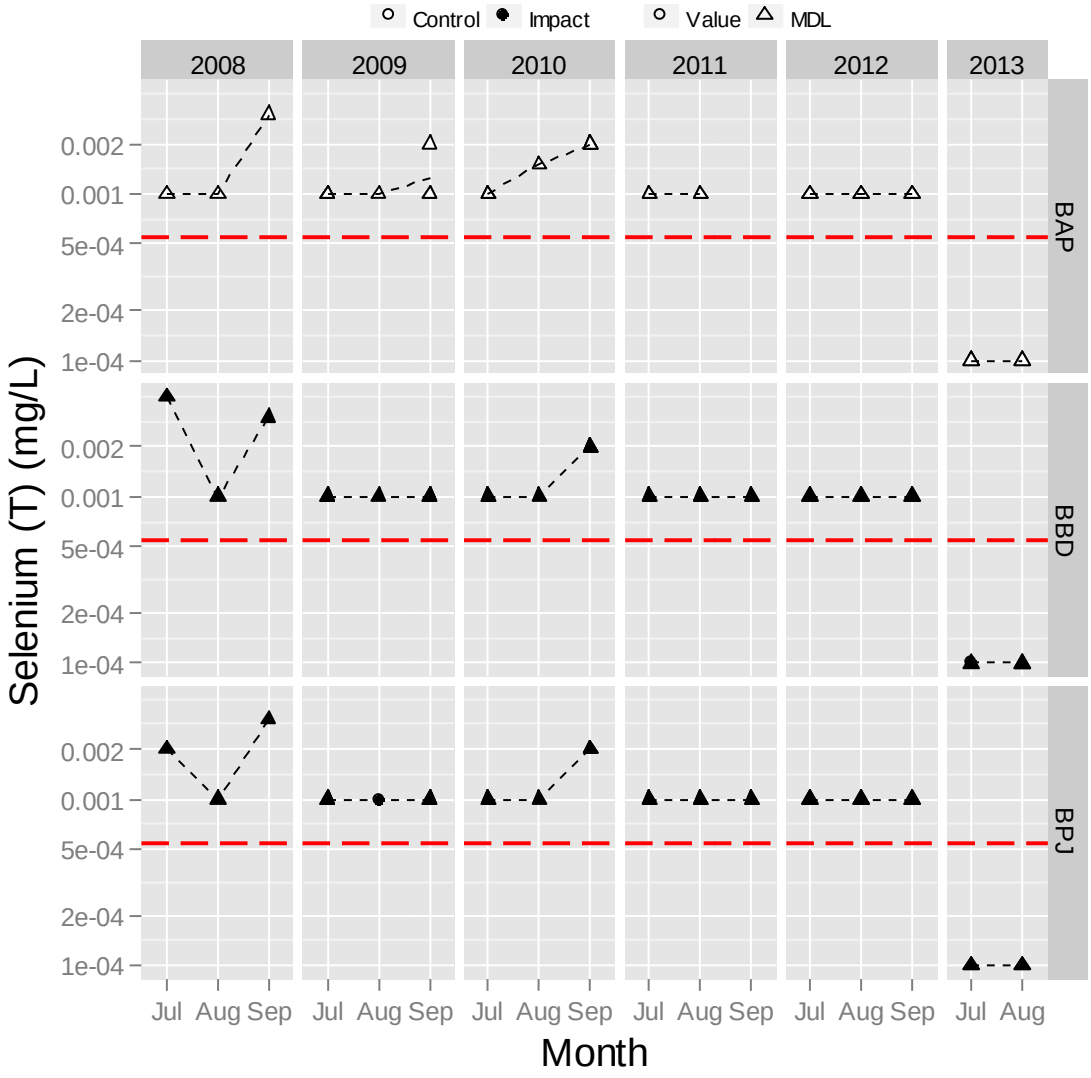

Control
Impact
Value
MDL
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
Boron (T) (mg/L)
0.5
0.2
0.1
0.05
0.02
0.01
Jul
Aug
Sep
Month

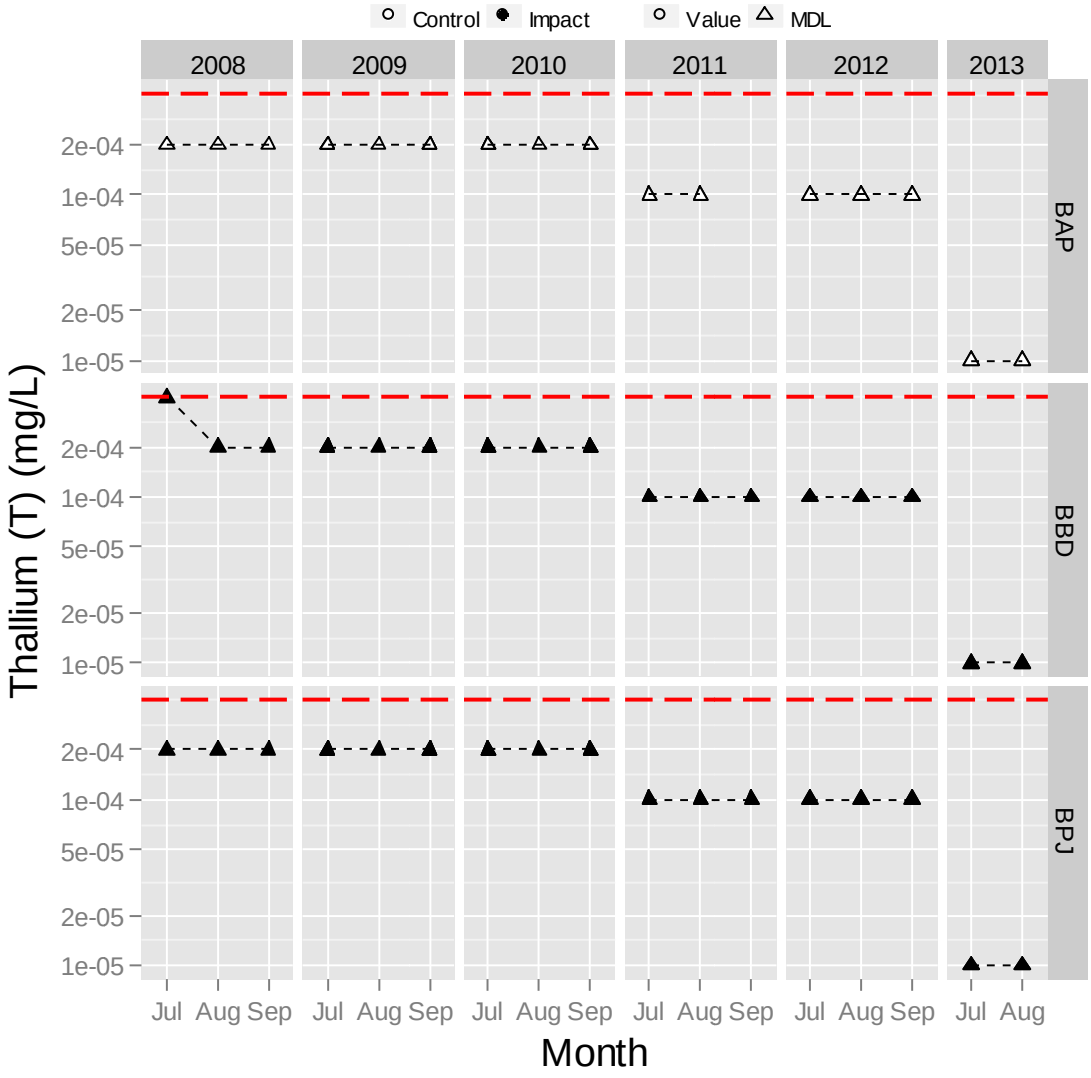

Control
Impact
Value
MDL
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
3e-05
2.5e-05
2e-05
1.5e-05
1e-05
Cadmium (T) (mg/L)
Jul
Aug
Sep
Month

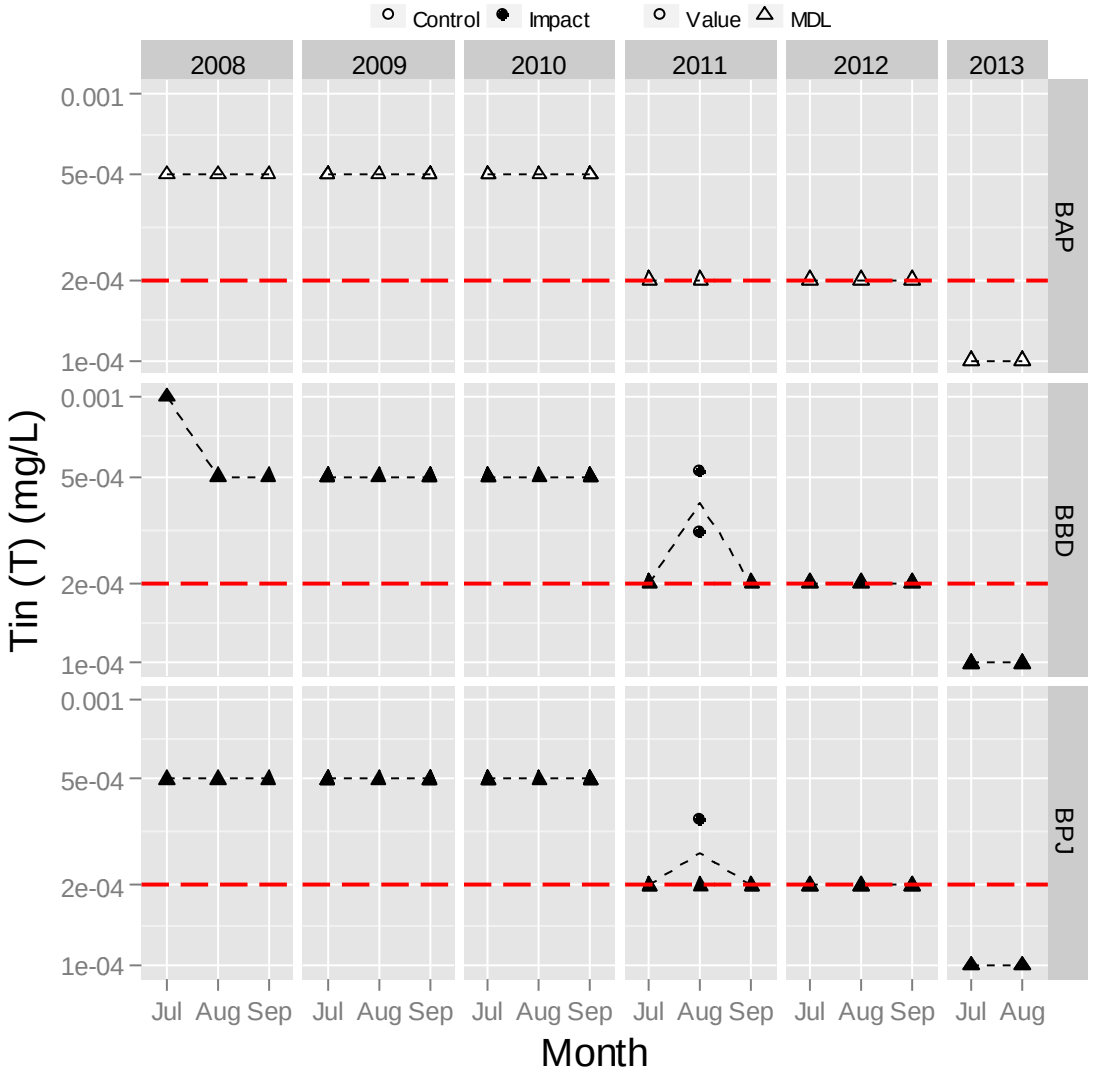

Control
Impact
Value
MDL
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
Chromium (T) (mg/L)
0.002
0.001
5e-04
2e-04
1e-04
Jul
Aug
Sep
Month

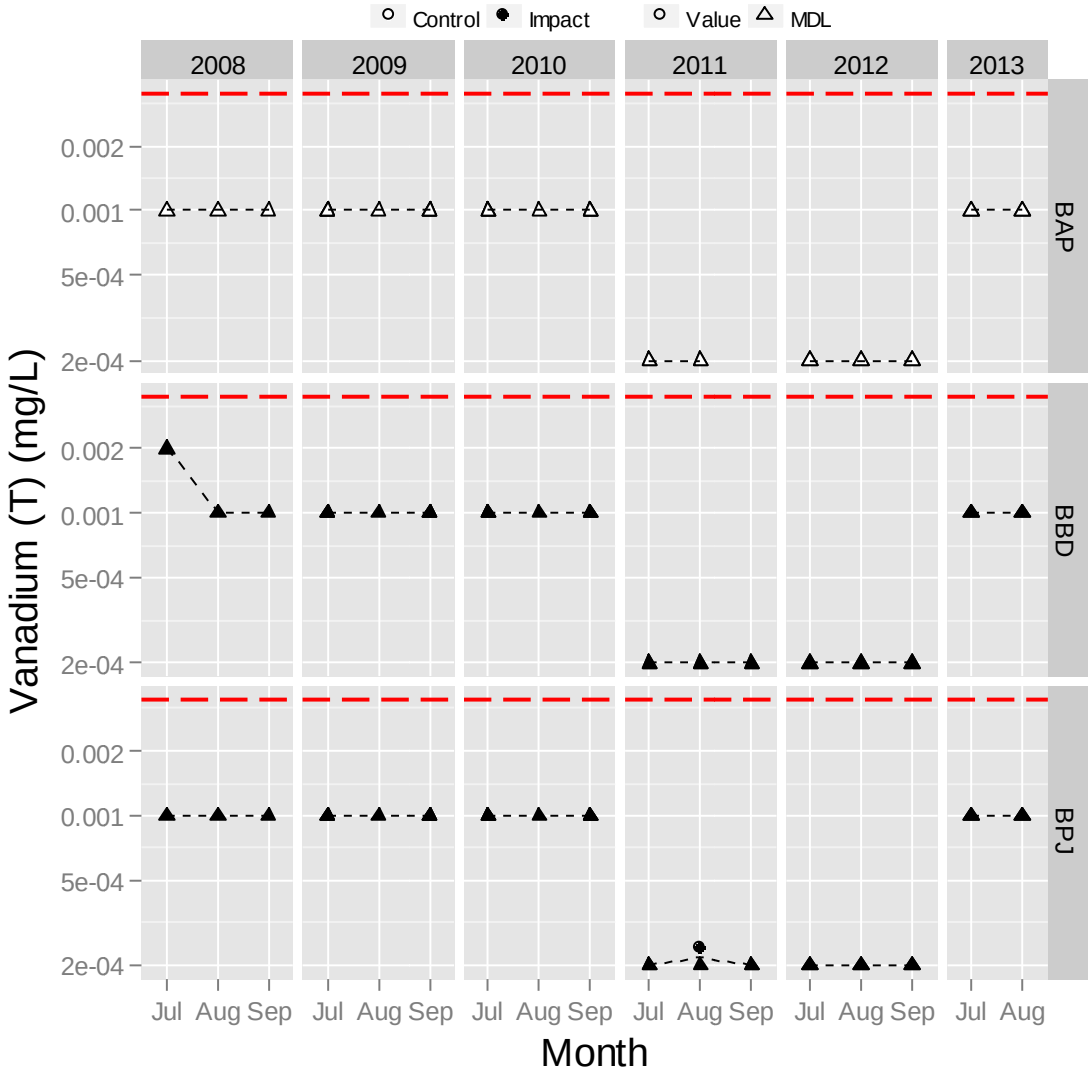

Control
Impact
Value
MDL
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
Mercury (T) (mg/L)
5e-05
4e-05
3e-05
2e-05
1e-05
Jul
Aug
Sep
Month

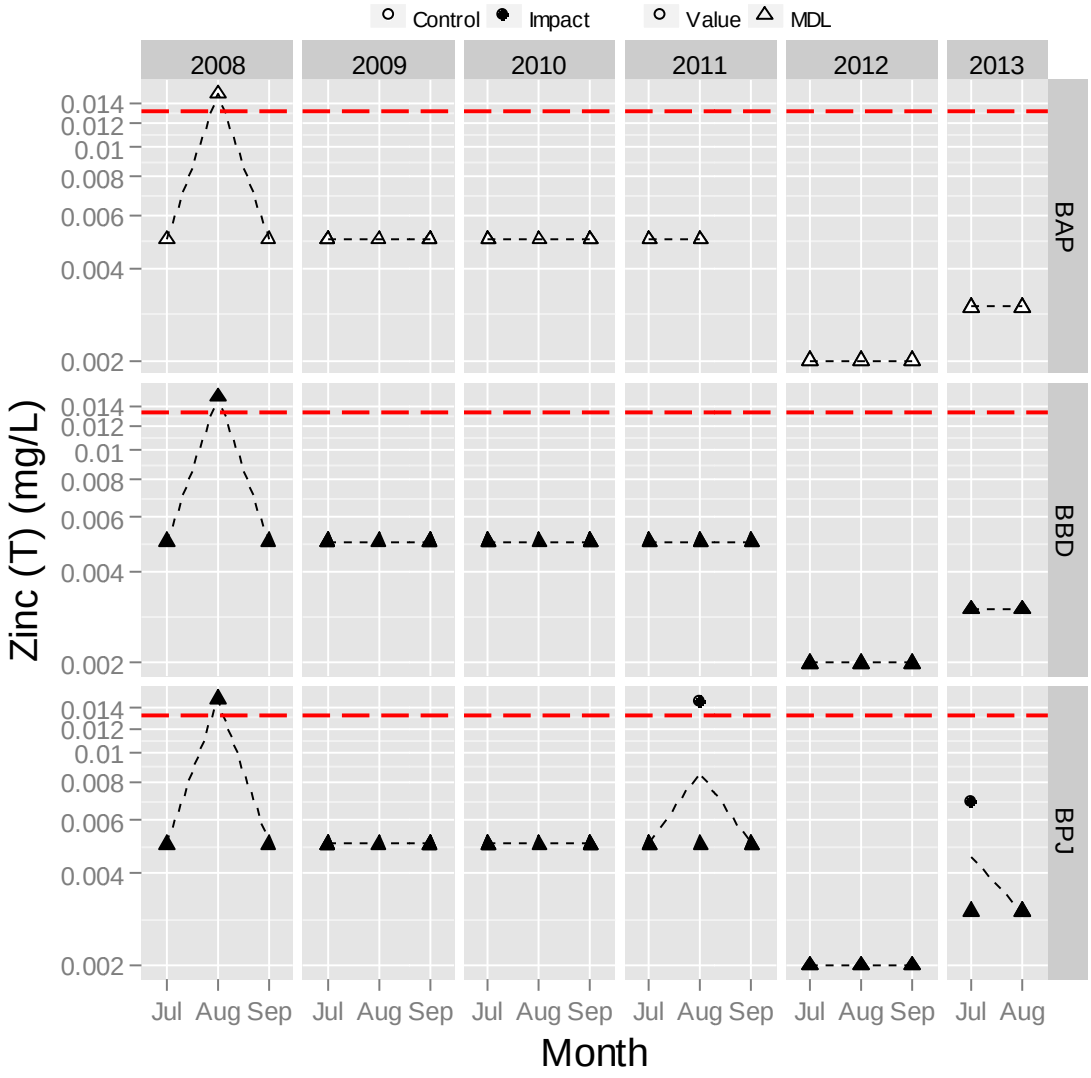

Control
Impact
Value
MDL
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
Nickel (T) (mg/L)
0.01
0.005
0.002
0.001
5e-04
Jul
Aug
Sep
Month

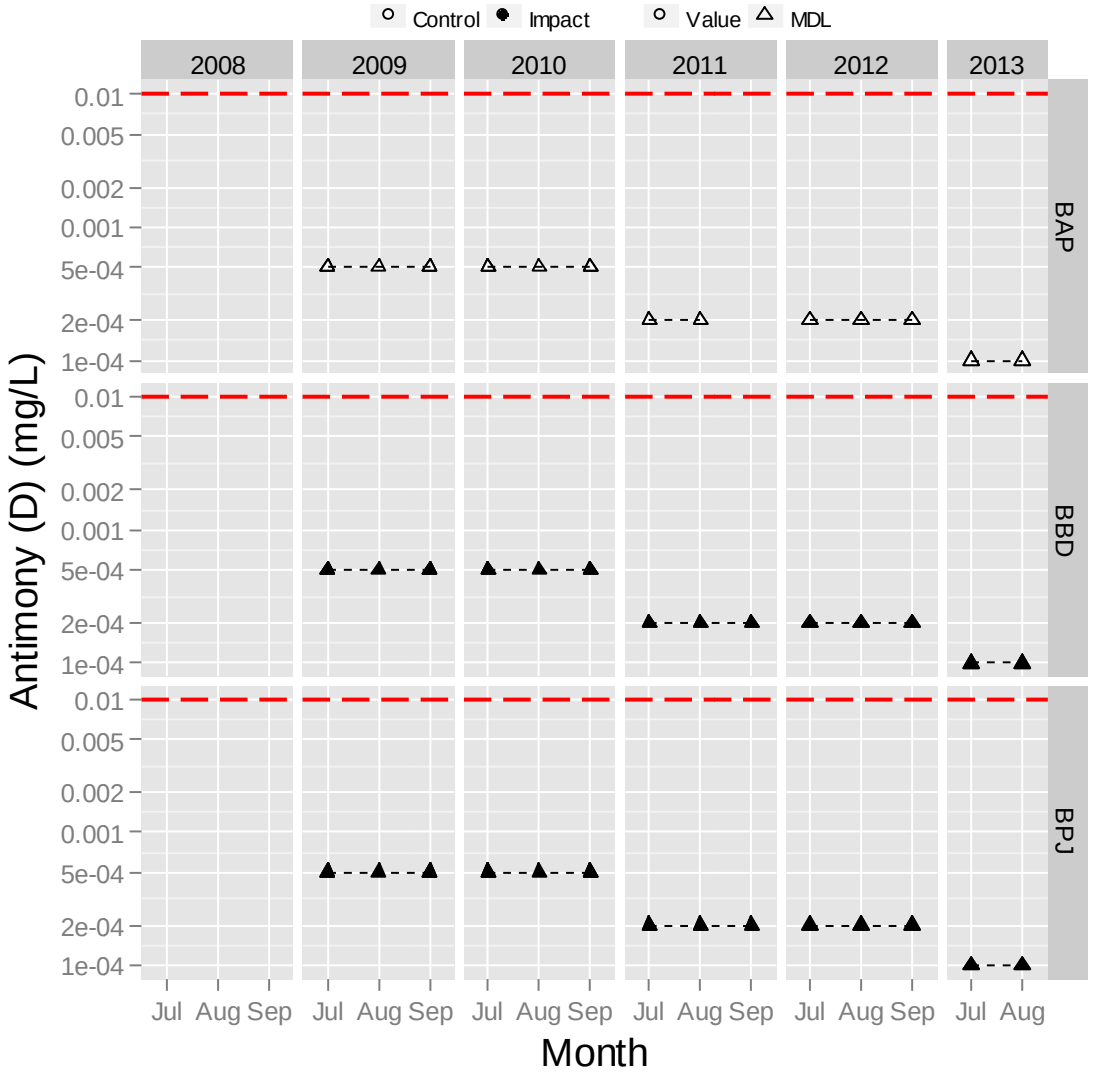

Control
Impact
Value
MDL
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
Selenium (T) (mg/L)
0.002
0.001
5e-04
2e-04
1e-04
Jul
Aug
Sep
Month

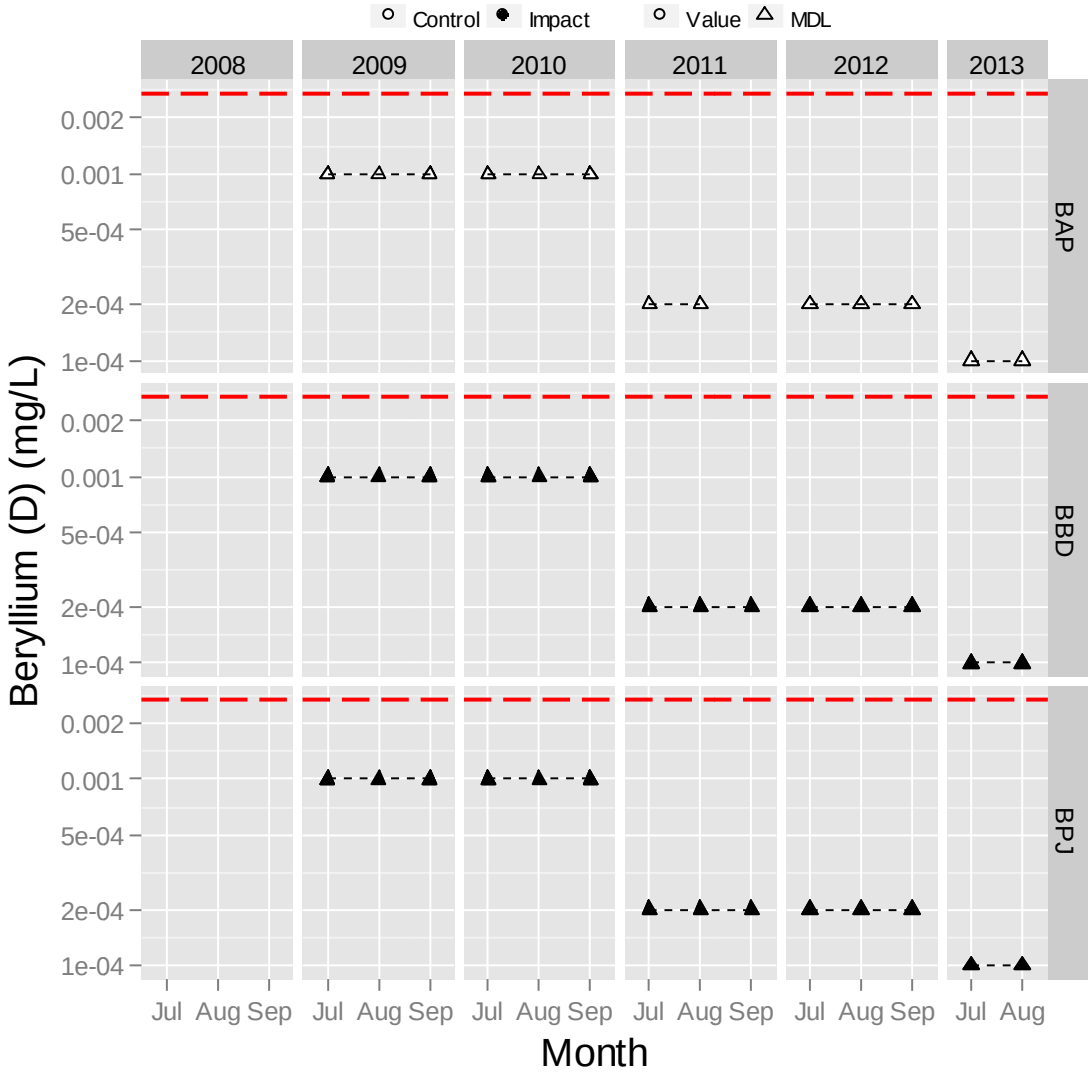

Control
Impact
Value
MDL
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
Thallium (T) (mg/L)
2e-04
1e-04
5e-05
2e-05
1e-05
Jul
Aug
Sep
Month

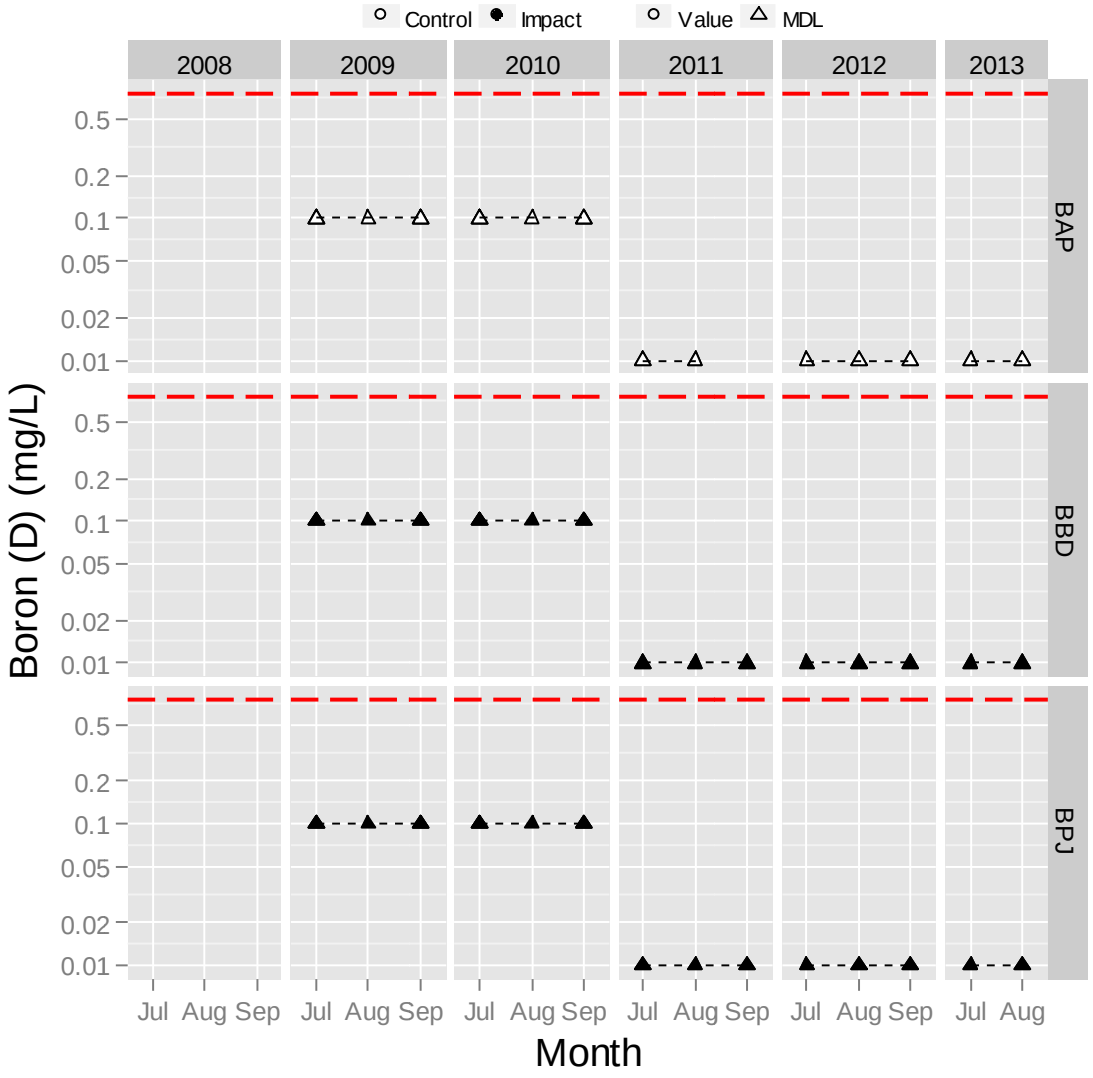

Control
Impact
Value
MDL
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
0.001
5e-04
2e-04
1e-04
Tin (T) (mg/L)
Jul
Aug
Sep
Month

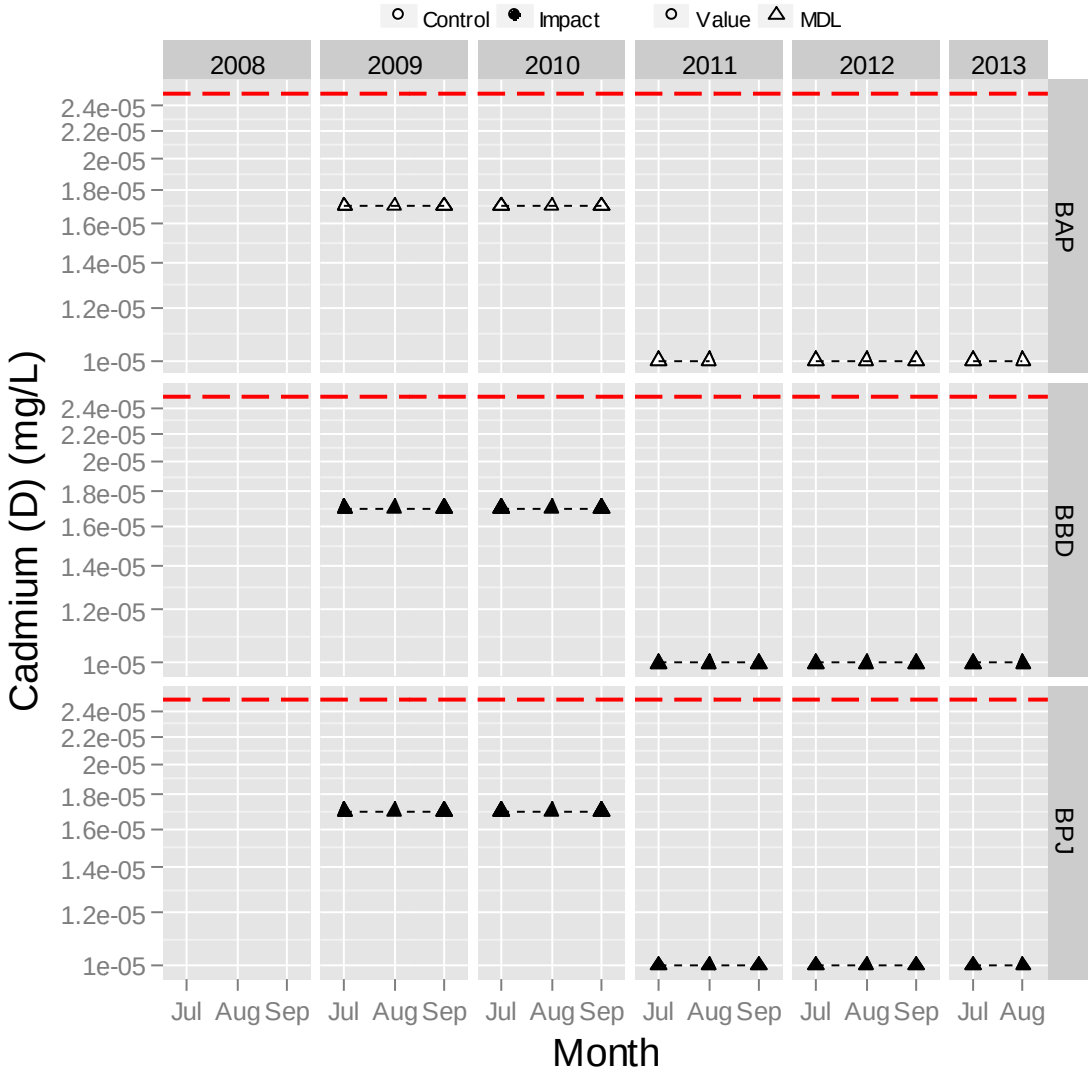

Control
Impact
Value
MDL
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
0.002
0.001
5e-04
2e-04
Vanadium (T) (mg/L)
Jul
Aug
Sep
Month

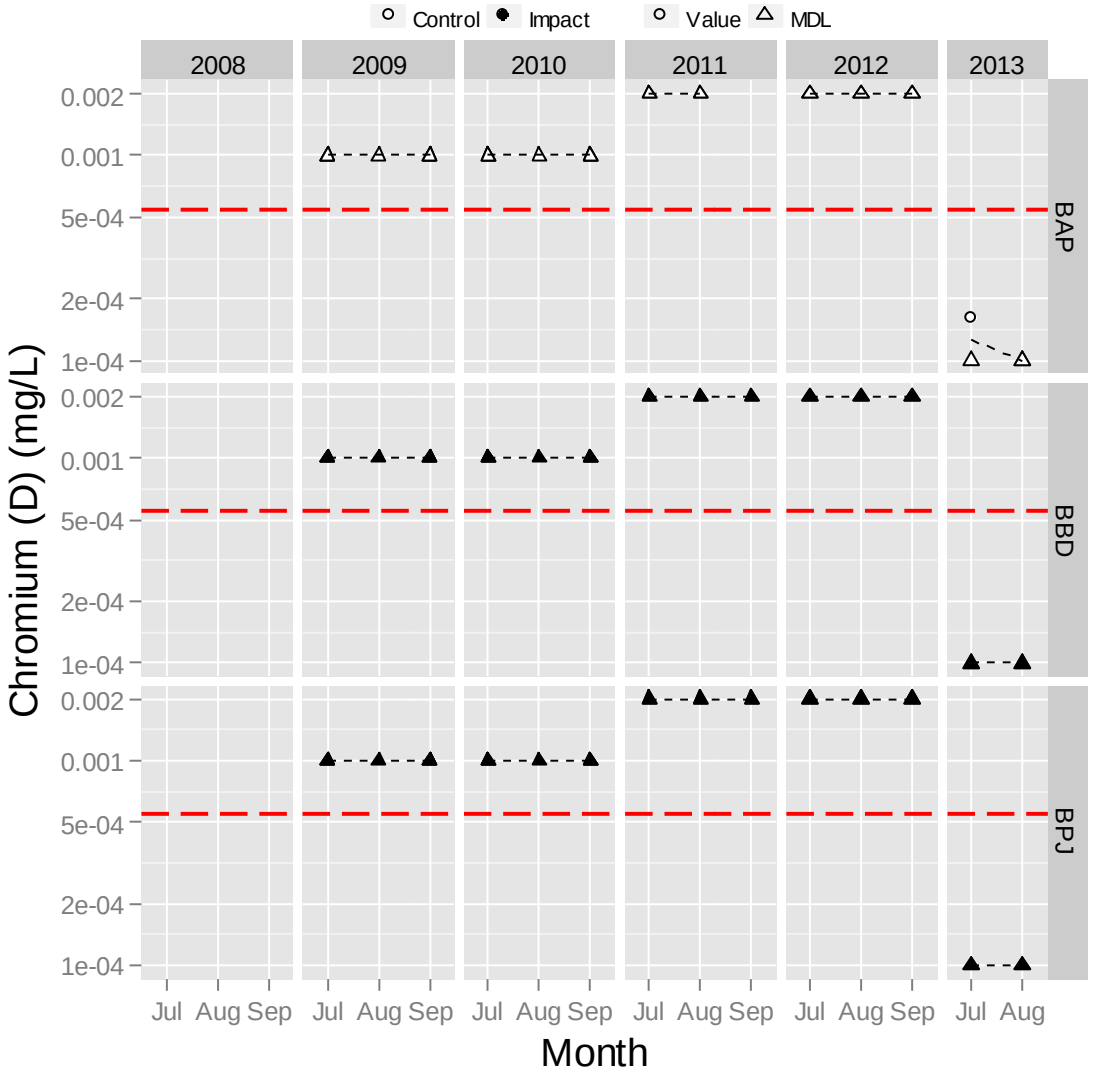

Control
Impact
Value
MDL
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
Zinc (T) (mg/L)
0.014
0.012
0.01
0.008
0.006
0.004
0.002
Jul
Aug
Sep
Month

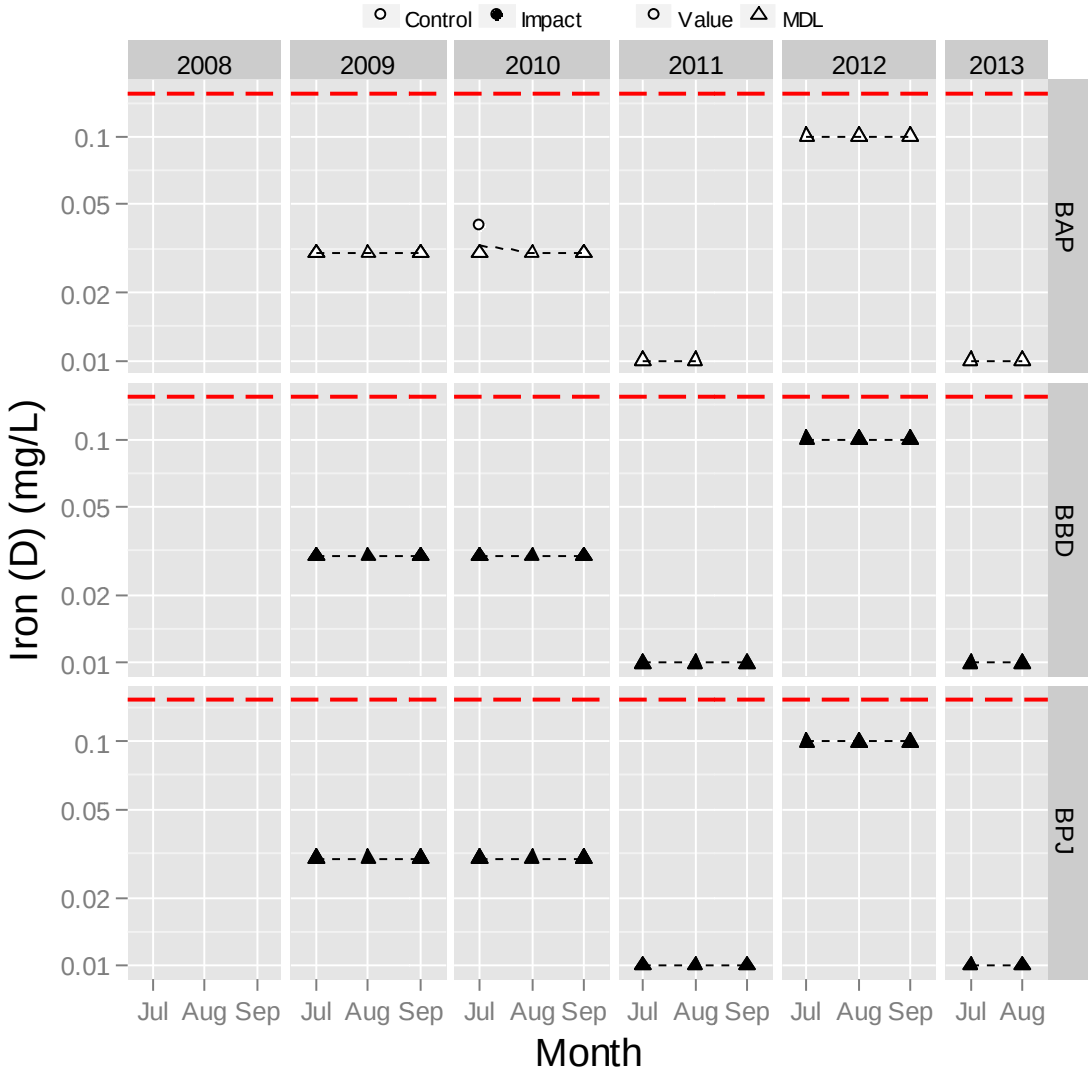

Control
Impact
Value
MDL
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
Antimony (D) (mg/L)
0.01
0.005
0.002
0.001
5e-04
2e-04
1e-04
Jul
Aug
Sep
Month

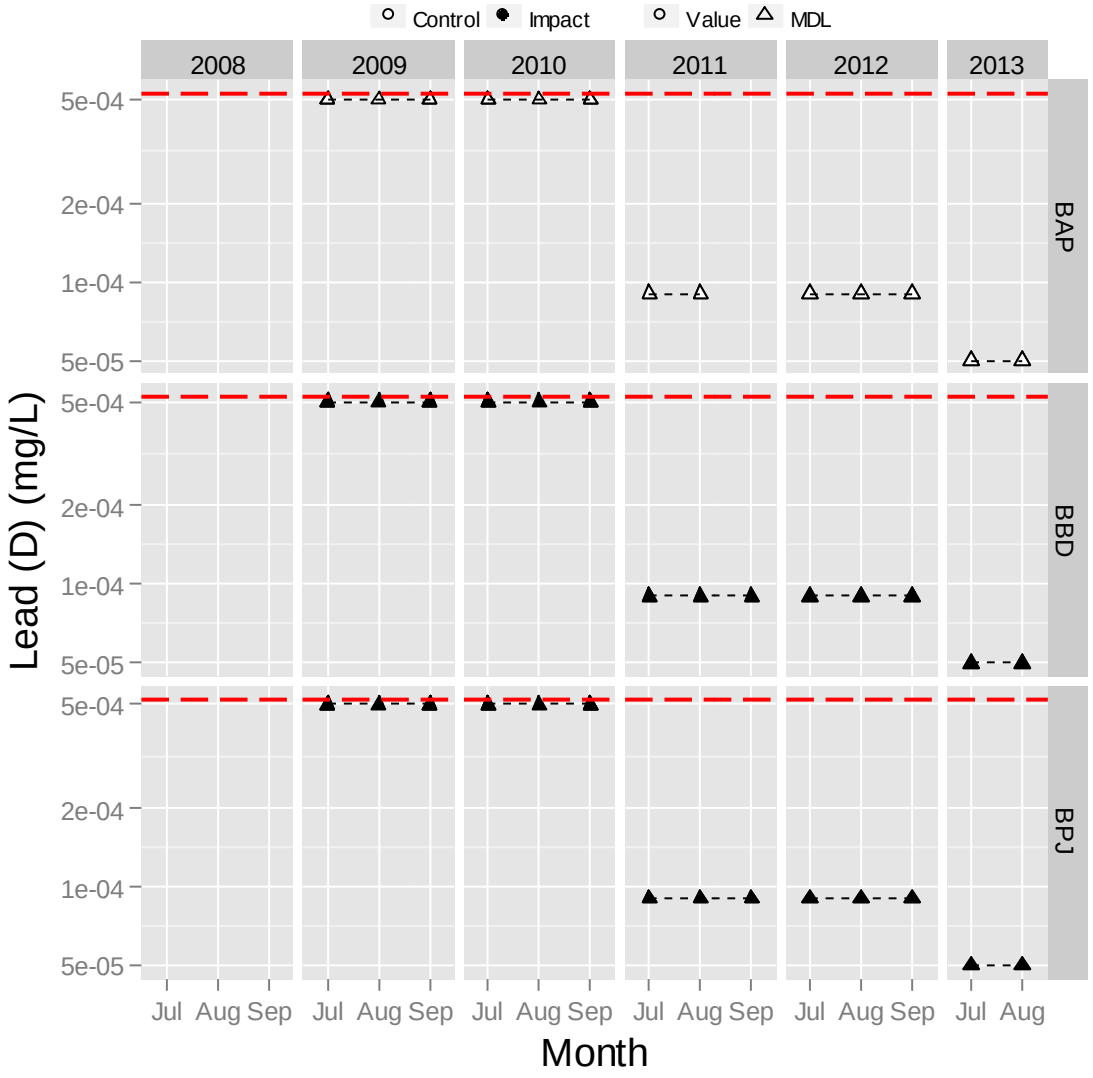

Control
Impact
Value
MDL
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
Beryllium (D) (mg/L)
0.002
0.001
5e-04
2e-04
1e-04
Jul
Aug
Sep
Month

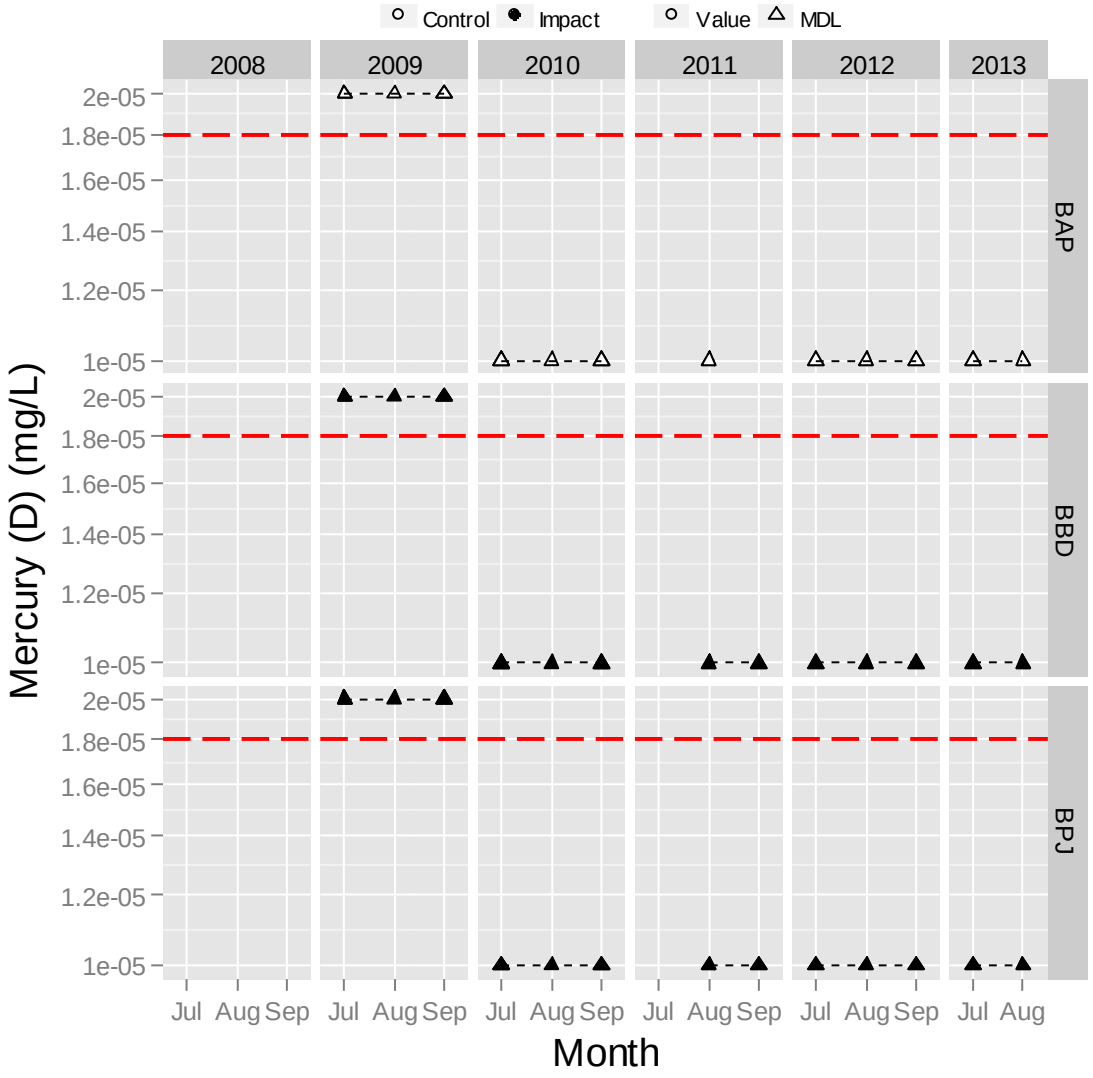

Control
Impact
Value
MDL
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
Boron (D) (mg/L)
0.5
0.2
0.1
0.05
0.02
0.01
Jul
Aug
Sep
Month

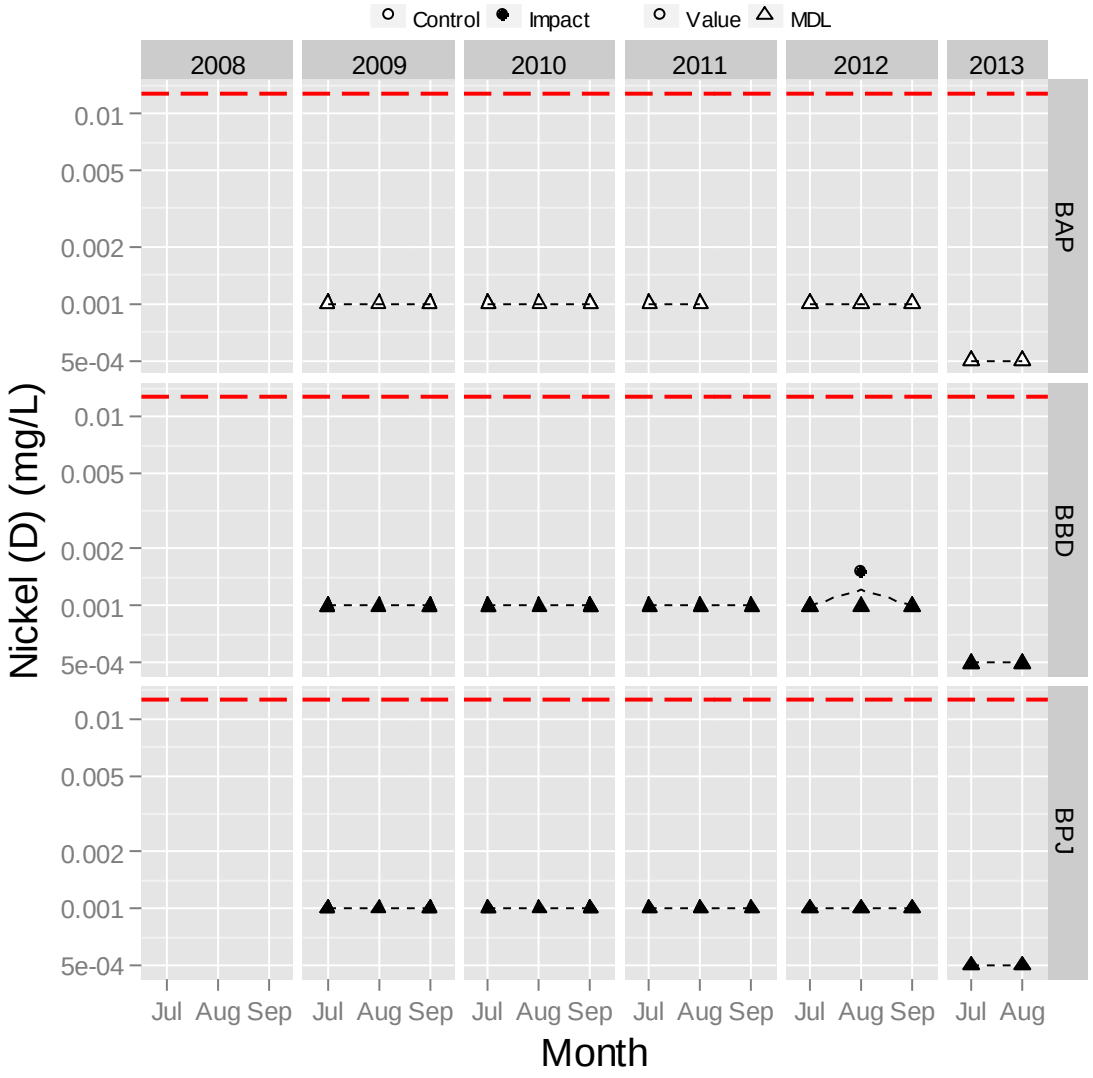

Control
Impact
Value
MDL
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
Cadmium (D) (mg/L)
2.4e-05
2.2e-05
2e-05
1.8e-05
1.6e-05
1.4e-05
1.2e-05
1e-05
Jul
Aug
Sep
Month

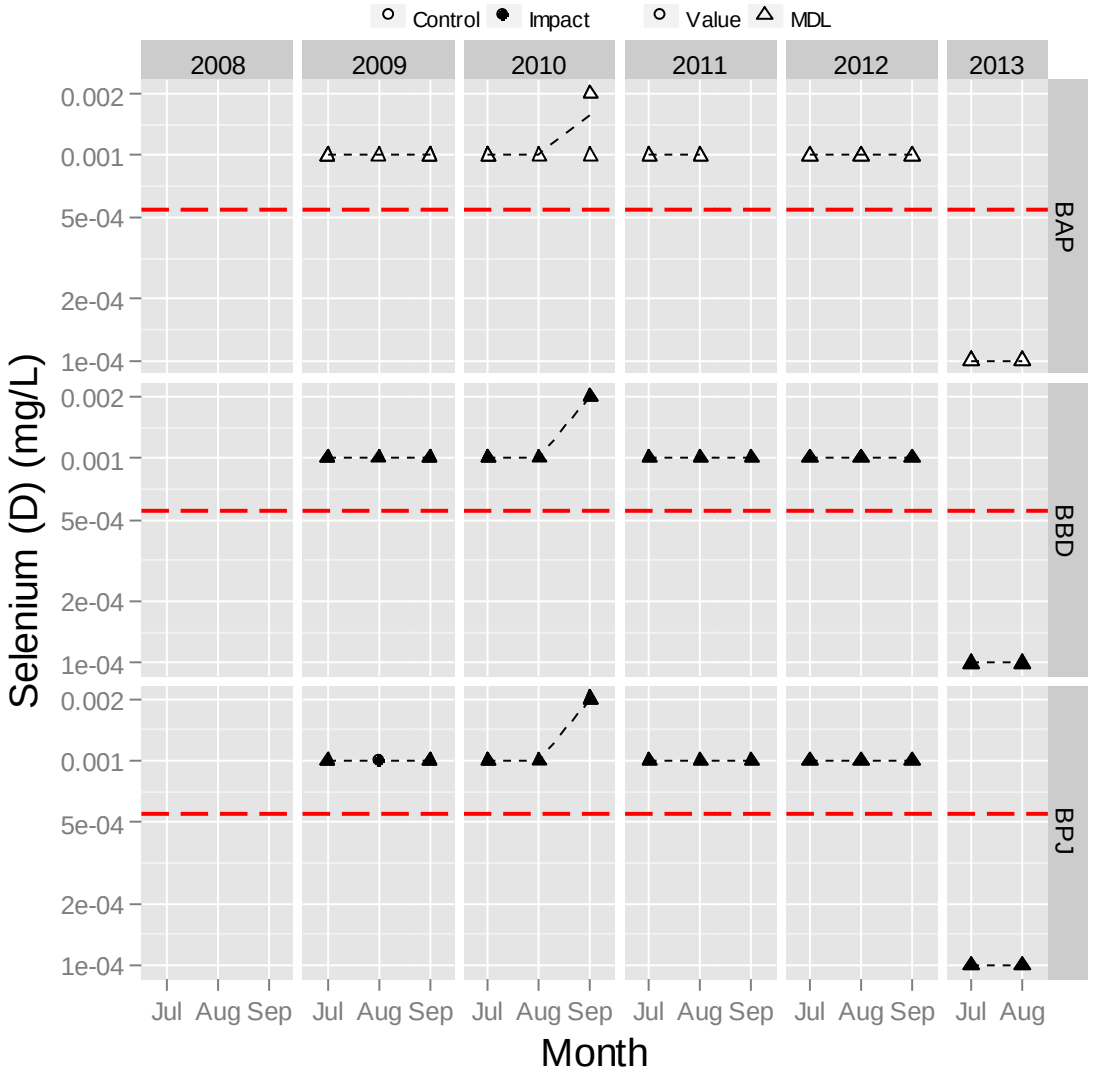

Control
Impact
Value
MDL
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
0.002
0.001
5e-04
2e-04
1e-04
Chromium (D) (mg/L)
Jul
Aug
Sep
Month

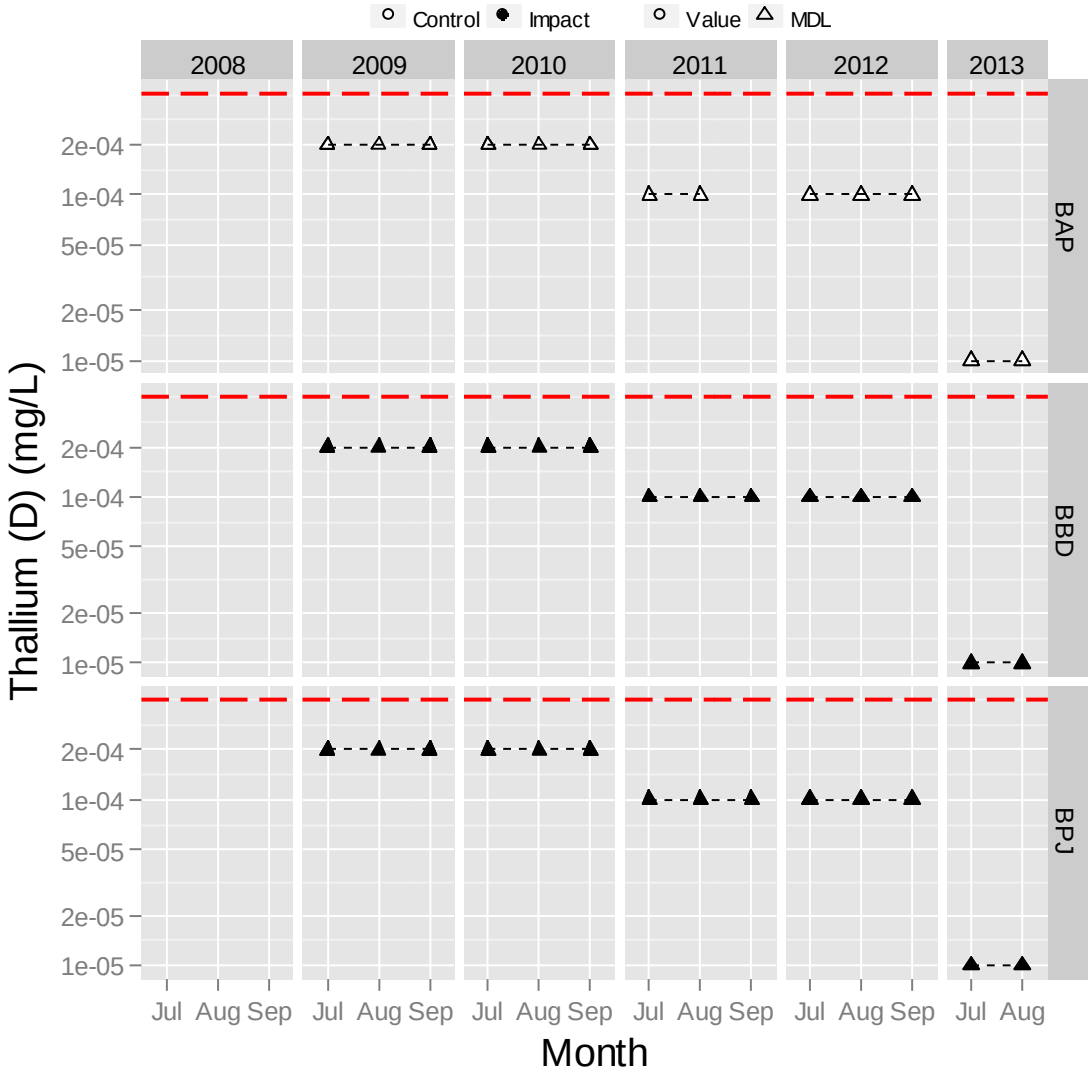

Control
Impact
Value
MDL
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
Iron (D) (mg/L)
0.1
0.05
0.02
0.01
Jul
Aug
Sep
Month

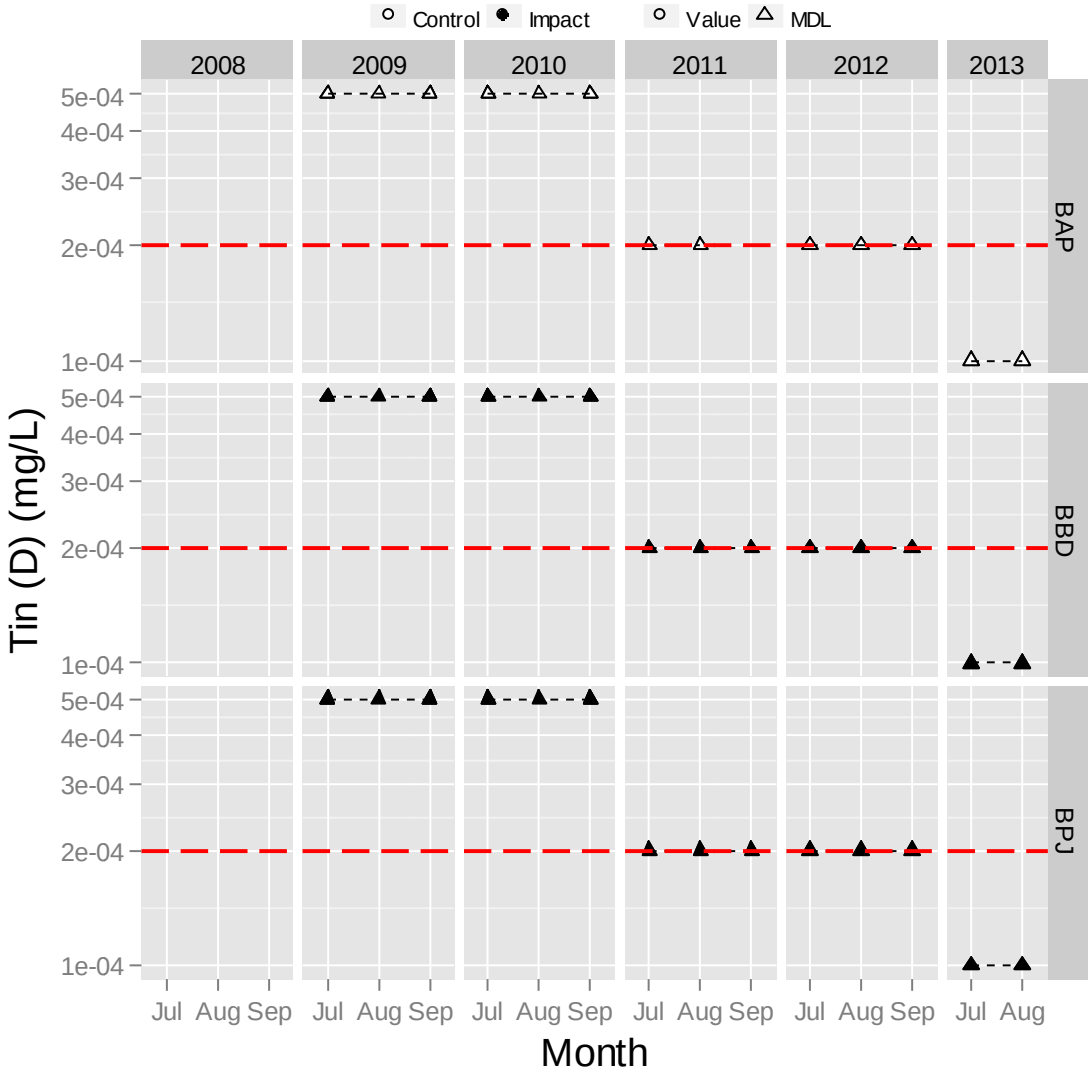

Control
Impact
Value
MDL
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
Lead (D) (mg/L)
5e-04
2e-04
1e-04
5e-05
Jul
Aug
Sep
Month

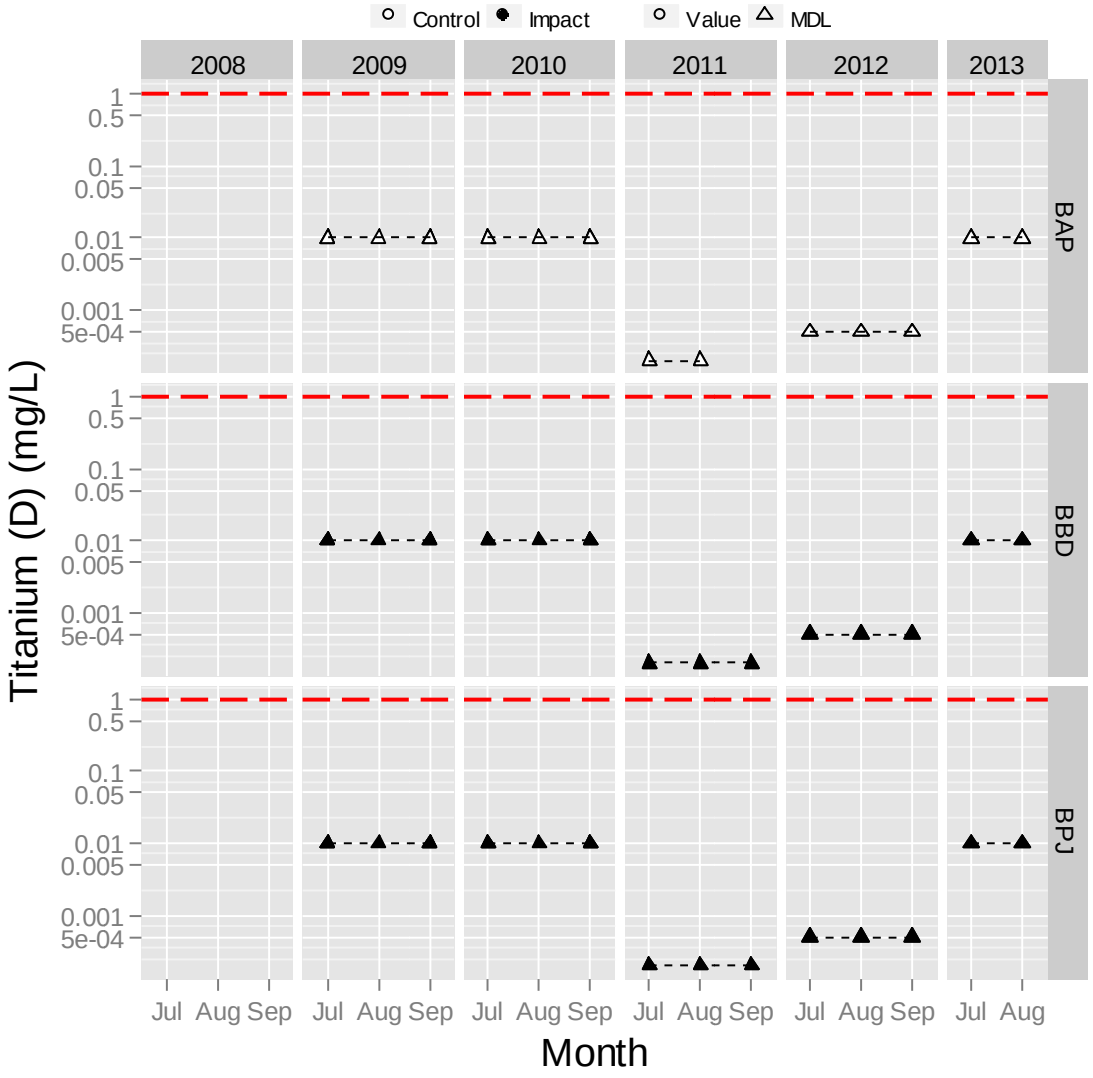

Control
Impact
Value
MDL
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
Mercury (D) (mg/L)
2e-05
1.8e-05
1.6e-05
1.4e-05
1.2e-05
1e-05
Jul
Aug
Sep
Month

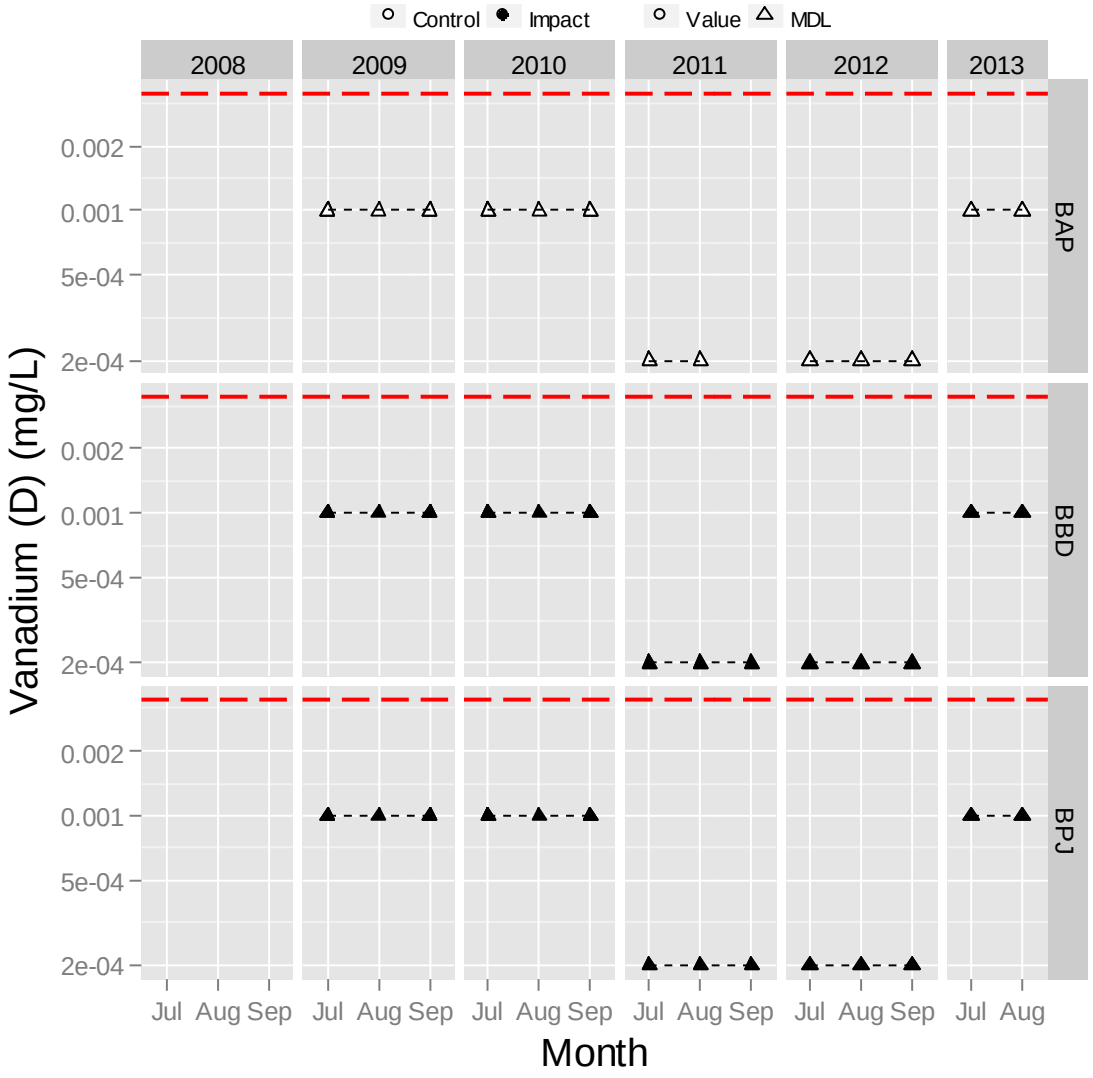

Control
Impact
Value
MDL
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
Nickel (D) (mg/L)
0.01
0.005
0.002
0.001
5e-04
Jul
Aug
Sep
Month

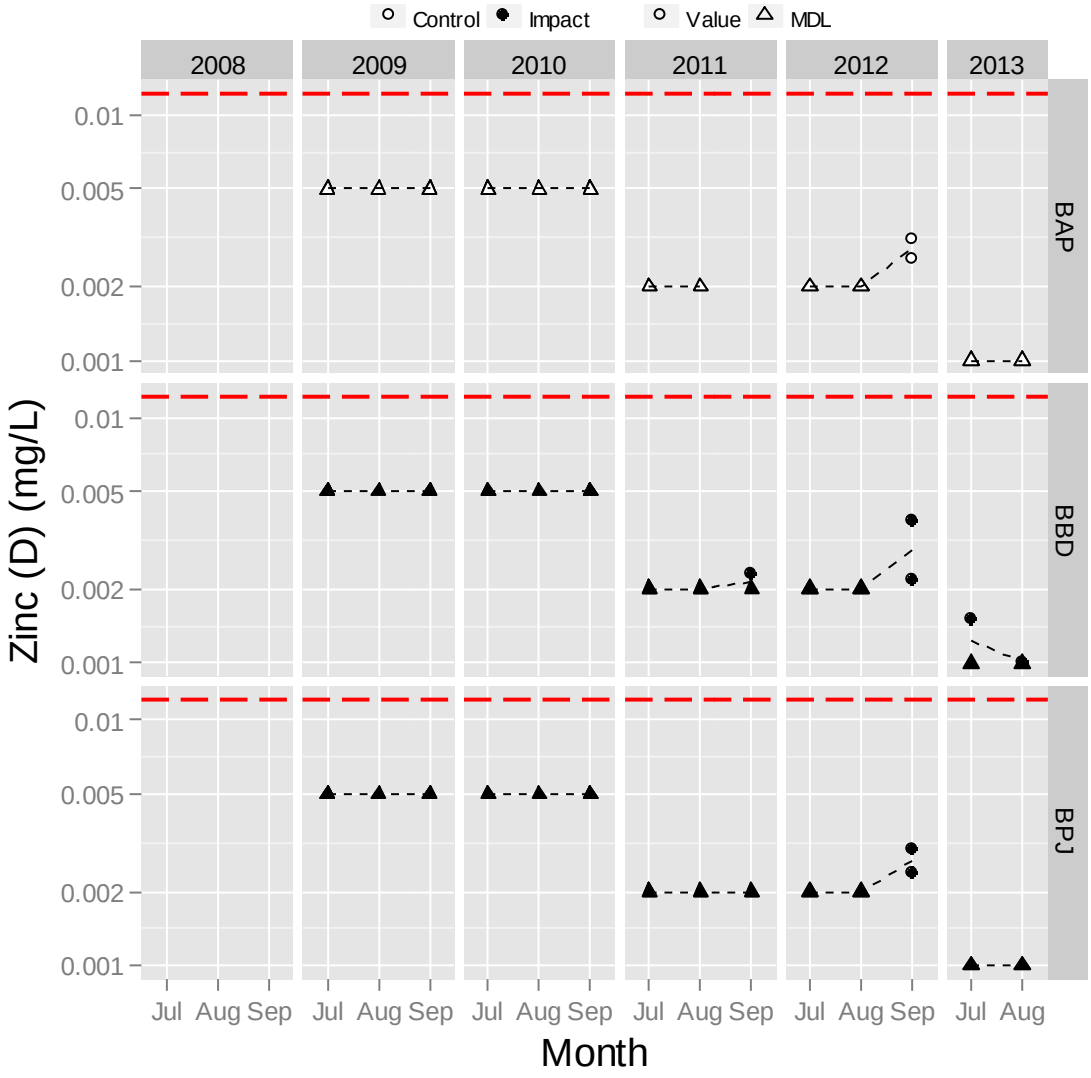

Control
Impact
Value
MDL
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
Selenium (D) (mg/L)
0.002
0.001
5e-04
2e-04
1e-04
Jul
Aug
Sep
Month


Control
Impact
Value
MDL
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
Thallium (D) (mg/L)
2e-04
1e-04
5e-05
2e-05
1e-05
Jul
Aug
Sep
Month


Control
Impact
Value
MDL
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
Tin (D) (mg/L)
5e-04
4e-04
3e-04
2e-04
1e-04
Jul
Aug
Sep
Month


Control
Impact
Value
MDL
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
Titanium (D) (mg/L)
1
0.5
0.1
0.05
0.01
0.005
0.001
5e-04
Jul
Aug
Sep
Month


Control
Impact
Value
MDL
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
0.002
0.001
5e-04
2e-04
Vanadium (D) (mg/L)
Jul
Aug
Sep
Month


Control
Impact
Value
MDL
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
Zinc (D) (mg/L)
0.01
0.005
0.002
0.001
Jul
Aug
Sep
Month

APPENDIX F

PRESENCE (+) / ABSENCE (-) MATRIX OF PHYTOPLANKTON SPECIES IN MEADOWBANK STUDY LAKES AND BAKER LAKE, 2013

Appendix F. Presence (+) / Absence (-) matrix of phytoplankton species in Meadowbank study lakes and Baker Lake, 2013.

		Baker Lake											
	Area-Replicate ID	BAP27	BAP28	BAP29	BAP30	BBD27	BBD28	BBD29	BBD30	BPJ27	BPJ28	BPJ29	BPJ30
Code	Species Name	20-Jul-13	20-Jul-13	30-Aug-13	30-Aug-13	20-Jul-13	20-Jul-13	30-Aug-13	30-Aug-13	20-Jul-13	20-Jul-13	30-Aug-13	30-Aug-13
	Cyanophyte												
1008	*Aphanocapsa* sp.	-	-	-	-	-	-	-	-	-	-	-	-
1012	*Aphanothece* sp.	-	-	-	-	-	-	-	-	-	-	-	-
1014	*Chroococcus limneticus* Lemmermann	-	-	-	-	-	-	-	-	-	-	-	-
1026	*Merismopedia tenuissima* Lemmermann	-	-	-	-	-	-	-	-	-	-	-	-
1051	*Oscillatoria lauterornii* Schmidle	-	-	-	-	-	-	-	-	-	-	-	-
1054	*Planktolyngbya limnetica*	-	-	-	-	-	+	+	-	-	-	-	-
1073	*Snowella* sp.	-	-	-	-	-	-	-	-	-	-	-	-
1089	*Cyanodictyon* sp.	-	-	-	-	-	-	-	-	-	-	-	-
1133	*Anabaena flos-aquae* (Lyngb.) Breb. & Bornet	-	-	-	-	+	-	-	-	-	-	-	-
	Chlorophyte												
2100	*Pyramidomonas tetrarhynchus* Schmarda	-	-	-	-	-	-	-	-	-	-	-	-
2101	*Carteria* sp.	-	-	-	-	-	-	-	-	-	-	-	-
2105	*Chlamydomonas* sp.	-	+	+	+	+	+	+	+	-	+	-	+
2107	*Chlorogonium maximum* Skuja	-	-	-	-	-	-	-	-	-	-	-	-
2112	*Sphaerocystis schroeteri* Chodat	-	-	+	-	-	-	+	-	-	-	+	+
2121	*Oocystis lacustris* Chodat	-	+	+	+	-	-	+	+	-	-	+	+
2126	*Chodatella* sp.	-	-	-	-	+	-	-	-	-	-	-	-
2132	*Scenedesmus denticulatus* Lagerhiem	-	+	+	+	-	+	+	+	-	+	+	+
2137	*Dictyosphaerium simplex* Sukja	-	-	-	+	-	+	+	+	+	-	+	+
2138	*Monoraphidium komarkovae* (Nyg.) Komarkova-Legnerova	+	+	-	-	+	-	-	-	+	+	-	-
2145	*Crucigenia quadrata* Morr.	-	-	-	-	-	-	+	-	-	-	+	+
2152	*Coelastrum cambricum* Archer	-	-	-	-	-	-	-	-	-	-	-	-
2164	*Quadrigula closterioides* (Bohl.) Printz	-	-	-	-	-	-	-	-	-	-	-	-
2167	*Elakatothrix gelatinosa* Willen	-	-	+	+	-	-	+	-	-	-	-	+
2178	*Cosmarium* sp.	-	-	-	-	-	-	-	-	-	+	-	-
2182	*Euastrum* sp.	-	-	-	-	-	-	-	-	-	-	-	-
2186	*Xanthidium* sp.	-	-	-	-	-	-	-	-	-	-	-	-
2187	*Staurodesmus extensus* (Andersson) Teiling	-	-	+	-	-	-	-	+	-	-	-	-
2193	*Staurodesmus paradoxum* Meyen	-	-	-	-	-	-	-	-	-	-	-	-
2199	*Spondylosium planum* (Wolle) W. and G.S. West	-	-	+	-	-	-	-	-	-	-	+	-
2205	*Mougeotia* sp.	-	-	-	-	+	-	-	-	-	-	-	-
2206	*Botryococcus braunii* Kutzing	+	-	-	-	-	-	-	+	+	-	-	+
2212	*Schroederia setigera* (Schrod.) Lemmermann	-	-	-	-	-	-	-	-	-	-	-	-
2215	*Tetraedron caudatum* (Corda) Hansgrig	+	+	+	+	-	+	+	+	-	+	+	-
2222	*Treubaria* sp.	-	-	-	-	-	-	-	-	-	-	-	-
2235	*Ankistrodesmus spiralis* Lemmermann	+	-	+	+	+	+	+	+	+	-	+	+
	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	*Spinifiromonas sirratus*	+	-	+	-	-	-	-	-	-	-	-	-
4364	*Mallomonas caudata* Ivanov	-	-	-	-	-	-	-	-	-	-	-	-
4367	*Mallomonas duerrschmidtiae* Siver, Hamer and Kling	-	-	-	-	-	-	-	-	-	-	-	-
4368	*Mallomonas crassisquama* (Asmund) Fott	+	+	+	-	-	+	-	+	+	+	-	+
4370	*Mallomonas akrokomos* Asmund and Kristiansen	-	-	-	-	-	-	-	-	-	-	-	-

Appendix F. Presence (+) / Absence (-) matrix of phytoplankton species in Meadowbank study lakes and Baker Lake, 2013.

						Baker Lake							
	Area-Replicate ID	BAP27	BAP28	BAP29	BAP30	BBD27	BBD28	BBD29	BBD30	BPJ27	BPJ28	BPJ29	BPJ30
Code	Species Name	20-Jul-13	20-Jul-13	30-Aug-13	30-Aug-13	20-Jul-13	20-Jul-13	30-Aug-13	30-Aug-13	20-Jul-13	20-Jul-13	30-Aug-13	30-Aug-13
4378	*Dinobryon borgei* Lemmermann	-	+	-	+	+	+	+	-	+	+	-	+
4381	*Dinobryon mucronutom* Nygaard	-	-	+	-	-	-	+	+	-	-	-	-
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* sp.	-	-	-	-	-	-	-	-	-	-	-	-
4418	*Salpingoeca frequentissima* (Zach.) Lemmermann	+	+	+	+	+	+	+	+	+	+	+	+
4431	*Synura petersenii* Korschikow	-	-	-	-	-	-	-	-	-	-	-	-
4436	*Dinobryon attenatum* Hill	-	-	+	-	-	-	-	-	+	+	-	-
4437	*Pteridomonas* sp.	-	-	-	-	-	-	-	-	-	-	-	-
	Diatom												
5507	*Cyclotella stelligera* Cleve and Grunow	+	+	+	+	+	+	+	+	+	-	+	+
5509	*Cyclotella ocellata* Pant.	+	+	+	+	+	+	+	+	-	-	+	+
5511	*Rhizosolenia eriense* H.L. Smith	+	+	+	+	+	+	+	+	+	+	+	-
5513	*Tabellaria fenestrata* (Lyngbye) Kutzing	-	-	+	+	+	-	-	-	-	+	-	+
5514	*Tabellaria flocculsa* (Roth) Kutzing	-	-	+	-	+	-	+	+	-	+	-	-
5518	*Synedra acus* Kutzing	+	+	+	+	+	+	+	+	+	+	+	+
5524	*Asterionella formosa* Hassall	+	+	+	+	+	+	+	+	+	+	+	+
5540	*Aulacoseira italica* v subarctica (O. Muller) Simonsen	+	+	+	+	+	+	+	+	+	+	+	+
5551	*Cyclotella michiganiana* Skvortzow	+	+	+	+	+	+	+	+	+	+	+	+
5720	*Cyclotella bodanica* Eulenst.	-	-	-	-	-	-	-	-	-	-	-	-
	Cryptophyte												
6554	*Rhodomonas minuta* Skuja	+	+	+	+	+	+	+	+	+	+	+	+
6558	*Cryptomonas erosa* Ehrenberg	+	+	+	+	+	+	+	+	+	+	+	+
6559	*Cryptomonas ovata* Ehrenberg	-	-	-	-	-	-	-	-	-	-	-	-
6562	*Cryptomonas reflexa* (Marsson) Skuja	-	+	-	-	+	+	-	-	+	+	-	-
6565	*Cryptomonas rostratiformis* Skuja	-	+	+	+	+	+	+	+	-	-	+	+
6568	*Katablepharis ovalis* Skuja	+	+	+	+	+	+	+	+	+	+	+	+
	Dinoflagellate												
7631	*Gymnodinium helveticum* Penard	-	+	-	-	+	-	-	-	-	-	-	-
7632	*Gymnodinium* sp.	+	+	-	+	+	+	-	-	+	+	+	-
7635	*Peridinium willei* Huitfeldt-Kaas	-	-	-	-	-	+	-	-	-	-	-	-
7639	*Peridinium pusillum* (Penard) Lemmermann	+	+	+	+	+	+	+	+	+	+	+	+
7641	*Peridinium aciculiferum* Lemmermann	+	+	+	+	+	+	-	+	+	+	-	-

Appendix F. Presence (+) / Absence (-) matrix of phytoplankton species in Meadowbank study lakes and Baker Lake, 2013.

		Innugugayualik Lake								Pipedream Lake			
	Area-Replicate ID	INUG48	INUG49	INUG50	INUG51	INUG54	INUG55	INUG56	INUG57	PDL27	PDL28	PDL29	PDL30
Code	Species Name	16-Jul-13	16-Jul-13	23-Aug-13	23-Aug-13	30-Nov-13	30-Nov-13	19-Dec-13	19-Dec-13	16-Jul-13	16-Jul-13	23-Aug-13	23-Aug-13
	Cyanophyte												
1008	*Aphanocapsa* sp.	-	-	-	-	-	-	-	-	-	-	-	-
1012	*Aphanothece* sp.	-	-	+	+	-	-	-	-	-	-	-	-
1014	*Chroococcus limneticus* Lemmermann	-	-	+	-	-	-	+	-	-	-	-	-
1026	*Merismopedia tenuissima* Lemmermann	-	-	-	-	-	-	-	-	-	-	-	-
1051	*Oscillatoria lauterornii* Schmidle	-	-	-	-	-	-	-	-	-	-	-	-
1054	*Planktolyngbya limnetica*	-	-	+	+	-	-	-	-	+	+	+	+
1073	*Snowella* sp.	-	-	-	-	-	-	-	-	-	-	+	-
1089	*Cyanodictyon* sp.	-	-	-	-	+	+	-	-	-	-	-	-
1133	*Anabaena flos-aquae* (Lyngb.) Breb. & Bornet	-	-	-	-	-	-	-	-	-	-	-	-
	Chlorophyte												
2100	*Pyramidomonas tetrarhynchus* Schmarda	-	-	+	+	-	-	-	-	-	-	-	-
2101	*Carteria* sp.	-	-	-	-	-	-	-	-	-	-	-	-
2105	*Chlamydomonas* sp.	+	+	-	+	-	-	-	-	+	+	-	-
2107	*Chlorogonium maximum* Skuja	-	-	-	-	-	-	-	-	-	-	-	-
2112	*Sphaerocystis schroeteri* Chodat	-	-	+	+	+	+	-	+	-	-	+	+
2121	*Oocystis lacustris* Chodat	+	+	+	+	-	-	-	-	+	+	+	+
2126	*Chodatella* sp.	-	-	-	-	-	-	-	-	-	-	-	-
2132	*Scenedesmus denticulatus* Lagerhiem	-	-	-	-	-	-	-	-	-	-	-	+
2137	*Dictyosphaerium simplex* Sukja	+	-	+	+	-	+	+	-	+	+	+	+
2138	*Monoraphidium komarkovae* (Nyg.) Komarkova-Legnerova	+	-	-	-	-	-	-	-	-	-	-	-
2145	*Crucigenia quadrata* Morr.	-	-	-	-	-	-	-	-	-	-	-	-
2152	*Coelastrum cambricum* Archer	-	-	-	-	-	-	-	-	-	-	-	-
2164	*Quadrigula closterioides* (Bohl.) Printz	-	-	-	-	-	-	-	-	-	-	-	-
2167	*Elakatothrix gelatinosa* Willen	+	-	+	+	-	-	-	+	-	-	+	+
2178	*Cosmarium* sp.	-	-	-	-	-	-	-	-	-	-	-	-
2182	*Euastrum* sp.	+	-	+	+	-	-	-	-	-	-	-	-
2186	*Xanthidium* sp.	-	-	-	-	-	-	-	-	-	+	-	-
2187	*Staurodesmus extensus* (Andersson) Teiling	-	-	+	+	-	-	+	-	-	-	+	+
2193	*Staurodesmus paradoxum* Meyen	-	-	-	-	-	-	-	-	-	-	-	-
2199	*Spondylosium planum* (Wolle) W. and G.S. West	+	+	+	-	-	-	-	-	+	+	-	-
2205	*Mougeotia* sp.	-	-	+	-	-	-	-	-	-	-	-	-
2206	*Botryococcus braunii* Kutzing	+	+	+	+	-	-	+	-	+	+	+	+
2212	*Schroederia setigera* (Schrod.) Lemmermann	-	-	-	-	-	-	-	-	-	-	-	-
2215	*Tetraedron caudatum* (Corda) Hansgrig	-	-	-	+	-	-	-	-	-	-	+	+
2222	*Treubaria* sp.	-	+	-	-	-	-	-	-	-	-	-	-
2235	*Ankistrodesmus spiralis* Lemmermann	-	-	+	+	+	-	-	+	+	+	+	+
	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	*Spinifiromonas sirratus*	+	-	-	-	-	-	-	-	-	-	+	-
4364	*Mallomonas caudata* Ivanov	-	-	-	-	-	-	-	-	-	-	-	-
4367	*Mallomonas duerrschmidtiae* Siver, Hamer and Kling	-	-	-	+	-	-	-	-	-	-	-	-
4368	*Mallomonas crassisquama* (Asmund) Fott	+	+	-	+	+	-	-	-	-	-	-	-
4370	*Mallomonas akrokomos* Asmund and Kristiansen	-	-	-	+	-	-	-	-	-	-	-	-

Appendix F. Presence (+) / Absence (-) matrix of phytoplankton species in Meadowbank study lakes and Baker Lake, 2013.

