Appendix 33

Meadowbank and Whale Tail 2021 Core Receiving Environment Monitoring Program Report

2021 Core Receiving Environment Monitoring Program

Meadowbank Complex

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EXECUTIVE SUMMARY

The Core Receiving Environment Monitoring Program for the Meadowbank Complex focuses on identifying changes in water quality, sediment chemistry, and aquatic communities—both primary producers (phytoplankton) and secondary producers (benthic invertebrate community)—that may be associated with mining activities. Changes are identified using a temporal/spatial trend assessment. The trend assessment includes the use of early warning *triggers* and action *thresholds* to support management decisions within the Aquatic Effects Management Program (AEMP). The AEMP is the overarching 'umbrella' program that integrates results of individual, but related, monitoring programs for the purpose of implementing management actions before unacceptable adverse impacts occur to aquatic life.

Meadowbank

The 2021 CREMP results for the Meadowbank study area are presented below and summarized in **Table ES-1**.

Water Quality (Limnology & Water Chemistry)

Water quality monitoring for limnology and chemistry was completed in March, May, July, August, and September 2021 according to the CREMP study design. Limnology profiles were taken at the Near-Field (NF) areas—Third Portage Lake sampling areas, (TPN, TPE), Second Portage Lake (SP), and Wally Lake (WAL)—in the winter months when ice conditions were safe (January, February, April, November, and December), to verify the absence of anomalous changes in water quality (e.g., conductivity) attributable to site-related activities.

The NF areas close to the mine have higher concentrations of dissolved solids and constituent major ions such as calcium and magnesium compared to baseline/reference conditions. This observation is consistent with previous findings. While these changes to water quality are mine-related, the observed concentrations are still relatively low and there is no evidence to suggest concentrations are increasing year-over-year or that the observed concentrations would result in adverse ecological effects. Consistent with previous reporting cycles, there were no trigger exceedances in 2021 for any water quality parameters with CCME water quality guidelines, including metals. In the context of the assessment framework outlined in the Final Environmental Impact Statement (FEIS), the magnitude of potential effect on water quality in each of the near-field lakes in 2021 was considered *low* (i.e., less than 1X the CCME WQGs) and consistent with the original predictions. **Routine water quality monitoring is recommended for 2022.**

Long-term Trend Analysis – In addition to the routine assessment of water quality at Meadowbank summarized above, a more detailed assessment of temporal changes for a subset of major ions in NF areas was completed in 2021 using a mixed-effects model approach. The purpose of the assessment was to better understand the pattern of change for key water chemistry parameters in the period after mining. Physical/ionic parameters were the focus of this analysis since they have consistently increased over time relative to control and exceeded triggers and/or FEIS predictions. These parameters included conductivity, water hardness, calcium, magnesium, total alkalinity, and TDS. The BACI analysis used in the routine assessment provides a useful and robust measure of changes in parameters relative to control during a given year. The mixed-effects trend analysis was developed in 2021 to complement the BACI analysis and provide a statistically supported understanding of long-term trends in key water chemistry parameters.

The trend analysis showed that there is strong evidence that differences in physical/ionic parameters relative to INUG have been stable since 2014 at TPN, TPE and SP, though there was more variability in year-to-year differences at SP between 2014 and 2021.

Phytoplankton Community

Phytoplankton community sampling was completed at the same time as the water chemistry sampling program in 2021. The phytoplankton community at TPN had higher biomass (47%; p=0.022) and richness (26% increase; p=0.011) in 2021 compared to reference/baseline conditions. The apparent increase in biomass and richness is not associated with higher nutrient concentrations, which implies the increase observed in 2021 may be natural. Ultimately, the long-term phytoplankton monitoring data demonstrates that mining operations have not contributed to pervasive changes in primary productivity among the NF areas. **The trends in phytoplankton biomass and richness will be reviewed again in 2022.**

Sediment Chemistry

Sediment grab sampling was conducted at the NF and reference areas to support the benthic invertebrate community monitoring component of the CREMP. An oversight by staff at the analytical laboratory during sample receipt resulted in some of the samples being discarded prior to analysis. Chemistry results for samples that were analyzed showed concentrations have not increased. **Sediment grab samples will be conducted in 2022 to replace the discarded samples from 2021 and to support the benthic invertebrate community sampling program. The next sediment coring program is scheduled for August 2023.**

Benthos Community

There were no statistically significant changes to the benthic invertebrate community at Meadowbank relative to baseline/reference conditions identified by the 2021 BACI assessment. **The trends in benthos abundance and richness will be reviewed again in 2022.**

Whale Tail

The 2021 CREMP results for the Whale Tail study area are presented below and summarized in **Table ES-2**.

Overview of the 2021 Whale Tail Pit CREMP

Data analysis for Whale Tail study areas follows the same methods and framework as Meadowbank. 2021 was the third full year where most Whale Tail study area lakes were classified as *impact*. Whale Tail South (WTS) and Mammoth Lake (MAM) switched from *control* to *impact* in 2018 coinciding with construction of the Whale Tail Dike. The status of Lake A20, Lake A76, and Lake DS1 switched to *impact* in January 2019. Nemo Lake (NEM) transitioned after July 2019.

Water Quality (Limnology & Water Chemistry)

Surface water monitoring for limnology and water chemistry were completed in March, May, July, August, and September according to the CREMP study design for the Whale Tail Pit study area. Supplemental limnology profiles were taken at Whale Tail South (WTS), Mammoth Lake (MAM), Nemo Lake (NEM) and Lake A20 in select winter months to verify that water quality is broadly within the range of expected values, particularly for conductivity and dissolved oxygen.

Changes in water quality in lakes downstream from the mine were predicted to occur during construction and operations. Water quality within the Whale Tail study area lakes exhibited fairly stable conditions during the baseline period. Consequently, when interpreting time series plots to examine spatial-temporal trends in water quality, the *signal* of development-related inputs was expected to be easily observed relative to the low *noise* levels of the baseline period. The following parameters have increased relative to baseline/reference conditions:

- *Ionic Compounds* – total dissolved solids (TDS) and constituent ions such as calcium, magnesium and potassium were elevated in the NF lakes and downstream of MAM to Lake A76.
- *Nutrients* – total Kjeldahl nitrogen (TKN) was elevated at NF areas WTS, MAM, and A20. Total phosphorous (TP) was elevated at WTS, A20, and A76. Total organic carbon (TOC) and dissolved organic carbon (DOC) were elevated at WTS and Lake A20. TOC was also elevated at MAM and NEM. The elevated parameters are likely the result of inputs from flooded terrestrial habitats following impoundment, dewatering inputs from WTN, and the joining of WTS to A20.
- *Metals/metalloids* – lithium was elevated at WTS and MAM and silicon was elevated at MAM. Neither of these parameters have effects-based guidelines for protection of freshwater aquatic life.

Of the parameters with trigger exceedances, FEIS predictions were exceeded for total phosphorous at WTS and total alkalinity, TDS, total lithium, and several ionic compounds at WTS and MAM in one or more sampling events. Importantly, the absolute concentrations of these parameters remain *low*. For WTS, the adaptive management Level 1 is in effect for total phosphorus and Level 0 is in effect for arsenic based on the results of the September sampling event. MAM is within the normal operating range and Level 0 water management strategy is in effect in 2022. **Routine water quality monitoring will continue in 2022 to track emerging spatial and temporal trends.**

Phytoplankton Community

Phytoplankton community sampling was completed at the same time as the water chemistry sampling program in 2021. Phytoplankton communities vary naturally throughout the year in total biomass (and density) and community composition (taxa richness). The primary stressors for the phytoplankton community include nutrients and metals in surface contact water discharged to MAM and WTS. Nutrient loading can manifest as an increase in total biomass or a change in community structure, while increasing metals concentrations would be expected to cause lower biomass and taxa diversity.

Increased total biomass was reported at WTS (10%), MAM (78%), A20 (222% increase), and A76 (119%) and NEM (95% increase) relative to control/baseline conditions. Only changes in total biomass at Lake A20 were statistically significant ($p=0.029$). The increase in biomass is consistent with higher concentrations of phosphorous and nitrogen in the NF and MF attributed to mining-related activities; however, some of the change in biomass may be natural.

No significant changes in the taxonomic richness of the phytoplankton community were observed in 2021. **Phytoplankton community monitoring is scheduled for 2022 according to the CREMP Plan.**

Sediment Chemistry

As previously mentioned, some of the sediment samples collected in August 2021 were discarded by the lab prior to being analyzed. Sediment samples from WTS, A76 and NEM were analyzed. Concentrations of metals were similar to results from the baseline period and early operations. **Sediment grab samples will be conducted in 2022 to replace the discarded samples from 2021 and to support the benthic invertebrate community sampling program. The next sediment coring program is scheduled for August 2023.**

Benthos Community

Benthic invertebrate (benthos) community structure (taxa richness) and function (abundance) in the Whale Tail study area lakes is typical of northern headwaters lakes in the region (i.e., relatively low abundance and few taxa). Although total abundance tends to be low, within-area variability can be substantial. Taxa richness, unlike abundance, is considerably less variable, both temporally (i.e., interannually) and spatially (i.e., among the different lakes). The typical number of taxa identified among the various study areas is 10 to 15. The range observed in 2021 was slightly higher in NEM than 2020 and slightly higher than the range of baseline conditions at NEM. All other study areas were comparable with baseline conditions. The comparatively high taxa richness, combined with no statistically significant changes in abundance at NF areas, implies that the changes in water quality observed in the NF and MF areas are not impacting the health of the benthos community. **Benthos community monitoring will be conducted in 2022 according to the scope and schedule of the CREMP Plan.**

Baker Lake

CREMP monitoring at Baker Lake started in 2008. Important mine-related activities in Baker Lake include barge/shipping traffic and general land-based activities associated with the tank farm area. The highest number of barge shipments were reported in 2021 since monitoring began in 2008. In 2021, there were three spills reported; two in-water spills and one in which it is uncertain whether the spill reached Baker Lake.

Water Quality and Sediment Quality

Water quality sampling was conducted at two NF areas (BBD, BPJ) and one FF area (BAP) in Baker Lake in July, August, and September 2021. The mean concentrations for total silicon and total titanium in water exceeded their respective triggers in 2021 at BBD and the BACI showed a statistically significant increase above baseline/reference. These increases were associated with spikes in other parameters (e.g., TSS), likely representing a natural isolated episodic event (e.g., river sediment plume, wave action etc.) rather than anthropogenic influence.

Sediment quality sampling was conducted at two NF areas (BBD, BPJ) and two FF areas (BAP, BES) in August 2021. Sediment grab samples were collected in 2021, however as previously mentioned, the laboratory discarded the samples prior to analysis. Sediment grab samples will be collected again in 2022, as part of the CREMP plan and to replace the discarded samples. Changes in sediment chemistry data are evaluated on a 3-year cycle as part of the sediment coring program (coinciding with the EEM cycle). The next sediment coring program is planned for 2023. There was no evidence of any barge-related impacts to water quality at *impact* areas in Baker Lake.

With the exception of the isolated increase in parameters at BBD where there are no mine-related activities, concentrations measured in water at Baker Lake in 2021 were comparable to results reported in previous annual monitoring reports **Monitoring in 2022 will follow the scope and schedule of the CREMP Plan.**

Biological Communities

The phytoplankton and benthos communities in Baker Lake have not exhibited any changes attributable to Agnico Eagle's activities in Baker Lake. **No follow-up management actions are required for 2022 beyond routine monitoring.**

Table ES-1. Summary of key findings from the 2021 Meadowbank CREMP.

Notes:
1. Temporal and spatial trends are outlined for Monitoring Components and Variables that exceeded trigger or thresholds (i.e., apparent change from baseline).
2. Spatial scale ratings are: localized = small area within the lake/area; widespread = basin to whole lake.
3. Causality ratings are: low = no evidence of a mine-related source; moderate = some likelihood of a mine-related source; high = the source of the change is likely mine-related.

Monitoring Component (and report section)	**Variable**	**Summary**	**Temporal and Spatial Trend Assessment**[1, 2, 3]	**Annual CREMP Results Compared to FEIS Predictions** (Cumberland, 2005)
Limnology Section 4.2	Temperature and Dissolved Oxygen	The limnology profiles collected in 2021 indicated dissolved oxygen and temperature readings are consistent with range of conditions typical of previous monitoring cycles.	There is no evidence to suggest seasonal fluctuation in dissolved oxygen and temperature among the NF study area lakes is attributed to mining site-related activities.	No predictions in the FEIS.
	Conductivity	The observations of minor stratification in early year monitoring events followed the pattern from previous years of being well mixed and unstratified by July. Stratification observed in January below 8 m at TPE, with conductivity ranging slightly higher than historical but within historical range in subsequent sampling events and could be due to instrumentation error.	The spatial and temporal trends appear to be consistent with previous years.	No predictions in the FEIS.
Water Chemistry Section 4.3	Conventional Parameters and Major Ions	Conductivity, hardness, TDS, alkalinity, and major cations exceeded their trigger values at one or more NF areas in 2021. These results are consistent with recent years. The trigger value for these parameters is set at the 95th percentile of concentrations measured during the baseline period. There are no thresholds (i.e., CCME water quality guidelines) for these parameters.	**Spatial scale – widespread**; concentrations have increased lake-wide in Third Portage from TPE to TPN and between lakes (SP and WAL). **Temporal trend – stable**; concentrations are elevated relative to the baseline period according to the BACI analysis, no evidence of-year-over-year increases (i.e., concentrations in 2021 are similar to 2020, 2019, 2018, etc.) **Causality – high**; the spatial pattern and temporal trend of increasing concentrations in the *after* period is plausibly attributed to activities at the mine.	Water quality constituents without effects-based CCME thresholds were not incorporated in the magnitude ratings for assigning effects in the FEIS; however, following the intent of the FEIS magnitude ratings, constituents exceeding baseline but below concentrations associated with adverse effects were considered consistent with a *low* magnitude rating.
	Nutrients	A minor trigger exceedance of reactive silica at WAL, similar to 2020, otherwise most nutrients' concentrations = baseline.	**Spatial scale – localized**; reactive silica is only elevated at WAL. **Temporal trend – none**. **Causality – low**; no evidence of mine-related source.	*Low* (i.e., < CCME water quality guidelines).
	Metals	The yearly mean for total and dissolved silicon exceeded the trigger value at SP, similar to 2020. There are no *before* data to use in the BACI statistical analysis of changes over time for silicon, but concentrations appear stable throughout the monitoring period. All other metals concentrations (total and dissolved) were consistently low or below their respective MDLs at the NF, MF, and FF locations in 2021.	**Spatial scale – localized, silicon (Si)**; Si is elevated at SP only. **Temporal trend – stable (Si)**; 2021 Si concentrations appear to be unchanged over all sample years in SP since 2011 (**Figure 4-44**). **Causality – low (Si)**; the long-term stability and the monthly stability in 2021 of Si concentrations in SP suggest conditions are not mine related.	Recent temporal water quality analysis for areas in Third Portage Lake (TPE and TPN), Second Portage Lake, and Wally Lake indicates the results conform with the *low* effect rating predicted in the FEIS. This conclusion is corroborated by the phytoplankton and benthos community results, which show relatively diverse, abundant, and stable communities at the NF areas relative to baseline / reference conditions.
Phytoplankton Section 4.4	Chlorophyll-a	There is no trigger for chlorophyll-a for the CREMP. For reference and NF areas (not WAL), chlorophyll-a concentrations peaked in September at NF and reference areas.	Concentrations in the reference area samples typically range between 0.2 and 0.9 µg/L in summer months, reflecting the oligotrophic, nutrient poor condition of these lakes; a trend that has not changed over time.	No predictions in the FEIS.

Monitoring Component (and report section)	**Variable**	**Summary**	**Temporal and Spatial Trend Assessment**[1, 2, 3]	**Annual CREMP Results Compared to FEIS Predictions** (Cumberland, 2005)
Phytoplankton (cont'd) Section 4.4	Total Biomass	Increases in phytoplankton biomass were detected at NF areas in 2021 relative to baseline/reference conditions but were not confirmed by the time-series plots. The magnitude of the BACI analysis increase ranged up to 47% at TPN. The only statistically significant change was at TPN (p=0.022). Nutrient concentrations (i.e., nitrogen and phosphorous) were similar to baseline (**Section 4.3**).	**Spatial scale – localized**; phytoplankton biomass increased in the BACI analysis at TPN relative to baseline/reference conditions in 2021. **Temporal trend** – **stable**; historical biomass for the NF areas (**Figure 4-62**) do not show obvious visual signs of temporal increases for individual NF study areas. **Causality – low**; SP was the only NF area that received effluent discharge in 2021. The magnitude of the change in biomass at the NF areas other than TPN suggests the observed pattern of increase in phytoplankton biomass is likely annual variability in the community rather than mine-related.	The absolute biomass values at the NF are comparable to their historical values. Taking into consideration all the lines of evidence (BACI and absolute values plotted over time), there is no evidence to suggest mining operations are increasing primary productivity in the NF areas.
	Taxa Richness	A statistically significant increase (26%; p=0.011) in taxa richness was noted at TPN in 2021 relative to baseline/reference conditions; which is slightly above the 20% trigger (**Table 4-8**).	**Spatial scale – localized**; increased taxa richness relative to reference/baseline conditions was only evident at TPN. **Temporal trend – stable**; richness has remained stable during the *after* period (**Figure 4-65**). The apparent increased richness at TPN in 2021 relative to baseline/reference conditions is likely an artefact of natural fluctuation in the community composition rather than an increase. **Causality – low**; there is no indication that mine activities are influencing taxa richness.	Taxa richness for the phytoplankton communities has been stable throughout the 'after' period (i.e., no apparent loss of community diversity).
Sediment Chemistry Section 4.5	Metals	Grab samples were collected alongside benthic invertebrate samples, however, in 2021 due to a laboratory error only samples from SP, TPE, and TPN were analyzed. Grab sample results are used to support benthic invertebrate interpretation. Grab sample chemistry (for areas that were analyzed) was similar to other years for most analytes. No core samples were collected in 2021 and the next coring program is planned for 2023.	**Spatial scale – localized, chromium (Cr)**; As exceeded trigger in a few samples at TPE. **Temporal trend – stable (Cr)**; 2021 Cr concentrations at TPE appear to be lower than previous years and stable or decreasing since 2017 (**Figure 4-70**). **Causality – high (Cr)**; elevated concentrations of chromium in a few sediment samples at TPE were likely related to use of ultramafic rock for dike construction. **Spatial scale – widespread, zinc (Zn)**; Zinc exceeded the trigger in a few samples at TPE and SP. **Temporal trend – stable (Zn)**; while there was an apparent increasing trend in Zn at both SP and TPE over the last few years, the 2021 concentrations remain within the range of baseline Zn concentrations and have decreased notably from 2019 (**Figure 4-74**). **Causality – low (Zn)**; it appears that the observed patterns of sediment Zn at SP and TPE are due to natural spatial heterogeneity.	The FEIS noted that release of effluent (i.e., settling of TSS and altered sediment chemistry) *may impact benthos.*
	Hydrocarbons	Grab samples were collected at TPE, TPN, SP, WAL, INUG, and PDL, however, in 2021 due to a laboratory error only samples from SP, TPE, and TPN were analyzed for organics. Sediment hydrocarbon concentrations were below detection for all NF area grab samples in 2021 except for benzo(g,h,i)perylene at SP.	Hydrocarbons are not contaminants of potential concern for the CREMP based on recent and historical results. There have been no instances of measured concentrations attributable to site-related activities during the monitoring period.	No predictions in the FEIS.

Monitoring Component (and report section)	**Variable**	**Summary**	**Temporal and Spatial Trend Assessment**[1, 2, 3]	**Annual CREMP Results Compared to FEIS Predictions** (Cumberland, 2005)
Benthos Section 4.6	Total Abundance	Benthic invertebrate communities at the NF areas were monitored in 2021. Decreased abundance at WAL relative to INUG in 2021 relative to reference/baseline conditions. No statistically significant differences were reported in the BACI. Abundance at WAL shows year-over-year variability consistent with baseline sampling results.	**Spatial scale – localized**; lower abundance (based on the BACI analysis) observed only at WAL. **Temporal trend – stable**; abundance (absolute values) at WAL was lower in 2021 compared to the last seven years but was consistent with the range observed in baseline (**Figure 4-75**). Absolute total abundance at WAL in 2021 (~1,626 organisms/m^2) was well within its baseline range. **Causality – low**; the 'apparent' reduction in abundance at WAL in the BACI analysis is partly an artefact of slightly increasing abundance at the reference area INUG while WAL has remained relatively stable during the operation phase.	The identification of potential mine-related impacts generally involves visually examining the data for spatial/temporal patterns that matched mine-related events. An apparent reduction in total abundance was identified in the BACI analyses at WAL in 2021 but the results were considered a BACI *artefact* as abundance has been consistently trending within the baseline range (**Figure 4-75**).
	Total Richness	No changes observed in taxa richness in 2021 at the NF areas compared to reference/baseline conditions.	Richness continues to track higher for most areas. The benthic communities are dominated by chironomids, and the relative proportion of major taxa remains stable at all areas.	No predictions in the FEIS.

Table ES-2. Summary of key findings from the 2021 Whale Tail CREMP.

Notes:
1. Temporal and spatial trends are outlined for Monitoring Components and Variables that exceeded trigger or thresholds (i.e., apparent change from baseline).
2. Spatial scale ratings are: localized = small area within the lake/area; widespread = basin to whole lake.
3. Causality ratings are: low = no evidence of a mine-related source; moderate = some likelihood of a mine-related source; high = the source of the change is likely mine-related.

Monitoring Component (and report Section)	**Variable**	**Summary**	**Temporal and Spatial Trend Assessment**[1, 2, 3]	**Monitoring Results Compared to FEIS Predictions (Golder, 2019) and AMP Thresholds**
Limnology Section 5.2	Temperature and Dissolved Oxygen	The limnology profiles collected in 2021 show dissolved oxygen and temperature readings are consistent with range of conditions observed in previous monitoring cycles (2015 to 2018).	Spatial and temporal trends were stable in 2021.	No predictions in the FEIS.
	Field Measured Conductivity	There was some stratification at WTS in May and conductivities were higher than in 2020 during periods of discharge (i.e., January, March, July, August). The conductivity in MAM indicated a spatial trend with higher conductivity readings in the east basin compared to the west basin. Conductivity readings in MAM increased to > 150 µS/cm from the baseline of approximately 60 µS/cm. Conductivity in NEM increased in late 2019 and remained elevated above baseline throughout 2020 and again in 2021. Conductivity in Lake A76 was higher than in 2020 and elevated compared to baseline during each sampling event in 2021.	**Spatial scale – localized**; no spatial trends within WTS but observed an increase in conductivity at A20. Slight spatial trend observed within Mammoth Lake (east basin elevated compared to west basin), which appeared to become more well mixed by July. The spatial trend extended to Lake A76, though not to further downstream area DS1. NEM is within a separate watershed and there is no spatial trend to review. **Temporal trend – stable (WTS); stable (MAM); variable (A20)**; similar to 2020, conductivity in WTS appeared to trend upwards March to May but declined to levels similar to baseline for the remainder of the year. Apparent increase in conductivity observed in MAM since late 2018 has remained relatively stable, though higher than baseline. Apparent increase in conductivity in 2021 at A20 with conductivities higher than baseline throughout the year trend appeared to stabilize August through September. NEM also increased in later 2019 and has remained higher than baseline but was relatively stable in 2020 and 2021. **Causality – moderate (WTS); moderate (A20); high (MAM);** similar to 2020, short duration spike in WTS followed by a return to conditions similar to baseline. A20 now joined to WTS and the two lakes are now expected to track more closely. Spatial and temporal trends at MAM suggest mine activities are influencing conductivity; however, the limited *after* data means assigning causality to one activity is not possible. Water management and construction were potentially impacting MAM in 2021.	No predictions in the FEIS.

Monitoring Component (and report Section)	Variable	Summary	Temporal and Spatial Trend Assessment[1, 2, 3]	Monitoring Results Compared to FEIS Predictions (Golder, 2019) and AMP Thresholds
Water Chemistry Section 5.3	Conventional Parameters and Major Ions	Statistically significant increases above trigger values were observed at all NF areas for major ions (e.g., calcium, magnesium). The statistically significant increases extended to MF areas A20 and A76 for all these parameters including alkalinity.	**Spatial scale – widespread**; the 2021 results indicated changes to WTS and MAM and to a lesser extent NEM, A20 and A76. **Temporal trend – stable (WTS, MAM, & NEM); increasing (A20 & A76)**; calcium, magnesium, potassium, and sodium may be trending upwards in NF and MF lakes. Evidence of increases in WTS, MAM, A20, A76, and NEM. **Causality – high**; these parameters have increased in the Meadowbank study area lakes and it seems likely that the apparent increase observed in the Whale Tail study area lakes in 2021 follows a similar trend and with more samples in the *after* period, it is easier to assign causality.	Water quality constituents without effects-based CCME thresholds were not incorporated in the magnitude ratings for assigning effects in the FEIS; however, following the intent of the FEIS magnitude ratings, constituents exceeding baseline but below concentrations associated with adverse effects were considered consistent with a *low* magnitude rating. FEIS predictions are for Mammoth Lake and Whale Tail South. Monthly mean concentrations for several parameters exceeded FEIS predictions but all conform with the *low* effect rating predicted in the FEIS. Conditions in WTS and MAM were relatively stable near to the trigger and elevated compared to baseline. With more samples in the *after* period at these areas the temporal trend can be confirmed. Primary producer indices indicated an increase in abundance but no significant change to richness. These parameters will be assessed closely in 2022.
	TDS	In 2021, TDS concentrations in WTS, MAM, NEM, A20, and A76 were elevated over the previous sample years, and the yearly means were above their respective triggers. All results were statistically significant in the BACI analysis of proportional change.	**Spatial scale – widespread**; TDS concentrations were elevated in WTS, MAM, NEM, A20, and A76 but did not extend to DS1. **Temporal trend – increasing**; TDS may be trending upwards in NF and MF lakes. However, conditions were relatively stable for the 2021 season. **Causality – high**; increased dissolved solids in MAM, WTS, NEM, A20, and A76 are likely related to construction and dewatering activities.	TDS did not meet FEIS predictions in MAM or WTS in 2021 but conformed with the *low* effect rating predicted in the FEIS. The increase in TDS observed in 2019 through 2021 is likely related to mine activities. This parameter will be monitored closely in 2022.
	Nutrients	Statistically significant increases above trigger values were observed at WTS, MAM, and A20 for TKN. Total phosphorous (TP) showed a statistically significant increase at WTS, A20, and A76, which may be in part due to inputs from flooded terrestrial habitats following impoundment.	**Spatial scale – widespread**; the 2021 results indicated changes in WTS, MAM, A20 and A76. **Temporal trend – variable**; no temporal trend was observed except an increase for total phosphorous in A20 and A76. **Causality – moderate**; the changes in TKN concentrations were restricted to NF and MF areas of the Whale Tail study area lakes, which suggests the apparent changes may be due to mine activities in 2021.	The yearly mean for total phosphorous did not meet FEIS predictions for WTS, however the trend was not observed at MAM, therefore, the increased total phosphorous concentrations may be at least in part due to the change in discharge sequence in WTS compared to the discharge levels used to develop FEIS predictions. Total phosphorous in 2021 conformed with the *medium* effect rating predicted in the FEIS for WTS. The AMP Levels 1 and 0 are in effect for WTS and MAM, respectively.
	TOC and DOC	The yearly mean for TOC and DOC exceeded the trigger in WTS, MAM, NEM (TOC only), A20, and DS1 in 2021. The BACI analysis indicated that the increases at WTS, NEM (TOC only), MAM (TOC only), and A20 were statistically significant.	**Spatial scale – widespread**; TOC and DOC were slightly over the trigger in WTS, MAM, NEM (TOC only), A20, and DS1. **Temporal trend – increasing**; there were apparent increases in TOC and DOC in WTS, NEM (TOC only), MAM (TOC only), and A20 in 2021. The increases may be in part associated with the flooding of WTS after the impoundment of WTN. There was no apparent increase at DS1. **Causality – high**; While changes in TOC and/or DOC at WTS, NEM, MAM, and A20 were likely due to inputs from flooded terrestrial areas and other mining activities.	No predictions in the FEIS. The changes in 2021 were comparable to 2020 and the increases in TOC and DOC are likely related to mine activities. Trend analysis was completed with three years of *after* data so it was easier to differentiate between natural variability and mine related activities. These parameters will be closely monitored in 2022.

Monitoring Component (and report Section)	**Variable**	**Summary**	**Temporal and Spatial Trend Assessment**[1, 2, 3]	**Monitoring Results Compared to FEIS Predictions (Golder, 2019) and AMP Thresholds**
Water Chemistry (cont'd) Section 5.3	Metals	Statistically significant increases of total and dissolved lithium were observed at NF areas WTS and MAM and at MAM for total and dissolved silicon.	**Spatial scale – localized**; mean lithium concentrations exceeded the trigger value in WTS and MAM but did not extend to Lakes A20 or A76. Mean silicon concentrations exceeded the trigger value at MAM only. **Temporal trend – variable**; lithium appeared to be relatively stable throughout 2021. Similar to 2020, silicon increased above the trigger in early 2021 and then decreased to below the trigger later in the year at WTS and MAM. **Causality – moderate**; the exceedances of lithium and silicon were only observed at NF areas suggesting they may be related to mining activities.	*Low* (i.e., < CCME water quality guidelines). For total arsenic, the AMP Level 0 is in effect for WTS and MAM.
Phytoplankton Section 5.4	Chlorophyll-a	There is no trigger for chlorophyll-a for the CREMP. Chlorophyll-a concentrations varied in 2021. Early season lows for WTS were around 0.13 µg/L in March. By July WTS had risen to 3.3 µg/L. All other area lakes were generally around baseline levels (~1.0 µg/L). Following the May event, chlorophyll-a appeared to be increasing at NF (MAM) and MF (A20, A76) areas through September. Chlorophyll-a at WTS appeared to increase from May to August and then began to decrease following the August event.	**Spatial scale – localized**; chlorophyll-a appeared to increase in WTS, MAM, A20 and A76 in 2021. There was no formal BACI analysis on this parameter. **Temporal trend – variable (WTS); increasing (MAM, A20, A76)**; a notable increase from May to August in WTS was followed by a notable decline in August through September. Increases were observed MAM, A20 and to a lesser extent at A76 from May through September. **Causality – moderate (WTS); moderate (MAM, A20, A76)**; a potential spatial trend was not supported by a temporal trend in WTS. Spatial trend supported by temporal trend for MAM, A20 and A76.	No predictions in the FEIS. Chlorophyll-a appears to have increased in WTS, MAM, A20, and A76 in 2021. An increase in productivity is normally indicative of an increase in nutrient concentrations. Nutrients are discussed above and increases may have been partly driven by natural variability in 2021. Nutrients and primary productivity in the water column will be closely monitored in 2022.
	Total Biomass	While WTS results were similar to 2020, MAM, A20, and A76 results showed an increased in biomass compared to baseline conditions in July through September. The BACI analysis showed non-significant increases for MAM, A76, and NEM (> 20% trigger). Only the increase at A20 was statistically significant.	**Spatial scale – localized**; an increase in phytoplankton biomass was observed at MAM, A76, A20 and NEM. **Temporal trend – variable**; statistical analysis indicated an increase in biomass at MAM, A76, A20 and NEM over baseline/control; however, time-series plots show biomass decreasing in September compared to August for WTS and A20. Total biomass at NEM appears to be within the historical range. The only statistically significant changes were at A20. **Causality – moderate**; the potential increases in biomass were only observed at NF and MF area lakes where mining activities would likely be an influence. An increase in nutrients as shown by the water chemistry data may have influenced phytoplankton growth. The trends observed were similar in terms of seasonal variability but the magnitude of change appeared to be greater at the NF and MF area lakes compared to the reference areas PDL and INUG a further indication of mining influence.	No predictions in the FEIS. The increase in total biomass at NF and MF area lakes but not FF and corresponding increases in nutrient concentrations in water suggest the changes may be attributed to mining activities. Total biomass will be monitored closely in 2022.
	Taxa Richness	Slight decreases in taxa richness were observed at WTS and MAM, though the changes were not statistically significant and the reductions at both areas were below the 20% trigger (**Table 5-11**).	**Spatial scale – localized**; Though slight decreases were observed at WTS and MAM relative to baseline/reference, the changes were small and not statistically significant. **Temporal trend – variable**; richness has been variable during the *after* period (**Figure 5-77**). The apparent decreased richness at WTS and MAM in 2020 relative to baseline/reference conditions is may be attributed to natural variability due to similar observed trends at reference areas INUG and PDL. **Causality – moderate**; the decrease in richness relative to baseline	No predictions in the FEIS. Taxa richness for the phytoplankton communities has been variable throughout the *after* period, however it appears there may be a slight loss in community diversity compared to the baseline period. Taxa richness will be monitored closely in 2022.

Monitoring Component (and report Section)	**Variable**	**Summary**	**Temporal and Spatial Trend Assessment**[1, 2, 3]	**Monitoring Results Compared to FEIS Predictions (Golder, 2019) and AMP Thresholds**
			suggests there may be influences from mine activities. However, there is uncertainty due to the limited *after* data.	
Sediment Chemistry Section 5.5	Metals	Grab samples were collected alongside benthic invertebrate samples, however, in 2021 due to a laboratory error only samples from WTS, A76, and NEM were analyzed. Grab sample results are used to support benthic invertebrate interpretation. Grab sample chemistry (for areas that were analyzed) was similar to other years for most analytes. No core samples were collected in 2021 and the next coring program is planned for 2023.	**(1.) Spatial scale – localized, arsenic (As)**; As concentrations in two replicates from WTS and A76 exceeded respective triggers. **Temporal trend – stable (As)**; As results for WTS, while highly variable within years due to spatial heterogeneity, do not show any apparent temporal trends across all years (**Figure 5-80**). **Causality – low (As)**; No evidence of mine-related changes for As. **(2.) Spatial scale – localized, chromium (Cr)**; Cr concentrations in two replicates from WTS and four replicates from A76 exceeded their respective triggers. This trend was not observed at NEM. No analysis was received for other WTP lakes therefore it is uncertain whether this trend occurred elsewhere in 2021. **Temporal trend– stable (Cr)**; Cr concentrations at WTS and A76 appear to be within the range observed in previous years (**Figure 5-82**). **Causality – low (Cr)**; Elevated Cr in sediment at WTS and A76 in 2021 may be an artifact of small spatial scale heterogeneity naturally present in each lake because similar increases were not observed at other lakes close to mining activities in 2020 (e.g., MAM and A20). This will be verified during the next coring program in 2023. **(3.) Spatial scale – localized, copper (Cu)**; Cu concentrations in four replicates at A76 and three replicates at NEM exceeded respective triggers. **Temporal trend – stable (Cu)**; the concentrations were variable at A76 and NEM. In both cases, concentrations in 2021 were within the range of baseline Cu concentrations (**Figure 5-83**). **Causality – low (Cu)**; it appears that the observed patterns of sediment Cu at A76 and NEM are due to natural spatial heterogeneity.	No predictions in the FEIS for grab sample chemistry.
Sediment Chemistry Section 5.5	Hydrocarbons	Grab samples were collected at all WTP and reference area lakes, however, in 2021 due to a laboratory error only samples from WTS, A76, and NEM were analyzed for organics. Sediment hydrocarbon concentrations were below detection for all NF area grab samples in 2021 except for mineral oil and grease at WTS, and NEM.	Hydrocarbons are not contaminants of potential concern for the CREMP based on recent and historical results. There have been no instances of measured concentrations attributable to site-related activities during the monitoring period.	No predictions in the FEIS for grab sample chemistry.
Benthos Section 5.6	Total Abundance	Benthic abundance was highly variable between replicates and was variable between areas. Statistical testing indicated an apparent but not statistically significant decrease in abundance in A76. Overall, 2021 results are similar to baseline years for all areas.	**Spatial scale – localized**; in 2021 lower abundance (based on the BACI analysis) observed only at A76. **Temporal trend – stable**; abundance (absolute values) at A76 show consistent results with the range observed in baseline (**Figure 5-87**). **Causality – low**; the ‘apparent’ reduction in abundance at A76 in the BACI analysis was not observed at NF areas closer to mine activities. Abundance at A76 has remained relatively stable since the baseline period.	No predictions in the FEIS.

Monitoring Component (and report Section)	**Variable**	**Summary**	**Temporal and Spatial Trend Assessment**[1, 2, 3]	**Monitoring Results Compared to FEIS Predictions (Golder, 2019) and AMP Thresholds**
	Total Richness	Statistical testing indicated a statistically significant decrease in taxa richness at DS1 in the time period 2020-2021. Overall, taxa richness was comparable to the baseline period.	**Spatial scale – localized**; lower taxa richness only observed at FF area DS1 in 2020-2021 period. **Temporal trend – variable;** taxa richness has been highly variable since baseline period, though there appears to be a downward trend at DS1. **Causality – low;** the benthic communities are dominated by chironomids, and the relative proportion of major taxa remains stable at all areas. Furthermore, the apparent decrease in taxa richness was not observed at NF areas closest to mining activities.	No predictions in the FEIS.

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ACKNOWLEDGEMENTS

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ACRONYMS

AEMP	Aquatic effects monitoring program
AMP	Adaptive management plan
AIC	Akaike information criterion
ANOVA	Analysis of variance
AWAR	All weather access road
BACI	Before/after control/impact
BACIP	Before/after control/impact paired
BAER	Baseline aquatic ecosystem report (for Meadowbank)
BAP	Baker Lake – Akilahaarjuk Point
BBD	Baker Lake – barge dock
BES	Baker Lake – east shore
BPJ	Baker Lake – proposed jetty
CCME	Canadian Council of Ministers of the Environment
COC	Chain of custody
CREMP	Core receiving environment monitoring program
CRM	Certified reference material
DFO	Department of Fisheries and Oceans
DI	Deionized blank
DOC	Dissolved organic carbon
DQO	Data quality objective
EAS	Effects assessment strategy
EB	Equipment blank
EEM	Environmental effects monitoring
EIA	Environmental impact assessment
FEIS	Final environmental impact statement
FF	Far-field
GPS	Global positioning system
HCF	Habitat compensation feature
HCMP	Habitat compensation monitoring program
HEPH	Heavy extractable petroleum hydrocarbons
ICP-MS	Inductively coupled plasma mass spectrometry
INUG	Inuggugayualik Lake
ISQG	Interim sediment quality guidelines

LCS	Laboratory control sample
LEPH	Light extractable petroleum hydrocarbons
MAM	Mammoth Lake
MDL	Method detection limit
MDMER	Metal and Diamond Mining Effluent Regulations
MF	Mid-field area
NEM	Nemo Lake
NF	Near-field
NWB	Nunavut Water Board
PAG	Potentially acid generating
PAHs	Polycyclic aromatic hydrocarbons
PDL	Pipedream Lake
PEL	Probable effect level
QA/QC	Quality assurance / quality control
REF	Reference
RPD	Relative percent difference
SEP	Sequential extraction procedure
SOP	Standard operating procedure
SP	Second Portage Lake
SQG	Sediment quality guidelines
SSD	Species sensitive distribution
SSWQO	Site specific water quality objective
TDS	Total dissolved solids
TE, TEFF	Tehek Lake sampling areas
TIA	Tailings impoundment area
TKN	Total Kjeldahl nitrogen
TOC	Total organic carbon
TP	Total phosphorous
TPE, TPN, TPS	Third Portage Lake sampling areas
TSF	Tailings Storage Facility (North and South Cells)
TSS	Total suspended solids
UTM	Universal Transverse Mercator
WAL	Wally Lake
WOE	Weight of evidence
WQG	Water quality guideline

WRSF	Waste rock storage facility
WTN, WTS	Whale Tail Lake – North and South basins

REPORT ORGANIZATION

The 2021 Core Receiving Environment Monitoring Program (CREMP) report is organized into a main document and 6 appendices (A through F). The document underwent a significant restructuring in 2018 with the integration of the Whale Tail Project into the annual CREMP report. An overview of the various sections of the report is provided to help guide the reader as they navigate the document.

Executive Summary provides a high-level summary of the monitoring results by study area (Meadowbank, Whale Tail, and Baker Lake).

Section 1 introduces the CREMP with overview of the environmental setting for the project. The pace and scope of mining development is also outlined to catalogue how the CREMP has been implemented to monitor changes in the aquatic receiving environment.

Section 2 outlines elements of the CREMP study design including sampling areas, a description of the routine monitoring components, details regarding any targeted studies conducted for a given cycle, and the statistical framework used to assess spatial and temporal changes in chemistry (water and sediment) and biological communities (phytoplankton and benthic invertebrates).

Section 3 summarizes results of the detailed quality assurance and quality control assessment (QA/QC) presented in **Appendix A**.

Section 4 (Meadowbank), **Section 5** (Whale Tail Pit) and **Section 6** (Baker Lake) are stand-alone chapters detailing the results of the spatial and temporal trends in water quality, sediment chemistry, and biological community health (phytoplankton and benthos) specific to each study area. Figures and Tables are included at the end of each section.

Section 7 provides recommendations for the scope of the 2022 CREMP for Meadowbank, Whale Tail, and Baker Lake study areas.

1 INTRODUCTION

The 2021 CREMP report documents the methods and results of aquatic receiving environment monitoring activities completed at Meadowbank, Whale Tail, and Baker Lake study areas in 2021. As in previous years, this report integrates historical data to identify changes in limnology or water chemistry parameters, sediment chemistry, phytoplankton biomass and benthic community structure associated with mine-related activities at Meadowbank Mine (since 2006) or in Baker Lake (since 2008). With the onset of in-water construction activities for Whale Tail Lake in August 2018, this study area has been brought into the CREMP.

1.1 Development of the Aquatic Monitoring Program

Agnico Eagle Mines Ltd.'s (Agnico Eagle) Meadowbank Complex is situated approximately 75 km north of the hamlet of Baker Lake, Nunavut. The aquatic monitoring program has evolved since its inception in 2005; terms and acronyms used to describe the aquatic monitoring programs for the Meadowbank Mine are described below:

AEMP

The AEMP acronym was first used in the 2005 report *(Aquatic Effects Management Program*[1]; Azimuth, 2005a). The AEMP was developed to address issues identified during the Environmental Impact Assessment (EIA) process that could potentially impact the aquatic receiving environments surrounding the development. The scope of the original AEMP 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 the term *AEMP* in the annual report titles[2].

Agnico Eagle has several 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. A restructuring of the AEMP was completed in 2012 (Azimuth, 2012c) to broaden the scope of the AEMP to serve as the overarching 'umbrella' strategy that provides an opportunity to integrate results of individual, but related, monitoring programs (e.g., construction, groundwater, water quality and flow, air quality) in accordance with the original Nunavut Water Board (NWB) Type A water license requirements. On an annual basis, the restructured AEMP brings in the

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[1] The 2005 AEMP refers to the original AEMP document that served as the blueprint for the CREMP until the CREMP Design Document 2012 (Azimuth, 2012d) was completed.

[2] The Nunavut Water Board Type A License, issued in 2008 and renewed in 2015, defines the "AEMP" as the *Aquatic Effects Monitoring Program*; annual receiving environment monitoring reports since 2008 reflect this subtle change.

results of the individual monitoring programs, assesses them using a site-specific conceptual model framework and recommends specific management actions to address potential issues. Previously, the term *AEMP* was essentially synonymous with receiving environment monitoring. Given the AEMP's broadened scope, more specific terminology (i.e., CREMP; see below for more details) was developed when referring to aquatic receiving environment monitoring for the Meadowbank mine. The AEMP Plan was updated in 2020 (Version 4). The report is included in Agnico Eagle's Annual Report for review by the NWB.

CREMP

CREMP is the acronym for Core Receiving Environment Monitoring Program. This term, which is synonymous with *core monitoring program* was first used for the 2009 annual report. It encompasses the core receiving environment monitoring program dating back to 2006. The study design for the CREMP was completed in 2012 (*Core Receiving Environment Monitoring Program (CREMP): Design Document 2012*; Azimuth, 2012d). The 2012 design document reviewed all historic monitoring CREMP data, presented the trigger/threshold derivation process (see **Section 1.5** for description of triggers/thresholds), determined trigger/threshold values for individual parameters, and established the experimental design to optimize the program. The resulting triggers/thresholds and experimental design changes have been integrated into the CREMP since 2012.

CREMP: 2021 Plan Update

The 2021 CREMP was completed according to the *CREMP: 2015 Plan Update* (aka the *CREMP Plan*). The *CREMP Plan* is the "how-to" manual for conducting aquatic receiving environment monitoring at the Meadowbank Complex. The document provides details on the study areas, monitoring components, frequency of sampling, collection methods, data evaluation criteria, and quality assurance and quality control procedures. The last substantial update to the *CREMP Plan* occurred in 2015 as part of the Type A Water Licence renewal (2AM-MEA1526). The *CREMP Plan* included refinements to the sampling design and an overview of the general risk-based framework for monitoring in the flooded pits at Meadowbank during the closure phase.

An addendum to the *CREMP Plan* was prepared in 2016 to incorporate monitoring areas in the vicinity of the Whale Tail Pit Project into the study design as a condition of the Nunavut Impact Review Board (NIRB) Project Certificate No .008 (the Approved Project) and the Nunavut Water Board (NWB) Type A Water Licence (2AM-WTP1826). The 2016 version of the *CREMP Plan* for Whale Tail Pit was re-issued (with minor updates) in May and December 2018 as part of the proposal to expand gold production in the form of a larger Whale Tail open pit, IVR Pit (and associated waste rock storage facility and attenuation pond), and an underground mining operation. The Expansion Project, as it is referred to, was approved by the NIRB on February 19th, 2020 (Project Certificate amendment No. 1). The amended Water Licence (2AM-WTP1830) was issued by the NWB on May 12th, 2020.

The *CREMP Plan* is currently being updated to reflect the current state of development at Meadowbank, Whale Tail, and Baker Lake and compile the aforementioned documents for Meadowbank and Baker Lake study areas (Azimuth, 2015) and the Whale Tail Pit study area (Azimuth, 2018) into one document. The updated *CREMP Plan* also included two modifications to the sampling design for the Meadowbank and Baker Lake study areas. First, winter water sampling in Third Portage Lake east basin (TPE), north basin (TPN), and Wally Lake (WAL) is no longer justified given that several years have passed since discharge occurred in each lake (2014 for Third Portage Lake [TPN]; 2017 for WAL). The second modification is for benthic invertebrate community monitoring at TPN, WAL, and Baker Lake to occur on a 3-year cycle rather than annually. This change is supported by the long-term data that clearly shows the benthic invertebrate communities are stable and healthy relative to baseline and reference conditions in each lake. If approved by the NWB, the next monitoring cycle for benthic invertebrates at TPN, WAL, and Baker Lake would occur in August 2023, coinciding with the timing of the sediment coring program.

1.2 Environmental Setting

1.2.1 Meadowbank and Whale Tail Study Areas

The Meadowbank and Whale Tail Projects (collectively termed the Meadowbank Complex) are situated in the barren-ground central Arctic region of Nunavut within an area of continuous permafrost known as the Wager Bay Plateau (Campbell et al., 2012). 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). Lakes near the Meadowbank project (i.e., Third Portage, Second Portage, and Tehek) flow into the Quoich River system, while CREMP reference lakes (Tasirjuaraajuk Lake; aka Pipedream Lake [PDL] and Inuggugayualik [INUG]) and lakes in the vicinity of Whale Tail flow north via the Meadowbank and Back River system (**Figure 1-1**).

The local landscape around Meadowbank and Whale Tail Pit 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. As is common of headwater lakes, all 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 often 2 m thick or more by March or April.

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

1.2.2 Baker Lake

Baker Lake receives drainage from three major river systems that drain much of the central Arctic: the Thelon River, the Kazan River, and the Dubawnt River (Hutchinson et al., 2018). Baker Lake is the 5th largest lake in Nunavut with a surface area of approximately 1,900 km^2 and 90 km from the mouth of the Thelon River to the narrows at the eastern end of the lake (Nunami, 2007). Water quality in Baker Lake is indicative of a nutrient poor, low alkalinity, soft water Arctic Lake (Hutchinson et al., 2018). Analysis of surface water for metals analysis indicate dilute concentrations throughout Baker Lake with no reported exceedances of human health or freshwater quality guidelines. Water quality in Baker Lake is strongly influenced by freshwater inputs during freshet; results from the lake-wide survey completed by Hutchinson et al. (2018) show only weak spatial and seasonal patterns in water quality except for conductivity.

Specific conductivity measurements collected throughout the monitoring period occasionally detect the influence of the deep marine-water influence in Baker Lake. A report by Johnson (1965) suggested three scenarios to explain saline conditions in Baker Lake: 1) ancient seawater trapped during isostatic rebound following glacial retreat, 2) seawater seeping into Baker Lake near the outlet, and 3) seawater entering Baker Lake driven by tides and storm events. Data generated from a more recent 3-year limnological study in Baker Lake between 2015 and 2017 suggest scenario 3 is the most likely explanation for saline water in Baker Lake. The channel or sill separating Baker Lake from marine influence is shallow and strong tidal currents and higher tidal amplitude at Chesterfield Inlet compared to other regions in Hudson Bay could contribute salt water to Baker Lake (Hutchinson et al., 2018). Conductivity readings over 1,000 µS/cm were recorded at depths between 10 and 20 m at locations further away from the influence of freshwater from the Thelon River (Hutchinson et al., 2018). Spring freshet is postulated as a key factor that prevents saline water from accumulating in Baker Lake year-over-year.

1.3 Mine Development and Operation

An overview of the mine development for the Meadowbank and Whale Tail Projects is provided below. A list of within-year site activities and a summary of previous CREMP results dating back to 2008 are provided in **Table 1-1**. In addition, a general description of mining-related activities at Baker Lake is provided for that location.

1.3.1 Meadowbank

The construction phase of the Meadowbank Mine officially started in June 2008, upon receipt of the NWB A Water License (2AM-MEA0815; renewed to 2AM-MEA1525 in 2015, amended to 2AM-MEA1526 in 2018 and to 2AM-MEA1530 in 2020) 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. Dike construction at Second Portage (East Dike) and Third Portage Lake (Bay-Goose Dike) between 2008 and 2010 allowed development of the open pit deposits. The mine officially opened on February 27, 2010, marking the start of the operations period. Five deposits were mined in the 10 years since the start of operations: North Portage, South Portage, Bay-Goose, Vault Phaser, and BB Phaser. Mining operation ceased in 2019 at Meadowbank Site but the mill is still in operation and process the ore from Whale Tail Site.

1.3.2 Whale Tail

The Whale Tail Pit Project (Whale Tail) is situated within the Amaruq property, a 408 km^2 exploration area on Inuit and federal crown land. The Project is located approximately 50 km northwest of the Meadowbank mine and is connected by a 64 km all-weather access road that was completed in 2018. The Project is permitted under a separate NWB license, 2AM-WTP1830, with ore being trucked to Meadowbank to take advantage of the existing infrastructure (e.g., mill, tailings storage, air strip). The first phase of the Project is a conventional open pit currently being developed at the Whale Tail and IVR satellite deposit. Major in-water construction activities at Whale Tail from 2018 to 2020 included:

- Dike construction in Whale Tail Lake
- Mammoth Dike Construction
- Fishout of the isolated north Basin of Whale Tail Lake
- Road construction around MAM
- Dewatering and surface water management at Whale Tail Lake (South Basin; WTS) and MAM
- Construction and completion of the diversion channel between WTS and MAM
- Dewatering and fishout of lakes in the footprint of the IVR Pit and IVR WRSF and the future attenuation pond
- Completion of the IVR diversion channel.

1.3.3 Baker Lake

The hamlet of Qamani'tuaq located on the northwest shore of Baker Lake is the point of entry for fuel, equipment and goods arriving by barge. Open water access to the hamlet from Chesterfield Inlet on Hudson Bay is limited to approximately 2.5 months from the end of July through to mid-October, depending on annual ice conditions. Goods and fuel typically travel from Quebec, around Labrador, and through Hudson Straight. Cargo and fuel tanker vessels moor in Chesterfield Inlet and shallow draft ships or barges pulled by tugs are used to navigate the channel that connects Baker Lake with Chesterfield Inlet (Agnico Eagle, 2018). Dry goods are transferred at a floating dock facility to the east of the hamlet (CREMP area BPJ is the closest sampling area). Fuel is transferred from the barges to a 70-million-liter capacity tank farm located upgradient from the floating dock. Equipment, goods, and fuel are trucked year-round from the hamlet to Meadowbank via 110 km all-weather access road (AWAR) completed by Agnico Eagle in 2008.

Monitoring at Baker Lake began in 2008, coinciding with the first barge season. The number of barge trips for fuel and goods dating back to 2008 are shown in **Figure 6-2**.

1.4 CREMP Objectives

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

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

Core Receiving Environment Monitoring Program – was designed 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 and Whale Tail in 2018. The program was updated based on the recommendations of the *CREMP: Design Document 2012* (Azimuth, 2012d) and more recently, described in detail in the *CREMP Plan* (Azimuth, 2015b) and *Whale Tail Pit Addendum* (Azimuth, 2018b). The study design is based on a before-after-control-impact (BACI) approach, but has also incorporated the concept of gradients in exposure (e.g., by incorporating near-field, mid-field, and far-field areas in addition to reference areas).

Targeted Studies – are designed to address specific questions related to mine development during construction or operation and typically have narrower temporal or spatial bounds. These results are integrated with and complementary to the routine CREMP. Examples include dike construction monitoring (e.g., Azimuth, 2009a) and the total suspended solids (TSS) effects assessment studies (EAS) (e.g., Azimuth, 2009b). Recently, targeted studies have been carried out to determine the toxicity and bioavailability of metals in sediments at TPE (Azimuth, 2016; Azimuth, 2020a).

1.5 CREMP Strategy

CREMP reporting for the Meadowbank and Baker Lake study areas changed substantially starting in 2011 with a stronger focus on assessing potential temporal and spatial trends in the data related to mining activity. Greater emphasis is now placed on identifying changes to support the AEMP (**Section 1.1**) and ultimately the environmental management process, rather than on providing a detailed description of the annual results in isolation. To that end, this CREMP report applies numerical decision criteria (i.e., triggers and thresholds) to assess the magnitude of change in CREMP monitoring variables (e.g., water quality, sediment chemistry, lower trophic level communities [i.e., phytoplankton and benthos]). The same approach has been applied at the Whale Tail study area for 2020; in 2019 this study area transitioned from the baseline 'before' period to the 'after' period.

The 2012 AEMP (Azimuth, 2012c) with minor updates in 2020 (Azimuth, 2020b) described a two-tiered approach (**Figure 2-2**) for evaluating changes in the monitoring components (e.g., water quality, benthos community) based on 'trigger' and 'threshold' level changes:

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

Comparison of the data to trigger values is the initial analytical focus. If trigger values are exceeded, the data are then compared to the applicable thresholds (if available[3]). Details regarding the derivation of trigger and threshold values for the CREMP are presented in the *CREMP: Design Document 2012* (Azimuth, 2012d).

In addition to triggers and thresholds, the results are also compared to water quality predictions developed as part of the Federal Environmental Impact Statement (FEIS) process (see **Section 2.3.1** for more details). The FEIS predictions provide context for whether any observed changes in water quality are consistent with expectations for the approved projects at two levels:

1. Numerical predictions – the actual concentrations predicted to occur for a suite of parameters. Given the uncertainties associated with water quality model development, these predictions are provided as a guide only.
2. Narrative predictions – these were categorical predictions used to classify the expected magnitude of change, typically relative to baseline conditions and water quality guidelines (see **Section 2.3.1**).

The application of trigger and 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 1.3**.

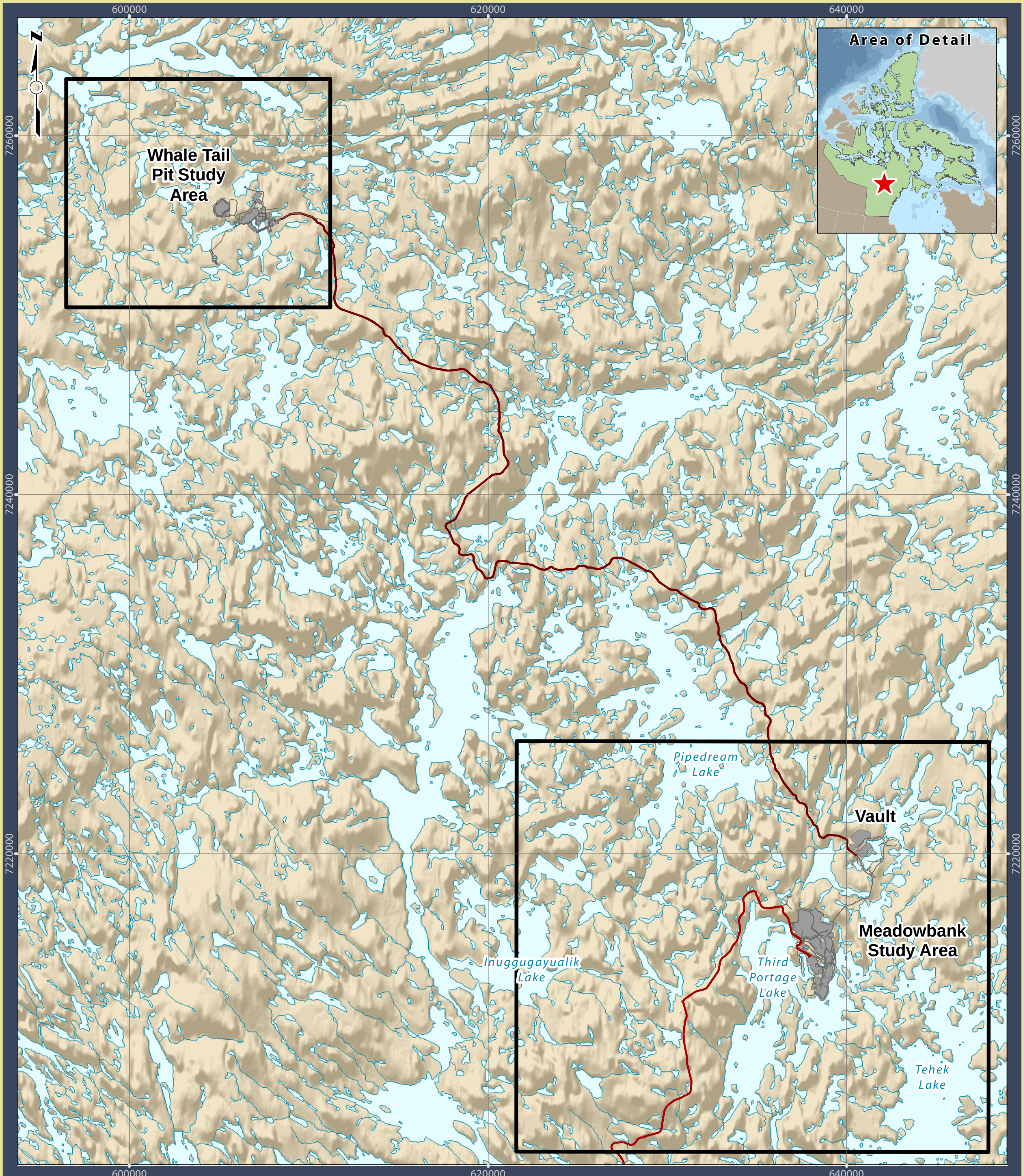
The general rationale for conducting the trend assessment followed these principles:

- **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 2-3**) 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).
- **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 1-1**) 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

[3] For water and sediment quality, thresholds were generally set to existing environmental quality guidelines. Thresholds were not derived in cases where guidelines were unavailable or when baseline concentrations naturally exceeded existing guidelines (e.g., some metals in sediment).

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?).

- **Provide Context for Magnitude of Change** – As discussed above, site-specific triggers and thresholds and FEIS predictions 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.
- **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.



Legend

- Mine Sites
- All-Weather Access Road
- Whale Tail Haul Road
- River
- Lake

0 2 4 6 8

Kilometres

Projection: UTM Zone 14 NAD83

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

Figure 1-1. Overview of the Meadowbank and Whale Tail Project Study Areas.

Meadowbank Gold Project

Prepared for: AGNICO EAGLE

By: CASLYS CONSULTING

March 2022

Table 1-1. Chronology of mine development, operational activities, and receiving environment findings (2008 – 2021).

Note: The summary provided here pertains to Meadowbank study areas (2008-2021) and Whale Tail areas (2018-2021). Baker Lake is not considered a receiving environment for the CREMP (annual results are not summarized in this table).

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

Year	Major Mine-Related Activities	Receiving Environment Overview
2014	• Effluent discharge to TPN from the Portage Attenuation Pond occurred only from June 10 to July 5. Discharge to TPN is now complete. The former Portage Attenuation Pond has now become the South Cell for tailings deposition. • EEM Cycle 2 Study Design was conducted at the end of August through the beginning of September (no TPN discharge at this time). • Vault Dewatering into Wally Lake from June 20 to 29 (now complete); discharge from Vault Attenuation Pond into Wally Lake from July 24 to August 14. No TSS treatment for Vault Discharge. • New discharge into Second Portage Lake during all of 2014 (except from May 3 to July 28): two seepage collection points (North and South) are situated on west side of the East Dike to collect seepage through dike from SP. Water is pumped from both collection points, which are connected together before discharging back into Second Portage Lake through a diffuser. No TSS treatment for East Dike Discharge. • No seepage water from Rock Storage Facility (ST-16) reaching the NP2 Lake in 2014. • Commercial mining in Vault Pit started at the beginning of 2014. No major construction or modifications in 2014.	• Minor mine-related trends identified for a number of water chemistry parameters at near-field areas: conductivity, hardness, Ca/Mg/K/Na and total dissolved solids. • Temporal trend in TPE sediment chromium confirmed in coring study; targeted study recommended for 2015.
2015	• No discharge to TPN in 2015. • Vault discharge to Wally from July 7 to September 10. No TSS treatment needed. • East dike (North-South) discharge to SP all year except from June 16 to August 10. Discharge was stopped for increasing TSS levels as no treatment is available for this location. The discharge from East Dike that was not directed to 2PL was discharged in the Portage Pit and then pumped to the South Cell TSF (Tailings Storage Facility). • No seepage water from Rock Storage Facility to NP-2. Monitoring ongoing. • HCMP work completed for TP, SP and Dogleg lakes and at water crossing R02 along the AWAR. • One incident of elevated TSS from Vault road culverts to NP-1, early June, during freshet. Barriers installed. No impacts observed to Dogleg Lake.	• Minor mine-related trends identified for a number of water chemistry parameters at near-field areas: conductivity, hardness, Ca/Mg/K/Na and total dissolved solids. Parameters with effects-based thresholds (e.g., CCME water quality criteria) were below their respective trigger values in 2016. • Targeted sediment bioavailability and toxicity testing was completed at TPE. Toxicity test results on *Chironomus dilutus* and *Hyalella azteca*, combined with sequential extraction tests on the sediment, indicated current chromium concentrations at TPE are unlike to adversely affect the benthic invertebrate community. Continued monitoring was recommended for 2016, but addition target studies were not recommended for 2016. • Phytoplankton and benthic invertebrate community results for the impact areas were within the range of reference/baseline conditions.
2016	• Vault discharge to Wally from June to September. No TSS treatment needed. • East dike (North-South) discharge to SP all year. • No seepage water from Rock Storage Facility to NP-2. Monitoring ongoing. • Phaser lake dewatering - August 26 to September 10 and September 15 to October 4. • Phaser Lake fishout from August 13 to 31 and September 10 to 25. • No Goose Pit reflooding activities. • Pit E and pushback assessment. • Mining focused on Vault Pit and Pit A. • Amaruq exploration road construction (km 25 at end of 2016).	• Minor mine-related trends identified for a number of water chemistry parameters at near-field areas: conductivity, hardness, Ca/Mg/K/Na and total dissolved solids. • Similar trend of elevated chromium in sediment grab samples from TPE, but the concentrations appear stable relative to those measured in 2015. • Phytoplankton and benthic invertebrate community results for the impact areas were within the range of reference/baseline conditions.
2017	• Vault discharge to Wally from June to October. No TSS treatment needed. • East dike (North-South) discharge to SP all year except from May 12 to September 5. Discharge was also stopped from September 23 to October 29. Discharge was stopped for increasing TSS levels as no treatment is available for this location. The discharge from East Dike that was not directed to SP was discharged in the Portage Pit and then pumped to the South Cell TSF (Tailings Storage Facility). • No seepage water from Rock Storage Facility to NP-2. Monitoring ongoing. • No Goose Pit reflooding activities. • Mining focused on Vault Pit and Pit A, Pit E and Phaser Pit. • Amaruq exploration road completed. • Phaser Pit started in November. • HCMP work completed for TP, SP and Dogleg lakes and at water crossing R02 along the AWAR. • One incident of elevated TSS from Vault road to NP-1, early June, during freshet. Barriers installed. No impacts observed to Dogleg Lake.	• Minor mine-related trends identified for a number of water chemistry parameters at near-field areas: conductivity, hardness, Ca/Mg/K/Na and total dissolved solids. Parameters with effects-based thresholds (e.g., CCME water quality criteria) were below their respective trigger values in 2017. • Phytoplankton and benthic invertebrate community results for the impact areas were within the range of reference/baseline conditions. • Core chemistry was analyzed for all study areas in 2017. Chromium in TPE and Arsenic in WAL were flagged for follow-up assessment in 2018 based on BACI results.

Year	Major Mine-Related Activities	Receiving Environment Overview
2018	*Meadowbank* • East dike (North-South) discharge to SP all year except from June 4 to August 21. Discharge was stopped for increasing TSS levels as no treatment is available for this location. The discharge from East Dike that was not directed to SP was discharged in the Portage Pit and then pumped to the South Cell TSF (Tailings Storage Facility). • No seepage water from Rock Storage Facility to NP-2; monitoring ongoing. • No Goose Pit reflooding activities. • Mining focused on Vault Pit and Pit A, Pit E and Phaser Pit. • No discharge to Wally in 2018.	• Minor mine-related trends identified for a number of water chemistry parameters at near-field areas: conductivity, hardness, Ca/Mg/K/Na and total dissolved solids. Parameters with effects-based thresholds (e.g., CCME water quality criteria) were below their respective trigger values in 2018. • Phytoplankton and benthic invertebrate community results for the impact areas were within the range of reference/baseline conditions. • Core chemistry was collected for TPE and WAL to follow-up on 2017 results. The 2018 results showed an overall improvement though concentrations for Chromium in TPE and Arsenic in WAL remain slightly above background concentrations.
	Whale Tail Pit Expansion Project • Whale Tail Dike Construction began on July 27. • Whale Tail Pit commencement of Quarry 2 began in September. • Freshwater intake from NEMO Lake started on October 28. • Whale Tail North fishout August 13 - September 28. • Newterra Wastewater treatment system at AMQ operational in March. • Crusher activities started on the waste rock storage facility (WRSF) on October 21. • Quarry 2 overburden stripping. • Snow removal in preparation of dike construction near Mammoth Lake (WRSF dike and Mammoth Dike).	• 2018 was a transition year for the Whale Tail Pit study area. Only WTS was considered *impact* from August onwards and impacts to water quality, sediments, and biota were not found for 2018.
2019	*Meadowbank* • East dike (North-South) discharge to SP was stopped on March 30. Restarted on November 13. • No seepage water from Rock Storage Facility to NP-2; monitoring ongoing. • Goose Pit water transfer from South Cell to Goose started on June 11. • In-pit disposal started at Bay-Goose in July. • End of mine production at Phaser Pit, BB Phaser Pit, Vault (Q1), and Pit E (Q4). • No discharge to Wally in 2019. • Addition of tank infrastructure at Baker Lake (1 tank, containment for 2).	• Study focused on monitoring changes in the near field study areas in TPE, SP and WAL. • Targeted bioavailability studies conducted at TPE. • Limnology results were consistent with previous years. • Minor mine-related trends identified for a number of water chemistry parameters at near-field areas: conductivity, hardness, Ca/Mg/K/Na, total silicon and total dissolved solids. • Phytoplankton community results for the impact areas showed an increase in biomass and taxa richness in 2019 compared to 2018. • Benthic invertebrate community results for the impact areas were within the range of reference/baseline conditions. • Core chemistry was collected for TPE to follow-up on 2018 results. Results were comparable to 2018 with concentrations of Chromium in TPE still slightly above background concentrations. In 2019, concentrations of zinc in one core sample exceeded the trigger and threshold values.
	Whale Tail Pit Expansion Project • Whale Tail Pit activities ongoing for all of 2019. • Dewatering/Diversion pumping into Whale Tail Lake South Basin started April 1 and is ongoing. • Dewatering of WTN to WTS occurred from April 1 to April 9, May 3 to May 17 and again from May 24 to May 29. • Dewatering/Diversion pumping into Mammoth Lake started June 22 and ended November 18. • Higher than expected precipitation in June and July required additional water management. • NE Dike impoundment pumped to AP5 and through to Nemo watershed June 21 to September 27. • Dewatering of Whale Tail North to Mammoth occurred from June 22 to June 30 and August 1 to October 26. • Water transfer from Quarry 1 pond to Mammoth Lake August 26 to October 23. • Water seep from WTS through dike pumped back into WTS from October 4 to November 2, and November 7 to 16. • Dewatering of Whale Tail North to Whale Tail South through WTP November 7 is ongoing. • Whale Tail Dike Grouting project started on November 14 is ongoing. • Pumping from Whale Tail South to Mammoth occurred October 24 to December 9. • Lake A45 dewatering to the tundra near Mammoth shoreline occurred from November 25 to November 27. • Construction in the South Whale Tail Channel (SWTC) between A20 and Mammoth began around December 1.	• 2019 was a transition year for the Whale Tail study area when most lakes switched designation from *control* to *impact*. • Minor mine-related trends identified for 16 water chemistry parameters at Whale Tail south basin. • Phytoplankton community results for WTS and MAM showed an increase in biomass in 2019 compared to 2018. • Benthic invertebrate community results for the impact areas were within the range of baseline conditions. • Sediment chemistry results for 2019 were generally consistent with previous years and showed no indications of construction-related changes.

<table>
<tr><th>Year</th><th>Major Mine-Related Activities</th><th>Receiving Environment Overview</th></tr>
<tr><td rowspan="2">2020</td><td>Meadowbank
• East Dike seepage discharge to SP was stopped on June 5 and restarted on October 23.
• No seepage water from Portage RSF to NP2; monitoring on-going.
• Tailings Discharge to Goose Pit up to July 2020 and the in-pit deposition started at Pit E started in August.
• Reclaim Water Set up in Pit A completed in October.
• No discharge to Wally in 2020.</td><td>• Study focused on monitoring changes in the near field study areas in TPN, TPE, SP and WAL.
• Limnology results were consistent with previous years.
• Minor mine-related trends identified for a number of water chemistry parameters at near-field areas: conductivity, hardness, Ca/Mg, TDS, and alkalinity. Other minor trends were identified for reactive silica, total & dissolved silicon, and dissolved zinc which were not mine-related.
• Phytoplankton community results for the impact areas showed a slight decrease in biomass and an increase in taxa richness in 2020 compared to 2019.
• The sediment coring program focused on NF and reference areas only. The mean sediment concentrations exceeded the trigger for arsenic at WAL, for chromium at TPE, and for zinc at SP and TPE. Concentrations were similar or less than those in 2019.
• Benthic invertebrate community data for impact areas were within the range of reference/baseline conditions.</td></tr>
<tr><td>Whale Tail Pit Expansion Project
• South Whale Tail Channel (SWTC) Construction between Lake A20 and Mammoth Lake is completed.
• Whale Tail Dike Remedial Grouting Project January 11 to March 25.
• WRSF Dike Mitigation Work from April 8 to April 28.
• NE Dike Dismantling occurred in September.
• IVR Diversion Construction.
• Temporary Diffuser installation in WTS occurred in October.
• Fishout occurred from August 1 to September 8.
• Dewatering of fishout lakes and installation of dewatering line from July to September.
• Construction of IVR Ring Road and IVR Waste Dump in September.
• IVR Pit began September 20.
• IVR Attenuation Pond jetty occurred in October.
• Dewatering completed and WTN became attenuation pond on May 20.
• Water transfer from WTN to WTS from January 1 to January 26, February 11 to February 23, February 29 to March 8, March 15 to March 22, March 30 to April 3, April 15 to April 20, April 25 to April 30, and May 7 to May 15.
• Water transfer from Quarry 1 to Mammoth Lake from April 13 to April 15 and April 25 to April 29.
• Water transfer from attenuation pond to Mammoth Lake from May 20 to May 28, June 14 to July 5, July 7 to July 22, July 25 to August 5, August 7 to September 20, September 15 to October 7.
• Water transfer from attenuation pond to WTS from May 28 to June 16 and October 12 to November 1, November 6 to December 2, December 5 to December 14, December 27 to December 31.</td><td>• All Whale Tail study area lakes designated as impact in 2020.
• Minor mine-related trends identified for about 18 water chemistry parameters at WTS and MAM, about 10 parameters at NEM, and 2-7 parameters at the MF/FF areas.
• Phytoplankton community results for WTS and MAM showed a decrease in biomass and total species in 2020 compared to 2019.
• Sediment chemistry results showed exceedances of As, Cr and Cu in 2020; however, it is uncertain whether these changes are related to mining activities.
• Benthic invertebrate community results for the impact areas were within the range of baseline conditions.</td></tr>
<tr><td>2021</td><td>Meadowbank
• East Dike seepage discharge to SPL (MMER-3) stopped on May 6 and restarted on December 9.
• No seepage water from Portage RSF to NP2; monitoring ongoing.
• Tailings discharge to Pit E all year long, with a hiatus in July and August when tailings were discharged in the North Cell.
• Reclaim Water from Pit A all year.
• Reclaim Water from Pit E ongoing November to December 2021.
• Aerial application of dust suppression on the Tailings Storage Facility in August.
• No discharge to Wally Lake or Third Portage Lake in 2021.</td><td>• Overall, results from NF areas were consistent with the previous 5 years demonstrating stabilization since mine activities ceased.
• Minor water chemistry trigger exceedances identified for physical/ionic parameters (conductivity, hardness, TDS, alkalinity Ca/Mg/K) at NF areas TPN. TPE, SP, and WAL. Minor trigger exceedances for Si and reactive silica at SP and WAL respectively.
• Long-term trend analysis on physical/ionic parameters supported the hypothesis that concentrations had increased during mine activity (2009-2013) and have now stabilized since 2014.
• Phytoplankton community results for the impact areas showed a slight increase in biomass and taxa richness in 2021 compared to 2020.
• Only sediment grabs were collected in 2021. A laboratory error resulted in a subset of the grab samples that were collected in 2021 to be discarded prior to analysis. Sediment chemistry results for samples that were analyzed showed no mining related temporal and spatial patterns. Sediment concentrations for a few replicates at TPE and SP exceeded the trigger for Cr (TPE only) and Zn. Concentrations were similar to 2020.
• Benthic invertebrate community data for impact areas were within the range of reference/baseline conditions.</td></tr>
</table>

Year	Major Mine-Related Activities	Receiving Environment Overview
	Whale Tail Pit Expansion Project • First year of operation - IVR diversion ditch. • Construction of IVR Dike D1. • Commissioning of IVR attenuation pond. • Excavation IVR West Pit began October 22. • Start of IVR WRSF. • Discharge to WTS through MDMER-5 between March 1 and June 8. • Discharge to WTS through MDMER-11 between January 1 to February 13, June 6 to June 17 and October 2 to November 23. • Discharge to Mammoth through MDMER-7 between June 9 and September 28. • Discharge to Mammoth through MDMER-8 between June 18 and August 26.	• Greatest magnitude of exceedances at NF area MAM where physical/ionic parameters (conductivity, hardness, TDS, alkalinity Ca/Mg/K), anions/nutrients (TKN, reactive silica), metals (Li and Si), and TOC/DOC exceeded triggers. • Increasing mine influence on MF areas A76 (down gradient of MAM) and A20 (inundated in summer 2019 and now connected to NF area WTS) where physical/ionic and TOC/DOC trigger exceedances occur, in addition to a threshold exceedance for P. • Phytoplankton community results for MAM, A76, and A20 showed an increase in biomass in 2021 compared to 2020. Taxa richness was similar to 2020. • A laboratory oversight upon sample receipt resulted in a subset of the grab samples that were collected in 2021 to be discarded prior to analysis. Sediment chemistry results for samples that were analyzed showed trigger exceedances in individual replicates for As, Cr, Cu, and Zn in 2021. Formal statistical assessment is planned for the next coring event in 2023. • Benthic invertebrate community results for the impact areas were within the range of baseline conditions.
	Baker Lake • Construction of fuel Tank #8. • Spud barge extension.	• Elevated July concentrations of total silicon and titanium above triggers at BBD likely representing an episodic event. No trigger exceedances at BPJ or BAP. • Phytoplankton and benthic invertebrate community data for impact areas were within the range of reference/baseline conditions. • All of the grab samples collected in Baker Lake in 2021 were discarded prior to analysis due to a laboratory error.

2 CREMP STUDY DESIGN

2.1 Overview

To streamline the annual report and reduce redundancy, aspects of the CREMP study design presented in the *CREMP Plan* are not repeated herein. Readers looking for detailed information on the aspects of the study design such as sampling methods, QA/QC protocols and procedures, and data evaluation criteria are referred to Azimuth (2015b). A summary of the CREMP study design is included to guide the reader.

2.2 Routine CREMP Sampling

2.2.1 Sampling Areas

The CREMP is designed to detect spatial and temporal changes in water quality, sediment chemistry, or biological communities (phytoplankton and benthos) at the scale of the lake or basin, in the case of large lakes such as Third Portage Lake. A common element for the Meadowbank and Whale Tail Pit study designs is the use of near-field (NF), mid-field (MF), and far-field (FF) areas to provide spatial context when interpreting potential changes year-over-year. Near-field areas provide the first line of early-warning for introductions of stressors into the receiving environment. These areas are situated closest to the development near dikes, dewatering discharge points, and proposed effluent sources. MF and FF areas are located farther downstream from the NF monitoring areas and provide insights into the spatial extent of any observed changes in chemistry or biological communities closer to the source. Brief descriptions of the Meadowbank, Whale Tail, and Baker study areas are provided below.

Meadowbank

There are 9 sampling areas included in the Meadowbank CREMP. Third Portage Lake East Basin and North Basin (TPE and TPN), Second Portage Lake (SP), and Wally Lake (WAL) are the NF areas monitored annually for changes related to operations at the Meadowbank mine and mill. Tehek (TE), the South Basin of Third Portage Lake (TPS), and Tehek far-field (TEFF) are monitored only if changes are detected upstream at the NF locations consistent with the strategy outline in **Section 2.2.3.** Two reference areas are shared for the Meadowbank and Whale Tail Pit programs: Inuggugayualik Lake (INUG) and Tasirjuaraajuk Lake (aka Pipedream Lake [PDL]). INUG has been the core reference area since formal monitoring began in 2006. PDL was added to the Meadowbank CREMP in 2009; while the absence of data at this area from 2006 to 2008 make its utility limited in the BACI statistical analyses, it provides insights into the strength of regional patterns (i.e., how well it matches INUG).

The 2021 sampling areas for the Meadowbank CREMP are shown in **Figure 4-1** (water and phytoplankton) and **Figure 4-2** (sediment and benthos).

Whale Tail

There are 6 lakes currently included in the Whale Tail Pit CREMP study design. Whale Tail Lake South Basin (WTS) and Mammoth Lake (MAM) are NF areas designed to detect changes related to dike construction in Whale Tail Lake and Mammoth Lake and discharge of treated water during operations. Nemo Lake (NEM) is also considered a NF area because of its proximity to the site, even though it is situated in a different watershed. MF areas are Lake A20 (upstream from WTS, but joined to WTS after flooding) and Lake A76 (downstream from MAM). Lake A76 is situated at the junction of the two flow paths leading to Lake DS1. Given its morphology and location, it represents an ideal MF exposure area for both flow paths. Lake DS1 is the FF location to provide additional context for characterizing spatial extent of effects.

The 2021 sampling areas for the Whale Tail Pit CREMP are shown in **Figure 5-1** (water and phytoplankton) and **Figure 5-2** (sediment and benthos).

Baker Lake

There are two NF areas for the Baker Lake CREMP, one targeting the hamlet's barge landing area (Baker Barge Dock [BBD]) and the other AEM's fuel storage facility (Baker Proposed Jetty[4] [BPJ]). The primary reference area for Baker Lake is located approximately 10 kilometers to the east of the hamlet along the north shore of the lake (Baker Akilahaarjuk Point [BAP]). A second reference area on the East Shore of Baker Lake (BES) between BAP and BPJ was added in 2011 to provide additional context for interpretation of sediment chemistry and benthic invertebrate data.

The 2021 sampling areas for the Baker Lake CREMP are shown in **Figure 6-1.**

2.2.2 Monitoring Components

Water quality, sediment quality, phytoplankton community, and benthic invertebrate community were monitored in the core 2021 program. Sampling was undertaken according to SOPs provided in the *CREMP Plan* (Azimuth, 2015b). Locations for water, limnology, and phytoplankton were selected randomly for the Meadowbank and Baker lakes areas from within their respective lake basins. The Whale Tail Pit study area lakes are smaller and more variable in depth compared to the Meadowbank project lakes. Fixed water quality monitoring locations are used for the Whale Tail Pit study area lakes to avoid selecting locations in less than 5 m of water. Two fixed locations were randomly selected for water

[4] Note that while a jetty was initially considered, the idea was abandoned in favour of continued use of the existing barge landing.

quality and phytoplankton community monitoring in each full event. Water sampling was completed in March, May, July, August, and September as per the study design. A single limnology profile is taken at the NF areas during the remaining winter months, when travel on ice is safe, to verify water quality is within the range of expected conditions. In 2021, limnology only monitoring occurred in January, February, April, November, and December[5]

Sediment for chemistry and benthic invertebrate community analyses were collected from the established areas (i.e., depositional zones between 6.5 m and 9 m) in each basin/lake.

Table 2-1 lists the monitoring components sampled at the various study areas in 2021. Global Positioning System (GPS) Universal Transverse Mercator (UTM) coordinates (in NAD 83) are shown in **Table 2-2** for the all CREMP study areas.

Samples from the 2021 CREMP were sent to the laboratories listed below for analysis:

- Water and bulk sediment chemistry – ALS Laboratories (Burnaby, BC)
- Phytoplankton taxonomy – Plankton R Us Inc. (Winnipeg, MB)
- Benthic invertebrate taxonomy – ZEAS Inc. (Nobleton, ON)

2.2.3 Sampling Effort

A results-driven sampling strategy for the Meadowbank study lakes was developed as part of the *CREMP Plan* (Azimuth, 2015b). The strategy was developed to increase the efficiency of the CREMP by focusing resources on monitoring in the areas most likely to be affected by mining-related activities. The decision framework outlines when the frequency of monitoring at MF and FF areas can safely be reduced. The annual decision framework presented in the *CREMP Plan* (Azimuth, 2015b; **Figure 2-1** [below]) applies to MF and FF areas at Meadowbank. This framework applies to MF area TE (which is paired with upstream NF areas TPE, SP, and WAL), MF area TPS (which is paired with NF area TPN), and to FF area TEFF (which is paired with upstream MF area TE). The same strategy may eventually be implemented at Whale Tail as more years of 'after' data become available. For the time being, monitoring at Whale Tail MF and FF areas will continue at the same frequency as the NF areas (i.e., there were five water chemistry/phytoplankton sampling events in 2021).

As per the normal Meadowbank CREMP data analysis process, NF results are evaluated on an annual basis (i.e., with CREMP reporting due at the end of March following each monitoring year), with the NF results (i.e., for *Year*) dictating the monitoring requirements for the MF area in the subsequent year (i.e., *Year +1*). The Year +1 NF and MF results are used as the basis to determine the MF and FF monitoring requirements for Year +2, and so on. While the full CREMP program will be conducted at each NF area

[5] Limnology only profiles are collected at a subset of the areas.

each year, the specific monitoring requirements for the MF and FF areas vary based on the NF and MF results, respectively. Below are the various outcomes of the CREMP data analysis and associated program requirements for MF and FF areas in the following year (see Azimuth, 2015b for more details, including a worked example of the strategy):

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

Minor changes to water quality parameters without toxicologically-derived effects-based thresholds were identified in the 2019 CREMP (Azimuth, 2020a). Following the strategy outlined above, these results warranted a pared-down monitoring program at MF (TPS and TE) and FF (TEFF) areas in 2021. Water sampling through-ice was completed (at NF, MF and FF areas) in March and May[6] 2021, but further water sampling at MF or FF areas during the open-water season was not completed.

[6] Water samples at TPS were planned for March, but were deferred to the May sampling event due to equipment issues.

Table 2-1. CREMP sampling summary, 2021.

Sampling Month	Sampling Crew	Conditions	Components	Meadowbank Areas									Baker Lake Areas				Whale Tail Pit Areas					
				INUG	PDL	TPN	SP	TPE	WAL	TPS	TE	TEFF	BAP	BES	BBD	BPJ	WTS	MAM	NEM	A20	A76	DS1
				REF	REF	NF	NF	NF	NF	MF	MF	FF	REF	REF	NF	NF	NF	NF	NF	MF	MF	FF
January	Agnico	Ice	L			✓	✓	✓	✓								✓	✓	✓	✓		
February	Agnico	Ice	L			✓	✓	✓	✓								✓	✓	✓	✓		
March	Agnico	Ice	L,W,P	✓	✓	✓	✓	✓	✓		✓	✓					✓	✓	✓	✓		
April	Agnico	Ice	L			✓	✓	✓	✓								✓	✓	✓	✓		
May	Agnico	Ice	L,W,P	✓	✓	✓	✓	✓	✓	✓							✓	✓	✓	✓	✓	✓
June	***Ice not safe***																					
July	Agnico	Open-water	L,W,P	✓	✓	✓	✓	✓	✓				✓		✓	✓	✓	✓	✓	✓	✓	✓
August	Azimuth	Open-water	L,W,P	✓	✓	✓	✓	✓	✓				✓		✓	✓	✓	✓	✓	✓	✓	✓
			B,S	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
September	Agnico	Open-water	L,W,P	✓	✓	✓	✓	✓	✓				✓		✓	✓	✓	✓	✓	✓	✓	✓
October	***Ice not safe***																					
November	Agnico	Ice	L			✓	✓	✓	✓								✓	✓	✓			
December	Agnico	Ice	L			✓	✓	✓	✓								✓	✓	✓	✓		

Notes:
Components: L=Limnology; W=Water chemistry; P=Phytoplankton; B=Benthic invertebrates; S=Sediment grab chemistry.
✓ = monitoring components were collected.
Area designations: C=Control; I=Impact; REF=reference (in grey shading); NF=near-field (in blue shading); MF=mid-field (in pink shading); FF=far-field (in teal shading)
Area IDs: Meadowbank and Whale Tail Pit Reference areas: INUG = Inuggugayualik Lake; PDL = Pipedream Lake. Meadowbank areas: TPN, TPE, TPS = Third Portage Lake – North, East, South basins; SP = Second Portage Lake; WAL = Wally Lake; TE, TEFF = Tehek Lake (Mid-field and Far-field). Baker Lake areas: BAP, BES, BBD, BPJ=Baker Lake – Akilahaarjuk Point, East Shore, Barge Dock, Proposed Jetty. Whale Tail Pit areas: WTS = Whale Tail Lake South Basin; MAM = Mammoth Lake; NEM = Nemo Lake; A20 = Lake A20; A76 = Lake A76; DS1 = Lake DS1.

Table 2-2. CREMP sampling coordinates for Meadowbank and Baker Lake study areas, 2021.

Area[1]	Area Type[2]	Area-Replicate	Water & Phytoplankton (Monthly)				Benthos & Sediment Chemistry (August)				
			Month	Depth (m)	Zone & Easting	Northing	Area-Replicate	Sample Type[3]	Depth (m)	Zone & Easting	Northing
Meadowbank											
TPE	NF	TPE-limno	January	14.0	14W 0638263	7211492	TPE-1	B & C	8.1	14W 0639061	7211503
		TPE-limno	February	17.4	14W 0639396	7211764	TPE-2	B & C	9.2	14W 0639107	7211534
		TPE-limno	April	12.5	14W 0638060	7211318	TPE-3	B & C	9.3	14W 0639127	7211561
		TPE Limno	November	7.7	14W 0638402	7211807	TPE-4	B & C	9	14W 0639143	7211744
		TPE Limno	December	8.8	14W 0638267	7211618	TPE-5	B & C	9.3	14W 0639156	7211700
		TPE-140	March	5.1	14W 0639310	7210411	TPE-COMP	C			
		TPE-141	March	9.8	14W 0637783	7211699					
		TPE-142	May	10.7	14W 0639341	7211297					
		TPE-143	May	5.0	14W 0638330	7211147					
		TPE-144	July	6.9	14W 0637262	7212022					
		TPE-145	July	5.1	14W 0639555	7211567					
		TPE-146	August	7.4	14W 0638994	7209852					
		TPE-147	August	9.5	14W 0638899	7211437					
		TPE-148	September	7.6	14W 0639088	7212521					
		TPE-149	September	> 19	14W 0637889	7211573					
TPN	NF	TPN-limno	January	> 20	14W 0635707	7213060	TPN-1	B & C	8.7	14W 0636341	7215524
		TPN-limno	February	> 20	14W 0636501	7213578	TPN-2	B & C	8.3	14W 0636372	7215538
		TPN-limno	April	8.6	14W 0635125	7213320	TPN-3	B & C	8.3	14W 0636391	7215539
		TPN-limno	November	N/R	14W 0636083	7213671	TPN-4	B & C	7.4	14W 0636425	7215520
		TPN-limno	December	13.5	14W 0636077	7213763	TPN-5	B & C	7.5	14W 0636437	7215502
		TPN-140	March	6.2	14W 0635325	7216063	TPN-COMP	C			
		TPN-141	March	14.5	14W 0634714	7216090					
		TPN-142	May	10.5	14W 0634265	7215092					
		TPN-143	May	6.6	14W 0635367	7216092					
		TPN-144	July	10.0	14W 0634805	7214790					
		TPN-145	July	11.3	14W 0636062	7213827					

Area[1]	Area Type[2]	Area-Replicate	Water & Phytoplankton (Monthly)				Benthos & Sediment Chemistry (August)				
			Month	Depth (m)	Zone & Easting	Northing	Area-Replicate	Sample Type[3]	Depth (m)	Zone & Easting	Northing
TPN		TPN-146	August	13.7	14W 0636066	7213608					
		TPN-147	August	8.6	14W 0634442	7214817					
		TPN-148	September	> 18	14W 0634842	7216050					
		TPN-149	September	9.3	14W 0636309	7214389					
TPS	MF	TPS-65	May	>19	14W 0634776	7207751					
		TPS-66	May	11.3	14W 0633347	7207235					
SP	NF	SP-limno	January	8.3	14W 0639831	7213170	SP-1	B & C	9.2	14W 0640007	7214081
		SP-limno	February	11.9	14W 0640118	7214228	SP-2	B & C	8.9	14W 0640050	7214129
		SP-limno	April	12.8	14W 0639979	7213886	SP-3	B & C	9	14W 0640059	7214144
		SP-limno	November	7.2	14W 0639604	7214471	SP-4	B & C	9.3	14W 0640076	7214184
		SP-limno	December	6.8	14W 0640557	7213142	SP-5	B & C	8.8	14W 0640074	7214204
		SP-140	March	6.3	14W 0640624	7212883	SP-COMP	C			
		SP-141	March	6.5	14W 0639572	7213586					
		SP-142	May	17.4	14W 0640474	7213653					
		SP-143	May	9.2	14W 0639531	7213670					
		SP-144	July	10.9	14W 0639581	7213665					
		SP-145	July	9.5	14W 0640111	7212823					
		SP-146	August	8.3	14W 0640758	7213317					
		SP-147	August	10.8	14W 0639653	7214078					
		SP-148	September	6.9	14W 0640577	7212837					
		SP-149	September	13.3	14W 0639998	7213898					
TE	MF	TE-100	March	14.2	15W 0360295	7212277					
		TE-101	March	5.1	15W 0361557	7212156					
TEFF	FF	TEFF-52	March	8.9	15W 0363559	7210082					
		TEFF-53	March	6.2	15W 0362170	7209040					
WAL	NF	WAL-limno	January	5.9	15W 0360453	7221522	WAL-1	B & C	8.9	15W 0360948	7220406
		WAL-limno	February	12.7	15W 0360959	7222061	WAL-2	B & C	7.4	15W 0360911	7220436
		WAL-limno	April	5.1	15W 0361054	7221605	WAL-3	B & C	8.9	15W 0360906	7220472
		WAL-limno	November	5.0	15W 0360698	7221293	WAL-4	B & C	8.6	15W 0360924	7220488

Area[1]	Area Type[2]	Area-Replicate	Water & Phytoplankton (Monthly)				Benthos & Sediment Chemistry (August)				
			Month	Depth (m)	Zone & Easting	Northing	Area-Replicate	Sample Type[3]	Depth (m)	Zone & Easting	Northing
WAL		WAL-limno	December	7.9	15W 0360994	7220414	WAL-5	B & C	8.4	15W 0360900	7220530
		WAL-109	March	7.4	15W 0361814	7222869	WAL-COMP	C			
		WAL-110	March	5.3	15W 0360698	7221296					
		WAL-111	May	7.0	15W 0360931	7221897					
		WAL-112	May	6.5	15W 0361226	7222270					
		WAL-113	July	6.6	15W 0361550	7221446					
		WAL-114	July	5.0	15W 0360800	7220924					
		WAL-115	August	6.4	15W 0361340	7221606					
		WAL-116	August	5.9	15W 0360549	7221114					
		WAL-117	September	11.0	15W 0360756	7220797					
		WAL-118	September	6.3	15W 0361859	7221866					
INUG	Ref	INUG-128	March	7.1	14W 0622981	7216570	INUG-1	B & C	8.2	14W 0622830	7216817
		INUG-129	March	5.1	14W 0622405	7216330	INUG-2	B & C	8.4	14W 0622780	7216791
		INUG-130	May	10.4	14W 0622830	7216538	INUG-3	B & C	8.5	14W 0622751	7216801
		INUG-131	May	7.7	14W 0621712	7214440	INUG-4	B & C	8.6	14W 0622719	7216804
		INUG-132	July	11.8	14W 0622941	7216724	INUG-5	B & C	8.8	14W 0622763	7216757
		INUG-133	July	11.5	14W 0622789	7214957	INUG-COMP	C			
		INUG-134	August	17.8	14W 0622191	7214864					
		INUG-135	August	8.9	14W 0621821	7215434					
		INUG-136	September	12.2	14W 0622713	7216494					
		INUG-137	September	9.0	14W 0621994	7215673					
PDL	Ref	PDL-93	March	5.7	14W 0630658	7222996	PDL-1	B & C	7.7	14W 0630675	7223052
		PDL-94	March	11.3	14W 0632733	7224742	PDL-2	B & C	8	14W 0630686	7222999
		PDL-95	May	13.2	14W 0630507	7223635	PDL-3	B & C	8.1	14W 0630681	7223023
		PDL-96	May	15.1	14W 0632907	7224275	PDL-4	B & C	8	14W 0630086	7222965
		PDL-97	July	5.7	14W 0630653	7222994	PDL-5	B & C	8.1	14W 0630685	7222923
		PDL-98	July	>20	14W 0631997	7225222	PDL-COMP	C			
		PDL-99	August	8.6	14W 0631049	7224661					

Area[1]	Area Type[2]	Area-Replicate	Water & Phytoplankton (Monthly)				Benthos & Sediment Chemistry (August)				
			Month	Depth (m)	Zone & Easting	Northing	Area-Replicate	Sample Type[3]	Depth (m)	Zone & Easting	Northing
PDL		PDL-100	August	10.4	14W 0632110	7224065					
		PDL-101	September	12.5	14W 0630089	7223596					
		PDL-102	September	> 20	14W 0631625	7224861					
Baker Lake											
BBD	NF	BBD-73	July	6.6	14W 0644637	7135334	BBD-1	B & C	9.2	14W 0644601	7135283
		BBD-74	July	12.8	14W 0643906	7135236	BBD-2	B & C	8.4	14W 0644567	7135296
		BBD-75	August	20.7	15W 0356699	7134176	BBD-3	B & C	9.2	14W 0644527	7135301
		BBD-76	August	12.2	14W 0643969	7135230	BBD-4	B & C	9.1	14W 0644484	7135319
		BBD-77	September	8.4	14W 0644659	7135297	BBD-5	B & C	9.4	14W 0644425	7135336
		BBD-78	September	9.6	14W 0643975	7135329	BBD-COMP	C			
BPJ	NF	BPJ-73	July	>20	15W 0356872	7134118	BPJ-1	B & C	8.8	15W 0357185	7134163
		BPJ-74	July	6.9	15W 0357517	7133975	BPJ-2	B & C	8.5	15W 0357231	7134126
		BPJ-75	August	12.7	14W 0644618	7135184	BPJ-3	B & C	8.1	15W 0357067	7134228
		BPJ-76	August	9.8	15W 0357212	7134113	BPJ-4	B & C	8.6	15W 0357023	7134227
		BPJ-77	September	6.3	15W 0357409	7134035	BPJ-5	B & C	8.4	15W 0357376	7134037
		BPJ-78	September	> 20	15W 0356710	7134174	BPJ-COMP	C			
BES	Ref						BES-1	B & C	9.3	15W 0361221	7132392
							BES-2	B & C	9	15W 0361268	7132377
							BES-3	B & C	9.3	15W 0361294	7132360
							BES-4	B & C	8.9	15W 0361366	7132326
							BES-5	B & C	8.5	15W 0361441	7132298
							BES-COMP	C			
BAP	Ref	BAP-73	July	17.6	15W 0363774	7131268	BAP-1	B & C	7.1	15W 0364006	7131213
		BAP-74	July	7.7	15W 0364082	7131015	BAP-2	B & C	8.4	15W 0364044	7131168
		BAP-75	August	18.0	15W 0363997	7130980	BAP-3	B & C	8.9	15W 0364081	7131152
		BAP-76	August	12.3	15W 0363245	7131332	BAP-4	B & C	9.3	15W 0364133	7131111
		BAP-77	September	> 20	15W 0362944	7131103	BAP-5	B & C	9	15W 0364145	7131051
		BAP-78	September	> 19	15W 0364352	7130768	BAP-COMP	C			

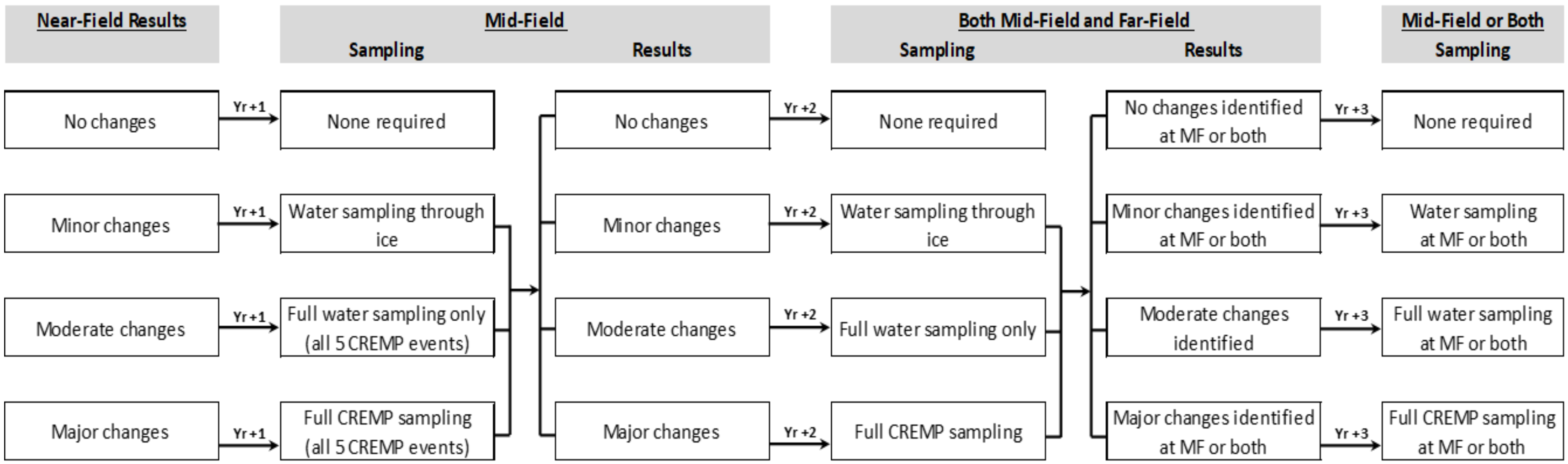
Area[1]	Area Type[2]	Area-Replicate	Water & Phytoplankton (Monthly)				Benthos & Sediment Chemistry (August)				
			Month	Depth (m)	Zone & Easting	Northing	Area-Replicate	Sample Type[3]	Depth (m)	Zone & Easting	Northing
Whale Tail Pit											
WTS	NF	WTS-limno	January	6.7	14W 0607629	7254679	WTS-1	B & C	9.2	14W 0607143	7253542
		WTS-limno	February	6.8	14W 0607629	7254676	WTS-2	B & C	10	14W 0607191	7253507
		WTS-limno	April	16.3	14W 0607264	7253577	WTS-3	B & C	10.8	14W 0607107	7253589
		WTS-limno	November	7.8	14W 0607341	7254572	WTS-4	B & C	10.1	14W 0607100	7253655
		WTS-limno	December	14.0	14W 0607435	7254376	WTS-5	B & C	10.5	14W 0607161	7253648
		WTS-57	March	7.2	14W 0607189	7253635	WTS-COMP	C			
		WTS-58	March	6.5	14W 0607638	7254078					
		WTS-59	May	10.8	14W 0607163	7253609					
		WTS-60	May	8.9	14W 0607696	7254008					
		WTS-61	July	10.8	14W 0607173	7253550					
		WTS-62	July	8.7	14W 0607686	7254010					
		WTS-63	August	9.1	14W 0607680	7263992					
		WTS-64	August	11.2	14W 0607159	7253617					
		WTS-65	September	10.6	14W 0607163	7253609					
		WTS-66	September	8.6	14W 0607696	7254008					
MAM	NF	MAM-limno	January	9.2	14W 0604997	7254745	MAM-1	B & C	8.2	14W 0605059	7254888
		MAM-limno	February	9.5	14W 0604997	7254745	MAM-2	B & C	9	14W 0605047	7254887
		MAM-limno	April	13.2	14W 0604049	7254459	MAM-3	B & C	8.5	14W 0605022	7254887
		MAM-limno	November	7.4	14W 0604997	7254745	MAM-4	B & C	8.6	14W 0604980	7254870
		MAM-limno	December	8.6	14W 0604965	7254823	MAM-5	B & C	8.9	14W 0605029	7254864
		MAM-57	March	12.9	14W 0604032	7254411	MAM-COMP	C			
		MAM-58	March	8.5	14W 0605393	7255097					
		MAM-59	May	7.4	14W 0604263	7253609					
		MAM-60	May	9.4	14W 0605359	7255129					
		MAM-61	July	8.5	14W 0605389	7255134					
		MAM-62	July	6.3	14W 0604145	7253925					
		MAM-63	August	8.5	14W 0605378	7255133					

Area[1]	Area Type[2]	Area-Replicate	Water & Phytoplankton (Monthly)				Benthos & Sediment Chemistry (August)				
			Month	Depth (m)	Zone & Easting	Northing	Area-Replicate	Sample Type[3]	Depth (m)	Zone & Easting	Northing
MAM		MAM-64	August	7.2	14W 0604177	7254221					
		MAM-65	September	12.4	14W 0604074	7254478					
		MAM-66	September	8.4	14W 0605076	7254879					
NEM	NF	NEM-limno	January	11.7	14W 0606613	7257588	NEM-1	B & C	9	14W 0606567	7257380
		NEM-limno	February	16.8	14W 0606619	7257709	NEM-2	B & C	8.2	14W 0606562	7257356
		NEM-limno	April	> 19	14W 0606534	7257679	NEM-3	B & C	9.1	14W 0606530	7257314
		NEM-limno	November	10.5	14W 0606427	7257051	NEM-4	B & C	6.9	14W 0606557	7257315
		NEM-limno	December	12.1	14W 0606412	7257339	NEM-5	B & C	7.3	14W 0606565	7257338
		NEM-57	March	9.1	14W 0606131	7257409	NEM-COMP	C			
		NEM-58	March	14.4	14W 0606987	7257841					
		NEM-59	May	12.7	14W 0606970	7257826					
		NEM-60	May	13.5	14W 0606152	7257527					
		NEM-61	July	7.6	14W 0606241	7257371					
		NEM-62	July	14.9	14W 0607018	7257843					
		NEM-63	August	11.5	14W 0606980	7257815					
		NEM-64	August	14.4	14W 0606221	7257616					
		NEM-65	September	14.9	14W 0606152	7257527					
		NEM-66	September	15.6	14W 0606987	7257841					
A20	MF	A20-limno	January	> 20	14W 0604387	7252619	A20-1	B & C	9.5	14W 0604609	7252543
		A20-limno	February	>19	14W 0604384	7252621	A20-2	B & C	9	14W 0604652	7252549
		A20-limno	April	5.8	14W 0604719	7252516	A20-3	B & C	8.5	14W 0604619	7252495
		A20-limno	November	N/R	N/R	N/R	A20-4	B & C	8.1	14W 0604678	7252532
		A20-limno	December	15.8	14W 0604464	7252582	A20-5	B & C	8.5	14W 0604614	7252557
		A20-51	March	6.9	14W 0605139	7252746	A20-COMP	C			
		A20-52	March	6.4	14W 0604703	7252487					
		A20-53	May	> 20	14W 0604383	7252617					
		A20-54	May	5.7	14W 0605263	7252781					
		A20-55	July	6.9	14W 0605218	7252784					

Area[1]	Area Type[2]	Area-Replicate	Water & Phytoplankton (Monthly)				Benthos & Sediment Chemistry (August)				
			Month	Depth (m)	Zone & Easting	Northing	Area-Replicate	Sample Type[3]	Depth (m)	Zone & Easting	Northing
A20		A20-56	July	24.4	14W 0604376	7252620					
		A20-57	August	6.9	14W 0605231	7252746					
		A20-58	August	18.7	14W 0604546	7252645					
		A20-59	September	5.7	14W 0605223	7252787					
		A20-60	September	5.4	14W 0604701	7252432					
A76	MF	A76-51	May	14.6	14W 0602554	7257152	A76-1	B & C	9.5	14W 0602271	7256919
		A76-52	May	8.7	14W 0602143	7257033	A76-2	B & C	8.6	14W 0602235	7256925
		A76-53	July	10.8	14W 0601719	7256905	A76-3	B & C	8.7	14W 0602273	7256947
		A76-54	July	6.4	14W 0602587	7257014	A76-4	B & C	8.9	14W 0602289	7256975
		A76-55	August	10.3	14W 0602085	7256866	A76-5	B & C	8.6	14W 0602215	7256937
		A76-56	August	13.2	14W 0601737	7256872	A76-COMP	C			
		A76-57	September	13.2	14W 0602555	7257139					
		A76-58	September	7.6	14W 0601735	7256980					
DS1	FF	DS1-49	May	11.5	14W 0598055	7258233	DS1-1	B & C	9.3	14W 0598009	7262023
		DS1-50	May	> 20	14W 0597501	7260997	DS1-2	B & C	8.6	14W 0598070	7262013
		DS1-51	July	> 20	14W 0597582	7260651	DS1-3	B & C	9.5	14W 0598060	7262050
		DS1-52	July	9.3	14W 0598028	7258274	DS1-4	B & C	7.6	14W 0598105	7262007
		DS1-53	August	10.5	14W 0597422	7261002	DS1-5	B & C	6.5	14W 0598112	7261986
		DS1-54	August	9.2	14W 0598016	7258278	DS1-COMP	C			
		DS1-55	September	15.7	14W 0597517	7260741					
		DS1-56	September	10.5	14W 0598028	7258274					

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.
WTS = Whale Tail Lake – South Basin; MAM = Mammoth Lake; NEM = Nemo Lake.
2. Area types: NF=near-field; MF=mid-field; FF=far-field; Ref=reference.
3. Sample types: B=Benthos; C=chemistry; Comp = composite sample of all 5 replicate samples from each area (no coordinates).
4. Comp = composite sample of all 5 replicate samples from each area (no coordinates).
Note that water sampling at BES and sediment/benthic invertebrate sampling at TPS, TE, or TEFF was not completed as per the study design (Azimuth, 2015b).
N/R = depth not recorded (no limnology data for this sample).

Figure 2-1. Annual results-based sampling strategy rules for mid-field and far-field sampling areas.



2.3 Data Evaluation Criteria

The specific methods used to apply triggers/thresholds in the evaluation of CREMP monitoring parameters varied by study component; details are presented in the following sections. 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.

2.3.1 Water Chemistry

An iterative process was utilized to identify water chemistry parameters of primary concern at the Meadowbank, Whale Tail and Baker Lake project areas. For each water chemistry parameter analyzed in 2021, the yearly mean concentration for each lake or basin was compared to its respective trigger value. Parameters where the yearly mean was equal to or exceeded the trigger value were formally tested using the Before-After-Control-Impact (BACI) statistical model. In addition to BACI analysis, a trigger screening assessment was conducted to evaluate the extent of changes in water quality as a guide decision making (See **Section 2.2.3**). Finally, a conservative three-step assessment process was used to identify parameters to include in the formal trend assessment to streamline the interpretation process. In this assessment, water chemistry trends were examined broadly for all parameters meeting detection limits (>10% of samples >MDL), control-impact, and mine related criteria outlined below.

Trigger Evaluation

Water quality data collected in 2021 were evaluated against triggers and thresholds consistent with the two-tiered approach outlined in **Section 1.5**. Formal comparison of the water quality data for decision-making purposes was done by comparing the yearly mean[7] parameter concentrations to the trigger values developed separately for the Meadowbank projects lakes, Wally Lake[8], Baker Lake areas, and the Whale Tail lakes[9]. The derivation methods and a full list of triggers and thresholds for each study area are provided in the *CREMP Plan*[10] (Azimuth, 2015b).

Parameters where the yearly mean was equal to, or exceeded the trigger value were formally tested using a one-tailed test of the null hypothesis[11] (significance level of p=0.05) using the Before-After-

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

[8] Separate water quality triggers were developed for Wally Lake from the other Meadowbank areas when mining activities transitioned from the North and South Portage Pits (discharge to TPN) to the Vault Lake area (discharge to WAL) in 2013.

[9] Water quality triggers specific to the Whale Tail Pit study area lakes were developed in 2019 (Azimuth, 2020a).

[10] The CREMP plan was revised in 2021. However, it has not been formally implemented and the *CREMP: 2015 Plan Update*, which has been approved, will continue to be used in the interim.

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

Control-Impact (BACI) statistical model. The BACI model is *paired* (i.e., BACIP) when multiple *before* and *after* events are available. Across each of the study areas, the following BACI components were included in the analysis:

- **Meadowbank Project Lakes and Wally Lake**: In the BACI model, INUG was used as the reference (*control*) area[12], with the other areas tested as exposure (*impact*) areas. True *pre-impact* data, when both INUG and the test area had *control* ("C") status, were used for the *before* data (see **Table 2-3**). Only events when both INUG and the test area were sampled in 2021 were used as the *after* data.
- **Whale Tail**: The 2021 CREMP study year was the third year to include formal statistical BACI analysis of the water quality results at Whale Tail. BACI analysis followed the approaches outlined for Meadowbank including INUG as the reference (*control*) area.
- **Baker Lake**: Baker Lake areas were designated as *control* (BAP) or *impact* (BPJ and BBD) when sampling started in 2008 (i.e., there was no detailed baseline sampling conducted for Baker Lake; see **Table 2-3**), so there are no true *pre-impact* or *before* data. While a spatial *CI* design could be used to test for differences between reference *control* and exposure *impact* areas, the design does not allow for distinguishing natural differences between areas from development-related changes. Given that no development-related changes had been identified to date, all years of data up to and including 2019 were considered in the *before* period, while the 2020 results were considered *after* period data (i.e., allowing the more robust BACI analysis). The BACI analyses specifically looked at changes in 2021 at the two *impact* areas relative to previous years.

In addition to BACI analysis, a trigger screening assessment was conducted to evaluate the extent of changes in water quality as a guide to future actions. This approach falls into the framework outlined in **Section 2.2.3** and involved evaluating the extent and magnitude of trigger exceedances to direct the level of sampling intensity in proceeding years.

Parameter Assessment

Given the number of parameters routinely below laboratory MDLs (i.e., thus providing little insight for assessing mine-related changes to water quality), a conservative three-step assessment process was used to identify parameters to include in the formal trend assessment to streamline the interpretation process (the results are summarized in **Table 4-2**):

[12] PDL and TEFF are excluded as control areas in the BACI analysis because neither area was sampled in the before period between 2006 and 2008 (i.e., limiting their utility as reference areas in the BACI model, but both providing valuable context for interpreting the strength and consistency of regional trends seen at INUG).

- **Overall Detection Frequency** – Only those water quality parameters that exceeded MDLs in at least 10% of the samples are included for this discussion. Because the project lakes are ultra-oligotrophic, it is normal for many parameters to be below MDLs. The temporal (and spatial) trend assessment includes data from all study years and is updated to include the 2021 data. In 2021, just over half (54%) the parameters exceeded MDLs at least 10% of the time. These parameters are included in this discussion. Overall, there were no changes in detection frequency between 2020 and 2021.
- **Control-Impact Detection Frequency Comparison** – To avoid screening out infrequently detected parameters that were detected more often in association with mining activities, the proportion of samples exceeding MDLs between *control* and *impact* samples was compared. The intent was to identify parameters with <10% detection frequency (i.e., those screened out above) for which the proportion of detected values increased by 0.1 or more. Based on this second screening, no parameters were added back into the trend assessment.
- **Apparent Detection Pattern Matching Mining Activity** – As a further step to avoid screening out potentially important parameters at Meadowbank and Whale Tail Pit study area lakes, trend plots for infrequently detected parameters were used to visually identify parameters with measured values associated with periods/locations of known mining activities (see **Table 1-1**). Where such patterns were observed or where parameters were measured at greater than five times the MDL at near-field sampling areas in at least one event, these parameters were added back into the trend assessment process. Dissolved zinc was added back into the trend assessment at this step to follow up on results from 2020 in which concentrations of this parameter were measured at greater than five times the MDL in two samples (one at TPN and one at SP) (i.e., this parameter's pattern does not match mine site activity).

FEIS Model Comparisons

In addition to the trigger/threshold BACI evaluation, the 2021 CREMP water quality data at Meadowbank and Whale Tail were compared to water quality predictions developed as part of the FEIS process introduced in **Section 1.5**.

- **Meadowbank Project Lakes and Wally Lake** – Annual Meadowbank CREMP water quality data were also compared to the maximum whole-lake average water quality modelling predictions for Third Portage, Second Portage, and Wally Lakes made during the environmental assessment process (Cumberland, 2005).
- **Whale Tail** – Monthly Whale Tail CREMP water quality data for Whale Tail Lake (South Basin) and Mammoth Lake were compared to their respective water quality monthly modeled predictions presented in the revised FEIS for the Expansion Project (see Golder, 2019).

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

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

Adaptive Management Strategy

Agnico Eagle developed an adaptive management strategy in 2021 to guide water management decisions for MAM and WTS[13] (Agnico Eagle, 2021). The strategy uses 'Levels' linked to specific criteria for phosphorus and arsenic, and each Level has prescribed management actions. The Levels range from 0 (normal operating conditions) to 4 (emergency situation). The 'Level' for each lake is based on the concentration of phosphorus and arsenic relative to predictions in the FEIS (Golder, 2019) and relative to the CCME water quality guidelines (WQG) of 0.01 mg/L for phosphorus and the site-specific water quality objective (SSWQO) of 0.025 mg/L for arsenic. The adaptive management thresholds and corresponding adaptive management levels and strategies are summarized in **Table 2-4**. A detailed description of the adaptive management thresholds and management strategies is provided in Table 3 of the Adaptive Management Plan (AMP; Agnico Eagle, 2021).

Water quality data collected as part of the annual CREMP are used in the assessment. Results of the water quality comparison to AMP thresholds are provided in **Section 5.3.4**.

2.3.2 Sediment Chemistry

Sediment grab samples are collected annually with the benthic invertebrate samples. In addition to characterizing physical conditions (e.g., grain size and organic carbon content), they provide additional information on temporal changes in concentrations of metals and organics in sediment. Sediment chemistry core sampling for the CREMP is completed every three years at the same time as Environmental Effects Monitoring (EEM) sampling. The intent of the coring program is to monitor long-term trends in metals concentrations in the top layer of sediment (1.5 cm [approximately]). In sediment

[13] Mitigation measures include but are not limited to targeted studies, implementing activities to prevent, stabilize or reverse a change in environmental conditions or to protect the receiving environment.

coring years, metals analyses from the core samples replaces metals analyses from the grab samples. The next full coring program is scheduled for 2023 (coinciding with the EEM program).

Trends in sediment chemistry are evaluated by comparing the yearly mean parameter concentrations in the core samples to the trigger[14] values applicable to the Meadowbank study area lakes, Wally Lake, and the Whale Tail study area lakes (see discussion below). Those parameters where the yearly mean was equal to or exceeded triggers were formally tested using a before-after (BA) statistical model[15]. Sediment chemistry can be quite variable over a small spatial scale within a given basin, but natural seasonal variability in sediment chemistry is assumed to be low given the low rates of natural sediment deposition in Arctic lakes (Azimuth, 2012d). The BA statistical model assumes that, in absence of mining-related inputs, annual variability in sediment chemistry is negligible.

The naturally high sediment concentrations in the Whale Tail study area lakes necessitated triggers that were lake specific, similar to the approach that was used to develop triggers for Wally Lake. The derivation of these triggers was completed in 2019 and included in the analysis of grab sediment chemistry. The statistical analysis of sediment in the Whale Tail study areas will be implemented for the next sediment coring program scheduled for August 2023 (3-year cycle). Evaluation of the data will follow the same approach used for Meadowbank by comparing the yearly mean concentrations to new trigger values and BA statistical analysis of temporal changes for parameters that exceeded their respective triggers. Triggers were developed using the baseline sediment core chemistry data collected in 2017 and the statistical approach described in Azimuth (2012d). CCME sediment quality guidelines were set as the thresholds when applicable (i.e., for those parameters with CCME sediment quality guidelines). Triggers were set to the maximum of one of three methods for the Whale Tail study area lakes:

- Method A: the value halfway between the baseline median and the threshold (CCME ISQG),
- Method B: the 90th percentile of the baseline data, or
- Method C: the value corresponding to a 20% increase above the median value.

2.3.3 Phytoplankton and Benthos Community Variables

Trigger and threshold value development for phytoplankton and benthos communities was presented in detail in the original *CREMP Design Document* (Azimuth, 2012d). Unlike water or sediment, where environmental quality guidelines can be used to develop thresholds or triggers, there are no universal benchmarks for biological variables such as abundance, biomass or diversity. Rather, the magnitude of

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[14] The trigger values for the Meadowbank project lakes were updated in the 2017 CREMP report (Azimuth, 2018c).

[15] One-tailed test of the null hypothesis that concentrations are not different (or lower) in the after period relative to the before period (significance level of p=0.05); the alternate hypothesis is that concentrations have increased in relation to mining.

change or difference relative to expected conditions must be used to establish *critical effect sizes* (CES) for biological variables. Effect sizes of 20% and 50% were established as the *trigge*r and *threshold* for assessing changes in biological variables. Importantly, the terms *threshold* and *trigge*r for biological variables are not used as strictly as for water and sediment chemistry parameters for two reasons:

1. Statistical Power – For most biological variables, natural variability can make it difficult to statistically detect effect sizes as low as 20%. It is more realistic to detect larger effect sizes such as 50%.
2. Causality – Even if statistically-significant changes are documented (at whatever effect size), the cause of the change needs to be understood in order to effectively manage the situation. For the Meadowbank biological data, effect sizes exceeding 50% have been observed due to natural variability in the baseline data.

The BACI framework developed for the phytoplankton and benthos community assessments at Meadowbank was implemented at Whale Tail starting in 2019.

Phytoplankton Taxonomy

Total phytoplankton biomass and taxa richness were selected as the metrics to assess changes in the phytoplankton community using the BACI framework[16]. Phytoplankton triggers and thresholds are set to relative changes of 20% and 50%, respectively. The evaluation procedure was analogous to that used for water chemistry, except that area means for 2021 were not directly comparable to triggers (i.e., since the triggers/thresholds are based on the relative change over time in a parameter rather than on a finite value), so the process started with the BACI testing. Two-tailed tests of the null hypothesis (i.e., that test areas experienced no relative change up or down) were conducted with a significance level of p=0.1.

Benthos Taxonomy

Trigger and threshold values for the benthos are set at reductions of 20% and 50%, respectively, for abundance and taxa richness. The CREMP uses percent change rather than standard deviations which are used in EEM, to maintain a transparent (fixed) effect size that is more likely to be ecologically relevant. Statistical power increases with consideration of more *after* period years; consequently, BACI analyses for the Meadowbank area were conducted on four *after* data period lengths: one year (2021 only), two years (2020–2021), three years (2019–2021), and four years (2018–2021) and for the Whale Tail area for either one year (2021 only) or for WTS and MAM both one year and two years (2020–2021). One-tailed tests of the null hypothesis were conducted with a significance level of p=0.1. Failure to reject the null hypothesis implies the endpoint (i.e., total abundance or species richness) either did not

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

change or increased. The alternative hypothesis is that the endpoint decreased. Despite this BACI being conducted as a one-tailed test, the p value was left at 0.1 to help improve statistical power for the benthic invertebrate endpoints.

No baseline benthic community data are available for Baker Lake, so there is no true *pre-impact* or *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, BACI analyses for Baker Lake benthos were conducted using a series of four temporal scenarios using all 14 years of data. (i.e., 2021 was compared to 2008–2020; 2020/2021 was compared to 2008–2019 and so on). These series of comparisons are a more robust method for identifying temporal changes due to mining-related activities in Baker Lake without needing to assume that sampling areas should have identical communities (i.e., like the *CI* design).

Figure 2-2. Management response plan for the Meadowbank Mine Aquatic Environment Monitoring Program (AEMP).

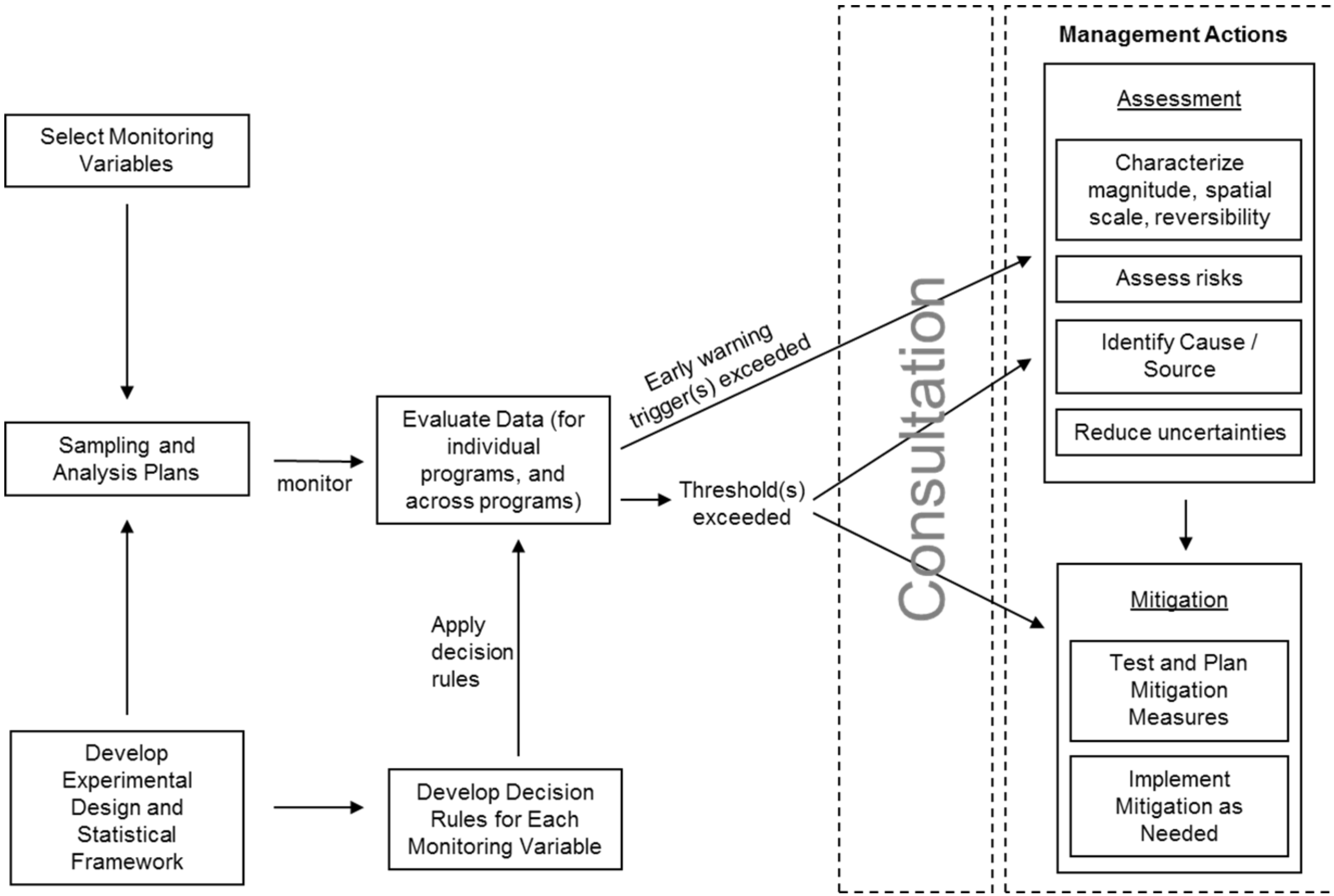


Table 2-3. Status of all CREMP sampling areas since the beginning of monitoring.

	Meadowbank Areas									Baker Lake Areas				Whale Tail Pit Areas					
Designation	**REF**	**REF**	**NF**	**NF**	**NF**	**NF**	**MF**	**MF**	**FF**	**REF**	**REF**	**NF**	**NF**	**NF**	**NF**	**NF**	**MF**	**MF**	**FF**
Area	**INUG**	**PDL**	**TPN**	**SP**	**TPE**	**WAL**	**TPS**	**TE**	**TEFF**	**BAP**	**BES**	**BBD**	**BPJ**	**WTS**	**MAM**	**NEM**	**A20**	**A76**	**DS1**
2006	C		C	C	C	C	C	C											
2007	C		C	C	C	C	C	C											
2008	C		C	I (Aug)	C	C	C	I (Aug)		C		I	I						
2009	C	C	I (Mar)	I	I (Aug)	C	C	I	C	C		I	I						
2010	C	C	I	I	I	C	C	I	C	C		I	I						
2011	C	C	I	I	I	C	C	I	C	C	C	I	I						
2012	C	C	I	I	I	C	C	I	C	C	C	I	I						
2013	C	C	I	I	I	I (Jul)	C	I	C	C	C	I	I						
2014	C	C	I	I	I	I	C	I	C	C	C	I	I	C	C	C			
2015	C	C	I	I	I	I	C	I	C	C	C	I	I	C	C	C			
2016	C	C	I	I	I	I	C	I	C	C	C	I	I	C	C	C	C	C	C
2017	C	C	I	I	I	I	C	I	C	C	C	I	I	C	C	C	C	C	C
2018	C	C	I	I	I	I	C	I	C	C	C	I	I	I (Aug)	I (Nov)	C	C	C	C
2019	C	C	I	I	I	I	C	I	C	C	C	I	I	I	I	I (Aug)	I	I	I
2020	C	C	I	I	I	I	C	I	C	C	C	I	I	I	I	I	I	I	I
2021	C	C	I	I	I	I	C	I	C	C	C	I	I	I	I	I	I	I	I

Notes:

Area designations:

C=Control; I=Impact; REF=reference (in grey shading); NF=near-field (in blue shading); MF=mid-field (in pink shading); FF=far-field (in teal shading).

Blank cells indicate the area was not part of the monitoring program that year.

Area IDs:

Meadowbank and Whale Tail Pit Reference areas: INUG = Inuggugayualik Lake; PDL = Pipedream Lake.

Meadowbank: TPN, TPE, TPS = Third Portage Lake - North, East, South basins; SP = Second Portage Lake; WAL = Wally Lake; TE, TEFF = Tehek Lake (Mid-and Far-field).

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

Whale Tail Pit areas: WTS = Whale Tail Lake South Basin; MAM = Mammoth Lake; NEM = Nemo Lake; A20 = Lake A20; A76 = Lake A76; DS1 = Lake DS1.

Table 2-4. Adaptive Management Strategy for contaminants of potential concern (COPCs) in water from Whale Tail Lake (South Basin) and Mammoth Lake*.

Adaptive Management Level	Threshold (Total Phosphorus and Arsenic)	Management Strategy[1]
Level 0 (Normal operating condition)	Within 20% of FEIS predicted concentrations.	No changes - continue with CREMP monitoring plan.
Level 1 (Area of concern)	Concentrations equal to or greater than 20% FEIS predicted concentrations AND less than 80% of the WQG or SSWQO.	Continue with Level 0 management strategy. Analyze site wide water quantity and quality data to identify and assess cause(s) of the difference(s) and reported to the NWB. Report results of data review in annual reporting to the NWB including implications on the Water Management Plan and evaluation of potential mitigation strategies (e.g., enhance water treatment plant efficiency and reduce maximum effluent discharge concentration by 10%).
Level 2 (Area of concern)	Concentrations equal to or greater than 20% FEIS predicted concentrations AND between 80% and 100% of the WQG or SSWQO.	Continue with Level 1 management strategy. Report results of data review to the NWB in the Annual Report, including implications on the Water Management Plan and the evaluation of potential mitigation strategies (e.g., enhance water treatment plant efficiency and reduce maximum effluent discharge concentration by 20%). Move discharge location to MAM or WTS. Assess potential discharge in lakes D1 or D5 in case level 3 is reached, with approval from the NWB as per NIRB Project Certificate Conditions.
Level 3 (High risk situation)	Concentrations equal to or greater than 20% FEIS predicted concentrations AND between 100% and 120% of the WQG or SSWQO.	Continue Level 2 management strategy. Report results of data review in the Annual Report to the NWB including implications on the Water management plan and the evaluation of potential mitigation strategies (e.g., review overall water management strategy to stay within assimilative capacity of the receivers). Continue monitoring in the original receiving area to evaluate if they recover and define threshold to restart using them.
Level 4 (Emergency situation)	Concentrations equal to or greater than 20% FEIS predicted concentrations AND greater than 120% of the WQG or SSWQO.	Continue Level 3 management strategy. Report results of detailed data review in the Annual Report to the NWB, including implications on the Water management plan and the evaluation of potential mitigation strategies (e.g., move discharge location to an approved location). Continue monitoring in the original receiving area to evaluate if they recover and define thresholds to restart using them. Evaluate potential new discharge location to resume operation.

Notes:

* Agnico Eagle will consult with the NWB on the required approval process, execution, and implementation prior to initiating the adaptive management strategy items for Adaptive Management Levels 3 and 4.

[1] See Table 3 in the Adaptive Management Plan for more details on management strategies for each Adaptive Management Level (Agnico Eagle, 2021).

Acronyms

FEIS = Final environmental impact statement.

SSWQO = Site-specific water quality objective.

WQG = Water quality guideline.

3 QUALITY ASSURANCE / QUALITY CONTROL

3.1 Overview of CREMP QA/QC

The objective of quality assurance/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 operating procedures, by using laboratories that have been certified for all applicable methods, and by staffing the program with experienced technicians.

The framework of the QA/QC program is outlined in *CREMP Plan* (Azimuth, 2015b), which includes a description of the established SOPs. The plan update document is the foundation for assessing data quality for each routine component of the CREMP (e.g., water, sediment) and was adopted for the Whale Tail Pit baseline sampling program (Azimuth, 2018b). Detailed analysis of the data quality for each component of the CREMP is provided in **Appendix A**. A summary of the key messages from the 2021 QA/QC program is provided in the subsections below.

3.2 Sample Shipping and Handling

Sample shipping and handling concerns documented in previous CREMP reports have largely been rectified in recent years. ALS's QA/QC summary results from each laboratory report are integrated into **Appendix A**.

The sample shipping and handling QA/QC for 2021 was comparable to 2020. There were a few discrepancies between samples submitted and the COCs, but most were rectified without impacting the analytical results. The logistics, distances, and general challenges of collecting and shipping samples from a remote mine in Nunavut meant that hold times were exceeded for several parameters/analytes, but the impact on results is considered negligible. Logistic efficiencies, increased familiarity with the expanded CREMP program (i.e., including Whale Tail study area), and attention to detail are likely contributing factors to this improvement over the past few years.

In 2021, a batch of sediment samples were not analyzed due to an oversight by staff at ALS during sample receipt. In response to the error, ALS has implemented a number of corrective actions outlined in **Appendix A2**. As a result, the majority of the QAQC for sediment chemistry was not completed.

3.3 Water Chemistry

Briefly, the standard QA procedures for the water chemistry program include thoroughly flushing the flexible tubing and pump to prevent cross-contamination between areas. Field QC procedures include collection and/or analysis of field duplicates and blanks (travel, equipment, and deionized water blanks). The laboratory QC program includes duplicate analysis, blanks, and analysis of spike samples and reference material to verify the accuracy and precision of the analytical method.

The objectives and methods for surface water QA/QC are outlined in detail in **Appendix A**. The field and laboratory QA/QC results for water chemistry for 2021 were very good and were comparable to the results from the 2020 sample year:

1. Sample integrity was good in 2021. There were slightly more lost samples from breakage or mislabeling than in 2020, however this still represents a small proportion of total samples submitted in 2021. Sample temperatures received at the laboratory were variable depending on season and reflect the challenges with shipping from a remote mine site. Likewise, hold time exceedances for parameters and analytes with short hold times are unavoidable but are not considered likely to impact data analysis and interpretation.
2. Travel, DI, and EB blank results for 2021 were similar to 2020 and indicated reliable sample handling and that cross-contamination related to sampling equipment is unlikely. The DI blanks and travel blanks did not warrant flagging any parameters as unreliable in the 2021 analyses. Several analytes were detected in the May sample, but very few or none were detected in other months (see summary discussion next bullet).
3. The implication of possible cross-contamination on interpretation of the 2021 water quality data was evaluated by comparing the sample concentrations with the equipment blank results from the same event. Sample results were given a cautionary flag (shown in tables using underlining; e.g., <u>0.001</u>) when the measured concentration was less than 5-times the concentration detected in the equipment blank. Several analytes were occasionally given cautionary flags, including aluminum, copper, lead, manganese, and molybdenum. None of the results with cautionary flags exceeded the trigger. Sample results, including results with cautionary flags, are reported in **Appendix B1** (Meadowbank), **Appendix B2** (Whale Tail), and **Appendix B3** (Baker Lake).
4. It should be noted that isolated instances of trigger exceedances for individual water chemistry parameters do not necessarily indicate a trend or even real conditions. The QA/QC program provides an added layer of context to data interpretation by highlighting those variables for which the results may be influenced by laboratory cross-contamination and not mining activities. Overall, potential cross-contamination is considered unlikely to bias interpretation of the 2021 water quality analysis.
5. There were a few cases where planned method detection limits (MDL) were not met by the laboratory. Specifically, the MDL for total and dissolved chromium was adjusted by the laboratory in May from 0.0001 mg/L to 0.0005 mg/L and remained slightly elevated for the subsequent sampling events. The change in MDL for chromium may be due to matrix

interferences during sample analysis. All of the chromium results for which the MDLs were adjusted were less than MDL, except for a few samples, and none of the detected concentrations exceeded the trigger.

6. The 2021 field duplicate results were very good, with only 1% of the calculated RPDs not meeting DQOs.
7. Laboratory QC results for water chemistry were also very good in 2021, with very few laboratory data quality qualifiers and none that were deemed likely to impact data interpretation.
8. In 2021, an initial QC screening of the water chemistry results was conducted to verify whether data required additional verification. This QC screening consisted of two analyses. The first analysis compared the total and dissolved concentrations for a given parameter in each sample. Samples for which dissolved concentrations were greater than total concentrations and which had a relative percent difference (RPD) of more than 30% were flagged for review. The second analysis compared parameter concentrations of samples collected within a given area in each sampling event; parameters within a given area and sampling event that had concentrations that differed by more than a factor of 5 (or a factor of 10, if at least one of the samples was within a factor of 10 from the MDL) were flagged for review. All samples that were flagged for further validation are summarized by sampling event in **Appendix A**. A few of the 2021 water quality results were removed from the analysis due to data quality issues (i.e., "unreliable" flags). For transparency, the results are shown in the water quality tables provided in **Appendix B**.

Unless discussed as unreliable above, the water quality QA/QC assessment verified that data are reliable for analysis and interpretation of spatial and temporal trends.

3.4 Sediment Chemistry

The sediment chemistry QA/QC assessment is comprised of field and laboratory duplicates, filter swipes for cross-contamination, and the QC report from ALS for sediment grab samples submitted in 2021. Key results of the sediment chemistry QA/QC, presented in **Appendix A**, are as follows:

- A laboratory error led to a number of sediment samples to be thrown away before they were analyzed. In response to the error, ALS has implemented a number of corrective actions outlined in **Appendix A2**. As a result, the majority of the sediment QA/QC for sediment chemistry could not be completed.
- For the sediment QA/QC samples that were analyzed, there were no sample integrity concerns.
- Results for only one filter swipe were received in 2021. Several analytes were detected in the swipe. Zinc was detected at concentrations > 10X the swipe MDL, however, the potential percent contribution from the swipe was 0.01%. For all other detected analytes, the concentrations

corresponded to well below 0.01% of the concentrations present in the sediment grabs. This shows that the potential or cross-contamination to affect the sediment chemistry results is negligible.

- There were nine grab sample field duplicates collected in 2021, however only four of the duplicates were analyzed due to the laboratory error. Out of the samples analyzed, all DQOs were met. Overall, field duplicate results indicate good field collection methods and a high degree of replicability in sampling.
- The laboratory QC results show a high degree of precision for the laboratory analysis and laboratory processing and analytical methods were consistent between sub-samples. The only qualifiers assigned to the sediment grab chemistry results were for polycyclic aromatic hydrocarbon (PAH) detection limits in composite samples due to high moisture content, however these results are unlikely to impact data interpretation.

3.5 Phytoplankton Taxonomy

Field duplicates are collected for phytoplankton during each sampling event in coordination with water sample duplicates and are taken in order to assess sampling variability and sample homogeneity. An RPD of 50% for total density and total biomass concentrations is considered acceptable. As a measure of laboratory QA/QC on the enumeration method, replicate counts are performed on 10% of the samples. Replicate samples are chosen at random and processed at different times from the original analysis to reduce biases.

Detailed analysis of the phytoplankton data quality is included in **Appendix A**. Phytoplankton QA/QC for both field and laboratory components in 2021 was good, indicating reproducible results across both sampling and taxonomic analysis process.

Phytoplankton taxonomy results for 2021 met project DQOs and are considered reliable for data analysis and interpretation of spatial and temporal trends.

3.6 Benthos Taxonomy

Quality assurance measures in the field involved adherence to the standardized method for collecting, sieving, and preserving samples for taxonomic identification (see Appendix B in Azimuth, 2015b). While field duplicates are not collected, inferences regarding within-area variability are gained by directly looking at results across replicate samples (see **Section 4.6**, **Section 5.6** and **Section 6.6**). The laboratory (ZEAS) QA/QC procedures include re-sorting and re-counting 10% of the samples targeting a DQO of > 90% recovery. Details of the benthos taxonomy data quality assessment is included in **Appendix A**. Percent recovery was above 95% in all re-sorted samples, with an average percent recovery of approximately 96.2%.

The 2021 benthos taxonomy metrics met DQOs and are considered reliable for data analysis and interpretation of spatial and temporal trends.

4 MEADOWBANK

4.1 Overview of the Meadowbank CREMP

This section summarizes the CREMP results for monitoring water quality, sediment chemistry, phytoplankton community, and benthic invertebrate communities at Meadowbank in 2021. Relevant figures and tables are included at the end of the section.

The 2021 CREMP focused on monitoring changes in the NF study areas in Third Portage Lake (East Basin [TPE] and North Basin [TPN]), Second Portage Lake (SP) and Wally Lake (WAL). Reference area sampling at INUG and PDL was completed concurrently with sampling at the NF areas. Water quality at TE, TEFF, and TPS was monitored once during the early season sampling event in March, but deferred for the rest of the year based on results of the 2019 CREMP[17]. Water quality sampling locations for the 2021 CREMP are shown in **Figure 4-1**. The sediment and benthos sampling areas are shown in **Figure 4-2.**

4.2 Limnology

Limnology data, when compared to previous monitoring data, provide an initial assessment of whether conditions are changing within a sampling area and may require additional investigation. At least one depth profile was conducted monthly for temperature, dissolved oxygen, and conductivity from NF areas except when ice conditions were unsafe in June and October. Two profiles were completed along with water sampling for chemistry and phytoplankton taxonomy in March, May, July, August, and September. Limnology profiles, without paired water chemistry or phytoplankton sampling, were also collected in January, February, April, November, and December. The CREMP monitoring plan for routine CREMP sampling years is outlined in **Section 2.2**. Qualitative evaluation of the limnology data was completed using plots of the deepest sample within each lake for a given event. Limnology profiles were recorded monthly in 2021 except for June and October. Samples used for plotting and interpreting limnology data in 2021 are specified in **Table 4-1**.

[17] There were no trigger exceedances for parameters with effects-based thresholds at the NF areas in 2019. Consistent with the new monitoring strategy implemented in 2015, sediment chemistry or benthic invertebrate community sampling was not required at MF and FF areas in 2020.

Table 4-1. Samples included in the limnology profiles in 2021.

Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
INUG			INUG-128		INUG-130	Ice not safe for travel	INUG-132	INUG-134	INUG-136	Ice not safe for travel		
PDL			PDL-94		PDL-96		PDL-98	PDL-100	PDL-102			
TPN	☑	☑	TPN-141	☑	TPN-142		TPN-145	TPN-146	TPN-148		☑	☑
TPE	☑	☑	TPE-141	☑	TPE-142		TPE-144	TPE-147	TPE-149		☑	☑
SP	☑	☑	SP-141	☑	SP-142		SP-144	SP-147	SP-149		☑	☑
WAL	☑	☑	WAL-109	☑	WAL-111		WAL-113	WAL-115	WAL-117		☑	☑
TPS					TPS-65							
TE			TE-100									
TEFF			TEFF-52									

Notes:
Empty cells indicate no limnology profiles were collected, consistent with the study design.
☑ = One profile is collected from the near-field areas (and occasionally one mid-field area) in months where water sampling is not completed.
The sample IDs shown represent the deeper of the two locations sampled each month.

4.2.1 General Observations

The ice-free season on the Meadowbank study lakes is very short. Ice break-up usually occurs during mid- to late-June, and ice begins to form again 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 occurs 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 organic decomposition (processes that consume oxygen from the water). Historically, there is typically a slight negative thermal stratification in the winter with water temperatures of 0°C near the ice-water interface and increasing to 3°C to 5 °C at depth.

The maximum temperature measured during the open water sampling events in 2021 was 10.7 °C at WAL in early September. During open water conditions, maximum water temperatures may reach 15°C in summer with little evidence of thermal stratification, except for brief periods (days) when there is typically only a 4°C to 5°C temperature difference. High winds maintain uniform temperature and high oxygen profiles in the water column due to vertical mixing.

4.2.2 Temporal and Spatial Trends

Temperature and Dissolved Oxygen

Water temperatures in the Meadowbank project lakes in 2021 followed similar patterns of seasonal change compared to previous monitoring cycles. **Figure 4-3** shows water temperatures at a depth of 3 m for these lakes, since 2006.

Surface water temperatures in 2021 were similar to previous years (**Figure 4-4** through **Figure 4-13**). Winter temperature profiles for the through-ice sampling events show a slight negative thermal stratification with water temperatures near 0°C at the ice-water interface, typically increasing to between 2°C and 3.5°C at depth. Oxygen concentrations in winter generally decrease slightly with increasing depth, with occasional values measured above theoretical limits of air saturation[18] (14.6 mg/L at 0°C). Oxygen concentrations in all basins are greater than 5 mg/L, and usually greater than 10 mg/L at even the lowest depths, despite nearly nine months of ice cover.

The project lakes typically turn over by mid-July, leading to a well-mixed water column with uniform temperature and high oxygen concentrations. Water temperatures warm rapidly to reach maximum temperatures of around 15°C by late July and into August. Deeper lakes and basins, such as TPN and INUG, are typically 2°C to 3°C colder than the shallower locations, Wally Lake (WAL) and Second Portage Lake (SP). Temperatures in 2021 were typical of historical temperature patterns (**Figure 4-3**). There was no evidence of vertical stratification in 2019, 2020, or 2021 from July through September in any lakes. In November, the study lakes froze and became stratified, with surface waters near 0^{o}C and bottom waters ranging up to 2^{o}C at WAL. With vertical mixing, oxygen concentrations were high, and the water was fully saturated in November (**Figure 4-12**).

In general, temperature and oxygen concentrations in 2021 were consistent with previous years, and the seasonal patterns were typical of this Arctic area. There were no differences in these patterns between the control lakes (INUG and PDL) and the NF and MF monitoring areas.

Conductivity

Field conductivity[19] is an indicator of stratification in the water column and is an effective way of assessing changes in water quality that may be related to mining activities such as discharge of treated water and seeps, for example. From a monitoring perspective, uniform conductivity provides confidence that the water column is well-mixed and that a water sample collected a discrete depth is representative

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

[19] Throughout this report, any discussion of "conductivity" refers to specific conductance, which is conductivity normalized to 25°C.

of conditions from the surface to near the bottom of the lake. In contrast, variable conductivity in areas close to mining activity may indicate the presence of water with different chemical properties. Surface water sampling is done at 3 m below the surface, but conductivity profiles can help identify if additional samples should be collected at other depth intervals. Conductivity of oligotrophic systems with low concentrations of dissolved solids is typically less than 50 µS/cm and is typically uniform from top to bottom in any given month, with minor seasonal fluctuations. While the overall range in conductivity is similar between ice-on (10–50 µS/cm) and ice-off (10–40 µS/cm) months, the conductivities in ice-off months are generally lower, which is consistent with cryo-concentration during progressive ice formation in winter.

Field-measured conductivity was unstratified for most of the profiles taken in 2021. Minor fluctuations in conductivity were evident during some of the winter sampling events due to cryo-concentration (see profiles for January, February and December [**Figure 4-4**, **Figure 4-5** and **Figure 4-13**, respectively]). The January profile at TPE was the only sampling event where conductivity showed evidence of stratification. Conductivity was uniform measuring 30 µS/cm from surface to 8 m. Below 8 m, conductivity increased steadily to 60 µS/cm at 13 m near the bottom. The underlying cause of this change is not likely related to mining given that subsequent profiles in TPE in 2021 were unstratified and absolute conductivity readings in 2021 were comparable to previous years. Profile spikes in conductivity at TPE (at approximately 5m) for April and May appear to be related to shallow water instrument error (i.e., lower conductivity than usual for measurements at the top of the profile), as conductivities have generally deviated little from 40 µS/cm in previous years during these months.

Conductivity values at SP in 2021 were generally within the range of historical values dating back to 2009. Field collected conductivity at SP was typically between 20 µS/cm and 30 µS/cm prior to 2014. More recent results from 2014–2021 have trended towards 30 µS/cm to 40 µS/cm. The change in laboratory reported conductivity at SP was identified previously in the water chemistry BACI analysis (see **Section 4.3** and **Figure 4-15** for more details), but has not been linked to any adverse effects to the biological community.

Conductivity at WAL exhibited a similar pattern as previous years, with higher conductivity observed from January through March (~ 50 µS/cm) and April through May (~ 60 µS/cm), and then stabilizing for the rest of the year (July through December) at around 40 µS/cm. Baseline results for WAL during the open water period were between 30 and 40 µS/cm. As with SP, laboratory reported conductivity at WAL has been identified in the BACI analysis, but has not been linked to any adverse effects to the biological community (see **Section 4.3** and **Figure 4-15** for more details).

4.3 Water Chemistry

Tabulated water quality data for 2021 are presented in **Appendix B1**. Water chemistry samples were collected simultaneously with limnology samples in March, May, July, August, and September (see **Section 4.2** for limnology results).

4.3.1 General Observations

The general conditions affecting water quality in this region were described in **Section 4.2**. Key points are:

- The Meadowbank study lakes are generally nutrient-poor and well-mixed (uniform temperature and oxygen profiles), with no winter anoxia beneath ice cover.
- The Meadowbank study lakes are headwater lakes with no significant natural sources of nutrients or sediment except from local runoff that contributes little nutrient enrichment, but sustains the aquatic ecosystems. Many chemicals in the water have typically been below laboratory detection limits (MDLs) since formal baseline monitoring started in 2006[20].

4.3.2 Temporal and Spatial Trends

Annual mean concentrations for each parameter were compared to triggers and thresholds according to the approach outlined in **Section 2.3.1**. If the annual mean concentration for a given parameter exceeds the trigger, BACI statistical comparisons to baseline conditions and reference location INUG were conducted. Given the number of parameters routinely below laboratory MDLs, a conservative three-step assessment process was used to identify parameters to include in the formal trend assessment to streamline the interpretation of the results. Details of the three-step assessment process are provided in **Section 2.3.1** and the results are summarized in **Table 4-2**. This approach is summarized as follows:

- **Overall Detection Frequency** – Only those water quality parameters that exceeded MDLs in at least 10% of the samples were retained for discussion.
- **Control-Impact Detection Frequency Comparison** – Parameters with <10% detection frequency (i.e., those screened out in the first step) for which the proportion of detected values increased by 0.1 or more were added back into the trend assessment.
- **Apparent Detection Pattern Matching Mining Activity** – Trend plots for infrequently detected parameters were used to visually identify parameters with measured values associated with periods/locations of known mining activities.

[20] 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.

Mean annual concentrations that exceeded trigger values were then compared to the Final Environmental Impact Statement (FEIS) water quality model predictions for Third Portage Lake, Second Portage Lake, and Wally Lake to highlight any deviations from predicted changes in water quality.

Water chemistry parameters that were retained for discussion are listed in **Table 4-2**. Monitoring results showing spatial (all NF, MF, FF, and REF areas) and temporal (all monitoring years) trends for surface water (samples collected from a depth of 3 meters) for retained parameters are shown in **Figure 4-15** to **Figure 4-57**. The red dashed line is the trigger value specific to the parameter and area. Blue dashed lines have been added for TPN, TPE, SP, and WAL (where appropriate) for parameters that have FEIS model predictions (see **Section 2.3.1**). Parameters with no clear spatial or temporal trends related to mining activities or natural variability were excluded from further consideration (see **Table 4-2**); for completeness and transparency, plots for these parameters are included in **Appendix B1**.

Each parameter/area that exceeded the trigger in 2021 was assessed in the BACI model (one-tailed; looking for uni-directional changes [i.e., increases]). In this analysis, the model interaction term (or BACI effect term) represents the change at the test area in 2021 (*after* period) relative to baseline (*before* period) after accounting for natural temporal changes (i.e., temporal changes at the reference area that account for regional factors expected to influence all the lakes). For simplicity, changes are noted *relative to baseline/reference* conditions whereas the BACI analysis statistics and p-value evaluate significance in the context of the observed natural temporal changes.

Parameters for which the 2021 yearly mean exceeded the trigger values in NF areas are shown in **Table 4-3**. For 2021, parameter/area trigger exceedances were similar to 2020 and included measures and indicators of conductivity, hardness, alkalinity, major ions, silicon, and reactive silica. Dissolved zinc, which exceeded its trigger in 2020, did not in 2021. The results of BACI analyses for exceeding parameter/area combinations are provided in **Table 4-4**. Note that it was not possible to complete a BACI analysis on silicon due to a lack of *control* data. BACI analysis results for 2021 were largely the same as last year, with statistically-significant increases relative to baseline/reference conditions ($p < 0.05$) in conductivity, major ions, and other non-threshold parameters for all NF lakes.

A literature review was completed in 2019 focusing on toxicity studies for major ions and other parameters that have routinely exceeded the 95th percentile of baseline concentrations during the operations phase. That summary report was prepared as a technical appendix in the 2020 CREMP report (Azimuth, 2021). Water chemistry results for parameters that exceeded their respective trigger values are discussed in the sections that follow.

Laboratory Conductivity and Hardness

Conductivity is a composite variable that increases in response to higher concentrations of ionic compounds such as chlorides, sulphates, carbonates, sodium, magnesium, calcium, potassium and metallic ions. Compared to more recent CREMP cycles in 2019 and 2020, conductivity and hardness at TPE, SP, and WAL in 2021 showed a slight reduction, dropping from 34 to 32, 45 to 39, and 47 to 44 µS/cm, respectively. At TPN, these parameters appear to be stable which is consistent with results from previous years and expected, given that discharge to TPN stopped in 2014. In 2021, conductivity and hardness were elevated at TPN, TPE, SP, and WAL relative to baseline/reference conditions (**Figure 4-15** and **Figure 4-16**).

Total Dissolved Solids (TDS)

Concentrations of total dissolved solids were elevated at TPN, TPE, SP, and WAL in 2021 relative to baseline/reference conditions but have been stable for the past several years (see **Figure 4-58** to **Figure 4-60**). The maximum reported concentration in 2021 was 51 mg/L at WAL in May, consistent with the concentration reported in the previous two years. 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 reported the average TDS in the world's rivers was approximately 120 mg/L. There are no federal water quality guidelines for TDS in Canada. In Alaska, TDS may not exceed 500 mg/L without a special permit and 1,000 mg/L at any time (ADEC, 2012). A site-specific TDS aquatic receiving environment benchmark of 500 mg/L was adopted at Diavik (WLWB, 2013). The changes measured at TPE, SP, and WAL with TDS concentrations in the order of 15 to 51 mg/L are, therefore, very low and unlikely to pose risks to aquatic receptors.

Alkalinity

The 2021 concentrations of bicarbonate and total alkalinity were elevated in TPN, TPE, and SP relative to baseline/reference conditions. Bicarbonate (HCO_3-) comprised 100% of the total alkalinity fraction, typical of surface water with pH in the range of 6.5 to 9. The trigger value for both bicarbonate and total alkalinity is 8.7 mg/L. Bicarbonate alkalinity at SP has consistently exceeded the trigger since 2011 and in 2021 the mean concentration at SP was 11 mg/L (as $CaCO_3$), slightly below the 2016–2020 range of 11 to 13 mg/L. No other areas exceeded triggers for mean bicarbonate concentrations.

From a potential-effects perspective, alkalinity measures the buffering capacity of water (i.e., how much acid can be added without changing pH) and low values are typically of concern for aquatic life. For example, the working water quality guidelines for British Columbia (BC MOE, 2017) have three categories of sensitivity to acid inputs based on alkalinity: highly sensitive (<10 mg/L), moderately sensitive (10 to 20 mg/L) and low sensitivity (>20 mg/L). Consequently, the temporal trend of slightly increasing alkalinity relative to baseline/reference conditions is unlikely to adversely affect biota at TPE or SP and would decrease their potential sensitivity of TPE and SP to acidic inputs (e.g., low pH snow melt and rain).

Ionic Compounds (Calcium, Magnesium, Potassium, Sodium)

TPN, TPE, SP, and WAL had elevated concentrations of one or more of these major ions relative to baseline/reference conditions. Mean concentrations of calcium and magnesium in 2021 were similar to those from 2019 and 2020 at TPN, TPE, and WAL. Since 2019, mean concentrations of calcium and magnesium at SP have decreased slightly (4.5 to 3.9, 1.5 to 1.3 mg/L respectively) similar to conductivity and alkalinity trends noted above. In 2021, the mean concentration of potassium at TPE (0.59 mg/L) marginally exceeded the trigger value of 0.58 mg/L. At the NF areas TPN, TPE and SP, mean 2021 concentrations ranged from 2.6 to 5.0 mg/L for calcium, and from 0.99 to 1.5 mg/L for magnesium.

Slight increases of these cations above triggers in the Meadowbank study lakes for the *after* period are unlikely to adversely affect biota. These major cations are essential elements, and all species of aquatic life, from algae to fish, have evolved to actively regulate their osmotic, ionic, and acid-base balance by taking up ions from their surrounding environment (Martemyanov and Mavrin, 2012). Furthermore, adverse effects on primary producers and secondary consumers (e.g., zooplankton) are more commonly associated with deficiency rather than enrichment of major cations in oligotrophic freshwater lake environments (Alstad, et al., 1999). Calcium deficient waters are defined for some species of algae at concentrations <10 mg Ca/L (Wetzel, 1983) and effects on zooplankton communities are more common in freshwater lakes that are calcium-depleted as a result of acidification and logging (Arnott et al., 2017).

Total and Dissolved Metals

Silicon – In 2019, an early warning trigger was derived for the Meadowbank area lakes for this *non-threshold* parameter. The trigger was exceeded for total silicon at SP in 2019, 2020, and again in 2021 with mean concentrations increasing from 0.21 to 0.27 and then to 0.31 mg/L respectively. Since collection started in 2011, SP has always had relatively high concentrations of silicon relative to the trigger. The lack of *control* data means that statistical BACI analysis cannot be completed. Though silicon has demonstrated an increasing trend at SP over the past two years, there is no evidence of temporal trends to have occurred during the active mining phase (2009–2013) to 2018 (**Figure 4-44** and **Figure 4-54**). Silicon increases could relate to indirect mine influences (e.g., road dust) since the Meadowbank site remains active as a tailing storage facility. This parameter will be monitored closely in 2022.

Zinc – CCME (2018) released an updated long-term freshwater aquatic life water quality guideline (WQG) for dissolved zinc which is calculated based on hardness, pH, and DOC. In 2019, the threshold and trigger for dissolved zinc were updated considering this new WQG, resulting in a decrease of the threshold value to 0.0025 mg/L and of the trigger value from 0.0053 mg/L (see Appendix D in Azimuth, 2015b) to 0.0018 mg/L (see Appendix I in Azimuth, 2020a). It is important to note that this new trigger is uncertain and perhaps overly conservative because the hardness levels used to calculate the WQG for trigger development are often much lower than the data range used to develop the long-term WQG (CCME, 2018).

In 2020 there were a number of unusual sample exceedances of the trigger in TPN, TPE, and SP which appeared to be outliers. Yearly means for dissolved zinc exceeded the trigger in each of these NF areas in 2020 (**Figure 4-57**). In 2021, no mean annual dissolved zinc concentrations exceeded triggers and the sole discrete sample exceeding trigger concentrations (0.0026 mg/L at SP in March) occurred during a similar small magnitude exceedance at reference area INUG (0.0023 mg/L in March).

Other metals – Concentrations of other metals (total and dissolved) were consistently low or below their respective MDLs at the NF, MF, and FF locations in 2021 (**Appendix B1**). None of these parameters have exceeded trigger or threshold values in the formal BACI analysis. In 2021, the same metals were measured above laboratory detection limits (MDLs) as in previous years. This is important to note in relation to ongoing discharge from dike seepage from the East Dike to Second Portage Lake.

Reactive Silica

The first trigger exceedance for reactive silica occurred in 2020 at WAL. A similar result was seen in 2021 (**Figure 4-28**). Given that the mean concentration of reactive silica at WAL (1.15 mg/L) was only slightly over the trigger value (1.08 mg/L) and that the exceedance occurred in an NF area that was not exposed to any mining activity since 2020, it is unlikely mine-related and will continue to be monitored. The maximum reported concentration in 2021 was 1.8 mg/L at WAL in May.

Long-term Trend Analysis

A more detailed assessment of temporal changes for key physical/ionic parameters in NF areas was completed in 2021 using a mixed-effects model approach. The analysis focused on conductivity, hardness, calcium, magnesium, total alkalinity, and TDS because they have consistently exceeded triggers and/or FEIS predictions. The BACI analysis is designed to test for changes in parameters for a particular year relative to baseline/reference conditions; it is not designed to test for longer-term trends in key parameters over time. The mixed-effects trend analysis was developed in 2021 to provide a statistically supported understanding of long-term trends in key water chemistry parameters.

Three mixed-effects models were tested with different structures for depicting changes at NF areas TPN, TPE, and SP relative to reference lake INUG. NF area WAL was not assessed since it was only designated as *impact* in 2012, and therefore only had limited timeseries data available as an *impact* area. The assessment included the following three models:

- Trend – this model assumed a simple linear trend across all years with a fixed effect term of *Area x Trend*. A constant linear increase in observed parameter concentrations would represent a best fit scenario for this model.

- Year – this model assumed that every year from 2009 to 2021 resulted in a unique trend. This model assumes that annual differences have varied across years in a manner inconsistent with a simple linear trend. This model was the most complex with the largest number of parameters with a fixed effect term of *Area x Year*.
- Stable – this hybrid model was analogous to the *Year* model for the operations period (2009 to 2013), but included a single categorical variable to represent the period from 2014 to 2021. Thus, this model allowed for an increasing, but variable, trend during operations to a peak that was then followed by a stabilization of conditions after operations.

In all three models, four random-effects terms were included to capture variation by:

- Fixed month – mean seasonal patterns common to both areas across years,
- Area by fixed month – potentially unique mean seasonal patterns for each area,
- Year-month combinations – mean differences specific to a given month in a given year, and
- Area-year-month combinations – mean differences specific to a given month in a given year for a given area.

In the case of the *Trend* model, two additional random-effects terms were included. These were intended to capture year-specific differences in mean about the linear trends that were either common to both areas or unique to a given area. All models were fit to log-transformed data using maximum likelihood to allow for comparisons between the three model types. Comparisons were made between models using the Akaike Information Criterion (AIC), a numerical score that can be used to determine which of the three models provides the best fit to the data. Specifically, the AICc was used, which is the AIC corrected for small samples sizes (Burnham and Anderson, 2002). In these comparisons, the effective samples size was set equal to two times the number of paired months of data available for the reference area INUG and each respective impact area.

Temporal trends in key physical/ionic parameters since 2009 at the three NF exposure areas (TPN, TPE, SP) are shown in **Figure 4-58** to **Figure 4-60**. Trends are depicted as proportional effect sizes relative to control (differences relative to INUG). Positive effect sizes indicate an increase for a particular parameter at a given area. An overall pattern of increase from 2009 to 2013 followed by stabilization from 2014 to 2021 can be observed for many parameters, particularly at areas TPN and TPE. Note that TDS tended to hold higher levels of uncertainty because many of the values at INUG and the NF areas during the "before" period (2006–2008) were below laboratory detection limits (MDL < 10 mg/L).

The results from the three mixed-effects models are provided in **Table 4-7**. The *Stable* model was generally the best-performing model as indicated by the lowest AICc in most cases, followed by the *Year* and *Trend* models. The relatively poor performance of the *Trend* model indicates that across NF areas there was less evidence of a simple increasing trend in concentrations across years compared to INUG. The *Stable* model was the best performing model at all areas for all parameters except total alkalinity at TPN where the *Trend* model was slightly preferred. At SP, year-to-year differences were more variable between 2014–2021, peaking in most cases in 2018 before declining somewhat in the past three years (**Figure 4-60**). Nevertheless, the *Stable* model was preferred for all parameters at SP. This strongly suggests that concentrations of conductivity, hardness, calcium, magnesium, total alkalinity, and TDS have been fairly stable since 2014.

4.3.3 Comparison to FEIS Model Predictions

The CREMP continues to detect changes in some general water quality parameters related to mining activity. These changes are also reflected in higher concentrations of some parameters when compared to the model predictions in the FEIS (Cumberland, 2005). The FEIS water quality predictions are estimates of water quality changes in Third Portage Lake, Second Portage Lake, and Wally Lake, assuming different mixing scenarios and loading estimates from water releases and dike leaching:

- **Third Portage Lake** – the model for Third Portage Lake includes treated water released from the project in years 1 to 4 and long-term loading of metals from the Bay-Goose dike material. Two mixing scenarios (upper range [169 Mm^3] and mid-range [92 Mm^3] mixing) are evaluated for Third Portage Lake with and without dike leaching.
- **Second Portage Lake** – The Second Portage Lake water quality model includes loading of parameters from the Third Portage and East dikes and inflow from Third Portage and Wally lakes. Changes in water quality in Second Portage Lake were modelled for the two different mixing scenarios for water released into Third Portage Lake listed above.
- **Wally Lake** – The water quality model for Wally incorporates long-term loadings from the Vault dike and effluent releases from the Vault Attenuation Pond.

As discussed in the 2019 report, the assessment of Meadowbank water chemistry results against FEIS predictions now only includes comparison to mean concentrations. The full screening results are for Third Portage Lake, Second Portage Lake, and Wally Lake and are summarized in **Appendix B1**. For perspective, the screening results against mean concentrations are provided in **Table 4-6**.

Overall, the same list of parameters that exceed the Meadowbank trigger values typically exceed the concentrations predicted in the FEIS, namely hardness, total alkalinity, and ionic compounds (calcium and magnesium (**Appendix B1**). Concentrations for most metals are below the predictions for Third Portage Lake, Second Portage Lake, and Wally Lake, except for total silicon at SP. Constituents such as silicon that were not reported in the 2003 baseline dataset were assumed to be zero (V. Bertrand, pers comm, March 30, 2020). The full suite of analytes currently included in the CREMP water quality analysis weren't available in the early stages of the program, hence, the absence of concentration data for silicon during the baseline phase. As a result, the predicted silicon concentrations are an underestimate of the actual baseline concentrations. Silicon is therefore not suitable for evaluating the accuracy of the FEIS predictions (see Azimuth, 2020a).

At the time the FEIS was issued in 2005, the freshwater aquatic life guideline for cadmium was lower than the MDL for the baseline data. A thorough review of the ecological significance of the predicted cadmium concentrations was presented in the FEIS, and the probability of cadmium causing toxicity was considered *extremely low* (Cumberland, 2005). Arsenic was also predicted to exceed the freshwater aquatic life guideline in Wally Lake (0.006 mg/L in the FEIS). Similar to cadmium, the MDL for arsenic was equal to the guideline (i.e., 0.005 mg/L) in 2005. The models were considered conservative because the MDLs were used as the baseline concentrations. The MDLs for arsenic and cadmium in the 2021 data are 0.0001 mg/L and 0.000005 mg/L, respectively. All the samples collected in 2021 from Third Portage, Second Portage, and Wally Lakes were below the MDL for cadmium, as they were in 2020 (**Appendix B1**). In the case of arsenic, the concentrations are below the trigger values for Meadowbank project lakes and WAL, and more than an order of magnitude lower than the CCME water quality guideline of 0.005 mg/L in all samples. Overall, the FEIS predicted the magnitude of potential effect on water quality in each of the lakes as *low* (see **Section 2.3.1** for more details on the decision criteria for effect magnitude). It is important to note that none of the parameters that exceeded trigger values or FEIS model predictions in 2021 had trigger values set in the context of effects-based threshold values (e.g., CCME water quality guidelines). Thus, CREMP water quality results are consistent with the *low* significance (i.e., <1x CCME WQG) rating applied to model predictions in the FEIS (Cumberland, 2005).

4.3.4 Summary and Implications

Water quality results from 2021 were evaluated according to the decision criteria outlined in **Section 2.2.3** to determine the effort level and sampling frequency required at the MF and FF areas in 2022. The assessment strategy interprets the water quality assessment results from the NF areas in the current year (in this case 2021) to inform sampling at MF and FF areas the following year (i.e., 2022) (**Figure 4-14**).

Trigger screening results for the Meadowbank study areas are presented in **Table 4-5** according to the degree of change interpretation framework:

- no trigger exceedance,
- minor changes = trigger exceeded for parameters without effects-based thresholds,
- moderate changes = trigger exceeded for parameters with effects-based thresholds, or
- major changes = exceedance of the threshold.

The outcome of the assessment for sampling at NF, MF, and FF areas in 2021 is summarized below.

Reference Areas (INUG, PDL)

- Trigger exceedances were documented for total silicon at INUG and for hardness and calcium at PDL. INUG and PDL are reference areas located beyond the influence of activities at the Mine related influence.
- The sampling strategy for 2022 is to complete a full CREMP program for reference areas.

Near-field (TPE, TPN, SP, and WAL)

- Trigger exceedances were documented for parameters without effects-based thresholds (i.e., conductivity, hardness, TDS, alkalinity, and cations).
- The mean reactive silica concentration exceeded the trigger in WAL.
- The mean total and dissolved silicon concentrations exceeded the trigger in SP.
- The full program will be completed at the NF locations in 2022.

Mid-field and Far-field (TE, TPS, and TEFF)

- One through-ice sampling event was conducted at MF and FF areas TE and TEFF in March 2021. Through-ice sampling at MF area TPS was planned for March, but due to malfunctioning equipment the sampling event occurred in May 2021.
- Some parameters without effects-based thresholds (i.e., conductivity, hardness, TDS, alkalinity, and cations) exceeded trigger values at TPS, TE, and TEFF.
- The mean concentration of fluoride exceeded the trigger at TE and TEFF.
- Metals concentrations in all samples were below their respective trigger values in 2021 except for total and dissolved silicon at TE and TEFF.
- Any potential exceedance of trigger values observed at the MF and FF areas are a snapshot of potential conditions at that moment. Samples collected in March and May confirm that concentrations are relatively stable at the MF and FF areas compared to previous years.
- Additional sampling during the open water period in 2021 was deemed unnecessary. Formal BACI analysis of the results was not completed, given the new sampling and analysis framework.
- Given there were no trigger exceedances for parameters with effects-based thresholds at the NF areas in 2021, a minimum of one (but ideally two) through-ice sampling events at the MF and FF areas are recommended in 2022 to verify there are no exceedances of effects-based thresholds. No other sampling (e.g., sediment chemistry or benthic invertebrate community) is required at MF and FF areas in 2022.

4.4 Phytoplankton Community

4.4.1 General Observations

The diversity in types and sizes of phytoplankton in the study lakes is large and their abundance is great. In summer, abundance typically exceeds 1 million individuals per liter with a total biomass of approximately 200 mg/m^3. Six major taxonomic groups of phytoplankton are present in the study lakes, namely blue-green algae (Cyanophyta), green algae (Chlorophyta), golden-brown algae (Chrysophyta), Diatoms, Cryptophytes and Dinoflagellates.

Chrysophytes (golden-brown algae) are small, usually unicellular phytoplankton that are consistently the most abundant taxonomic group in the Meadowbank area lakes. Chrysophytes also dominate phytoplankton biomass in all project lakes, typically representing 65% or more of total phytoplankton biomass in summer samples, with smaller proportions (usually <10% each) from 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 are *Oocystis* for chlorophytes, *Planktolyngbya* for cyanophytes, *Cyclotella* for diatoms, *Rhodomonas* and *Cryptomonas* for cryptophytes, and *Gymnodinium* and *Peridinium* for dinoflagellates (Azimuth, 2012a, 2011b, 2010a, 2009c, 2008a, and 2008b).

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

4.4.2 Temporal and Spatial Trend Interpretation

The approach for identifying potential mine-related impacts involved visually searching for temporal-spatial patterns that might be associated with mine-related activities (see **Table 1-1** for details), augmented by statistical analyses of 2021 data to test for changes relative to baseline/reference conditions using the BACI model (see **Section 2.3.3** for details). Both methods look for evidence of temporal-spatial patterns that might be associated with the mine-related activities.

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

Expected response patterns in phytoplankton biomass and species richness are 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, introducing other substances, such as nitrogen associated with blasting by-products, could increase primary production. We therefore look for both reductions and increases (i.e., two-tailed statistical tests) in phytoplankton-related metrics coinciding with mining activities (i.e., focusing primarily on data for SP, TPE, TPN, and WAL).

An important consideration when working with phytoplankton data is the naturally high 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 signals are quite large.

Density and biomass results for phytoplankton samples collected from the Meadowbank study lakes are provided in **Appendix D1**. The 2012 CREMP (Azimuth, 2013) provided a detailed description of historical trends in phytoplankton-related metrics. The current report emphasizes results for 2021, but retains the historical context by showing the results of all monitoring years. Trend data for chlorophyll-a, total biomass, major taxa composition, and species richness are presented from **Figure 4-61** to **Figure 4-65**. Plots for all other phytoplankton metrics are presented in **Appendix D1**. The BACI statistical test results of changes in the phytoplankton community in 2021 compared to baseline/reference conditions are provided in **Table 4-8**; key results are described below.

Key Results for the 2021 BACI Model Statistical Tests

Chlorophyll-a

Concentrations in the reference area samples typically ranged between 0.3 and 0.94 µg/L in summer months, reflecting the oligotrophic, nutrient poor condition of these lakes. Temporal patterns at the reference areas INUG and PDL have been fairly consistent, with some inter-annual variability but no apparent trends. This suggests a lack of regional changes in this metric.

Chlorophyll-a concentrations at the NF exposure areas TPN, TPE, SP, and WAL show no evidence of abnormal seasonal or longer-term temporal trend (**Figure 4-61**) and generally remain less than 1 µg/L, which is consistent with oligotrophic conditions (Kasprzak et al. 2008). The 2021 results are consistent with this conclusion.

Total Biomass

The total phytoplankton biomass results for 2021 were very similar to 2017–2020. Biomass results followed the same seasonal trends, with higher biomass reported in the summer months (July to September) compared to early spring. Winter under-ice biomass has been naturally very low at most locations in all the years it has been measured, and, generally, the same pattern was noted in 2021.

- For reference lakes, summer biomass estimates at INUG in 2021 ranged from 118 to 188 mg/m^3, which was within the range observed historically. The peak biomass at PDL was 236 mg/m^3 in August, which was similar to 2020. Overall, these results point to the expected seasonal variability and are consistent with the range observed in previous years for the reference areas (**Figure 4-62**).
- Peak total biomass in 2021 for NF areas TPE, TPN, and WAL ranged slightly higher than in 2020. For all NF areas, total biomass was largely within the range observed historically.
- BACI analysis demonstrated apparent increases ranging from 4% to 47% at the NF areas in 2021 relative to reference area INUG. There was a 47% increase at TPN which exceeded the trigger (> 20% effect size) and was statistically significant (p-value=0.02; **Table 4-8**). However, as in previous years where similar results were observed, the apparent increase in 2021 is likely due to natural variability as biomass at the NF areas, including TPN, is consistent with historical results.

Major Taxa Composition

Chrysophytes tend to dominate in the study lakes in all open-water months, a pattern that has been consistent since monitoring began in 2006 (**Figure 4-63**). The continued dominance of chrysophytes provides an additional line of evidence suggesting any *potential* incremental increase in nutrients or changes in water quality has not resulted in major structural changes to the community. Among the major taxa, chlorophytes are typically the first to response to nutrient enrichment in freshwater systems (Holmgren, 1984). The direct positive effect of nutrient enrichment on chlorophytes has been shown to have an indirect negative effect on chrysophytes, which compete with chlorophytes for nutrients (Klug and Cottingham, 2001). In the same study by Klug and Cottingham, chrysophytes were among the dominant taxa prior to artificial fertilization of the study lakes. These observations from the primary literature substantiate findings from the CREMP that the structure of the phytoplankton community is consistent with pre-development oligotrophic conditions (**Figure 4-64**).

Taxa Richness

Seasonal profiles for all areas were as expected, with a general increase from low richness in under-ice months to peak richness of approximately 30 to 40 taxa during the open water season (**Appendix D1**). The seasonal pattern of taxa richness at the exposure areas was similar to the reference areas and consistent with previous years (**Figure 4-65**). There was a statistically significant increase (26%; p=0.011) in taxa richness at TPN in 2021 relative to baseline/reference conditions and the effect size was above the 20% trigger level (**Table 4-8**). Similarly, there was significantly higher richness observed in TPN in 2018 and 2020.

4.4.3 Summary and Implications

The seasonal trends in phytoplankton community taxa biomass and taxa richness data from 2021 are generally similar to previous years and largely appear within the range of historical baseline/reference conditions. For most areas, chlorophyll-a concentrations peaked in May and September and total biomass and richness peaked in the summer months.

Total biomass and total richness results for 2021 for NF areas showed apparent increases at TPN relative to INUG, but the TPN results were within the historical range for both metrics. It is difficult to determine in a single year whether these changes are related to mining but when compared to the trends observed over the years, and given the lack of mining-related activities occurring in 2021, natural variability is considered to be the most likely driver. Notwithstanding, this trend will continue to be watched closely in 2022 to verify whether future patterns are consistent with this conclusion or whether they provide stronger evidence of mine-related causality.

4.5 Sediment Chemistry

In 2021, a batch of sediment samples were not analyzed due to a sample receipt error by the laboratory. As such, we did not receive the results for sediment collected at most Meadowbank study areas. For more information see **Appendix A**.

4.5.1 General Observations

Natural sedimentation rates in the Meadowbank study lakes are considered low, due to the headwater nature of the watersheds and the lack of any substantial riverine or tributary inflow. Thus, very little sediment is carried into the lakes other than what erodes off the nearby tundra during spring run-off or heavy rain events, or from dust deposition. The only site discharge in 2021 was from East Dike seepage into Second Portage Lake (**Table 1-1**).

Based on historical bulk sampling of sediment using grab samples, we have observed reasonably large, within-basin or within-lake differences in surface sediment (i.e., top 3–5 cm) concentrations for various metals, indicating natural spatial heterogeneity driven by localized mineralization. Several processes 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. Metals concentrations are highly dependent on grain size, with coarse grain size (i.e., sandier) typically correlating with lower metals concentrations. Therefore, our sediment programs target low energy, depositional areas that are dominated by silt/clay sediment in areas of similar water depth (6–10 m), where grain size tends to be finer and more consistent.

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

- **2008** – Baseline coring was conducted in July 2008 prior to onset of East Dike construction to characterize baseline surface metals concentrations at all monitoring areas.
- **2009** – The 2009 coring program was implemented to monitor potential changes to surface sediment chemistry that may have occurred as a result of the East Dike sedimentation event in August 2008. The 2009 study was conducted only at SP, TE, TPE, and INUG. TPE and INUG were used as the reference areas for SP and TE.
- **2010 to 2013** – The 2010 to 2013 sediment grab sampling programs covered all NF, MF, and FF Meadowbank study lakes as well as the reference areas INUG and PDL. Sediment coring was completed as part of the 2012 program.
- **2014** – The 2014 program was advanced a year ahead to align with EEM program. It covered all Meadowbank study lakes, sampling areas, and reference areas. Additional sampling was completed at TPE in 2014 to help assess whether the apparent changes in sediment chromium concentrations were related to spatially biased sampling or were a real temporal trend. Two zones in TPE were targeted for coring: the zone sampled initially in 2008 and 2009 (prior to dike construction; TPE-B) and the zone sampled in 2010 (TPE). Results from this analysis helped inform the design of the targeted chromium bioavailability study conducted at TPE in 2015.
- **2015** – The routine 2015 sediment sampling program was limited to the NF study lakes in accordance with the new approach outlined in the *CREMP Plan* (Azimuth, 2015b). In addition to routine sampling, a targeted bioavailability and toxicity testing program was completed on TPE sediments to help determine whether the apparent increase in chromium concentrations adversely affects the benthic invertebrate community. Sediment grab samples were collected from two zones in TPE and from the reference areas. Samples were analyzed for total metals and other conventional parameters, as per the routine CREMP program, and sequential

extraction testing was performed to determine the bioavailability of sediment chromium. Bulk sediment was sent to a toxicity testing laboratory where two tests were run using *Chironomus dilutus* and *Hyalella azteca.*

- **2016** – Sediment sampling in 2016 was limited to grab sampling at the Meadowbank study lakes.
- **2017** – Sediment grab and core sampling was completed at all Meadowbank project lakes. Samples were spaced throughout each basin. Grabs for chemistry and benthic invertebrates were collected at the same location. Core samples were opportunistically collected from some of the grab sampling locations. The remaining replicates were spaced throughout the basin in areas with the targeted depth and substrate composition.
- **2018** – Sediment grab sampling at the Meadowbank study lakes was conducted concurrently with the benthic invertebrate community sampling locations. Targeted studies were conducted at TPE and WAL to follow up on recommendations in the 2017 CREMP (Azimuth, 2018c). The 2017 CREMP study found that chromium concentrations in the sediments at TPE and the arsenic concentrations at WAL appeared elevated compared to pre-development baseline concentrations. Sediment coring (10 replicates per location[21]) was conducted to verify the 2017 results, and toxicity testing was conducted following the method used in 2018.
- **2019** – Sediment grab sampling was completed at the Meadowbank study lakes concurrently with benthic invertebrate community sampling. The targeted bioavailability study completed in 2018 indicated lower mean chromium concentrations at TPE than were observed in 2017 but appeared to confirm that concentrations were higher than before-impact concentrations. Another year of coring was completed at TPE to provide three consecutive years of chemistry data to evaluate temporal changes in sediment chromium concentrations. Sediment coring at WAL in 2018 confirmed there are no temporal changes in sediment metals at WAL attributable to activities at the mine; no follow-up was completed in 2019.
- **2020** – Sediment grab and core sampling was completed at the NF and reference areas only. Samples were spaced throughout each basin. Grabs for chemistry and benthic invertebrates were collected at the same location. Core samples were opportunistically collected from some of the grab sampling locations. The remaining replicates were spaced throughout the basin in areas with the targeted depth and substrate composition. Targeted studies focusing on chromium in sediment at TPE were completed in 2019 and concluded that, while concentrations of chromium have increased relative to the baseline period and are most likely mining-related,

[21] A "replicate" is a discrete core sample following the standard operating procedure (SOP) in Azimuth 2015b.

current concentrations of chromium in sediment and porewater do not pose risks to the benthos at TPE.

- **2021** – Sediment grab sampling was completed at the NF and reference areas only. Samples were spaced throughout each basin. Grabs for chemistry and benthic invertebrates were collected at the same location. In 2021, due to a laboratory error, some of the sediment samples were discarded prior finalizing the request for analysis. As such, only one batch of sediment samples was analyzed which included the NF areas at Meadowbank (SP, TPE, and TPN [only grain size]). Samples from reference areas INUG and PDL, and from NF area WAL were accidentally discarded by the laboratory prior to analysis (See **Appendix A** and **Appendix A2** for details).

4.5.2 Temporal and Spatial Trend Interpretation

Tabulated 2021 sediment chemistry results for the grab samples are presented in **Appendix C1**. Sediment grain size is plotted in **Figure 4-66** and concentrations of individual metals have been plotted in **Figure 4-67** to **Figure 4-74**. Metals concentrations are shown by area/basin for the different sampling methods (grab [data points] vs core samples [box and whisker plots]). The red dashed line in each of sediment metals figure is the trigger value specific to the parameter and area (i.e., Meadowbank lakes and Wally Lake each have their own trigger values as of 2017). The box and whisker plots illustrate the statistical distribution of core samples within each area. Data interpretation for the box and whisker plots is as follows:

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

2021 Sediment Grab Chemistry Results

Grab samples for sediment chemistry were collected with benthos community samples at all Meadowbank areas. Due to the laboratory error, only sediment samples from TPE and SP were analyzed for metals and were screened against the trigger and threshold values (**Appendix C1** and **Figure 4-67** to **Figure 4-74**). Furthermore, TPN was only analyzed for grain size. Sediment grab samples will be collected and assessed for metals at Meadowbank area lakes in 2022 as per the CREMP monitoring plan

(**Table 7-1**). The chemistry results for samples analyzed by the laboratory (i.e., SP and TPE) are discussed below.

Chromium

- The sediment chromium concentrations in four of the five grabs collected at TPE exceeded the trigger value in 2021 (ranging from 136 to 148 mg/kg; trigger value = 135 mg/kg). These values are lower than the means reported in years 2017 through 2020 (**Figure 4-70**).
- Sediment chromium levels at TPE have been elevated in past coring programs and were further investigated in 2018 and 2019, as mentioned in **Section 4.5.1**. The studies completed in 2018 and 2019 concluded that while concentrations of chromium have increased relative to the baseline period and have continued to exceed the trigger, chromium concentrations at TPE appear to have stabilized relative to the increasing temporal trend that was apparent prior to approximately 2013. It is likely that increasing concentrations of chromium in sediment at TPE were related to use of ultramafic rock for dike construction. The 2018 and 2019 studies also concluded that current conditions do not pose risks to the benthos at TPE.

Zinc

- The sediment zinc concentrations in two of five replicates collected at TPE exceeded the trigger and the threshold values in 2021 (values ranging from 127 to 133 mg/kg; trigger = 114 mg/kg; threshold = 123 mg/kg). This is similar to sediment zinc concentrations from core samples collected in 2020 (**Figure 4-74**).
- The sediment zinc concentrations in three of five replicates collected at SP exceeded the trigger and threshold values and one sample only exceeded the trigger value in 2021 (values ranging from 118 to 126 mg/kg; trigger = 114 mg/kg; threshold = 123 mg/kg). This is similar to sediment zinc concentrations from core samples collected in 2020 (**Figure 4-74**).
- While there was an apparent increasing trend in zinc at both SP and TPE over the last few years, the 2020 and 2021 concentrations remain within the range of baseline zinc concentrations. It is possible that the observed patterns at SP and TPE are due to natural spatial heterogeneity.

In addition to the above metals, there were single trigger exceedances for lead in two replicates collected at TPE (26 to 27 mg/kg; trigger = 25 mg/kg). These exceedances were generally reflective of natural spatial variability rather than mining-related changes as supported by the lack of temporal changes relative to baseline conditions, the lack of a corresponding change in water quality, and by the lack of co-located mine discharges. Grab sampling results for organics analysis only identified one detectable concentration of benzo(g,h,i)perylene in the SP composite sample. Confirmation of the observed trends using sediment grabs will be conducted in 2022.

4.6 Benthos Community

4.6.1 General Observations

The abundance and species composition of benthic invertebrates are influenced 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 August, after most groups have emerged, but it is still a source of some variability.

Benthic invertebrate communities in the Meadowbank study lakes are characterized by relatively few taxa and low abundance. Abundance is generally less than 2,000 organisms/m^2 and is often less than 1,000 organisms/m^2 at reference and exposure areas (e.g., **Table 4-9** and **Figure 4-75**). Despite abundance generally being low at the study lakes, values above 5,000 organisms/m^2 are not uncommon, and on occasion abundance has exceeded 10,000 organisms/m^2. Relatively large total benthic invertebrate abundance values were periodically observed in samples collected prior to mine development (e.g., one replicate had 26,000 organism/m^2 at WAL in 2006) and in more recent sampling events (e.g., one replicate had 31,000 organism/m^2 at WAL in 2016). The high variability in total abundance within an area has also recently been observed at lakes sampled for the Whale Tail Pit project during the baseline period (i.e., the *before* period). Total abundance at Lake A76 in 2017 was between 3,000 and >24,000 organisms/m^2 (Azimuth, 2018a). Whale Tail Lake – South Basin also showed comparatively large variance in abundance in 2017, ranging from 1,800 to over 10,000 organisms/m^2. Abundance data for the Meadowbank study lakes between 2006 and 2020, as well as more recent baseline data from the Whale Tail Pit program, demonstrates that benthos abundance is naturally variable, both spatially (i.e., among areas) and temporally (i.e., between years).

Taxa richness typically ranged from 8–12 for most area-year combinations (**Figure 4-78**). Typical of most Arctic lakes, the benthic invertebrate community has been dominated by the aquatic larval stages of insects, especially chironomids (Family Chironomidae), both in terms of abundance and taxa richness (e.g., **Figure 4-76** and **Figure 4-79**). The next most abundant group was Mollusca (clams), particularly *Cyclocalyx* / *Neopisidium* genera of the family Sphaeriidae (fingernail clams). Oligochaete worms were also relatively common in the lake sediments; generally, at least one oligochaete taxon was present at most area-year combinations.

4.6.2 Temporal and Spatial Trend Interpretation

Benthic invertebrate abundance and richness results from the reference (INUG and PDL) and NF (TPE, TPN, SP, and WAL) Meadowbank study lakes in 2021 are provided in **Appendix E1**, by major taxonomic group (i.e., Insecta, Mollusca, Oligochaeta, and other taxa). Geometric means of total abundance and total richness for the entire data set dating back to 2006 are provided in **Table 4-9**.

Time-series plots showing abundance and richness endpoints are presented in **Figure 4-75** to **Figure 4-80**. Below are descriptions of the endpoints, based on Environment Canada EEM guidance (2012):

- 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.
- Abundance of major taxa (absolute and relative abundance of each major taxon).
- Richness of major taxa (absolute and proportional richness of each major taxon).

Other benthic invertebrate community results presented in **Appendix E1,** but not discussed in detail, include time-series plots of abundance and richness within each major taxon, Simpson's Diversity, and Bray-Curtis Index values.

Identifying potential mine-related impacts generally involved visually examining the data for spatial/temporal patterns that matched mine-related events. This was followed up with formal statistical analyses of the data to test for changes relative to baseline/reference conditions using the BACI model (see **Section 2.3.3** for details). The BACI comparisons involved testing for single-year (i.e., 2021) and multi-year (i.e., up to four years) trends and focused on benthic invertebrate total abundance and taxa richness. Details regarding historical trends (e.g., related to sedimentation events) were discussed in the 2011 CREMP (Azimuth, 2012a) and the 2011 EAS (Azimuth, 2012b). This report focuses on the 2021 results and discusses temporal and spatial trends over the last four years (i.e., dating back to 2017). As discussed in **Section 2.2.3**, MF (TPS and TE) and FF (TEFF) areas were not sampled in 2021. BACI model results for benthic invertebrate abundance and richness are presented in **Table 4-10** and **Table 4-11**, respectively. Key results are described below.

Total Abundance

Total abundance at both INUG and PDL was lower in 2021 compared to 2020. INUG is the main reference area used for the BACI comparisons, so it is noteworthy that total abundance has been generally higher for INUG over the last six years compared to earlier years (**Table 4-9**). However, the range in abundance since monitoring began is generally lower at INUG relative to the NF areas, with maximum abundance of 2,100 organisms/m^2 (2016) relative to SP (2,796 in 2014), TPN (3,025 in 2015), TPE (5,556 in 2008), and WAL (14,253 in 2016).

Yearly total abundance is plotted in **Figure 4-75**. Visually, the plots suggest lower abundance at WAL and to a lesser degree, SP, compared to 2020, when there were recent highs at these locations, and a slightly higher abundance in 2021 at TPN relative to 2020. Overall, the BACI results in **Table 4-10** show negative effect sizes (i.e., reduction) in abundances for TPE and WAL sampling areas and positive effects sizes (i.e., increases) for TPN and SP when compared to reference area INUG in 2021, though none of the results are statistically significant. The effect size for WAL in 2021 exceeded the 20% trigger and 50% threshold, but was not significant (ES = 53%). As noted above, these results appear to be influenced by natural inter-annual variability rather than mining activities.

Interpreting the BACI analysis results can be challenging for three reasons: 1) because natural variability exists between years and areas, 2) because abundance at the control area INUG has increased above baseline over the past few years (a trend not seen at PDL, the other reference area), and 3) because there is heterogeneity within areas. Total abundance at TPE continues to be fairly stable with relatively minor variability between years (**Figure 4-75**). The BACI assessment of total abundance at TPE in each time period assessed over the past four years showed a reduction ranging from 18% to 35% compared to INUG, though these changes in total abundance were not statistically significant (**Table 4-10**). In contrast, the trend over the past four years for SP appears to be generally downwards, after peaking in 2014. However, this trend is not resulting in a decrease relative to reference in the BACI analysis, partly because baseline total abundance at SP (e.g., pre-2008) was relatively low and because total abundance in SP increased markedly after 2010. Effect sizes relative to reference at SP have varied including an increase in 2018 (ES = 1.1%) and 2021 (ES = 2%), and reductions in 2019 (ES = 32%) and 2020 (ES = 7%) all of which were not statistically significant.

A further challenge is accounting for heterogeneity within sites and the influence that differing abundance in replicates can have on the yearly mean for an area. For example, in 2021, abundance at replicate WAL-4 had a low total abundance of 783 organisms/m^2 compared to replicate WAL-3 which had a high abundance of 2,174 organisms/m^2. An even larger difference between replicates was observed in 2020, abundance at replicate WAL-4 had a low total abundance of 2,065 organisms/m^2 compared to replicate WAL-5 had a high abundance of 24,261 organisms/m^2.

The only statistically significant decrease in abundance observed in recent years has been in TPE over the period of 2017–2020. In 2021, and for all *after* periods up to four years, the effect size at TPE was negative and not statistically significant (i.e., reduced abundance, see **Table 4-10**). As discussed, the apparent reduction in abundance is not supported by the temporal trends for total benthic abundance for TPE shown in **Figure 4-75**. The time-series plots highlight that abundance at TPE has remained remarkably consistent over the last seven years of operations and is similar to baseline results. The apparent reduction in abundance at TPE in the BACI analysis is related to the combined effect of two factors: 1) high abundance at TPE during the baseline period and 2) increased abundance at INUG in recent years (relative to baseline). Regarding the first factor, abundance measured at TPE during the baseline period (2006 and 2008) was particularly high (two of the three highest abundances measured at TPE occurred during baseline), making the mean abundance for the baseline period higher compared to more recent data from the 2017–2020 monitoring period (**Figure 4-75**). Second, as described above, abundance at INUG has increased slightly compared to TPE since 2014 and compared to the INUG abundance during baseline years (i.e., pre-2008; **Figure 4-75**). Combined, these two factors led to the detection of an apparent reduction in benthic invertebrate abundance at TPE. In this context, the BACI results for TPE are interpreted strictly as a *relative* reduction in abundance compared to INUG rather than an absolute reduction in benthos abundance. The BACI results, while important for identifying potential temporal changes in benthos metrics, need to be interpreted in the broader context of the absolute change in the benthos community over time. Overall, the abundance data do not suggest there are changes to benthos abundance in the NF areas that are attributable to mining activity.

Major Taxa Abundance

Insects were the dominant taxon with generally over 60% relative abundance followed by molluscs with roughly between 10–20% relative abundance (**Figure 4-76** and **Figure 4-77**). While there were no apparent trends in composition changes related to mining at most areas, it is notable that most peaks or valleys in total abundance over the years appear to be driven by changes in abundance of insects, predominantly chironomids. Notable examples are WAL in 2006, 2016, 2018 and 2020, TPE in 2008, or TPS in 2015. The community composition at WAL in 2020 was dominated by insects (89%) and molluscs (10%), whereas in 2021 the abundance was more similar between insects (56%) and molluscs (41%). The community shift observed in 2021 is actually closer to historical trends than the insect-dominated result observed in 2020. Given the large inter-annual change in total abundance seen between 2020 and 2021, it is not unexpected to see a change in the relative dominance of major taxa groups. While this change appears to be the result of natural variability, this trend will be monitored closely in 2022.

Taxa Richness

Taxa richness in 2021 was generally within the range of other sampling years except for TPN where richness in 2021 ranged slightly higher than previously observed (**Figure 4-78**). Mean taxa at the reference areas was 12.9 at INUG and 7 at PDL, which was the lowest reported number of taxa at PDL since monitoring began in 2009 (**Table 4-9**). Results of the BACI suggested there were no statistically significant changes in taxa richness in 2021 or in the other time periods (i.e., 2020-21, 2019-21, 2018-21). Apparent effect sizes showed an increase for all areas, except for WAL which showed a slight decrease of 7% in 2021 (**Table 4-11**). Overall, taxa richness was within range of richness observed over the duration of sampling years. Despite some within-year variability in taxa richness, the NF areas show either stable or slightly increasing taxa richness.

Major Taxa Richness

Insects were dominant in terms of absolute and proportional richness (generally between five to ten taxa), followed by molluscs (~one to three taxa) (**Figure 4-79** and **Figure 4-80**). There were no apparent trends in composition related to mining.

4.6.3 Summary and Implications

The benthic invertebrate metrics (total abundance and taxa richness) for the NF and reference areas were generally within the range reported for previous years. Furthermore, the BACI analysis did not detect any significant changes in abundance or taxa richness in 2021, nor in the three longer-term time periods assessed (i.e., 2020-21, 2019-21, 2018-21). In the time period 2017-2020, the BACI analysis detected a significant decrease in abundance at TPE relative to INUG, however the decrease in 2021 was not significant. Furthermore, the differences at TPE are primarily driven by increased abundance at INUG which was not seen at the other reference area, PDL, so attributed to local trends in INUG rather than to a true regional trend. Total abundance at TPE has been remarkably stable over the past 8 years. Importantly, the richness of the benthic invertebrate community at TPE is consistent with previous CREMP years, indicating the benthic community at TPE remains functionally diverse. In summary, the apparent changes in benthic community observed in 2021 are likely due to natural variability rather than to mining activities, and will continue to be monitored in 2022.

4.7 Meadowbank Tables and Figures

The tables and figures for the Meadowbank CREMP are provided in this section, except for the large tabulated datasets and figures for parameters not included in the detailed analysis (see in-text references to appropriate Appendices). Subsections are provided for each of the CREMP components (e.g., limnology, water chemistry, phytoplankton, sediment chemistry, and benthos).

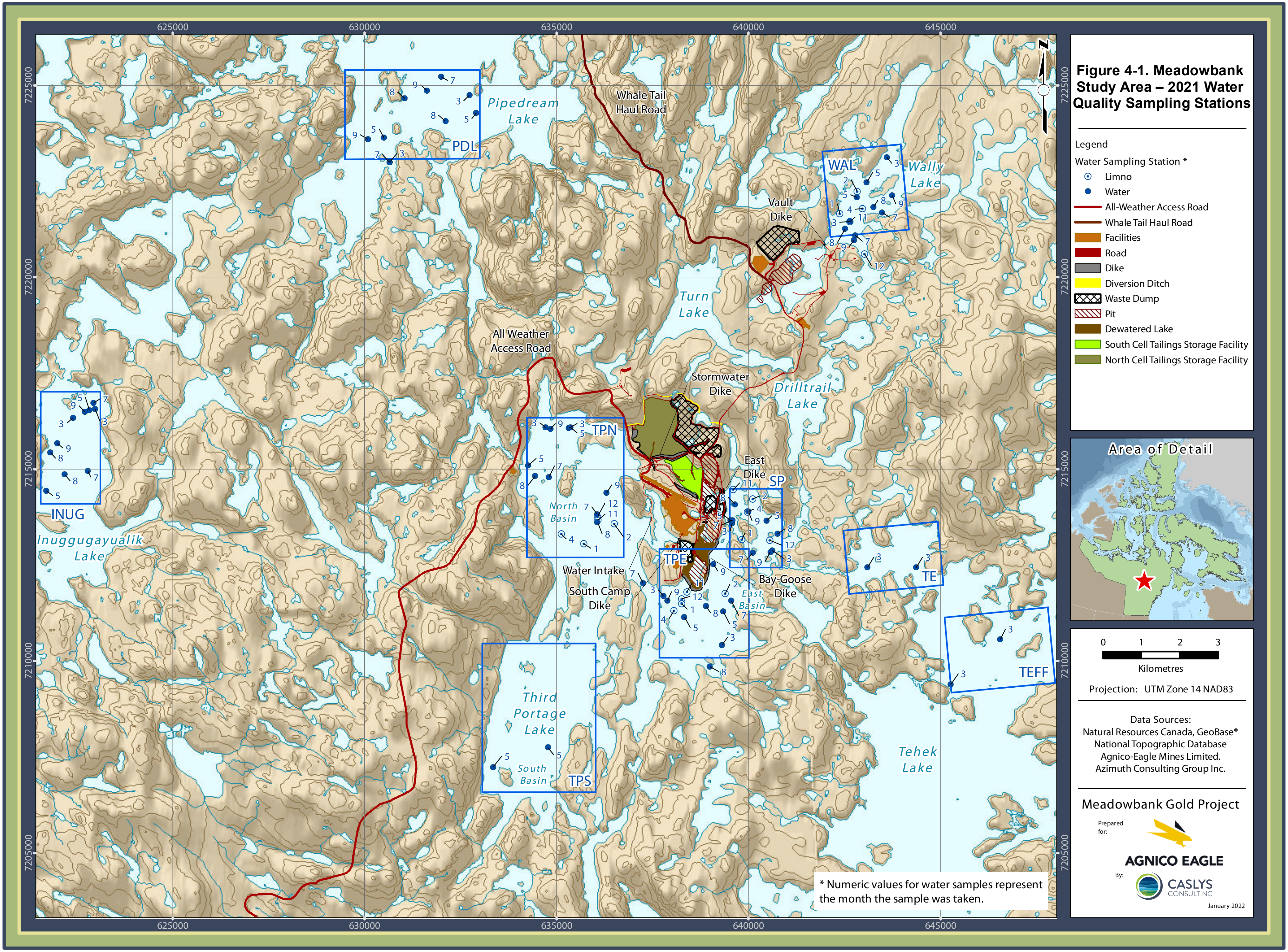
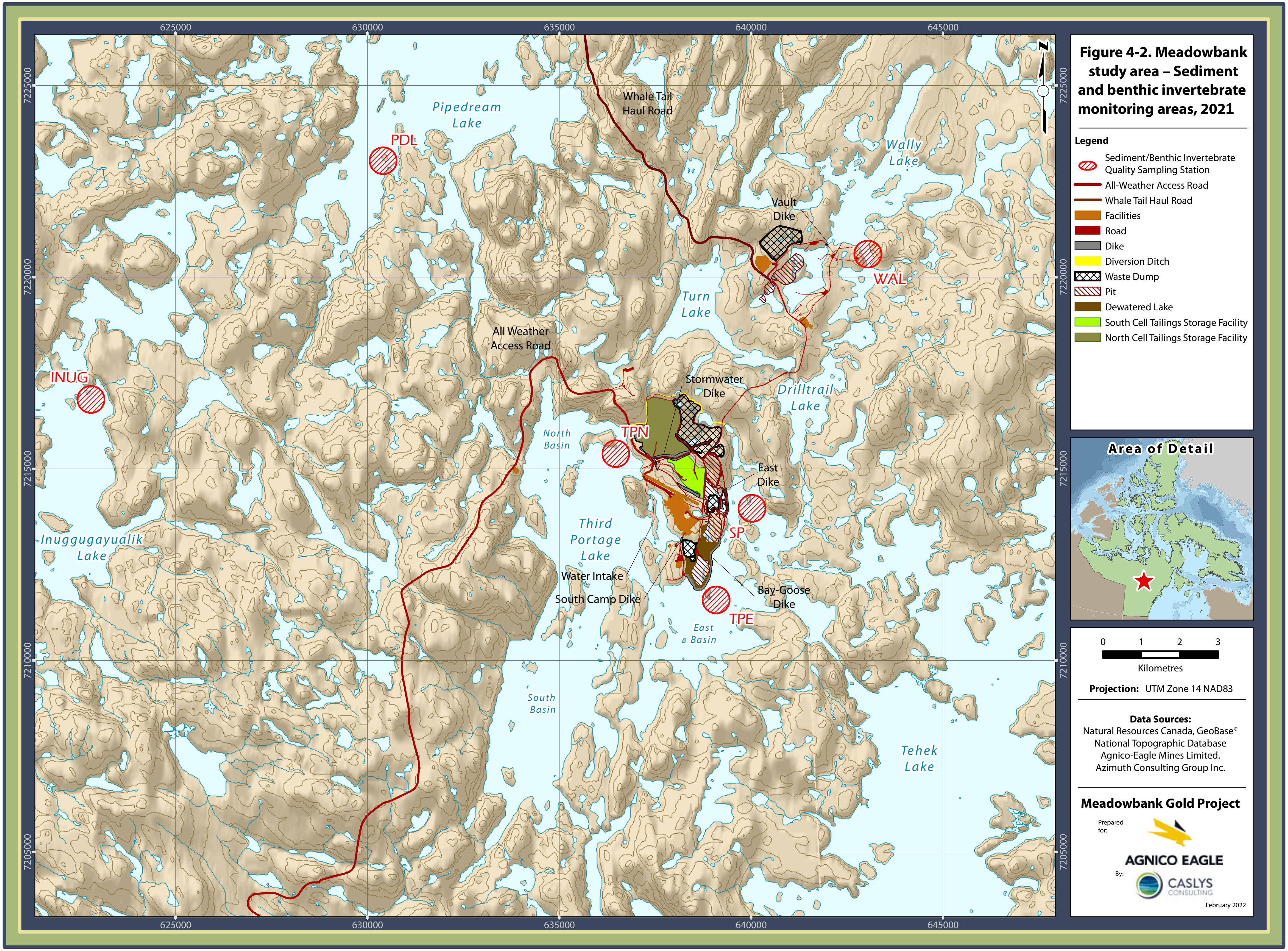


Figure 4-1. Meadowbank Study Area – 2021 Water Quality Sampling Stations



625000
630000
635000
640000
645000
7225000
7220000
7215000
7210000
7205000
Pipedream Lake
PDL
Whale Tail Haul Road
Wally Lake
Vault Dike
WAL
Turn Lake
All Weather Access Road
INUG
Stormwater Dike
Drilltrail Lake
North Basin
TPN
East Dike
Third Portage Lake
SP
Inuggugayualik Lake
Water Intake
South Camp Dike
Bay-Goose Dike
TPE
East Basin
South Basin
Tehek Lake
N
Figure 4-2. Meadowbank study area – Sediment and benthic invertebrate monitoring areas, 2021
Legend
Sediment/Benthic Invertebrate Quality Sampling Station
All-Weather Access Road
Whale Tail Haul Road
Facilities
Road
Dike
Diversion Ditch
Waste Dump
Pit
Dewatered Lake
South Cell Tailings Storage Facility
North Cell Tailings Storage Facility
Area of Detail
0
1
2
3
Kilometres
Projection: UTM Zone 14 NAD83
Data Sources:
Natural Resources Canada, GeoBase® National Topographic Database
Agnico-Eagle Mines Limited.
Azimuth Consulting Group Inc.
Meadowbank Gold Project
Prepared for:
AGNICO EAGLE
By:
CASLYS CONSULTING
February 2022

Limnology Tables and Figures

Figure 4-3. Mean monthly field-measured temperature (°C) at 3 m depth since 2006, Meadowbank project area lakes.

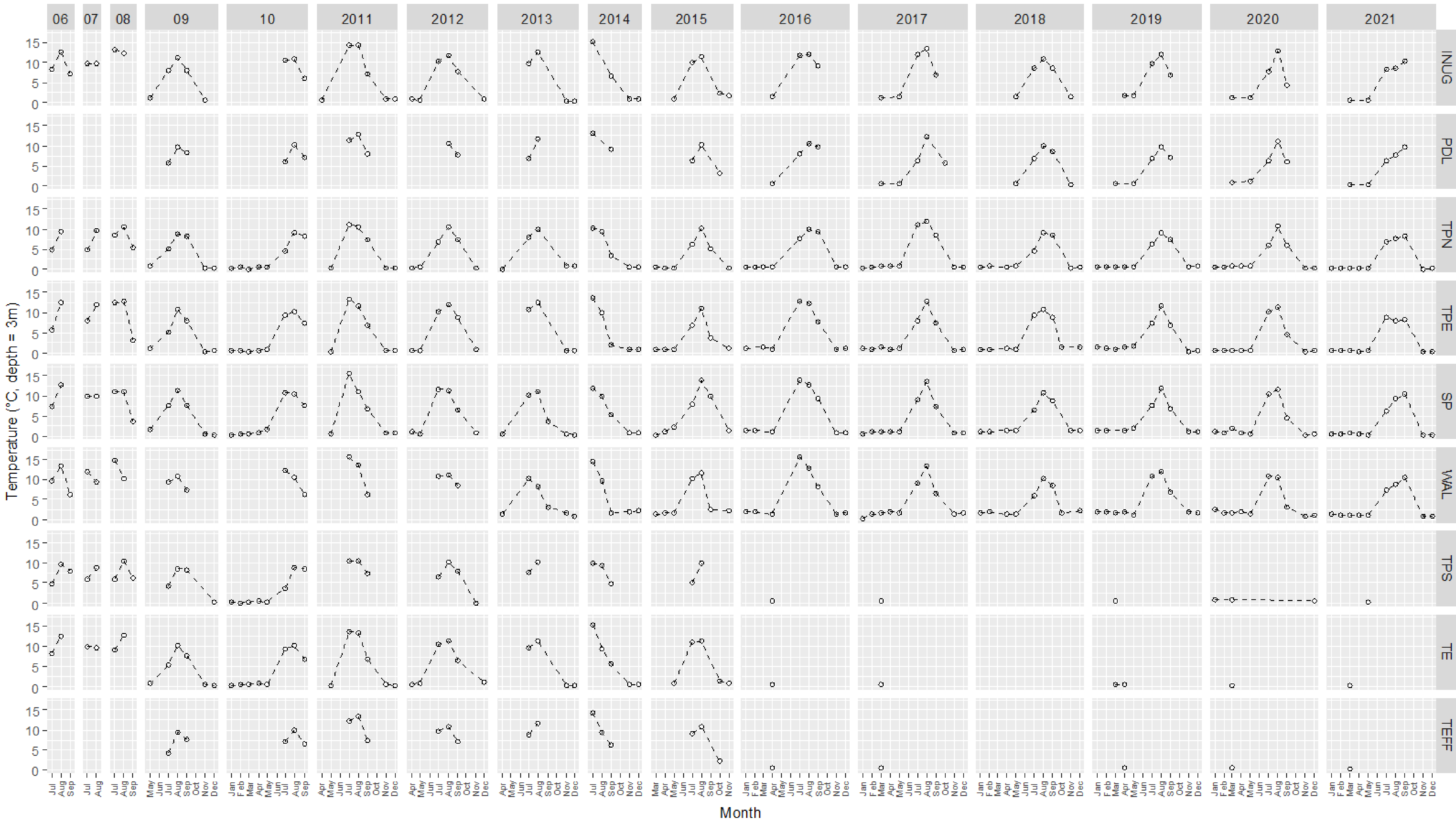


Figure 4-4. Meadowbank – Field-measured conductivity, dissolved oxygen, and temperature profiles, January 2021.

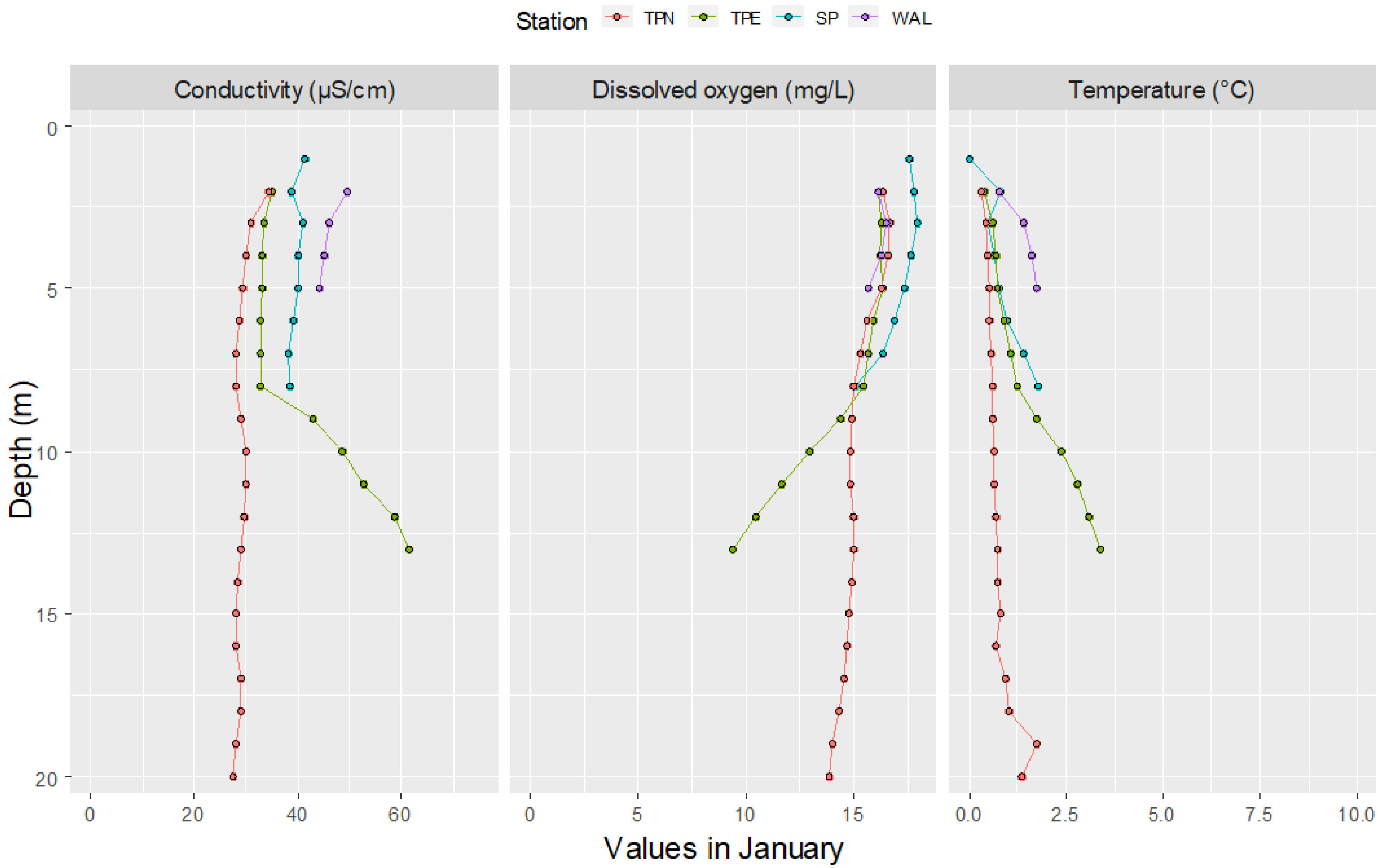


Figure 4-5. Meadowbank – Field-measured conductivity, dissolved oxygen, and temperature profiles, February 2021.

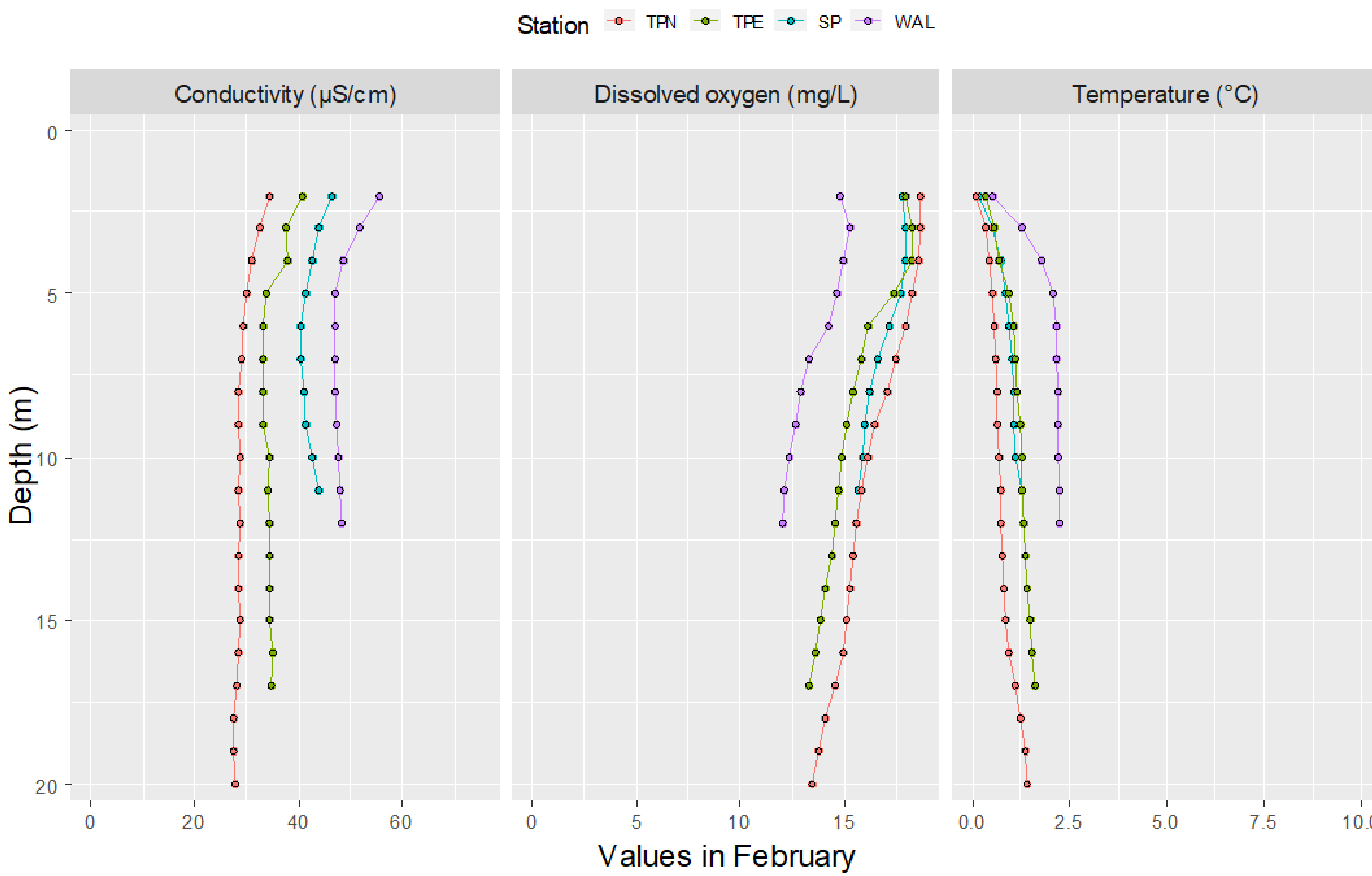


Figure 4-6. Meadowbank – Field-measured conductivity, dissolved oxygen, and temperature profiles, March 2021.

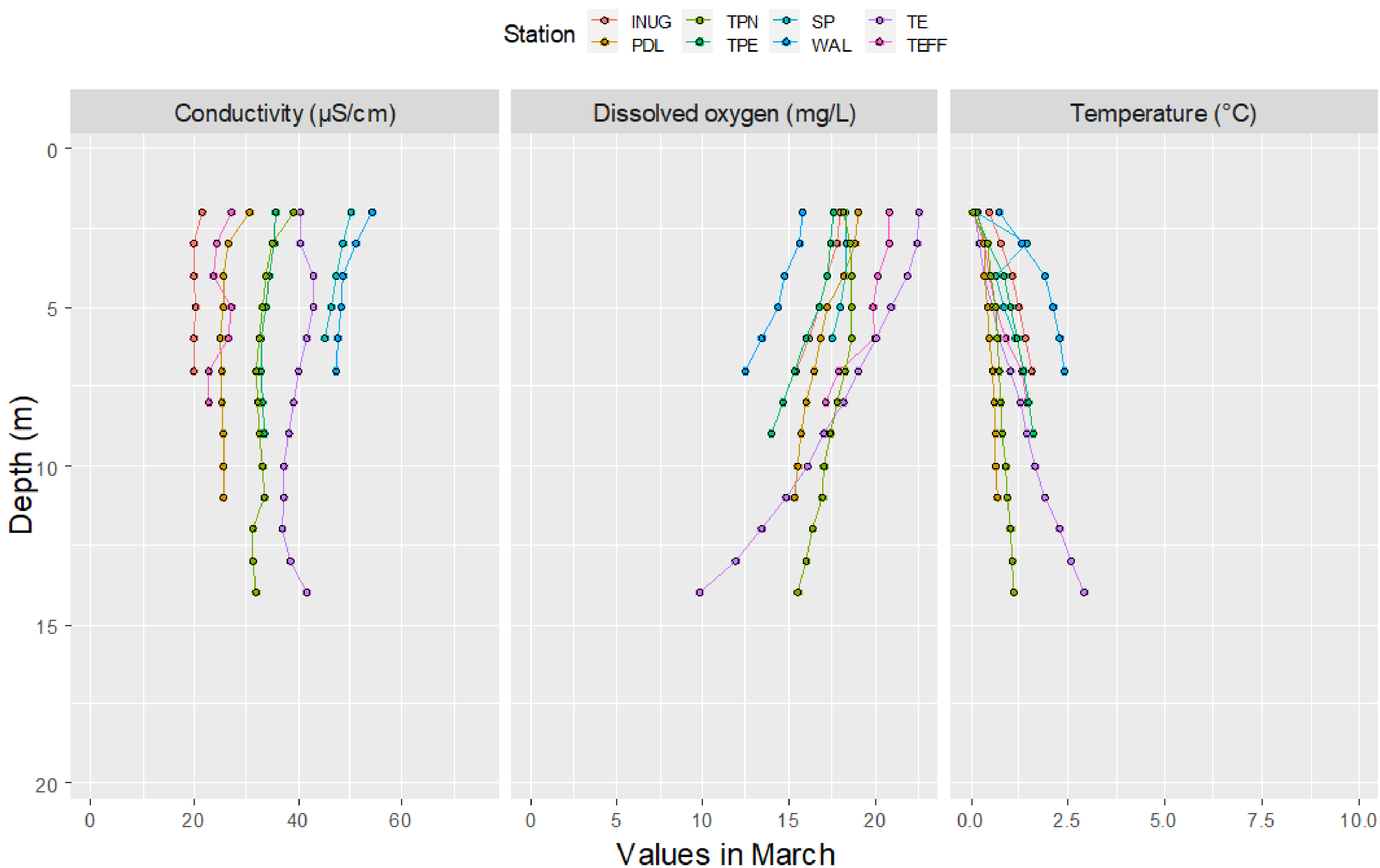


Figure 4-7. Meadowbank – Field-measured conductivity, dissolved oxygen, and temperature profiles, April 2021.

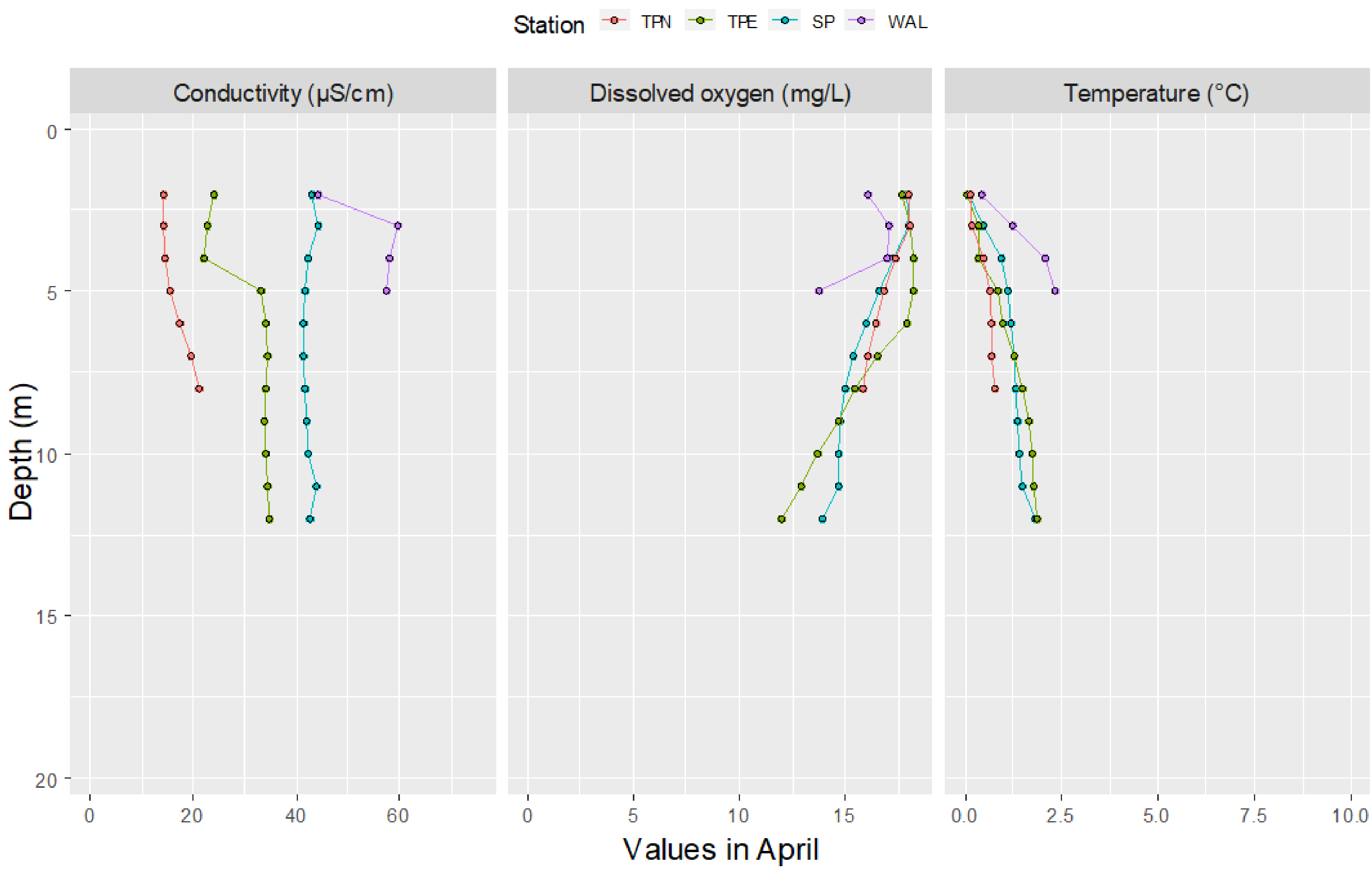


Figure 4-8. Meadowbank – Field-measured conductivity, dissolved oxygen, and temperature profiles, May 2021.

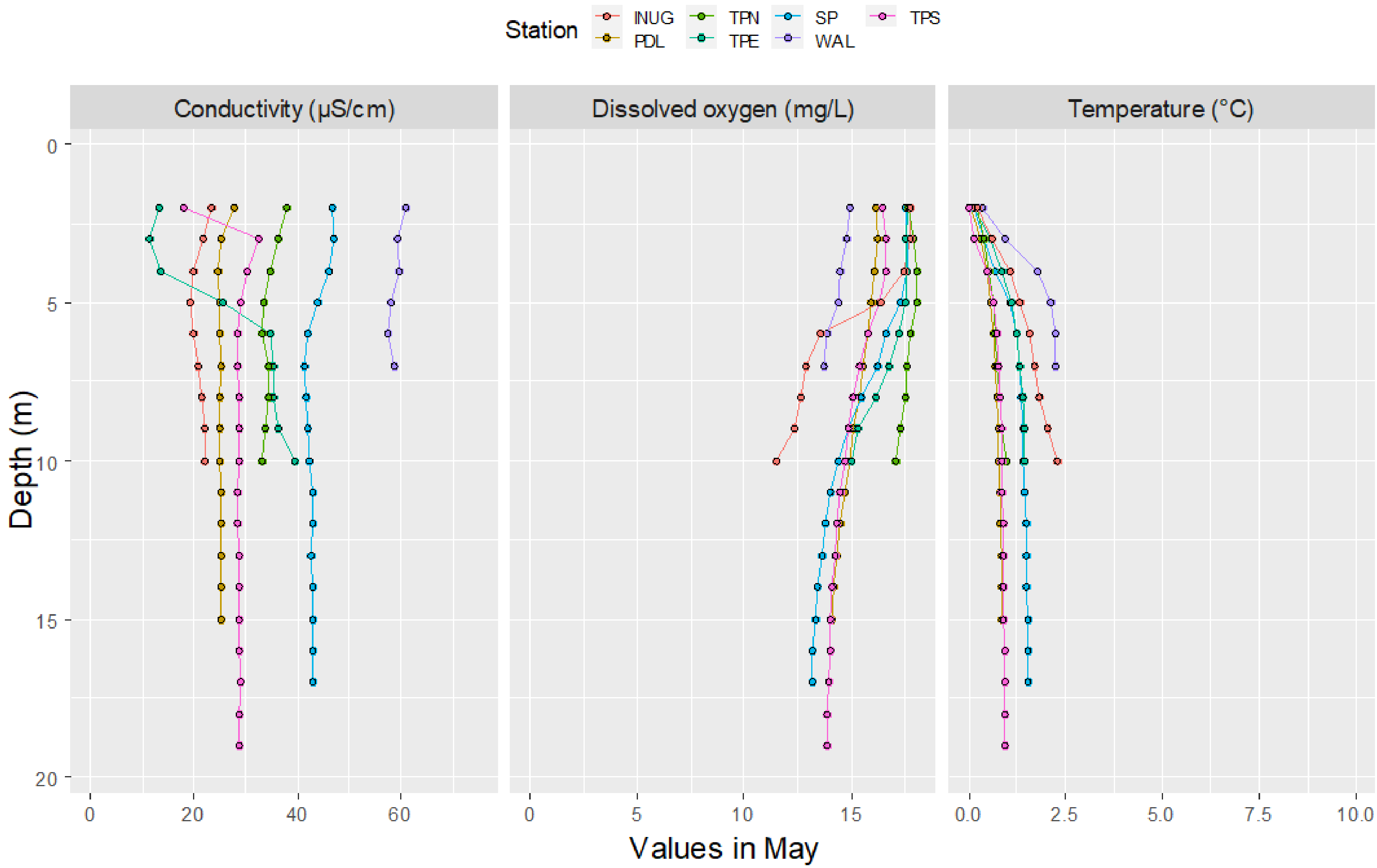


Figure 4-9. Meadowbank – Field-measured conductivity, dissolved oxygen, and temperature profiles, July 2021.

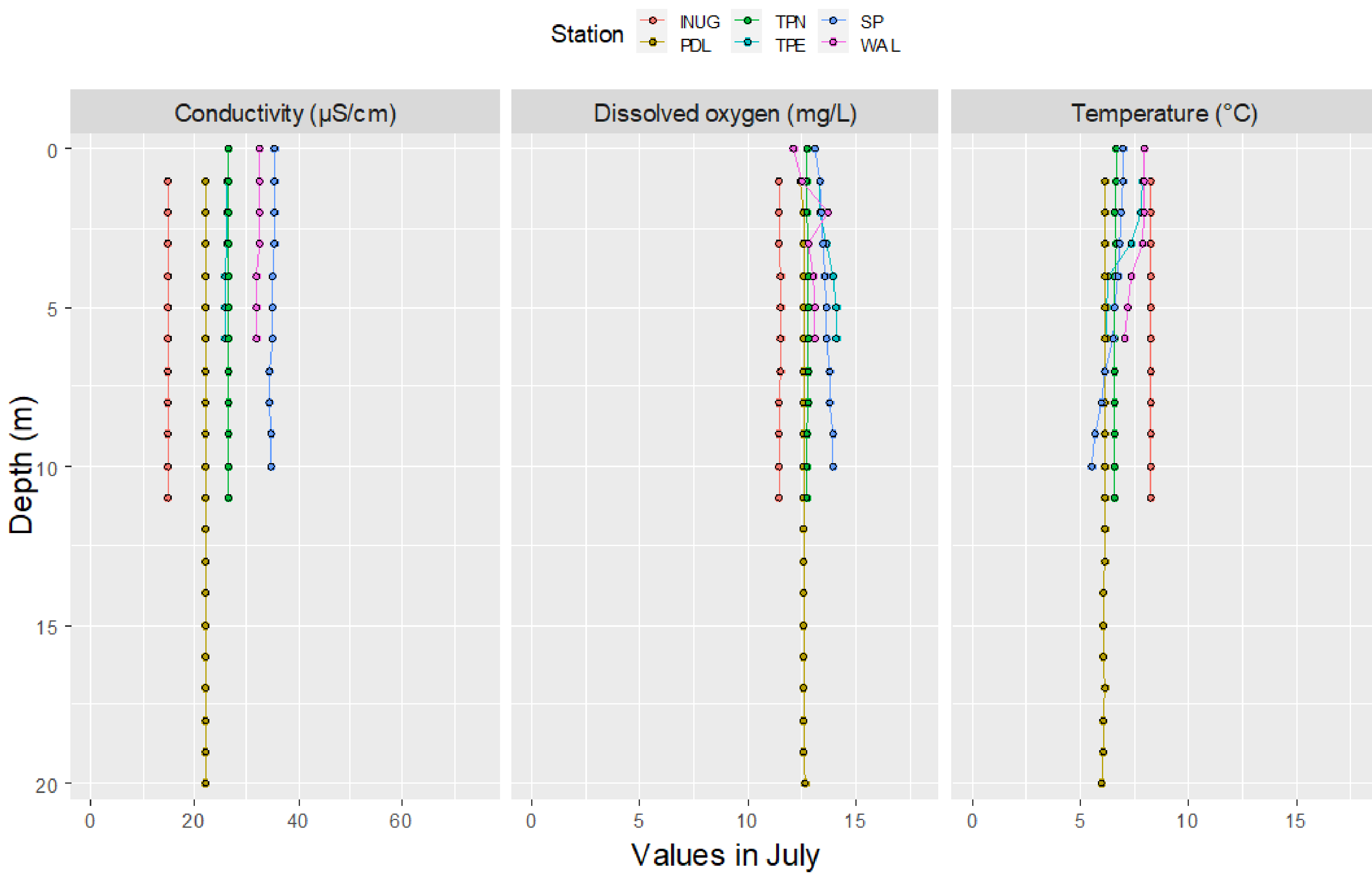


Figure 4-10. Meadowbank – Field-measured conductivity, dissolved oxygen, and temperature profiles, August 2021.

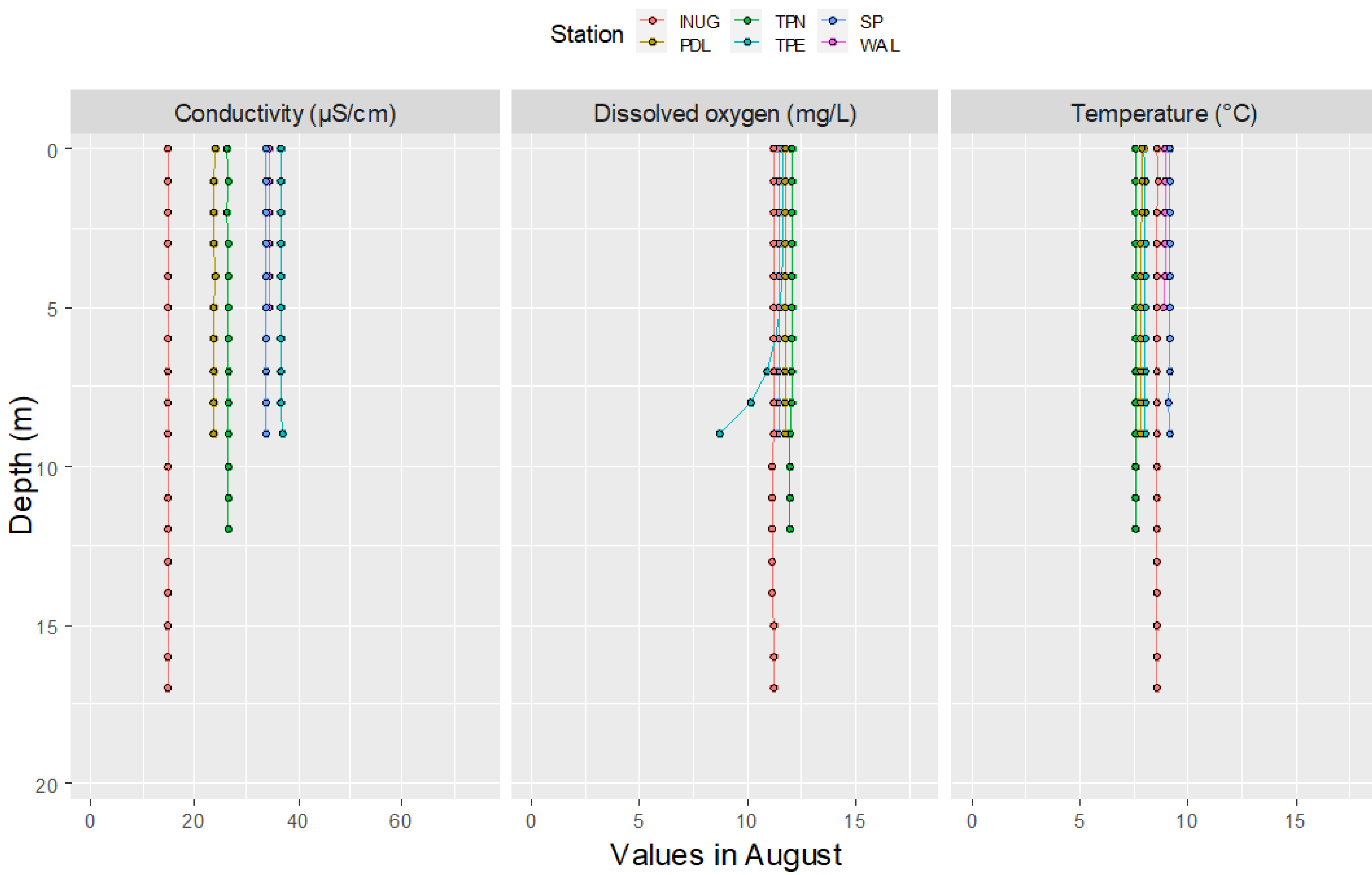


Figure 4-11. Meadowbank – Field-measured conductivity, dissolved oxygen, and temperature profiles, September 2021.

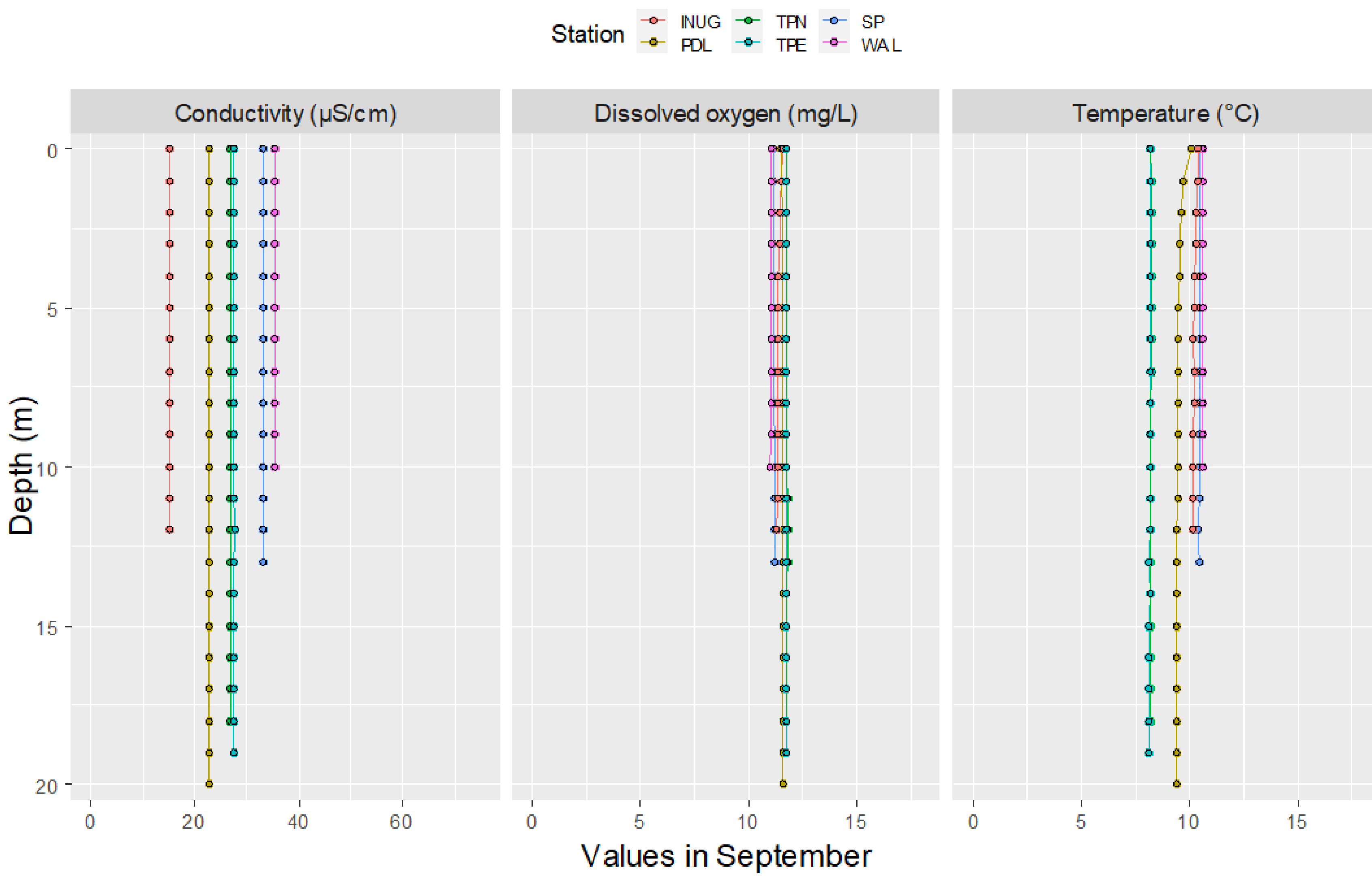


Figure 4-12. Meadowbank – Field-measured conductivity, dissolved oxygen, and temperature profiles, November 2021.

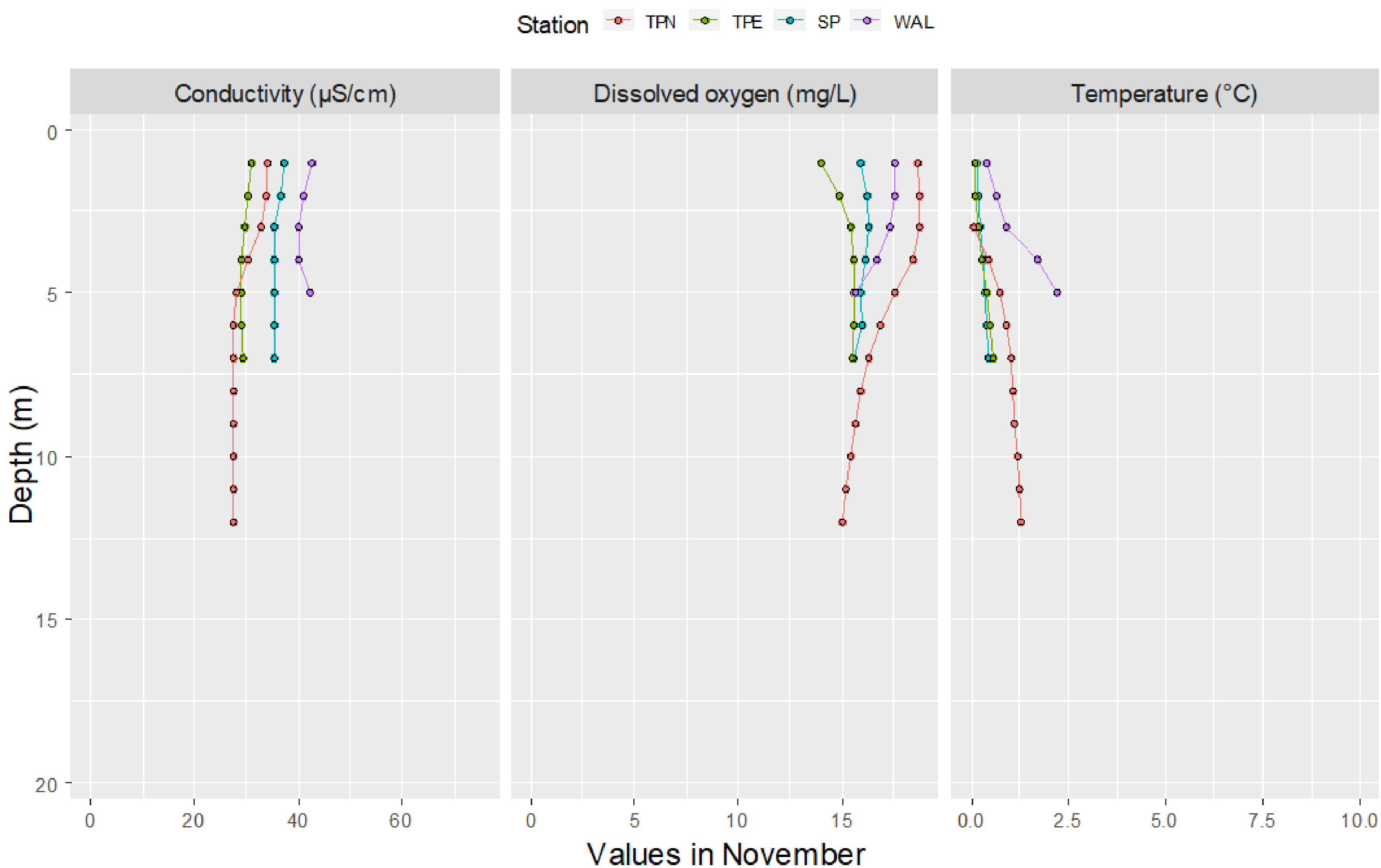
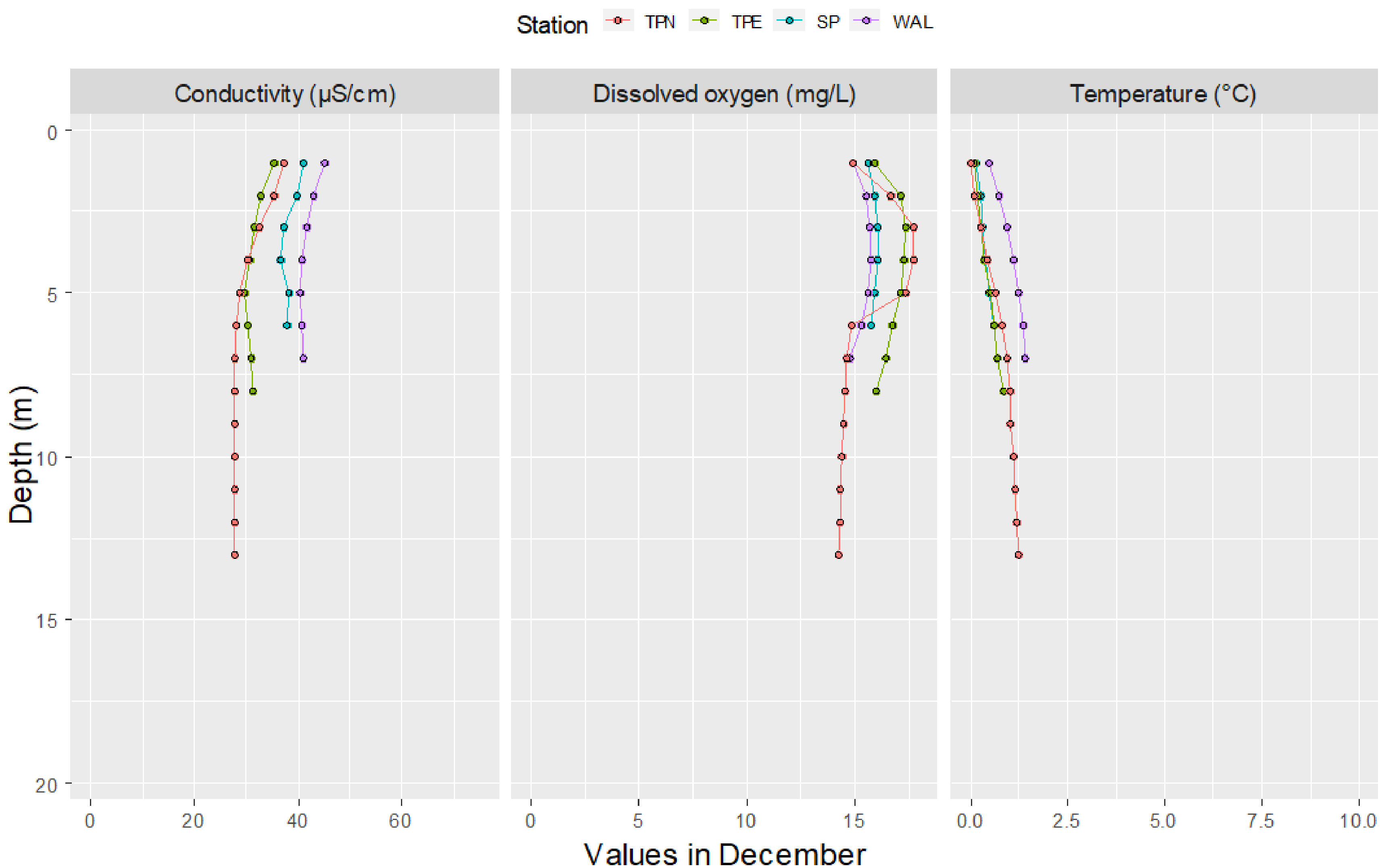


Figure 4-13. Meadowbank – Field-measured conductivity, dissolved oxygen, and temperature profiles, December 2021.



Water Chemistry Tables and Figures

Table 4-2. Assessment process for water quality parameters, Meadowbank study area lakes, 2021.

CONVENTIONALS			
Screening Level	**1**	**2**	**3**
Screening Rule[1]	**>DL ≥ 10% frequency**	**C-I > 0.1 frequency**	**Pattern = Activity**
Conductivity	Figure 4-15		
Hardness	Figure 4-16		
pH -Field	Figure 4-17		
pH -Lab	Figure 4-18		
TSS*	No	No	No
TDS	Figure 4-19		
B-Alkalinity	Figure 4-20		
C-Alkalinity*	No	No	No
T-Alkalinity	Figure 4-21		
Ammonia-N	Figure 4-22		
Chloride	Figure 4-23		
Fluoride	Figure 4-24		
Nitrate-N	Figure 4-25		
Nitrite-N*	No	No	No
TKN	Figure 4-26		
T-phosphorous	Figure 4-27		
Ortho-phosphate*	No	No	No
Reactive silica	Figure 4-28		
Sulphate	Figure 4-29		
DOC	Figure 4-30		
TOC	Figure 4-31		
T-Cyanide*	No	No	No
Free Cyanide*	No	No	No

TOTAL METALS			
Screening Level	**1**	**2**	**3**
Screening Rule[1]	**>DL ≥ 10% frequency**	**C-I > 0.1 frequency**	**Pattern = Activity**
Aluminum	Figure 4-32		
Antimony*	No	No	No
Arsenic	Figure 4-33		
Barium	Figure 4-34		
Beryllium*	No	No	No
Boron*	No	No	No
Cadmium*	No	No	No
Calcium	Figure 4-35		
Chromium	Figure 4-36		
Copper	Figure 4-37		
Iron	Figure 4-38		
Lead*	No	No	No
Lithium*	No	No	No
Magnesium	Figure 4-39		
Manganese	Figure 4-40		
Mercury*	No	No	No
Molybdenum	Figure 4-41		
Nickel	Figure 4-42		
Potassium	Figure 4-43		
Selenium*	No	No	No
Silicon	Figure 4-44		
Silver*	No	No	No
Sodium	Figure 4-45		
Strontium	Figure 4-46		
Thallium*	No	No	No
Tin*	No	No	No
Titanium*	No	No	No
Uranium	Figure 4-47		
Vanadium*	No	No	No
Zinc*	No	No	No

DISSOLVED METALS			
Screening Level	**1**	**2**	**3**
Screening Rule[1]	**>DL ≥ 10% frequency**	**C-I > 0.1 frequency**	**Pattern = Activity**
Aluminum	Figure 4-48		
Antimony*	No	No	No
Arsenic	Figure 4-49		
Barium	Figure 4-50		
Beryllium*	No	No	No
Boron*	No	No	No
Cadmium*	No	No	No
Chromium*	No	No	No
Copper	Figure 4-51		
Iron*	No	No	No
Lead*	No	No	No
Lithium*	No	No	No
Manganese	Figure 4-52		
Mercury*	No	No	No
Molybdenum	Figure 4-53		
Nickel*	No	No	No
Selenium*	No	No	No
Silicon	Figure 4-54		
Silver*	No	No	No
Strontium	Figure 4-55		
Thallium*	No	No	No
Tin*	No	No	No
Titanium*	No	No	No
Uranium	Figure 4-56		
Vanadium*	No	No	No
Zinc	No	No	Figure 4-57

Notes:
"*" indicates plots for these parameters are presented in **Appendix B1**.
1. See **Section 4.3.2** for information on the screening process for deciding which parameters are carried forward in the temporal and spatial trend assessment.
2. The time series plot for dissolved zinc were included in the report (**Figure 4-57**). See discussion in **Section 4.3.2**.

Table 4-3. Water quality variables at the Meadowbank study areas for which 2021 mean concentration exceeded the trigger.

Meadowbank Study Areas

Parameter	Trigger	Threshold	2021 Mean		
			TPN	TPE	SP
			NF	NF	NF
Conductivity	27.4	-	30.9	32.0	39.4
Hardness	9.5	-	10.5	11.6	15.1
TDS	19.0	-	20.5	20.3	25.2
HCO_3 alkalinity	8.7	-	-	-	11.0
Total alkalinity	8.7	-	-	-	11.0
Calcium	2.4	-	2.6	2.9	3.9
Magnesium	0.93	-	0.99	1.1	1.3
Potassium	0.58	-	-	0.59	-
T. Silicon	0.20	-	-	-	0.31
D. Silicon	0.18	-	-	-	0.27

Wally Lake

Parameter	Trigger	Threshold	2021 Mean
Conductivity	36.6	-	44.0
Hardness	16.7	-	18.7
TDS	25.3	-	30.2
Reactive silica	1.1	-	1.2
Calcium	4.9	-	5.0
Magnesium	1.4	-	1.5

Notes:

"-" indicates no threshold available, and/or mean annual concentration was < the trigger value.
Reported mean values are all in units of mg/L except for conductivity (µS/cm).

Table 4-4. Results of BACI tests for selected water variables at Meadowbank study areas in 2021.

Parameter	Test Area	n(B)	n(A)	Estimate	SE	F	DF	P-value[1]	Proportional change		
									exp(Est)	LCI	UCI
Conductivity	TPN	6	5	0.54	0.019	824	9	**< 0.001**	1.7	1.6	1.8
	TPE	8	5	0.55	0.043	168	11	**< 0.001**	1.7	1.6	1.9
	SP	5	5	0.36	0.024	227	8	**< 0.001**	1.4	1.4	1.5
	WAL	18	5	0.12	0.071	3.0	21	0.050	1.1	0.97	1.3
Hardness	TPN	6	5	0.50	0.024	440	9	**< 0.001**	1.7	1.6	1.7
	TPE	8	5	0.59	0.042	194	11	**< 0.001**	1.8	1.6	2.0
	SP	5	5	0.34	0.045	55.7	8	**< 0.001**	1.4	1.3	1.6
	WAL	18	5	0.19	0.061	10.1	21	**0.0020**	1.2	1.1	1.4
TDS	TPN	6	5	0.33	0.073	19.7	9	**< 0.001**	1.4	1.2	1.6
	TPE	8	5	0.36	0.063	31.5	11	**< 0.001**	1.4	1.2	1.6
	SP	5	5	0.50	0.085	34.7	8	**< 0.001**	1.7	1.4	2.0
	WAL	18	5	0.16	0.15	1.2	21	0.15	1.2	0.86	1.6
HCO_3 alkalinity	SP	5	5	0.28	0.045	40.2	8	**< 0.001**	1.3	1.2	1.5
Total alkalinity	SP	5	5	0.28	0.045	40.2	8	**< 0.001**	1.3	1.2	1.5
Reactive silica	WAL	16	5	0.43	0.24	3.3	19	**0.043**	1.5	0.94	2.5
Calcium	TPN	6	5	0.57	0.022	658	9	**< 0.001**	1.8	1.7	1.9
	TPE	8	5	0.64	0.045	204	11	**< 0.001**	1.9	1.7	2.1
	SP	5	5	0.36	0.051	49.4	8	**< 0.001**	1.4	1.3	1.6
	WAL	18	5	0.17	0.041	17.0	21	**< 0.001**	1.2	1.1	1.3
Magnesium	TPN	6	5	0.41	0.030	182	9	**< 0.001**	1.5	1.4	1.6
	TPE	8	5	0.49	0.042	134	11	**< 0.001**	1.6	1.5	1.8
	SP	5	5	0.31	0.040	63.0	8	**< 0.001**	1.4	1.3	1.5
	WAL	18	5	0.18	0.037	23.9	21	**< 0.001**	1.2	1.1	1.3

Notes: 1. Bolded P-values are statistically significant (p < 0.05). Test area = area compared to control (INUG).
n(B) = number of paired months in the *before* period. n(A) = number of paired months in the *after* period (i.e., in 2021).
Estimate = BACI model estimate of the 2021 change in mean for log-transformed data. SE = standard error of the estimate.
P-value = one-tailed test of the null hypothesis (no change or a decrease in mean [opposite for lower pH trigger]).
Exp(Est.) = estimated proportional change. LCI = lower 95% confidence interval; UCI = upper 95% confidence interval.

Table 4-5. Sampling effort and frequency assessment results for the 2021 Meadowbank study area lakes.

Areas	Area Designation	Triggers Exceeded?	Minor Changes [1]		Moderate Changes [2]		Major Changes [3]		Plan for 2021
		Yes/No	Yes/No	Parameters	Yes/No	Parameters	Yes/No	Parameters	
Sampling Strategy for Reference Areas									
INUG	Ref	Yes	Yes	T. Silicon	No	-	No	-	Full CREMP (reference area)
PDL	Ref	Yes	Yes	Hard., Ca	No	-	No	-	Full CREMP (reference area)
Sampling Strategy for Near-field Areas									
TPE	NF	Yes	Yes	Cond., Hard., TDS, Ca, Mg, K	No	-	No	-	Full CREMP (near-field area)
TPN	NF	Yes	Yes	Cond., Hard., TDS, Ca, Mg	No	-	No	-	Full CREMP (near-field area)
SP	NF	Yes	Yes	Cond., Hard., TDS, Alkalinity (HCO_3 & Total), Ca, Mg, T.&D. Silicon	No	-	No	-	Full CREMP (near-field area)
WAL	NF	Yes	Yes	Cond., Hard., TDS, Reactive silica, Ca, Mg.	No	-	No	-	Full CREMP (near-field area)
Sampling Strategy for Mid-field and Far-field Areas									
TE	MF	Yes	NA	-	NA	-	NA	-	Winter through-ice sampling
TEFF	FF	Yes	NA	-	NA	-	NA	-	Winter through-ice sampling
TPS	MF	Yes	NA	-	NA	-	NA	-	Winter through-ice sampling

Notes:
1. Minor = exceedance of the early warning trigger values for parameters without effects-based threshold values.
2. Moderate = exceedance of the early warning trigger values for parameters with effects-based thresholds.
3. Major = exceedance of the effects-based threshold values.

NA = MF and/or FF areas were not assessed using the formal BACI analysis in the current CREMP year.

Table 4-6. Meadowbank Study Area FEIS screening predictions compared to 2021 mean concentrations.

Parameter	Meadowbank Study Area							
	FEIS Screening Prediction				2021 Annual Mean			
	TPN	TPE	SP	WAL	TPN	TPE	SP	WAL
Hardness	5.7	5.7	8.9	17.2	10.5	11.6	15.1	18.7
Total Alkalinity	4.1	4.1	7.0	13.2	-	-	11.0	-
Calcium	1.3	1.3	2.3	4.7	2.6	2.9	3.9	5.0
Magnesium	0.60	0.60	0.80	1.3	0.99	1.1	1.3	1.5
Silicon (T)	0.010	0.010	0.010	0.040	-	-	0.31	-

Notes:
Reported mean concentrations are all in units of mg/L.

Table 4-7. Values of delta AICc for three mixed-effects models fitted to select water variables at Meadowbank near-field area lakes (compared to control INUG).

Variable	TPN			TPE			SP		
	Trend	Year	Stable	Trend	Year	Stable	Trend	Year	Stable
Conductivity	47	20	**0**	45	20	**0**	14	4.9	**0**
Hardness	31	21	**0**	47	29	**0**	4.4	12	**0**
Calcium	37	31	**0**	60	32	**0**	10	18	**0**
Magnesium	34	38	**0**	47	38	**0**	25	27	**0**
Total Alkalinity	**0**	4.3	1.9	25	9.1	**0**	7.7	4.3	**0**
TDS	4.7	28	**0**	16	27	**0**	0.80	17	**0**

Notes:
For the three models: Trend = a simple linear trend difference relative to INUG across years; Year = year-specific differences relative to INUG during the "after" period; and Stable = year-specific differences relative to INUG during the "after" period up to 2013, followed by a fixed difference for years 2014 to 2021. Values of delta AICc = 0.0 (in bold) denote the best-supported model. See text for details.

Figure 4-14. Flow chart showing sampling effort and frequency plan for mid-field and far-field sampling in 2022.

Note: Blue-shaded cells show the linkage between 2021 CREMP results and the sampling effort and frequency for mid-field and far-field sampling in 2022. *Minor changes* refer to statistically significant increased concentrations for parameters without effects-based threshold values that exceed the early warning trigger values. Refer to **Section 2.2.3** for more information.

Near-Field Results 2021 CREMP		**Mid-Field and Far-Field Plan for 2022 (TPS, TE, TEFF)**
No changes identified	Yr +1 →	None required
Minor changes identified	Yr +1 →	Water sampling through ice (1 to 2 events)
Moderate changes identified	Yr +1 →	Full water sampling only (all 5 CREMP events)
Major changes identified	Yr +1 →	Full CREMP sampling (all 5 CREMP events)

Figure 4-15. Laboratory-measured conductivity (µS/cm) in water samples from Meadowbank Study lakes since 2006.

Note: The red dashed line = trigger value. Conductivity data from 2014 should be interpreted with caution (See Azimuth [2015c] for more details).

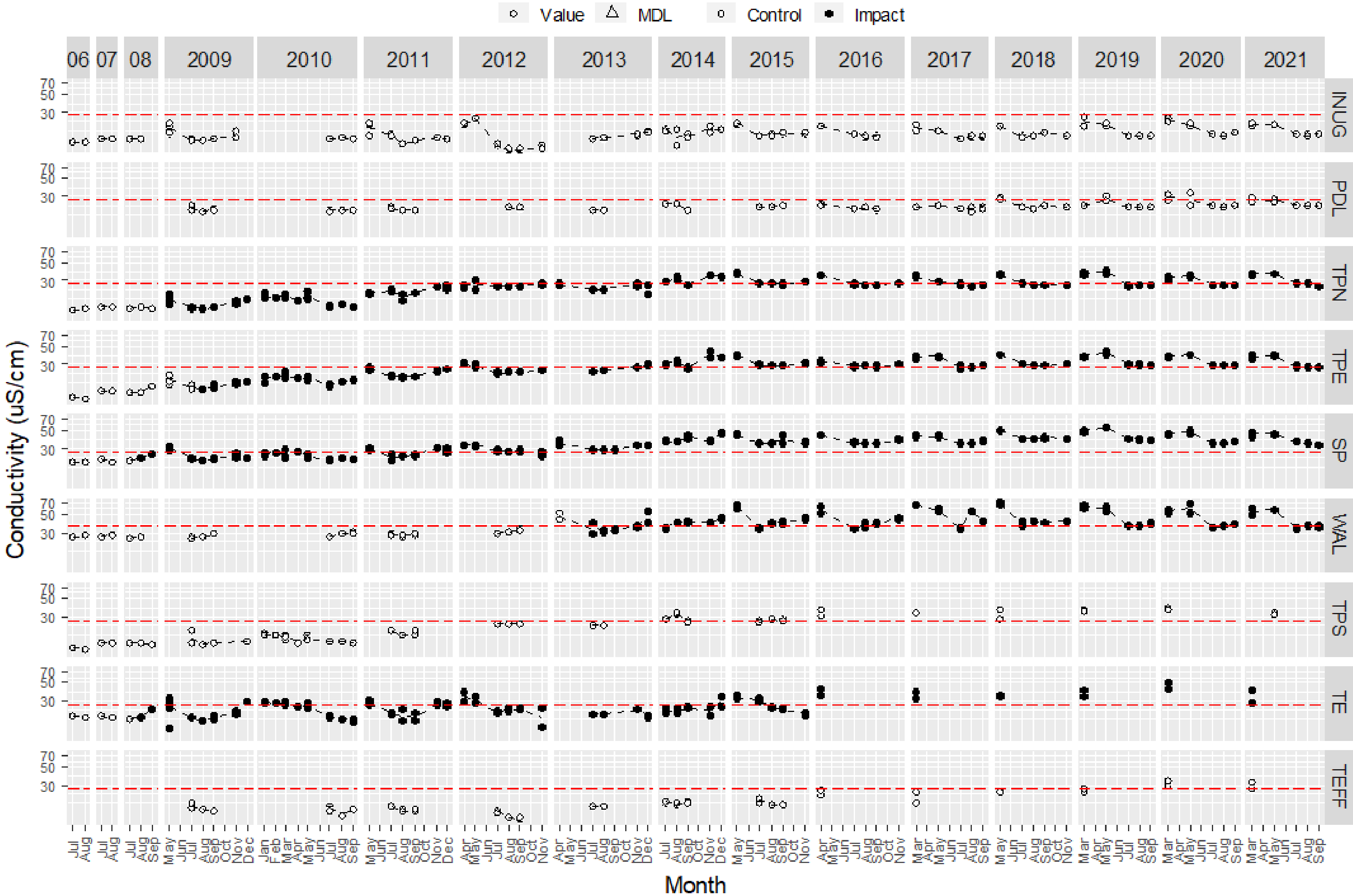


Figure 4-16. Laboratory-measured hardness (mg/L) in water samples from Meadowbank Study lakes since 2006.

Note: The red dashed line = trigger value. The blue dashed line = FEIS screening prediction.

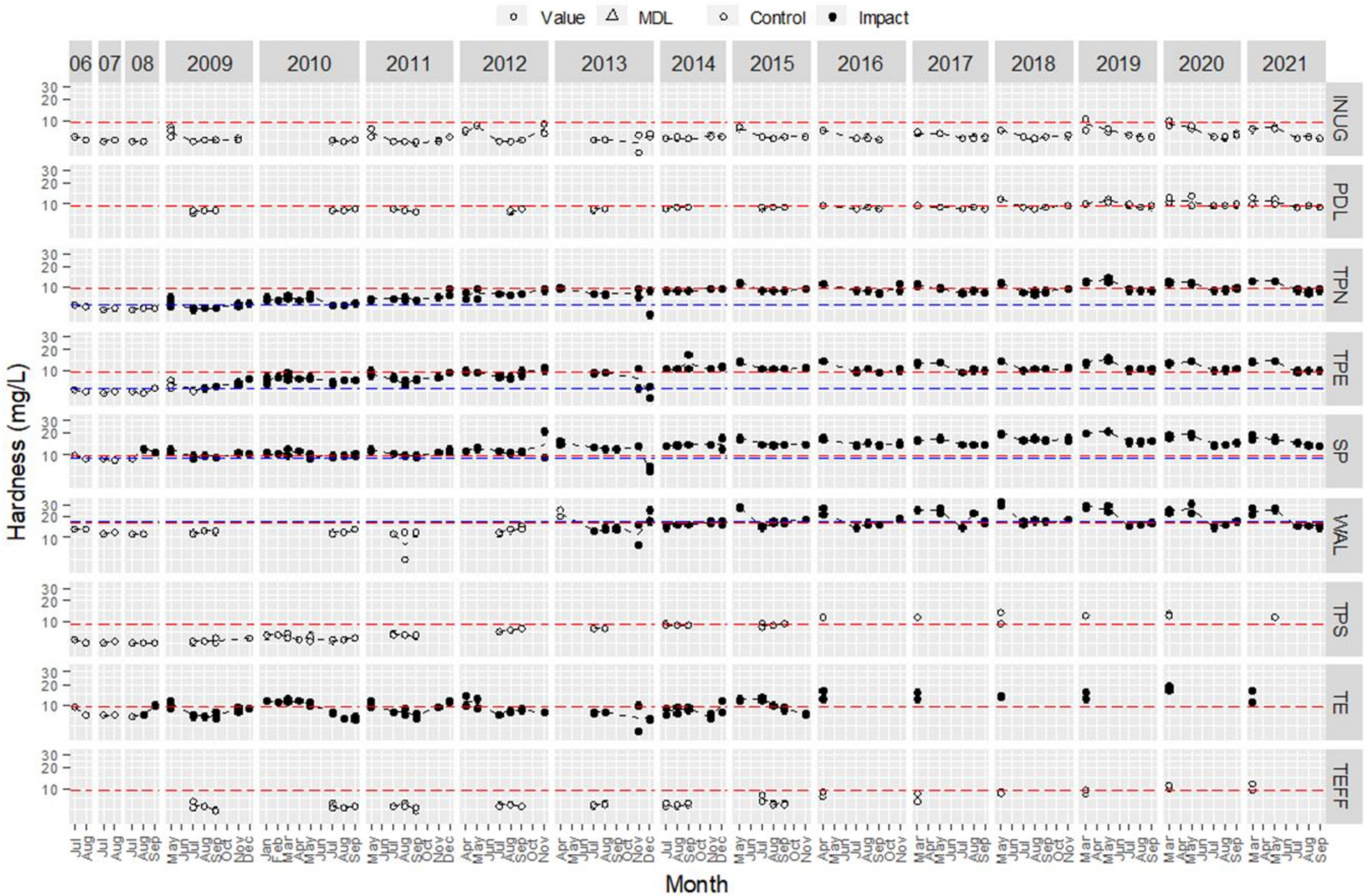


Figure 4-17. Field-measured pH in water samples from Meadowbank Study lakes since 2006.

Note: The red dashed line = trigger value.

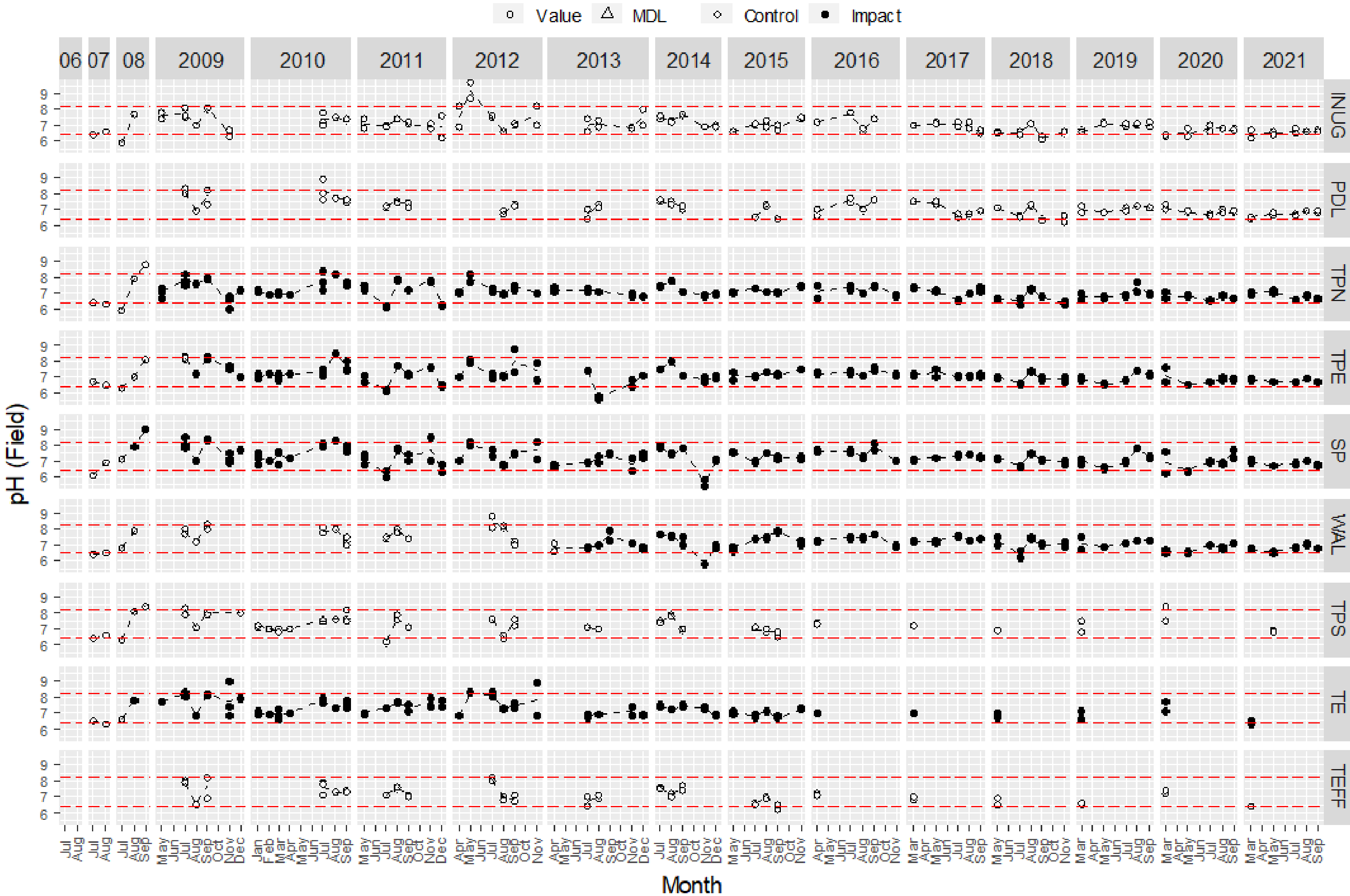


Figure 4-18. Laboratory-measured pH in water samples from Meadowbank Study lakes since 2006.

Note: The red dashed line = trigger value.

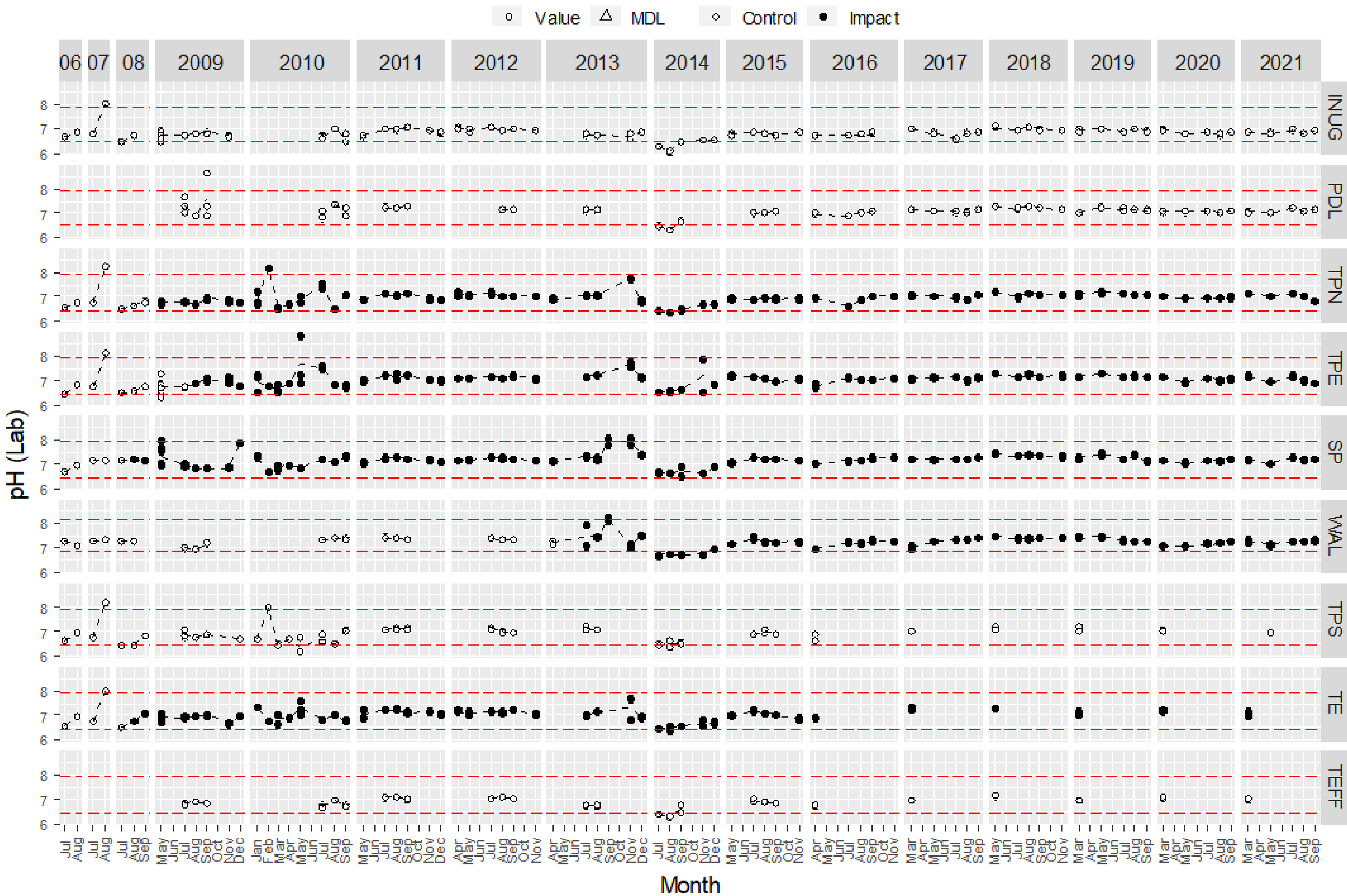


Figure 4-19. Total Dissolved Solids (TDS; mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value. TDS data from 2014 were removed due to data quality concerns. See Azimuth (2015c) for more details.

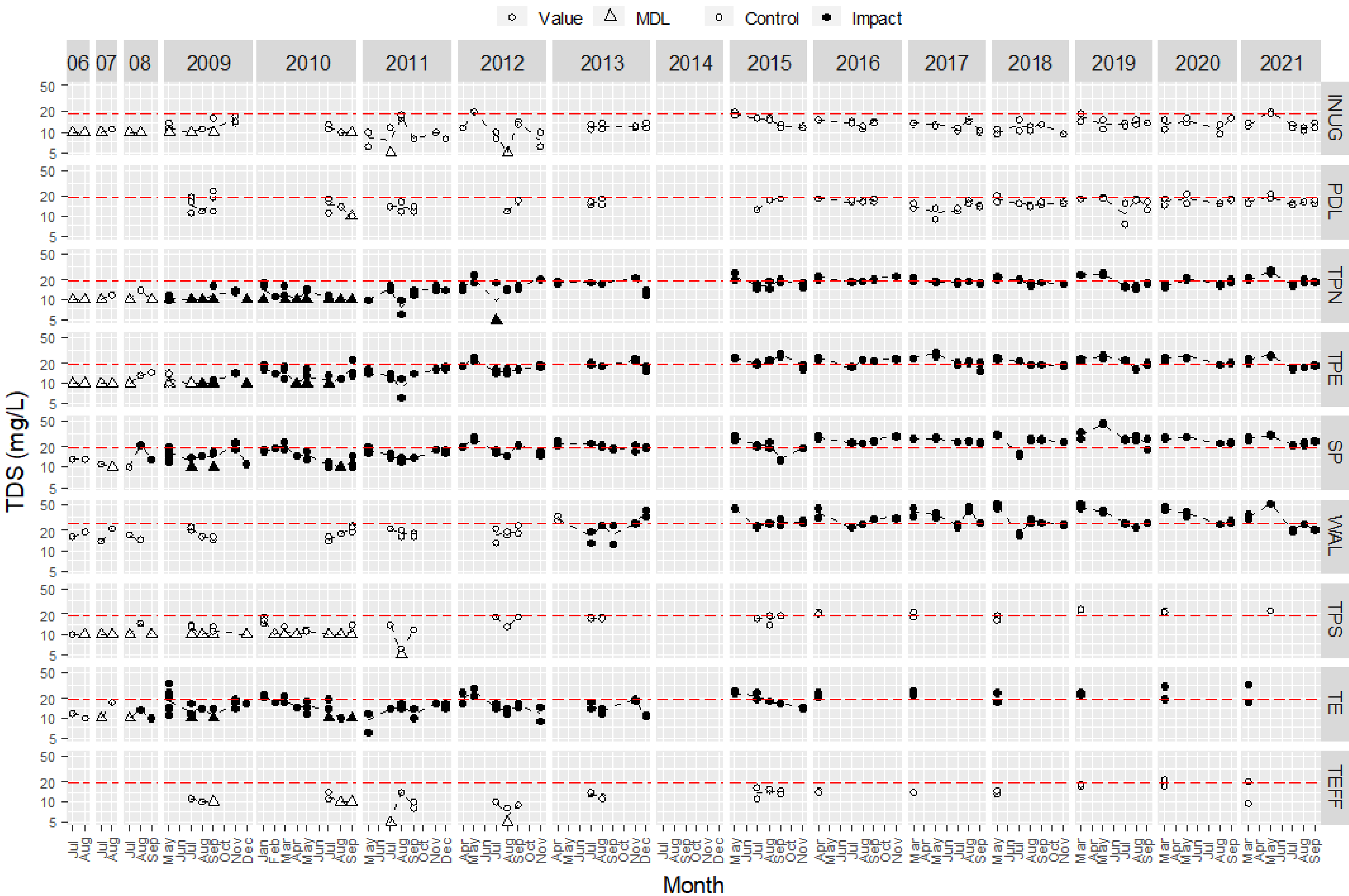


Figure 4-20. Bicarbonate alkalinity (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value. Bicarbonate alkalinity data from 2014 were removed due to data quality concerns. See Azimuth (2015c) for more details.

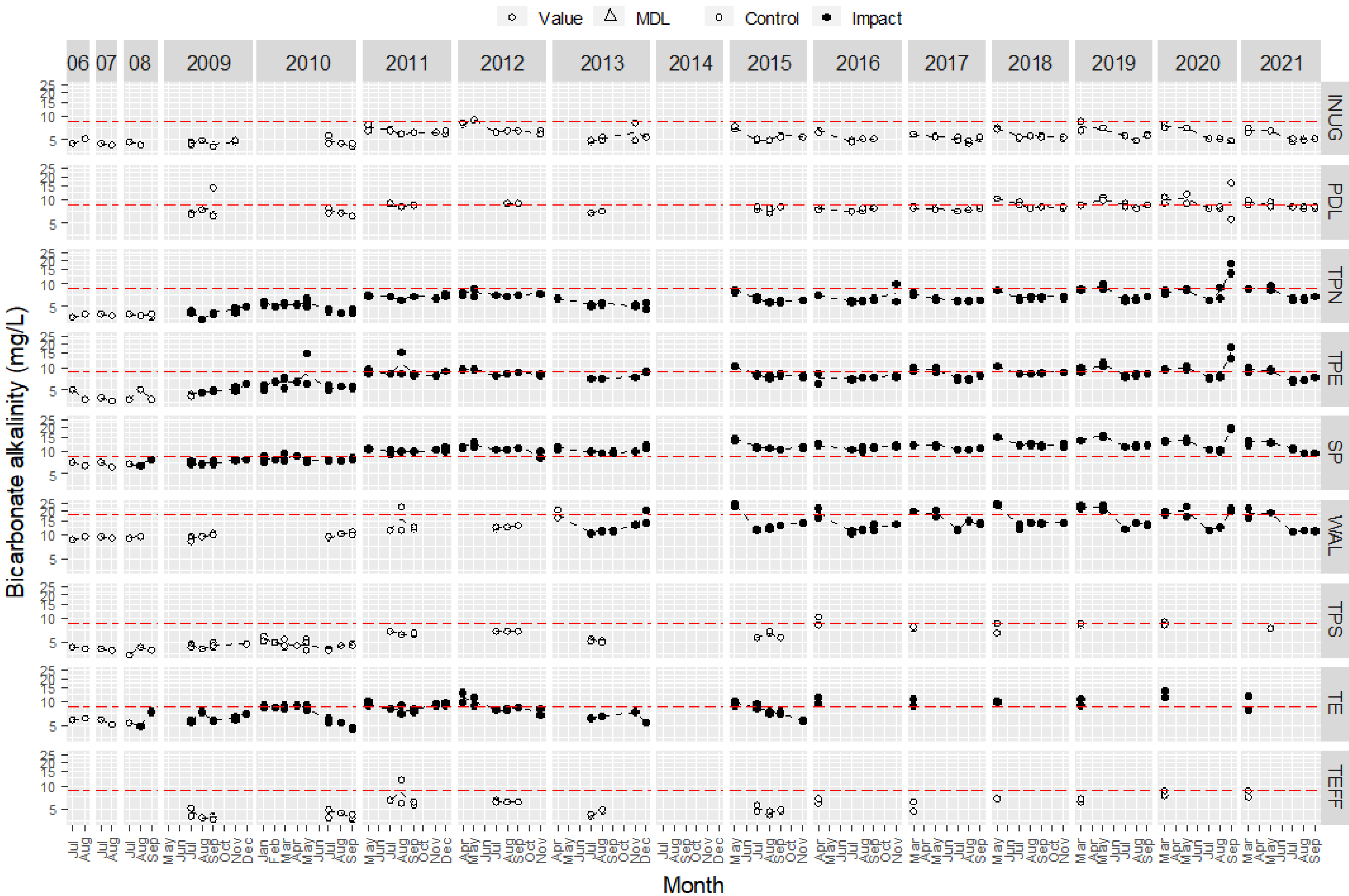


Figure 4-21. Total alkalinity (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value. Total alkalinity data from 2014 were removed due to data quality concerns. See Azimuth (2015c) for more details. The blue dashed line = FEIS screening prediction.

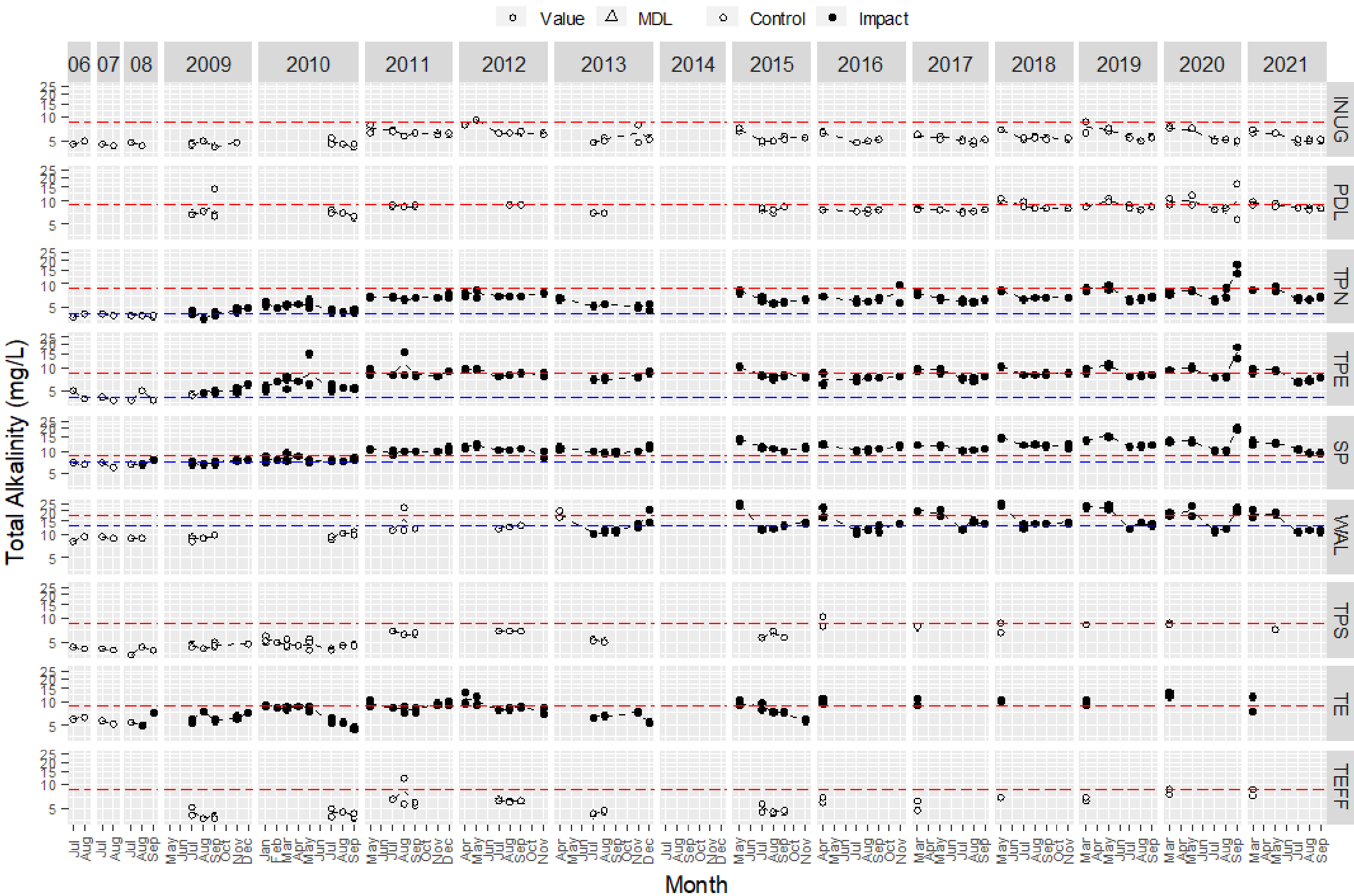


Figure 4-22. Ammonia-N (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value. The blue dashed line = FEIS screening prediction.

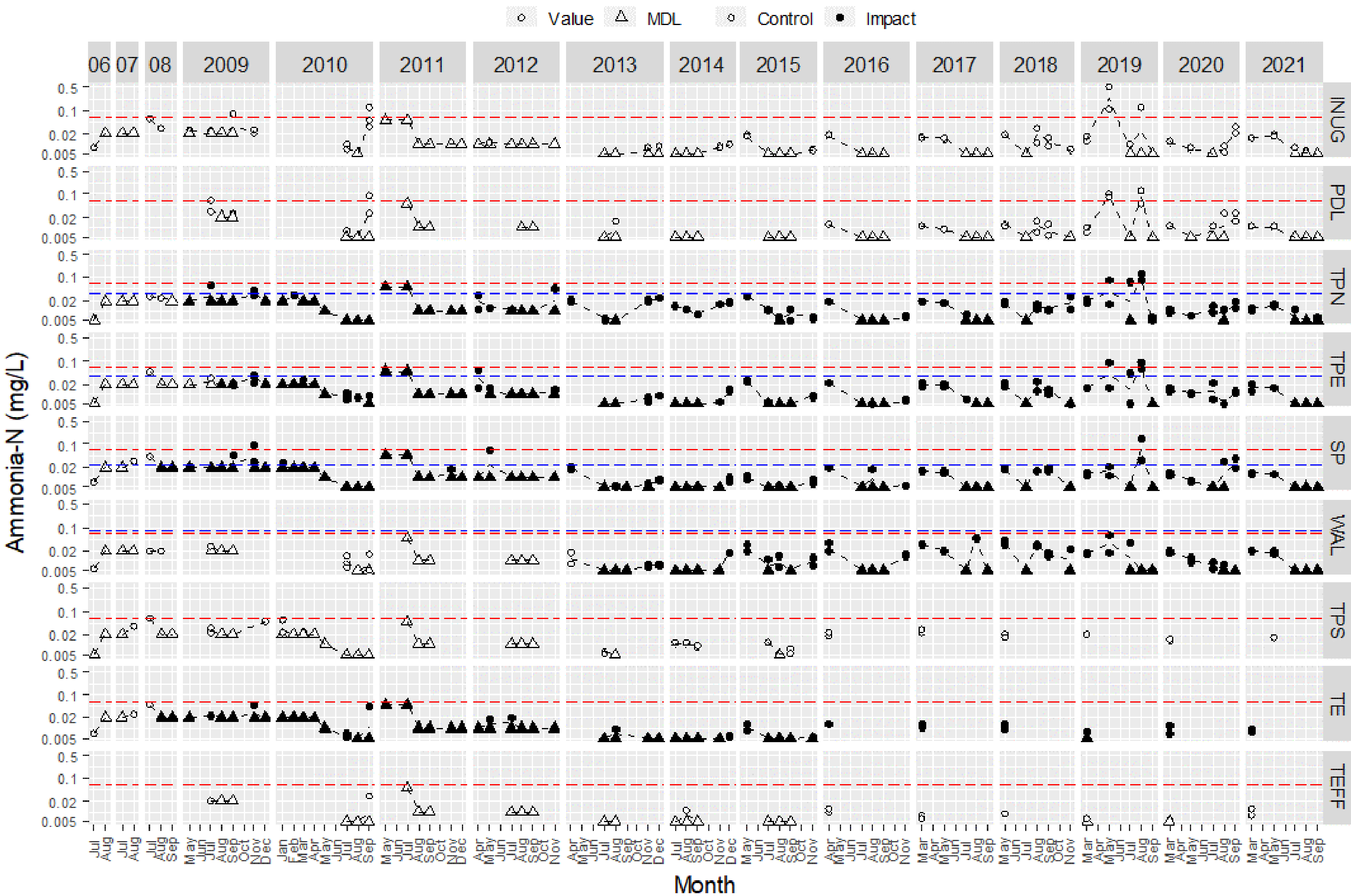


Figure 4-23. Chloride (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value. The blue dashed line = FEIS screening prediction.

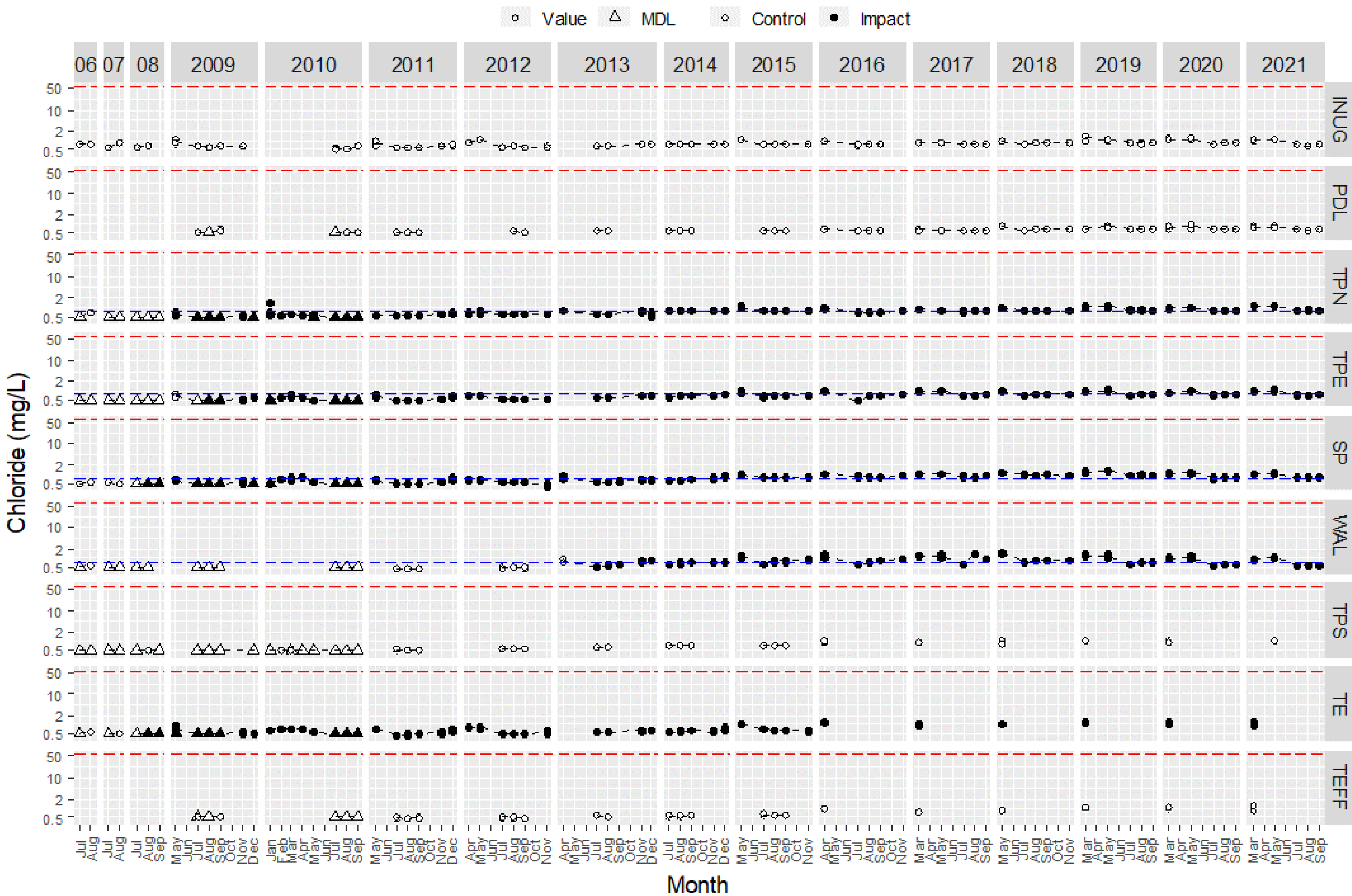


Figure 4-24. Fluoride (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value. The blue dashed line = FEIS screening prediction.