		Innugugayualik Lake								Pipedream Lake			
	Area-Replicate ID	INUG48	INUG49	INUG50	INUG51	INUG54	INUG55	INUG56	INUG57	PDL27	PDL28	PDL29	PDL30
Code	Species Name	16-Jul-13	16-Jul-13	23-Aug-13	23-Aug-13	30-Nov-13	30-Nov-13	19-Dec-13	19-Dec-13	16-Jul-13	16-Jul-13	23-Aug-13	23-Aug-13
4378	*Dinobryon borgei* Lemmermann	+	+	+	-	-	-	+	-	+	+	+	-
4381	*Dinobryon mucronutom* Nygaard	+	+	+	+	-	-	-	-	+	+	+	+
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* sp.	+	+	+	+	-	-	-	-	+	-	+	+
4418	*Salpingoeca frequentissima* (Zach.) Lemmermann	+	+	+	+	+	+	+	+	-	-	-	+
4431	*Synura petersenii* Korschikow	-	-	-	-	-	-	-	-	-	-	-	-
4436	*Dinobryon attenatum* Hill	-	-	-	-	-	-	-	-	-	-	-	-
4437	*Pteridomonas* sp.	-	-	-	-	-	-	-	-	-	-	-	-
	Diatom												
5507	*Cyclotella stelligera* Cleve and Grunow	+	+	+	+	+	+	+	+	+	+	+	+
5509	*Cyclotella ocellata* Pant.	+	+	-	+	+	+	-	+	+	+	+	+
5511	*Rhizosolenia eriense* H.L. Smith	+	+	+	+	-	-	+	-	+	+	+	+
5513	*Tabellaria fenestrata* (Lyngbye) Kutzing	-	-	-	+	-	-	-	-	-	-	-	-
5514	*Tabellaria flocculsa* (Roth) Kutzing	-	-	-	-	-	+	-	-	-	+	-	+
5518	*Synedra acus* Kutzing	+	+	+	+	+	+	+	+	+	+	+	+
5524	*Asterionella formosa* Hassall	-	-	-	-	-	-	-	-	-	-	-	-
5540	*Aulacoseira italica* v subarctica (O. Muller) Simonsen	-	-	+	-	-	-	-	-	-	-	-	-
5551	*Cyclotella michiganiana* Skvortzow	+	+	+	+	+	+	+	+	+	+	+	+
5720	*Cyclotella bodanica* Eulenst.	-	-	-	-	-	+	-	-	-	-	-	+
	Cryptophyte												
6554	*Rhodomonas minuta* Skuja	+	+	+	+	+	+	+	+	+	+	+	+
6558	*Cryptomonas erosa* Ehrenberg	+	+	+	+	+	+	+	+	+	+	+	-
6559	*Cryptomonas ovata* Ehrenberg	-	-	-	-	-	-	-	-	-	-	-	+
6562	*Cryptomonas reflexa* (Marsson) Skuja	+	+	-	-	-	-	-	-	-	-	+	+
6565	*Cryptomonas rostratiformis* Skuja	+	+	-	-	+	-	-	-	-	-	+	+
6568	*Katablepharis ovalis* Skuja	+	+	+	+	-	-	+	+	-	+	+	+
	Dinoflagellate												
7631	*Gymnodinium helveticum* Penard	-	-	-	-	-	-	-	-	+	+	+	-
7632	*Gymnodinium* sp.	+	+	+	+	-	+	+	-	+	+	+	+
7635	*Peridinium willei* Huitfeldt-Kaas	-	-	-	-	-	-	-	-	+	-	-	-
7639	*Peridinium pusillum* (Penard) Lemmermann	+	+	+	+	+	-	-	+	-	-	+	+
7641	*Peridinium aciculiferum* Lemmermann	+	+	-	-	-	-	-	-	+	+	-	-

Appendix F. Presence (+) / Absence (-) matrix of phytoplankton species in Meadowbank study lakes and Baker Lake, 2013.

			Second Portage Lake											
		Area-Replicate ID	SP58	SP59	SP60	SP61	SP62	SP63	SP64	SP65	SP66	SP67	SP68	SP69
Code	Species Name		19-Apr-13	19-Apr-13	19-Jul-13	19-Jul-13	25-Aug-13	25-Aug-13	18-Sep-13	18-Sep-13	24-Nov-13	24-Nov-13	8-Dec-13	8-Dec-13
	Cyanophyte													
1008	*Aphanocapsa* sp.		+	+	-	-	-	-	-	-	-	-	-	-
1012	*Aphanothece* sp.		-	-	-	-	+	-	-	-	-	-	-	-
1014	*Chroococcus limneticus* Lemmermann		-	-	-	-	+	+	-	-	-	-	-	-
1026	*Merismopedia tenuissima* Lemmermann		-	-	-	-	-	-	-	-	-	-	-	-
1051	*Oscillatoria lauterornii* Schmidle		-	-	-	-	-	-	-	-	-	-	-	-
1054	*Planktolyngbya limnetica*		-	+	+	+	+	+	+	+	-	-	+	-
1073	*Snowella* sp.		-	-	-	-	-	-	-	-	-	-	-	-
1089	*Cyanodictyon* sp.		-	-	-	-	-	-	-	-	-	-	-	-
1133	*Anabaena flos-aquae* (Lyngb.) Breb. & Bornet		-	-	-	-	-	-	-	-	-	-	-	-
	Chlorophyte													
2100	*Pyramidomonas tetrarhynchus* Schmarda		-	+	-	-	-	-	-	-	-	-	-	-
2101	*Carteria* sp.		-	-	-	-	-	-	-	-	-	-	-	+
2105	*Chlamydomonas* sp.		-	-	-	+	+	-	+	+	-	-	-	+
2107	*Chlorogonium maximum* Skuja		-	-	-	-	-	-	-	-	-	-	-	-
2112	*Sphaerocystis schroeteri* Chodat		-	-	-	-	+	-	-	-	-	-	-	-
2121	*Oocystis lacustris* Chodat		+	-	+	+	+	+	+	+	+	-	-	-
2126	*Chodatella* sp.		-	-	-	-	-	-	-	-	-	-	-	-
2132	*Scenedesmus denticulatus* Lagerhiem		-	-	-	-	-	-	-	-	-	-	-	-
2137	*Dictyosphaerium simplex* Sukja		-	-	+	+	+	+	-	-	+	-	+	+
2138	*Monoraphidium komarkovae* (Nyg.) Komarkova-Legnerova		-	-	-	-	-	-	-	-	-	-	+	+
2145	*Crucigenia quadrata* Morr.		-	-	-	-	-	-	-	+	-	-	-	-
2152	*Coelastrum cambricum* Archer		-	-	-	-	-	-	-	-	-	-	-	-
2164	*Quadrigula closterioides* (Bohl.) Printz		-	-	-	-	+	-	-	-	-	-	-	-
2167	*Elakatothrix gelatinosa* Willen		-	-	+	+	+	-	+	+	+	+	+	-
2178	*Cosmarium* sp.		-	-	-	-	-	-	-	-	-	-	-	-
2182	*Euastrum* sp.		-	-	-	-	-	-	-	-	-	-	-	-
2186	*Xanthidium* sp.		-	-	-	-	-	-	-	-	-	-	-	-
2187	*Staurodesmus extensus* (Andersson) Teiling		-	-	+	+	-	+	+	+	-	-	-	-
2193	*Staurodesmus paradoxum* Meyen		-	-	-	-	-	-	-	-	-	-	-	-
2199	*Spondylosium planum* (Wolle) W. and G.S. West		-	-	-	-	-	-	-	-	-	-	-	-
2205	*Mougeotia* sp.		-	-	-	-	-	-	-	-	-	-	-	-
2206	*Botryococcus braunii* Kutzing		+	+	-	-	+	-	+	-	+	+	-	-
2212	*Schroederia setigera* (Schrod.) Lemmermann		-	-	-	-	-	-	+	-	-	-	-	-
2215	*Tetraedron caudatum* (Corda) Hansgrig		-	-	+	+	+	+	+	+	-	-	-	-
2222	*Treubaria* sp.		-	-	-	-	-	-	-	-	-	-	-	-
2235	*Ankistrodesmus spiralis* Lemmermann		+	+	+	+	+	+	+	+	-	-	-	-
	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	*Spinifiromonas sirratus*		-	-	+	-	+	-	+	+	-	-	-	-
4364	*Mallomonas caudata* Ivanov		-	-	-	-	-	-	-	-	-	-	-	-
4367	*Mallomonas duerrschmidtiae* Siver, Hamer and Kling		-	-	-	-	-	-	-	-	-	-	-	-
4368	*Mallomonas crassisquama* (Asmund) Fott		+	+	+	-	-	-	+	-	-	-	-	-
4370	*Mallomonas akrokomos* Asmund and Kristiansen		-	-	-	-	-	-	-	+	-	-	-	-

Appendix F. Presence (+) / Absence (-) matrix of phytoplankton species in Meadowbank study lakes and Baker Lake, 2013.

		Second Portage Lake											
	Area-Replicate ID	SP58	SP59	SP60	SP61	SP62	SP63	SP64	SP65	SP66	SP67	SP68	SP69
Code	Species Name	19-Apr-13	19-Apr-13	19-Jul-13	19-Jul-13	25-Aug-13	25-Aug-13	18-Sep-13	18-Sep-13	24-Nov-13	24-Nov-13	8-Dec-13	8-Dec-13
4378	*Dinobryon borgei* Lemmermann	-	-	+	+	-	+	+	-	-	-	-	-
4381	*Dinobryon mucronutom* Nygaard	-	-	+	+	-	+	+	+	+	-	+	-
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* sp.	-	-	-	-	-	+	+	+	+	+	-	-
4418	*Salpingoeca frequentissima* (Zach.) Lemmermann	+	+	-	-	+	-	+	+	-	-	+	+
4431	*Synura petersenii* Korschikow	-	+	-	-	-	-	-	-	-	-	-	-
4436	*Dinobryon attenatum* Hill	-	-	-	-	-	-	-	-	-	-	-	-
4437	*Pteridomonas* sp.	-	-	-	-	-	-	-	-	-	-	-	-
	Diatom												
5507	*Cyclotella stelligera* Cleve and Grunow	+	+	+	+	+	+	+	+	+	+	+	+
5509	*Cyclotella ocellata* Pant.	-	-	+	+	+	+	+	+	-	-	+	-
5511	*Rhizosolenia eriense* H.L. Smith	+	-	+	+	+	+	-	+	-	+	+	+
5513	*Tabellaria fenestrata* (Lyngbye) Kutzing	-	-	-	-	-	-	-	-	-	-	-	-
5514	*Tabellaria flocculsa* (Roth) Kutzing	-	-	-	-	-	+	+	-	-	-	-	-
5518	*Synedra acus* Kutzing	+	+	+	+	+	+	+	+	+	+	+	+
5524	*Asterionella formosa* Hassall	-	-	-	-	+	-	-	-	-	-	-	-
5540	*Aulacoseira italica* v subarctica (O. Muller) Simonsen	-	-	-	-	-	-	-	-	-	-	-	-
5551	*Cyclotella michiganiana* Skvortzow	+	+	+	+	+	+	+	+	+	+	+	+
5720	*Cyclotella bodanica* Eulenst.	-	-	+	+	+	+	+	+	-	-	+	+
	Cryptophyte												
6554	*Rhodomonas minuta* Skuja	+	+	+	+	+	+	+	+	+	+	-	-
6558	*Cryptomonas erosa* Ehrenberg	+	+	+	+	+	+	+	+	+	+	+	+
6559	*Cryptomonas ovata* Ehrenberg	-	-	-	-	-	-	-	-	-	-	-	+
6562	*Cryptomonas reflexa* (Marsson) Skuja	-	+	+	+	+	+	+	-	-	-	-	-
6565	*Cryptomonas rostratiformis* Skuja	-	+	+	+	+	+	-	+	+	-	-	-
6568	*Katablepharis ovalis* Skuja	-	+	+	+	+	+	+	+	-	-	+	+
	Dinoflagellate												
7631	*Gymnodinium helveticum* Penard	+	+	-	+	-	-	+	+	-	-	+	-
7632	*Gymnodinium* sp.	+	+	+	+	+	+	+	+	-	+	-	-
7635	*Peridinium willei* Huitfeldt-Kaas	-	-	-	-	-	+	-	-	-	-	-	-
7639	*Peridinium pusillum* (Penard) Lemmermann	+	-	+	+	+	+	+	-	-	+	-	-
7641	*Peridinium aciculiferum* Lemmermann	+	+	+	+	-	-	-	+	-	-	-	-

Appendix F. Presence (+) / Absence (-) matrix of phytoplankton species in Meadowbank study lakes and Baker Lake, 2013.

		Tehek Lake								Tehek Lake - Farfield			
	Area-Replicate ID	TE60	TE61	TE62	TE63	TE66	TE67	TE68	TE69	TEFF27	TEFF28	TEFF29	TEFF30
Code	Species Name	15-Jul-13	15-Jul-13	24-Aug-13	24-Aug-13	28-Nov-13	28-Nov-13	22-Dec-13	22-Dec-13	15-Jul-13	15-Jul-13	24-Aug-13	24-Aug-13
	Cyanophyte												
1008	*Aphanocapsa* sp.	-	-	-	-	-	-	-	-	-	-	-	-
1012	*Aphanothece* sp.	-	-	-	-	-	-	-	-	-	-	-	-
1014	*Chroococcus limneticus* Lemmermann	-	-	-	-	-	-	-	-	-	-	-	-
1026	*Merismopedia tenuissima* Lemmermann	-	-	-	-	-	-	-	-	-	-	-	-
1051	*Oscillatoria lauterornii* Schmidle	-	-	-	-	-	-	-	-	-	-	+	-
1054	*Planktolyngbya limnetica*	-	-	+	+	+	+	+	+	-	-	-	+
1073	*Snowella* sp.	-	-	-	-	-	-	-	-	-	-	-	-
1089	*Cyanodictyon* sp.	-	-	-	-	-	-	-	-	-	-	-	-
1133	*Anabaena flos-aquae* (Lyngb.) Breb. & Bornet	-	-	-	-	-	-	-	-	-	-	-	-
	Chlorophyte												
2100	*Pyramidomonas tetrarhynchus* Schmarda	-	-	-	+	-	-	-	-	-	-	+	+
2101	*Carteria* sp.	-	-	-	-	-	-	-	-	-	-	-	-
2105	*Chlamydomonas* sp.	+	+	+	-	+	-	-	-	-	-	-	-
2107	*Chlorogonium maximum* Skuja	-	-	-	-	-	-	-	-	-	-	-	-
2112	*Sphaerocystis schroeteri* Chodat	-	-	+	+	-	-	-	-	-	-	-	-
2121	*Oocystis lacustris* Chodat	+	+	+	+	+	+	-	+	+	-	+	-
2126	*Chodatella* sp.	-	-	-	-	-	-	-	-	-	-	-	-
2132	*Scenedesmus denticulatus* Lagerhiem	-	-	-	-	-	-	-	-	-	-	-	-
2137	*Dictyosphaerium simplex* Sukja	-	-	+	+	-	+	+	-	+	-	+	+
2138	*Monoraphidium komarkovae* (Nyg.) Komarkova-Legnerova	-	-	-	-	-	-	-	-	+	-	-	-
2145	*Crucigenia quadrata* Morr.	-	-	-	-	-	-	-	-	-	-	-	-
2152	*Coelastrum cambricum* Archer	-	-	-	-	-	-	-	-	-	-	-	-
2164	*Quadrigula closterioides* (Bohl.) Printz	-	-	-	-	-	-	-	-	-	-	-	-
2167	*Elakatothrix gelatinosa* Willen	-	-	+	+	-	-	-	-	+	+	+	+
2178	*Cosmarium* sp.	-	-	-	-	-	-	+	-	+	-	-	-
2182	*Euastrum* sp.	-	-	-	+	-	-	-	-	-	-	-	-
2186	*Xanthidium* sp.	-	-	-	-	-	-	-	-	-	-	-	+
2187	*Staurodesmus extensus* (Andersson) Teiling	+	-	+	-	-	-	-	+	-	-	+	-
2193	*Staurodesmus paradoxum* Meyen	-	-	-	-	-	-	-	-	-	+	-	-
2199	*Spondylosium planum* (Wolle) W. and G.S. West	-	-	-	-	-	-	+	-	-	-	-	-
2205	*Mougeotia* sp.	-	-	-	-	-	-	-	-	-	-	-	-
2206	*Botryococcus braunii* Kutzing	-	-	+	+	+	-	+	+	-	-	-	+
2212	*Schroederia setigera* (Schrod.) Lemmermann	-	-	-	-	-	-	-	-	-	-	-	-
2215	*Tetraedron caudatum* (Corda) Hansgrig	+	+	-	+	-	-	+	-	+	+	+	+
2222	*Treubaria* sp.	-	-	-	-	-	-	-	-	-	-	-	-
2235	*Ankistrodesmus spiralis* Lemmermann	+	+	-	+	-	+	-	+	+	-	+	+
	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	*Spinifiromonas sirratus*	-	+	+	-	-	-	-	-	-	-	-	-
4364	*Mallomonas caudata* Ivanov	-	-	-	-	-	-	-	-	-	-	-	-
4367	*Mallomonas duerrschmidtiae* Siver, Hamer and Kling	-	-	-	-	-	-	-	-	-	-	-	-
4368	*Mallomonas crassisquama* (Asmund) Fott	-	+	-	-	-	-	-	-	+	-	+	+
4370	*Mallomonas akrokomos* Asmund and Kristiansen	-	-	-	-	-	-	-	-	-	-	-	-

Appendix F. Presence (+) / Absence (-) matrix of phytoplankton species in Meadowbank study lakes and Baker Lake, 2013.

		Tehek Lake								Tehek Lake - Farfield			
	Area-Replicate ID	TE60	TE61	TE62	TE63	TE66	TE67	TE68	TE69	TEFF27	TEFF28	TEFF29	TEFF30
Code	Species Name	15-Jul-13	15-Jul-13	24-Aug-13	24-Aug-13	28-Nov-13	28-Nov-13	22-Dec-13	22-Dec-13	15-Jul-13	15-Jul-13	24-Aug-13	24-Aug-13
4378	*Dinobryon borgei* Lemmermann	+	+	+	+	-	-	-	-	+	+	+	+
4381	*Dinobryon mucronutom* Nygaard	+	+	-	+	-	+	-	-	+	-	+	+
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* sp.	-	-	+	+	-	-	-	-	+	+	+	+
4418	*Salpingoeca frequentissima* (Zach.) Lemmermann	+	-	-	-	+	+	-	+	-	-	-	+
4431	*Synura petersenii* Korschikow	-	-	-	-	-	-	-	-	-	-	-	-
4436	*Dinobryon attenatum* Hill	-	-	-	-	-	-	-	+	-	-	-	-
4437	*Pteridomonas* sp.	-	-	-	-	-	-	-	-	-	+	-	-
	Diatom												
5507	*Cyclotella stelligera* Cleve and Grunow	+	+	+	+	+	+	+	+	+	+	+	+
5509	*Cyclotella ocellata* Pant.	+	+	-	-	-	-	+	-	+	+	+	+
5511	*Rhizosolenia eriense* H.L. Smith	+	+	+	+	+	-	+	+	+	+	+	+
5513	*Tabellaria fenestrata* (Lyngbye) Kutzing	-	-	+	-	-	-	-	-	-	-	-	-
5514	*Tabellaria flocculsa* (Roth) Kutzing	-	-	-	-	-	-	-	-	-	+	+	-
5518	*Synedra acus* Kutzing	+	+	+	+	+	+	-	+	+	+	+	+
5524	*Asterionella formosa* Hassall	-	-	-	-	-	-	-	-	-	-	-	-
5540	*Aulacoseira italica* v subarctica (O. Muller) Simonsen	-	-	-	-	-	-	-	-	-	-	-	-
5551	*Cyclotella michiganiana* Skvortzow	+	+	+	+	+	+	+	+	+	+	+	-
5720	*Cyclotella bodanica* Eulenst.	-	-	-	-	-	-	-	-	-	-	-	-
	Cryptophyte												
6554	*Rhodomonas minuta* Skuja	+	+	+	+	+	+	+	-	+	+	+	+
6558	*Cryptomonas erosa* Ehrenberg	+	+	+	+	+	+	+	+	+	+	+	+
6559	*Cryptomonas ovata* Ehrenberg	-	-	-	-	-	-	-	-	-	-	-	-
6562	*Cryptomonas reflexa* (Marsson) Skuja	-	+	+	-	-	-	+	+	-	-	-	-
6565	*Cryptomonas rostratiformis* Skuja	+	+	+	-	+	-	-	-	+	+	-	-
6568	*Katablepharis ovalis* Skuja	+	+	+	+	-	-	+	-	+	+	+	+
	Dinoflagellate												
7631	*Gymnodinium helveticum* Penard	-	-	-	-	-	-	-	-	-	-	+	-
7632	*Gymnodinium* sp.	+	+	+	+	+	+	+	-	+	+	+	+
7635	*Peridinium willei* Huitfeldt-Kaas	+	-	-	-	-	+	-	-	-	-	-	-
7639	*Peridinium pusillum* (Penard) Lemmermann	+	+	+	+	+	+	+	-	+	+	+	+
7641	*Peridinium aciculiferum* Lemmermann	+	+	+	-	-	-	-	-	+	+	-	-

Appendix F. Presence (+) / Absence (-) matrix of phytoplankton species in Meadowbank study lakes and Baker Lake, 2013.

		Third Portage Lake - East Basin								TPN- North Basin		
	Area-Replicate ID	TPE60	TPE61	TPE62	TPE63	TPE66	TPE67	TPE68	TPE69	TPN58	TPN59	TPN60
Code	Species Name	21-Jul-13	21-Jul-13	22-Aug-13	22-Aug-13	26-Nov-13	26-Nov-13	9-Dec-13	9-Dec-13	18-Apr-13	18-Apr-13	21-Jul-13
	Cyanophyte											
1008	*Aphanocapsa* sp.	-	-	-	-	-	-	-	-	-	-	-
1012	*Aphanothece* sp.	-	-	-	-	-	-	-	-	-	-	-
1014	*Chroococcus limneticus* Lemmermann	-	-	-	-	-	-	-	+	-	+	-
1026	*Merismopedia tenuissima* Lemmermann	-	-	-	-	-	-	-	-	-	-	-
1051	*Oscillatoria lauterornii* Schmidle	-	-	-	-	-	-	-	-	-	-	-
1054	*Planktolyngbya limnetica*	-	-	+	+	+	+	+	+	-	-	-
1073	*Snowella* sp.	-	-	-	-	-	-	-	-	-	-	-
1089	*Cyanodictyon* sp.	-	-	-	-	-	-	-	-	-	-	-
1133	*Anabaena flos-aquae* (Lyngb.) Breb. & Bornet	-	-	-	-	-	-	-	-	-	-	-
	Chlorophyte											
2100	*Pyramidomonas tetrarhynchus* Schmarda	-	-	+	-	-	-	-	-	-	-	-
2101	*Carteria* sp.	-	-	-	-	-	-	-	-	-	-	-
2105	*Chlamydomonas* sp.	-	-	+	+	-	+	+	-	-	-	+
2107	*Chlorogonium maximum* Skuja	-	-	-	-	-	-	-	-	-	-	-
2112	*Sphaerocystis schroeteri* Chodat	-	-	+	-	-	-	-	-	-	-	-
2121	*Oocystis lacustris* Chodat	-	+	+	+	+	-	-	-	-	-	+
2126	*Chodatella* sp.	-	-	-	-	-	-	-	-	-	-	-
2132	*Scenedesmus denticulatus* Lagerhiem	-	-	-	+	-	-	-	-	-	-	-
2137	*Dictyosphaerium simplex* Sukja	-	+	+	+	+	+	-	-	-	-	-
2138	*Monoraphidium komarkovae* (Nyg.) Komarkova-Legnerova	+	+	-	-	-	-	-	+	-	-	+
2145	*Crucigenia quadrata* Morr.	-	-	-	-	-	-	-	-	-	-	-
2152	*Coelastrum cambricum* Archer	-	-	-	-	-	-	-	-	-	-	-
2164	*Quadrigula closterioides* (Bohl.) Printz	-	-	-	-	-	-	-	-	-	-	-
2167	*Elakatothrix gelatinosa* Willen	-	-	+	+	+	-	+	+	-	-	-
2178	*Cosmarium* sp.	-	-	-	-	-	-	-	-	-	-	+
2182	*Euastrum* sp.	-	-	-	-	-	-	-	-	-	-	-
2186	*Xanthidium* sp.	-	+	-	-	-	-	-	-	-	-	-
2187	*Staurodesmus extensus* (Andersson) Teiling	+	+	+	-	+	-	+	-	-	-	+
2193	*Staurodesmus paradoxum* Meyen	-	-	-	-	-	-	-	-	-	-	-
2199	*Spondylosium planum* (Wolle) W. and G.S. West	-	+	-	-	-	-	-	-	-	-	-
2205	*Mougeotia* sp.	-	-	-	-	-	-	-	-	-	-	-
2206	*Botryococcus braunii* Kutzing	-	-	-	+	+	+	+	-	-	+	+
2212	*Schroederia setigera* (Schrod.) Lemmermann	-	-	-	-	-	-	-	-	-	-	-
2215	*Tetraedron caudatum* (Corda) Hansgrig	+	+	+	+	-	-	+	+	-	-	+
2222	*Treubaria* sp.	-	-	-	-	-	-	-	-	-	-	-
2235	*Ankistrodesmus spiralis* Lemmermann	-	-	+	+	-	-	-	-	+	+	-
	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	*Spinifiromonas sirratus*	+	-	-	+	-	-	-	-	-	-	+
4364	*Mallomonas caudata* Ivanov	-	-	-	-	-	-	-	-	-	-	-
4367	*Mallomonas duerrschmidtiae* Siver, Hamer and Kling	-	-	-	-	-	-	-	-	-	-	-
4368	*Mallomonas crassisquama* (Asmund) Fott	-	-	-	-	-	-	-	-	-	-	-
4370	*Mallomonas akrokomos* Asmund and Kristiansen	-	-	-	-	-	-	-	-	-	-	-

Appendix F. Presence (+) / Absence (-) matrix of phytoplankton species in Meadowbank study lakes and Baker Lake, 2013.

		Third Portage Lake - East Basin								TPN- North Basin		
	Area-Replicate ID	TPE60	TPE61	TPE62	TPE63	TPE66	TPE67	TPE68	TPE69	TPN58	TPN59	TPN60
Code	Species Name	21-Jul-13	21-Jul-13	22-Aug-13	22-Aug-13	26-Nov-13	26-Nov-13	9-Dec-13	9-Dec-13	18-Apr-13	18-Apr-13	21-Jul-13
4378	*Dinobryon borgei* Lemmermann	+	+	+	+	-	-	+	+	-	-	+
4381	*Dinobryon mucronutom* Nygaard	+	+	+	+	-	-	+	-	-	-	+
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* sp.	+	-	+	+	-	-	-	-	-	-	-
4418	*Salpingoeca frequentissima* (Zach.) Lemmermann	-	-	-	-	+	+	+	+	-	-	+
4431	*Synura petersenii* Korschikow	-	-	-	-	-	-	-	-	-	-	-
4436	*Dinobryon attenatum* Hill	-	-	-	-	-	-	+	-	-	-	-
4437	*Pteridomonas* sp.	-	-	-	-	-	-	-	-	-	-	-
	Diatom											
5507	*Cyclotella stelligera* Cleve and Grunow	+	+	+	+	+	+	+	+	+	+	+
5509	*Cyclotella ocellata* Pant.	+	+	+	+	-	-	-	-	-	-	+
5511	*Rhizosolenia eriense* H.L. Smith	+	+	+	+	+	+	+	+	+	+	+
5513	*Tabellaria fenestrata* (Lyngbye) Kutzing	-	-	-	-	-	-	-	-	-	-	-
5514	*Tabellaria flocculsa* (Roth) Kutzing	-	-	-	-	+	-	-	-	-	-	-
5518	*Synedra acus* Kutzing	+	+	+	+	+	+	+	+	+	-	+
5524	*Asterionella formosa* Hassall	-	-	-	-	-	-	-	-	-	+	-
5540	*Aulacoseira italica* v subarctica (O. Muller) Simonsen	-	-	-	-	-	-	-	-	-	-	-
5551	*Cyclotella michiganiana* Skvortzow	+	+	+	+	+	+	+	+	+	+	+
5720	*Cyclotella bodanica* Eulenst.	-	-	-	-	-	-	-	-	-	-	-
	Cryptophyte											
6554	*Rhodomonas minuta* Skuja	+	+	+	+	+	+	+	-	-	-	+
6558	*Cryptomonas erosa* Ehrenberg	+	+	+	+	+	+	+	+	+	+	+
6559	*Cryptomonas ovata* Ehrenberg	-	-	-	-	-	-	+	+	-	-	-
6562	*Cryptomonas reflexa* (Marsson) Skuja	-	-	+	+	-	-	-	+	-	-	-
6565	*Cryptomonas rostratiformis* Skuja	+	+	+	+	+	-	-	-	+	+	+
6568	*Katablepharis ovalis* Skuja	+	+	+	+	-	-	+	-	-	-	+
	Dinoflagellate											
7631	*Gymnodinium helveticum* Penard	-	-	-	-	-	-	+	-	-	-	-
7632	*Gymnodinium* sp.	+	+	+	+	-	+	-	+	+	+	+
7635	*Peridinium willei* Huitfeldt-Kaas	-	-	-	-	-	-	-	-	-	-	-
7639	*Peridinium pusillum* (Penard) Lemmermann	+	+	+	+	+	-	-	+	+	+	+
7641	*Peridinium aciculiferum* Lemmermann	+	-	+	-	-	-	-	-	-	-	+

Appendix F. Presence (+) / Absence (-) matrix of phytoplankton species in Meadowbank study lakes and Baker Lake, 2013.

		Third Portage Lake - North Basin							Third Portage - South Basin			
	Area-Replicate ID	TPN61	TPN62	TPN63	TPN66	TPN67	TPN68	TPN69	TPS39	TPS40	TPS41	TPS42
Code	Species Name	21-Jul-13	26-Aug-13	26-Aug-13	26-Nov-13	26-Nov-13	10-Dec-13	10-Dec-13	21-Jul-13	21-Jul-13	26-Aug-13	26-Aug-13
	Cyanophyte											
1008	*Aphanocapsa* sp.	-	-	-	-	-	-	-	-	-	-	-
1012	*Aphanothece* sp.	-	-	-	-	-	-	-	-	-	-	-
1014	*Chroococcus limneticus* Lemmermann	-	-	-	-	-	-	-	-	-	-	-
1026	*Merismopedia tenuissima* Lemmermann	-	-	-	-	-	-	-	+	-	-	-
1051	*Oscillatoria lauterornii* Schmidle	-	-	-	-	-	-	-	-	-	-	-
1054	*Planktolyngbya limnetica*	-	+	+	-	-	-	+	-	-	-	-
1073	*Snowella* sp.	-	-	-	-	-	-	-	-	-	-	-
1089	*Cyanodictyon* sp.	-	-	-	-	-	-	-	-	-	-	-
1133	*Anabaena flos-aquae* (Lyngb.) Breb. & Bornet	-	-	-	-	-	-	-	-	-	-	-
	Chlorophyte											
2100	*Pyramidomonas tetrarhynchus* Schmarda	-	-	-	-	-	-	-	-	-	-	-
2101	*Carteria* sp.	-	-	-	-	-	-	-	-	-	-	-
2105	*Chlamydomonas* sp.	-	+	-	-	-	+	+	-	-	+	-
2107	*Chlorogonium maximum* Skuja	-	-	-	-	-	-	-	-	-	-	-
2112	*Sphaerocystis schroeteri* Chodat	+	-	-	-	-	-	-	-	-	+	-
2121	*Oocystis lacustris* Chodat	-	+	+	-	-	-	-	+	+	+	+
2126	*Chodatella* sp.	-	-	-	-	-	-	-	-	-	-	-
2132	*Scenedesmus denticulatus* Lagerhiem	-	-	-	-	-	-	-	-	-	-	-
2137	*Dictyosphaerium simplex* Sukja	-	-	+	+	+	-	-	+	+	+	+
2138	*Monoraphidium komarkovae* (Nyg.) Komarkova-Legnerova	-	-	-	-	-	-	-	-	+	-	+
2145	*Crucigenia quadrata* Morr.	-	-	-	-	-	-	-	-	-	-	-
2152	*Coelastrum cambricum* Archer	+	-	-	-	-	-	-	-	-	-	-
2164	*Quadrigula closterioides* (Bohl.) Printz	-	-	-	-	-	-	-	-	-	-	-
2167	*Elakatothrix gelatinosa* Willen	-	+	+	+	+	-	+	+	-	+	+
2178	*Cosmarium* sp.	-	-	-	-	-	-	+	-	-	-	-
2182	*Euastrum* sp.	-	-	-	-	-	-	-	-	-	-	-
2186	*Xanthidium* sp.	-	+	-	-	-	-	-	-	-	-	+
2187	*Staurodesmus extensus* (Andersson) Teiling	-	+	+	-	+	-	+	+	+	+	+
2193	*Staurodesmus paradoxum* Meyen	-	-	-	-	-	-	-	-	-	-	-
2199	*Spondylosium planum* (Wolle) W. and G.S. West	-	+	-	-	+	-	-	+	-	+	+
2205	*Mougeotia* sp.	-	-	-	-	-	-	-	-	-	-	-
2206	*Botryococcus braunii* Kutzing	-	+	+	+	-	+	+	-	-	-	-
2212	*Schroederia setigera* (Schrod.) Lemmermann	-	-	-	-	-	-	-	-	-	-	-
2215	*Tetraedron caudatum* (Corda) Hansgrig	-	+	+	-	-	+	-	+	-	+	+
2222	*Treubaria* sp.	-	-	-	-	-	-	-	-	-	-	-
2235	*Ankistrodesmus spiralis* Lemmermann	-	+	-	-	-	-	-	-	-	-	-
	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	*Spinifiromonas sirratus*	+	-	-	-	-	-	-	+	+	-	-
4364	*Mallomonas caudata* Ivanov	-	-	-	-	-	-	-	-	-	-	-
4367	*Mallomonas duerrschmidtiae* Siver, Hamer and Kling	-	-	-	-	-	-	-	-	-	-	-
4368	*Mallomonas crassisquama* (Asmund) Fott	-	-	-	-	-	-	-	-	-	-	+
4370	*Mallomonas akrokomos* Asmund and Kristiansen	-	-	-	-	-	-	-	-	-	-	-

Appendix F. Presence (+) / Absence (-) matrix of phytoplankton species in Meadowbank study lakes and Baker Lake, 2013.

		Third Portage Lake - North Basin							Third Portage - South Basin			
	Area-Replicate ID	TPN61	TPN62	TPN63	TPN66	TPN67	TPN68	TPN69	TPS39	TPS40	TPS41	TPS42
Code	Species Name	21-Jul-13	26-Aug-13	26-Aug-13	26-Nov-13	26-Nov-13	10-Dec-13	10-Dec-13	21-Jul-13	21-Jul-13	26-Aug-13	26-Aug-13
4378	*Dinobryon borgei* Lemmermann	+	+	+	-	-	+	+	+	+	+	+
4381	*Dinobryon mucronutom* Nygaard	+	+	+	+	-	+	-	+	+	+	+
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* sp.	-	+	+	-	-	-	-	-	-	-	+
4418	*Salpingoeca frequentissima* (Zach.) Lemmermann	+	+	-	-	+	+	+	-	-	+	-
4431	*Synura petersenii* Korschikow	-	-	-	-	-	-	-	-	-	-	-
4436	*Dinobryon attenatum* Hill	-	-	-	-	-	-	-	-	-	-	-
4437	*Pteridomonas* sp.	-	-	-	-	-	-	-	-	-	-	-
	Diatom											
5507	*Cyclotella stelligera* Cleve and Grunow	+	+	+	+	+	+	+	+	+	+	+
5509	*Cyclotella ocellata* Pant.	+	+	+	-	-	+	+	-	-	+	+
5511	*Rhizosolenia eriense* H.L. Smith	+	+	+	+	+	+	+	+	+	+	+
5513	*Tabellaria fenestrata* (Lyngbye) Kutzing	-	-	+	-	-	-	-	-	-	-	-
5514	*Tabellaria flocculsa* (Roth) Kutzing	-	-	-	-	+	-	-	-	-	-	-
5518	*Synedra acus* Kutzing	+	+	+	+	+	+	+	+	+	+	+
5524	*Asterionella formosa* Hassall	-	-	-	-	-	-	-	-	-	-	-
5540	*Aulacoseira italica* v subarctica (O. Muller) Simonsen	-	-	-	-	-	-	-	-	-	-	-
5551	*Cyclotella michiganiana* Skvortzow	+	+	+	+	+	+	+	+	+	+	+
5720	*Cyclotella bodanica* Eulenst.	-	-	-	-	-	-	-	-	-	-	-
	Cryptophyte											
6554	*Rhodomonas minuta* Skuja	+	+	+	+	+	+	+	+	+	+	+
6558	*Cryptomonas erosa* Ehrenberg	+	+	+	+	+	+	+	+	+	+	+
6559	*Cryptomonas ovata* Ehrenberg	-	-	-	-	-	-	-	-	-	-	-
6562	*Cryptomonas reflexa* (Marsson) Skuja	-	+	-	-	-	+	-	-	-	+	+
6565	*Cryptomonas rostratiformis* Skuja	-	+	+	+	-	-	-	-	-	+	+
6568	*Katablepharis ovalis* Skuja	-	+	+	-	-	+	+	+	+	+	+
	Dinoflagellate											
7631	*Gymnodinium helveticum* Penard	-	-	-	-	-	+	-	-	-	-	-
7632	*Gymnodinium* sp.	+	+	+	-	+	-	-	+	+	+	+
7635	*Peridinium willei* Huitfeldt-Kaas	-	-	+	-	-	-	-	-	-	-	-
7639	*Peridinium pusillum* (Penard) Lemmermann	+	+	+	-	+	+	+	+	+	+	+
7641	*Peridinium aciculiferum* Lemmermann	+	-	+	-	-	-	-	+	+	+	+

Appendix F. Presence (+) / Absence (-) matrix of phytoplankton species in Meadowbank study lakes and Baker Lake, 2013.

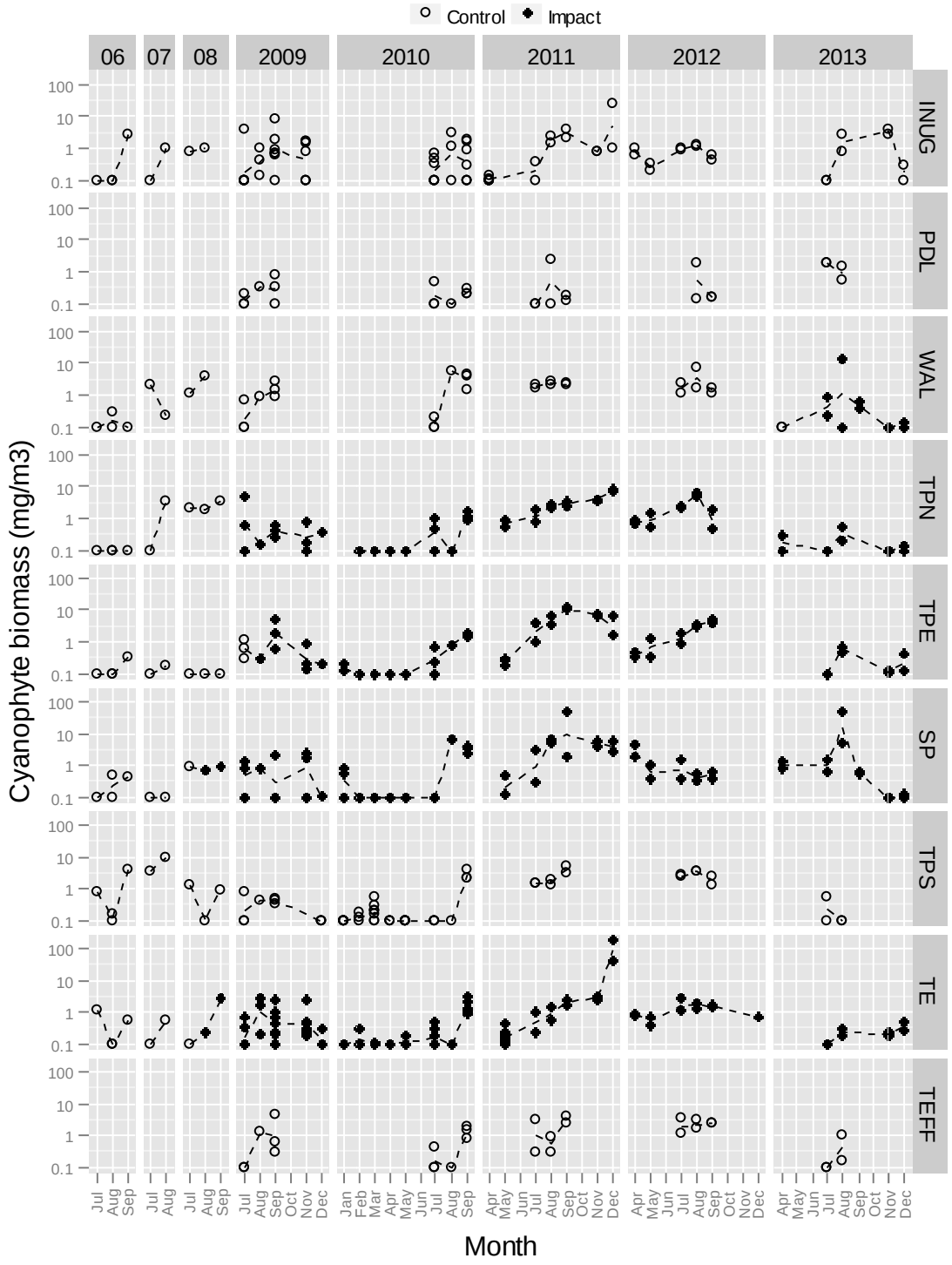
						Wally Lake							
	Area-Replicate ID	WAL27	WAL28	WAL29	WAL30	WAL31	WAL32	WAL33	WAL34	WAL35	WAL36	WAL37	WAL38
Code	Species Name	20-Apr-13	20-Apr-13	19-Jul-13	19-Jul-13	26-Aug-13	26-Aug-13	15-Sep-13	15-Sep-13	28-Nov-13	28-Nov-13	22-Dec-13	22-Dec-13
	Cyanophyte												
1008	*Aphanocapsa* sp.	-	-	-	-	-	-	-	-	-	-	-	-
1012	*Aphanothece* sp.	-	-	-	-	-	-	+	+	-	-	-	-
1014	*Chroococcus limneticus* Lemmermann	-	-	-	-	-	+	-	-	-	-	-	-
1026	*Merismopedia tenuissima* Lemmermann	-	-	-	-	-	-	-	-	-	-	-	-
1051	*Oscillatoria lauterornii* Schmidle	-	-	-	-	-	-	-	-	-	-	-	-
1054	*Planktolyngbya limnetica*	-	-	+	+	-	-	+	-	-	-	-	+
1073	*Snowella* sp.	-	-	-	-	-	-	-	-	-	-	-	-
1089	*Cyanodictyon* sp.	-	-	-	-	-	-	-	-	-	-	-	-
1133	*Anabaena flos-aquae* (Lyngb.) Breb. & Bornet	-	-	-	-	-	-	-	-	-	-	-	-
	Chlorophyte												
2100	*Pyramidomonas tetrarhynchus* Schmarda	-	-	-	-	-	-	-	-	-	-	-	-
2101	*Carteria* sp.	-	-	-	-	+	-	-	-	-	-	-	-
2105	*Chlamydomonas* sp.	-	-	-	-	+	+	-	-	+	+	-	+
2107	*Chlorogonium maximum* Skuja	-	-	-	-	-	-	-	-	-	-	-	-
2112	*Sphaerocystis schroeteri* Chodat	-	-	-	-	+	-	+	+	-	-	-	-
2121	*Oocystis lacustris* Chodat	+	-	+	+	+	+	+	+	-	+	-	-
2126	*Chodatella* sp.	-	-	-	-	-	-	-	-	-	-	-	-
2132	*Scenedesmus denticulatus* Lagerhiem	-	-	-	-	-	-	-	-	-	-	-	-
2137	*Dictyosphaerium simplex* Sukja	-	-	+	+	+	+	+	-	+	+	-	+
2138	*Monoraphidium komarkovae* (Nyg.) Komarkova-Legnerova	-	-	-	-	+	+	-	-	-	-	-	-
2145	*Crucigenia quadrata* Morr.	-	-	-	-	-	-	-	-	-	-	-	-
2152	*Coelastrum cambricum* Archer	-	-	-	-	-	-	-	-	-	-	-	-
2164	*Quadrigula closterioides* (Bohl.) Printz	-	-	-	-	+	+	+	+	-	-	-	-
2167	*Elakatothrix gelatinosa* Willen	-	-	+	+	+	+	+	+	-	-	-	-
2178	*Cosmarium* sp.	-	-	-	-	-	-	+	-	-	-	-	-
2182	*Euastrum* sp.	-	-	+	+	-	-	-	-	-	-	-	-
2186	*Xanthidium* sp.	-	-	-	-	-	-	-	-	-	-	-	-
2187	*Staurodesmus extensus* (Andersson) Teiling	-	+	+	+	+	+	-	+	-	-	+	-
2193	*Staurodesmus paradoxum* Meyen	-	-	-	-	-	-	-	-	-	-	-	-
2199	*Spondylosium planum* (Wolle) W. and G.S. West	-	-	+	+	+	+	+	+	-	-	-	-
2205	*Mougeotia* sp.	-	-	-	-	-	-	-	-	-	-	-	-
2206	*Botryococcus braunii* Kutzing	-	-	-	+	+	+	+	+	+	-	-	-
2212	*Schroederia setigera* (Schrod.) Lemmermann	-	-	-	-	-	-	-	-	-	-	-	-
2215	*Tetraedron caudatum* (Corda) Hansgrig	-	-	+	-	+	+	+	+	+	-	+	+
2222	*Treubaria* sp.	-	-	-	-	-	-	-	-	-	-	-	-
2235	*Ankistrodesmus spiralis* Lemmermann	+	+	+	+	-	-	+	+	+	+	+	+
	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	*Spinifiromonas sirratus*	-	-	-	+	+	+	+	-	-	-	-	-
4364	*Mallomonas caudata* Ivanov	+	-	-	-	-	-	-	-	-	-	-	-
4367	*Mallomonas duerrschmidtiae* Siver, Hamer and Kling	-	-	-	-	-	-	-	-	-	-	-	-
4368	*Mallomonas crassisquama* (Asmund) Fott	+	+	+	-	+	-	+	+	-	-	-	-
4370	*Mallomonas akrokomos* Asmund and Kristiansen	-	-	-	-	-	-	-	-	-	-	-	-

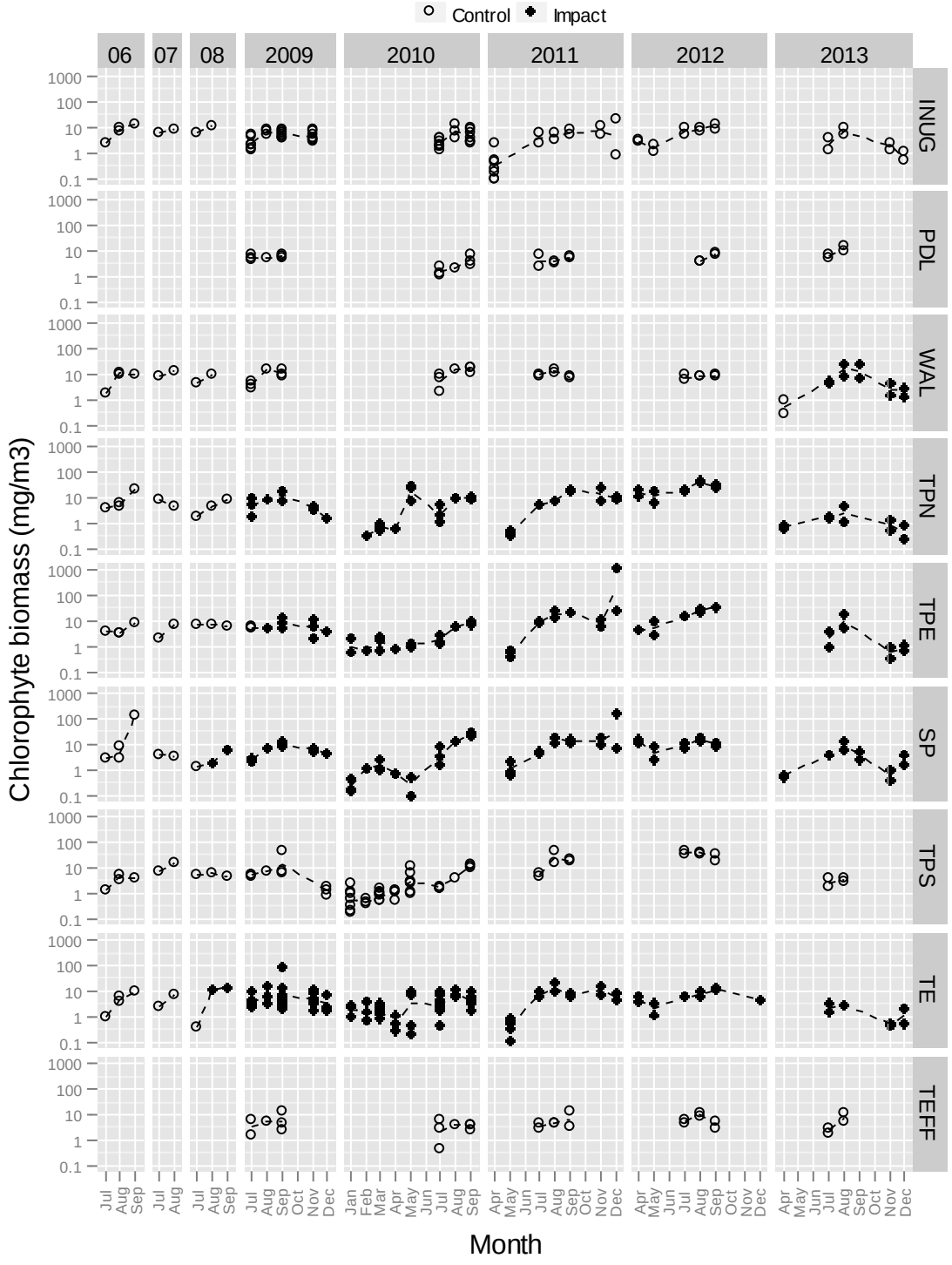
Appendix F. Presence (+) / Absence (-) matrix of phytoplankton species in Meadowbank study lakes and Baker Lake, 2013.

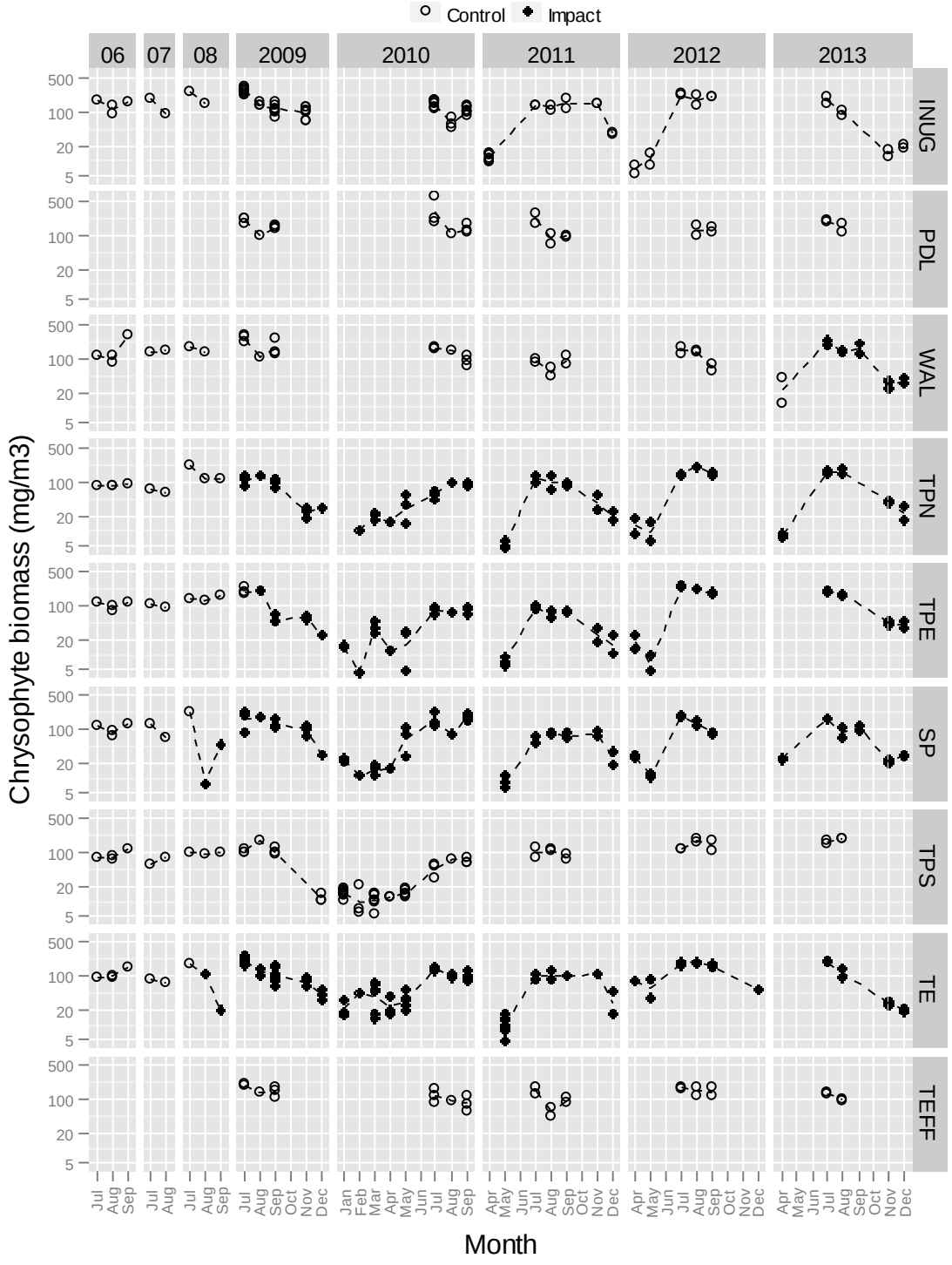
		Wally Lake											
	Area-Replicate ID	WAL27	WAL28	WAL29	WAL30	WAL31	WAL32	WAL33	WAL34	WAL35	WAL36	WAL37	WAL38
Code	Species Name	20-Apr-13	20-Apr-13	19-Jul-13	19-Jul-13	26-Aug-13	26-Aug-13	15-Sep-13	15-Sep-13	28-Nov-13	28-Nov-13	22-Dec-13	22-Dec-13
4378	*Dinobryon borgei* Lemmermann	-	-	+	+	+	-	+	+	-	-	+	-
4381	*Dinobryon mucronutom* Nygaard	-	-	+	+	-	+	+	+	-	-	+	-
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* sp.	-	-	-	+	+	+	+	+	-	+	-	-
4418	*Salpingoeca frequentissima* (Zach.) Lemmermann	+	+	-	-	+	-	+	+	-	+	+	+
4431	*Synura petersenii* Korschikow	-	-	-	-	-	-	-	-	-	-	-	-
4436	*Dinobryon attenatum* Hill	-	-	-	-	-	-	-	-	-	-	-	-
4437	*Pteridomonas* sp.	-	-	-	-	-	-	-	-	-	-	-	-
	Diatom												
5507	*Cyclotella stelligera* Cleve and Grunow	+	+	+	+	+	+	+	+	+	+	+	+
5509	*Cyclotella ocellata* Pant.	+	-	+	+	+	+	+	+	-	-	+	-
5511	*Rhizosolenia eriense* H.L. Smith	+	-	-	-	+	+	-	-	-	-	-	-
5513	*Tabellaria fenestrata* (Lyngbye) Kutzing	-	-	+	-	-	-	-	-	-	+	-	-
5514	*Tabellaria flocculsa* (Roth) Kutzing	-	-	-	-	-	-	-	+	-	-	-	-
5518	*Synedra acus* Kutzing	+	+	+	+	+	+	+	+	+	+	+	+
5524	*Asterionella formosa* Hassall	-	-	-	-	-	-	-	-	-	-	-	-
5540	*Aulacoseira italica* v subarctica (O. Muller) Simonsen	-	-	-	-	-	-	-	-	-	-	-	-
5551	*Cyclotella michiganiana* Skvortzow	+	+	+	+	+	+	+	+	+	+	+	+
5720	*Cyclotella bodanica* Eulenst.	-	-	+	+	-	-	+	+	+	-	-	-
	Cryptophyte												
6554	*Rhodomonas minuta* Skuja	+	+	+	+	+	+	+	+	+	+	+	+
6558	*Cryptomonas erosa* Ehrenberg	+	+	+	+	+	+	+	+	+	+	+	+
6559	*Cryptomonas ovata* Ehrenberg	-	-	-	-	-	-	-	-	-	-	-	-
6562	*Cryptomonas reflexa* (Marsson) Skuja	+	+	+	+	+	-	+	+	-	-	+	+
6565	*Cryptomonas rostratiformis* Skuja	-	+	+	+	+	+	-	-	+	+	+	+
6568	*Katablepharis ovalis* Skuja	-	-	+	+	+	-	+	+	-	-	+	+
	Dinoflagellate												
7631	*Gymnodinium helveticum* Penard	-	-	+	+	+	+	-	+	-	-	-	-
7632	*Gymnodinium* sp.	-	-	+	+	+	+	+	+	-	-	+	-
7635	*Peridinium willei* Huitfeldt-Kaas	+	-	-	-	-	-	-	-	-	-	-	+
7639	*Peridinium pusillum* (Penard) Lemmermann	+	+	-	-	+	+	+	+	+	-	+	-
7641	*Peridinium aciculiferum* Lemmermann	-	-	-	-	-	-	-	-	-	-	-	-

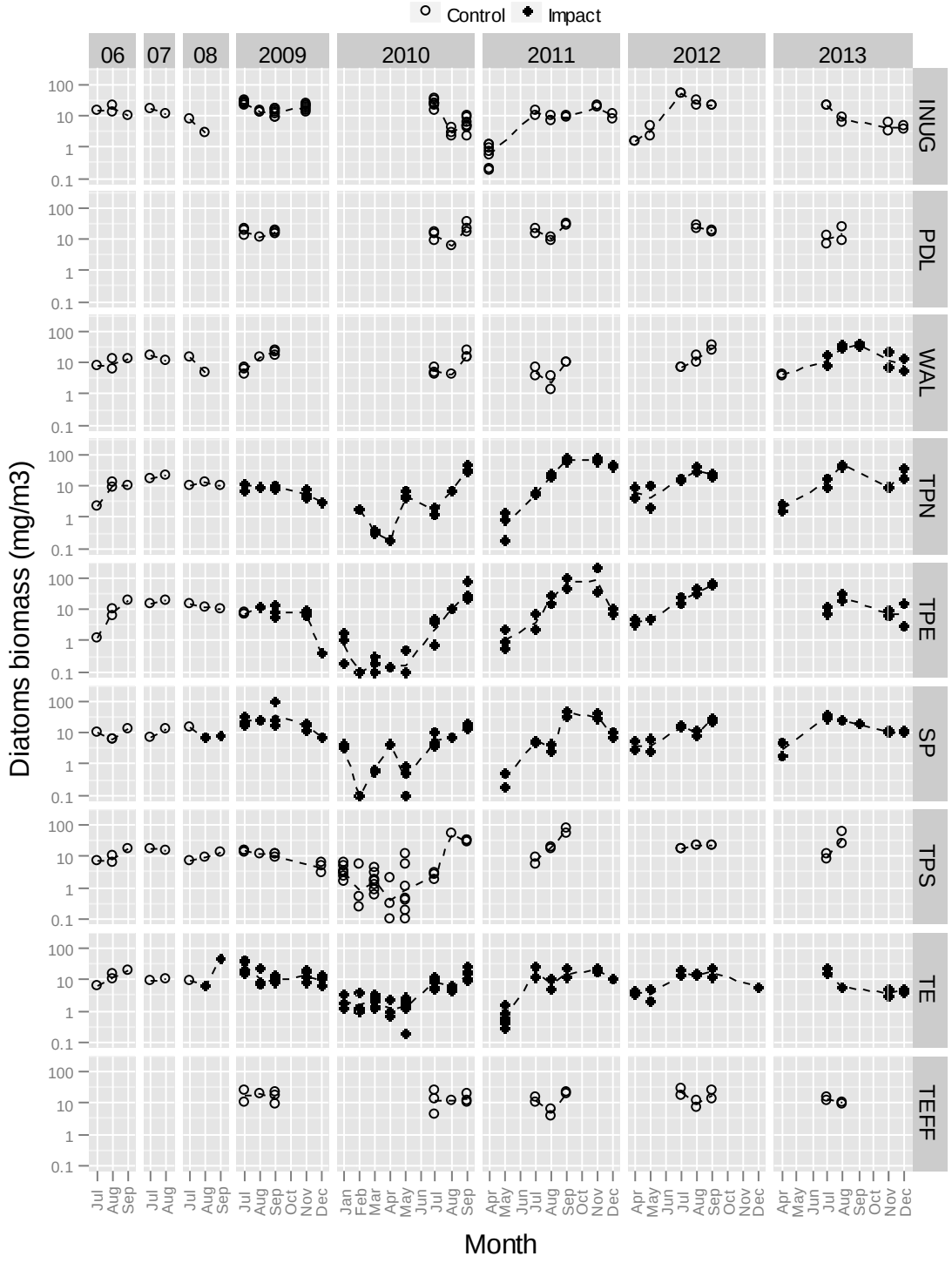
APPENDIX G

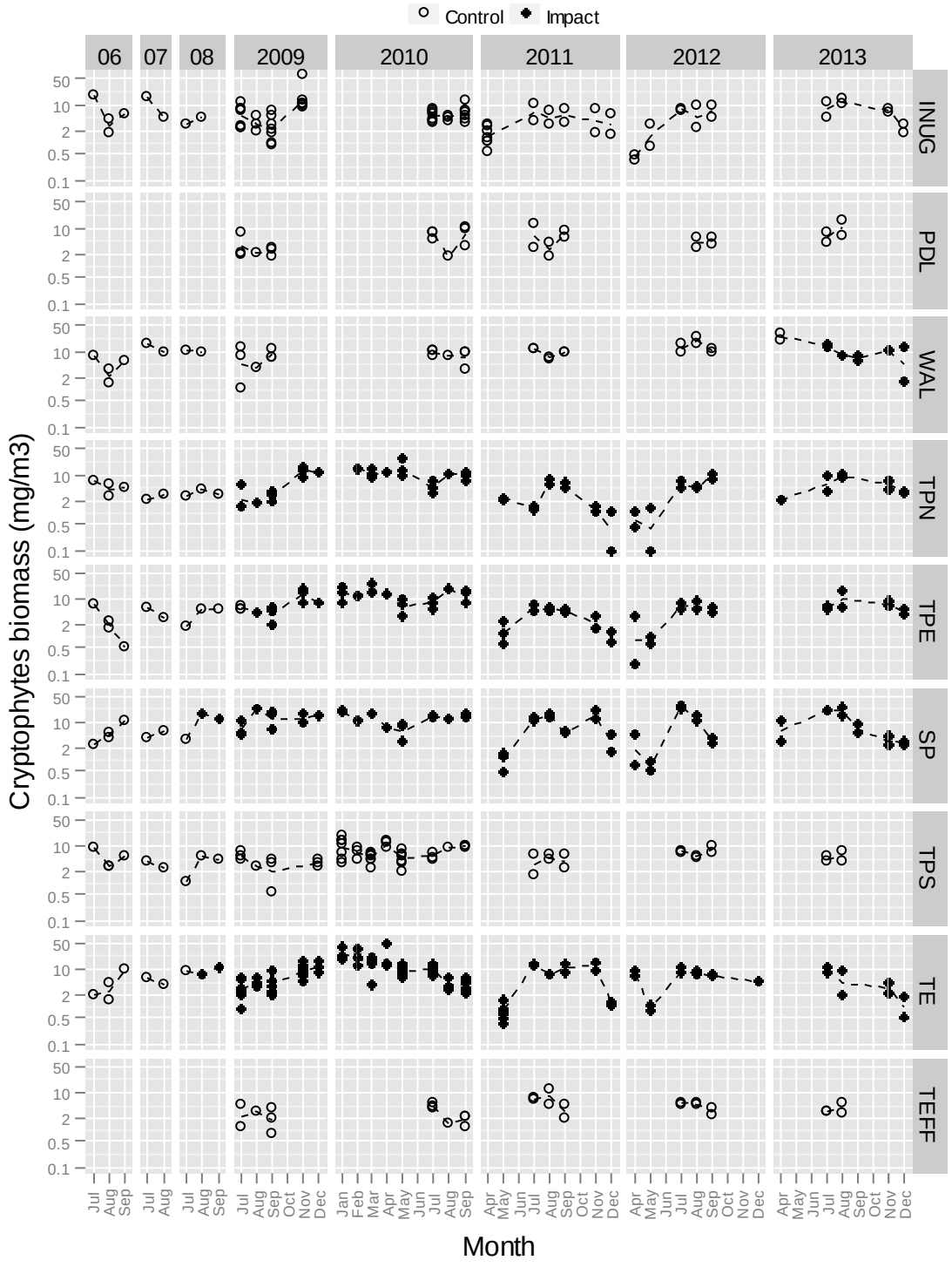
PHYTOPLANKTON PLOTS 2006 – 2013

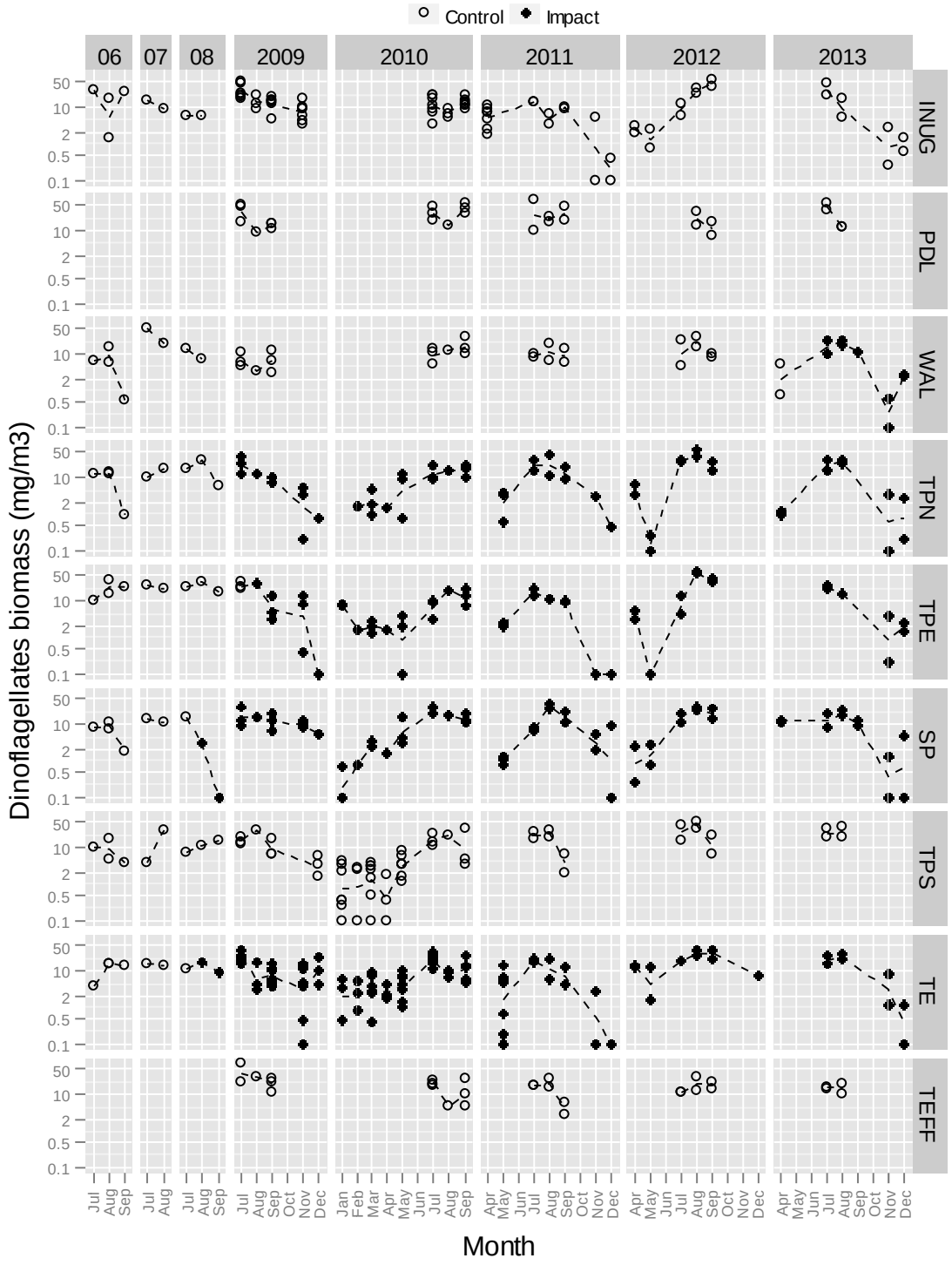

Control
Impact
06
07
08
2009
2010
2011
2012
2013
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Cyanophyte biomass (mg/m3)
100
10
1
0.1
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Month

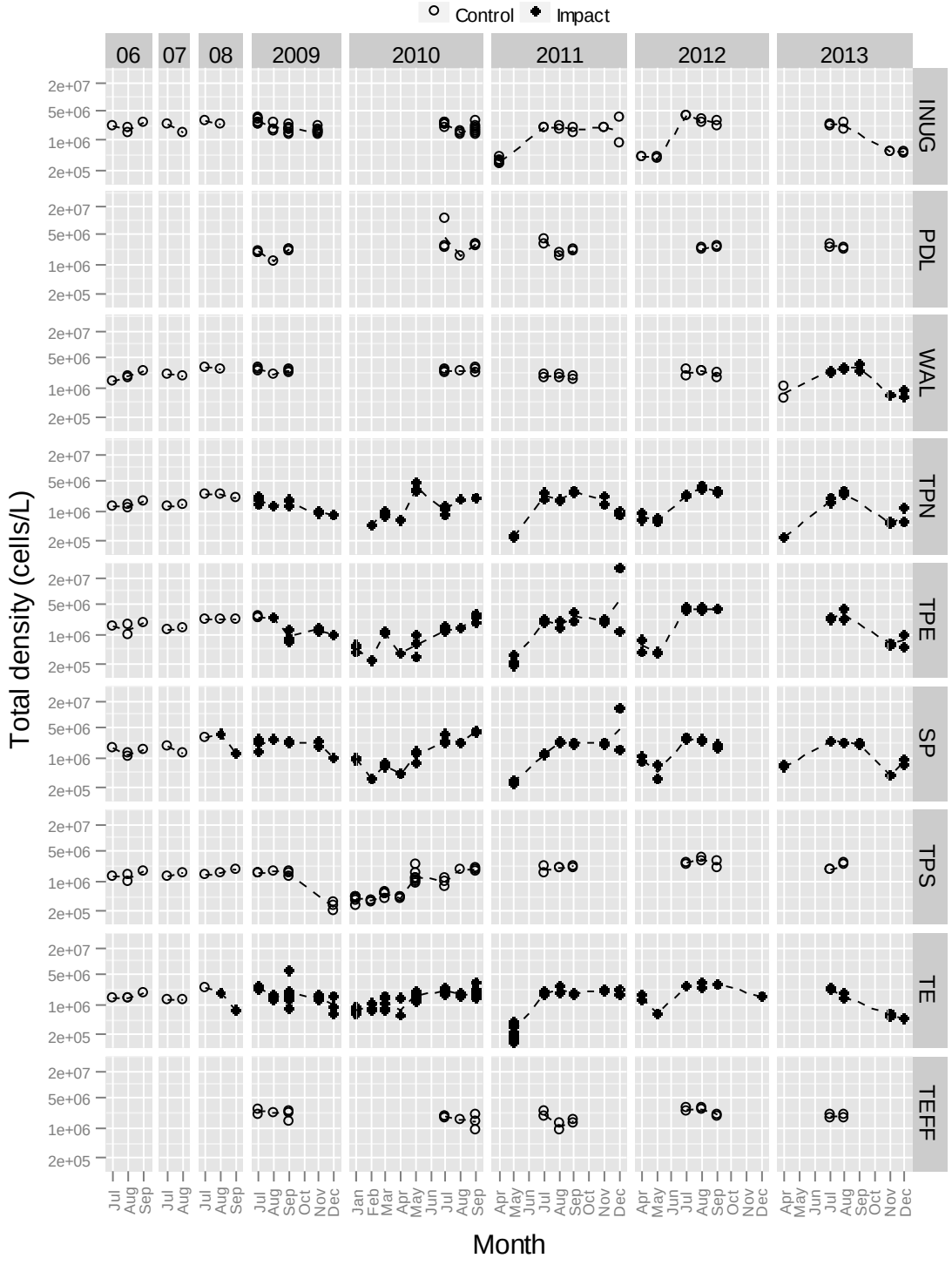

Control
Impact
06
07
08
2009
2010
2011
2012
2013
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Chlorophyte biomass (mg/m3)
1000
100
10
1
0.1
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month

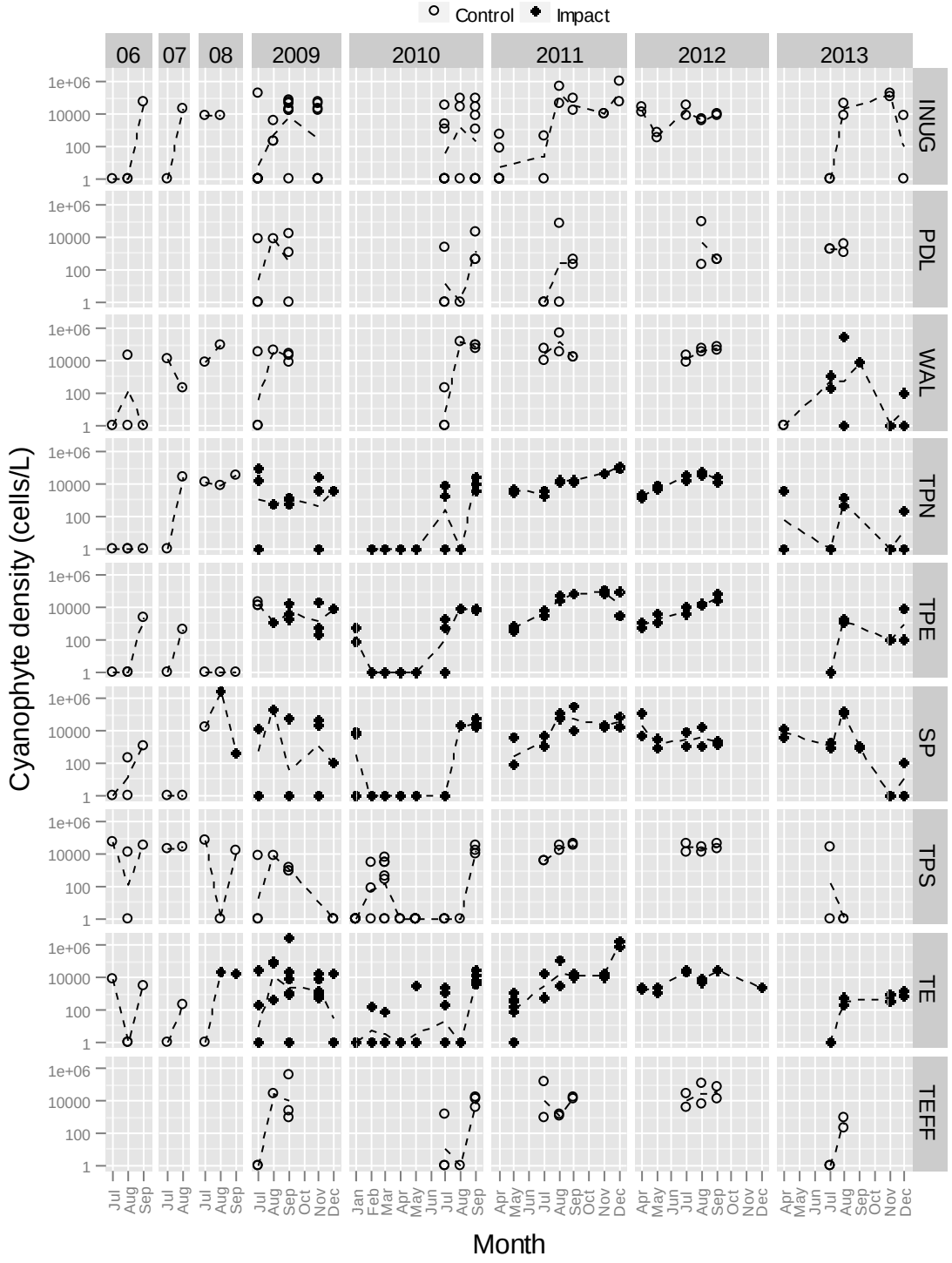

Control
Impact
06
07
08
2009
2010
2011
2012
2013
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Chrysophyte biomass (mg/m3)
500
100
20
5
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Month


Control
Impact
06
07
08
2009
2010
2011
2012
2013
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Diatoms biomass (mg/m3)
100
10
1
0.1
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month

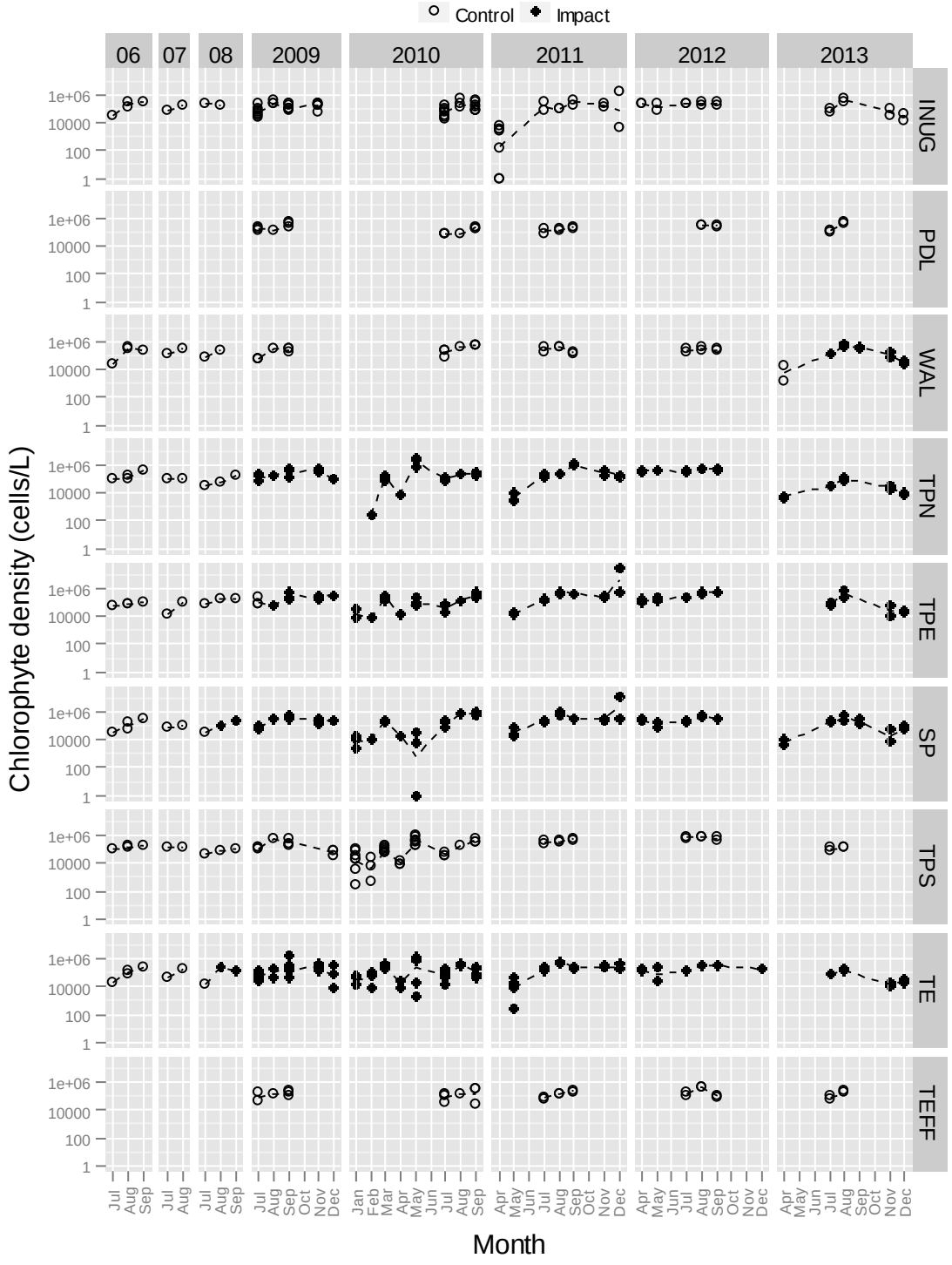

Control
Impact
06
07
08
2009
2010
2011
2012
2013
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Cryptophytes biomass (mg/m3)
50
10
2
0.5
0.1
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Month

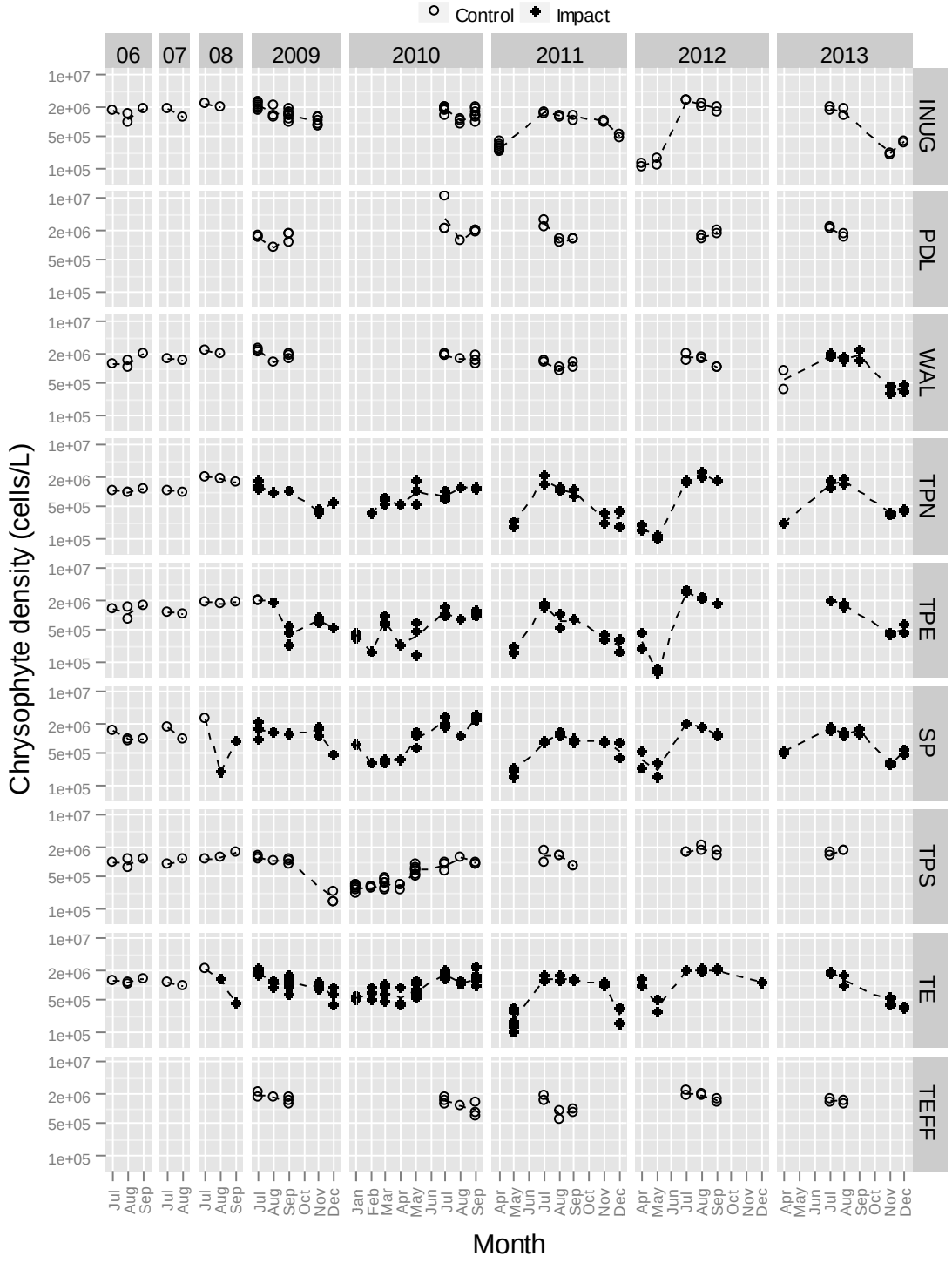

Control
Impact
06
07
08
2009
2010
2011
2012
2013
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Dinoflagellates biomass (mg/m3)
50
10
2
0.5
0.1
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Month

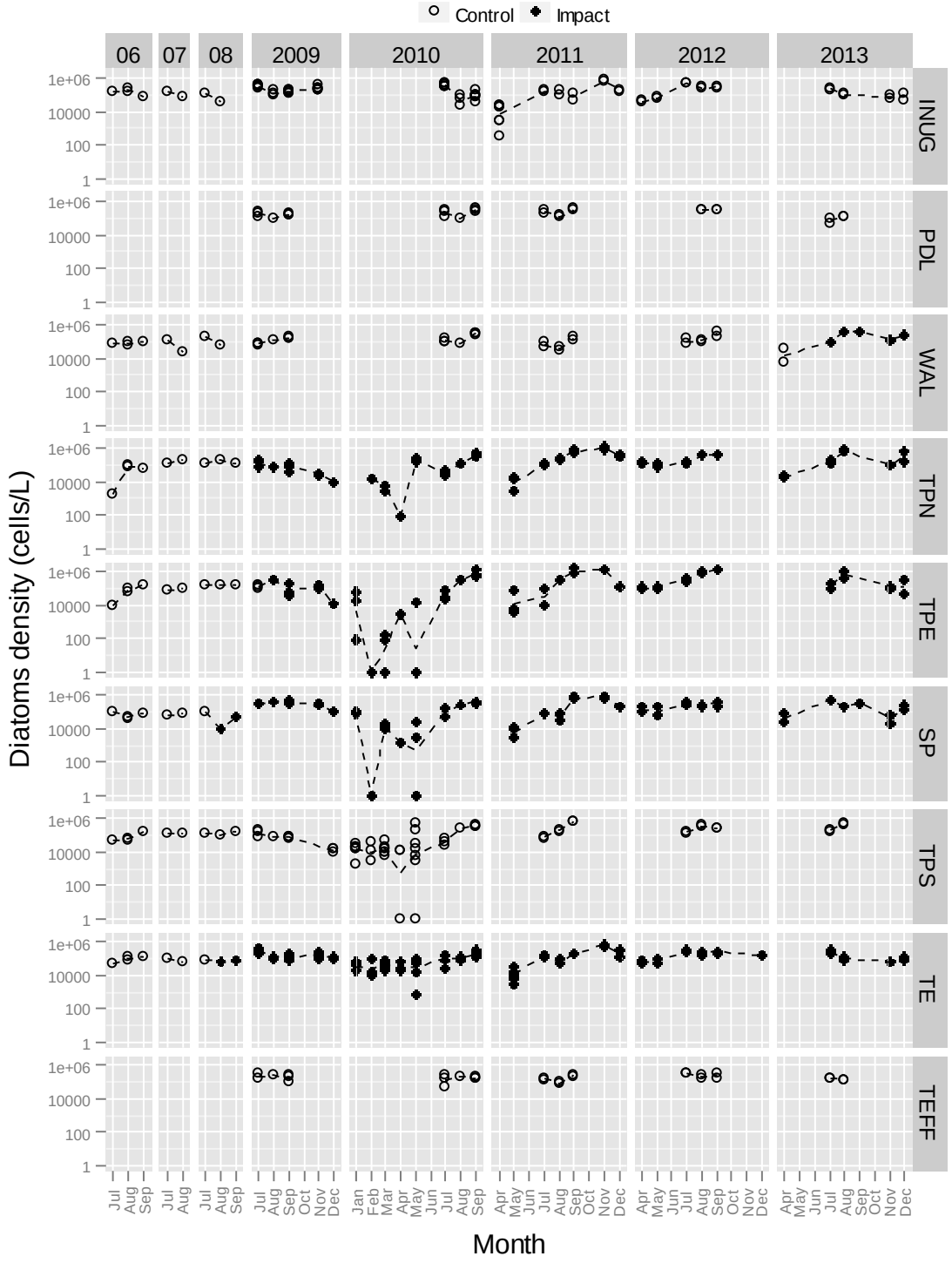

Control
Impact
06
07
08
2009
2010
2011
2012
2013
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Total density (cells/L)
2e+07
5e+06
1e+06
2e+05
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month