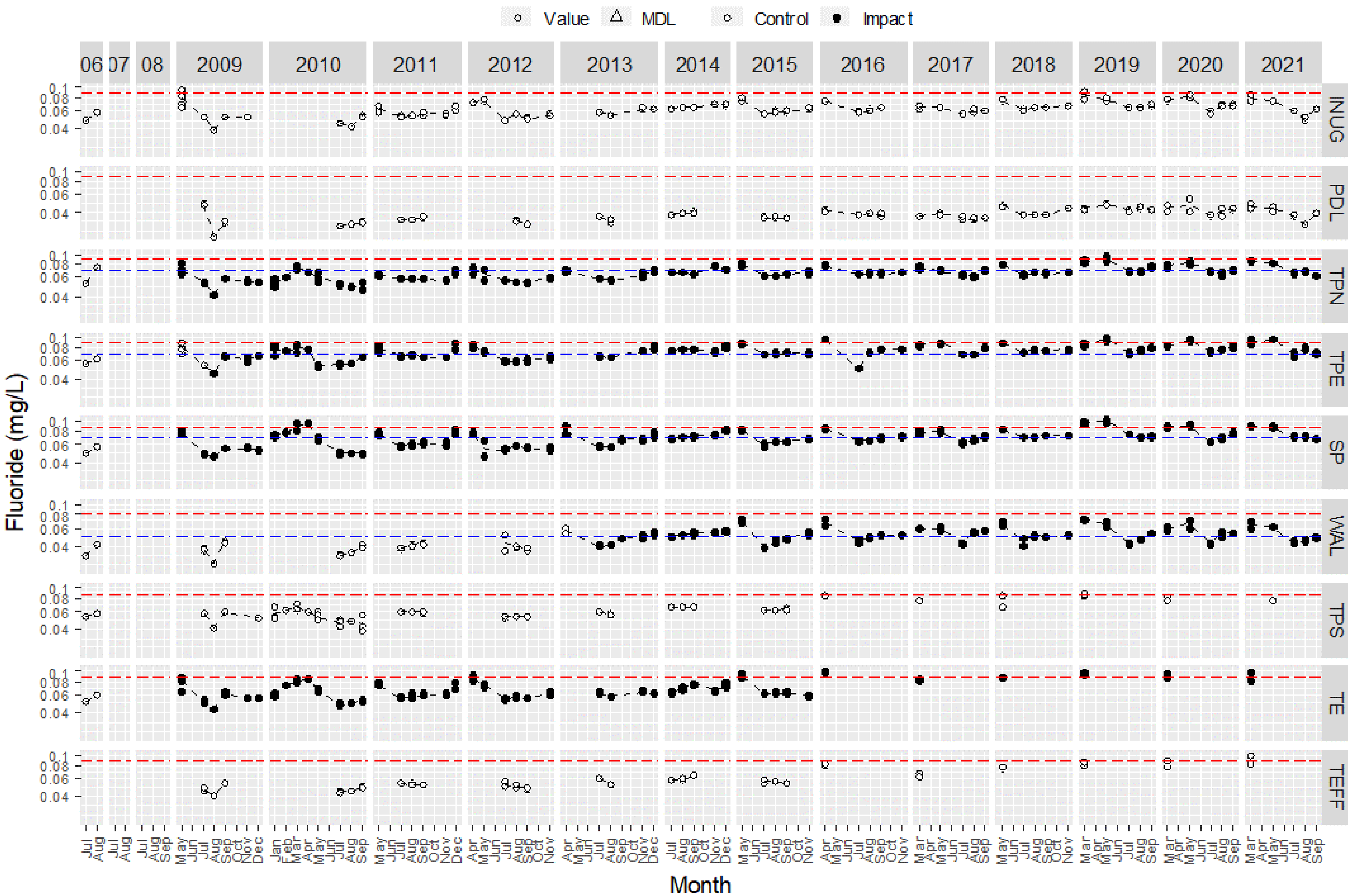


Figure 4-25. Nitrate-N (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value.

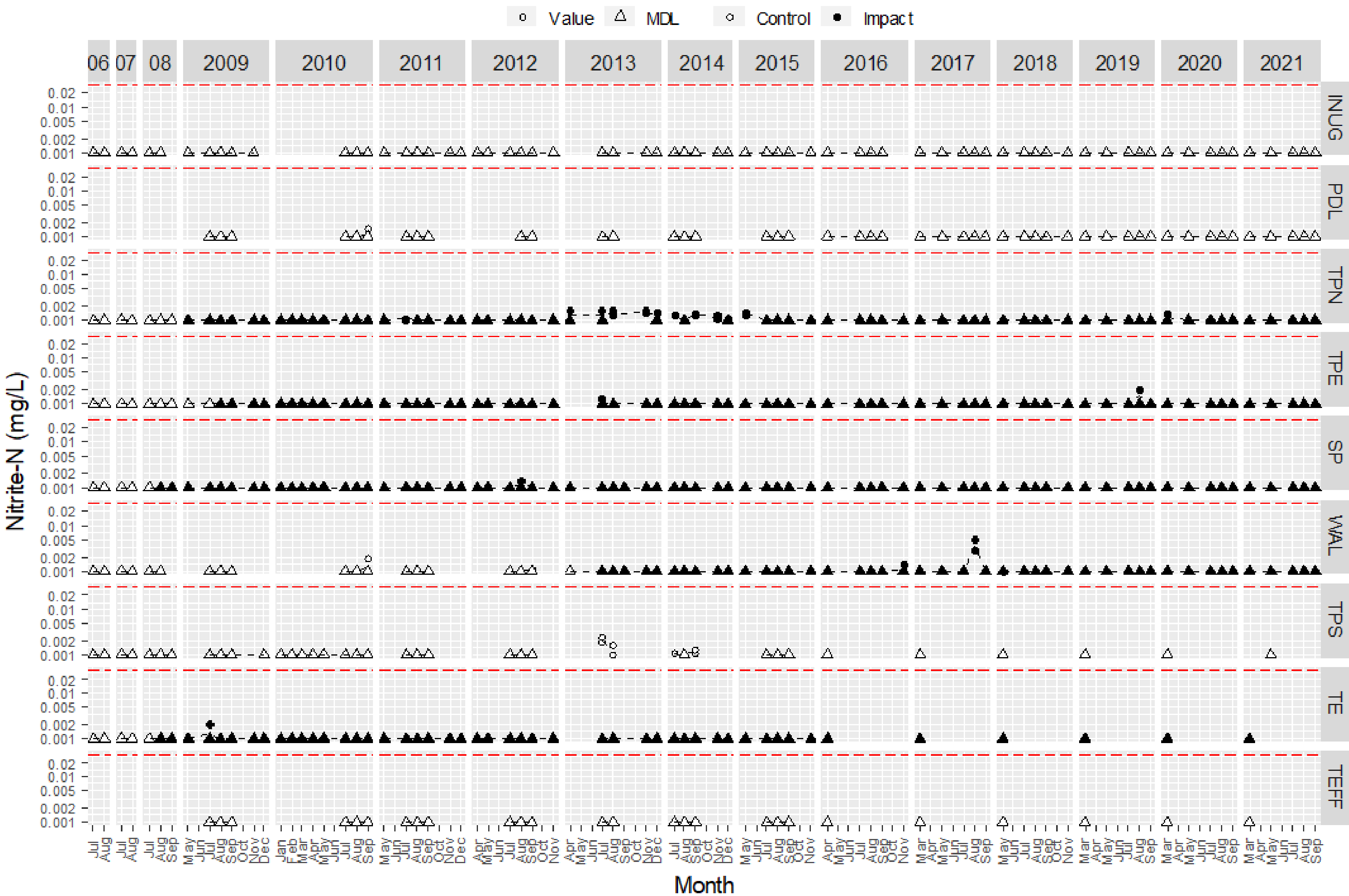


Figure 4-26. Total Kjeldahl Nitrogen (TKN; mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value. TKN data from 2014 were removed due to data quality concerns. See Azimuth (2015c) for more details.

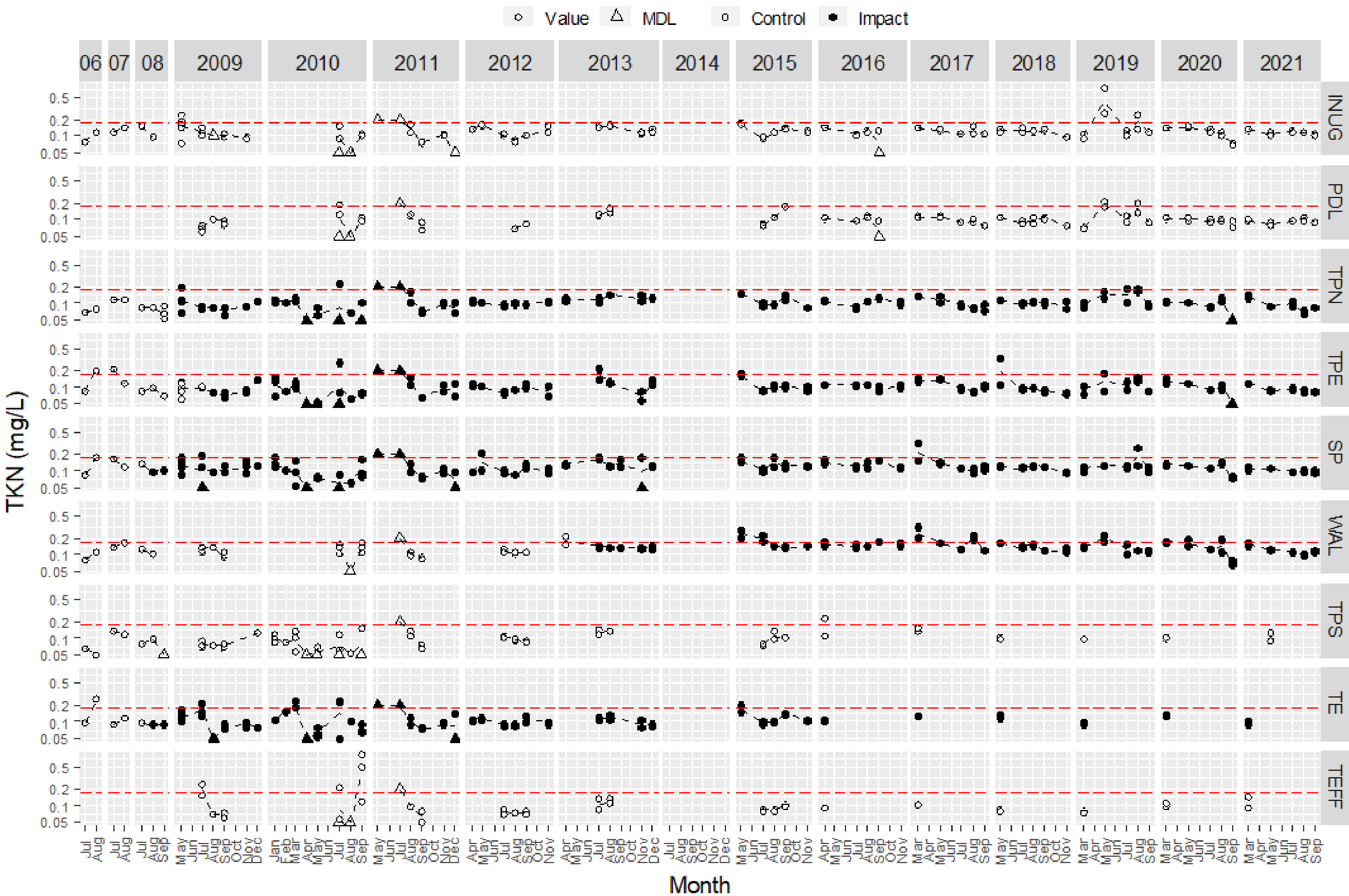


Figure 4-27. Total phosphorous (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value. The blue dashed line = FEIS screening prediction.

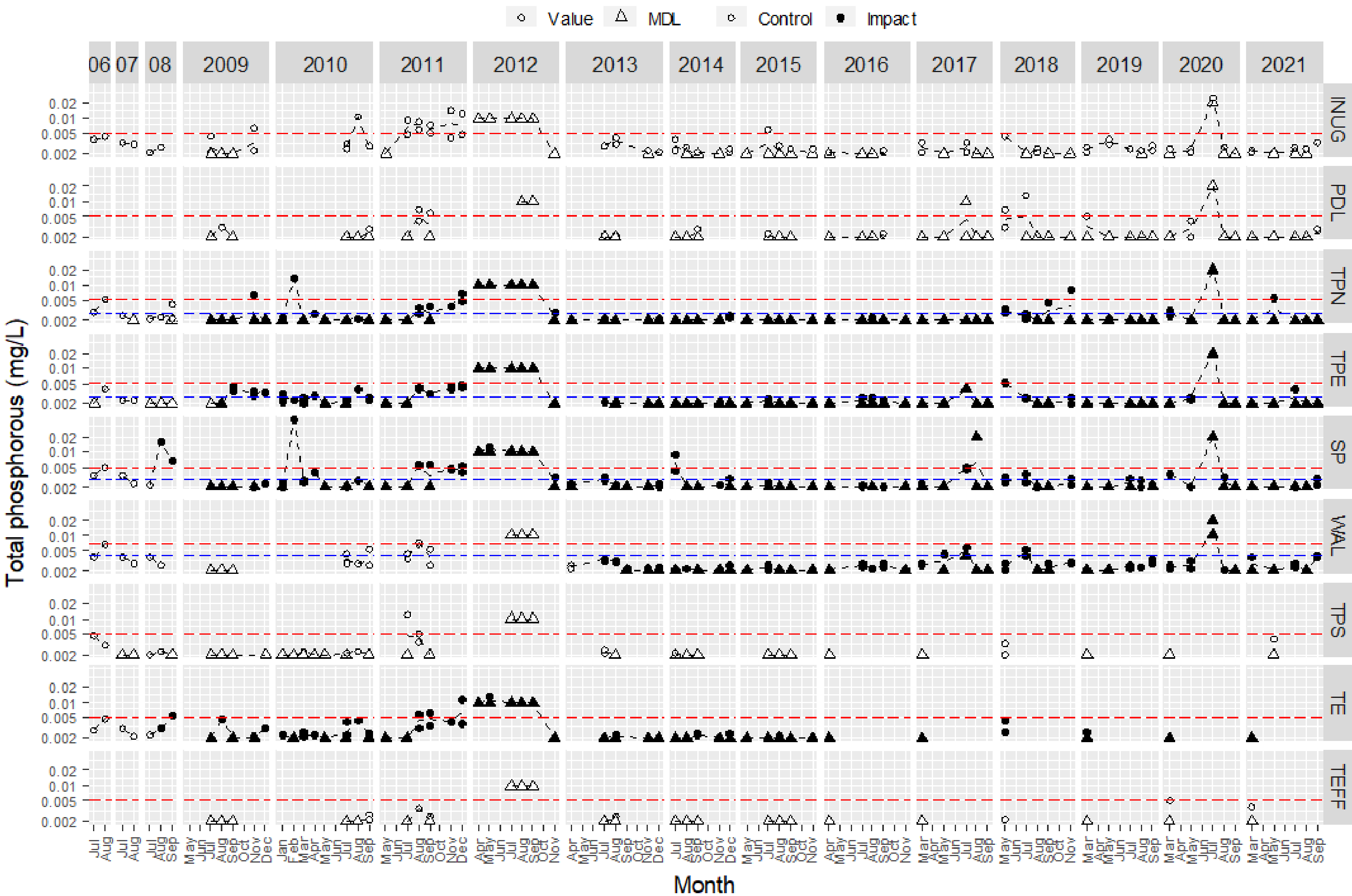


Figure 4-28. Reactive silica (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value.

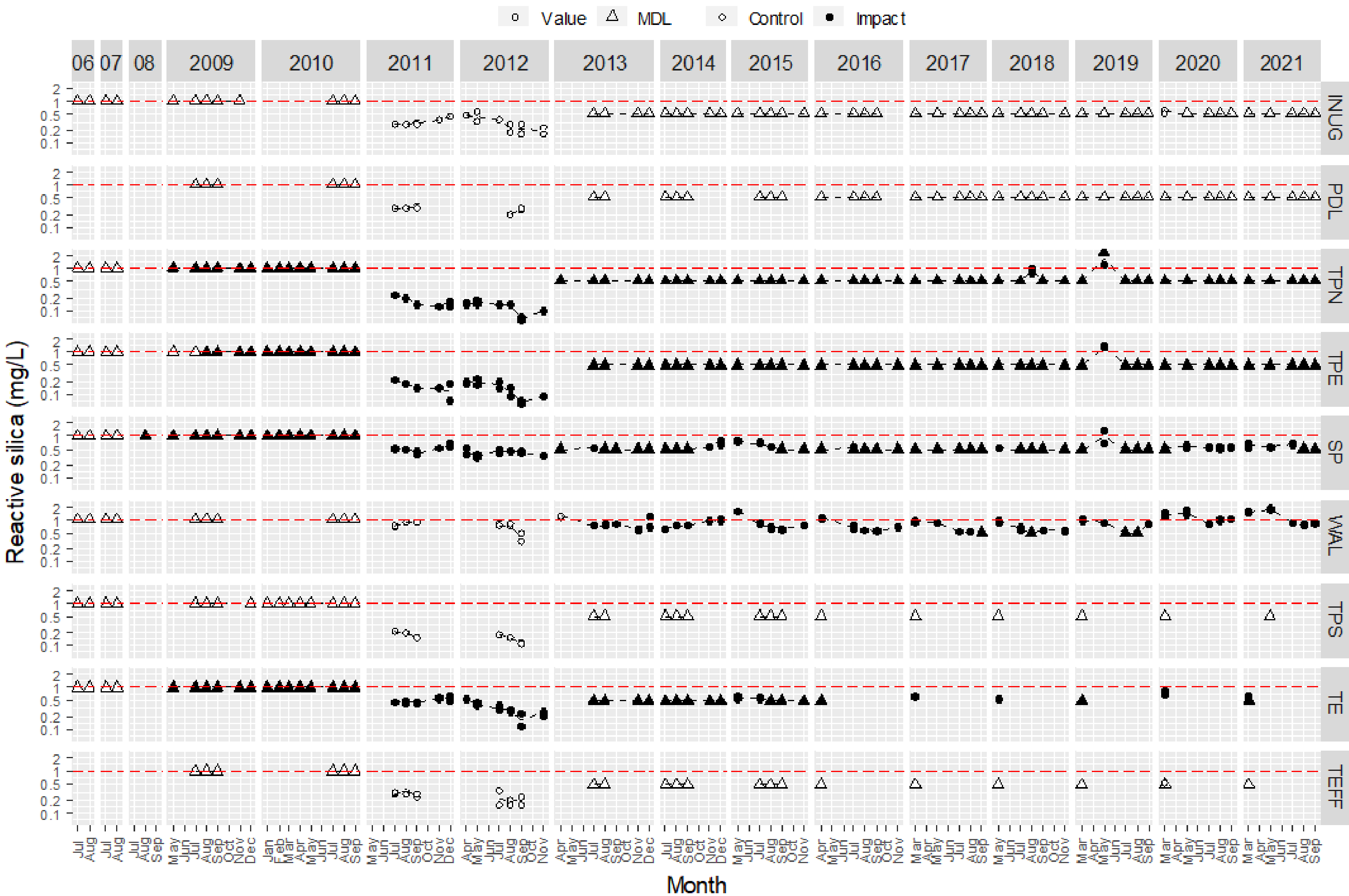


Figure 4-29. Sulphate (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value. The blue dashed line = FEIS screening prediction.

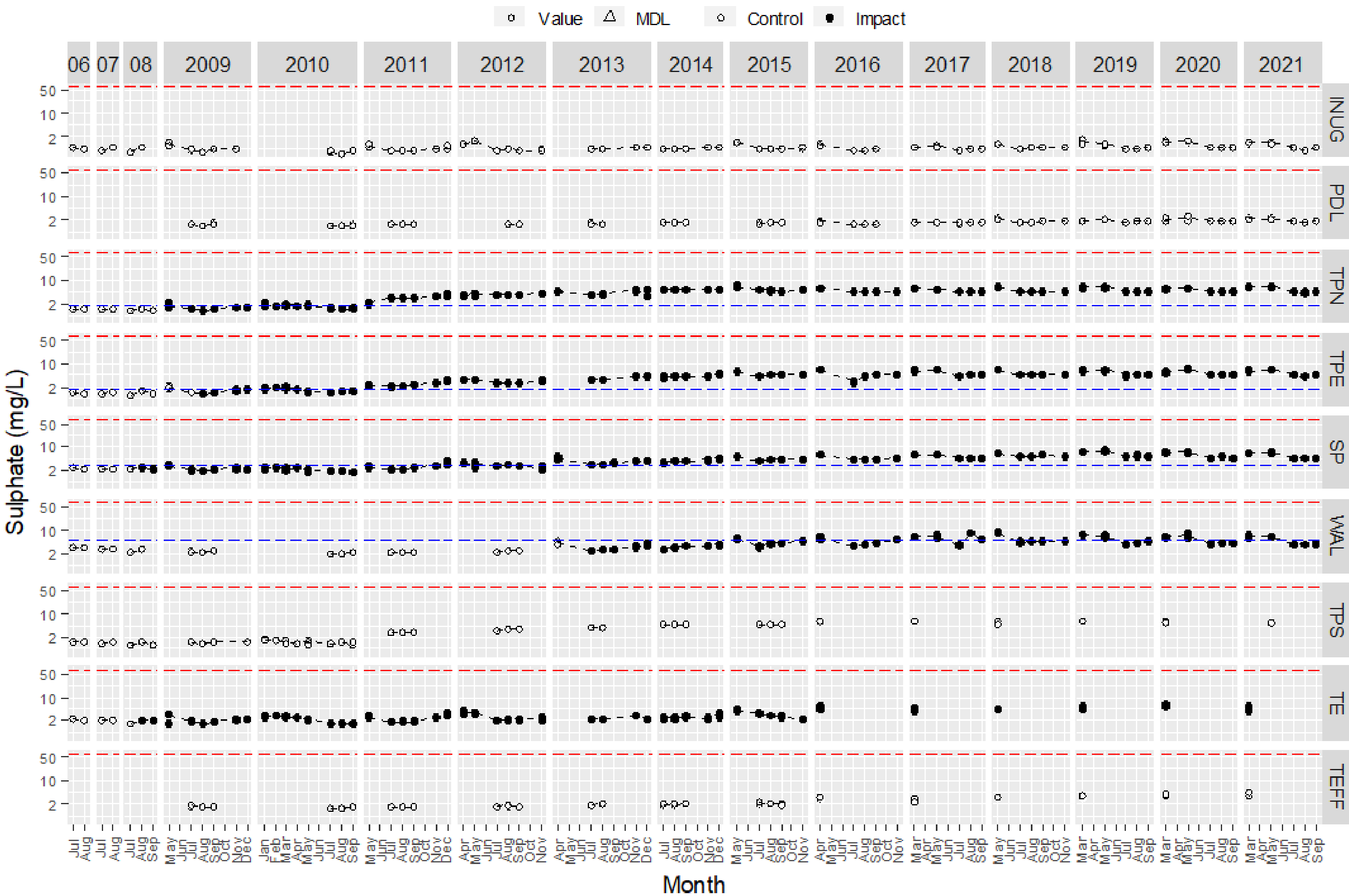


Figure 4-30. Dissolved Organic Carbon (DOC; mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value.

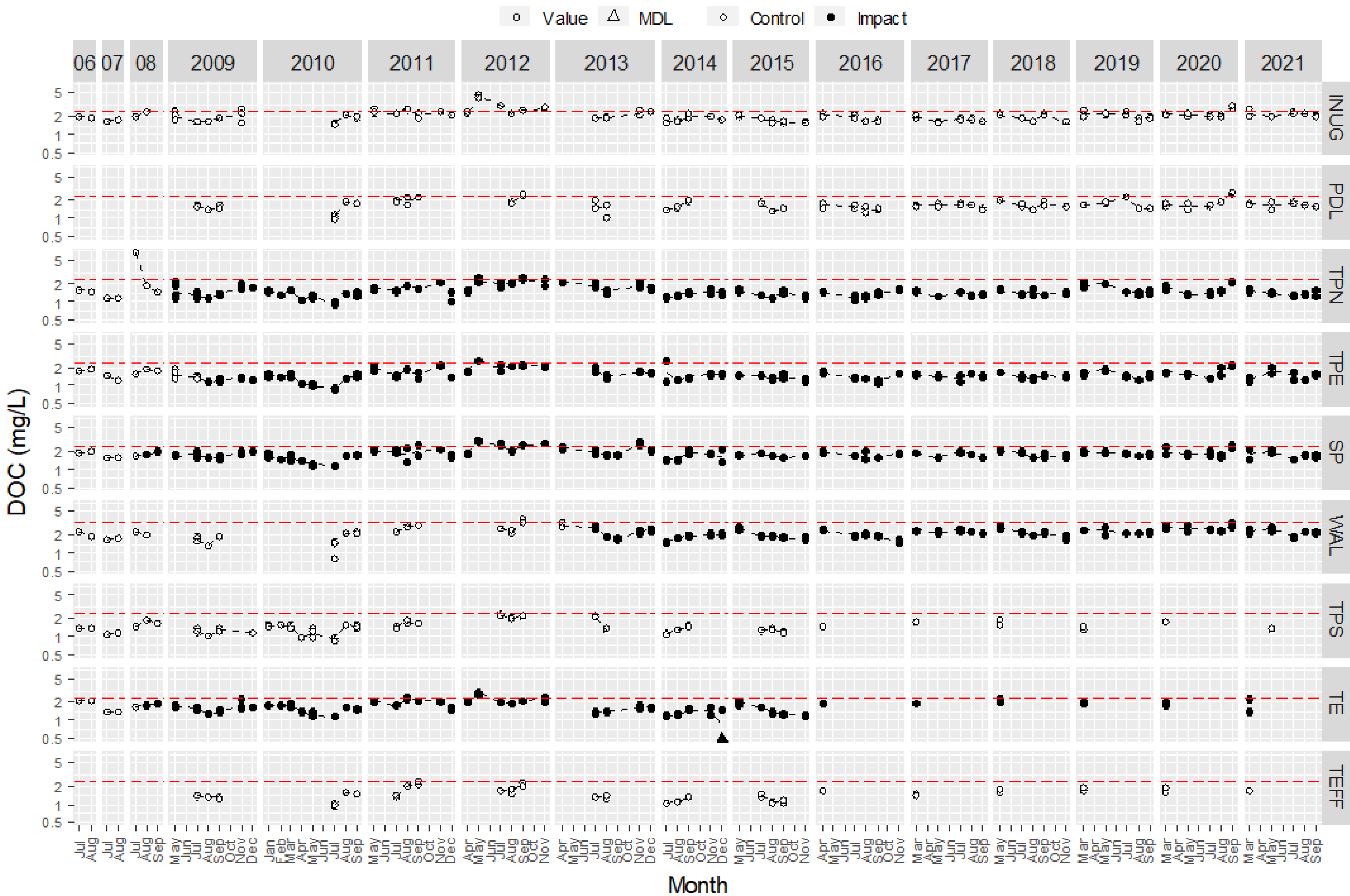


Figure 4-31. Total Organic Carbon (TOC; mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value.

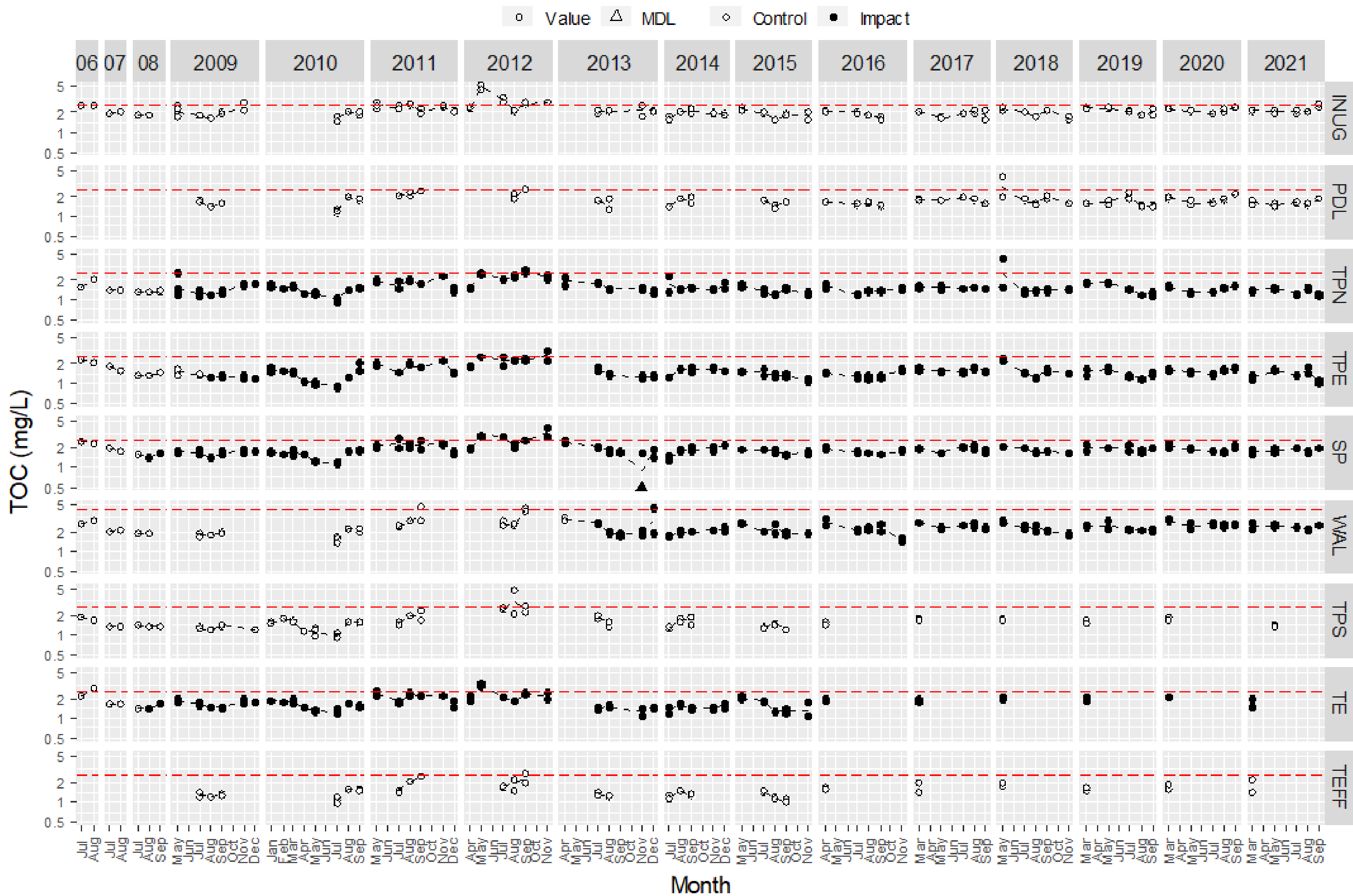


Figure 4-32. Total aluminum (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value. The blue dashed line = FEIS screening prediction.

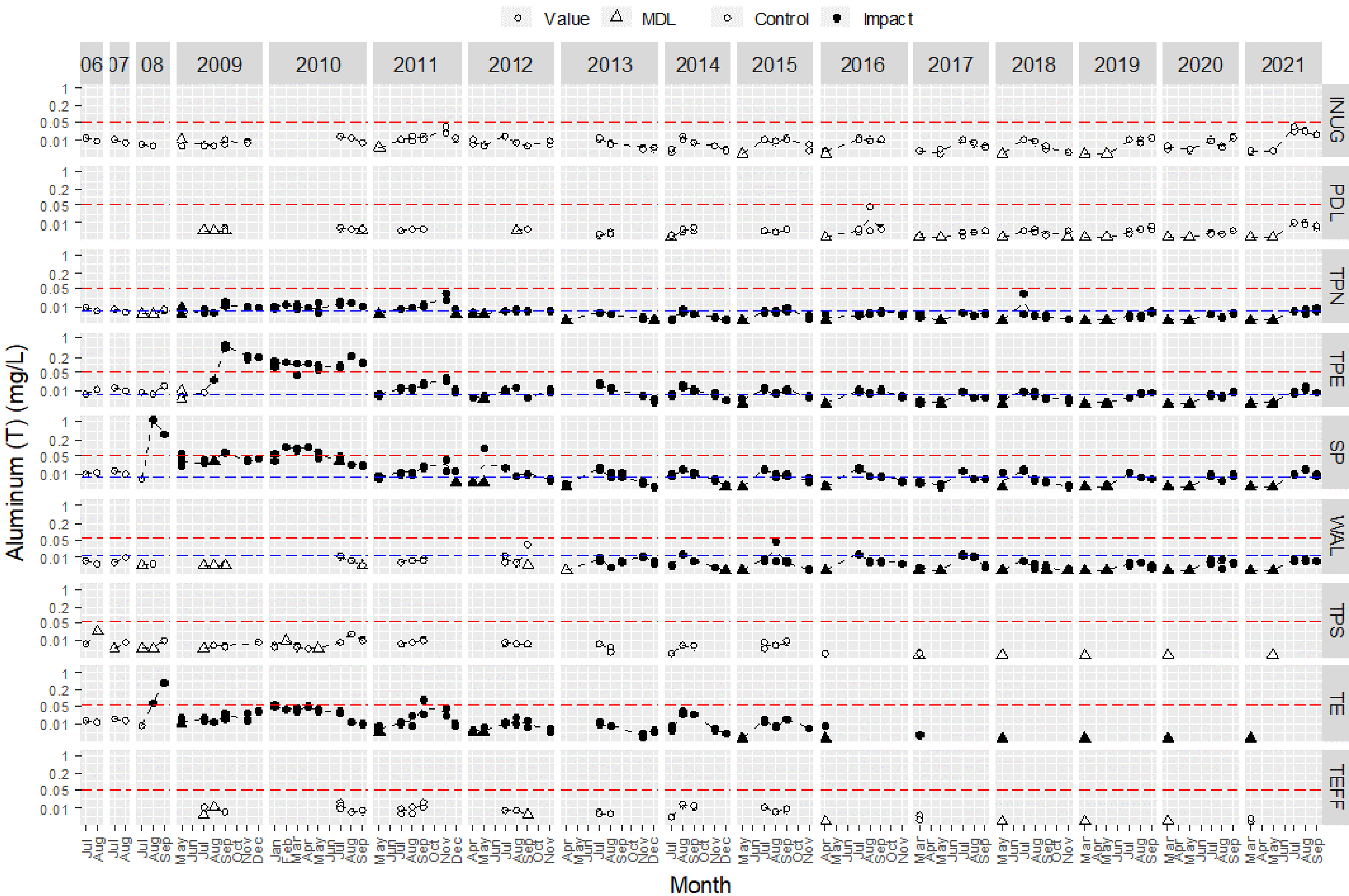


Figure 4-33. Total arsenic (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value. The blue dashed line = FEIS screening prediction.

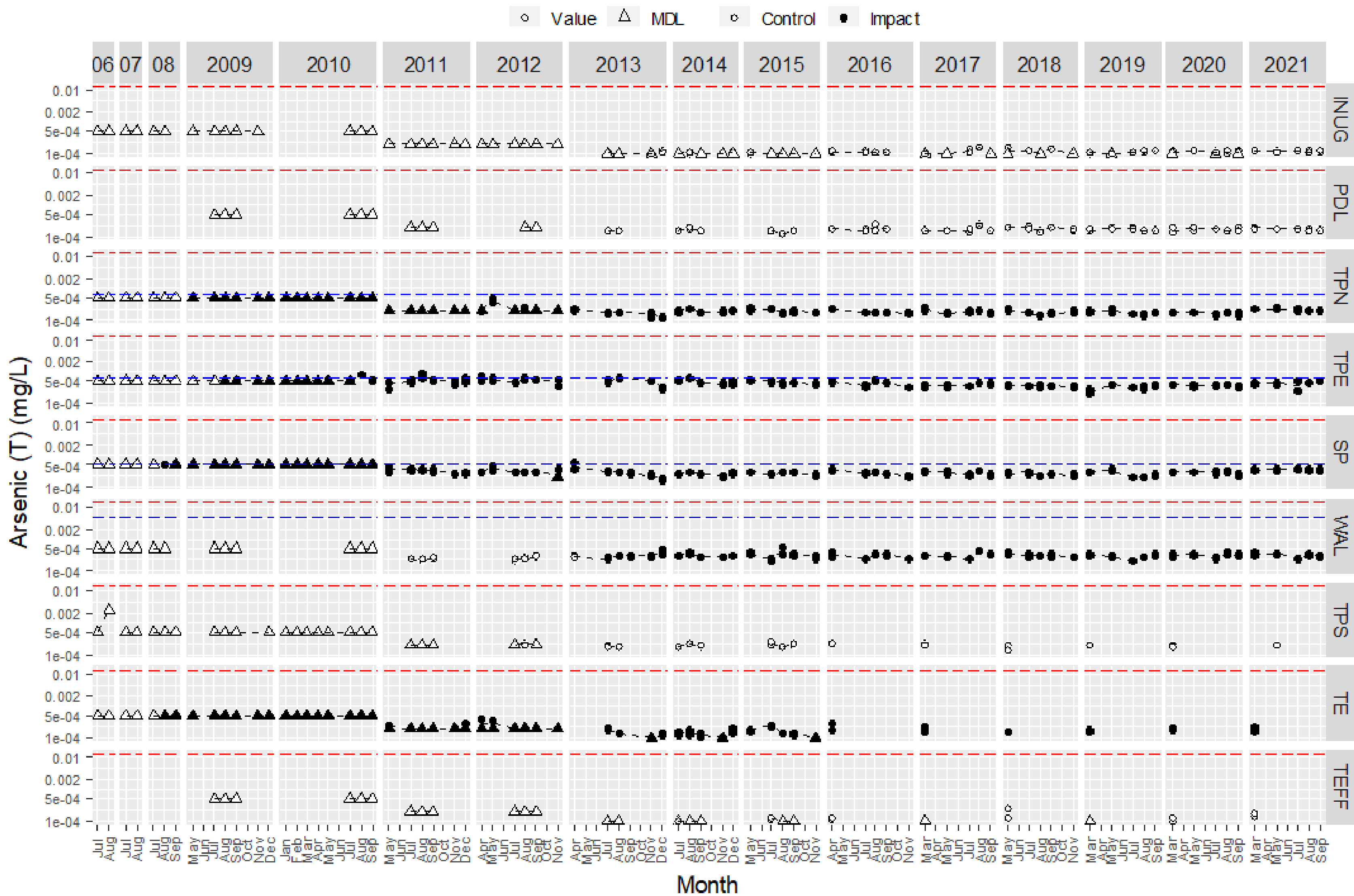


Figure 4-34. Total barium (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value. The blue dashed line = FEIS screening prediction.

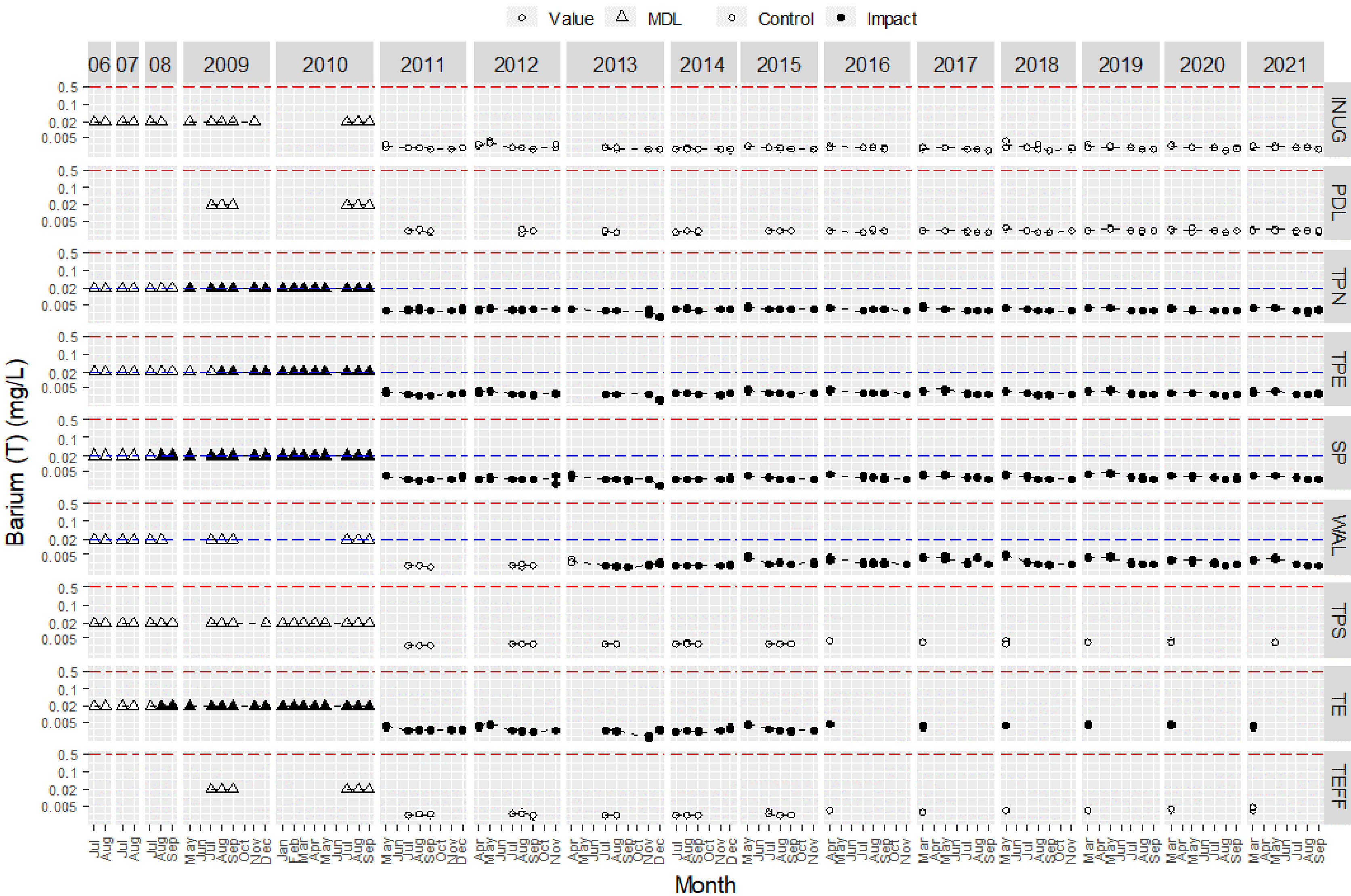


Figure 4-35. Total calcium (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value. The blue dashed line = FEIS screening prediction.

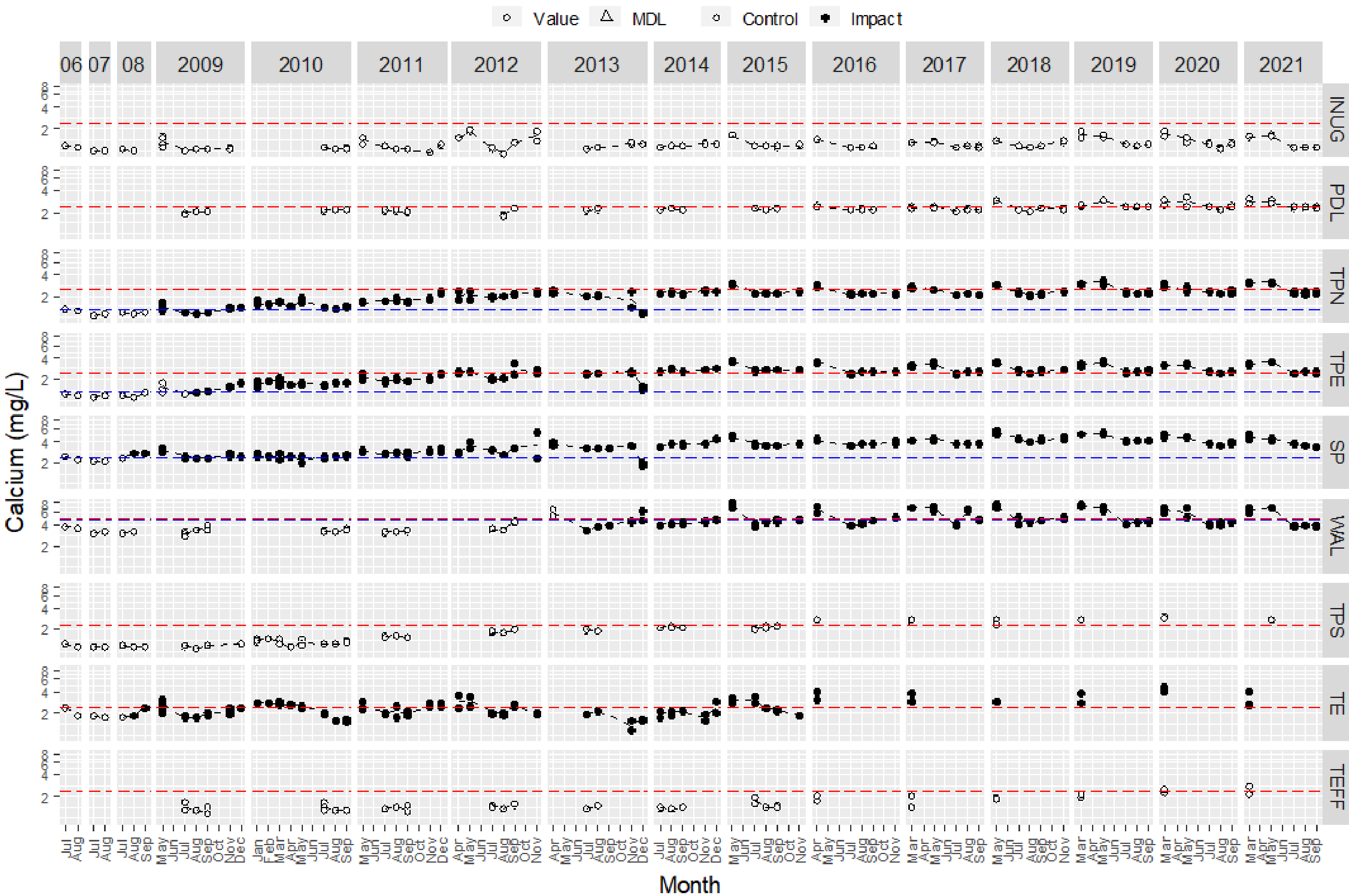


Figure 4-36. Total chromium (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value. The blue dashed line = FEIS screening prediction. The detection limit for total chromium was adjusted from 0.0001 mg/L to 0.0005 mg/L for samples collected in May, July, August and September, 2021.

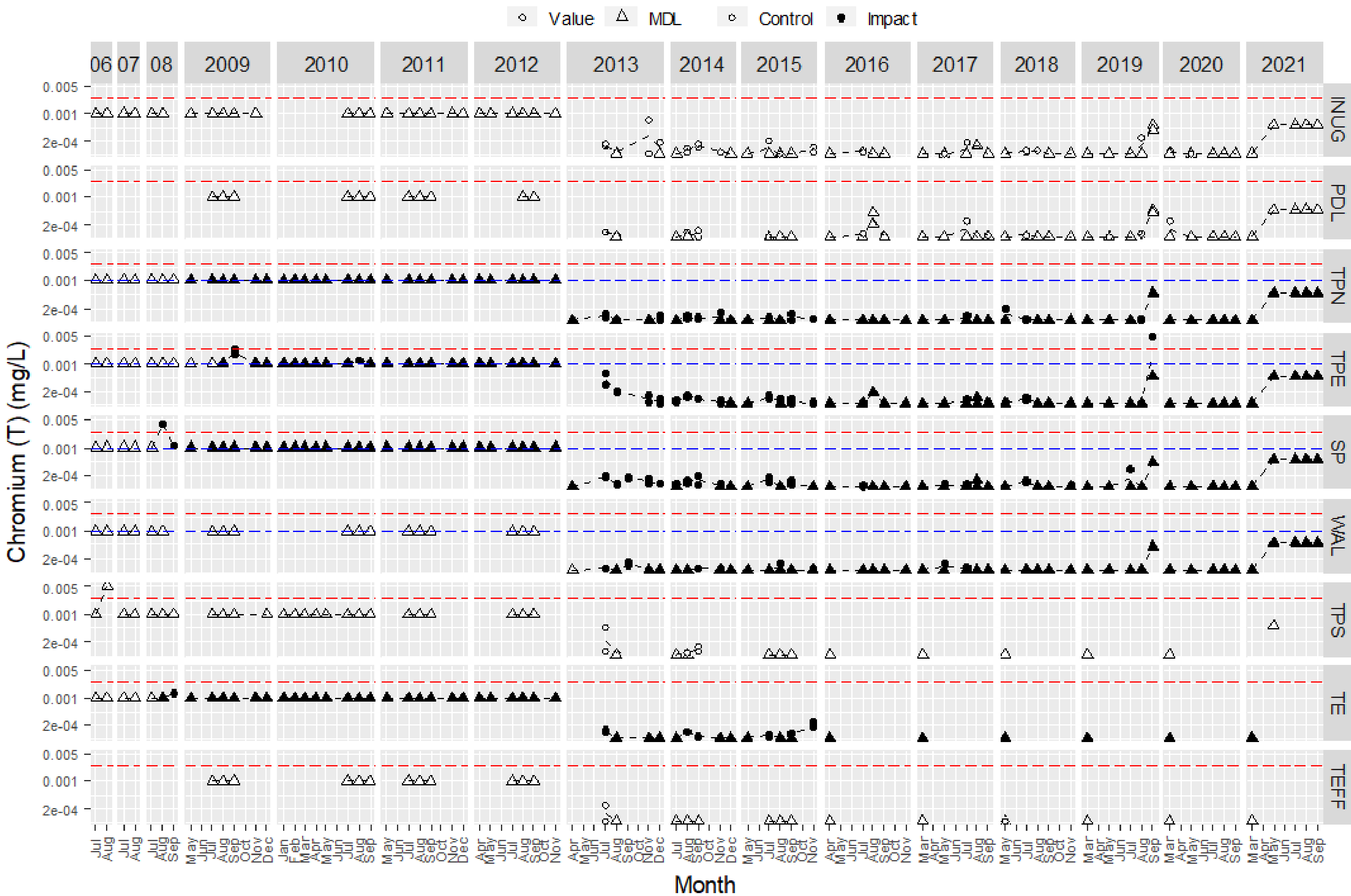


Figure 4-37. Total copper (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value. The blue dashed line = FEIS screening prediction.

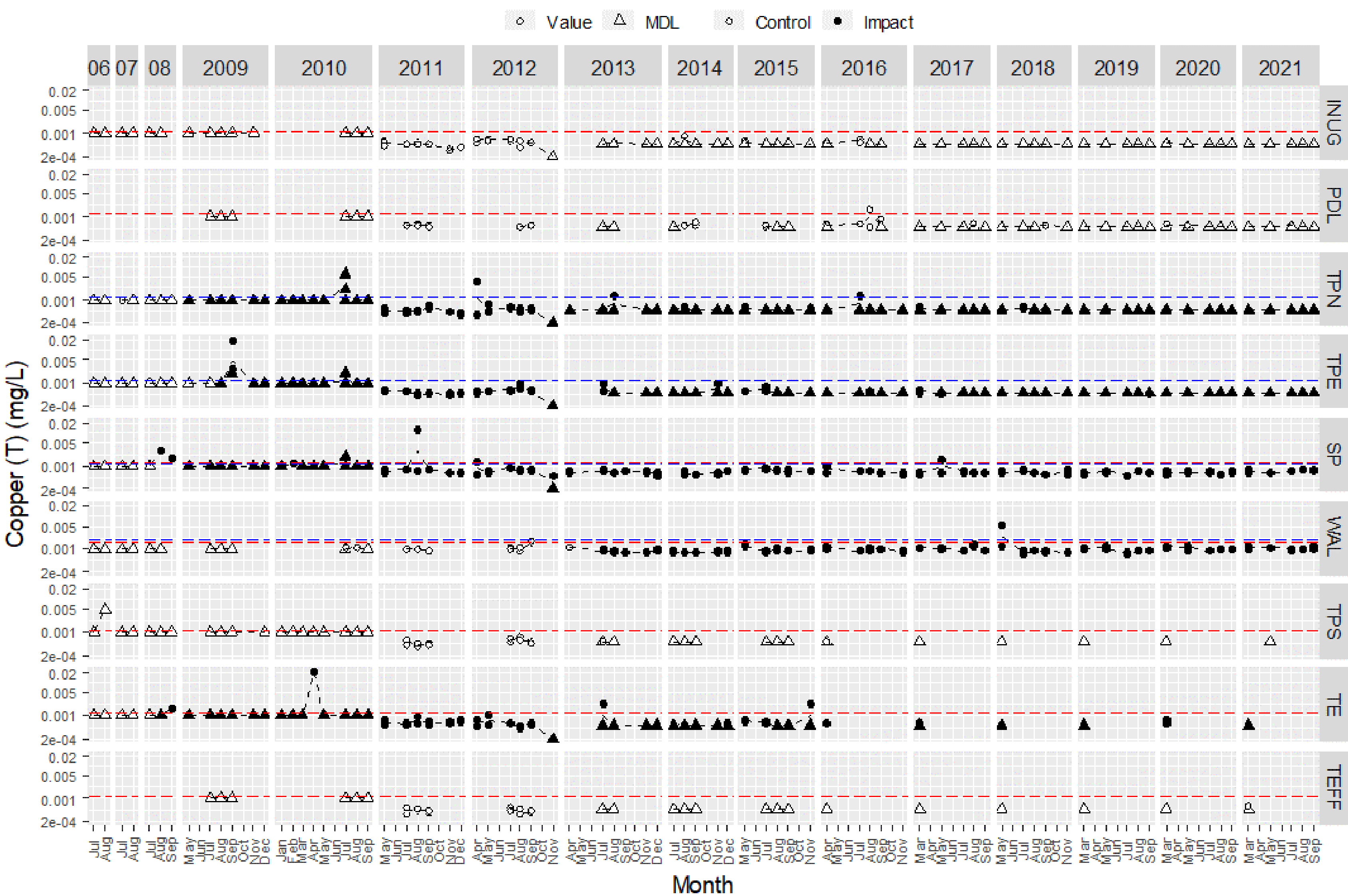


Figure 4-38. Total iron (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value. The blue dashed line = FEIS screening prediction.

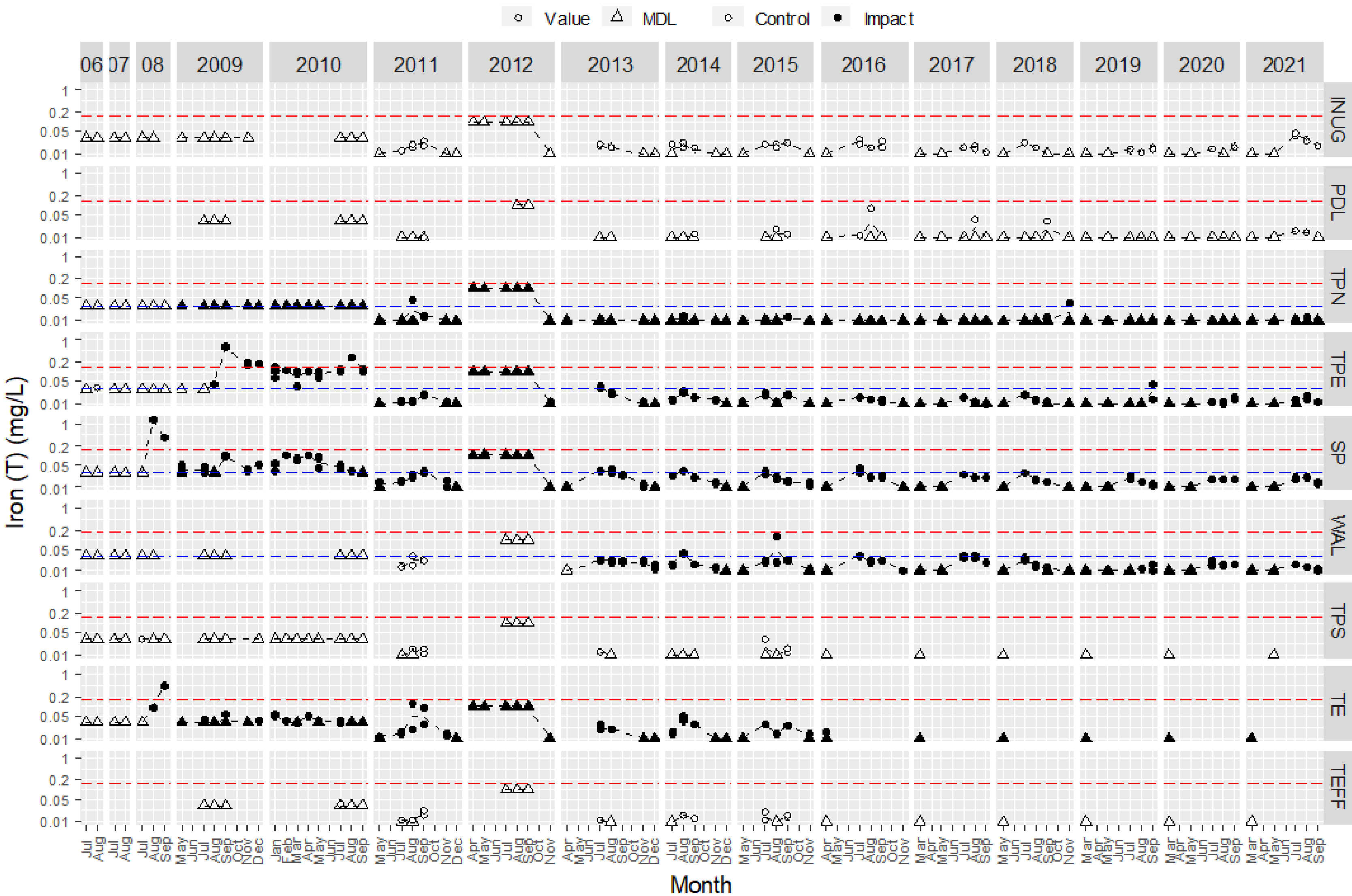


Figure 4-39. Total magnesium (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value. The blue dashed line = FEIS screening prediction.

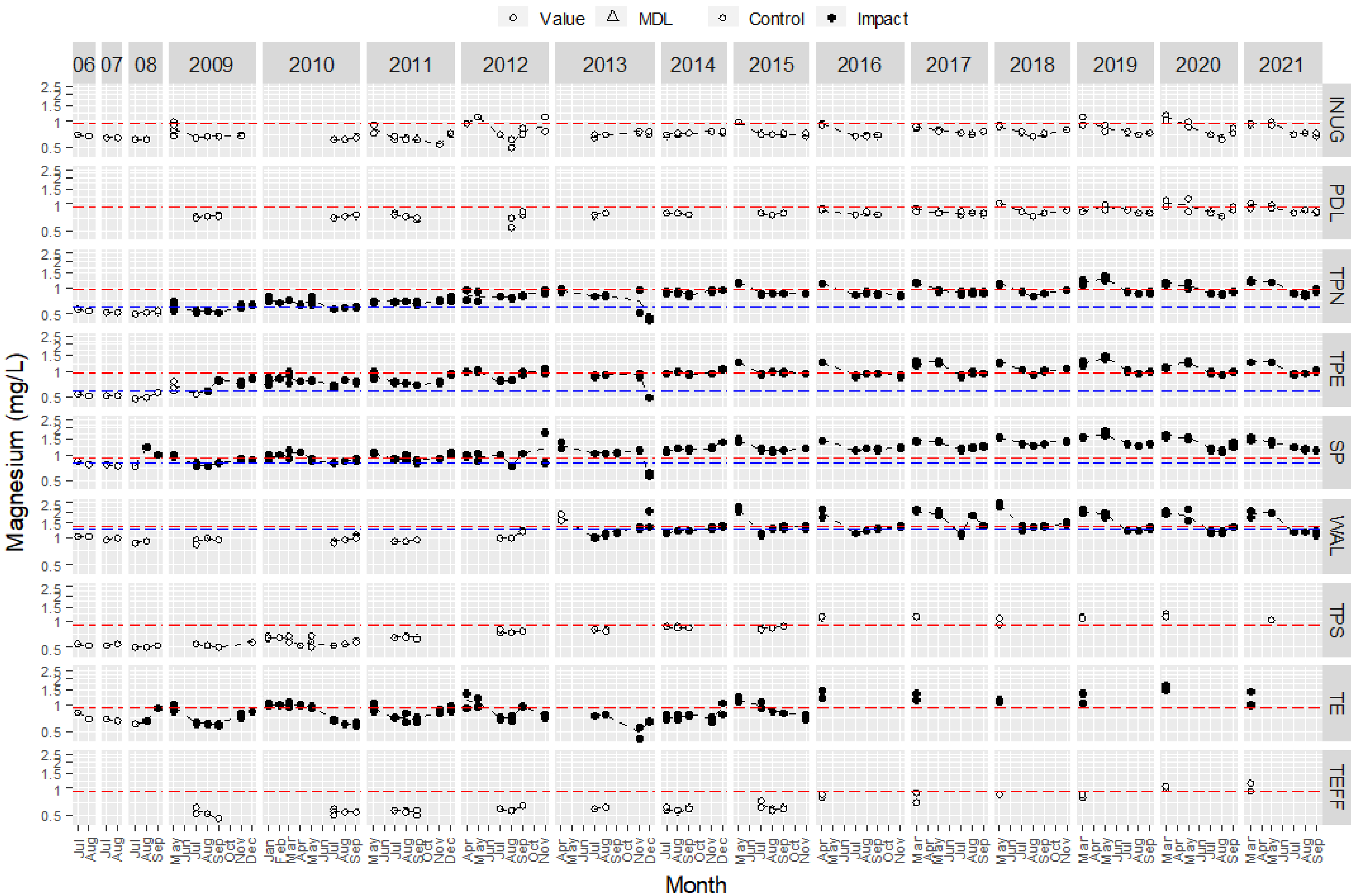


Figure 4-40. Total manganese (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value. The blue dashed line = FEIS screening prediction.

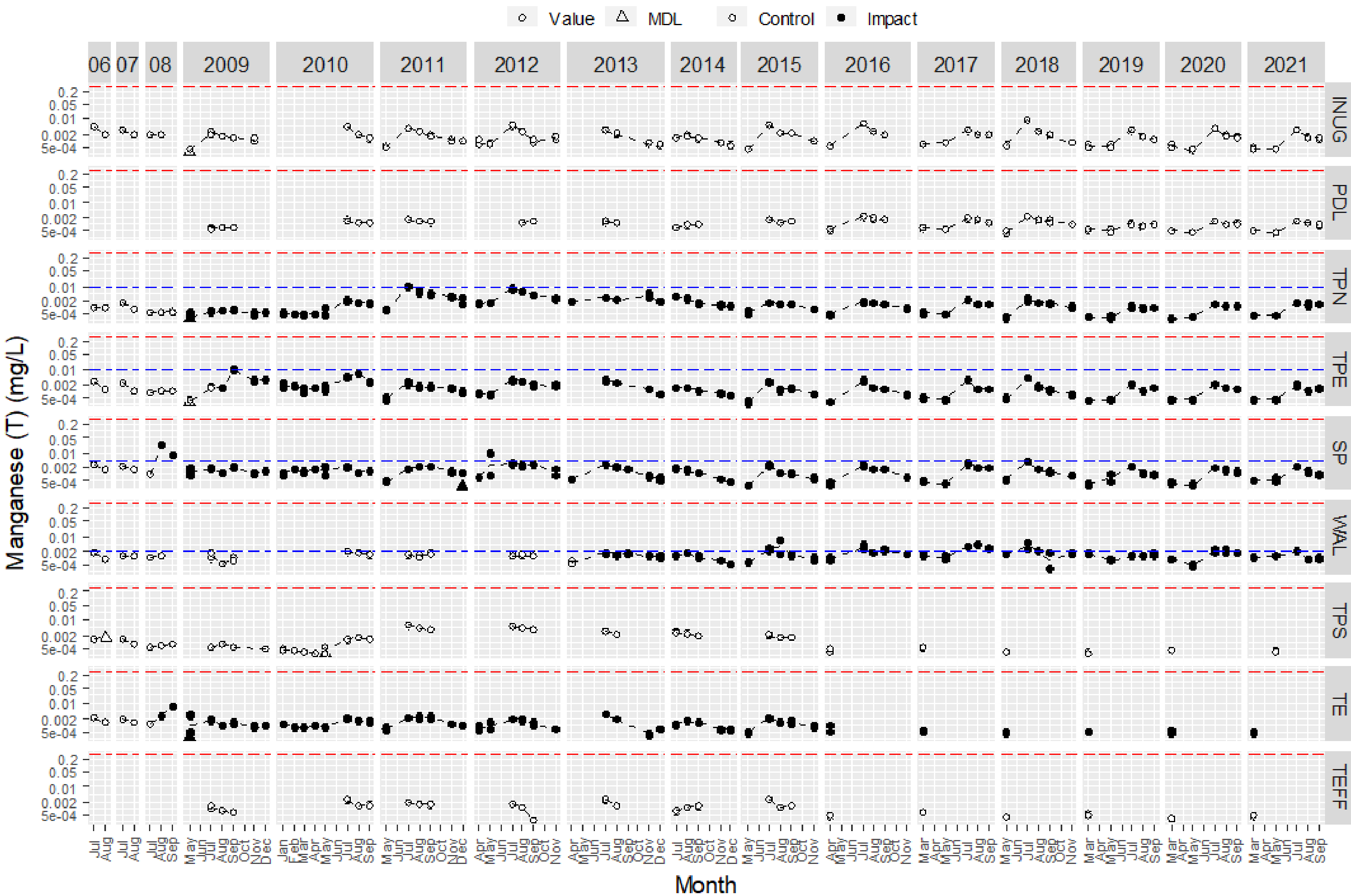


Figure 4-41. Total molybdenum (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value. The blue dashed line = FEIS screening prediction.

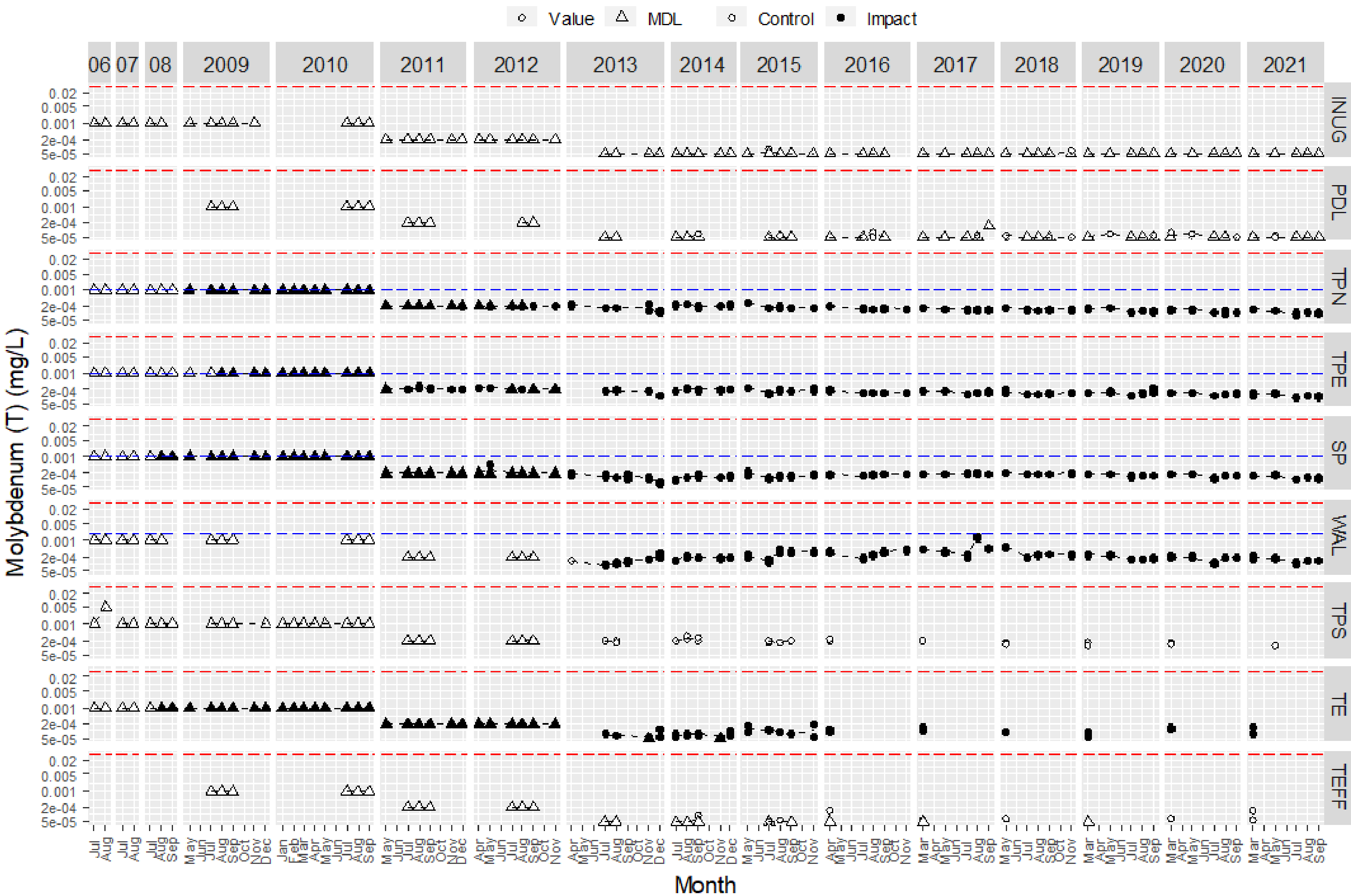


Figure 4-42. Total nickel (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value. The blue dashed line = FEIS screening prediction.

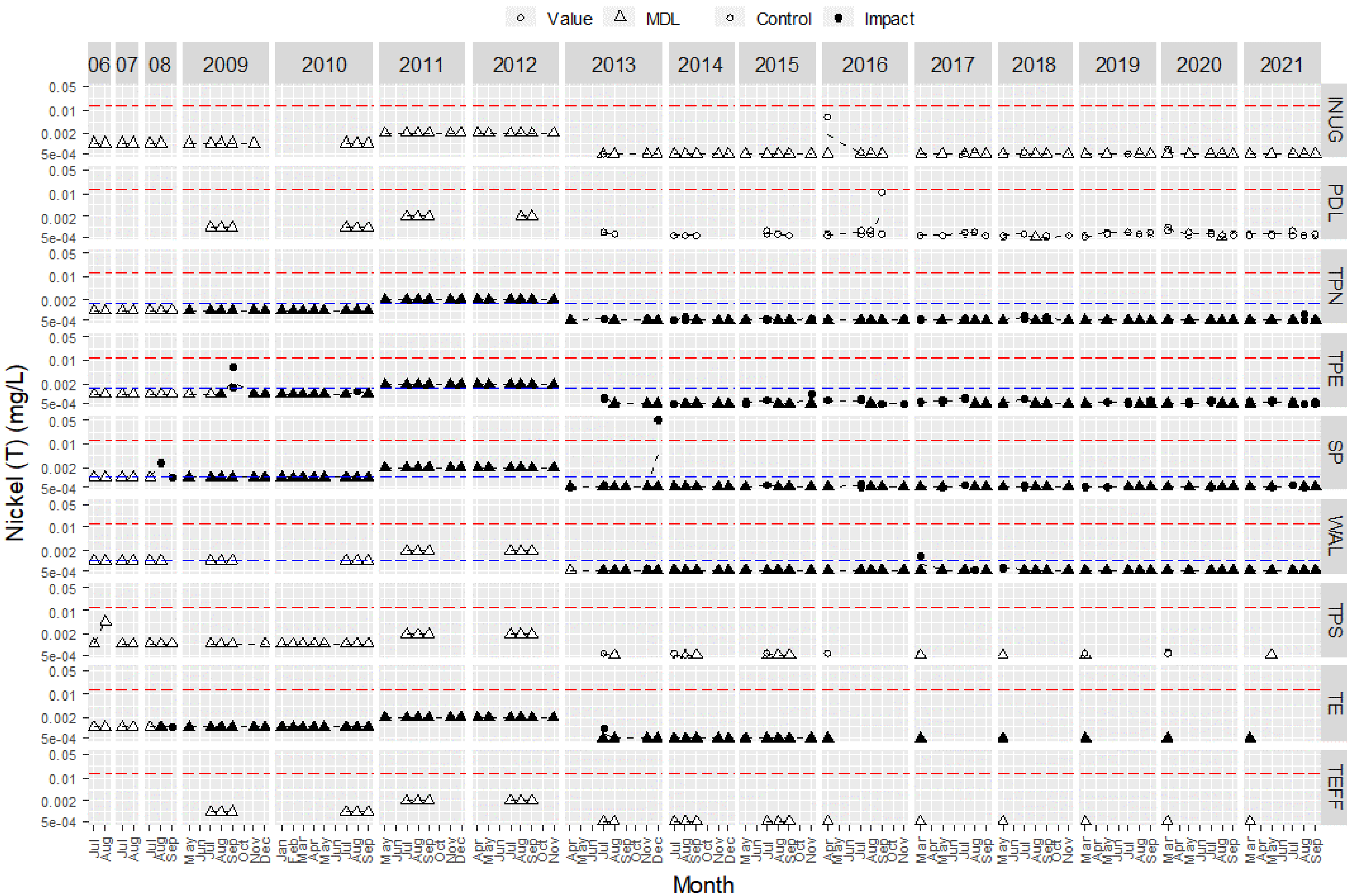


Figure 4-43. Total potassium (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value. The blue dashed line = FEIS screening prediction.

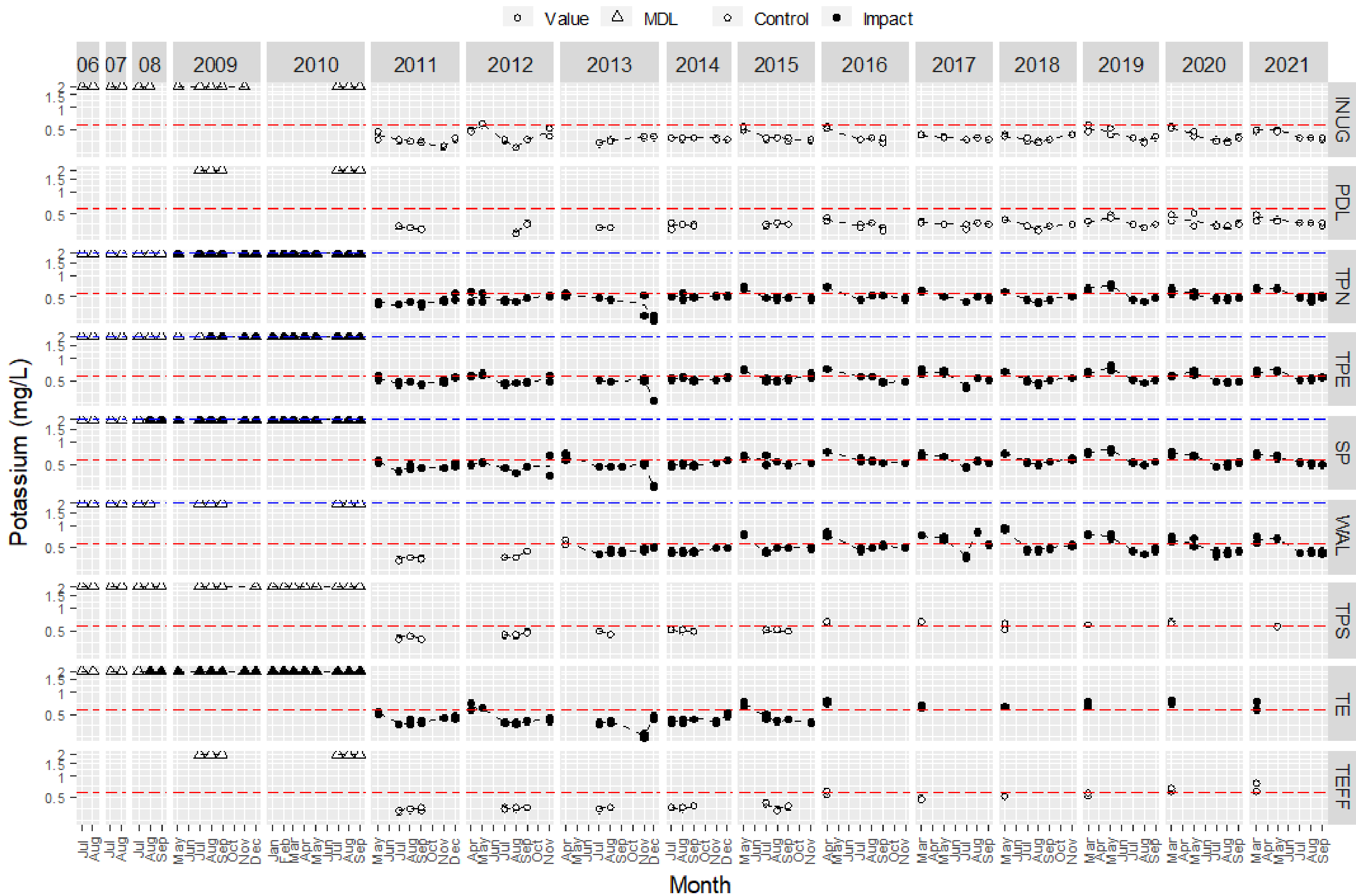


Figure 4-44. Total silicon (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value. The blue dashed line = FEIS screening prediction.

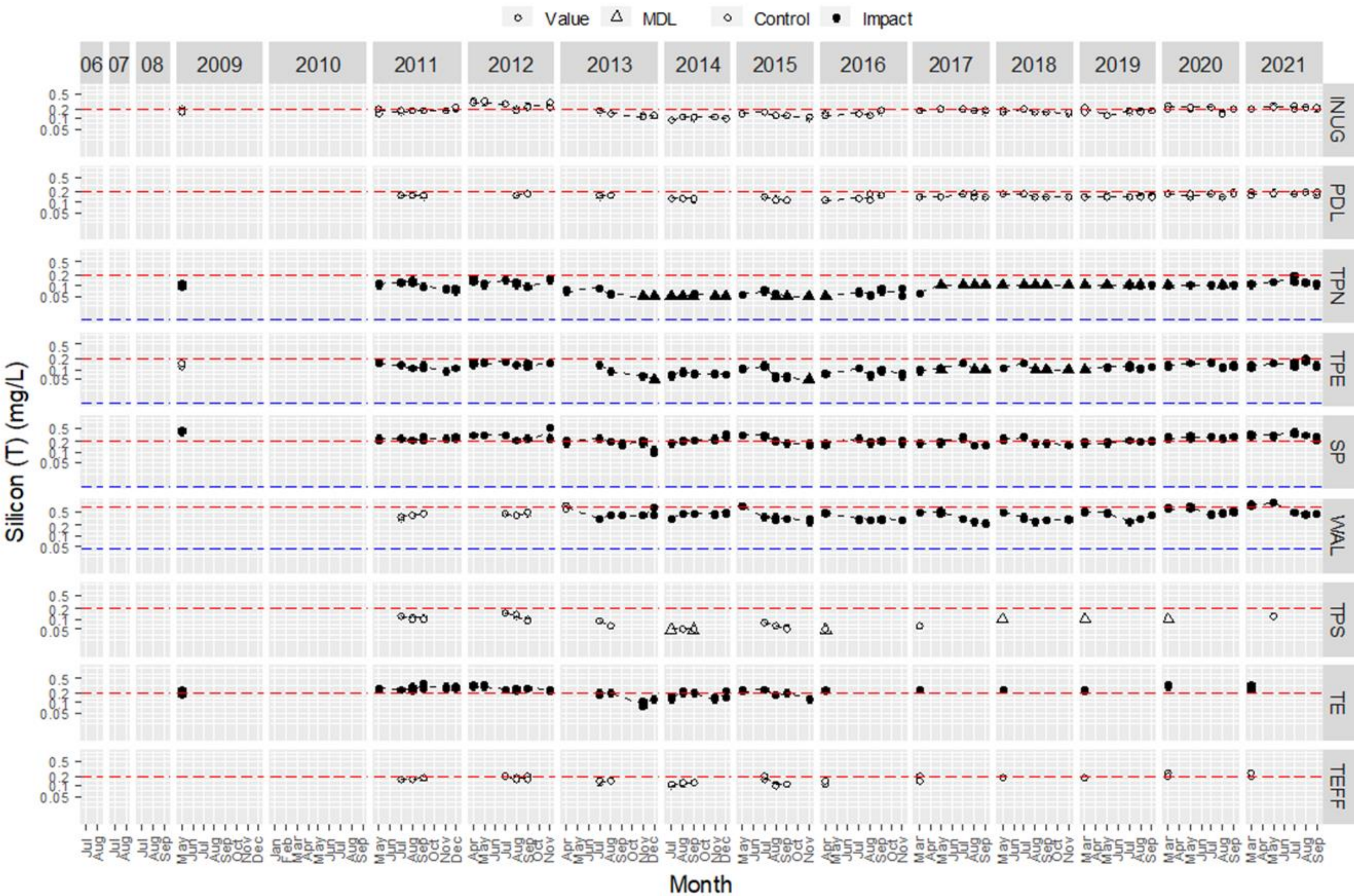


Figure 4-45. Total sodium (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value. The blue dashed line = FEIS screening prediction.

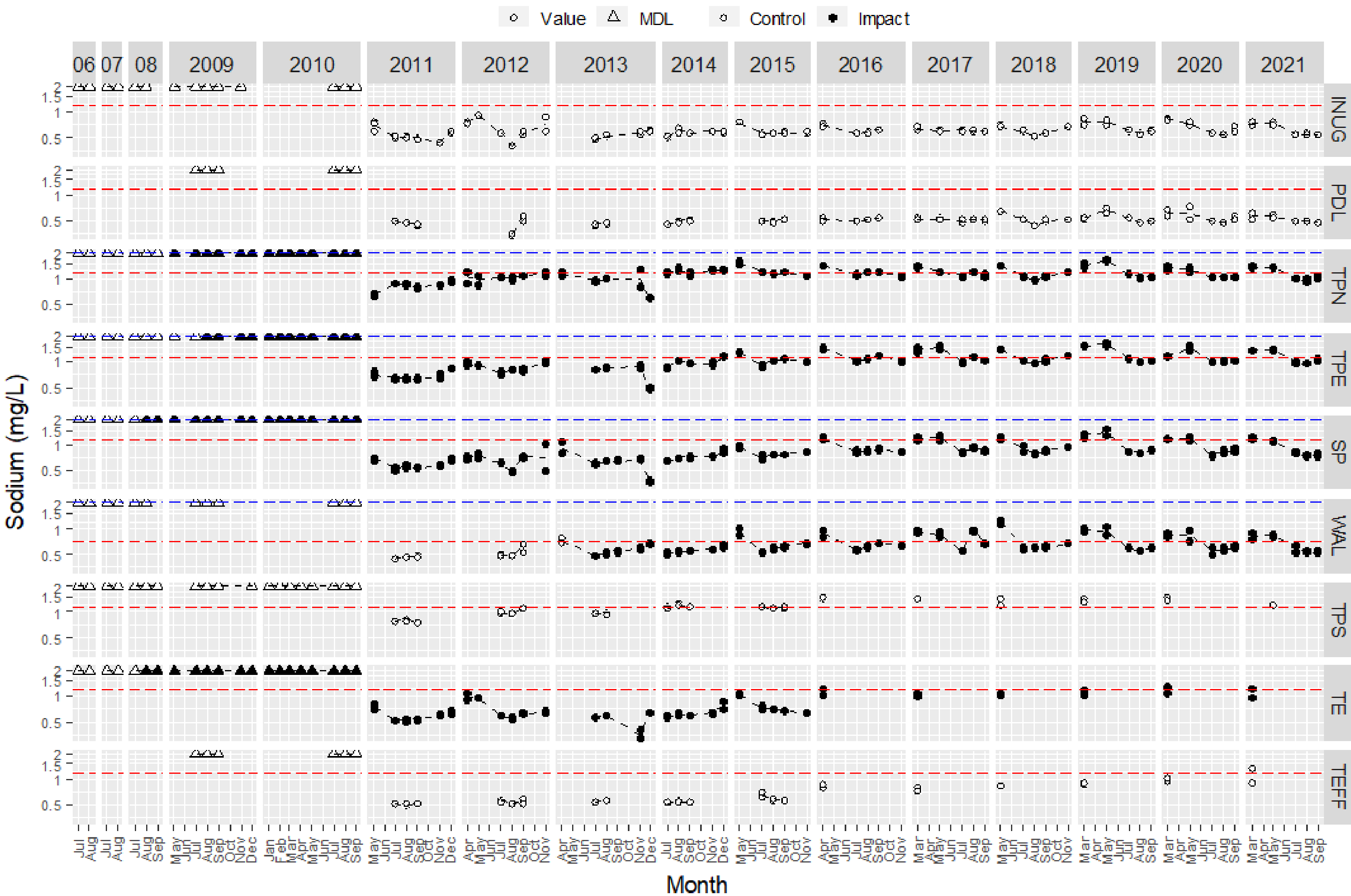


Figure 4-46. Total strontium (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value. The blue dashed line = FEIS screening prediction.

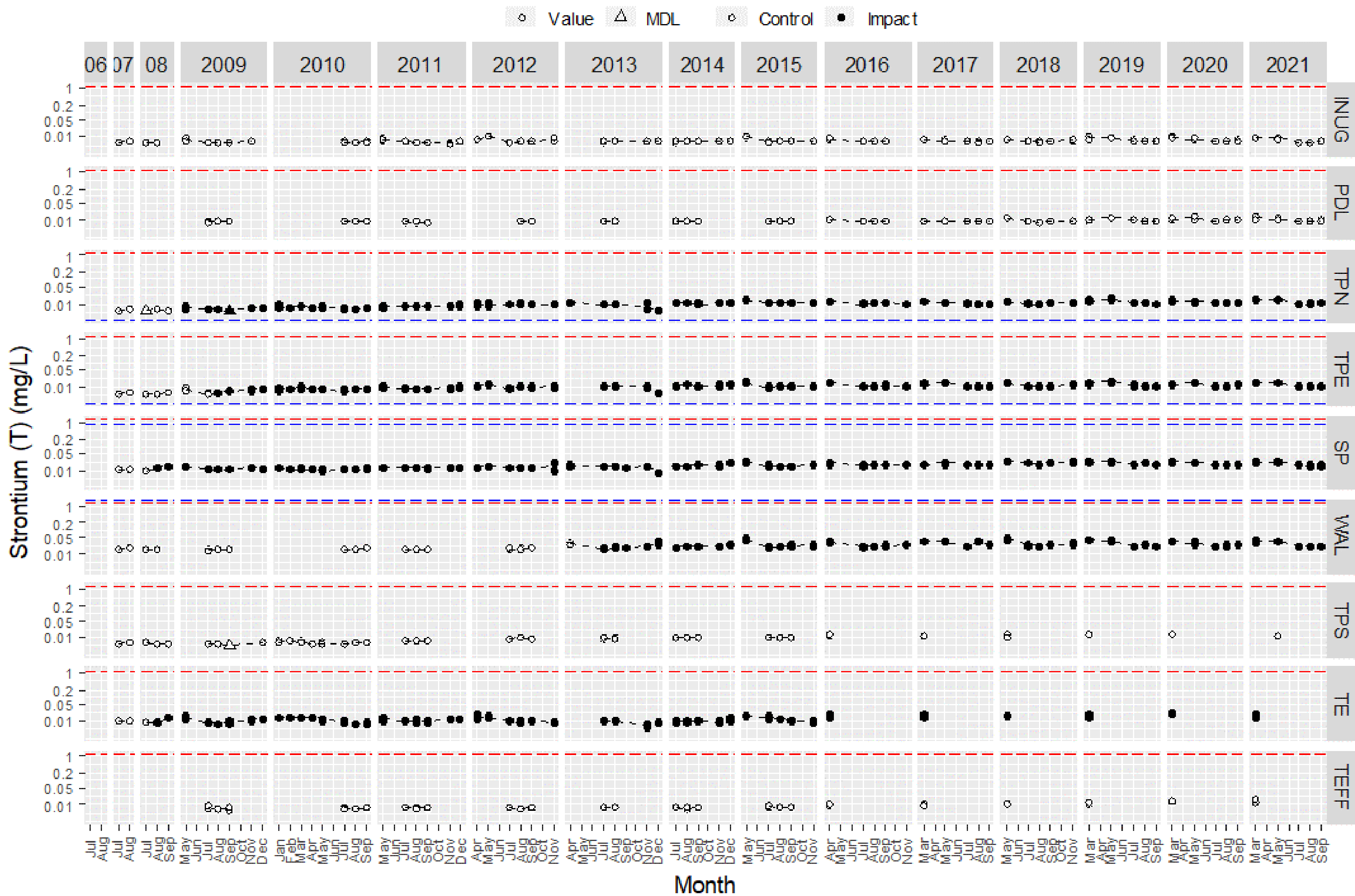


Figure 4-47. Total uranium (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value. The blue dashed line = FEIS screening prediction.

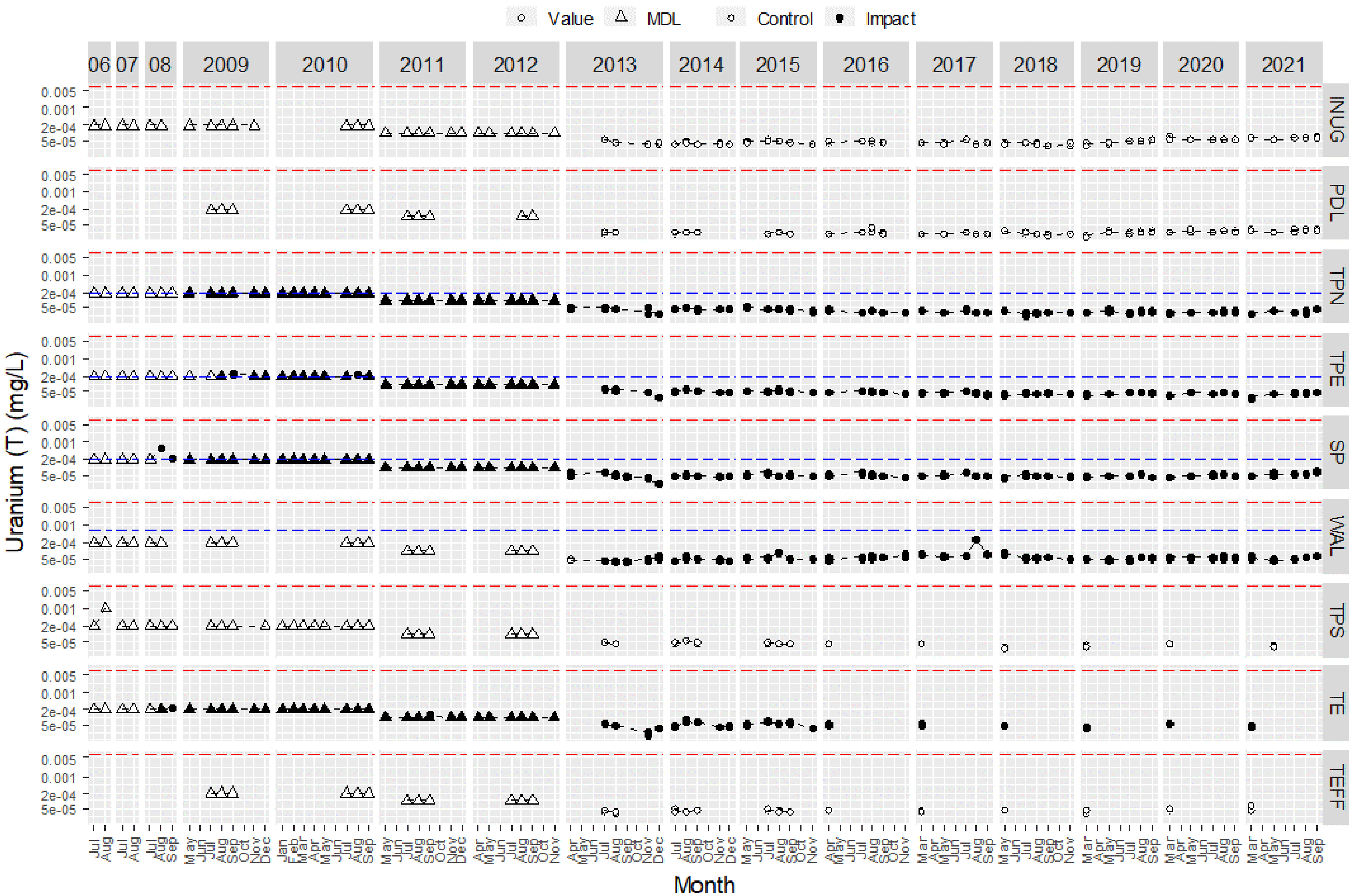


Figure 4-48. Dissolved aluminum (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value.

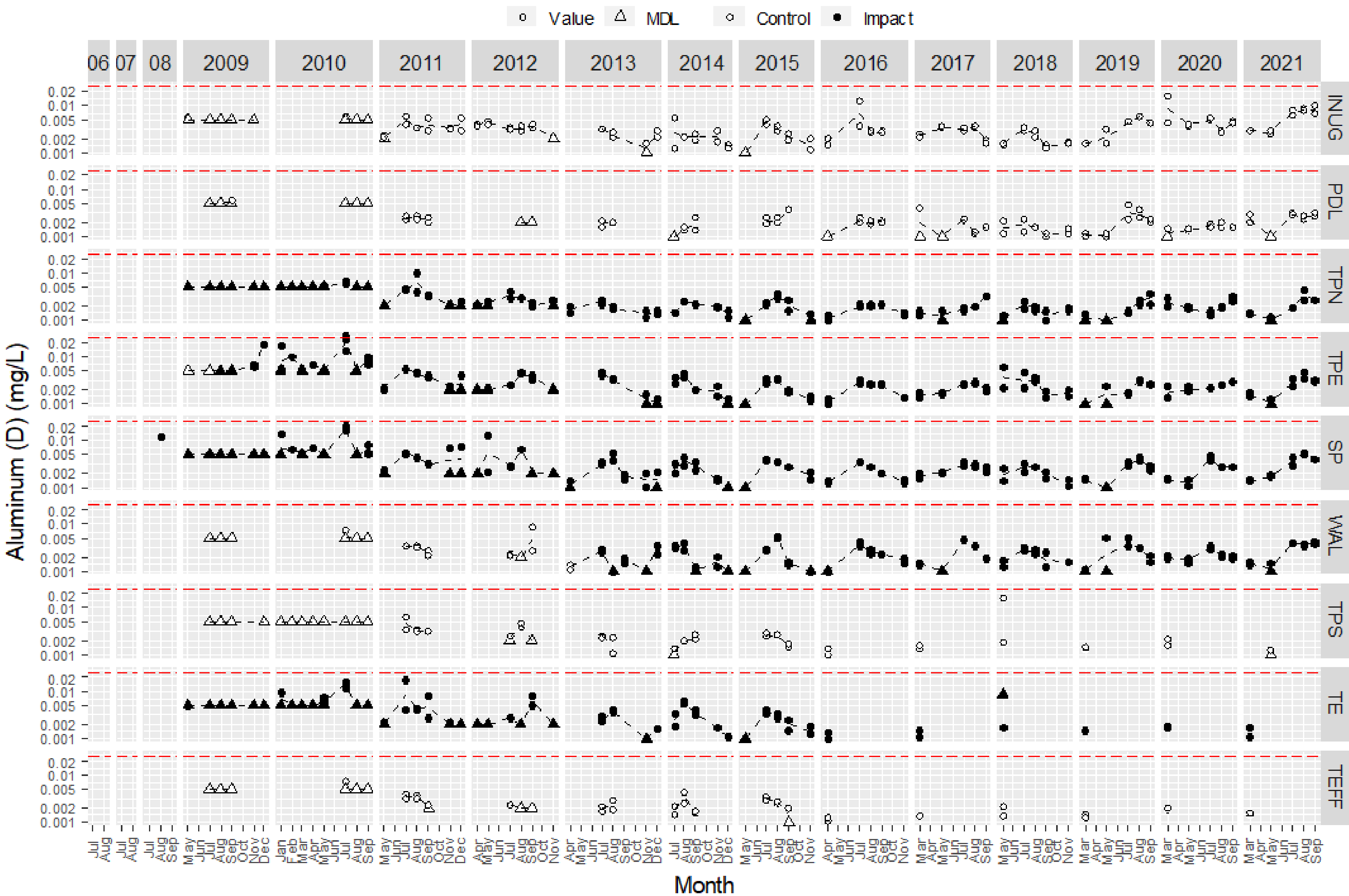


Figure 4-49. Dissolved arsenic (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value.

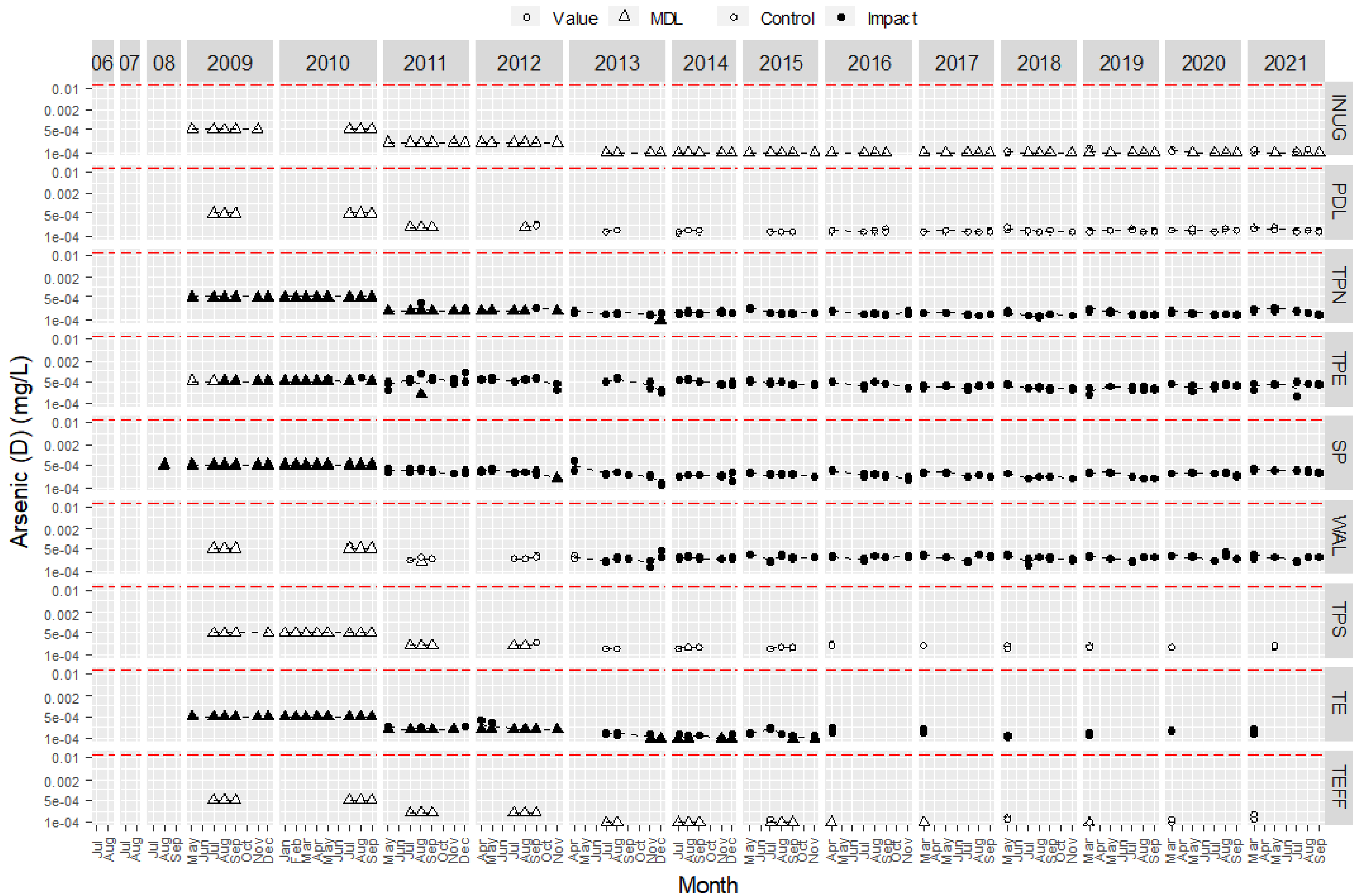


Figure 4-50. Dissolved barium (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value.

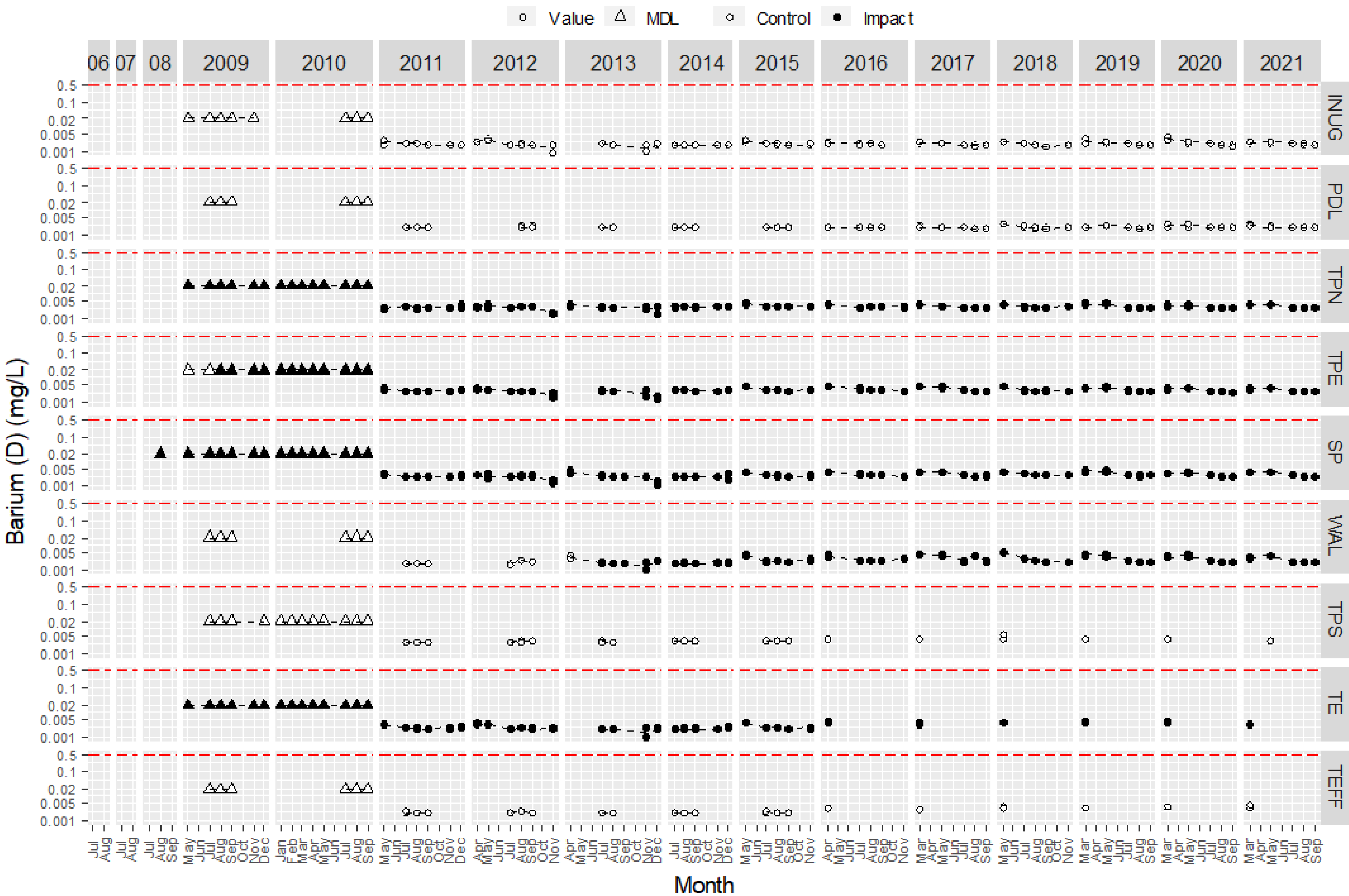


Figure 4-51. Dissolved copper (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value.

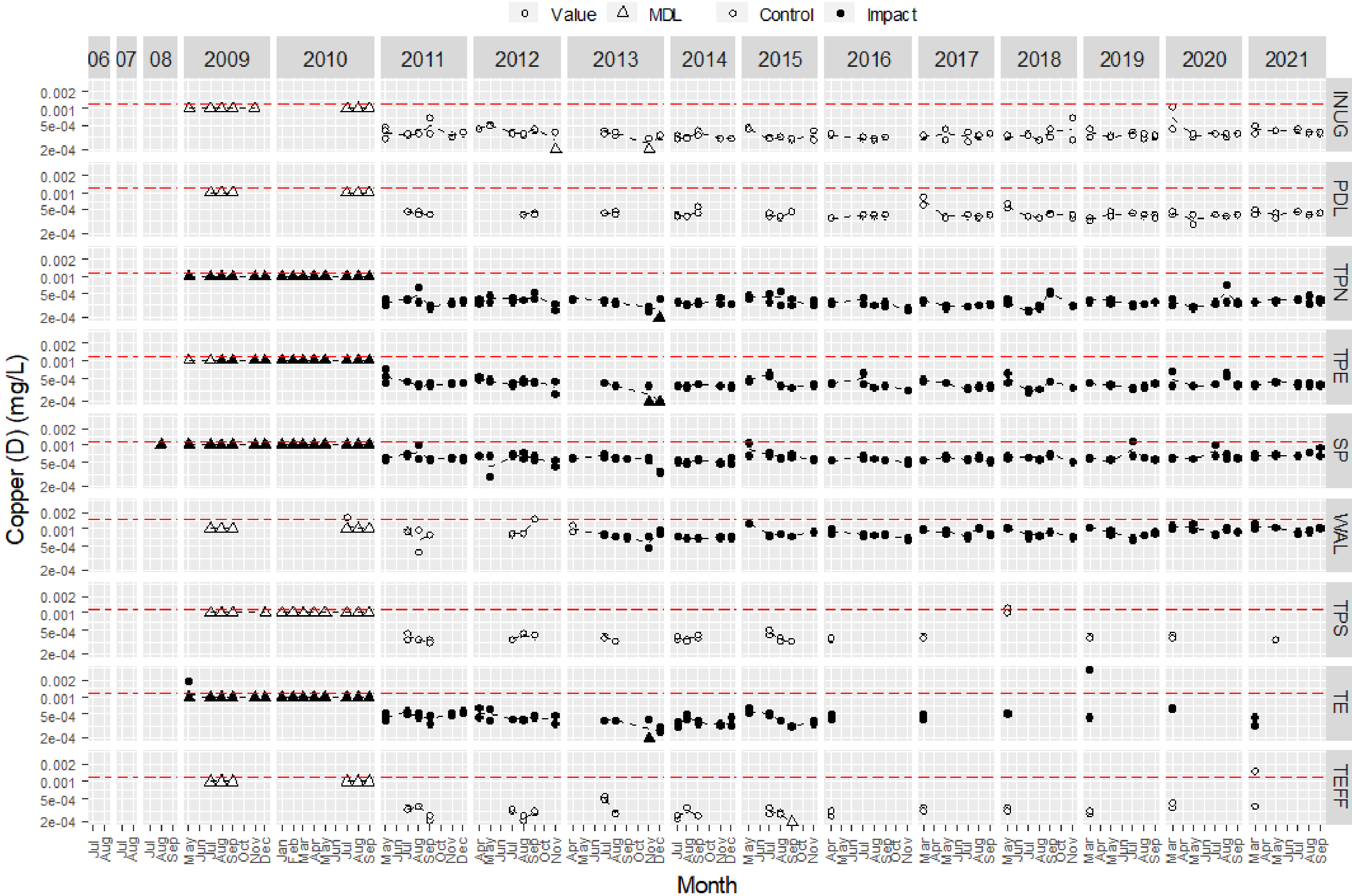


Figure 4-52. Dissolved manganese (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value.

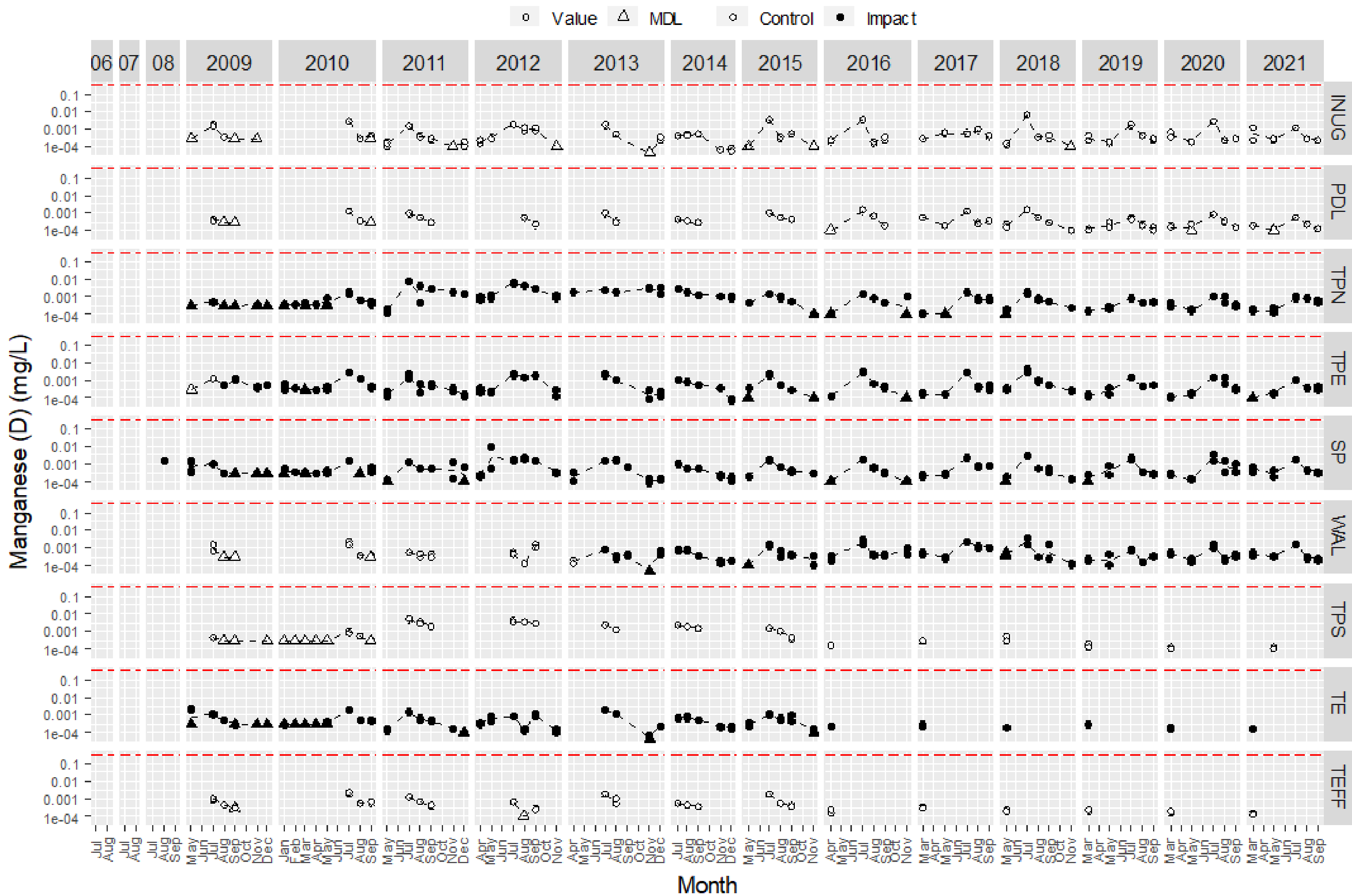


Figure 4-53. Dissolved molybdenum (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value.

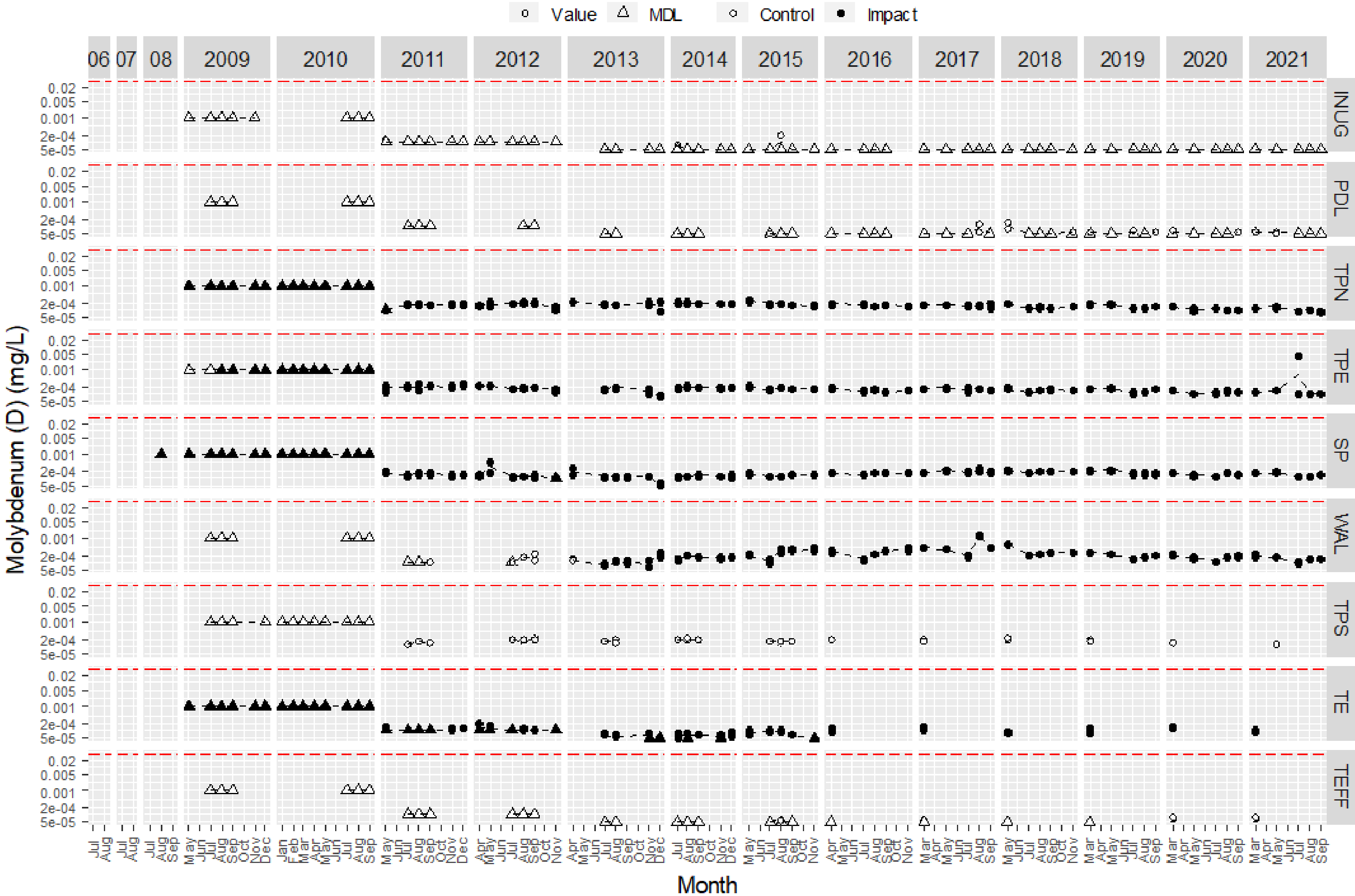


Figure 4-54. Dissolved silicon (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value.

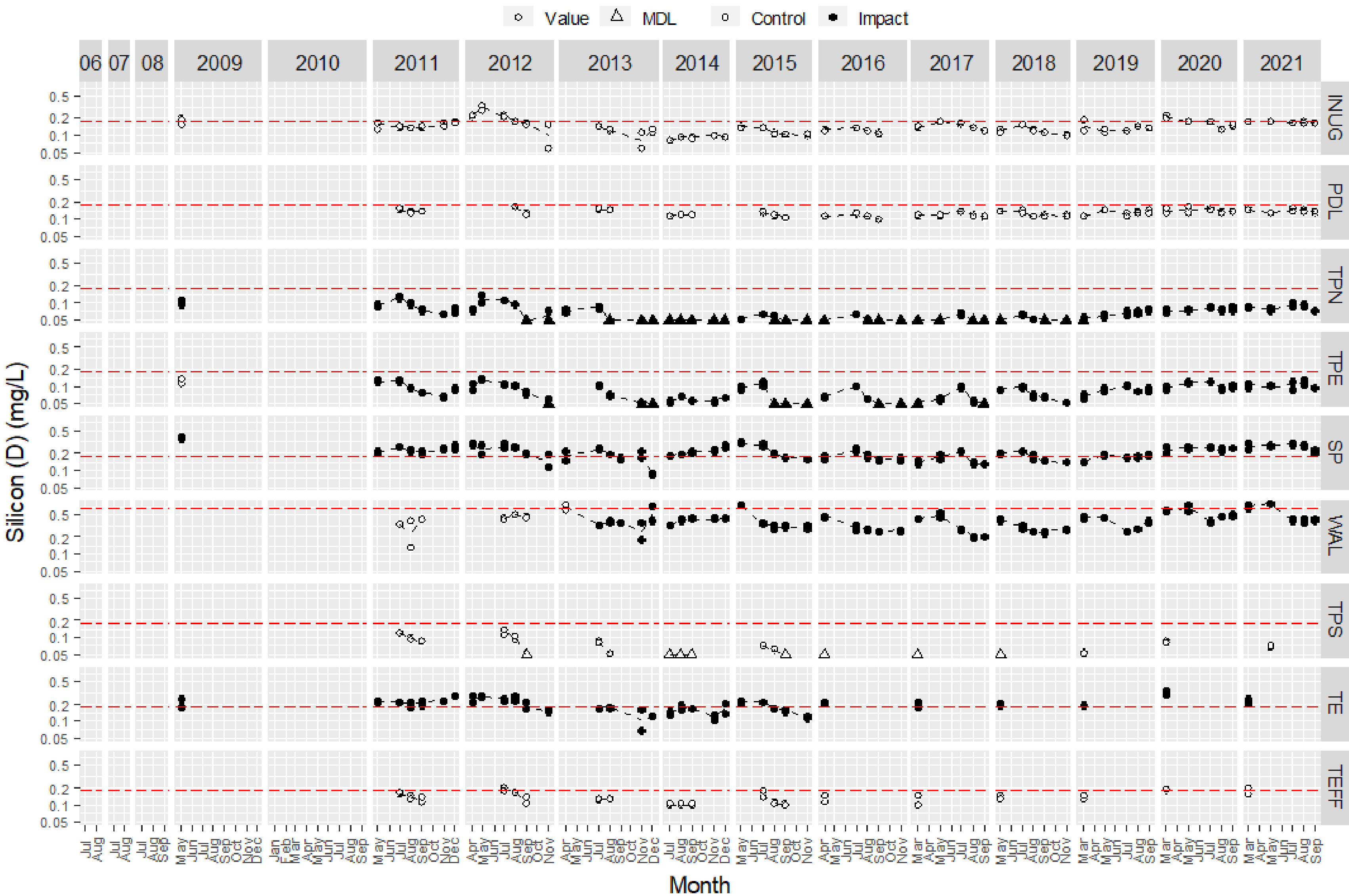


Figure 4-55. Dissolved strontium (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value.

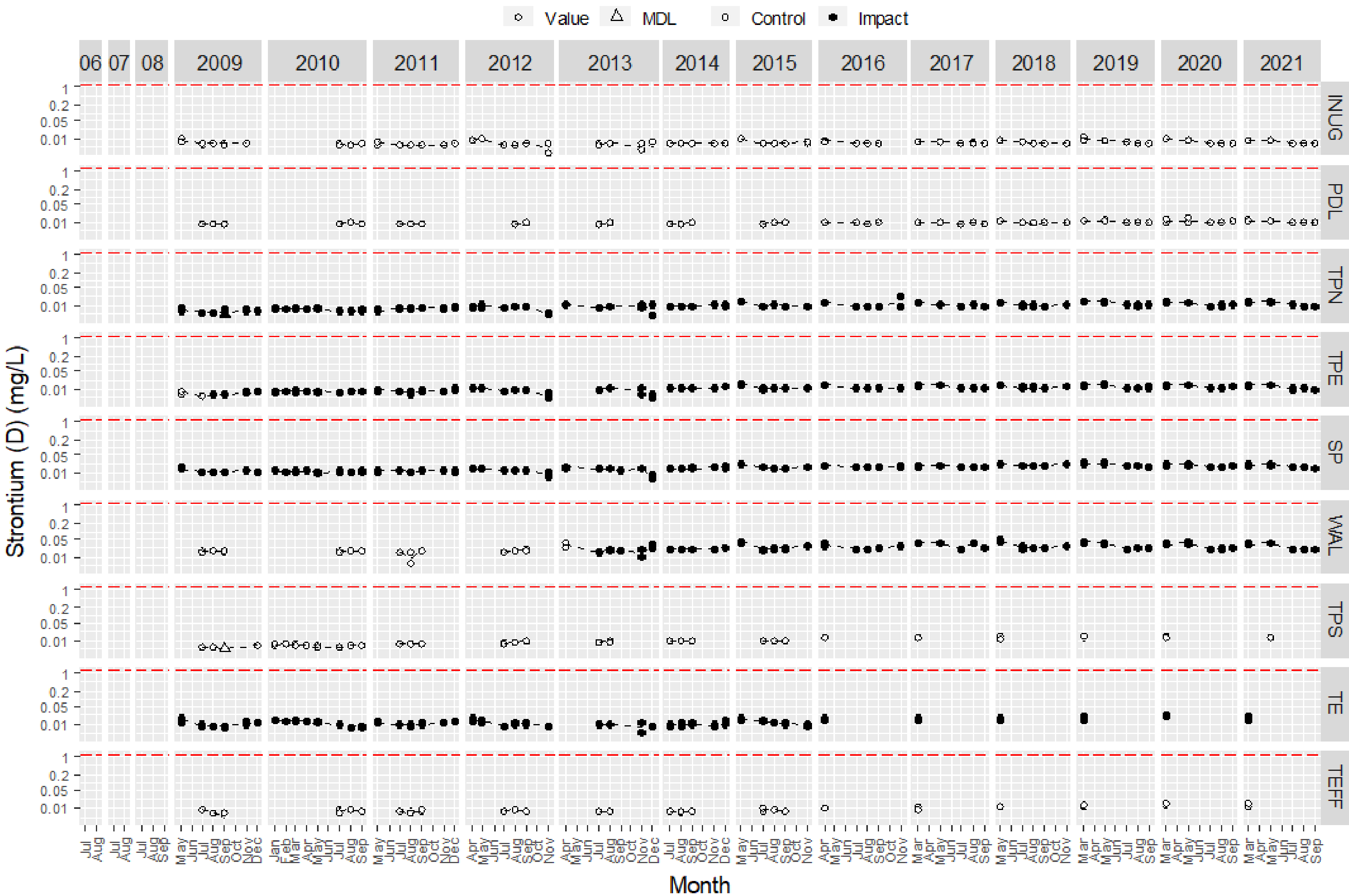


Figure 4-56. Dissolved uranium (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value.

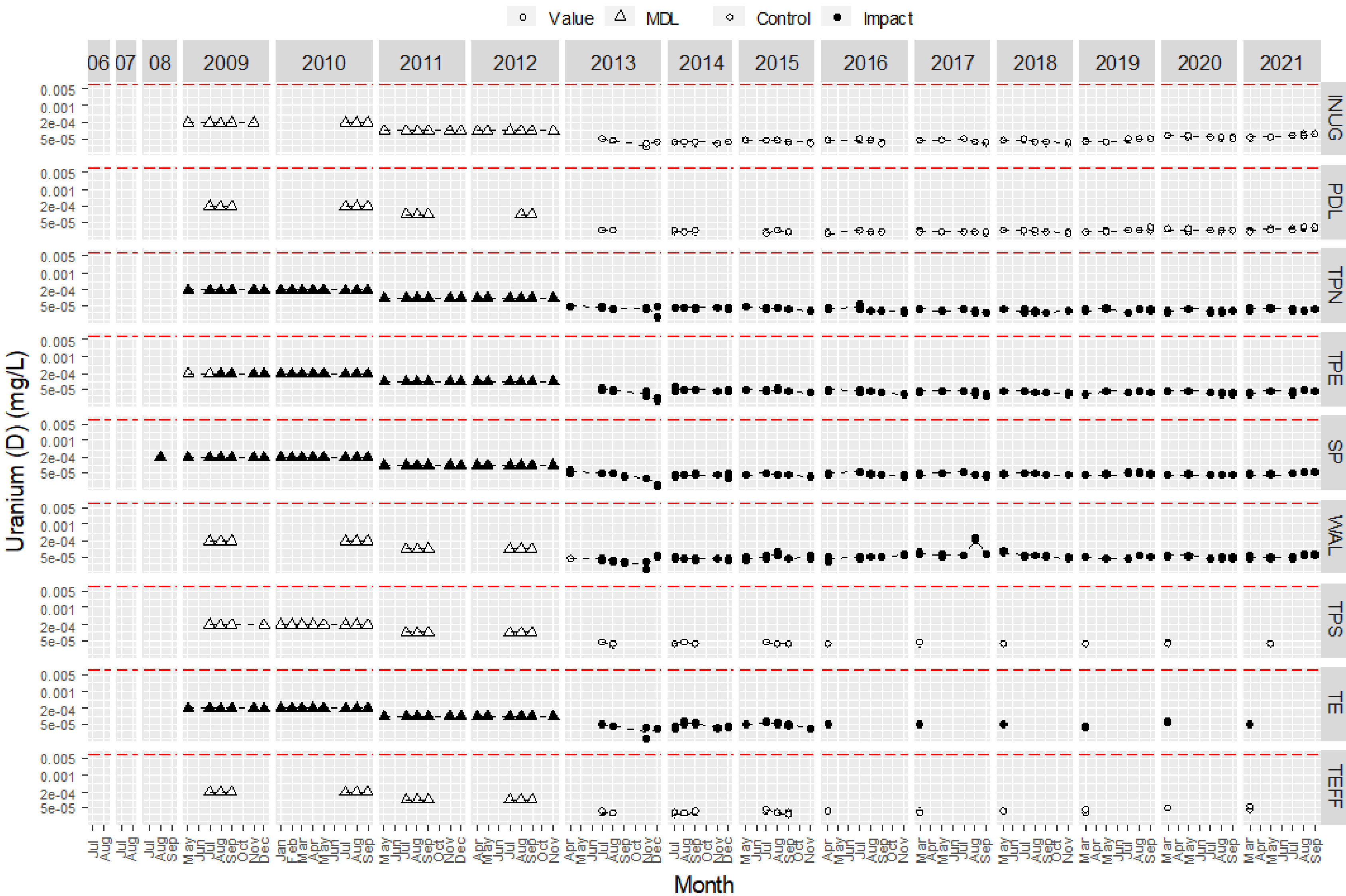


Figure 4-57. Dissolved zinc (mg/L) in water samples from Meadowbank study lakes since 2006.

Note: The red dashed line = trigger value.

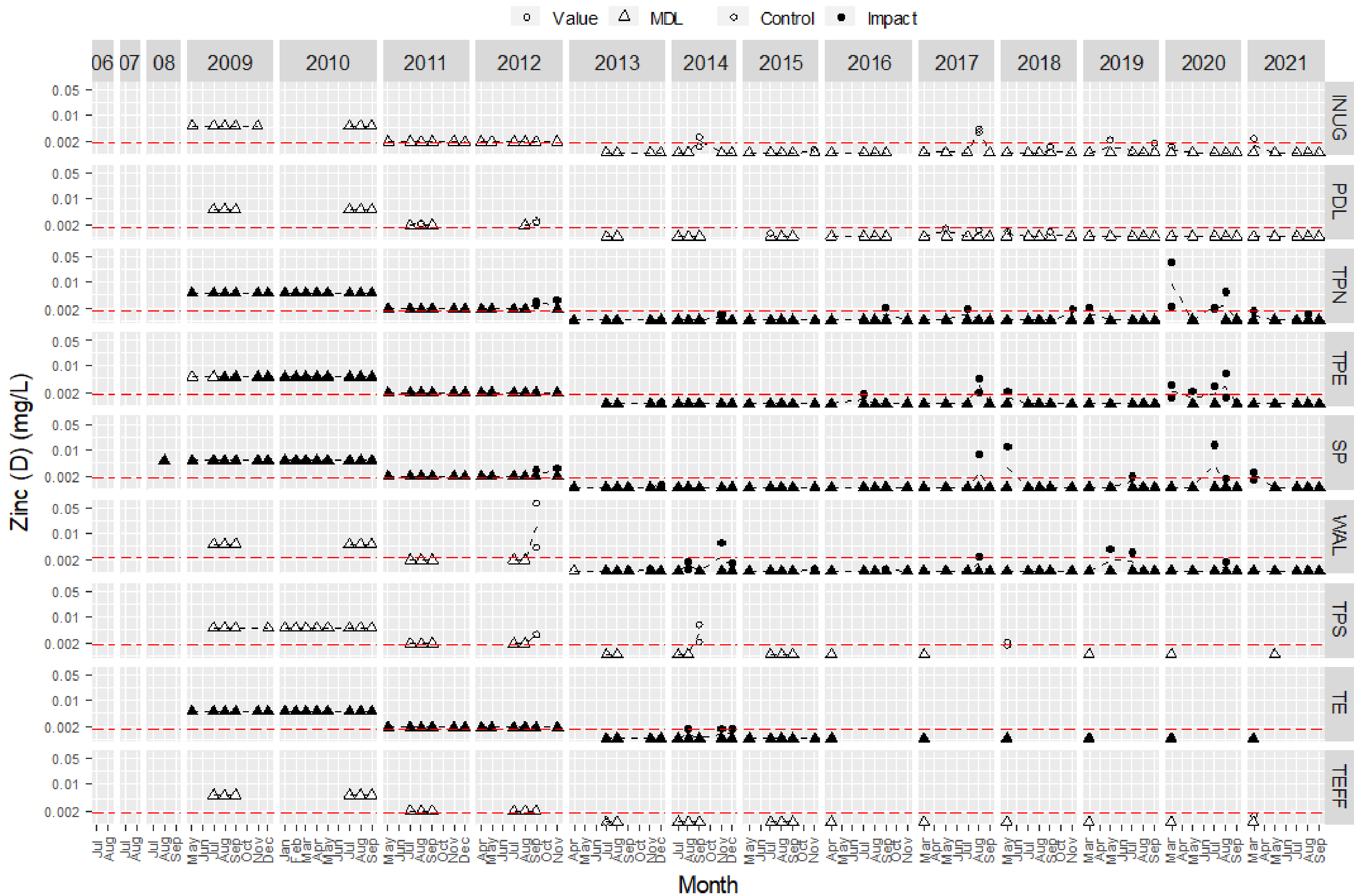


Figure 4-58. Long-term trends in key physical/ionic water chemistry parameters at Meadowbank area TPN relative to reference area INUG.

Note: 1. Estimates of annual proportional effect sizes (i.e., differences relative to reference area INUG) for variables at area TPN. The grey horizontal line at 1.0 reflects no difference relative to INUG. Error bars depict 95% confidence intervals.
2. Total alkalinity trends best supported by the "Year" model; all other trends best supported by the "Stable" model (**Section 4.3.2**).

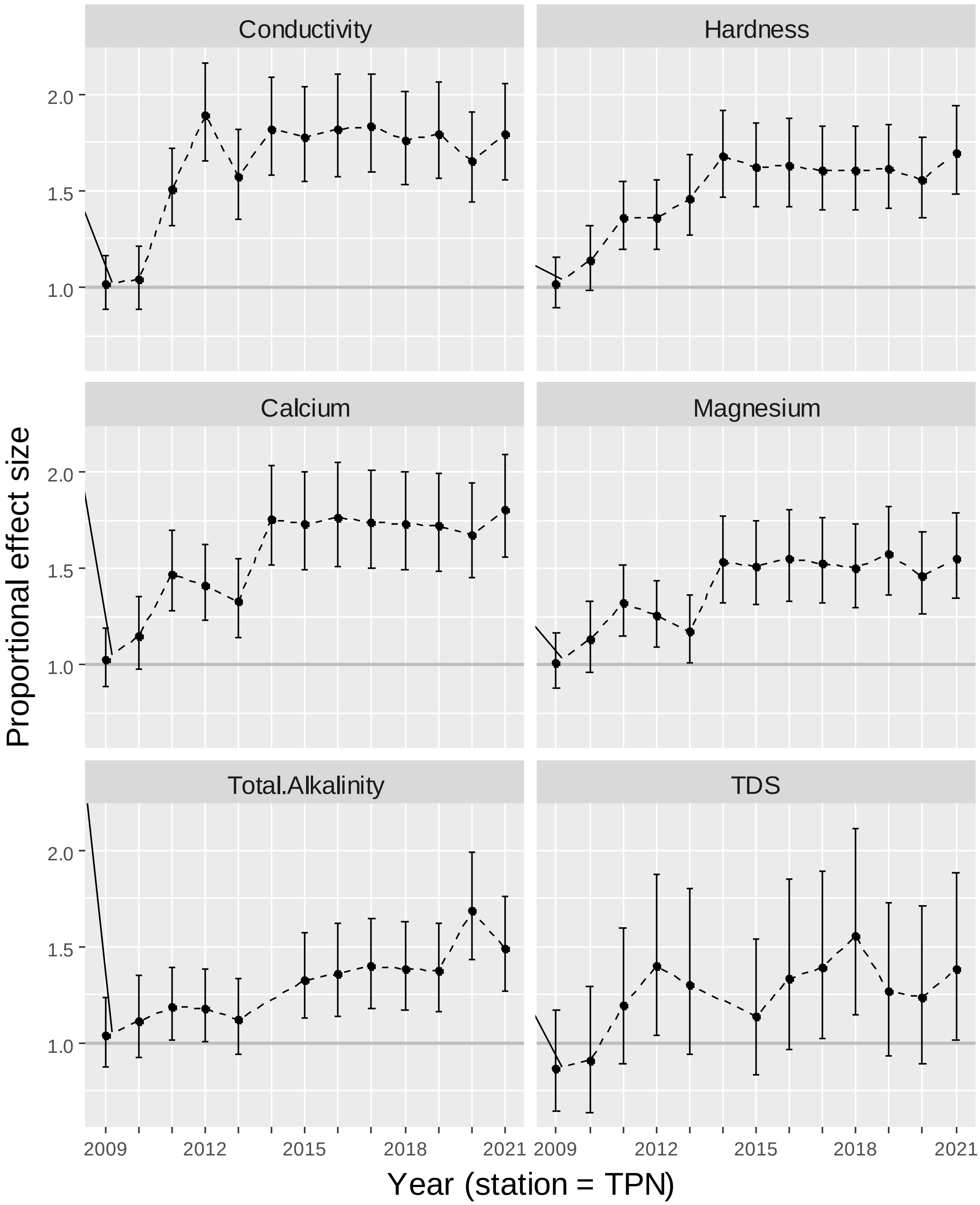


Figure 4-59. Long-term trends in key physical/ionic water chemistry parameters at Meadowbank area TPE relative to reference area INUG.

Note: 1. Estimates of annual proportional effect sizes (i.e., differences relative to reference area INUG) for variables at area TPN. The grey horizontal line at 1.0 reflects no difference relative to INUG. Error bars depict 95% confidence intervals.
2. Total alkalinity trends best supported by the "Year" model; all other trends best supported by the "Stable" model (**Section 4.3.2**).

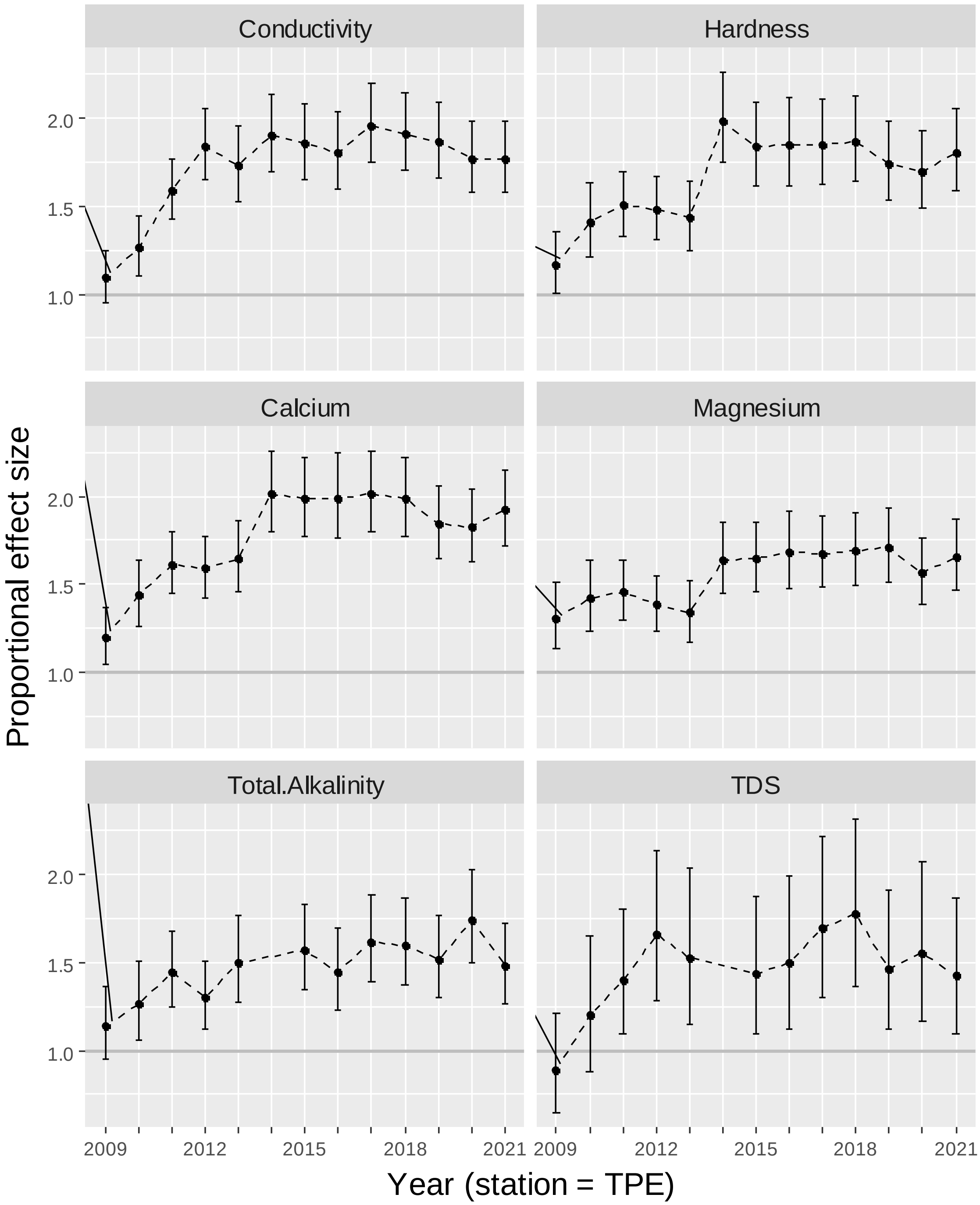
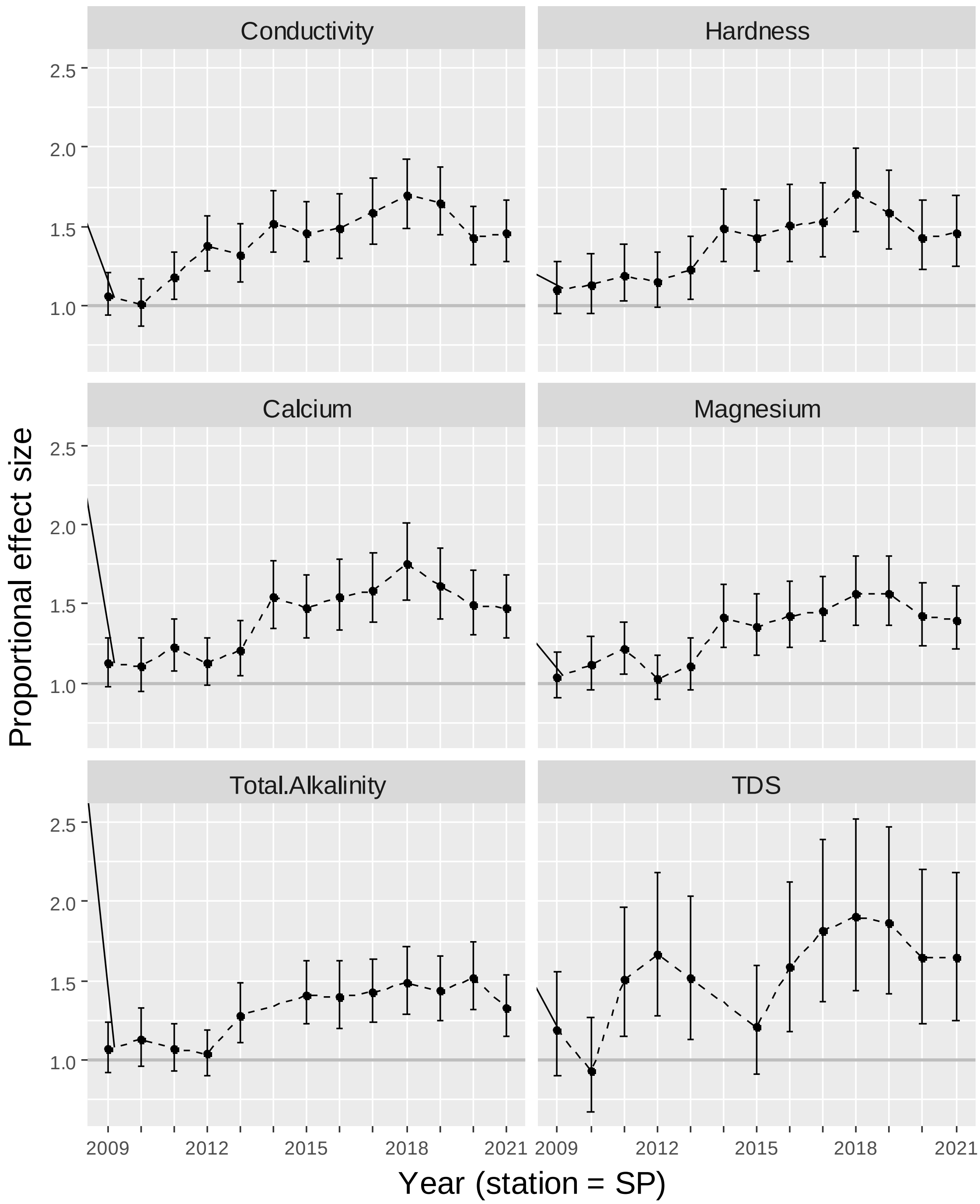


Figure 4-60. Long-term trends in key physical/ionic water chemistry parameters at Meadowbank area SP relative to reference area INUG.

Note: 1. Estimates of annual proportional effect sizes (i.e., differences relative to reference area INUG) for variables at area TPN. The grey horizontal line at 1.0 reflects no difference relative to INUG. Error bars depict 95% confidence intervals.
2. Total alkalinity, conductivity, and hardness trends best supported by the “Year” model; all other trends best supported by the “Stable” model (**Section 4.3.2**).



Phytoplankton Tables and Figures

Table 4-8. Results of the BACI test for phytoplankton variables at Meadowbank areas, 2021.

Parameter Measured	Test Area	n(B)	n(A)	Estimate	SE	P-value*	Effect size (%)		
							ES	LCI	UCI
Total Biomass	TPN	7	5	0.39	0.14	**0.022**	47	7	102
	TPE	8	5	0.11	0.13	0.395	12	-16	49
	SP	6	5	0.13	0.12	0.314	14	-14	50
	WAL	19	5	0.04	0.22	0.844	4	-34	65
Taxa Richness	TPN	7	5	0.23	0.07	**0.011**	26	7	49
	TPE	8	5	0.03	0.06	0.696	3	-11	18
	SP	6	5	-0.03	0.06	0.656	-3	-15	11
	WAL	19	5	-0.05	0.06	0.392	-5	-16	7

Notes:

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

Shaded cells indicate positive (increased) or negative (reduced) effect sizes of 20% or more.

Test area = area compared to control (INUG).

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

n(A) = number of months in the "after" period (i.e., in 2021).

Estimate = BACI model estimate of the 2021 change in mean for log-transformed data.

SE = standard error of the estimate.

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

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

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

Figure 4-61. Chlorophyll-a (µg/L) in water samples from Meadowbank study area lakes since 2006.

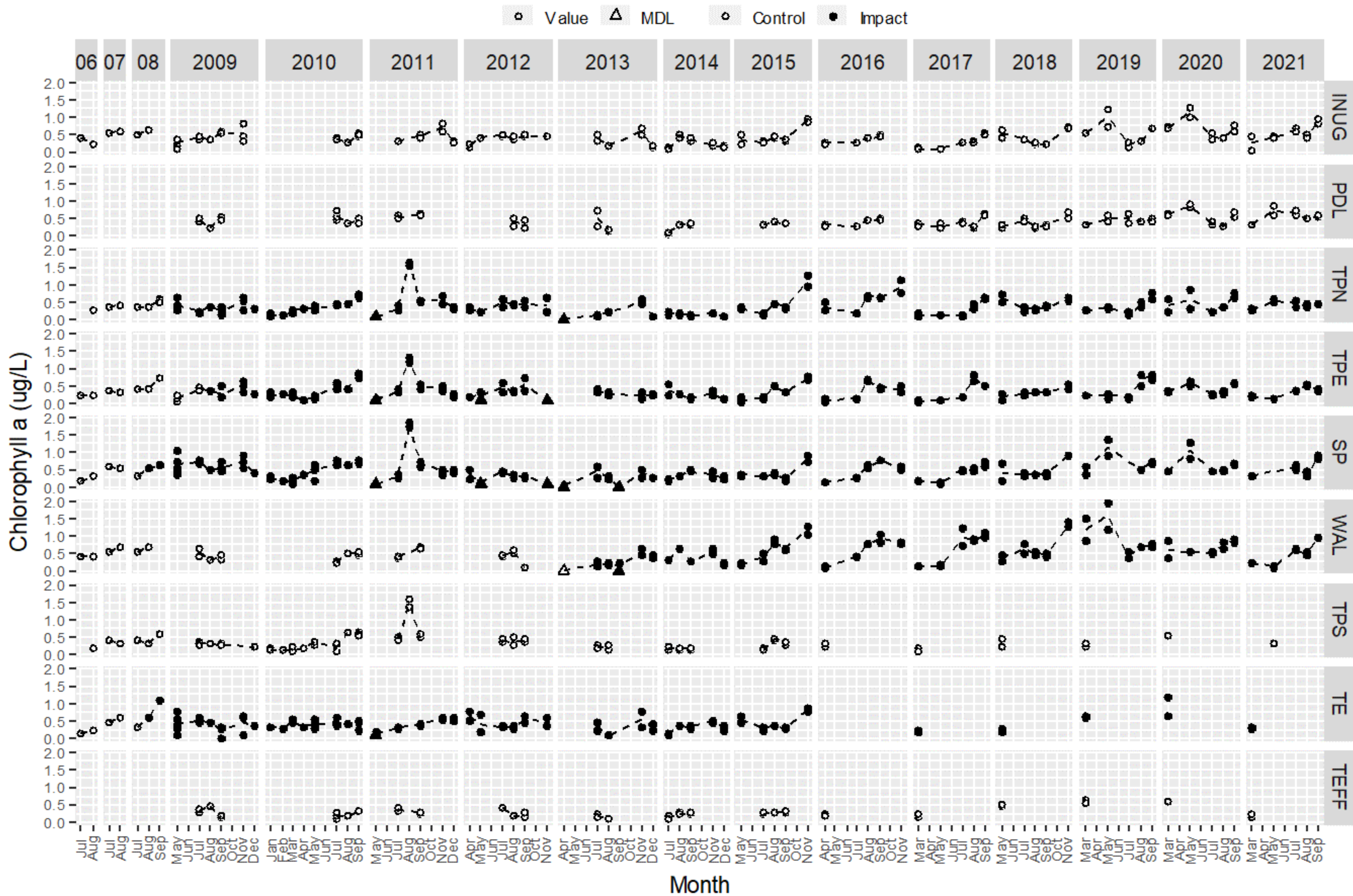


Figure 4-62. Total phytoplankton biomass (mg/m³) from Meadowbank study area lakes since 2006.

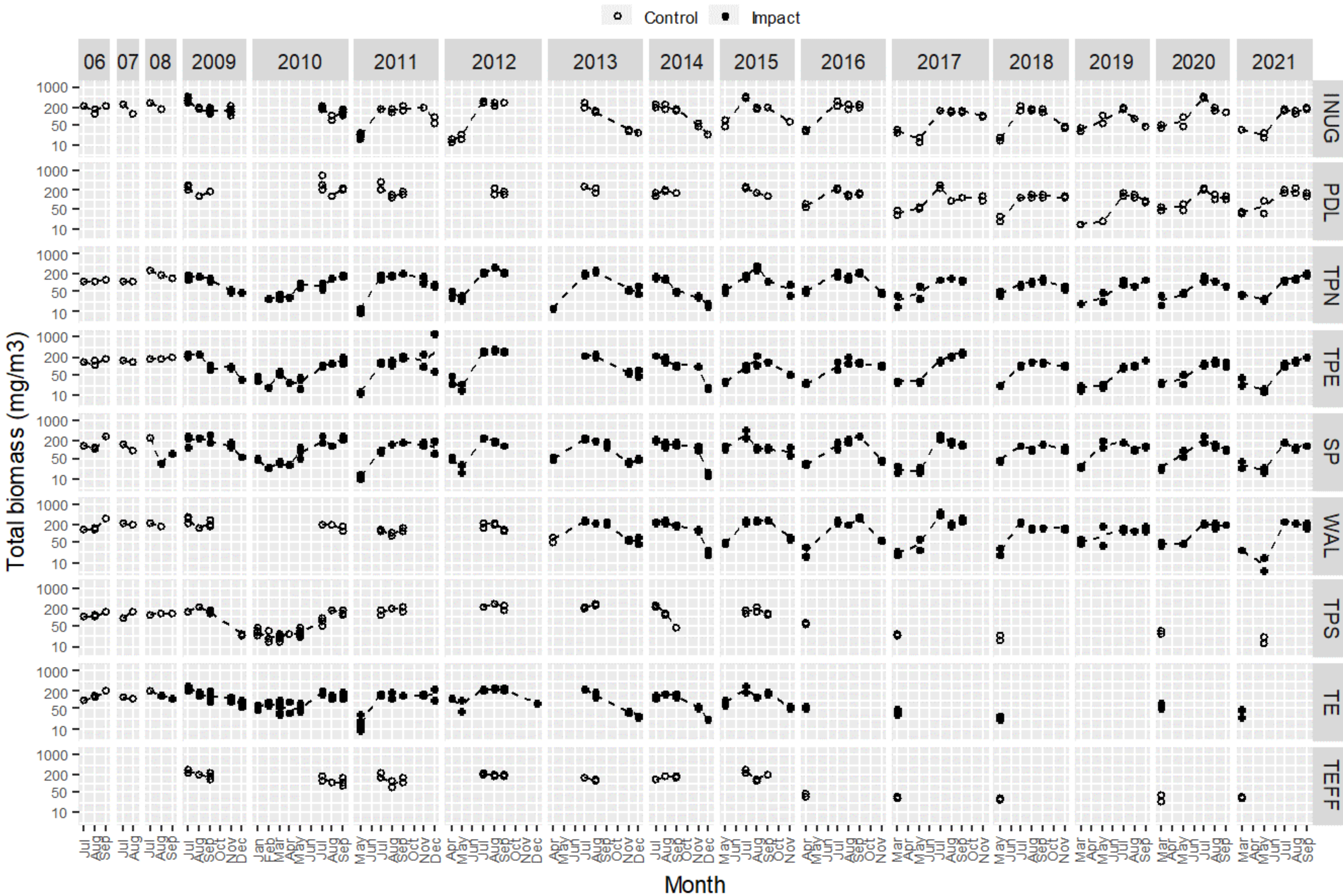


Figure 4-63. Phytoplankton biomass (mg/m³) by major taxa from Meadowbank study area lakes since 2006.

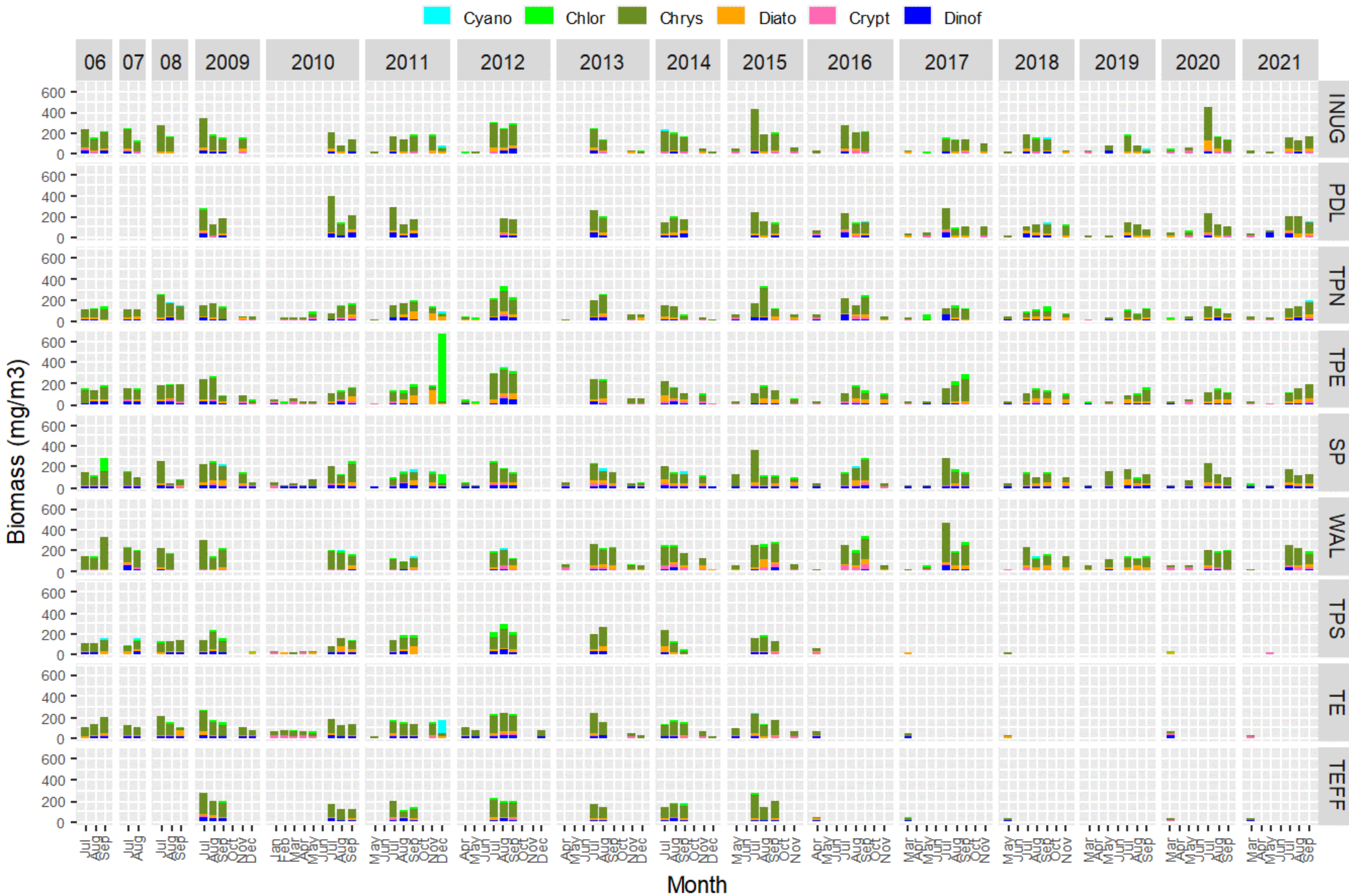
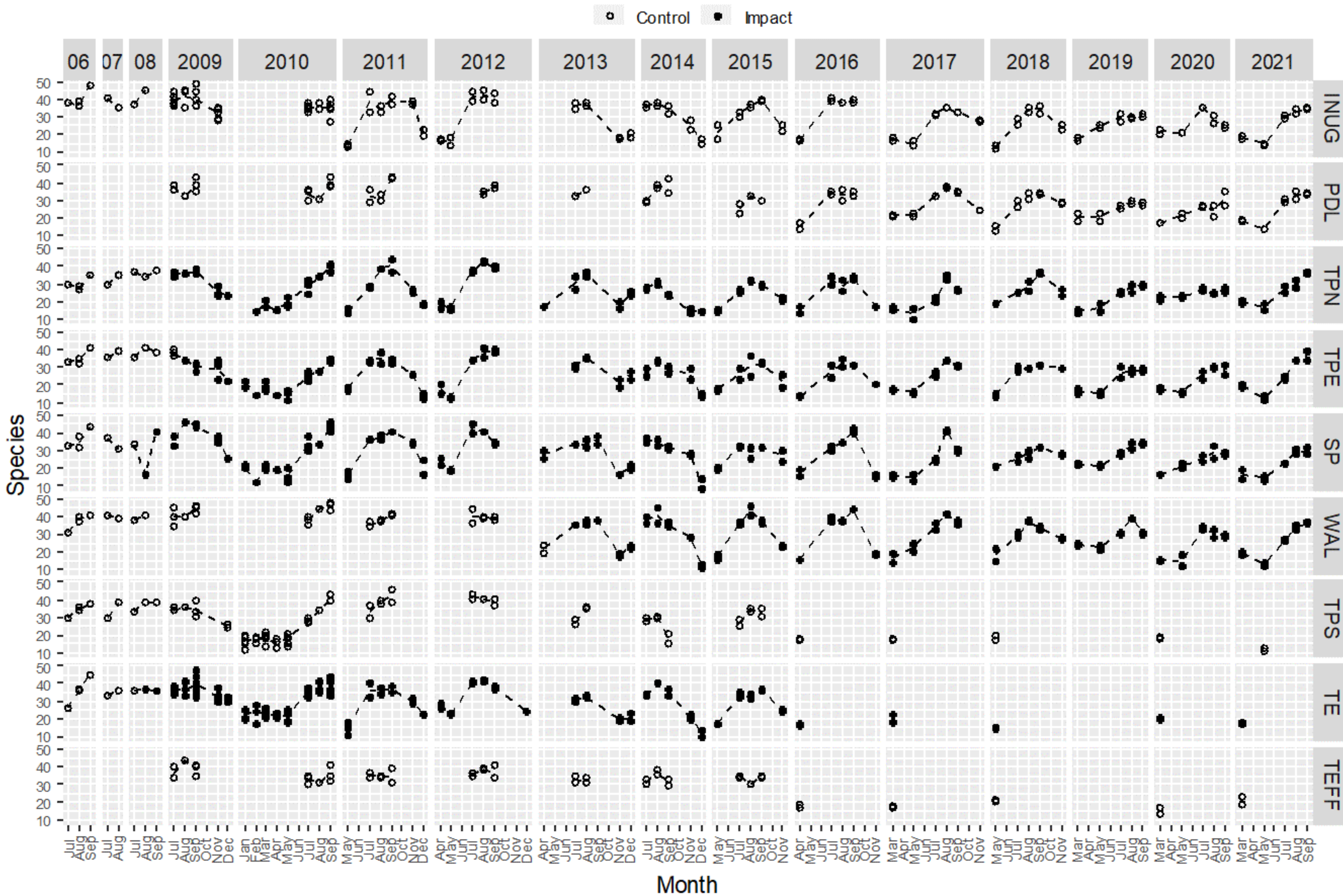


Figure 4-64. Relative phytoplankton biomass by major taxa group from Meadowbank study area lakes since 2006.

Figure 4-65. Phytoplankton species richness from Meadowbank study area lakes since 2006.



Sediment Chemistry Tables and Figures

In 2021, a batch of sediment samples were not analyzed due to a sample receipt error by the laboratory. As such, we did not receive the results for sediment collected at most Meadowbank study areas. Results for samples that were analyzed are presented in the tables and figures in this section. For more information see **Appendix A**.

Figure 4-66. Sediment grain size in sediment samples from Meadowbank study lakes since 2007.

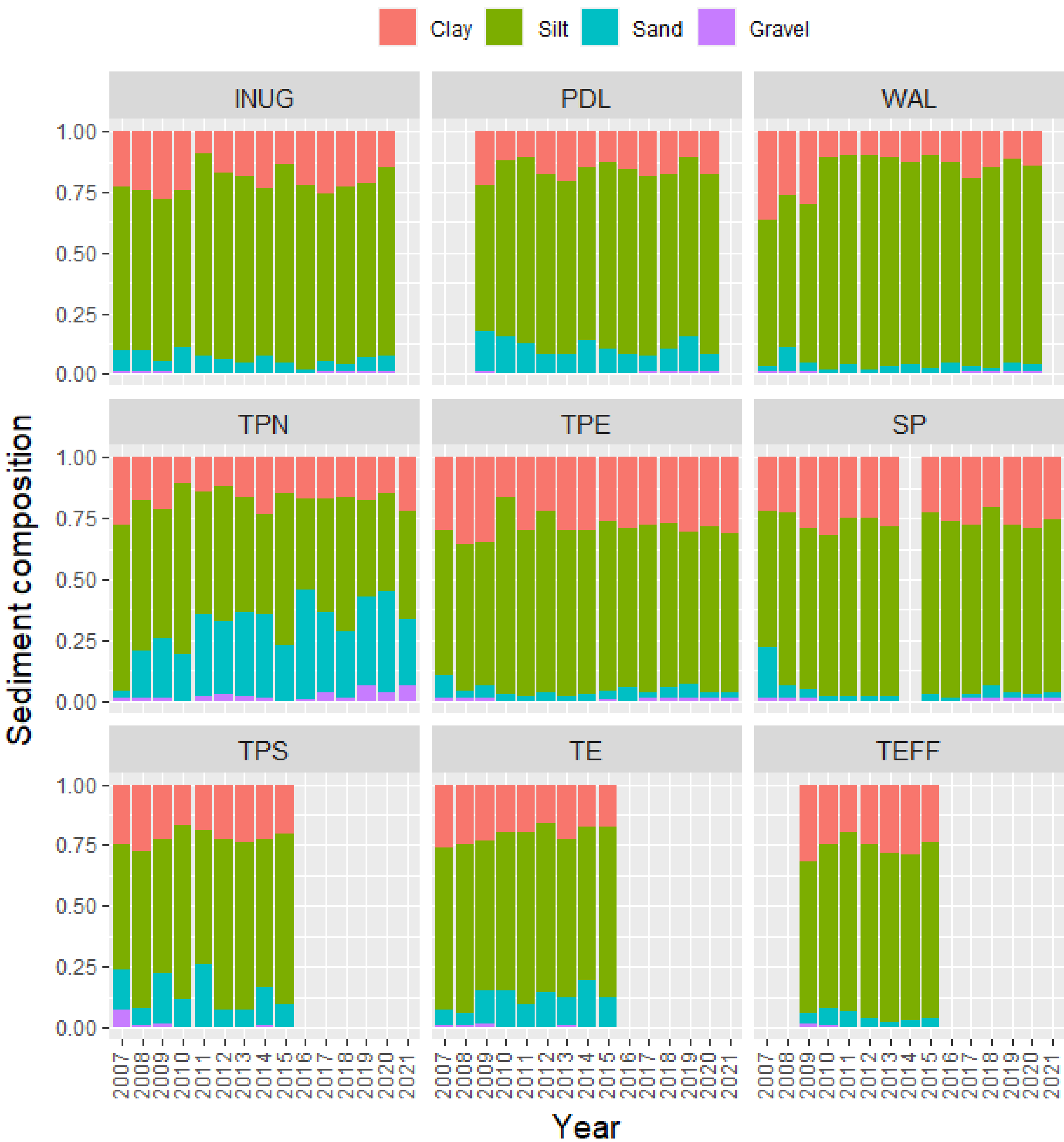


Figure 4-67. Total aluminum (mg/kg) in sediment samples (grabs & cores) from Meadowbank project lakes since 2006.

Note: Cores samples = box and whisker. Box and whisker plots are interpreted as follows: horizontal line in the box = median concentration, upper and lower margins = upper (75th) and lower (25th) percentile concentrations or the interquartile range, vertical lines are maximum and/or minimum concentrations, 'x's beyond vertical lines are outlier concentrations.

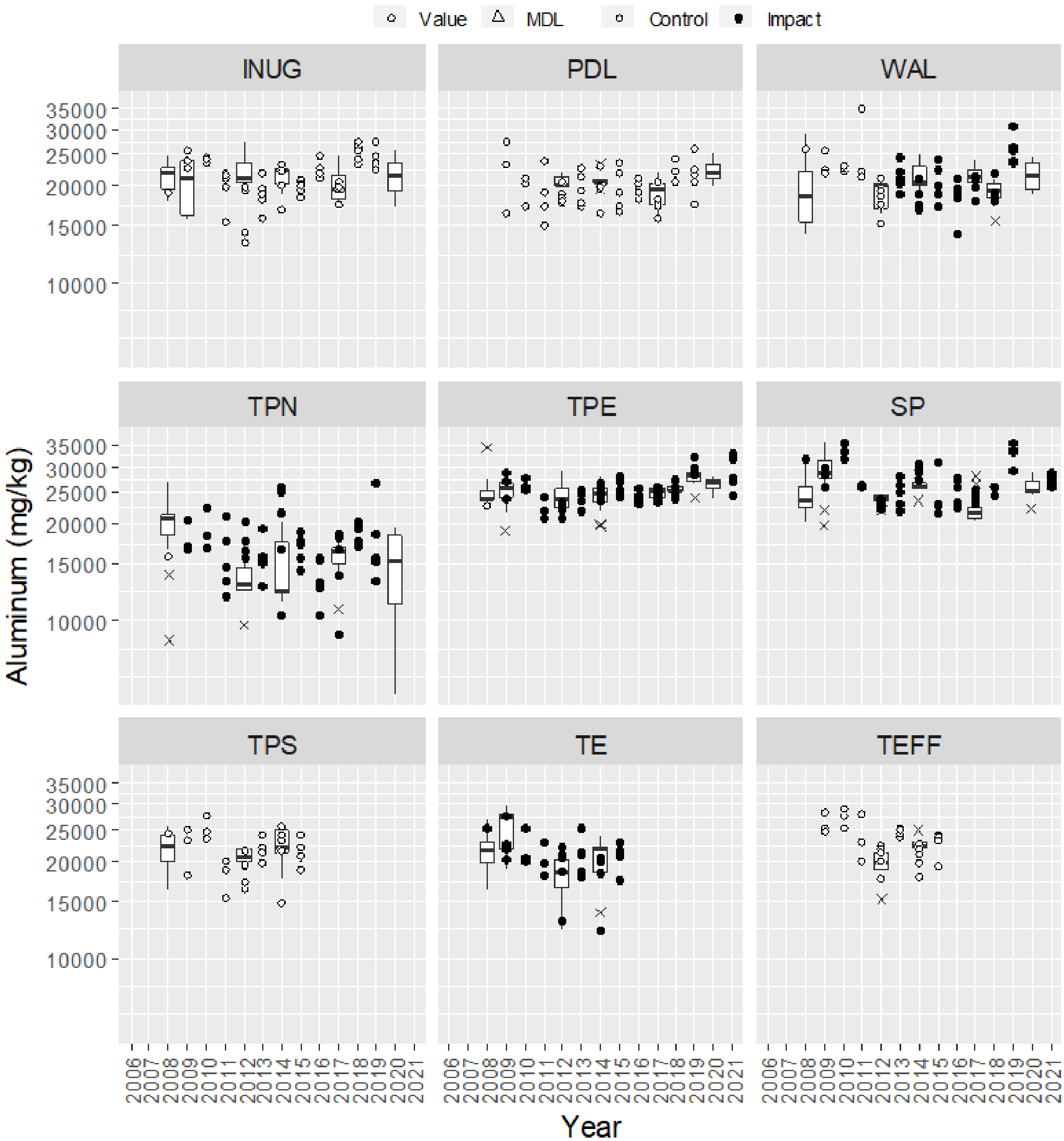


Figure 4-68. Total arsenic (mg/kg) in sediment samples (grabs & cores) from Meadowbank project lakes since 2006.

Note: The red dashed line = trigger value. Cores samples = box and whisker. Box and whisker plots are interpreted as follows: horizontal line in the box = median concentration, upper and lower margins = upper (75th) and lower (25th) percentile concentrations or the interquartile range, vertical lines are maximum and/or minimum concentrations, 'x's beyond vertical lines are outlier concentrations.

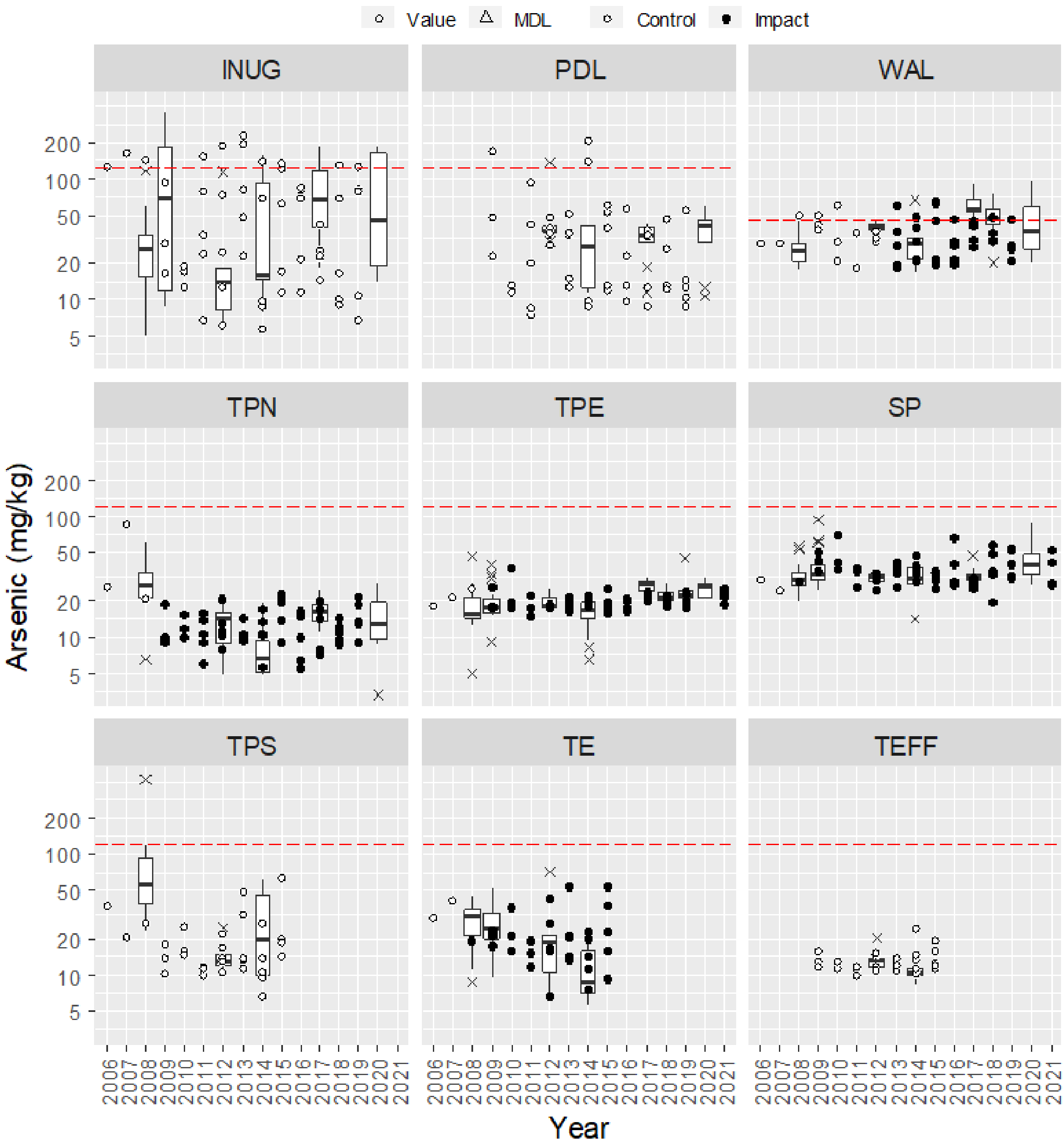


Figure 4-69. Total cadmium (mg/kg) in sediment samples (grabs & cores) from Meadowbank project lakes since 2006.

Note: The red dashed line = trigger value. Cores samples = box and whisker. Box and whisker plots are interpreted as follows: horizontal line in the box = median concentration, upper and lower margins = upper (75th) and lower (25th) percentile concentrations or the interquartile range, vertical lines are maximum and/or minimum concentrations, 'x's beyond vertical lines are outlier concentrations.

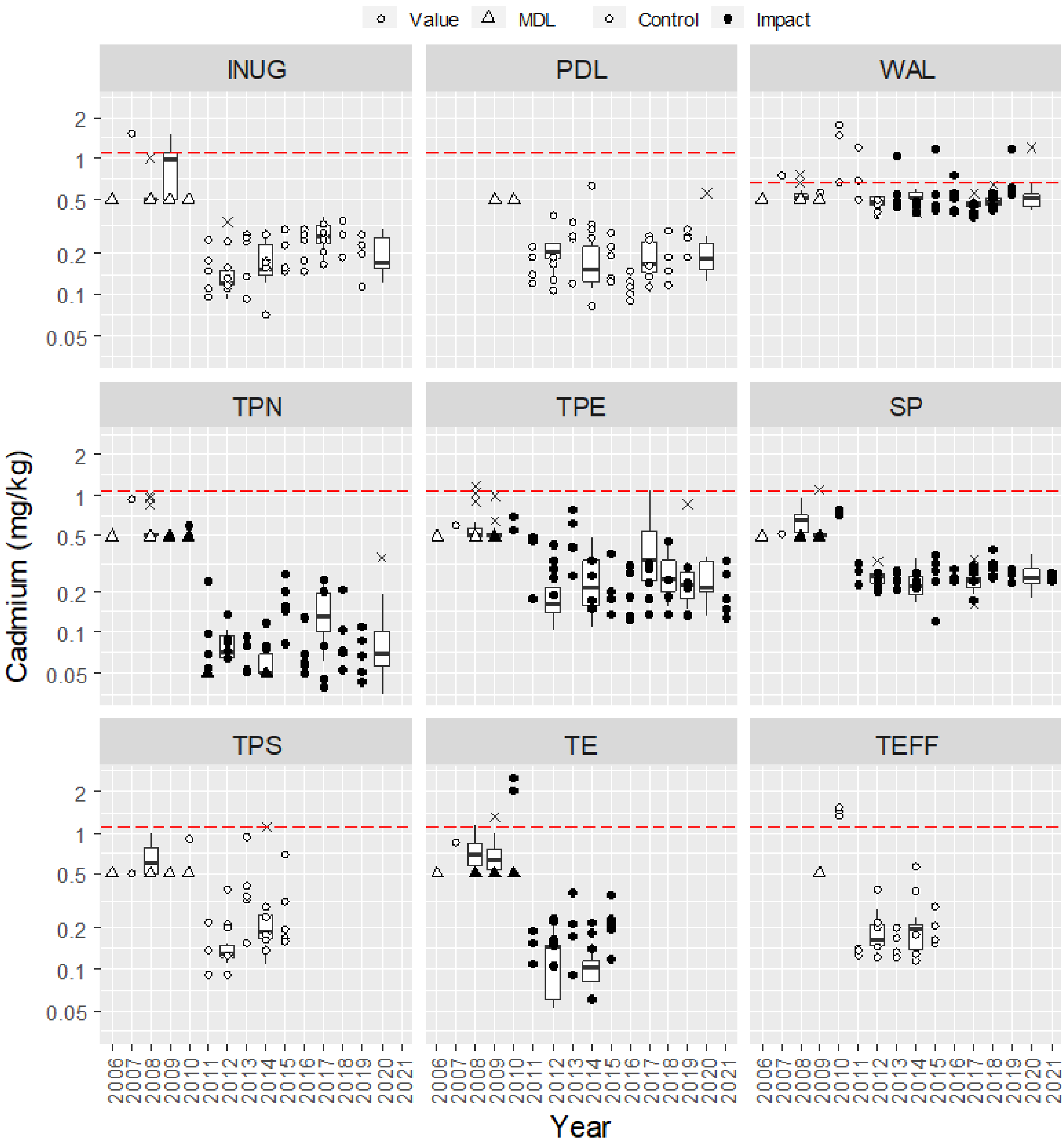


Figure 4-70. Total chromium (mg/kg) in sediment samples (grabs & cores) from Meadowbank project lakes since 2006.

Note: The red dashed line = trigger value. Cores samples = box and whisker. Box and whisker plots are interpreted as follows: horizontal line in the box = median concentration, upper and lower margins = upper (75th) and lower (25th) percentile concentrations or the interquartile range, vertical lines are maximum and/or minimum concentrations, 'x's beyond vertical lines are outlier concentrations.

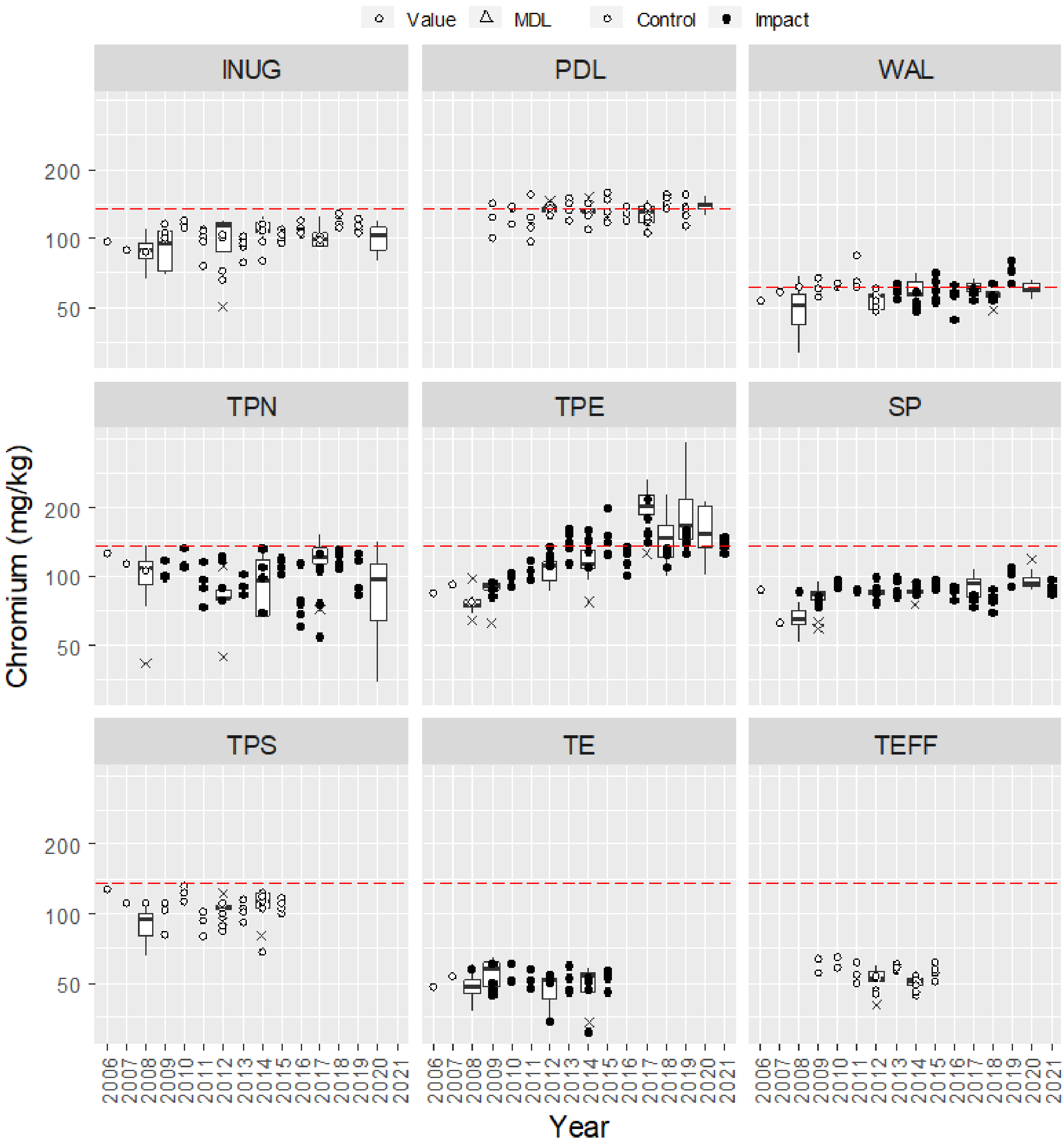


Figure 4-71. Total copper (mg/kg) in sediment samples (grabs & cores) from Meadowbank project lakes since 2006.

Note: The red dashed line = trigger value. Cores samples = box and whisker. Box and whisker plots are interpreted as follows: horizontal line in the box = median concentration, upper and lower margins = upper (75th) and lower (25th) percentile concentrations or the interquartile range, vertical lines are maximum and/or minimum concentrations, 'x's beyond vertical lines are outlier concentrations.

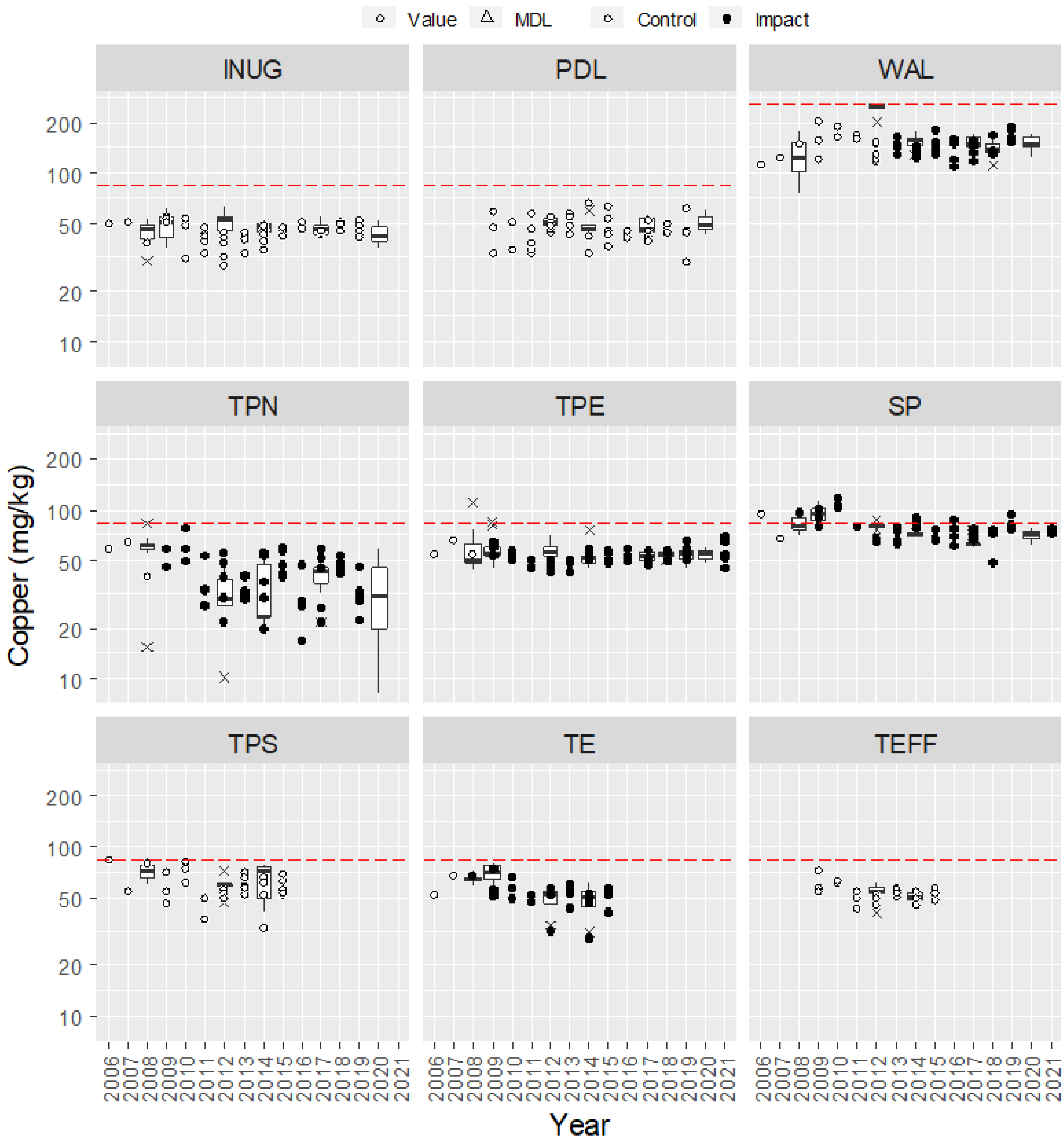


Figure 4-72. Total lead (mg/kg) in sediment samples (grabs & cores) from Meadowbank project lakes since 2006.

Note: The red dashed line = trigger value. Cores samples = box and whisker. Box and whisker plots are interpreted as follows: horizontal line in the box = median concentration, upper and lower margins = upper (75th) and lower (25th) percentile concentrations or the interquartile range, vertical lines are maximum and/or minimum concentrations, 'x's beyond vertical lines are outlier concentrations.

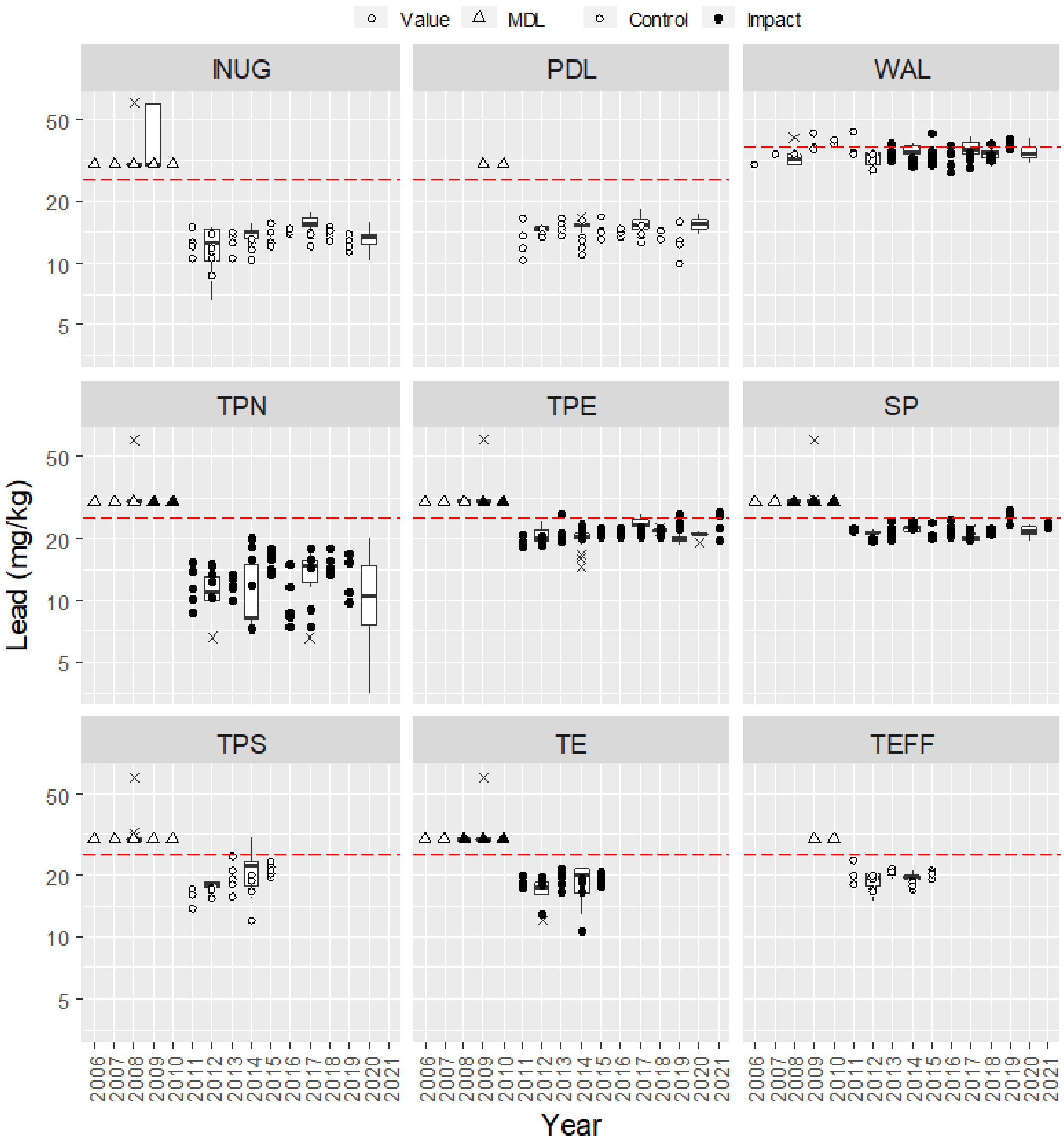


Figure 4-73. Total mercury (mg/kg) in sediment samples (grabs & cores) from Meadowbank project lakes since 2006.

Note: The red dashed line = trigger value. Cores samples = box and whisker. Box and whisker plots are interpreted as follows: horizontal line in the box = median concentration, upper and lower margins = upper (75th) and lower (25th) percentile concentrations or the interquartile range, vertical lines are maximum and/or minimum concentrations, 'x's beyond vertical lines are outlier concentrations. The detection limit for mercury was adjusted in 2019 from 0.005 mg/L to 0.05 mg/L. These changes are notable on this plot for all study areas if mercury concentrations are below 0.05 mg/L. This adjustment does not impact trigger screening.

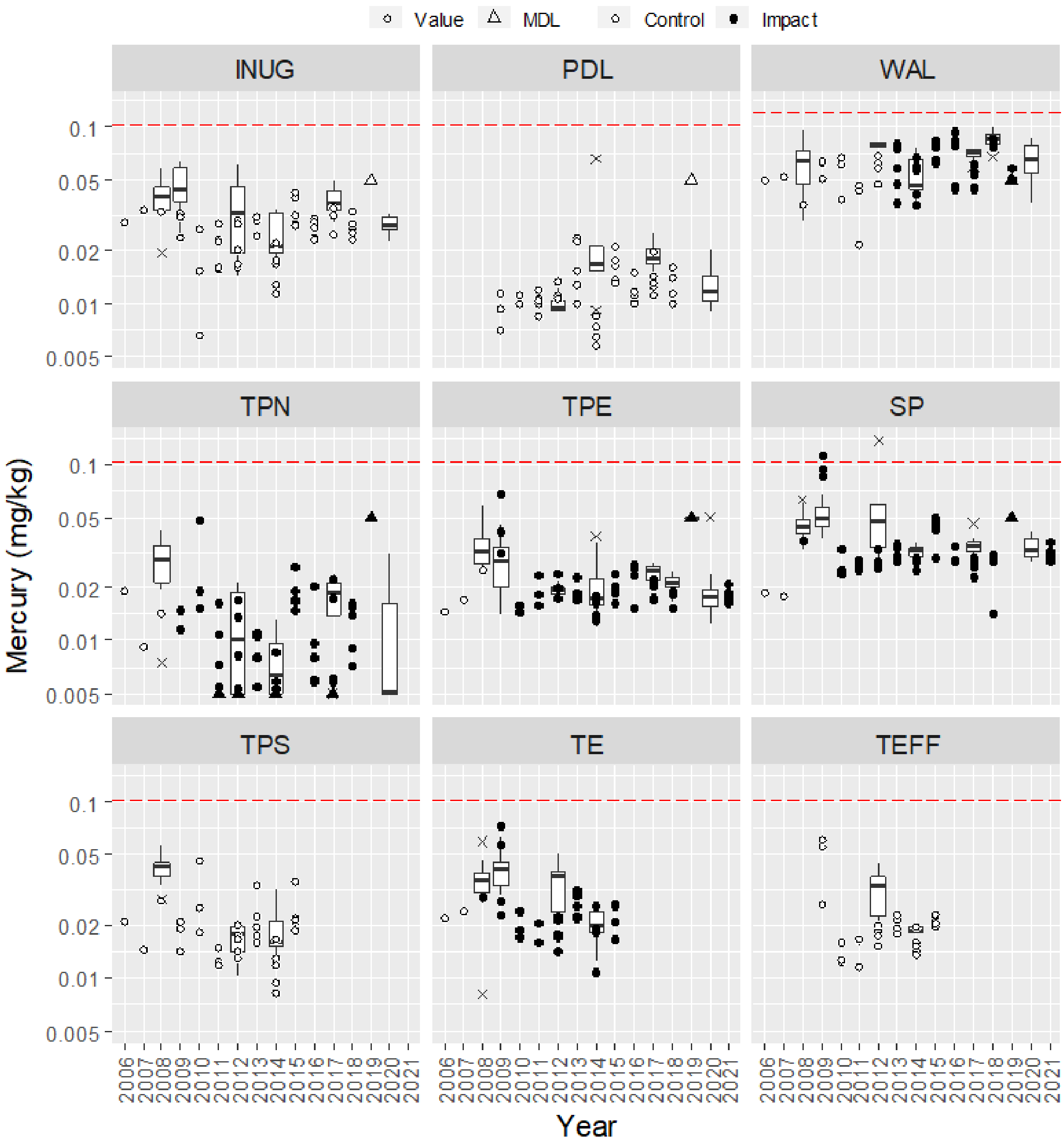
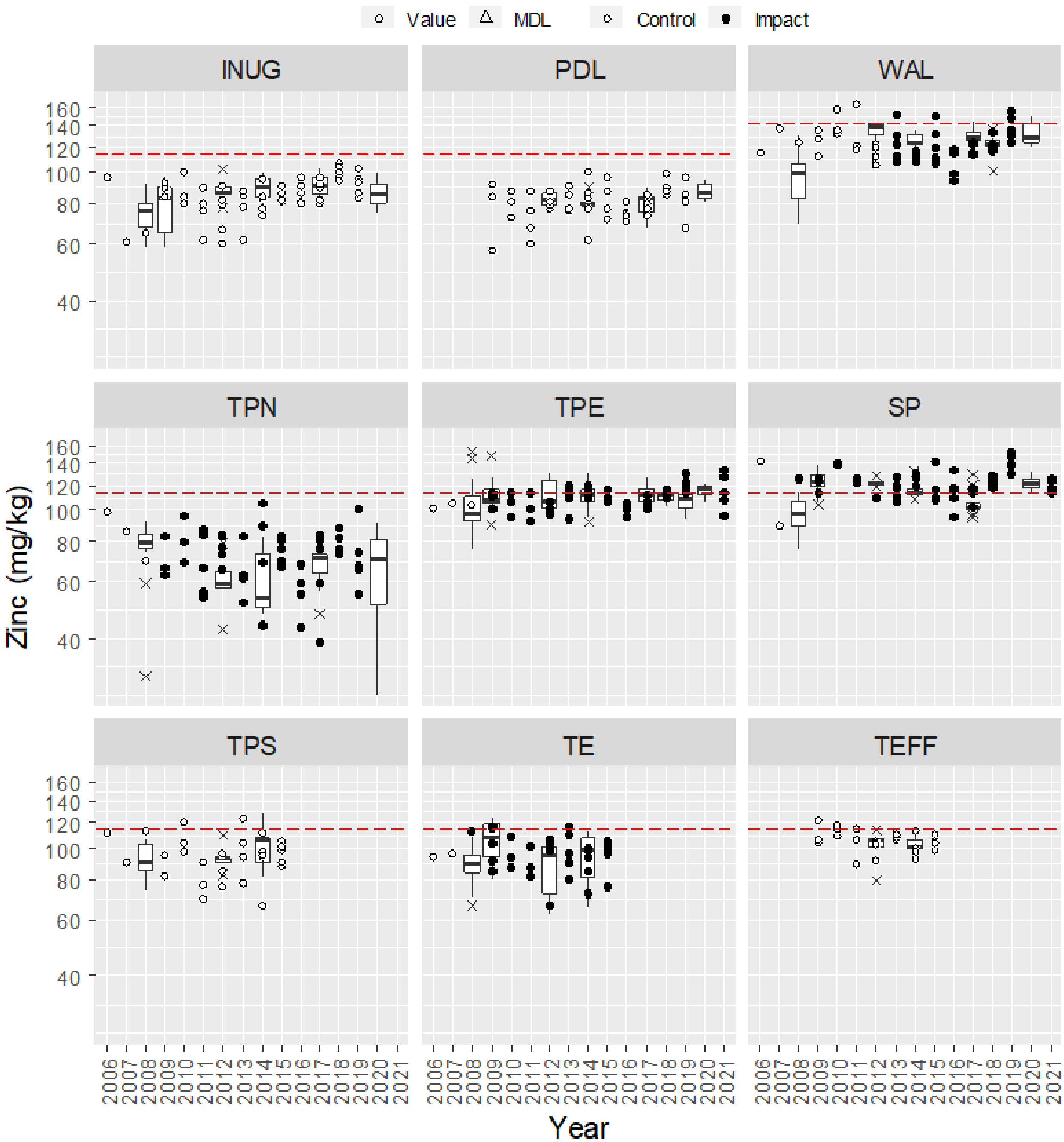


Figure 4-74. Total zinc (mg/kg) in sediment samples (grabs & cores) from Meadowbank project lakes since 2006.

Note: The red dashed line = trigger value. Cores samples = box and whisker. Box and whisker plots are interpreted as follows: horizontal line in the box = media concentration, upper and lower margins = upper (75th) and lower (25th) percentile concentrations or the interquartile range, vertical lines are maximum and/or minimum concentrations, 'x's beyond vertical lines are outlier concentrations.



Benthic Invertebrate Tables and Figures

Table 4-9. Geometric means for total abundance and total richness, Meadowbank study lakes.

Geometric means for Total abundance[1]																
Station	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
INUG	731 (14)	975 (12)	1300 (9)	1129 (10)	628 (15)	881 (13)	1042 (11)	1975 (3)	621 (16)	1648 (5)	2100 (1)	1712 (4)	1497 (6)	1452 (7)	2055 (2)	1398 (8)
PDL	NA	NA	NA	1522 (1)	776 (11)	927 (8)	942 (7)	1279 (3)	473 (13)	1127 (4)	1373 (2)	748 (12)	779 (10)	990 (5)	951 (6)	829 (9)
WAL	12894 (2)	4357 (6)	1057 (15)	1834 (9)	1727 (11)	800 (16)	1874 (8)	1445 (14)	2222 (7)	1568 (12)	14253 (1)	4942 (5)	12035 (3)	1761 (10)	6117 (4)	1524 (13)
TPN	NA	1359 (6)	864 (12)	1214 (8)	1029 (11)	498 (14)	1141 (9)	1407 (5)	373 (15)	3025 (1)	1696 (4)	1309 (7)	2051 (3)	594 (13)	1075 (10)	2283 (2)
TPE	3220 (6)	1563 (15)	5556 (1)	1663 (13)	1126 (16)	1584 (14)	3915 (2)	2244 (12)	2827 (8)	2765 (10)	2787 (9)	3147 (7)	2485 (11)	3490 (4)	3224 (5)	3505 (3)
SP	619 (13)	842 (10)	395 (15)	771 (12)	241 (16)	563 (14)	1169 (9)	2279 (2)	2796 (1)	1927 (4)	1420 (6)	2058 (3)	1298 (7)	842 (11)	1631 (5)	1222 (8)
TPS	935 (9)	1597 (4)	1501 (6)	1714 (3)	1130 (8)	932 (10)	1932 (2)	1581 (5)	1217 (7)	5939 (1)	NA	NA	NA	NA	NA	NA
TE	913 (4)	930 (3)	743 (8)	757 (6)	517 (10)	725 (9)	747 (7)	819 (5)	1158 (2)	1548 (1)	NA	NA	NA	NA	NA	NA
TEFF	NA	NA	NA	1215 (1)	886 (5)	615 (7)	921 (3)	955 (2)	891 (4)	816 (6)	NA	NA	NA	NA	NA	NA

Geometric means for Total richness																
Station	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
INUG	10.1 (14)	12 (11)	13.5 (6)	13.2 (7)	8.1 (16)	10.5 (13)	10.7 (12)	15.4 (3)	9.3 (15)	12.4 (10)	15.7 (2)	13.6 (5)	14.2 (4)	13.1 (8)	16.2 (1)	13 (9)
PDL	NA	NA	NA	10.8 (1)	8.4 (7)	9.1 (5)	7.9 (10)	9.9 (3)	5 (13)	8.8 (6)	10.1 (2)	9.7 (4)	5.8 (12)	8.2 (8)	8.1 (9)	7.1 (11)
WAL	11.6 (6)	13.1 (4)	7.9 (15)	10.6 (11)	10.4 (13)	6.9 (16)	11.5 (7)	10.5 (12)	10.8 (10)	10.2 (14)	14.5 (3)	13.1 (4)	14.9 (2)	11.1 (9)	15.5 (1)	11.2 (8)
TPN	NA	9.3 (9)	7.5 (14)	9 (11)	10.3 (7)	7.8 (13)	10.1 (8)	12.4 (3)	5.7 (15)	10.7 (6)	12.4 (3)	12.2 (5)	12.5 (2)	8.7 (12)	9.1 (10)	14.9 (1)
TPE	8.2 (16)	10.7 (13)	14.2 (4)	11.3 (11)	9.7 (14)	9.3 (15)	12.5 (9)	14 (6)	10.9 (12)	14.1 (5)	13.7 (7)	12.5 (9)	12.9 (8)	15.6 (1)	15.6 (2)	14.7 (3)
SP	6.1 (15)	9.3 (12)	7.1 (14)	7.2 (13)	4.1 (16)	10.2 (11)	12.7 (6)	11.6 (7)	13.3 (4)	12.9 (5)	15.1 (1)	11.2 (8)	10.5 (9)	10.3 (10)	14.1 (2)	13.4 (3)
TPS	10.6 (5)	9.4 (8)	10.7 (3)	10.7 (3)	8.1 (9)	7.8 (10)	10.2 (6)	10.1 (7)	10.8 (2)	16.5 (1)	NA	NA	NA	NA	NA	NA
TE	5 (10)	8.7 (5)	9.9 (2)	7.1 (7)	5.8 (9)	5.9 (8)	8.8 (4)	7.7 (6)	9 (3)	12.8 (1)	NA	NA	NA	NA	NA	NA
TEFF	NA	NA	NA	10.3 (3)	10.6 (2)	8.5 (6)	8.3 (7)	9.5 (5)	10.3 (3)	11.4 (1)	NA	NA	NA	NA	NA	NA

Notes:
1. Total abundance in organisms/m^2.
Rank order of abundance and richness shown in parentheses.
Red vertical lines mark the year that area designations switched from *control* to *impact.*
NA = Benthic invertebrate sampling was not completed for the given area/year.

Table 4-10. Results of the BACI tests for benthic invertebrate abundance at Meadowbank study lakes.

After Period	Test Area	n(B)	n(A)	Estimate	SE	P-value*	Effect size (%)		
							ES	LCI	UCI
2021	TPN	2	1	0.53	0.47	0.77	70	-100	65,015
	TPE	3	1	-0.20	0.67	0.40	-18	-95	1,357
	SP	2	1	0.02	0.30	0.52	2	-98	4,771
	WAL	7	1	-0.76	0.98	0.23	-53	-96	419
2020-21	TPN	2	2	-0.04	0.50	0.47	-4	-89	729
	TPE	3	2	-0.43	0.47	0.21	-35	-85	186
	SP	2	2	-0.03	0.23	0.46	-3	-64	162
	WAL	7	2	-0.26	0.75	0.37	-23	-87	356
2019-21	TPN	2	3	-0.31	0.56	0.31	-27	-88	341
	TPE	3	3	-0.36	0.37	0.19	-30	-75	92
	SP	2	3	-0.15	0.21	0.26	-14	-55	66
	WAL	7	3	-0.39	0.61	0.27	-32	-84	180
2018-21	TPN	2	4	-0.15	0.51	0.40	-14	-79	261
	TPE	3	4	-0.42	0.31	0.12	-34	-71	47
	SP	2	4	-0.11	0.19	0.30	-10	-47	52
	WAL	7	4	0.01	0.60	0.51	1	-74	294

Notes:

* **Bolded & underlined** values are P-values < 0.1.

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

Test area = area compared to control (INUG).

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

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

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

SE = standard error of the estimate.

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

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

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

Table 4-11. Results of the BACI tests for benthic invertebrate taxa richness at Meadowbank study area lakes.

After Period	Test Area	n(B)	n(A)	Estimate	SE	P-value*	Effect size (%)		
							ES	LCI	UCI
2021	TPN	2	1	0.54	0.24	0.87	71	-92	3,528
	TPE	3	1	0.20	0.15	0.84	22	-35	129
	SP	2	1	0.40	0.20	0.85	50	-88	1,763
	WAL	7	1	-0.07	0.31	0.42	-7	-56	99
2020-21	TPN	2	2	0.18	0.30	0.70	20	-67	331
	TPE	3	2	0.12	0.11	0.82	12	-21	59
	SP	2	2	0.32	0.15	0.92	38	-26	157
	WAL	7	2	-0.01	0.22	0.48	-1	-42	67
2019-21	TPN	2	3	0.12	0.26	0.66	13	-50	156
	TPE	3	3	0.16	0.10	0.92	18	-10	54
	SP	2	3	0.27	0.13	0.94	31	-13	96
	WAL	7	3	-0.04	0.18	0.42	-4	-36	46
2018-21	TPN	2	4	0.16	0.22	0.75	17	-36	117
	TPE	3	4	0.12	0.10	0.86	13	-12	45
	SP	2	4	0.22	0.13	0.92	25	-13	79
	WAL	7	4	0.01	0.16	0.52	1	-29	44

Notes:

* **Bolded & underlined** values are P-values < 0.1.

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

Test area = area compared to control (INUG).

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

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

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

SE = standard error of the estimate.

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

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

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

Figure 4-75. Benthic invertebrate total abundance (#/m²) from Meadowbank project lakes since 2006.

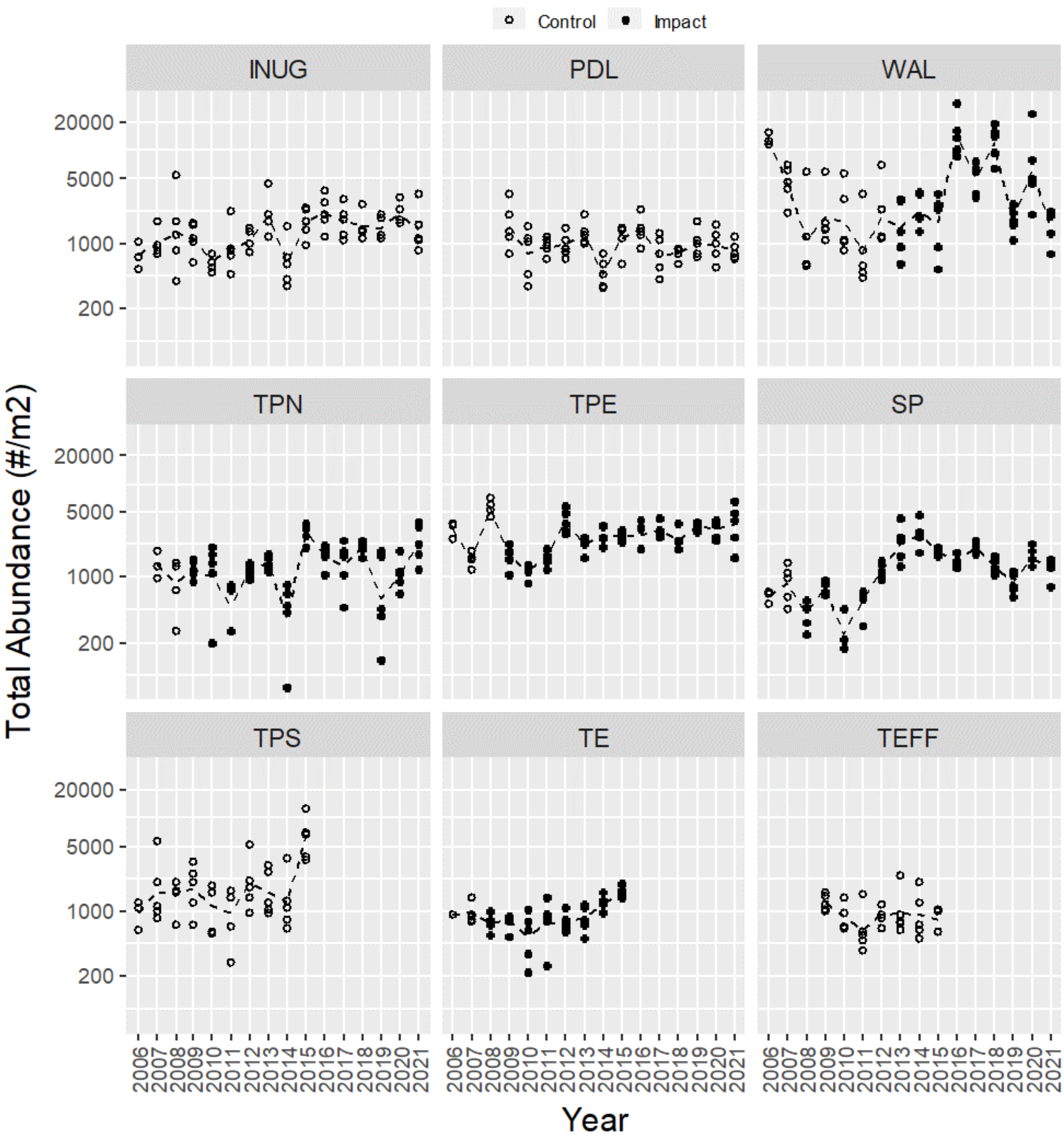


Figure 4-76. Benthic invertebrate abundance (#/m²) by major taxa from Meadowbank project lakes since 2006.

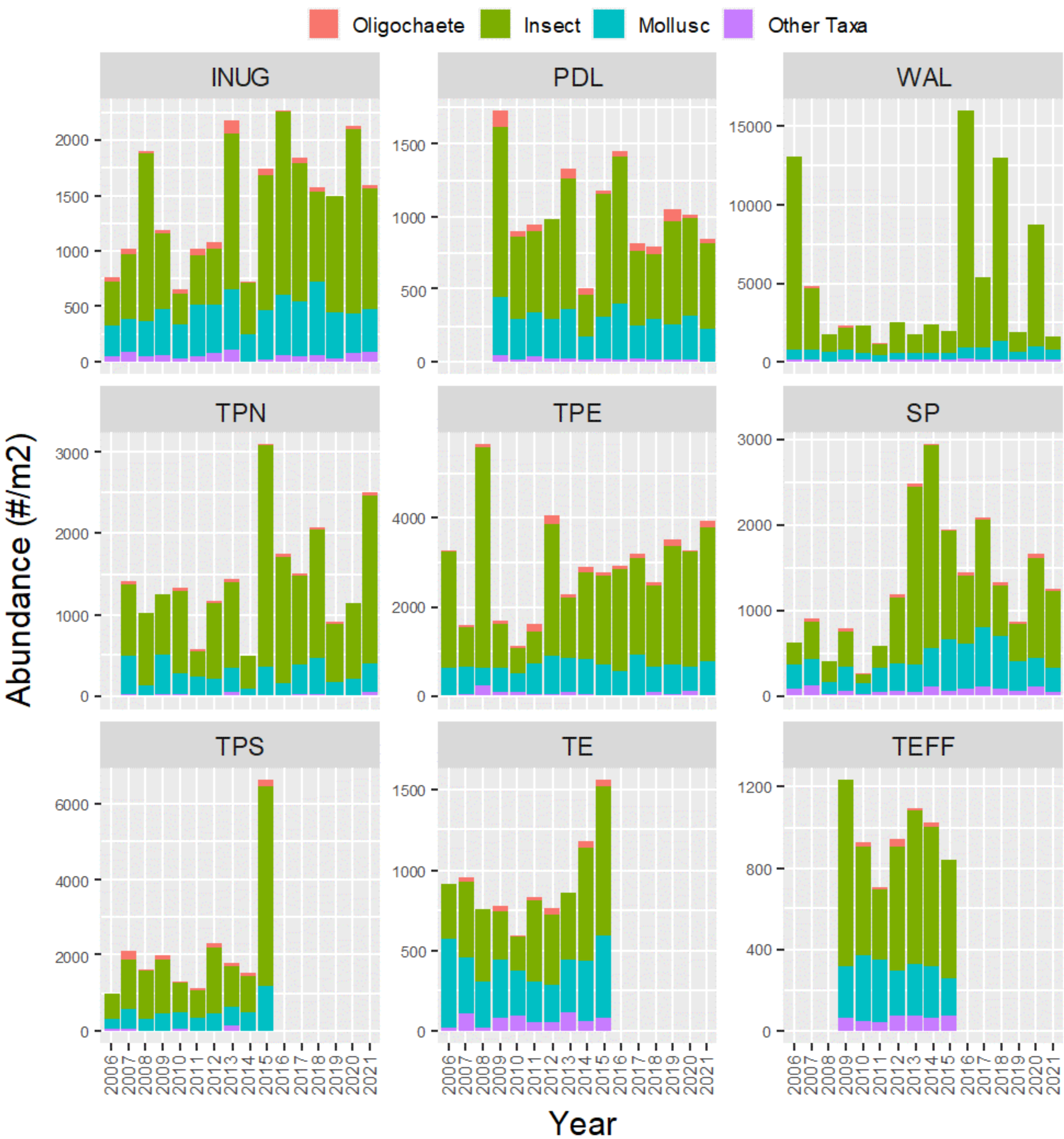


Figure 4-77. Benthic invertebrate relative abundance by major taxa from Meadowbank project lakes since 2006.

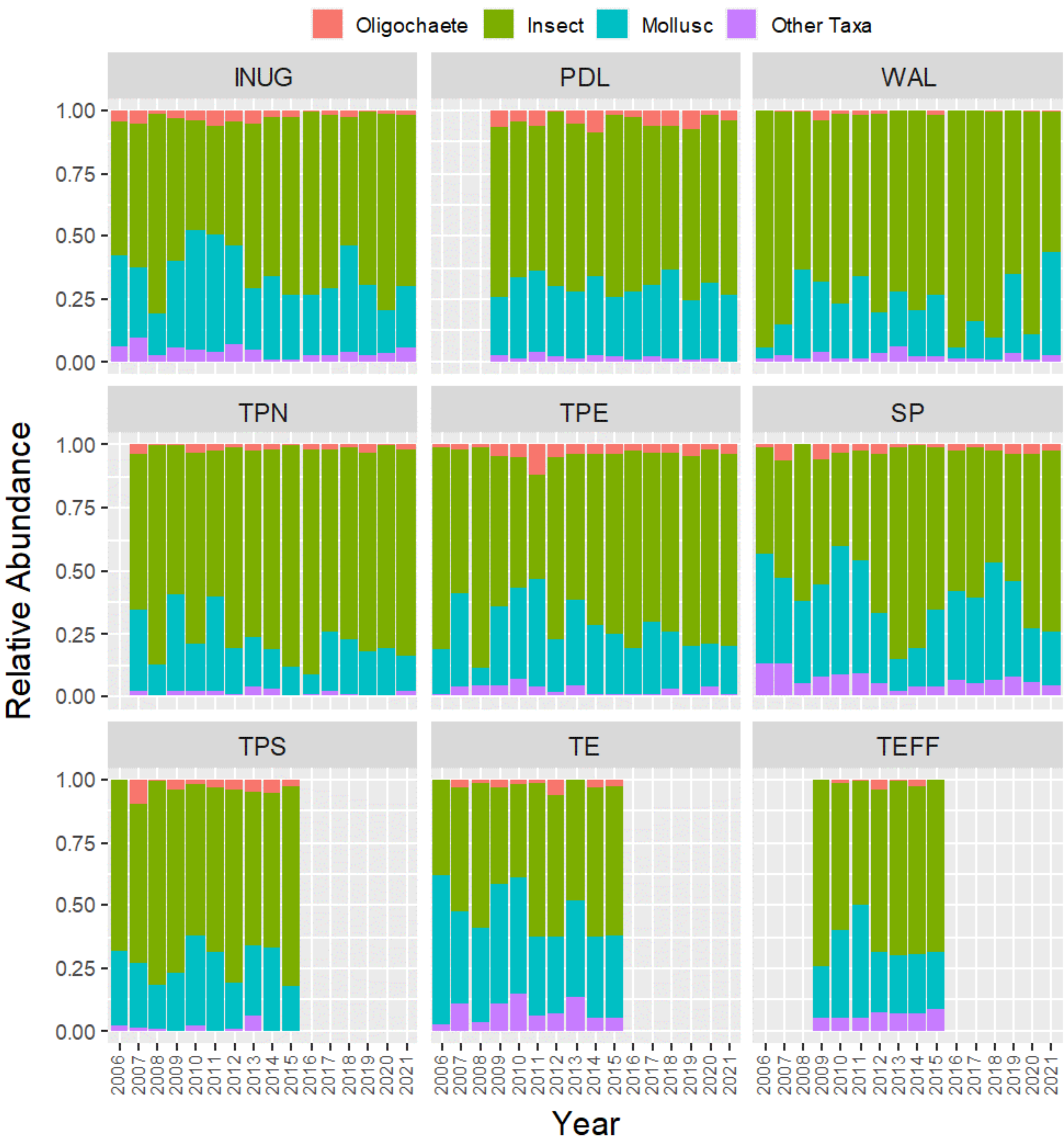


Figure 4-78. Benthic invertebrate total richness (# taxa) from Meadowbank project lakes since 2006.

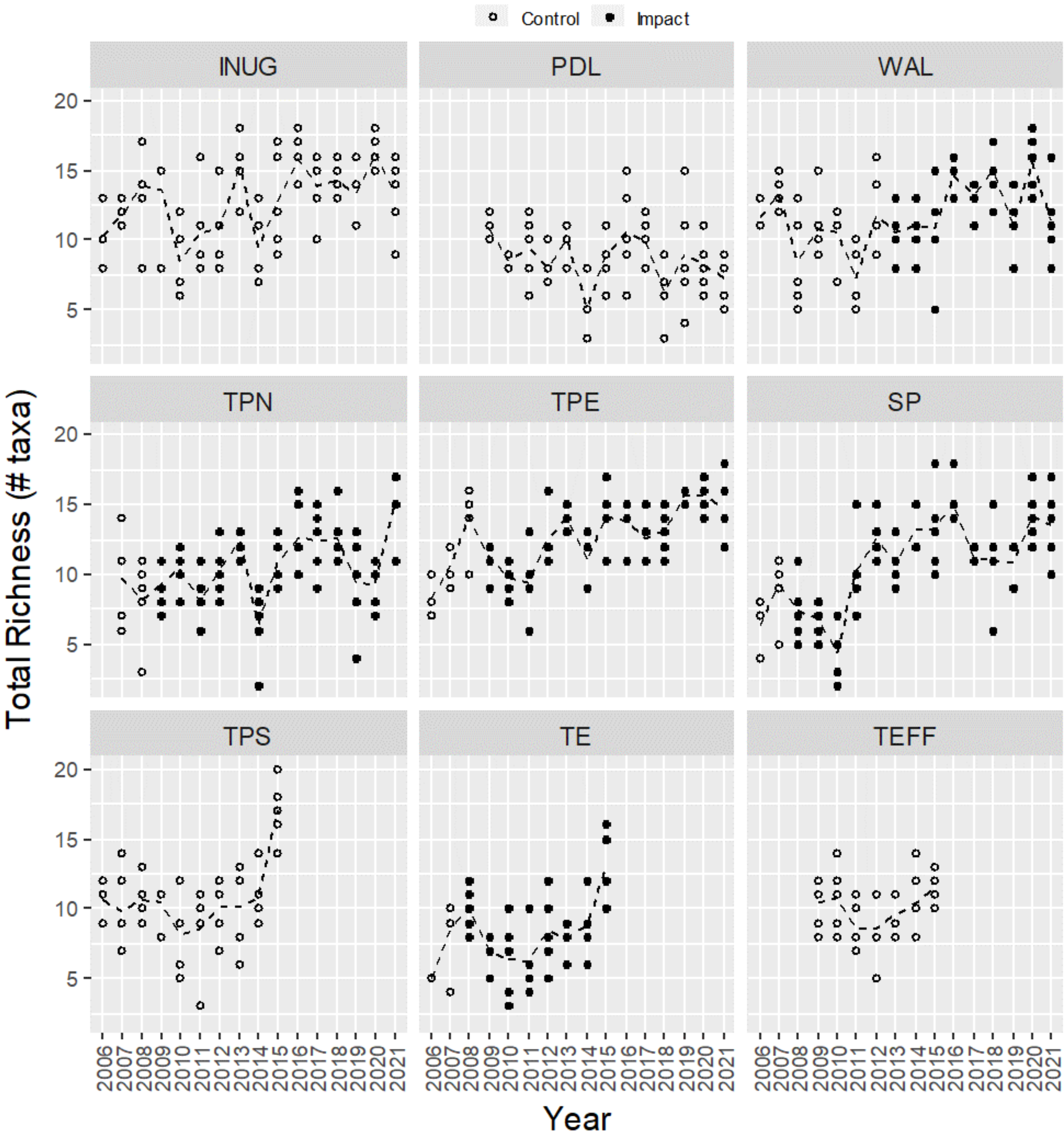


Figure 4-79. Benthic invertebrate richness (# taxa) by major taxa from Meadowbank project lakes since 2006.

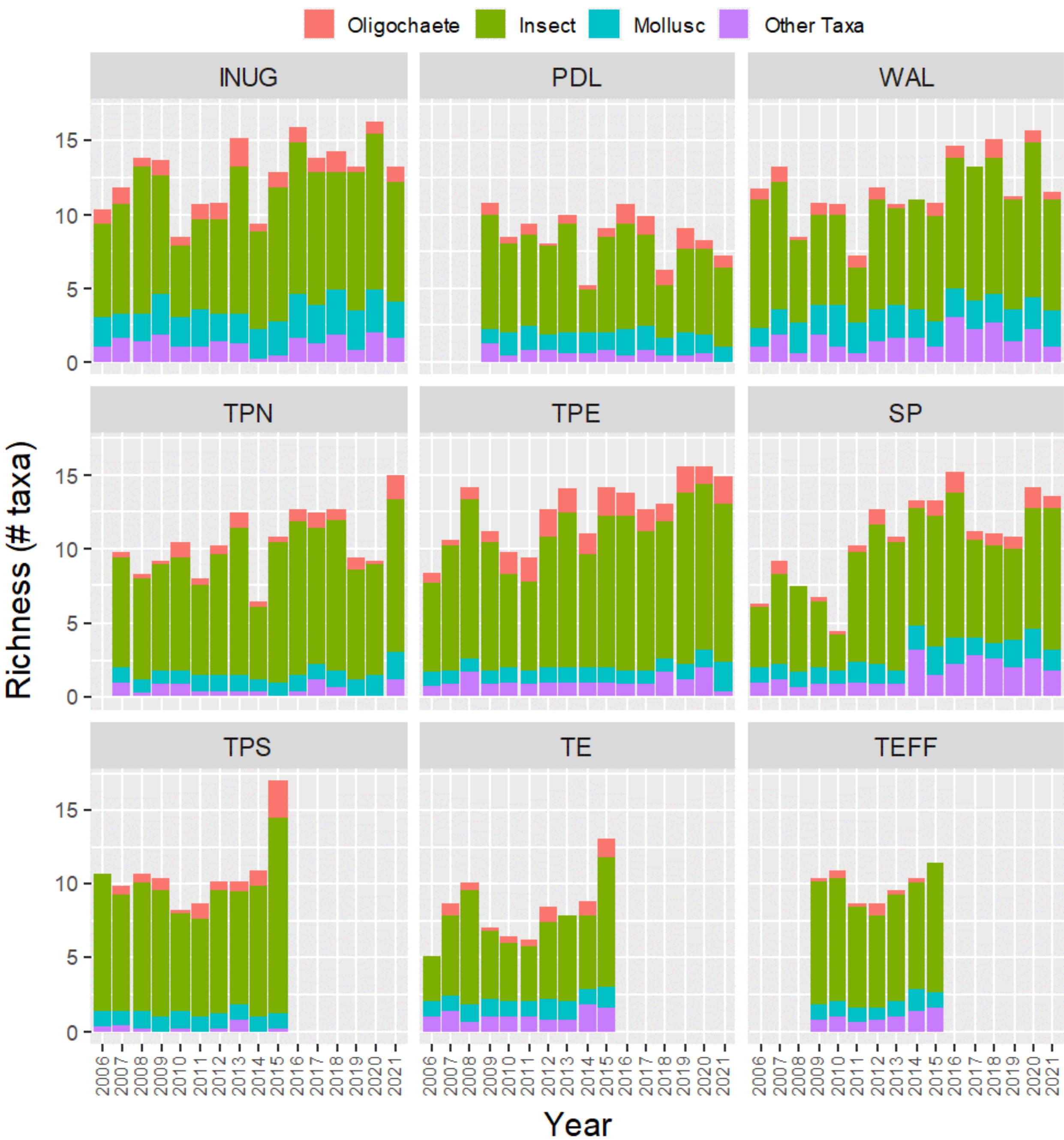
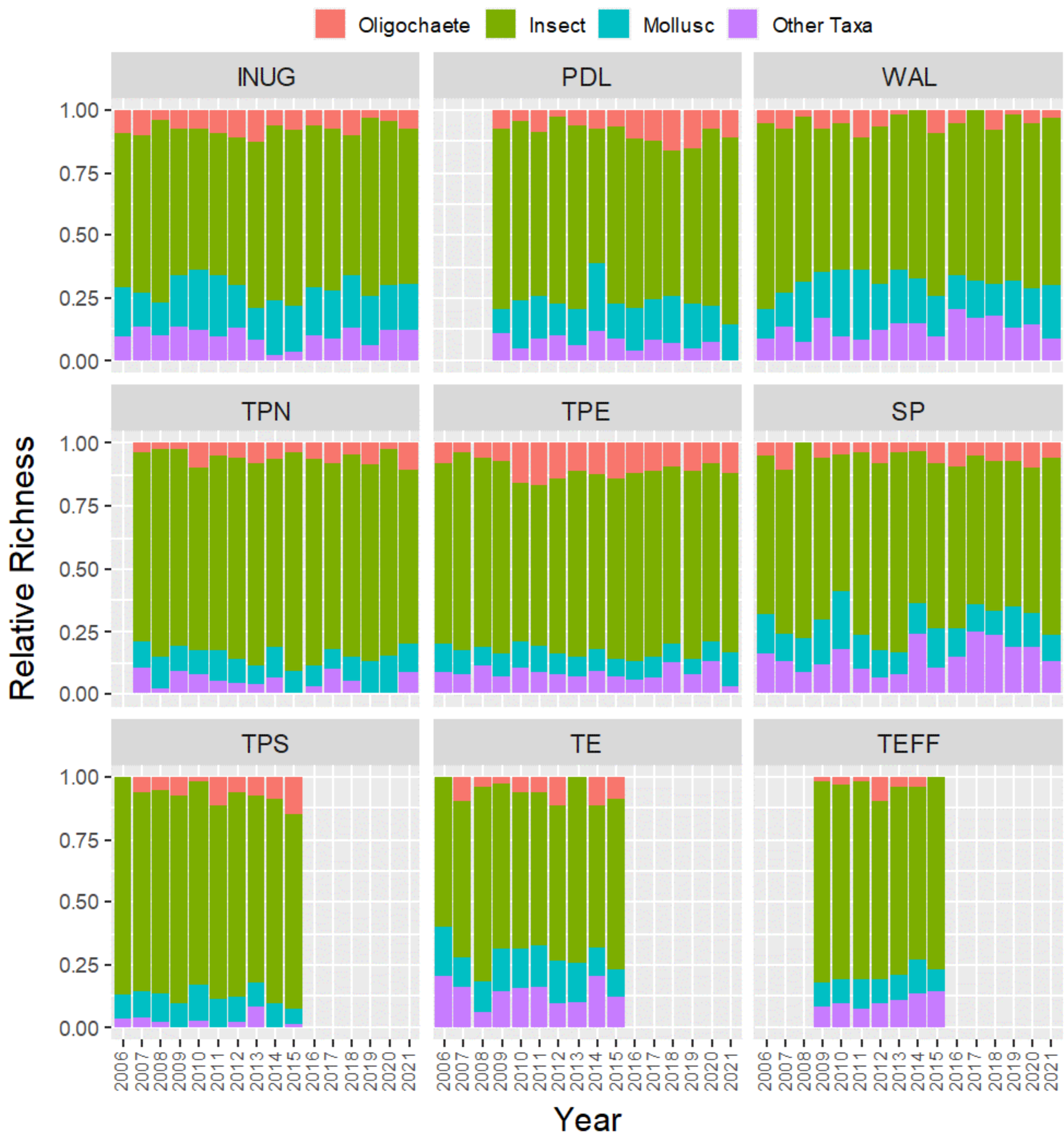


Figure 4-80. Benthic invertebrate relative richness by major taxa from Meadowbank project lakes since 2006.



5 WHALE TAIL

5.1 Overview of the Whale Tail CREMP

This section presents findings from the 2021 CREMP for the Whale Tail Pit study area lakes. The scope of the 2021 program included water quality, sediment chemistry, phytoplankton community, and benthic invertebrate community monitoring. Figures and tables relevant to the Whale Tail Project are organized at the end of the section, by study component.

Six lakes are currently[22] included in the study design for monitoring mining-related changes downstream of the Whale Tail Project:

- **Near-field**: Whale Tail Lake – South Basin (WTS), Mammoth Lake (MAM) and Nemo Lake (NEM)
- **Mid-field**: Lake A20 and Lake A76
- **Far-field**: Lake DS1

INUG and PDL are the primary reference areas for the Whale Tail Pit CREMP. Locations where water sampling was done in 2021 are shown in **Figure 5-1**. Sediment and benthic invertebrate sampling areas are shown in **Figure 5-2**.

The landscape around the Amaruq property 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. Except for Nemo Lake, all Whale Tail study area lakes are part of the *A* Watershed that flows from SE to NW and drains into Amur Lake (aka DS1). Nemo Lake is located north of Amaruq in Watershed *C* that is separated from Whale Tail and Mammoth Lakes by a drainage divide to the north of Whale Tail Lake.

Construction of the Whale Tail Dike in 2018 to develop the Whale Tail Pit deposit altered the flow path and hydrology in the area to the south of Whale Tail Lake. Prior to construction of the Whale Tail Dike, water flowed from Lake A20 through Whale Tail Lake, Mammoth Lake, Lake A76, and into Lake DS1. Construction of the dike and ensuing changes in the local hydrology raised the level of the south basin of Whale Tail Lake. Higher water levels flooded tributary lakes A20, A65, and A63, among others, and created an impoundment. Lake A20 is no longer *upstream*, as the channel between WTS and A20 flooded; however, the connection between WTS and A20 is shallow, and hydrostatic pressure from input sources to Lake A20 likely limits water exchange. To regulate water level in the impoundment, a

[22] Additional lakes may be added to the study design to fulfill monitoring requirements for the Whale Tail Pit Expansion Project.

diversion channel was constructed in 2019/2020 for water to flow from the north end Lake A20 to the south end of Mammoth Lake. The changes to Whale Tail Lake and Lake A20 are shown in **Figure 5-1**.

Area designations changed from *control* to *impact* for WTS and MAM in 2018 as a result of the onset of construction activities. The other four lakes were unaffected by construction activities in 2018 and remained in the baseline (*control*) designation. Lakes A20, A76, and DS1 changed from *control* to *impact* at the start of 2019 as mine construction and mine activities continued to expand. Nemo Lake switched to *impact* after the July 2019 sampling event when heavy precipitation necessitated dewatering AP5 (sump) onto the tundra within the Nemo Lake watershed.

A chronology of construction activities relevant for interpreting results from the Whale Tail Pit CREMP are provided in **Table 1-1**.Construction activities and onsite water management in 2020/2021 are summarized below:

- **Whale Tail Impoundment** – Construction of the Whale Tail dike began in July 2018 (**Figure 5-3**). The impoundment caused water levels to rise in 2018/2019, resulting in Lakes A55, A20, and A18 being fully connected to the south basin of Whale Tail Lake by August 2019. Pumping from the north basin to the south was required throughout much of 2019 to address dike seepage and to create the Whale Tail attenuation pond. Up to May 2020, water transfer occurred from the north basin to the south basin. Construction activities (e.g., dike grouting) started late in 2019 to address seepage and continued until late March 2020. Currently, seepage water is directed to the Whale Tail Attenuation Pond and managed as part of this infrastructure.
- **IVR Expansion** – 2021 marked first year of operation for the IVR diversion ditch along with the commissioning of the associated attenuation pond and the construction of IVR Dike D1 (**Figure 5-3**). Excavation of the IVR West Pit began on October 22nd with the IVR waste rock storage facility now being actively used.
- **Effluent Discharge to Mammoth Lake** – Treated water meeting MDMER and WL limits was discharged to Mammoth Lake between June 9th and September 28th.
- **Effluent Discharge to Whale Tail South Basin** – Treated water meeting MDMER and WL limits was discharged to WTS between January 1st and February 13th, March 1st and June 17th, and between October 2nd and November 23rd.

5.2 Limnology

Limnology data provide an initial assessment of whether conditions are changing within a sampling area to a degree that may require additional investigation. The general timing of the limnology and water sampling program for Whale Tail coincided with the Meadowbank CREMP sampling program. Limnology profiles were conducted at locations shown in **Figure 5-1**. Each point shown on the map is labelled with a number corresponding to the month the profiles were collected (e.g., 5 = May). Results for each lake focus on the deepest location sampled per event; matching water chemistry sample IDs (where available) for 2021 are listed in **Table 5-1** for cross-reference.

Table 5-1. Samples included in the limnology profiles for the Whale Tail study area lakes in 2021.

Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
WTS	☑	☑	WTS-57	☑	WTS-59	Ice not safe for travel	WTS-61	WTS-64	WTS-65	Ice not safe for travel	☑	☑
MAM	☑	☑	MAM-57	☑	MAM-60		MAM-61	MAM-63	MAM-65		☑	☑
NEM	☑	☑	NEM-58	☑	NEM-60		NEM-62	NEM-64	NEM-66		☑	☑
A20	☑	☑	A20-51	☑	A20-53		A20-56	A20-58	A20-59			☑
A76					A76-51		A76-53	A76-56	A76-57			
DS1					DS1-50		DS1-51	DS1-53	DS1-55			

Notes:
☑ = One profile is collected from the near-field areas (and occasionally one mid-field area) in months where water sampling is not completed.
The sample IDs shown represent the deeper of the two locations sampled each month.
Due to equipment related issues samples were not collected at A76 and DS1 in March or at A20 in November 2021.

5.2.1 General Observations

The lakes in the Whale Tail study area are, for the most part, shallow and oligotrophic. DS1 is the deepest lake in the study area, with a maximum recorded depth of approximately 33 m. A20, A76, and NEM have areas of steep relief, but most of the surface area is less than 15 m deep.

Like the Meadowbank lakes, the ice-free season is short for lakes within the Whale Tail study area. Ice break-up usually occurs during mid to late June in the region and begins to form again in October. Sampling in June and October is avoided due to safety concerns surrounding ice conditions. Surface water temperatures measured at 3 m depth typically reach a yearly high between 10°C and 15°C sometime in August before cooling in the fall (**Figure 5-4**). Temperature, specific conductivity, and dissolved oxygen profiles for each of the 2021 sample events are shown in **Figure 5-5** to **Figure 5-14**. Profiles for INUG and PDL are included in monthly plots for reference, where available.

Temperature and Dissolved Oxygen

Lakes in the Whale Tail Pit study area are typically unstratified for temperature and oxygen during the open-water season due to strong winds and shallow depths. This also ensures that the distribution of phytoplankton, and to a lesser extent, zooplankton is vertically more uniform than it would be without mixing. Thermal stratification, if any, is brief (days) and water temperatures only differ 4°C to 5°C between surface and bottom during these times when the wind is calm.

The lakes are well oxygenated throughout the year, with DO generally above 10 mg/L. In 2021, the lakes were mostly unstratified, with slight stratification observed only during the winter months: February

(**Figure 5-6**), March (**Figure 5-7**) , May (**Figure 5-9**), November (**Figure 5-13**) and December (**Figure 5-14**). Conditions were mixed in summer months July (**Figure 5-10**) and August (**Figure 5-11**).

Temperature and DO concentrations in 2021 were consistent with previous years, and the seasonal patterns were typical of this Arctic area. Further, patterns were similar between the control lakes (INUG and PDL) and the NF and MF monitoring areas.

Conductivity

Whale Tail Lake – South Basin – Specific conductivity profiling is a cost-effective way to monitor changes in water quality, particularly when the source is direct or indirect discharge of water. Conductivity is a surrogate parameter for total dissolved solids (TDS), which is a broad measure of the combined content of all dissolved inorganic and organic substances. In 2021, conductivity in WTS ranged from approximately 75 to 135 µS/cm and was generally similar to NEM for January to April (**Figure 5-5** to **Figure 5-8**). In May, there was evidence of some stratification in WTS with conductivity ranging from approximately 75 to 135 µS/cm (**Figure 5-9**). In July, the conductivity in WTS dropped to approximately 100 µS/cm (**Figure 5-10**) and remained between 75 to 100 µS/cm until December, when the conductivity showed some stratification (**Figure 5-14**). In January, March, July, and August of 2021, overall conductivity was higher than in 2020 (generally ~ 25 µS/cm) while profiles during the other months were comparable to 2020. The months in which conductivity was higher in 2021 compared to 2020 correspond to discharging periods into WTS (January and March to June).

Mammoth Lake – Prior to November 2018, conductivity in Mammoth Lake was characteristically unstratified, measuring below 60 µS/cm (Azimuth, 2019a). In November and December 2018, the conductivity in MAM increased to 150 µS/cm, following the discharge of treated contact water into MAM which stopped in fall 2020. Since then, we have observed an increase in conductivity during winter months with a subsequent decline during open water periods. Conductivity readings in 2021 were often above 175 µS/cm and as high as 360 µS/cm (**Figure 5-5** through **Figure 5-14**). Seasonally, conductivity was similar to 2020 (**Table 5-3**). The decrease in conductivity from winter months to open water periods was more pronounced compared to 2020. In July 2021, for example, conductivity was approximately 130 µS/cm (**Figure 5-16**), which corresponds to a 60% decrease compared to peak values measured in May (360 µS/cm). Furthermore, maximum conductivity reported in September through December suggests conductivity may be decreasing in Mammoth Lake. Maximum conductivity readings from each sampling event are provided in **Table 5-2**. A comparison of maximum conductivity readings from each sampling event in 2020 and 2021 is provided in **Table 5-3**.

The Whale Tail Environment Team added turbidity to the May limnology profiles in 2019 after noticing spatial differences in conductivity within Mammoth Lake and potential stratification. Turbidity readings from the Mammoth Lake profiles in 2021 ranged from 0-1.4 NTU, well below the range reported in May 2019 (i.e., 13-21 NTU).

Mammoth Lake is fairly shallow, orientated east to west, and somewhat hourglass shaped. Water chemistry sampling and limnology profiling requires sample depths of more than 5 m and, to meet minimum depth requirements, samples and profiles are generally collected in the east and west basins of the lake. Limnology-only profiles are collected from only one location in each area during a sampling event when there are no paired water chemistry samples collected. In each sampling event, two water samples are collected and, historically, one is collected in the east basin and one in the west basin. This practice provides good spatial coverage while meeting minimum depth requirements. For paired samples, which are samples taken within the same month or sampling event, the conductivity observed in the east basin was higher than the conductivity in the west basin, similar to 2020 (**Table 5-2** and **Table 5-3**). The narrow portion in the middle of the lake is relatively shallow and creates a natural barrier that slows water exchange between the basins, particularly during winter months when ice cover further limits potential water exchange between the basins. Thus, mine influences on water quality are temporarily concentrated in the east basin. Both basins demonstrated a comparative reduction in conductivity in July following breakup as a result of natural freshet and lake-turnover affects (see **Table 5-2**).

The within-lake spatial trend in conductivity and turbidity suggests that mine site activities are influencing water quality in Mammoth Lake. A plume delineation survey conducted was completed in August 2020 as part of the Whale Tail Pit Cycle 1 Environmental Effects Monitoring (EEM) biological monitoring study demonstrated that the extent of 1% effluent plume includes the east end of Mammoth Lake and part of the west basin (Portt and Associates and Kilgour & Associates, 2021).

Table 5-2. Maximum conductivity readings from each sampling event in Mammoth Lake, 2021.

Month	West Basin of Mammoth Lake		East Basin of Mammoth Lake	
	Sample ID	Max Conductivity (µS/cm)	Sample ID	Max Conductivity (µS/cm)
January	-	-	MAM-JAN	258
February	-	-	MAM-FEB	286
March	MAM-57	242	MAM-58	333
April	MAM-APR	244	-	-
May	MAM-59	271	MAM-60	360
July	MAM-62	122	MAM-61	135
August	MAM-64	121	MAM-63	157
September	MAM-65	118	MAM-66	166
November	-	-	MAM-NOV	154
December	-	-	MAM-DEC	154
ANNUAL MEAN	**-**	**186**	**-**	**223**

Notes: "-" not collected as per the study design.

Table 5-3. Maximum conductivity readings from each sampling event in Mammoth Lake and relative percent difference (RPD) between readings from 2020 and 2021.

Month	West Basin			East Basin		
	2020	2021	RPD	2020	2021	RPD
January	204	-	na	-	258	na
February	215	-	na	-	286	na
March	210	242	15%	376	333	-11%
April	-	244	na	246	-	na
May	249	271	9%	-	360	na
July	124	122	-2%	137	135	-1%
August	129	121	-6%	147	157	7%
September	134	118	-12%	183	166	-9%
November	-	-	na	215	154	-28%
December	-	-	na	232	154	-34%

Notes: "-" not collected as per the study design. "na" = RPD not calculated.

Nemo Lake, Lake A20, Lake A76, and Lake DS1 – In 2019, field conductivity measurements at NEM after August showed evidence of an upward trend in response to temporary discharge of contact water to NEM. Since then, conductivity has stabilized with 2020 and 2021 showing similar seasonal patterns. Conductivity remains elevated throughout the year at around 100 µS/cm and reaches a maximum conductivity of approximately 140 µS/cm in May.

Lake A20 showed a continued trend of rising conductivity, with generally higher levels in 2021 than those seen in 2020 (**Figure 5-16**). Lake A76 was also elevated in 2021 compared to 2020, ranging between 75 to 100 µS/cm during the open water season and up to 140 µS/cm under ice in May. Similar to A20, conductivity at A76 appears to be following an increasing trend.

As seen in the *Control* (baseline) period in **Figure 5-16**, minor seasonal fluctuations in conductivity are normal across seasons and years, but since 2019, changes in conductivity observed in Mammoth Lake extend downstream to A76. Farther downstream at Lake DS1, conductivity is within the range of baseline conditions.

5.3 Water Chemistry

Water quality data for the Whale Tail CREMP were evaluated according to methods described in **Section 2.3.1** and followed the framework used for Meadowbank (**Section 4.3.2**) and Baker Lake (**Section 6.3.2**). 2021 was the third year of formal BACI analyses to assess spatial and temporal changes in water quality at the Whale Tail study area lakes. The analysis included the comparison of monitoring results to predicted water quality presented in the revised FEIS Approved Expansion Project (Golder, 2019).

5.3.1 General Observations

Water chemistry samples were collected along with limnology monitoring for the months of March, May, July, August, and September (see **Section 5.2** for limnology results); the results, screened against the federal water quality guidelines and project-specific water quality triggers, are tabulated in **Appendix B2**.

As with the Meadowbank lakes, key lake characteristics were considered when interpreting water quality results from the Whale Tail study area:

- The study lakes are generally nutrient-poor, thermally un-stratified, and well-mixed (uniform temperature and oxygen profiles), with no winter anoxia beneath the ice cover.
- The study lakes are headwater lakes, so no significant natural sources of nutrients or sediment are introduced to these lakes, except for local runoff that contributes little nutrient enrichment but sustains these aquatic ecosystems.

- Many parameters have been below laboratory detection limits (MDLs) since baseline monitoring started in 2014.

Water quality in the Whale Tail study area lakes is characteristic of northern headwater lakes. Surface water hardness is low, typically measuring less than 20 mg/L (as $CaCO_3$) during the baseline period (**Figure 5-17**). The buffering capacity of the surface water is also quite low, as evidenced by alkalinity concentrations (as bicarbonate) typically below 6 mg/L (**Figure 5-21**). Based on total phosphorous, the lakes are ultra-oligotrophic (< 0.004 mg/L; CCME, 2004); productivity is discussed in more detail in **Section 5.3.4**. Productivity of northern lakes can be limited by low concentrations of nitrogen, phosphorous, or both (Ogbego et al., 2009); concentrations of nitrate, nitrite, and phosphorous were frequently below their respective detection limits during the baseline period; however, these parameters have increased somewhat in NF lakes since late 2018. Despite being situated in a region of mineralized geology, concentrations of metals are generally low or below MDLs; when measurable, most metals are associated with the particulate phase (i.e., total rather than dissolved).

5.3.2 Temporal and Spatial Trends

Parameters included in the temporal and spatial trends assessment are listed in **Table 5-6**. Fifty-eight parameters out of 79 (approximately 73%) were retained for further examination in 2021. Of these, 55 were retained because the frequency of detected concentrations exceeded 10%. Total and dissolved selenium detection frequencies were less than 10%, but they were retained for discussion because they were detected more frequently at impact areas compared to control areas.

Parameters retained in the analysis are plotted in **Figure 5-16** through **Figure 5-72**. Trigger values[23] are shown on the time series plots as a red dashed line. Water quality predictions were developed for some parameters for Mammoth Lake and WTS. The predicted change in concentration over time is depicted as a blue dashed line in the plots. Plots and raw data for parameters that were excluded from the trend assessment are included in **Appendix B2**.

BACI analyses were conducted for parameter/area combinations if the mean concentration in 2021 exceeded the trigger value. The BACI model tests for statistically significant increases (i.e., one-tailed test looking for uni-directional changes [i.e., increases]). In this analysis, the model interaction term (or BACI effect term) represents the change at the test area in 2021 (*after* period) relative to baseline (*before* period) after accounting for natural temporal changes (i.e., temporal changes at the reference area). For simplicity, changes are noted *relative to baseline/reference* conditions.

[23] Refer to Appendix I in the 2019 CREMP report (Azimuth, 2020a) for a description of the methods used to establish triggers for each parameter.

Parameter/area combinations for which the yearly mean exceeded the trigger are listed in **Table 5-7** and were carried forward for BACI analysis (**Table 5-8**). The results are discussed in terms of ecological significance and spatial context below. Based on the mine site activities (**Section 5.1** and **Table 1-1**), the areas most likely to be impacted in 2021 were WTS and MAM, but now also Lake A76 (downstream of MAM), Lake A20 (now contiguous with WTS), and NEM (due to lingering effects of dewatering into the NEM watershed in 2019).

Laboratory Conductivity and Hardness

Conductivity and hardness parameters have trended higher in WTS and MAM since 2019, in Lake A76 and NEM in 2020 and in A20 in 2021 (**Figure 5-16** and **Figure 5-17**). The release of sump water into NEM in July 2019 resulted in an episodic increase in conductivity and hardness, though these parameters appear to have stabilized. The trigger for conductivity (48.6 µS/cm) was exceeded in all the 2021 samples for each of these five lakes (with the exception of May to September at A20). Not surprisingly, the yearly mean also exceeded the trigger (mean conductivity for WTS was 101 µS/cm, for MAM was 189 µS/cm, for Lake A76 was 96.9 µS/cm, for Lake A20 was 55.9 µS/cm, and for NEM was 100 µS/cm). The results for hardness followed an identical pattern for all five lakes, with all individual samples and the yearly means exceeding the trigger (trigger = 17.4 mg/L; mean concentration for WTS was 36.7 mg/L, for MAM was 69.4 mg/L, for Lake A76 was 33.9 mg/L, for A20 was 20.5 mg/L, and for NEM was 38.2 mg/L). The BACI analysis indicated that the changes to conductivity and hardness in WTS, MAM, Lake A76, Lake A20, and NEM were statistically significant. In all cases, the increases from reference/baseline conditions were substantial ranging from 3 to 4-fold above baseline.

In 2019, the increase in conductivity and hardness observed appeared to be limited spatially to NF areas, but as mining activities expanded in 2020 and 2021, these results have extended into MF areas. The upward trend for conductivity and hardness will continue to be monitored closely in 2022 to examine whether conductivity and hardness have stabilized or are continuing to increase. Conductivity is a composite variable that responds positively when concentrations of ionic compounds increase (e.g., chlorides, sulphates, carbonates, sodium, magnesium, calcium, potassium and metallic ions). The observed change represents an increase in concentrations of major ions (e.g., see discussion below).

Total Dissolved Solids (TDS)

The potential impacts of TDS toxicity to aquatic life are discussed in more detail in **Section 4.3.2**. TDS concentrations in MAM have been consistently above or near the trigger value (38.5 mg/L) since 2016 (**Figure 5-20**). By 2021, TDS concentrations in MAM had increased 7-fold from reference/baseline conditions, and the yearly mean (mean = 137 mg/L) was above both the trigger and the FEIS predictions. The yearly means at WTS (mean = 74.7 mg/L), Lake A76 (mean = 73.2 mg/L), Lake A20 (mean = 40.8

mg/L) and NEM (mean = 77.1 mg/L) also exceeded the trigger in 2021. All five results were statistically significant in the BACI analysis of proportional change compared to reference/baseline conditions.

Alkalinity

Like the Meadowbank area lakes, the total alkalinity fraction for the Whale Tail study area lakes is entirely bicarbonate alkalinity (HCO_3-). The 2021 yearly mean for total alkalinity exceeded the trigger (trigger = 9.6 mg/L) in WTS, MAM, NEM, A76, and A20. At NF areas WTS and MAM, an increasing trend was noted from 2019 to 2020, however, 2021 data suggests that this parameter is beginning to stabilize. For instance, while total alkalinity concentrations were generally below 7 mg/L during *before* sampling, WTS alkalinity ranges during 2019, 2020, and 2021 were 7.3 to 13.2, 11.9 to 18.6, and 12.9 to 17.7 mg/L respectively. In contrast, the MF lakes A76 and A20 have shown an increasing trend in alkalinity since 2019 which will be monitored closely in 2022. The variability of alkalinity in WTS and the other Whale Tail study area lakes is shown in **Figure 5-21** and **Figure 5-22**. Slight increases in bicarbonate alkalinity help neutralize changes in pH. In this respect, it is important to evaluate whether the increase in concentration constitutes a change of ecological-significance, not just whether an increase has occurred relative to baseline conditions.

Ionic Compounds (Calcium, Magnesium, Potassium, Sodium)

Monitoring results from 2019, 2020, and 2021 suggest that these ionic parameters are following an upward trend similar to observations of conductivity, hardness, and TDS. Concentrations of calcium, magnesium, potassium, and sodium were elevated above triggers for WTS, MAM, NEM, Lake A76, and Lake A20 in 2021 (**Figure 5-39**, **Figure 5-45**, **Figure 5-49**, and **Figure 5-52**). 2021 marks the first year that mean annual concentrations exceeded triggers at Lake A20 for all four of these ions. BACI analysis indicated a statistically significant change for these parameters in all five areas relative to reference/baseline conditions. The largest increases were seen at MAM, with apparent increases from reference/baseline conditions between 3.4 and 5.0-fold.

As discussed in detail in **Section 4.3.2**, these major cations are essential elements, and all species of aquatic life, from algae to fish, have evolved to actively regulate their osmotic, ionic, and acid-base balance by uptake of ions from their environment (Martemyanov and Mavrin, 2012). Furthermore, in oligotrophic freshwater lake environments adverse effects on primary producers and secondary consumers (e.g., zooplankton) are more commonly associated with major cation deficiency than enrichment (Alstad et al., 1999).

Nutrients

Nitrates – From 2020 to 2021, notable increases relative to baseline and reference lake conditions were observed for nitrate-N in NF area WTS and MF areas A20 and A76 (**Figure 5-26** and **Figure 5-27**). A 3-fold increase in mean annual nitrate levels was observed at WTS in 2021 relative to 2020 levels. Historically, nitrate concentrations have remained below detection at A20, however 2021 marks the first year in which the majority of samples registered concentrations above detection limits (ranging up to 0.11 mg/L). At A76, the first indications of nitrate increases occurred in 2020 with concentrations ranging up to 0.048 mg/L. In 2021, concentrations increased with a maximum concentration of 0.15 mg/L occurring in May.

As with previous years (since 2019), Total Kjeldahl Nitrogen (TKN) exceeded triggers at WTS and MAM (**Figure 5-28**). TKN also exceeded the trigger value for the first time at A20 in 2021. BACI analysis indicated that observed changes were statistically significant at both NF areas (WTS, MAM) as well as MF area A20.

Phosphorous – Phosphorous is an important component of the nutrient cycle in lake systems. It is an essential nutrient for all living organisms, however, even in water bodies with low concentrations of phosphorous, aquatic life tends to be relatively diverse and abundant (CCME, 2004).

The CCME provides guidance for site-specific application rather than a particular guideline for total phosphorous (total-P). While the framework provides a specification of <0.004 mg/L of total-P for ultra-oligotrophic lakes, up to a 50% increase in total-P over baseline is considered acceptable (Azimuth, 2020; see Appendix I). Since the 95th percentile baseline concentrations for total-P for Meadowbank, Wally, Baker, and Whale Tail Pit exceeded 0.004 mg/L, the lake-specific triggers were set to those 95th percentile concentrations and the threshold was set to 0.01 mg/L (higher end of the range for oligotrophic lakes; CCME, 2004). The trigger was exceeded in all *impact* Whale Tail study lakes at least once in 2021 with the exception of NEM (**Figure 5-29**). 2021 marked the first year that annual mean total phosphorous exceeded the trigger concentration at MF areas A20 and A76. The annual increase was most pronounced at A76, where a 1.7-fold increase occurred relative to 2020. It is worth noting that the mean concentration of total phosphorous at A76 was influenced by two samples in the May and July sampling events exceeding the trigger and no trigger exceedance was reported upstream at MAM, suggesting it may be due in part to natural variability. No samples were collected in March at A76 due to issues with the sampling equipment and as such the mean is based on the four sampling events in 2021. The annual mean total phosphorous concentration at WTS in 2021 also exceeded the trigger, although concentrations appear to have decreased compared to 2020. BACI analysis indicated that observed changes were statistically significant at NF area WTS and at both MF areas (A20, A76).

The increase in nutrients (nitrate and/or phosphorous) at WTS, A20, and A76 in 2021, combined with occasional exceedances in other lakes downstream could contribute towards an increase in primary productivity, as predicted in the FEIS (**Table 5-4**; Golder, 2018). Of particular importance is the observed increases at MF areas with concentrations now beginning to exceed triggers. This shows that nutrient concentrations are elevated beyond Mammoth Lake and the impoundment. In 2021, there appeared to be increased phytoplankton productivity (in terms of biomass) at Lake A20 relative to reference area INUG (see **Section 5.3.4**).

Table 5-4. FEIS predictions and trigger values compared to mean concentrations of total phosphorous in Mammoth Lake and Whale Tail Lake (South Basin), 2021.

Area	2021 FEIS predictions		Trigger	2021 Mean
	Minimum	Maximum		
MAM	0.0090	0.013	0.0045	0.0040
WTS	0.0051	0.0065	0.0045	0.0055

Notes: Reported values are all in units of mg/L.

Reactive Silica

Reactive silica concentrations are variable but appear to have a seasonal trend of higher concentrations in the spring and lower concentrations in fall (**Figure 5-31**). Only MAM exceeded trigger values in 2021, with an overall decrease in annual concentrations compared to 2020. The maximum reported concentration in 2021 was 3.1 mg/L at MAM in May. The mean concentration of reactive silica at MAM (1.61 mg/L) exceeded the trigger value (1.33 mg/L) and BACI analysis indicated this increase was significant.

TOC and DOC

In 2021, TOC and DOC concentrations exceeded the triggers for all samples in WTS and exceeded the triggers multiple times in most other *impact* lakes, except for A76 (**Figure 5-33** and **Figure 5-34**)**.** Mean annual concentrations exceeded the triggers (TOC trigger = 2.42 mg/L and DOC trigger = 2.43 mg/L) in WTS, MAM, NEM (TOC only), Lake A20, and Lake DS1 (**Table 5-7**). The increases in mean TOC were statistically significant for WTS, MAM, NEM, and A20 and the increases in mean DOC were only significant for WTS and A20.

The increase in TOC and DOC in WTS at the end of 2019 was likely related to the flooding of terrestrial habitat with impoundment of the south basin and dewatering inputs from WTN; this also explains the increases in Lake A20, which experienced flooding and has been joined to WTS since 2019. The increases in TOC and DOC were not statistically significant at Lake DS1 in 2021, which is downstream of the site and is considered a far-field lake and, therefore, less likely to be impacted by mining-related activities. Therefore, the apparent increase observed at Lake DS1 may be associated with natural variability.

There are no effects-based thresholds for TOC or DOC, but increases in these parameters can be related to increased productivity or allochthonous carbon inputs. While changes in TOC and DOC at WTS were likely due to inputs from flooded terrestrial areas, changes observed at far-field Lake DS1 were likely due to natural inputs (e.g., terrestrial organic matter; BC MOE, 1998). These patterns will be tracked closely in 2022.

Total and Dissolved Metals

Lithium and silicon were the only metals in which yearly mean total and/or dissolved concentrations exceeded their respective triggers in NF areas WTS and MAM in 2021.

Lithium – Time series of total and dissolved lithium concentrations are presented in **Figure 5-44** (total) and **Figure 5-64** (dissolved); patterns in total and dissolved lithium concentration are generally similar. Lithium concentrations in both WTS and MAM were highest in spring 2019 and have decreased since then. A steady decrease has been observed at WTS since 2019, falling below trigger concentrations (total & dissolved lithium trigger = 0.0020 mg/L) in August and September 2021. At MAM, since 2019, concentrations appear to have stabilized at levels above triggers (mean annual lithium (total or dissolved) = 0.0031 mg/L). The yearly mean concentration of total lithium at NEM was below the trigger in 2021, whereas the yearly mean marginally exceeded the trigger in 2020. There are no effects-based thresholds for lithium. The BACI analysis indicated that the change in total & dissolved lithium relative to INUG was statistically significant at WTS and MAM.

Silicon – Silicon concentrations have historically been close to the trigger value for most Whale Tail study area lakes (**Figure 5-51** and **Figure 5-69**). Total silicon concentrations exceeded the trigger (0.61 mg/L) in one or more samples collected in 2021 in all Whale Tail impact lakes except for Nemo Lake. Concentrations in all impact lakes were higher during the first half of the year, however, the yearly mean concentrations exceeded the trigger solely in MAM (0.82 mg/L). While exceeding the trigger in 2021, the yearly mean concentration of total silicon at MAM represents a decrease from 2020 (1.0 mg/L). Dissolved silicon concentrations followed a similar pattern to the total values with the yearly mean also exceeding the dissolved silicon trigger (0.57 mg/L) at MAM in 2021. Across all NF and MF areas where mine influence is most significant, silicon concentrations appear to be trending downwards since peak concentrations at the beginning of 2020.

Summary

As was the case for Meadowbank, CREMP monitoring has resulted in the identification of a number of changes in water quality at Whale Tail relative to baseline conditions that started in 2019 and have continued as mining-related construction activities expanded in 2021. Given the ultra-oligotrophic status of these lakes and the strong wind-driven mixing during the open water season, baseline conditions were fairly stable (although some parameters exhibit seasonal patterns). This makes it relatively easy to identify changes statistically using the BACI and to visually confirm these patterns in the time series plots (**Figure 5-16** through **Figure 5-72**). The overall patterns of water quality changes observed to date are summarized below.

The ecological implications of these changes to biological communities in the water column (phytoplankton) and in sediments (benthic invertebrates) are discussed in detail in **Section 5.3.4** (phytoplankton) and **Section 5.6** (benthos).

Whale Tail Lake – South Basin (WTS)

Similar to 2020, some water quality parameters trended higher at WTS in 2021. Of the 79 water quality parameters that have triggers, the yearly mean concentrations of 15 exceeded the trigger (**Table 5-7**). The BACI analyses indicated that the proportional change was significant for all of these parameters.

WTS has been designated *impact* since mid-2018. While the dike was completed in 2018, water was discharged from Whale Tail Lake North Basin into WTS in 2019 (see **Table 1-1**). In addition, rising water levels in WTS (expected with its impoundment) inundated terrestrial habitat, which likely impacted water quality, and joined Lake A20. In 2021, WTS was not the primary receiving environment for treated water discharge from the mine and received less water discharge compared to 2020.

For all parameters whose yearly means exceeded their respective triggers, the changes were also statistically significant. Physical and ionic chemistry (conductivity, hardness, TDS, alkalinity, Ca, Mg, K, Na), TOC, and DOC in WTS and MAM displayed similar patterns in 2021. The observed patterns included increasing trends up to about May, then decreasing to July, followed by a slower increase through the end of the year. Since 2019 these parameters have stabilized into seasonal patterns with no observable pattern of annual increase from 2020 to 2021.

The nutrients nitrate and phosphate showed divergent trends in 2021 at WTS. Annual TKN levels increased moderately since 2020, while mean annual total phosphate levels have dropped since peak concentrations occurred in 2020.

Although lithium concentrations exceeded triggers in 2021 at WTS, mean annual concentrations have declined by more than a third since peak concentrations in 2019. If a similar pattern of decline occurs into 2022, lithium will no longer exceed trigger levels.

Mammoth Lake (MAM)

Mammoth Lake transitioned from *control* to *impact* in late 2018 and, as expected, there were changes to water chemistry attributable to activities at the mine. MAM had 17 water quality parameters with yearly mean concentrations exceeding their respective triggers (compared to 15 for WTS). For 16 of 17, the change was statistically significant in the BACI analysis. Since baseline monitoring, the largest increases in conductivity, hardness, TDS, and major ions (Ca, Mg, K, Na) have occurred at MAM. These increases were predicted by the FEIS and correspond with higher levels of effluent discharge. During the initial operations phase the majority of treated water was sent to MAM. More recently, the plan has shifted to discharge treated water into MAM during open water months. Most of the water quality parameters elevated in MAM were the same as those listed for WTS above and are strong indicators of mining-related changes to water quality.

Nemo Lake (NEM)

Nemo Lake transitioned from *control* to *impact* in July 2019. NEM had 10 water quality parameters with yearly mean concentrations exceeding triggers. For all 10 parameters, the change was statistically significant in the BACI analysis. The changes were mostly less pronounced than for WTS and MAM in 2021, but show that residual impacts from the dewatering at NEM in 2019 are still impacting the water body. The physical (conductivity, hardness, TDS, alkalinity) and major ion parameters (Ca, Mg, K, Na) exceeding triggers at NEM appear to have stabilized.

Mid and Far-field Areas (Lakes A20, A76, DS1)

Lake A76 is downstream from Mammoth Lake and therefore further from mine site activities (lake locations are shown in **Figure 5-1**). Conductivity, hardness, TDS, alkalinity, total phosphorous, and the four major cations in Lake A76 had yearly mean concentrations above their triggers with differences that were statistically significant in the BACI analysis. Concentrations of these parameters have been increasing over time in a dampened pattern similar to MAM (upstream of A76).

The channel dividing WTS and Lake A20 was flooded in 2019, increasing water exchange between the two systems. 2021 marked the first year in which mean annual physical parameters (conductivity, hardness, TDS, alkalinity) and major ions (Ca, Mg, K, Na) exceeded triggers. With treated water being discharged into MAM during summer months and, to a lesser extent, into WTS in October and November 2021, these parameters are expected to increase during the 2022 monitoring program.

Lake DS1 was furthest downstream from the mine site, but in the same drainage as Mammoth Lake and Lake A76. For Lake DS1, yearly mean concentrations of TOC and DOC exceeded their triggers but these increases were not statistically significant.

5.3.3 Comparison to FEIS Model Predictions

A number of water quality changes have been identified in the CREMP as a result of development-related activities in the Whale Tail Pit area and effluent discharge to the downstream environment. The FEIS water quality predictions are estimates of water quality changes in Mammoth Lake and Whale Tail Lake (South Basin). The monthly mean results for water quality parameters were screened against the FEIS monthly predictions for MAM and WTS and a summary of exceedances is provided in **Table 5-10**. Water quality data for 2021 were screened against the FEIS predictions and are tabulated in **Appendix B2**.

Often, parameters that exceed the trigger also exceed the FEIS predictions in one or more sampling events. In 2021, the yearly mean concentrations for total phosphorous, total alkalinity, TDS, lithium, and the ionic compounds calcium, magnesium, potassium and sodium exceeded both their respective triggers and the monthly FEIS predictions in WTS. At MAM, annual mean concentrations for total alkalinity, TDS, lithium and the ionic compounds calcium, magnesium and potassium exceeded both their respective triggers and monthly FEIS predictions. Of the parameters that exceeded their respective trigger values and FEIS model predictions in 2021, only total phosphorous at WTS had trigger values set in the context of threshold values (e.g., CCME water quality guidelines). Phosphorous, along with several other COPCs (e.g., nitrate, arsenic) were predicted by the FEIS to exceed baseline conditions following the discharge of treated effluent into Whale Tail Lake (South Basin) and Mammoth Lake. Phosphorous was the only COPC that was also predicted to exceed water quality guidelines (Golder, 2018). Both TDS and lithium are discussed above, and although both will be monitored closely in 2022, the concentrations were similar to historical *baseline* concentrations or appeared to stabilize close to the trigger level (i.e., the 95th percentile of baseline) for the latter half of 2021.

Overall, the FEIS predicted the magnitude of potential effects on water quality in each of the lakes as *low* for all parameters except for total phosphorous which was *medium* (see **Section 2.3.1** for more details on the decision criteria for effects magnitude). Thus, Whale Tail study area water quality results are consistent with the *low* significance (i.e., <1x CCME WQG) rating for all parameters except for total phosphorous which was consistent with *medium* significance (i.e., between 1 and 10-times CCME WQG) rating applied to model predictions in the FEIS.

5.3.4 Comparison to Adaptive Management Thresholds

For parameters identified as COPCs for the Whale Tail Project (i.e., total phosphorus and arsenic), there are associated AMP water quality thresholds that correspond to adaptive management 'Levels' as described in **Section 2.3.1**. The adaptive management thresholds and corresponding adaptive management levels and strategies are summarized in **Table 2-4**. The water quality data collected as part of the annual CREMP were used to assess adaptive management levels going into 2022. Results of the water quality comparison to AMP thresholds are provided in **Table 5-5** and summarized here:

Whale Tail South

- Total phosphorus was at Level 0 for most of the samples collected from WTS in 2021. Two samples exceeded Level 0: one in March (Level 1) and one in September (Level 2).
- Arsenic was at Level 0 for most for most of the samples collected from WTS in 2021. The only exceptions were four samples collected in March and May that were in Level 1.
- Conclusion – Total phosphorus concentrations will be assessed throughout 2022 and the management strategy will be implemented accordingly. For now, Level 1 is in effect for total phosphorus and Level 0 is in effect for arsenic based on the results of the September 2021 sampling event.

Mammoth Lake

- For both total phosphorus and arsenic, all samples from Mammoth Lake were within the normal operating conditions (Level 0).
- Total phosphorus is well below the predicted concentrations. However, because the predicted concentrations are high relative to the CCME WQG of 0.01 mg/L for oligotrophic freshwater lakes, a management Level 3 or 4 would be triggered as soon as concentrations from two consecutive sampling (or seasonal) events exceed the FEIS predictions.
- Conclusion – Mammoth Lake is within the normal operating range and Level 0 water management strategy is in effect in 2022.

It is important to note that the 2021 water quality data were compared to thresholds that are based on the 2019 FEIS predictions. The 2019 FEIS model predictions do not consider changes in water management activities that occurred on Site in 2020 and 2021.

Table 5-5. Water chemistry data compared to AMP thresholds for total phosphorous and arsenic for Whale Tail Lake (South Basin) and Mammoth Lake, 2021.

Lake & Area	AMP Benchmark[1]	WTS FEIS Predictions for 2021					Whale Tail Lake South Basin (Impoundment)										AMP Level for 2022
Month							March		May		July		August		September		
Area-Replicate ID							WTS-57	WTS-58	WTS-59	WTS-60	WTS-61	WTS-62	WTS-63	WTS-64	WTS-65	WTS-66	
Date		Mar	May	Jul	Aug	Sep	25-Mar	25-Mar	12-May	12-May	8-Jul	8-Jul	10-Aug	10-Aug	8-Sep	8-Sep	
Phosphorus (mg/L)	0.01	0.0051	0.0051	0.0055	0.0059	0.0063	0.0075	0.0059	0.0036	0.0038	0.0046	0.0045	0.0038	0.0045	**0.0096**	0.007	Level 1
Arsenic (mg/L)	0.025	0.0002	0.0002	0.0024	0.0031	0.0041	0.00076	0.00082	0.0007	0.00078	0.00164	0.00174	0.00112	0.00106	0.00102	0.00102	Level 0

Lake & Area	AMP Benchmark[1]	MAM FEIS Predictions for 2021					Mammoth Lake										AMP Level for 2022
Month							March		May		July		August		September		
Area-Replicate ID							MAM-57	MAM-58	MAM-59	MAM-60	MAM-61	MAM-62	MAM-63	MAM-64	MAM-65	MAM-66	
Date		Mar	May	Jul	Aug	Sep	25-Mar	25-Mar	12-May	12-May	9-Jul	9-Jul	7-Aug	7-Aug	9-Sep	9-Sep	
Phosphorus (mg/L)	0.01	0.013	0.013	0.0096	0.0096	0.0093	0.004	0.0038	0.0021	0.0023	0.0031	0.0028	0.0058	0.0054	0.0052	0.0051	Level 0
Arsenic (mg/L)	0.025	0.0162	0.016	0.0102	0.0102	0.0097	0.00071	0.00081	0.00088	0.00087	0.00145	0.00094	0.0019	0.0011	0.00144	0.00316	

Notes:

[1] The AMP Benchmark for phosphorus guideline is the upper limit of oligotrophic status from CCME (2004); The AMP Benchmark for arsenic is the site-specific water quality objective (Golder, 2019).

Formatting aligns with the AMP thresholds in the *Whale Tail Pit Expansion Project – Adaptive Management Plan* (Agnico Eagle, 2021):

Level 0	Normal conditions	<= 20% FEIS predictions.
Level 1	Area of concern	>= 20% FEIS predictions AND < 80% water quality guideline.
Level 2	Area of concern	>= 20% FEIS predictions AND between 80% and 100% water quality guideline.
Level 3	High risk	>= 20% FEIS predictions AND between 100% and 120% water quality guideline.
Level 4	Emergency situation	>= 20% FEIS predictions AND > 120% water quality guideline.

5.3.5 Summary and Implications

Following the new assessment strategy for MF and FF areas outlined in the *CREMP Plan* (Azimuth, 2018b), the 2021 trigger exceedances were evaluated and applied to the decision criteria outlined in **Section 2.2.3** to determine the effort level and sampling frequency required at the MF and FF areas in 2021. The assessment strategy interprets the water quality assessment results from the NF areas in the current year (in this case 2021) to inform sampling at MF and FF areas the following year (i.e., 2022) (**Figure 5-15**).

A summary of the trigger screening results for the Whale Tail study areas are presented in **Table 5-9** according to their corresponding degree of change:

- no trigger exceedance,
- minor changes = trigger exceeded for parameters without effects-based thresholds,
- moderate changes = trigger exceeded for parameters with effects-based thresholds, or
- major changes = exceedance of the threshold.

In 2021, most observed water quality differences and trigger exceedances classified as *minor changes* (**Table 5-9**). The one exception was total phosphorous at WTS, A20, and A76 which is classified as a *moderate change* because there were significant increases above the early warning trigger in 2021. The threshold for phosphorous is 0.01 mg/L, which corresponds to the upper bound value for oligotrophic lakes (CCME, 2004). The CCME guideline is not associated with adverse effects to aquatic life, rather the framework is meant to protect against secondary effects to aquatic life from eutrophication and oxygen depletion. Based on this *moderate change*, the full suite of CREMP water sampling is scheduled for 2022.

5.4 Phytoplankton Community

2021 was the second full year in which all Whale Tail study area lakes were designated as *impact*. Areas WTS and MAM have been classified as *impact* areas since mid-2018. Areas A20, A76, and DS1 were classified as *impact* areas from the beginning of 2019, and NEM switched to *impact* in August 2019[24].

5.4.1 General Observations

The general characterization of phytoplankton taxa in Meadowbank project lakes (**Section 4.3.3**) applies equally to the lakes within the Whale Tail study area. Six major taxonomic groups of phytoplankton are present in the Whale Tail study lakes. These are blue-green algae (Cyanophyta), green algae (Chlorophyta), golden-brown algae (Chrysophyta), diatoms (Bacillariophyta), cryptophytes

[24] Baseline phytoplankton taxonomy data for the Whale Tail study area lakes was summarized in Azimuth (2018b). The baseline report focused on describing the dominant species and seasonal variability in taxonomy metrics (e.g., biomass and richness) within and between areas.

(Cryptophyta), and dinoflagellates (Dinoflagellata). Species composition varies throughout the year depending on water temperature, nutrient concentration, time of year, water clarity and amount of sunlight, and predation by zooplankton. In general, the biomass of the phytoplankton community during the baseline period or at the reference areas was comprised predominately of chrysophytes (golden-brown algae) (**Figure 5-75**).

5.4.2 Temporal and Spatial Trends

The approach for identifying potential mine-related impacts involved visually searching for temporal-spatial patterns that might be associated with mine-related activities (outlined in **Section 5.1** and summarized in **Table 1-1**), augmented by statistical analyses of 2021 data to test for changes relative to baseline/reference conditions using the BACI model (see **Section 2.3.3** for details). Both methods look for evidence of temporal-spatial patterns that might be associated with the mine-related activities.

Tabulated phytoplankton community data from the 2021 CREMP are presented in **Appendix D2**. The metrics used to assess changes in the community were chlorophyll-a (**Figure 5-73**), total phytoplankton biomass (**Figure 5-74** to **Figure 5-76**), and species richness (**Figure 5-77**). Supplemental plots showing major taxa biomass (mg/m^3) and density (mg/L) are included in **Appendix D2**. The BACI statistical test results of changes in the phytoplankton community in 2021 compared to baseline/reference conditions are provided in **Table 5-11**; key results are discussed below.

Chlorophyll-a

Chlorophyll-a is an indicator of primary productivity and corresponds closely to phytoplankton biomass. Given the direct measure of total phytoplankton biomass (see below), statistical analysis is not completed for chlorophyll-a. However, the time series plots provided in **Figure 5-73** show clearly increasing trends at WTS, MAM, and A20, and possible increases at A76 and NEM, suggesting that changing water quality may have increased primary productivity in those lakes. Peak concentrations in 2021 at these locations exceeded 1 µg/L, which is considered characteristic of oligotrophic systems (Kasprzak et al., 2008). The linkage of these results to phytoplankton biomass are discussed in more detail below.

Phytoplankton Biomass

Time series plots for total phytoplankton biomass (mg/m^3) are provided in **Figure 5-74**[25]. As expected, the seasonal pattern for phytoplankton biomass was comparable to that observed for chlorophyll-a, with lower levels under ice cover and higher levels during the open water period. The inter-annual

[25] The time series plot uses a log-scale for total biomass as mg/m^3. This tends to *mute* the visual increase in total biomass observed in WTS, MAM, A20, and A76 in 2021.

temporal pattern for total biomass was also similar to chlorophyll-a, with elevated phytoplankton biomass at WTS, MAM, A20, A76, and NEM during the open water period relative to baseline/reference conditions. The biggest changes in the community biomass were seen in chrysophytes, followed to a lesser extent by diatoms (**Figure 5-75** and **Figure 5-76**).

In the BACI analysis, the model interaction term (or BACI effect term) represents the change at the test area in 2021 (*after* period) relative to baseline (*before* period) after accounting for natural regional temporal changes observed at reference area INUG. For simplicity, changes are noted *relative to baseline/reference* conditions. For 2021, total phytoplankton biomass changes relative to reference included increases of 78% at MAM (p=0.28), 222% at A20 (p=0.029), 119% at A76 (p=0.15), and 95% at NEM (p=0.106). While the changes in biomass at MAM, A20, A76 and NEM exceeded the trigger of a 20% effect size, only the change at A20 was statistically significant and the results showed high annual variation (**Table 5-11**). The significance of these results is discussed in the summary below.

These 2021 patterns suggest that along with the normal cycle of increased productivity as lakes warm and nutrient levels increase during freshet, mine-activities also appear to be influencing phytoplankton biomass at NF and MF areas. This is further corroborated with the water quality results, which indicated large proportional changes (around 2-fold) in nutrients total Kjeldahl nitrogen (A20, MAM, WTS) and total phosphorous (A20, A76, WTS). With the shift to increased productivity predicted to occur following mine-related activities and discharges at the Site since mid-2018 (Golder, 2018), changes in total biomass were expected to increase.

The overall increase in phytoplankton biomass found in the BACI analysis at some of the NF areas suggests that along with natural increased productivity in the summer months, mine activities may be influencing phytoplankton in NF and MF areas.

Community Composition

The number of taxa varies by season, with a more diverse community present during the open water season than when ice covers the lakes. The pattern of seasonal variability in species richness observed in 2021 was generally similar to previous years for the various lakes (**Figure 5-77**). Typically, more than 30 different species of phytoplankton are present during the open water season. At WTS, the richness in July through September 2021 ranged from 27 to 39 taxa, which was higher than the 19 to 26 taxa observed in 2020, and similar to the range of taxa observed in summer months in 2019. In MAM, richness ranged from 19 to 31 in 2021, which was similar to the number of taxa observed in summer 2020 and lower than the 33 to 38 taxa observed in August and September 2019. The ranges of taxa richness observed at WTS and MAM, were slightly higher than in 2020 and were within the range at the reference areas. For context, total richness in the reference areas in 2021 ranged from 14 to 35 at both INUG and PDL.

The BACI effect size of reductions in taxa richness were below the trigger at all areas and none of the changes were statistically significant in 2021 (**Table 5-11**). The slight decrease in richness observed at all areas except DS1 could be attributed to community structure changes associated with enrichment and the shift to increased productivity that was predicted to occur following mine-related activities and discharges at the Site since mid-2018 (Golder, 2018). Further discussion related to the ecological significance of these results is presented in the summary below.

5.4.3 Summary and Implications

There was a statistically significant change in phytoplankton biomass at A20 in 2021, and changes at MAM, A76, and NEM exceeded the 20% effect size trigger for phytoplankton outlined in **Section 2.3.3**. The pattern of response, however, did not match well with proximity to mining activity, with the largest relative changes occurring at A20, A76 and NEM, followed by MAM, DS1 and WTS.

No statistically significant decreases in richness were observed for the Whale Tail study area lakes in 2021; however, slight reductions were observed at the NF and MF areas that generally matched proximity to mining activity.

The response patterns observed in phytoplankton biomass and taxa richness suggest a combination of mining influence and natural variability. As described in **Section 5.3**, mining-related changes in water quality have been identified at Whale Tail at all NF and MF areas. Nutrients are generally a limiting factor for phytoplankton growth in oligotrophic systems and any inputs can lead to changes in productivity. However, these communities also respond to a host of natural factors such as sunlight, and water temperature. Minor changes (e.g., changes in biomass that retain the general structure of the community and are relatively short-lived) are unlikely to be important ecologically, while larger or more extensive changes could start to change food chain dynamics in these typically low-productivity lakes. Phytoplankton productivity, biomass and richness, as well as associated patterns in key nutrients will continue to be tracked closely in 2022.

The Whale Tail phytoplankton program will follow the same schedule as the routine water quality monitoring component of the program in 2022.

5.5 Sediment Chemistry

In 2021, due to a laboratory error, some of the sediment samples collected in August 2021 were discarded prior finalizing the request for analysis. The samples that were analyzed and therefore discussed in the sections that follow included sediment collected from WTS, A76, and NEM. The sediment samples from reference areas INUG and PDL, and from Whale Tail Pit areas MAM, A20, and DS1 were not analyzed. See **Appendix A** for more details. Since 2021 was not a coring year, no formal statistical analyses were conducted and a qualitative assessment of the sediment chemistry results from grab samples is provided below.

5.5.1 General Observations

Lake sediments in the Project area are generally similar to those described for the Meadowbank lakes in **Section 0**. Key points are:

- Natural sedimentation rates in these headwater lakes are low. However, there are several development-related activities that can increase sediment loading to the lakes.
- Sediments are generally dominated by silt and clay fractions. Particle size distribution in sediment grab samples (top 3–5 cm of sediment surface) is predominantly silt and clay, characteristic of depositional areas in all the lakes sampled in this region. Nemo Lake, historically, has a higher percentage of sand than the other Whale Tail study area lakes (**Figure 5-78**).
- Lakes within the Project area are naturally enriched in some metals compared to CCME sediment quality guidelines (SQGs). Arsenic, cadmium, chromium, copper, mercury and zinc exceeded the interim sediment quality guideline (ISQG[26]) in at least one sample collected during the baseline period. Lake-specific[27] triggers were developed (due to strong natural spatial trends among the lakes) in 2019.

5.5.2 Temporal and Spatial Trends

Sediment chemistry results from 2015 to 2021 are provided in **Figure 5-79** for aluminum and in **Figure 5-80** to **Figure 5-86** for the metals with trigger values. For the purpose of interpreting the 2021 sediment data, all Whale Tail study area lakes (WTS, MAM, NEM, A20, A76, DS1) are considered *impact*.

Sediment quality in 2021 was similar to 2020 for all parameters measured and for the results received from the laboratory. There were a few instances of the mean concentrations exceeding the triggers.

Sediment chemistry in Whale Tail Lake and Mammoth Lake has remained consistent over time despite changes in water quality in these areas (**Section 5.2** and **Section 5.3**). There were no results for MAM in 2021 due to the aforementioned laboratory error.

Hydrocarbon concentrations (**Appendix C2**) were less than the detection limits for most analytes measured in the 2021 composite samples. Analytes that had detectable concentrations did not have ISQG or PEL screening values. Elevated detection limits were reported for several analytes due to

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[26] The ISQG is equivalent to the threshold effect level (TEL): calculated as the geometric mean of the lower 15th percentile of the effect data set and the 50th percentile of the no-effect data set (CCME, 1999).

[27] Note that triggers for Meadowbank and Baker Lake were generally applied across all sampling areas; WAL was the only location to have lake-specific triggers.

naturally high moisture content in the sediments. In most cases, the lowest reported detection limit was below the ISQG; however, WTS, A76 and NEM had detection limits for acenaphthene, acenaphthylene and dibenz(a,h)anthracene, fluorene (A76 and NEM) and 2-methylnaphthalene (A76 and NEM) that were greater than their respective ISQGs, similar to 2020. The DLs were below the PEL concentration in all instances. High moisture content has periodically resulted in elevated reporting limits for hydrocarbons in the baseline Whale Tail CREMP and annual Meadowbank CREMP. Notwithstanding, hydrocarbon contamination has not been an issue at either site.

Metals concentrations are shown by area/basin for the different sampling methods (grab [data points] vs core samples [box and whisker plots]; **Figure 5-79** to **Figure 5-86**). The red dashed line in each of the sediment metals figures is the trigger value specific to the parameter and area (i.e., each of the Whale Tail Area lakes have their own trigger values (developed in 2019). The box and whisker plots illustrate the statistical distribution of core samples within each area. Data interpretation for the box and whisker plots is as follows:

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

2021 Sediment Grab Chemistry Results

Grab samples for sediment chemistry were collected at WTS, MAM, A20, A76, DS1 and NEM however, only samples from WTS, A76, and NEM were analyzed and screened against their respective trigger values (**Appendix C** and **Figure 5-80** to **Figure 5-86**). Arsenic, chromium, copper, and zinc were the only metals where the concentrations in sediment grabs exceeded their respective trigger values in at least one study area lake. These are discussed below.

Arsenic

- Sediment arsenic concentrations in two individual replicates from WTS and two replicates from A76 in 2021 exceeded their respective trigger values. Temporal and spatial trends are shown in **Figure 5-80**. Previous years' results show elevated arsenic at a number of areas, even during baseline/reference conditions. It has been particularly high at A76, WTS and MAM, even during the baseline period, which shows that this is a natural phenomenon. Importantly, there are no trends of increasing concentrations since the onset of mining activities. Notwithstanding, concentrations will continue to be monitored for change.

Chromium

- Sediment chromium concentrations in two individual replicates from WTS and four replicates from A76 exceeded their respective trigger values in 2021. Temporal and spatial trends are shown in **Figure 5-82**. Overall, the concentrations observed in WTS and A76 were within the ranges of concentrations observed in previous years. In the absence of results from the other NF and FF areas, there is uncertainty whether the elevated sediment chromium is mining related or due to natural variability. The extent and cause of elevated sediment chromium in WTP area lakes will continue to be reviewed in future years of the CREMP.

Copper

- Sediment copper concentrations in four individual replicates at A76 and three replicates at NEM exceeded their respective triggers in 2021. Despite trigger exceedances in some replicates in 2021, the concentrations at A76 and NEM remain within the range observed in previous years (**Figure 5-83**) and are likely explained by natural spatial heterogeneity.

Zinc

- Sediment zinc concentrations in four individual replicates at A76 exceeded the trigger. However, the range of concentrations observed in 2021 is well within the range observed during the baseline period, so this is considered reflective of natural spatial variability rather than mining-related changes. This is supported by the lack, overall, of temporal changes relative to baseline conditions for zinc at the locations listed above, the lack of a corresponding change in water quality, and by the lack of co-located mine discharges. In addition, 2020 core sampling results showed no mining-related temporal or spatial patterns. Confirmation of the observed trends (or lack of) using sediment grabs will be conducted in 2022.

In summary, sediment chemistry in the Whale Tail study area is naturally elevated in several metals. Results for 2021 were generally consistent with previous years and showed no indication of construction-related changes. Confirmation of the observed trends (or lack of) using sediment grabs will be conducted in 2022.

5.6 Benthos Community

5.6.1 General Observations

Benthos abundance in the Whale Tail study area lakes can vary widely for a given lake on an annual basis, and multiple years of baseline data help define the normal range of variability in benthos abundance among the areas. Richness tends to be relatively stable year-over-year. While the relative proportions of various taxa may vary, the number of total taxa was consistent throughout the baseline period and start of construction. Abundance (organisms/m^2) and richness (# unique taxa) of benthic invertebrates have been calculated for each replicate and study year. Abundance and richness of benthos in Whale Tail study area lakes during baseline were characteristic of depositional areas in northern lakes with low productivity and nutrient cycling with insects, primarily chironomids in the subfamilies Chironominae and Tanypodinae, and fingernail clams (Sphaeriidae) being the dominant benthic invertebrates.

5.6.2 Temporal and Spatial Trends

The methods and approaches used to assess benthic invertebrate (benthos) community metrics described for the Meadowbank CREMP apply for the Whale Tail Program. Changes in benthos total abundance and richness were evaluated in 2021 using the same BACI study design outlined in **Section 2.3.3**. Dike construction started on July 27, 2018, approximately three weeks prior to benthos sampling in the area. While changes in sediment quality or benthic invertebrates at WTS as a result of dike construction were considered unlikely, the area designation was changed from *control* to *impact* in 2018 due to the proximity to construction activities. In contrast, MAM was considered to have changed to *impact* after the 2018 benthos sampling (i.e., thus providing an extra annual event in the baseline period; this decision was supported by an assessment of water quality results from construction monitoring). The remaining Whale Tail area study lakes were designated *impact* prior to the August 2019 benthic sampling; however, Nemo Lake remained in baseline conditions through July 2019 coinciding with the discharge of water to the tundra south of the lake. Benthos data from NEM was added to the BACI analysis in 2020, as there is now sufficient data for NEM in the *after* period. Consistent with the end of 2019 and the entirety of 2020, in 2021 all the Whale Tail study area lakes were designated *impact*.

Summary results for abundance and richness of major taxa in 2021 are presented in **Appendix E2,** along with supplemental plots showing abundance and richness at the major taxonomic group level since the start of baseline sampling. Time-series plots showing total abundance and richness endpoints were used to assess spatial and temporal trends for the Whale Tail study area lakes (**Figure 5-87** to **Figure 5-92**).

Identifying potential mine-related impacts generally involved visually examining the data for spatial/temporal patterns that matched mine-related events. This was followed up with formal statistical analyses of the data to test for changes relative to baseline/reference conditions using the BACI model (see **Section 2.3.3** for details). Key results for 2021 were as follows:

Abundance

Total benthos abundance is highly variable within the lakes and among years. In a very general sense, the range of mean total abundance in the baseline period at the six study areas is 1,675 to 6,311 organisms/m^2 (**Table 5-12**); however, the range of abundance between replicates is highly variable. For example, abundance at Lake A76 in 2021 ranged from a low of 1,391 organisms/m^2 in replicate 2 to 5,739 organisms/m^2 in replicate 4. Estimates of total abundance at the high-end of this range were common throughout the baseline phase, but only a few samples had fewer than 1,000 organisms/m^2. In 2021, no replicate sample at any area had less than 1,000 organisms/m^2. Compared to the reference areas INUG and PDL, the Whale Tail study area lakes appear to be more productive and variable—four out of five PDL replicates were below 1,000 organisms/m^2 and only one replicate in INUG exceeded 2,000 organisms/m^2 in 2021.

In 2021, benthos abundance was generally within the range reported during the baseline period for all Whale Tail study area lakes, except A20 and A76 which were slightly lower than baseline. At both reference areas, PDL and INUG, the mean abundance was lower in 2021 compared to 2020. The mean abundance at INUG was the lowest reported abundance thus far and was slightly lower than baseline. For PDL, benthos abundance was slightly lower than in 2020, but was still within the range of baseline (**Table 5-12**). Thus, the *expected* change from a BACI context, where results are assessed relative to baseline/reference conditions, was a corresponding decrease at the other sampling areas. So, even if abundance was the same at an area, the BACI interaction term would show an increase because the reference area decreased. For clarity, we refer to those cases as *apparent* increases or changes. Abundance at DS1 in 2021 was higher than baseline and higher than in 2020. The BACI result for DS1 (57% increase) was not significant (**Table 5-13**). Abundance at WTS, MAM and NEM in 2021 was within the range of baseline, but lower than 2020 (**Figure 5-87**). The BACI results for WTS, MAM and NEM (WTS 7% increase; MAM 31% increase; NEM 19% increase) were not significant (**Table 5-13**). Note that the BACI is run as a one-tailed test, to increase statistical power for detecting decreases in abundance (**Section 2.3.3**).

As noted above, interpreting the total abundance BACI analysis can be challenging when there is an increase or decline at the reference areas relative to the test areas (e.g., the decrease at INUG and PDL in 2021; see **Figure 5-87**)[28]. One of the BACI assumptions is that variability at the reference areas is due to regional factors that should affect all sampling areas; our experience is that random area-year variability exists that can affect interpretation of BACI results. For example, the time series plot for total abundance provided in **Figure 5-87** indicates that the mean abundance for WTS decreased between 2018 and 2019; however, the BACI analysis indicated that the effect size for WTS was positive (48%) because of the *expected* changes within a BACI framework. In 2021, the effect size for WTS was positive (7%), but not statistically significant. Furthermore, the negative effect size for A76 was greater than 20%

[28] While mean abundance has decreased slightly in PDL, the abundance appears to be fairly stable and within the range of baseline conditions. Mean abundance at INUG decreased in 2021 at levels below the range of baseline conditions.

in 2021 (A76 = 22%) when compared to the control area INUG, but it is considered unlikely that there would be greater negative effect sizes at mid-field lakes compared to near-field lakes.

Overall, none of the BACI results for abundance were statistically significant and none of the observed changes were attributed to mining activities. Some interannual variation in abundance was observed in baseline years and continues to be observed at reference lakes and it is considered likely that total abundance findings for 2021 reflect this natural variability. That said, continued monitoring should help determine the true nature of the observed spatial-temporal differences in abundance.

In 2021, the relative abundance of major taxa groups had not changed compared to baseline with insects and molluscs being the dominant benthic invertebrates (**Figure 5-89**).

Taxa Richness

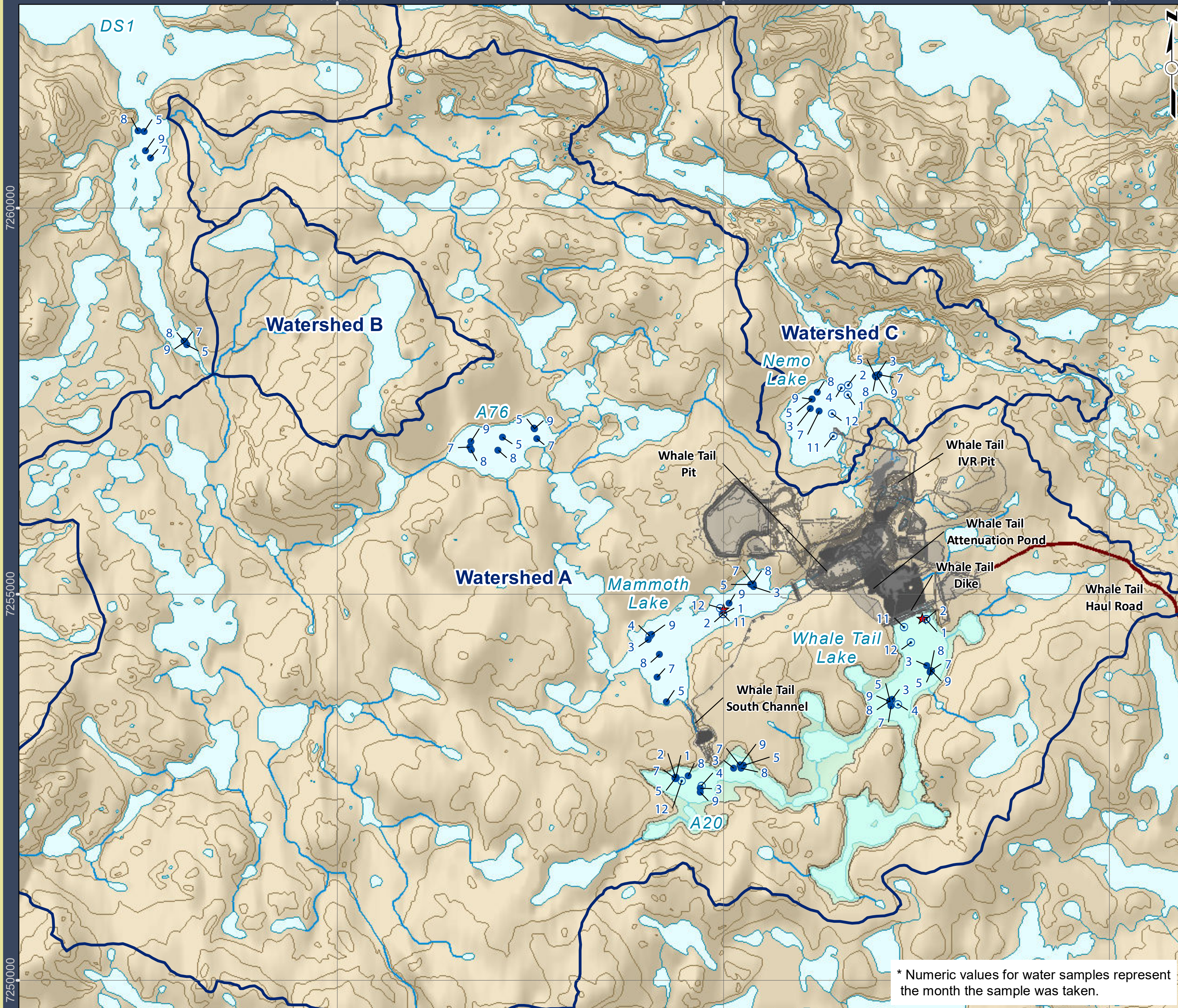
The same taxa observed at the Meadowbank project lakes were documented during the baseline period for the Whale Tail study area lakes. Unlike abundance, taxa richness was less variable within and among areas on an annual and inter-annual basis (**Figure 5-90**). Taxa richness at the lowest practical level is typically between 10 and 15 taxa in the Whale Tail study area lakes, with insects dominating in both number of taxa (**Figure 5-91**) and proportion of the total sample richness (**Figure 5-92**). Molluscs were the next most dominant taxonomic group in terms of the number species and relative richness.

Taxa richness at WTS appeared to be slightly less variable and lower in 2021, ranging from 9–20 taxa in 2020 and 6–15 taxa in 2021. Replicate 1 collected at WTS had relatively low total abundance (1,500 organisms/m^2) and 6 taxa; however, the other replicates were within the range of baseline. To limit potential spatial heterogeneity, sample crews attempt to revisit replicate coordinates in subsequent benthos sample events. Benthos sampling targets a depth range of 6.5 to 9.5 m, but with completion of the Whale Tail dike, the total water depth in the benthos study area increased over 2 m from an average of 7.7 m in 2018 to over 10 m in 2019. Altered flow and increased water levels in the south basin of Whale Tail have the potential to favor taxa that are more well adapted to deeper conditions. Notwithstanding the potential for the impoundment to alter the structure of the benthos community, the 2021 results for taxa richness in WTS appear to be broadly within the range reported during baseline monitoring. The apparent differences between 2020 and 2021 taxa numbers shown in **Figure 5-90** are likely related to between-year variability and the natural heterogeneity between replicates. Apart from DS1 and WTS, which showed decreases in richness relative to baseline/reference conditions, all the other sampling areas had increases in richness in 2021 (**Table 5-14**); only DS1 had a statistically significant negative effect size greater than 20% in the time period 2020-2021 (-25%; p-value=0.07). None of the 2021 BACI results for the other Whale Tail study areas were statistically significant. Since the changes that occurred in the far-field area DS1 were not reflected in the near or mid-field areas, it is unlikely that the effects were related to mining activities. Overall, these results indicate that mining-activities conducted to date have not altered the structure or function of the benthic invertebrate community in the Whale Tail study lakes.

5.7 Whale Tail Tables and Figures

The tables and figures for the Whale Tail study areas provided in this section follow, except for the large tabulated datasets and figures for parameters that are not included in the detailed analysis (see in-text references to appropriate Appendices). Subsections are provided for each of the CREMP components (e.g., limnology, water chemistry, phytoplankton, sediment chemistry, and benthos).

Figure 5-1. Whale Tail Pit study area - Water Quality Sampling Stations, 2021.



Legend

Water Sampling Station *
- Limno
- Water

Mine Features
- Whale Tail Haul Road
- Mammoth Lake and Whale Tail Lake Diffusers
- Whale Tail Mine Plan
- Whale Tail Lake (South Basin)
- Amaruq Watersheds

Area of Detail

0 0.5 1 1.5
Kilometres

Projection: UTM Zone 14 NAD83

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

Meadowbank Gold Project

Prepared for: AGNICO EAGLE

By: CASLYS CONSULTING

January 2022

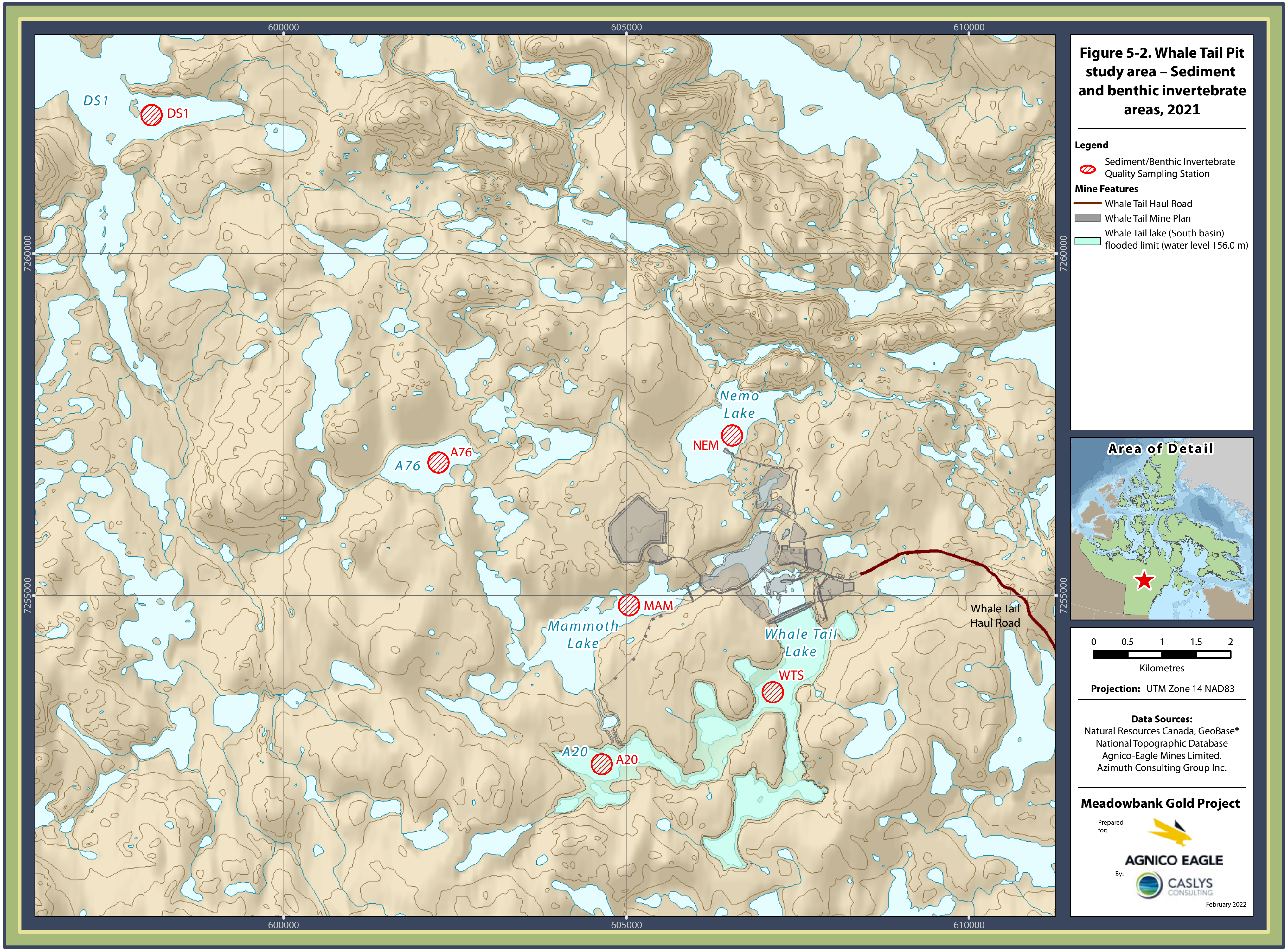
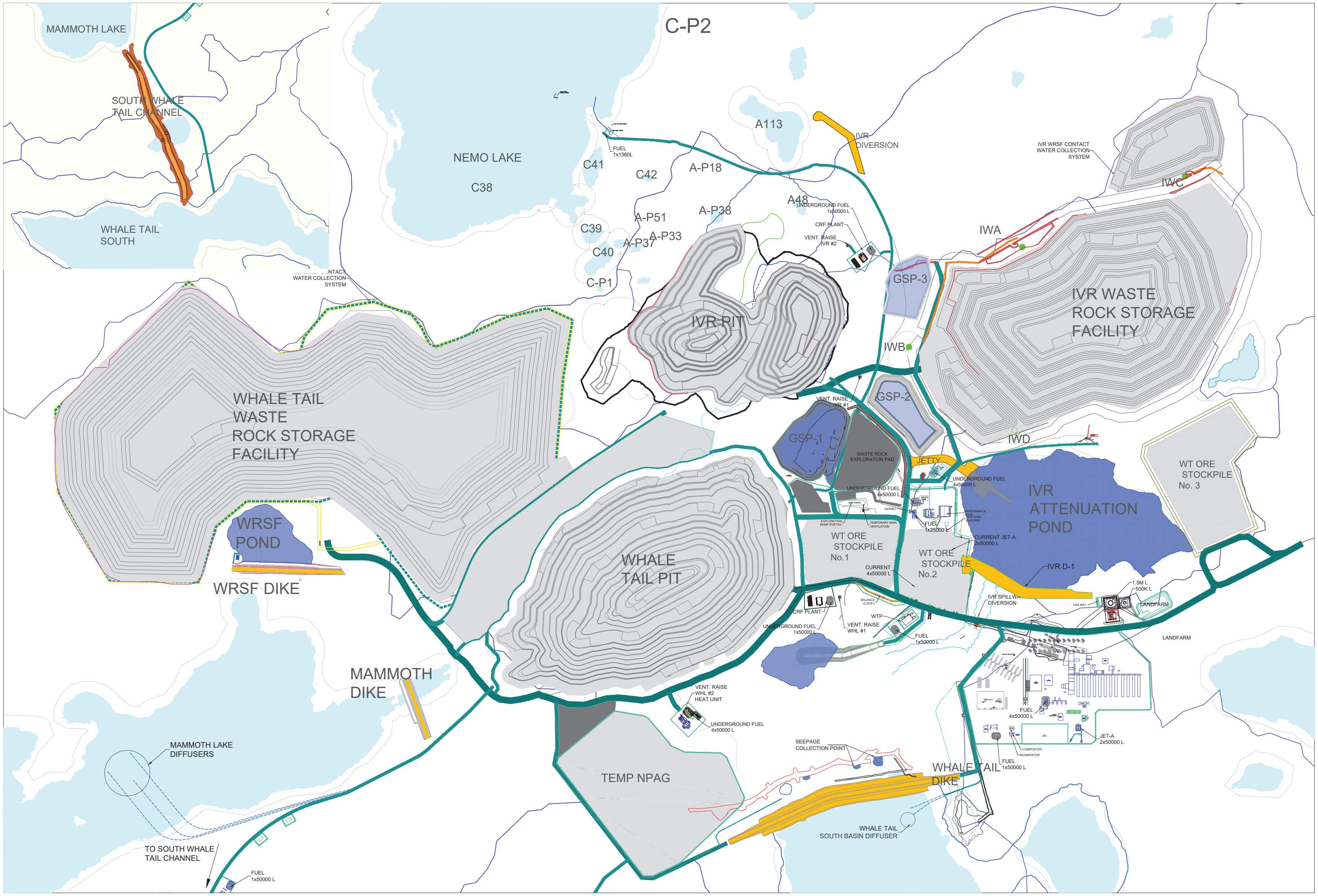


Figure 5-2. Whale Tail Pit study area – Sediment and benthic invertebrate areas, 2021



PLAN CLÉ / KEY PLAN

Baker Lake Wind Frequency by Direction Winter

NOTES GÉNÉRALES / GENERAL NOTES

LEGEND

- WATERSHED

DESSINS EN RÉFÉRENCE / REFERENCE DRAWINGS

TITRE / TITLE	# DWG

AGNICO EAGLE

REV.	DATE	DESCRIPTION	PAR/BY	APP.	CLIENT

REVISIONS

TITRE / TITLE
AGNICO EAGLE – MEADOWBANK DIVISION
AMARUQ MINE PROJECT

GENERAL ARRANGEMENT PHASE 2

DESSINÉ PAR / DRAWN BY	THOMAS DAHM	DATE 2021–03–02
VERIFIÉ PAR / CHECKED BY		
APPROUVÉ PAR / APPROVED BY	FREDERICK L BOLDUC	2021–03–02
ÉCHELLE / SCALE	DATE 2021–03–02	
NO. DESSIN / DRAWING NO.		
NO. PROJET / PROJECT NO.	REVISION	FEUILLE / SHT / –

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P:\Engineering\05–Geotechnic\14– Amaruq\99– Site Maps\2019 AMQ site map submitted phase 2 permit\6117–005–210–001_RD_BIND\Phase 2.dwg

Limnology Tables and Figures

Figure 5-4. Mean monthly field-measured temperature (°C) at 3 m depth since 2014, Whale Tail study area lakes.

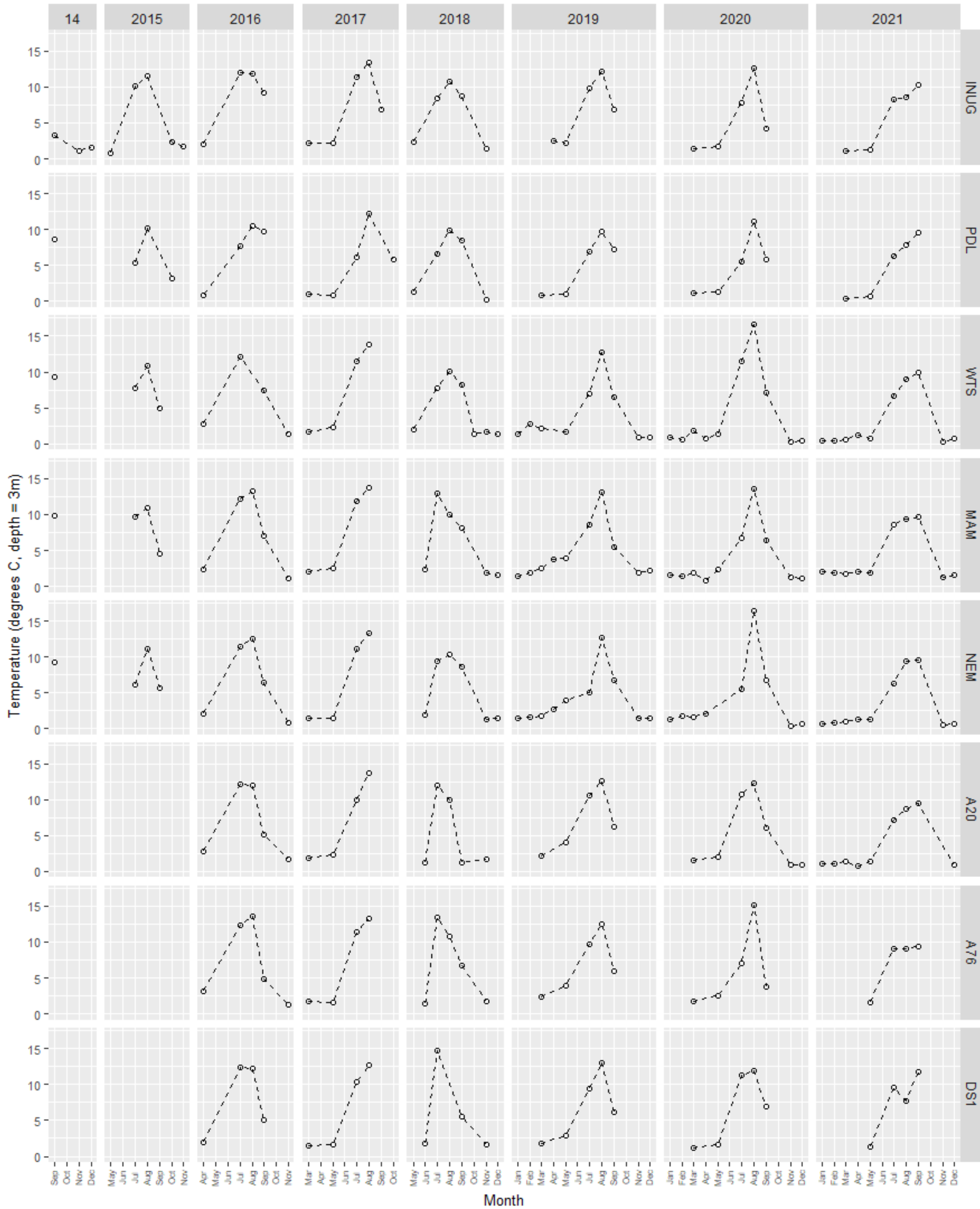


Figure 5-5. Whale Tail – Field-measured conductivity, dissolved oxygen, and temperature profiles, January 2021.

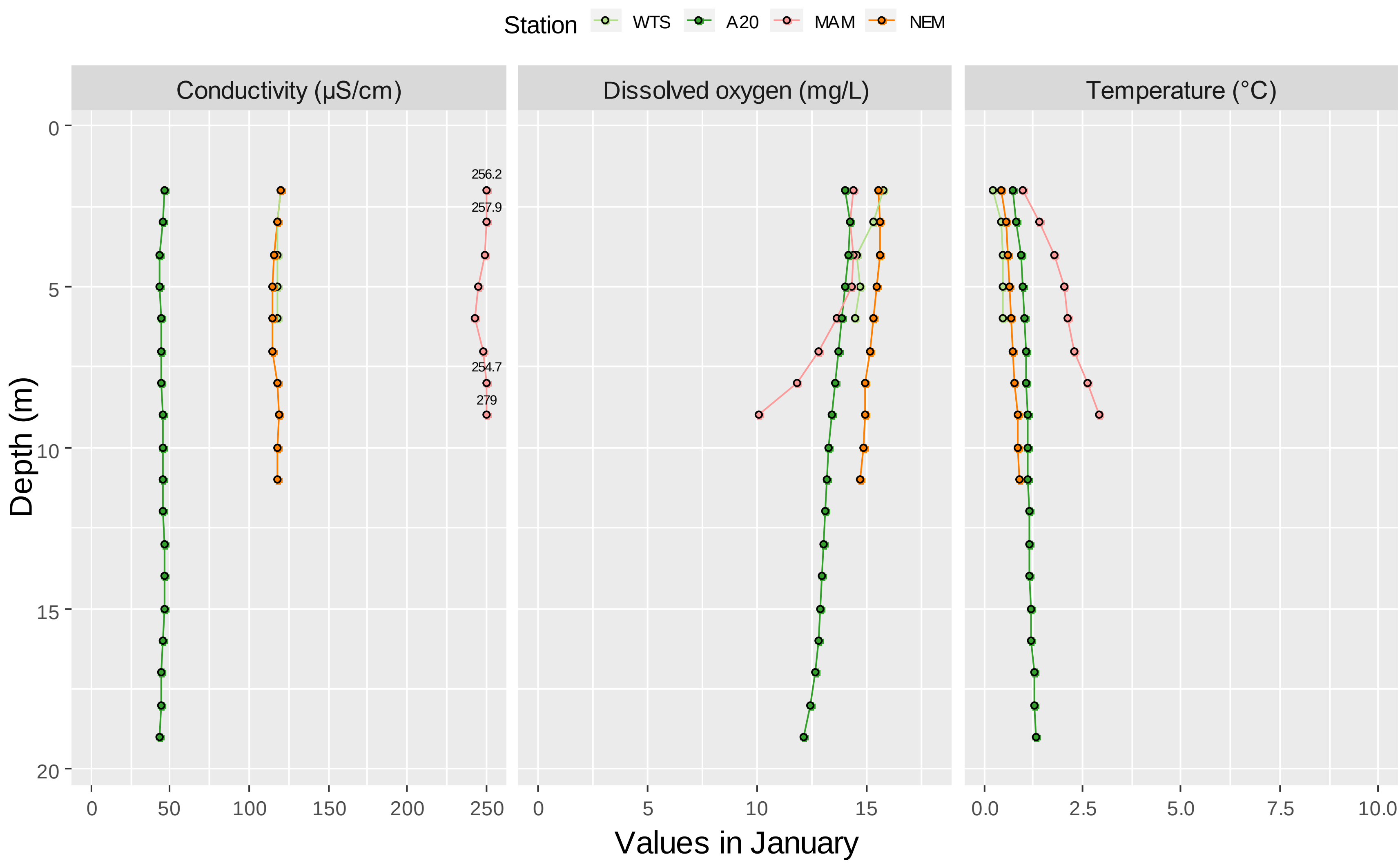


Figure 5-6. Whale Tail – Field-measured conductivity, dissolved oxygen, and temperature profiles, February 2021.

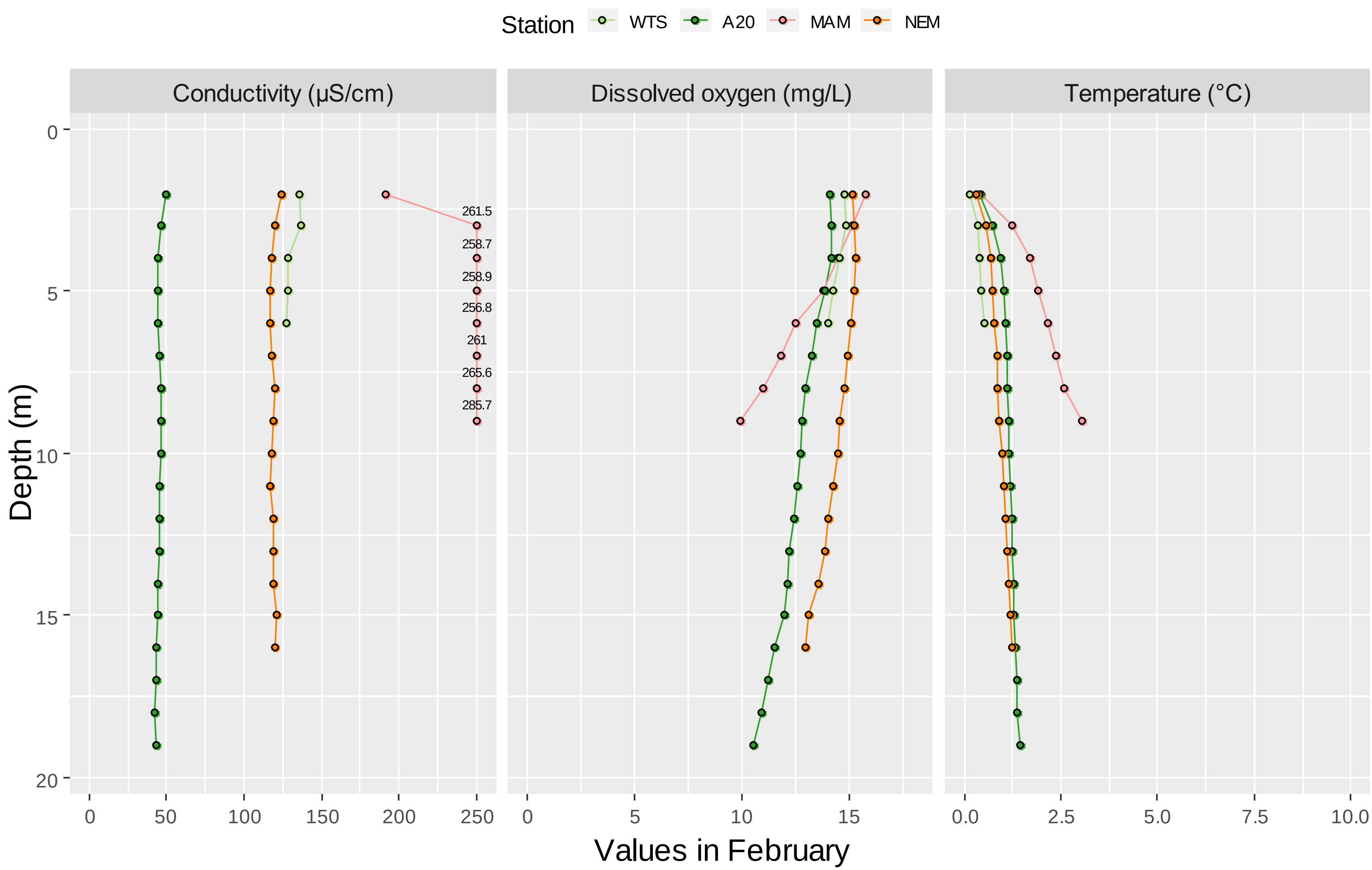


Figure 5-7. Whale Tail – Field-measured conductivity, dissolved oxygen, and temperature profiles, March 2021.

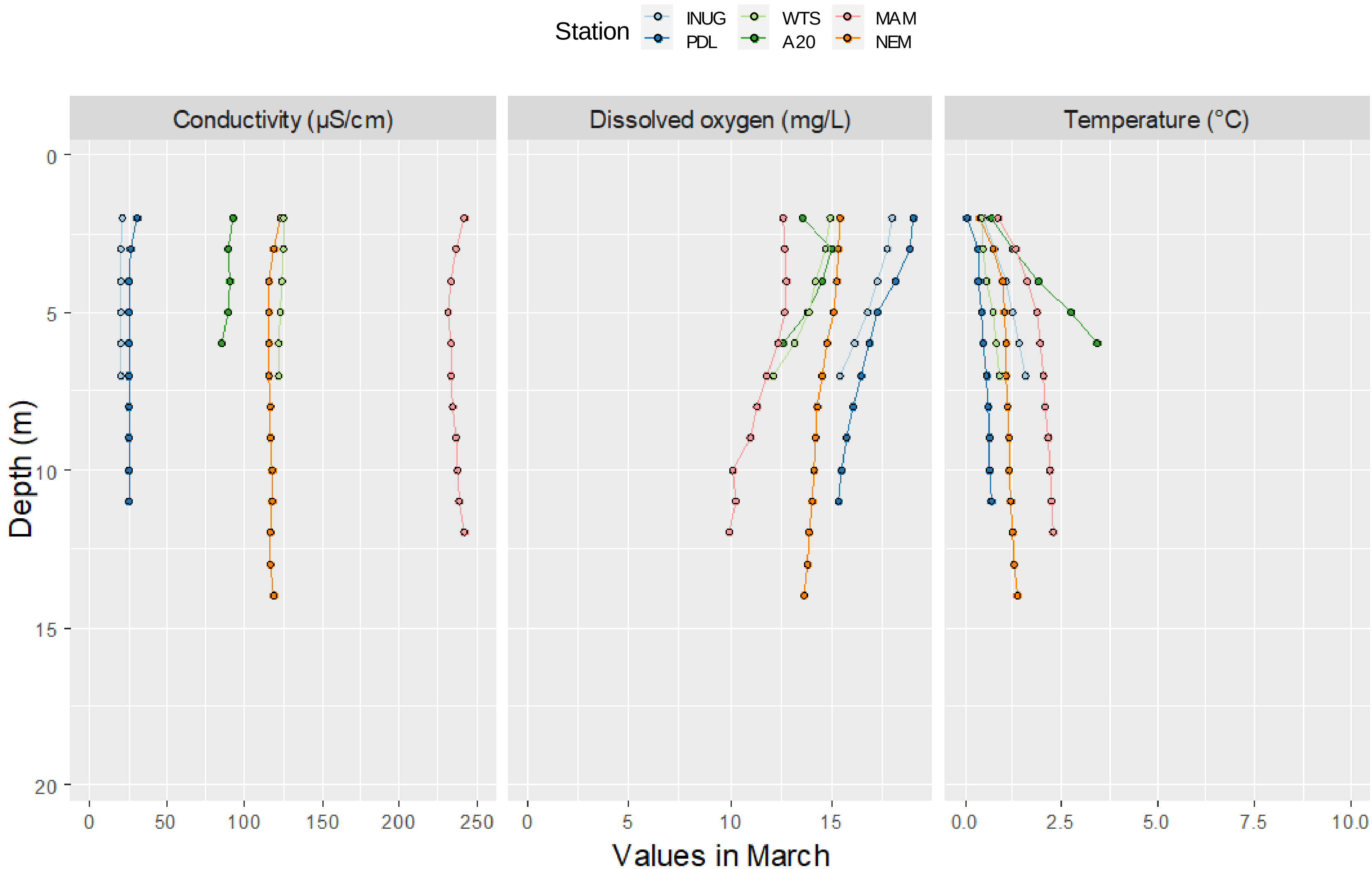


Figure 5-8. Whale Tail – Field-measured conductivity, dissolved oxygen, and temperature profiles, April 2021.

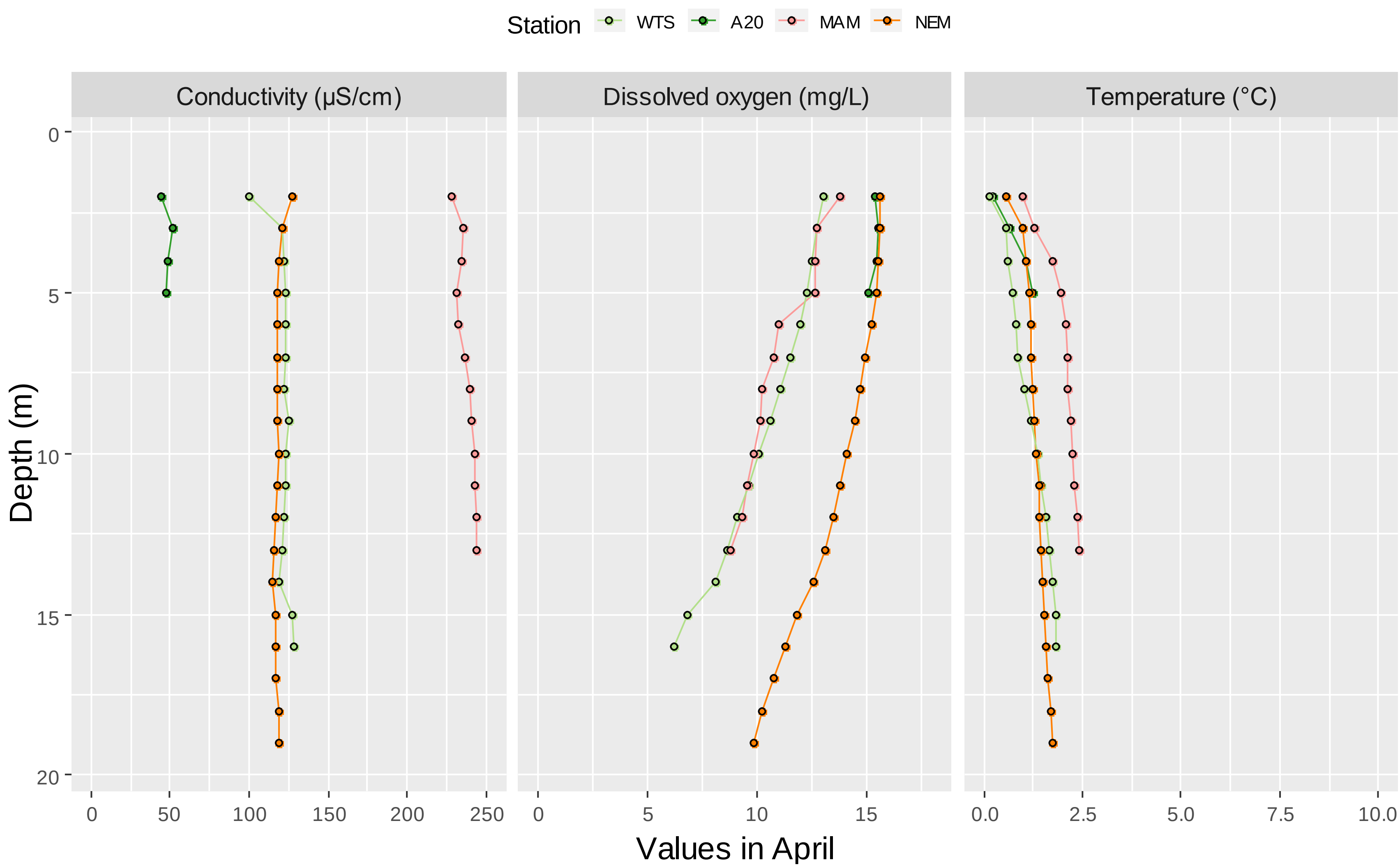


Figure 5-9. Whale Tail – Field-measured conductivity, dissolved oxygen, and temperature profiles, May 2021.

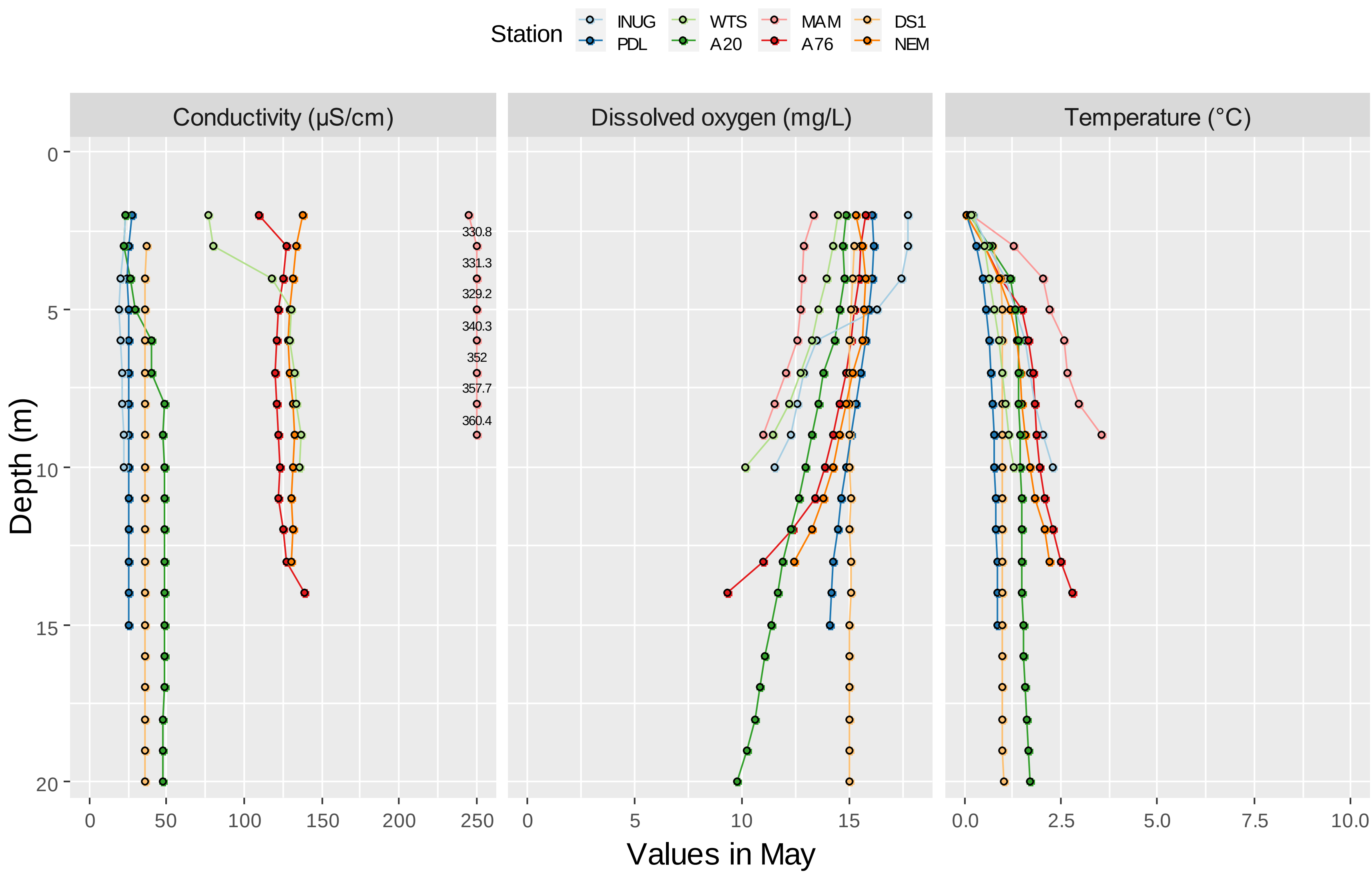


Figure 5-10. Whale Tail – Field-measured conductivity, dissolved oxygen, and temperature profiles, July 2021.

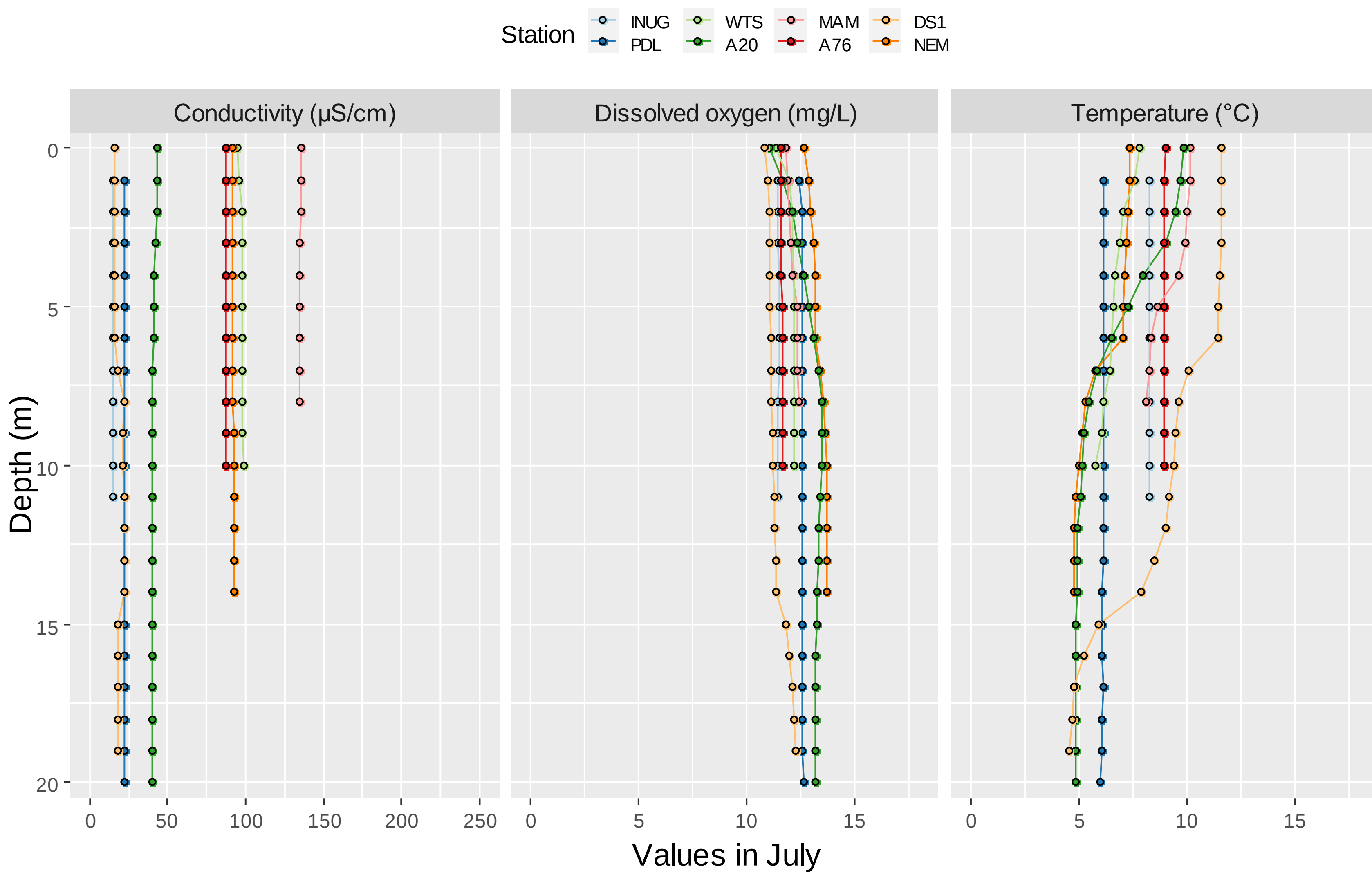


Figure 5-11. Whale Tail – Field-measured conductivity, dissolved oxygen, and temperature profiles, August 2021.

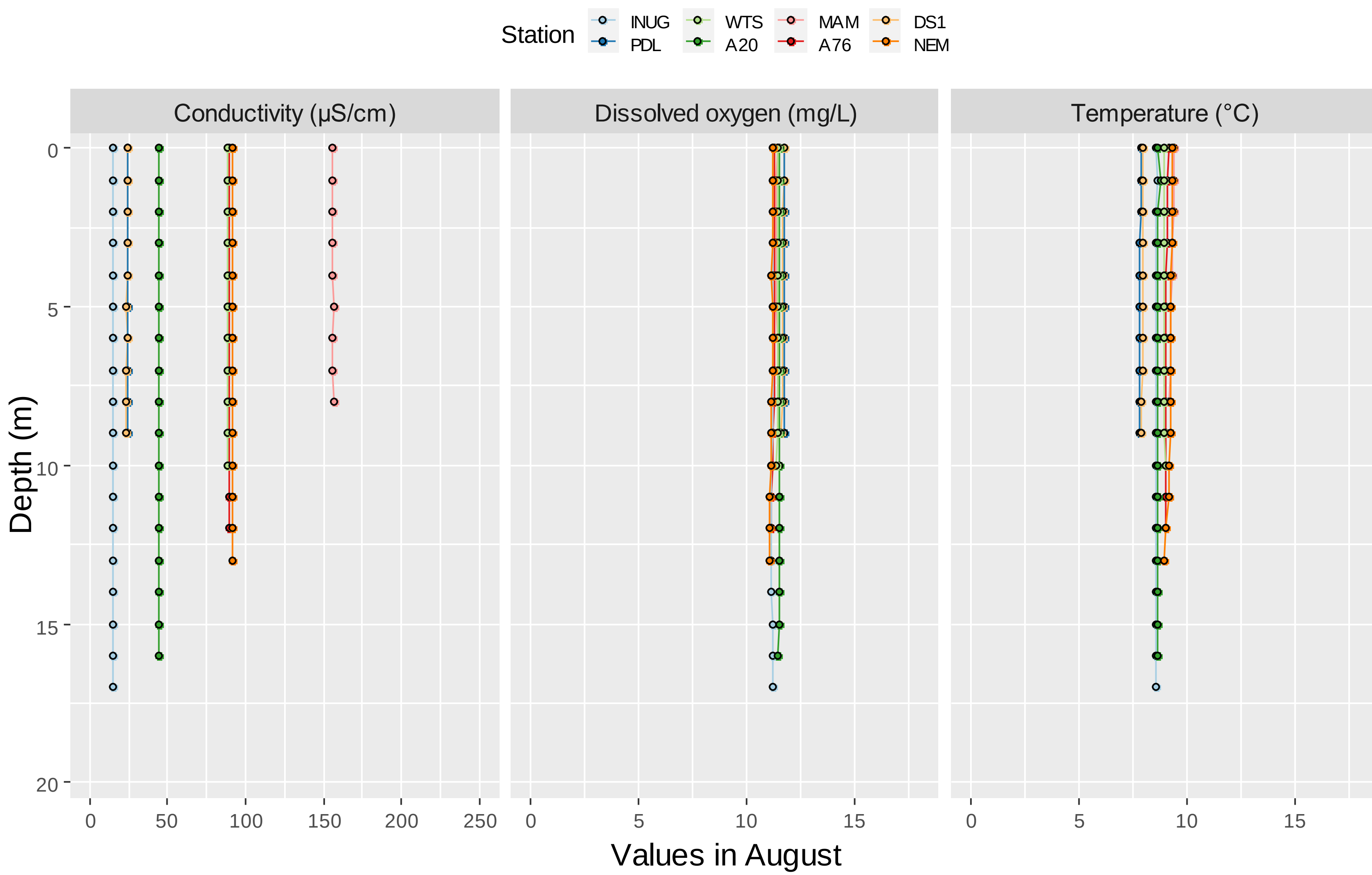


Figure 5-12. Whale Tail – Field-measured conductivity, dissolved oxygen, and temperature profiles, September 2021.

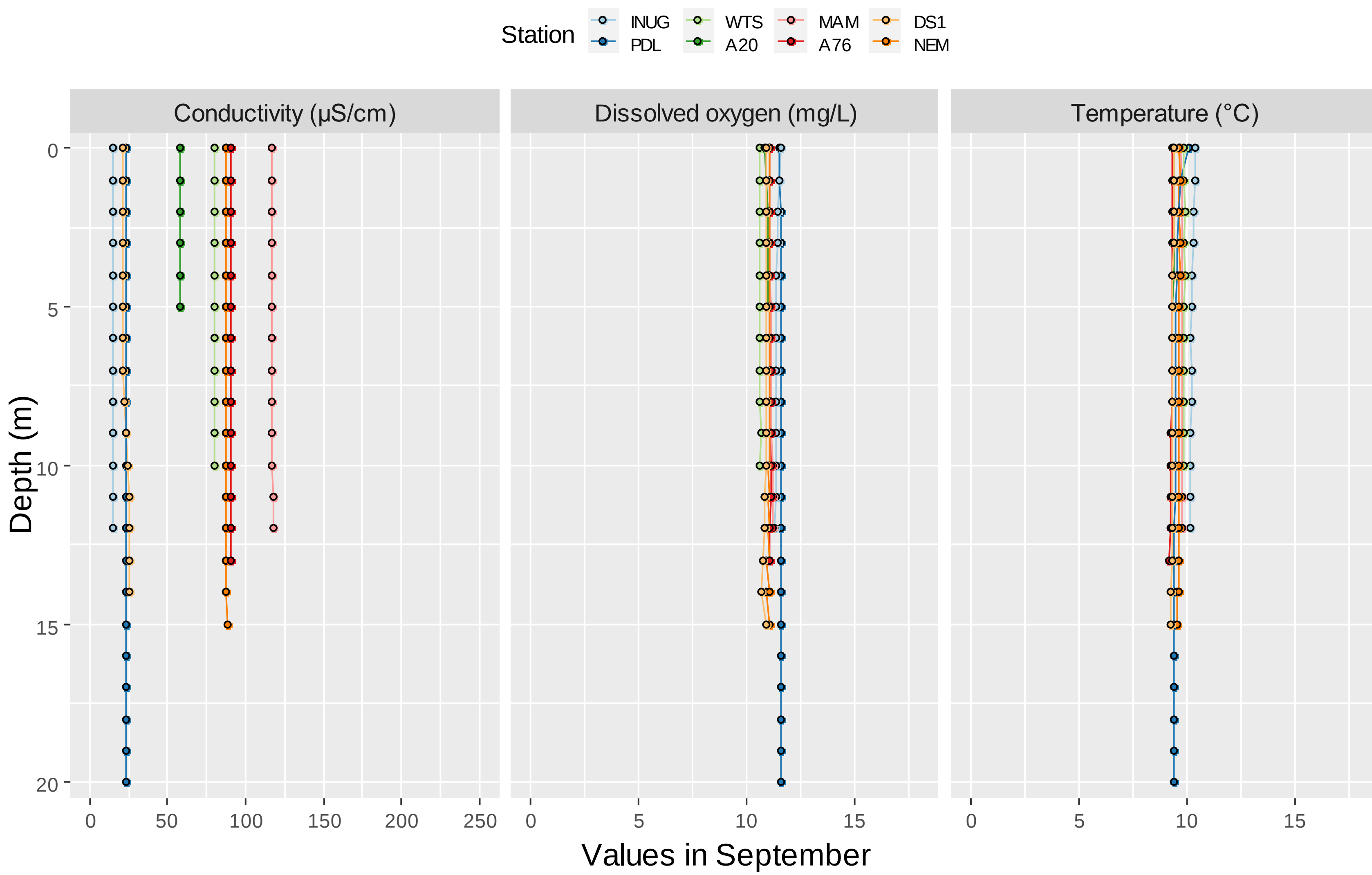


Figure 5-13. Whale Tail – Field-measured conductivity, dissolved oxygen, and temperature profiles, November 2021.

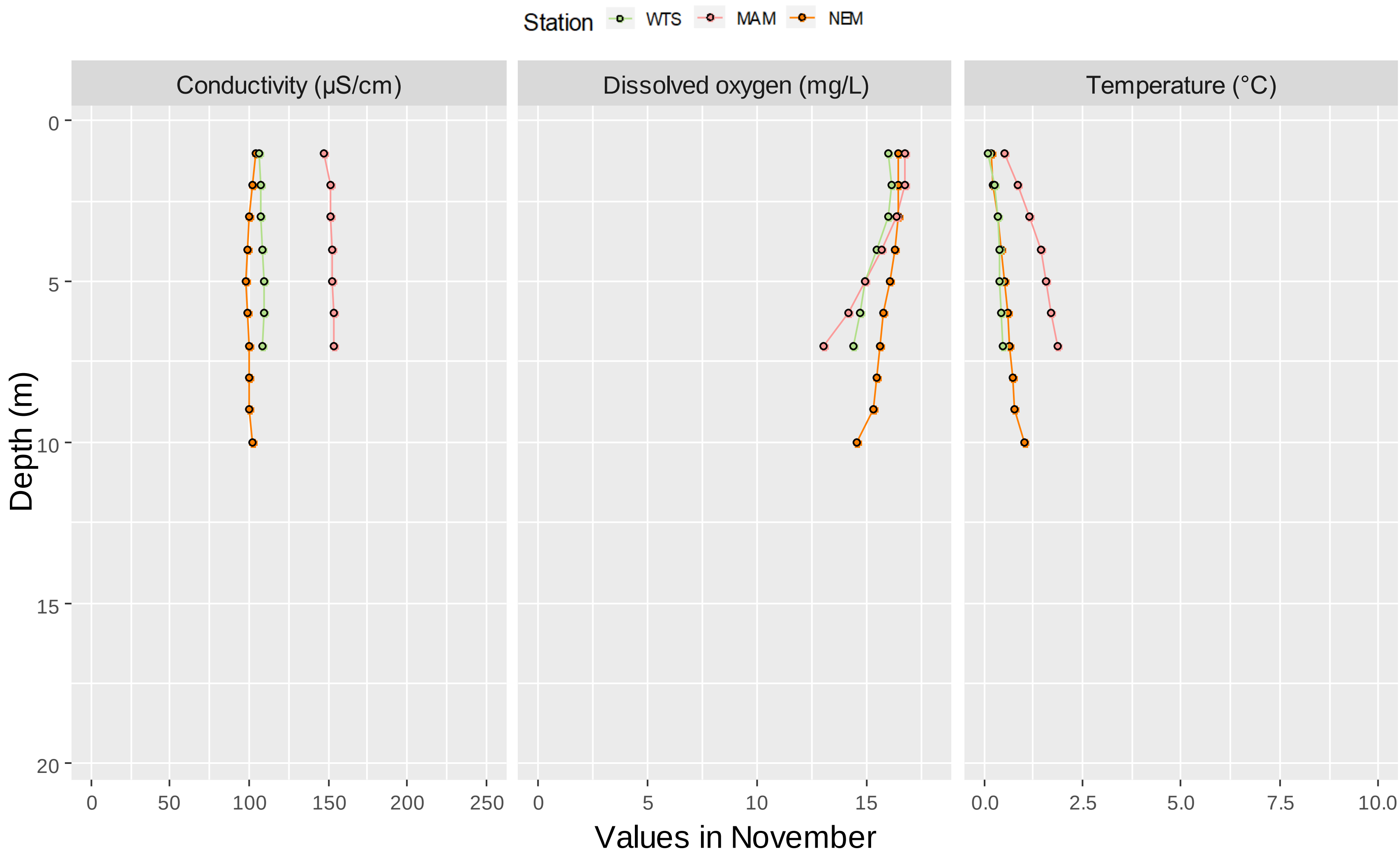
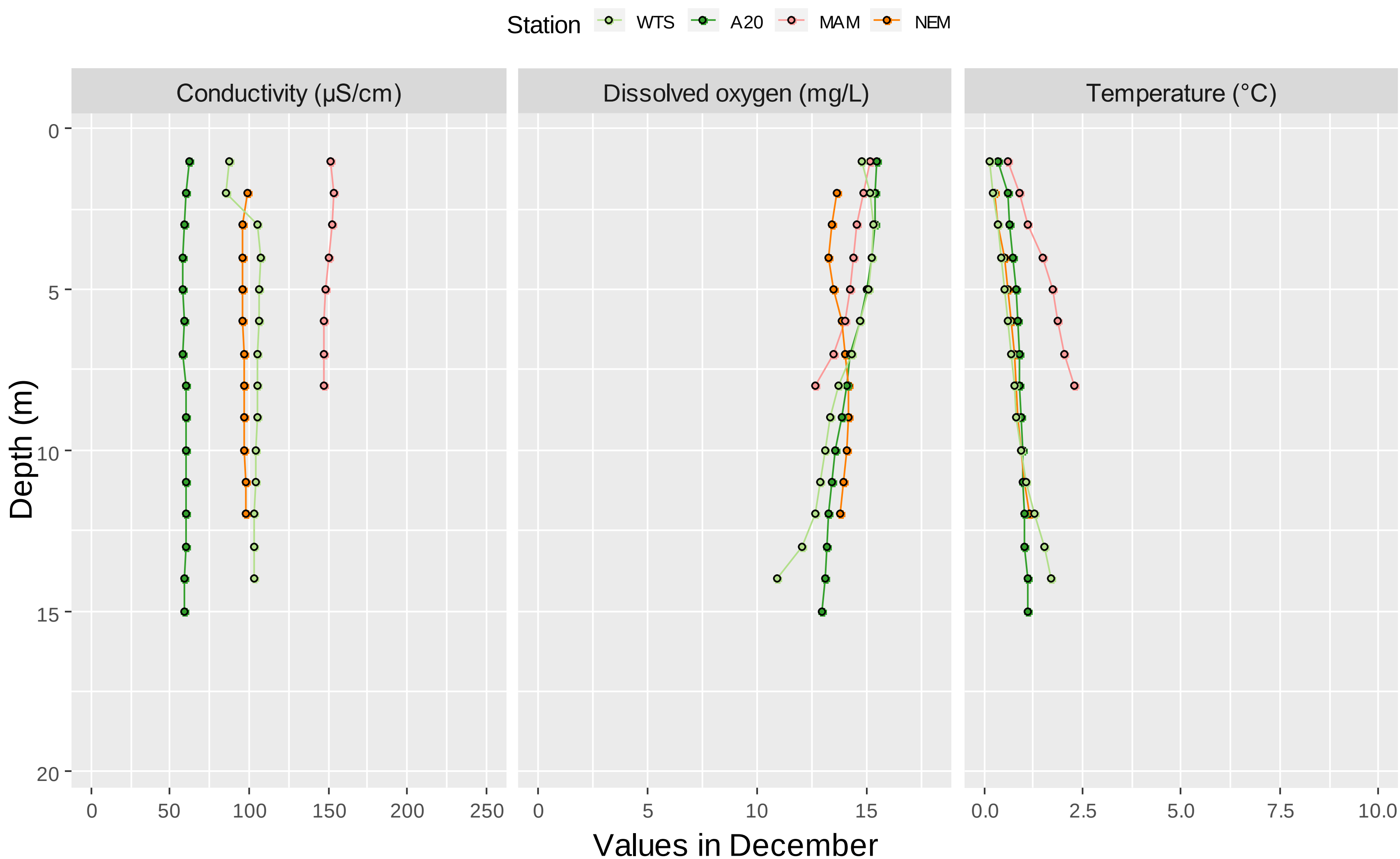


Figure 5-14. Whale Tail – Field-measured conductivity, dissolved oxygen, and temperature profiles, December 2021.



Water Chemistry Tables and Figures

Table 5-6. Screening process for water quality parameters, Whale Tail Pit monitoring areas, 2021.

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 5-16			Aluminum	Figure 5-35			Aluminum	Figure 5-56		
Hardness	Figure 5-17			Antimony	Figure 5-36			Antimony	Figure 5-57		
pH -Field	Figure 5-18			Arsenic	Figure 5-37			Arsenic	Figure 5-58		
pH -Lab	Figure 5-19			Barium	Figure 5-38			Barium	Figure 5-59		
TSS	No	No	No	Beryllium*	No	No	No	Beryllium*	No	No	No
TDS	Figure 5-20			Boron*	No	No	No	Boron*	No	No	No
B-Alkalinity	Figure 5-21			Cadmium*	No	No	No	Cadmium*	No	No	No
C-Alkalinity*	No	No	No	Calcium	Figure 5-39			Chromium	Figure 5-60		
T-Alkalinity	Figure 5-22			Chromium	Figure 5-40			Copper	Figure 5-61		
Ammonia-N	Figure 5-23			Copper	Figure 5-41			Iron	Figure 5-62		
Chloride	Figure 5-24			Iron	Figure 5-42			Lead	Figure 5-63		
Fluoride	Figure 5-25			Lead	Figure 5-43			Lithium	Figure 5-64		
Nitrate-N	Figure 5-26			Lithium	Figure 5-44			Manganese	Figure 5-65		
Nitrite-N	Figure 5-27			Magnesium	Figure 5-45			Mercury*	No	No	No
TKN	Figure 5-28			Manganese	Figure 5-46			Molybdenum	Figure 5-66		
T-phosphorous	Figure 5-29			Mercury*	No	No	No	Nickel	Figure 5-67		
Ortho-phosphate	Figure 5-30			Molybdenum	Figure 5-47			Selenium	No	Figure 5-68	No
Reactive silica	Figure 5-31			Nickel	Figure 5-48			Silicon	Figure 5-69		
Sulphate	Figure 5-32			Potassium	Figure 5-49			Silver*	No	No	No
DOC	Figure 5-33			Selenium	No	Figure 5-50	No	Strontium	Figure 5-70		
TOC	Figure 5-34			Silicon	Figure 5-51			Thallium*	No	No	No
T-Cyanide*	No	No	No	Silver*	No	No	No	Tin*	No	No	No
Free Cyanide*	No	No	No	Sodium	Figure 5-52			Titanium*	No	No	No
				Strontium	Figure 5-53			Uranium	Figure 5-71		
				Thallium*	No	No	No	Vanadium*	No	No	No
				Tin*	No	No	No	Zinc	Figure 5-72		
				Titanium	Figure 5-54						
				Uranium	Figure 5-55						
				Vanadium*	No	No	No				
				Zinc*	No	No	No				

Notes:
"*" indicates plots for these parameters are presented in **Appendix B2**.
1. See **Section 4.3.2** for information on the screening process for deciding which parameters are carried forward in the temporal and spatial trend assessment.

Table 5-7. Water quality variables at the Whale Tail Pit areas for which 2021 mean concentrations exceeded the trigger.

Parameter	Trigger	Threshold	2021 Mean					
			WTS	MAM	NEM	A20	A76	DS1
			NF	NF	NF	MF	MF	FF
Conductivity	48.6	-	101	189	100	55.9	96.9	-
Hardness	17.4	-	36.7	69.4	38.2	20.5	33.9	-
TDS	38.5	-	74.7	137	77.1	40.8	73.2	-
HCO_3 Alkalinity	9.6	-	15.3	17.9	10.9	10.6	10.7	-
Total Alkalinity	9.6	-	15.3	17.9	10.9	10.6	10.7	-
TKN	0.17	-	0.27	0.31	-	0.19	-	-
Total phosphorous	0.0045	-	0.0055	-	-	0.0048	0.0052	-
Reactive Silica	1.3	-	-	1.6	-	-	-	-
TOC	2.4	-	3.5	2.6	2.8	3.4	-	2.6
DOC	2.4	-	3.4	2.5	-	3.1	-	2.6
Calcium	4.6	-	10.4	20.4	11.7	5.6	9.7	-
Magnesium	1.4	-	2.6	4.5	2.2	1.6	2.4	-
Potassium	0.84	-	2.4	4.1	1.6	1.4	1.9	-
Sodium	1	-	1.9	2.8	1.0	1.2	1.5	-
T. Lithium	0.0020	-	0.0021	0.0031	-	-	-	-
T. Silicon	0.61	-	-	0.82	-	-	-	-
D. Lithium	0.0020	-	0.0020	0.0031	-	-	-	-
D. Silicon	0.57	-	-	0.78	-	-	-	-

Notes:
"-" indicates mean annual concentration was < the trigger value.
Reported mean values are all in units of mg/L except for conductivity (µS/cm).
1. Total titanium was not carried forward for BACI analysis since the annual mean was driven by exceedances in one sampling event likely related to seasonality. See **Section 5.3.2** for details.

Table 5-8. Results of BACI tests for selected water variables at the Whale Tail Pit areas in 2021.

Parameter	Test Area	n(B)	n(A)	Estimate	SE	F	DF	P-value[1]	Proportional change exp(Est)	LCI	UCI
Conductivity	WTS	14	5	1.2	0.15	66.0	17	**< 0.001**	3.3	2.4	4.4
	MAM	15	5	1.4	0.16	80.1	18	**< 0.001**	4.2	3.0	5.9
	A20	13	5	1.2	0.074	247	16	**< 0.001**	3.2	2.7	3.7
	A76	13	4	1.0	0.095	112	15	**< 0.001**	2.7	2.2	3.4
	NEM	20	5	1.2	0	1744	23	**< 0.001**	3.4	3.4	3.4
Hardness	WTS	14	5	1.2	0.14	79.3	17	**< 0.001**	3.3	2.5	4.4
	MAM	15	5	1.5	0.15	94.4	18	**< 0.001**	4.4	3.2	6.0
	A20	13	5	1.2	0.076	263	16	**< 0.001**	3.4	2.9	4.0
	A76	13	4	0.97	0.085	130	15	**< 0.001**	2.6	2.2	3.2
	NEM	20	5	1.2	0	1514	23	**< 0.001**	3.4	3.4	3.4
TDS	WTS	13	5	1.1	0.20	32.0	16	**< 0.001**	3.1	2.0	4.7
	MAM	14	5	1.4	0.24	34.3	17	**< 0.001**	4.0	2.4	6.5
	A20	13	5	0.95	0.15	41.0	16	**< 0.001**	2.6	1.9	3.6
	A76	13	4	1.0	0.15	44.8	15	**< 0.001**	2.8	2.0	3.8
	NEM	19	5	1.3	0.13	104	22	**< 0.001**	3.8	2.9	4.9
HCO_3 alkalinity	WTS	13	5	1.1	0.051	467	16	**< 0.001**	3.0	2.7	3.4
	MAM	14	5	1.1	0.073	239	17	**< 0.001**	3.1	2.6	3.6
	A20	13	5	0.63	0.073	74.7	16	**< 0.001**	1.9	1.6	2.2
	A76	13	4	0.48	0.051	87.7	15	**< 0.001**	1.6	1.5	1.8
	NEM	19	5	0.29	0.046	39.5	22	**< 0.001**	1.3	1.2	1.5
Total alkalinity	WTS	13	5	1.1	0.051	467	16	**< 0.001**	3.0	2.7	3.4
	MAM	14	5	1.1	0.073	239	17	**< 0.001**	3.1	2.6	3.6
	A20	13	5	0.63	0.073	74.7	16	**< 0.001**	1.9	1.6	2.2
	A76	13	4	0.48	0.051	87.7	15	**< 0.001**	1.6	1.5	1.8
	NEM	19	5	0.29	0.046	39.5	22	**< 0.001**	1.3	1.2	1.5
TKN	WTS	13	5	0.71	0.10	47.4	16	**< 0.001**	2.0	1.6	2.5
	MAM	14	5	0.92	0.098	89.2	17	**< 0.001**	2.5	2.1	3.1
	A20	13	5	0.59	0.13	21.5	16	**< 0.001**	1.8	1.4	2.4
Total phosphorus	WTS	14	5	0.71	0.24	9.0	17	**0.0040**	2.0	1.2	3.4
	A20	13	5	0.59	0.18	10.5	16	**0.0030**	1.8	1.2	2.7
	A76	13	4	0.55	0.25	4.7	15	**0.023**	1.7	1.0	3.0
Reactive silica	MAM	15	5	0.64	0.23	7.6	18	**0.0066**	1.9	1.2	3.1
TOC	WTS	14	5	0.35	0.071	23.9	17	**< 0.001**	1.4	1.2	1.6
	MAM	15	5	0.20	0.083	5.9	18	**0.013**	1.2	1.0	1.5
	A20	13	5	0.51	0.091	31.1	16	**< 0.001**	1.7	1.4	2.0
	DS1	13	4	0.0040	0.075	0	15	0.48	1.0	0.86	1.2
	NEM	20	5	0.23	0.11	4.1	23	**0.028**	1.3	0.99	1.6
DOC	WTS	14	5	0.29	0.066	19.2	17	**< 0.001**	1.3	1.2	1.5
	MAM	15	5	0.14	0.084	2.7	18	0.059	1.2	0.96	1.4
	A20	13	5	0.40	0.092	18.6	16	**< 0.001**	1.5	1.2	1.8
	DS1	13	4	0.036	0.087	0.20	15	0.34	1.0	0.86	1.3
Calcium	WTS	14	5	1.3	0.18	50.1	17	**< 0.001**	3.5	2.4	5.2
	MAM	15	5	1.5	0.18	70.4	18	**< 0.001**	4.6	3.1	6.7
	A20	13	5	1.3	0.079	257	16	**< 0.001**	3.6	3.0	4.2
	A76	13	4	1.0	0.089	138	15	**< 0.001**	2.8	2.4	3.4
	NEM	20	5	1.5	0	2087	23	**< 0.001**	4.5	4.5	4.5
Magnesium	WTS	14	5	1.0	0.11	95.6	17	**< 0.001**	2.8	2.2	3.5
	MAM	15	5	1.3	0.12	123	18	**< 0.001**	3.7	2.9	4.8
	A20	13	5	1.1	0.083	173	16	**< 0.001**	3.0	2.5	3.5
	A76	13	4	0.76	0.069	119	15	**< 0.001**	2.1	1.8	2.5
	NEM	20	5	0.61	0.040	226	23	**< 0.001**	1.8	1.7	2.0
Potassium	WTS	14	5	1.6	0.11	209	17	**< 0.001**	4.9	3.9	6.1
	MAM	15	5	1.7	0.12	202	18	**< 0.001**	5.4	4.2	6.9
	A20	13	5	1.2	0.092	169	16	**< 0.001**	3.3	2.7	4.0
	A76	13	4	0.97	0.074	172	15	**< 0.001**	2.6	2.3	3.1
	NEM	20	5	0.86	0.053	268	23	**< 0.001**	2.4	2.1	2.6
Sodium	WTS	14	5	1.0	0.082	160	17	**< 0.001**	2.8	2.4	3.4
	MAM	15	5	1.4	0.096	204	18	**< 0.001**	3.9	3.2	4.8
	A20	13	5	0.60	0.089	46.0	16	**< 0.001**	1.8	1.5	2.2
	A76	13	4	0.78	0.068	135	15	**< 0.001**	2.2	1.9	2.5
	NEM	20	5	0.62	0.048	171	23	**< 0.001**	1.9	1.7	2.1
T. Lithium	WTS	14	5	0.62	0.083	55.9	17	**< 0.001**	1.9	1.6	2.2
	MAM	15	5	0.83	0.16	25.8	18	**< 0.001**	2.3	1.6	3.3
T. Silicon	MAM	15	5	0.37	0.20	3.6	18	**0.038**	1.5	0.96	2.2
D. Lithium	WTS	14	5	0.65	0.076	73.5	17	**< 0.001**	1.9	1.6	2.3
	MAM	15	5	0.86	0.16	28.9	18	**< 0.001**	2.4	1.7	3.3
D. Silicon	MAM	15	5	0.40	0.20	3.8	18	**0.033**	1.5	0.97	2.3

Notes:
1. Bolded P-values are statistically significant ($p < 0.05$). Test area = area compared to control (INUG).
n(B) = number of paired months in the "before" period. n(A) = number of paired months in the "after" period (i.e., in 2021).
Estimate = BACI model estimate of the 2021 change in mean for log-transformed data. SE = standard error of the estimate.
P-value = one-tailed test of the null hypothesis (no change or a decrease in mean [opposite for lower pH trigger]).
Exp(Est.) = estimated proportional change. LCI = lower 95% confidence interval; UCI = upper 95% confidence interval.

Table 5-9. Sampling effort and frequency assessment results for the 2021 Whale Tail Pit area lakes.

Areas	Area Designation	Triggers Exceeded?	Minor Changes [1]		Moderate Changes [2]		Major Changes [3]		Plan for 2021
		Yes/No	Yes/No	Parameters	Yes/No	Parameters	Yes/No	Parameters	
Sampling Strategy for Near-field Areas									
WTS	NF	Yes	Yes	Cond., Hard., TDS, Alkalinity (HCO_3 & Total), TKN, TOC, DOC, Ca, Mg, K, Na, T.&D. Lithium.	Yes	T. Phosphorus	No	-	Full CREMP (near-field area)
MAM	NF	Yes	Yes	Cond., Hard., TDS, Alkalinity (HCO_3 & Total), TKN, Reactive Silica, TOC, DOC, Ca, Mg, K, Na, T.&D. Lithium, T.&D. Silicon.	No	-	No	-	Full CREMP (near-field area)
NEM	NF	Yes	Yes	Cond., Hard., TDS, Alkalinity (HCO_3 & Total), TOC, Ca, Mg, K, Na.	No	-	No	-	Full CREMP (near-field area)
Sampling Strategy for Mid-field and Far-field Areas									
A20	MF	Yes	Yes	Cond., Hard., TDS, Alkalinity (HCO_3 & Total), TKN, TOC, DOC, Ca, Mg, K, Na.	Yes	T. Phosphorus	No	-	Full water sampling
A76	MF	Yes	Yes	Cond., Hard., TDS, Alkalinity (HCO_3 & Total), Ca, Mg, K, Na.	Yes	T. Phosphorus	No	-	Full water sampling
DS1	FF	Yes	Yes	TOC, DOC.	No	-	No	-	Full water sampling

Notes:
1. Minor = exceedance of the early warning trigger values for parameters without effects-based threshold values.
2. Moderate = exceedance of the early warning trigger values for parameters with effects-based thresholds.
3. Major = exceedance of the effects-based threshold values.

Table 5-10. Number of monthly mean concentrations exceeding monthly FEIS screening predictions, annual mean trigger exceedances and trend directions for parameters in Mammoth Lake and Whale Tail South in 2021.

	Number of Monthly Exceedances of FEIS Predictions [1]		Annual Mean Exceeds Trigger		Direction of Change [2]	
Parameter	Whale Tail South	Mammoth Lake	Whale Tail South	Mammoth Lake	Whale Tail South	Mammoth Lake
Ammonia (as N)	2	0	No	No	↓	↓
Nitrate (as N)	3	2	No	No	↓	=
Total Phosphorous	2	0	**Yes**	No	**↑**	=
Chloride	5	2	No	No	=	=
Fluoride	5	2	No	No	=	=
Calcium	5	5	**Yes**	**Yes**	↓	=
Potassium	5	5	**Yes**	**Yes**	=	**↑**
Magnesium	5	5	**Yes**	**Yes**	↓	**↑**
Sodium	4	0	**Yes**	No	=	**↑**
Sulphate	5	5	No	No	=	**↑**
Total Alkalinity	5	5	**Yes**	**Yes**	↓	**↑**
TDS	5	5	**Yes**	**Yes**	↓	↓
Total Metals						
Aluminum	5	3	No	No	↓	**↑**
Antimony	4	5	No	No	↓	**↑**
Arsenic	2	0	No	No	↓	**↑**
Barium	5	5	No	No	↓	=
Chromium	1	1	No	No	=	=
Copper	3	0	No	No	=	**↑**
Iron	5	0	No	No	↓	↓
Lithium	5	5	**Yes**	**Yes**	↓	**↑**
Manganese	3	0	No	No	=	**↑**
Molybdenum	4	0	No	No	=	**↑**
Nickel	5	1	No	No	↓	**↑**
Strontium	5	5	No	No	↓	**↑**
Uranium	2	0	No	No	=	**↑**
Total	**100**	**61**	-	-	-	-

Notes:

1 In all cases, five months of data were available.

2 Qualitative direction of trend according to 2021 water quality plots.

Shaded values indicate parameter exceeded FEIS prediction during all 2021 monthly sampling events.

Bolded and underlined values indicate yearly mean exceeded trigger.

Bolded arrows indicate parameter concentrations appeared to be increasing in last sampling events of 2021.

"-" indicates mean annual concentration was < the trigger value.

Reported mean values are all in units of mg/L.

Figure 5-15. Flow chart showing sampling effort and frequency plan for mid-field and far-field sampling in 2021.

Note: Blue-shaded cells show the linkage between 2021 CREMP results and the sampling effort and frequency for mid-field and far-field sampling in 2022. *Moderate changes* refer to statistically significant increased concentrations for parameters with effects-based threshold values that exceed the early warning trigger values. Refer to **Section 2.2.3** for more information.

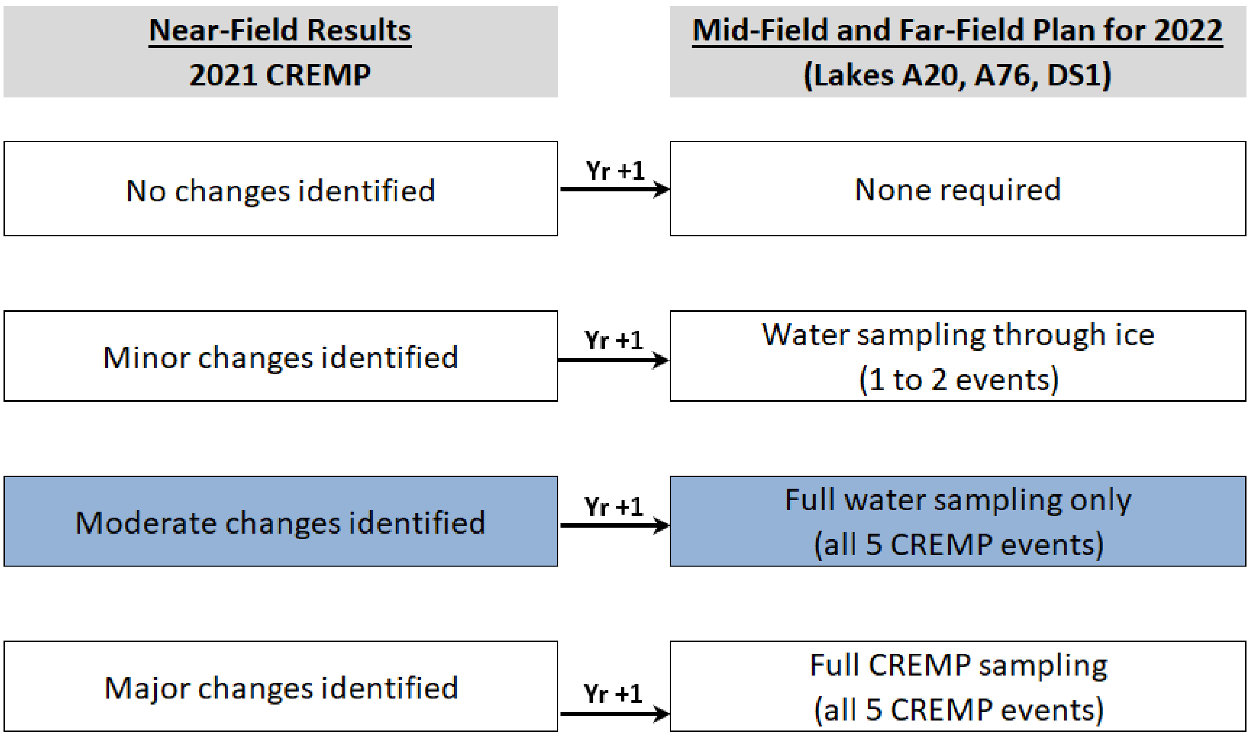


Figure 5-16. Laboratory-measured conductivity (µS/cm) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes.

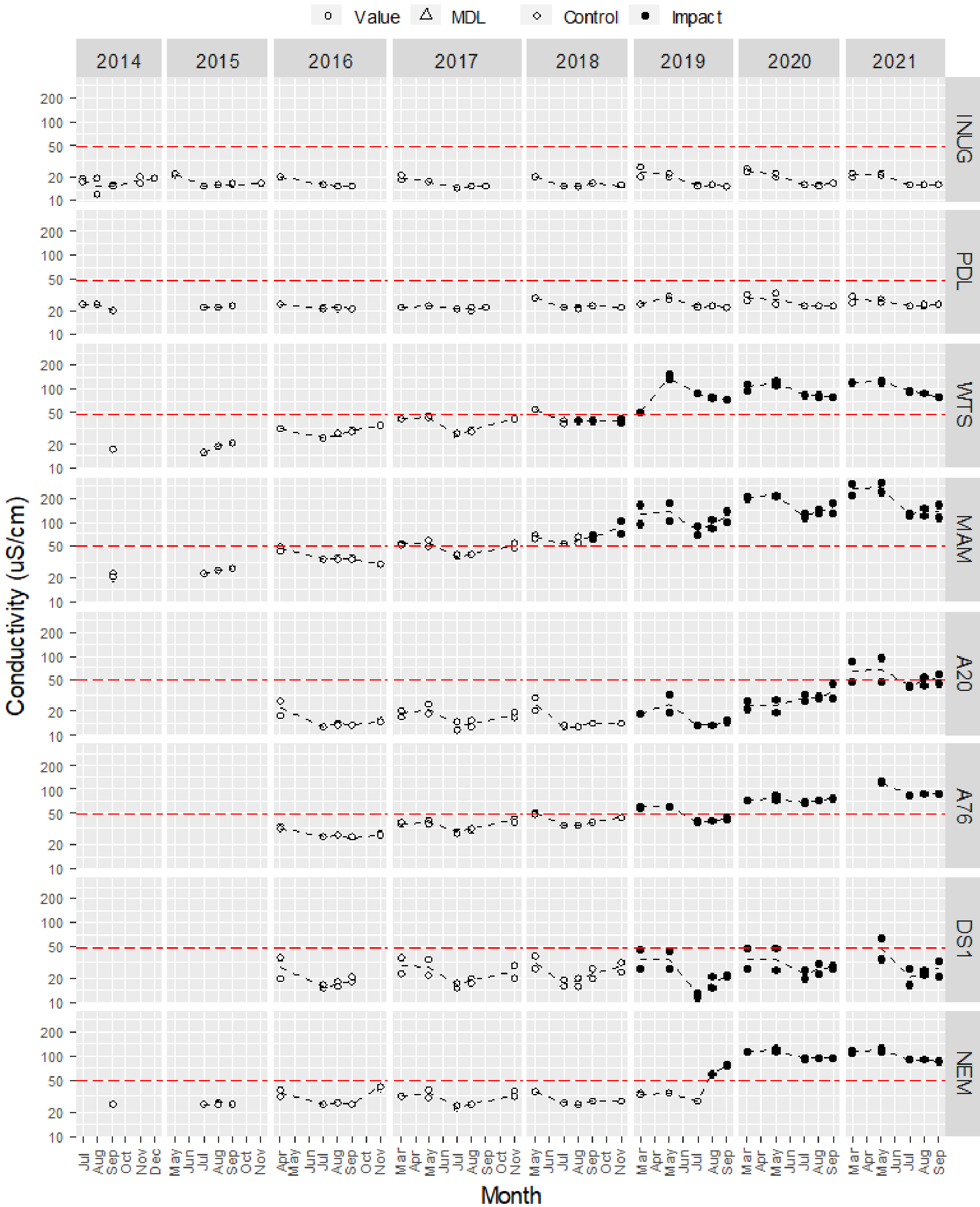


Figure 5-17. Laboratory measured hardness (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes.

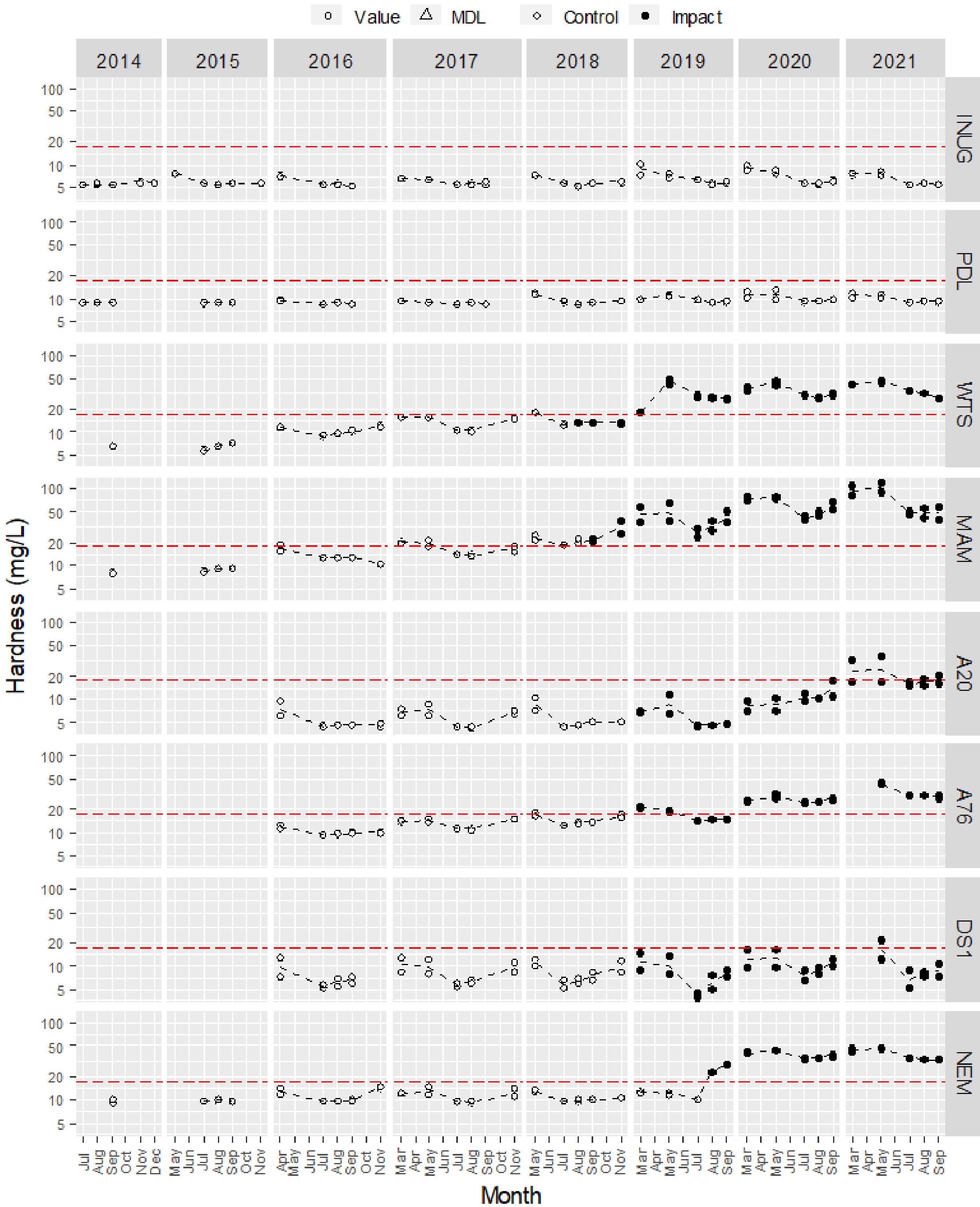


Figure 5-18. Field-measured pH in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes.

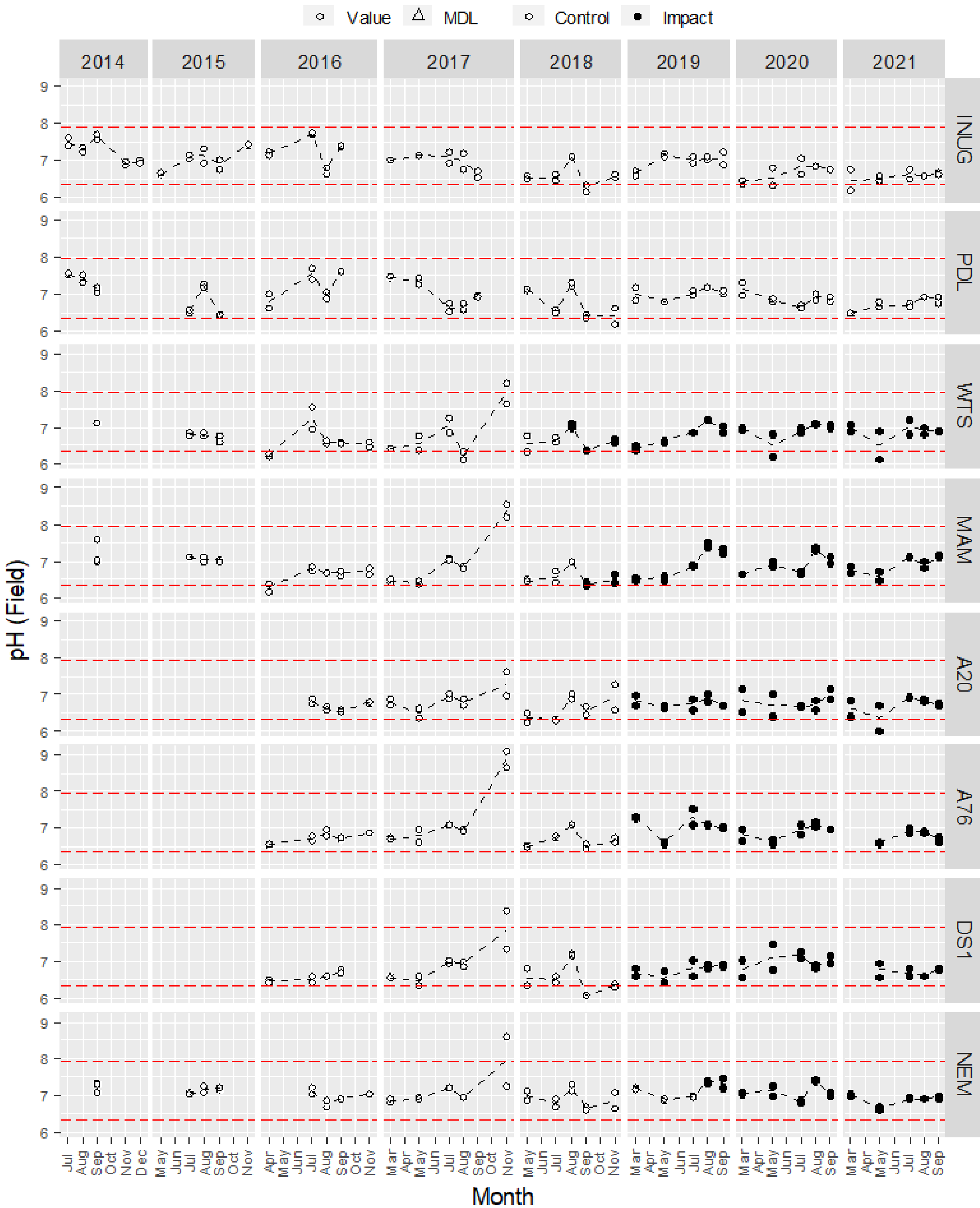


Figure 5-19. Laboratory-measured pH in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes.

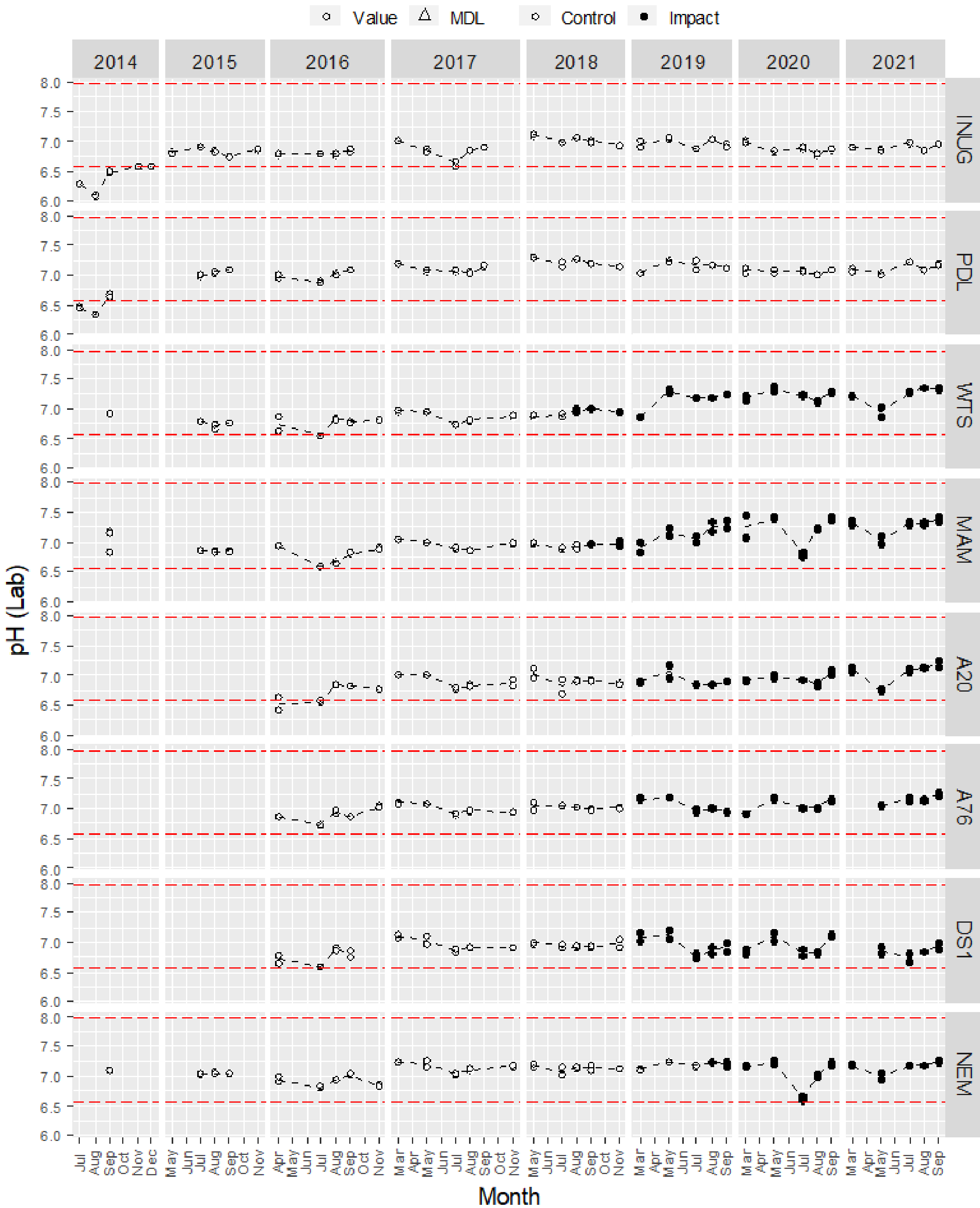


Figure 5-20. Total dissolved solids (TDS; mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes. The blue dashed line = FEIS screening prediction.

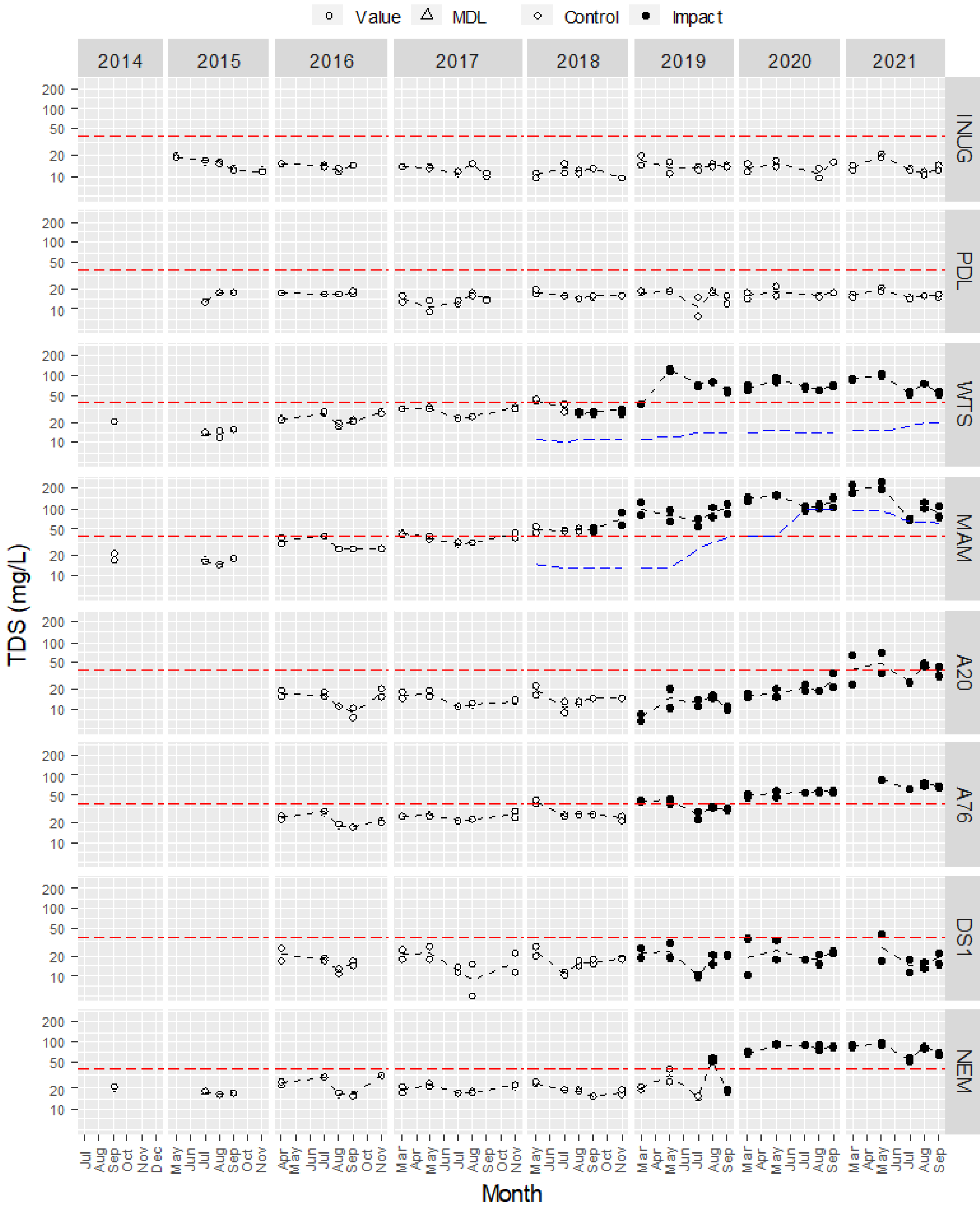


Figure 5-21. Bicarbonate alkalinity (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes.

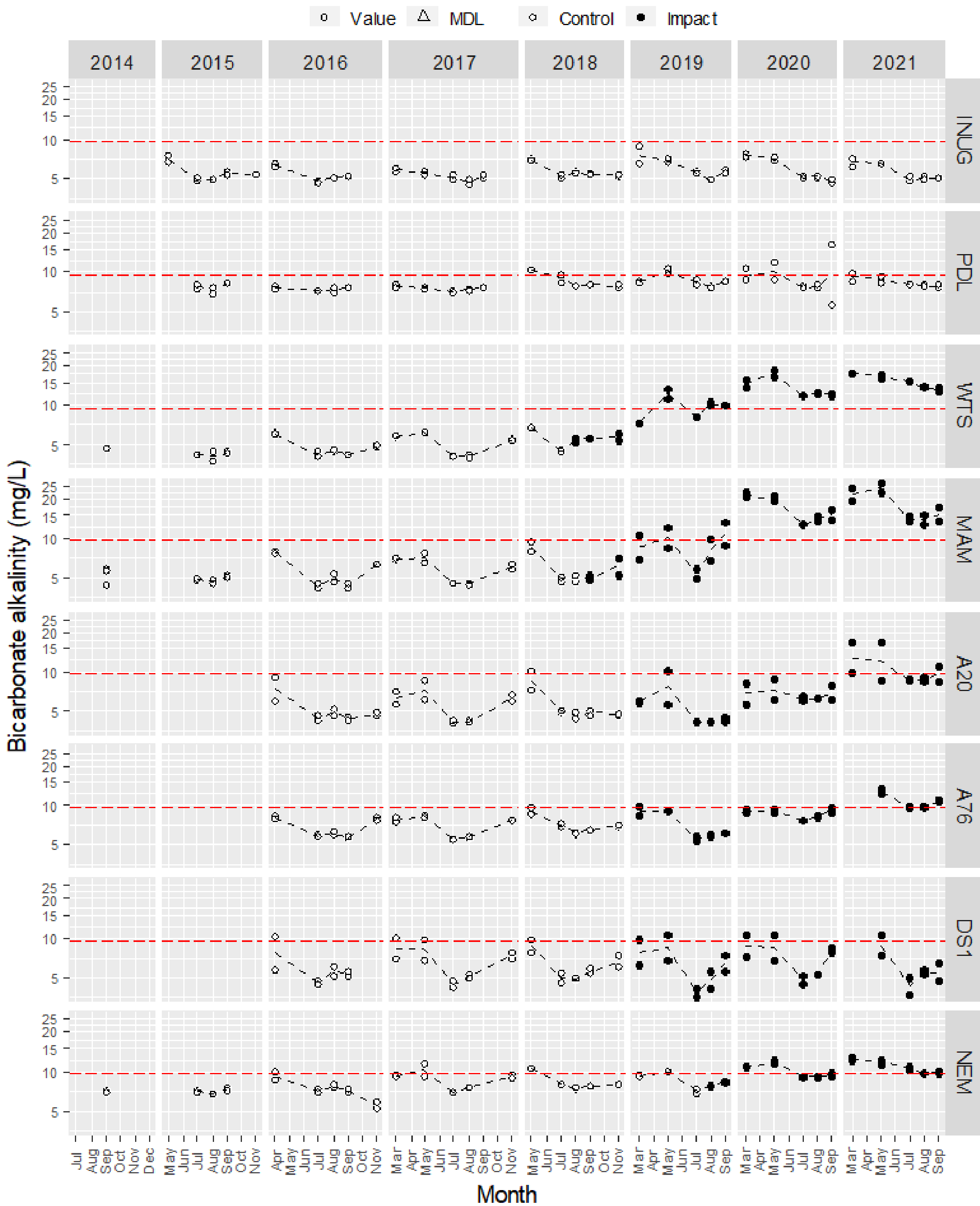


Figure 5-22. Total alkalinity (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes. The blue dashed line = FEIS screening prediction.

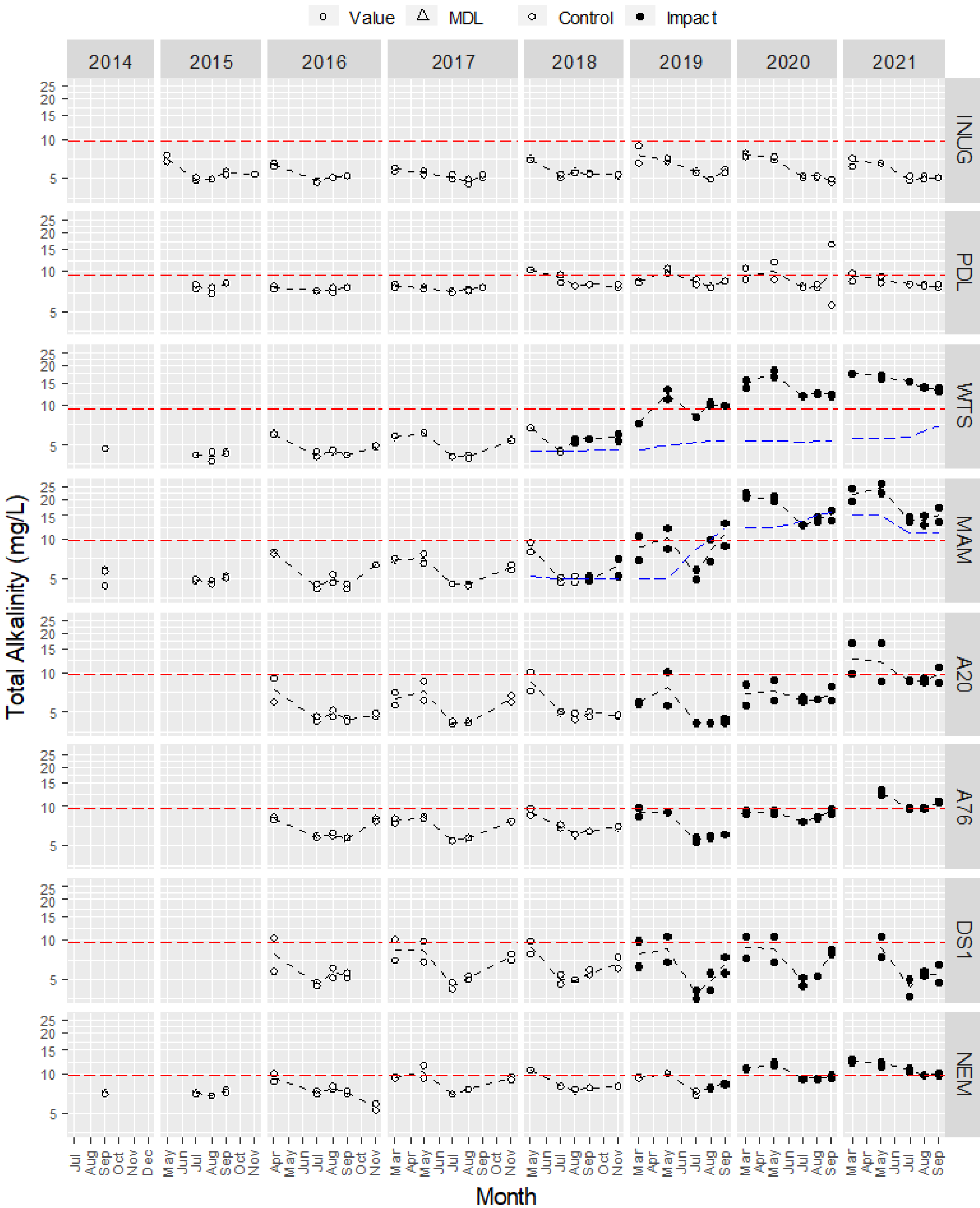


Figure 5-23. Ammonia-N (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes. The blue dashed line = FEIS screening prediction.

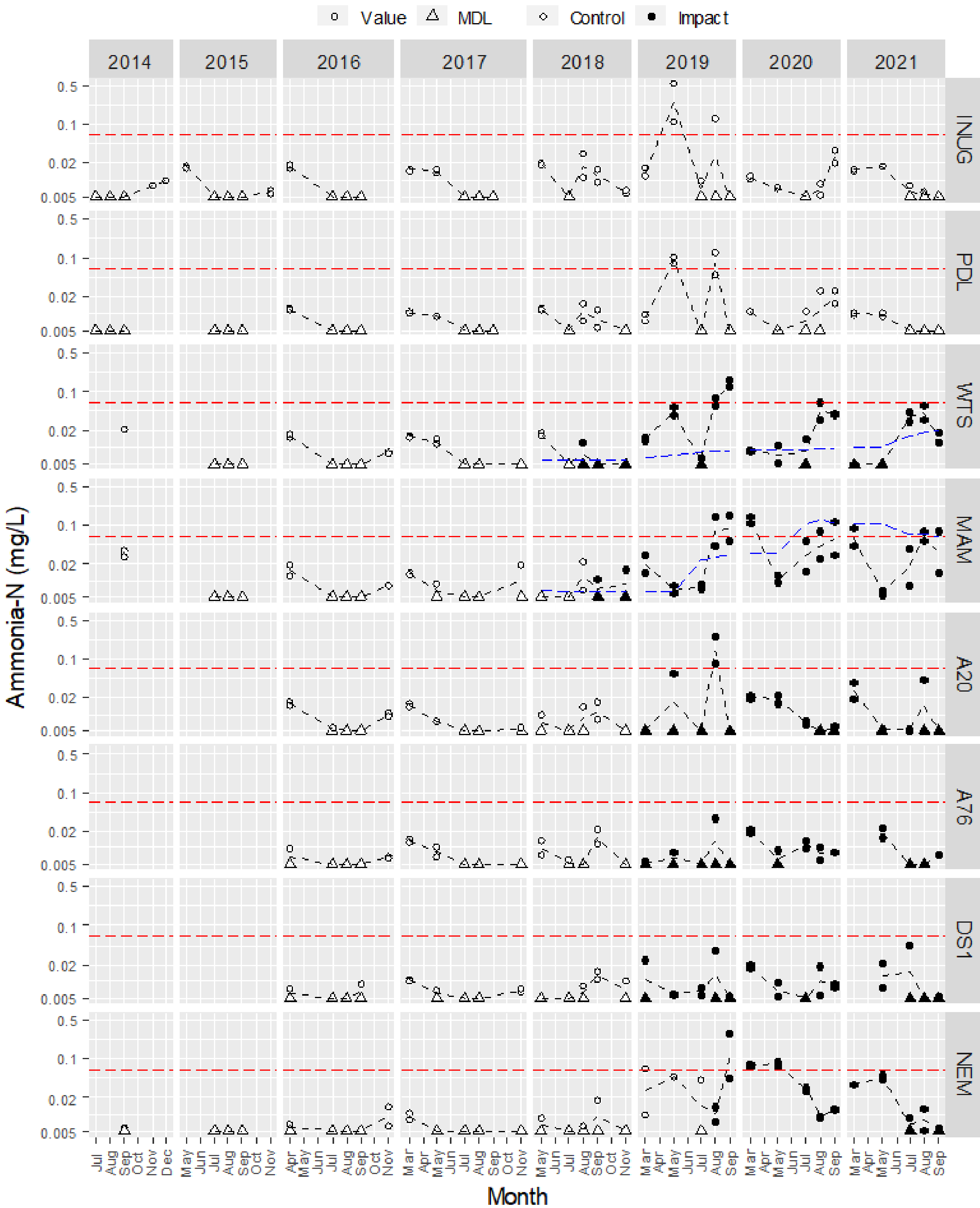


Figure 5-24. Chloride (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes. The blue dashed line = FEIS screening prediction.

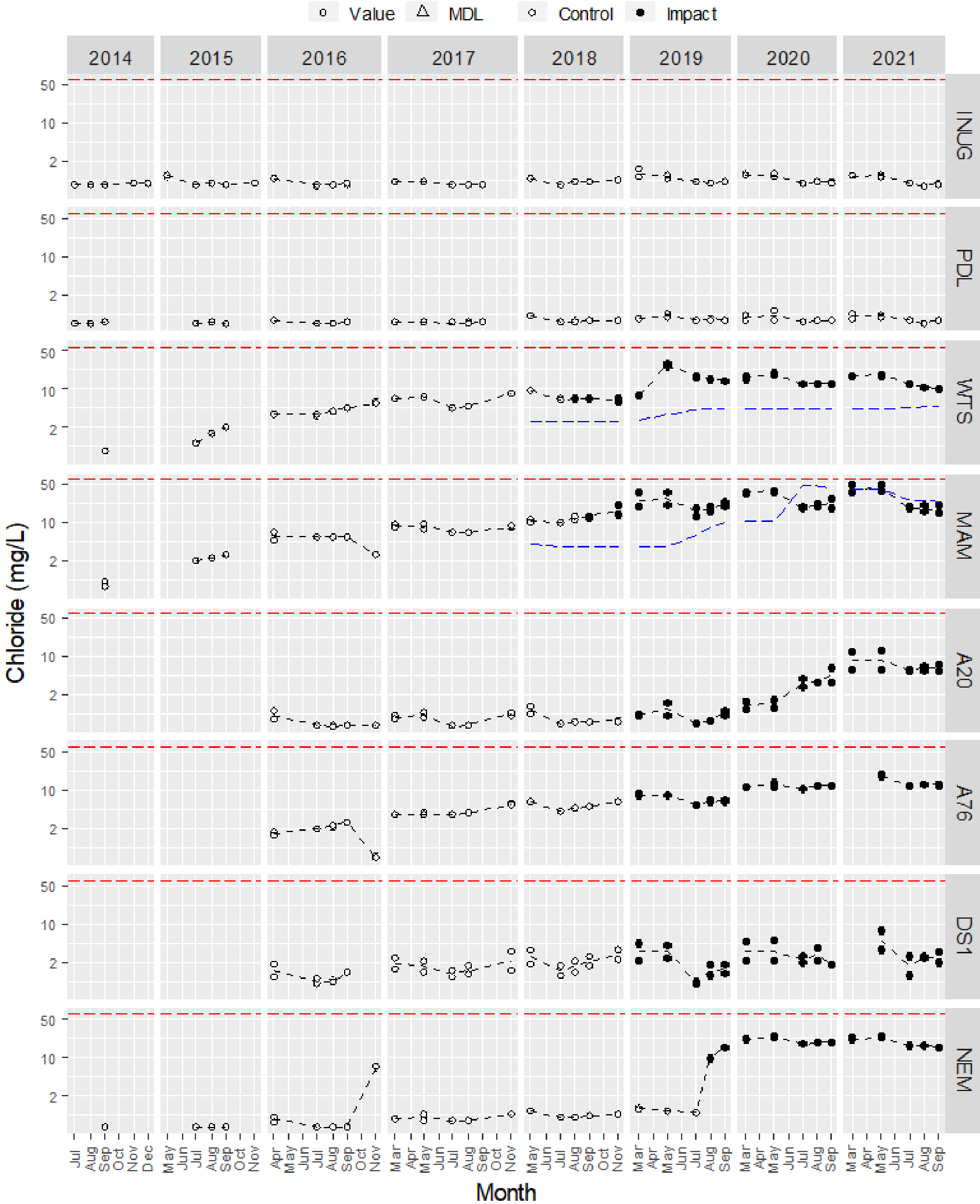


Figure 5-25. Fluoride (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes. The blue dashed line = FEIS screening prediction.

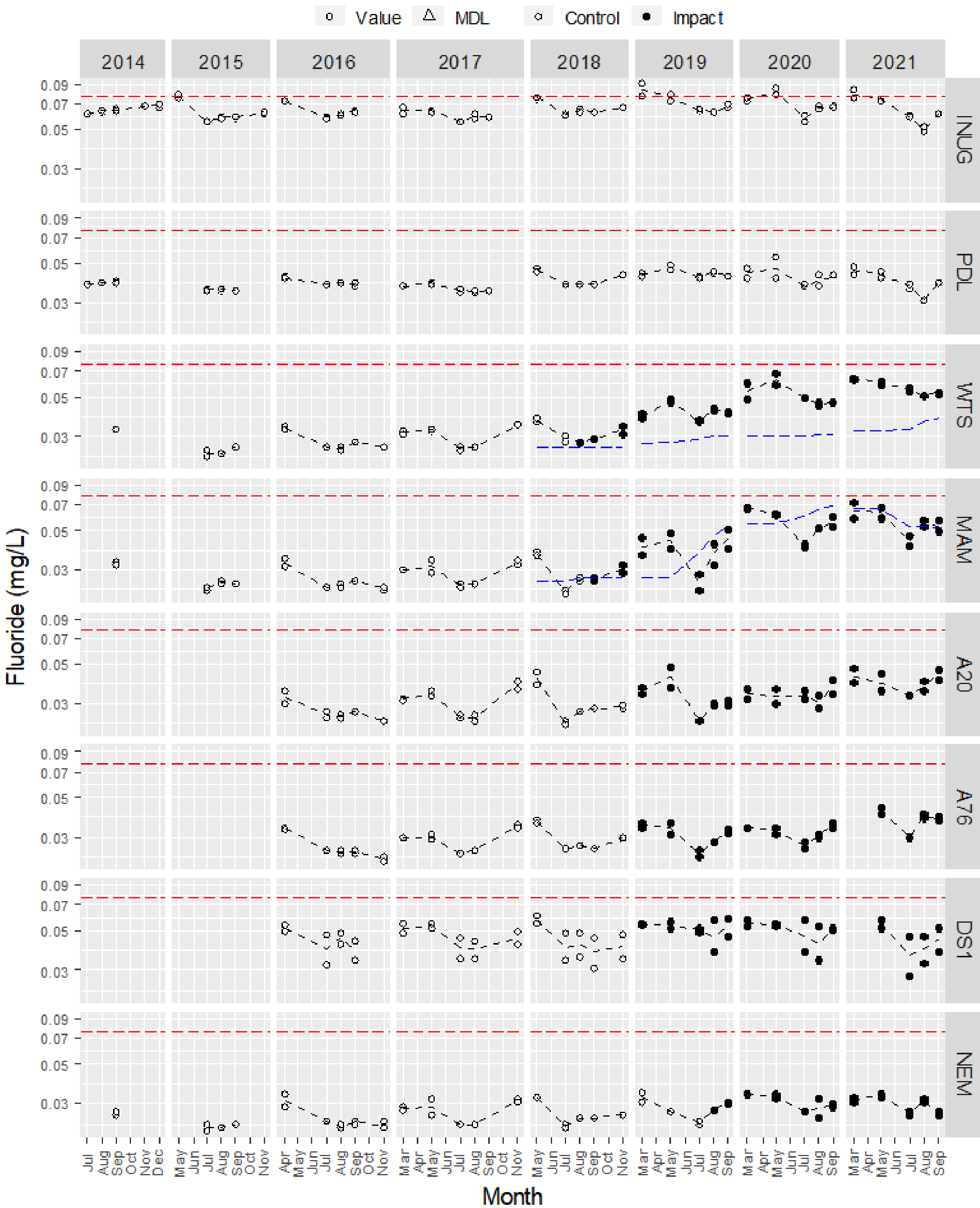


Figure 5-26. Nitrate-N (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes. The blue dashed line = FEIS screening prediction.

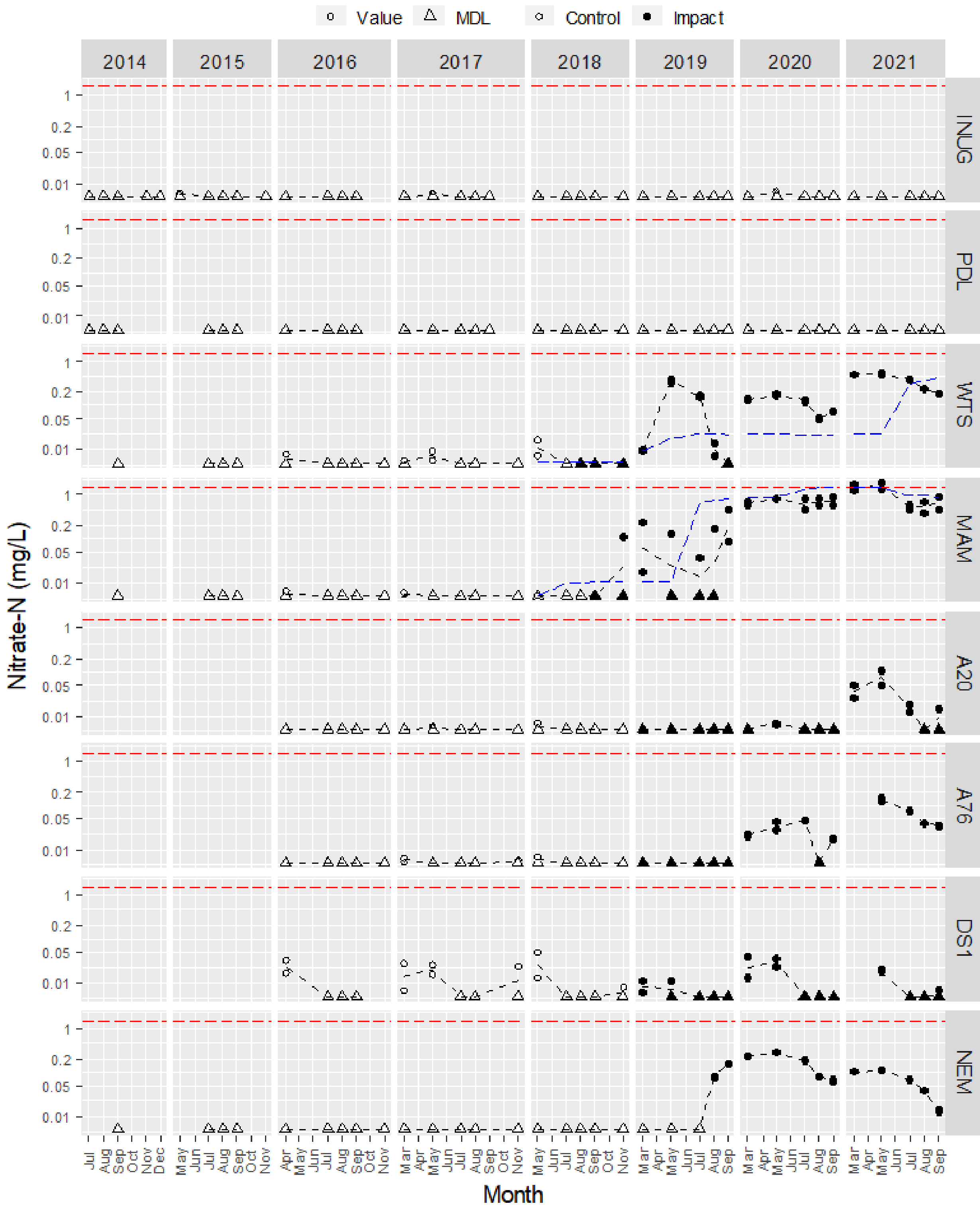


Figure 5-27. Nitrite-N (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes.

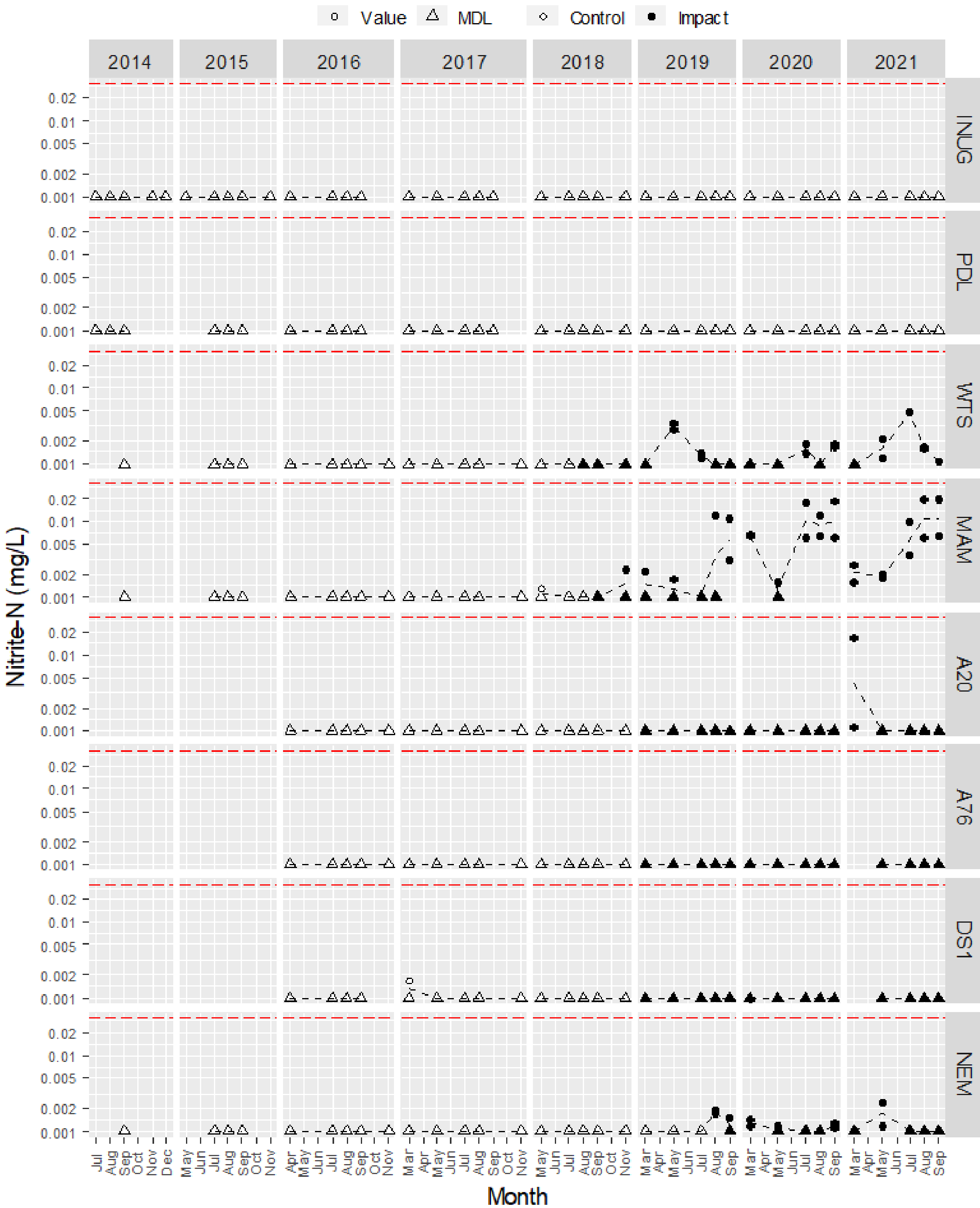


Figure 5-28. Total Kjeldahl Nitrogen (TKN; mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes.

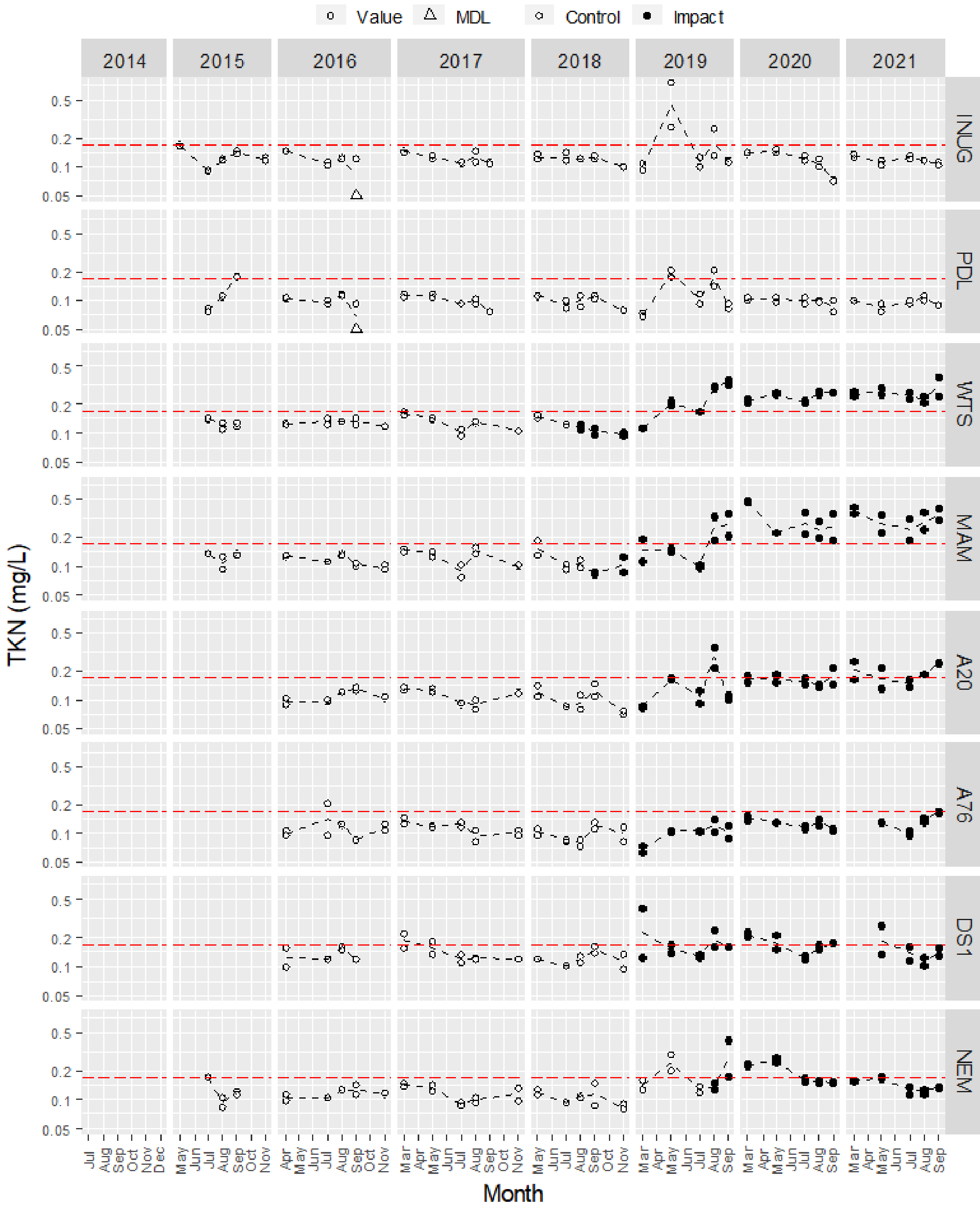


Figure 5-29. Total phosphorous (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes. The blue dashed line = FEIS screening prediction. The detection limit for total phosphorous was adjusted for some July 2020 samples from 0.002 mg/L to 0.010 mg/L or 0.020 mg/L.

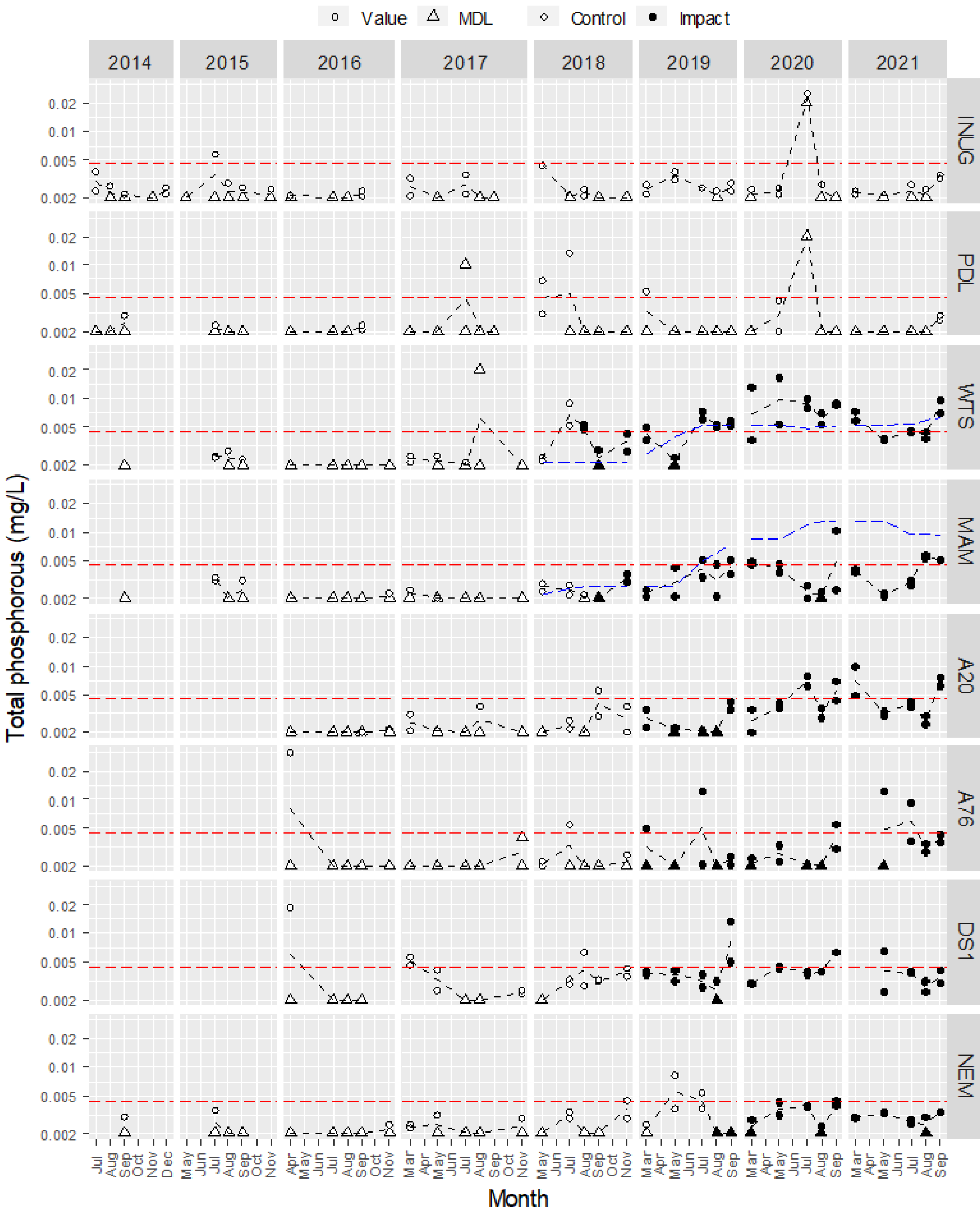


Figure 5-30. Ortho-phosphate (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes.

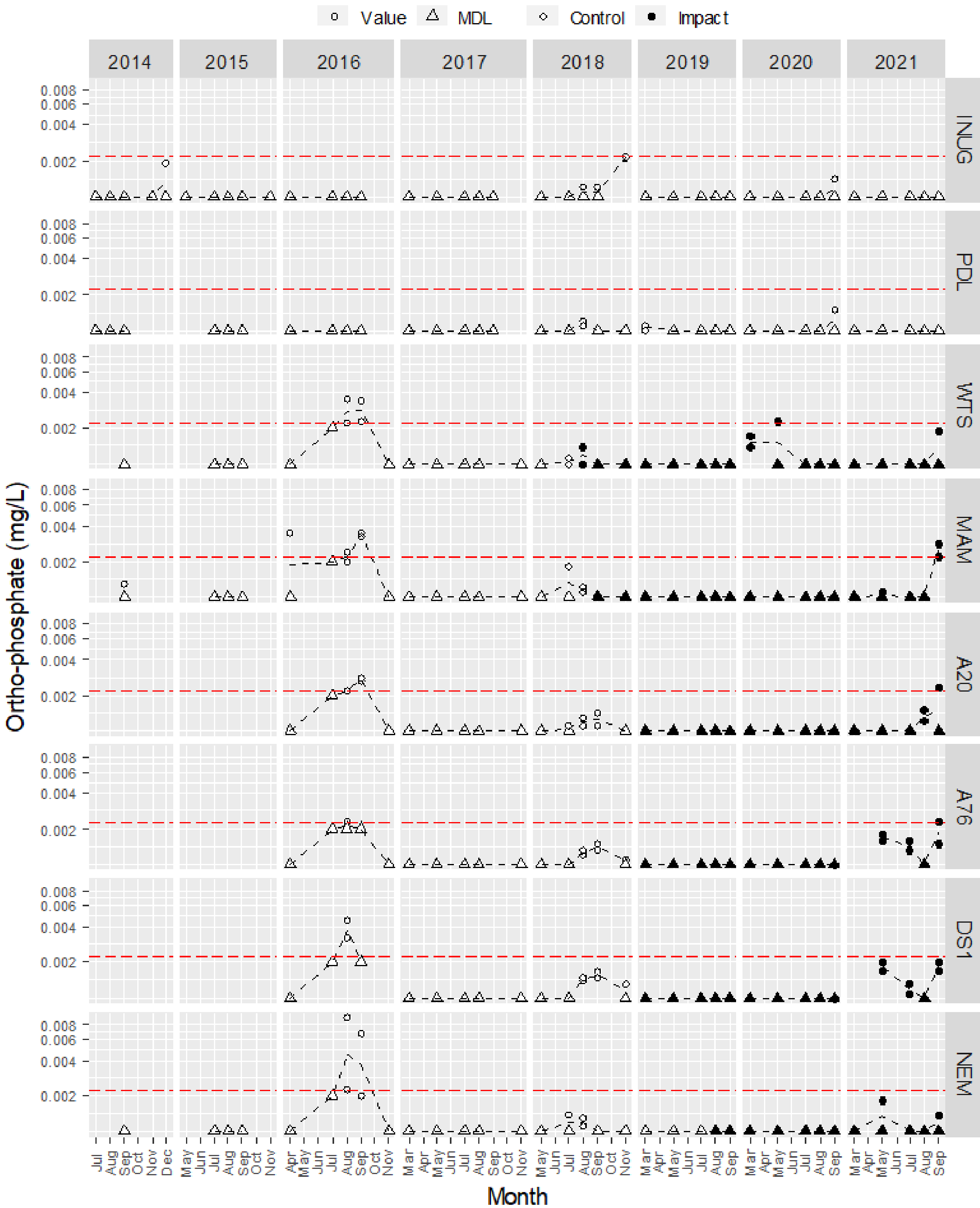


Figure 5-31. Reactive silica (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes.

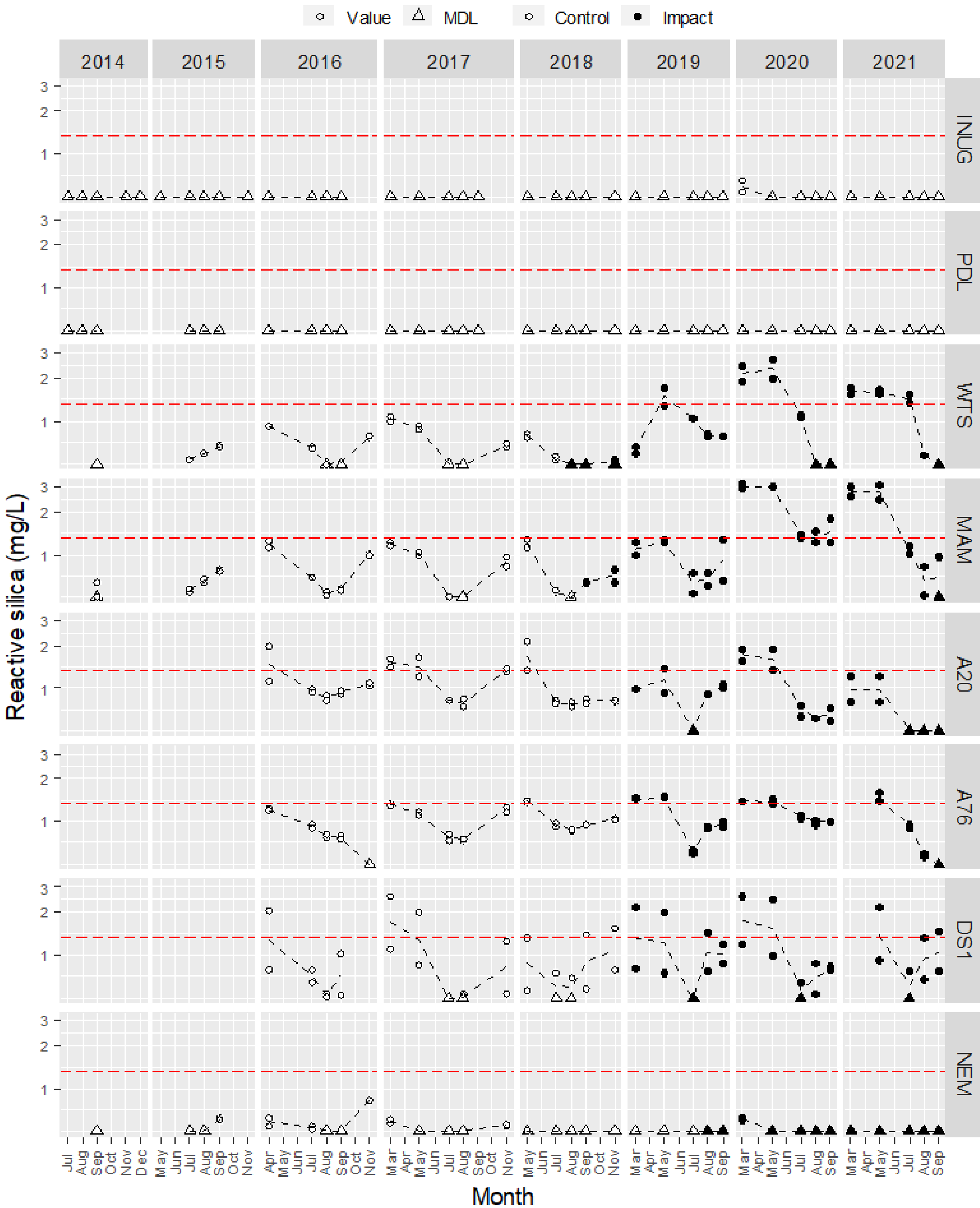


Figure 5-32. Sulphate (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes. The blue dashed line = FEIS screening prediction.

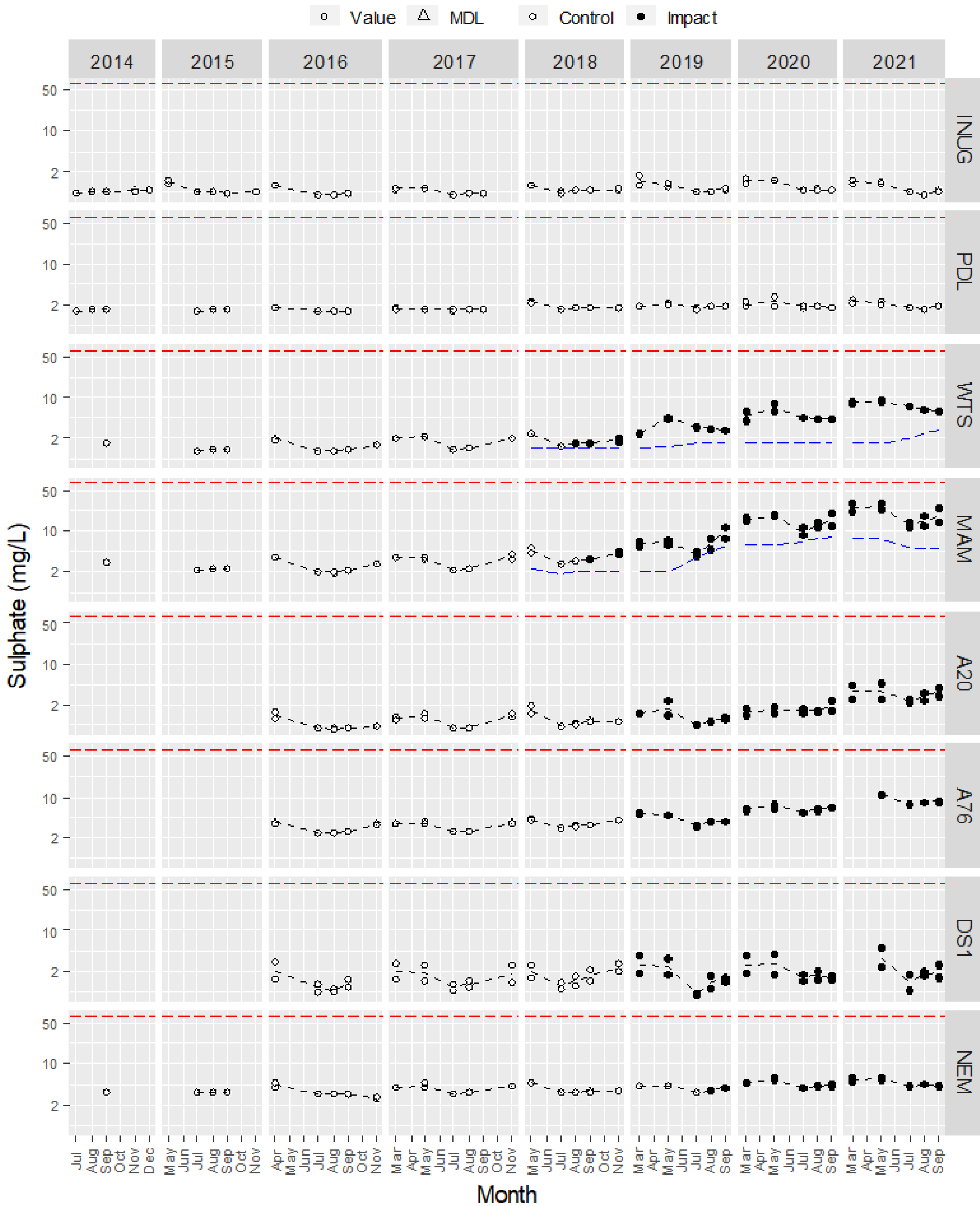


Figure 5-33. Dissolved organic carbon (DOC; mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes.

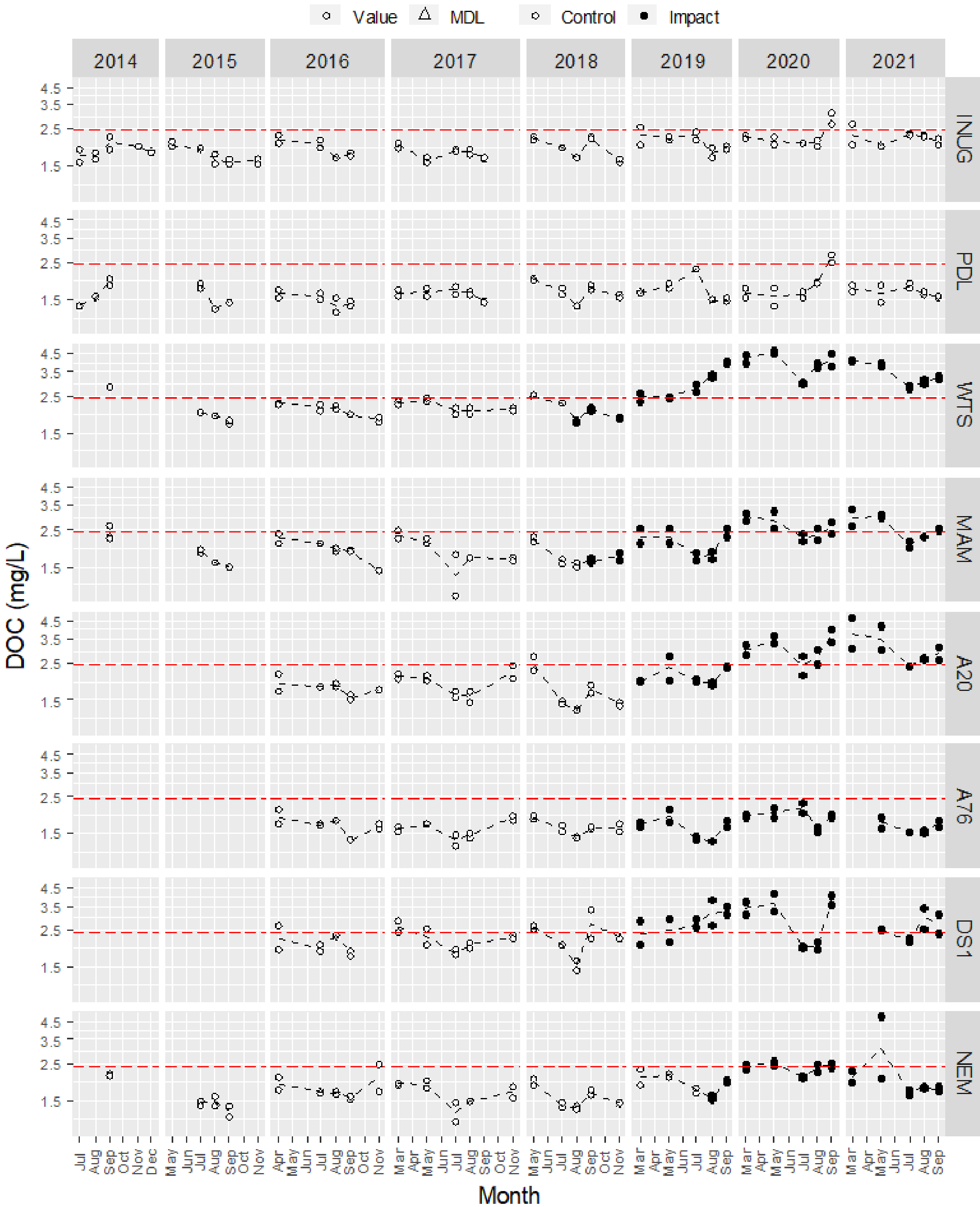


Figure 5-34. Total organic carbon (TOC; mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes.

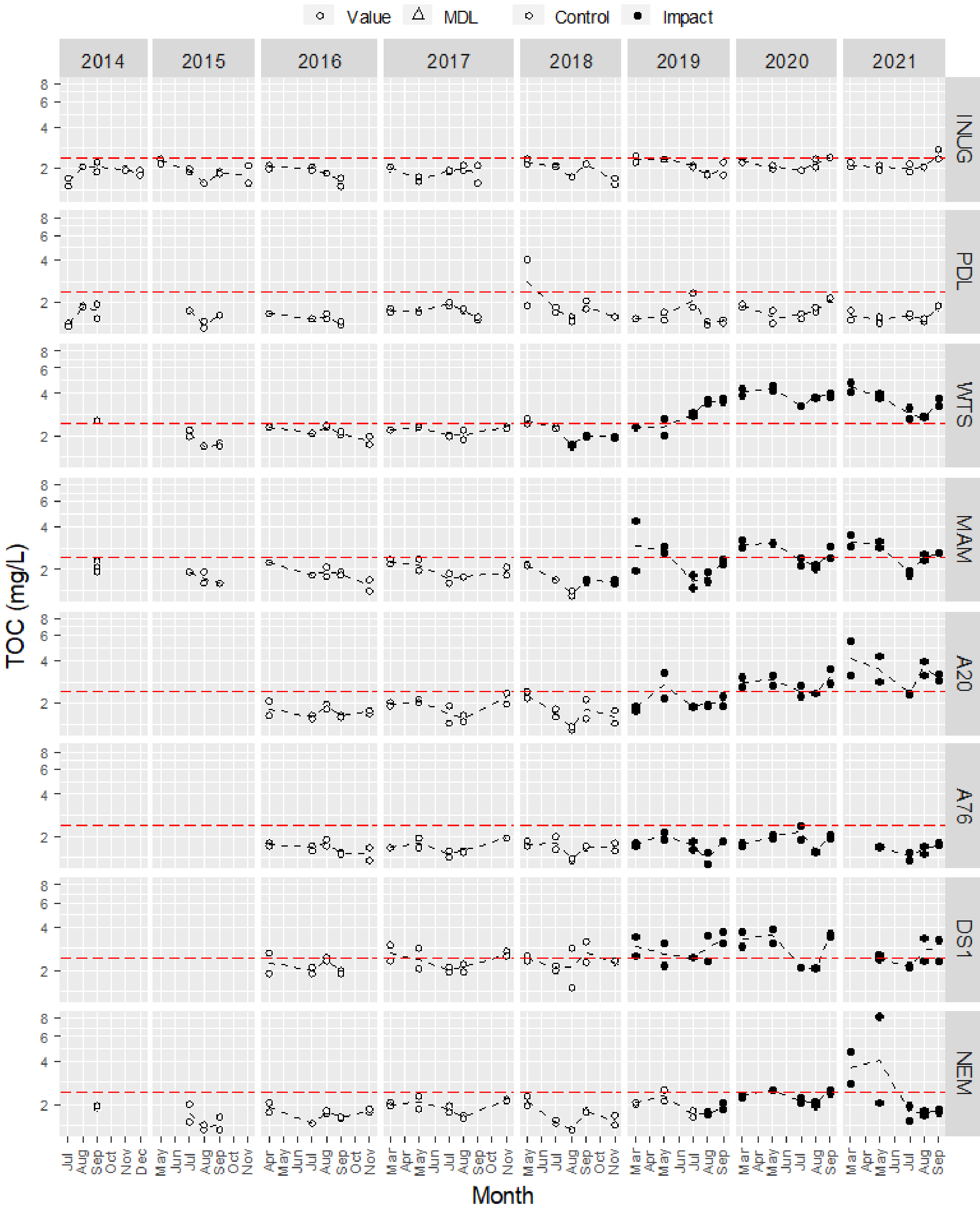


Figure 5-35. Total aluminum (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes. The blue dashed line = FEIS screening prediction.

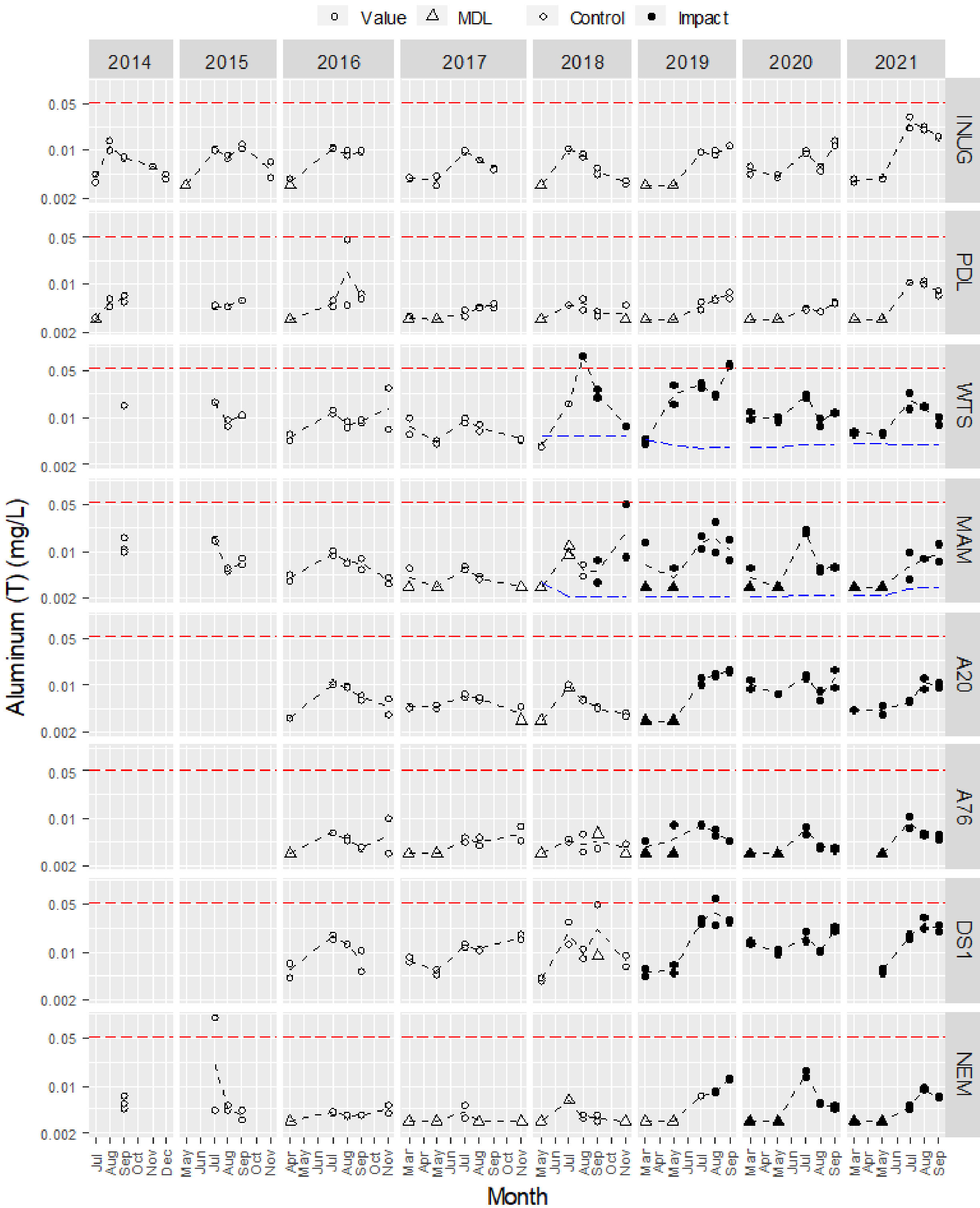


Figure 5-36. Total antimony (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes. The blue dashed line = FEIS screening prediction.

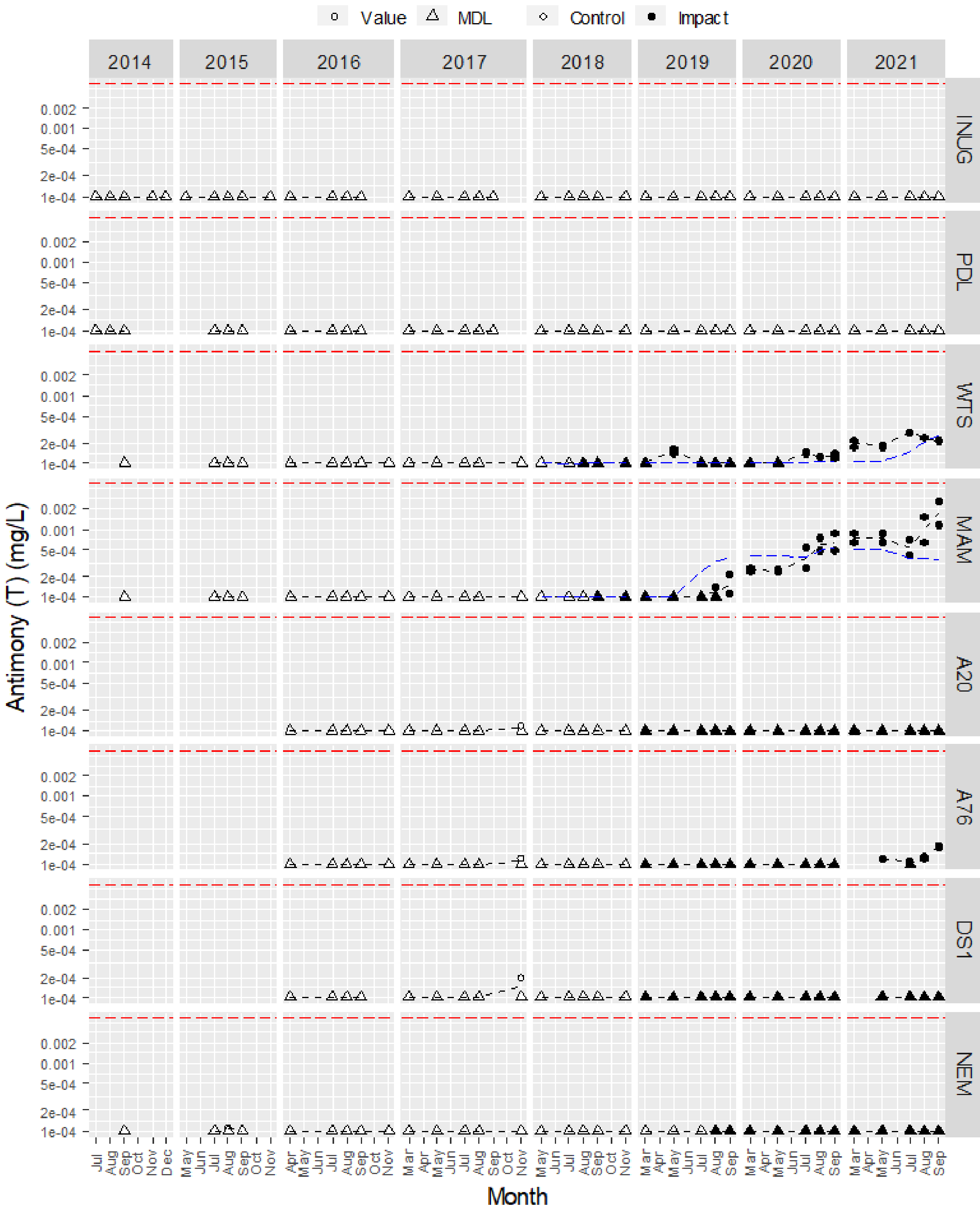


Figure 5-37. Total arsenic (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes. The blue dashed line = FEIS screening prediction.

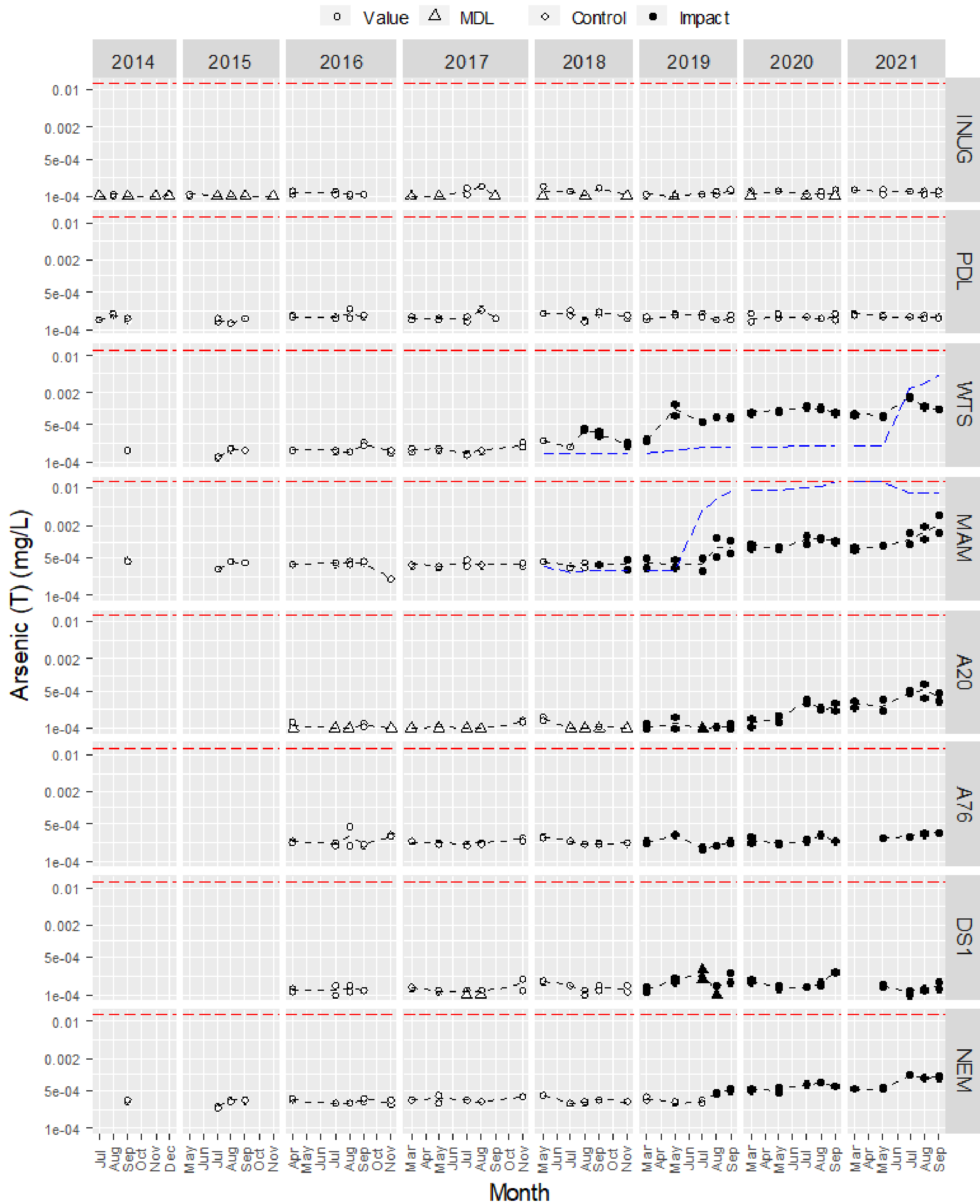


Figure 5-38. Total barium (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes. The blue dashed line = FEIS screening prediction.

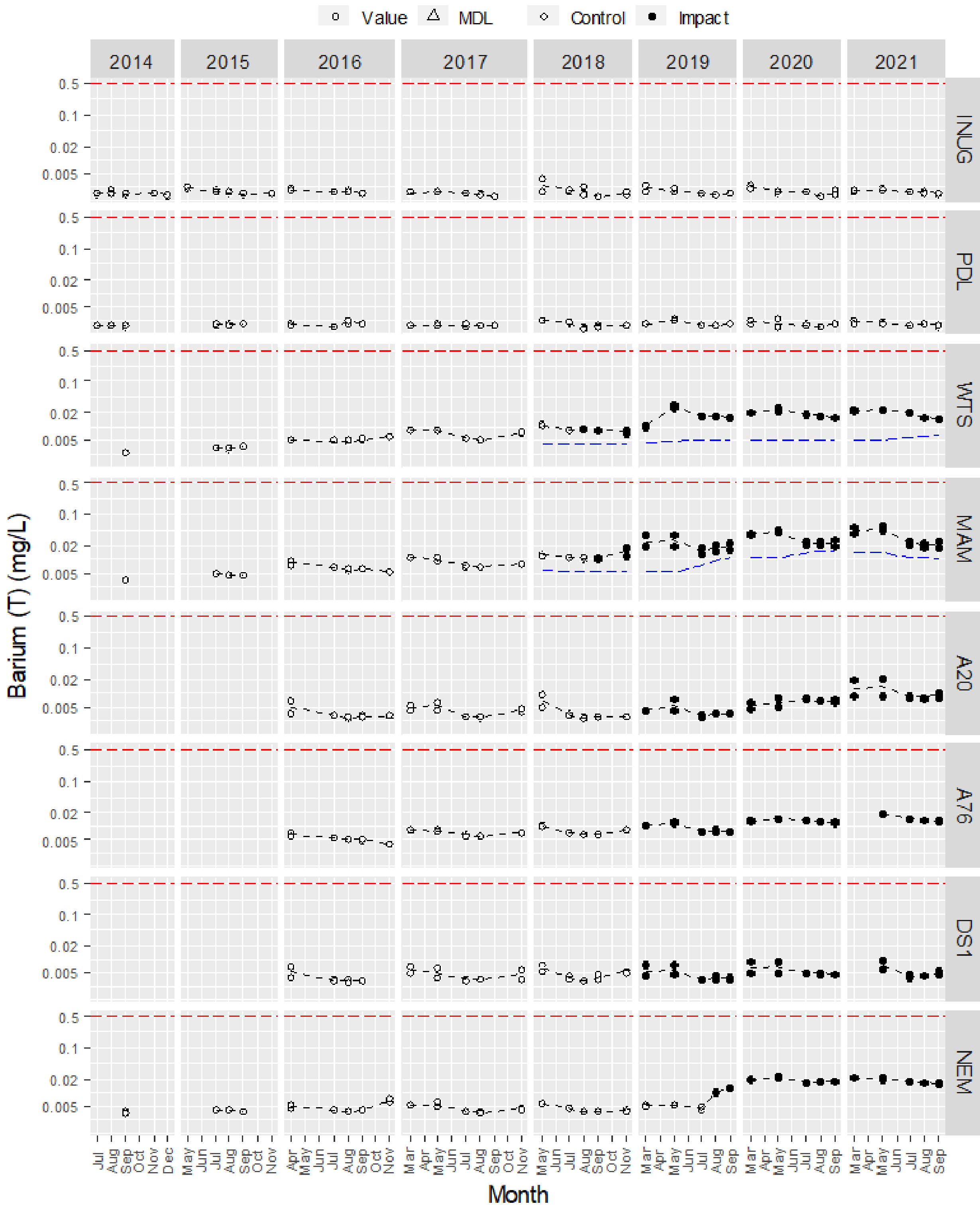


Figure 5-39. Total calcium (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes. The blue dashed line = FEIS screening prediction.

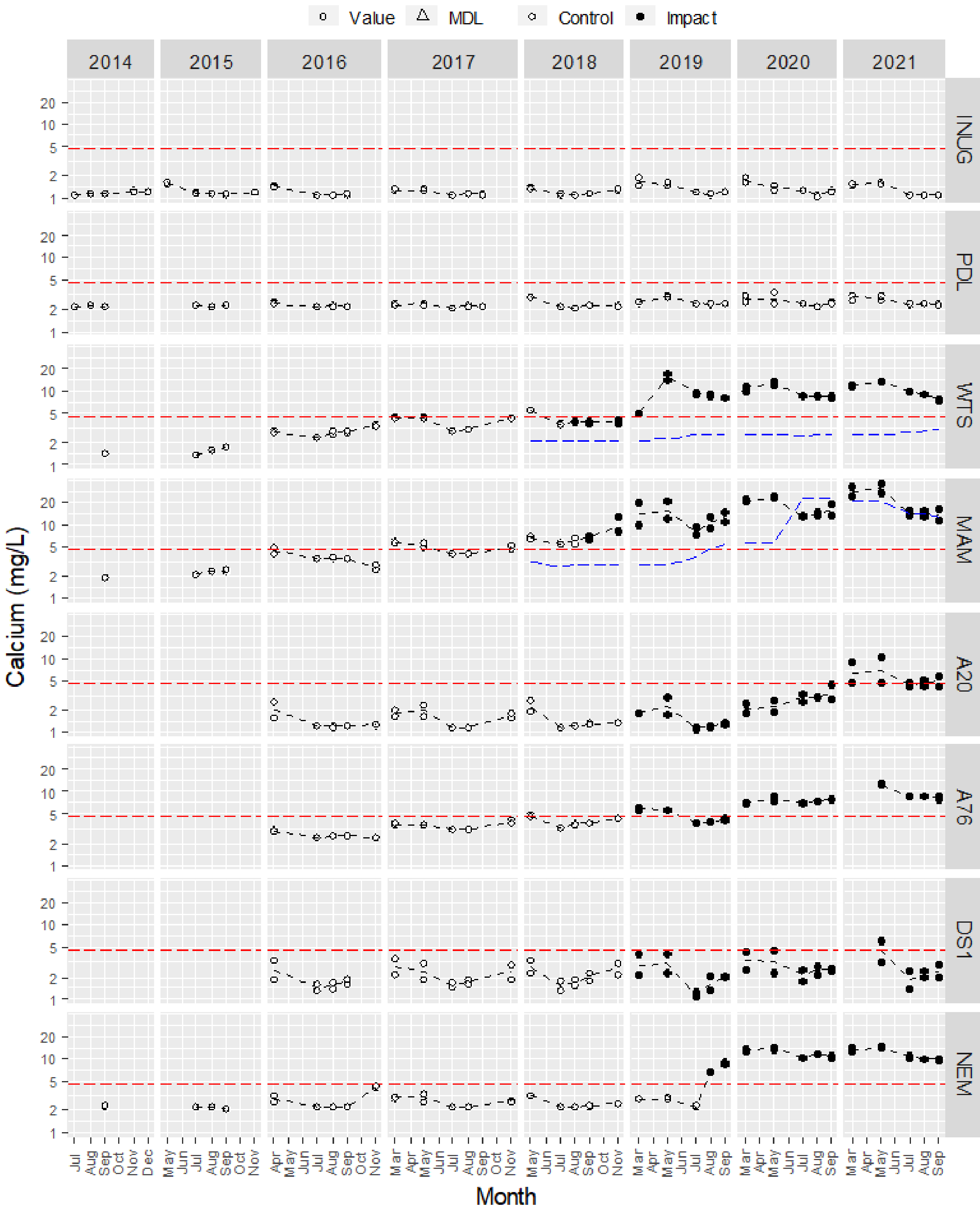


Figure 5-40. Total chromium (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes. The blue dashed line = FEIS screening prediction. The detection limit for total chromium was adjusted from 0.0001 mg/L to 0.0005 mg/L for samples collected in May, July, August and September, 2021.

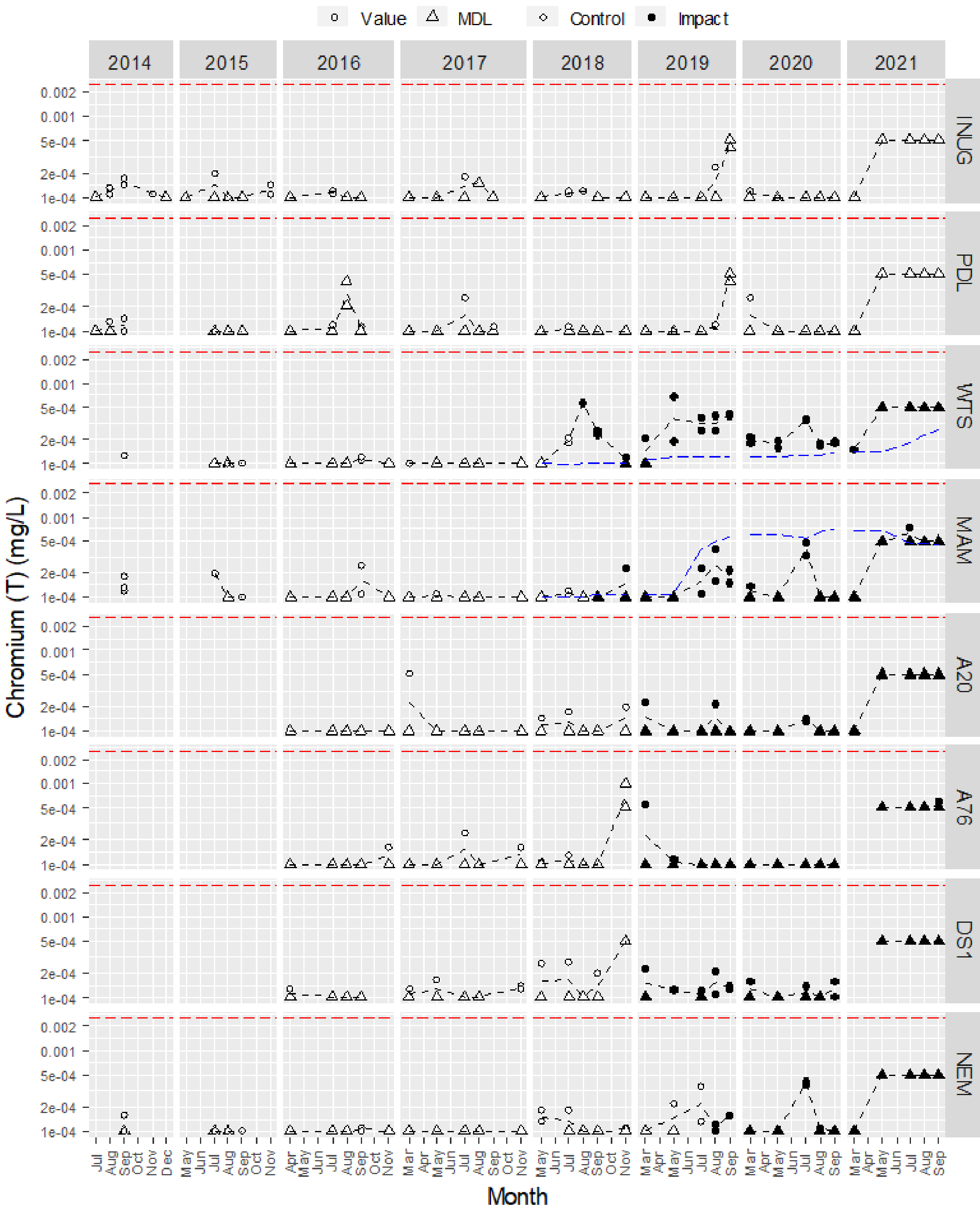


Figure 5-41. Total copper (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes. The blue dashed line = FEIS screening prediction.

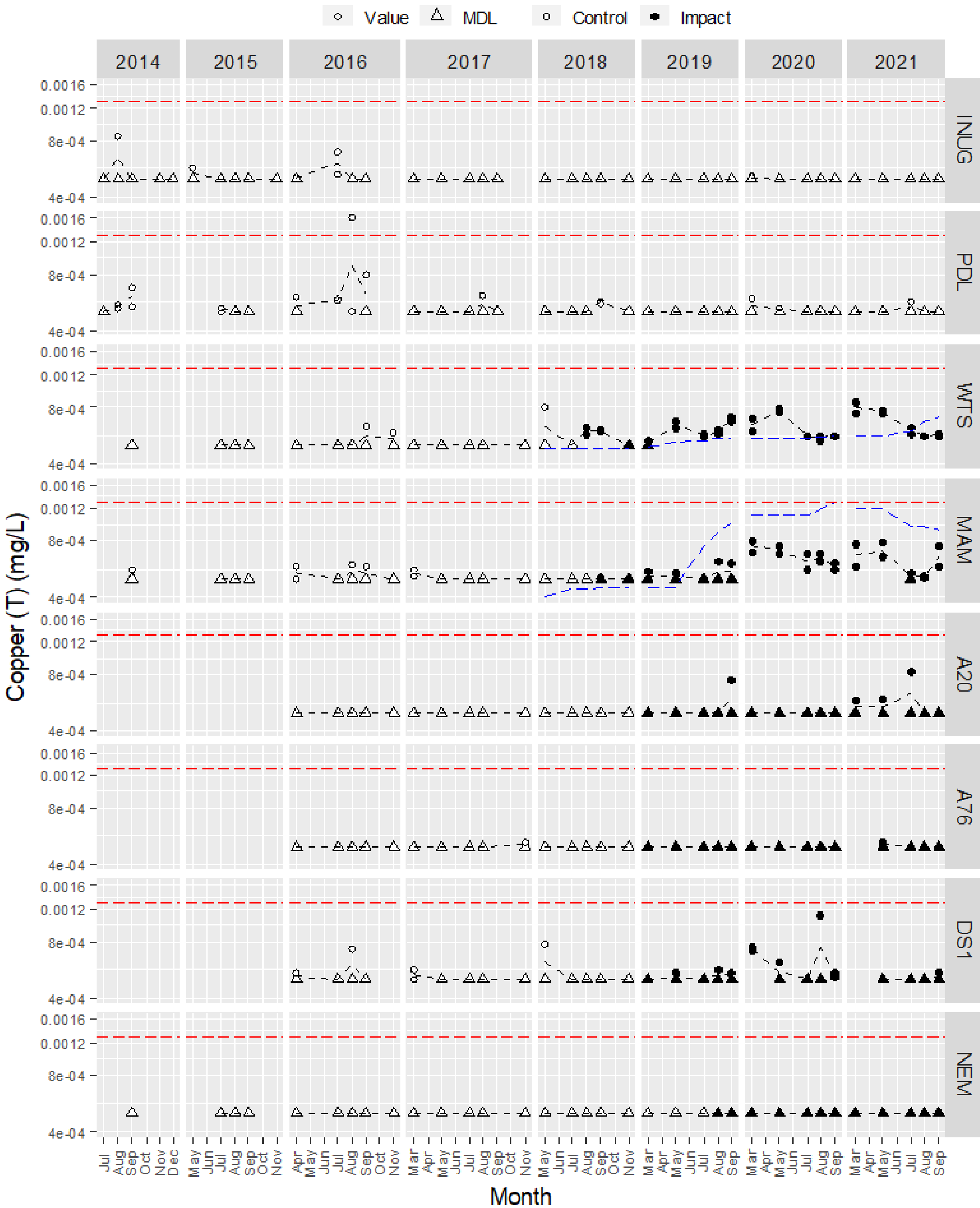


Figure 5-42. Total iron (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes. The blue dashed line = FEIS screening prediction.

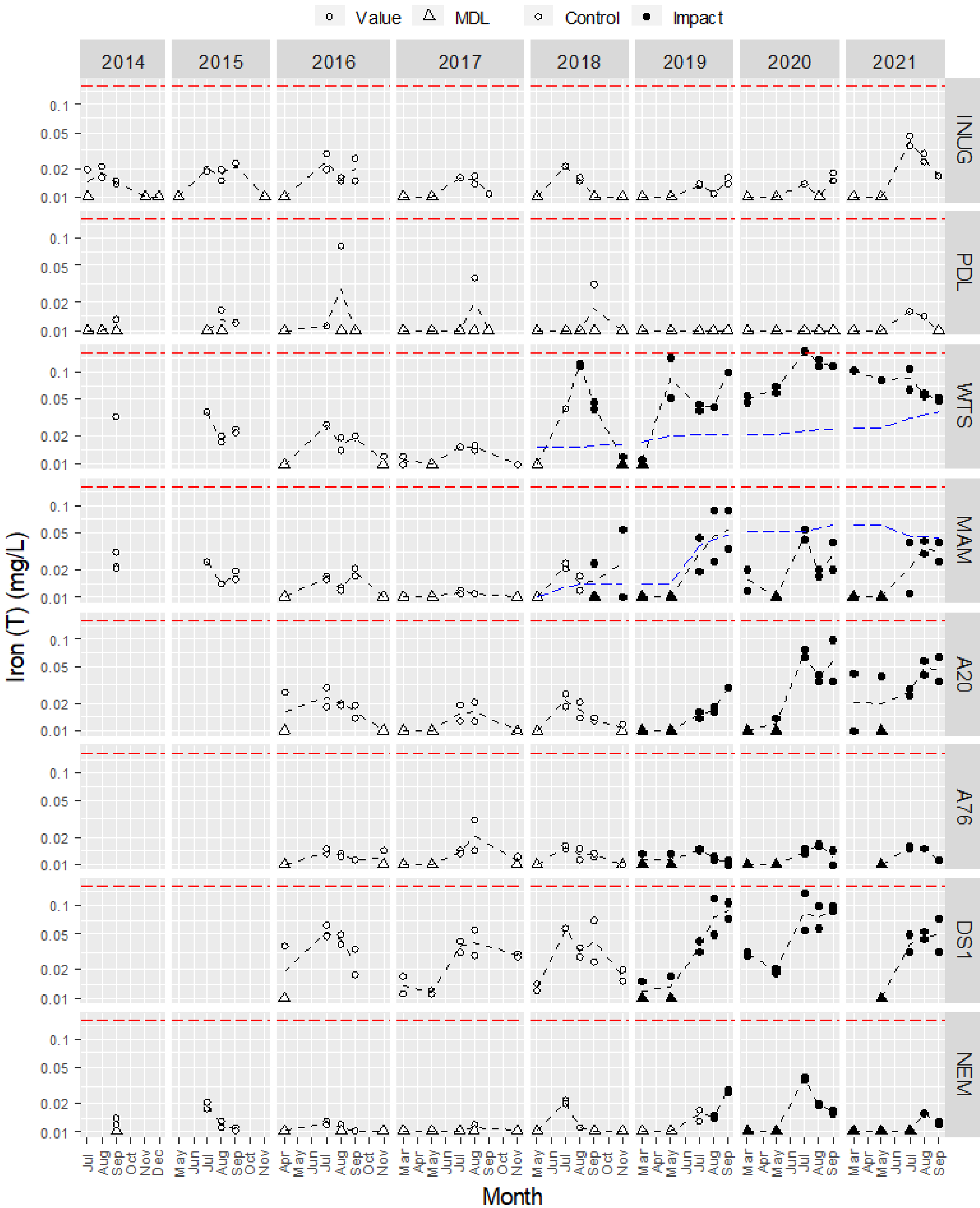


Figure 5-43. Total lead (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes. The blue dashed line = FEIS screening prediction.

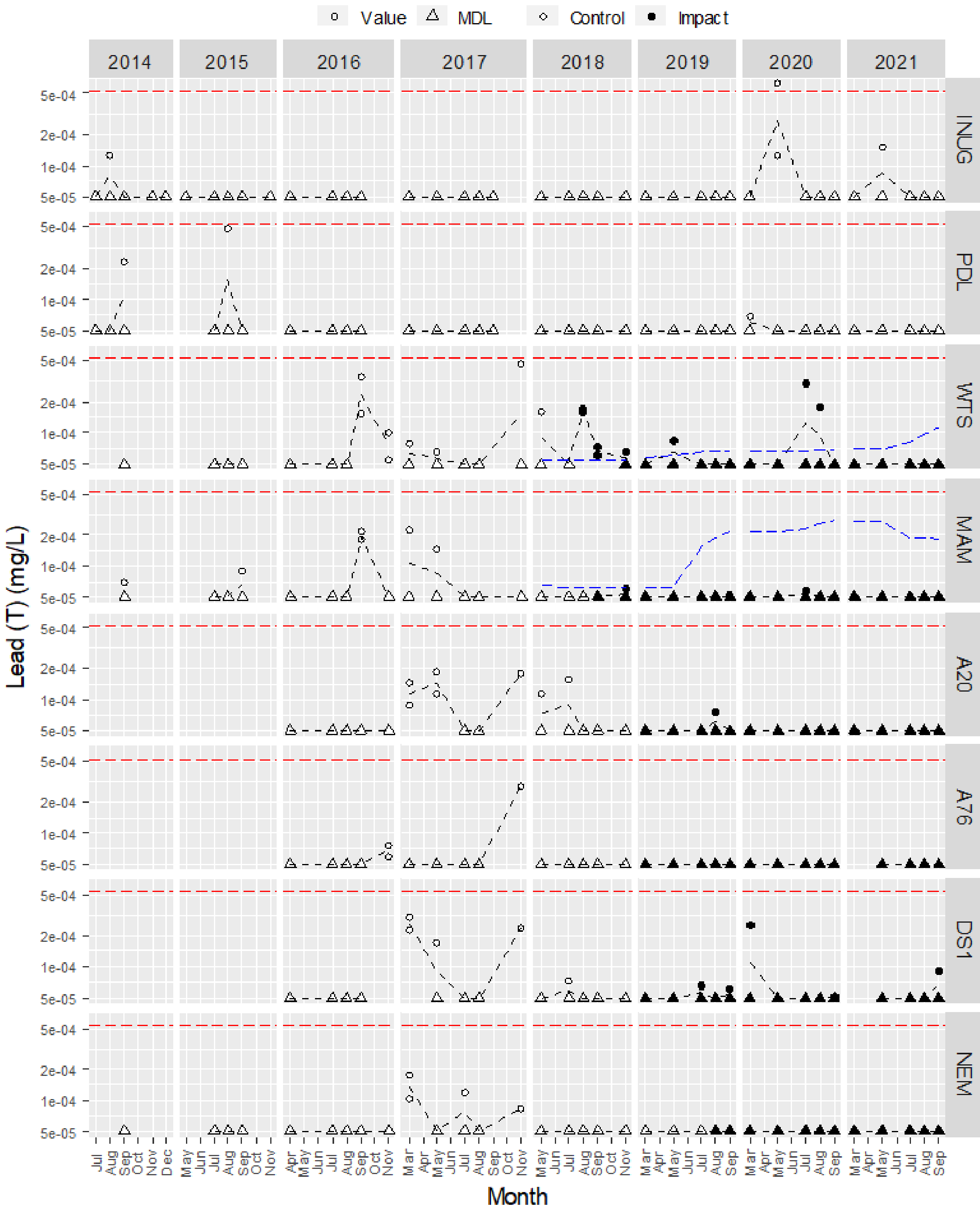


Figure 5-44. Total lithium (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes. The blue dashed line = FEIS screening prediction.

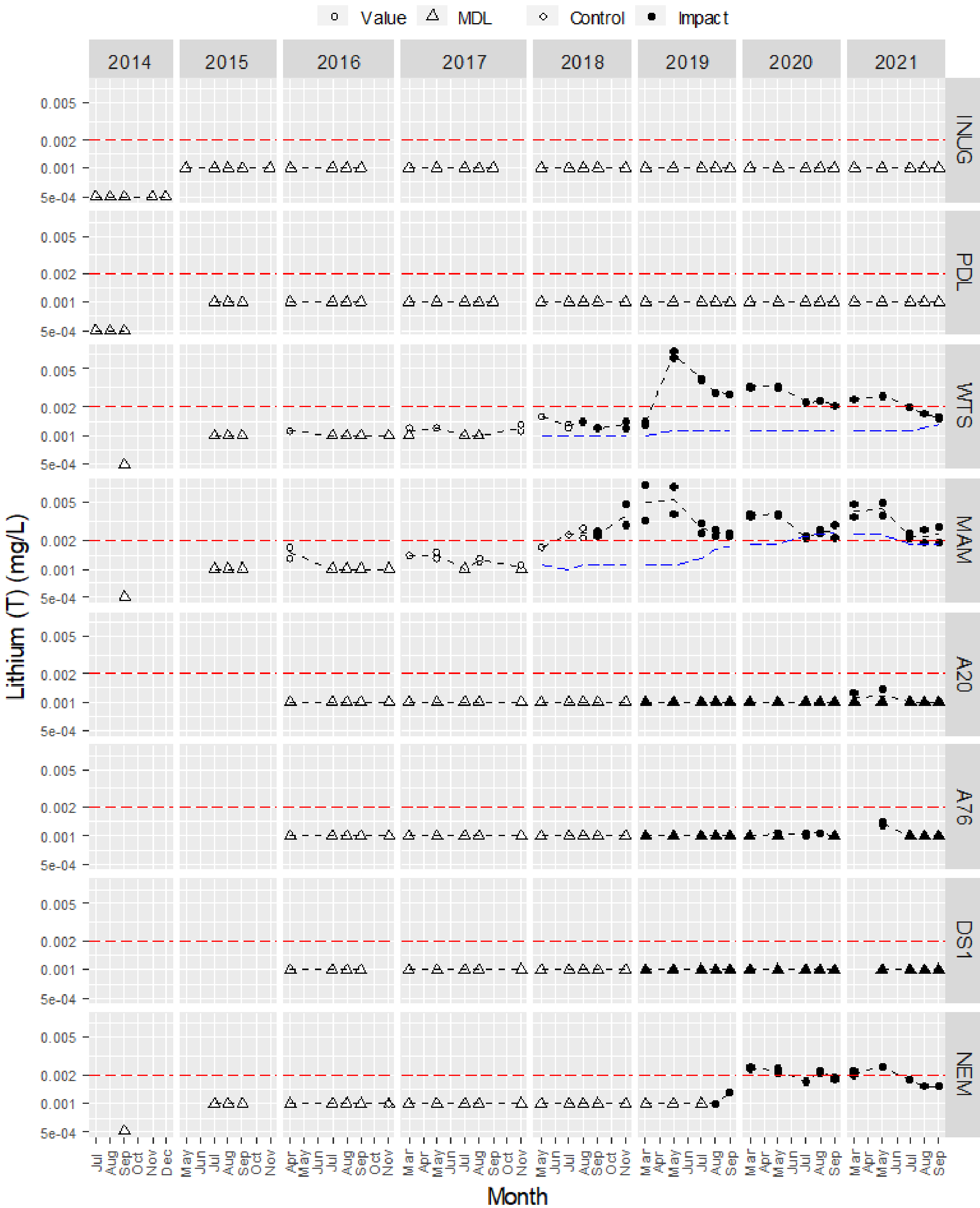


Figure 5-45. Total magnesium (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes. The blue dashed line = FEIS screening prediction.

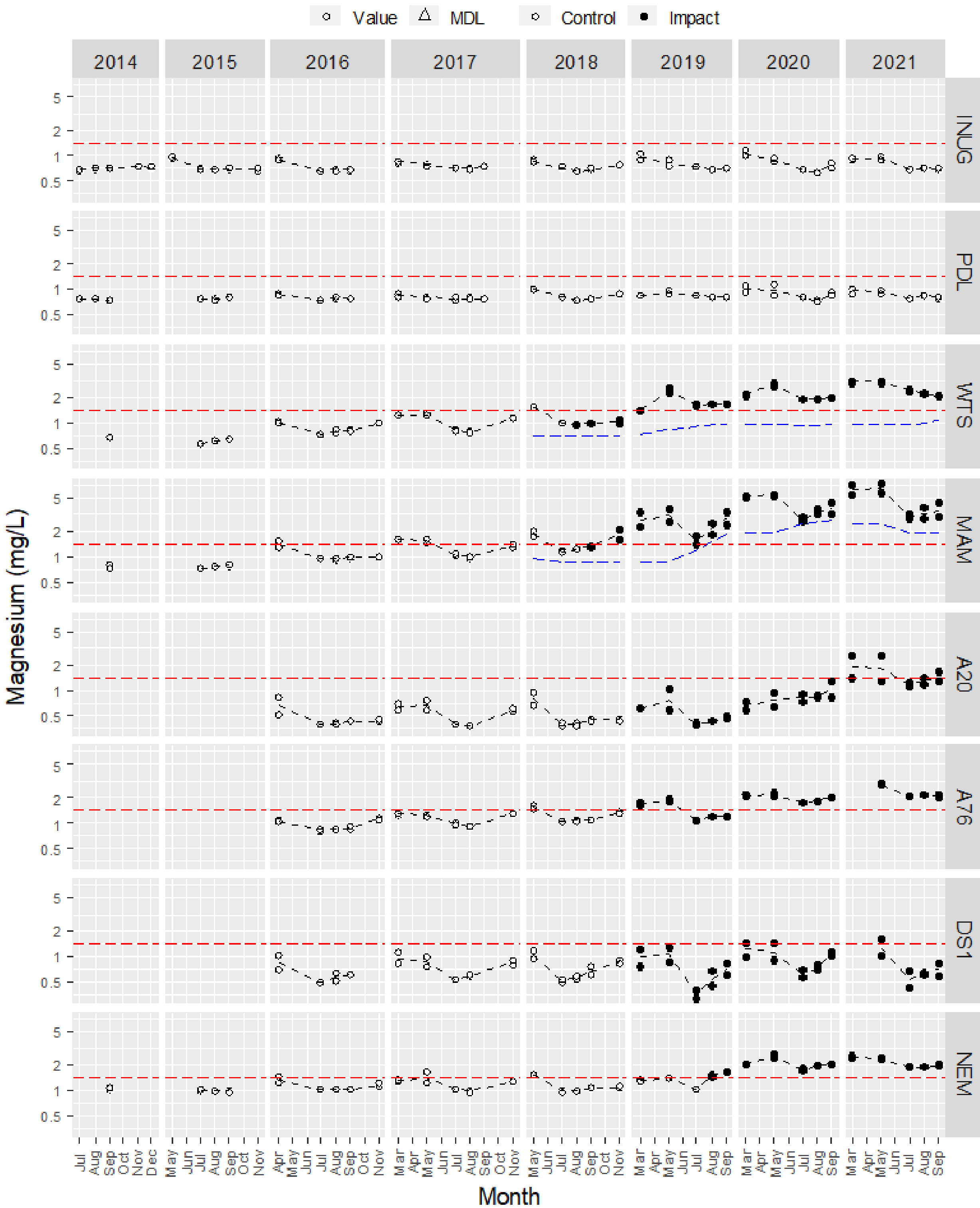


Figure 5-46. Total manganese (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes. The blue dashed line = FEIS screening prediction.

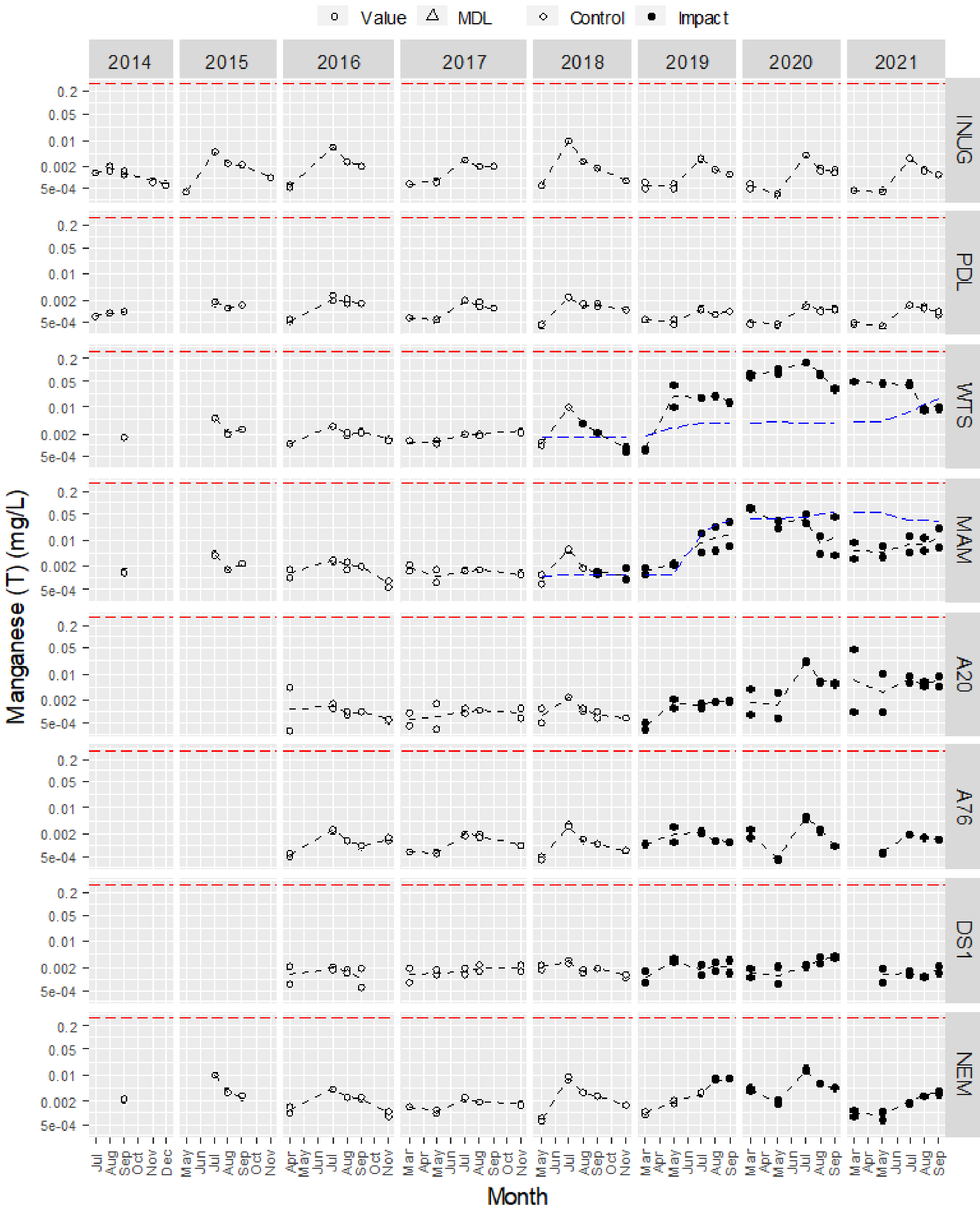


Figure 5-47. Total molybdenum (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes. The blue dashed line = FEIS screening prediction.

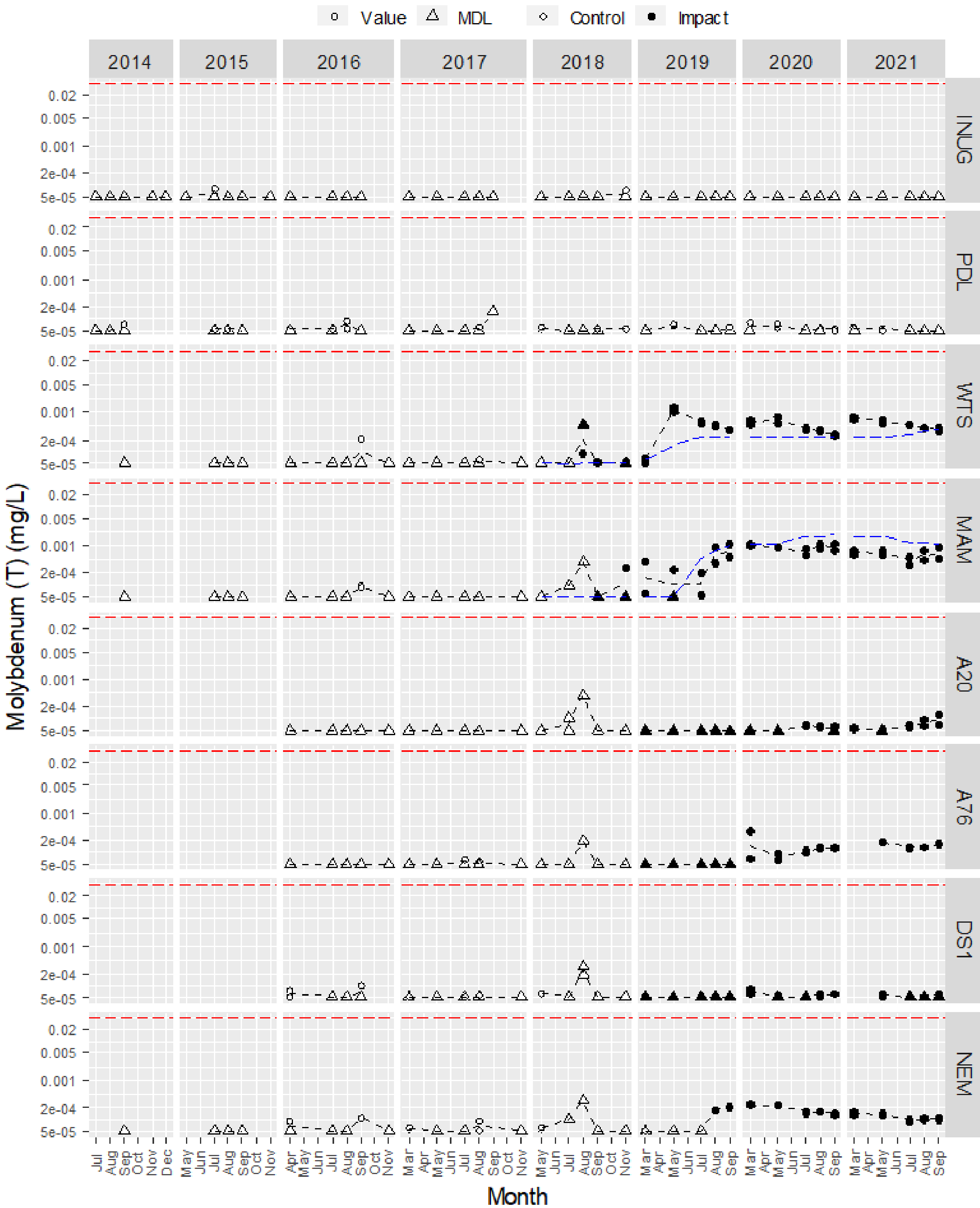


Figure 5-48. Total nickel (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes. The blue dashed line = FEIS screening prediction.

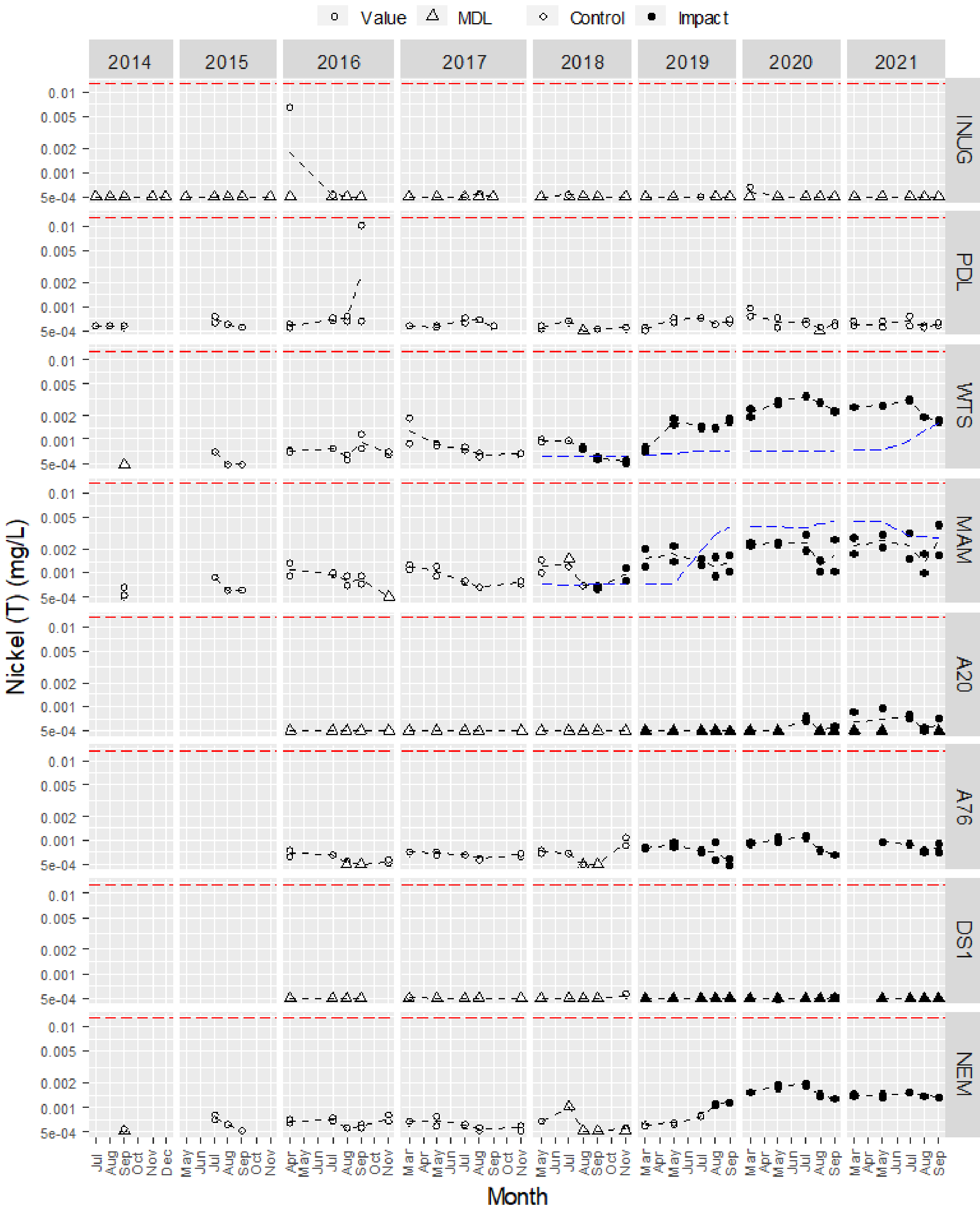


Figure 5-49. Total potassium (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes. The blue dashed line = FEIS screening prediction.

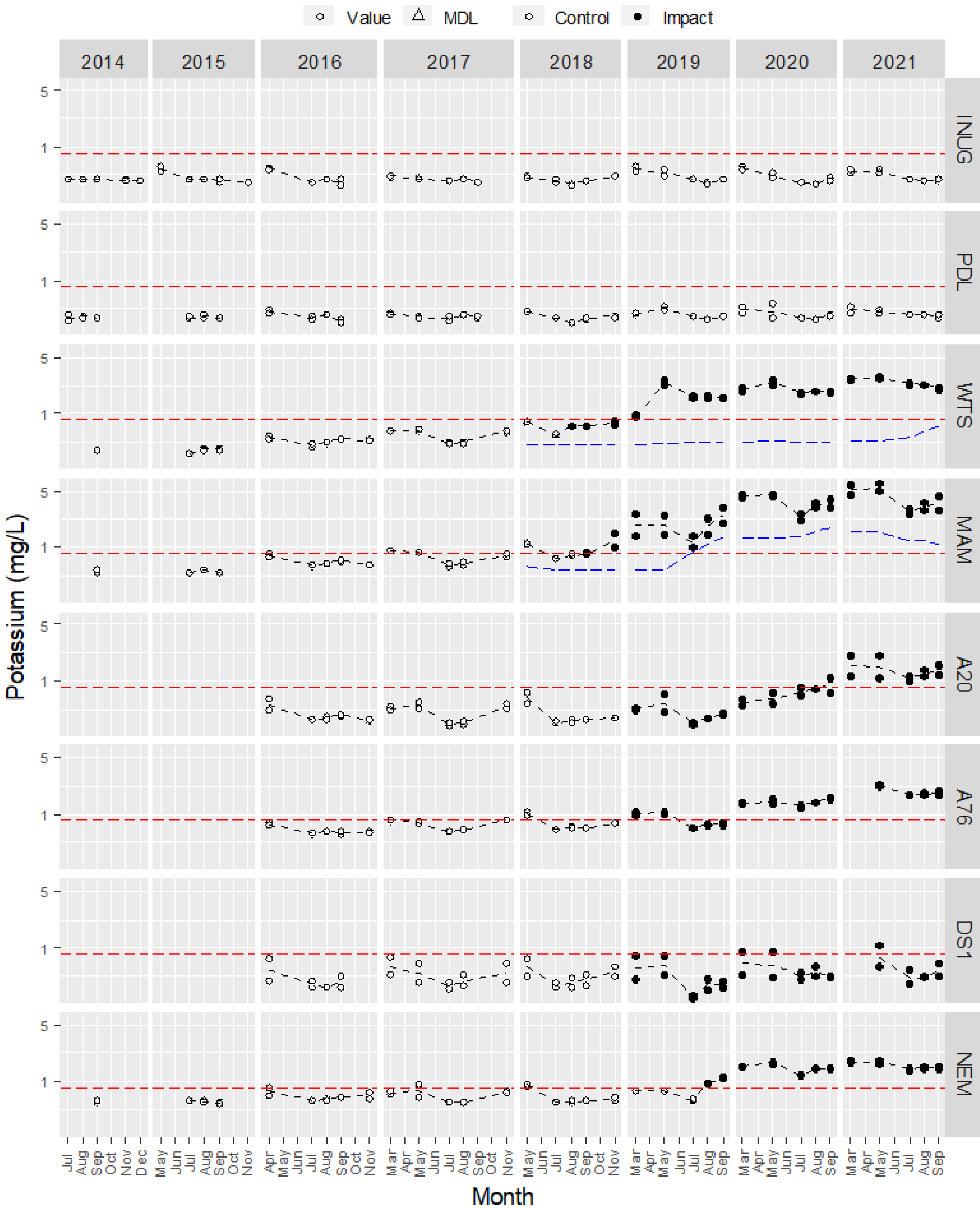


Figure 5-50. Total selenium (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes. The blue dashed line = FEIS screening prediction.

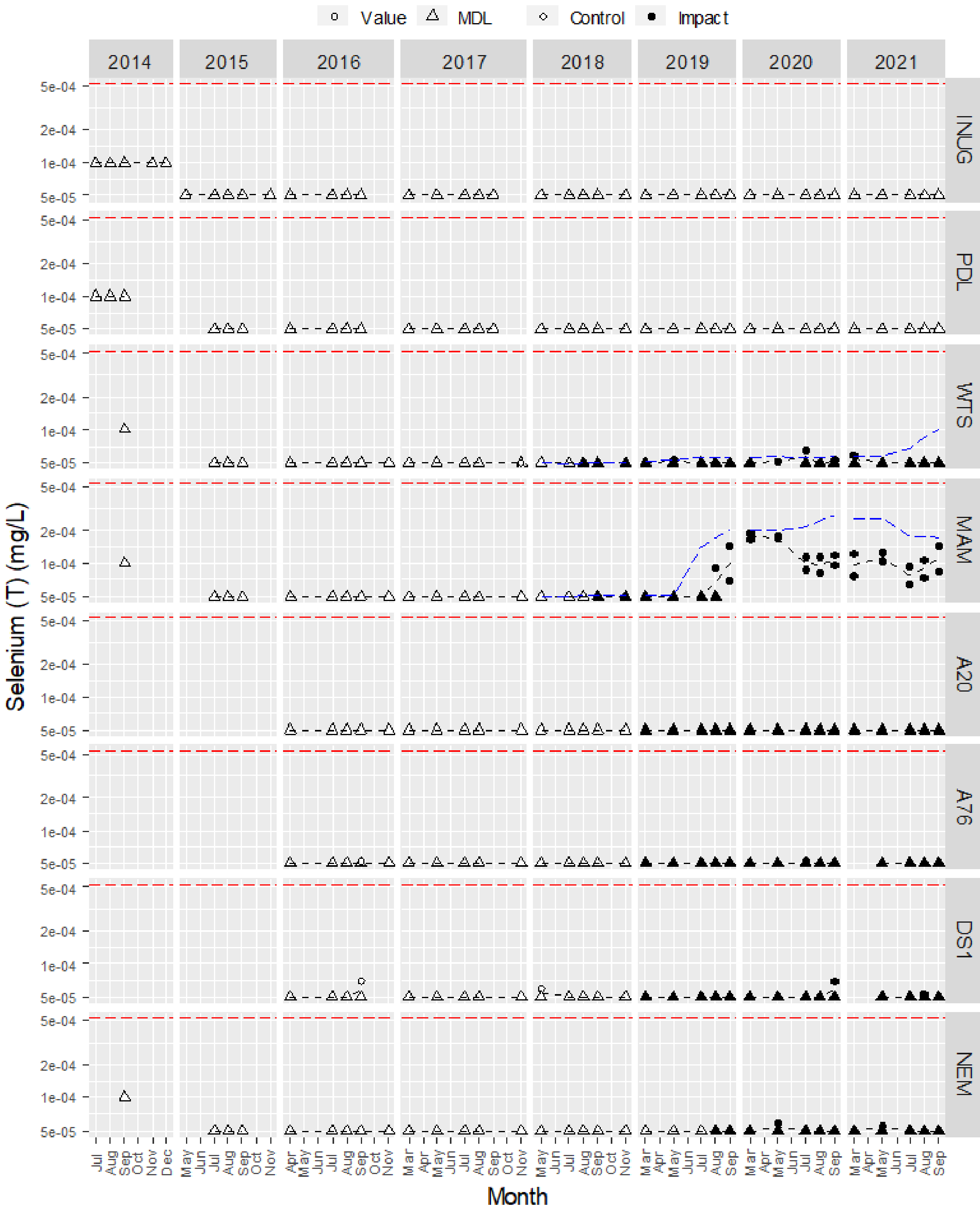


Figure 5-51. Total silicon (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes.

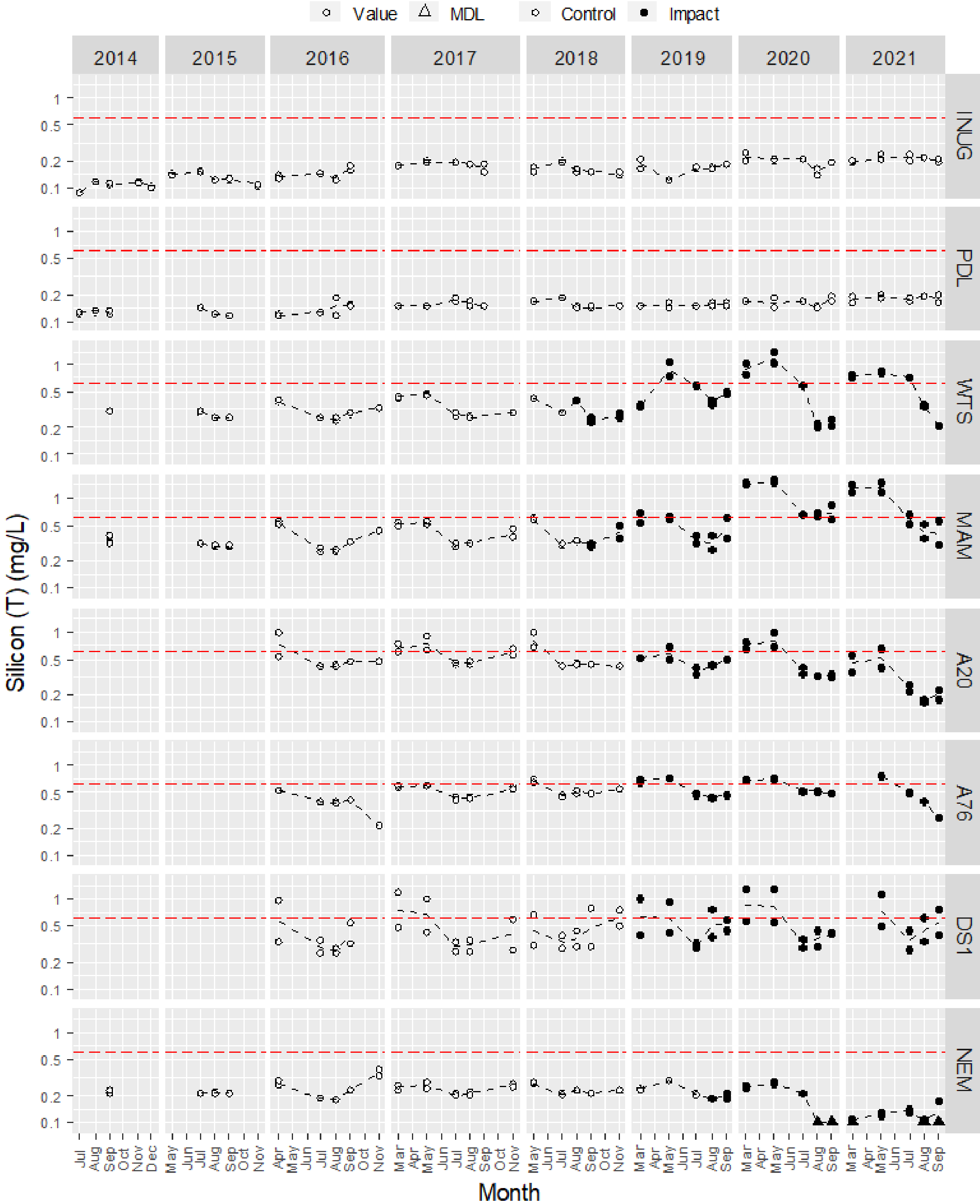


Figure 5-52. Total sodium (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes. The blue dashed line = FEIS screening prediction.

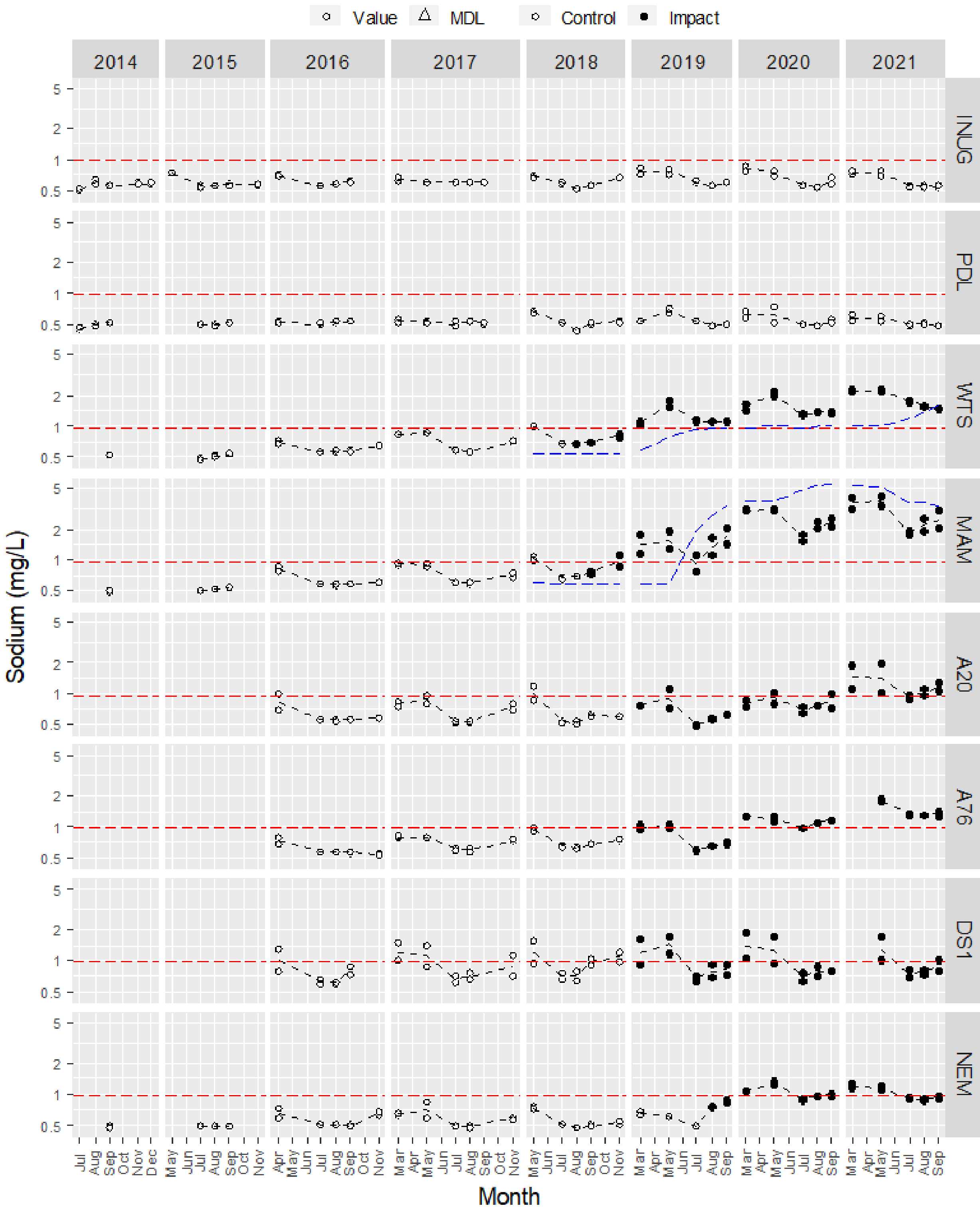


Figure 5-53. Total strontium (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes. The blue dashed line = FEIS screening prediction.

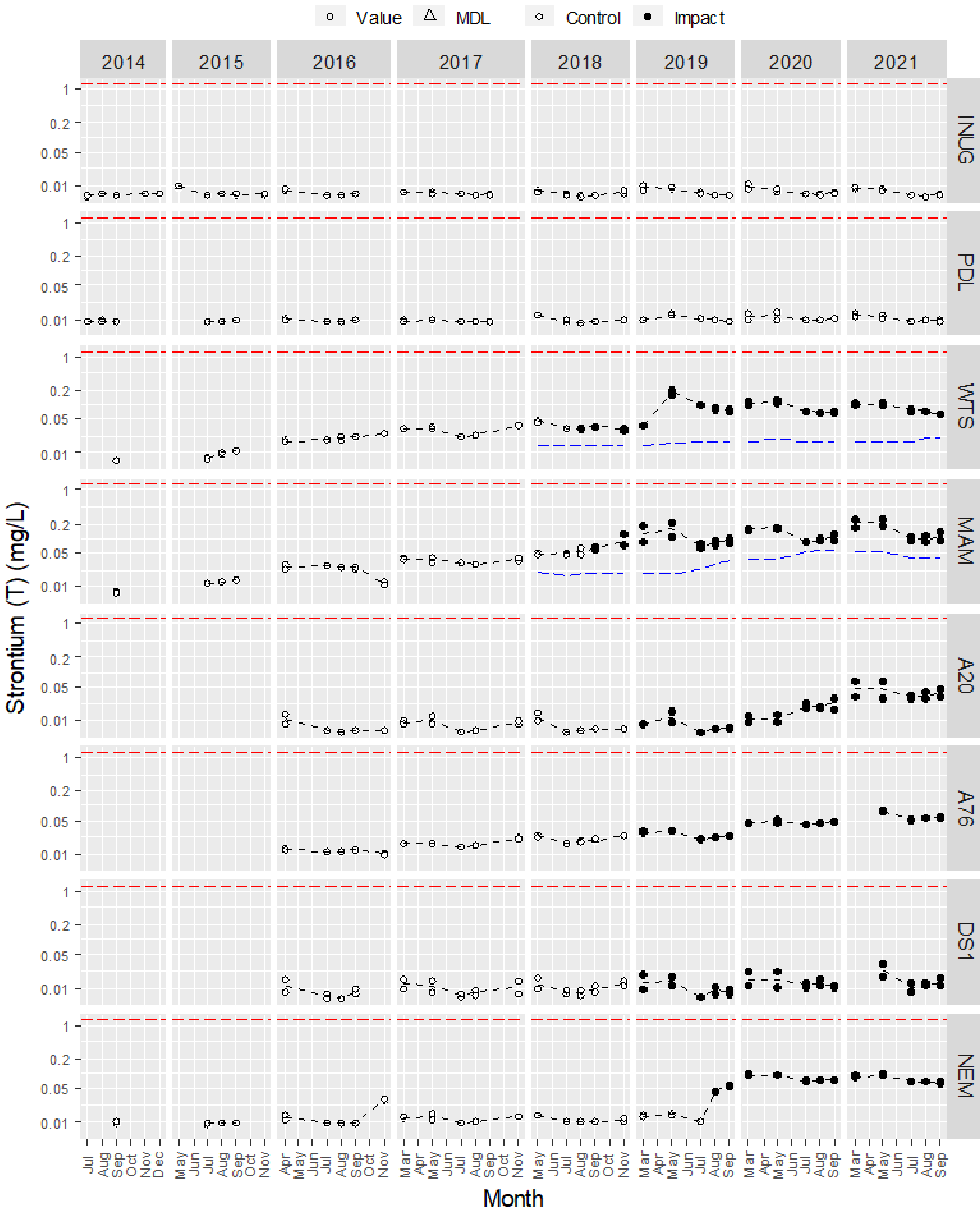


Figure 5-54. Total titanium (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes.

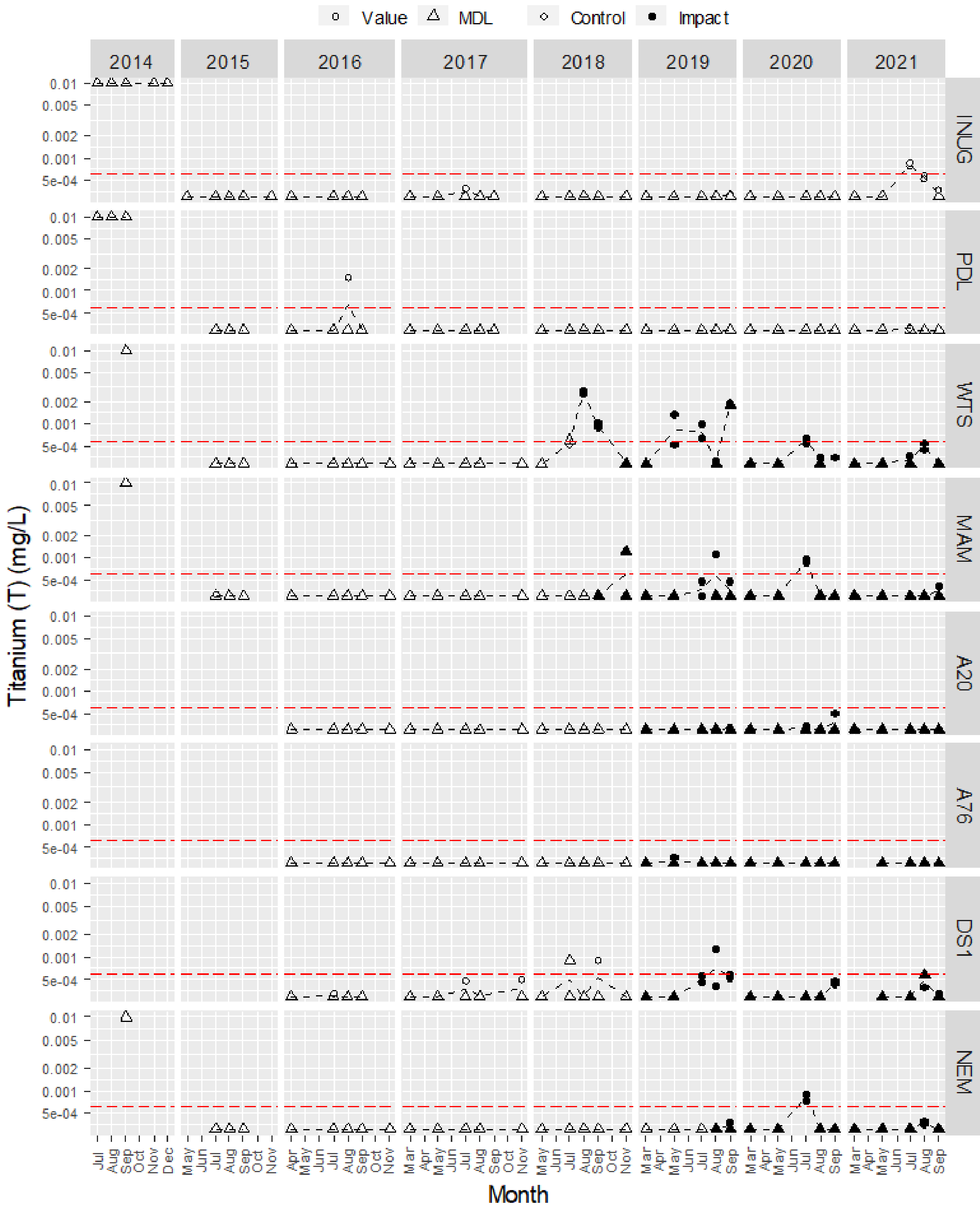


Figure 5-55. Total uranium (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes. The blue dashed line = FEIS screening prediction.

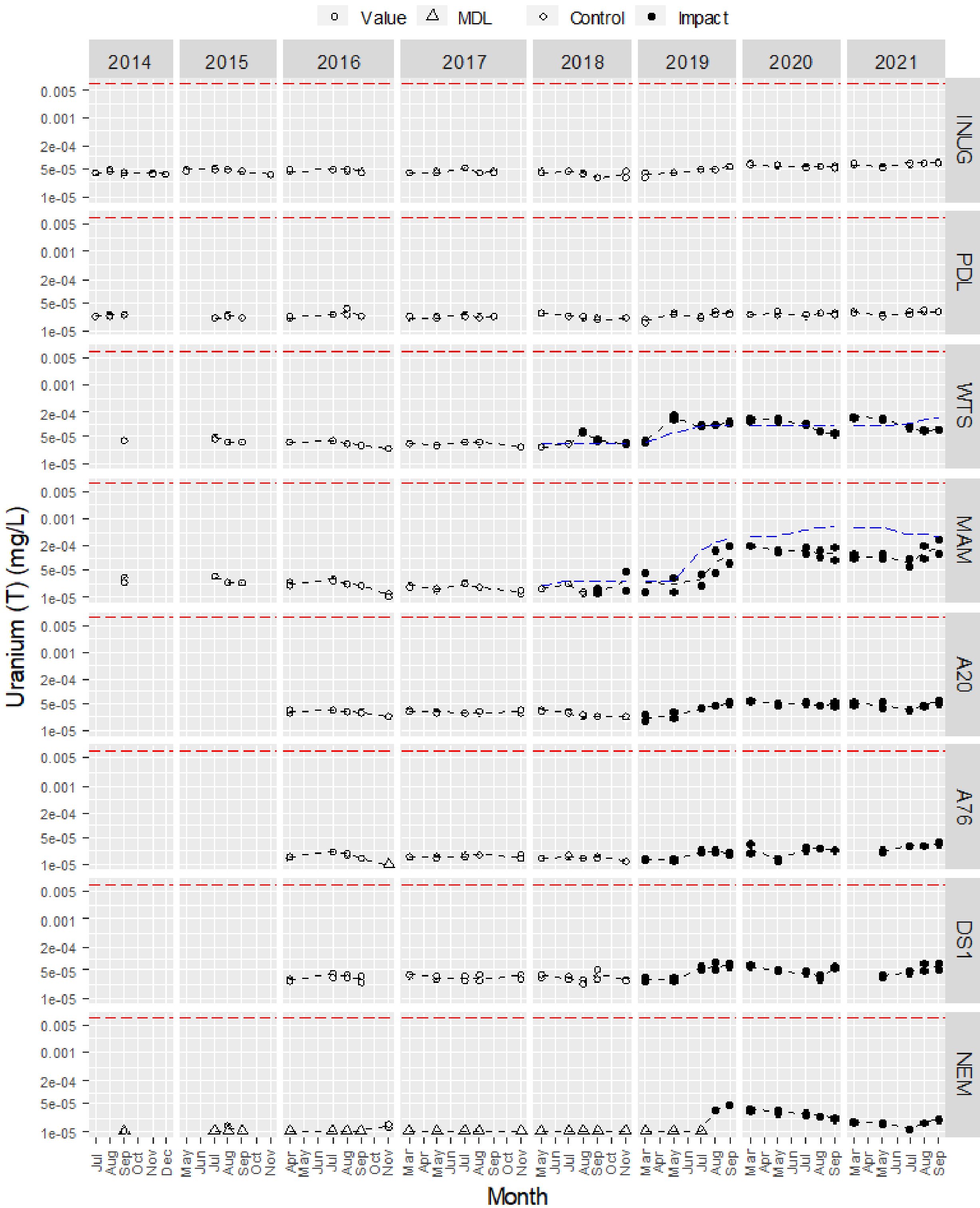


Figure 5-56. Dissolved aluminum (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes.

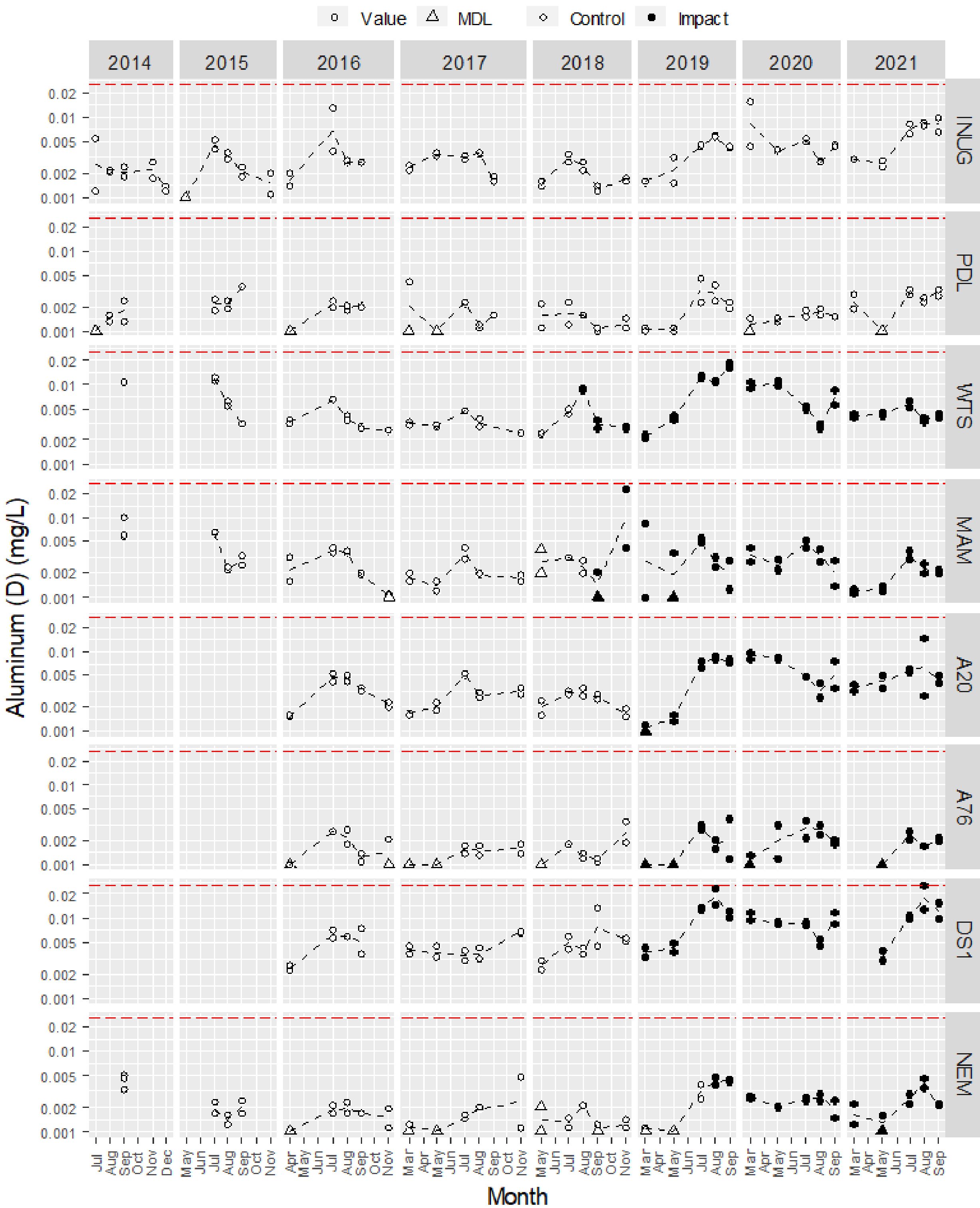


Figure 5-57. Dissolved antimony (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes.

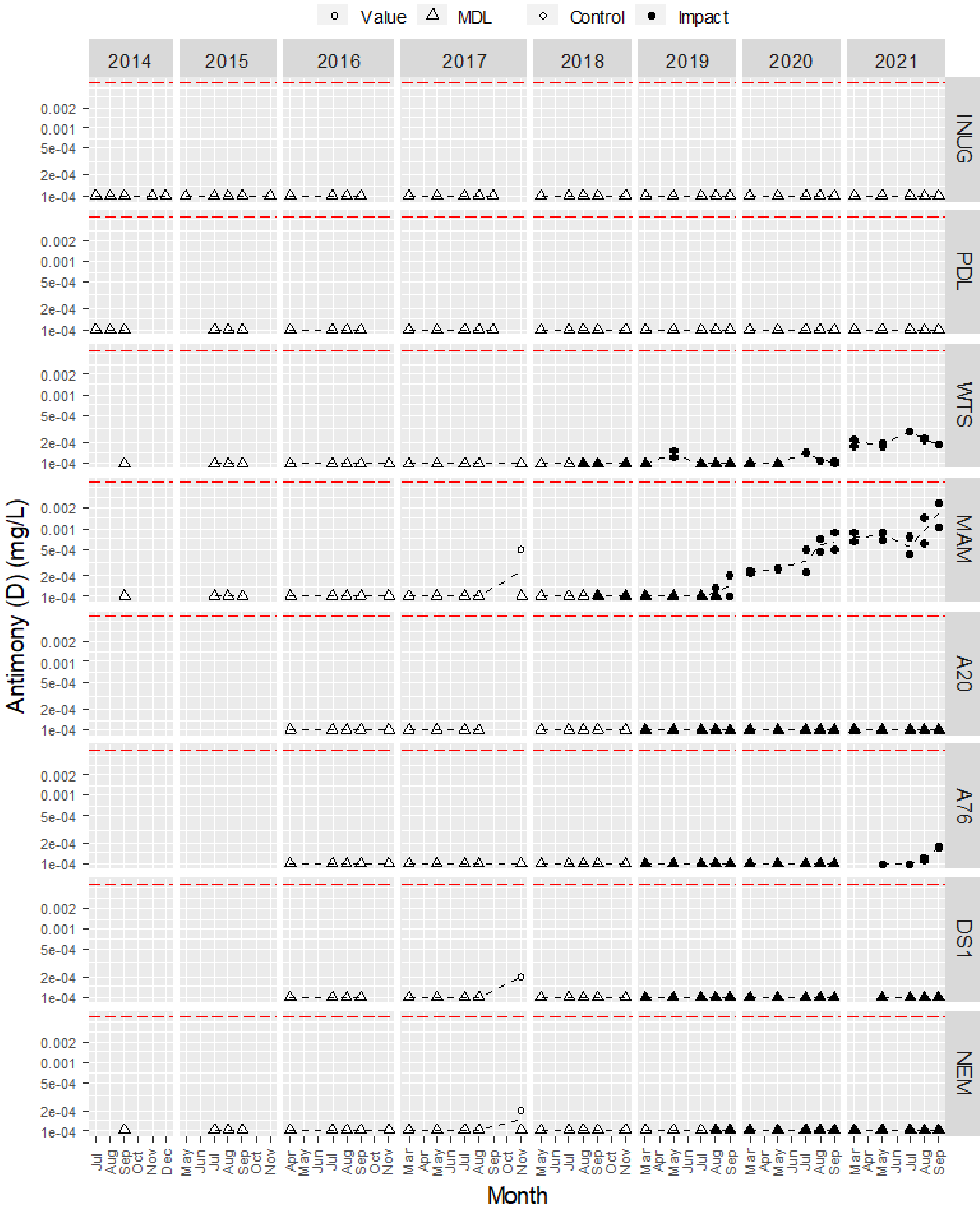


Figure 5-58. Dissolved arsenic (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes.

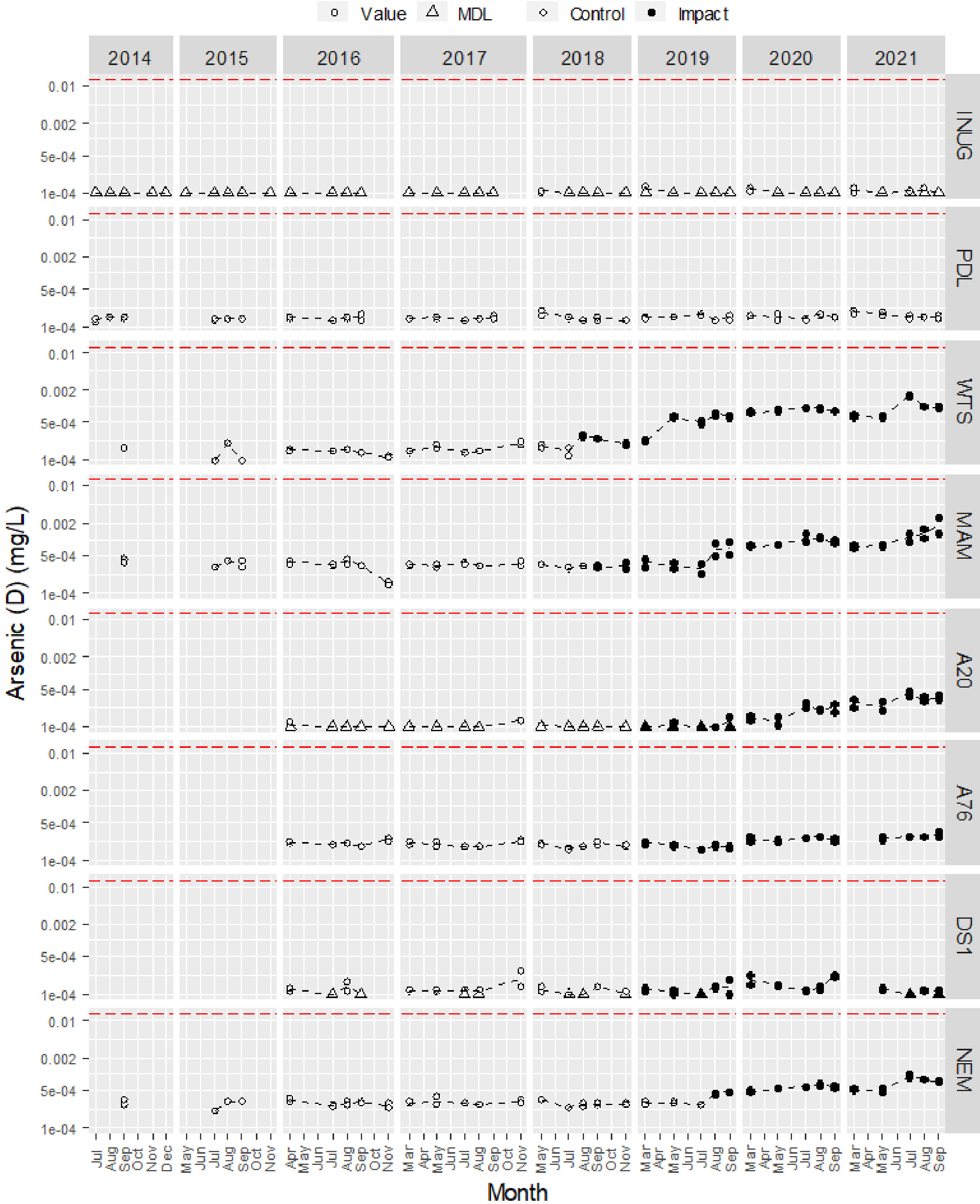


Figure 5-59. Dissolved barium (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes.

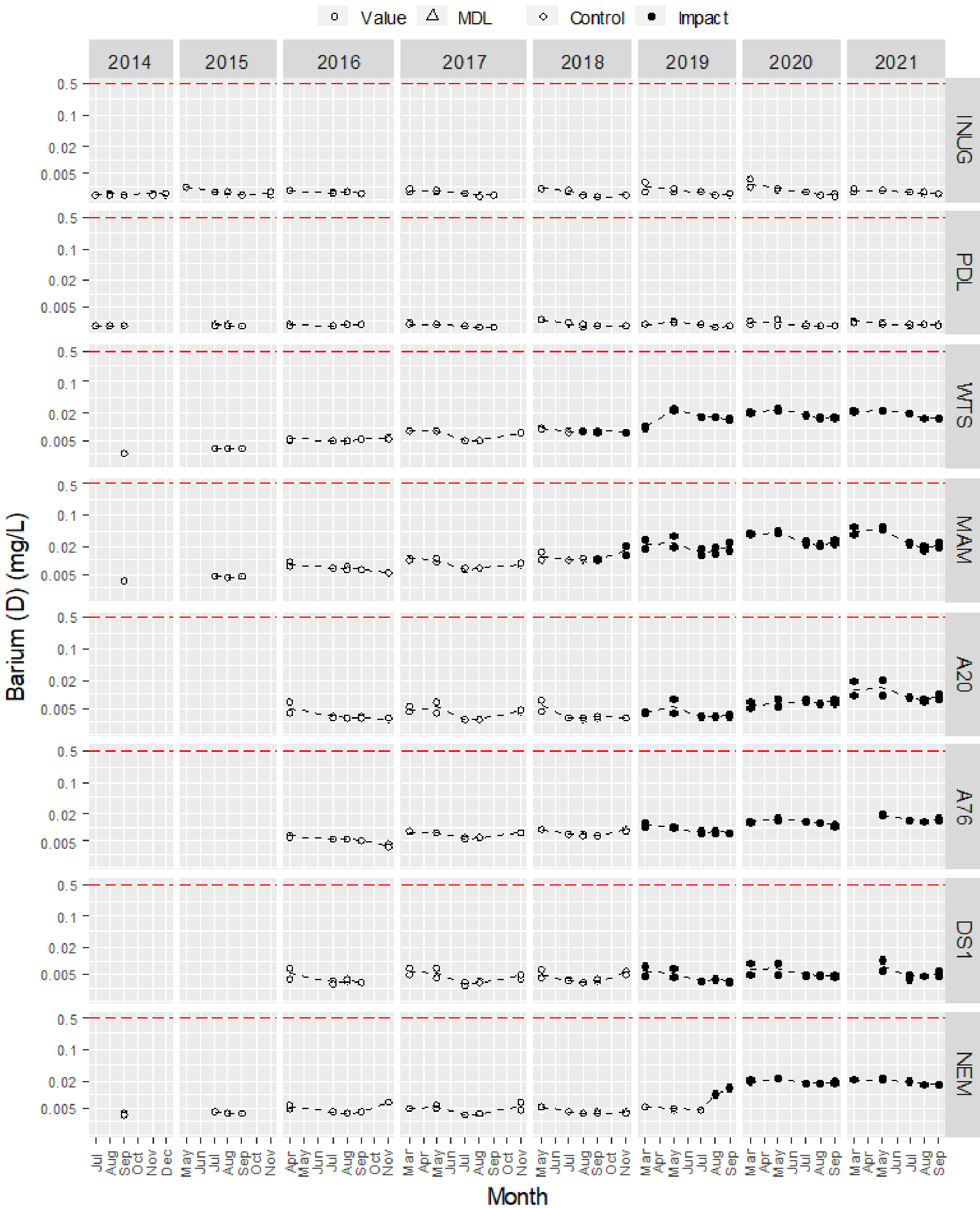


Figure 5-60. Dissolved chromium (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes. The detection limit for dissolved chromium was adjusted from 0.0001 mg/L to 0.0005 mg/L for samples collected in May, July, August and September, 2021.

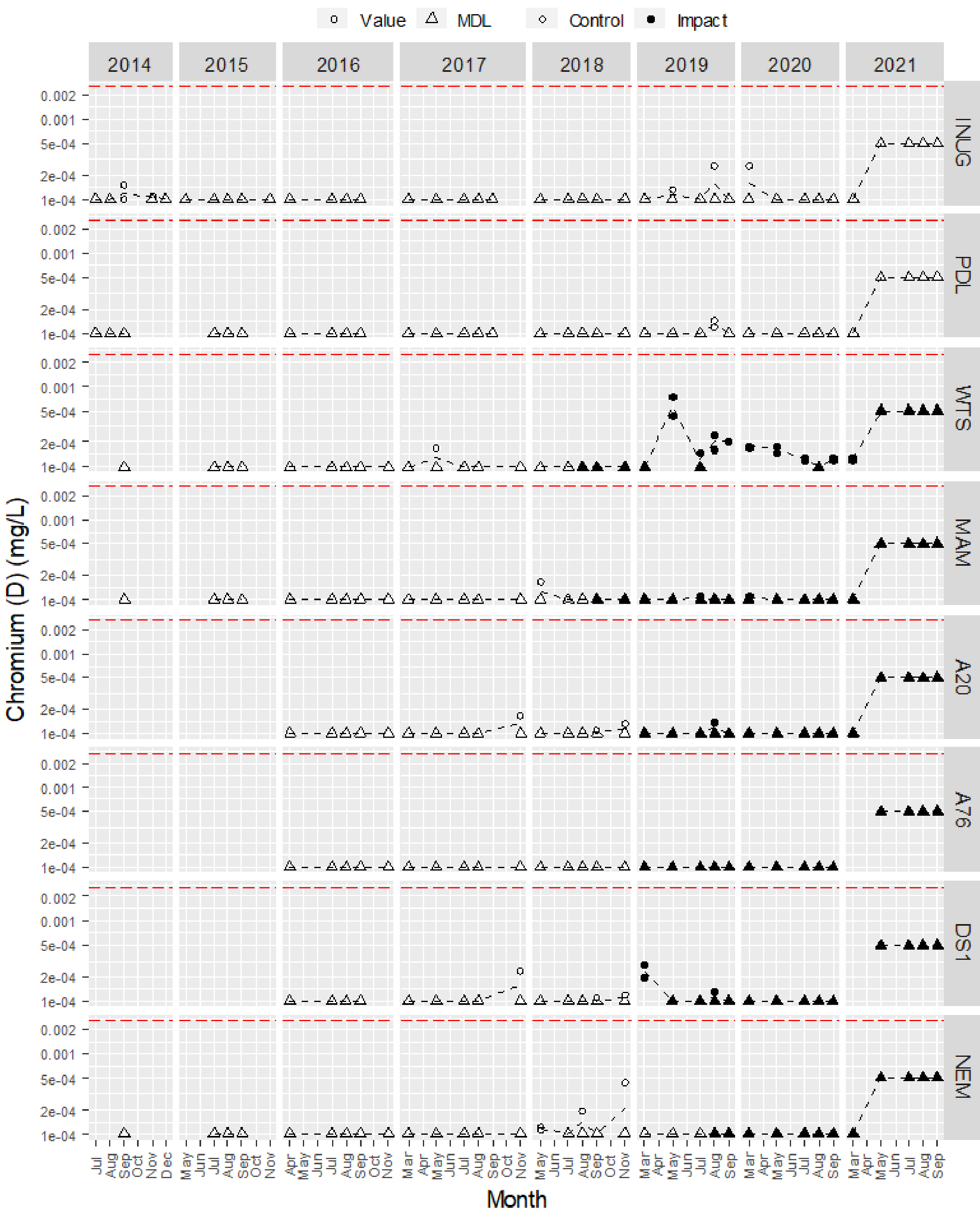


Figure 5-61. Dissolved copper (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes.

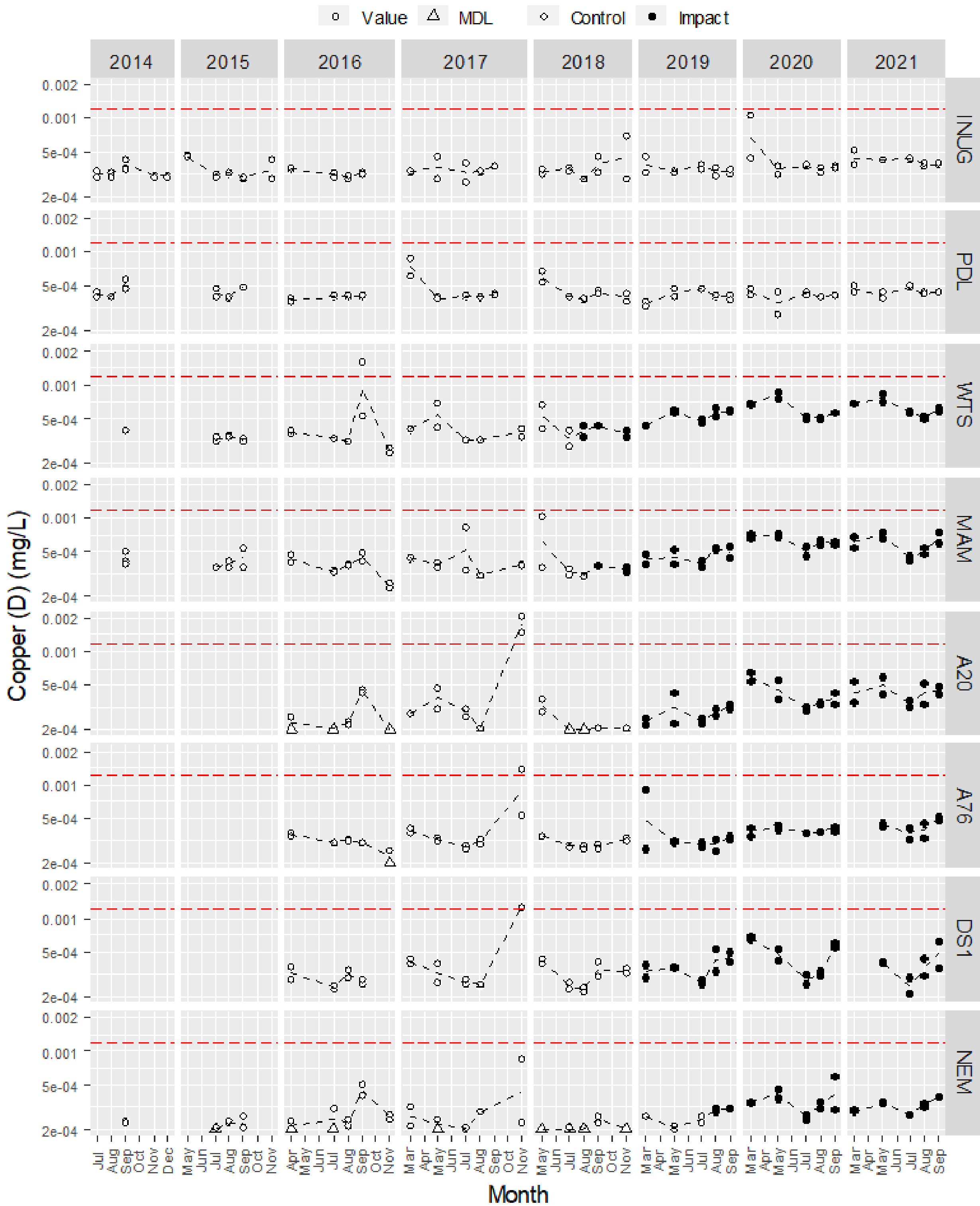


Figure 5-62. Dissolved iron (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes.

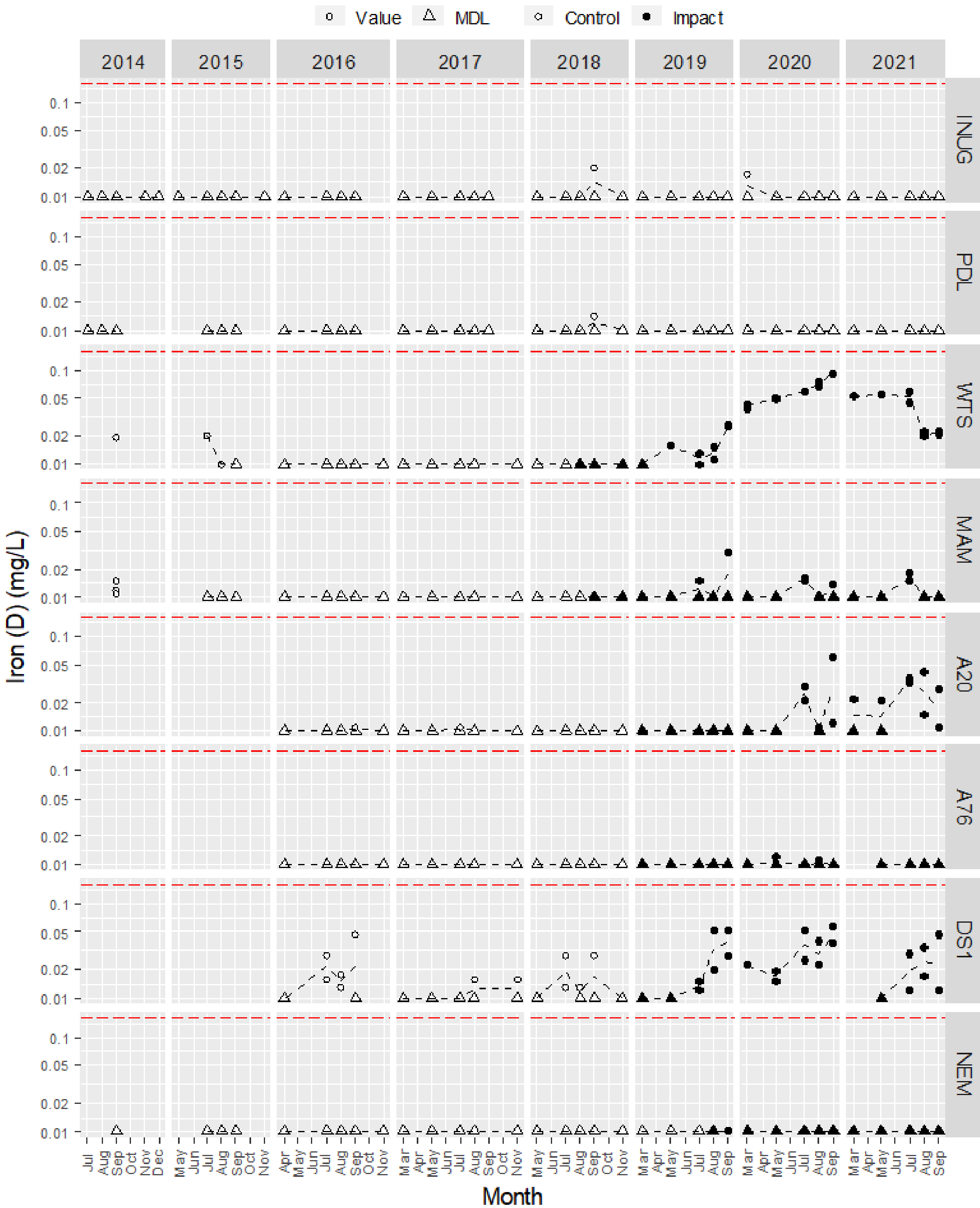


Figure 5-63. Dissolved lead (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes.

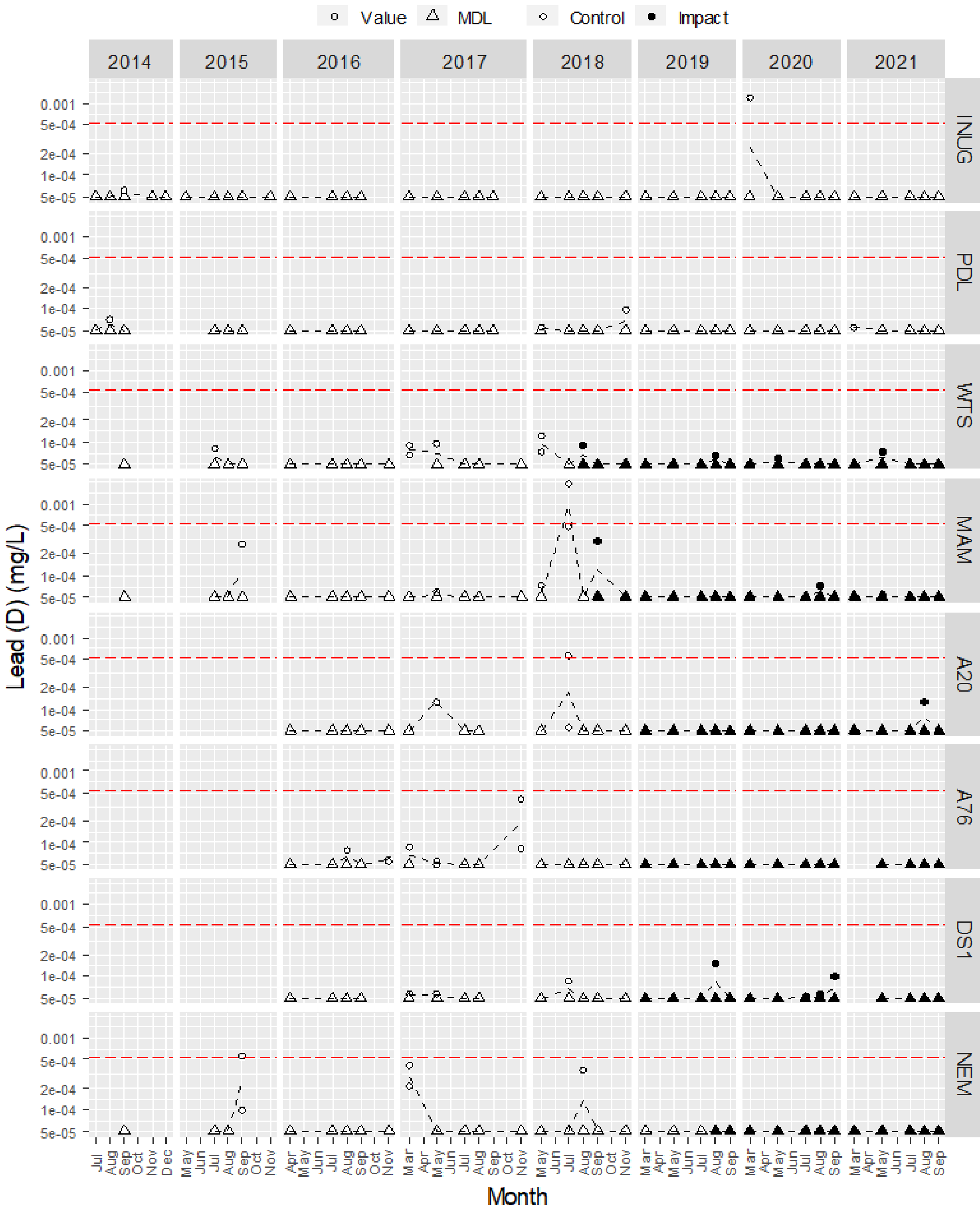


Figure 5-64. Dissolved lithium (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes.

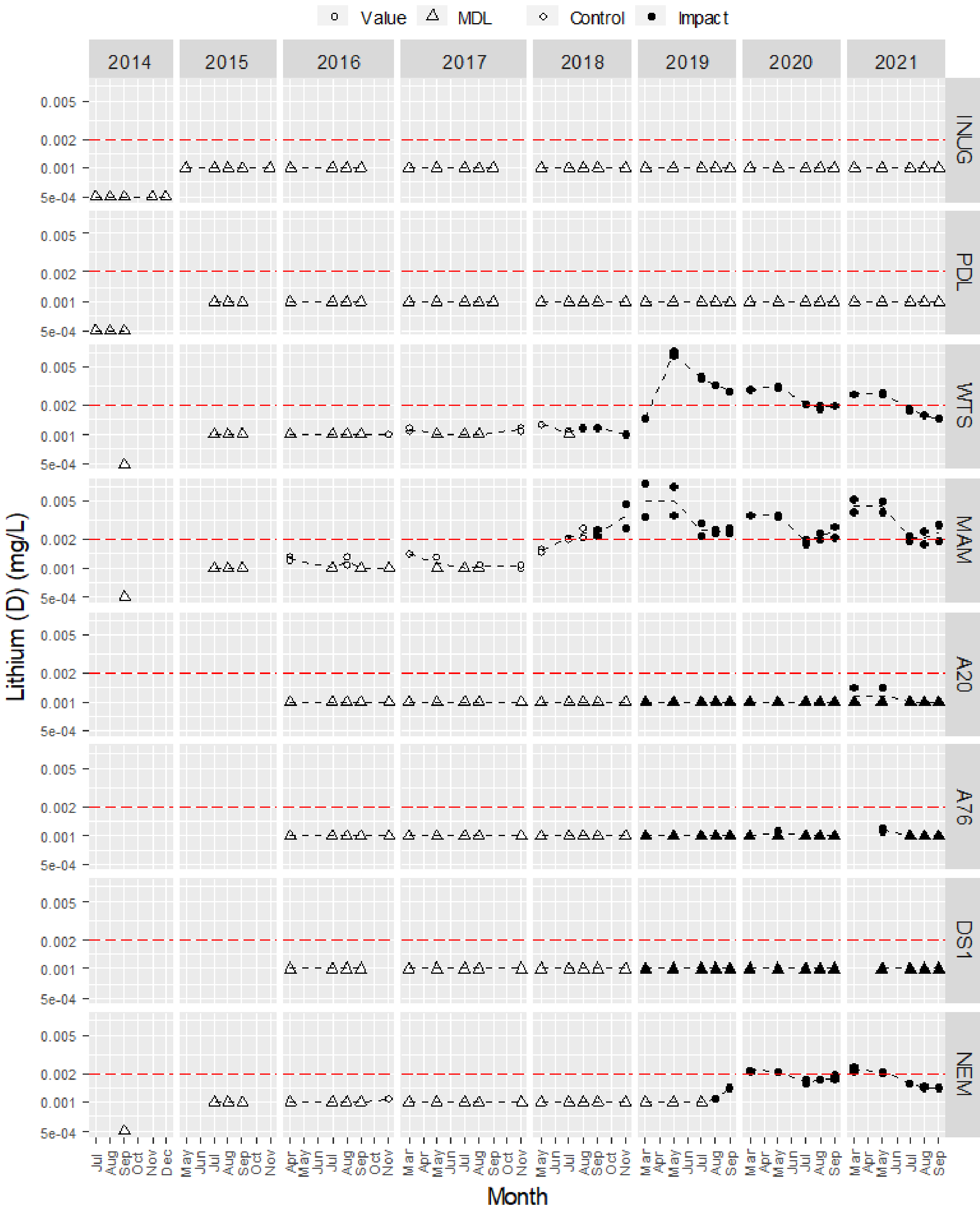


Figure 5-65. Dissolved manganese (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes.

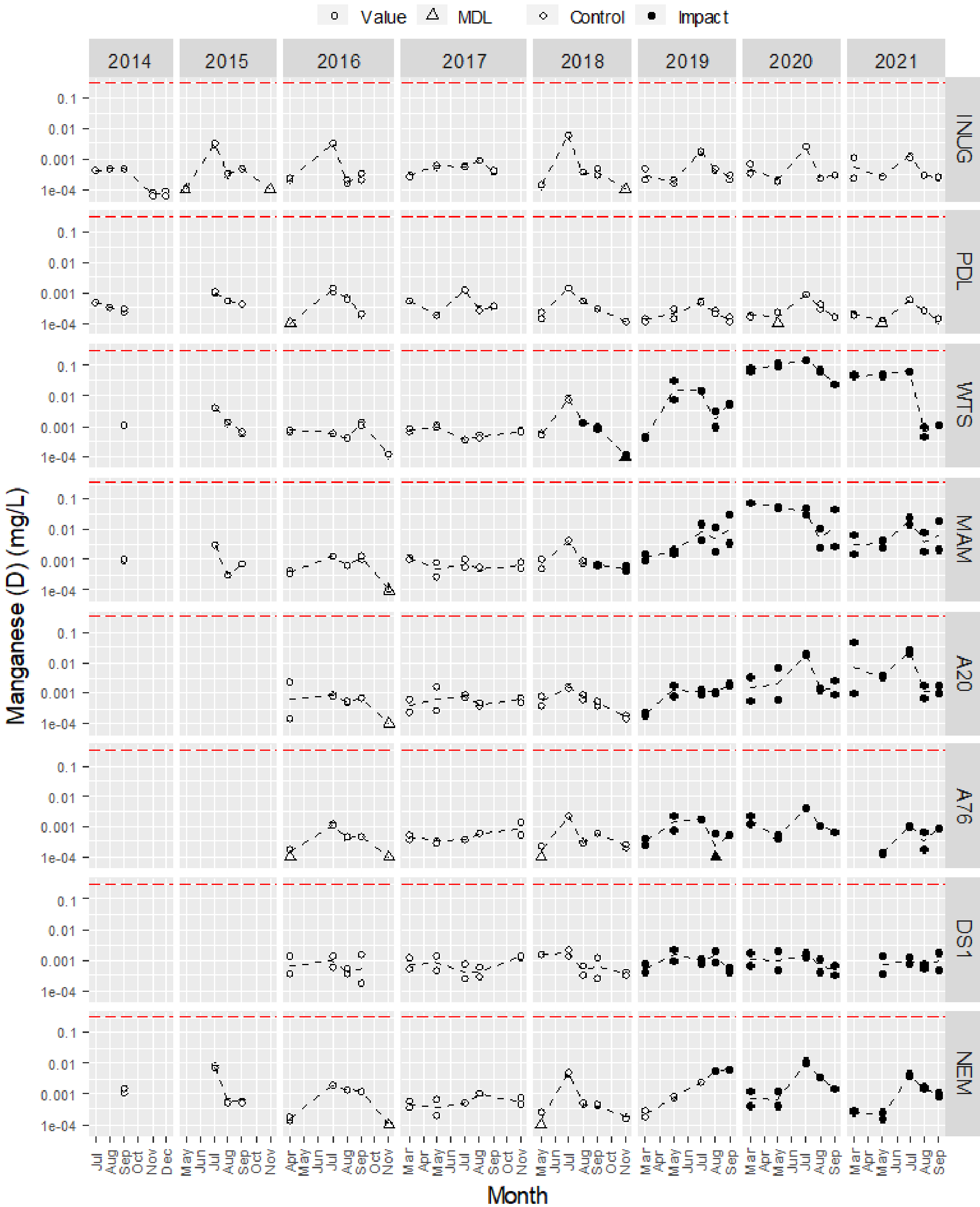


Figure 5-66. Dissolved molybdenum (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes.

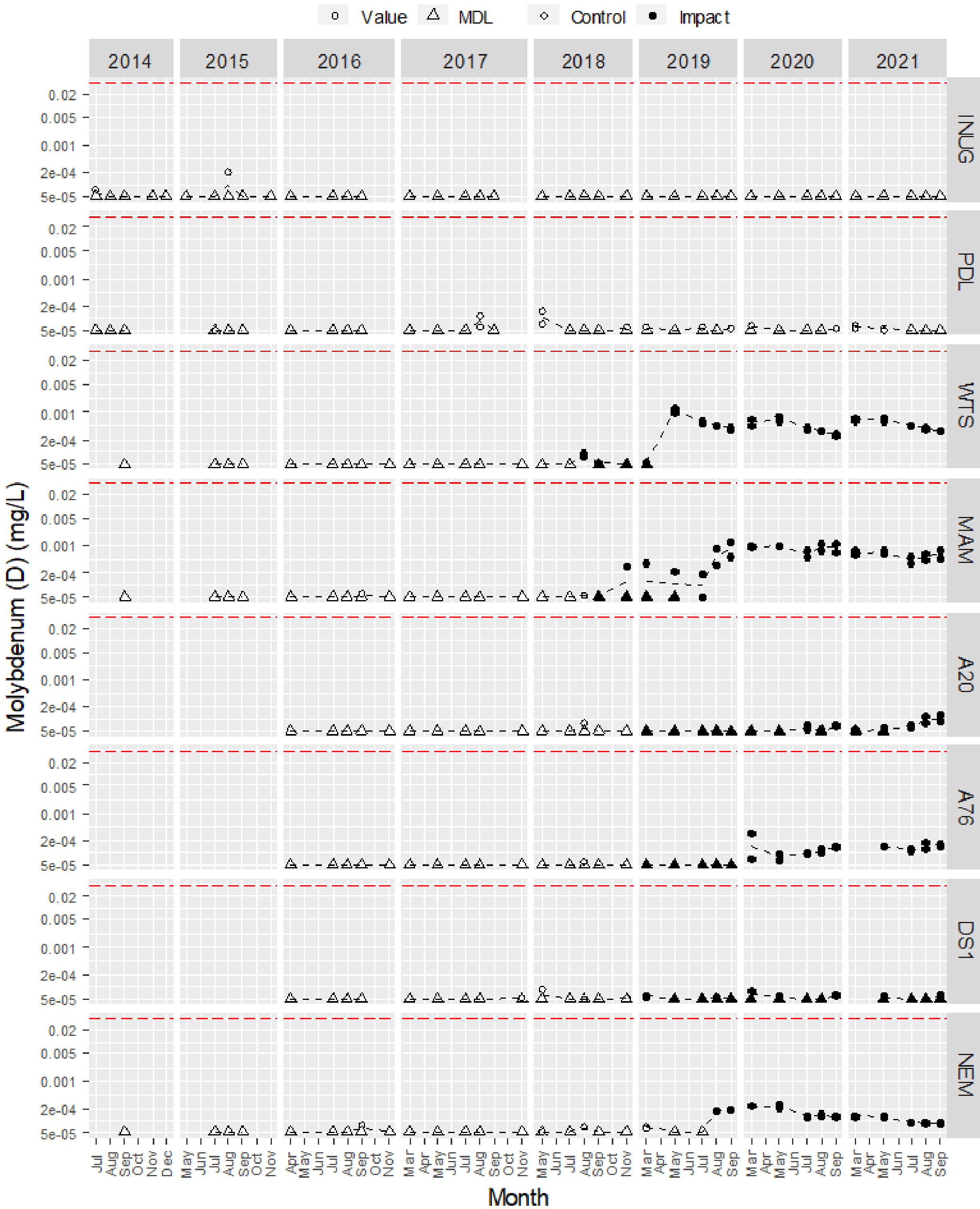


Figure 5-67. Dissolved nickel (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes.

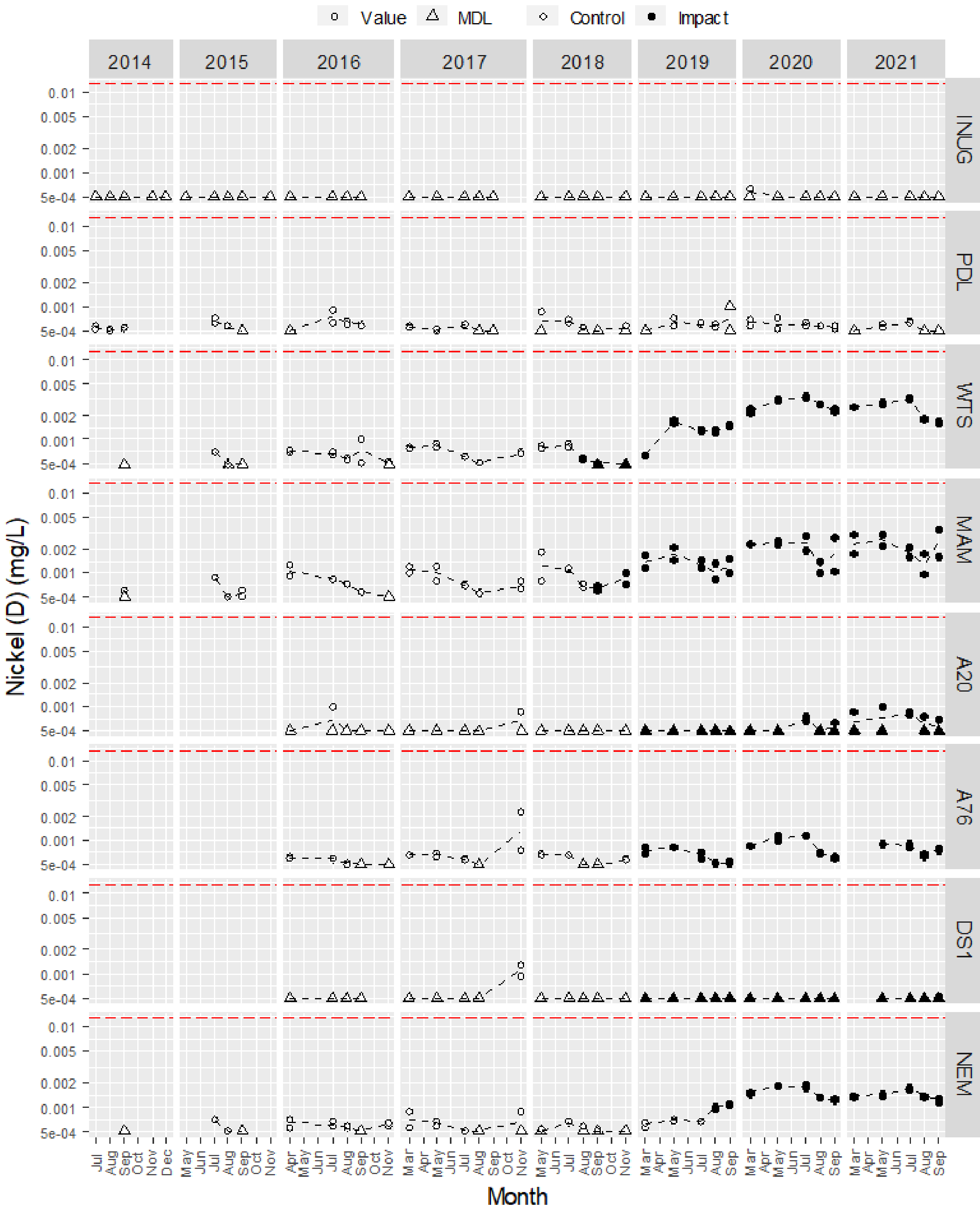


Figure 5-68 Dissolved selenium (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes.

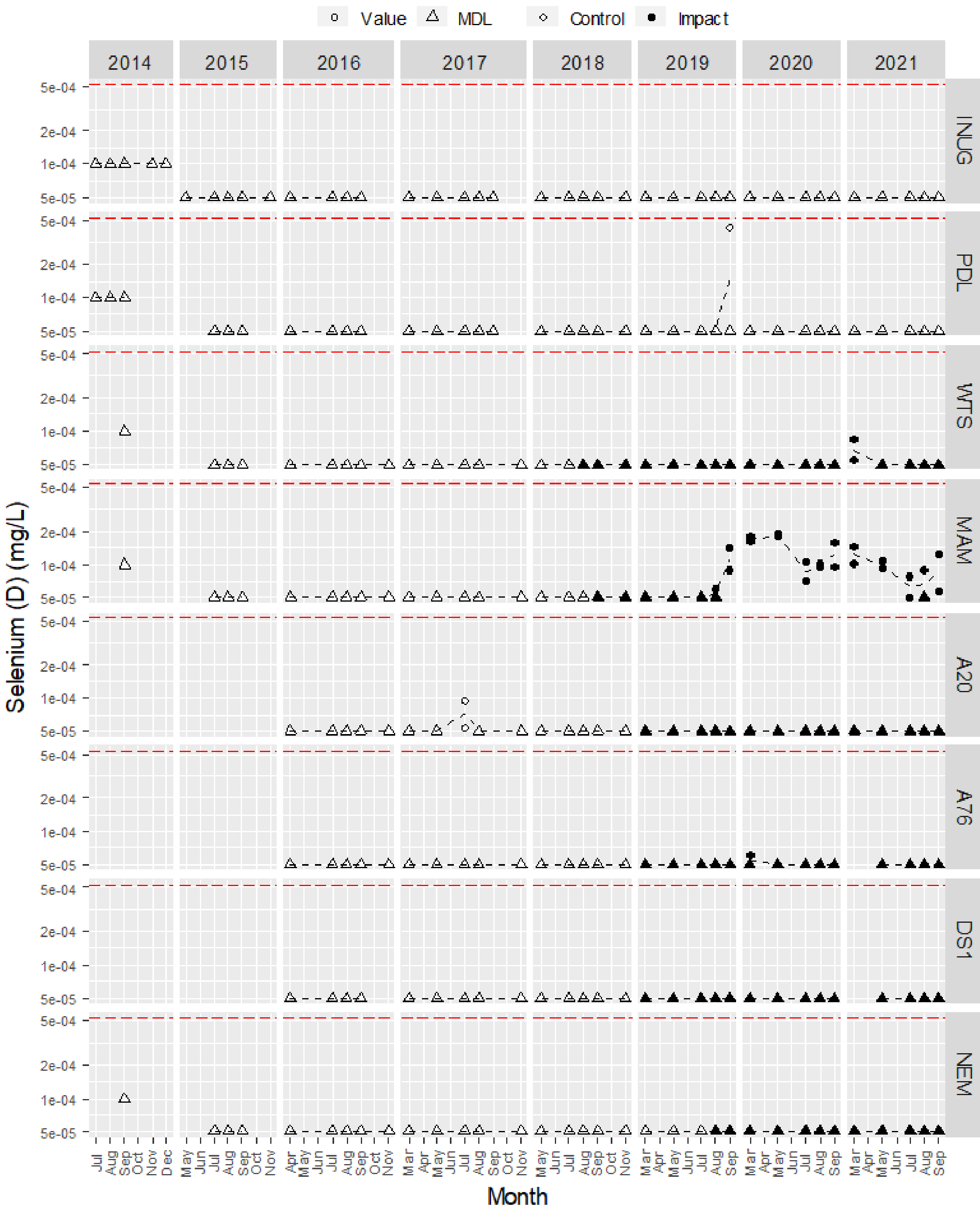


Figure 5-69. Dissolved silicon (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes.

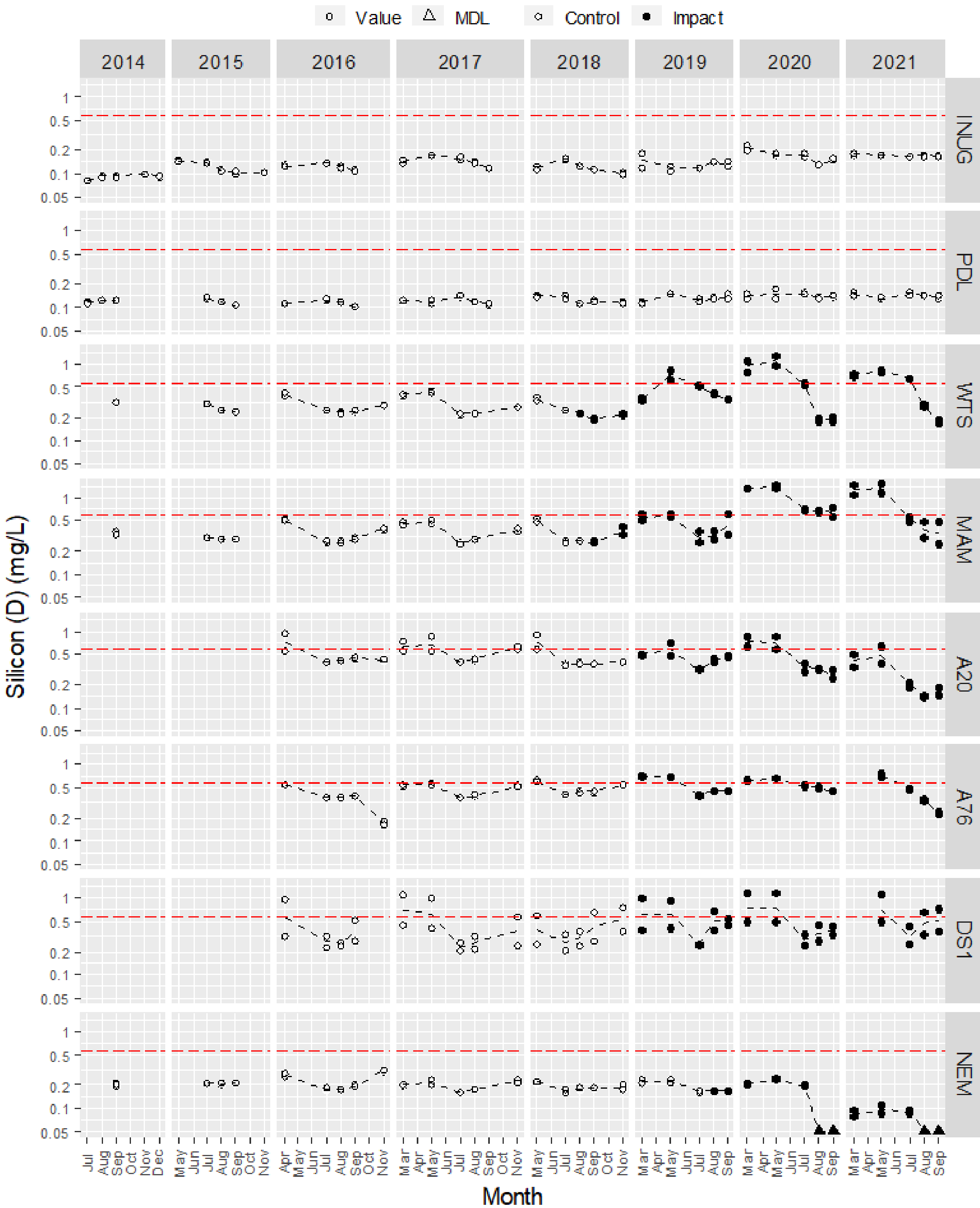


Figure 5-70. Dissolved strontium (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes.

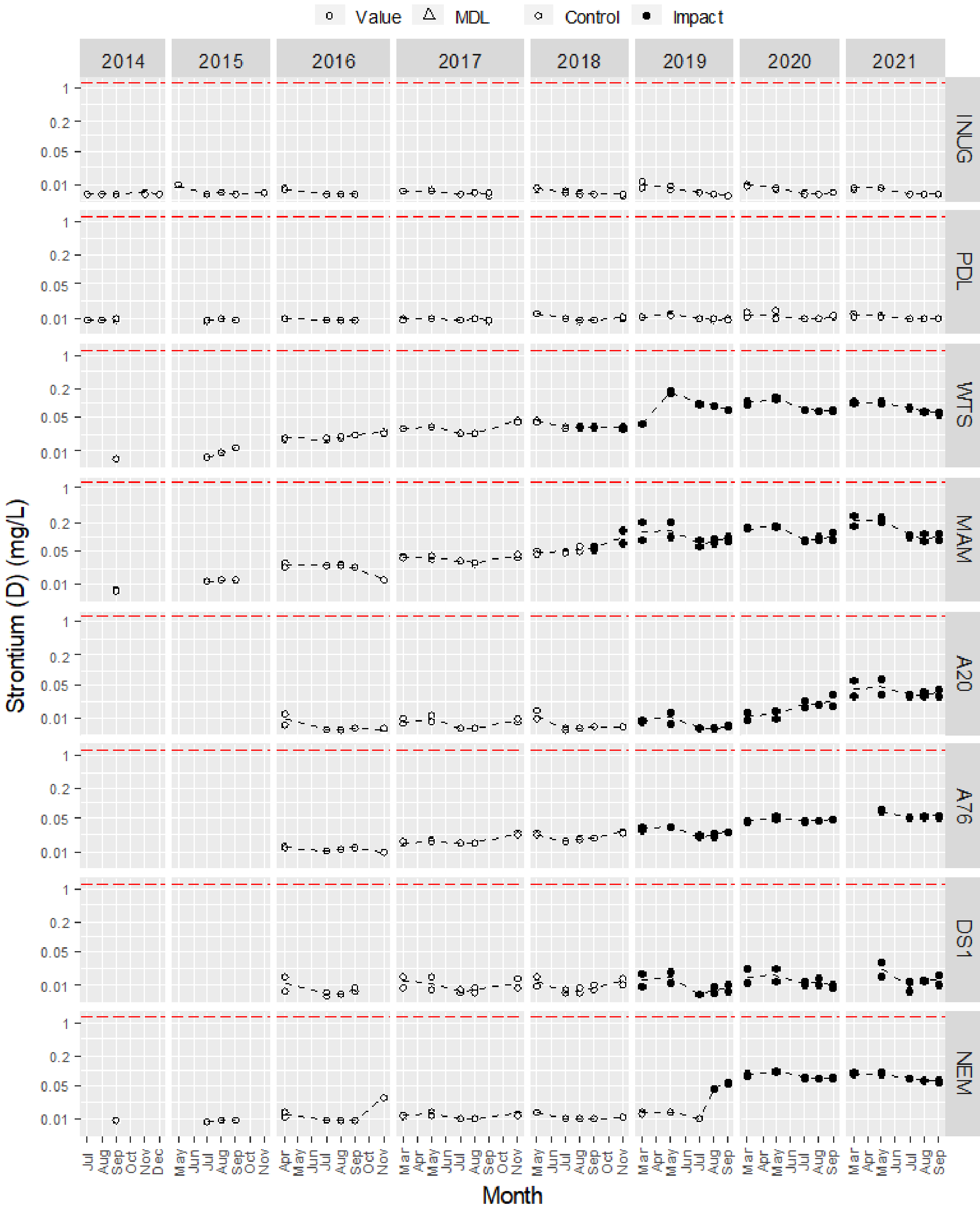


Figure 5-71. Dissolved uranium (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes.

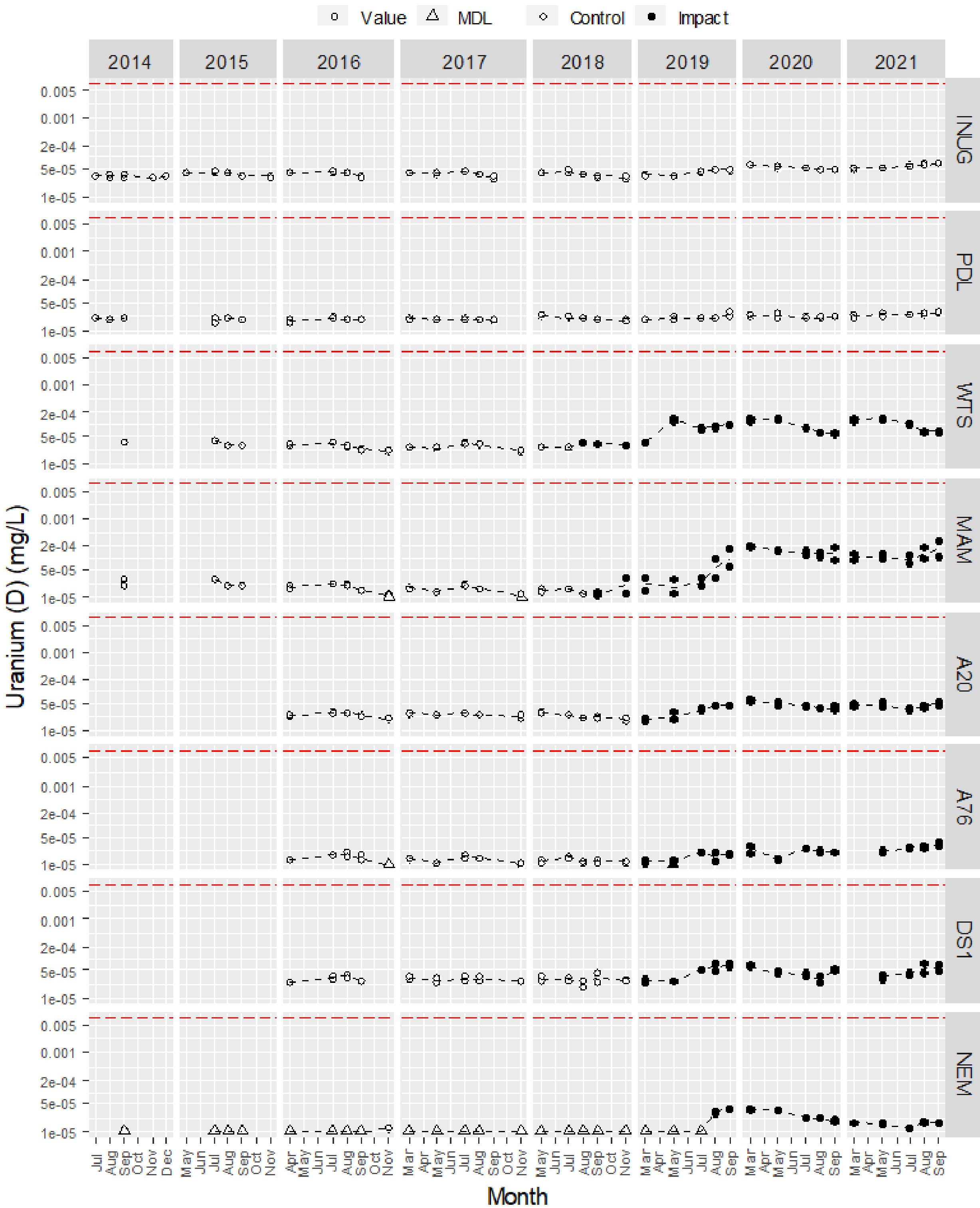
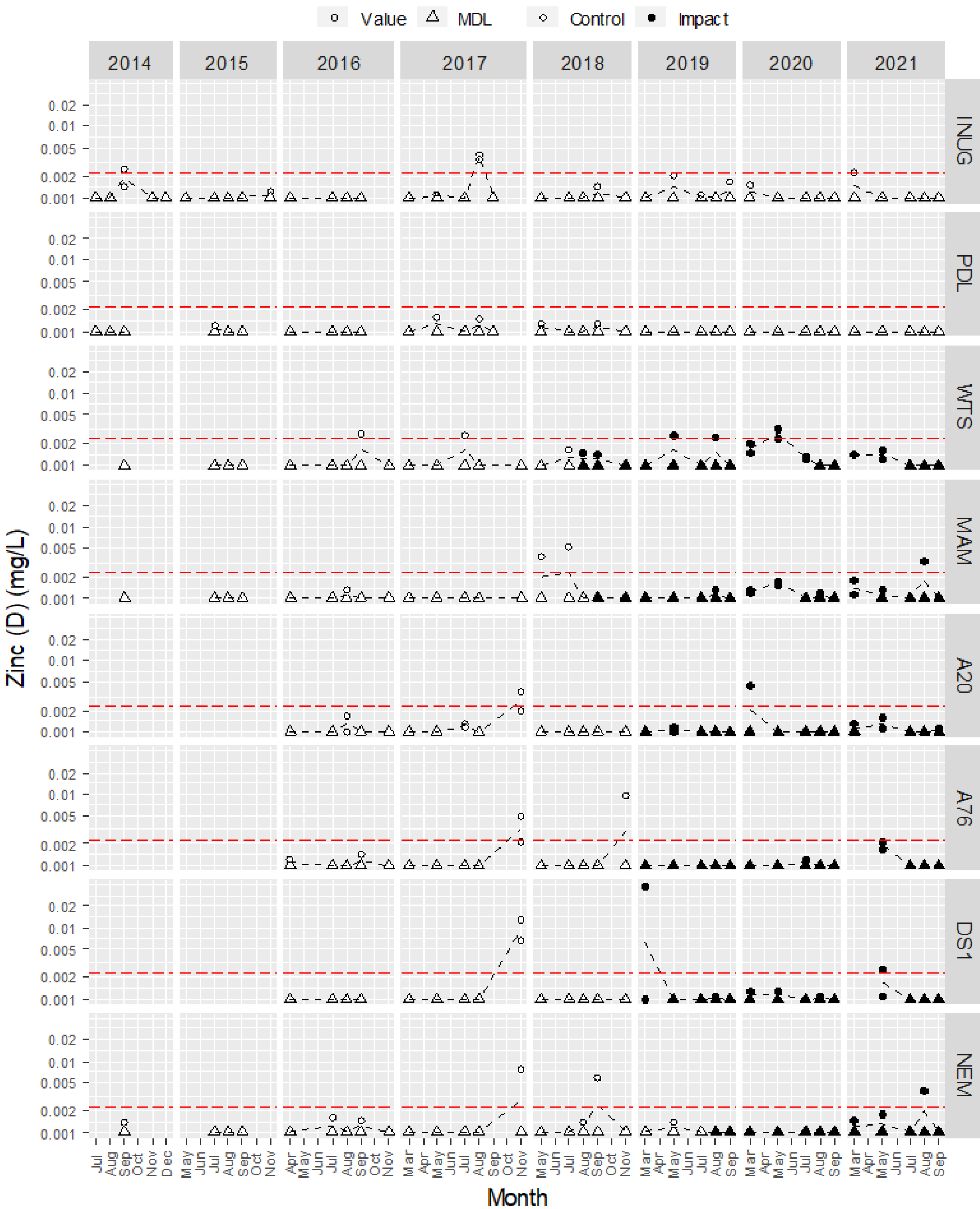


Figure 5-72. Dissolved zinc (mg/L) in water samples from Whale Tail study area lakes since 2014.

Note: The red dashed line is the trigger value specific to Whale Tail study area lakes.



Phytoplankton Tables and Figures

Table 5-11. Results of the BACI test for phytoplankton variables at Whale Tail Pit areas, 2021.

Parameter Measured	Test Area	n(B)	n(A)	Estimate	SE	P-value*	Effect size (%)		
							ES	LCI	UCI
Total Biomass	WTS	15	5	0.10	0.34	0.776	10	-46	127
	MAM	16	5	0.58	0.51	0.275	78	-39	419
	A20	14	5	1.17	0.49	**0.029**	222	15	805
	A76	14	4	0.79	0.51	0.146	119	-26	552
	DS1	14	4	0.18	0.62	0.775	20	-68	342
	NEM	21	5	0.67	0.40	0.106	95	-14	343
Taxa Richness	WTS	15	5	-0.11	0.10	0.255	-11	-27	9
	MAM	16	5	-0.14	0.17	0.417	-13	-39	24
	A20	14	5	-0.01	0.17	0.950	-1	-31	42
	A76	14	4	-0.05	0.18	0.772	-5	-35	39
	DS1	14	4	0.11	0.16	0.510	11	-21	57
	NEM	21	5	-0.09	0.12	0.449	-9	-28	16

Notes:

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

Shaded cells indicate positive (increased) or negative (reduced) effect sizes of 20% or more.

Test area = area compared to control (INUG).

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

n(A) = number of months in the "after" period (i.e., in 2021).

Estimate = BACI model estimate of the 2021 change in mean for log-transformed data.

SE = standard error of the estimate.

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

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

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

Figure 5-73. Chlorophyll-a (µg/L) in water samples from Whale Tail Pit study lakes since 2015.

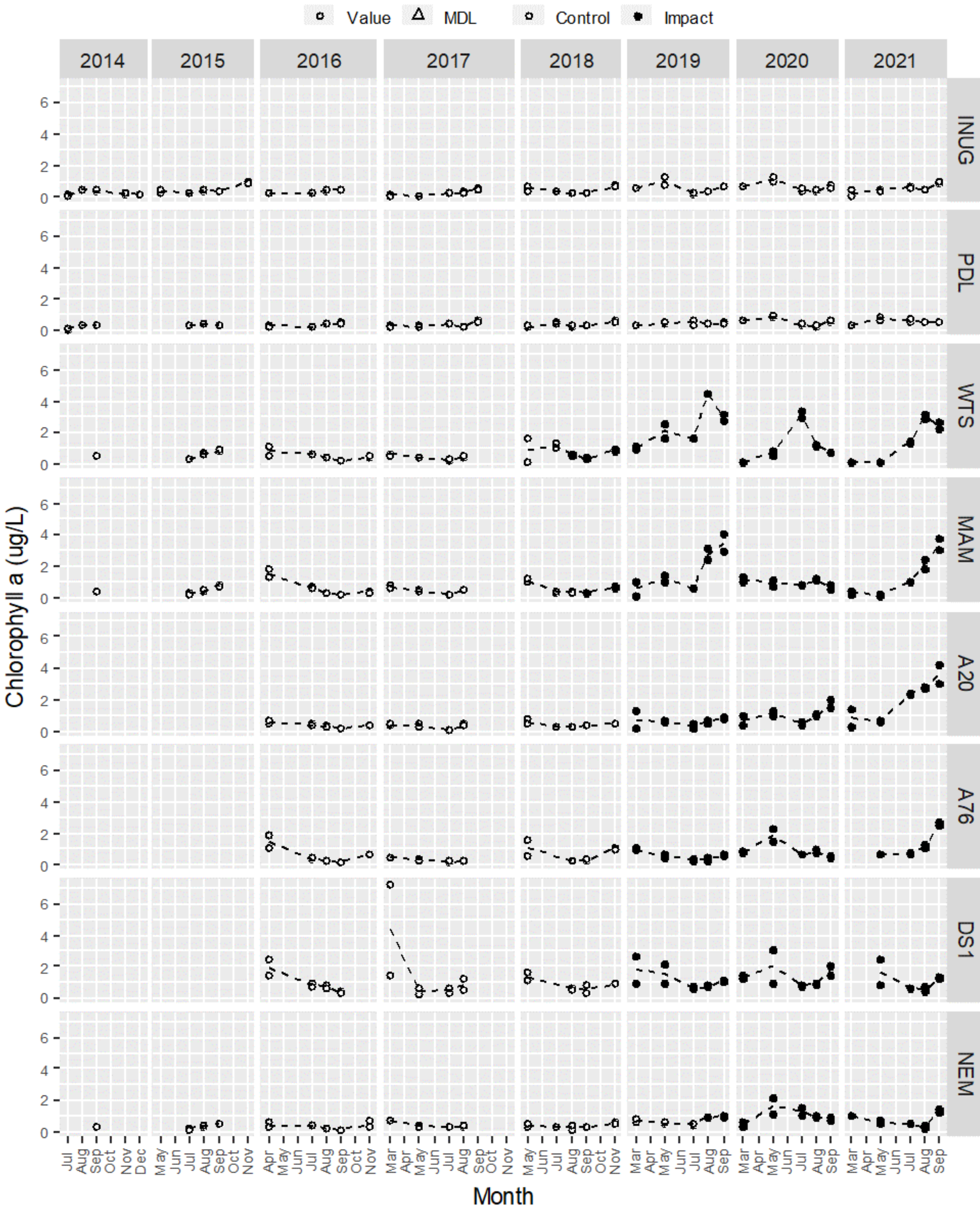


Figure 5-74. Total phytoplankton biomass (mg/m³) from Whale Tail Pit study lakes since 2015.

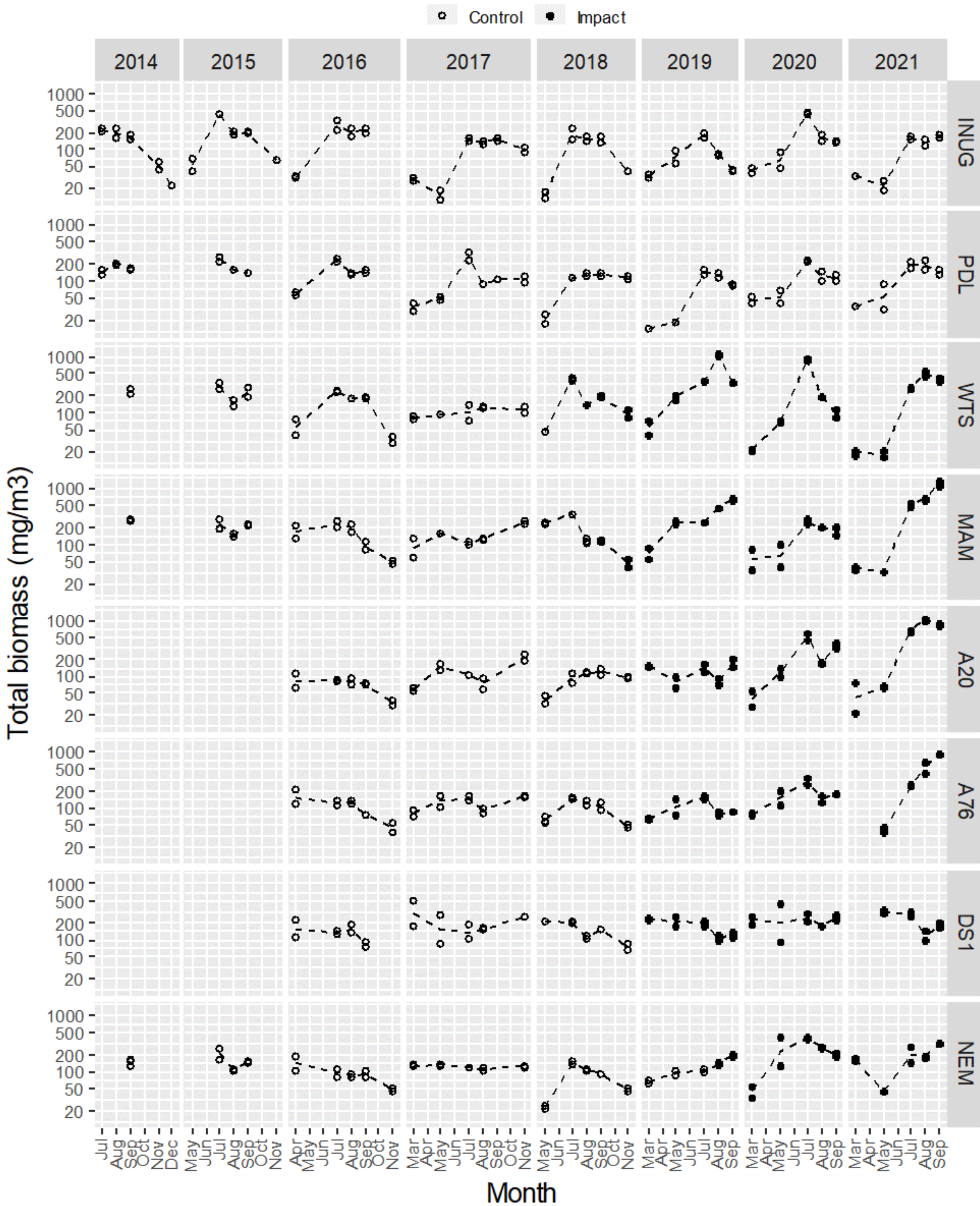


Figure 5-75. Phytoplankton biomass (mg/m^3) by major taxa group from Whale Tail Pit study lakes since 2015.

Figure 5-76. Relative phytoplankton biomass by major taxa from Meadowbank study lakes since 2015.