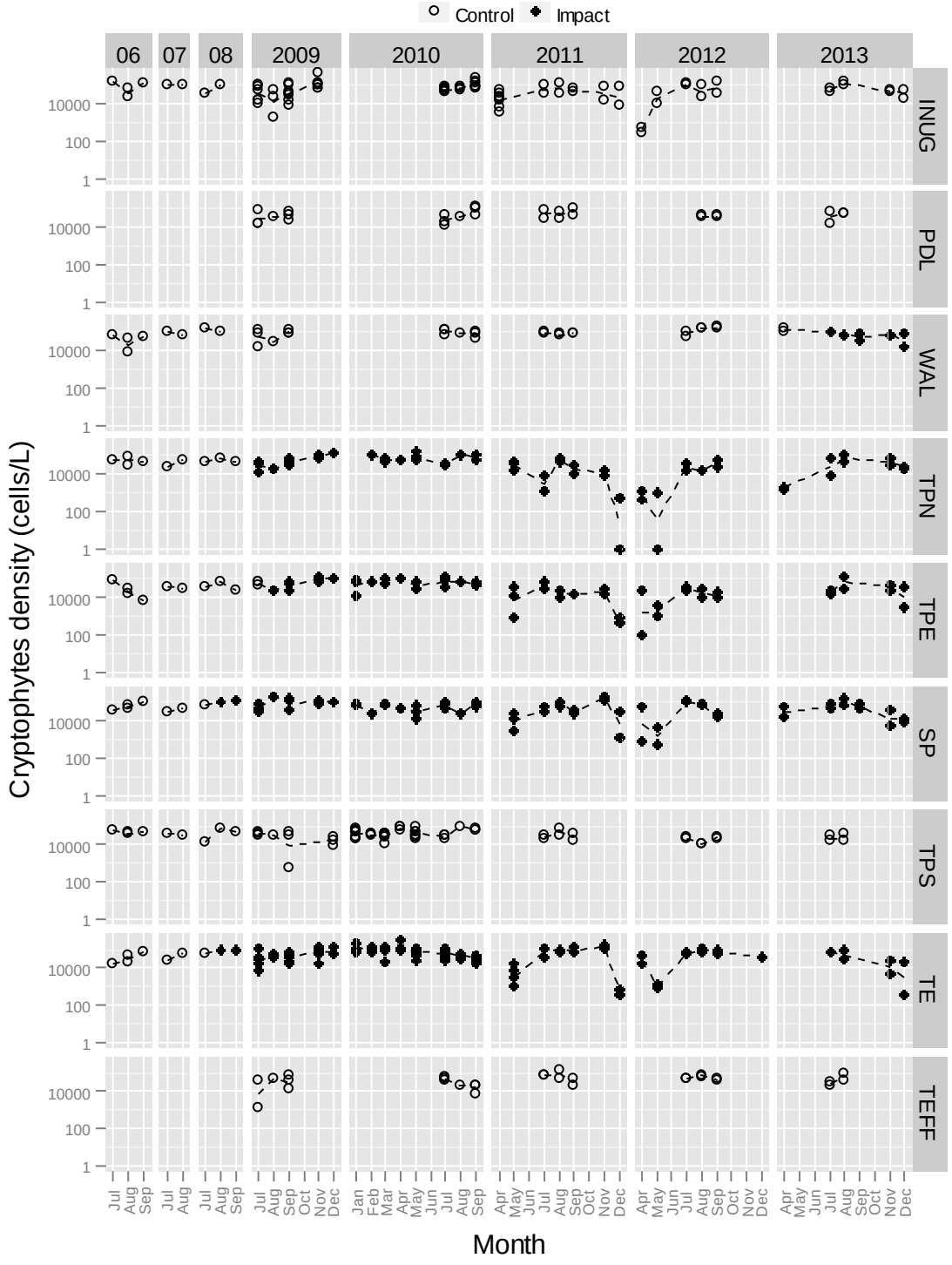

Control
Impact
06
07
08
2009
2010
2011
2012
2013
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Cyanophyte density (cells/L)
1e+06
10000
100
1
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Month

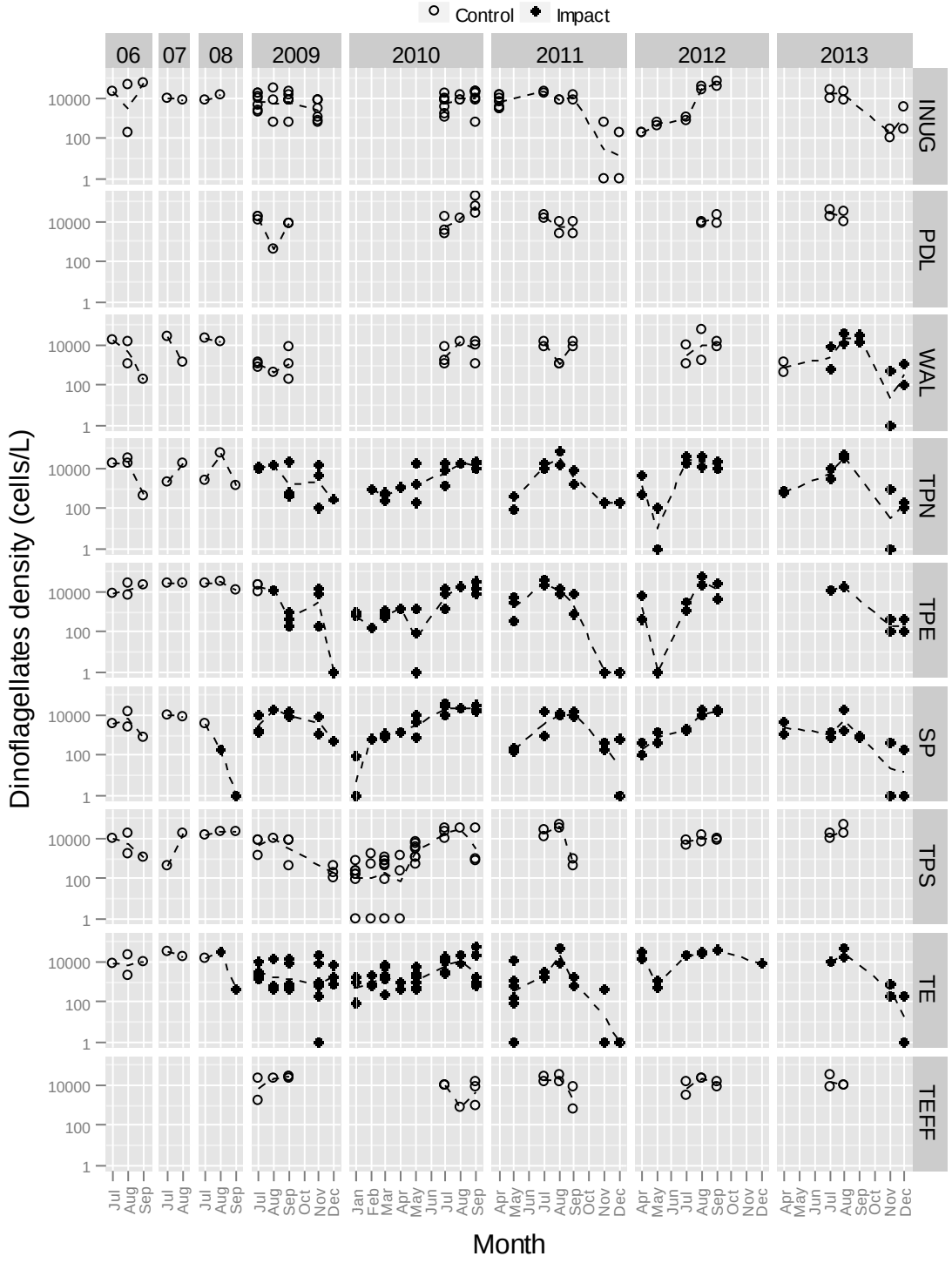
CREMP Phytoplankton Plots 2006 – 2013
Meadowbank Study Lakes

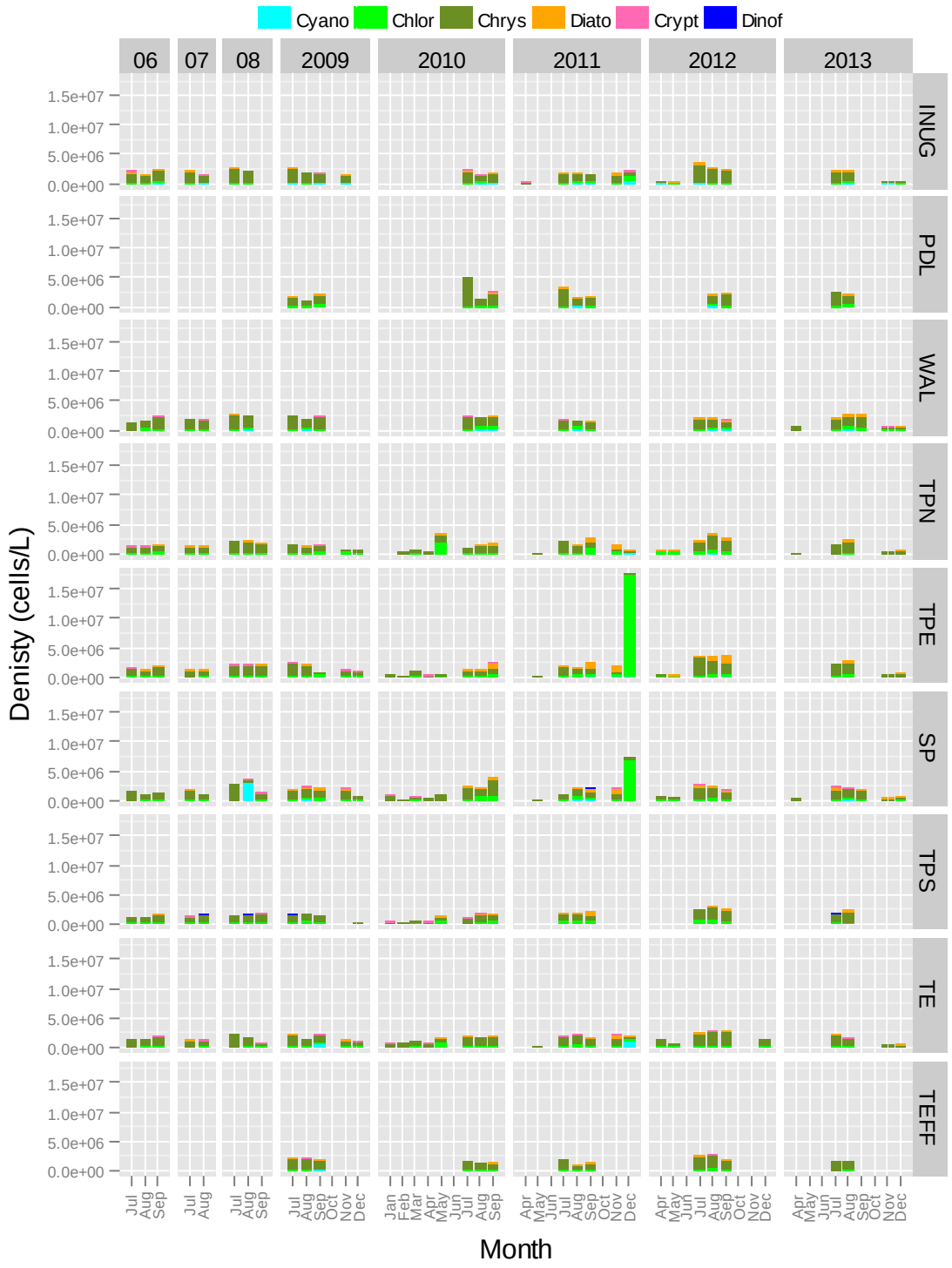



Control
Impact
06
07
08
2009
2010
2011
2012
2013
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Chrysophyte density (cells/L)
1e+07
2e+06
5e+05
1e+05
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month

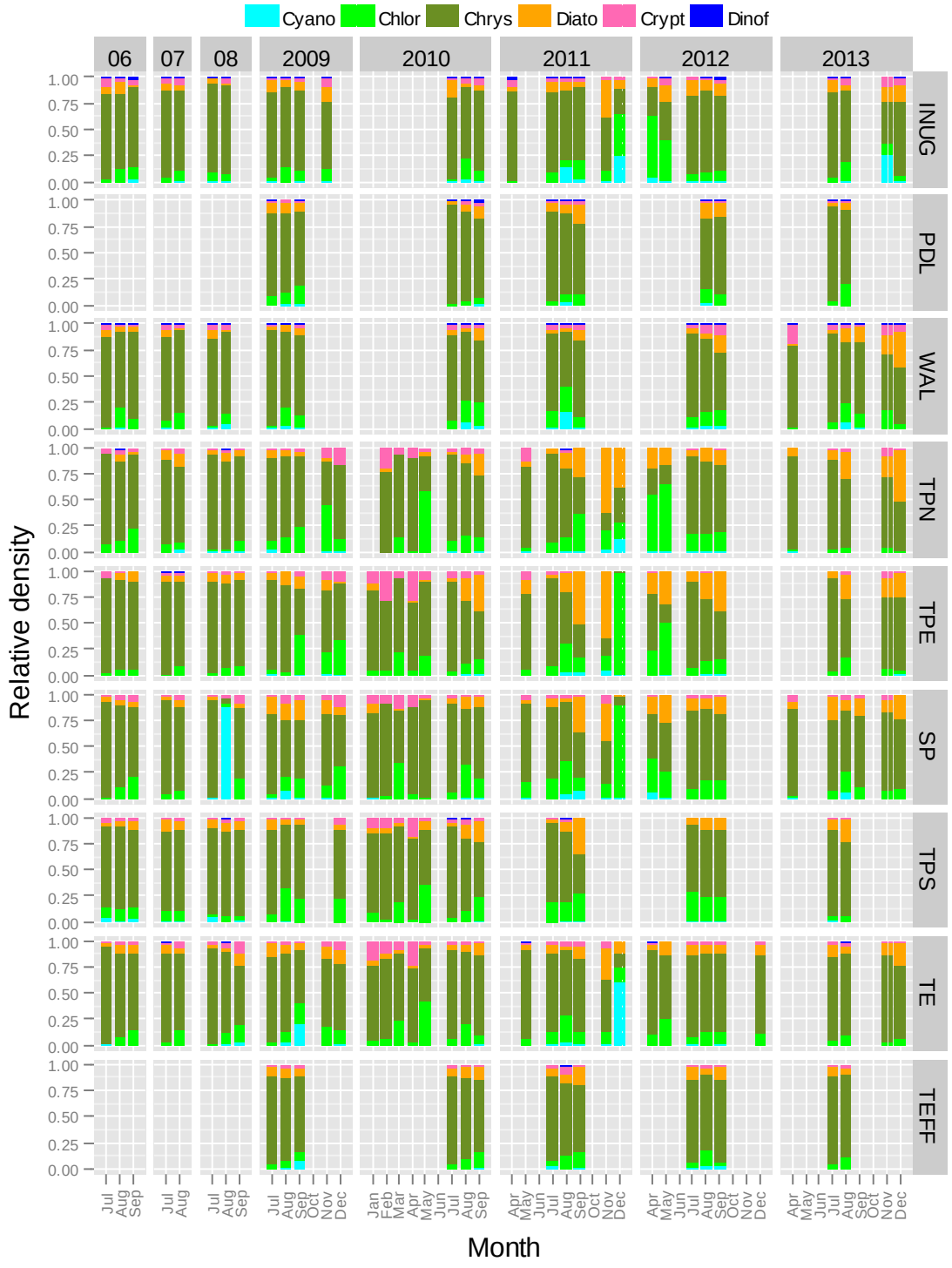

Control
Impact
06
07
08
2009
2010
2011
2012
2013
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Diatoms density (cells/L)
1e+06
10000
100
1
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month

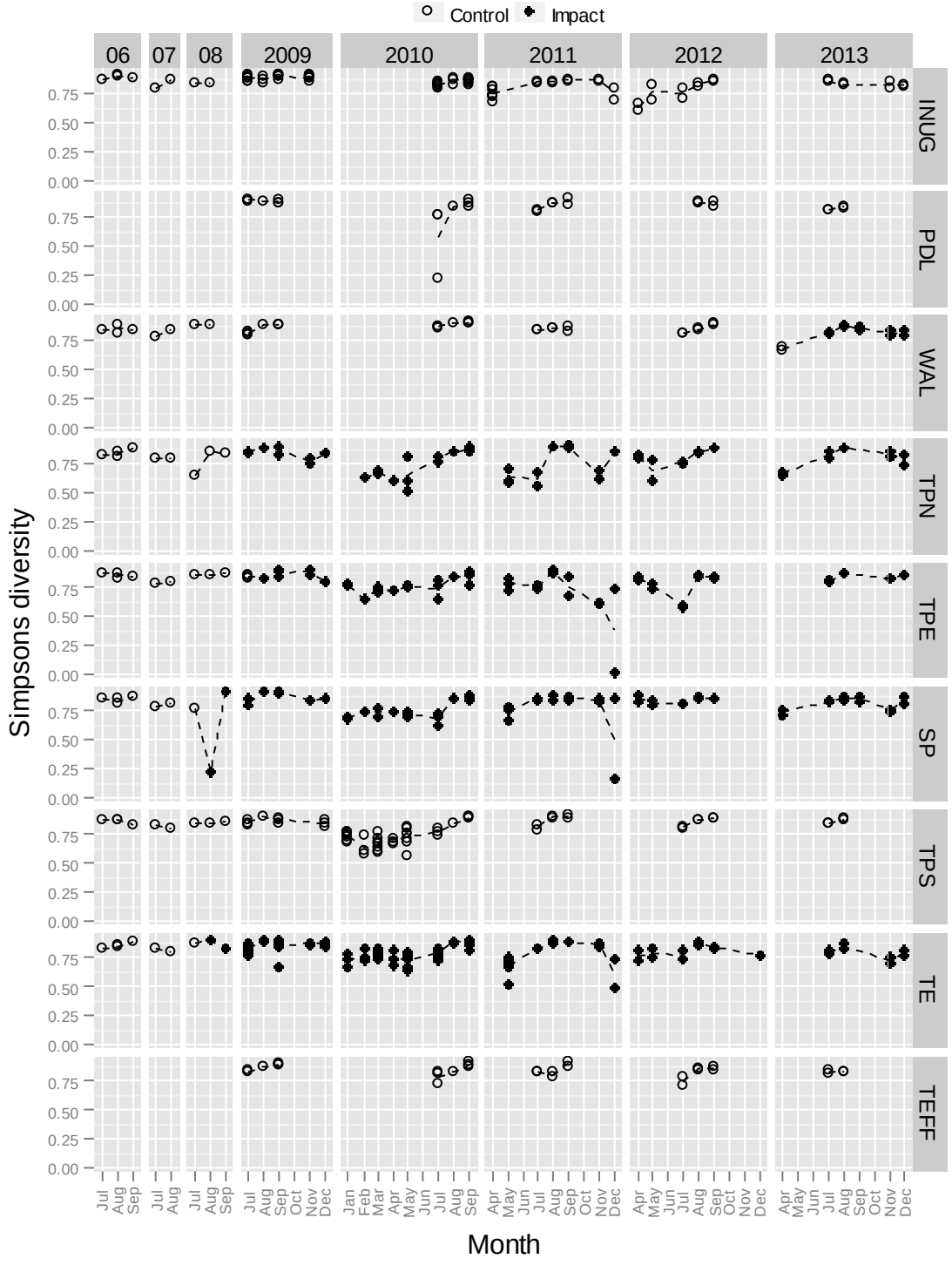

Control
Impact
06
07
08
2009
2010
2011
2012
2013
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Cryptophytes density (cells/L)
10000
100
1
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month

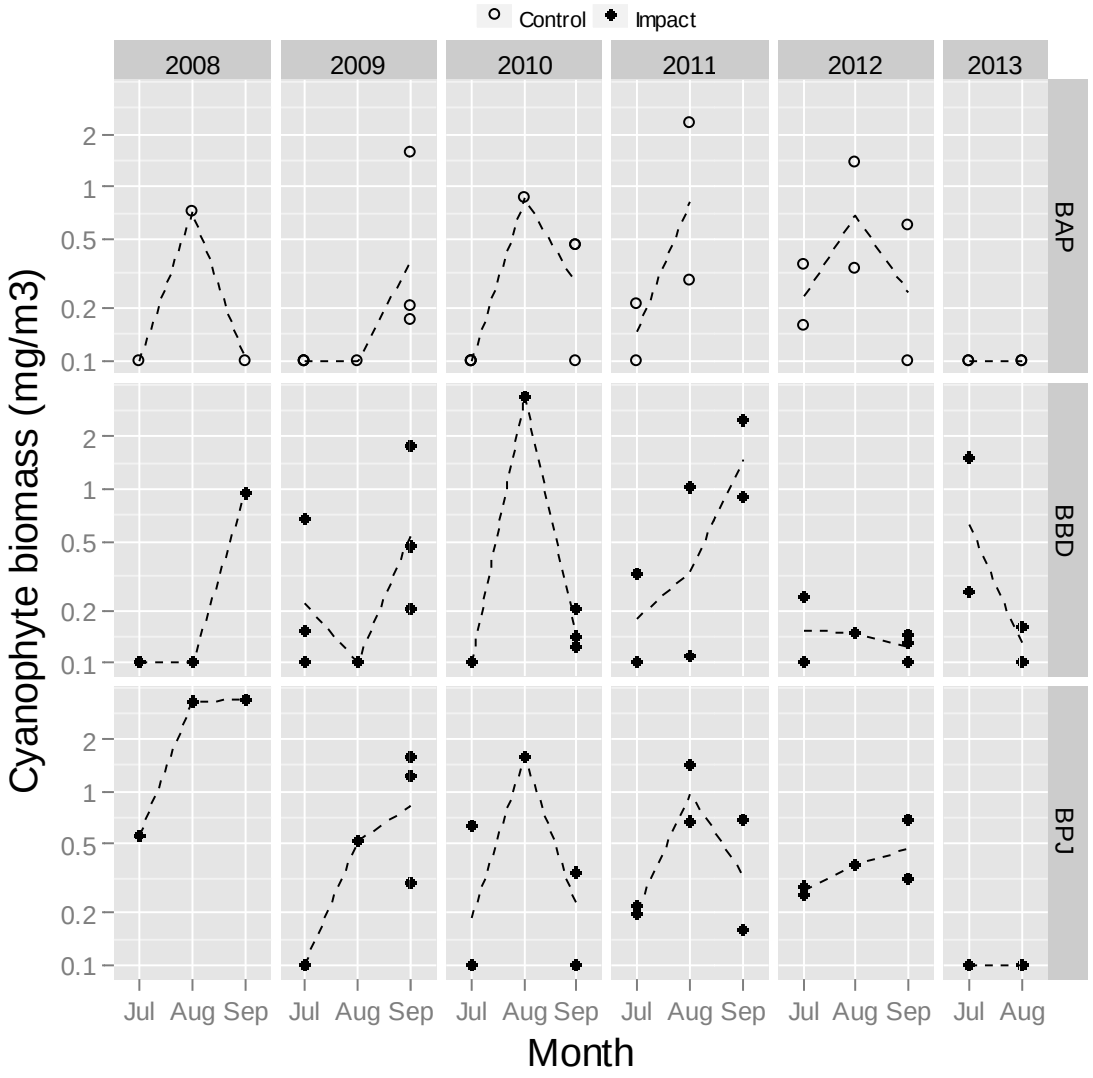

Control
Impact
06
07
08
2009
2010
2011
2012
2013
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Dinoflagellates density (cells/L)
10000
100
1
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Month

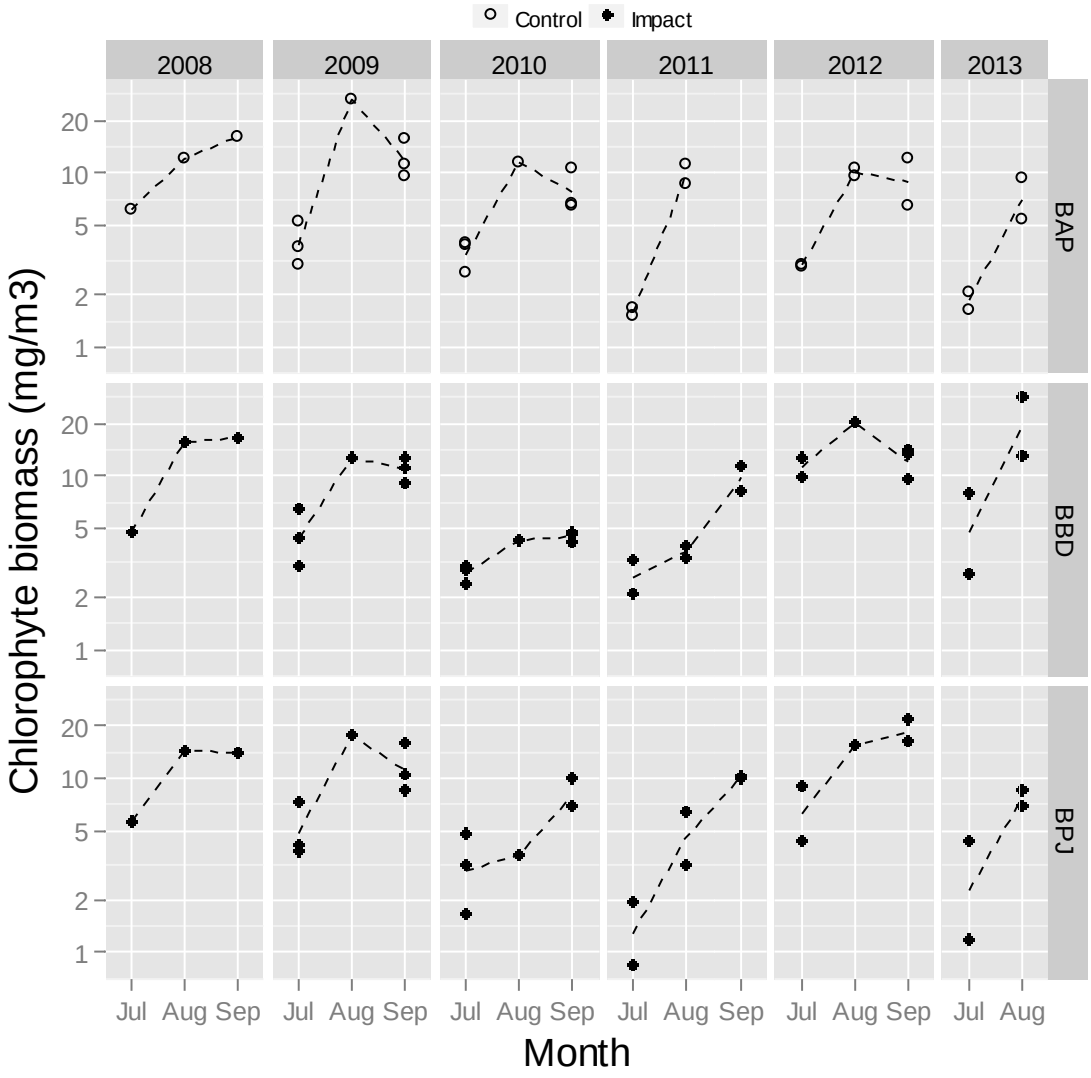

Cyano
Chlor
Chrys
Diato
Crypt
Dinof
06
07
08
2009
2010
2011
2012
2013
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Denisty (cells/L)
1.5e+07
1.0e+07
5.0e+06
0.0e+00
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Month

CREMP Phytoplankton Plots 2006 – 2013
Meadowbank Study Lakes

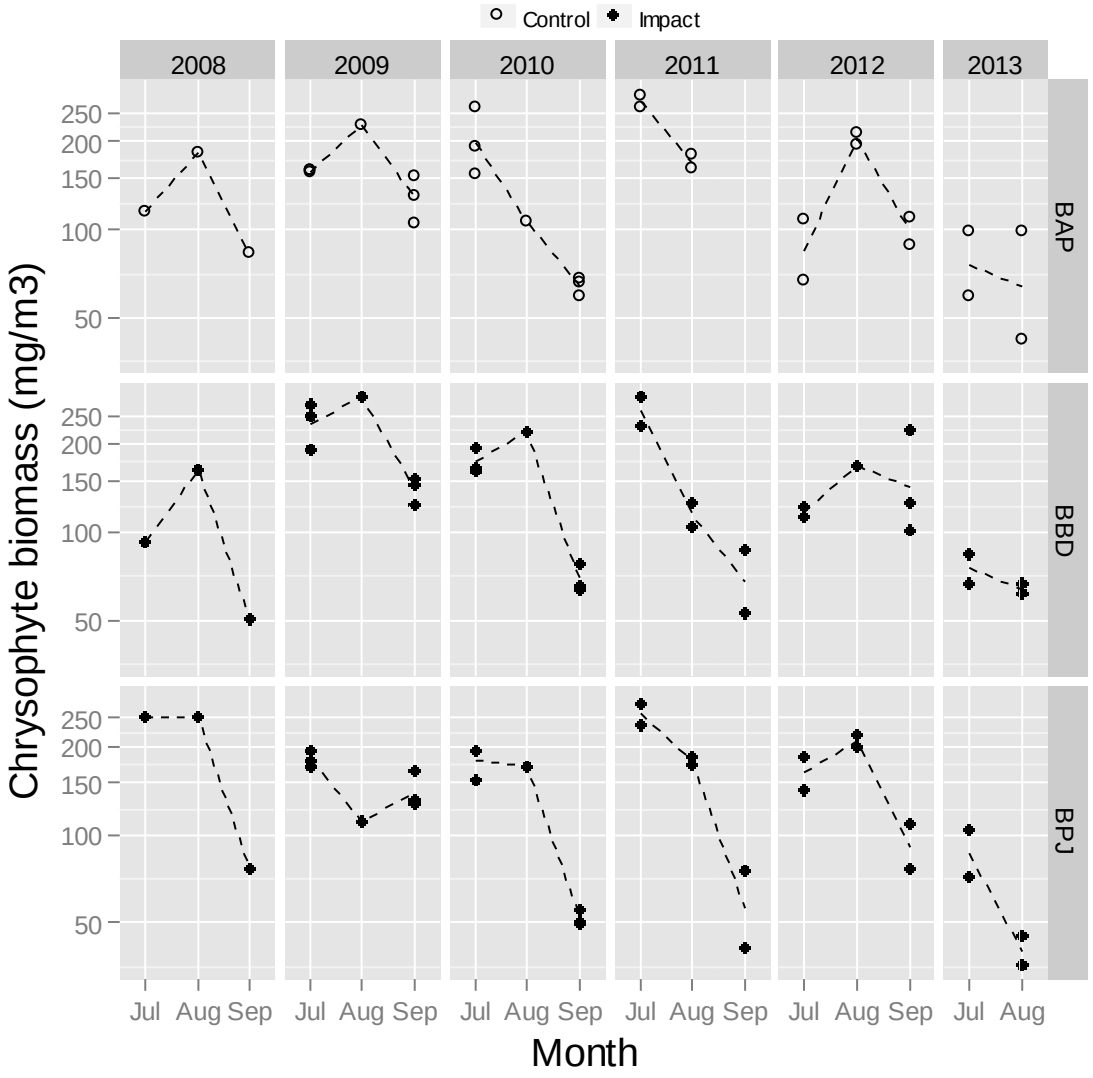



Control
Impact
06
07
08
2009
2010
2011
2012
2013
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Simpsons diversity
0.00
0.25
0.50
0.75
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month

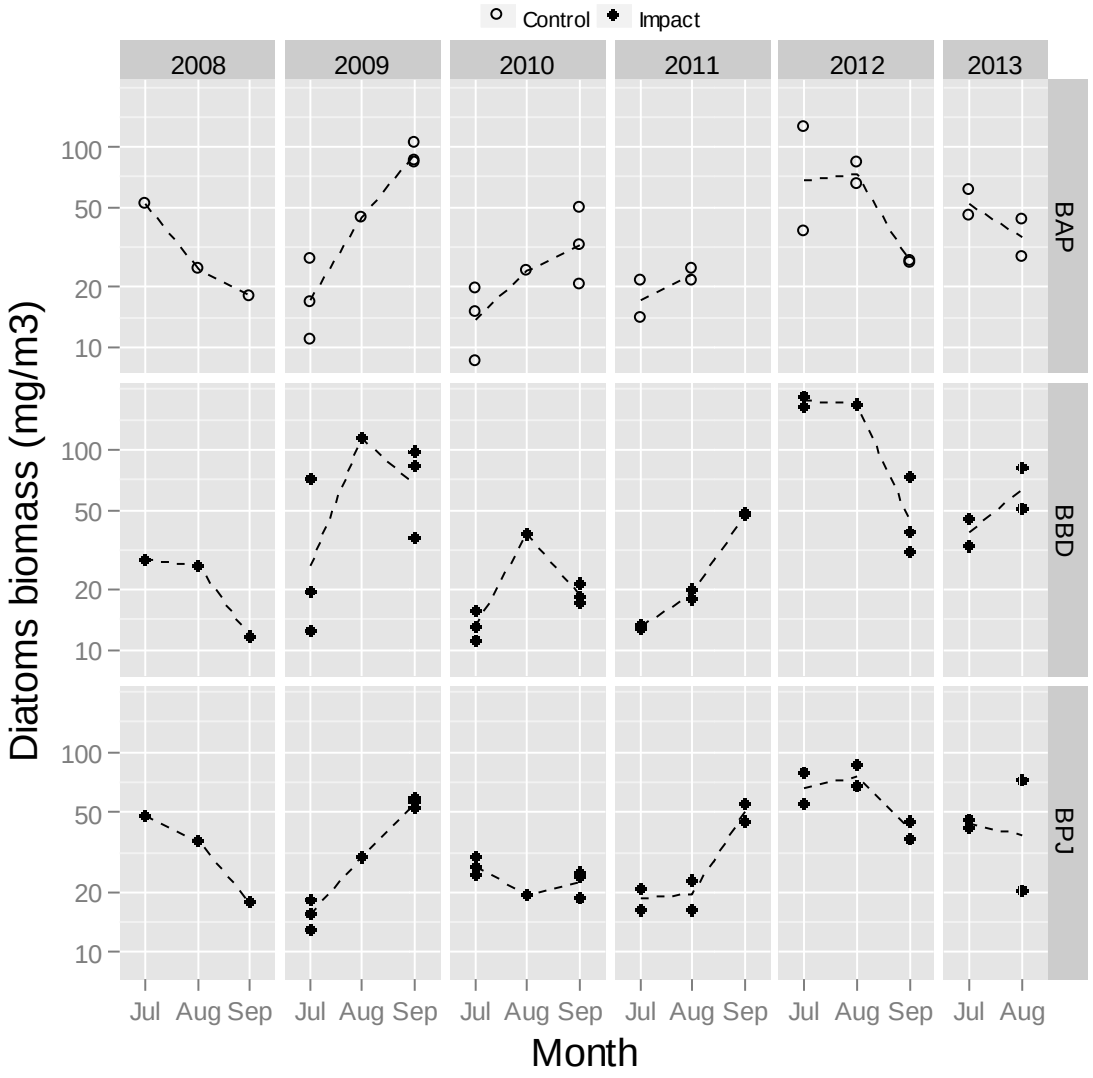

Control
Impact
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
Cyanophyte biomass (mg/m3)
2
1
0.5
0.2
0.1
Jul
Aug
Sep
Month

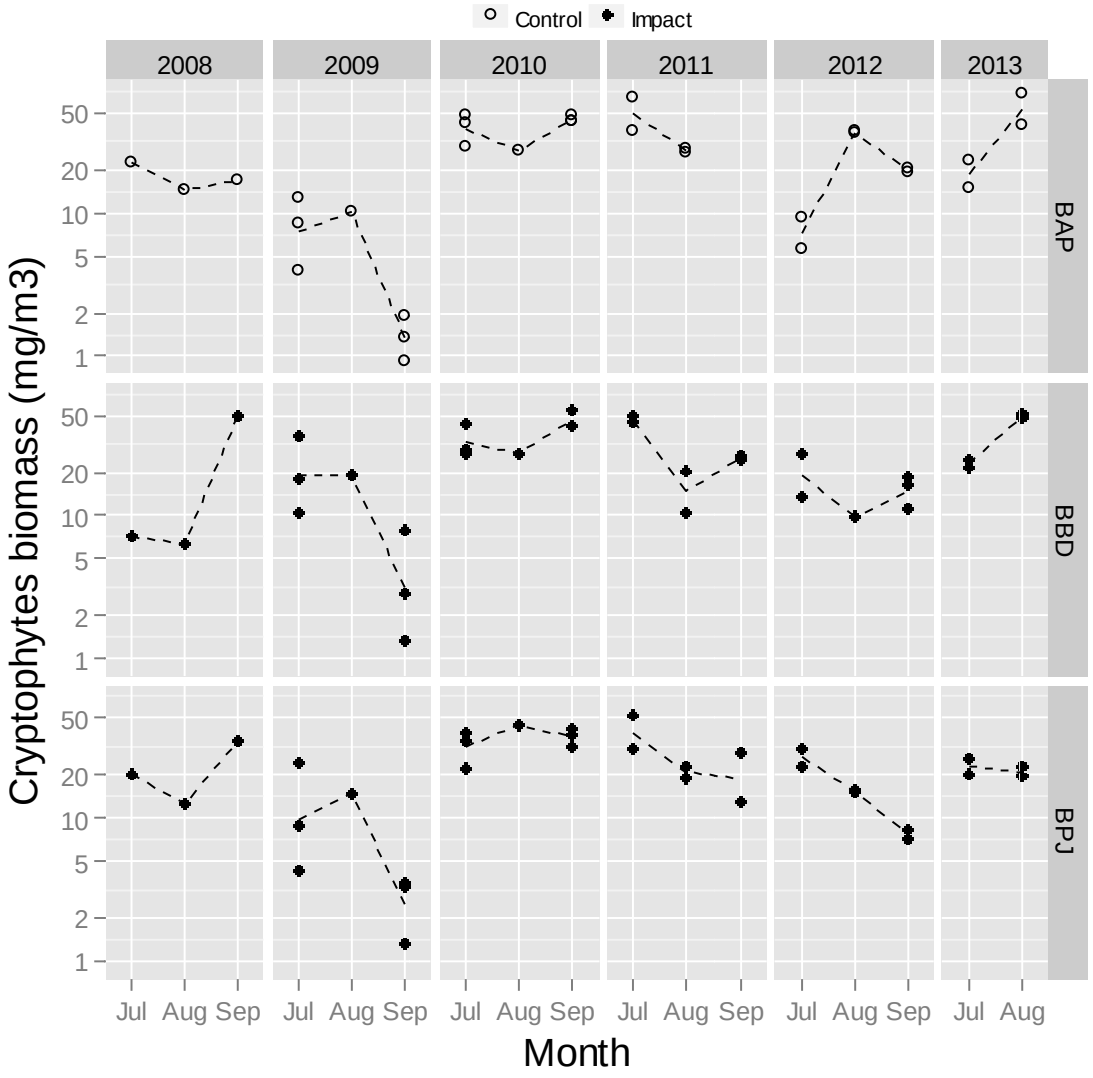

Control
Impact
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
Chlorophyte biomass (mg/m3)
20
10
5
2
1
Jul
Aug
Sep
Month

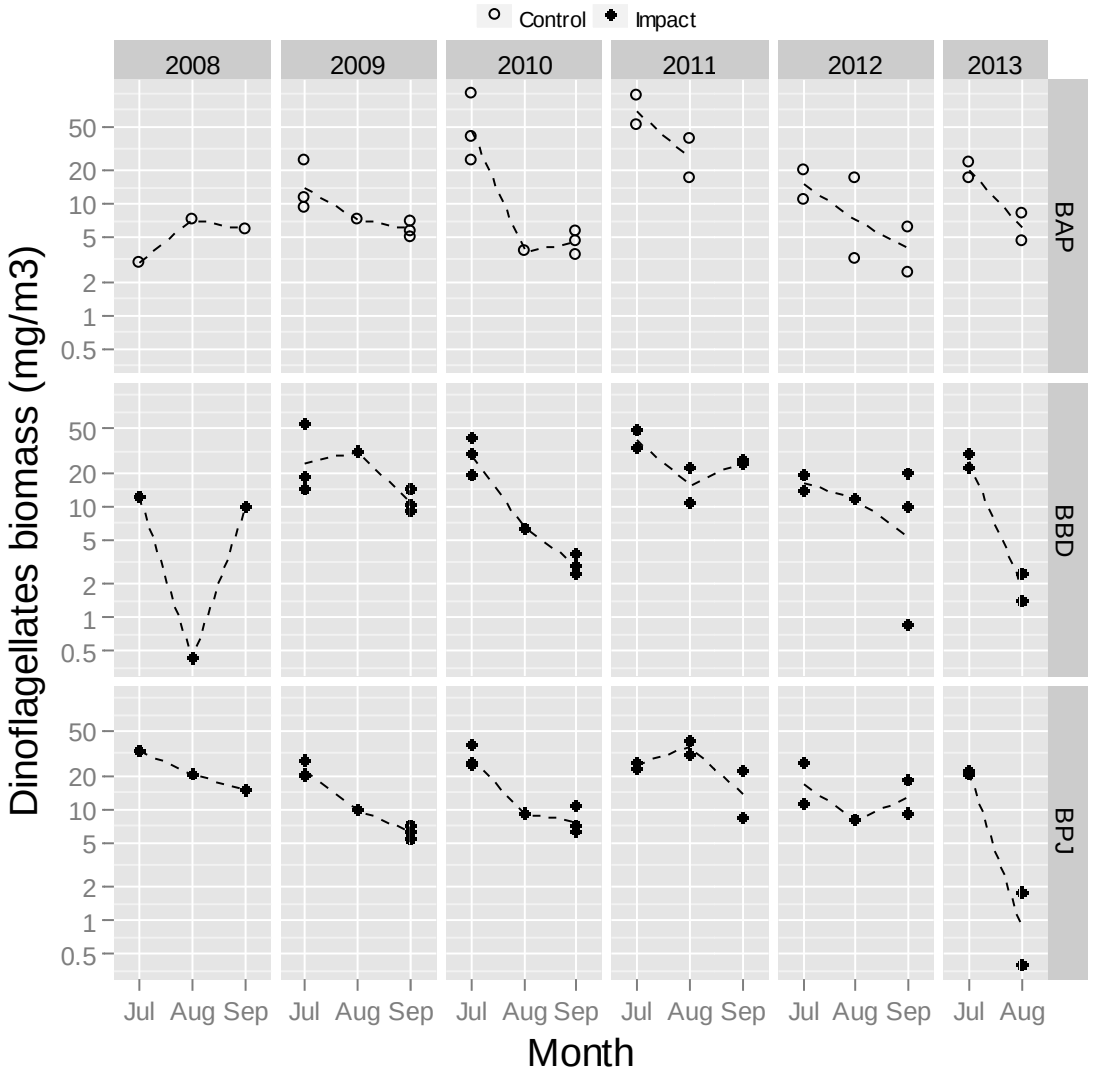
CREMP Phytoplankton Plots 2008 – 2013
Baker Lake



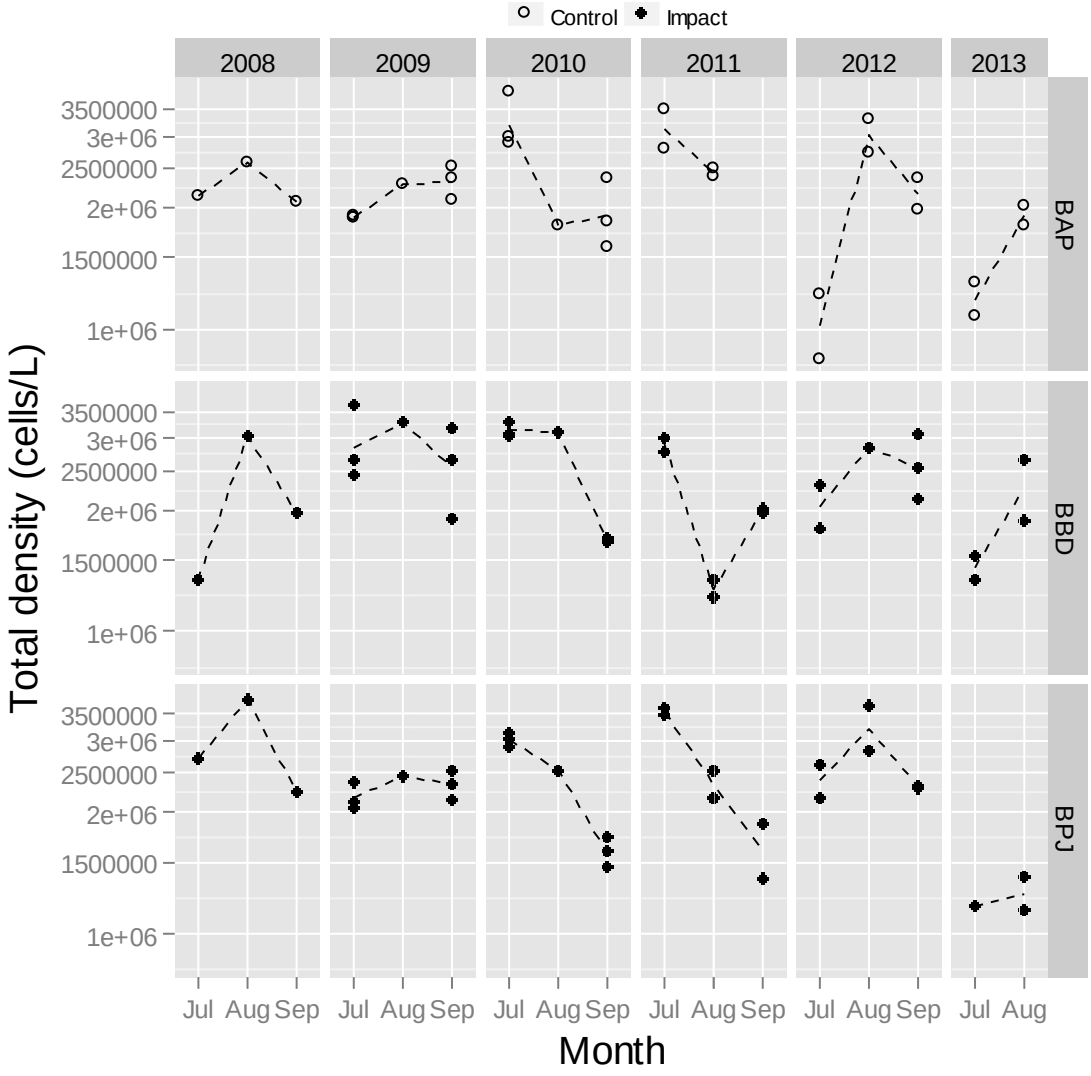
CREMP Phytoplankton Plots 2008 – 2013
Baker Lake



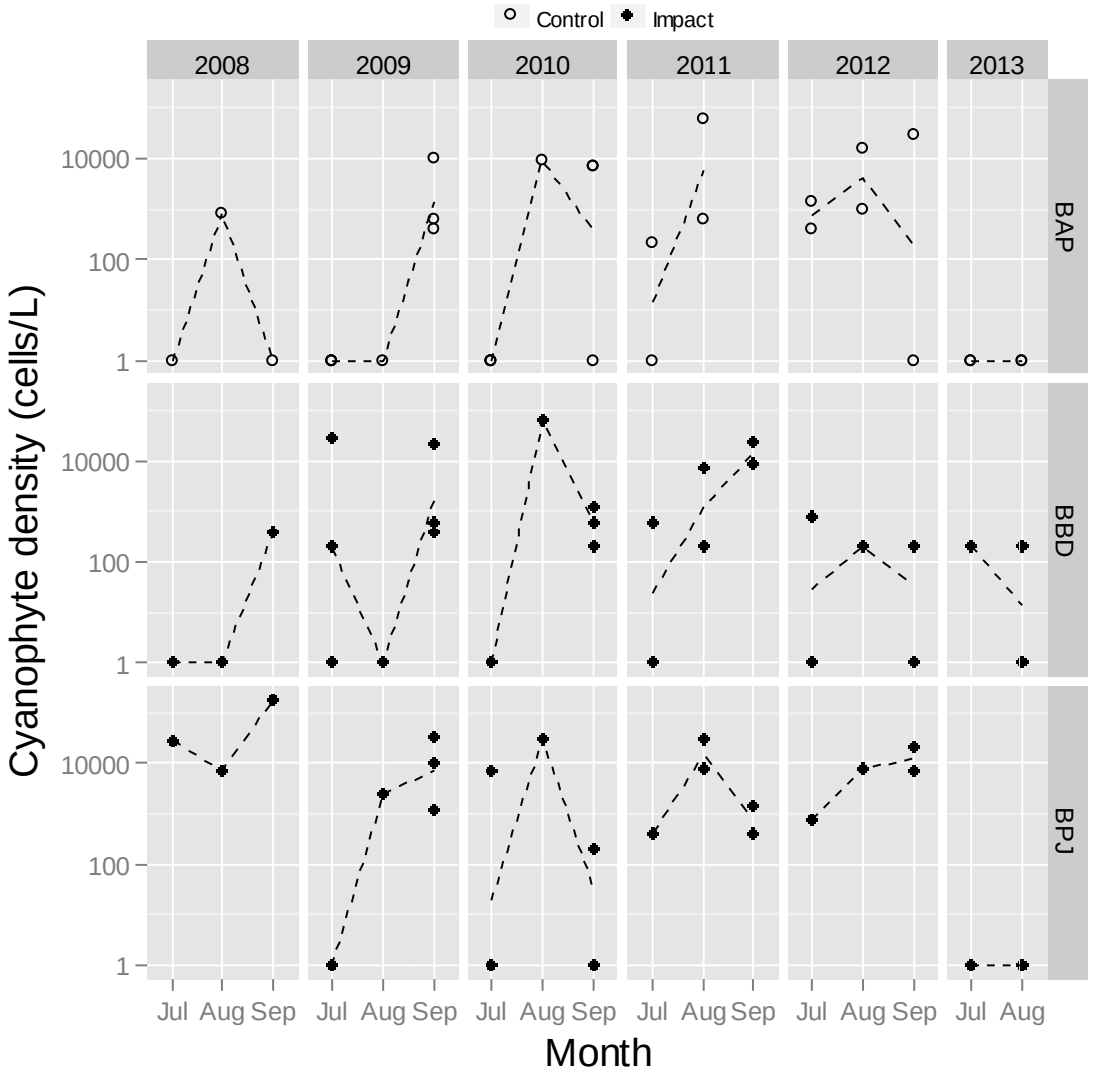

Control
Impact
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
Cryptophytes biomass (mg/m3)
50
20
10
5
2
1
Jul
Aug
Sep
Month


Control
Impact
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
Dinoflagellates biomass (mg/m3)
50
20
10
5
2
1
0.5
Jul
Aug
Sep
Month

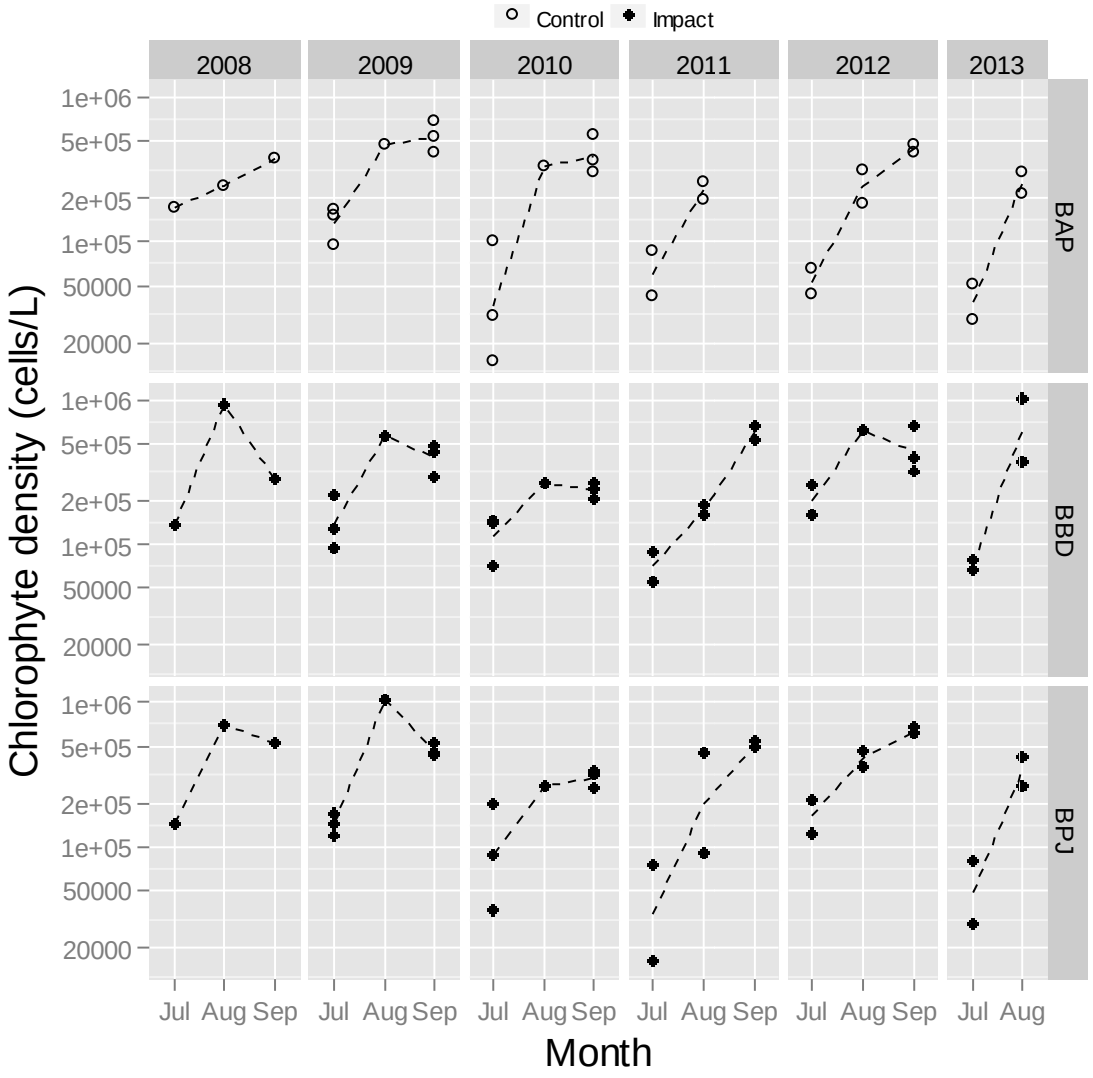
CREMP Phytoplankton Plots 2008 – 2013
Baker Lake

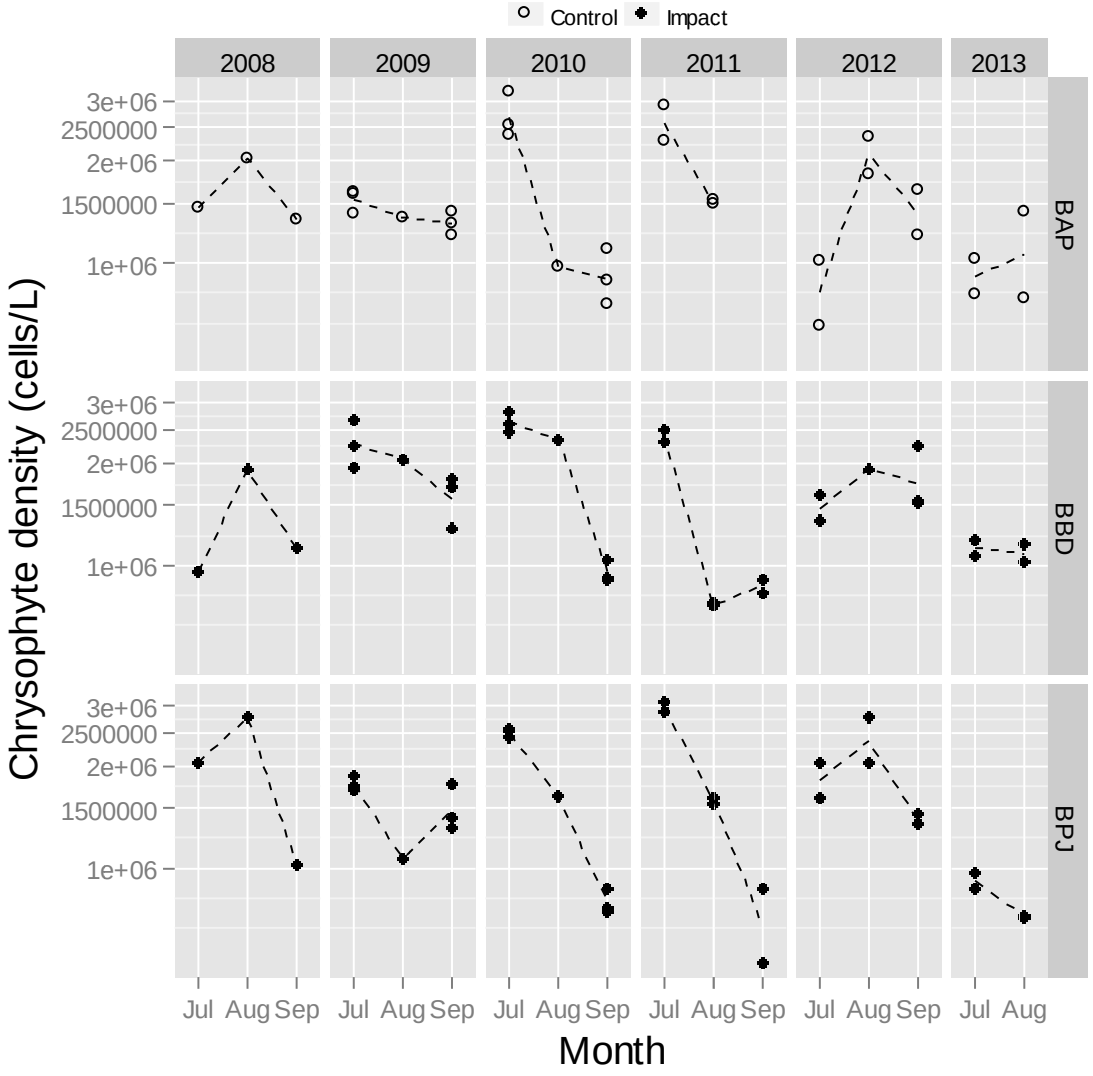


CREMP Phytoplankton Plots 2008 – 2013
Baker Lake

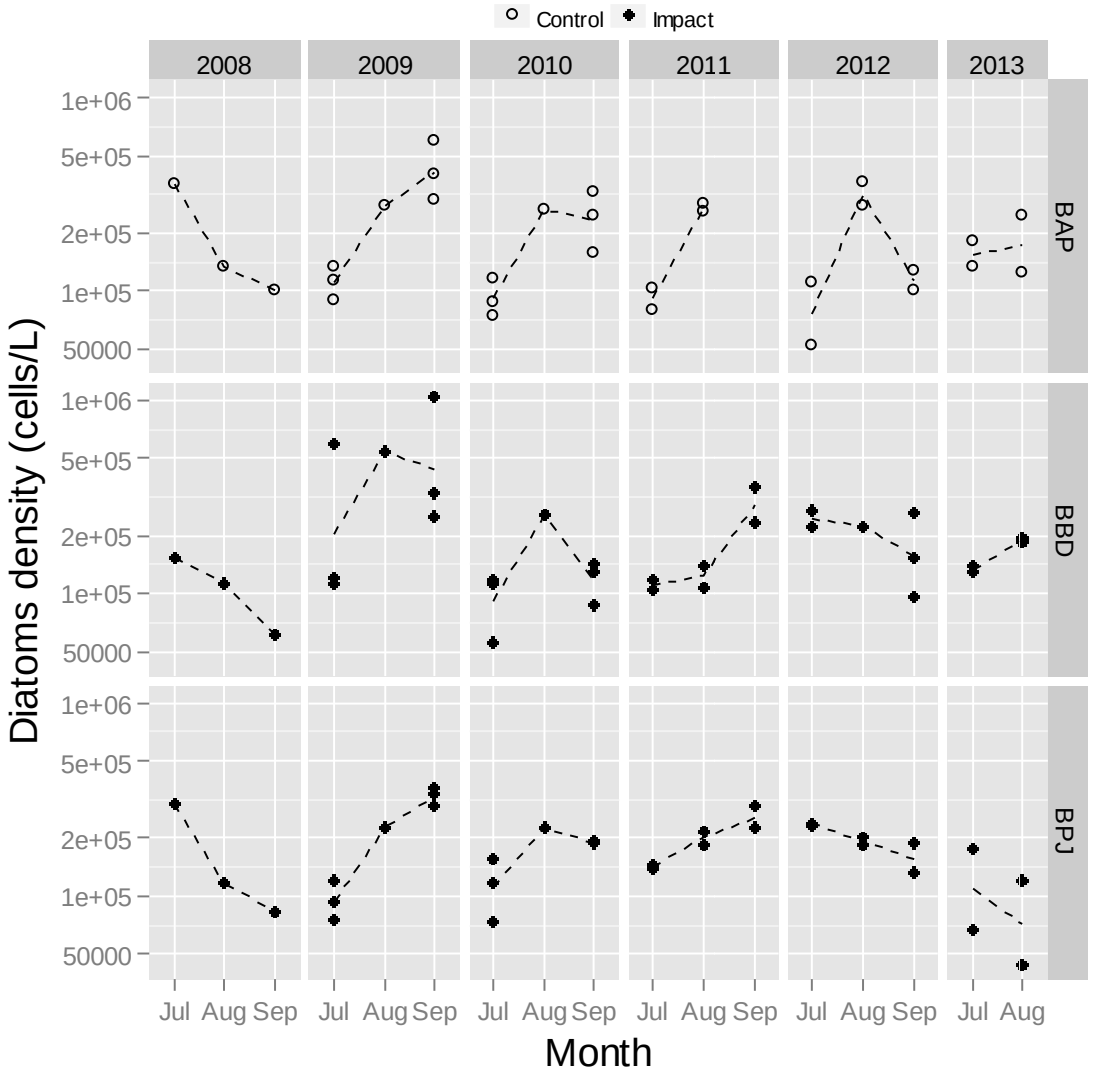


CREMP Phytoplankton Plots 2008 – 2013
Baker Lake

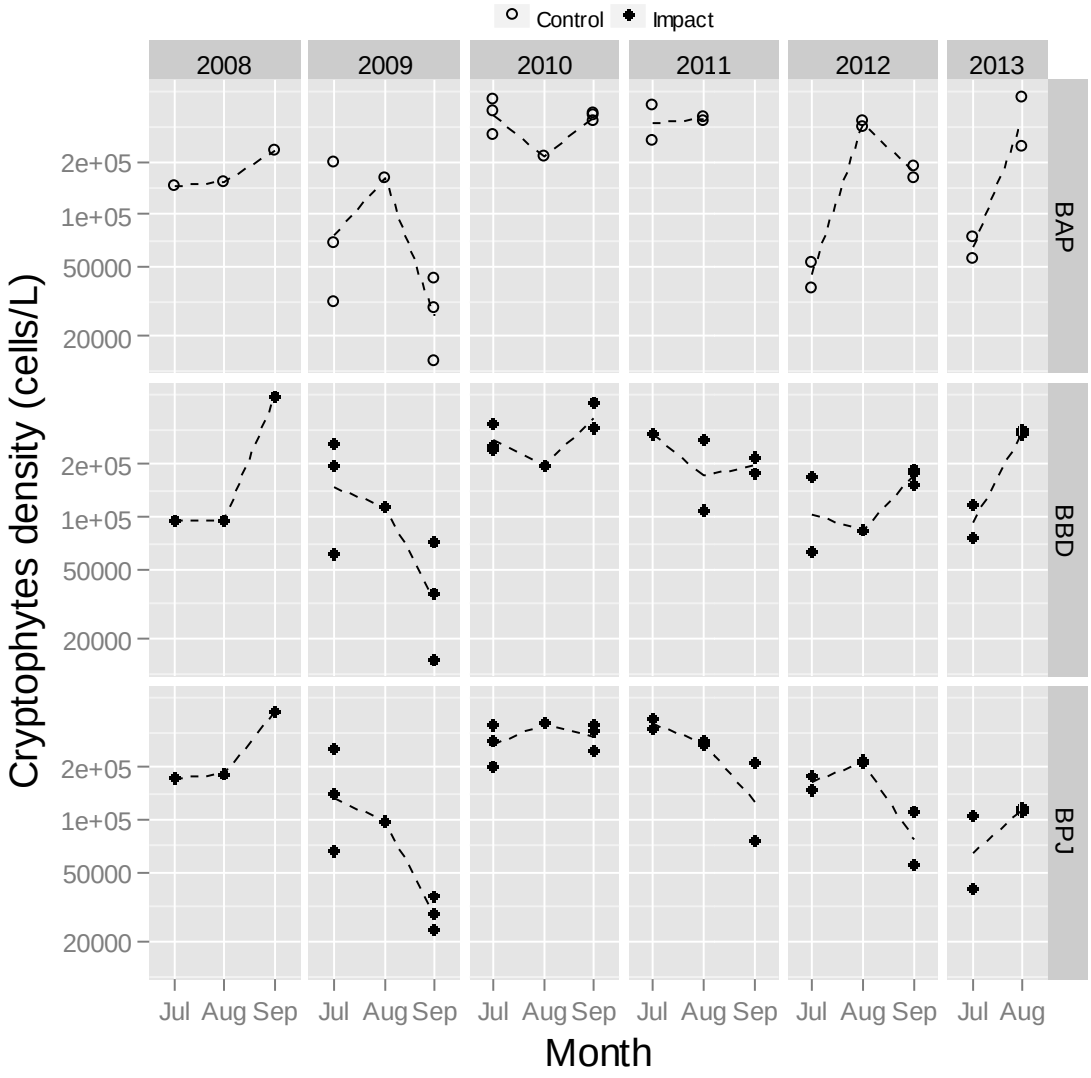



Control
Impact
2008
2009
2010
2011
2012
2013
BAP
BBD
BPJ
Chrysophyte density (cells/L)
3e+06
2500000
2e+06
1500000
1e+06
Jul
Aug
Sep
Month

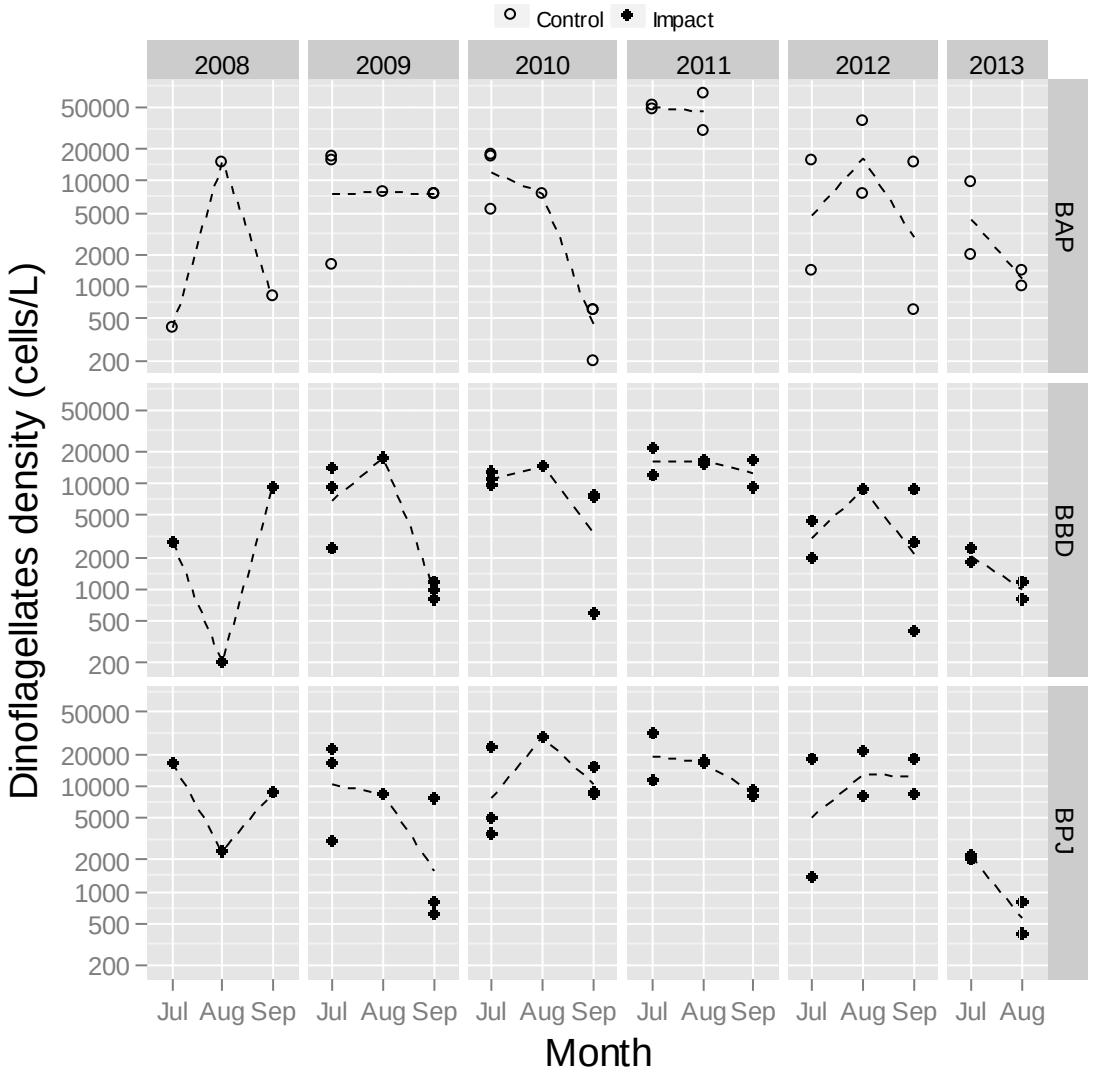
CREMP Phytoplankton Plots 2008 – 2013
Baker Lake



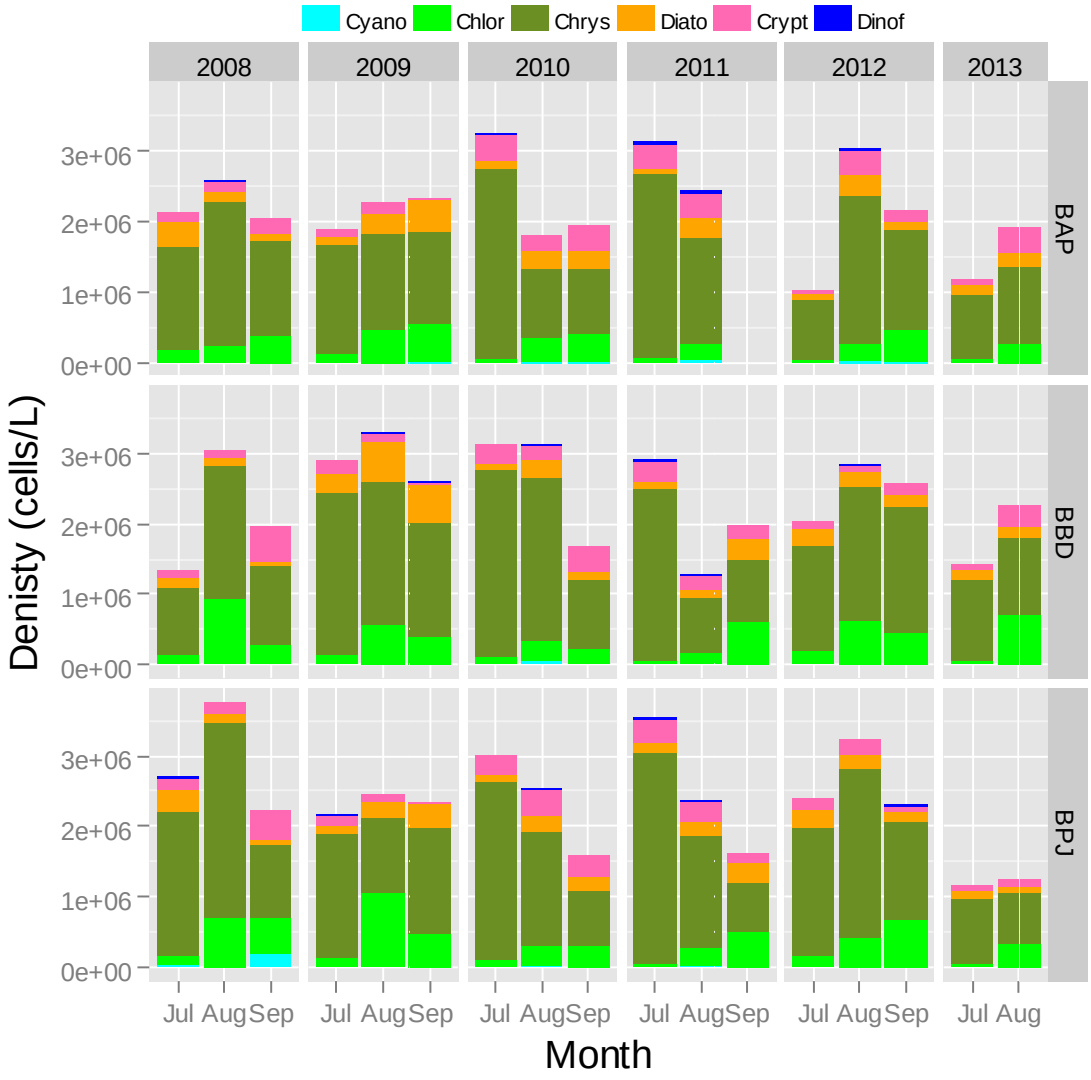
CREMP Phytoplankton Plots 2008 – 2013
Baker Lake



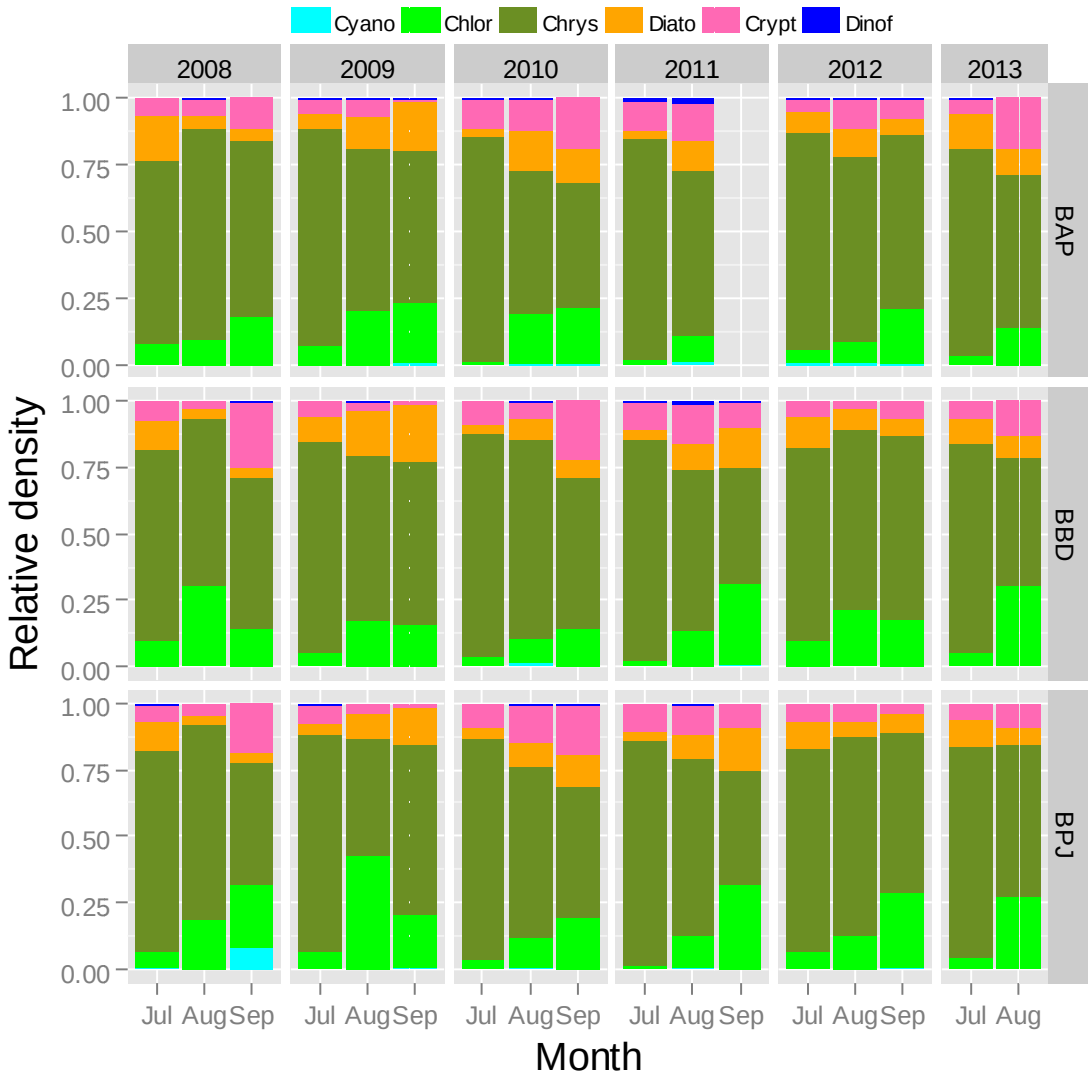
CREMP Phytoplankton Plots 2008 – 2013
Baker Lake



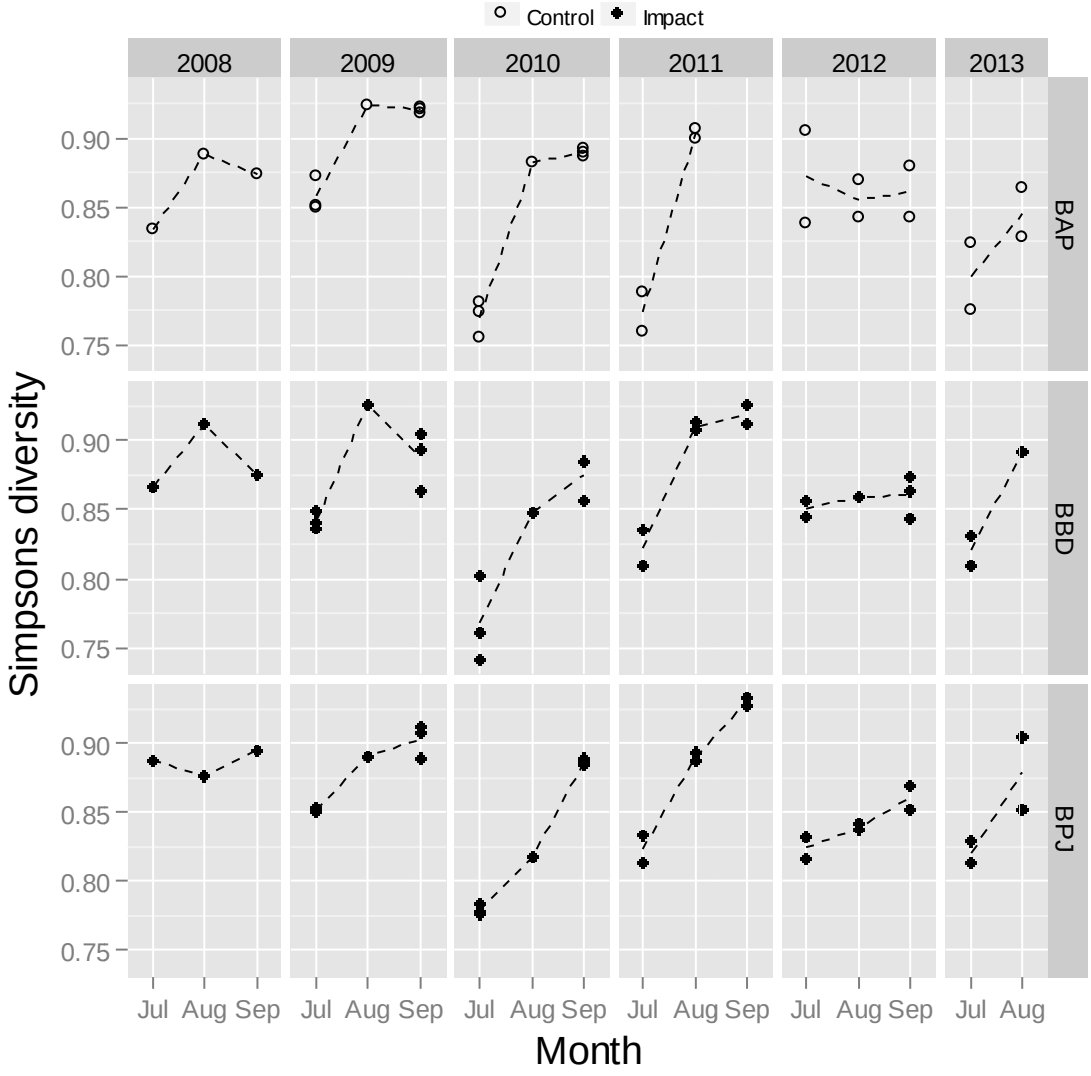
CREMP Phytoplankton Plots 2008 – 2013
Baker Lake



CREMP Phytoplankton Plots 2008 – 2013
Baker Lake



CREMP Phytoplankton Plots 2008 – 2013
Baker Lake



APPENDIX H

BENTHIC INVERTEBRATE RAW DATA, MEADOWBANK STUDY LAKES AND BAKER LAKE, 2013

Appendix H. Benthic Invertebrate raw data (total number of organisms in two 0.023 m^2 grabs), Meadowbank Study Lakes and Baker Lake, August 2013.

Location	Baker Akilahaarjuk Point					Baker Barge Dock					Baker East Shore				
Station	BAP	BAP	BAP	BAP	BAP	BBD	BBD	BBD	BBD	BBD	BES	BES	BES	BES	BES
Replicate	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
DepthOfSample (m)	8.3	7.7	8.6	8.6	9.1	8.4	8.9	7	7.5	7.3	7	7.2	8.2	8.3	8.8
# 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
ROUNDWORMS															
P. Nemata	14	43	21	15	17	2		4	2	1	8	2	17	17	16
FLATWORMS															
P. Platyhelminthes															
Cl. Turbellaria															
indeterminate															
ANNELIDS															
P. Annelida															
WORMS															
Cl. Oligochaeta															
F. Enchytraeidae	6	14	12	4			2				4		7	13	
F. Naididae															
S.F. Naidinae															
Nais	2														
Slavina appendiculata					7										
S.F. Rhyacodrilinae															
Rhyacodrilus coccineus					22										
Rhyacodrilus montana	19	88	40	53	50	11			2	10	5	1	2	2	
S.F. Tubificinae															
Limnodrilus hoffmeisteri			4	4	7		17		3	2					
Tasserkidrilus americanus							4					1			
immatures with hair chaetae	5	14	16	11	43				1	2		5			
immatures without hair chaetae		13	8	4	14	1	14			2		5			
F. Lumbriculidae															
Lumbriculus															
Stylodrilus											3	13			
ARTHROPODS															
P. Arthropoda															
MITES															
Cl. Arachnida															
O. Acarina	6	9	5	5	8			2	2	3	11	9	7	9	8
SEED SHRIMPS															
Cl. Ostracoda	9	52	14	11	21	15		5	13	39	5	15	3	15	4
INSECTS															
Cl. Insecta															
CADDISFLIES															
O. Trichoptera															
F. Apataniidae															
Apatania		1									1				
F. Limnephilidae															
Grensia praeterita															
TRUE FLIES															
O. Diptera															
MIDGES															
F. Chironomidae															
chironomid pupae	**17**	**22**	**31**	**8**	**8**	**2**	**1**	**1**	**2**	**2**	**23**	**3**	**44**	**63**	**50**
S.F. Chironominae															
Chironomus															
Cladotanytarsus	3														
Constempellina	5	2	3	2	1				9	9	4	2	3	6	1
Corynocera												3			
Dicrotendipes															
Micropsectra	9	86	6	7	30	14		5	12	23	3	21	4	3	3
Microtendipes															
Paracladopelma	3			2										2	1
Paratanytarsus	6	40		2	18						42	13	20	31	21
Polypedilum		1										1			

Appendix H. Benthic Invertebrate raw data (total number of organisms in two 0.023 m^2 grabs), Meadowbank Study Lakes and Baker Lake, August 2013.

Location	Baker Akilahaarjuk Point					Baker Barge Dock					Baker East Shore				
Station	BAP	BAP	BAP	BAP	BAP	BBD	BBD	BBD	BBD	BBD	BES	BES	BES	BES	BES
Replicate	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
DepthOfSample (m)	8.3	7.7	8.6	8.6	9.1	8.4	8.9	7	7.5	7.3	7	7.2	8.2	8.3	8.8
# 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
Sergentia			1			4	1			1		1			
Stempellinella									3						
Stictochironomus	11	47	13	22	44	321	115	2	69	96	8	37			
Tanytarsus	12	6	11	3	9	23	2	11	15	45	14	11	16	15	8
S.F. Diamesinae															
Protanypus	1		4	4	2			1	1				1		
Potthastia	1										1			4	2
Pseudodiamesa	5		1	4				1					3	1	2
S.F. Orthocladiinae															
Abiskomyia	5	2	8	3	7	2			3	21	1	9		2	
Cricotopus															
Cricotopus/Orthocladius	9	4	6	1	1						3	1	3		3
Heterotrissocladius	25	2	8	8	6	12	1	5	12	19	2		15	9	15
Mesocricotopus				1											
Paracladius				3							6		3	7	3
Parakiefferiella			5								1		3	2	7
Psectrocladius			2						2			1			
Zalutschia															
indeterminate													2	3	
S.F. Prodiamesinae															
Monodiamesa	3	2	3	3	4	2	3	4	4	7	9	4	3	13	4
S.F. Tanypodinae															
Ablabesmyia															
Procladius	2	3	3	2	7	2		4	13	8	1	5	2	4	4
Thienemannimyia complex								1			1	1		1	
F. Empididae															
Chelifera/Neoplasta	1			1	2			1		1			2	3	1
Wiedemannia								1							
pupae			1											**1**	
MOLLUSCS															
P. Mollusca															
CLAMS															
Cl. Bivalvia															
F. Sphaeriidae															
Cyclocalyx/Neopisidium	5	34	11	16	33	19	1		2	10	7		9	21	9
Cyclocalyx										1				1	
Sphaerium nitidum															
R (Richness) - totals															
Total	21	16	20	21	18	10	9	12	15	15	20	18	17	20	16
Oligochaete	3	2	3	3	4	1	3	0	2	2	3	3	2	2	0
Insect	16	12	15	16	12	8	5	11	11	10	15	14	13	15	14
Mollusc	1	1	1	1	1	1	1	0	1	2	1	0	1	2	1
Other	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1
N (Abundance) - raw															
Total	161	390	202	173	323	413	161	39	155	262	150	147	149	216	142
Oligochaete	32	129	80	76	143	12	37	0	6	16	12	25	9	15	0
Insect	118	218	106	76	139	382	123	37	145	232	120	113	124	170	125
Mollusc	5	34	11	16	33	19	1	0	2	11	7	0	9	22	9
Other	6	9	5	5	8	0	0	2	2	3	11	9	7	9	8
N (Abundance) - #/m^2															
Total	3500	8478	4391	3761	7022	8978	3500	848	3370	5696	3261	3196	3239	4696	3087
Oligochaete	696	2804	1739	1652	3109	261	804	0	130	348	261	543	196	326	0
Insect	2565	4739	2304	1652	3022	8304	2674	804	3152	5043	2609	2457	2696	3696	2717
Mollusc	109	739	239	348	717	413	22	0	43	239	152	0	196	478	196
Other	130	196	109	109	174	0	0	43	43	65	239	196	152	196	174
TOTAL NUMBER OF TAXA[1]	**21**	**16**	**20**	**21**	**18**	**10**	**9**	**12**	**15**	**15**	**20**	**18**	**17**	**20**	**16**
TOTAL NUMBER OF ORGANISMS[2]	**161**	**390**	**202**	**173**	**323**	**413**	**161**	**39**	**155**	**262**	**150**	**147**	**149**	**216**	**142**

Notes:

[1] Number of taxa totals exclude nematodes & ostracods, immatures & pupae (Tubificidae, Limnephilidae, Chironomidae, Empididae), and indeterminates (Lumbriculidae, Diptera, Chironominae, Orthocladiinae, Tanypodinae).

[2] Number of organisms totals exclude nematodes (P. Nemata) & ostracods (Cl. Ostracoda).

Appendix H. Benthic Invertebrate raw data (total number of organisms in two 0.023 m^2 grabs), Meadowbank Study Lakes and Baker Lake, August 2013.

Location	Baker Proposed Jetty					Inuggugayualik Lake					Pipedream Lake				
Station	BPJ	BPJ	BPJ	BPJ	BPJ	INUG	INUG	INUG	INUG	INUG	PDL	PDL	PDL	PDL	PDL
Replicate	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
DepthOfSample (m)	7.9	8.5	9	7.8	7.7	7.9	8.4	6.5	7.5	8.3	8.6	6.6	6.8	7	7.3
# 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
ROUNDWORMS															
P. Nemata	10	3	2	5	2	1	1	3	3	23	2	1	3	7	4
FLATWORMS															
P. Platyhelminthes															
Cl. Turbellaria															
indeterminate						1	2		15						
ANNELIDS															
P. Annelida															
WORMS															
Cl. Oligochaeta															
F. Enchytraeidae									5	1					
F. Naididae															
S.F. Naidinae															
Nais															
Slavina appendiculata															
S.F. Rhyacodrilinae															
Rhyacodrilus coccineus		1				2				1					
Rhyacodrilus montana	9	5	1		2										
S.F. Tubificinae															
Limnodrilus hoffmeisteri															
Tasserkidrilus americanus								1							
immatures with hair chaetae							2		2			6	7		
immatures without hair chaetae								4							
F. Lumbriculidae															
Lumbriculus						1	3	2	2	2	1	2	1		
Stylodrilus															
ARTHROPODS															
P. Arthropoda															
MITES															
Cl. Arachnida															
O. Acarina	6	6		4	8	2	1		3		1		2		1
SEED SHRIMPS															
Cl. Ostracoda		1		3	7	4	3	2	24	3	2	5	13	3	3
INSECTS															
Cl. Insecta															
CADDISFLIES															
O. Trichoptera															
F. Apataniidae															
Apatania															
F. Limnephilidae															
Grensia praeterita						1		1				4		2	1
TRUE FLIES															
O. Diptera															
MIDGES															
F. Chironomidae															
chironomid pupae	**1**	**1**	**3**	**12**	**5**										
S.F. Chironominae															
Chironomus												2			
Cladotanytarsus															
Constempellina					1										
Corynocera							3		6	2					
Dicrotendipes															
Micropsectra			1		2	3	2	18	2	11		1	14		1
Microtendipes						27	30	4	46	22					
Paracladopelma				1											
Paratanytarsus			1	1		1	2		10	5					
Polypedilum			1												

Appendix H. Benthic Invertebrate raw data (total number of organisms in two 0.023 m^2 grabs), Meadowbank Study Lakes and Baker Lake, August 2013.

Location	Baker Proposed Jetty					Inuggugayualik Lake					Pipedream Lake				
Station	BPJ	BPJ	BPJ	BPJ	BPJ	INUG	INUG	INUG	INUG	INUG	PDL	PDL	PDL	PDL	PDL
Replicate	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
DepthOfSample (m)	7.9	8.5	9	7.8	7.7	7.9	8.4	6.5	7.5	8.3	8.6	6.6	6.8	7	7.3
# 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
Sergentia												2			
Stempellinella															1
Stictochironomus	2	37			20	11	1	10	26	1	10	6	19	12	5
Tanytarsus	7	1	2	2	10		5		5		1			1	1
S.F. Diamesinae															
Protanypus				2	3	2	2	2	1	3	1		2		
Potthastia															
Pseudodiamesa				1											
S.F. Orthocladiinae															
Abiskomyia	2	3			1		1	1							
Cricotopus															
Cricotopus/Orthocladius															
Heterotrissocladius	10	1	1	7	10						1			1	
Mesocricotopus															
Paracladius	2			3	2	1				1					
Parakiefferiella	2														
Psectrocladius						1		1	2		7	3	6	13	5
Zalutschia											1				
indeterminate															
S.F. Prodiamesinae															
Monodiamesa	6	1		1	2	1	2		5		1				1
S.F. Tanypodinae															
Ablabesmyia										1					
Procladius	3	1	1	11	4	10	5	3	15	7	10	10	13	12	24
Thienemannimyia complex				1				1	2	1			8	1	1
F. Empididae															
Chelifera/Neoplasta															
Wiedemannia															
pupae															
MOLLUSCS															
P. Mollusca															
CLAMS															
Cl. Bivalvia															
F. Sphaeriidae															
Cyclocalyx/Neopisidium	9		2			16	27	7	45	18	14	4	12	18	15
Cyclocalyx							2		3	2		6	11		
Sphaerium nitidum							2		1						
R (Richness) - totals															
Total	11	9	8	11	12	15	16	12	18	15	11	10	10	8	11
Oligochaete	1	2	1	0	1	2	1	2	2	3	1	1	1	0	0
Insect	8	6	6	10	10	10	10	9	11	10	8	7	6	7	9
Mollusc	1	0	1	0	0	1	3	1	3	2	1	2	2	1	1
Other	1	1	0	1	1	2	2	0	2	0	1	0	1	0	1
N (Abundance) - raw															
Total	59	57	13	46	70	80	92	55	196	78	48	46	95	60	56
Oligochaete	9	6	1	0	2	3	5	7	9	4	1	8	8	0	0
Insect	35	45	10	42	60	58	53	41	120	54	32	28	62	42	40
Mollusc	9	0	2	0	0	16	31	7	49	20	14	10	23	18	15
Other	6	6	0	4	8	3	3	0	18	0	1	0	2	0	1
N (Abundance) - #/m^2															
Total	1283	1239	283	1000	1522	1739	2000	1196	4261	1696	1043	1000	2065	1304	1217
Oligochaete	196	130	22	0	43	65	109	152	196	87	22	174	174	0	0
Insect	761	978	217	913	1304	1261	1152	891	2609	1174	696	609	1348	913	870
Mollusc	196	0	43	0	0	348	674	152	1065	435	304	217	500	391	326
Other	130	130	0	87	174	65	65	0	391	0	22	0	43	0	22
TOTAL NUMBER OF TAXA[1]	**11**	**9**	**8**	**11**	**12**	**15**	**16**	**12**	**18**	**15**	**11**	**10**	**10**	**8**	**11**
TOTAL NUMBER OF ORGANISMS[2]	**59**	**57**	**13**	**46**	**70**	**80**	**92**	**55**	**196**	**78**	**48**	**46**	**95**	**60**	**56**

Notes:

[1] Number of taxa totals exclude nematodes & ostracods, immatu
Orthocladiinae, Tanypodinae).

[2] Number of organisms totals exclude nematodes (P. Nemata) & (

Appendix H. Benthic Invertebrate raw data (total number of organisms in two 0.023 m^2 grabs), Meadowbank Study Lakes and Baker Lake, August 2013.

Location	Second Portage Lake					Tehek Lake					Tehek Lake - Farfield				
Station	SP	SP	SP	SP	SP	TE	TE	TE	TE	TE	TEFF	TEFF	TEFF	TEFF	TEFF
Replicate	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
DepthOfSample (m)	8	8.1	8.8	7.4	7	7.4	9.3	8.6	8	6.7	8.6	7.4	8.5	8.7	7
# 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
ROUNDWORMS															
P. Nemata	2	3	2	1	1		3		2	3		1	8	4	7
FLATWORMS															
P. Platyhelminthes															
Cl. Turbellaria															
indeterminate															
ANNELIDS															
P. Annelida															
WORMS															
Cl. Oligochaeta															
F. Enchytraeidae															
F. Naididae															
S.F. Naidinae															
Nais															
Slavina appendiculata															
S.F. Rhyacodrilinae															
Rhyacodrilus coccineus												1			
Rhyacodrilus montana															
S.F. Tubificinae															
Limnodrilus hoffmeisteri															
Tasserkidrilus americanus															
immatures with hair chaetae	2		1	1	1										
immatures without hair chaetae															
F. Lumbriculidae															
Lumbriculus		1		1											1
Stylodrilus															
ARTHROPODS															
P. Arthropoda															
MITES															
Cl. Arachnida															
O. Acarina	2	3	4		2	1	6	2	17		2	5	3	3	4
SEED SHRIMPS															
Cl. Ostracoda	10	31	1	8	3	7	11	5	17	6	12	26	10	13	8
INSECTS															
Cl. Insecta															
CADDISFLIES															
O. Trichoptera															
F. Apataniidae															
Apatania															
F. Limnephilidae															
Grensia praeterita				2					1						
TRUE FLIES															
O. Diptera															
MIDGES															
F. Chironomidae															
chironomid pupae															
S.F. Chironominae															
Chironomus															
Cladotanytarsus															
Constempellina															
Corynocera						1									
Dicrotendipes														1	
Micropsectra	62	124	25	62	21		2	1	1	6	2			1	1
Microtendipes															
Paracladopelma															
Paratanytarsus		1	10		2					1	1		3		1
Polypedilum														1	

Appendix H. Benthic Invertebrate raw data (total number of organisms in two 0.023 m^2 grabs), Meadowbank Study Lakes and Baker Lake, August 2013.

Location	Second Portage Lake					Tehek Lake					Tehek Lake - Farfield				
Station	SP	SP	SP	SP	SP	TE	TE	TE	TE	TE	TEFF	TEFF	TEFF	TEFF	TEFF
Replicate	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
DepthOfSample (m)	8	8.1	8.8	7.4	7	7.4	9.3	8.6	8	6.7	8.6	7.4	8.5	8.7	7
# 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
Sergentia												2			
Stempellinella												3			
Stictochironomus	5	7	11	5	7	2			11	1	5	33	10	6	1
Tanytarsus					1							28		1	
S.F. Diamesinae															
Protanypus	4	1	1	2	1	1	1	1		1		1			
Potthastia															
Pseudodiamesa															
S.F. Orthocladiinae															
Abiskomyia	11	4	3	5			1	1			1		1		
Cricotopus															
Cricotopus/Orthocladius															
Heterotrissocladius			2	1	1						3		5	4	1
Mesocricotopus		1													
Paracladius		1	1	1		1	1					1		4	
Parakiefferiella															
Psectrocladius	12	24	5	10	2	2								1	
Zalutschia													1		1
indeterminate															
S.F. Prodiamesinae															
Monodiamesa	2	2				3	4		2	1	2				
S.F. Tanypodinae															
Ablabesmyia															
Procladius	4	9	5	12	8	4	22	7	9	5	1	30	7	7	2
Thienemannimyia complex									1			1			
F. Empididae															
Chelifera/Neoplasta															
Wiedemannia															
pupae															
MOLLUSCS															
P. Mollusca															
CLAMS															
Cl. Bivalvia															
F. Sphaeriidae															
Cyclocalyx/Neopisidium	18	20	10	10	14	18	17	11	8	20	17	5	12	7	17
Cyclocalyx										2					
Sphaerium nitidum															
R (Richness) - totals															
Total	9	13	11	11	10	9	8	6	8	8	9	11	8	11	9
Oligochaete	0	1	0	1	0	0	0	0	0	0	0	1	0	0	1
Insect	7	10	9	9	8	7	6	4	6	6	7	8	6	9	6
Mollusc	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1
Other	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1
N (Abundance) - raw															
Total	122	198	78	112	60	33	54	23	50	37	34	110	42	36	29
Oligochaete	2	1	1	2	1	0	0	0	0	0	0	1	0	0	1
Insect	100	174	63	100	43	14	31	10	25	15	15	99	27	26	7
Mollusc	18	20	10	10	14	18	17	11	8	22	17	5	12	7	17
Other	2	3	4	0	2	1	6	2	17	0	2	5	3	3	4
N (Abundance) - #/m^2															
Total	2652	4304	1696	2435	1304	717	1174	500	1087	804	739	2391	913	783	630
Oligochaete	43	22	22	43	22	0	0	0	0	0	0	22	0	0	22
Insect	2174	3783	1370	2174	935	304	674	217	543	326	326	2152	587	565	152
Mollusc	391	435	217	217	304	391	370	239	174	478	370	109	261	152	370
Other	43	65	87	0	43	22	130	43	370	0	43	109	65	65	87
TOTAL NUMBER OF TAXA[1]	**9**	**13**	**11**	**11**	**10**	**9**	**8**	**6**	**8**	**8**	**9**	**11**	**8**	**11**	**9**
TOTAL NUMBER OF ORGANISMS[2]	**122**	**198**	**78**	**112**	**60**	**33**	**54**	**23**	**50**	**37**	**34**	**110**	**42**	**36**	**29**

res & pupae (Tubificidae, Limnephilidae, Chironomidae, Empididae), and indeterminates (Lumbriculidae, Diptera, Chironominae,

ostracods (Cl. Ostracoda).

Appendix H. Benthic Invertebrate raw data (total number of organisms in two 0.023 m^2 grabs), Meadowbank Study Lakes and Baker Lake, August 2013.

Location	Third Portage Lake - East Basin					Third Portage Lake - North Basin					Third Portage Lake - South Basin					Wally Lake				
Station	TPE	TPE	TPE	TPE	TPE	TPN	TPN	TPN	TPN	TPN	TPS	TPS	TPS	TPS	TPS	WAL	WAL	WAL	WAL	WAL
Replicate	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
DepthOfSample (m)	7.4	7.2	7.5	7.5	8.8	8	7.5	9.4	8.6	7.7	9	8	8.3	8.5	7	8	9	6.5	9.2	8.4
# Grabs/sample	2	2	2	2	2	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	500	500	500	500	500
ROUNDWORMS																				
P. Nemata	3		1	10	4		2	1	1	1	4	4	35	19	10	1	3			3
FLATWORMS																				
P. Platyhelminthes																				
Cl. Turbellaria																				
indeterminate																		1	1	4
ANNELIDS																				
P. Annelida																				
WORMS																				
Cl. Oligochaeta																				
F. Enchytraeidae																				
F. Naididae																				
S.F. Naidinae																				
Nais															1					
Slavina appendiculata																				
S.F. Rhyacodrilinae																				
Rhyacodrilus coccineus		2	4	3	1															
Rhyacodrilus montana							1													
S.F. Tubificinae																				
Limnodrilus hoffmeisteri																				
Tasserkidrilus americanus											1									
immatures with hair chaetae											2			2	10					
immatures without hair chaetae																				
F. Lumbriculidae																				
Lumbriculus	2	2	2		3	1	4	1		1				2	1		1			
Stylodrilus																				
ARTHROPODS																				
P. Arthropoda																				
MITES																				
Cl. Arachnida																				
O. Acarina	12	1	5	1	3				1	11	2	16		4	1	5	3	1	4	4
SEED SHRIMPS																				
Cl. Ostracoda	54	28	28	52	57	3	4	8	3		12	11	2	38	29	6	10	3	21	25
INSECTS																				
Cl. Insecta																				
CADDISFLIES																				
O. Trichoptera																				
F. Apataniidae																				
Apatania			2																	
F. Limnephilidae																				
Grensia praeterita							1	1	1			1						1	2	2
TRUE FLIES																				
O. Diptera																				
MIDGES																				
F. Chironomidae																				
chironomid pupae			**1**					**1**	**1**											
S.F. Chironominae																				
Chironomus																				
Cladotanytarsus																2				17
Constempellina																				
Corynocera														3		2		1	9	21
Dicrotendipes																				
Micropsectra	10	7	10	9	12	8		2	1	1	1		3	7	8	10		2	52	22
Microtendipes																				
Paracladopelma																				
Paratanytarsus	13	14	13	22	4	8	6	11	7	4	2		21	31	55					4
Polypedilum																				

Appendix H. Benthic Invertebrate raw data (total number of organisms in two 0.023 m^2 grabs), Meadowbank Study Lakes and Baker Lake, August 2013.

Location	Third Portage Lake - East Basin					Third Portage Lake - North Basin					Third Portage Lake - South Basin					Wally Lake				
Station	TPE	TPE	TPE	TPE	TPE	TPN	TPN	TPN	TPN	TPN	TPS	TPS	TPS	TPS	TPS	WAL	WAL	WAL	WAL	WAL
Replicate	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
DepthOfSample (m)	7.4	7.2	7.5	7.5	8.8	8	7.5	9.4	8.6	7.7	9	8	8.3	8.5	7	8	9	6.5	9.2	8.4
# Grabs/sample	2	2	2	2	2	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	500	500	500	500	500
Sergentia																				
Stempellinella																				
Stictochironomus	2	22	2	4	4	17	4	3		23	6			4	13	13	1	19	36	14
Tanytarsus	8	7	8	6	3	2	7	6	2	1	2		7							22
S.F. Diamesinae																				
Protanypus	1	1	3				1		1	1	3	1		1				1	1	3
Potthastia																				
Pseudodiamesa																				
S.F. Orthocladiinae																				
Abiskomyia	2	2	1	4	1	1					2									
Cricotopus						1														
Cricotopus/Orthocladius																				
Heterotrissocladius	5	2	8	4	8	4	2	6	6		2	3	2	6	1					
Mesocricotopus				1																
Paracladius												1								
Parakiefferiella															1					
Psectrocladius	2	1	3	1		2	2	5	2	9	1			2	3					
Zalutschia						1	1		1											
indeterminate			1																	
S.F. Prodiamesinae																				
Monodiamesa	1	2			4			2	1							1	2			
S.F. Tanypodinae																				
Ablabesmyia																				
Procladius	5	5	13	4	7	10	10	4	7	4	6	4		5	4	6	4	4	7	3
Thienemannimyia complex	4	6	8	11	2	10	7	9	12	4	3	5	3	18	14	1		1	1	
F. Empididae																				
Chelifera/Neoplasta																				
Wiedemannia																				
pupae																				
MOLLUSCS																				
P. Mollusca																				
CLAMS																				
Cl. Bivalvia																				
F. Sphaeriidae																				
Cyclocalyx/Neopisidium	36	32	32	55	22	17	6	7	19	15	24	13	11	35	32	12	6	8	17	11
Cyclocalyx																9	8	3	6	6
Sphaerium nitidum																	3			
R (Richness) - totals																				
Total	14	15	15	13	13	13	13	12	13	11	13	8	6	12	12	10	8	11	11	13
Oligochaete	1	2	2	1	2	1	2	1	0	1	1	0	0	1	2	0	1	0	0	0
Insect	11	11	11	10	9	11	10	10	11	8	10	6	5	9	8	7	3	7	7	9
Mollusc	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	3	2	2	2
Other	1	1	1	1	1	0	0	0	1	1	1	1	0	1	1	1	1	2	2	2
N (Abundance) - raw																				
Total	103	106	116	125	74	82	52	58	62	74	57	44	47	120	144	61	28	42	136	133
Oligochaete	2	4	6	3	4	1	5	1	0	1	3	0	0	4	12	0	1	0	0	0
Insect	53	69	73	66	45	64	41	50	42	47	28	15	36	77	99	35	7	29	108	108
Mollusc	36	32	32	55	22	17	6	7	19	15	24	13	11	35	32	21	17	11	23	17
Other	12	1	5	1	3	0	0	0	1	11	2	16	0	4	1	5	3	2	5	8
N (Abundance) - #/m^2																				
Total	2239	2304	2522	2717	1609	1783	1130	1261	1348	1609	1239	957	1022	2609	3130	1326	609	913	2957	2891
Oligochaete	43	87	130	65	87	22	109	22	0	22	65	0	0	87	261	0	22	0	0	0
Insect	1152	1500	1587	1435	978	1391	891	1087	913	1022	609	326	783	1674	2152	761	152	630	2348	2348
Mollusc	783	696	696	1196	478	370	130	152	413	326	522	283	239	761	696	457	370	239	500	370
Other	261	22	109	22	65	0	0	0	22	239	43	348	0	87	22	109	65	43	109	174
TOTAL NUMBER OF TAXA[1]	**14**	**15**	**15**	**13**	**13**	**13**	**13**	**12**	**13**	**11**	**13**	**8**	**6**	**12**	**12**	**10**	**8**	**11**	**11**	**13**
TOTAL NUMBER OF ORGANISMS[2]	**103**	**106**	**116**	**125**	**74**	**82**	**52**	**58**	**62**	**74**	**57**	**44**	**47**	**120**	**144**	**61**	**28**	**42**	**136**	**133**

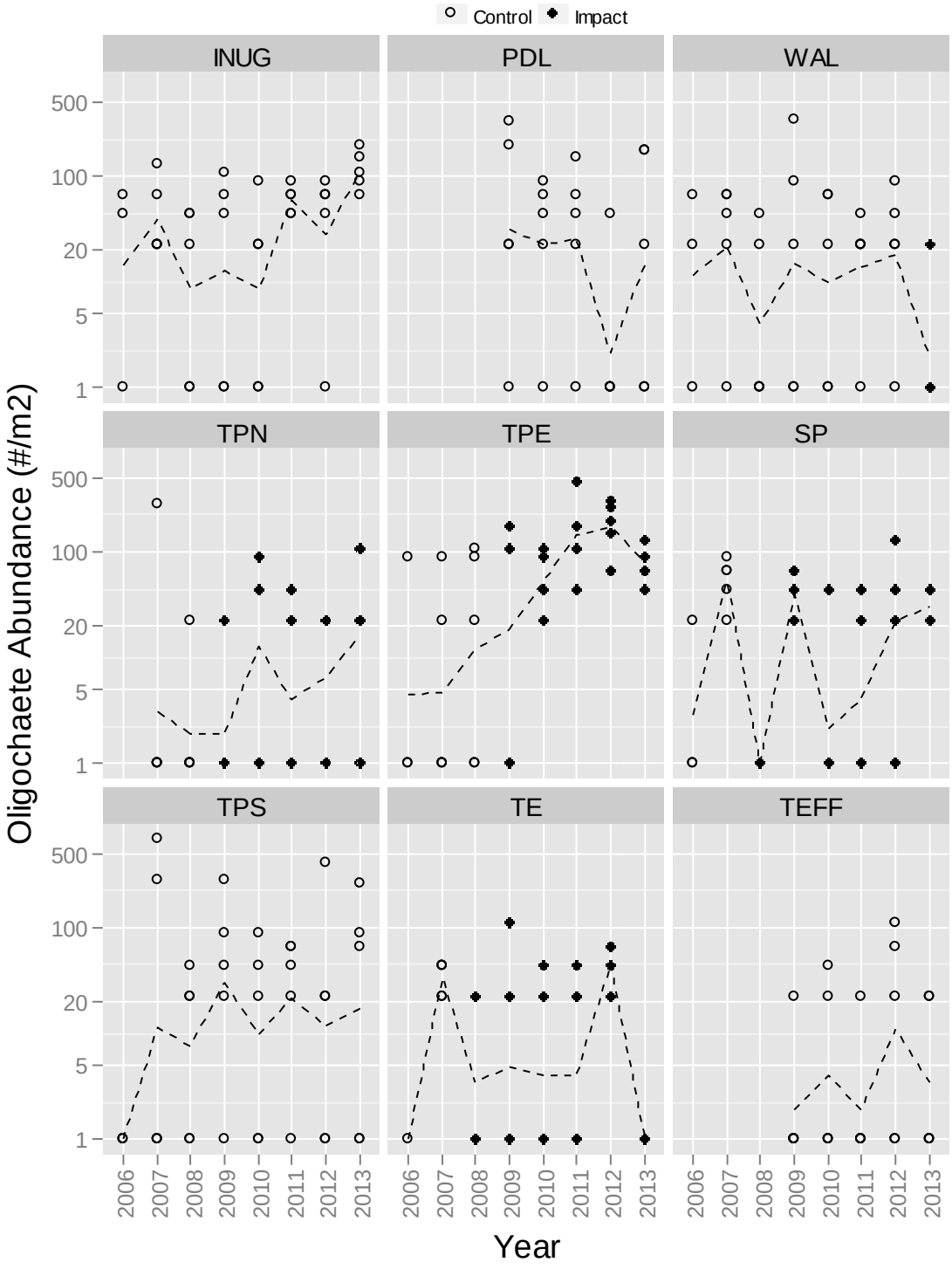
Notes:

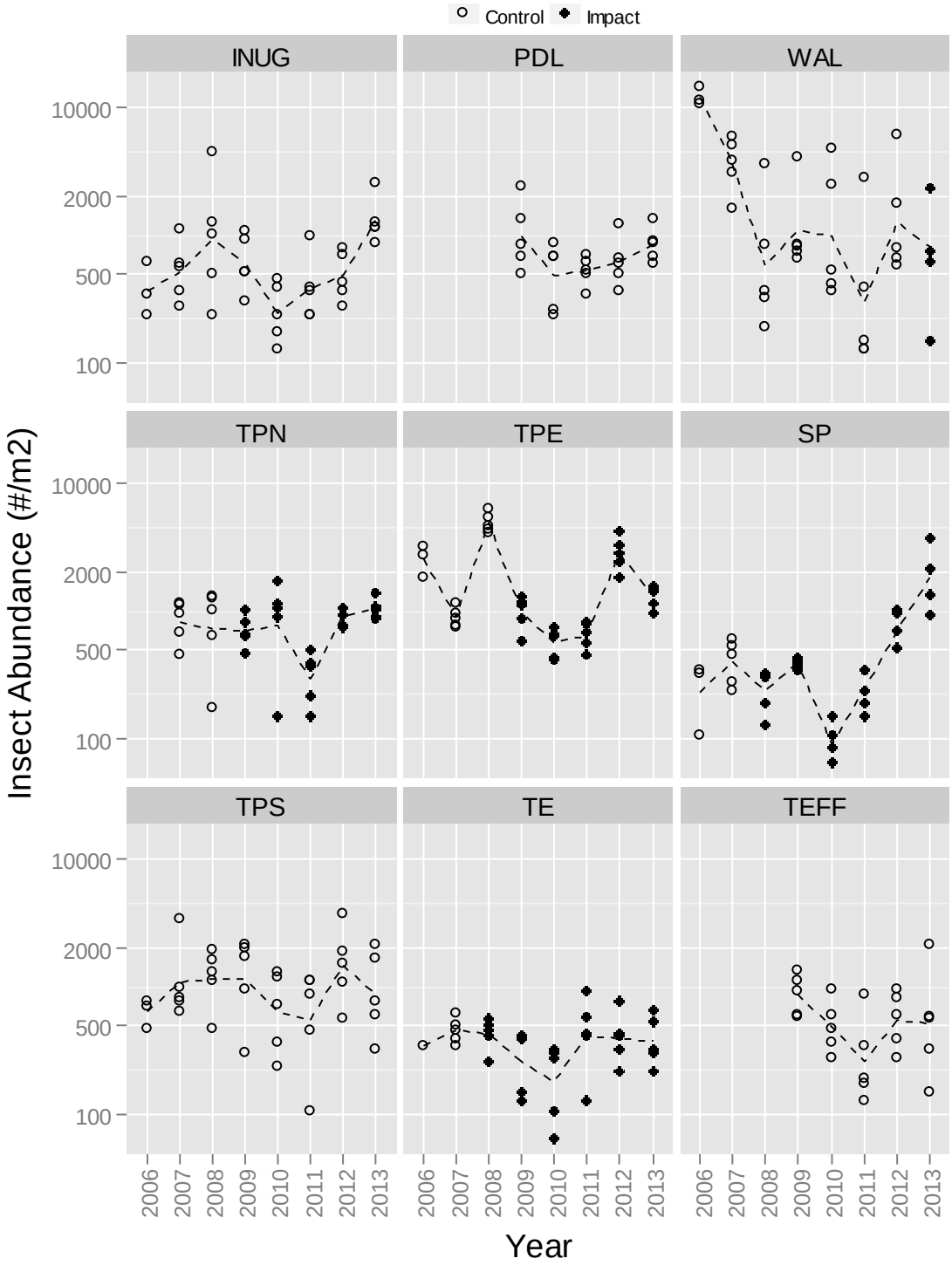
[1] Number of taxa totals exclude nematodes & ostracods, immatures & pupae (Tubificidae, Limnephilidae, Chironomidae, Empididae), and indeterminates (Lumbriculidae, Diptera, Chironominae, Orthocladiinae, Tanypodinae).

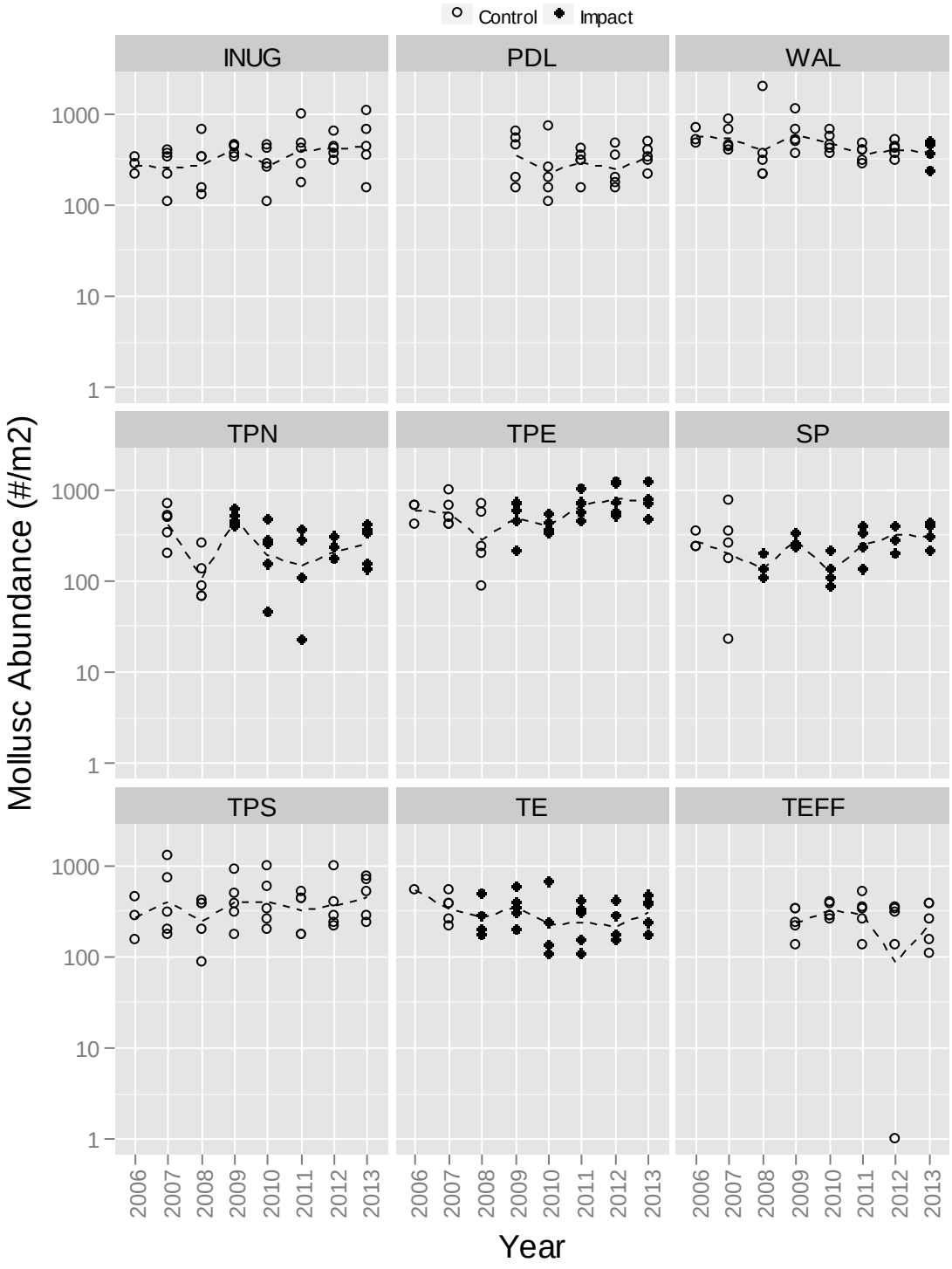
[2] Number of organisms totals exclude nematodes (P. Nemata) & ostracods (Cl. Ostracoda).

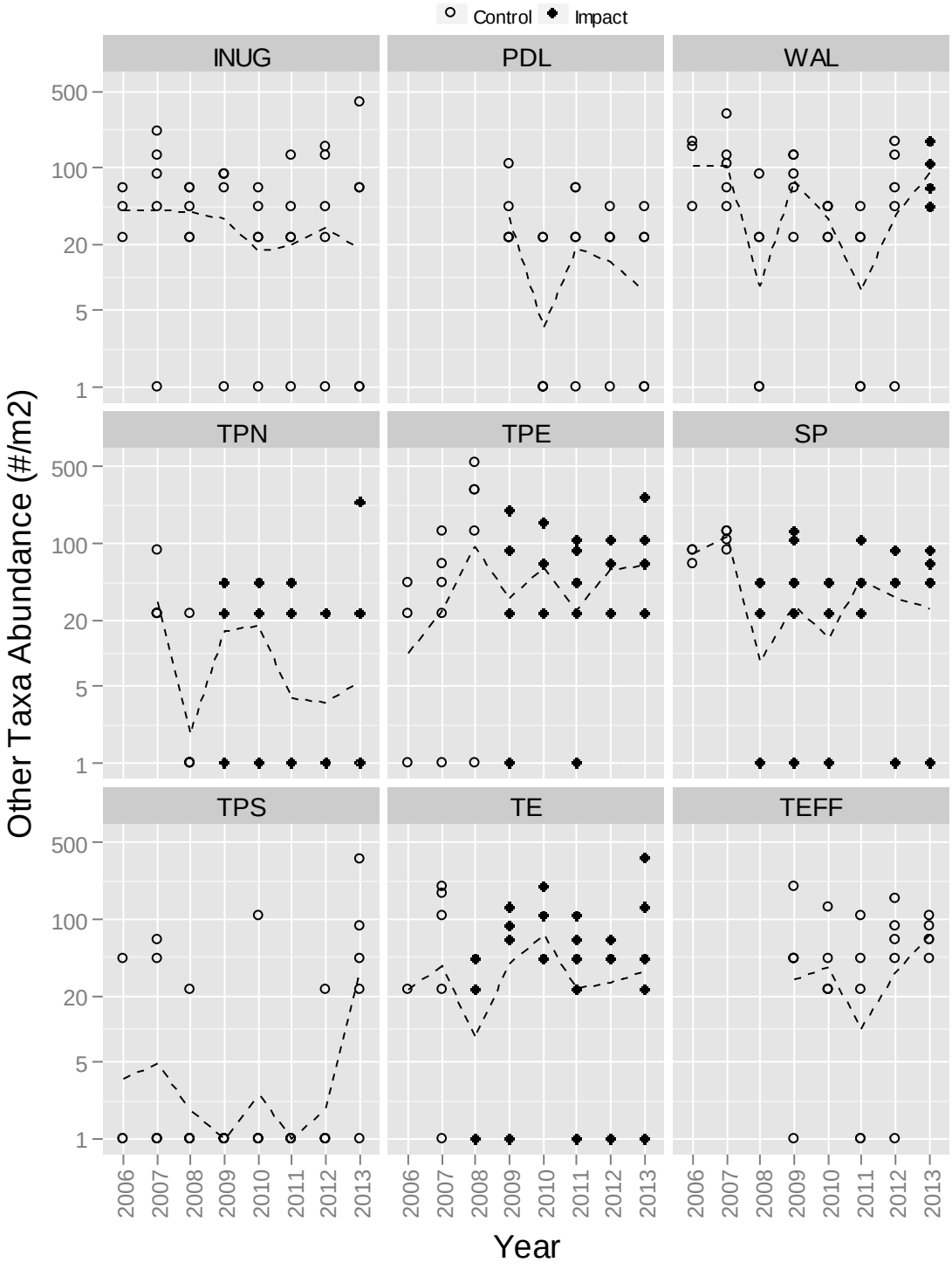
APPENDIX I

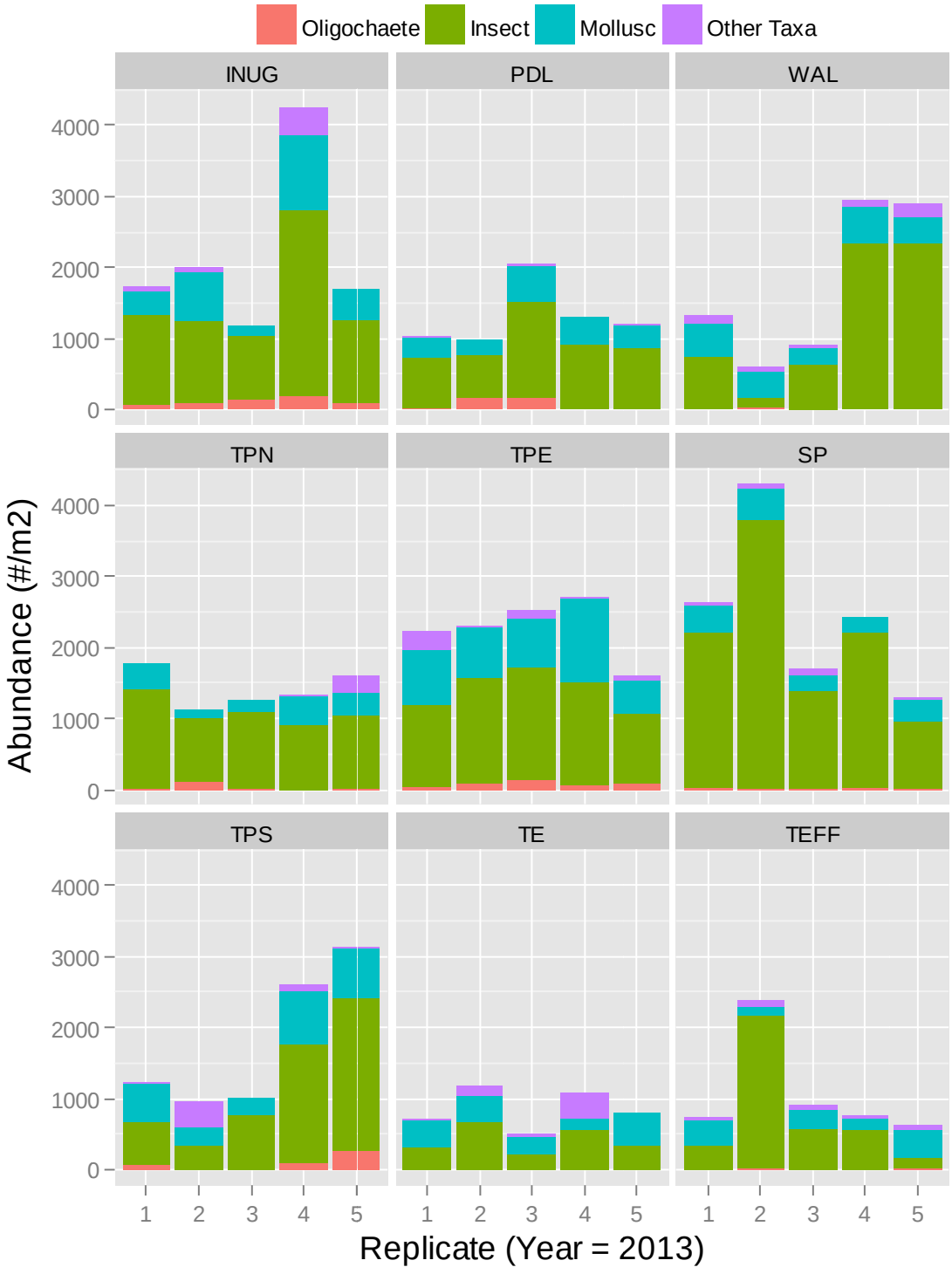
BENTHIC INVERTEBRATE PLOTS 2006 – 2013

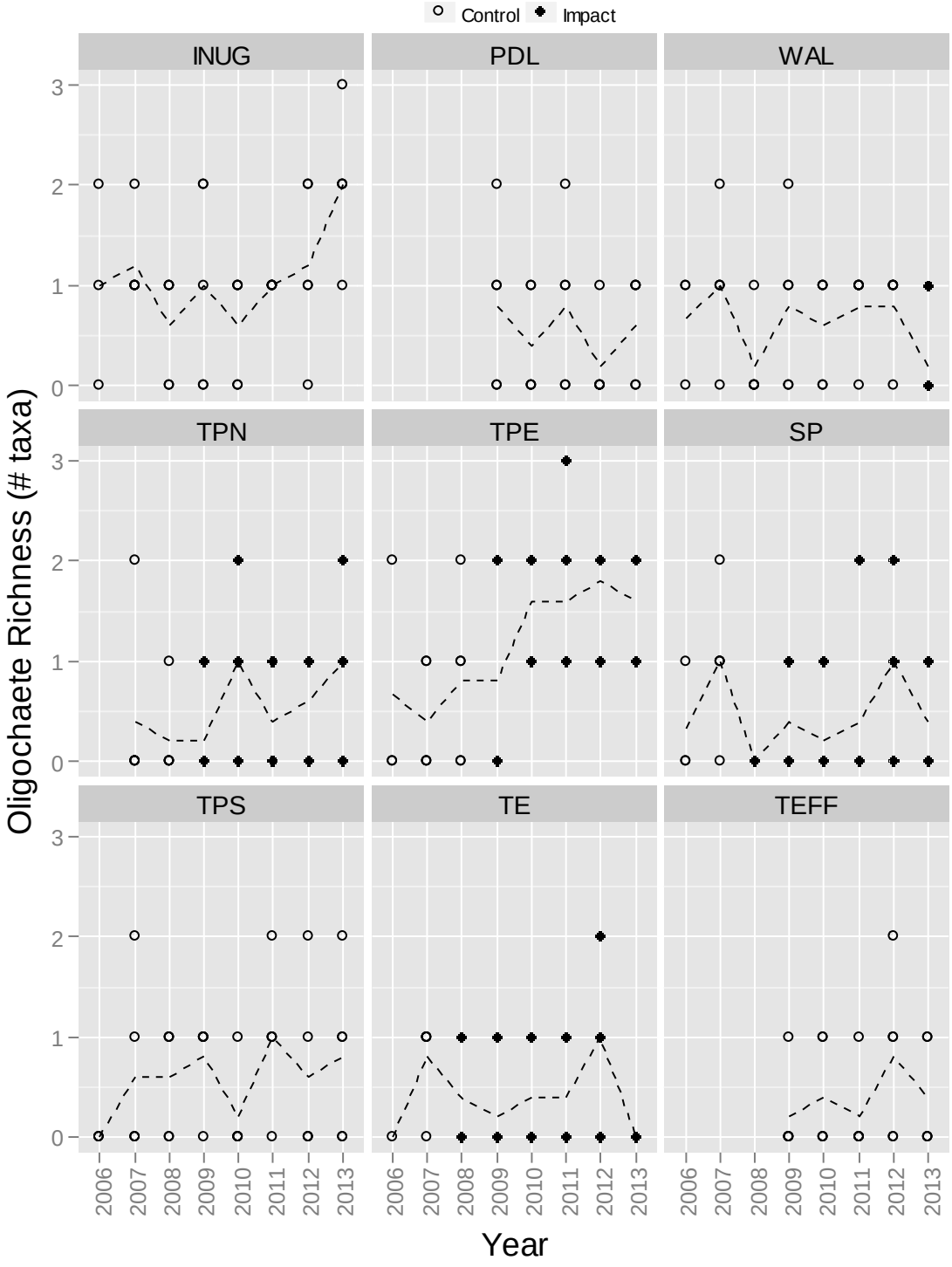

Control
Impact
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Oligochaete Abundance (#/m2)
500
100
20
5
1
2006
2007
2008
2009
2010
2011
2012
2013
Year

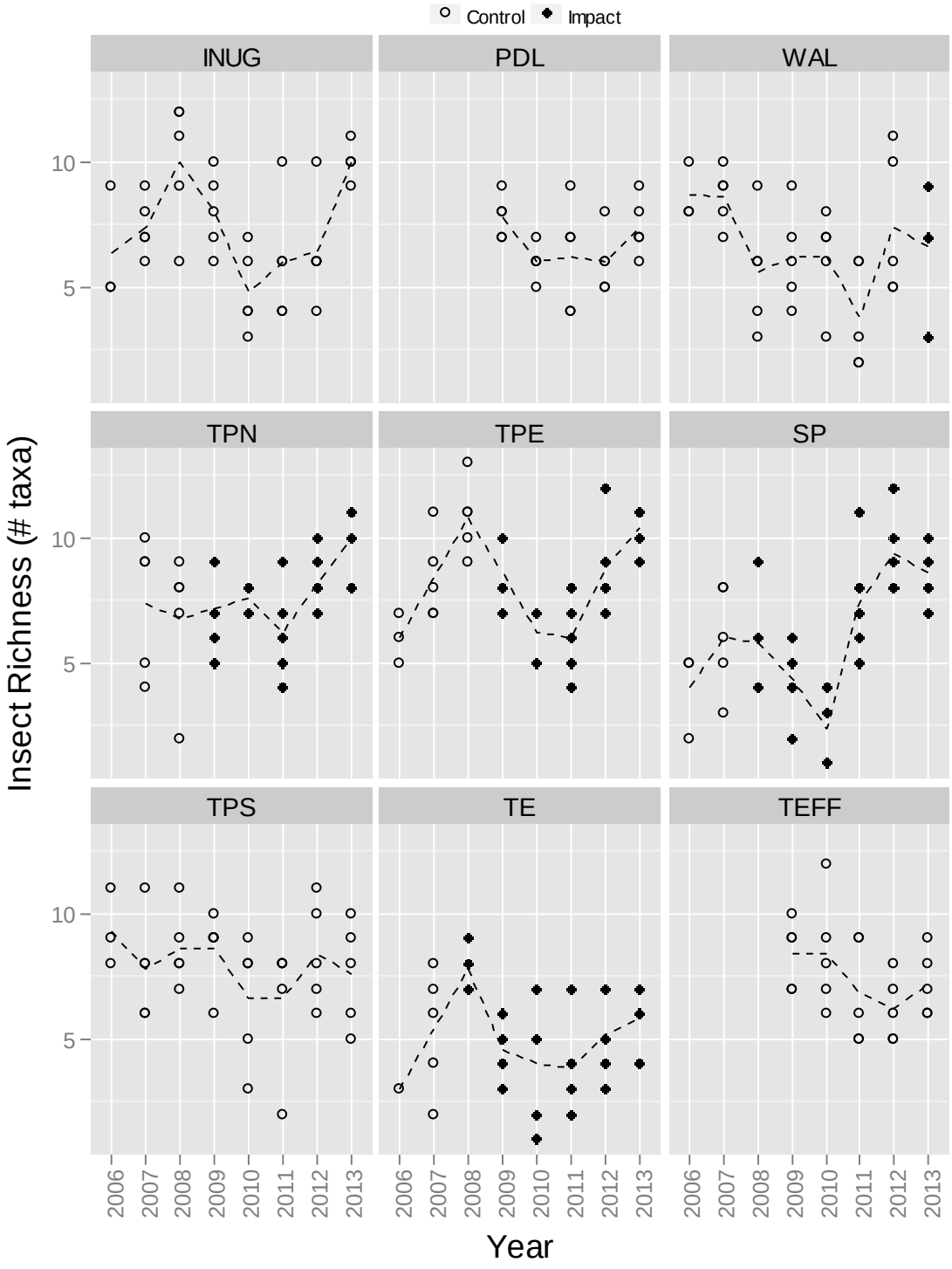

Control
Impact
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Insect Abundance (#/m2)
10000
2000
500
100
2006
2007
2008
2009
2010
2011
2012
2013
Year

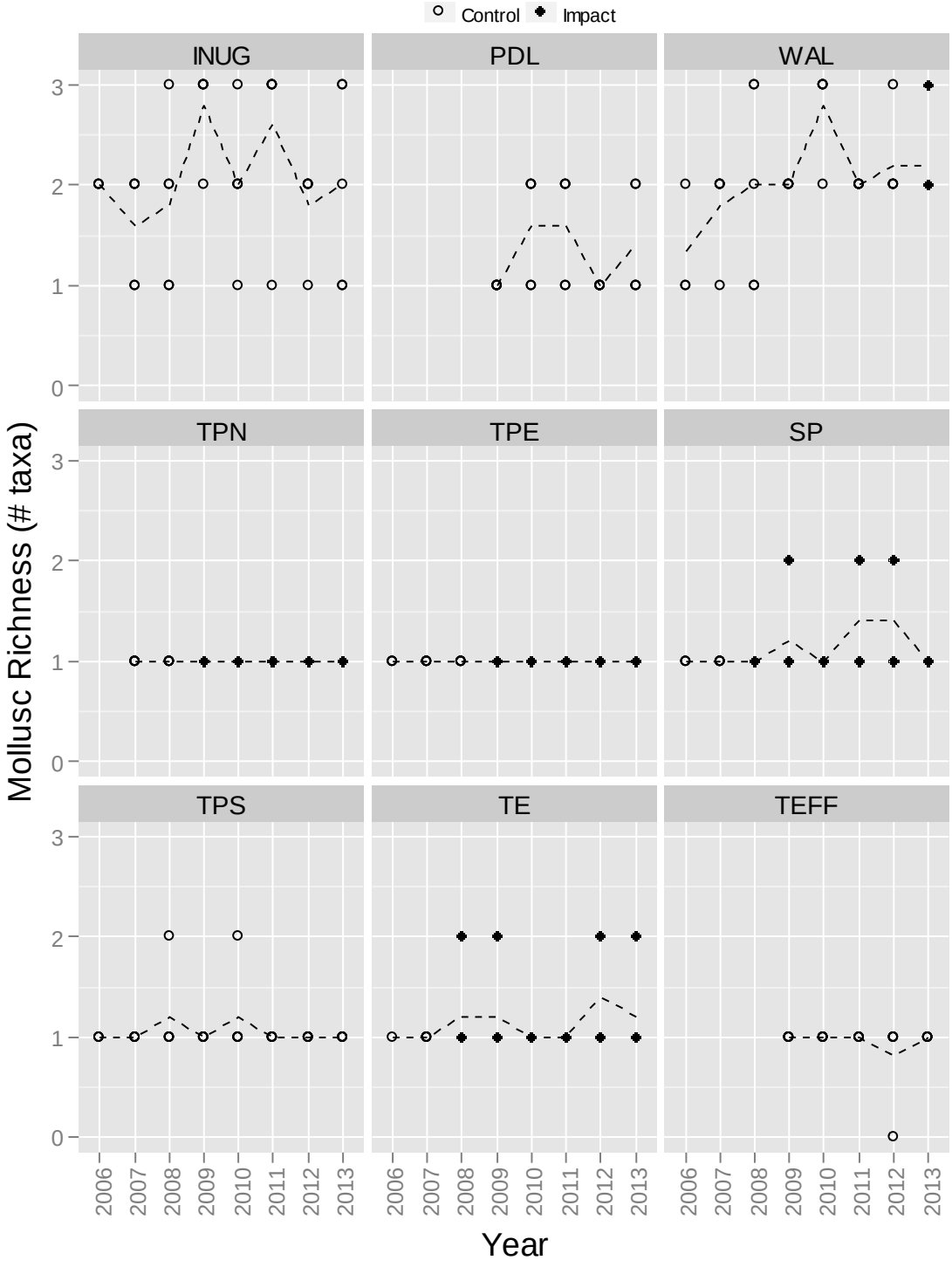

Control
Impact
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Mollusc Abundance (#/m2)
1000
100
10
1
2006
2007
2008
2009
2010
2011
2012
2013
Year

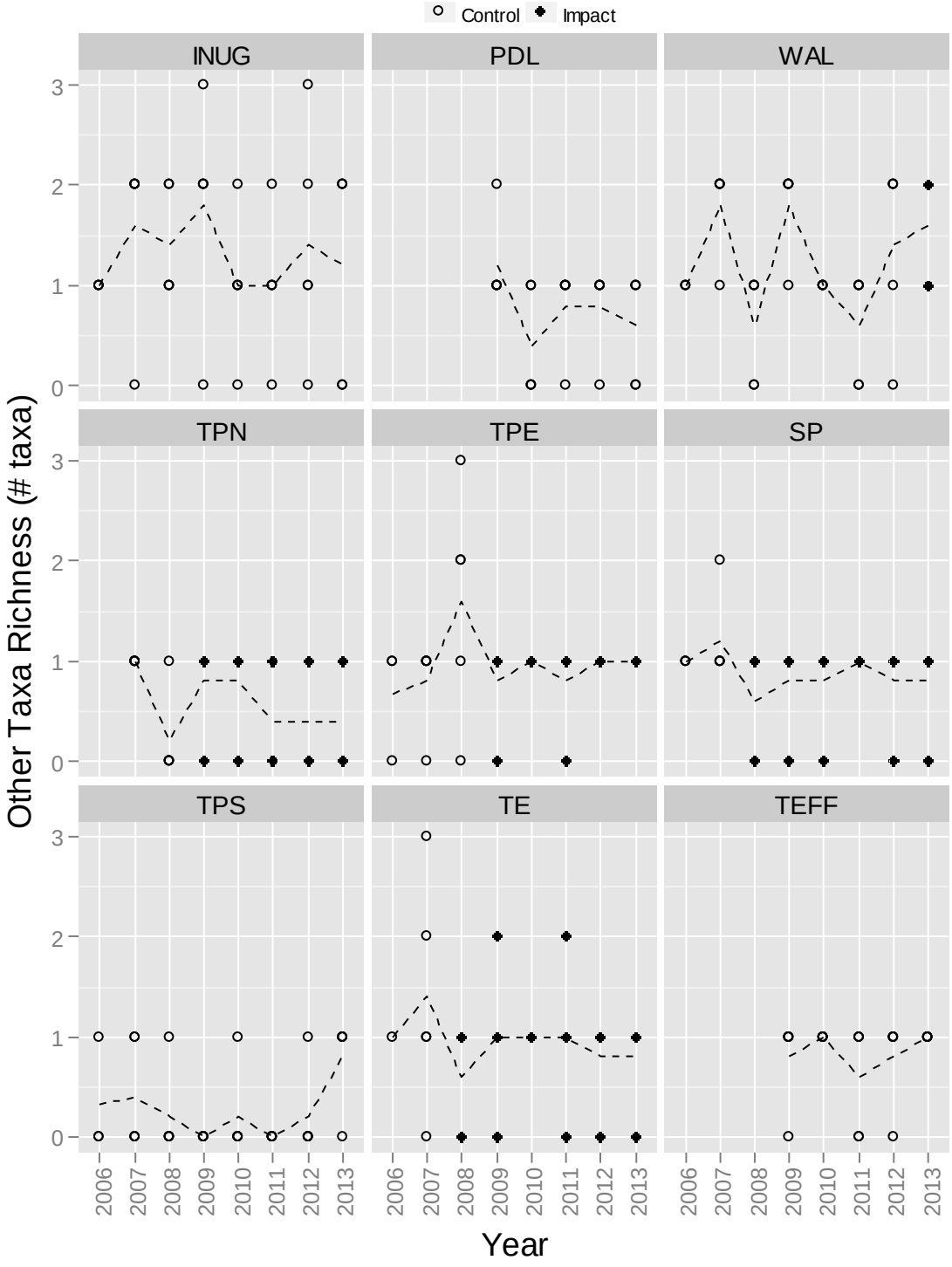

Control
Impact
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Other Taxa Abundance (#/m2)
500
100
20
5
1
2006
2007
2008
2009
2010
2011
2012
2013
Year

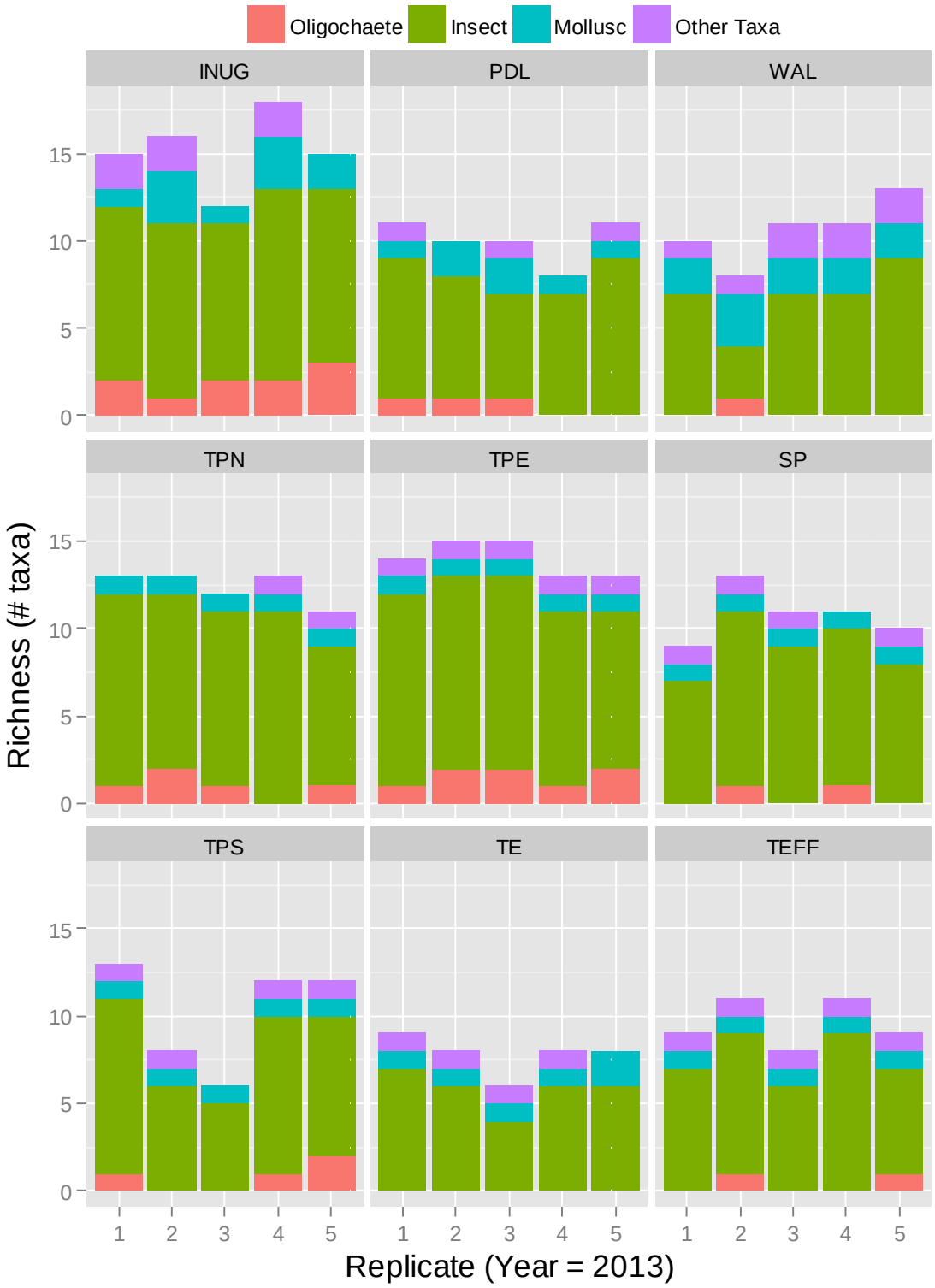

Oligochaete
Insect
Mollusc
Other Taxa
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Abundance (#/m2)
0
1000
2000
3000
4000
1
2
3
4
5
Replicate (Year = 2013)

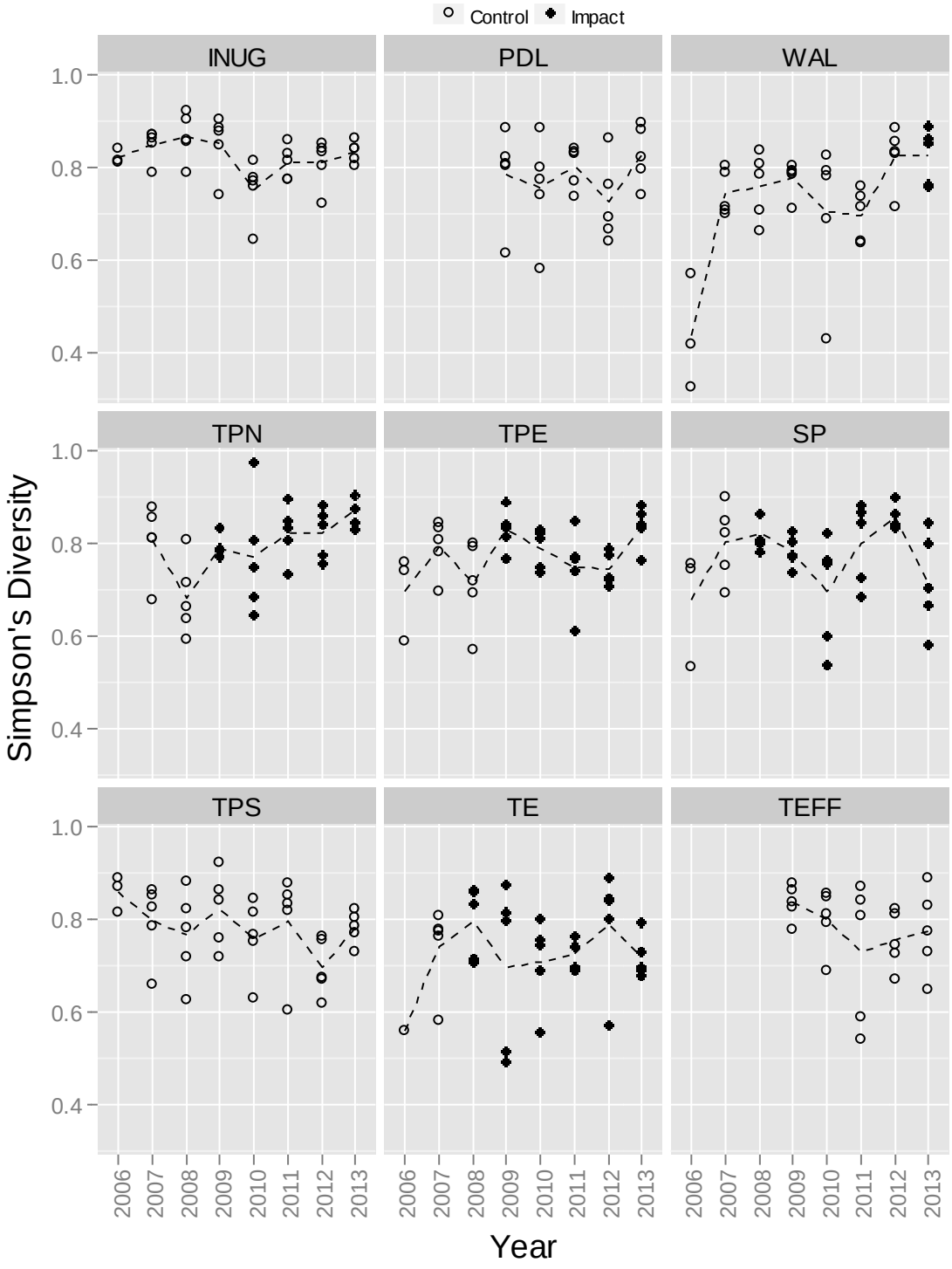

Control
Impact
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Oligochaete Richness (# taxa)
0
1
2
3
2006
2007
2008
2009
2010
2011
2012
2013
Year

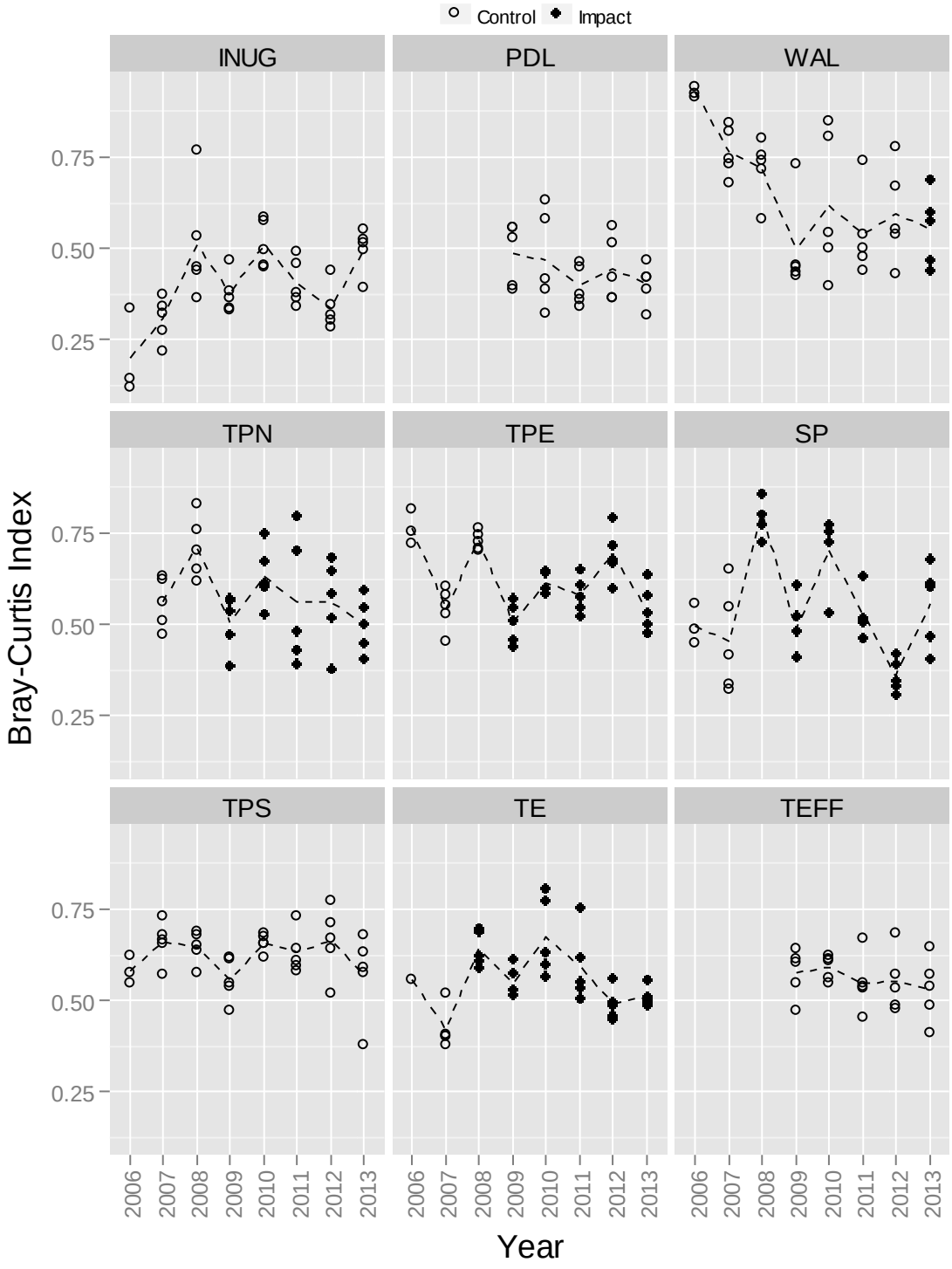

Control
Impact
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Insect Richness (# taxa)
10
5
2006
2007
2008
2009
2010
2011
2012
2013
Year

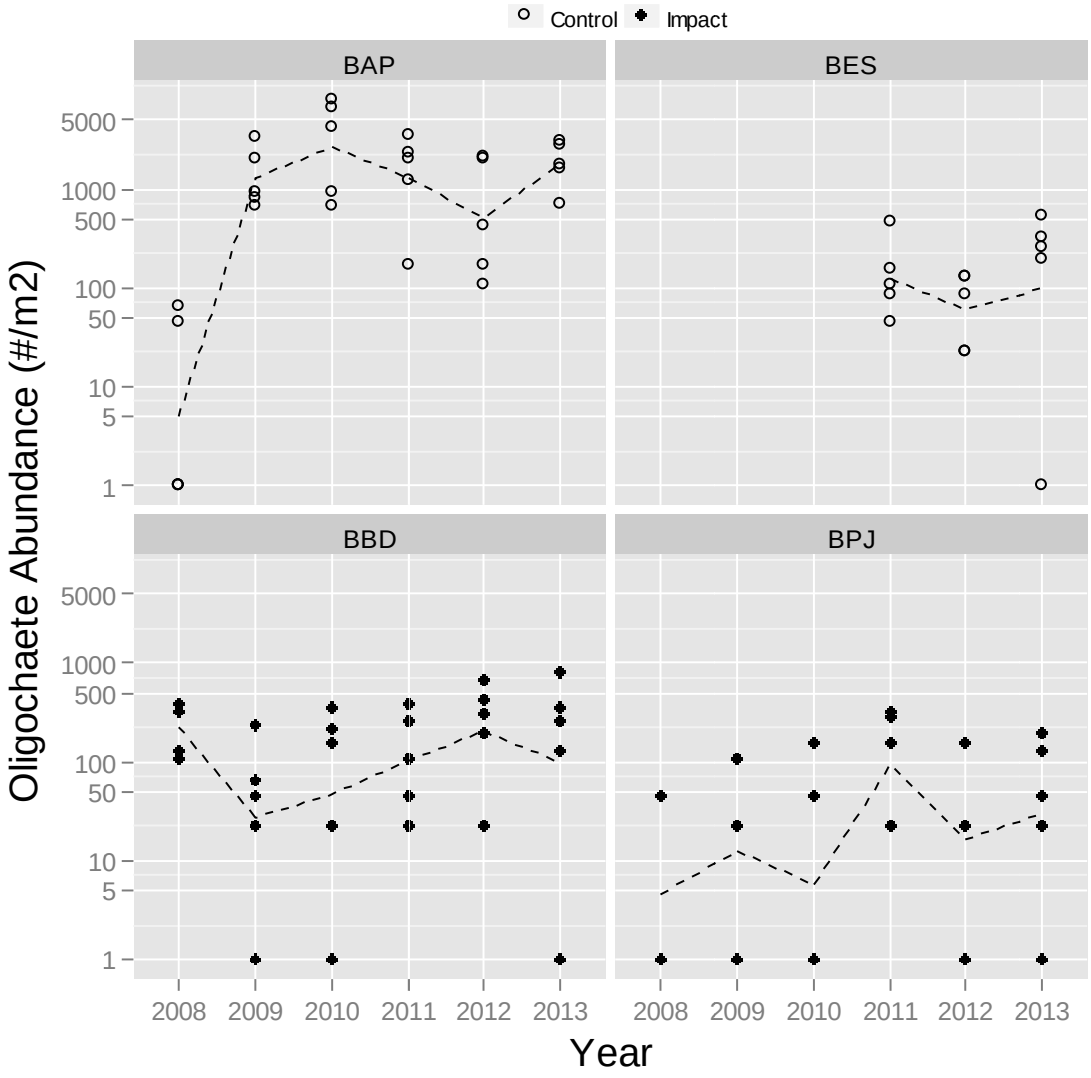

Control
Impact
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Mollusc Richness (# taxa)
0
1
2
3
2006
2007
2008
2009
2010
2011
2012
2013
Year


Control
Impact
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Other Taxa Richness (# taxa)
0
1
2
3
2006
2007
2008
2009
2010
2011
2012
2013
Year

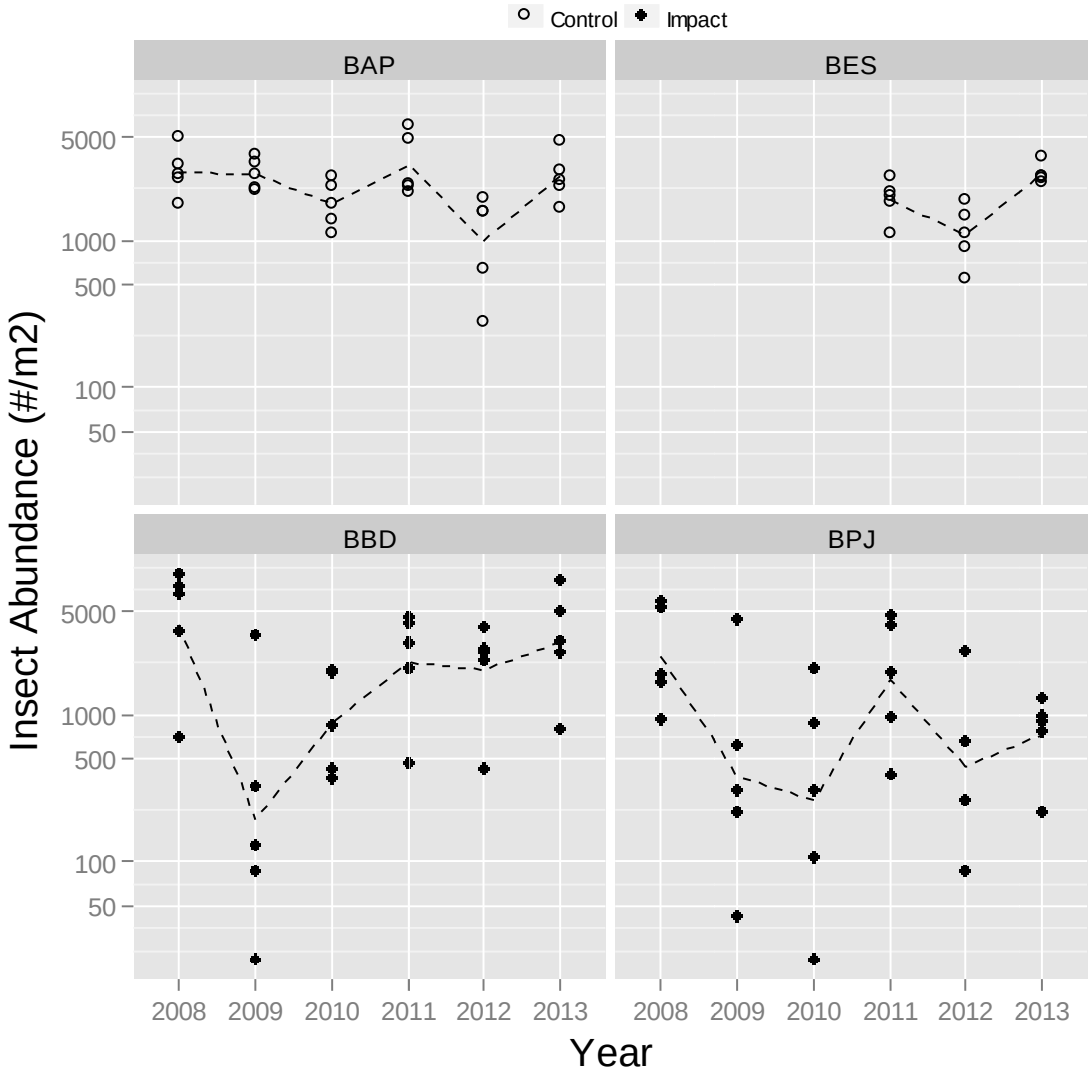

Oligochaete
Insect
Mollusc
Other Taxa
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Richness (# taxa)
0
5
10
15
1
2
3
4
5
Replicate (Year = 2013)

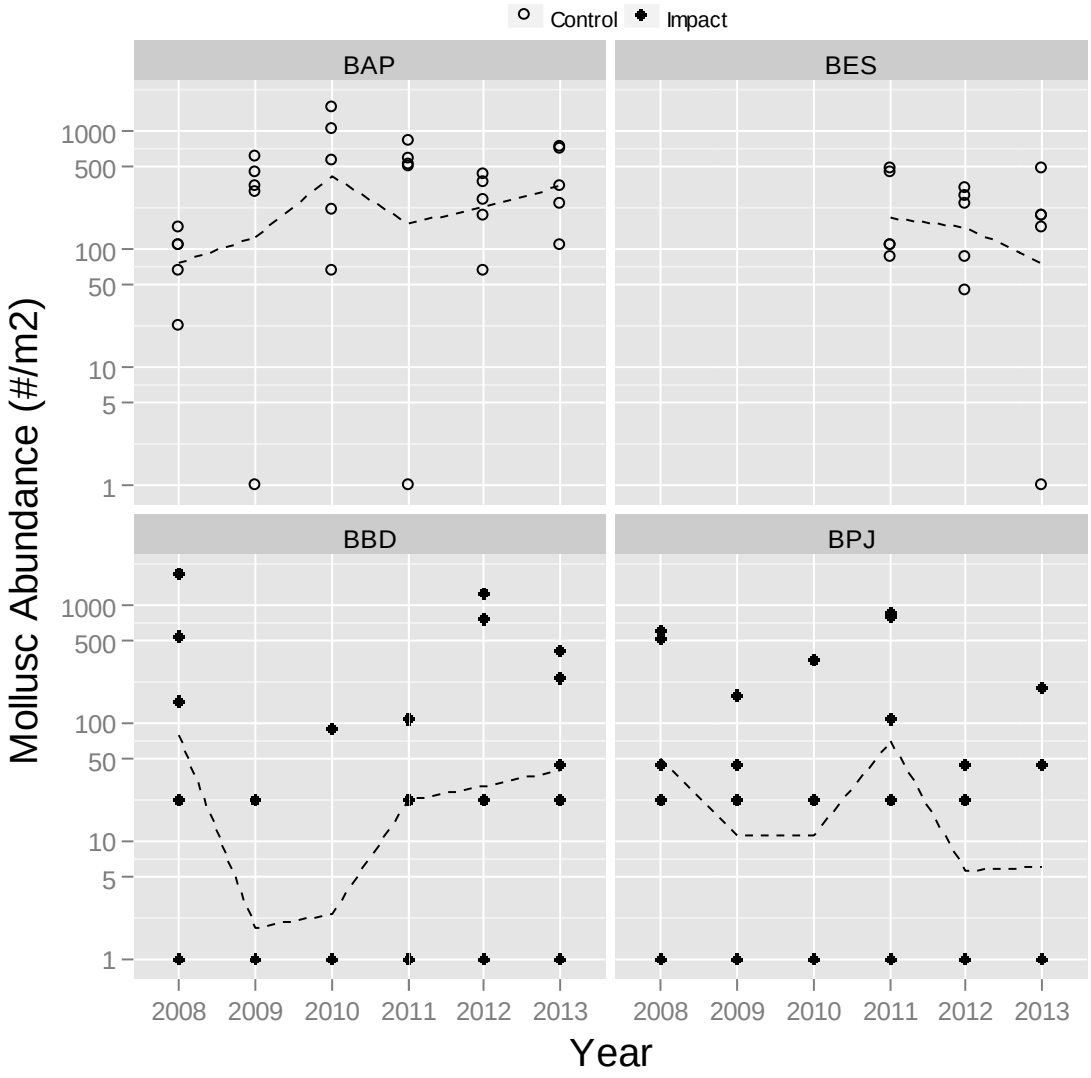

Control
Impact
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Simpson's Diversity
1.0
0.8
0.6
0.4
2006
2007
2008
2009
2010
2011
2012
2013
Year

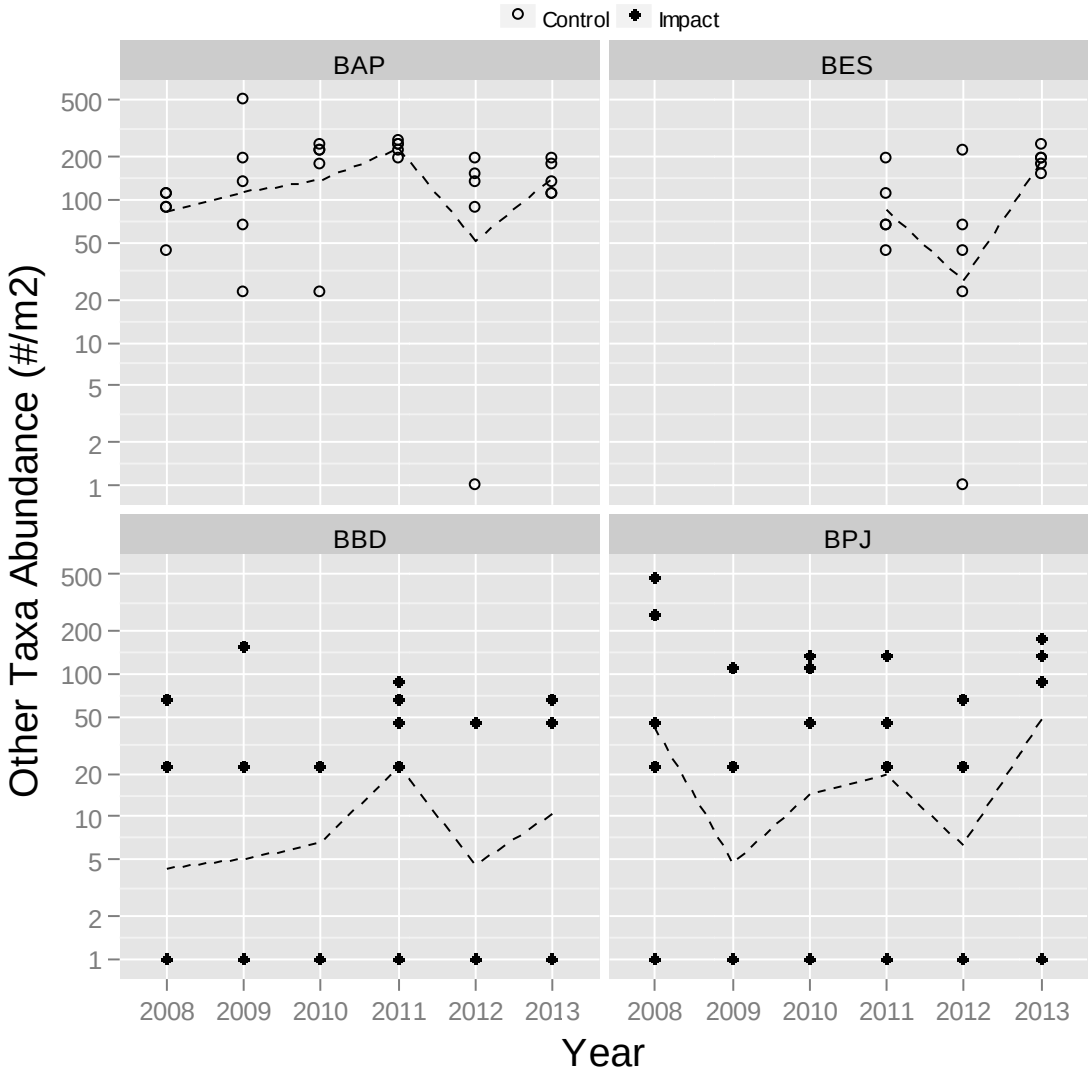

Control
Impact
INUG
PDL
WAL
TPN
TPE
SP
TPS
TE
TEFF
Bray-Curtis Index
0.25
0.50
0.75
2006
2007
2008
2009
2010
2011
2012
2013
Year


Control
Impact
BAP
BES
BBD
BPJ
Oligochaete Abundance (#/m2)
5000
1000
500
100
50
10
5
1
2008
2009
2010
2011
2012
2013
Year

CREMP Benthic Invertebrate Plots 2008 – 2013
Baker Lake




Control
Impact
BAP
BES
BBD
BPJ
Mollusc Abundance (#/m2)
1000
500
100
50
10
5
1
2008
2009
2010
2011
2012
2013
Year


Control
Impact
BAP
BES
BBD
BPJ
Other Taxa Abundance (#/m2)
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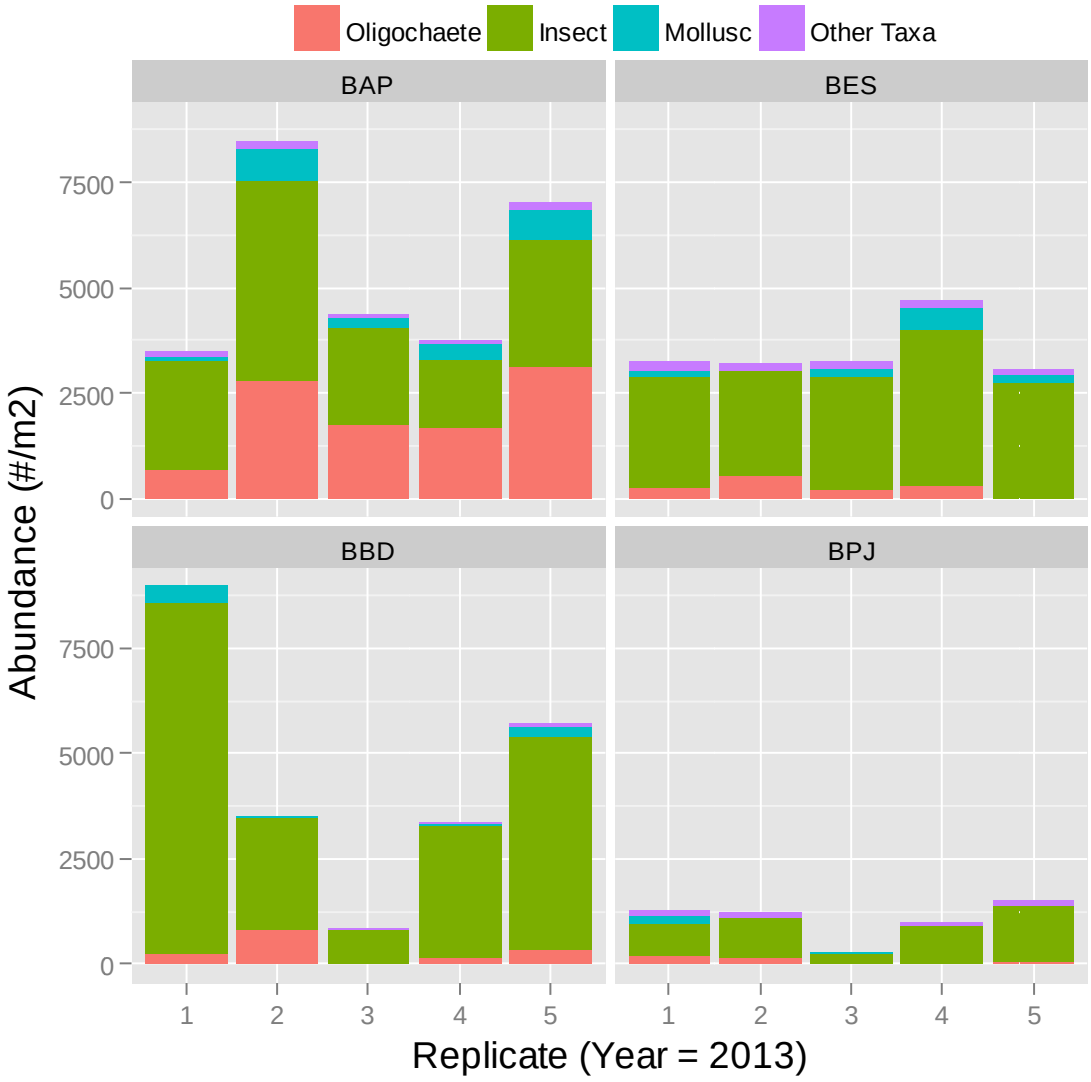
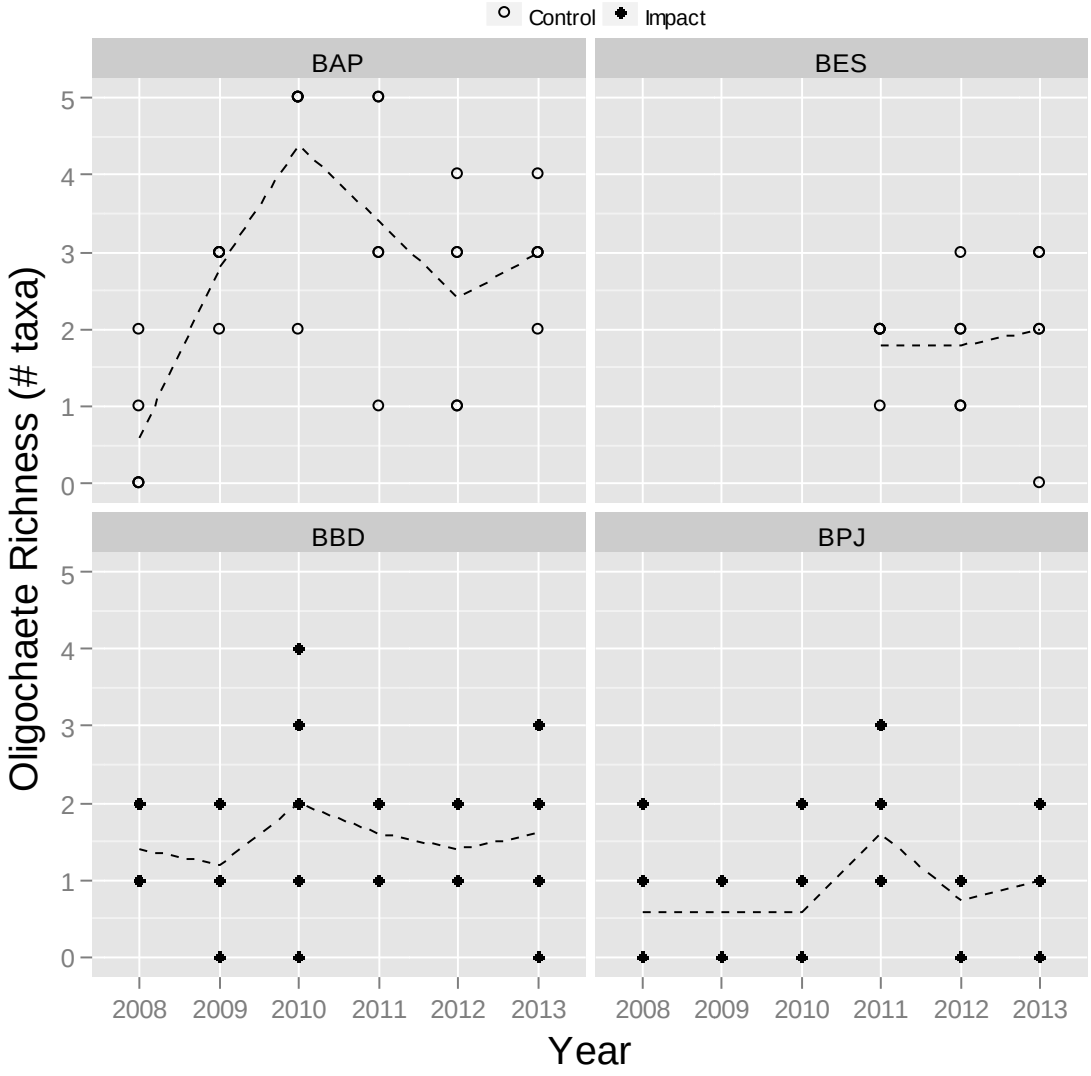
200
100
50
20
10
5
2
1
2008
2009
2010
2011
2012
2013
Year


Oligochaete
Insect
Mollusc
Other Taxa
BAP
BES
BBD
BPJ
Abundance (#/m2)
0
2500
5000
7500
1
2
3
4
5
Replicate (Year = 2013)