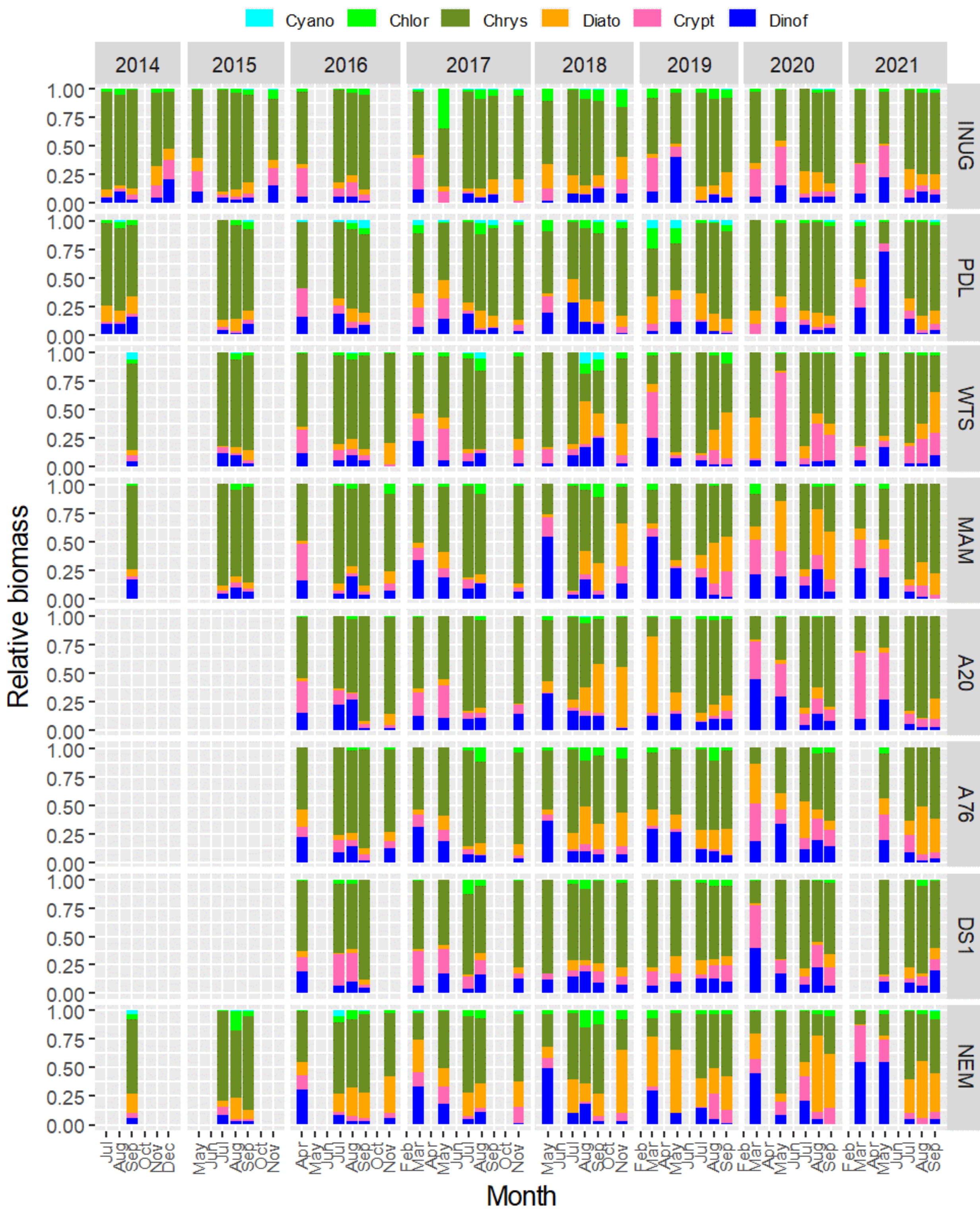
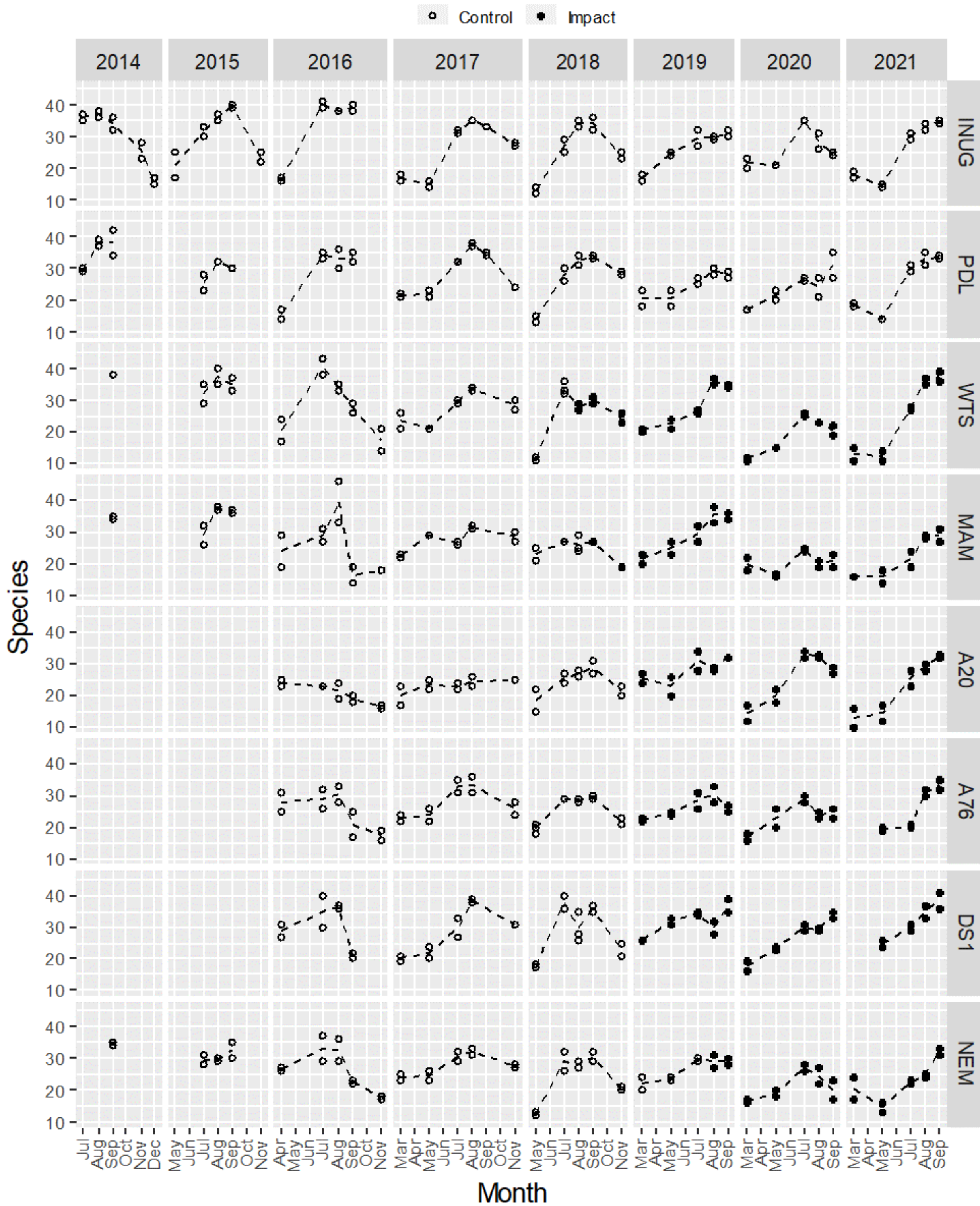


Figure 5-77. Phytoplankton species richness from Whale Tail Pit study lakes since 2015.



Sediment Chemistry Tables and Figures

In 2021, a batch of sediment samples were not analyzed due to a sample receipt error by the laboratory. As such, we did not receive the results for sediment collected at most Whale Tail study areas. Results for samples that were analyzed are presented in the tables and figures in this section. For more information see **Appendix A**.

Figure 5-78. Grain size composition in sediment from the Whale Tail study area lakes.

Note: In 2021, a batch of sediment samples were not analyzed due to a sample receipt error by the laboratory. Missing results in 2021 correspond to samples that were discarded prior to analysis.

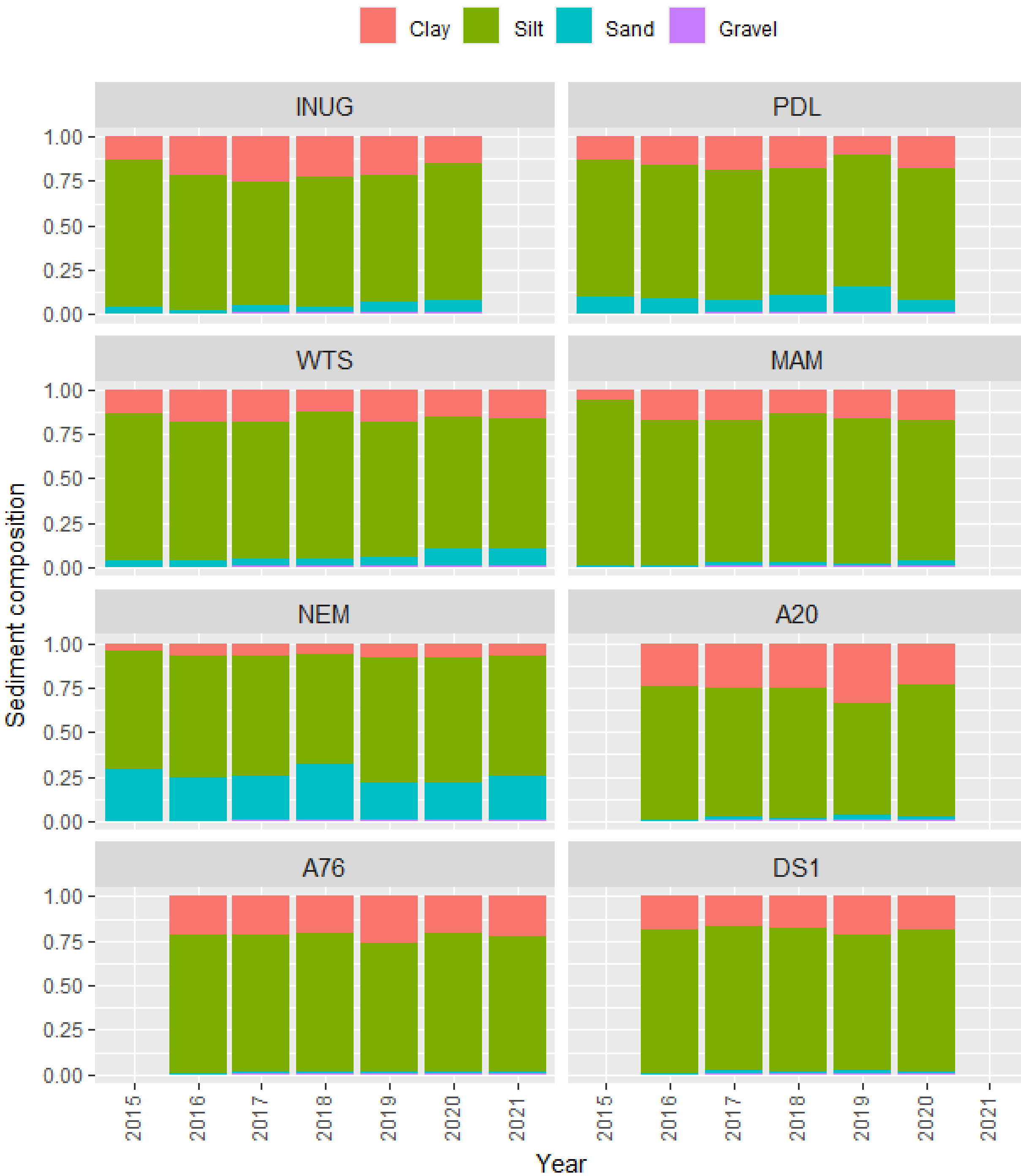


Figure 5-79. Total aluminum (mg/kg dw) in sediment samples (grabs & cores) from Whale Tail study area lakes since 2015.

Note: Cores samples = box and whisker. Box and whisker plots are interpreted as follows: horizontal line in the box = median concentration, upper and lower margins = upper (75th) and lower (25th) percentile concentrations or the interquartile range, vertical lines are maximum and/or minimum concentrations, 'x's beyond vertical lines are outlier concentrations.

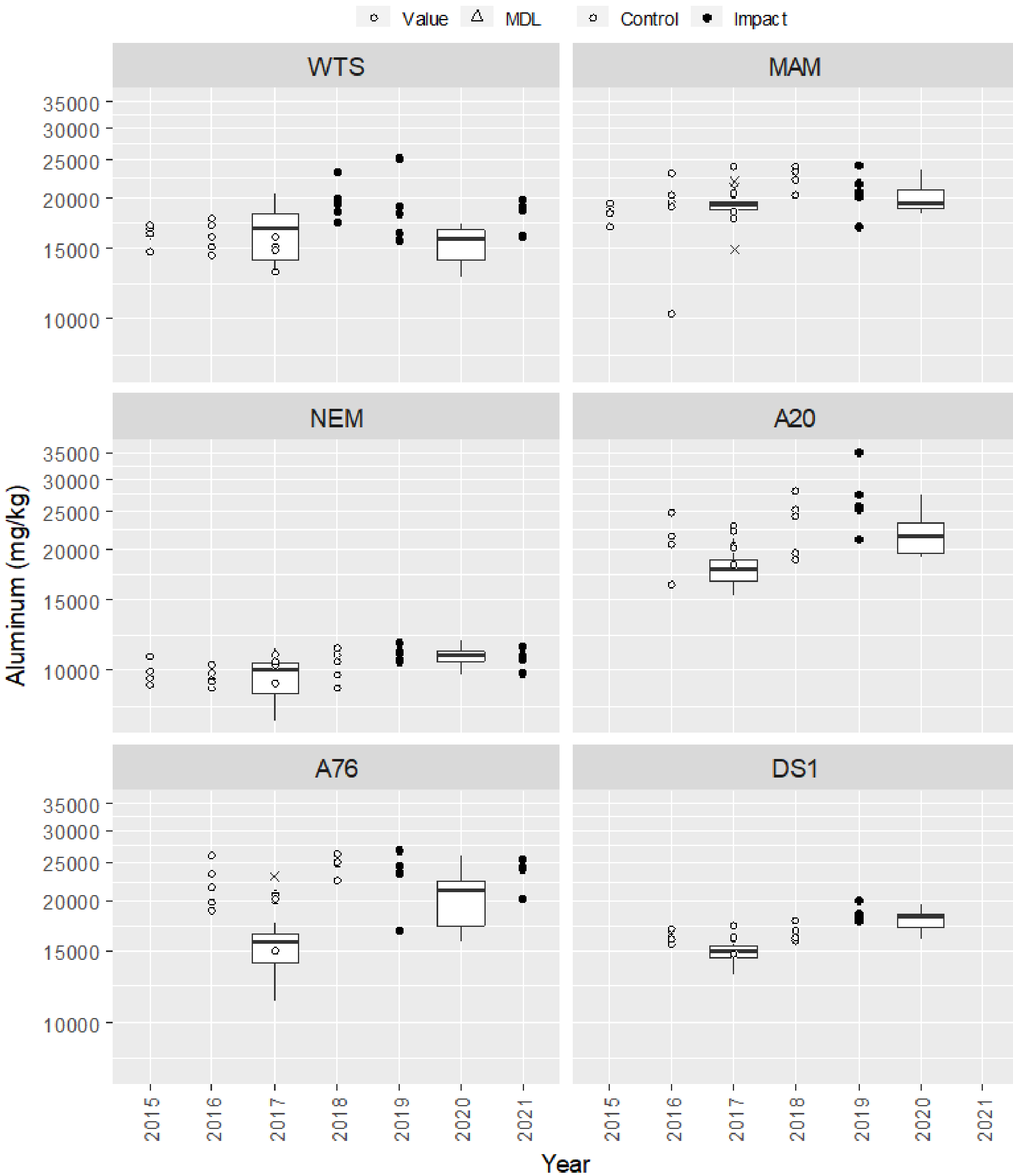


Figure 5-80. Arsenic (mg/kg dw) in sediment samples (grab & cores) from Whale Tail study area lakes since 2015.

Note: The red dashed line represents the trigger value for the Whale Tail study area lakes. Cores samples = box and whisker. Box and whisker plots are interpreted as follows: horizontal line in the box = median concentration, upper and lower margins = upper (75th) and lower (25th) percentile concentrations or the interquartile range, vertical lines are maximum and/or minimum concentrations, 'x's beyond vertical lines are outlier concentrations.

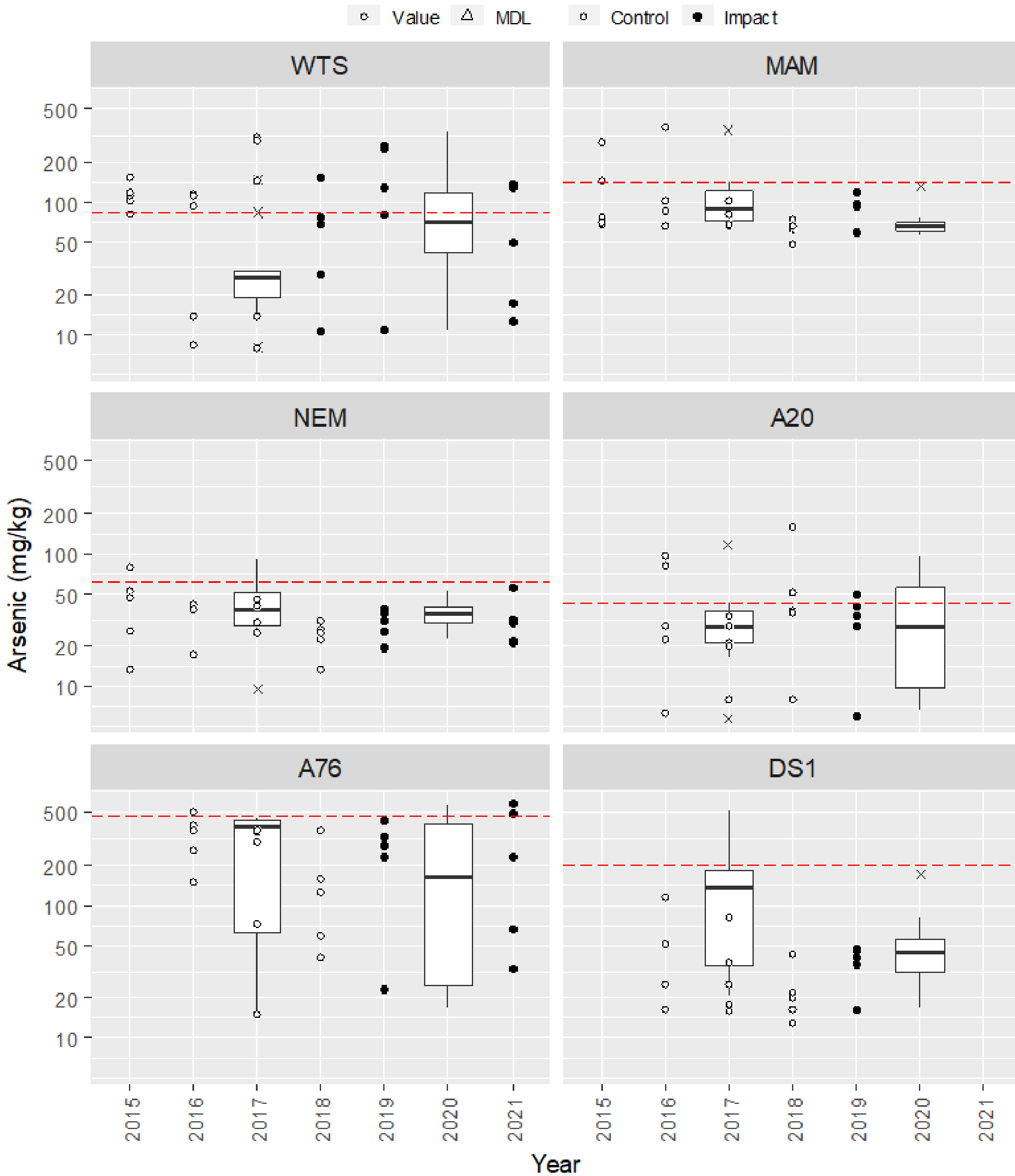


Figure 5-81. Cadmium (mg/kg dw) in sediment samples (grab & cores) from Whale Tail study area lakes since 2015.

Note: The red dashed line represents the trigger value for the Whale Tail study area lakes. Cores samples = box and whisker. Box and whisker plots are interpreted as follows: horizontal line in the box = median concentration, upper and lower margins = upper (75th) and lower (25th) percentile concentrations or the interquartile range, vertical lines are maximum and/or minimum concentrations, 'x's beyond vertical lines are outlier concentrations.

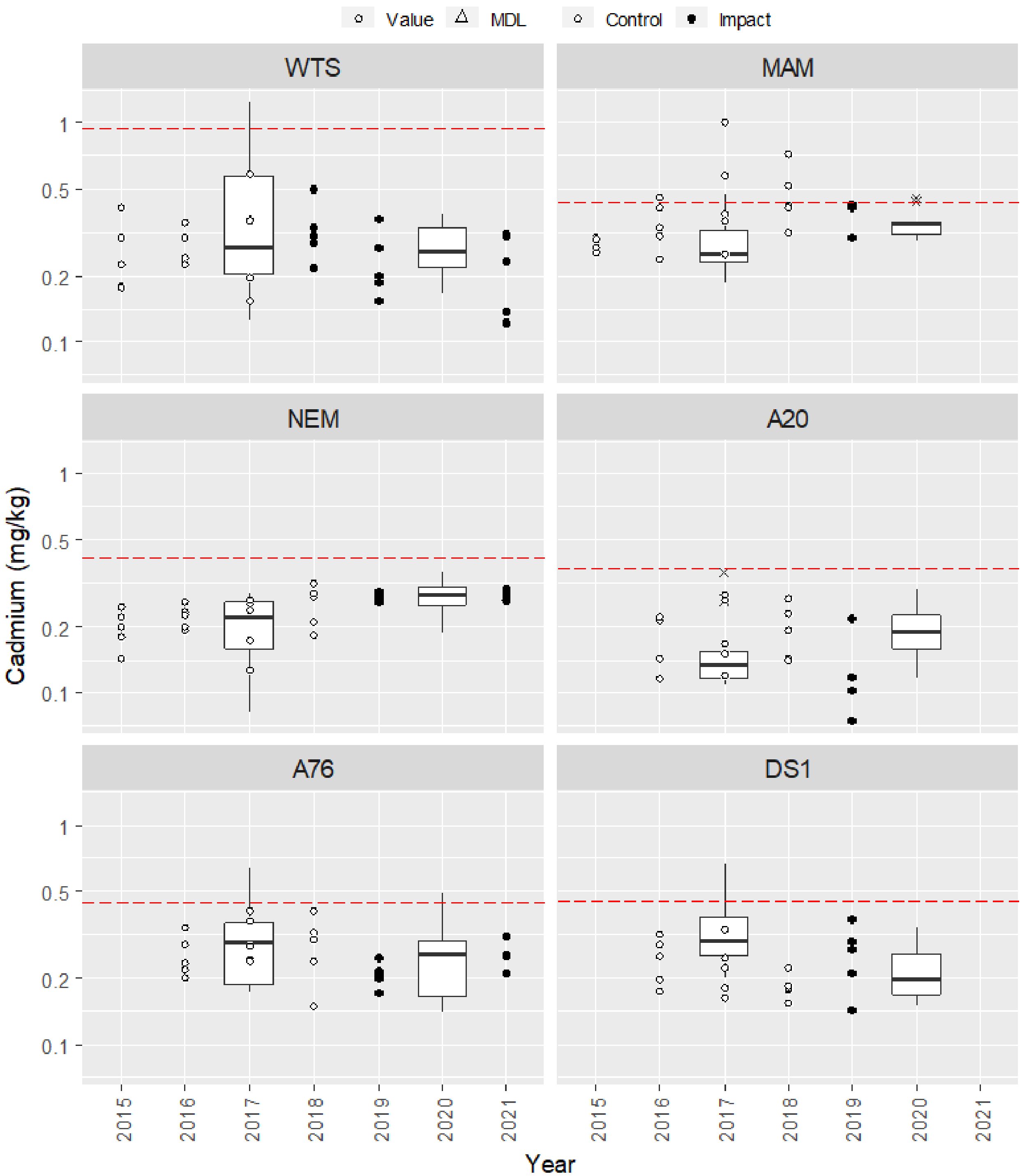


Figure 5-82. Chromium (mg/kg dw) in sediment samples (grab & cores) from Whale Tail study area lakes since 2015.

Note: The red dashed line represents the trigger value for the Whale Tail study area lakes. Cores samples = box and whisker. Box and whisker plots are interpreted as follows: horizontal line in the box = media concentration, upper and lower margins = upper (75th) and lower (25th) percentile concentrations or the interquartile range, vertical lines are maximum and/or minimum concentrations, 'x's beyond vertical lines are outlier concentrations.

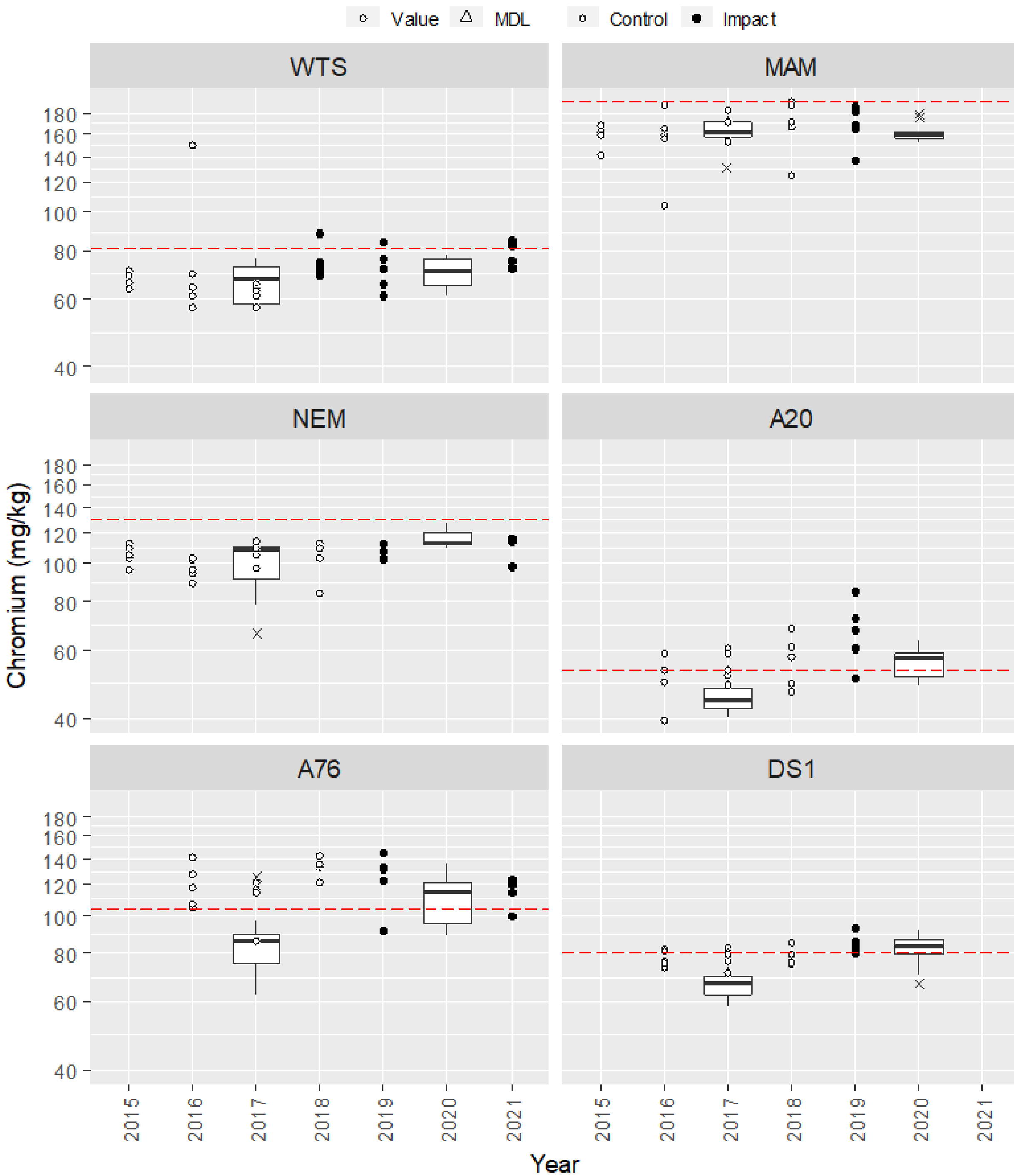


Figure 5-83. Copper (mg/kg dw) in sediment samples (grab & cores) from Whale Tail study area lakes since 2015.

Note: The red dashed line represents the trigger value for the Whale Tail study area lakes. Cores samples = box and whisker. Box and whisker plots are interpreted as follows: horizontal line in the box = median concentration, upper and lower margins = upper (75th) and lower (25th) percentile concentrations or the interquartile range, vertical lines are maximum and/or minimum concentrations, 'x's beyond vertical lines are outlier concentrations.

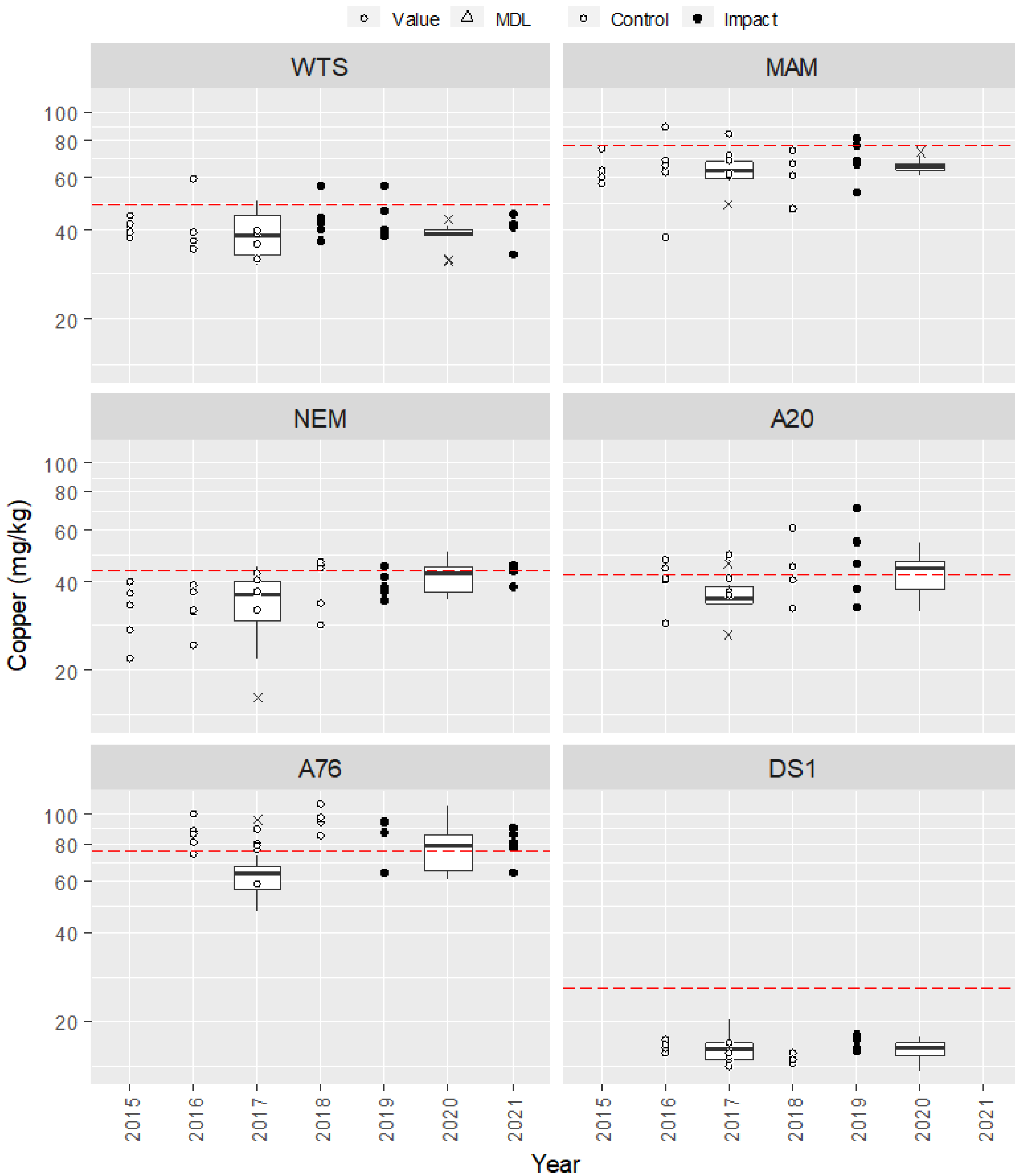


Figure 5-84. Lead (mg/kg dw) in sediment samples (grab & cores) from Whale Tail study area lakes since 2015.

Note: The red dashed line represents the trigger value for the Whale Tail study area lakes. Cores samples = box and whisker. Box and whisker plots are interpreted as follows: horizontal line in the box = median concentration, upper and lower margins = upper (75th) and lower (25th) percentile concentrations or the interquartile range, vertical lines are maximum and/or minimum concentrations, 'x's beyond vertical lines are outlier concentrations.

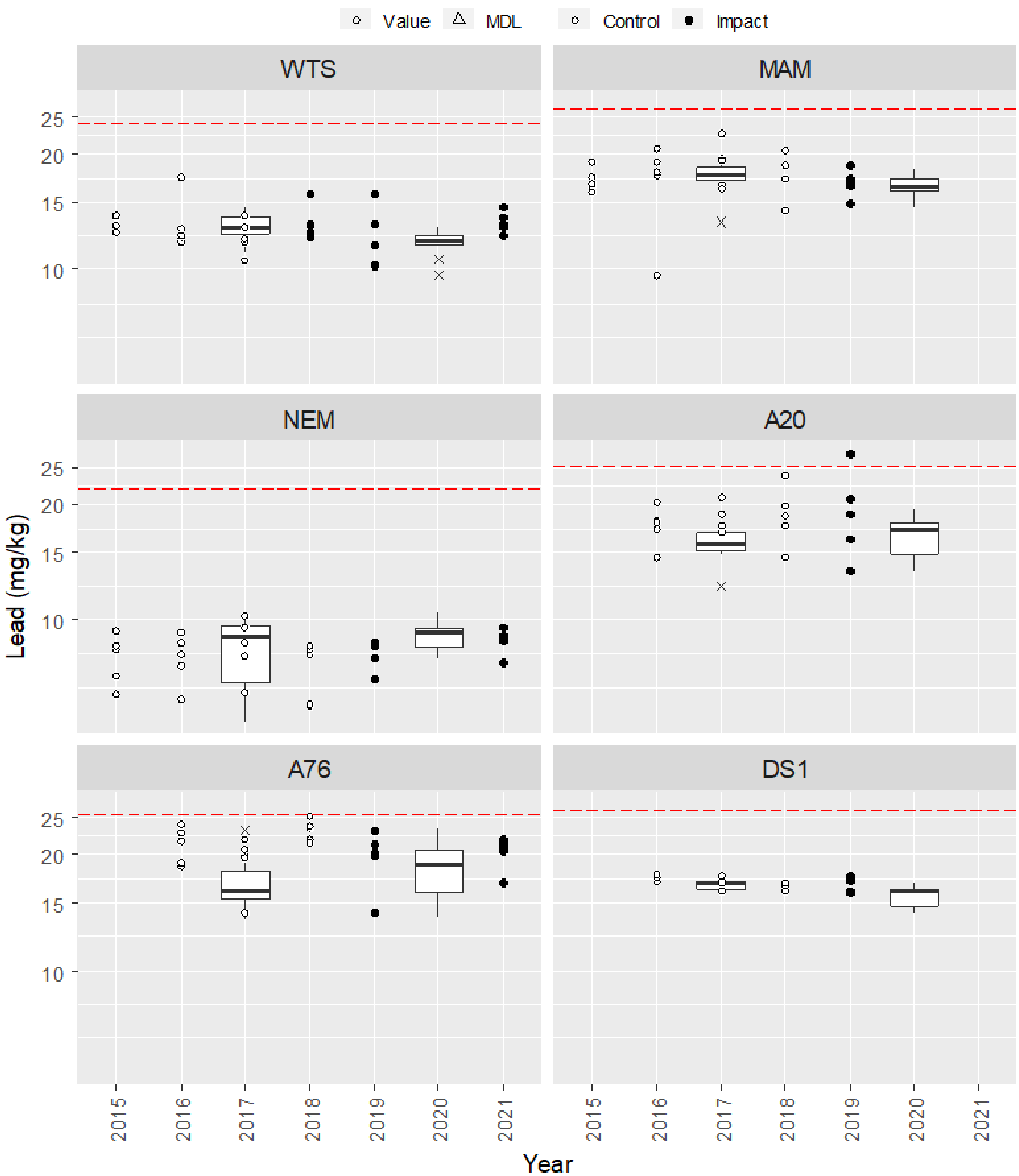


Figure 5-85. Mercury (mg/kg dw) in sediment samples (grab & cores) from Whale Tail study area lakes since 2015.

Note: The red dashed line represents the trigger value for the Whale Tail study area lakes. Cores samples = box and whisker. Box and whisker plots are interpreted as follows: horizontal line in the box = median concentration, upper and lower margins = upper (75th) and lower (25th) percentile concentrations or the interquartile range, vertical lines are maximum and/or minimum concentrations, 'x's beyond vertical lines are outlier concentrations.

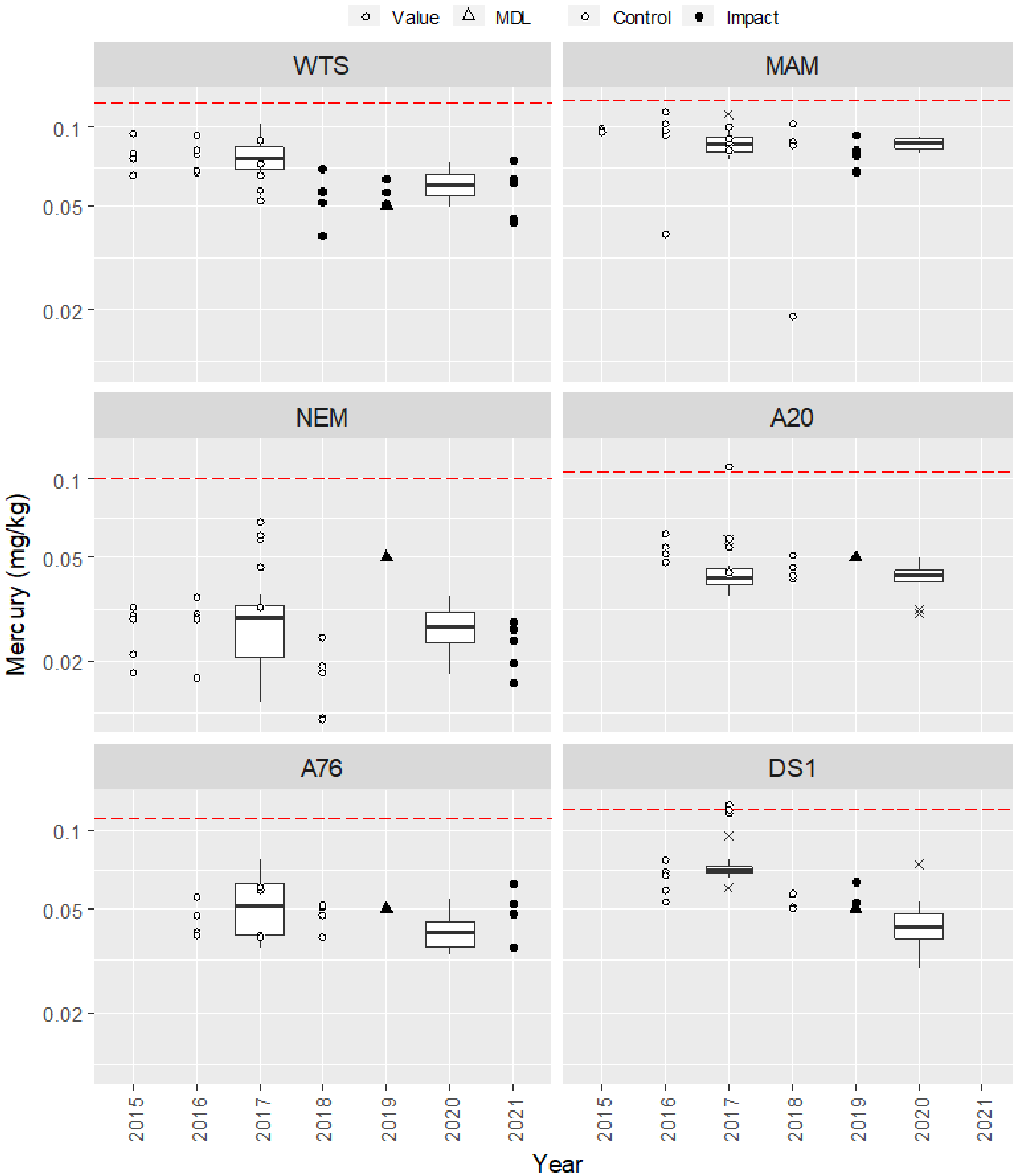
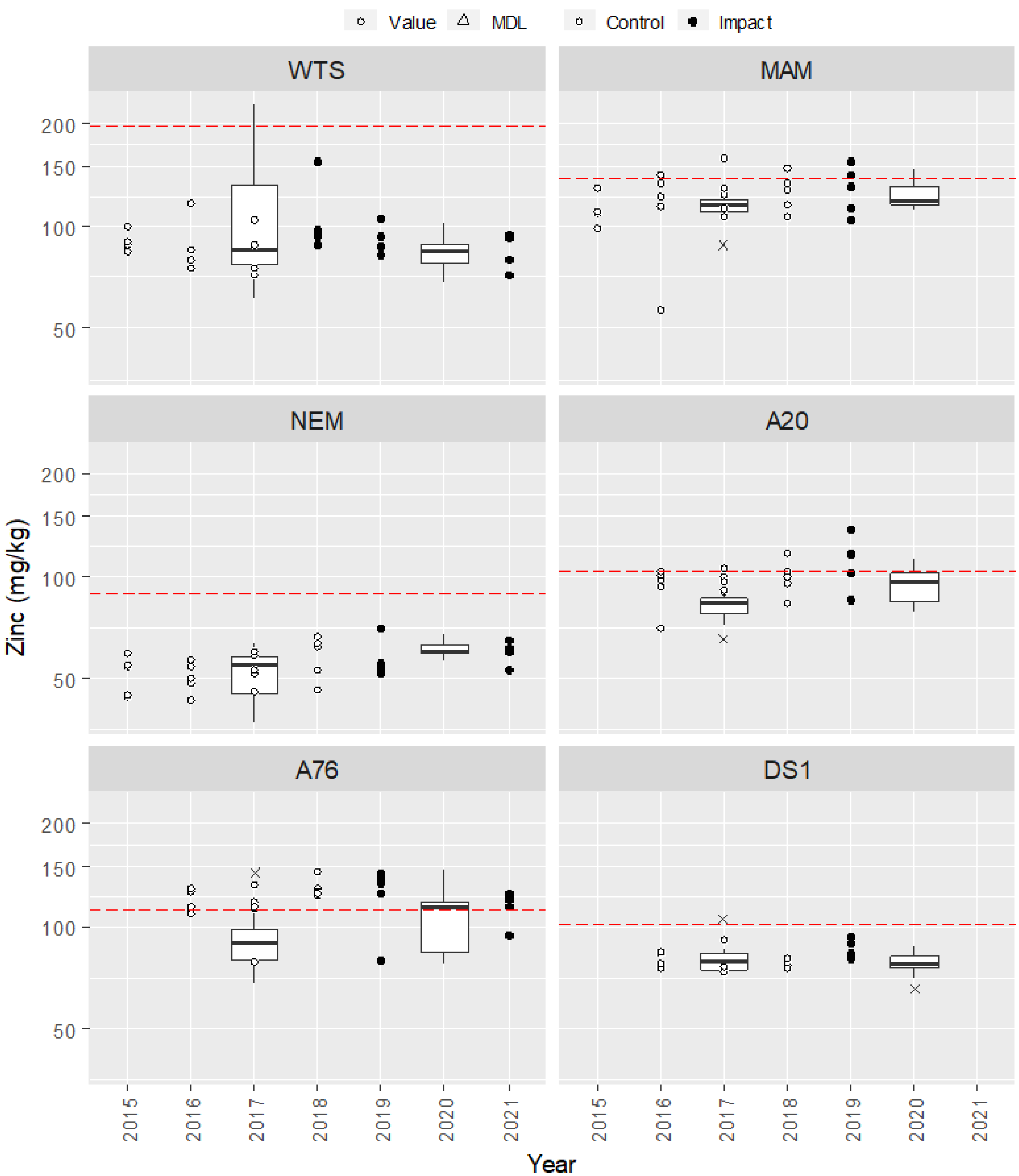


Figure 5-86. Zinc (mg/kg dw) in sediment samples (grab & cores) from Whale Tail study area lakes since 2015.

Note: The red dashed line represents the trigger value for the Whale Tail study area lakes. Cores samples = box and whisker. Box and whisker plots are interpreted as follows: horizontal line in the box = median concentration, upper and lower margins = upper (75th) and lower (25th) percentile concentrations or the interquartile range, vertical lines are maximum and/or minimum concentrations, 'x's beyond vertical lines are outlier concentrations.



Benthic Invertebrate Tables and Figures

Table 5-12. Geometric means for total abundance and total richness, Whale Tail study area lakes.

Geometric means for total abundance[1]								
Control/Impact	Station	2015	2016	2017	2018	2019	2020	2021
Control	INUG	1648 (4)	2100 (1)	1712 (3)	1497 (5)	1452 (6)	2055 (2)	1398 (7)
	PDL	1127 (2)	1373 (1)	748 (7)	779 (6)	990 (3)	951 (4)	829 (5)
Impact	WTS	1675 (7)	2102 (5)	3546 (2)	4005 (1)	2757 (3)	2356 (4)	1911 (6)
	MAM	3964 (4)	3050 (7)	4236 (3)	3444 (6)	7235 (1)	6133 (2)	3878 (5)
	A20	NA	2562 (4)	4246 (1)	2793 (2)	2546 (5)	2662 (3)	2146 (6)
	A76	NA	2525 (5)	6312 (1)	3094 (2)	2823 (3)	2794 (4)	2269 (6)
	DS1	NA	3090 (2)	1919 (6)	2564 (4)	2205 (5)	2619 (3)	3095 (1)
	NEM	2897 (3)	2744 (4)	1712 (7)	2708 (5)	5278 (1)	3945 (2)	2374 (6)

Geometric means for total richness								
Control/Impact	Station	2015	2016	2017	2018	2019	2020	2021
Control	INUG	13 (7)	16 (2)	14 (4)	15 (3)	14 (5)	17 (1)	13 (6)
	PDL	9 (3)	11 (1)	10 (2)	6 (7)	9 (4)	8 (5)	7 (6)
Impact	WTS	15 (3)	15 (2)	15 (5)	18 (1)	13 (6)	15 (4)	11 (7)
	MAM	13 (7)	14 (6)	15 (3)	15 (5)	15 (4)	19 (1)	17 (2)
	A20	NA	14 (5)	13 (6)	15 (3)	15 (4)	18 (1)	17 (2)
	A76	NA	16 (3)	17 (1)	15 (6)	15 (5)	17 (2)	15 (4)
	DS1	NA	12 (4)	15 (1)	14 (2)	14 (3)	10 (6)	11 (5)
	NEM	12 (5)	12 (3)	10 (7)	10 (6)	12 (4)	13 (2)	14 (1)

Notes:
1. Total abundance in organisms/m^2.
Rank order of abundance and richness shown in parentheses.
Red vertical lines mark the year that area designations switched from *control* to *impact.*
NA = Benthic invertebrate sampling was not completed for the given area/year.

Table 5-13. Results of the BACI tests for benthic invertebrate abundance from Whale Tail study area lakes.

After Period	Test Area	n(B)	n(A)	Estimate	SE	P-value*	Effect size (%)		
							ES	LCI	UCI
2021	WTS	3	1	0.06	0.47	0.55	7	-86	702
	MAM	4	1	0.27	0.34	0.76	31	-55	284
	A20	3	1	-0.15	0.37	0.36	-14	-82	322
	A76	3	1	-0.25	0.59	0.35	-22	-94	880
	DS1	3	1	0.45	0.28	0.87	57	-54	430
	NEM	4	1	0.17	0.31	0.69	19	-56	221
2020-21	WTS	3	2	-0.02	0.32	0.47	-2	-64	168
	MAM	4	2	0.31	0.25	0.86	36	-32	172
	A20	3	2	-0.23	0.27	0.23	-21	-67	89
	A76	3	2	-0.34	0.41	0.23	-29	-81	165
	DS1	3	2	0.17	0.26	0.72	19	-48	172
	NEM	4	2	0.23	0.22	0.82	26	-32	135
2019-21	WTS	3	3	0.12	0.28	0.65	12	-49	145
	MAM	4	3	0.49	0.21	0.96	64	-6	184
	A20	3	3	-0.16	0.23	0.26	-15	-55	63
	A76	3	3	-0.25	0.33	0.24	-22	-69	93
	DS1	3	3	0.14	0.2	0.73	15	-35	103
	NEM	4	3	0.47	0.26	0.94	60	-18	210
2018-21	WTS	3	4	0.27	0.29	0.8	31	-38	176
						-			

Notes:

* **Bolded & underlined** values are P-values < 0.1.

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

Test area = area compared to control (INUG).

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

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

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

SE = standard error of the estimate.

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

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

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

Table 5-14. Results of the BACI tests for benthic invertebrate taxa richness from Whale Tail study area lakes.

After Period	Test Area	n(B)	n(A)	Estimate	SE	P-value*	Effect size (%)		
							ES	LCI	UCI
2021	WTS	3	1	-0.20	0.15	0.16	-18	-58	59
	MAM	4	1	0.26	0.12	0.94	29	-13	92
	A20	3	1	0.29	0.13	0.92	33	-25	137
	A76	3	1	0.03	0.13	0.58	3	-42	84
	DS1	3	1	-0.13	0.17	0.26	-12	-57	81
	NEM	4	1	0.32	0.13	0.96	37	-8	105
2020-21	WTS	3	2	-0.18	0.12	0.12	-16	-43	23
	MAM	4	2	0.20	0.09	0.96	22	-5	56
	A20	3	2	0.22	0.10	0.95	25	-8	70
	A76	3	2	-0.01	0.10	0.46	-1	-27	35
	DS1	3	2	-0.29	0.14	**<u>0.07</u>**	-25	-53	17
	NEM	4	2	0.16	0.13	0.86	17	-18	66
2019-21	WTS	3	3	-0.14	0.10	0.12	-13	-35	16
	MAM	4	3	0.17	0.08	0.97	19	-2	44
	A20	3	3	0.19	0.09	0.96	21	-5	55
	A76	3	3	0.00	0.09	0.50	0	-22	28
	DS1	3	3	-0.16	0.15	0.18	-15	-44	31
	NEM	4	3	0.16	0.10	0.91	17	-10	53
2018-21	WTS	3	4	-0.06	0.12	0.31	-6	-30	26

Notes:

* **<u>Bolded & underlined</u>** values are P-values < 0.1.

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

Test area = area compared to control (INUG).

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

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

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

SE = standard error of the estimate.

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

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

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

Figure 5-87. Benthic invertebrate total abundance (#/m²) from Whale Tail study area lakes since 2015.

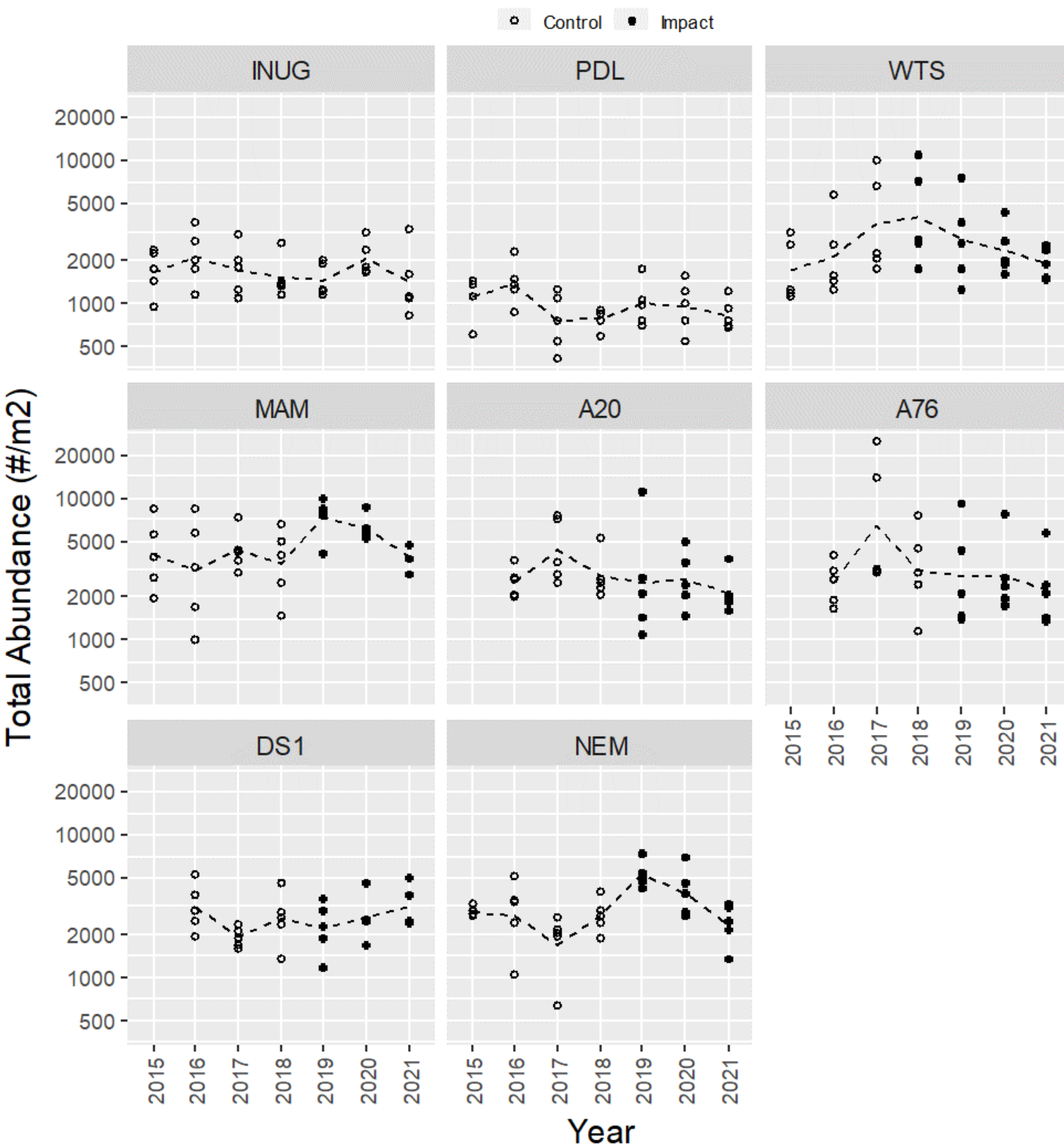


Figure 5-88. Benthic invertebrate abundance (#/m²) by major taxa group from Whale Tail study area lakes since 2015.

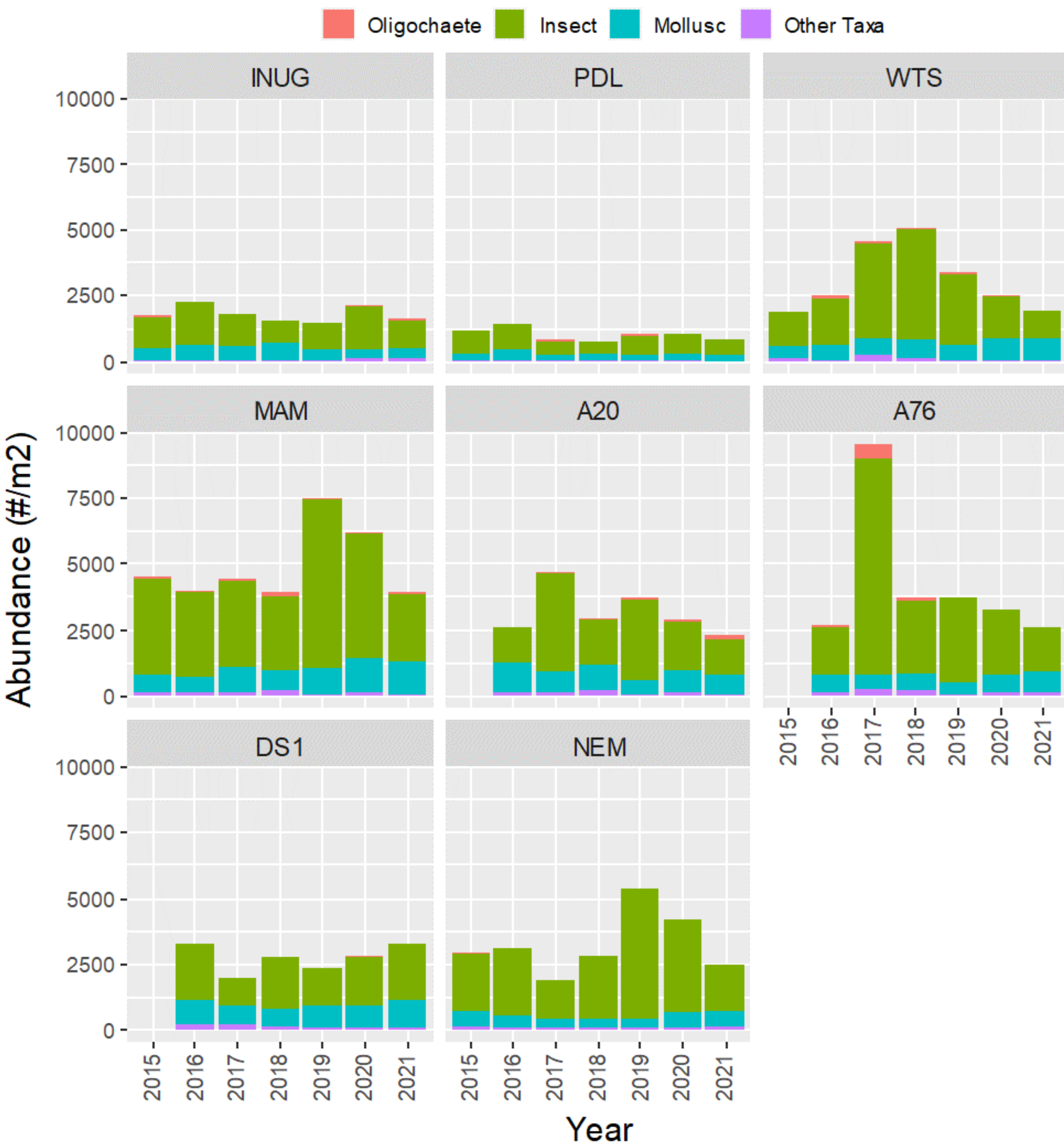


Figure 5-89. Benthic invertebrate relative abundance by major taxa from Whale Tail study area lakes since 2015.

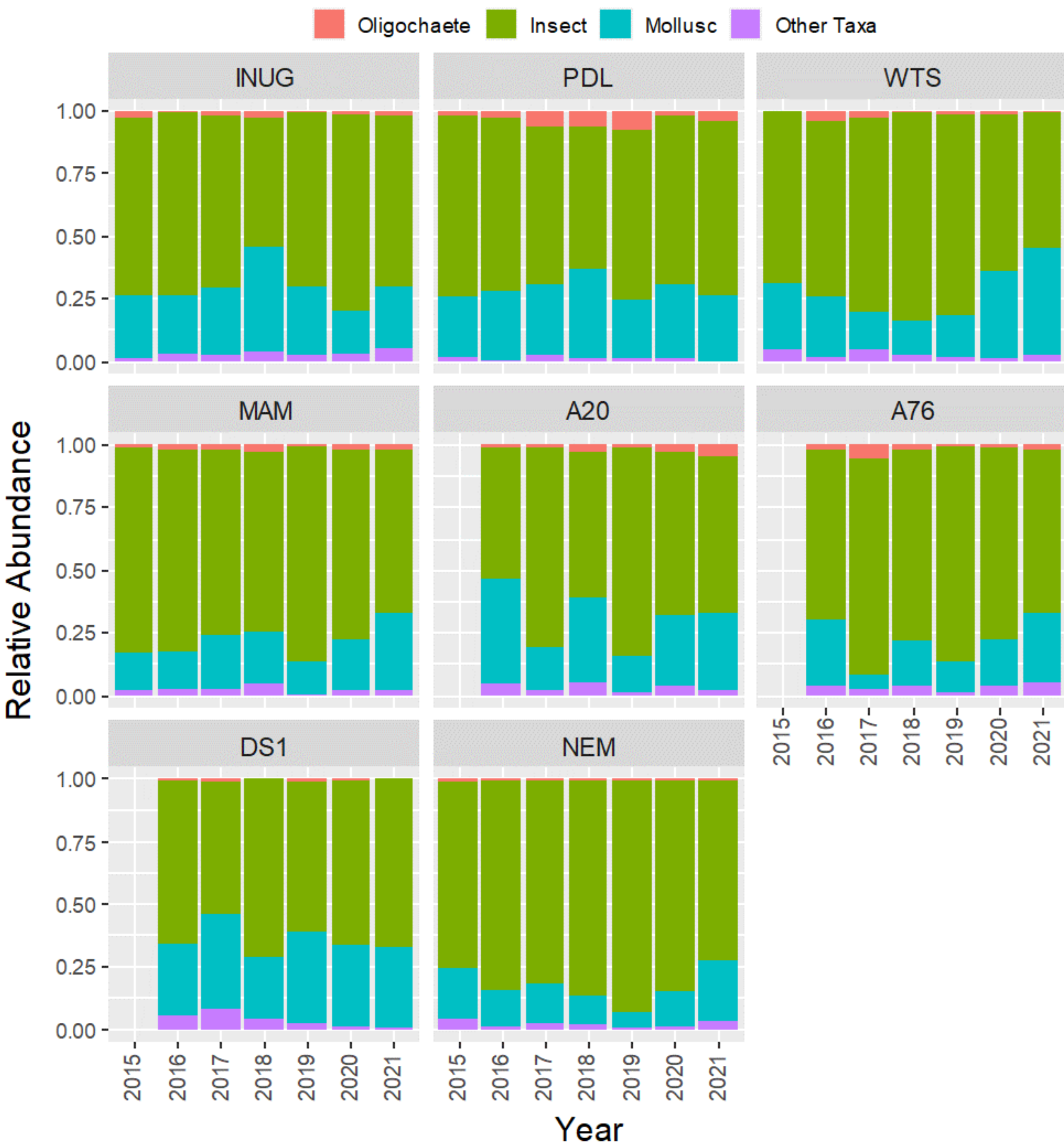


Figure 5-90. Benthic invertebrate total richness (# taxa) from Whale Tail study area lakes since 2015.

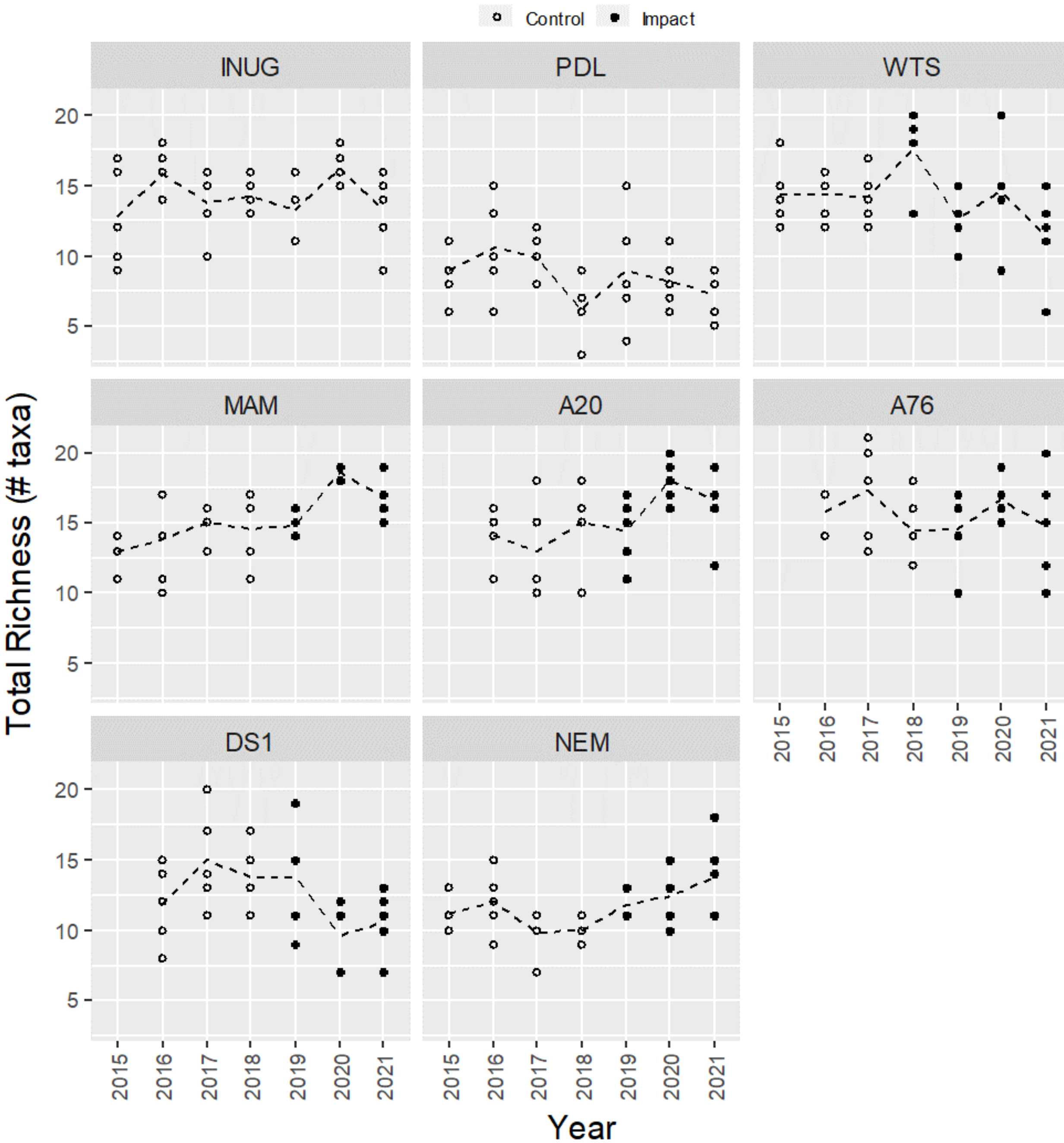


Figure 5-91. Benthic invertebrate richness (# taxa) by major taxa group from Whale Tail study area lakes since 2015.

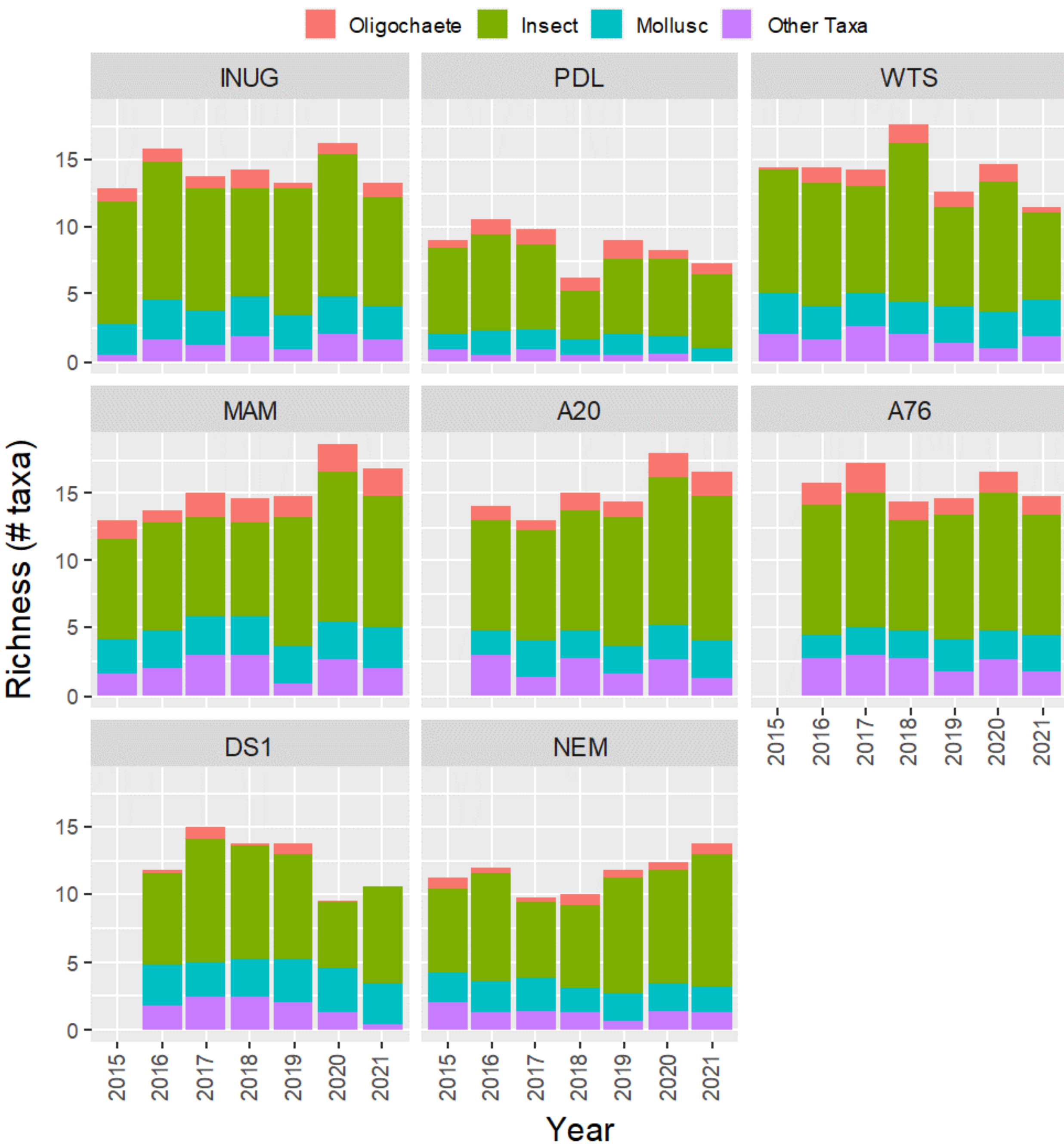
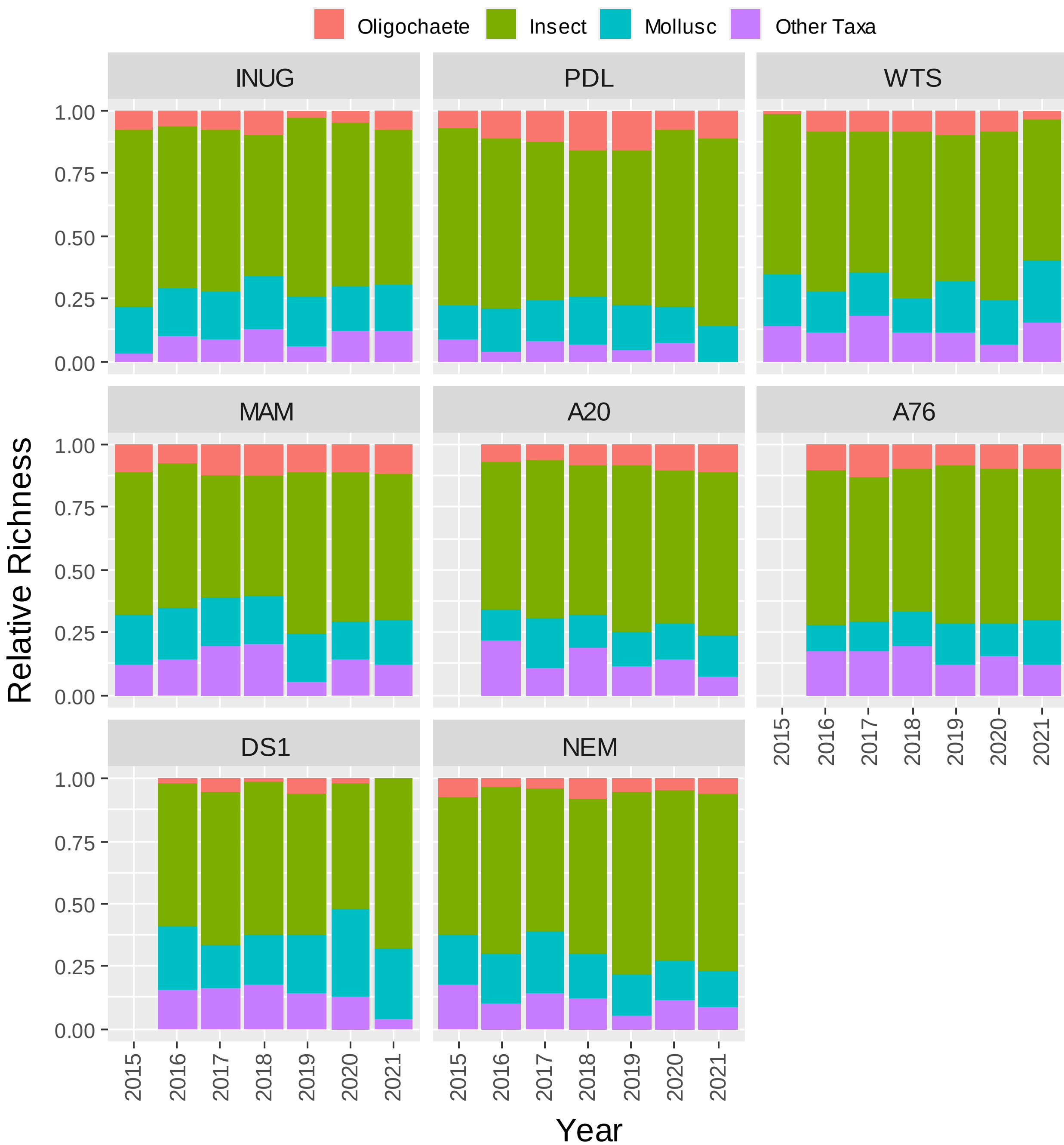


Figure 5-92. Benthic invertebrate relative richness by major taxa from Whale Tail study area lakes since 2015.



6 BAKER LAKE

6.1 Overview of the Baker Lake CREMP

This section summarizes the 2021 CREMP results for water and sediment chemistry, along with metrics of phytoplankton and benthic invertebrate communities in Baker Lake.

Baker Lake monitoring was added to the core program to ensure activities related primarily to barge traffic and shipping in the area were tracked. There are two near-field impact areas, one targeting the hamlet's barge landing area (BBD) and the other Agnico Eagle'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 sediment chemistry and benthic community structure (it is not monitored for water quality or phytoplankton community). Sampling locations are shown in **Figure 6-1**.

Barge trips from Chesterfield Inlet numbered 40 for general cargo and 37 for fuel (**Figure 6-2**). With the expansion at the Whale Tail site, traffic increased in 2018 and 2019 compared to previous years (e.g., from < 40 in 2016 and 2017 to ~ 55 in 2018). In 2021, the number of trips increased for general cargo and fuel compared to 2020 and represented the highest reported number of trips since monitoring began in 2008.

In 2021, three spills were reported:

- A plume of total suspended solids (TSS) in Baker Lake at the end of June.
- A spill of petroleum product from the secondary containment from the Baker Lake Tank Farm was reported in September. It is uncertain whether the potentially contaminated petroleum product reached Baker Lake.
- A spill of unknown composition and origin in Baker Lake near the shipping vessel was reported in October.

Due to a laboratory error, a batch of sediment samples collected in August 2021 were discarded prior to being analyzed. As a result, none of the sediment samples collected from Baker Lake were analyzed. See **Section 6.5** and **Appendix A** for more details.

6.2 Limnology

6.2.1 General Observations

Baker Lake is large with much greater wind fetch than the Meadowbank or Whale Tail study lakes and unique limnology. Factors that contribute to the unique limnology include the lake's proximity to the tidally influenced Chesterfield Inlet, the 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 Thelon River water, which is less-saline and Baker Lake water, which is more-saline. 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 the north shore, these factors may combine to confound the detection of potential subtle changes in water quality related to barge activity, with the *signal* getting lost in the *noise* of natural variability in this dynamic location.

Parameters associated with more-saline or higher conductivity water that appears to be present in deep water (>10–15 m) and which demonstrate considerable fluctuations within and between years include conductivity, hardness, calcium, chloride, magnesium, sodium, and TDS. Other parameters that have a high level of natural variability and appear to be correlated with these deep-water parameters in Baker Lake include ammonia, nitrate, TKN, total phosphorous, sulphate, and TOC/DOC. A deep limnology survey was conducted in August 2012 to explore this situation specifically. While it provided a single *snapshot* of this dynamic limnological process, 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, depending on location. Conductivity remained uniformly high to the maximum depth sampled (40 m). The implication of this is that results for any event will reflect the relative influence of the deeper, brackish Baker Lake water and the less-saline Thelon River water on the day of the event.

6.2.2 Temporal and Spatial Trends

In addition to the Thelon-Baker influence, several other factors have potential to affect the limnology. Seasonal barge traffic is the major mine-related activity in the area, occurring during the summer months when Baker Lake is ice-free. The hamlet of Baker Lake's sewage lagoons and landfill are situated in a watershed that discharges seasonally into Baker Lake between BBD and BPJ. And locally, propeller wash may cause vertical mixing in very discrete areas when there is active traffic. Otherwise, except for spills and occasional discharge from commercial vessels etc., no other activities have the potential for altering limnological parameters.

Limnological conditions at Baker Lake are similar to the Meadowbank study lakes, except that water temperatures are cooler, typically reaching no more than 10°C in mid-summer. Mean temperatures at all locations were generally low in 2021, staying between 4.9 and 8.2°C (**Figure 6-3**).

Summer stratification was less pronounced in 2021 compared to previous years at Baker Lake. The August profile from BBD demonstrated thermal and saline stratification patterns related to the influence of the Thelon River, the saline-influenced deeper water in Baker Lake, and limited mixing, though it was not seen in any other profiles (**Figure 6-4**). As described in **Section 6.2.1**, the influence of wind and wave action during the sampling period may be responsible for the limited vertical stratification observed.

Although vertical stratification was absent from most profiles (with the exception of BBD in August), the relative influence of low salinity Thelon River water and Baker Lake deep water can be observed throughout the open water season (**Figure 6-4**). In July and August, BAP (furthest east from the Thelon River outflow) was influence least by freshwater, while surface waters (0 to 5 m) closest to the river mouth at BBD were characterized by riverine salinity throughout the season. BPJ, at an intermediate location, demonstrated predominantly riverine salinities in July and deep-water salinities in August. All areas showed profiles characteristic of riverine influence in September.

The relatively low temperatures are also evidence of a well-mixed water column. Baker Lake is large and open, and winds can generate large waves that promote mixing.

6.3 Water Chemistry

6.3.1 General Observations

As discussed in **Section 6.2**, Baker Lake is very large and is exposed to high wind and wind-generated currents. Adding to the complexity, monitoring areas along the north shore are exposed to two different water masses: the less-saline Thelon River, which discharges into Baker Lake at its western end, and the saline-influenced deeper water in Baker Lake. Depending on wind speed and direction, water from these two sources (e.g., individually or mixed) can strongly influence some surface water chemistry parameters (conductivity, salts, and dissolved solids). Consequently, certain parameters can display pronounced spatial (horizontal and vertical) and temporal variability. This variability is evident mainly in *conventional* parameters (described above); In contrast, concentrations of metals in the Baker Lake samples are typically below laboratory MDLs.

6.3.2 Temporal and Spatial Trends

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

Baker Lake water chemistry results for 2021, screened against site-specific triggers and thresholds, are tabulated in **Appendix B3**. Most water quality parameters in Baker Lake, across all years, are routinely below laboratory MDLs, similar to the results for the Meadowbank study lakes. Data screening at Baker Lake followed the same methodology as Meadowbank and Whale Tail (**Section 2.3.1**) except that matching patterns in mining activity was not conducted as it is not relevant to this study area.

The screening results for all parameters that were screened into the assessment process are summarized in **Table 6-1** with figure number references (**Figure 6-5** to **Figure 6-53**). The samples were collected from a depth of 3 meters for all areas and events, consistent with the SOP. The red dashed line in each of these figures is the trigger value specific to Baker Lake for that parameter[29]. 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 (for completeness and transparency, plots for these parameters are included in **Appendix B3**).

Mean concentrations of total silicon and total titanium at near-field area BBD exceeded their respective trigger values. The elevated means for both parameters resulted from two samples collected on July 30th with concentrations approximately 1.5- and 5-fold higher than their respective trigger values (**Figure 6-37**and **Figure 6-40**). The July spike represents the highest concentrations of total silicon and titanium observed at any Baker Lake area since the beginning of the timeseries (2008) and also corresponds to maximum levels of TSS (**Figure 6-9**) and other metal parameters (e.g., iron and aluminum). The high TSS concentration, which was not observed during other 2021 sampling events at BBD nor at other areas (BAP, BPJ) on the same day, suggests that a spatially isolated episodic disturbance may be responsible for the anomalous results. For example, a sediment plume from the Thelon River, an erosional event caused by rain or shoreline waves or sediment disturbance caused by boat traffic could have contributed to the high TSS. Laboratory results for titanium from the BBD-73 sample on July 30th were flagged for matrix effects (resulting in an 8-fold increase in detection limit) which is indicative of unusually high TSS concentrations. Although peak spring freshet occurred on June 29th on the Thelon River, variable flows and wind effects could be responsible for the stochastic peak in TSS cause by a riverine suspended sediment plume. Field notes for the day indicate rain, with reported wind speeds ranging up to 43 km/h from the east, factors which could also contribute to the entrainment of sediment and elevated TSS. Precipitation in the summer was higher than normal in 2021 and surface runoff could have also contributed to the elevated TSS. There were three reported spills in 2021, and as mentioned in **Section 6.1**, fuel tank construction occurred at the Baker Lake site in 2021 (**Table 1-1**).

In the BACI analysis (**Table 6-3**), the proportional changes in total silicon and titanium at BBD were significant ($p<0.05$) and positive ($\exp(Est)>1$). In other words, there were increases in these variables above what could be explained by potential increases at BAP (the control area). Parameters at BAP and BPJ did not exceed trigger values and were not included in BACI analysis.

[29] See Appendix I in the 2019 CREMP report (Azimuth, 2020a) for details on trigger updates and derivation for Baker Lake.

The increase in total silicon and titanium at Baker Lake area BBD during the July sampling event appears to be related to a spatially isolated episodic event driven by the elevated TSS concentrations. The increases were unlikely related to Agnico activities in Baker Lake.

There are no follow-up measures for management beyond routine CREMP water quality sampling during the open water season.

6.4 Phytoplankton Community

6.4.1 General Observations

The phytoplankton community of Baker Lake is relatively similar to the Meadowbank Lakes, despite some seasonal differences in water quality due to the competing influences of less saline water from the Thelon River and more saline water from the deeper portion of Baker Lake (see **Section 6.2**). Taxonomic composition and biomass in Baker Lake were similar to the Meadowbank study lakes, with chrysophytes (golden algae, e.g., *Chrysococcus, Kephyrion, Dinobryon*) having been the dominant taxonomic group since monitoring began in 2008. Mean summer phytoplankton biomass in Baker Lake is generally similar to the Meadowbank lakes, reaching a maximum between 200 to 300 mg/m^3.

6.4.2 Temporal and Spatial Trends

Sampling at the Baker Lake areas is only conducted during the summer open water period, which coincides with barge activity. Because of Baker Lake's large size, it is unlikely that barge traffic (in the absence of a fuel or chemical spill) could influence the phytoplankton community of the whole lake.

The 2021 density and biomass results for phytoplankton are tabulated in **Appendix D3**. The results for the BACI model statistical tests of the 2021 results against baseline/reference conditions are provided in **Table 6-4**. Major findings at Baker Lake areas in 2021 for chlorophyll-a, total biomass, taxa richness, and group composition of major taxa were as follows:

- **Chlorophyll-a** – Concentrations at reference area BAP historically ranged between 0.4 to 1.5 µg/L (**Figure 6-54**). In 2021, the range and pattern of chlorophyll-a concentrations at the three Baker Lake areas were similar relative to previous years.
- **Total biomass** – Phytoplankton biomass was comparable to previous years. Annual variation in biomass generally co-varies between the BAP reference area and BPJ. In 2021, biomass at BBD and BPJ were both comparable to biomass at BAP and were within the range of recent years (**Figure 6-55** to **Figure 6-57**). While there were increases in phytoplankton biomass at impact areas BBD and BPJ with effect sizes greater than 20%, these results were not significant (p-value>0.1; **Table 6-4**).

- **Major taxa composition** – There were no apparent differences in relative composition of phytoplankton communities between BAP and impact areas BBD and BPJ in 2021 (**Figure 6-57**). Chrysophytes are the dominant taxa at the reference and impact areas, making up approximately 40 to 50% of the total phytoplankton biomass in each area. Diatoms, and cryptophytes make up about 20 to 25% each, and the remainder of the biomass is made up of chlorophytes and dinoflagellates (**Appendix D3**).
- **Taxa richness** – Richness in Baker Lake phytoplankton samples was within the historical range for the impact and reference areas (**Figure 6-58**). Similar to patterns observed historically, there is evidence of seasonal variability in 2021, and different trends appear for different areas. Richness at BBD and BAP, for example, appears to increase between July and August and then decreases between August and September, whereas BPJ richness appears to decrease between July and September. There were only slight increases in richness at BBD and BPJ in 2021, though the changes between the control (BAP) and impact areas (BBD and BPJ) were not statistically significant (**Table 6-4**).

Phytoplankton biomass will continue to be monitored for potential temporal trends, but no follow-up measures other than routine monitoring is recommended for 2022.

6.5 Sediment Chemistry

Baker Lake has multiple confounding influences with potential to affect water quality (including potential inputs from the hamlet of Baker Lake's sewage lagoons and landfill, which are situated in a watershed that discharges seasonally into Baker Lake between BBD and BPJ). Shipping-related influence on concentrations of metals in sediment would be limited to ship propeller wash disturbing bottom sediments and possibly from introducing contaminants (e.g., discharges, leaks, or spills). In 2021, there were two spills to water. There was also a spill of petroleum product from the Baker Lake Tank Farm, though it is uncertain whether it reached Baker Lake.

Sediment grab chemistry data were collected from BAP, BES, BPJ, and BBD at the same time the benthic invertebrate samples were taken. Five replicate grab samples were collected at each area (**Figure 6-1**), however, the sediment samples collected in 2021 were not analyzed due to an oversight by the laboratory during sample receipt. For more information regarding the laboratory error see **Appendix A**. Results for Baker Lake sediment core and grab samples collected in 2020 are provided in the 2020 CREMP report (Azimuth, 2021).

6.6 Benthos Community

6.6.1 General Observations

Benthic invertebrates have been collected from Baker Lake annually in August since 2008. Baker Lake monitoring was added to the core program to ensure that mining activities in that area related primarily to barge traffic and shipping were tracked. There are two near-field impact areas, one targeting the hamlet's barge landing area (BBD) and the other Agnico's fuel storage facility (BPJ). The initial (since 2008) reference area (BAP) is several kilometers to the east of the hamlet along the north shore of the lake, a second reference area (BES) was added in 2011 to provide a broader perspective for temporal patterns in benthic community structure (**Figure 6-1**).

Abundance and species composition of benthic invertebrate communities at Baker Lake are strongly affected by various parameters, including grain size, water depth, and sediment organic content (as discussed for the Meadowbank lakes in **Section 4.6.1**). Investigations in the Meadowbank study lakes and Baker Lake have targeted habitats of similar depth and grain size (i.e., dominated by silt/clay with a small [<5%] sand fraction). Unlike the Meadowbank study lakes, sediment grain size in Baker Lake has tended to be more variable and less predictable at all locations, with consistently coarser grain size (due to more sand) than Meadowbank lakes (see the 2021 results in **Appendix E3** as an example of the variability within and between areas). Higher sand content is typically associated with a lower TOC concentration, which in turn influences the type of benthic community.

Like Meadowbank study lakes, the Baker Lake benthic community is characterized by relatively low abundance and taxa richness, although benthic invertebrate community abundance at Baker Lake often exceeds 2,000 organisms/m^2 (**Figure 6-59**), which is higher than typically-reported abundance at the Meadowbank study area lakes (**Figure 4-75**). Annual variability is sometimes high, as seen at BBD (e.g., from 2008 to 2009). There have also been consistent spatial differences in abundance between areas (e.g., BBD and BPJ have generally had lower abundance than BAP). Taxa richness historically ranged from 5–19 in exposure areas and from 15–22 in reference areas, although considerable within-area variability in taxa richness has been documented, particularly at the exposure areas BBD and BPJ (e.g., **Figure 6-62** and **Figure 6-63**).

The benthic invertebrate community in Baker Lake is dominated by the aquatic larval stages of insects, especially chironomids (family Chironomidae), both in terms of abundance (**Figure 6-59** to **Figure 6-61**) and taxa richness (**Figure 6-62** to **Figure 6-64**). The next most abundant group is typically Mollusca (clams) especially, *Cyclocalyx/Neopisidium*, genera of the family Sphaeriidae (fingernail clams). Oligochaete worms can also be relatively abundant in the lake sediments, possibly because of higher sand content; generally, at least one oligochaete taxon was present for most area/year combinations.

6.6.2 Temporal and Spatial Trends

Benthic invertebrate abundance and richness results from 2021 are tabulated in **Appendix E3**. Details regarding historical trends are discussed in the 2011 CREMP (Azimuth, 2012a). The 2021 report focuses on recent results and on trends over the last four years. Statistical test results for abundance and richness are presented in **Table 6-5** and **Table 6-6**, respectively. Note that because sampling started in 2008 after development-related activities started, there is no true *before* period, and a series of BACI tests are run that compare *control* and *impact* areas over a range of *after* periods (see **Section 2.3.3** for more details). Key results are described below:

- **Total abundance** – Mean 2021 abundance increased at Baker Lake areas BAP, BBD, and BPJ, but decreased at reference area BES compared to 2020 (**Figure 6-59**). Overall, there are no obvious temporal trends in total abundance at *impact* areas BBD and BPJ, and none of the BACI *after* period groupings showed statistically significant changes had occurred at the *impact* areas (**Table 6-5**). Similar to 2020, while the results were not statistically significant, the effect sizes for abundance at both BBD and BPJ in 2021 were close to 100% relative to *before/reference* conditions (**Table 6-5**) and this trend is apparent in the 2020-2021 time period. The effect sizes for abundance at both BBD and BPJ in the 2019-21 and 2018-21 time periods were all higher than 100% relative to *before/reference* conditions. These results are likely an artefact of natural variability, with the mean abundance in 2021 ranked third and fourth highest across years at BBD and BPJ, respectively. The conclusion that the variability is natural is corroborated by the taxa richness results (**Figure 6-59**), which showed a consistent benthic invertebrate taxa diversity compared to the past five years that were all within the historical range (including at reference area BES).
- **Abundance of Major taxa** – As discussed previously, the benthic invertebrate communities at reference and impact areas in Baker Lake are comprised primarily of chironomid larvae. However, the relative proportion of different taxa is markedly different for the impact areas BBD and BPJ compared to reference area BAP (apart from 2008; **Figure 6-60** and **Figure 6-61**). Since 2009, approximately 25 to 60% of individuals at BAP have been oligochaetes, compared to less than 10% at the impact areas and reference area BES (which was added in 2011 to provide a reference area with more similar characteristics to the exposure areas). As was the case in recent years, the dominant oligochaete taxa in terms of density at BAP in 2021 were from the Naididae subfamilies Rhyacodrilinae (*Rhyacodrilus sp*) and Tubificinae (see **Appendix E3**). *Rhyacodrilus sp* were identified in at least three replicate samples from BES, BBD, and BPJ, but at lower abundances. The differences observed in major taxa composition between the two reference areas, and likely both NF areas, appear to be completely natural.

- **Taxa richness** – Mean taxa richness in 2021 was higher than 2020 at Baker Lake impact areas BBD and BPJ and reference BAP, but lower than in 2020 at reference BES (**Figure 6-62**). The geometric mean for total richness was ranked tenth among all years for BES, and the fifth highest for BAP, BBD, and BPJ. Consequently, the BACI model results showed positive, yet uncertain (p-value>0.1) effects sizes for total richness in 2021 and the other time periods (**Table 6-6**). These trends likely reflect of natural variability in the community.

  Insects dominate the benthos the communities at the control and impact areas (**Figure 6-63** and **Figure 6-64**). There were no apparent trends in species composition, indicating the barge operations are not adversely affecting the community.

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

6.7 Baker Lake Tables and Figures

The tables and figures for the Baker Lake CREMP are provided in this section except for the large tabulated datasets and figures for parameters that are not included in the detailed analysis (see in-text references to appropriate Appendices). Subsections are provided for each of the CREMP components (e.g., limnology, water chemistry, phytoplankton, and benthos).

In 2021, a batch of sediment samples were not analyzed due to a sample receipt error by the laboratory. As such, we did not receive any of the results for sediment collected at Baker Lake study areas. For more information see **Appendix A**.

Legend

- Water Sampling Point
- Sediment/Benthic Invertebrate Quality Sampling Station
- All-Weather Access Road
- Whale Tail Haul 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 6-1. Baker Lake – water, sediment, and benthic invertebrate sampling areas, 2021

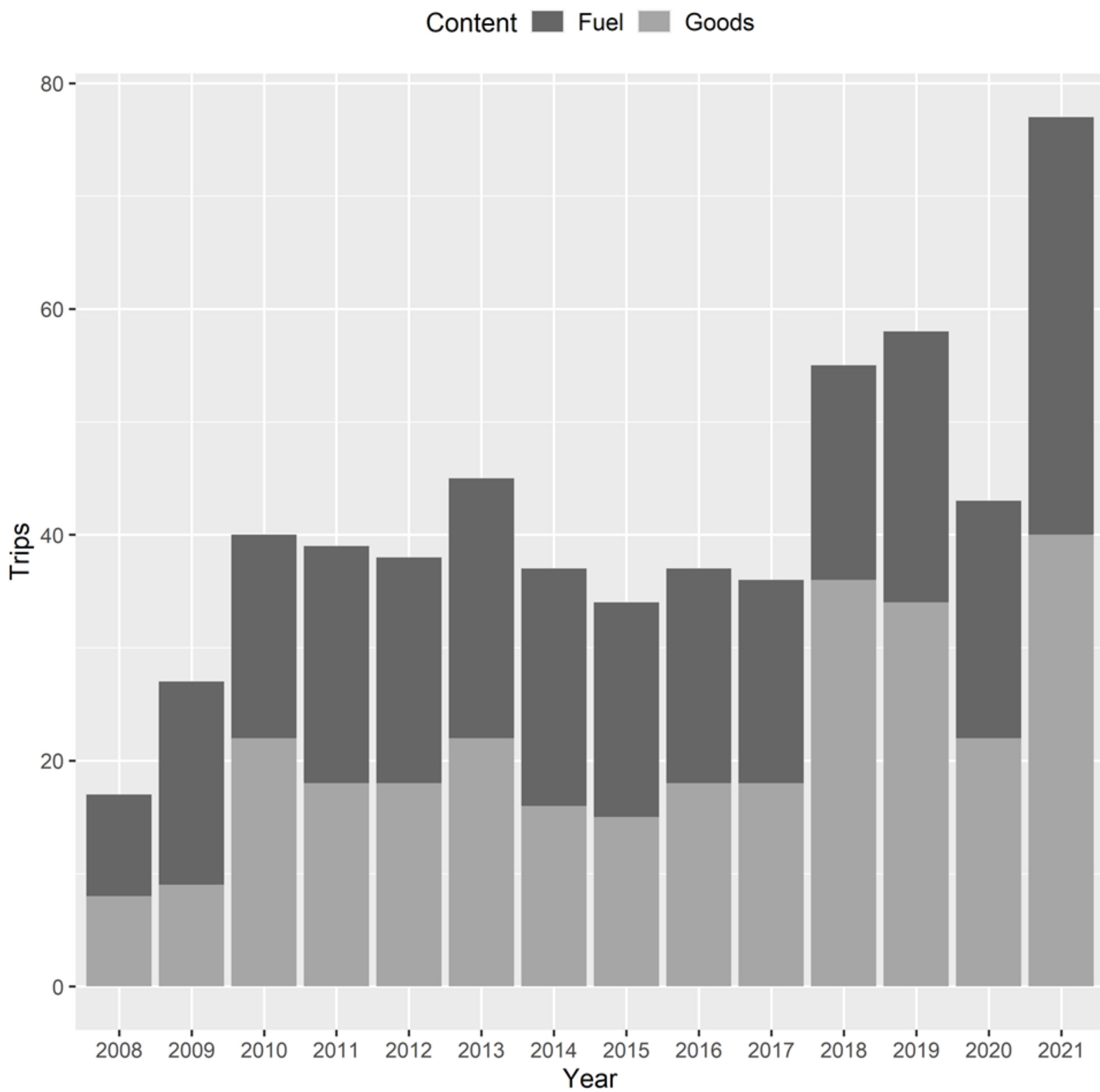
Meadowbank Gold Project

Prepared for: AGNICO EAGLE

By: CASLYS CONSULTING

February 2022

Figure 6-2. Baker Lake barge traffic from Chesterfield Inlet since 2008.



Limnology Tables and Figures

Figure 6-3. Mean monthly field-measured temperature (°C) at 3 m depth since 2008, Baker Lake.

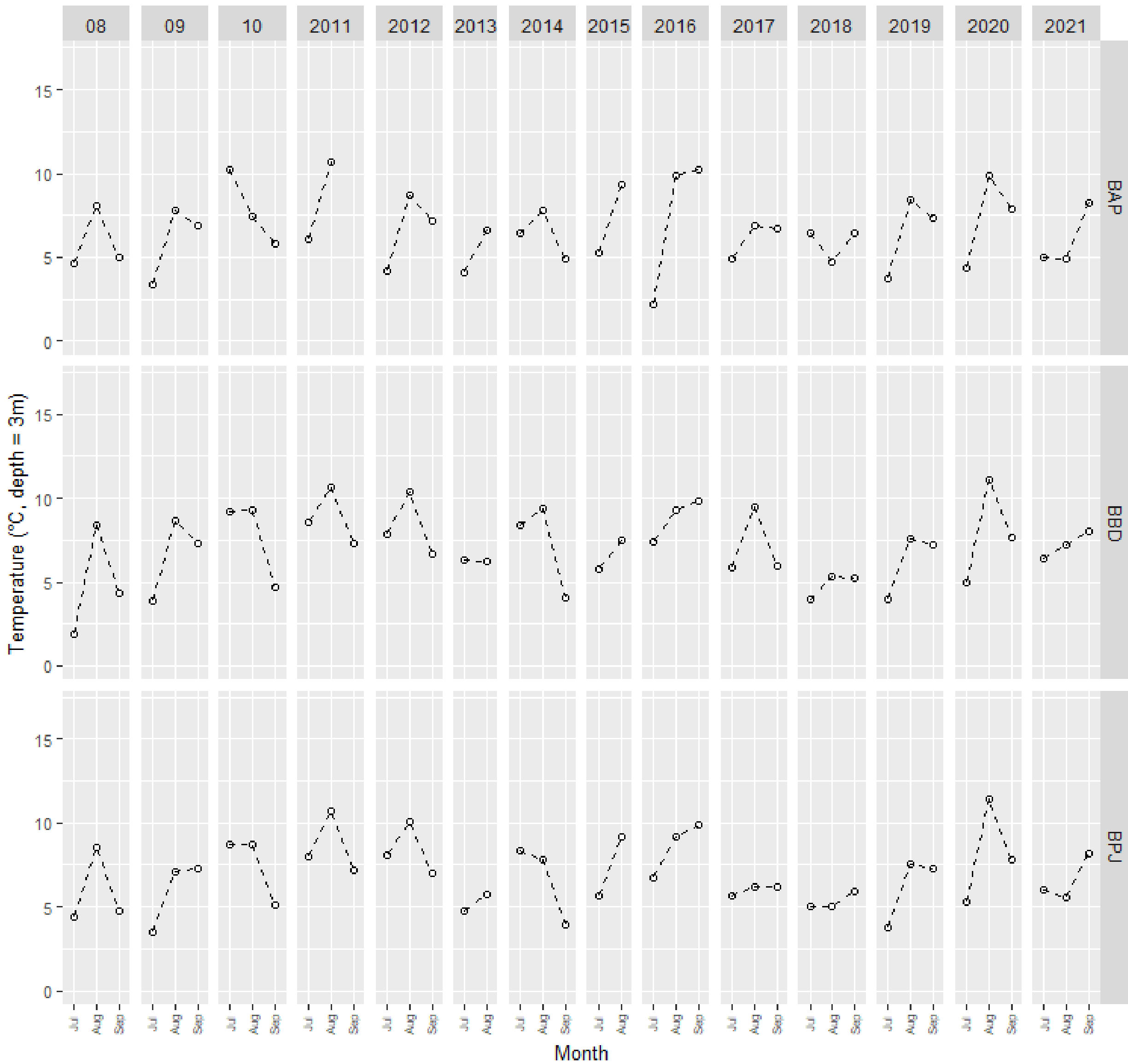
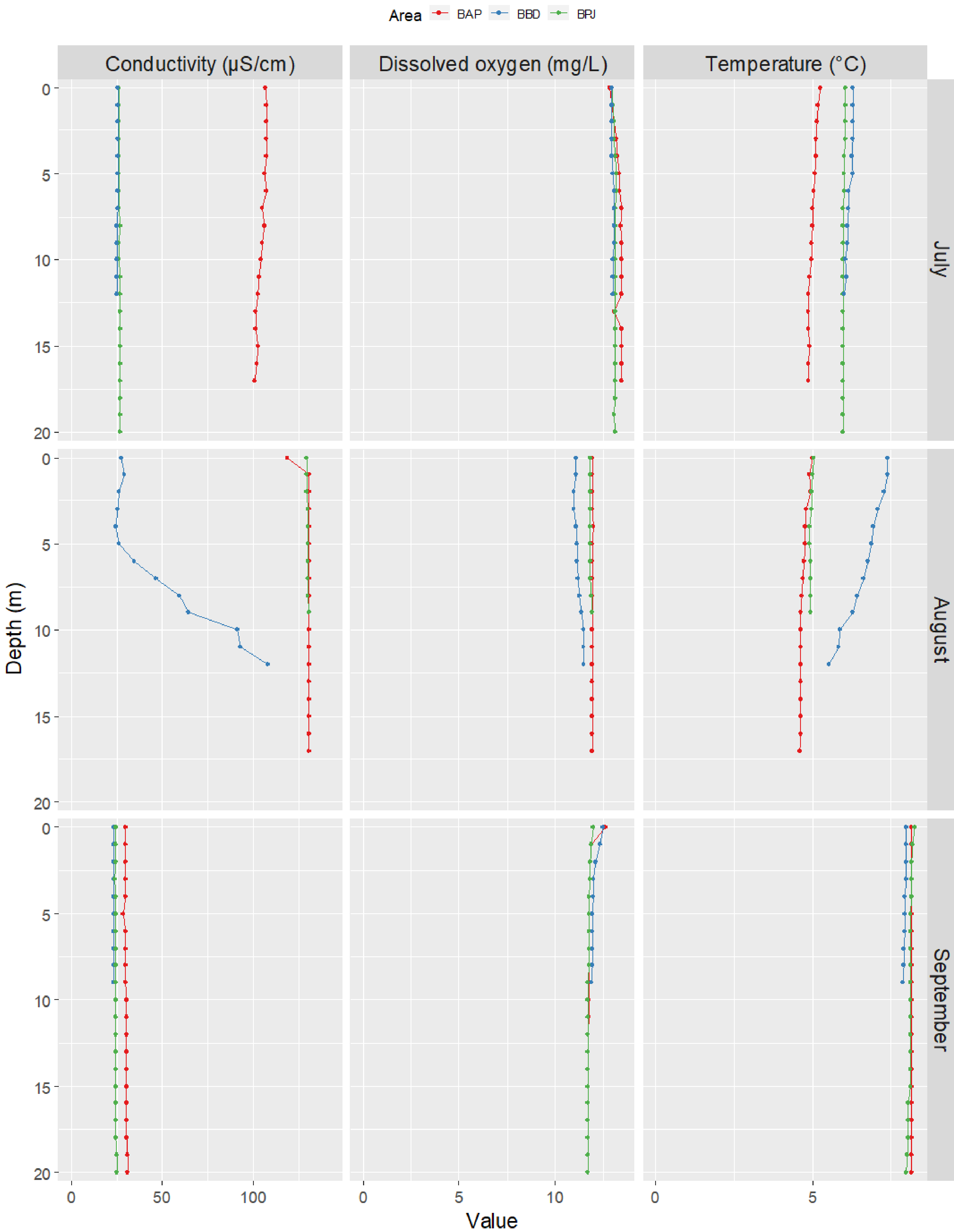


Figure 6-4. Baker Lake – Field-measured conductivity, dissolved oxygen, and temperature profiles, 2021.

Note: Only the field measured values up to 20 m depth shown in figure.



Water Chemistry Tables and Figures

Table 6-1. Screening process for water quality parameters, Baker Lake, 2021.

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 6-5		Aluminum	Figure 6-24		Aluminum	Figure 6-42	
Hardness	Figure 6-6		Antimony*	No	No	Antimony*	No	No
pH-Field	Figure 6-7		Arsenic	Figure 6-25		Arsenic	Figure 6-43	
pH-Lab	Figure 6-8		Barium	Figure 6-26		Barium	Figure 6-44	
TSS	Figure 6-9		Beryllium*	No	No	Beryllium*	No	No
TDS	Figure 6-10		Boron	Figure 6-27		Boron	Figure 6-45	
B-Alkalinity	Figure 6-11		Cadmium*	No	No	Cadmium*	No	No
C-Alkalinity*	No	No	Calcium	Figure 6-28		Chromium*	No	No
T-Alkalinity	Figure 6-12		Chromium	Figure 6-29		Copper	Figure 6-46	
Ammonia-N	Figure 6-13		Copper	Figure 6-30		Iron	Figure 6-47	
Chloride	Figure 6-14		Iron	Figure 6-31		Lead*	No	No
Fluoride	Figure 6-15		Lead*	No	No	Lithium	Figure 6-48	
Nitrate-N	Figure 6-16		Lithium	Figure 6-32		Manganese	Figure 6-49	
Nitrite-N*	No	No	Magnesium	Figure 6-33		Mercury*	No	No
TKN	Figure 6-17		Manganese	Figure 6-34		Molybdenum	Figure 6-50	
T-Phosphorous	Figure 6-18		Mercury*	No	No	Nickel*	No	No
Ortho-phosphate	Figure 6-19		Molybdenum	Figure 6-35		Selenium*	No	No
Reactive Silica	Figure 6-20		Nickel*	No	No	Silicon	Figure 6-51	
Sulphate	Figure 6-21		Potassium	Figure 6-36		Silver	No	No
DOC	Figure 6-22		Selenium*	No	No	Strontium	Figure 6-52	
TOC	Figure 6-23		Silicon	Figure 6-37		Thallium*	No	No
T-Cyanide*	No	No	Silver*	No	No	Tin*	No	No
Free Cyanide*	No	No	Sodium	Figure 6-38		Titanium*	No	No
			Strontium	Figure 6-39		Uranium	Figure 6-53	
			Thallium*	No	No	Vanadium*	No	No
			Tin*	No	No	Zinc*	No	No
			Titanium	Figure 6-40				
			Uranium	Figure 6-41				
			Vanadium*	No	No			
			Zinc*	No	No			

Notes:
"*" Plots for these parameters are presented in **Appendix B3**.
1. See text for further detail.

Table 6-2. Water quality variables at the Bake Lake monitoring areas for which 2021 mean concentration exceeded the trigger.

Parameter	Trigger	2021 Mean		
		BAP	BBD	BPJ
		Ref	NF	NF
T. Silicon	0.28	-	0.32	-
T. Titanium	0.001	-	0.0012	-

Notes:
"-" indicates mean annual concentration was < the trigger value.

Reported mean concentrations are all in units of mg/L.

Table 6-3. Results of BACI tests for selected water variables at Baker Lake monitoring areas in 2021.

									Proportional change		
Parameter	**Test Area**	**n(B)**	**n(A)**	**Estimate**	**SE**	**F**	**DF**	**P-value[1]**	**exp(Est)**	**LCI**	**UCI**
T. Silicon	BBD	27	3	0.28	0.12	5.5	28	**0.013**	1.3	1.0	1.7
T. Titanium	BBD	36	3	0.69	0.15	20.5	37	**< 0.001**	2.0	1.5	2.7

Notes:
Bolded P-values are statistically significant < 0.05.
Test area = area compared to control (BAP).
n(B) = number of paired months in the "before" period.
n(A) = number of paired months in the "after" period (i.e., in 2021).
Estimate = BACI model estimate of the 2021 change in mean for log-transformed data.
SE = standard error of the estimate.
P-value = one-tailed test of the null hypothesis (no change or a decrease in mean [opposite for lower pH trigger]).
Exp(Est.) = estimated proportional change.
LCI = lower 95% confidence interval; UCI = upper 95% confidence interval.

Figure 6-5. Laboratory-measured conductivity (µS/cm) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake. Laboratory-measured conductivity data from 2014 should be interpreted with caution, particularly at low concentrations (see Azimuth, 2015c for details).

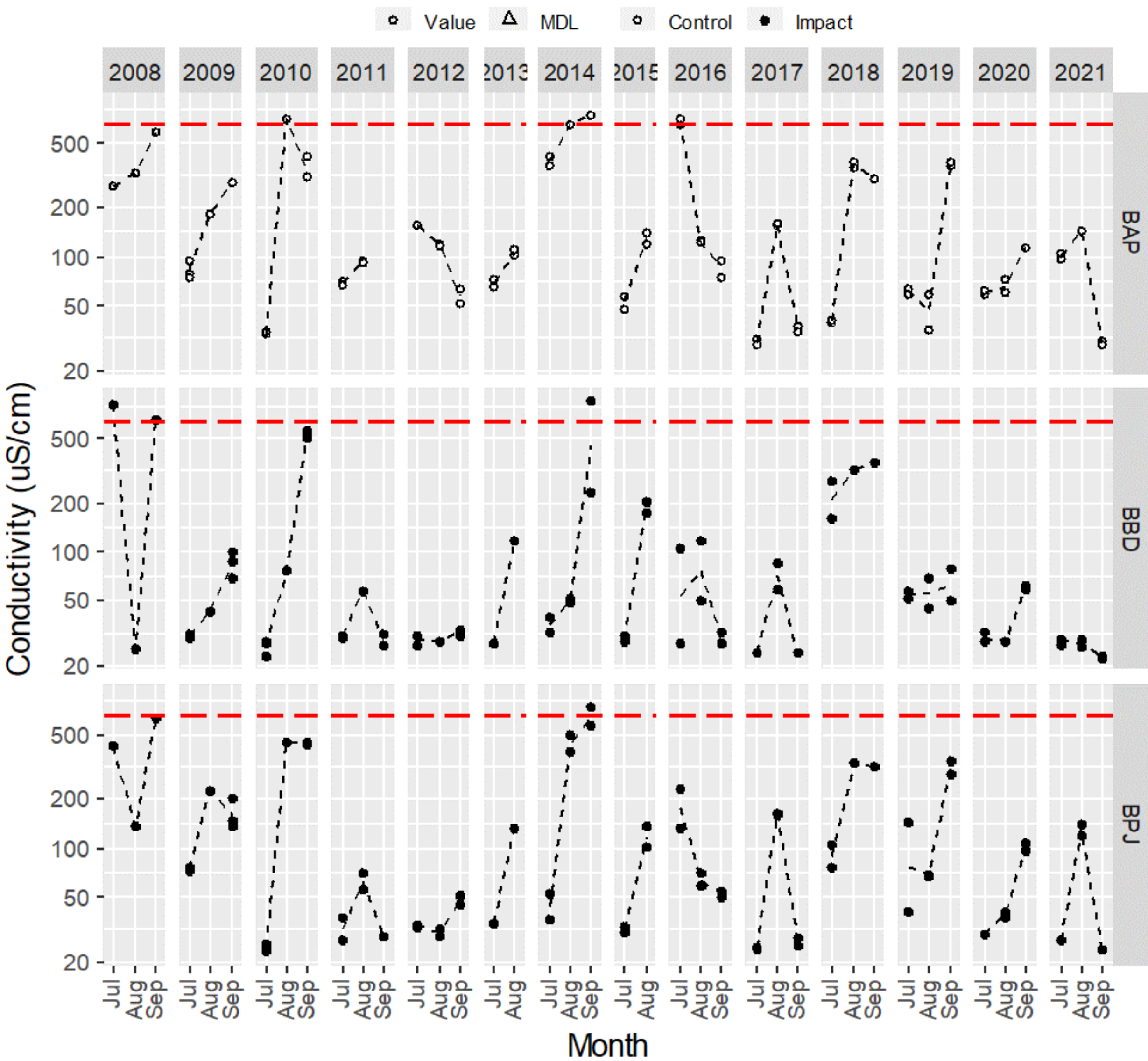


Figure 6-6. Laboratory-measured hardness (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

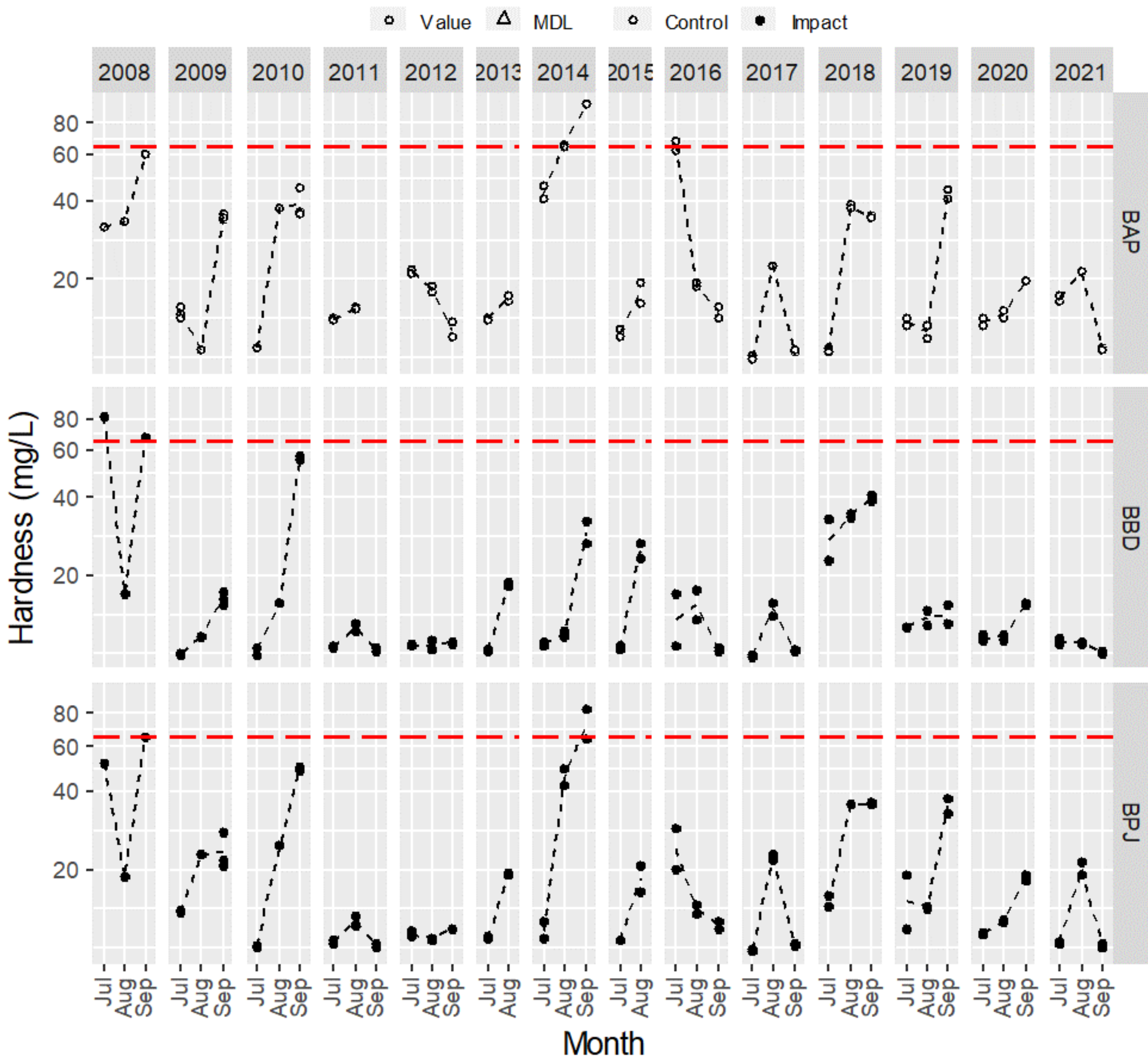


Figure 6-7. Field-measured pH in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

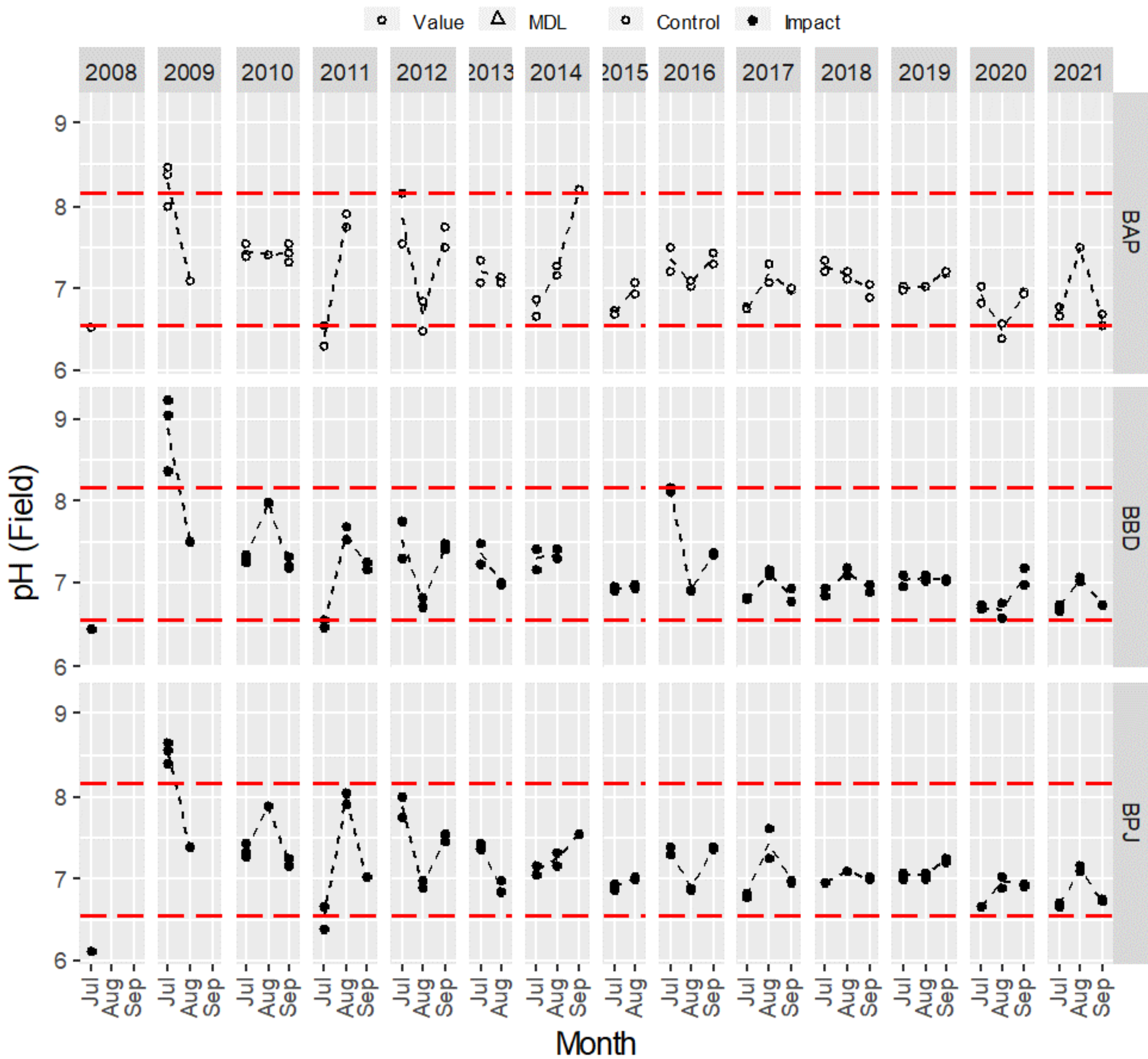


Figure 6-8. Laboratory-measured pH in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

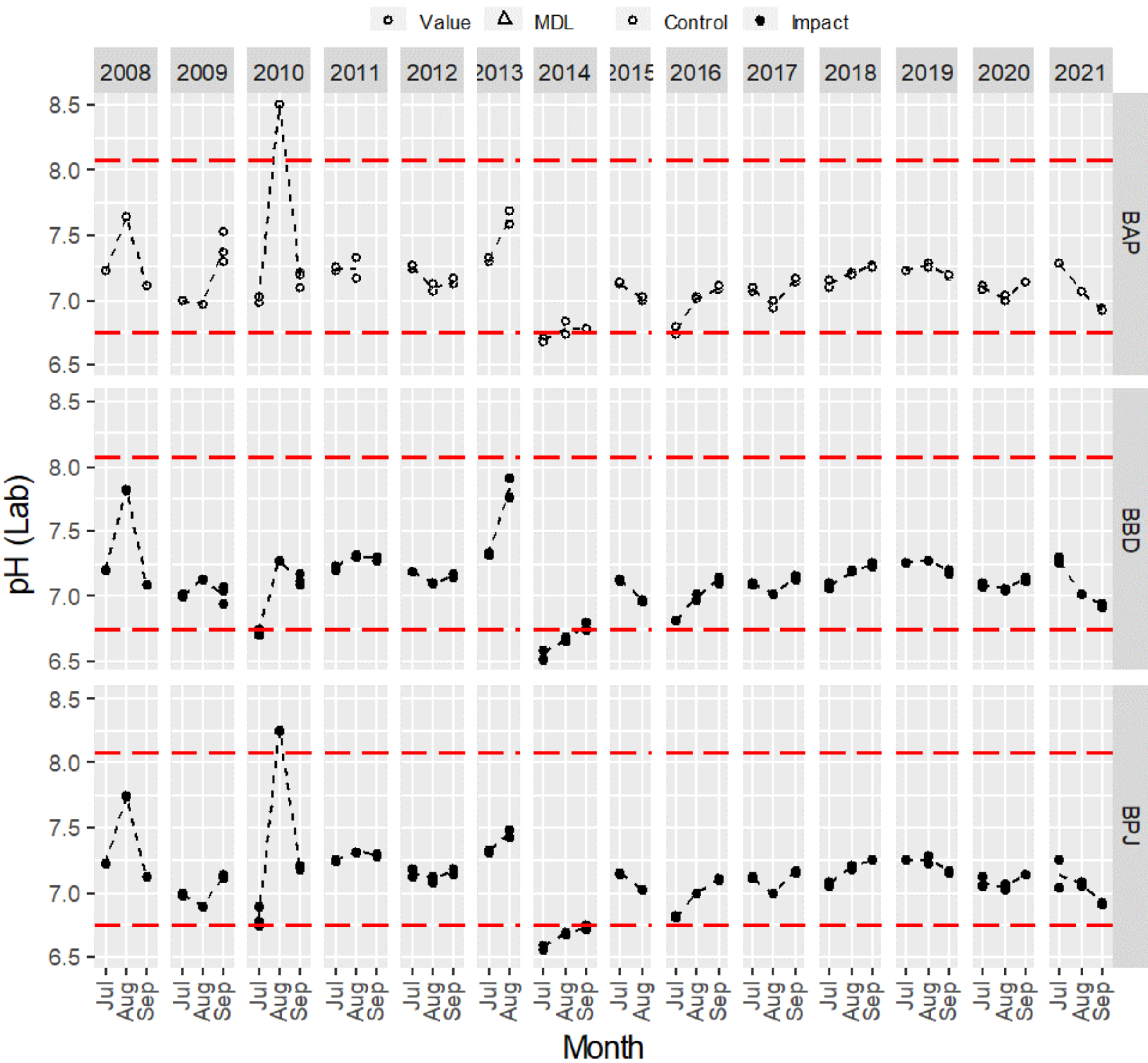


Figure 6-9. Total suspended solids (TSS; mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

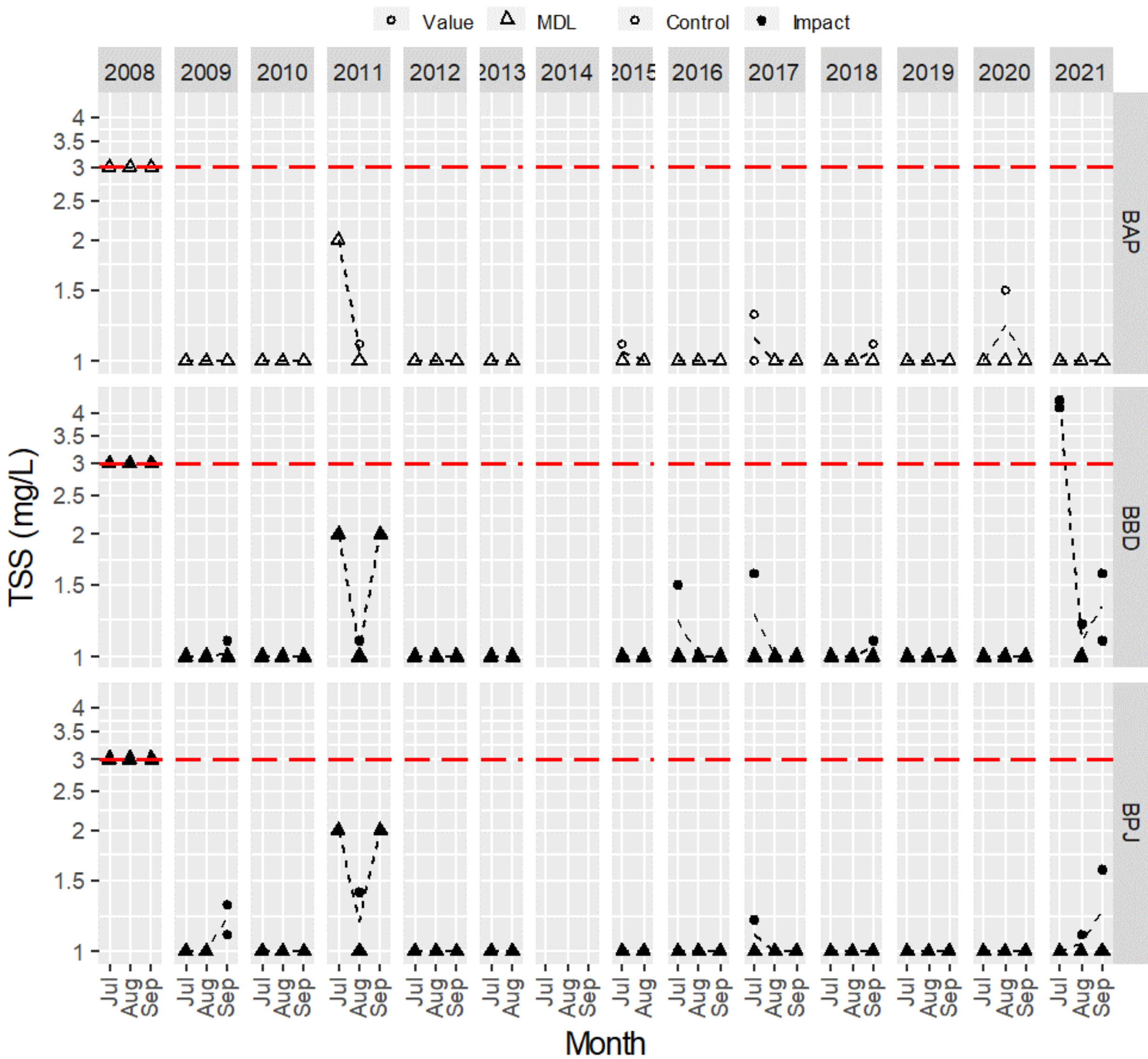


Figure 6-10. Total dissolved solids (TDS; mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

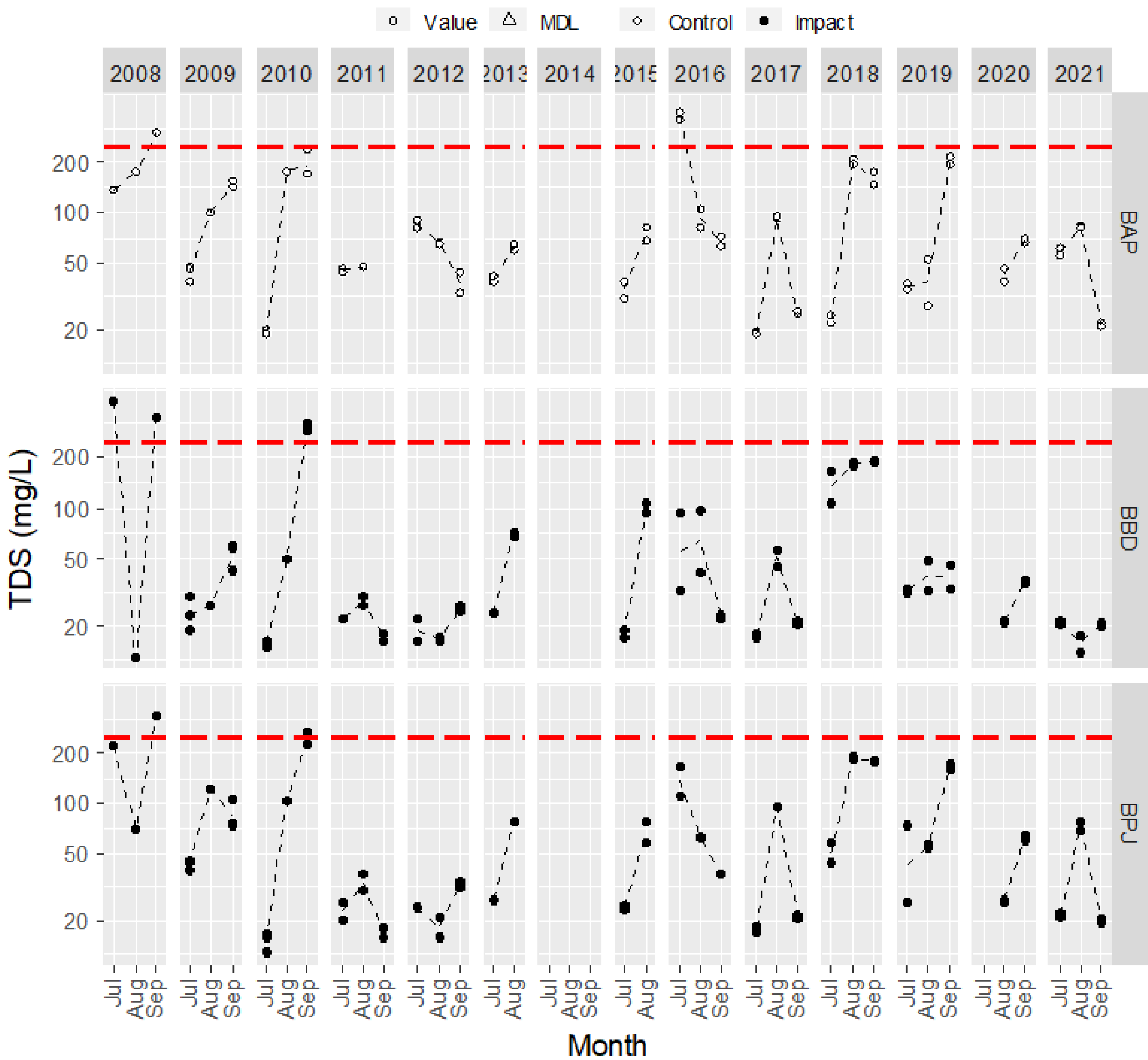


Figure 6-11. Bicarbonate-alkalinity (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

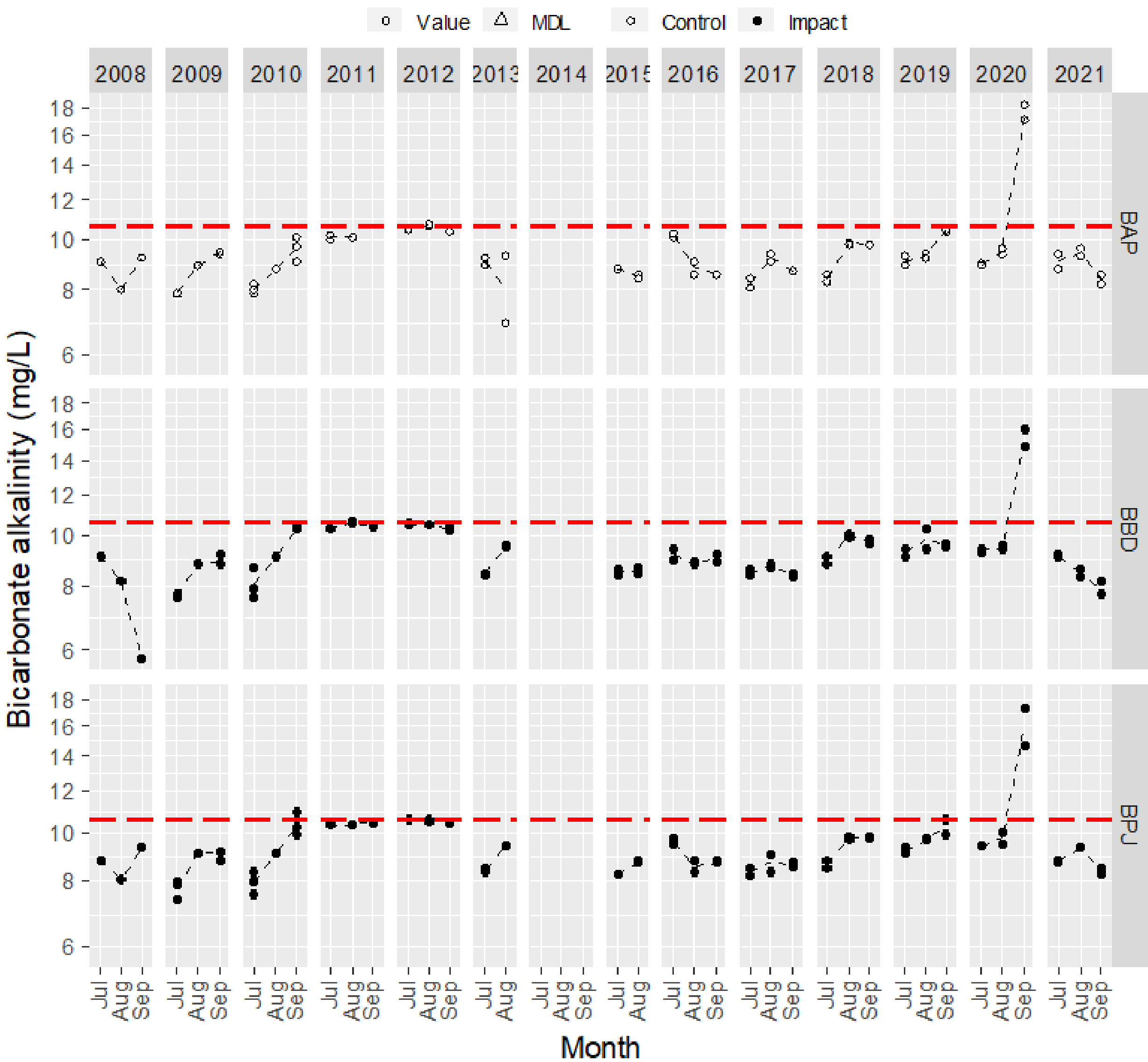


Figure 6-12. Total alkalinity (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

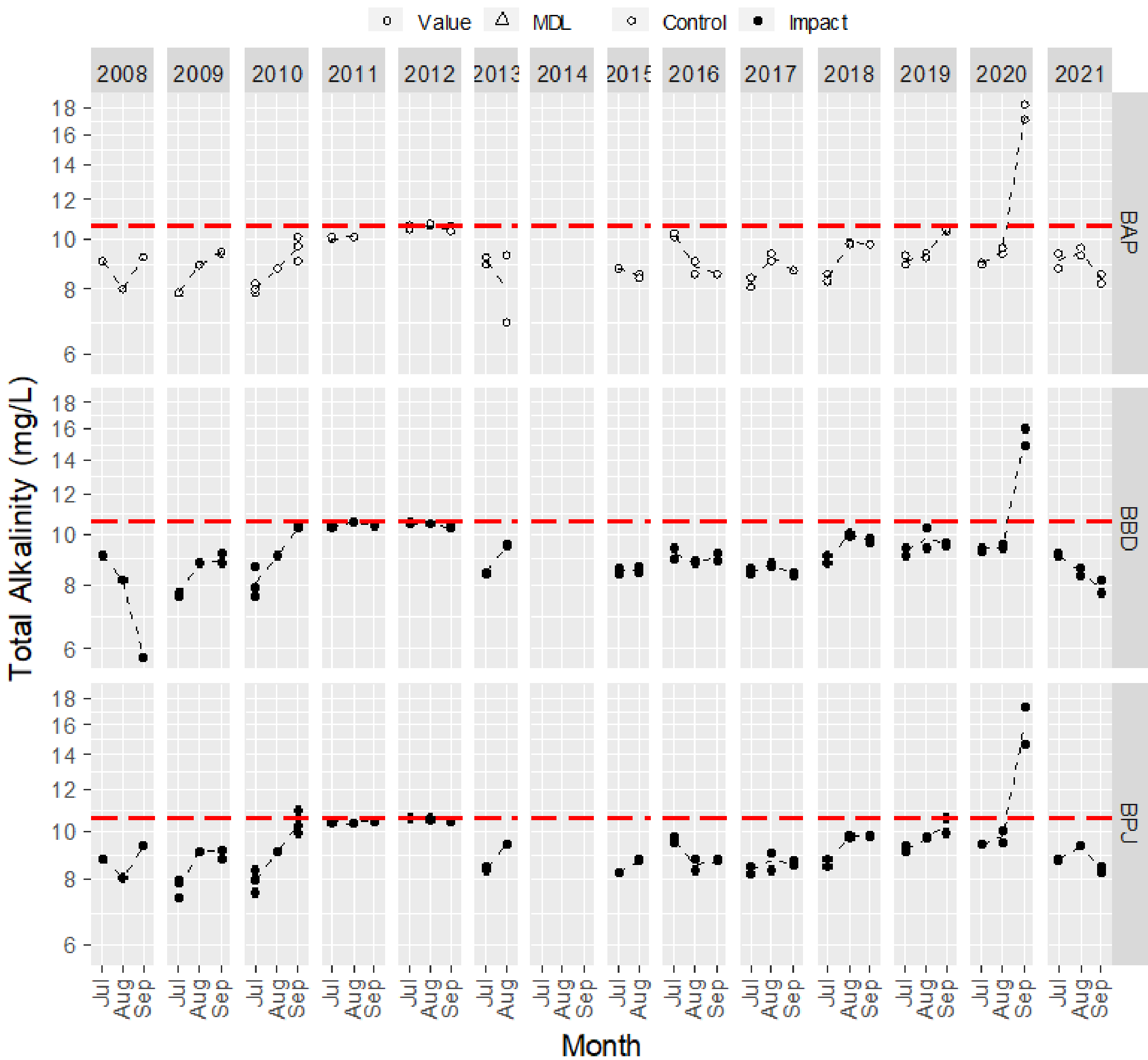


Figure 6-13. Ammonia-N (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

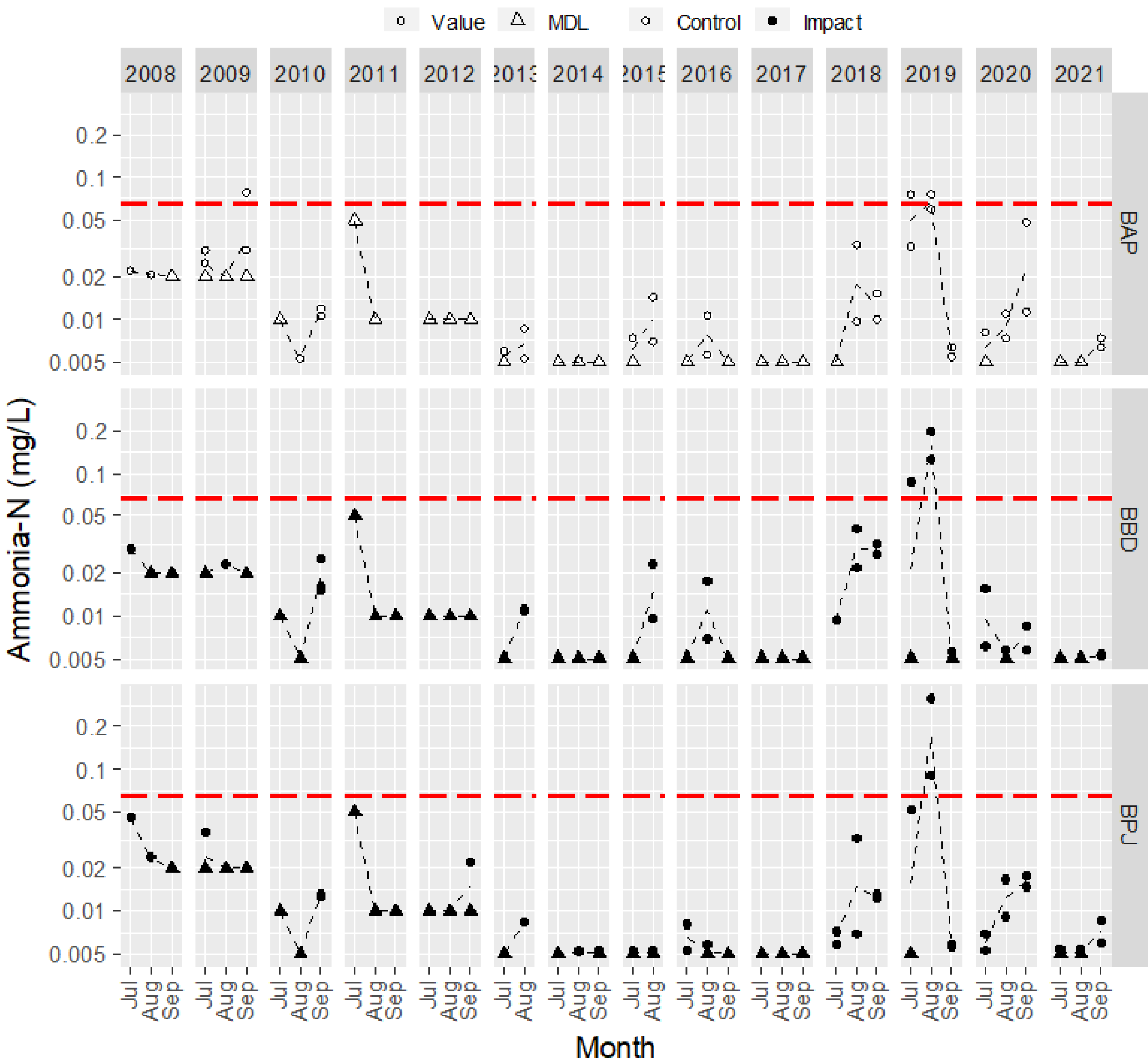


Figure 6-14. Chloride (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

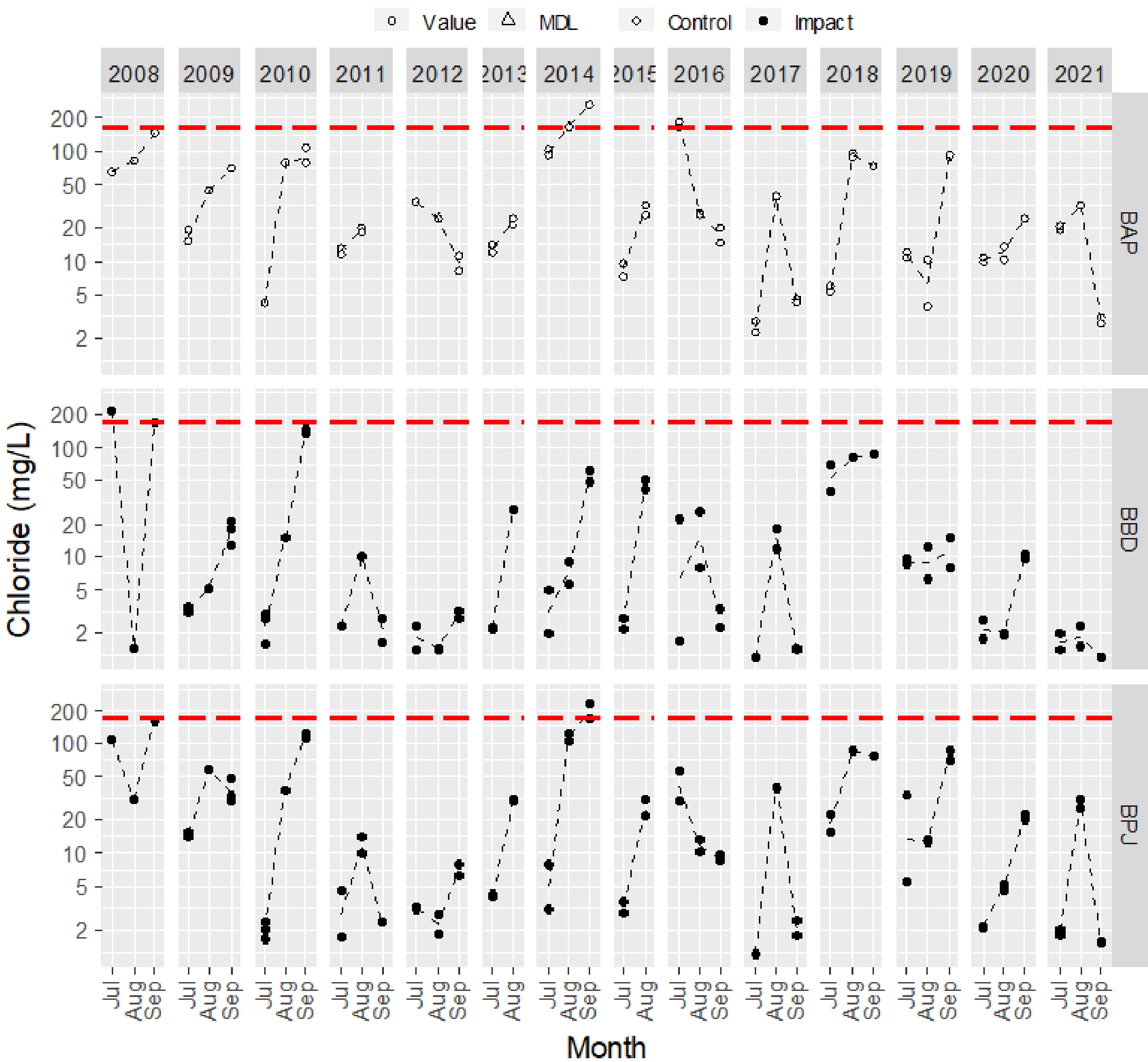


Figure 6-15. Fluoride (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

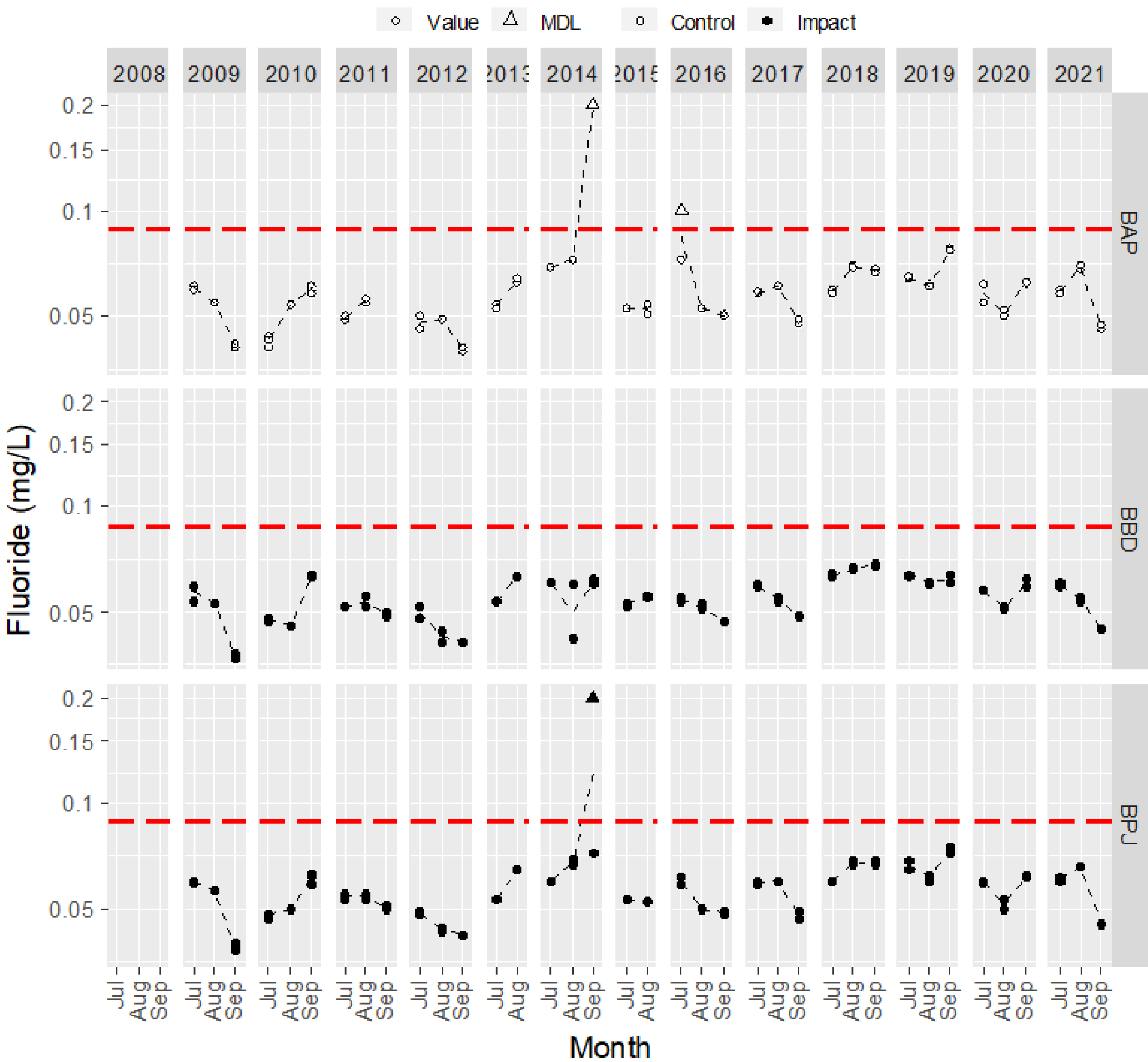


Figure 6-16. Nitrate-N (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

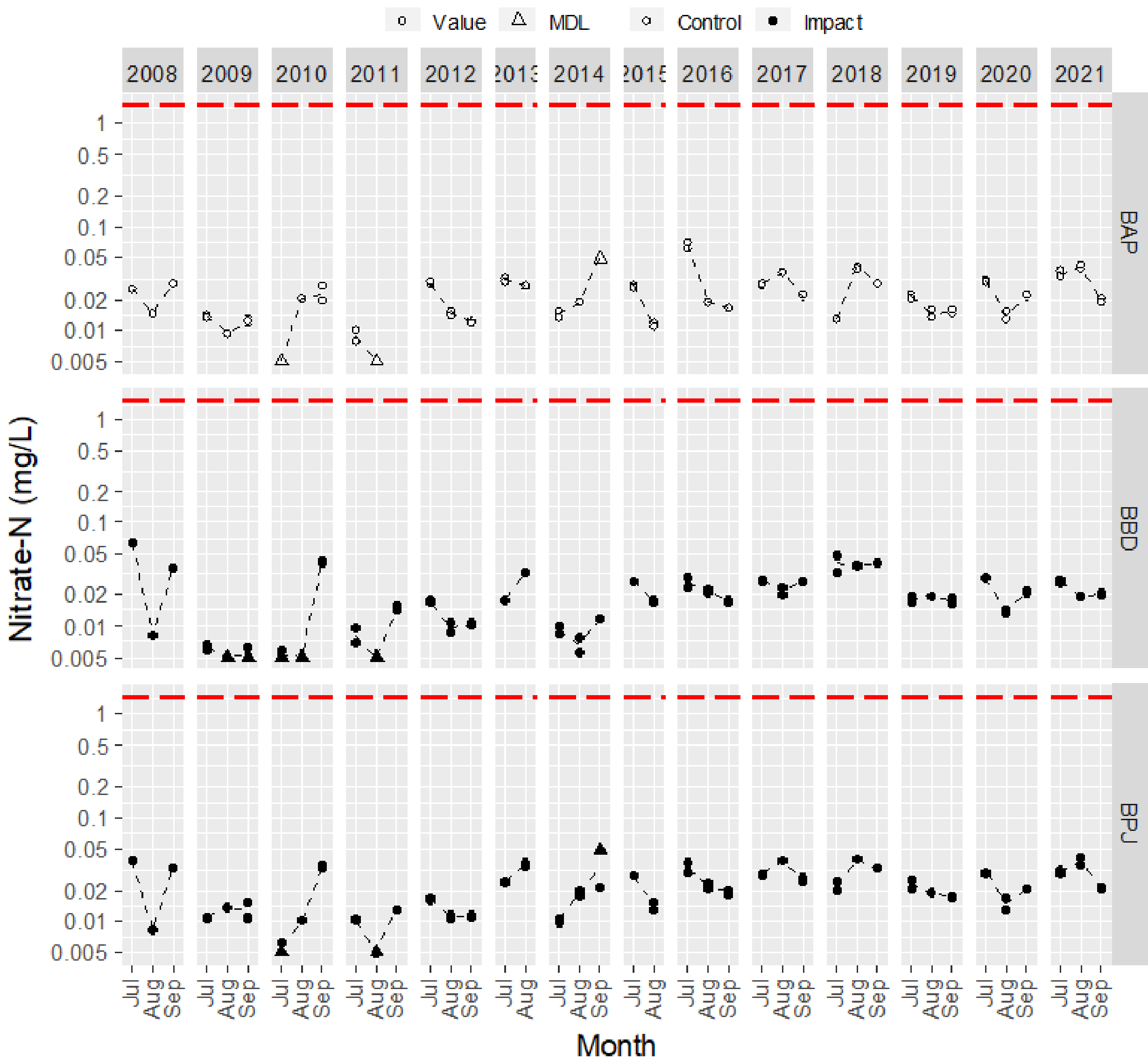


Figure 6-17. Total Kjeldahl Nitrogen (TKN; mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

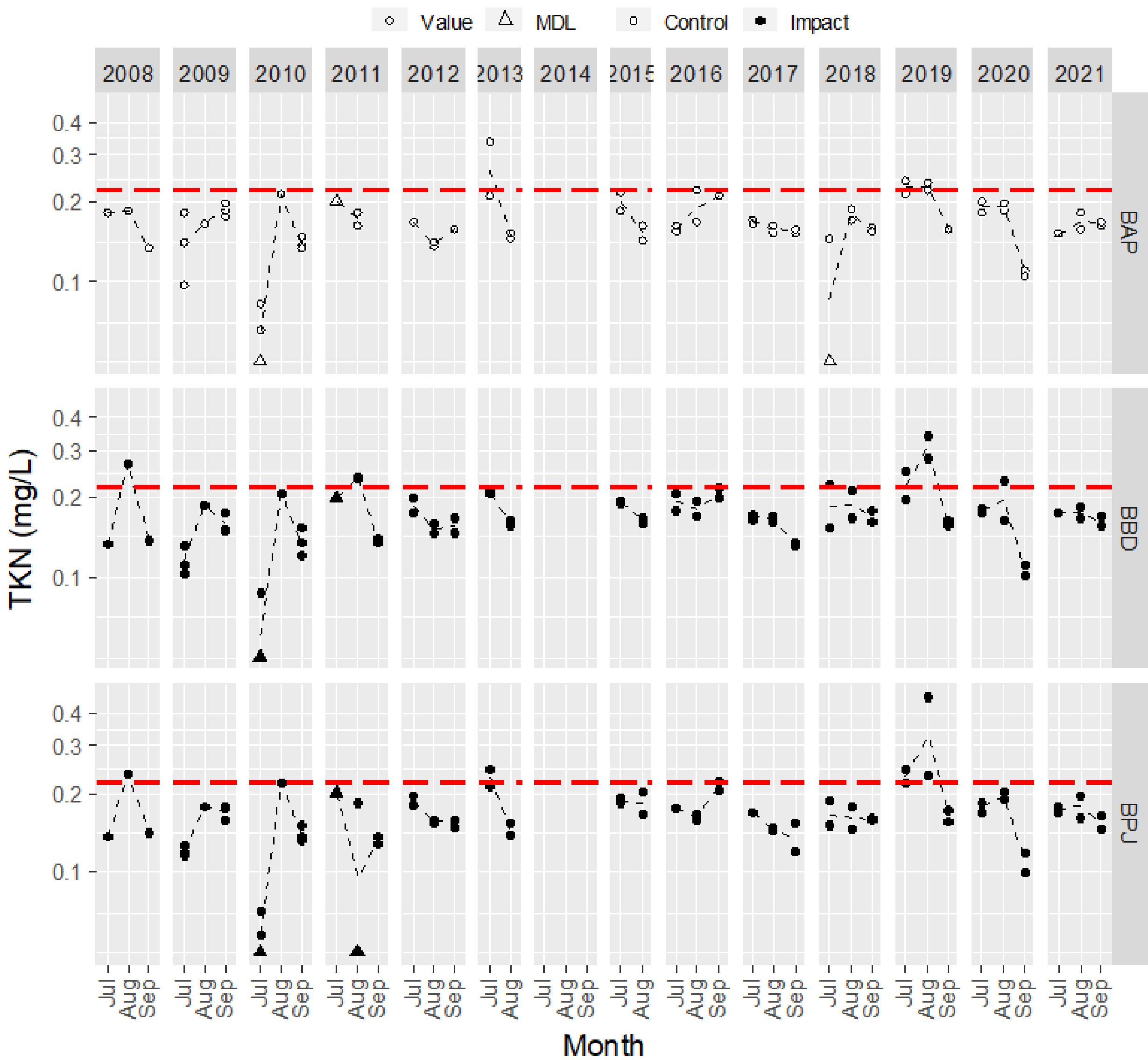


Figure 6-18. Total phosphorous (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake. The detection limit for total phosphorous was adjusted for some July 2020 samples from 0.002 mg/L to 0.010 mg/L or 0.020 mg/L.

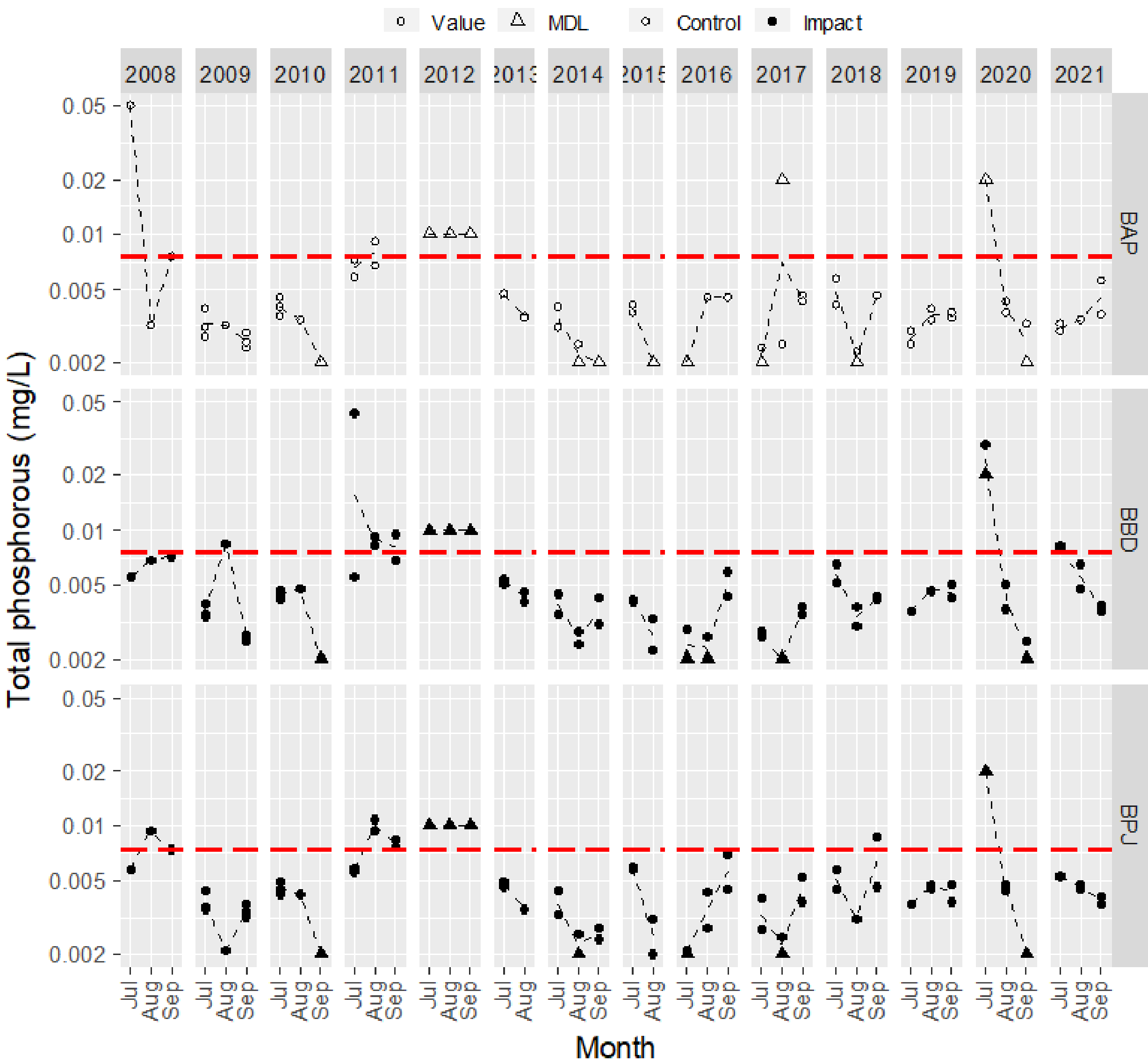


Figure 6-19. Ortho-phosphate (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

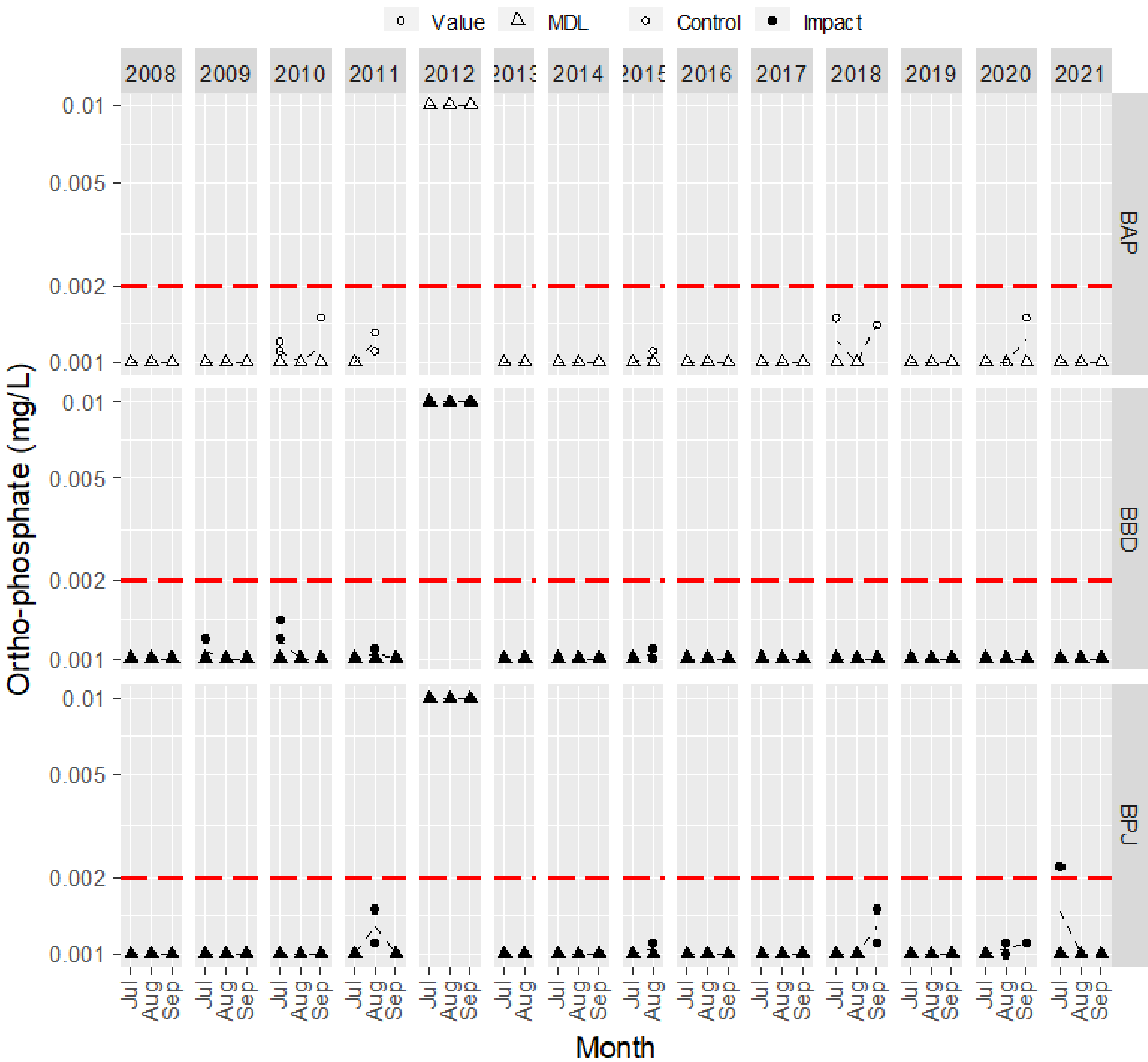


Figure 6-20. Reactive silica (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

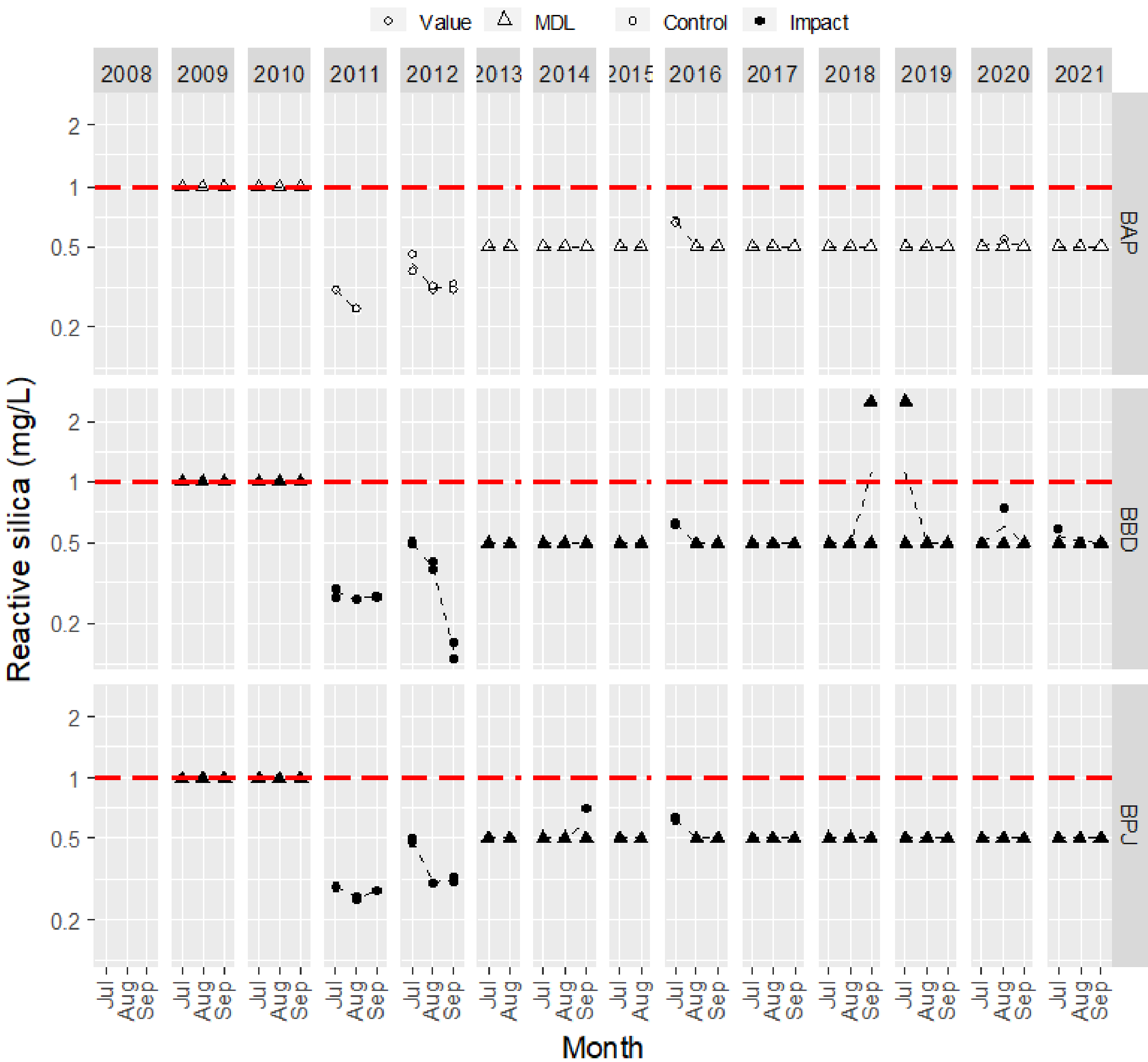


Figure 6-21. Sulphate (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

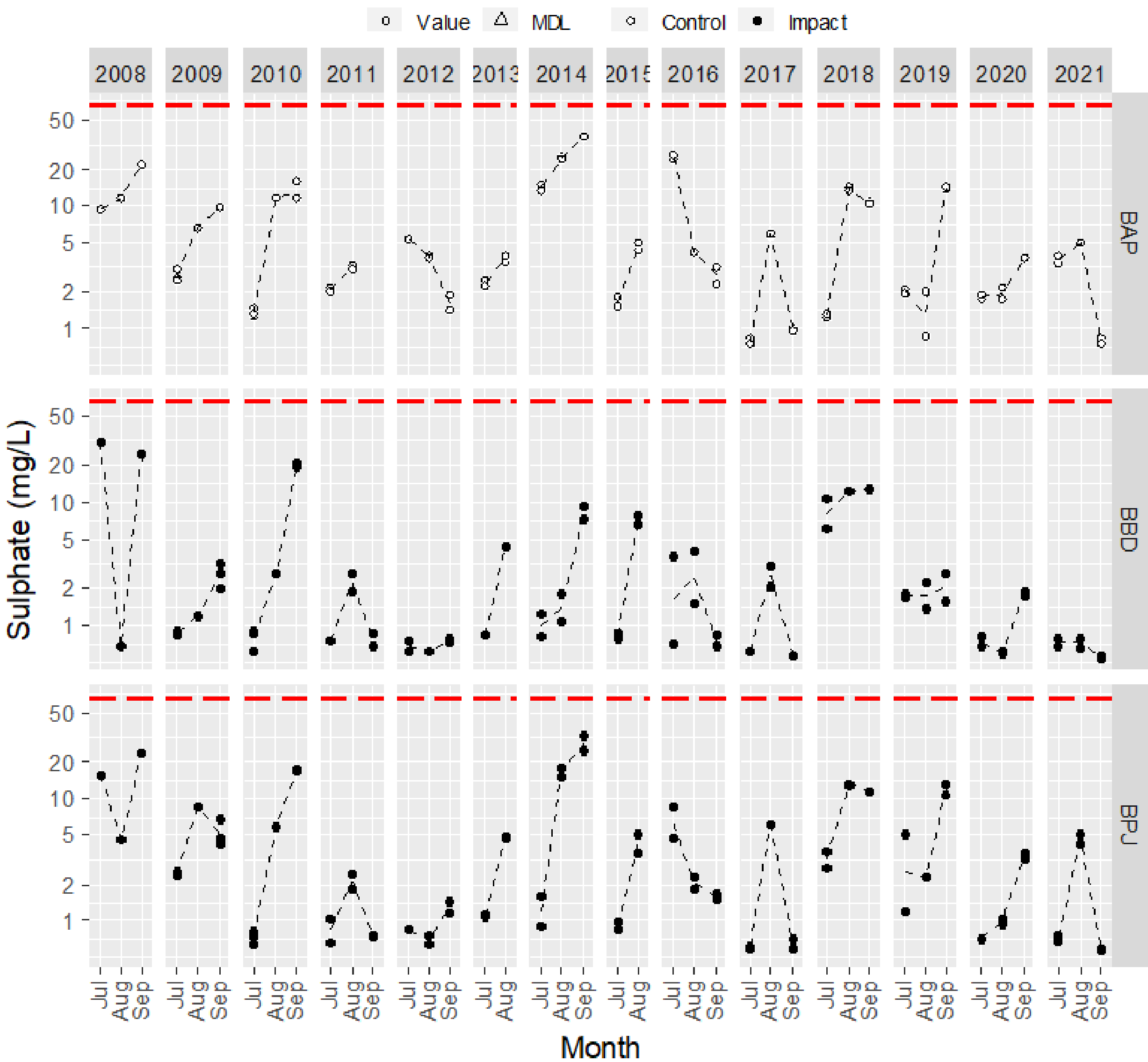


Figure 6-22. Dissolved organic carbon (DOC; mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

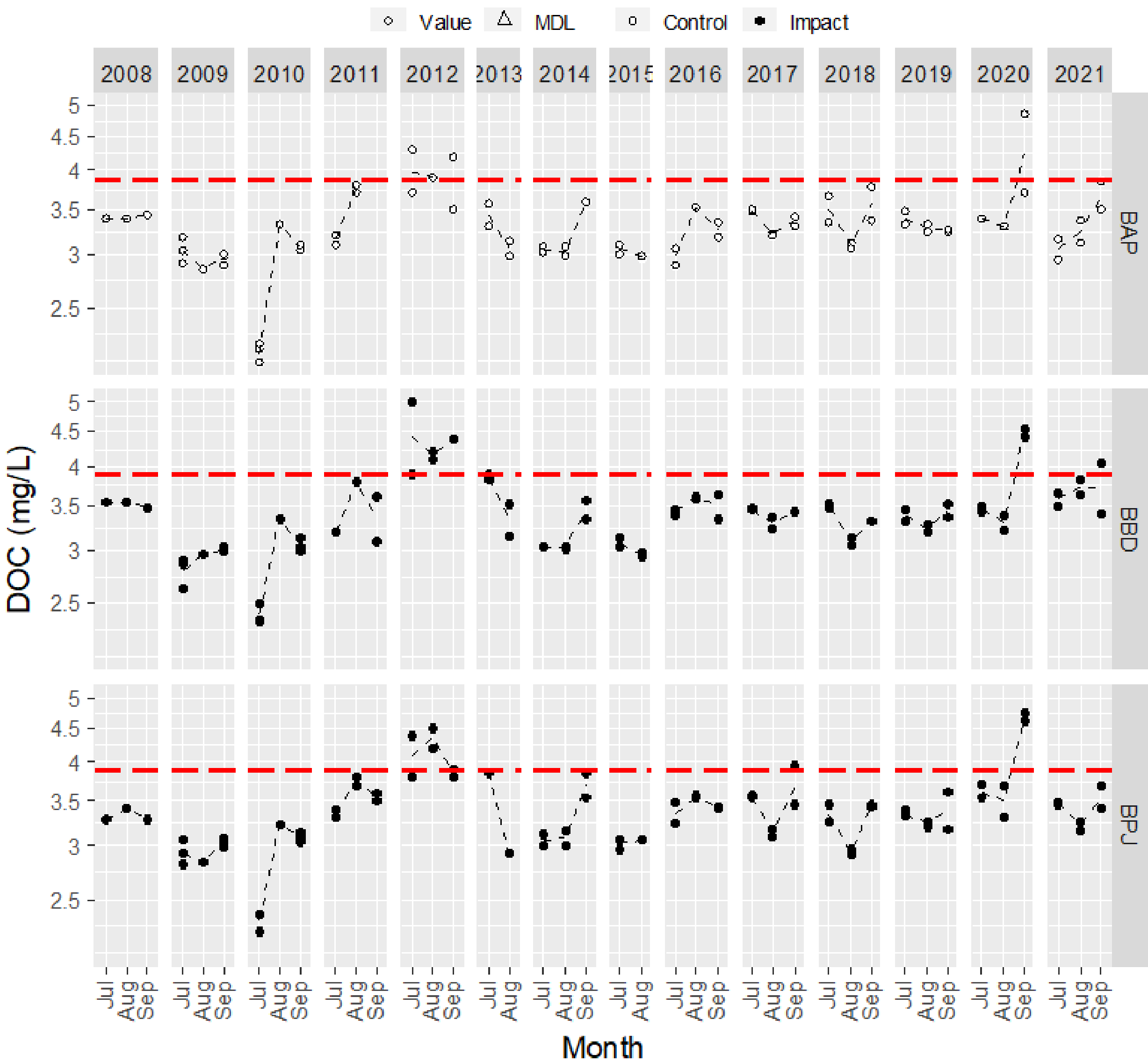


Figure 6-23. Total organic carbon (TOC; mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

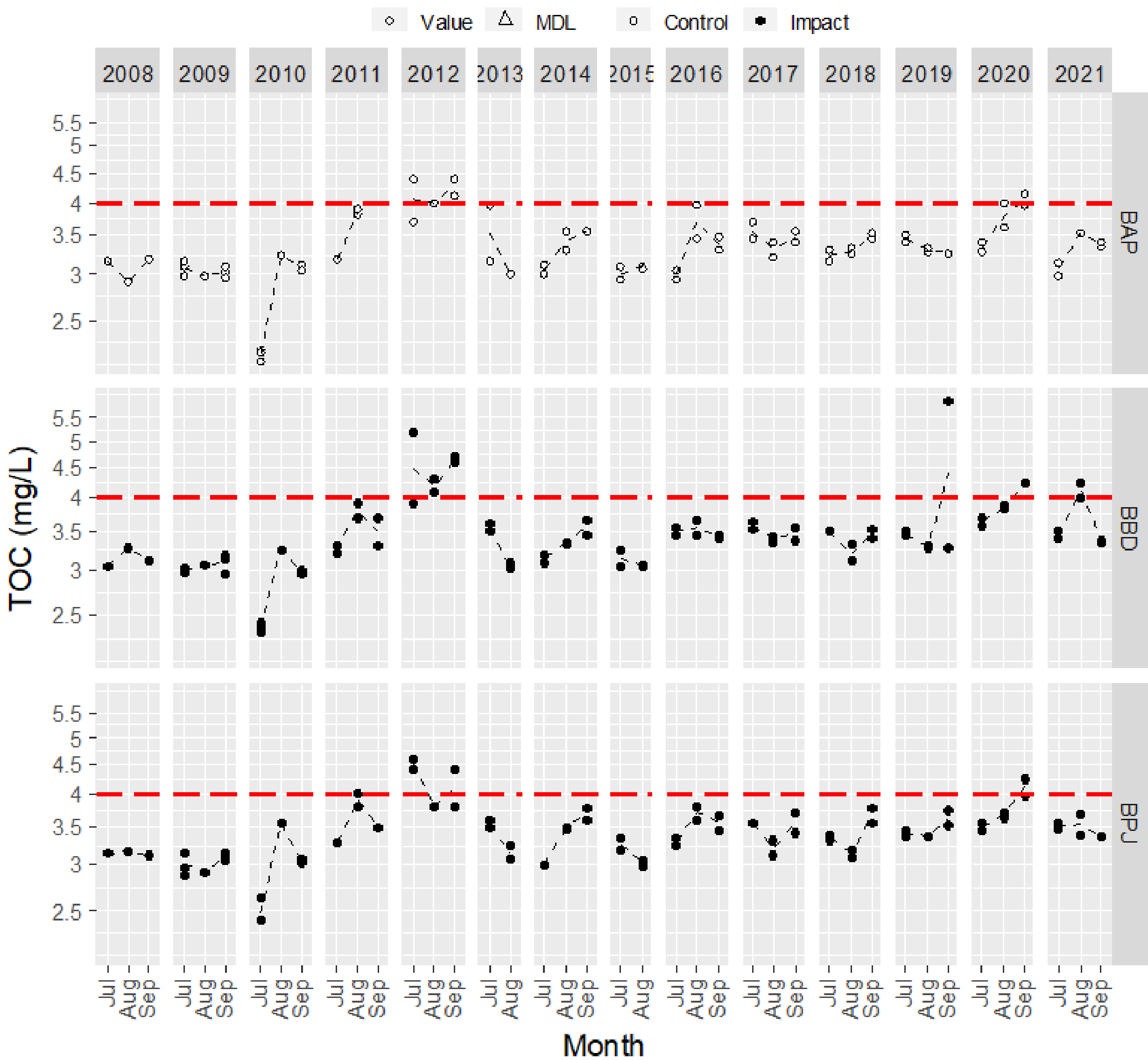


Figure 6-24. Total aluminum (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

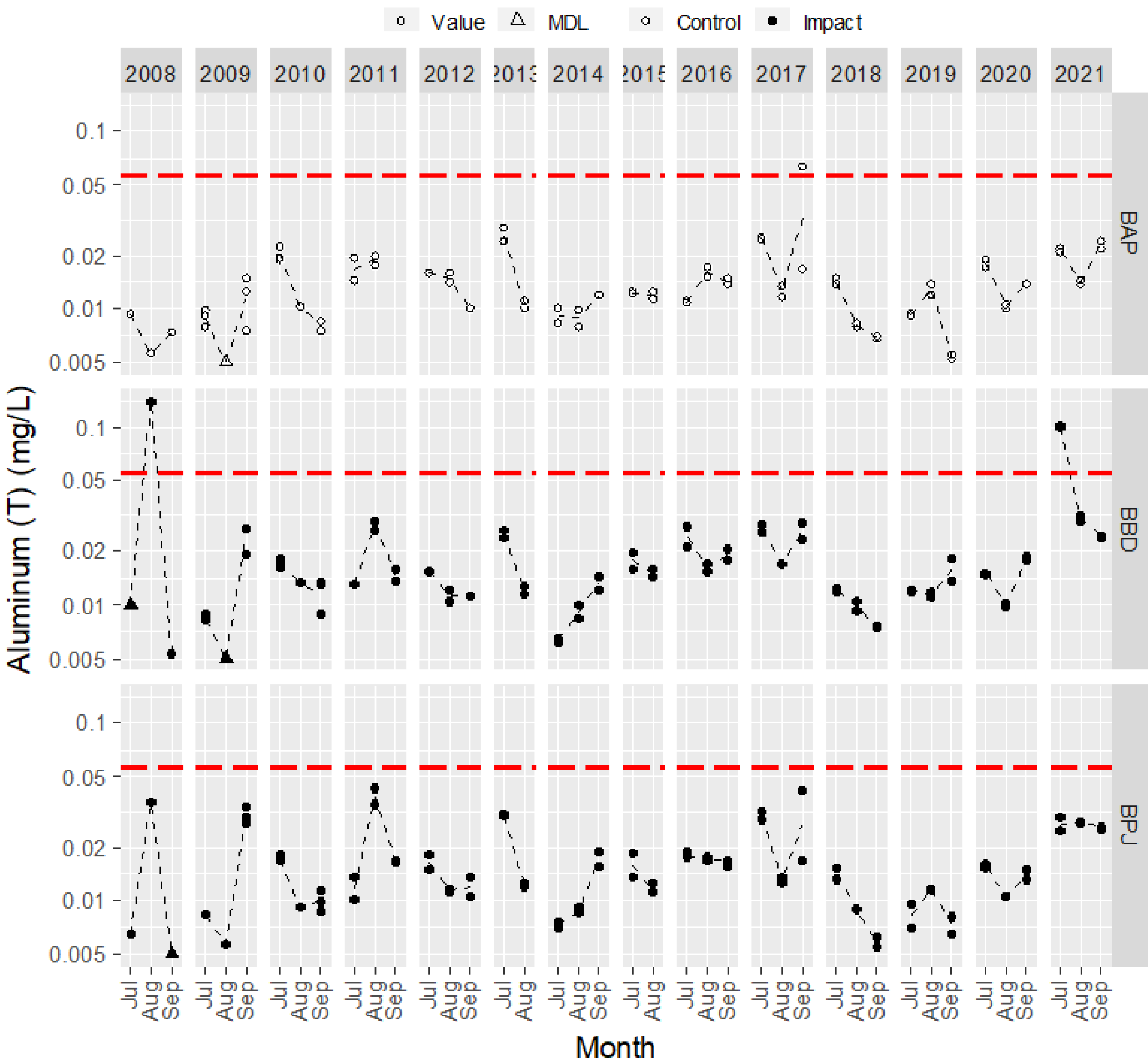


Figure 6-25. Total arsenic (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

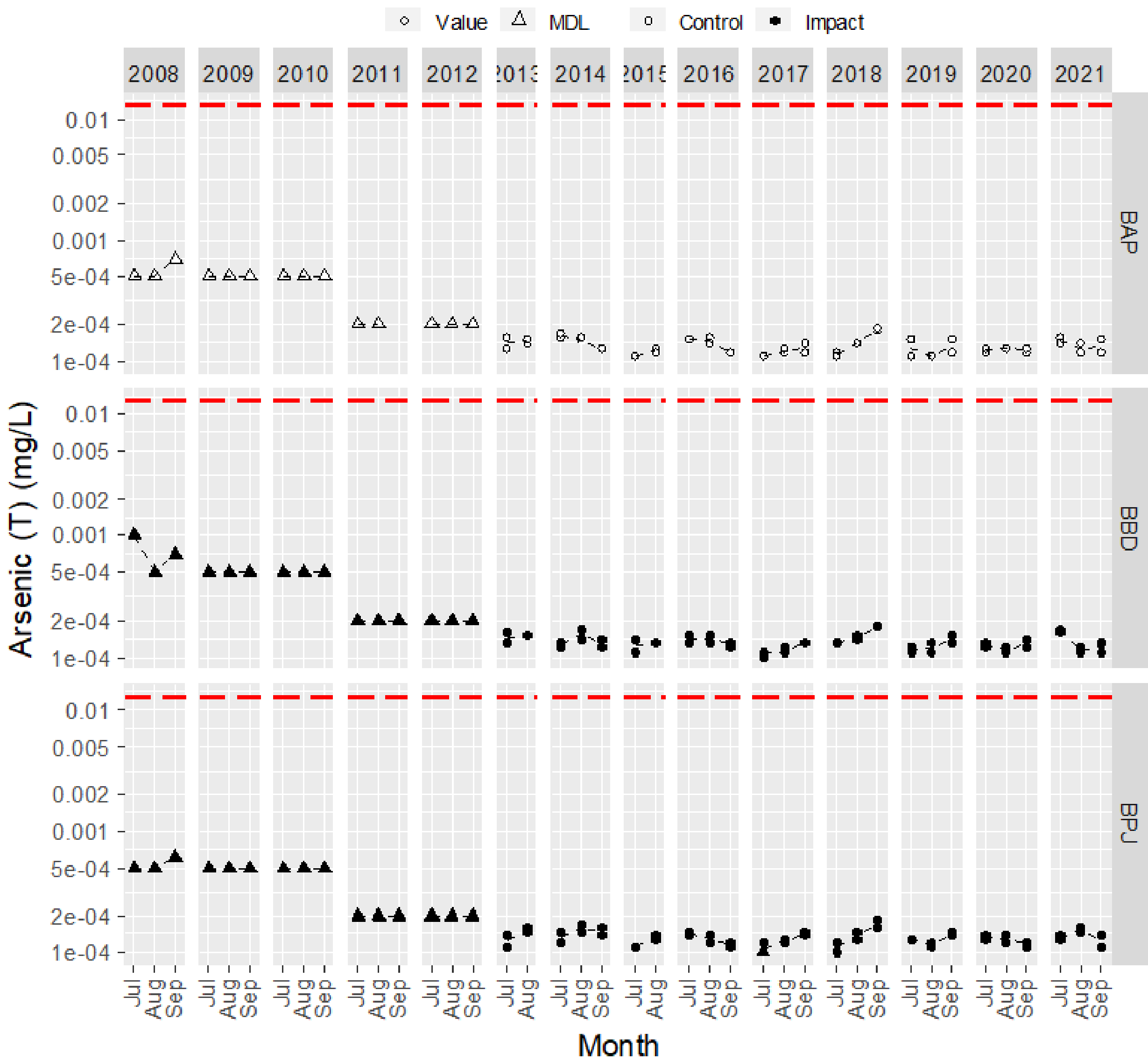


Figure 6-26. Total barium (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

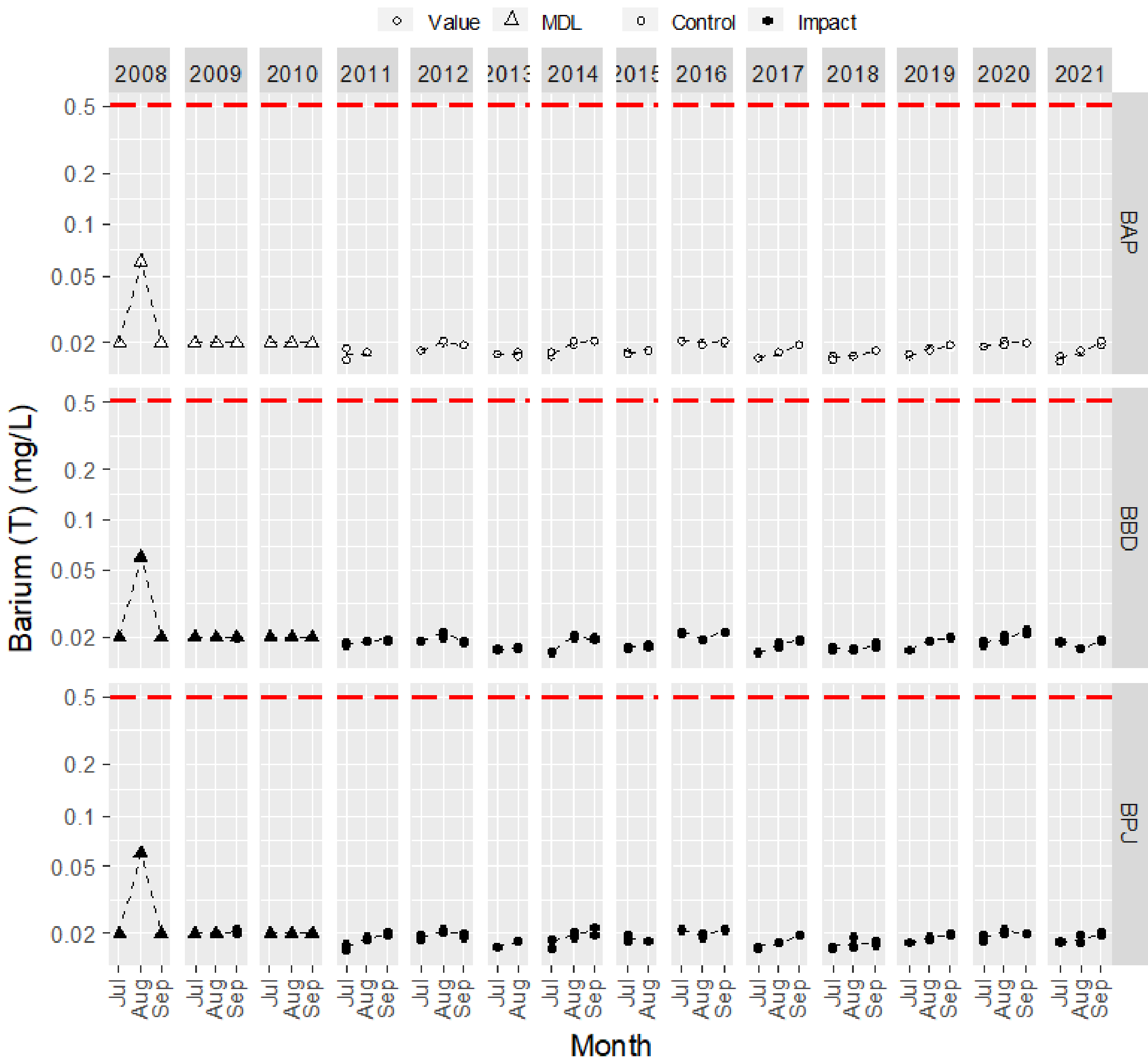


Figure 6-27. Total boron (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

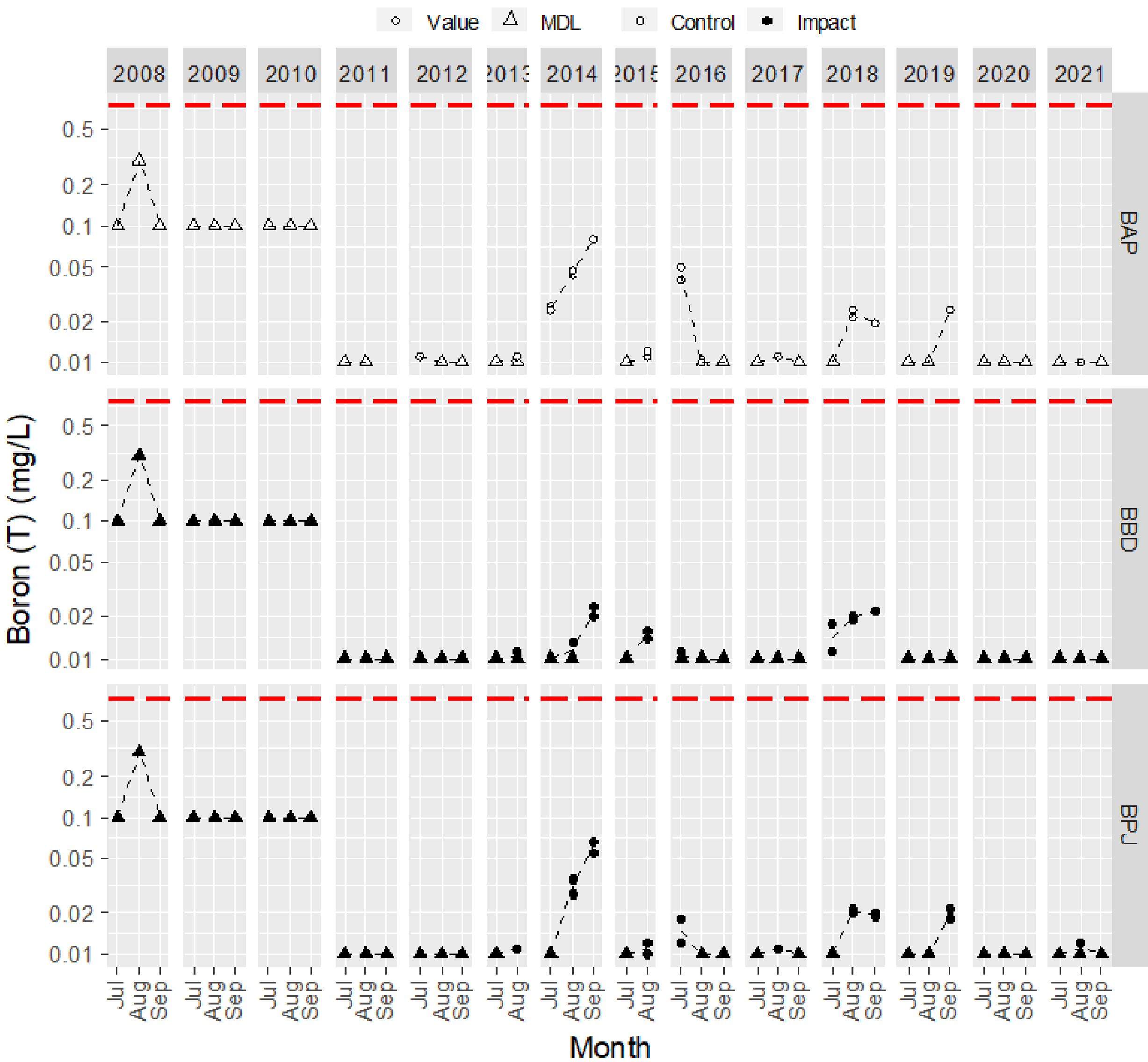


Figure 6-28. Total calcium (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

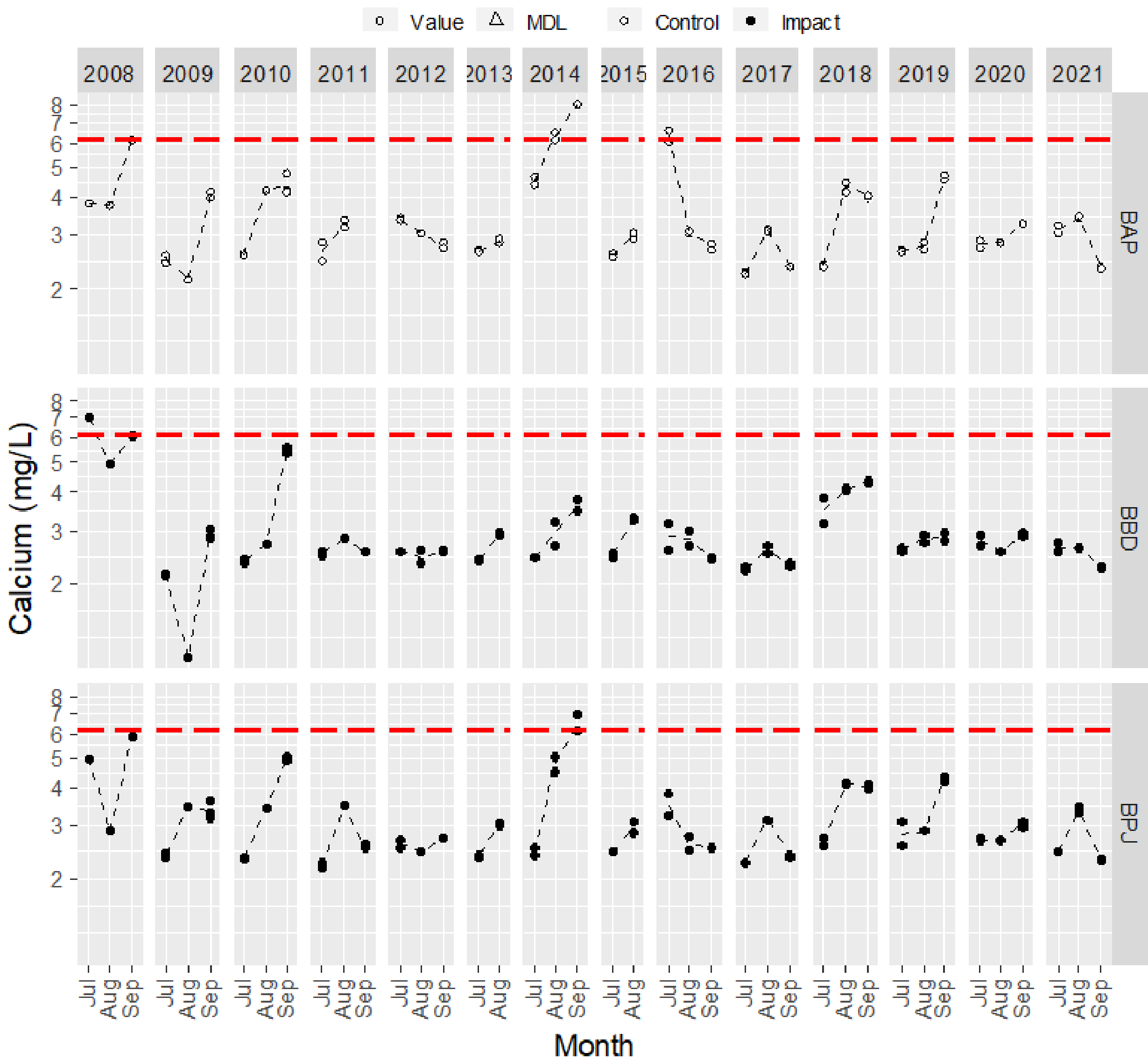


Figure 6-29. Total chromium (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake. The detection limit for total chromium was adjusted from 0.0001 mg/L to 0.0005 mg/L for samples collected in 2021.

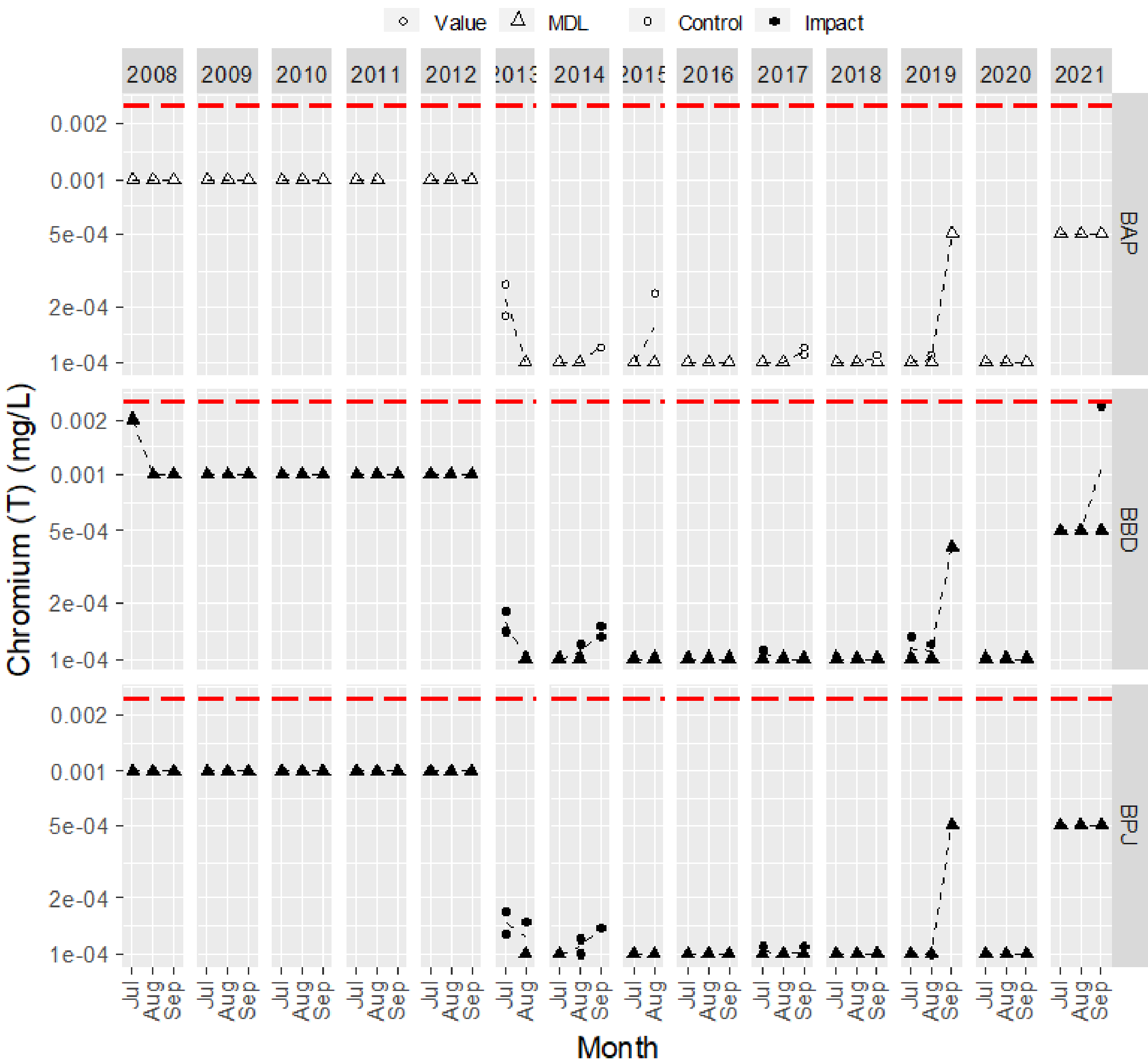


Figure 6-30. Total copper (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

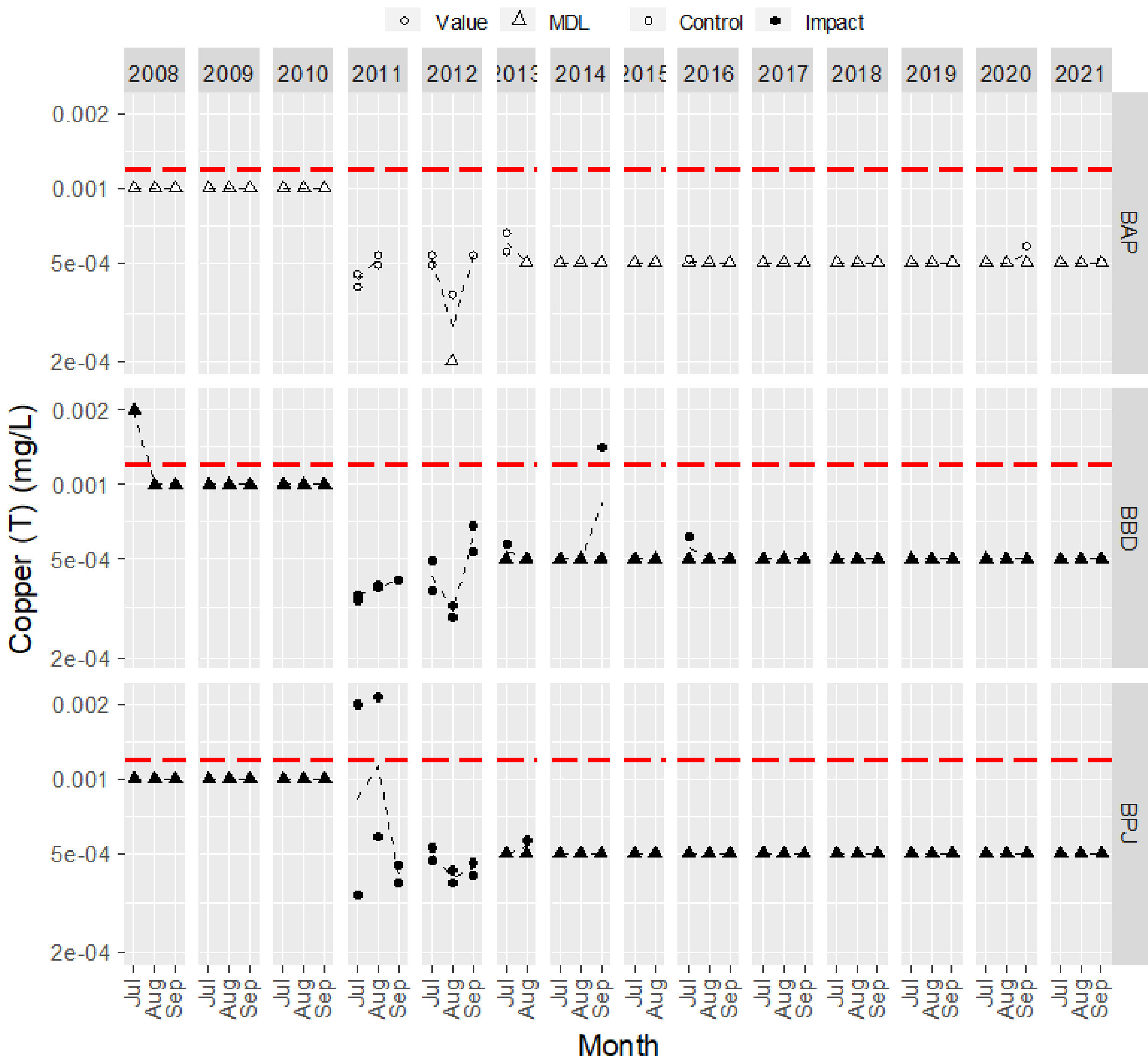


Figure 6-31. Total iron (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

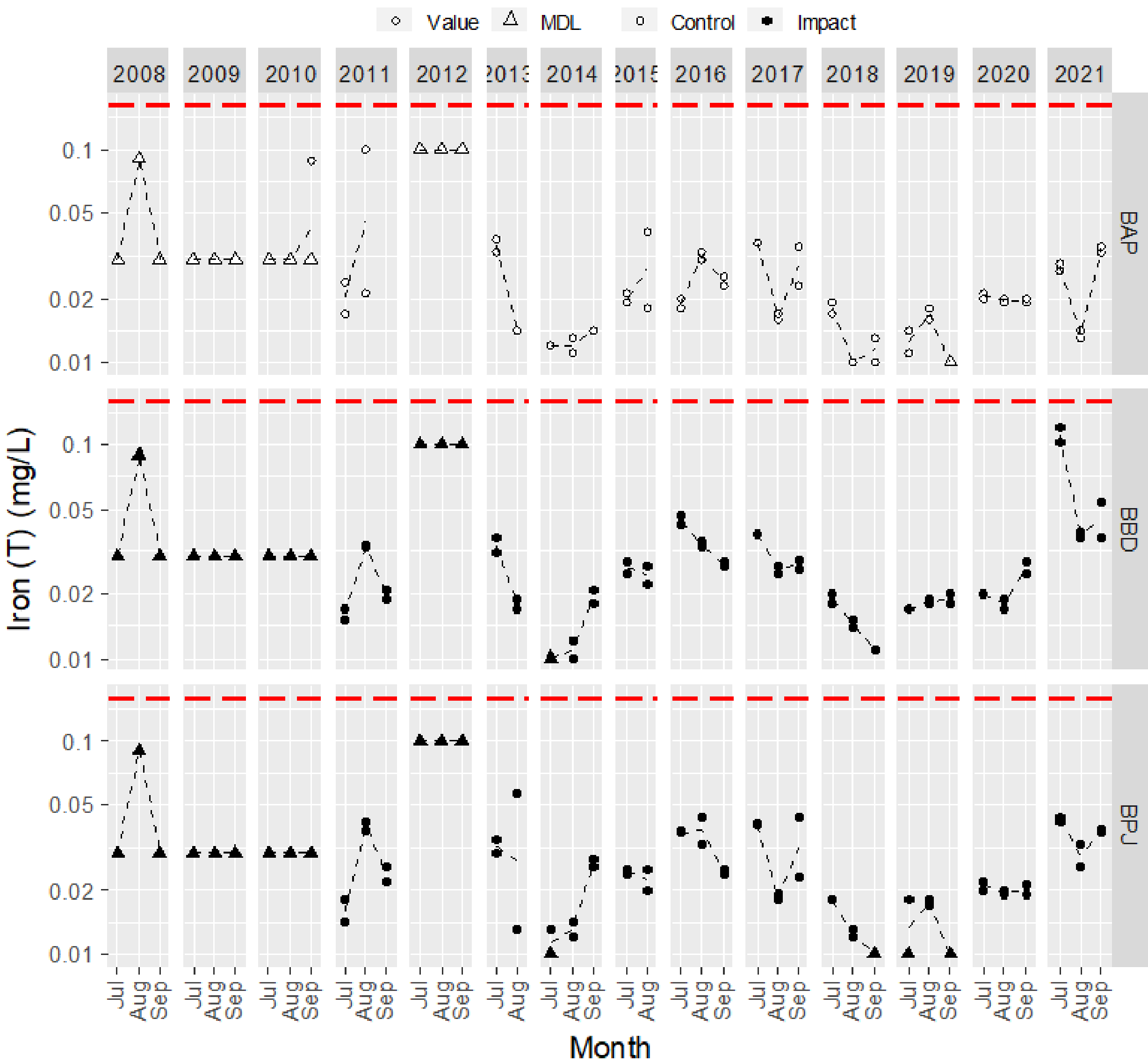


Figure 6-32. Total lithium (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

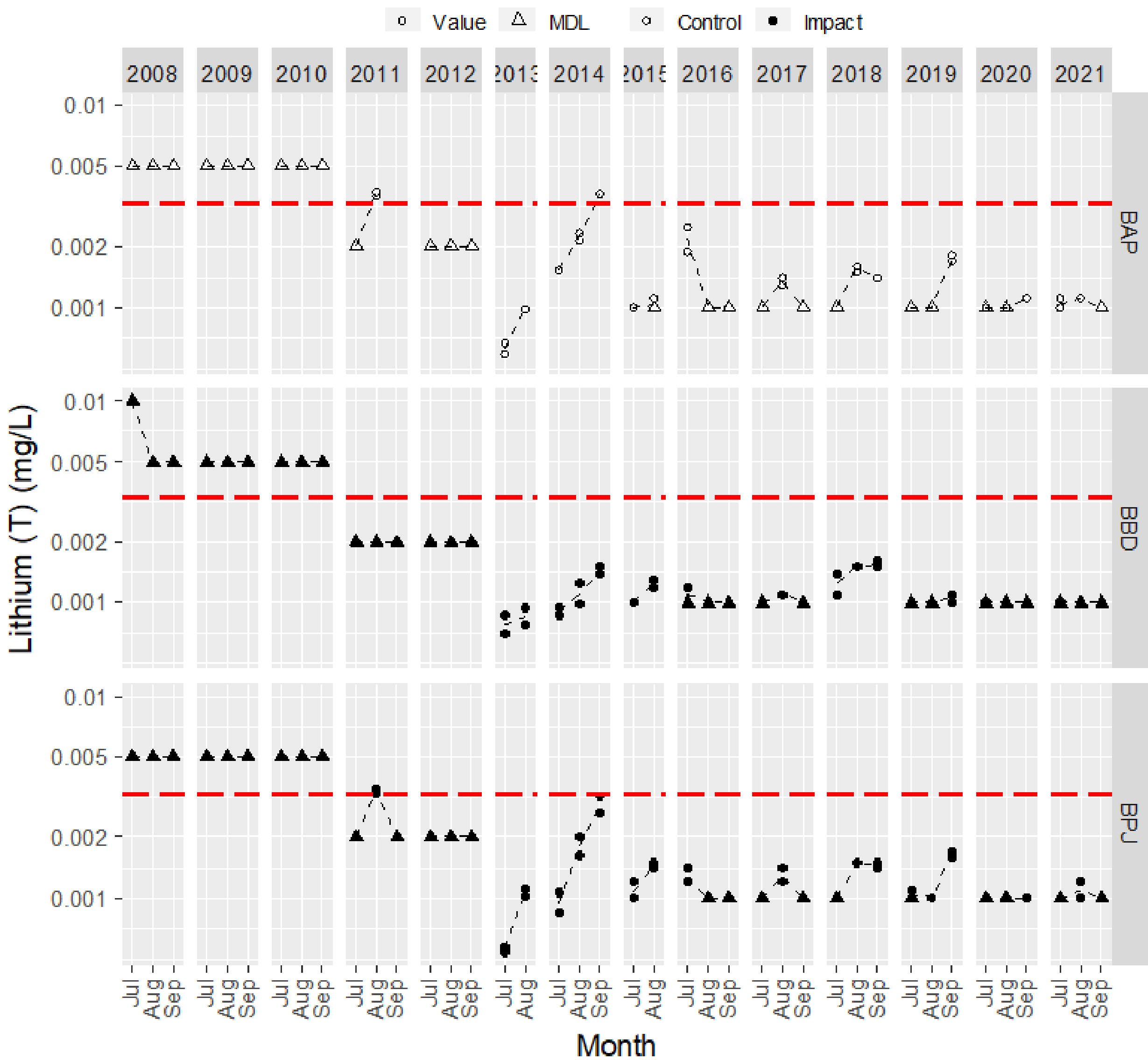


Figure 6-33. Total magnesium (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

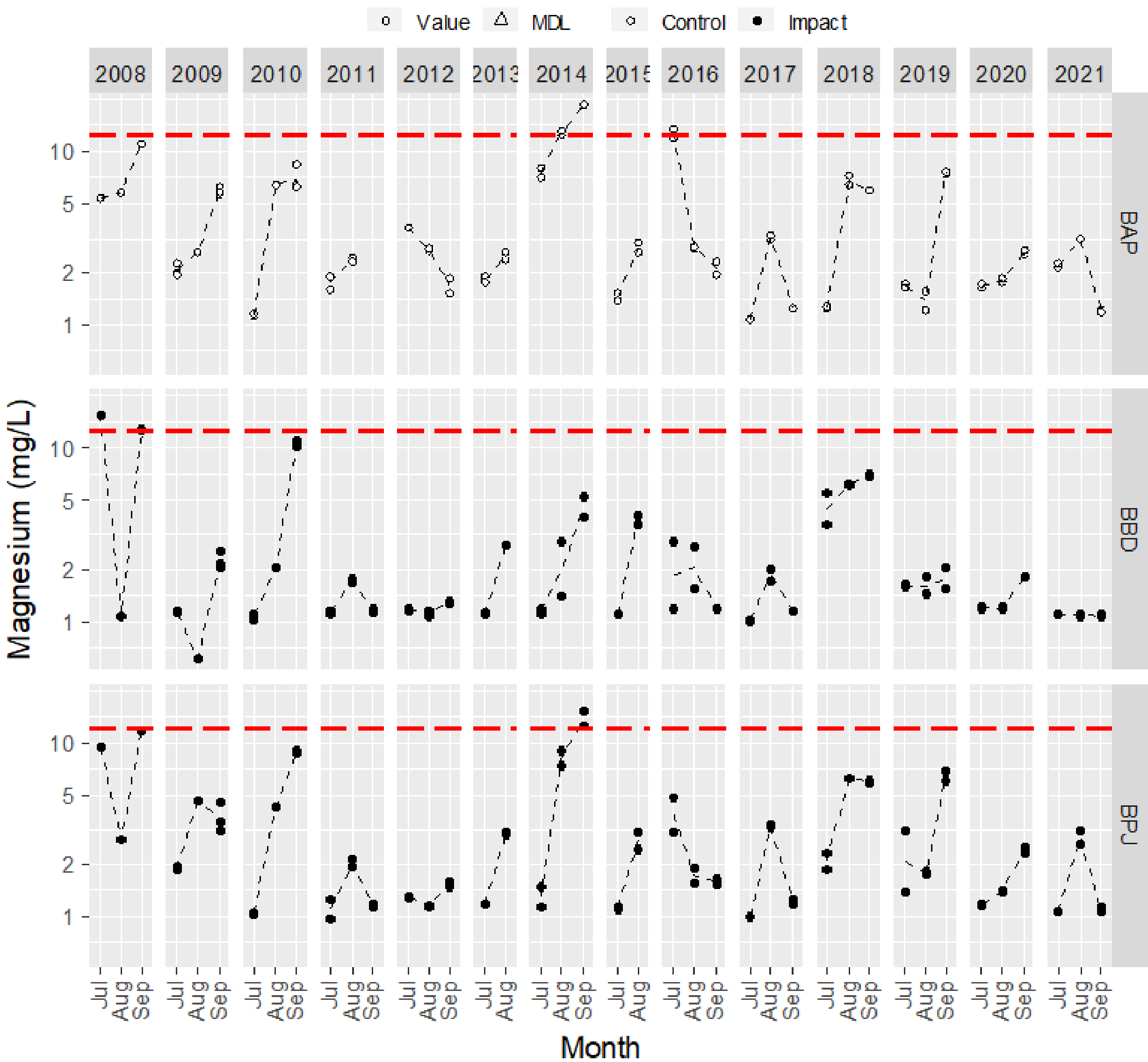


Figure 6-34. Total manganese (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

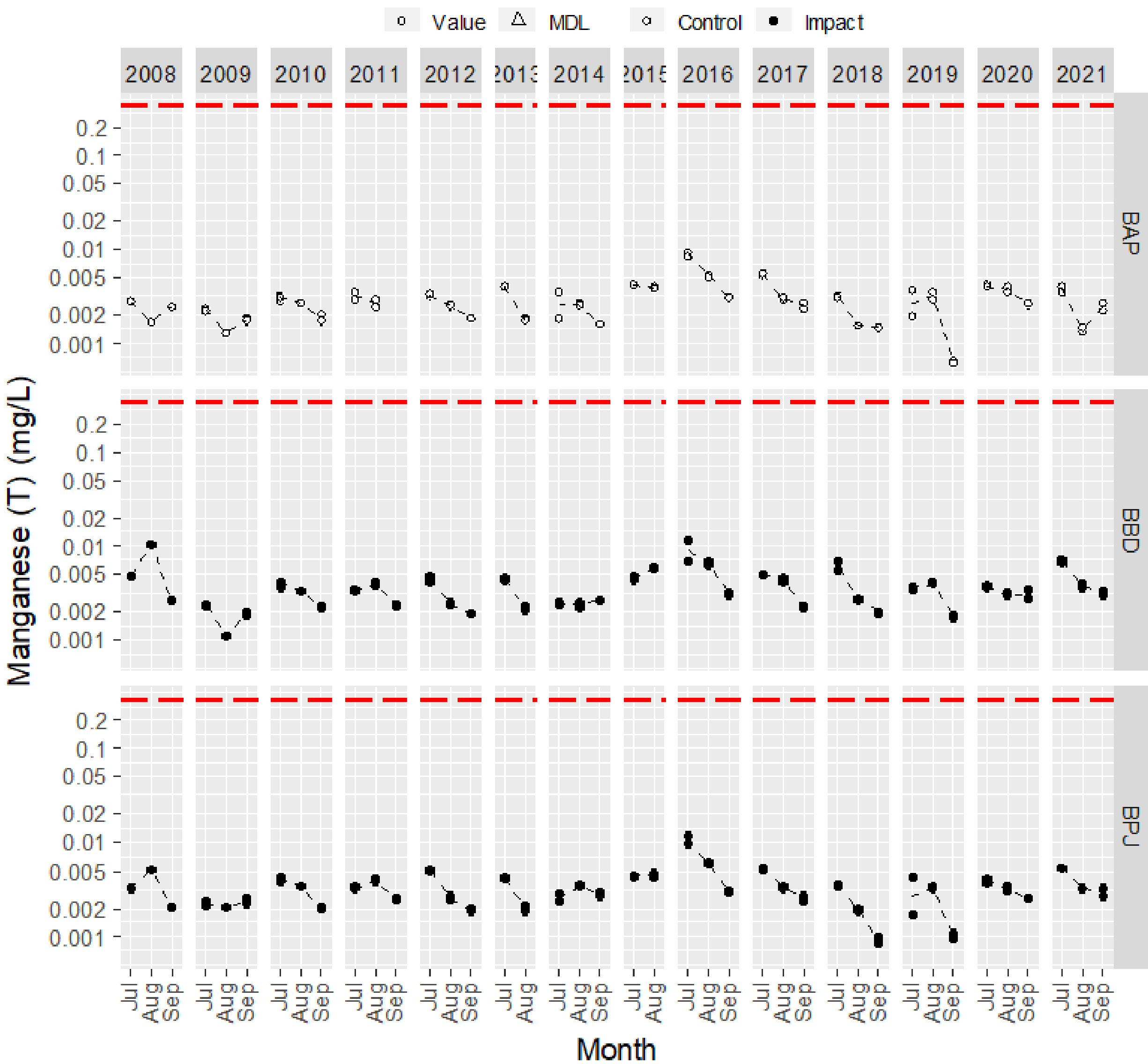


Figure 6-35. Total molybdenum (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

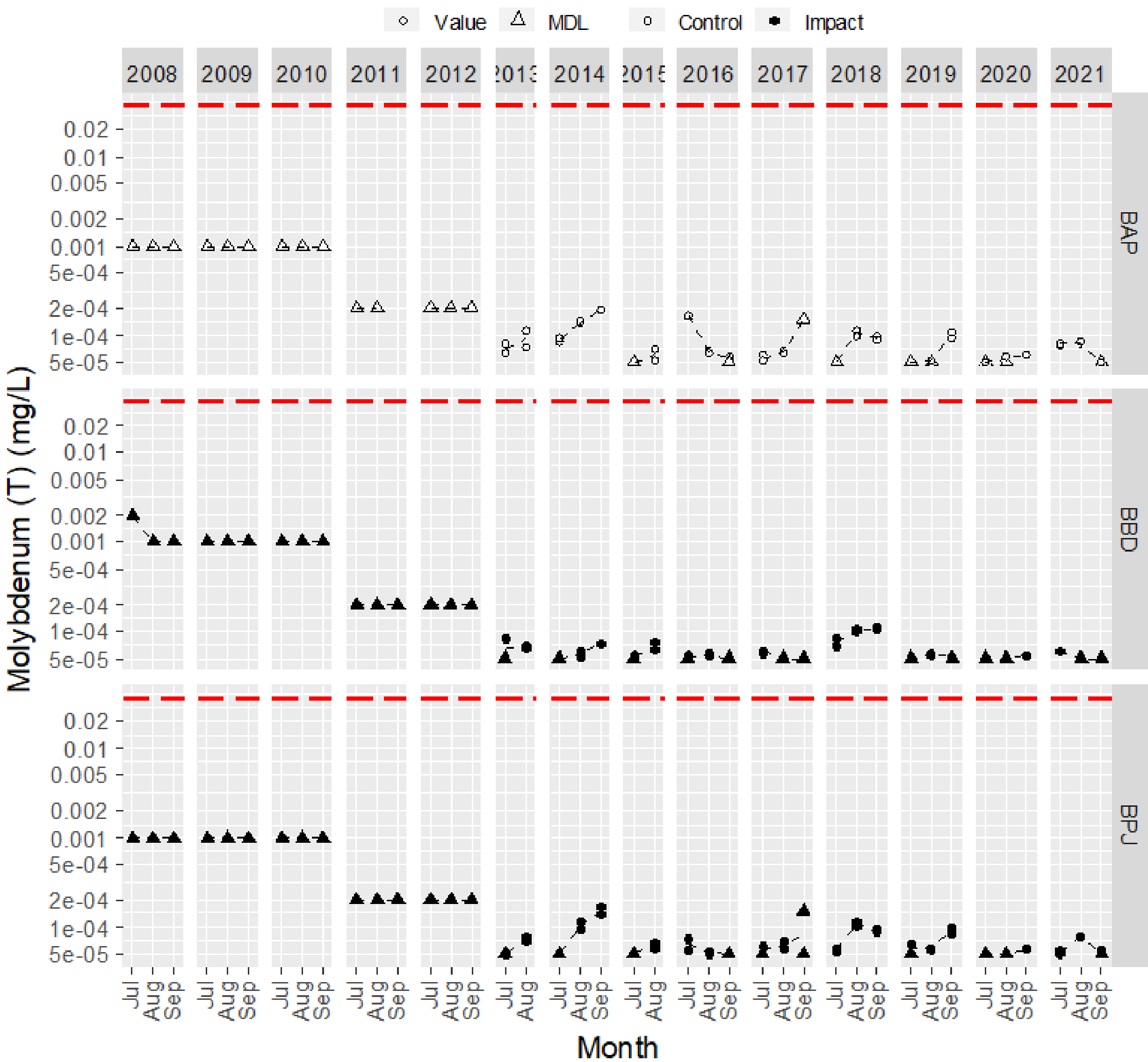


Figure 6-36. Total potassium (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

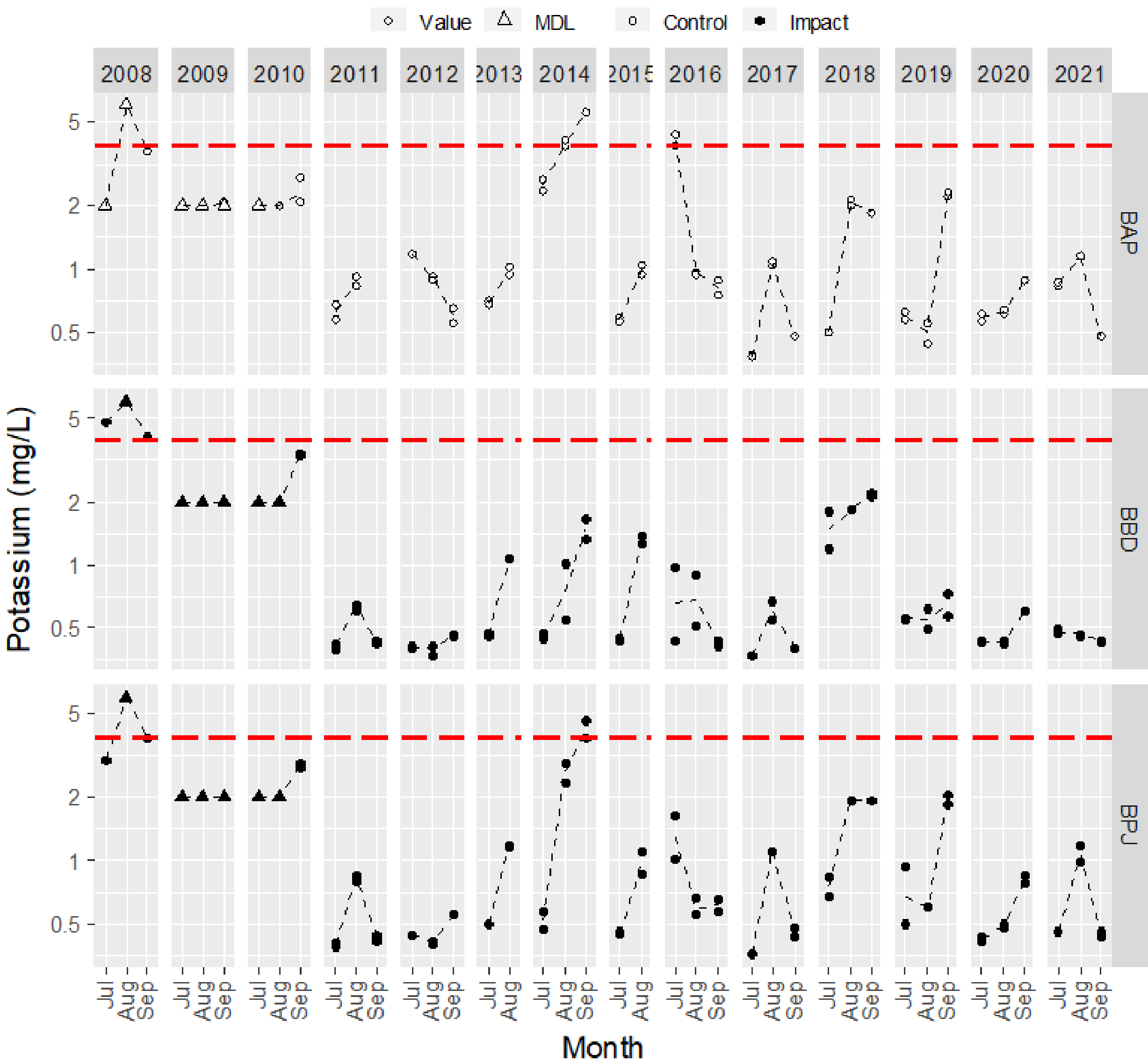


Figure 6-37. Total silicon (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

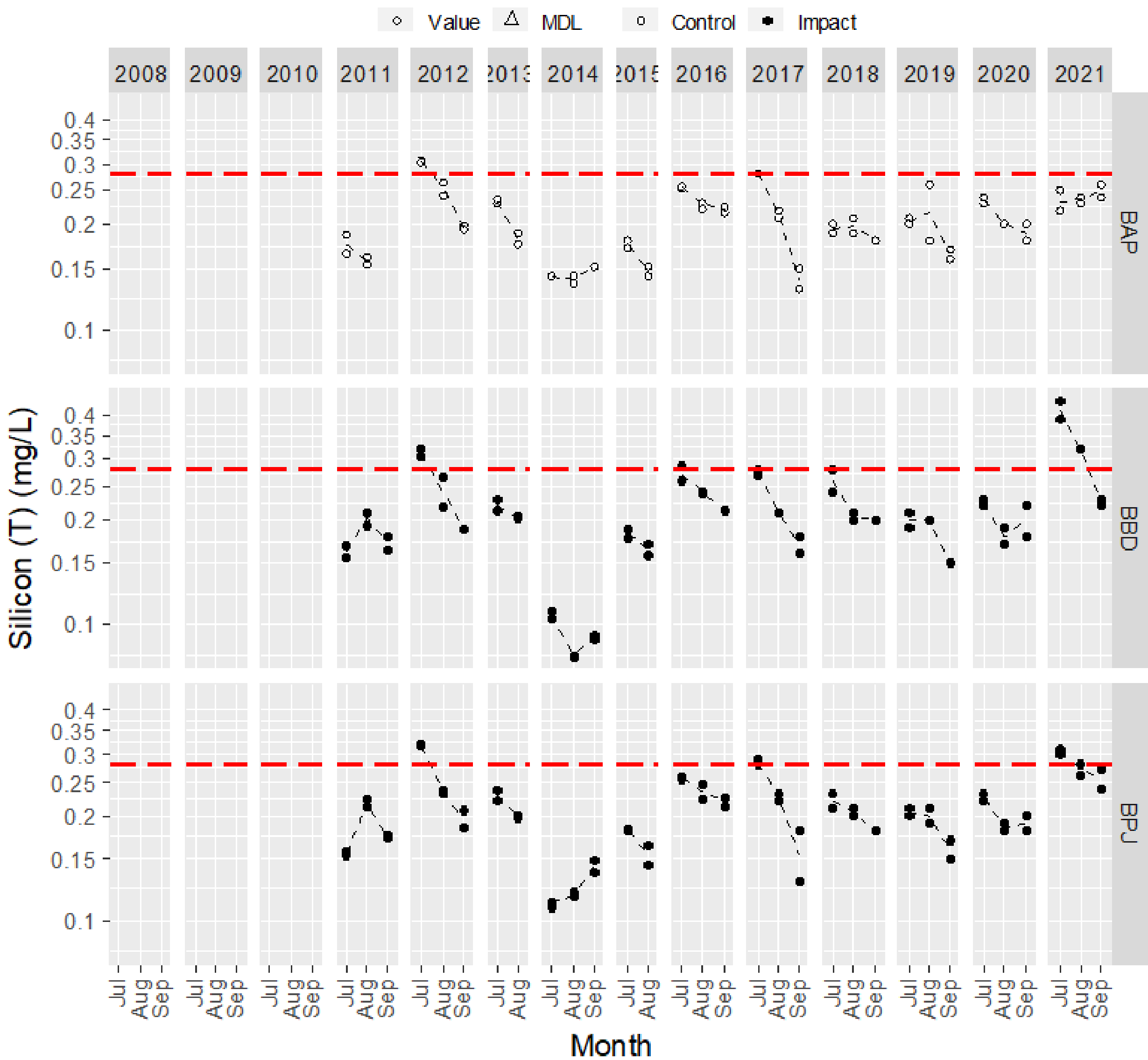


Figure 6-38. Total sodium (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

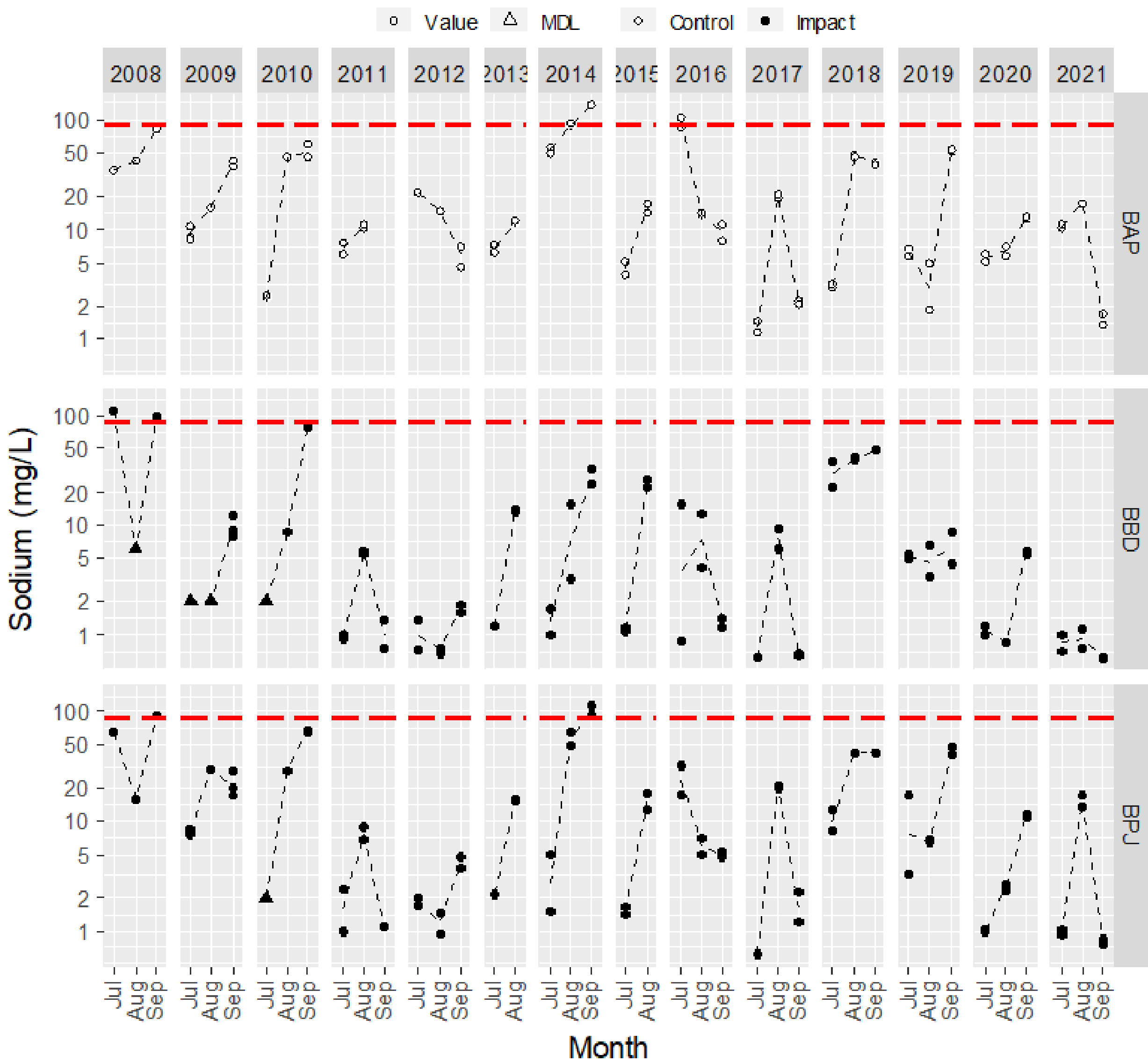


Figure 6-39. Total strontium (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

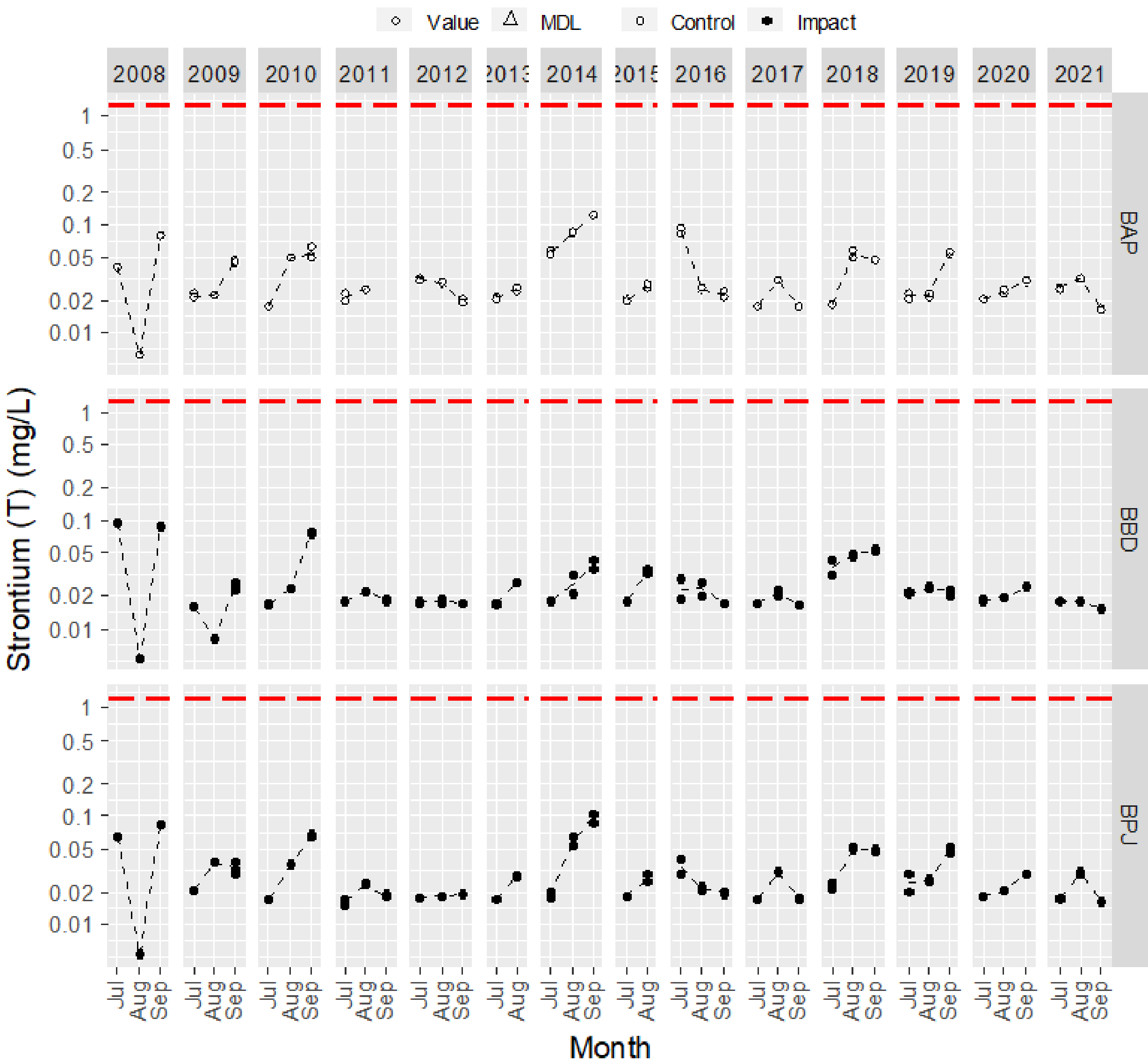


Figure 6-40. Total titanium (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake. The detection limit for total titanium was adjusted from 0.0003 mg/L to 0.0024 mg/L for samples collected at BBD in July due to sample matrix effects (e.g., turbidity, colour) and adjusted to 0.0006 for samples collected at all Baker Lake areas in September, 2021.

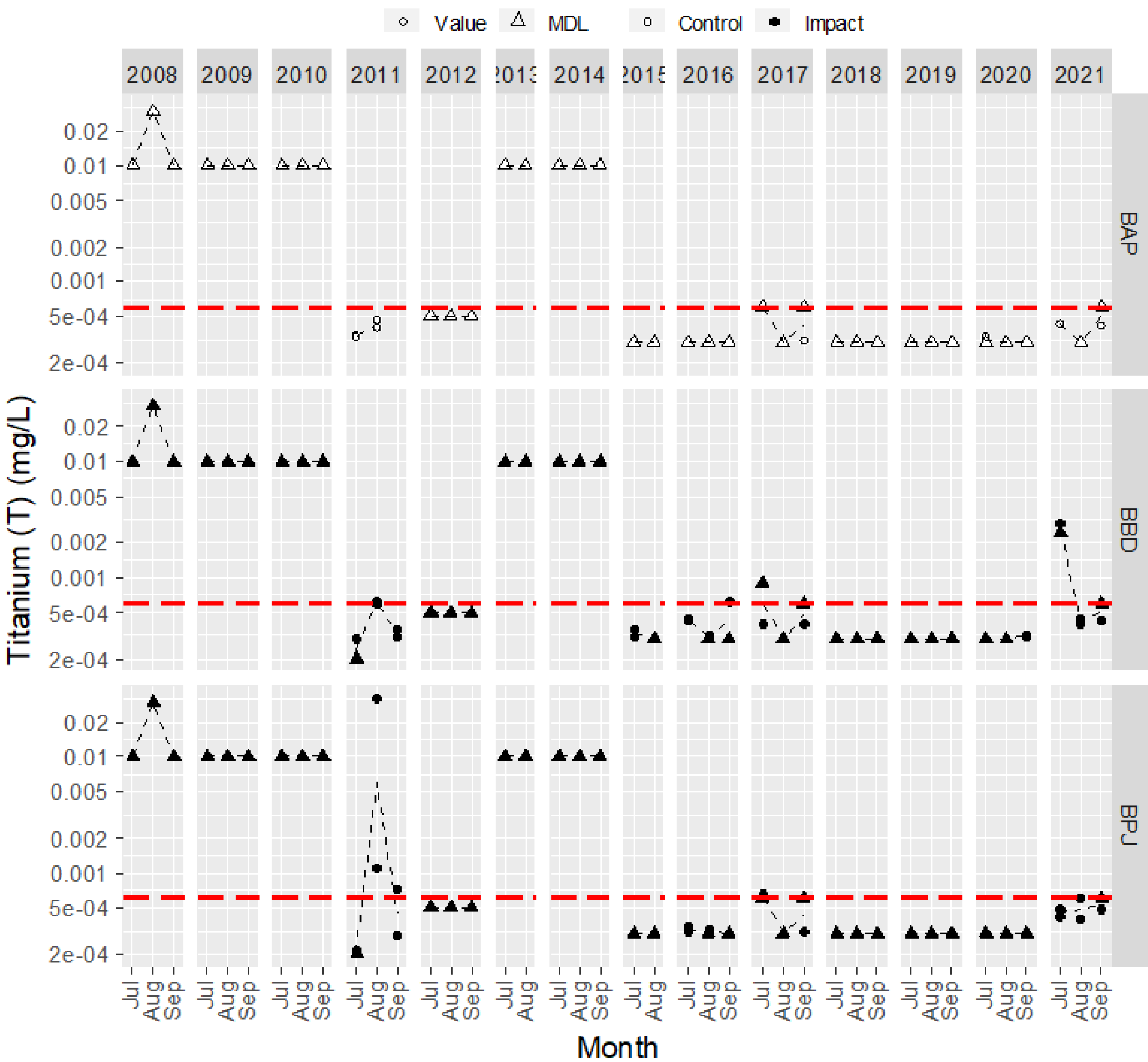


Figure 6-41. Total uranium (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

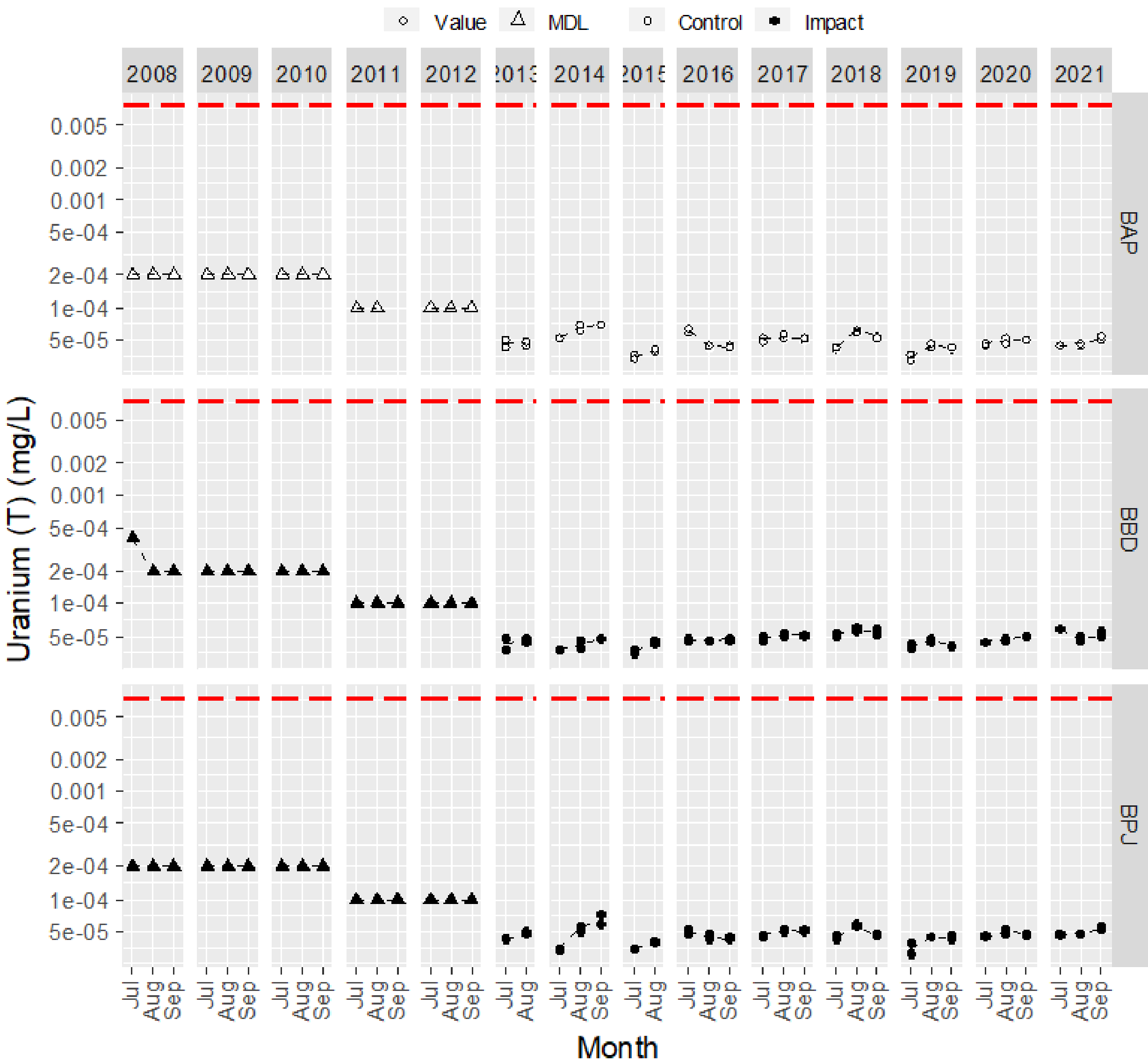


Figure 6-42. Dissolved aluminum (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

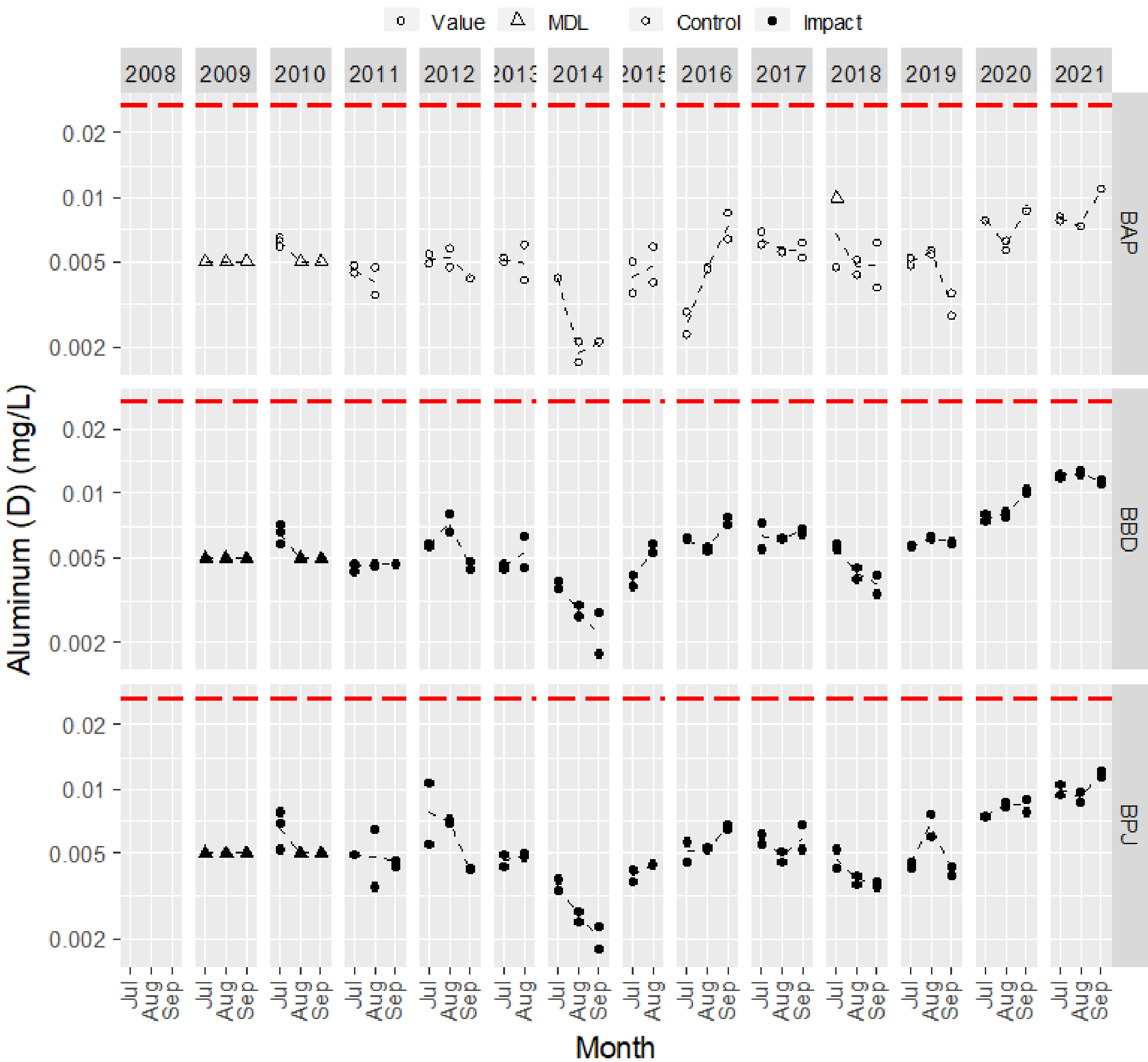


Figure 6-43. Dissolved arsenic (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

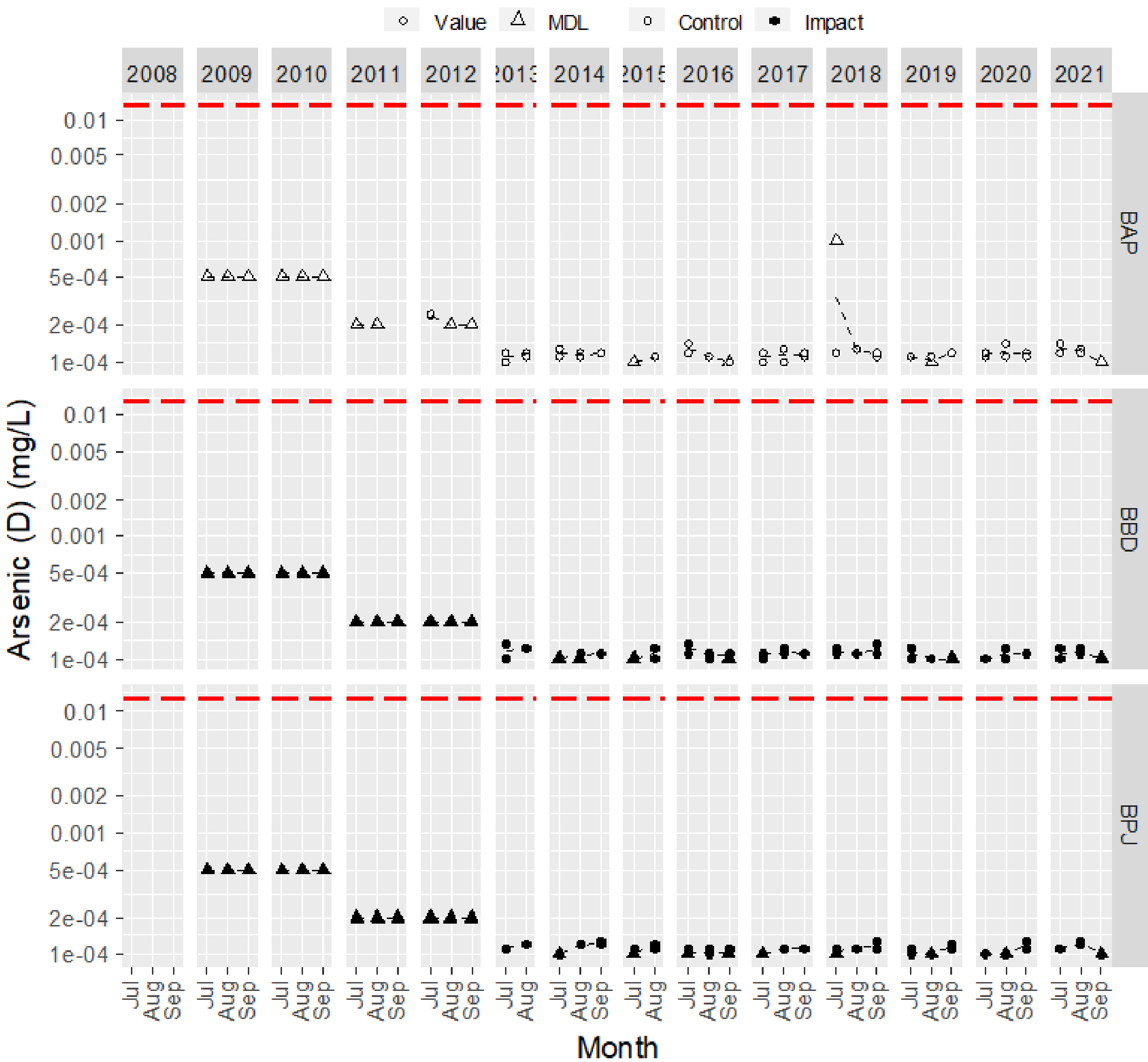


Figure 6-44. Dissolved barium (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

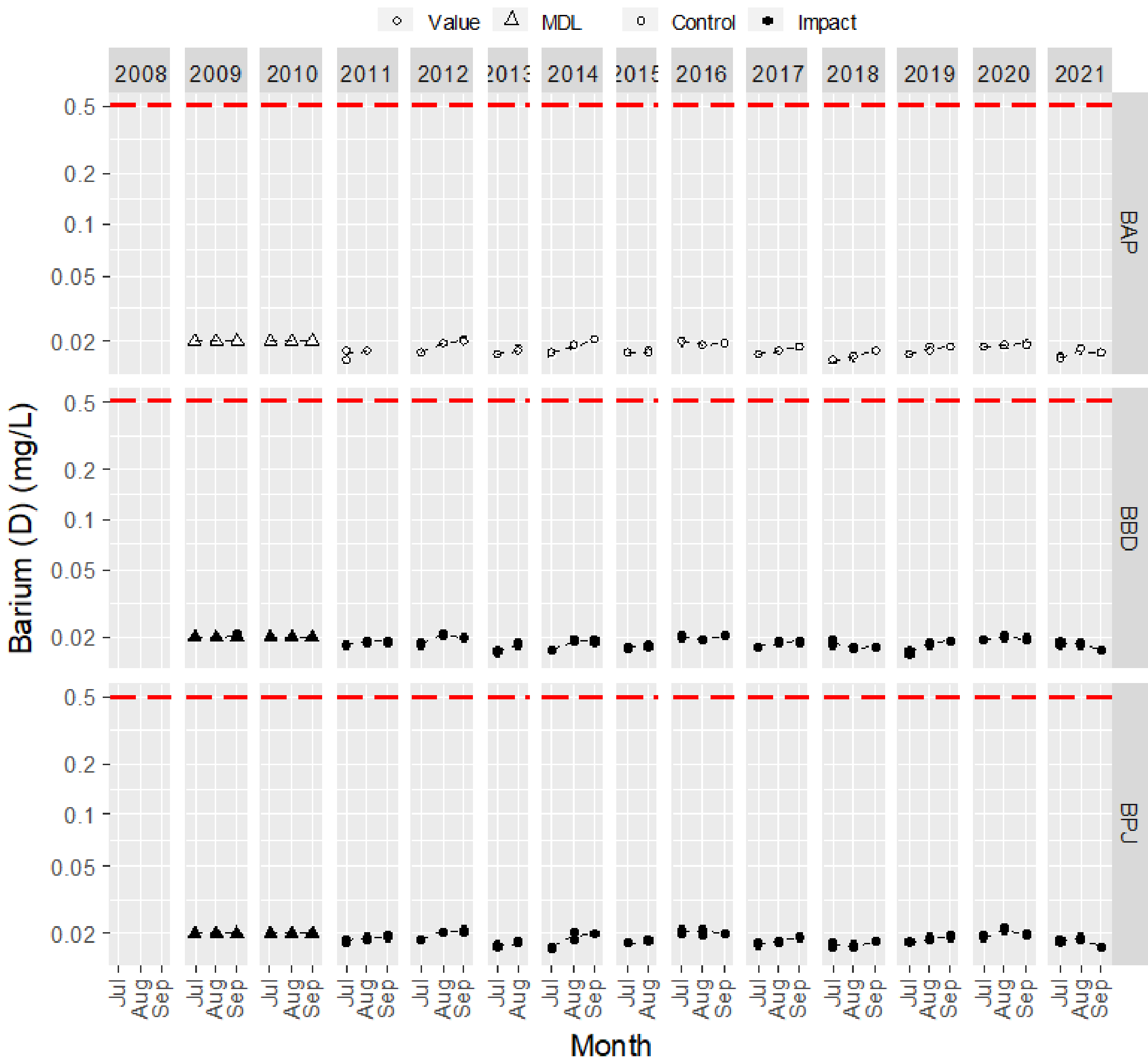


Figure 6-45. Dissolved boron (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

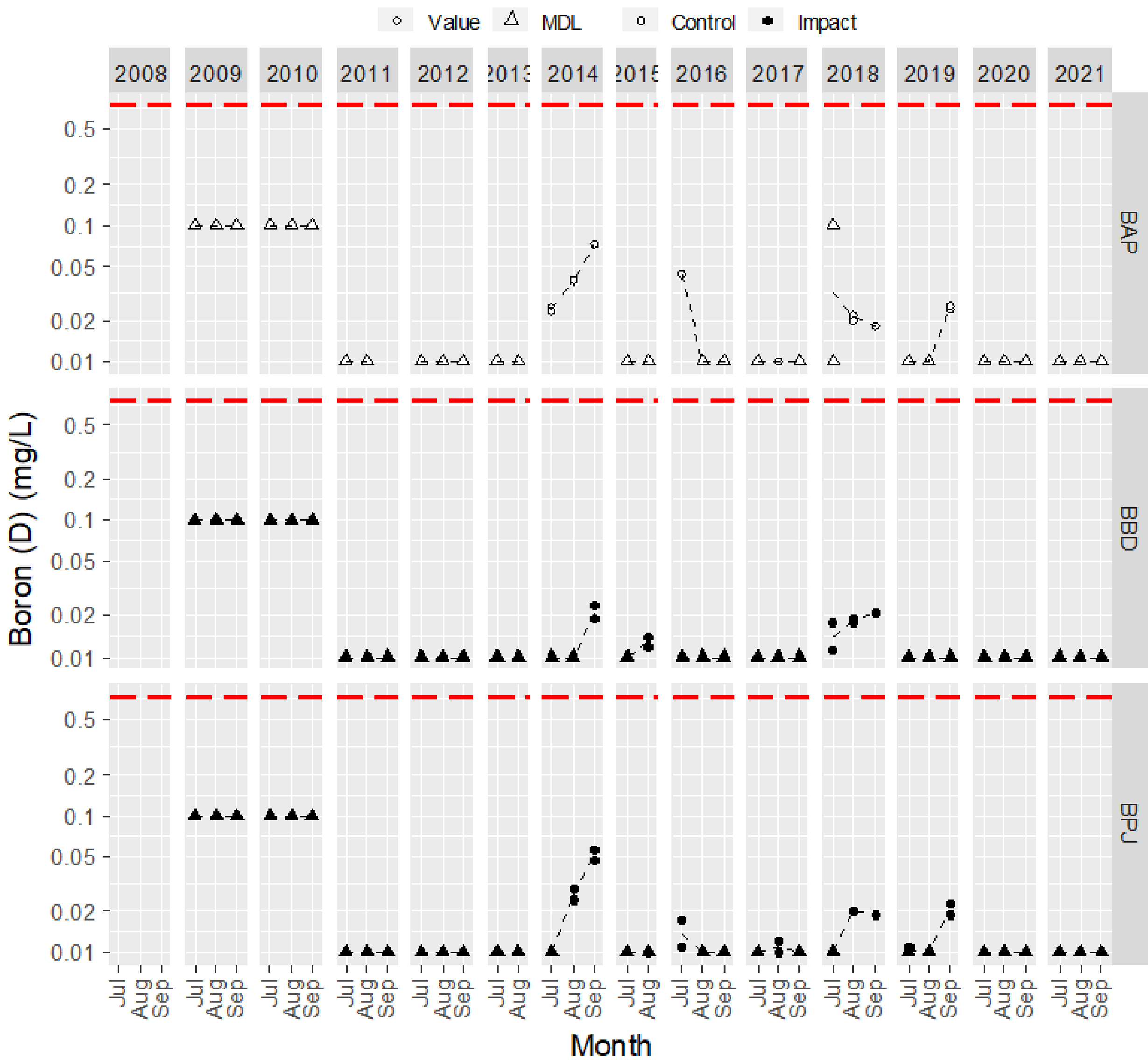


Figure 6-46. Dissolved copper (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

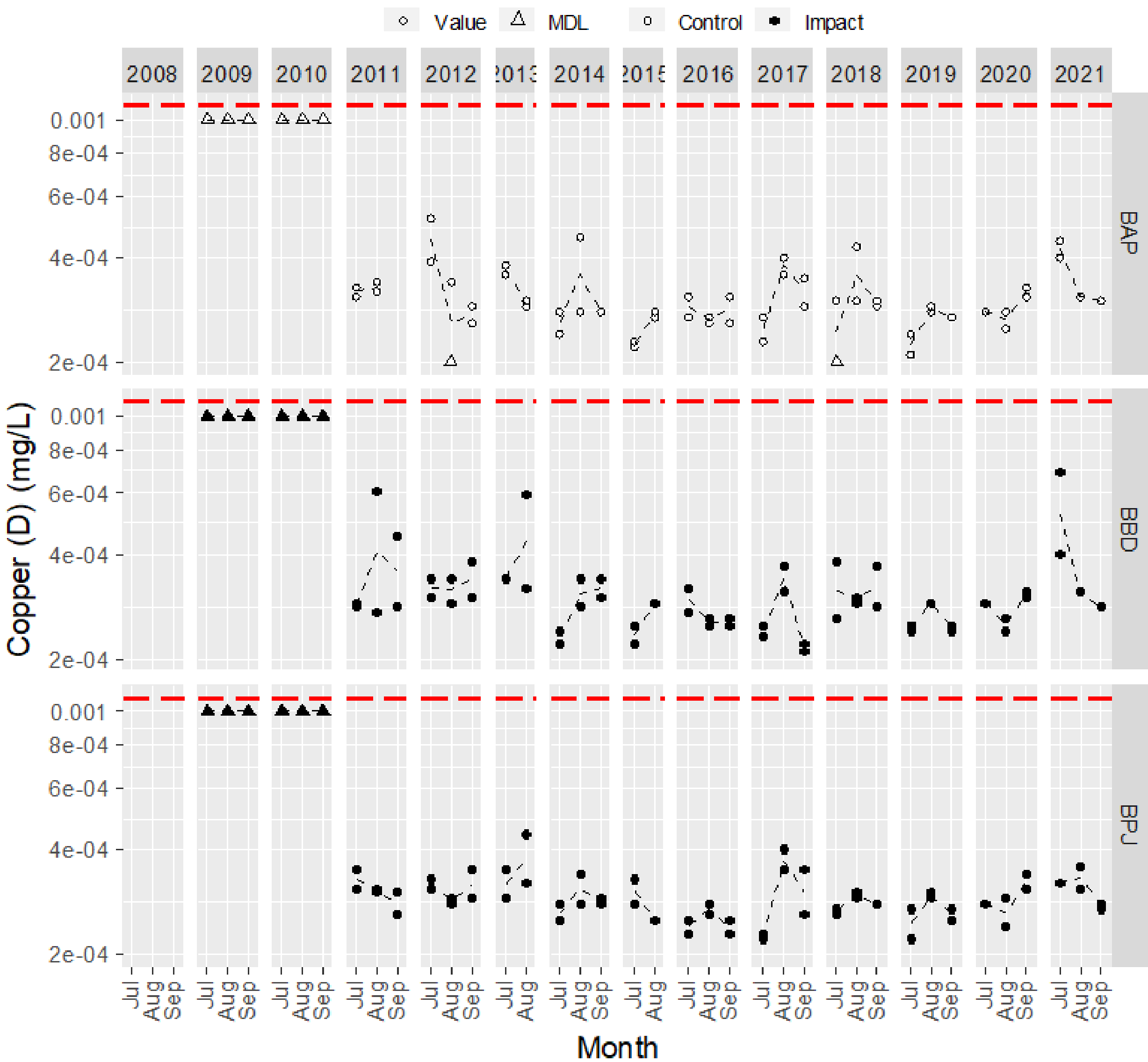


Figure 6-47. Dissolved iron (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

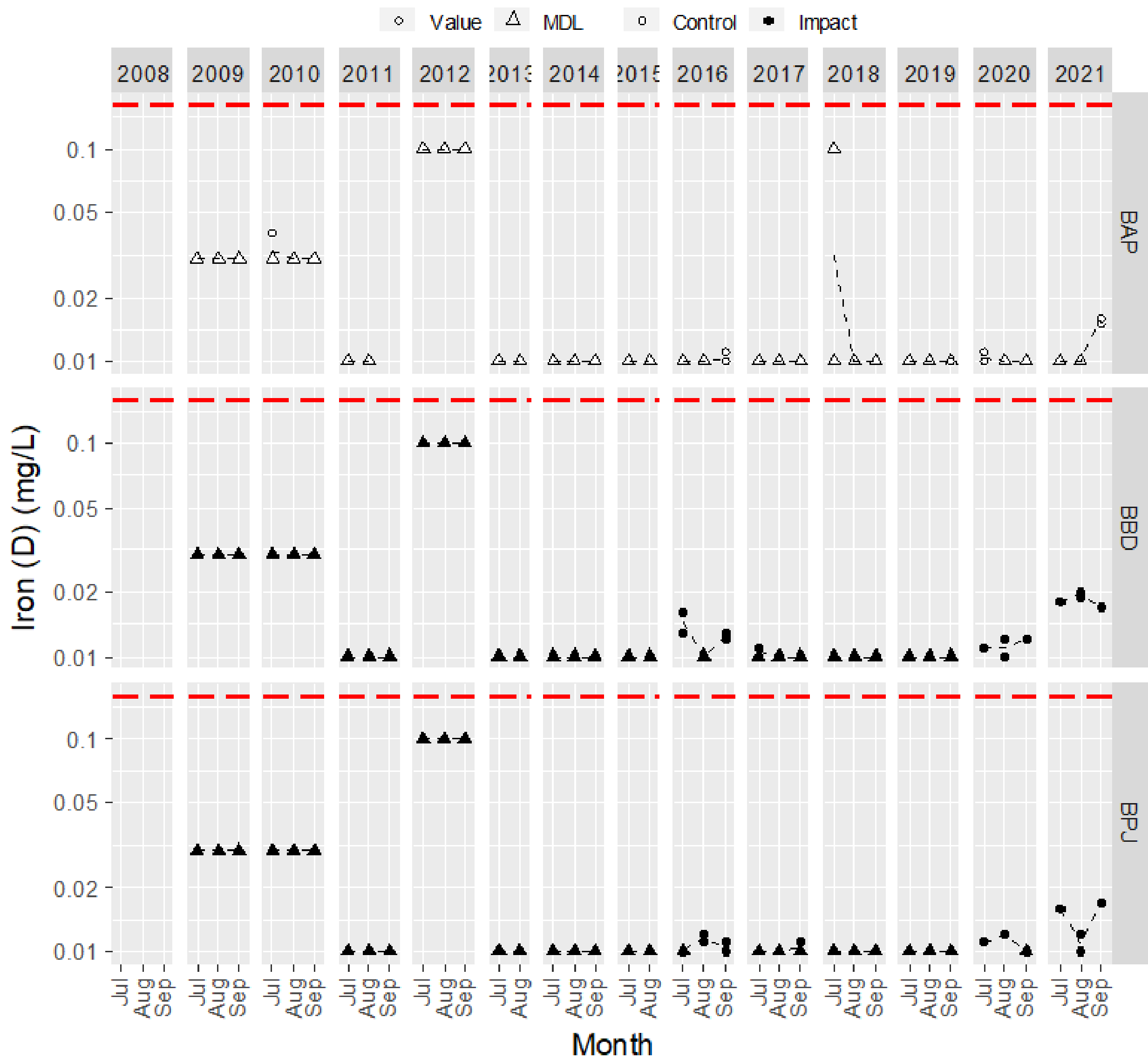


Figure 6-48. Dissolved lithium (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

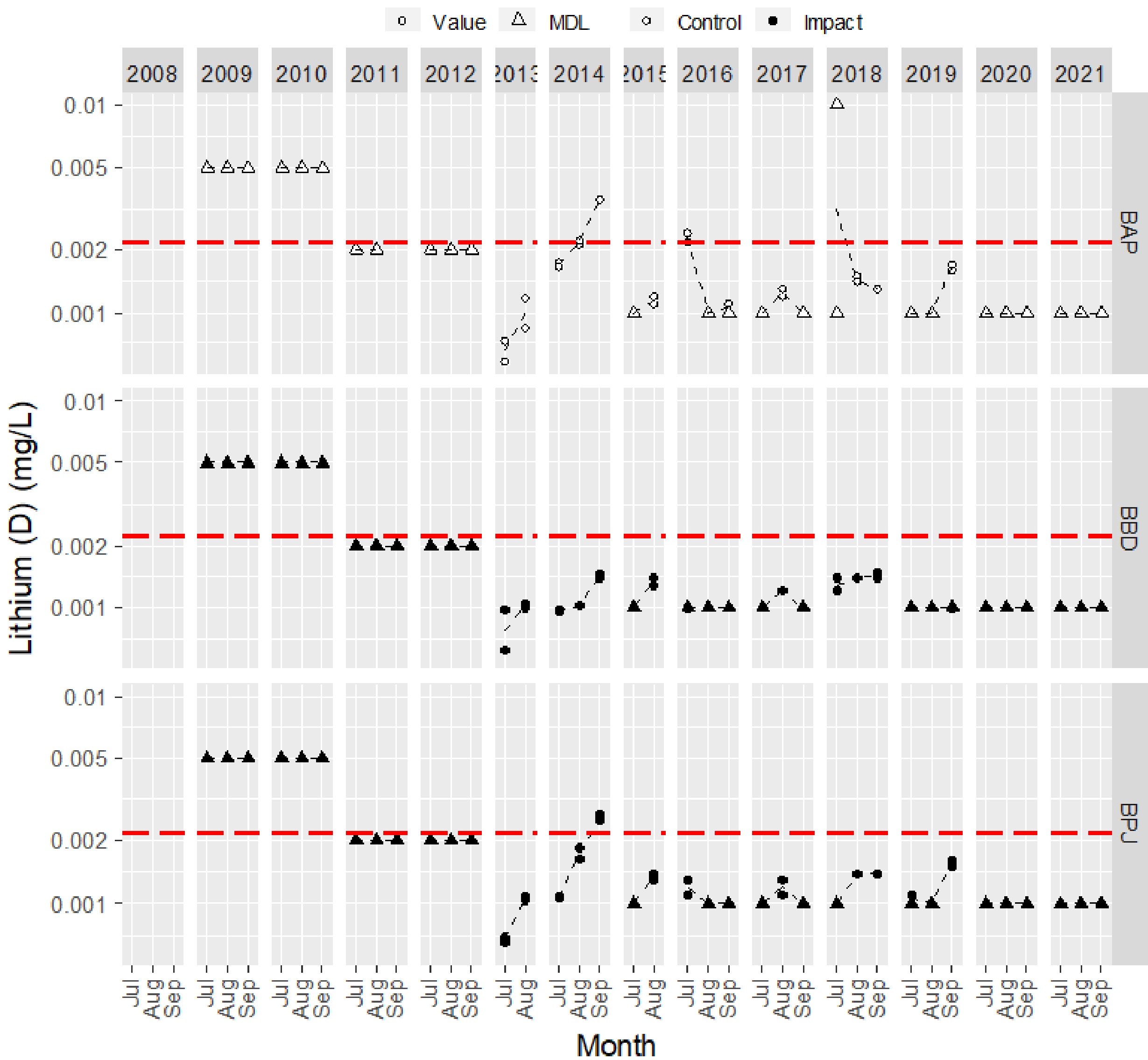


Figure 6-49. Dissolved manganese (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

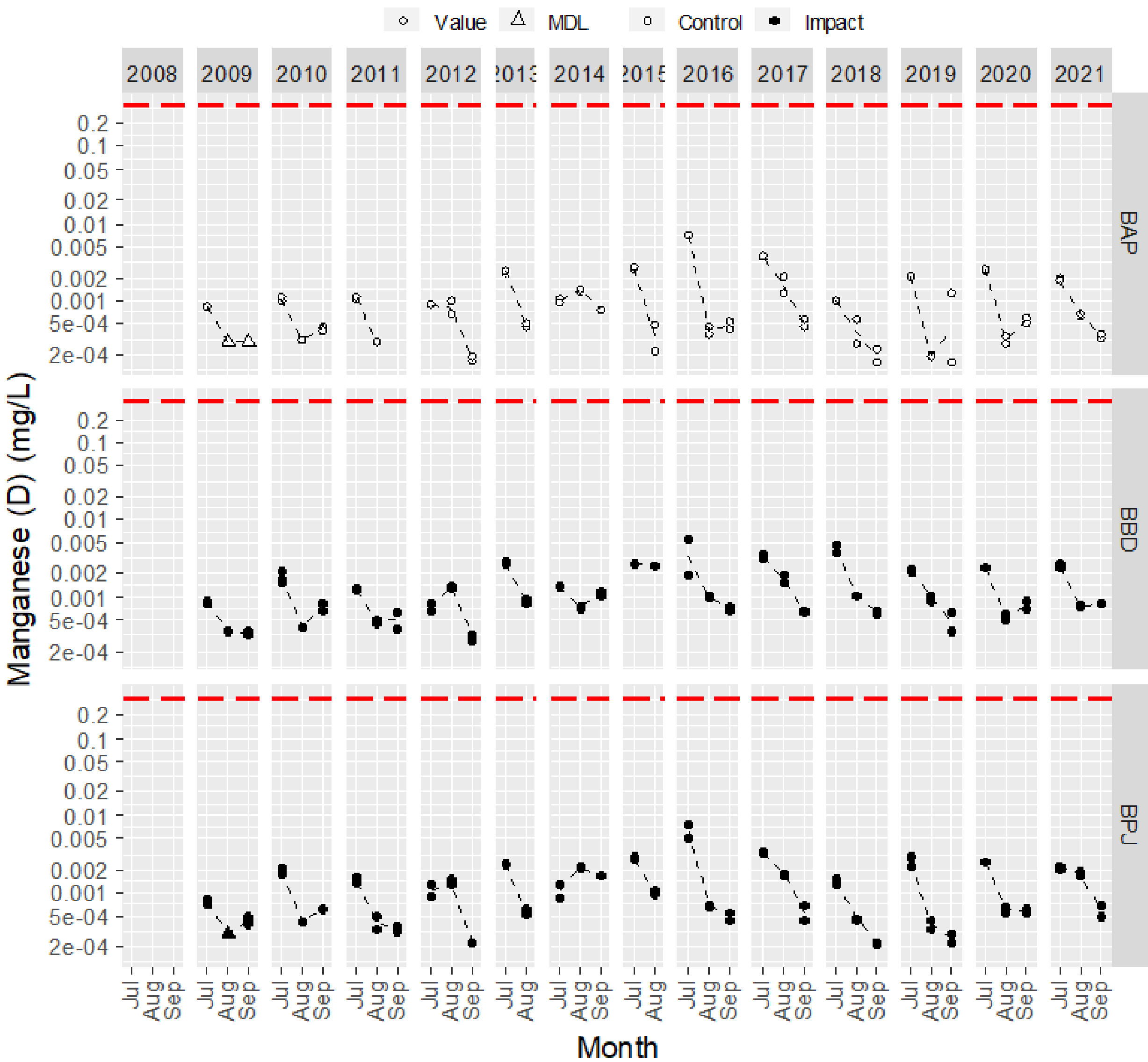


Figure 6-50. Dissolved molybdenum (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

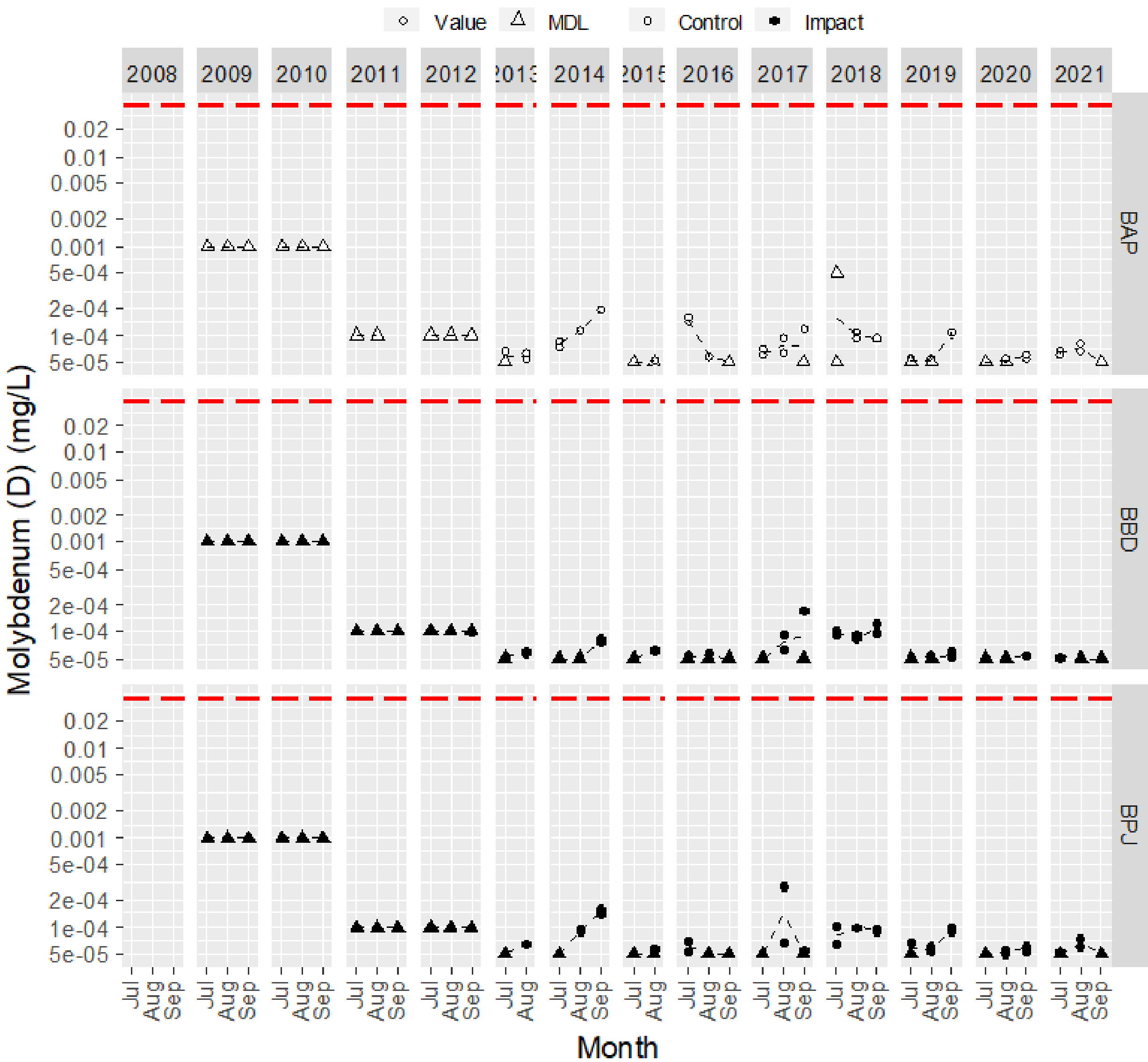


Figure 6-51. Dissolved silicon (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

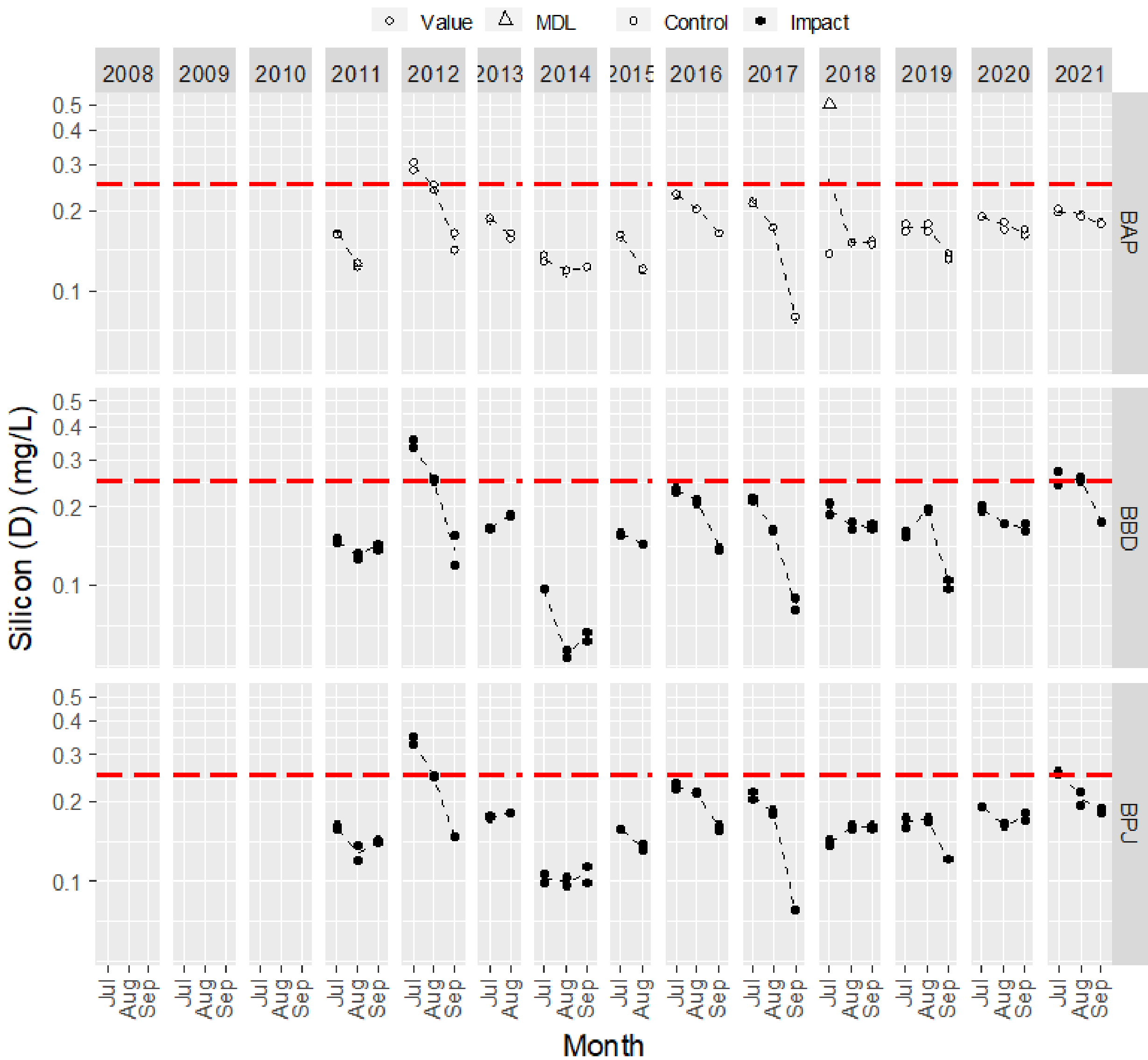


Figure 6-52. Dissolved strontium (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.

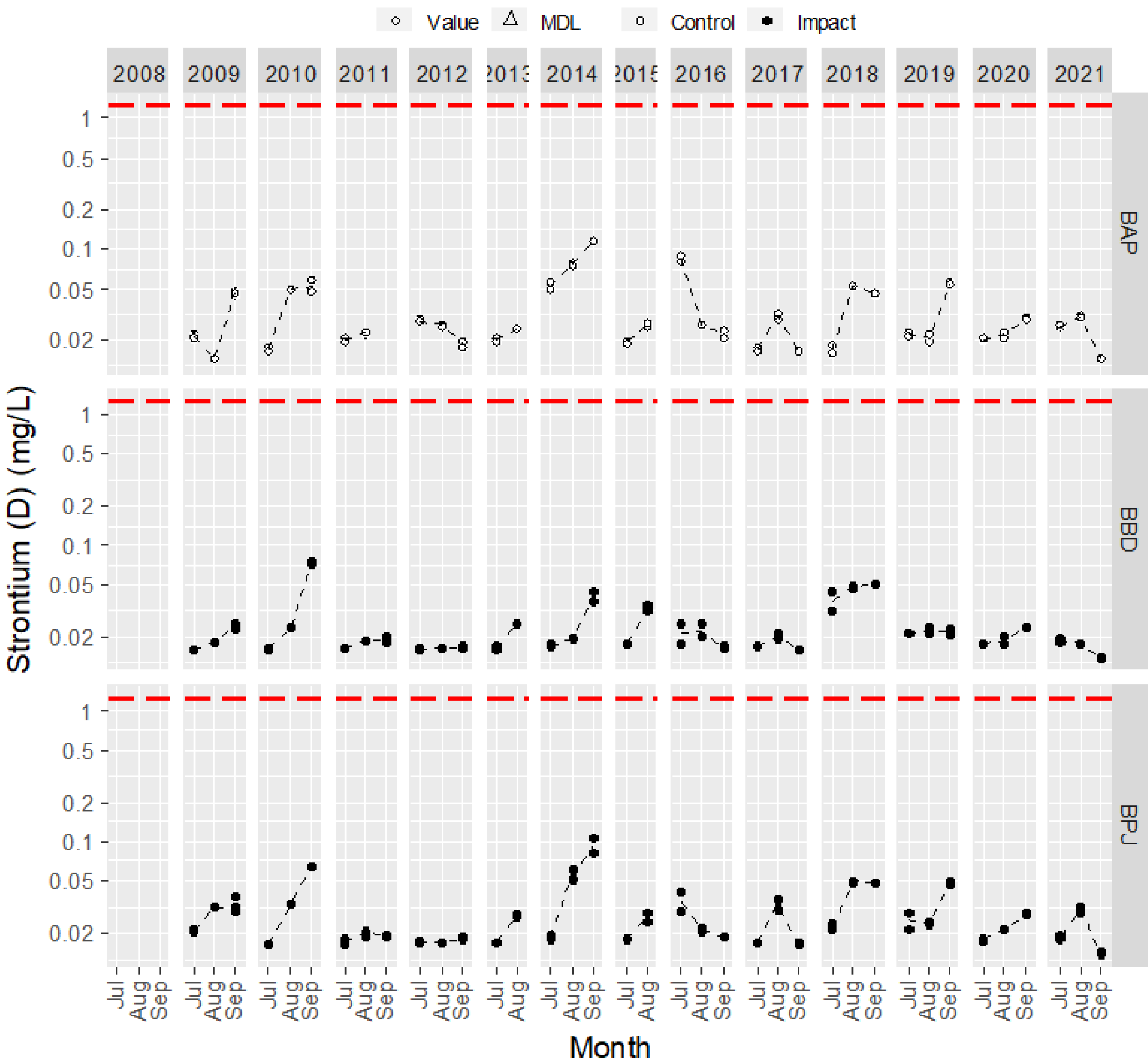
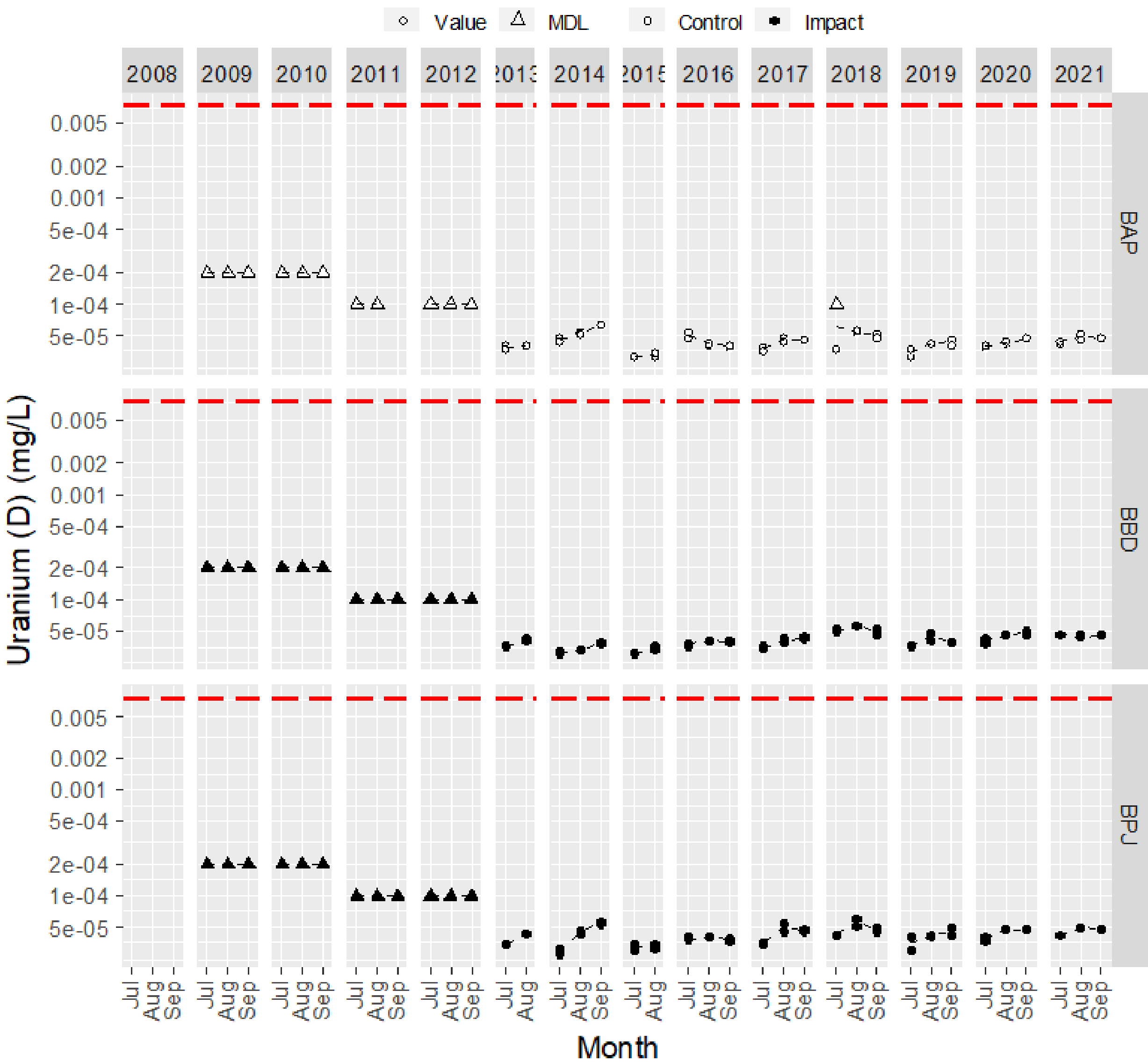


Figure 6-53. Dissolved uranium (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line is the trigger value specific to Baker Lake.



Phytoplankton Tables and Figures

Table 6-4. Results of the BACI tests for phytoplankton variables at Baker Lake areas.

Parameter Measured	Test Area	n(B)	n(A)	Estimate	SE	P-value*	Effect Size (%)		
							ES	LCI	UCI
Total Biomass	BBD	36	3	0.37	0.23	0.120	45	-10	133
	BPJ	36	3	0.19	0.16	0.255	21	-13	68
Species	BBD	36	3	0.02	0.06	0.721	2	-9	14
	BPJ	36	3	0.03	0.06	0.604	3	-9	16

Notes:

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

Shaded cells indicate positive (increased) or negative (reduced) effect sizes of 20% or more.

Test area = area compared to control (BAP).

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

n(A) = number of months in the "after" period (i.e., in 2021).

Estimate = BACI model estimate of the 2021 change in mean for log-transformed data.

SE = standard error of the estimate.

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

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

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

Figure 6-54. Chlorophyll-a (µg/L) in water samples from Baker Lake since 2008.

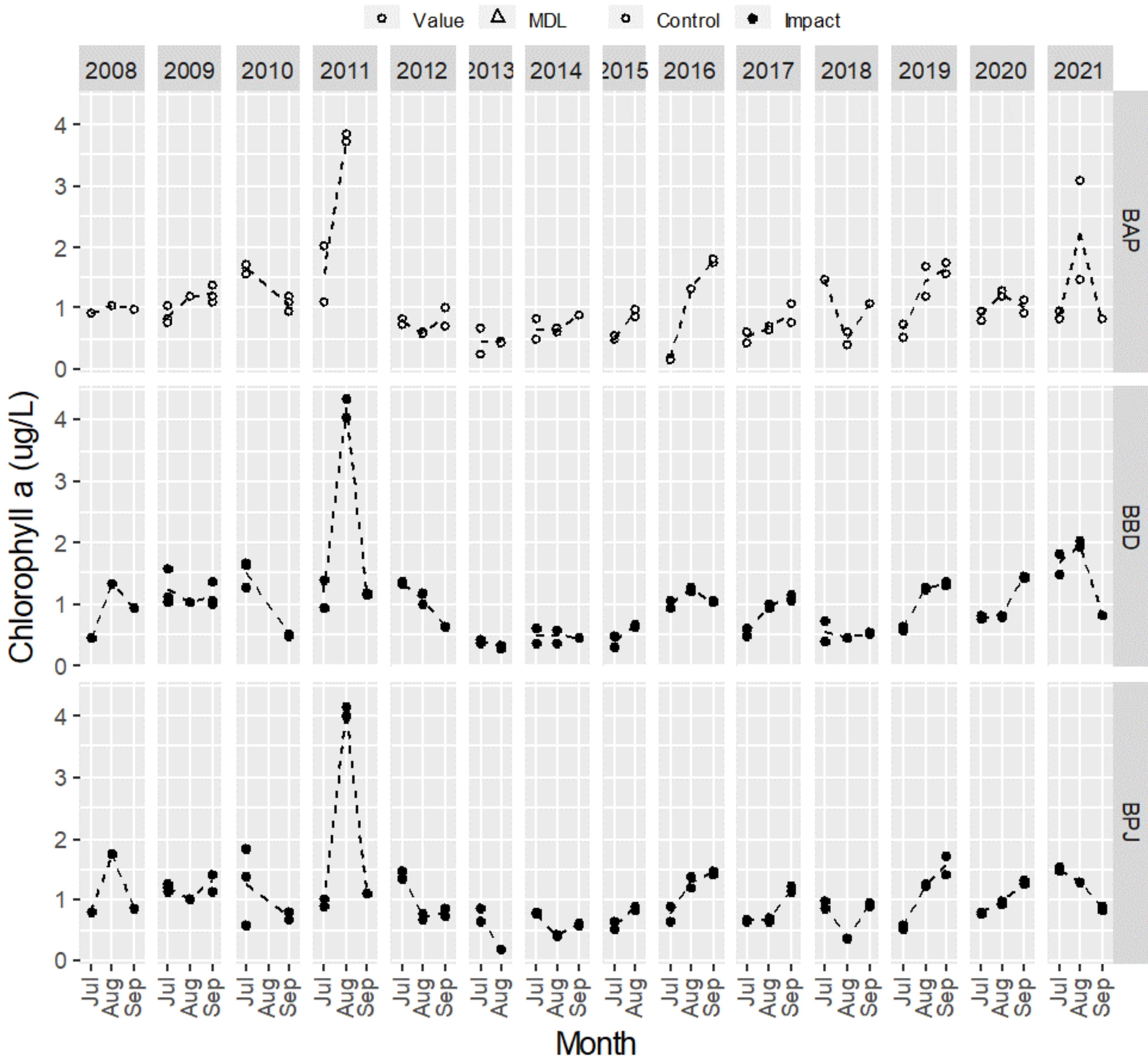


Figure 6-55. Total phytoplankton biomass (mg/m³) from Baker Lake since 2008.