Control
Impact
BAP
BES
BBD
BPJ
Oligochaete Richness (# taxa)
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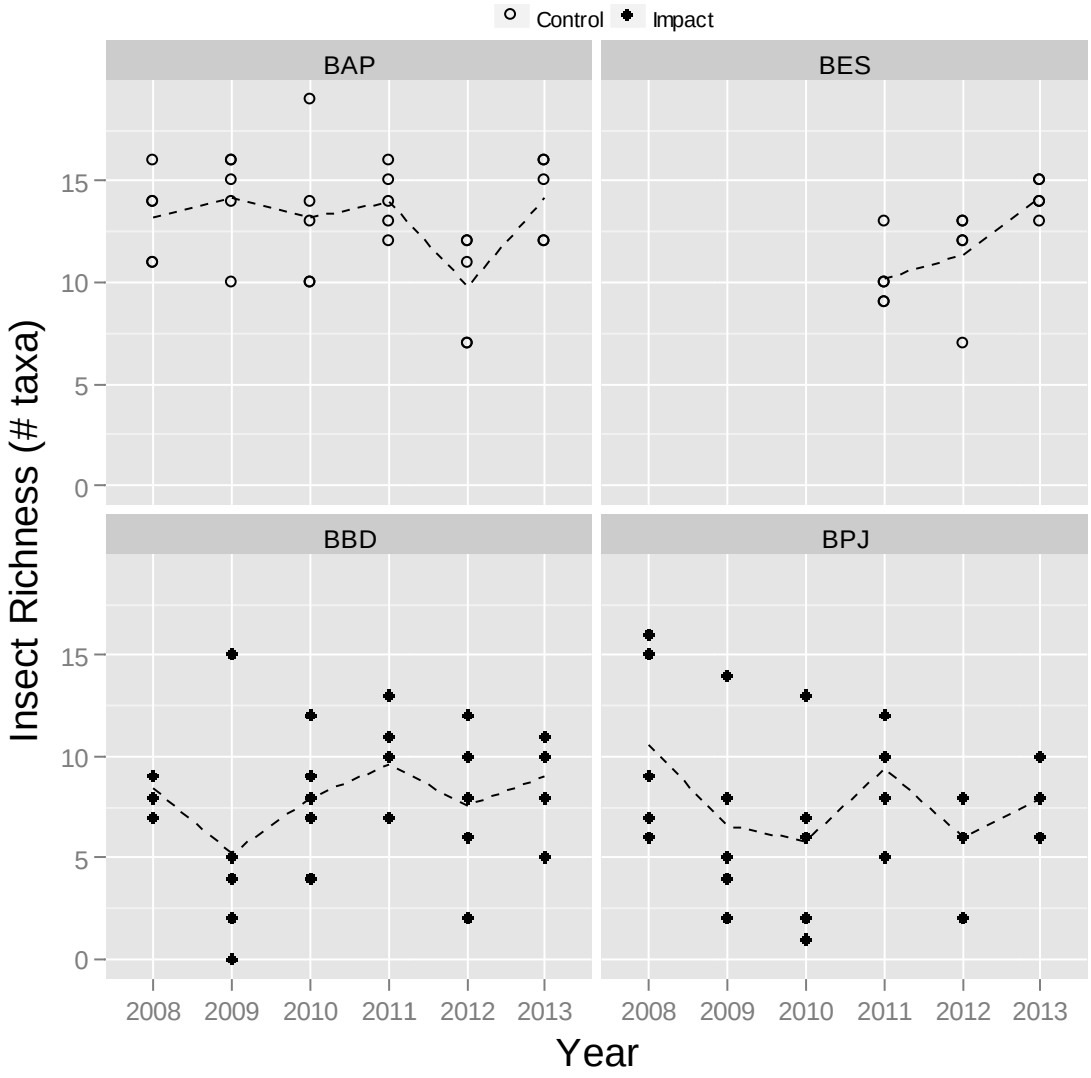
1
2
3
4
5
2008
2009
2010
2011
2012
2013
Year


Control
Impact
BAP
BES
BBD
BPJ
Insect Richness (# taxa)
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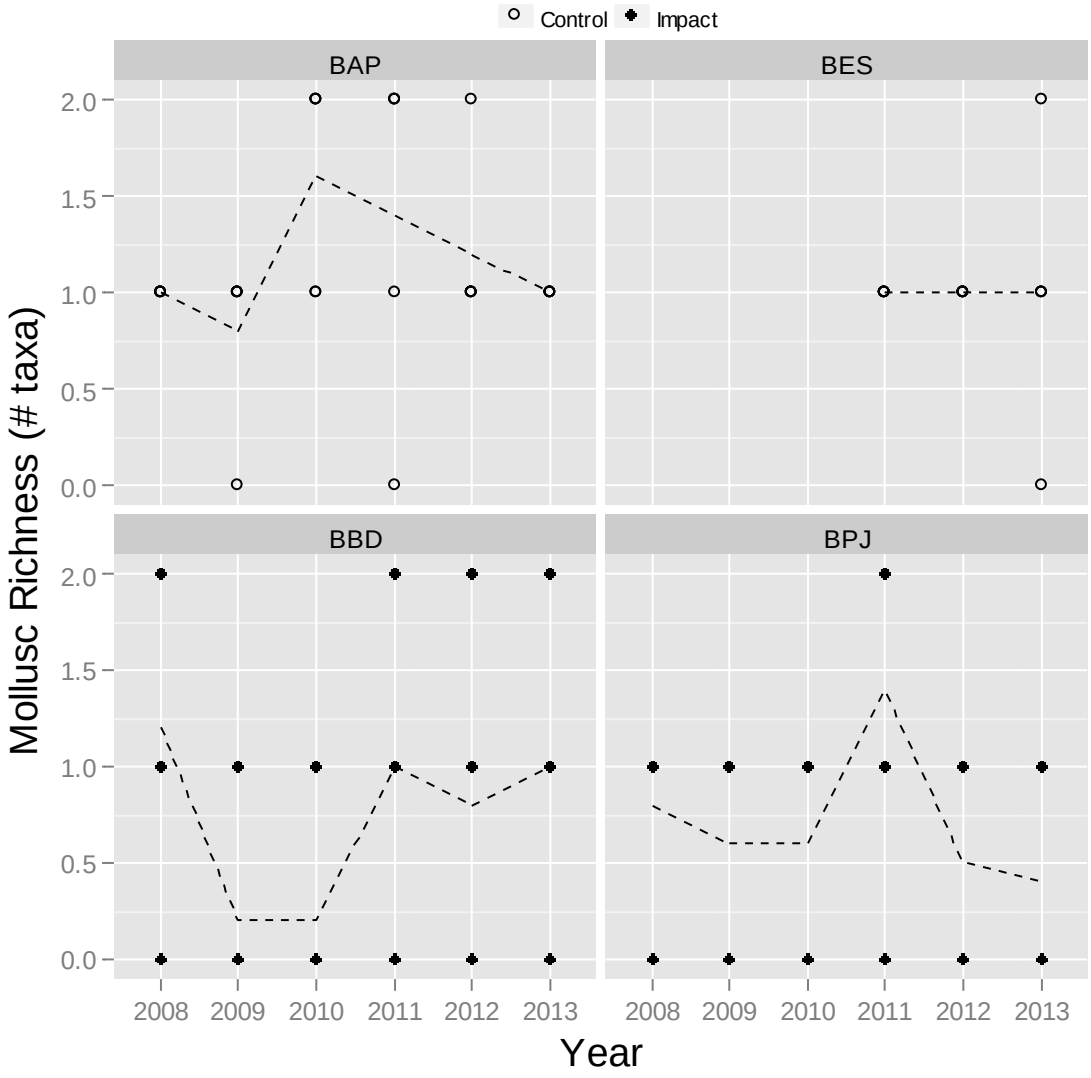
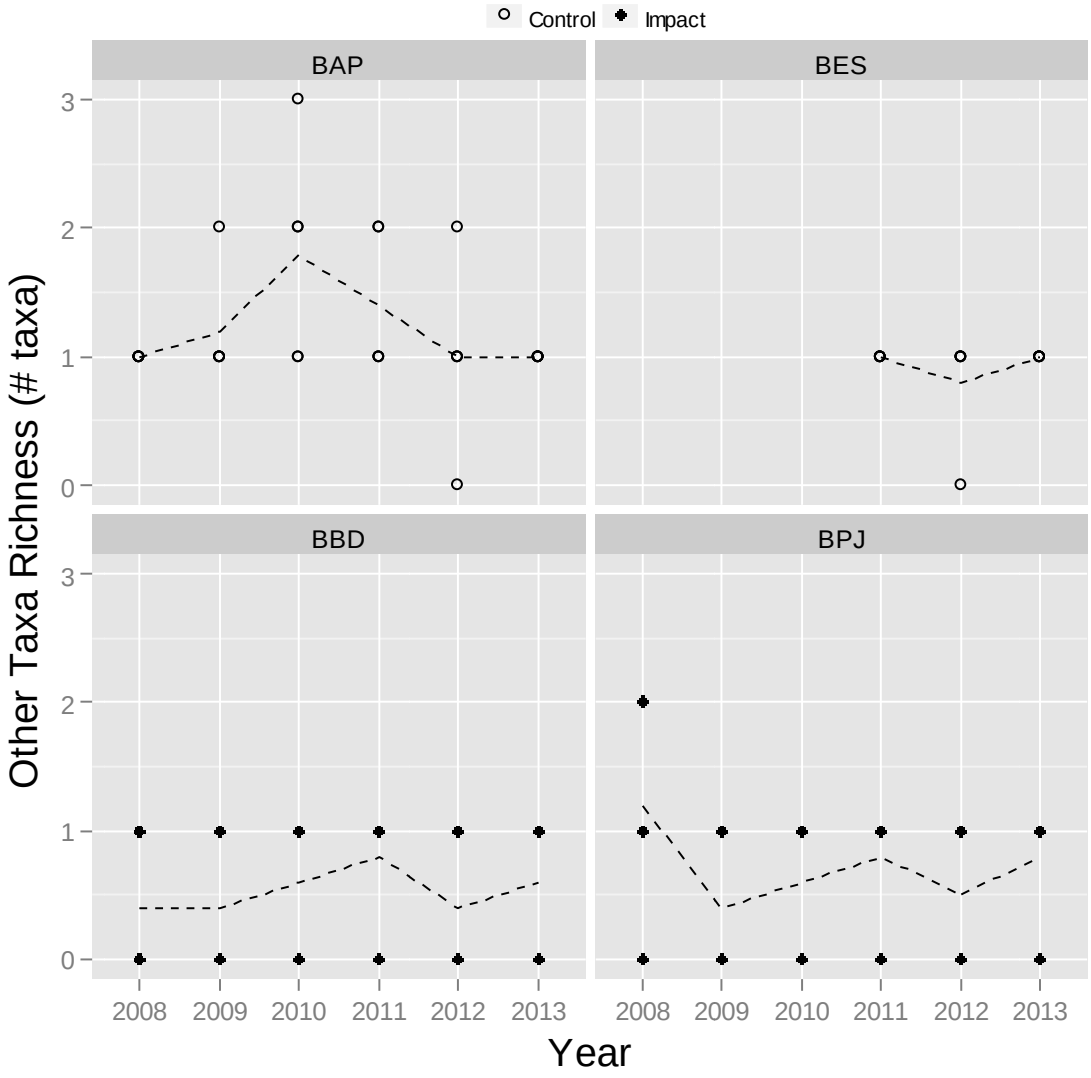
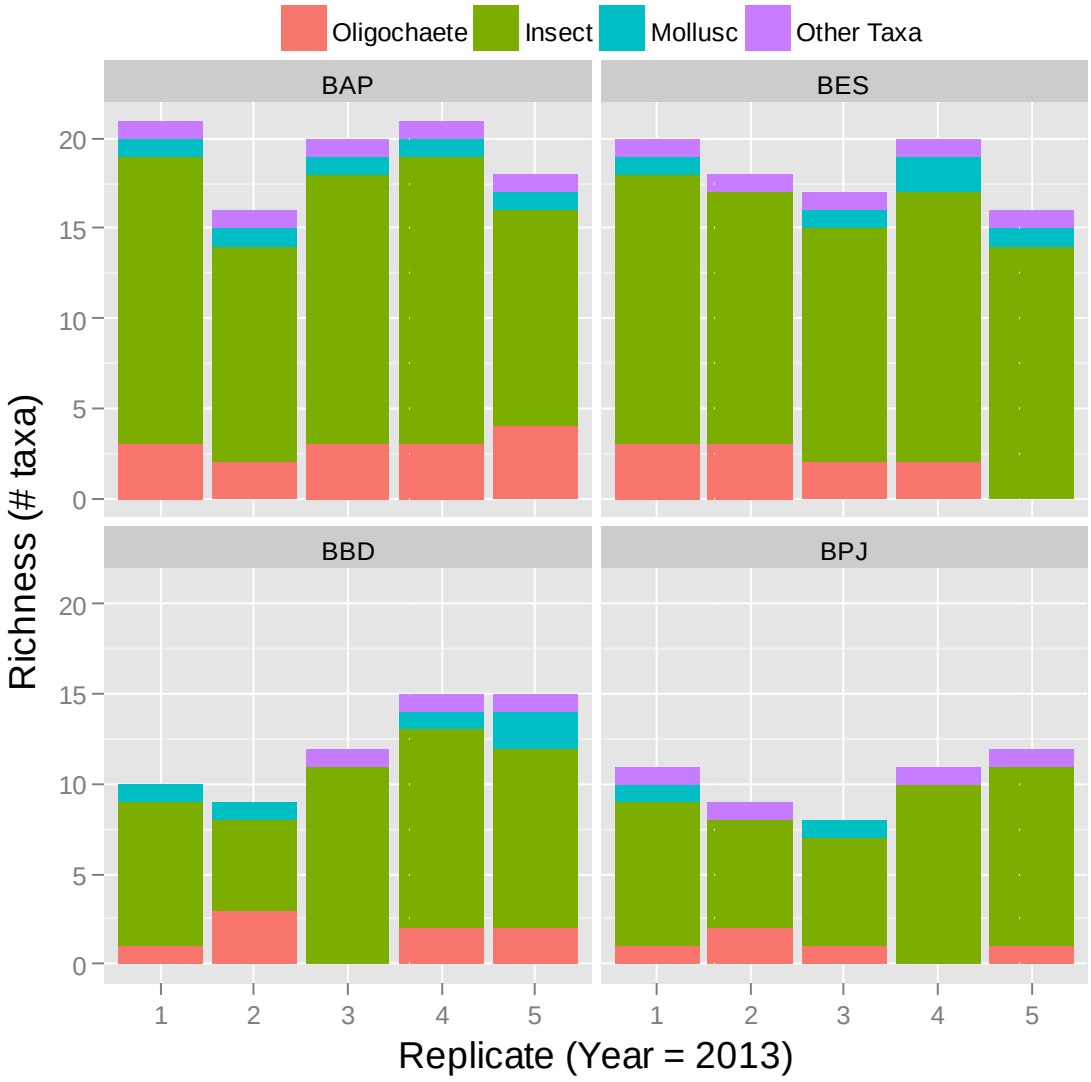
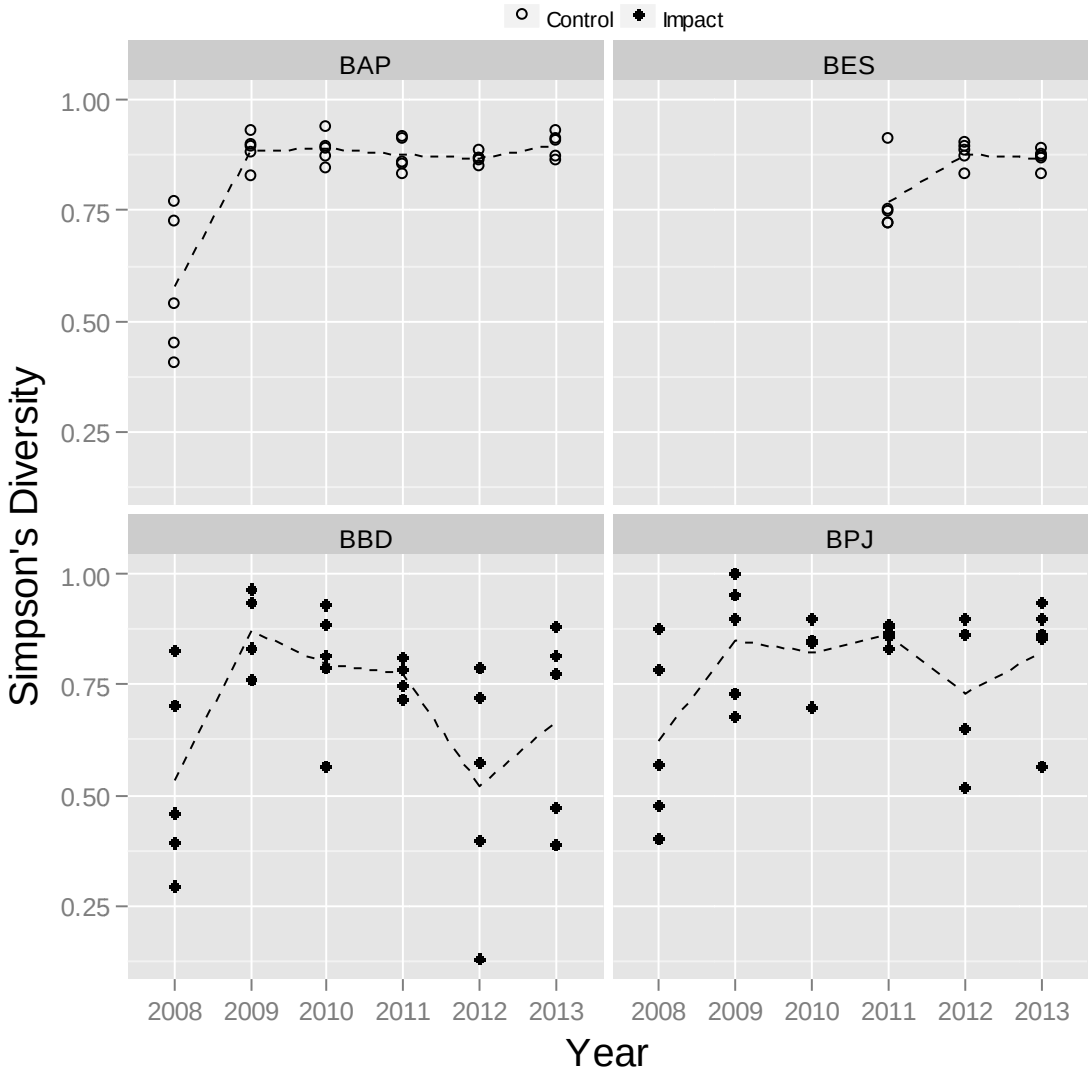
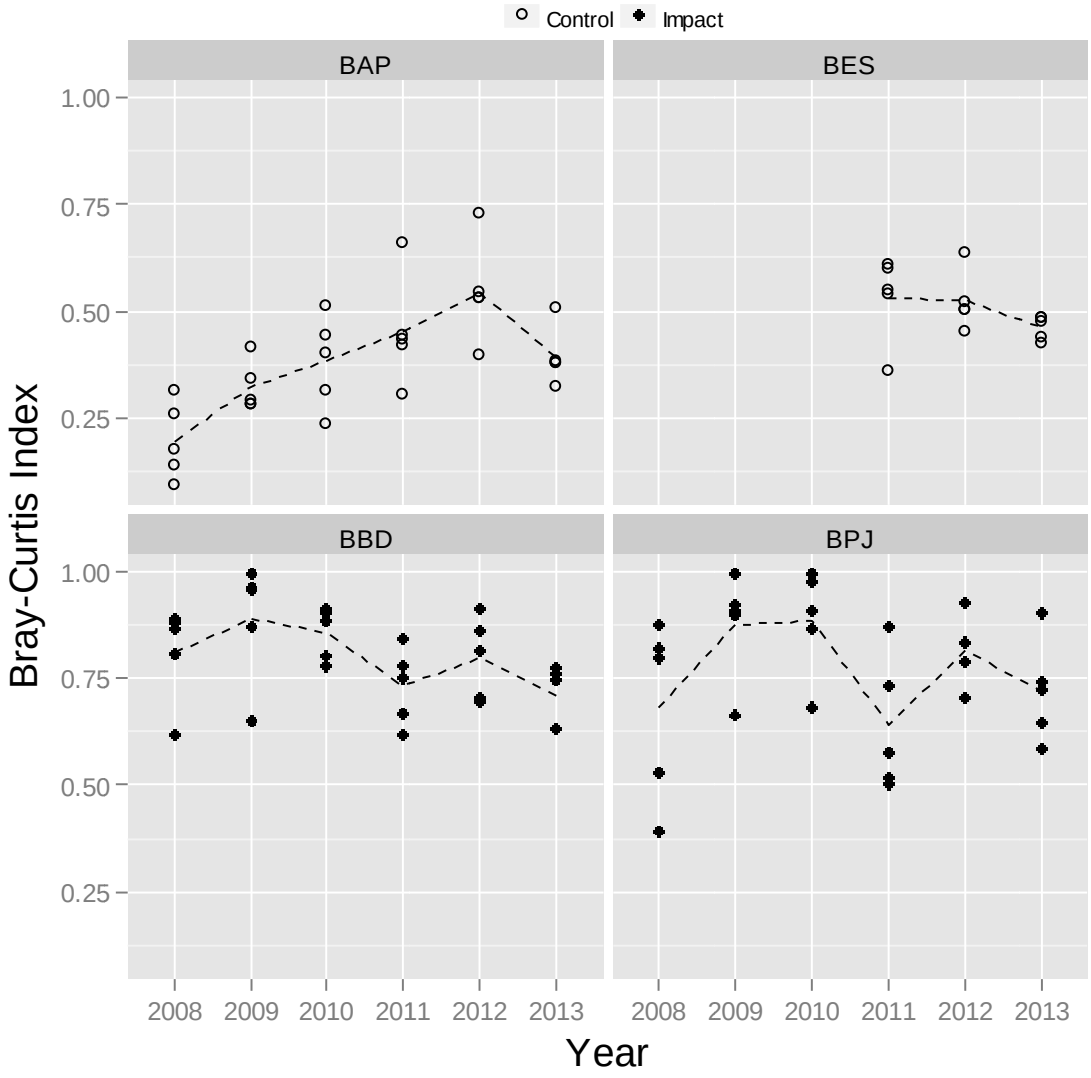
5
10
15
2008
2009
2010
2011
2012
2013
Year


Control
Impact
BAP
BES
BBD
BPJ
Mollusc Richness (# taxa)
0.0
0.5
1.0
1.5
2.0
2008
2009
2010
2011
2012
2013
Year


Control
Impact
BAP
BES
BBD
BPJ
Other Taxa Richness (# taxa)
0
1
2
3
2008
2009
2010
2011
2012
2013
Year


Oligochaete
Insect
Mollusc
Other Taxa
BAP
BES
BBD
BPJ
Richness (# taxa)
0
5
10
15
20
1
2
3
4
5
Replicate (Year = 2013)


Control
Impact
BAP
BES
BBD
BPJ
Simpson's Diversity
1.00
0.75
0.50
0.25
2008
2009
2010
2011
2012
2013
Year


Control
Impact
BAP
BES
BBD
BPJ
Bray-Curtis Index
1.00
0.75
0.50
0.25
2008
2009
2010
2011
2012
2013
Year

APPENDIX J

ALS LABORATORY REPORTS 2013

AZIMUTH CONSULTING GROUP INC.
ATTN: Laura Bekar
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 01-MAY-13
Report Date: 10-MAY-13 18:11 (MT)
Version: FINAL

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1295808

Project P.O. #: NOT SUBMITTED
Job Reference: MEADOWBANK SURFACEWATER
C of C Numbers:
Legal Site Desc:

Brent Mack
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1295808-1	L1295808-2	L1295808-3	L1295808-4	L1295808-5
	Description	WATER	WATER	WATER	WATER	WATER
	Sampled Date	17-APR-13	17-APR-13	17-APR-13	17-APR-13	17-APR-13
	Sampled Time	16:30	16:30	16:30	16:30	16:30
	Client ID	CREMP APR EB-1	TPN-59-S	CREMP APR DUP-1	TPN-58-S	SP-59-S
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	<2.0	26.3	26.3	28.3	33.2
	Hardness (as CaCO3) (mg/L)	<0.50	9.47	9.32	10.3	13.9
	pH (pH)	5.98	6.86	6.94	6.97	7.14
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Total Dissolved Solids (mg/L)	<3.0	17.0	14.6	19.4	21.0
	Turbidity (NTU)	<0.10	0.15	0.12	0.11	0.19
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	<2.0	6.4	6.4	6.6	10.2
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Total (as CaCO3) (mg/L)	<2.0	6.4	6.4	6.6	10.2
	Ammonia, Total (as N) (mg/L)	<0.0050	0.0208	0.0188	0.0193	0.0172
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	<0.10	0.74	0.73	0.79	0.74
	Fluoride (F) (mg/L)	<0.020	0.066	0.067	0.072	0.074
	Nitrate (as N) (mg/L)	<0.0050	0.0664	0.0662	0.0682	0.0176
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	0.0011	0.0016	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	<0.050	0.112	0.126	0.126	0.128
	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	0.0024
	Phosphorus (P)-Total (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	0.0024
	Silicate (as SiO2) (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Sulfate (SO4) (mg/L)	<0.50	4.53	4.49	4.82	4.07
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	1.25	2.14	2.58	2.09	2.17
	Total Organic Carbon (mg/L)	1.01	1.66	2.08	2.17	2.30
Total Metals	Aluminum (Al)-Total (mg/L)	<0.0030	<0.0030	<0.0030	0.0031	<0.0030
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	<0.00010	0.00022	0.00020	0.00021	0.00037
	Barium (Ba)-Total (mg/L)	0.000478 RRV	0.00325	0.00318	0.00343	0.00305
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)-Total (mg/L)	0.153	2.24	2.18	2.41	3.56
	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	0.00064

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1295808-6	L1295808-7	L1295808-8		
	Description	WATER	WATER	WATER		
	Sampled Date	17-APR-13	17-APR-13	17-APR-13		
	Sampled Time	16:30	16:30	16:30		
	Client ID	SP-58-S	WAL-27-S	WAL-28-S		
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	37.8	52.2	43.4		
	Hardness (as CaCO3) (mg/L)	15.5	25.3	20.4		
	pH (pH)	7.09	7.26	7.17		
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0		
	Total Dissolved Solids (mg/L)	24.8	32.8	27.7		
	Turbidity (NTU)	0.22	0.27	0.12		
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	11.5	20.5	16.4		
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0		
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0		
	Alkalinity, Total (as CaCO3) (mg/L)	11.5	20.5	16.4		
	Ammonia, Total (as N) (mg/L)	0.0211	0.0082	0.0176		
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050		
	Chloride (Cl) (mg/L)	0.93	0.89	0.73		
	Fluoride (F) (mg/L)	0.090	0.060	0.053		
	Nitrate (as N) (mg/L)	0.0319	0.0068	<0.0050		
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010		
	Total Kjeldahl Nitrogen (mg/L)	0.132	0.215	0.151		
	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	0.0025	0.0022		
	Silicate (as SiO2) (mg/L)	<0.50	1.14	1.23		
	Sulfate (SO4) (mg/L)	5.07	4.64	3.86		
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	2.43	3.22	2.67		
	Total Organic Carbon (mg/L)	2.58	3.16	2.80		
Total Metals	Aluminum (Al)-Total (mg/L)	0.0041	<0.0030	<0.0030		
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010		
	Arsenic (As)-Total (mg/L)	0.00057	0.00029	0.00026		
	Barium (Ba)-Total (mg/L)	0.00405	0.00347	0.00268		
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010		
	Bismuth (Bi)-Total (mg/L)	<0.00050	<0.00050	<0.00050		
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010		
	Cadmium (Cd)-Total (mg/L)	<0.000010	<0.000010	<0.000010		
	Calcium (Ca)-Total (mg/L)	3.83	6.48	5.47		
	Chromium (Cr)-Total (mg/L)	<0.00010	<0.00010	<0.00010		
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010		
	Copper (Cu)-Total (mg/L)	0.00067	0.00118	0.00112		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1295808-1 WATER 17-APR-13 16:30 CREMP APR EB-1	L1295808-2 WATER 17-APR-13 16:30 TPN-59-S	L1295808-3 WATER 17-APR-13 16:30 CREMP APR DUP-1	L1295808-4 WATER 17-APR-13 16:30 TPN-58-S	L1295808-5 WATER 17-APR-13 16:30 SP-59-S
WATER						
Total Metals	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)	<0.00050	0.00088	0.00087	0.00076	0.00083
	Magnesium (Mg)-Total (mg/L)	<0.10	0.90	0.88	0.97	1.20
	Manganese (Mn)-Total (mg/L)	<0.000050	0.00202	0.00203	0.00194	0.000621
	Mercury (Hg)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Total (mg/L)	<0.000050	0.000221	0.000225	0.000232	0.000155
	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)	<0.10	0.51	0.51	0.56	0.56
	Selenium (Se)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Silicon (Si)-Total (mg/L)	<0.050	0.068	0.077	0.074	0.236
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	<0.050	1.07	1.03	1.16	0.803
	Strontium (Sr)-Total (mg/L)	<0.00020	0.0104	0.0106	0.0111	0.0155
	Sulfur (S)-Total (mg/L)	<0.50	1.57	1.46	1.63	1.32
	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)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Total (mg/L)	<0.000010	0.000048	0.000050	0.000052	0.000049
	Vanadium (V)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	<0.0010	0.0014	0.0017	0.0020	<0.0010
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	<0.00010	0.00018	0.00018	0.00019	0.00033
	Barium (Ba)-Dissolved (mg/L)	0.000500 RRV	0.00327	0.00339	0.00363	0.00298
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	0.000096 RRV	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)-Dissolved (mg/L)	0.147	2.28	2.24	2.48	3.55
	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)	<0.00020	0.00039	0.00038	0.00043	0.00058
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Lead (Pb)-Dissolved (mg/L)	0.000141 RRV	<0.000050	<0.000050	<0.000050	<0.000050

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1295808-6	L1295808-7	L1295808-8		
	Description	WATER	WATER	WATER		
	Sampled Date	17-APR-13	17-APR-13	17-APR-13		
	Sampled Time	16:30	16:30	16:30		
	Client ID	SP-58-S	WAL-27-S	WAL-28-S		
Grouping	**Analyte**					
WATER						
Total Metals	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)	0.00079	0.00093	0.00077		
	Magnesium (Mg)-Total (mg/L)	1.37	1.91	1.62		
	Manganese (Mn)-Total (mg/L)	0.000605	0.000739	0.000512		
	Mercury (Hg)-Total (mg/L)	<0.000010	<0.000010	<0.000010		
	Molybdenum (Mo)-Total (mg/L)	0.000223	0.000131	0.000134		
	Nickel (Ni)-Total (mg/L)	0.00051	<0.00050	<0.00050		
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050		
	Potassium (K)-Total (mg/L)	0.70	0.65	0.56		
	Selenium (Se)-Total (mg/L)	<0.00010	<0.00010	<0.00010		
	Silicon (Si)-Total (mg/L)	0.182	0.718	0.611		
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010		
	Sodium (Na)-Total (mg/L)	1.09	0.791	0.677		
	Strontium (Sr)-Total (mg/L)	0.0166	0.0311	0.0253		
	Sulfur (S)-Total (mg/L)	1.69	1.57	1.36		
	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)	<0.010	<0.010	<0.010		
	Uranium (U)-Total (mg/L)	0.000063	0.000045	0.000043		
	Vanadium (V)-Total (mg/L)	<0.0010	<0.0010	<0.0010		
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030		
Dissolved Metals	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD		
	Aluminum (Al)-Dissolved (mg/L)	0.0013	0.0013	0.0011		
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Arsenic (As)-Dissolved (mg/L)	0.00064	0.00030	0.00024		
	Barium (Ba)-Dissolved (mg/L)	0.00453	0.00350	0.00261		
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050		
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010		
	Cadmium (Cd)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010		
	Calcium (Ca)-Dissolved (mg/L)	3.87	6.81	5.51		
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Copper (Cu)-Dissolved (mg/L)	0.00060	0.00116	0.00093		
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010		
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1295808-1 WATER 17-APR-13 16:30 CREMP APR EB-1	L1295808-2 WATER 17-APR-13 16:30 TPN-59-S	L1295808-3 WATER 17-APR-13 16:30 CREMP APR DUP-1	L1295808-4 WATER 17-APR-13 16:30 TPN-58-S	L1295808-5 WATER 17-APR-13 16:30 SP-59-S
WATER						
Dissolved Metals	Lithium (Li)-Dissolved (mg/L)	<0.00050	0.00083	0.00075	0.00076	0.00080
	Magnesium (Mg)-Dissolved (mg/L)	<0.10	0.92	0.91	1.00	1.21
	Manganese (Mn)-Dissolved (mg/L)	<0.000050	0.00171	0.00164	0.00188	0.000109
	Mercury (Hg)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Dissolved (mg/L)	<0.000050	0.000209	0.000201	0.000229	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)	<0.10	0.53	0.54	0.59	0.56
	Selenium (Se)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Silicon (Si)-Dissolved (mg/L)	<0.050	0.067	0.082	0.076	0.215
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	<0.050	1.09	1.08	1.12	0.802
	Strontium (Sr)-Dissolved (mg/L)	<0.00020	0.0105	0.00996	0.0111	0.0154
	Sulfur (S)-Dissolved (mg/L)	<0.50	1.54	1.50	1.68	1.38
	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)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Dissolved (mg/L)	<0.000010	0.000045	0.000046	0.000050	0.000044
	Vanadium (V)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)-Dissolved (mg/L)	0.0029 RRV	<0.0010	<0.0010	<0.0010	<0.0010
Plant Pigments	Chlorophyll a (ug/L)		<0.010	<0.010	<0.010	0.055

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1295808-6	L1295808-7	L1295808-8		
	Description	WATER	WATER	WATER		
	Sampled Date	17-APR-13	17-APR-13	17-APR-13		
	Sampled Time	16:30	16:30	16:30		
	Client ID	SP-58-S	WAL-27-S	WAL-28-S		
Grouping	**Analyte**					
WATER						
Dissolved Metals	Lithium (Li)-Dissolved (mg/L)	0.00126	0.00128	0.00069		
	Magnesium (Mg)-Dissolved (mg/L)	1.42	2.01	1.62		
	Manganese (Mn)-Dissolved (mg/L)	0.000338	0.000214	0.000126		
	Mercury (Hg)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010		
	Molybdenum (Mo)-Dissolved (mg/L)	0.000262	0.000139	0.000122		
	Nickel (Ni)-Dissolved (mg/L)	0.00055	<0.00050	<0.00050		
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050		
	Potassium (K)-Dissolved (mg/L)	0.78	0.68	0.55		
	Selenium (Se)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Silicon (Si)-Dissolved (mg/L)	0.152	0.751	0.615		
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010		
	Sodium (Na)-Dissolved (mg/L)	1.21	0.811	0.647		
	Strontium (Sr)-Dissolved (mg/L)	0.0179	0.0349	0.0244		
	Sulfur (S)-Dissolved (mg/L)	1.82	1.58	1.32		
	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)	<0.010	<0.010	<0.010		
	Uranium (U)-Dissolved (mg/L)	0.000065	0.000042	0.000041		
	Vanadium (V)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010		
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010		
Plant Pigments	Chlorophyll a (ug/L)	<0.010	<0.010	<0.010		

* 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)	DLM	L1295808-1, -2, -3, -4, -5, -6, -7, -8
Duplicate	Nitrite (as N)	DLM	L1295808-1, -2, -3, -4, -5, -6, -7, -8
Duplicate	Nitrate (as N)	DLM	L1295808-1, -2, -3, -4, -5, -6, -7, -8
Duplicate	Chlorophyll a	DUP-H	L1295808-2, -3, -4, -5, -6, -7, -8
Duplicate	Chlorophyll a	DUP-H	L1295808-2, -3, -4, -5, -6, -7, -8
Duplicate	Chlorophyll a	DUP-H	L1295808-2, -3, -4, -5, -6, -7, -8
Duplicate	Chlorophyll a	DUP-H	L1295808-2, -3, -4, -5, -6, -7, -8
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1295808-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1295808-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1295808-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Total Kjeldahl Nitrogen	MS-B	L1295808-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Total Kjeldahl Nitrogen	MS-B	L1295808-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Total Kjeldahl Nitrogen	MS-B	L1295808-8
Matrix Spike	Total Kjeldahl Nitrogen	MS-B	L1295808-8
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1295808-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1295808-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1295808-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Phosphorus (P)-Total	MS-B	L1295808-5
Matrix Spike	Total Organic Carbon	MS-B	L1295808-1

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLM	Detection Limit Adjusted For Sample Matrix Effects
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.
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-SCR-VA	Water	Alkalinity by colour or titration	EPA 310.2 OR APHA 2320

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.
OR
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.

ANIONS-BR-IC-VA	Water	Bromide by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-CL-LOW-IC-VA	Water	Low level Chloride by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-F-IC-VA	Water	Fluoride by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-NO2-IC-VA	Water	Nitrite in Water by Ion Chromatography	EPA 300.0

This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Nitrite is detected by UV absorbance.

ANIONS-NO3-IC-VA	Water	Nitrate in Water by Ion Chromatography	EPA 300.0

This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Nitrate is detected by UV absorbance.

ANIONS-SO4-IC-VA	Water	Sulfate by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310 TOTAL ORGANIC CARBON (TOC)

Reference Information

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 5310 TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

CHLOROA-VA Water Chlorophyll a by Fluorometer 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.

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.

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-DIS-LOW-CVAFS-VA Water Dissolved Mercury in Water by CVAFS(Low) EPA SW-846 3005A & EPA 245.7

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 filtration (EPA Method 3005A) and involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry (EPA Method 245.7).

HG-TOT-LOW-CVAFS-VA Water Total Mercury in Water by CVAFS(Low) EPA 245.7

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 a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry (EPA Method 245.7).

MET-D-CCMS-VA Water Dissolved Metals in Water by CRC ICPMS APHA 3030 B&E / EPA SW-846 6020A

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 hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

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 APHA 3030 B&E / EPA SW-846 6020A

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 hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

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 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-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorous 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 Phosphorous 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 Phosphorous

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.

TDS-LOW-VA Water Low Level TDS (3.0mg/L) by Gravimetric APHA 2540 Gravimetric

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 2540 Gravimetric

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.

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.

ALS Environmental

...st Form
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COC # _____

Page 1 of

L1295808-COFC

Report To				Service Requested (Rush for routine analysis subject to availability)
Company:	Azimuth Consulting Group			◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Laura Bekar	☐ PDF ☐ Excel ☐ Digital ☐ Fax		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1:	lbekar@azimuthgroup.ca	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6K2G8	Email 2:	ryan.vanengen@agnicoeagle.com	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax:	Email 3:		**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 #:	Meadowbank Surfacewater	
Company:		PO / AFE:		
Contact:		LSD:		
Address:				
Phone:	Fax:	Quote #:	Q39503	
Lab Work Order # (lab use only)	L1295808	ALS Contact:	Sampler:	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Alkalinity Species, Anions-All	pH, EC, Turb, TDS, Silicate	T-P, TD-P, Ortho-PO4	TSS-Low	Ammonia, TKN	TOC	DOC	Total Metals (MET-T-NDR-VA)	Diss. Metals (MET-D-NDR-VA)	Total Mercury (Low Level)	Diss. Mercury (Low Level)	Chlorophyl 'a'
	CREMP APR EB-1	17-Apr-13	16:30	Water	x	x	x	x	x	x	x	x	x	x	x	
	TPN-59-S	18-Apr-13	10:37	Water	x	x	x	x	x	x	x	x	x	x	x	x
	CREMP APR DUP-1	18-Apr-13	10:37	Water	x	x	x	x	x	x	x	x	x	x	x	x
	TPN-58-S	18-Apr-13	11:28	Water	x	x	x	x	x	x	x	x	x	x	x	x
	SP-59-S	19-Apr-13	10:26	Water	x	x	x	x	x	x	x	x	x	x	x	x
	SP-58-S	19-Apr-13	15:13	Water	x	x	x	x	x	x	x	x	x	x	x	x
	WAL-27-S	20-Apr-13	11:35	Water	x	x	x	x	x	x	x	x	x	x	x	x
	WAL-28-S	20-Apr-13	12:28	Water	x	x	x	x	x	x	x	x	x	x	x	x

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

* Number of Bottles = 10 + 1 Chlorophyll A. No Chlorophyll A for EB-1

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:	Observatic Yes / No ? If Yes add
Tom Thomson	23-Apr-13	9:00	BP	May 1	9:50	11.8/12.8°C				

AZIMUTH CONSULTING GROUP INC.
ATTN: Laura Bekar
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 25-JUL-13
Report Date: 06-AUG-13 12:42 (MT)
Version: FINAL

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1337910

Project P.O. #: NOT SUBMITTED
Job Reference: MEADOWBANK SURFACEWATER
C of C Numbers:
Legal Site Desc:

Brent Mack
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1337910-1	L1337910-2	L1337910-3	L1337910-4	L1337910-5
	Description	water	water	water	water	water
	Sampled Date	15-JUL-13	15-JUL-13	15-JUL-13	15-JUL-13	16-JUL-13
	Sampled Time	15:50	16:21	17:06	17:37	11:50
	Client ID	TEFF-27-S	TEFF-28-S	TE-60-S	TE-61-S	INUG-48-S
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	16.1	16.5	20.4	20.9	14.1
	Hardness (as CaCO3) (mg/L)	5.60	5.89	7.78	8.05	5.32
	pH (pH)	6.72	6.75	6.94	7.05	6.77
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Total Dissolved Solids (mg/L)	13	14	14	17	13
	Turbidity (NTU)	0.26	0.28	0.60	0.38	0.33
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	4.0	4.3	6.1	6.3	4.6
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Total (as CaCO3) (mg/L)	4.0	4.3	6.1	6.3	4.6
	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)	0.57	0.57	0.58	0.56	0.65
	Fluoride (F) (mg/L)	0.059	0.060	0.063	0.062	0.057
	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
	Total Kjeldahl Nitrogen (mg/L)	0.130	0.084	0.114	0.107	0.149
	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	0.0026
	Silicate (as SiO2) (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Sulfate (SO4) (mg/L)	1.89	1.95	2.37	2.40	0.85
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	1.33	1.35	1.35	1.36	1.86
	Total Organic Carbon (mg/L)	1.39	1.23	1.32	1.47	1.91
Total Metals	Aluminum (Al)-Total (mg/L)	0.0065	0.0061	0.0107	0.0113	0.0099
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	<0.00010	<0.00010	0.00019	0.00017	0.00011
	Barium (Ba)-Total (mg/L)	0.00217	0.00215	0.00230	0.00220	0.00194
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)-Total (mg/L)	1.34	1.36	1.92	1.93	1.02
	Chromium (Cr)-Total (mg/L)	0.00024	0.00010	0.00014	0.00015	0.00015
	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	0.00231	<0.00050

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1337910-6 water 16-JUL-13 12:20 INUG-49-S	L1337910-7 water 16-JUL-13 15:00 PDL-28-S	L1337910-8 water 16-JUL-13 15:37 PDL-27-S	L1337910-9 water 17-JUL-13 15:35 JUL-EB1	
WATER						
Physical Tests	Conductivity (uS/cm)	14.1	20.1	20.0	<2.0	
	Hardness (as CaCO3) (mg/L)	5.35	8.31	8.33	<0.50	
	pH (pH)	6.80	7.09	7.12	5.82	
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	
	Total Dissolved Solids (mg/L)	11	15	16	<10	
	Turbidity (NTU)	0.34	0.20	0.21	0.10	
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	4.8	6.9	6.9	<2.0	
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	
	Alkalinity, Total (as CaCO3) (mg/L)	4.8	6.9	6.9	<2.0	
	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	
	Chloride (Cl) (mg/L)	0.65	0.59	0.59	<0.10	
	Fluoride (F) (mg/L)	0.057	0.037	0.037	<0.020	
	Nitrate (as N) (mg/L)	<0.0050	0.0065	0.0054	<0.0050	
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	
	Total Kjeldahl Nitrogen (mg/L)	0.141	0.115	0.126	<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)	0.0029	<0.0020	0.0021	<0.0020	
	Silicate (as SiO2) (mg/L)	<0.50	<0.50	<0.50	<0.50	
	Sulfate (SO4) (mg/L)	0.87	1.63	1.59	<0.50	
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	1.84	1.46	1.99	1.08 RRV	
	Total Organic Carbon (mg/L)	2.17	1.70	1.75	<0.50	
Total Metals	Aluminum (Al)-Total (mg/L)	0.0114	0.0035	0.0038	<0.0030	
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Arsenic (As)-Total (mg/L)	<0.00010	0.00015	0.00015	<0.00010	
	Barium (Ba)-Total (mg/L)	0.00195	0.00188	0.00194	0.000097 RRV	
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Bismuth (Bi)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	
	Cadmium (Cd)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Calcium (Ca)-Total (mg/L)	1.06	2.03	2.13	0.058	
	Chromium (Cr)-Total (mg/L)	0.00017	0.00013	0.00013	<0.00010	
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Copper (Cu)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1337910-1 water 15-JUL-13 15:50 TEFF-27-S	L1337910-2 water 15-JUL-13 16:21 TEFF-28-S	L1337910-3 water 15-JUL-13 17:06 TE-60-S	L1337910-4 water 15-JUL-13 17:37 TE-61-S	L1337910-5 water 16-JUL-13 11:50 INUG-48-S
Sample ID						
Description						
Sampled Date						
Sampled Time						
Client ID						
WATER						
Total Metals	Iron (Fe)-Total (mg/L)	0.011	0.011	0.020	0.026	0.017
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Magnesium (Mg)-Total (mg/L)	0.58	0.59	0.75	0.74	0.64
	Manganese (Mn)-Total (mg/L)	0.00242	0.00270	0.00309	0.00316	0.00325
	Mercury (Hg)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Total (mg/L)	<0.000050	<0.000050	0.000074	0.000082	<0.000050
	Nickel (Ni)-Total (mg/L)	<0.00050	<0.00050	<0.00050	0.00095	<0.00050
	Phosphorus (P)-Total (mg/L)	<0.30	<0.30	<0.30	<0.30	<0.30
	Potassium (K)-Total (mg/L)	0.342	0.358	0.382	0.375	0.325
	Selenium (Se)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Silicon (Si)-Total (mg/L)	0.129	0.134	0.178	0.183	0.161
	Silver (Ag)-Total (mg/L)	<0.000010	0.000014	<0.000010	0.000110	<0.000010
	Sodium (Na)-Total (mg/L)	0.533	0.539	0.565	0.549	0.478
	Strontium (Sr)-Total (mg/L)	0.00734	0.00766	0.0100	0.0100	0.00594
	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)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Total (mg/L)	0.000040	0.000042	0.000054	0.000057	0.000057
	Vanadium (V)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0017	0.0022	0.0023	0.0029	0.0031
	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	0.00016	<0.00010
	Barium (Ba)-Dissolved (mg/L)	0.00199	0.00204	0.00217	0.00218	0.00185
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)-Dissolved (mg/L)	1.31	1.40	1.92	2.00	1.05
	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)	0.00053	0.00048	0.00041	0.00041	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	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1337910-6	L1337910-7	L1337910-8	L1337910-9	
	Description	water	water	water	water	
	Sampled Date	16-JUL-13	16-JUL-13	16-JUL-13	17-JUL-13	
	Sampled Time	12:20	15:00	15:37	15:35	
	Client ID	INUG-49-S	PDL-28-S	PDL-27-S	JUL-EB1	
Grouping	**Analyte**					
WATER						
Total Metals	Iron (Fe)-Total (mg/L)	0.020	<0.010	<0.010	<0.010	
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	
	Lithium (Li)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Magnesium (Mg)-Total (mg/L)	0.68	0.74	0.76	<0.10	
	Manganese (Mn)-Total (mg/L)	0.00343	0.00114	0.00149	0.000071 RRV	
	Mercury (Hg)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Molybdenum (Mo)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	
	Nickel (Ni)-Total (mg/L)	0.00050	0.00069	0.00068	<0.00050	
	Phosphorus (P)-Total (mg/L)	<0.30	<0.30	<0.30	<0.30	
	Potassium (K)-Total (mg/L)	0.346	0.317	0.320	<0.050	
	Selenium (Se)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Silicon (Si)-Total (mg/L)	0.169	0.143	0.158	<0.050	
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Sodium (Na)-Total (mg/L)	0.483	0.442	0.452	<0.050	
	Strontium (Sr)-Total (mg/L)	0.00614	0.00877	0.00886	<0.00020	
	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)	<0.010	<0.010	<0.010	<0.010	
	Uranium (U)-Total (mg/L)	0.000059	0.000022	0.000025	<0.000010	
	Vanadium (V)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	
Dissolved Metals	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	
	Aluminum (Al)-Dissolved (mg/L)	0.0032	0.0016	0.0021	<0.0010	
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Arsenic (As)-Dissolved (mg/L)	<0.00010	0.00013	0.00014	<0.00010	
	Barium (Ba)-Dissolved (mg/L)	0.00185	0.00197	0.00191	0.000173 RRV	
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	
	Cadmium (Cd)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Calcium (Ca)-Dissolved (mg/L)	1.06	2.09	2.10	0.108	
	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)	0.00036	0.00046	0.00046	0.00041 RRV	
	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)	<0.00050	<0.00050	<0.00050	<0.00050	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1337910-1	L1337910-2	L1337910-3	L1337910-4	L1337910-5
	Description	water	water	water	water	water
	Sampled Date	15-JUL-13	15-JUL-13	15-JUL-13	15-JUL-13	16-JUL-13
	Sampled Time	15:50	16:21	17:06	17:37	11:50
	Client ID	TEFF-27-S	TEFF-28-S	TE-60-S	TE-61-S	INUG-48-S
Grouping	**Analyte**					
WATER						
Dissolved Metals	Magnesium (Mg)-Dissolved (mg/L)	0.56	0.58	0.73	0.74	0.65
	Manganese (Mn)-Dissolved (mg/L)	0.00158	0.00178	0.00179	0.00182	0.00165
	Mercury (Hg)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Dissolved (mg/L)	<0.000050	<0.000050	0.000062	0.000078	<0.000050
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Phosphorus (P)-Dissolved (mg/L)	<0.30	<0.30	<0.30	<0.30	<0.30
	Potassium (K)-Dissolved (mg/L)	0.345	0.354	0.373	0.370	0.337
	Selenium (Se)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Silicon (Si)-Dissolved (mg/L)	0.119	0.130	0.164	0.170	0.147
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	0.525	0.530	0.552	0.546	0.475
	Strontium (Sr)-Dissolved (mg/L)	0.00705	0.00728	0.00942	0.00977	0.00584
	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)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Dissolved (mg/L)	0.000030	0.000034	0.000046	0.000046	0.000047
	Vanadium (V)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	0.0010	<0.0010	<0.0010	<0.0010
Plant Pigments	Chlorophyll a (ug/L)	0.213	0.122	0.249	0.474	0.293

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1337910-6 water 16-JUL-13 12:20 INUG-49-S	L1337910-7 water 16-JUL-13 15:00 PDL-28-S	L1337910-8 water 16-JUL-13 15:37 PDL-27-S	L1337910-9 water 17-JUL-13 15:35 JUL-EB1	
Sample ID						
Description						
Sampled Date						
Sampled Time						
Client ID						
WATER						
Dissolved Metals	Magnesium (Mg)-Dissolved (mg/L)	0.66	0.75	0.75	<0.10	
	Manganese (Mn)-Dissolved (mg/L)	0.00171	0.000805	0.000935	0.000182 RRV	
	Mercury (Hg)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Molybdenum (Mo)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	0.00067	0.00068	<0.00050	
	Phosphorus (P)-Dissolved (mg/L)	<0.30	<0.30	<0.30	<0.30	
	Potassium (K)-Dissolved (mg/L)	0.342	0.320	0.323	<0.050	
	Selenium (Se)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Silicon (Si)-Dissolved (mg/L)	0.146	0.147	0.155	<0.050	
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Sodium (Na)-Dissolved (mg/L)	0.481	0.437	0.446	<0.050	
	Strontium (Sr)-Dissolved (mg/L)	0.00571	0.00846	0.00843	0.00034 RRV	
	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)	<0.010	<0.010	<0.010	<0.010	
	Uranium (U)-Dissolved (mg/L)	0.000046	0.000024	0.000024	<0.000010	
	Vanadium (V)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	0.0015 RRV	
Plant Pigments	Chlorophyll a (ug/L)	0.486	0.287	0.699		

* 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	Bromide (Br)	DLM	L1337910-1, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Chloride (Cl)	DLM	L1337910-1, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Nitrite (as N)	DLM	L1337910-1, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Nitrate (as N)	DLM	L1337910-1, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Bromide (Br)	DLM	L1337910-1, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Nitrite (as N)	DLM	L1337910-1, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Chlorophyll a	DUP-H	L1337910-1, -2, -3, -4, -5, -6, -7, -8
Method Blank	Chromium (Cr)-Total	MB-LOR	L1337910-1, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Silicate (as SiO2)	MS-B	L1337910-1, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Total Organic Carbon	MS-B	L1337910-7
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1337910-1, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1337910-1, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Arsenic (As)-Dissolved	MS-B	L1337910-1, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1337910-1, -2, -3, -4, -5, -6, -7, -8, -9

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLM	Detection Limit Adjusted For Sample Matrix Effects
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.
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-SCR-VA	Water	Alkalinity by colour or titration	EPA 310.2 OR APHA 2320

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.
OR
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.

ANIONS-BR-IC-VA	Water	Bromide by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-CL-IC-VA	Water	Chloride by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-CL-LOW-IC-VA	Water	Low level Chloride by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-F-IC-VA	Water	Fluoride by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-NO2-IC-VA	Water	Nitrite in Water by Ion Chromatography	EPA 300.0

This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Nitrite is detected by UV absorbance.

ANIONS-NO3-IC-VA	Water	Nitrate in Water by Ion Chromatography	EPA 300.0

This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Nitrate is detected by UV absorbance.

ANIONS-SO4-IC-VA	Water	Sulfate by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310 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.

Reference Information

CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310 TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

CHLOROA-VA	Water	Chlorophyll a by Fluorometer	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.

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.

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-DIS-LOW-CVAFS-VA	Water	Dissolved Mercury in Water by CVAFS(Low)	EPA SW-846 3005A & EPA 245.7

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 filtration (EPA Method 3005A) and involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

HG-TOT-LOW-CVAFS-VA	Water	Total Mercury in Water by CVAFS(Low)	EPA 245.7

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 a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030 B&E / EPA SW-846 6020A

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 hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

MET-DIS-ICP-VA	Water	Dissolved Metals 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 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	APHA 3030 B&E / EPA SW-846 6020A

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 hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

MET-TOT-ICP-VA	Water	Total Metals 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 (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

N-TOTKJ-TB	Water	Total Kjeldahl Nitrogen by Colourimetry	APHA 4500-Norg B (modified)

Total Kjeldahl Nitrogen in aqueous matrices is analyzed using an autoanalyzer with colourimetric detection.

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-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorous 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 Phosphorous is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Reference Information

PH-MAN-VA	Water	pH by Manual Meter	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-MAN-VA	Water	pH by Manual Meter	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.

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 Phosphorous

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.

TDS-VA	Water	Total Dissolved Solids by Gravimetric	APHA 2540 C - GRAVIMETRIC

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 2540 Gravimetric

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.

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
TB	ALS ENVIRONMENTAL - THUNDER BAY, ONTARIO, CANADA
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

L1337910-COFC

COC # _____

Page 1 of

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:	Laura Bekar	☐ PDF ☐ Excel ☐ Digital ☐ Fax		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1:	lbekar@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		Analysis Request
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	Meadowbank Surfacewater	Please indicate below Filtered, Preserved or both (F, P, F/P)
Company:		PO / AFE:		
Contact:		LSD:		
Address:				
Phone:	Fax:	Quote #:	Q39503	
Lab Work Order # (lab use only)	L1337910	ALS Contact:	Sampler:	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Alkalinity Species, Anions-All	pH, EC, Turb, TDS, Silicate	T-P, TD-P, Ortho-PO4	TSS-Low	Ammonia, TKN	TOC	DOC	Total Metals (MET-T-NDR-VA)	Diss. Metals (MET-D-NDR-VA)	Total Mercury (Low Level)	Diss. Mercury (Low Level)	Chlorophyll 'a'	
	TEFF-27-S	15-Jul-13	15:50	Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	TEFF-28-S	15-Jul-13	16:21	Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	TE-60-S	15-Jul-13	17:06	Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	TE-61-S	15-Jul-13	17:37	Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	INUG-48-S	16-Jul-13	11:50	Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	INUG-49-S	16-Jul-13	12:20	Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	PDL-28-S	16-Jul-13	15:00	Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	PDL-27-S	16-Jul-13	15:37	Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	JUL-EB1	17-Jul-13	15:35	Water	x	x	x	x	x	x	x	x	x	x	x		6

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

(1) there are no Chlorophyll-a filters for samples with IDs including "EB-" and for "travel/trip blank" samples; however, all other analyses should be conducted on these samples. (2) 500 mL of water we filtered for all Chlorophyll-a sample filters included in this shipment.

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:	Observatio Yes / No ? If Yes add
			Britt	July 25	10:15	21.2 °C				

GENF 20.00 Front

AZIMUTH CONSULTING GROUP INC.
ATTN: Laura Bekar
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 29-JUL-13
Report Date: 07-AUG-13 18:29 (MT)
Version: FINAL

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1339412

Project P.O. #: NOT SUBMITTED
Job Reference: MEADOWBANK SURFACEWATER
C of C Numbers: 1, 2
Legal Site Desc:

Brent Mack
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1339412-1 water 19-JUL-13 08:54 WAL-30-S	L1339412-2 water 19-JUL-13 08:54 CREMP JULY DUP 1	L1339412-3 water 19-JUL-13 09:26 WAL-29-S	L1339412-4 water 19-JUL-13 14:29 SP-61-S	L1339412-5 water 19-JUL-13 14:48 SP-60-S
Sample ID						
Description						
Sampled Date						
Sampled Time						
Client ID						
WATER						
Physical Tests	Conductivity (uS/cm)	39.6	31.4	28.7	28.7	29.2
	Hardness (as CaCO3) (mg/L)	12.5	12.5	12.7	12.3	12.8
	pH (pH)	7.93	7.56	7.08	7.30	7.34
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Total Dissolved Solids (mg/L)	19.0	22.7	13.5	22.8	22.7
	Turbidity (NTU)	0.26	0.32	0.29	0.47	0.44
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	10.3	10.3	10.5	9.8	9.8
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Total (as CaCO3) (mg/L)	10.3	10.3	10.5	9.8	9.8
	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)	0.49	0.49	0.49	0.56	0.57
	Fluoride (F) (mg/L)	0.041	0.041	0.040	0.057	0.058
	Nitrate (as N) (mg/L)	<0.0050	<0.0050	<0.0050	0.0052	0.0073
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	0.142	0.138	0.135	0.160	0.169
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Phosphorus (P)-Total Dissolved (mg/L)	0.0021	0.0021	<0.0020	<0.0020	<0.0020
	Phosphorus (P)-Total (mg/L)	0.0034	0.0034	0.0033	0.0028	0.0032
	Silicate (as SiO2) (mg/L)	0.72	0.69	0.71	0.52	0.51
	Sulfate (SO4) (mg/L)	2.51	2.51	2.51	3.14	3.20
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	2.85	2.95	2.51	2.10	1.83
	Total Organic Carbon (mg/L)	2.77	2.51	2.60	2.09	1.92
Total Metals	Aluminum (Al)-Total (mg/L)	0.0070	0.0072	0.0096	0.0161	0.0142
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00024	0.00021	0.00026	0.00030	0.00032
	Barium (Ba)-Total (mg/L)	0.00196	0.00185	0.00190	0.00260	0.00267
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)-Total (mg/L)	3.33	3.23	3.42	3.22	3.11
	Chromium (Cr)-Total (mg/L)	0.00011	0.00011	0.00012	0.00019	0.00018
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Total (mg/L)	0.00095	0.00101	0.00088	0.00076	0.00071

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1339412-6	L1339412-7	L1339412-8	L1339412-9	L1339412-10
	Description	water	water	water	water	water
	Sampled Date	20-JUL-13	20-JUL-13	20-JUL-13	20-JUL-13	20-JUL-13
	Sampled Time	08:43	08:43	09:15	09:55	10:18
	Client ID	BAP-28-S	CREMP JULY DUP 2	BAP-27-S	BPJ-27-S	BPJ-28-S
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	71.3	71.3	64.1	34.7	34.7
	Hardness (as CaCO3) (mg/L)	14.3	14.5	13.9	11.1	10.9
	pH (pH)	7.30	7.30	7.32	7.33	7.32
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Total Dissolved Solids (mg/L)	39.0	45.3	41.7	26.4	26.9
	Turbidity (NTU)	0.47	0.48	0.47	0.48	0.46
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	9.2	8.7	8.9	8.4	8.5
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Total (as CaCO3) (mg/L)	9.2	8.7	8.9	8.4	8.5
	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	0.0060	<0.0050	<0.0050
	Bromide (Br) (mg/L)	0.060	0.061	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	14.0	13.9	12.1	4.15	4.12
	Fluoride (F) (mg/L)	0.054	0.054	0.053	0.053	0.053
	Nitrate (as N) (mg/L)	0.0320	0.0314	0.0303	0.0235	0.0246
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	0.211	0.209	0.337	0.212	0.245
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Phosphorus (P)-Total Dissolved (mg/L)	0.0027	0.0036	0.0030	0.0030	0.0028
	Phosphorus (P)-Total (mg/L)	0.0046	0.0048	0.0047	0.0047	0.0050
	Silicate (as SiO2) (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Sulfate (SO4) (mg/L)	2.50	2.50	2.23	1.11	1.10
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	3.30	3.31	3.58	3.85	3.85
	Total Organic Carbon (mg/L)	3.17	3.60	3.95	3.60	3.50
Total Metals	Aluminum (Al)-Total (mg/L)	0.0241	0.0230	0.0285	0.0298	0.0306
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00016	0.00013	0.00013	0.00014	0.00011
	Barium (Ba)-Total (mg/L)	0.0172	0.0166	0.0170	0.0165	0.0166
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)-Total (mg/L)	2.68	2.66	2.63	2.40	2.38
	Chromium (Cr)-Total (mg/L)	0.00027	0.00013	0.00018	0.00017	0.00013
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Total (mg/L)	0.00056	<0.00050	0.00066	<0.00050	<0.00050

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1339412-11 water 20-JUL-13 11:00 BBD-27-S	L1339412-12 water 20-JUL-13 11:17 BBD-28-S	L1339412-13 water 21-JUL-13 11:05 TPS-39-S	L1339412-14 water 21-JUL-13 11:46 TPS-40-S	L1339412-15 water 21-JUL-13 12:11 TPN-61-S
WATER						
Physical Tests	Conductivity (uS/cm)	27.4	27.8	23.6	23.6	23.7
	Hardness (as CaCO3) (mg/L)	10.3	10.2	8.08	8.16	8.18
	pH (pH)	7.33	7.32	7.22	7.09	7.06
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Total Dissolved Solids (mg/L)	23.6	23.7	18.0	16.9	18.1
	Turbidity (NTU)	0.44	0.57	0.25	0.28	0.24
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	8.4	8.5	5.4	5.2	5.2
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Total (as CaCO3) (mg/L)	8.4	8.5	5.4	5.2	5.2
	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	0.0063	0.0054	0.0058
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	2.22	2.30	0.62	0.62	0.62
	Fluoride (F) (mg/L)	0.054	0.054	0.059	0.059	0.059
	Nitrate (as N) (mg/L)	0.0174	0.0175	0.0652	0.0647	0.0634
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	0.0023	0.0018	0.0016
	Total Kjeldahl Nitrogen (mg/L)	0.205	0.214	0.141	0.116	0.124
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Phosphorus (P)-Total Dissolved (mg/L)	0.0032	0.0032	0.0022	0.0026	<0.0020
	Phosphorus (P)-Total (mg/L)	0.0051	0.0054	0.0021	0.0025	<0.0020
	Silicate (as SiO2) (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Sulfate (SO4) (mg/L)	0.83	0.84	3.86	3.86	3.88
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	3.89	3.82	2.22	2.10	1.73
	Total Organic Carbon (mg/L)	3.61	3.51	1.76	1.96	1.70
Total Metals	Aluminum (Al)-Total (mg/L)	0.0261	0.0237	0.0067	0.0081	0.0065
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00016	0.00013	0.00020	0.00018	0.00016
	Barium (Ba)-Total (mg/L)	0.0167	0.0173	0.00299	0.00305	0.00286
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Total (mg/L)	<0.010	<0.010	0.011	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)-Total (mg/L)	2.40	2.39	1.97	1.99	1.97
	Chromium (Cr)-Total (mg/L)	0.00018	0.00014	0.00045	0.00012	0.00012
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Total (mg/L)	0.00057	<0.00050	<0.00050	0.00052	<0.00050

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1339412-16	L1339412-17	L1339412-18		
	Description	water	water	water		
	Sampled Date	21-JUL-13	21-JUL-13	21-JUL-13		
	Sampled Time	12:47	13:52	14:18		
	Client ID	TPN-60-S	TPE-60-S	TPE-61-S		
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	23.6	25.0	24.4		
	Hardness (as CaCO3) (mg/L)	8.08	9.47	9.06		
	pH (pH)	7.04	7.13	7.13		
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0		
	Total Dissolved Solids (mg/L)	18.2	20.3	19.2		
	Turbidity (NTU)	0.22	0.58	0.51		
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	5.3	7.1	7.0		
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0		
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0		
	Alkalinity, Total (as CaCO3) (mg/L)	5.3	7.1	7.0		
	Ammonia, Total (as N) (mg/L)	0.0052	<0.0050	<0.0050		
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050		
	Chloride (Cl) (mg/L)	0.62	0.58	0.58		
	Fluoride (F) (mg/L)	0.059	0.067	0.066		
	Nitrate (as N) (mg/L)	0.0607	0.0237	0.0212		
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	0.0012		
	Total Kjeldahl Nitrogen (mg/L)	0.105	0.208	0.131		
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	<0.0010		
	Phosphorus (P)-Total Dissolved (mg/L)	0.0027	0.0025	0.0027		
	Phosphorus (P)-Total (mg/L)	0.0021	0.0022	0.0022		
	Silicate (as SiO2) (mg/L)	<0.50	<0.50	<5.0		
	Sulfate (SO4) (mg/L)	3.88	3.31	3.29		
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	2.16	1.96	1.68		
	Total Organic Carbon (mg/L)	1.86	1.76	1.54		
Total Metals	Aluminum (Al)-Total (mg/L)	0.0065	0.0187	0.0166		
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010		
	Arsenic (As)-Total (mg/L)	0.00019	0.00058	0.00048		
	Barium (Ba)-Total (mg/L)	0.00289	0.00292	0.00279		
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010		
	Bismuth (Bi)-Total (mg/L)	<0.00050	<0.00050	<0.00050		
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010		
	Cadmium (Cd)-Total (mg/L)	<0.000010	<0.000010	<0.000010		
	Calcium (Ca)-Total (mg/L)	1.95	2.40	2.35		
	Chromium (Cr)-Total (mg/L)	0.00014	0.00057	0.00032		
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010		
	Copper (Cu)-Total (mg/L)	0.00050	0.00054	0.00095		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1339412-1	L1339412-2	L1339412-3	L1339412-4	L1339412-5
	Description	water	water	water	water	water
	Sampled Date	19-JUL-13	19-JUL-13	19-JUL-13	19-JUL-13	19-JUL-13
	Sampled Time	08:54	08:54	09:26	14:29	14:48
	Client ID	WAL-30-S	CREMP JULY DUP 1	WAL-29-S	SP-61-S	SP-60-S
Grouping	**Analyte**					
WATER						
Total Metals	Iron (Fe)-Total (mg/L)	0.020	0.020	0.023	0.034	0.032
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	0.000052	<0.000050
	Lithium (Li)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Magnesium (Mg)-Total (mg/L)	0.99	0.96	1.02	1.05	1.03
	Manganese (Mn)-Total (mg/L)	0.00161	0.00157	0.00194	0.00282	0.00276
	Mercury (Hg)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Total (mg/L)	0.000083	0.000085	0.000094	0.000133	0.000176
	Nickel (Ni)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	0.00055
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	0.40	0.39	0.40	0.47	0.48
	Selenium (Se)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Silicon (Si)-Total (mg/L)	0.325	0.317	0.331	0.257	0.244
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	0.478	0.454	0.481	0.619	0.610
	Strontium (Sr)-Total (mg/L)	0.0165	0.0159	0.0171	0.0148	0.0143
	Sulfur (S)-Total (mg/L)	0.88	0.85	0.91	1.12	1.10
	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)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Total (mg/L)	0.000043	0.000044	0.000044	0.000061	0.000059
	Vanadium (V)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0025	0.0028	0.0030	0.0031	0.0033
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00021	0.00021	0.00020	0.00025	0.00027
	Barium (Ba)-Dissolved (mg/L)	0.00190	0.00179	0.00182	0.00248	0.00253
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)-Dissolved (mg/L)	3.38	3.37	3.42	3.20	3.44
	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	0.00079	0.00078	0.00069	0.00061
	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

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1339412-6 water 20-JUL-13 08:43 BAP-28-S	L1339412-7 water 20-JUL-13 08:43 CREMP JULY DUP 2	L1339412-8 water 20-JUL-13 09:15 BAP-27-S	L1339412-9 water 20-JUL-13 09:55 BPJ-27-S	L1339412-10 water 20-JUL-13 10:18 BPJ-28-S
WATER						
Total Metals	Iron (Fe)-Total (mg/L)	0.033	0.029	0.038	0.030	0.034
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	0.000065	0.000065	<0.000050
	Lithium (Li)-Total (mg/L)	0.00066	0.00054	0.00059	0.00058	0.00054
	Magnesium (Mg)-Total (mg/L)	1.90	1.86	1.75	1.20	1.20
	Manganese (Mn)-Total (mg/L)	0.00397	0.00390	0.00408	0.00424	0.00415
	Mercury (Hg)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Total (mg/L)	0.000080	0.000064	0.000062	0.000051	<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)	0.71	0.70	0.68	0.50	0.50
	Selenium (Se)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Silicon (Si)-Total (mg/L)	0.230	0.228	0.237	0.219	0.237
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	7.26	7.21	6.31	2.14	2.14
	Strontium (Sr)-Total (mg/L)	0.0215	0.0211	0.0208	0.0171	0.0169
	Sulfur (S)-Total (mg/L)	0.96	0.89	0.81	<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)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Total (mg/L)	0.000050	0.000050	0.000043	0.000043	0.000042
	Vanadium (V)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	0.0069	<0.0030
Dissolved Metals	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0050	0.0052	0.0052	0.0049	0.0044
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00012	<0.00010	0.00010	0.00011	0.00011
	Barium (Ba)-Dissolved (mg/L)	0.0170	0.0172	0.0171	0.0170	0.0164
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)-Dissolved (mg/L)	2.67	2.70	2.65	2.46	2.41
	Chromium (Cr)-Dissolved (mg/L)	0.00016	<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)	0.00036	0.00033	0.00038	0.00035	0.00029
	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

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1339412-11 water 20-JUL-13 11:00 BBD-27-S	L1339412-12 water 20-JUL-13 11:17 BBD-28-S	L1339412-13 water 21-JUL-13 11:05 TPS-39-S	L1339412-14 water 21-JUL-13 11:46 TPS-40-S	L1339412-15 water 21-JUL-13 12:11 TPN-61-S
WATER						
Total Metals	Iron (Fe)-Total (mg/L)	0.037	0.031	0.012	0.012	0.011
	Lead (Pb)-Total (mg/L)	0.000066	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Total (mg/L)	0.00070	0.00087	<0.00050	<0.00050	<0.00050
	Magnesium (Mg)-Total (mg/L)	1.11	1.09	0.81	0.82	0.81
	Manganese (Mn)-Total (mg/L)	0.00457	0.00441	0.00297	0.00302	0.00290
	Mercury (Hg)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Total (mg/L)	0.000083	<0.000050	0.000189	0.000183	0.000180
	Nickel (Ni)-Total (mg/L)	<0.00050	<0.00050	0.00056	0.00056	0.00054
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	0.46	0.47	0.50	0.50	0.48
	Selenium (Se)-Total (mg/L)	0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Silicon (Si)-Total (mg/L)	0.228	0.213	0.091	0.091	0.081
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	1.21	1.22	0.959	0.973	0.955
	Strontium (Sr)-Total (mg/L)	0.0168	0.0170	0.00924	0.00949	0.00935
	Sulfur (S)-Total (mg/L)	<0.50	<0.50	1.32	1.40	1.35
	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)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Total (mg/L)	0.000047	0.000037	0.000049	0.000050	0.000047
	Vanadium (V)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0047	0.0044	0.0025	0.0024	0.0022
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00013	0.00010	0.00015	0.00015	0.00015
	Barium (Ba)-Dissolved (mg/L)	0.0168	0.0163	0.00322	0.00285	0.00282
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)-Dissolved (mg/L)	2.37	2.34	1.94	1.95	1.96
	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)	0.00034	0.00034	0.00039	0.00038	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

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1339412-16 water 21-JUL-13 12:47 TPN-60-S	L1339412-17 water 21-JUL-13 13:52 TPE-60-S	L1339412-18 water 21-JUL-13 14:18 TPE-61-S		
	Sample ID	L1339412-16	L1339412-17	L1339412-18		
	Description	water	water	water		
	Sampled Date	21-JUL-13	21-JUL-13	21-JUL-13		
	Sampled Time	12:47	13:52	14:18		
	Client ID	TPN-60-S	TPE-60-S	TPE-61-S		
WATER						
Total Metals	Iron (Fe)-Total (mg/L)	<0.010	0.036	0.031		
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	0.000052		
	Lithium (Li)-Total (mg/L)	<0.00050	<0.00050	<0.00050		
	Magnesium (Mg)-Total (mg/L)	0.80	0.89	0.87		
	Manganese (Mn)-Total (mg/L)	0.00284	0.00363	0.00311		
	Mercury (Hg)-Total (mg/L)	<0.000010	<0.000010	<0.000010		
	Molybdenum (Mo)-Total (mg/L)	0.000191	0.000181	0.000172		
	Nickel (Ni)-Total (mg/L)	0.00057	0.00082	0.00070		
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050		
	Potassium (K)-Total (mg/L)	0.48	0.51	0.52		
	Selenium (Se)-Total (mg/L)	<0.00010	<0.00010	<0.00010		
	Silicon (Si)-Total (mg/L)	0.088	0.132	0.131		
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010		
	Sodium (Na)-Total (mg/L)	0.932	0.805	0.823		
	Strontium (Sr)-Total (mg/L)	0.00926	0.0105	0.0103		
	Sulfur (S)-Total (mg/L)	1.31	1.18	1.14		
	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)	<0.010	<0.010	<0.010		
	Uranium (U)-Total (mg/L)	0.000050	0.000065	0.000062		
	Vanadium (V)-Total (mg/L)	<0.0010	<0.0010	<0.0010		
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	0.0046		
Dissolved Metals	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD		
	Aluminum (Al)-Dissolved (mg/L)	0.0027	0.0041	0.0045		
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Arsenic (As)-Dissolved (mg/L)	0.00016	0.00048	0.00045		
	Barium (Ba)-Dissolved (mg/L)	0.00292	0.00288	0.00294		
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050		
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010		
	Cadmium (Cd)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010		
	Calcium (Ca)-Dissolved (mg/L)	1.94	2.38	2.27		
	Chromium (Cr)-Dissolved (mg/L)	0.00013	<0.00010	<0.00010		
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Copper (Cu)-Dissolved (mg/L)	0.00038	0.00041	0.00043		
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010		
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1339412-1	L1339412-2	L1339412-3	L1339412-4	L1339412-5
	Description	water	water	water	water	water
	Sampled Date	19-JUL-13	19-JUL-13	19-JUL-13	19-JUL-13	19-JUL-13
	Sampled Time	08:54	08:54	09:26	14:29	14:48
	Client ID	WAL-30-S	CREMP JULY DUP 1	WAL-29-S	SP-61-S	SP-60-S
Grouping	**Analyte**					
WATER						
Dissolved Metals	Lithium (Li)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Magnesium (Mg)-Dissolved (mg/L)	0.99	0.99	1.01	1.05	1.02
	Manganese (Mn)-Dissolved (mg/L)	0.000773	0.000741	0.000813	0.00143	0.00157
	Mercury (Hg)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Dissolved (mg/L)	0.000074	0.000079	0.000083	0.000110	0.000123
	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	0.38	0.38	0.45	0.46
	Selenium (Se)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Silicon (Si)-Dissolved (mg/L)	0.328	0.320	0.316	0.240	0.227
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	0.478	0.469	0.466	0.616	0.619
	Strontium (Sr)-Dissolved (mg/L)	0.0160	0.0157	0.0159	0.0141	0.0140
	Sulfur (S)-Dissolved (mg/L)	0.87	0.89	0.89	1.08	1.08
	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)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Dissolved (mg/L)	0.000038	0.000039	0.000040	0.000046	0.000049
	Vanadium (V)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Plant Pigments	Chlorophyll a (ug/L)	0.261	0.294	0.140	0.583	0.292

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1339412-6 water 20-JUL-13 08:43 BAP-28-S	L1339412-7 water 20-JUL-13 08:43 CREMP JULY DUP 2	L1339412-8 water 20-JUL-13 09:15 BAP-27-S	L1339412-9 water 20-JUL-13 09:55 BPJ-27-S	L1339412-10 water 20-JUL-13 10:18 BPJ-28-S
WATER						
Dissolved Metals	Lithium (Li)-Dissolved (mg/L)	0.00058	0.00066	0.00073	0.00069	0.00065
	Magnesium (Mg)-Dissolved (mg/L)	1.85	1.87	1.77	1.21	1.18
	Manganese (Mn)-Dissolved (mg/L)	0.00232	0.00252	0.00246	0.00238	0.00234
	Mercury (Hg)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Dissolved (mg/L)	0.000067	<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)	0.69	0.70	0.66	0.47	0.45
	Selenium (Se)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Silicon (Si)-Dissolved (mg/L)	0.186	0.190	0.188	0.175	0.173
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	7.04	7.35	6.52	2.21	2.21
	Strontium (Sr)-Dissolved (mg/L)	0.0207	0.0204	0.0198	0.0166	0.0166
	Sulfur (S)-Dissolved (mg/L)	0.95	0.90	0.82	<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)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Dissolved (mg/L)	0.000041	0.000039	0.000037	0.000035	0.000035
	Vanadium (V)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Plant Pigments	Chlorophyll a (ug/L)	0.245	0.454	0.689	0.854	0.638

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1339412-11 water 20-JUL-13 11:00 BBD-27-S	L1339412-12 water 20-JUL-13 11:17 BBD-28-S	L1339412-13 water 21-JUL-13 11:05 TPS-39-S	L1339412-14 water 21-JUL-13 11:46 TPS-40-S	L1339412-15 water 21-JUL-13 12:11 TPN-61-S
WATER						
Dissolved Metals	Lithium (Li)-Dissolved (mg/L)	0.00099	0.00063	<0.00050	<0.00050	<0.00050
	Magnesium (Mg)-Dissolved (mg/L)	1.06	1.05	0.79	0.80	0.80
	Manganese (Mn)-Dissolved (mg/L)	0.00267	0.00282	0.00217	0.00222	0.00224
	Mercury (Hg)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Dissolved (mg/L)	0.000052	<0.000050	0.000167	0.000154	0.000183
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	0.00055	<0.00050
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)	0.43	0.43	0.46	0.49	0.47
	Selenium (Se)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Silicon (Si)-Dissolved (mg/L)	0.167	0.163	0.086	0.082	0.075
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	1.18	1.18	0.923	0.901	0.955
	Strontium (Sr)-Dissolved (mg/L)	0.0171	0.0160	0.00888	0.00891	0.00894
	Sulfur (S)-Dissolved (mg/L)	<0.50	<0.50	1.28	1.34	1.35
	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)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Dissolved (mg/L)	0.000036	0.000036	0.000042	0.000041	0.000047
	Vanadium (V)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)-Dissolved (mg/L)	0.0015	<0.0010	<0.0010	<0.0010	<0.0010
Plant Pigments	Chlorophyll a (ug/L)	0.409	0.344	0.263	0.166	0.144

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1339412-16	L1339412-17	L1339412-18		
	Description	water	water	water		
	Sampled Date	21-JUL-13	21-JUL-13	21-JUL-13		
	Sampled Time	12:47	13:52	14:18		
	Client ID	TPN-60-S	TPE-60-S	TPE-61-S		
Grouping	**Analyte**					
WATER						
Dissolved Metals	Lithium (Li)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050		
	Magnesium (Mg)-Dissolved (mg/L)	0.79	0.85	0.82		
	Manganese (Mn)-Dissolved (mg/L)	0.00209	0.00241	0.00204		
	Mercury (Hg)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010		
	Molybdenum (Mo)-Dissolved (mg/L)	0.000162	0.000168	0.000149		
	Nickel (Ni)-Dissolved (mg/L)	0.00054	0.00057	0.00055		
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050		
	Potassium (K)-Dissolved (mg/L)	0.47	0.49	0.48		
	Selenium (Se)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Silicon (Si)-Dissolved (mg/L)	0.085	0.103	0.108		
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010		
	Sodium (Na)-Dissolved (mg/L)	0.911	0.774	0.795		
	Strontium (Sr)-Dissolved (mg/L)	0.00891	0.0101	0.00964		
	Sulfur (S)-Dissolved (mg/L)	1.28	1.13	1.10		
	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)	<0.010	<0.010	<0.010		
	Uranium (U)-Dissolved (mg/L)	0.000040	0.000056	0.000047		
	Vanadium (V)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010		
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010		
Plant Pigments	Chlorophyll a (ug/L)	0.084	0.336	0.426		

* 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	Phosphorus (P)-Total	MS-B	L1339412-1, -10, -11, -12, -13, -14, -16, -17, -18, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Phosphorus (P)-Total Dissolved	MS-B	L1339412-1, -10, -11, -12, -13, -14, -16, -17, -18, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Sodium (Na)-Total	MS-B	L1339412-1, -2, -3, -4, -5, -6
Matrix Spike	Strontium (Sr)-Total	MS-B	L1339412-1, -2, -3, -4, -5, -6
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1339412-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1339412-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1339412-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1339412-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1339412-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1339412-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1339412-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -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-SCR-VA	Water	Alkalinity by colour or titration	EPA 310.2 OR APHA 2320

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.
OR
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.

ANIONS-BR-IC-VA	Water	Bromide by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-CL-LOW-IC-VA	Water	Low level Chloride by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-F-IC-VA	Water	Fluoride by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-NO2-IC-VA	Water	Nitrite in Water by Ion Chromatography	EPA 300.0

This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Nitrite is detected by UV absorbance.

ANIONS-NO3-IC-VA	Water	Nitrate in Water by Ion Chromatography	EPA 300.0

This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Nitrate is detected by UV absorbance.

ANIONS-SO4-IC-VA	Water	Sulfate by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310 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 5310 TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

CHLOROA-VA	Water	Chlorophyll a by Fluorometer	EPA 445.0

Reference Information

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.

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.

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-DIS-LOW-CVAFS-VA Water Dissolved Mercury in Water by CVAFS(Low) EPA SW-846 3005A & EPA 245.7

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 filtration (EPA Method 3005A) and involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

HG-TOT-LOW-CVAFS-VA Water Total Mercury in Water by CVAFS(Low) EPA 245.7

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 a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

MET-D-CCMS-VA Water Dissolved Metals in Water by CRC ICPMS APHA 3030 B&E / EPA SW-846 6020A

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 hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

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 APHA 3030 B&E / EPA SW-846 6020A

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 hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

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).

N-TOTKJ-TB Water Total Kjeldahl Nitrogen by Colourimetry APHA 4500-Norg B (modified)

Total Kjeldahl Nitrogen in aqueous matrices is analyzed using an autoanalyzer with colourimetric detection.

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-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorous 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 Phosphorous 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

Reference Information

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 Phosphorous

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.

TDS-LOW-VA Water Low Level TDS (3.0mg/L) by Gravimetric APHA 2540 Gravimetric

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 2540 Gravimetric

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.

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
TB	ALS ENVIRONMENTAL - THUNDER BAY, ONTARIO, CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

1 2

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

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC # _____

Page 1 of

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:	Laura Bekar	☐ PDF ☐ Excel ☐ Digital ☐ Fax		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1:	lbekar@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		Analysis Request
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	Meadowbank Surfacewater	Please indicate below Filtered, Preserved or both (F, P, F/P)
Company:		PO / AFE:		
Contact:		LSD:		
Address:				
Phone:	Fax:	Quote #:	Q39503	
Lab Work Order # (lab use only)	L1339412	ALS Contact:	Sampler:	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Alkalinity Species, Anions-All	pH, EC, Turb, TDS, Silicate	T-P, TD-P, Ortho-PO4	TSS-Low	Ammonia, TKN	TOC	DOC	Total Metals (MET-T-NDR-VA)	Diss. Metals (MET-D-NDR-VA)	Total Mercury (Low Level)	Diss. Mercury (Low Level)	Chlorophyll 'a'
	WAL-30-S	19-Jul-13	8:54	Water	x	x	x	x	x	x	x	x	x	x	x	x
	CREMP JULY DUP 1	19-Jul-13	8:54	Water	x	x	x	x	x	x	x	x	x	x	x	x
	WAL-29-S	19-Jul-13	9:26	Water	x	x	x	x	x	x	x	x	x	x	x	x
	SP-61-S	19-Jul-13	14:29	Water	x	x	x	x	x	x	x	x	x	x	x	x
	SP-60-S	19-Jul-13	14:48	Water	x	x	x	x	x	x	x	x	x	x	x	x
	BAP-28-S	20-Jul-13	8:43	Water	x	x	x	x	x	x	x	x	x	x	x	x
	CREMP JULY DUP 2	20-Jul-13	8:43	Water	x	x	x	x	x	x	x	x	x	x	x	x
	BAP-27-S	20-Jul-13	9:15	Water	x	x	x	x	x	x	x	x	x	x	x	x
	BPJ-27-S	20-Jul-13	9:55	Water	x	x	x	x	x	x	x	x	x	x	x	x
	BPJ-28-S	20-Jul-13	10:18	Water	x	x	x	x	x	x	x	x	x	x	x	x

L1339412-COFC

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

(1) there are no Chlorophyll-a filters for samples with IDs including "EB-" and for "travel/trip blank" samples; however, all other analyses should be conducted on these samples. (2) 500 mL of water we filtered for all Chlorophyll-a sample filters included in this shipment.

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:	Observatio Yes / No ? If Yes add
			Elise	July 29	12:50	19.3 19.4 °C 19.0 19.9				

GENF 20.00 Front

L1339412-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:	Laura Bekar	☐ PDF ☐ Excel ☐ Digital ☐ Fax	○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1: lbekar@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 #: 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	Alkalinity Species, Anions-All	pH, EC, Turb, TDS, Silicate	T-P, TD-P, Ortho-PO4	TSS-Low	Ammonia, TKN	TOC	DOC	Total Metals (MET-T-NDR-VA)	Diss. Metals (MET-D-NDR-VA)	Total Mercury (Low Level)	Diss. Mercury (Low Level)	Chlorophyll 'a'
	BBD-27-S	20-Jul-13	11:00	Water	x	x	x	x	x	x	x	x	x	x	x	x
	BBD-28-S	20-Jul-13	11:17	Water	x	x	x	x	x	x	x	x	x	x	x	x
	TPS-39-S	21-Jul-13	11:05	Water	x	x	x	x	x	x	x	x	x	x	x	x
	TPS-40-S	21-Jul-13	11:46	Water	x	x	x	x	x	x	x	x	x	x	x	x
	TPN-61-S	21-Jul-13	12:11	Water	x	x	x	x	x	x	x	x	x	x	x	x
	TPN-60-S	21-Jul-13	12:47	Water	x	x	x	x	x	x	x	x	x	x	x	x
	TPE-60-S	21-Jul-13	13:52	Water	x	x	x	x	x	x	x	x	x	x	x	x
	TPE-61-S	21-Jul-13	14:18	Water	x	x	x	x	x	x	x	x	x	x	x	x

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

(1) there are no Chlorophyll-a filters for samples with IDs including "EB-" and for "travel/trip blank" samples; however, all other analyses should be conducted on these samples. (2) 500 mL of water we filtered for all Chlorophyll-a sample filters included in this shipment.

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:	Observatic Yes / No ? If Yes add
			Flint	July 29	12:50	19.3/19.4 19.0/18.9°C				

AZIMUTH CONSULTING GROUP INC.
ATTN: Laura Bekar
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 04-SEP-13
Report Date: 07-MAR-14 15:28 (MT)
Version: FINAL REV. 2

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1357680

Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers: 1, 2, 3
Legal Site Desc:

Comments:

7-MAR-2014 This report replaces the previous version and contains updated Chloro 'a' results for all samples. The new results were calculated using a Volume Filtered of 500mL per sample.

Brent Mack
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1357680-1 WATER WAL-31-S	L1357680-2 WATER WAL-32-S	L1357680-3 WATER SP-62-S	L1357680-4 WATER SP-63-S	L1357680-5 WATER CREMP AUG DUP 1
WATER						
Physical Tests	Conductivity (uS/cm)	32.6	30.9	28.8	28.8	14.3
	Hardness (as CaCO3) (mg/L)	13.8	13.3	11.9	11.9	5.30
	pH (pH)	7.50	7.44	7.18	7.29	6.64
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Total Dissolved Solids (mg/L)	24.2	23.7	21.4	20.4	14.3
	Turbidity (NTU)	0.23	0.35	0.28	0.25	0.28
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	11.3	11.0	9.5	9.6	4.9
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Total (as CaCO3) (mg/L)	11.3	11.0	9.5	9.6	4.9
	Ammonia, Total (as N) (mg/L)	<0.0050	0.0051	0.0052	0.0061	0.0249
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	0.62	0.56	0.57	0.57	0.66
	Fluoride (F) (mg/L)	0.042	0.041	0.057	0.057	0.053
	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
	Total Kjeldahl Nitrogen (mg/L)	0.135	0.131	0.119	0.123	0.142
	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)	0.0030	0.0031	0.0022	<0.0020	0.0033
	Silicate (as SiO2) (mg/L)	0.75	0.77	<0.50	<0.50	<0.50
	Sulfate (SO4) (mg/L)	2.71	2.66	3.18	3.19	0.85
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	1.94	1.89	1.73	1.65	1.76
	Total Organic Carbon (mg/L)	1.88	1.90	1.89	1.64	1.76
Total Metals	Aluminum (Al)-Total (mg/L)	0.0043	0.0040	0.0112	0.0073	0.0067
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00031	0.00031	0.00030	0.00031	<0.00010
	Barium (Ba)-Total (mg/L)	0.00183	0.00175	0.00241	0.00240	0.00175
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)-Total (mg/L)	3.84	3.67	3.20	3.22	1.12
	Chromium (Cr)-Total (mg/L)	<0.00010	<0.00010	0.00012	0.00011	0.00010
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Total (mg/L)	0.00086	0.00081	0.00066	0.00064	<0.00050

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1357680-6	L1357680-7	L1357680-8	L1357680-9	L1357680-10
	Description	WATER	WATER	WATER	WATER	WATER
	Sampled Date					
	Sampled Time					
	Client ID	CREMP AUG DUP 3	TPS-41-S	TPS-42-S	TPN-62-S	TPN-63S
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	23.4	23.0	23.0	23.4	23.4
	Hardness (as CaCO3) (mg/L)	7.98	7.79	7.78	8.04	7.91
	pH (pH)	7.05	7.07	7.08	7.05	7.08
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Total Dissolved Solids (mg/L)	17.8	17.9	17.5	17.7	17.6
	Turbidity (NTU)	0.23	0.23	0.24	0.23	0.27
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	5.4	5.1	4.8	5.6	5.4
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Total (as CaCO3) (mg/L)	5.4	5.1	4.8	5.6	5.4
	Ammonia, Total (as N) (mg/L)	0.0052	<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)	0.63	0.62	0.62	0.63	0.64
	Fluoride (F) (mg/L)	0.057	0.057	0.056	0.057	0.056
	Nitrate (as N) (mg/L)	0.0484	0.0499	0.0517	0.0490	0.0476
	Nitrite (as N) (mg/L)	<0.0010	0.0010	0.0016	0.0016	0.0012
	Total Kjeldahl Nitrogen (mg/L)	0.133	0.134	0.136	0.138	0.139
	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)	3.93	3.83	3.83	3.93	3.89
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	1.43	1.29	1.41	1.58	1.42
	Total Organic Carbon (mg/L)	1.36	1.33	1.57	1.51	1.39
Total Metals	Aluminum (Al)-Total (mg/L)	0.0056	0.0058	0.0040	0.0055	0.0050
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00018	0.00017	0.00017	0.00019	0.00019
	Barium (Ba)-Total (mg/L)	0.00308	0.00287	0.00281	0.00282	0.00270
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)-Total (mg/L)	2.08	1.95	1.92	2.04	1.99
	Chromium (Cr)-Total (mg/L)	<0.00010	0.00011	<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	0.00130	<0.00050

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1357680-11 WATER TPE-62-S	L1357680-12 WATER TPE-63-S	L1357680-13 WATER AUG-TRAV1	L1357680-14 WATER TEFF-29-S	L1357680-15 WATER TEFF-30-S
	Sample ID	L1357680-11	L1357680-12	L1357680-13	L1357680-14	L1357680-15
	Description	WATER	WATER	WATER	WATER	WATER
	Sampled Date					
	Sampled Time					
	Client ID	TPE-62-S	TPE-63-S	AUG-TRAV1	TEFF-29-S	TEFF-30-S
WATER						
Physical Tests	Conductivity (uS/cm)	25.3	25.4	<2.0	16.4	16.4
	Hardness (as CaCO3) (mg/L)	9.40	9.37	<0.50	6.07	5.97
	pH (pH)	7.20	7.21	6.03	6.73	6.75
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Total Dissolved Solids (mg/L)	18.4	18.2	<3.0	11.7	11.4
	Turbidity (NTU)	0.34	0.37	<0.10	0.25	0.25
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	7.2	7.0	<2.0	4.6	4.8
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Total (as CaCO3) (mg/L)	7.2	7.0	<2.0	4.6	4.8
	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)	0.59	0.59	<0.10	0.54	0.54
	Fluoride (F) (mg/L)	0.065	0.064	<0.020	0.051	0.051
	Nitrate (as N) (mg/L)	0.0097	0.0132	<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)	0.125	0.118	0.122 RRV	0.130	0.107
	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	0.0022	<0.0020	0.0024	<0.0020
	Silicate (as SiO2) (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Sulfate (SO4) (mg/L)	3.41	3.46	<0.50	1.98	1.98
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	1.33	1.44		1.23	1.42
	Total Organic Carbon (mg/L)	1.31	1.40	<0.50	1.20	1.24
Total Metals	Aluminum (Al)-Total (mg/L)	0.0105	0.0120	<0.0030	0.0058	0.0060
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00067	0.00062	<0.00010	<0.00010	<0.00010
	Barium (Ba)-Total (mg/L)	0.00278	0.00280	<0.000050	0.00199	0.00196
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)-Total (mg/L)	2.49	2.46	<0.050	1.51	1.52
	Chromium (Cr)-Total (mg/L)	0.00019	0.00021	<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

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1357680-16 WATER TE-62-S	L1357680-17 WATER TE-63-S	L1357680-18 WATER INUG-50-S	L1357680-19 WATER INUG-51-S	L1357680-20 WATER PDL-29-S
WATER						
Physical Tests	Conductivity (uS/cm)	20.8	20.6	14.3	15.0	20.2
	Hardness (as CaCO3) (mg/L)	8.08	8.03	5.38	5.42	8.40
	pH (pH)	7.15	7.17	6.75	6.75	7.08
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Total Dissolved Solids (mg/L)	12.0	14.3	13.8	11.3	14.7
	Turbidity (NTU)	0.40	0.30	0.28	0.26	0.22
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	6.6	6.4	5.4	4.9	7.0
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Total (as CaCO3) (mg/L)	6.6	6.4	5.4	4.9	7.0
	Ammonia, Total (as N) (mg/L)	0.0097	<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)	0.57	0.56	0.66	0.66	0.58
	Fluoride (F) (mg/L)	0.058	0.057	0.053	0.053	0.032
	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
	Total Kjeldahl Nitrogen (mg/L)	0.138	0.112	0.157	0.148	0.130
	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	0.0023	0.0030	0.0041	0.0021
	Silicate (as SiO2) (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Sulfate (SO4) (mg/L)	2.39	2.36	0.85	0.85	1.56
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	1.42	1.37	1.95	1.90	1.67
	Total Organic Carbon (mg/L)	1.53	1.45	2.05	2.12	1.85
Total Metals	Aluminum (Al)-Total (mg/L)	0.0087	0.0093	0.0081	0.0068	0.0045
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00014	0.00014	<0.00010	<0.00010	0.00014
	Barium (Ba)-Total (mg/L)	0.00210	0.00220	0.00177	0.00187	0.00189
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)-Total (mg/L)	2.11	2.10	1.12	1.12	2.22
	Chromium (Cr)-Total (mg/L)	<0.00010	<0.00010	0.00011	<0.00010	0.00011
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Total (mg/L)	<0.00050	<0.00050	0.00054	<0.00050	<0.00050

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1357680-21	L1357680-22			
	Description	WATER	WATER			
	Sampled Date					
	Sampled Time					
	Client ID	PDL-30-S	AUG-EB1			
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	20.2	<2.0			
	Hardness (as CaCO3) (mg/L)	8.39	<0.50			
	pH (pH)	7.18	6.00			
	Total Suspended Solids (mg/L)	<1.0	<1.0			
	Total Dissolved Solids (mg/L)	18.2	<3.0			
	Turbidity (NTU)	0.21	<0.10			
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	7.0	<2.0			
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0			
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0			
	Alkalinity, Total (as CaCO3) (mg/L)	7.0	<2.0			
	Ammonia, Total (as N) (mg/L)	0.0152	<0.0050			
	Bromide (Br) (mg/L)	<0.050	<0.050			
	Chloride (Cl) (mg/L)	0.59	<0.10			
	Fluoride (F) (mg/L)	0.034	<0.020			
	Nitrate (as N) (mg/L)	<0.0050	<0.0050			
	Nitrite (as N) (mg/L)	<0.0010	<0.0010			
	Total Kjeldahl Nitrogen (mg/L)	0.159	<0.050			
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010			
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020	<0.0020			
	Phosphorus (P)-Total (mg/L)	<0.0020	<0.0020			
	Silicate (as SiO2) (mg/L)	<0.50	<0.50			
	Sulfate (SO4) (mg/L)	1.56	<0.50			
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	1.05	<0.50			
	Total Organic Carbon (mg/L)	1.22	<0.50			
Total Metals	Aluminum (Al)-Total (mg/L)	0.0041	<0.0030			
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010			
	Arsenic (As)-Total (mg/L)	0.00016	<0.00010			
	Barium (Ba)-Total (mg/L)	0.00188	<0.000050			
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010			
	Bismuth (Bi)-Total (mg/L)	<0.00050	<0.00050			
	Boron (B)-Total (mg/L)	<0.010	<0.010			
	Cadmium (Cd)-Total (mg/L)	<0.000010	<0.000010			
	Calcium (Ca)-Total (mg/L)	2.26	<0.050			
	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			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1357680-1 WATER WAL-31-S	L1357680-2 WATER WAL-32-S	L1357680-3 WATER SP-62-S	L1357680-4 WATER SP-63-S	L1357680-5 WATER CREMP AUG DUP 1
	Sample ID					
	Description					
	Sampled Date					
	Sampled Time					
	Client ID					
WATER						
Total Metals	Iron (Fe)-Total (mg/L)	0.021	0.019	0.028	0.038	0.014
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Total (mg/L)	<0.00050	<0.00050	0.00054	0.00064	<0.00050
	Magnesium (Mg)-Total (mg/L)	1.14	1.10	1.04	1.05	0.68
	Manganese (Mn)-Total (mg/L)	0.00139	0.00154	0.00224	0.00230	0.00195
	Mercury (Hg)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Total (mg/L)	0.000119	0.000107	0.000127	0.000133	<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)	0.47	0.43	0.48	0.48	0.37
	Selenium (Se)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Silicon (Si)-Total (mg/L)	0.379	0.385	0.202	0.199	0.132
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	0.534	0.517	0.652	0.657	0.521
	Strontium (Sr)-Total (mg/L)	0.0200	0.0182	0.0153	0.0153	0.00636
	Sulfur (S)-Total (mg/L)	0.95	0.93	1.10	1.10	<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)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Total (mg/L)	0.000040	0.000037	0.000051	0.000048	0.000046
	Vanadium (V)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
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	0.0036	0.0055	0.0019
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00024	0.00026	0.00029	0.00029	<0.00010
	Barium (Ba)-Dissolved (mg/L)	0.00173	0.00168	0.00230	0.00232	0.00166
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)-Dissolved (mg/L)	3.75	3.59	3.10	3.12	1.05
	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)	0.00077	0.00076	0.00058	0.00061	0.00035
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	0.018	0.017	<0.010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1357680-6	L1357680-7	L1357680-8	L1357680-9	L1357680-10
Description	WATER	WATER	WATER	WATER	WATER
Sampled Date					
Sampled Time					
Client ID	CREMP AUG DUP 3	TPS-41-S	TPS-42-S	TPN-62-S	TPN-63S
Grouping / **Analyte**					
WATER					
Total Metals 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	0.000091	<0.000050
Lithium (Li)-Total (mg/L)	<0.00050	0.00052	<0.00050	<0.00050	<0.00050
Magnesium (Mg)-Total (mg/L)	0.82	0.80	0.79	0.82	0.81
Manganese (Mn)-Total (mg/L)	0.00261	0.00226	0.00219	0.00258	0.00253
Mercury (Hg)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Total (mg/L)	0.000187	0.000188	0.000169	0.000191	0.000183
Nickel (Ni)-Total (mg/L)	0.00051	0.00051	<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)	0.48	0.46	0.46	0.46	0.47
Selenium (Se)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)-Total (mg/L)	0.059	0.063	0.062	0.059	0.054
Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)-Total (mg/L)	1.01	0.976	0.950	0.984	0.990
Strontium (Sr)-Total (mg/L)	0.00984	0.00951	0.00898	0.00974	0.00947
Sulfur (S)-Total (mg/L)	1.39	1.32	1.28	1.37	1.32
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)	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)-Total (mg/L)	0.000044	0.000045	0.000040	0.000045	0.000042
Vanadium (V)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
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)	0.0025	0.0023	0.0011	0.0017	0.0020
Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic (As)-Dissolved (mg/L)	0.00015	0.00015	0.00015	0.00018	0.00016
Barium (Ba)-Dissolved (mg/L)	0.00267	0.00284	0.00270	0.00281	0.00269
Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth (Bi)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)-Dissolved (mg/L)	1.91	1.87	1.87	1.94	1.90
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)	0.00035	0.00033	0.00033	0.00035	0.00038
Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1357680-11 WATER TPE-62-S	L1357680-12 WATER TPE-63-S	L1357680-13 WATER AUG-TRAV1	L1357680-14 WATER TEFF-29-S	L1357680-15 WATER TEFF-30-S
Sample ID						
Description						
Sampled Date						
Sampled Time						
Client ID						
WATER						
Total Metals	Iron (Fe)-Total (mg/L)	0.022	0.021	<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)	<0.00050	<0.00050	<0.00050	0.00067	0.00052
	Magnesium (Mg)-Total (mg/L)	0.90	0.90	<0.10	0.62	0.62
	Manganese (Mn)-Total (mg/L)	0.00262	0.00245	<0.000050	0.00142	0.00141
	Mercury (Hg)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Total (mg/L)	0.000185	0.000198	<0.000050	<0.000050	<0.000050
	Nickel (Ni)-Total (mg/L)	0.00053	<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)	0.49	0.50	<0.10	0.38	0.38
	Selenium (Se)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Silicon (Si)-Total (mg/L)	0.086	0.089	<0.050	0.139	0.137
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	0.851	0.862	<0.050	0.552	0.553
	Strontium (Sr)-Total (mg/L)	0.0111	0.0109	<0.00020	0.00822	0.00795
	Sulfur (S)-Total (mg/L)	1.18	1.19	<0.50	0.66	0.67
	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)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Total (mg/L)	0.000056	0.000059	<0.000010	0.000034	0.000036
	Vanadium (V)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD		FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD		FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0031	0.0033		0.0019	0.0030
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010		<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00059	0.00064		<0.00010	<0.00010
	Barium (Ba)-Dissolved (mg/L)	0.00260	0.00268		0.00196	0.00204
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010		<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050	<0.00050		<0.00050	<0.00050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010		<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.000010	<0.000010		<0.000010	<0.000010
	Calcium (Ca)-Dissolved (mg/L)	2.38	2.36		1.46	1.44
	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)	0.00036	0.00038		0.00029	0.00028
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010		<0.010	<0.010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1357680-16 WATER TE-62-S	L1357680-17 WATER TE-63-S	L1357680-18 WATER INUG-50-S	L1357680-19 WATER INUG-51-S	L1357680-20 WATER PDL-29-S
WATER						
Total Metals	Iron (Fe)-Total (mg/L)	0.020	0.020	0.018	0.015	<0.010
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Total (mg/L)	<0.00050	0.00057	<0.00050	0.00054	<0.00050
	Magnesium (Mg)-Total (mg/L)	0.78	0.78	0.69	0.70	0.78
	Manganese (Mn)-Total (mg/L)	0.00191	0.00183	0.00207	0.00210	0.00111
	Mercury (Hg)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Total (mg/L)	0.000066	0.000065	<0.000050	<0.000050	<0.000050
	Nickel (Ni)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	0.00061
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	0.41	0.40	0.37	0.35	0.32
	Selenium (Se)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Silicon (Si)-Total (mg/L)	0.186	0.190	0.138	0.143	0.156
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	0.590	0.584	0.519	0.531	0.459
	Strontium (Sr)-Total (mg/L)	0.0104	0.0106	0.00641	0.00662	0.00930
	Sulfur (S)-Total (mg/L)	0.82	0.82	<0.50	<0.50	0.55
	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)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Total (mg/L)	0.000049	0.000046	0.000046	0.000046	0.000024
	Vanadium (V)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
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)	0.0039	0.0036	0.0021	0.0026	0.0018
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00015	0.00012	<0.00010	<0.00010	0.00015
	Barium (Ba)-Dissolved (mg/L)	0.00203	0.00206	0.00173	0.00172	0.00191
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)-Dissolved (mg/L)	2.02	2.01	1.07	1.08	2.16
	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)	0.00039	0.00041	0.00034	0.00039	0.00047
	Iron (Fe)-Dissolved (mg/L)	0.012	0.011	<0.010	<0.010	<0.010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1357680-21	L1357680-22			
		Description	WATER	WATER			
		Sampled Date					
		Sampled Time					
		Client ID	PDL-30-S	AUG-EB1			
Grouping	**Analyte**						
WATER							
Total Metals	Iron (Fe)-Total (mg/L)		<0.010	<0.010			
	Lead (Pb)-Total (mg/L)		<0.000050	<0.000050			
	Lithium (Li)-Total (mg/L)		<0.00050	<0.00050			
	Magnesium (Mg)-Total (mg/L)		0.80	<0.10			
	Manganese (Mn)-Total (mg/L)		0.00109	0.000051 RRV			
	Mercury (Hg)-Total (mg/L)		<0.000010	<0.000010			
	Molybdenum (Mo)-Total (mg/L)		<0.000050	<0.000050			
	Nickel (Ni)-Total (mg/L)		0.00062	<0.00050			
	Phosphorus (P)-Total (mg/L)		<0.050	<0.050			
	Potassium (K)-Total (mg/L)		0.32	<0.10			
	Selenium (Se)-Total (mg/L)		<0.00010	<0.00010			
	Silicon (Si)-Total (mg/L)		0.154	<0.050			
	Silver (Ag)-Total (mg/L)		<0.000010	<0.000010			
	Sodium (Na)-Total (mg/L)		0.470	<0.050			
	Strontium (Sr)-Total (mg/L)		0.00914	<0.00020			
	Sulfur (S)-Total (mg/L)		0.56	<0.50			
	Thallium (Tl)-Total (mg/L)		<0.000010	<0.000010			
	Tin (Sn)-Total (mg/L)		<0.00010	<0.00010			
	Titanium (Ti)-Total (mg/L)		<0.010	<0.010			
	Uranium (U)-Total (mg/L)		0.000024	<0.000010			
	Vanadium (V)-Total (mg/L)		<0.0010	<0.0010			
	Zinc (Zn)-Total (mg/L)		<0.0030	<0.0030			
Dissolved Metals	Dissolved Mercury Filtration Location		FIELD	FIELD			
	Dissolved Metals Filtration Location		FIELD	FIELD			
	Aluminum (Al)-Dissolved (mg/L)		0.0020	<0.0010			
	Antimony (Sb)-Dissolved (mg/L)		<0.00010	<0.00010			
	Arsenic (As)-Dissolved (mg/L)		0.00016	<0.00010			
	Barium (Ba)-Dissolved (mg/L)		0.00187	<0.000050			
	Beryllium (Be)-Dissolved (mg/L)		<0.00010	<0.00010			
	Bismuth (Bi)-Dissolved (mg/L)		<0.00050	<0.00050			
	Boron (B)-Dissolved (mg/L)		<0.010	<0.010			
	Cadmium (Cd)-Dissolved (mg/L)		<0.000010	<0.000010			
	Calcium (Ca)-Dissolved (mg/L)		2.13	<0.050			
	Chromium (Cr)-Dissolved (mg/L)		<0.00010	<0.00010			
	Cobalt (Co)-Dissolved (mg/L)		<0.00010	<0.00010			
	Copper (Cu)-Dissolved (mg/L)		0.00042	<0.00020			
	Iron (Fe)-Dissolved (mg/L)		<0.010	<0.010			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1357680-1 WATER WAL-31-S	L1357680-2 WATER WAL-32-S	L1357680-3 WATER SP-62-S	L1357680-4 WATER SP-63-S	L1357680-5 WATER CREMP AUG DUP 1
WATER						
Dissolved Metals	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Magnesium (Mg)-Dissolved (mg/L)	1.09	1.06	1.00	1.01	0.65
	Manganese (Mn)-Dissolved (mg/L)	0.000270	0.000403	0.00173	0.00162	0.000388
	Mercury (Hg)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Dissolved (mg/L)	0.000122	0.000098	0.000116	0.000111	<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)	0.42	0.40	0.44	0.44	0.33
	Selenium (Se)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Silicon (Si)-Dissolved (mg/L)	0.370	0.382	0.189	0.196	0.121
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	0.517	0.508	0.642	0.633	0.503
	Strontium (Sr)-Dissolved (mg/L)	0.0194	0.0183	0.0147	0.0153	0.00631
	Sulfur (S)-Dissolved (mg/L)	0.92	0.89	1.04	1.04	<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)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Dissolved (mg/L)	0.000033	0.000032	0.000045	0.000044	0.000038
	Vanadium (V)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Plant Pigments	Chlorophyll a (ug/L)	0.233	0.185	0.244	0.314	0.133

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	Sample ID: L1357680-6	L1357680-7	L1357680-8	L1357680-9	L1357680-10
	Description:	WATER	WATER	WATER	WATER	WATER
	Sampled Date:					
	Sampled Time:					
	Client ID:	CREMP AUG DUP 3	TPS-41-S	TPS-42-S	TPN-62-S	TPN-63S
WATER						
Dissolved Metals	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Magnesium (Mg)-Dissolved (mg/L)	0.78	0.76	0.76	0.78	0.77
	Manganese (Mn)-Dissolved (mg/L)	0.00178	0.00135	0.00132	0.00174	0.00172
	Mercury (Hg)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Dissolved (mg/L)	0.000164	0.000182	0.000151	0.000173	0.000172
	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)	0.43	0.42	0.44	0.42	0.43
	Selenium (Se)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Silicon (Si)-Dissolved (mg/L)	0.051	0.051	0.052	0.050	<0.050
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	0.957	0.923	0.922	0.945	0.941
	Strontium (Sr)-Dissolved (mg/L)	0.00946	0.00940	0.00879	0.00923	0.00947
	Sulfur (S)-Dissolved (mg/L)	1.29	1.26	1.25	1.29	1.26
	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)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Dissolved (mg/L)	0.000035	0.000032	0.000034	0.000035	0.000035
	Vanadium (V)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Plant Pigments	Chlorophyll a (ug/L)	0.195	0.152	0.278	0.225	0.220

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1357680-11	L1357680-12	L1357680-13	L1357680-14	L1357680-15
Description	WATER	WATER	WATER	WATER	WATER
Sampled Date					
Sampled Time					
Client ID	TPE-62-S	TPE-63-S	AUG-TRAV1	TEFF-29-S	TEFF-30-S
Grouping **Analyte**					
WATER					
Dissolved Metals Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050		<0.000050	<0.000050
Lithium (Li)-Dissolved (mg/L)	<0.00050	<0.00050		0.00053	<0.00050
Magnesium (Mg)-Dissolved (mg/L)	0.84	0.84		0.59	0.58
Manganese (Mn)-Dissolved (mg/L)	0.00110	0.00109		0.000539	0.000976
Mercury (Hg)-Dissolved (mg/L)	<0.000010	<0.000010		<0.000010	<0.000010
Molybdenum (Mo)-Dissolved (mg/L)	0.000176	0.000181		<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)	0.43	0.45		0.35	0.34
Selenium (Se)-Dissolved (mg/L)	<0.00010	<0.00010		<0.00010	<0.00010
Silicon (Si)-Dissolved (mg/L)	0.066	0.073		0.130	0.129
Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010		<0.000010	<0.000010
Sodium (Na)-Dissolved (mg/L)	0.797	0.807		0.530	0.525
Strontium (Sr)-Dissolved (mg/L)	0.0106	0.0105		0.00782	0.00739
Sulfur (S)-Dissolved (mg/L)	1.11	1.12		0.62	0.64
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)	<0.010	<0.010		<0.010	<0.010
Uranium (U)-Dissolved (mg/L)	0.000043	0.000047		0.000028	0.000031
Vanadium (V)-Dissolved (mg/L)	<0.0010	<0.0010		<0.0010	<0.0010
Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010		<0.0010	<0.0010
Plant Pigments Chlorophyll a (ug/L)	0.223	0.311		0.090	0.095

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1357680-16	L1357680-17	L1357680-18	L1357680-19	L1357680-20
Description	WATER	WATER	WATER	WATER	WATER
Sampled Date					
Sampled Time					
Client ID	TE-62-S	TE-63-S	INUG-50-S	INUG-51-S	PDL-29-S
Grouping / **Analyte**					
WATER					
Dissolved Metals Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Magnesium (Mg)-Dissolved (mg/L)	0.74	0.74	0.66	0.66	0.73
Manganese (Mn)-Dissolved (mg/L)	0.00120	0.00115	0.000433	0.000506	0.000349
Mercury (Hg)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved (mg/L)	0.000065	0.000053	<0.000050	<0.000050	<0.000050
Nickel (Ni)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	0.00058
Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium (K)-Dissolved (mg/L)	0.37	0.37	0.33	0.32	0.30
Selenium (Se)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)-Dissolved (mg/L)	0.175	0.174	0.122	0.126	0.146
Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)-Dissolved (mg/L)	0.579	0.572	0.499	0.496	0.459
Strontium (Sr)-Dissolved (mg/L)	0.0102	0.0101	0.00600	0.00621	0.00886
Sulfur (S)-Dissolved (mg/L)	0.76	0.76	<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)	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)-Dissolved (mg/L)	0.000040	0.000039	0.000035	0.000038	0.000023
Vanadium (V)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Plant Pigments Chlorophyll a (ug/L)		0.100	0.168	0.163	0.149

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1357680-21	L1357680-22			
	Description	WATER	WATER			
	Sampled Date					
	Sampled Time					
	Client ID	PDL-30-S	AUG-EB1			
Grouping	**Analyte**					
WATER						
Dissolved Metals	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050			
	Lithium (Li)-Dissolved (mg/L)	<0.00050	<0.00050			
	Magnesium (Mg)-Dissolved (mg/L)	0.75	<0.10			
	Manganese (Mn)-Dissolved (mg/L)	0.000312	<0.000050			
	Mercury (Hg)-Dissolved (mg/L)	<0.000010	<0.000010			
	Molybdenum (Mo)-Dissolved (mg/L)	<0.000050	<0.000050			
	Nickel (Ni)-Dissolved (mg/L)	0.00058	<0.00050			
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050			
	Potassium (K)-Dissolved (mg/L)	0.31	<0.10			
	Selenium (Se)-Dissolved (mg/L)	<0.00010	<0.00010			
	Silicon (Si)-Dissolved (mg/L)	0.145	<0.050			
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010			
	Sodium (Na)-Dissolved (mg/L)	0.454	<0.050			
	Strontium (Sr)-Dissolved (mg/L)	0.00897	<0.00020			
	Sulfur (S)-Dissolved (mg/L)	0.53	<0.50			
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010			
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010			
	Titanium (Ti)-Dissolved (mg/L)	<0.010	<0.010			
	Uranium (U)-Dissolved (mg/L)	0.000022	<0.000010			
	Vanadium (V)-Dissolved (mg/L)	<0.0010	<0.0010			
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010			
Plant Pigments	Chlorophyll a (ug/L)	0.196				

* 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	Barium (Ba)-Dissolved	MS-B	L1357680-1, -10, -11, -12, -14, -15, -16, -17, -18, -19, -2, -20, -21, -22, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1357680-1, -10, -11, -12, -14, -15, -16, -17, -18, -19, -2, -20, -21, -22, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1357680-1, -10, -11, -12, -14, -15, -16, -17, -18, -19, -2, -20, -21, -22, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Ammonia, Total (as N)	MS-B	L1357680-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -21, -22, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Barium (Ba)-Total	MS-B	L1357680-18, -19, -20, -21, -22
Matrix Spike	Manganese (Mn)-Total	MS-B	L1357680-18, -19, -20, -21, -22
Matrix Spike	Molybdenum (Mo)-Total	MS-B	L1357680-18, -19, -20, -21, -22
Matrix Spike	Sodium (Na)-Total	MS-B	L1357680-18, -19, -20, -21, -22
Matrix Spike	Strontium (Sr)-Total	MS-B	L1357680-18, -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.
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-SCR-VA	Water	Alkalinity by colour or titration	EPA 310.2 OR APHA 2320

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.
OR
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.

ANIONS-BR-IC-VA	Water	Bromide by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-CL-LOW-IC-VA	Water	Low level Chloride by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-F-IC-VA	Water	Fluoride by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-NO2-IC-VA	Water	Nitrite in Water by Ion Chromatography	EPA 300.0

This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Nitrite is detected by UV absorbance.

ANIONS-NO3-IC-VA	Water	Nitrate in Water by Ion Chromatography	EPA 300.0

This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Nitrate is detected by UV absorbance.

ANIONS-SO4-IC-VA	Water	Sulfate by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310 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 5310 TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

CHLOROA-VA	Water	Chlorophyll a by Fluorometer	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.

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.

Reference Information

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-DIS-LOW-CVAFS-VA Water Dissolved Mercury in Water by CVAFS(Low) EPA SW-846 3005A & EPA 245.7

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 filtration (EPA Method 3005A) and involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

HG-TOT-LOW-CVAFS-VA Water Total Mercury in Water by CVAFS(Low) EPA 245.7

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 a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

MET-D-CCMS-VA Water Dissolved Metals in Water by CRC ICPMS APHA 3030 B&E / EPA SW-846 6020A

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 hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

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 APHA 3030 B&E / EPA SW-846 6020A

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 hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

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 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-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorous 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 Phosphorous is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

PH-MAN-VA Water pH by Manual Meter 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-MAN-VA Water pH by Manual Meter 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

Reference Information

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 Phosphorous

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.

TDS-LOW-VA Water Low Level TDS (3.0mg/L) by Gravimetric APHA 2540 Gravimetric

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 2540 Gravimetric

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.

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:

1 2 3

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.

L1357680-COFC

ALS Enviro...

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC # _____

Page 1 of 3

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:	Laura Bekar	☐ PDF ☐ Excel ☐ Digital ☐ Fax		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1:	lbekar@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		Analysis Request
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:	Meadowbank Surfacewater	Please indicate below Filtered, Preserved or both (F, P, F/P)
Company:		PO / AFE:		
Contact:		LSD:		
Address:				
Phone:	Fax:	Quote #:	Q39503	
Lab Work Order # (lab use only)	L1357680	ALS Contact:	Sampler:	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Alkalinity Species, Anions-All	pH, EC, Turb, TDS, Silicate	T-P, TD-P, Ortho-PO4	TSS-Low	Ammonia, TKN	TOC	DOC	Total Metals (MET-T-NDR-VA)	Diss. Metals (MET-D-NDR-VA)	Total Mercury (Low Level)	Diss. Mercury (Low Level)	Chlorophyll 'a'	Number of Containers
	WAL-31-S			Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	WAL-32-S			Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	SP-62-S			Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	SP-63-S			Water	x	x	x	x	x	x	x	x	x	x	x	x	6
				Water	x	x	x	x	x	x	x	x	x	x	x	x	
				Water	x	x	x	x	x	x	x	x	x	x	x	x	
				Water	x	x	x	x	x	x	x	x	x	x	x	x	
				Water	x	x	x	x	x	x	x	x	x	x	x	x	
	CREMP AUG DUP 1			Water	x	x	x	x	x	x	x	x	x	x	x	x	6
				Water	x	x	x	x	x	x	x	x	x	x	x	x	
	CREMP AUG DUP 3			Water	x	x	x	x	x	x	x	x	x	x	x	x	6

Short Holding Time
Rush Processing

Special Instructions / R... or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

(1) there are no Chlorophyll-a filters for samples with IDs including "EB-" and for "travel/trip blank" samples; however, all other analyses should be conducted on these samples. (2) 500 mL of water were filtered for all Chlorophyll-a sample filters included in this shipment.

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
Morgan Finley	27-Aug-13	8:00	Paige	Sept 4	10:25	19.1 °C 19.5 19.3				

L1357680-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:	Laura Bekar	☐ PDF ☐ Excel ☐ Digital ☐ Fax	○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1: lbekar@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 #: Meadowbank Surfacewater	
Company:		PO / AFE:	
Contact:		LSD:	
Address:			
Phone:	Fax:	Quote #: Q39503	
Lab Work Order # (lab use only)	L1357680	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	Alkalinity Species, Anions-All	pH, EC, Turb, TDS, Silicate	T-P, TD-P, Ortho-PO4	TSS-Low	Ammonia, TKN	TOC	DOC	Total Metals (MET-T-NDR-VA)	Diss. Metals (MET-D-NDR-VA)	Total Mercury (Low Level)	Diss. Mercury (Low Level)	Chlorophyll 'a'	Number of Containers
				Water	x	x	x	x	x	x	x	x	x	x	x	x	
				Water	x	x	x	x	x	x	x	x	x	x	x	x	
	TPS-41-S			Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	TPS-42-S			Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	TPN-62-S			Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	TPN-63-S			Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	TPE-62-S			Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	TPE-63-S			Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	AUG-TRAV1			Water	x	x	x	x	x	x	x	x	x	x			5
				Water	x	x	x	x	x	x	x	x	x	x			

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

(1) there are no Chlorophyll-a filters for samples with IDs including "EB-" and for "travel/trip blank" samples; however, all other analyses should be conducted on these samples. (2) 500 mL of water were filtered for all Chlorophyll-a sample filters included in this shipment.

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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
Morgan Finley	27-Aug-13	8:00				°C				

L1357680-COFC

ALS Environmental

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC # _____

Page 3 of 3

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:	Laura Bekar			☐ PDF	☐ Excel	☐ Digital	☐ Fax	○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway			Email 1:	lbekar@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 #:	Meadowbank Surfacewater			
Company:				PO / AFE:				
Contact:				LSD:				
Address:								
Phone:		Fax:		Quote #:	Q39503			
Lab Work Order # (lab use only)		L1357680		ALS Contact:		Sampler:		

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Alkalinity Species, Anions-All	pH, EC, Turb, TDS, Silicate	T-P, TD-P, Ortho-PO4	TSS-Low	Ammonia, TKN	TOC	DOC	Total Metals (MET-T-NDR-VA)	Diss. Metals (MET-D-NDR-VA)	Total Mercury (Low Level)	Diss. Mercury (Low Level)	Chlorophyll 'a'	Number of Containers
	TEFF-29-S			Water	X	X	X	X	X	X	X	X	X	X	X	X	6
	TEFF-30-S			Water	X	X	X	X	X	X	X	X	X	X	X	X	6
	TE-62-S			Water	X	X	X	X	X	X	X	X	X	X	X	X	6
	TE-63-S			Water	X	X	X	X	X	X	X	X	X	X	X	X	6
	INUG-50-S			Water	X	X	X	X	X	X	X	X	X	X	X	X	6
	INUG-51-S			Water	X	X	X	X	X	X	X	X	X	X	X	X	6
	PDL-29-S			Water	X	X	X	X	X	X	X	X	X	X	X	X	6
	PDL-30-S			Water	X	X	X	X	X	X	X	X	X	X	X	X	6
	AUG-EB1			Water	X	X	X	X	X	X	X	X	X	X	X		5
				Water	X	X	X	X	X	X	X	X	X	X	X		

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

(1) there are no Chlorophyll-a filters for samples with IDs including "EB-" and for "travel/trip blank" samples; however, all other analyses should be conducted on these samples. (2) 500 mL of water were filtered for all Chlorophyll-a sample filters included in this shipment.

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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
Morgan Finley	27-Aug-13	8:00				°C				

AZIMUTH CONSULTING GROUP INC.
ATTN: Laura Bekar
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 10-SEP-13
Report Date: 07-MAR-14 15:31 (MT)
Version: FINAL REV. 2

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1360508

Project P.O. #: NOT SUBMITTED
Job Reference: MEADOWBANK SURFACEWATER
C of C Numbers: 1
Legal Site Desc:

Comments: 7-MAR-2014 This report replaces the previous version and contains updated Chloro ¿a¿ results for all samples. The new results were calculated using a Volume Filtered of 500mL per sample.

Brent Mack
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1360508-1	L1360508-2	L1360508-3	L1360508-4	L1360508-5
	Description	WATER	WATER	WATER	WATER	WATER
	Sampled Date	30-AUG-13	30-AUG-13	30-AUG-13	30-AUG-13	30-AUG-13
	Sampled Time					
	Client ID	BBD-29-S	BBD-30-S	BAP-29-S	BAP-30-S	BPJ-29-S
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	119	118	101	110	132
	Hardness (as CaCO3) (mg/L)	18.7	18.1	16.5	17.4	19.3
	pH (pH)	7.91	7.77	7.68	7.58	7.49
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Total Dissolved Solids (mg/L)	70.1	67.0	60.1	64.8	77.8
	Turbidity (NTU)	0.24	0.24	0.23	0.24	0.23
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	9.5	9.6	6.9	9.3	9.4
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Total (as CaCO3) (mg/L)	9.5	9.6	6.9	9.3	9.4
	Ammonia, Total (as N) (mg/L)	0.0112	0.0107	0.0053	0.0086	0.0085
	Bromide (Br) (mg/L)	0.096	0.097	0.079	0.089	0.114
	Chloride (Cl) (mg/L)	27.0	26.8	22.0	24.5	30.7
	Fluoride (F) (mg/L)	0.063	0.063	0.063	0.064	0.064
	Nitrate (as N) (mg/L)	0.0334	0.0333	0.0259	0.0278	0.0346
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	0.165	0.156	0.146	0.154	0.154
	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)	0.0046	0.0041	0.0036	0.0035	0.0035
	Silicate (as SiO2) (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Sulfate (SO4) (mg/L)	4.32	4.30	3.62	3.97	4.86
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	3.51	3.16	3.13	2.98	2.92
	Total Organic Carbon (mg/L)	3.02	3.08	3.00	3.00	3.23
Total Metals	Aluminum (Al)-Total (mg/L)	0.0127	0.0115	0.0100	0.0110	0.0125
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00015	0.00015	0.00014	0.00015	0.00015
	Barium (Ba)-Total (mg/L)	0.0174	0.0177	0.0174	0.0168	0.0178
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Total (mg/L)	<0.010	0.011	<0.010	0.011	0.011
	Cadmium (Cd)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)-Total (mg/L)	2.92	2.90	2.83	2.90	3.04
	Chromium (Cr)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	0.00015
	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	0.00057

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1360508-6	L1360508-7	L1360508-8	L1360508-9	
	Description	WATER	WATER	WATER	WATER	
	Sampled Date	30-AUG-13	30-AUG-13	30-AUG-13		
	Sampled Time					
	Client ID	BPJ-30-S	CREMP AUG DUP 2	AUG-EB2	AUG-TRAV2	
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	131	101	<2.0	<2.0	
	Hardness (as CaCO3) (mg/L)	19.5	16.6	<0.50	<0.50	
	pH (pH)	7.43	7.40	5.55	5.82	
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	
	Total Dissolved Solids (mg/L)	77.2	61.3	<3.0	<3.0	
	Turbidity (NTU)	0.22	0.26	<0.10	<0.10	
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	9.4	9.3	<2.0	<2.0	
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	
	Alkalinity, Total (as CaCO3) (mg/L)	9.4	9.3	<2.0	<2.0	
	Ammonia, Total (as N) (mg/L)	0.0084	0.0183	<0.0050	0.0540 RRV	
	Bromide (Br) (mg/L)	0.109	0.079	<0.050	<0.050	
	Chloride (Cl) (mg/L)	30.3	22.0	<0.10	<0.10	
	Fluoride (F) (mg/L)	0.064	0.063	<0.020	<0.020	
	Nitrate (as N) (mg/L)	0.0369	0.0263	<0.0050	<0.0050	
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	
	Total Kjeldahl Nitrogen (mg/L)	0.138	0.163	<0.050	<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)	0.0035	0.0040	<0.0020	<0.0020	
	Silicate (as SiO2) (mg/L)	<0.50	<0.50	<0.50	<0.50	
	Sulfate (SO4) (mg/L)	4.81	3.62	<0.50	<0.50	
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	2.93	3.06	<0.50		
	Total Organic Carbon (mg/L)	3.08	2.98	<0.50	<0.50	
Total Metals	Aluminum (Al)-Total (mg/L)	0.0119	0.0105	<0.0030	<0.0030	
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Arsenic (As)-Total (mg/L)	0.00016	0.00015	<0.00010	<0.00010	
	Barium (Ba)-Total (mg/L)	0.0178	0.0178	<0.000050	<0.000050	
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Bismuth (Bi)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Boron (B)-Total (mg/L)	0.011	<0.010	<0.010	<0.010	
	Cadmium (Cd)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Calcium (Ca)-Total (mg/L)	3.02	2.79	<0.050	<0.050	
	Chromium (Cr)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Copper (Cu)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1360508-1	L1360508-2	L1360508-3	L1360508-4	L1360508-5
	Description	WATER	WATER	WATER	WATER	WATER
	Sampled Date	30-AUG-13	30-AUG-13	30-AUG-13	30-AUG-13	30-AUG-13
	Sampled Time					
	Client ID	BBD-29-S	BBD-30-S	BAP-29-S	BAP-30-S	BPJ-29-S
Grouping	**Analyte**					
WATER						
Total Metals	Iron (Fe)-Total (mg/L)	0.017	0.019	0.014	0.014	0.057
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Total (mg/L)	0.00078	0.00094	0.00098	0.00097	0.00102
	Magnesium (Mg)-Total (mg/L)	2.72	2.71	2.41	2.63	3.04
	Manganese (Mn)-Total (mg/L)	0.00213	0.00231	0.00187	0.00176	0.00218
	Mercury (Hg)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Total (mg/L)	0.000066	0.000069	0.000074	0.000115	0.000078
	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)	1.08	1.07	0.95	1.02	1.18
	Selenium (Se)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Silicon (Si)-Total (mg/L)	0.204	0.203	0.176	0.189	0.200
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	13.6	13.7	11.5	12.1	15.7
	Strontium (Sr)-Total (mg/L)	0.0264	0.0263	0.0243	0.0260	0.0284
	Sulfur (S)-Total (mg/L)	1.42	1.42	1.23	1.38	1.62
	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)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Total (mg/L)	0.000047	0.000044	0.000045	0.000048	0.000050
	Vanadium (V)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
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)	0.0045	0.0063	0.0041	0.0060	0.0048
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00012	0.00012	0.00012	0.00011	0.00012
	Barium (Ba)-Dissolved (mg/L)	0.0180	0.0185	0.0182	0.0177	0.0177
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)-Dissolved (mg/L)	2.96	2.92	2.76	2.84	2.96
	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)	0.00032	0.00059	0.00029	0.00030	0.00044
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

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		Sample ID	L1360508-6	L1360508-7	L1360508-8	L1360508-9	
		Description	WATER	WATER	WATER	WATER	
		Sampled Date	30-AUG-13	30-AUG-13	30-AUG-13		
		Sampled Time					
		Client ID	BPJ-30-S	CREMP AUG DUP 2	AUG-EB2	AUG-TRAV2	
Grouping	**Analyte**						
WATER							
Total Metals	Iron (Fe)-Total (mg/L)		0.013	0.012	<0.010	<0.010	
	Lead (Pb)-Total (mg/L)		<0.000050	<0.000050	<0.000050	<0.000050	
	Lithium (Li)-Total (mg/L)		0.00112	0.00106	<0.00050	<0.00050	
	Magnesium (Mg)-Total (mg/L)		2.99	2.44	<0.10	<0.10	
	Manganese (Mn)-Total (mg/L)		0.00184	0.00187	<0.000050	<0.000050	
	Mercury (Hg)-Total (mg/L)		<0.000010	<0.000010	<0.000010	<0.000010	
	Molybdenum (Mo)-Total (mg/L)		0.000071	0.000057	<0.000050	<0.000050	
	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)		1.16	0.97	<0.10	<0.10	
	Selenium (Se)-Total (mg/L)		<0.00010	<0.00010	<0.00010	<0.00010	
	Silicon (Si)-Total (mg/L)		0.196	0.177	<0.050	<0.050	
	Silver (Ag)-Total (mg/L)		<0.000010	<0.000010	<0.000010	<0.000010	
	Sodium (Na)-Total (mg/L)		15.8	11.4	<0.050	<0.050	
	Strontium (Sr)-Total (mg/L)		0.0274	0.0246	<0.00020	<0.00020	
	Sulfur (S)-Total (mg/L)		1.61	1.24	<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)		<0.010	<0.010	<0.010	<0.010	
	Uranium (U)-Total (mg/L)		0.000048	0.000046	<0.000010	<0.000010	
	Vanadium (V)-Total (mg/L)		<0.0010	<0.0010	<0.0010	<0.0010	
	Zinc (Zn)-Total (mg/L)		<0.0030	<0.0030	<0.0030	<0.0030	
Dissolved Metals	Dissolved Mercury Filtration Location		FIELD	FIELD	FIELD		
	Dissolved Metals Filtration Location		FIELD	FIELD	FIELD		
	Aluminum (Al)-Dissolved (mg/L)		0.0050	0.0047	<0.0010		
	Antimony (Sb)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010		
	Arsenic (As)-Dissolved (mg/L)		0.00012	0.00012	<0.00010		
	Barium (Ba)-Dissolved (mg/L)		0.0173	0.0172	0.000091 RRV		
	Beryllium (Be)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010		
	Bismuth (Bi)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050		
	Boron (B)-Dissolved (mg/L)		<0.010	<0.010	<0.010		
	Cadmium (Cd)-Dissolved (mg/L)		<0.000010	<0.000010	<0.000010		
	Calcium (Ca)-Dissolved (mg/L)		2.98	2.75	<0.050		
	Chromium (Cr)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010		
	Cobalt (Co)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010		
	Copper (Cu)-Dissolved (mg/L)		0.00032	0.00030	<0.00020		
	Iron (Fe)-Dissolved (mg/L)		<0.010	<0.010	<0.010		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

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Grouping	Analyte	L1360508-1 WATER 30-AUG-13 BBD-29-S	L1360508-2 WATER 30-AUG-13 BBD-30-S	L1360508-3 WATER 30-AUG-13 BAP-29-S	L1360508-4 WATER 30-AUG-13 BAP-30-S	L1360508-5 WATER 30-AUG-13 BPJ-29-S
Sample ID / Description / Sampled Date / Sampled Time / Client ID						
WATER						
Dissolved Metals	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	0.00101	0.00105	0.00116	0.00084	0.00104
	Magnesium (Mg)-Dissolved (mg/L)	2.74	2.63	2.34	2.51	2.89
	Manganese (Mn)-Dissolved (mg/L)	0.000824	0.000905	0.000469	0.000526	0.000607
	Mercury (Hg)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Dissolved (mg/L)	0.000060	0.000056	0.000054	0.000064	0.000064
	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)	1.01	0.95	0.88	0.93	1.05
	Selenium (Se)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Silicon (Si)-Dissolved (mg/L)	0.187	0.184	0.158	0.165	0.182
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	13.9	13.9	11.4	12.4	15.4
	Strontium (Sr)-Dissolved (mg/L)	0.0256	0.0256	0.0246	0.0247	0.0275
	Sulfur (S)-Dissolved (mg/L)	1.44	1.43	1.22	1.30	1.59
	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)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Dissolved (mg/L)	0.000043	0.000042	0.000041	0.000041	0.000044
	Vanadium (V)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	0.0010	<0.0010	<0.0010	<0.0010
Plant Pigments	Chlorophyll a (ug/L)	0.251	0.333	0.471	0.428	0.196

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1360508-6	L1360508-7	L1360508-8	L1360508-9	
	Description	WATER	WATER	WATER	WATER	
	Sampled Date	30-AUG-13	30-AUG-13	30-AUG-13		
	Sampled Time					
	Client ID	BPJ-30-S	CREMP AUG DUP 2	AUG-EB2	AUG-TRAV2	
Grouping	**Analyte**					
WATER						
Dissolved Metals	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050		
	Lithium (Li)-Dissolved (mg/L)	0.00108	0.00104	<0.00050		
	Magnesium (Mg)-Dissolved (mg/L)	2.93	2.36	<0.10		
	Manganese (Mn)-Dissolved (mg/L)	0.000507	0.000437	0.000068 RRV		
	Mercury (Hg)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010		
	Molybdenum (Mo)-Dissolved (mg/L)	0.000064	0.000057	<0.000050		
	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)	1.07	0.87	<0.10		
	Selenium (Se)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Silicon (Si)-Dissolved (mg/L)	0.181	0.160	<0.050		
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010		
	Sodium (Na)-Dissolved (mg/L)	15.9	11.2	<0.050		
	Strontium (Sr)-Dissolved (mg/L)	0.0267	0.0235	<0.00020		
	Sulfur (S)-Dissolved (mg/L)	1.59	1.19	<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)	<0.010	<0.010	<0.010		
	Uranium (U)-Dissolved (mg/L)	0.000044	0.000041	<0.000010		
	Vanadium (V)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010		
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010		
Plant Pigments	Chlorophyll a (ug/L)	0.188	0.444			

* 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	Manganese (Mn)-Dissolved	MS-B	L1360508-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1360508-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Total Kjeldahl Nitrogen	MS-B	L1360508-1, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1360508-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1360508-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Cadmium (Cd)-Dissolved	MS-B	L1360508-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1360508-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1360508-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Zinc (Zn)-Dissolved	MS-B	L1360508-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Aluminum (Al)-Dissolved	MS-B	L1360508-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1360508-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1360508-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Aluminum (Al)-Total	MS-B	L1360508-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Strontium (Sr)-Total	MS-B	L1360508-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1360508-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1360508-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Boron (B)-Dissolved	MS-B	L1360508-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1360508-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1360508-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1360508-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1360508-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1360508-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1360508-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Ammonia, Total (as N)	MS-B	L1360508-1, -2, -3, -4, -5, -6, -7, -8

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-SCR-VA	Water	Alkalinity by colour or titration	EPA 310.2 OR APHA 2320

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.
OR
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.

ANIONS-BR-IC-VA	Water	Bromide by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-CL-IC-VA	Water	Chloride by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-CL-LOW-IC-VA	Water	Low level Chloride by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-F-IC-VA	Water	Fluoride by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-NO2-IC-VA	Water	Nitrite in Water by Ion Chromatography	EPA 300.0

This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Nitrite is detected by UV absorbance.

ANIONS-NO3-IC-VA	Water	Nitrate in Water by Ion Chromatography	EPA 300.0

Reference Information

This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Nitrate is detected by UV absorbance.

ANIONS-SO4-IC-VA	Water	Sulfate by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310 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 5310 TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

CHLOROA-VA	Water	Chlorophyll a by Fluorometer	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.

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.

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-DIS-LOW-CVAFS-VA	Water	Dissolved Mercury in Water by CVAFS(Low)	EPA SW-846 3005A & EPA 245.7

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 filtration (EPA Method 3005A) and involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

HG-TOT-LOW-CVAFS-VA	Water	Total Mercury in Water by CVAFS(Low)	EPA 245.7

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 a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030 B&E / EPA SW-846 6020A

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 hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

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	APHA 3030 B&E / EPA SW-846 6020A

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 hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

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	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.

		Total P in Water by Colour	APHA 4500-P Phosphorous

Reference Information

P-T-COL-VA Water

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorous 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 Phosphorous is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

PH-MAN-VA Water pH by Manual Meter 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-MAN-VA Water pH by Manual Meter 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.

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 Phosphorous

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.

TDS-LOW-VA Water Low Level TDS (3.0mg/L) by Gravimetric APHA 2540 Gravimetric

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 2540 Gravimetric

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total suspended solids

Reference Information

(TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.

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:

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.

L1360508-COFC

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**				**Service Requested** (Rush for routine analysis subject to availability)
Company:	Azimuth Consulting Group			☐ Standard ☐ Other				◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Laura Bekar			☐ PDF ☐ Excel ☐ Digital ☐ Fax				○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway			Email 1:	lbekar@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 #:	Meadowbank Surfacewater			
Company:				PO / AFE:				
Contact:				LSD:				
Address:								
Phone:		Fax:		Quote #:	Q39503			
Lab Work Order # (lab use only)		L1360508		**ALS Contact:**		**Sampler:**	MF, EF	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Alkalinity Species, Anions-All	pH, EC, Turb, TDS, Silicate	T-P, TD-P, Ortho-PO4	TSS-Low	Ammonia, TKN	TOC	DOC	Total Metals (MET-T-NDR-VA)	Diss. Metals (MET-D-NDR-VA)	Total Mercury (Low Level)	Diss. Mercury (Low Level)	Chlorophyll 'a'	Number of Containers
	BBD-29-S	30-Aug-13		Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	BBD-30-S	30-Aug-13		Water	x	x	x	x	x	x	x	x	x	x	x	x	6
				Water	x	x	x	x	x	x	x	x	x	x	x	x	6
				Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	BAP-29-S	30-Aug-13		Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	BAP-30-S	30-Aug-13		Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	BPJ-29-S	30-Aug-13		Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	BPJ-30-S	30-Aug-13		Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	CREMP AUG DUP 2	30-Aug-13		Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	AUG-EB2	30-Aug-13		Water	x	x	x	x	x	x	x	x	x	x	x		5
	AUG-TRAV2			Water	x	x	x	x	x	x	x	x	x	x	x		3

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

(1) there are no Chlorophyll-a filters for samples with IDs including "EB-" and for "travel/trip blank" samples; however, all other analyses should be conducted on these samples. (2) 500 mL of water were filtered for all Chlorophyll-a sample filters included in this shipment.

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
Morgan Finley	3-Sep-13		Christi	Sept 10	1105	19.1 °C				

AZIMUTH CONSULTING GROUP INC.
ATTN: LAURA BEKAR
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 10-SEP-13
Report Date: 26-SEP-13 15:04 (MT)
Version: FINAL

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1360541

Project P.O. #: NOT SUBMITTED
Job Reference: MEADOWBANK CREMP 2013
C of C Numbers: 1, 2, 3, 4, 5, 6, 7, 8, 9
Legal Site Desc:

Brent Mack
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1360541-1 SEDIMENT 27-AUG-13 TPE-1	L1360541-2 SEDIMENT 27-AUG-13 TPE-2	L1360541-3 SEDIMENT 27-AUG-13 TPE-3	L1360541-4 SEDIMENT 27-AUG-13 TPE-4	L1360541-5 SEDIMENT 27-AUG-13 TPE-5
	Sample ID	L1360541-1	L1360541-2	L1360541-3	L1360541-4	L1360541-5
	Description	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT
	Sampled Date	27-AUG-13	27-AUG-13	27-AUG-13	27-AUG-13	27-AUG-13
	Sampled Time					
	Client ID	TPE-1	TPE-2	TPE-3	TPE-4	TPE-5
SOIL						
Physical Tests	Moisture (%)	86.7	87.5	85.3	87.3	86.5
	pH (1:2 soil:water) (pH)	6.54	6.77	6.88	6.80	7.60
Particle Size	% Gravel (>2mm) (%)	<0.10	<0.10	<0.10	<0.10	<0.10
	% Sand (2.0mm - 0.063mm) (%)	2.07	2.04	1.28	1.57	1.93
	% Silt (0.063mm - 4um) (%)	68.7	67.0	67.5	68.4	70.1
	% Clay (<4um) (%)	29.3	30.9	31.2	30.1	28.0
	Texture	Silt loam	Silt loam	Silt loam	Silt loam	Silt loam
Organic / Inorganic Carbon	Total Organic Carbon (%)	4.02	3.82	3.84	4.06	4.42
Metals	Aluminum (Al) (mg/kg)	21900	24900	25400	25500	23500
	Antimony (Sb) (mg/kg)	0.25	0.23	0.26	0.24	0.26
	Arsenic (As) (mg/kg)	16.4	17.2	21.6	18.8	20.8
	Barium (Ba) (mg/kg)	103	140	127	133	138
	Beryllium (Be) (mg/kg)	1.48	1.69	1.73	1.62	1.54
	Bismuth (Bi) (mg/kg)	1.80	2.28	2.15	2.17	2.02
	Cadmium (Cd) (mg/kg)	0.257	0.623	0.425	0.411	0.785
	Calcium (Ca) (mg/kg)	2780	2190	2320	2420	2300
	Chromium (Cr) (mg/kg)	132	114	162	139	152
	Cobalt (Co) (mg/kg)	15.1	16.5	19.2	16.9	18.2
	Copper (Cu) (mg/kg)	43.4	50.9	50.9	49.0	49.9
	Iron (Fe) (mg/kg)	40500	41400	47800	45200	44100
	Lead (Pb) (mg/kg)	19.2	26.2	20.6	19.9	21.1
	Lithium (Li) (mg/kg)	36.4	46.1	43.2	41.8	39.7
	Magnesium (Mg) (mg/kg)	9120	9390	10700	10400	10300
	Manganese (Mn) (mg/kg)	2580	4150	3410	3480	6630
	Mercury (Hg) (mg/kg)	0.0188	0.0180	0.0185	0.0172	0.0230
	Molybdenum (Mo) (mg/kg)	4.27	3.82	4.45	3.88	4.14
	Nickel (Ni) (mg/kg)	93.6	164	120	125	204
	Phosphorus (P) (mg/kg)	384	425	432	457	435
	Potassium (K) (mg/kg)	3830	4310	4150	4070	3770
	Selenium (Se) (mg/kg)	0.76	0.83	0.92	0.89	0.84
	Silver (Ag) (mg/kg)	<0.10	<0.10	0.12	0.13	0.19
	Sodium (Na) (mg/kg)	250	180	160	170	160
	Strontium (Sr) (mg/kg)	20.5	18.4	18.4	19.3	18.0
	Thallium (Tl) (mg/kg)	0.321	0.513	0.430	0.433	0.504
	Tin (Sn) (mg/kg)	3.3	13.5	<2.0	<2.0	2.0
	Titanium (Ti) (mg/kg)	760	807	765	796	682

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1360541-6 SEDIMENT 27-AUG-13 TPE-COMP	L1360541-7 SEDIMENT 26-AUG-13 WAL-1	L1360541-8 SEDIMENT 26-AUG-13 WAL-2	L1360541-9 SEDIMENT 26-AUG-13 WAL-3	L1360541-10 SEDIMENT 26-AUG-13 WAL-4
Sample ID / Description / Sampled Date / Sampled Time / Client ID						
SOIL						
Physical Tests	Moisture (%)	86.9	91.0	88.4	88.7	90.5
	pH (1:2 soil:water) (pH)		6.50	6.80	6.69	6.65
Particle Size	% Gravel (>2mm) (%)		<0.10	<0.10	<0.10	<0.10
	% Sand (2.0mm - 0.063mm) (%)		1.38	3.00	6.07	2.05
	% Silt (0.063mm - 4um) (%)		87.5	81.6	84.9	88.3
	% Clay (<4um) (%)		11.2	15.4	9.08	9.67
	Texture		Silt	Silt loam	Silt	Silt
Organic / Inorganic Carbon	Total Organic Carbon (%)		9.12	6.51	5.80	8.98
Metals	Aluminum (Al) (mg/kg)		20400	24500	22200	21200
	Antimony (Sb) (mg/kg)		0.45	0.66	0.36	0.39
	Arsenic (As) (mg/kg)		61.4	18.2	19.3	36.3
	Barium (Ba) (mg/kg)		121	157	118	117
	Beryllium (Be) (mg/kg)		1.68	1.73	1.59	1.62
	Bismuth (Bi) (mg/kg)		2.09	2.45	2.25	2.10
	Cadmium (Cd) (mg/kg)		0.533	1.04	0.482	0.436
	Calcium (Ca) (mg/kg)		3920	3950	3480	4430
	Chromium (Cr) (mg/kg)		60.8	64.3	61.8	58.7
	Cobalt (Co) (mg/kg)		10.1	10.7	8.53	9.38
	Copper (Cu) (mg/kg)		162	150	141	143
	Iron (Fe) (mg/kg)		47400	28200	27600	36400
	Lead (Pb) (mg/kg)		35.5	38.3	33.2	34.7
	Lithium (Li) (mg/kg)		31.8	43.3	39.0	33.6
	Magnesium (Mg) (mg/kg)		7550	9150	8210	7690
	Manganese (Mn) (mg/kg)		431	366	305	379
	Mercury (Hg) (mg/kg)		0.0807	0.0473	0.0368	0.0745
	Molybdenum (Mo) (mg/kg)		12.8	6.49	5.72	8.78
	Nickel (Ni) (mg/kg)		58.6	65.0	54.1	54.4
	Phosphorus (P) (mg/kg)		804	617	460	722
	Potassium (K) (mg/kg)		3370	4230	3650	3480
	Selenium (Se) (mg/kg)		1.23	1.25	0.91	1.03
	Silver (Ag) (mg/kg)		0.68	0.62	0.43	0.56
	Sodium (Na) (mg/kg)		160	170	160	170
	Strontium (Sr) (mg/kg)		25.8	27.1	25.1	28.6
	Thallium (Tl) (mg/kg)		0.317	0.401	0.319	0.315
	Tin (Sn) (mg/kg)		<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)		528	815	714	597

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	Sample ID / Description / Sampled Date / Sampled Time / Client ID				
		L1360541-11 SEDIMENT 26-AUG-13 WAL-5	L1360541-12 SEDIMENT 26-AUG-13 WAL-COMP	L1360541-13 SEDIMENT 24-AUG-13 TE-1	L1360541-14 SEDIMENT 24-AUG-13 TE-2	L1360541-15 SEDIMENT 24-AUG-13 TE-3
SOIL						
Physical Tests	Moisture (%)	89.7	89.9	77.3	80.2	82.0
	pH (1:2 soil:water) (pH)	6.82		5.49	6.02	6.32
Particle Size	% Gravel (>2mm) (%)	<0.10		0.15	1.57	<0.10
	% Sand (2.0mm - 0.063mm) (%)	2.45		22.3	23.7	8.07
	% Silt (0.063mm - 4um) (%)	88.0		60.5	56.6	66.9
	% Clay (<4um) (%)	9.57		17.0	18.2	25.1
	Texture	Silt		Silt loam	Silt loam	Silt loam
Organic / Inorganic Carbon	Total Organic Carbon (%)	8.00		2.54	2.64	3.01
Metals	Aluminum (Al) (mg/kg)	18900		18500	17900	21200
	Antimony (Sb) (mg/kg)	0.39		0.15	0.13	0.18
	Arsenic (As) (mg/kg)	28.4		13.3	14.2	21.2
	Barium (Ba) (mg/kg)	102		95.6	82.1	112
	Beryllium (Be) (mg/kg)	1.42		1.59	1.51	1.78
	Bismuth (Bi) (mg/kg)	1.91		1.69	1.60	1.95
	Cadmium (Cd) (mg/kg)	0.434		0.173	0.091	0.215
	Calcium (Ca) (mg/kg)	3890		1940	1910	1900
	Chromium (Cr) (mg/kg)	54.2		46.7	45.4	52.8
	Cobalt (Co) (mg/kg)	8.63		8.40	8.78	13.0
	Copper (Cu) (mg/kg)	129		44.5	42.9	52.8
	Iron (Fe) (mg/kg)	30400		37000	54700	75500
	Lead (Pb) (mg/kg)	31.5		18.1	16.6	19.4
	Lithium (Li) (mg/kg)	32.9		36.3	34.5	38.6
	Magnesium (Mg) (mg/kg)	7450		7220	6810	7520
	Manganese (Mn) (mg/kg)	343		452	844	3620
	Mercury (Hg) (mg/kg)	0.0583		0.0220	0.0254	0.0294
	Molybdenum (Mo) (mg/kg)	6.54		3.82	5.87	7.45
	Nickel (Ni) (mg/kg)	50.2		34.6	29.9	41.8
	Phosphorus (P) (mg/kg)	633		801	554	554
	Potassium (K) (mg/kg)	3230		3570	3360	3910
	Selenium (Se) (mg/kg)	0.91		0.56	0.71	0.84
	Silver (Ag) (mg/kg)	0.53		0.13	0.12	0.13
	Sodium (Na) (mg/kg)	180		150	140	170
	Strontium (Sr) (mg/kg)	26.0		16.4	14.8	16.7
	Thallium (Tl) (mg/kg)	0.294		0.305	0.271	0.335
	Tin (Sn) (mg/kg)	<2.0		<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	622		848	746	817

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1360541-16	L1360541-17	L1360541-18	L1360541-19	L1360541-20
Description	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT
Sampled Date	24-AUG-13	24-AUG-13	24-AUG-13	24-AUG-13	24-AUG-13
Sampled Time					
Client ID	TE-4	TE-5	TE-COMP	TEFF-1	TEFF-2
Grouping / **Analyte**					
SOIL					
Physical Tests Moisture (%)	85.1	84.6	81.6	86.7	86.5
pH (1:2 soil:water) (pH)	6.04	5.95		6.12	6.32
Particle Size % Gravel (>2mm) (%)	<0.10	<0.10		<0.10	<0.10
% Sand (2.0mm - 0.063mm) (%)	3.50	2.78		1.28	2.87
% Silt (0.063mm - 4um) (%)	70.9	68.8		67.7	67.5
% Clay (<4um) (%)	25.6	28.4		31.0	29.6
Texture	Silt loam	Silt loam		Silt loam	Silt loam
Organic / Inorganic Carbon Total Organic Carbon (%)	3.96	3.12		4.05	4.19
Metals Aluminum (Al) (mg/kg)	21100	25500		25300	23900
Antimony (Sb) (mg/kg)	0.21	0.18		0.19	0.16
Arsenic (As) (mg/kg)	53.8	20.7		12.3	10.8
Barium (Ba) (mg/kg)	132	132		121	117
Beryllium (Be) (mg/kg)	1.83	2.10		2.14	1.86
Bismuth (Bi) (mg/kg)	1.97	2.21		1.95	1.81
Cadmium (Cd) (mg/kg)	0.362	0.214		0.168	0.172
Calcium (Ca) (mg/kg)	2040	2150		2110	1960
Chromium (Cr) (mg/kg)	52.6	59.0		60.4	55.9
Cobalt (Co) (mg/kg)	11.6	14.8		13.3	11.8
Copper (Cu) (mg/kg)	55.8	59.4		55.9	51.4
Iron (Fe) (mg/kg)	88500	64500		41900	39900
Lead (Pb) (mg/kg)	20.7	21.7		21.6	20.4
Lithium (Li) (mg/kg)	39.7	46.6		51.7	46.8
Magnesium (Mg) (mg/kg)	7690	8790		8800	8180
Manganese (Mn) (mg/kg)	2620	5260		2110	1640
Mercury (Hg) (mg/kg)	0.0310	0.0223		0.0206	0.0211
Molybdenum (Mo) (mg/kg)	11.9	8.68		4.87	4.36
Nickel (Ni) (mg/kg)	54.3	53.8		40.1	40.9
Phosphorus (P) (mg/kg)	1490	542		469	617
Potassium (K) (mg/kg)	3820	4470		4620	4360
Selenium (Se) (mg/kg)	0.87	0.83		0.75	0.83
Silver (Ag) (mg/kg)	0.20	<0.10		<0.10	<0.10
Sodium (Na) (mg/kg)	170	200		190	200
Strontium (Sr) (mg/kg)	18.2	19.2		19.6	18.6
Thallium (Tl) (mg/kg)	0.363	0.396		0.434	0.386
Tin (Sn) (mg/kg)	<2.0	<2.0		<2.0	2.4
Titanium (Ti) (mg/kg)	760	896		855	833

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1360541-21 SEDIMENT 24-AUG-13 TEFF-3	L1360541-22 SEDIMENT 24-AUG-13 TEFF-4	L1360541-23 SEDIMENT 24-AUG-13 TEFF-5	L1360541-24 SEDIMENT 24-AUG-13 TEFF-COMP	L1360541-25 SEDIMENT 25-AUG-13 SP-1
Sample ID / Description / Sampled Date / Sampled Time / Client ID						
SOIL						
Physical Tests	Moisture (%)	86.6	88.0	85.9	87.1	85.0
	pH (1:2 soil:water) (pH)	6.19	6.24	6.34		6.17
Particle Size	% Gravel (>2mm) (%)	<0.10	<0.10	<0.10		<0.10
	% Sand (2.0mm - 0.063mm) (%)	1.80	1.62	2.96		1.49
	% Silt (0.063mm - 4um) (%)	67.6	68.8	75.4		69.7
	% Clay (<4um) (%)	30.6	29.6	21.7		28.8
	Texture	Silt loam	Silt loam	Silt		Silt loam
Organic / Inorganic Carbon	Total Organic Carbon (%)	3.74	4.42	3.73		3.93
Metals	Aluminum (Al) (mg/kg)	25200	24500	24900		25000
	Antimony (Sb) (mg/kg)	0.16	0.22	0.15		0.24
	Arsenic (As) (mg/kg)	13.6	12.2	12.0		41.3
	Barium (Ba) (mg/kg)	119	118	113		129
	Beryllium (Be) (mg/kg)	1.95	1.84	1.92		2.02
	Bismuth (Bi) (mg/kg)	1.90	1.94	1.88		2.32
	Cadmium (Cd) (mg/kg)	0.135	0.200	0.122		0.234
	Calcium (Ca) (mg/kg)	1890	2050	1970		2210
	Chromium (Cr) (mg/kg)	57.4	56.9	57.7		81.2
	Cobalt (Co) (mg/kg)	13.4	13.1	12.9		17.2
	Copper (Cu) (mg/kg)	57.0	55.4	53.4		74.9
	Iron (Fe) (mg/kg)	51800	43100	42600		79900
	Lead (Pb) (mg/kg)	20.6	21.4	20.9		21.1
	Lithium (Li) (mg/kg)	47.7	45.2	53.7		42.0
	Magnesium (Mg) (mg/kg)	8660	8520	8360		9080
	Manganese (Mn) (mg/kg)	3130	2500	1680		1780
	Mercury (Hg) (mg/kg)	0.0190	0.0226	0.0179		0.0302
	Molybdenum (Mo) (mg/kg)	5.33	4.54	4.52		7.80
	Nickel (Ni) (mg/kg)	38.9	42.2	38.0		63.9
	Phosphorus (P) (mg/kg)	536	503	543		714
	Potassium (K) (mg/kg)	4560	4500	4600		4510
	Selenium (Se) (mg/kg)	0.78	0.85	0.73		0.95
	Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10		0.15
	Sodium (Na) (mg/kg)	190	210	230		210
	Strontium (Sr) (mg/kg)	18.3	18.8	19.1		20.5
	Thallium (Tl) (mg/kg)	0.405	0.422	0.403		0.388
	Tin (Sn) (mg/kg)	<2.0	2.3	<2.0		<2.0
	Titanium (Ti) (mg/kg)	812	810	878		830

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1360541-26 SEDIMENT 25-AUG-13 SP-2	L1360541-27 SEDIMENT 25-AUG-13 SP-3	L1360541-28 SEDIMENT 25-AUG-13 SP-4	L1360541-29 SEDIMENT 25-AUG-13 SP-5	L1360541-30 SEDIMENT 25-AUG-13 SP-COMP
SOIL						
Physical Tests	Moisture (%)	86.2	86.4	85.8	86.2	86.6
	pH (1:2 soil:water) (pH)	6.08	6.44	6.37	6.27	
Particle Size	% Gravel (>2mm) (%)	<0.10	<0.10	<0.10	<0.10	
	% Sand (2.0mm - 0.063mm) (%)	1.76	1.40	1.67	2.04	
	% Silt (0.063mm - 4um) (%)	73.7	68.4	71.4	65.1	
	% Clay (<4um) (%)	24.6	30.2	26.9	32.9	
	Texture	Silt loam	Silt loam	Silt loam	Silt loam	
Organic / Inorganic Carbon	Total Organic Carbon (%)	4.58	3.95	4.53	4.03	
Metals	Aluminum (Al) (mg/kg)	21900	26500	22900	28000	
	Antimony (Sb) (mg/kg)	0.27	0.24	0.25	0.26	
	Arsenic (As) (mg/kg)	37.9	26.5	35.0	34.2	
	Barium (Ba) (mg/kg)	144	126	135	129	
	Beryllium (Be) (mg/kg)	1.67	1.96	1.80	2.21	
	Bismuth (Bi) (mg/kg)	1.94	2.44	2.11	2.58	
	Cadmium (Cd) (mg/kg)	0.274	0.203	0.280	0.240	
	Calcium (Ca) (mg/kg)	2530	2280	2420	2390	
	Chromium (Cr) (mg/kg)	85.6	85.8	94.7	98.5	
	Cobalt (Co) (mg/kg)	21.0	15.8	17.6	16.2	
	Copper (Cu) (mg/kg)	63.5	74.5	67.0	79.9	
	Iron (Fe) (mg/kg)	80000	58500	78000	58100	
	Lead (Pb) (mg/kg)	19.8	22.3	20.9	24.1	
	Lithium (Li) (mg/kg)	36.5	44.1	37.7	50.3	
	Magnesium (Mg) (mg/kg)	8730	9880	9370	10200	
	Manganese (Mn) (mg/kg)	7150	2160	3930	1710	
	Mercury (Hg) (mg/kg)	0.0355	0.0302	0.0337	0.0284	
	Molybdenum (Mo) (mg/kg)	6.66	5.75	6.88	6.78	
	Nickel (Ni) (mg/kg)	78.2	62.6	74.0	69.8	
	Phosphorus (P) (mg/kg)	593	591	572	528	
	Potassium (K) (mg/kg)	3850	4720	3970	4640	
	Selenium (Se) (mg/kg)	0.92	0.82	0.89	0.72	
	Silver (Ag) (mg/kg)	0.18	0.11	0.17	0.11	
	Sodium (Na) (mg/kg)	170	210	170	170	
	Strontium (Sr) (mg/kg)	21.7	20.8	20.8	20.9	
	Thallium (Tl) (mg/kg)	0.339	0.385	0.360	0.398	
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	
	Titanium (Ti) (mg/kg)	662	817	699	778	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1360541-31	L1360541-32	L1360541-33	L1360541-34	L1360541-35
Description	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT
Sampled Date	23-AUG-13	23-AUG-13	23-AUG-13	23-AUG-13	23-AUG-13
Sampled Time					
Client ID	INUG-1	INUG-2	INUG-3	INUG-4	INUG-5
Grouping / **Analyte**					
SOIL					
Physical Tests Moisture (%)	86.5	85.9	85.5	84.9	84.2
pH (1:2 soil:water) (pH)	5.82	5.48	5.30	5.79	5.97
Particle Size % Gravel (>2mm) (%)	<0.10	<0.10	<0.10	<0.10	<0.10
% Sand (2.0mm - 0.063mm) (%)	2.48	2.89	10.9	3.73	2.15
% Silt (0.063mm - 4um) (%)	78.9	78.2	73.5	74.2	80.1
% Clay (<4um) (%)	18.6	19.0	15.6	22.1	17.7
Texture	Silt loam	Silt loam	Silt loam	Silt loam	Silt
Organic / Inorganic Carbon Total Organic Carbon (%)	4.49	4.47	4.00	4.47	3.96
Metals Aluminum (Al) (mg/kg)	18100	19500	18900	21900	15900
Antimony (Sb) (mg/kg)	0.18	0.17	0.15	0.17	0.13
Arsenic (As) (mg/kg)	228	82.1	47.3	22.8	193
Barium (Ba) (mg/kg)	138	127	93.2	120	86.2
Beryllium (Be) (mg/kg)	1.24	1.29	1.14	1.32	1.00
Bismuth (Bi) (mg/kg)	1.02	1.15	1.08	1.16	0.92
Cadmium (Cd) (mg/kg)	0.245	0.274	0.134	0.260	0.093
Calcium (Ca) (mg/kg)	1810	1770	1640	1980	1600
Chromium (Cr) (mg/kg)	92.6	98.5	95.2	103	79.1
Cobalt (Co) (mg/kg)	14.8	14.8	11.2	14.3	14.2
Copper (Cu) (mg/kg)	43.6	44.7	40.9	44.9	33.4
Iron (Fe) (mg/kg)	124000	89100	58300	52400	162000
Lead (Pb) (mg/kg)	12.5	13.7	12.6	14.2	10.5
Lithium (Li) (mg/kg)	21.7	23.0	21.6	24.5	19.5
Magnesium (Mg) (mg/kg)	7910	8480	8180	8940	7040
Manganese (Mn) (mg/kg)	2710	1940	644	1350	1930
Mercury (Hg) (mg/kg)	0.0292	0.0295	0.0242	0.0311	0.0241
Molybdenum (Mo) (mg/kg)	9.03	5.64	5.64	3.72	13.7
Nickel (Ni) (mg/kg)	84.1	85.0	62.8	85.4	49.8
Phosphorus (P) (mg/kg)	3430	2300	942	994	1460
Potassium (K) (mg/kg)	2800	3040	3010	3270	2490
Selenium (Se) (mg/kg)	0.80	0.76	0.66	0.73	0.71
Silver (Ag) (mg/kg)	0.16	0.18	0.11	0.16	0.12
Sodium (Na) (mg/kg)	140	140	160	170	130
Strontium (Sr) (mg/kg)	23.0	23.6	22.4	25.0	19.9
Thallium (Tl) (mg/kg)	0.201	0.215	0.185	0.217	0.146
Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti) (mg/kg)	435	487	544	557	426

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	Sample ID / Description / Sampled Date / Sampled Time / Client ID				
		L1360541-36 SEDIMENT 23-AUG-13 INUG-COMP	L1360541-37 SEDIMENT 23-AUG-13 PDL-1	L1360541-38 SEDIMENT 23-AUG-13 PDL-2	L1360541-39 SEDIMENT 23-AUG-13 PDL-3	L1360541-40 SEDIMENT 23-AUG-13 PDL-4
SOIL						
Physical Tests	Moisture (%)	85.9	82.5	84.9	84.7	71.9
	pH (1:2 soil:water) (pH)		6.23	5.65	5.72	6.40
Particle Size	% Gravel (>2mm) (%)		<0.10	<0.10	<0.10	<0.10
	% Sand (2.0mm - 0.063mm) (%)		6.94	10.2	10.6	7.40
	% Silt (0.063mm - 4um) (%)		73.1	73.4	73.4	68.4
	% Clay (<4um) (%)		20.0	16.4	16.0	24.2
	Texture		Silt loam / Silt	Silt loam	Silt loam	Silt loam
Organic / Inorganic Carbon	Total Organic Carbon (%)		3.14	4.44	3.64	1.92
Metals	Aluminum (Al) (mg/kg)		19400	17400	17800	22800
	Antimony (Sb) (mg/kg)		0.25	0.27	0.23	0.24
	Arsenic (As) (mg/kg)		34.2	15.1	12.6	51.8
	Barium (Ba) (mg/kg)		83.8	85.4	89.7	105
	Beryllium (Be) (mg/kg)		0.99	0.88	0.90	1.08
	Bismuth (Bi) (mg/kg)		0.95	0.77	0.78	1.08
	Cadmium (Cd) (mg/kg)		0.120	0.260	0.266	0.334
	Calcium (Ca) (mg/kg)		2170	2360	2120	1960
	Chromium (Cr) (mg/kg)		134	120	121	150
	Cobalt (Co) (mg/kg)		16.9	11.0	10.9	20.7
	Copper (Cu) (mg/kg)		48.6	43.0	43.0	58.2
	Iron (Fe) (mg/kg)		40300	27600	25300	33900
	Lead (Pb) (mg/kg)		14.9	14.5	13.5	16.4
	Lithium (Li) (mg/kg)		24.1	23.9	25.0	31.3
	Magnesium (Mg) (mg/kg)		10300	9530	9580	11700
	Manganese (Mn) (mg/kg)		1090	274	274	2300
	Mercury (Hg) (mg/kg)		0.0235	0.0225	0.0154	0.0099
	Molybdenum (Mo) (mg/kg)		2.75	2.40	2.31	4.75
	Nickel (Ni) (mg/kg)		82.0	82.2	79.8	127
	Phosphorus (P) (mg/kg)		512	488	462	463
	Potassium (K) (mg/kg)		2680	2380	2330	3050
	Selenium (Se) (mg/kg)		0.46	0.52	0.46	<0.20
	Silver (Ag) (mg/kg)		<0.10	0.22	0.20	<0.10
	Sodium (Na) (mg/kg)		120	110	<100	<100
	Strontium (Sr) (mg/kg)		22.9	22.1	20.0	23.3
	Thallium (Tl) (mg/kg)		0.186	0.177	0.168	0.253
	Tin (Sn) (mg/kg)		<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)		476	514	495	612

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1360541-41	L1360541-42	L1360541-43	L1360541-44	L1360541-45
	Description	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT
	Sampled Date	23-AUG-13	23-AUG-13	29-AUG-13	29-AUG-13	29-AUG-13
	Sampled Time					
	Client ID	PDL-5	PDL-COMP	BBD-1	BBD-2	BBD-3
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	80.6	81.5	35.8	20.7	35.5
	pH (1:2 soil:water) (pH)	6.37		6.30	6.41	6.70
Particle Size	% Gravel (>2mm) (%)	<0.10		0.14	0.51	0.62
	% Sand (2.0mm - 0.063mm) (%)	5.37		74.9	93.8	46.4
	% Silt (0.063mm - 4um) (%)	69.1		22.2	5.35	44.4
	% Clay (<4um) (%)	25.6		2.75	0.35	8.57
	Texture	Silt loam		Loamy sand	Sand	Sandy loam
Organic / Inorganic Carbon	Total Organic Carbon (%)	2.67		0.29	<0.10	0.23
Metals	Aluminum (Al) (mg/kg)	21500		5600	4160	7660
	Antimony (Sb) (mg/kg)	0.28		<0.10	<0.10	0.14
	Arsenic (As) (mg/kg)	35.9		5.89	3.57	5.40
	Barium (Ba) (mg/kg)	88.1		61.6	30.9	68.8
	Beryllium (Be) (mg/kg)	1.07		0.26	<0.20	0.36
	Bismuth (Bi) (mg/kg)	1.09		<0.20	<0.20	<0.20
	Cadmium (Cd) (mg/kg)	0.119		<0.050	<0.050	<0.050
	Calcium (Ca) (mg/kg)	2070		1730	1010	2530
	Chromium (Cr) (mg/kg)	144		11.1	8.17	18.3
	Cobalt (Co) (mg/kg)	18.0		3.80	2.80	5.45
	Copper (Cu) (mg/kg)	54.9		4.65	2.85	6.81
	Iron (Fe) (mg/kg)	41600		11500	9750	13900
	Lead (Pb) (mg/kg)	15.7		4.36	2.50	6.61
	Lithium (Li) (mg/kg)	28.7		8.3	6.3	10.3
	Magnesium (Mg) (mg/kg)	10900		3310	2750	3930
	Manganese (Mn) (mg/kg)	1010		230	128	291
	Mercury (Hg) (mg/kg)	0.0128		<0.0050	<0.0050	<0.0050
	Molybdenum (Mo) (mg/kg)	3.15		<0.50	2.12	1.14
	Nickel (Ni) (mg/kg)	89.5		7.59	6.42	10.3
	Phosphorus (P) (mg/kg)	494		477	342	764
	Potassium (K) (mg/kg)	2850		910	630	1570
	Selenium (Se) (mg/kg)	0.36		<0.20	<0.20	<0.20
	Silver (Ag) (mg/kg)	<0.10		<0.10	<0.10	<0.10
	Sodium (Na) (mg/kg)	100		<100	<100	120
	Strontium (Sr) (mg/kg)	22.0		34.4	24.9	44.8
	Thallium (Tl) (mg/kg)	0.194		<0.050	<0.050	0.065
	Tin (Sn) (mg/kg)	<2.0		<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	489		276	195	426

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1360541-46 SEDIMENT 29-AUG-13 BBD-4	L1360541-47 SEDIMENT 29-AUG-13 BBD-5	L1360541-48 SEDIMENT 29-AUG-13 BBD-COMP	L1360541-49 SEDIMENT 29-AUG-13 BPJ-1	L1360541-50 SEDIMENT 29-AUG-13 BPJ-2
Sample ID						
Description						
Sampled Date						
Sampled Time						
Client ID						
SOIL						
Physical Tests	Moisture (%)	28.6	49.2	29.1	43.3	48.0
	pH (1:2 soil:water) (pH)	7.05	6.63		6.61	6.52
Particle Size	% Gravel (>2mm) (%)	0.14	0.35		<0.10	<0.10
	% Sand (2.0mm - 0.063mm) (%)	91.2	85.9		46.9	45.0
	% Silt (0.063mm - 4um) (%)	7.85	12.5		46.9	48.9
	% Clay (<4um) (%)	0.81	1.25		6.19	5.99
	Texture	Sand	Sand		Silt loam / Sandy loam	Silt loam
Organic / Inorganic Carbon	Total Organic Carbon (%)	<0.10	0.18		0.42	0.51
Metals	Aluminum (Al) (mg/kg)	3830	4240		7260	7950
	Antimony (Sb) (mg/kg)	<0.10	<0.10		0.10	0.12
	Arsenic (As) (mg/kg)	2.12	3.14		5.05	16.0
	Barium (Ba) (mg/kg)	30.9	49.4		75.3	104
	Beryllium (Be) (mg/kg)	<0.20	<0.20		0.33	0.35
	Bismuth (Bi) (mg/kg)	<0.20	<0.20		<0.20	<0.20
	Cadmium (Cd) (mg/kg)	<0.050	<0.050		0.051	0.072
	Calcium (Ca) (mg/kg)	1040	1280		2180	2270
	Chromium (Cr) (mg/kg)	7.22	11.4		16.4	19.9
	Cobalt (Co) (mg/kg)	2.91	3.57		5.56	6.05
	Copper (Cu) (mg/kg)	2.74	4.46		7.16	7.17
	Iron (Fe) (mg/kg)	6720	9500		15000	20500
	Lead (Pb) (mg/kg)	2.29	3.57		7.21	8.38
	Lithium (Li) (mg/kg)	6.3	6.7		8.9	10.2
	Magnesium (Mg) (mg/kg)	2600	2960		3970	4310
	Manganese (Mn) (mg/kg)	184	192		1580	2870
	Mercury (Hg) (mg/kg)	<0.0050	<0.0050		0.0079	0.0110
	Molybdenum (Mo) (mg/kg)	<0.50	<0.50		0.87	1.73
	Nickel (Ni) (mg/kg)	6.00	7.26		10.9	12.3
	Phosphorus (P) (mg/kg)	277	413		640	807
	Potassium (K) (mg/kg)	550	670		1320	1470
	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)	<100	<100		140	130
	Strontium (Sr) (mg/kg)	25.0	24.4		44.1	49.3
	Thallium (Tl) (mg/kg)	<0.050	<0.050		0.057	0.065
	Tin (Sn) (mg/kg)	<2.0	<2.0		<2.0	<2.0
	Titanium (Ti) (mg/kg)	196	206		374	390

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1360541-51	L1360541-52	L1360541-53	L1360541-54	L1360541-55
	Description	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT
	Sampled Date	29-AUG-13	29-AUG-13	29-AUG-13	29-AUG-13	30-AUG-13
	Sampled Time					
	Client ID	BPJ-3	BPJ-4	BPJ-5	BPJ-COMP	BAP-1
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	51.4	44.7	54.7	53.0	38.0
	pH (1:2 soil:water) (pH)	6.61	6.17	6.48		6.94
Particle Size	% Gravel (>2mm) (%)	<0.10	<0.10	1.81		<0.10
	% Sand (2.0mm - 0.063mm) (%)	22.1	16.3	27.1		73.5
	% Silt (0.063mm - 4um) (%)	68.7	67.9	61.2		23.8
	% Clay (<4um) (%)	9.16	15.8	9.87		2.71
	Texture	Silt loam	Silt loam	Silt loam		Loamy sand
Organic / Inorganic Carbon	Total Organic Carbon (%)	0.54	0.48	0.63		0.36
Metals	Aluminum (Al) (mg/kg)	10400	11300	9060		5360
	Antimony (Sb) (mg/kg)	0.14	0.16	0.16		0.14
	Arsenic (As) (mg/kg)	24.2	8.03	44.9		6.83
	Barium (Ba) (mg/kg)	133	90.6	142		425
	Beryllium (Be) (mg/kg)	0.45	0.51	0.40		0.33
	Bismuth (Bi) (mg/kg)	0.23	0.25	0.22		<0.20
	Cadmium (Cd) (mg/kg)	0.080	0.064	0.063		<0.050
	Calcium (Ca) (mg/kg)	2920	3150	2710		2270
	Chromium (Cr) (mg/kg)	22.4	25.4	20.4		15.9
	Cobalt (Co) (mg/kg)	7.24	7.35	7.72		4.27
	Copper (Cu) (mg/kg)	9.51	11.3	8.88		4.72
	Iron (Fe) (mg/kg)	22100	18900	29800		13500
	Lead (Pb) (mg/kg)	10.3	10.7	8.91		4.53
	Lithium (Li) (mg/kg)	12.1	13.8	10.4		8.1
	Magnesium (Mg) (mg/kg)	5260	5510	4700		3100
	Manganese (Mn) (mg/kg)	2520	432	2310		439
	Mercury (Hg) (mg/kg)	0.0133	0.0079	0.0087		<0.0050
	Molybdenum (Mo) (mg/kg)	1.46	0.90	2.65		0.77
	Nickel (Ni) (mg/kg)	14.1	14.9	13.0		9.47
	Phosphorus (P) (mg/kg)	1060	941	1680		681
	Potassium (K) (mg/kg)	2000	2220	1770		1200
	Selenium (Se) (mg/kg)	<0.20	0.21	0.20		<0.20
	Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10		<0.10
	Sodium (Na) (mg/kg)	230	200	150		<100
	Strontium (Sr) (mg/kg)	59.7	60.7	51.5		45.2
	Thallium (Tl) (mg/kg)	0.079	0.091	0.070		0.058
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0		<2.0
	Titanium (Ti) (mg/kg)	496	548	425		326