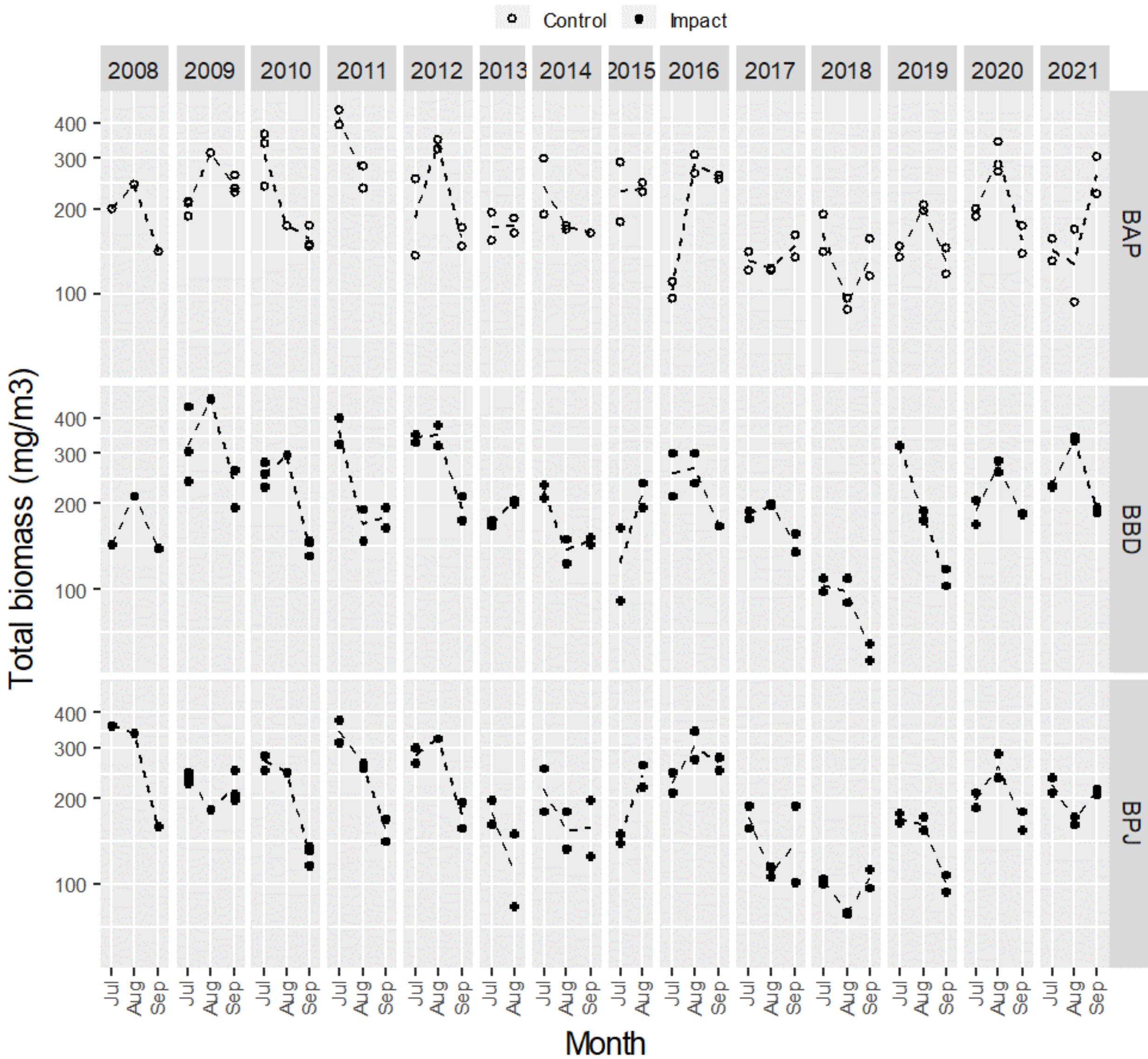


Figure 6-56. Phytoplankton biomass (mg/m³) by major taxa from Baker Lake since 2008.

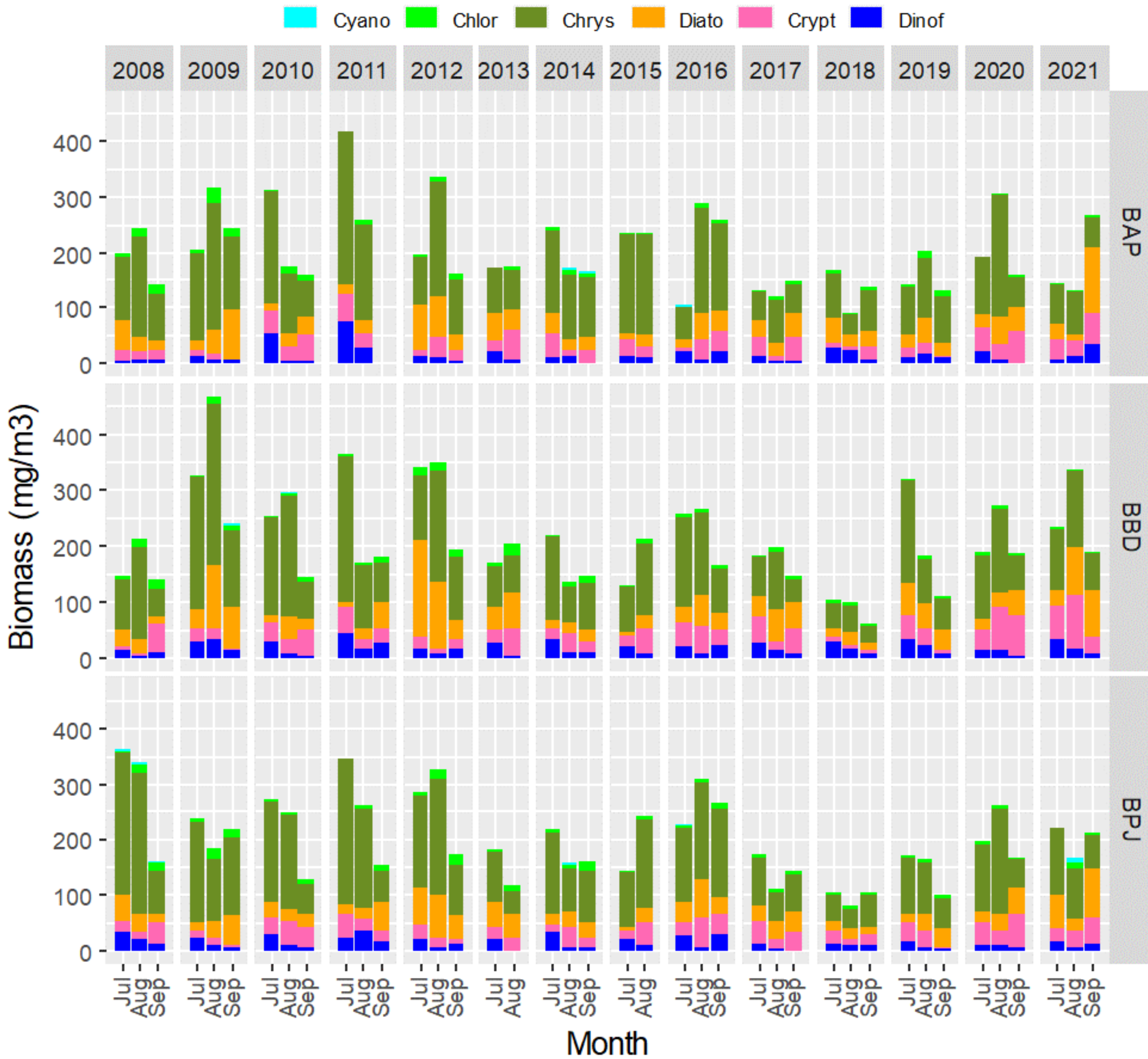


Figure 6-57. Relative phytoplankton biomass by major taxa from Baker Lake since 2008.

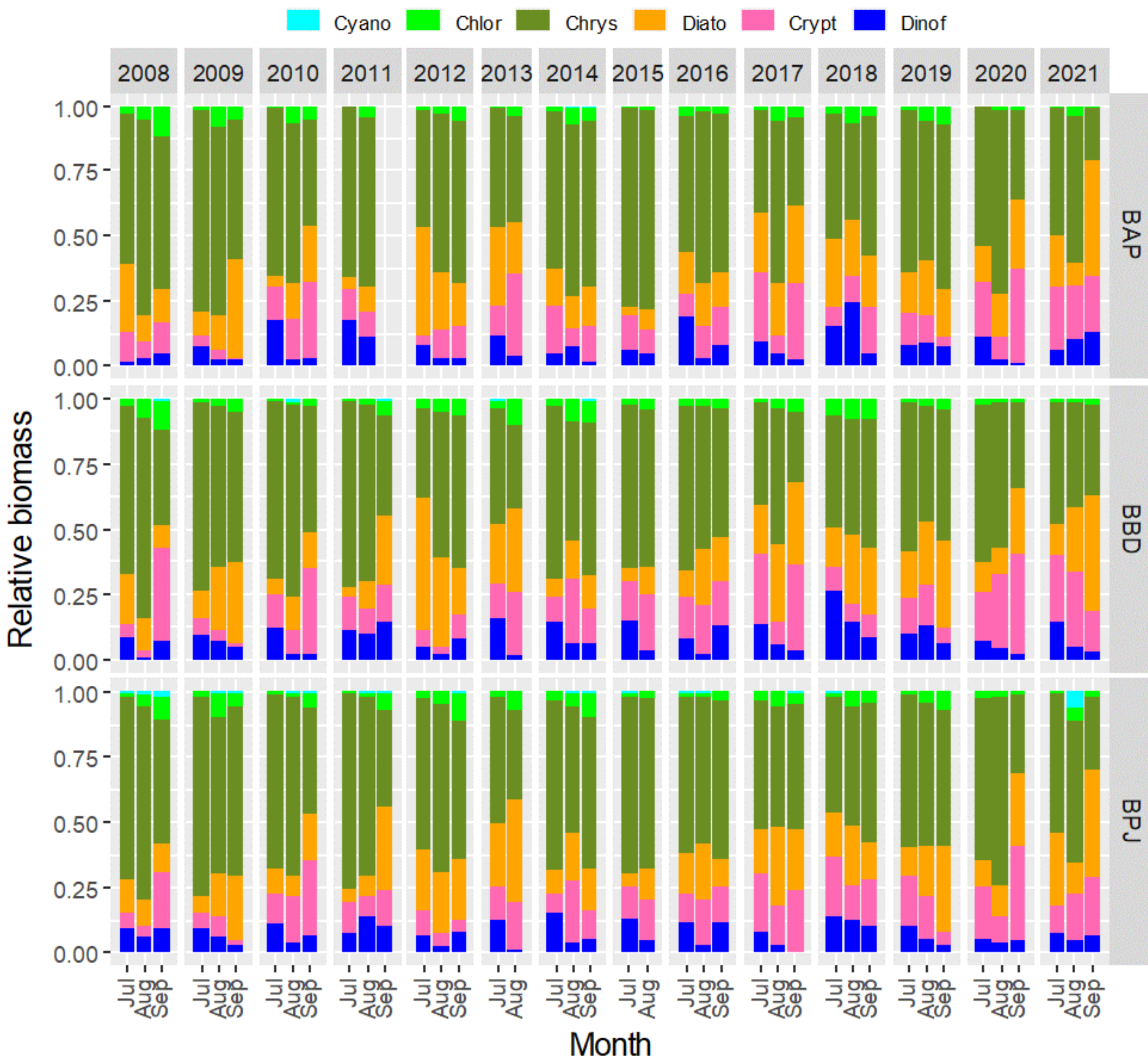
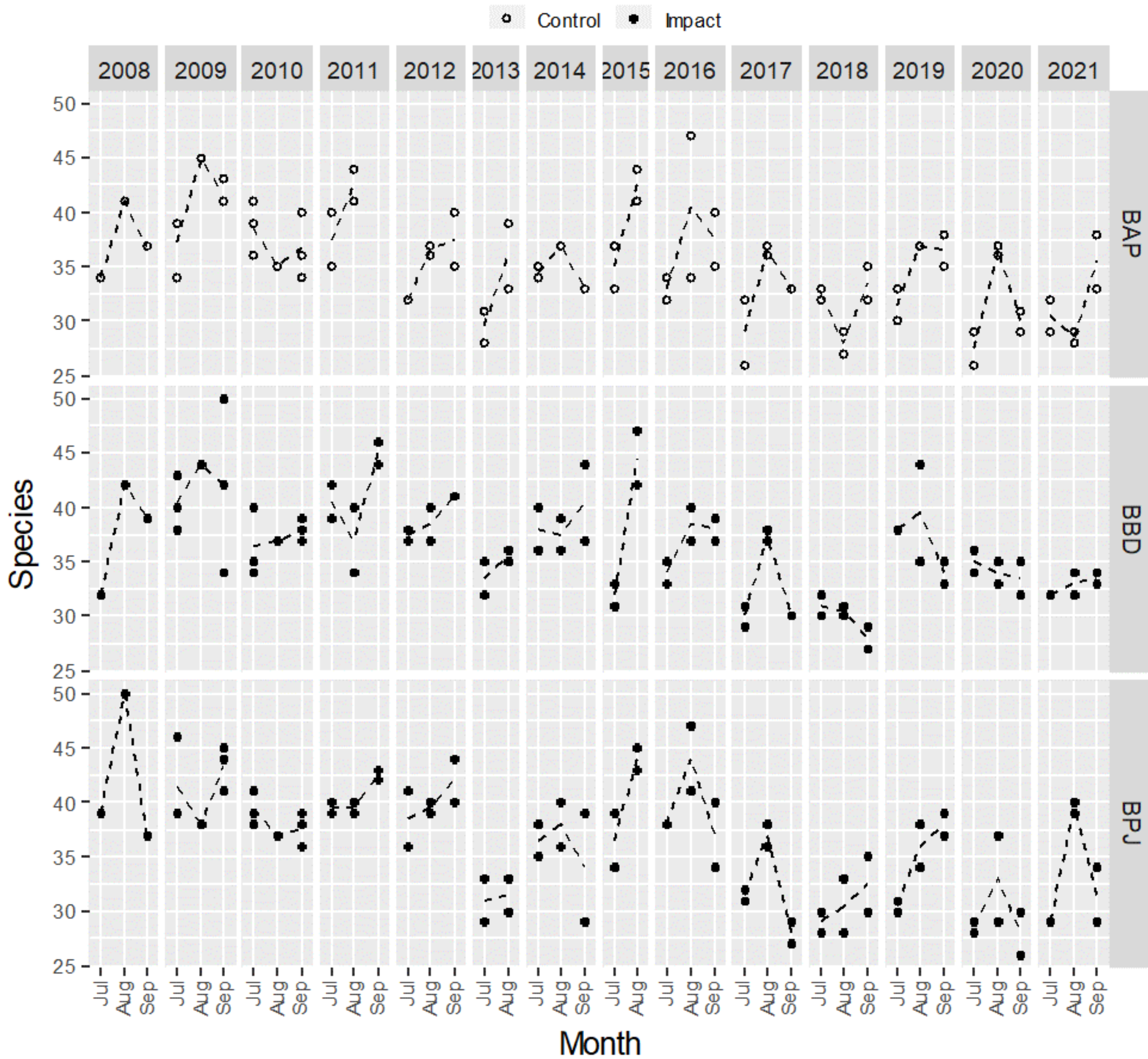


Figure 6-58. Phytoplankton species richness by major taxa from Baker Lake since 2008.



Benthic Invertebrate Tables and Figures

Table 6-5. Results of the BACI tests for benthic invertebrate abundance at Baker Lake areas.

After Period	Test Area	n(B)	n(A)	Estimate	SE	P-value*	Effect size (%)		
							ES	LCI	UCI
2021	BBD	13	1	0.54	0.93	0.71	71	-78	1,214
	BPJ	13	1	0.63	0.91	0.75	88	-74	1,268
2020-21	BBD	12	2	0.67	0.68	0.83	95	-56	755
	BPJ	12	2	0.52	0.67	0.77	68	-61	617
2019-21	BBD	11	3	0.9	0.55	0.92	134	-30	681
	BPJ	11	3	0.7	0.55	0.89	106	-38	583
2018-21	BBD	10	4	1.1	0.46	0.98	188	6	677
	BPJ	10	4	0.97	0.45	0.97	165	-1	610

Notes:

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

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

Test area = area compared to control (BAP).

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

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

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

SE = standard error of the estimate.

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

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

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

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

After Period	Test Area	n(B)	n(A)	Estimate	SE	P-value*	Effect size (%)		
							ES	LCI	UCI
2021	BBD	13	1	0.13	0.19	0.74	14	-25	74
	BPJ	13	1	0.28	0.40	0.75	33	-45	219
2020-21	BBD	12	2	0.03	0.15	0.59	3	-25	42
	BPJ	12	2	0.07	0.30	0.59	7	-44	108
2019-21	BBD	11	3	0.08	0.12	0.75	9	-17	42
	BPJ	11	3	0.18	0.25	0.75	19	-31	108
2018-21	BBD	10	4	0.17	0.10	0.94	19	-5	48
	BPJ	10	4	0.33	0.22	0.92	39	-13	122

Notes:

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

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

Test area = area compared to control (BAP).

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

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

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

SE = standard error of the estimate.

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

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

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

Figure 6-59. Benthic invertebrate total abundance (#/m²) from Baker Lake since 2008.

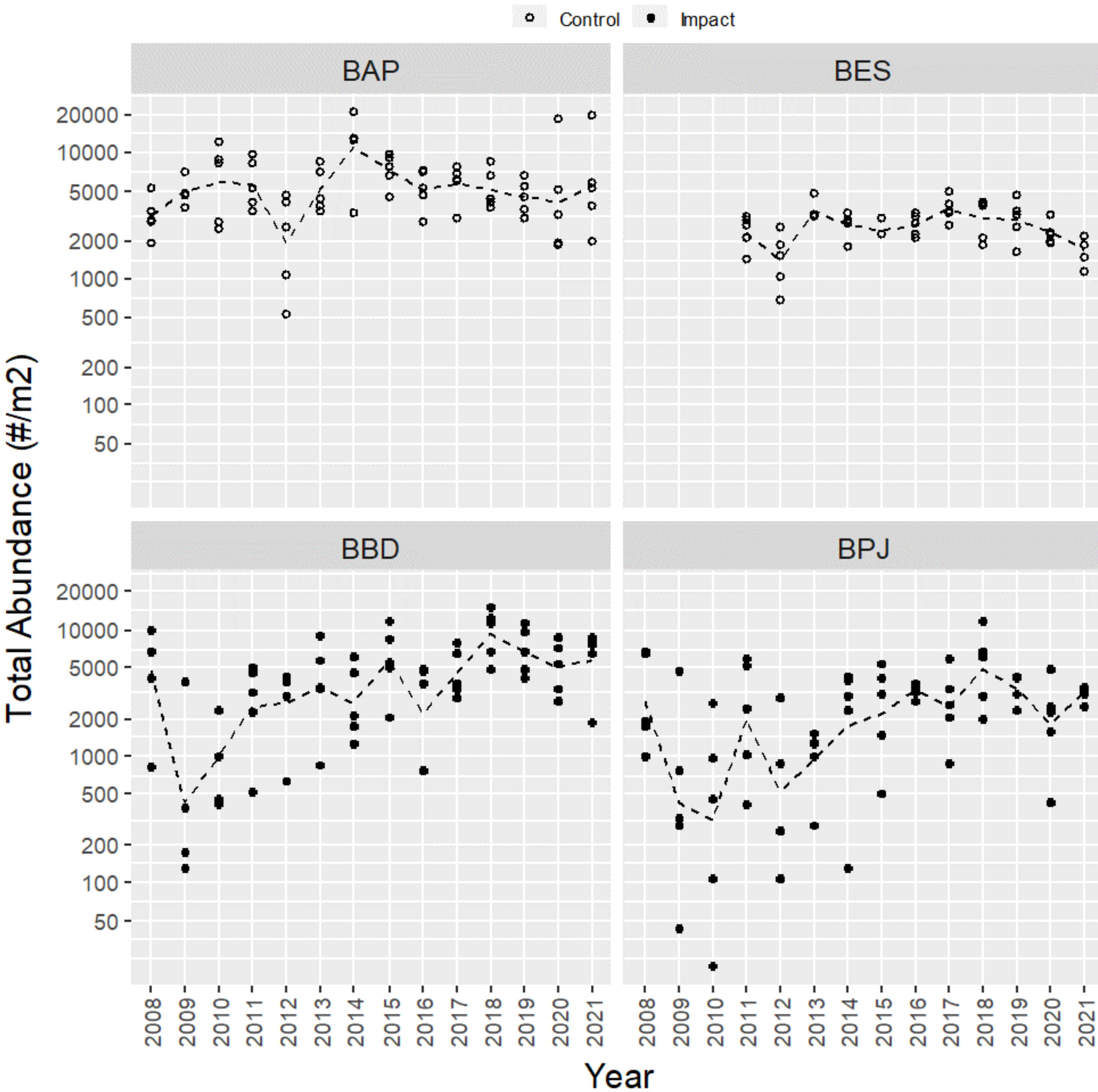


Figure 6-60. Benthic invertebrate total abundance (#/m²) by major taxa from Baker Lake since 2008.

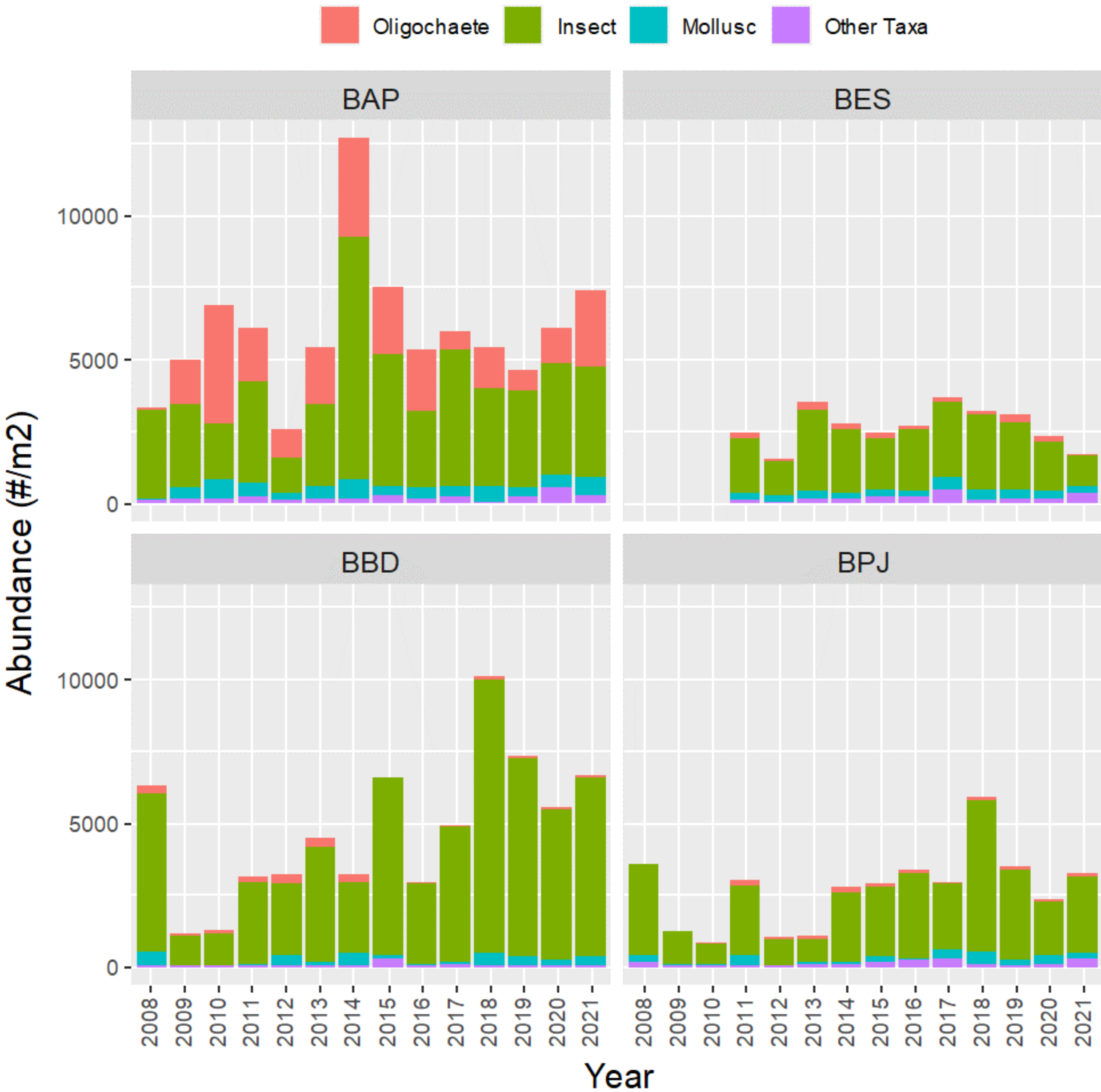


Figure 6-61. Benthic invertebrate relative abundance by major taxa from Baker Lake since 2008.

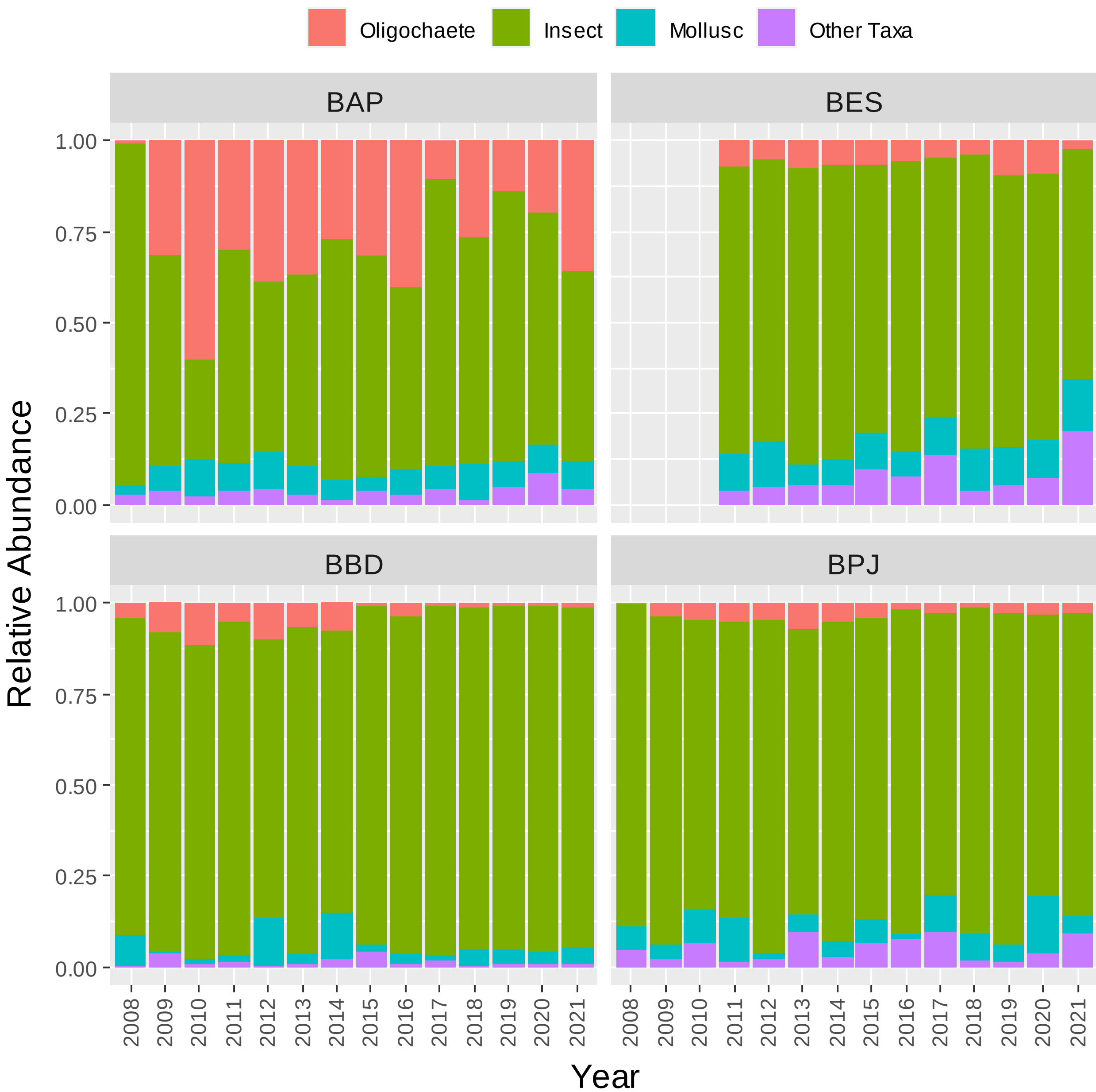


Figure 6-62. Benthic invertebrate total richness (# taxa) from Baker Lake since 2008.

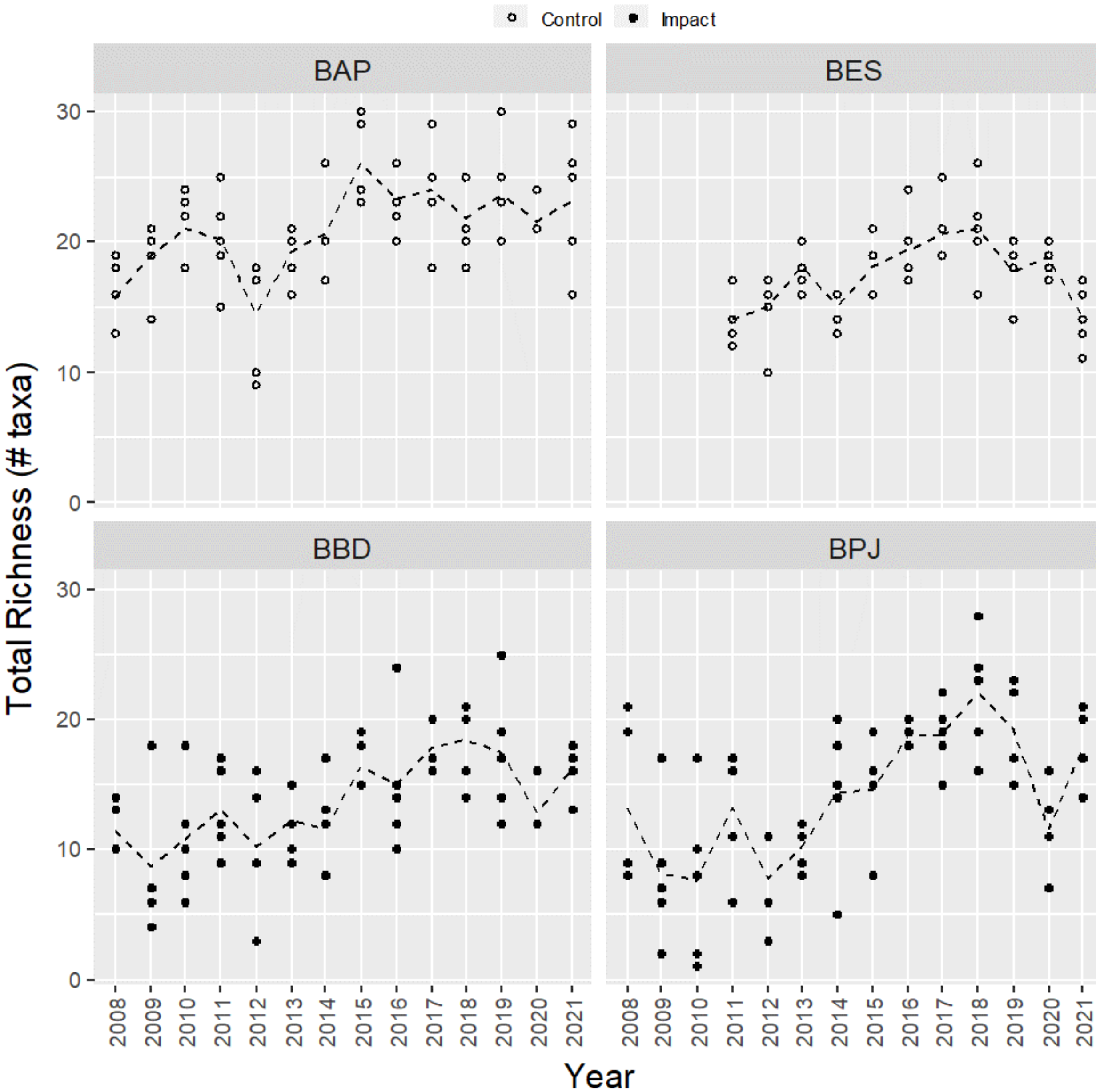


Figure 6-63. Benthic invertebrate total richness (# taxa) by major taxa from Baker Lake since 2008.

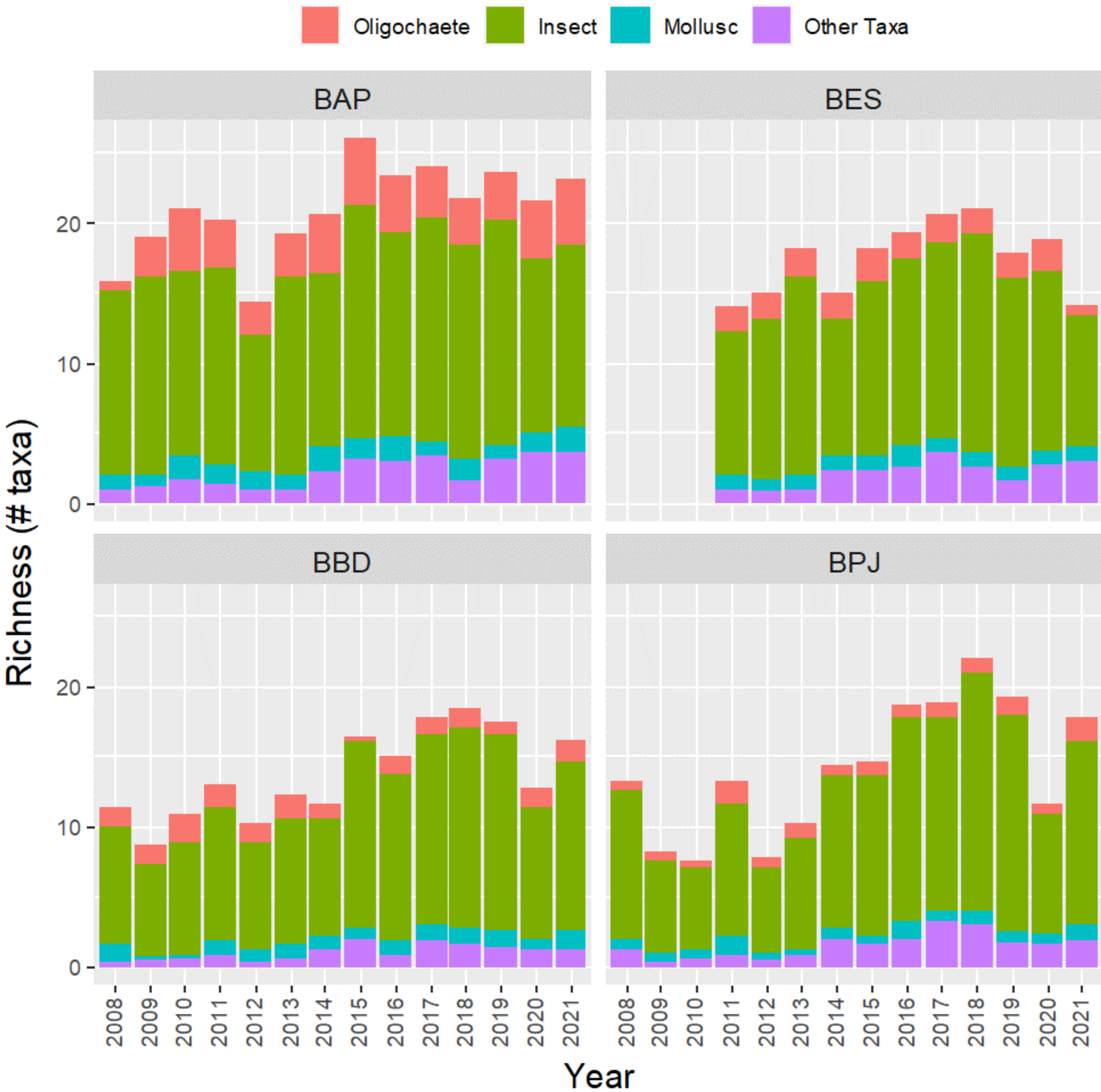
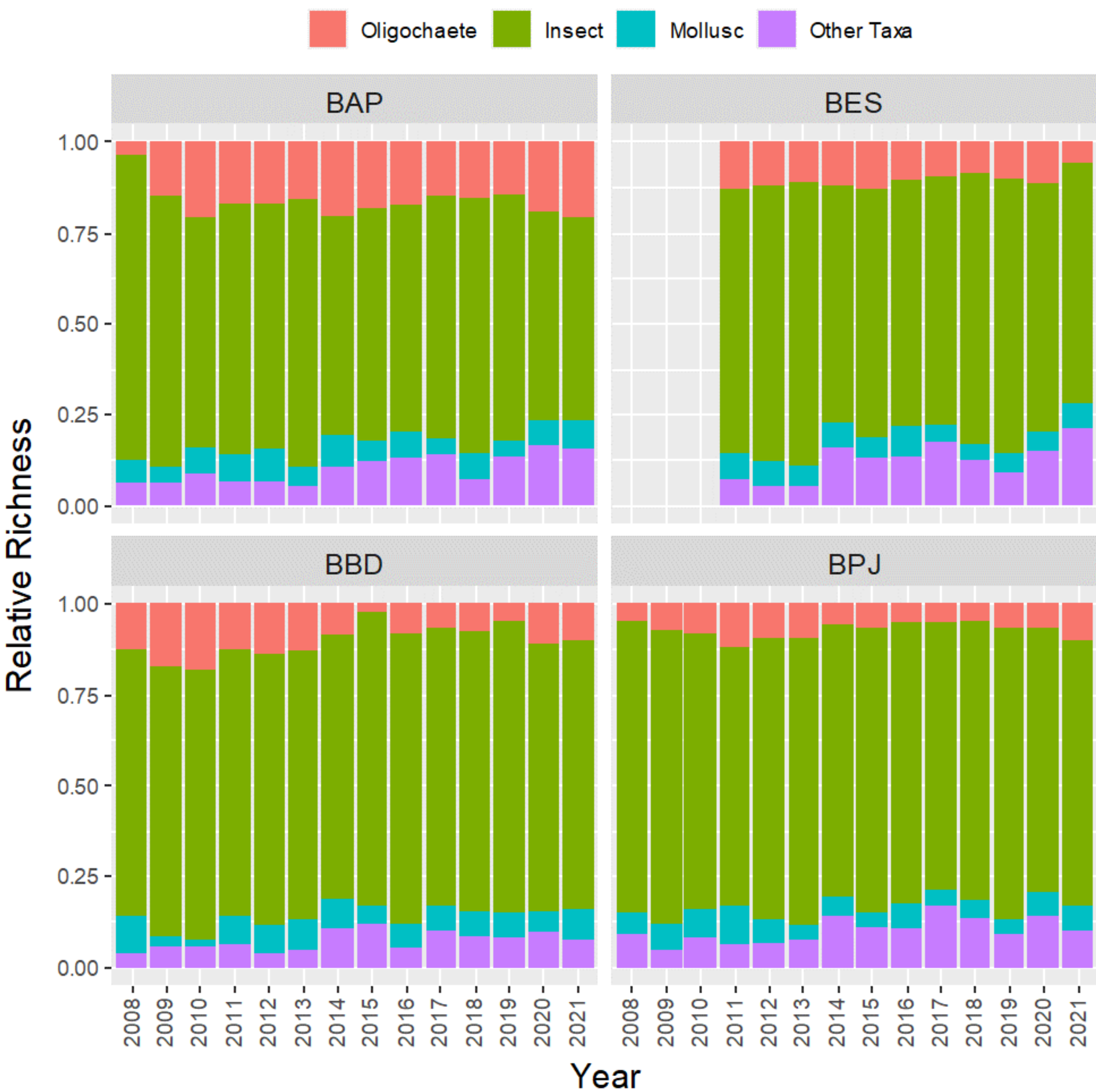


Figure 6-64. Benthic invertebrate relative richness by major taxa from Baker Lake since 2008.



7 SCOPE OF THE 2022 CREMP

The CREMP focuses on identifying changes in limnology, water, and sediment chemistry, and primary (phytoplankton) and secondary (benthic invertebrate community) aquatic producers that may be associated with mine development activities. This is accomplished by applying a temporal/spatial trend assessment that includes applying quantitative decision criteria (i.e., early warning *triggers* and action *thresholds*) to facilitate making immediate and objective decisions about appropriate management actions. CREMP results are integrated annually into the Aquatic Ecosystem Monitoring Program (AEMP) for holistic environmental management and decision making. Recommendations for the scope of the 2022 CREMP are provided for Meadowbank, Whale Tail, and Baker Lake based on the 2021 monitoring results discussed in **Sections 4**, **5**, and **6**, respectively.

7.1 Meadowbank

Based on the 2021 results and the annual decision framework for the sampling strategy (**Section 2.2.3**), the components and schedule for the 2021 CREMP for the Meadowbank study area is summarized in **Table 7-1**. The scope of work proposed for 2022 includes:

- Water quality – Water sampling for three open water and two through-ice sampling events is recommended at the NF areas in 2022. Through-ice limnology and water chemistry sampling at TPS, TE, and TEFF is planned for one event in 2022. In addition, contingency water samples may need to be collected during the limnology-only, through-ice sampling event(s) at the NF areas, if anomalous in-situ limnology results are observed.
- Phytoplankton – Routine sampling at the NF areas, at the same time as the three open water and two through-ice sampling events. Sampling at MF and FF areas is not required.
- Sediment chemistry – Sediment chemistry samples will be collected by grab sampler with benthos samples at all NF areas and reference in 2022.
- Benthos – Routine sampling at the NF areas in 2022.

7.2 Whale Tail

Timing of the field sampling at the Whale Tail study area lakes matches the schedule for Meadowbank because of share-reference area sampling at INUG and PDL. The frequency of sampling and study components at each area are outlined in **Table 7-2**.

- Water quality – The full CREMP program (through-ice and open water) is recommended at the NF, MF, and FF areas 2022. Through-ice limnology profiles are recommended at MAM, WTS, and

NEM in the months when water sampling is not completed. In addition, contingency water samples may need to be collected during the limnology-only, through-ice sampling event(s), if anomalous *in-situ* limnology results are observed.

- Phytoplankton – Routine sampling with the full water quality sampling program.
- Sediment chemistry – Routine sediment grab chemistry sampling with the replicate benthos sampling stations in each area.
- Benthos – Sampling at NF areas (WTS and MAM) to monitor for changes in the community due to construction and discharge. Sampling at NEM to monitor potential changes related to the temporary authorized discharge into the Nemo Lake watershed in 2019, and sampling at areas A20, A76 and DS1 to provide more information on the range of normal conditions to support future BACI-style analysis.

7.3 Baker Lake

The scope of the 2022 Baker Lake CREMP is presented in **Table 7-3**. Monthly water quality monitoring is planned for July, August, and September consistent with previous years. Sediment chemistry and benthos sampling are currently planned for completion in August 2022, but monitoring frequency for this area will be revisited in the forthcoming CREMP Design Plan update.

Table 7-1. Monitoring components planned for 2022 Meadowbank CREMP.

Area ID	Through-Ice					Open-Water			Through-Ice	
	Jan	Feb	Mar	April	May	Jul	Aug	Sep	Nov	Dec
Reference Areas										
INUG			WQ		WQ	WQ	WQ	WQ		
			Phyto		Phyto	Phyto	Phyto	Phyto		
							Sed			
							Benthos			
PDL			WQ		WQ	WQ	WQ	WQ		
			Phyto		Phyto	Phyto	Phyto	Phyto		
							Sed			
							Benthos			
Near-Field Areas										
TPE	Limno	Limno	WQ	Limno	WQ	WQ	WQ	WQ	Limno	Limno
			Phyto		Phyto	Phyto	Phyto	Phyto		
							Sed			
							Benthos			
TPN	Limno	Limno	WQ	Limno	WQ	WQ	WQ	WQ	Limno	Limno
			Phyto		Phyto	Phyto	Phyto	Phyto		
							Sed			
							Benthos			
SP	Limno	Limno	WQ	Limno	WQ	WQ	WQ	WQ	Limno	Limno
			Phyto		Phyto	Phyto	Phyto	Phyto		
							Sed			
							Benthos			
WAL	Limno	Limno	WQ	Limno	WQ	WQ	WQ	WQ	Limno	Limno
			Phyto		Phyto	Phyto	Phyto	Phyto		
							Sed			
							Benthos			
Mid- and Far-Field Areas [3]										
TPS, TE, and TEFF			WQ							
			Phyto							

Notes:
No sampling in June and October due to unsafe ice conditions.
Limno: 1 limno depth profile should be collected at key near-field areas (TPN, TPE, SP, and WAL) during the winter months; water chemistry will also be collected if profiling shows unusual results.
WQ: 2 replicate samples from 3 m depth and limno profiles at each location.
Phyto: 2 replicate samples from 3 m depth; same locations as limno.
Sed: 1 composite for organics (LEPH, HEPH, PAH(low), Mineral Oil and Grease); 5 replicates for grab physical (TOC, Grain Size, Moisture); 10 replicates for core physical (metals, TOC, Moisture).
Benthos: 5 replicate samples (2 grab composite/sample); same locations as sediment.

Table 7-2. Monitoring components planned for 2022 Whale Tail CREMP.

Area ID	Through-Ice				Open-Water			Through-Ice	
	Jan	Feb	Mar	April	May	Jul	Aug	Sep	Nov	Dec
Near-Field Areas										
WTS	Limno	Limno	WQ	Limno	WQ	WQ	WQ	WQ	Limno	Limno
			Phyto		Phyto	Phyto	Phyto	Phyto		
							Sed			
							Benthos			
MAM	Limno	Limno	WQ	Limno	WQ	WQ	WQ	WQ	Limno	Limno
			Phyto		Phyto	Phyto	Phyto	Phyto		
							Sed			
							Benthos			
NEM	Limno	Limno	WQ	Limno	WQ	WQ	WQ	WQ	Limno	Limno
			Phyto		Phyto	Phyto	Phyto	Phyto		
							Sed			
							Benthos			
Mid- and Far-Field Areas [3]										
A20			WQ		WQ	WQ	WQ	WQ		
			Phyto		Phyto	Phyto	Phyto	Phyto		
							Sed			
							Benthos			
A76			WQ		WQ	WQ	WQ	WQ		
			Phyto		Phyto	Phyto	Phyto	Phyto		
							Sed			
							Benthos			
DS1			WQ		WQ	WQ	WQ	WQ		
			Phyto		Phyto	Phyto	Phyto	Phyto		
							Sed			
							Benthos			

Notes:
No sampling in June and October due to unsafe ice conditions.
Limno: 1 limno depth profile should be collected at key near-field areas (MAM and WTS) to reduce uncertainty regarding the potential occurrence of changes over winter; water chemistry will also be collected if profiling shows unusual results.
WQ: 2 replicate samples from 3 m depth and limno profiles at each location.
Phyto: 2 replicate samples from 3 m depth; same locations as limno.
Sed: 1 composite for organics (LEPH, HEPH, PAH (low), Mineral Oil and Grease); 5 replicates for grab physical (TOC, Grain Size, Moisture); 10 replicates for core physical (metals, TOC, 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.

Table 7-3. Monitoring components planned for 2022 Baker Lake CREMP.

Area ID	Open-Water		
	July	August	September
BBD	WQ	WQ	WQ
	Phyto	Phyto	Phyto
		Sed	
		Benthos	
BPJ	WQ	WQ	WQ
	Phyto	Phyto	Phyto
		Sed	
		Benthos	
BAP	WQ	WQ	WQ
	Phyto	Phyto	Phyto
		Sed	
		Benthos	
BES		Sed	
		Benthos	

Notes:
WQ: 2 replicate samples from 3 m depth and limno profiles at each location.
Phyto: 2 replicate samples from 3 m depth; same locations as limno.
Sed: 1 composite for organics (LEPH, HEPH, PAH (low), Mineral Oil and Grease); 5 replicates for grab physical (TOC, Grain Size, Moisture); 10 replicates for core physical (metals, TOC, 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.

8 REFERENCES

The references section is organized into three sections: Annual CREMP Reports, guidance documents related to the CREMP, and other literature cited in the report, including peer-reviewed studies and technical reports.

Annual CREMP Reports and Baseline Studies

Azimuth. 2021. 2020 Core Receiving Environment Monitoring Program, Meadowbank Complex. Report prepared by Azimuth Consulting Group, Vancouver, BC for Agnico Eagle Mines Ltd., Baker Lake, NU. March 2021.

Azimuth. 2020a. 2019 Core Receiving Environment Monitoring Program, Meadowbank Mine and Whale Tail Project. Report prepared by Azimuth Consulting Group, Vancouver, BC for Agnico Eagle Mines Ltd., Baker Lake, NU. March 2020.

Azimuth. 2019a. 2018 Core Receiving Environment Monitoring Program, Meadowbank Mine and Whale Tail Project. Report prepared by Azimuth Consulting Group, Vancouver, BC for Agnico Eagle Mines Ltd., Baker Lake, NU. March 2019.

Azimuth. 2019b. Memorandum: Whale Tail Permitting Support – Stream Tributary Water Quality Data Summary (KivIA Aquatic-TC#3). Memo prepared for Agnico Eagle Mines Ltd. October 28, 2019.

Azimuth. 2018a. Whale Tail Pit Core Receiving Environment Monitoring Program (CREMP): 2014-2017 Baseline Studies. Report prepared by Azimuth Consulting Group, Vancouver, BC for Agnico Eagle Mines Ltd., Baker Lake, NU. February, 2018.

Azimuth. 2018c. Core Receiving Environment Monitoring Program 2017. Report prepared by Azimuth Consulting Group, Vancouver, BC for Agnico Eagle Mines Ltd., Baker Lake, NU. March 2018.

Azimuth. 2017a. Core Receiving Environment Monitoring Program (CREMP) 2016, Meadowbank Mine. Report prepared by Azimuth Consulting Group, Vancouver, BC for Agnico Eagle Mines Ltd., Baker Lake, NU. March, 2017.

Azimuth. 2017b. Whale Tail Pit Core Receiving Environment Monitoring Program (CREMP): Rationale for Selection of Reference Areas. Technical Memorandum prepared by Azimuth Consulting Group, Vancouver, BC for Agnico Eagle Mines Ltd., Baker Lake, NU, November 10, 2017.

Azimuth. 2016. Core Receiving Environment Monitoring Program (CREMP) 2015, Meadowbank Mine. Report prepared by Azimuth Consulting Group, Vancouver, BC for Agnico Eagle Mines Ltd., Baker Lake, NU. March, 2016.

Azimuth. 2015c. Core Receiving Environment Monitoring Program (CREMP) 2014, Meadowbank Mine. Report prepared by Azimuth Consulting Group, Vancouver, BC for Agnico Eagle Mines Ltd., Baker Lake, NU. March, 2015.

Azimuth. 2014. Core Receiving Environment Monitoring Program (CREMP) 2013, Meadowbank Mine. Report prepared by Azimuth Consulting Group, Vancouver, BC for Agnico Eagle Mines Ltd., Baker Lake, NU. March, 2014.

Azimuth. 2013. Core Receiving Environment Monitoring Program (CREMP) 2012, Meadowbank Mine. Report prepared by Azimuth Consulting Group, Vancouver, BC for Agnico Eagle Mines Ltd., Baker Lake, NU. March, 2013.

Azimuth. 2012a. Aquatic Effects Monitoring Program – Core Receiving Environment Monitoring Program 2011, Meadowbank Mine. Report prepared by Azimuth Consulting Group, Vancouver, BC for Agnico Eagle Mines Ltd., Baker Lake, NU. March, 2012.

Azimuth. 2012b. Aquatic Effects Monitoring Program – Targeted Study: Dike Construction TSS Effects Assessment Study 2011, Meadowbank Mine. Report prepared by Azimuth Consulting Group, Vancouver, BC for Agnico Eagle Mines Ltd., Baker Lake, NU. March, 2012.

Azimuth. 2011a. Aquatic Effects Monitoring Program – Targeted Study: Dike Construction TSS Effects Assessment Study 2010, Meadowbank Mine. Report prepared by Azimuth Consulting Group Inc., Vancouver, BC for Agnico Eagle Mines Ltd., Baker Lake, NU. March, 2011.

Azimuth. 2011b. Aquatic Effects Monitoring Program – Core Receiving Environment Monitoring Program 2010, Meadowbank Gold Project. Report prepared by Azimuth Consulting Group Inc., Vancouver, BC for Agnico Eagle Mines Ltd., Baker Lake, NU. March, 2011.

Azimuth. 2010a. Aquatic Effects Monitoring Program – Core Receiving Environment Monitoring Program 2009, Meadowbank Gold Project. Report prepared by Azimuth Consulting Group Inc., Vancouver, BC for Agnico Eagle Mines Ltd., Baker Lake, NU.

Azimuth. 2010b. Aquatic Effects Monitoring Program – Targeted Study: Dike Construction Monitoring 2009, Meadowbank Gold Project. Report prepared by Azimuth Consulting Group Inc., Vancouver, BC for Agnico Eagle Mines Ltd., Baker Lake, NU.

Azimuth. 2010c. Aquatic Effects Monitoring Program – Targeted Study: Dike Construction TSS Effects Assessment Study 2009, Meadowbank Gold Project. Report prepared by Azimuth Consulting Group Inc., Vancouver, BC for Agnico Eagle Mines Ltd., Baker Lake, NU.

Azimuth. 2009a. Aquatic Effects Monitoring Program – Targeted Study: Dike Construction Monitoring 2008, Meadowbank Gold Project. Report prepared by Azimuth Consulting Group Inc., Vancouver, BC for Agnico Eagle Mines Ltd., Vancouver, BC. March 2009.

Azimuth. 2009b. Aquatic Effects Monitoring Program – Targeted Study: Second Portage Lake TSS Effects Assessment Study 2008, Meadowbank Gold Project. Report prepared by Azimuth Consulting Group Inc., Vancouver, BC for Agnico Eagle Mines Ltd., Vancouver, BC. March 2009.

Azimuth. 2009c. Aquatic Effects Monitoring Program – Receiving Environment Monitoring 2008, Meadowbank Gold Project. Report prepared by Azimuth Consulting Group Inc., Vancouver, BC for Agnico Eagle Mines Ltd., Vancouver, BC. March 2009.

Azimuth. 2008a. Aquatic Effects Management Program Monitoring – Meadowbank Gold Project, 2007. Report prepared by Azimuth Consulting Group Inc., Vancouver, BC for Agnico Eagle Mines Ltd., Vancouver, BC. March 2008.

Azimuth. 2008b. Aquatic Effects Management Program Monitoring – Meadowbank Gold Project, 2006. Report prepared by Azimuth Consulting Group Inc., Vancouver, BC for Agnico Eagle Mines Ltd., Vancouver, BC. March 2008.

Azimuth. 2005b. Baseline Aquatic Ecosystem Report (BAER) – Meadowbank Gold Project. A report prepared by Azimuth Consulting Group Inc., Vancouver for Cumberland Resources Ltd. October, 2005.

Azimuth. 2003. Baseline water and sediment quality data for the Meadowbank Gold Project, March 2003.

Guidance Documents

Agnico Eagle Mines Ltd. 2021. Whale Tail Pit Expansion Project – Adaptive Management Plan. Report prepared by Agnico Eagle Mines Limited – Meadowbank Division. July, 2021.

Agnico Eagle Mines Ltd. 2019. Whale Tail 2018 Mercury monitoring report. Report prepared by Agnico Eagle Mines Limited – Meadowbank Division. March 2019.

Azimuth. 2020b. Aquatic Effects Management Program (AEMP), Meadowbank Mine. Report prepared by Azimuth Consulting Group, Vancouver, BC for Agnico Eagle Mines Ltd., Baker Lake, NU. March, 2020.

Azimuth. 2018b. Core Receiving Environment Monitoring Program (CREMP): 2015 Plan Update – Whale Tail Pit Addendum. Report prepared by Azimuth Consulting Group, Vancouver, BC for Agnico Eagle Mines Ltd., Baker Lake, NU. December, 2018.

Azimuth. 2015a. Aquatic Effects Management Program (AEMP), Meadowbank Mine. Report prepared by Azimuth Consulting Group, Vancouver, BC for Agnico Eagle Mines Ltd., Baker Lake, NU. November, 2015.

Azimuth. 2015b. Core Receiving Environment Monitoring Program (CREMP): 2015 Plan Update. Report prepared by Azimuth Consulting Group, Vancouver, BC for Agnico Eagle Mines Ltd., Baker Lake, NU. November, 2015.

Azimuth. 2012c. Aquatic Effects Management Program (AEMP), Meadowbank Mine. Report prepared by Azimuth Consulting Group, Vancouver, BC for Agnico Eagle Mines Ltd., Baker Lake, NU. December, 2012.

Azimuth. 2012d. Core Receiving Environment Monitoring Program (CREMP): Design Document 2012, Meadowbank Mine. Report prepared by Azimuth Consulting Group, Vancouver, BC for Agnico Eagle Mines Ltd., Baker Lake, NU. December, 2012.

Azimuth. 2010d. Core Receiving Environment Monitoring Program (CREMP): 2010 Plan Update, Meadowbank Gold Project. Report prepared by Azimuth Consulting Group Inc., Vancouver, BC for Agnico Eagle Mines Ltd., Baker Lake, NU. June 2010.

Azimuth. 2005a. Aquatic Effects Management Program (AEMP) – Meadowbank Gold Project. 2005. A report prepared by Azimuth Consulting Group, Vancouver for Cumberland Resources Ltd. October, 2005.

Other References

ADEC (Alaska Department of Environmental Conservation). 2012. Water Quality Standards. 18 AAC 70. Amended as of April 8, 2012. Juneau, AK, USA. Available at: Link. Accessed March 2014.

Agnico Eagle Mined Ltd. (Agnico Eagle). 2018. Technical Report on the Mineral Resources and Mineral Reserves at Meadowbank Gold Complex including the Amaruq Satellite Mine Development, Nunavut, Canada as at December 31, 2017.

Agnico Eagle. 2016. Whale Tail Pit Project - Meadowbank Mine Final Environmental Impact Statement and Type A Water Licence Amendments. Amendment/Reconsideration of the Project Certificate (No. 004/ File No. 03MN107) and Amendment to the Type A Water Licence (No. 2AM-MEA1525). Submitted to the Nunavut Impact Review Board. June 2016.

Agnico Eagle. 2011. Aquatic Effects Monitoring Program – Targeted Study: Dike Construction Monitoring 2010, Meadowbank Mine. Report prepared by Agnico Eagle Mines Ltd., Baker Lake, NU.

Alstad, N.E., Skardal, L. and Hessen, D.O. 1999. The effect of calcium concentration on the calcification of Daphnia magna. Limnology and Oceanography, 44(8), pp.2011-2017.

Arnott, S.E., Azan, S.S.E. and Ross, A.J. 2017. Calcium decline reduces population growth rates of zooplankton in field mesocosms. Canadian Journal of Zoology, 95(5), pp.323-333.

British Columbia Ministry of Environment (BC MOE). 2017. British Columbia Working Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture.

British Columbia Ministry of Environment (BC MOE). 2016. Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators.

British Columbia Ministry of Environment (BC MOE). 1998. Ambient Water Quality Criteria for Organic Carbon in British Columbia. Victoria BC.

Burnham, K.P. and Anderson, D.R., 2002. A practical information-theoretic approach. Model selection and multimodel inference, 2, pp.70-71.

Campbell, M. W., J. G. Shaw, and C.A. Blyth. 2012. Kivalliq Ecological Land Classification Map Atlas: a wildlife perspective. Government of Nunavut, Department of Environment. Technical Report Series #1-2012. 274 pp.

Calvert, S.E. and Pedersen, T.F. 1996. Sedimentary geochemistry of manganese; implications for the environment of formation of manganiferous black shales. Economic Geology, 91(1), pp.36-47.

CCME. 2019. Canadian Water Quality Guidelines for the Protection of Aquatic Life. In: Canadian environmental quality guidelines, 1999. Canadian Council of Ministers of the Environment, Winnipeg, MB.

CCME. 2018. Canadian water quality guidelines for the protection of aquatic life: zinc. In: Canadian environmental quality guidelines, 1999. Canadian Council of Ministers of the Environment, Winnipeg, MB.

CCME. 2010. Canadian Water Quality Guidelines for the Protection of Aquatic Life: Ammonia. In: Canadian environmental quality guidelines, 1999. Canadian Council of Ministers of the Environment, Winnipeg, MB.

CCME. 2004. Canadian Water Quality Guidelines for the Protection of Aquatic Life: Phosphorus: Canadian Guidance Framework for the Management of Freshwater Systems. Canadian Environmental Quality Guidelines, 2004. Winnipeg, MB, Canada.

CCME. 2002. Canadian Sediment Quality Guidelines for the Protection of Freshwater Aquatic Life, 1999, updated 2002.

CCME. 1999. Polycyclic Aromatic Hydrocarbons (PAHs). Canadian Sediment Quality Guidelines for the Protection of Freshwater Aquatic Life.

CCME. 1995. Protocol for the derivation of Canadian sediment quality guidelines for the protection of aquatic life. CCME EPC-98E. Prepared by Environment Canada, Guidelines Division, Technical Secretariat of the CCME Task Group on Water Quality Guidelines, Ottawa. [Reprinted in Canadian environmental quality guidelines, Chapter 6, Canadian Council of Ministers of the Environment, 1999, Winnipeg.]

Cumberland Resources Ltd. (Cumberland). 2005. Meadowbank Gold Project. Final Environmental Impact Statement. November 2005.

De Schamphelaire, L., Rabaey, K., Boon, N., Verstraete, W. and Boeckx, P. 2007. Minireview: The potential of enhanced manganese redox cycling for sediment oxidation. Geomicrobiology Journal, 24(7-8), pp.547-558.

Doig, L., and K. Liber. 2000. Dialysis minipeeper for measuring porewater metal concentrations in laboratory sediment toxicity and bioavailability tests. Environ. Toxicol. Chem. 19(12): 2882-2889.

Doyle, C.J., F. Pablo, R.P. Lim, and R.V. Hyne. 2003. Assessment of metal toxicity in sediment pore water from Lake Macquarie, Australia. Arch Environ Contam Toxicol, 44(3), pp.0343-0350.

Environment Canada. 2012. Metal Mining Environmental Effects Monitoring Technical Guidance Document. Can be viewed at Environment Canada's website: Link

Environment Canada. 1997. Biological test method: Test for survival and growth in sediment and water using the larvae of freshwater midges (*Chironomus tentans* and *Chironomus riparius*). EPS 1/RM/32, Second Edition, December 1997. Environment Canada, Method Development and Application Section, Environmental Technology Centre, Ottawa, ON. 131 pp.

Environment Canada. 2013. Biological test method: Test for survival and growth in sediment and water using the freshwater amphipod, *Hyalella azteca*. EPS 1/RM/33, Second Edition, January 2013. Environment Canada, Method Development and Application Section, Environmental Technology Centre, Ottawa, ON. 150 pp.

EVS Environment Consultants. 1999. Fisheries evaluation of candidate reference lakes, Meadowbank Gold Project Nunavut, 1998. A report prepared for Cumberland Resources Ltd., Vancouver BC by EVS Environment Consultants, North Vancouver, April 1999. 60 pp.

Golder. 2020. Predicted 1% Water Treatment Plant Effluent Dilution Location in Mammoth Lake. Technical Memorandum prepared by Golder Associates Ltd., Vancouver, BC for Agnico Eagle Mines Ltd., Baker Lake, NU. April 2020.

Golder Associates Ltd. 2019. Whale Tail Pit Expansion Project. Mine Site and Downstream Receiving Water Quality Predictions. Report Submitted to Agnico Eagle Mines Ltd, Meadowbank Division, May 2019.

Golder. 2018. Final Environmental Impact Statement (FEIS) Addendum. Whale Tail Pit – Expansion Project. Submitted to Nunavut Impact Review Board. November 2018.

Holmgren, S.K. 1984. Experimental lake fertilization in the Kuokkel area, northern Sweden: phytoplankton biomass and algal composition in natural and fertilized subarctic lakes. International Revue der Gesamten Hydrobiologie 69: 781–817.

Hutchinson, N.J., Hadley, K.R., Nesbitt, R.A., and Manzo, L. 2018. Establishing baseline limnological conditions in Baker Lake, Nunavut. Polar Knowledge: Aqhaliat 2018, Polar Knowledge Canada. Available online (Link).

Johnson, L. 1965. The salinity of Baker Lake, NWT, Canada. Journal of the Fisheries Board of Canada, 22(1), 239-241.

Kalff, J., H.J. Kling, S.H. Holmgren, and H.E. Welch. 1975. Phytoplankton, phytoplankton growth and biomass cycles in an unpolluted and in a polluted polar lake. Verh. int. Verein. Limnol. 19: 487–495.

Kasprzak, P., J. Padisák, R. Koschel, L. Krienitz, and F. Gervais. 2008. Chlorophyll a concentration across a trophic gradient of lakes: An estimator of phytoplankton biomass? Limnologica. 38: 327–338.

Lasier, P.J., Winger, P.V. and Bogenrieder, K.J. 2000. Toxicity of manganese to Ceriodaphnia dubia and Hyalella azteca. Archives of Environmental Contamination and Toxicology, 38(3), pp.298-304.

McKee P., R. Watters, and D.L. Lush. 1989. Aquatic Baseline Conditions – Kiggavik Project Area. Environmental Assessment – Supporting Document No. 4. Report prepared by Beak Consultants Limited for Urangesellschaft Canada Limited. December 1989.

Natural Resources Canada (NRC). 2004. Lakes. The Atlas of Canada (2004). 1 November 2006.

Nunami Jacques Whitford Limited (Nunami). 2007. Report of the Environmental Study and Evaluation of the Water and Sewage System, Qamani'tuaq, Nunavut. Prepared for the Department of Community and Government Services, Government of Nunavut, Rankin Inlet, NU. October 15, 2007.

Ogbego, F.E., M.S. Evans, M.J. Waiser, V.P. Tumber and J.J. Keating. 2009. Nutrient limitation of phytoplankton growth in Arctic lakes of the lower Mackenzie River Basin, northern Canada. Can J Fish Aquat Sci 66: 247-260.

Portt and Associates (C. Portt and Associates) and Kilgour & Associates Ltd. 2021. Environmental Effects Monitoring: Whale Tail Pit Cycle 1 Biological Study Interpretive Report. Report submitted to Agnico Eagle Mines Ltd.: Meadowbank Division, Val d'Or, Québec. July 2021.

Portt and Associates (C. Portt and Associates). 2015a. Amaruq Lakes 2014 Aquatic Field Investigations. Report submitted to Agnico Eagle Mines Ltd.: Meadowbank Division, Val d'Or, Québec. January 2015.

Pueyo, M., Rauret, G., Lück, D., Yli-Halla, M., Muntau, H., Quevauviller, P., & López-Sánchez, J. F. 2001. Certification of the extractable contents of Cd, Cr, Cu, Ni, Pb and Zn in a freshwater sediment following a collaboratively tested and optimised three-step sequential extraction procedure. Journal of Environmental Monitoring, 3(2), 243-250.

Science Advisory Board (SAB) for Contaminated Sites in British Columbia. 2008. Guidance for Detailed Ecological Risk Assessments (DERA) in British Columbia. British Columbia, Canada.

Shuttleworth, S.M., Davison, W. and Hamilton-Taylor, J. 1999. Two-dimensional and fine structure in the concentrations of iron and manganese in sediment pore-waters. Environmental science & technology, 33(23), pp.4169-4175.

Smith, R. 2013. Integrated Water Quality Report 2012. Monaghan and Louth. Published by the Environmental Protection Agency, Ireland. Edited by Ray Smith.

Weber-Scannell, P.K and L.K. Duffy. 2007. Effects of Total Dissolved Solids on Aquatic Organisms: A Review of Literature and Recommendation for Salmonid Species. Amer. J. Environ. Sci. 3: 1-6.

Welch, H.E., J.A. Legault, and H.J. Kling. 1989. Phytoplankton, nutrients, and primary production in fertilized and natural lakes at Saqvaqjuac, N.W.T. Can. J. Fish. Aquat. Sci. 46: 90-107.

Wetzel, R.G. 1983. Limnology. W.B. Saunders Co. Toronto Ont. 743 pp.

WLWB. 2013. AEMP - Version 3.1 – Response Framework. Decision from Wek’èezhìi Land and Water Board Meeting of August 12, 2013. File W2009L2-0001 (Type “A”). Letter to Diavik Diamond Mine Inc., Yellowknife, NWT, Canada.

APPENDICES

APPENDIX A
QUALITY ASSURANCE / QUALITY CONTROL ASSESSMENT

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A.1 INTRODUCTION

A.1.1 Quality Assurance / Quality Control

The objective of quality assurance and quality control (QA/QC) was to assure that the chemical and biological data collected were representative of the material or populations being sampled, were of known quality, had sufficient laboratory precision to be highly repeatable, were properly documented, and were 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.

A brief description of quality assurance and quality control practices are provided here.

- *Quality Assurance* (QA) are the practices employed to collect scientifically defensible samples meeting pre-defined data quality objectives (DQOs). For example, employing experienced field staff, standard operating procedures (SOPs), field data sheets, and certified laboratories.
- *Quality Control* (QC) are measures taken to verify that the specific DQOs are met.

The 2021 CREMP QA/QC program was completed at the Meadowbank Lakes, Baker Lake, and Whale Tail Pit Lakes. The QA/QC program is completed at each area to refine the sample procedures and QA/QC protocols and ensure consistency between Meadowbank and Whale Tail Pit Environment teams. An overview of the QA/QC program for each component is provided below; refer to the *2015 CREMP Plan Update* (Azimuth, 2015) for a complete description.

The QA/QC results presented below for the 2021 CREMP program are summarized in **Section 3** of the main report.

Sample Integrity

The first step in the QC program involved documenting any issues with the sample submission. This step applies to all sampling components (e.g., water chemistry, sediment chemistry, phytoplankton, benthic invertebrates). The analytical laboratory used for water and sediment chemistry in 2021 was ALS Environmental who reported concerns surrounding sample submission as “Sample Integrity” issues in the Sample Receipt Confirmation (SRC) email after the samples were received. Plankton-R-Us Inc. (phytoplankton) and Zaranko Environmental Assessment Services (ZEAS; benthic invertebrates) also reported sample integrity concerns via email. For ALS reports, the results were typically recorded in the sample integrity assessment for one of three reasons: (1) samples were damaged during transport, (2) the temperature inside the cooler was above 10°C when received by the laboratory, or (3) the recommended hold time was exceeded prior to analysis. Sample integrity issues do not necessarily mean the data were unusable; rather, this information is meant to help the client make an informed decision on how to proceed with analysis and use the results.

Data Quality Objectives - Duplicates

Quality control results of the laboratory and field duplicates were assessed by measuring the relative percent difference (RPD) as a percentage between original and duplicate measurements. The RPD serves as a measure of precision by the laboratory and the magnitude of variability between original and field duplicate samples, respectively. The variability in field duplicates may be attributed to sampling procedures but may also be attributed to natural conditions (i.e., spatial heterogeneity in the sampling media). The equation used to calculate the RPD is:

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

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

Laboratory duplicate DQOs were parameter-specific and depended on the concentration in the sample. Field duplicate samples were collected for water and sediment chemistry, and phytoplankton. Laboratory duplicates were completed for water chemistry, sediment chemistry, phytoplankton, and benthic invertebrates. DQOs for the duplicate samples are discussed below.

The DQOs for field duplicates were 1.5X the laboratory RPDs unless no RPD was provided by the laboratory (e.g., for chlorophyll-a where the laboratory does not run duplicates) in which case the field duplicate DQO was set at 40% by default. The DQO approach for field duplicates was adopted for both water chemistry and sediment chemistry. Field DQOs were adjusted above laboratory RPD levels to reflect that field duplicates are inherently more variable compared to laboratory duplicates partly because field duplicate samples are collected from a large sample volume (i.e., the lake or stream) as opposed to a small, well mixed sample volume (i.e., the single sample container in the laboratory). The Canadian Council of Ministers of the Environment (CCME) states that acceptance limits for field-based QC are broader than laboratory QC and are typically 1.5 to 2 times the laboratory QC limits (CCME, 2016).

As stated, RPD values may be either positive or negative, and ideally should provide a mix of the two, clustered around zero. RPDs were not calculated when one of the samples (i.e., either A or B above) was below detection and the other was not. If an RPD value was outside the field duplicate DQO it was flagged for further review. When analyte concentrations were less than 10X the detection limit (DL) we expected a greater likelihood of not meeting the DQOs because laboratory precision was slightly less close to the DLs and smaller concentrations of analytes per volume tends to magnify variability between the original sample and the duplicate. These occurrences were still flagged in order to assess the implications on sampling protocol and data interpretation; however, given the higher potential to not meet DQOs for those reasons outlined above, they were not weighted as heavily unless there was a relatively high percentage of RPD values that did not meet DQOs or if the RPD values themselves were very high. Analyte concentrations that were greater than 10X DL and did not meet the DQOs were given more weight in the QA/QC assessment.

Phytoplankton DQOs did not change in 2021. The laboratory did not calculate RPD values though they did run duplicate samples. The DQOs for phytoplankton laboratory duplicates were less than ±25% RPD and for field duplicates were less than ±50% RPD.

There were no benthic invertebrate field duplicates and RPDs were not calculated for laboratory duplicates. For laboratory duplicates, ZEAS calculated the re-sort and re-count percent recovery (the difference between the original sorting and a second sorting from the same sample) with DQOs of 90% or better.

A.1.2 Overview

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

In 2021, a batch of sediment samples were not analyzed due to an oversight by staff at ALS during sample receipt. In response to the error, ALS has implemented a number of corrective actions outlined in **Appendix A2**. As a result, the majority of the QAQC for sediment chemistry was not completed. QA/QC results for the grab samples that were analyzed are provided in **Section A.3**.

Sample Shipping and Handling

Sample shipping and handling concerns documented in previous CREMP reports have largely been rectified in recent years. The Meadowbank and Whale Tail Pit Environment departments plan water sampling events to minimize the amount of time that samples are in transit between Site, Val d'Or, and ALS in Burnaby. The remote location of the mine will always present challenges with some analytes meeting recommended hold times but the effect of slightly exceeding hold times on the quality of the results is considered negligible. Correspondence with the laboratory regarding hold time exceedance has not led to establishing definitive benchmarks for data quality. ALS recommends using *professional judgement* when interpreting chemistry data for parameters that exceeded hold times for analysis.

Table A-1 summarizes the sample integrity observations (e.g., broken sample containers, mislabeled containers), the temperature in the shipping coolers upon arrival to the laboratory, and the parameters that exceeded their recommended hold times for analysis.

The target temperature for samples arriving at ALS was between 5°C and 10 °C. The range of temperatures reported in 2021 was between 4°C in March to a high of 24°C in August. The range of temperatures was similar to past years and reflects the seasonal ambient temperatures. The effect on preserved samples is considered negligible, but for chlorophyll-a samples, the increase in temperature means samples may have arrived thawed. Keeping the chlorophyll-a samples frozen is a recurring challenge for this program given the logistics of shipping samples from Nunavut to Vancouver in a timely fashion.

There were a few broken containers in the water shipments from the July and August sampling events. Given the large number of sample containers shipped during a CREMP cycle year, this represents a very small number of lost samples to breakage or spillage.

There were several incidents of chain of custody (CoC) discrepancies – mislabeled samples or samples either submitted and not included on the CoC or included on the CoC but not submitted. CoC discrepancies were identified and forwarded to CREMP project managers immediately after the laboratory received the samples. As such, these types of errors were often rectified shortly after ALS received the samples. The discrepancies are listed in **Table A-1**.

Recommended hold times were provided by the laboratory for analytes and water quality parameters. The times varied from a low of 0.25 days for pH to six months for metals. Hold times for water samples were regularly exceeded for turbidity, pH, nitrate, nitrite, total dissolved solids (TDS), total suspended solids (TSS) and dissolved orthophosphate (as P). Very occasionally hold times were exceeded for cyanides (free and total). Hold times for sediments were exceeded for pH, mercury, methylmercury, extractable petroleum hydrocarbons (EPHs) and polycyclic aromatic hydrocarbons (PAHs). Samples were generally shipped very soon after collection and though shipping from the Meadowbank Mine has improved in recent years, the distances and logistics make it impossible to meet short hold times. However, it is highly unlikely that results were affected for those parameters or analytes where hold times were not met in 2021.

The sample shipping and handling QA/QC for 2021 was comparable to 2020. There were a few discrepancies between samples submitted and the CoCs but most were rectified without impacting the analytical results. The logistics, distances, and general challenges of collecting and shipping samples from a remote mine in Nunavut meant that hold times were exceeded for several parameters/analytes but the impact on results is considered negligible. Bringing the Meadowbank/Baker CREMP program and the Whale Tail Pit program together under one umbrella has likely contributed to the overall improvement in QA/QC results in the past few years. Logistic efficiencies, increased familiarity with the CREMP program, and attention to detail are also likely contributing factors.

A.2 SURFACE WATER

A.2.1 Field QA/QC Procedures

The standard QA procedures included thoroughly flushing the flexible tubing and pump to prevent cross-contamination between areas and thoroughly rinsing the sample containers with site water prior to sample collection. Field QC procedures included collecting and analyzing field duplicates, and three types of *blank* samples: travel blanks, de-ionized water (DI) blanks and equipment blanks. Blank sample collection, particularly equipment blank samples, required careful planning, attention to detail, focus on the importance of cleanliness, and generally provided a good opportunity to refine sample collection skills.

Blank samples were collected once per sample event, and were submitted *blind* to the laboratory to ensure they were treated the same as field collected samples during analysis. Results from both the equipment and travel blanks were examined for detectable concentrations of any of the parameters measured; no parameter in either blank should exceed laboratory method DLs. If an analyte is detected in a blank, the results for the batch of samples submitted with the blank were compared to the measured concentration in the blank. Results that were less than 5-times the detected analyte concentration in the equipment blank were flagged to examine the potential for cross-contamination to affect the results. Results carried forward in the QA/QC assessment were given either a cautionary flag or an unreliable flag. Cautionary flags were applied to sample results if the analyte was detected in the blank but the effect of potential cross-contamination was considered minor (e.g., the concentration in the equipment blank was a small percentage of the concentration in the samples). Unreliable data flags were applied to water quality results that were unrepresentative of the water quality (e.g., elevated metals concentrations in a sample that were not observed in other replicate sample(s) collected during the same event). The *cautionary* and *unreliable* data flags were provided for clarity on which results should be examined further and/or excluded from decision making.

A.2.2 Laboratory QC Procedures

There were four main components of the water chemistry laboratory QC program used to assess analytical precision, bias, and completeness:

- Laboratory Duplicate – duplicates provided insight into the precision of laboratory analyses. The laboratory randomly chose samples to re-run as duplicates. Duplicate aliquots were taken from the same sample and run through the entire laboratory analytical process. The difference between the concentrations in the two samples is a measure of the variability associated with duplicate analyses of the same sample in the laboratory.

- Method Blank (MB) – samples were analyzed to assess background interference or contamination that existed in the analytical system that could lead to elevated concentrations or false positive data. An analyte-free matrix, such as de-ionized water, was subjected to the entire analytical process to demonstrate that the analytical system itself did not introduce contamination.
- Matrix Spike (MS) / Matrix Duplicate (MD) – a known amount of a compound that is chemically similar to the target analyte, was added to samples to ascertain any matrix effects on recoveries and to determine the accuracy and precision of the method in this matrix.
- Laboratory Control Sample (LCS) – this is a well-characterized sample of known analytes and concentrations. A reference material (i.e., certified reference material) containing certified amounts of target analytes may be used as an LCS. Percent recovery of the target analytes in the LCS was compared to established control limits and assisted in determining whether the methodology was in control and whether the laboratory could make accurate and precise measurements at the required reporting limit.

Laboratory QC results are included in each laboratory report for CREMP water quality samples.

A.2.3 Water Chemistry

Field duplicates, laboratory duplicates, and blank samples were analyzed as part of the QA/QC program in each of the five sampling events in 2021. The blank results and field duplicate samples in 2021 have been fully integrated for all CREMP study areas. Similar to last year, in order to better identify potential QA/QC weakness, each team (i.e., Meadowbank Environment and Whale Tail Pit Environment) took a turn collecting blank samples and the field duplicate samples were split evenly between the Meadowbank/Baker Lake study areas and the Whale Tail Pit study area. This approach ensured both teams were familiar with the QA/QC process and better appreciated the nuances of sample collection and handling methods. Blank sample collection, particularly equipment blank samples, required careful planning, attention to detail, focus on the importance of cleanliness, and generally provided a good opportunity to refine sample collection skills.

Results of the QA/QC analysis are discussed below, along with a discussion on the implications of the QA/QC assessment on the sample results from 2021.

Travel Blanks

Travel blanks should be included in sample container shipments, come directly from the analytical laboratory and be stored in a cool place (e.g., refrigerator). Travel blanks were only submitted in May and July; and in both events there were no detectable concentrations of any analytes.

Travel blank results are summarized in **Table A-2** and complete results are provided in **Table A-4**.

De-ionized (DI) Blanks

The goal of collecting these blanks was to test the quality of the DI water batch and variability in laboratory analytical methods. One DI blank with the full suite of analyses was submitted for all sample events in 2021. DI Blanks were collected for the Meadowbank and Baker Lake CREMP and the Whale Tail Pit CREMP; results are reported in **Table A-4**.

In the DI blanks, there were no detectable concentrations for any analytes in March, May, August or September. In July, total and bicarbonate alkalinity, TKN, and ammonia as N were detected above detection limits in the DI blank but not in the equipment blank. None of the parameters were detected above 10X DL.

Equipment Blanks

Equipment blanks (EBs) represent a good opportunity to assess not only the water sampling equipment but the skills of the sampling teams. Collecting these samples require careful planning and close attention to detail in the sample collection methods which are updated yearly but underwent a notable review in 2015 (Azimuth, 2015).

Several analytes were detected for at least one of the EBs submitted in 2021, results are provided in **Table A-4**. In general, results were very good for most events and were comparable to past years:

- Total molybdenum was detected in the EB sample collected in March at a concentration > 10X DL. No other parameters were detected in EB collected in the March sampling event.
- In May, dissolved aluminum, total and dissolved barium, lead, magnesium, manganese and strontium were detected in the EB sample at concentrations slightly above the DL.
- In July, total and dissolved copper were detected in the EB sample at concentrations slightly above the DL.
- No parameters were detected in the August sampling event.
- Total and dissolved molybdenum, dissolved aluminum, and dissolved lead were detected slightly above the DLs in the EB sample collected in September.

The implications of possible cross-contamination on the interpretation of the water quality data from the same event was considered inconsequential for all sampling events. Only total molybdenum was detected in the March event at 10X DL, however, it is likely an anomaly. No analytes were detected at >10X DL in the EBs from subsequent events; therefore, no additional scrutiny is warranted.

Field Duplicates

Field duplicate analysis combined results for the Meadowbank, Baker Lake and Whale Tail Pit study areas. The target frequency of duplicate sample collection was approximately 10% of the total number of samples collected. In 2021, there was a combined total of 20 duplicates collected between the

Meadowbank Lakes, Baker Lake, and the Whale Tail Pit Lakes, corresponding to approximately 15% of the total number of water samples (n=134). Across all CREMP study areas, four field duplicates were collected in each sampling event. The field duplicate assessment is provided in **Table A-5**.

As mentioned in **Section A.1.1**, the DQOs for field duplicates were 1.5X the laboratory RPD for each analyte unless no RPD was available and a default 40% was used. The laboratory RPDs for water chemistry for most analytes is 20% therefore the DQOs for field duplicate were less than ±30%. In 2021, there were only 28 RPDs that did not meet DQOs out of the 2410 RPDs calculated[1], corresponding to approximately 1% of the RPDs. Of the 28 RPDs in 2021, seven were for concentrations >10X DL (see **Table A-5**).

Table A-6 is provided below to show RPDs by analyte that did not meet their DQOs for each month. A shaded cell indicates that concentrations were >10X DL, in addition to exceeding their DQOs. Most of the RPDs that did not meet DQOs showed no pattern except that total ammonia (as N) did not meet DQOs in five samples from March, May, August, and September. Total ammonia is measured as nitrogen and was most variable in May, August and September. Some of the variability may be attributed to increased plant (algae) growth in the summer months. The ammonia concentrations observed in 2021 in all study areas were variable between months and there were no statistically significant increases compared to previous years.

Four RPDs did not meet the DQOs when an analyte concentration was > 10X DL. This was not a significant increase from previous years and the low percentage of field duplicate RPDs that do not meet DQOs suggests that sample collection and sample handling in 2021 have maintained a high standard.

Laboratory QC Samples

ALS provided a thorough account of their QA assessment in each certificate of analysis (COA) report that was issued[2]. These results are provided in **Table A-3**. The various components of the QA assessment are

[1] Reporting an analyte does not necessarily calculate an RPD. See **Section A.1.2** for a description on how RPD values are not calculated when either the parent sample or the duplicate are below detection limits.

[2] The COA may include data qualifiers that relate to the sample "batch". The sample batch may include samples that are from other projects and the qualifiers included in the COA may relate to those and not the CREMP samples. In general this does not impact the assessment of laboratory QA; however, in some instances, particularly for sediment laboratory duplicates, data qualifiers in the COA related to sample heterogeneity may not relate to CREMP samples. The Microsoft Excel® report that accompanies the COA includes tabs with detailed assessments of laboratory QA that are project specific and can be reviewed in conjunction with the COAs.

provided to help make informed decisions when interpreting the data. The QA program was comprised of four main elements:

- **Laboratory Duplicates** – the laboratory DQO for most parameters was an RPD of less than 20%. Most laboratory duplicates met the DQOs for water chemistry in 2021, except six duplicates in March and one duplicate in August. While this corresponds to a few more laboratory duplicates that did not meet DQOs compared to 2020, there were still relatively few cases in which laboratory duplicates did not meet the DQOs for water chemistry.
- **Method blanks (MB)** – the MB was a blank matrix sample that was taken through the entire analytical procedure to test variability in the analytical method and report any bias in the analysis. MB results were equal to the limit of reporting (LOR or DL[3] as termed here). MB qualifiers were either:
    - "B" – MB exceeded ALS DQO. Associated sample results which were less than DL or greater than 5X blank levels were considered reliable.
    - "MB-LOR" – MB exceeded ALS DQO. DLs were adjusted for samples with positive hits below 5x blank levels.
- For most sample analyses there were no flags or very few flags (e.g., one or two analytes in one sample may have been flagged for B) in the method blank results. However, the limited number of cases with DQO flags for MB samples were nonetheless reviewed; the results did not affect the interpretation of the 2021 water quality data.
- **Matrix Spike (MS)** – MS recovery is periodically flagged in the QC assessment due to high concentrations of the analyte in the sample. These instances are generally rare, and typically associated with parameters such as major cations (e.g., magnesium) or certain metals with detected results above the DL (e.g., strontium in 2020). In 2021, there were no cases with DQO flags for MS samples.
- **Laboratory Control Samples (LCS) / Certified Reference Material (CRM) / Internal Reference Material (IRM)** – reference material analysis met the ALS DQOs for all samples analyzed as part of the 2021 program except for three results in the August submission. These results did not affect the interpretation of the 2021 water quality data.

[3] The DL is sometimes referred to as the MDL (method detection limit) in this appendix and the main report.

Part of the QA assessment involved comparing the paired sampling events collected at each station within a given event to confirm the data were representative of current conditions and to determine whether the data required additional review. First, the dissolved and total concentrations for a given parameter were compared for each location. Samples where the dissolved concentrations were greater than the total with an RPD of more than 30% were reviewed further. The second analysis compared the concentrations of parameters from the paired samples located within each water body (lake or basin). Parameters for which the difference between the paired intra-lake samples was greater than a factor of 5 (or factor of 10 in cases where at least one of the samples was within a factor of 10 of the DL) were flagged for further validation. The results that required additional assessment are reported in each of the QC screening events (see **Appendix A1**). The sample review resulted in a few results being flagged and removed from formal analysis. For transparency, the sample results that were removed from formal analysis are retained in the water chemistry tables provided in **Appendix B**.

Water Chemistry QA/QC Summary

The field and laboratory QA/QC results for water chemistry for 2021 were very good and were comparable to the 2020 results:

Sample Integrity – a similar number of lost samples from breakage or mislabeling were reported in 2021 compared to 2020. Sample temperatures received at the laboratory were variable depending on the season and reflected the challenges with shipping from a remote mine site. Likewise, hold time exceedances for parameters and analytes with short hold times were unavoidable but were not considered likely to impact data analysis and interpretation. For most samples in Meadowbank, Whale Tail Pit, and Baker Lake, the detection limit for total and dissolved chromium was adjusted by the laboratory in May from 0.0001 mg/L to 0.0005 mg/L and remained elevated for the subsequent sampling events. All of the results were less than MDL, except for a few samples, and none of the detected concentrations exceeded the trigger.

Blanks – blank results for 2021 indicated reliable sample handling and that cross-contamination related to sampling equipment was unlikely. Several analytes were detected in the May sample but very few or none were detected in other months.

The implication of possible cross-contamination on interpretation of the 2021 water quality data was evaluated by comparing the sample concentrations with the equipment blank results from the same event. Sample results in the complete datasets were given a cautionary flag using underlining (e.g., 0.001) to indicate that the measured concentration was less than 5-times the concentration detected in the equipment blank sample. Several analytes were occasionally given cautionary flags, including aluminum, copper, lead, manganese, and molybdenum. None of the results with cautionary flags exceeded the trigger. Sample results, including results with cautionary flags, are reported in **Appendix B1** (Meadowbank), **Appendix B2** (Whale Tail), and **Appendix B3** (Baker Lake).

Despite the assigned cautionary flags in 2021, potential cross-contamination is considered unlikely to bias interpretation of the 2021 water quality analysis.

Field Duplicates – the 2021 field duplicate results were very good with only 1% of the calculated RPDs not meeting their DQOs.

Laboratory QC Assessment – the laboratory QC assessment completed by ALS indicated the 2021 water quality data were typically within the established DQOs. In the few instances where a DQO was exceeded, the laboratory concluded the results were reliable and fit for use in the water quality assessment.

A.3 SEDIMENT

In 2021, a batch of sediment samples were not analyzed due to a sample receipt error by the laboratory. In response to the error, ALS has implemented a number of corrective actions outlined in **Appendix A2**. As a result, the majority of the sediment QAQC for sediment chemistry could not be completed. The samples that were collected in the field but not analyzed by the laboratory are summarized in **Table A-10**.

A.3.1 Field QA/QC Procedures

Field QA consisted of taking care between sampling areas by rinsing and cleaning the sampling gear for sediment grabs (Petite Ponar grab, stainless steel compositing bowls and spoons) using site water and phosphate-free cleaning detergent, to avoid the possibility of cross-contamination. Field QC measures included collection and analysis of field duplicates and filter swipes.

A filter swipe sample consisted of metals analysis of an ashless filter (QA/QC Filter) that was wiped 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 two Petite Ponar grab samplers (assuming a thickness of 3 cm was collected from each) multiplied by the density of sediment (assumed to be 2 g/cm^3).

A.3.2 Laboratory QC Procedures

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

A.3.3 Sediment Chemistry

Filter Swipes

Filter swipes were collected for various pieces of the sampling gear to quantify potential metals cross-contamination for grab samples. Ashless filters were wiped on the various sampling gear including the stainless-steel spoons and bowls, and the Petite Ponar, and analyzed for metals (µg/filter). The ashless filters themselves can sometimes pose a problem if they contain any trace metals. For example, in 2017 Whatman™ glass microfiber filters (47 mm) were used as swipe material. These filters were made entirely of borosilicate glass and were touted as “the industry standard for high purity filtration”; however, detectable amounts of copper, iron, magnesium, sodium, and zinc were found on the blank filters as well as the equipment swipes of the sampling equipment. A new filter swipe product was used in 2018, which was an improvement from the prior year, and has been used in each CREMP sampling event since 2018. Since the discovery of detectable metals on filters in 2017 we have added the collection of a *blank* filter swipe for every sediment program to account for any metals found on the filters themselves. A blank filter swipe was collected but not analyzed in 2021 due to an oversight by the laboratory (see **Section A.1.2**).

Several analytes were detected on the grab equipment filter swipe that was analyzed including: chromium, manganese, strontium, and zinc. All detectable analytes were at concentrations <10X DL, except for zinc which was > 10X DL (**Table A-7**). When comparing the amount of each metal on the filters to the concentration in the sediment grab samples, the potential percent contribution from the swipe was less than 0.01% for zinc. For all the other detected analytes, the concentrations corresponded to well below 0.01% of the concentrations present in the sediment grabs. The QA results from 2021 show the potential for cross-contamination to affect the sediment chemistry results is negligible.

Field Duplicates

Nine grab sample field duplicates were collected in 2021 for general chemistry (moisture, pH, particle size, TOC and metals). Additionally, one composite field duplicate was collected for moisture, hydrocarbon and PAH chemistry. The field duplicates for grab samples are provided in **Table A-8** (particle size and TOC) and **Table A-9** (hydrocarbons and PAHs). The DQOs for sediment samples are outlined in **Section A.1.1**. Generally, the RPD limits were 1.5 times the laboratory RPDs unless no RPD was provided in which case a default ±40% was applied. For grab samples, RPDs are also calculated on particle size and moisture content where default DQOs of 40% and 30% DQO were applied, respectively.

Of the nine grab sample field duplicates collected in 2021, only four of the duplicates were analyzed due to the laboratory oversight described in **Appendix A2**. All DQOs were met for the samples that were analyzed in 2021. Furthermore, for the one composite sample duplicate analyzed, all RPDs met the DQOs for hydrocarbon/PAHs in sediment. Overall, field duplicate results indicate good field collection methods and a high degree of replicability in sampling.

Laboratory QC Samples

Laboratory QC for sediment samples included laboratory duplicates, method blanks, matrix spikes, and reference material. The summary for the laboratory QC is provided in **Table A-3**.

No qualifiers were identified for the laboratory QC results indicating a high degree of precision for the laboratory analysis and that laboratory processing and analytical methods were consistent between sub-samples. Detection limits were adjusted for PAHs due to high moisture content in the composite samples.

A.4 PHYTOPLANKTON

The phytoplankton QA/QC assessment for 2021 was combined for the Meadowbank, Baker Lake and the Whale Tail Pit study areas. Four field duplicate samples were collected for each sampling event. The field duplicates and laboratory QC duplicates were analyzed for RPDs for total density and total biomass between the original sample and the duplicate. RPD values were also calculated for the major taxa groups, but these results are not relied on for QC purposes because of the tendency for small differences in abundance/biomass between the original and the duplicate to cause large differences in the RPD. Thus, we evaluate the quality of these data based on total density and total biomass both for field and laboratory duplicates.

Results of the RPD analysis for all these parameters are presented in **Table A-11** (field) and **Table A-12** (laboratory) and are discussed below.

Field Duplicates

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

The DQOs for phytoplankton field duplicates were ±50% RPD. There was one RPD that did not meet the DQO for total biomass: the RPD at PDL-96 was 125%, from the May sampling event. None of the RPDs for total density exceeded the DQO. Overall, there were less RPDs that exceeded the DQOs compared to 2020. All other RPDs in 2021 for total density and total biomass were below 50% indicating very good replicability in sample collection.

Laboratory Duplicates

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 was a new aliquot (10 mL) from the sample jar and was counted from the start in the same manner as the original aliquot (10 mL) taken from the jar. A RPD of 25% for total density and biomass was considered acceptable for laboratory replicates.

The DQOs for laboratory duplicates for phytoplankton are ±25% RPD. In 2021 one laboratory duplicate was above the DQO for total density: the RPD at A20-59 was 64%, in the September sampling event. All other laboratory RPDs in 2021 for total density and total biomass met the DQOs.

Phytoplankton QA/QC for both field and laboratory components in 2021 was good and overall results of the QA/QC analysis were similar to 2020. This indicates very good replicability and sample handling in the field and in the laboratory.

A.5 BENTHIC INVERTEBRATES

Standard procedures were used to collect phytoplankton and benthic invertebrate samples (Azimuth, 2015). 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.

A.5.1.1 Field QA/QC

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

A.5.1.2 Laboratory QC

ZEAS re-sorted and re-counted approximately 10% of the samples, targeting greater than 90% recovery between the original and re-sorted sample.

No field duplicate samples were collected for benthic invertebrates. Laboratory replicate counts were performed on approximately 10% of all samples. Replicate samples were chosen at random and processed at different times from the original analysis to reduce bias. Percent recovery was above 95% in all re-sorted samples, with an average percent recovery of approximately 96.2% (**Table A-13,** Table A-14). These results suggest that the majority of individual organisms are recovered by the taxonomist during enumeration. As in previous years, the reference collection of benthic taxa for this project has been maintained.

There were no QA/QC concerns for benthic invertebrates in 2021.

A.6 REFERENCES

Azimuth. 2015. Core Receiving Environment Monitoring Program (CREMP): 2015 Plan Update. Report prepared by Azimuth Consulting Group, Vancouver, BC for Agnico Eagle Mines Ltd., Baker Lake, NU. November, 2015.

Canadian Council of Ministers of the Environment (CCME). 2016. Guidance Manual for Environmental Site Characterization in Support of Environmental and Human Health Risk Assessment. PN 1551.

TABLES

Table A-1. Sample submission and integrity QA/QC summary for the water and phytoplankton for all CREMP study areas, 2021.

Event	Lab ID(s)	Parameters Measured	Date Sampled	Sample Integrity Observations	Temperature (°C)	Hold-time Exceedances
March	VA21A6084 VA21A6300 VA21A6519	All parameters	March 9, 11, 17, 18, 20, 24, 25, 29, 30	None	4, 6, 10, 11, 8	pH, D.O-PO_4, T.Cyanide, T.Hg, D.Hg, TDS, Chl-a. See lab reports.
May	VA21A9149 VA21A9442 VA21A9444 VA21A9848	All parameters	May 6, 7, 8, 9, 10, 11, 12	MAY-DUP-3 Chl-a sample not received. CoC requested As speciation at LK1-28 but bottle provided for LK1-27; analysis logged for LK1-27 instead. Labelling issue on CoC, only one page of 2 received. Samples SP-142 and SP-143 not received - submitted at a later date. SP-142 and SP-143 chl-a listed on CoC but not received. For MAY TB total metals analysis requested on CoC but container not received. Subsample cannot be taken since it is travel blank.	15, 18, 18.3	pH, D.O-PO4, Nitrate. See lab reports.
July	VA21B4721 VA21B4723 VA21B5426 VA21B5671 VA21B6241	All parameters	July 8, 9, 10, 11, 17, 19, 21, 23, 27, 29, 30	LK5-29 total mercury vial was received broken. Analysis would be conducted from the HDPE container received. Results may be biased low. Cyanide bottle for sample TPN-144 mislabeled as TPN-145, the bottle will be reported as per CoC as TPN-144.	19, 22, 20.3	pH, TOC, Turbidity, TSS, TDS, Nitrite, Nitrate, Ammonia, TKN, T.P, D. O-OP_4. See lab reports.
August	VA21B6886 VA21B7111 VA21B7253 VA21B7537 VA21B7541 VA21B7863	All parameters	August 6, 7, 10, 11, 13, 14, 15, 16, 18.	A76-55 dissolved metals bottle opened in transit, subsample taken and filtered again. Sample AUG-DUP-1 not indicated on nutrients bottles which is total and which is dissolved, assigned at random. AUG-DI-BLANK-01 D.Hg container and BPJ-75 T.Hg were received broken in transit. Vial will be discarded and analysis performed from metals bottles supplied. BPJ-75 chl-a tube was received broken in transit. Tube will be discarded and testing removed.	24, 19, 20, 21	pH, Turbidity, Nitrite, Nitrate, D. O-OP_4, TSS, TDS. See lab reports.
September	VA21B9414 VA21C0214 VA21C0949 VA21C0994	All parameters	September 3, 4, 8, 9, 12, 16, 17, 18	None	9, 15, 16, 17	pH, Turbidity, Nitrite, Nitrate, D. O-OP_4, TSS, TDS, Alkalinity. See lab reports.

Acronyms

CoC = Chain of custody

O-PO4 = Orthophosphate

TB = Travel blank

TDS = Total dissolved solids

TOC = Total organic carbon

TSS = Total suspended solids

Table A-2. Field QA/QC summary for the water and phytoplankton at CREMP study areas, 2021.

Event	Field QC summary [1]			
	Travel Blank	DI Blank	Equipment Blank	Duplicates
March	N/A	None	1 result failed to meet DQO	3 duplicate results failed to meet DQOs
May	1 result failed to meet DQO	None	11 results failed to meet DQOs	3 duplicate results failed to meet DQOs
July	None	3 results failed to meet DQO	2 results failed to meet DQOs	1 duplicate result failed to meet DQO
August	N/A	None	None	3 duplicate results failed to meet DQOs
September	N/A	None	4 results failed to meet DQOs	1 duplicate result failed to meet DQO

Notes

1 - For more details on parameters that failed to meet DQOs, see lab reports and **Appendix A1**.
N/A = No field QC sample collected during this sampling event.
DQO = Data quality objective.

Table A-3. Laboratory QA/QC summary for the water, phytoplankton, and sediment for all CREMP study areas, 2021.

Event	Laboratory QC Summary [1]				
	Detection Limits	Duplicates	Method Blanks	Matrix Spike	LCS / CRM
March	None	6 duplicates failed to meet DQOs; See lab reports and **Appendix A1**.	None	None	None
May	None	None	1 result failed to meet DQOs; see lab reports and **Appendix A1**.	None	None
July	None	None	2 results failed to meet DQOs; see lab reports and **Appendix A1**.	None	None
August	None	1 duplicate failed to meet DQOs; See lab reports and **Appendix A1**.	1 result failed to meet DQOs; see lab reports and **Appendix A1**.	None	3 results failed to meet DQOs; see lab reports and **Appendix A1**.
August (Sediment)	DLHM for most PAHs in composite samples	None	None	None	None
September	None	None	None	None	None

Notes

[1] Data qualifiers referring to laboratory QC methods (e.g., Method Blanks, Matrix Spikes, and LCS/CRM) are flagged here.

DLHM = Detection limit adjusted: Sample has high moisture content.

DQO = Data quality objectives.

LCS / CRM = laboratory control sample / certified reference material.

PAH = Polycyclic aromatic hydrocarbons.

Table A-4. Laboratory detection limits and blanks (travel, de-ionized, and equipment) for all CREMP study areas, 2021.

Month	March			May				July				August			September		
Blank (Travel, DI, or EB)	Detection Limits	DI Blank	Equip. Blank	Detection Limits	Travel Blank	DI Blank	Equip. Blank	Detection Limits	Travel Blank	DI Blank	Equip. Blank	Detection Limits	DI Blank	Equip. Blank	Detection Limits	DI Blank	Equip. Blank
Date		30-Mar	30-Mar		12-May-2021	12-May-2021	12-May-2021		21-Jul-2021	21-Jul-2021	21-Jul-2021		11-Aug-2021	11-Aug-2021		17-Sep-2021	17-Sep-2021
ALS Sample ID		VA21A6519-006	VA21A6519-007		VA21A9444-019	VA21A9444-020	VA21A9444-021		VA21B5426-017	VA21B5426-019	VA21B5426-018		VA21B7537-010	VA21B7253-007		VA21C0994-005	VA21C0994-006
Physical Tests																	
Conductivity (µS/cm)	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	1.0	<1.0	<1.0	1.0	<1.0	<1.0	<1.0	1.0	<1.0	**1.1**	<1.0	1.0	<1.0	<1.0	1.0	<1.0	<1.0
Alkalinity, Bicarbonate	1.0	<1.0	<1.0	1.0	<1.0	<1.0	<1.0	1.0	<1.0	**1.1**	<1.0	1.0	<1.0	<1.0	1.0	<1.0	<1.0
Alkalinity, Carbonate	1.0	<1.0	<1.0	1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	1.0	<1.0	<1.0
Alkalinity, Hydroxide	1.0	<1.0	<1.0	1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	1.0	<1.0	<1.0
Hardness (mg/L), Dissolved	0.60	<0.60	<0.60	0.60	-	<0.60	<0.60	0.60	-	<0.60	<0.60	0.60	<0.60	<0.60	0.60	<0.60	<0.60
Hardness (as $CaCO_3$), from total Ca/Mg	0.60	<0.60	<0.60	0.60	-	<0.60	<0.60	0.60	<0.60	<0.60	<0.60	0.60	<0.60	<0.60	0.60	<0.60	<0.60
pH (Laboratory)	0.10	5.7	5.7	0.10	5.3	5.2	5.2	0.10	5.4	5.3	5.2	0.10	5.3	5.3	0.10	5.3	5.2
Total Dissolved Solids (mg/L)	3.0	<3.0	<3.0	3.0	<3.0	<3.0	<3.0	3.0	<3.0	<3.0	<3.0	3.0	<3.0	<3.0	3.0	<3.0	<3.0
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	1.0	<1.0	<1.0	1.0	<1.0	<1.0
Turbidity (NTU)	0.10	<0.10	<0.10	0.10	<0.10	<0.10	<0.10	0.10	<0.10	<0.10	<0.10	0.10	<0.10	<0.10	0.10	<0.10	<0.10
Anions and Nutrients (mg/L)																	
Total Kjeldahl Nitrogen	0.050	<0.050	<0.050	0.050	<0.050	<0.050	<0.050	0.050	<0.050	**0.050**	<0.050	0.050	<0.050	<0.050	0.050	<0.050	<0.050
Ammonia, Total (as N)	0.0050	<0.0050	<0.0050	0.0050	<0.0050	<0.0050	<0.0050	0.0050	<0.0050	**0.047**	<0.0050	0.0050	<0.0050	<0.0050	0.0050	<0.0050	<0.0050
Bromide (Br)	0.050	<0.050	<0.050	0.050	<0.050	<0.050	<0.050	0.050	<0.050	<0.050	<0.050	0.050	<0.050	<0.050	0.050	<0.050	<0.050
Chloride (Cl)	0.10	<0.10	<0.10	0.10	<0.10	<0.10	<0.10	0.10	<0.10	<0.10	<0.10	0.10	<0.10	<0.10	0.10	<0.10 <0.50	<0.10 <0.50
Fluoride (F)	0.020	<0.020	<0.020	0.020	<0.020	<0.020	<0.020	0.020	<0.020	<0.020	<0.020	0.020	<0.020	<0.020	0.020	<0.020	<0.020
Nitrate (as N)	0.0050	<0.0050	<0.0050	0.0050	<0.0050	<0.0050	<0.0050	0.0050	<0.0050	<0.0050	<0.0050	0.0050	<0.0050	<0.0050	0.0050	<0.0050	<0.0050
Nitrite (as N)	0.0010	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	0.0010	<0.0010	<0.0010
Orthophosphate-Dissolved (as P)	0.0010	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	0.0010	<0.0010	<0.0010
Phosphorus (P)-Total	0.0020	<0.0020	<0.0020	0.0020	<0.0020	<0.0020	<0.0020	0.0020	<0.0020	<0.0020	<0.0020	0.0020	<0.0020	<0.0020	0.0020	<0.0020	<0.0020
Phosphorus (P)-Total Dissolved	0.0020	<0.0020	<0.0020	0.0020	-	<0.0020	<0.0020	0.0020		<0.0020	<0.0020	0.0020	<0.0020	<0.0020	0.0020	<0.0020	<0.0020
Reactive Silica (as SiO_2)	0.50	<0.50	<0.50	0.50	<0.50	<0.50	<0.50	0.50	<0.50	<0.50	<0.50	0.50	<0.50	<0.50	0.50	<0.50	<0.50
Sulfate (SO_4)	0.30	<0.30	<0.30	0.30	<0.30	<0.30	<0.30	0.30	<0.30	<0.30	<0.30	0.30	<0.30	<0.30	0.30	<0.30	<0.30
Cyanides (mg/L)																	
Free Cyanide	0.0010	<0.0010	<0.0010	0.0010	-	-	-	-	-	-	-	0.0010	<0.0010	<0.0010	-	-	-
Total Cyanide	0.0010	<0.0010	<0.0010	0.0010	-	-	-	-	-	-	-	0.0010	<0.0010	<0.0010	-	-	-
Organic / Inorganic Carbon (mg/L)																	
Dissolved Organic Carbon	0.50	<0.50	<0.50	0.50	-	<0.50	<0.50	0.50	<0.50	-	<0.50	0.50	<0.50	<0.50	0.50	<0.50	<0.50
Total Organic Carbon	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
Total Metals (mg/L)																	
Aluminum	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
Antimony	0.00010	<0.00010	<0.00010	0.00010	-	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010
Arsenic	0.00010	<0.00010	<0.00010	0.00010	-	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010
Barium	0.00010	<0.00010	<0.00010	0.00010	-	<0.00010	**0.00019**	0.00010	<0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010
Beryllium	0.00010	<0.000100	<0.000100	0.00010	-	<0.000100	<0.000100	0.00010	<0.000100	<0.000100	<0.000100	0.00010	<0.000100	<0.000100	0.00010	<0.000100	<0.000100
Bismuth	0.000050	<0.000050	<0.000050	0.000050	-	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050
Boron	0.010	<0.010	<0.010	0.010	-	<0.010	<0.010	0.010	<0.010	<0.010	<0.010	0.010	<0.010	<0.010	0.010	<0.010	<0.010
Cadmium	0.000005	<0.0000050	<0.0000050	0.000005	-	<0.0000050	<0.0000050	0.000005	<0.0000050	<0.0000050	<0.0000050	0.000005	<0.0000050	<0.0000050	0.000005	<0.0000050	<0.0000050
Calcium	0.050	<0.050	<0.050	0.050	-	<0.050	<0.050	0.050	<0.050	<0.050	<0.050	0.050	<0.050	<0.050	0.050	<0.050	<0.050
Cesium	0.000010	<0.000010	<0.000010	0.000010	-	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010
Chromium	0.00050	<0.00010	<0.00010	0.00010	-	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050
Cobalt	0.00010	<0.00010	<0.00010	0.00010	-	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010
Copper	0.00050	<0.00050	<0.00050	0.00050	-	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	**0.00057**	0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050
Iron	0.010	<0.010	<0.010	0.010	-	<0.010	<0.010	0.010	<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	**0.00024**	0.000050	<0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050
Lithium	0.0010	<0.0010	<0.0010	0.0010	-	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	0.0010	<0.0010	<0.0010
Magnesium	0.0050	<0.0050	<0.0050	0.0050	-	<0.0050	**0.0089**	0.0050	<0.0050	<0.0050	<0.0050	0.0050	<0.0050	<0.0050	0.0050	<0.0050	<0.0050
Manganese	0.00010	<0.00010	<0.00010	0.00010	-	<0.00010	**0.00018**	0.00010	<0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010
Mercury	0.000005	<0.0000050	<0.0000050	0.000005	<0.0000050	<0.0000050	<0.0000050	0.000005	<0.0000050	<0.0000050	<0.0000050	0.000005	<0.0000050	<0.0000050	0.000005	<0.0000050	<0.0000050
Molybdenum	0.000050	<0.000050	0.012	0.000050	-	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	0.000050	<0.000050	**0.00016**
Nickel	0.00050	<0.00050	<0.00050	0.00050	-	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050
Phosphorus	0.050	<0.050	<0.050	0.050	-	<0.050	<0.050	0.050	<0.050	<0.050	<0.050	0.050	<0.050	<0.050	0.050	<0.050	<0.050
Potassium	0.050	<0.050	<0.050	0.050	-	<0.050	<0.050	0.050	<0.050	<0.050	<0.050	0.050	<0.050	<0.050	0.050	<0.050	<0.050
Rubidium	0.00020	<0.00020	<0.00020	0.00020	-	<0.00020	<0.00020	0.00020	<0.00020	<0.00020	<0.00020	0.00020	<0.00020	<0.00020	0.00020	<0.00020	<0.00020
Selenium	0.000050	<0.000050	<0.000050	0.000050	-	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050
Silicon	0.10	<0.10	<0.10	0.10	-	<0.10	<0.10	0.10	<0.10	<0.10	<0.10	0.10	<0.10	<0.10	0.10	<0.10	<0.10
Silver	0.000010	<0.000010	<0.000010	0.000010	-	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010
Sodium	0.050	<0.050	<0.050	0.050	-	<0.050	<0.050	0.050	<0.050	<0.050	<0.050	0.050	<0.050	<0.050	0.050	<0.050	<0.050
Strontium	0.00020	<0.00020	<0.00020	0.00020	-	<0.00020	**0.00022**	0.00020	<0.00020	<0.00020	<0.00020	0.00020	<0.00020	<0.00020	0.00020	<0.00020	<0.00020
Sulfur	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
Tellurium	0.00020	<0.00020	<0.00020	0.00020	-	<0.00020	<0.00020	0.00020	<0.00020	<0.00020	<0.00020	0.00020	<0.00020	<0.00020	0.00020	<0.00020	<0.00020
Thallium	0.000010	<0.000010	<0.000010	0.000010	-	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010
Thorium	0.00010	<0.00010	<0.00010	0.00010	-	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010
Tin	0.00010	<0.00010	<0.00010	0.00010	-	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010
Titanium	0.00030	<0.00030	<0.00030	0.00030	-	<0.00030	<0.00030	0.00030	<0.00030	<0.00030	<0.00030	0.00030	<0.00030	<0.00030	0.00030	<0.00030	<0.00030
Tungsten	0.00010	<0.00010	<0.00010	0.00010	-	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010
Uranium	0.000010	<0.000010	<0.000010	0.000010	-	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010
Vanadium	0.00050	<0.00050	<0.00050	0.00050	-	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050
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	<0.0030	0.0030	<0.0030	<0.0030
Zirconium	0.00020	<0.00020	<0.00020	0.00020	-	<0.00020	<0.00020	0.00020	<0.00020	<0.00020	<0.00020	0.00020	<0.00020	<0.00020	0.00020	<0.00020	<0.00020
Dissolved Metals (mg/L)																	
Aluminum	0.0010	<0.0010	<0.0010	0.0010	-	<0.0010	**0.0018**	0.0010	-	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	0.0010	<0.0010	**0.0023**
Antimony	0.00010	<0.00010	<0.00010	0.00010	-	<0.00010	<0.00010	0.00010	-	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010
Arsenic	0.00010	<0.00010	<0.00010	0.00010	-	<0.00010	<0.00010	0.00010	-	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010
Barium	0.00010	<0.00010	<0.00010	0.00010	-	<0.00010	**0.00013**	0.00010	-	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010
Beryllium	0.00010	<0.000100	<0.000100	0.00010	-	<0.000100	<0.000100	0.00010	-	<0.000100	<0.000100	0.00010	<0.000100	<0.000100	0.00010	<0.000100	<0.000100
Bismuth	0.000050	<0.000050	<0.000050	0.000050	-	<0.000050	<0.000050	0.000050	-	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050
Boron	0.010	<0.010	<0.010	0.010	-	<0.010	<0.010	0.010	-	<0.010	<0.010	0.010	<0.010	<0.010	0.010	<0.010	<0.010
Cadmium	0.000005	<0.0000050	<0.0000050	0.000005	-	<0.0000050	<0.0000050	0.000005	-	<0.0000050	<0.0000050	0.000005	<0.0000050	<0.0000050	0.000005	<0.0000050	<0.0000050
Calcium	0.050	<0.050	<0.050	0.050	-	<0.050	<0.050	0.050	-	<0.050	<0.050	0.050	<0.050	<0.050	0.050	<0.050	<0.050
Cesium	0.000010	<0.000010	<0.000010	0.000010	-	<0.000010	<0.000010	0.000010	-	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010
Chromium	0.00010	<0.00010	<0.00010	0.00010	-	<0.00050	<0.00050	0.00010	-	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	0.00010	<0.00050	<0.00050
Cobalt	0.00010	<0.00010	<0.00010	0.00010	-	<0.00010	<0.00010	0.00010	-	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010
Copper	0.00020	<0.00020	<0.00020	0.00020	-	<0.00020	<0.00020	0.00020	-	<0.00020	**0.00049**	0.00020	<0.00020	<0.00020	0.00020	<0.00020	<0.00020
Iron	0.010	<0.010	<0.010	0.010	-	<0.010	<0.010	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	**0.00021**	0.000050	-	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	0.000050	<0.000050	**0.00026**
Lithium	0.0010	<0.0010	<0.0010	0.0010	-	<0.0010	<0.0010	0.0010	-	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	0.0010	<0.0010	<0.0010
Magnesium	0.0050	<0.0050	<0.0050	0.0050	-	<0.0050	**0.0081**	0.0050	-	<0.0050	<0.0050	0.0050	<0.0050	<0.0050	0.0050	<0.0050	<0.0050
Manganese	0.00010	<0.00010	<0.00010	0.00010	-	<0.00010	**0.00016**	0.00010	-	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010
Mercury	0.000005	<0.0000050	<0.0000050	0.000005	-	<0.0000050	<0.0000050	0.000005	-	<0.0000050	<0.0000050	0.000005	<0.0000050	<0.0000050	0.000005	<0.0000050	<0.0000050
Molybdenum	0.000050	<0.000050	<0.000050	0.000050	-	<0.000050	<0.000050	0.000050	-	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	0.000050	<0.000050	**0.00012**
Nickel	0.00050	<0.00050	<0.00050	0.00050	-	<0.00050	<0.00050	0.00050	-	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050
Phosphorus	0.050	<0.050	<0.050	0.050	-	<0.050	<0.050	0.050	-	<0.050	<0.050	0.050	<0.050	<0.050	0.050	<0.050	<0.050
Potassium	0.050	<0.050	<0.050	0.050	-	<0.050	<0.050	0.050	-	<0.050	<0.050	0.050	<0.050	<0.050	0.050	<0.050	<0.050
Rubidium	0.00020	<0.00020	<0.00020	0.00020	-	<0.00020	<0.00020	0.00020	-	<0.00020	<0.00020	0.00020	<0.00020	<0.00020	0.00020	<0.00020	<0.00020
Selenium	0.000050	<0.000050	<0.000050	0.000050	-	<0.000050	<0.000050	0.000050	-	<0.000050	<0.000050	0.000050	<0.000050	<0.000050	0.000050	<0.000050	<0.000050
Silicon	0.050	<0.050	<0.050	0.050	-	<0.050	<0.050	0.050	-	<0.050	<0.050	0.050	<0.050	<0.050	0.050	<0.050	<0.050
Silver	0.000010	<0.000010	<0.000010	0.000010	-	<0.000010	<0.000010	0.000010	-	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010
Sodium	0.050	<0.050	<0.050	0.050	-	<0.050	<0.050	0.050	-	<0.050	<0.050	0.050	<0.050	<0.050	0.050	<0.050	<0.050
Strontium	0.00020	<0.00020	<0.00020	0.00020	-	<0.00020	**0.00023**	0.00020	-	<0.00020	<0.00020	0.00020	<0.00020	<0.00020	0.00020	<0.00020	<0.00020
Sulfur	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
Tellurium	0.00020	<0.00020	<0.00020	0.00020	-	<0.00020	<0.00020	0.00020	-	<0.00020	<0.00020	0.00020	<0.00020	<0.00020	0.00020	<0.00020	<0.00020
Thallium	0.000010	<0.000010	<0.000010	0.000010	-	<0.000010	<0.000010	0.000010	-	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010
Thorium	0.00010	<0.00010	<0.00010	0.00010	-	<0.00010	<0.00010	0.00010	-	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010
Tin	0.00010	<0.00010	<0.00010	0.00010	-	<0.00010	<0.00010	0.00010	-	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010
Titanium	0.00030	<0.00030	<0.00030	0.00030	-	<0.00030	<0.00030	0.00030	-	<0.00030	<0.00030	0.00030	<0.00030	<0.00030	0.00030	<0.00030	<0.00030
Tungsten	0.00010	<0.00010	<0.00010	0.00010	-	<0.00010	<0.00010	0.00010	-	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010
Uranium	0.000010	<0.000010	<0.000010	0.000010	-	<0.000010	<0.000010	0.000010	-	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010
Vanadium	0.00050	<0.00050	<0.00050	0.00050	-	<0.00050	<0.00050	0.00050	-	<0.00050	<0.00050	0.00050	<0.00050	<0.00050	0.00050	<0.00050	<0.00050
Zinc	0.0010	<0.0010	<0.0010	0.0010	-	<0.0010	<0.0010	0.0010	-	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	0.0010	<0.0010	<0.0010
Zirconium	0.00020	<0.00020	<0.00020	0.00020	-	<0.00020	<0.00020	0.00020	-	<0.00020	<0.00020	0.00020	<0.00020	<0.00020	0.00020	<0.00020	<0.00020

Notes:

Bolded Travel, DI, or Equipment Blank concentration exceeds laboratory DLs but < 10x DL.

Shaded Travel, DI, or Equipment Blank concentration is > 10x DL.

Italicized numbers are below detection limits.

"-" analyte not measured

Table A-5. Field QA/QC summary for water quality for all CREMP study areas, 2021.

Month				March											
	Lab RPD Values (%)	Field RPD Values (%)	March MDLs	Pipe Dream Lake			Third Portage Lake - North			Lake A20			Nemo Lake		
Analyte				PDL-93	MAR-DUP-1	**RPD (%)**	TPN-141	MAR-DUP-2	**RPD (%)**	A20-52	MAR-DUP-3	**RPD (%)**	NEM-57	MAR-DUP-4	**RPD (%)**
Date Sampled				20-Mar-21	20-Mar-21		29-Mar-21	29-Mar-21		24-Mar-21	24-Mar-21		24-Mar-21	24-Mar-21	
ALS Sample ID				VA21A6084-011	VA21A6084-013		VA21A6519-002	VA21A6519-005		VA21A6300-006	VA21A6300-009		VA21A6300-007	VA21A6300-010	
Physical Tests															
Conductivity (µS/cm)	10	15	2.0	30	30	0	36	36	0.84	46	46	-0.2	118	119	-0.8
Alkalinity, Total	20	30	1.0	9.8	10	-5	8.5	8.7	-2	9.8	9.3	5.2	13	13	0
Alkalinity, Bicarbonate	20	30	0.60	9.8	10	-5	8.5	8.7	-2	9.8	9.3	5.2	13	13	0
Alkalinity, Carbonate	20	30	0.60	*<1.0*	*<1.0*		*<1.0*	*<1.0*		*<1.0*	*<1.0*		*<1.0*	*<1.0*	
Alkalinity, Hydroxide	20	30	0.10	*<1.0*	*<1.0*		*<1.0*	*<1.0*		*<1.0*	*<1.0*		*<1.0*	*<1.0*	
Hardness (mg/L), dissolved		40	15	12	12	-2	13	12	5.6	17	17	0.59	47	48	-3
Hardness (as $CaCO_3$), from total Ca/Mg		40	1.0	12	12	-2	12	13	-2	17	17	1.2	46	44	3.8
pH (Laboratory)		40	0.10	7.1	7.1	0	7.1	7.1	-0.3	7.1	7.1	0.14	7.2	7.2	0.28
Total Dissolved Solids (mg/L)		40	1.0	16	16	3.7	21	21	0	24	29	-20	90	88	2.2
Total Suspended Solids (mg/L)		40	1.0	*<1.0*	*<1.0*		*<1.0*	*<1.0*		*<1.0*	*<1.0*		*<1.0*	*<1.0*	
Turbidity (NTU)	15	23	1.0	*<0.10*	0.12		*<0.10*	*<0.10*		*<0.10*	*<0.10*		*<0.10*	*<0.10*	
Anions and Nutrients (mg/L)															
Total Kjeldahl Nitrogen	20	30	0.050	0.098	0.12	-23	0.14	0.12	21	0.17	0.17	-0.6	0.16	0.17	-1
Ammonia, Total (as N)	20	30	0.0050	0.0097	0.029	**-98**	0.012	0.012	-0.8	0.019	0.016	15	0.035	0.033	4.4
Bromide (Br)	20	30	0.050	*<0.050*	*<0.050*		*<0.050*	*<0.050*		0.064	0.063	1.6	0.17	0.16	3.6
Chloride (Cl)	20	30	0.10	0.86	0.87	-1	1.1	1.1	-0.9	6.0	5.9	1.0	23	23	0.44
Fluoride (F)	20	30	0.020	0.048	0.049	-2	0.086	0.086	0	0.039	0.038	2.6	0.033	0.033	0
Nitrate (as N)	20	30	0.0050	*<0.0050*	*<0.0050*		*<0.0050*	*<0.0050*		0.027	0.026	1.1	0.099	0.100	-0.4
Nitrite (as N)	20	30	0.0010	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		0.0011	0.0021	**-63**	*<0.0010*	*<0.0010*	
Orthophosphate-Dissolved (as P)	20	30	0.0010	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*	
Phosphorus (P)-Total	20	30	0.0020	*<0.0020*	*<0.0020*		*<0.0020*	*<0.0020*		0.0049	0.0046	6.3	0.0029	0.0027	7.1
Phosphorus (P)-Total Dissolved	25	38	0.0020	*<0.0020*	*<0.0020*		*<0.0020*	*<0.0020*		*<0.0020*	*<0.0020*		*<0.0020*	*<0.0020*	
Reactive Silica (as SiO_2)	20	30	0.50	*<0.50*	*<0.50*		*<0.50*	*<0.50*		0.79	0.79	0	*<0.50*	*<0.50*	
Sulfate (SO_4)	20	30	0.30	2.4	2.5	-1	6.2	6.2	-0.5	2.5	2.5	0.79	5.6	5.6	0
Cyanides (mg/L)															
Free Cyanide	20	30	0.0010	-	-		*<0.0010*	*<0.0010*		-	-		-	-	
Total Cyanide	20	30	0.0010	-	-		*<0.0010*	*<0.0010*		-	-		-	-	
Organic / Inorganic Carbon (mg/L)															
Dissolved Organic Carbon	20	30	0.50	1.8	1.7	8.0	1.6	1.3	23	3.0	2.8	7.5	2.3	2.1	9.7
Total Organic Carbon	20	30	0.50	1.8	1.7	3.4	1.4	1.4	-1	3.1	3.3	-6	4.7	2.7	**55**
Total Metals (mg/L)															
Aluminum	20	30	0.0030	*<0.0030*	*<0.0030*		*<0.0030*	*<0.0030*		0.0042	0.0036	15	*<0.0030*	*<0.0030*	
Antimony	20	30	0.00010	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*	
Arsenic	20	30	0.00010	0.00020	0.00021	-5	0.00022	0.00021	4.7	0.00024	0.00024	0	0.00054	0.00056	-4
Barium	20	30	0.00010	0.0025	0.0025	-3	0.0035	0.0035	0	0.0088	0.0088	-0.8	0.022	0.022	-0.5
Beryllium	20	30	0.00010	*<0.000100*	*<0.000100*		*<0.000100*	*<0.000100*		*<0.000100*	*<0.000100*		*<0.000100*	*<0.000100*	
Bismuth	20	30	0.000050	*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*	
Boron	20	30	0.010	*<0.010*	*<0.010*		*<0.010*	*<0.010*		*<0.010*	*<0.010*		*<0.010*	*<0.010*	
Cadmium	20	30	0.000005	*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*	
Calcium	20	30	0.050	3.1	3.1	-1	3.0	3.1	-2	4.6	4.5	1.5	14	13	5.1
Cesium	20	30	0.000010	*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		0.000010	*<0.000010*	
Chromium	20	30	0.00010	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*	
Cobalt	20	30	0.00010	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*	
Copper	20	30	0.00050	*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*	
Iron	20	30	0.010	*<0.010*	*<0.010*		*<0.010*	*<0.010*		0.010	*<0.010*		*<0.010*	*<0.010*	
Lead	20	30	0.000050	*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*	
Lithium	20	30	0.0010	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		0.0022	0.0021	4.7
Magnesium	20	30	0.0050	1.0	1.1	-4	1.2	1.2	-2	1.4	1.4	0.74	2.6	2.6	-0.4
Manganese	20	30	0.00010	0.00047	0.00043	8.9	0.00047	0.00045	4.3	0.0010	0.0010	1.9	0.00081	0.00081	0
Mercury	20	30	0.000005	*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*	
Molybdenum	20	30	0.000050	0.000056	0.000059	-5	0.00016	0.00013	25	0.000058	0.000059	-2	0.00016	0.00014	13
Nickel	20	30	0.00050	0.00065	0.00068	-5	*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*		0.0014	0.0014	0.70
Phosphorus	20	30	0.050	*<0.050*	*<0.050*		*<0.050*	*<0.050*		*<0.050*	*<0.050*		*<0.050*	*<0.050*	
Potassium	20	30	0.050	0.47	0.48	-1	0.65	0.66	-2	1.2	1.2	0.87	1.8	1.8	1.1
Rubidium	20	30	0.00020	0.00057	0.00056	1.8	0.00092	0.0010	-11	0.0015	0.0015	1.3	0.0026	0.0026	-1
Selenium	20	30	0.000050	*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*	
Silicon	20	30	0.10	0.19	0.19	0	0.12	0.13	-8	0.36	0.38	-5	*<0.10*	*<0.10*	
Silver	20	30	0.000010	*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*	
Sodium	20	30	0.050	0.62	0.63	-0.8	1.4	1.4	0	1.1	1.1	0.90	1.3	1.2	3.2
Strontium	20	30	0.00020	0.014	0.013	2.2	0.015	0.013	10	0.032	0.032	-0.9	0.090	0.090	0.56
Sulfur	20	30	0.50	0.72	0.79	-9	1.8	2.0	-9	0.80	0.79	1.3	2.1	1.8	13
Tellurium	20	30	0.00020	*<0.00020*	*<0.00020*		*<0.00020*	*<0.00020*		*<0.00020*	*<0.00020*		*<0.00020*	*<0.00020*	
Thallium	20	30	0.000010	*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*	
Thorium	20	30	0.00010	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*	
Tin	20	30	0.00010	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*	
Titanium	20	30	0.00030	*<0.00030*	*<0.00030*		*<0.00030*	*<0.00030*		*<0.00030*	*<0.00030*		*<0.00030*	*<0.00030*	
Tungsten	20	30	0.00010	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*	
Uranium	20	30	0.000010	0.000031	0.000029	6.7	0.000031	0.000029	6.7	0.000044	0.000042	4.7	0.000018	0.000017	5.7
Vanadium	20	30	0.00050	*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*	
Zinc	20	30	0.0030	*<0.0030*	*<0.0030*		*<0.0030*	*<0.0030*		*<0.0030*	*<0.0030*		*<0.0030*	*<0.0030*	
Zirconium	20	30	0.00020	*<0.00020*	*<0.00020*		*<0.00020*	*<0.00020*		*<0.00020*	*<0.00020*		*<0.00020*	*<0.00020*	
Dissolved Metals (mg/L)															
Aluminum	20	30	0.0010	0.0019	0.0022	-15	0.0013	0.0014	-7	0.0032	0.0036	-12	0.0012	0.0017	**-34**
Antimony	20	30	0.00010	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*	
Arsenic	20	30	0.00010	0.00020	0.00019	5.1	0.00021	0.00022	-5	0.00023	0.00021	9.1	0.00051	0.00056	-9
Barium	20	30	0.00010	0.0025	0.0025	0	0.0035	0.0037	-6	0.0089	0.0085	4.7	0.022	0.022	-2
Beryllium	20	30	0.00010	*<0.000100*	*<0.000100*		*<0.000100*	*<0.000100*		*<0.000100*	*<0.000100*		*<0.000100*	*<0.000100*	
Bismuth	20	30	0.000050	*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*	
Boron	20	30	0.010	*<0.010*	*<0.010*		*<0.010*	*<0.010*		*<0.010*	*<0.010*		*<0.010*	*<0.010*	
Cadmium	20	30	0.000005	*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*	
Calcium	20	30	0.050	3.1	3.1	-2	3.3	3.1	6.9	4.5	4.5	0.22	14	15	-3
Cesium	20	30	0.000010	*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		0.000010	0.000010	0
Chromium	20	30	0.00010	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	0.00010	
Cobalt	20	30	0.00010	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*	
Copper	20	30	0.00020	0.00050	0.00064	-25	0.00036	0.00039	-8	0.00035	0.00040	-13	0.00030	0.00030	0
Iron	20	30	0.010	*<0.010*	*<0.010*		*<0.010*	*<0.010*		*<0.010*	*<0.010*		*<0.010*	*<0.010*	
Lead	20	30	0.000050	0.000054	0.00021	**-119**	*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*	
Lithium	20	30	0.0010	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		0.0023	0.0023	0
Magnesium	20	30	0.0050	1.0	1.1	-4	1.1	1.1	1.8	1.4	1.4	1.4	2.8	2.8	-2
Manganese	20	30	0.00010	0.00021	0.00016	27	0.00021	0.00028	-29	0.00097	0.0010	-3	0.00027	0.00024	12
Mercury	20	30	0.000005	*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*	
Molybdenum	20	30	0.000050	0.000062	0.000062	0	0.00012	0.00014	-12	0.000054	0.000051	5.7	0.00014	0.00014	-4
Nickel	20	30	0.00050	*<0.00050*	*<0.00050*		0.00058	*<0.00050*		*<0.00050*	*<0.00050*		0.0014	0.0015	-5
Phosphorus	20	30	0.050	*<0.050*	*<0.050*		*<0.050*	*<0.050*		*<0.050*	*<0.050*		*<0.050*	*<0.050*	
Potassium	20	30	0.050	0.49	0.47	3.6	0.65	0.65	0	1.2	1.2	0	1.9	1.9	-2
Rubidium	20	30	0.00020	0.00052	0.00061	-16	0.00091	0.00074	21	0.0015	0.0015	0.66	0.0026	0.0024	9.2
Selenium	20	30	0.000050	*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*	
Silicon	20	30	0.050	0.16	0.18	-13	0.080	0.082	-2	0.34	0.34	-1	0.080	0.074	7.8
Silver	20	30	0.000010	*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*	
Sodium	20	30	0.050	0.64	0.64	1.1	1.3	1.3	0	1.1	1.1	1.8	1.3	1.3	-0.8
Strontium	20	30	0.00020	0.013	0.013	-0.8	0.013	0.014	-6	0.030	0.031	-4	0.092	0.094	-2
Sulfur	20	30	0.50	0.95	0.82	15	2.1	2.0	5.9	0.91	1.1	-14	1.9	2.0	-8
Tellurium	20	30	0.00020	*<0.00020*	*<0.00020*		*<0.00020*	*<0.00020*		*<0.00020*	*<0.00020*		*<0.00020*	*<0.00020*	
Thallium	20	30	0.000010	*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*	
Thorium	20	30	0.00010	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*	
Tin	20	30	0.00010	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*	
Titanium	20	30	0.00030	*<0.00030*	*<0.00030*		*<0.00030*	*<0.00030*		*<0.00030*	*<0.00030*		*<0.00030*	*<0.00030*	
Tungsten	20	30	0.00010	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		0.00019	0.00031	**-48**	0.00050	0.00029	**53**
Uranium	20	30	0.000010	0.000024	0.000023	4.3	0.000032	0.000034	-6	0.000040	0.000042	-5	0.000016	0.000017	-6
Vanadium	20	30	0.00050	*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*	
Zinc	20	30	0.0010	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		*<0.0010*	0.0016		*<0.0010*	*<0.0010*	
Zirconium		40	0.00020	*<0.00020*	*<0.00020*		*<0.00020*	*<0.00020*		*<0.00020*	*<0.00020*		*<0.00020*	*<0.00020*	
Speciated Metals (µg/L)															
Arsenate (As V)	20	30	0.020	0.025	0.031	-21	-	-		0.027	0.032	-17	-	0.17	
Arsenite (As III)	20	30	0.020	0.042	0.044	-5	-	-		0.045	0.032	**34**	-	0.070	
Arsenobetaine (AsB)	20	30	0.050	*<0.050*	*<0.050*		-	-		*<0.050*	*<0.050*		-	*<0.050*	
Dimethylarsinic Acid (DMA)	20	30	0.020	*<0.020*	*<0.020*		-	-		*<0.020*	*<0.020*		-	0.057	
Monomethylarsonic Acid (MMA)	20	30	0.040	*<0.020*	*<0.020*		-	-		*<0.020*	*<0.020*		-	*<0.040*	
Plant Pigments (µg/L)															
chlorophyll-a		40	0.010	0.30	0.27	12	0.30	0.32	-7	1.4	1.4	-3	0.99	1.0	-5

Notes:
RPD = Relative Percent Difference (%) = ((original - duplicate) / (original + duplicate)/2) x 100.
RPDs are only calculated when both samples are above detection.
The data quality objective (DQO) for field duplicates is an RPD of 1.5 x the laboratory RPD or 40% in the absence of a lab RPD.

Bolded RPDs	**RPD values exceeded but < 10 x MDL.**
Shaded RPDs	RPD values exceeded and > 10 x MDL.

Italicized numbers are below detection limits.
"-" = No measurement

Table A-5. Field QA/QC summary for water quality for all CREMP study areas, 2021.

Month				May											
	Lab RPD Values (%)	Field RPD Values (%)	May MDLs	Pipe Dream Lake			Wally Lake			Nemo Lake			Mammoth Lake		
Analyte				PDL-96	MAY-DUP-1	**RPD (%)**	WAL-112	MAY-DUP-2	**RPD (%)**	NEM-59	MAY-DUP-3	**RPD (%)**	MAM-60	MAY-DUP-4	**RPD (%)**
Date Sampled				09-May-21	09-May-21		09-May-21	09-May-21		06-May-21	06-May-21		12-May-21	12-May-21	
ALS Sample ID				VA21A9442-010	VA21A9442-015		VA21A9442-006	VA21A9442-016		VA21A9149-001	VA21A9149-011		VA21A9444-013	VA21A9444-018	
Physical Tests															
Conductivity (µS/cm)	10	15	2.0	25	25	1.2	59	58	1.0	116	117	-0.86	310	313	-0.96
Alkalinity, Total	20	30	1.0	8.2	8.3	-1.2	19	19	1.6	11	11	0	26	26	1.5
Alkalinity, Bicarbonate	20	30	0.60	8.2	8.3	-1.2	19	19	1.6	11	11	0	26	26	1.5
Alkalinity, Carbonate	20	30	0.60	<1.0	<1.0		<1.0	<1.0		<1.0	<1.0		<1.0	<1.0	
Alkalinity, Hydroxide	20	30	0.10	<1.0	<1.0		<1.0	<1.0		<1.0	<1.0		<1.0	<1.0	
Hardness (mg/L), dissolved		40	15	10	10	0	24	25	-0.82	43	43	0.23	111	114	-2.7
Hardness (as $CaCO_3$), from total Ca/Mg		40	1.0	10	10	-1.9	25	26	-1.6	46	44	2.7	118	123	-4.1
pH (Laboratory)		40	0.10	7.0	7.0	-0.57	7.1	7.2	-1.4	7.0	7.0	-1.1	7.0	6.9	0.43
Total Dissolved Solids (mg/L)		40	1.0	18	19	-4.3	51	46	9.5	88	92	-3.7	244	234	4.2
Total Suspended Solids (mg/L)		40	1.0	<1.0	<1.0		<1.0	<1.0		<1.0	<1.0		<1.0	<1.0	
Turbidity (NTU)	15	23	1.0	<0.10	<0.10		<0.10	<0.10		<0.10	<0.10		<0.10	<0.10	
Anions and Nutrients (mg/L)															
Total Kjeldahl Nitrogen	20	30	0.050	0.077	0.092	-18	0.12	0.12	0	0.17	0.15	8.2	0.34	0.36	-5.6
Ammonia, Total (as N)	20	30	0.0050	0.010	0.010	2.0	0.019	0.017	11	0.053	0.024	76.5	0.0068	0.0068	0
Bromide (Br)	20	30	0.050	<0.050	<0.050		<0.050	<0.050		0.15	0.15	-0.65	0.50	0.51	-1.6
Chloride (Cl)	20	30	0.10	0.76	0.74	2.7	0.98	0.94	4.2	23	23	0	53	53	-0.57
Fluoride (F)	20	30	0.020	0.041	0.041	0	0.062	0.061	1.6	0.033	0.032	3.1	0.068	0.068	0
Nitrate (as N)	20	30	0.0050	<0.0050	<0.0050		0.018	0.019	-2.7	0.11	0.12	-1.7	1.8	1.8	1.7
Nitrite (as N)	20	30	0.0010	<0.0010	<0.0010		<0.0010	<0.0010		0.0024	0.0033	**-32**	0.0018	0.0015	18
Orthophosphate-Dissolved (as P)	20	30	0.0010	<0.0010	<0.0010		<0.0010	<0.0010		<0.0010	0.0016		<0.0010	<0.0010	
Phosphorus (P)-Total	20	30	0.0020	<0.0020	0.0028		<0.0020	<0.0020		0.0032	0.0021	**42**	0.0023	0.0023	0
Phosphorus (P)-Total Dissolved	25	38	0.0020	<0.0020	<0.0020		<0.0020	<0.0020		<0.0020	<0.0020		0.0021	<0.0020	
Reactive Silica (as SiO_2)	20	30	0.50	<0.50	<0.50		1.8	1.8	-1.1	<0.50	<0.50		3.1	3.1	0.64
Sulfate (SO_4)	20	30	0.30	2.0	2.0	-1.5	6.8	6.7	1.9	5.5	5.5	0	30	30	-0.66
Cyanides (mg/L)															
Free Cyanide	20	30	0.0010	-	-		<0.0010	<0.0010		-	-		-	-	
Total Cyanide	20	30	0.0010	-	-		<0.0010	<0.0010		-	-		-	-	
Organic / Inorganic Carbon (mg/L)															
Dissolved Organic Carbon	20	30	0.50	1.4	1.6	-11	2.3	2.3	-1.7	4.8	2.0	**83**	3.1	3.1	0.32
Total Organic Carbon	20	30	0.50	1.4	1.9	-26	2.4	2.4	-0.84	8.2	1.8	127.1	3.2	3.0	4.2
Total Metals (mg/L)															
Aluminum	20	30	0.0030	<0.0030	<0.0030		<0.0030	<0.0030		<0.0030	<0.0030		<0.0030	<0.0030	
Antimony	20	30	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010		0.00087	0.00091	-4.5
Arsenic	20	30	0.00010	0.00017	0.00016	6.1	0.00032	0.00031	3.2	0.00054	0.00052	3.8	0.00087	0.00079	9.6
Barium	20	30	0.00010	0.0021	0.0021	2.4	0.0036	0.0037	-1.4	0.020	0.020	-1.00	0.056	0.057	-1.9
Beryllium	20	30	0.00010	<0.000100	<0.000100		<0.000100	<0.000100		<0.000100	<0.000100		<0.000100	<0.000100	
Bismuth	20	30	0.000050	<0.000050	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050	
Boron	20	30	0.010	<0.010	<0.010		<0.010	<0.010		<0.010	<0.010		<0.010	<0.010	
Cadmium	20	30	0.000005	<0.0000050	<0.0000050		<0.0000050	<0.0000050		<0.0000050	<0.0000050		0.000005	<0.0000050	
Calcium	20	30	0.050	2.7	2.7	-1.9	6.9	7.0	-1.7	14	14	3.5	35	37	-3.9
Cesium	20	30	0.000010	<0.000010	<0.000010		<0.000010	<0.000010		0.000010	<0.000010		0.000029	0.000027	7.1
Chromium	20	30	0.00050	<0.00050	<0.00050		<0.00050	<0.00050		<0.00050	<0.00050		<0.00050	<0.00050	
Cobalt	20	30	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010		0.00010	0.00012	-18
Copper	20	30	0.00050	<0.00050	<0.00050		0.0011	0.0011	0	<0.00050	<0.00050		0.00078	0.00081	-3.8
Iron	20	30	0.010	<0.010	<0.010		<0.010	<0.010		<0.010	<0.010		<0.010	<0.010	
Lead	20	30	0.000050	<0.000050	<0.000050		0.000054	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050	
Lithium	20	30	0.0010	<0.0010	<0.0010		<0.0010	<0.0010		0.0024	0.0022	8.7	0.0051	0.0050	2.0
Magnesium	20	30	0.0050	0.88	0.88	0.34	1.9	1.9	-0.52	2.3	2.4	-0.85	7.2	7.5	-4.1
Manganese	20	30	0.00010	0.00041	0.00042	-2.4	0.0012	0.0012	1.7	0.0011	0.0010	2.8	0.0070	0.0071	-0.85
Mercury	20	30	0.000005	<0.0000050	<0.0000050		<0.0000050	<0.0000050		<0.0000050	<0.0000050		<0.0000050	<0.0000050	
Molybdenum	20	30	0.000050	0.000050	<0.000050		0.00015	0.00016	-2.6	0.00013	0.00013	0.79	0.00075	0.00071	5.5
Nickel	20	30	0.00050	0.00055	0.00058	-5.3	<0.00050	0.00050		0.0013	0.0014	-5.1	0.0030	0.0031	-3.6
Phosphorus	20	30	0.050	<0.050	<0.050		<0.050	<0.050		<0.050	<0.050		<0.050	<0.050	
Potassium	20	30	0.050	0.39	0.38	1.0	0.66	0.65	0.31	1.7	1.7	-1.2	6.1	6.2	-1.3
Rubidium	20	30	0.00020	0.00050	0.00049	2.0	0.00089	0.00096	-7.6	0.0023	0.0023	-1.3	0.0074	0.0074	-1.1
Selenium	20	30	0.000050	<0.000050	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050		0.00013	0.00015	-18
Silicon	20	30	0.10	0.18	0.18	0	0.88	0.89	-1.1	0.13	0.14	-7.4	1.5	1.5	-0.66
Silver	20	30	0.000010	<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010	
Sodium	20	30	0.050	0.53	0.54	-0.19	0.83	0.83	-0.12	1.1	1.1	0.90	4.2	4.6	-9.7
Strontium	20	30	0.00020	0.011	0.010	4.7	0.034	0.034	0.29	0.091	0.091	0.22	0.24	0.26	-5.2
Sulfur	20	30	0.50	0.61	0.74	-19	2.1	2.2	-4.1	1.7	1.8	-4.5	10	11	-3.8
Tellurium	20	30	0.00020	<0.00020	<0.00020		<0.00020	<0.00020		<0.00020	<0.00020		<0.00020	<0.00020	
Thallium	20	30	0.000010	<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010	
Thorium	20	30	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Tin	20	30	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Titanium	20	30	0.00030	<0.00030	<0.00030		<0.00030	<0.00030		<0.00030	<0.00030		<0.00030	<0.00030	
Tungsten	20	30	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Uranium	20	30	0.000010	0.000023	0.000020	14	0.000043	0.000043	0	0.000015	0.000015	0	0.00012	0.00012	1.6
Vanadium	20	30	0.00050	<0.00050	<0.00050		<0.00050	<0.00050		<0.00050	<0.00050		<0.00050	<0.00050	
Zinc	20	30	0.0030	<0.0030	<0.0030		<0.0030	<0.0030		<0.0030	<0.0030		<0.0030	<0.0030	
Zirconium	20	30	0.00020	<0.00020	<0.00020		<0.00020	<0.00020		<0.00020	<0.00020		<0.00020	<0.00020	
Dissolved Metals (mg/L)															
Aluminum	20	30	0.0010	<0.0010	0.0011		0.0014	0.0019	-30	0.0016	0.0016	0	0.0014	0.0016	-13
Antimony	20	30	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010		0.00089	0.00084	5.8
Arsenic	20	30	0.00010	0.00016	0.00015	6.5	0.00026	0.00030	-14	0.00048	0.00049	-2.1	0.00076	0.00081	-6.4
Barium	20	30	0.00010	0.0020	0.0022	-9.0	0.0036	0.0035	1.1	0.021	0.021	0	0.056	0.056	0.90
Beryllium	20	30	0.00010	<0.000100	<0.000100		<0.000100	<0.000100		<0.000100	<0.000100		<0.000100	<0.000100	
Bismuth	20	30	0.000050	<0.000050	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050	
Boron	20	30	0.010	<0.010	<0.010		<0.010	<0.010		<0.010	<0.010		<0.010	<0.010	
Cadmium	20	30	0.000005	<0.0000050	<0.0000050		<0.0000050	<0.0000050		<0.0000050	<0.0000050		<0.0000050	<0.0000050	
Calcium	20	30	0.050	2.6	2.7	-0.38	6.7	6.8	-1.3	13	13	0.77	33	34	-3.3
Cesium	20	30	0.000010	<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010		0.000032	0.000029	9.8
Chromium	20	30	0.00050	<0.00050	<0.00050		<0.00050	<0.00050		<0.00050	<0.00050		<0.00050	<0.00050	
Cobalt	20	30	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	0.00010	
Copper	20	30	0.00020	0.00038	0.00040	-5.1	0.0011	0.0011	0	0.00034	0.00033	3.0	0.00075	0.00076	-1.3
Iron	20	30	0.010	<0.010	<0.010		<0.010	<0.010		<0.010	<0.010		<0.010	<0.010	
Lead	20	30	0.000050	<0.000050	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050	
Lithium	20	30	0.0010	<0.0010	<0.0010		<0.0010	<0.0010		0.0020	0.0020	0	0.0050	0.0051	-2.0
Magnesium	20	30	0.0050	0.85	0.85	-0.47	1.9	1.9	0	2.5	2.5	-1.2	7.3	7.3	0.82
Manganese	20	30	0.00010	<0.00010	0.00011		0.00030	0.00032	-6.5	0.00026	0.00020	26	0.0046	0.0046	-1.3
Mercury	20	30	0.000005	<0.0000050	<0.0000050		<0.0000050	<0.0000050		<0.0000050	<0.0000050		<0.0000050	<0.0000050	
Molybdenum	20	30	0.000050	0.000050	0.000053	-5.8	0.00016	0.00016	-1.8	0.00012	0.00011	3.5	0.00074	0.00073	2.0
Nickel	20	30	0.00050	0.00054	0.00054	0	<0.00050	<0.00050		0.0014	0.0014	0	0.0031	0.0032	-4.1
Phosphorus	20	30	0.050	<0.050	<0.050		<0.050	<0.050		<0.050	<0.050		<0.050	<0.050	
Potassium	20	30	0.050	0.41	0.39	2.8	0.65	0.66	-1.7	1.7	1.7	-1.2	6.3	6.6	-3.4
Rubidium	20	30	0.00020	0.00052	0.00046	12	0.00096	0.00091	5.3	0.0025	0.0024	3.6	0.0074	0.0075	-1.6
Selenium	20	30	0.000050	<0.000050	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050		0.00011	0.00015	**-31**
Silicon	20	30	0.050	0.13	0.14	-5.1	0.81	0.80	1.00	0.11	0.11	0	1.5	1.5	-2.0
Silver	20	30	0.000010	<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010	
Sodium	20	30	0.050	0.55	0.56	-0.18	0.85	0.86	-0.93	1.2	1.2	-2.6	4.4	4.4	0
Strontium	20	30	0.00020	0.011	0.011	0	0.036	0.038	-6.5	0.084	0.083	1.3	0.25	0.24	4.9
Sulfur	20	30	0.50	<0.50	<0.50		1.9	1.9	0.53	1.6	1.7	-7.1	9.7	10	-3.9
Tellurium	20	30	0.00020	<0.00020	<0.00020		<0.00020	<0.00020		<0.00020	<0.00020		<0.00020	<0.00020	
Thallium	20	30	0.000010	<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010	
Thorium	20	30	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Tin	20	30	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Titanium	20	30	0.00030	<0.00030	<0.00030		<0.00030	<0.00030		<0.00030	<0.00030		<0.00030	<0.00030	
Tungsten	20	30	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Uranium	20	30	0.000010	0.000022	0.000022	0	0.000044	0.000045	-2.2	0.000016	0.000015	6.5	0.00013	0.00013	-2.4
Vanadium	20	30	0.00050	<0.00050	<0.00050		<0.00050	<0.00050		<0.00050	<0.00050		<0.00050	<0.00050	
Zinc	20	30	0.0010	<0.0010	<0.0010		<0.0010	<0.0010		0.0018	<0.0010		0.0013	0.0015	-14
Zirconium		40	0.00020	<0.00020	<0.00020		<0.00020	<0.00020		<0.00020	<0.00020		<0.00020	<0.00020	
Speciated Metals (µg/L)															
Arsenate (As V)	20	30	0.020	0.035	0.031	12	-	-		-	-		0.40	0.40	0.50
Arsenite (As III)	20	30	0.020	0.042	0.039	7.4	-	-		-	-		0.10	0.10	3.0
Arsenobetaine (AsB)	20	30	0.050	<0.050	<0.050		-	-		-	-		<0.050	<0.050	
Dimethylarsinic Acid (DMA)	20	30	0.020	<0.020	<0.020		-	-		-	-		<0.020	<0.020	
Monomethylarsonic Acid (MMA)	20	30	0.020	<0.020	<0.020		-	-		-	-		0.025	0.026	-3.9
Plant Pigments (µg/L)															
chlorophyll-a		40	0.010	0.59	0.58	1.4	0.16	0.17	-7.4	0.54	0.48	11	0.20	0.16	22

Notes:
RPD = Relative Percent Difference (%) = ((original - duplicate) / (original + duplicate)/2) x 100.
RPDs are only calculated when both samples are above detection.
The data quality objective (DQO) for field duplicates is an RPD of 1.5 x the laboratory RPD or 40% in the absence of a lab RPD.
Bolded RPDs RPD values exceeded but < 10 x MDL.
Shaded RPD RPD values exceeded and > 10 x MDL.
Italicized numbers are below detection limits.
"-" = No measurement

Table A-5. Field QA/QC summary for water quality for all CREMP study areas, 2021.

Month				July											
	Lab RPD Values (%)	Field RPD Values (%)	July MDLs	Third Portage Lake - North			Baker Lake - Akilahaarjuk Point			Mammoth Lake			Lake A76		
Analyte				TPN-144	JUL-DUP-1	RPD (%)	BAP-73	JUL-DUP-2	RPD (%)	MAM-62	JUL-DUP-3	RPD (%)	A76-53	JUL-DUP-4	RPD (%)
Date Sampled				29-Jul-21	29-Jul-21		30-Jul-21	30-Jul-21		09-Jul-21	09-Jul-21		17-Jul-21	17-Jul-21	
ALS Sample ID				VA21B6241-009	VA21B6241-019		VA21B6241-013	VA21B6241-020		VA21B4721-004	VA21B4721-009		VA21B5426-001	VA21B5426-016	
Physical Tests															
Conductivity (µS/cm)	10	15	2.0	28	26	5.6	97	84	14	119	119	0	86	85	1.3
Alkalinity, Total	20	30	1.0	6.5	6.3	3.1	8.8	9.6	-8.7	13	13	3.8	9.8	9.9	-1.0
Alkalinity, Bicarbonate	20	30	0.60	6.5	6.3	3.1	8.8	9.6	-8.7	13	13	3.8	9.8	9.9	-1.0
Alkalinity, Carbonate	20	30	0.60	*<1.0*	*<1.0*		*<1.0*	*<1.0*		*<1.0*	*<1.0*		*<1.0*	*<1.0*	
Alkalinity, Hydroxide	20	30	0.10	*<1.0*	*<1.0*		*<1.0*	*<1.0*		*<1.0*	*<1.0*		*<1.0*	*<1.0*	
Hardness (mg/L), dissolved		40	10	9.2	9.0	2.6	17	15	10	46	42	10	31	30	2.9
Hardness (as $CaCO_3$), from total Ca/Mg		40	1.0	8.9	9.3	-4.1	17	16	5.6	45	45	1.1	31	31	0.33
pH (Laboratory)		40	0.10	7.1	7.0	2.6	7.3	7.1	2.8	7.3	7.3	0.27	7.2	7.2	0.14
Total Dissolved Solids (mg/L)		40	1.0	16	17	-2.4	56	50	11	68	71	-4.3	62	66	-5.3
Total Suspended Solids (mg/L)		40	1.0	*<1.0*	*<1.0*		*<1.0*	*<1.0*		*<1.0*	*<1.0*		*<1.0*	1.2	
Turbidity (NTU)	15	23	1.0	0.21	0.18	15	0.54	0.47	14	0.25	0.30	-18	0.20	0.19	5.1
Anions and Nutrients (mg/L)															
Total Kjeldahl Nitrogen	20	30	0.050	0.092	0.092	0	0.15	0.17	-11	0.18	0.16	15	0.11	0.11	-5.4
Ammonia, Total (as N)	20	30	0.0050	*<0.0050*	*<0.0050*		*<0.0050*	*<0.0050*		0.0083	0.011	-23	*<0.0050*	*<0.0050*	
Bromide (Br)	20	30	0.050	*<0.050*	*<0.050*		0.061	0.065	-6.3	0.17	0.17	0	0.12	0.12	0
Chloride (Cl)	20	30	0.10	0.79	0.79	0	19	17	11	18	18	0.55	12	12	0
Fluoride (F)	20	30	0.020	0.066	0.066	0	0.060	0.064	-6.5	0.041	0.040	2.5	0.030	0.030	0
Nitrate (as N)	20	30	0.0050	0.0090	0.0090	0	0.037	0.037	1.6	0.47	0.47	0.21	0.074	0.074	1.2
Nitrite (as N)	20	30	0.0010	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		0.0035	0.0036	-2.8	*<0.0010*	*<0.0010*	
Orthophosphate-Dissolved (as P)	20	30	0.0010	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		0.0013	0.0012	8.0
Phosphorus (P)-Total	20	30	0.0020	*<0.0020*	*<0.0020*		0.0033	0.0042	-24	0.0028	0.0026	7.4	0.0037	0.0033	11
Phosphorus (P)-Total Dissolved	25	38	0.0020	*<0.0020*	*<0.0020*		*<0.0020*	*<0.0020*		*<0.0020*	*<0.0020*		0.0024	0.0021	13
Reactive Silica (as SiO_2)	20	30	0.50	*<0.50*	*<0.50*		*<0.50*	*<0.50*		1.0	0.92	10	0.96	0.92	4.3
Sulfate (SO_4)	20	30	0.30	4.5	4.4	1.3	3.5	3.0	14	11	11	0	7.5	7.4	0.54
Cyanides (mg/L)															
Free Cyanide	20	30	0.0010	*<0.0010*	*<0.0010*		-	-		-	-		-	-	
Total Cyanide	20	30	0.0010	*<0.0010*	*<0.0010*		-	-		-	-		-	-	
Organic / Inorganic Carbon (mg/L)															
Dissolved Organic Carbon	20	30	0.50	1.2	1.4	-14	3.2	3.1	1.6	2.1	2.0	7.9	1.6	1.5	0.65
Total Organic Carbon	20	30	0.50	1.2	1.5	-24	3.2	3.3	-3.7	1.8	1.8	-1.6	1.3	1.7	-21
Total Metals (mg/L)															
Aluminum	20	30	0.0030	0.0069	0.0081	-16	0.022	0.026	-16	0.0039	0.0059	**-41**	0.011	0.0063	**53**
Antimony	20	30	0.00010	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		0.00041	0.00040	2.5	*<0.00010*	0.00011	
Arsenic	20	30	0.00010	0.00021	0.00019	10	0.00016	0.00013	21	0.00094	0.00095	-1.1	0.00030	0.00035	-15
Barium	20	30	0.00010	0.0026	0.0028	-8.5	0.017	0.017	-2.4	0.022	0.022	-1.4	0.015	0.014	1.4
Beryllium	20	30	0.00010	*<0.000100*	*<0.000100*		*<0.000100*	*<0.000100*		*<0.000100*	*<0.000100*		*<0.000100*	*<0.000100*	
Bismuth	20	30	0.000050	*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*	
Boron	20	30	0.010	*<0.010*	*<0.010*		*<0.010*	*<0.010*		*<0.010*	*<0.010*		*<0.010*	*<0.010*	
Cadmium	20	30	0.000005	*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*	
Calcium	20	30	0.050	2.2	2.3	-4.0	3.1	2.9	4.4	14	13	3.0	8.8	8.7	1.0
Cesium	20	30	0.000010	*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		0.000013	0.000012	8.0	*<0.000010*	*<0.000010*	
Chromium	20	30	0.00050	*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*	
Cobalt	20	30	0.00010	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*	
Copper	20	30	0.00050	*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*		0.00054	*<0.00050*		*<0.00050*	0.00052	
Iron	20	30	0.010	*<0.010*	0.011		0.029	0.032	-9.8	0.011	0.017	**-43**	0.015	0.015	0
Lead	20	30	0.000050	*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*		*<0.000050*	0.000063	
Lithium	20	30	0.0010	*<0.0010*	*<0.0010*		0.0010	0.0010	0	0.0021	0.0020	4.9	*<0.0010*	*<0.0010*	
Magnesium	20	30	0.0050	0.85	0.89	-4.3	2.2	2.1	6.1	2.8	2.9	-3.9	2.1	2.2	-1.4
Manganese	20	30	0.00010	0.0016	0.0017	-8.5	0.0041	0.0042	-4.1	0.0048	0.0090	-60.6	0.0019	0.0019	-3.1
Mercury	20	30	0.000005	*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*		0.000005	*<0.0000050*	
Molybdenum	20	30	0.000050	0.000087	0.00010	-14	0.000076	0.000065	16	0.00033	0.00033	0	0.00012	0.00013	-5.5
Nickel	20	30	0.00050	*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*		0.0015	0.0014	5.5	0.00089	0.00091	-2.2
Phosphorus	20	30	0.050	*<0.050*	*<0.050*		*<0.050*	*<0.050*		*<0.050*	*<0.050*		*<0.050*	*<0.050*	
Potassium	20	30	0.050	0.49	0.50	-2.2	0.83	0.78	6.6	2.6	2.7	-3.0	1.8	1.8	-1.1
Rubidium	20	30	0.00020	0.00066	0.00074	-11	0.00099	0.00091	8.4	0.0031	0.0034	-8.3	0.0021	0.0020	2.4
Selenium	20	30	0.000050	*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*		0.000064	0.000050	25	*<0.000050*	*<0.000050*	
Silicon	20	30	0.10	0.19	0.12	**45**	0.25	0.29	-15	0.52	0.54	-3.8	0.51	0.50	2.0
Silver	20	30	0.000010	*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*	
Sodium	20	30	0.050	0.98	1.00	-1.9	10	8.8	17	1.7	1.8	-3.9	1.4	1.3	2.2
Strontium	20	30	0.00020	0.0095	0.010	-8.6	0.026	0.024	5.2	0.092	0.091	0.99	0.053	0.053	0.94
Sulfur	20	30	0.50	1.4	1.4	0.70	1.2	1.2	0	3.8	4.0	-4.9	2.3	2.5	-8.7
Tellurium	20	30	0.00020	*<0.00020*	*<0.00020*		*<0.00020*	*<0.00020*		*<0.00020*	*<0.00020*		*<0.00020*	*<0.00020*	
Thallium	20	30	0.000010	*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*	
Thorium	20	30	0.00010	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*	
Tin	20	30	0.00010	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*	
Titanium	20	30	0.0024	*<0.00030*	*<0.00030*		0.00043	0.00043	0	*<0.00030*	*<0.00030*		*<0.00030*	*<0.00030*	
Tungsten	20	30	0.00010	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*	
Uranium	20	30	0.000010	0.000036	0.000037	-2.7	0.000045	0.000047	-4.3	0.000061	0.000060	1.7	0.000031	0.000029	6.7
Vanadium	20	30	0.00050	*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*	
Zinc	20	30	0.0030	*<0.0030*	*<0.0030*		*<0.0030*	*<0.0030*		*<0.0030*	*<0.0030*		*<0.0030*	*<0.0030*	
Zirconium	20	30	0.00020	*<0.00020*	*<0.00020*		*<0.00020*	*<0.00020*		*<0.00020*	*<0.00020*		*<0.00020*	*<0.00020*	
Dissolved Metals (mg/L)															
Aluminum	20	30	0.0010	0.0018	0.0023	-24	0.0082	0.0078	5.0	0.0039	0.0031	23	0.0026	0.0021	21
Antimony	20	30	0.00010	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		0.00042	0.00038	10	0.00010	*<0.00010*	
Arsenic	20	30	0.00010	0.00019	0.00017	11	0.00012	0.00010	18	0.00094	0.00083	12	0.00028	0.00026	7.4
Barium	20	30	0.00010	0.0028	0.0027	6.6	0.016	0.017	-3.6	0.023	0.022	8.0	0.015	0.015	2.7
Beryllium	20	30	0.00010	*<0.000100*	*<0.000100*		*<0.000100*	*<0.000100*		*<0.000100*	*<0.000100*		*<0.000100*	*<0.000100*	
Bismuth	20	30	0.000050	*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*	
Boron	20	30	0.010	*<0.010*	*<0.010*		*<0.010*	*<0.010*		*<0.010*	*<0.010*		*<0.010*	*<0.010*	
Cadmium	20	30	0.000005	*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*	
Calcium	20	30	0.050	2.3	2.2	4.5	3.0	2.8	7.5	13	12	11	8.8	8.6	2.5
Cesium	20	30	0.000010	*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		0.000014	0.000013	7.4	*<0.000010*	*<0.000010*	
Chromium	20	30	0.00050	*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*	
Cobalt	20	30	0.00010	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*	
Copper	20	30	0.00020	0.00041	0.00040	2.5	0.00040	0.00035	13	0.00042	0.00044	-4.7	0.00033	0.00032	3.1
Iron	20	30	0.010	*<0.010*	*<0.010*		*<0.010*	*<0.010*		0.018	0.021	-15	*<0.010*	*<0.010*	
Lead	20	30	0.000050	*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*	
Lithium	20	30	0.0010	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		0.0019	0.0016	17	*<0.0010*	*<0.0010*	
Magnesium	20	30	0.0050	0.86	0.86	-0.47	2.2	2.0	12	3.1	2.8	7.5	2.2	2.1	3.7
Manganese	20	30	0.00010	0.00094	0.00091	3.2	0.0020	0.0019	3.6	0.016	0.014	7.4	0.0010	0.00096	7.0
Mercury	20	30	0.000005	*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*		*<0.0000050*	*<0.0000050*	
Molybdenum	20	30	0.000050	0.000084	0.00010	-18	0.000068	0.000059	14	0.00035	0.00033	5.9	0.00011	0.00011	-2.7
Nickel	20	30	0.00050	*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*		0.0016	0.0015	5.1	0.00084	0.00083	1.2
Phosphorus	20	30	0.050	*<0.050*	*<0.050*		*<0.050*	*<0.050*		*<0.050*	*<0.050*		*<0.050*	*<0.050*	
Potassium	20	30	0.050	0.49	0.49	-1.0	0.86	0.77	11	2.9	2.6	9.4	1.8	1.8	2.8
Rubidium	20	30	0.00020	0.00069	0.00071	-2.9	0.00088	0.00090	-2.2	0.0035	0.0033	8.5	0.0021	0.0020	2.0
Selenium	20	30	0.000050	*<0.000050*	*<0.000050*		*<0.000050*	*<0.000050*		0.000050	0.000058	-15	*<0.000050*	*<0.000050*	
Silicon	20	30	0.050	0.089	0.094	-5.5	0.20	0.21	-7.8	0.49	0.46	6.4	0.48	0.48	-0.63
Silver	20	30	0.000010	*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*	
Sodium	20	30	0.050	0.99	1.0	-5.0	11	8.6	23	1.9	1.9	1.1	1.3	1.3	3.1
Strontium	20	30	0.00020	0.011	0.010	1.9	0.025	0.024	4.0	0.097	0.088	10	0.052	0.051	1.2
Sulfur	20	30	0.50	1.3	1.5	-11	0.99	0.81	20	3.5	3.5	-0.57	2.7	2.6	3.8
Tellurium	20	30	0.00020	*<0.00020*	*<0.00020*		*<0.00020*	*<0.00020*		*<0.00020*	*<0.00020*		*<0.00020*	*<0.00020*	
Thallium	20	30	0.000010	*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*		*<0.000010*	*<0.000010*	
Thorium	20	30	0.00010	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*	
Tin	20	30	0.00010	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*	
Titanium	20	30	0.00030	*<0.00030*	*<0.00030*		*<0.00030*	*<0.00030*		*<0.00030*	*<0.00030*		*<0.00030*	*<0.00030*	
Tungsten	20	30	0.00010	*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*		*<0.00010*	*<0.00010*	
Uranium	20	30	0.000010	0.000032	0.000034	-6.1	0.000042	0.000042	0	0.000074	0.000075	-1.3	0.000028	0.000027	3.6
Vanadium	20	30	0.00050	*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*		*<0.00050*	*<0.00050*	
Zinc	20	30	0.0010	*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*		*<0.0010*	*<0.0010*	
Zirconium		40	0.00020	*<0.00020*	*<0.00020*		*<0.00020*	*<0.00020*		*<0.00020*	*<0.00020*		*<0.00020*	*<0.00020*	
Speciated Metals (µg/L)															
Arsenate (As V)	20	30	0.020	-	-		-	-		-	-		-	-	
Arsenite (As III)	20	30	0.020	-	-		-	-		-	-		-	-	
Arsenobetaine (AsB)	20	30	0.050	-	-		-	-		-	-		-	-	
Dimethylarsinic Acid (DMA)	20	30	0.020	-	-		-	-		-	-		-	-	
Monomethylarsonic Acid (MMA)	20	30	0.020	-	-		-	-		-	-		-	-	
Plant Pigments (µg/L)															
chlorophyll-a		40	0.020	0.54	0.46	16	0.94	0.99	-5.2	0.94	0.94	0	0.64	0.68	-5.1

Notes:
RPD = Relative Percent Difference (%) = ((original - duplicate) / (original + duplicate)/2) x 100.
RPDs are only calculated when both samples are above detection.
The data quality objective (DQO) for field duplicates is an RPD of 1.5 x the laboratory RPD or 40% in the absence of a lab RPD.
Bolded RPDs RPD values exceeded but < 10 x MDL.
Shaded RPD RPD values exceeded and > 10 x MDL.
Italicized numbers are below detection limits.
"-" = No measurement

Table A-5. Field QA/QC summary for water quality for all CREMP study areas, 2021.

Month				August											
	Lab RPD Values (%)	Field RPD Values (%)	August MDLs	Mammoth Lake			Whale Tail South			Wally Lake			Baker Lake - Akilahaarjuk Point		
Analyte				MAM-64	AUG-DUP-1	RPD (%)	WTS-63	AUG-DUP-2	RPD (%)	WAL-116	AUG-DUP-3	RPD (%)	BAP-75	AUG-DUP-4	RPD (%)
Date Sampled				07-Aug-21	07-Aug-21		10-Aug-21	10-Aug-21		10-Aug-21	10-Aug-21		14-Aug-21	14-Aug-21	
ALS Sample ID				VA21B6886-006	VA21B6886-007		VA21B7111-003	VA21B7111-005		VA21B7253-004	VA21B7253-005		VA21B7537-005	VA21B7537-009	
Physical Tests															
Conductivity (µS/cm)	10	15	2.0	119	119	0	86	85	0.93	36	36	1.9	142	142	0
Alkalinity, Total	20	30	1.0	13	13	-1.6	14	14	2.9	11	11	-0.88	9.6	9.7	-1.0
Alkalinity, Bicarbonate	20	30	0.60	13	13	-1.6	14	14	2.9	11	11	-0.88	9.6	9.7	-1.0
Alkalinity, Carbonate	20	30	0.60	<1.0	<1.0		<1.0	<1.0		<1.0	<1.0		<1.0	<1.0	
Alkalinity, Hydroxide	20	30	0.10	<1.0	<1.0		<1.0	<1.0		<1.0	<1.0		<1.0	<1.0	
Hardness (mg/L), dissolved		40	10	41	41	-0.49	30	30	0	15	15	0.67	22	22	-0.46
Hardness (as $CaCO_3$), from total Ca/Mg		40	1.0	43	42	1.2	31	31	0.64	15	15	2.0	21	22	-1.9
pH (Laboratory)		40	0.10	7.3	7.3	0	7.3	7.3	0	7.3	7.3	0.41	7.1	7.1	0
Total Dissolved Solids (mg/L)		40	1.0	96	106	-9.6	76	75	1.3	25	25	2.4	83	69	19
Total Suspended Solids (mg/L)		40	1.0	<1.0	<1.0		<1.0	<1.0		<1.0	<1.0		<1.0	<1.0	
Turbidity (NTU)	15	23	1.0	0.49	0.46	6.3	0.46	0.54	-16	0.20	0.20	0	0.42	0.46	-9.1
Anions and Nutrients (mg/L)															
Total Kjeldahl Nitrogen	20	30	0.050	0.25	0.22	13	0.21	0.21	0.96	0.10	0.10	-2.0	0.18	0.14	23
Ammonia, Total (as N)	20	30	0.0050	0.052	0.020	90.1	0.030	0.0085	**112**	<0.0050	<0.0050		<0.0050	<0.0050	
Bromide (Br)	20	30	0.050	0.16	0.16	2.5	0.12	0.12	-5.8	<0.050	<0.050		0.10	0.10	3.0
Chloride (Cl)	20	30	0.50	17	17	0	11	11	0.90	0.55	0.55	0	32	32	0
Fluoride (F)	20	30	0.020	0.052	0.051	1.9	0.051	0.050	2.0	0.045	0.045	0	0.068	0.065	4.5
Nitrate (as N)	20	30	0.0050	0.38	0.39	-0.52	0.24	0.24	0	<0.0050	<0.0050		0.041	0.041	-1.2
Nitrite (as N)	20	30	0.0010	0.0060	0.0060	0	0.0017	0.0016	6.1	<0.0010	<0.0010		<0.0010	<0.0010	
Orthophosphate-Dissolved (as P)	20	30	0.0010	<0.0010	<0.0010		<0.0010	<0.0010		<0.0010	0.0010		<0.0010	<0.0010	
Phosphorus (P)-Total	20	30	0.0020	0.0054	0.0052	3.8	0.0038	0.0039	-2.6	<0.0020	<0.0020		0.0034	0.0043	-23
Phosphorus (P)-Total Dissolved	25	38	0.0020	0.0022	<0.0020		0.0030	0.0029	3.4	<0.0020	<0.0020		0.0021	<0.0020	
Reactive Silica (as SiO_2)	20	30	0.50	0.52	<0.50		0.58	0.61	-5.0	0.77	0.78	-1.3	<0.50	<0.50	
Sulfate (SO_4)	20	30	0.30	12	12	0	6.2	6.2	0	4.0	4.0	0.25	5.0	5.0	0.80
Cyanides (mg/L)															
Free Cyanide	20	30	0.0050	-	-		-	-		-	-		-	-	
Total Cyanide	20	30	0.0050	-	-		-	-		-	-		-	-	
Organic / Inorganic Carbon (mg/L)															
Dissolved Organic Carbon	20	30	0.50	2.2	2.3	-2.2	3.0	3.3	-11	2.2	2.2	0	3.1	3.0	3.6
Total Organic Carbon	20	30	0.50	2.3	2.2	5.3	2.7	2.8	-3.6	2.2	2.3	-2.7	3.6	3.6	-1.7
Total Metals (mg/L)															
Aluminum	20	30	0.0030	0.0078	0.0072	8.0	0.015	0.014	6.1	0.0081	0.0073	10	0.014	0.015	-7.0
Antimony	20	30	0.00010	0.00064	0.00064	0	0.00024	0.00023	4.3	<0.00010	<0.00010		<0.00010	<0.00010	
Arsenic	20	30	0.00010	0.0011	0.0012	-7.9	0.0011	0.0011	1.8	0.00032	0.00032	0	0.00012	0.00014	-15
Barium	20	30	0.00010	0.019	0.018	2.2	0.016	0.016	1.2	0.0019	0.0018	3.3	0.018	0.018	-2.8
Beryllium	20	30	0.00010	<0.000100	<0.000100		<0.000100	<0.000100		<0.000100	<0.000100		<0.000100	<0.000100	
Bismuth	20	30	0.000050	<0.000050	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050	
Boron	20	30	0.010	<0.010	<0.010		<0.010	<0.010		<0.010	<0.010		0.010	0.010	0
Cadmium	20	30	0.000005	<0.0000050	<0.0000050		<0.0000050	<0.0000050		<0.0000050	<0.0000050		<0.0000050	<0.0000050	
Calcium	20	30	0.050	13	12	0.80	8.9	8.8	0.90	4.1	3.9	2.8	3.4	3.5	-3.8
Cesium	20	30	0.000010	0.000013	0.000013	0	0.000017	0.000014	19	<0.000010	<0.000010		<0.000010	<0.000010	
Chromium	20	30	0.00050	<0.00050	<0.00050		<0.00050	<0.00050		<0.00050	<0.00050		<0.00050	<0.00050	
Cobalt	20	30	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Copper	20	30	0.00050	0.00051	<0.00050		0.00056	0.00057	-1.8	0.00098	0.0010	-5.0	<0.00050	<0.00050	
Iron	20	30	0.010	0.030	0.027	11	0.054	0.054	0	0.014	0.012	15	0.013	0.014	-7.4
Lead	20	30	0.000050	<0.000050	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050	
Lithium	20	30	0.0010	0.0019	0.0019	0	0.0017	0.0017	0	<0.0010	<0.0010		0.0011	0.0011	0
Magnesium	20	30	0.0050	2.8	2.7	1.8	2.2	2.2	0	1.2	1.2	0	3.1	3.1	-0.64
Manganese	20	30	0.00010	0.0054	0.0053	2.1	0.0084	0.0083	1.3	0.00089	0.00084	5.8	0.0014	0.0015	-7.1
Mercury	20	30	0.000005	<0.0000050	<0.0000050		<0.0000050	<0.0000050		<0.0000050	<0.0000050		<0.0000050	<0.0000050	
Molybdenum	20	30	0.000050	0.00045	0.00045	0.67	0.00041	0.00041	1.7	0.00014	0.00014	-4.3	0.000079	0.000079	0
Nickel	20	30	0.00050	0.0010	0.0011	-4.8	0.0019	0.0019	0.52	<0.00050	<0.00050		<0.00050	<0.00050	
Phosphorus	20	30	0.050	<0.050	<0.050		<0.050	<0.050		<0.050	<0.050		<0.050	<0.050	
Potassium	20	30	0.050	2.8	2.8	1.1	2.3	2.3	0.88	0.44	0.43	1.9	1.1	1.2	-1.7
Rubidium	20	30	0.00020	0.0034	0.0034	-0.59	0.0036	0.0037	-2.4	0.00058	0.00059	-1.7	0.0011	0.0011	-2.8
Selenium	20	30	0.000050	0.000074	0.000071	4.1	<0.000050	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050	
Silicon	20	30	0.10	0.35	0.34	2.9	0.36	0.36	0	0.41	0.43	-4.8	0.23	0.26	-12
Silver	20	30	0.000010	<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010	
Sodium	20	30	0.050	1.9	1.9	2.7	1.6	1.6	-1.3	0.53	0.53	1.1	18	18	-2.3
Strontium	20	30	0.00020	0.088	0.087	1.9	0.072	0.072	0.14	0.020	0.019	3.0	0.031	0.031	-0.97
Sulfur	20	30	0.50	4.1	4.2	-1.2	2.1	2.3	-7.6	1.5	1.3	9.4	1.9	1.7	6.7
Tellurium	20	30	0.00020	<0.00020	<0.00020		<0.00020	<0.00020		<0.00020	<0.00020		<0.00020	<0.00020	
Thallium	20	30	0.000010	<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010	
Thorium	20	30	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Tin	20	30	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Titanium	20	30	0.00060	<0.00030	<0.00030		0.00057	0.00034	**51**	<0.00030	<0.00030		<0.00030	<0.00030	
Tungsten	20	30	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Uranium	20	30	0.000010	0.000094	0.000098	-4.2	0.000066	0.000076	-14	0.000058	0.000059	-1.7	0.000045	0.000048	-6.5
Vanadium	20	30	0.00050	<0.00050	<0.00050		<0.00050	<0.00050		<0.00050	<0.00050		<0.00050	<0.00050	
Zinc	20	30	0.0030	<0.0030	<0.0030		<0.0030	<0.0030		<0.0030	<0.0030		<0.0030	<0.0030	
Zirconium	20	30	0.00020	<0.00020	<0.00020		<0.00020	<0.00020		<0.00020	<0.00020		<0.00020	<0.00020	
Dissolved Metals (mg/L)															
Aluminum	20	30	0.0010	0.0027	0.0021	25	0.0038	0.0035	8.2	0.0035	0.0033	5.9	0.0073	0.0078	-6.6
Antimony	20	30	0.00010	0.00060	0.00060	0	0.00022	0.00022	0	<0.00010	<0.00010		<0.00010	<0.00010	
Arsenic	20	30	0.00010	0.0010	0.0010	0.98	0.00098	0.00095	3.1	0.00026	0.00027	-3.8	0.00013	0.00013	0
Barium	20	30	0.00010	0.017	0.018	-4.6	0.015	0.015	-2.0	0.0019	0.0019	0.52	0.018	0.019	-4.9
Beryllium	20	30	0.00010	<0.000100	<0.000100		<0.000100	<0.000100		<0.000100	<0.000100		<0.000100	<0.000100	
Bismuth	20	30	0.000050	<0.000050	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050	
Boron	20	30	0.010	<0.010	<0.010		<0.010	<0.010		<0.010	<0.010		<0.010	0.010	
Cadmium	20	30	0.000005	<0.0000050	<0.0000050		<0.0000050	<0.0000050		<0.0000050	<0.0000050		<0.0000050	<0.0000050	
Calcium	20	30	0.050	12	12	0	8.5	8.5	0	4.1	4.1	-0.24	3.4	3.4	-1.5
Cesium	20	30	0.000010	0.000013	0.000012	8.0	0.000014	0.000014	0	<0.000010	<0.000010		<0.000010	<0.000010	
Chromium	20	30	0.00050	<0.00050	<0.00050		<0.00050	<0.00050		<0.00050	<0.00050		<0.00050	<0.00050	
Cobalt	20	30	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Copper	20	30	0.00020	0.00048	0.00049	-2.1	0.00052	0.00052	0	0.00099	0.00096	3.1	0.00031	0.00031	0
Iron	20	30	0.010	<0.010	<0.010		0.020	0.020	0	<0.010	<0.010		<0.010	<0.010	
Lead	20	30	0.000050	<0.000050	0.00087		<0.000050	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050	
Lithium	20	30	0.0010	0.0018	0.0018	0	0.0016	0.0016	0	<0.0010	<0.0010		<0.0010	0.0010	
Magnesium	20	30	0.0050	2.8	2.9	-1.7	2.2	2.2	0	1.2	1.2	0.87	3.2	3.2	0
Manganese	20	30	0.00010	0.0019	0.0018	5.4	0.00049	0.00050	-2.0	0.00027	0.00028	-3.6	0.00066	0.00069	-4.4
Mercury	20	30	0.000005	<0.0000050	<0.0000050		<0.0000050	<0.0000050		<0.0000050	<0.0000050		<0.0000050	<0.0000050	
Molybdenum	20	30	0.000050	0.00043	0.00040	8.5	0.00039	0.00039	1.5	0.00014	0.00015	-9.0	0.000067	0.000070	-4.4
Nickel	20	30	0.00050	0.00096	0.00099	-3.1	0.0018	0.0018	-3.3	<0.00050	<0.00050		<0.00050	<0.00050	
Phosphorus	20	30	0.050	<0.050	<0.050		<0.050	<0.050		<0.050	<0.050		<0.050	<0.050	
Potassium	20	30	0.050	2.8	2.8	-0.36	2.2	2.2	0.93	0.43	0.42	2.6	1.1	1.1	0
Rubidium	20	30	0.00020	0.0034	0.0035	-3.5	0.0035	0.0034	1.2	0.00056	0.00058	-3.5	0.0011	0.00099	9.6
Selenium	20	30	0.000050	<0.000050	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050	
Silicon	20	30	0.050	0.30	0.30	2.3	0.30	0.31	-0.66	0.37	0.37	0.54	0.19	0.20	-1.0
Silver	20	30	0.000010	<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010	
Sodium	20	30	0.050	1.9	1.9	4.2	1.6	1.6	1.3	0.54	0.53	1.1	18	18	-0.56
Strontium	20	30	0.00020	0.080	0.081	-1.2	0.066	0.065	1.4	0.021	0.020	2.5	0.031	0.031	-0.32
Sulfur	20	30	0.50	4.1	3.9	5.7	2.2	2.0	13	1.4	1.3	6.0	1.9	1.8	1.1
Tellurium	20	30	0.00020	<0.00020	<0.00020		<0.00020	<0.00020		<0.00020	<0.00020		<0.00020	<0.00020	
Thallium	20	30	0.000010	<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010	
Thorium	20	30	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Tin	20	30	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Titanium	20	30	0.00030	<0.00030	<0.00030		<0.00030	<0.00030		<0.00030	<0.00030		<0.00030	<0.00030	
Tungsten	20	30	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Uranium	20	30	0.000010	0.000095	0.000099	-4.1	0.000066	0.000065	1.5	0.000060	0.000055	8.7	0.000051	0.000049	4.0
Vanadium	20	30	0.00050	<0.00050	<0.00050		<0.00050	<0.00050		<0.00050	<0.00050		<0.00050	<0.00050	
Zinc	20	30	0.0010	0.0033	<0.0010		<0.0010	<0.0010		<0.0010	<0.0010		<0.0010	<0.0010	
Zirconium		40	0.00020	<0.00020	<0.00020		<0.00020	<0.00020		<0.00020	<0.00020		<0.00020	<0.00020	
Speciated Metals (µg/L)															
Arsenate (As V)	20	30	0.020	0.058	0.060	-3.4	0.037	-		-	-		-	-	
Arsenite (As III)	20	30	0.020	0.58	0.58	0.17	0.58	-		-	-		-	-	
Arsenobetaine (AsB)	20	30	0.050	<0.050	<0.050		<0.050	-		-	-		-	-	
Dimethylarsinic Acid (DMA)	20	30	0.020	0.10	0.10	2.0	0.18	-		-	-		-	-	
Monomethylarsonic Acid (MMA)	20	30	0.020	<0.020	<0.020		<0.020	-		-	-		-	-	
Plant Pigments (µg/L)															
chlorophyll-a		40	0.010	2.4	1.8	27	3.2	3.0	6.5	0.47	0.58	-21	3.1	3.1	0

Notes:

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

RPDs are only calculated when both samples are above detection.

The data quality objective (DQO) for field duplicates is an RPD of 1.5 x the laboratory RPD or 40% in the absence of a lab RPD.

Bolded RPDs RPD values exceeded but < 10 x MDL.

Shaded RPD RPD values exceeded and > 10 x MDL.

Itolicized numbers are below detection limits.

"-" = No measurement

Table A-5. Field QA/QC summary for water quality for all CREMP study areas, 2021.

Month								September							
	Lab RPD Values (%)	Field RPD Values (%)	Sep. MDLs	Inuggugayualik Lake			Third Portage Lake - North			Whale Tail South			DS1 Lake		
Analyte				INUG-137	SEP-DUP-1	RPD (%)	TPN-149	SEP-DUP-2	RPD (%)	WTS-65	SEP-DUP-3	RPD (%)	DS1-55	SEP-DUP-4	RPD (%)
Date Sampled				04-Sep-21	04-Sep-21		17-Sep-21	17-Sep-21		08-Sep-21	08-Sep-21		12-Sep-21	12-Sep-21	
ALS Sample ID				VA21B9414-006	VA21B9414-009		VA21C0949-002	VA21C0949-011		VA21C0214-003	VA21C0214-009		VA21C0214-013	VA21C0214-010	
Physical Tests															
Conductivity (µS/cm)	10	15	2.0	16	16	0	26	27	-6.0	81	80	0.99	21	21	0.47
Alkalinity, Total	20	30	1.0	5.0	4.8	4.1	6.9	6.3	9.1	13	13	-3.8	4.7	4.5	4.3
Alkalinity, Bicarbonate	20	30	1.0	5.0	4.8	4.1	6.9	6.3	9.1	13	13	-3.8	4.7	4.5	4.3
Alkalinity, Carbonate	20	30	1.0	<1.0	<1.0		<1.0	<1.0		<1.0	<1.0		<1.0	<1.0	
Alkalinity, Hydroxide	20	30	1.0	<1.0	<1.0		<1.0	<1.0		<1.0	<1.0		<1.0	<1.0	
Hardness (mg/L), dissolved		40	0.60	5.5	5.4	2.8	9.0	9.0	0.22	29	28	1.8	7.2	7.0	2.8
Hardness (as $CaCO_3$), from total Ca/Mg		40	0.60	5.6	5.8	-4.7	9.2	9.7	-5.0	27	29	-7.1	7.2	7.2	0.28
pH (Laboratory)		40	0.10	7.0	7.0	0	6.8	6.8	-0.15	7.3	7.3	0	6.9	6.9	0
Total Dissolved Solids (mg/L)		40	10	14	14	1.4	18	23	-23	51	50	1.4	15	16	-7.7
Total Suspended Solids (mg/L)		40	1.0	<1.0	<1.0		<1.0	<1.0		<1.0	<1.0		<1.0	<1.0	
Turbidity (NTU)	15	23	0.10	0.36	0.39	-8.0	0.16	0.22	**-32**	0.33	0.34	-3.0	0.29	0.31	-6.7
Anions and Nutrients (mg/L)															
Total Kjeldahl Nitrogen	20	30	0.050	0.11	0.10	10	0.084	0.086	-2.4	0.39	0.23	**51**	0.13	0.25	**-62**
Ammonia, Total (as N)	20	30	0.0050	<0.0050	<0.0050		<0.0050	<0.0050		0.018	0.013	**36**	0.0053	<0.0050	
Bromide (Br)	20	30	0.050	<0.050	<0.050		<0.050	<0.050		0.11	0.11	0	<0.050	<0.050	
Chloride (Cl)	20	30	0.10	0.76	0.75	1.3	0.77	0.77	0	10.2 10.2	10.3 10.3		1.9	2.4	-21
Fluoride (F)	20	30	0.020	0.062	0.062	0	0.062	0.064	-3.2	0.052	0.052	0	0.052	0.050	3.9
Nitrate (as N)	20	30	0.0050	<0.0050	<0.0050		<0.0050	<0.0050		0.19	0.19	-2.1	<0.0050	0.0069	
Nitrite (as N)	20	30	0.0010	<0.0010	<0.0010		<0.0010	<0.0010		0.0011	0.0011	0	<0.0010	<0.0010	
Orthophosphate-Dissolved (as P)	20	30	0.0010	<0.0010	<0.0010		<0.0010	<0.0010		0.0019	0.0012	**45**	0.0017	0.0012	**34**
Phosphorus (P)-Total	20	30	0.0020	0.0034	0.0039	-14	<0.0020	<0.0020		0.0096	0.0082	16	0.0030	0.0027	11
Phosphorus (P)-Total Dissolved	25	38	0.020	<0.0020	<0.0020		0.0021	0.0021	0	0.0035	0.0035	0	0.0022	<0.0020	
Reactive Silica (as SiO_2)	20	30	0.50	<0.50	<0.50		<0.50	<0.50		<0.50	<0.50		0.76	0.74	2.7
Sulfate (SO_4)	20	30	0.30	0.95	0.93	2.1	4.5	4.6	-0.44	6.0	6.0	0.50	1.6	2.0	-27
Cyanides (mg/L)															
Free Cyanide	20	30	0.0010	-	-		<0.0010	<0.0010		-	-		-	-	
Total Cyanide	20	30	0.0010	-	-		<0.0010	<0.0010		-	-		-	-	
Organic / Inorganic Carbon (mg/L)															
Dissolved Organic Carbon	20	30	0.50	2.2	1.9	12	1.2	1.6	-26	3.3	3.1	5.0	2.4	2.4	-0.42
Total Organic Carbon	20	30	0.50	2.4	2.2	6.1	1.2	1.0	18	3.7	3.3	12	2.3	2.4	-4.7
Total Metals (mg/L)															
Aluminum	20	30	0.0030	0.016	0.015	4.5	0.0075	0.0093	-21	0.0081	0.011	**-30**	0.020	0.020	3.0
Antimony	20	30	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		0.00022	0.00022	0	<0.00010	<0.00010	
Arsenic	20	30	0.00010	0.00011	0.00011	0	0.00021	0.00022	-4.7	0.0010	0.0011	-8.5	0.00013	0.00016	-21
Barium	20	30	0.00010	0.0017	0.0018	-4.5	0.0029	0.0032	-9.3	0.014	0.015	-6.8	0.0047	0.0046	2.4
Beryllium	20	30	0.00010	<0.000100	<0.000100		<0.000100	<0.000100		<0.000100	<0.000100		<0.000100	<0.000100	
Bismuth	20	30	0.000050	<0.000050	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050	
Boron	20	30	0.010	<0.010	<0.010		<0.010	<0.010		<0.010	<0.010		<0.010	<0.010	
Cadmium	20	30	0.000005	<0.0000050	<0.0000050		<0.0000050	<0.0000050		<0.0000050	<0.0000050		<0.0000050	<0.0000050	
Calcium	20	30	0.050	1.1	1.2	-3.5	2.2	2.3	-2.2	7.5	8.0	-5.7	1.9	1.9	1.1
Cesium	20	30	0.000010	<0.000010	<0.000010		<0.000010	<0.000010		0.000017	0.000013	27	<0.000010	<0.000010	
Chromium	20	30	0.00050	<0.00050	<0.00050		<0.00050	<0.00050		<0.00050	<0.00050		<0.00050	<0.00050	
Cobalt	20	30	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Copper	20	30	0.00050	<0.00050	<0.00050		<0.00050	<0.00050		0.00057	0.00059	-3.4	<0.00050	<0.00050	
Iron	20	30	0.010	0.017	0.016	6.1	<0.010	0.010		0.049	0.055	-12	0.032	0.032	0
Lead	20	30	0.000050	<0.000050	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050		0.000090	<0.000050	
Lithium	20	30	0.0010	<0.0010	<0.0010		<0.0010	<0.0010		0.0015	0.0016	-6.5	<0.0010	<0.0010	
Magnesium	20	30	0.0050	0.68	0.72	-5.9	0.88	0.97	-9.0	2.1	2.3	-10	0.60	0.60	-1.0
Manganese	20	30	0.00010	0.0013	0.0013	-3.9	0.0014	0.0014	-3.6	0.0093	0.011	-19	0.0014	0.0014	-0.71
Mercury	20	30	0.000005	<0.0000050	<0.0000050		<0.0000050	<0.0000050		<0.0000050	<0.0000050		<0.0000050	<0.0000050	
Molybdenum	20	30	0.000050	<0.000050	<0.000050		0.00011	0.00010	6.7	0.00040	0.00033	19	<0.000050	<0.000050	
Nickel	20	30	0.00050	<0.00050	<0.00050		<0.00050	<0.00050		0.0017	0.0019	-7.7	<0.00050	<0.00050	
Phosphorus	20	30	0.050	<0.050	<0.050		<0.050	<0.050		<0.050	<0.050		<0.050	<0.050	
Potassium	20	30	0.050	0.38	0.40	-4.4	0.49	0.55	-11	2.1	2.2	-8.4	0.44	0.46	-3.3
Rubidium	20	30	0.00020	0.00050	0.00062	-21	0.00081	0.00073	10	0.0033	0.0037	-10	0.00064	0.00060	6.5
Selenium	20	30	0.000050	<0.000050	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050	
Silicon	20	30	0.10	0.19	0.21	-10.0	0.10	0.11	-9.5	0.21	0.21	0	0.40	0.41	-2.5
Silver	20	30	0.000010	<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010	
Sodium	20	30	0.050	0.54	0.54	-0.37	1.0	1.1	-11	1.5	1.6	-8.9	0.79	0.79	-0.76
Strontium	20	30	0.00020	0.0069	0.0067	3.7	0.011	0.011	-2.7	0.063	0.068	-7.4	0.011	0.011	-1.8
Sulfur	20	30	0.50	<0.50	<0.50		1.5	1.5	-4.0	2.1	2.1	0.47	0.52	0.66	-24
Tellurium	20	30	0.00020	<0.00020	<0.00020		<0.00020	<0.00020		<0.00020	<0.00020		<0.00020	<0.00020	
Thallium	20	30	0.000010	<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010	
Thorium	20	30	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Tin	20	30	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Titanium	20	30	0.00060	<0.00030	<0.00060		<0.00030	<0.00030		<0.00030	<0.00030		<0.00030	<0.00030	
Tungsten	20	30	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Uranium	20	30	0.000010	0.000076	0.000079	-3.9	0.000043	0.000047	-8.9	0.000072	0.000076	-5.4	0.000054	0.000056	-3.6
Vanadium	20	30	0.00050	<0.00050	<0.00050		<0.00050	<0.00050		<0.00050	<0.00050		<0.00050	<0.00050	
Zinc	20	30	0.0030	<0.0030	<0.0030		<0.0030	<0.0030		<0.0030	<0.0030		<0.0030	<0.0030	
Zirconium	20	30	0.00020	<0.00020	<0.00020		<0.00020	<0.00020		<0.00020	<0.00020		<0.00020	<0.00020	
Dissolved Metals (mg/L)															
Aluminum	20	30	0.0010	0.0067	0.0062	7.8	0.0027	0.0025	7.7	0.0039	0.0038	2.6	0.0098	0.011	-12
Antimony	20	30	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		0.00019	0.00019	0	<0.00010	<0.00010	
Arsenic	20	30	0.00010	<0.00010	<0.00010		0.00016	0.00017	-6.1	0.00091	0.00091	0	<0.00010	0.00010	
Barium	20	30	0.00010	0.0018	0.0017	4.6	0.0026	0.0026	0	0.015	0.015	2.7	0.0048	0.0048	-0.21
Beryllium	20	30	0.00010	<0.000100	<0.000100		<0.000100	<0.000100		<0.000100	<0.000100		<0.000100	<0.000100	
Bismuth	20	30	0.000050	<0.000050	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050	
Boron	20	30	0.010	<0.010	<0.010		<0.010	<0.010		<0.010	<0.010		<0.010	<0.010	
Cadmium	20	30	0.000005	<0.0000050	<0.0000050		<0.0000050	<0.0000050		<0.0000050	<0.0000050		<0.0000050	<0.0000050	
Calcium	20	30	0.050	1.1	1.1	3.7	2.2	2.2	-1.4	7.9	7.8	1.4	1.9	1.8	3.7
Cesium	20	30	0.000010	<0.000010	<0.000010		<0.000010	<0.000010		0.000014	0.000013	7.4	<0.000010	<0.000010	
Chromium	20	30	0.00050	<0.00050	<0.00050		<0.00050	<0.00050		<0.00050	<0.00050		<0.00050	<0.00050	
Cobalt	20	30	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Copper	20	30	0.00020	0.00038	0.00038	0	0.00036	0.00034	5.7	0.00062	0.00062	0	0.00036	0.00039	-8.0
Iron	20	30	0.010	<0.010	<0.010		<0.010	<0.010		0.021	0.020	4.9	0.012	0.012	0
Lead	20	30	0.000050	<0.000050	<0.000050		<0.000050	0.000094		<0.000050	<0.000050		<0.000050	<0.000050	
Lithium	20	30	0.0010	<0.0010	<0.0010		<0.0010	<0.0010		0.0015	0.0015	0	<0.0010	<0.0010	
Magnesium	20	30	0.0050	0.67	0.66	2.0	0.87	0.85	2.6	2.2	2.2	1.8	0.58	0.57	1.2
Manganese	20	30	0.00010	0.00023	0.00019	19	0.00041	0.00035	16	0.0010	0.00087	17	0.00048	0.00055	-14
Mercury	20	30	0.000005	<0.0000050	<0.0000050		<0.0000050	<0.0000050		<0.0000050	<0.0000050		<0.0000050	<0.0000050	
Molybdenum	20	30	0.000050	<0.000050	<0.000050		0.000078	0.000073	6.6	0.00035	0.00031	12	<0.000050	<0.000050	
Nickel	20	30	0.00050	<0.00050	<0.00050		<0.00050	<0.00050		0.0017	0.0017	-3.6	<0.00050	<0.00050	
Phosphorus	20	30	0.050	<0.050	<0.050		<0.050	<0.050		<0.050	<0.050		<0.050	<0.050	
Potassium	20	30	0.050	0.40	0.37	6.5	0.49	0.48	1.0	2.2	2.2	1.4	0.43	0.44	-0.69
Rubidium	20	30	0.00020	0.00049	0.00050	-2.0	0.00072	0.00070	2.8	0.0037	0.0036	4.4	0.00063	0.00057	10
Selenium	20	30	0.000050	<0.000050	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050		<0.000050	<0.000050	
Silicon	20	30	0.050	0.17	0.17	-0.58	0.072	0.072	0	0.17	0.18	-3.4	0.37	0.38	-4.6
Silver	20	30	0.000010	<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010	
Sodium	20	30	0.050	0.54	0.52	2.3	0.96	0.94	2.8	1.5	1.5	0.67	0.75	0.75	0.27
Strontium	20	30	0.00020	0.0062	0.0061	0.65	0.0097	0.0096	1.0	0.062	0.060	4.1	0.010	0.010	-0.97
Sulfur	20	30	0.50	<0.50	<0.50		1.3	1.3	0.77	1.8	1.9	-0.54	<0.50	0.51	
Tellurium	20	30	0.00020	<0.00020	<0.00020		<0.00020	<0.00020		<0.00020	<0.00020		<0.00020	<0.00020	
Thallium	20	30	0.000010	<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010		<0.000010	<0.000010	
Thorium	20	30	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Tin	20	30	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Titanium	20	30	0.00030	<0.00030	<0.00030		<0.00030	<0.00030		<0.00030	<0.00030		<0.00030	<0.00030	
Tungsten	20	30	0.00010	<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010		<0.00010	<0.00010	
Uranium	20	30	0.000010	0.000068	0.000064	6.1	0.000034	0.000037	-8.5	0.000064	0.000060	6.5	0.000048	0.000050	-4.1
Vanadium	20	30	0.00050	<0.00050	<0.00050		<0.00050	<0.00050		<0.00050	<0.00050		<0.00050	<0.00050	
Zinc	20	30	0.0010	<0.0010	<0.0010		<0.0010	<0.0010		<0.0010	<0.0010		<0.0010	<0.0010	
Zirconium		40	0.00020	<0.00020	<0.00020		<0.00020	<0.00020		<0.00020	<0.00020		<0.00020	<0.00020	
Speciated Metals (µg/L)															
Arsenate (As V)	20	30	0.020	<0.020	<0.020		-	<0.020		0.030	-		<0.020	<0.020	
Arsenite (As III)	20	30	0.020	<0.020	0.021		-	0.071		0.47	-		<0.020	<0.020	
Arsenobetaine (AsB)	20	30	0.050	<0.050	<0.050		-	<0.050		<0.050	-		<0.050	<0.050	
Dimethylarsinic Acid (DMA)	20	30	0.020	<0.020	<0.020		-	<0.020		0.18	-		<0.020	<0.020	
Monomethylarsonic Acid (MMA)	20	30	0.020	<0.020	<0.020		-	<0.020		<0.020	-		<0.020	<0.020	
Plant Pigments (µg/L)															
chlorophyll-a		40	0.020	0.83	0.78	5.2	0.44	0.48	-9.3	2.2	2.5	-12	1.2	1.2	-1.6

Notes:
RPD = Relative Percent Difference (%) = ((original - duplicate) / (original + duplicate)/2) x 100.
RPDs are only calculated when both samples are above detection.
The data quality objective (DQO) for field duplicates is an RPD of 1.5 x the laboratory RPD or 40% in the absence of a lab RPD.
Bolded RPDs RPD values exceeded but < 10 x MDL.
Shaded RPD RPD values exceeded and > 10 x MDL.
Italicized numbers are below detection limits.
"-" = No measurement

Table A-6. Water chemistry field duplicate RPDs greater than QA/QC DQOs in 2021.

Parameter	March	May	July	August	September
Turbidity					I
Total Kjeldahl Nitrogen					II
Ammonia, Total (as N)	I	I		II	I
Nitrite (as N)	I	I			
Orthophosphate-Dissolved (as P)					II
Phosphorus (P)-Total		I			
DOC		I			
TOC	I	I			
Total metals					
Aluminum			II		I
Iron			I		
Manganese			I		
Silicon			I		
Titanium				I	
Dissolved metals					
Aluminum	I				
Lead	I				
Selenium		I			
Speciated metals					
Arsenite (As III)	I				

Notes

I — Tally indicates number of DQO exceedances

(shaded) — Shading indicates that the DQO was exceeded and the concentrations were >10X MDL.

Shaded cells: Ammonia, Total (as N) – May and August; TOC – May; Manganese – July.

Table A-7. Swipe chemistry data for sediment grab analyses, 2021.

		Equipment Swipes [1]
		SWIPE-1
	Swipe DLs (µg)	FILTER
		06-Aug
Analyte	**ALS Sample ID**	VA21B6915-048
Total Metals (µg)		
Aluminum	20	*<20*
Antimony	20	*<20*
Arsenic	20	*<20*
Barium	1	*<1.0*
Beryllium	0.5	*<0.50*
Bismuth	20	*<20*
Cadmium	1	*<1.0*
Calcium	200	*<200*
Chromium	2	**9.1**
Cobalt	1	*<1.0*
Copper	1	*<1.0*
Lead	0.4	*<0.40*
Lithium	1	*<1.0*
Manganese	0.5	**0.87**
Mercury	0.01	*<0.010*
Molybdenum	3	*<3.0*
Nickel	5	*<5.0*
Potassium	200	*<200*
Selenium	20	*<20*
Silver	1	*<1.0*
Strontium	0.5	**0.75**
Thallium	20	*<20*
Tin	3	*<3.0*
Titanium	1	*<1.0*
Vanadium	3	*<3.0*
Zinc	0.5	34

Notes

[1] Swipe-QA is a blank swipe. In 2021, the blank swipe along with the other equipment swipes were not analyzed due to a laboratory error.

Bold Filter Swipes	**concentration exceeds laboratory DLs, but < 10x DL.**
Shaded Filter Swipes	concentration is > 10x DL.

Table A-8. Field duplicate results for the sediment grabs collected in 2021.

Analyte	DLs	Lab RPD Values (%)	Field RPD Values (%)[1]	DUP-01			DUP-03			DUP-05			DUP-06		
				WTS-1	Field Dup[2]	RPD (%)	A76-1	Field Dup[2]	RPD (%)	SP-4	Field Dup[2]	RPD (%)	TPE-1	Field Dup[2]	RPD (%)
Date Sampled				5-Aug-21	6-Aug-21		7-Aug-21	6-Aug-21		6-Aug-21	6-Aug-21		8-Aug-21	6-Aug-21	
ALS Sample ID				VA21B6915-031	VA21B6915-046		VA21B6915-037	VA21B6915-047		VA21B6915-004	VA21B6915-043		VA21B6915-019	VA21B6915-044	
Physical Tests															
Moisture (%)	0.25	20	30	81	81	0	92	92	0	86	86	0	86	86	0
pH	0.10	5	8	6	6	-3	6	6	0	6	6	2	6	6	1
Particle Size (%)															
Clay (<0.004mm)	1.00	-	40	15	17	-11	21	22	-2	26	27	-3	31	29	7
Silt (0.063mm - 0.004mm)	1.00	-	40	67	67	0	78	77	1	71	71	0	68	68	1
Sand (2.0mm - 0.063mm)	1.00	-	40	18	16	13	*<1.0*	2		2	2	23	*<1.0*	3	
Gravel (>2mm)	1.00	-	40	*<1.0*	*<1.0*		*<1.0*	*<1.0*		*<1.0*	*<1.0*		*<1.0*	*<1.0*	
Organic Carbon (% dw)															
Total Organic Carbon	0.10	20	30	4	4	5	9	9	0	4	4	2	3	3	0
Total Metals (mg/kg dw)															
Aluminum	50	40	60	19900	19900	0	25500	25300	1	28900	31100	-7	24500	27800	-13
Antimony	0.10	30	45	0	0	17	0	0	2	0	0	-7	0	0	-30
Arsenic	0.100	30	45	49	43	13	68	68	-1	27	29	-6	19	20	-6
Barium	0.50	40	60	99	92	7	242	240	1	130	136	-5	109	113	-4
Beryllium	0.10	30	45	2	1	8	2	2	0	2	2	-2	2	2	-11
Bismuth	0.20	30	45	1	1	8	1	1	3	3	3	-5	2	2	-7
Boron	5.0	30	45	8	7	7	16	16	0	11	12	-5	8	9	-14
Cadmium	0.020	30	45	0	0	4	0	0	-1	0	0	-1	0	0	-5
Calcium	50	30	45	2740	2550	7	4090	4280	-5	2520	2670	-6	2130	2260	-6
Chromium	0.50	30	45	85	79	7	124	127	-2	89	92	-3	142	149	-5
Cobalt	0.10	30	45	19	18	9	10	10	1	16	16	-4	15	15	-3
Copper	0.50	30	45	45	41	11	91	90	1	79	79	-1	46	48	-5
Iron	50	30	45	47500	42700	11	45500	46200	-2	60600	60400	0	42000	43100	-3
Lead	0.50	40	60	15	13	9	22	21	2	24	25	-3	20	22	-9
Lithium	2.0	30	45	18	16	10	19	19	-1	49	50	-2	42	47	-11
Magnesium	20	30	45	7670	7140	7	8910	9060	-2	10500	10800	-3	10900	11500	-5
Manganese	1.0	30	45	1620	1470	10	310	307	1	1830	2120	-15	1730	1800	-4
Mercury	0.0050	40	60	0	0	0	0	0	-4	0	0	-12	0	0	-6
Molybdenum	0.10	40	60	4	3	7	6	6	3	7	7	-5	4	4	-18
Nickel	0.50	30	45	69	63	9	100	99	1	68	70	-3	73	76	-5
Phosphorus	50	30	45	976	828	16	852	819	4	601	576	4	418	427	-2
Potassium	100	40	60	2480	2310	7	3460	3510	-1	4560	4950	-8	3830	4280	-11
Selenium	0.20	30	45	1	1	12	1	1	4	1	1	-23	1	1	2
Silver	0.10	40	60	0	0	12	1	1	5	0	0	-7	*<0.10*	0	
Sodium	50	40	60	134	129	4	205	221	-8	191	201	-5	162	178	-9
Strontium	0.50	40	60	36	35	2	35	36	-4	26	28	-8	18	21	-12
Sulfur	1000	30	45	1600	1400	13	3000	2700	11	1800	1600	12	1900	1900	0
Thallium	0.050	30	45	0	0	9	0	0	4	0	0	-4	0	0	-9
Tin	2.0	40	60	*<2.0*	*<2.0*		*<2.0*	*<2.0*		*<2.0*	*<2.0*		*<2.0*	*<2.0*	
Titanium	1.0	40	60	516	480	7	481	482	0	777	810	-4	616	776	-23
Tungsten	0.50	30	45	*<0.50*	*<0.50*		1	1	12	1	1	7	*<0.50*	1	
Uranium	0.050	30	45	13	12	8	16	15	3	26	27	-5	14	15	-5
Vanadium	0.20	30	45	29	27	9	41	41	1	41	42	-3	35	40	-14
Zinc	2.0	30	45	94	86	9	120	119	1	124	129	-4	97	103	-7
Zirconium	1.0	30	45	1	1	0	4	4	6	2	2	0	3	3	3
Speciated Metals (mg/kg dw)															
Methyl Mercury (as MeHg)	0.1			-	1		-	0		-	-		-	-	

Notes:

[1] The DQO for field duplicates is an RPD 1.5x the laboratory RPD or 40% in the absence of a lab RPD.

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

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

RPDs are only calculated when both samples are above detection.

Bold RPDs **RPD values exceeded but < 10 x MDL.**

Shaded RPDs RPD values exceeded and > 10 x MDL.

Italicized numbers are below detection limits.

Table A-9. QA/QC results for sediment grab sample hydrocarbon and PAH analyses, 2021.

Analyte	Detection Limits	Lab DQO Values	Field DQO Values[1]	COMP-DUP-01 TPE-COMP	Dup[2]	RPD (%)
Date Sampled				08-Aug-21	06-Aug-21	
ALS Sample ID				VA21B6915-024	VA21B6915-045	
Physical Parameters						
Moisture (%)	*0.25*	20	30	84.2	84.2	0.0
Aggregate Organics (mg/kg)						
Mineral Oil and Grease	*500*	<1000	1500	*<500*	950	-
Hydrocarbons (mg/kg)						
EPH10-19	*200*	<400	600	*<300*	*<280*	-
EPH19-32	*200*	<400	600	*<300*	*<280*	-
LEPH	*200*	<400	600	*<300*	*<280*	-
HEPH	*200*	<400	600	*<300*	*<280*	-
Hydrocarbons Surrogates (%)						
2-Bromobenzotrifluoride	*5*	60-140	15	86.8	95.7	-9.8
Polycyclic Aromatic Hydrocarbons (mg/kg)						
acenaphthene	*0.005*	<0.01	0.015	*<0.0148*	*<0.0139*	-
acenaphthylene	*0.005*	<0.01	0.015	*<0.0148*	*<0.0139*	-
acridine	*0.01*	<0.02	0.03	*<0.015*	*<0.014*	-
anthracene	*0.004*	<0.008	0.012	*<0.0148*	*<0.0139*	-
benz(a)anthracene	*0.01*	<0.02	0.03	*<0.015*	*<0.014*	-
benzo(a)pyrene	*0.01*	<0.02	0.03	*<0.015*	*<0.014*	-
benzo(b+j)fluoranthene	*0.01*	<0.02	0.03	*<0.015*	*<0.014*	-
benzo(b+j+k)fluoranthene	*0.015*	<0.03	0.045	*<0.021*	*<0.020*	-
benzo(g,h,i)perylene	*0.01*	<0.02	0.03	*<0.015*	*<0.014*	-
benzo(k)fluoranthene	*0.01*	<0.02	0.03	*<0.015*	*<0.014*	-
chrysene	*0.01*	<0.02	0.03	*<0.015*	*<0.014*	-
dibenz(a,h)anthracene	*0.005*	<0.01	0.015	*<0.0148*	*<0.0139*	-
fluoranthene	*0.01*	<0.02	0.03	*<0.015*	*<0.014*	-
fluorene	*0.01*	<0.02	0.03	*<0.015*	*<0.014*	-
indeno(1,2,3-c,d)pyrene	*0.01*	<0.02	0.03	*<0.015*	*<0.014*	-
methylnaphthalene, 1-	*0.05*	<0.1	0.15	*<0.015*	*<0.014*	-
methylnaphthalene, 2-	*0.01*	<0.02	0.03	*<0.015*	*<0.014*	-
naphthalene	*0.01*	<0.02	0.03	*<0.015*	*<0.014*	-
phenanthrene	*0.01*	<0.02	0.03	*<0.015*	*<0.014*	-
pyrene	*0.01*	<0.02	0.03	*<0.015*	*<0.014*	-
quinoline	*0.05*	<0.1	0.15	*<0.015*	*<0.014*	-
B(a)P total potency equivalents [B(a)P TPE]	*0.02*	<0.04	0.06	*<0.020*	*<0.020*	-
PAH Surrogates (%)						
acridine-d9	*0.01*	35	52.5	95.8	77.8	20.7
chrysene-d12	*0.01*	35	52.5	104	117	-11.8
naphthalene-d8	*0.01*	40	60	100	112	-11.3
phenanthrene-d10	*0.01*	35	52.5	97.1	113	-15.1

Notes:

[1] The DQO for field duplicates is an RPD 1.5x the laboratory DQO or 1.5x twice the DL when lab DQOs are "<" values.

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

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

RPDs are only calculated when both samples are above detection.

Bold RPDs	**RPD values exceeded but < 10 x MDL.**
Shaded RPDs	RPD values exceeded and > 10 x MDL.

Italicized numbers are below detection limits.

Table A-10. Sediment samples collected from Meadowbank, Whale Tail Pit and Baker Lake study areas that were discarded by the laboratory prior to analysis, 2021.

Sampling Area	Control or Impact	Lake or Basin	Sample IDs	Sample Type
Meadowbank	Impact	Wally Lake	WAL-1	Grabs
			WAL-2	
			WAL-3	
			WAL-4	
			WAL-5	
			WAL-Comp	Composite
	Control	Inuggugayualik Lake	INUG-1	Grabs
			INUG-2	
			INUG-3	
			INUG-4	
			INUG-5	
			INUG-Comp	Composite
		Pipedream Lake	PDL-1	Grabs
			PDL-2	
			PDL-3	
			PDL-4	
			PDL-5	
			PDL-Comp	Composite
Whale Tail Pit	Impact	Mammoth Lake	MAM-1	Grabs
			MAM-2	
			MAM-3	
			MAM-4	
			MAM-5	
			MAM-Comp	Composite
		Lake A20	A20-1	Grabs
			A20-2	
			A20-3	
			A20-4	
			A20-5	
			A20-Comp	Composite
		Lake DS1	DS1-1	Grabs
			DS1-2	
			DS1-3	
			DS1-4	
			DS1-5	
			DS1-Comp	Composite
Baker Lake	Control	Baker Lake - Akilahaarjuk Point (BAP)	BAP-1	Grabs
			BAP-2	
			BAP-3	
			BAP-4	
			BAP-5	
			BAP-Comp	Composite
		Baker Lake – east shore	BES-1	Grabs
			BES-2	
			BES-3	
			BES-4	
			BES-5	
			BES-Comp	Composite
	Impact	Baker Lake – proposed jetty	BPJ-1	Grabs
			BPJ-2	
			BPJ-3	
			BPJ-4	
			BPJ-5	
			BPJ-Comp	Composite
		Baker Lake – barge dock	BBD-1	Grabs
			BBD-2	
			BBD-3	
			BBD-4	
			BBD-5	
			BBD-Comp	Composite
QA/QC Samples			Dup-2	Grabs
			Dup-4	
			Dup-7	
			Dup-8	
			Dup-9	
			Comp-Dup-1	Composite
			Swipe-2	Swipe
			Swipe-3	

Table A-11. Field QA/QC data for phytoplankton for all CREMP study areas, 2021.

Area-Replicate	Date	Phytoplankton Biomass (mg/m^3)								Taxa Richness
		Cyanophyte	Chlorophyte	Euglenophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	**TOTAL**	
March										
PDL-93	20-Mar-21	0.42	0.83	0	17	1.7	7.5	8.4	36	18
DUP - 1	1-Mar-21	0.27	0.87	0	17	1.6	8.5	9.6	38	21
RPD (%)		45	-5.7		1.3	7.1	-13	-14	-5.0	-15
TPN-141	29-Mar-21	0.50	2.4	0	19	2.8	11	0	35	19
DUP - 2	1-Mar-21	0.17	1.6	0	20	3.7	6.2	1.8	34	22
RPD (%)		**98**	41		-6.8	-28	**53**	**NA**	4.3	-15
A20-52	24-Mar-21	0	0.087	0	15	0.78	54	8.8	79	16
DUP - 3	1-Mar-21	0	0	0	14	1.4	60	12	88	18
RPD (%)			**NA**		5.1	**-55**	-11	-32	-11	-12
NEM-57	24-Mar-21	0	0.60	0	25	2.3	42	86	156	24
DUP - 4	1-Mar-21	0	0.34	0	13	1.2	50	76	140	17
RPD (%)			**55**		**62**	**64**	-16	13	11	34
May										
PDL-96	9-May-21	0.081	0.91	0	11	0.31	5.0	69	86	14
DUP - 1	1-May-21	0.20	1.1	0	6.2	0.62	3.5	8.2	20	15
RPD (%)		**-83**	-16		**54**	**-67**	37	**158**	**125**	-6.9
WAL-112	9-May-21	0.20	0.88	0	4.6	0.36	6.1	2.7	15	14
DUP - 2	1-May-21	0	1.5	0	4.7	0.90	7.5	0.61	15	13
RPD (%)		**NA**	-49		-0.89	**-86**	-21	**127**	-2.0	7.4
NEM-59	6-May-21	0	3.2	0	5.4	1.2	3.5	33	46	16
DUP - 3	1-May-21	0	2.3	0	4.7	0.65	4.6	36	48	15
RPD (%)			31		15	**57**	-27	-9.6	-4.9	6.5
MAM-60	12-May-21	0	0.51	0	13	2.8	9.8	7.0	33	18
DUP - 4	12-May-21	0	0.095	0	10	1.0	15	7.3	34	13
RPD (%)			**137**		27	**93**	-45	-3.7	-1.6	32
July										
TPN-144	29-Jul-21	0.72	2.8	0	99	4.0	3.4	6.6	117	25
DUP - 1	29-Jul-21	0.43	2.8	0	89	6.7	6.7	24	129	23
RPD (%)		**51**	1.9		11	**-50**	**-64**	**-113**	-10	8.3
BAP-73	30-Jul-21	0.14	1.6	0	81	28	34	12	157	32
DUP - 2	1-Jul-21	0	4.4	0.87	101	31	19	5.8	162	32
RPD (%)		**NA**	**-95**		-21	-12	**57**	**67**	-3.5	0
MAM-62	9-Jul-21	0	0	0	450	31	35	32	548	19
DUP - 3	1-Jul-21	0	2.6	0	472	26	32	31	563	23
RPD (%)			**NA**		-4.6	17	9.4	5.7	-2.6	-19
A76-53	17-Jul-21	0	0.060	0	156	34	38	16	245	20
DUP - 4	1-Jul-21	0	0.96	0	165	21	42	12	242	20
RPD (%)			**-176**		-5.7	46	-9.5	29	1.2	0
August										
MAM-64	7-Aug-21	0	4.8	0	454	144	67	5.8	674	29
DUP - 1	1-Aug-21	0	3.0	0	400	135	61	3.4	603	31
RPD (%)			48		13	5.8	9.0	**53**	11	-6.7
WTS-63	10-Aug-21	0.10	12	0	279	47	108	10	457	37
DUP - 2	1-Aug-21	0.043	12	0	387	91	129	12	630	36
RPD (%)		**80**	6.2		-32	**-63**	-18	-14	-32	2.7
WAL-116	10-Aug-21	2.5	7.0	0	171	30	17	2.2	230	33
DUP - 3	1-Aug-21	1.3	14	0	164	23	11	17	230	38
RPD (%)		**65**	**-67**		4.3	28	43	**-155**	-0.11	-14
BAP-75	14-Aug-21	0	6.9	0	95	16	31	22	170	29
DUP - 4	1-Aug-21	0	0.54	0	103	5.7	18	13	141	28
RPD (%)			**171**		-8.5	**92**	**51**	**50**	19	3.5
September										
INUG-137	4-Sep-21	3.2	3.4	0	106	20	13	18	163	35
DUP - 1	4-Sep-21	3.2	9.8	0	109	13	3.4	12	151	36
RPD (%)		1.5	**-96**		-3.4	45	**118**	34	7.9	-2.8
TPN-149	17-Sep-21	3.9	14	0	126	28	11	17	201	36
DUP - 2	17-Sep-21	2.7	13	0	94	32	8.5	7.8	157	34
RPD (%)		37	8.9		29	-13	30	76	24	5.7
WTS-65	8-Sep-21	0	8.6	0	127	134	71	36	376	36
DUP - 3	8-Sep-21	0	12	0	131	120	62	2.9	328	33
RPD (%)			-36		-3.4	11	14	**170**	14	8.7
DS1-55	12-Sep-21	0.068	4.9	0	110	19	15	50	199	41
DUP - 4	12-Sep-21	0.068	2.8	0	119	12	18	33	185	36
RPD (%)		0	**55**		-7.7	45	-16	41	7.6	13

Notes:

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

Bolded RPD values exceed 50%.

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

Table A-11. Field QA/QC data for phytoplankton for all CREMP study areas, 2021.

Area-Replicate	Date	Phytoplankton Density (cells/L)							
		Cyanophyte	Chlorophyte	Euglenophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	**TOTAL**
March									
PDL-93	20-Mar-21	1,900	145,490	0	336,880	15,184	53,892	1,800	555,146
DUP - 1	1-Mar-21	1,200	173,859	0	351,164	8,492	64,330	2,100	601,145
RPD (%)		45	-18		-4.2	**57**	-18	-15	-8.0
TPN-141	29-Mar-21	2,200	170,713	0	461,093	103,737	69,176	0	806,919
DUP - 2	1-Mar-21	1,000	127,760	0	340,426	72,222	23,377	300	565,084
RPD (%)		**75**	29		30	36	**99**	**NA**	35
A20-52	24-Mar-21	0	3,546	0	291,080	3,846	303,334	1,100	602,907
DUP - 3	1-Mar-21	0	0	0	276,696	8,192	280,119	1,100	566,107
RPD (%)			**NA**		5.1	**-72**	8.0	0	6.3
NEM-57	24-Mar-21	0	18,031	0	323,095	26,223	322,549	16,446	706,343
DUP - 4	1-Mar-21	0	3,646	0	245,781	4,246	375,641	11,900	641,214
RPD (%)			**133**		27	**144**	-15	32	9.7
May									
PDL-96	9-May-21	500	46,699	0	166,667	1,600	33,315	11,400	260,181
DUP - 1	1-May-21	1,200	74,568	0	152,482	7,792	35,561	1,300	272,904
RPD (%)		**-82**	-46		8.9	**-132**	-6.5	**159**	-4.8
WAL-112	9-May-21	3,546	39,707	0	95,745	4,646	53,992	400	198,036
DUP - 2	1-May-21	0	15,284	0	81,660	4,946	44,653	100	146,644
RPD (%)		**NA**	**89**		16	-6.3	19	**120**	30
NEM-59	6-May-21	0	138,398	0	109,929	39,807	18,231	3,700	310,065
DUP - 3	1-May-21	0	102,837	0	74,568	29,269	28,569	4,100	239,343
RPD (%)			29		38	31	-44	-10	26
MAM-60	12-May-21	0	88,653	0	205,774	40,561	38,461	1,100	374,548
DUP - 4	12-May-21	0	3,546	0	195,036	27,023	57,792	900	284,296
RPD (%)			**185**		5.4	40	-40	20	27
July									
TPN-144	29-Jul-21	3,200	65,256	0	1,383,328	134,912	8,784	1,800	1,597,280
DUP - 1	29-Jul-21	1,800	29,336	0	1,024,528	186,400	37,920	2,600	1,282,584
RPD (%)		**56**	**76**		30	-32	**-125**	-36	22
BAP-73	30-Jul-21	600	86,208	0	1,374,344	222,136	190,584	1,400	1,875,272
DUP - 2	1-Jul-21	0	179,600	200	1,669,088	226,520	89,608	800	2,165,816
RPD (%)		**NA**	**-70**		-19	-2.0	**72**	**55**	-14
MAM-62	9-Jul-21	0	0	0	3,114,968	672,760	121,960	4,400	3,914,088
DUP - 3	1-Jul-21	0	7,784	0	3,347,056	566,800	154,480	3,200	4,079,320
RPD (%)			**NA**		-7.2	17	-24	32	-4.1
A76-53	17-Jul-21	0	14,368	0	1,822,984	357,712	108,592	2,400	2,306,056
DUP - 4	1-Jul-21	0	64,856	0	2,072,624	335,912	116,576	1,400	2,591,368
RPD (%)			**-127**		-13	6.3	-7.1	**53**	-12
August									
MAM-64	7-Aug-21	0	395,120	0	2,527,112	3,692,736	67,520	1,400	6,683,888
DUP - 1	1-Aug-21	0	187,184	0	1,681,600	3,426,312	64,520	800	5,360,416
RPD (%)			**71**		40	7.5	4.5	**55**	22
WTS-63	10-Aug-21	200	891,016	0	3,923,464	302,336	257,736	1,600	5,376,352
DUP - 2	1-Aug-21	200	1,099,552	0	4,785,744	375,272	302,856	2,000	6,565,624
RPD (%)		0	-21		-20	-22	-16	-22	-20
WAL-116	10-Aug-21	29,136	418,472	0	1,564,928	82,840	127,328	400	2,223,104
DUP - 3	1-Aug-21	7,184	420,072	0	1,346,808	31,952	115,744	1,800	1,923,560
RPD (%)		**121**	-0.38		15	**89**	9.5	**-127**	14
BAP-75	14-Aug-21	0	129,912	0	1,193,344	133,160	185,800	17,168	1,659,384
DUP - 4	1-Aug-21	0	21,552	0	1,057,048	53,104	113,160	1,600	1,246,464
RPD (%)			**143**		12	**86**	49	**166**	28
September									
INUG-137	4-Sep-21	119,744	109,360	0	1,068,032	311,128	109,560	9,584	1,727,408
DUP - 1	4-Sep-21	21,568	548,584	0	1,628,984	198,368	8,784	1,800	2,408,088
RPD (%)		**139**	**-134**		-42	44	**170**	**137**	-33
TPN-149	17-Sep-21	16,000	419,672	0	1,584,680	915,184	47,504	2,000	2,985,040
DUP - 2	17-Sep-21	11,000	346,432	0	1,018,544	841,744	32,136	1,200	2,251,056
RPD (%)		37	19		43	8.4	39	50	28
WTS-65	8-Sep-21	0	474,744	0	1,811,568	2,057,520	279,224	1,400	4,624,456
DUP - 3	8-Sep-21	0	733,168	0	1,969,016	2,085,440	269,640	400	5,057,664
RPD (%)			-43		-8.3	-1.3	3.5	**111**	-8.9
DS1-55	12-Sep-21	400	123,528	0	1,499,272	160,264	28,952	7,200	1,819,616
DUP - 4	12-Sep-21	400	181,400	0	1,483,504	185,800	63,672	5,600	1,920,376
RPD (%)		0	-38		1.1	-15	**-75**	25	-5.4

Notes:

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

Bolded RPD values exceed 50%.

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

Table A-12. Laboratory QA/QC data for phytoplankton for all CREMP study areas, 2021.

Area-Replicate	Date	Phytoplankton Biomass (mg/m^3)								Taxa Richness	Simpson's Diversity	Phytoplankton Density (cells/L)							
		Cyanophyte	Chlorophyte	Euglenophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	TOTAL			Cyanophyte	Chlorophyte	Euglenophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	TOTAL
INUG - 128S	10-Mar-21	0	0.53	0	19	0.47	10	2.2	32	17	0.77	0	35,861	0	322,695	7,492	58,938	400	425,386
INUG - 128SR	10-Mar-21	0	0.18	0	21	1.1	8.7	4.6	36	18	0.71	0	200	0	319,149	14,884	57,738	500	392,471
RPD (%)			**98**		-9.8	**-80**	15	**-72**	-9.5	-5.7	7.5		**198**		1.1	**-66**	2.1	-22	8.0
SP - 140S	18-Mar-21	0	0.81	0	12	1.6	9.2	0.97	24	14	0.72	0	21,777	0	404,255	29,769	51,245	200	507,246
SP - 140SR	18-Mar-21	0	0.73	0	12	2.5	7.3	0.61	23	16	0.71	0	18,131	0	411,348	43,853	40,407	100	513,838
RPD (%)			9.5		-6.6	-45	23	46	2.8	-13	1.8		18		-1.7	-38	24	**67**	-1.3
NEM - 58	24-Mar-21	0	2.4	0	11	0.87	62	95	171	17	0.59	0	10,938	0	237,589	39,507	476,877	14,300	779,212
NEM - 58R	24-Mar-21	0	0.81	0	15	0.43	64	83	163	18	0.56	0	3,646	0	237,589	25,023	501,100	12,800	780,158
RPD (%)			**100**		-27	**68**	-3.8	13	4.8	-5.7	6.5		**100**		0.00000	45	-5.0	11	-0.12
NEM - 60	6-May-21	0	0.53	0	10	2.4	15	16	44	13	0.79	0	67,376	0	131,306	43,553	89,353	2,100	333,687
NEM - 60R	6-May-21	0	1.1	0	12	2.5	11	19	45	14	0.83	0	120,567	0	148,936	57,938	67,776	2,100	397,317
RPD (%)			**-72**		-13	-2.0	29	-19	-3.7	-7.4	-4.7		**-57**		-13	-28	27	0	-17
LK5 - 27	8-May-21	0	1.7	0	9.4	3.5	42	0	56	16	0.79	0	276,596	0	287,234	78,714	273,450	0	915,994
LK5 - 27R	8-May-21	0	1.3	0	9.6	3.4	45	0	59	16	0.79	0	226,950	0	280,142	64,430	294,926	0	866,448
RPD (%)			22		-1.9	1.7	-8.3		-5.8	0	-0.06100		20		2.5	20	-7.6		5.6
PDL - 95S	9-May-21	0.074	0.40	0	12	0.81	2.9	15	31	14	0.80	500	60,384	0	166,667	22,577	15,084	2,500	267,711
PDL - 95SR	9-May-21	0.059	0.35	0	8.1	0.89	4.0	19	32	13	0.79	400	49,845	0	127,660	18,831	22,477	3,100	222,312
RPD (%)		22	15		38	-8.9	-34	-21	-3.2	7.4	0.91	22	19		27	18	-39	-21	19
TPS - 66S	10-May-21	0	0.38	0	7.0	0.10	4.1	9.4	21	13	0.76	0	49,745	0	113,475	3,746	35,961	1,000	203,928
TPS - 66SR	10-May-21	0.016	0.14	0	4.9	0.51	5.9	5.9	17	12	0.78	100	28,369	0	102,837	14,584	50,445	700	197,036
RPD (%)		**NA**	**95**		36	**-133**	-36	45	19	8.0	-2.2	**NA**	**55**		9.8	**-118**	-34	35	3.4
NEM - 61	10-Jul-21	0	1.7	0	77	55	4.0	9.1	147	22	0.81	0	29,536	0	1,489,704	1,133,352	22,752	800	2,676,144
NEM - 61R	10-Jul-21	0	1.0	0	84	55	3.9	13	157	23	0.80	0	7,984	0	1,360,392	1,211,760	29,536	1,000	2,610,672
RPD (%)			**50**		-8.2	-0.44	1.8	-35	-6.5	-4.4	1.1		**115**		9.1	-6.7	-26	-22	2.5
A20 - 56	11-Jul-21	0	0.37	0	534	9.7	82	16	642	23	0.89	0	79,024	0	3,110,496	115,592	173,496	2,400	3,481,008
A20 - 56R	11-Jul-21	0	0.17	0	539	14	82	14	649	23	0.87	0	35,920	0	3,066,392	122,376	151,744	2,200	3,378,632
RPD (%)			**75**		-0.90	-39	0.37	12	-1.1	0	1.5		**75**		1.4	-5.7	13	8.7	3.0
PDL - 98S	27-Jul-21	0.14	1.9	0	109	26	11	21	170	29	0.77	600	36,120	0	1,253,232	316,192	12,984	3,200	1,622,328
PDL - 98SR	27-Jul-21	0.045	1.4	0	111	32	11	22	178	30	0.80	200	29,336	0	1,145,472	392,416	18,768	3,000	1,589,192
RPD (%)		**100**	26		-1.6	-20	5.1	-6.2	-4.5	-3.4	-4.5	**100**	21		9.0	-22	-36	6.5	2.1
TPN - 145S	29-Jul-21	0.81	2.8	0	88	4.7	8.9	22	128	29	0.80	3,600	58,672	0	1,145,456	154,264	39,120	2,600	1,403,712
TPN - 145SR	29-Jul-21	0.50	5.1	0	91	7.2	10	23	138	27	0.82	2,200	93,792	0	1,002,776	205,952	60,272	2,600	1,367,592
RPD (%)		48	**-57**		-3.2	-42	-14	-4.8	-7.3	7.1	-3.0	48	-46		13	-29	-43	0	2.6
WAL - 115S	10-Aug-21	0.28	7.6	0	155	17	25	12	217	35	0.85	600	368,984	0	1,708,408	99,592	254,440	1,800	2,433,824
WAL - 115SR	10-Aug-21	0.27	7.0	0	157	18	28	13	223	33	0.83	1,200	411,488	0	1,743,128	93,608	197,168	1,400	2,447,992
RPD (%)		3.3	9.0		-1.4	-5.5	-9.1	-10	-2.8	5.9	2.6	-67	-11		-2.0	6.2	25	25	-0.58
BAP - 76	14-Aug-21	0.045	3.6	0	55	7.5	24	4.0	94	28	0.84	200	79,224	0	869,664	167,664	141,296	800	1,258,848
BAP - 76R	14-Aug-21	0.27	2.9	0	50	9.5	24	4.1	91	29	0.84	1,200	50,888	0	805,208	224,536	135,312	1,000	1,218,144
RPD (%)		**-143**	21		9.6	-24	-1.8	-3.5	3.1	-3.5	0.063	**-143**	44		7.7	-29	4.3	-22	3.3
LK5 - 32	14-Aug-21	2.6	12	0	245	14	5.1	13	291	39	0.88	114,944	504,480	0	2,050,656	227,720	9,984	1,600	2,909,384
LK5 - 32R	14-Aug-21	1.3	11	0	264	14	6.1	13	309	36	0.87	57,472	418,672	0	2,132,080	277,608	16,968	2,000	2,904,800
RPD (%)		**67**	5.2		-7.2	-2.2	-18	-2.7	-6.0	8.0	1.8	**67**	19		-3.9	-20	**-52**	-22	0.16
DS1 - 54	15-Aug-21	0	8.4	0	74	2.8	6.3	5.0	97	33	0.79	0	496,296	0	1,732,144	11,784	30,336	1,200	2,271,760
DS1 - 54R	15-Aug-21	0	7.7	0	75	3.7	6.9	3.5	97	31	0.79	0	453,592	0	1,653,120	4,600	17,568	1,000	2,129,880
RPD (%)			9.5		-0.66	-28	-9.0	35	0.26	6.3	0.34		9.0		4.7	**88**	**53**	18	6.4
SP - 149S	3-Sep-21	0	7.6	0	92	30	3.5	5.6	139	32	0.83	0	281,976	0	1,109,936	521,864	8,784	1,200	1,923,760
SP - 149SR	3-Sep-21	0	5.2	0	80	34	6.0	5.4	130	34	0.82	0	181,400	0	1,044,480	593,904	23,752	1,200	1,844,736
RPD (%)			38		15	-11	**-52**	3.9	6.8	-6.1	0.82		43		6.1	-13	**-92**	0	4.2
A20 - 59	9-Sep-21	0	1.2	0	613	143	51	24	833	32	0.76	0	72,240	0	3,476,600	157,608	75,088	3,200	3,784,736
A20 - 59R	9-Sep-21	0.14	1.5	0	581	277	51	20	931	33	0.74	600	79,224	0	3,387,992	3,819,464	67,704	3,000	7,357,984
RPD (%)		**NA**	-18		5.3	**-64**	-1.0	21	-11	-3.1	3.4	**NA**	-9.2		2.6	**-184**	10	6.5	**-64**
LK5 - 34	16-Sep-21	0	17	0	176	33	7.9	2.2	236	37	0.90	0	668,912	0	2,014,520	516,864	32,136	400	3,232,832
LK5 - 34R	16-Sep-21	0	17	0	170	42	10	4.3	244	36	0.89	0	690,264	0	1,957,848	633,208	26,952	600	3,308,872
RPD (%)			-2.2		3.6	-25	-26	**-66**	-3.4	2.7	1.4		-3.1		2.9	-20	18	-40	-2.3
BBD - 78	18-Sep-21	0.56	5.1	0	75	79	27	6.2	193	33	0.84	14,368	151,264	0	822,376	84,752	158,864	800	1,232,424
BBD - 78R	18-Sep-21	0.10	5.1	0	72	100	30	5.3	213	34	0.84	200	180,000	0	878,848	115,088	118,160	800	1,293,096
RPD (%)		**139**	-0.93		3.8	-23	-9.1	16	-9.4	-3.0	0.42	**195**	-17		-6.6	-30	29	0	-4.8

Notes:
RPD = Relative Percent Difference (%) = ((original - duplicate) / (original + duplicate)/2) x 100.
Bolded RPD values exceed 25%.
RPDs have not been calculated for cases where one or both of the samples is "0".

Table A-13. Percent recovery of benthic invertebrate samples for all CREMP study areas, 2021.

Area-Replicate	Number of Organisms Recovered	Number of Organisms in Re-sort	Percent Recovery
BBD-1	327	328	99.7%
BES-4	56	58	96.6%
INUG-5	87	88	98.9%
LK5-4	88	96	91.7%
MAM-1	130	140	92.9%
PDL-3	60	63	95.2%
TPN-3	187	189	98.9%
WAL-4	42	43	97.7%
NEM-4	126	133	94.7%
		Average % Recovery	96.2%

Notes

All samples were sorted in their entirety.

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

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

The exceptions to this rule are immature tubificidae with and without hairs. Immature oligochaetes are counted as taxa as the probability of the immature being a unique taxa is high.

Indeterminates are unique taxa that could not be identified further for various reasons (e.g., small, damaged).

Table A-14. Calculation of subsampling error for benthic macroinvertebrate samples for all CREMP study areas, 2021.

Station	Whole Organisms	Number of Organisms in Fraction 1	Number of Organisms in Fraction 2	Number of Organisms in Fraction 3	Number of Organisms in Fraction 4	Actual Density*	Precision	Accuracy	
							% range	Min	Max
A76-1	-	62	64	-	-	126	3	2	-
BAP-3	-	139	143	-	-	282	3	1	-

Notes:

* whole large organisms excluded in calculations. Density expressed per sample area.

min = minimum absolute % error

max = maximum absolute % error

Sample fractions sorted from CREMP study areas, 2021

Station	Fraction Sorted (500 µm)
A20-3	1/2
A76-4	1/2
BAP-4	1/4
DS1-2	1/2
DS1-3	1/2
DS1-4	1/2
DS1-5	1/2
TPE-2	1/2
TPE-3	1/2

SUB-APPENDICES

Appendix A1
2021 Water Quality Monitoring Preliminary QC Screening

Meadowbank Mine - Water Quality Monitoring 2021

Preliminary Screening of March, 2021 Water Quality Monitoring

Azimuth Consulting Group Inc.
on behalf of Agnico Eagle Mines Ltd.

Report Date: 2021-11-01

Table of Contents

1. Introduction & Sampling Overview

This document was prepared by Azimuth Consulting Group Inc (Azimuth) to provide the Meadowbank Environment Department with a brief overview of the water chemistry results collected in March, 2021 as part of the Core Receiving Environment Monitoring Program (CREMP). CREMP water quality monitoring occurs in all summer months (July - September) as well as two through-ice sampling events in March and May. CREMP monitoring occurs at near-field, mid-field, and far-field stations in three distinct areas - the Meadowbank Mine Project, The Whale Tail Pit Project, and Baker Lake, however sampling does not occur at all stations or all areas in each sampling event. The purpose of this preliminary document is to:

1. Screen the water chemistry results from ALS against the trigger values to keep the Environment Department informed about potential changes in water quality, including the early identification of potentially anomalous data (Section 2).

2. Review the data for laboratory QC issues (blanks, duplicates, matrix spikes, etc.) and potential field quality assurance (QA) concerns, ensuring that questionable results are verified by reanalysis (Section 3).

Samples included in this report are shown in Table 1, while field blanks are shown in Table 2.

Table 1: Summary of March, 2021 samples.

Area	Sample ID	ID	ID_Name	Duplicate	Date_Sampled
Meadowbank					
	INUG-128	INUG	Inuggugayualik	-	2021-03-11
	INUG-129	INUG	Inuggugayualik	-	2021-03-17
	PDL-93	PDL	Pipedream	MARCH DUP-1	2021-03-20
	PDL-94	PDL	Pipedream	-	2021-03-20
	SP-140	SP	Second Portage	-	2021-03-18
	SP-141	SP	Second Portage	-	2021-03-18
	TE-100	TE	Tehek - Mid Field	-	2021-03-09
	TE-101	TE	Tehek - Mid Field	-	2021-03-09
	TEFF-52	TEFF	Tehek - Far Field	-	2021-03-09
	TEFF-53	TEFF	Tehek - Far Field	-	2021-03-09
	TPE-140	TPE	Third Portage - East Basin	-	2021-03-29
	TPE-141	TPE	Third Portage - East Basin	-	2021-03-29
	TPN-140	TPN	Third Portage - North Basin	-	2021-03-29
	TPN-141	TPN	Third Portage - North Basin	MARCH DUP-2	2021-03-29
	WAL-109	WAL	Wally	-	2021-03-18
	WAL-110	WAL	Wally	-	2021-03-18
Whale Tail Pit					
	A20-51	A20	Lake A20	-	2021-03-24
	A20-52	A20	Lake A20	MARCH DUP-3	2021-03-24
	MAM-57	MAM	Mammoth	-	2021-03-25
	MAM-58	MAM	Mammoth	-	2021-03-25
	NEM-57	NEM	Nemo	MARCH DUP-4	2021-03-24

Area	Sample ID	ID	ID_Name	Duplicate	Date_Sampled
	NEM-58	NEM	Nemo	-	2021-03-24
	WTS-57	WTS	Whale Tail South	-	2021-03-25
	WTS-58	WTS	Whale Tail South	-	2021-03-25

Table 2: Summary of field blanks collected in March, 2021.

Client_Sample_ID	ID_Name
MARCH DI	DI Blank
MARCH EB	Equipment Blank

2. Trigger Screening

Sampling results were screened relative to relevant triggers and thresholds. A summary of trigger and threshold exceedances is provided in Table 3. Subsequent tables provide all sample results above trigger and threshold values for Meadowbank (Table 4), Whale Tail Pit (Table 5), and Baker Lake (Baker Lake not sampled in this sampling event). Samples exceeding triggers or thresholds but failing reliability checks (see Section 2.1) are labeled as uncertain.

Table 3: Summary of trigger and threshold exceedances in March, 2021.

Area	Parameter	Samples Exceeding Trigger	Samples Exceeding Threshold	Stations
Meadowbank				
	Bicarbonate alkalinity	6	0	PDL-93, SP-140, SP-141, TE-100, TPE-140, WAL-110
	Calcium (T)	13	0	PDL-93, PDL-94, SP-140, SP-141, TE-100, TE-101, TEFF-52, TPE-140, TPE-141, TPN-140, TPN-141, WAL-109, WAL-110
	Conductivity	12	0	PDL-93, SP-140, SP-141, TE-100, TE-101, TEFF-52, TPE-140, TPE-141, TPN-140, TPN-141, WAL-109, WAL-110
	Copper (D)	1	0	TEFF-53*
	Fluoride	5	0	SP-140, SP-141, TE-100, TEFF-52, TPE-140

Area	Parameter	Samples Exceeding Trigger	Samples Exceeding Threshold	Stations
	Hardness	13	0	PDL-93, PDL-94, SP-140, SP-141, TE-100, TE-101, TEFF-52, TPE-140, TPE-141, TPN-140, TPN-141, WAL-109, WAL-110
	Lead (D)	1	1	PDL-94*
	Magnesium (T)	14	0	INUG-129, PDL-93, SP-140, SP-141, TE-100, TE-101, TEFF-52, TEFF-53, TPE-140, TPE-141, TPN-140, TPN-141, WAL-109, WAL-110
	Potassium (T)	11	0	SP-140, SP-141, TE-100, TE-101, TEFF-52, TEFF-53, TPE-140, TPE-141, TPN-140, TPN-141, WAL-110
	Reactive silica	2	0	WAL-109, WAL-110
	Silicon (D)	7	0	INUG-129, SP-140, SP-141, TE-100, TE-101, TEFF-52, WAL-110
	Silicon (T)	7	0	SP-140, SP-141, TE-100, TE-101, TEFF-52, WAL-109, WAL-110
	Sodium (T)	10	0	SP-140, SP-141, TE-100, TEFF-52, TPE-140, TPE-141, TPN-140, TPN-141, WAL-109, WAL-110
	TDS	10	0	SP-140, SP-141, TE-100, TEFF-52, TPE-140, TPE-141, TPN-140, TPN-141, WAL-109, WAL-110
	TKN	1	0	WAL-110
	Total Alkalinity	6	0	PDL-93, SP-140, SP-141, TE-100, TPE-140, WAL-110
	Zinc (D)	2	0	INUG-129, SP-141

Area	Parameter	Samples Exceeding Trigger	Samples Exceeding Threshold	Stations
Whale Tail Pit				
	Ammonia-N	1	0	MAM-58
	Bicarbonate alkalinity	8	0	A20-51, A20-52, MAM-57, MAM-58, NEM-57, NEM-58, WTS-57, WTS-58
	Calcium (T)	7	0	A20-51, MAM-57, MAM-58, NEM-57, NEM-58, WTS-57, WTS-58
	Conductivity	7	0	A20-51, MAM-57, MAM-58, NEM-57, NEM-58, WTS-57, WTS-58
	Hardness	7	0	A20-51, MAM-57, MAM-58, NEM-57, NEM-58, WTS-57, WTS-58
	Lithium (D)	6	0	MAM-57, MAM-58, NEM-57, NEM-58, WTS-57, WTS-58
	Lithium (T)	5	0	MAM-57, MAM-58, NEM-57, WTS-57, WTS-58
	Magnesium (T)	7	0	A20-51, MAM-57, MAM-58, NEM-57, NEM-58, WTS-57, WTS-58
	Nitrate-N	1	0	MAM-58
	Potassium (T)	8	0	A20-51, A20-52, MAM-57, MAM-58, NEM-57, NEM-58, WTS-57, WTS-58
	Reactive silica	4	0	MAM-57, MAM-58, WTS-57, WTS-58
	Silicon (D)	4	0	MAM-57, MAM-58, WTS-57, WTS-58

Area	Parameter	Samples Exceeding Trigger	Samples Exceeding Threshold	Stations
	Silicon (T)	4	0	MAM-57, MAM-58, WTS-57, WTS-58
	Sodium (T)	8	0	A20-51, A20-52, MAM-57, MAM-58, NEM-57, NEM-58, WTS-57, WTS-58
	TDS	7	0	A20-51, MAM-57, MAM-58, NEM-57, NEM-58, WTS-57, WTS-58
	TKN	5	0	A20-51, MAM-57, MAM-58, WTS-57, WTS-58
	Total Alkalinity	8	0	A20-51, A20-52, MAM-57, MAM-58, NEM-57, NEM-58, WTS-57, WTS-58
	Total phosphorous	4	4	A20-51, A20-52, WTS-57, WTS-58

* Indicates samples which failed reliability checks and are consequently uncertain.

Table 4: Trigger and threshold exceedances at Meadowbank sampling stations.

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
INUG-129	Inuggugayualik	Magnesium (T)	0.95000	0.00500	mg/L	-	-	0.93000	-
INUG-129	Inuggugayualik	Silicon (D)	0.18200	0.05000	mg/L	-	-	0.18000	-
INUG-129	Inuggugayualik	Zinc (D)	0.00230	0.00100	mg/L	-	0.003	0.00180	-
PDL-93	Pipedream	Bicarbonate alkalinity	9.80000	1.00000	mg/L	-	-	8.70000	-
PDL-93	Pipedream	Calcium (T)	3.09000	0.05000	mg/L	-	-	2.39000	-
PDL-93	Pipedream	Conductivity	29.80000	2.00000	µS/cm	-	-	27.40000	-
PDL-93	Pipedream	Hardness	12.00000	0.60000	mg/L	-	-	9.50000	-
PDL-93	Pipedream	Magnesium (T)	1.03000	0.00500	mg/L	-	-	0.93000	-
PDL-93	Pipedream	Total Alkalinity	9.80000	1.00000	mg/L	-	-	8.70000	-
PDL-94	Pipedream	Calcium (T)	2.64000	0.05000	mg/L	-	-	2.39000	-
PDL-94	Pipedream	Hardness	10.20000	0.60000	mg/L	-	-	9.50000	-
PDL-94	Pipedream	Lead (D)	***0.00168***	0.00005	mg/L	-	0.001	0.00053	Uncertain
SP-140	Second Portage	Bicarbonate alkalinity	13.90000	1.00000	mg/L	-	-	8.70000	-
SP-140	Second Portage	Calcium (T)	5.14000	0.05000	mg/L	-	-	2.39000	-
SP-140	Second Portage	Conductivity	47.20000	2.00000	µS/cm	-	-	27.40000	-
SP-140	Second Portage	Fluoride	0.09000	0.02000	mg/L	-	0.12	0.08800	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
SP-140	Second Portage	Hardness	19.30000	0.60000	mg/L	-	-	9.50000	-
SP-140	Second Portage	Magnesium (T)	1.58000	0.00500	mg/L	-	-	0.93000	-
SP-140	Second Portage	Potassium (T)	0.68900	0.05000	mg/L	-	-	0.58000	-
SP-140	Second Portage	Silicon (D)	0.30500	0.05000	mg/L	-	-	0.18000	-
SP-140	Second Portage	Silicon (T)	0.34000	0.10000	mg/L	-	-	0.20000	-
SP-140	Second Portage	Sodium (T)	1.23000	0.05000	mg/L	-	-	1.16000	-
SP-140	Second Portage	TDS	27.60000	3.00000	mg/L	-	-	19.00000	-
SP-140	Second Portage	Total Alkalinity	13.90000	1.00000	mg/L	-	-	8.70000	-
SP-141	Second Portage	Bicarbonate alkalinity	11.90000	1.00000	mg/L	-	-	8.70000	-
SP-141	Second Portage	Calcium (T)	4.26000	0.05000	mg/L	-	-	2.39000	-
SP-141	Second Portage	Conductivity	43.00000	2.00000	µS/cm	-	-	27.40000	-
SP-141	Second Portage	Fluoride	0.08900	0.02000	mg/L	-	0.12	0.08800	-
SP-141	Second Portage	Hardness	16.50000	0.60000	mg/L	-	-	9.50000	-
SP-141	Second Portage	Magnesium (T)	1.43000	0.00500	mg/L	-	-	0.93000	-
SP-141	Second Portage	Potassium (T)	0.66700	0.05000	mg/L	-	-	0.58000	-
SP-141	Second Portage	Silicon (D)	0.23800	0.05000	mg/L	-	-	0.18000	-
SP-141	Second Portage	Silicon (T)	0.27000	0.10000	mg/L	-	-	0.20000	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
SP-141	Second Portage	Sodium (T)	1.18000	0.05000	mg/L	-	-	1.16000	-
SP-141	Second Portage	TDS	24.80000	3.00000	mg/L	-	-	19.00000	-
SP-141	Second Portage	Total Alkalinity	11.90000	1.00000	mg/L	-	-	8.70000	-
SP-141	Second Portage	Zinc (D)	0.00260	0.00100	mg/L	-	0.003	0.00180	-
TE-100	Tehek - Mid Field	Bicarbonate alkalinity	11.80000	1.00000	mg/L	-	-	8.70000	-
TE-100	Tehek - Mid Field	Calcium (T)	3.91000	0.05000	mg/L	-	-	2.39000	-
TE-100	Tehek - Mid Field	Conductivity	41.10000	2.00000	µS/cm	-	-	27.40000	-
TE-100	Tehek - Mid Field	Fluoride	0.09700	0.02000	mg/L	-	0.12	0.08800	-
TE-100	Tehek - Mid Field	Hardness	15.60000	0.60000	mg/L	-	-	9.50000	-
TE-100	Tehek - Mid Field	Magnesium (T)	1.42000	0.00500	mg/L	-	-	0.93000	-
TE-100	Tehek - Mid Field	Potassium (T)	0.75400	0.05000	mg/L	-	-	0.58000	-
TE-100	Tehek - Mid Field	Silicon (D)	0.24100	0.05000	mg/L	-	-	0.18000	-
TE-100	Tehek - Mid Field	Silicon (T)	0.31000	0.10000	mg/L	-	-	0.20000	-
TE-100	Tehek - Mid Field	Sodium (T)	1.20000	0.05000	mg/L	-	-	1.16000	-
TE-100	Tehek - Mid Field	TDS	30.80000	3.00000	mg/L	-	-	19.00000	-
TE-100	Tehek - Mid Field	Total Alkalinity	11.80000	1.00000	mg/L	-	-	8.70000	-
TE-101	Tehek - Mid Field	Calcium (T)	2.61000	0.05000	mg/L	-	-	2.39000	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
TE-101	Tehek - Mid Field	Conductivity	28.40000	2.00000	µS/cm	-	-	27.40000	-
TE-101	Tehek - Mid Field	Hardness	10.70000	0.60000	mg/L	-	-	9.50000	-
TE-101	Tehek - Mid Field	Magnesium (T)	1.01000	0.00500	mg/L	-	-	0.93000	-
TE-101	Tehek - Mid Field	Potassium (T)	0.59500	0.05000	mg/L	-	-	0.58000	-
TE-101	Tehek - Mid Field	Silicon (D)	0.20900	0.05000	mg/L	-	-	0.18000	-
TE-101	Tehek - Mid Field	Silicon (T)	0.24000	0.10000	mg/L	-	-	0.20000	-
TEFF-52	Tehek - Far Field	Calcium (T)	2.87000	0.05000	mg/L	-	-	2.39000	-
TEFF-52	Tehek - Far Field	Conductivity	32.90000	2.00000	µS/cm	-	-	27.40000	-
TEFF-52	Tehek - Far Field	Fluoride	0.09800	0.02000	mg/L	-	0.12	0.08800	-
TEFF-52	Tehek - Far Field	Hardness	11.80000	0.60000	mg/L	-	-	9.50000	-
TEFF-52	Tehek - Far Field	Magnesium (T)	1.13000	0.00500	mg/L	-	-	0.93000	-
TEFF-52	Tehek - Far Field	Potassium (T)	0.80000	0.05000	mg/L	-	-	0.58000	-
TEFF-52	Tehek - Far Field	Silicon (D)	0.20500	0.05000	mg/L	-	-	0.18000	-
TEFF-52	Tehek - Far Field	Silicon (T)	0.25000	0.10000	mg/L	-	-	0.20000	-
TEFF-52	Tehek - Far Field	Sodium (T)	1.35000	0.05000	mg/L	-	-	1.16000	-
TEFF-52	Tehek - Far Field	TDS	20.60000	3.00000	mg/L	-	-	19.00000	-
TEFF-53	Tehek - Far Field	Copper (D)	0.00156	0.00020	mg/L	-	0.002	0.00120	Uncertain

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
TEFF-53	Tehek - Far Field	Magnesium (T)	0.94200	0.00500	mg/L	-	-	0.93000	-
TEFF-53	Tehek - Far Field	Potassium (T)	0.60500	0.05000	mg/L	-	-	0.58000	-
TPE-140	Third Portage - East Basin	Bicarbonate alkalinity	10.00000	1.00000	mg/L	-	-	8.70000	-
TPE-140	Third Portage - East Basin	Calcium (T)	3.42000	0.05000	mg/L	-	-	2.39000	-
TPE-140	Third Portage - East Basin	Conductivity	39.30000	2.00000	µS/cm	-	-	27.40000	-
TPE-140	Third Portage - East Basin	Fluoride	0.09600	0.02000	mg/L	-	0.12	0.08800	-
TPE-140	Third Portage - East Basin	Hardness	13.90000	0.60000	mg/L	-	-	9.50000	-
TPE-140	Third Portage - East Basin	Magnesium (T)	1.30000	0.00500	mg/L	-	-	0.93000	-
TPE-140	Third Portage - East Basin	Potassium (T)	0.68000	0.05000	mg/L	-	-	0.58000	-
TPE-140	Third Portage - East Basin	Sodium (T)	1.38000	0.05000	mg/L	-	-	1.16000	-
TPE-140	Third Portage - East Basin	TDS	24.50000	3.00000	mg/L	-	-	19.00000	-
TPE-140	Third Portage - East Basin	Total Alkalinity	10.00000	1.00000	mg/L	-	-	8.70000	-
TPE-141	Third Portage - East Basin	Calcium (T)	3.12000	0.05000	mg/L	-	-	2.39000	-
TPE-141	Third Portage - East Basin	Conductivity	34.90000	2.00000	µS/cm	-	-	27.40000	-
TPE-141	Third Portage - East Basin	Hardness	12.90000	0.60000	mg/L	-	-	9.50000	-
TPE-141	Third Portage - East Basin	Magnesium (T)	1.25000	0.00500	mg/L	-	-	0.93000	-
TPE-141	Third Portage - East Basin	Potassium (T)	0.64000	0.05000	mg/L	-	-	0.58000	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
TPE-141	Third Portage - East Basin	Sodium (T)	1.33000	0.05000	mg/L	-	-	1.16000	-
TPE-141	Third Portage - East Basin	TDS	20.40000	3.00000	mg/L	-	-	19.00000	-
TPN-140	Third Portage - North Basin	Calcium (T)	3.10000	0.05000	mg/L	-	-	2.39000	-
TPN-140	Third Portage - North Basin	Conductivity	36.70000	2.00000	µS/cm	-	-	27.40000	-
TPN-140	Third Portage - North Basin	Hardness	12.70000	0.60000	mg/L	-	-	9.50000	-
TPN-140	Third Portage - North Basin	Magnesium (T)	1.20000	0.00500	mg/L	-	-	0.93000	-
TPN-140	Third Portage - North Basin	Potassium (T)	0.67000	0.05000	mg/L	-	-	0.58000	-
TPN-140	Third Portage - North Basin	Sodium (T)	1.38000	0.05000	mg/L	-	-	1.16000	-
TPN-140	Third Portage - North Basin	TDS	21.30000	3.00000	mg/L	-	-	19.00000	-
TPN-141	Third Portage - North Basin	Calcium (T)	2.99000	0.05000	mg/L	-	-	2.39000	-
TPN-141	Third Portage - North Basin	Conductivity	35.80000	2.00000	µS/cm	-	-	27.40000	-
TPN-141	Third Portage - North Basin	Hardness	12.30000	0.60000	mg/L	-	-	9.50000	-
TPN-141	Third Portage - North Basin	Magnesium (T)	1.18000	0.00500	mg/L	-	-	0.93000	-
TPN-141	Third Portage - North Basin	Potassium (T)	0.64500	0.05000	mg/L	-	-	0.58000	-
TPN-141	Third Portage - North Basin	Sodium (T)	1.37000	0.05000	mg/L	-	-	1.16000	-
TPN-141	Third Portage - North Basin	TDS	20.50000	3.00000	mg/L	-	-	19.00000	-
WAL-109	Wally	Calcium (T)	5.85000	0.05000	mg/L	-	-	4.88000	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
WAL-109	Wally	Conductivity	49.40000	2.00000	µS/cm	-	-	36.60000	-
WAL-109	Wally	Hardness	21.60000	0.60000	mg/L	-	-	16.70000	-
WAL-109	Wally	Magnesium (T)	1.70000	0.00500	mg/L	-	-	1.36000	-
WAL-109	Wally	Reactive silica	1.41000	0.50000	mg/L	-	-	1.08000	-
WAL-109	Wally	Silicon (T)	0.71000	0.10000	mg/L	-	-	0.65000	-
WAL-109	Wally	Sodium (T)	0.74200	0.05000	mg/L	-	-	0.72000	-
WAL-109	Wally	TDS	29.40000	3.00000	mg/L	-	-	25.30000	-
WAL-110	Wally	Bicarbonate alkalinity	21.60000	1.00000	mg/L	-	-	17.80000	-
WAL-110	Wally	Calcium (T)	7.08000	0.05000	mg/L	-	-	4.88000	-
WAL-110	Wally	Conductivity	59.70000	2.00000	µS/cm	-	-	36.60000	-
WAL-110	Wally	Hardness	26.10000	0.60000	mg/L	-	-	16.70000	-
WAL-110	Wally	Magnesium (T)	2.05000	0.00500	mg/L	-	-	1.36000	-
WAL-110	Wally	Potassium (T)	0.70600	0.05000	mg/L	-	-	0.59000	-
WAL-110	Wally	Reactive silica	1.56000	0.50000	mg/L	-	-	1.08000	-
WAL-110	Wally	Silicon (D)	0.76700	0.05000	mg/L	-	-	0.67000	-
WAL-110	Wally	Silicon (T)	0.82000	0.10000	mg/L	-	-	0.65000	-
WAL-110	Wally	Sodium (T)	0.89700	0.05000	mg/L	-	-	0.72000	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
WAL-110	Wally	TDS	35.80000	10.00000	mg/L	-	-	25.30000	-
WAL-110	Wally	TKN	0.16200	0.05000	mg/L	-	-	0.16000	-
WAL-110	Wally	Total Alkalinity	21.60000	1.00000	mg/L	-	-	17.80000	-

[1]Bold values are above the threshold as well as above the trigger value.

[2]Results failing to meet reliability checks are indicated as uncertain.

Table 5: Trigger and threshold exceedances at Whale Tail Pit sampling stations

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
A20-51	Lake A20	Bicarbonate alkalinity	16.9000	1.000	mg/L	-	-	9.6000	-
A20-51	Lake A20	Calcium (T)	8.8800	0.050	mg/L	-	-	4.6000	-
A20-51	Lake A20	Conductivity	86.9000	2.000	µS/cm	-	-	48.6000	-
A20-51	Lake A20	Hardness	32.5000	0.600	mg/L	-	-	17.4000	-
A20-51	Lake A20	Magnesium (T)	2.5100	0.005	mg/L	-	-	1.4100	-
A20-51	Lake A20	Potassium (T)	2.0500	0.050	mg/L	-	-	0.8400	-
A20-51	Lake A20	Sodium (T)	1.8900	0.050	mg/L	-	-	0.9700	-
A20-51	Lake A20	TDS	64.7000	10.000	mg/L	-	-	38.5000	-
A20-51	Lake A20	TKN	0.2530	0.050	mg/L	-	-	0.1700	-
A20-51	Lake A20	Total Alkalinity	16.9000	1.000	mg/L	-	-	9.6000	-
A20-51	Lake A20	Total phosphorous	***0.0099***	0.002	mg/L	-	0.004	0.0045	-
A20-52	Lake A20	Bicarbonate alkalinity	9.8000	1.000	mg/L	-	-	9.6000	-
A20-52	Lake A20	Potassium (T)	1.1600	0.050	mg/L	-	-	0.8400	-
A20-52	Lake A20	Sodium (T)	1.1200	0.050	mg/L	-	-	0.9700	-
A20-52	Lake A20	Total Alkalinity	9.8000	1.000	mg/L	-	-	9.6000	-
A20-52	Lake A20	Total phosphorous	***0.0049***	0.002	mg/L	-	0.004	0.0045	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
MAM-57	Mammoth	Bicarbonate alkalinity	19.4000	1.000	mg/L	-	-	9.6000	-
MAM-57	Mammoth	Calcium (T)	23.8000	0.050	mg/L	-	-	4.6000	-
MAM-57	Mammoth	Conductivity	223.0000	2.000	µS/cm	-	-	48.6000	-
MAM-57	Mammoth	Hardness	81.3000	0.600	mg/L	-	-	17.4000	-
MAM-57	Mammoth	Lithium (D)	0.0038	0.001	mg/L	-	-	0.0020	-
MAM-57	Mammoth	Lithium (T)	0.0036	0.001	mg/L	-	-	0.0020	-
MAM-57	Mammoth	Magnesium (T)	5.3100	0.005	mg/L	-	-	1.4100	-
MAM-57	Mammoth	Potassium (T)	4.5800	0.050	mg/L	-	-	0.8400	-
MAM-57	Mammoth	Reactive silica	2.5600	0.500	mg/L	-	-	1.3300	-
MAM-57	Mammoth	Silicon (D)	1.1100	0.050	mg/L	-	-	0.5700	-
MAM-57	Mammoth	Silicon (T)	1.1800	0.100	mg/L	-	-	0.6100	-
MAM-57	Mammoth	Sodium (T)	3.1500	0.050	mg/L	-	-	0.9700	-
MAM-57	Mammoth	TDS	166.0000	10.000	mg/L	-	-	38.5000	-
MAM-57	Mammoth	TKN	0.3560	0.050	mg/L	-	-	0.1700	-
MAM-57	Mammoth	Total Alkalinity	19.4000	1.000	mg/L	-	-	9.6000	-
MAM-58	Mammoth	Ammonia-N	0.0872	0.005	mg/L	-	0.126	0.0650	-
MAM-58	Mammoth	Bicarbonate alkalinity	24.5000	1.000	mg/L	-	-	9.6000	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
MAM-58	Mammoth	Calcium (T)	32.6000	0.050	mg/L	-	-	4.6000	-
MAM-58	Mammoth	Conductivity	306.0000	2.000	µS/cm	-	-	48.6000	-
MAM-58	Mammoth	Hardness	111.0000	0.600	mg/L	-	-	17.4000	-
MAM-58	Mammoth	Lithium (D)	0.0053	0.001	mg/L	-	-	0.0020	-
MAM-58	Mammoth	Lithium (T)	0.0048	0.001	mg/L	-	-	0.0020	-
MAM-58	Mammoth	Magnesium (T)	7.1000	0.005	mg/L	-	-	1.4100	-
MAM-58	Mammoth	Nitrate-N	1.6900	0.005	mg/L	-	3	1.5000	-
MAM-58	Mammoth	Potassium (T)	6.0200	0.050	mg/L	-	-	0.8400	-
MAM-58	Mammoth	Reactive silica	3.0400	0.500	mg/L	-	-	1.3300	-
MAM-58	Mammoth	Silicon (D)	1.4500	0.050	mg/L	-	-	0.5700	-
MAM-58	Mammoth	Silicon (T)	1.4400	0.100	mg/L	-	-	0.6100	-
MAM-58	Mammoth	Sodium (T)	4.0800	0.050	mg/L	-	-	0.9700	-
MAM-58	Mammoth	TDS	228.0000	15.000	mg/L	-	-	38.5000	-
MAM-58	Mammoth	TKN	0.4130	0.050	mg/L	-	-	0.1700	-
MAM-58	Mammoth	Total Alkalinity	24.5000	1.000	mg/L	-	-	9.6000	-
NEM-57	Nemo	Bicarbonate alkalinity	12.8000	1.000	mg/L	-	-	9.6000	-
NEM-57	Nemo	Calcium (T)	14.0000	0.050	mg/L	-	-	4.6000	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
NEM-57	Nemo	Conductivity	118.0000	2.000	µS/cm	-	-	48.6000	-
NEM-57	Nemo	Hardness	45.7000	0.600	mg/L	-	-	17.4000	-
NEM-57	Nemo	Lithium (D)	0.0023	0.001	mg/L	-	-	0.0020	-
NEM-57	Nemo	Lithium (T)	0.0022	0.001	mg/L	-	-	0.0020	-
NEM-57	Nemo	Magnesium (T)	2.6200	0.005	mg/L	-	-	1.4100	-
NEM-57	Nemo	Potassium (T)	1.8300	0.050	mg/L	-	-	0.8400	-
NEM-57	Nemo	Sodium (T)	1.2800	0.050	mg/L	-	-	0.9700	-
NEM-57	Nemo	TDS	90.3000	10.000	mg/L	-	-	38.5000	-
NEM-57	Nemo	Total Alkalinity	12.8000	1.000	mg/L	-	-	9.6000	-
NEM-58	Nemo	Bicarbonate alkalinity	12.3000	1.000	mg/L	-	-	9.6000	-
NEM-58	Nemo	Calcium (T)	12.6000	0.050	mg/L	-	-	4.6000	-
NEM-58	Nemo	Conductivity	111.0000	2.000	µS/cm	-	-	48.6000	-
NEM-58	Nemo	Hardness	41.5000	0.600	mg/L	-	-	17.4000	-
NEM-58	Nemo	Lithium (D)	0.0021	0.001	mg/L	-	-	0.0020	-
NEM-58	Nemo	Magnesium (T)	2.4300	0.005	mg/L	-	-	1.4100	-
NEM-58	Nemo	Potassium (T)	1.7200	0.050	mg/L	-	-	0.8400	-
NEM-58	Nemo	Sodium (T)	1.1600	0.050	mg/L	-	-	0.9700	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
NEM-58	Nemo	TDS	85.0000	10.000	mg/L	-	-	38.5000	-
NEM-58	Nemo	Total Alkalinity	12.3000	1.000	mg/L	-	-	9.6000	-
WTS-57	Whale Tail South	Bicarbonate alkalinity	17.4000	1.000	mg/L	-	-	9.6000	-
WTS-57	Whale Tail South	Calcium (T)	11.9000	0.050	mg/L	-	-	4.6000	-
WTS-57	Whale Tail South	Conductivity	118.0000	2.000	µS/cm	-	-	48.6000	-
WTS-57	Whale Tail South	Hardness	42.0000	0.600	mg/L	-	-	17.4000	-
WTS-57	Whale Tail South	Lithium (D)	0.0026	0.001	mg/L	-	-	0.0020	-
WTS-57	Whale Tail South	Lithium (T)	0.0024	0.001	mg/L	-	-	0.0020	-
WTS-57	Whale Tail South	Magnesium (T)	2.9800	0.005	mg/L	-	-	1.4100	-
WTS-57	Whale Tail South	Potassium (T)	2.6600	0.050	mg/L	-	-	0.8400	-
WTS-57	Whale Tail South	Reactive silica	1.5400	0.500	mg/L	-	-	1.3300	-
WTS-57	Whale Tail South	Silicon (D)	0.6790	0.050	mg/L	-	-	0.5700	-
WTS-57	Whale Tail South	Silicon (T)	0.7300	0.100	mg/L	-	-	0.6100	-
WTS-57	Whale Tail South	Sodium (T)	2.1800	0.050	mg/L	-	-	0.9700	-
WTS-57	Whale Tail South	TDS	86.3000	10.000	mg/L	-	-	38.5000	-
WTS-57	Whale Tail South	TKN	0.2470	0.050	mg/L	-	-	0.1700	-
WTS-57	Whale Tail South	Total Alkalinity	17.4000	1.000	mg/L	-	-	9.6000	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
WTS-57	Whale Tail South	Total phosphorous	***0.0075***	0.002	mg/L	-	0.004	0.0045	-
WTS-58	Whale Tail South	Bicarbonate alkalinity	17.7000	1.000	mg/L	-	-	9.6000	-
WTS-58	Whale Tail South	Calcium (T)	12.2000	0.050	mg/L	-	-	4.6000	-
WTS-58	Whale Tail South	Conductivity	122.0000	2.000	µS/cm	-	-	48.6000	-
WTS-58	Whale Tail South	Hardness	43.4000	0.600	mg/L	-	-	17.4000	-
WTS-58	Whale Tail South	Lithium (D)	0.0026	0.001	mg/L	-	-	0.0020	-
WTS-58	Whale Tail South	Lithium (T)	0.0024	0.001	mg/L	-	-	0.0020	-
WTS-58	Whale Tail South	Magnesium (T)	3.1400	0.005	mg/L	-	-	1.4100	-
WTS-58	Whale Tail South	Potassium (T)	2.7600	0.050	mg/L	-	-	0.8400	-
WTS-58	Whale Tail South	Reactive silica	1.7100	0.500	mg/L	-	-	1.3300	-
WTS-58	Whale Tail South	Silicon (D)	0.7470	0.050	mg/L	-	-	0.5700	-
WTS-58	Whale Tail South	Silicon (T)	0.7900	0.100	mg/L	-	-	0.6100	-
WTS-58	Whale Tail South	Sodium (T)	2.2700	0.050	mg/L	-	-	0.9700	-
WTS-58	Whale Tail South	TDS	89.3000	10.000	mg/L	-	-	38.5000	-
WTS-58	Whale Tail South	TKN	0.2700	0.050	mg/L	-	-	0.1700	-
WTS-58	Whale Tail South	Total Alkalinity	17.7000	1.000	mg/L	-	-	9.6000	-
WTS-58	Whale Tail South	Total phosphorous	***0.0059***	0.002	mg/L	-	0.004	0.0045	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]

[1]Bold values are above the threshold as well as above the trigger value.

[2]Results failing to meet reliability checks are indicated as uncertain.

2.1 Result Reliability Checks

Two preliminary analyses were conducted to assess the reliability of sample results. Samples failing either one of these tests have been flagged as uncertain, and warrant further evaluation.

The first analysis compares dissolved and total concentrations for a given parameters at each location. Samples where dissolved concentrations are greater than total with a relative percent difference (RPD) of more than 30% are considered potentially unreliable. All samples failing to meet this reliability check are summarized in Table 6.

The second analysis compares parameter concentrations from the two sampling stations located within each water body (either lake or basin). Parameters for which the difference between these two intra-lake samples was greater than a factor of 5 (or a factor of 10 if at least one of the samples was within a factor of 10 of the MDL) are considered potentially unreliable. All samples failing to meet this reliability check are summarized in Table 7.

Table 6: Samples with uncertain reliability due to differences in dissolved and total parameter results.

Area	Sample ID	ID_Name	Parameter	Result (T)	Result (D)	MDL (T)	MDL (D)	RPD
Meadowbank	PDL-94	Pipedream	Lead	0.00005	0.00168	MDL	-	188.4
Meadowbank	TEFF-53	Tehek - Far Field	Copper	0.0005	0.00156	MDL	-	102.9
Meadowbank	INUG-129	Inuggugayualik	Manganese	0.00045	0.00115	-	-	87.5
Meadowbank	PDL-94	Pipedream	Tin	0.0001	0.00017	MDL	-	51.9
Meadowbank	SP-141	Second Portage	Lead	0.00005	0.000071	MDL	-	34.7
Whale Tail Pit	WTS-57	Whale Tail South	Selenium	0.00005	0.000083	MDL	-	49.6

Table 7: Samples with uncertain reliability due to differences between results from the same sampling area.

Area	**ID**	**ID_Name**	**Parameter**	**Difference**	**Threshold[1]**
Whale Tail Pit	A20	Lake A20	Manganese (D)	50.41237	10
Whale Tail Pit	A20	Lake A20	Manganese (T)	46.25000	5
Meadowbank	PDL	Pipedream	Lead (D)	31.11111	10
Whale Tail Pit	A20	Lake A20	Nitrite-N	15.18182	10

[1]Threshold is set at a factor of 5, unless one or more sample is within a factor of 10 of the MDL in which case the threshold is set at a factor of 10.

3. Laboratory & Field Quality Control Results

ALS' laboratory QC samples for water are:

- *Laboratory duplicates* (LD) - these samples provide insights into the precision of laboratory analyses. Duplicate aliquots are taken from the samples and run through part (aliquots taken post digestion) or all (aliquots taken from the sample bottle) the laboratory analytical process.
- *Laboratory control samples* (LCS) - these samples provide insights into whether the laboratory systems are working as intended. They are comprised of a mixture of analyte-free water to which known amounts of the method analytes are added. They are essentially an internal version of a certified reference material.
- *Matrix spikes* (MS) - these samples involve the analysis of actual samples, to which a known amount of method analytes are added in amounts high enough that the spikes are clearly discernible relative to existing concentrations. These samples provide insights into the degree that the sample matrix could interfere with analyses.
- *Matrix blanks* (MB) - these samples are analyzed to assess background interference or contamination that exists in the analytical system that could lead to elevated concentrations or false positive data. These samples are comprised of analyte-free water.

The following field QC samples were collected and submitted blind to ALS:

- *Field duplicates* (FD) - these samples provide insights into (a) variability in field conditions and (b) the precision of laboratory analyses. Duplicate samples are collected from the same location and treated independently through the sampling and analysis process.
- *Deionized blanks* (DB) - these samples are analyzed to verify the "analyte-free" status of the deionized water to help interpret the equipment blank results. These samples are comprised of deionized water poured directly into the sampling containers.
- *Equipment blanks* (EB) - these samples are analyzed to assess cross contamination in the sampling equipment that could lead to elevated concentrations or false positive data. These samples are comprised of analyte-free deionized water passed through the sampling equipment.
- *Travel blanks* (TB) - these samples are analyzed to assess cross contamination occurring during the transport of samples. These samples comprise analyte-free deionized water prepared in the lab by ALS, and travel to the site and back to the lab without being opened.

3.1 Overall QC Results

Overall laboratory and field QC results are summarized in Table 8.

Table 8: Summary of laboratory and field QC results by sample type.

	QC_Element	Pass	Fail	ND
Laboratory	Lab Duplicate	556	6	0
	Lab Control Sample	433	0	0
	Matrix Spike	373	0	40
	Matrix Blank	439	0	0
Field	Field Duplicate	441	3	1
	Deionized Water Blank	105	0	0
	Equipment Blank	104	1	0

3.2 Laboratory Duplicates

In this sampling event, 6 laboratory duplicates failed to meet the QC objectives. Laboratory duplicate results not meeting QC objectives are summarized in Table 9.

Table 9: Details for laboratory duplicate results not meeting QC objectives.

QC_Lot	ALS_QC_ID[1]	Analyte	RPD	DIFFx	LD.QC
173694	ANONYMOUS	cadmium, total	199.6	9,230.6	Fail
173694	ANONYMOUS	cobalt, total	199.6	580,416.0	Fail
176970	ANONYMOUS	Kjeldahl nitrogen, total [TKN]	23.9	2.9	Fail
176426	ANONYMOUS	cadmium, dissolved	199.6	28,573.6	Fail
176426	ANONYMOUS	cobalt, dissolved	199.6	163,838.0	Fail
176426	ANONYMOUS	selenium, dissolved	199.6	161,239.0	Fail

[1]ALS_QC_ID listing of 'Anonymous' indicates QC sample from another client used.

3.3 Laboratory Control Samples

All laboratory control sample results met laboratory QC objectives.

3.4 Matrix Spike

All matrix spike results met laboratory QC objectives.

In addition, some parameters had spike levels too low to confidently quantify them relative to existing concentrations in the sample. Consequently, QC results for these results could not be calculated (see Table 10).

Table 10: Analytes not determined for matrix spikes.

QC_Lot	Analyte	ALS_QC_ID[1]
172828	phosphorus, total	Anonymous
172827	carbon, total organic [TOC]	Anonymous
173619	magnesium, total	TE-100
173619	strontium, total	TE-100
173694	calcium, total	Anonymous
173694	cobalt, total	Anonymous
173694	magnesium, total	Anonymous
173694	manganese, total	Anonymous
173694	nickel, total	Anonymous
173694	potassium, total	Anonymous
173694	sodium, total	Anonymous
173694	strontium, total	Anonymous
173694	sulfur, total	Anonymous
173694	uranium, total	Anonymous
173209	magnesium, dissolved	TE-100
175009	ammonia, total (as N)	Anonymous
175007	carbon, total organic [TOC]	Anonymous
174426	barium, total	WTS-57
174426	calcium, total	WTS-57
174426	magnesium, total	WTS-57
174426	manganese, total	WTS-57
174426	sodium, total	WTS-57

QC_Lot	Analyte	ALS_QC_ID[1]
174426	strontium, total	WTS-57
174539	barium, dissolved	WTS-57
174539	calcium, dissolved	WTS-57
174539	magnesium, dissolved	WTS-57
174539	manganese, dissolved	WTS-57
174539	sodium, dissolved	WTS-57
174539	strontium, dissolved	WTS-57
175965	magnesium, total	TPN-140
175997	magnesium, total	March Dup-2
176426	barium, dissolved	Anonymous
176426	calcium, dissolved	Anonymous
176426	magnesium, dissolved	Anonymous
176426	manganese, dissolved	Anonymous
176426	nickel, dissolved	Anonymous
176426	sodium, dissolved	Anonymous
176426	strontium, dissolved	Anonymous
176426	sulfur, dissolved	Anonymous
176426	uranium, dissolved	Anonymous

[1]ALS_QC_ID listing of 'Anonymous' indicates QC sample from another client used.

3.5 Matrix Blank

All matrix blank results met laboratory QC objectives.

3.6 Field Duplicates

In this sampling event, 3 field duplicate samples failed to meet the QC objectives. Field duplicate sample results not meeting QC objectives are summarized in Table 11.

In addition, some field duplicate samples could not be appropriately compared to other samples due to differences in detection limits. Consequently, QC results for these results could not be calculated (see Table 12).

Table 11: Details for field duplicate results not meeting QC objectives.

QC_Lot.x	Analyte	RPD	DIFFx	FD.QC
172829	ammonia, total (as N)	98.4	3.8	Fail
173233	lead, dissolved	118.8	3.2	Fail
175007	carbon, total organic [TOC]	55.2	4.1	Fail

Table 12: Details for field duplicate results which could not be determined.

QC_Lot.x	Analyte	RPD	DIFFx	FD.QC
174285	monomethylarsonic acid [MMA], (as As)	62.3		ND

3.7 DI Blank

All deionized water blank results met laboratory QC objectives.

3.8 Equipment Blank

In this sampling event, 1 equipment blank sample failed to meet the QC objectives. Equipment blank results not meeting QC objectives are summarized in Table 13.

Table 13: Details for equipment blank results not meeting QC objectives.

QC_Lot	ID	Analyte	Results	DL	FB.QC
175997	EB	molybdenum, total	0.0118	0.00005	Fail

3.9 Travel Blank

Travel blank results were not analyzed in this sampling event.

3.10 Holding Time Exceedances

In addition to those ALS laboratory QC samples described above, during QC screening samples were also assessed agianst recommended hold times. Parameters and associated sample numbers exceeding recommended hold times in this sampling event are shown in Table 14. Note that pH is included in the suite of field measurements and has a very short recommended hold time, so exceeding the hold time for laboratory analysis is expected and of little importance.

Table 14: Analytes and associated number of samples exceeding holding times.

ALS_Method	n
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)	30
pH by Meter	27
Chlorophyll-a by Fluorometry (Field Filtered µg)	5
Total Cyanide by CFA (Low Level)	5
Dissolved Mercury in Water by CVAAS	4
TDS by Gravimetry (Low Level)	3
Total Mercury in Water by CVAAS	1
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	1

Meadowbank Mine - Water Quality Monitoring 2021

Preliminary Screening of May, 2021 Water Quality Monitoring

Azimuth Consulting Group Inc.
on behalf of Agnico Eagle Mines Ltd.

Report Date: 2021-11-01

Table of Contents

1. Introduction & Sampling Overview

This document was prepared by Azimuth Consulting Group Inc (Azimuth) to provide the Meadowbank Environment Department with a brief overview of the water chemistry results collected in May, 2021 as part of the Core Receiving Environment Monitoring Program (CREMP). CREMP water quality monitoring occurs in all summer months (July - September) as well as two through-ice sampling events in March and May. CREMP monitoring occurs at near-field, mid-field, and far-field stations in three distinct areas - the Meadowbank Mine Project, The Whale Tail Pit Project, and Baker Lake, however sampling does not occur at all stations or all areas in each sampling event. The purpose of this preliminary document is to:

1. Screen the water chemistry results from ALS against the trigger values to keep the Environment Department informed about potential changes in water quality, including the early identification of potentially anomalous data (Section 2).

2. Review the data for laboratory QC issues (blanks, duplicates, matrix spikes, etc.) and potential field quality assurance (QA) concerns, ensuring that questionable results are verified by reanalysis (Section 3).

Samples included in this report are shown in Table 1, while field blanks are shown in Table 2.

Table 1: Summary of May, 2021 samples.

Area	Sample ID	ID	ID_Name	Duplicate	Date_Sampled
Meadowbank					
	INUG-130	INUG	Inuggugayualik	-	2021-05-11
	INUG-131	INUG	Inuggugayualik	-	2021-05-11
	PDL-95	PDL	Pipedream	-	2021-05-09
	PDL-96	PDL	Pipedream	MAY DUP-1	2021-05-09
	SP-142	SP	Second Portage	-	2021-05-09
	SP-143	SP	Second Portage	-	2021-05-09
	TPE-142	TPE	Third Portage - East Basin	-	2021-05-10
	TPE-143	TPE	Third Portage - East Basin	-	2021-05-10
	TPN-142	TPN	Third Portage - North Basin	-	2021-05-10
	TPN-143	TPN	Third Portage - North Basin	-	2021-05-10
	TPS-65	TPS	Third Portage - South Basin	-	2021-05-10
	TPS-66	TPS	Third Portage - South Basin	-	2021-05-10
	WAL-111	WAL	Wally	-	2021-05-09
	WAL-112	WAL	Wally	MAY DUP-2	2021-05-09
Whale Tail Pit					
	A20-53	A20	Lake A20	-	2021-05-12
	A20-54	A20	Lake A20	-	2021-05-12
	A76-51	A76	Lake A76	-	2021-05-07
	A76-52	A76	Lake A76	-	2021-05-07
	DS1-49	DS1	Lake DS1	-	2021-05-07
	DS1-50	DS1	Lake DS1	-	2021-05-07

Area	Sample ID	ID	ID_Name	Duplicate	Date_Sampled
	MAM-59	MAM	Mammoth	-	2021-05-12
	MAM-60	MAM	Mammoth	MAY DUP-4	2021-05-12
	NEM-59	NEM	Nemo	MAY DUP-3	2021-05-06
	NEM-60	NEM	Nemo	-	2021-05-06
	WTS-59	WTS	Whale Tail South	-	2021-05-12
	WTS-60	WTS	Whale Tail South	-	2021-05-12

Table 2: Summary of field blanks collected in May, 2021.

Client_Sample_ID	ID_Name
MAY DI	DI Blank
MAY EB	Equipment Blank
MAY TB	Travel Blank

2. Trigger Screening

Sampling results were screened relative to relevant triggers and thresholds. A summary of trigger and threshold exceedances is provided in Table 3. Subsequent tables provide all sample results above trigger and threshold values for Meadowbank (Table 4), Whale Tail Pit (Table 5), and Baker Lake (Baker Lake not sampled in this sampling event). Samples exceeding triggers or thresholds but failing reliability checks (see Section 2.1) are labeled as uncertain.

Table 3: Summary of trigger and threshold exceedances in May, 2021.

Area	Parameter	Samples Exceeding Trigger	Samples Exceeding Threshold	Stations
Meadowbank				
	Bicarbonate alkalinity	8	0	PDL-95, SP-142, SP-143, TPE-142, TPE-143, TPN-142, WAL-111, WAL-112
	Calcium (T)	12	0	PDL-95, PDL-96, SP-142, SP-143, TPE-142, TPE-143, TPN-142, TPN-143, TPS-65, TPS-66, WAL-111, WAL-112
	Chromium (D)	14	0	INUG-130, INUG-131, PDL-95, PDL-96, SP-142, SP-143, TPE-142, TPE-143, TPN-142, TPN-143, TPS-65, TPS-66, WAL-111, WAL-112
	Conductivity	11	0	PDL-95, SP-142, SP-143, TPE-142, TPE-143, TPN-142, TPN-143, TPS-65, TPS-66, WAL-111, WAL-112
	Fluoride	3	0	SP-142, TPE-142, TPE-143

Area	Parameter	Samples Exceeding Trigger	Samples Exceeding Threshold	Stations
	Hardness	12	0	PDL-95, PDL-96, SP-142, SP-143, TPE-142, TPE-143, TPN-142, TPN-143, TPS-65, TPS-66, WAL-111, WAL-112
	Magnesium (T)	12	0	INUG-130, PDL-95, SP-142, SP-143, TPE-142, TPE-143, TPN-142, TPN-143, TPS-65, TPS-66, WAL-111, WAL-112
	Potassium (T)	9	0	SP-142, SP-143, TPE-142, TPE-143, TPN-142, TPN-143, TPS-66, WAL-111, WAL-112
	Reactive silica	2	0	WAL-111, WAL-112
	Silicon (D)	4	0	SP-142, SP-143, WAL-111, WAL-112
	Silicon (T)	6	0	INUG-130, INUG-131, SP-142, SP-143, WAL-111, WAL-112
	Sodium (T)	8	0	TPE-142, TPE-143, TPN-142, TPN-143, TPS-65, TPS-66, WAL-111, WAL-112
	TDS	13	0	INUG-130, INUG-131, PDL-95, SP-142, SP-143, TPE-142, TPE-143, TPN-142, TPN-143, TPS-65, TPS-66, WAL-111, WAL-112
	Total Alkalinity	8	0	PDL-95, SP-142, SP-143, TPE-142, TPE-143, TPN-142, WAL-111, WAL-112
	Total phosphorous	1	1	TPN-143
Whale Tail Pit				

Area	Parameter	Samples Exceeding Trigger	Samples Exceeding Threshold	Stations
	Bicarbonate alkalinity	10	0	A20-54, A76-51, A76-52, DS1-49, MAM-59, MAM-60, NEM-59, NEM-60, WTS-59, WTS-60
	Calcium (T)	11	0	A20-53, A20-54, A76-51, A76-52, DS1-49, MAM-59, MAM-60, NEM-59, NEM-60, WTS-59, WTS-60
	Conductivity	10	0	A20-54, A76-51, A76-52, DS1-49, MAM-59, MAM-60, NEM-59, NEM-60, WTS-59, WTS-60
	Hardness	10	0	A20-54, A76-51, A76-52, DS1-49, MAM-59, MAM-60, NEM-59, NEM-60, WTS-59, WTS-60
	Lithium (D)	5	0	MAM-59, MAM-60, NEM-60, WTS-59, WTS-60
	Lithium (T)	6	0	MAM-59, MAM-60, NEM-59, NEM-60, WTS-59, WTS-60
	Magnesium (T)	10	0	A20-54, A76-51, A76-52, DS1-49, MAM-59, MAM-60, NEM-59, NEM-60, WTS-59, WTS-60
	Nitrate-N	1	0	MAM-60
	Potassium (T)	11	0	A20-53, A20-54, A76-51, A76-52, DS1-49, MAM-59, MAM-60, NEM-59, NEM-60, WTS-59, WTS-60
	Reactive silica	7	0	A76-51, A76-52, DS1-49, MAM-59, MAM-60, WTS-59, WTS-60
	Silicon (D)	8	0	A20-54, A76-51, A76-52, DS1-49, MAM-59, MAM-60, WTS-59, WTS-60
	Silicon (T)	8	0	A20-54, A76-51, A76-52, DS1-49, MAM-59, MAM-60, WTS-59, WTS-60

Area	Parameter	Samples Exceeding Trigger	Samples Exceeding Threshold	Stations
	Sodium (T)	12	0	A20-53, A20-54, A76-51, A76-52, DS1-49, DS1-50, MAM-59, MAM-60, NEM-59, NEM-60, WTS-59, WTS-60
	TDS	10	0	A20-54, A76-51, A76-52, DS1-49, MAM-59, MAM-60, NEM-59, NEM-60, WTS-59, WTS-60
	TKN	6	0	A20-54, DS1-49, MAM-59, MAM-60, WTS-59, WTS-60
	Total Alkalinity	10	0	A20-54, A76-51, A76-52, DS1-49, MAM-59, MAM-60, NEM-59, NEM-60, WTS-59, WTS-60
	Total phosphorous	2	2	A76-51, DS1-49
	Zinc (D)	1	0	DS1-50

* Indicates samples which failed reliability checks and are consequently uncertain.

Table 4: Trigger and threshold exceedances at Meadowbank sampling stations.