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1360541-56 SEDIMENT 30-AUG-13 BAP-2	L1360541-57 SEDIMENT 30-AUG-13 BAP-3	L1360541-58 SEDIMENT 30-AUG-13 BAP-4	L1360541-59 SEDIMENT 30-AUG-13 BAP-5	L1360541-60 SEDIMENT 30-AUG-13 BAP-COMP
SOIL						
Physical Tests	Moisture (%)	40.4	36.8	54.7	42.2	42.1
	pH (1:2 soil:water) (pH)	6.19	6.25	5.85	6.26	
Particle Size	% Gravel (>2mm) (%)	<0.10	<0.10	<0.10	<0.10	
	% Sand (2.0mm - 0.063mm) (%)	72.2	71.4	53.8	62.9	
	% Silt (0.063mm - 4um) (%)	24.8	25.9	41.1	32.2	
	% Clay (<4um) (%)	3.00	2.76	5.14	4.85	
	Texture	Loamy sand	Loamy sand	Sandy loam	Sandy loam	
Organic / Inorganic Carbon	Total Organic Carbon (%)	0.53	0.37	0.86	0.59	
Metals	Aluminum (Al) (mg/kg)	5710	5210	6360	5420	
	Antimony (Sb) (mg/kg)	0.15	0.13	0.16	0.21	
	Arsenic (As) (mg/kg)	9.19	8.82	7.82	3.38	
	Barium (Ba) (mg/kg)	340	387	296	284	
	Beryllium (Be) (mg/kg)	0.36	0.31	0.37	0.33	
	Bismuth (Bi) (mg/kg)	<0.20	<0.20	<0.20	<0.20	
	Cadmium (Cd) (mg/kg)	<0.050	<0.050	0.057	<0.050	
	Calcium (Ca) (mg/kg)	2090	2250	2250	2160	
	Chromium (Cr) (mg/kg)	17.4	15.7	17.5	16.6	
	Cobalt (Co) (mg/kg)	4.30	3.75	4.76	4.28	
	Copper (Cu) (mg/kg)	5.65	4.41	7.16	6.44	
	Iron (Fe) (mg/kg)	13600	14600	15400	12900	
	Lead (Pb) (mg/kg)	5.93	4.35	5.84	5.82	
	Lithium (Li) (mg/kg)	9.0	8.0	9.9	8.3	
	Magnesium (Mg) (mg/kg)	3370	2960	3600	3260	
	Manganese (Mn) (mg/kg)	180	195	188	131	
	Mercury (Hg) (mg/kg)	0.0056	<0.0050	0.0089	0.0059	
	Molybdenum (Mo) (mg/kg)	<0.50	0.53	0.63	<0.50	
	Nickel (Ni) (mg/kg)	10.3	8.80	10.5	9.75	
	Phosphorus (P) (mg/kg)	738	716	694	682	
	Potassium (K) (mg/kg)	1380	1170	1480	1270	
	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)	<100	<100	110	<100	
	Strontium (Sr) (mg/kg)	47.6	45.7	42.9	38.3	
	Thallium (Tl) (mg/kg)	0.062	0.054	0.072	0.067	
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	
	Titanium (Ti) (mg/kg)	319	324	349	285	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1360541-61 SEDIMENT 30-AUG-13 BES-1	L1360541-62 SEDIMENT 30-AUG-13 BES-2	L1360541-63 SEDIMENT 30-AUG-13 BES-3	L1360541-64 SEDIMENT 30-AUG-13 BES-4	L1360541-65 SEDIMENT 30-AUG-13 BES-5
SOIL						
Physical Tests	Moisture (%)	38.8	38.4	37.3	46.6	42.3
	pH (1:2 soil:water) (pH)	8.05	7.78	7.02	6.95	6.79
Particle Size	% Gravel (>2mm) (%)	<0.10	0.37	0.19	<0.10	<0.10
	% Sand (2.0mm - 0.063mm) (%)	77.0	78.2	67.4	74.1	62.1
	% Silt (0.063mm - 4um) (%)	20.1	18.7	27.9	22.8	32.8
	% Clay (<4um) (%)	2.92	2.68	4.51	3.09	5.11
	Texture	Loamy sand	Loamy sand	Loamy sand	Loamy sand	Sandy loam
Organic / Inorganic Carbon	Total Organic Carbon (%)	0.36	0.30	0.34	0.43	0.41
Metals	Aluminum (Al) (mg/kg)	4890	5270	6220	5880	6020
	Antimony (Sb) (mg/kg)	0.13	0.15	0.13	0.13	0.13
	Arsenic (As) (mg/kg)	3.10	3.63	3.53	3.78	3.54
	Barium (Ba) (mg/kg)	163	151	98.3	137	92.8
	Beryllium (Be) (mg/kg)	0.30	0.30	0.32	0.32	0.34
	Bismuth (Bi) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Cadmium (Cd) (mg/kg)	<0.050	<0.050	<0.050	<0.050	<0.050
	Calcium (Ca) (mg/kg)	2170	2240	2400	2180	2090
	Chromium (Cr) (mg/kg)	16.8	16.4	17.2	17.7	16.8
	Cobalt (Co) (mg/kg)	4.10	4.09	4.45	4.48	4.66
	Copper (Cu) (mg/kg)	3.89	3.83	4.89	4.84	4.82
	Iron (Fe) (mg/kg)	12200	13900	14000	13100	13100
	Lead (Pb) (mg/kg)	4.37	4.36	5.40	4.63	5.00
	Lithium (Li) (mg/kg)	8.4	8.6	8.8	8.8	8.3
	Magnesium (Mg) (mg/kg)	3300	3410	3560	3600	3570
	Manganese (Mn) (mg/kg)	631	662	304	548	397
	Mercury (Hg) (mg/kg)	<0.0050	<0.0050	0.0056	0.0056	0.0061
	Molybdenum (Mo) (mg/kg)	0.68	0.55	<0.50	0.56	<0.50
	Nickel (Ni) (mg/kg)	9.69	10.2	9.70	10.4	10.4
	Phosphorus (P) (mg/kg)	672	740	728	615	585
	Potassium (K) (mg/kg)	970	1050	1270	1230	1250
	Selenium (Se) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10
	Sodium (Na) (mg/kg)	<100	<100	<100	<100	<100
	Strontium (Sr) (mg/kg)	31.5	35.3	39.6	38.9	36.9
	Thallium (Tl) (mg/kg)	0.051	<0.050	0.050	0.056	0.058
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	284	325	354	335	331

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1360541-66	L1360541-67	L1360541-68	L1360541-69	L1360541-70
Description	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT
Sampled Date	30-AUG-13	27-AUG-13	27-AUG-13	27-AUG-13	27-AUG-13
Sampled Time					
Client ID	BES-COMP	TPS-1	TPS-2	TPS-3	TPS-4
Grouping / **Analyte**					
SOIL					
Physical Tests Moisture (%)	42.5	85.8	84.7	83.6	87.0
pH (1:2 soil:water) (pH)		5.99	5.88	5.55	6.13
Particle Size % Gravel (>2mm) (%)		<0.10	<0.10	<0.10	<0.10
% Sand (2.0mm - 0.063mm) (%)		2.85	2.65	12.2	3.79
% Silt (0.063mm - 4um) (%)		70.3	68.7	61.7	75.6
% Clay (<4um) (%)		26.9	28.7	26.1	20.6
Texture		Silt loam	Silt loam	Silt loam	Silt loam
Organic / Inorganic Carbon Total Organic Carbon (%)		4.55	4.32	3.92	5.70
Metals Aluminum (Al) (mg/kg)		24100	19800	22000	22000
Antimony (Sb) (mg/kg)		0.25	0.19	0.22	0.29
Arsenic (As) (mg/kg)		31.5	13.2	13.9	48.9
Barium (Ba) (mg/kg)		108	80.1	102	142
Beryllium (Be) (mg/kg)		1.52	1.15	1.38	1.45
Bismuth (Bi) (mg/kg)		1.59	1.23	1.39	1.52
Cadmium (Cd) (mg/kg)		0.323	0.156	0.405	0.942
Calcium (Ca) (mg/kg)		1860	1400	1790	1940
Chromium (Cr) (mg/kg)		115	91.7	106	106
Cobalt (Co) (mg/kg)		19.3	12.8	16.1	41.5
Copper (Cu) (mg/kg)		70.1	52.3	59.0	65.8
Iron (Fe) (mg/kg)		46300	25000	27800	73700
Lead (Pb) (mg/kg)		21.0	15.7	19.3	24.5
Lithium (Li) (mg/kg)		34.5	28.6	34.3	31.1
Magnesium (Mg) (mg/kg)		9470	7400	8980	8390
Manganese (Mn) (mg/kg)		1270	609	758	3690
Mercury (Hg) (mg/kg)		0.0222	0.0158	0.0175	0.0333
Molybdenum (Mo) (mg/kg)		5.96	3.02	2.89	6.36
Nickel (Ni) (mg/kg)		79.0	57.8	78.1	145
Phosphorus (P) (mg/kg)		473	391	361	966
Potassium (K) (mg/kg)		3800	3110	3710	3550
Selenium (Se) (mg/kg)		1.00	0.59	0.62	1.06
Silver (Ag) (mg/kg)		0.19	0.12	0.14	0.24
Sodium (Na) (mg/kg)		160	140	180	190
Strontium (Sr) (mg/kg)		16.9	13.3	16.6	17.8
Thallium (Tl) (mg/kg)		0.295	0.224	0.288	0.426
Tin (Sn) (mg/kg)		<2.0	<2.0	<2.0	<2.0
Titanium (Ti) (mg/kg)		635	560	725	635

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1360541-71 SEDIMENT 27-AUG-13 TPS-5	L1360541-72 SEDIMENT 27-AUG-13 TPS-COMP	L1360541-73 SEDIMENT 28-AUG-13 TPN-1	L1360541-74 SEDIMENT 28-AUG-13 TPN-2	L1360541-75 SEDIMENT 28-AUG-13 TPN-3
Sample ID						
Description						
Sampled Date						
Sampled Time						
Client ID						
SOIL						
Physical Tests	Moisture (%)	85.0	85.5	79.0	80.3	60.5
	pH (1:2 soil:water) (pH)	5.56		5.87	5.69	5.81
Particle Size	% Gravel (>2mm) (%)	<0.10		<0.10	<0.10	9.30
	% Sand (2.0mm - 0.063mm) (%)	12.7		31.0	39.7	40.5
	% Silt (0.063mm - 4um) (%)	69.1		51.3	46.9	36.2
	% Clay (<4um) (%)	18.2		17.8	13.4	14.1
	Texture	Silt loam		Silt loam	Silt loam / Loam	Loam
Organic / Inorganic Carbon	Total Organic Carbon (%)	4.57		2.75	2.00	1.00
Metals	Aluminum (Al) (mg/kg)	21200		15900	12800	15500
	Antimony (Sb) (mg/kg)	0.20		0.15	0.13	0.13
	Arsenic (As) (mg/kg)	11.3		9.17	10.0	10.6
	Barium (Ba) (mg/kg)	97.5		58.1	49.1	57.0
	Beryllium (Be) (mg/kg)	1.31		0.94	0.75	0.81
	Bismuth (Bi) (mg/kg)	1.25		0.93	0.73	0.89
	Cadmium (Cd) (mg/kg)	0.347		0.079	0.053	0.051
	Calcium (Ca) (mg/kg)	1900		1440	1110	1030
	Chromium (Cr) (mg/kg)	101		102	82.5	91.0
	Cobalt (Co) (mg/kg)	11.2		8.37	7.56	9.53
	Copper (Cu) (mg/kg)	57.5		40.2	31.5	33.0
	Iron (Fe) (mg/kg)	26000		22300	22500	26600
	Lead (Pb) (mg/kg)	18.2		12.8	10.0	11.8
	Lithium (Li) (mg/kg)	30.8		24.9	20.5	27.1
	Magnesium (Mg) (mg/kg)	8950		7190	6270	7360
	Manganese (Mn) (mg/kg)	336		253	311	412
	Mercury (Hg) (mg/kg)	0.0193		0.0110	0.0080	0.0055
	Molybdenum (Mo) (mg/kg)	2.75		1.81	1.62	1.74
	Nickel (Ni) (mg/kg)	69.7		49.5	40.4	46.7
	Phosphorus (P) (mg/kg)	472		481	380	309
	Potassium (K) (mg/kg)	3360		2270	1870	2220
	Selenium (Se) (mg/kg)	0.86		0.44	0.30	0.22
	Silver (Ag) (mg/kg)	0.18		<0.10	<0.10	<0.10
	Sodium (Na) (mg/kg)	160		<100	<100	<100
	Strontium (Sr) (mg/kg)	16.1		13.4	10.8	10.8
	Thallium (Tl) (mg/kg)	0.258		0.163	0.131	0.166
	Tin (Sn) (mg/kg)	<2.0		<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	690		480	412	540

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1360541-76	L1360541-77	L1360541-78	L1360541-79	L1360541-81
Description	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT
Sampled Date	28-AUG-13	28-AUG-13	28-AUG-13		
Sampled Time					
Client ID	TPN-4	TPN-5	TPN-COMP	DUP-1	DUP-2
Grouping / **Analyte**					
SOIL					
Physical Tests Moisture (%)	60.2	80.1	74.5	85.7	91.3
pH (1:2 soil:water) (pH)	6.32	6.90		5.82	6.60
Particle Size % Gravel (>2mm) (%)	0.37	<0.10		<0.10	<0.10
% Sand (2.0mm - 0.063mm) (%)	45.0	15.6		1.90	2.07
% Silt (0.063mm - 4um) (%)	39.4	65.4		85.7	90.5
% Clay (<4um) (%)	15.3	19.1		12.4	7.48
Texture	Loam	Silt loam		Silt	Silt
Organic / Inorganic Carbon Total Organic Carbon (%)	1.15	2.68		4.33	9.26
Metals Aluminum (Al) (mg/kg)	19200	15100		18200	22200
Antimony (Sb) (mg/kg)	0.15	0.17		0.21	0.41
Arsenic (As) (mg/kg)	14.1	14.2		229	63.1
Barium (Ba) (mg/kg)	80.2	71.4		133	123
Beryllium (Be) (mg/kg)	1.00	0.77		1.18	1.79
Bismuth (Bi) (mg/kg)	1.11	0.82		1.02	2.13
Cadmium (Cd) (mg/kg)	0.093	0.091		0.248	0.534
Calcium (Ca) (mg/kg)	1600	1800		1840	4190
Chromium (Cr) (mg/kg)	102	90.5		91.2	61.3
Cobalt (Co) (mg/kg)	12.5	9.46		14.7	10.2
Copper (Cu) (mg/kg)	41.4	29.7		43.3	165
Iron (Fe) (mg/kg)	31400	26900		125000	48000
Lead (Pb) (mg/kg)	13.3	11.5		12.6	36.1
Lithium (Li) (mg/kg)	34.6	21.8		20.8	36.5
Magnesium (Mg) (mg/kg)	8970	6870		7860	7660
Manganese (Mn) (mg/kg)	690	596		2440	429
Mercury (Hg) (mg/kg)	0.0081	0.0105		0.0305	0.0700
Molybdenum (Mo) (mg/kg)	2.32	2.20		8.82	13.6
Nickel (Ni) (mg/kg)	59.4	45.2		82.0	59.5
Phosphorus (P) (mg/kg)	312	323		3560	860
Potassium (K) (mg/kg)	3040	2280		2890	3560
Selenium (Se) (mg/kg)	0.26	0.49		0.78	1.23
Silver (Ag) (mg/kg)	<0.10	<0.10		0.16	0.67
Sodium (Na) (mg/kg)	120	130		160	190
Strontium (Sr) (mg/kg)	16.4	15.6		23.2	29.0
Thallium (Tl) (mg/kg)	0.206	0.158		0.198	0.328
Tin (Sn) (mg/kg)	<2.0	<2.0		<2.0	<2.0
Titanium (Ti) (mg/kg)	704	497		454	609

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1360541-83	L1360541-85	L1360541-87	L1360541-89	L1360541-91
Description	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT
Sampled Date					
Sampled Time					
Client ID	DUP-3	DUP-4	DUP-5	DUP-6	DUP-7
Grouping / **Analyte**					
SOIL					
Physical Tests Moisture (%)	86.6	86.4	42.6	38.0	83.9
pH (1:2 soil:water) (pH)	6.13	6.18	7.21	7.51	5.86
Particle Size % Gravel (>2mm) (%)	<0.10	<0.10	0.15	4.64	<0.10
% Sand (2.0mm - 0.063mm) (%)	1.31	1.26	43.8	63.6	2.88
% Silt (0.063mm - 4um) (%)	75.1	83.8	50.5	28.0	79.7
% Clay (<4um) (%)	23.6	14.9	5.48	3.76	17.4
Texture	Silt loam	Silt	Silt loam	Sandy loam / Loamy sand	Silt loam
Organic / Inorganic Carbon Total Organic Carbon (%)	4.37	4.67	0.59	0.32	4.36
Metals Aluminum (Al) (mg/kg)	25000	23900	7290	5890	26900
Antimony (Sb) (mg/kg)	0.19	0.31	0.28	0.14	0.27
Arsenic (As) (mg/kg)	12.4	39.0	16.0	3.24	18.0
Barium (Ba) (mg/kg)	121	146	106	97.7	115
Beryllium (Be) (mg/kg)	2.08	1.76	0.34	0.33	1.69
Bismuth (Bi) (mg/kg)	1.95	2.02	<0.20	<0.20	1.86
Cadmium (Cd) (mg/kg)	0.155	0.298	0.084	<0.050	0.221
Calcium (Ca) (mg/kg)	2090	2600	2280	2340	1950
Chromium (Cr) (mg/kg)	60.4	90.3	18.5	16.9	128
Cobalt (Co) (mg/kg)	13.0	21.4	6.12	4.33	18.0
Copper (Cu) (mg/kg)	54.7	66.2	8.45	4.63	72.0
Iron (Fe) (mg/kg)	41700	84000	19700	13500	35000
Lead (Pb) (mg/kg)	21.4	20.5	9.43	5.67	22.6
Lithium (Li) (mg/kg)	51.7	37.8	9.4	8.4	40.1
Magnesium (Mg) (mg/kg)	8640	9130	4090	3530	10600
Manganese (Mn) (mg/kg)	2070	7280	3070	290	839
Mercury (Hg) (mg/kg)	0.0208	0.0368	0.0097	0.0050	0.0182
Molybdenum (Mo) (mg/kg)	4.66	6.61	1.80	<0.50	4.17
Nickel (Ni) (mg/kg)	40.7	81.9	11.6	9.81	80.6
Phosphorus (P) (mg/kg)	493	614	794	750	522
Potassium (K) (mg/kg)	4680	4090	1260	1200	4210
Selenium (Se) (mg/kg)	0.73	0.99	<0.20	<0.20	0.87
Silver (Ag) (mg/kg)	<0.10	0.20	<0.10	<0.10	0.17
Sodium (Na) (mg/kg)	200	190	120	<100	170
Strontium (Sr) (mg/kg)	19.5	22.7	44.1	39.0	18.0
Thallium (Tl) (mg/kg)	0.425	0.348	0.063	0.053	0.320
Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti) (mg/kg)	903	763	327	330	750

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1360541-93				
	Description	SEDIMENT				
	Sampled Date					
	Sampled Time					
	Client ID	DUP-8				
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	78.2				
	pH (1:2 soil:water) (pH)	6.60				
Particle Size	% Gravel (>2mm) (%)	<0.10				
	% Sand (2.0mm - 0.063mm) (%)	30.2				
	% Silt (0.063mm - 4um) (%)	61.1				
	% Clay (<4um) (%)	8.75				
	Texture	Silt loam				
Organic / Inorganic Carbon	Total Organic Carbon (%)	2.64				
Metals	Aluminum (Al) (mg/kg)	17100				
	Antimony (Sb) (mg/kg)	0.28				
	Arsenic (As) (mg/kg)	10.4				
	Barium (Ba) (mg/kg)	69.1				
	Beryllium (Be) (mg/kg)	1.03				
	Bismuth (Bi) (mg/kg)	1.08				
	Cadmium (Cd) (mg/kg)	0.082				
	Calcium (Ca) (mg/kg)	1710				
	Chromium (Cr) (mg/kg)	112				
	Cobalt (Co) (mg/kg)	9.29				
	Copper (Cu) (mg/kg)	45.5				
	Iron (Fe) (mg/kg)	24800				
	Lead (Pb) (mg/kg)	15.0				
	Lithium (Li) (mg/kg)	27.3				
	Magnesium (Mg) (mg/kg)	8370				
	Manganese (Mn) (mg/kg)	291				
	Mercury (Hg) (mg/kg)	0.0129				
	Molybdenum (Mo) (mg/kg)	2.04				
	Nickel (Ni) (mg/kg)	55.1				
	Phosphorus (P) (mg/kg)	552				
	Potassium (K) (mg/kg)	2540				
	Selenium (Se) (mg/kg)	0.41				
	Silver (Ag) (mg/kg)	<0.10				
	Sodium (Na) (mg/kg)	120				
	Strontium (Sr) (mg/kg)	15.0				
	Thallium (Tl) (mg/kg)	0.195				
	Tin (Sn) (mg/kg)	<2.0				
	Titanium (Ti) (mg/kg)	505				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1360541-1	L1360541-2	L1360541-3	L1360541-4	L1360541-5
	Description	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT
	Sampled Date	27-AUG-13	27-AUG-13	27-AUG-13	27-AUG-13	27-AUG-13
	Sampled Time					
	Client ID	TPE-1	TPE-2	TPE-3	TPE-4	TPE-5
Grouping	**Analyte**					
SOIL						
Metals	Uranium (U) (mg/kg)	12.3	15.6	14.8	14.9	13.5
	Vanadium (V) (mg/kg)	37.6	40.2	43.0	41.3	40.0
	Zinc (Zn) (mg/kg)	93.7	119	109	112	117
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

Grouping	Analyte	Sample ID: L1360541-6 Description: SEDIMENT Sampled Date: 27-AUG-13 Sampled Time: Client ID: TPE-COMP	L1360541-7 SEDIMENT 26-AUG-13 WAL-1	L1360541-8 SEDIMENT 26-AUG-13 WAL-2	L1360541-9 SEDIMENT 26-AUG-13 WAL-3	L1360541-10 SEDIMENT 26-AUG-13 WAL-4
SOIL						
Metals	Uranium (U) (mg/kg)		17.4	24.4	16.4	16.1
	Vanadium (V) (mg/kg)		32.4	35.6	33.2	31.6
	Zinc (Zn) (mg/kg)		130	152	113	122
Aggregate Organics	Mineral Oil and Grease (mg/kg)	<1800				
Hydrocarbons	EPH10-19 (mg/kg)	<640 DLHM				
	EPH19-32 (mg/kg)	<640 DLHM				
	LEPH (mg/kg)	<640				
	HEPH (mg/kg)	<640				
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)	<0.010 DLHM				
	Acenaphthylene (mg/kg)	<0.010 DLHM				
	Anthracene (mg/kg)	<0.0080 DLHM				
	Benz(a)anthracene (mg/kg)	<0.020 DLHM				
	Benzo(a)pyrene (mg/kg)	<0.020 DLHM				
	Benzo(b)fluoranthene (mg/kg)	<0.020 DLHM				
	Benzo(b+j+k)fluoranthene (mg/kg)	<0.028				
	Benzo(g,h,i)perylene (mg/kg)	<0.020 DLHM				
	Benzo(k)fluoranthene (mg/kg)	<0.020 DLHM				
	Chrysene (mg/kg)	<0.020 DLHM				
	Dibenz(a,h)anthracene (mg/kg)	<0.010 DLHM				
	Fluoranthene (mg/kg)	<0.020 DLHM				
	Fluorene (mg/kg)	<0.020 DLHM				
	Indeno(1,2,3-c,d)pyrene (mg/kg)	<0.020 DLHM				
	2-Methylnaphthalene (mg/kg)	<0.020 DLHM				
	Naphthalene (mg/kg)	<0.020 DLHM				
	Phenanthrene (mg/kg)	<0.020 DLHM				
	Pyrene (mg/kg)	<0.020 DLHM				
	Surrogate: Acenaphthene d10 (%)	99.7				
	Surrogate: Chrysene d12 (%)	112.8				
	Surrogate: Naphthalene d8 (%)	99.1				
	Surrogate: Phenanthrene d10 (%)	106.0				
	B(a)P Total Potency Equivalent (mg/kg)	<0.020				
	IACR (CCME) (mg/kg)	<0.21				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1360541-11	L1360541-12	L1360541-13	L1360541-14	L1360541-15
	Description	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT
	Sampled Date	26-AUG-13	26-AUG-13	24-AUG-13	24-AUG-13	24-AUG-13
	Sampled Time					
	Client ID	WAL-5	WAL-COMP	TE-1	TE-2	TE-3
Grouping	**Analyte**					
SOIL						
Metals	Uranium (U) (mg/kg)	15.5		16.6	15.2	18.9
	Vanadium (V) (mg/kg)	29.4		30.2	28.3	32.9
	Zinc (Zn) (mg/kg)	109		90.0	80.1	96.3
Aggregate Organics	Mineral Oil and Grease (mg/kg)		<2100			
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)		<0.010			
	Phenanthrene (mg/kg)		<0.010			
	Pyrene (mg/kg)		<0.010			
	Surrogate: Acenaphthene d10 (%)		90.1			
	Surrogate: Chrysene d12 (%)		108.3			
	Surrogate: Naphthalene d8 (%)		78.7			
	Surrogate: Phenanthrene d10 (%)		104.2			
	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	Sample ID: L1360541-16 Description: SEDIMENT Sampled Date: 24-AUG-13 Client ID: TE-4	L1360541-17 SEDIMENT 24-AUG-13 TE-5	L1360541-18 SEDIMENT 24-AUG-13 TE-COMP	L1360541-19 SEDIMENT 24-AUG-13 TEFF-1	L1360541-20 SEDIMENT 24-AUG-13 TEFF-2
SOIL						
Metals	Uranium (U) (mg/kg)	18.8	22.2		25.2	22.5
	Vanadium (V) (mg/kg)	33.0	38.1		39.0	36.1
	Zinc (Zn) (mg/kg)	111	116		112	107
Aggregate Organics	Mineral Oil and Grease (mg/kg)			<2300		
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 (%)			88.2		
	Surrogate: Chrysene d12 (%)			106.2		
	Surrogate: Naphthalene d8 (%)			78.1		
	Surrogate: Phenanthrene d10 (%)			102.4		
	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	L1360541-21	L1360541-22	L1360541-23	L1360541-24	L1360541-25
	Description	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT
	Sampled Date	24-AUG-13	24-AUG-13	24-AUG-13	24-AUG-13	25-AUG-13
	Sampled Time					
	Client ID	TEFF-3	TEFF-4	TEFF-5	TEFF-COMP	SP-1
Grouping	**Analyte**					
SOIL						
Metals	Uranium (U) (mg/kg)	24.8	23.9	23.8		19.6
	Vanadium (V) (mg/kg)	37.8	37.0	38.4		40.5
	Zinc (Zn) (mg/kg)	108	110	110		119
Aggregate Organics	Mineral Oil and Grease (mg/kg)				<1300	
Hydrocarbons	EPH10-19 (mg/kg)				<560 DLHM	
	EPH19-32 (mg/kg)				<560 DLHM	
	LEPH (mg/kg)				<560	
	HEPH (mg/kg)				<560	
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 (%)				82.0	
	Surrogate: Chrysene d12 (%)				99.5	
	Surrogate: Naphthalene d8 (%)				71.9	
	Surrogate: Phenanthrene d10 (%)				96.7	
	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

Grouping	Analyte	L1360541-26 SEDIMENT 25-AUG-13 SP-2	L1360541-27 SEDIMENT 25-AUG-13 SP-3	L1360541-28 SEDIMENT 25-AUG-13 SP-4	L1360541-29 SEDIMENT 25-AUG-13 SP-5	L1360541-30 SEDIMENT 25-AUG-13 SP-COMP
SOIL						
Metals	Uranium (U) (mg/kg)	16.4	20.8	17.7	23.0	
	Vanadium (V) (mg/kg)	36.7	42.6	38.9	45.6	
	Zinc (Zn) (mg/kg)	107	118	111	127	
Aggregate Organics	Mineral Oil and Grease (mg/kg)					<1700
Hydrocarbons	EPH10-19 (mg/kg)					<600 DLHM
	EPH19-32 (mg/kg)					<600 DLHM
	LEPH (mg/kg)					<600
	HEPH (mg/kg)					<600
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 (%)					84.5
	Surrogate: Chrysene d12 (%)					98.1
	Surrogate: Naphthalene d8 (%)					73.6
	Surrogate: Phenanthrene d10 (%)					96.5
	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	L1360541-31	L1360541-32	L1360541-33	L1360541-34	L1360541-35
	Description	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT
	Sampled Date	23-AUG-13	23-AUG-13	23-AUG-13	23-AUG-13	23-AUG-13
	Sampled Time					
	Client ID	INUG-1	INUG-2	INUG-3	INUG-4	INUG-5
Grouping	**Analyte**					
SOIL						
Metals	Uranium (U) (mg/kg)	14.1	15.4	14.0	16.0	11.8
	Vanadium (V) (mg/kg)	30.8	33.0	32.6	35.1	26.8
	Zinc (Zn) (mg/kg)	85.5	85.4	78.4	88.0	61.4
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	L1360541-36	L1360541-37	L1360541-38	L1360541-39	L1360541-40
	Description	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT
	Sampled Date	23-AUG-13	23-AUG-13	23-AUG-13	23-AUG-13	23-AUG-13
	Sampled Time					
	Client ID	INUG-COMP	PDL-1	PDL-2	PDL-3	PDL-4
Grouping	**Analyte**					
SOIL						
Metals	Uranium (U) (mg/kg)		9.07	7.57	7.57	11.4
	Vanadium (V) (mg/kg)		36.2	32.5	33.0	41.9
	Zinc (Zn) (mg/kg)		76.8	76.8	77.7	91.2
Aggregate Organics	Mineral Oil and Grease (mg/kg)	<1700				
Hydrocarbons	EPH10-19 (mg/kg)	<560 DLHM				
	EPH19-32 (mg/kg)	<560 DLHM				
	LEPH (mg/kg)	<560				
	HEPH (mg/kg)	<560				
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 (%)	83.5				
	Surrogate: Chrysene d12 (%)	100.2				
	Surrogate: Naphthalene d8 (%)	72.4				
	Surrogate: Phenanthrene d10 (%)	100.4				
	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	L1360541-41 SEDIMENT 23-AUG-13 PDL-5	L1360541-42 SEDIMENT 23-AUG-13 PDL-COMP	L1360541-43 SEDIMENT 29-AUG-13 BBD-1	L1360541-44 SEDIMENT 29-AUG-13 BBD-2	L1360541-45 SEDIMENT 29-AUG-13 BBD-3
SOIL						
Metals	Uranium (U) (mg/kg)	10.5		0.851	0.514	2.23
	Vanadium (V) (mg/kg)	39.0		15.0	10.7	22.8
	Zinc (Zn) (mg/kg)	85.3		21.9	17.3	28.3
Aggregate Organics	Mineral Oil and Grease (mg/kg)		<1200			
Hydrocarbons	EPH10-19 (mg/kg)		<440 DLHM			
	EPH19-32 (mg/kg)		<440 DLHM			
	LEPH (mg/kg)		<440			
	HEPH (mg/kg)		<440			
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 (%)		85.7			
	Surrogate: Chrysene d12 (%)		103.5			
	Surrogate: Naphthalene d8 (%)		73.4			
	Surrogate: Phenanthrene d10 (%)		101.2			
	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	L1360541-46	L1360541-47	L1360541-48	L1360541-49	L1360541-50
	Description	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT
	Sampled Date	29-AUG-13	29-AUG-13	29-AUG-13	29-AUG-13	29-AUG-13
	Sampled Time					
	Client ID	BBD-4	BBD-5	BBD-COMP	BPJ-1	BPJ-2
Grouping	**Analyte**					
SOIL						
Metals	Uranium (U) (mg/kg)	0.441	0.679		1.48	1.60
	Vanadium (V) (mg/kg)	10.1	12.8		20.9	24.7
	Zinc (Zn) (mg/kg)	16.6	20.5		31.3	34.4
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 (%)			82.6		
	Surrogate: Chrysene d12 (%)			112.8		
	Surrogate: Naphthalene d8 (%)			80.3		
	Surrogate: Phenanthrene d10 (%)			97.2		
	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	L1360541-51 SEDIMENT 29-AUG-13 BPJ-3	L1360541-52 SEDIMENT 29-AUG-13 BPJ-4	L1360541-53 SEDIMENT 29-AUG-13 BPJ-5	L1360541-54 SEDIMENT 29-AUG-13 BPJ-COMP	L1360541-55 SEDIMENT 30-AUG-13 BAP-1
SOIL						
Metals	Uranium (U) (mg/kg)	1.99	2.49	2.04		1.47
	Vanadium (V) (mg/kg)	26.5	30.2	25.4		19.3
	Zinc (Zn) (mg/kg)	42.1	43.8	37.0		22.4
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)				0.012	
	Benzo(b)fluoranthene (mg/kg)				0.017	
	Benzo(b+j+k)fluoranthene (mg/kg)				0.017	
	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 (%)				83.2	
	Surrogate: Chrysene d12 (%)				115.0	
	Surrogate: Naphthalene d8 (%)				80.8	
	Surrogate: Phenanthrene d10 (%)				100.2	
	B(a)P Total Potency Equivalent (mg/kg)				<0.020	
	IACR (CCME) (mg/kg)				0.20	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1360541-56	L1360541-57	L1360541-58	L1360541-59	L1360541-60
	Description	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT
	Sampled Date	30-AUG-13	30-AUG-13	30-AUG-13	30-AUG-13	30-AUG-13
	Sampled Time					
	Client ID	BAP-2	BAP-3	BAP-4	BAP-5	BAP-COMP
Grouping	**Analyte**					
SOIL						
Metals	Uranium (U) (mg/kg)	1.34	1.22	1.67	1.57	
	Vanadium (V) (mg/kg)	19.6	20.0	22.5	20.5	
	Zinc (Zn) (mg/kg)	24.5	21.4	28.6	25.7	
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 (%)					84.1
	Surrogate: Chrysene d12 (%)					109.6
	Surrogate: Naphthalene d8 (%)					79.3
	Surrogate: Phenanthrene d10 (%)					98.8
	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	L1360541-61	L1360541-62	L1360541-63	L1360541-64	L1360541-65
	Description	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT
	Sampled Date	30-AUG-13	30-AUG-13	30-AUG-13	30-AUG-13	30-AUG-13
	Sampled Time					
	Client ID	BES-1	BES-2	BES-3	BES-4	BES-5
Grouping	**Analyte**					
SOIL						
Metals	Uranium (U) (mg/kg)	1.03	1.08	1.34	1.14	1.24
	Vanadium (V) (mg/kg)	17.3	19.8	20.2	18.8	19.1
	Zinc (Zn) (mg/kg)	21.6	21.7	23.7	23.1	23.7
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	L1360541-66	L1360541-67	L1360541-68	L1360541-69	L1360541-70
	Description	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT
	Sampled Date	30-AUG-13	27-AUG-13	27-AUG-13	27-AUG-13	27-AUG-13
	Sampled Time					
	Client ID	BES-COMP	TPS-1	TPS-2	TPS-3	TPS-4
Grouping	**Analyte**					
SOIL						
Metals	Uranium (U) (mg/kg)		18.6	13.9	16.5	17.2
	Vanadium (V) (mg/kg)		40.0	32.6	38.7	37.6
	Zinc (Zn) (mg/kg)		104	77.8	104	124
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 (%)	78.5				
	Surrogate: Chrysene d12 (%)	107.0				
	Surrogate: Naphthalene d8 (%)	73.9				
	Surrogate: Phenanthrene d10 (%)	93.8				
	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

Grouping	Analyte	Sample ID: L1360541-71 Description: SEDIMENT Sampled Date: 27-AUG-13 Client ID: TPS-5	Sample ID: L1360541-72 Description: SEDIMENT Sampled Date: 27-AUG-13 Client ID: TPS-COMP	Sample ID: L1360541-73 Description: SEDIMENT Sampled Date: 28-AUG-13 Client ID: TPN-1	Sample ID: L1360541-74 Description: SEDIMENT Sampled Date: 28-AUG-13 Client ID: TPN-2	Sample ID: L1360541-75 Description: SEDIMENT Sampled Date: 28-AUG-13 Client ID: TPN-3
SOIL						
Metals	Uranium (U) (mg/kg)	16.7		11.4	9.10	11.3
	Vanadium (V) (mg/kg)	36.1		27.5	23.1	27.9
	Zinc (Zn) (mg/kg)	93.7		61.6	51.6	63.5
Aggregate Organics	Mineral Oil and Grease (mg/kg)		<1600			
Hydrocarbons	EPH10-19 (mg/kg)		<640 DLHM			
	EPH19-32 (mg/kg)		<640 DLHM			
	LEPH (mg/kg)		<640			
	HEPH (mg/kg)		<640			
Polycyclic Aromatic Hydrocarbons	Acenaphthene (mg/kg)		<0.010 DLHM			
	Acenaphthylene (mg/kg)		<0.010 DLHM			
	Anthracene (mg/kg)		<0.0080 DLHM			
	Benz(a)anthracene (mg/kg)		<0.020 DLHM			
	Benzo(a)pyrene (mg/kg)		<0.020 DLHM			
	Benzo(b)fluoranthene (mg/kg)		<0.020 DLHM			
	Benzo(b+j+k)fluoranthene (mg/kg)		<0.028			
	Benzo(g,h,i)perylene (mg/kg)		<0.020 DLHM			
	Benzo(k)fluoranthene (mg/kg)		<0.020 DLHM			
	Chrysene (mg/kg)		<0.020 DLHM			
	Dibenz(a,h)anthracene (mg/kg)		<0.010 DLHM			
	Fluoranthene (mg/kg)		<0.020 DLHM			
	Fluorene (mg/kg)		<0.020 DLHM			
	Indeno(1,2,3-c,d)pyrene (mg/kg)		<0.020 DLHM			
	2-Methylnaphthalene (mg/kg)		<0.020 DLHM			
	Naphthalene (mg/kg)		<0.020 DLHM			
	Phenanthrene (mg/kg)		<0.020 DLHM			
	Pyrene (mg/kg)		<0.020 DLHM			
	Surrogate: Acenaphthene d10 (%)		90.2			
	Surrogate: Chrysene d12 (%)		110.4			
	Surrogate: Naphthalene d8 (%)		90.9			
	Surrogate: Phenanthrene d10 (%)		101.6			
	B(a)P Total Potency Equivalent (mg/kg)		<0.020			
	IACR (CCME) (mg/kg)		<0.21			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1360541-76 SEDIMENT 28-AUG-13 TPN-4	L1360541-77 SEDIMENT 28-AUG-13 TPN-5	L1360541-78 SEDIMENT 28-AUG-13 TPN-COMP	L1360541-79 SEDIMENT DUP-1	L1360541-81 SEDIMENT DUP-2
SOIL						
Metals	Uranium (U) (mg/kg)	13.3	9.15		14.2	18.1
	Vanadium (V) (mg/kg)	33.4	26.2		30.5	33.1
	Zinc (Zn) (mg/kg)	83.6	62.1		83.7	128
Aggregate Organics	Mineral Oil and Grease (mg/kg)			<850		
Hydrocarbons	EPH10-19 (mg/kg)			<320 DLHM		
	EPH19-32 (mg/kg)			<320 DLHM		
	LEPH (mg/kg)			<320		
	HEPH (mg/kg)			<320		
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)			0.022		
	Phenanthrene (mg/kg)			<0.010		
	Pyrene (mg/kg)			<0.010		
	Surrogate: Acenaphthene d10 (%)			81.1		
	Surrogate: Chrysene d12 (%)			101.0		
	Surrogate: Naphthalene d8 (%)			78.7		
	Surrogate: Phenanthrene d10 (%)			90.5		
	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	L1360541-83	L1360541-85	L1360541-87	L1360541-89	L1360541-91
Description	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT
Sampled Date					
Sampled Time					
Client ID	DUP-3	DUP-4	DUP-5	DUP-6	DUP-7
Grouping / **Analyte**					
SOIL					
Metals / Uranium (U) (mg/kg)	24.6	17.0	1.54	1.36	20.9
Vanadium (V) (mg/kg)	38.0	37.9	22.2	20.2	45.4
Zinc (Zn) (mg/kg)	108	112	36.8	23.2	108
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	L1360541-93				
	Description	SEDIMENT				
	Sampled Date					
	Sampled Time					
	Client ID	DUP-8				
Grouping	**Analyte**					
SOIL						
Metals	Uranium (U) (mg/kg)	12.7				
	Vanadium (V) (mg/kg)	30.2				
	Zinc (Zn) (mg/kg)	69.3				
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

Grouping	Analyte	Sample ID: L1360541-80 / Description: OTHER / Sampled Date / Sampled Time / Client ID: SWIPE-1	L1360541-82 OTHER SWIPE-2	L1360541-84 OTHER SWIPE-3	L1360541-86 OTHER SWIPE-4	L1360541-88 OTHER SWIPE-5
SWAB						
Metals	Aluminum (Al)-Total (ug)	<20	<20	<20	<20	<20
	Antimony (Sb)-Total (ug)	<20	<20	<20	<20	<20
	Arsenic (As)-Total (ug)	<20	<20	<20	<20	<20
	Barium (Ba)-Total (ug)	<1.0	<1.0	<1.0	<1.0	<1.0
	Beryllium (Be)-Total (ug)	<0.50	<0.50	<0.50	<0.50	<0.50
	Bismuth (Bi)-Total (ug)	<20	<20	<20	<20	<20
	Cadmium (Cd)-Total (ug)	<1.0	<1.0	<1.0	<1.0	<1.0
	Calcium (Ca)-Total (ug)	51.8	54.7	46.4	57.3	45.0
	Chromium (Cr)-Total (ug)	3.7	3.6	4.6	2.3	<2.0
	Cobalt (Co)-Total (ug)	<1.0	<1.0	<1.0	<1.0	<1.0
	Copper (Cu)-Total (ug)	<1.0	<1.0	<1.0	<1.0	<1.0
	Iron (Fe)-Total (ug)	42.3	35.4	42.9	23.8	20.8
	Lead (Pb)-Total (ug)	<5.0	<5.0	<5.0	<5.0	<5.0
	Lithium (Li)-Total (ug)	<1.0	<1.0	<1.0	<1.0	<1.0
	Magnesium (Mg)-Total (ug)	24	20	20	23	25
	Manganese (Mn)-Total (ug)	1.06	0.70	1.61	0.67	1.76
	Mercury (Hg)-Total (ug)	<0.010	<0.010	<0.010	<0.010	<0.010
	Molybdenum (Mo)-Total (ug)	<3.0	<3.0	<3.0	<3.0	<3.0
	Nickel (Ni)-Total (ug)	<5.0	<5.0	<5.0	<5.0	<5.0
	Phosphorus (P)-Total (ug)	<30	<30	<30	<30	<30
	Potassium (K)-Total (ug)	<200	<200	<200	<200	<200
	Selenium (Se)-Total (ug)	<20	<20	<20	<20	<20
	Silver (Ag)-Total (ug)	<1.0	<1.0	<1.0	<1.0	<1.0
	Sodium (Na)-Total (ug)	<200	<200	<200	<200	220
	Strontium (Sr)-Total (ug)	<0.50	<0.50	<0.50	<0.50	<0.50
	Thallium (Tl)-Total (ug)	<20	<20	<20	<20	<20
	Tin (Sn)-Total (ug)	3.2	<3.0	<3.0	<3.0	<3.0
	Titanium (Ti)-Total (ug)	<1.0	<1.0	<1.0	<1.0	<1.0
	Vanadium (V)-Total (ug)	<3.0	<3.0	<3.0	<3.0	<3.0
	Zinc (Zn)-Total (ug)	1.19	<0.50	0.63	<0.50	<0.50

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	Sample ID: L1360541-90	L1360541-92	L1360541-94		
		Description: OTHER	OTHER	OTHER		
		Sampled Date:				
		Sampled Time:				
		Client ID: SWIPE-6	SWIPE-7	SWIPE-8		
SWAB						
Metals	Aluminum (Al)-Total (ug)	<20	<20	<20		
	Antimony (Sb)-Total (ug)	<20	<20	<20		
	Arsenic (As)-Total (ug)	<20	<20	<20		
	Barium (Ba)-Total (ug)	<1.0	<1.0	<1.0		
	Beryllium (Be)-Total (ug)	<0.50	<0.50	<0.50		
	Bismuth (Bi)-Total (ug)	<20	<20	<20		
	Cadmium (Cd)-Total (ug)	<1.0	<1.0	<1.0		
	Calcium (Ca)-Total (ug)	35.4	40.3	35.5		
	Chromium (Cr)-Total (ug)	2.7	<2.0	2.2		
	Cobalt (Co)-Total (ug)	<1.0	<1.0	<1.0		
	Copper (Cu)-Total (ug)	<1.0	<1.0	<1.0		
	Iron (Fe)-Total (ug)	18.7	16.5	23.7		
	Lead (Pb)-Total (ug)	<5.0	<5.0	<5.0		
	Lithium (Li)-Total (ug)	<1.0	<1.0	<1.0		
	Magnesium (Mg)-Total (ug)	17	12	15		
	Manganese (Mn)-Total (ug)	0.50	<0.50	0.73		
	Mercury (Hg)-Total (ug)	<0.010	<0.010	<0.010		
	Molybdenum (Mo)-Total (ug)	<3.0	<3.0	<3.0		
	Nickel (Ni)-Total (ug)	<5.0	<5.0	<5.0		
	Phosphorus (P)-Total (ug)	<30	<30	<30		
	Potassium (K)-Total (ug)	<200	<200	<200		
	Selenium (Se)-Total (ug)	<20	<20	<20		
	Silver (Ag)-Total (ug)	<1.0	<1.0	<1.0		
	Sodium (Na)-Total (ug)	<200	<200	<200		
	Strontium (Sr)-Total (ug)	<0.50	<0.50	<0.50		
	Thallium (Tl)-Total (ug)	<20	<20	<20		
	Tin (Sn)-Total (ug)	<3.0	<3.0	<3.0		
	Titanium (Ti)-Total (ug)	<1.0	<1.0	<1.0		
	Vanadium (V)-Total (ug)	<3.0	<3.0	<3.0		
	Zinc (Zn)-Total (ug)	<0.50	<0.50	<0.50		

* 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	Benz(a)anthracene	ABL	L1360541-60, -66
Duplicate	Benzo(a)pyrene	ABL	L1360541-60, -66
Duplicate	Benzo(b)fluoranthene	ABL	L1360541-60, -66
Duplicate	Benzo(g,h,i)perylene	ABL	L1360541-60, -66
Duplicate	Benzo(k)fluoranthene	ABL	L1360541-60, -66
Duplicate	Chrysene	ABL	L1360541-60, -66
Duplicate	Dibenz(a,h)anthracene	ABL	L1360541-60, -66
Duplicate	Indeno(1,2,3-c,d)pyrene	ABL	L1360541-60, -66
Duplicate	Pyrene	ABL	L1360541-60, -66
Duplicate	EPH10-19	DLHM	L1360541-12, -18, -24, -30, -36, -42
Duplicate	EPH19-32	DLHM	L1360541-12, -18, -24, -30, -36, -42
Duplicate	Tin (Sn)	DUP-H	L1360541-1, -2, -3, -4, -5, -67, -68, -69, -70, -71
Duplicate	pH (1:2 soil:water)	DUP-H	L1360541-76, -77
Duplicate	Antimony (Sb)	DUP-H	L1360541-43, -44, -45, -46, -47, -49, -50, -51, -52, -53
Duplicate	Phosphorus (P)	DUP-H	L1360541-43, -44, -45, -46, -47, -49, -50, -51, -52, -53
Duplicate	Calcium (Ca)	DUP-H	L1360541-55, -56, -57, -58
Duplicate	Antimony (Sb)	DUP-H	L1360541-59, -61, -62, -63, -64, -65
Duplicate	Antimony (Sb)	DUP-H	L1360541-87, -89, -91, -93
Duplicate	Bismuth (Bi)	DUP-H	L1360541-87, -89, -91, -93
Duplicate	Cobalt (Co)	DUP-H	L1360541-87, -89, -91, -93
Duplicate	Copper (Cu)	DUP-H	L1360541-87, -89, -91, -93
Duplicate	Lead (Pb)	DUP-H	L1360541-87, -89, -91, -93
Duplicate	Lithium (Li)	DUP-H	L1360541-87, -89, -91, -93
Duplicate	Nickel (Ni)	DUP-H	L1360541-87, -89, -91, -93
Duplicate	Silver (Ag)	DUP-H	L1360541-87, -89, -91, -93
Duplicate	Tin (Sn)	DUP-H	L1360541-87, -89, -91, -93
Duplicate	Titanium (Ti)	DUP-H	L1360541-87, -89, -91, -93

Qualifiers for Individual Parameters Listed:

Qualifier	Description
ABL	Approximate Result: May Be Biased Low
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-TOT-ORG-LECO-SK	Soil	Organic Carbon by combustion method	SSSA (1996) p. 973

Total Organic Carbon (C-TOT-ORG-LECO-SK, C-TOT-ORG-SK)

Total C and inorganic C are determined on separate samples. The total C is determined by combustion and thermal conductivity detection, while inorganic C is determined by weight lass after addition of hydrochloric acid. Organic C is calculated by the difference between these two determinations.

Reference for Total C:
Nelson, D.W. and Sommers, L.E. 1996. Total Carbon, organic carbon and organic matter. P. 961-1010 In: J.M. Bartels et al. (ed.) Methods of soil analysis: Part 3 Chemical methods. (3rd ed.) ASA and SSSA, Madison, WI. Book series no. 5

Reference for Inorganic C:
Loeppert, R.H. and Suarez, D.L. 1996. Gravimetric Method for Loss of Carbon Dioxide. P. 455-456 In: J.M. Bartels et al. (ed.) Methods of soil analysis: Part 3 Chemical methods. (3rd ed.) ASA and SSSA, Madison, WI. Book series no. 5

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).

Reference Information

HG-200.2-CVAF-VA Soil Mercury in Soil by CVAFS EPA 200.2/245.7

This analysis is carried out using procedures from CSR Analytical Method: "Strong Acid Leachable Metals (SALM) in Soil", BC Ministry of Environment, 26 June 2009, and procedures adapted from EPA Method 200.2. The sample is manually homogenized, dried at 60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed. The sample is then digested at 95 degrees Celsius for 2 hours by block digester using concentrated nitric and hydrochloric acids. Instrumental analysis is by atomic fluorescence spectrophotometry or atomic absorption spectrophotometry(EPA Method 245.7).

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. By design, elements bound in silicate structures are not normally dissolved by this procedure as they are not usually mobile in the environment.

HG-UG-CVAF-VA Swab Mercury in Swab by CVAFS NIOSH 7303/EPA 245.7

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 cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

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

This analysis is carried out using procedures from CSR Analytical Method: "Strong Acid Leachable Metals (SALM) in Soil", BC Ministry of Environment, 26 June 2009, and procedures adapted from EPA Method 200.2. The sample is manually homogenized, dried at 60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed. The sample is then digested at 95 degrees Celsius for 2 hours by block digester using concentrated nitric and hydrochloric acids. Instrumental analysis of the digested extract is by collision cell inductively coupled plasma - mass spectrometry (modifed from EPA Method 6020A).

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. By design, elements bound in silicate structures are not normally dissolved by this procedure as they are not usually mobile in the environment.

MET-UG-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 CWS MOG with Silica Gel 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 3545 & 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

Reference Information

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	7	8	9	

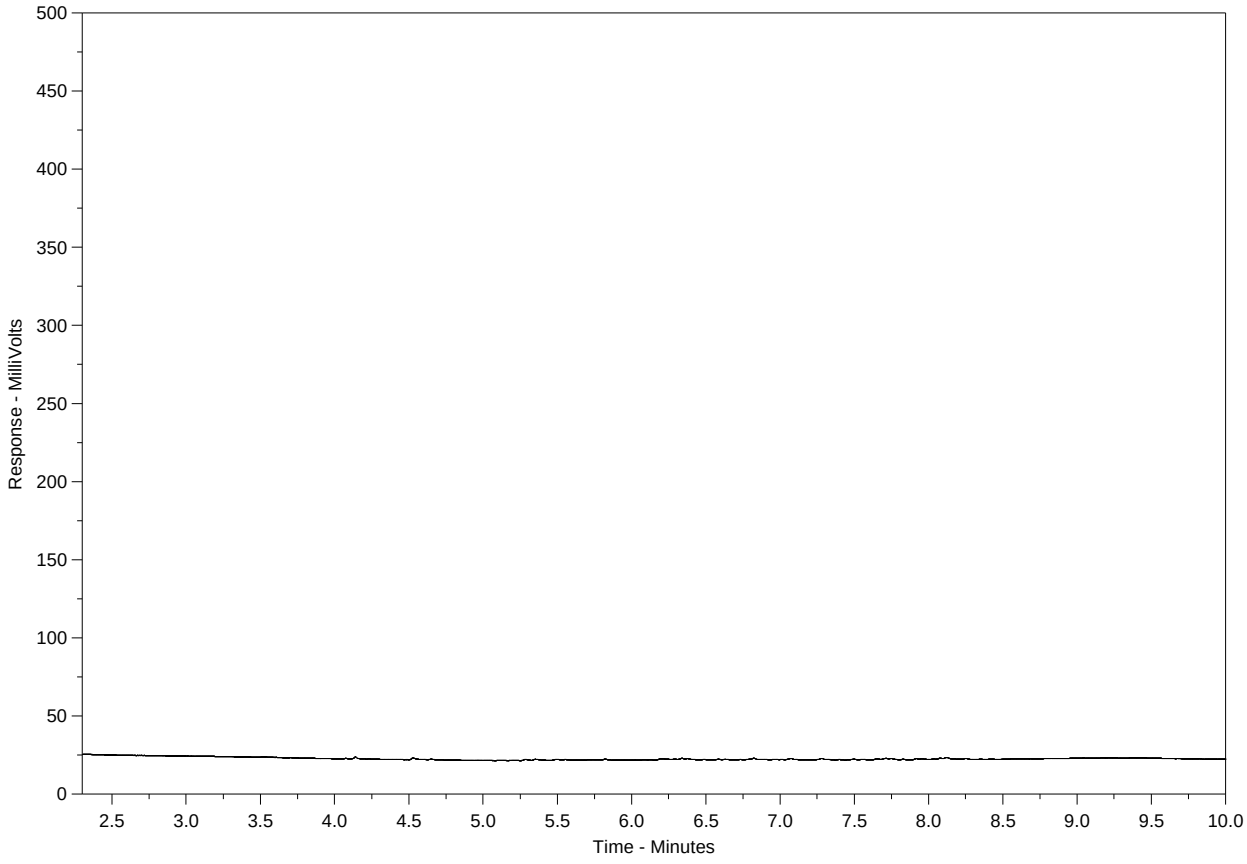
GLOSSARY OF REPORT TERMS

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: L1360541-6
Client Sample ID: TPE-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.

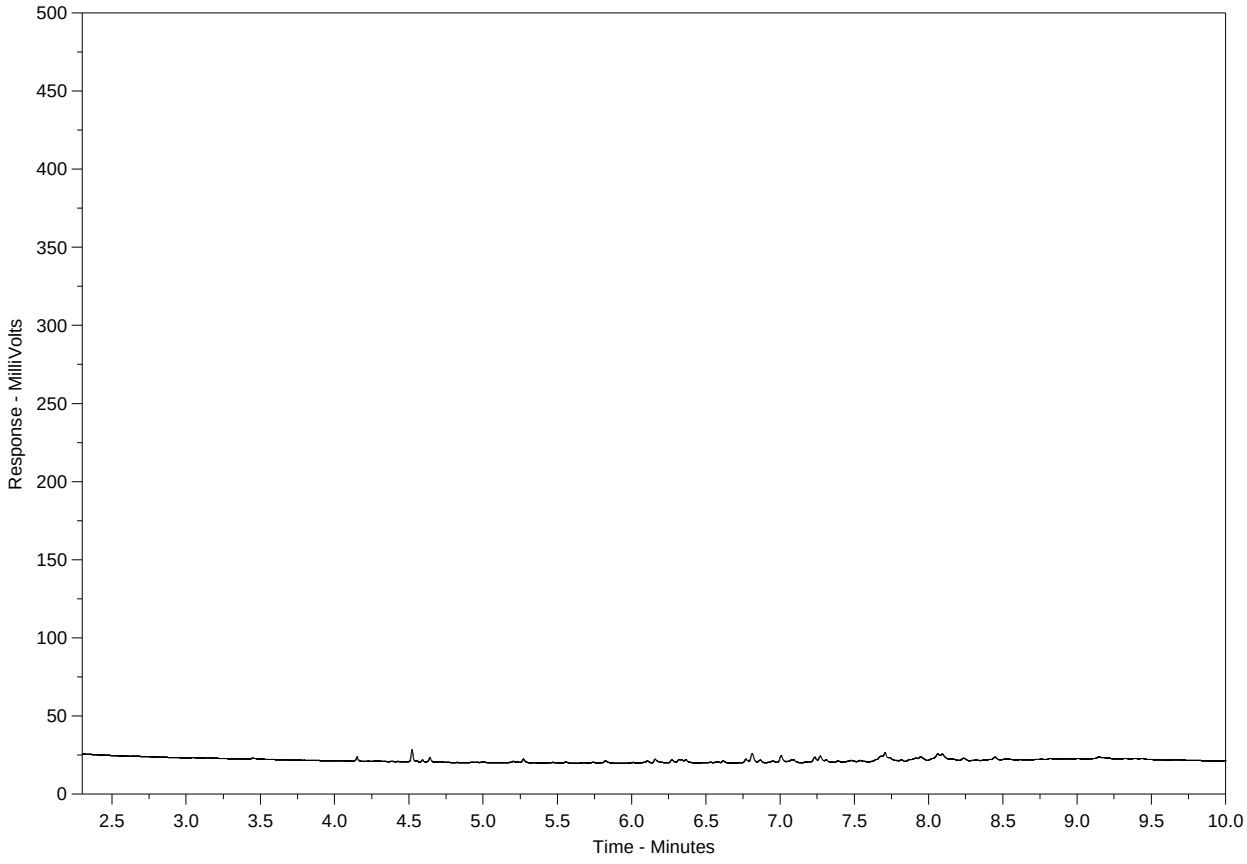
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

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: L1360541-12
Client Sample ID: WAL-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.

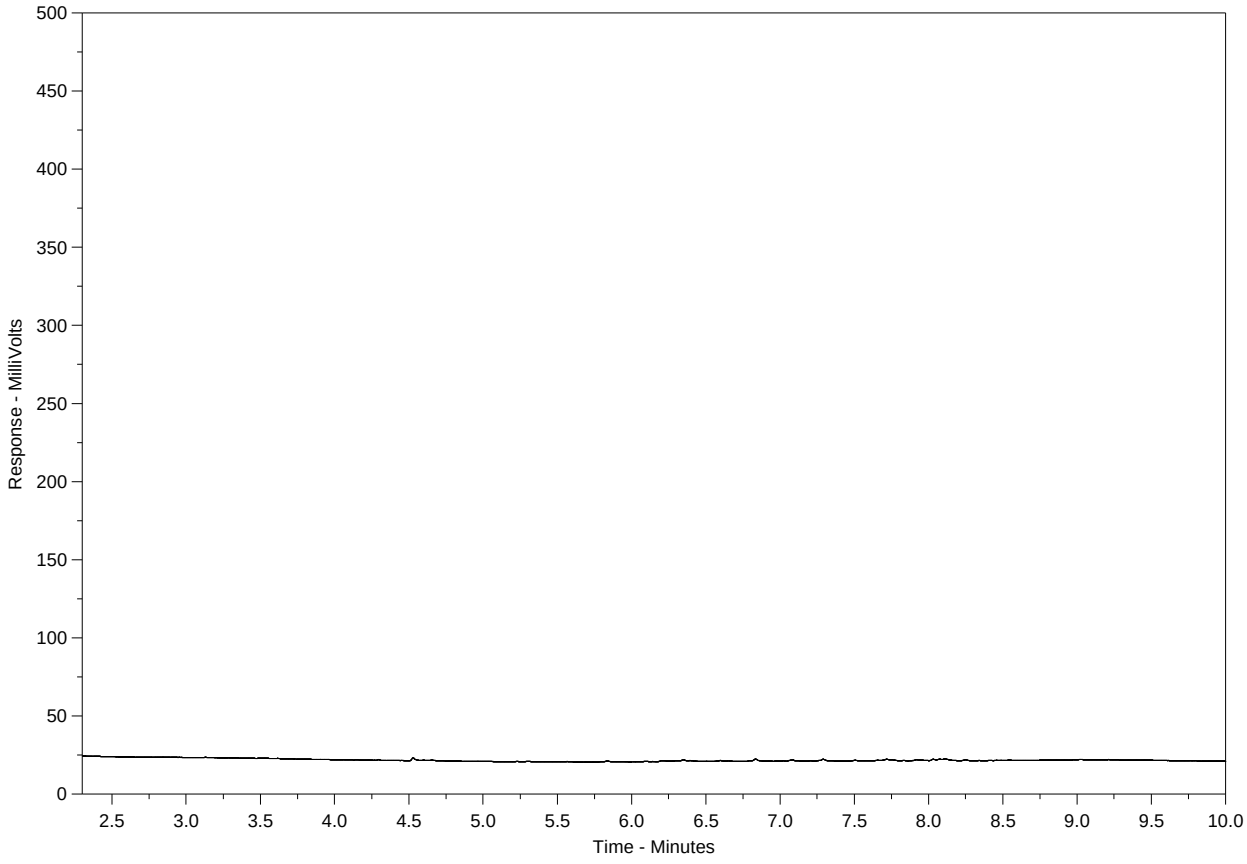
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

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: L1360541-18
Client Sample ID: TE-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.

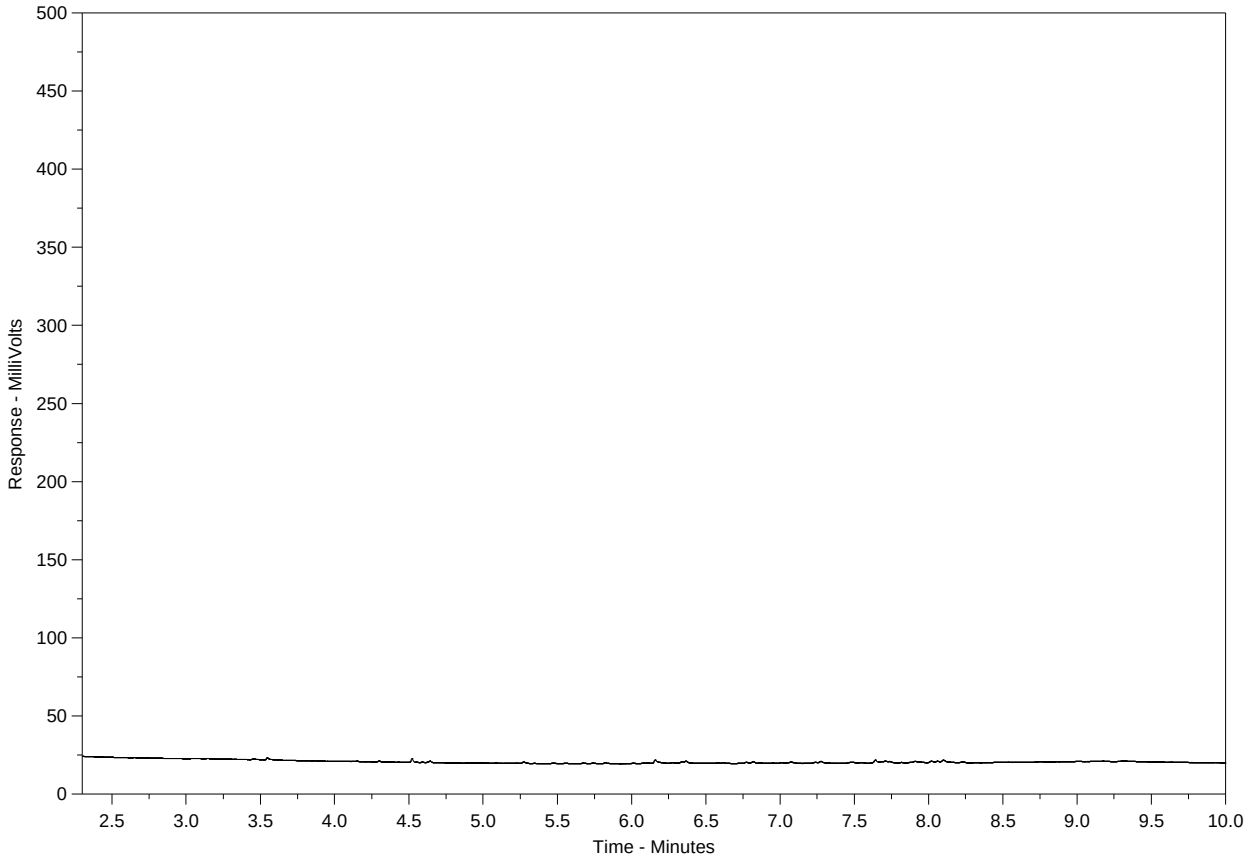
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

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: L1360541-24
Client Sample ID: TEFF-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.

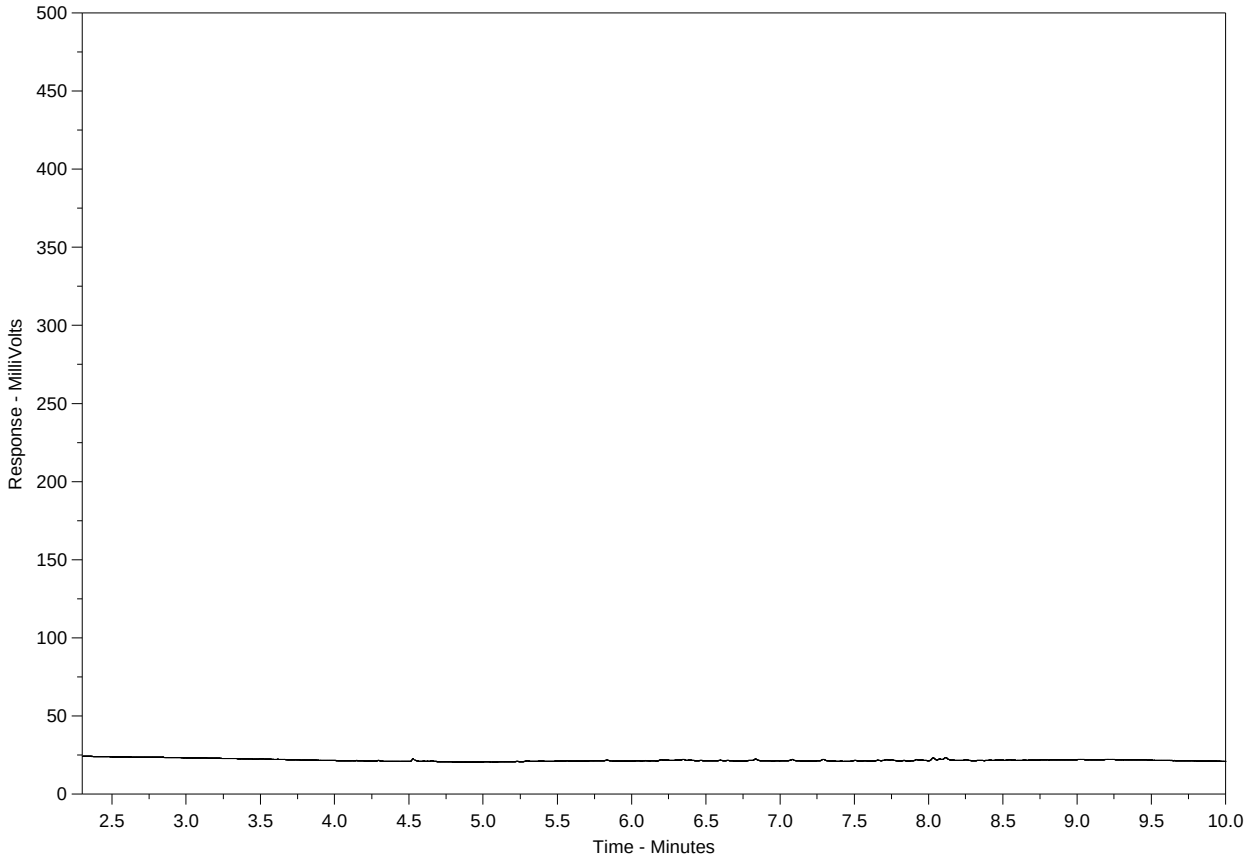
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

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: L1360541-30
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.

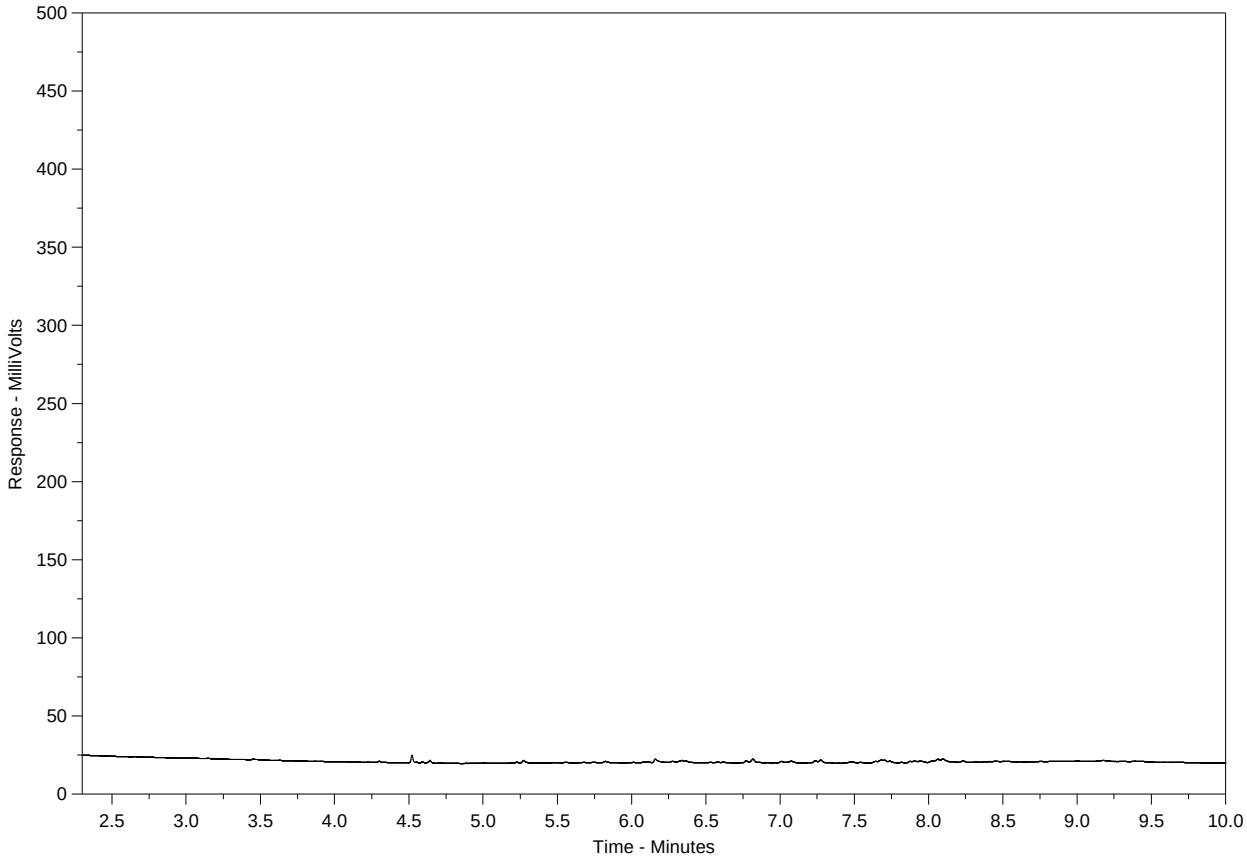
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

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: L1360541-36
Client Sample ID: INUG-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.

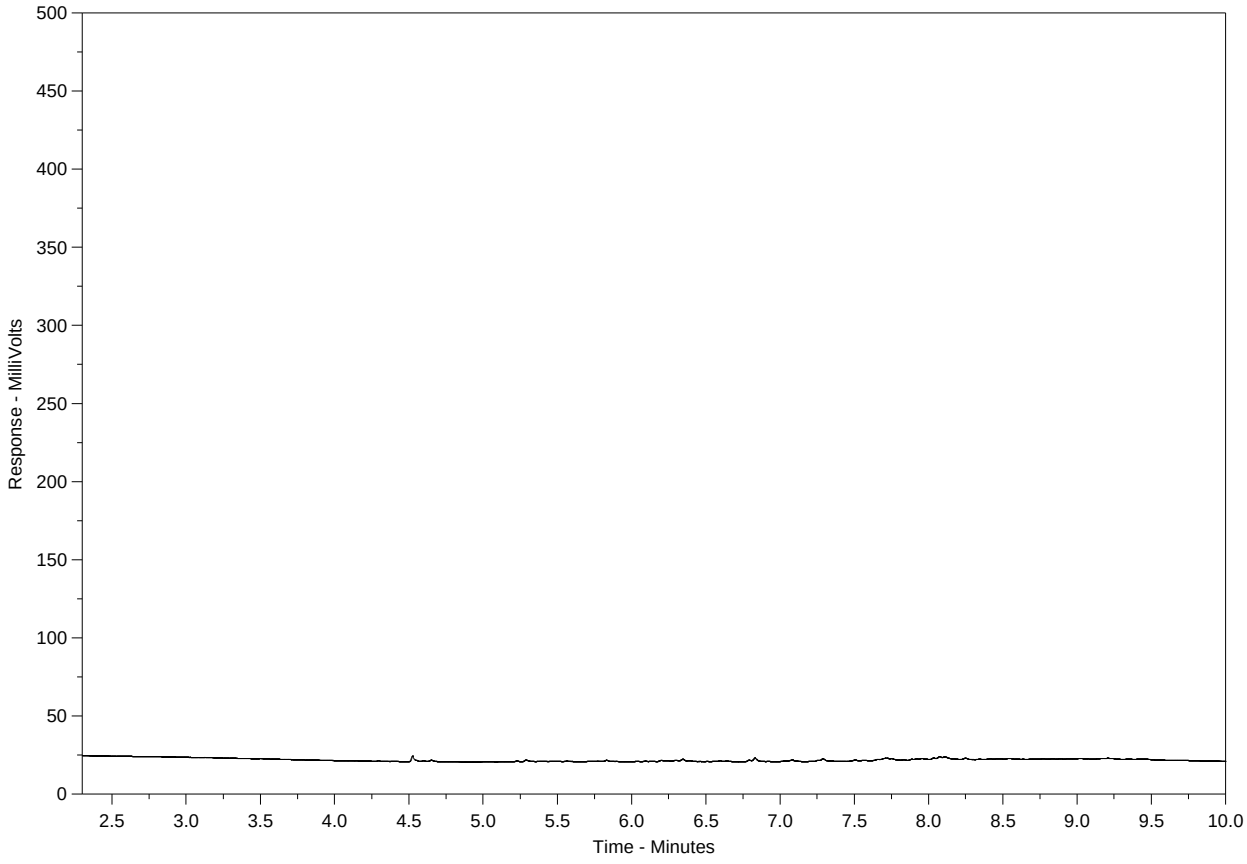
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

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: WG1746210-5#L1360541-36
Client Sample ID: INUG-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.

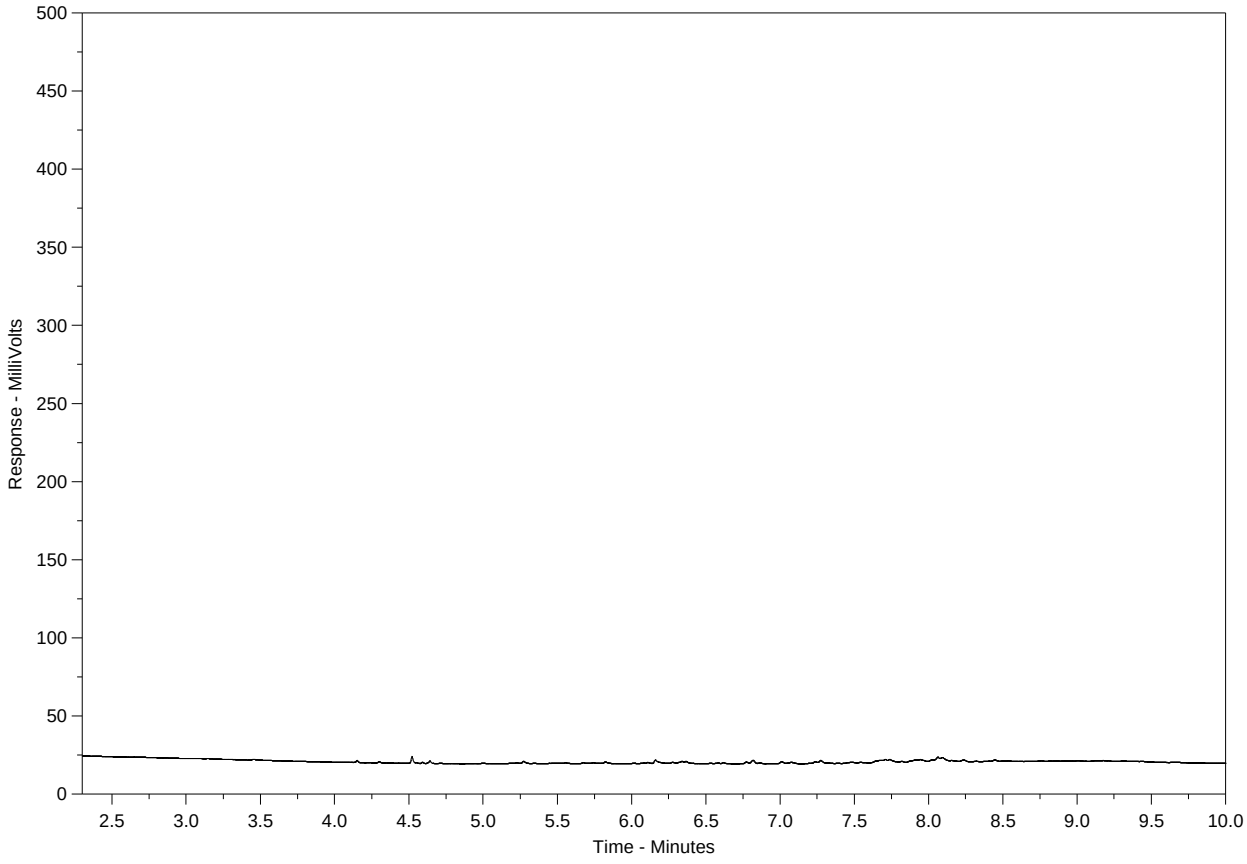
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

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: L1360541-42
Client Sample ID: PDL-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 →		

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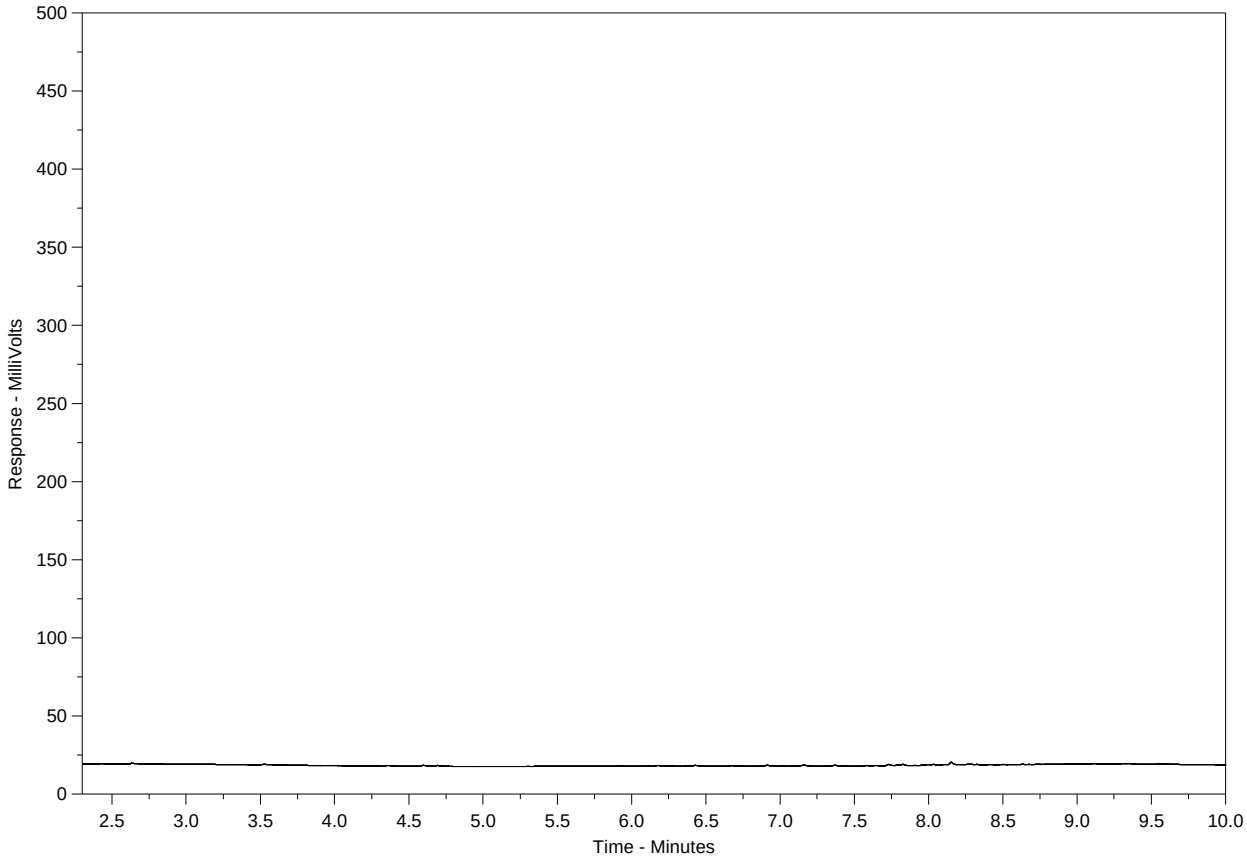
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

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: L1360541-48
Client Sample ID: BBD-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.

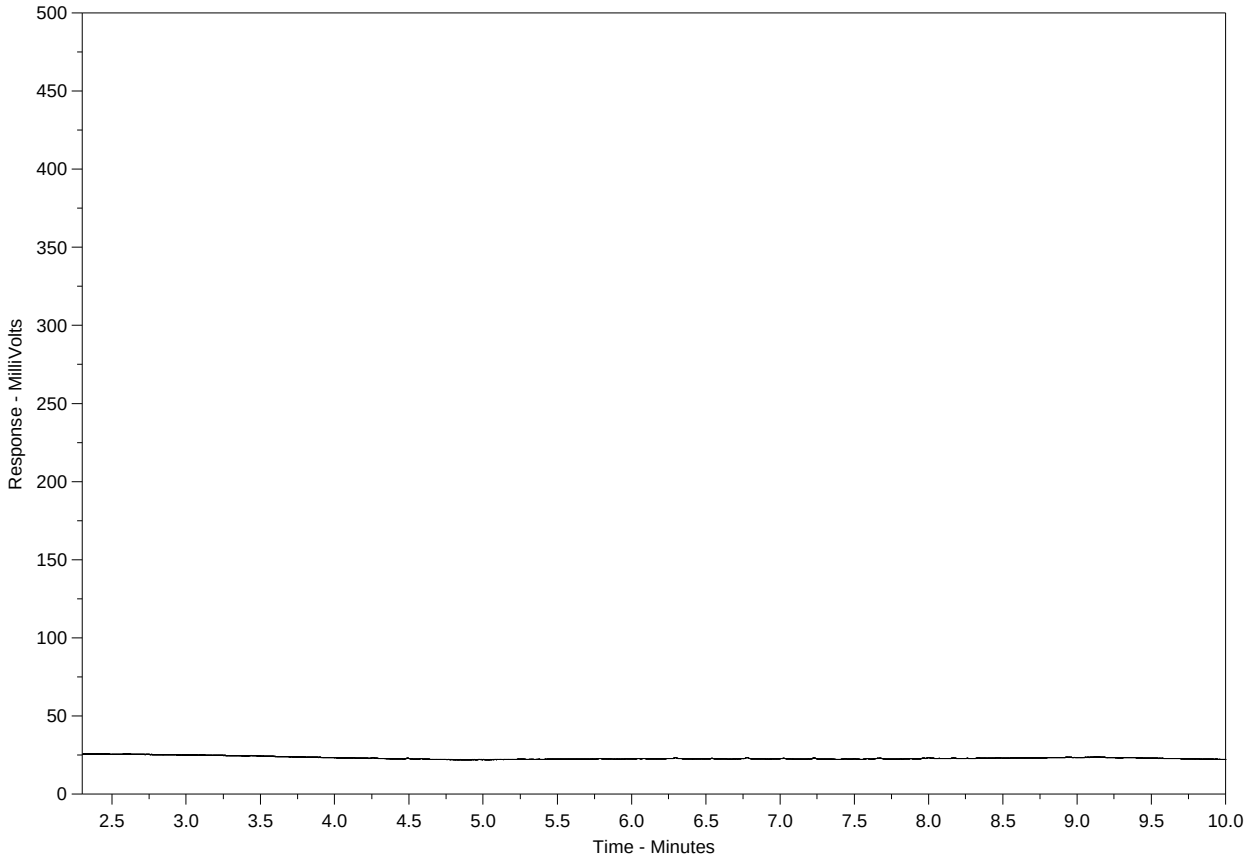
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

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: L1360541-54
Client Sample ID: BPJ-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.

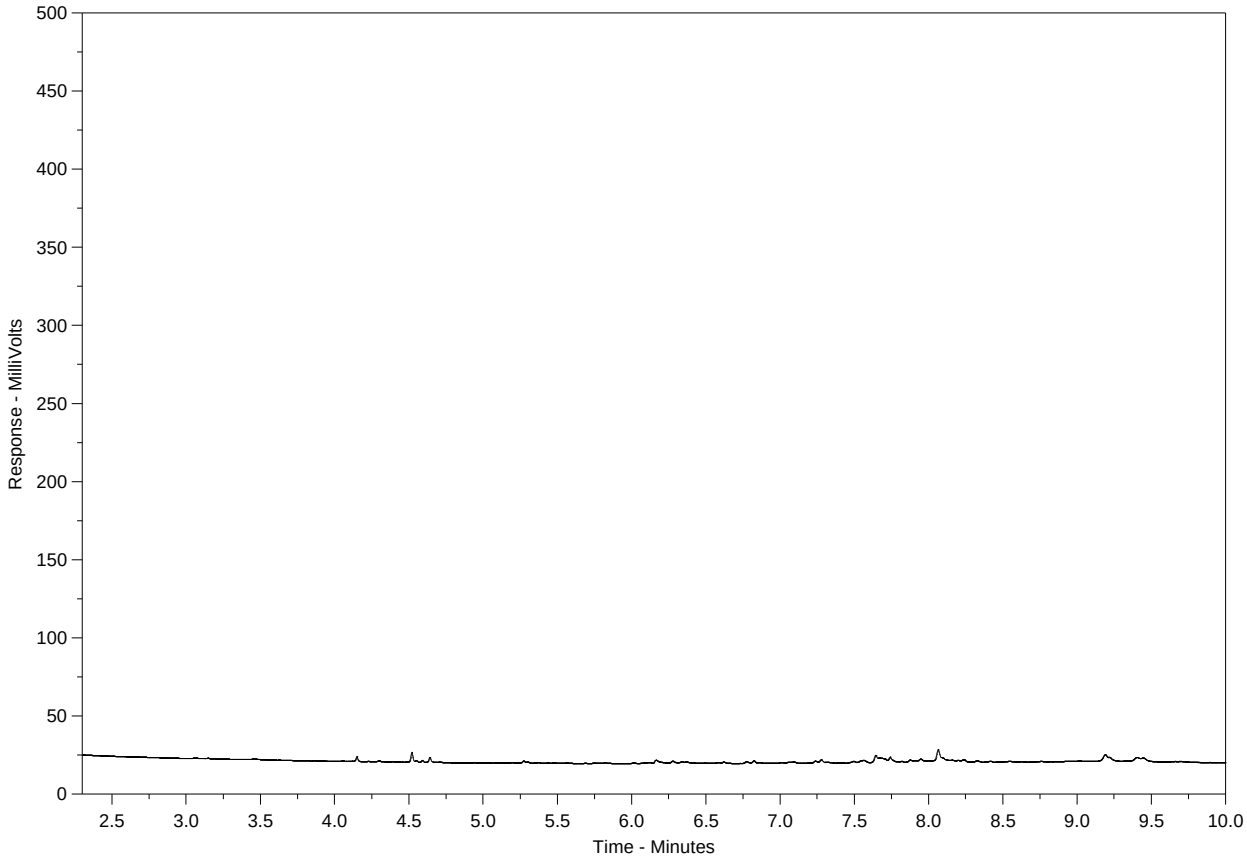
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

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: L1360541-60
Client Sample ID: BAP-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 →		

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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.

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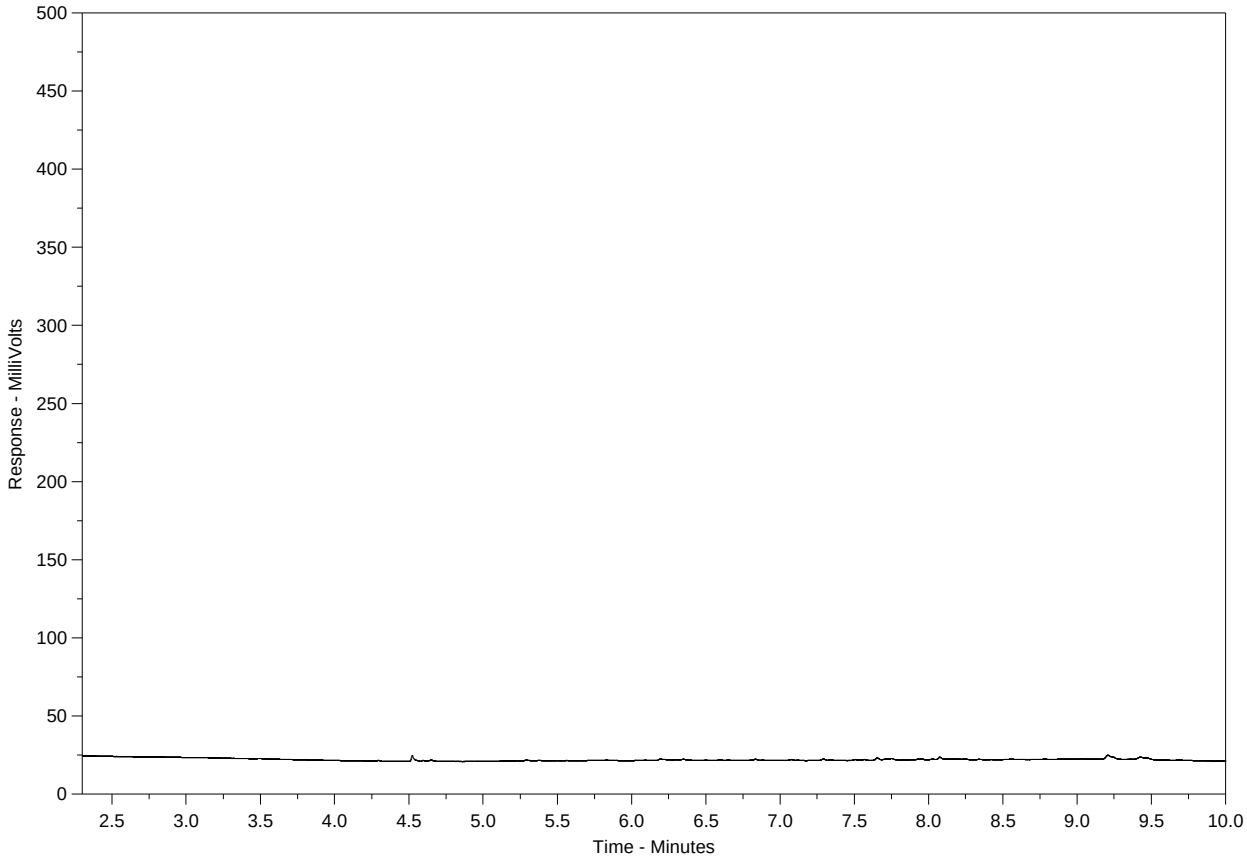
Hydrocarbon Distribution Report

ALS Sample ID: L1360541-66
Client Sample ID: BES-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.