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
INUG-130	Inuggugayualik	Chromium (D)	0.0005	0.0005	mg/L	MDL	0.005	0.00026	-
INUG-130	Inuggugayualik	Magnesium (T)	0.9760	0.0050	mg/L	-	-	0.93000	-
INUG-130	Inuggugayualik	Silicon (T)	0.2300	0.1000	mg/L	-	-	0.20000	-
INUG-130	Inuggugayualik	TDS	20.6000	3.0000	mg/L	-	-	19.00000	-
INUG-131	Inuggugayualik	Chromium (D)	0.0005	0.0005	mg/L	MDL	0.005	0.00026	-
INUG-131	Inuggugayualik	Silicon (T)	0.2100	0.1000	mg/L	-	-	0.20000	-
INUG-131	Inuggugayualik	TDS	19.2000	3.0000	mg/L	-	-	19.00000	-
PDL-95	Pipedream	Bicarbonate alkalinity	9.3000	1.0000	mg/L	-	-	8.70000	-
PDL-95	Pipedream	Calcium (T)	3.0000	0.0500	mg/L	-	-	2.39000	-
PDL-95	Pipedream	Chromium (D)	0.0005	0.0005	mg/L	MDL	0.005	0.00026	-
PDL-95	Pipedream	Conductivity	28.2000	2.0000	µS/cm	-	-	27.40000	-
PDL-95	Pipedream	Hardness	11.5000	0.6000	mg/L	-	-	9.50000	-
PDL-95	Pipedream	Magnesium (T)	0.9780	0.0050	mg/L	-	-	0.93000	-
PDL-95	Pipedream	TDS	21.0000	3.0000	mg/L	-	-	19.00000	-
PDL-95	Pipedream	Total Alkalinity	9.3000	1.0000	mg/L	-	-	8.70000	-
PDL-96	Pipedream	Calcium (T)	2.6500	0.0500	mg/L	-	-	2.39000	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
PDL-96	Pipedream	Chromium (D)	0.0005	0.0005	mg/L	MDL	0.005	0.00026	-
PDL-96	Pipedream	Hardness	10.2000	0.6000	mg/L	-	-	9.50000	-
SP-142	Second Portage	Bicarbonate alkalinity	13.2000	1.0000	mg/L	-	-	8.70000	-
SP-142	Second Portage	Calcium (T)	4.4500	0.0500	mg/L	-	-	2.39000	-
SP-142	Second Portage	Chromium (D)	0.0005	0.0005	mg/L	MDL	0.005	0.00026	-
SP-142	Second Portage	Conductivity	46.2000	2.0000	µS/cm	-	-	27.40000	-
SP-142	Second Portage	Fluoride	0.0890	0.0200	mg/L	-	0.12	0.08800	-
SP-142	Second Portage	Hardness	17.1000	0.6000	mg/L	-	-	9.50000	-
SP-142	Second Portage	Magnesium (T)	1.4600	0.0050	mg/L	-	-	0.93000	-
SP-142	Second Portage	Potassium (T)	0.6680	0.0500	mg/L	-	-	0.58000	-
SP-142	Second Portage	Silicon (D)	0.2810	0.0500	mg/L	-	-	0.18000	-
SP-142	Second Portage	Silicon (T)	0.3200	0.1000	mg/L	-	-	0.20000	-
SP-142	Second Portage	TDS	30.8000	3.0000	mg/L	-	-	19.00000	-
SP-142	Second Portage	Total Alkalinity	13.2000	1.0000	mg/L	-	-	8.70000	-
SP-143	Second Portage	Bicarbonate alkalinity	12.4000	1.0000	mg/L	-	-	8.70000	-
SP-143	Second Portage	Calcium (T)	4.0600	0.0500	mg/L	-	-	2.39000	-
SP-143	Second Portage	Chromium (D)	0.0005	0.0005	mg/L	MDL	0.005	0.00026	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
SP-143	Second Portage	Conductivity	44.1000	2.0000	µS/cm	-	-	27.40000	-
SP-143	Second Portage	Hardness	15.6000	0.6000	mg/L	-	-	9.50000	-
SP-143	Second Portage	Magnesium (T)	1.3400	0.0050	mg/L	-	-	0.93000	-
SP-143	Second Portage	Potassium (T)	0.6150	0.0500	mg/L	-	-	0.58000	-
SP-143	Second Portage	Silicon (D)	0.2660	0.0500	mg/L	-	-	0.18000	-
SP-143	Second Portage	Silicon (T)	0.2900	0.1000	mg/L	-	-	0.20000	-
SP-143	Second Portage	TDS	30.4000	3.0000	mg/L	-	-	19.00000	-
SP-143	Second Portage	Total Alkalinity	12.4000	1.0000	mg/L	-	-	8.70000	-
TPE-142	Third Portage - East Basin	Bicarbonate alkalinity	9.0000	1.0000	mg/L	-	-	8.70000	-
TPE-142	Third Portage - East Basin	Calcium (T)	3.5800	0.0500	mg/L	-	-	2.39000	-
TPE-142	Third Portage - East Basin	Chromium (D)	0.0005	0.0005	mg/L	MDL	0.005	0.00026	-
TPE-142	Third Portage - East Basin	Conductivity	38.8000	2.0000	µS/cm	-	-	27.40000	-
TPE-142	Third Portage - East Basin	Fluoride	0.0950	0.0200	mg/L	-	0.12	0.08800	-
TPE-142	Third Portage - East Basin	Hardness	14.2000	0.6000	mg/L	-	-	9.50000	-
TPE-142	Third Portage - East Basin	Magnesium (T)	1.2700	0.0050	mg/L	-	-	0.93000	-
TPE-142	Third Portage - East Basin	Potassium (T)	0.6790	0.0500	mg/L	-	-	0.58000	-
TPE-142	Third Portage - East Basin	Sodium (T)	1.3600	0.0500	mg/L	-	-	1.16000	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
TPE-142	Third Portage - East Basin	TDS	27.0000	3.0000	mg/L	-	-	19.00000	-
TPE-142	Third Portage - East Basin	Total Alkalinity	9.0000	1.0000	mg/L	-	-	8.70000	-
TPE-143	Third Portage - East Basin	Bicarbonate alkalinity	9.3000	1.0000	mg/L	-	-	8.70000	-
TPE-143	Third Portage - East Basin	Calcium (T)	3.5600	0.0500	mg/L	-	-	2.39000	-
TPE-143	Third Portage - East Basin	Chromium (D)	0.0005	0.0005	mg/L	MDL	0.005	0.00026	-
TPE-143	Third Portage - East Basin	Conductivity	39.3000	2.0000	µS/cm	-	-	27.40000	-
TPE-143	Third Portage - East Basin	Fluoride	0.0970	0.0200	mg/L	-	0.12	0.08800	-
TPE-143	Third Portage - East Basin	Hardness	14.2000	0.6000	mg/L	-	-	9.50000	-
TPE-143	Third Portage - East Basin	Magnesium (T)	1.2800	0.0050	mg/L	-	-	0.93000	-
TPE-143	Third Portage - East Basin	Potassium (T)	0.6890	0.0500	mg/L	-	-	0.58000	-
TPE-143	Third Portage - East Basin	Sodium (T)	1.4000	0.0500	mg/L	-	-	1.16000	-
TPE-143	Third Portage - East Basin	TDS	25.4000	3.0000	mg/L	-	-	19.00000	-
TPE-143	Third Portage - East Basin	Total Alkalinity	9.3000	1.0000	mg/L	-	-	8.70000	-
TPN-142	Third Portage - North Basin	Bicarbonate alkalinity	9.3000	1.0000	mg/L	-	-	8.70000	-
TPN-142	Third Portage - North Basin	Calcium (T)	3.1600	0.0500	mg/L	-	-	2.39000	-
TPN-142	Third Portage - North Basin	Chromium (D)	0.0005	0.0005	mg/L	MDL	0.005	0.00026	-
TPN-142	Third Portage - North Basin	Conductivity	37.0000	2.0000	µS/cm	-	-	27.40000	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
TPN-142	Third Portage - North Basin	Hardness	12.7000	0.6000	mg/L	-	-	9.50000	-
TPN-142	Third Portage - North Basin	Magnesium (T)	1.1600	0.0050	mg/L	-	-	0.93000	-
TPN-142	Third Portage - North Basin	Potassium (T)	0.6590	0.0500	mg/L	-	-	0.58000	-
TPN-142	Third Portage - North Basin	Sodium (T)	1.3600	0.0500	mg/L	-	-	1.16000	-
TPN-142	Third Portage - North Basin	TDS	28.4000	3.0000	mg/L	-	-	19.00000	-
TPN-142	Third Portage - North Basin	Total Alkalinity	9.3000	1.0000	mg/L	-	-	8.70000	-
TPN-143	Third Portage - North Basin	Calcium (T)	3.0400	0.0500	mg/L	-	-	2.39000	-
TPN-143	Third Portage - North Basin	Chromium (D)	0.0005	0.0005	mg/L	MDL	0.005	0.00026	-
TPN-143	Third Portage - North Basin	Conductivity	37.2000	2.0000	µS/cm	-	-	27.40000	-
TPN-143	Third Portage - North Basin	Hardness	12.3000	0.6000	mg/L	-	-	9.50000	-
TPN-143	Third Portage - North Basin	Magnesium (T)	1.1500	0.0050	mg/L	-	-	0.93000	-
TPN-143	Third Portage - North Basin	Potassium (T)	0.6520	0.0500	mg/L	-	-	0.58000	-
TPN-143	Third Portage - North Basin	Sodium (T)	1.3300	0.0500	mg/L	-	-	1.16000	-
TPN-143	Third Portage - North Basin	TDS	25.6000	3.0000	mg/L	-	-	19.00000	-
TPN-143	Third Portage - North Basin	Total phosphorous	***0.0054***	0.0020	mg/L	-	0.004	0.00510	-
TPS-65	Third Portage - South Basin	Calcium (T)	2.7600	0.0500	mg/L	-	-	2.39000	-
TPS-65	Third Portage - South Basin	Chromium (D)	0.0005	0.0005	mg/L	MDL	0.005	0.00026	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
TPS-65	Third Portage - South Basin	Conductivity	32.7000	2.0000	µS/cm	-	-	27.40000	-
TPS-65	Third Portage - South Basin	Hardness	11.2000	0.6000	mg/L	-	-	9.50000	-
TPS-65	Third Portage - South Basin	Magnesium (T)	1.0400	0.0050	mg/L	-	-	0.93000	-
TPS-65	Third Portage - South Basin	Sodium (T)	1.2100	0.0500	mg/L	-	-	1.16000	-
TPS-65	Third Portage - South Basin	TDS	23.0000	3.0000	mg/L	-	-	19.00000	-
TPS-66	Third Portage - South Basin	Calcium (T)	2.8100	0.0500	mg/L	-	-	2.39000	-
TPS-66	Third Portage - South Basin	Chromium (D)	0.0005	0.0005	mg/L	MDL	0.005	0.00026	-
TPS-66	Third Portage - South Basin	Conductivity	33.5000	2.0000	µS/cm	-	-	27.40000	-
TPS-66	Third Portage - South Basin	Hardness	11.3000	0.6000	mg/L	-	-	9.50000	-
TPS-66	Third Portage - South Basin	Magnesium (T)	1.0400	0.0050	mg/L	-	-	0.93000	-
TPS-66	Third Portage - South Basin	Potassium (T)	0.5910	0.0500	mg/L	-	-	0.58000	-
TPS-66	Third Portage - South Basin	Sodium (T)	1.2200	0.0500	mg/L	-	-	1.16000	-
TPS-66	Third Portage - South Basin	TDS	22.6000	3.0000	mg/L	-	-	19.00000	-
WAL-111	Wally	Bicarbonate alkalinity	19.0000	1.0000	mg/L	-	-	17.80000	-
WAL-111	Wally	Calcium (T)	7.0200	0.0500	mg/L	-	-	4.88000	-
WAL-111	Wally	Chromium (D)	0.0005	0.0005	mg/L	MDL	0.005	0.00026	-
WAL-111	Wally	Conductivity	58.2000	2.0000	µS/cm	-	-	36.60000	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
WAL-111	Wally	Hardness	25.7000	0.6000	mg/L	-	-	16.70000	-
WAL-111	Wally	Magnesium (T)	1.9800	0.0050	mg/L	-	-	1.36000	-
WAL-111	Wally	Potassium (T)	0.6820	0.0500	mg/L	-	-	0.59000	-
WAL-111	Wally	Reactive silica	1.8300	0.5000	mg/L	-	-	1.08000	-
WAL-111	Wally	Silicon (D)	0.7980	0.0500	mg/L	-	-	0.67000	-
WAL-111	Wally	Silicon (T)	0.8900	0.1000	mg/L	-	-	0.65000	-
WAL-111	Wally	Sodium (T)	0.8520	0.0500	mg/L	-	-	0.72000	-
WAL-111	Wally	TDS	50.5000	10.0000	mg/L	-	-	25.30000	-
WAL-111	Wally	Total Alkalinity	19.0000	1.0000	mg/L	-	-	17.80000	-
WAL-112	Wally	Bicarbonate alkalinity	18.8000	1.0000	mg/L	-	-	17.80000	-
WAL-112	Wally	Calcium (T)	6.9200	0.0500	mg/L	-	-	4.88000	-
WAL-112	Wally	Chromium (D)	0.0005	0.0005	mg/L	MDL	0.005	0.00026	-
WAL-112	Wally	Conductivity	58.8000	2.0000	µS/cm	-	-	36.60000	-
WAL-112	Wally	Hardness	25.2000	0.6000	mg/L	-	-	16.70000	-
WAL-112	Wally	Magnesium (T)	1.9300	0.0050	mg/L	-	-	1.36000	-
WAL-112	Wally	Potassium (T)	0.6560	0.0500	mg/L	-	-	0.59000	-
WAL-112	Wally	Reactive silica	1.7700	0.5000	mg/L	-	-	1.08000	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
WAL-112	Wally	Silicon (D)	0.8050	0.0500	mg/L	-	-	0.67000	-
WAL-112	Wally	Silicon (T)	0.8800	0.1000	mg/L	-	-	0.65000	-
WAL-112	Wally	Sodium (T)	0.8310	0.0500	mg/L	-	-	0.72000	-
WAL-112	Wally	TDS	50.8000	10.0000	mg/L	-	-	25.30000	-
WAL-112	Wally	Total Alkalinity	18.8000	1.0000	mg/L	-	-	17.80000	-

[1]Bold values are above the threshold as well as above the trigger value.

[2]Results failing to meet reliability checks are indicated as uncertain.

Table 5: Trigger and threshold exceedances at Whale Tail Pit sampling stations

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
A20-53	Lake A20	Calcium (T)	4.6700	0.050	mg/L	-	-	4.6000	-
A20-53	Lake A20	Potassium (T)	1.1100	0.050	mg/L	-	-	0.8400	-
A20-53	Lake A20	Sodium (T)	1.0400	0.050	mg/L	-	-	0.9700	-
A20-54	Lake A20	Bicarbonate alkalinity	16.6000	1.000	mg/L	-	-	9.6000	-
A20-54	Lake A20	Calcium (T)	10.1000	0.050	mg/L	-	-	4.6000	-
A20-54	Lake A20	Conductivity	94.5000	2.000	µS/cm	-	-	48.6000	-
A20-54	Lake A20	Hardness	35.8000	0.600	mg/L	-	-	17.4000	-
A20-54	Lake A20	Magnesium (T)	2.5600	0.005	mg/L	-	-	1.4100	-
A20-54	Lake A20	Potassium (T)	2.0900	0.050	mg/L	-	-	0.8400	-
A20-54	Lake A20	Silicon (D)	0.6270	0.050	mg/L	-	-	0.5700	-
A20-54	Lake A20	Silicon (T)	0.6400	0.100	mg/L	-	-	0.6100	-
A20-54	Lake A20	Sodium (T)	1.9900	0.050	mg/L	-	-	0.9700	-
A20-54	Lake A20	TDS	69.8000	10.000	mg/L	-	-	38.5000	-
A20-54	Lake A20	TKN	0.2110	0.050	mg/L	-	-	0.1700	-
A20-54	Lake A20	Total Alkalinity	16.6000	1.000	mg/L	-	-	9.6000	-
A76-51	Lake A76	Bicarbonate alkalinity	12.4000	1.000	mg/L	-	-	9.6000	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
A76-51	Lake A76	Calcium (T)	12.4000	0.050	mg/L	-	-	4.6000	-
A76-51	Lake A76	Conductivity	127.0000	2.000	µS/cm	-	-	48.6000	-
A76-51	Lake A76	Hardness	42.8000	0.600	mg/L	-	-	17.4000	-
A76-51	Lake A76	Magnesium (T)	2.8800	0.005	mg/L	-	-	1.4100	-
A76-51	Lake A76	Potassium (T)	2.2700	0.050	mg/L	-	-	0.8400	-
A76-51	Lake A76	Reactive silica	1.3900	0.500	mg/L	-	-	1.3300	-
A76-51	Lake A76	Silicon (D)	0.7070	0.050	mg/L	-	-	0.5700	-
A76-51	Lake A76	Silicon (T)	0.7600	0.100	mg/L	-	-	0.6100	-
A76-51	Lake A76	Sodium (T)	1.8000	0.050	mg/L	-	-	0.9700	-
A76-51	Lake A76	TDS	84.7000	10.000	mg/L	-	-	38.5000	-
A76-51	Lake A76	Total Alkalinity	12.4000	1.000	mg/L	-	-	9.6000	-
A76-51	Lake A76	Total phosphorous	***0.0122***	0.002	mg/L	-	0.004	0.0045	-
A76-52	Lake A76	Bicarbonate alkalinity	13.2000	1.000	mg/L	-	-	9.6000	-
A76-52	Lake A76	Calcium (T)	12.9000	0.050	mg/L	-	-	4.6000	-
A76-52	Lake A76	Conductivity	122.0000	2.000	µS/cm	-	-	48.6000	-
A76-52	Lake A76	Hardness	44.5000	0.600	mg/L	-	-	17.4000	-
A76-52	Lake A76	Magnesium (T)	2.9900	0.005	mg/L	-	-	1.4100	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
A76-52	Lake A76	Potassium (T)	2.3700	0.050	mg/L	-	-	0.8400	-
A76-52	Lake A76	Reactive silica	1.5800	0.500	mg/L	-	-	1.3300	-
A76-52	Lake A76	Silicon (D)	0.7540	0.050	mg/L	-	-	0.5700	-
A76-52	Lake A76	Silicon (T)	0.7700	0.100	mg/L	-	-	0.6100	-
A76-52	Lake A76	Sodium (T)	1.8500	0.050	mg/L	-	-	0.9700	-
A76-52	Lake A76	TDS	88.3000	10.000	mg/L	-	-	38.5000	-
A76-52	Lake A76	Total Alkalinity	13.2000	1.000	mg/L	-	-	9.6000	-
DS1-49	Lake DS1	Bicarbonate alkalinity	10.7000	1.000	mg/L	-	-	9.6000	-
DS1-49	Lake DS1	Calcium (T)	6.1500	0.050	mg/L	-	-	4.6000	-
DS1-49	Lake DS1	Conductivity	62.8000	2.000	µS/cm	-	-	48.6000	-
DS1-49	Lake DS1	Hardness	22.0000	0.600	mg/L	-	-	17.4000	-
DS1-49	Lake DS1	Magnesium (T)	1.6200	0.005	mg/L	-	-	1.4100	-
DS1-49	Lake DS1	Potassium (T)	1.0800	0.050	mg/L	-	-	0.8400	-
DS1-49	Lake DS1	Reactive silica	2.1900	0.500	mg/L	-	-	1.3300	-
DS1-49	Lake DS1	Silicon (D)	1.0900	0.050	mg/L	-	-	0.5700	-
DS1-49	Lake DS1	Silicon (T)	1.1300	0.100	mg/L	-	-	0.6100	-
DS1-49	Lake DS1	Sodium (T)	1.7200	0.050	mg/L	-	-	0.9700	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
DS1-49	Lake DS1	TDS	43.0000	10.000	mg/L	-	-	38.5000	-
DS1-49	Lake DS1	TKN	0.2620	0.050	mg/L	-	-	0.1700	-
DS1-49	Lake DS1	Total Alkalinity	10.7000	1.000	mg/L	-	-	9.6000	-
DS1-49	Lake DS1	Total phosphorous	***0.0066***	0.002	mg/L	-	0.004	0.0045	-
DS1-50	Lake DS1	Sodium (T)	1.0100	0.050	mg/L	-	-	0.9700	-
DS1-50	Lake DS1	Zinc (D)	0.0026	0.001	mg/L	-	0.003	0.0023	-
MAM-59	Mammoth	Bicarbonate alkalinity	22.3000	1.000	mg/L	-	-	9.6000	-
MAM-59	Mammoth	Calcium (T)	27.0000	0.050	mg/L	-	-	4.6000	-
MAM-59	Mammoth	Conductivity	242.0000	2.000	µS/cm	-	-	48.6000	-
MAM-59	Mammoth	Hardness	90.8000	0.600	mg/L	-	-	17.4000	-
MAM-59	Mammoth	Lithium (D)	0.0039	0.001	mg/L	-	-	0.0020	-
MAM-59	Mammoth	Lithium (T)	0.0037	0.001	mg/L	-	-	0.0020	-
MAM-59	Mammoth	Magnesium (T)	5.6800	0.005	mg/L	-	-	1.4100	-
MAM-59	Mammoth	Potassium (T)	5.0100	0.050	mg/L	-	-	0.8400	-
MAM-59	Mammoth	Reactive silica	2.4300	0.500	mg/L	-	-	1.3300	-
MAM-59	Mammoth	Silicon (D)	1.1600	0.050	mg/L	-	-	0.5700	-
MAM-59	Mammoth	Silicon (T)	1.1800	0.100	mg/L	-	-	0.6100	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
MAM-59	Mammoth	Sodium (T)	3.3900	0.050	mg/L	-	-	0.9700	-
MAM-59	Mammoth	TDS	187.0000	15.000	mg/L	-	-	38.5000	-
MAM-59	Mammoth	TKN	0.2270	0.050	mg/L	-	-	0.1700	-
MAM-59	Mammoth	Total Alkalinity	22.3000	1.000	mg/L	-	-	9.6000	-
MAM-60	Mammoth	Bicarbonate alkalinity	26.2000	1.000	mg/L	-	-	9.6000	-
MAM-60	Mammoth	Calcium (T)	35.4000	0.050	mg/L	-	-	4.6000	-
MAM-60	Mammoth	Conductivity	310.0000	2.000	µS/cm	-	-	48.6000	-
MAM-60	Mammoth	Hardness	118.0000	0.600	mg/L	-	-	17.4000	-
MAM-60	Mammoth	Lithium (D)	0.0050	0.001	mg/L	-	-	0.0020	-
MAM-60	Mammoth	Lithium (T)	0.0051	0.001	mg/L	-	-	0.0020	-
MAM-60	Mammoth	Magnesium (T)	7.2000	0.005	mg/L	-	-	1.4100	-
MAM-60	Mammoth	Nitrate-N	1.7900	0.005	mg/L	-	3	1.5000	-
MAM-60	Mammoth	Potassium (T)	6.0800	0.050	mg/L	-	-	0.8400	-
MAM-60	Mammoth	Reactive silica	3.1200	0.500	mg/L	-	-	1.3300	-
MAM-60	Mammoth	Silicon (D)	1.4900	0.050	mg/L	-	-	0.5700	-
MAM-60	Mammoth	Silicon (T)	1.5200	0.100	mg/L	-	-	0.6100	-
MAM-60	Mammoth	Sodium (T)	4.2100	0.050	mg/L	-	-	0.9700	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
MAM-60	Mammoth	TDS	244.0000	15.000	mg/L	-	-	38.5000	-
MAM-60	Mammoth	TKN	0.3440	0.050	mg/L	-	-	0.1700	-
MAM-60	Mammoth	Total Alkalinity	26.2000	1.000	mg/L	-	-	9.6000	-
NEM-59	Nemo	Bicarbonate alkalinity	11.2000	1.000	mg/L	-	-	9.6000	-
NEM-59	Nemo	Calcium (T)	14.4000	0.050	mg/L	-	-	4.6000	-
NEM-59	Nemo	Conductivity	116.0000	2.000	µS/cm	-	-	48.6000	-
NEM-59	Nemo	Hardness	45.6000	0.600	mg/L	-	-	17.4000	-
NEM-59	Nemo	Lithium (T)	0.0024	0.001	mg/L	-	-	0.0020	-
NEM-59	Nemo	Magnesium (T)	2.3300	0.005	mg/L	-	-	1.4100	-
NEM-59	Nemo	Potassium (T)	1.6800	0.050	mg/L	-	-	0.8400	-
NEM-59	Nemo	Sodium (T)	1.1200	0.050	mg/L	-	-	0.9700	-
NEM-59	Nemo	TDS	88.2000	10.000	mg/L	-	-	38.5000	-
NEM-59	Nemo	Total Alkalinity	11.2000	1.000	mg/L	-	-	9.6000	-
NEM-60	Nemo	Bicarbonate alkalinity	12.2000	1.000	mg/L	-	-	9.6000	-
NEM-60	Nemo	Calcium (T)	14.5000	0.050	mg/L	-	-	4.6000	-
NEM-60	Nemo	Conductivity	125.0000	2.000	µS/cm	-	-	48.6000	-
NEM-60	Nemo	Hardness	46.6000	0.600	mg/L	-	-	17.4000	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
NEM-60	Nemo	Lithium (D)	0.0021	0.001	mg/L	-	-	0.0020	-
NEM-60	Nemo	Lithium (T)	0.0024	0.001	mg/L	-	-	0.0020	-
NEM-60	Nemo	Magnesium (T)	2.5200	0.005	mg/L	-	-	1.4100	-
NEM-60	Nemo	Potassium (T)	1.8300	0.050	mg/L	-	-	0.8400	-
NEM-60	Nemo	Sodium (T)	1.2000	0.050	mg/L	-	-	0.9700	-
NEM-60	Nemo	TDS	99.8000	10.000	mg/L	-	-	38.5000	-
NEM-60	Nemo	Total Alkalinity	12.2000	1.000	mg/L	-	-	9.6000	-
WTS-59	Whale Tail South	Bicarbonate alkalinity	16.2000	1.000	mg/L	-	-	9.6000	-
WTS-59	Whale Tail South	Calcium (T)	13.2000	0.050	mg/L	-	-	4.6000	-
WTS-59	Whale Tail South	Conductivity	122.0000	2.000	µS/cm	-	-	48.6000	-
WTS-59	Whale Tail South	Hardness	45.4000	0.600	mg/L	-	-	17.4000	-
WTS-59	Whale Tail South	Lithium (D)	0.0026	0.001	mg/L	-	-	0.0020	-
WTS-59	Whale Tail South	Lithium (T)	0.0026	0.001	mg/L	-	-	0.0020	-
WTS-59	Whale Tail South	Magnesium (T)	3.0200	0.005	mg/L	-	-	1.4100	-
WTS-59	Whale Tail South	Potassium (T)	2.7500	0.050	mg/L	-	-	0.8400	-
WTS-59	Whale Tail South	Reactive silica	1.5300	0.500	mg/L	-	-	1.3300	-
WTS-59	Whale Tail South	Silicon (D)	0.7730	0.050	mg/L	-	-	0.5700	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
WTS-59	Whale Tail South	Silicon (T)	0.8000	0.100	mg/L	-	-	0.6100	-
WTS-59	Whale Tail South	Sodium (T)	2.1900	0.050	mg/L	-	-	0.9700	-
WTS-59	Whale Tail South	TDS	100.0000	10.000	mg/L	-	-	38.5000	-
WTS-59	Whale Tail South	TKN	0.2950	0.050	mg/L	-	-	0.1700	-
WTS-59	Whale Tail South	Total Alkalinity	16.2000	1.000	mg/L	-	-	9.6000	-
WTS-60	Whale Tail South	Bicarbonate alkalinity	16.9000	1.000	mg/L	-	-	9.6000	-
WTS-60	Whale Tail South	Calcium (T)	13.8000	0.050	mg/L	-	-	4.6000	-
WTS-60	Whale Tail South	Conductivity	128.0000	2.000	µS/cm	-	-	48.6000	-
WTS-60	Whale Tail South	Hardness	47.4000	0.600	mg/L	-	-	17.4000	-
WTS-60	Whale Tail South	Lithium (D)	0.0027	0.001	mg/L	-	-	0.0020	-
WTS-60	Whale Tail South	Lithium (T)	0.0026	0.001	mg/L	-	-	0.0020	-
WTS-60	Whale Tail South	Magnesium (T)	3.1500	0.005	mg/L	-	-	1.4100	-
WTS-60	Whale Tail South	Potassium (T)	2.8600	0.050	mg/L	-	-	0.8400	-
WTS-60	Whale Tail South	Reactive silica	1.6500	0.500	mg/L	-	-	1.3300	-
WTS-60	Whale Tail South	Silicon (D)	0.8410	0.050	mg/L	-	-	0.5700	-
WTS-60	Whale Tail South	Silicon (T)	0.8600	0.100	mg/L	-	-	0.6100	-
WTS-60	Whale Tail South	Sodium (T)	2.2600	0.050	mg/L	-	-	0.9700	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
WTS-60	Whale Tail South	TDS	104.0000	10.000	mg/L	-	-	38.5000	-
WTS-60	Whale Tail South	TKN	0.2590	0.050	mg/L	-	-	0.1700	-
WTS-60	Whale Tail South	Total Alkalinity	16.9000	1.000	mg/L	-	-	9.6000	-

[1]Bold values are above the threshold as well as above the trigger value.

[2]Results failing to meet reliability checks are indicated as uncertain.

2.1 Result Reliability Checks

Two preliminary analyses were conducted to assess the reliability of sample results. Samples failing either one of these tests have been flagged as uncertain, and warrant further evaluation.

The first analysis compares dissolved and total concentrations for a given parameters at each location. Samples where dissolved concentrations are greater than total with a relative percent difference (RPD) of more than 30% are considered potentially unreliable. All samples failing to meet this reliability check are summarized in Table 6.

The second analysis compares parameter concentrations from the two sampling stations located within each water body (either lake or basin). Parameters for which the difference between these two intra-lake samples was greater than a factor of 5 (or a factor of 10 if at least one of the samples was within a factor of 10 of the MDL) are considered potentially unreliable. All samples failing to meet this reliability check are summarized in Table 7.

Table 6: Samples with uncertain reliability due to differences in dissolved and total parameter results.

Area	Sample ID	ID_Name	Parameter	Result (T)	Result (D)	MDL (T)	MDL (D)	RPD
Meadowbank	TPE-142	Third Portage - East Basin	Selenium	0.00005	0.000097	MDL	-	63.9
Whale Tail Pit	A20-53	Lake A20	Manganese	0.00105	0.00329	-	-	103.2
Whale Tail Pit	WTS-59	Whale Tail South	Lead	0.00005	0.000073	MDL	-	37.4

Table 7: Samples with uncertain reliability due to differences between results from the same sampling area.

Area	ID	ID_Name	Parameter	Difference	Threshold[1]
Whale Tail Pit	A20	Lake A20	Manganese (T)	10.38095	5

[1]Threshold is set at a factor of 5, unless one or more sample is within a factor of 10 of the MDL in which case the threshold is set at a factor of 10.

3. Laboratory & Field Quality Control Results

ALS' laboratory QC samples for water are:

- *Laboratory duplicates* (LD) - these samples provide insights into the precision of laboratory analyses. Duplicate aliquots are taken from the samples and run through part (aliquots taken post digestion) or all (aliquots taken from the sample bottle) the laboratory analytical process.
- *Laboratory control samples* (LCS) - these samples provide insights into whether the laboratory systems are working as intended. They are comprised of a mixture of analyte-free water to which known amounts of the method analytes are added. They are essentially an internal version of a certified reference material.
- *Matrix spikes* (MS) - these samples involve the analysis of actual samples, to which a known amount of method analytes are added in amounts high enough that the spikes are clearly discernible relative to existing concentrations. These samples provide insights into the degree that the sample matrix could interfere with analyses.
- *Matrix blanks* (MB) - these samples are analyzed to assess background interference or contamination that exists in the analytical system that could lead to elevated concentrations or false positive data. These samples are comprised of analyte-free water.

The following field QC samples were collected and submitted blind to ALS:

- *Field duplicates* (FD) - these samples provide insights into (a) variability in field conditions and (b) the precision of laboratory analyses. Duplicate samples are collected from the same location and treated independently through the sampling and analysis process.
- *Deionized blanks* (DB) - these samples are analyzed to verify the "analyte-free" status of the deionized water to help interpret the equipment blank results. These samples are comprised of deionized water poured directly into the sampling containers.
- *Equipment blanks* (EB) - these samples are analyzed to assess cross contamination in the sampling equipment that could lead to elevated concentrations or false positive data. These samples are comprised of analyte-free deionized water passed through the sampling equipment.
- *Travel blanks* (TB) - these samples are analyzed to assess cross contamination occurring during the transport of samples. These samples comprise analyte-free deionized water prepared in the lab by ALS, and travel to the site and back to the lab without being opened.

3.1 Overall QC Results

Overall laboratory and field QC results are summarized in Table 8.

Table 8: Summary of laboratory and field QC results by sample type.

	QC_Element	Pass	Fail	ND
Laboratory	Lab Duplicate	574	0	0
	Lab Control Sample	471	0	0
	Matrix Spike	399	0	38
	Matrix Blank	478	1	0
Field	Field Duplicate	437	3	0
	Deionized Water Blank	103	0	0
	Equipment Blank	92	11	0
	Travel Blank	23	1	0

3.2 Laboratory Duplicates

All laboratory duplicate results met laboratory QC objectives.

3.3 Laboratory Control Samples

All laboratory control sample results met laboratory QC objectives.

3.4 Matrix Spike

All matrix spike results met laboratory QC objectives.

In addition, some parameters had spike levels too low to confidently quantify them relative to existing concentrations in the sample. Consequently, QC results for these results could not be calculated (see Table 9).

Table 9: Analytes not determined for matrix spikes.

QC_Lot	Analyte	ALS_QC_ID[1]
199922	calcium, total	NEM-59

QC_Lot	Analyte	ALS_QC_ID[1]
199922	magnesium, total	NEM-59
199922	strontium, total	NEM-59
200712	barium, dissolved	NEM-59
200712	calcium, dissolved	NEM-59
200712	magnesium, dissolved	NEM-59
200712	strontium, dissolved	NEM-59
202347	silicate (as SiO2)	Anonymous
200385	magnesium, total	TPE-142
200734	magnesium, dissolved	TPE-142
202347	silicate (as SiO2)	Anonymous
204557	bromide	MAM-60
200383	aluminum, total	Anonymous
200383	boron, total	Anonymous
200383	calcium, total	Anonymous
200383	magnesium, total	Anonymous
200383	potassium, total	Anonymous
200383	sodium, total	Anonymous
200383	strontium, total	Anonymous
200383	sulfur, total	Anonymous
200385	magnesium, total	Anonymous
200758	barium, dissolved	MAM-59
200758	calcium, dissolved	MAM-59
200758	magnesium, dissolved	MAM-59
200758	potassium, dissolved	MAM-59
200758	sodium, dissolved	MAM-59
200758	strontium, dissolved	MAM-59
207083	carbon, total organic [TOC]	Anonymous
205621	calcium, total	Anonymous

QC_Lot	Analyte	ALS_QC_ID[1]
205621	magnesium, total	Anonymous
205621	manganese, total	Anonymous
205621	sodium, total	Anonymous
205621	strontium, total	Anonymous
205621	sulfur, total	Anonymous
205621	uranium, total	Anonymous
204841	calcium, dissolved	SP-142
204841	magnesium, dissolved	SP-142
204841	strontium, dissolved	SP-142

[1]ALS_QC_ID listing of 'Anonymous' indicates QC sample from another client used.

3.5 Matrix Blank

In this sampling event, 1 matrix blanks result failed to meet the QC objectives. Matrix blank results not meeting QC objectives are summarized in Table 10.

Table 10: Details for matrix blank results not meeting QC objectives.

QC_Lot	Analyte	Result	Limit	MDL	MB.QC
200734	magnesium, dissolved	0.0051	0.005	-	Fail

3.6 Field Duplicates

In this sampling event, 3 field duplicate samples failed to meet the QC objectives. Field duplicate sample results not meeting QC objectives are summarized in Table 11.

Table 11: Details for field duplicate results not meeting QC objectives.

QC_Lot.x	Analyte	RPD	DIFFx	FD.QC
200818	ammonia, total (as N)	76.5	5.9	Fail
201028	carbon, dissolved organic [DOC]	83.2	5.6	Fail
200816	carbon, total organic [TOC]	127.1	12.7	Fail

3.7 DI Blank

All deionized water blank results met laboratory QC objectives.

3.8 Equipment Blank

In this sampling event, 11 equipment blank samples failed to meet the QC objectives. Equipment blank results not meeting QC objectives are summarized in Table 12.

Table 12: Details for equipment blank results not meeting QC objectives.

QC_Lot	ID	Analyte	Results	DL	FB.QC
200383	EB	barium, total	0.000190	0.00010	Fail
200383	EB	lead, total	0.000235	0.00005	Fail
200383	EB	magnesium, total	0.008900	0.00500	Fail
200383	EB	manganese, total	0.000180	0.00010	Fail
200383	EB	strontium, total	0.000220	0.00020	Fail
200758	EB	aluminum, dissolved	0.001800	0.00100	Fail
200758	EB	barium, dissolved	0.000130	0.00010	Fail
200758	EB	lead, dissolved	0.000205	0.00005	Fail
200758	EB	magnesium, dissolved	0.008100	0.00500	Fail
200758	EB	manganese, dissolved	0.000160	0.00010	Fail
200758	EB	strontium, dissolved	0.000230	0.00020	Fail

3.9 Travel Blank

In this sampling event, 1 travel blank sample failed to meet the QC objectives. Travel blank results not meeting QC objectives are summarized in Table 13.

Table 13: Details for travel blank results not meeting QC objectives.

QC_Lot	ID	Analyte	Results	DL	FB.QC
	TB	sampling volume, field	0.5	0.01	Fail

3.10 Holding Time Exceedances

In addition to those ALS laboratory QC samples described above, during QC screening samples were also assessed agianst recommended hold times. Parameters and associated sample numbers exceeding recommended hold times in this sampling event are shown in Table 14. Note that pH is included in the suite of field measurements and has a very short recommended hold time, so exceeding the hold time for laboratory analysis is expected and of little importance.

Table 14: Analytes and associated number of samples exceeding holding times.

ALS_Method	n
pH by Meter	37
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)	26
Nitrate in Water by IC (Low Level)	11

Meadowbank Mine - Water Quality Monitoring 2021

Preliminary Screening of July, 2021 Water Quality Monitoring

Azimuth Consulting Group Inc.
on behalf of Agnico Eagle Mines Ltd.

Report Date: 2021-11-01

Table of Contents

1. Introduction & Sampling Overview

This document was prepared by Azimuth Consulting Group Inc (Azimuth) to provide the Meadowbank Environment Department with a brief overview of the water chemistry results collected in July, 2021 as part of the Core Receiving Environment Monitoring Program (CREMP). CREMP water quality monitoring occurs in all summer months (July - September) as well as two through-ice sampling events in March and May. CREMP monitoring occurs at near-field, mid-field, and far-field stations in three distinct areas - the Meadowbank Mine Project, The Whale Tail Pit Project, and Baker Lake, however sampling does not occur at all stations or all areas in each sampling event. The purpose of this preliminary document is to:

1. Screen the water chemistry results from ALS against the trigger values to keep the Environment Department informed about potential changes in water quality, including the early identification of potentially anomalous data (Section 2).
2. Review the data for laboratory QC issues (blanks, duplicates, matrix spikes, etc.) and potential field quality assurance (QA) concerns, ensuring that questionable results are verified by reanalysis (Section 3).

Samples included in this report are shown in Table 1, while field blanks are shown in Table 2.

Table 1: Summary of July, 2021 samples.

Area	Sample ID	ID	ID_Name	Duplicate	Date_Sampled
Baker Lake					
	BAP-73	BAP	Baker - Akilahaarjuk Point	JULY DUP-2	2021-07-30
	BAP-74	BAP	Baker - Akilahaarjuk Point	-	2021-07-30
	BBD-73	BBD	Baker - Barge Dock	-	2021-07-30
	BBD-74	BBD	Baker - Barge Dock	-	2021-07-30
	BPJ-73	BPJ	Baker - Proposed Jetty	-	2021-07-30
	BPJ-74	BPJ	Baker - Proposed Jetty	-	2021-07-30
Meadowbank					
	INUG-132	INUG	Inuggugayualik	-	2021-07-27
	INUG-133	INUG	Inuggugayualik	-	2021-07-27
	PDL-97	PDL	Pipedream	-	2021-07-27
	PDL-98	PDL	Pipedream	-	2021-07-27
	SP-144	SP	Second Portage	-	2021-07-11
	SP-145	SP	Second Portage	-	2021-07-11
	TPE-144	TPE	Third Portage - East Basin	-	2021-07-23
	TPE-145	TPE	Third Portage - East Basin	-	2021-07-23
	TPN-144	TPN	Third Portage - North Basin	JULY DUP-1	2021-07-29
	TPN-145	TPN	Third Portage - North Basin	-	2021-07-29
	WAL-113	WAL	Wally	-	2021-07-11
	WAL-114	WAL	Wally	-	2021-07-11
Whale Tail Pit					
	A20-55	A20	Lake A20	-	2021-07-11
	A20-56	A20	Lake A20	-	2021-07-11
	A76-53	A76	Lake A76	JULY DUP-4	2021-07-17
	A76-54	A76	Lake A76	-	2021-07-17

Area	Sample ID	ID	ID_Name	Duplicate	Date_Sampled
	DS1-51	DS1	Lake DS1	-	2021-07-19
	DS1-52	DS1	Lake DS1	-	2021-07-19
	MAM-61	MAM	Mammoth	-	2021-07-09
	MAM-62	MAM	Mammoth	DUP-3	2021-07-09
	NEM-61	NEM	Nemo	-	2021-07-10
	NEM-62	NEM	Nemo	-	2021-07-10
	WTS-61	WTS	Whale Tail South	-	2021-07-08
	WTS-62	WTS	Whale Tail South	-	2021-07-08

Table 2: Summary of field blanks collected in July, 2021.

Client_Sample_ID	ID_Name
JULY DI	DI Blank
JULY EB	Equipment Blank
JULY TB	Travel Blank

2. Trigger Screening

Sampling results were screened relative to relevant triggers and thresholds. A summary of trigger and threshold exceedances is provided in Table 3. Subsequent tables provide all sample results above trigger and threshold values for Meadowbank (Table 4), Whale Tail Pit (Table 5), and Baker Lake (Table 6). Samples exceeding triggers or thresholds but failing reliability checks (see Section 2.1) are labeled as uncertain.

Table 3: Summary of trigger and threshold exceedances in July, 2021.

Area	Parameter	Samples Exceeding Trigger	Samples Exceeding Threshold	Stations
Baker Lake				
	Aluminum (T)	2	1	BBD-73, BBD-74
	Chromium (D)	6	0	BAP-73, BAP-74, BBD-73, BBD-74, BPJ-73, BPJ-74
	Ortho-phosphate	1	0	BPJ-74
	Silicon (D)	3	0	BBD-74, BPJ-73, BPJ-74
	Silicon (T)	4	0	BBD-73, BBD-74, BPJ-73, BPJ-74
	Titanium (T)	2	0	BBD-73, BBD-74

Area	Parameter	Samples Exceeding Trigger	Samples Exceeding Threshold	Stations
	Total phosphorous	2	4	BBD-73, BBD-74, BPJ-73, BPJ-74
	TSS	2	0	BBD-73, BBD-74
Meadowbank				
	Bicarbonate alkalinity	2	0	SP-144, SP-145
	Calcium (T)	3	0	SP-144, SP-145, TPE-144
	Chromium (D)	12	0	INUG-132, INUG-133, PDL-97, PDL-98, SP-144, SP-145, TPE-144, TPE-145, TPN-144, TPN-145, WAL-113, WAL-114
	Conductivity	5	0	SP-144, SP-145, TPE-144, TPE-145, TPN-144
	Hardness	4	0	SP-144, SP-145, TPE-144, TPE-145
	Magnesium (T)	3	0	SP-144, SP-145, TPE-144
	Silicon (D)	2	0	SP-144, SP-145
	Silicon (T)	3	0	INUG-133, SP-144, SP-145
	TDS	2	0	SP-144, SP-145
	Tin (T)	1	0	TPE-144

Area	Parameter	Samples Exceeding Trigger	Samples Exceeding Threshold	Stations
	Titanium (T)	2	0	INUG-132, INUG-133
	Total Alkalinity	2	0	SP-144, SP-145
Whale Tail Pit				
	Bicarbonate alkalinity	7	0	A76-53, MAM-61, MAM-62, NEM-61, NEM-62, WTS-61, WTS-62
	Calcium (T)	9	0	A20-55, A76-53, A76-54, MAM-61, MAM-62, NEM-61, NEM-62, WTS-61, WTS-62
	Conductivity	8	0	A76-53, A76-54, MAM-61, MAM-62, NEM-61, NEM-62, WTS-61, WTS-62
	Hardness	8	0	A76-53, A76-54, MAM-61, MAM-62, NEM-61, NEM-62, WTS-61, WTS-62
	Lithium (D)	1	0	MAM-61
	Lithium (T)	2	0	MAM-61, MAM-62
	Magnesium (T)	8	0	A76-53, A76-54, MAM-61, MAM-62, NEM-61, NEM-62, WTS-61, WTS-62
	Potassium (T)	10	0	A20-55, A20-56, A76-53, A76-54, MAM-61, MAM-62, NEM-61, NEM-62, WTS-61, WTS-62
	Reactive silica	2	0	WTS-61, WTS-62

Area	Parameter	Samples Exceeding Trigger	Samples Exceeding Threshold	Stations
	Silicon (D)	2	0	WTS-61, WTS-62
	Silicon (T)	3	0	MAM-61, WTS-61, WTS-62
	Sodium (T)	7	0	A20-55, A76-53, A76-54, MAM-61, MAM-62, WTS-61, WTS-62
	TDS	8	0	A76-53, A76-54, MAM-61, MAM-62, NEM-61, NEM-62, WTS-61, WTS-62
	TKN	4	0	MAM-61, MAM-62, WTS-61, WTS-62
	Total Alkalinity	7	0	A76-53, MAM-61, MAM-62, NEM-61, NEM-62, WTS-61, WTS-62
	Total phosphorous	2	4	A20-55, A76-54, WTS-61, WTS-62

* Indicates samples which failed reliability checks and are consequently uncertain.

Table 6: Trigger and threshold exceedances at Baker Lake sampling stations

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
BAP-73	Baker - Akilahaarjuk Point	Chromium (D)	0.00050	0.0005	mg/L	MDL	0.005	0.00026	-
BAP-74	Baker - Akilahaarjuk Point	Chromium (D)	0.00050	0.0005	mg/L	MDL	0.005	0.00026	-
BBD-73	Baker - Barge Dock	Aluminum (T)	***0.10100***	0.0030	mg/L	-	0.1	0.05600	-
BBD-73	Baker - Barge Dock	Chromium (D)	0.00050	0.0005	mg/L	MDL	0.005	0.00026	-
BBD-73	Baker - Barge Dock	Silicon (T)	0.39000	0.1000	mg/L	-	-	0.28000	-
BBD-73	Baker - Barge Dock	Titanium (T)	0.00240	0.0024	mg/L	MDL	-	0.00060	-
BBD-73	Baker - Barge Dock	Total phosphorous	***0.00780***	0.0020	mg/L	-	0.004	0.00750	-
BBD-73	Baker - Barge Dock	TSS	4.10000	1.0000	mg/L	-	5	3.00000	-
BBD-74	Baker - Barge Dock	Aluminum (T)	0.09950	0.0030	mg/L	-	0.1	0.05600	-
BBD-74	Baker - Barge Dock	Chromium (D)	0.00050	0.0005	mg/L	MDL	0.005	0.00026	-
BBD-74	Baker - Barge Dock	Silicon (D)	0.27000	0.0500	mg/L	-	-	0.25000	-
BBD-74	Baker - Barge Dock	Silicon (T)	0.44000	0.1000	mg/L	-	-	0.28000	-
BBD-74	Baker - Barge Dock	Titanium (T)	0.00295	0.0003	mg/L	-	-	0.00060	-
BBD-74	Baker - Barge Dock	Total phosphorous	***0.00820***	0.0020	mg/L	-	0.004	0.00750	-
BBD-74	Baker - Barge Dock	TSS	4.30000	1.0000	mg/L	-	5	3.00000	-
BPJ-73	Baker - Proposed Jetty	Chromium (D)	0.00050	0.0005	mg/L	MDL	0.005	0.00026	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
BPJ-73	Baker - Proposed Jetty	Silicon (D)	0.25400	0.0500	mg/L	-	-	0.25000	-
BPJ-73	Baker - Proposed Jetty	Silicon (T)	0.30000	0.1000	mg/L	-	-	0.28000	-
BPJ-73	Baker - Proposed Jetty	Total phosphorous	***0.00520***	0.0020	mg/L	-	0.004	0.00750	-
BPJ-74	Baker - Proposed Jetty	Chromium (D)	0.00050	0.0005	mg/L	MDL	0.005	0.00026	-
BPJ-74	Baker - Proposed Jetty	Ortho-phosphate	0.00220	0.0010	mg/L	-	-	0.00200	-
BPJ-74	Baker - Proposed Jetty	Silicon (D)	0.26200	0.0500	mg/L	-	-	0.25000	-
BPJ-74	Baker - Proposed Jetty	Silicon (T)	0.31000	0.1000	mg/L	-	-	0.28000	-
BPJ-74	Baker - Proposed Jetty	Total phosphorous	***0.00540***	0.0020	mg/L	-	0.004	0.00750	-

[1]Bold values are above the threshold as well as above the trigger value.

[2]Results failing to meet reliability checks are indicated as uncertain.

Table 4: Trigger and threshold exceedances at Meadowbank sampling stations.

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
INUG-132	Inuggugayualik	Chromium (D)	0.00050	0.0005	mg/L	MDL	0.005	0.00026	-
INUG-132	Inuggugayualik	Titanium (T)	0.00076	0.0003	mg/L	-	-	0.00060	-
INUG-133	Inuggugayualik	Chromium (D)	0.00050	0.0005	mg/L	MDL	0.005	0.00026	-
INUG-133	Inuggugayualik	Silicon (T)	0.23000	0.1000	mg/L	-	-	0.20000	-
INUG-133	Inuggugayualik	Titanium (T)	0.00085	0.0003	mg/L	-	-	0.00060	-
PDL-97	Pipedream	Chromium (D)	0.00050	0.0005	mg/L	MDL	0.005	0.00026	-
PDL-98	Pipedream	Chromium (D)	0.00050	0.0005	mg/L	MDL	0.005	0.00026	-
SP-144	Second Portage	Bicarbonate alkalinity	10.80000	1.0000	mg/L	-	-	8.70000	-
SP-144	Second Portage	Calcium (T)	3.79000	0.0500	mg/L	-	-	2.39000	-
SP-144	Second Portage	Chromium (D)	0.00050	0.0005	mg/L	MDL	0.005	0.00026	-
SP-144	Second Portage	Conductivity	37.50000	2.0000	µS/cm	-	-	27.40000	-
SP-144	Second Portage	Hardness	14.60000	0.6000	mg/L	-	-	9.50000	-
SP-144	Second Portage	Magnesium (T)	1.24000	0.0050	mg/L	-	-	0.93000	-
SP-144	Second Portage	Silicon (D)	0.28800	0.0500	mg/L	-	-	0.18000	-
SP-144	Second Portage	Silicon (T)	0.36000	0.1000	mg/L	-	-	0.20000	-
SP-144	Second Portage	TDS	21.90000	3.0000	mg/L	-	-	19.00000	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
SP-144	Second Portage	Total Alkalinity	10.80000	1.0000	mg/L	-	-	8.70000	-
SP-145	Second Portage	Bicarbonate alkalinity	10.50000	1.0000	mg/L	-	-	8.70000	-
SP-145	Second Portage	Calcium (T)	3.71000	0.0500	mg/L	-	-	2.39000	-
SP-145	Second Portage	Chromium (D)	0.00050	0.0005	mg/L	MDL	0.005	0.00026	-
SP-145	Second Portage	Conductivity	36.60000	2.0000	µS/cm	-	-	27.40000	-
SP-145	Second Portage	Hardness	14.40000	0.6000	mg/L	-	-	9.50000	-
SP-145	Second Portage	Magnesium (T)	1.25000	0.0050	mg/L	-	-	0.93000	-
SP-145	Second Portage	Silicon (D)	0.30900	0.0500	mg/L	-	-	0.18000	-
SP-145	Second Portage	Silicon (T)	0.39000	0.1000	mg/L	-	-	0.20000	-
SP-145	Second Portage	TDS	21.90000	3.0000	mg/L	-	-	19.00000	-
SP-145	Second Portage	Total Alkalinity	10.50000	1.0000	mg/L	-	-	8.70000	-
TPE-144	Third Portage - East Basin	Calcium (T)	2.47000	0.0500	mg/L	-	-	2.39000	-
TPE-144	Third Portage - East Basin	Chromium (D)	0.00050	0.0005	mg/L	MDL	0.005	0.00026	-
TPE-144	Third Portage - East Basin	Conductivity	27.50000	2.0000	µS/cm	-	-	27.40000	-
TPE-144	Third Portage - East Basin	Hardness	10.00000	0.6000	mg/L	-	-	9.50000	-
TPE-144	Third Portage - East Basin	Magnesium (T)	0.94100	0.0050	mg/L	-	-	0.93000	-
TPE-144	Third Portage - East Basin	Tin (T)	0.00041	0.0001	mg/L	-	-	0.00020	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
TPE-145	Third Portage - East Basin	Chromium (D)	0.00050	0.0005	mg/L	MDL	0.005	0.00026	-
TPE-145	Third Portage - East Basin	Conductivity	28.90000	2.0000	µS/cm	-	-	27.40000	-
TPE-145	Third Portage - East Basin	Hardness	9.66000	0.6000	mg/L	-	-	9.50000	-
TPN-144	Third Portage - North Basin	Chromium (D)	0.00050	0.0005	mg/L	MDL	0.005	0.00026	-
TPN-144	Third Portage - North Basin	Conductivity	27.50000	2.0000	µS/cm	-	-	27.40000	-
TPN-145	Third Portage - North Basin	Chromium (D)	0.00050	0.0005	mg/L	MDL	0.005	0.00026	-
WAL-113	Wally	Chromium (D)	0.00050	0.0005	mg/L	MDL	0.005	0.00026	-
WAL-114	Wally	Chromium (D)	0.00050	0.0005	mg/L	MDL	0.005	0.00026	-

[1]Bold values are above the threshold as well as above the trigger value.

[2]Results failing to meet reliability checks are indicated as uncertain.

Table 5: Trigger and threshold exceedances at Whale Tail Pit sampling stations

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
A20-55	Lake A20	Calcium (T)	4.7500	0.050	mg/L	-	-	4.6000	-
A20-55	Lake A20	Potassium (T)	1.1500	0.050	mg/L	-	-	0.8400	-
A20-55	Lake A20	Sodium (T)	0.9710	0.050	mg/L	-	-	0.9700	-
A20-55	Lake A20	Total phosphorous	***0.0042***	0.002	mg/L	-	0.004	0.0045	-
A20-56	Lake A20	Potassium (T)	1.0100	0.050	mg/L	-	-	0.8400	-
A76-53	Lake A76	Bicarbonate alkalinity	9.8000	1.000	mg/L	-	-	9.6000	-
A76-53	Lake A76	Calcium (T)	8.7900	0.050	mg/L	-	-	4.6000	-
A76-53	Lake A76	Conductivity	85.9000	2.000	µS/cm	-	-	48.6000	-
A76-53	Lake A76	Hardness	30.7000	0.600	mg/L	-	-	17.4000	-
A76-53	Lake A76	Magnesium (T)	2.1300	0.005	mg/L	-	-	1.4100	-
A76-53	Lake A76	Potassium (T)	1.7800	0.050	mg/L	-	-	0.8400	-
A76-53	Lake A76	Sodium (T)	1.3500	0.050	mg/L	-	-	0.9700	-
A76-53	Lake A76	TDS	62.3000	10.000	mg/L	-	-	38.5000	-
A76-53	Lake A76	Total Alkalinity	9.8000	1.000	mg/L	-	-	9.6000	-
A76-54	Lake A76	Calcium (T)	8.6700	0.050	mg/L	-	-	4.6000	-
A76-54	Lake A76	Conductivity	85.2000	2.000	µS/cm	-	-	48.6000	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
A76-54	Lake A76	Hardness	30.3000	0.600	mg/L	-	-	17.4000	-
A76-54	Lake A76	Magnesium (T)	2.1000	0.005	mg/L	-	-	1.4100	-
A76-54	Lake A76	Potassium (T)	1.7700	0.050	mg/L	-	-	0.8400	-
A76-54	Lake A76	Sodium (T)	1.3200	0.050	mg/L	-	-	0.9700	-
A76-54	Lake A76	TDS	63.7000	10.000	mg/L	-	-	38.5000	-
A76-54	Lake A76	Total phosphorous	***0.0096***	0.002	mg/L	-	0.004	0.0045	-
MAM-61	Mammoth	Bicarbonate alkalinity	14.7000	1.000	mg/L	-	-	9.6000	-
MAM-61	Mammoth	Calcium (T)	15.2000	0.050	mg/L	-	-	4.6000	-
MAM-61	Mammoth	Conductivity	134.0000	2.000	µS/cm	-	-	48.6000	-
MAM-61	Mammoth	Hardness	51.3000	0.600	mg/L	-	-	17.4000	-
MAM-61	Mammoth	Lithium (D)	0.0022	0.001	mg/L	-	-	0.0020	-
MAM-61	Mammoth	Lithium (T)	0.0024	0.001	mg/L	-	-	0.0020	-
MAM-61	Mammoth	Magnesium (T)	3.2400	0.005	mg/L	-	-	1.4100	-
MAM-61	Mammoth	Potassium (T)	2.9400	0.050	mg/L	-	-	0.8400	-
MAM-61	Mammoth	Silicon (T)	0.6500	0.100	mg/L	-	-	0.6100	-
MAM-61	Mammoth	Sodium (T)	1.9200	0.050	mg/L	-	-	0.9700	-
MAM-61	Mammoth	TDS	72.7000	10.000	mg/L	-	-	38.5000	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
MAM-61	Mammoth	TKN	0.3170	0.050	mg/L	-	-	0.1700	-
MAM-61	Mammoth	Total Alkalinity	14.7000	1.000	mg/L	-	-	9.6000	-
MAM-62	Mammoth	Bicarbonate alkalinity	13.4000	1.000	mg/L	-	-	9.6000	-
MAM-62	Mammoth	Calcium (T)	13.6000	0.050	mg/L	-	-	4.6000	-
MAM-62	Mammoth	Conductivity	119.0000	2.000	µS/cm	-	-	48.6000	-
MAM-62	Mammoth	Hardness	45.4000	0.600	mg/L	-	-	17.4000	-
MAM-62	Mammoth	Lithium (T)	0.0021	0.001	mg/L	-	-	0.0020	-
MAM-62	Mammoth	Magnesium (T)	2.7800	0.005	mg/L	-	-	1.4100	-
MAM-62	Mammoth	Potassium (T)	2.5900	0.050	mg/L	-	-	0.8400	-
MAM-62	Mammoth	Sodium (T)	1.7400	0.050	mg/L	-	-	0.9700	-
MAM-62	Mammoth	TDS	67.7000	10.000	mg/L	-	-	38.5000	-
MAM-62	Mammoth	TKN	0.1830	0.050	mg/L	-	-	0.1700	-
MAM-62	Mammoth	Total Alkalinity	13.4000	1.000	mg/L	-	-	9.6000	-
NEM-61	Nemo	Bicarbonate alkalinity	10.9000	1.000	mg/L	-	-	9.6000	-
NEM-61	Nemo	Calcium (T)	10.7000	0.050	mg/L	-	-	4.6000	-
NEM-61	Nemo	Conductivity	89.1000	2.000	µS/cm	-	-	48.6000	-
NEM-61	Nemo	Hardness	34.6000	0.600	mg/L	-	-	17.4000	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
NEM-61	Nemo	Magnesium (T)	1.9100	0.005	mg/L	-	-	1.4100	-
NEM-61	Nemo	Potassium (T)	1.4100	0.050	mg/L	-	-	0.8400	-
NEM-61	Nemo	TDS	51.0000	10.000	mg/L	-	-	38.5000	-
NEM-61	Nemo	Total Alkalinity	10.9000	1.000	mg/L	-	-	9.6000	-
NEM-62	Nemo	Bicarbonate alkalinity	10.2000	1.000	mg/L	-	-	9.6000	-
NEM-62	Nemo	Calcium (T)	11.1000	0.050	mg/L	-	-	4.6000	-
NEM-62	Nemo	Conductivity	89.7000	2.000	µS/cm	-	-	48.6000	-
NEM-62	Nemo	Hardness	35.7000	0.600	mg/L	-	-	17.4000	-
NEM-62	Nemo	Magnesium (T)	1.9300	0.005	mg/L	-	-	1.4100	-
NEM-62	Nemo	Potassium (T)	1.4400	0.050	mg/L	-	-	0.8400	-
NEM-62	Nemo	TDS	58.7000	10.000	mg/L	-	-	38.5000	-
NEM-62	Nemo	Total Alkalinity	10.2000	1.000	mg/L	-	-	9.6000	-
WTS-61	Whale Tail South	Bicarbonate alkalinity	15.3000	1.000	mg/L	-	-	9.6000	-
WTS-61	Whale Tail South	Calcium (T)	10.1000	0.050	mg/L	-	-	4.6000	-
WTS-61	Whale Tail South	Conductivity	93.7000	2.000	µS/cm	-	-	48.6000	-
WTS-61	Whale Tail South	Hardness	35.5000	0.600	mg/L	-	-	17.4000	-
WTS-61	Whale Tail South	Magnesium (T)	2.4900	0.005	mg/L	-	-	1.4100	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
WTS-61	Whale Tail South	Potassium (T)	2.4300	0.050	mg/L	-	-	0.8400	-
WTS-61	Whale Tail South	Reactive silica	1.3400	0.500	mg/L	-	-	1.3300	-
WTS-61	Whale Tail South	Silicon (D)	0.6420	0.050	mg/L	-	-	0.5700	-
WTS-61	Whale Tail South	Silicon (T)	0.7200	0.100	mg/L	-	-	0.6100	-
WTS-61	Whale Tail South	Sodium (T)	1.8000	0.050	mg/L	-	-	0.9700	-
WTS-61	Whale Tail South	TDS	57.3000	10.000	mg/L	-	-	38.5000	-
WTS-61	Whale Tail South	TKN	0.2240	0.050	mg/L	-	-	0.1700	-
WTS-61	Whale Tail South	Total Alkalinity	15.3000	1.000	mg/L	-	-	9.6000	-
WTS-61	Whale Tail South	Total phosphorous	***0.0046***	0.002	mg/L	-	0.004	0.0045	-
WTS-62	Whale Tail South	Bicarbonate alkalinity	15.1000	1.000	mg/L	-	-	9.6000	-
WTS-62	Whale Tail South	Calcium (T)	10.1000	0.050	mg/L	-	-	4.6000	-
WTS-62	Whale Tail South	Conductivity	93.3000	2.000	µS/cm	-	-	48.6000	-
WTS-62	Whale Tail South	Hardness	35.1000	0.600	mg/L	-	-	17.4000	-
WTS-62	Whale Tail South	Magnesium (T)	2.4000	0.005	mg/L	-	-	1.4100	-
WTS-62	Whale Tail South	Potassium (T)	2.3000	0.050	mg/L	-	-	0.8400	-
WTS-62	Whale Tail South	Reactive silica	1.5300	0.500	mg/L	-	-	1.3300	-
WTS-62	Whale Tail South	Silicon (D)	0.6460	0.050	mg/L	-	-	0.5700	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
WTS-62	Whale Tail South	Silicon (T)	0.7300	0.100	mg/L	-	-	0.6100	-
WTS-62	Whale Tail South	Sodium (T)	1.7200	0.050	mg/L	-	-	0.9700	-
WTS-62	Whale Tail South	TDS	52.0000	10.000	mg/L	-	-	38.5000	-
WTS-62	Whale Tail South	TKN	0.2680	0.050	mg/L	-	-	0.1700	-
WTS-62	Whale Tail South	Total Alkalinity	15.1000	1.000	mg/L	-	-	9.6000	-
WTS-62	Whale Tail South	Total phosphorous	***0.0045***	0.002	mg/L	-	0.004	0.0045	-

[1]Bold values are above the threshold as well as above the trigger value.

[2]Results failing to meet reliability checks are indicated as uncertain.

2.1 Result Reliability Checks

Two preliminary analyses were conducted to assess the reliability of sample results. Samples failing either one of these tests have been flagged as uncertain, and warrant further evaluation.

The first analysis compares dissolved and total concentrations for a given parameters at each location. Samples where dissolved concentrations are greater than total with a relative percent difference (RPD) of more than 30% are considered potentially unreliable. All samples failing to meet this reliability check are summarized in Table 7.

The second analysis compares parameter concentrations from the two sampling stations located within each water body (either lake or basin). Parameters for which the difference between these two intra-lake samples was greater than a factor of 5 (or a factor of 10 if at least one of the samples was within a factor of 10 of the MDL) are considered potentially unreliable. All samples failing to meet this reliability check are summarized in Table 8.

Table 7: Samples with uncertain reliability due to differences in dissolved and total parameter results.

Area	Sample ID	ID_Name	Parameter	Result (T)	Result (D)	MDL (T)	MDL (D)	RPD
Baker Lake	BBD-74	Baker - Barge Dock	Copper	0.0005	0.00069	MDL	-	31.9
Meadowbank	TPE-145	Third Portage - East Basin	Molybdenum	0.000101	0.00423	-	-	190.7
Meadowbank	TPE-145	Third Portage - East Basin	Arsenic	0.00025	0.00045	-	-	57.1
Whale Tail Pit	A20-55	Lake A20	Manganese	0.00616	0.0211	-	-	109.6
Whale Tail Pit	MAM-62	Mammoth	Manganese	0.00482	0.0155	-	-	105.1
Whale Tail Pit	A20-56	Lake A20	Manganese	0.00894	0.0251	-	-	94.9
Whale Tail Pit	NEM-61	Nemo	Manganese	0.00174	0.00411	-	-	81
Whale Tail Pit	NEM-62	Nemo	Manganese	0.00188	0.00423	-	-	76.9
Whale Tail Pit	MAM-61	Mammoth	Manganese	0.0137	0.0239	-	-	54.3
Whale Tail Pit	MAM-62	Mammoth	Iron	0.011	0.018	-	-	48.3

Area	Sample ID	ID_Name	Parameter	Result (T)	Result (D)	MDL (T)	MDL (D)	RPD
Whale Tail Pit	WTS-61	Whale Tail South	Manganese	0.039	0.0633	-	-	47.5
Whale Tail Pit	A20-56	Lake A20	Iron	0.024	0.036	-	-	40
Whale Tail Pit	WTS-62	Whale Tail South	Manganese	0.0431	0.0627	-	-	37.1

Table 8: Samples with uncertain reliability due to differences between results from the same sampling area.

Area	ID	ID_Name	Parameter	Difference	Threshold[1]
Meadowbank	TPE	Third Portage - East Basin	Molybdenum (D)	40.28571	10

[1]Threshold is set at a factor of 5, unless one or more sample is within a factor of 10 of the MDL in which case the threshold is set at a factor of 10.

3. Laboratory & Field Quality Control Results

ALS' laboratory QC samples for water are:

- *Laboratory duplicates* (LD) - these samples provide insights into the precision of laboratory analyses. Duplicate aliquots are taken from the samples and run through part (aliquots taken post digestion) or all (aliquots taken from the sample bottle) the laboratory analytical process.
- *Laboratory control samples* (LCS) - these samples provide insights into whether the laboratory systems are working as intended. They are comprised of a mixture of analyte-free water to which known amounts of the method analytes are added. They are essentially an internal version of a certified reference material.
- *Matrix spikes* (MS) - these samples involve the analysis of actual samples, to which a known amount of method analytes are added in amounts high enough that the spikes are clearly discernible relative to existing concentrations. These samples provide insights into the degree that the sample matrix could interfere with analyses.
- *Matrix blanks* (MB) - these samples are analyzed to assess background interference or contamination that exists in the analytical system that could lead to elevated concentrations or false positive data. These samples are comprised of analyte-free water.

The following field QC samples were collected and submitted blind to ALS:

- *Field duplicates* (FD) - these samples provide insights into (a) variability in field conditions and (b) the precision of laboratory analyses. Duplicate samples are collected from the same location and treated independently through the sampling and analysis process.
- *Deionized blanks* (DB) - these samples are analyzed to verify the "analyte-free" status of the deionized water to help interpret the equipment blank results. These samples are comprised of deionized water poured directly into the sampling containers.
- *Equipment blanks* (EB) - these samples are analyzed to assess cross contamination in the sampling equipment that could lead to elevated concentrations or false positive data. These samples are comprised of analyte-free deionized water passed through the sampling equipment.
- *Travel blanks* (TB) - these samples are analyzed to assess cross contamination occurring during the transport of samples. These samples comprise analyte-free deionized water prepared in the lab by ALS, and travel to the site and back to the lab without being opened.

3.1 Overall QC Results

Overall laboratory and field QC results are summarized in Table 9.

Table 9: Summary of laboratory and field QC results by sample type.

	QC_Element	Pass	Fail	ND
Laboratory	Lab Duplicate	805	0	0
	Lab Control Sample	601	0	0
	Matrix Spike	492	0	62
	Matrix Blank	610	2	0
Field	Field Duplicate	426	1	0
	Deionized Water Blank	100	3	0
	Equipment Blank	101	2	0
	Travel Blank	67	0	0

3.2 Laboratory Duplicates

All laboratory duplicate results met laboratory QC objectives.

3.3 Laboratory Control Samples

All laboratory control sample results met laboratory QC objectives.

3.4 Matrix Spike

All matrix spike results met laboratory QC objectives.

In addition, some parameters had spike levels too low to confidently quantify them relative to existing concentrations in the sample. Consequently, QC results for these results could not be calculated (see Table 10).

Table 10: Analytes not determined for matrix spikes.

QC_Lot	Analyte	ALS_QC_ID[1]
249219	phosphorus, total	Anonymous

QC_Lot	Analyte	ALS_QC_ID[1]
248940	calcium, total	WTS-62
248940	magnesium, total	WTS-62
248940	manganese, total	WTS-62
248940	strontium, total	WTS-62
249151	barium, dissolved	WTS-62
249151	calcium, dissolved	WTS-62
249151	magnesium, dissolved	WTS-62
249151	manganese, dissolved	WTS-62
249151	strontium, dissolved	WTS-62
250067	magnesium, dissolved	A20-56
250067	manganese, dissolved	A20-56
250067	strontium, dissolved	A20-56
249219	phosphorus, total	Anonymous
249340	magnesium, total	WAL-114
249340	strontium, total	WAL-114
250067	magnesium, dissolved	Anonymous
250067	manganese, dissolved	Anonymous
250067	strontium, dissolved	Anonymous
254454	aluminum, total	Anonymous
254454	calcium, total	Anonymous
254454	magnesium, total	Anonymous
254454	sodium, total	Anonymous
254454	strontium, total	Anonymous
254616	calcium, dissolved	A76-54
254616	magnesium, dissolved	A76-54
254616	strontium, dissolved	A76-54
257035	phosphorus, total	Anonymous
256906	carbon, dissolved organic [DOC]	Anonymous

QC_Lot	Analyte	ALS_QC_ID[1]
256907	carbon, total organic [TOC]	Anonymous
257034	carbon, dissolved organic [DOC]	Anonymous
256480	boron, total	Anonymous
256480	calcium, total	Anonymous
256480	magnesium, total	Anonymous
256480	potassium, total	Anonymous
256480	sodium, total	Anonymous
256480	strontium, total	Anonymous
256480	sulfur, total	Anonymous
255845	barium, dissolved	Anonymous
255845	boron, dissolved	Anonymous
255845	calcium, dissolved	Anonymous
255845	magnesium, dissolved	Anonymous
255845	molybdenum, dissolved	Anonymous
255845	potassium, dissolved	Anonymous
255845	sodium, dissolved	Anonymous
255845	strontium, dissolved	Anonymous
255845	sulfur, dissolved	Anonymous
264144	antimony, dissolved	Anonymous
264144	arsenic, dissolved	Anonymous
264144	boron, dissolved	Anonymous
264144	calcium, dissolved	Anonymous
264144	copper, dissolved	Anonymous
264144	lithium, dissolved	Anonymous
264144	magnesium, dissolved	Anonymous
264144	manganese, dissolved	Anonymous
264144	molybdenum, dissolved	Anonymous
264144	potassium, dissolved	Anonymous

QC_Lot	Analyte	ALS_QC_ID[1]
264144	rubidium, dissolved	Anonymous
264144	sodium, dissolved	Anonymous
264144	strontium, dissolved	Anonymous
264144	sulfur, dissolved	Anonymous
264144	uranium, dissolved	Anonymous

[1]ALS_QC_ID listing of 'Anonymous' indicates QC sample from another client used.

3.5 Matrix Blank

In this sampling event, 2 matrix blanks results failed to meet the QC objectives. Matrix blank results not meeting QC objectives are summarized in Table 11.

Table 11: Details for matrix blank results not meeting QC objectives.

QC_Lot	Analyte	Result	Limit	MDL	MB.QC
248940	barium, total	0.000150	0.00010	-	Fail
254454	thallium, total	0.000013	0.00001	-	Fail

3.6 Field Duplicates

In this sampling event, 1 field duplicate sample failed to meet the QC objectives. Field duplicate sample results not meeting QC objectives are summarized in Table 12.

Table 12: Details for field duplicate results not meeting QC objectives.

QC_Lot.x	Analyte	RPD	DIFFx	FD.QC
248940	manganese, total	60.6	41.9	Fail

3.7 DI Blank

In this sampling event, 3 deionized water blank samples failed to meet the QC objectives. Deionized water blank results not meeting QC objectives are summarized in Table 14.

Table 14: Details for deionized water blank results not meeting QC objectives.

QC_Lot	ID	Analyte	Results	DL	FB.QC
253188	DI	alkalinity, total (as CaCO3)	1.1000	1.000	Fail
253188	DI	alkalinity, bicarbonate (as CaCO3)	1.1000	1.000	Fail
255354	DI	ammonia, total (as N)	0.0466	0.005	Fail

3.8 Equipment Blank

In this sampling event, 2 equipment blank samples failed to meet the QC objectives. Equipment blank results not meeting QC objectives are summarized in Table 13.

Table 13: Details for equipment blank results not meeting QC objectives.

QC_Lot	ID	Analyte	Results	DL	FB.QC
254454	EB	copper, total	0.00057	0.0005	Fail
254616	EB	copper, dissolved	0.00049	0.0002	Fail

3.9 Travel Blank

All travel blank results met laboratory QC objectives.

3.10 Holding Time Exceedances

In addition to those ALS laboratory QC samples described above, during QC screening samples were also assessed agianst recommended hold times. Parameters and associated sample numbers exceeding recommended hold times in this sampling event are shown in Table 15. Note that pH is included in the suite of field measurements and has a very short recommended hold time, so exceeding the hold time for laboratory analysis is expected and of little importance.

Table 15: Analytes and associated number of samples exceeding holding times.

ALS_Method	n
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)	41
Nitrate in Water by IC (Low Level)	41
Nitrite in Water by IC (Low Level)	41
pH by Meter	41
Turbidity by Nephelometry	41
TDS by Gravimetry (Low Level)	26

ALS_Method	n
TSS by Gravimetry (Low Level)	26
Ammonia by Fluorescence	1
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	1
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	1
Total Phosphorus by Colourimetry (Ultra Trace)	1

Meadowbank Mine - Water Quality Monitoring 2021

Preliminary Screening of August, 2021 Water Quality Monitoring

Azimuth Consulting Group Inc.
on behalf of Agnico Eagle Mines Ltd.

Report Date: 2021-11-18

Table of Contents

1. Introduction & Sampling Overview

This document was prepared by Azimuth Consulting Group Inc (Azimuth) to provide the Meadowbank Environment Department with a brief overview of the water chemistry results collected in August, 2021 as part of the Core Receiving Environment Monitoring Program (CREMP). CREMP water quality monitoring occurs in all summer months (July - September) as well as two through-ice sampling events in March and May. CREMP monitoring occurs at near-field, mid-field, and far-field stations in three distinct areas - the Meadowbank Mine Project, The Whale Tail Pit Project, and Baker Lake, however sampling does not occur at all stations or all areas in each sampling event. The purpose of this preliminary document is to:

1. Screen the water chemistry results from ALS against the trigger values to keep the Environment Department informed about potential changes in water quality, including the early identification of potentially anomalous data (Section 2).
2. Review the data for laboratory QC issues (blanks, duplicates, matrix spikes, etc.) and potential field quality assurance (QA) concerns, ensuring that questionable results are verified by reanalysis (Section 3).

Samples included in this report are shown in Table 1, while field blanks are shown in Table 2.

Table 1: Summary of August, 2021 samples.

Area	Sample ID	ID	ID_Name	Duplicate	Date_Sampled
Baker Lake					
	BAP-75	BAP	Baker - Akilahaarjuk Point	AUGUST DUP-4	2021-08-14
	BAP-76	BAP	Baker - Akilahaarjuk Point	-	2021-08-14
	BBD-75	BBD	Baker - Barge Dock	-	2021-08-14
	BBD-76	BBD	Baker - Barge Dock	-	2021-08-14
	BPJ-75	BPJ	Baker - Proposed Jetty	-	2021-08-14
	BPJ-76	BPJ	Baker - Proposed Jetty	-	2021-08-14
Meadowbank					
	INUG-134	INUG	Inuggugayualik	-	2021-08-18
	INUG-135	INUG	Inuggugayualik	-	2021-08-18
	PDL-100	PDL	Pipedream	-	2021-08-16
	PDL-99	PDL	Pipedream	-	2021-08-16
	SP-146	SP	Second Portage	-	2021-08-06
	SP-147	SP	Second Portage	-	2021-08-06
	TPE-146	TPE	Third Portage - East Basin	-	2021-08-13
	TPE-147	TPE	Third Portage - East Basin	-	2021-08-13
	TPN-146	TPN	Third Portage - North Basin	-	2021-08-10
	TPN-147	TPN	Third Portage - North Basin	-	2021-08-10
	WAL-115	WAL	Wally	-	2021-08-10
	WAL-116	WAL	Wally	AUGUST DUP-3	2021-08-10
Whale Tail Pit					
	A20-57	A20	Lake A20	-	2021-08-10
	A20-58	A20	Lake A20	-	2021-08-10
	A76-55	A76	Lake A76	-	2021-08-07

Area	Sample ID	ID	ID_Name	Duplicate	Date_Sampled
	A76-56	A76	Lake A76	-	2021-08-07
	DS1-53	DS1	Lake DS1	-	2021-08-15
	DS1-54	DS1	Lake DS1	-	2021-08-15
	MAM-63	MAM	Mammoth	-	2021-08-07
	MAM-64	MAM	Mammoth	AUGUST DUP-1	2021-08-07
	NEM-63	NEM	Nemo	-	2021-08-07
	NEM-64	NEM	Nemo	-	2021-08-07
	WTS-63	WTS	Whale Tail South	AUGUST DUP-2	2021-08-10
	WTS-64	WTS	Whale Tail South	-	2021-08-10

Table 2: Summary of field blanks collected in August, 2021.

Client_Sample_ID	ID_Name
AUGUST DI	DI Blank
AUGUST EB	Equipment Blank

2. Trigger Screening

Sampling results were screened relative to relevant triggers and thresholds. A summary of trigger and threshold exceedances is provided in Table 3. Subsequent tables provide all sample results above trigger and threshold values for Meadowbank (Table 4), Whale Tail Pit (Table 5), and Baker Lake (Table 6). Samples exceeding triggers or thresholds but failing reliability checks (see Section 2.1) are labeled as uncertain.

Table 3: Summary of trigger and threshold exceedances in August, 2021.

Area	Parameter	Samples Exceeding Trigger	Samples Exceeding Threshold	Stations
Baker Lake				
	Chromium (D)	6	0	BAP-75, BAP-76, BBD-75, BBD-76, BPJ-75, BPJ-76
	Silicon (D)	1	0	BBD-75
	Silicon (T)	2	0	BBD-75, BBD-76
	Titanium (T)	1	0	BPJ-76
	Total phosphorous	0	4	BBD-75, BBD-76, BPJ-75, BPJ-76
Meadowbank				
	Bicarbonate alkalinity	2	0	SP-146, SP-147
	Calcium (T)	5	0	PDL-100, SP-146, SP-147, TPE-146, TPE-147
	Chromium (D)	12	0	INUG-134, INUG-135, PDL-100, PDL-99, SP-146, SP-147, TPE-146, TPE-147, TPN-146, TPN-147, WAL-115, WAL-116
	Conductivity	6	0	SP-146, SP-147, TPE-146, TPE-147, TPN-146, TPN-147

Area	Parameter	Samples Exceeding Trigger	Samples Exceeding Threshold	Stations
	Hardness	5	0	PDL-100, SP-146, SP-147, TPE-146, TPE-147
	Magnesium (T)	4	0	SP-146, SP-147, TPE-146, TPE-147
	Silicon (D)	2	0	SP-146, SP-147
	Silicon (T)	4	0	INUG-134, INUG-135, SP-146, SP-147
	TDS	5	0	SP-146, SP-147, TPN-147, WAL-115, WAL-116
	Total Alkalinity	2	0	SP-146, SP-147
Whale Tail Pit				
	Ammonia-N	1	0	MAM-63
	Bicarbonate alkalinity	5	0	A76-55, MAM-63, MAM-64, WTS-63, WTS-64
	Calcium (T)	9	0	A20-57, A76-55, A76-56, MAM-63, MAM-64, NEM-63, NEM-64, WTS-63, WTS-64
	Conductivity	9	0	A20-57, A76-55, A76-56, MAM-63, MAM-64, NEM-63, NEM-64, WTS-63, WTS-64
	Hardness	9	0	A20-57, A76-55, A76-56, MAM-63, MAM-64, NEM-63, NEM-64, WTS-63, WTS-64
	Lead (D)	1	1	DS1-54*
	Lithium (D)	1	0	MAM-63
	Lithium (T)	1	0	MAM-63

Area	Parameter	Samples Exceeding Trigger	Samples Exceeding Threshold	Stations
	Magnesium (T)	8	0	A76-55, A76-56, MAM-63, MAM-64, NEM-63, NEM-64, WTS-63, WTS-64
	Potassium (T)	10	0	A20-57, A20-58, A76-55, A76-56, MAM-63, MAM-64, NEM-63, NEM-64, WTS-63, WTS-64
	Silicon (D)	1	0	DS1-54
	Sodium (T)	7	0	A20-57, A76-55, A76-56, MAM-63, MAM-64, WTS-63, WTS-64
	TDS	10	0	A20-57, A20-58, A76-55, A76-56, MAM-63, MAM-64, NEM-63, NEM-64, WTS-63, WTS-64
	Titanium (D)	1	0	A20-57*
	TKN	6	0	A20-57, A20-58, MAM-63, MAM-64, WTS-63, WTS-64
	Total Alkalinity	5	0	A76-55, MAM-63, MAM-64, WTS-63, WTS-64
	Total phosphorous	2	3	MAM-63, MAM-64, WTS-64
	Zinc (D)	3	3	A20-57*, MAM-64, NEM-63

* Indicates samples which failed reliability checks and are consequently uncertain.

Table 6: Trigger and threshold exceedances at Baker Lake sampling stations

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
BAP-75	Baker - Akilahaarjuk Point	Chromium (D)	0.00050	0.0005	mg/L	MDL	0.005	0.00026	-
BAP-76	Baker - Akilahaarjuk Point	Chromium (D)	0.00050	0.0005	mg/L	MDL	0.005	0.00026	-
BBD-75	Baker - Barge Dock	Chromium (D)	0.00050	0.0005	mg/L	MDL	0.005	0.00026	-
BBD-75	Baker - Barge Dock	Silicon (D)	0.25700	0.0500	mg/L	-	-	0.25000	-
BBD-75	Baker - Barge Dock	Silicon (T)	0.32000	0.1000	mg/L	-	-	0.28000	-
BBD-75	Baker - Barge Dock	Total phosphorous	***0.00480***	0.0020	mg/L	-	0.004	0.00750	-
BBD-76	Baker - Barge Dock	Chromium (D)	0.00050	0.0005	mg/L	MDL	0.005	0.00026	-
BBD-76	Baker - Barge Dock	Silicon (T)	0.32000	0.1000	mg/L	-	-	0.28000	-
BBD-76	Baker - Barge Dock	Total phosphorous	***0.00650***	0.0020	mg/L	-	0.004	0.00750	-
BPJ-75	Baker - Proposed Jetty	Chromium (D)	0.00050	0.0005	mg/L	MDL	0.005	0.00026	-
BPJ-75	Baker - Proposed Jetty	Total phosphorous	***0.00480***	0.0020	mg/L	-	0.004	0.00750	-
BPJ-76	Baker - Proposed Jetty	Chromium (D)	0.00050	0.0005	mg/L	MDL	0.005	0.00026	-
BPJ-76	Baker - Proposed Jetty	Titanium (T)	0.00061	0.0003	mg/L	-	-	0.00060	-
BPJ-76	Baker - Proposed Jetty	Total phosphorous	***0.00450***	0.0020	mg/L	-	0.004	0.00750	-

[1]Bold values are above the threshold as well as above the trigger value.

[2]Results failing to meet reliability checks are indicated as uncertain.

Table 4: Trigger and threshold exceedances at Meadowbank sampling stations.

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
INUG-134	Inuggugayualik	Chromium (D)	0.0005	0.0005	mg/L	MDL	0.005	0.00026	-
INUG-134	Inuggugayualik	Silicon (T)	0.2200	0.1000	mg/L	-	-	0.20000	-
INUG-135	Inuggugayualik	Chromium (D)	0.0005	0.0005	mg/L	MDL	0.005	0.00026	-
INUG-135	Inuggugayualik	Silicon (T)	0.2200	0.1000	mg/L	-	-	0.20000	-
PDL-100	Pipedream	Calcium (T)	2.4000	0.0500	mg/L	-	-	2.39000	-
PDL-100	Pipedream	Chromium (D)	0.0005	0.0005	mg/L	MDL	0.005	0.00026	-
PDL-100	Pipedream	Hardness	9.5400	0.6000	mg/L	-	-	9.50000	-
PDL-99	Pipedream	Chromium (D)	0.0005	0.0005	mg/L	MDL	0.005	0.00026	-
SP-146	Second Portage	Bicarbonate alkalinity	9.6000	1.0000	mg/L	-	-	8.70000	-
SP-146	Second Portage	Calcium (T)	3.5300	0.0500	mg/L	-	-	2.39000	-
SP-146	Second Portage	Chromium (D)	0.0005	0.0005	mg/L	MDL	0.005	0.00026	-
SP-146	Second Portage	Conductivity	35.5000	2.0000	µS/cm	-	-	27.40000	-
SP-146	Second Portage	Hardness	13.6000	0.6000	mg/L	-	-	9.50000	-
SP-146	Second Portage	Magnesium (T)	1.1500	0.0050	mg/L	-	-	0.93000	-
SP-146	Second Portage	Silicon (D)	0.2740	0.0500	mg/L	-	-	0.18000	-
SP-146	Second Portage	Silicon (T)	0.3200	0.1000	mg/L	-	-	0.20000	-
SP-146	Second Portage	TDS	23.7000	3.0000	mg/L	-	-	19.00000	-
SP-146	Second Portage	Total Alkalinity	9.6000	1.0000	mg/L	-	-	8.70000	-
SP-147	Second Portage	Bicarbonate alkalinity	9.5000	1.0000	mg/L	-	-	8.70000	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
SP-147	Second Portage	Calcium (T)	3.6200	0.0500	mg/L	-	-	2.39000	-
SP-147	Second Portage	Chromium (D)	0.0005	0.0005	mg/L	MDL	0.005	0.00026	-
SP-147	Second Portage	Conductivity	35.3000	2.0000	µS/cm	-	-	27.40000	-
SP-147	Second Portage	Hardness	13.8000	0.6000	mg/L	-	-	9.50000	-
SP-147	Second Portage	Magnesium (T)	1.1700	0.0050	mg/L	-	-	0.93000	-
SP-147	Second Portage	Silicon (D)	0.2670	0.0500	mg/L	-	-	0.18000	-
SP-147	Second Portage	Silicon (T)	0.3100	0.1000	mg/L	-	-	0.20000	-
SP-147	Second Portage	TDS	21.4000	3.0000	mg/L	-	-	19.00000	-
SP-147	Second Portage	Total Alkalinity	9.5000	1.0000	mg/L	-	-	8.70000	-
TPE-146	Third Portage - East Basin	Calcium (T)	2.5600	0.0500	mg/L	-	-	2.39000	-
TPE-146	Third Portage - East Basin	Chromium (D)	0.0005	0.0005	mg/L	MDL	0.005	0.00026	-
TPE-146	Third Portage - East Basin	Conductivity	27.8000	2.0000	µS/cm	-	-	27.40000	-
TPE-146	Third Portage - East Basin	Hardness	10.3000	0.6000	mg/L	-	-	9.50000	-
TPE-146	Third Portage - East Basin	Magnesium (T)	0.9570	0.0050	mg/L	-	-	0.93000	-
TPE-147	Third Portage - East Basin	Calcium (T)	2.6000	0.0500	mg/L	-	-	2.39000	-
TPE-147	Third Portage - East Basin	Chromium (D)	0.0005	0.0005	mg/L	MDL	0.005	0.00026	-
TPE-147	Third Portage - East Basin	Conductivity	28.1000	2.0000	µS/cm	-	-	27.40000	-
TPE-147	Third Portage - East Basin	Hardness	10.3000	0.6000	mg/L	-	-	9.50000	-
TPE-147	Third Portage - East Basin	Magnesium (T)	0.9310	0.0050	mg/L	-	-	0.93000	-
TPN-146	Third Portage - North Basin	Chromium (D)	0.0005	0.0005	mg/L	MDL	0.005	0.00026	-
TPN-146	Third Portage - North Basin	Conductivity	27.8000	2.0000	µS/cm	-	-	27.40000	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
TPN-147	Third Portage - North Basin	Chromium (D)	0.0005	0.0005	mg/L	MDL	0.005	0.00026	-
TPN-147	Third Portage - North Basin	Conductivity	27.9000	2.0000	µS/cm	-	-	27.40000	-
TPN-147	Third Portage - North Basin	TDS	20.6000	3.0000	mg/L	-	-	19.00000	-
WAL-115	Wally	Chromium (D)	0.0005	0.0005	mg/L	MDL	0.005	0.00026	-
WAL-115	Wally	TDS	25.6000	3.0000	mg/L	-	-	25.30000	-
WAL-116	Wally	Chromium (D)	0.0005	0.0005	mg/L	MDL	0.005	0.00026	-
WAL-116	Wally	TDS	25.4000	3.0000	mg/L	-	-	25.30000	-

[1]Bold values are above the threshold as well as above the trigger value.

[2]Results failing to meet reliability checks are indicated as uncertain.

Table 5: Trigger and threshold exceedances at Whale Tail Pit sampling stations

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
A20-57	Lake A20	Calcium (T)	5.20000	0.05000	mg/L	-	-	4.60000	-
A20-57	Lake A20	Conductivity	53.10000	2.00000	µS/cm	-	-	48.60000	-
A20-57	Lake A20	Hardness	18.70000	0.60000	mg/L	-	-	17.40000	-
A20-57	Lake A20	Potassium (T)	1.38000	0.05000	mg/L	-	-	0.84000	-
A20-57	Lake A20	Sodium (T)	1.09000	0.05000	mg/L	-	-	0.97000	-
A20-57	Lake A20	TDS	49.00000	10.00000	mg/L	-	-	38.50000	-
A20-57	Lake A20	Titanium (D)	0.00089	0.00030	mg/L	-	-	0.00060	Uncertain
A20-57	Lake A20	TKN	0.18300	0.05000	mg/L	-	-	0.17000	-
A20-57	Lake A20	Zinc (D)	***0.01300***	0.00100	mg/L	-	0.003	0.00230	Uncertain
A20-58	Lake A20	Potassium (T)	1.13000	0.05000	mg/L	-	-	0.84000	-
A20-58	Lake A20	TDS	42.70000	10.00000	mg/L	-	-	38.50000	-
A20-58	Lake A20	TKN	0.18200	0.05000	mg/L	-	-	0.17000	-
A76-55	Lake A76	Bicarbonate alkalinity	9.70000	1.00000	mg/L	-	-	9.60000	-
A76-55	Lake A76	Calcium (T)	8.84000	0.05000	mg/L	-	-	4.60000	-
A76-55	Lake A76	Conductivity	88.40000	2.00000	µS/cm	-	-	48.60000	-
A76-55	Lake A76	Hardness	31.10000	0.60000	mg/L	-	-	17.40000	-
A76-55	Lake A76	Magnesium (T)	2.20000	0.00500	mg/L	-	-	1.41000	-
A76-55	Lake A76	Potassium (T)	1.80000	0.05000	mg/L	-	-	0.84000	-
A76-55	Lake A76	Sodium (T)	1.29000	0.05000	mg/L	-	-	0.97000	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
A76-55	Lake A76	TDS	71.30000	10.00000	mg/L	-	-	38.50000	-
A76-55	Lake A76	Total Alkalinity	9.70000	1.00000	mg/L	-	-	9.60000	-
A76-56	Lake A76	Calcium (T)	8.93000	0.05000	mg/L	-	-	4.60000	-
A76-56	Lake A76	Conductivity	88.30000	2.00000	µS/cm	-	-	48.60000	-
A76-56	Lake A76	Hardness	31.40000	0.60000	mg/L	-	-	17.40000	-
A76-56	Lake A76	Magnesium (T)	2.22000	0.00500	mg/L	-	-	1.41000	-
A76-56	Lake A76	Potassium (T)	1.83000	0.05000	mg/L	-	-	0.84000	-
A76-56	Lake A76	Sodium (T)	1.31000	0.05000	mg/L	-	-	0.97000	-
A76-56	Lake A76	TDS	77.30000	10.00000	mg/L	-	-	38.50000	-
DS1-54	Lake DS1	Lead (D)	***0.01260***	0.00005	mg/L	-	0.001	0.00053	Uncertain
DS1-54	Lake DS1	Silicon (D)	0.65600	0.05000	mg/L	-	-	0.57000	-
MAM-63	Mammoth	Ammonia-N	0.07620	0.00500	mg/L	-	0.126	0.06500	-
MAM-63	Mammoth	Bicarbonate alkalinity	15.00000	1.00000	mg/L	-	-	9.60000	-
MAM-63	Mammoth	Calcium (T)	15.80000	0.05000	mg/L	-	-	4.60000	-
MAM-63	Mammoth	Conductivity	154.00000	2.00000	µS/cm	-	-	48.60000	-
MAM-63	Mammoth	Hardness	55.00000	0.60000	mg/L	-	-	17.40000	-
MAM-63	Mammoth	Lithium (D)	0.00240	0.00100	mg/L	-	-	0.00200	-
MAM-63	Mammoth	Lithium (T)	0.00260	0.00100	mg/L	-	-	0.00200	-
MAM-63	Mammoth	Magnesium (T)	3.77000	0.00500	mg/L	-	-	1.41000	-
MAM-63	Mammoth	Potassium (T)	3.64000	0.05000	mg/L	-	-	0.84000	-
MAM-63	Mammoth	Sodium (T)	2.54000	0.05000	mg/L	-	-	0.97000	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
MAM-63	Mammoth	TDS	126.00000	10.00000	mg/L	-	-	38.50000	-
MAM-63	Mammoth	TKN	0.36400	0.05000	mg/L	-	-	0.17000	-
MAM-63	Mammoth	Total Alkalinity	15.00000	1.00000	mg/L	-	-	9.60000	-
MAM-63	Mammoth	Total phosphorous	***0.00580***	0.00200	mg/L	-	0.004	0.00450	-
MAM-64	Mammoth	Bicarbonate alkalinity	12.70000	1.00000	mg/L	-	-	9.60000	-
MAM-64	Mammoth	Calcium (T)	12.50000	0.05000	mg/L	-	-	4.60000	-
MAM-64	Mammoth	Conductivity	119.00000	2.00000	µS/cm	-	-	48.60000	-
MAM-64	Mammoth	Hardness	42.70000	0.60000	mg/L	-	-	17.40000	-
MAM-64	Mammoth	Magnesium (T)	2.79000	0.00500	mg/L	-	-	1.41000	-
MAM-64	Mammoth	Potassium (T)	2.82000	0.05000	mg/L	-	-	0.84000	-
MAM-64	Mammoth	Sodium (T)	1.91000	0.05000	mg/L	-	-	0.97000	-
MAM-64	Mammoth	TDS	96.30000	10.00000	mg/L	-	-	38.50000	-
MAM-64	Mammoth	TKN	0.24600	0.05000	mg/L	-	-	0.17000	-
MAM-64	Mammoth	Total Alkalinity	12.70000	1.00000	mg/L	-	-	9.60000	-
MAM-64	Mammoth	Total phosphorous	***0.00540***	0.00200	mg/L	-	0.004	0.00450	-
MAM-64	Mammoth	Zinc (D)	***0.00330***	0.00100	mg/L	-	0.003	0.00230	-
NEM-63	Nemo	Calcium (T)	10.10000	0.05000	mg/L	-	-	4.60000	-
NEM-63	Nemo	Conductivity	90.20000	2.00000	µS/cm	-	-	48.60000	-
NEM-63	Nemo	Hardness	33.20000	0.60000	mg/L	-	-	17.40000	-
NEM-63	Nemo	Magnesium (T)	1.94000	0.00500	mg/L	-	-	1.41000	-
NEM-63	Nemo	Potassium (T)	1.48000	0.05000	mg/L	-	-	0.84000	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
NEM-63	Nemo	TDS	83.30000	10.00000	mg/L	-	-	38.50000	-
NEM-63	Nemo	Zinc (D)	***0.00380***	0.00100	mg/L	-	0.003	0.00230	-
NEM-64	Nemo	Calcium (T)	10.20000	0.05000	mg/L	-	-	4.60000	-
NEM-64	Nemo	Conductivity	90.10000	2.00000	µS/cm	-	-	48.60000	-
NEM-64	Nemo	Hardness	33.50000	0.60000	mg/L	-	-	17.40000	-
NEM-64	Nemo	Magnesium (T)	1.95000	0.00500	mg/L	-	-	1.41000	-
NEM-64	Nemo	Potassium (T)	1.52000	0.05000	mg/L	-	-	0.84000	-
NEM-64	Nemo	TDS	81.70000	10.00000	mg/L	-	-	38.50000	-
WTS-63	Whale Tail South	Bicarbonate alkalinity	13.90000	1.00000	mg/L	-	-	9.60000	-
WTS-63	Whale Tail South	Calcium (T)	8.89000	0.05000	mg/L	-	-	4.60000	-
WTS-63	Whale Tail South	Conductivity	86.20000	2.00000	µS/cm	-	-	48.60000	-
WTS-63	Whale Tail South	Hardness	31.30000	0.60000	mg/L	-	-	17.40000	-
WTS-63	Whale Tail South	Magnesium (T)	2.22000	0.00500	mg/L	-	-	1.41000	-
WTS-63	Whale Tail South	Potassium (T)	2.29000	0.05000	mg/L	-	-	0.84000	-
WTS-63	Whale Tail South	Sodium (T)	1.56000	0.05000	mg/L	-	-	0.97000	-
WTS-63	Whale Tail South	TDS	75.70000	10.00000	mg/L	-	-	38.50000	-
WTS-63	Whale Tail South	TKN	0.21000	0.05000	mg/L	-	-	0.17000	-
WTS-63	Whale Tail South	Total Alkalinity	13.90000	1.00000	mg/L	-	-	9.60000	-
WTS-64	Whale Tail South	Bicarbonate alkalinity	13.60000	1.00000	mg/L	-	-	9.60000	-
WTS-64	Whale Tail South	Calcium (T)	8.86000	0.05000	mg/L	-	-	4.60000	-
WTS-64	Whale Tail South	Conductivity	86.20000	2.00000	µS/cm	-	-	48.60000	-

Sample ID	ID_Name	Parameter	Results[1]	DL	Units	MDL	Threshold	Trigger	Reliability[2]
WTS-64	Whale Tail South	Hardness	31.40000	0.60000	mg/L	-	-	17.40000	-
WTS-64	Whale Tail South	Magnesium (T)	2.25000	0.00500	mg/L	-	-	1.41000	-
WTS-64	Whale Tail South	Potassium (T)	2.30000	0.05000	mg/L	-	-	0.84000	-
WTS-64	Whale Tail South	Sodium (T)	1.60000	0.05000	mg/L	-	-	0.97000	-
WTS-64	Whale Tail South	TDS	74.30000	10.00000	mg/L	-	-	38.50000	-
WTS-64	Whale Tail South	TKN	0.24800	0.05000	mg/L	-	-	0.17000	-
WTS-64	Whale Tail South	Total Alkalinity	13.60000	1.00000	mg/L	-	-	9.60000	-
WTS-64	Whale Tail South	Total phosphorous	***0.00450***	0.00200	mg/L	-	0.004	0.00450	-

[1]Bold values are above the threshold as well as above the trigger value.

[2]Results failing to meet reliability checks are indicated as uncertain.

2.1 Result Reliability Checks

Two preliminary analyses were conducted to assess the reliability of sample results. Samples failing either one of these tests have been flagged as uncertain, and warrant further evaluation.

The first analysis compares dissolved and total concentrations for a given parameters at each location. Samples where dissolved concentrations are greater than total with a relative percent difference (RPD) of more than 30% are considered potentially unreliable. All samples failing to meet this reliability check are summarized in Table 7.

The second analysis compares parameter concentrations from the two sampling stations located within each water body (either lake or basin). Parameters for which the difference between these two intra-lake samples was greater than a factor of 5 (or a factor of 10 if at least one of the samples was within a factor of 10 of the MDL) are considered potentially unreliable. All samples failing to meet this reliability check are summarized in Table 8.

Table 7: Samples with uncertain reliability due to differences in dissolved and total parameter results.

Area	Sample ID	ID_Name	Parameter	Result (T)	Result (D)	MDL (T)	MDL (D)	RPD
Baker Lake	BBD-76	Baker - Barge Dock	Selenium	0.00005	0.00012	MDL	-	82.4
Meadowbank	SP-146	Second Portage	Lead	0.00005	0.000403	MDL	-	155.8
Meadowbank	TPE-146	Third Portage - East Basin	Lead	0.00005	0.000114	MDL	-	78
Whale Tail Pit	DS1-54	Lake DS1	Lead	0.00005	0.0126	MDL	-	198.4
Whale Tail Pit	A20-57	Lake A20	Zinc	0.003	0.013	MDL	-	125
Whale Tail Pit	A20-57	Lake A20	Titanium	0.0003	0.00089	MDL	-	99.2
Whale Tail Pit	A20-57	Lake A20	Lead	0.00005	0.000127	MDL	-	87
Whale Tail Pit	A20-57	Lake A20	Nickel	0.00054	0.00076	-	-	33.8
Whale Tail Pit	A76-55	Lake A76	Molybdenum	0.000136	0.000186	-	-	31.1

Table 8: Samples with uncertain reliability due to differences between results from the same sampling area.

Area	ID	ID_Name	Parameter	Difference	Threshold[1]
Whale Tail Pit	DS1	Lake DS1	Lead (D)	252	10
Whale Tail Pit	A20	Lake A20	Zinc (D)	13	10

[1]Threshold is set at a factor of 5, unless one or more sample is within a factor of 10 of the MDL in which case the threshold is set at a factor of 10.

3. Laboratory & Field Quality Control Results

ALS' laboratory QC samples for water are:

- *Laboratory duplicates* (LD) - these samples provide insights into the precision of laboratory analyses. Duplicate aliquots are taken from the samples and run through part (aliquots taken post digestion) or all (aliquots taken from the sample bottle) the laboratory analytical process.
- *Laboratory control samples* (LCS) - these samples provide insights into whether the laboratory systems are working as intended. They are comprised of a mixture of analyte-free water to which known amounts of the method analytes are added. They are essentially an internal version of a certified reference material.
- *Matrix spikes* (MS) - these samples involve the analysis of actual samples, to which a known amount of method analytes are added in amounts high enough that the spikes are clearly discernible relative to existing concentrations. These samples provide insights into the degree that the sample matrix could interfere with analyses.
- *Matrix blanks* (MB) - these samples are analyzed to assess background interference or contamination that exists in the analytical system that could lead to elevated concentrations or false positive data. These samples are comprised of analyte-free water.

The following field QC samples were collected and submitted blind to ALS:

- *Field duplicates* (FD) - these samples provide insights into (a) variability in field conditions and (b) the precision of laboratory analyses. Duplicate samples are collected from the same location and treated independently through the sampling and analysis process.
- *Deionized blanks* (DB) - these samples are analyzed to verify the "analyte-free" status of the deionized water to help interpret the equipment blank results. These samples are comprised of deionized water poured directly into the sampling containers.
- *Equipment blanks* (EB) - these samples are analyzed to assess cross contamination in the sampling equipment that could lead to elevated concentrations or false positive data. These samples are comprised of analyte-free deionized water passed through the sampling equipment.
- *Travel blanks* (TB) - these samples are analyzed to assess cross contamination occurring during the transport of samples. These samples comprise analyte-free deionized water prepared in the lab by ALS, and travel to the site and back to the lab without being opened.

3.1 Overall QC Results

Overall laboratory and field QC results are summarized in Table 9.

Table 9: Summary of laboratory and field QC results by sample type.

	QC_Element	Pass	Fail	ND
Laboratory	Lab Duplicate	885	1	0
	Lab Control Sample	814	3	0
	Matrix Spike	648	0	77
	Matrix Blank	828	1	0
Field	Field Duplicate	430	3	0
	Deionized Water Blank	110	0	0
	Equipment Blank	110	0	0

3.2 Laboratory Duplicates

In this sampling event, 1 laboratory duplicate failed to meet the QC objectives. Laboratory duplicate results not meeting QC objectives are summarized in Table 10.

Table 10: Details for laboratory duplicate results not meeting QC objectives.

QC_Lot	ALS_QC_ID[1]	Analyte	RPD	DIFFx	LD.QC
277859	ANONYMOUS	chromium, total	32.1	2.4	Fail

[1]ALS_QC_ID listing of 'Anonymous' indicates QC sample from another client used.

3.3 Laboratory Control Samples

In this sampling event, 3 laboratory control samples failed to meet the QC objectives. Laboratory control sample results not meeting QC objectives are summarized in Table 11.

Table 11: Details for laboratory control sample results not meeting QC objectives.

QC_Lot	ALS_QC_ID[1]	Analyte	Percent	Limit	LCS.QC
270340	QC-270340-002	selenium, total	123	80-120	Fail

QC_Lot	ALS_QC_ID[1]	Analyte	Percent	Limit	LCS.QC
270340	QC-270340-002	tellurium, total	123	80-120	Fail
270909	QC-270909-002	phosphorus, dissolved	123	80-120	Fail

[1]ALS_QC_ID listing of 'Anonymous' indicates QC sample from another client used.

3.4 Matrix Spike

All matrix spike results met laboratory QC objectives.

In addition, some parameters had spike levels too low to confidently quantify them relative to existing concentrations in the sample. Consequently, QC results for these results could not be calculated (see Table 12).

Table 12: Analytes not determined for matrix spikes.

QC_Lot	Analyte	ALS_QC_ID[1]
270340	calcium, total	A76-56
270340	magnesium, total	A76-56
270340	strontium, total	A76-56
270135	barium, dissolved	Anonymous
270135	calcium, dissolved	Anonymous
270135	copper, dissolved	Anonymous
270135	magnesium, dissolved	Anonymous
270135	manganese, dissolved	Anonymous
270135	sodium, dissolved	Anonymous
270135	strontium, dissolved	Anonymous
270135	sulfur, dissolved	Anonymous
270891	barium, total	Anonymous
270891	boron, total	Anonymous
270891	calcium, total	Anonymous
270891	lithium, total	Anonymous

QC_Lot	Analyte	ALS_QC_ID[1]
270891	magnesium, total	Anonymous
270891	selenium, total	Anonymous
270891	sodium, total	Anonymous
270891	strontium, total	Anonymous
270891	sulfur, total	Anonymous
270891	uranium, total	Anonymous
272771	calcium, dissolved	Anonymous
272771	magnesium, dissolved	Anonymous
272771	sodium, dissolved	Anonymous
272771	strontium, dissolved	Anonymous
275474	magnesium, total	BPJ-76
275474	sodium, total	BPJ-76
275474	strontium, total	BPJ-76
275629	calcium, dissolved	Anonymous
275629	magnesium, dissolved	Anonymous
275629	manganese, dissolved	Anonymous
275629	silicon, dissolved	Anonymous
275629	sodium, dissolved	Anonymous
275629	strontium, dissolved	Anonymous
275474	magnesium, total	Anonymous
275474	sodium, total	Anonymous
275474	strontium, total	Anonymous
275480	magnesium, total	LK5-31
275629	calcium, dissolved	Anonymous
275629	magnesium, dissolved	Anonymous
275629	manganese, dissolved	Anonymous
275629	silicon, dissolved	Anonymous

QC_Lot	Analyte	ALS_QC_ID[1]
275629	sodium, dissolved	Anonymous
275629	strontium, dissolved	Anonymous
277887	aluminum, total	Anonymous
277887	boron, total	Anonymous
277887	calcium, total	Anonymous
277887	magnesium, total	Anonymous
277887	manganese, total	Anonymous
277887	potassium, total	Anonymous
277887	rubidium, total	Anonymous
277887	sodium, total	Anonymous
277887	strontium, total	Anonymous
277887	sulfur, total	Anonymous
277859	barium, total	Anonymous
277859	boron, total	Anonymous
277859	calcium, total	Anonymous
277859	magnesium, total	Anonymous
277859	manganese, total	Anonymous
277859	potassium, total	Anonymous
277859	silicon, total	Anonymous
277859	sodium, total	Anonymous
277859	strontium, total	Anonymous
277859	sulfur, total	Anonymous
277875	arsenic, dissolved	Anonymous
277875	barium, dissolved	Anonymous
277875	boron, dissolved	Anonymous
277875	calcium, dissolved	Anonymous
277875	lithium, dissolved	Anonymous

QC_Lot	Analyte	ALS_QC_ID[1]
277875	magnesium, dissolved	Anonymous
277875	manganese, dissolved	Anonymous
277875	molybdenum, dissolved	Anonymous
277875	potassium, dissolved	Anonymous
277875	sodium, dissolved	Anonymous
277875	strontium, dissolved	Anonymous
277875	sulfur, dissolved	Anonymous
277875	uranium, dissolved	Anonymous

[1]ALS_QC_ID listing of 'Anonymous' indicates QC sample from another client used.

3.5 Matrix Blank

In this sampling event, 1 matrix blanks result failed to meet the QC objectives. Matrix blank results not meeting QC objectives are summarized in Table 13.

Table 13: Details for matrix blank results not meeting QC objectives.

QC_Lot	Analyte	Result	Limit	MDL	MB.QC
273550	Kjeldahl nitrogen, total [TKN]	0.24	0.05	-	Fail

3.6 Field Duplicates

In this sampling event, 3 field duplicate samples failed to meet the QC objectives. Field duplicate sample results not meeting QC objectives are summarized in Table 14.

Table 14: Details for field duplicate results not meeting QC objectives.

QC_Lot.x	Analyte	RPD	DIFFx	FD.QC
268403	ammonia, total (as N)	90.1	6.4	Fail
270135	lead, dissolved	178.1	16.3	Fail
272281	ammonia, total (as N)	112.4	4.4	Fail

3.7 DI Blank

All deionized water blank results met laboratory QC objectives.

3.8 Equipment Blank

All equipment blank results met laboratory QC objectives.

3.9 Travel Blank

Travel blank results were not analyzed in this sampling event.

3.10 Holding Time Exceedances

In addition to those ALS laboratory QC samples described above, during QC screening samples were also assessed agianst recommended hold times. Parameters and associated sample numbers exceeding recommended hold times in this sampling event are shown in Table 15. Note that pH is included in the suite of field measurements and has a very short recommended hold time, so exceeding the hold time for laboratory analysis is expected and of little importance.

Table 15: Analytes and associated number of samples exceeding holding times.

ALS_Method	n
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level)	40
Nitrate in Water by IC (Low Level)	40
Nitrite in Water by IC (Low Level)	40
pH by Meter	40
Turbidity by Nephelometry	35
TDS by Gravimetry (Low Level)	3
TSS by Gravimetry (Low Level)	3

Appendix A2
ALS Corrective Action Report – Sediment Testing and Missed Analyses for CREMP Sediment Grabs

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December 6, 2021

Azimuth Consulting Group
218-2902 West Broadway
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V6K 2G8

Dear Marianna DiMauro,

Re: ALS Corrective Action Report (CAR) #21562 – Sediment Testing and Missed Analyses for CREMP Sediment Grabs - Quote #Q38011 - ALS Work Order VA21B7872

ALS Burnaby received 86 sediment samples from Azimuth Consulting on Aug 23, 2021 under ALS Quote #Q38011. The submission was registered at ALS under the file number VA21B7872 and samples were placed on hold as per client request. On Aug 26, 2021, Azimuth e-mailed ALS with the updated testing requirements. Unfortunately, due to an error in sample receipt, the requested analyses were not added to the above referenced file. By the time this error was discovered, the samples had exceeded their ALS 45 day in-house archive time and samples had been disposed of.

In response to this error, ALS has implemented the following corrective actions:

1. Review of the details of this issue with all Client Services staff
   This issue and the implications for Azimuth, have been discussed with all of the ALS Client Services and Sample Login staff.

2. Clarification of expectations for on hold analysis requests
   A review of the process for adding analyses to on hold samples was conducted and several modifications were made to the procedure to prevent this issue from reoccurring.

ALS sincerely apologizes for the inconvenience that this issue has caused Azimuth Consulting and their client. We recognize and understand the implications of this type of error and take this issue very seriously.

If you require any additional information, please do not hesitate to contact either myself or Jerry Holzbecher.

Sincerely,

Katherine B. Thomas, B.Sc.
Operations Manager – Vancouver

Jerry Holzbecher, B.Sc.
Client Services Manager – Vancouver

APPENDIX B
WATER CHEMISTRY DATA AND SUPPLEMENTAL PLOTS

Appendix B1
Water Chemistry – Meadowbank Study Area Lakes

LIST OF TABLES

LIST OF FIGURES

Note: Water quality results dating as far back as the start of baseline sampling in 2006 are shown.

TABLES

Table B1-1. Water quality results from the Meadowbank study area lakes, 2021.

Lake & Area	Aquatic Life Guideline[1]	Meadowbank Screening Values[2]			Inuggugayualik Lake (INUG)									
Month					March	March	May	May	July	July	August	August	September	September
Area-Replicate ID					INUG-128	INUG-129	INUG-130	INUG-131	INUG-132	INUG-133	INUG-134	INUG-135	INUG-136	INUG-137
Date		Triggers			10-Mar	17-Mar	11-May	11-May	27-Jul	27-Jul	18-Aug	18-Aug	04-Sep	04-Sep
Time		Meadowbank	Wally Lake	Thresholds	10:30	14:48	9:08	9:25	10:45	11:15	7:51	8:11	14:20	13:36
ALS Sample ID					VA21A6084-005	VA21A6084-006	VA21A9442-007	VA21A9442-008	VA21B6241-005	VA21B6241-006	VA21B7863-003	VA21B7863-004	VA21B9414-005	VA21B9414-006
Field Measurements (Surface 3m)														
Dissolved Oxygen (mg/L)					18	17	18	16	11	11	11	11	11	11
Specific Conductivity (µS/cm)					20	21	22	20	15	15	15	15	15	15
pH	6.5 - 9.0	6.30 - 8.25	6.54 - 8.34	6.5 - 9.0	6.2	6.7	6.6	6.4	6.8	6.5	6.6	6.6	6.6	6.7
Temperature (°C)					0.77	0.66	0.59	0.76	8.3	8.3	8.6	8.6	10	10
Physical Tests (mg/L)														
Conductivity (µS/cm)		27	37		20	22	22	21	16	16	16	16	16	16
Alkalinity - Total (as $CaCO_3$)		8.7	18		6.2	7.0	6.4	6.4	4.7	5.2	5.2	4.9	5.1	5.0
Alkalinity - Bicarbonate		8.7	18		6.2	7.0	6.4	6.4	4.7	5.2	5.2	4.9	5.1	5.0
Alkalinity - Carbonate		2.0	2.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity - Hydroxide					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hardness (as CaCO3), dissolved		9.5	17		7.2	7.8	7.7	7.7	5.5	5.4	5.5	5.6	5.6	5.5
Hardness (as CaCO3), from total Ca/Mg					7.4	7.8	8.1	7.6	5.6	5.6	5.8	5.7	5.7	5.6
pH (Laboratory)	6.5 - 9.0	6.47-7.95	6.92 - 8.17	6.5 - 9.0	6.9	6.9	6.9	6.8	7.0	7.0	6.8	6.9	7.0	7.0
Total Dissolved Solids		19	25		12	14	**21**	**19**	13	12	12	11	12	14
Total Suspended Solids		3.0	3.0	5.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.4	1.4	1.5	<1.0	<1.0
Turbidity (NTU)					0.20	0.23	<0.10	<0.10	0.72	0.71	0.55	0.55	0.40	0.36
Anions and Nutrients (mg/L)														
Total Kjeldahl Nitrogen		0.17	0.16		0.12	0.14	0.12	0.11	0.13	0.12	0.12	0.12	0.10	0.11
Ammonia (as N)[3]	***equation***	0.065	0.067	0.13	0.014	0.016	0.018	0.017	<0.0050	0.0077	0.0060	<0.0050	<0.0050	<0.0050
Bromide					<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride	120	60	60	120	0.99	1.1	1.1	1.0	0.76	0.76	0.68	0.67	0.75	0.76
Fluoride	0.12	0.088	0.080	0.12	0.075	0.084	0.074	0.073	0.060	0.059	0.049	0.052	0.062	0.062
Nitrate (as N)	3.0	1.5	1.5	3.0	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrite (as N)	0.060	0.031	0.031	0.060	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Ortho Phosphate (as P)		0.0020	0.0020		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Phosphorus (P) - Total	0.010	0.0051	0.0067	0.010	0.0023	0.0022	0.0021	<0.0020	0.0027	<0.0020	<0.0020	0.0024	0.0032	0.0034
Phosphorus (P) - Total Diss.					<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Reactive Silica (as SiO_2)		1.0	1.1		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Sulphate (SO_4)		65	65	128	1.3	1.4	1.3	1.2	0.92	0.93	0.79	0.78	0.93	0.95
Cyanides (mg/L)														
Free Cyanide	0.0050				<0.0010	-	<0.0010	-	-	<0.0010	-	<0.0050	<0.0010	-
Total Cyanide					<0.0010	-	<0.0010	-	-	<0.0010	-	<0.0050	<0.0010	-
Organic / Inorganic Carbon (mg/L)														
Dissolved Organic Carbon		2.5	3.2		2.0	**2.7**	2.0	2.0	2.4	2.3	2.3	2.2	2.0	2.2
Total Organic Carbon		2.6	4.1		2.1	2.2	2.1	2.0	1.9	2.2	2.1	2.1	**2.8**	2.4
Total Metals (mg/L)														
Aluminum[3]	***equation***	0.053	0.053	0.10	0.0034	0.0039	0.0040	0.0039	0.022	0.031	0.023	0.020	0.016	0.016
Antimony		0.0046	0.0046	0.0090	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	0.0050	0.0026	0.0026	0.0050	0.00013	0.00013	0.00013	0.00011	0.00012	0.00012	0.00012	0.00011	0.00012	0.00011
Barium		0.50	0.50	1.0	0.0020	0.0022	0.0023	0.0021	0.0019	0.0020	0.0019	0.0019	0.0018	0.0017
Beryllium		0.00012	0.00012	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth					<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	1.5	0.76	0.76	1.5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium[3]	***equation***	0.00002	0.00002	0.00004	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium		2.4	4.9		1.5	1.6	1.7	1.6	1.1	1.1	1.1	1.1	1.1	1.1
Chromium[4]	0.0010	0.0025	0.0026	0.0050	<0.00010	<0.00010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt				0.00077	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper[3]	***equation***	0.0012	0.0015	0.0020	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Iron	0.30	0.15	0.16	0.30	<0.010	<0.010	<0.010	<0.010	0.036	0.045	0.029	0.024	0.017	0.017
Lead[3]	***equation***	0.00053	0.00053	0.0010	<0.000050	<0.000050	<0.000050	0.00015	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium		0.0020	0.0020		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium		0.93	1.4		0.90	**0.95**	**0.98**	0.90	0.68	0.68	0.72	0.71	0.71	0.68
Manganese[3]		0.32	0.33	***See text***	0.00046	0.00045	0.00045	0.00042	0.0031	0.0033	0.0017	0.0015	0.0013	0.0013
Mercury	0.00003	0.00002	0.00002	0.00003	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum	0.073	0.037	0.037	0.073	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel[3]	***equation***	0.013	0.013	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Phosphorus		0.0051	0.0067	0.0040	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium		0.58	0.59		0.48	0.51	0.52	0.48	0.39	0.39	0.39	0.39	0.39	0.38
Rubidium					0.00065	0.00068	0.00069	0.00060	0.00054	0.00049	0.00057	0.00057	0.00052	0.00050
Selenium	0.0010	0.00053	0.00053	0.0010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon		0.20	0.65		0.19	0.20	**0.23**	**0.21**	0.20	**0.23**	**0.22**	**0.22**	**0.21**	0.19
Silver	0.00010	0.00013	0.00013	0.00025	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium		1.2	0.72		0.71	0.77	0.76	0.70	0.55	0.55	0.56	0.54	0.55	0.54
Strontium		1.3	1.3	2.5	0.0085	0.0090	0.0088	0.0081	0.0061	0.0061	0.0061	0.0060	0.0063	0.0069
Sulfur					<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Tellurium					<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Thallium	0.00080	0.00041	0.00041	0.00080	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Thorium					<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin		0.00020	0.00020		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium		0.00060	0.00060		<0.00030	<0.00030	<0.00030	<0.00030	**0.00076**	**0.00085**	0.00057	0.00052	0.00036	<0.00030
Tungsten					<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Uranium	0.015	0.0075	0.0075	0.015	0.00006	0.00007	0.00006	0.00006	0.00007	0.00007	0.00007	0.00007	0.00007	0.00008
Vanadium		0.060	0.060	0.12	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc					<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Zirconium					<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Dissolved Metals (mg/L)														
Aluminum[3]		0.026	0.026	0.050	0.0030	0.0030	0.0024	0.0029	0.0082	0.0064	0.0085	0.0078	0.0098	0.0067
Antimony		0.0046	0.0046	0.0090	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic		0.0026	0.0026	0.0050	0.00010	0.00012	0.00010	<0.00010	<0.00010	0.00011	<0.00010	0.00012	<0.00010	<0.00010
Barium		0.50	0.50	1.0	0.0019	0.0024	0.0021	0.0022	0.0019	0.0019	0.0018	0.0019	0.0018	0.0018
Beryllium		0.00012	0.00012	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth					<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron		0.76	0.76	1.5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium		0.00002	0.00002	0.00004	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium		2.4	4.9		1.5	1.5	1.6	1.6	1.1	1.1	1.1	1.1	1.1	1.1
Chromium		0.00026	0.00026	0.0050	<0.00010	<0.00010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt				0.00077	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper		0.0012	0.0015	0.0020	0.00038	0.00052	0.00043	0.00042	0.00043	0.00044	0.00037	0.00040	0.00040	0.00038
Iron		0.16	0.16	0.30	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Lead		0.00053	0.00053	0.0010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium		0.0020	0.0020		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium		0.93	1.4		0.85	**0.95**	0.92	0.91	0.66	0.65	0.69	0.70	0.69	0.67
Manganese[3]		0.32	0.33	***See text***	0.00025	0.0012	0.00026	0.00028	0.0012	0.0012	0.00030	0.00031	0.00026	0.00023
Mercury		0.00002	0.00002	0.00003	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum		0.037	0.037	0.073	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel		0.013	0.013	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Phosphorus					<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium		0.58	0.59		0.49	0.53	0.51	0.51	0.38	0.36	0.40	0.40	0.40	0.40
Selenium		0.00053	0.00053	0.0010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon		0.18	0.67		0.17	**0.18**	0.18	0.18	0.17	0.17	0.17	0.17	0.16	0.17
Silver		0.00013	0.00013	0.00025	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium		1.2	0.72		0.68	0.75	0.76	0.74	0.55	0.53	0.56	0.57	0.54	0.54
Strontium		1.3	1.3	2.5	0.0080	0.0088	0.0087	0.0084	0.0065	0.0064	0.0062	0.0063	0.0062	0.0062
Sulfur					0.50	0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Thallium		0.00041	0.00041	0.00080	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin		0.00020	0.00020		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium		0.00060	0.00060		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Uranium		0.0075	0.0075	0.015	0.00005	0.00006	0.00006	0.00006	0.00006	0.00006	0.00007	0.00006	0.00007	0.00007
Vanadium		0.060	0.060	0.12	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc[3]		0.0018	0.0024	***See text***	<0.0010	**0.0023**	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Speciated Metals (µg/L)														
Arsenate (As V)					<0.020	-	-	<0.020	<0.020	-	-	<0.020	-	<0.020
Arsenite (As III)					<0.020	-	-	<0.020	0.033	-	-	0.020	-	<0.020
Arsenobetaine (AsB)					<0.050	-	-	<0.050	<0.050	-	-	<0.050	-	<0.050
Dimethylarsinic Acid (DMA)					<0.020	-	-	<0.020	<0.020	-	-	<0.020	-	<0.020
Monomethylarsonic Acid (MMA)					<0.020	-	-	<0.020	<0.020	-	-	<0.020	-	<0.020
Plant Pigments (µg/L)														
chlorophyll a					0.045	0.46	0.43	0.38	0.66	0.58	0.47	0.42	0.94	0.83

Notes:

1. CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life, 1999, updated up to 2018.
2. Trigger and threshold values were developed in *CREMP Design Document 2012* (Azimuth, 2012d) and updated in 2019. A number of thresholds were derived from methods (or sources) other than CCME guidelines. Refer to the CREMP: 2015 Plan Update (Azimuth, 2015b) for more details.
3. "***equation***" means that CCME guidelines (or thresholds) are calculated based on an equation which is either pH or hardness dependent. The ammonia and aluminum (t & d) guidelines vary with pH; the cadmium, copper, lead, manganese, nickel and zinc guidelines vary with hardness.
4. Chromium CCME guideline is for Cr VI.

123 Bolded concentrations exceed the trigger value.

123 Bolded and shaded concentrations also exceed the threshold value.

Italicized numbers are below detection limits.

underline = results were given a cautionary flag in the QC assessment (refer to **Section 3.3** for details)

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

Table B1-1. Water quality results from the Meadowbank study area lakes, 2021.

Lake & Area	Aquatic Life Guideline[1]	Meadowbank Screening Values[2]			Pipe Dream Lake (PDL)									
Month		Triggers		Thresholds	March	March	May	May	July	July	August	August	September	September
Area-Replicate ID		Meadowbank	Wally Lake		PDL-93	PDL-94	PDL-95	PDL-96	PDL-97	PDL-98	PDL-99	PDL-100	PDL-101	PDL-102
Date					20-Mar	20-Mar	09-May	09-May	27-Jul	27-Jul	16-Aug	16-Aug	04-Sep	04-Sep
Time					11:15	12:00	9:42	10:20	13:15	13:55	9:27	9:58	17:05	16:20
ALS Sample ID					VA21A6084-011	VA21A6084-012	VA21A9442-009	VA21A9442-010	VA21B6241-007	VA21B6241-008	VA21B7863-001	VA21B7863-002	VA21B9414-007	VA21B9414-008
Field Measurements (Surface 3m)														
Dissolved Oxygen (mg/L)					19	19	16	16	12	13	12	12	12	12
Specific Conductivity (µS/cm)					31	26	28	25	22	22	24	24	23	23
pH	6.5 - 9.0	6.30 - 8.25	6.54 - 8.34	6.5 - 9.0	6.5	6.5	6.6	6.8	6.7	6.6	6.9	6.9	6.9	6.8
Temperature (°C)					0.060	0.34	0.33	0.32	6.7	6.2	7.7	7.8	9.9	9.6
Physical Tests (mg/L)														
Conductivity (µS/cm)		27	37		**30**	25	**28**	25	23	23	23	24	24	24
Alkalinity - Total (as $CaCO_3$)		8.7	18		**9.8**	8.6	**9.3**	8.2	8.0	8.1	8.0	7.8	8.1	7.7
Alkalinity - Bicarbonate		8.7	18		**9.8**	8.6	**9.3**	8.2	8.0	8.1	8.0	7.8	8.1	7.7
Alkalinity - Carbonate		2.0	2.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity - Hydroxide					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hardness (as CaCO3), dissolved		9.5	17		**12**	**10**	**11**	**10**	9.0	9.3	9.1	9.1	9.0	9.1
Hardness (as CaCO3), from total Ca/Mg					12	10	12	10	9.0	9.1	9.4	9.5	9.2	9.1
pH (Laboratory)	6.5 - 9.0	6.47-7.95	6.92 - 8.17	6.5 - 9.0	7.1	7.1	7.0	7.0	7.2	7.2	7.1	7.1	7.2	7.2
Total Dissolved Solids		19	25		16	15	**21**	18	15	15	16	16	17	15
Total Suspended Solids		3.0	3.0	5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Turbidity (NTU)					<0.10	0.15	<0.10	<0.10	0.27	0.28	0.36	0.32	0.20	0.19
Anions and Nutrients (mg/L)														
Total Kjeldahl Nitrogen		0.17	0.16		0.098	0.099	0.092	0.077	0.093	0.098	0.11	0.098	0.089	0.087
Ammonia (as N)[3]	***equation***	0.065	0.067	0.13	0.0097	0.010	0.0092	0.010	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Bromide					<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride	120	60	60	120	0.86	0.74	0.84	0.76	0.66	0.67	0.59	0.60	0.66	0.67
Fluoride	0.12	0.088	0.080	0.12	0.048	0.043	0.045	0.041	0.036	0.038	0.031	0.031	0.039	0.039
Nitrate (as N)	3.0	1.5	1.5	3.0	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrite (as N)	0.060	0.031	0.031	0.060	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Ortho Phosphate (as P)		0.0020	0.0020		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Phosphorus (P) - Total	0.010	0.0051	0.0067	0.010	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0029	0.0026
Phosphorus (P) - Total Diss.					<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Reactive Silica (as SiO_2)		1.0	1.1		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Sulphate (SO_4)		65	65	128	2.4	2.1	2.3	2.0	1.8	1.8	1.7	1.7	1.9	1.9
Cyanides (mg/L)														
Free Cyanide	0.0050				-	<0.0010	<0.0010	-	-	<0.0010	<0.0010	-	<0.0010	-
Total Cyanide					-	<0.0010	<0.0010	-	-	<0.0010	<0.0010	-	<0.0010	-
Organic / Inorganic Carbon (mg/L)														
Dissolved Organic Carbon		2.5	3.2		1.8	1.7	1.9	1.4	1.9	1.8	1.6	1.7	1.6	1.6
Total Organic Carbon		2.6	4.1		1.8	1.5	1.6	1.4	1.6	1.7	1.5	1.5	1.9	1.8
Total Metals (mg/L)														
Aluminum[3]	***equation***	0.053	0.053	0.10	<0.0030	<0.0030	<0.0030	<0.0030	0.011	0.010	0.011	0.0098	0.0079	0.0070
Antimony		0.0046	0.0046	0.0090	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	0.0050	0.0026	0.0026	0.0050	0.00020	0.00018	0.00018	0.00017	0.00017	0.00017	0.00018	0.00016	0.00016	0.00017
Barium		0.50	0.50	1.0	0.0025	0.0021	0.0023	0.0021	0.0019	0.0019	0.0020	0.0021	0.0019	0.0018
Beryllium		0.00012	0.00012	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth					<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	1.5	0.76	0.76	1.5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium[3]	***equation***	0.00002	0.00002	0.00004	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium		2.4	4.9		**3.1**	**2.6**	**3.0**	**2.7**	2.3	2.4	2.3	**2.4**	2.3	2.4
Chromium[4]	0.0010	0.0025	0.0026	0.0050	<0.00010	<0.00010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt				0.00077	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper[3]	***equation***	0.0012	0.0015	0.0020	<0.00050	<0.00050	<0.00050	<0.00050	0.00057	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Iron	0.30	0.15	0.16	0.30	<0.010	<0.010	<0.010	<0.010	0.016	0.016	0.014	0.014	<0.010	<0.010
Lead[3]	***equation***	0.00053	0.00053	0.0010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium		0.0020	0.0020		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium		0.93	1.4		**1.0**	0.89	**0.98**	0.88	0.79	0.79	0.87	0.86	0.83	0.78
Manganese[3]		0.32	0.33	***See text***	0.00047	0.00049	0.00038	0.00041	0.0015	0.0015	0.0013	0.0011	0.00097	0.00078
Mercury	0.00003	0.00002	0.00002	0.00003	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum	0.073	0.037	0.037	0.073	0.00006	<0.000050	0.000054	0.00005	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel[3]	***equation***	0.013	0.013	0.025	0.00065	0.00057	0.00065	0.00055	0.00074	0.00056	0.00057	0.00055	0.00061	0.00056
Phosphorus		0.0051	0.0067	0.0040	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium		0.58	0.59		0.47	0.40	0.43	0.39	0.37	0.37	0.38	0.38	0.37	0.34
Rubidium					0.00057	0.00046	0.00054	0.00050	0.00040	0.00040	0.00046	0.00047	0.00044	0.00042
Selenium	0.0010	0.00053	0.00053	0.0010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon		0.20	0.65		0.19	0.16	0.20	0.18	0.17	0.18	0.19	0.19	0.20	0.16
Silver	0.00010	0.00013	0.00013	0.00025	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium		1.2	0.72		0.62	0.53	0.59	0.53	0.49	0.49	0.51	0.50	0.48	0.47
Strontium		1.3	1.3	2.5	0.014	0.011	0.012	0.011	0.0091	0.0093	0.0096	0.0098	0.0094	0.010
Sulfur					0.72	0.58	0.75	0.61	0.57	0.67	0.66	0.65	0.57	<0.50
Tellurium					<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Thallium	0.00080	0.00041	0.00041	0.00080	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Thorium					<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin		0.00020	0.00020		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium		0.00060	0.00060		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	0.00031	<0.00030	<0.00030	<0.00030	<0.00030
Tungsten					<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Uranium	0.015	0.0075	0.0075	0.015	0.00003	0.00003	0.00002	0.00002	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003
Vanadium		0.060	0.060	0.12	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc					<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Zirconium					<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	0.00026	<0.00020	<0.00020	<0.00020
Dissolved Metals (mg/L)														
Aluminum[3]		0.026	0.026	0.050	0.0019	0.0028	<0.0010	<0.0010	0.0032	0.0028	0.0023	0.0026	0.0032	0.0027
Antimony		0.0046	0.0046	0.0090	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic		0.0026	0.0026	0.0050	0.00020	0.00017	0.00018	0.00016	0.00016	0.00014	0.00015	0.00015	0.00014	0.00016
Barium		0.50	0.50	1.0	0.0025	0.0023	0.0023	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020
Beryllium		0.00012	0.00012	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth					<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron		0.76	0.76	1.5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium		0.00002	0.00002	0.00004	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium		2.4	4.9		**3.1**	**2.5**	**2.8**	**2.6**	2.3	2.4	2.3	2.3	2.3	2.3
Chromium		0.00026	0.00026	0.0050	<0.00010	<0.00010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt				0.00077	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper		0.0012	0.0015	0.0020	0.00050	0.00043	0.00044	0.00038	0.00048	0.00049	0.00043	0.00042	0.00044	0.00044
Iron		0.16	0.16	0.30	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Lead		0.00053	0.00053	0.0010	0.00005	~~0.00168~~	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium		0.0020	0.0020		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium		0.93	1.4		**1.0**	0.90	**0.96**	0.85	0.78	0.80	0.81	0.82	0.80	0.81
Manganese[3]		0.32	0.33	***See text***	0.00021	0.00019	0.00013	<0.00010	0.00052	0.00057	0.00025	0.00026	0.00014	0.00012
Mercury		0.00002	0.00002	0.00003	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum		0.037	0.037	0.073	0.00006	0.00005	0.00006	0.00005	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel		0.013	0.013	0.025	<0.00050	<0.00050	0.00059	0.00054	0.00064	0.00062	<0.00050	<0.00050	<0.00050	<0.00050
Phosphorus					<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium		0.58	0.59		0.49	0.42	0.44	0.41	0.35	0.37	0.39	0.39	0.37	0.37
Selenium		0.00053	0.00053	0.0010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon		0.18	0.67		0.16	0.14	0.13	0.13	0.15	0.14	0.14	0.14	0.14	0.13
Silver		0.00013	0.00013	0.00025	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium		1.2	0.72		0.64	0.55	0.62	0.55	0.49	0.50	0.51	0.51	0.49	0.49
Strontium		1.3	1.3	2.5	0.013	0.011	0.012	0.011	0.0094	0.0100	0.0095	0.0096	0.0096	0.0096
Sulfur					0.95	1.1	0.52	<0.50	<0.50	<0.50	0.66	0.69	<0.50	0.51
Thallium		0.00041	0.00041	0.00080	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin		0.00020	0.00020		<0.00010	0.00017	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium		0.00060	0.00060		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Uranium		0.0075	0.0075	0.015	0.00002	0.00002	0.00003	0.00002	0.00003	0.00002	0.00003	0.00003	0.00003	0.00003
Vanadium		0.060	0.060	0.12	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc[3]		0.0018	0.0024	***See text***	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Speciated Metals (µg/L)														
Arsenate (As V)					0.025	-	-	0.035	<0.020	-	<0.020	-	-	<0.020
Arsenite (As III)					0.042	-	-	0.042	0.057	-	0.064	-	-	0.062
Arsenobetaine (AsB)					<0.050	-	-	<0.050	<0.050	-	<0.050	-	-	<0.050
Dimethylarsinic Acid (DMA)					<0.020	-	-	<0.020	<0.020	-	<0.020	-	-	<0.020
Monomethylarsonic Acid (MMA)					<0.020	-	-	<0.020	<0.020	-	<0.020	-	-	<0.020
Plant Pigments (µg/L)														
chlorophyll a					0.31	0.30	0.87	0.59	0.57	0.71	0.48	0.50	0.58	0.54

Notes:

1. CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life, 1999, updated up to 2018.
2. Trigger and threshold values were developed in *CREMP Design Document 2012* (Azimuth, 2012d) and updated in 2019. A number of thresholds were derived from methods (or sources) other than CCME guidelines. Refer to the CREMP: 2015 Plan Update (Azimuth, 2015b) for more details.
3. "***equation***" means that CCME guidelines (or thresholds) are calculated based on an equation which is either pH or hardness dependent. The ammonia and aluminum (t & d) guidelines vary with pH; the cadmium, copper, lead, manganese, nickel and zinc guidelines vary with hardness.
4. Chromium CCME guideline is for Cr VI.

123 Bolded concentrations exceed the trigger value.

123 Bolded and shaded concentrations also exceed the threshold value.

Italicized numbers are below detection limits.

underline = results were given a cautionary flag in the QC assessment (refer to **Section 3.3** for details)

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

Table B1-1. Water quality results from the Meadowbank study area lakes, 2021.

Lake & Area					Third Portage Lake - East Basin (TPE)									
Month	Aquatic Life Guideline[1]	Meadowbank Screening Values[2]			March	March	May	May	July	July	August	August	September	September
Area-Replicate ID					TPE-140	TPE-141	TPE-142	TPE-143	TPE-144	TPE-145	TPE-146	TPE-147	TPE-148	TPE-149
Date		Triggers			29-Mar	29-Mar	10-May	10-May	23-Jul	23-Jul	13-Aug	13-Aug	17-Sep	17-Sep
Time		Meadowbank	Wally Lake	Thresholds	17:20	18:00	14:06	14:33	10:57	10:20	09:00	09:44	15:15	14:56
ALS Sample ID					VA21A6519-003	VA21A6519-004	VA21A9442-001	VA21A9442-002	VA21B6241-011	VA21B6241-012	VA21B7537-007	VA21B7537-008	VA21C0949-003	VA21C0949-004
Field Measurements (Surface 3m)														
Dissolved Oxygen (mg/L)					18	17	18	17	14	12	12	12	12	102.2
Specific Conductivity (µS/cm)					38	35	11	39	26	27	36	37	28	28
pH	6.5 - 9.0	6.30 - 8.25	6.54 - 8.34	6.5 - 9.0	6.9	6.9	6.7	6.7	6.7	6.8	6.9	6.9	6.8	6.7
Temperature (°C)					0.59	0.43	0.55	0.60	7.4	10	7.7	8.0	8.5	8.2
Physical Tests (mg/L)														
Conductivity (µS/cm)		27	37		**39**	**35**	**39**	**39**	**28**	**29**	**28**	**28**	27	**28**
Alkalinity - Total (as $CaCO_3$)		8.7	18		**10**	8.7	**9.0**	**9.3**	6.5	6.7	6.8	6.9	7.5	7.4
Alkalinity - Bicarbonate		8.7	18		**10**	8.7	**9.0**	**9.3**	6.5	6.7	6.8	6.9	7.5	7.4
Alkalinity - Carbonate		2.0	2.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity - Hydroxide					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hardness (as CaCO3), dissolved		9.5	17		**14**	**13**	**14**	**14**	8.6	9.3	**10**	**10**	**9.6**	**9.7**
Hardness (as CaCO3), from total Ca/Mg					14	13	14	14	10	9.7	10	10	10	10
pH (Laboratory)	6.5 - 9.0	6.47-7.95	6.92 - 8.17	6.5 - 9.0	7.2	7.2	6.9	7.0	7.1	7.2	7.0	7.0	6.9	6.9
Total Dissolved Solids		19	25		**25**	**20**	**27**	**25**	17	17	17	17	19	19
Total Suspended Solids		3.0	3.0	5.0	<1.0	<1.0	1.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Turbidity (NTU)					<0.10	<0.10	<0.10	<0.10	0.13	0.19	0.44	0.39	0.16	0.16
Anions and Nutrients (mg/L)														
Total Kjeldahl Nitrogen		0.17	0.16		0.12	0.11	0.082	0.088	0.095	0.092	0.087	0.078	0.077	0.082
Ammonia (as N)[3]	***equation***	0.065	0.067	0.13	0.019	0.012	0.016	0.016	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Bromide					<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride	120	60	60	120	1.1	0.94	1.0	1.1	0.77	0.73	0.71	0.72	0.74	0.74
Fluoride	0.12	0.088	0.080	0.12	**0.096**	0.086	**0.095**	**0.097**	0.066	0.072	0.081	0.077	0.073	0.071
Nitrate (as N)	3.0	1.5	1.5	3.0	<0.0050	<0.0050	0.0060	0.010	0.010	0.0053	<0.0050	<0.0050	<0.0050	<0.0050
Nitrite (as N)	0.060	0.031	0.031	0.060	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Ortho Phosphate (as P)		0.0020	0.0020		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Phosphorus (P) - Total	0.010	0.0051	0.0067	0.010	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0039	<0.0020	<0.0020	<0.0020	<0.0020
Phosphorus (P) - Total Diss.					<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0030	0.0021
Reactive Silica (as SiO_2)		1.0	1.1		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Sulphate (SO_4)		65	65	128	6.5	5.8	6.7	6.4	4.5	4.5	4.4	4.4	4.7	4.6
Cyanides (mg/L)														
Free Cyanide	0.0050				<0.0010	-	-	<0.0010	<0.0010	-	<0.0010	-	-	<0.0010
Total Cyanide					<0.0010	-	-	<0.0010	<0.0010	-	<0.0010	-	-	<0.0010
Organic / Inorganic Carbon (mg/L)														
Dissolved Organic Carbon		2.5	3.2		1.4	1.1	2.0	1.6	1.3	1.7	1.3	1.3	1.5	1.6
Total Organic Carbon		2.6	4.1		1.4	1.1	1.5	1.6	1.3	1.3	1.7	1.4	1.0	1.1
Total Metals (mg/L)														
Aluminum[3]	***equation***	0.053	0.053	0.10	<0.0030	<0.0030	<0.0030	0.0038	0.0093	0.0068	0.015	0.011	0.0088	0.0089
Antimony		0.0046	0.0046	0.0090	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	0.0050	0.0026	0.0026	0.0050	0.00046	0.00043	0.00048	0.00043	0.00054	0.00025	0.00045	0.00047	0.00052	0.00049
Barium		0.50	0.50	1.0	0.0036	0.0033	0.0037	0.0038	0.0028	0.0028	0.0028	0.0027	0.0029	0.0032
Beryllium		0.00012	0.00012	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth					<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	1.5	0.76	0.76	1.5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium[3]	***equation***	0.00002	0.00002	0.00004	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium		2.4	4.9		**3.4**	**3.1**	**3.6**	**3.6**	**2.5**	2.4	**2.6**	**2.6**	**2.5**	**2.5**
Chromium[4]	0.0010	0.0025	0.0026	0.0050	<0.00010	<0.00010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt				0.00077	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper[3]	***equation***	0.0012	0.0015	0.0020	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Iron	0.30	0.15	0.16	0.30	<0.010	<0.010	<0.010	<0.010	0.015	<0.010	0.018	0.014	0.012	0.012
Lead[3]	***equation***	0.00053	0.00053	0.0010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium		0.0020	0.0020		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium		0.93	1.4		**1.3**	**1.3**	**1.3**	**1.3**	**0.94**	0.90	**0.96**	**0.93**	**0.98**	**1.0**
Manganese[3]		0.32	0.33	***See text***	0.00047	0.00038	0.00041	0.00048	0.0019	0.0018	0.00096	0.0010	0.0012	0.0014
Mercury	0.00003	0.00002	0.00002	0.00003	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum	0.073	0.037	0.037	0.073	0.000153	0.00012	0.000138	0.000143	0.00010	0.00010	0.00011	0.00012	0.00010	0.00012
Nickel[3]	***equation***	0.013	0.013	0.025	0.00056	<0.00050	0.00056	0.00061	0.00055	<0.00050	0.00051	0.00051	0.00057	0.00054
Phosphorus		0.0051	0.0067	0.0040	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium		0.58	0.59		**0.68**	**0.64**	**0.68**	**0.69**	0.51	0.52	0.54	0.53	0.53	0.56
Rubidium					0.0010	0.00090	0.0011	0.0011	0.00081	0.00072	0.00075	0.00077	0.0010	0.00090
Selenium	0.0010	0.00053	0.00053	0.0010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon		0.20	0.65		0.13	0.11	0.15	0.15	0.16	0.12	0.20	0.16	0.13	0.12
Silver	0.00010	0.00013	0.00013	0.00025	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium		1.2	0.72		**1.4**	**1.3**	**1.4**	**1.4**	0.97	1.0	0.96	0.95	1.0	1.1
Strontium		1.3	1.3	2.5	0.016	0.014	0.016	0.016	0.011	0.011	0.011	0.011	0.012	0.012
Sulfur					2.1	2.0	2.0	2.1	1.5	1.6	1.6	1.6	1.6	1.6
Tellurium					<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Thallium	0.00080	0.00041	0.00041	0.00080	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Thorium					<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin		0.00020	0.00020		<0.00010	<0.00010	<0.00010	<0.00010	**0.00041**	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium		0.00060	0.00060		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	0.00042	0.00031	<0.00030	<0.00030
Tungsten					<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Uranium	0.015	0.0075	0.0075	0.015	0.00003	0.00003	0.00004	0.00004	0.00005	0.00004	0.00005	0.00004	0.00005	0.00005
Vanadium		0.060	0.060	0.12	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc					<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Zirconium					<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Dissolved Metals (mg/L)														
Aluminum[3]		0.026	0.026	0.050	0.0017	0.0014	<0.0010	0.0012	0.0023	0.0034	0.0046	0.0033	0.0031	0.0029
Antimony		0.0046	0.0046	0.0090	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic		0.0026	0.0026	0.0050	0.00041	0.00027	0.00043	0.00039	0.00018	0.00045	0.00040	0.00044	0.00041	0.00036
Barium		0.50	0.50	1.0	0.0039	0.0032	0.0036	0.0036	0.0026	0.0027	0.0028	0.0028	0.0025	0.0025
Beryllium		0.00012	0.00012	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth					<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron		0.76	0.76	1.5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium		0.00002	0.00002	0.00004	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium		2.4	4.9		**3.7**	**3.3**	**3.6**	**3.6**	2.1	2.3	**2.5**	**2.5**	2.4	2.4
Chromium		0.00026	0.00026	0.0050	<0.00010	<0.00010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt				0.00077	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper		0.0012	0.0015	0.0020	0.00039	0.00037	0.00045	0.00043	0.00038	0.00043	0.00036	0.00041	0.00039	0.00038
Iron		0.16	0.16	0.30	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Lead		0.00053	0.00053	0.0010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.00011	<0.000050	<0.000050	<0.000050
Lithium		0.0020	0.0020		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium		0.93	1.4		**1.2**	**1.0**	**1.2**	**1.2**	0.82	0.86	**0.95**	**0.97**	0.91	0.91
Manganese[3]		0.32	0.33	***See text***	<0.00010	<0.00010	0.00017	0.00019	0.0011	0.0010	0.00036	0.00037	0.00031	0.00044
Mercury		0.00002	0.00002	0.00003	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum		0.037	0.037	0.073	0.000128	0.00012	0.00015	0.00013	0.00011	0.0042	0.00010	0.00010	0.00010	0.00010
Nickel		0.013	0.013	0.025	0.00062	0.00055	0.00051	0.00054	<0.00050	0.00060	<0.00050	<0.00050	<0.00050	<0.00050
Phosphorus					<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium		0.58	0.59		**0.67**	0.56	**0.67**	**0.68**	0.46	0.48	0.52	0.53	0.51	0.50
Selenium		0.00053	0.00053	0.0010	<0.000050	<0.000050	0.00010	0.00006	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon		0.18	0.67		0.12	0.095	0.098	0.10	0.090	0.12	0.13	0.11	0.091	0.092
Silver		0.00013	0.00013	0.00025	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium		1.2	0.72		**1.3**	1.1	**1.4**	**1.4**	0.95	0.93	0.98	0.99	0.92	0.94
Strontium		1.3	1.3	2.5	0.016	0.013	0.015	0.015	0.0100	0.010	0.011	0.011	0.010	0.010
Sulfur					2.2	1.8	1.7	1.8	1.3	1.2	1.5	1.5	1.2	1.4
Thallium		0.00041	0.00041	0.00080	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin		0.00020	0.00020		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium		0.00060	0.00060		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Uranium		0.0075	0.0075	0.015	0.00004	0.00003	0.00004	0.00004	0.00003	0.00004	0.00005	0.00004	0.00004	0.00004
Vanadium		0.060	0.060	0.12	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc[3]		0.0018	0.0024	***See text***	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Speciated Metals (µg/L)														
Arsenate (As V)					-	-	-	-	-	-	-	-	-	-
Arsenite (As III)					-	-	-	-	-	-	-	-	-	-
Arsenobetaine (AsB)					-	-	-	-	-	-	-	-	-	-
Dimethylarsinic Acid (DMA)					-	-	-	-	-	-	-	-	-	-
Monomethylarsonic Acid (MMA)					-	-	-	-	-	-	-	-	-	-
Plant Pigments (µg/L)														
chlorophyll a					0.18	0.22	0.12	0.14	0.34	0.38	0.56	0.48	0.42	0.36

Notes:

1. CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life, 1999, updated up to 2018.
2. Trigger and threshold values were developed in *CREMP Design Document 2012* (Azimuth, 2012d) and updated in 2019. A number of thresholds were derived from methods (or sources) other than CCME guidelines. Refer to the CREMP: 2015 Plan Update (Azimuth, 2015b) for more details.
3. "***equation***" means that CCME guidelines (or thresholds) are calculated based on an equation which is either pH or hardness dependent. The ammonia and aluminum (t & d) guidelines vary with pH; the cadmium, copper, lead, manganese, nickel and zinc guidelines vary with hardness.
4. Chromium CCME guideline is for Cr VI.

123 Bolded concentrations exceed the trigger value.

123 Bolded and shaded concentrations also exceed the threshold value.

Italicized numbers are below detection limits.

underline = results were given a cautionary flag in the QC assessment (refer to **Section 3.3** for details)

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

Table B1-1. Water quality results from the Meadowbank study area lakes, 2021.

Lake & Area	Aquatic Life Guideline[1]	Meadowbank Screening Values[2]			Third Portage Lake - North Basin (TPN)									
Month		Triggers		Thresholds	March	March	May	May	July	July	August	August	September	September
Area-Replicate ID		Meadowbank	Wally Lake		TPN-140	TPN-141	TPN-142	TPN-143	TPN-144	TPN-145	TPN-146	TPN-147	TPN-148	TPN-149
Date					29-Mar	29-Mar	10-May	10-May	29-Jul	29-Jul	10-Aug	10-Aug	17-Sep	17-Sep
Time					13:20	14:00	11:57	11:32	13:50	14:10	15:42	15:10	13:30	14:10
ALS Sample ID					VA21A6519-001	VA21A6519-002	VA21A9442-011	VA21A9442-012	VA21B6241-009	VA21B6241-010	VA21B7253-001	VA21B7253-002	VA21C0949-001	VA21C0949-002
Field Measurements (Surface 3m)														
Dissolved Oxygen (mg/L)					18	19	18	19	14	13	12	12	12	12
Specific Conductivity (µS/cm)					26	35	36	37	27	27	26	26	27	27
pH	6.5 - 9.0	6.30 - 8.25	6.54 - 8.34	6.5 - 9.0	6.9	7.1	7.0	7.2	6.6	6.6	6.9	6.8	6.6	6.7
Temperature (°C)					0.47	0.42	0.39	0.32	6.9	6.7	7.6	7.6	8.3	8.3
Physical Tests (mg/L)														
Conductivity (µS/cm)		27	37		**37**	**36**	**37**	**37**	**28**	27	**28**	**28**	26	26
Alkalinity - Total (as $CaCO_3$)		8.7	18		8.5	8.5	**9.3**	8.2	6.5	6.3	6.2	6.4	6.8	6.9
Alkalinity - Bicarbonate		8.7	18		8.5	8.5	**9.3**	8.2	6.5	6.3	6.2	6.4	6.8	6.9
Alkalinity - Carbonate		2.0	2.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity - Hydroxide					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hardness (as CaCO3), dissolved		9.5	17		**13**	**13**	**12**	**12**	9.2	9.2	9.4	9.4	9.0	9.0
Hardness (as CaCO3), from total Ca/Mg					13	12	13	12	8.9	9.3	8.3	9.3	9.8	9.2
pH (Laboratory)	6.5 - 9.0	6.47-7.95	6.92 - 8.17	6.5 - 9.0	7.1	7.1	7.0	7.0	7.1	7.1	7.0	7.1	6.8	6.8
Total Dissolved Solids		19	25		**21**	**21**	**28**	**26**	16	17	18	**21**	**20**	18
Total Suspended Solids		3.0	3.0	5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Turbidity (NTU)					<0.10	<0.10	<0.10	<0.10	0.21	0.18	0.17	0.18	0.20	0.16
Anions and Nutrients (mg/L)														
Total Kjeldahl Nitrogen		0.17	0.16		0.12	0.14	0.092	0.088	0.092	0.11	0.072	0.062	0.084	0.084
Ammonia (as N)[3]	***equation***	0.065	0.067	0.13	0.010	0.012	0.015	0.013	<0.0050	0.011	<0.0050	<0.0050	0.0061	<0.0050
Bromide					<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride	120	60	60	120	1.1	1.1	1.1	1.1	0.79	0.78	0.78	0.84	0.79	0.77
Fluoride	0.12	0.088	0.080	0.12	0.087	0.086	0.082	0.083	0.066	0.065	0.068	0.069	0.063	0.062
Nitrate (as N)	3.0	1.5	1.5	3.0	<0.0050	<0.0050	<0.0050	<0.0050	0.0090	0.0088	<0.0050	0.0084	<0.0050	<0.0050
Nitrite (as N)	0.060	0.031	0.031	0.060	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Ortho Phosphate (as P)		0.0020	0.0020		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	<0.0010	<0.0010
Phosphorus (P) - Total	0.010	0.0051	0.0067	0.010	<0.0020	<0.0020	<0.0020	**0.0054**	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Phosphorus (P) - Total Diss.					<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0021
Reactive Silica (as SiO_2)		1.0	1.1		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Sulphate (SO_4)		65	65	128	6.4	6.2	6.2	6.2	4.5	4.5	4.3	4.4	4.6	4.5
Cyanides (mg/L)														
Free Cyanide	0.0050				-	<0.0010	-	<0.0010	<0.0010	-	<0.0010	-	-	<0.0010
Total Cyanide					-	<0.0010	-	<0.0010	<0.0010	-	<0.0010	-	-	<0.0010
Organic / Inorganic Carbon (mg/L)														
Dissolved Organic Carbon		2.5	3.2		1.4	1.6	1.4	1.5	1.2	1.3	1.3	1.4	1.6	1.2
Total Organic Carbon		2.6	4.1		1.3	1.4	1.5	1.4	1.2	1.3	1.6	1.4	1.1	1.2
Total Metals (mg/L)														
Aluminum[3]	***equation***	0.053	0.053	0.10	<0.0030	<0.0030	<0.0030	<0.0030	0.0069	0.0067	0.0055	0.0078	0.0091	0.0075
Antimony		0.0046	0.0046	0.0090	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	0.0050	0.0026	0.0026	0.0050	0.00022	0.00022	0.00025	0.00022	0.00021	0.00022	0.00020	0.00020	0.00021	0.00021
Barium		0.50	0.50	1.0	0.0035	0.0035	0.0037	0.0036	0.0026	0.0028	0.0024	0.0028	0.0032	0.0029
Beryllium		0.00012	0.00012	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth					<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	1.5	0.76	0.76	1.5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium[3]	***equation***	0.00002	0.00002	0.00004	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium		2.4	4.9		**3.1**	**3.0**	**3.2**	**3.0**	2.2	2.3	2.0	2.3	2.3	2.2
Chromium[4]	0.0010	0.0025	0.0026	0.0050	<0.00010	<0.00010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt				0.00077	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper[3]	***equation***	0.0012	0.0015	0.0020	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Iron	0.30	0.15	0.16	0.30	<0.010	<0.010	<0.010	<0.010	<0.010	0.011	<0.010	0.012	0.010	<0.010
Lead[3]	***equation***	0.00053	0.00053	0.0010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium		0.0020	0.0020		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium		0.93	1.4		**1.2**	**1.2**	**1.2**	**1.2**	0.85	0.87	0.78	0.86	**0.98**	0.88
Manganese[3]		0.32	0.33	***See text***	0.00046	0.00047	0.00046	0.00046	0.0016	0.0017	0.0011	0.0016	0.0015	0.0014
Mercury	0.00003	0.00002	0.00002	0.00003	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum	0.073	0.037	0.037	0.073	0.00015	0.000161	0.00014	0.000139	0.000087	0.00010	0.00011	0.00010	0.00010	0.00011
Nickel[3]	***equation***	0.013	0.013	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00075	0.00051	0.00051	<0.00050
Phosphorus		0.0051	0.0067	0.0040	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium		0.58	0.59		**0.67**	**0.65**	**0.66**	**0.65**	0.49	0.50	0.44	0.51	0.54	0.49
Rubidium					0.00089	0.00092	0.0010	0.00097	0.00066	0.00064	0.00065	0.00069	0.00069	0.00081
Selenium	0.0010	0.00053	0.00053	0.0010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon		0.20	0.65		0.10	0.12	0.13	0.13	0.19	0.13	0.13	0.12	0.12	0.10
Silver	0.00010	0.00013	0.00013	0.00025	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium		1.2	0.72		**1.4**	**1.4**	**1.4**	**1.3**	0.98	1.0	0.90	0.99	1.1	1.0
Strontium		1.3	1.3	2.5	0.015	0.015	0.014	0.014	0.0095	0.010	0.0089	0.010	0.011	0.011
Sulfur					1.9	1.8	2.0	1.9	1.4	1.6	1.5	1.4	1.5	1.5
Tellurium					<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Thallium	0.00080	0.00041	0.00041	0.00080	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Thorium					<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin		0.00020	0.00020		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium		0.00060	0.00060		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Tungsten					<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Uranium	0.015	0.0075	0.0075	0.015	0.00003	0.00003	0.00004	0.00004	0.00004	0.00004	0.00003	0.00004	0.00004	0.00004
Vanadium		0.060	0.060	0.12	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc					<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Zirconium					<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Dissolved Metals (mg/L)														
Aluminum[3]		0.026	0.026	0.050	0.0014	0.0013	0.0011	<0.0010	0.0018	0.0018	0.0043	0.0026	0.0027	0.0027
Antimony		0.0046	0.0046	0.0090	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic		0.0026	0.0026	0.0050	0.00020	0.00021	0.00023	0.00020	0.00019	0.00020	0.00018	0.00018	0.00014	0.00016
Barium		0.50	0.50	1.0	0.0034	0.0035	0.0036	0.0037	0.0028	0.0028	0.0027	0.0028	0.0027	0.0026
Beryllium		0.00012	0.00012	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth					<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron		0.76	0.76	1.5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium		0.00002	0.00002	0.00004	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium		2.4	4.9		**3.4**	**3.3**	**3.1**	**3.0**	2.3	2.3	2.3	2.3	2.2	2.2
Chromium		0.00026	0.00026	0.0050	<0.00010	<0.00010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt				0.00077	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper		0.0012	0.0015	0.0020	0.00036	0.00036	0.00040	0.00038	0.00041	0.00040	0.00035	0.00048	0.00041	0.00036
Iron		0.16	0.16	0.30	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Lead		0.00053	0.00053	0.0010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium		0.0020	0.0020		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium		0.93	1.4		**1.1**	**1.1**	**1.1**	**1.1**	0.86	0.86	0.87	0.88	0.87	0.87
Manganese[3]		0.32	0.33	***See text***	0.00015	0.00021	0.00014	0.00022	0.00094	0.00089	0.00075	0.00076	0.00067	0.00041
Mercury		0.00002	0.00002	0.00003	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum		0.037	0.037	0.073	0.000125	0.000122	0.00014	0.00013	0.00008	0.00009	0.00010	0.00011	0.00008	0.00008
Nickel		0.013	0.013	0.025	0.00054	0.00058	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Phosphorus					<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium		0.58	0.59		**0.66**	**0.65**	**0.68**	**0.67**	0.49	0.50	0.51	0.51	0.49	0.49
Selenium		0.00053	0.00053	0.0010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon		0.18	0.67		0.090	0.080	0.074	0.083	0.089	0.10	0.095	0.089	0.074	0.072
Silver		0.00013	0.00013	0.00025	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium		1.2	0.72		**1.3**	**1.3**	**1.4**	**1.4**	0.99	1.00	1.0	1.0	0.96	0.96
Strontium		1.3	1.3	2.5	0.014	0.013	0.014	0.014	0.011	0.011	0.010	0.010	0.0099	0.0097
Sulfur					2.0	2.1	1.9	1.7	1.3	1.3	1.4	1.6	1.2	1.3
Thallium		0.00041	0.00041	0.00080	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin		0.00020	0.00020		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium		0.00060	0.00060		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Uranium		0.0075	0.0075	0.015	0.00004	0.00003	0.00004	0.00003	0.00003	0.00004	0.00003	0.00003	0.00004	0.00003
Vanadium		0.060	0.060	0.12	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc[3]		0.0018	0.0024	***See text***	0.0017	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0015	<0.0010	<0.0010
Speciated Metals (µg/L)														
Arsenate (As V)					-	-	-	-	-	-	-	-	-	-
Arsenite (As III)					-	-	-	-	-	-	-	-	-	-
Arsenobetaine (AsB)					-	-	-	-	-	-	-	-	-	-
Dimethylarsinic Acid (DMA)					-	-	-	-	-	-	-	-	-	-
Monomethylarsonic Acid (MMA)					-	-	-	-	-	-	-	-	-	-
Plant Pigments (µg/L)														
chlorophyll a					0.28	0.30	0.61	0.50	0.54	0.38	0.43	0.38	0.45	0.44

Notes:

1. CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life, 1999, updated up to 2018.
2. Trigger and threshold values were developed in *CREMP Design Document 2012* (Azimuth, 2012d) and updated in 2019. A number of thresholds were derived from methods (or sources) other than CCME guidelines. Refer to the CREMP: 2015 Plan Update (Azimuth, 2015b) for more details.
3. "***equation***" means that CCME guidelines (or thresholds) are calculated based on an equation which is either pH or hardness dependent. The ammonia and aluminum (t & d) guidelines vary with pH; the cadmium, copper, lead, manganese, nickel and zinc guidelines vary with hardness.
4. Chromium CCME guideline is for Cr VI.

123 Bolded concentrations exceed the trigger value.

123 Bolded and shaded concentrations also exceed the threshold value.

Italicized numbers are below detection limits.

underline = results were given a cautionary flag in the QC assessment (refer to **Section 3.3** for details)

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

Table B1-1. Water quality results from the Meadowbank study area lakes, 2021.

Lake & Area					Second Portage Lake (SP)									
Month	Aquatic Life Guideline[1]	Meadowbank Screening Values[2]			March	March	May	May	July	July	August	August	September	September
Area-Replicate ID					SP-140	SP-141	SP-142	SP-143	SP-144	SP-145	SP-146	SP-147	SP-148	SP-149
Date		Triggers			18-Mar	18-Mar	09-May	09-May	11-Jul	11-Jul	06-Aug	06-Aug	03-Sep	03-Sep
Time		Meadowbank	Wally Lake	Thresholds	14:48	15:15	15:40	15:18	14:51	14:28	16:41	12:10	10:00	10:22
ALS Sample ID					VA21A6084-007	VA21A6084-008	VA21A9848-001	VA21A9848-002	VA21B4723-003	VA21B4723-004	VA21B6886-008	VA21B6886-009	VA21B9414-001	VA21B9414-002
Field Measurements (Surface 3m)														
Dissolved Oxygen (mg/L)					18	18	18	18	14	14	11	11	11	11
Specific Conductivity (µS/cm)					49	44	47	45	35	35	34	34	33	33
pH	6.5 - 9.0	6.30 - 8.25	6.54 - 8.34	6.5 - 9.0	7.1	7.0	6.7	6.7	6.9	6.9	7.0	7.1	6.7	6.8
Temperature (°C)					1.4	0.48	0.40	0.39	6.3	5.9	9.4	9.2	10	10
Physical Tests (mg/L)														
Conductivity (µS/cm)		27	37		**47**	**43**	**46**	**44**	**38**	**37**	**36**	**35**	**34**	**34**
Alkalinity - Total (as $CaCO_3$)		8.7	18		**14**	**12**	**13**	**12**	**11**	**11**	**9.6**	**9.5**	**9.2**	**9.2**
Alkalinity - Bicarbonate		8.7	18		**14**	**12**	**13**	**12**	**11**	**11**	**9.6**	**9.5**	**9.2**	**9.2**
Alkalinity - Carbonate		2.0	2.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity - Hydroxide					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hardness (as CaCO3), dissolved		9.5	17		**18**	**17**	**18**	**17**	**14**	**14**	**13**	**14**	**13**	**13**
Hardness (as CaCO3), from total Ca/Mg					19	17	17	16	15	14	14	14	13	13
pH (Laboratory)	6.5 - 9.0	6.47-7.95	6.92 - 8.17	6.5 - 9.0	7.2	7.2	7.1	7.0	7.3	7.3	7.2	7.2	7.2	7.2
Total Dissolved Solids		19	25		**28**	**25**	**31**	**30**	**22**	**22**	**24**	**21**	**24**	**25**
Total Suspended Solids		3.0	3.0	5.0	<1.0	<1.0	1.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Turbidity (NTU)					0.11	0.14	<0.10	<0.10	0.24	0.25	0.30	0.28	0.26	0.24
Anions and Nutrients (mg/L)														
Total Kjeldahl Nitrogen		0.17	0.16		0.12	0.11	0.11	0.11	0.098	0.093	0.10	0.097	0.10	0.092
Ammonia (as N)[3]	***equation***	0.065	0.067	0.13	0.015	0.012	0.012	0.012	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Bromide					<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride	120	60	60	120	1.1	0.99	1.1	1.0	0.82	0.78	0.77	0.78	0.77	0.77
Fluoride	0.12	0.088	0.080	0.12	**0.090**	**0.089**	**0.089**	0.086	0.073	0.069	0.070	0.072	0.068	0.068
Nitrate (as N)	3.0	1.5	1.5	3.0	<0.0050	0.0075	0.0098	0.012	0.0086	0.0053	<0.0050	<0.0050	<0.0050	<0.0050
Nitrite (as N)	0.060	0.031	0.031	0.060	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Ortho Phosphate (as P)		0.0020	0.0020		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Phosphorus (P) - Total	0.010	0.0051	0.0067	0.010	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0020	<0.0020	<0.0020	0.0029	0.0022
Phosphorus (P) - Total Diss.					<0.0020	<0.0020	<0.0020	<0.0020	0.0033	0.0027	<0.0020	<0.0020	<0.0020	<0.0020
Reactive Silica (as SiO_2)		1.0	1.1		0.68	0.53	0.58	0.52	0.64	0.68	<0.50	<0.50	<0.50	<0.50
Sulphate (SO_4)		65	65	128	6.8	6.4	7.0	6.6	4.9	4.8	4.9	4.9	4.7	4.8
Cyanides (mg/L)														
Free Cyanide	0.0050				<0.0010	-	<0.0010	-	-	<0.0010	-	<0.0010	<0.0010	-
Total Cyanide					<0.0010	-	<0.0010	-	-	<0.0010	-	<0.0010	<0.0010	-
Organic / Inorganic Carbon (mg/L)														
Dissolved Organic Carbon		2.5	3.2		2.2	1.5	2.1	1.9	1.5	1.5	1.8	1.7	1.8	1.6
Total Organic Carbon		2.6	4.1		1.8	1.6	1.6	2.0	2.0	1.9	1.8	1.7	2.0	2.0
Total Metals (mg/L)														
Aluminum[3]	***equation***	0.053	0.053	0.10	<0.0030	<0.0030	<0.0030	<0.0030	0.0092	0.010	0.015	0.014	0.0094	0.0086
Antimony		0.0046	0.0046	0.0090	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	0.0050	0.0026	0.0026	0.0050	0.00032	0.00037	0.00034	0.00036	0.00038	0.00036	0.00032	0.00036	0.00033	0.00036
Barium		0.50	0.50	1.0	0.0034	0.0034	0.0034	0.0033	0.0030	0.0028	0.0026	0.0027	0.0024	0.0025
Beryllium		0.00012	0.00012	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth					<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	1.5	0.76	0.76	1.5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium[3]	***equation***	0.00002	0.00002	0.00004	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium		2.4	4.9		**5.1**	**4.3**	**4.5**	**4.1**	**3.8**	**3.7**	**3.5**	**3.6**	**3.3**	**3.4**
Chromium[4]	0.0010	0.0025	0.0026	0.0050	<0.00010	<0.00010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt				0.00077	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper[3]	***equation***	0.0012	0.0015	0.0020	0.00076	0.00060	0.00064	0.00060	0.00067	0.00069	0.00076	0.00079	0.00078	0.00073
Iron	0.30	0.15	0.16	0.30	<0.010	<0.010	<0.010	<0.010	0.018	0.020	0.022	0.022	0.015	0.013
Lead[3]	***equation***	0.00053	0.00053	0.0010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium		0.0020	0.0020		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium		0.93	1.4		**1.6**	**1.4**	**1.5**	**1.3**	**1.2**	**1.3**	**1.2**	**1.2**	**1.2**	**1.2**
Manganese[3]		0.32	0.33	***See text***	0.00050	0.00056	0.00049	0.00070	0.0026	0.0027	0.0013	0.0014	0.0010	0.00098
Mercury	0.00003	0.00002	0.00002	0.00003	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum	0.073	0.037	0.037	0.073	0.00017	0.000156	0.000166	0.00017	0.000121	0.000123	0.00014	0.00014	0.00014	0.00012
Nickel[3]	***equation***	0.013	0.013	0.025	<0.00050	<0.00050	0.00051	<0.00050	0.00060	0.00061	0.00050	<0.00050	<0.00050	<0.00050
Phosphorus		0.0051	0.0067	0.0040	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium		0.58	0.59		**0.69**	**0.67**	**0.67**	**0.62**	0.54	0.51	0.50	0.52	0.49	0.49
Rubidium					0.0011	0.00094	0.00099	0.00088	0.00081	0.00065	0.00073	0.00076	0.00070	0.00076
Selenium	0.0010	0.00053	0.00053	0.0010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon		0.20	0.65		**0.34**	**0.27**	**0.32**	**0.29**	**0.36**	**0.39**	**0.32**	**0.31**	**0.27**	**0.23**
Silver	0.00010	0.00013	0.00013	0.00025	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium		1.2	0.72		**1.2**	**1.2**	1.2	1.1	0.84	0.81	0.74	0.77	0.74	0.80
Strontium		1.3	1.3	2.5	0.023	0.022	0.023	0.022	0.017	0.017	0.017	0.017	0.016	0.017
Sulfur					2.3	2.1	2.5	2.3	1.7	1.4	1.6	1.6	1.6	1.3
Tellurium					<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Thallium	0.00080	0.00041	0.00041	0.00080	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Thorium					<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin		0.00020	0.00020		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium		0.00060	0.00060		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00060	0.00039	<0.00030	<0.00030
Tungsten					<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Uranium	0.015	0.0075	0.0075	0.015	0.00005	0.00005	0.00006	0.00005	0.00005	0.00005	0.00005	0.00006	0.00006	0.00007
Vanadium		0.060	0.060	0.12	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc					<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Zirconium					<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Dissolved Metals (mg/L)														
Aluminum[3]		0.026	0.026	0.050	0.0014	0.0013	0.0017	0.0018	0.0029	0.0044	0.0053	0.0052	0.0039	0.0040
Antimony		0.0046	0.0046	0.0090	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic		0.0026	0.0026	0.0050	0.00034	0.00038	0.00034	0.00034	0.00033	0.00034	0.00029	0.00032	0.00029	0.00028
Barium		0.50	0.50	1.0	0.0034	0.0036	0.0035	0.0035	0.0028	0.0028	0.0024	0.0024	0.0025	0.0025
Beryllium		0.00012	0.00012	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth					<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron		0.76	0.76	1.5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium		0.00002	0.00002	0.00004	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium		2.4	4.9		**4.7**	**4.3**	**4.7**	**4.5**	**3.5**	**3.5**	**3.4**	**3.4**	**3.3**	**3.3**
Chromium		0.00026	0.00026	0.0050	<0.00010	<0.00010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt				0.00077	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper		0.0012	0.0015	0.0020	0.00071	0.00061	0.00069	0.00065	0.00064	0.00067	0.00073	0.00074	0.00092	0.00067
Iron		0.16	0.16	0.30	0.011	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Lead		0.00053	0.00053	0.0010	<0.000050	0.000071	<0.000050	<0.000050	<0.000050	<0.000050	0.000403	<0.000050	<0.000050	<0.000050
Lithium		0.0020	0.0020		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium		0.93	1.4		**1.6**	**1.5**	**1.6**	**1.5**	**1.2**	**1.2**	**1.2**	**1.2**	**1.1**	**1.1**
Manganese[3]		0.32	0.33	***See text***	0.0064	0.00040	0.00020	0.00049	0.0018	0.0020	0.00041	0.00045	0.00036	0.0032
Mercury		0.00002	0.00002	0.00003	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum		0.037	0.037	0.073	0.00016	0.000155	0.000178	0.00017	0.00012	0.00011	0.00011	0.00011	0.00013	0.00014
Nickel		0.013	0.013	0.025	<0.00050	<0.00050	<0.00050	<0.00050	0.00052	0.00054	<0.00050	<0.00050	<0.00050	<0.00050
Phosphorus					<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium		0.58	0.59		**0.71**	**0.67**	**0.77**	**0.73**	0.51	0.51	0.51	0.54	0.50	0.51
Selenium		0.00053	0.00053	0.0010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon		0.18	0.67		**0.31**	**0.24**	**0.28**	**0.27**	**0.29**	**0.31**	**0.27**	**0.27**	**0.23**	**0.20**
Silver		0.00013	0.00013	0.00025	<0.000010	0.00001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium		1.2	0.72		1.1	1.2	**1.3**	**1.2**	0.82	0.79	0.79	0.82	0.74	0.77
Strontium		1.3	1.3	2.5	0.022	0.021	0.022	0.020	0.018	0.018	0.017	0.017	0.016	0.015
Sulfur					2.3	1.8	2.7	2.2	1.5	1.7	1.6	1.5	1.4	1.6
Thallium		0.00041	0.00041	0.00080	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin		0.00020	0.00020		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium		0.00060	0.00060		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Uranium		0.0075	0.0075	0.015	0.00004	0.00005	0.00004	0.00004	0.00005	0.00005	0.00006	0.00005	0.00006	0.00006
Vanadium		0.060	0.060	0.12	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc[3]		0.0018	0.0024	***See text***	0.0016	**0.0026**	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Speciated Metals (µg/L)														
Arsenate (As V)					-	-	-	-	-	-	-	-	-	-
Arsenite (As III)					-	-	-	-	-	-	-	-	-	-
Arsenobetaine (AsB)					-	-	-	-	-	-	-	-	-	-
Dimethylarsinic Acid (DMA)					-	-	-	-	-	-	-	-	-	-
Monomethylarsonic Acid (MMA)					-	-	-	-	-	-	-	-	-	-
Plant Pigments (µg/L)														
chlorophyll a					0.33	0.33	-	-	0.51	0.64	0.46	0.30	0.80	0.90

Notes:

1. CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life, 1999, updated up to 2018.
2. Trigger and threshold values were developed in *CREMP Design Document 2012* (Azimuth, 2012d) and updated in 2019. A number of thresholds were derived from methods (or sources) other than CCME guidelines. Refer to the CREMP: 2015 Plan Update (Azimuth, 2015b) for more details.
3. "***equation***" means that CCME guidelines (or thresholds) are calculated based on an equation which is either pH or hardness dependent. The ammonia and aluminum (t & d) guidelines vary with pH; the cadmium, copper, lead, manganese, nickel and zinc guidelines vary with hardness.
4. Chromium CCME guideline is for Cr VI.

123 Bolded concentrations exceed the trigger value.

123 Bolded and shaded concentrations also exceed the threshold value.

Italicized numbers are below detection limits.

underline = results were given a cautionary flag in the QC assessment (refer to **Section 3.3** for details)

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

Table B1-1. Water quality results from the Meadowbank study area lakes, 2021.

Lake & Area	Aquatic Life Guideline[1]	Meadowbank Screening Values[2]			Wally Lake (WAL)									
Month					March	March	May	May	July	July	August	August	September	September
Area-Replicate ID					WAL-109	WAL-110	WAL-111	WAL-112	WAL-113	WAL-114	WAL-115	WAL-116	WAL-117	WAL-118
Date		Triggers		Thresholds	18-Mar	18-Mar	09-May	09-May	11-Jul	11-Jul	10-Aug	10-Aug	03-Sep	03-Sep
Time		Meadowbank	Wally Lake		09:05	09:45	14:23	14:02	12:55	13:21	11:42	12:10	11:40	11:18
ALS Sample ID					VA21A6084-009	VA21A6084-010	VA21A9442-005	VA21A9442-006	VA21B4723-001	VA21B4723-002	VA21B7253-003	VA21B7253-004	VA21B9414-003	VA21B9414-004
Field Measurements (Surface 3m)														
Dissolved Oxygen (mg/L)					16	19	15	15	13	13	11	11	11	11
Specific Conductivity (µS/cm)					51	59	59	59	33	33	34	35	35	34
pH	6.5 - 9.0	6.30 - 8.25	6.54 - 8.34	6.5 - 9.0	6.7	6.9	6.5	6.7	6.9	6.8	7.1	7.1	6.8	6.9
Temperature (°C)					1.3	1.2	0.96	1.2	7.9	7.1	9.0	8.9	11	11
Physical Tests (mg/L)														
Conductivity (µS/cm)		27	37		**49**	**60**	**58**	**59**	34	35	36	36	**37**	36
Alkalinity - Total (as $CaCO_3$)		8.7	18		17	**22**	**19**	**19**	11	11	11	11	11	11
Alkalinity - Bicarbonate		8.7	18		17	**22**	**19**	**19**	11	11	11	11	11	11
Alkalinity - Carbonate		2.0	2.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity - Hydroxide					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hardness (as CaCO3), dissolved		9.5	17		**21**	**26**	**25**	**24**	14	13	15	15	15	14
Hardness (as CaCO3), from total Ca/Mg					22	26	26	25	15	15	15	15	15	14
pH (Laboratory)	6.5 - 9.0	6.47-7.95	6.92 - 8.17	6.5 - 9.0	7.2	7.3	7.1	7.1	7.3	7.3	7.3	7.3	7.3	7.3
Total Dissolved Solids		19	25		**29**	**36**	**51**	**51**	20	22	**26**	**25**	21	22
Total Suspended Solids		3.0	3.0	5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Turbidity (NTU)					0.17	0.16	<0.10	<0.10	0.25	0.19	0.23	0.20	0.25	0.25
Anions and Nutrients (mg/L)														
Total Kjeldahl Nitrogen		0.17	0.16		0.14	0.16	0.13	0.12	0.11	0.11	0.096	0.10	0.11	0.12
Ammonia (as N)[3]	***equation***	0.065	0.067	0.13	0.019	0.020	0.016	0.019	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Bromide					<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride	120	60	60	120	0.78	0.95	1.0	0.98	0.54	0.54	0.56	0.55	0.55	0.55
Fluoride	0.12	0.088	0.080	0.12	0.059	0.068	0.062	0.062	0.044	0.043	0.046	0.045	0.047	0.049
Nitrate (as N)	3.0	1.5	1.5	3.0	0.0074	0.0070	0.021	0.018	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrite (as N)	0.060	0.031	0.031	0.060	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Ortho Phosphate (as P)		0.0020	0.0020		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Phosphorus (P) - Total	0.010	0.0051	0.0067	0.010	0.0037	<0.0020	<0.0020	<0.0020	0.0024	0.0027	<0.0020	<0.0020	0.0036	0.0040
Phosphorus (P) - Total Diss.					<0.0020	<0.0020	<0.0020	<0.0020	0.0046	0.0031	<0.0020	<0.0020	<0.0020	<0.0020
Reactive Silica (as SiO_2)		1.0	1.1		**1.4**	**1.6**	**1.8**	**1.8**	0.87	0.89	0.76	0.77	0.82	0.86
Sulphate (SO_4)		65	65	128	5.8	7.1	6.8	6.8	3.8	3.8	4.0	4.0	4.3	4.1
Cyanides (mg/L)														
Free Cyanide	0.0050				<0.0010	-	-	<0.0010	<0.0010	-	<0.0010	-	-	<0.0010
Total Cyanide					<0.0010	-	-	<0.0010	<0.0010	-	<0.0010	-	-	<0.0010
Organic / Inorganic Carbon (mg/L)														
Dissolved Organic Carbon		2.5	3.2		2.1	2.6	2.8	2.3	1.8	1.9	2.2	2.2	2.2	2.2
Total Organic Carbon		2.6	4.1		2.1	2.7	2.5	2.4	2.2	2.3	2.1	2.2	2.4	2.4
Total Metals (mg/L)														
Aluminum[3]	***equation***	0.053	0.053	0.10	<0.0030	<0.0030	<0.0030	<0.0030	0.0074	0.0084	0.0076	0.0081	0.0080	0.0080
Antimony		0.0046	0.0046	0.0090	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	0.0050	0.0026	0.0026	0.0050	0.00030	0.00037	0.00032	0.00032	0.00025	0.00025	0.00029	0.00032	0.00029	0.00028
Barium		0.50	0.50	1.0	0.0029	0.0034	0.0037	0.0036	0.0022	0.0023	0.0019	0.0019	0.0020	0.0018
Beryllium		0.00012	0.00012	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth					<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	1.5	0.76	0.76	1.5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium[3]	***equation***	0.00002	0.00002	0.00004	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium		2.4	4.9		**5.9**	**7.1**	**7.0**	**6.9**	3.9	3.8	4.0	4.1	4.0	3.8
Chromium[4]	0.0010	0.0025	0.0026	0.0050	<0.00010	<0.00010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt				0.00077	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper[3]	***equation***	0.0012	0.0015	0.0020	0.0010	0.0013	0.0012	0.0011	0.00092	0.0010	0.00096	0.00098	0.0012	0.00096
Iron	0.30	0.15	0.16	0.30	<0.010	<0.010	<0.010	<0.010	0.016	0.017	0.013	0.014	0.012	0.011
Lead[3]	***equation***	0.00053	0.00053	0.0010	0.00012	<0.000050	0.00008	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium		0.0020	0.0020		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium		0.93	1.4		**1.7**	**2.1**	**2.0**	**1.9**	1.2	1.2	1.2	1.2	1.3	1.1
Manganese[3]		0.32	0.33	***See text***	0.0010	0.0011	0.0012	0.0012	0.0022	0.0022	0.00096	0.00089	0.0011	0.00097
Mercury	0.00003	0.00002	0.00002	0.00003	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum	0.073	0.037	0.037	0.073	0.00017	0.00021	0.000175	0.000153	0.00010	0.000114	0.000136	0.00014	0.00014	0.00014
Nickel[3]	***equation***	0.013	0.013	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Phosphorus		0.0051	0.0067	0.0040	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium		0.58	0.59		0.57	**0.71**	**0.68**	**0.66**	0.42	0.42	0.45	0.44	0.45	0.40
Rubidium					0.00076	0.00093	0.00095	0.00089	0.00059	0.00051	0.00060	0.00058	0.00062	0.00054
Selenium	0.0010	0.00053	0.00053	0.0010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon		0.20	0.65		**0.71**	**0.82**	**0.89**	**0.88**	0.49	0.48	0.43	0.41	0.45	0.42
Silver	0.00010	0.00013	0.00013	0.00025	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium		1.2	0.72		**0.74**	**0.90**	**0.85**	**0.83**	0.54	0.64	0.54	0.53	0.55	0.52
Strontium		1.3	1.3	2.5	0.030	0.037	0.035	0.034	0.020	0.021	0.020	0.020	0.020	0.020
Sulfur					1.9	2.4	2.2	2.1	1.4	1.4	1.4	1.5	1.1	1.2
Tellurium					<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Thallium	0.00080	0.00041	0.00041	0.00080	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Thorium					<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin		0.00020	0.00020		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium		0.00060	0.00060		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Tungsten					<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Uranium	0.015	0.0075	0.0075	0.015	0.00005	0.00006	0.00005	0.00004	0.00005	0.00005	0.00005	0.00006	0.00006	0.00007
Vanadium		0.060	0.060	0.12	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc					<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Zirconium					<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Dissolved Metals (mg/L)														
Aluminum[3]		0.026	0.026	0.050	0.0016	0.0013	<0.0010	0.0014	0.0041	0.0040	0.0038	0.0035	0.0036	0.0042
Antimony		0.0046	0.0046	0.0090	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic		0.0026	0.0026	0.0050	0.00025	0.00033	0.00026	0.00026	0.00020	0.00021	0.00027	0.00026	0.00026	0.00026
Barium		0.50	0.50	1.0	0.0028	0.0034	0.0036	0.0036	0.0022	0.0022	0.0020	0.0019	0.0020	0.0020
Beryllium		0.00012	0.00012	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth					<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron		0.76	0.76	1.5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium		0.00002	0.00002	0.00004	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium		2.4	4.9		**5.6**	**6.9**	**7.0**	**6.7**	3.6	3.5	4.2	4.1	4.0	3.7
Chromium		0.00026	0.00026	0.0050	<0.00010	<0.00010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt				0.00077	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper		0.0012	0.0015	0.0020	0.0010	0.0013	0.0011	0.0011	0.00090	0.00084	0.00091	0.00099	0.0011	0.00103
Iron		0.16	0.16	0.30	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Lead		0.00053	0.00053	0.0010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium		0.0020	0.0020		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium		0.93	1.4		**1.6**	**2.0**	**1.9**	**1.9**	1.1	1.1	1.2	1.2	1.2	1.1
Manganese[3]		0.32	0.33	***See text***	0.00038	0.00060	0.00036	0.00030	0.0016	0.0016	0.00028	0.00027	0.00026	0.00021
Mercury		0.00002	0.00002	0.00003	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum		0.037	0.037	0.073	0.00017	0.00021	0.000159	0.000161	0.00010	0.00009	0.00014	0.00014	0.00015	0.00014
Nickel		0.013	0.013	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Phosphorus					<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium		0.58	0.59		0.58	**0.73**	**0.68**	**0.65**	0.40	0.38	0.45	0.43	0.44	0.44
Selenium		0.00053	0.00053	0.0010	<0.000050	<0.000050	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon		0.18	0.67		0.65	**0.77**	**0.80**	**0.81**	0.39	0.41	0.41	0.37	0.39	0.42
Silver		0.00013	0.00013	0.00025	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium		1.2	0.72		0.72	**0.91**	**0.90**	**0.85**	0.51	0.49	0.54	0.54	0.53	0.54
Strontium		1.3	1.3	2.5	0.028	0.036	0.035	0.036	0.020	0.019	0.020	0.021	0.019	0.019
Sulfur					2.0	2.4	2.4	1.9	1.2	1.3	1.3	1.4	1.2	1.1
Thallium		0.00041	0.00041	0.00080	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin		0.00020	0.00020		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium		0.00060	0.00060		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Uranium		0.0075	0.0075	0.015	0.00004	0.00005	0.00005	0.00004	0.00005	0.00004	0.00006	0.00006	0.00006	0.00006
Vanadium		0.060	0.060	0.12	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc[3]		0.0018	0.0024	***See text***	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Speciated Metals (µg/L)														
Arsenate (As V)					-	-	-	-	-	-	-	-	-	-
Arsenite (As III)					-	-	-	-	-	-	-	-	-	-
Arsenobetaine (AsB)					-	-	-	-	-	-	-	-	-	-
Dimethylarsinic Acid (DMA)					-	-	-	-	-	-	-	-	-	-
Monomethylarsonic Acid (MMA)					-	-	-	-	-	-	-	-	-	-
Plant Pigments (µg/L)														
chlorophyll a					0.22	0.24	0.097	0.16	0.58	0.64	0.55	0.47	0.97	0.93

Notes:

1. CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life, 1999, updated up to 2018.
2. Trigger and threshold values were developed in *CREMP Design Document 2012* (Azimuth, 2012d) and updated in 2019. A number of thresholds were derived from methods (or sources) other than CCME guidelines. Refer to the CREMP: 2015 Plan Update (Azimuth, 2015b) for more details.
3. "***equation***" means that CCME guidelines (or thresholds) are calculated based on an equation which is either pH or hardness dependent. The ammonia and aluminum (t & d) guidelines vary with pH; the cadmium, copper, lead, manganese, nickel and zinc guidelines vary with hardness.
4. Chromium CCME guideline is for Cr VI.

123 Bolded concentrations exceed the trigger value.

123 Bolded and shaded concentrations also exceed the threshold value.

Italicized numbers are below detection limits.

underline = results were given a cautionary flag in the QC assessment (refer to **Section 3.3** for details)

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

Table B1-1. Water quality results from the Meadowbank study area lakes, 2021.

Lake & Area	Aquatic Life Guideline[1]	Meadowbank Screening Values[2]			Tehek Lake (TE)		Tehek Lake - Far Field (TEFF)		Third Portage Lake - South Basin (TPS)	
Month					March	March	March	March	May	May
Area-Replicate ID					TE-100	TE-101	TEFF-52	TEFF-53	TPS-65	TPS-66
Date		Triggers		Thresholds	09-Mar	09-Mar	09-Mar	09-Mar	10-May	10-May
Time		Meadowbank	Wally Lake		13:20	12:07	11:30	10:11	13:18	12:54
ALS Sample ID					VA21A6084-001	VA21A6084-002	VA21A6084-003	VA21A6084-004	VA21A9442-013	VA21A9442-014
Field Measurements (Surface 3m)										
Dissolved Oxygen (mg/L)					22	19	21	21	17	17
Specific Conductivity (µS/cm)					40	29	24	25	32	33
pH	6.5 - 9.0	6.30 - 8.25	6.54 - 8.34	6.5 - 9.0	6.6	6.3	6.4	6.5	6.8	7.0
Temperature (°C)					0.23	0.48	0.34	0.38	0.16	0.31
Physical Tests (mg/L)										
Conductivity (µS/cm)		27	37		**41**	**28**	**33**	27	**33**	**34**
Alkalinity - Total (as $CaCO_3$)		8.7	18		**12**	7.7	8.6	7.2	7.3	7.3
Alkalinity - Bicarbonate		8.7	18		**12**	7.7	8.6	7.2	7.3	7.3
Alkalinity - Carbonate		2.0	2.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity - Hydroxide					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hardness (as CaCO3), dissolved		9.5	17		**14**	**11**	**12**	9.4	**11**	**11**
Hardness (as CaCO3), from total Ca/Mg					16	11	12	9.4	11	11
pH (Laboratory)	6.5 - 9.0	6.47-7.95	6.92 - 8.17	6.5 - 9.0	7.1	7.0	7.0	7.0	7.0	7.0
Total Dissolved Solids		19	25		**31**	17	**21**	9.6	**23**	**23**
Total Suspended Solids		3.0	3.0	5.0	1.6	<1.0	<1.0	<1.0	<1.0	<1.0
Turbidity (NTU)					0.19	0.14	<0.10	<0.10	<0.10	<0.10
Anions and Nutrients (mg/L)										
Total Kjeldahl Nitrogen		0.17	0.16		0.10	0.089	0.15	0.088	0.089	0.12
Ammonia (as N)[3]	***equation***	0.065	0.067	0.13	0.0095	0.0076	0.012	0.0077	0.017	0.016
Bromide					<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride	120	60	60	120	1.2	0.91	1.2	0.90	0.99	1.0
Fluoride	0.12	0.088	0.080	0.12	**0.097**	0.081	**0.098**	0.081	0.076	0.076
Nitrate (as N)	3.0	1.5	1.5	3.0	0.0062	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrite (as N)	0.060	0.031	0.031	0.060	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Ortho Phosphate (as P)		0.0020	0.0020		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Phosphorus (P) - Total	0.010	0.0051	0.0067	0.010	<0.0020	<0.0020	0.0038	<0.0020	0.0040	<0.0020
Phosphorus (P) - Total Diss.					<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Reactive Silica (as SiO_2)		1.0	1.1		0.61	<0.50	<0.50	<0.50	<0.50	<0.50
Sulphate (SO_4)		65	65	128	5.7	3.9	4.5	3.6	5.5	5.5
Cyanides (mg/L)										
Free Cyanide	0.0050				-	<0.0010	-	<0.0010	<0.0010	-
Total Cyanide					-	<0.0010	-	<0.0010	<0.0010	-
Organic / Inorganic Carbon (mg/L)										
Dissolved Organic Carbon		2.5	3.2		2.3	1.4	1.7	1.7	1.4	1.3
Total Organic Carbon		2.6	4.1		1.9	1.5	2.2	1.4	1.3	1.4
Total Metals (mg/L)										
Aluminum[3]	***equation***	0.053	0.053	0.10	<0.0030	<0.0030	0.0039	0.0030	<0.0030	<0.0030
Antimony		0.0046	0.0046	0.0090	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	0.0050	0.0026	0.0026	0.0050	0.00023	0.00015	0.00018	0.00014	0.00020	0.00019
Barium		0.50	0.50	1.0	0.0036	0.0031	0.0040	0.0032	0.0032	0.0033
Beryllium		0.00012	0.00012	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth					<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	1.5	0.76	0.76	1.5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium[3]	***equation***	0.00002	0.00002	0.00004	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium		2.4	4.9		**3.9**	**2.6**	**2.9**	2.2	**2.8**	**2.8**
Chromium[4]	0.0010	0.0025	0.0026	0.0050	<0.00010	<0.00010	<0.00010	<0.00010	<0.00050	<0.00050
Cobalt				0.00077	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper[3]	***equation***	0.0012	0.0015	0.0020	<0.00050	<0.00050	0.00063	<0.00050	<0.00050	<0.00050
Iron	0.30	0.15	0.16	0.30	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Lead[3]	***equation***	0.00053	0.00053	0.0010	<0.000050	<0.000050	0.00012	<0.000050	<0.000050	<0.000050
Lithium		0.0020	0.0020		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium		0.93	1.4		**1.4**	**1.0**	**1.1**	**0.94**	**1.0**	**1.0**
Manganese[3]		0.32	0.33	***See text***	0.00043	0.00045	0.00047	0.00041	0.00037	0.00040
Mercury	0.00003	0.00002	0.00002	0.00003	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum	0.073	0.037	0.037	0.073	0.00014	0.00007	0.00015	0.00006	0.00013	0.000125
Nickel[3]	***equation***	0.013	0.013	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Phosphorus		0.0051	0.0067	0.0040	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium		0.58	0.59		**0.75**	**0.60**	**0.80**	**0.61**	0.58	**0.59**
Rubidium					0.0012	0.0011	0.0015	0.0011	0.00087	0.00092
Selenium	0.0010	0.00053	0.00053	0.0010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon		0.20	0.65		**0.31**	**0.24**	**0.25**	0.20	0.12	0.13
Silver	0.00010	0.00013	0.00013	0.00025	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium		1.2	0.72		**1.2**	0.93	**1.4**	0.91	**1.2**	**1.2**
Strontium		1.3	1.3	2.5	0.020	0.014	0.017	0.012	0.013	0.013
Sulfur					1.8	1.3	1.6	1.2	1.8	1.9
Tellurium					<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Thallium	0.00080	0.00041	0.00041	0.00080	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Thorium					<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin		0.00020	0.00020		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium		0.00060	0.00060		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Tungsten					<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Uranium	0.015	0.0075	0.0075	0.015	0.00004	0.00005	0.00007	0.00005	0.00003	0.00004
Vanadium		0.060	0.060	0.12	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc					<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Zirconium					<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Dissolved Metals (mg/L)										
Aluminum[3]		0.026	0.026	0.050	0.0011	0.0017	0.0016	0.0015	0.0012	<0.0010
Antimony		0.0046	0.0046	0.0090	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic		0.0026	0.0026	0.0050	0.00019	0.00014	0.00017	0.00013	0.00019	0.00018
Barium		0.50	0.50	1.0	0.0034	0.0030	0.0041	0.0031	0.0031	0.0032
Beryllium		0.00012	0.00012	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth					<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron		0.76	0.76	1.5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium		0.00002	0.00002	0.00004	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium		2.4	4.9		**3.5**	**2.6**	**2.7**	2.3	**2.8**	**2.8**
Chromium		0.00026	0.00026	0.0050	<0.00010	<0.00010	<0.00010	<0.00010	<0.00050	<0.00050
Cobalt				0.00077	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper		0.0012	0.0015	0.0020	0.00044	0.00032	0.00037	**0.0016**	0.00035	0.00035
Iron		0.16	0.16	0.30	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Lead		0.00053	0.00053	0.0010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium		0.0020	0.0020		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium		0.93	1.4		**1.3**	**1.0**	**1.2**	0.90	**0.98**	**1.00**
Manganese[3]		0.32	0.33	***See text***	0.00017	0.00015	0.00013	0.00017	0.00010	0.00013
Mercury		0.00002	0.00002	0.00003	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum		0.037	0.037	0.073	0.00010	0.00009	0.00008	0.00007	0.00013	0.00013
Nickel		0.013	0.013	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Phosphorus					<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium		0.58	0.59		**0.67**	0.58	**0.78**	0.58	0.58	**0.60**
Selenium		0.00053	0.00053	0.0010	<0.000050	<0.000050	<0.000050	0.00006	<0.000050	<0.000050
Silicon		0.18	0.67		**0.24**	**0.21**	**0.21**	0.16	0.075	0.069
Silver		0.00013	0.00013	0.00025	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium		1.2	0.72		1.0	0.88	1.1	0.83	**1.2**	**1.2**
Strontium		1.3	1.3	2.5	0.019	0.014	0.015	0.012	0.013	0.012
Sulfur					1.5	1.1	1.4	1.2	1.7	1.5
Thallium		0.00041	0.00041	0.00080	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin		0.00020	0.00020		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium		0.00060	0.00060		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Uranium		0.0075	0.0075	0.015	0.00005	0.00005	0.00005	0.00004	0.00004	0.00004
Vanadium		0.060	0.060	0.12	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc[3]		0.0018	0.0024	***See text***	<0.0010	<0.0010	<0.0010	0.0014	<0.0010	<0.0010
Speciated Metals (µg/L)										
Arsenate (As V)					-	-	-	-	-	-
Arsenite (As III)					-	-	-	-	-	-
Arsenobetaine (AsB)					-	-	-	-	-	-
Dimethylarsinic Acid (DMA)					-	-	-	-	-	-
Monomethylarsonic Acid (MMA)					-	-	-	-	-	-
Plant Pigments (µg/L)										
chlorophyll a					0.27	0.30	0.25	0.14	0.32	0.31

Notes:

1. CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aq
2. Trigger and threshold values were developed in *CREMP Design*
3. "***equation***" means that CCME guidelines (or thresholds) are
4. Chromium CCME guideline is for Cr VI.

123 Bolded concentrations exceed the trigger value.

123 Bolded and shaded concentrations also exceed the threshold value.

Italicized numbers are below detection limits.

underline = results were given a cautionary flag in the QC assessment (refer to **Section 3.3** for details)

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

Table B1-2. Water quality results from Third Portage Lake in 2021 compared against predicted concentrations in the FEIS.

Lake and Area		Simulated Maximum Whole Lake Concentration (mg/L) Third Portage Lake[2]				Third Portage Lake East Basin (TPE)									
Area-Replicate ID	CCME (2012) Guideline[1]	Upper Mixing Estimate (169 Mm^3)		Mid-range Mixing Estimate (92 Mm^3)		TPE-140	TPE-141	TPE-142	TPE-143	TPE-145	TPE-144	TPE-146	TPE-147	TPE-148	TPE-149
Depth (m)		Without Dike Leaching	With Dike Leaching	Without Dike Leaching	With Dike Leaching	3	3	3	3	3	3	3	3	3	3
Date						29-Mar-21	29-Mar-21	10-May-21	10-May-21	23-Jul-21	23-Jul-21	13-Aug-21	13-Aug-21	17-Sep-21	17-Sep-21
Physical Tests (mg/L)															
Hardness		5.7	6.0	6.0	6.4	***14***	***13***	***14***	***14***	***9.3***	***8.6***	***10***	***10***	***9.6***	***9.7***
Anions and Nutrients (mg/L)															
Alkalinity - Total		4.1	4.1	4.2	4.2	***10***	***8.7***	***9.0***	***9.3***	***6.7***	***6.5***	***6.8***	***6.9***	***7.5***	***7.4***
Ammonia (as N)[3]	***equation***	0.033	0.033	0.050	0.050	0.019	0.012	0.016	0.016	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*
Chloride	120	0.80	0.80	1.0	1.1	**1.1**	0.94	**1.0**	**1.1**	0.73	0.77	0.71	0.72	0.74	0.74
Fluoride	0.12	0.070	0.080	0.070	0.090	***0.096***	**0.086**	***0.095***	***0.097***	**0.072**	0.066	**0.081**	**0.077**	**0.073**	**0.071**
Nitrate (as N)	3.0	0.035	0.036	0.057	0.059	*<0.0050*	*<0.0050*	0.0060	0.010	0.0053	0.010	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*
Ortho Phosphate (as P)		0.0022	0.0022	0.0024	0.0024	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Phosphorus (P) - Total	0.0040	0.0027	0.0029	0.0032	0.0035	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	***0.0039***	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*
Sulphate (SO_4)		1.7	1.7	2.0	2.0	***6.5***	***5.8***	***6.7***	***6.4***	***4.5***	***4.5***	***4.4***	***4.4***	***4.7***	***4.6***
Cyanides (mg/L)															
Total Cyanide		0	0	0	0	*<0.0010*	-	-	*<0.0010*	-	*<0.0010*	*<0.0010*	-	-	*<0.0010*
Total Metals (mg/L)															
Aluminum[3]	***equation***	0.0070	0.0090	0.0070	0.010	*<0.0030*	*<0.0030*	*<0.0030*	0.0038	0.0068	**0.0093**	***0.015***	***0.011***	**0.0088**	**0.0089**
Antimony		0.00056	0.00057	0.00060	0.00062	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Arsenic	0.0050	0.00062	0.00062	0.00072	0.00072	0.00046	0.00043	0.00048	0.00043	0.00025	0.00054	0.00045	0.00047	0.00052	0.00049
Barium		0.020	0.022	0.020	0.023	0.0036	0.0033	0.0037	0.0038	0.0028	0.0028	0.0028	0.0027	0.0029	0.0032
Beryllium		0.0010	0.0010	0.0010	0.0010	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*
Bismuth		0.10	0.10	0.10	0.10	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Boron	1.5	0.00001	0.00001	0.00001	0.00001	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Cadmium[3]	***equation***	<0.000051	<0.000051	<0.000052	<0.000052	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Calcium		1.3	1.4	1.5	1.5	***3.4***	***3.1***	***3.6***	***3.6***	***2.4***	***2.5***	***2.6***	***2.6***	***2.5***	***2.5***
Chromium[4]	0.001	0.0010	0.0010	0.0010	0.0010	*<0.00010*	*<0.00010*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Cobalt		0.0040	0.0013	0.00040	0.0017	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Copper[3]	***equation***	0.0012	0.0012	0.0013	0.0013	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Iron	0.3	0.030	0.030	0.030	0.030	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	0.015	0.018	0.014	0.012	0.012
Lead[3]	***equation***	0.00060	0.00060	0.00060	0.00070	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Lithium		0.0050	0.0050	0.0050	0.0050	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Magnesium		0.60	0.60	0.60	0.70	***1.3***	***1.3***	***1.3***	***1.3***	***0.90***	***0.94***	***0.96***	***0.93***	***0.98***	***1.0***
Manganese[3]		0.0090	0.052	0.015	0.072	0.00047	0.00038	0.00041	0.00048	0.0018	0.0019	0.00096	0.0010	0.0012	0.0014
Mercury	0.000026	0.00005	0.00005	0.00005	0.00005	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Molybdenum	0.073	0.0010	0.0010	0.0010	0.0010	0.00015	0.00012	0.00014	0.00014	0.00010	0.00010	0.00011	0.00012	0.00010	0.00012
Nickel[3]	***equation***	0.0016	0.0016	0.0020	0.0021	0.00056	*<0.00050*	0.00056	0.00061	*<0.00050*	0.00055	0.00051	0.00051	0.00057	0.00054
Potassium		2.0	2.1	2.0	2.1	0.68	0.64	0.68	0.69	0.52	0.51	0.54	0.53	0.53	0.56
Selenium	0.001	0.0010	0.0010	0.0010	0.0010	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Silicon		0.010	0.080	0.020	0.12	***0.13***	**0.11**	***0.15***	***0.15***	**0.12**	***0.16***	***0.20***	***0.16***	***0.13***	**0.12**
Silver	0.0001	0.00002	0.00002	0.00002	0.00002	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Sodium		2.0	2.0	2.0	2.1	1.4	1.3	1.4	1.4	1.0	0.97	0.96	0.95	1.0	1.1
Strontium		0.0020	0.0050	0.0040	0.0070	***0.016***	***0.014***	***0.016***	***0.016***	***0.011***	***0.011***	***0.011***	***0.011***	***0.012***	***0.012***
Thallium	0.0008	0.00020	0.00020	0.00020	0.00020	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Uranium	0.015	0.00020	0.00020	0.00020	0.00030	0.00003	0.00003	0.00004	0.00004	0.00004	0.00005	0.00005	0.00004	0.00005	0.00005
Vanadium		0.030	0.030	0.030	0.030	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Zinc		0.011	0.011	0.015	0.015	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*

Notes:

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

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

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

4. Chromium CCME guideline is for Cr VI.

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

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

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

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

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

Italicized numbers are below detection limits.

Table B1-2. Water quality results from Third Portage Lake in 2021 compared against predicted concentrations in the FEIS.

Lake and Area		Simulated Maximum Whole Lake Concentration (mg/L) Third Portage Lake[2]				Third Portage Lake North Basin (TPN)										Third Portage Lake South Basin (TPS)	
Area-Replicate ID	CCME (2012) Guideline[1]	Upper Mixing Estimate (169 Mm^3)		Mid-range Mixing Estimate (92 Mm^3)		TPN-140	TPN-141	TPN-143	TPN-142	TPN-144	TPN-145	TPN-146	TPN-147	TPN-148	TPN-149	TPS-65	TPS-66
Depth (m)		Without Dike Leaching	With Dike Leaching	Without Dike Leaching	With Dike Leaching	3	3	3	3	3	3	3	3	3	3	3	3
Date						29-Mar-21	29-Mar-21	10-May-21	10-May-21	29-Jul-21	29-Jul-21	10-Aug-21	10-Aug-21	17-Sep-21	17-Sep-21	10-May-21	10-May-21
Physical Tests (mg/L)																	
Hardness		5.7	6.0	6.0	6.4	***13***	***13***	***12***	***12***	***9.2***	***9.2***	***9.4***	***9.4***	***9.0***	***9.0***	***11***	***11***
Anions and Nutrients (mg/L)																	
Alkalinity - Total		4.1	4.1	4.2	4.2	***8.5***	***8.5***	***8.2***	***9.3***	***6.5***	***6.3***	***6.2***	***6.4***	***6.8***	***6.9***	***7.3***	***7.3***
Ammonia (as N)[3]	***equation***	0.033	0.033	0.050	0.050	0.010	0.012	0.013	0.015	<0.0050	0.011	<0.0050	<0.0050	0.0061	<0.0050	0.017	0.016
Chloride	120	0.80	0.80	1.0	1.1	**1.1**	**1.1**	**1.1**	**1.1**	0.79	0.78	0.78	0.84	0.79	0.77	0.99	1.0
Fluoride	0.12	0.070	0.080	0.070	0.090	**0.087**	**0.086**	**0.083**	**0.082**	0.066	0.065	0.068	0.069	0.063	0.062	**0.076**	**0.076**
Nitrate (as N)	3.0	0.035	0.036	0.057	0.059	<0.0050	<0.0050	<0.0050	<0.0050	0.0090	0.0088	<0.0050	0.0084	<0.0050	<0.0050	<0.0050	<0.0050
Ortho Phosphate (as P)		0.0022	0.0022	0.0024	0.0024	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Phosphorus (P) - Total	0.0040	0.0027	0.0029	0.0032	0.0035	<0.0020	<0.0020	***0.0054***	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	***0.0040***	<0.0020
Sulphate (SO_4)		1.7	1.7	2.0	2.0	***6.4***	***6.2***	***6.2***	***6.2***	***4.5***	***4.5***	***4.3***	***4.4***	***4.6***	***4.5***	***5.5***	***5.5***
Cyanides (mg/L)																	
Total Cyanide		0	0	0	0	-	<0.0010	<0.0010	-	<0.0010	-	<0.0010	-	-	<0.0010	<0.0010	-
Total Metals (mg/L)																	
Aluminum[3]	***equation***	0.0070	0.0090	0.0070	0.010	<0.0030	<0.0030	<0.0030	<0.0030	0.0069	0.0067	0.0055	**0.0078**	**0.0091**	**0.0075**	<0.0030	<0.0030
Antimony		0.00056	0.00057	0.00060	0.00062	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	0.0050	0.00062	0.00062	0.00072	0.00072	0.00022	0.00022	0.00022	0.00025	0.00021	0.00022	0.00020	0.00020	0.00021	0.00021	0.00020	0.00019
Barium		0.020	0.022	0.020	0.023	0.0035	0.0035	0.0036	0.0037	0.0026	0.0028	0.0024	0.0028	0.0032	0.0029	0.0032	0.0033
Beryllium		0.0010	0.0010	0.0010	0.0010	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth		0.10	0.10	0.10	0.10	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	1.5	0.00001	0.00001	0.00001	0.00001	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium[3]	***equation***	<0.000051	<0.000051	<0.000052	<0.000052	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium		1.3	1.4	1.5	1.5	***3.1***	***3.0***	***3.0***	***3.2***	***2.2***	***2.3***	***2.0***	***2.3***	***2.3***	***2.2***	***2.8***	***2.8***
Chromium[4]	0.001	0.0010	0.0010	0.0010	0.0010	<0.00010	<0.00010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt		0.0040	0.0013	0.00040	0.0017	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper[3]	***equation***	0.0012	0.0012	0.0013	0.0013	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Iron	0.3	0.030	0.030	0.030	0.030	<0.010	<0.010	<0.010	<0.010	<0.010	0.011	<0.010	0.012	0.010	<0.010	<0.010	<0.010
Lead[3]	***equation***	0.00060	0.00060	0.00060	0.00070	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium		0.0050	0.0050	0.0050	0.0050	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium		0.60	0.60	0.60	0.70	***1.2***	***1.2***	***1.2***	***1.2***	***0.85***	***0.87***	***0.78***	***0.86***	***0.98***	***0.88***	***1.0***	***1.0***
Manganese[3]		0.0090	0.052	0.015	0.072	0.00046	0.00047	0.00046	0.00046	0.0016	0.0017	0.0011	0.0016	0.0015	0.0014	0.00037	0.00040
Mercury	0.000026	0.00005	0.00005	0.00005	0.00005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum	0.073	0.0010	0.0010	0.0010	0.0010	0.00015	0.00016	0.00014	0.00014	0.00009	0.00010	0.00011	0.00010	0.00010	0.00011	0.00013	0.00013
Nickel[3]	***equation***	0.0016	0.0016	0.0020	0.0021	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00075	0.00051	0.00051	<0.00050	<0.00050	<0.00050
Potassium		2.0	2.1	2.0	2.1	0.67	0.65	0.65	0.66	0.49	0.50	0.44	0.51	0.54	0.49	0.58	0.59
Selenium	0.001	0.0010	0.0010	0.0010	0.0010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon		0.010	0.080	0.020	0.12	**0.10**	**0.12**	***0.13***	***0.13***	***0.19***	***0.13***	***0.13***	**0.12**	**0.12**	**0.10**	**0.12**	***0.13***
Silver	0.0001	0.00002	0.00002	0.00002	0.00002	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium		2.0	2.0	2.0	2.1	1.4	1.4	1.3	1.4	0.98	1.0	0.90	0.99	1.1	1.0	1.2	1.2
Strontium		0.0020	0.0050	0.0040	0.0070	***0.015***	***0.015***	***0.014***	***0.014***	***0.0095***	***0.010***	***0.0089***	***0.010***	***0.011***	***0.011***	***0.013***	***0.013***
Thallium	0.0008	0.00020	0.00020	0.00020	0.00020	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Uranium	0.015	0.00020	0.00020	0.00020	0.00030	0.00003	0.00003	0.00004	0.00004	0.00004	0.00004	0.00003	0.00004	0.00004	0.00004	0.00003	0.00004
Vanadium		0.030	0.030	0.030	0.030	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc		0.011	0.011	0.015	0.015	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes:

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

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

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

4. Chromium CCME guideline is for Cr VI.

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

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

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

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

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

Italicized numbers are below detection limits.

Table B1-3. Water quality results from Second Portage Lake in 2021 compared against predicted concentrations in the FEIS.

Lake and Area		Simulated Maximum Whole Lake Concentration (mg/L) Second Portage Lake[2]				Second Portage Lake (SP)									
Area-Replicate ID	CCME (2012)	Upper Mixing Estimate (169 Mm^3)		Mid-range Mixing Estimate (92 Mm^3)		SP-140	SP-141	SP-143	SP-142	SP-144	SP-145	SP-146	SP-147	SP-148	SP-149
Depth (m)	Guideline[1]	Without Dike Leaching	With Dike Leaching	Without Dike Leaching	With Dike Leaching	3	3	3	3	3	3	3	3	3	3
Date						18-Mar-21	18-Mar-21	9-May-21	9-May-21	11-Jul-21	11-Jul-21	6-Aug-21	6-Aug-21	3-Sep-21	3-Sep-21
Physical Tests (mg/L)															
Hardness		8.9	8.9	8.9	8.9	***18***	***17***	***17***	***18***	***14***	***14***	***13***	***14***	***13***	***13***
Anions and Nutrients (mg/L)															
Alkalinity - Total		7.0	7.0	7.0	7.0	***14***	***12***	***12***	***13***	***11***	***11***	***9.6***	***9.5***	***9.2***	***9.2***
Ammonia (as N)[3]	***equation***	0.025	0.025	0.031	0.031	0.015	0.012	0.012	0.012	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Chloride	120	0.70	0.70	0.80	0.80	***1.1***	***0.99***	***1.0***	***1.1***	***0.82***	0.78	0.77	0.78	0.77	0.77
Fluoride	0.12	0.070	0.071	0.070	0.071	***0.090***	***0.089***	***0.086***	***0.089***	***0.073***	0.069	0.070	***0.072***	0.068	0.068
Nitrate (as N)	3.0	0.017	0.017	0.025	0.025	<0.0050	0.0075	0.012	0.0098	0.0086	0.0053	<0.0050	<0.0050	<0.0050	<0.0050
Ortho Phosphate (as P)		0.0030	0.0030	0.0030	0.0030	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Phosphorus (P) - Total	0.0040	0.0030	0.0030	0.0031	0.0031	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0020	<0.0020	<0.0020	0.0029	0.0022
Sulphate (SO_4)		2.8	2.8	2.8	2.8	***6.8***	***6.4***	***6.6***	***7.0***	***4.9***	***4.8***	***4.9***	***4.9***	***4.7***	***4.8***
Cyanides (mg/L)															
Total Cyanide		0	0	0	0	<0.0010	-	-	<0.0010	-	<0.0010	-	<0.0010	<0.0010	-
Total Metals (mg/L)															
Aluminum[3]	***equation***	0.0070	0.0070	0.0070	0.0070	<0.0030	<0.0030	<0.0030	<0.0030	***0.0092***	***0.010***	***0.015***	***0.014***	***0.0094***	***0.0086***
Antimony		0.00050	0.00050	0.00050	0.00050	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	0.0050	0.00050	0.00050	0.00060	0.00060	0.00032	0.00037	0.00036	0.00034	0.00038	0.00036	0.00032	0.00036	0.00033	0.00036
Barium		0.020	0.020	0.020	0.020	0.0034	0.0034	0.0033	0.0034	0.0030	0.0028	0.0026	0.0027	0.0024	0.0025
Beryllium		0.0010	0.0010	0.0010	0.0010	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth		0.10	0.10	0.10	0.10	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	1.5	0.00001	0.00001	0.00001	0.00001	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium[3]	***equation***	<0.000050	<0.000050	<0.000051	<0.000051	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium		2.3	2.3	2.3	2.3	***5.1***	***4.3***	***4.1***	***4.5***	***3.8***	***3.7***	***3.5***	***3.6***	***3.3***	***3.4***
Chromium[4]	0.0010	0.0010	0.0010	0.0010	0.0010	<0.00010	<0.00010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt		0.00030	0.00040	0.00030	0.00040	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper[3]	***equation***	0.0011	0.0011	0.0011	0.0011	0.00076	0.00060	0.00060	0.00064	0.00067	0.00069	0.00076	0.00079	0.00078	0.00073
Iron	0.30	0.030	0.030	0.030	0.030	<0.010	<0.010	<0.010	<0.010	0.018	0.020	0.022	0.022	0.015	0.013
Lead[3]	***equation***	0.00090	0.00090	0.00090	0.00090	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium		0.0050	0.0050	0.0050	0.0050	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium		0.80	0.80	0.80	0.80	***1.6***	***1.4***	***1.3***	***1.5***	***1.2***	***1.3***	***1.2***	***1.2***	***1.2***	***1.2***
Manganese[3]		0.0044	0.0067	0.0066	0.0089	0.00050	0.00056	0.00070	0.00049	0.0026	0.0027	0.0013	0.0014	0.0010	0.00098
Mercury	0.00003	0.00005	0.00005	0.00005	0.00005	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum	0.073	0.0010	0.0010	0.0010	0.0010	0.00017	0.00016	0.00017	0.00017	0.00012	0.00012	0.00014	0.00014	0.00014	0.00012
Nickel[3]	***equation***	0.0010	0.0010	0.0010	0.0010	<0.00050	<0.00050	<0.00050	0.00051	0.00060	0.00061	0.00050	<0.00050	<0.00050	<0.00050
Potassium		2.0	2.0	2.0	2.0	0.69	0.67	0.62	0.67	0.54	0.51	0.50	0.52	0.49	0.49
Selenium	0.0010	0.0010	0.0010	0.0010	0.0010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon		0.010	0.010	0.010	0.010	***0.34***	***0.27***	***0.29***	***0.32***	***0.36***	***0.39***	***0.32***	***0.31***	***0.27***	***0.23***
Silver	0.00010	0.00001	0.00001	0.00001	0.00001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium		2.0	2.0	2.0	2.0	1.2	1.2	1.1	1.2	0.84	0.81	0.74	0.77	0.74	0.80
Strontium		0.80	0.80	0.80	0.80	0.023	0.022	0.022	0.023	0.017	0.017	0.017	0.017	0.016	0.017
Thallium	0.00080	0.00020	0.00020	0.00020	0.00020	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Uranium	0.015	0.00020	0.00020	0.00020	0.00020	0.00005	0.00005	0.00005	0.00006	0.00005	0.00005	0.00005	0.00006	0.00006	0.00007
Vanadium		0.030	0.030	0.030	0.030	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc		0.0070	0.0070	0.0090	0.0090	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes:

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

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

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

4. Chromium CCME guideline is for Cr VI.

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

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

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

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

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

Italicized numbers are below detection limits.

Table B1-4. Water quality results from Wally Lake in 2021 compared against predicted concentrations in the FEIS.

Lake and Area		Simulated Maximum Whole Lake Concentration (mg/L) Wally Lake[2]		Wally Lake (WAL)									
Area-Replicate ID	**CCME (2012) Guideline[1]**	Without Dike Leaching	With Dike Leaching	WAL-109	WAL-110	WAL-111	WAL-112	WAL-113	WAL-114	WAL-115	WAL-116	WAL-117	WAL-118
Depth (m)				3	3	3	3	3	3	3	3	3	3
Date				18-Mar-21	18-Mar-21	9-May-21	9-May-21	11-Jul-21	11-Jul-21	10-Aug-21	10-Aug-21	3-Sep-21	3-Sep-21
Physical Tests (mg/L)													
Hardness		17	17	***21***	***26***	***25***	***24***	14	13	15	15	15	14
Anions and Nutrients (mg/L)													
Alkalinity - Total		13	13	***17***	***22***	***19***	***19***	11	11	11	11	11	11
Ammonia (as N)[3]	***equation***	0.089	0.089	0.019	0.020	0.016	0.019	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*
Chloride	120	0.70	0.70	***0.78***	***0.95***	***1.0***	***0.98***	0.54	0.54	0.56	0.55	0.55	0.55
Fluoride	0.12	0.050	0.050	***0.059***	***0.068***	***0.062***	***0.062***	0.044	0.043	0.046	0.045	0.047	0.049
Nitrate (as N)	3.0	0.10	0.10	0.0074	0.0070	0.021	0.018	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*	*<0.0050*
Ortho Phosphate (as P)		0.0030	0.0030	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Phosphorus (P) - Total	0.0040	0.0039	0.0040	0.0037	*<0.0020*	*<0.0020*	*<0.0020*	0.0024	0.0027	*<0.0020*	*<0.0020*	0.0036	**0.0040**
Sulphate (SO_4)		5.3	5.3	***5.8***	***7.1***	***6.8***	***6.8***	3.8	3.8	4.0	4.0	4.3	4.1
Cyanides (mg/L)													
Total Cyanide		0	0	*<0.0010*	-	-	*<0.0010*	*<0.0010*	-	*<0.0010*	-	-	*<0.0010*
Total Metals (mg/L)													
Aluminum[3]	***equation***	0.012	0.013	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	0.0074	0.0084	0.0076	0.0081	0.0080	0.0080
Antimony		0.00090	0.00090	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Arsenic	0.0050	0.0050	0.0060	0.00030	0.00037	0.00032	0.00032	0.00025	0.00025	0.00029	0.00032	0.00029	0.00028
Barium		0.020	0.020	0.0029	0.0034	0.0037	0.0036	0.0022	0.0023	0.0019	0.0019	0.0020	0.0018
Beryllium		0.0010	0.0010	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*
Bismuth		0.10	0.10	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Boron	1.5	0.00001	0.00001	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Cadmium[3]	***equation***	0.00018	0.00019	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Calcium		4.7	4.7	***5.9***	***7.1***	***7.0***	***6.9***	3.9	3.8	4.0	4.1	4.0	3.8
Chromium[4]	0.001	0.0010	0.0010	*<0.00010*	*<0.00010*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Cobalt		0.00030	0.00030	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Copper[3]	***equation***	0.0020	0.0020	0.0010	0.0013	0.0012	0.0011	0.00092	0.0010	0.00096	0.00098	0.0012	0.00096
Iron	0.3	0.030	0.030	*<0.010*	*<0.010*	*<0.010*	*<0.010*	0.016	0.017	0.013	0.014	0.012	0.011
Lead[3]	***equation***	0.00070	0.00070	0.00012	*<0.000050*	0.00008	0.00005	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Lithium		0.0050	0.0050	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Magnesium		1.3	1.3	***1.7***	***2.1***	***2.0***	***1.9***	1.2	1.2	1.2	1.2	1.3	1.1
Manganese[3]		0.0020	0.0020	0.0010	0.0011	0.0012	0.0012	***0.0022***	***0.0022***	0.00096	0.00089	0.0011	0.00097
Mercury	0.000026	0.00010	0.00010	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Molybdenum	0.073	0.0020	0.0020	0.00017	0.00021	0.00018	0.00015	0.00010	0.00011	0.00014	0.00014	0.00014	0.00014
Nickel[3]	***equation***	0.0010	0.0010	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Potassium		2.0	2.0	0.57	0.71	0.68	0.66	0.42	0.42	0.45	0.44	0.45	0.40
Selenium	0.001	0.0010	0.0010	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Silicon		0.040	0.040	***0.71***	***0.82***	***0.89***	***0.88***	***0.49***	***0.48***	***0.43***	***0.41***	***0.45***	***0.42***
Silver	0.0001	0.00002	0.00002	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Sodium		2.0	2.0	0.74	0.90	0.85	0.83	0.54	0.64	0.54	0.53	0.55	0.52
Thallium	0.0008	0.00020	0.00020	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Uranium	0.015	0.00070	0.00070	0.00005	0.00006	0.00005	0.00004	0.00005	0.00005	0.00005	0.00006	0.00006	0.00007
Vanadium		0.030	0.030	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Zinc		0.013	0.013	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*

Notes:

1. CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life, 1999, updated up to 2016.
2. Preliminary modelling of whole lake water quality in the receiving environment water bodies incorporates long-term loadings from the Vault dike and effluent releases from the Vault Attenuation pond (Cumberland, 2005).
3. "***equation***" means that CCME guidelines (or thresholds) are calculated based on an equation which is either pH or hardness dependent. Ammonia and aluminum (t & d) guidelines vary with pH; cadmium, copper, lead, manganese, nickel and zinc guidelines vary with hardness.
4. Chromium CCME guideline is for Cr VI.

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

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

Italicized numbers are below detection limits.

FIGURES

Figure B1-1. Total Suspended Solids (TSS; mg/L).

Note: The red dashed line = trigger value.

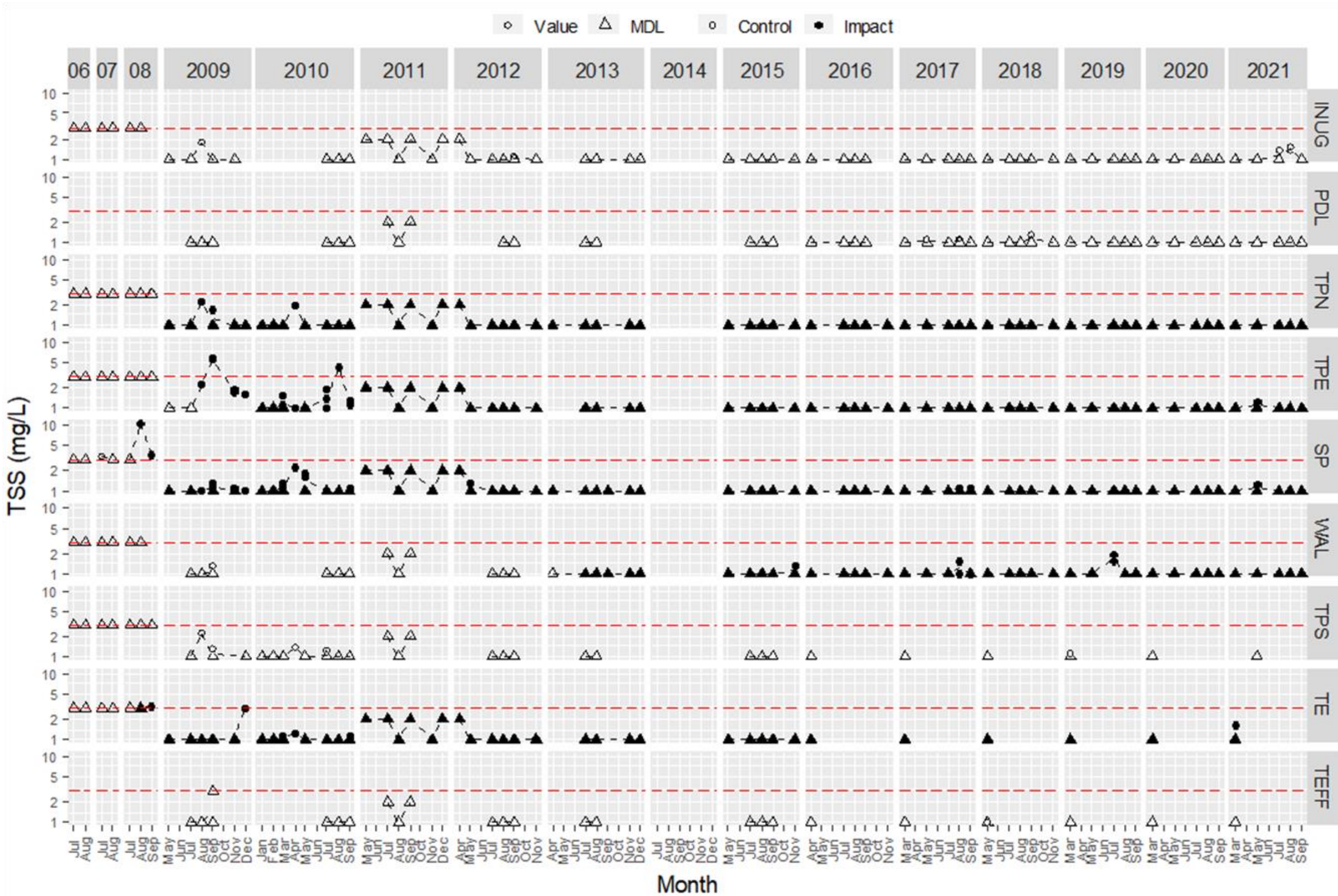


Figure B1-2. Carbonate alkalinity (mg/L).

Note: The red dashed line = trigger value.

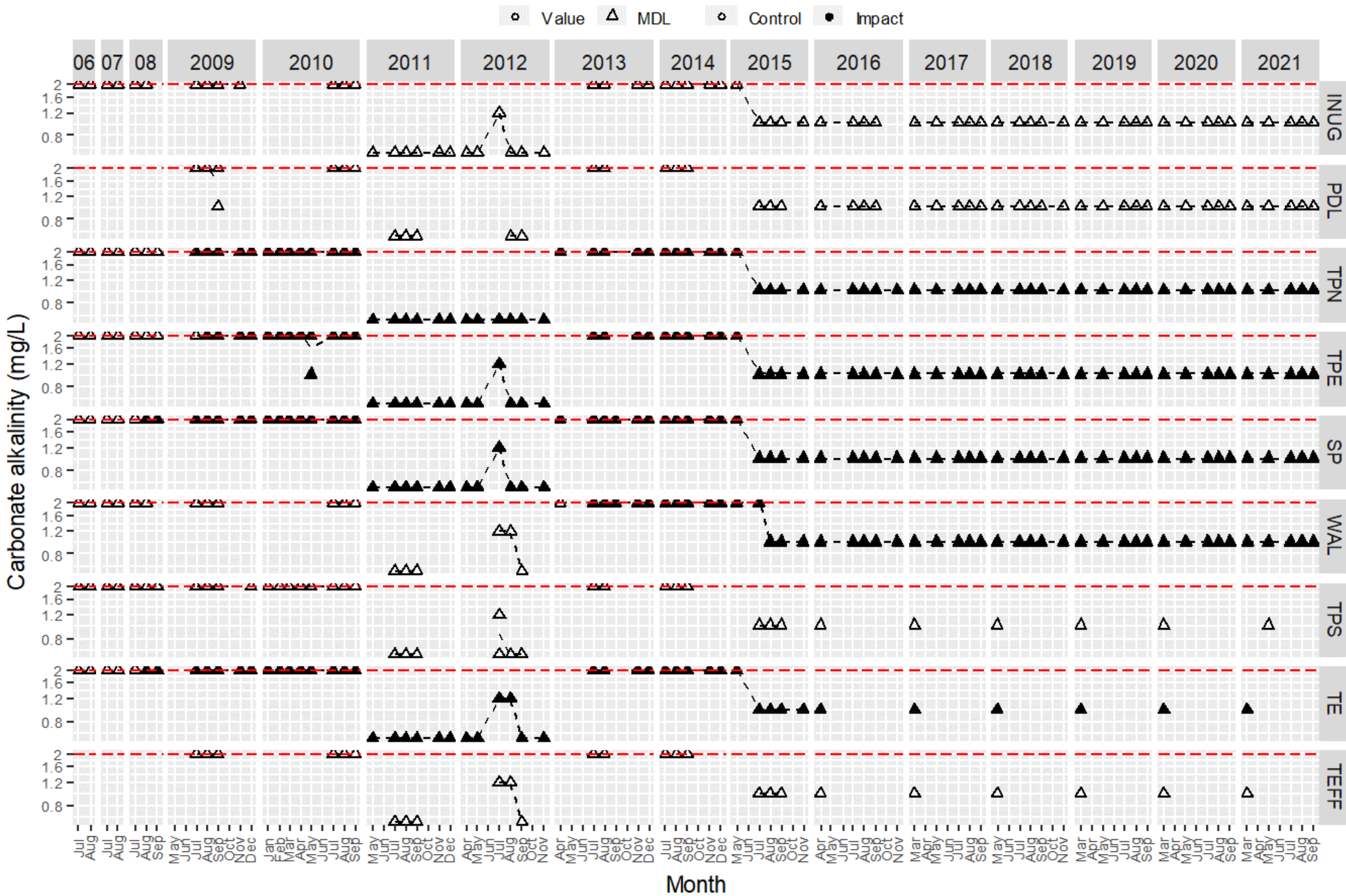


Figure B1-3. Nitrite-N (mg/L).

Note: The red dashed line = trigger value.

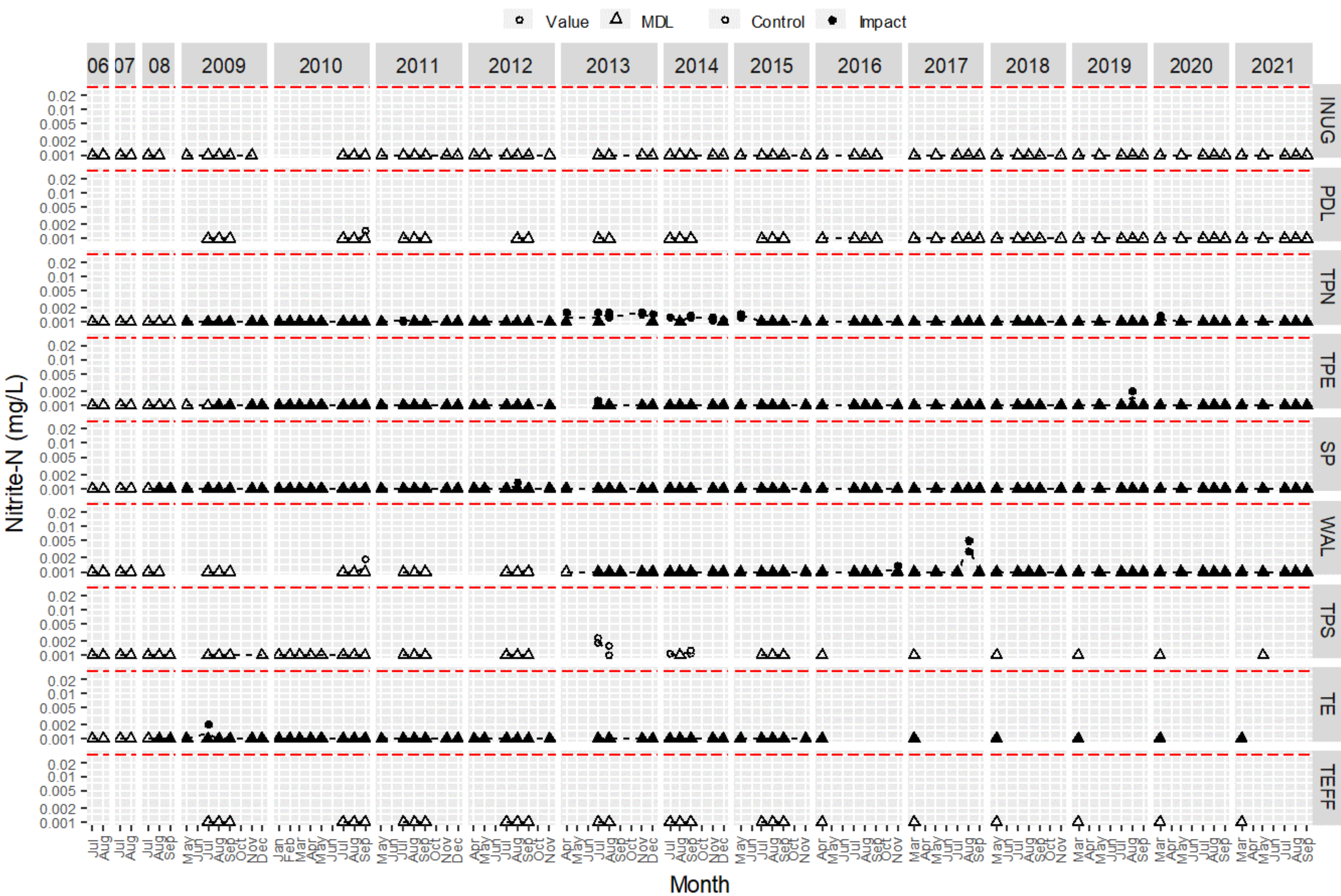


Figure B1-4. Ortho-phosphate (mg/L).

Note: The red dashed line = trigger value. The blue dashed line = FEIS prediction.

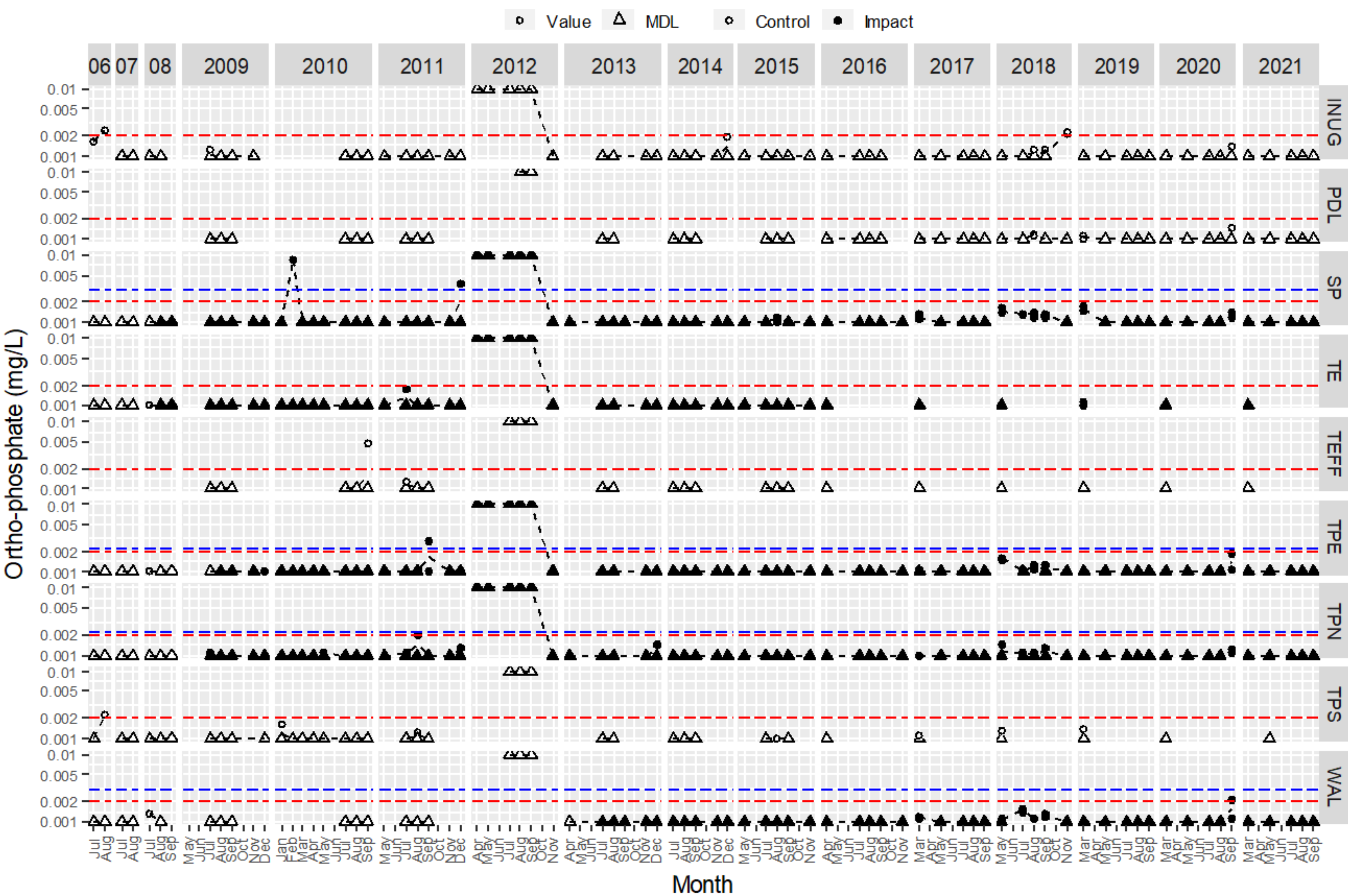


Figure B1-5. Total cyanide (mg/L).

Note: The blue dashed line = FEIS screening prediction.

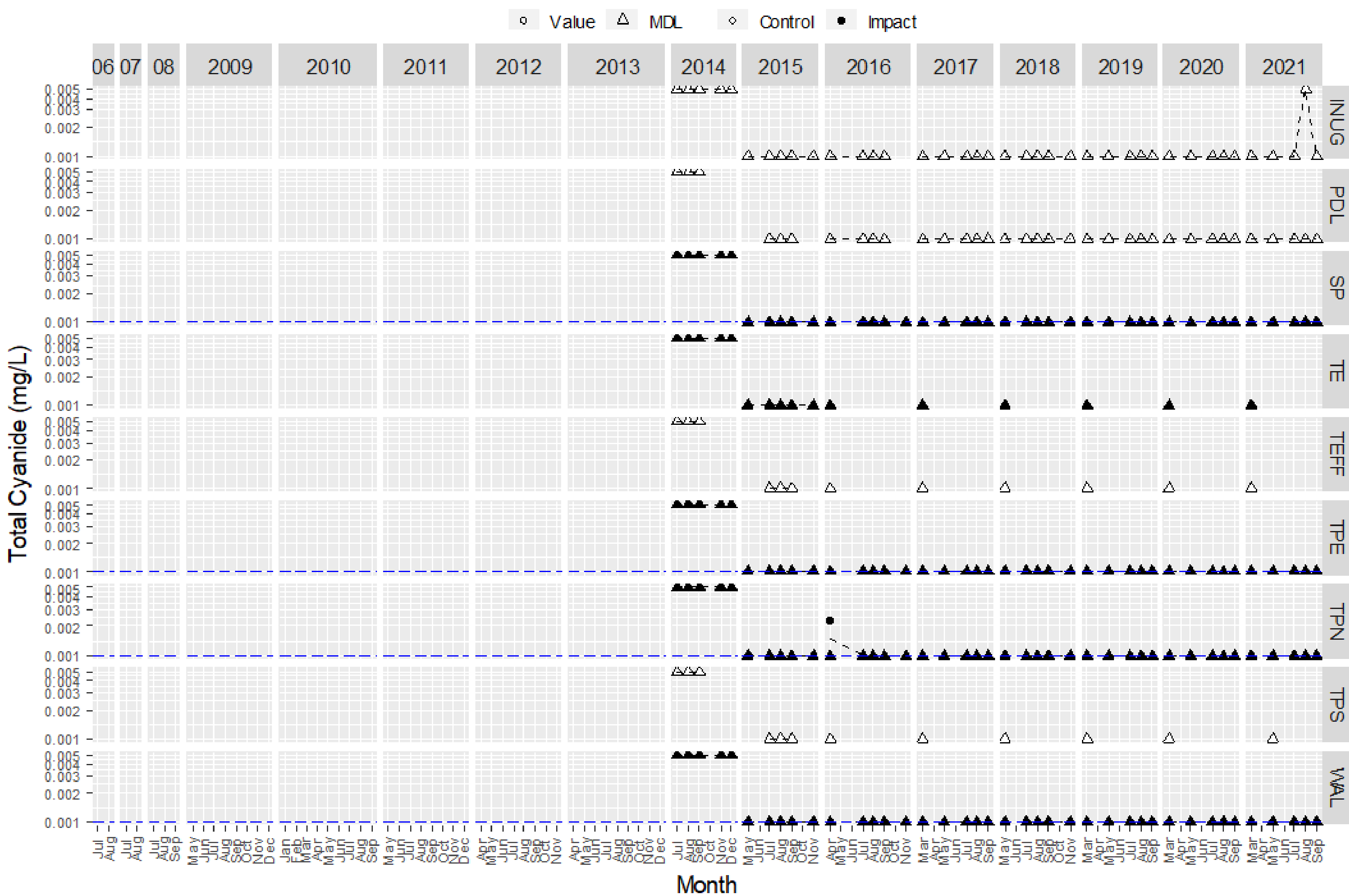


Figure B1-6. Free cyanide (mg/L).

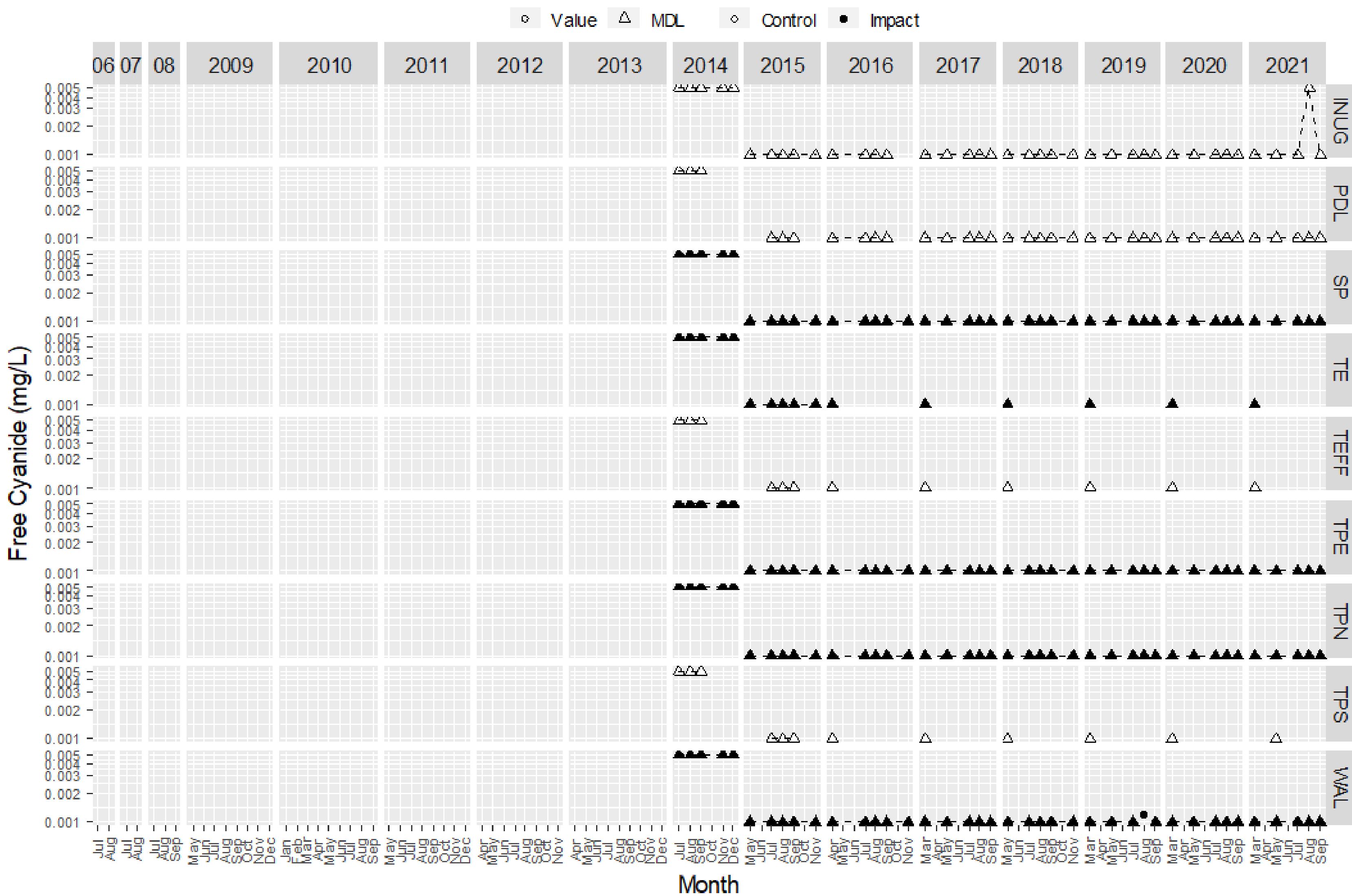


Figure B1-7. Total antimony (mg/L).

Note: The red dashed line = trigger value. The blue dashed line = FEIS screening prediction.

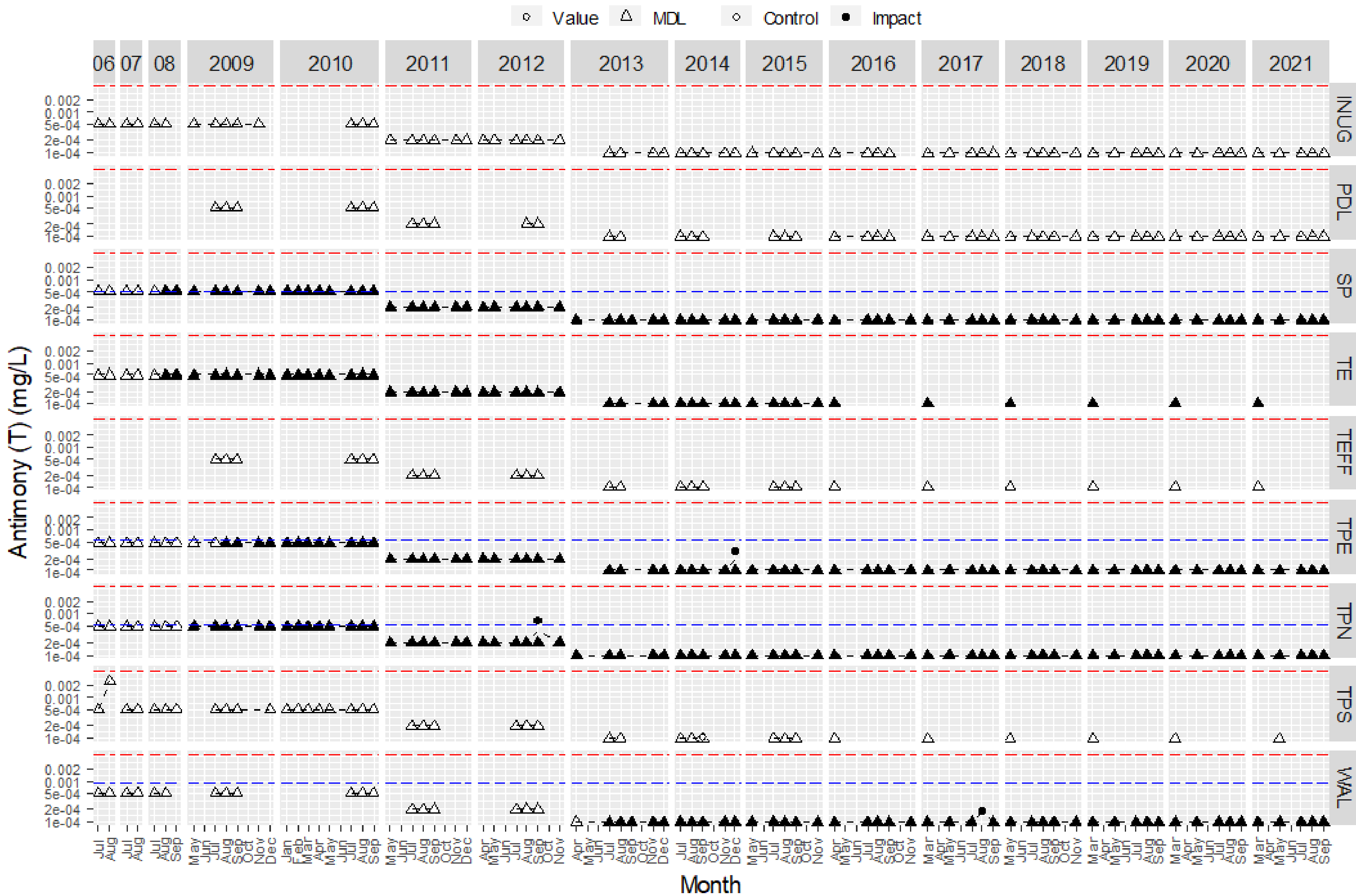


Figure B1-8. Total beryllium (mg/L).

Note: The red dashed line = trigger value. The blue dashed line = FEIS screening prediction.

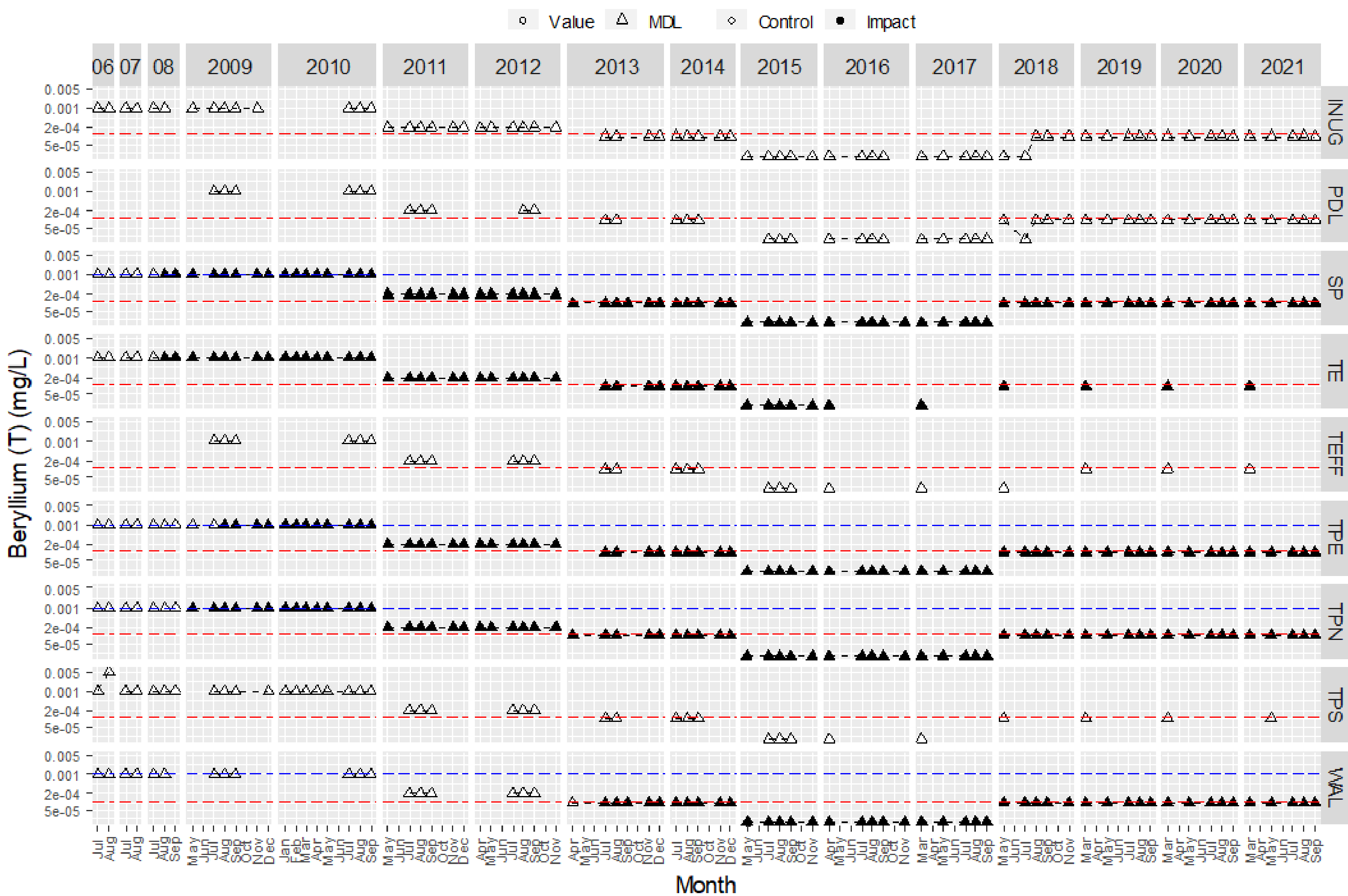


Figure B1-9. Total boron (mg/L).

Note: The red dashed line = trigger value.

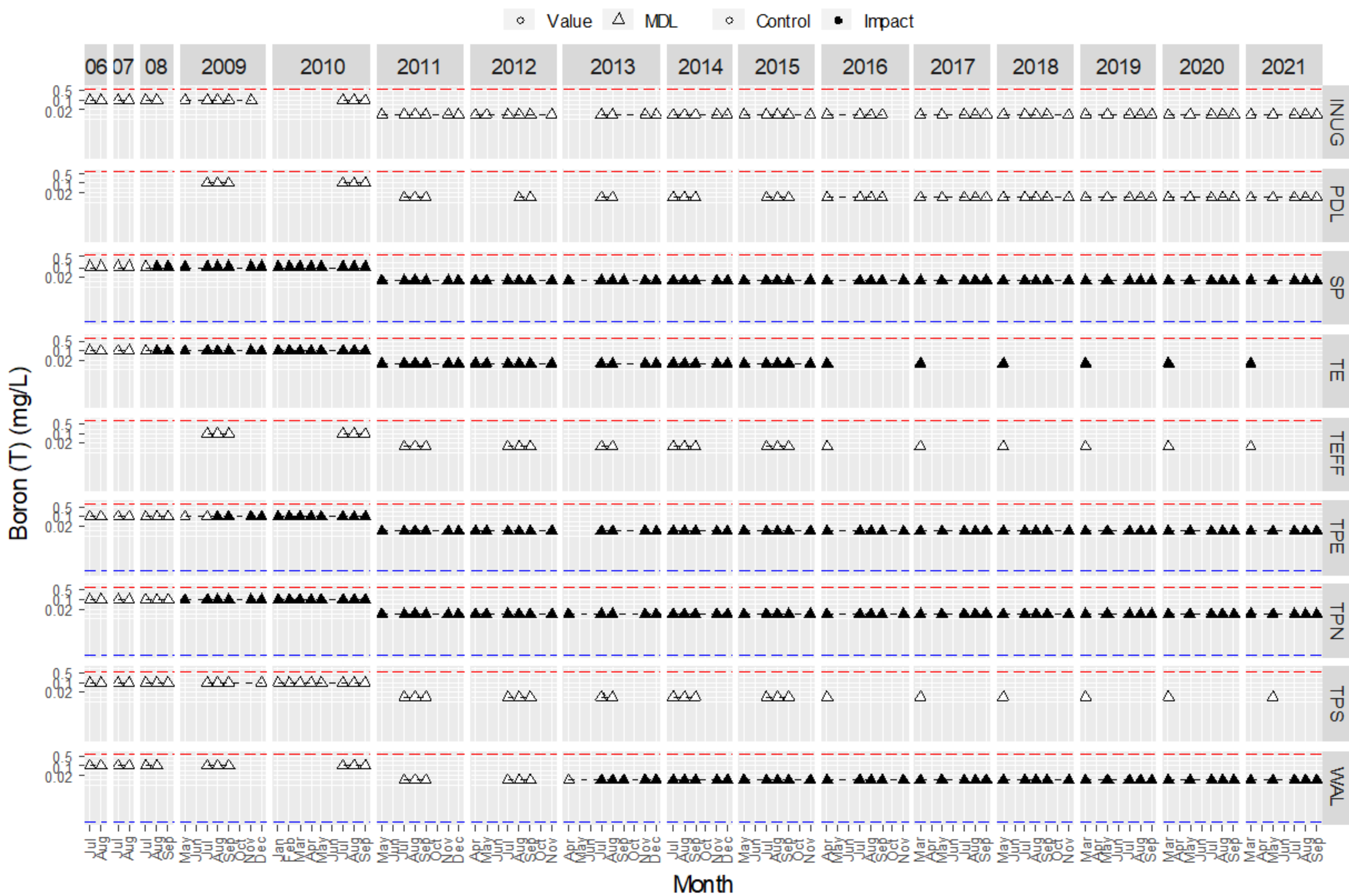


Figure B1-10. Total cadmium (mg/L).

Note: The red dashed line = trigger value. The blue dashed line = FEIS prediction.

Figure B1-11. Total lead (mg/L).

Note: The red dashed line = trigger value. The blue dashed line = FEIS prediction.

Figure B1-12. Total lithium (mg/L).

Note: The red dashed line = trigger value. The blue dashed line = FEIS prediction.

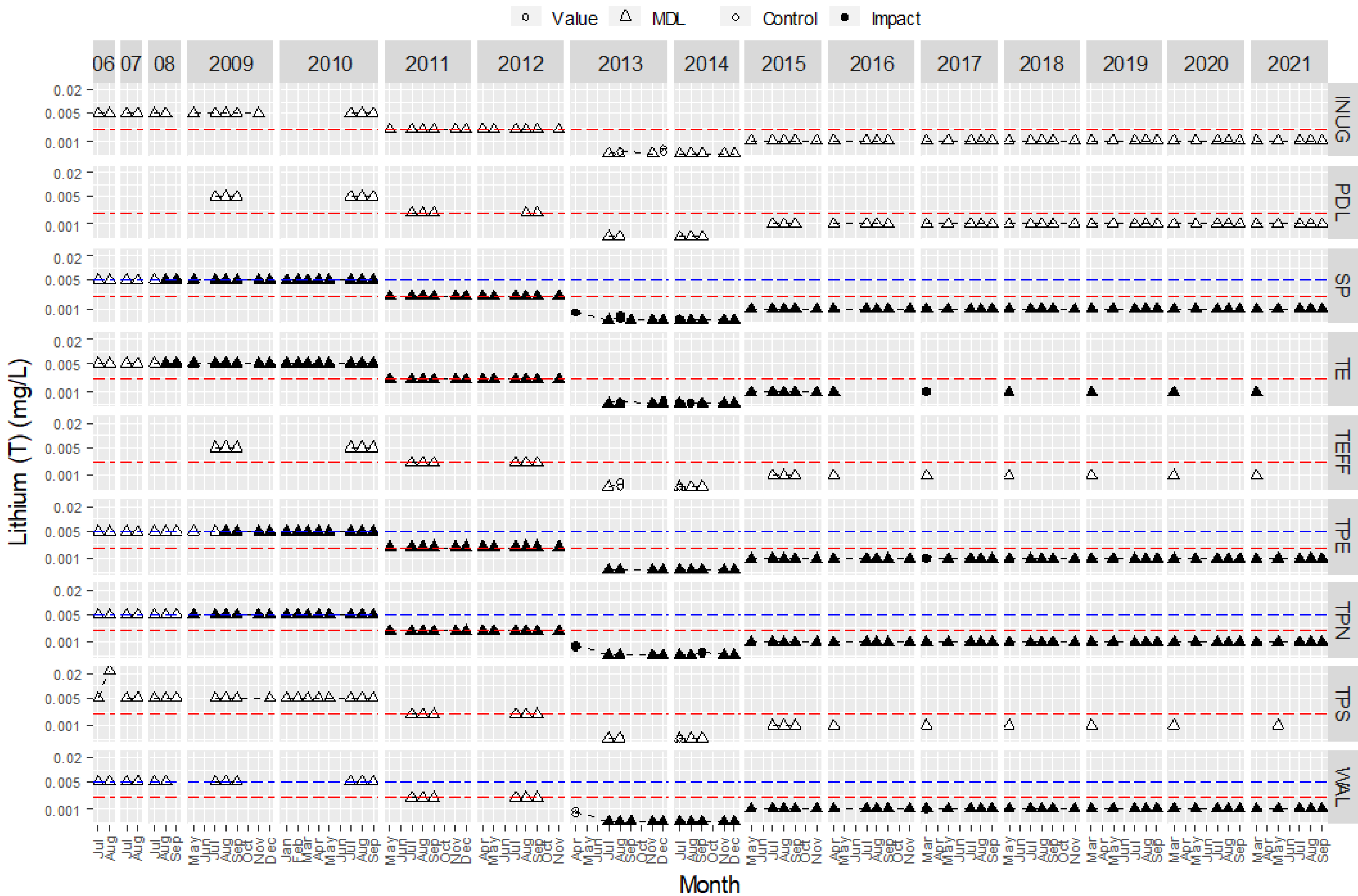


Figure B1-13. Total mercury (mg/L).

Note: The red dashed line = trigger value. The blue dashed line = FEIS prediction.

Figure B1-14. Total selenium (mg/L).

Note: The red dashed line = trigger value. The blue dashed line = FEIS prediction.

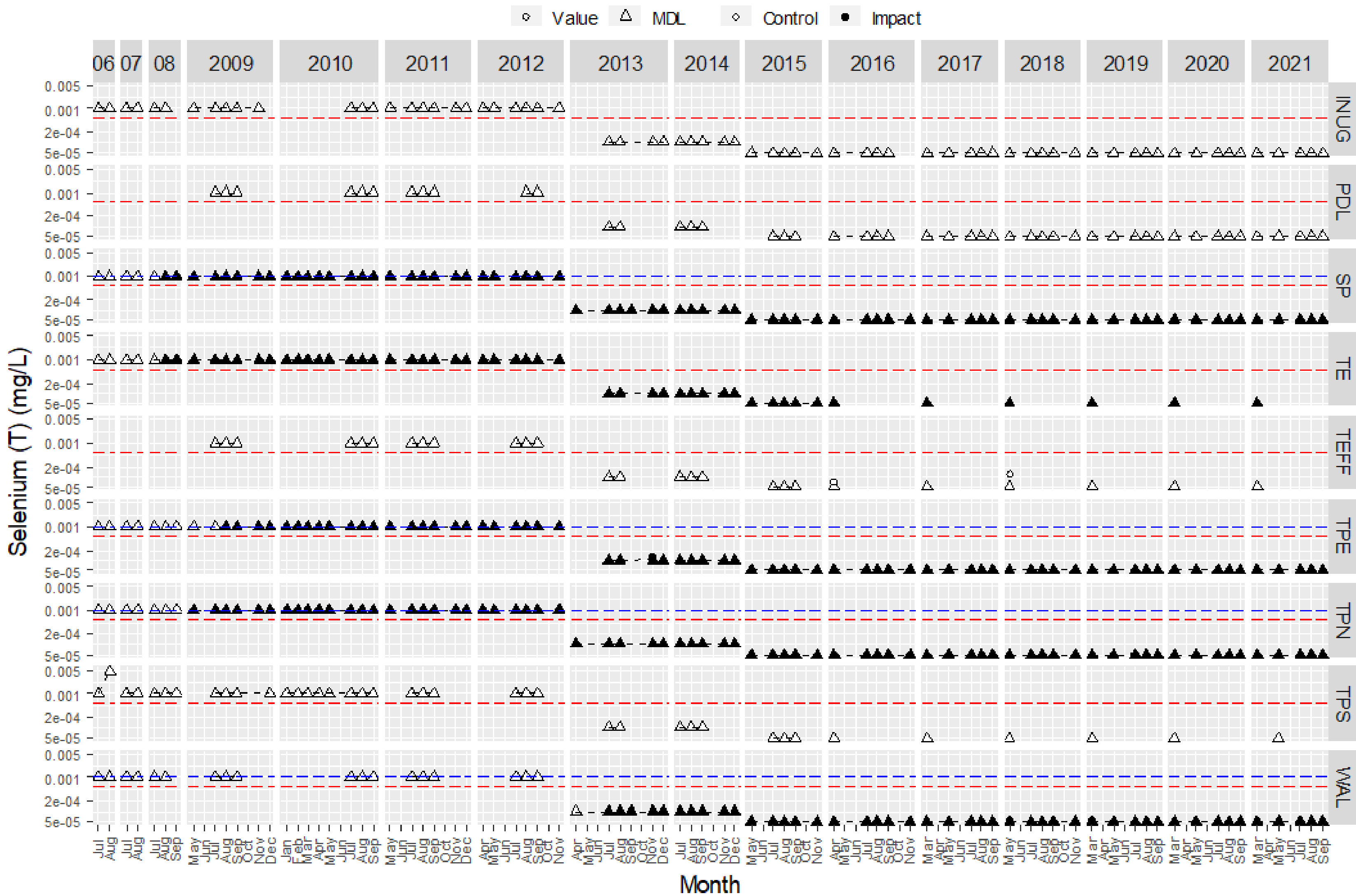


Figure B1-15. Total silver (mg/L).

Note: The red dashed line = trigger value. The blue dashed line = FEIS prediction.

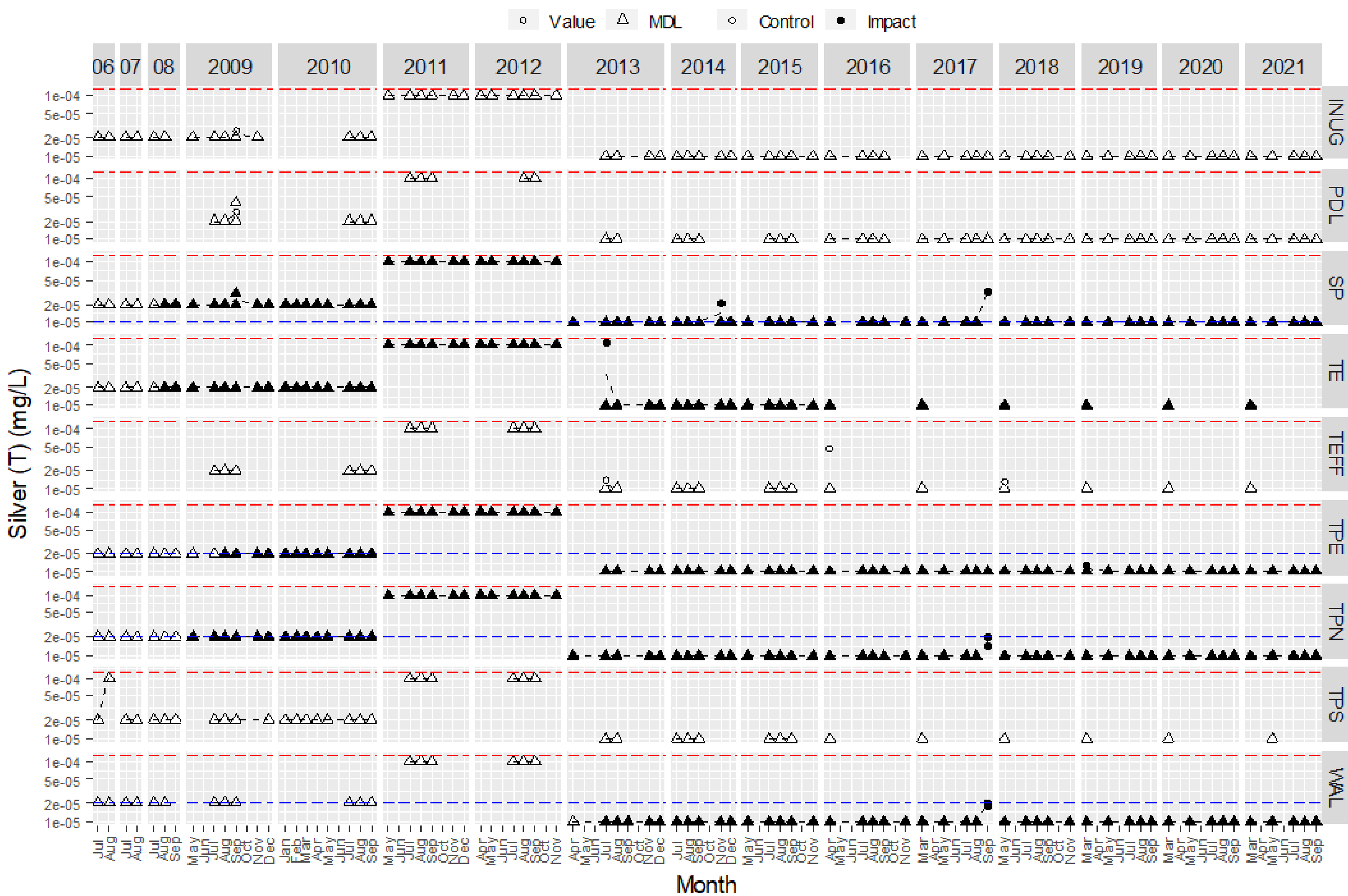


Figure B1-16. Total thallium (mg/L).

Note: The red dashed line = trigger value. The blue dashed line = FEIS prediction.

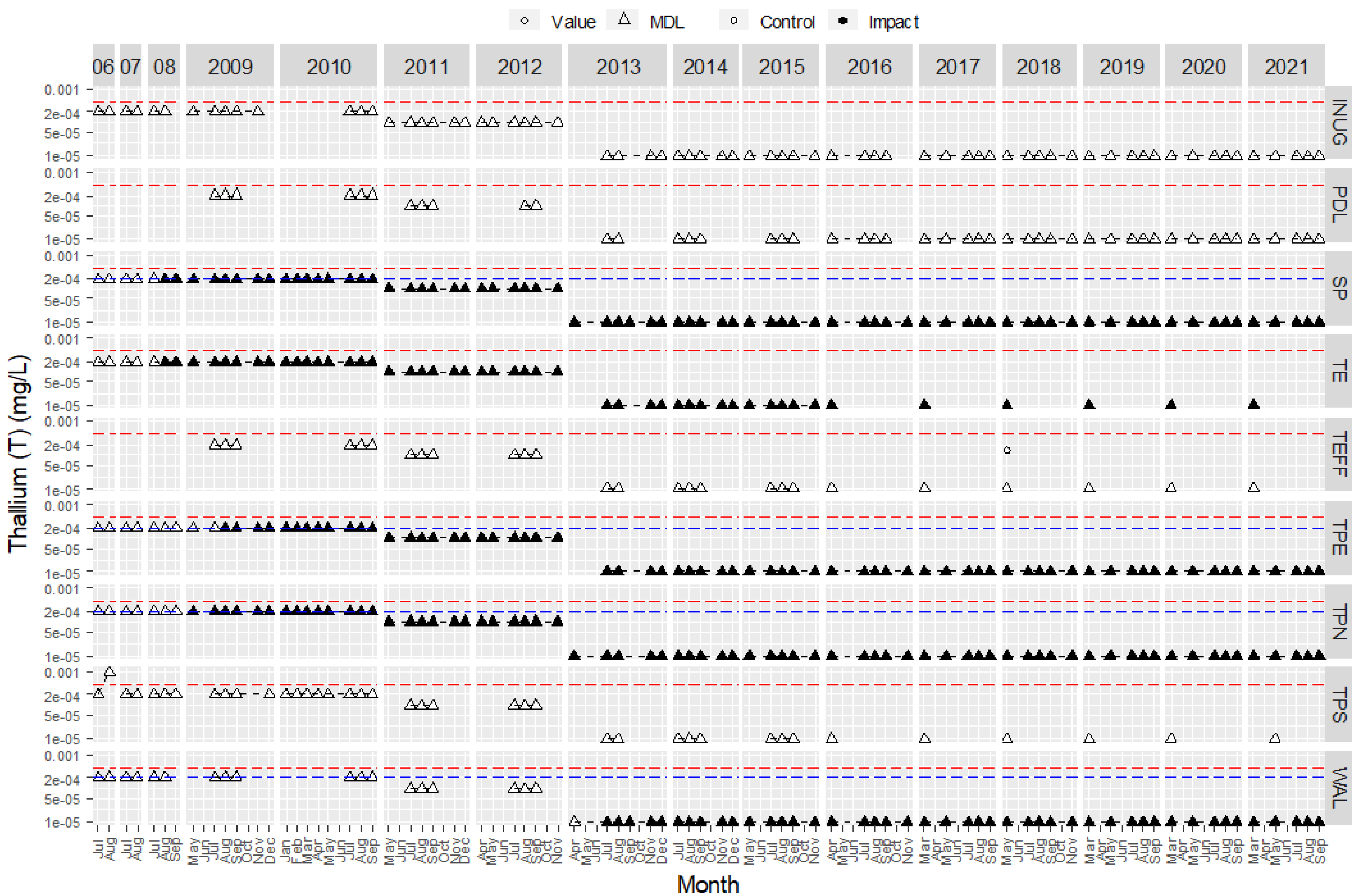


Figure B1-17. Total tin (mg/L).

Note: The red dashed line = trigger value.

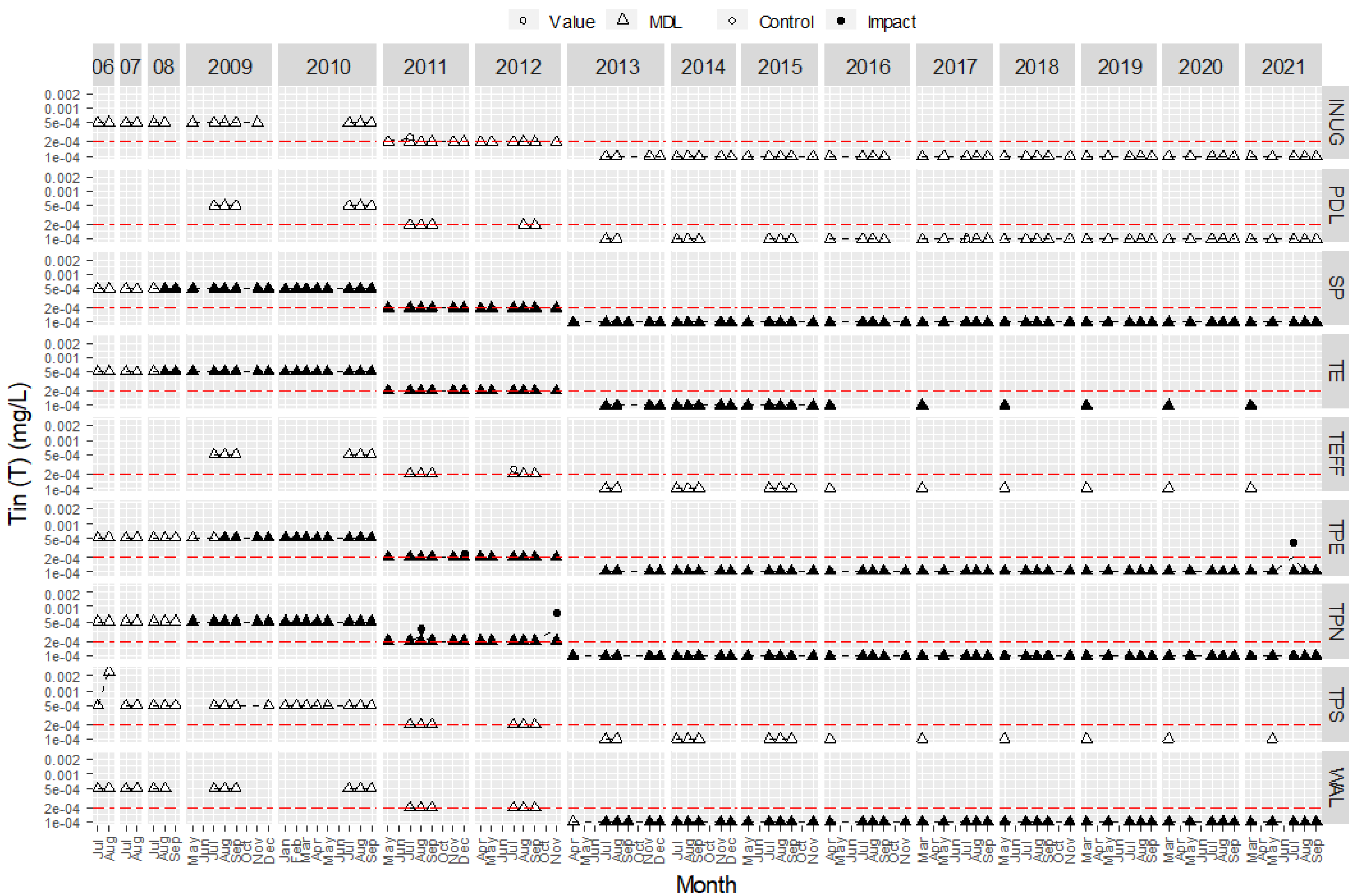


Figure B1-18. Total titanium (mg/L).

Note: The red dashed line = trigger value.

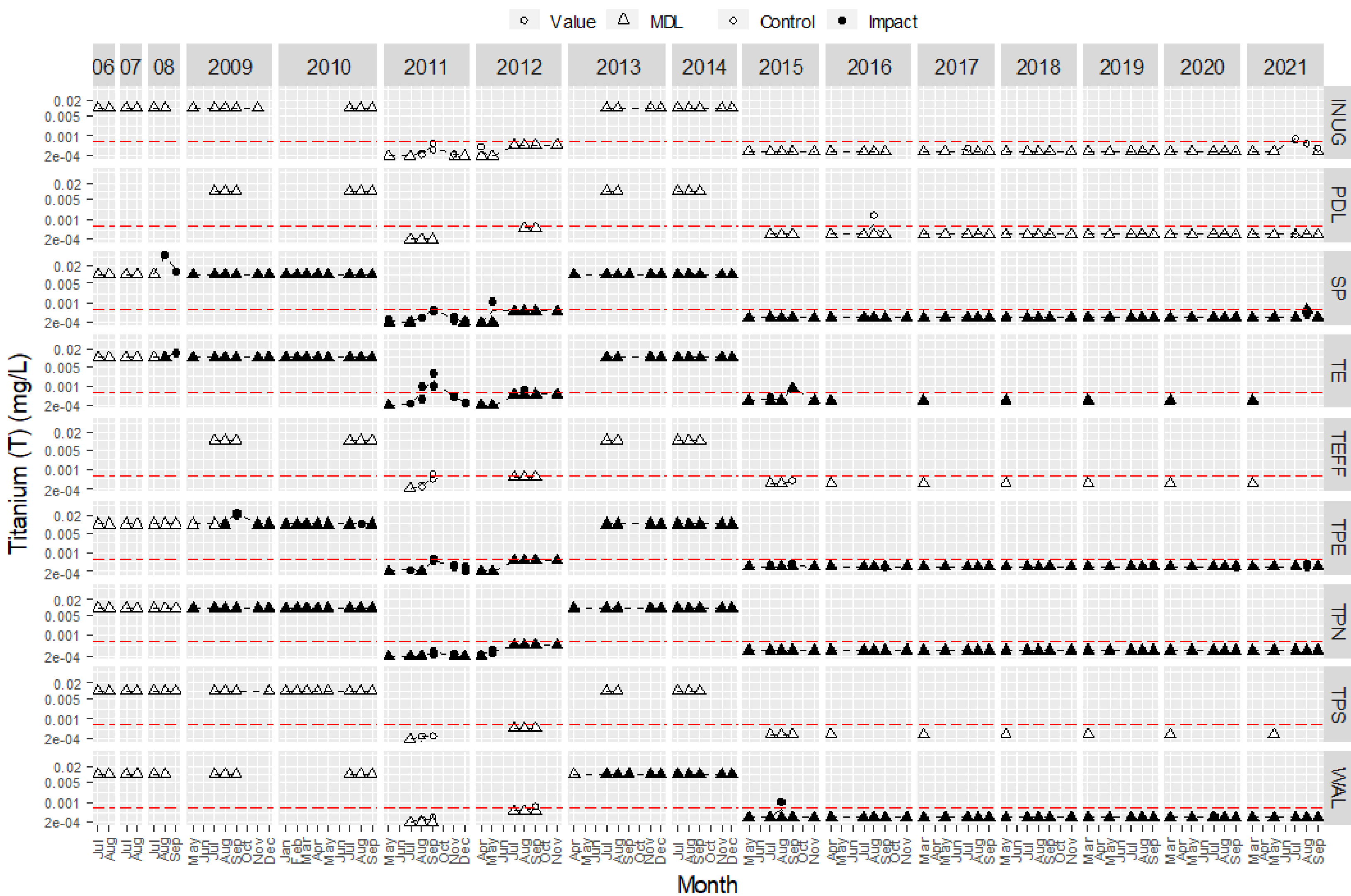


Figure B1-19. Total vanadium (mg/L).

Note: The red dashed line = trigger value. The blue dashed line = FEIS prediction.

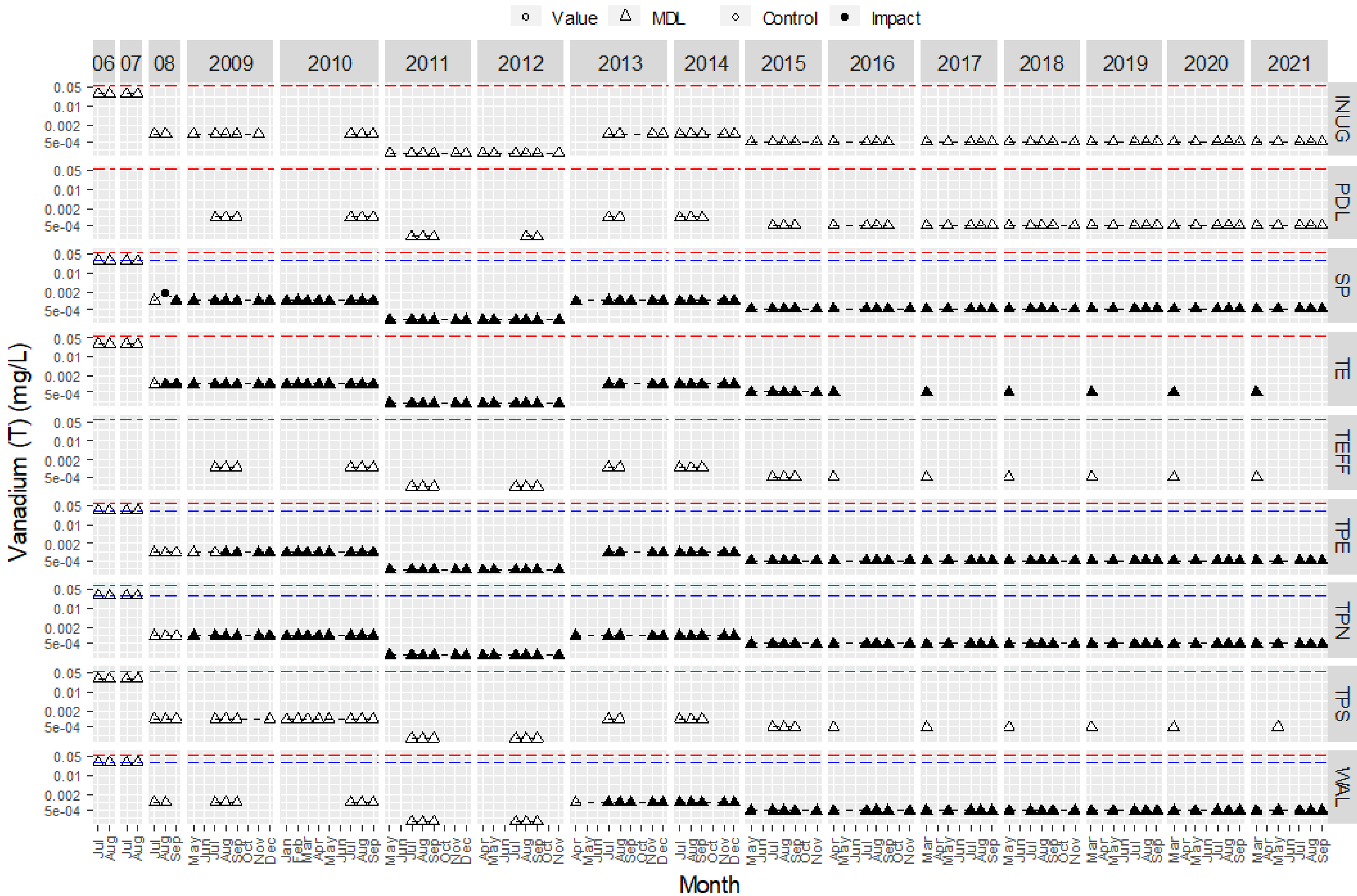


Figure B1-20. Total zinc (mg/L).

Note: The blue dashed line = FEIS prediction.

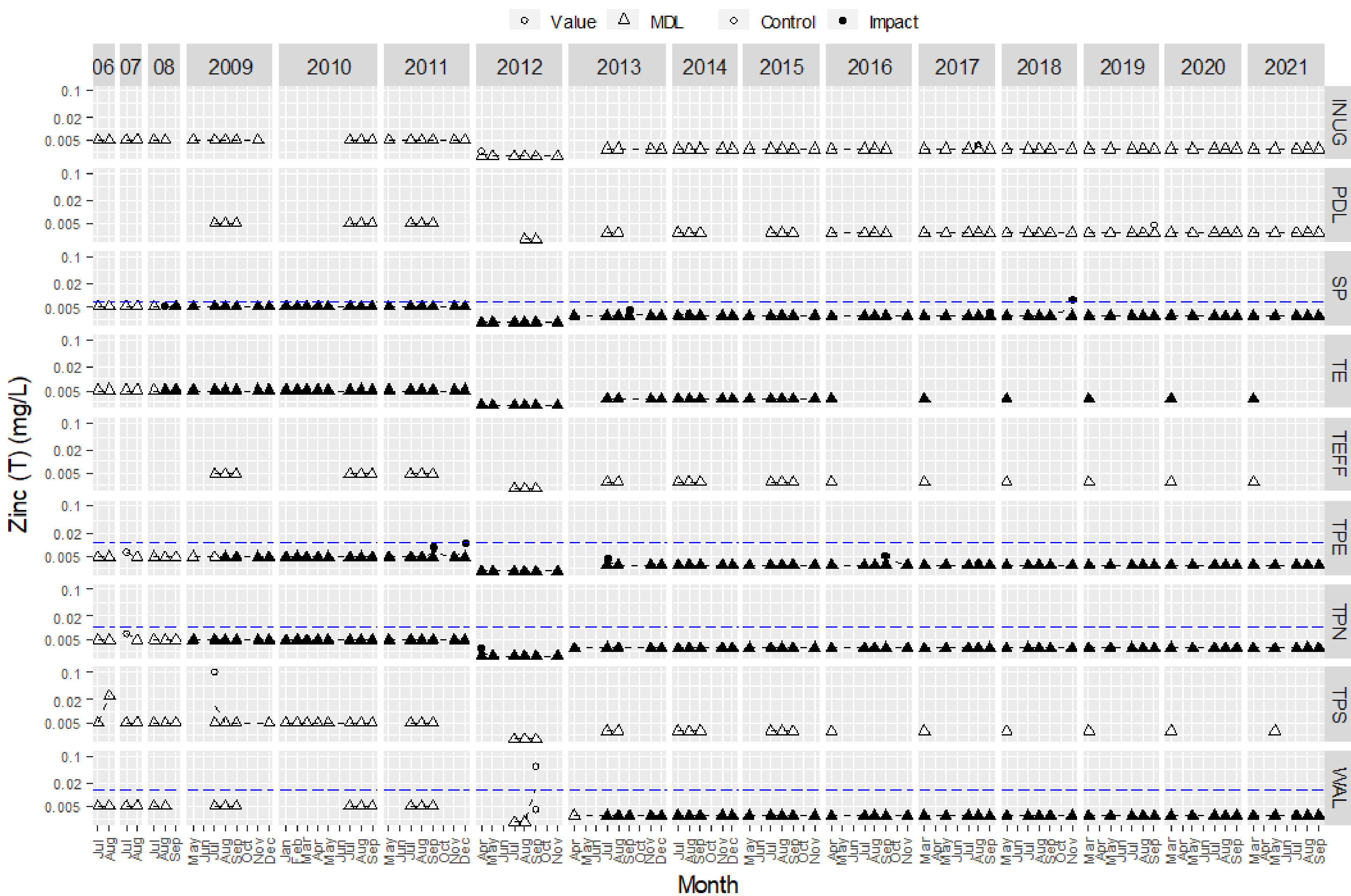


Figure B1-21. Dissolved antimony (mg/L).

Note: The red dashed line = trigger value.

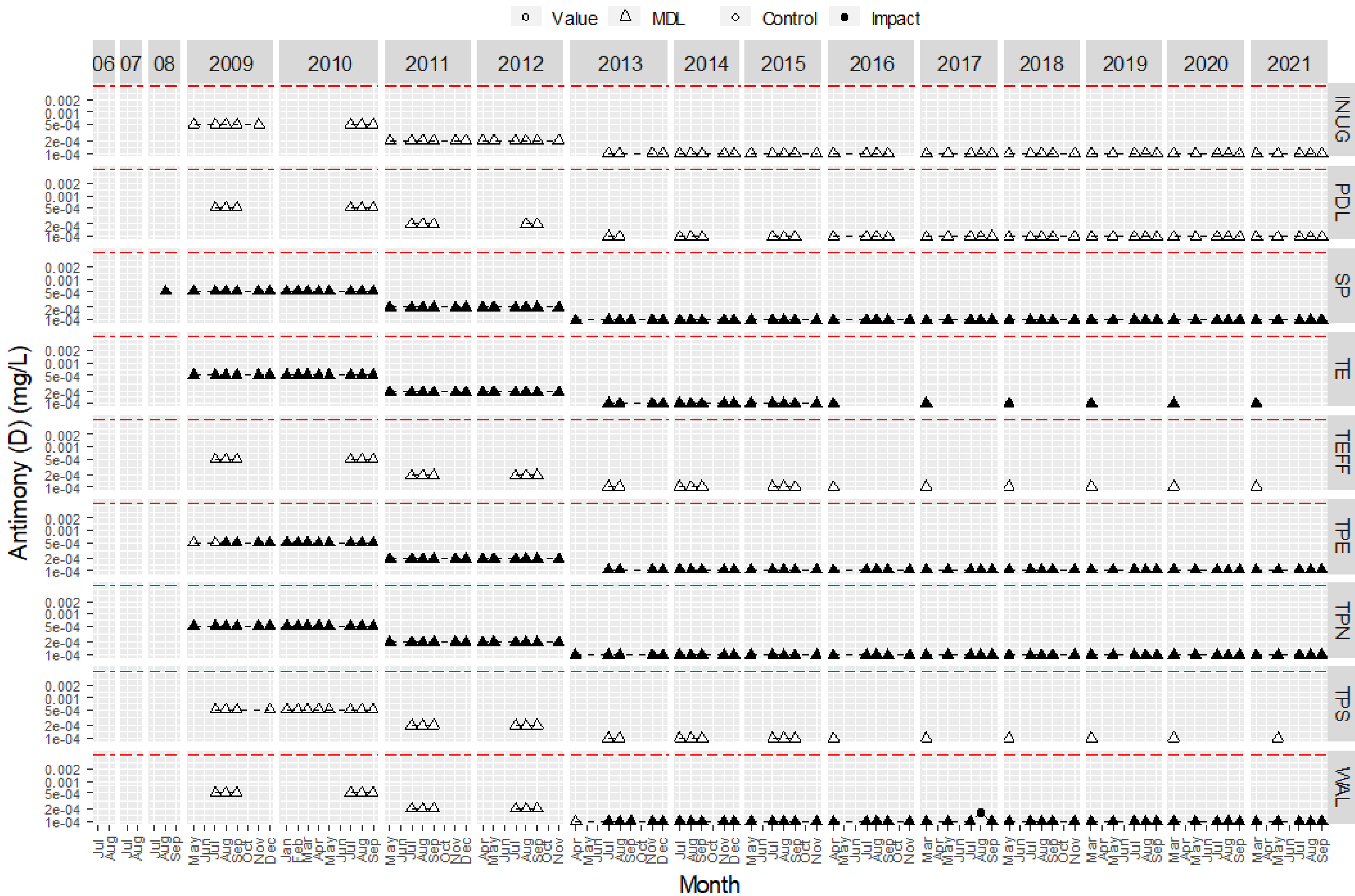


Figure B1-22. Dissolved beryllium (mg/L).

Note: The red dashed line = trigger value.

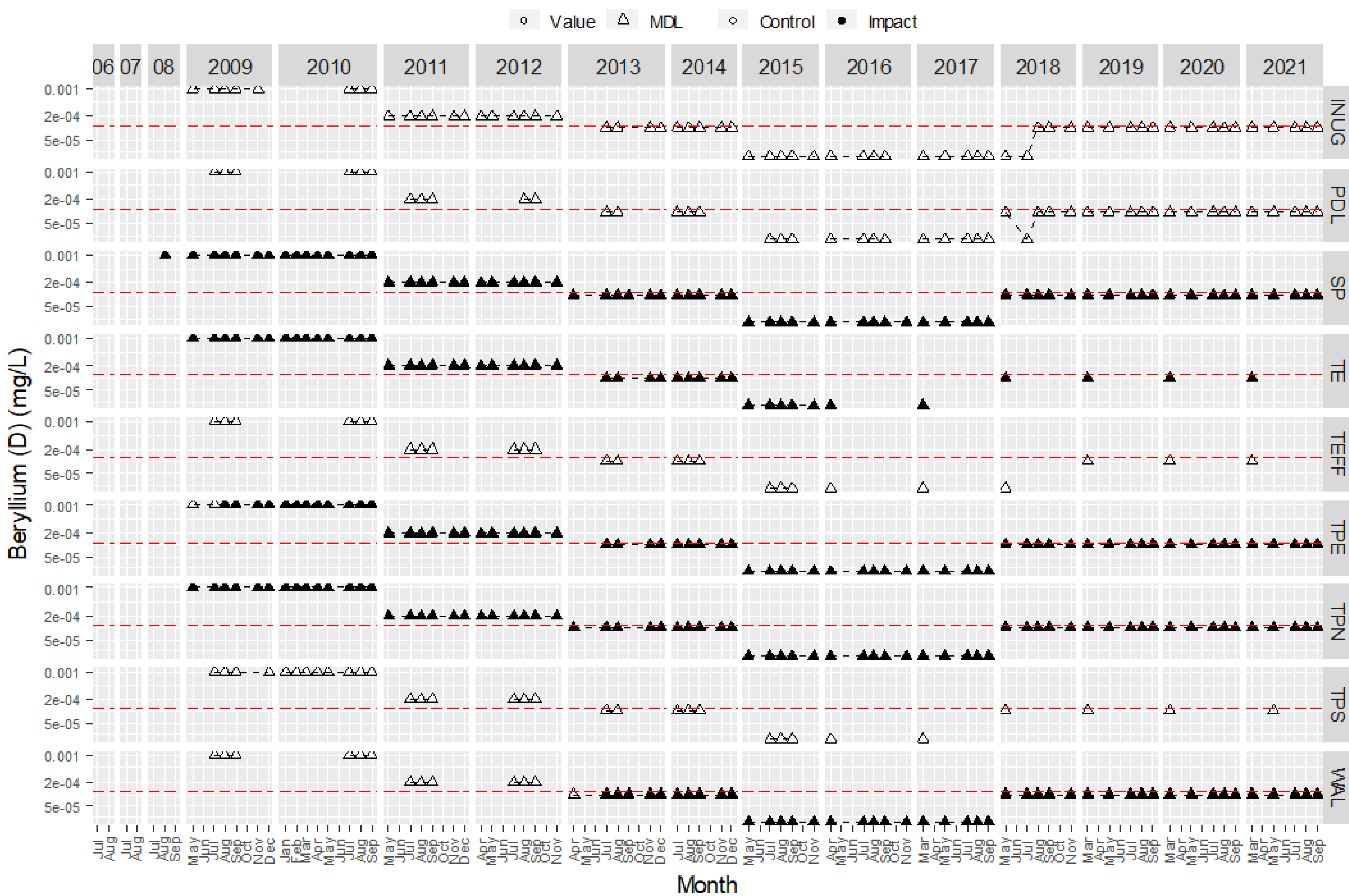


Figure B1-23. Dissolved boron (mg/L).

Note: The red dashed line = trigger value.

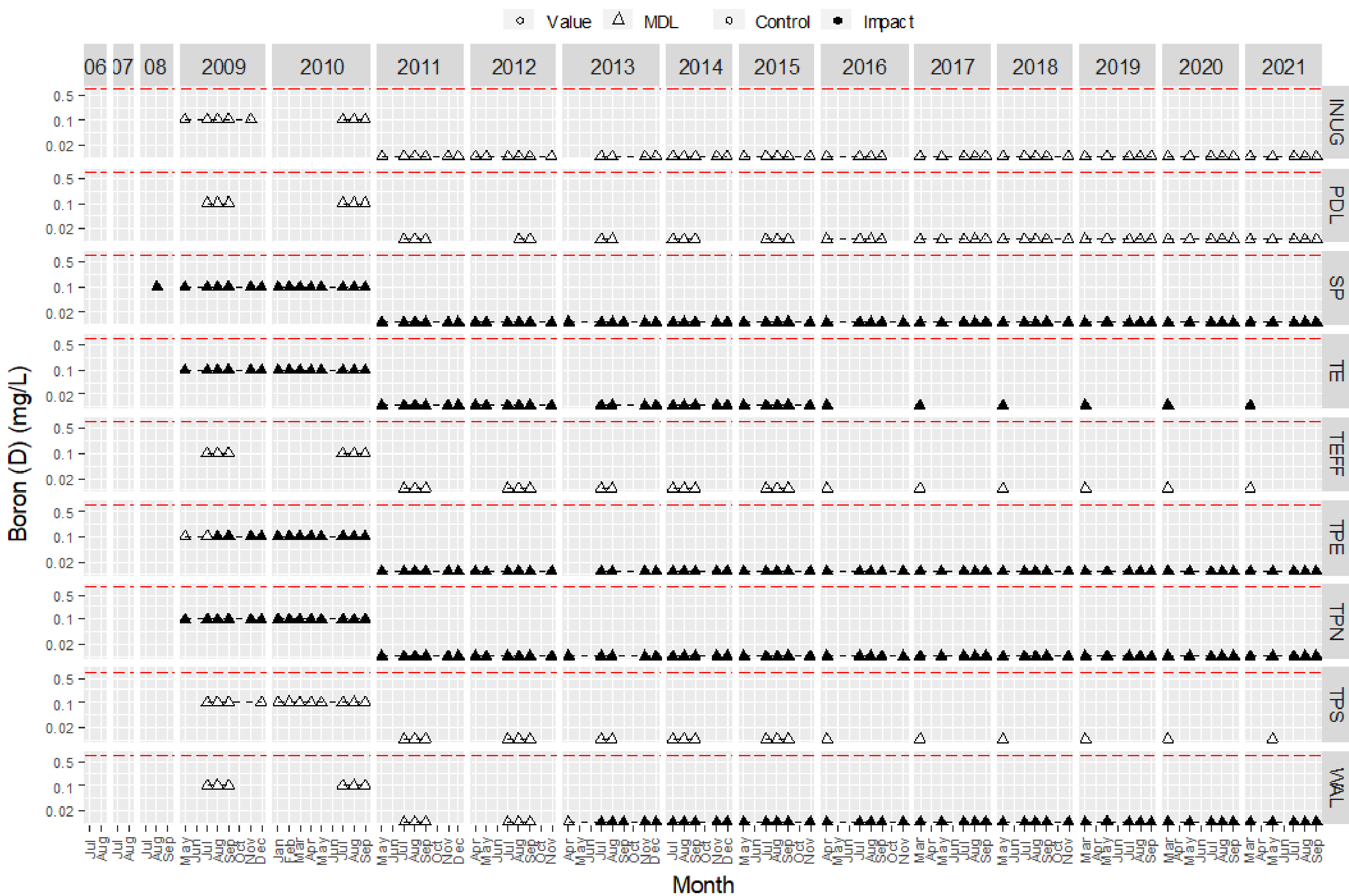


Figure B1-24. Dissolved cadmium (mg/L).

Note: The red dashed line = trigger value.

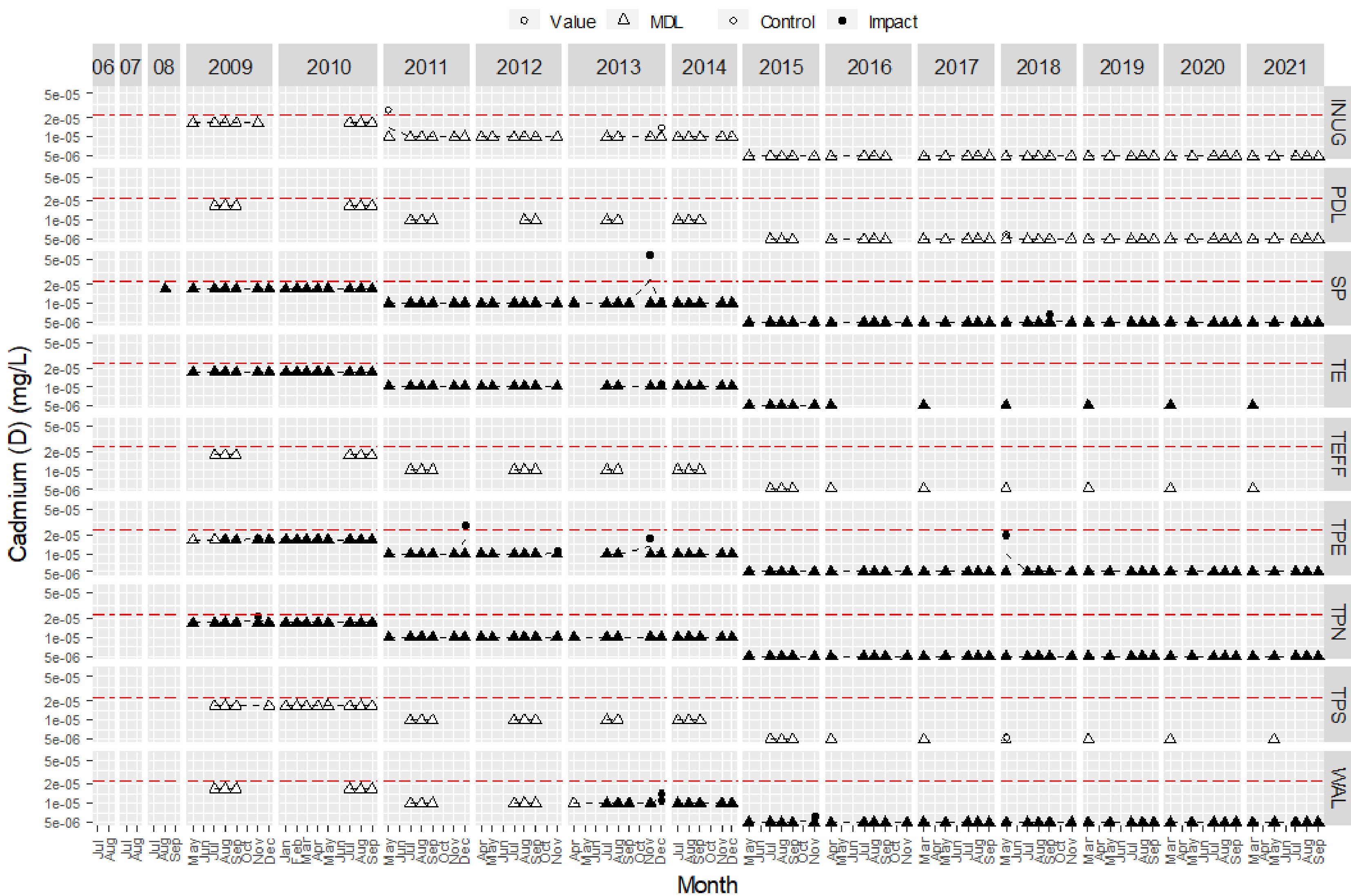


Figure B1-25. Dissolved chromium (mg/L).

Note: The red dashed line = trigger value.

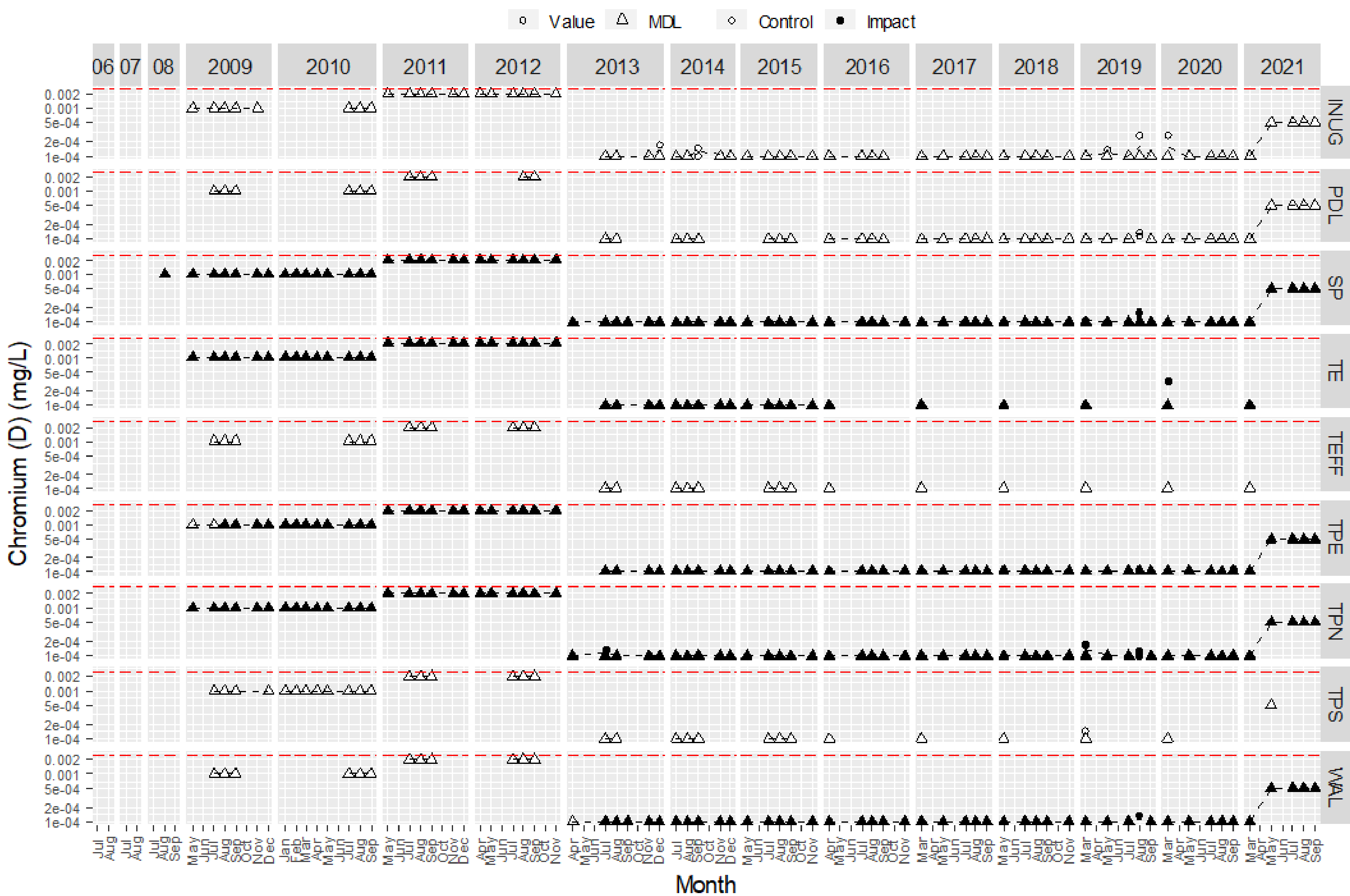


Figure B1-26. Dissolved iron (mg/L).

Note: The red dashed line = trigger value.

Figure B1-27. Dissolved lead (mg/L).

Note: The red dashed line = trigger value.

Figure B1-28. Dissolved lithium (mg/L).

Note: The red dashed line = trigger value.

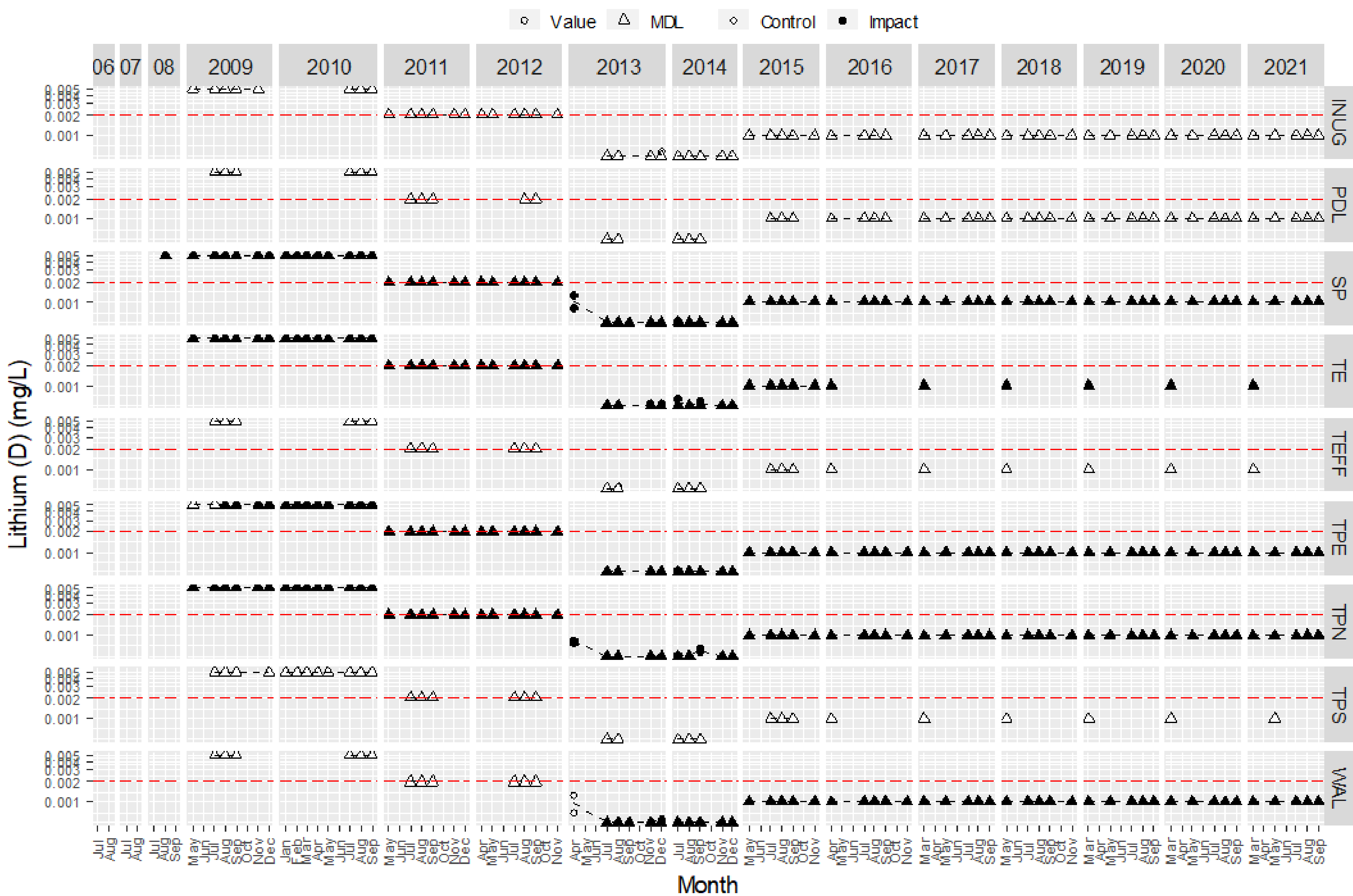


Figure B1-29. Dissolved mercury (mg/L).

Note: The red dashed line = trigger value.

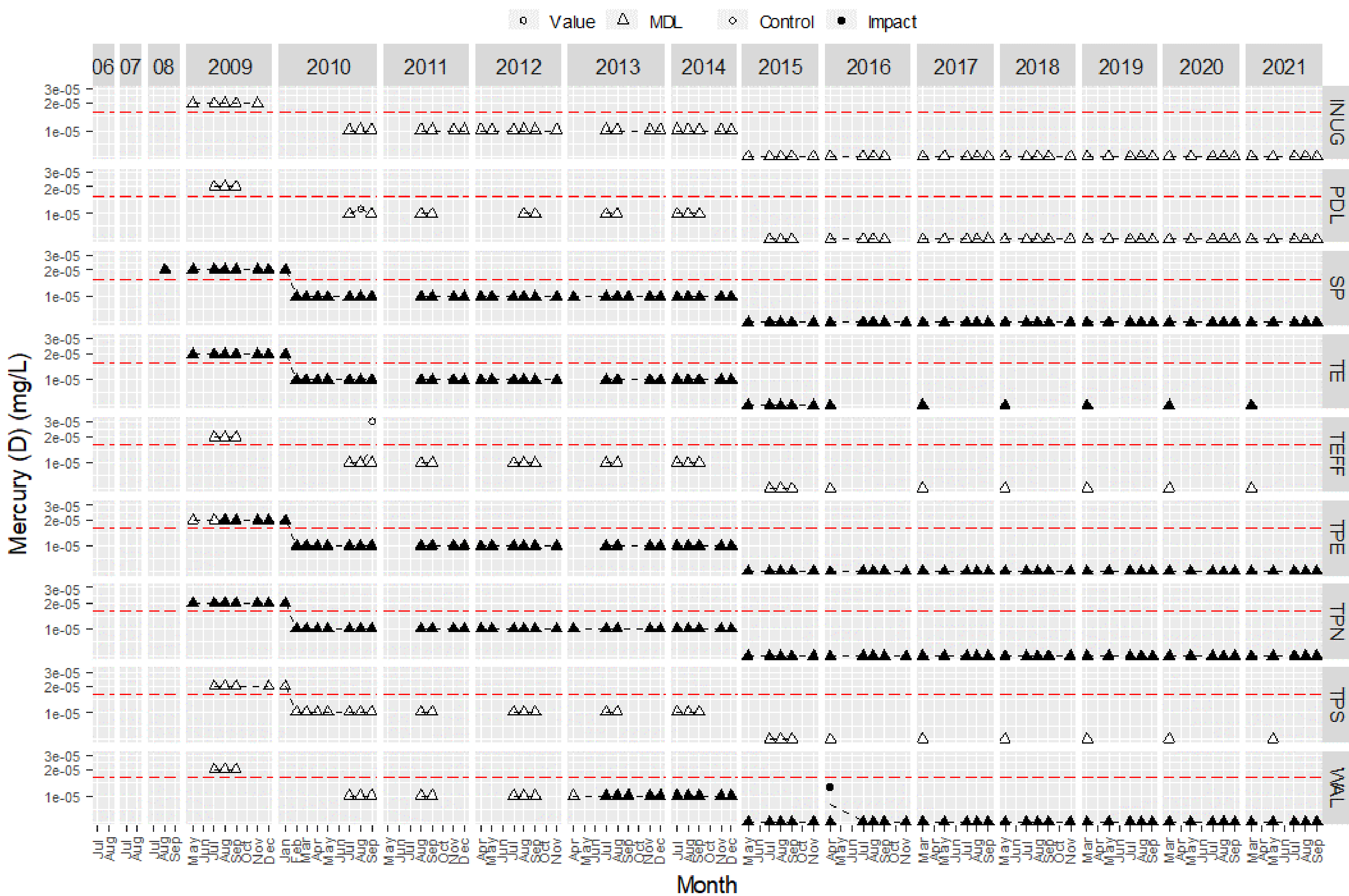


Figure B1-30. Dissolved nickel (mg/L).

Note: The red dashed line = trigger value.

Figure B1-31. Dissolved selenium (mg/L).

Note: The red dashed line = trigger value.

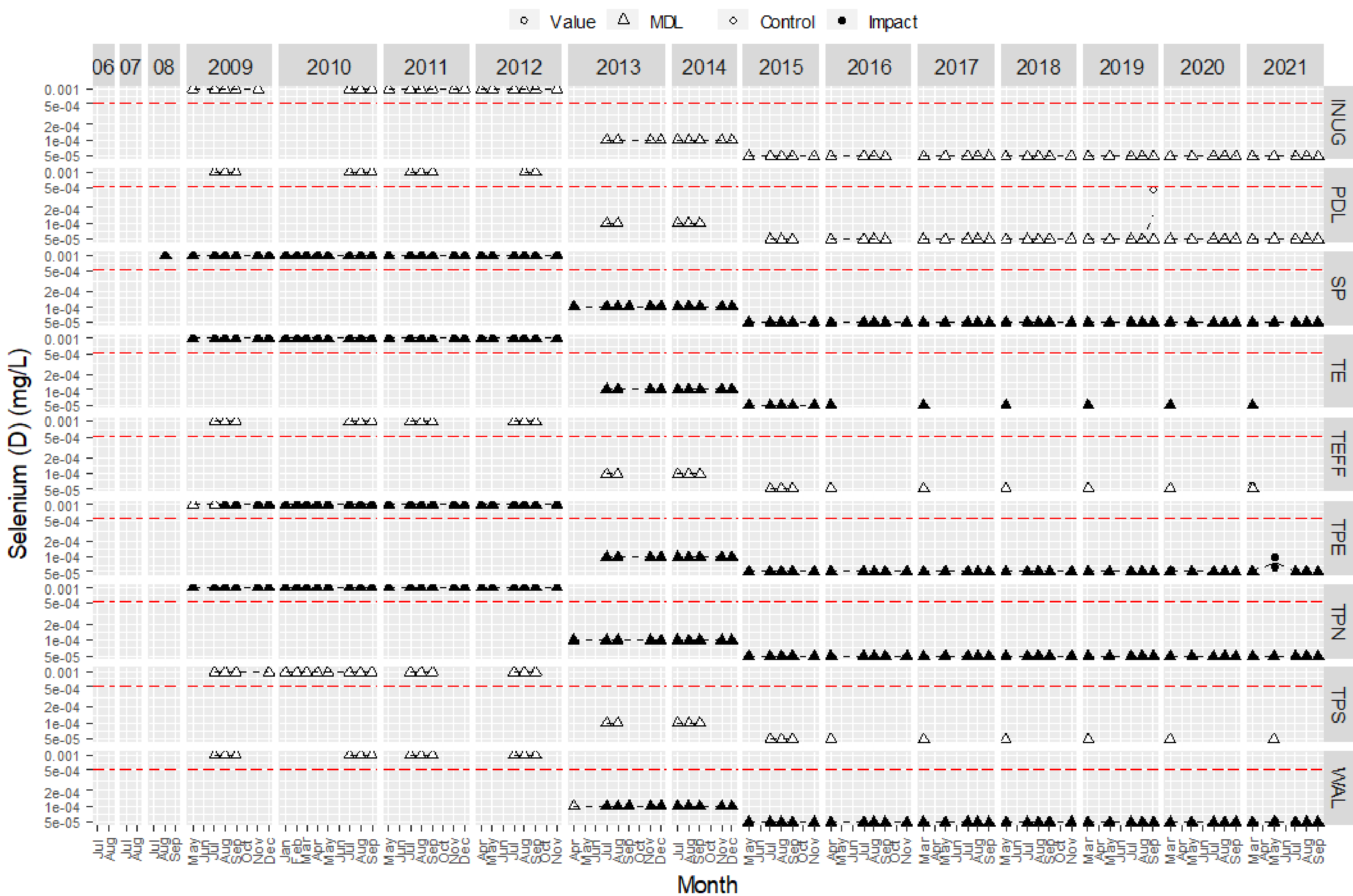


Figure B1-32. Dissolved silver (mg/L).

Note: The red dashed line = trigger value.

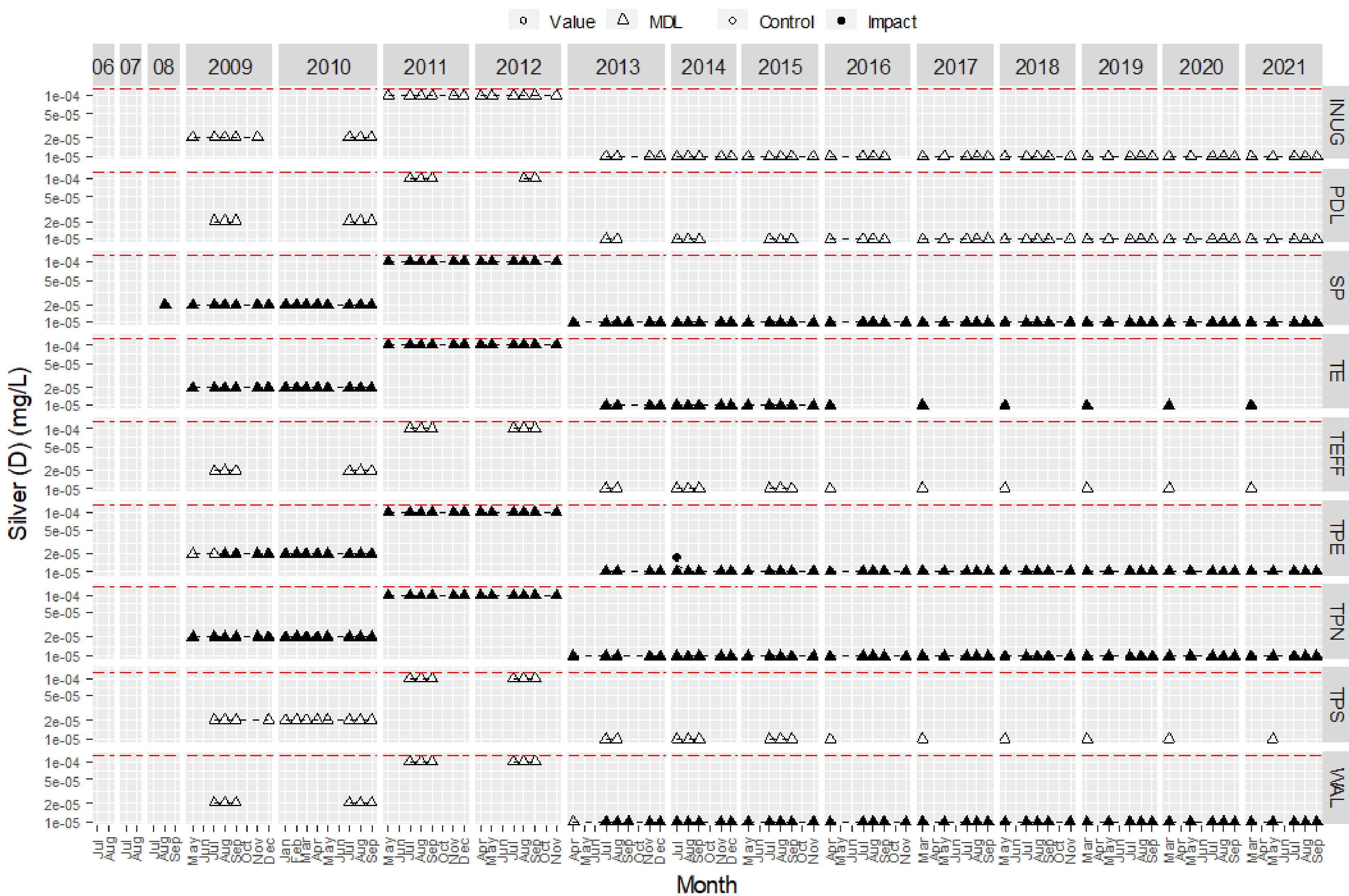


Figure B1-33. Dissolved thallium (mg/L).

Note: The red dashed line = trigger value.

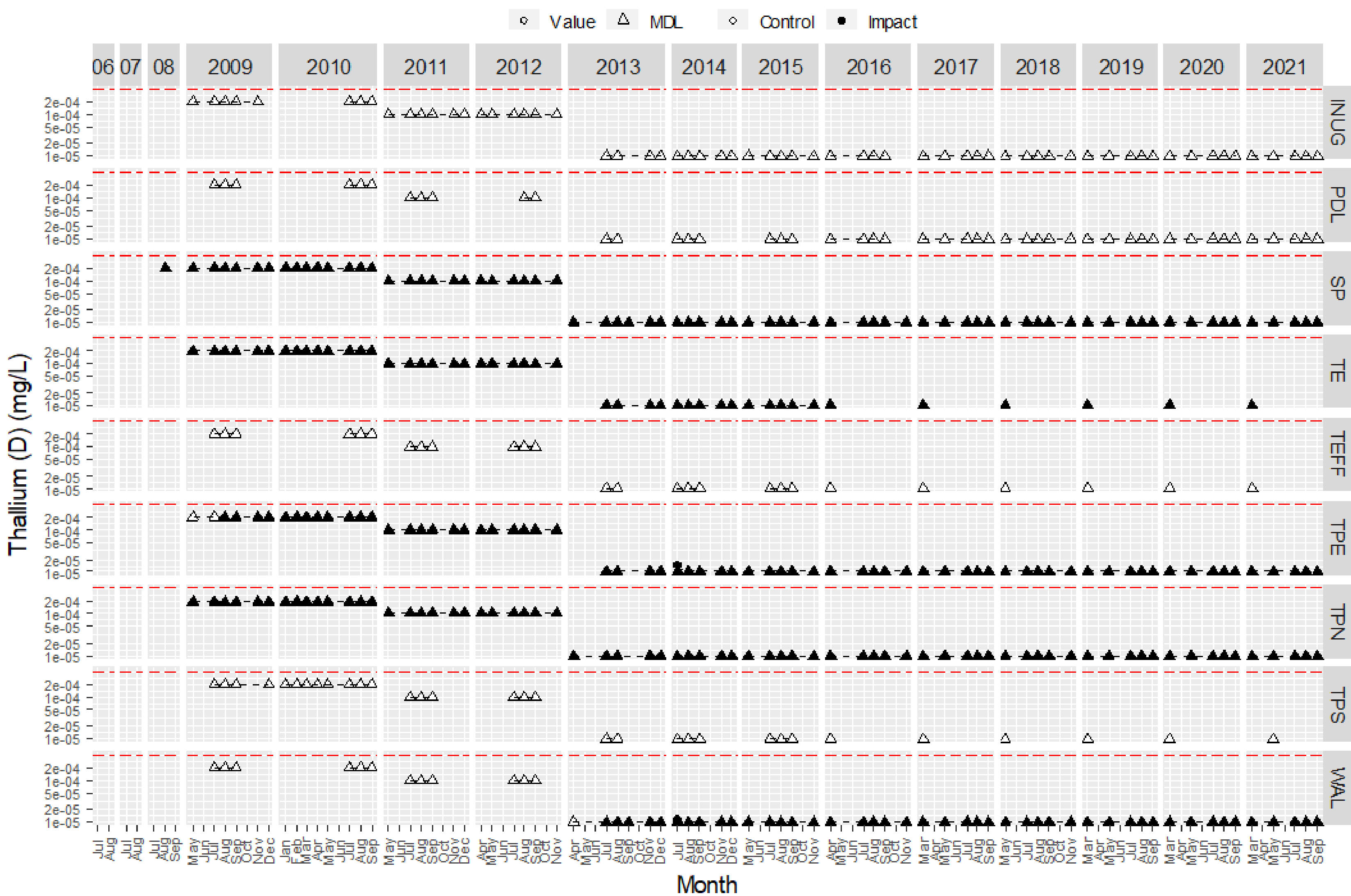


Figure B1-34. Dissolved tin (mg/L).

Note: The red dashed line = trigger value.

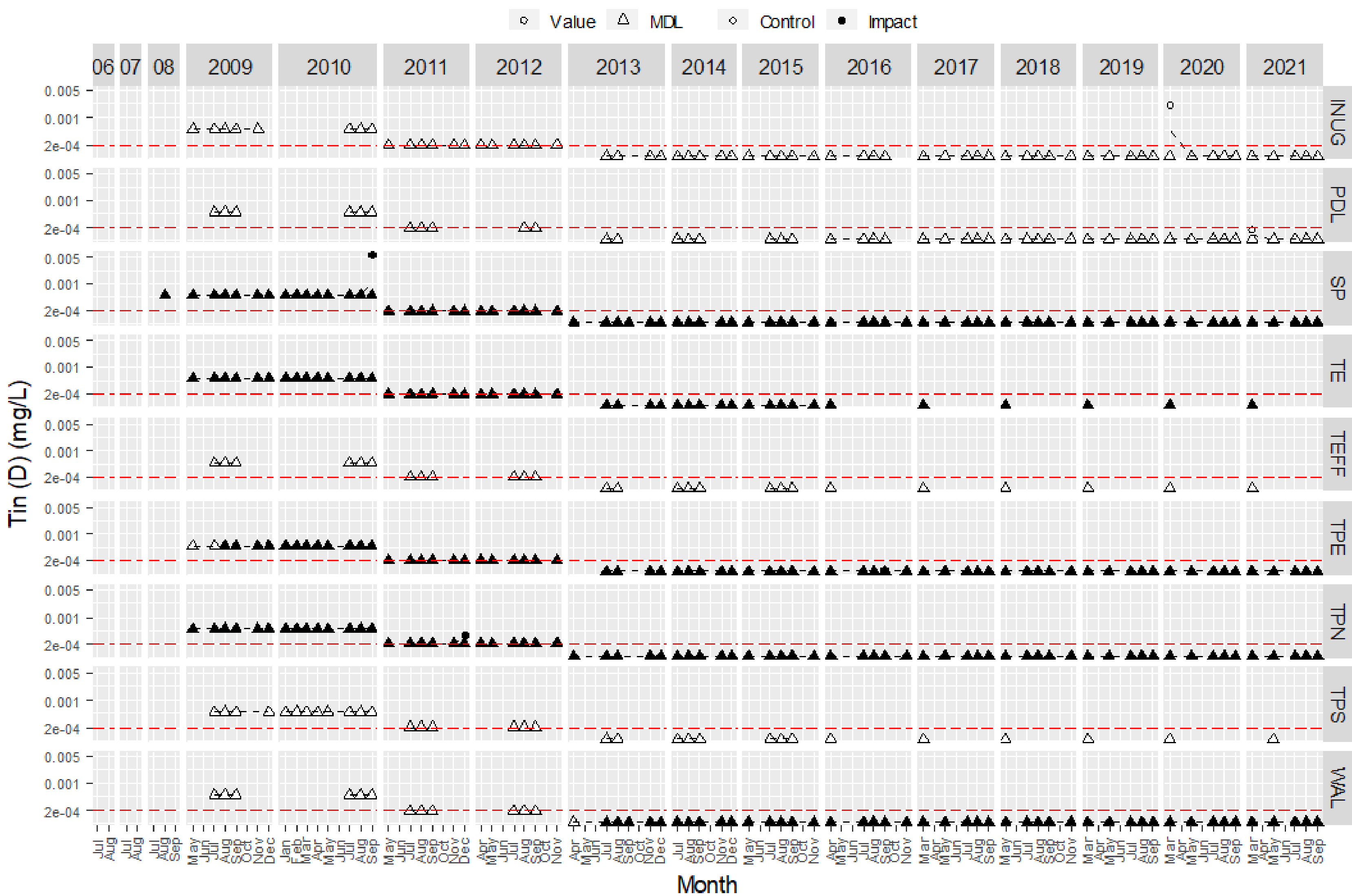


Figure B1-35. Dissolved titanium (mg/L).

Note: The red dashed line = trigger value.

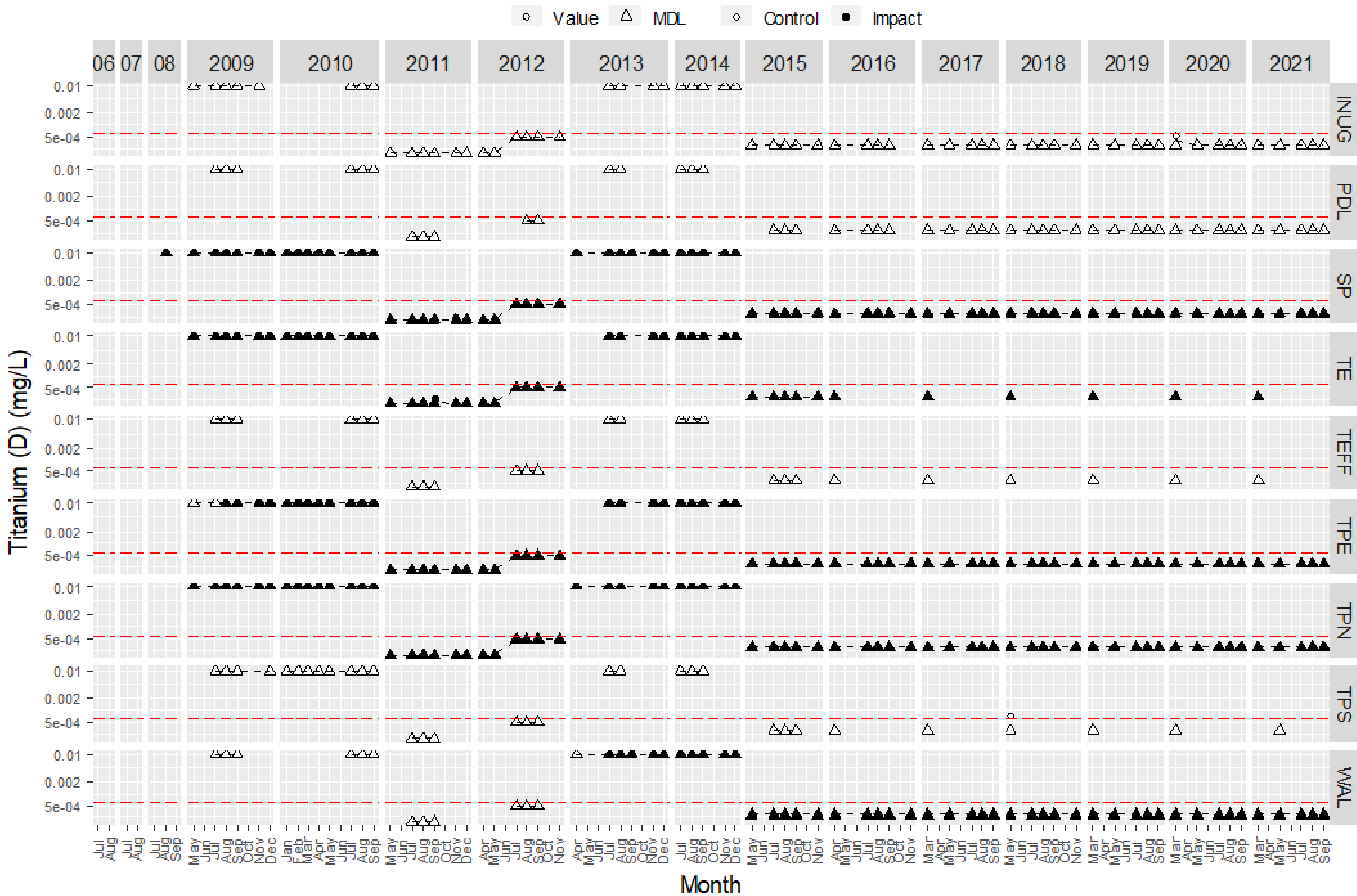
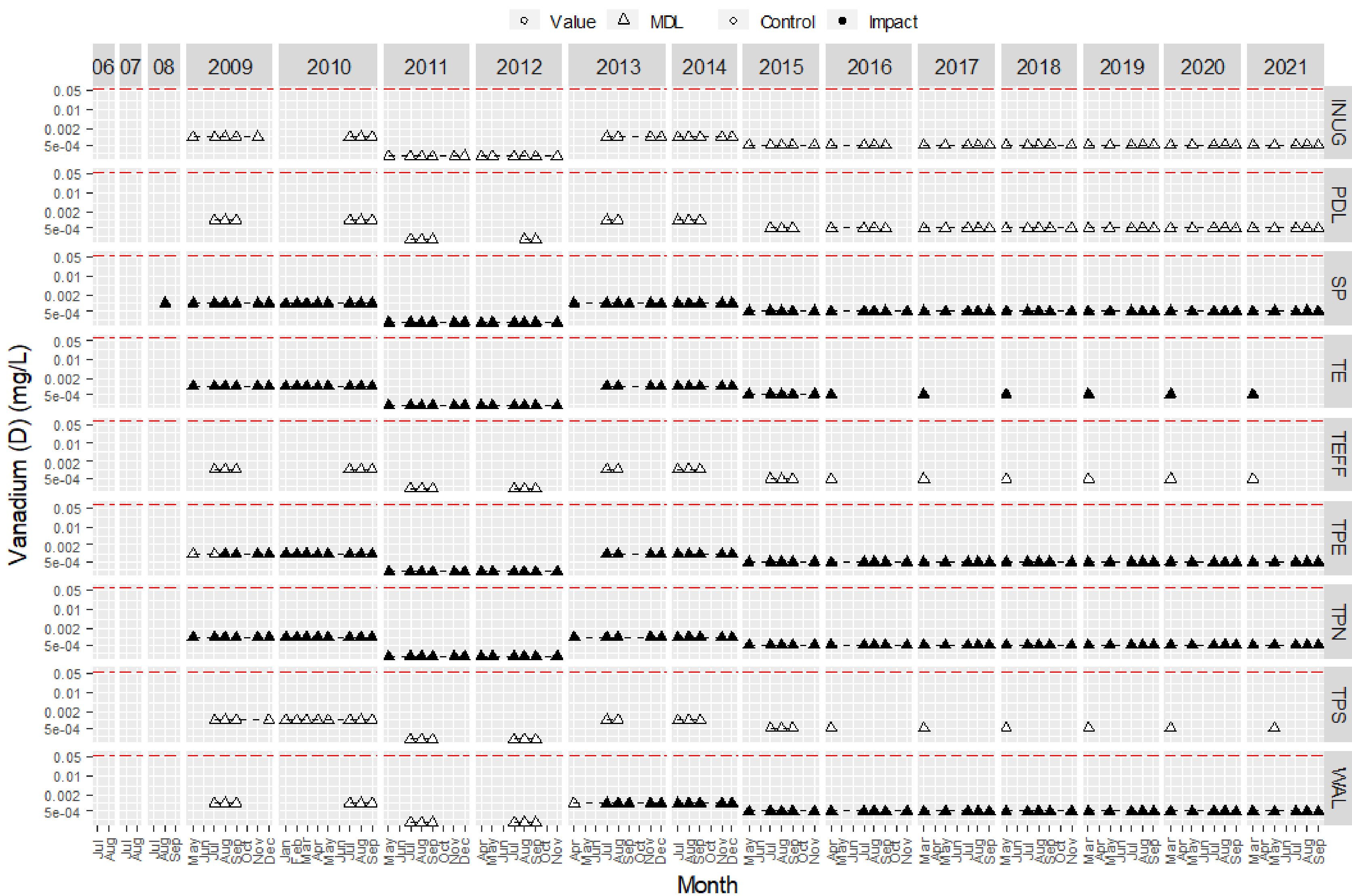


Figure B1-36. Dissolved vanadium (mg/L).

Note: The red dashed line = trigger value.



Appendix B2
Water Chemistry – Whale Tail Study Area Lakes

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Table B2-1. Water quality results from the Whale Tail study area lakes, 2021.

Lake & Area	Aquatic Life Guideline[1]	WTP Screening Values[2] Triggers	WTP Screening Values[2] Thresholds	Whale Tail Lake South Basin (Impoundment)									
Month				March	March	May	May	July	July	August	August	September	September
Area-Replicate ID				WTS-57	WTS-58	WTS-59	WTS-60	WTS-61	WTS-62	WTS-63	WTS-64	WTS-65	WTS-66
Date				25-Mar	25-Mar	12-May	12-May	08-Jul	08-Jul	10-Aug	10-Aug	08-Sep	08-Sep
Time				15:30	15:05	17:15	17:48	15:37	16:10	4:30	15:27	13:40	14:05
ALS Sample ID				VA21A6300-001	VA21A6300-002	VA21A9444-016	VA21A9444-017	VA21B4721-001	VA21B4721-002	VA21B7111-003	VA21B7111-004	VA21C0214-003	VA21C0214-004
Field Measurements (3 m)													
Dissolved Oxygen (mg/L)				14.7	12.6	14.2	14.1	12.2	12.2	11.4	11.4	10.6	10.7
Specific Conductivity (µS/cm)				126	131	80	18.9	98	99	89	89	81	80
pH	6.5 - 9.0			7.1	6.9	6.1	6.9	7.2	6.8	6.8	7.0	6.9	6.9
Temperature (°C)				0.50	0.47	0.51	0.57	6.9	6.5	9.0	9.0	9.9	9.9
Physical Tests (mg/L)													
Conductivity (µS/cm)		48.6		**118**	**122**	**122**	**128**	**94**	**93**	**86**	**86**	**81**	**80**
Alkalinity - Total (as $CaCO_3$)		9.61		**17.4**	**17.7**	**16.2**	**16.9**	**15.3**	**15.1**	**13.9**	**13.6**	**12.9**	**13.5**
Alkalinity - Bicarbonate		9.60		**17.4**	**17.7**	**16.2**	**16.9**	**15.3**	**15.1**	**13.9**	**13.6**	**12.9**	**13.5**
Alkalinity - Carbonate		2.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity - Hydroxide				<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hardness (as CaCO3), dissolved		17.4		**46**	**47**	**43**	**46**	**35**	**36**	**30**	**30**	**29**	**29**
Hardness (as CaCO3), from total Ca/Mg				42	43	45	47	36	35	31	31	27	28
pH (Laboratory)	6.5 - 9.0	6.57-7.97	6.5-9.0	7.2	7.2	7.0	6.9	7.3	7.3	7.3	7.3	7.3	7.3
Total Dissolved Solids		38.5		**86**	**89**	**100**	**104**	**57**	**52**	**76**	**74**	**51**	**57**
Total Suspended Solids		3	5	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Turbidity (NTU)				0.22	0.24	0.25	0.21	0.42	0.39	0.46	0.49	0.33	0.36
Anions and Nutrients (mg/L)													
Total Kjeldahl Nitrogen		0.17		**0.25**	**0.27**	**0.30**	**0.26**	**0.22**	**0.27**	**0.21**	**0.25**	**0.39**	**0.25**
Ammonia (as N)[3]	***equation***	0.065	0.126	0.0050	<0.0050	<0.0050	<0.0050	0.043	0.030	0.030	0.058	0.018	0.012
Bromide				0.19	0.20	0.19	0.20	0.13	0.13	0.12	0.12	0.11	0.11
Chloride	120	60.4	120	17.4	18.0	18.1	18.9	12.4	12.5	11.2	11.1	10.2	10.2
Fluoride	0.12	0.077	0.12	0.062	0.064	0.058	0.061	0.056	0.054	0.051	0.051	0.052	0.053
Nitrate (as N)	3	1.5	3	0.49	0.51	0.51	0.54	0.38	0.39	0.24	0.24	0.19	0.19
Nitrite (as N)	0.06	0.031	0.06	<0.0010	<0.0010	0.0012	0.0021	0.0049	0.0049	0.0017	0.0016	0.0011	0.0011
Ortho Phosphate (as P)		0.0022		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0019	<0.0010
Phosphorus (P)-Total	0.01	0.0045	0.01	**0.0075**	**0.0059**	0.0036	0.0038	**0.0046**	0.0045	0.0038	0.0045	**0.0096**	**0.0070**
Phosphorus (P)-Total Diss.				0.0040	0.0044	0.0031	0.0031	0.0047	0.0035	0.0030	0.0027	0.0035	0.0032
Reactive Silica (as SiO_2)		1.33		**1.5**	**1.7**	**1.5**	**1.7**	**1.3**	**1.5**	0.58	0.58	<0.50	<0.50
Sulphate (SO_4)		64.8	128	8.1	8.5	8.4	8.9	6.8	6.9	6.2	6.1	6.0	6.0
Organic / Inorganic Carbon (mg/L)													
Dissolved Organic Carbon		2.43		**4.1**	**4.1**	**4.0**	**3.8**	**2.8**	**2.9**	**3.0**	**3.1**	**3.3**	**3.2**
Total Organic Carbon		2.42		**4.1**	**4.8**	**3.7**	**4.0**	**3.2**	**2.6**	**2.7**	**2.8**	**3.7**	**3.3**
Total Metals (mg/L)													
Aluminum[3]	***equation***	0.052	0.1	0.0064	0.0059	0.0061	0.0056	0.024	0.014	0.015	0.014	0.0081	0.010
Antimony		0.0046	0.009	0.00018	0.00022	0.00018	0.00019	0.00029	0.00029	0.00024	0.00024	0.00022	0.00022
Arsenic	0.005	0.013	0.025	0.00076	0.00082	0.00070	0.00078	0.0016	0.0017	0.0011	0.0011	0.0010	0.0010
Barium		0.5	1	0.022	0.023	0.023	0.024	0.020	0.020	0.016	0.016	0.014	0.015
Beryllium		0.000115	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth				<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	1.5	0.76	1.5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium[3]	***equation***	0.000023	0.00004	<0.0000050	<0.0000050	0.00001	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium		4.6		**11.9**	**12.2**	**13.2**	**13.8**	**10.1**	**10.1**	**8.9**	**8.9**	**7.5**	**7.8**
Chromium[4]	0.001	0.0025	0.005	0.00015	0.00015	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt				0.00012	0.00012	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper[3]	***equation***	0.0013	0.002	0.00075	0.00086	0.00078	0.00074	0.00058	0.00063	0.00056	0.00056	0.00057	0.00058
Iron	0.3	0.16	0.3	0.10	0.10	0.082	0.083	0.11	0.064	0.054	0.060	0.049	0.053
Lead[3]	***equation***	0.00053	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium		0.002		**0.0024**	**0.0024**	**0.0026**	**0.0026**	0.0020	0.0020	0.0017	0.0017	0.0015	0.0016
Magnesium		1.41		**3.0**	**3.1**	**3.0**	**3.2**	**2.5**	**2.4**	**2.2**	**2.3**	**2.1**	**2.1**
Manganese[3]		0.32	***See text***	0.048	0.051	0.043	0.046	0.039	0.043	0.0084	0.0094	0.0093	0.011
Mercury	0.000026	0.000016	0.000026	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum	0.073	0.037	0.073	0.00065	0.00076	0.00054	0.00063	0.00047	0.00049	0.00041	0.00040	0.00040	0.00034
Nickel[3]	***equation***	0.013	0.025	0.0026	0.0026	0.0027	0.0027	0.0031	0.0033	0.0019	0.0019	0.0017	0.0017
Phosphorus		0.0045	0.004	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium		0.84		**2.7**	**2.8**	**2.8**	**2.9**	**2.4**	**2.3**	**2.3**	**2.3**	**2.1**	**2.1**
Rubidium				0.0043	0.0047	0.0044	0.0046	0.0038	0.0038	0.0036	0.0036	0.0033	0.0034
Selenium	0.001	0.00053	0.001	<0.000050	0.00006	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon		0.61		**0.73**	**0.79**	**0.80**	**0.86**	**0.72**	**0.73**	0.36	0.34	0.21	0.21
Silver	0.00025	0.00013	0.00025	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium		1		**2.2**	**2.3**	**2.2**	**2.3**	**1.8**	**1.7**	**1.6**	**1.6**	**1.5**	**1.5**
Strontium		1.26	2.5	0.099	0.11	0.10	0.11	0.077	0.079	0.072	0.072	0.063	0.065
Sulfur				2.7	2.6	2.9	3.0	2.6	2.4	2.1	2.1	2.1	2.2
Tellurium				<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Thallium	0.0008	0.00013	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Thorium				<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin		0.033		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium		0.00041		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	0.00038	**0.00057**	**0.00046**	<0.00030	<0.00030
Tungsten				<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Uranium	0.015	0.0002	0.015	0.00015	0.00017	0.00013	0.00014	0.00008	0.00009	0.00007	0.00008	0.00007	0.00007
Vanadium		0.0006	0.12	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc[3]	0.03	0.0075	***See text***	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Zirconium				<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Dissolved Metals (mg/L)													
Aluminum[3]		0.026	0.05	0.0038	0.0043	0.0044	0.0041	0.0061	0.0051	0.0038	0.0034	0.0039	0.0042
Antimony		0.005	0.009	0.00018	0.00022	0.00018	0.00020	0.00029	0.00028	0.00022	0.00023	0.00019	0.00019
Arsenic		0.013	0.025	0.00062	0.00069	0.00061	0.00066	0.0016	0.0016	0.00098	0.00099	0.00091	0.00098
Barium		0.5	1	0.022	0.024	0.024	0.024	0.020	0.020	0.015	0.016	0.015	0.016
Beryllium		0.000115	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth				<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron		0.76	1.5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium		0.000023	0.00004	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.00001	0.00001	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium		4.6		**13.0**	**13.1**	**12.1**	**12.9**	**10.0**	**10.3**	**8.5**	**8.5**	**7.9**	**7.9**
Cesium				0.00001	0.00001	0.00002	0.00002	0.00002	0.00002	0.00001	0.00001	0.00001	0.00001
Chromium		0.0026	0.005	0.00013	0.00012	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt				<0.00010	<0.00010	<0.00010	<0.00010	0.00016	0.00016	<0.00010	<0.00010	<0.00010	<0.00010
Copper		0.0012	0.002	0.00068	0.00069	0.00070	0.00084	0.00054	0.00056	0.00052	0.00050	0.00062	0.00059
Iron		0.16	0.3	0.052	0.053	0.054	0.055	0.060	0.046	0.020	0.022	0.021	0.022
Lead		0.00053	0.001	<0.000050	<0.000050	0.00007	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium		0.002		**0.0026**	**0.0026**	**0.0026**	**0.0027**	0.0018	0.0019	0.0016	0.0016	0.0015	0.0015
Magnesium		1.41		**3.3**	**3.3**	**3.1**	**3.3**	**2.5**	**2.6**	**2.2**	**2.2**	**2.2**	**2.2**
Manganese[3]		0.32	***See text***	0.044	0.048	0.046	0.050	0.063	0.063	0.00049	0.00095	0.0010	0.0010
Mercury		0.000016	0.000026	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum		0.037	0.073	0.00060	0.00073	0.00062	0.00073	0.00045	0.00045	0.00039	0.00039	0.00036	0.00035
Nickel		0.013	0.025	0.0025	0.0025	0.0028	0.0030	0.0032	0.0033	0.0018	0.0018	0.0017	0.0017
Phosphorus				<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium		0.84		**2.7**	**2.9**	**2.9**	**3.0**	**2.4**	**2.4**	**2.2**	**2.2**	**2.2**	**2.2**
Rubidium				0.0042	0.0044	0.0045	0.0046	0.0040	0.0043	0.0035	0.0035	0.0037	0.0037
Selenium		0.00053	0.001	0.00008	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon		0.57		**0.68**	**0.75**	**0.77**	**0.84**	**0.64**	**0.65**	0.30	0.27	0.17	0.19
Silver		0.00013	0.00025	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium		1		**2.3**	**2.3**	**2.3**	**2.4**	**1.8**	**1.8**	**1.6**	**1.6**	**1.5**	**1.5**
Strontium		1.26	2.5	0.099	0.11	0.10	0.11	0.079	0.077	0.066	0.066	0.062	0.060
Sulfur				2.8	2.9	2.8	2.9	2.3	2.1	2.2	1.9	1.8	1.9
Tellurium				<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Thallium		0.00041	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Thorium				<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin		0.0002		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium		0.0006		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Tungsten				0.00021	0.00033	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Uranium		0.0075	0.015	0.00013	0.00015	0.00013	0.00015	0.00010	0.00010	0.00007	0.00007	0.00006	0.00007
Vanadium		0.06	0.12	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc[3]		0.0023	***See text***	0.0014	0.0014	0.0012	0.0016	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zirconium				<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Speciated Metals (µg/L)													
Arsenate (As V)				0.29	-	0.31	-	-	0.16	0.037	-	0.030	-
Arsenite (As III)				0.056	-	0.060	-	-	1.1	0.58	-	0.47	-
Arsenobetaine (AsB)				<0.050	-	<0.050	-	-	<0.050	<0.050	-	<0.050	-
Dimethylarsinic Acid (DMA)				0.084	-	0.032	-	-	0.076	0.18	-	0.18	-
Monomethylarsonic Acid (MMA)				<0.020	-	<0.020	-	-	<0.020	<0.020	-	<0.020	-
Plant Pigments (µg/L)													
Chlorophyll-a				0.11	0.13	0.055	0.055	1.4	1.3	3.2	2.8	2.2	2.6

Notes:

1. CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life, 1999, updated up to 2018.
2. Trigger and threshold values are presented in *CREMP 2015 Plan Update* (Azimuth, 2015b). A number of thresholds were derived from methods (or sources) other than CCME guidelines - see Azimuth (2015b) 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 values exceed the trigger.
123 Bold and shaded values exceed the threshold.
Italicized numbers are below detection limits.
"-" not analyzed/not sampled
n/a = issues with the water quality probe. No data collected.
underline = results were given a cautionary flag in the QC assessment (refer to **Appendix A** for details).
strikethrough = results flagged as unreliable in the QC assessment (refer to **Appendix A** for details).

Table B2-1. Water quality results from the Whale Tail study area lakes, 2021.

Lake & Area	Aquatic Life Guideline[1]	WTP Screening Values[2]		Mammoth Lake									
Month		Triggers	Thresholds	March	March	May	May	July	July	August	August	September	September
Area-Replicate ID				MAM-57	MAM-58	MAM-59	MAM-60	MAM-61	MAM-62	MAM-63	MAM-64	MAM-65	MAM-66
Date				25-Mar	25-Mar	12-May	12-May	09-Jul	09-Jul	07-Aug	07-Aug	09-Sep	09-Sep
Time				13:40	14:15	15:30	14:50	14:48	15:39	15:37	15:00	13:45	14:10
ALS Sample ID				VA21A6300-003	VA21A6300-004	VA21A9444-012	VA21A9444-013	VA21B4721-003	VA21B4721-004	VA21B6886-005	VA21B6886-006	VA21C0214-005	VA21C0214-006
Field Measurements (3 m)													
Dissolved Oxygen (mg/L)				12.7	13.7	12.5	12.9	12.0	12.6	11.4	11.3	11.1	11.1
Specific Conductivity (µS/cm)				237	309	257	331	135	121	156	121	117	164
pH	6.5 - 9.0			6.8	6.7	6.5	6.7	7.1	7.1	7.0	6.8	7.1	7.1
Temperature (°C)				1.3	1.1	0.99	1.3	9.9	8.0	9.4	9.3	9.8	9.7
Physical Tests (mg/L)													
Conductivity (µS/cm)		48.6		**223**	**306**	**242**	**310**	**134**	**119**	**154**	**119**	**116**	**165**
Alkalinity - Total (as $CaCO_3$)		9.61		**19.4**	**25**	**22**	**26**	**14.7**	**13.4**	**15.0**	**12.7**	**13.7**	**17.2**
Alkalinity - Bicarbonate		9.60		**19.4**	**25**	**22**	**26**	**14.7**	**13.4**	**15.0**	**12.7**	**13.7**	**17.2**
Alkalinity - Carbonate		2.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity - Hydroxide				<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hardness (as CaCO3), dissolved		17.4		**86**	**122**	**90**	**111**	**51**	**46**	**54**	**41**	**41**	**58**
Hardness (as CaCO3), from total Ca/Mg				81	111	91	118	51	45	55	43	41	58
pH (Laboratory)	6.5 - 9.0	6.57-7.97	6.5-9.0	7.3	7.4	7.1	7.0	7.4	7.3	7.3	7.3	7.4	7.4
Total Dissolved Solids		38.5		**166**	**228**	**187**	**244**	**73**	**68**	**126**	**96**	**76**	**108**
Total Suspended Solids		3	5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Turbidity (NTU)				0.10	0.15	<0.10	<0.10	0.31	0.25	0.41	0.49	0.64	0.55
Anions and Nutrients (mg/L)													
Total Kjeldahl Nitrogen		0.17		**0.36**	**0.41**	**0.23**	**0.34**	**0.32**	**0.18**	**0.36**	**0.25**	**0.30**	**0.40**
Ammonia (as N)[3]	***equation***	0.065	0.126	0.041	**0.087**	0.0055	0.0068	0.037	0.0083	**0.076**	0.052	0.014	**0.076**
Bromide				0.36	0.50	0.38	0.50	0.19	0.17	0.21	0.16	0.15	0.20
Chloride	120	60.4	120	36	51	39	53	19.7	18.2	21	16.6	14.8	21
Fluoride	0.12	0.077	0.12	0.058	0.071	0.058	0.068	0.046	0.041	0.057	0.052	0.049	0.057
Nitrate (as N)	3	1.5	3	1.2	**1.7**	1.3	**1.8**	0.57	0.47	0.71	0.38	0.44	0.89
Nitrite (as N)	0.06	0.031	0.06	0.0016	0.0027	0.0020	0.0018	0.0098	0.0035	0.020	0.0060	0.0064	0.019
Ortho Phosphate (as P)		0.0022		<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	**0.0028**	0.0022
Phosphorus (P)-Total	0.01	0.0045	0.01	0.0040	0.0038	0.0021	0.0023	0.0031	0.0028	**0.0058**	**0.0054**	**0.0052**	**0.0051**
Phosphorus (P)-Total Diss.				<0.0020	<0.0020	<0.0020	0.0021	<0.0020	<0.0020	<0.0020	0.0022	0.0026	0.0026
Reactive Silica (as SiO_2)		1.33		**2.6**	**3.0**	**2.4**	**3.1**	1.1	1.0	0.82	0.52	<0.50	0.97
Sulphate (SO_4)		64.8	128	21	29	23	30	13.6	11.1	18.2	12.2	13.7	24
Organic / Inorganic Carbon (mg/L)													
Dissolved Organic Carbon		2.43		**2.6**	**3.3**	**2.9**	**3.1**	2.0	2.1	2.3	2.2	**2.5**	**2.5**
Total Organic Carbon		2.42		**2.9**	**3.5**	**2.8**	**3.2**	2.0	1.8	**2.5**	2.3	**2.6**	**2.6**
Total Metals (mg/L)													
Aluminum[3]	***equation***	0.052	0.1	<0.0030	<0.0030	<0.0030	<0.0030	0.0095	0.0039	0.0079	0.0078	0.0070	0.013
Antimony		0.0046	0.009	0.00062	0.00087	0.00065	0.00087	0.00071	0.00041	0.0015	0.00064	0.0011	0.0025
Arsenic	0.005	0.013	0.025	0.00071	0.00081	0.00088	0.00087	0.0015	0.00094	0.0019	0.0011	0.0014	0.0032
Barium		0.5	1	0.037	0.053	0.044	0.056	0.024	0.022	0.023	0.019	0.019	0.024
Beryllium		0.000115	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth				<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	1.5	0.76	1.5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium[3]	***equation***	0.000023	0.00004	<0.0000050	<0.0000050	<0.0000050	0.00001	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.00001
Calcium		4.6		**24**	**33**	**27**	**35**	**15.2**	**13.6**	**15.8**	**12.5**	**11.5**	**16.3**
Chromium[4]	0.001	0.0025	0.005	<0.00010	<0.00010	<0.00050	<0.00050	0.00076	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt				<0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	0.00012	<0.00010	<0.00010	0.00019
Copper[3]	***equation***	0.0013	0.002	0.00059	0.00077	0.00066	0.00078	<0.00050	0.00054	0.00052	0.00051	0.00058	0.00075
Iron	0.3	0.16	0.3	<0.010	<0.010	<0.010	<0.010	0.039	0.011	0.041	0.030	0.024	0.040
Lead[3]	***equation***	0.00053	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium		0.002		**0.0036**	**0.0048**	**0.0037**	**0.0051**	**0.0024**	**0.0021**	**0.0026**	0.0019	0.0019	**0.0028**
Magnesium		1.41		**5.3**	**7.1**	**5.7**	**7.2**	**3.2**	**2.8**	**3.8**	**2.8**	**2.9**	**4.3**
Manganese[3]		0.32	***See text***	0.0035	0.0086	0.0037	0.0070	0.014	0.0048	0.012	0.0054	0.0064	0.022
Mercury	0.000026	0.000016	0.000026	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum	0.073	0.037	0.073	0.00060	0.00075	0.00058	0.00075	0.00055	0.00033	0.00073	0.00045	0.00047	0.00091
Nickel[3]	***equation***	0.013	0.025	0.0018	0.0028	0.0021	0.0030	0.0031	0.0015	0.0017	0.0010	0.0017	0.0040
Phosphorus		0.0045	0.004	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium		0.84		**4.6**	**6.0**	**5.0**	**6.1**	**2.9**	**2.6**	**3.6**	**2.8**	**2.9**	**4.2**
Rubidium				0.0056	0.0072	0.0061	0.0074	0.0036	0.0031	0.0043	0.0034	0.0034	0.0048
Selenium	0.001	0.00053	0.001	0.00008	0.00012	0.00010	0.00013	0.00009	0.00006	0.00011	0.00007	0.00009	0.00014
Silicon		0.61		**1.2**	**1.4**	**1.2**	**1.5**	**0.65**	0.52	0.52	0.35	0.30	0.55
Silver	0.00025	0.00013	0.00025	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium		1		**3.2**	**4.1**	**3.4**	**4.2**	**1.9**	**1.7**	**2.5**	**1.9**	**2.0**	**3.0**
Strontium		1.26	2.5	0.17	0.24	0.18	0.24	0.11	0.092	0.12	0.088	0.089	0.13
Sulfur				7.1	9.8	8.3	10.4	4.5	3.8	6.1	4.1	5.0	7.9
Tellurium				<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Thallium	0.0008	0.00013	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Thorium				<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin		0.033		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium		0.00041		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	0.00041
Tungsten				<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Uranium	0.015	0.0002	0.015	0.00010	0.00013	0.00009	0.00012	0.00010	0.00006	0.00020	0.00009	0.00013	**0.00029**
Vanadium		0.0006	0.12	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc[3]	0.03	0.0075	***See text***	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Zirconium				<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Dissolved Metals (mg/L)													
Aluminum[3]		0.026	0.05	0.0013	0.0011	0.0012	0.0014	0.0030	0.0039	0.0020	0.0027	0.0020	0.0022
Antimony		0.005	0.009	0.00063	0.00089	0.00069	0.00089	0.00074	0.00042	0.0014	0.00060	0.0011	0.0023
Arsenic		0.013	0.025	0.00072	0.00078	0.00080	0.00076	0.0013	0.00094	0.0015	0.0010	0.0013	0.0026
Barium		0.5	1	0.038	0.056	0.047	0.056	0.024	0.023	0.021	0.017	0.019	0.026
Beryllium		0.000115	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth				<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron		0.76	1.5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium		0.000023	0.00004	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium		4.6		**25**	**36**	**26**	**33**	**14.9**	**13.4**	**15.2**	**11.7**	**11.6**	**16.3**
Cesium				0.00003	0.00003	0.00003	0.00003	0.00002	0.00001	0.00002	0.00001	0.00002	0.00002
Chromium		0.0026	0.005	<0.00010	<0.00010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt				<0.00010	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00016
Copper		0.0012	0.002	0.00055	0.00069	0.00066	0.00075	0.00046	0.00042	0.00054	0.00048	0.00059	0.00074
Iron		0.16	0.3	<0.010	<0.010	<0.010	<0.010	0.015	0.018	<0.010	<0.010	<0.010	<0.010
Lead		0.00053	0.001	<0.000050	<0.000050	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium		0.002		**0.0038**	**0.0053**	**0.0039**	**0.0050**	**0.0022**	0.0019	**0.0024**	0.0018	0.0019	**0.0028**
Magnesium		1.41		**5.8**	**8.1**	**6.0**	**7.3**	**3.2**	**3.1**	**3.8**	**2.8**	**3.0**	**4.1**
Manganese[3]		0.32	***See text***	0.0015	0.0066	0.0024	0.0046	0.024	0.016	0.0078	0.0019	0.0021	0.018
Mercury		0.000016	0.000026	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum		0.037	0.073	0.00060	0.00074	0.00062	0.00074	0.00051	0.00035	0.00067	0.00043	0.00049	0.00078
Nickel		0.013	0.025	0.0018	0.0030	0.0022	0.0031	0.0021	0.0016	0.0017	0.00096	0.0016	0.0036
Phosphorus				<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium		0.84		**4.8**	**7.0**	**5.4**	**6.3**	**3.1**	**2.9**	**3.7**	**2.8**	**3.0**	**4.1**
Rubidium				0.0056	0.0073	0.0061	0.0074	0.0040	0.0035	0.0043	0.0034	0.0040	0.0048
Selenium		0.00053	0.001	0.00010	0.00015	0.00009	0.00011	0.00008	0.00005	0.00009	<0.000050	0.00006	0.00012
Silicon		0.57		**1.1**	**1.5**	**1.2**	**1.5**	0.57	0.49	0.48	0.30	0.25	0.49
Silver		0.00013	0.00025	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium		1		**3.2**	**4.5**	**3.6**	**4.4**	**2.1**	**1.9**	**2.6**	**1.9**	**2.0**	**2.8**
Strontium		1.26	2.5	0.17	0.26	0.19	0.25	0.11	0.097	0.11	0.080	0.081	0.12
Sulfur				6.8	10.5	7.5	9.7	4.4	3.5	6.3	4.1	4.3	7.2
Tellurium				<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Thallium		0.00041	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Thorium				<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin		0.0002		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium		0.0006		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Tungsten				0.00040	0.00050	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Uranium		0.0075	0.015	0.00009	0.00013	0.00010	0.00013	0.00011	0.00007	0.00019	0.00010	0.00011	0.00027
Vanadium		0.06	0.12	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc[3]		0.0023	***See text***	0.0018	0.0011	<0.0010	0.0013	<0.0010	<0.0010	<0.0010	**0.0033**	<0.0010	<0.0010
Zirconium				<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Speciated Metals (µg/L)													
Arsenate (As V)				0.38	-	-	0.40	0.16	-	-	0.058	-	0.24
Arsenite (As III)				0.086	-	-	0.10	0.83	-	-	0.58	-	1.8
Arsenobetaine (AsB)				<0.050	-	-	<0.050	<0.050	-	-	<0.050	-	<0.050
Dimethylarsinic Acid (DMA)				<0.020	-	-	<0.020	0.11	-	-	0.10	-	0.22
Monomethylarsonic Acid (MMA)				0.023	-	-	0.025	<0.020	-	-	<0.020	-	<0.020
Plant Pigments (µg/L)													
Chlorophyll-a				0.21	0.34	0.13	0.20	0.95	0.94	1.8	2.4	3.7	3.1

Notes:

1. CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life, 1999, updated up to 2018.
2. Trigger and threshold values are presented in *CREMP 2015 Plan Update* (Azimuth, 2015b). A number of thresholds were derived from methods (or sources) other than CCME guidelines - see Azimuth (2015b) 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 values exceed the trigger.

123 Bold and shaded values exceed the threshold.

Italicized numbers are below detection limits.

"-" not analyzed/not sampled

n/a = issues with the water quality probe. No data collected.

underline = results were given a cautionary flag in the QC assessment (refer to **Appendix A** for details).

strikethrough = results flagged as unreliable in the QC assessment (refer to **Appendix A** for details).

Table B2-1. Water quality results from the Whale Tail study area lakes, 2021.

Lake & Area	Aquatic Life Guideline[1]	WTP Screening Values[2]		Lake A20 (Impoundment)									
Month				March	March	May	May	July	July	August	August	September	September
Area-Replicate ID				A20-51	A20-52	A20-53	A20-54	A20-55	A20-56	A20-57	A20-58	A20-59	A20-60
Date				24-Mar	24-Mar	12-May	12-May	11-Jul	11-Jul	10-Aug	10-Aug	09-Sep	09-Sep
Time		Triggers	Thresholds	15:25	15:00	16:13	16:30	15:25	14:54	8:30	9:24	09:00	08:30
ALS Sample ID				VA21A6300-005	VA21A6300-006	VA21A9444-014	VA21A9444-015	VA21B4721-007	VA21B4721-008	VA21B7111-001	VA21B7111-002	VA21C0214-001	VA21C0214-002
Field Measurements (3 m)													
Dissolved Oxygen (mg/L)				15.0	16.2	14.7	11.5	11.8	12.4	11.6	11.5	11.0	10.9
Specific Conductivity (µS/cm)				90	50	23	102	46	42	54	44	58	45
pH	6.5 - 9.0			6.4	6.9	6.7	6.0	6.9	6.9	6.8	6.9	6.7	6.7
Temperature (°C)				1.2	0.70	0.63	1.3	10.1	9.0	8.4	8.7	9.4	9.6
Physical Tests (mg/L)													
Conductivity (µS/cm)		48.6		**87**	46	47	**95**	44	41	**53**	43	**58**	45
Alkalinity - Total (as $CaCO_3$)		9.61		**16.9**	**9.8**	8.6	**16.6**	8.5	8.9	9.0	8.4	**11.0**	8.4
Alkalinity - Bicarbonate		9.60		**16.9**	**9.8**	8.6	**16.6**	8.5	8.9	9.0	8.4	**11.0**	8.4
Alkalinity - Carbonate		2.0		*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Alkalinity - Hydroxide				*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Hardness (as CaCO3), dissolved		17.4		**32**	17.1	17.1	**34**	15.4	14.2	**18.2**	14.9	**20**	15.8
Hardness (as CaCO3), from total Ca/Mg				33	17.1	16.9	36	16.9	15.1	18.7	15.4	21	15.8
pH (Laboratory)	6.5 - 9.0	6.57-7.97	6.5-9.0	7.2	7.1	6.7	6.8	7.1	7.1	7.1	7.1	7.2	7.1
Total Dissolved Solids		38.5		**65**	24	34	**70**	26	25	**49**	**43**	**42**	31
Total Suspended Solids		3	5	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	1.2	*<1.0*	*<1.0*	*<1.0*
Turbidity (NTU)				0.15	*<0.10*	*<0.10*	*<0.10*	0.45	0.71	0.74	0.73	0.68	0.57
Anions and Nutrients (mg/L)													
Total Kjeldahl Nitrogen		0.17		**0.25**	0.17	0.13	**0.21**	0.17	0.14	**0.18**	**0.18**	**0.24**	**0.24**
Ammonia (as N)[3]	***equation***	0.065	0.126	0.037	0.019	*<0.0050*	0.0055	0.0051	0.0054	*<0.0050*	0.041	*<0.0050*	*<0.0050*
Bromide				0.13	0.064	0.054	0.14	0.055	0.051	0.066	0.064	0.065	*<0.050*
Chloride	120	60.4	120	12.1	6.0	5.9	13.2	5.8	5.3	6.9	5.4	7.4	5.6
Fluoride	0.12	0.077	0.12	0.047	0.039	0.035	0.044	0.033	0.033	0.040	0.035	0.046	0.041
Nitrate (as N)	3	1.5	3	0.052	0.027	0.053	0.11	0.019	0.013	*<0.0050*	*<0.0050*	0.015	*<0.0050*
Nitrite (as N)	0.06	0.031	0.06	0.017	0.0011	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Ortho Phosphate (as P)		0.0022		*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	0.0010	0.0015	0.0012	**0.0023**	*<0.0010*
Phosphorus (P)-Total	0.01	0.0045	0.01	**0.0099**	**0.0049**	0.0033	0.0030	0.0042	0.0038	0.0024	0.0030	**0.0074**	**0.0062**
Phosphorus (P)-Total Diss.				*<0.0020*	*<0.0020*	*<0.0020*	*<0.0020*	0.0028	0.0029	*<0.0020*	*<0.0020*	0.0042	0.0030
Reactive Silica (as SiO_2)		1.33		1.2	0.79	0.79	1.2	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*
Sulphate (SO_4)		64.8	128	4.4	2.5	2.5	4.8	2.5	2.3	3.2	2.4	3.9	2.8
Organic / Inorganic Carbon (mg/L)													
Dissolved Organic Carbon		2.43		**4.7**	**3.0**	**3.0**	**4.1**	2.4	2.4	**2.7**	**2.6**	**3.1**	**2.6**
Total Organic Carbon		2.42		**5.6**	**3.1**	**2.8**	**4.3**	2.3	2.4	**4.0**	**3.2**	**3.2**	**2.9**
Total Metals (mg/L)													
Aluminum[3]	***equation***	0.052	0.1	0.0043	0.0042	0.0037	0.0051	0.0060	0.0055	0.013	0.0088	0.011	0.0089
Antimony		0.0046	0.009	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Arsenic	0.005	0.013	0.025	0.00032	0.00024	0.00021	0.00034	0.00052	0.00046	0.00071	0.00036	0.00045	0.00033
Barium		0.5	1	0.019	0.0088	0.0088	0.021	0.0087	0.0082	0.0083	0.0075	0.010	0.0080
Beryllium		0.000115	0.00013	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*
Bismuth				*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Boron	1.5	0.76	1.5	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Cadmium[3]	***equation***	0.000023	0.00004	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Calcium		4.6		**8.9**	4.6	**4.7**	**10.1**	**4.8**	4.2	**5.2**	4.3	**5.5**	4.3
Chromium[4]	0.001	0.0025	0.005	*<0.00010*	*<0.00010*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Cobalt				*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Copper[3]	***equation***	0.0013	0.002	0.00058	*<0.00050*	*<0.00050*	0.00059	0.00083	*<0.00050*	*<0.00050*	*<0.00050*	0.00050	*<0.00050*
Iron	0.3	0.16	0.3	0.043	0.010	*<0.010*	0.039	0.028	0.024	0.059	0.040	0.063	0.034
Lead[3]	***equation***	0.00053	0.001	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Lithium		0.002		0.0013	*<0.0010*	*<0.0010*	0.0014	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	0.0010	*<0.0010*
Magnesium		1.41		**2.5**	1.4	1.3	**2.6**	1.2	1.1	1.4	1.2	**1.7**	1.3
Manganese[3]		0.32	***See text***	0.048	0.0010	0.0011	0.011	0.0062	0.0089	0.0048	0.0063	0.0084	0.0047
Mercury	0.000026	0.000016	0.000026	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Molybdenum	0.073	0.037	0.073	0.00006	0.00006	0.00005	*<0.000050*	0.00007	0.00006	0.00009	0.00006	0.00012	0.00007
Nickel[3]	***equation***	0.013	0.025	0.00088	*<0.00050*	*<0.00050*	0.00095	0.00073	0.00079	0.00054	0.00050	0.00073	*<0.00050*
Phosphorus		0.0045	0.004	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*
Potassium		0.84		**2.1**	**1.2**	**1.1**	**2.1**	**1.2**	**1.0**	**1.4**	**1.1**	**1.5**	**1.2**
Rubidium				0.0028	0.0015	0.0015	0.0030	0.0019	0.0015	0.0020	0.0016	0.0022	0.0018
Selenium	0.001	0.00053	0.001	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Silicon		0.61		0.56	0.36	0.40	**0.64**	0.22	0.26	0.16	0.18	0.18	0.23
Silver	0.00025	0.00013	0.00025	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Sodium		1		**1.9**	**1.1**	**1.0**	**2.0**	0.97	0.90	**1.1**	0.95	**1.3**	**1.1**
Strontium		1.26	2.5	0.065	0.032	0.030	0.066	0.034	0.030	0.039	0.028	0.044	0.031
Sulfur				1.4	0.80	0.90	1.7	1.1	0.70	1.3	0.87	1.3	1.2
Tellurium				*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*
Thallium	0.0008	0.00013	0.0008	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Thorium				*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Tin		0.033		*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Titanium		0.00041		*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*
Tungsten				*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Uranium	0.015	0.0002	0.015	0.00005	0.00004	0.00004	0.00006	0.00004	0.00003	0.00005	0.00004	0.00006	0.00005
Vanadium		0.0006	0.12	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Zinc[3]	0.03	0.0075	***See text***	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*
Zirconium				*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*
Dissolved Metals (mg/L)													
Aluminum[3]		0.026	0.05	0.0038	0.0032	0.0034	0.0051	0.0061	0.0056	0.014	0.0028	0.0050	0.0039
Antimony		0.005	0.009	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Arsenic		0.013	0.025	0.00033	0.00023	0.00020	0.00031	0.00045	0.00038	0.00036	0.00030	0.00039	0.00032
Barium		0.5	1	0.019	0.0089	0.0090	0.021	0.0085	0.0084	0.0080	0.0069	0.010	0.0079
Beryllium		0.000115	0.00013	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*
Bismuth				*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Boron		0.76	1.5	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Cadmium		0.000023	0.00004	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Calcium		4.6		**8.7**	4.5	4.6	**9.4**	4.2	3.8	**5.0**	4.1	**5.5**	4.2
Cesium				*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Chromium		0.0026	0.005	*<0.00010*	*<0.00010*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Cobalt				*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Copper		0.0012	0.002	0.00053	0.00035	0.00041	0.00060	0.00036	0.00032	0.00052	0.00034	0.00049	0.00041
Iron		0.16	0.3	0.022	*<0.010*	*<0.010*	0.021	0.033	0.036	0.043	0.015	0.028	0.011
Lead		0.00053	0.001	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	0.00013	*<0.000050*	*<0.000050*	*<0.000050*
Lithium		0.002		0.0014	*<0.0010*	*<0.0010*	0.0014	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*	*<0.0010*
Magnesium		1.41		**2.6**	1.4	1.4	**2.7**	1.2	1.2	1.4	1.2	**1.6**	1.3
Manganese[3]		0.32	***See text***	0.049	0.00097	0.0033	0.0036	0.021	0.025	0.0019	0.00067	0.0019	0.00098
Mercury		0.000016	0.000026	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Molybdenum		0.037	0.073	*<0.000050*	0.00005	0.00006	*<0.000050*	0.00007	0.00006	0.00012	0.00008	0.00013	0.00009
Nickel		0.013	0.025	0.00086	*<0.00050*	*<0.00050*	0.0010	0.00086	0.00080	0.00076	*<0.00050*	0.00068	*<0.00050*
Phosphorus				*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*	*<0.050*
Potassium		0.84		**2.1**	**1.2**	**1.2**	**2.2**	**1.1**	**1.0**	**1.3**	**1.1**	**1.5**	**1.2**
Rubidium				0.0026	0.0015	0.0016	0.0029	0.0017	0.0015	0.0019	0.0014	0.0023	0.0018
Selenium		0.00053	0.001	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Silicon		0.57		0.51	0.34	0.38	**0.63**	0.18	0.22	0.14	0.15	0.15	0.19
Silver		0.00013	0.00025	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Sodium		1		**1.9**	**1.1**	**1.1**	**2.1**	0.96	0.91	**1.1**	0.91	**1.2**	**1.0**
Strontium		1.26	2.5	0.061	0.030	0.031	0.064	0.032	0.028	0.036	0.028	0.039	0.029
Sulfur				1.5	0.91	0.85	1.7	0.69	0.68	1.2	0.76	1.4	0.94
Tellurium				*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*
Thallium		0.00041	0.0008	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Thorium				*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Tin		0.0002		*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Titanium		0.0006		*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	*<0.00030*	**0.00089**	*<0.00030*	*<0.00030*	*<0.00030*
Tungsten				0.00033	0.00019	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	0.00055	0.00010
Uranium		0.0075	0.015	0.00005	0.00004	0.00004	0.00005	0.00004	0.00003	0.00004	0.00004	0.00005	0.00004
Vanadium		0.06	0.12	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Zinc[3]		0.0023	***See text***	0.0013	*<0.0010*	0.0016	0.0011	*<0.0010*	*<0.0010*	**0.013**	*<0.0010*	0.0011	*<0.0010*
Zirconium				*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*	*<0.00020*
Speciated Metals (µg/L)													
Arsenate (As V)				-	0.027	0.037	-	-	0.070	-	*<0.020*	*<0.020*	-
Arsenite (As III)				-	0.045	0.028	-	-	0.16	-	0.080	0.083	-
Arsenobetaine (AsB)				-	*<0.050*	*<0.050*	-	-	*<0.050*	-	*<0.050*	*<0.050*	-
Dimethylarsinic Acid (DMA)				-	*<0.020*	*<0.020*	-	-	0.061	-	0.049	0.063	-
Monomethylarsonic Acid (MMA)				-	*<0.020*	*<0.020*	-	-	*<0.020*	-	*<0.020*	*<0.020*	-
Plant Pigments (µg/L)													
Chlorophyll-a				0.27	1.4	0.63	0.52	2.4	2.3	2.7	2.8	4.2	3.0

Notes:

1. CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life, 1999, updated up to 2018.
2. Trigger and threshold values are presented in *CREMP 2015 Plan Update* (Azimuth, 2015b). A number of thresholds were derived from methods (or sources) other than CCME guidelines - see Azimuth (2015b) 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 values exceed the trigger.

123 Bold and shaded values exceed the threshold.

Italicized numbers are below detection limits.

"-" not analyzed/not sampled

n/a = issues with the water quality probe. No data collected.

underline = results were given a cautionary flag in the QC assessment (refer to **Appendix A** for details).

strikethrough = results flagged as unreliable in the QC assessment (refer to **Appendix A** for details).

Table B2-1. Water quality results from the Whale Tail study area lakes, 2021.

Lake & Area	Aquatic Life Guideline[1]	WTP Screening Values[2]		Lake A76							
Month		Triggers	Thresholds	May	May	July	July	August	August	September	September
Area-Replicate ID				A76-51	A76-52	A76-53	A76-54	A76-55	A76-56	A76-57	A76-58
Date				07-May	07-May	17-Jul	17-Jul	07-Aug	07-Aug	12-Sep	12-Sep
Time				14:22	13:51	14:25	14:50	11:04	11:30	13:05	13:20
ALS Sample ID				VA21A9149-005	VA21A9149-006	VA21B5426-001	VA21B5426-002	VA21B6886-001	VA21B6886-002	VA21C0214-011	VA21C0214-012
Field Measurements (3 m)											
Dissolved Oxygen (mg/L)				15.6	16.6	11.6	11.7	11.3	11.3	11.1	11.1
Specific Conductivity (µS/cm)				127	130	87	87	90	90	90	90
pH	6.5 - 9.0			6.6	6.6	7.0	6.9	6.9	6.9	6.6	6.8
Temperature (°C)				0.54	0.63	9.0	9.2	9.1	9.1	9.4	9.4
Physical Tests (mg/L)											
Conductivity (µS/cm)		48.6		**127**	**122**	**86**	**85**	**88**	**88**	**89**	**89**
Alkalinity - Total (as $CaCO_3$)		9.61		**12.4**	**13.2**	**9.8**	9.5	**9.7**	9.6	**11.0**	**10.6**
Alkalinity - Bicarbonate		9.60		**12.4**	**13.2**	**9.8**	9.5	**9.7**	9.6	**11.0**	**10.6**
Alkalinity - Carbonate		2.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity - Hydroxide				<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hardness (as CaCO3), dissolved		17.4		**41**	**43**	**31**	**31**	**32**	**31**	**32**	**32**
Hardness (as CaCO3), from total Ca/Mg				43	45	31	30	31	31	31	29
pH (Laboratory)	6.5 - 9.0	6.57-7.97	6.5-9.0	7.1	7.1	7.2	7.2	7.2	7.2	7.3	7.2
Total Dissolved Solids		38.5		**85**	**88**	**62**	**64**	**71**	**77**	**70**	**67**
Total Suspended Solids		3	5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Turbidity (NTU)				<0.10	<0.10	0.20	0.22	0.31	0.30	0.40	0.33
Anions and Nutrients (mg/L)											
Total Kjeldahl Nitrogen		0.17		0.13	0.13	0.11	0.094	0.13	0.14	0.17	0.17
Ammonia (as N)[3]	***equation***	0.065	0.126	0.022	0.015	<0.0050	<0.0050	<0.0050	<0.0050	0.0076	0.0073
Bromide				0.18	0.18	0.12	0.12	0.12	0.12	0.12	0.12
Chloride	120	60.4	120	18.2	18.9	12.4	12.4	13.2	13.2	12.8	12.4
Fluoride	0.12	0.077	0.12	0.041	0.044	0.030	0.030	0.038	0.041	0.039	0.037
Nitrate (as N)	3	1.5	3	0.15	0.12	0.074	0.075	0.038	0.038	0.038	0.033
Nitrite (as N)	0.06	0.031	0.06	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Ortho Phosphate (as P)		0.0022		0.0018	0.0016	0.0013	0.0016	<0.0010	<0.0010	0.0015	**0.0023**
Phosphorus (P)-Total	0.01	0.0045	0.01	**0.012**	<0.0020	0.0037	**0.0096**	0.0034	0.0028	0.0035	0.0043
Phosphorus (P)-Total Diss.				<0.0020	<0.0020	0.0024	0.0022	<0.0020	<0.0020	0.0021	<0.0020
Reactive Silica (as SiO_2)		1.33		**1.4**	**1.6**	0.96	0.90	0.57	0.59	<0.50	<0.50
Sulphate (SO_4)		64.8	128	10.8	11.0	7.5	7.5	8.3	8.3	8.8	8.3
Organic / Inorganic Carbon (mg/L)											
Dissolved Organic Carbon		2.43		1.6	1.9	1.6	1.5	1.6	1.5	1.7	1.8
Total Organic Carbon		2.42		1.7	1.7	1.3	1.6	1.5	1.7	1.8	1.8
Total Metals (mg/L)											
Aluminum[3]	***equation***	0.052	0.1	<0.0030	<0.0030	0.011	0.0072	0.0056	0.0061	0.0058	0.0050
Antimony		0.0046	0.009	0.00012	0.00012	<0.00010	0.00011	0.00012	0.00013	0.00019	0.00018
Arsenic	0.005	0.013	0.025	0.00028	0.00028	0.00030	0.00030	0.00035	0.00032	0.00034	0.00035
Barium		0.5	1	0.019	0.019	0.015	0.014	0.014	0.014	0.014	0.012
Beryllium		0.000115	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth				<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	1.5	0.76	1.5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium[3]	***equation***	0.000023	0.00004	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium		4.6		**12.4**	**12.9**	**8.8**	**8.7**	**8.8**	**8.9**	**8.9**	**8.1**
Chromium[4]	0.001	0.0025	0.005	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00062
Cobalt				<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper[3]	***equation***	0.0013	0.002	0.00053	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Iron	0.3	0.16	0.3	<0.010	<0.010	0.015	0.016	0.015	0.015	0.011	0.011
Lead[3]	***equation***	0.00053	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium		0.002		0.0013	0.0014	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium		1.41		**2.9**	**3.0**	**2.1**	**2.1**	**2.2**	**2.2**	**2.2**	**2.1**
Manganese[3]		0.32	***See text***	0.00068	0.00061	0.0019	0.0020	0.0016	0.0016	0.0015	0.0015
Mercury	0.000026	0.000016	0.000026	<0.0000050	<0.0000050	0.00001	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum	0.073	0.037	0.073	0.00017	0.00017	0.00012	0.00014	0.00014	0.00014	0.00016	0.00017
Nickel[3]	***equation***	0.013	0.025	0.00093	0.00094	0.00089	0.00090	0.00073	0.00074	0.00072	0.00090
Phosphorus		0.0045	0.004	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium		0.84		**2.3**	**2.4**	**1.8**	**1.8**	**1.8**	**1.8**	**1.9**	**1.7**
Rubidium				0.0026	0.0028	0.0021	0.0022	0.0021	0.0021	0.0024	0.0022
Selenium	0.001	0.00053	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon		0.61		**0.76**	**0.77**	0.51	0.48	0.39	0.40	0.26	0.26
Silver	0.00025	0.00013	0.00025	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium		1		**1.8**	**1.9**	**1.4**	**1.3**	**1.3**	**1.3**	**1.4**	**1.3**
Strontium		1.26	2.5	0.077	0.081	0.053	0.054	0.057	0.057	0.059	0.054
Sulfur				3.5	3.4	2.3	2.2	2.6	2.8	3.1	3.5
Tellurium				<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Thallium	0.0008	0.00013	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Thorium				<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin		0.033		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium		0.00041		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Tungsten				<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Uranium	0.015	0.0002	0.015	0.00002	0.00002	0.00003	0.00003	0.00003	0.00003	0.00004	0.00003
Vanadium		0.0006	0.12	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc[3]	0.03	0.0075	***See text***	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Zirconium				<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Dissolved Metals (mg/L)											
Aluminum[3]		0.026	0.05	<0.0010	<0.0010	0.0026	0.0021	0.0017	0.0017	0.0020	0.0022
Antimony		0.005	0.009	0.00010	0.00010	0.00010	0.00010	0.00012	0.00011	0.00018	0.00017
Arsenic		0.013	0.025	0.00025	0.00027	0.00028	0.00027	0.00028	0.00028	0.00028	0.00034
Barium		0.5	1	0.019	0.020	0.015	0.015	0.014	0.014	0.015	0.016
Beryllium		0.000115	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth				<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron		0.76	1.5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium		0.000023	0.00004	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium		4.6		**11.2**	**11.9**	**8.8**	**8.7**	**8.9**	**8.5**	**9.1**	**9.0**
Cesium				<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Chromium		0.0026	0.005	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt				<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper		0.0012	0.002	0.00043	0.00045	0.00031	0.00041	0.00034	0.00045	0.00049	0.00051
Iron		0.16	0.3	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Lead		0.00053	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium		0.002		0.0011	0.0012	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium		1.41		**3.2**	**3.2**	**2.2**	**2.2**	**2.3**	**2.3**	**2.3**	**2.3**
Manganese[3]		0.32	***See text***	0.00013	0.00015	0.0010	0.0011	0.00019	0.00066	0.00087	0.00086
Mercury		0.000016	0.000026	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum		0.037	0.073	0.00015	0.00016	0.00011	0.00013	0.00019	0.00013	0.00016	0.00017
Nickel		0.013	0.025	0.00091	0.00091	0.00084	0.00089	0.00069	0.00063	0.00076	0.00079
Phosphorus				<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium		0.84		**2.3**	**2.4**	**1.8**	**1.8**	**1.9**	**1.8**	**2.0**	**2.1**
Rubidium				0.0025	0.0029	0.0021	0.0020	0.0021	0.0021	0.0024	0.0025
Selenium		0.00053	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon		0.57		**0.71**	**0.75**	0.48	0.49	0.35	0.35	0.23	0.24
Silver		0.00013	0.00025	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium		1		**1.8**	**1.9**	**1.3**	**1.3**	**1.3**	**1.4**	**1.4**	**1.4**
Strontium		1.26	2.5	0.069	0.073	0.052	0.053	0.057	0.052	0.055	0.054
Sulfur				3.3	3.3	2.7	2.4	2.8	2.7	2.6	2.9
Tellurium				<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Thallium		0.00041	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Thorium				<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin		0.0002		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium		0.0006		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Tungsten				<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Uranium		0.0075	0.015	0.00002	0.00002	0.00003	0.00003	0.00002	0.00003	0.00003	0.00004
Vanadium		0.06	0.12	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc[3]		0.0023	***See text***	0.0021	0.0017	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zirconium				<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Speciated Metals (µg/L)											
Arsenate (As V)				0.081	-	-	<0.020	-	<0.020	<0.020	-
Arsenite (As III)				0.028	-	-	0.14	-	0.12	0.13	-
Arsenobetaine (AsB)				<0.050	-	-	<0.050	-	<0.050	<0.050	-
Dimethylarsinic Acid (DMA)				0.028	-	-	0.030	-	0.025	0.033	-
Monomethylarsonic Acid (MMA)				<0.020	-	-	<0.020	-	<0.020	<0.020	-
Plant Pigments (µg/L)											
Chlorophyll-a				0.67	0.60	0.64	0.72	1.0	1.3	2.4	2.7

Lake & Area	Lake DS1							
Month	May	May	July	July	August	August	September	September
Area-Replicate ID	DS1-49	DS1-50	DS1-51	DS1-52	DS1-53	DS1-54	DS1-55	DS1-56
Date	07-May	07-May	19-Jul	19-Jul	15-Aug	15-Aug	12-Sep	12-Sep
Time	12:15	9:30	15:26	14:52	11:37	12:30	11:40	11:15
ALS Sample ID	VA21A9149-003	VA21A9149-004	VA21B5426-003	VA21B5426-004	VA21B7541-005	VA21B7541-006	VA21C0214-013	VA21C0214-014
Field Measurements (3 m)								
Dissolved Oxygen (mg/L)	18.1	15.3	11.1	11.0	11.7	11.8	11.0	11.1
Specific Conductivity (µS/cm)	63	37	15.6	26	24	27	21	33
pH	6.6	7.0	6.6	6.8	6.6	6.6	6.8	6.8
Temperature (°C)	0.96	0.72	11.6	12.1	8.0	7.6	9.4	85
Physical Tests (mg/L)								
Conductivity (µS/cm)	**63**	35	16.4	26	22	25	21	32
Alkalinity - Total (as $CaCO_3$)	**10.7**	7.3	3.7	5.0	5.7	5.3	4.7	6.4
Alkalinity - Bicarbonate	**10.7**	7.3	3.7	5.0	5.7	5.3	4.7	6.4
Alkalinity - Carbonate	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity - Hydroxide	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hardness (as CaCO3), dissolved	**22**	12.2	5.2	9.2	8.3	9.4	7.2	11.2
Hardness (as CaCO3), from total Ca/Mg	22	12.3	5.2	8.8	7.4	8.6	7.2	10.9
pH (Laboratory)	6.9	6.8	6.7	6.8	6.8	6.8	6.9	7.0
Total Dissolved Solids	**43**	16.6	11.5	17.6	12.4	15.6	14.9	22
Total Suspended Solids	<1.0	<1.0	<1.0	1.1	<1.0	<1.0	<1.0	<1.0
Turbidity (NTU)	0.14	<0.10	0.35	0.30	0.41	0.42	0.29	0.41
Anions and Nutrients (mg/L)								
Total Kjeldahl Nitrogen	**0.26**	0.13	0.16	0.12	0.10	0.13	0.13	0.15
Ammonia (as N)[3]	0.020	0.0080	0.044	<0.0050	<0.0050	<0.0050	0.0053	<0.0050
Bromide	0.054	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride	7.5	3.4	1.2	2.6	2.3	2.5	1.9	3.1
Fluoride	0.052	0.058	0.047	0.028	0.047	0.033	0.052	0.038
Nitrate (as N)	0.018	0.019	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0065
Nitrite (as N)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Ortho Phosphate (as P)	0.0017	0.0020	0.0011	0.0013	<0.0010	<0.0010	0.0017	0.0020
Phosphorus (P)-Total	**0.0066**	0.0024	0.0039	0.0038	0.0024	0.0031	0.0030	0.0042
Phosphorus (P)-Total Diss.	0.0023	<0.0020	0.0021	0.0026	0.0021	<0.0020	0.0022	0.0026
Reactive Silica (as SiO_2)	**2.2**	0.91	<0.50	0.76	0.67	1.3	0.76	**1.5**
Sulphate (SO_4)	5.1	2.4	0.92	1.8	1.7	2.0	1.6	2.5
Organic / Inorganic Carbon (mg/L)								
Dissolved Organic Carbon	**2.5**	**2.5**	2.1	2.2	**2.6**	**3.4**	2.4	**3.1**
Total Organic Carbon	**2.6**	2.4	2.1	2.1	2.4	**3.3**	2.3	**3.3**
Total Metals (mg/L)								
Aluminum[3]	0.0048	0.0059	0.018	0.015	0.022	0.032	0.020	0.025
Antimony	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	0.00014	0.00016	0.00010	0.00012	0.00013	0.00012	0.00013	0.00017
Barium	0.010	0.0058	0.0041	0.0047	0.0044	0.0042	0.0047	0.0055
Beryllium	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium[3]	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	**6.2**	3.2	1.4	2.4	1.9	2.4	1.9	3.0
Chromium[4]	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper[3]	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00054
Iron	<0.010	<0.010	0.031	0.049	0.043	0.053	0.032	0.074
Lead[3]	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.00009	<0.000050
Lithium	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	**1.6**	1.0	0.44	0.68	0.63	0.66	0.60	0.86
Manganese[3]	0.0019	0.00080	0.0014	0.0015	0.0012	0.0011	0.0014	0.0022
Mercury	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum	0.00006	0.00005	<0.000050	<0.000050	<0.000050	0.00005	<0.000050	0.00007
Nickel[3]	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Phosphorus	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium	**1.1**	0.58	0.35	0.53	0.42	0.45	0.44	0.65
Rubidium	0.0013	0.00078	0.00049	0.00062	0.00066	0.00061	0.00064	0.00088
Selenium	<0.000050	<0.000050	<0.000050	<0.000050	0.00005	<0.000050	<0.000050	<0.000050
Silicon	**1.1**	0.50	0.27	0.45	0.33	0.61	0.40	**0.74**
Silver	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	**1.7**	**1.0**	0.67	0.82	0.73	0.82	0.79	1.0
Strontium	0.033	0.017	0.0082	0.013	0.012	0.013	0.011	0.016
Sulfur	1.5	0.56	<0.50	<0.50	0.77	0.58	0.52	1.0
Tellurium	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Thallium	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Thorium	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	<0.00030	<0.00030	<0.00030	<0.00030	0.00040	<0.00060	<0.00030	0.00032
Tungsten	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Uranium	0.00003	0.00004	0.00005	0.00005	0.00005	0.00008	0.00005	0.00008
Vanadium	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc[3]	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Zirconium	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Dissolved Metals (mg/L)								
Aluminum[3]	0.0030	0.0039	0.011	0.0097	0.013	0.025	0.0098	0.016
Antimony	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	0.00013	0.00012	<0.00010	<0.00010	0.00012	0.00011	<0.00010	0.00012
Barium	0.011	0.0058	0.0041	0.0049	0.0047	0.0047	0.0048	0.0061
Beryllium	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium	**5.8**	3.0	1.4	2.5	2.2	2.5	1.9	3.1
Cesium	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Chromium	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	0.00041	0.00039	0.00021	0.00029	0.00030	0.00043	0.00036	0.00063
Iron	<0.010	<0.010	0.012	0.030	0.017	0.035	0.012	0.047
Lead	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	~~0.0126~~	<0.000050	<0.000050
Lithium	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	**1.8**	1.1	0.44	0.71	0.69	0.74	0.58	0.85
Manganese[3]	0.0014	0.00038	0.00079	0.0012	0.00050	0.00078	0.00048	0.0018
Mercury	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum	0.00006	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.00006
Nickel	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00051
Phosphorus	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium	**1.1**	0.58	0.34	0.53	0.48	0.53	0.43	0.74
Rubidium	0.0013	0.00075	0.00050	0.00067	0.00059	0.00057	0.00063	0.00085
Selenium	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon	**1.1**	0.48	0.25	0.42	0.34	**0.66**	0.37	**0.72**
Silver	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	**1.8**	**1.1**	0.65	0.81	0.80	0.92	0.75	1.00
Strontium	0.031	0.016	0.0078	0.012	0.012	0.013	0.010	0.016
Sulfur	1.5	0.67	<0.50	<0.50	0.78	0.84	<0.50	0.89
Tellurium	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Thallium	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Thorium	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Tungsten	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Uranium	0.00003	0.00004	0.00004	0.00004	0.00004	0.00007	0.00005	0.00007
Vanadium	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc[3]	0.0011	**0.0026**	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zirconium	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Speciated Metals (µg/L)								
Arsenate (As V)	<0.020	-	-	<0.020	<0.020	-	<0.020	-
Arsenite (As III)	0.023	-	-	0.026	0.029	-	<0.020	-
Arsenobetaine (AsB)	<0.050	-	-	<0.050	<0.050	-	<0.050	-
Dimethylarsinic Acid (DMA)	<0.020	-	-	<0.020	<0.020	-	<0.020	-
Monomethylarsonic Acid (MMA)	<0.020	-	-	<0.020	<0.020	-	<0.020	-
Plant Pigments (µg/L)								
Chlorophyll-a	2.4	0.82	0.66	0.63	0.67	0.40	1.2	1.3

Notes:

1. CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life, 1999, updated up to 2018.
2. Trigger and threshold values are presented in *CREMP 2015 Plan Update* (Azimuth, 2015b). A number of thresholds were derived from methods (or sources) other than CCME guidelines - see Azimuth (2015b) 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 values exceed the trigger.

123 Bold and shaded values exceed the threshold.

Italicized numbers are below detection limits.

"-" not analyzed/not sampled

n/a = issues with the water quality probe. No data collected.

underline = results were given a cautionary flag in the QC assessment (refer to **Appendix A** for details).

~~strikethrough~~ = results flagged as unreliable in the QC assessment (refer to **Appendix A** for details).

Table B2-1. Water quality results from the Whale Tail study area lakes, 2021.

Lake & Area	Aquatic Life Guideline[1]	WTP Screening Values[2]		Nemo Lake									
Month				March	March	May	May	July	July	August	August	September	September
Area-Replicate ID				NEM-57	NEM-58	NEM-59	NEM-60	NEM-61	NEM-62	NEM-63	NEM-64	NEM-65	NEM-66
Date				24-Mar	24-Mar	06-May	06-May	10-Jul	10-Jul	07-Aug	07-Aug	09-Sep	09-Sep
Time		Triggers	Thresholds	13:20	13:45	14:40	14:00	16:08	16:29	17:00	16:40	10:00	10:20
ALS Sample ID				VA21A6300-007	VA21A6300-008	VA21A9149-001	VA21A9149-002	VA21B4721-005	VA21B4721-006	VA21B6886-003	VA21B6886-004	VA21C0214-007	VA21C0214-008
Field Measurements (3 m)													
Dissolved Oxygen (mg/L)				16.5	15.3	15.0	15.6	12.9	13.1	11.1	11.2	11.1	11.1
Specific Conductivity (µS/cm)				129	119	127	134	91	91	92	92	88	88
pH	6.5 - 9.0			7.0	7.0	6.6	6.7	6.9	6.9	6.9	6.9	6.9	7.0
Temperature (°C)				0.60	0.73	0.58	0.53	7.0	7.2	9.6	9.3	9.7	9.7
Physical Tests (mg/L)													
Conductivity (µS/cm)		48.6		**118**	**111**	**116**	**125**	**89**	**90**	**90**	**90**	**88**	**87**
Alkalinity - Total (as $CaCO_3$)		9.61		**12.8**	**12.3**	**11.2**	**12.2**	**10.9**	**10.2**	9.6	9.6	**9.9**	**9.8**
Alkalinity - Bicarbonate		9.60		**12.8**	**12.3**	**11.2**	**12.2**	**10.9**	**10.2**	9.6	9.6	**9.9**	**9.8**
Alkalinity - Carbonate		2.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity - Hydroxide				<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hardness (as CaCO3), dissolved		17.4		**47**	**44**	**43**	**46**	**36**	**36**	**34**	**32**	**32**	**31**
Hardness (as CaCO3), from total Ca/Mg				46	42	46	47	35	36	33	34	33	33
pH (Laboratory)	6.5 - 9.0	6.57-7.97	6.5-9.0	7.2	7.2	7.0	7.1	7.2	7.2	7.2	7.2	7.3	7.2
Total Dissolved Solids		38.5		**90**	**85**	**88**	**100**	**51**	**59**	**83**	**82**	**64**	**69**
Total Suspended Solids		3	5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Turbidity (NTU)				<0.10	<0.10	<0.10	<0.10	0.18	0.20	0.18	0.21	0.20	0.19
Anions and Nutrients (mg/L)													
Total Kjeldahl Nitrogen		0.17		0.16	0.16	0.17	0.17	0.12	0.14	0.12	0.13	0.13	0.14
Ammonia (as N)[3]	***equation***	0.065	0.126	0.035	0.034	0.053	0.044	0.0089	<0.0050	0.0052	0.013	0.0060	<0.0050
Bromide				0.17	0.16	0.15	0.17	0.11	0.12	0.11	0.10	0.11	0.10
Chloride	120	60.4	120	23	21	23	24	16.8	16.8	16.5	16.5	15.7	15.7
Fluoride	0.12	0.077	0.12	0.033	0.031	0.033	0.034	0.026	0.027	0.031	0.032	0.027	0.026
Nitrate (as N)	3	1.5	3	0.099	0.10	0.11	0.11	0.068	0.068	0.037	0.037	0.014	0.013
Nitrite (as N)	0.06	0.031	0.06	<0.0010	<0.0010	0.0024	0.0012	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Ortho Phosphate (as P)		0.0022		<0.0010	<0.0010	<0.0010	0.0018	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0014
Phosphorus (P)-Total	0.01	0.0045	0.01	0.0029	0.0030	0.0032	0.0034	0.0026	0.0028	<0.0020	0.0030	0.0034	0.0034
Phosphorus (P)-Total Diss.				<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0032	<0.0020	<0.0020	0.0022	<0.0020
Reactive Silica (as SiO_2)		1.33		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Sulphate (SO_4)		64.8	128	5.6	5.2	5.5	5.8	4.1	4.1	4.4	4.4	4.3	4.2
Organic / Inorganic Carbon (mg/L)													
Dissolved Organic Carbon		2.43		2.3	1.9	**4.8**	2.0	1.7	1.6	1.8	1.8	1.7	1.8
Total Organic Carbon		2.42		**4.7**	**2.7**	**8.2**	2.0	1.5	1.9	1.8	1.6	1.8	1.7
Total Metals (mg/L)													
Aluminum[3]	***equation***	0.052	0.1	<0.0030	<0.0030	<0.0030	<0.0030	0.0047	0.0052	0.0088	0.0092	0.0066	0.0069
Antimony		0.0046	0.009	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	0.005	0.013	0.025	0.00054	0.00054	0.00054	0.00056	0.0010	0.00097	0.00088	0.00089	0.00089	0.00090
Barium		0.5	1	0.022	0.021	0.020	0.022	0.018	0.018	0.017	0.018	0.016	0.016
Beryllium		0.000115	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth				<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	1.5	0.76	1.5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium[3]	***equation***	0.000023	0.00004	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium		4.6		**14.0**	**12.6**	**14.4**	**14.5**	**10.7**	**11.1**	**10.1**	**10.2**	**9.9**	**9.6**
Chromium[4]	0.001	0.0025	0.005	<0.00010	<0.00010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt				<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper[3]	***equation***	0.0013	0.002	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Iron	0.3	0.16	0.3	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.016	0.016	0.012	0.013
Lead[3]	***equation***	0.00053	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium		0.002		**0.0022**	0.0020	**0.0024**	**0.0024**	0.0018	0.0018	0.0015	0.0015	0.0015	0.0015
Magnesium		1.41		**2.6**	**2.4**	**2.3**	**2.5**	**1.9**	**1.9**	**1.9**	**2.0**	**2.0**	**2.1**
Manganese[3]		0.32	***See text***	0.00081	0.0011	0.0011	0.00065	0.0017	0.0019	0.0028	0.0028	0.0031	0.0036
Mercury	0.000026	0.000016	0.000026	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.00001	<0.0000050	<0.0000050	<0.0000050
Molybdenum	0.073	0.037	0.073	0.00016	0.00013	0.00013	0.00014	0.00009	0.00010	0.00011	0.00009	0.00011	0.00010
Nickel[3]	***equation***	0.013	0.025	0.0014	0.0014	0.0013	0.0015	0.0016	0.0016	0.0014	0.0014	0.0014	0.0014
Phosphorus		0.0045	0.004	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium		0.84		**1.8**	**1.7**	**1.7**	**1.8**	**1.4**	**1.4**	**1.5**	**1.5**	**1.5**	**1.5**
Rubidium				0.0026	0.0025	0.0023	0.0025	0.0022	0.0022	0.0022	0.0023	0.0023	0.0023
Selenium	0.001	0.00053	0.001	<0.000050	<0.000050	<0.000050	0.00006	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon		0.61		<0.10	0.11	0.13	0.12	0.13	0.14	0.11	<0.10	0.17	<0.10
Silver	0.00025	0.00013	0.00025	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium		1		**1.3**	**1.2**	**1.1**	**1.2**	0.90	0.92	0.88	0.89	0.91	0.96
Strontium		1.26	2.5	0.090	0.085	0.091	0.098	0.068	0.068	0.068	0.067	0.066	0.064
Sulfur				2.1	1.8	1.7	1.8	1.4	1.4	1.5	1.4	1.5	1.6
Tellurium				<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Thallium	0.0008	0.00013	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Thorium				<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin		0.033		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium		0.00041		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	0.00039	0.00036	<0.00030	<0.00030
Tungsten				<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Uranium	0.015	0.0002	0.015	0.00002	0.00002	0.00002	0.00002	0.00001	0.00001	0.00002	0.00002	0.00002	0.00002
Vanadium		0.0006	0.12	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc[3]	0.03	0.0075	***See text***	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Zirconium				<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Dissolved Metals (mg/L)													
Aluminum[3]		0.026	0.05	0.0012	0.0022	0.0016	<0.0010	0.0030	0.0022	0.0047	0.0036	0.0021	0.0022
Antimony		0.005	0.009	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic		0.013	0.025	0.00051	0.00052	0.00048	0.00054	0.00088	0.00098	0.00081	0.00078	0.00073	0.00071
Barium		0.5	1	0.022	0.022	0.021	0.023	0.019	0.019	0.017	0.016	0.016	0.016
Beryllium		0.000115	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth				<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron		0.76	1.5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium		0.000023	0.00004	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium		4.6		**14.2**	**13.2**	**13.1**	**13.8**	**11.1**	**10.7**	**10.1**	**9.6**	**9.5**	**9.4**
Cesium				0.00001	<0.000010	<0.000010	<0.000010	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Chromium		0.0026	0.005	<0.00010	<0.00010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt				<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper		0.0012	0.002	0.00030	0.00029	0.00034	0.00035	0.00027	0.00027	0.00034	0.00032	0.00039	0.00039
Iron		0.16	0.3	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Lead		0.00053	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium		0.002		**0.0023**	**0.0021**	0.0020	**0.0021**	0.0016	0.0016	0.0015	0.0014	0.0014	0.0014
Magnesium		1.41		**2.8**	**2.6**	**2.5**	**2.7**	**2.1**	**2.1**	**2.0**	**2.0**	**1.9**	**1.9**
Manganese[3]		0.32	***See text***	0.00027	0.00024	0.00026	0.00015	0.0041	0.0042	0.0016	0.0014	0.00082	0.0011
Mercury		0.000016	0.000026	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum		0.037	0.073	0.00014	0.00013	0.00012	0.00013	0.00009	0.00009	0.00009	0.00009	0.00009	0.00008
Nickel		0.013	0.025	0.0014	0.0014	0.0014	0.0015	0.0017	0.0018	0.0014	0.0014	0.0013	0.0012
Phosphorus				<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium		0.84		**1.9**	**1.8**	**1.7**	**1.9**	**1.6**	**1.6**	**1.5**	**1.5**	**1.5**	**1.4**
Rubidium				0.0026	0.0024	0.0025	0.0025	0.0026	0.0025	0.0023	0.0021	0.0022	0.0021
Selenium		0.00053	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon		0.57		0.080	0.094	0.11	0.086	0.087	0.095	<0.050	<0.050	<0.050	<0.050
Silver		0.00013	0.00025	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium		1		**1.3**	**1.2**	**1.2**	**1.3**	1.00	0.99	0.96	0.94	0.86	0.85
Strontium		1.26	2.5	0.092	0.083	0.084	0.091	0.069	0.069	0.062	0.062	0.063	0.059
Sulfur				1.9	1.8	1.6	1.7	1.1	1.2	1.4	1.5	1.4	1.4
Tellurium				<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Thallium		0.00041	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Thorium				<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin		0.0002		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium		0.0006		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Tungsten				0.00050	0.00032	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Uranium		0.0075	0.015	0.00002	0.00002	0.00002	0.00002	0.00001	0.00001	0.00002	0.00002	0.00002	0.00002
Vanadium		0.06	0.12	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc[3]		0.0023	***See text***	<0.0010	0.0015	0.0018	<0.0010	<0.0010	<0.0010	**0.0038**	<0.0010	<0.0010	<0.0010
Zirconium				<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Speciated Metals (µg/L)													
Arsenate (As V)				0.17	-	-	0.27	0.078	-	0.10	-	-	0.087
Arsenite (As III)				0.087	-	-	<0.020	0.55	-	0.39	-	-	0.36
Arsenobetaine (AsB)				<0.050	-	-	<0.050	<0.050	-	<0.050	-	-	<0.050
Dimethylarsinic Acid (DMA)				0.061	-	-	<0.020	0.062	-	0.083	-	-	0.099
Monomethylarsonic Acid (MMA)				0.021	-	-	0.027	<0.020	-	<0.020	-	-	<0.020
Plant Pigments (µg/L)													
Chlorophyll-a				0.99	0.97	0.54	0.66	0.52	0.50	0.21	0.42	1.3	1.4

Notes:

1. CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life, 1999, updated up to 2018.
2. Trigger and threshold values are presented in *CREMP 2015 Plan Update* (Azimuth, 2015b). A number of thresholds were derived from methods (or sources) other than CCME guidelines - see Azimuth (2015b) 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 values exceed the trigger.

123 Bold and shaded values exceed the threshold.

Italicized numbers are below detection limits.

"-" not analyzed/not sampled

n/a = issues with the water quality probe. No data collected.

underline = results were given a cautionary flag in the QC assessment (refer to **Appendix A** for details).

strikethrough = results flagged as unreliable in the QC assessment (refer to **Appendix A** for details).

Table B2-2. Water chemistry data screening against FEIS predictions for Whale Tail South, 2021.

Lake & Area	WTS FEIS Predictions					Whale Tail Lake South Basin (Impoundment)									
Month						March	March	May	May	July	July	August	August	September	September
Area-Replicate ID						WTS-57	WTS-58	WTS-59	WTS-60	WTS-61	WTS-62	WTS-63	WTS-64	WTS-65	WTS-66
Date	March	May	July	August	September	25-Mar	25-Mar	12-May	12-May	08-Jul	08-Jul	10-Aug	10-Aug	08-Sep	08-Sep
Time						15:30	15:05	17:15	17:48	15:37	16:10	4:30	15:27	13:40	14:05
ALS Sample ID						VA21A6300-001	VA21A6300-002	VA21A9444-016	VA21A9444-017	VA21B4721-001	VA21B4721-002	VA21B7111-003	VA21B7111-004	VA21C0214-003	VA21C0214-004
Physical Tests (mg/L)															
Alkalinity - Total (as $CaCO_3$)	5.5	5.5	5.8	6.4	7.0	**17.4**	**17.7**	**16.2**	**16.9**	**15.3**	**15.1**	**13.9**	**13.6**	**12.9**	**13.5**
Total Dissolved Solids	14.6	14.6	16.6	18.6	20	**86**	**89**	**100**	**104**	**57**	**52**	**76**	**74**	**51**	**57**
Anions and Nutrients (mg/L)															
Ammonia (as N)	0.010	0.010	0.016	0.018	0.020	0.0050	*<0.0050*	*<0.0050*	*<0.0050*	**0.043**	**0.030**	**0.030**	**0.058**	0.018	0.012
Chloride	4.4	4.4	4.5	4.8	5.0	**17.4**	**18.0**	**18.1**	**18.9**	**12.4**	**12.5**	**11.2**	**11.1**	**10.2**	**10.2**
Fluoride	0.032	0.032	0.033	0.036	0.038	**0.062**	**0.064**	**0.058**	**0.061**	**0.056**	**0.054**	**0.051**	**0.051**	**0.052**	**0.053**
Nitrate (as N)	0.023	0.024	0.30	0.36	0.43	**0.49**	**0.51**	**0.51**	**0.54**	**0.38**	**0.39**	0.24	0.24	0.19	0.19
Phosphorus (P)-Total	0.0051	0.0051	0.0055	0.0059	0.0063	**0.0075**	**0.0059**	0.0036	0.0038	0.0046	0.0045	0.0038	0.0045	**0.0096**	**0.0070**
Sulphate (SO_4)	1.7	1.7	2.0	2.4	2.7	**8.1**	**8.5**	**8.4**	**8.9**	**6.8**	**6.9**	**6.2**	**6.1**	**6.0**	**6.0**
Total Metals (mg/L)															
Aluminum	0.0041	0.0041	0.0039	0.0040	0.0040	**0.0064**	**0.0059**	**0.0061**	**0.0056**	**0.024**	**0.014**	**0.015**	**0.014**	**0.0081**	**0.010**
Antimony	0.00011	0.00011	0.00015	0.00021	0.00026	**0.00018**	**0.00022**	**0.00018**	**0.00019**	**0.00029**	**0.00029**	**0.00024**	**0.00024**	0.00022	0.00022
Arsenic	0.00021	0.00021	0.0024	0.0031	0.0041	**0.00076**	**0.00082**	**0.00070**	**0.00078**	0.0016	0.0017	0.0011	0.0011	0.0010	0.0010
Barium	0.0052	0.0052	0.0053	0.0058	0.0063	**0.022**	**0.023**	**0.023**	**0.024**	**0.020**	**0.020**	**0.016**	**0.016**	**0.014**	**0.015**
Beryllium	0.00002	0.00002	0.00002	0.00002	0.00002	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*	*<0.000100*
Bismuth	0.00005	0.00005	0.00005	0.00005	0.00005	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Boron	0.014	0.014	0.017	0.021	0.026	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*	*<0.010*
Cadmium	0.00001	0.00001	0.00001	0.00001	0.00001	*<0.0000050*	*<0.0000050*	0.00001	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Calcium	2.6	2.6	2.7	2.9	3.1	**11.9**	**12.2**	**13.2**	**13.8**	**10.1**	**10.1**	**8.9**	**8.9**	**7.5**	**7.8**
Chromium	0.00014	0.00014	0.00018	0.00023	0.00027	**0.00015**	**0.00015**	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Cobalt	0.00012	0.00012	0.00014	0.00017	0.00020	0.00012	0.00012	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Copper	0.00056	0.00056	0.00060	0.00067	0.00072	**0.00075**	**0.00086**	**0.00078**	**0.00074**	0.00058	**0.00063**	0.00056	0.00056	0.00057	0.00058
Iron	0.025	0.025	0.031	0.034	0.037	**0.10**	**0.10**	**0.082**	**0.083**	**0.11**	**0.064**	**0.054**	**0.060**	**0.049**	**0.053**
Lead	0.00007	0.00007	0.00008	0.00010	0.00011	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Lithium	0.0011	0.0011	0.0011	0.0012	0.0013	**0.0024**	**0.0024**	**0.0026**	**0.0026**	**0.0020**	**0.0020**	**0.0017**	**0.0017**	**0.0015**	**0.0016**
Magnesium	0.95	0.95	0.96	1.0	1.1	**3.0**	**3.1**	**3.0**	**3.2**	**2.5**	**2.4**	**2.2**	**2.3**	**2.1**	**2.1**
Manganese	0.0040	0.0040	0.0074	0.012	0.016	**0.048**	**0.051**	**0.043**	**0.046**	**0.039**	**0.043**	0.0084	0.0094	0.0093	0.011
Mercury	0.00001	0.00001	0.00001	0.00001	0.00001	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*	*<0.0000050*
Molybdenum	0.00024	0.00024	0.00027	0.00033	0.00038	**0.00065**	**0.00076**	**0.00054**	**0.00063**	**0.00047**	**0.00049**	**0.00041**	**0.00040**	**0.00040**	0.00034
Nickel	0.00073	0.00073	0.00096	0.0013	0.0016	**0.0026**	**0.0026**	**0.0027**	**0.0027**	**0.0031**	**0.0033**	**0.0019**	**0.0019**	**0.0017**	**0.0017**
Potassium	0.46	0.46	0.52	0.62	0.72	**2.7**	**2.8**	**2.8**	**2.9**	**2.4**	**2.3**	**2.3**	**2.3**	**2.1**	**2.1**
Selenium	0.00006	0.00006	0.00007	0.00008	0.00010	*<0.000050*	**0.00006**	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*	*<0.000050*
Silver	0.00001	0.00001	0.00001	0.00001	0.00001	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Sodium	1.0	1.0	1.2	1.4	1.6	**2.2**	**2.3**	**2.2**	**2.3**	**1.8**	**1.7**	**1.6**	**1.6**	1.5	1.5
Strontium	0.018	0.018	0.018	0.020	0.021	**0.099**	**0.11**	**0.10**	**0.11**	**0.077**	**0.079**	**0.072**	**0.072**	**0.063**	**0.065**
Thallium	0.00001	0.00001	0.00001	0.00001	0.00001	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*	*<0.000010*
Tin	0.00010	0.00010	0.00010	0.00011	0.00011	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*	*<0.00010*
Uranium	0.00009	0.00009	0.00011	0.00013	0.00015	**0.00015**	**0.00017**	**0.00013**	**0.00014**	0.00008	0.00009	0.00007	0.00008	0.00007	0.00007
Vanadium	0.00052	0.00052	0.00053	0.00057	0.00061	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*	*<0.00050*
Zinc	0.0012	0.0012	0.0013	0.0014	0.0014	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*	*<0.0030*

Notes:

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

123 Bolded values exceed FEIS by < 10X.

123 Bold and shaded values exceed the FEIS by ≥ 10X.

Italicized numbers are below detection limits.

"-" not analyzed/not sampled.

Table B2-3. Water chemistry data screening against FEIS predictions for Mammoth Lake, 2021.

Lake & Area	MAM FEIS Predictions					Mammoth Lake									
Month						March	March	May	May	July	July	August	August	September	September
Area-Replicate ID						MAM-57	MAM-58	MAM-59	MAM-60	MAM-61	MAM-62	MAM-63	MAM-64	MAM-65	MAM-66
Date	March	May	July	August	September	25-Mar	25-Mar	12-May	12-May	09-Jul	09-Jul	07-Aug	07-Aug	09-Sep	09-Sep
Time						13:40	14:15	15:30	14:50	14:48	15:39	15:37	15:00	13:45	14:10
ALS Sample ID						VA21A6300-003	VA21A6300-004	VA21A9444-012	VA21A9444-013	VA21B4721-003	VA21B4721-004	VA21B6886-005	VA21B6886-006	VA21C0214-005	VA21C0214-006
Physical Tests (mg/L)															
Alkalinity - Total (as $CaCO_3$)	15.0	14.9	11.2	11.3	10.9	**19.4**	**25**	**22**	**26**	**14.7**	**13.4**	**15.0**	**12.7**	**13.7**	**17.2**
Total Dissolved Solids	94	93	63	63	60	**166**	**228**	**187**	**244**	**73**	**68**	**126**	**96**	**76**	**108**
Anions and Nutrients (mg/L)															
Ammonia (as N)	0.11	0.11	0.069	0.069	0.065	0.041	0.087	0.0055	0.0068	0.037	0.0083	**0.076**	0.052	0.014	**0.076**
Chloride	41	41	26	26	25	36	**51**	39	**53**	19.7	18.2	21	16.6	14.8	21
Fluoride	0.066	0.066	0.052	0.052	0.051	0.058	**0.071**	0.058	**0.068**	0.046	0.041	**0.057**	0.052	0.049	**0.057**
Nitrate (as N)	1.4	1.4	0.92	0.92	0.87	1.2	**1.7**	1.3	**1.8**	0.57	0.47	0.71	0.38	0.44	**0.89**
Phosphorus (P)-Total	0.013	0.013	0.0096	0.0096	0.0093	0.0040	0.0038	0.0021	0.0023	0.0031	0.0028	0.0058	0.0054	0.0052	0.0051
Sulphate (SO_4)	7.3	7.2	5.1	5.2	5.0	**21**	**29**	**23**	**30**	**13.6**	**11.1**	**18.2**	**12.2**	**13.7**	**24**
Total Metals (mg/L)															
Aluminum	0.0022	0.0022	0.0028	0.0029	0.0029	<0.0030	<0.0030	<0.0030	<0.0030	**0.0095**	**0.0039**	**0.0079**	**0.0078**	**0.0070**	**0.013**
Antimony	0.00052	0.00052	0.00036	0.00036	0.00035	**0.00062**	**0.00087**	**0.00065**	**0.00087**	**0.00071**	**0.00041**	**0.0015**	**0.00064**	**0.0011**	**0.0025**
Arsenic	0.013	0.013	0.0085	0.0085	0.0081	0.00071	0.00081	0.00088	0.00087	0.0015	0.00094	0.0019	0.0011	0.0014	0.0032
Barium	0.014	0.014	0.011	0.011	0.010	**0.037**	**0.053**	**0.044**	**0.056**	**0.024**	**0.022**	**0.023**	**0.019**	**0.019**	**0.024**
Beryllium	0.00003	0.00003	0.00003	0.00003	0.00003	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	0.00005	0.00005	0.00005	0.00005	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	0.079	0.078	0.053	0.053	0.051	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	0.00001	0.00001	0.00001	0.00001	0.00001	<0.0000050	<0.0000050	<0.0000050	0.00001	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.00001
Calcium	21	21	13.7	13.8	13.0	**24**	**33**	**27**	**35**	**15.2**	13.6	**15.8**	12.5	11.5	**16.3**
Chromium	0.00068	0.00068	0.00047	0.00047	0.00045	<0.00010	<0.00010	<0.00050	<0.00050	**0.00076**	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	0.00047	0.00047	0.00033	0.00033	0.00032	<0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	0.00012	<0.00010	<0.00010	0.00019
Copper	0.0012	0.0012	0.00095	0.00096	0.00093	0.00059	0.00077	0.00066	0.00078	<0.00050	0.00054	0.00052	0.00051	0.00058	0.00075
Iron	0.062	0.061	0.046	0.046	0.045	<0.010	<0.010	<0.010	<0.010	0.039	0.011	0.041	0.030	0.024	0.040
Lead	0.00027	0.00027	0.00019	0.00019	0.00018	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	0.0023	0.0023	0.0018	0.0018	0.0018	**0.0036**	**0.0048**	**0.0037**	**0.0051**	**0.0024**	**0.0021**	**0.0026**	**0.0019**	**0.0019**	**0.0028**
Magnesium	2.5	2.5	1.9	1.9	1.9	**5.3**	**7.1**	**5.7**	**7.2**	**3.2**	**2.8**	**3.8**	**2.8**	**2.9**	**4.3**
Manganese	0.055	0.055	0.035	0.035	0.033	0.0035	0.0086	0.0037	0.0070	0.014	0.0048	0.012	0.0054	0.0064	0.022
Mercury	0.00001	0.00001	0.00001	0.00001	0.00001	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum	0.0018	0.0018	0.0012	0.0012	0.0011	0.00060	0.00075	0.00058	0.00075	0.00055	0.00033	0.00073	0.00045	0.00047	0.00091
Nickel	0.0043	0.0043	0.0029	0.0029	0.0028	0.0018	0.0028	0.0021	0.0030	**0.0031**	0.0015	0.0017	0.0010	0.0017	**0.0040**
Potassium	1.6	1.6	1.2	1.2	1.1	**4.6**	**6.0**	**5.0**	**6.1**	**2.9**	**2.6**	**3.6**	**2.8**	**2.9**	**4.2**
Selenium	0.00026	0.00026	0.00018	0.00018	0.00017	0.00008	0.00012	0.00010	0.00013	0.00009	0.00006	0.00011	0.00007	0.00009	0.00014
Silver	0.00002	0.00002	0.00002	0.00002	0.00002	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	5.3	5.2	3.6	3.6	3.4	3.2	4.1	3.4	4.2	1.9	1.7	2.5	1.9	2.0	3.0
Strontium	0.054	0.053	0.040	0.040	0.039	**0.17**	**0.24**	**0.18**	**0.24**	**0.11**	**0.092**	**0.12**	**0.088**	**0.089**	**0.13**
Thallium	0.00001	0.00001	0.00001	0.00001	0.00001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	0.00013	0.00013	0.00012	0.00012	0.00012	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Uranium	0.00057	0.00056	0.00038	0.00038	0.00036	0.00010	0.00013	0.00009	0.00012	0.00010	0.00006	0.00020	0.00009	0.00013	0.00029
Vanadium	0.00080	0.00079	0.00068	0.00069	0.00068	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	0.0025	0.0025	0.0020	0.0020	0.0019	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes:
Formatting for indicating the parameters that exceed the model predictions in the FEIS:
123 Bolded values exceed FEIS by < 10X.
123 Bold and shaded values exceed the FEIS by ≥ 10X.
Italicized numbers are below detection limits.
"-" not analyzed/not sampled.

FIGURES

Figure B2 - 1. Carbonate alkalinity (mg/L) in water samples from Whale Tail Pit since 2014.

Note: The red dashed line = trigger value.

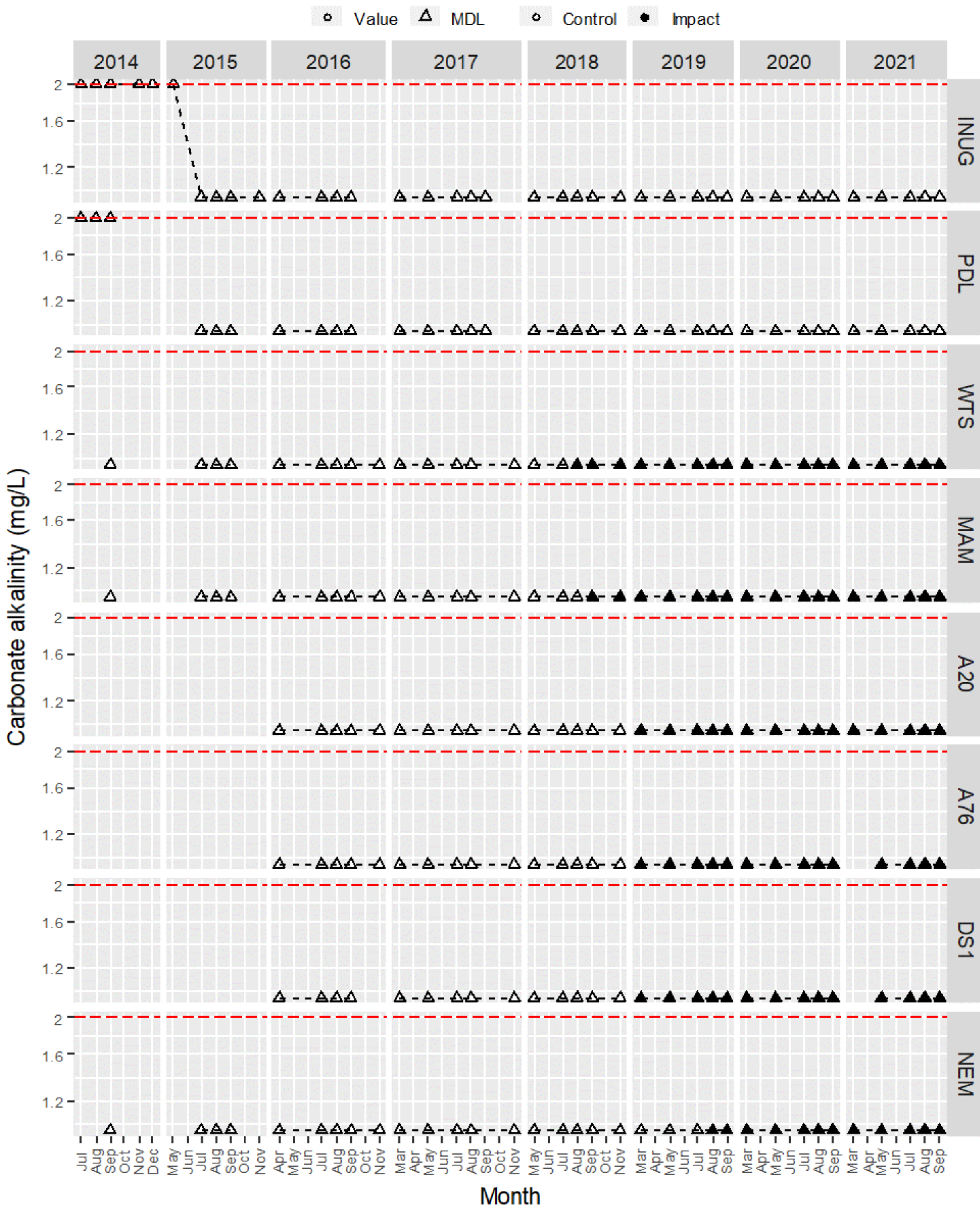


Figure B2 - 2. Total cyanide (mg/L) in water samples from Whale Tail Pit since 2014.

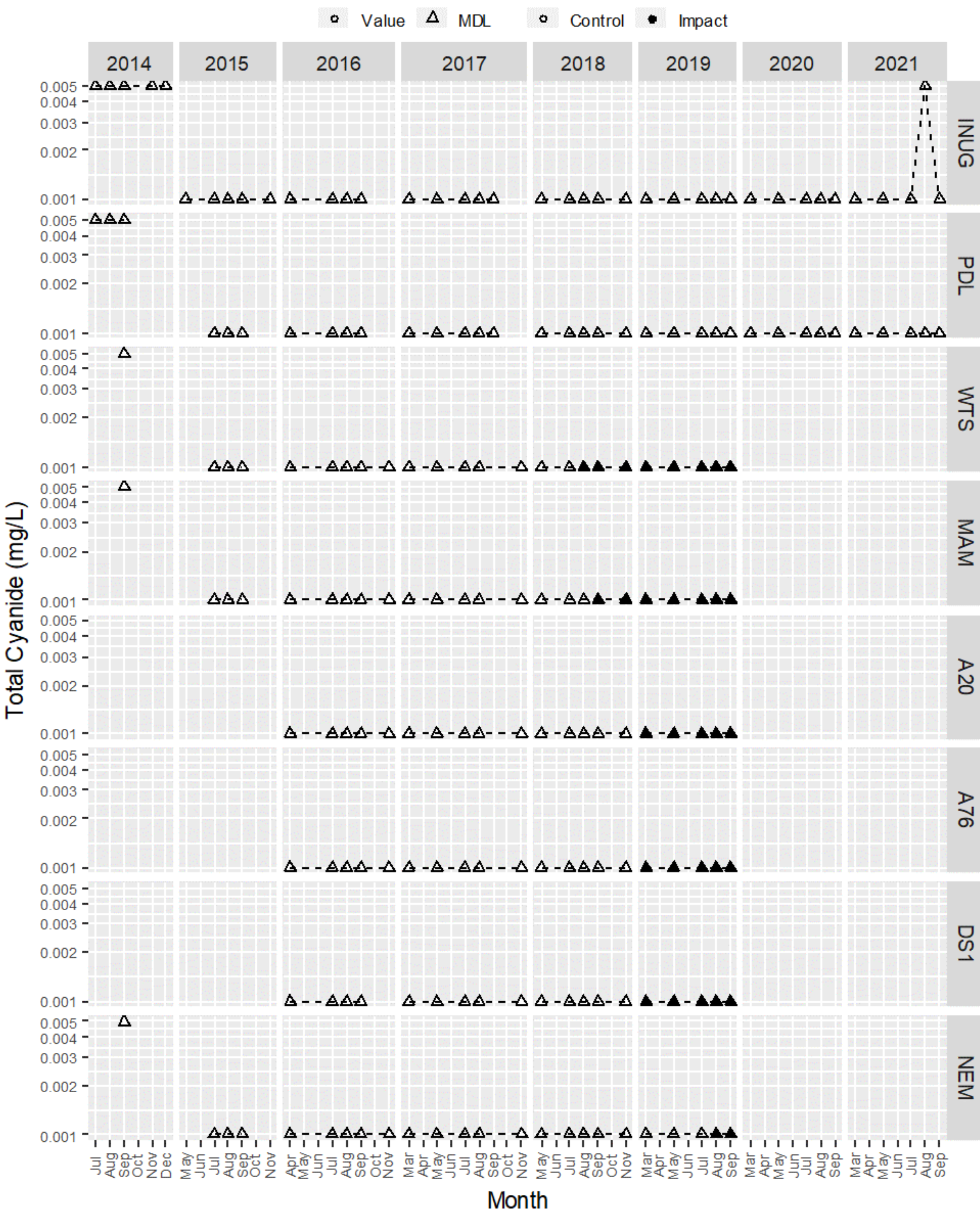


Figure B2 - 3. Free cyanide (mg/L) in water samples from Whale Tail Pit since 2014.

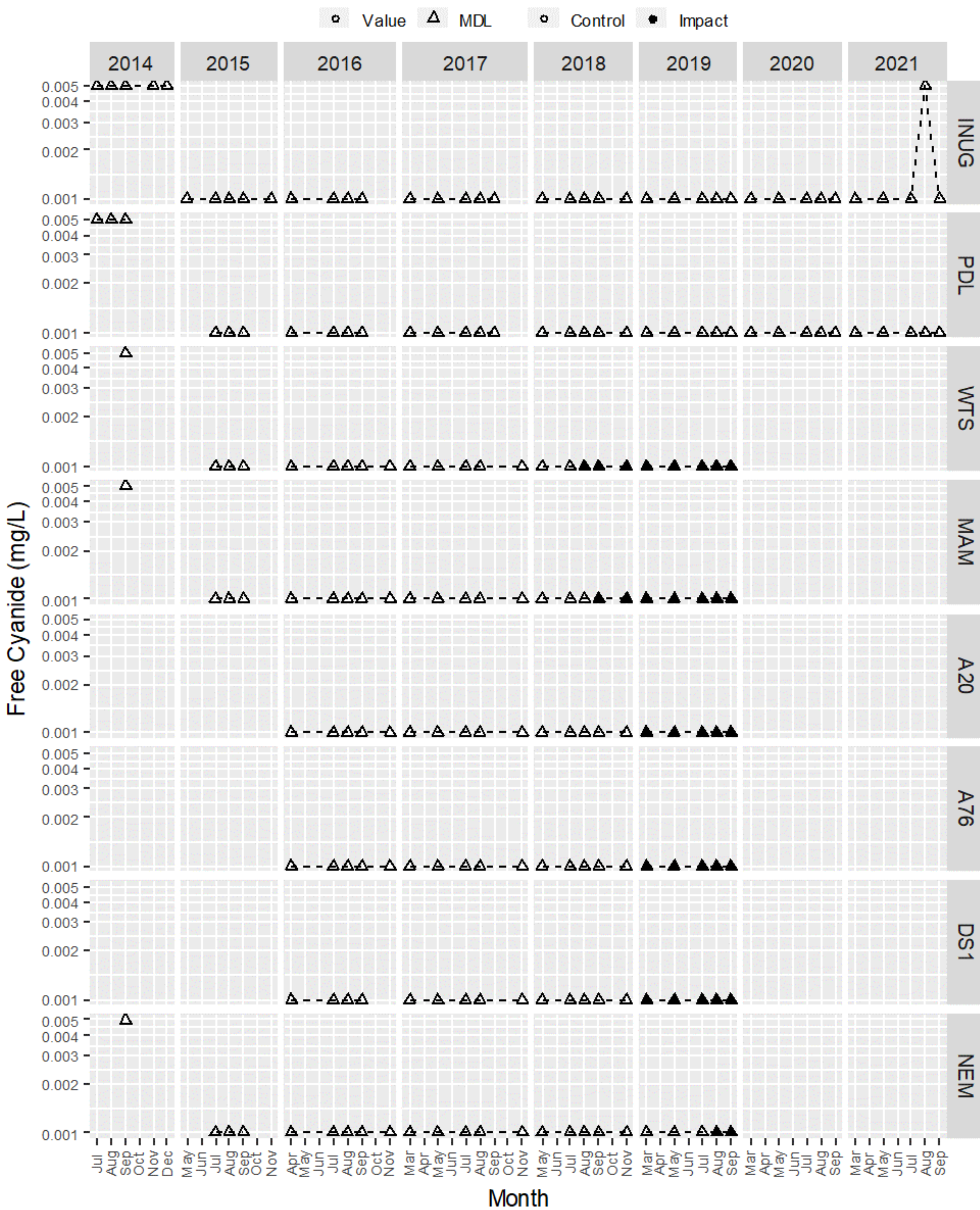


Figure B2 - 4. Total beryllium (mg/L) in water samples from Whale Tail Pit since 2014.

Note: The red dashed line = trigger value. The blue dashed line = FEIS screening prediction.

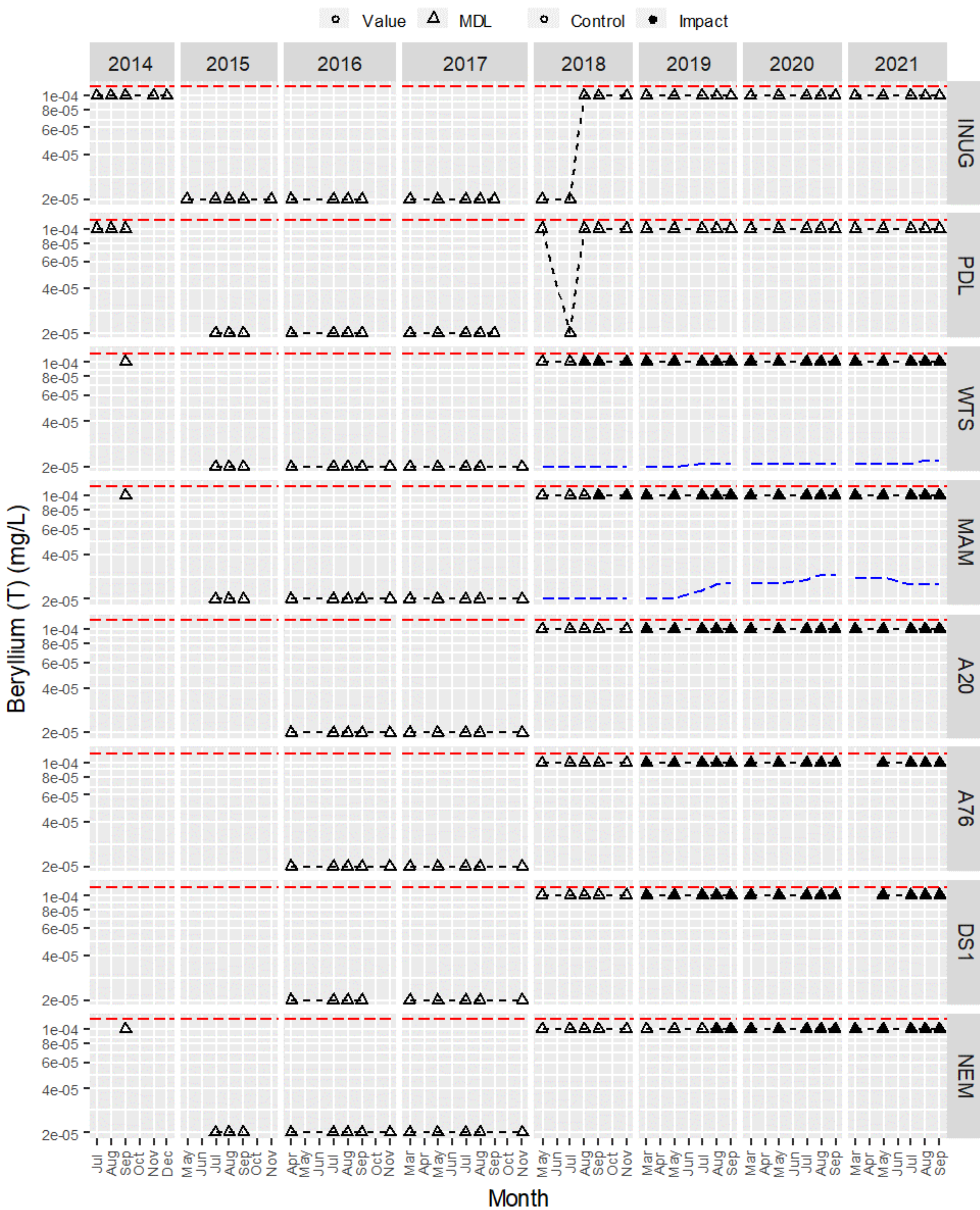


Figure B2 - 5. Total boron (mg/L) in water samples from Whale Tail Pit since 2014.

Note: The red dashed line = trigger value. The blue dashed line = FEIS screening prediction.

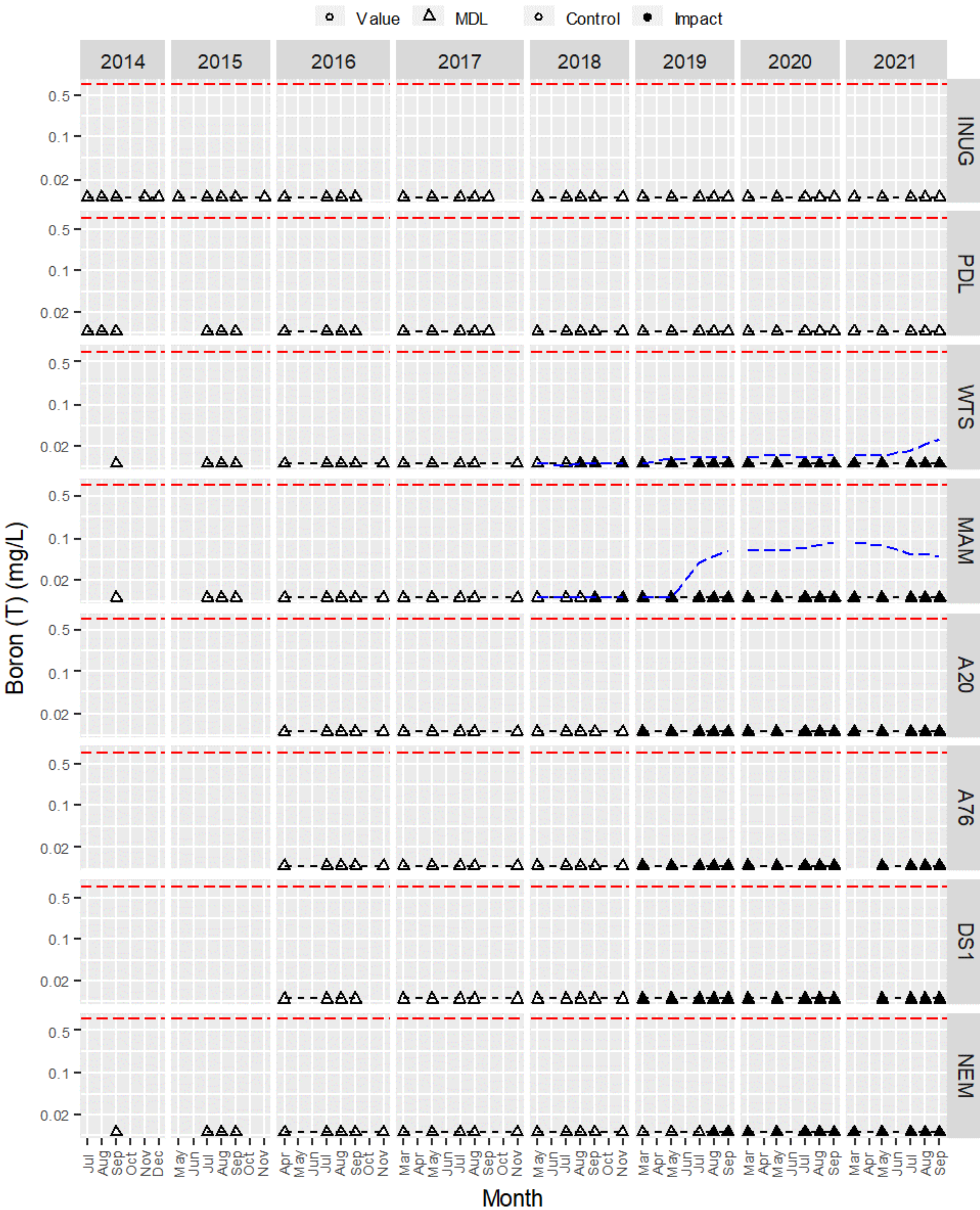


Figure B2 - 6. Total cadmium (mg/L) in water samples from Whale Tail Pit since 2014.

Note: The red dashed line = trigger value. The blue dashed line = FEIS screening prediction.

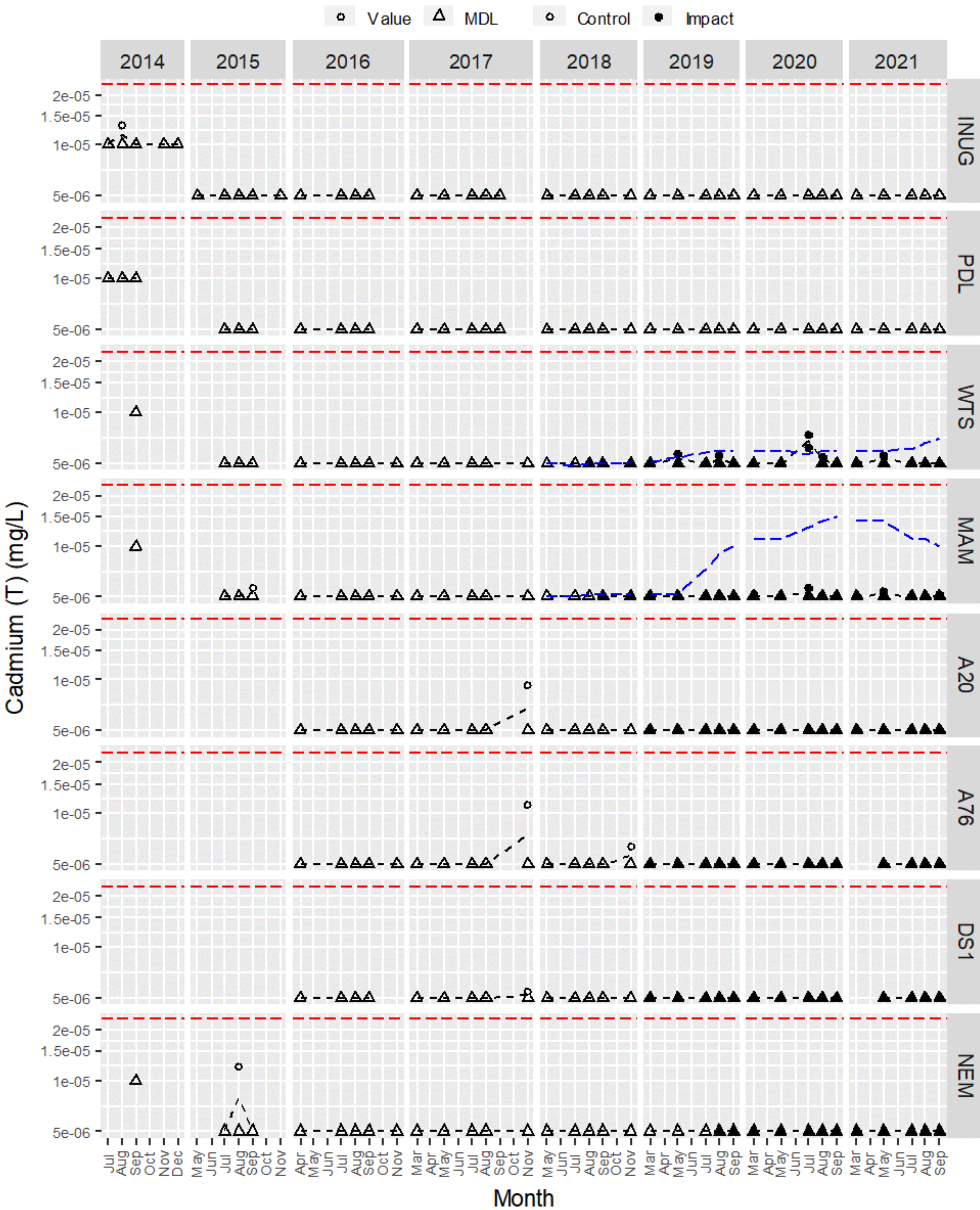


Figure B2 - 7. Total mercury (mg/L) in water samples from Whale Tail Pit since 2014.

Note: The red dashed line = trigger value. The blue dashed line = FEIS screening prediction.

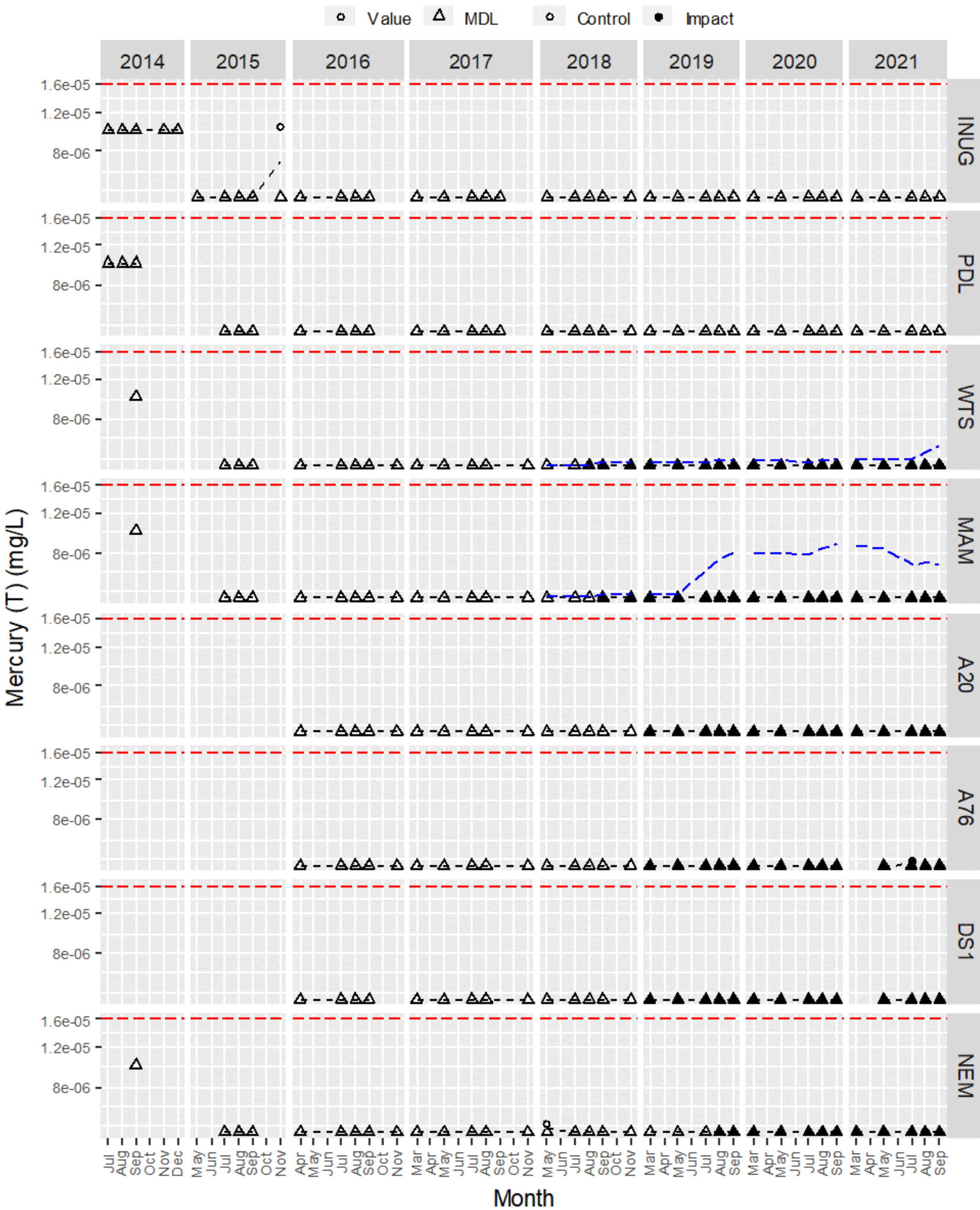


Figure B2 - 8. Total silver (mg/L) in water samples from Whale Tail Pit since 2014.

Note: The red dashed line = trigger value. The blue dashed line = FEIS screening prediction.

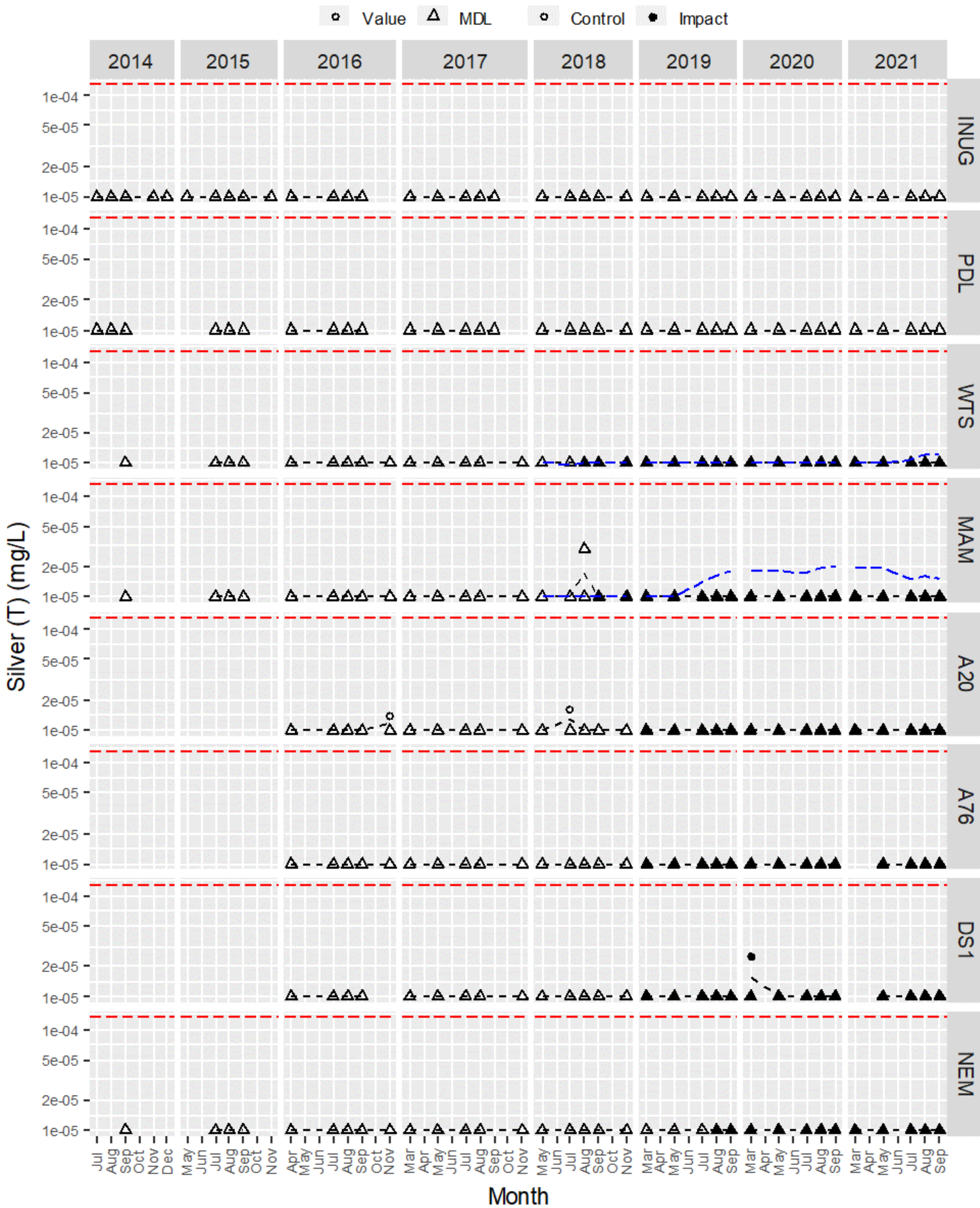


Figure B2 - 9. Total thallium (mg/L) in water samples from Whale Tail Pit since 2014.

Note: The red dashed line = trigger value. The blue dashed line = FEIS screening prediction.

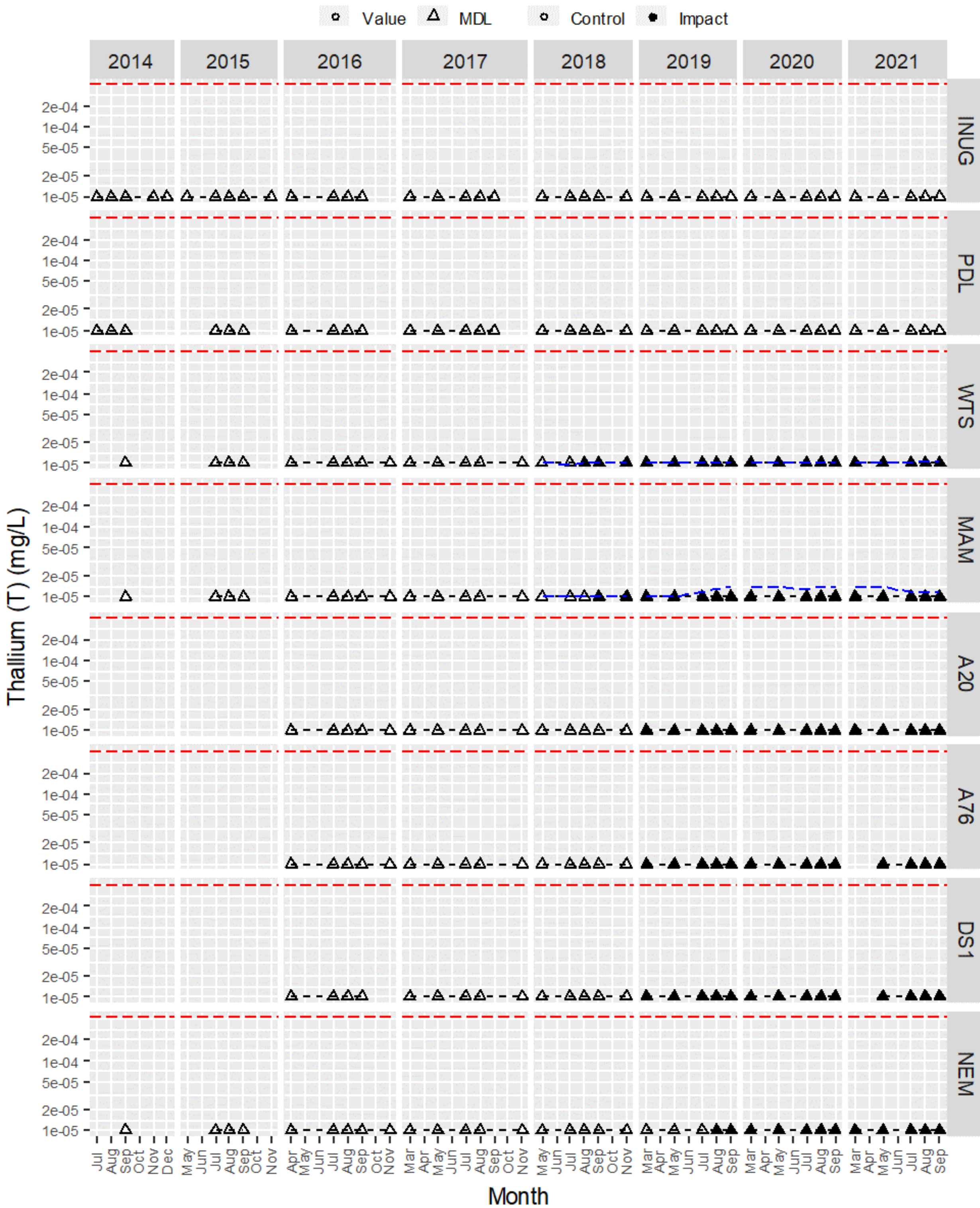


Figure B2 - 10. Total tin (mg/L) in water samples from Whale Tail Pit since 2014.

Note: The red dashed line = trigger value. The blue dashed line = FEIS screening prediction.

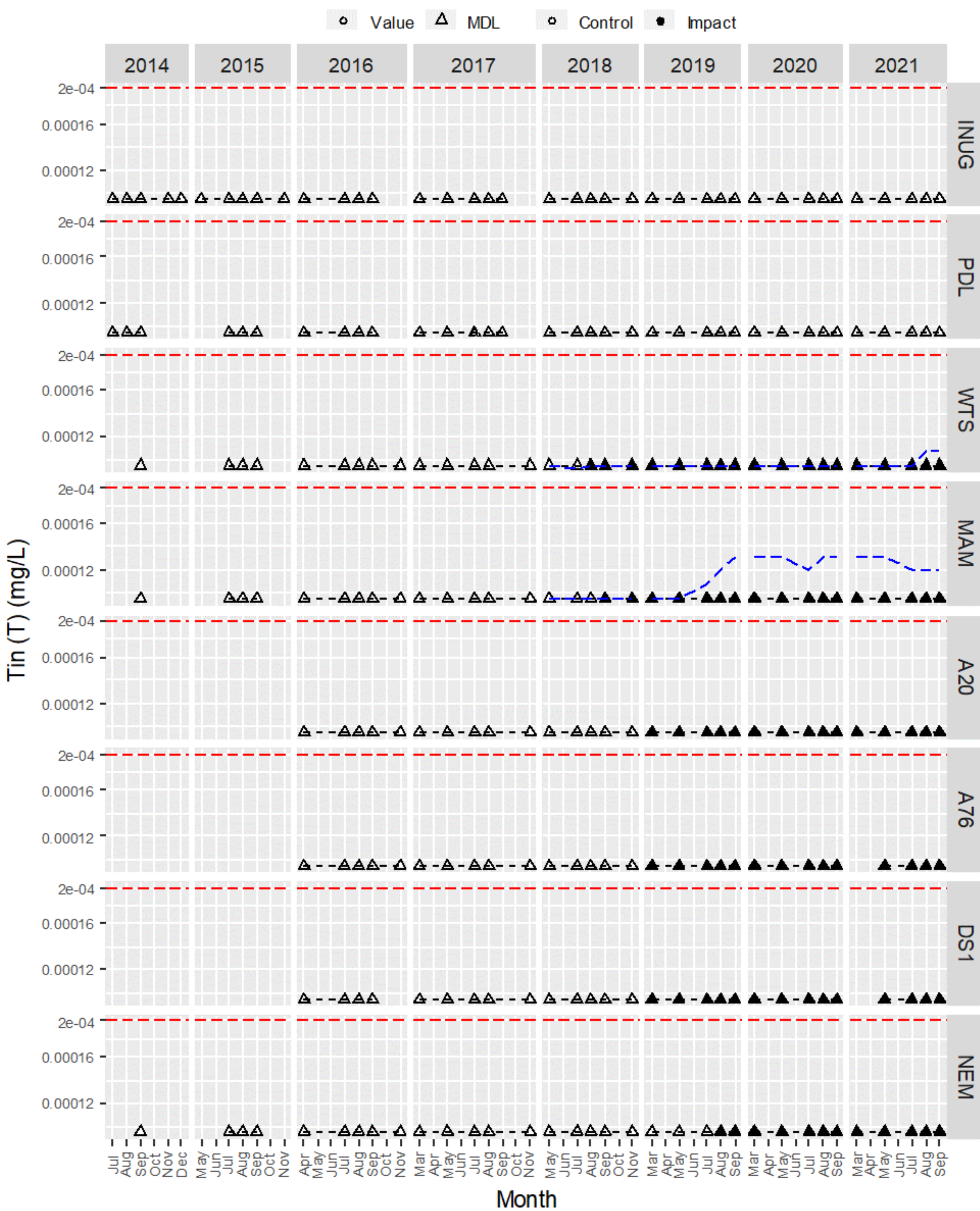


Figure B2 - 11. Total vanadium (mg/L) in water samples from Whale Tail Pit since 2014.

Note: The red dashed line = trigger value. The blue dashed line = FEIS screening prediction.

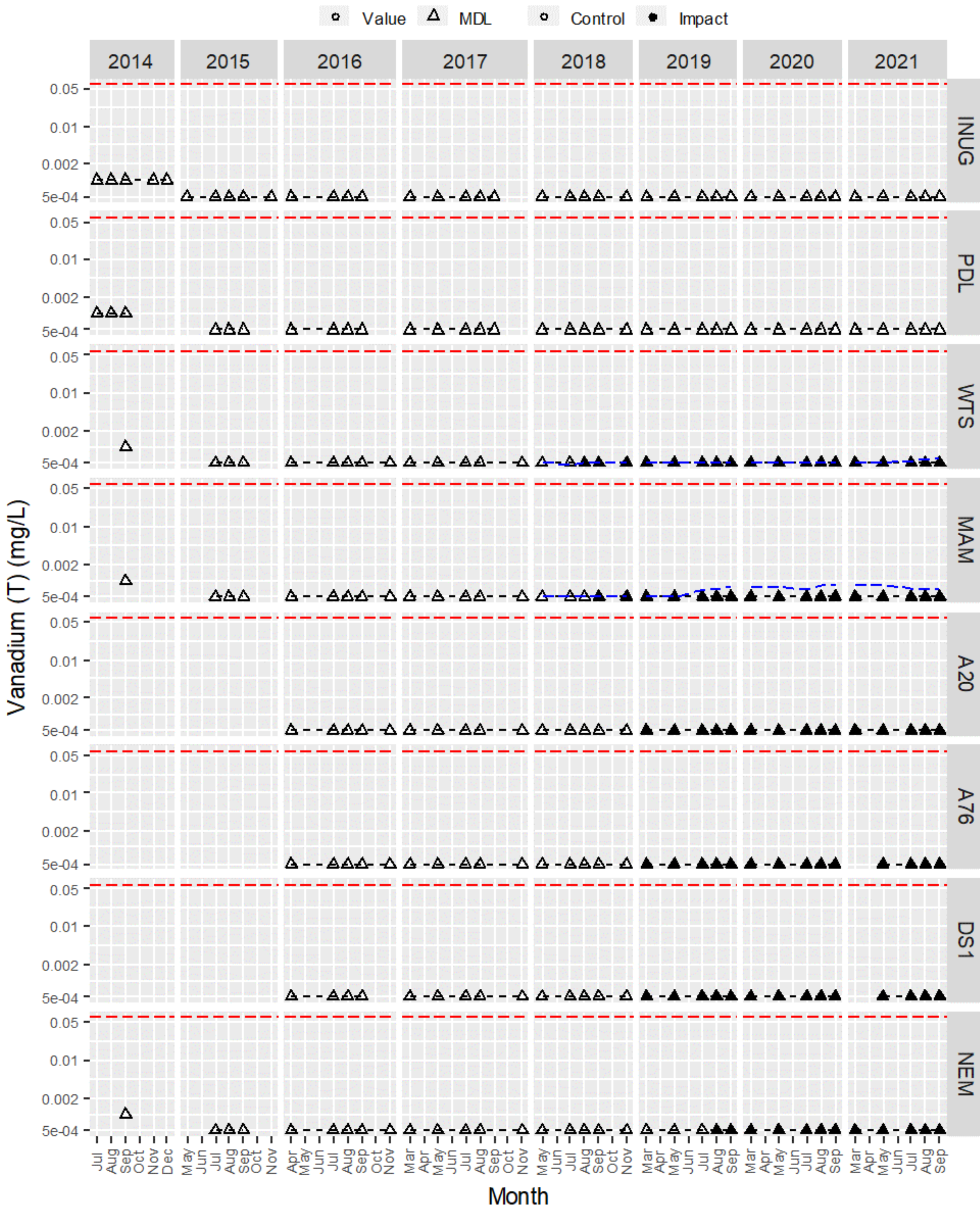


Figure B2 - 12. Total zinc (mg/L) in water samples from Whale Tail Pit since 2014.

Note: The blue dashed line = FEIS screening prediction.

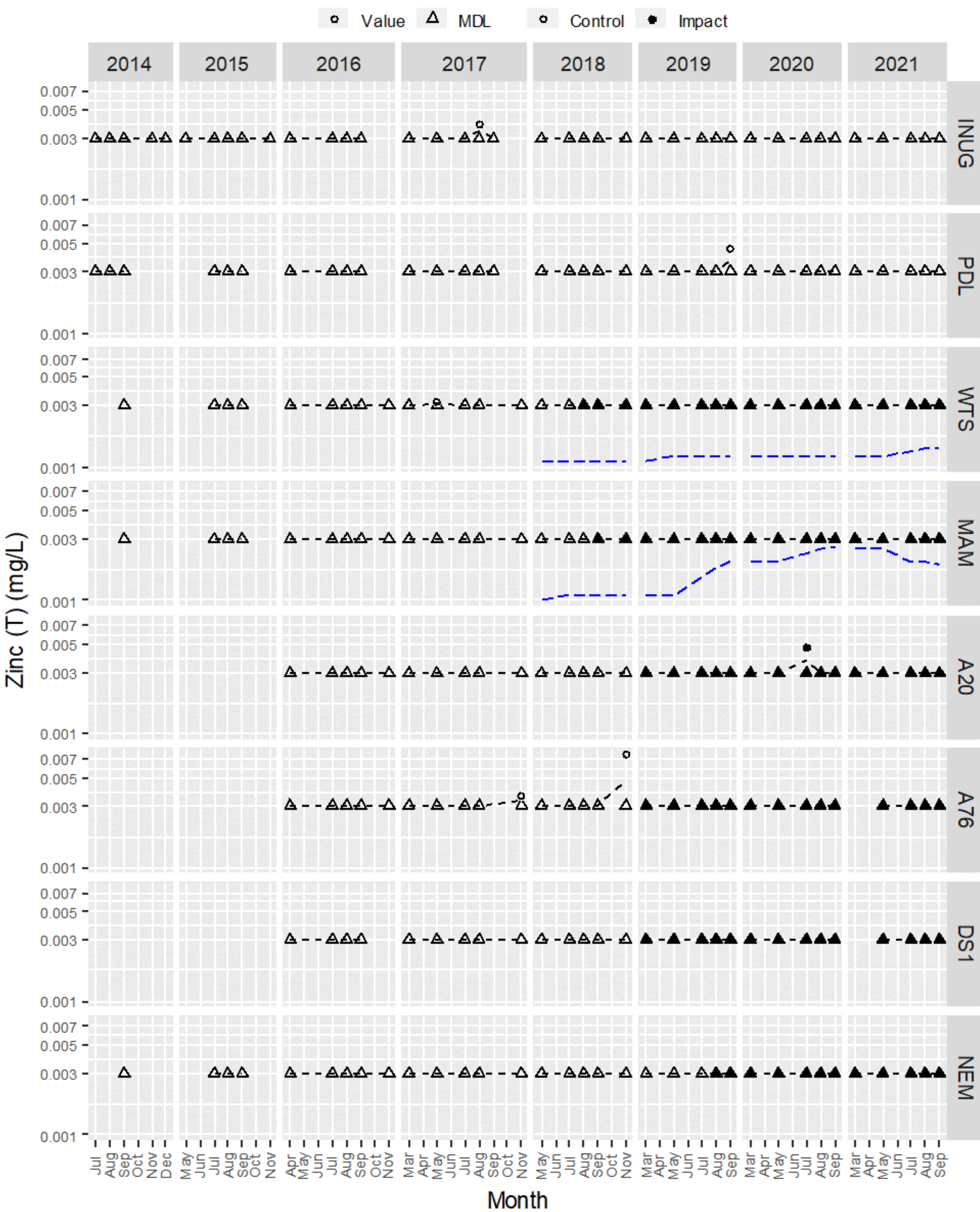


Figure B2 - 13. Dissolved beryllium (mg/L) in water samples from Whale Tail Pit since 2014.

Note: The red dashed line = trigger value.

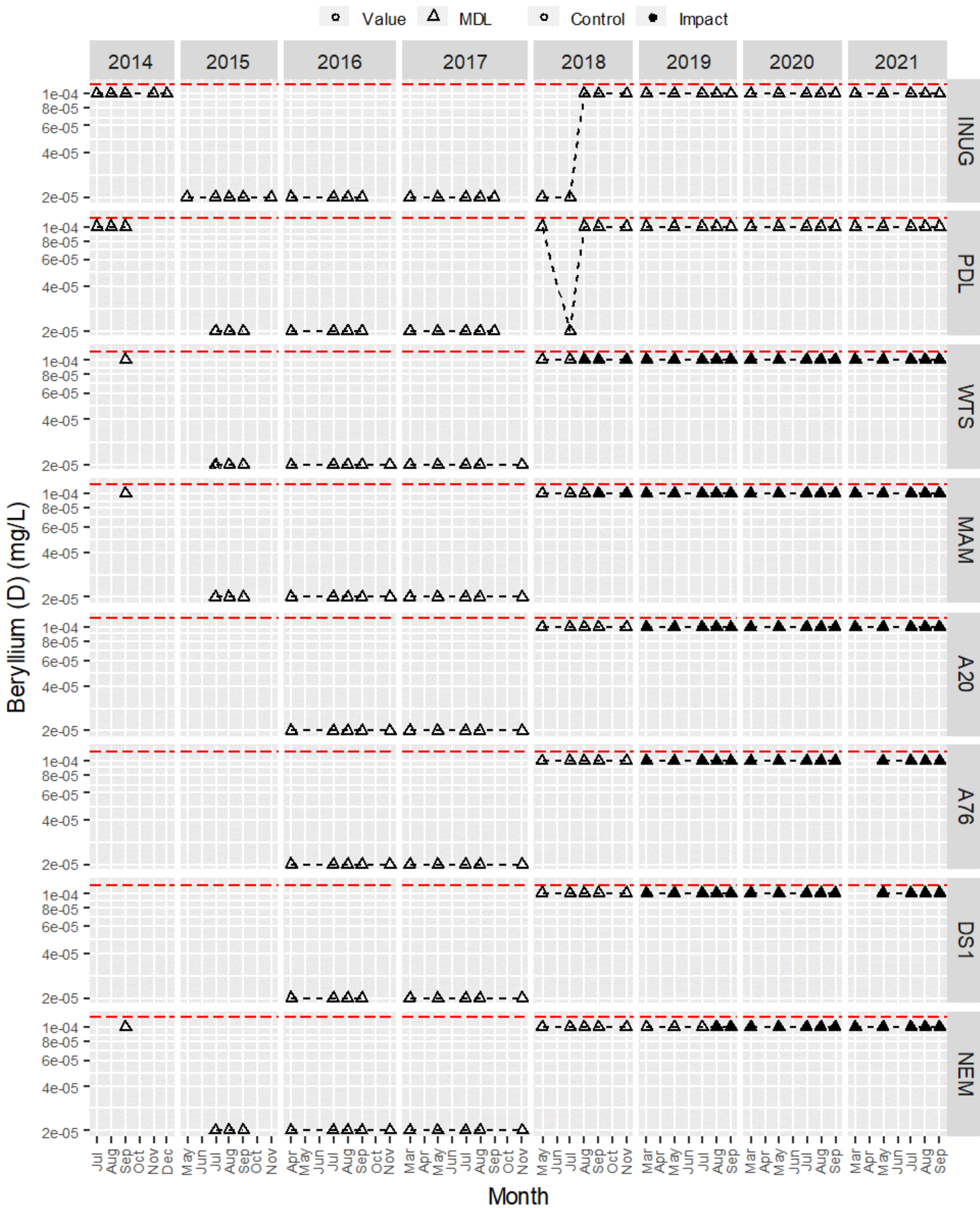


Figure B2 - 14. Dissolved boron (mg/L) in water samples from Whale Tail Pit since 2014.

Note: The red dashed line = trigger value.

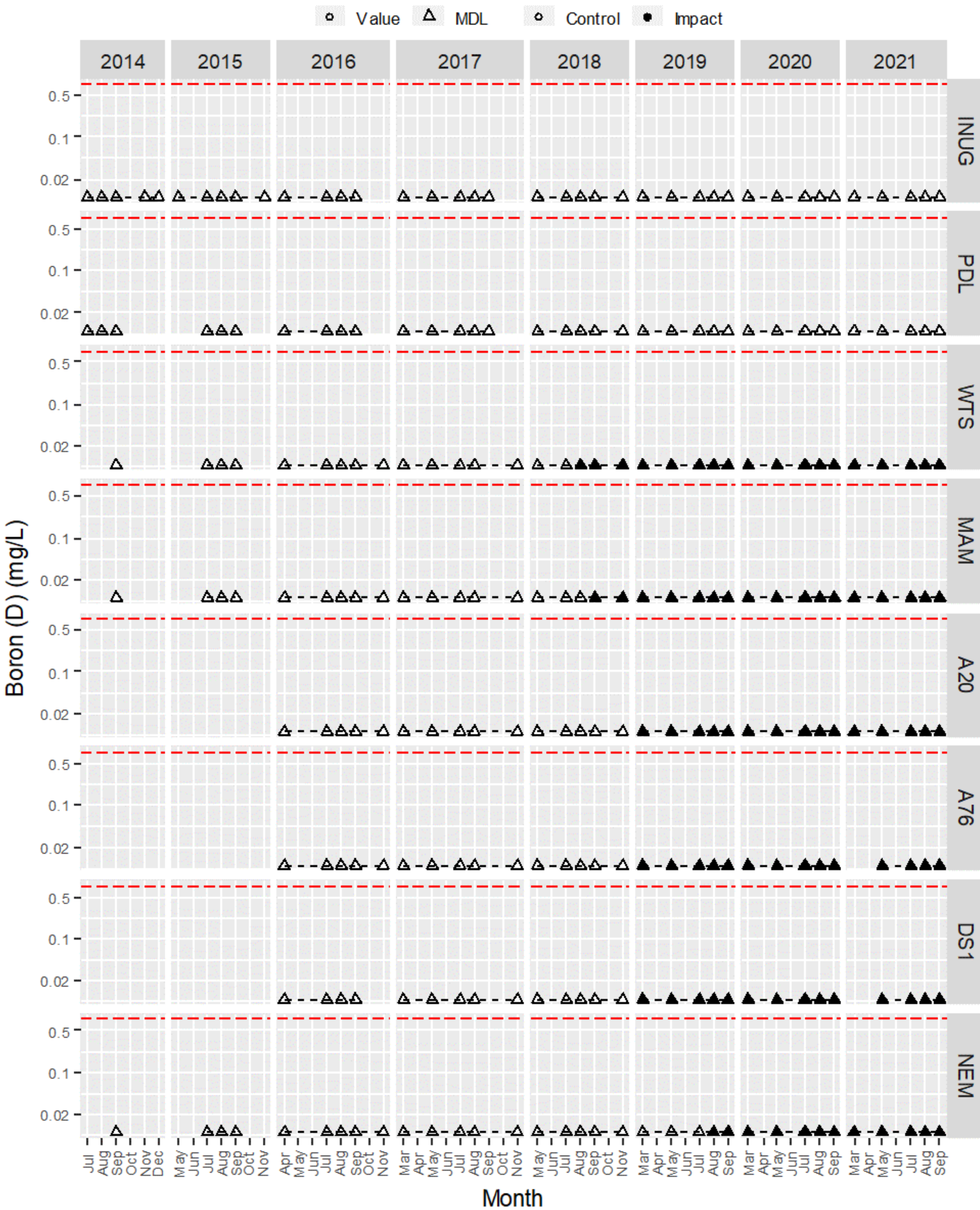


Figure B2 - 15. Dissolved cadmium (mg/L) in water samples from Whale Tail Pit since 2014.

Note: The red dashed line = trigger value.

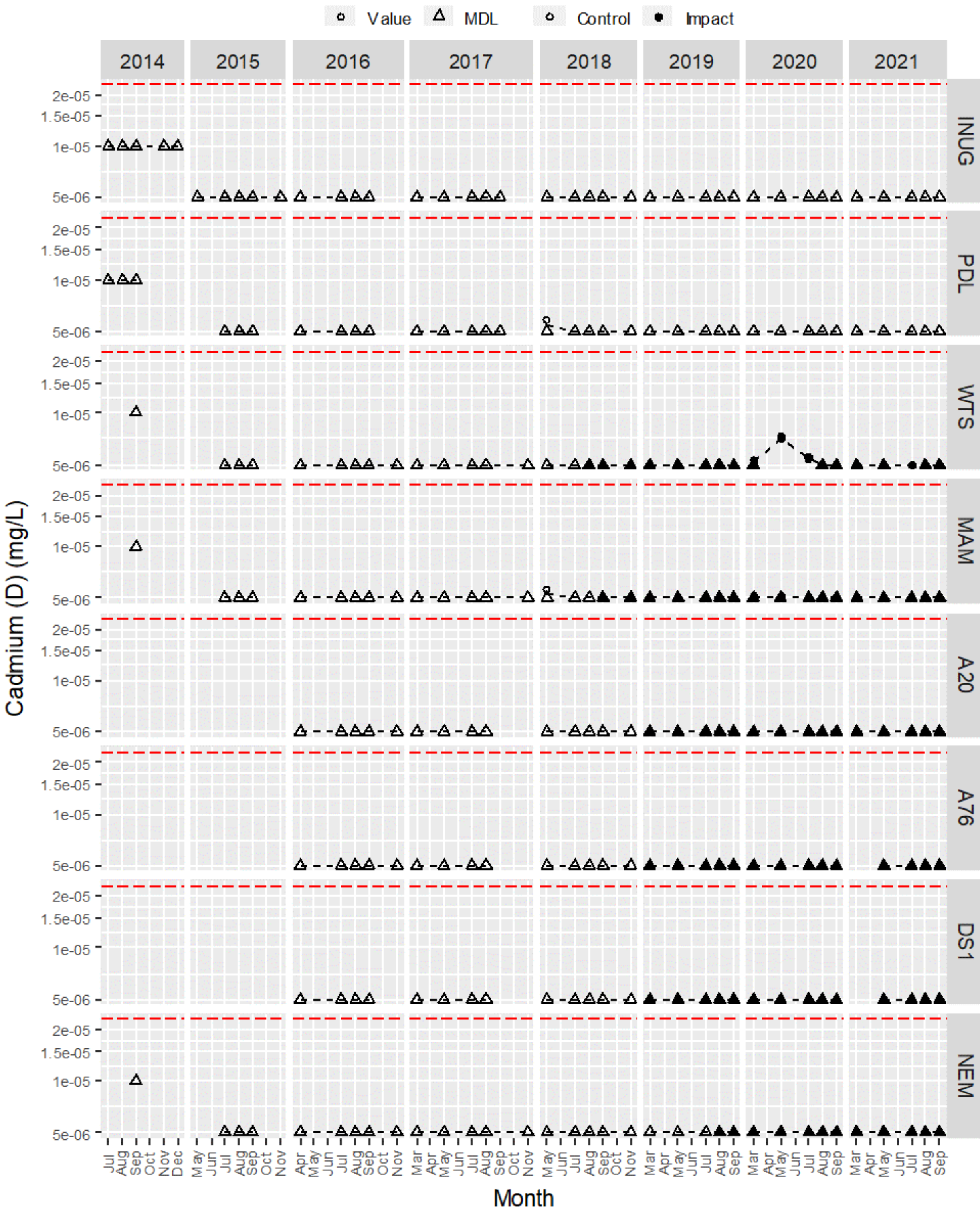


Figure B2 - 16. Dissolved mercury (mg/L) in water samples from Whale Tail Pit since 2014.

Note: The red dashed line = trigger value.

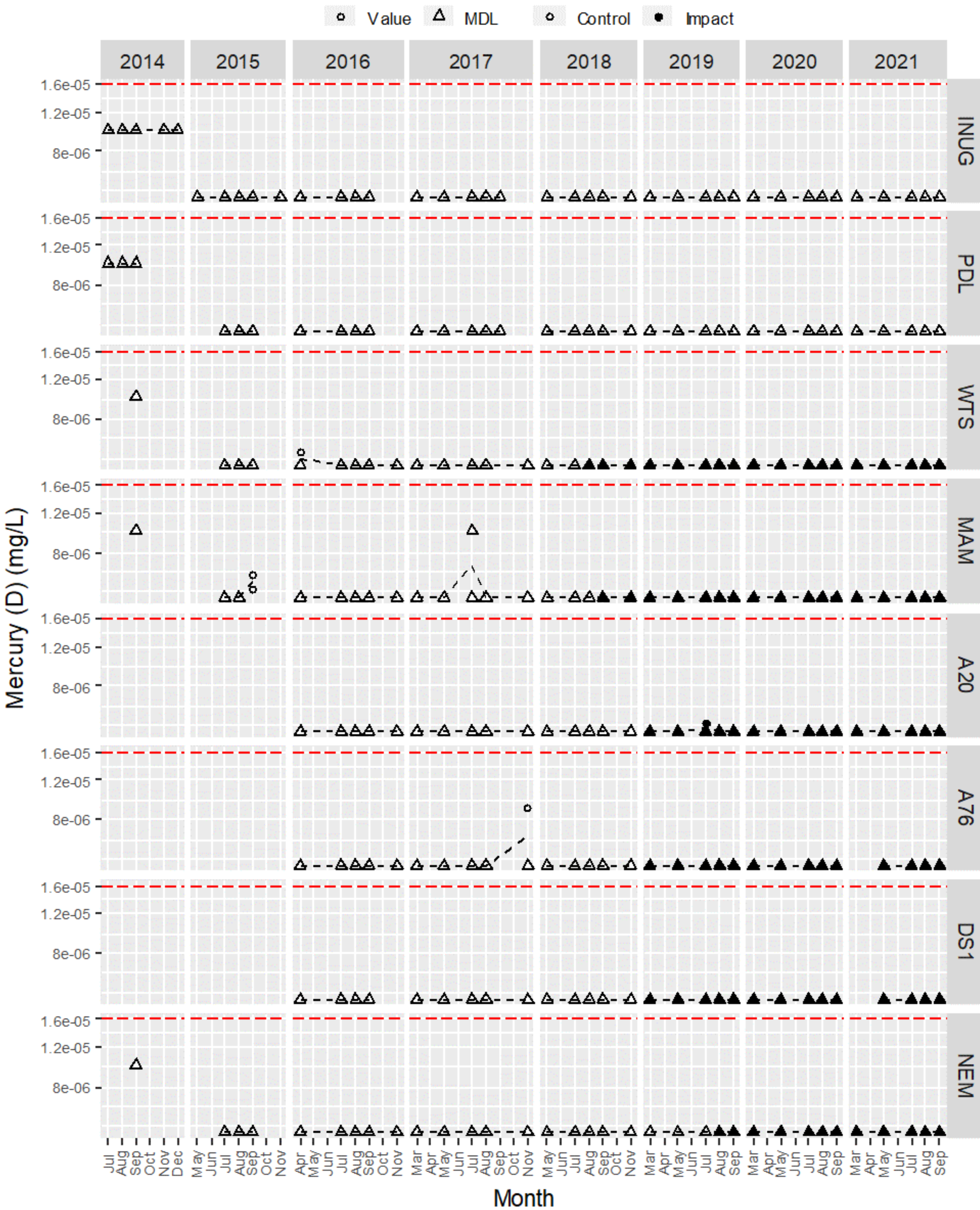


Figure B2 - 17. Dissolved selenium (mg/L) in water samples from Whale Tail Pit since 2014.

Note: The red dashed line = trigger value.

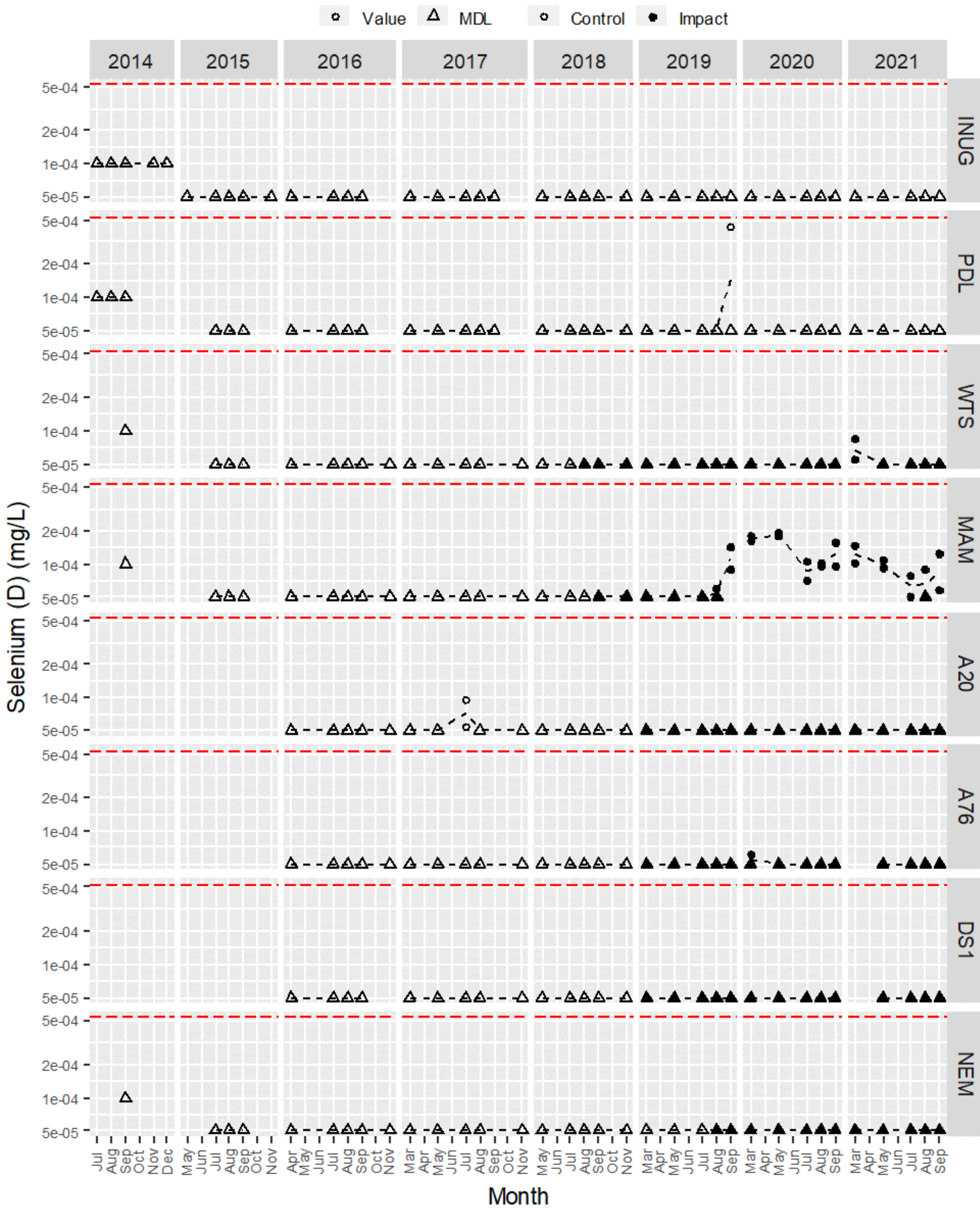


Figure B2 - 18. Dissolved silver (mg/L) in water samples from Whale Tail Pit since 2014.

Note: The red dashed line = trigger value.

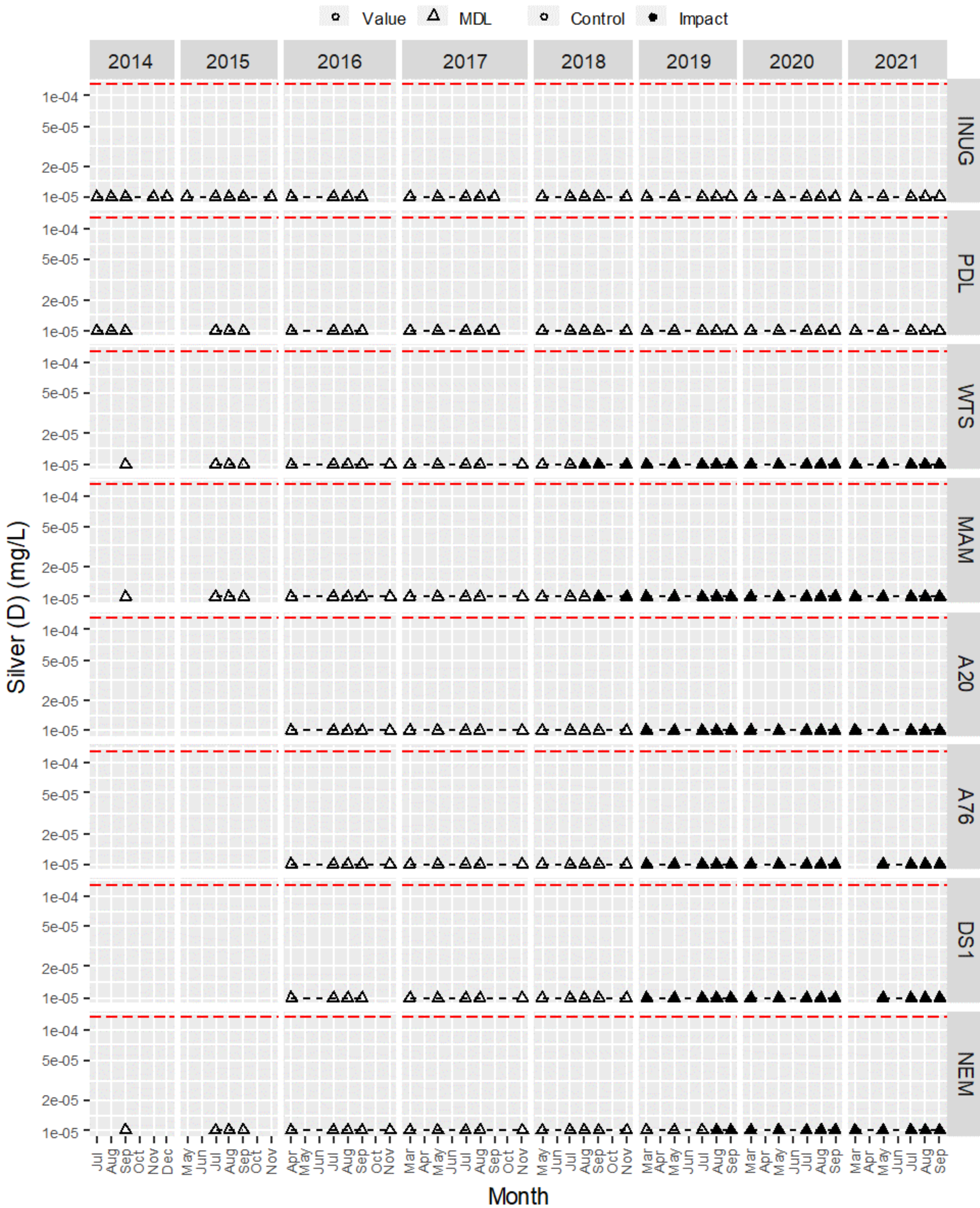


Figure B2 - 19. Dissolved thallium (mg/L) in water samples from Whale Tail Pit since 2014.

Note: The red dashed line = trigger value.

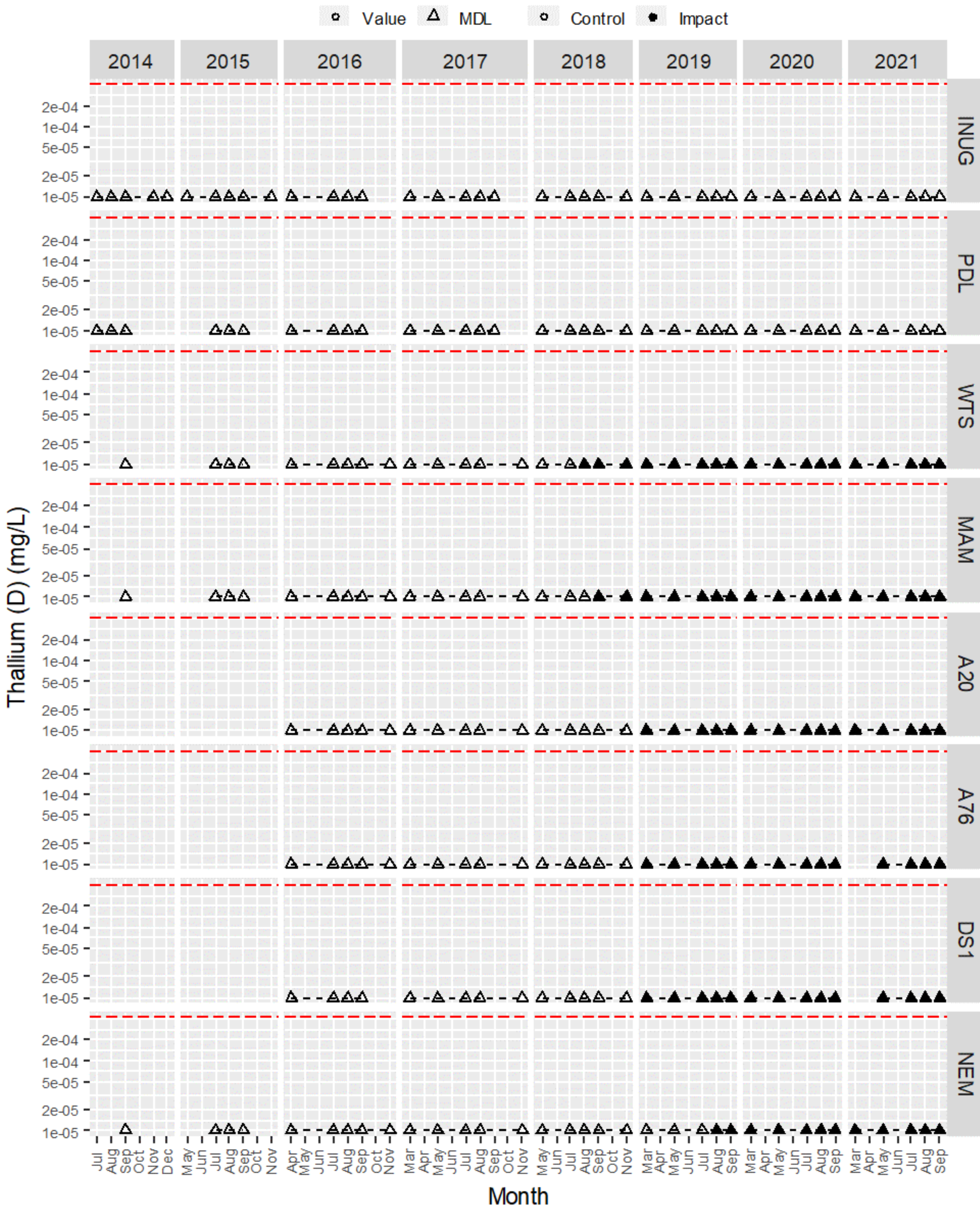


Figure B2 - 20. Dissolved tin (mg/L) in water samples from Whale Tail Pit since 2014.

Note: The red dashed line = trigger value.

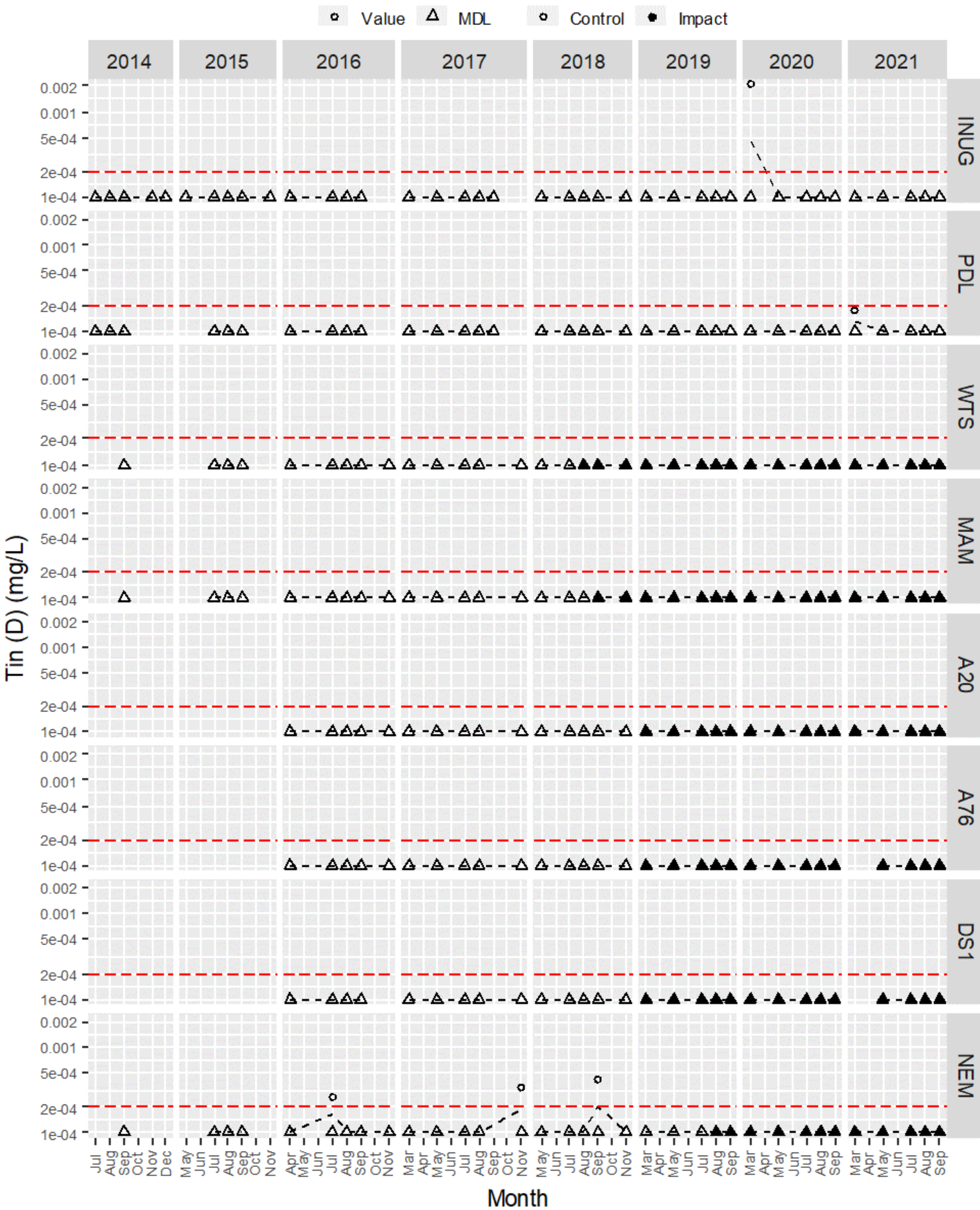


Figure B2 - 21. Dissolved titanium (mg/L) in water samples from Whale Tail Pit since 2014.

Note: The red dashed line = trigger value.

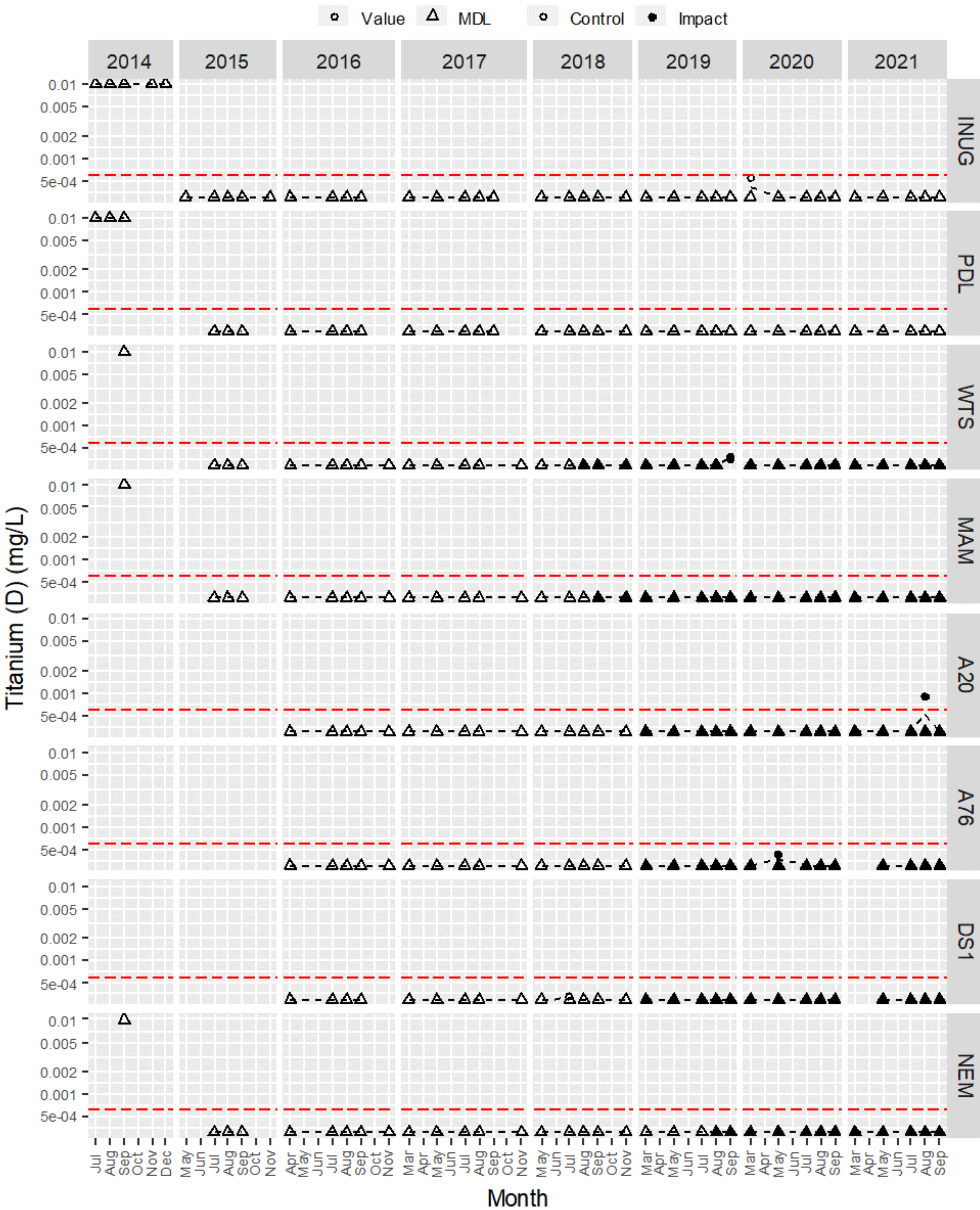
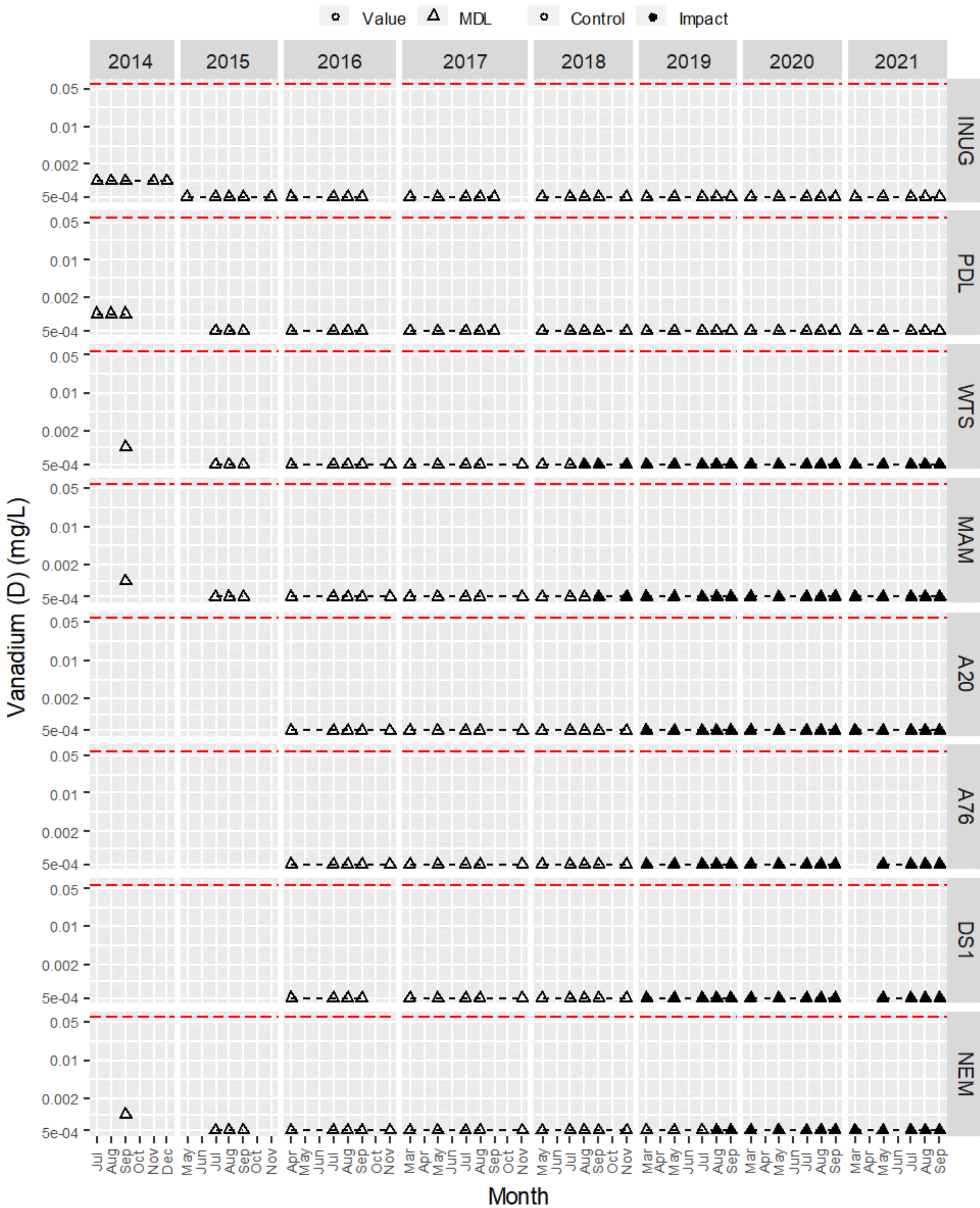


Figure B2 - 22. Dissolved vanadium (mg/L) in water samples from Whale Tail Pit since 2014.

Note: The red dashed line = trigger value.



Appendix B3
Water Chemistry – Baker Lake

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Table B3–1. Water quality results from Baker Lake, 2021.

Lake & Area	Aquatic Life Guideline[1]	Baker Lake Screening Values[2]		Baker Lake - Akilahaarjuk Point (BAP)						Baker Lake - Barge Dock (BBD)						Baker Lake - Proposed Jetty (BPJ)					
Month		Triggers	Thresholds	July	July	August	August	September	September	July	July	August	August	September	September	July	July	August	August	September	September
Area-Replicate ID				BAP-73	BAP-74	BAP-75	BAP-76	BAP-77	BAP-78	BBD-73	BBD-74	BBD-75	BBD-76	BBD-77	BBD-78	BPJ-73	BPJ-74	BPJ-75	BPJ-76	BPJ-77	BPJ-78
Ortho Phosphate (as P)		0.0020		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	**0.0022**	<0.0010	<0.0010	<0.0010	<0.0010
Phosphorus (P)-Total	0.01	0.0075	0.010	0.0033	0.0030	0.0034	0.0034	0.0037	0.0056	**0.0078**	**0.0082**	0.0048	0.0065	0.0039	0.0036	0.0052	0.0054	0.0048	0.0045	0.0038	0.0041
Phosphorus (P)-Total Diss.				<0.0020	<0.0020	0.0021	0.0021	0.0041	0.23	<0.0020	0.0021	0.0022	<0.0020	0.0046	0.0033	<0.0020	<0.0020	0.0035	<0.0020	0.0037	0.0038
Reactive Silica (as SiO_2)		1.0		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.59	<0.50	0.51	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Sulphate (SO_4)		66	128	3.5	3.9	5.0	5.0	0.77	0.86	0.78	0.69	0.79	0.65	0.57	0.54	0.70	0.76	4.3	5.0	0.60	0.59
Cyanides (mg/L)																					
Free Cyanide																					
Total Cyanide	0.005																				
Organic / Inorganic Carbon (mg/L)																					
Dissolved Organic Carbon		3.9		3.2	3.0	3.1	3.4	3.9	3.5	3.5	3.7	3.8	3.6	3.4	**4.0**	3.5	3.5	3.2	3.3	3.7	3.4
Total Organic Carbon		4.0		3.2	3.0	3.6	3.5	3.4	3.4	3.5	3.4	**4.3**	4.0	3.4	3.4	3.5	3.5	3.4	3.7	3.4	3.4
Total Metals (mg/L)																					
Aluminum[3]	*equation*	0.056	0.10	0.022	0.021	0.014	0.014	0.024	0.022	**0.10**	**0.100**	0.032	0.030	0.024	0.025	0.029	0.025	0.027	0.028	0.025	0.026
Antimony		0.0046	0.0090	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	0.005	0.0026	0.0050	0.00016	0.00014	0.00012	0.00014	0.00015	0.00012	0.00016	0.00017	0.00012	0.00011	0.00013	0.00011	0.00013	0.00014	0.00015	0.00016	0.00014	0.00011
Barium		0.51	1.0	0.017	0.015	0.018	0.018	0.020	0.019	0.019	0.019	0.017	0.017	0.020	0.019	0.018	0.018	0.018	0.019	0.020	0.019
Beryllium		0.00012	0.00013	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth				<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	1.5	0.75	1.5	<0.010	<0.010	0.010	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.012	<0.010	<0.010
Cadmium[3]	*equation*	0.00002	0.00004	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Calcium		6.2		3.1	3.2	3.4	3.4	2.3	2.4	2.7	2.6	2.6	2.6	2.3	2.3	2.5	2.5	3.3	3.5	2.3	2.3
Cesium				<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.00002	0.00001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Chromium[4]	0.001	0.0025	0.0050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.0024	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt				<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper[2]	*equation*	0.0012	0.0020	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00051	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Iron	0.3	0.16	0.30	0.029	0.027	0.013	0.014	0.035	0.033	0.10	0.12	0.037	0.039	0.054	0.037	0.044	0.042	0.026	0.033	0.039	0.037
Lead[3]	*equation*	0.00053	0.0010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.00007	0.00008	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium		0.0030	0.096	0.0010	0.0011	0.0011	0.0011	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	0.0012	<0.0010	<0.0010
Magnesium		12.44		2.2	2.3	3.1	3.2	1.2	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	2.6	3.1	1.1	1.1
Manganese[3]		0.34	*equation*	0.0041	0.0036	0.0014	0.0015	0.0027	0.0023	0.0066	0.0072	0.0036	0.0040	0.0033	0.0030	0.0055	0.0053	0.0032	0.0033	0.0032	0.0027
Mercury	0.000026	0.00002	0.00003	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum	0.073	0.037	0.073	0.00008	0.00008	0.00008	0.00008	0.00005	<0.000050	0.00006	0.00006	0.00005	<0.000050	0.00005	<0.000050	0.00005	0.00006	0.00008	0.00008	0.00005	<0.000050
Nickel[3]	*equation*	0.013	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Phosphorus				<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium		3.9		0.83	0.87	1.1	1.2	0.48	0.48	0.50	0.48	0.46	0.46	0.44	0.43	0.46	0.46	0.98	1.2	0.46	0.43
Rubidium				0.00099	0.00086	0.0011	0.0011	0.00082	0.00080	0.00092	0.00095	0.00081	0.00075	0.00077	0.00080	0.00084	0.00080	0.00096	0.0012	0.00080	0.00063
Selenium	0.001	0.00053	0.0010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon		0.28		0.25	0.22	0.23	0.24	0.26	0.24	**0.39**	**0.44**	**0.32**	**0.32**	0.22	0.23	**0.30**	**0.31**	0.28	0.26	0.24	0.27
Silver	0.00025	0.00013	0.00025	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium		89		10.4	11.4	17.5	17.5	1.3	1.7	1.0	0.71	1.1	0.75	0.62	0.61	0.90	1.0	13.6	17.5	0.84	0.75
Strontium		1.3	2.5	0.026	0.025	0.031	0.032	0.016	0.017	0.018	0.018	0.018	0.018	0.016	0.016	0.018	0.017	0.029	0.030	0.016	0.016
Sulfur				1.2	1.4	1.9	1.8	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	1.5	1.7	<0.50	<0.50
Tellurium				<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Thallium	0.0008	0.00041	0.00080	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Thorium				<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin		0.00020		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium		0.00060	2.0	0.00043	0.00044	<0.00030	<0.00030	0.00042	<0.00060	<0.00240	**0.0030**	0.00045	0.00039	<0.00060	0.00043	0.00042	0.00048	0.00040	**0.00061**	<0.00060	0.00048
Tungsten				<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Uranium	0.015	0.0075	0.015	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00006	0.00006	0.00005	0.00005	0.00005	0.00006	0.00005	0.00005	0.00005	0.00005	0.00006	0.00005
Vanadium		0.060	0.12	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc[3]	0.03	***see text***	***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

FIGURES

Figure B3 - 1. Carbonate alkalinity (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line = trigger value.

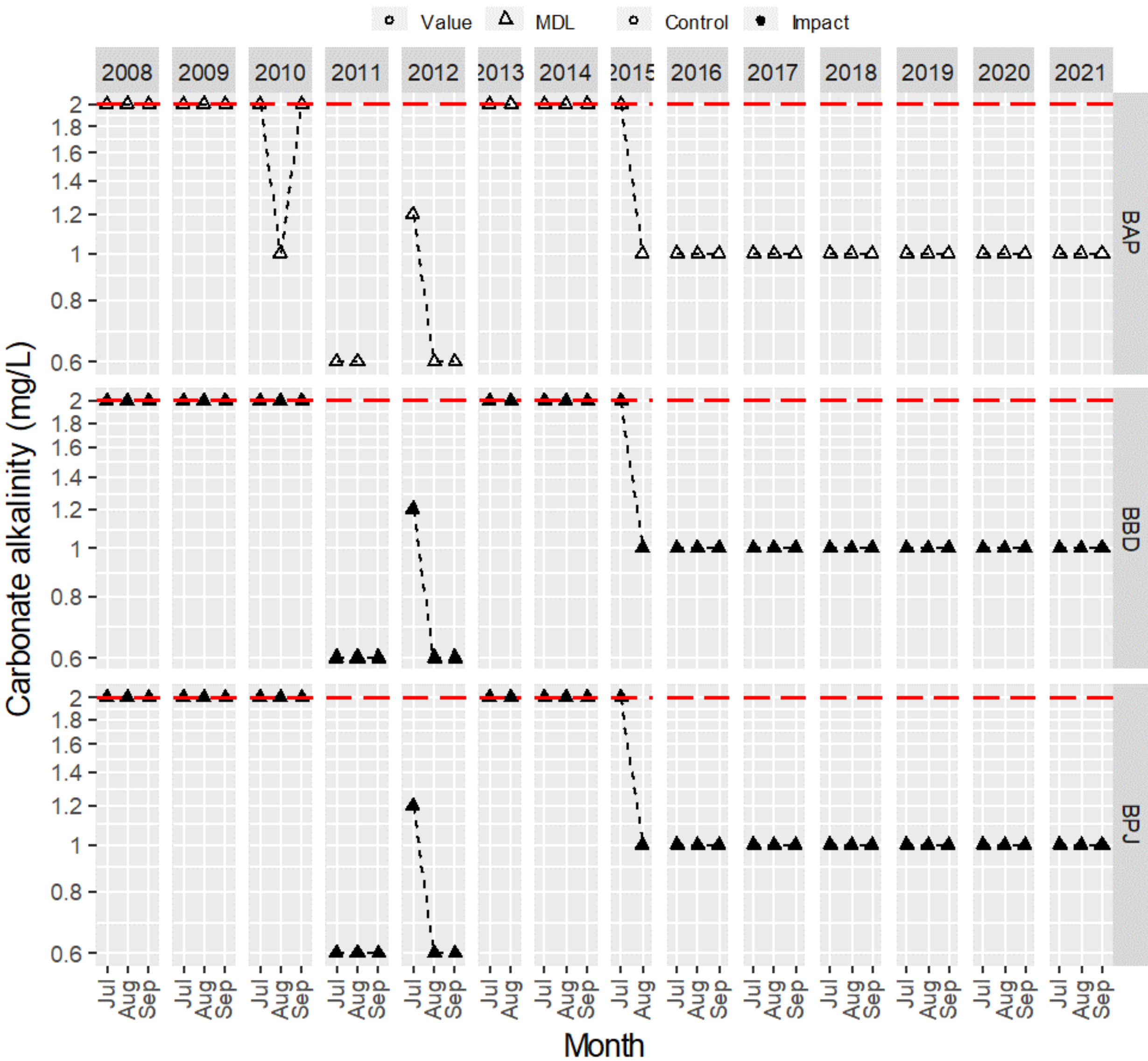


Figure B3 - 2. Nitrite-N (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line = trigger value.

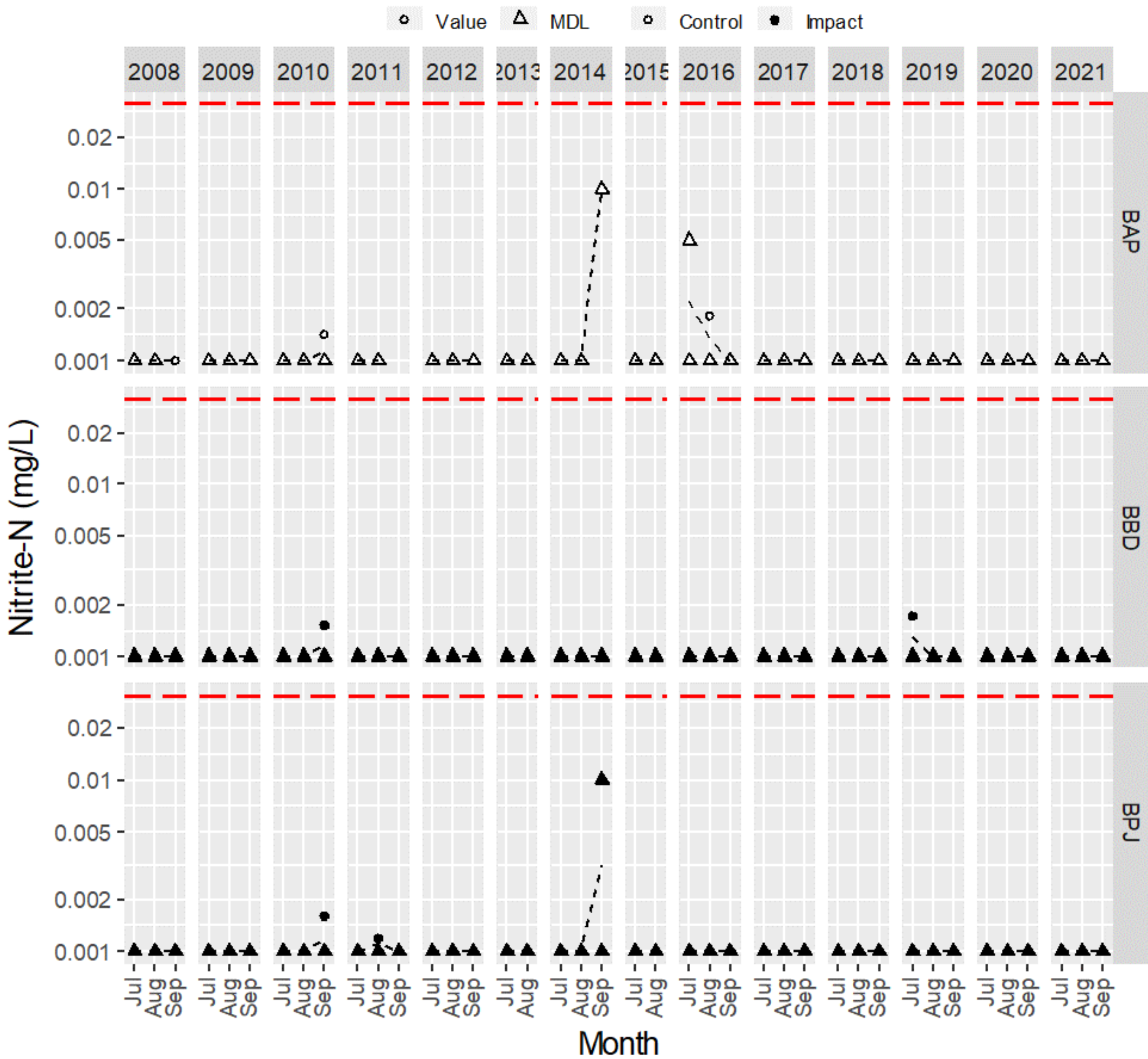


Figure B3 - 3. Total cyanide (mg/L) in water samples from Baker Lake since 2008.

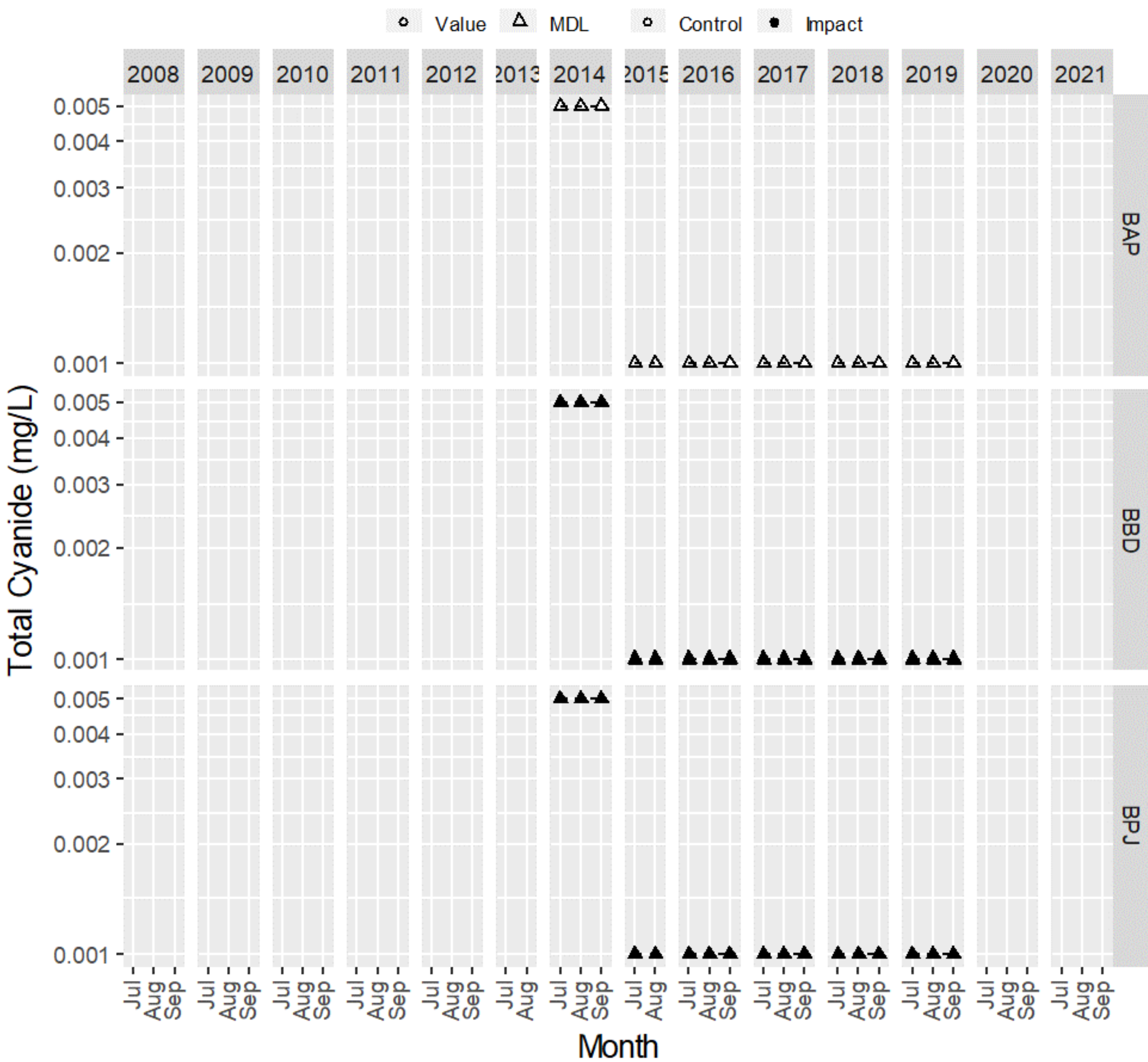


Figure B3 - 4. Free cyanide (mg/L) in water samples from Baker Lake since 2008.

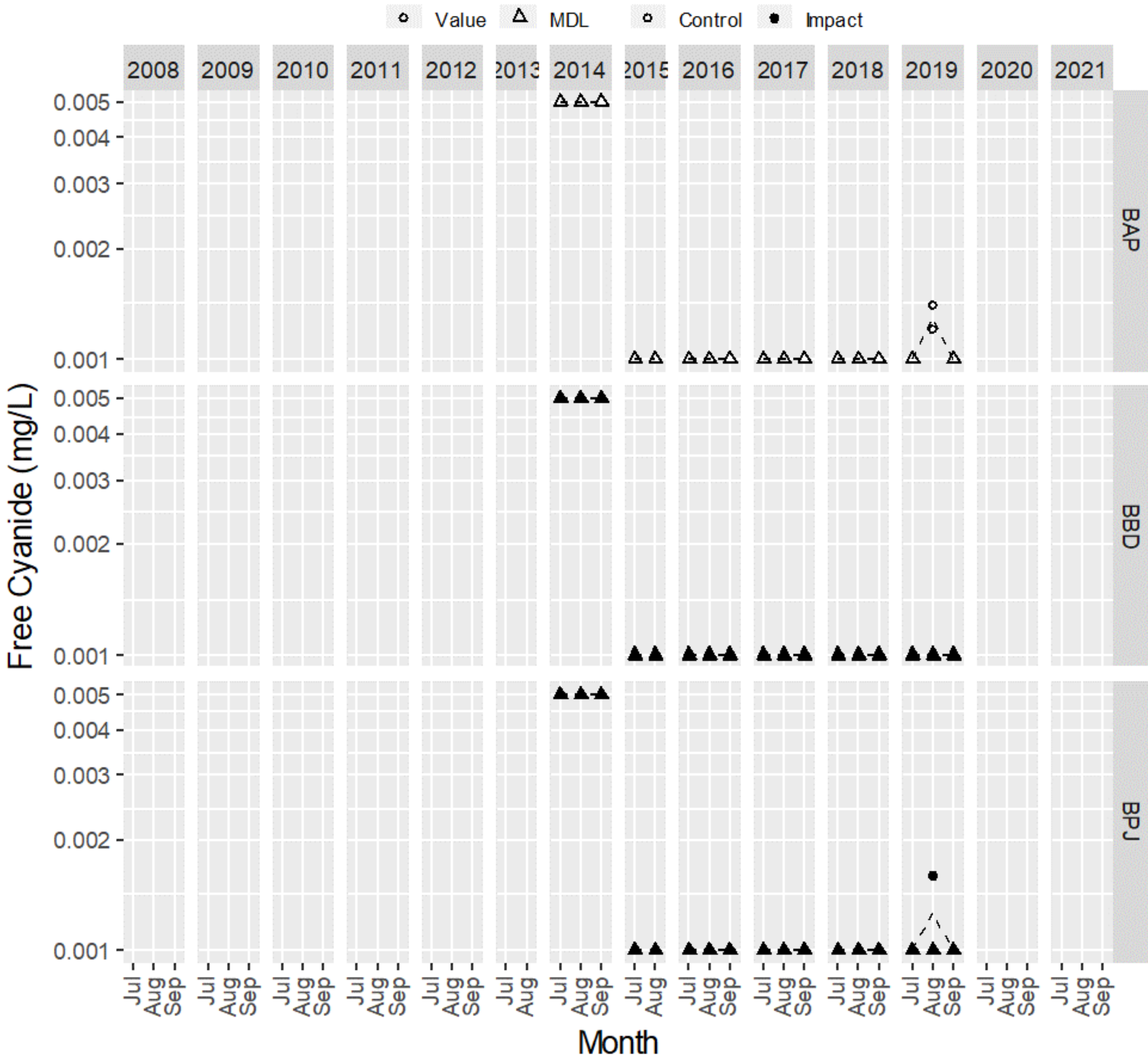


Figure B3 - 5. Total antimony (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line = trigger value.

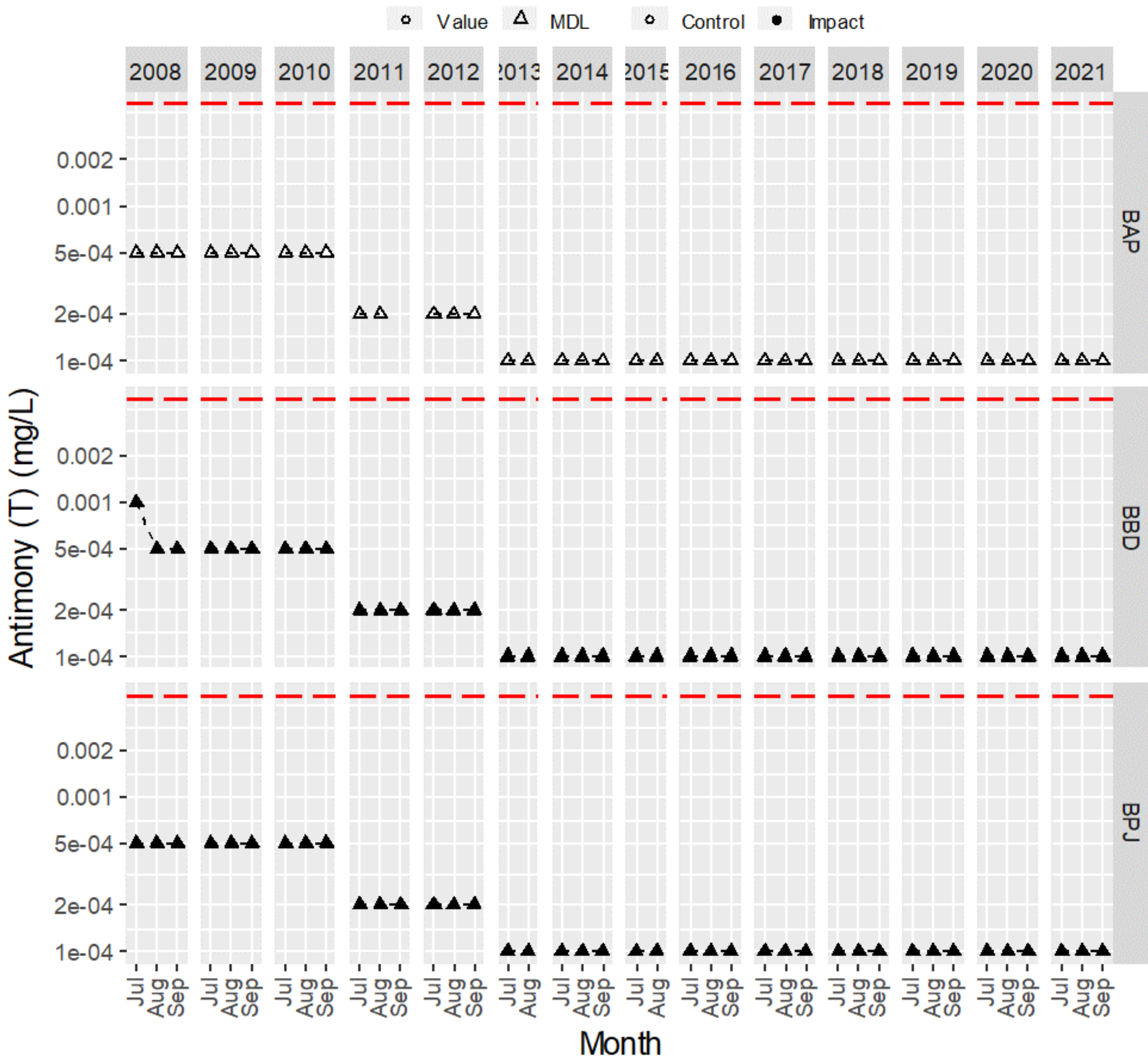


Figure B3 - 6. Total beryllium (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line = trigger value.

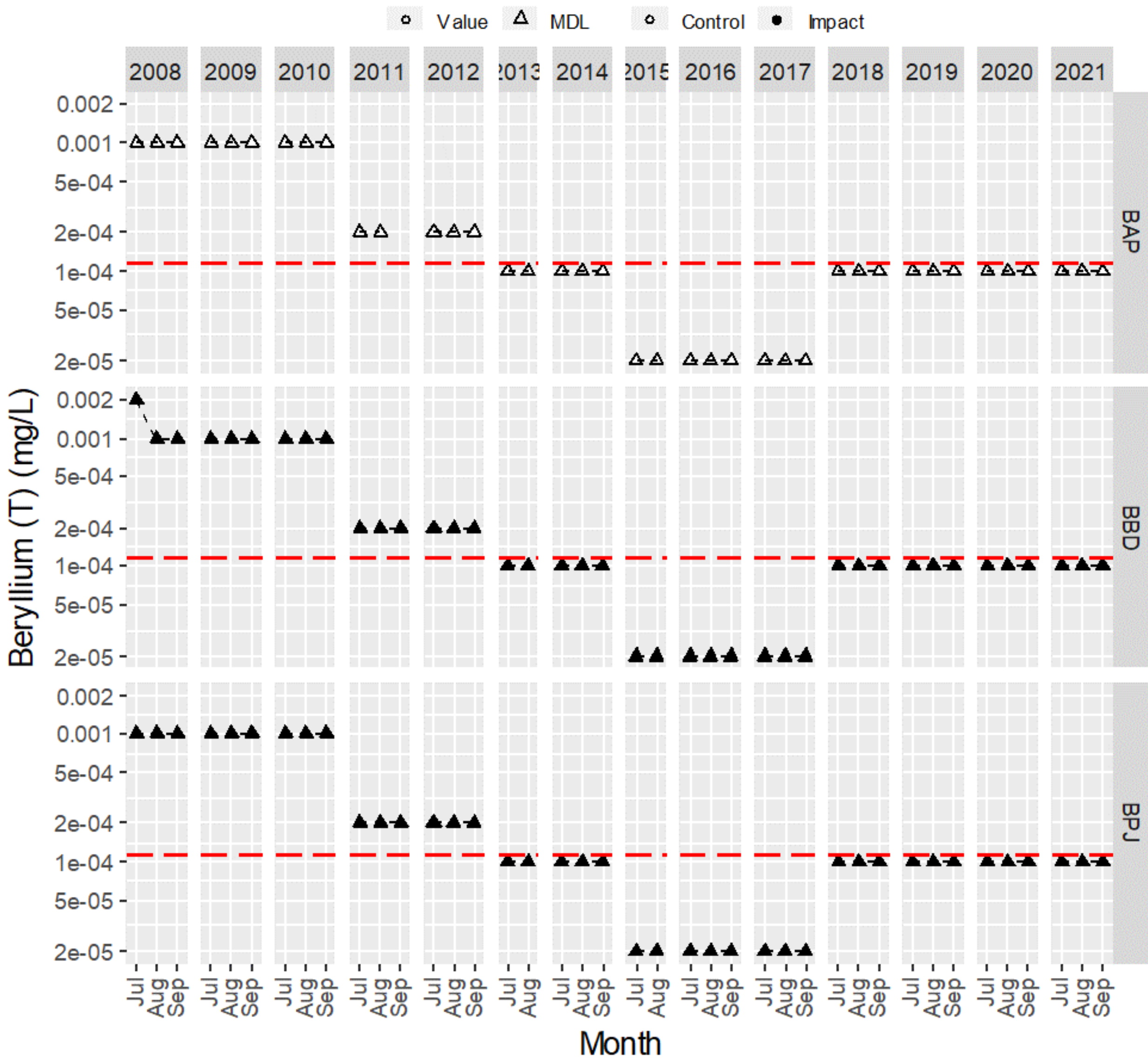


Figure B3 - 7. Total cadmium (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line = trigger value.

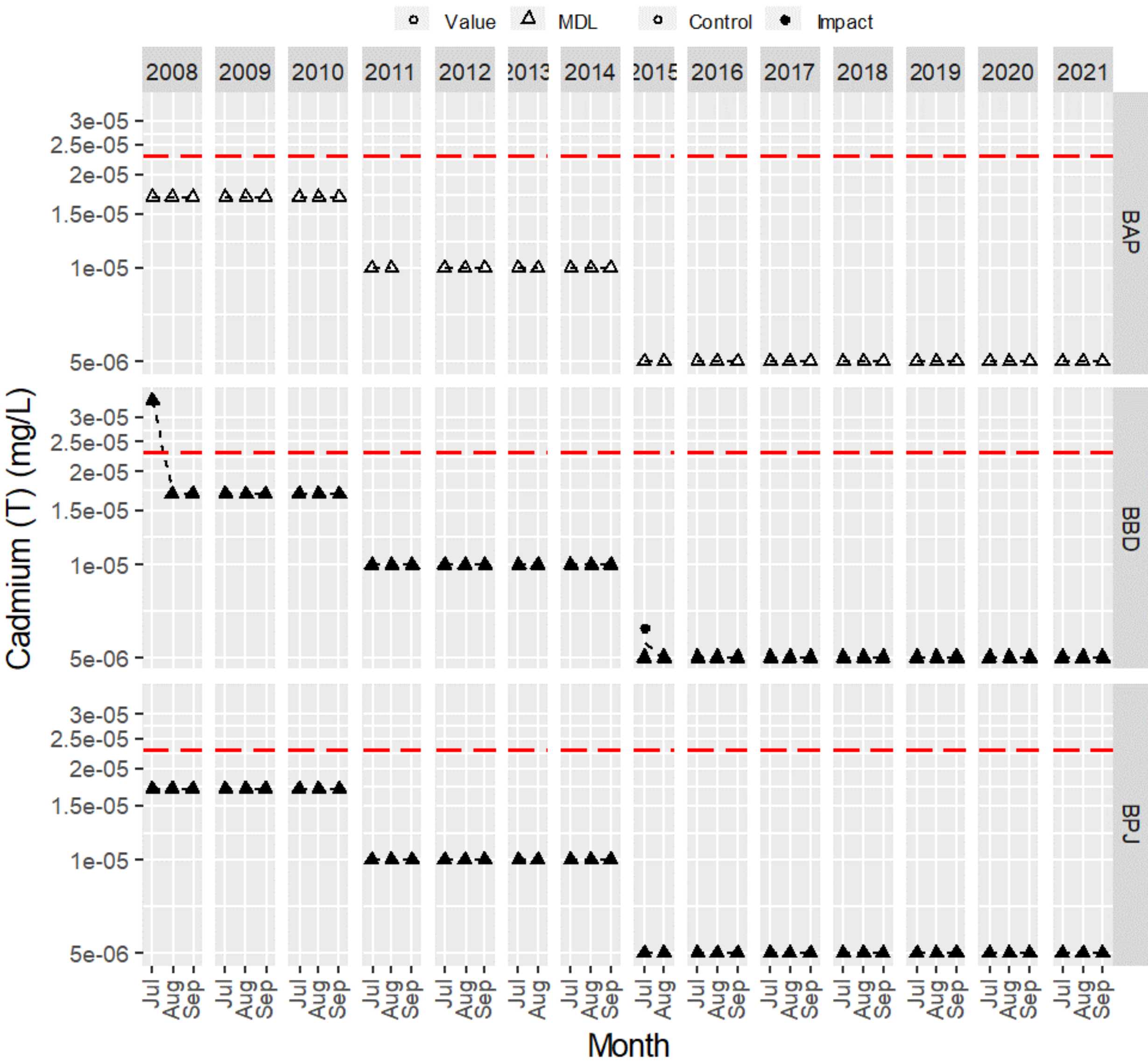


Figure B3 - 8. Total lead (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line = trigger value.

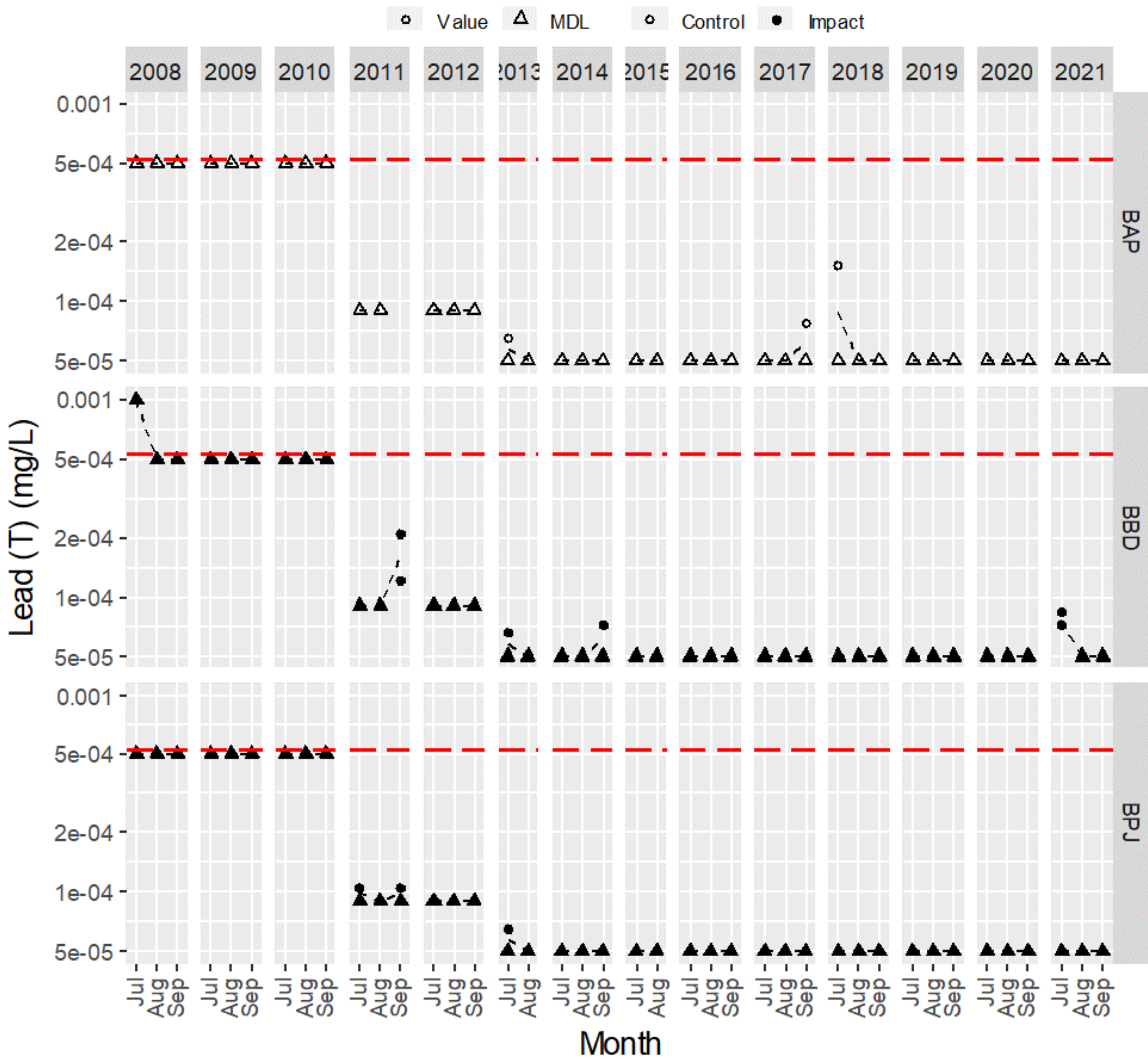


Figure B3 - 9. Total mercury (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line = trigger value.

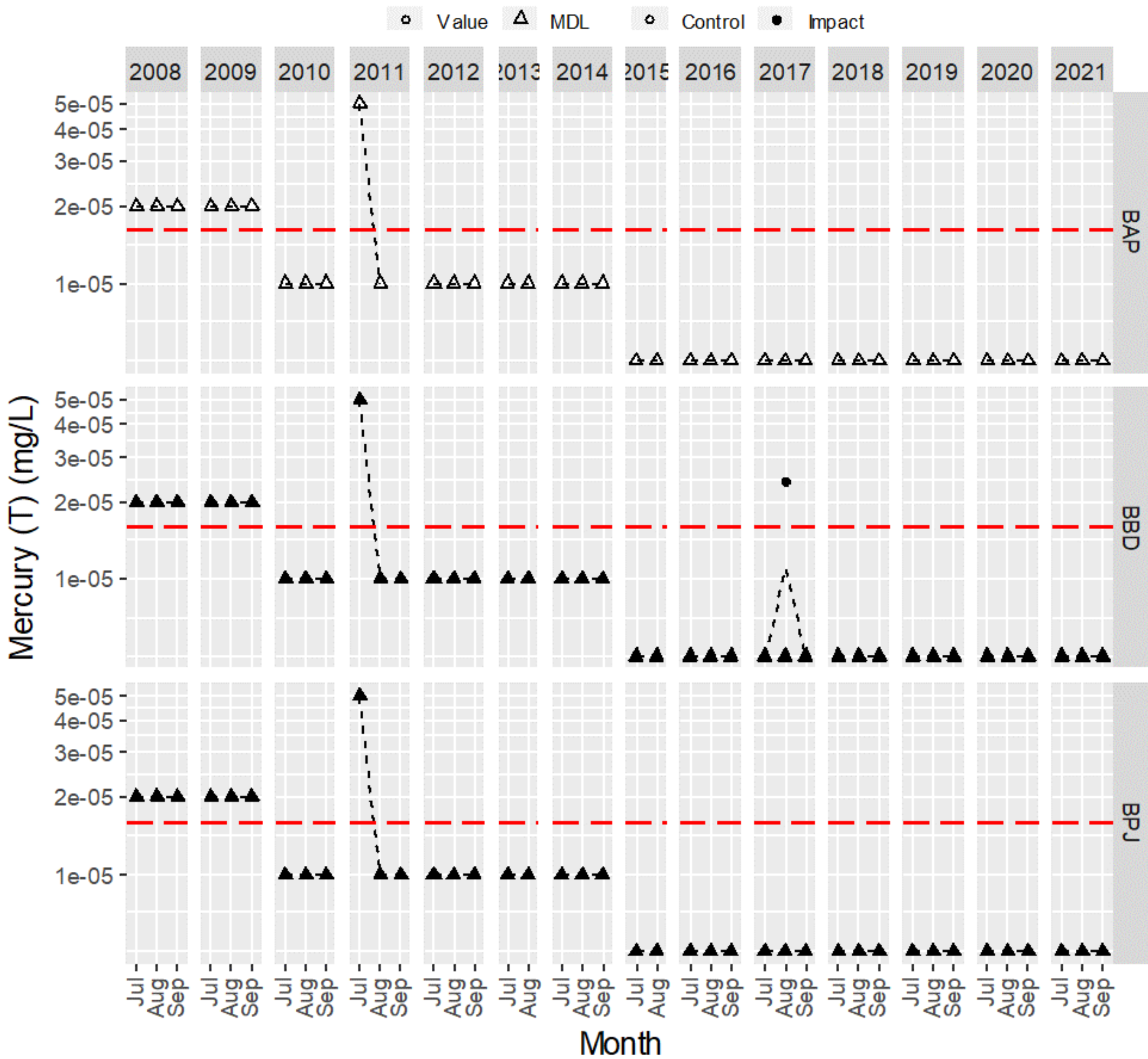


Figure B3 - 10. Total nickel (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line = trigger value.

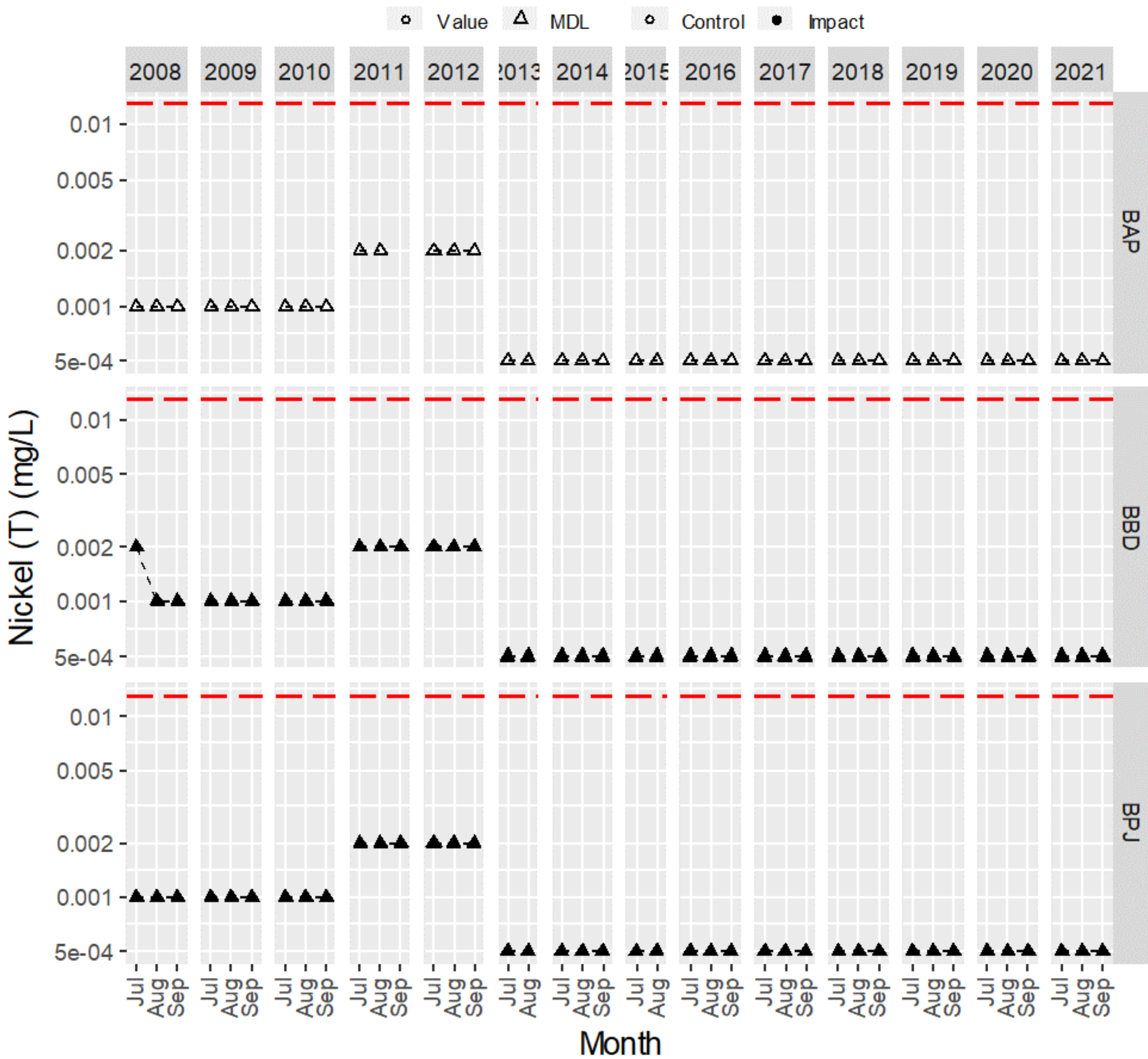


Figure B3 - 11. Total selenium (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line = trigger value.

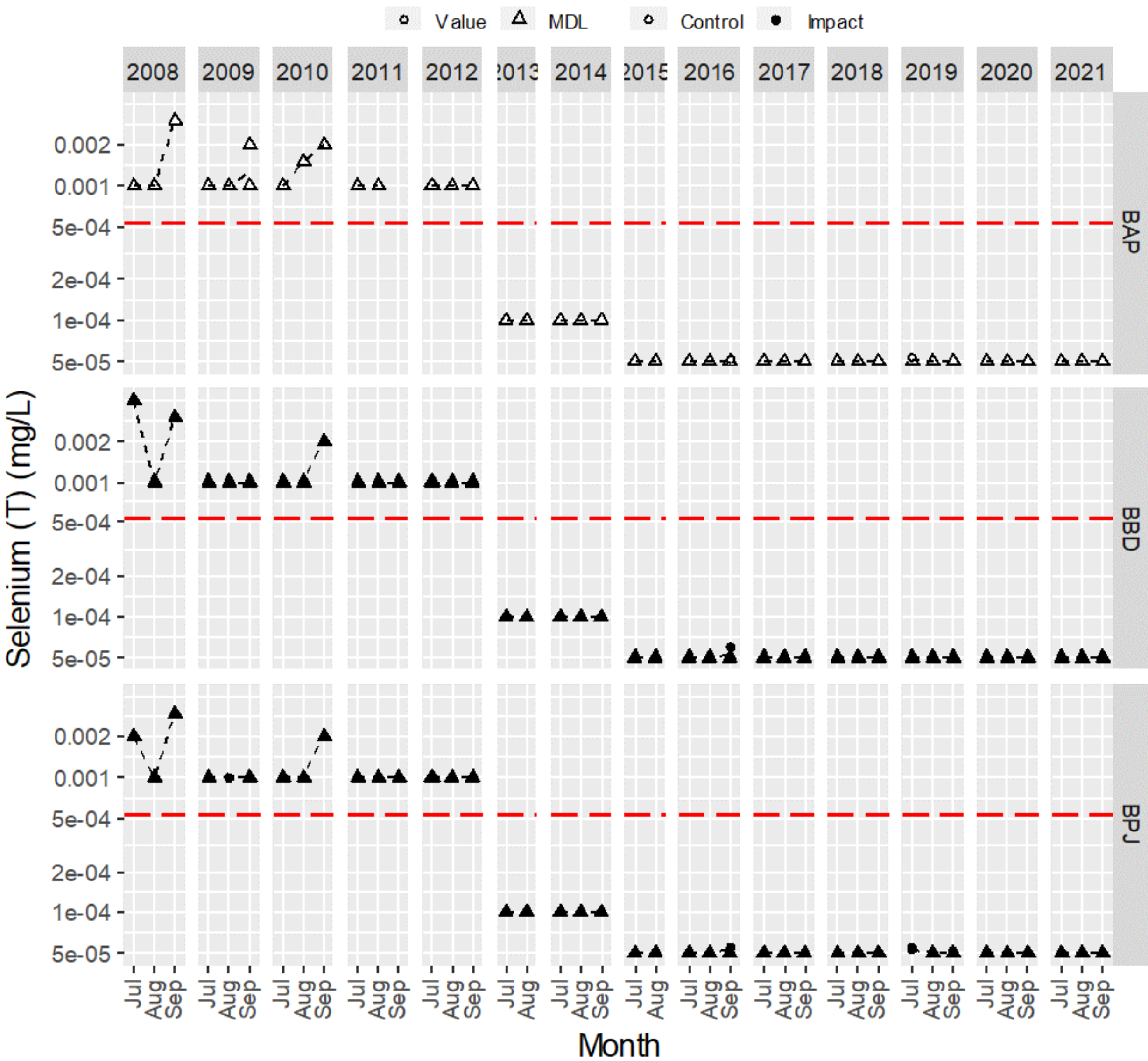


Figure B3 - 12. Total silver (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line = trigger value.

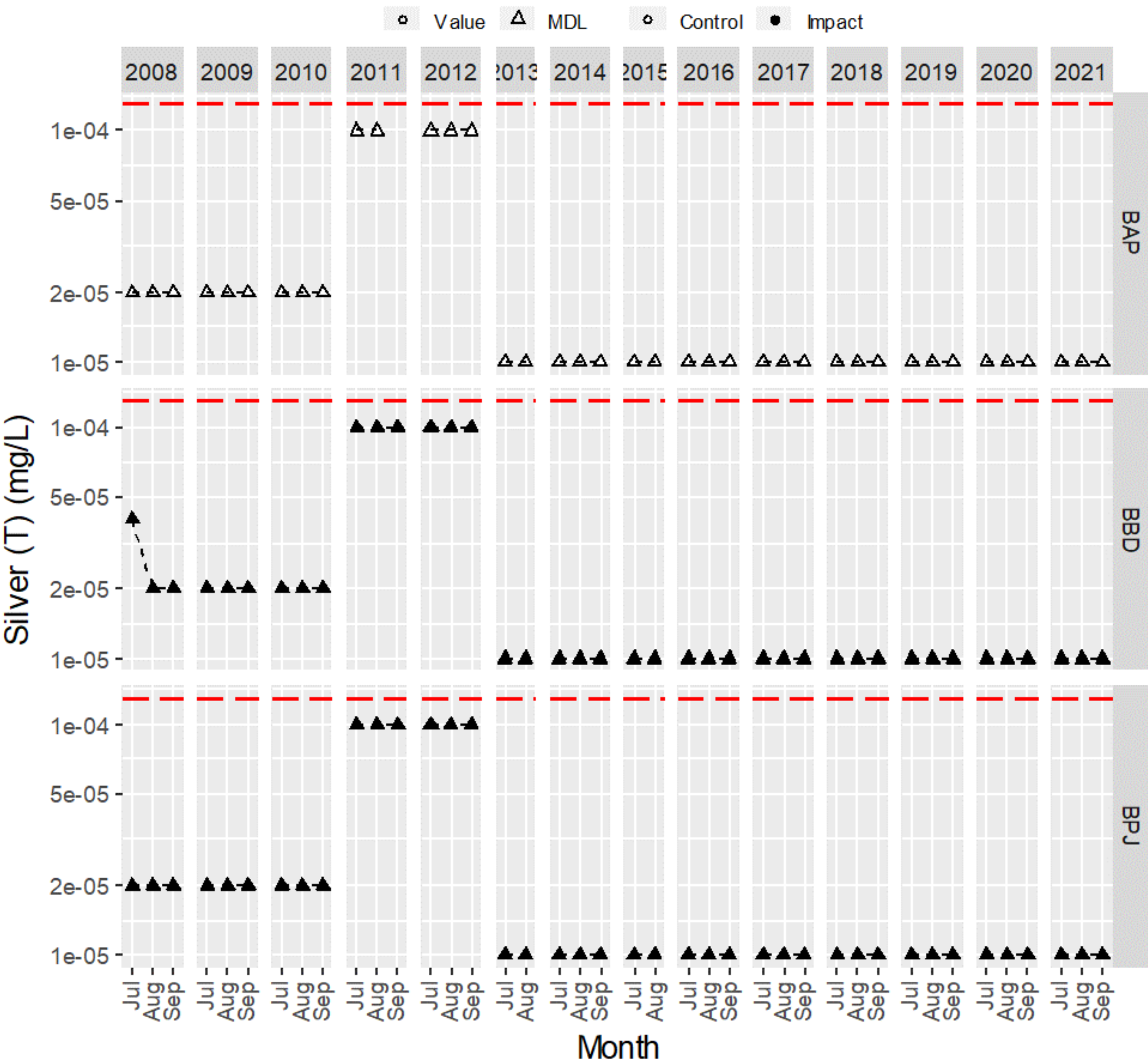


Figure B3 - 13. Total thallium (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line = trigger value.

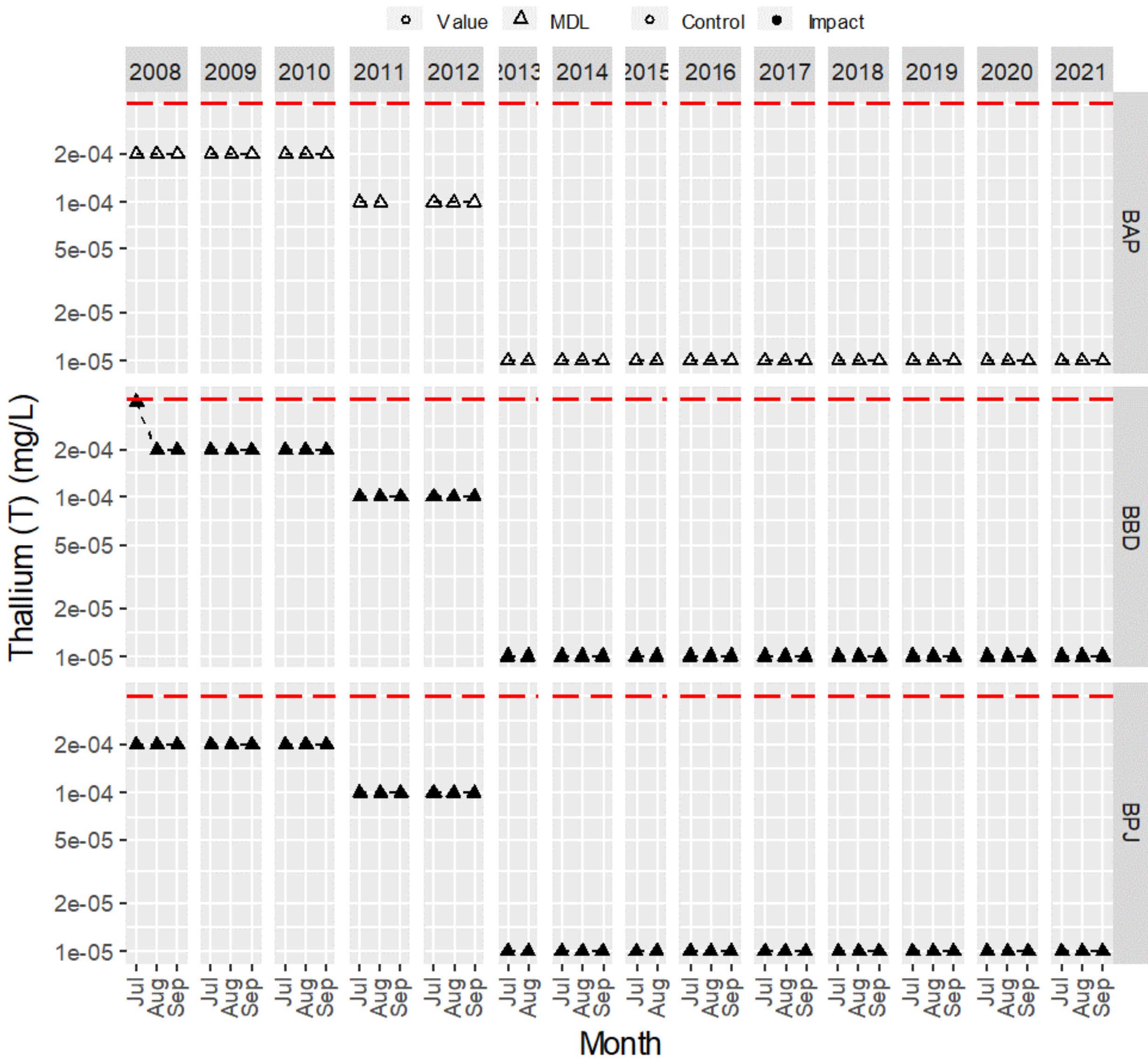


Figure B3 - 14. Total tin (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line = trigger value.

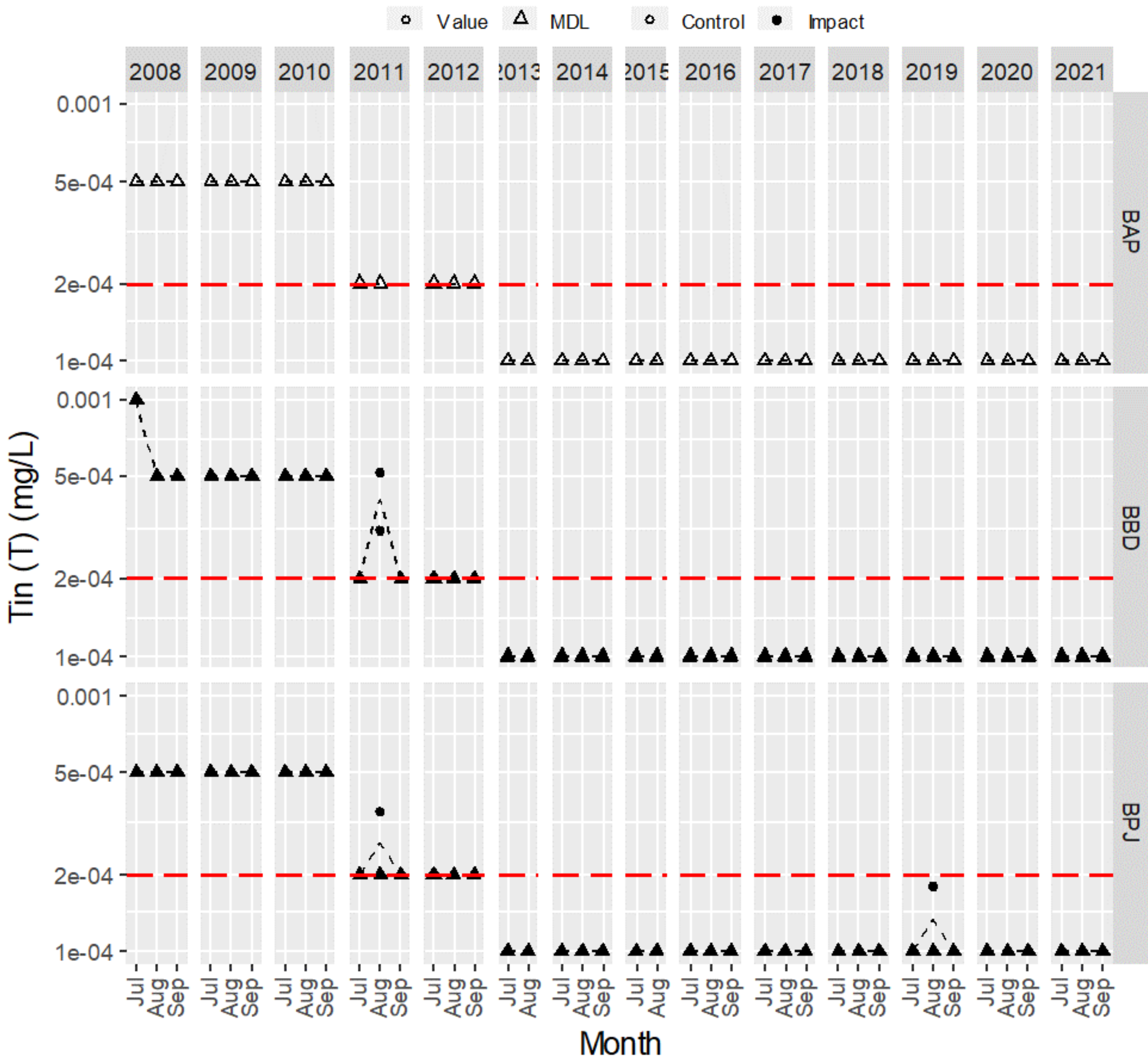


Figure B3 - 15. Total vanadium (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line = trigger value.

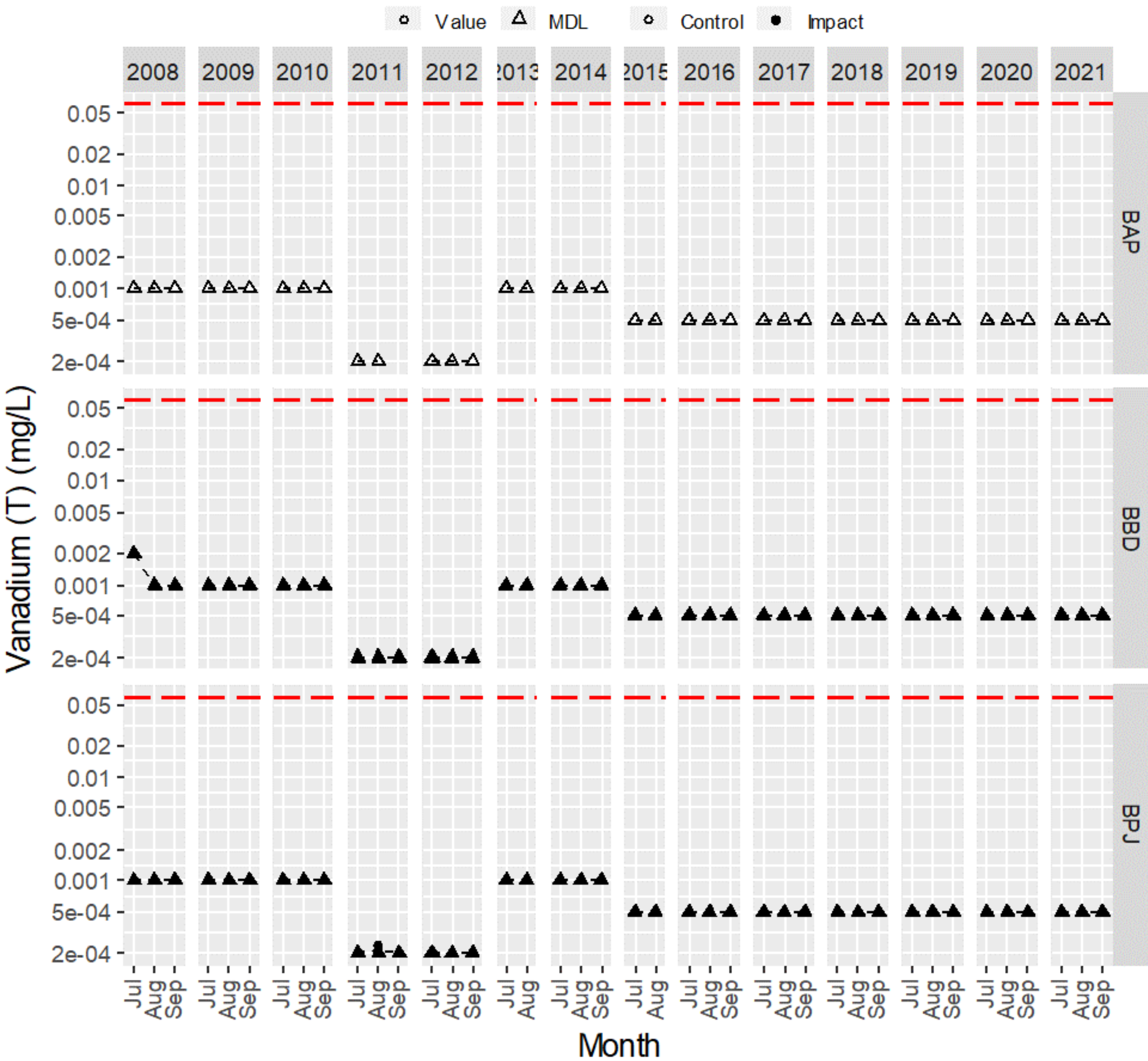


Figure B3 - 16. Total zinc (mg/L) in water samples from Baker Lake since 2008.

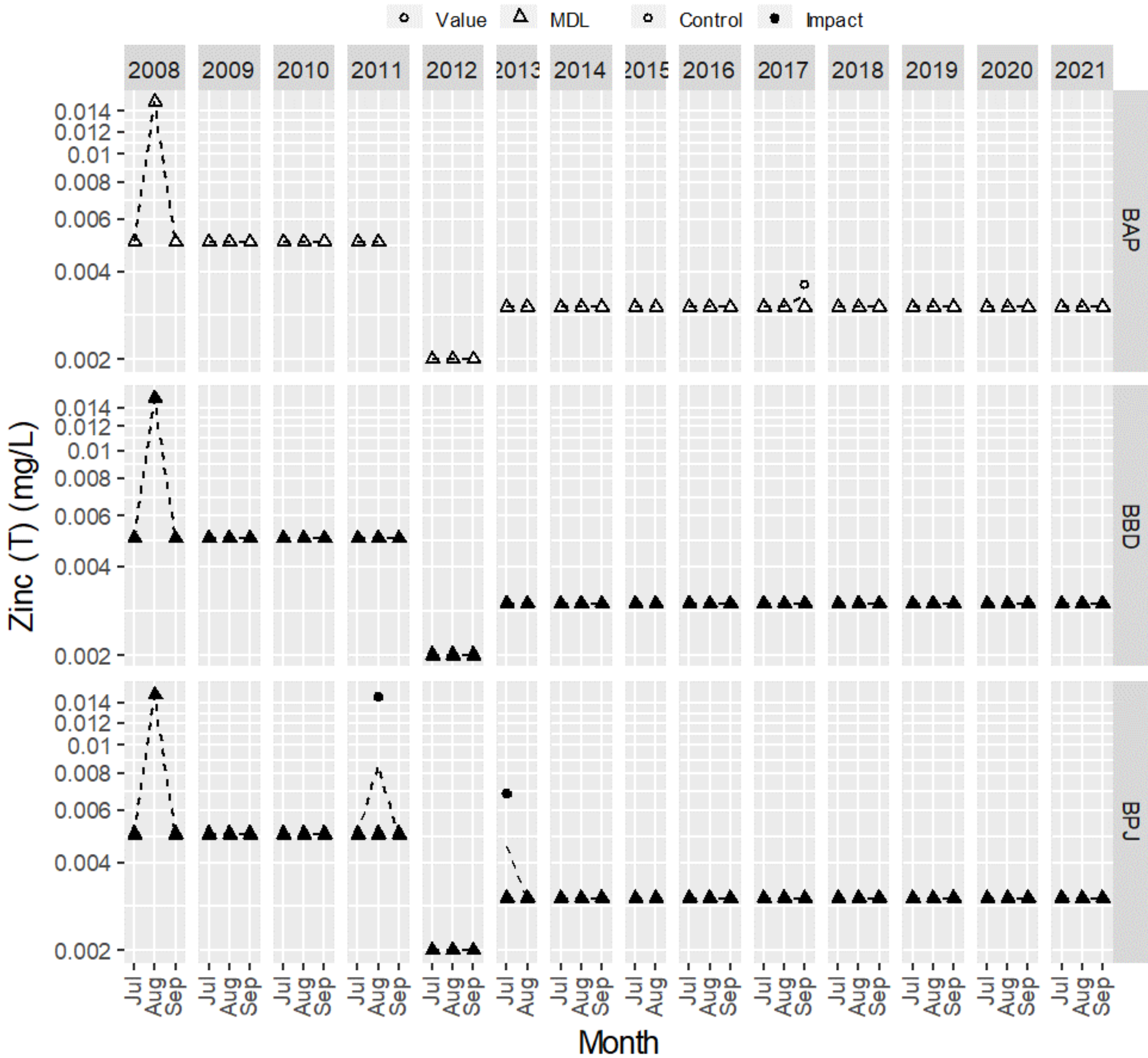


Figure B3 - 17. Dissolved antimony (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line = trigger value.

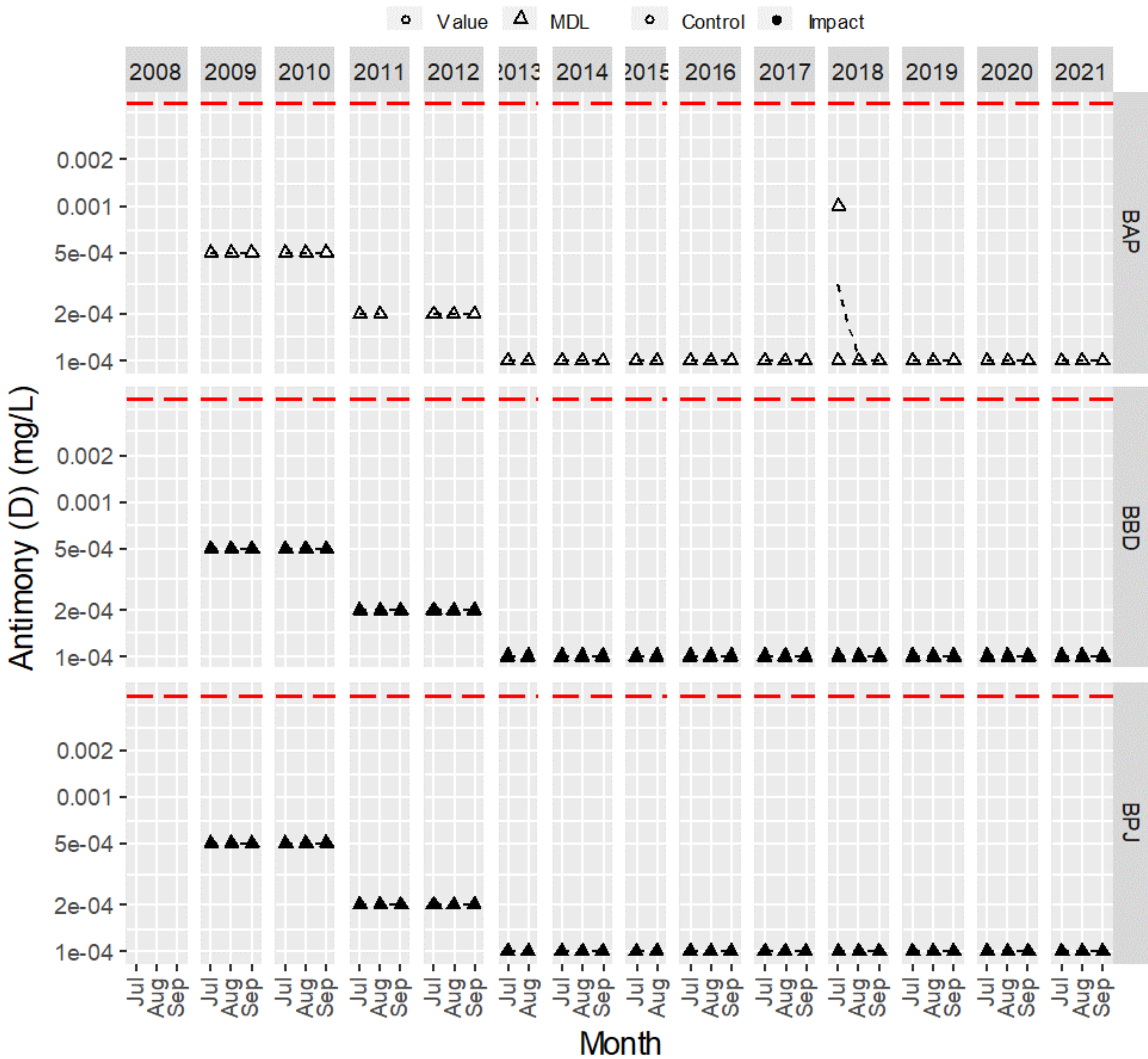


Figure B3 - 18. Dissolved beryllium (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line = trigger value.

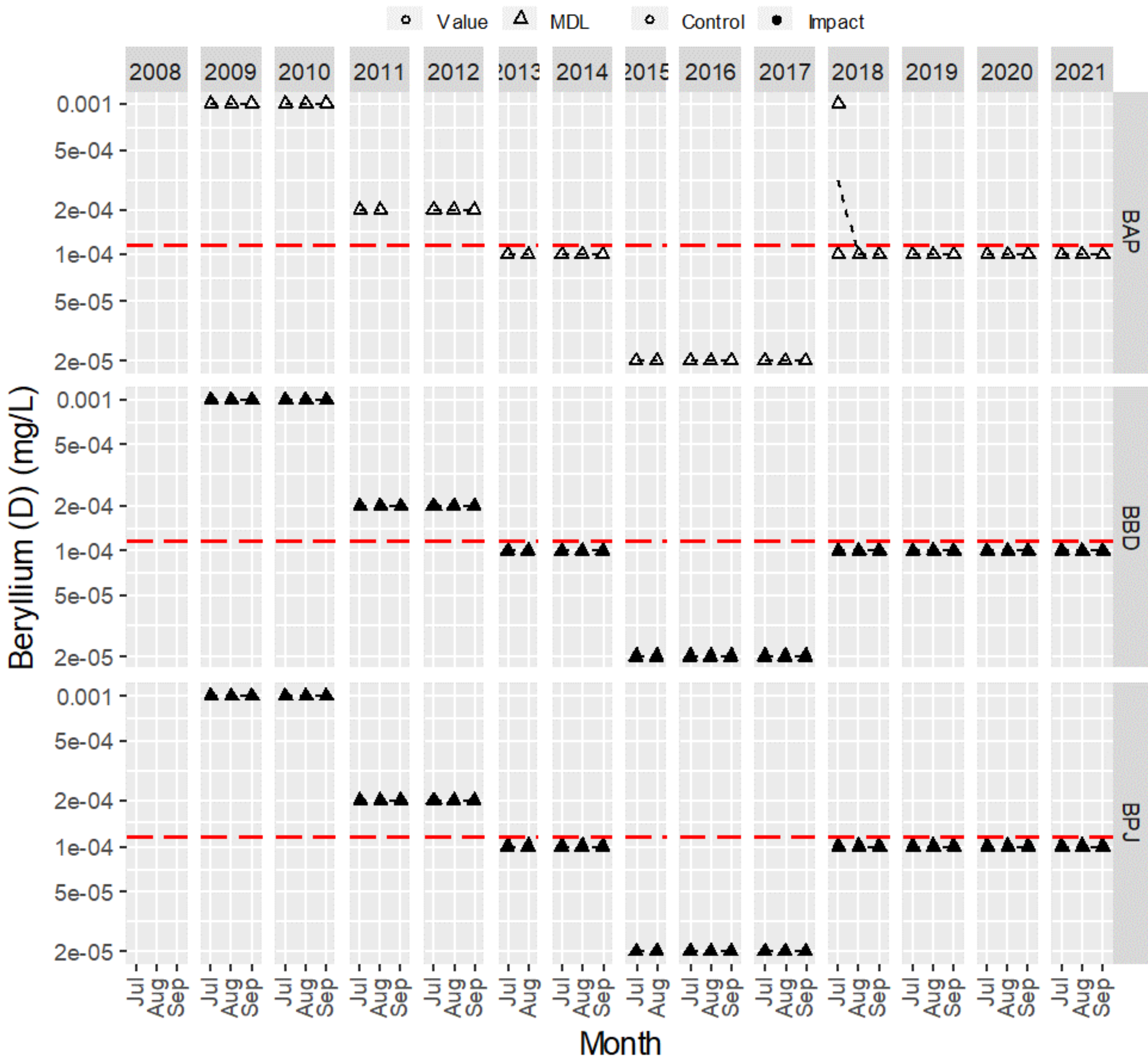


Figure B3 - 19. Dissolved cadmium (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line = trigger value.

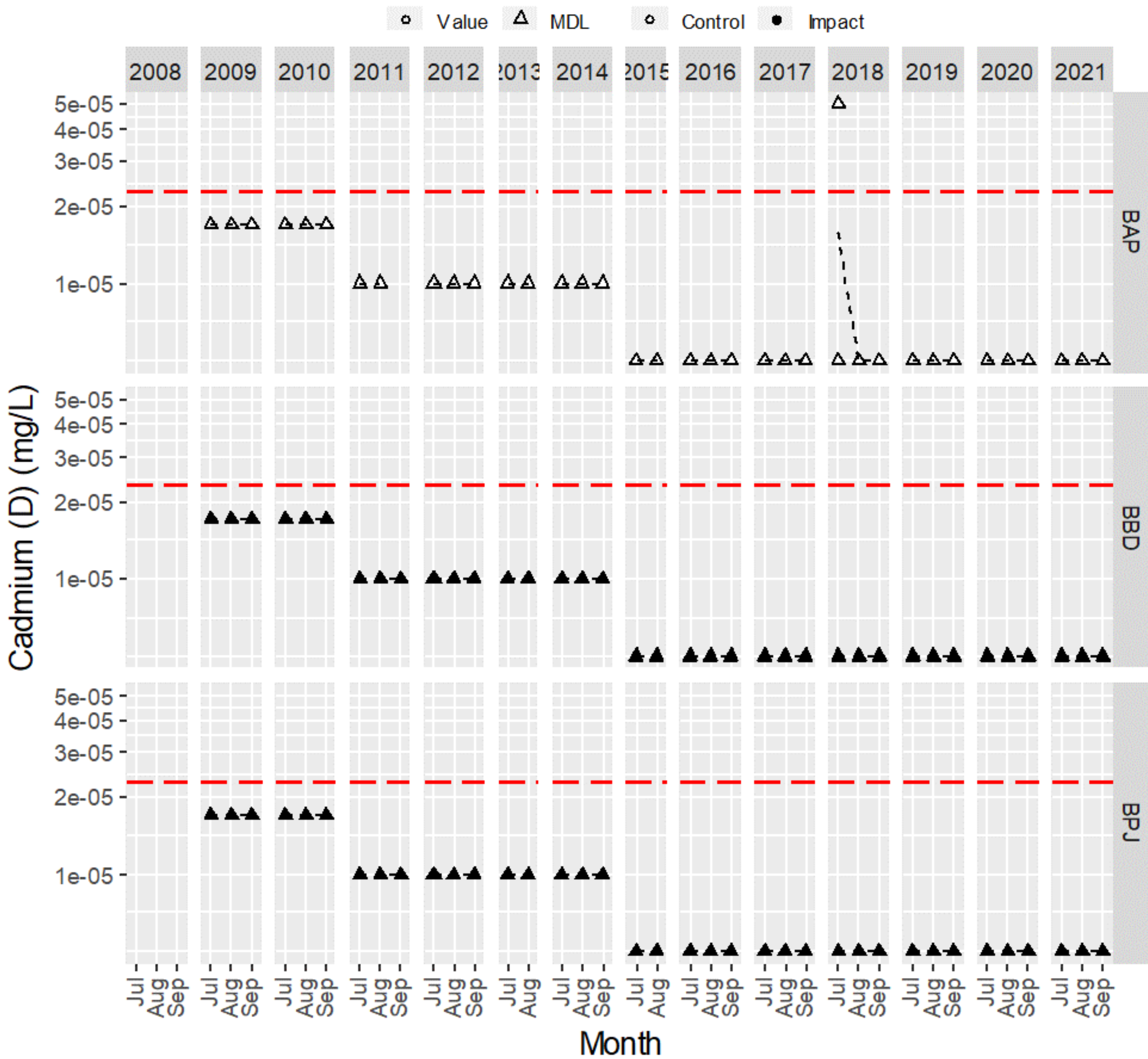


Figure B3 - 20. Dissolved chromium (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line = trigger value.