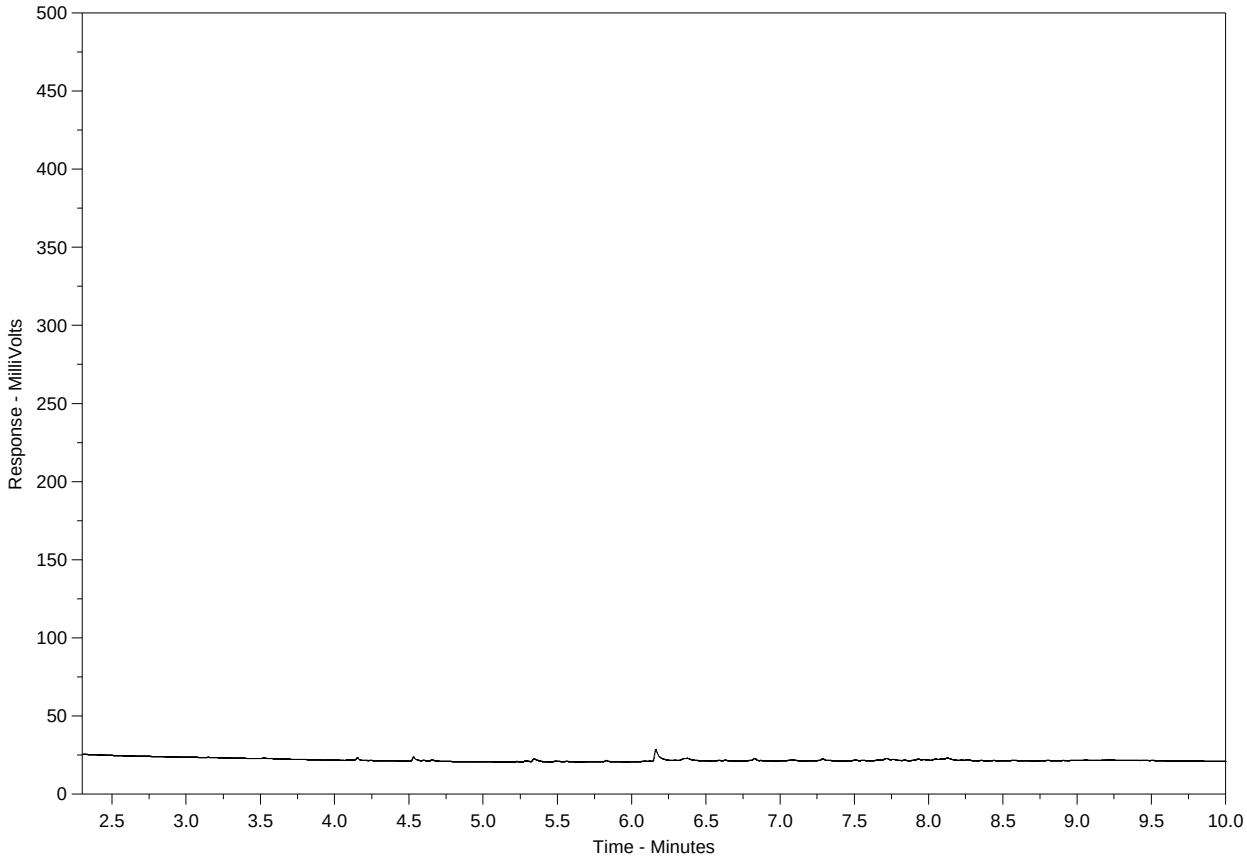
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

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: L1360541-72
Client Sample ID: TPS-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.

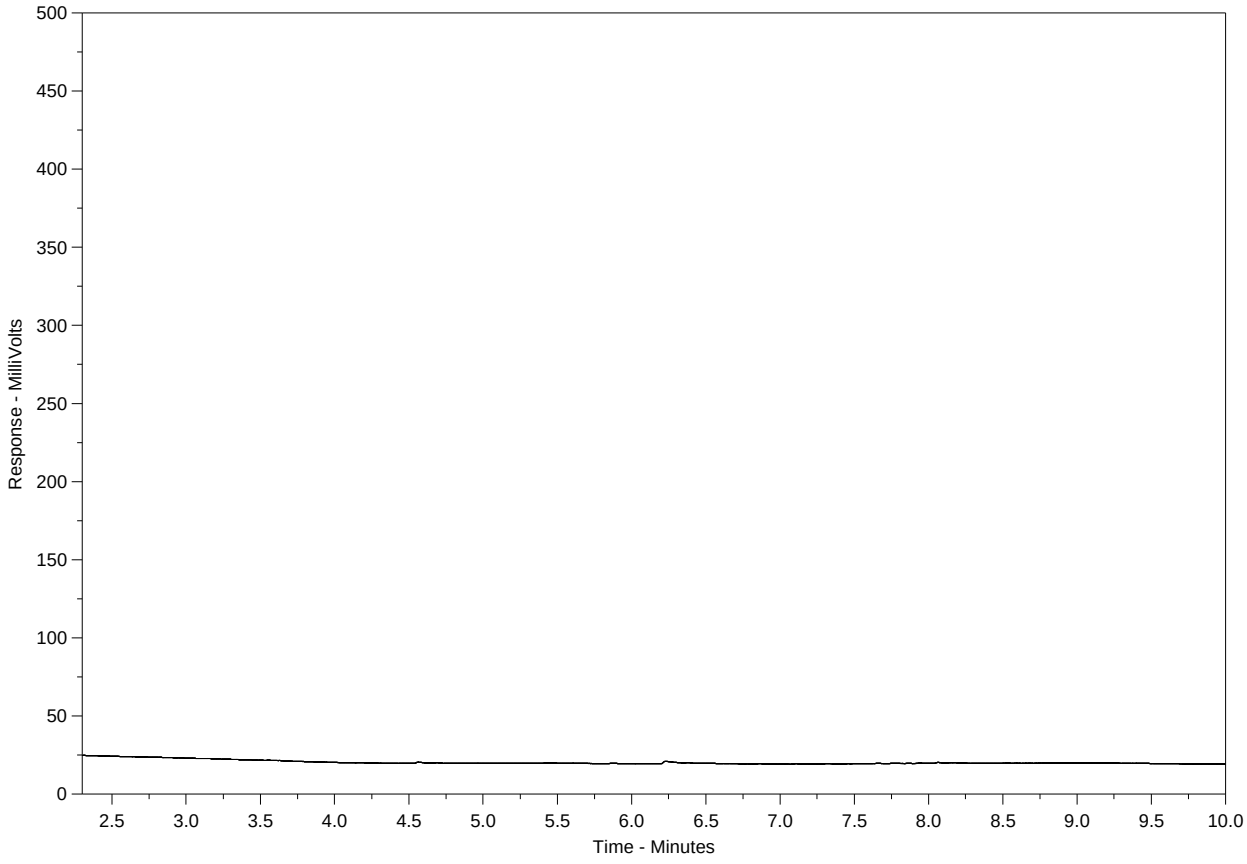
The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products, and three n-alkane hydrocarbon marker compounds. Retention times may vary between samples by as much as 0.5 minutes.

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: L1360541-78
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 →		

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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.

L1360541-COFC

Chain of Custody / Analytical Request Form
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www.alsglobal.com

COC # _____

Page 1 of 9

Report To		**Report Format / Distribution**	**Service Requested** (Rush for routine analysis subject to availability)
Company:	Azimuth Consulting Group	☑ Standard ☐ Other; ☑ PDF ☑ Excel ☐ Digital ☐ Fax	◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Laura Bekar / Gary Mann		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	#218 - 2902 West Broadway	Email 1: lbekar@azimuthgroup.ca	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC ☑ Yes ☐ No	Email 2: gmann@azimuthgroup.ca	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax: 604-739-8511	Email 3: ☐ Yes ☑ No	**Analysis Request**
Invoice To	Same as Report ?	**Client / Project Information**	Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?		Job #: **Meadowbank CREMP 2013**	
Company:		PO / AFE:	
Contact:		LSD:	
Address:			
Phone:	Fax:	Quote #: **Q38011**	
Lab Work Order # (lab use only)	L1360541	**ALS Contact:** Brent Mack	**Sampler:** MM, MF

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	MET-CCME+FULL - VA	MOISTURE & pH- VA	C-TOT-ORG-LECO - SK	PSA-PIPET+GRAVEL - SK	LEPH/HEPH/PAH-LOW - VA	OGG-TUMB-SG - VA							Number of Containers
[redacted]	TPE-1	27-Aug-13		Sediment	X	X	X	X									2
[redacted]	TPE-2	"		Sediment	X	X	X	X									2
[redacted]	TPE-3	"		Sediment	X	X	X	X									2
[redacted]	TPE-4	"		Sediment	X	X	X	X									2
[redacted]	TPE-5	"		Sediment	X	X	X	X									2
[redacted]	TPE-COMP	"		Sediment					X	X							1
[redacted]	WAL-1	26-Aug-13		Sediment	X	X	X	X									2
[redacted]	WAL-2	"		Sediment	X	X	X	X									2
[redacted]	WAL-3	"		Sediment	X	X	X	X									2
[redacted]	WAL-4	"		Sediment	X	X	X	X									2
[redacted]	WAL-5	"		Sediment	X	X	X	X									2
[redacted]	WAL-COMP	"		Sediment					X	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 maydelay 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 / preseration / 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
Morgan Finley	02-Sept-13		Christ	Sept 10	1105	19.1 °C				

L1360541-COFC

ALS Env.

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC # _____

Report To	☐ Standard ☐ Other	**Report Format / Distribution**	☑ PDF ☑ Excel ☐ Digital ☐ Fax
Company:	Azimuth Consulting Group		
Contact:	Laura Bekar / Gary Mann		
Address:	#218 - 2902 West Broadway	Email 1:	lbekar@azimuthgroup.ca
	Vancouver, BC ☑ Yes ☐ No	Email 2:	gmann@azimuthgroup.ca
Phone:	604-730-1220 Fax: 604-739-8511	Email 3:	☐ Yes ☑ No
Invoice To	Same as Report ?	**Client / Project Information**	
Hardcopy of Invoice with Report?		Job #:	**Meadowbank CREMP 2013**
Company:		PO / AFE:	
Contact:		LSD:	
Address:			
Phone:	Fax:	Quote #:	**Q38011**
Lab Work Order # (lab use only)	L1360541	**ALS Contact:** Brent Mack	**Sampler:** MM, MF

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	MET-CCME+FULL - VA	MOISTURE & pH- VA	C-TOT-ORG-LECO - SK	PSA-PIPET+GRAVEL - SK	LEPH/HEPH/PAH-LOW - VA	OGG-TUMB-SG - VA							Number of Containers
	TE-1	24-Aug-13		Sediment	X	X	X	X									2
	TE-2			Sediment	X	X	X	X									2
	TE-3			Sediment	X	X	X	X									2
	TE-4			Sediment	X	X	X	X									2
	TE-5			Sediment	X	X	X	X									2
	TE-COMP			Sediment					X	X							1
	TEFF-1			Sediment	X	X	X	X									2
	TEFF-2			Sediment	X	X	X	X									2
	TEFF-3			Sediment	X	X	X	X									2
	TEFF-4			Sediment	X	X	X	X									2
	TEFF-5			Sediment	X	X	X	X									2
	TEFF-COMP	↓		Sediment					X	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:	Date (dd-mmm-yy)	Time (hh-mm)	Received by: Chrisn	Date: Sep 10	Time: 1105	Temperature: 19.1 °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

L1360541-COFC

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	☑ PDF ☑ Excel ☐ Digital ☐ Fax	○ Regular (Standard Turnaround Times – Business Days)
Contact:	Laura Bekar / Gary Mann		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	#218 - 2902 West Broadway	Email 1: lbekar@azimuthgroup.ca	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC ☑ Yes ☐ No	Email 2: gmann@azimuthgroup.ca	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax: 604-739-8511	Email 3:	**Analysis Request**
Invoice To	Same as Report ?	**Client / Project Information**	Please Indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?		Job #: **Meadowbank CREMP 2013**	
Company:		PO / AFE:	
Contact:		LSD:	
Address:			
Phone:	Fax:	Quote #: **Q38011**	
Lab Work Order # (lab use only)	L1360541	**ALS Contact:** Brent Mack	**Sampler:** MM, MF

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	MET-CCME+FULL - VA	MOISTURE & pH- VA	C-TOT-ORG-LECO - SK	PSA-PIPET+GRAVEL - SK	LEPH/HEPH/PAH-LOW - VA	OGG-TUMB-SG - VA	Number of Containers
	SP-1	25-Aug-13		Sediment	X	X	X	X			2
	SP-2	↓		Sediment	X	X	X	X			2
	SP-3	↓		Sediment	X	X	X	X			2
	SP-4	↓		Sediment	X	X	X	X			2
	SP-5	↓		Sediment	X	X	X	X			2
	SP-COMP	↓		Sediment					X	X	1
	INUG-1	23-Aug-13		Sediment	X	X	X	X			2
	INUG-2	↓		Sediment	X	X	X	X			2
	INUG-3	↓		Sediment	X	X	X	X			2
	INUG-4	↓		Sediment	X	X	X	X			2
	INUG-5	↓		Sediment	X	X	X	X			2
	INUG-COMP	↓		Sediment					X	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:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
			Chrish.	Sept 10	1105	19.1 °C				

L1360541-COFC

ALS Environmental

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC # _____

Report To	☐ Standard ☐ Other	**Report Format / Distribution** ☑ PDF ☑ Excel ☐ Digital ☐ Fax	**Service Requested** (Rush for routine analysis subject to availability)
Company:	Azimuth Consulting Group		○ Regular (Standard Turnaround Times – Business Days)
Contact:	Laura Bekar / Gary Mann		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	#218 - 2902 West Broadway	Email 1: lbekar@azimuthgroup.ca	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC ☑ Yes ☐ No	Email 2: gmann@azimuthgroup.ca	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax: 604-739-8511 ☐ Yes ☑ No	Email 3:	**Analysis Request**
Invoice To	Same as Report ?	**Client / Project Information**	Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?		Job #: **Meadowbank CREMP 2013**	
Company:		PO / AFE:	
Contact:		LSD:	
Address:			
Phone:	Fax:	Quote #: **Q38011**	
Lab Work Order # (lab use only)	L1360541	**ALS Contact:** Brent Mack	**Sampler:** MM, MF

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	MET-CCME+FULL - VA	MOISTURE & pH- VA	C-TOT-ORG-LECO - SK	PSA-PIPET+GRAVEL - SK	LEPH/HEPH/PAH-LOW - VA	OGG-TUMB-SG - VA							Number of Containers
[redacted]	PDL-1	23-Aug-13		Sediment	X	X	X	X									2
[redacted]	PDL-2			Sediment	X	X	X	X									2
[redacted]	PDL-3			Sediment	X	X	X	X									2
[redacted]	PDL-4			Sediment	X	X	X	X									2
[redacted]	PDL-5			Sediment	X	X	X	X									2
[redacted]	PDL-COMP			Sediment					X	X							1
[redacted]	BBD-1	29-Aug-13		Sediment	X	X	X	X									2
[redacted]	BBD-2			Sediment	X	X	X	X									2
[redacted]	BBD-3			Sediment	X	X	X	X									2
[redacted]	BBD-4			Sediment	X	X	X	X									2
[redacted]	BBD-5			Sediment	X	X	X	X									2
[redacted]	BBD-COMP			Sediment					X	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:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
			Chrisn	Sept 10	1105	19.1 °C				

L1360541-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; ☑ PDF ☑ Excel ☐ Digital ☐ Fax	○ Regular (Standard Turnaround Times – Business Days)
Contact:	Laura Bekar / Gary Mann		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	#218 - 2902 West Broadway	Email 1: lbekar@azimuthgroup.ca	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC ☑ Yes ☐ No	Email 2: gmann@azimuthgroup.ca	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax: 604-739-8511	Email 3: ☐ Yes ☑ No	
Invoice To	Same as Report ?	Client / Project Information	Analysis Request
Hardcopy of Invoice with Report?		Job #: Meadowbank CREMP 2013	Please indicate below Filtered, Preserved or both (F, P, F/P)
Company:		PO / AFE:	
Contact:		LSD:	
Address:			
Phone:	Fax:	Quote #: Q38011	
Lab Work Order # (lab use only)	L1360541	ALS Contact: Brent Mack	Sampler: MM, MF

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	MET-CCME+FULL - VA	MOISTURE & pH- VA	C-TOT-ORG-LECO - SK	PSA-PIPET+GRAVEL - SK	LEPH/HEPH/PAH-LOW - VA	OGG-TUMB-SG - VA	Number of Containers
	BPJ-1	29-Aug-13		Sediment	X	X	X	X			2
	BPJ-2			Sediment	X	X	X	X			2
	BPJ-3			Sediment	X	X	X	X			2
	BPJ-4			Sediment	X	X	X	X			2
	BPJ-5			Sediment	X	X	X	X			2
	BPJ-COMP			Sediment					X	X	1
	BAP-1	30-Aug-13		Sediment	X	X	X	X			2
	BAP-2			Sediment	X	X	X	X			2
	BAP-3			Sediment	X	X	X	X			2
	BAP-4			Sediment	X	X	X	X			2
	BAP-5			Sediment	X	X	X	X			2
	BAP-COMP			Sediment					X	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:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
			Chrisn	Sept 10	1105	19.1 °C				

L1360541-COFC

ALS Enviro

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COC # _____

Report To	☐ Standard ☐ Other	**Report Format / Distribution**	☑ PDF ☑ Excel ☐ Digital ☐ Fax	**Service Requested** (Rush for routine analysis subject to availability)
Company:	Azimuth Consulting Group			○ Regular (Standard Turnaround Times – Business Days)
Contact:	Laura Bekar / Gary Mann			○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	#218 - 2902 West Broadway	Email 1:	lbekar@azimuthgroup.ca	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC ☑ Yes ☐ No	Email 2:	gmann@azimuthgroup.ca	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax: 604-739-8511 ☐ Yes ☑ No	Email 3:		**Analysis Request**
Invoice To	Same as Report ?	**Client / Project Information**		Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?		Job #:	**Meadowbank CREMP 2013**	
Company:		PO / AFE:		
Contact:		LSD:		
Address:				
Phone:	Fax:	Quote #:	**Q38011**	
Lab Work Order # (lab use only)	L1360541	**ALS Contact:**	Brent Mack	**Sampler:** MM, MF

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	MET-CCME+FULL - VA	MOISTURE & pH- VA	C-TOT-ORG-LECO - SK	PSA-PIPET+GRAVEL - SK	LEPH/HEPH/PAH-LOW - VA	OGG-TUMB-SG - VA	Number of Containers
	BES-1	30-Aug-13		Sediment	X	X	X	X			2
	BES-2			Sediment	X	X	X	X			2
	BES-3			Sediment	X	X	X	X			2
	BES-4			Sediment	X	X	X	X			2
	BES-5			Sediment	X	X	X	X			2
	BES-COMP	↓		Sediment					X	X	1
	TPS-1	27-Aug-13		Sediment	X	X	X	X			2
	TPS-2			Sediment	X	X	X	X			2
	TPS-3			Sediment	X	X	X	X			2
	TPS-4			Sediment	X	X	X	X			2
	TPS-5			Sediment	X	X	X	X			2
	TPS-COMP	↓		Sediment					X	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:	Date (dd-mmm-yy)	Time (hh-mm)	Received by: Chrisn	Date: Sept	Time: 1105	Temperature: 19.1 °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

L1360541-COFC

ALS Environmental

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COC # _____

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Company:	Azimuth Consulting Group	☐ Standard ☐ Other; ☑ PDF ☑ Excel ☐ Digital ☐ Fax	○ Regular (Standard Turnaround Times – Business Days)
Contact:	Laura Bekar / Gary Mann		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	#218 - 2902 West Broadway	Email 1: lbekar@azimuthgroup.ca	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC ☑ Yes ☐ No	Email 2: gmann@azimuthgroup.ca	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax: 604-739-8511 ☐ Yes ☑ No	Email 3:	**Analysis Request**
Invoice To	Same as Report ?	**Client / Project Information**	Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?		Job #: **Meadowbank CREMP 2013**	
Company:		PO / AFE:	
Contact:		LSD:	
Address:			
Phone:	Fax:	Quote #: **Q38011**	
Lab Work Order # (lab use only)	L1360541	**ALS Contact:** Brent Mack	**Sampler:** MM, MF

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	MET-CCME+FULL - VA	MOISTURE & pH- VA	C-TOT-ORG-LECO - SK	PSA-PIPET+GRAVEL - SK	LEPH/HEPH/PAH-LOW - VA	OGG-TUMB-SG - VA	Number of Containers
	TPN-1	28-Aug-13		Sediment	X	X	X	X			2
	TPN-2	"		Sediment	X	X	X	X			2
	TPN-3	"		Sediment	X	X	X	X			2
	TPN-4	"		Sediment	X	X	X	X			2
	TPN-5	"		Sediment	X	X	X	X			2
	TPN-COMP	"		Sediment					X	X	1

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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: Chrishi	Date: SEP 10	Time: 1105	Temperature: 19.1 °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

L1360541-COFC

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Company:		PO / AFE:	
Contact:		LSD:	
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Phone:	Fax:	Quote #: **Q38011**	
Lab Work Order # (lab use only)	L1360541	**ALS Contact:** Brent Mack	**Sampler:** MM, MF

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	MET-CCME+FULL - VA	MOISTURE & pH- VA	C-TOT-ORG-LECO - SK	PSA-PIPET+GRAVEL - SK	LEPH/HEPH/PAH-LOW - VA	OGG-TUMB-SG - VA	Number of Containers
	DUP-1			Sediment	X	X	X	X			2
	SWIPE-1			Other	X						1
	DUP-2			Sediment	X	X	X	X			2
	SWIPE-2			Other	X						1
	DUP-3			Sediment	X	X	X	X			2
	SWIPE-3			Other	X						1
	DUP-4			Sediment	X	X	X	X			2
	SWIPE-4			Other	X						1
	DUP-5			Sediment	X	X	X	X			2
	SWIPE-5			Other	X						1
	DUP-6			Sediment	X	X	X	X			2
	SWIPE-6			Other	X						1

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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
			Chris	Sep 10	1105	19.1 °C				

L1360541-COFC

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Address:	#218 - 2902 West Broadway	☑ Yes ☐ No	Email 1: lbekar@azimuthgroup.ca				○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC	☐ Yes ☑ No	Email 2: gmann@azimuthgroup.ca				○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220	Fax: 604-739-8511	Email 3:				**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 #: **Meadowbank CREMP 2013**				
Company:			PO / AFE:				
Contact:			LSD:				
Address:							
Phone:		Fax:	Quote #: **Q38011**				
Lab Work Order # (lab use only)		L1360541	**ALS Contact:** Brent Mack		**Sampler:** MM, MF		

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	MET-CCME+FULL - VA	MOISTURE & pH- VA	C-TOT-ORG-LECO - SK	PSA-PIPET+GRAVEL - SK	LEPH/HEPH/PAH-LOW - VA	OGG-TUMB-SG - VA	Number of Containers
	DUP-7			Sediment	X	X	X	X			2
	SWIPE-7			Other	X						1
	DUP-8			Sediment	X	X	X	X			2
	SWIPE-8			Other	X						1

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Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by: Christi	Date: SEP 10	Time: 1105	Temperature: 19.1 °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

AZIMUTH CONSULTING GROUP INC.
ATTN: Laura Bekar
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 30-SEP-13
Report Date: 09-OCT-13 13:50 (MT)
Version: FINAL

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1370598

Project P.O. #: NOT SUBMITTED
Job Reference: MEADOWBANK SURFACEWATER
C of C Numbers: 1
Legal Site Desc:

Brent Mack
Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1370598-1	L1370598-2	L1370598-3	L1370598-4	L1370598-5
	Description	WATER	WATER	WATER	WATER	WATER
	Sampled Date	15-SEP-13	15-SEP-13	15-SEP-13	18-SEP-13	18-SEP-13
	Sampled Time	15:46	15:21	16:50	15:11	14:46
	Client ID	WAL-33-S	WAL-34-S	CREMP-SEPT-EB-1	SP-64-S	SP-65-S
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	33.5	32.2	<2.0	29.9	29.8
	Hardness (as CaCO3) (mg/L)	14.2	13.5	0.89	12.0	11.9
	pH (pH)	8.28	8.14	5.75	7.83	8.04
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Total Dissolved Solids (mg/L)	24.5	12.5	<3.0	18.2	19.0
	Turbidity (NTU)	0.30	0.34	<0.10	0.27	0.31
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	11.6	10.9	<2.0	9.9	9.3
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Total (as CaCO3) (mg/L)	11.6	10.9	<2.0	9.9	9.3
	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)	0.62	0.60	<0.10	0.58	0.59
	Fluoride (F) (mg/L)	0.047	0.048	<0.020	0.066	0.067
	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
	Total Kjeldahl Nitrogen (mg/L)	0.138	0.134	<0.050	0.114	0.162
	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	0.0023	<0.0020	<0.0020	<0.0020
	Silicate (as SiO2) (mg/L)	0.82	0.79	<0.50	<0.50	<0.50
	Sulfate (SO4) (mg/L)	2.86	2.80	<0.50	3.34	3.36
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	1.75	1.66	2.34 RRV	1.77	1.70
	Total Organic Carbon (mg/L)	1.69	1.80	<0.50 RRV	1.63	1.73
Total Metals	Aluminum (Al)-Total (mg/L)	0.0067	0.0078	<0.0030	0.0072	0.0114
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00029	0.00028	<0.00010	0.00027	0.00028
	Barium (Ba)-Total (mg/L)	0.00168	0.00171	<0.000050	0.00236	0.00232
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)-Total (mg/L)	3.98	3.87	0.082	3.24	3.16
	Chromium (Cr)-Total (mg/L)	0.00016	0.00014	<0.00010	0.00017	0.00018
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Total (mg/L)	0.00081	0.00084	<0.00050	0.00067	0.00069

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1370598-1	L1370598-2	L1370598-3	L1370598-4	L1370598-5
	Description	WATER	WATER	WATER	WATER	WATER
	Sampled Date	15-SEP-13	15-SEP-13	15-SEP-13	18-SEP-13	18-SEP-13
	Sampled Time	15:46	15:21	16:50	15:11	14:46
	Client ID	WAL-33-S	WAL-34-S	CREMP-SEPT-EB-1	SP-64-S	SP-65-S
Grouping	**Analyte**					
WATER						
Total Metals	Iron (Fe)-Total (mg/L)	0.019	0.020	<0.010	0.023	0.027
	Lead (Pb)-Total (mg/L)	0.000114	<0.000050	0.000070 RRV	<0.000050	<0.000050
	Lithium (Li)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Magnesium (Mg)-Total (mg/L)	1.19	1.14	<0.10	1.06	1.03
	Manganese (Mn)-Total (mg/L)	0.00147	0.00176	0.000059 RRV	0.00174	0.00173
	Mercury (Hg)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Total (mg/L)	0.000128	0.000123	<0.000050	0.000185	0.000124
	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	0.43	<0.10	0.47	0.47
	Selenium (Se)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Silicon (Si)-Total (mg/L)	0.396	0.395	<0.050	0.179	0.174
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	0.529	0.561	<0.050	0.663	0.671
	Strontium (Sr)-Total (mg/L)	0.0189	0.0179	0.00029 RRV	0.0133	0.0138
	Sulfur (S)-Total (mg/L)	1.11	1.11	<0.50	1.19	1.22
	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)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Total (mg/L)	0.000037	0.000040	<0.000010	0.000047	0.000042
	Vanadium (V)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	0.0043	<0.0030
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	0.0019	0.0011 RRV	0.0015	0.0019
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00024	0.00024	<0.00010	0.00023	0.00025
	Barium (Ba)-Dissolved (mg/L)	0.00162	0.00165	0.000231 RRV	0.00226	0.00219
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)-Dissolved (mg/L)	3.83	3.65	0.357 DTC	3.13	3.08
	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)	0.00072	0.00074	<0.00020	0.00058	0.00058
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010

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ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1370598-1	L1370598-2	L1370598-3	L1370598-4	L1370598-5
	Description	WATER	WATER	WATER	WATER	WATER
	Sampled Date	15-SEP-13	15-SEP-13	15-SEP-13	18-SEP-13	18-SEP-13
	Sampled Time	15:46	15:21	16:50	15:11	14:46
	Client ID	WAL-33-S	WAL-34-S	CREMP-SEPT-EB-1	SP-64-S	SP-65-S
Grouping	**Analyte**					
WATER						
Dissolved Metals	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Magnesium (Mg)-Dissolved (mg/L)	1.13	1.07	<0.10	1.01	1.01
	Manganese (Mn)-Dissolved (mg/L)	0.000450	0.000339	0.000081 RRV	0.000688	0.000629
	Mercury (Hg)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Dissolved (mg/L)	0.000119	0.000094	<0.000050	0.000120	0.000106
	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)	0.42	0.38	<0.10	0.45	0.44
	Selenium (Se)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Silicon (Si)-Dissolved (mg/L)	0.373	0.372	<0.050	0.172	0.156
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	0.552	0.518	<0.050	0.642	0.656
	Strontium (Sr)-Dissolved (mg/L)	0.0176	0.0173	0.00168 RRV	0.0135	0.0125
	Sulfur (S)-Dissolved (mg/L)	1.05	1.01	<0.50	1.13	1.19
	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)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Dissolved (mg/L)	0.000030	0.000028	<0.000010	0.000034	0.000034
	Vanadium (V)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Plant Pigments	Chlorophyll a (ug/L)	<0.010	0.234	<0.010	<0.010	<0.010

* 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)	DLM	L1370598-1, -2, -3, -4, -5
Matrix Spike	Total Organic Carbon	MS-B	L1370598-1, -2, -4, -5
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1370598-1, -2, -3, -4, -5
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1370598-1, -2, -3, -4, -5
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1370598-1, -2, -3, -4, -5
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1370598-1, -2, -3, -4, -5
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1370598-1, -2, -3, -4, -5
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1370598-1, -2, -3, -4, -5
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1370598-1, -2, -3, -4, -5
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1370598-1, -2, -3, -4, -5
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1370598-1, -2, -3, -4, -5
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1370598-1, -2, -3, -4, -5
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1370598-1, -2, -3, -4, -5
Matrix Spike	Total Kjeldahl Nitrogen	MSTN	L1370598-1, -2, -3, -4, -5

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLM	Detection Limit Adjusted For Sample Matrix Effects
DTC	Dissolved concentration exceeds total. Results were confirmed by re-analysis.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
MSTN	TKN Matrix Spike recovery was low due to interference from high nitrate, which causes negative bias on TKN.
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-SCR-VA	Water	Alkalinity by colour or titration	EPA 310.2 OR APHA 2320

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.
OR
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.

ANIONS-BR-IC-VA	Water	Bromide by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-CL-LOW-IC-VA	Water	Low level Chloride by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-F-IC-VA	Water	Fluoride by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-NO2-IC-VA	Water	Nitrite in Water by Ion Chromatography	EPA 300.0

This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Nitrite is detected by UV absorbance.

ANIONS-NO3-IC-VA	Water	Nitrate in Water by Ion Chromatography	EPA 300.0

This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Nitrate is detected by UV absorbance.

ANIONS-SO4-IC-VA	Water	Sulfate by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310 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 5310 TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

Reference Information

CHLOROA-VA	Water	Chlorophyll a by Fluorometer	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.

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.

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-DIS-LOW-CVAFS-VA	Water	Dissolved Mercury in Water by CVAFS(Low)	EPA SW-846 3005A & EPA 245.7

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 filtration (EPA Method 3005A) and involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

HG-TOT-LOW-CVAFS-VA	Water	Total Mercury in Water by CVAFS(Low)	EPA 245.7

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 a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030 B&E / EPA SW-846 6020A

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 hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

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	APHA 3030 B&E / EPA SW-846 6020A

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 hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

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	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-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorous 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 Phosphorous is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

PH-MAN-VA	Water	pH by Manual Meter	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-MAN-VA	Water	pH by Manual Meter	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.

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 Phosphorous

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.

TDS-LOW-VA Water Low Level TDS (3.0mg/L) by Gravimetric APHA 2540 Gravimetric

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 2540 Gravimetric

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.

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

Reference Information

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

L1370598-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:	Laura Bekar	☐ PDF ☐ Excel ☐ Digital ☐ Fax	○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1: lbekar@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	Analysis Request
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #: Meadowbank Surfacewater	Please indicate below Filtered, Preserved or both (F, P, F/P)
Company:		PO / AFE:	
Contact:		LSD:	
Address:			
Phone:	Fax:	Quote #: Q39503	
Lab Work Order # (lab use only)	L1370598	ALS Contact:	Sampler:

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Alkalinity Species, Anions-All	pH, EC, Turb, TDS, Silicate	T-P, TD-P, Ortho-PO4	TSS-Low	Ammonia, TKN	TOC	DOC	Total Metals (MET-T-NDR-VA)	Diss. Metals (MET-D-NDR-VA)	Total Mercury (Low Level)	Diss. Mercury (Low Level)	Chlorophyl 'a'	Number of Containers
	WAL-33-S	15-09-2013	15:46	Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	WAL-34-S	15-09-2013	15:21	Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	CREMP-SEPT-EB-1	15-09-2013	16:50	Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	SP-64-S	18-09-2013	15:11	Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	SP-65-S	18-09-2013	14:46	Water	x	x	x	x	x	x	x	x	x	x	x	x	6
				Water	x	x	x	x	x	x	x	x	x	x	x	x	6
				Water	x	x	x	x	x	x	x	x	x	x	x	x	6
				Water	x	x	x	x	x	x	x	x	x	x	x	x	6
				Water	x	x	x	x	x	x	x	x	x	x	x	x	6

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

(1) there are no Chlorophyll-a filters for samples with IDs including "EB-" and for "travel/trip blank" samples; however, all other analyses should be conducted on these samples. (2) 500 mL of water were filtered for all Chlorophyll-a sample filters included in this shipment.

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
			Joyce	Sept 30	11:25	15.3 °C				

AZIMUTH CONSULTING GROUP INC.
ATTN: Eric Franz
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 11-DEC-13
Report Date: 23-DEC-13 14:20 (MT)
Version: FINAL

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1402362

Project P.O. #: NOT SUBMITTED
Job Reference: MEADOWBANK SURFACEWATER
C of C Numbers: 1, 2
Legal Site Desc:

Brent Mack
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1402362-1	L1402362-2	L1402362-3	L1402362-4	L1402362-5
	Description	WATER	WATER	WATER	WATER	WATER
	Sampled Date	24-NOV-13	24-NOV-13	26-NOV-13	26-NOV-13	26-NOV-13
	Sampled Time	14:20	14:52	13:57	13:57	14:46
	Client ID	SP-67-S	SP-66-S	TPE-67-S	CREMP NOV DUP 1	TPE-66-S
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	34.2	33.1	28.1	28.4	28.1
	Hardness (as CaCO3) (mg/L)	13.3	13.4	5.76	10.5	10.4
	pH (pH)	8.07	7.81	7.56	7.42	7.74
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Total Dissolved Solids (mg/L)	17.4	22.0	23.7	21.0	21.8
	Turbidity (NTU)	0.23	0.27	0.37	0.28	0.36
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	9.7	10.0	7.6	7.5	7.5
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Total (as CaCO3) (mg/L)	9.7	10.0	7.6	7.5	7.5
	Ammonia, Total (as N) (mg/L)	0.0068	<0.0050	0.0059	0.0085	0.0082
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	0.69	0.65	0.68	0.67	0.68
	Fluoride (F) (mg/L)	0.068	0.065	0.076	0.075	0.074
	Nitrate (as N) (mg/L)	0.0052	<0.0050	0.0127	0.0131	0.0134
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	0.174	<0.050	0.056	0.090	0.086
	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)	3.62	3.63	4.05	4.01	4.01
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	2.84	2.57 RRV	1.65	1.31	1.78
	Total Organic Carbon (mg/L)	1.62 RRV	<0.50 RRV	1.20	1.07	1.29
Total Metals	Aluminum (Al)-Total (mg/L)	0.0059	0.0041	0.0060	0.0044	0.0065
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00025	0.00023	0.00051	0.00028	0.00050
	Barium (Ba)-Total (mg/L)	0.00259	0.00235	0.00280	0.00156	0.00292
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	0.000046	0.000037	<0.000010	<0.000010	0.000017
	Calcium (Ca)-Total (mg/L)	3.52	3.60	2.45	1.36	2.62
	Chromium (Cr)-Total (mg/L)	0.00016	0.00012	0.00016	<0.00010	0.00011
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Total (mg/L)	0.00072	0.00066	<0.00050	<0.00050	<0.00050

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1402362-6	L1402362-7	L1402362-8	L1402362-9	L1402362-10
	Description	WATER	WATER	WATER	WATER	WATER
	Sampled Date	26-NOV-13	26-NOV-13	28-NOV-13	28-NOV-13	28-NOV-13
	Sampled Time	15:23	15:58	11:35	11:45	13:38
	Client ID	TPN-66-S	TPN-67-S	TE-66-S	TE-67-S	WAL-36-S
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	26.0	28.0	23.6	23.2	37.0
	Hardness (as CaCO3) (mg/L)	7.18	9.56	4.26	9.98	7.82
	pH (pH)	7.72	7.72	7.69	6.85	7.04
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Total Dissolved Solids (mg/L)	21.0	21.8	19.2	18.7	27.0
	Turbidity (NTU)	0.18	0.27	0.28	0.20	0.38
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	5.0	5.3	7.3	7.4	13.6
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Total (as CaCO3) (mg/L)	5.0	5.3	7.3	7.4	13.6
	Ammonia, Total (as N) (mg/L)	0.0210	0.0195	<0.0050	<0.0050	0.0064
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	0.71	0.78	0.67	0.60	0.78
	Fluoride (F) (mg/L)	0.061	0.066	0.066	0.063	0.052
	Nitrate (as N) (mg/L)	0.0563	0.0609	<0.0050	<0.0050	<0.0050
	Nitrite (as N) (mg/L)	0.0014	0.0016	<0.0010	<0.0010	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	0.110	0.138	0.109	0.079	0.135
	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	0.63
	Sulfate (SO4) (mg/L)	4.76	5.21	2.82	2.75	3.37
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	1.73	2.08 RRV	1.56	1.80 RRV	2.12
	Total Organic Carbon (mg/L)	1.54	1.42 RRV	1.38	1.09 RRV	2.06
Total Metals	Aluminum (Al)-Total (mg/L)	0.0033	0.0039	0.0035	0.0045	0.0116
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00013	0.00019	<0.00010	0.00010	0.00030
	Barium (Ba)-Total (mg/L)	0.00213	0.00326	0.00116	0.00149	0.00206
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)-Total (mg/L)	1.34	2.35	1.14	1.58	4.55
	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	0.00084

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1402362-11	L1402362-12	L1402362-13	L1402362-14	
	Description	WATER	WATER	WATER	WATER	
	Sampled Date	28-NOV-13	30-NOV-13	30-NOV-13	24-NOV-13	
	Sampled Time	14:03	11:26	11:54	11:00	
	Client ID	WAL-35-S	INUG-54-S	INUG-55-S	CREMP NOV EB 1	
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	35.9	15.8	16.4	<2.0	
	Hardness (as CaCO3) (mg/L)	16.0	3.51	6.13	<0.50	
	pH (pH)	7.13	6.60	6.80	6.07	
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	
	Total Dissolved Solids (mg/L)	25.7	11.9	12.4	<3.0	
	Turbidity (NTU)	0.30	0.36	0.20	0.13	
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	12.9	8.0	4.8	<2.0	
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	
	Alkalinity, Total (as CaCO3) (mg/L)	12.9	8.0	4.8	<2.0	
	Ammonia, Total (as N) (mg/L)	0.0080	0.0075	<0.0050	<0.0050	
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	
	Chloride (Cl) (mg/L)	0.75	0.73	0.75	<0.10	
	Fluoride (F) (mg/L)	0.048	0.062	0.063	<0.020	
	Nitrate (as N) (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	
	Total Kjeldahl Nitrogen (mg/L)	0.125	0.111	0.115	<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)	0.0023	<0.0020	0.0023	<0.0020	
	Silicate (as SiO2) (mg/L)	0.59	<0.50	<0.50	<0.50	
	Sulfate (SO4) (mg/L)	3.22	0.94	0.98	<0.50	
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	2.38 RRV	2.08	2.55	1.57 RRV	
	Total Organic Carbon (mg/L)	1.76	1.73	2.59	<0.50 RRV	
Total Metals	Aluminum (Al)-Total (mg/L)	0.0100	0.0053	0.0047	<0.0030	
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Arsenic (As)-Total (mg/L)	0.00028	<0.00010	0.00010	<0.00010	
	Barium (Ba)-Total (mg/L)	0.00203	0.00166	0.00172	<0.000050	
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Bismuth (Bi)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	
	Cadmium (Cd)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Calcium (Ca)-Total (mg/L)	4.48	1.19	1.25	<0.050	
	Chromium (Cr)-Total (mg/L)	0.00010	0.00010	0.00071	<0.00010	
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Copper (Cu)-Total (mg/L)	0.00082	<0.00050	<0.00050	<0.00050	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1402362-1	L1402362-2	L1402362-3	L1402362-4	L1402362-5
	Description	WATER	WATER	WATER	WATER	WATER
	Sampled Date	24-NOV-13	24-NOV-13	26-NOV-13	26-NOV-13	26-NOV-13
	Sampled Time	14:20	14:52	13:57	13:57	14:46
	Client ID	SP-67-S	SP-66-S	TPE-67-S	CREMP NOV DUP 1	TPE-66-S
Grouping	**Analyte**					
WATER						
Total Metals	Iron (Fe)-Total (mg/L)	0.013	0.011	0.011	<0.010	<0.010
	Lead (Pb)-Total (mg/L)	0.000667	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Magnesium (Mg)-Total (mg/L)	1.14	1.15	0.87	0.49	0.96
	Manganese (Mn)-Total (mg/L)	0.000937	0.000756	0.00122	0.000723	0.00129
	Mercury (Hg)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Total (mg/L)	0.000141	0.000123	0.000178	0.000109	0.000192
	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)	0.51	0.50	0.48	0.26	0.55
	Selenium (Se)-Total (mg/L)	<0.00010	<0.00010	0.00012	<0.00010	<0.00010
	Silicon (Si)-Total (mg/L)	0.180	0.218	0.065	<0.050	0.061
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	0.699	0.669	0.833	0.454	0.915
	Strontium (Sr)-Total (mg/L)	0.0152	0.0156	0.0102	0.00576	0.0110
	Sulfur (S)-Total (mg/L)	1.27	1.26	1.21	0.69	1.34
	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)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Total (mg/L)	0.000038	0.000035	0.000047	0.000027	0.000046
	Vanadium (V)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
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)	0.0020	0.0010	<0.0010	0.0012	0.0016
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00023	0.00022	0.00029	0.00052 DTC	0.00045
	Barium (Ba)-Dissolved (mg/L)	0.00237	0.00222	0.00167	0.00288 DTC	0.00294
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	0.000059	<0.000010	<0.000010	<0.000010	0.000018
	Calcium (Ca)-Dissolved (mg/L)	3.47	3.50	1.45	2.65 DTC	2.60
	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)	0.00060	0.00054	<0.00020	0.00034	0.00036
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1402362-6	L1402362-7	L1402362-8	L1402362-9	L1402362-10
	Description	WATER	WATER	WATER	WATER	WATER
	Sampled Date	26-NOV-13	26-NOV-13	28-NOV-13	28-NOV-13	28-NOV-13
	Sampled Time	15:23	15:58	11:35	11:45	13:38
	Client ID	TPN-66-S	TPN-67-S	TE-66-S	TE-67-S	WAL-36-S
Grouping	**Analyte**					
WATER						
Total Metals	Iron (Fe)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	0.022
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Magnesium (Mg)-Total (mg/L)	0.53	0.94	0.42	0.56	1.34
	Manganese (Mn)-Total (mg/L)	0.00284	0.00432	0.000340	0.000442	0.00120
	Mercury (Hg)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Total (mg/L)	0.000130	0.000230	<0.000050	0.000054	0.000168
	Nickel (Ni)-Total (mg/L)	<0.00050	0.00054	<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)	0.28	0.54	0.24	0.28	0.49
	Selenium (Se)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Silicon (Si)-Total (mg/L)	<0.050	<0.050	0.080	0.111	0.404
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	0.813	1.27	0.322	0.390	0.591
	Strontium (Sr)-Total (mg/L)	0.00627	0.0110	0.00541	0.00740	0.0224
	Sulfur (S)-Total (mg/L)	1.01	1.85	<0.50	0.58	1.19
	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)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Total (mg/L)	0.000031	0.000055	0.000021	0.000027	0.000046
	Vanadium (V)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
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)	0.0011	0.0016	<0.0010	<0.0010	<0.0010
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00013	0.00016	<0.00010	0.00014	0.00013
	Barium (Ba)-Dissolved (mg/L)	0.00231	0.00309	0.00102	0.00242 DTC	0.000998
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)-Dissolved (mg/L)	1.75 DTC	2.30	1.06	2.52 DTC	2.10
	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	0.00031	<0.00020	0.00042	0.00048
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1402362-11 WATER 28-NOV-13 14:03 WAL-35-S	L1402362-12 WATER 30-NOV-13 11:26 INUG-54-S	L1402362-13 WATER 30-NOV-13 11:54 INUG-55-S	L1402362-14 WATER 24-NOV-13 11:00 CREMP NOV EB 1	
WATER						
Total Metals	Iron (Fe)-Total (mg/L)	0.018	<0.010	<0.010	<0.010	
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	
	Lithium (Li)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Magnesium (Mg)-Total (mg/L)	1.31	0.72	0.76	<0.10	
	Manganese (Mn)-Total (mg/L)	0.00125	0.000693	0.000804	<0.000050	
	Mercury (Hg)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Molybdenum (Mo)-Total (mg/L)	0.000170	<0.000050	<0.000050	<0.000050	
	Nickel (Ni)-Total (mg/L)	0.00060	<0.00050	<0.00050	<0.00050	
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	<0.050	
	Potassium (K)-Total (mg/L)	0.46	0.39	0.42	<0.10	
	Selenium (Se)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Silicon (Si)-Total (mg/L)	0.395	0.123	0.114	<0.050	
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Sodium (Na)-Total (mg/L)	0.567	0.526	0.575	<0.050	
	Strontium (Sr)-Total (mg/L)	0.0207	0.00611	0.00662	<0.00020	
	Sulfur (S)-Total (mg/L)	1.09	<0.50	<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)	<0.010	<0.010	<0.010	<0.010	
	Uranium (U)-Total (mg/L)	0.000043	0.000039	0.000040	<0.000010	
	Vanadium (V)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	0.0035 RRV	
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	
	Aluminum (Al)-Dissolved (mg/L)	<0.0010	<0.0010	0.0015	<0.0010	
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Arsenic (As)-Dissolved (mg/L)	0.00022	<0.00010	<0.00010	<0.00010	
	Barium (Ba)-Dissolved (mg/L)	0.00190	0.00102	0.00182	<0.000050	
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	
	Cadmium (Cd)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Calcium (Ca)-Dissolved (mg/L)	4.33	0.700	1.23	<0.050	
	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)	0.00073	<0.00020	0.00031	<0.00020	
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1402362-1	L1402362-2	L1402362-3	L1402362-4	L1402362-5
	Description	WATER	WATER	WATER	WATER	WATER
	Sampled Date	24-NOV-13	24-NOV-13	26-NOV-13	26-NOV-13	26-NOV-13
	Sampled Time	14:20	14:52	13:57	13:57	14:46
	Client ID	SP-67-S	SP-66-S	TPE-67-S	CREMP NOV DUP 1	TPE-66-S
Grouping	**Analyte**					
WATER						
Dissolved Metals	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Magnesium (Mg)-Dissolved (mg/L)	1.12	1.13	0.52	0.93 DTC	0.95
	Manganese (Mn)-Dissolved (mg/L)	0.000173	0.000081	0.000088	0.000241	0.000275
	Mercury (Hg)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Dissolved (mg/L)	0.000116	0.000122	0.000097	0.000186	0.000175
	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	0.46	0.28	0.51 DTC	0.55
	Selenium (Se)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Silicon (Si)-Dissolved (mg/L)	0.164	0.212	<0.050	0.065	0.053
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	0.688	0.674	0.475	0.869 DTC	0.929
	Strontium (Sr)-Dissolved (mg/L)	0.0147	0.0153	0.00592	0.0107 DTC	0.0109
	Sulfur (S)-Dissolved (mg/L)	1.16	1.17	0.69	1.28	1.32
	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)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Dissolved (mg/L)	0.000030	0.000029	0.000026	0.000043	0.000038
	Vanadium (V)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Plant Pigments	Chlorophyll a (ug/L)	0.505	0.280	0.114	0.434	0.337

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1402362-6	L1402362-7	L1402362-8	L1402362-9	L1402362-10
	Description	WATER	WATER	WATER	WATER	WATER
	Sampled Date	26-NOV-13	26-NOV-13	28-NOV-13	28-NOV-13	28-NOV-13
	Sampled Time	15:23	15:58	11:35	11:45	13:38
	Client ID	TPN-66-S	TPN-67-S	TE-66-S	TE-67-S	WAL-36-S
Grouping	**Analyte**					
WATER						
Dissolved Metals	Lead (Pb)-Dissolved (mg/L)	0.000217 DTC	<0.000050	<0.000050	0.000089	<0.000050
	Lithium (Li)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	0.00053	<0.00050
	Magnesium (Mg)-Dissolved (mg/L)	0.68	0.93	0.39	0.90 DTC	0.62
	Manganese (Mn)-Dissolved (mg/L)	0.00264	0.00355	<0.000050	0.000080	<0.000050
	Mercury (Hg)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Dissolved (mg/L)	0.000170	0.000213	<0.000050	0.000083	0.000070
	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)	0.38	0.52	0.20	0.46	0.22
	Selenium (Se)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Silicon (Si)-Dissolved (mg/L)	<0.050	<0.050	0.070	0.159	0.177
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	0.910	1.23	0.292	0.635 DTC	0.265
	Strontium (Sr)-Dissolved (mg/L)	0.00800 DTC	0.0105	0.00489	0.0117 DTC	0.00995
	Sulfur (S)-Dissolved (mg/L)	1.32	1.74	<0.50	0.97	<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)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Dissolved (mg/L)	0.000034	0.000041	0.000013	0.000037	0.000015
	Vanadium (V)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Plant Pigments	Chlorophyll a (ug/L)	0.435	0.588	0.758	0.314	0.618

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1402362-11	L1402362-12	L1402362-13	L1402362-14	
	Description	WATER	WATER	WATER	WATER	
	Sampled Date	28-NOV-13	30-NOV-13	30-NOV-13	24-NOV-13	
	Sampled Time	14:03	11:26	11:54	11:00	
	Client ID	WAL-35-S	INUG-54-S	INUG-55-S	CREMP NOV EB 1	
Grouping	**Analyte**					
WATER						
Dissolved Metals	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	
	Lithium (Li)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Magnesium (Mg)-Dissolved (mg/L)	1.26	0.43	0.74	<0.10	
	Manganese (Mn)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	
	Mercury (Hg)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Molybdenum (Mo)-Dissolved (mg/L)	0.000129	<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)	0.45	0.23	0.39	<0.10	
	Selenium (Se)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Silicon (Si)-Dissolved (mg/L)	0.368	0.059	0.113	<0.050	
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
	Sodium (Na)-Dissolved (mg/L)	0.549	0.304	0.564	<0.050	
	Strontium (Sr)-Dissolved (mg/L)	0.0202	0.00377	0.00647	<0.00020	
	Sulfur (S)-Dissolved (mg/L)	1.11	<0.50	<0.50	<0.50	
	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)	<0.010	<0.010	<0.010	<0.010	
	Uranium (U)-Dissolved (mg/L)	0.000031	0.000021	0.000031	<0.000010	
	Vanadium (V)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	
	Zinc (Zn)-Dissolved (mg/L)	0.0011	<0.0010	<0.0010	<0.0010	
Plant Pigments	Chlorophyll a (ug/L)	0.452	0.475	0.666		

* 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	Chlorophyll a	DUP-H	L1402362-1, -10, -11, -12, -13, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Dissolved Organic Carbon	MS-B	L1402362-13
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1402362-1, -10, -11, -12, -13, -14, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Total Kjeldahl Nitrogen	MS-B	L1402362-1
Matrix Spike	Total Organic Carbon	MS-B	L1402362-1
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1402362-1, -10, -11, -12, -13, -14, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1402362-1, -10, -11, -12, -13, -14, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Total Kjeldahl Nitrogen	MSTN	L1402362-10, -11, -12, -13, -14, -7, -8, -9
Duplicate	Total Kjeldahl Nitrogen	TKND	L1402362-1

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DTC	Dissolved concentration exceeds total. Results were confirmed by re-analysis.
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
MSTN	TKN Matrix Spike recovery was low due to interference from high nitrate, which causes negative bias on TKN.
RRV	Reported Result Verified By Repeat Analysis
TKND	TKN duplication was poor due to interference from high nitrate, which causes negative bias on TKN.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-SCR-VA	Water	Alkalinity by colour or titration	EPA 310.2 OR APHA 2320

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.
OR
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.

ANIONS-BR-IC-VA	Water	Bromide by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-CL-IC-VA	Water	Chloride by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-CL-LOW-IC-VA	Water	Low level Chloride by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-F-IC-VA	Water	Fluoride by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-NO2-IC-VA	Water	Nitrite in Water by Ion Chromatography	EPA 300.0

This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Nitrite is detected by UV absorbance.

ANIONS-NO3-IC-VA	Water	Nitrate in Water by Ion Chromatography	EPA 300.0

This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Nitrate is detected by UV absorbance.

ANIONS-SO4-IC-VA	Water	Sulfate by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310 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 5310 TOTAL ORGANIC CARBON (TOC)

Reference Information

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

CHLOROA-VA Water Chlorophyll a by Fluorometer 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.

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.

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-DIS-LOW-CVAFS-VA Water Dissolved Mercury in Water by CVAFS(Low) EPA SW-846 3005A & EPA 245.7

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 filtration (EPA Method 3005A) and involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

HG-TOT-LOW-CVAFS-VA Water Total Mercury in Water by CVAFS(Low) EPA 245.7

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 a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

MET-D-CCMS-VA Water Dissolved Metals in Water by CRC ICPMS APHA 3030 B&E / EPA SW-846 6020A

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 hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

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 APHA 3030 B&E / EPA SW-846 6020A

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 hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

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 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-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorous 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 Phosphorous is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

PH-MAN-VA Water pH by Manual Meter 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.

Reference Information

It is recommended that this analysis be conducted in the field.

PH-MAN-VA Water pH by Manual Meter 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.

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 Phosphorous

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.

TDS-LOW-VA Water Low Level TDS (3.0mg/L) by Gravimetric APHA 2540 Gravimetric

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 2540 Gravimetric

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.

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.

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 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 Ti

L1402362-COFC

ical Request Form
300 668 9878
l.com

COC # _____

Page 1 of 2

Rush Processing

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 #: 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	Alkalinity Species, Anions-All	pH, EC, Turb, TDS, Silicate	T-P, TD-P, Ortho-PO4	TSS-Low	Ammonia, TKN	TOC	DOC	Total Metals (MET-T-NDR-VA)	Diss. Metals (MET-D-NDR-VA)	Total Mercury (Low Level)	Diss. Mercury (Low Level)	Chlorophyll 'a'	Number of Containers
	SP-67-S	24-Nov-13	14:20	Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	SP-66-S	24-Nov-13	14:52	Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	TPE-67-S	26-Nov-13	13:57	Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	CREMP NOV DUP 1	26-Nov-13	13:57	Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	TPE-66-S	26-Nov-13	14:46	Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	TPN-66-S	26-Nov-13	15:23	Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	TPN-67-S	26-Nov-13	15:58	Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	TE-66-S	28-Nov-13	11:35	Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	TE-67-S	28-Nov-13	11:45	Water	x	x	x	x	x	x	x	x	x	x	x	x	6

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

(1) there are no Chlorophyll-a filters for samples with IDs including "EB-" and for "travel/trip blank" samples; however, all other analyses should be conducted on these samples. (2) 500 mL of water were filtered for all Chlorophyll-a sample filters included in this shipment.

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
			Paige	Dec 11	10:25	0,0,1.5°C				

GENF 20.00 Front

L1402362-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 #: 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	Alkalinity Species, Anions-All	pH, EC, Turb, TDS, Silicate	T-P, TD-P, Ortho-PO4	TSS-Low	Ammonia, TKN	TOC	DOC	Total Metals (MET-T-NDR-VA)	Diss. Metals (MET-D-NDR-VA)	Total Mercury (Low Level)	Diss. Mercury (Low Level)	Chlorophyll 'a'	Number of Containers
	WAL-36-S	28-Nov-13	13:38	Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	WAL-35-S	28-Nov-13	14:03	Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	INUG-54-S	30-Nov-13	11:26	Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	INUG-55-S	30-Nov-13	11:54	Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	CREMP NOV EB 1	24-Nov-13	11:00	Water	x	x	x	x	x	x	x	x	x	x	x	x	6

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

(1) there are no Chlorophyll-a filters for samples with IDs including "EB-" and for "travel/trip blank" samples; however, all other analyses should be conducted on these samples. (2) 500 mL of water were filtered for all Chlorophyll-a sample filters included in this shipment.

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
			Paige	Dec 11	10:25	0,0,1.5°C				

AZIMUTH CONSULTING GROUP INC.
ATTN: Laura Bekar
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 24-DEC-13
Report Date: 08-JAN-14 14:40 (MT)
Version: FINAL

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1406897

Project P.O. #: NOT SUBMITTED
Job Reference: MEADOWBANK SURFACEWATER
C of C Numbers: 1
Legal Site Desc:

Brent Mack
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1406897-1 WATER 08-DEC-13 SP-68-S	L1406897-2 WATER 08-DEC-13 SP-69-S	L1406897-3 WATER 09-DEC-13 TPE-68-S	L1406897-4 WATER CREMP DEC DUP1	L1406897-5 WATER 09-DEC-13 TPE-69-S
Sample ID						
Description						
Sampled Date						
Sampled Time						
Client ID						
WATER						
Physical Tests	Conductivity (uS/cm)	33.2	34.3	30.4	30.7	29.5
	Hardness (as CaCO3) (mg/L)	5.76	6.70	4.17	7.70	5.91
	pH (pH)	7.40	7.37	7.12	7.09	7.06
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Total Dissolved Solids (mg/L)	19.2	20.4	15.4	17.6	18.1
	Turbidity (NTU)	0.18	0.17	0.19	0.19	0.26
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	10.7	11.7	9.0	8.7	8.5
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Total (as CaCO3) (mg/L)	10.7	11.7	9.0	8.7	8.5
	Ammonia, Total (as N) (mg/L)	0.0083	0.0095	0.0087	0.0381	0.0088
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	0.63	0.67	0.72	0.72	0.68
	Fluoride (F) (mg/L)	0.071	0.078	0.084	0.085	0.078
	Nitrate (as N) (mg/L)	<0.0050	<0.0050	0.0138	0.0134	0.0132
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	0.116	0.121	0.108	0.139	0.132
	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)	0.0023	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)	3.66	3.82	4.33	4.35	4.15
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	1.97	2.14	1.68	1.35 SFP	1.53
	Total Organic Carbon (mg/L)	1.43	1.85	1.26	1.51	1.29
Total Metals	Aluminum (Al)-Total (mg/L)	0.0031	<0.0030 0.0032	0.0037	0.0042	0.0046
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00018	0.00017	0.00032	0.00025	0.00030
	Barium (Ba)-Total (mg/L)	0.00150	0.00127 0.00138	0.00172	0.00129	0.00168
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)-Total (mg/L)	2.03	1.79	1.44	1.17	1.59

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1406897-6	L1406897-7	L1406897-8		
	Description	WATER	WATER	WATER		
	Sampled Date	10-DEC-13	10-DEC-13			
	Sampled Time					
	Client ID	TPN-68-S	TPN-69-S	CREMP DEC EB-1		
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	20.0	26.6	<2.0		
	Hardness (as CaCO3) (mg/L)	4.14	9.26	<0.50		
	pH (pH)	6.75	6.91	6.07		
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0		
	Total Dissolved Solids (mg/L)	11.6	13.9	<3.0		
	Turbidity (NTU)	0.16	0.15	<0.10		
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	4.6	5.6	<2.0		
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0		
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0		
	Alkalinity, Total (as CaCO3) (mg/L)	4.6	5.6	<2.0		
	Ammonia, Total (as N) (mg/L)	0.0252	0.0235	<0.0050		
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050		
	Chloride (Cl) (mg/L)	0.47	0.72	<0.10		
	Fluoride (F) (mg/L)	0.071	0.066	<0.020		
	Nitrate (as N) (mg/L)	0.0374	0.0557	<0.0050		
	Nitrite (as N) (mg/L)	<0.0010	0.0015	<0.0010		
	Total Kjeldahl Nitrogen (mg/L)	0.127	0.124	<0.050		
	Orthophosphate-Dissolved (as P) (mg/L)	0.0014	<0.0010	<0.0010		
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020	<0.0020	<0.0020		
	Phosphorus (P)-Total (mg/L)	0.0022	<0.0020	<0.0020		
	Silicate (as SiO2) (mg/L)	<0.50	<0.50	<0.50		
	Sulfate (SO4) (mg/L)	3.46	4.89	<0.50		
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	1.81	1.59	1.31 RRV		
	Total Organic Carbon (mg/L)	1.42	1.25	0.71 RRV		
Total Metals	Aluminum (Al)-Total (mg/L)	0.0037	<0.0030	<0.0030		
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010		
	Arsenic (As)-Total (mg/L)	0.00012	0.00013	<0.00010		
	Barium (Ba)-Total (mg/L)	0.00160	0.00154	0.000173		
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010		
	Bismuth (Bi)-Total (mg/L)	<0.00050	<0.00050	<0.00050		
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010		
	Cadmium (Cd)-Total (mg/L)	0.000010	<0.000010	0.000040		
	Calcium (Ca)-Total (mg/L)	1.17	1.12	0.474		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1406897-1 WATER 08-DEC-13 SP-68-S	L1406897-2 WATER 08-DEC-13 SP-69-S	L1406897-3 WATER 09-DEC-13 TPE-68-S	L1406897-4 WATER CREMP DEC DUP1	L1406897-5 WATER 09-DEC-13 TPE-69-S
WATER						
Total Metals	Chromium (Cr)-Total (mg/L)	0.00013	0.00012	0.00010	0.00013	0.00013
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Total (mg/L)	0.00052	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)	0.000055	0.000111	<0.000050	<0.000050	0.000065
	Lithium (Li)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Magnesium (Mg)-Total (mg/L)	0.62	0.57	0.51	0.41	0.50
	Manganese (Mn)-Total (mg/L)	0.000524	0.000417	0.000705	0.000524	0.000684
	Mercury (Hg)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Total (mg/L)	0.000086	0.000075	0.000113	0.000082	0.000114
	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)	0.26	0.24	0.27	0.24	0.27
	Selenium (Se)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Silicon (Si)-Total (mg/L)	0.116	0.093	<0.050	<0.050	<0.050
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	0.394	0.366	0.492	0.393	0.476
	Strontium (Sr)-Total (mg/L)	0.00888	0.00785	0.00630	0.00497	0.00622
	Sulfur (S)-Total (mg/L)	0.70	0.66	0.72	0.57	0.68
	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)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Total (mg/L)	0.000024	0.000022	0.000028	0.000023	0.000029
	Vanadium (V)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
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	0.0022	<0.0010	0.0027	0.0012
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00012	0.00014	0.00021	0.00031	0.00028

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1406897-6	L1406897-7	L1406897-8		
	Description	WATER	WATER	WATER		
	Sampled Date	10-DEC-13	10-DEC-13			
	Sampled Time					
	Client ID	TPN-68-S	TPN-69-S	CREMP DEC EB-1		
Grouping	**Analyte**					
WATER						
Total Metals	Chromium (Cr)-Total (mg/L)	0.00010	0.00013	<0.00010		
	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)	<0.010	<0.010	<0.010		
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	0.000381		
	Lithium (Li)-Total (mg/L)	<0.00050	<0.00050	<0.00050		
	Magnesium (Mg)-Total (mg/L)	0.43	0.45	<0.10		
	Manganese (Mn)-Total (mg/L)	0.00197	0.00204	0.000293		
	Mercury (Hg)-Total (mg/L)	<0.000010	<0.000010	<0.000010		
	Molybdenum (Mo)-Total (mg/L)	0.000114	0.000124	<0.000050		
	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)	0.24	0.28	<0.10		
	Selenium (Se)-Total (mg/L)	<0.00010	<0.00010	<0.00010		
	Silicon (Si)-Total (mg/L)	<0.050	<0.050	<0.050		
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010		
	Sodium (Na)-Total (mg/L)	0.581	0.599	<0.050		
	Strontium (Sr)-Total (mg/L)	0.00523	0.00526	0.00060		
	Sulfur (S)-Total (mg/L)	0.82	0.89	<0.50		
	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)	<0.010	<0.010	<0.010		
	Uranium (U)-Total (mg/L)	0.000027	0.000028	<0.000010		
	Vanadium (V)-Total (mg/L)	<0.0010	<0.0010	<0.0010		
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030		
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD		
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD		
	Aluminum (Al)-Dissolved (mg/L)	0.0013	0.0016	<0.0010		
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Arsenic (As)-Dissolved (mg/L)	<0.00010	0.00018	<0.00010		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1406897-1	L1406897-2	L1406897-3	L1406897-4	L1406897-5
	Description	WATER	WATER	WATER	WATER	WATER
	Sampled Date	08-DEC-13	08-DEC-13	09-DEC-13		09-DEC-13
	Sampled Time					
	Client ID	SP-68-S	SP-69-S	TPE-68-S	CREMP DEC DUP1	TPE-69-S
Grouping	**Analyte**					
WATER						
Dissolved Metals	Barium (Ba)-Dissolved (mg/L)	0.00114	0.00143	0.00128	0.00199 DTC	0.00164
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.000010	0.000011	<0.000010	0.000019	<0.000010
	Calcium (Ca)-Dissolved (mg/L)	1.55	1.77	1.06	2.11 DTC	1.58
	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	0.00034	<0.00020	0.00034	0.00020
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Lead (Pb)-Dissolved (mg/L)	<0.000050	0.000180	<0.000050	0.000114	<0.000050
	Lithium (Li)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Magnesium (Mg)-Dissolved (mg/L)	0.46	0.55	0.37	0.59	0.48
	Manganese (Mn)-Dissolved (mg/L)	0.000137	0.000155	0.000139	0.000356	0.000224
	Mercury (Hg)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Dissolved (mg/L)	0.000051	0.000064	0.000078	0.000129	0.000085
	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)	0.18	0.24	0.19	0.34	0.26
	Selenium (Se)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Silicon (Si)-Dissolved (mg/L)	0.082	0.088	<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)	0.311	0.376	0.354	0.588 DTC	0.463
	Strontium (Sr)-Dissolved (mg/L)	0.00660	0.00803	0.00473	0.00782 DTC	0.00594
	Sulfur (S)-Dissolved (mg/L)	0.51	0.62	<0.50	0.87	0.66
	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)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Dissolved (mg/L)	0.000014	0.000018	0.000017	0.000029	0.000024
	Vanadium (V)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	0.0012	<0.0010	0.0011	0.0011
Plant Pigments	Chlorophyll a (ug/L)	0.285	0.265	0.279	0.186	0.205

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1406897-6	L1406897-7	L1406897-8		
	Description	WATER	WATER	WATER		
	Sampled Date	10-DEC-13	10-DEC-13			
	Sampled Time					
	Client ID	TPN-68-S	TPN-69-S	CREMP DEC EB-1		
Grouping	**Analyte**					
WATER						
Dissolved Metals	Barium (Ba)-Dissolved (mg/L)	0.00141	0.00316 DTC	<0.000050		
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050		
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010		
	Cadmium (Cd)-Dissolved (mg/L)	<0.000010	<0.000010	0.000019		
	Calcium (Ca)-Dissolved (mg/L)	1.07	2.26 DTC	<0.050		
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Copper (Cu)-Dissolved (mg/L)	<0.00020	0.00041	<0.00020		
	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)	<0.00050	<0.00050	<0.00050		
	Magnesium (Mg)-Dissolved (mg/L)	0.36	0.88 DTC	<0.10		
	Manganese (Mn)-Dissolved (mg/L)	0.00147	0.00371 DTC	<0.000050		
	Mercury (Hg)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010		
	Molybdenum (Mo)-Dissolved (mg/L)	0.000085	0.000235 DTC	<0.000050		
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	0.00153 DTC	<0.00050		
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050		
	Potassium (K)-Dissolved (mg/L)	0.21	0.53 DTC	<0.10		
	Selenium (Se)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	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)	0.503	1.23 DTC	<0.050		
	Strontium (Sr)-Dissolved (mg/L)	0.00441	0.0107 DTC	<0.00020		
	Sulfur (S)-Dissolved (mg/L)	0.69	1.85	<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)	<0.010	<0.010	<0.010		
	Uranium (U)-Dissolved (mg/L)	0.000018	0.000046	<0.000010		
	Vanadium (V)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010		
	Zinc (Zn)-Dissolved (mg/L)	0.0010	<0.0010	0.0011		
Plant Pigments	Chlorophyll a (ug/L)	0.094	0.098			

* 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	Arsenic (As)-Dissolved	DLA	L1406897-1, -2, -3, -4, -5, -6, -7, -8
Duplicate	Beryllium (Be)-Dissolved	DLA	L1406897-1, -2, -3, -4, -5, -6, -7, -8
Duplicate	Bismuth (Bi)-Dissolved	DLA	L1406897-1, -2, -3, -4, -5, -6, -7, -8
Duplicate	Cadmium (Cd)-Dissolved	DLA	L1406897-1, -2, -3, -4, -5, -6, -7, -8
Duplicate	Chromium (Cr)-Dissolved	DLA	L1406897-1, -2, -3, -4, -5, -6, -7, -8
Duplicate	Cobalt (Co)-Dissolved	DLA	L1406897-1, -2, -3, -4, -5, -6, -7, -8
Duplicate	Lead (Pb)-Dissolved	DLA	L1406897-1, -2, -3, -4, -5, -6, -7, -8
Duplicate	Silver (Ag)-Dissolved	DLA	L1406897-1, -2, -3, -4, -5, -6, -7, -8
Duplicate	Tin (Sn)-Dissolved	DLA	L1406897-1, -2, -3, -4, -5, -6, -7, -8
Duplicate	Titanium (Ti)-Dissolved	DLA	L1406897-1, -2, -3, -4, -5, -6, -7, -8
Duplicate	Vanadium (V)-Dissolved	DLA	L1406897-1, -2, -3, -4, -5, -6, -7, -8
Duplicate	Bromide (Br)	DLM	L1406897-1, -2, -3, -4, -5, -6, -7, -8
Duplicate	Nitrite (as N)	DLM	L1406897-1, -2, -3, -4, -5, -6, -7, -8
Duplicate	Nitrate (as N)	DLM	L1406897-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1406897-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Boron (B)-Dissolved	MS-B	L1406897-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Cobalt (Co)-Dissolved	MS-B	L1406897-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1406897-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Nickel (Ni)-Dissolved	MS-B	L1406897-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1406897-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1406897-1, -2, -3, -4, -5, -6, -7, -8

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution
DLM	Detection Limit Adjusted due to sample matrix effects.
DTC	Dissolved concentration exceeds total. Results were confirmed by re-analysis.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RRV	Reported Result Verified By Repeat Analysis
SFP	Sample was Filtered and Preserved at the laboratory

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-SCR-VA	Water	Alkalinity by colour or titration	EPA 310.2 OR APHA 2320

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.
OR
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.

ANIONS-BR-IC-VA	Water	Bromide by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-CL-LOW-IC-VA	Water	Low level Chloride by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-F-IC-VA	Water	Fluoride by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-NO2-IC-VA	Water	Nitrite in Water by Ion Chromatography	EPA 300.0

This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Nitrite is detected by UV absorbance.

ANIONS-NO3-IC-VA	Water	Nitrate in Water by Ion Chromatography	EPA 300.0

This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Nitrate is detected by UV absorbance.

Reference Information

ANIONS-SO4-IC-VA	Water	Sulfate by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310 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 5310 TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

CHLOROA-VA	Water	Chlorophyll a by Fluorometer	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.

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.

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-DIS-LOW-CVAFS-VA	Water	Dissolved Mercury in Water by CVAFS(Low)	EPA SW-846 3005A & EPA 245.7

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 filtration (EPA Method 3005A) and involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

HG-TOT-LOW-CVAFS-VA	Water	Total Mercury in Water by CVAFS(Low)	EPA 245.7

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 a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030 B&E / EPA SW-846 6020A

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 hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

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	APHA 3030 B&E / EPA SW-846 6020A

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 hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

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	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-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorous is determined colourimetrically after persulphate digestion of the sample.

Reference Information

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 Phosphorous 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 Phosphorous

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.

TDS-LOW-VA Water Low Level TDS (3.0mg/L) by Gravimetric APHA 2540 Gravimetric

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 2540 Gravimetric

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.

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

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

h Processing

L1406897-COFC

ain 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:	Laura Bekar	☐ PDF ☐ Excel ☐ Digital ☐ Fax	○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1: lbekar@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 #: Meadowbank Surfacewater	
Company:		PO / AFE:	
Contact:		LSD:	
Address:			
Phone:	Fax:	Quote #: Q39503	
ab 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	Alkalinity Species, Anions-All	pH, EC, Turb, TDS, Silicate	T-P, TD-P, Ortho-PO4	TSS-Low	Ammonia, TKN	TOC	DOC	Total Metals (MET-T-MDR-VA)	Diss. Metals (MET-D-MDR-VA)	Total Mercury (Low Level)	Diss. Mercury (Low Level)	Chlorophyl 'a'	Number of Containers
	SP-68-S	08-Dec-13		Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	SP-69-S	08-Dec-13		Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	TPE-68-S	09-Dec-13		Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	CREMP DEC DUP 1			Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	TPE-69-S	09-Dec-13		Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	TPN-68-S	10-Dec-13		Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	TPN-69-S	10-Dec-13		Water	x	x	x	x	x	x	x	x	x	x	x	x	6
	CREMP DEC EB-1			Water	x	x	x	x	x	x	x	x	x	x	x	x	6

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

(1) there are no Chlorophyll-a filters for samples with IDs including "EB-" and for "travel/trip blank" samples; however, all other analyses should be conducted on these samples. (2) 500 mL of water were filtered for all Chlorophyll-a sample filters included in this shipment.

PR/24DEC/9:45 .6/-.6°C

AZIMUTH CONSULTING GROUP INC.
ATTN: Eric Franz
218 - 2902 West Broadway
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Date Received: 09-JAN-14
Report Date: 17-JAN-14 18:02 (MT)
Version: FINAL

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1410025

Project P.O. #: NOT SUBMITTED
Job Reference: MEADOWBANK SURFACEWATER
C of C Numbers:
Legal Site Desc:

Brent Mack
Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1410025-1	L1410025-2	L1410025-3	L1410025-4	L1410025-5
	Description	Water	Water	Water	Water	Water
	Sampled Date	19-DEC-13	19-DEC-13	22-DEC-13	22-DEC-13	22-DEC-13
	Sampled Time	11:51	12:19	10:55	11:30	15:45
	Client ID	INUG-56-S	INUG-57-S	TE-68-S	TE-69-S	WALLY-37-S
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	17.4	16.9	19.3	19.0	55.4
	Hardness (as CaCO3) (mg/L)	5.87	6.54	6.51	6.30	25.4
	pH (pH)	6.89	6.91	6.93	6.94	7.54
	Total Suspended Solids (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Total Dissolved Solids (mg/L)	11.7	13.5	10.7	11.0	41.9
	Turbidity (NTU)	0.16	0.20	0.19	0.17	0.22
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	5.4	5.3	5.3	5.4	21.3
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Alkalinity, Total (as CaCO3) (mg/L)	5.4	5.3	5.3	5.4	21.3
	Ammonia, Total (as N) (mg/L)	0.0083	<0.0050	<0.0050	<0.0050	0.0078
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	0.73	0.74	0.62	0.62	0.83
	Fluoride (F) (mg/L)	0.061	0.062	0.061	0.061	0.051
	Nitrate (as N) (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	0.0088
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	0.133	0.115	0.090	0.084	0.140
	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)	0.0021	0.0021	<0.0020	<0.0020	0.0024
	Silicate (as SiO2) (mg/L)	<0.50	<0.50	<0.50	<0.50	1.19
	Sulfate (SO4) (mg/L)	0.99	1.01	2.29	2.25	4.15
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	2.37	2.38	1.66	1.63	2.61
	Total Organic Carbon (mg/L)	2.18	2.08	1.40	1.50	4.36
Total Metals	Aluminum (Al)-Total (mg/L)	0.0045	0.0052	0.0059	0.0052	0.0054
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00013	0.00011	0.00012	0.00013	0.00045
	Barium (Ba)-Total (mg/L)	0.00176	0.00185	0.00228	0.00259	0.00242
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	0.000011	0.000011	0.000020	<0.000010	0.000085
	Calcium (Ca)-Total (mg/L)	1.20	1.21	1.68	1.59	6.37
	Chromium (Cr)-Total (mg/L)	<0.00010	0.00019	<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	0.00102

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1410025-6				
	Description	Water				
	Sampled Date	22-DEC-13				
	Sampled Time	14:15				
	Client ID	WALLY-38-S				
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	41.1				
	Hardness (as CaCO3) (mg/L)	16.9				
	pH (pH)	7.46				
	Total Suspended Solids (mg/L)	<1.0				
	Total Dissolved Solids (mg/L)	33.0				
	Turbidity (NTU)	0.27				
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	14.5				
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<2.0				
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<2.0				
	Alkalinity, Total (as CaCO3) (mg/L)	14.5				
	Ammonia, Total (as N) (mg/L)	0.0071				
	Bromide (Br) (mg/L)	<0.050				
	Chloride (Cl) (mg/L)	0.83				
	Fluoride (F) (mg/L)	0.055				
	Nitrate (as N) (mg/L)	<0.0050				
	Nitrite (as N) (mg/L)	<0.0010				
	Total Kjeldahl Nitrogen (mg/L)	0.123				
	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)	0.68				
	Sulfate (SO4) (mg/L)	3.63				
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	2.27				
	Total Organic Carbon (mg/L)	1.82				
Total Metals	Aluminum (Al)-Total (mg/L)	0.0078				
	Antimony (Sb)-Total (mg/L)	<0.00010				
	Arsenic (As)-Total (mg/L)	0.00032				
	Barium (Ba)-Total (mg/L)	0.00222				
	Beryllium (Be)-Total (mg/L)	<0.00010				
	Bismuth (Bi)-Total (mg/L)	<0.00050				
	Boron (B)-Total (mg/L)	<0.010				
	Cadmium (Cd)-Total (mg/L)	<0.000010				
	Calcium (Ca)-Total (mg/L)	4.61				
	Chromium (Cr)-Total (mg/L)	<0.00010				
	Cobalt (Co)-Total (mg/L)	<0.00010				
	Copper (Cu)-Total (mg/L)	0.00094				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1410025-1 Water 19-DEC-13 11:51 INUG-56-S	L1410025-2 Water 19-DEC-13 12:19 INUG-57-S	L1410025-3 Water 22-DEC-13 10:55 TE-68-S	L1410025-4 Water 22-DEC-13 11:30 TE-69-S	L1410025-5 Water 22-DEC-13 15:45 WALLY-37-S
Sample ID						
Description						
Sampled Date						
Sampled Time						
Client ID						
WATER						
Total Metals	Iron (Fe)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010	0.012
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	0.000081
	Lithium (Li)-Total (mg/L)	0.00063	0.00053	<0.00050	0.00063	<0.00050
	Magnesium (Mg)-Total (mg/L)	0.70	0.74	0.67	0.64	2.06
	Manganese (Mn)-Total (mg/L)	0.000587	0.000650	0.000649	0.000635	0.00136
	Mercury (Hg)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Total (mg/L)	<0.000050	<0.000050	0.000058	0.000115	0.000298
	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)	0.39	0.42	0.48	0.43	0.53
	Selenium (Se)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Silicon (Si)-Total (mg/L)	0.114	0.131	0.130	0.125	0.660
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	0.625	0.596	0.645	0.638	0.685
	Strontium (Sr)-Total (mg/L)	0.00652	0.00671	0.00855	0.00845	0.0321
	Sulfur (S)-Total (mg/L)	<0.50	<0.50	0.84	0.85	1.44
	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)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Total (mg/L)	0.000037	0.000042	0.000039	0.000039	0.000063
	Vanadium (V)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
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)	0.0022	0.0029	0.0016	0.0016	0.0024
	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	<0.00010	0.00041
	Barium (Ba)-Dissolved (mg/L)	0.00175	0.00194	0.00213	0.00224	0.00247
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	0.000014	<0.000010	0.000011	<0.000010	0.000014
	Calcium (Ca)-Dissolved (mg/L)	1.19	1.32	1.55	1.50	6.66
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	0.00017	<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)	0.00032	0.00035	0.00026	0.00030	0.00095
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1410025-6				
	Description	Water				
	Sampled Date	22-DEC-13				
	Sampled Time	14:15				
	Client ID	WALLY-38-S				
Grouping	**Analyte**					
WATER						
Total Metals	Iron (Fe)-Total (mg/L)	0.016				
	Lead (Pb)-Total (mg/L)	0.000669				
	Lithium (Li)-Total (mg/L)	<0.00050				
	Magnesium (Mg)-Total (mg/L)	1.35				
	Manganese (Mn)-Total (mg/L)	0.00106				
	Mercury (Hg)-Total (mg/L)	<0.000010				
	Molybdenum (Mo)-Total (mg/L)	0.000178				
	Nickel (Ni)-Total (mg/L)	<0.00050				
	Phosphorus (P)-Total (mg/L)	<0.050				
	Potassium (K)-Total (mg/L)	0.49				
	Selenium (Se)-Total (mg/L)	<0.00010				
	Silicon (Si)-Total (mg/L)	0.412				
	Silver (Ag)-Total (mg/L)	<0.000010				
	Sodium (Na)-Total (mg/L)	0.660				
	Strontium (Sr)-Total (mg/L)	0.0234				
	Sulfur (S)-Total (mg/L)	1.25				
	Thallium (Tl)-Total (mg/L)	<0.000010				
	Tin (Sn)-Total (mg/L)	<0.00010				
	Titanium (Ti)-Total (mg/L)	<0.010				
	Uranium (U)-Total (mg/L)	0.000045				
	Vanadium (V)-Total (mg/L)	<0.0010				
	Zinc (Zn)-Total (mg/L)	<0.0030				
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD				
	Dissolved Metals Filtration Location	FIELD				
	Aluminum (Al)-Dissolved (mg/L)	0.0033				
	Antimony (Sb)-Dissolved (mg/L)	<0.00010				
	Arsenic (As)-Dissolved (mg/L)	0.00027				
	Barium (Ba)-Dissolved (mg/L)	0.00219				
	Beryllium (Be)-Dissolved (mg/L)	<0.00010				
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050				
	Boron (B)-Dissolved (mg/L)	<0.010				
	Cadmium (Cd)-Dissolved (mg/L)	0.000011				
	Calcium (Ca)-Dissolved (mg/L)	4.56				
	Chromium (Cr)-Dissolved (mg/L)	<0.00010				
	Cobalt (Co)-Dissolved (mg/L)	<0.00010				
	Copper (Cu)-Dissolved (mg/L)	0.00084				
	Iron (Fe)-Dissolved (mg/L)	<0.010				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1410025-1 Water 19-DEC-13 11:51 INUG-56-S	L1410025-2 Water 19-DEC-13 12:19 INUG-57-S	L1410025-3 Water 22-DEC-13 10:55 TE-68-S	L1410025-4 Water 22-DEC-13 11:30 TE-69-S	L1410025-5 Water 22-DEC-13 15:45 WALLY-37-S
WATER						
Dissolved Metals	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	0.000367 DTC	0.000075
	Lithium (Li)-Dissolved (mg/L)	0.00057	<0.00050	<0.00050	0.00053	<0.00050
	Magnesium (Mg)-Dissolved (mg/L)	0.71	0.79	0.64	0.62	2.14
	Manganese (Mn)-Dissolved (mg/L)	0.000243	0.000356	0.000230	0.000244	0.000735
	Mercury (Hg)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	0.000254
	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	0.45	0.39	0.40	0.54
	Selenium (Se)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Silicon (Si)-Dissolved (mg/L)	0.112	0.128	0.119	0.122	0.682
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	0.557	0.589	0.587	0.613	0.684
	Strontium (Sr)-Dissolved (mg/L)	0.00612	0.00677	0.00808	0.00810	0.0308
	Sulfur (S)-Dissolved (mg/L)	<0.50	<0.50	0.72	0.71	1.42
	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)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Dissolved (mg/L)	0.000036	0.000035	0.000030	0.000030	0.000057
	Vanadium (V)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Plant Pigments	Chlorophyll a (ug/L)	0.109	0.157	0.416	0.238	0.464

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1410025-6				
	Description	Water				
	Sampled Date	22-DEC-13				
	Sampled Time	14:15				
	Client ID	WALLY-38-S				
Grouping	**Analyte**					
WATER						
Dissolved Metals	Lead (Pb)-Dissolved (mg/L)	<0.000050				
	Lithium (Li)-Dissolved (mg/L)	0.00056				
	Magnesium (Mg)-Dissolved (mg/L)	1.34				
	Manganese (Mn)-Dissolved (mg/L)	0.000472				
	Mercury (Hg)-Dissolved (mg/L)	<0.000010				
	Molybdenum (Mo)-Dissolved (mg/L)	0.000174				
	Nickel (Ni)-Dissolved (mg/L)	<0.00050				
	Phosphorus (P)-Dissolved (mg/L)	<0.050				
	Potassium (K)-Dissolved (mg/L)	0.46				
	Selenium (Se)-Dissolved (mg/L)	<0.00010				
	Silicon (Si)-Dissolved (mg/L)	0.397				
	Silver (Ag)-Dissolved (mg/L)	<0.000010				
	Sodium (Na)-Dissolved (mg/L)	0.649				
	Strontium (Sr)-Dissolved (mg/L)	0.0226				
	Sulfur (S)-Dissolved (mg/L)	1.19				
	Thallium (Tl)-Dissolved (mg/L)	<0.000010				
	Tin (Sn)-Dissolved (mg/L)	<0.00010				
	Titanium (Ti)-Dissolved (mg/L)	<0.010				
	Uranium (U)-Dissolved (mg/L)	0.000045				
	Vanadium (V)-Dissolved (mg/L)	<0.0010				
	Zinc (Zn)-Dissolved (mg/L)	<0.0010				
Plant Pigments	Chlorophyll a (ug/L)	0.373				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

Qualifiers for Sample Submission Listed:

Qualifier	Description
WSMD	Water sample(s) for dissolved mercury analysis was not submitted in glass 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)	DLM	L1410025-1, -2, -3, -4, -5, -6
Duplicate	Fluoride (F)	DLM	L1410025-1, -2, -3, -4, -5, -6
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1410025-1, -2, -3, -4, -5, -6
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1410025-1, -2, -3, -4, -5, -6
Matrix Spike	Strontium (Sr)-Total	MS-B	L1410025-1, -2, -3, -4, -5, -6
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1410025-1, -2, -3, -4, -5, -6
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1410025-1, -2, -3, -4, -5, -6
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1410025-1, -2, -3, -4, -5, -6
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1410025-1, -2, -3, -4, -5, -6
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1410025-1, -2, -3, -4, -5, -6
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1410025-1, -2, -3, -4, -5, -6
Matrix Spike	Total Organic Carbon	MS-B	L1410025-5
Duplicate	Total Kjeldahl Nitrogen	TKND	L1410025-1, -2, -3, -4, -5, -6

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLM	Detection Limit Adjusted due to sample matrix effects.
DTC	Dissolved concentration exceeds total. Results were confirmed by re-analysis.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
TKND	TKN duplication was poor due to interference from high nitrate, which causes negative bias on TKN.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-SCR-VA	Water	Alkalinity by colour or titration	EPA 310.2 OR APHA 2320

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.
OR
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.

ANIONS-BR-IC-VA	Water	Bromide by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-CL-LOW-IC-VA	Water	Low level Chloride by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-F-IC-VA	Water	Fluoride by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-NO2-IC-VA	Water	Nitrite in Water by Ion Chromatography	EPA 300.0

This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Nitrite is detected by UV absorbance.

ANIONS-NO3-IC-VA	Water	Nitrate in Water by Ion Chromatography	EPA 300.0

This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Nitrate is detected by UV absorbance.

ANIONS-SO4-IC-VA	Water	Sulfate by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310 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.

Reference Information

CARBONS-TOC-VA Water Total organic carbon by combustion APHA 5310 TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

CHLOROA-VA Water Chlorophyll a by Fluorometer 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.

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.

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-DIS-LOW-CVAFS-VA Water Dissolved Mercury in Water by CVAFS(Low) EPA SW-846 3005A & EPA 245.7

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 filtration (EPA Method 3005A) and involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

HG-TOT-LOW-CVAFS-VA Water Total Mercury in Water by CVAFS(Low) EPA 245.7

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 a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

MET-D-CCMS-VA Water Dissolved Metals in Water by CRC ICPMS APHA 3030 B&E / EPA SW-846 6020A

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 hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

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 APHA 3030 B&E / EPA SW-846 6020A

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 hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

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 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-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorous 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 Phosphorous is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

PH-MAN-VA Water pH by Manual Meter 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.

Reference Information

It is recommended that this analysis be conducted in the field.

PH-MAN-VA Water pH by Manual Meter 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.

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 Phosphorous

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.

TDS-LOW-VA Water Low Level TDS (3.0mg/L) by Gravimetric APHA 2540 Gravimetric

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 2540 Gravimetric

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.

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.

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.

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	Analysis Request
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #: Meadowbank Surfacewater	Please indicate below Filtered, Preserved or both (F, P, F/P)
Company:		PO / AFE:	
Contact:		LSD:	
Address:			
Phone:	Fax:	Quote #: Q39503	
Lab Work Order # (lab use only)	L1410025	ALS Contact:	Sampler:

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Alk Species, pH, EC, Turbidity	Anions (F, NO2, NO3, Br, SO4)	Low Level Chloride by IC	Silicate, Turbidity	Total-P, TD-P, Ortho-PO4	TSS-Low, TDS-Low	Ammonia, TKN	TOC (P)	DOC (F/P)	T. Met.+Hg (MET-T-BCMDG-VA) (P)	D. Met.+Hg(MET-D-BCMDG-VA) (F/P)	Chlorophyll-a	Number of Containers
	INUG-56-S	19-Dec-13	11:51	Water	X	X	X	X	X	X	X	X	X	X	X	X	6
	INUG-57-S	19-Dec-13	12:19	Water	X	X	X	X	X	X	X	X	X	X	X	X	6
	TE-68-S	22-Dec-13	10:55	Water	X	X	X	X	X	X	X	X	X	X	X	X	6
	TE-69-S	22-Dec-13	11:30	Water	X	X	X	X	X	X	X	X	X	X	X	X	6
	WALLY-37-S	22-Dec-13	15:45	Water	X	X	X	X	X	X	X	X	X	X	X	X	6
	WALLY-38-S	22-Dec-13	14:15	Water	X	X	X	X	X	X	X	X	X	X	X	X	6

Short Holding Time

Rush Processing

L1410025-COFC

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

*** 500 mL of water were filtered for all Chlorophyll-a sample filters included in this shipment.***

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
			PR	9 JAN	9:15	0.4 °C				