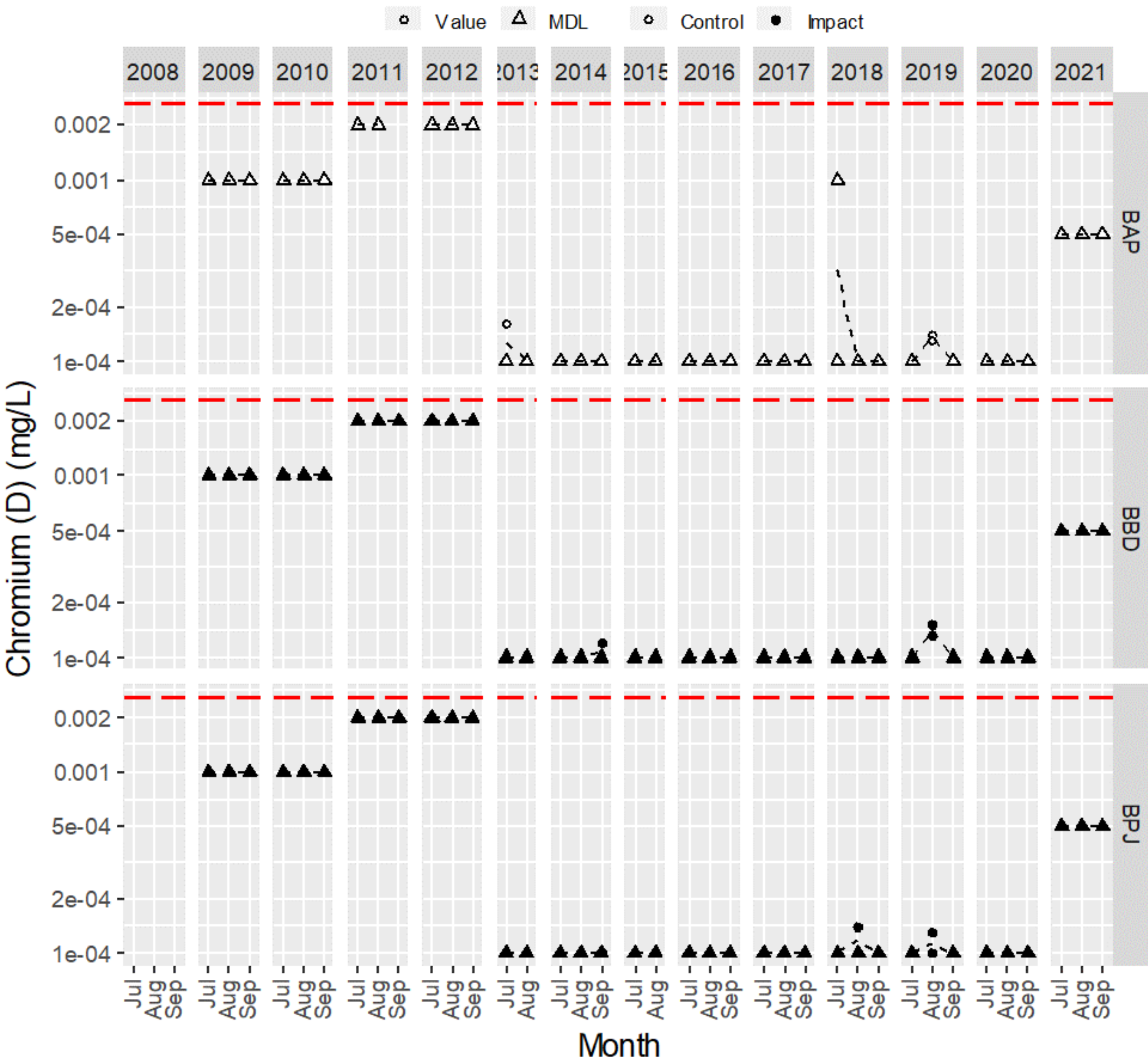


Figure B3 - 21. Dissolved lead (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line = trigger value.

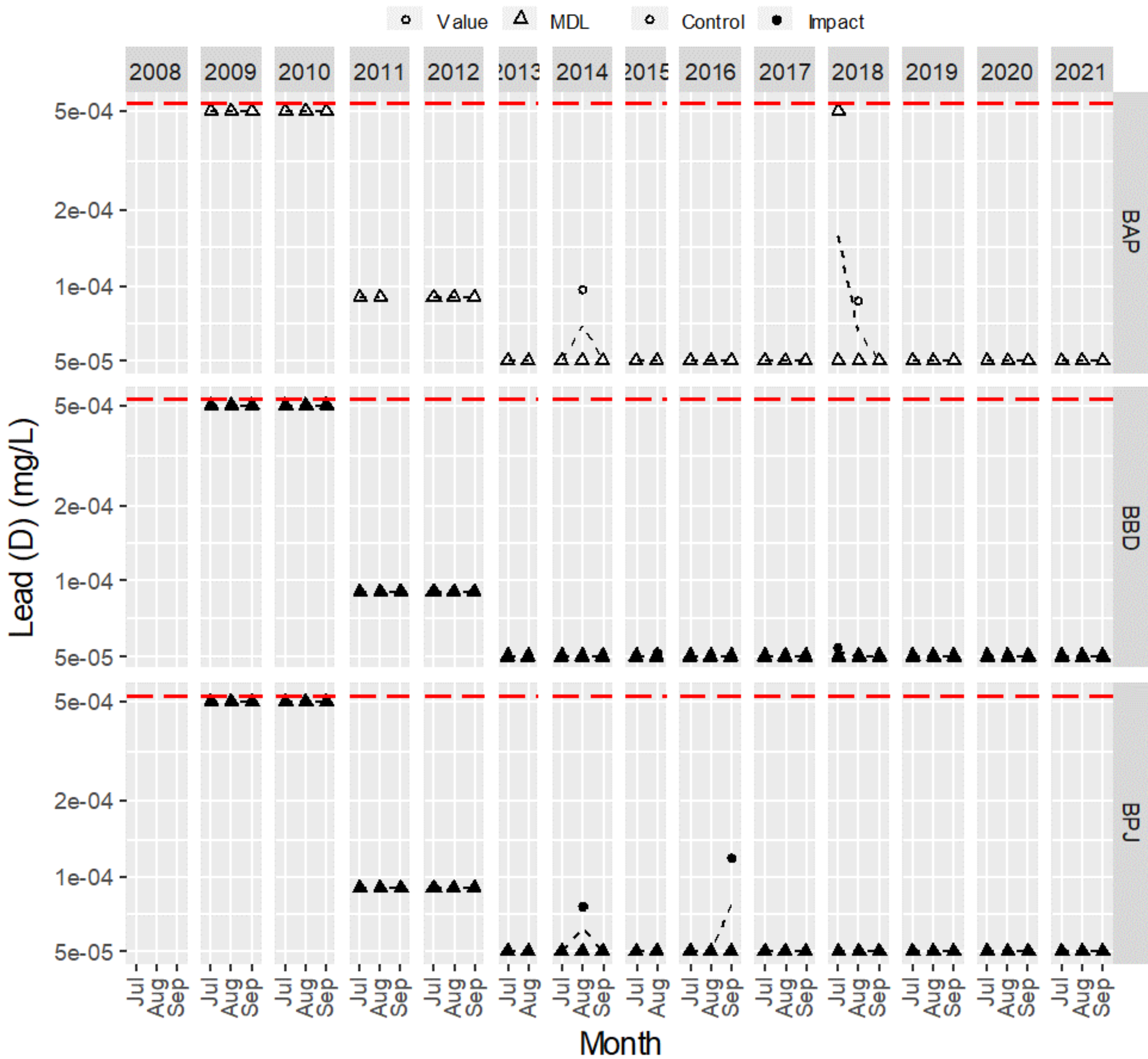


Figure B3 - 22. Dissolved mercury (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line = trigger value.

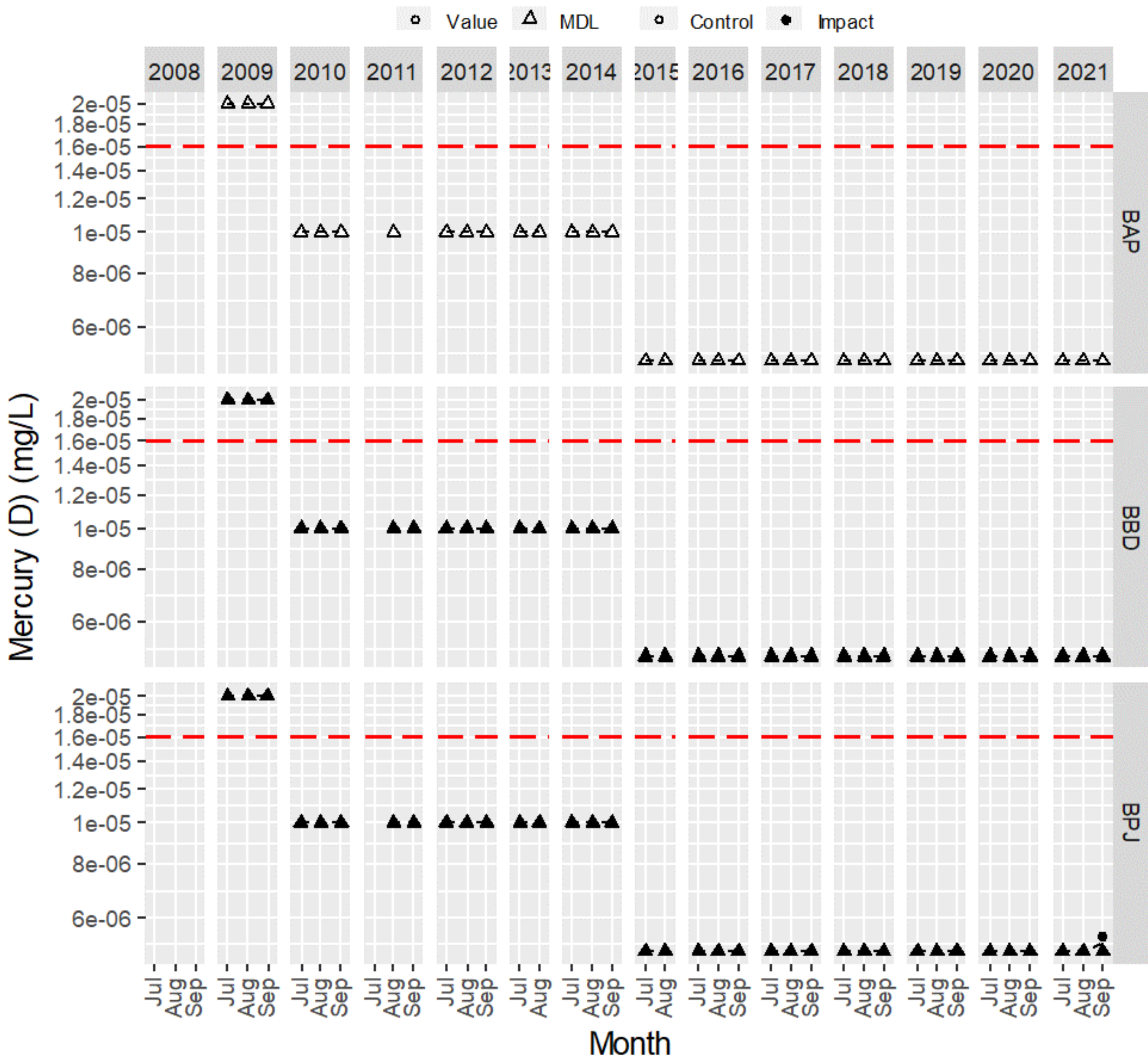


Figure B3 - 23. Dissolved nickel (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line = trigger value.

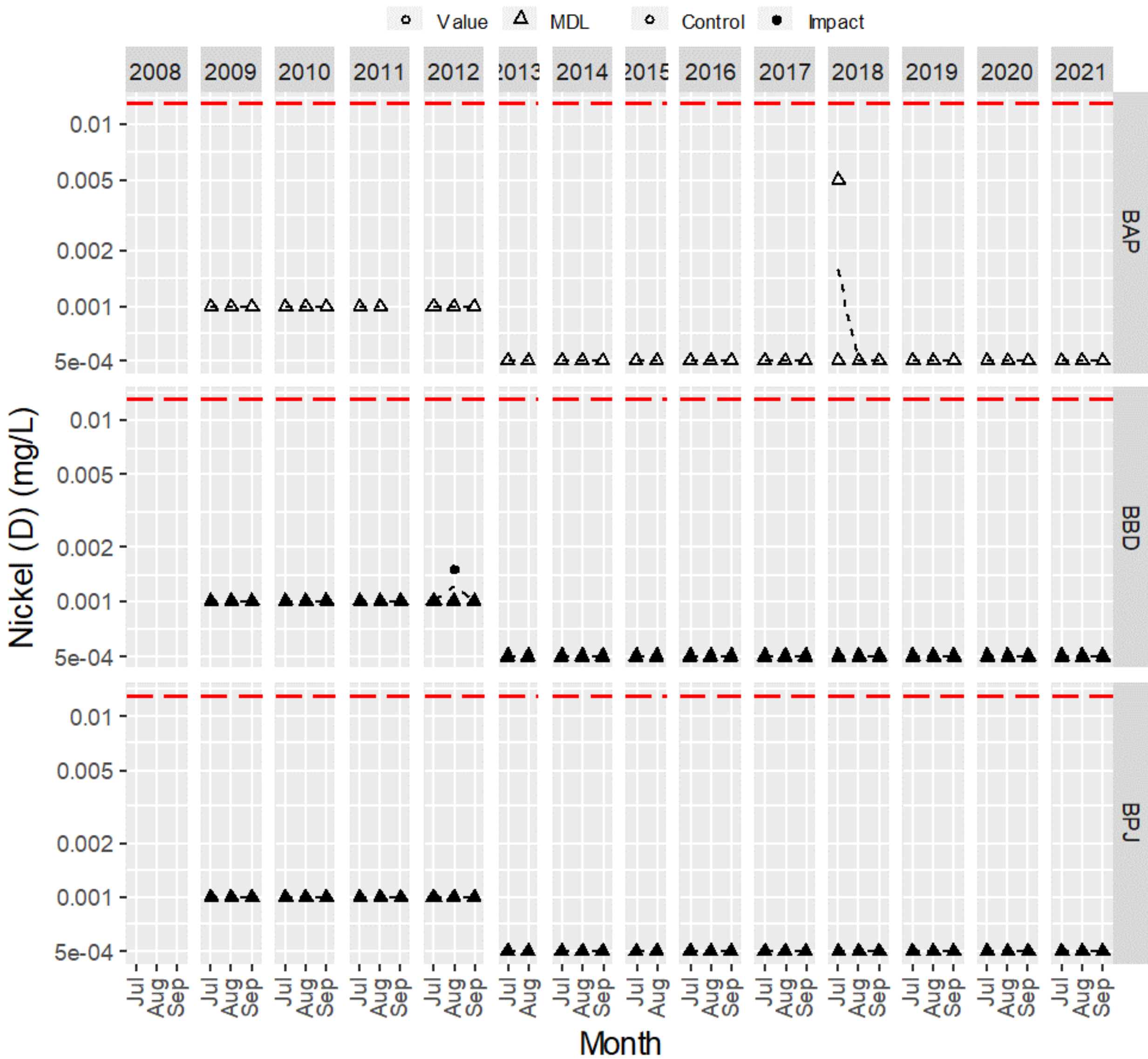


Figure B3 - 24. Dissolved selenium (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line = trigger value.

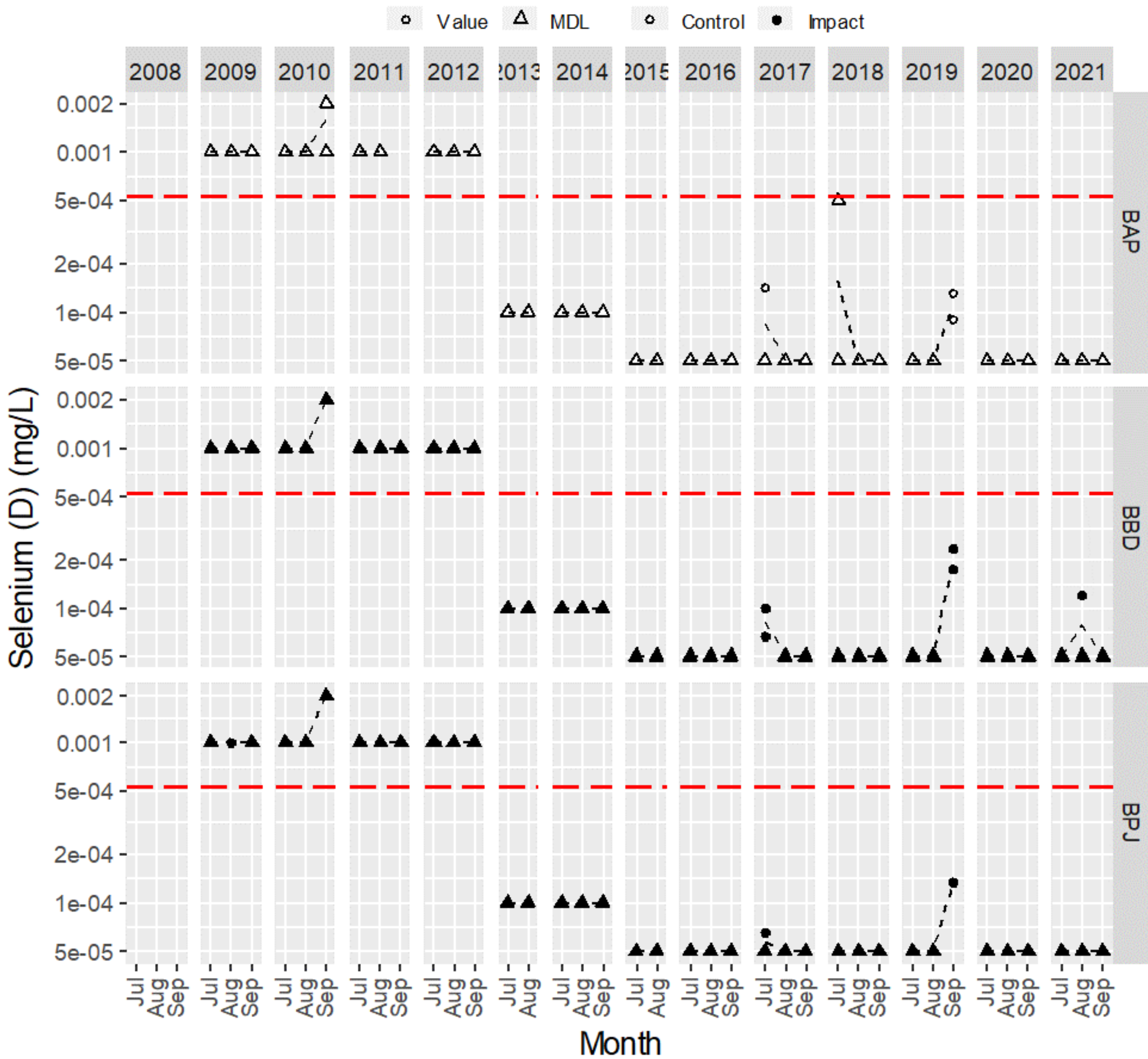


Figure B3 - 25. Dissolved silver (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line = trigger value.

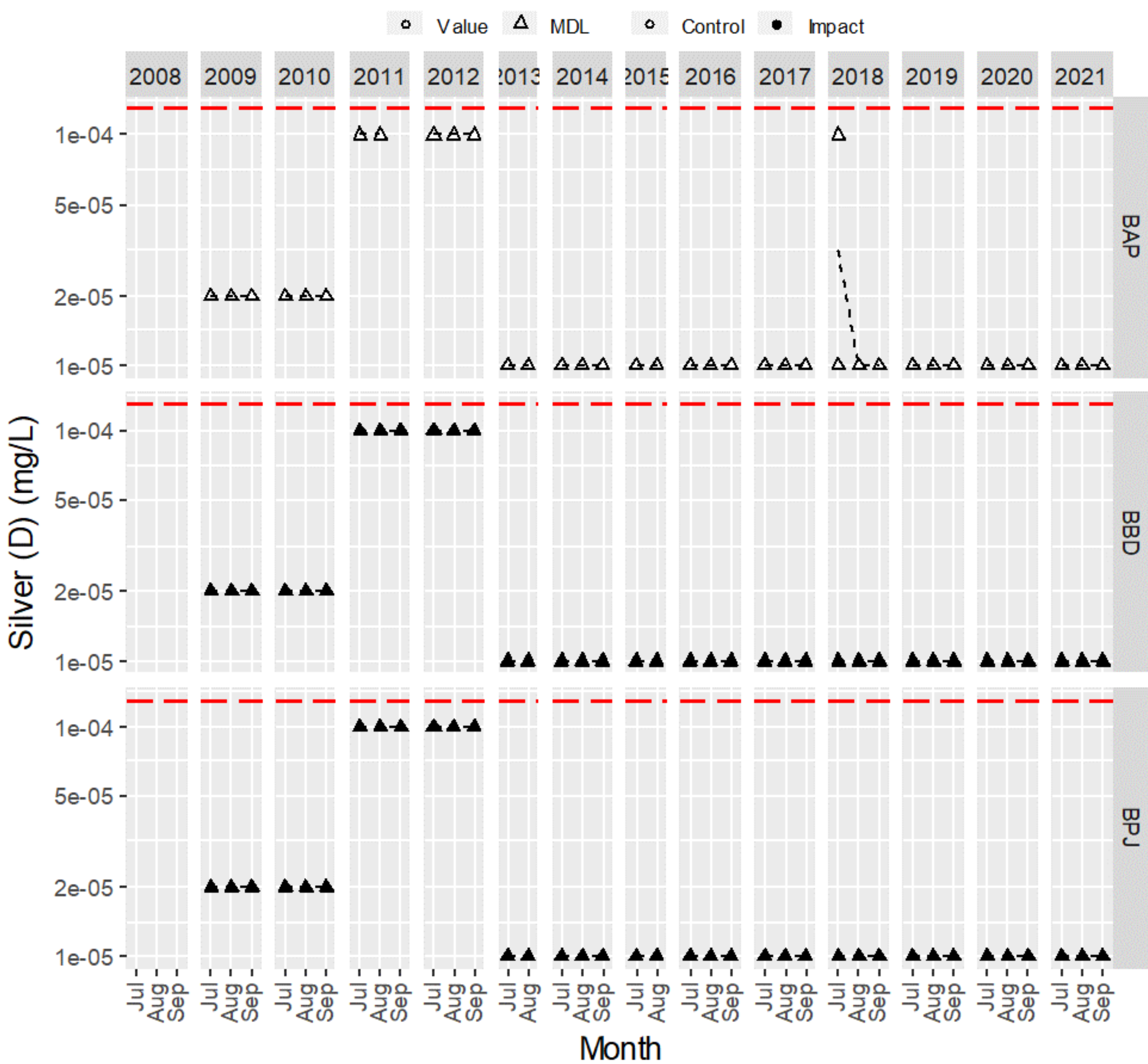


Figure B3 - 26. Dissolved thallium (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line = trigger value.

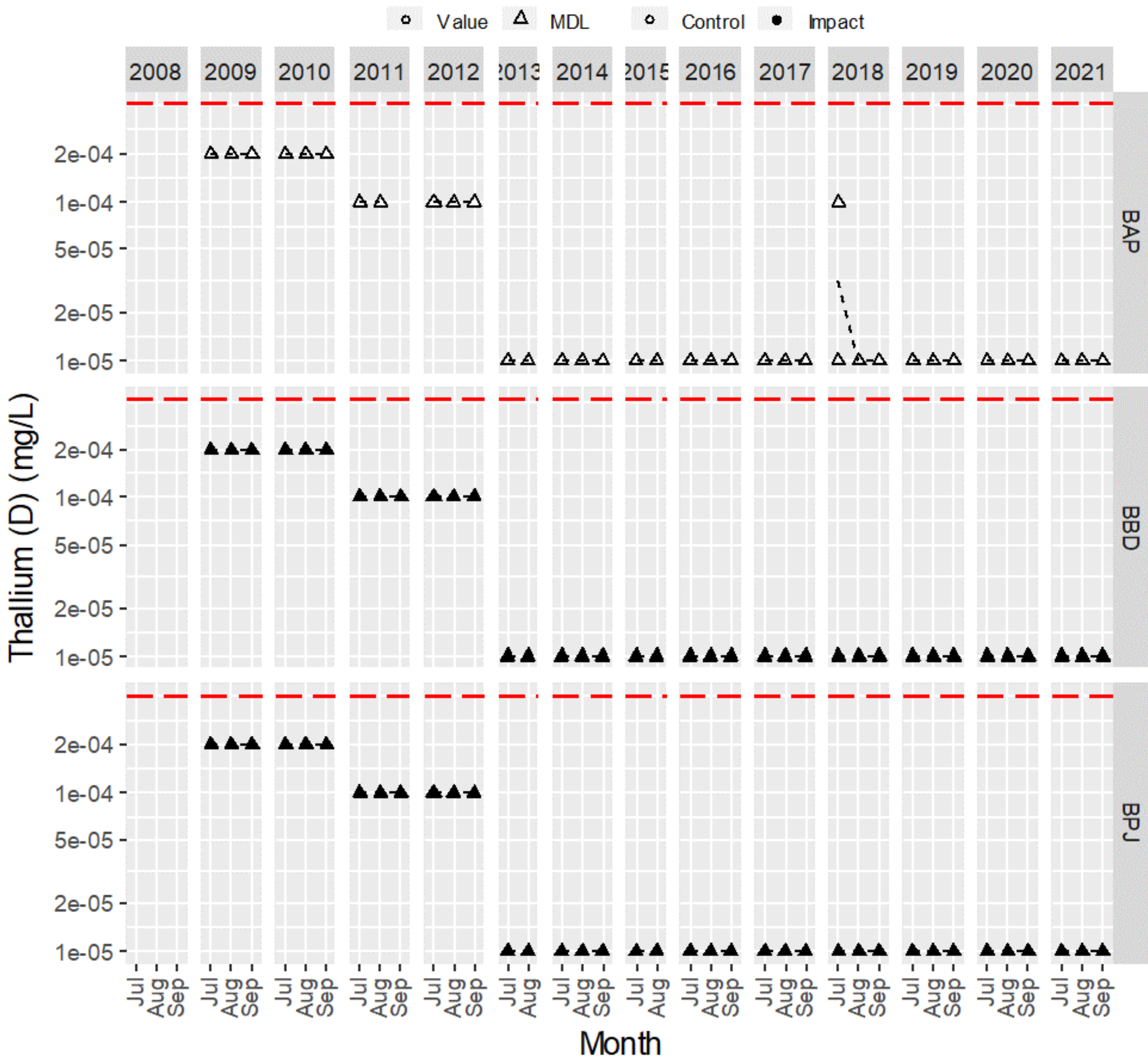


Figure B3 - 27. Dissolved tin (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line = trigger value.

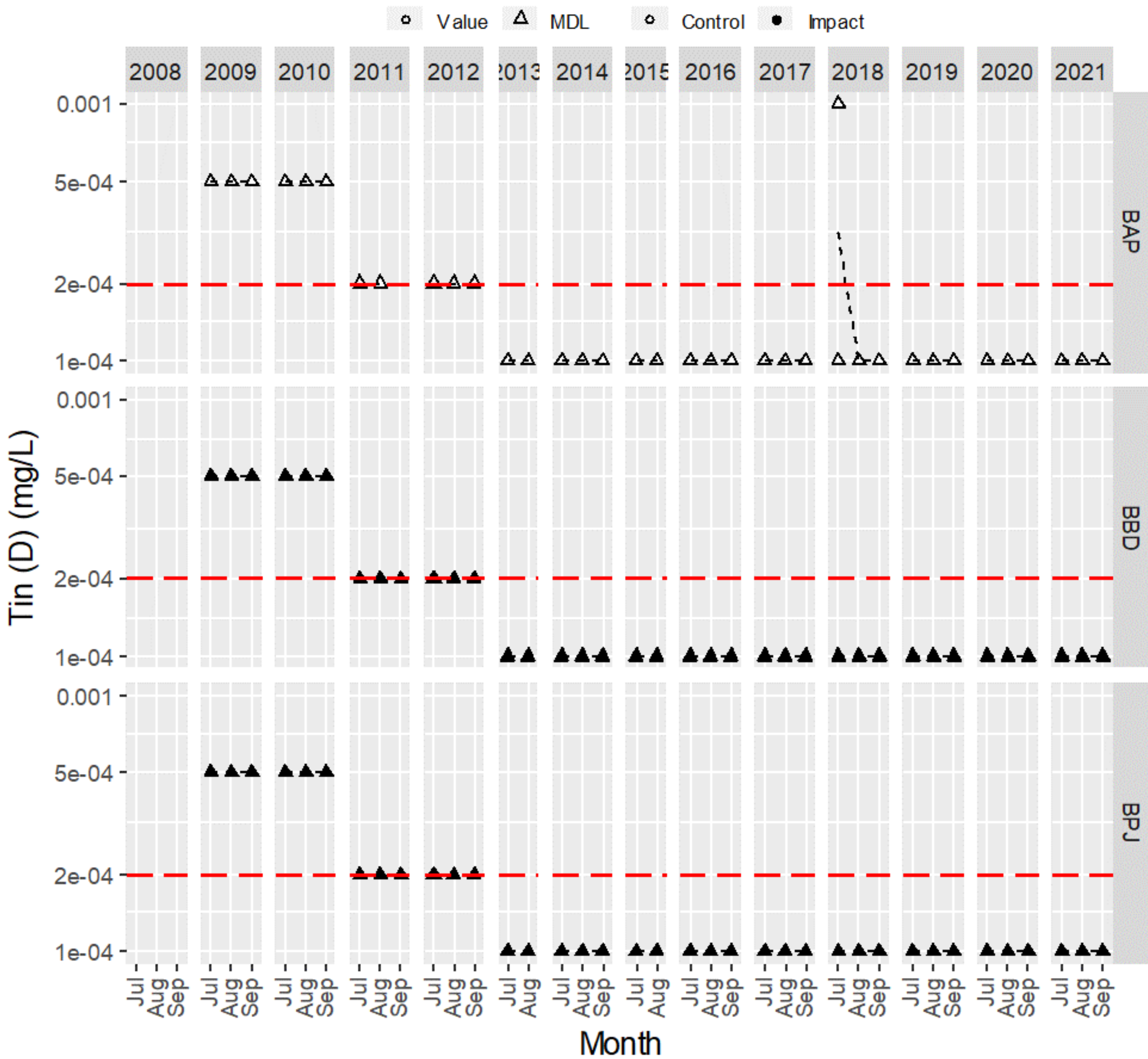


Figure B3 - 28. Dissolved titanium (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line = trigger value.

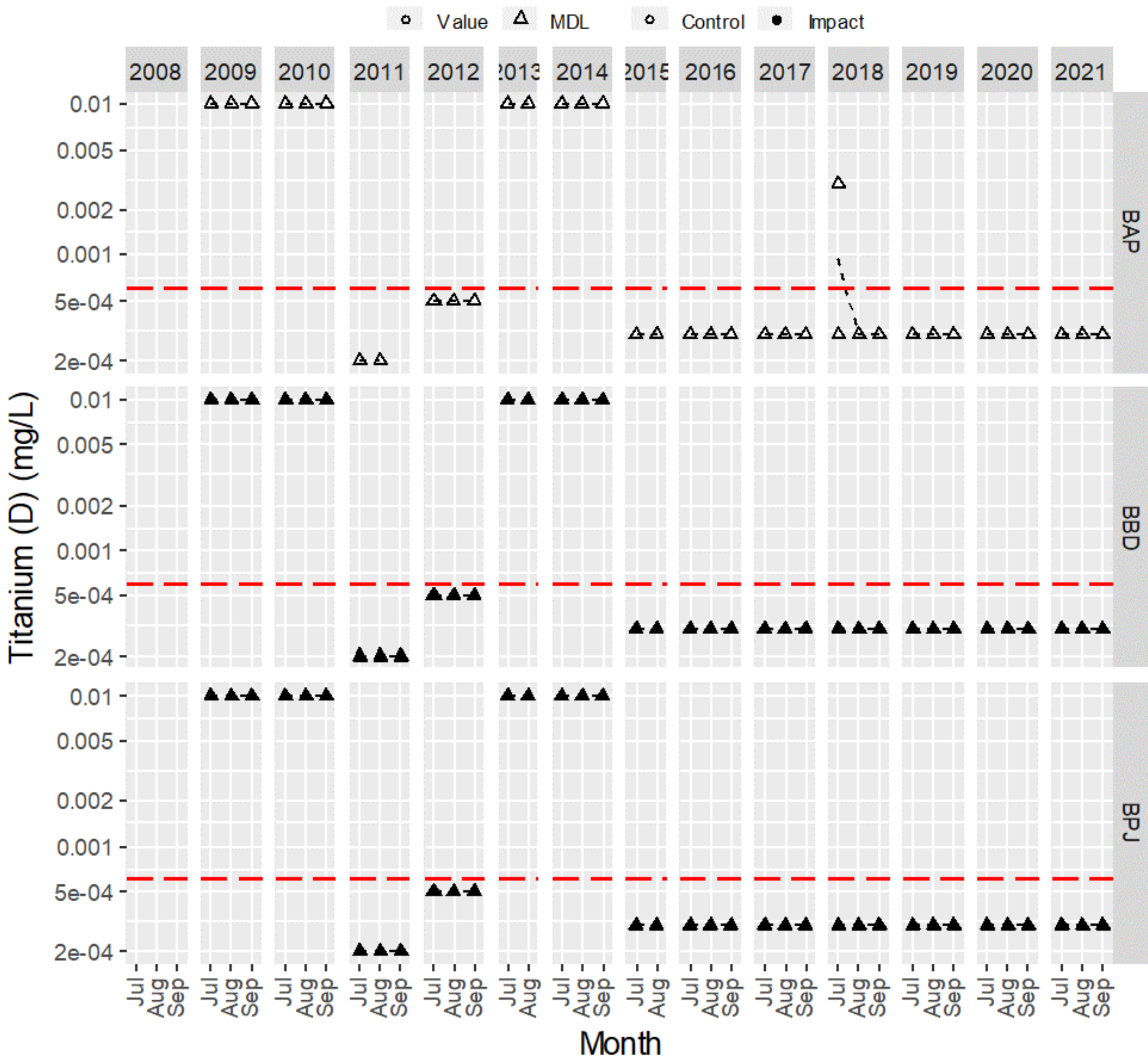


Figure B3 - 29. Dissolved vanadium (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line = trigger value.

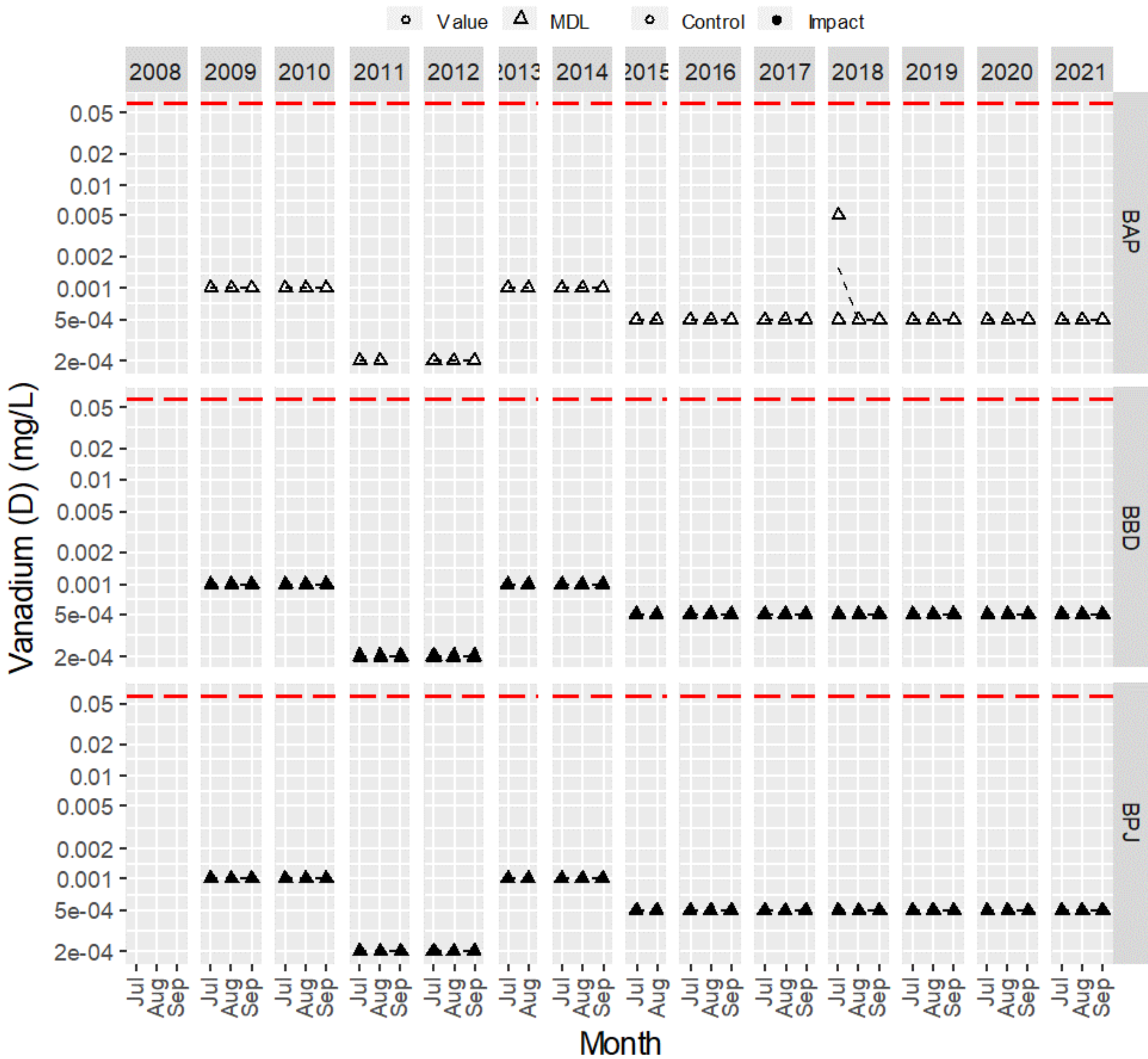
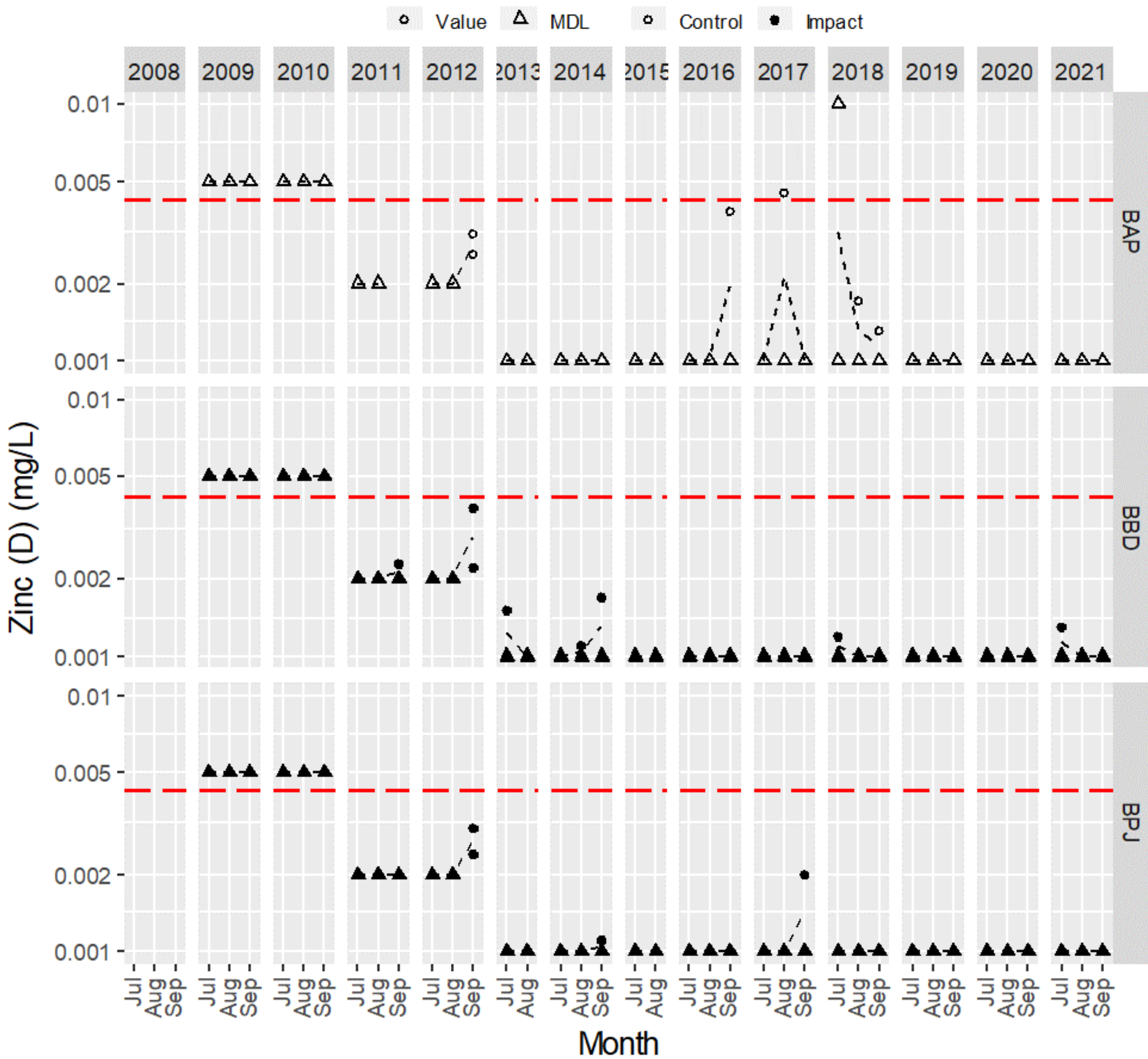


Figure B3 - 30. Dissolved zinc (mg/L) in water samples from Baker Lake since 2008.

Note: The red dashed line = trigger value.



APPENDIX C
SEDIMENT CHEMISTRY DATA

Appendix C1
Sediment Chemistry – Meadowbank Study Area Lakes

LIST OF TABLES

TABLES

Table C1-1. Sediment grab chemistry results, Meadowbank study lakes, 2021.

Lake & Basin	Screening Criteria			Third Portage Lake - East Basin (TPE)					Third Portage Lake - North Basin (TPN)					Second Portage Lake (SP)				
Area-Replicate ID	MBK Triggers[2]		Thresholds[3]	TPE-1	TPE-2	TPE-3	TPE-4	TPE-5	TPN-1	TPN-2	TPN-3	TPN-4	TPN-5	SP-1	SP-2	SP-3	SP-4	SP-5
Date				8-Aug-21	8-Aug-21	8-Aug-21	8-Aug-21	8-Aug-21	7-Aug-21	7-Aug-21	7-Aug-21	7-Aug-21	7-Aug-21	6-Aug-21	6-Aug-21	6-Aug-21	6-Aug-21	5-Aug-21
ALS Sample ID	MBK	WAL		VA21B6915-019	VA21B6915-020	VA21B6915-021	VA21B6915-022	VA21B6915-023	VA21B6915-013	VA21B6915-014	VA21B6915-015	VA21B6915-016	VA21B6915-017	VA21B6915-001	VA21B6915-002	VA21B6915-003	VA21B6915-004	VA21B6915-005
Physical Tests																		
Moisture (%)				86	86	86	79	81	38	80	84	46	33	85	85	85	86	85
pH				5.8	5.9	6.1	5.8	5.7	6.1	5.6	5.5	5.9	6.2	5.9	6.1	6.0	6.0	5.7
Particle Size (%)																		
clay (<0.004mm)				31	26	30	35	35	29	14	17	34	19	28	24	26	26	27
silt (0.063mm - 0.004mm)				68	73	67	63	61	26	54	64	42	38	70	74	72	71	72
sand (2.0mm - 0.063mm)				*<1.0*	*<1.0*	2.2	2.4	3.9	30	32	19	25	30	2.8	2.0	2.2	2.4	1.7
gravel (>2mm)				*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	15	*<1.0*	*<1.0*	*<1.0*	14	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*
Organic Carbon																		
TOC (% dw)				3.4	3.6	3.5	2.6	2.7	0.21	3.2	3.9	0.68	0.26	4.0	3.9	4.0	4.0	3.8
Total Metals (mg/kg dw)																		
Aluminum				24500	27000	27600	33000	31700	-	-	-	-	-	27600	25900	26600	28900	27700
Antimony				0.20	0.26	0.25	0.25	0.26	-	-	-	-	-	0.32	0.28	0.28	0.28	0.25
Arsenic*	121	45		19	22	22	24	25	-	-	-	-	-	42	28	52	27	42
Barium				109	124	130	174	135	-	-	-	-	-	134	124	120	130	131
Beryllium				1.6	1.8	1.9	2.3	2.3	-	-	-	-	-	2.1	2.0	2.0	2.3	2.3
Bismuth				2.2	2.4	2.5	3.2	3.1	-	-	-	-	-	2.3	2.4	2.5	2.5	2.5
Boron				8.1	9.9	10	10	9.8	-	-	-	-	-	10	9.1	8.1	11	11
Cadmium*	1.1	0.66		0.18	0.26	0.34	0.13	0.15	-	-	-	-	-	0.26	0.24	0.26	0.27	0.24
Calcium				2130	2360	2280	2200	2160	-	-	-	-	-	2620	2500	2200	2520	2440
Chromium*	135	61		**142**	**148**	**143**	**136**	127	-	-	-	-	-	97	86	83	89	90
Cobalt				15	17	17	19	20	-	-	-	-	-	16	16	20	16	17
Copper*	83	257		46	52	54	69	65	-	-	-	-	-	76	73	79	79	77
Iron				42000	44200	45000	56500	57400	-	-	-	-	-	67200	66800	86600	60600	76600
Lead †	25	37	35	20	23	23	**27**	**26**	-	-	-	-	-	23	23	23	24	23
Lithium				42	48	50	64	62	-	-	-	-	-	47	47	47	49	48
Magnesium				10900	11500	11400	13200	12400	-	-	-	-	-	10500	10100	9900	10500	10500
Manganese				1730	2260	2720	1980	2230	-	-	-	-	-	4400	2410	2340	1830	1570
Mercury	0.10	0.12	0.17	0.019	0.021	0.018	0.016	0.017	-	-	-	-	-	0.036	0.032	0.028	0.030	0.030
Molybdenum				3.5	4.0	4.3	5.3	5.4	-	-	-	-	-	8.1	6.2	7.8	7.0	8.0
Nickel				73	92	108	74	70	-	-	-	-	-	72	64	65	68	64
Phosphorus				418	455	438	451	441	-	-	-	-	-	636	571	580	601	652
Potassium				3830	4340	4450	5960	5030	-	-	-	-	-	4570	4210	4100	4560	4570
Selenium				0.59	0.75	0.79	0.31	0.45	-	-	-	-	-	0.74	0.65	0.71	0.50	0.62
Silver				*<0.10*	0.10	*<0.10*	*<0.10*	*<0.10*	-	-	-	-	-	0.18	0.16	0.12	0.13	0.12
Sodium				162	180	180	164	158	-	-	-	-	-	199	175	166	191	188
Strontium				18	21	21	23	20	-	-	-	-	-	27	24	20	26	24
Sulfur				1900	2000	2000	1400	1600	-	-	-	-	-	1700	1500	1600	1800	1600
Thallium				0.35	0.43	0.46	0.49	0.46	-	-	-	-	-	0.39	0.37	0.39	0.41	0.40
Tin				*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*	-	-	-	-	-	*<2.0*	*<2.0*	*<2.0*	*<2.0*	*<2.0*
Titanium				616	786	818	1030	1010	-	-	-	-	-	814	720	670	777	755
Tungsten				*<0.50*	0.61	0.70	0.62	0.77	-	-	-	-	-	0.75	0.77	0.70	0.72	0.55
Uranium				14	16	19	29	27	-	-	-	-	-	24	23	24	26	25
Vanadium				35	41	42	53	50	-	-	-	-	-	41	39	39	41	40
Zinc †	114	142	123	97	108	114	**133**	**127**	-	-	-	-	-	**118**	113	**126**	**124**	**125**
Zirconium				3.0	2.4	2.5	4.5	3.6	-	-	-	-	-	1.9	2.4	2.6	2.4	2.5

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 sediment quality guideline; PEL = probable effect level

2. Trigger values developed in the *CREMP Design Document 2012* (Azimuth, 2012d) were updated in 2017. Trigger values were developed for Wally Lake (WAL) separate from the other Meadowbank project lakes.
3. 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.

"†" CCME guideline not used as threshold value at Wally Lake.

123 Bolded concentrations exceed the trigger value.

123 Bolded and shaded concentrations also exceed the threshold value.

Italicized numbers are below detection limits.

Table C1 - 2. Hydrocarbon and PAH results for composite sediment grabs at Meadowbank study lakes, 2021.

Area-Replicate ID	CCME Sediment Quality Guidelines[1]		TPE-COMP	TPN-COMP	SP-COMP
Date			8-Aug-21	7-Aug-21	6-Aug-21
ALS Sample ID	**ISQG**	**PEL**	VA21B6915-024	VA21B6915-018	VA21B6915-006
Physical Parameters					
Moisture (%)	-	-	84	49	86
Aggregate Organics (mg/kg)					
Mineral Oil and Grease	-	-	*<500*	*<500*	710
Hydrocarbons (mg/kg)					
EPH10-19	-	-	*<300*	*<200*	*<280*
EPH19-32	-	-	*<300*	*<200*	*<280*
LEPH	-	-	*<300*	*<200*	*<280*
HEPH	-	-	*<300*	*<200*	*<280*
Polycyclic Aromatic Hydrocarbons (mg/kg)					
acenaphthene	0.0067	0.089	*<0.0148*	*<0.0050*	*<0.0143*
acenaphthylene	0.0059	0.13	*<0.0148*	*<0.0050*	*<0.0143*
acridine	-	-	*<0.015*	*<0.010*	*<0.014*
anthracene	0.047	0.25	*<0.0148*	*<0.0040*	*<0.0143*
benz(a)anthracene	0.032	0.39	*<0.015*	*<0.010*	*<0.014*
benzo(a)pyrene	0.032	0.78	*<0.015*	*<0.010*	*<0.014*
benzo(b+j)fluoranthene	-	-	*<0.015*	*<0.010*	*<0.014*
benzo(b+j+k)fluoranthene	-	-	*<0.021*	*<0.015*	*<0.020*
benzo(g,h,i)perylene	-	-	*<0.015*	*<0.010*	0.027
benzo(k)fluoranthene	-	-	*<0.015*	*<0.010*	*<0.014*
chrysene	0.057	0.86	*<0.015*	*<0.010*	*<0.014*
dibenz(a,h)anthracene	0.0062	0.14	*<0.0148*	*<0.0050*	*<0.0143*
fluoranthene	0.11	2.36	*<0.015*	*<0.010*	*<0.014*
fluorene	0.021	0.144	*<0.015*	*<0.010*	*<0.014*
indeno(1,2,3-c,d)pyrene	-	-	*<0.015*	*<0.010*	*<0.014*
methylnaphthalene, 1-	-	-	*<0.015*	*<0.010*	*<0.014*
methylnaphthalene, 2-	0.020	0.20	*<0.015*	*<0.010*	*<0.014*
naphthalene	0.035	0.39	*<0.015*	*<0.010*	*<0.014*
phenanthrene	0.042	0.52	*<0.015*	*<0.010*	*<0.014*
pyrene	0.053	0.88	*<0.015*	*<0.010*	*<0.014*
quinoline	-	-	*<0.015*	*<0.010*	*<0.014*
PAH Surrogates (%)					
acridine-d9	-	-	96	101	92
chrysene-d12	-	-	104	109	101
naphthalene-d8	-	-	100	101	96
phenanthrene-d10	-	-	97	99	93

Notes:

1. Canadian Sediment Quality Guidelines for the Protection of Aquatic Life, 1999, updated in 2002.

ISQG = Interim freshwater Sediment Quality Guideline; PEL = probably effect level concentration

Bolded concentrations exceed the ISQG guideline.

Italicized numbers are below detection limits.

Appendix C2
Sediment Chemistry – Whale Tail Study Area Lakes

LIST OF TABLES

TABLES

Table C2-1. Sediment grab chemistry, Whale Tail Pit study lakes, 2021.

Lake & Basin	Screening Criteria				Whale Tail Lake - South Basin (WTS)						Lake A76						Nemo Lake (NEM)				
Area-Replicate ID	CCME[1]		Thresholds[3] (All Lakes)	WTS Triggers	WTS-1	WTS-2	WTS-3	WTS-4	WTS-5	A76 Triggers	A76-1	A76-2	A76-3	A76-4	A76-5	NEM Triggers	NEM-1	NEM-2	NEM-3	NEM-4	NEM-5
Date					5-Aug-21	5-Aug-21	5-Aug-21	5-Aug-21	5-Aug-21		7-Aug-21	7-Aug-21	7-Aug-21	7-Aug-21	7-Aug-21		5-Aug-21	5-Aug-21	5-Aug-21	5-Aug-21	5-Aug-21
ALS Sample ID	ISQG	PEL			VA21B6915-031	VA21B6915-032	VA21B6915-033	VA21B6915-034	VA21B6915-035		VA21B6915-037	VA21B6915-038	VA21B6915-039	VA21B6915-040	VA21B6915-041		VA21B6915-025	VA21B6915-026	VA21B6915-027	VA21B6915-028	VA21B6915-029
Physical Tests																					
Moisture (%)					81	82	89	88	83		92	88	88	92	90		90	91	84	83	90
pH					5.8	5.8	5.9	5.5	5.4		5.8	5.1	5.5	5.8	5.5		6.4	6.1	6.4	6.3	6.1
Particle Size (%)																					
clay (<0.004mm)					15	14	20	17	17		21	25	22	23	24		8.2	6.8	5.9	7.3	8.6
silt (0.063mm - 0.004mm)					67	70	76	80	78		78	75	78	77	75		67	77	71	56	67
sand (2.0mm - 0.063mm)					18	16	3.9	3.4	5.7		*<1.0*	1.0	*<1.0*	*<1.0*	1.1		25	17	23	36	24
gravel (>2mm)					*<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*
Organic Carbon																					
TOC (% dw)					3.9	3.9	6.2	5.9	4.5		9.4	5.2	5.3	9.7	6.9		9.2	8.5	9.7	6.1	7.5
Total Metals (mg/kg dw)																					
Aluminum					19900	16100	19100	16200	18700		25500	24200	24100	20200	24300		9820	10900	10600	9850	11500
Antimony					0.26	0.22	0.25	0.24	0.24		0.45	0.40	0.41	0.31	0.38		0.41	0.47	0.41	0.40	0.44
Arsenic*	5.9	17	5.9	83.1	49	17	13	**127**	**138**	461	68	**587**	**492**	33	231	61	56	30	33	22	22
Barium					99	88	126	112	91		242	206	200	195	220		88	96	78	72	89
Beryllium					1.6	1.2	1.3	1.4	1.6		1.6	1.6	1.3	1.2	1.6		0.63	0.74	0.67	0.59	0.75
Bismuth					0.62	0.48	0.51	0.56	0.57		0.74	0.77	0.71	0.50	0.73		0.25	0.27	0.25	0.22	0.27
Boron					7.9	6.6	11	8.0	6.4		16	7.9	7.1	13	8.6		11	12	14	8.7	11
Cadmium*	0.60	3.5	0.60	0.93	0.24	0.14	0.30	0.31	0.12	0.44	0.31	0.21	0.26	0.31	0.25	0.41	0.27	0.30	0.28	0.28	0.27
Calcium					2740	2830	3440	2800	2320		4090	2520	2570	3600	3100		3420	3390	4000	2660	3240
Chromium*	37	90	37	80.6	**85**	73	**82**	72	75	103	**124**	**123**	**114**	99	**120**	130	115	114	117	99	116
Cobalt					19	8.5	8.4	12	14		10	18	24	8.3	14		8.8	7.6	7.7	6.4	7.4
Copper*	36	197	36	48.5	45	33	41	41	42	76	**91**	**86**	**78**	64	**81**	43	**43**	**46**	39	43	**44**
Iron					47500	26300	23300	75500	77200		45500	143000	134000	27500	81500		27400	21200	20700	17800	20200
Lead	35	91	35	24.0	15	12	13	13	14	26	22	21	21	17	22	22	9.0	8.8	9.6	7.8	9.1
Lithium					18	16	18	14	14		19	18	17	16	18		11	12	13	11	13
Magnesium					7670	7200	7640	6590	6540		8910	8870	8790	7640	9070		7080	7140	7400	6510	7440
Manganese					1620	504	432	1140	1010		310	844	2140	232	813		510	268	241	233	314
Mercury	0.17	0.49	0.17	0.123	0.045	0.043	0.064	0.074	0.061	0.11	0.063	0.035	0.048	0.053	0.048	0.10	0.026	0.024	0.028	0.017	0.020
Molybdenum					3.5	2.2	2.0	3.9	5.5		5.9	6.6	6.3	3.3	6.1		3.5	3.3	2.8	2.2	2.6
Nickel					69	47	60	67	52		100	113	107	83	96		85	84	80	74	85
Phosphorus					976	860	804	1830	1570		852	2420	996	575	1140		653	530	598	401	519
Potassium					2480	2020	2520	2080	2120		3460	3450	3190	2850	3350		1200	1290	1350	1160	1380
Selenium					0.62	0.44	0.56	0.66	0.64		0.92	1.1	1.0	0.71	0.90		0.65	0.54	0.47	0.38	0.54
Silver					0.18	0.17	0.35	0.31	0.24		0.68	0.40	0.33	0.50	0.50		0.17	0.21	0.16	0.14	0.18
Sodium					134	131	171	146	120		205	158	159	178	182		74	83	82	64	84
Strontium					36	34	38	34	30		35	28	27	31	29		33	32	38	30	34
Sulfur					1600	1300	1900	1600	1600		3000	1900	2200	2900	2500		2400	2400	2400	1600	1900
Thallium					0.24	0.15	0.18	0.19	0.17		0.32	0.32	0.33	0.25	0.32		0.097	0.11	0.099	0.080	0.094
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					516	450	460	320	329		481	518	426	408	424		175	217	257	226	255
Tungsten					*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*		0.62	0.63	0.50	0.53	*<0.50*		*<0.50*	*<0.50*	*<0.50*	*<0.50*	*<0.50*
Uranium					13	8.6	10	11	11		16	14	13	11	14		4.2	5.2	4.4	4.0	5.0
Vanadium					29	25	26	24	26		41	42	38	32	39		22	24	24	21	24
Zinc*	123	315	123	196	94	72	80	92	92	112	**120**	**125**	**115**	95	**123**	89	61	65	60	53	60
Zirconium					1.1	1.3	1.6	2.1	1.5		3.7	2.7	1.8	3.1	2.7		*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*

Notes:

1. CCME (Canadian Council of Ministers of the Environment) Canadian Sediment Quality Guidelines for the Protection o
   ISQG = interim sediment quality guideline; PEL = probable effect level
2. Trigger and threshold values were developed for the 2019 CREMP (Azimuth, 2020).

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 lake specific trigger.

123 Bolded and shaded concentrations also exceed the threshold if threshold is greater than lake specific trigger.

Italicized numbers are below detection limits.

Table C2-2. Hydrocarbon and PAH results for composite sediment grabs at Whale Tail Pit study lakes, 2021.

Area-Replicate ID	CCME Sediment Quality Guidelines[1]		WTS-COMP	A76-COMP	NEM-COMP
Date			05-Aug-21	07-Aug-21	05-Aug-21
ALS Sample ID	ISQG	PEL	VA21B6915-036	VA21B6915-042	VA21B6915-030
Physical Parameters					
Moisture (%)	-	-	85	90	91
Aggregate Organics (mg/kg)					
Mineral Oil and Grease	-	-	910	*<500*	3460
Hydrocarbons (mg/kg)					
EPH10-19	-	-	*<290*	*<560*	*<570*
EPH19-32	-	-	*<290*	*<560*	*<570*
LEPH	-	-	*<290*	*<560*	*<570*
HEPH	-	-	*<290*	*<560*	*<570*
Polycyclic Aromatic Hydrocarbons (mg/kg)					
acenaphthene	0.0067	0.089	*<0.0143*	*<0.0281*	*<0.0286*
acenaphthylene	0.0059	0.13	*<0.0143*	*<0.0281*	*<0.0286*
acridine	-	-	*<0.014*	*<0.028*	*<0.028*
anthracene	0.047	0.25	*<0.0143*	*<0.0281*	*<0.0286*
benz(a)anthracene	0.032	0.39	*<0.014*	*<0.028*	*<0.028*
benzo(a)pyrene	0.032	0.78	*<0.014*	*<0.028*	*<0.028*
benzo(b+j)fluoranthene	-	-	*<0.014*	*<0.028*	*<0.028*
benzo(b+j+k)fluoranthene	-	-	*<0.020*	*<0.040*	*<0.040*
benzo(g,h,i)perylene	-	-	*<0.014*	*<0.028*	*<0.028*
benzo(k)fluoranthene	-	-	*<0.014*	*<0.028*	*<0.028*
chrysene	0.057	0.86	*<0.014*	*<0.028*	*<0.028*
dibenz(a,h)anthracene	0.0062	0.14	*<0.0143*	*<0.0281*	*<0.0286*
fluoranthene	0.11	2.36	*<0.014*	*<0.028*	*<0.028*
fluorene	0.021	0.144	*<0.014*	*<0.028*	*<0.028*
indeno(1,2,3-c,d)pyrene	-	-	*<0.014*	*<0.028*	*<0.028*
methylnaphthalene, 1-	-	-	*<0.014*	*<0.028*	*<0.028*
methylnaphthalene, 2-	0.020	0.20	*<0.014*	*<0.028*	*<0.028*
naphthalene	0.035	0.39	*<0.014*	*<0.028*	*<0.028*
phenanthrene	0.042	0.52	*<0.014*	*<0.028*	*<0.028*
pyrene	0.053	0.88	*<0.014*	*<0.028*	*<0.028*
quinoline	-	-	*<0.014*	*<0.028*	*<0.028*
B(a)P total potency equivalents [B(a)P TPE]	-	-	*<0.020*	0.034	0.034
IACR (CCME)	-	-	0.17	0.33	0.33
PAH Surrogates (%)					
acridine-d9	-	-	84	74	86
chrysene-d12	-	-	115	107	115
naphthalene-d8	-	-	110	102	110
phenanthrene-d10	-	-	109	97	114

Notes:

1. Canadian Sediment Quality Guidelines for the Protection of Aquatic Life, 1999, updated in 2002.
   ISQG = Interim freshwater Sediment Quality Guideline; PEL = probably effect level concentration

Bolded concentrations exceed the ISQG guideline.

Italicized numbers are below detection limits.

APPENDIX D
PHYTOPLANKTON TAXONOMY DATA AND SUPPLEMENTAL PLOTS

Appendix D1
Phyto Data – Meadowbank Study Area Lakes

LIST OF TABLES – APPENDIX D1

LIST OF FIGURES – APPENDIX D1

Table D1-1. Phytoplankton density (cells/L), biomass (mg/m3), and diversity by major taxa group, Meadowbank study lakes, 2021.

Area-Replicate	Date	Phytoplankton Biomass (mg/m^3)								Taxa Richness	Simpson's Diversity
		Cyanophyte	Chlorophyte	Euglenophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	TOTAL		
Inuggugayualik Lake											
INUG - 128	10-Mar-21	0	0.53	0	19	0.47	10	2.2	32	17	0.77
INUG - 129	10-Mar-21	0	0.45	0	23	0.63	7.0	3.1	34	19	0.64
INUG - 130	11-May-21	0.14	0.34	0	8.6	0.32	6.7	2.9	19	14	0.78
INUG - 131	11-May-21	0	0.70	0	13	0.027	6.1	7.3	27	15	0.78
INUG - 132	27-Jul-21	0.40	1.1	0	117	33	12	8.7	173	29	0.79
INUG - 133	27-Jul-21	0.37	3.4	0	104	26	13	3.3	150	31	0.81
INUG - 134	18-Aug-21	0.20	6.3	0	85	11	5.4	10	118	32	0.85
INUG - 135	18-Aug-21	0.20	4.6	0	102	14	8.8	16	146	34	0.86
INUG - 136	4-Sep-21	1.6	3.9	0	146	26	4.5	5.8	188	34	0.89
INUG - 137	4-Sep-21	3.2	3.4	0	106	20	13	18	163	35	0.87
Percent Density or Biomass		***0.59***	***2.4***	***<0.1***	***69***	***13***	***8.2***	***7.4***			
Pipedream Lake											
PDL - 93	20-Mar-21	0.42	0.83	0	17	1.7	7.5	8.4	36	18	0.78
PDL - 94	20-Mar-21	0.73	1.7	0	15	3.2	5.0	8.6	35	19	0.78
PDL - 95	9-May-21	0.074	0.40	0	12	0.81	2.9	15	31	14	0.80
PDL - 96	9-May-21	0.081	0.91	0	11	0.31	5.0	69	86	14	0.69
PDL - 97	27-Jul-21	0.090	1.9	0	151	15	15	35	218	31	0.77
PDL - 98	27-Jul-21	0.14	1.9	0	109	26	11	21	170	29	0.77
PDL - 99	16-Aug-21	0.34	3.6	0	194	27	7.0	3.5	236	35	0.83
PDL - 100	16-Aug-21	0.35	1.5	0	131	22	3.7	3.3	162	31	0.79
PDL - 101	4-Sep-21	2.1	5.6	0	95	17	7.4	2.5	129	33	0.90
PDL - 102	4-Sep-21	1.5	3.5	0	126	15	11	7.4	164	34	0.89
Percent Density or Biomass		***0.46***	***1.7***	***<0.1***	***68***	***10***	***6.0***	***14***			
Third Portage Lake - East Basin											
TPE - 140	29-Mar-21	0.12	1.2	0	21	2.2	11	2.4	38	20	0.77
TPE - 141	29-Mar-21	0.20	1.1	0	8.6	3.3	6.3	2.2	22	19	0.83
TPE - 142	10-May-21	0	0.26	0	9.7	0.20	4.0	3.6	18	11	0.81
TPE - 143	10-May-21	0.017	0.71	0	4.7	0.72	6.4	0.61	13	14	0.79
TPE - 144	23-Jul-21	1.0	5.4	0	70	5.6	7.4	11	101	23	0.77
TPE - 145	23-Jul-21	0.76	2.1	0	99	8.3	2.8	9.7	123	25	0.67
TPE - 146	13-Aug-21	0.24	4.8	0	101	25	6.1	12	149	34	0.85
TPE - 147	13-Aug-21	0.34	5.1	0	99	29	6.7	6.6	147	34	0.83
TPE - 148	17-Sep-21	1.6	7.0	0	125	34	10	21	199	34	0.80
TPE - 149	17-Sep-21	1.3	7.5	0	131	39	9.2	3.3	192	39	0.79
Percent Density or Biomass		***0.56***	***3.5***	***<0.1***	***67***	***15***	***7.0***	***7.2***			

Table D1-1. Phytoplankton density (cells/L), biomass (mg/m3), and diversity by major taxa group, Meadowbank study lakes, 2021.

Area-Replicate	Date	Phytoplankton Biomass (mg/m³)								Taxa Richness	Simpson's Diversity
		Cyanophyte	Chlorophyte	Euglenophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	TOTAL		
Third Portage Lake - North Basin											
TPN - 140	29-Mar-21	0.54	0.99	0	31	3.3	5.2	1.9	42	21	0.82
TPN - 141	29-Mar-21	0.50	2.4	0	19	2.8	11	0	35	19	0.81
TPN - 142	10-May-21	0.062	1.4	0	10	0.27	9.3	2.4	24	15	0.80
TPN - 143	10-May-21	0.014	0.55	0	14	1.7	8.9	3.0	28	19	0.76
TPN - 144	29-Jul-21	0.72	2.8	0	99	4.0	3.4	6.6	117	25	0.78
TPN - 145	29-Jul-21	0.81	2.8	0	88	4.7	8.9	22	128	29	0.80
TPN - 146	10-Aug-21	0.27	1.9	0	92	8.0	5.3	44	151	32	0.76
TPN - 147	10-Aug-21	1.9	0.43	0	100	16	5.5	3.3	127	28	0.82
TPN - 148	17-Sep-21	2.4	9.5	0	98	40	10	17	177	37	0.84
TPN - 149	17-Sep-21	3.9	14	0	126	28	11	17	201	36	0.84
Percent Density or Biomass		***1.1***	***3.6***	***<0.1***	***66***	***11***	***7.7***	***11***			
Third Portage Lake - South Basin											
TPS - 65	10-May-21	0	0.27	0	5.0	0.087	6.6	0.61	13	11	0.76
TPS - 66	10-May-21	0	0.38	0	7.0	0.10	4.1	9.4	21	13	0.76
Percent Density or Biomass		***<0.1***	***2.0***	***<0.1***	***36***	***0.56***	***32***	***30***			
Second Portage Lake											
SP - 140	18-Mar-21	0	0.81	0	12	1.6	9.2	0.97	24	14	0.72
SP - 141	18-Mar-21	0.051	1.3	0	22	5.9	6.6	3.1	39	19	0.79
SP - 142	9-May-21	0	0.072	0	4.2	1.7	7.5	12	25	13	0.73
SP - 143	9-May-21	0.015	0.57	0	8.3	5.7	1.7	0.95	17	16	0.66
SP - 144	11-Jul-21	0	1.4	0	136	11	5.8	16	171	23	0.79
SP - 145	11-Jul-21	0	0.53	0	115	41	10.0	16	182	23	0.74
SP - 146	6-Aug-21	2.4	7.9	0	61	21	6.1	8.1	106	28	0.90
SP - 147	6-Aug-21	1.2	3.1	0	78	24	12	3.7	121	31	0.84
SP - 148	3-Sep-21	0.72	3.4	0	99	14	4.2	6.6	128	28	0.82
SP - 149	3-Sep-21	0	7.6	0	92	30	3.5	5.6	139	32	0.83
Percent Density or Biomass		***0.46***	***2.8***	***<0.1***	***66***	***16***	***6.9***	***7.6***			

Table D1-1. Phytoplankton density (cells/L), biomass (mg/m3), and diversity by major taxa group, Meadowbank study lakes, 2021.

Area-Replicate	Date	Phytoplankton Biomass (mg/m^3)								Taxa Richness	Simpson's Diversity
		Cyanophyte	Chlorophyte	Euglenophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	**TOTAL**		
Tehek Lake											
TE - 100	9-Mar-21	0.72	0.43	0	37	1.6	5.5	0.61	46	17	0.80
TE - 101	9-Mar-21	0.32	0.55	0	16	0.58	7.5	0.97	25	18	0.75
Percent Density or Biomass		***1.5***	***1.4***	***<0.1***	***74***	***3.1***	***18***	***2.2***			
Tehek Lake - Far-field											
TEFF - 52	9-Mar-21	0.024	1.9	0	11	0.70	5.3	14	32	19	0.74
TEFF - 53	9-Mar-21	0.88	1.4	0	20	1.3	4.5	5.4	34	23	0.76
Percent Density or Biomass		***1.4***	***5.0***	***<0.1***	***47***	***3.0***	***15***	***29***			
Wally Lake											
WAL - 109	18-Mar-21	0	1.4	0	16	1.0	6.6	0.61	26	18	0.74
WAL - 110	18-Mar-21	0	1.3	0	13	3.8	6.3	2.2	27	20	0.74
WAL - 111	9-May-21	0	0.59	0	2.3	1.3	0.84	0	5.0	12	0.74
WAL - 112	9-May-21	0.20	0.88	0	4.6	0.36	6.1	2.7	15	14	0.77
WAL - 113	11-Jul-21	0	2.5	0	200	11	9.4	29	252	26	0.73
WAL - 114	11-Jul-21	0	1.4	0	177	12	16	31	238	27	0.74
WAL - 115	10-Aug-21	0.28	7.6	0	155	17	25	12	217	35	0.85
WAL - 116	10-Aug-21	2.5	7.0	0	171	30	17	2.2	230	33	0.85
WAL - 117	3-Sep-21	0.56	18	0	87	18	9.1	14	146	36	0.88
WAL - 118	3-Sep-21	0.53	27	0	116	38	19	21	222	37	0.88
Percent Density or Biomass		***0.29***	***4.9***	***<0.1***	***68***	***9.6***	***8.4***	***8.3***			
All 2021 Locations Relative Density or Biomass (%)		***0.57***	***3.2***	***<0.1***	***67***	***12***	***7.7***	***9.6***			

Table D1-1. Phytoplankton density (cells/L), biomass (mg/m3), and diversity by major taxa group, Meadowbank study lakes, 2021.

Area-Replicate	Date	Phytoplankton Density (cells/L)						
		Cyanophyte	Chlorophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	**TOTAL**
Inuggugayualik Lake								
INUG - 128	10-Mar-21	0	35,861	322,695	7,492	58,938	400	425,386
INUG - 129	10-Mar-21	0	500	439,716	14,384	31,069	200	485,870
INUG - 130	11-May-21	900	39,107	145,390	4,246	44,153	200	233,997
INUG - 131	11-May-21	0	63,930	152,482	300	47,299	1,200	265,211
INUG - 132	27-Jul-21	1,000	7,584	1,566,328	417,704	75,040	1,200	2,068,856
INUG - 133	27-Jul-21	600	17,368	1,421,448	351,848	103,376	400	1,895,040
INUG - 134	18-Aug-21	1,200	175,016	1,267,384	156,264	44,504	1,000	1,645,368
INUG - 135	18-Aug-21	1,200	159,248	1,165,808	96,392	80,224	1,600	1,504,472
INUG - 136	4-Sep-21	7,000	245,856	1,507,056	408,104	30,136	800	2,198,952
INUG - 137	4-Sep-21	119,744	109,360	1,068,032	311,128	109,560	9,584	1,727,408
Percent Density or Biomass		***1.1***	***6.9***	***73***	***14***	***5.0***	***0.13***	
Pipedream Lake								
PDL - 93	20-Mar-21	1,900	145,490	336,880	15,184	53,892	1,800	555,146
PDL - 94	20-Mar-21	3,300	241,635	237,589	51,545	35,961	4,746	574,776
PDL - 95	9-May-21	500	60,384	166,667	22,577	15,084	2,500	267,711
PDL - 96	9-May-21	500	46,699	166,667	1,600	33,315	11,400	260,181
PDL - 97	27-Jul-21	400	30,336	1,642,168	245,336	48,504	4,200	1,970,944
PDL - 98	27-Jul-21	600	36,120	1,253,232	316,192	12,984	3,200	1,622,328
PDL - 99	16-Aug-21	2,000	108,960	1,864,456	287,992	58,272	600	2,322,280
PDL - 100	16-Aug-21	2,000	115,944	1,443,200	195,200	8,984	600	1,765,928
PDL - 101	4-Sep-21	34,736	205,152	850,112	129,728	38,520	600	1,258,848
PDL - 102	4-Sep-21	11,784	217,320	1,253,216	199,968	81,624	1,200	1,765,112
Percent Density or Biomass		***0.47***	***9.8***	***75***	***12***	***3.1***	***0.25***	
Third Portage Lake - East Basin								
TPE - 140	29-Mar-21	600	39,507	379,633	57,538	78,814	400	556,492
TPE - 141	29-Mar-21	1,000	85,806	205,674	85,806	43,253	400	421,940
TPE - 142	10-May-21	0	39,007	102,837	200	29,169	600	171,813
TPE - 143	10-May-21	100	32,015	113,475	1,300	40,607	100	187,597
TPE - 144	23-Jul-21	3,800	101,518	1,051,864	190,584	31,336	1,600	1,380,702
TPE - 145	23-Jul-21	2,800	14,968	1,395,896	142,696	8,384	1,600	1,566,344
TPE - 146	13-Aug-21	1,400	217,920	1,309,088	289,192	31,136	1,800	1,850,536
TPE - 147	13-Aug-21	2,000	208,736	1,230,664	280,424	38,320	1,600	1,761,744
TPE - 148	17-Sep-21	7,200	219,920	1,193,376	993,008	101,776	2,400	2,517,680
TPE - 149	17-Sep-21	5,200	218,520	1,268,200	1,090,200	66,656	600	2,649,376
Percent Density or Biomass		***0.18***	***9.0***	***63***	***24***	***3.6***	***<0.1***	

Table D1-1. Phytoplankton density (cells/L), biomass (mg/m3), and diversity by major taxa group, Meadowbank study lakes, 2021.

Area-Replicate	Date	Phytoplankton Density (cells/L)						
		Cyanophyte	Chlorophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	**TOTAL**
Third Portage Lake - North Basin								
TPN - 140	29-Mar-21	200	280,542	117,321	143,244	4,046	0	545,353
TPN - 141	29-Mar-21	400	258,965	340,926	119,221	35,761	0	755,273
TPN - 142	10-May-21	200	74,868	260,165	36,461	33,115	1,300	406,109
TPN - 143	10-May-21	100	110,429	216,512	93,699	62,084	1,100	483,924
TPN - 144	29-Jul-21	1,400	424,256	834,389	147,480	24,552	2,000	1,434,077
TPN - 145	29-Jul-21	400	144,480	1,177,192	141,496	9,184	2,400	1,475,152
TPN - 146	10-Aug-21	30,736	246,456	715,616	319,696	24,152	8,784	1,345,440
TPN - 147	10-Aug-21	2,200	102,176	606,456	305,328	72,840	2,400	1,091,400
TPN - 148	17-Sep-21	2,600	103,376	513,664	325,880	23,152	600	969,272
TPN - 149	17-Sep-21	2,200	80,424	405,104	528,032	30,736	800	1,047,296
Percent Density or Biomass		***0.42***	***19***	***54***	***23***	***3.3***	***0.20***	
Third Portage Lake - South Basin								
TPS - 65	10-May-21	0	49,745	131,506	1,000	47,499	100	229,850
TPS - 66	10-May-21	0	49,745	113,475	3,746	35,961	1,000	203,928
Percent Density or Biomass		***<0.1***	***23***	***56***	***1.1***	***19***	***0.25***	
Second Portage Lake								
SP - 140	18-Mar-21	0	21,777	404,255	29,769	51,245	200	507,246
SP - 141	18-Mar-21	300	70,922	414,994	67,630	36,561	200	590,607
SP - 142	9-May-21	0	7,192	88,653	1,600	51,245	2,000	150,690
SP - 143	9-May-21	100	17,731	195,236	17,984	7,692	200	238,943
SP - 144	11-Jul-21	0	43,304	1,497,688	206,968	71,840	1,400	1,821,200
SP - 145	11-Jul-21	0	43,104	1,509,056	191,800	94,792	2,400	1,841,152
SP - 146	6-Aug-21	28,736	496,896	648,160	322,096	10,584	1,000	1,507,472
SP - 147	6-Aug-21	14,368	80,424	1,138,072	310,528	75,240	400	1,619,032
SP - 148	3-Sep-21	7,184	245,256	1,191,360	203,368	30,336	1,400	1,678,904
SP - 149	3-Sep-21	0	281,976	1,109,936	521,864	8,784	1,200	1,923,760
Percent Density or Biomass		***0.43***	***11***	***69***	***16***	***3.7***	***<0.1***	

Table D1-1. Phytoplankton density (cells/L), biomass (mg/m3), and diversity by major taxa group, Meadowbank study lakes, 2021.

Area-Replicate	Date	Phytoplankton Density (cells/L)						
		Cyanophyte	Chlorophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	**TOTAL**
Tehek Lake								
TE - 100	9-Mar-21	3,200	70,922	397,163	60,684	39,507	100	571,576
TE - 101	9-Mar-21	1,400	95,845	258,865	24,923	57,038	200	438,270
Percent Density or Biomass		***0.46***	***17***	***65***	***8.5***	***9.6***	***<0.1***	
Tehek Lake - Far-field								
TEFF - 52	9-Mar-21	100	266,058	220,258	28,469	36,261	1,600	552,746
TEFF - 53	9-Mar-21	4,800	78,514	316,003	14,584	32,315	3,846	450,063
Percent Density or Biomass		***0.49***	***34***	***53***	***4.3***	***6.8***	***0.54***	
Wally Lake								
WAL - 109	18-Mar-21	0	18,231	290,780	30,069	40,007	100	379,187
WAL - 110	18-Mar-21	0	32,015	276,696	37,261	23,377	100	369,448
WAL - 111	9-May-21	0	35,661	81,560	8,692	3,846	0	129,760
WAL - 112	9-May-21	3,546	39,707	95,745	4,646	53,992	400	198,036
WAL - 113	11-Jul-21	0	72,240	2,175,216	264,488	73,640	3,200	2,588,784
WAL - 114	11-Jul-21	0	44,304	2,287,344	240,352	145,680	3,000	2,720,680
WAL - 115	10-Aug-21	600	368,984	1,708,408	99,592	254,440	1,800	2,433,824
WAL - 116	10-Aug-21	29,136	418,472	1,564,928	82,840	127,328	400	2,223,104
WAL - 117	3-Sep-21	2,600	470,560	1,195,344	79,040	52,288	2,000	1,801,832
WAL - 118	3-Sep-21	2,200	433,256	1,278,168	133,344	145,880	9,784	2,002,632
Percent Density or Biomass		***0.26***	***13***	***74***	***6.6***	***6.2***	***0.14***	
All 2021 Locations Relative Density or Biomass (%)		***0.46***	***12***	***68***	***15***	***4.4***	***0.15***	

Figure D1-1. Cyanophyte biomass (mg/m[3]) from Meadowbank study lakes since 2006.

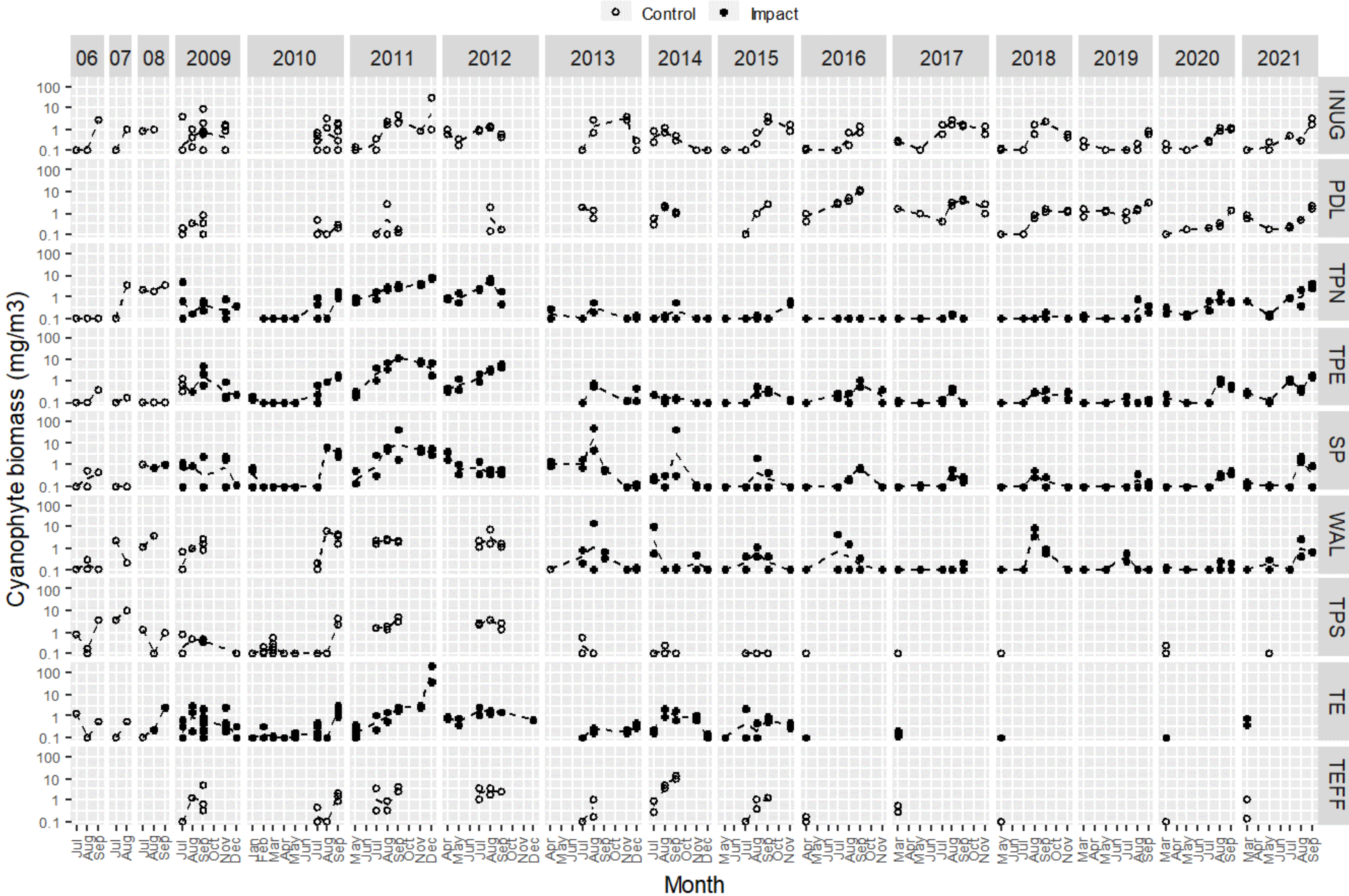


Figure D1-2. Chlorophyte biomass (mg/m³) from Meadowbank study lakes since 2006.

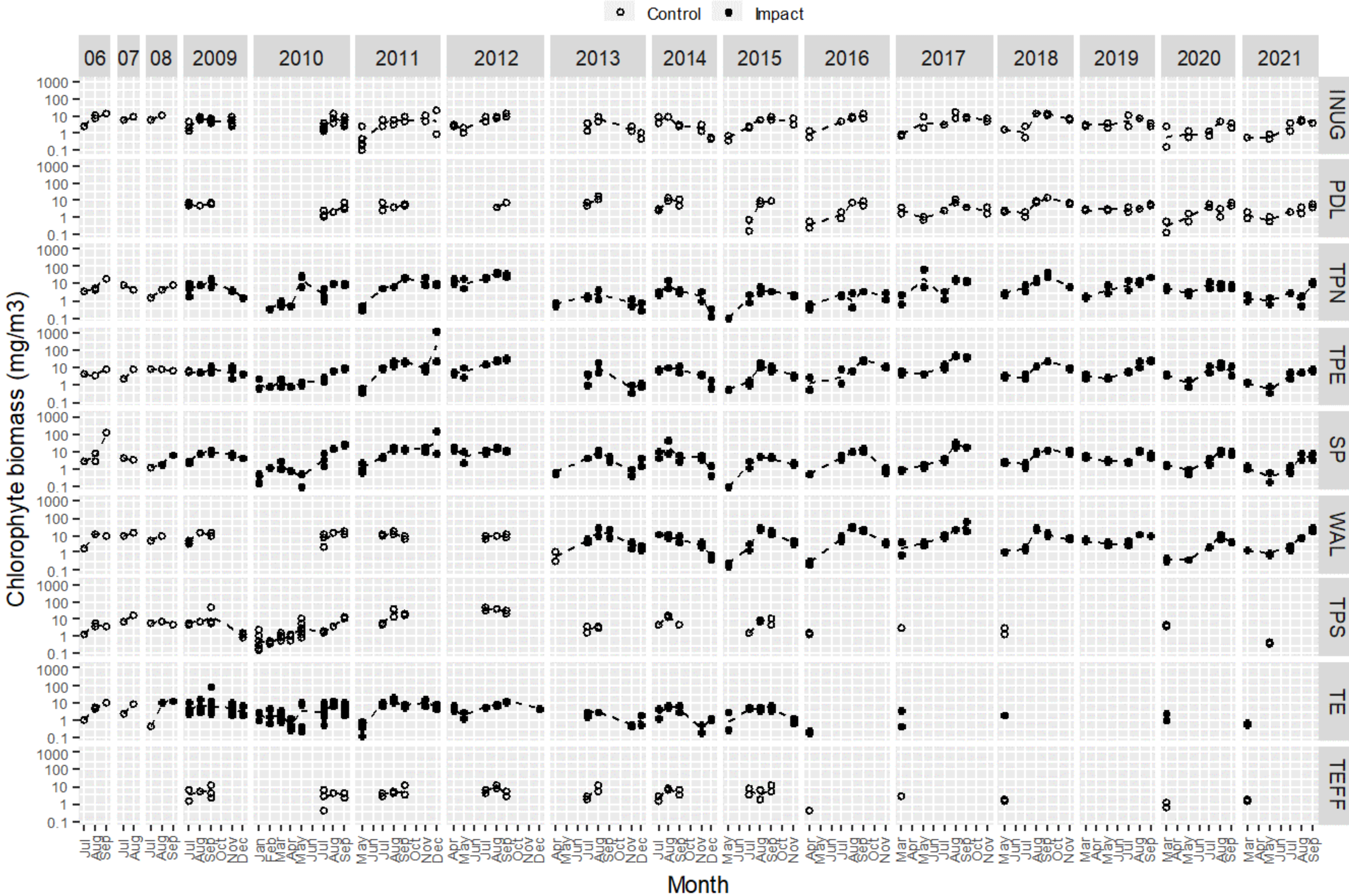


Figure D1-3. Chrysophyte biomass (mg/m³) from Meadowbank study lakes since 2006.

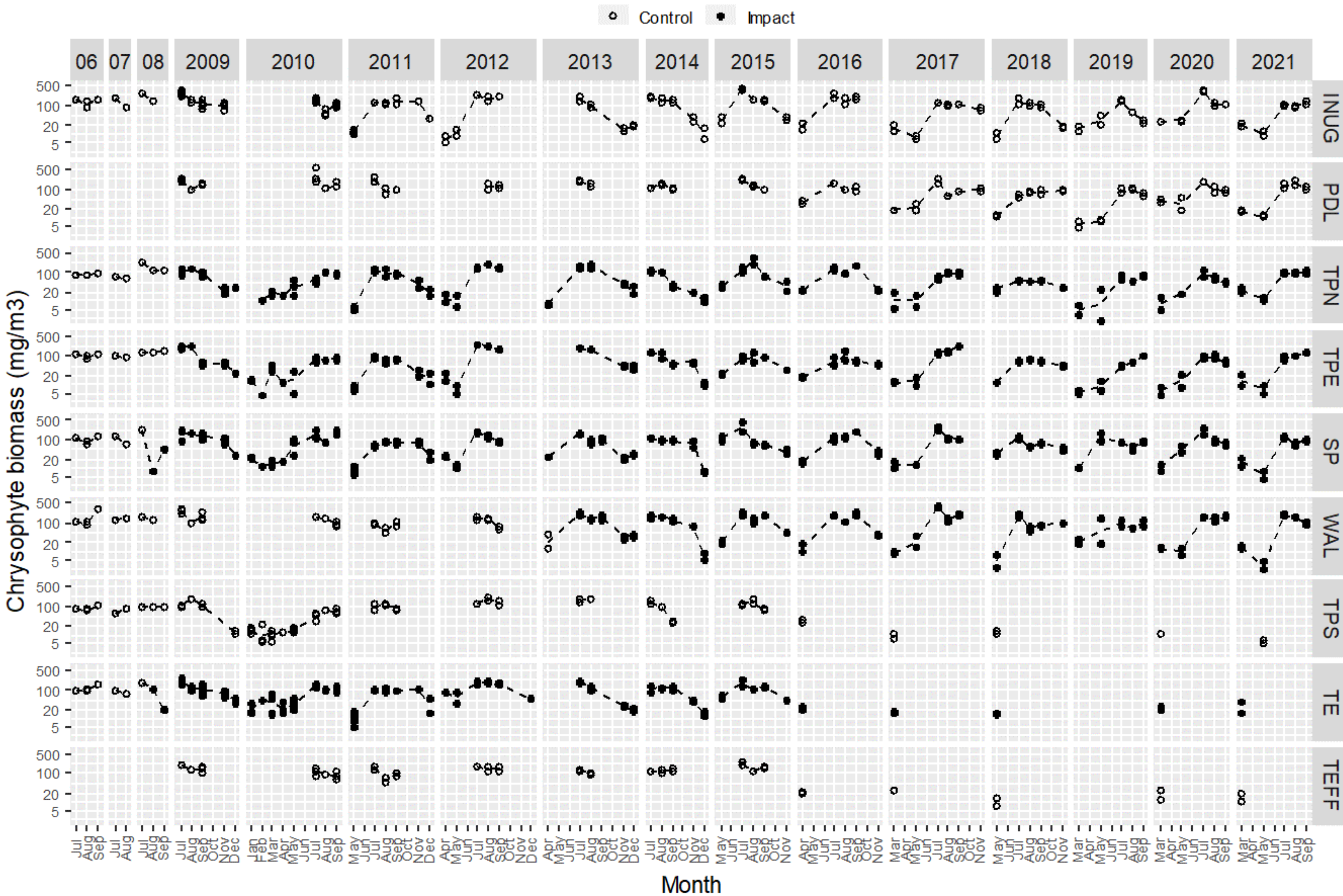


Figure D1-4. Diatom biomass (mg/m^3) from Meadowbank study lakes since 2006.

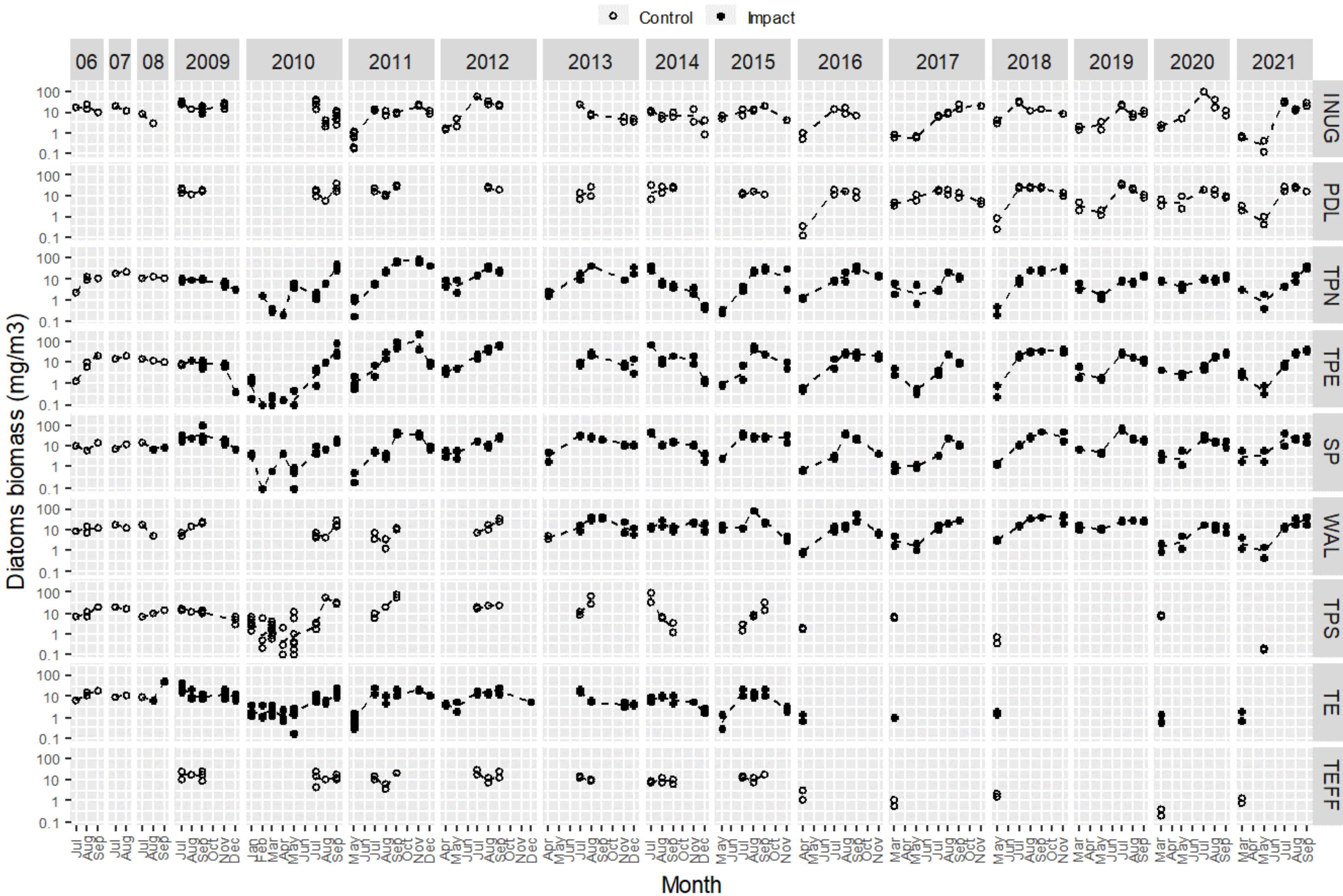


Figure D1-5. Cryptophyte biomass (mg/m³) from Meadowbank study lakes since 2006.

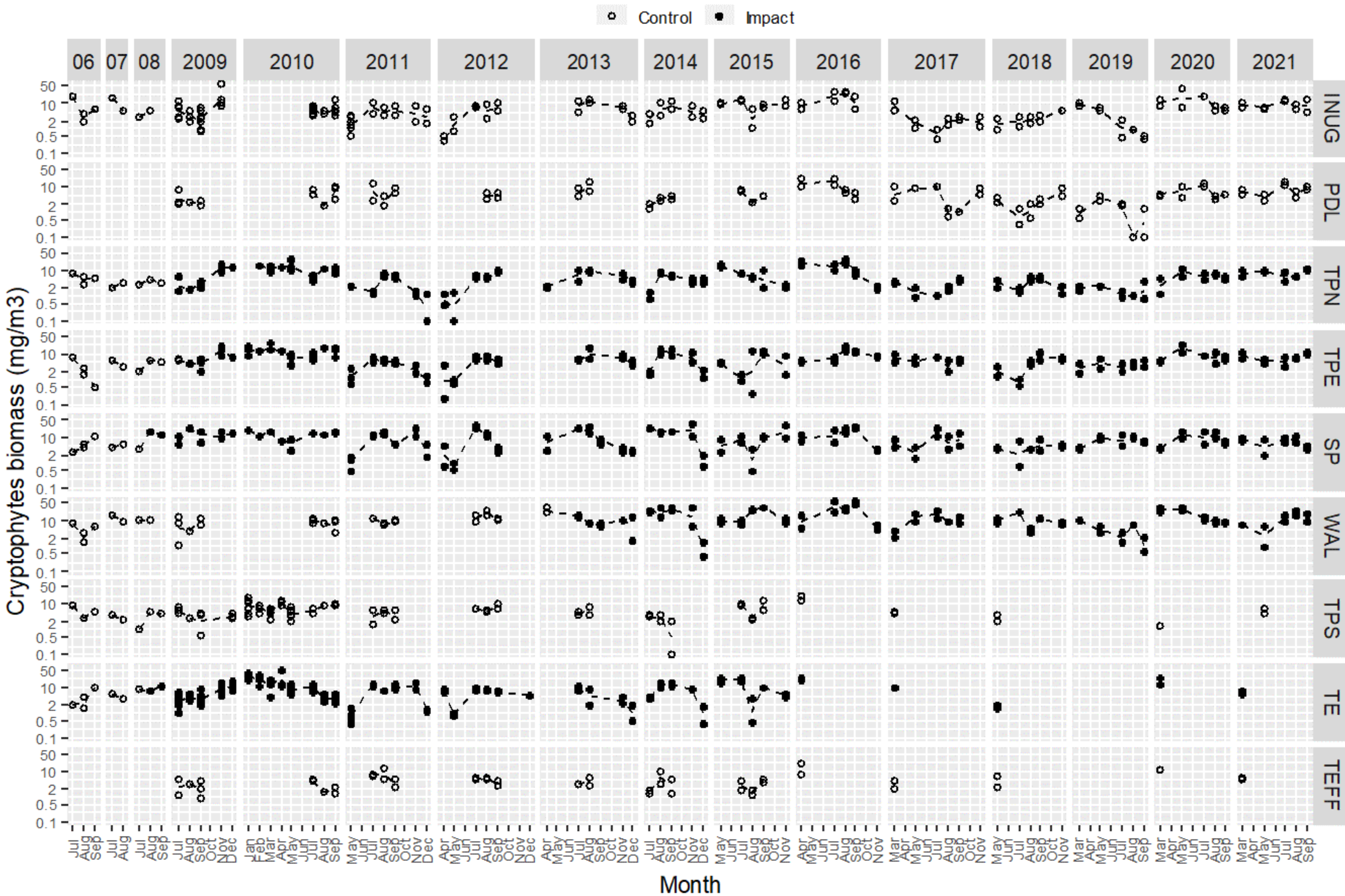


Figure D1-6. Dinoflagellate biomass (mg/m³) from Meadowbank study lakes since 2006.

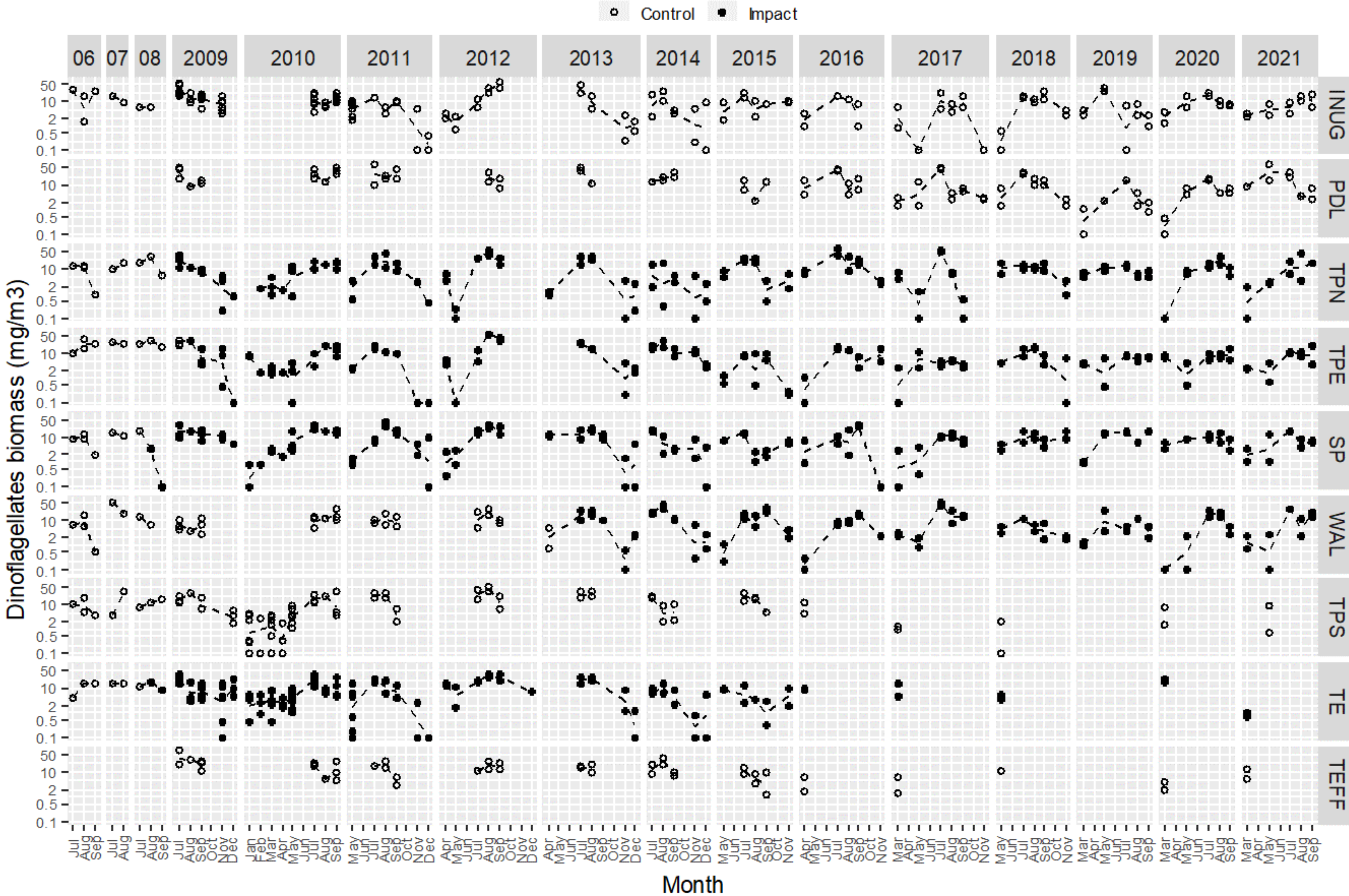


Figure D1-7. Phytoplankton density (cells/L) by major taxa group from Meadowbank study lakes since 2006.

Note: High chlorophyll value in December 2011 at TPE omitted.

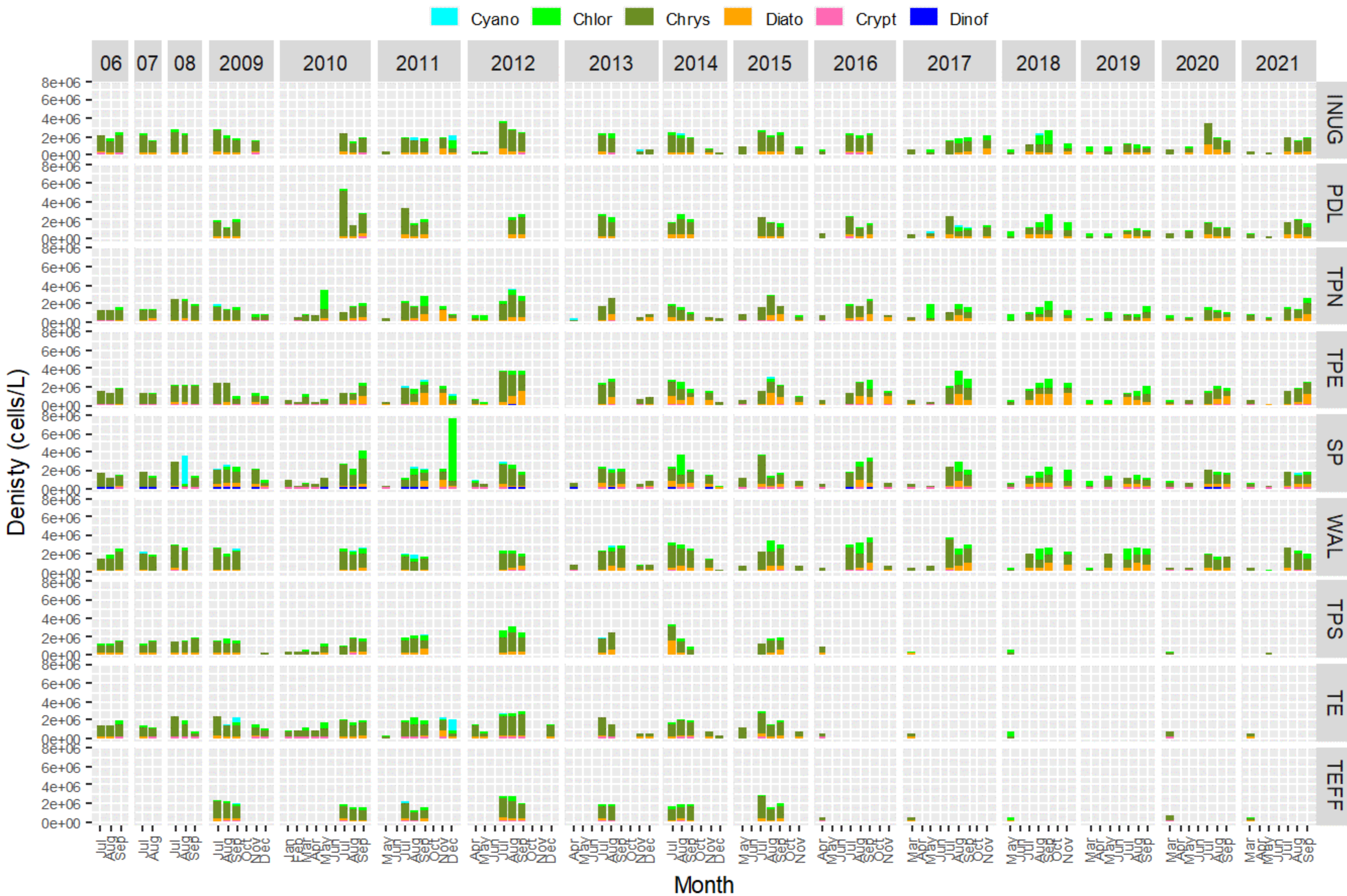


Figure D1-8. Relative phytoplankton density by major taxa group from Meadowbank study lakes since 2006.

Figure D1-9. Cyanophyte density (cells/L) by major taxa group from Meadowbank study lakes since 2006.

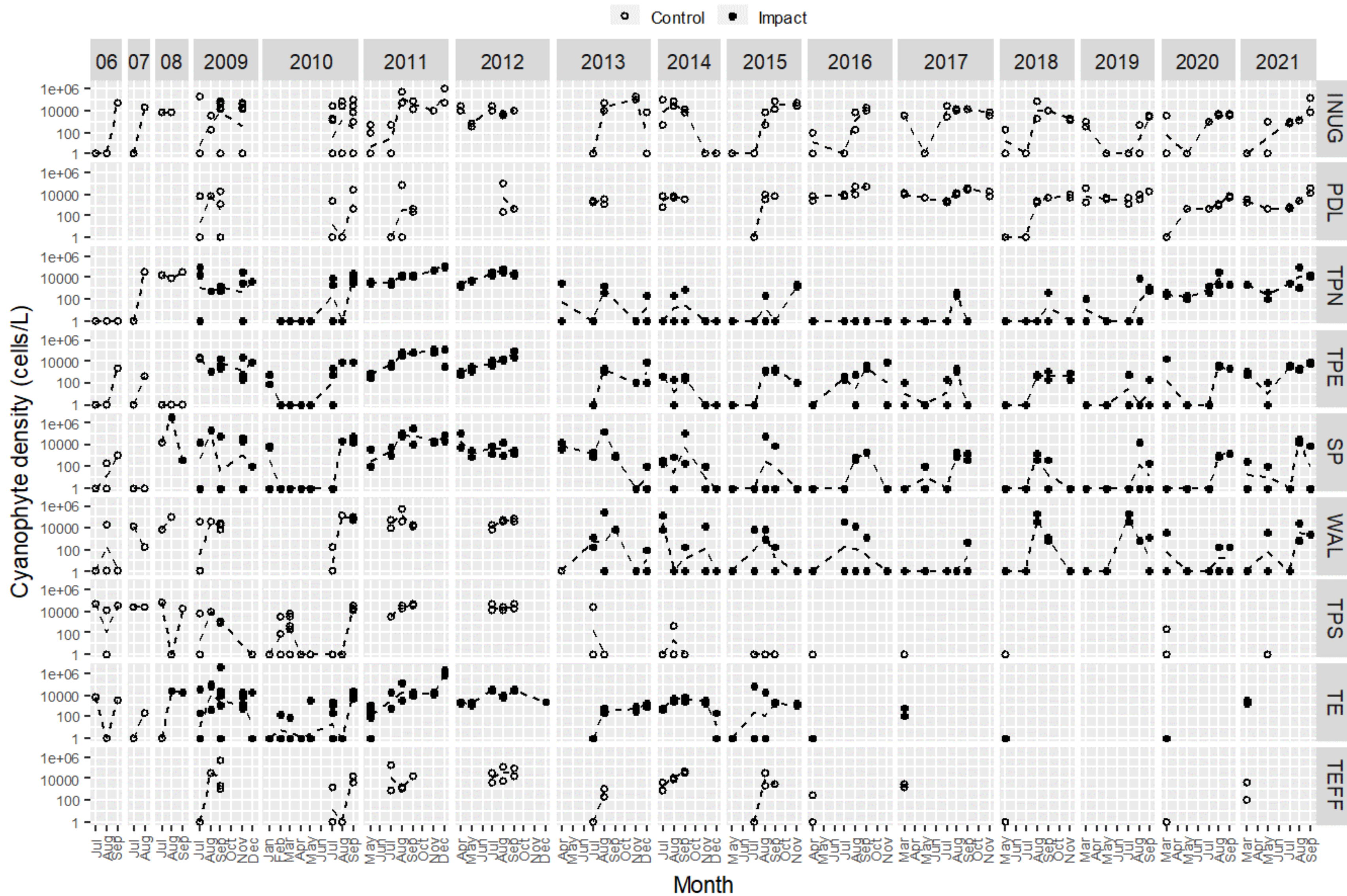


Figure D1-10. Chlorophyte density (cells/L) by major taxa group from Meadowbank study lakes since 2006.

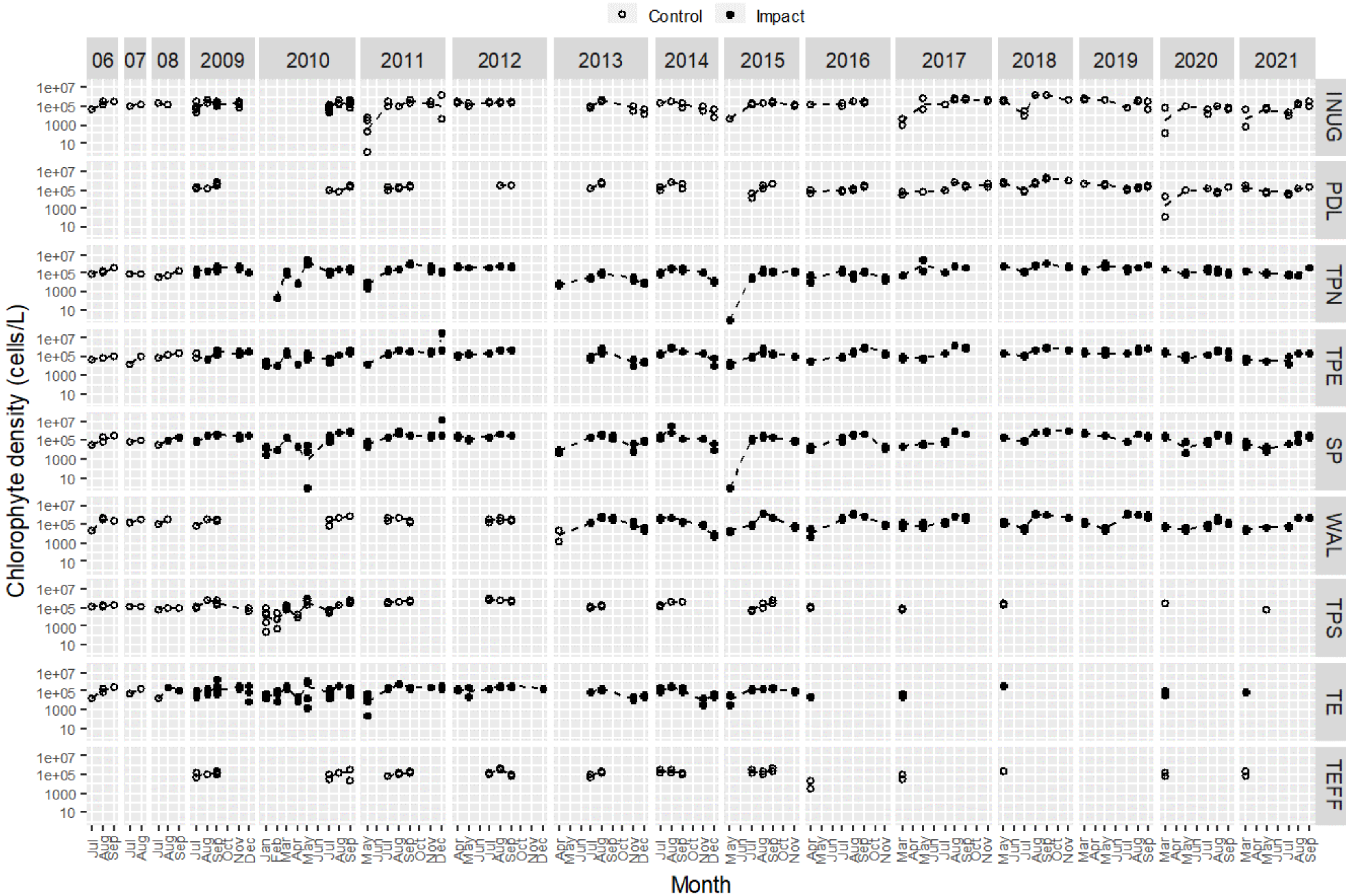


Figure D1-11. Chrysophyte density (cells/L) by major taxa group from Meadowbank study lakes since 2006.

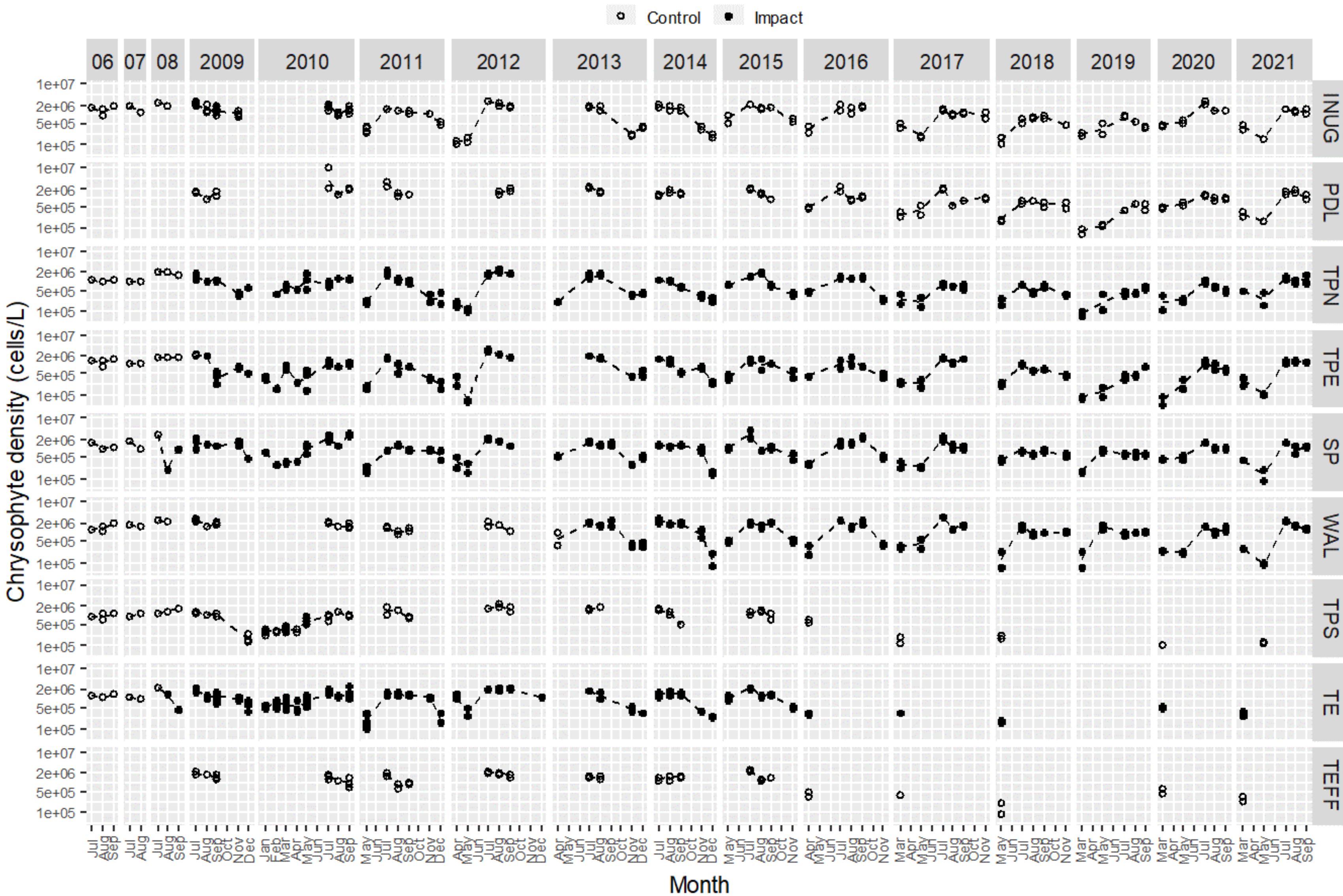


Figure D1-12. Diatoms density (cells/L) by major taxa group from Meadowbank study lakes since 2006.

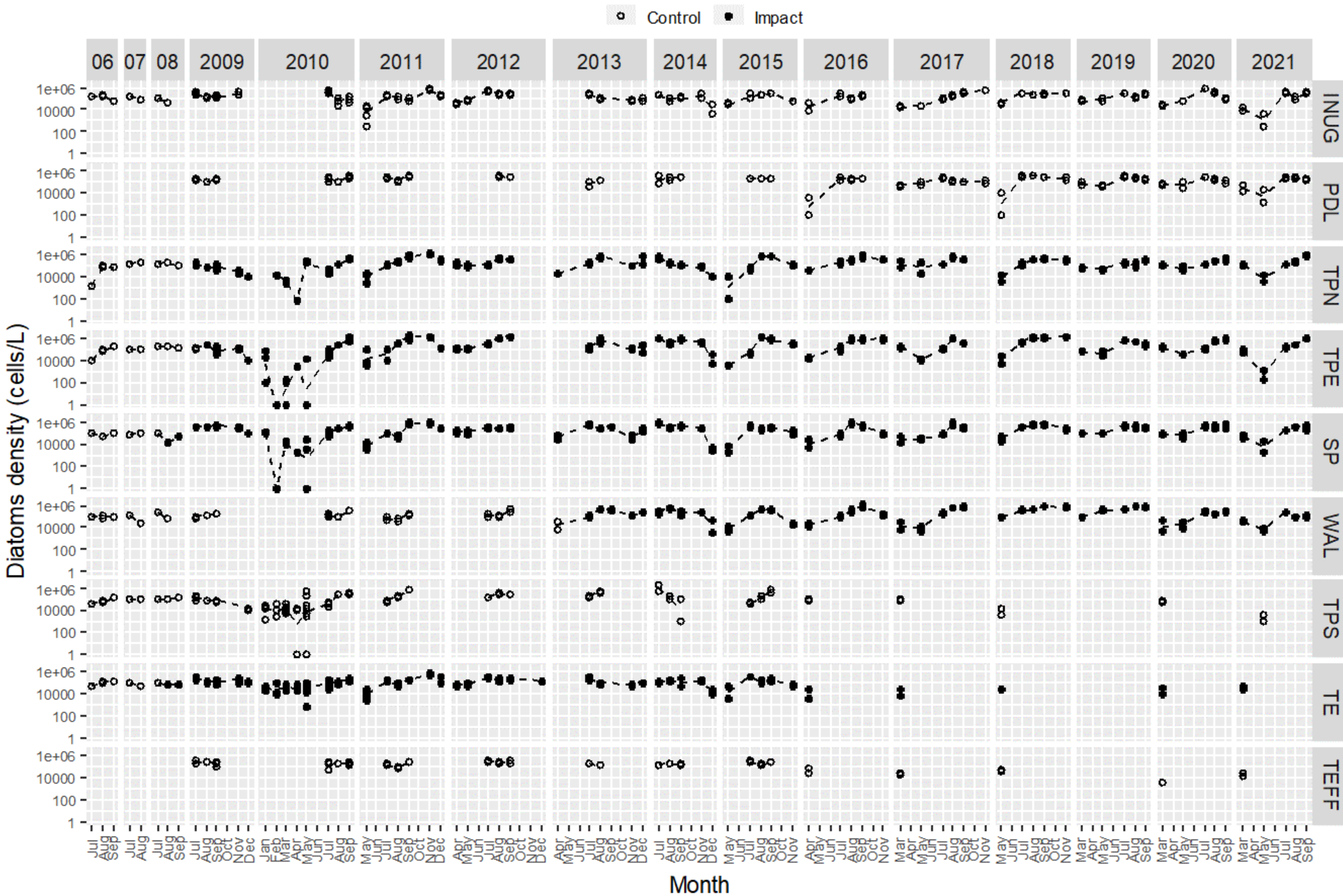


Figure D1-13. Cryptophytes density (cells/L) by major taxa group from Meadowbank study lakes since 2006.

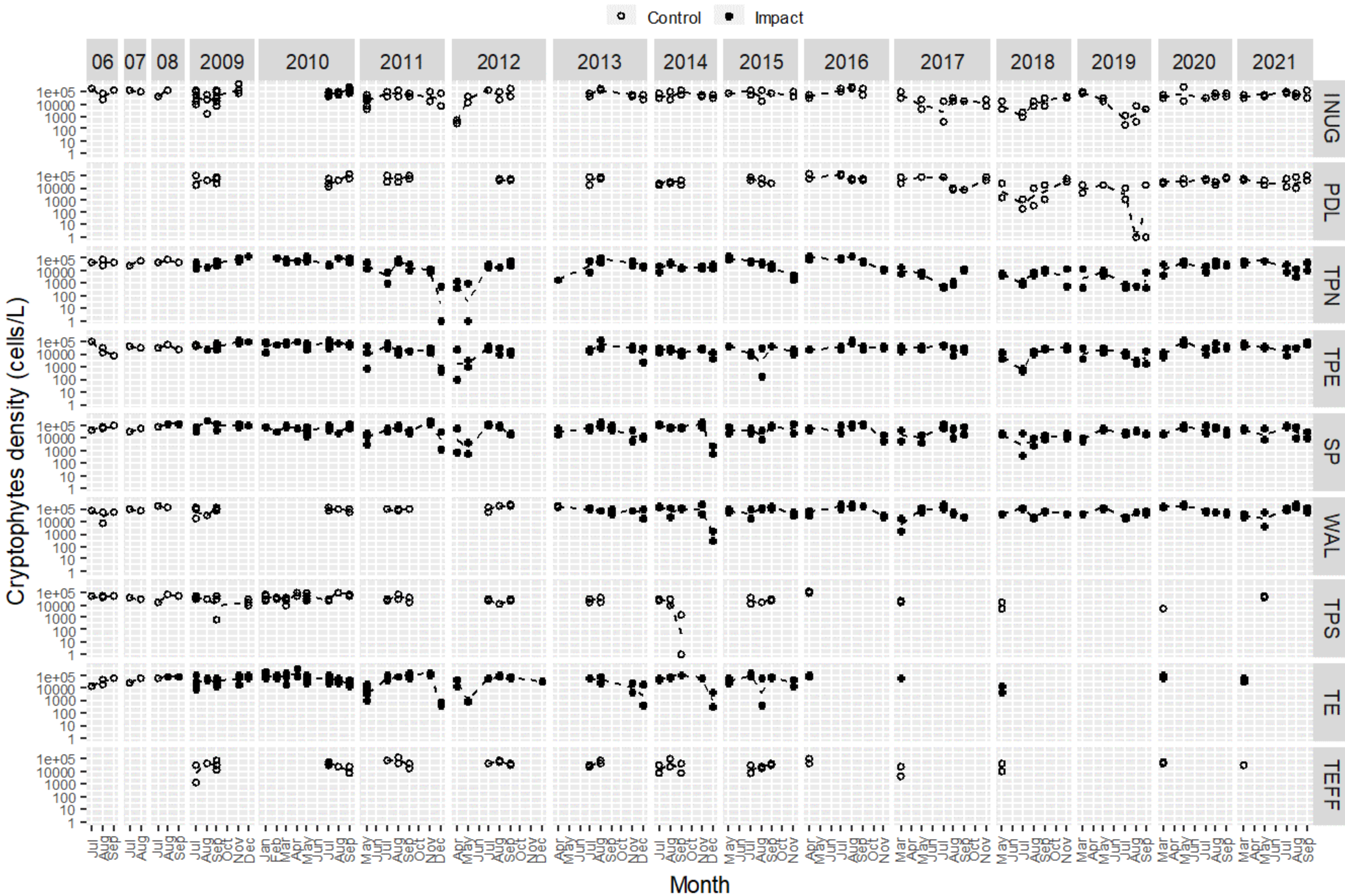


Figure D1-14. Dinoflagellates density (cells/L) by major taxa group from Meadowbank study lakes since 2006.

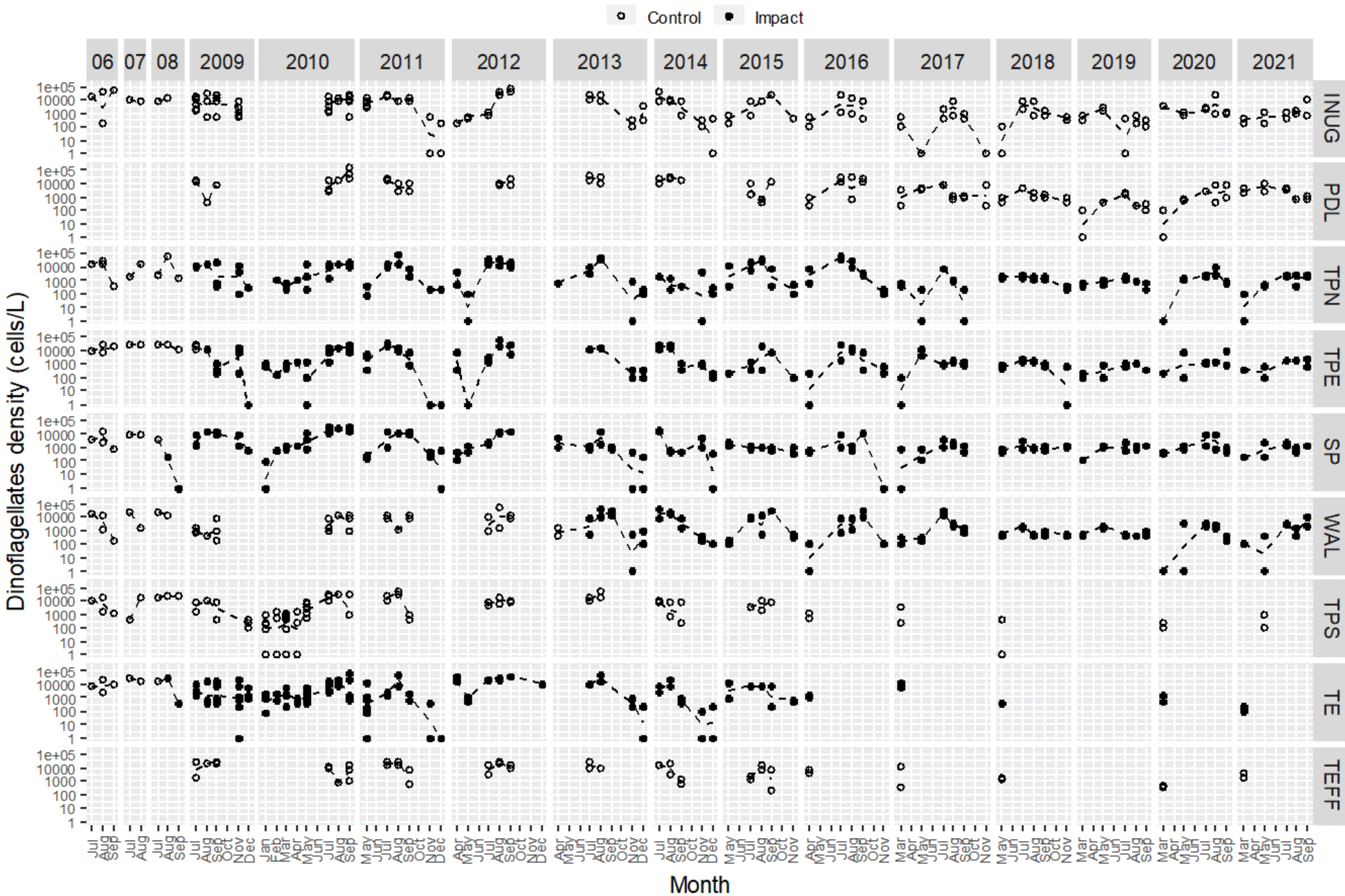
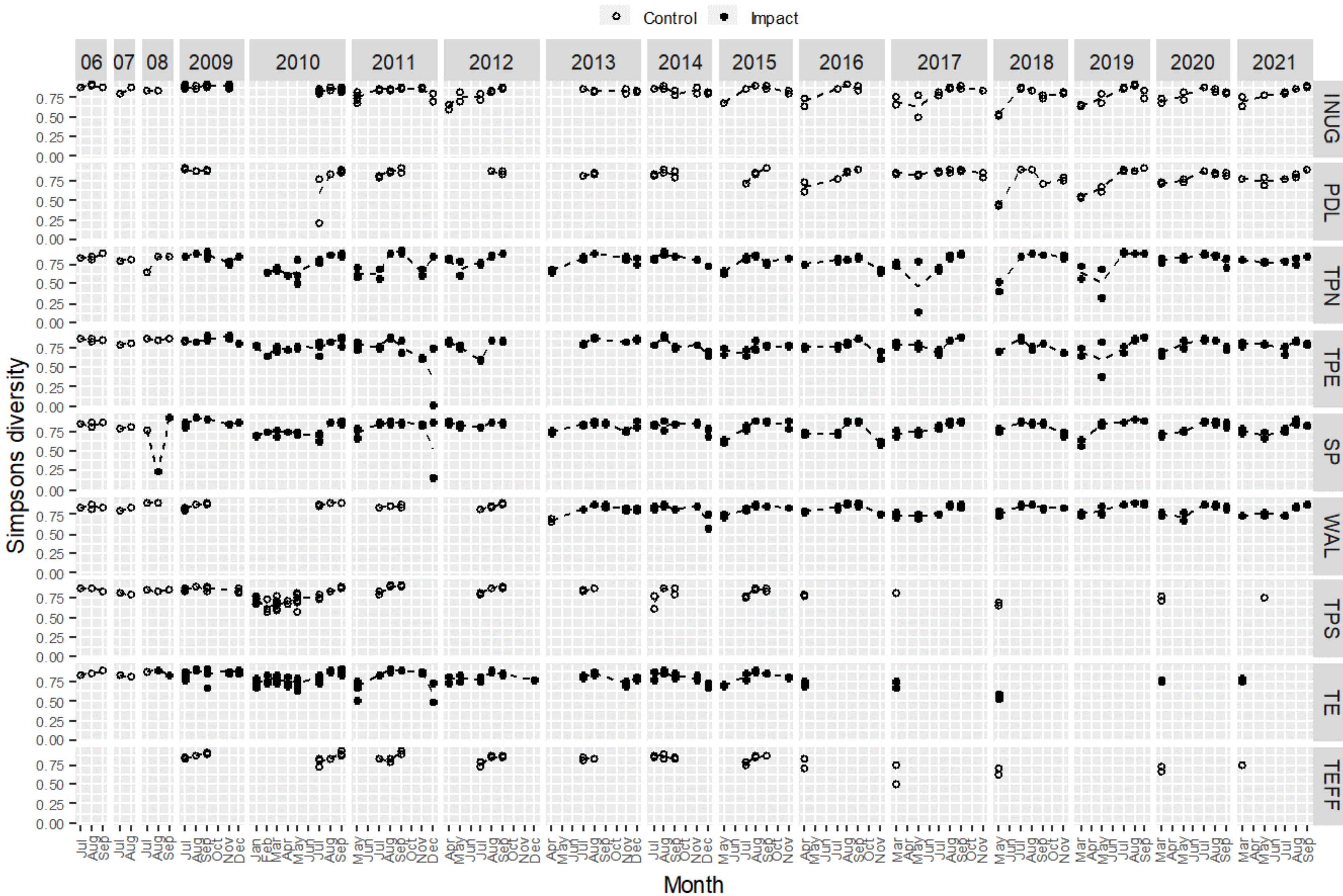


Figure D1-15. Simpsons' Diversity for the phytoplankton community from Meadowbank study lakes since 2006.



Appendix D2

Phyto Data – Whale Tail Study Area Lakes

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Table D2-1. Phytoplankton density (cells/L), biomass (mg/m3), and diversity by major taxa group, Whale Tail Pit study lakes, 2021.

Area-Replicate	Date	Phytoplankton Biomass (mg/m^3)							Taxa Richness	Simpson's Diversity
		Cyanophyte	Chlorophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	**TOTAL**		
Mammoth Lake										
MAM - 57	25-Mar-21	0	0.22	11	3.8	7.6	13	36	16	0.80
MAM - 58	25-Mar-21	0	0.67	17	3.9	11	6.3	39	16	0.79
MAM - 59	12-May-21	0	2.8	15	2.8	6.6	4.6	32	14	0.74
MAM - 60	12-May-21	0	0.51	13	2.8	9.8	7.0	33	18	0.74
MAM - 61	9-Jul-21	0	2.4	414	24	22	22	485	24	0.87
MAM - 62	9-Jul-21	0	0	450	31	35	32	548	19	0.87
MAM - 63	7-Aug-21	0	1.9	429	139	55	5.6	631	28	0.63
MAM - 64	7-Aug-21	0	4.8	454	144	67	5.8	674	29	0.69
MAM - 65	9-Sep-21	0	4.4	1,072	253	36	2.9	1,369	27	0.62
MAM - 66	9-Sep-21	0	7.8	867	215	26	0.74	1,117	31	0.61
Percent Density or Biomass		***<0.1***	***0.52***	***75***	***17***	***5.6***	***2.0***			
Nemo Lake										
NEM - 57	24-Mar-21	0	0.60	25	2.3	42	86	156	24	0.75
NEM - 58	24-Mar-21	0	2.4	11	0.87	62	95	171	17	0.59
NEM - 59	6-May-21	0	3.2	5.4	1.2	3.5	33	46	16	0.75
NEM - 60	6-May-21	0	0.53	10	2.4	15	16	44	13	0.79
NEM - 61	10-Jul-21	0	1.7	77	55	4.0	9.1	147	22	0.81
NEM - 62	10-Jul-21	0	0.52	171	66	18	12	268	23	0.84
NEM - 63	7-Aug-21	0	5.7	63	93	10	2.1	174	24	0.73
NEM - 64	7-Aug-21	0	6.7	84	85	12	0	188	25	0.75
NEM - 65	9-Sep-21	0	21	156	96	19	29	322	31	0.89
NEM - 66	9-Sep-21	0.10	23	147	122	24	1.4	318	33	0.89
Percent Density or Biomass		***<0.1***	***3.6***	***41***	***29***	***11***	***15***			
Whale Tail South										
WTS - 57	25-Mar-21	0	1.2	18	0.55	0.80	0.61	21	11	0.62
WTS - 58	25-Mar-21	0	0.18	12	0.18	3.1	1.6	17	15	0.75
WTS - 59	12-May-21	0	0.25	13	0.79	1.2	1.2	17	11	0.71
WTS - 60	13-May-21	0	0.47	14	0.71	1.2	4.9	21	14	0.74
WTS - 61	8-Jul-21	0	3.7	236	10	31	5.3	286	28	0.82
WTS - 62	8-Jul-21	0	1.0	200	7.7	50	9.8	268	27	0.82
WTS - 63	10-Aug-21	0.10	12	279	47	108	10	457	37	0.82
WTS - 64	10-Aug-21	0	14	326	96	115	8.8	560	35	0.85
WTS - 65	8-Sep-21	0	8.6	127	134	71	36	376	36	0.82
WTS - 66	8-Sep-21	0	16	127	155	86	41	425	39	0.84
Percent Density or Biomass		***<0.1***	***2.4***	***55***	***18***	***19***	***4.9***			

Table D2-1. Phytoplankton density (cells/L), biomass (mg/m3), and diversity by major taxa group, Whale Tail Pit study lakes, 2021.

Area-Replicate	Date	Phytoplankton Biomass (mg/m^3)							Taxa Richness	Simpson's Diversity
		Cyanophyte	Chlorophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	**TOTAL**		
Lake A-20										
A20 - 51	24-Mar-21	0	0	17	0.33	5.1	0	22	10	0.62
A20 - 52	24-Mar-21	0	0.087	15	0.78	54	8.8	79	16	0.66
A20 - 53	12-May-21	0	0.095	11	0.87	24	29	66	12	0.72
A20 - 54	12-May-21	0	0.17	24	3.4	29	4.3	61	17	0.72
A20 - 55	11-Jul-21	0	2.7	524	23	37	44	631	28	0.90
A20 - 56	11-Jul-21	0	0.37	534	9.7	82	16	642	23	0.89
A20 - 57	10-Aug-21	0	7.5	888	13	67	26	1,001	28	0.85
A20 - 58	10-Aug-21	0.045	4.1	905	16	72	15	1,012	30	0.87
A20 - 59	9-Sep-21	0	1.2	613	143	51	24	833	32	0.76
A20 - 60	9-Sep-21	0	2.8	573	164	55	24	820	33	0.79
Percent Density or Biomass		***<0.1***	***0.37***	***79***	***7.2***	***9.2***	***3.7***			
Lake A-76										
A76 - 51	7-May-21	0	2.0	13	4.6	10	7.0	37	20	0.81
A76 - 52	7-May-21	0	2.8	19	6.4	8.2	8.8	45	19	0.83
A76 - 53	17-Jul-21	0	0.060	156	34	38	16	245	20	0.85
A76 - 54	17-Jul-21	0	0.87	165	31	37	23	256	21	0.86
A76 - 55	7-Aug-21	0	3.5	320	319	26	6.5	675	32	0.70
A76 - 56	7-Aug-21	0.18	2.5	247	141	29	5.3	425	30	0.73
A76 - 57	12-Sep-21	0	2.7	576	271	61	16	927	32	0.74
A76 - 58	12-Sep-21	0	2.1	564	267	50	13	896	35	0.70
Percent Density or Biomass		***<0.1***	***0.47***	***59***	***31***	***7.4***	***2.7***			
Lake DS-1										
DS1 - 49	7-May-21	0	1.9	293	4.3	11	31	341	26	0.72
DS1 - 50	7-May-21	0	1.7	240	6.2	16	33	297	24	0.74
DS1 - 51	19-Jul-21	0	1.5	234	40	6.3	31	313	29	0.82
DS1 - 52	19-Jul-21	0	2.7	201	12	18	21	255	31	0.83
DS1 - 53	15-Aug-21	0	5.6	111	3.5	14	8.9	143	37	0.83
DS1 - 54	15-Aug-21	0	8.4	74	2.8	6.3	5.0	97	33	0.79
DS1 - 55	12-Sep-21	0.068	4.9	110	19	15	50	199	41	0.85
DS1 - 56	12-Sep-21	0	3.4	101	12	21	24	161	36	0.83
Percent Density or Biomass		***<0.1***	***1.7***	***75***	***5.6***	***6.0***	***11***			
All 2021 Locations Relative Density or Biomass (%)		***<0.1***	***1.1***	***68***	***17***	***9.1***	***5.0***			

Table D2-1. Phytoplankton density (cells/L), biomass (mg/m3), and diversity by major taxa group, Whale Tail Pit study lakes, 2021.

Area-Replicate	Date	Phytoplankton Density (cells/L)						
		Cyanophyte	Chlorophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	**TOTAL**
Mammoth Lake								
MAM - 57	25-Mar-21	0	17,731	219,858	61,884	47,699	5,446	352,618
MAM - 58	25-Mar-21	0	3,546	273,150	41,607	72,322	4,146	394,771
MAM - 59	12-May-21	0	134,752	248,227	20,831	36,261	700	440,770
MAM - 60	12-May-21	0	88,653	205,774	40,561	38,461	1,100	374,548
MAM - 61	9-Jul-21	0	36,920	2,967,288	396,568	74,056	3,800	3,478,632
MAM - 62	9-Jul-21	0	0	3,114,968	672,760	121,960	4,400	3,914,088
MAM - 63	7-Aug-21	0	158,048	1,934,040	3,343,504	48,552	1,400	5,485,544
MAM - 64	7-Aug-21	0	395,120	2,527,112	3,692,736	67,520	1,400	6,683,888
MAM - 65	9-Sep-21	0	193,968	4,398,424	6,841,080	33,368	600	11,467,440
MAM - 66	9-Sep-21	0	288,360	3,658,592	6,097,512	28,168	200	10,072,832
Percent Density or Biomass		***<0.1***	***3.1***	***46***	***50***	***1.3***	***<0.1***	
Nemo Lake								
NEM - 57	24-Mar-21	0	18,031	323,095	26,223	322,549	16,446	706,343
NEM - 58	24-Mar-21	0	10,938	237,589	39,507	476,877	14,300	779,212
NEM - 59	6-May-21	0	138,398	109,929	39,807	18,231	3,700	310,065
NEM - 60	6-May-21	0	67,376	131,306	43,553	89,353	2,100	333,687
NEM - 61	10-Jul-21	0	29,536	1,489,704	1,133,352	22,752	800	2,676,144
NEM - 62	10-Jul-21	0	35,920	1,498,088	864,360	119,344	1,800	2,519,512
NEM - 63	7-Aug-21	0	309,712	635,592	1,525,640	19,968	200	2,491,112
NEM - 64	7-Aug-21	0	167,432	993,792	1,330,672	20,568	0	2,512,464
NEM - 65	9-Sep-21	0	835,544	1,756,296	711,680	45,320	200	3,349,040
NEM - 66	9-Sep-21	200	906,784	1,741,928	664,008	54,304	200	3,367,424
Percent Density or Biomass		***<0.1***	***13***	***47***	***33***	***6.2***	***0.21***	
Whale Tail South								
WTS - 57	25-Mar-21	0	3,546	290,880	7,192	3,946	100	305,665
WTS - 58	25-Mar-21	0	31,915	343,972	3,646	32,315	300	412,148
WTS - 59	12-May-21	0	3,546	216,412	32,015	3,946	200	256,119
WTS - 60	13-May-21	0	17,731	248,227	21,477	3,946	800	292,180
WTS - 61	8-Jul-21	0	71,840	2,391,288	145,096	271,608	1,000	2,880,832
WTS - 62	8-Jul-21	0	57,472	1,994,968	94,608	261,256	1,800	2,410,104
WTS - 63	10-Aug-21	200	891,016	3,923,464	302,336	257,736	1,600	5,376,352
WTS - 64	10-Aug-21	0	985,008	4,067,744	382,008	260,936	1,600	5,697,296
WTS - 65	8-Sep-21	0	474,744	1,811,568	2,057,520	279,224	1,400	4,624,456
WTS - 66	8-Sep-21	0	619,024	2,135,048	2,145,760	200,032	2,200	5,102,064
Percent Density or Biomass		***<0.1***	***12***	***64***	***19***	***5.8***	***<0.1***	

Table D2-1. Phytoplankton density (cells/L), biomass (mg/m3), and diversity by major taxa group, Whale Tail Pit study lakes, 2021.

Area-Replicate	Date	Phytoplankton Density (cells/L)						
		Cyanophyte	Chlorophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	**TOTAL**
Lake A-20								
A20 - 51	24-Mar-21	0	0	329,787	7,392	26,523	0	363,702
A20 - 52	24-Mar-21	0	3,546	291,080	3,846	303,334	1,100	602,907
A20 - 53	12-May-21	0	3,546	187,943	32,915	108,237	4,600	337,241
A20 - 54	12-May-21	0	7,192	453,901	53,992	140,052	700	655,836
A20 - 55	11-Jul-21	0	107,960	3,100,096	230,352	225,120	7,000	3,670,528
A20 - 56	11-Jul-21	0	79,024	3,110,496	115,592	173,496	2,400	3,481,008
A20 - 57	10-Aug-21	0	346,632	1,529,832	14,600	140,944	12,584	2,044,592
A20 - 58	10-Aug-21	200	194,768	1,409,336	18,600	205,400	3,400	1,831,704
A20 - 59	9-Sep-21	0	72,240	3,476,600	157,608	75,088	3,200	3,784,736
A20 - 60	9-Sep-21	0	107,960	3,213,376	209,712	104,224	3,400	3,638,672
Percent Density or Biomass		***<0.1***	***4.5***	***84***	***4.1***	***7.4***	***0.19***	
Lake A-76								
A76 - 51	7-May-21	0	138,798	204,682	33,338	38,061	1,100	415,979
A76 - 52	7-May-21	0	159,575	230,597	36,138	43,553	1,400	471,263
A76 - 53	17-Jul-21	0	14,368	1,822,984	357,712	108,592	2,400	2,306,056
A76 - 54	17-Jul-21	0	57,472	1,895,024	318,776	120,160	2,400	2,393,832
A76 - 55	7-Aug-21	0	151,664	1,777,096	2,416,032	48,520	1,600	4,394,912
A76 - 56	7-Aug-21	800	86,608	1,271,416	1,583,744	49,920	1,200	2,993,688
A76 - 57	12-Sep-21	0	129,512	3,333,104	3,775,376	121,392	2,000	7,361,384
A76 - 58	12-Sep-21	0	87,208	3,063,112	3,986,880	81,672	1,400	7,220,272
Percent Density or Biomass		***<0.1***	***3.0***	***49***	***45***	***2.2***	***<0.1***	
Lake DS-1								
DS1 - 49	7-May-21	0	57,472	1,406,128	78,456	88,808	3,400	1,634,264
DS1 - 50	7-May-21	0	28,736	1,191,992	91,024	132,312	3,600	1,447,664
DS1 - 51	19-Jul-21	0	15,768	3,176,744	509,080	31,336	4,600	3,737,528
DS1 - 52	19-Jul-21	0	23,352	2,920,504	150,680	52,904	3,600	3,151,040
DS1 - 53	15-Aug-21	0	237,672	1,655,320	77,640	75,240	2,000	2,047,872
DS1 - 54	15-Aug-21	0	496,296	1,732,144	11,784	30,336	1,200	2,271,760
DS1 - 55	12-Sep-21	400	123,528	1,499,272	160,264	28,952	7,200	1,819,616
DS1 - 56	12-Sep-21	0	151,664	1,346,408	214,736	107,176	3,600	1,823,784
Percent Density or Biomass		***<0.1***	***6.3***	***83***	***7.2***	***3.1***	***0.16***	
All 2021 Locations Relative Density or Biomass (%)		***<0.1***	***6.4***	***59***	***31***	***3.9***	***0.10***	

Figure D2-1. Cyanophyte biomass (mg/m³) from Whale Tail Pit lakes since 2015.

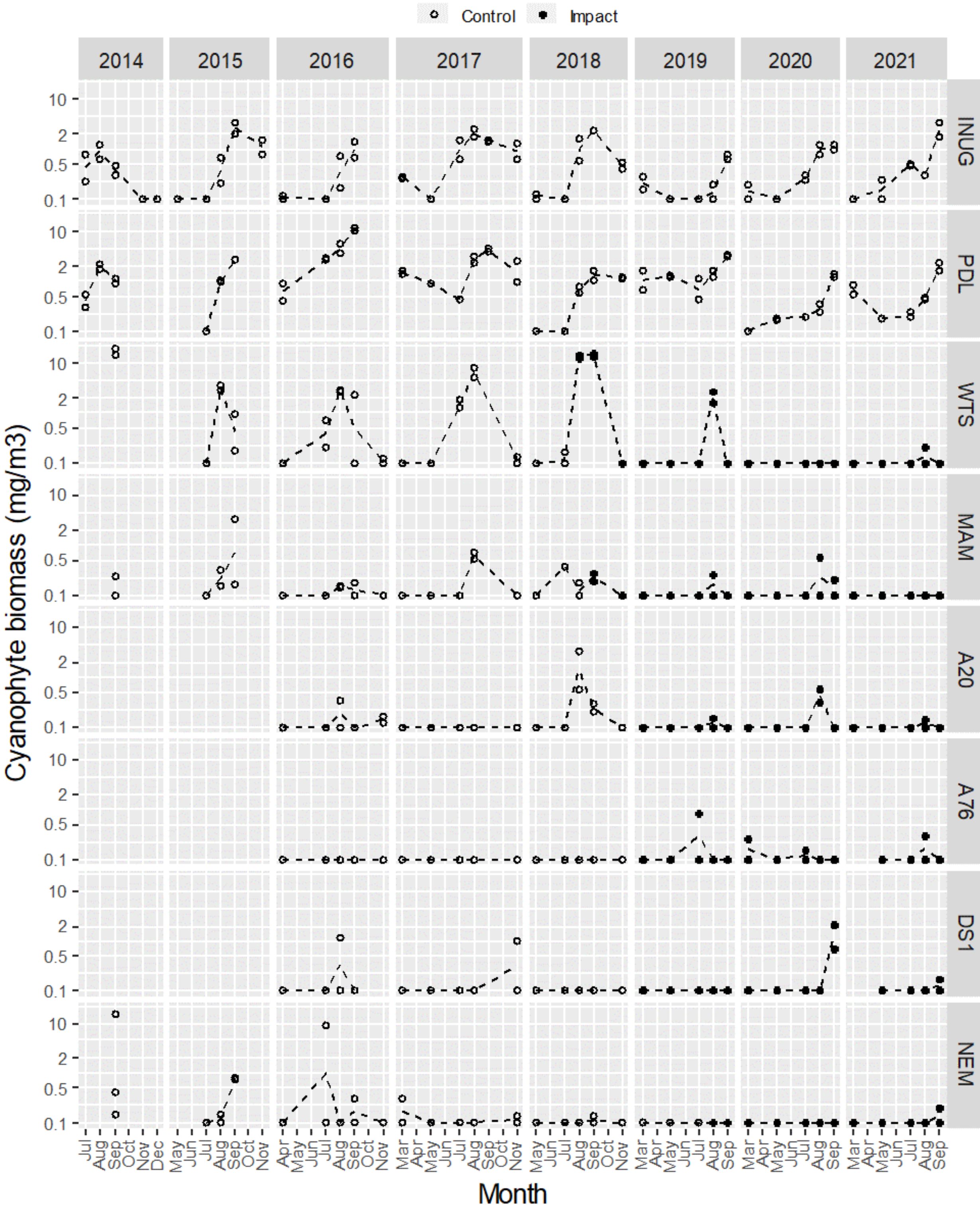


Figure D2-2. Chlorophyte biomass (mg/m^3) from Whale Tail Pit lakes since 2015.

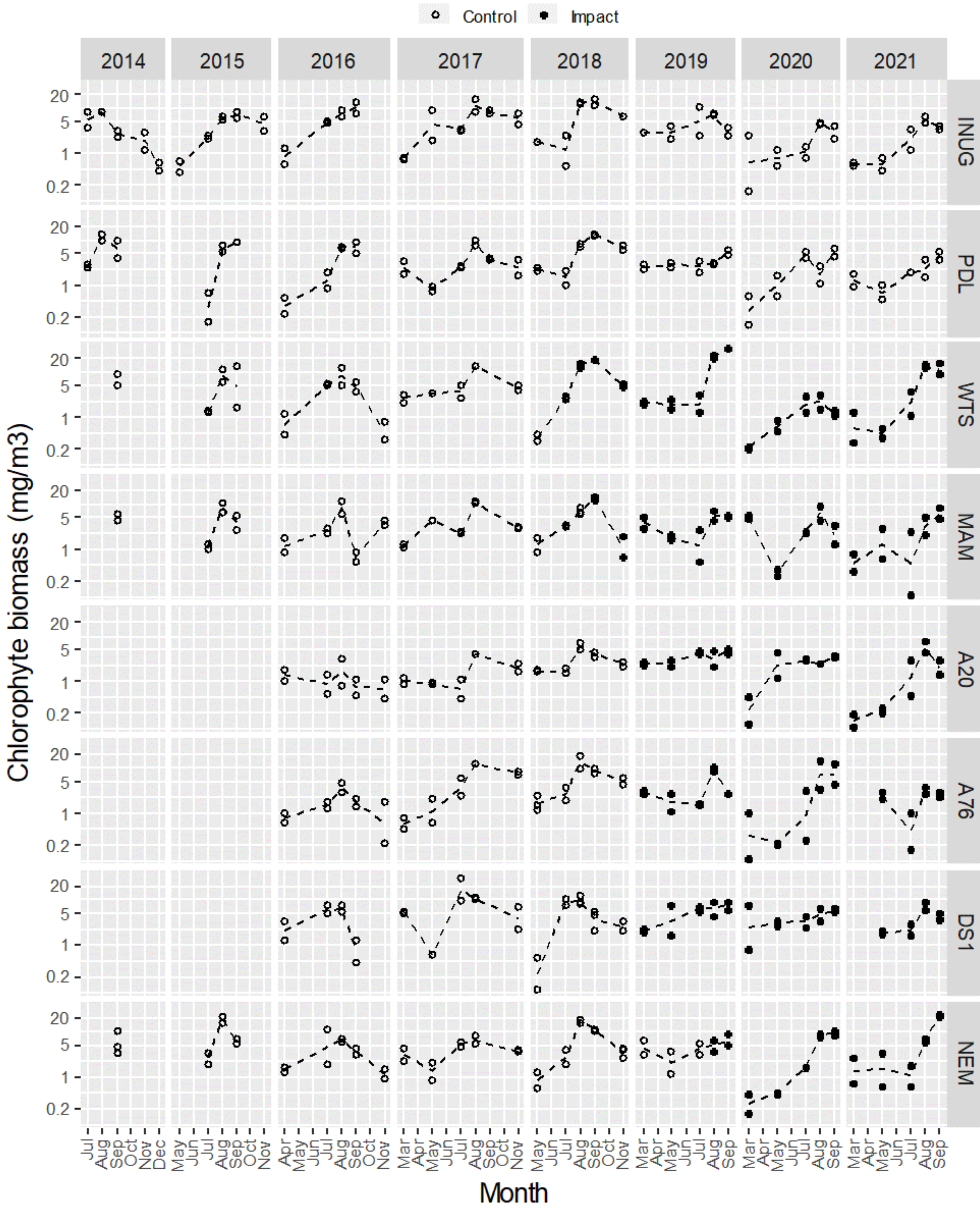


Figure D2-3. Chrysophyte biomass (mg/m³) from Whale Tail Pit lakes since 2015.

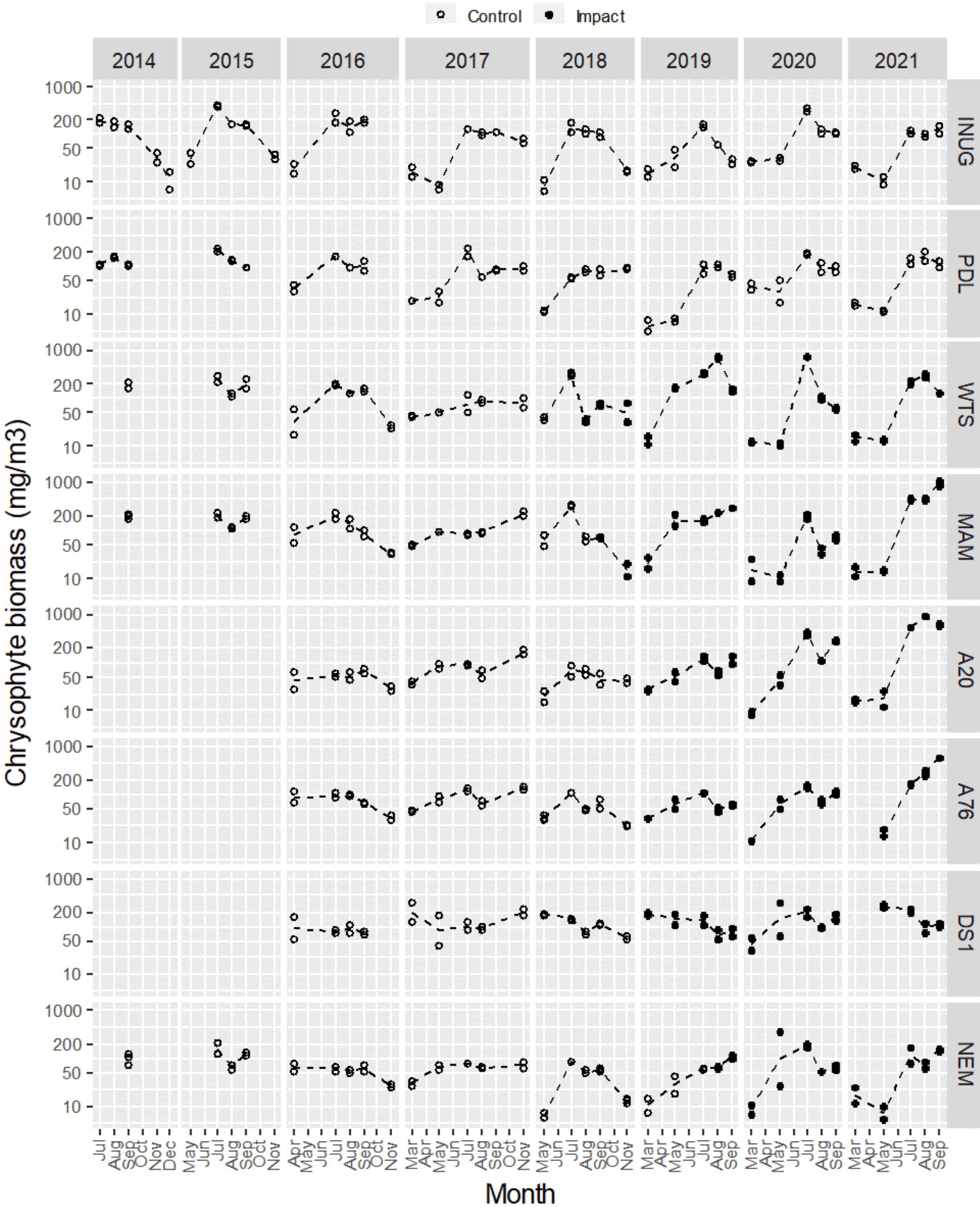


Figure D2-4. Diatoms biomass (mg/m³) from Whale Tail Pit lakes since 2015.

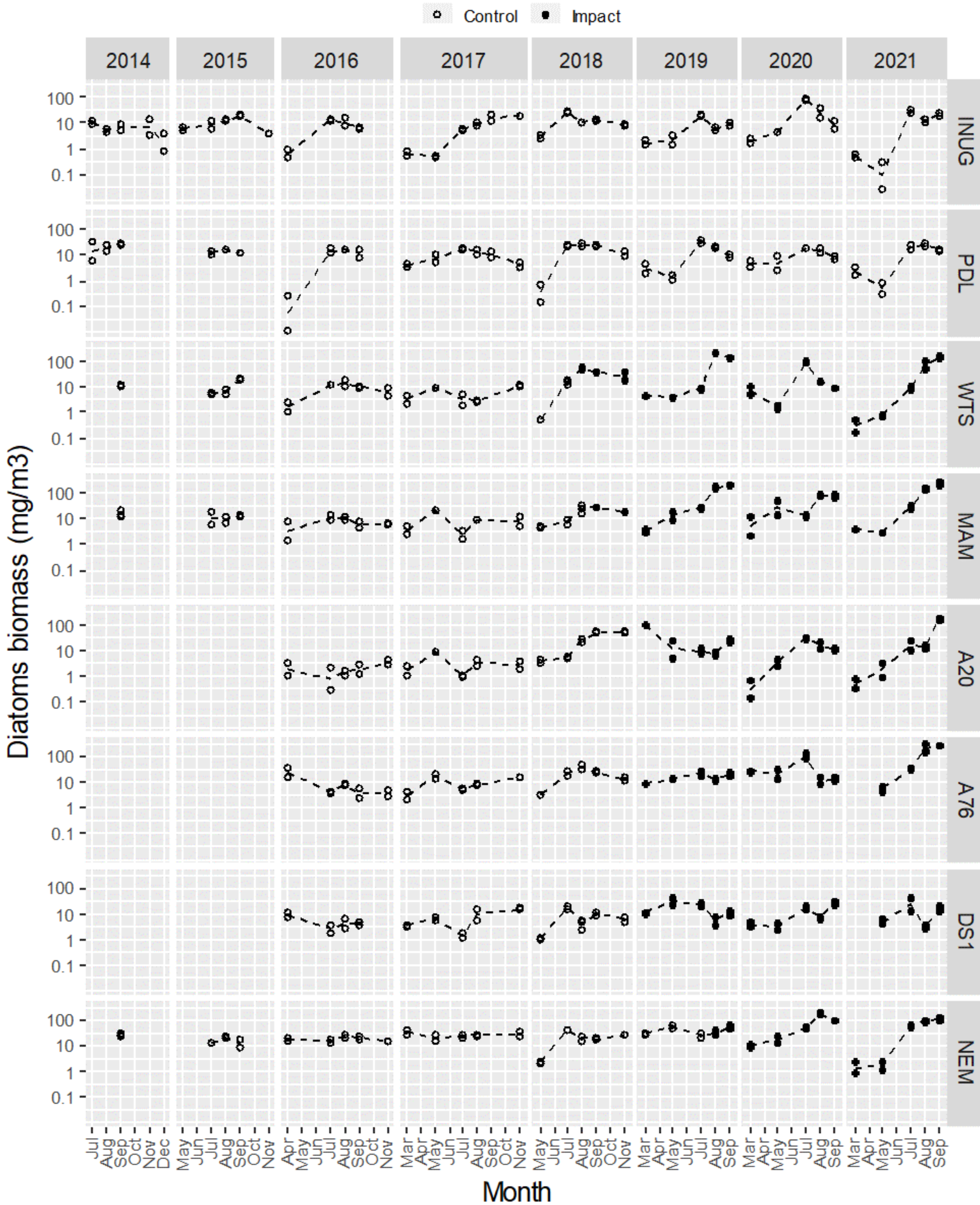


Figure D2-5. Cryptophytes biomass (mg/m³) from Whale Tail Pit lakes since 2015.

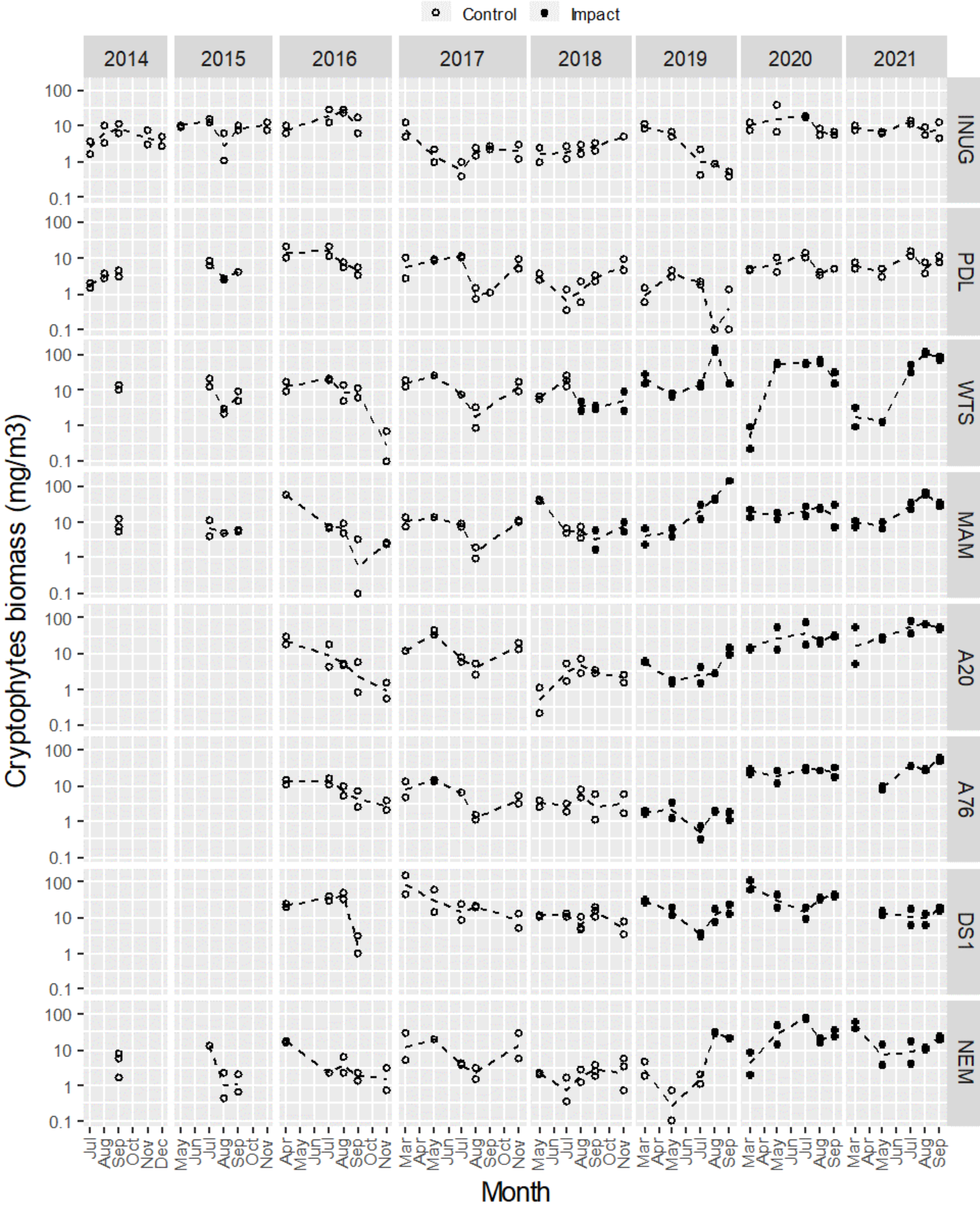


Figure D2-6. Dinoflagellates biomass (mg/m³) from Whale Tail Pit lakes since 2015.

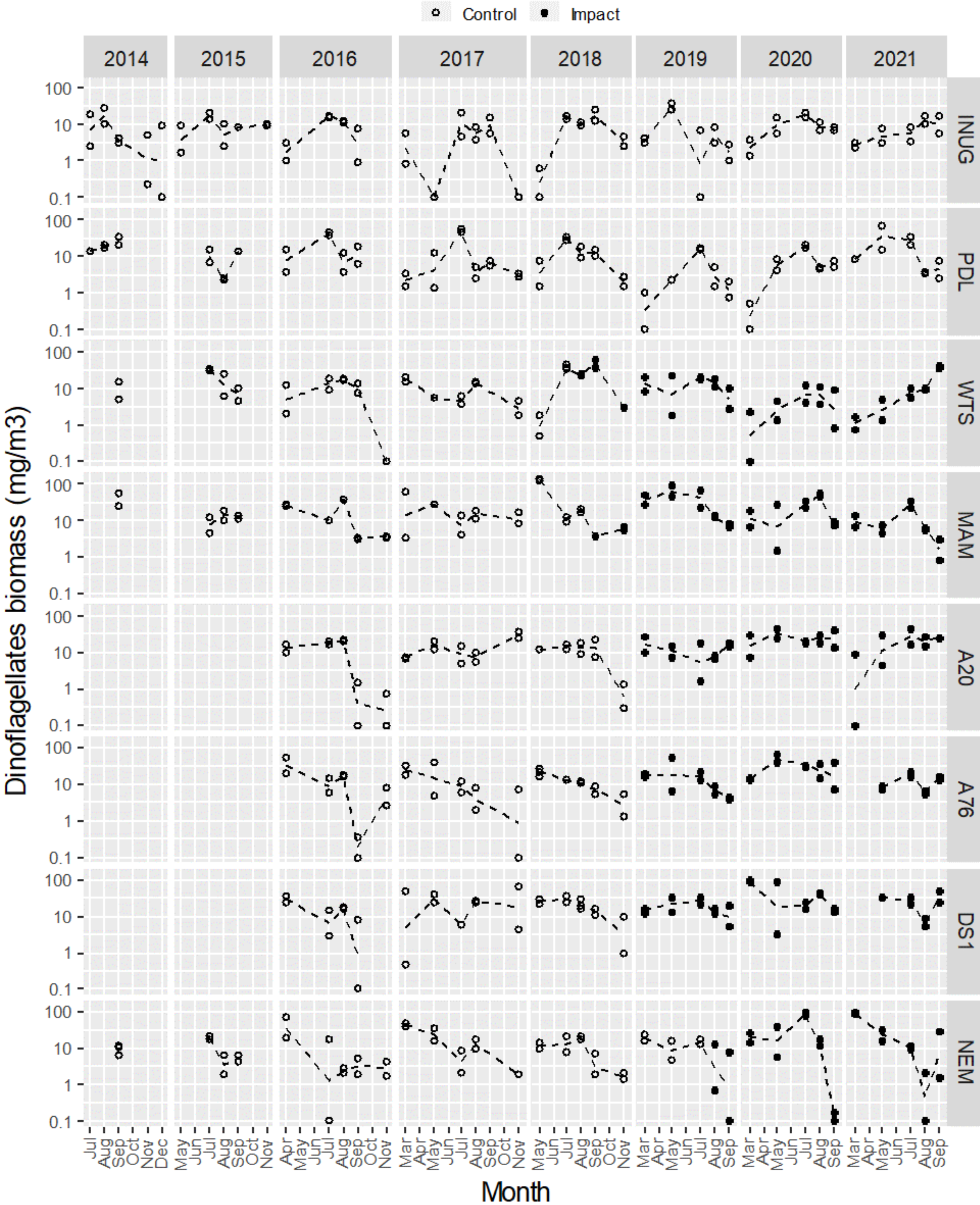


Figure D2-7. Phytoplankton density (cells/L) by major taxa group from Whale Tail Pit lakes since 2015.

Figure D2-8. Relative phytoplankton density from Whale Tail Pit lakes since 2015.

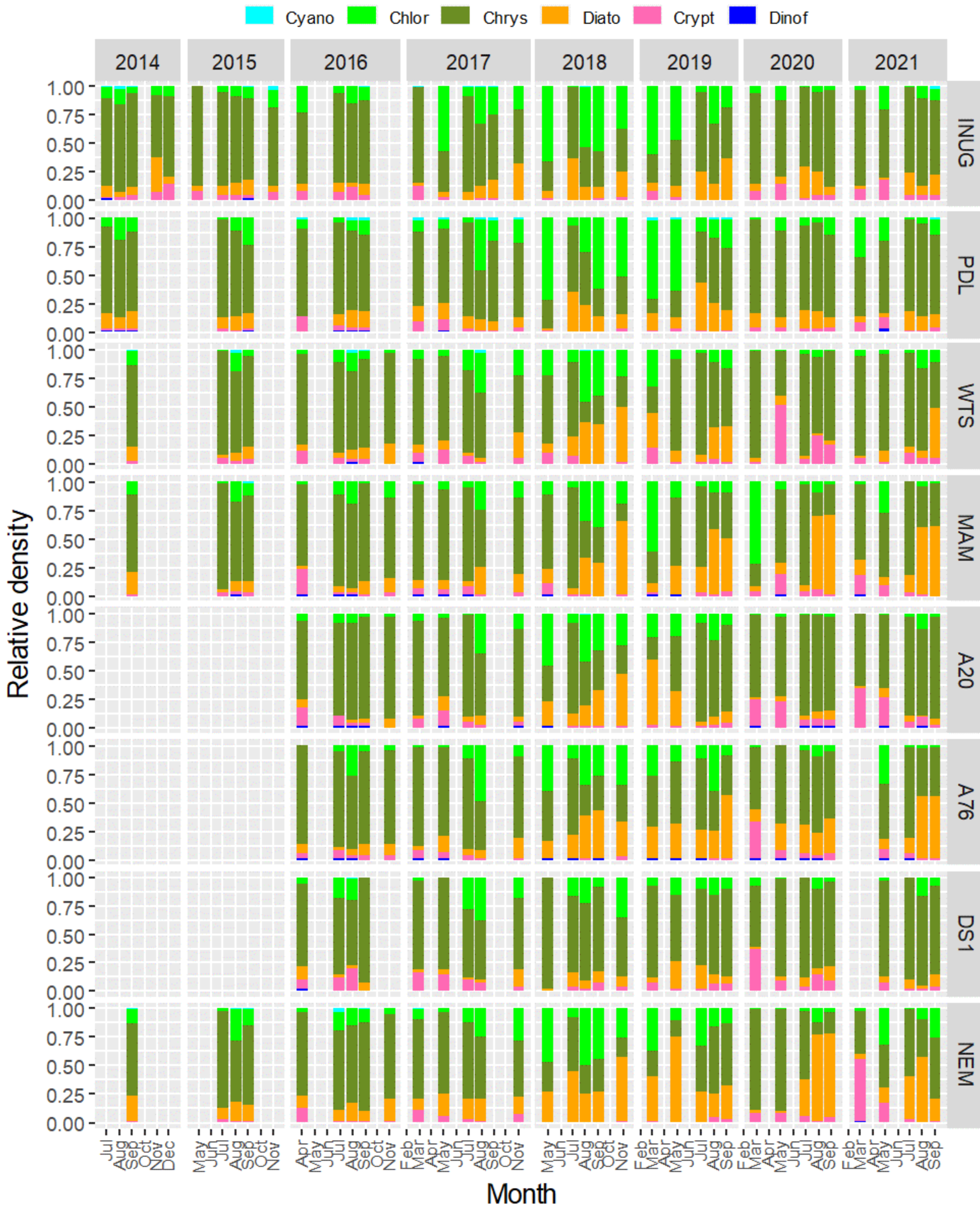


Figure D2-9. Cyanophyte density (cells/L) from Whale Tail Pit lakes since 2015.

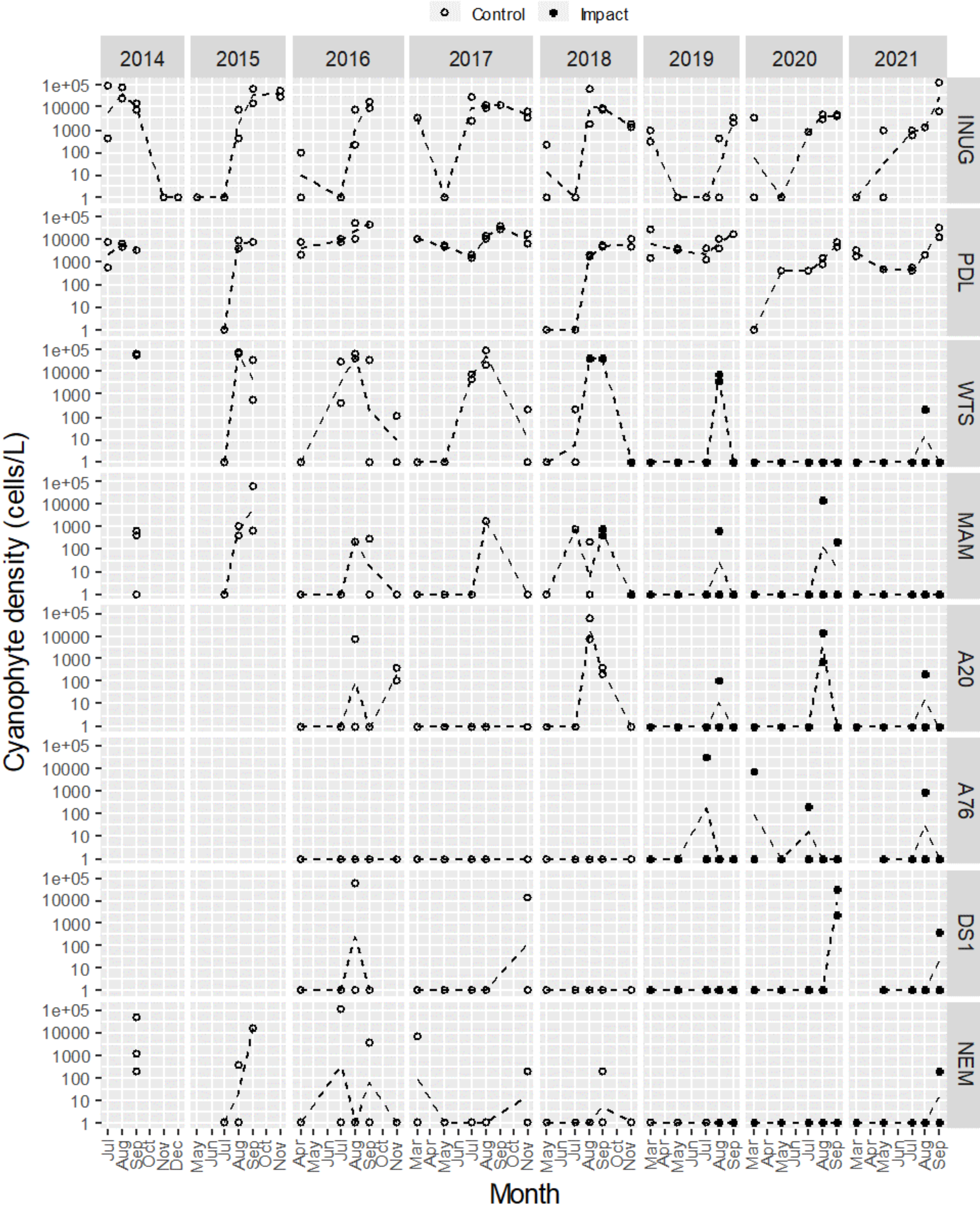


Figure D2-10. Chlorophyte density (cells/L) from Whale Tail Pit lakes since 2015.

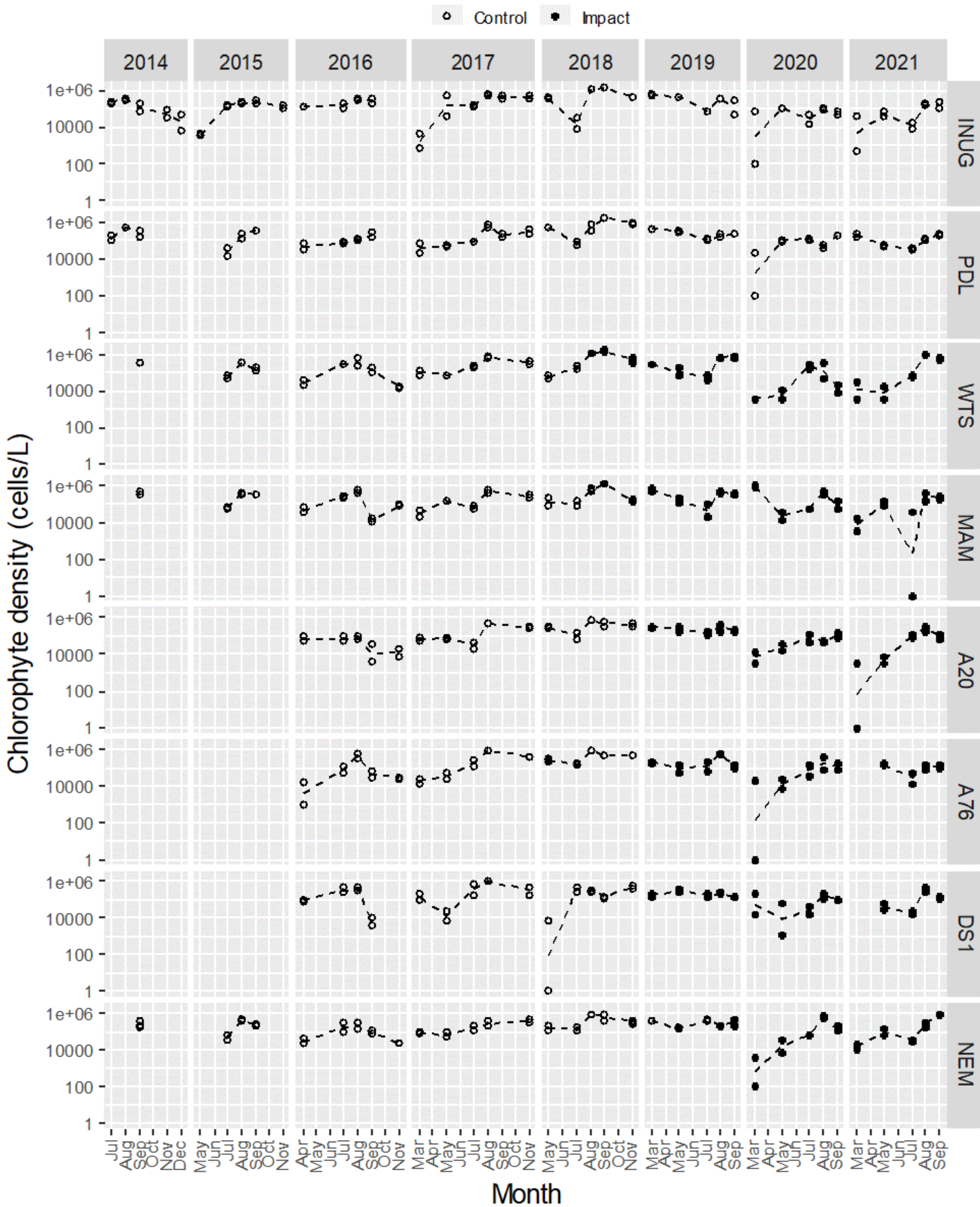


Figure D2-11. Chrysophyte density (cells/L) from Whale Tail Pit lakes since 2015.

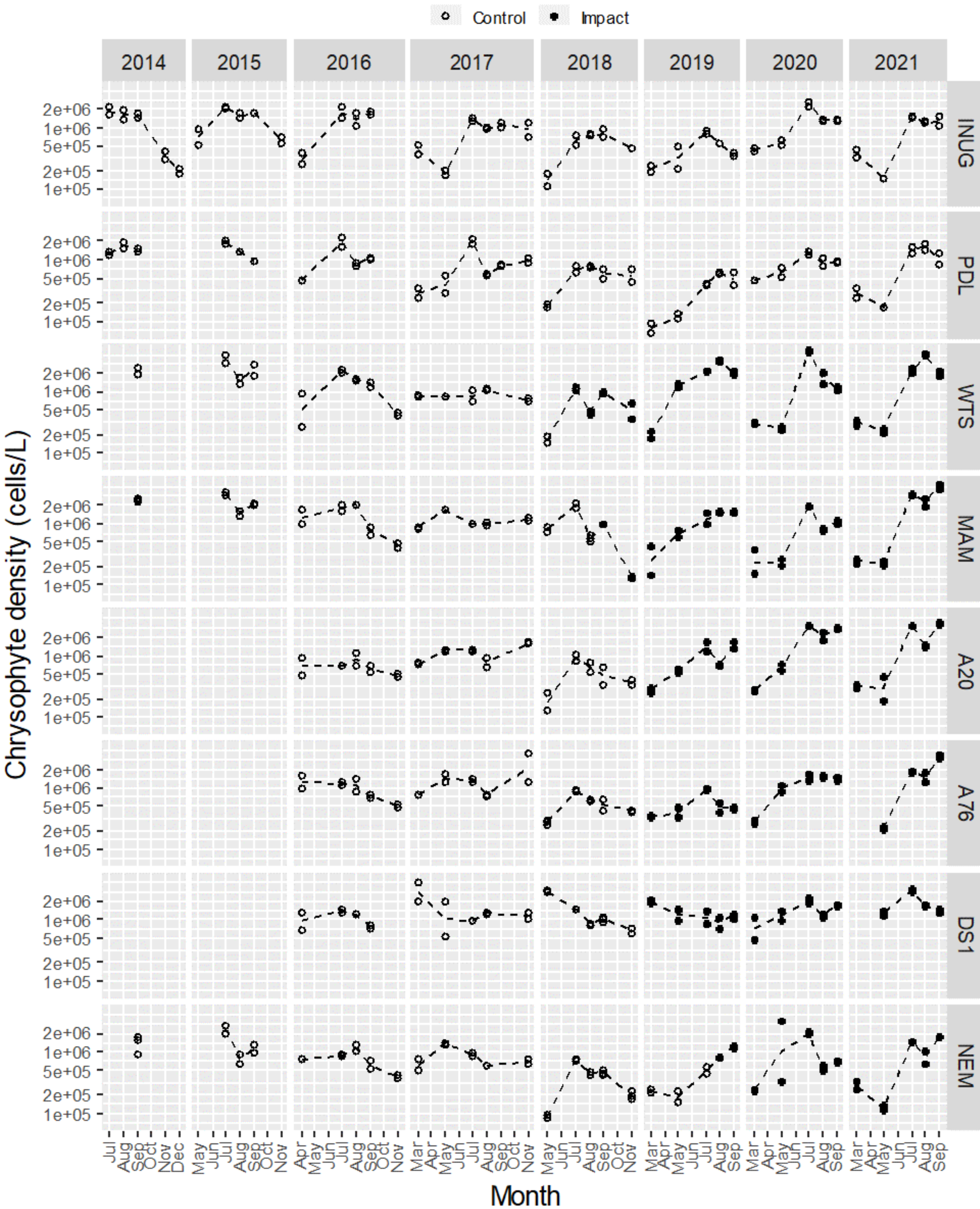


Figure D2-12. Diatoms density (cells/L) from Whale Tail Pit lakes since 2015.

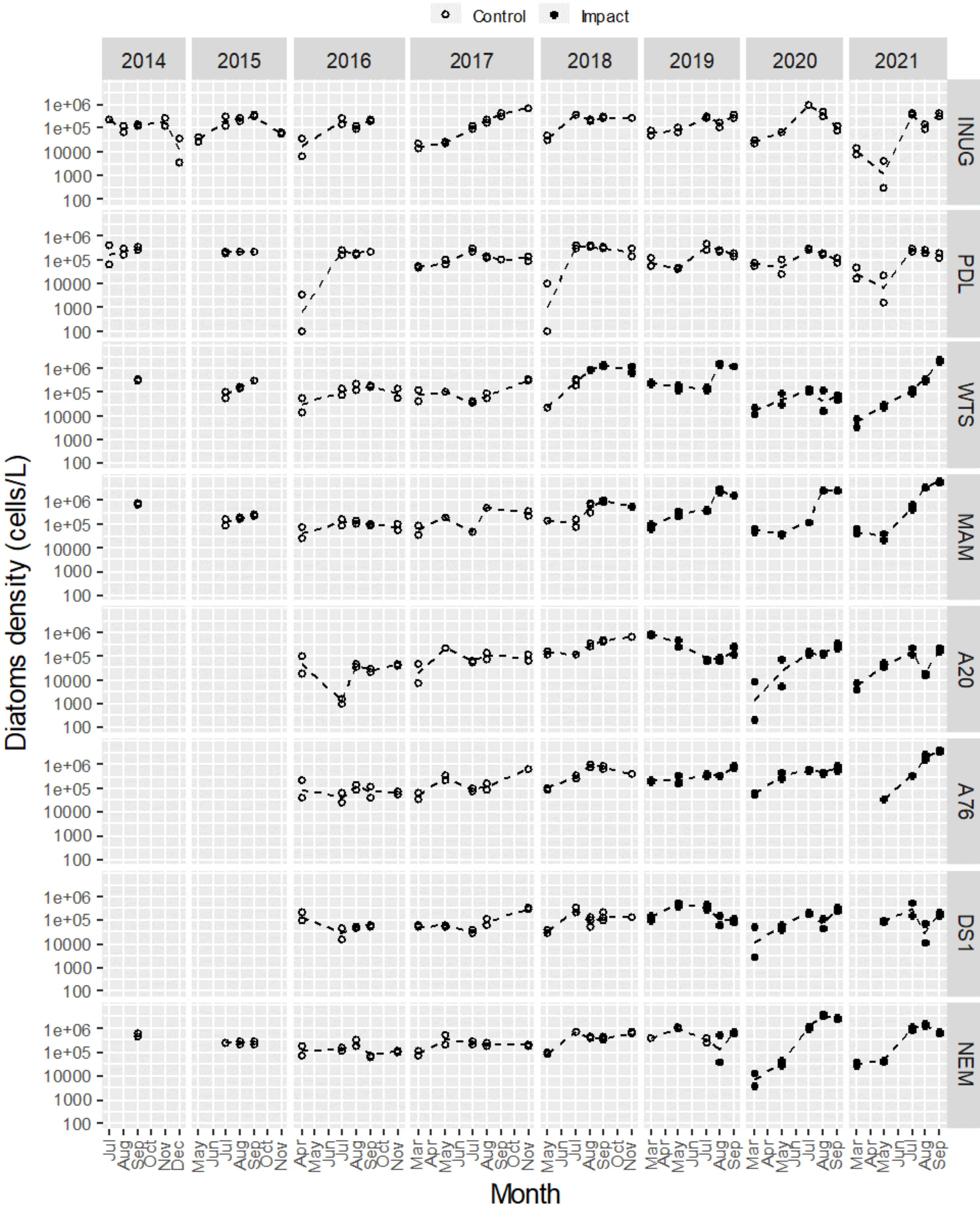


Figure D2-13. Cryptophytes density (cells/L) from Whale Tail Pit lakes since 2015.

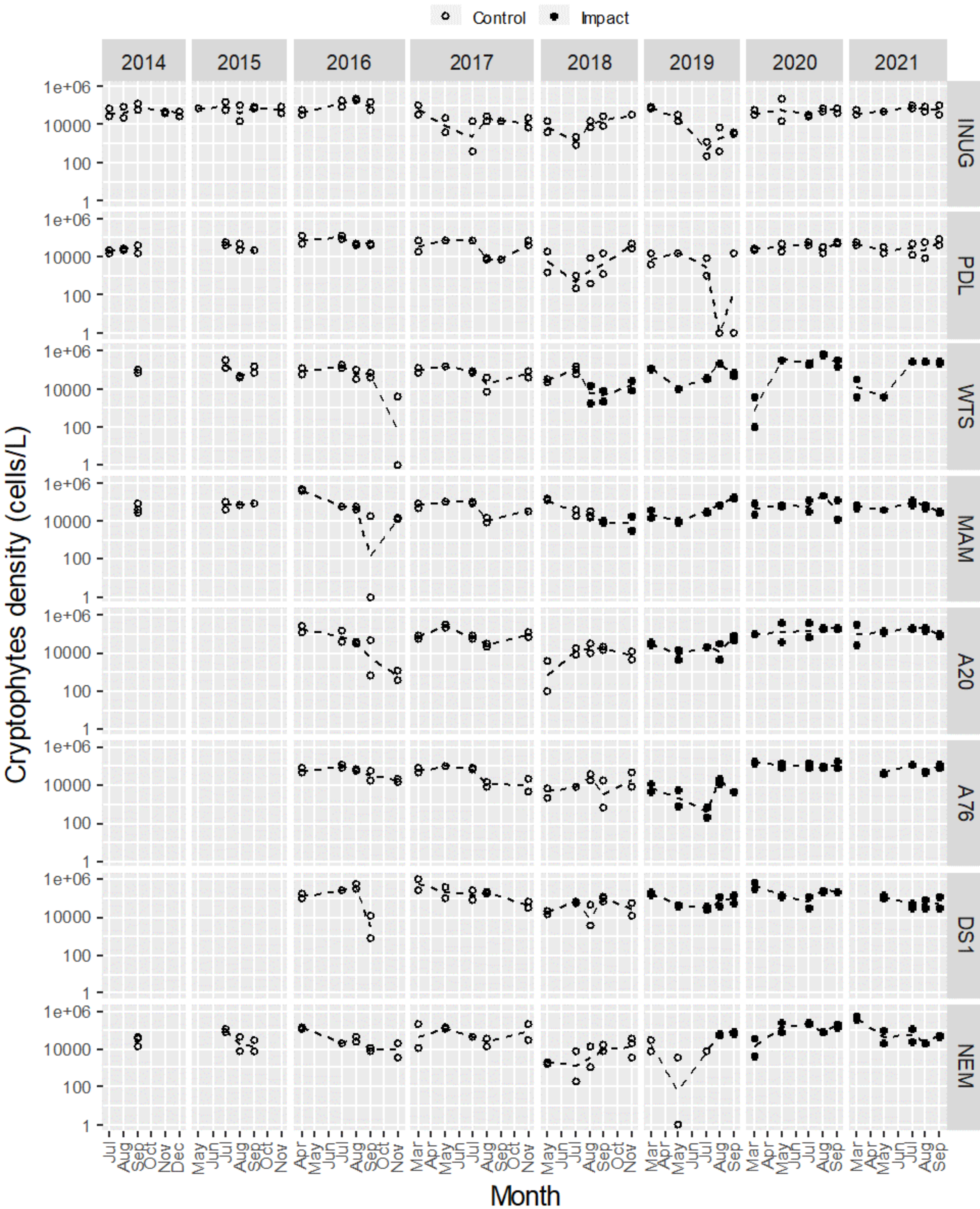


Figure D2-14. Dinoflagellates density (cells/L) from Whale Tail Pit lakes since 2015.

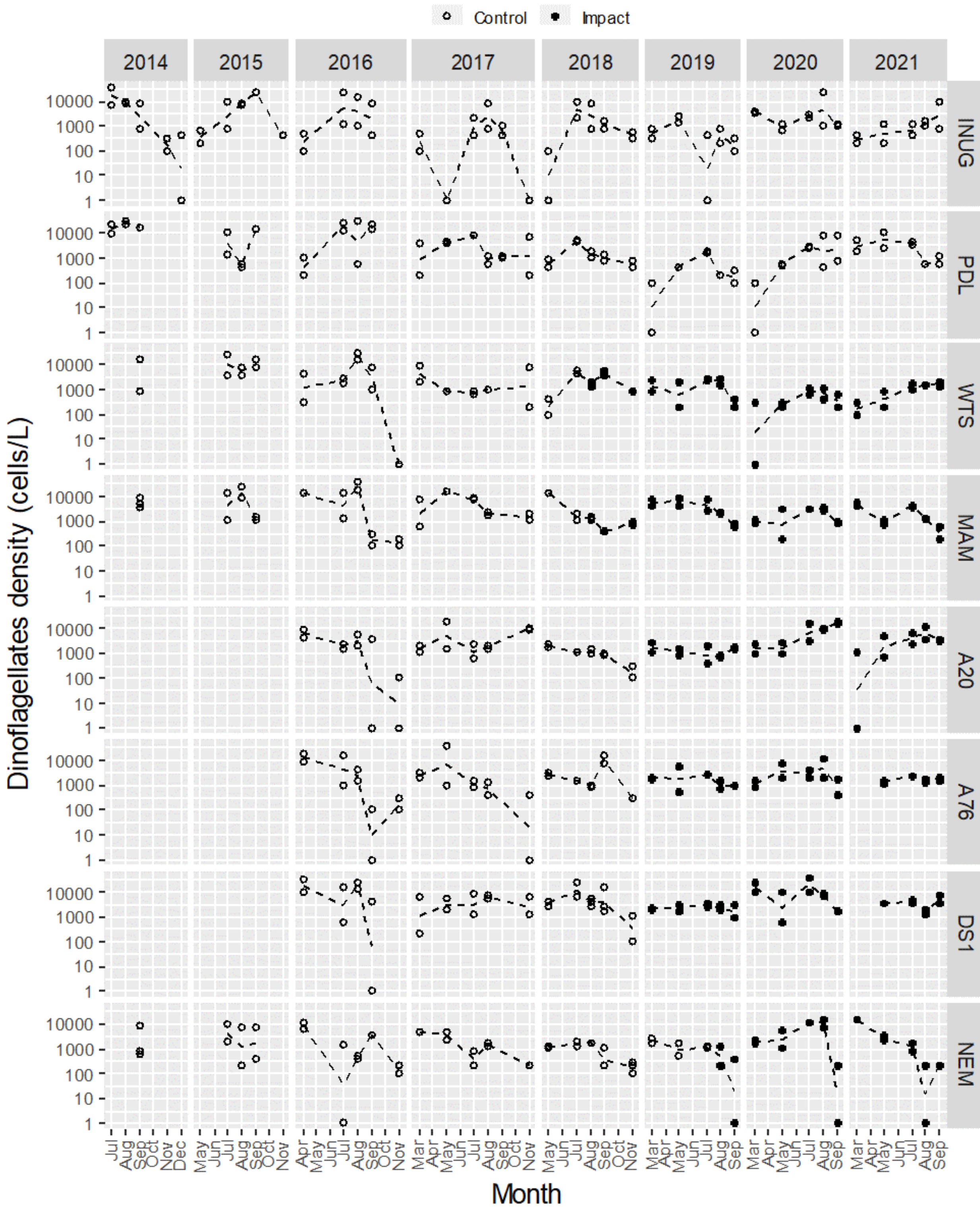
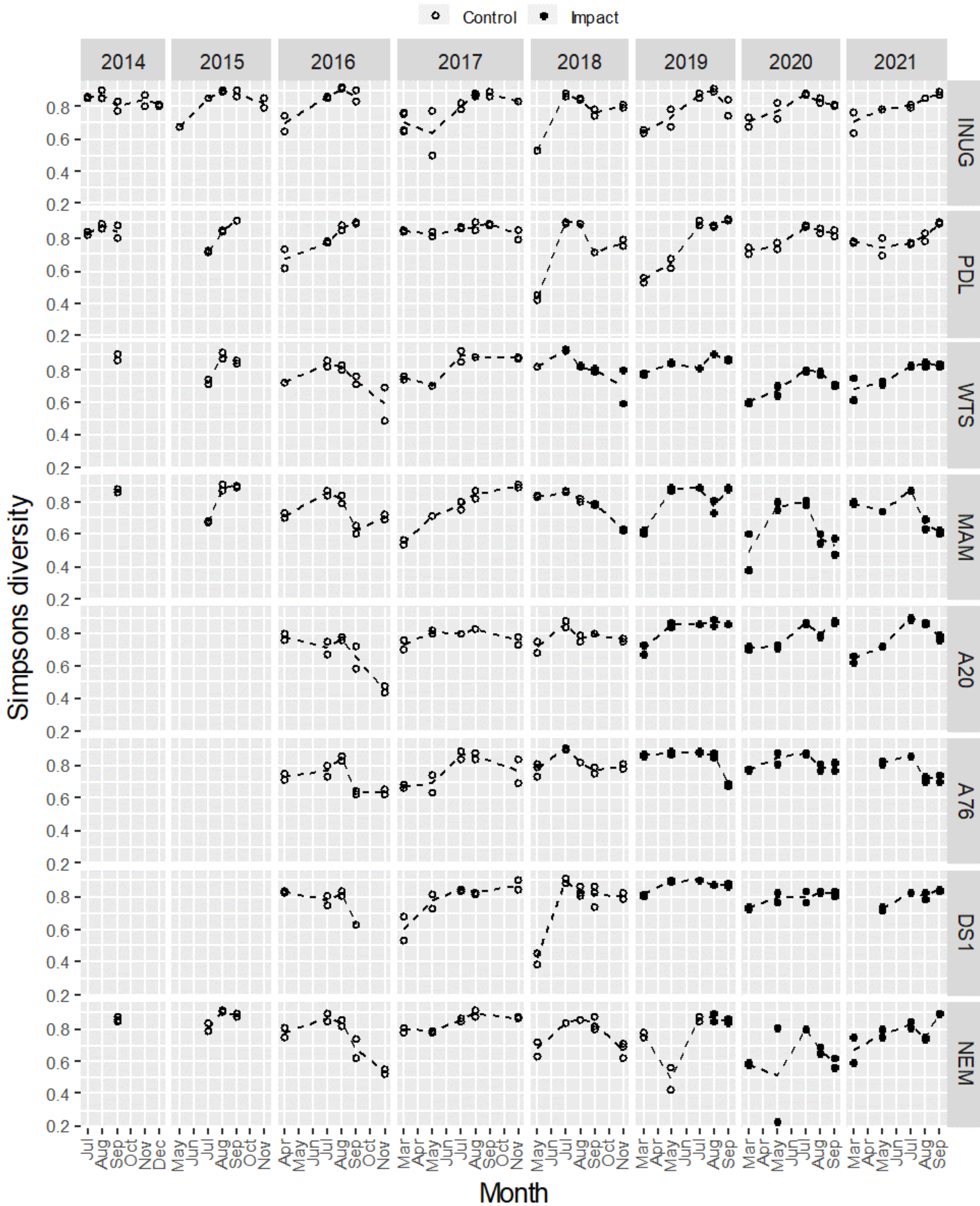


Figure D2-15. Simpsons' Diversity for the phytoplankton community from Whale Tail Pit lakes since 2015.



Appendix D3
Phyto Data – Baker Lake

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Table D3-1. Phytoplankton density (cells/L), biomass (mg/m3), and diversity by major taxa group, Baker Lake, 2021.

Area-Replicate	Date	Phytoplankton Biomass (mg/m^3)							Taxa Richness	Simpson's Diversity
		Cyanophyte	Chlorophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	**TOTAL**		
Baker Akilahaarjuk Point										
BAP - 73	30-Jul-21	0	2	81	28	34	12	157	32	0.81
BAP - 74	30-Jul-21	0	0	60	28	37	5	130	29	0.81
BAP - 75	14-Aug-21	0	7	95	16	31	22	170	29	0.83
BAP - 76	14-Aug-21	0	4	55	7	24	4	94	28	0.84
BAP - 77	18-Sep-21	0	2	40	94	47	42	225	38	0.79
BAP - 78	18-Sep-21	1	3	67	140	70	26	307	33	0.79
Percent Density or Biomass		***0.13***	***1.6***	***37***	***29***	***22***	***10***			
Baker Barge Dock										
BBD - 73	30-Jul-21	0	2	102	28	67	32	231	32	0.83
BBD - 74	30-Jul-21	0	4	115	29	54	32	233	32	0.82
BBD - 75	14-Aug-21	0	3	143	69	107	12	334	34	0.87
BBD - 76	14-Aug-21	0	4	131	99	89	20	343	32	0.87
BBD - 77	18-Sep-21	0	3	59	88	32	3	185	34	0.83
BBD - 78	18-Sep-21	1	5	75	79	27	6	193	33	0.84
Percent Density or Biomass		***<0.1***	***1.4***	***41***	***26***	***25***	***6.9***			
Baker Proposed Jetty										
BPJ - 73	30-Jul-21	0	0	131	47	25	5	209	29	0.77
BPJ - 74	30-Jul-21	0	1	109	74	22	28	235	29	0.79
BPJ - 75	14-Aug-21	13	12	90	20	35	4	173	40	0.87
BPJ - 76	14-Aug-21	7	7	92	22	26	9	162	39	0.88
BPJ - 77	18-Sep-21	0	4	62	83	52	16	216	34	0.79
BPJ - 78	18-Sep-21	0	4	57	93	42	11	208	29	0.75
Percent Density or Biomass		***1.7***	***2.2***	***45***	***28***	***17***	***6.1***			
All 2021 Locations Relative Density or Biomass (%)		***0.60***	***1.7***	***41***	***27***	***22***	***7.6***			

Table D3-1. Phytoplankton density (cells/L), biomass (mg/m3), and diversity by major taxa group, Baker Lake, 2021.

Area-Replicate	Date	Phytoplankton Density (cells/L)						
		Cyanophyte	Chlorophyte	Chrysophyte	Diatom	Cryptophyte	Dinoflagellate	**TOTAL**
Baker Akilahaarjuk Point								
BAP - 73	30-Jul-21	600	86,208	1,374,344	222,136	190,584	1,400	1,875,272
BAP - 74	30-Jul-21	0	129,312	1,100,152	122,360	204,952	800	1,557,576
BAP - 75	14-Aug-21	0	129,912	1,193,344	133,160	185,800	17,168	1,659,384
BAP - 76	14-Aug-21	200	79,224	869,664	167,664	141,296	800	1,258,848
BAP - 77	18-Sep-21	0	93,792	1,037,696	145,472	283,976	2,200	1,563,136
BAP - 78	18-Sep-21	200	86,408	1,000,976	143,472	361,616	3,200	1,595,872
Percent Density or Biomass		***<0.1***	***6.4***	***69***	***9.8***	***14***	***0.27***	
Baker Barge Dock								
BBD - 73	30-Jul-21	0	101,376	1,654,920	228,400	406,104	3,400	2,394,200
BBD - 74	30-Jul-21	0	173,416	1,763,280	280,472	292,760	2,800	2,512,728
BBD - 75	14-Aug-21	0	71,840	1,434,216	560,424	553,200	1,400	2,621,080
BBD - 76	14-Aug-21	0	93,392	1,298,920	544,056	451,424	2,400	2,390,192
BBD - 77	18-Sep-21	0	215,920	921,752	90,736	249,256	600	1,478,264
BBD - 78	18-Sep-21	14,368	151,264	822,376	84,752	158,864	800	1,232,424
Percent Density or Biomass		***0.11***	***6.4***	***63***	***14***	***17***	***<0.1***	
Baker Proposed Jetty								
BPJ - 73	30-Jul-21	0	7,184	1,922,528	168,864	119,144	600	2,218,320
BPJ - 74	30-Jul-21	0	21,552	1,763,480	221,200	71,656	3,400	2,081,288
BPJ - 75	14-Aug-21	3,400	560,552	1,294,920	150,776	172,632	600	2,182,880
BPJ - 76	14-Aug-21	1,800	395,120	1,165,808	173,896	120,944	1,200	1,858,768
BPJ - 77	18-Sep-21	800	115,144	993,192	100,520	246,272	2,000	1,457,928
BPJ - 78	18-Sep-21	400	101,176	1,058,448	86,952	194,584	1,600	1,443,160
Percent Density or Biomass		***<0.1***	***11***	***73***	***8.0***	***8.2***	***<0.1***	
All 2021 Locations Relative Density or Biomass (%)		***<0.1***	***7.8***	***68***	***11***	***13***	***0.14***	

Figure D3-1. Cyanophyte biomass (mg/m³) from Baker Lake since 2008.

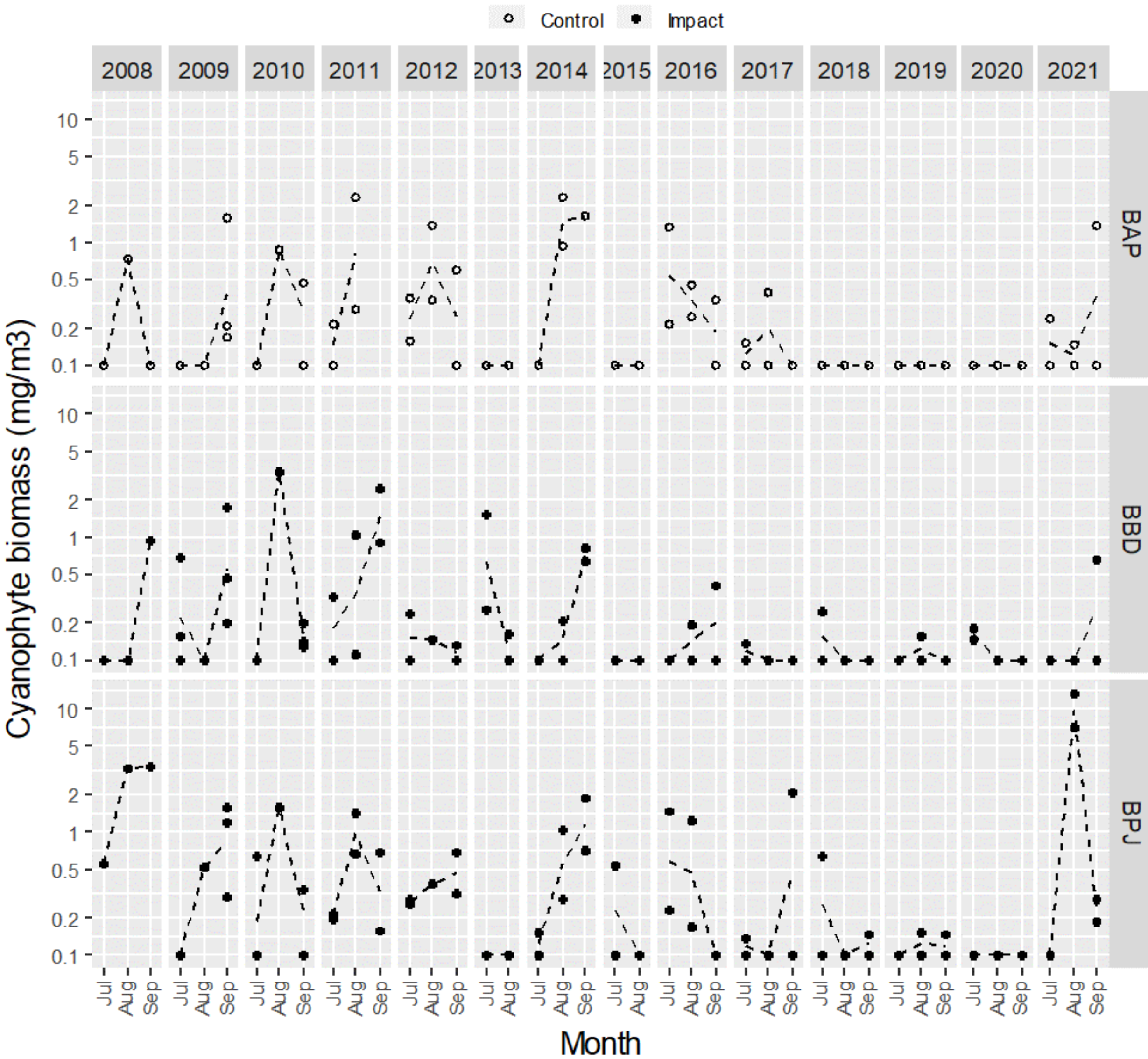


Figure D3-2. Chlorophyte biomass (mg/m³) from Baker Lake since 2008.

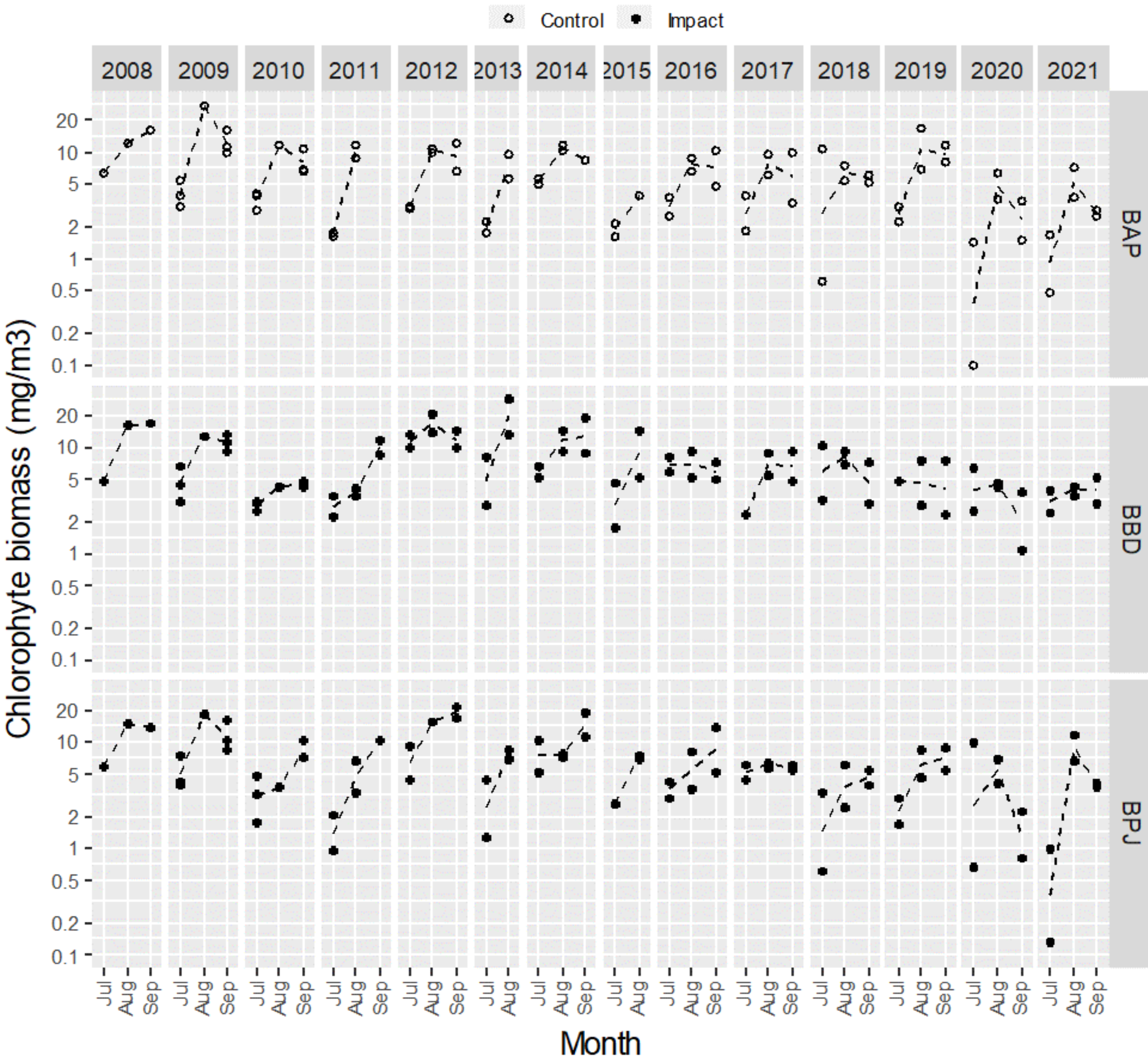


Figure D3-3. Chrysophyte biomass (mg/m³) from Baker Lake since 2008.

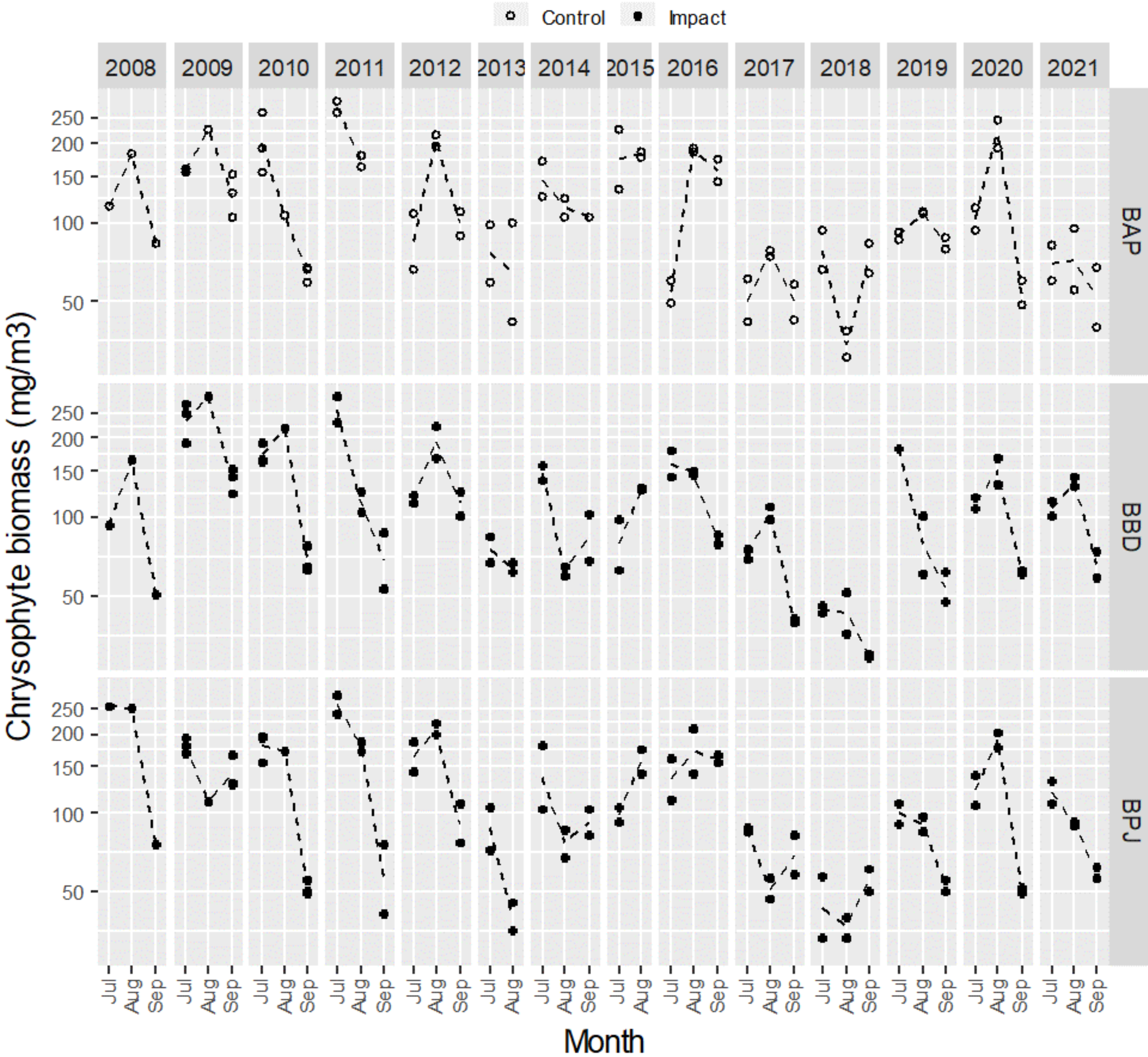


Figure D3-4. Diatoms biomass (mg/m³) from Baker Lake since 2008.

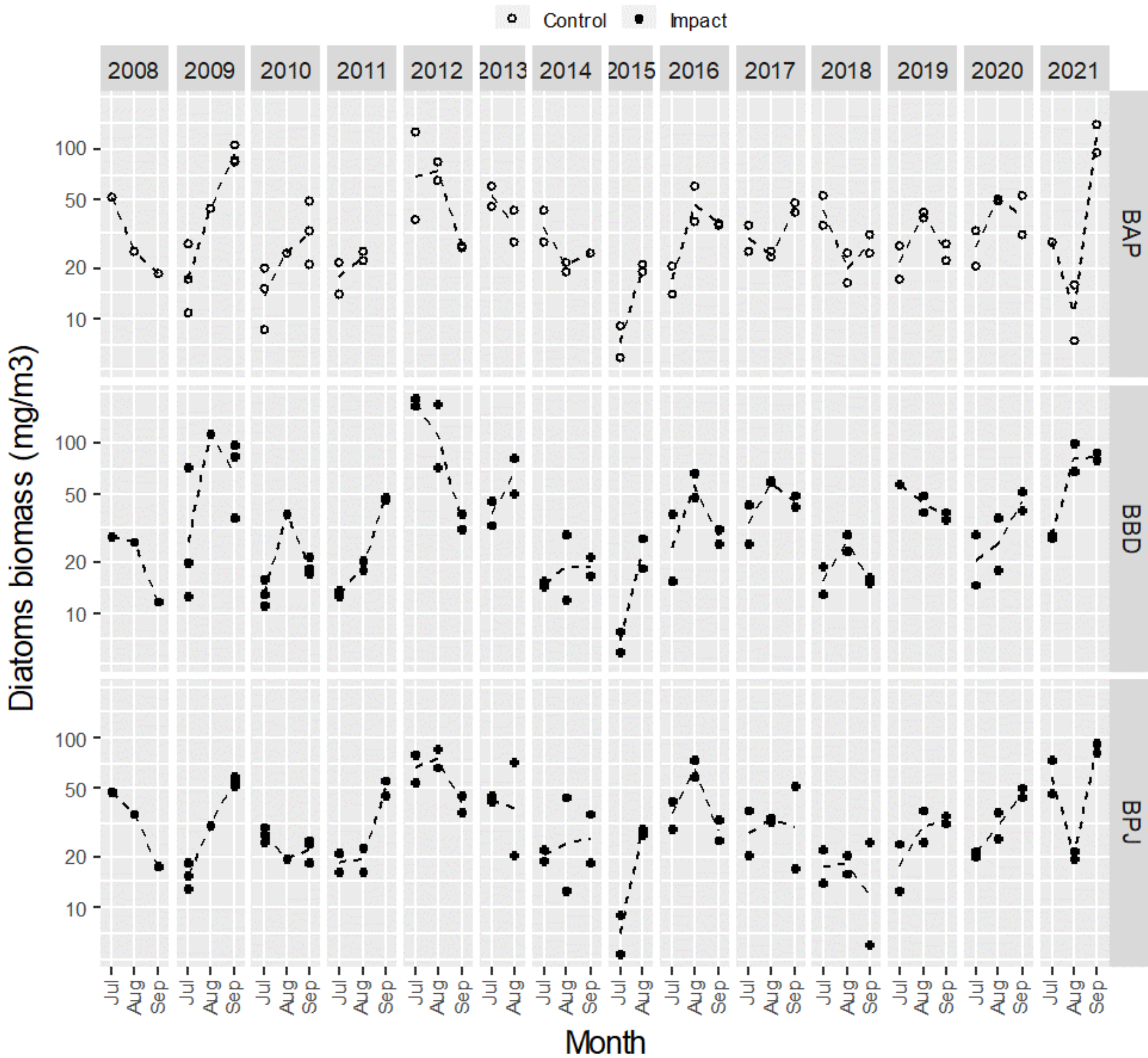


Figure D3-5. Cryptophytes biomass (mg/m³) from Baker Lake since 2008.

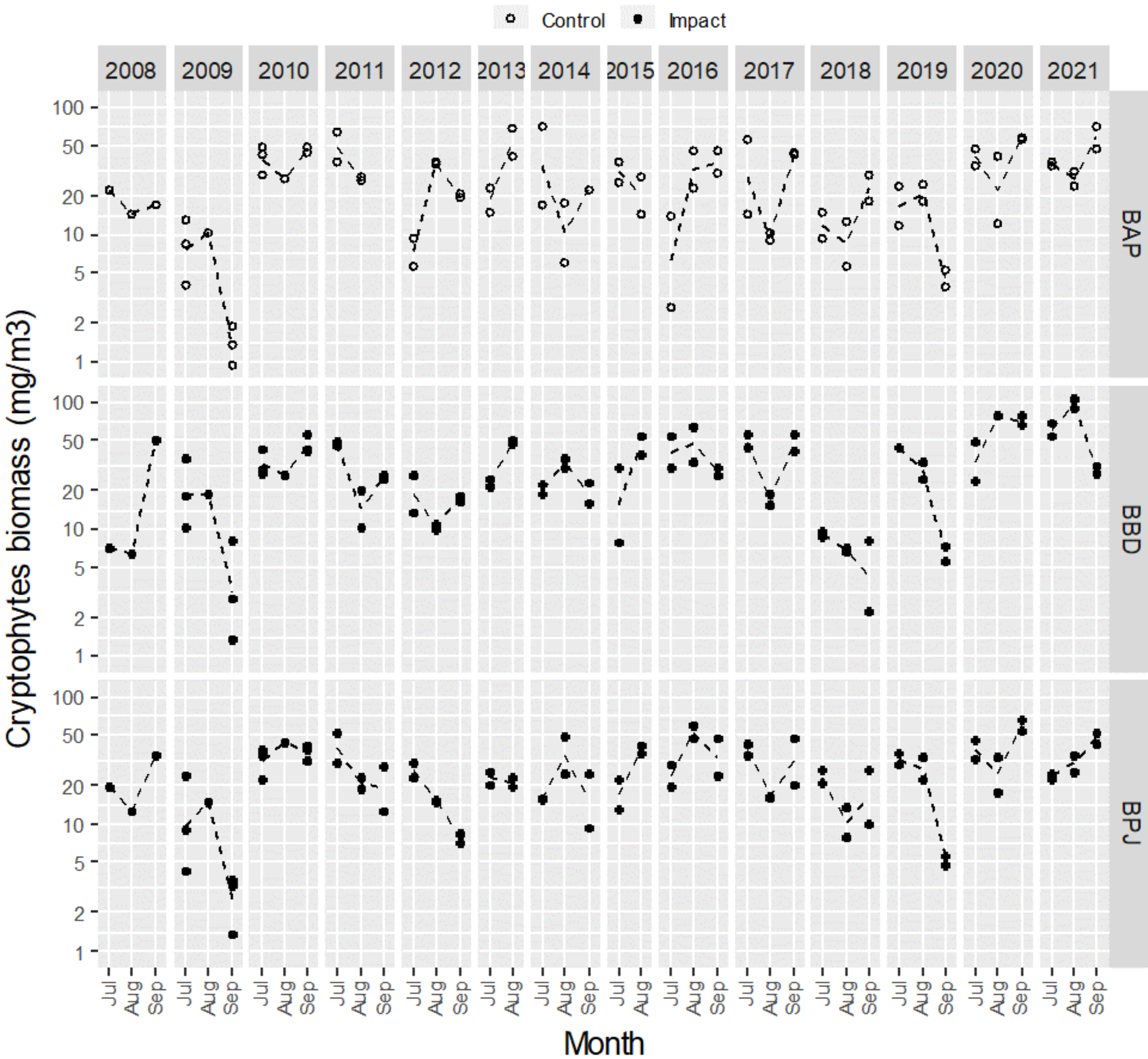


Figure D3-6. Dinoflagellates biomass (mg/m³) from Baker Lake since 2008.

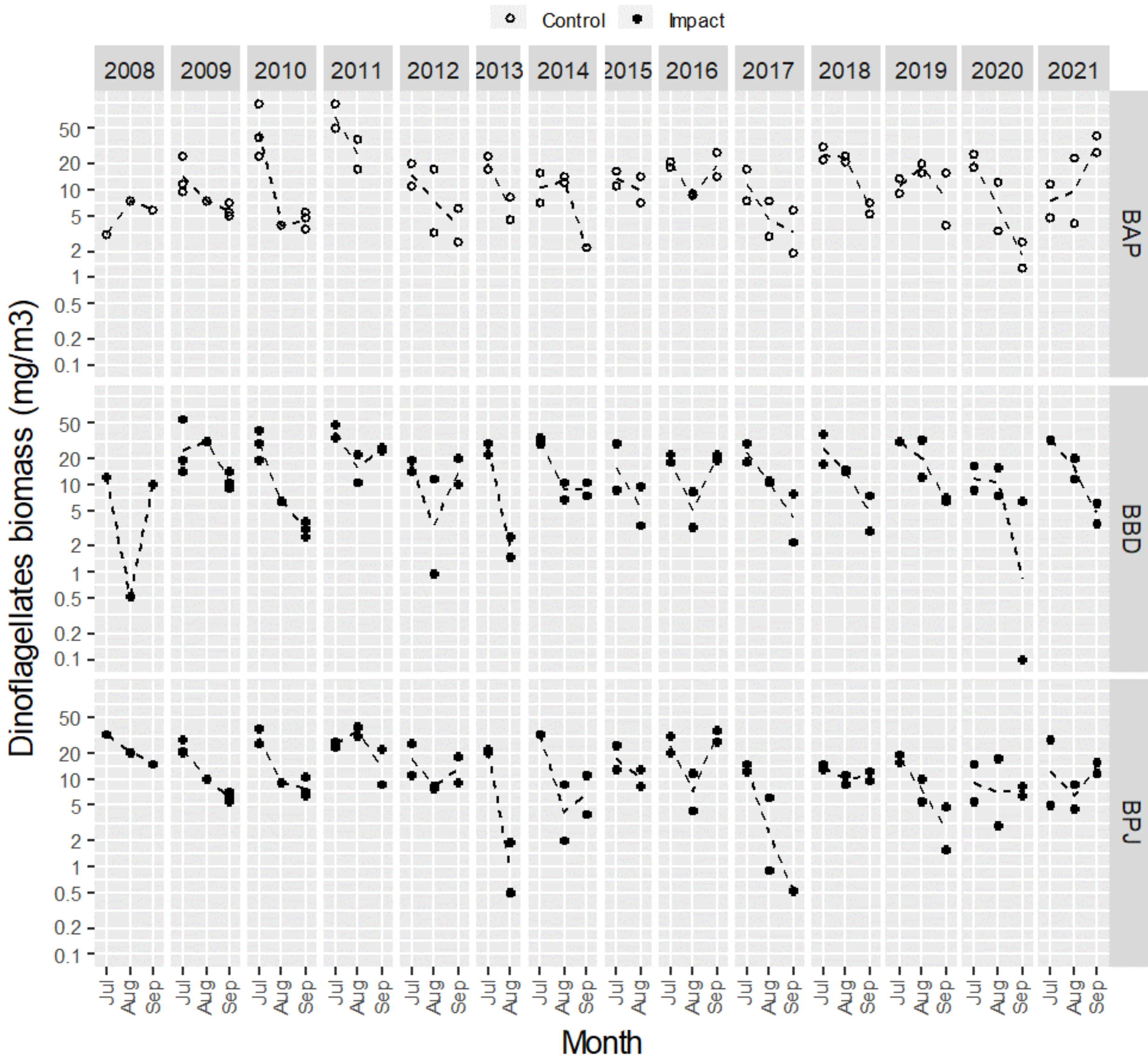


Figure D3-7. Phytoplankton density (cells/L) by major taxa group from Baker Lake since 2008.

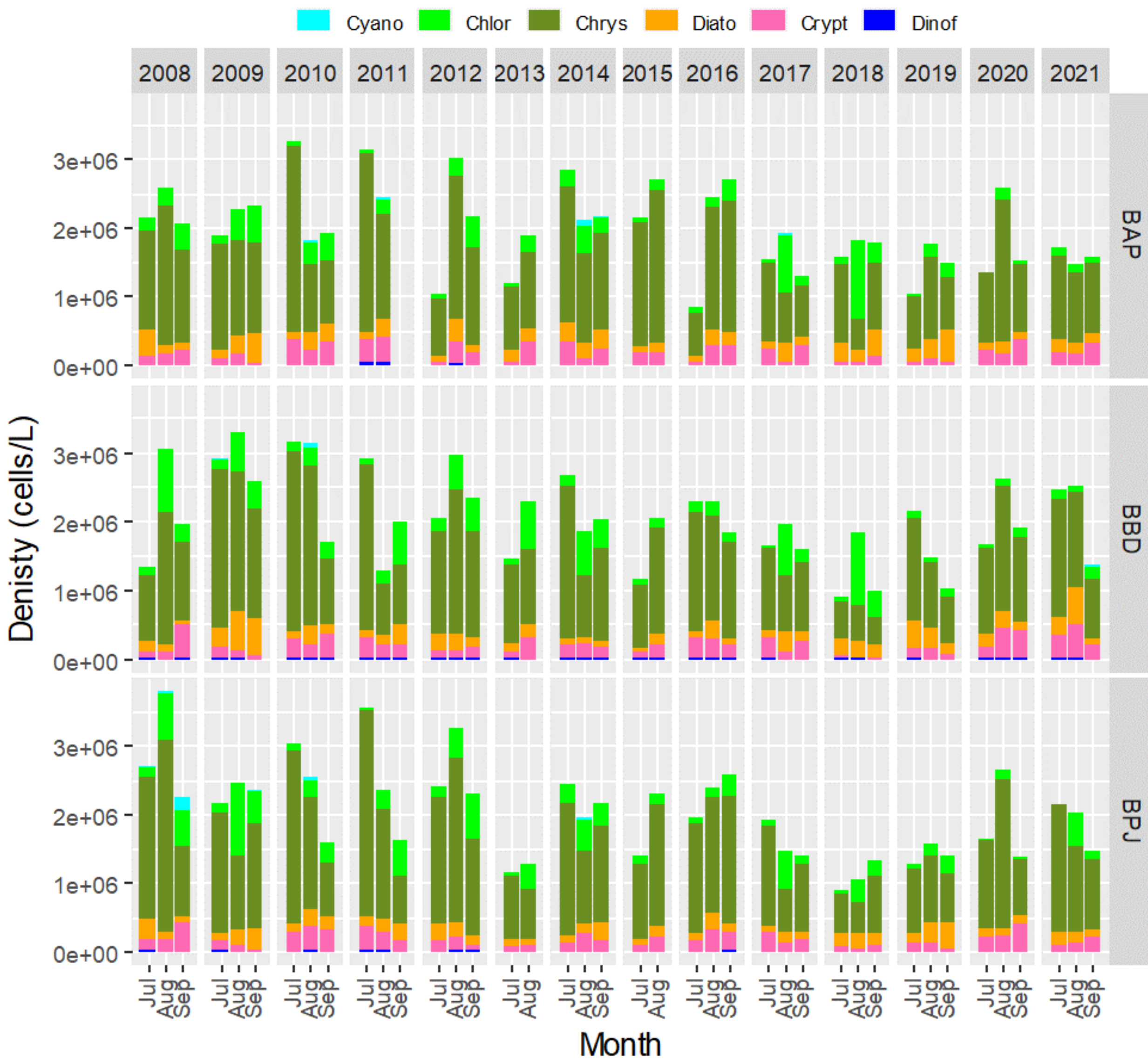


Figure D3-8. Relative phytoplankton density from Baker Lake since 2008.

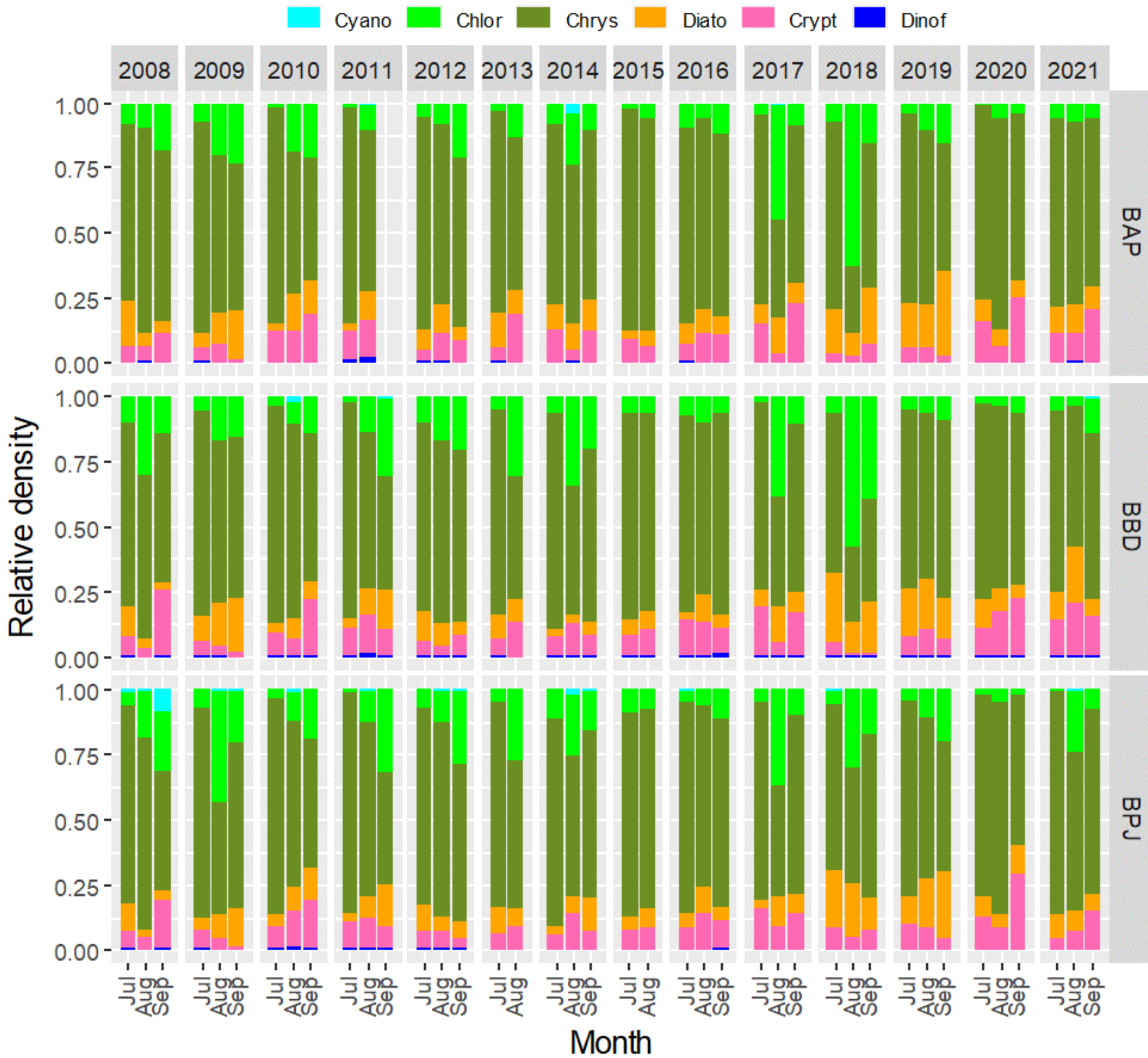


Figure D3-9. Cyanophyte density (cells/L) from Baker Lake since 2008.

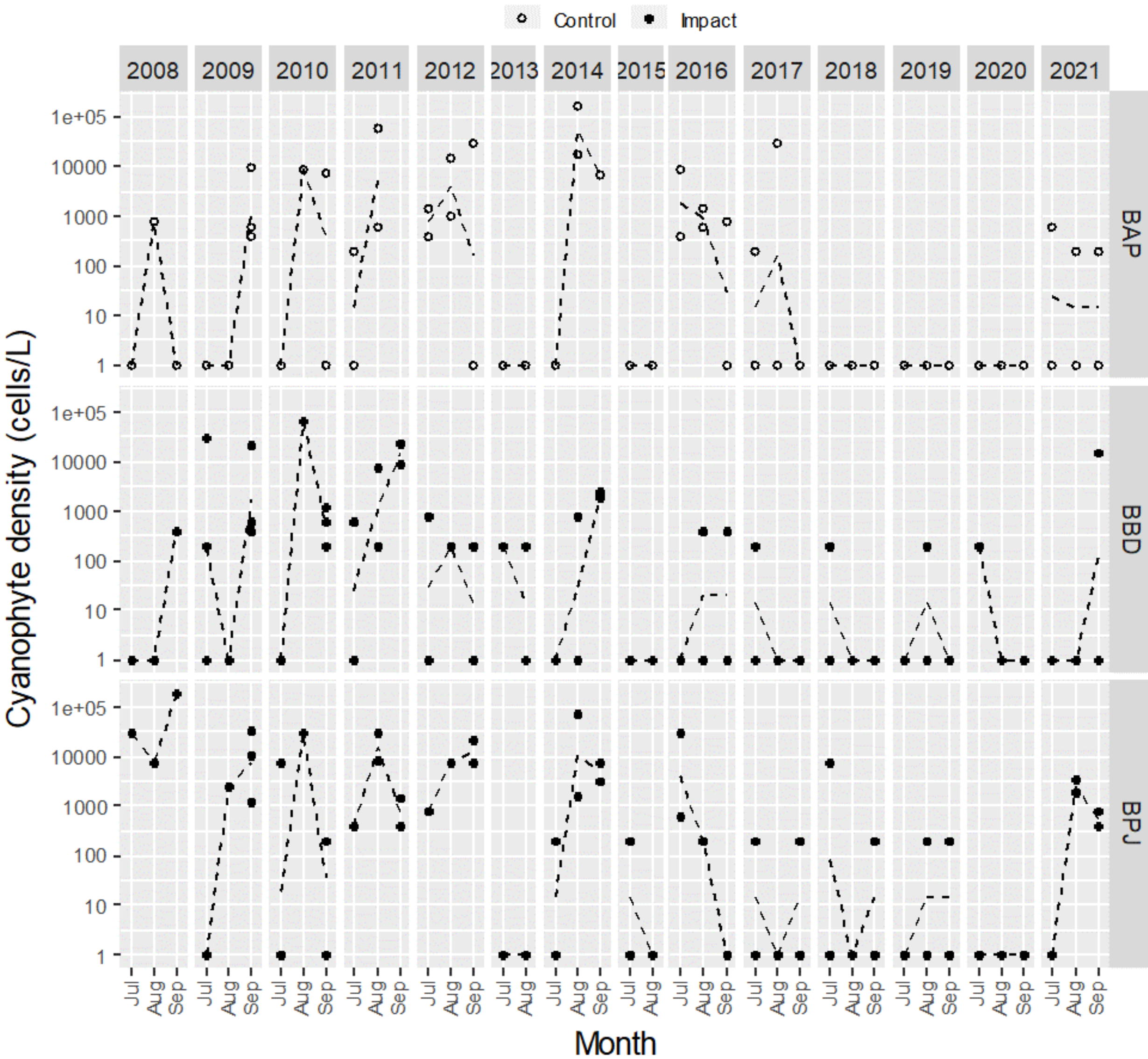


Figure D3-10. Chlorophyte density (cells/L) from Baker Lake since 2008.

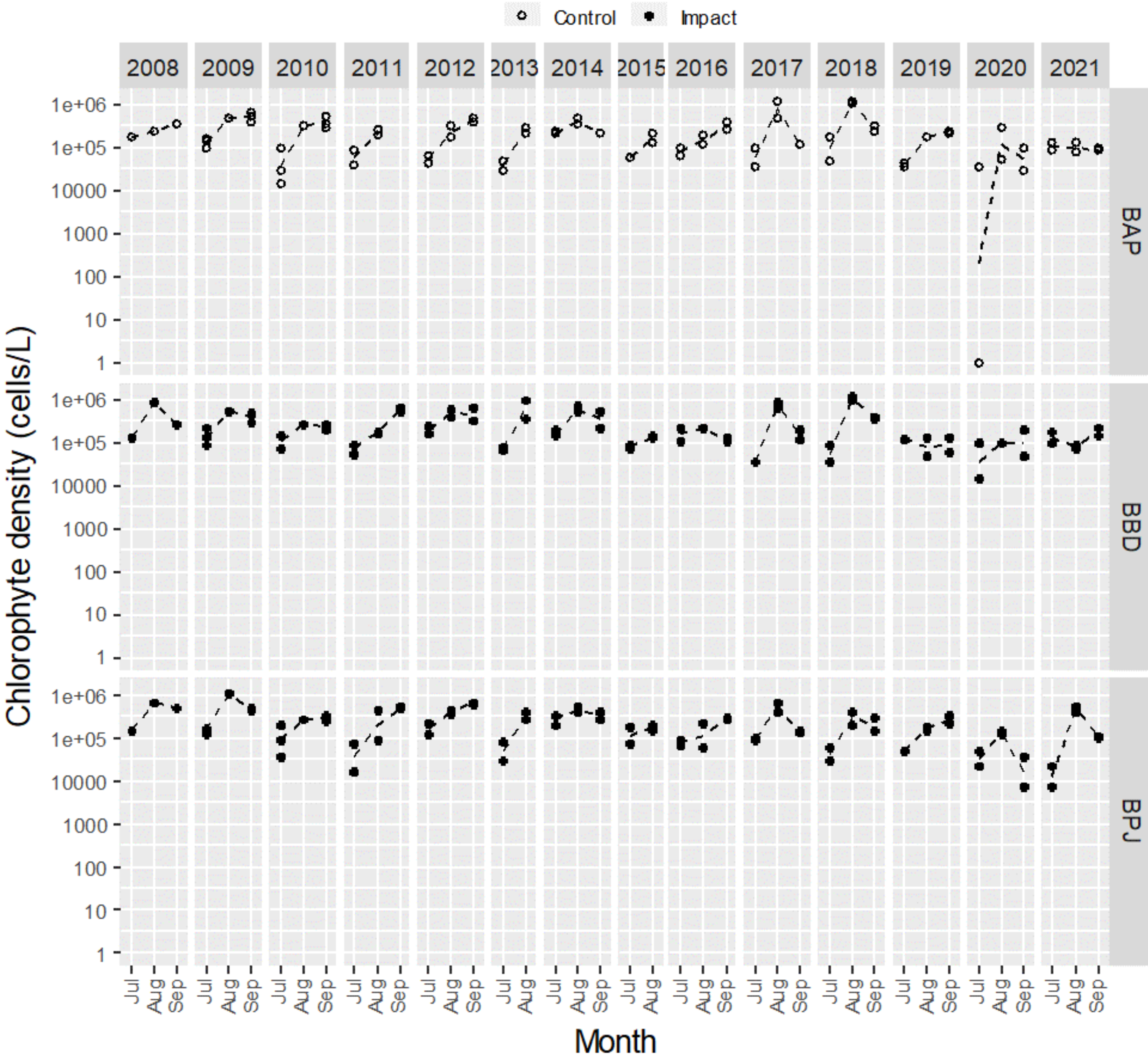


Figure D3-11. Chrysophyte density (cells/L) from Baker Lake since 2008.

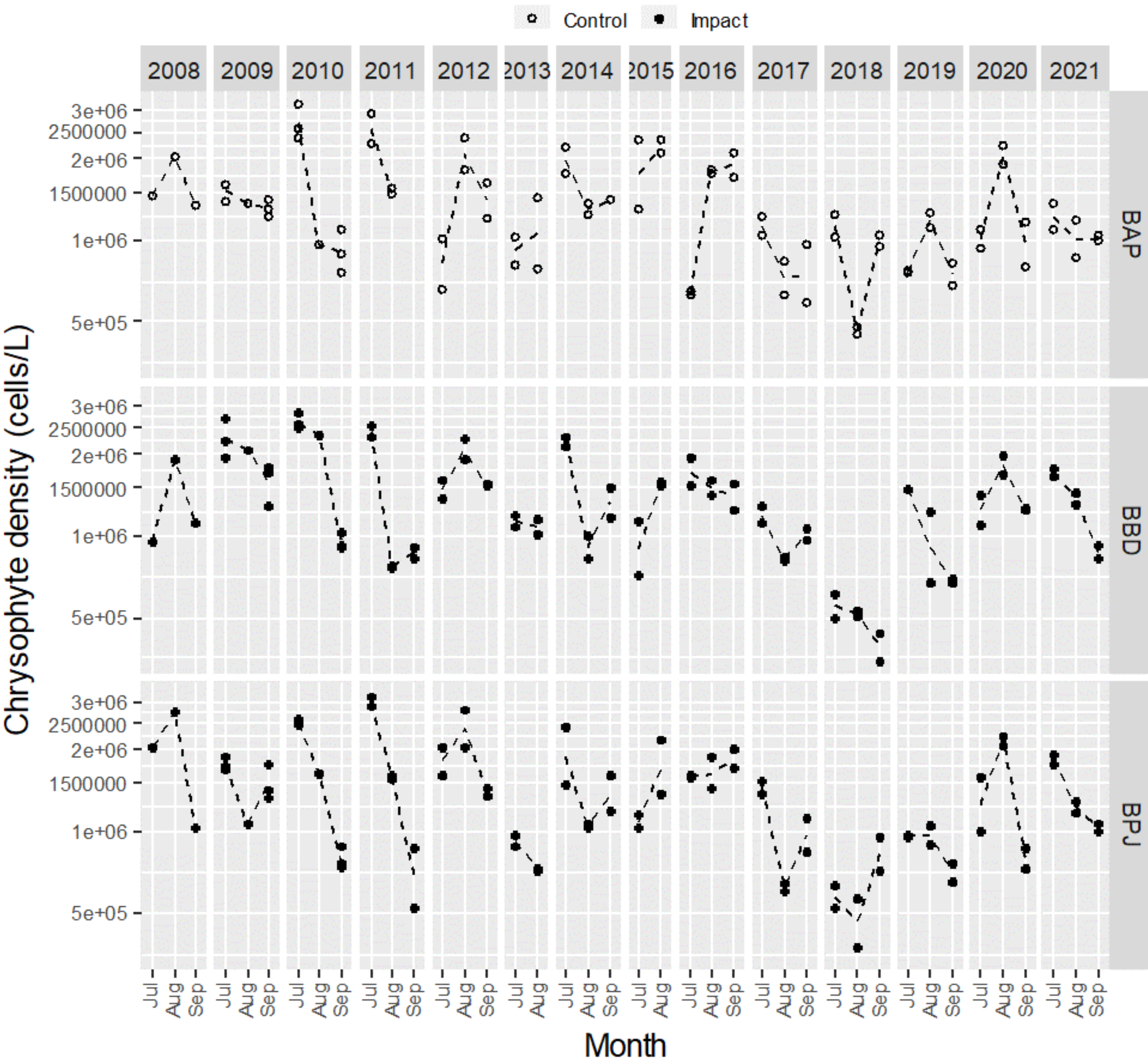


Figure D3-12. Diatoms density (cells/L) from Baker Lake since 2008.

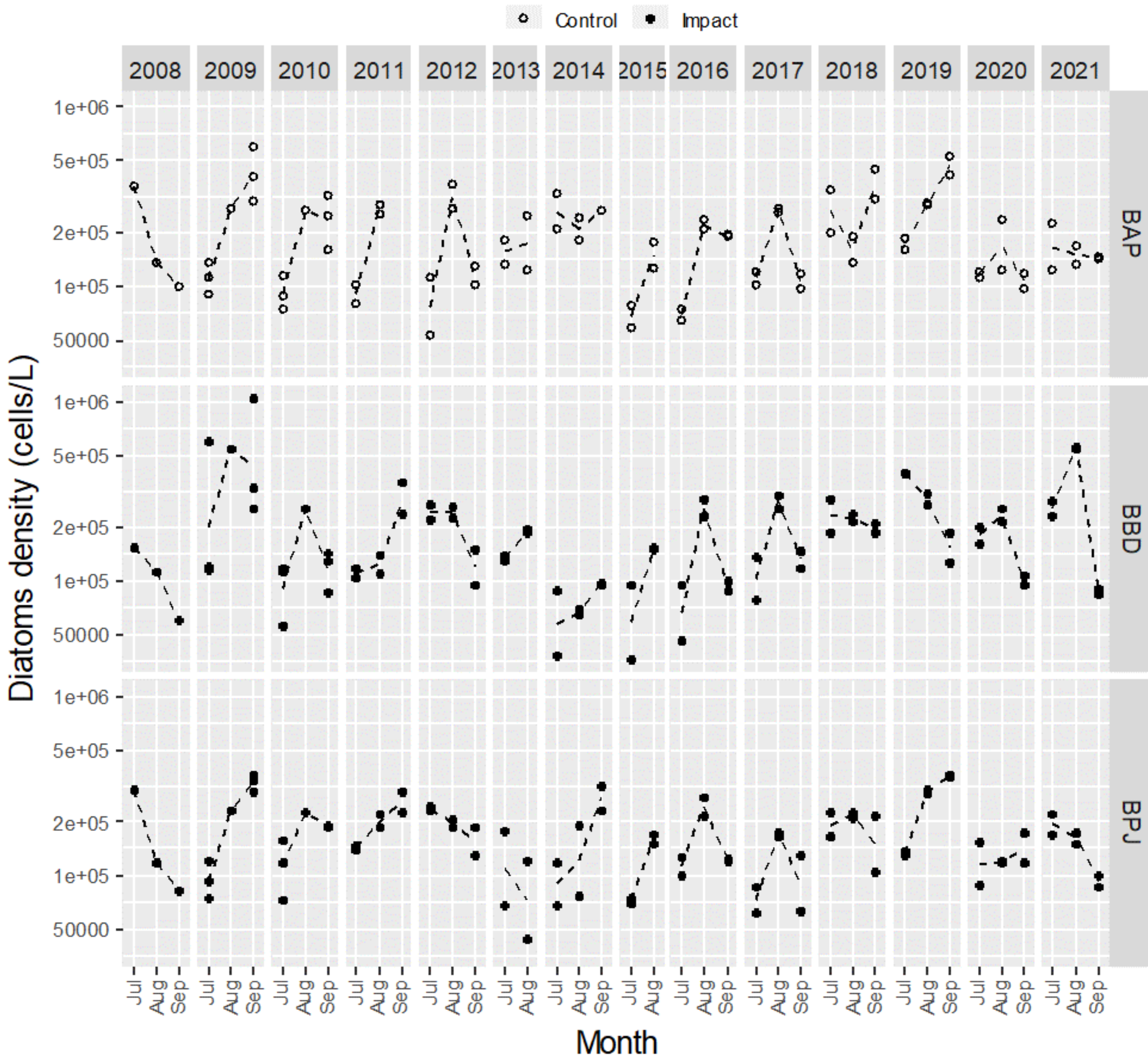


Figure D3-13. Cryptophytes density (cells/L) from Baker Lake since 2008.

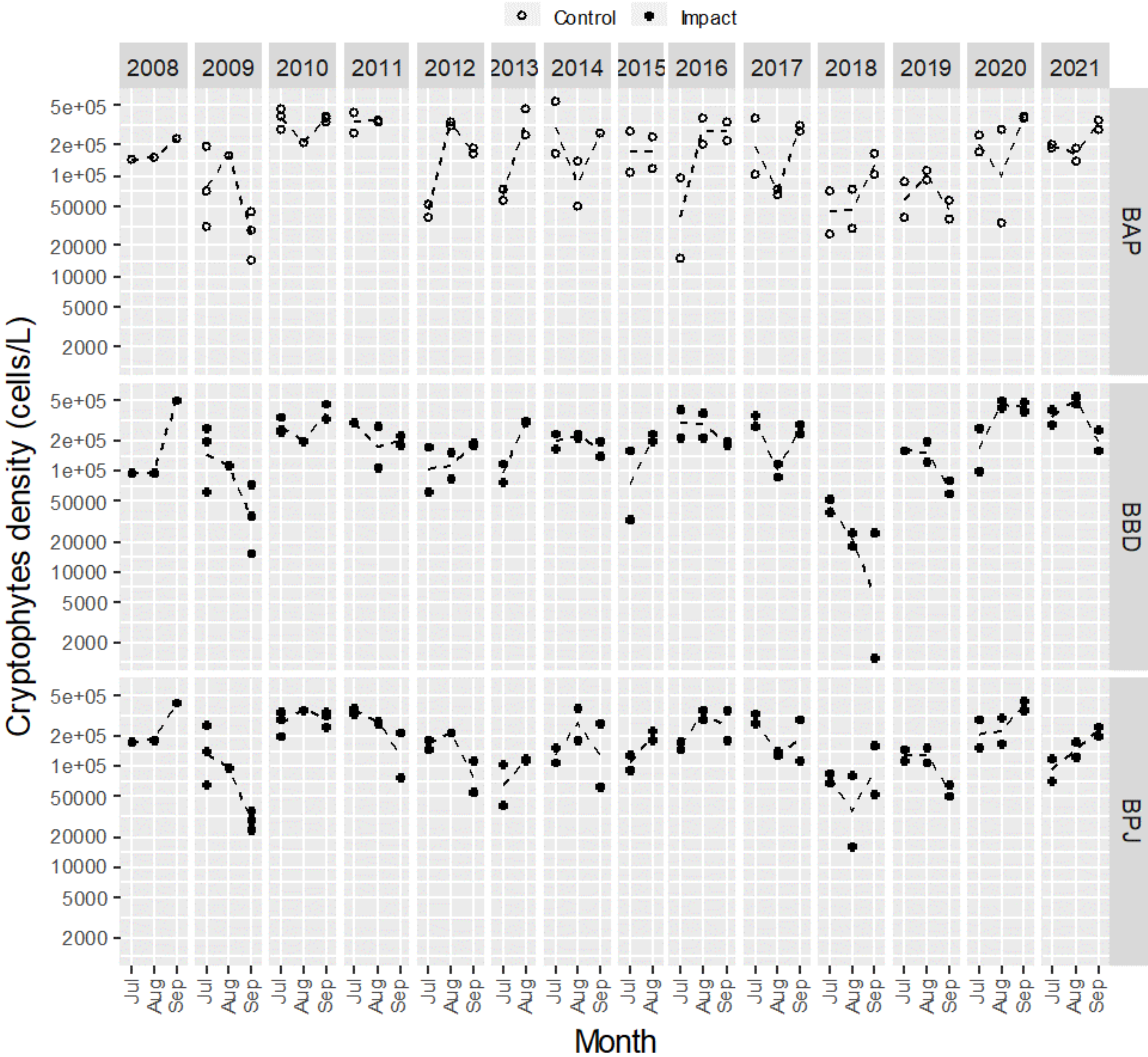


Figure D3-14. Dinoflagellate density (cells/L) from Baker Lake since 2008.

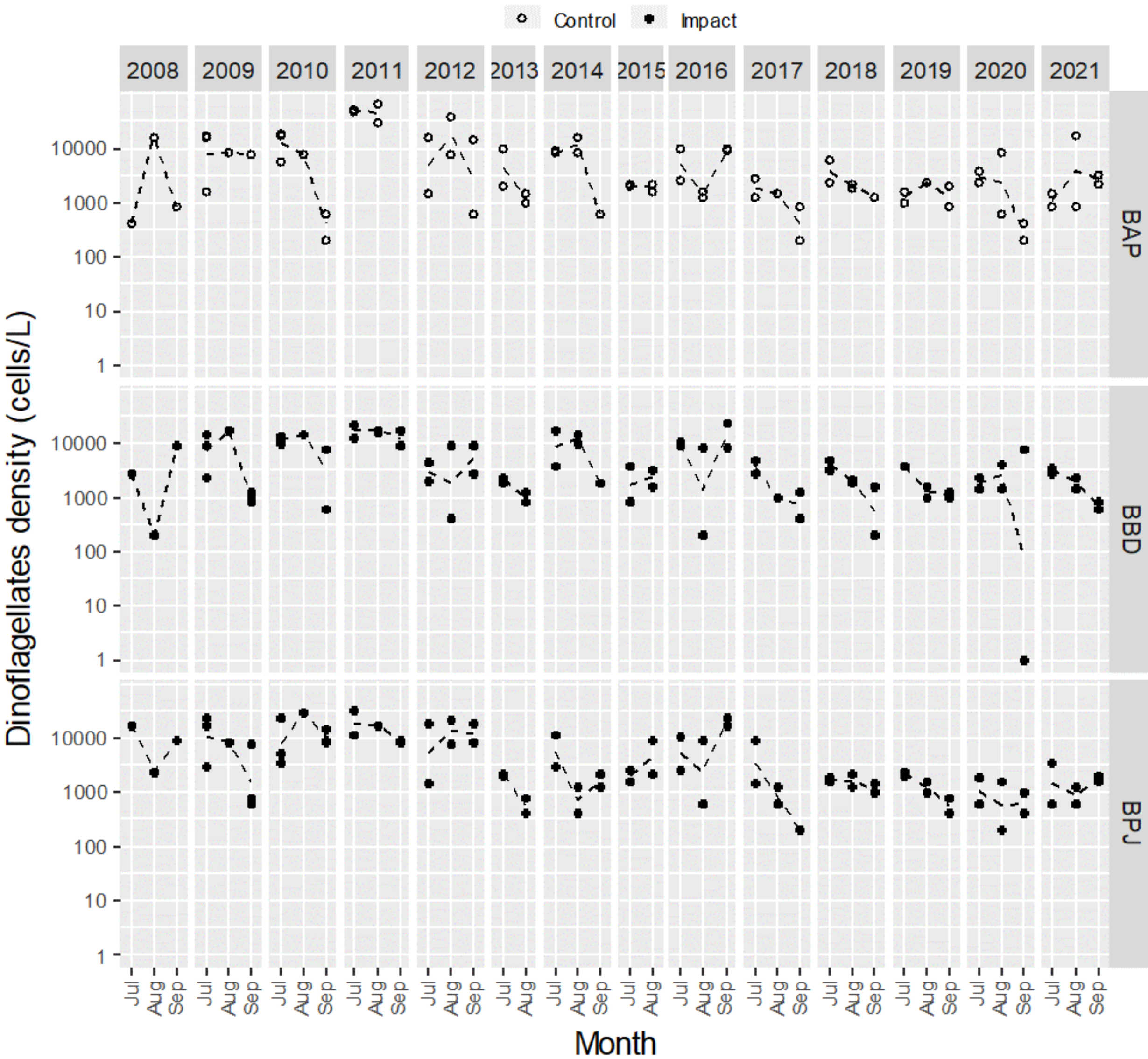
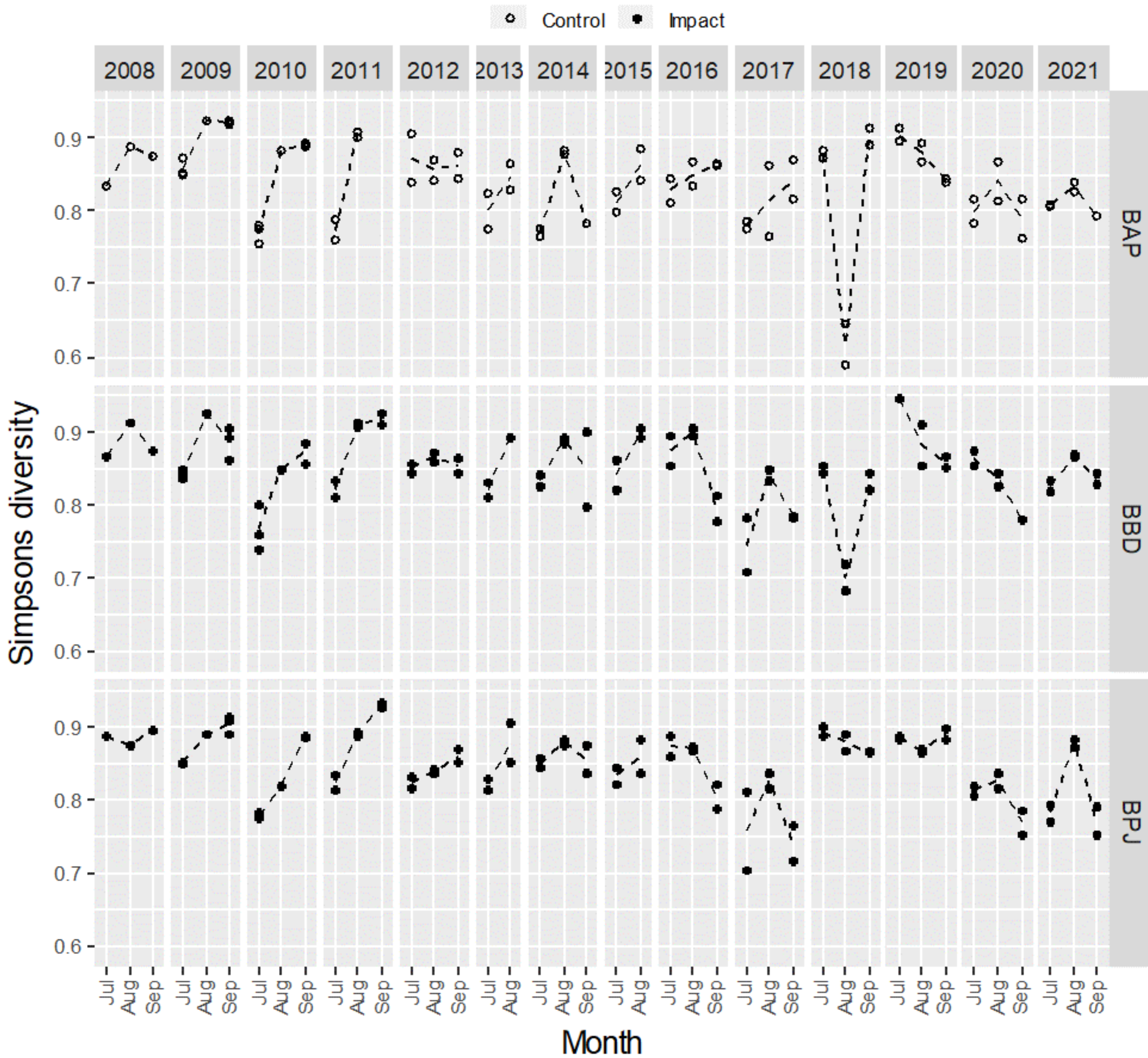


Figure D3-15. Simpsons' Diversity for the phytoplankton community from Baker Lake since 2008.



APPENDIX E
BENTHOS TAXONOMY DATA AND SUPPLEMENTAL PLOTS

Appendix E1

Benthos Data – Meadowbank Study Area Lakes

LIST OF TABLES – APPENDIX E1

LIST OF FIGURES – APPENDIX E1

Table E1-1. Benthic invertebrate abundance (#/m2) and richness (# taxa) by major taxa group, Meadowbank study area lakes, 2021.

Area-Replicate	Date	Depth (m)	Abundance (#/m²)					Richness (# taxa)					Simpson's Diversity	Bray-Curtis Index
			Oligochaetes	Insects	Molluscs	Other Taxa[1]	TOTAL	Oligochaetes	Insects	Molluscs	Other Taxa[1]	TOTAL		
Inuggugayualik Lake														
INUG-1	14-Aug-21	8.2	65	457	239	65	826	2	10	3	1	16	0.94	0.21
INUG-2	14-Aug-21	8.4	22	2,587	696	22	3,326	1	7	3	1	12	0.79	0.32
INUG-3	14-Aug-21	8.5	0	804	152	130	1,087	0	10	1	3	14	0.92	0.31
INUG-4	14-Aug-21	8.6	0	652	348	109	1,109	0	5	2	2	9	0.78	0.25
INUG-5	14-Aug-21	8.8	87	891	522	109	1,609	2	9	3	1	15	0.87	0.16
Area Mean			***35***	***1,078***	***391***	***87***	***1,591***	***1.0***	***8.2***	***2.4***	***1.6***	***13.2***	***0.86***	***0.25***
Pipedream Lake														
PDL-1	16-Aug-21	7.7	22	457	283	0	761	1	4	1	0	6	0.77	0.18
PDL-2	16-Aug-21	8.0	0	609	304	0	913	0	7	1	0	8	0.82	0.17
PDL-3	16-Aug-21	8.1	109	891	196	0	1,196	1	6	1	0	8	0.79	0.19
PDL-4	16-Aug-21	8.0	0	500	174	0	674	0	4	1	0	5	0.71	0.10
PDL-5	16-Aug-21	8.1	43	478	174	0	696	2	6	1	0	9	0.81	0.17
Area Mean			***35***	***587***	***226***	***0.0***	***848***	***0.8***	***5.4***	***1.0***	***0.0***	***7.2***	***0.78***	***0.16***
Second Portage Lake														
SP-1	6-Aug-21	9.2	0	1,022	239	65	1,326	0	12	1	2	15	0.89	0.31
SP-2	6-Aug-21	8.9	43	957	435	87	1,522	1	9	1	3	14	0.86	0.40
SP-3	6-Aug-21	9.0	65	761	326	87	1,239	2	10	2	3	17	0.89	0.29
SP-4	6-Aug-21	9.3	22	1,196	152	22	1,391	1	9	1	1	12	0.83	0.51
SP-5	5-Aug-21	8.8	0	587	196	0	783	0	8	2	0	10	0.86	0.40
Area Mean			***26***	***904***	***270***	***52***	***1,252***	***0.8***	***9.6***	***1.4***	***1.8***	***13.6***	***0.87***	***0.38***
Third Portage Lake - East Basin														
TPE-1	8-Aug-21	8.1	130	3,348	630	0	4,109	3	11	2	0	16	0.89	0.59
TPE-2	8-Aug-21	9.2	391	4,652	1,261	87	6,391	2	12	3	1	18	0.86	0.71
TPE-3	8-Aug-21	9.3	174	3,913	696	0	4,783	1	12	1	0	14	0.88	0.69
TPE-4	8-Aug-21	9.0	22	1,174	370	22	1,587	1	8	2	1	12	0.88	0.42
TPE-5	8-Aug-21	9.3	43	1,826	783	0	2,652	2	10	2	0	14	0.87	0.46
Area Mean			***152***	***2,983***	***748***	***22***	***3,904***	***1.8***	***10.6***	***2.0***	***0.4***	***14.8***	***0.88***	***0.57***
Third Portage Lake - North Basin														
TPN-1	7-Aug-21	8.7	22	1,130	22	22	1,196	1	14	1	1	17	0.90	0.49
TPN-2	7-Aug-21	8.3	65	2,826	478	130	3,500	3	10	2	2	17	0.85	0.49
TPN-3	7-Aug-21	8.3	65	3,000	761	22	3,848	2	10	2	1	15	0.84	0.54
TPN-4	7-Aug-21	7.4	43	1,826	326	43	2,239	2	10	2	1	15	0.85	0.45
TPN-5	7-Aug-21	7.5	0	1,543	152	22	1,717	0	8	2	1	11	0.83	0.61
Area Mean			***39***	***2,065***	***348***	***48***	***2,500***	***1.6***	***10.4***	***1.8***	***1.2***	***15.0***	***0.85***	***0.52***
Wally Lake														
WAL-1	10-Aug-21	8.9	22	1,065	826	43	1,957	1	10	3	2	16	0.83	0.32
WAL-2	10-Aug-21	7.4	43	1,109	717	87	1,957	1	7	2	1	11	0.85	0.32
WAL-3	10-Aug-21	8.9	0	1,283	848	43	2,174	0	9	2	1	12	0.82	0.38
WAL-4	10-Aug-21	8.6	0	283	478	22	783	0	5	2	1	8	0.77	0.23
WAL-5	10-Aug-21	8.4	0	804	457	0	1,261	0	7	3	0	10	0.82	0.30
Area Mean			***13***	***909***	***665***	***39***	***1,626***	***0.4***	***7.6***	***2.4***	***1.0***	***11.4***	***0.82***	***0.31***

Notes:

1. "Other taxa" includes flatworms (Turbellaria) and arthropods (Acalyptonotidae, Hygrobatidae, Lebertiidae, Oxidae, Pionidae, Harpacticoida, O. Notostraca, and Gammaracanthidae).

Table E1-2. Raw benthic invertebrate data from the Meadowbank Study Lakes 2021.

Program	**Meadowbank**									
Location	**Inuggugayualik Lake**					**Pipedream Lake**				
Station	**INUG**					**PDL**				
Control/Impact?	Control					Control				
Replicate	1	2	3	4	5	1	2	3	4	5
Date	14-Aug-21	14-Aug-21	14-Aug-21	14-Aug-21	14-Aug-21	16-Aug-21	16-Aug-21	16-Aug-21	16-Aug-21	16-Aug-21
Sample Depth (m)	8.2	8.4	8.5	8.6	8.8	7.7	8.0	8.1	8.0	8.1
ROUNDWORMS										
P. Nemata	2	-	-	1	3	1	1	2	1	1
FLATWORMS										
P. Platyhelminthes										
Cl. Turbellaria										
indeterminate	3	-	3	4	-	-	-	-	-	-
ANNELIDS										
P. Annelida										
WORMS										
Cl. Oligochaeta										
F. Enchytraeidae	-	-	-	-	-	-	-	-	-	-
F. Naididae	-	-	-	-	-	-	-	-	-	-
S.F. Tubificinae										
Limnodrilus hoffmeisteri	-	-	-	-	-	-	-	-	-	-
Potamothrix bavaricus	-	-	-	-	-	-	-	-	-	-
Slavina appendiculata	-	-	-	-	-	-	-	-	-	-
Tasserkidrilus americanus	1	-	-	-	-	-	-	2	-	-
immatures with hair chaetae	-	-	-	-	-	-	-	3	-	1
immatures without hair chaetae	-	-	-	-	-	-	-	-	-	-
S.F. Rhyacodrilinae										
Rhyacodrilus coccineus	2	-	-	-	2	-	-	-	-	-
Rhyacodrilus montana	-	-	-	-	-	-	-	-	-	-
F. Lumbriculidae										
Lumbriculus	-	1	-	-	2	1	-	-	-	1
ARTHROPODS										
P. Arthropoda										
MITES										
Cl. Arachnida										
O. Acarina	-	-	-	-	-	-	-	-	-	-
F. Acalyptonotidae										
Acalyptonotus	-	-	1	-	-	-	-	-	-	-
F. Hygrobatidae										
Hygrobates	-	-	-	-	-	-	-	-	-	-
F. Lebertiidae										
Lebertia	-	-	-	1	5	-	-	-	-	-
F. Oxidae										
Oxus	-	1	2	-	-	-	-	-	-	-
F. Pionidae										
indeterminate	-	-	-	-	-	-	-	-	-	-
HARPACTICOIDS										
O. Harpacticoida	-	-	-	-	-	-	-	-	-	-
SEED SHRIMPS										
Cl. Ostracoda	-	-	-	1	11	1	3	6	1	5
FAIRY SHRIMP										
O. Notostraca										
Lepidurus arcticus	-	-	-	-	-	-	-	-	-	-
WATER SCUDS										
O. Amphipoda										
F. Gammaracanthidae										
Gammaracanthus	-	-	-	-	-	-	-	-	-	-
INSECTS										
Cl. Insecta										
CADDISFLIES										
O. Trichoptera										
F. Apataniidae										
Apatania	-	-	-	-	-	-	-	-	-	-
F. Limnephilidae										
Grensia praeterita	-	-	-	-	-	-	-	-	-	1
TRUE FLIES										
O. Diptera										
MIDGES										
F. Chironomidae										
chironomid pupae	-	-	**5**	**1**	**3**	**2**	**3**	**2**	**1**	**1**
S.F. Chironominae										
Chironomus	-	-	-	-	-	-	-	-	-	-
Cladotanytarsus	-	-	-	-	-	-	-	-	-	-
Constempellina	-	-	-	-	-	-	-	-	-	-
Corynocera ambigua	-	-	-	-	-	-	-	-	-	-
?Corynocera oliveri	-	-	-	-	-	-	-	-	-	-
Dicrotendipes	1	-	1	-	-	-	-	-	-	-
Micropsectra	1	1	5	-	3	-	3	-	-	-
Microtendipes	-	-	2	-	2	-	-	-	-	-
Parachironomus	-	-	-	-	-	-	-	-	-	-
Paracladopelma	-	-	-	-	-	-	-	-	-	-
Paratanytarsus	2	-	7	-	1	-	-	-	-	-
Polypedilum	-	-	-	-	-	-	-	-	-	-
Sergentia	-	-	-	-	-	-	-	-	-	-
Stempellinella	-	-	2	-	-	-	1	1	-	-
Stictochironomus	5	46	3	21	20	9	10	22	14	11
Tanytarsus	2	22	2	1	3	-	1	-	-	-
S.F. Diamesinae										
Pagastia	-	-	-	-	-	-	-	-	-	-
Protanypus	-	-	-	-	-	-	-	-	-	-
Potthastia	-	-	-	-	-	-	-	-	-	-
Pseudodiamesa	-	-	-	-	-	-	-	-	-	-
S.F. Orthocladiinae										
Abiskomyia	-	-	-	-	-	-	4	-	-	1
Corynoneura	-	42	-	-	-	-	-	-	-	-
Cricotopus	-	-	-	-	-	-	-	-	-	-
Cricotopus/Orthocladius	-	-	-	-	-	-	-	-	-	-
Heterotrissocladius	1	-	7	2	2	2	1	3	1	1
Hydrobaenus	-	-	-	-	-	-	-	-	-	-
Mesocricotopus	-	-	-	-	-	-	-	-	-	-
Nanocladius	-	-	-	-	-	-	-	-	-	-
Paracladius	-	-	-	-	-	-	-	-	-	-
Parakiefferiella	-	-	-	-	-	-	-	-	-	-
Psectrocladius	2	2	2	-	1	-	-	2	1	-
Zalutschia	-	-	-	-	-	-	-	-	-	-
Orthocladiinae *Genus "Greenland"*	-	-	-	-	-	-	-	-	-	-
indeterminate	-	-	-	-	-	-	-	-	-	-
S.F. Prodiamesinae										
Monodiamesa	2	1	-	3	3	1	-	2	-	5
S.F. Tanypodinae										
Ablabesmyia	1	-	-	-	-	-	-	-	-	-
Procladius	4	5	1	2	3	7	5	9	6	2
Thienemannimyia complex	-	-	-	-	-	-	-	-	-	-
F. Empididae										
Chelifera/Metachela	-	-	-	-	-	-	-	-	-	-
Clinocera	-	-	-	-	-	-	-	-	-	-
pupae	-	-	-	-	-	-	-	-	-	-

Table E1-2. Raw benthic invertebrate data from the Meadowbank Study Lakes 2021.

Program	Meadowbank									
Location	Inuggugayualik Lake					Pipedream Lake				
Station	INUG					PDL				
Control/Impact?	Control					Control				
Replicate	1	2	3	4	5	1	2	3	4	5
Date	14-Aug-21	14-Aug-21	14-Aug-21	14-Aug-21	14-Aug-21	16-Aug-21	16-Aug-21	16-Aug-21	16-Aug-21	16-Aug-21
Sample Depth (m)	8.2	8.4	8.5	8.6	8.8	7.7	8.0	8.1	8.0	8.1
MOLLUSCS										
P. Mollusca										
SNAILS										
Cl. Gastropoda										
F. Valvatidae										
Valvata	-	-	-	-	-	-	-	-	-	-
CLAMS										
Cl. Bivalvia										
F. Sphaeriidae										
Pisidium/Cyclocalyx	5	26	-	5	14	-	-	-	-	-
Pisidium (Cyclocalyx/Neopisidium)	5	4	7	11	8	13	14	9	8	8
Sphaerium nitidum	1	2	-	-	2	-	-	-	-	-
R (Richness) - totals [2,3]										
Total	16	12	14	9	15	6	8	8	5	9
Oligochaete	2	1	0	0	2	1	0	1	0	2
Insect	10	7	10	5	9	4	7	6	4	6
Mollusc	3	3	1	2	3	1	1	1	1	1
Other[4]	1	1	3	2	1	0	0	0	0	0
Abundance (raw) - totals [5,6]										
Total	38	153	50	51	74	35	42	55	31	32
Oligochaete	3	1	0	0	4	1	0	5	0	2
Insect	21	119	37	30	41	21	28	41	23	22
Mollusc	11	32	7	16	24	13	14	9	8	8
Other[4]	3	1	6	5	5	0	0	0	0	0
N (Abundance) - #/m²										
Total	826	3,326	1,087	1,109	1,609	761	913	1,196	674	696
Oligochaete	65	22	0	0	87	22	0	109	0	43
Insect	457	2,587	804	652	891	457	609	891	500	478
Mollusc	239	696	152	348	522	283	304	196	174	174
Other[4]	65	22	130	109	109	0	0	0	0	0

Notes:

1. Benthic invertebrate count data shown in this table are from composite of two grabs sieved to 500 µm.
2. Richness totals exclude P. Nemata, Cl. Ostracoda, indeterminates (O. Acarina, F. Lumbriculidae), immatures (S.F. Tubificinae, O. Acarina), and pupae.
3. Pupae and immatures (bolded values) are excluded from the richness totals if other life stages are present in the replicate sample.
4. Other Taxa include: Cl. Turbellaria, F. Acalyptonotidae, F. Hygrobatidae, F. Lebertiidae, F. Oxidae, F. Pionidae, O. Harpacticoida, O. Notostraca, and F. Gammaracanthidae.
5. Abundance totals exclude P. Nemata and Cl. Ostracoda.
6. Raw abundance from two grabs (grab area = 0.023 m^2).

Table E1-2. Raw benthic invertebrate data from the Meadowbank Study Lakes 2021.

Program	Meadowbank									
Location	Second Portage Lake					Third Portage Lake - East Basin				
Station	SP					TPE				
Control/Impact?	Impact					Impact				
Replicate	1	2	3	4	5	1	2	3	4	5
Date	6-Aug-21	6-Aug-21	6-Aug-21	6-Aug-21	5-Aug-21	8-Aug-21	8-Aug-21	8-Aug-21	8-Aug-21	8-Aug-21
Sample Depth (m)	9.2	8.9	9.0	9.3	8.8	8.1	9.2	9.3	9.0	9.3
ROUNDWORMS										
P. Nemata	9	5	6	11	2	1	4	6	7	11
FLATWORMS										
P. Platyhelminthes										
Cl. Turbellaria										
indeterminate	-	1	1	-	-	-	-	-	-	-
ANNELIDS										
P. Annelida										
WORMS										
Cl. Oligochaeta										
F. Enchytraeidae	-	-	-	-	-	-	-	-	-	-
F. Naididae	-	-	-	-	-	-	-	-	-	-
S.F. Tubificinae										
Limnodrilus hoffmeisteri	-	-	-	-	-	-	-	-	-	-
Potamothrix bavaricus	-	-	-	-	-	-	-	-	-	-
Slavina appendiculata	-	-	-	-	-	-	-	-	-	-
Tasserkidrilus americanus	-	-	-	-	-	-	-	-	-	-
immatures with hair chaetae	-	2	1	-	-	1	-	-	-	-
immatures without hair chaetae	-	-	-	-	-	-	-	-	-	-
S.F. Rhyacodrilinae										
Rhyacodrilus coccineus	-	-	-	-	-	1	16	8	-	1
Rhyacodrilus montana	-	-	-	-	-	-	-	-	-	-
F. Lumbriculidae										
Lumbriculus	-	-	2	1	-	4	2	-	1	1
ARTHROPODS										
P. Arthropoda										
MITES										
Cl. Arachnida										
O. Acarina	-	-	-	-	-	-	-	-	-	-
F. Acalyptonotidae										
Acalyptonotus	-	-	-	1	-	-	-	-	-	-
F. Hygrobatidae										
Hygrobates	-	-	-	-	-	-	-	-	-	-
F. Lebertiidae										
Lebertia	1	1	1	-	-	-	-	-	1	-
F. Oxidae										
Oxus	2	2	2	-	-	-	4	-	-	-
F. Pionidae										
indeterminate	-	-	-	-	-	-	-	-	-	-
HARPACTICOIDS										
O. Harpacticoida	-	-	-	-	-	-	-	-	-	-
SEED SHRIMPS										
Cl. Ostracoda	4	5	3	1	-	118	122	32	27	19
FAIRY SHRIMP										
O. Notostraca										
Lepidurus arcticus	-	-	-	-	-	-	-	-	-	-
WATER SCUDS										
O. Amphipoda										
F. Gammaracanthidae										
Gammaracanthus	-	-	-	-	-	-	-	-	-	-
INSECTS										
Cl. Insecta										
CADDISFLIES										
O. Trichoptera										
F. Apataniidae										
Apatania	-	-	-	-	-	-	-	-	-	-
F. Limnephilidae										
Grensia praeterita	1	-	-	-	-	-	-	-	-	-
TRUE FLIES										
O. Diptera										
MIDGES										
F. Chironomidae										
chironomid pupae	**15**	**15**	**4**	**21**	**6**	**16**	**24**	**28**	**14**	**16**
S.F. Chironominae										
Chironomus	-	-	-	-	-	-	-	-	-	-
Cladotanytarsus	-	-	-	-	-	-	-	-	-	-
Constempellina	-	-	-	-	-	-	-	-	-	-
Corynocera ambigua	-	-	-	-	-	-	-	-	-	-
?Corynocera oliveri	-	-	-	-	-	-	-	-	-	-
Dicrotendipes	-	-	-	-	-	-	-	-	-	-
Micropsectra	3	3	-	4	1	8	18	14	7	5
Microtendipes	1	-	2	-	-	-	-	-	-	-
Parachironomus	-	-	-	-	-	-	-	-	-	-
Paracladopelma	-	-	-	-	-	-	-	-	-	-
Paratanytarsus	-	1	-	1	-	40	76	48	15	29
Polypedilum	-	-	-	-	-	-	-	-	-	-
Sergentia	-	-	-	-	-	-	-	-	-	-
Stempellinella	1	4	4	11	1	-	-	-	-	1
Stictochironomus	6	4	11	1	2	16	12	28	4	9
Tanytarsus	4	4	-	6	-	6	2	6	5	2
S.F. Diamesinae										
Pagastia	-	-	-	-	-	-	-	-	-	-
Protanypus	1	-	1	1	-	-	-	-	-	-
Potthastia	-	-	-	-	-	-	-	-	-	-
Pseudodiamesa	-	-	-	-	-	-	-	-	-	-
S.F. Orthocladiinae										
Abiskomyia	-	-	-	-	-	7	2	-	-	-
Corynoneura	-	-	-	-	-	-	-	-	-	-
Cricotopus	-	-	-	-	-	-	-	-	-	-
Cricotopus/Orthocladius	-	-	-	-	-	-	-	-	-	-
Heterotrissocladius	-	-	1	-	1	-	14	8	1	4
Hydrobaenus	-	-	-	-	1	-	-	-	-	-
Mesocricotopus	-	-	-	-	-	-	2	-	-	-
Nanocladius	-	-	-	-	-	-	-	-	-	-
Paracladius	-	-	-	-	-	-	4	2	-	-
Parakiefferiella	-	-	-	-	-	-	-	-	-	-
Psectrocladius	2	2	1	1	2	20	14	20	1	5
Zalutschia	1	-	3	1	-	-	-	-	-	-
Orthocladiinae *Genus "Greenland"*	-	-	-	-	-	2	-	2	-	-
indeterminate	-	-	-	-	-	-	-	-	-	-
S.F. Prodiamesinae										
Monodiamesa	3	2	1	-	3	4	2	2	2	1
S.F. Tanypodinae										
Ablabesmyia	3	2	1	-	-	-	-	-	-	-
Procladius	6	7	6	8	10	31	42	18	5	11
Thienemannimyia complex	-	-	-	-	-	1	2	2	-	-
F. Empididae										
Chelifera/Metachela	-	-	-	-	-	3	-	2	-	1
Clinocera	-	-	-	-	-	-	-	-	-	-
pupae	-	-	-	-	-	-	-	-	-	-

Program	Meadowbank									
Location	Second Portage Lake					Third Portage Lake - East Basin				
Station	SP					TPE				
Control/Impact?	Impact					Impact				
Replicate	1	2	3	4	5	1	2	3	4	5
Date	6-Aug-21	6-Aug-21	6-Aug-21	6-Aug-21	5-Aug-21	8-Aug-21	8-Aug-21	8-Aug-21	8-Aug-21	8-Aug-21
Sample Depth (m)	9.2	8.9	9.0	9.3	8.8	8.1	9.2	9.3	9.0	9.3
MOLLUSCS										
P. Mollusca										
SNAILS										
Cl. Gastropoda										
F. Valvatidae										
Valvata	-	-	-	-	-	-	2	-	-	-
CLAMS										
Cl. Bivalvia										
F. Sphaeriidae										
Pisidium/Cyclocalyx	-	-	1	-	2	7	4	-	5	15
Pisidium (Cyclocalyx/Neopisidium)	11	20	14	7	7	22	52	32	12	21
Sphaerium nitidum	-	-	-	-	-	-	-	-	-	-
R (Richness) - totals [2,3]										
Total	15	14	17	12	10	16	18	14	12	14
Oligochaete	0	1	2	1	0	3	2	1	1	2
Insect	12	9	10	9	8	11	12	12	8	10
Mollusc	1	1	2	1	2	2	3	1	2	2
Other[4]	2	3	3	1	0	0	1	0	1	0
Abundance (raw) - totals [5,6]										
Total	61	70	57	64	36	189	294	220	73	122
Oligochaete	0	2	3	1	0	6	18	8	1	2
Insect	47	44	35	55	27	154	214	180	54	84
Mollusc	11	20	15	7	9	29	58	32	17	36
Other[4]	3	4	4	1	0	0	4	0	1	0
N (Abundance) - #/m²										
Total	1,326	1,522	1,239	1,391	783	4,109	6,391	4,783	1,587	2,652
Oligochaete	0	43	65	22	0	130	391	174	22	43
Insect	1,022	957	761	1,196	587	3,348	4,652	3,913	1,174	1,826
Mollusc	239	435	326	152	196	630	1,261	696	370	783
Other[4]	65	87	87	22	0	0	87	0	22	0

Notes:

1. Benthic invertebrate count data shown in this table are from composite of two grabs sieved to 500 µm.
2. Richness totals exclude P. Nemata, Cl. Ostracoda, indeterminates (O. Acarina, F. Lumbriculidae), immatures (S.F. Tubificinae, O. Acarina), and pupae.
3. Pupae and immatures (bolded values) are excluded from the richness totals if other life stages are present in the replicate sample.
4. Other Taxa include: Cl. Turbellaria, F. Acalyptonotidae, F. Hygrobatidae, F. Lebertiidae, F. Oxidae, F. Pionidae, O. Harpacticoida, O. Notostraca, and F. Gammaracanthidae.
5. Abundance totals exclude P. Nemata and Cl. Ostracoda.
6. Raw abundance from two grabs (grab area = 0.023 m^2).

Table E1-2. Raw benthic invertebrate data from the Meadowbank Study Lakes 2021.

Program	Meadowbank									
Location	Third Portage Lake - North Basin					Wally Lake				
Station	TPN					WAL				
Control/Impact?	Impact					Impact				
Replicate	1	2	3	4	5	1	2	3	4	5
Date	7-Aug-21	7-Aug-21	7-Aug-21	7-Aug-21	7-Aug-21	10-Aug-21	10-Aug-21	10-Aug-21	10-Aug-21	10-Aug-21
Sample Depth (m)	8.7	8.3	8.3	7.4	7.5	8.9	7.4	8.9	8.6	8.4
ROUNDWORMS										
P. Nemata	4	8	1	5	2	4	1	-	3	2
FLATWORMS										
P. Platyhelminthes										
Cl. Turbellaria										
indeterminate	-	-	1	-	-	1	4	2	-	-
ANNELIDS										
P. Annelida										
WORMS										
Cl. Oligochaeta										
F. Enchytraeidae	-	-	-	-	-	-	-	-	-	-
F. Naididae	-	-	-	-	-	-	-	-	-	-
S.F. Tubificinae										
Limnodrilus hoffmeisteri	-	-	-	-	-	-	-	-	-	-
Potamothrix bavaricus	-	-	-	-	-	-	-	-	-	-
Slavina appendiculata	-	-	-	-	-	-	-	-	-	-
Tasserkidrilus americanus	-	-	-	-	-	-	-	-	-	-
immatures with hair chaetae	-	1	2	1	-	-	-	-	-	-
immatures without hair chaetae	-	-	-	-	-	-	-	-	-	-
S.F. Rhyacodrilinae										
Rhyacodrilus coccineus	-	1	1	1	-	-	-	-	-	-
Rhyacodrilus montana	-	-	-	-	-	-	-	-	-	-
F. Lumbriculidae										
Lumbriculus	1	1	-	-	-	1	2	-	-	-
ARTHROPODS										
P. Arthropoda										
MITES										
Cl. Arachnida										
O. Acarina	-	-	-	-	-	-	-	-	-	-
F. Acalyptonotidae										
Acalyptonotus	-	5	-	2	-	1	-	-	-	-
F. Hygrobatidae										
Hygrobates	-	-	-	-	-	-	-	-	-	-
F. Lebertiidae										
Lebertia	-	1	-	-	1	-	-	-	-	-
F. Oxidae										
Oxus	1	-	-	-	-	-	-	-	1	-
F. Pionidae										
indeterminate	-	-	-	-	-	-	-	-	-	-
HARPACTICOIDS										
O. Harpacticoida	-	-	-	-	-	-	-	-	-	-
SEED SHRIMPS										
Cl. Ostracoda	18	14	11	21	18	2	1	10	4	6
FAIRY SHRIMP										
O. Notostraca										
Lepidurus arcticus	-	-	-	-	-	-	-	-	-	-
WATER SCUDS										
O. Amphipoda										
F. Gammaracanthidae										
Gammaracanthus	-	-	-	-	-	-	-	-	-	-
INSECTS										
Cl. Insecta										
CADDISFLIES										
O. Trichoptera										
F. Apataniidae										
Apatania	-	-	-	-	-	-	-	-	-	-
F. Limnephilidae										
Grensia praeterita	3	-	-	-	-	1	-	-	-	-
TRUE FLIES										
O. Diptera										
MIDGES										
F. Chironomidae										
chironomid pupae	**11**	**21**	35	**34**	19	7	13	12	-	**11**
S.F. Chironominae										
Chironomus	-	-	-	-	-	-	-	-	-	-
Cladotanytarsus	-	-	-	-	-	2	-	2	-	-
Constempellina	-	-	-	-	-	-	-	-	-	-
Corynocera ambigua	-	-	-	-	-	8	4	6	-	-
?Corynocera oliveri	-	-	-	-	-	-	-	-	-	-
Dicrotendipes	-	-	-	-	-	-	-	-	-	-
Micropsectra	7	6	8	6	10	1	-	1	-	1
Microtendipes	-	-	-	-	-	-	-	-	-	-
Parachironomus	-	-	-	-	-	-	-	-	-	-
Paracladopelma	-	-	-	-	1	-	-	-	-	-
Paratanytarsus	1	2	3	3	6	1	-	1	-	-
Polypedilum	-	-	-	-	-	-	-	-	-	-
Sergentia	1	-	-	-	-	-	-	-	-	-
Stempellinella	-	-	-	-	2	-	1	-	-	2
Stictochironomus	4	53	52	11	-	18	20	28	8	16
Tanytarsus	3	18	21	8	6	4	-	1	1	-
S.F. Diamesinae										
Pagastia	-	-	-	-	-	-	-	-	-	-
Protanypus	-	-	-	-	-	-	1	-	-	-
Potthastia	-	-	-	-	-	-	-	-	-	-
Pseudodiamesa	-	-	-	-	-	-	-	-	-	-
S.F. Orthocladiinae										
Abiskomyia	-	-	-	-	-	-	-	-	-	-
Corynoneura	-	-	-	-	-	-	-	-	-	-
Cricotopus	-	-	-	-	-	-	-	-	-	-
Cricotopus/Orthocladius	-	-	-	-	-	-	-	-	-	-
Heterotrissocladius	9	6	4	3	23	-	1	-	-	1
Hydrobaenus	-	-	-	1	-	-	-	-	-	-
Mesocricotopus	-	1	-	-	-	-	-	-	-	-
Nanocladius	-	-	-	-	-	-	-	-	-	-
Paracladius	1	-	-	-	-	-	-	-	-	-
Parakiefferiella	-	3	-	-	-	-	-	-	-	-
Psectrocladius	1	-	4	-	-	-	-	-	-	1
Zalutschia	1	10	-	5	-	-	-	-	1	-
Orthocladiinae *Genus "Greenland"*	-	-	1	-	-	-	-	-	-	-
indeterminate	1	-	-	-	-	-	-	-	-	-
S.F. Prodiamesinae										
Monodiamesa	1	1	2	1	-	2	4	3	1	1
S.F. Tanypodinae										
Ablabesmyia	-	-	-	-	-	1	-	1	-	-
Procladius	7	9	6	7	3	4	7	4	2	4
Thienemannimyia complex	1	-	2	5	1	-	-	-	-	-
F. Empididae										
Chelifera/Metachela	-	-	-	-	-	-	-	-	-	-
Clinocera	-	-	-	-	-	-	-	-	-	-
pupae	-	-	-	-	-	-	-	-	-	-

Table E1-2. Raw benthic invertebrate data from the Meadowbank Study Lakes 2021.

Program	Meadowbank									
Location	Third Portage Lake - North Basin					Wally Lake				
Station	TPN					WAL				
Control/Impact?	Impact					Impact				
Replicate	1	2	3	4	5	1	2	3	4	5
Date	7-Aug-21	7-Aug-21	7-Aug-21	7-Aug-21	7-Aug-21	10-Aug-21	10-Aug-21	10-Aug-21	10-Aug-21	10-Aug-21
Sample Depth (m)	8.7	8.3	8.3	7.4	7.5	8.9	7.4	8.9	8.6	8.4
MOLLUSCS										
P. Mollusca										
SNAILS										
Cl. Gastropoda										
F. Valvatidae										
Valvata	-	-	-	-	-	-	-	-	-	-
CLAMS										
Cl. Bivalvia										
F. Sphaeriidae										
Pisidium/Cyclocalyx	1	10	12	4	1	7	11	13	8	5
Pisidium (Cyclocalyx/Neopisidium)	-	12	23	11	6	30	22	26	14	15
Sphaerium nitidum	-	-	-	-	-	1	-	-	-	1
R (Richness) - totals [2,3]										
Total	17	17	15	15	11	16	11	12	8	10
Oligochaete	1	3	2	2	0	1	1	0	0	0
Insect	14	10	10	10	8	10	7	9	5	7
Mollusc	1	2	2	2	2	3	2	2	2	3
Other[4]	1	2	1	1	1	2	1	1	1	0
Abundance (raw) - totals [5,6]										
Total	55	161	177	103	79	90	90	100	36	58
Oligochaete	1	3	3	2	0	1	2	0	0	0
Insect	52	130	138	84	71	49	51	59	13	37
Mollusc	1	22	35	15	7	38	33	39	22	21
Other[4]	1	6	1	2	1	2	4	2	1	0
N (Abundance) - #/m²										
Total	1,196	3,500	3,848	2,239	1,717	1,957	1,957	2,174	783	1,261
Oligochaete	22	65	65	43	0	22	43	0	0	0
Insect	1,130	2,826	3,000	1,826	1,543	1,065	1,109	1,283	283	804
Mollusc	22	478	761	326	152	826	717	848	478	457
Other[4]	22	130	22	43	22	43	87	43	22	0

Notes:

1. Benthic invertebrate count data shown in this table are from composite of two grabs sieved to 500 µm.
2. Richness totals exclude P. Nemata, Cl. Ostracoda, indeterminates (O. Acarina, F. Lumbriculidae), immatures (S.F. Tubificinae, O. Acarina), and pupae.
3. Pupae and immatures (bolded values) are excluded from the richness totals if other life stages are present in the replicate sample.
4. Other Taxa include: Cl. Turbellaria, F. Acalyptonotidae, F. Hygrobatidae, F. Lebertiidae, F. Oxidae, F. Pionidae, O. Harpacticoida, O. Notostraca, and F. Gammaracanthidae.
5. Abundance totals exclude P. Nemata and Cl. Ostracoda.
6. Raw abundance from two grabs (grab area = 0.023 m^2).

Figure E1-1. Oligochaete abundance (#/m^2) from Meadowbank study lakes since 2006.

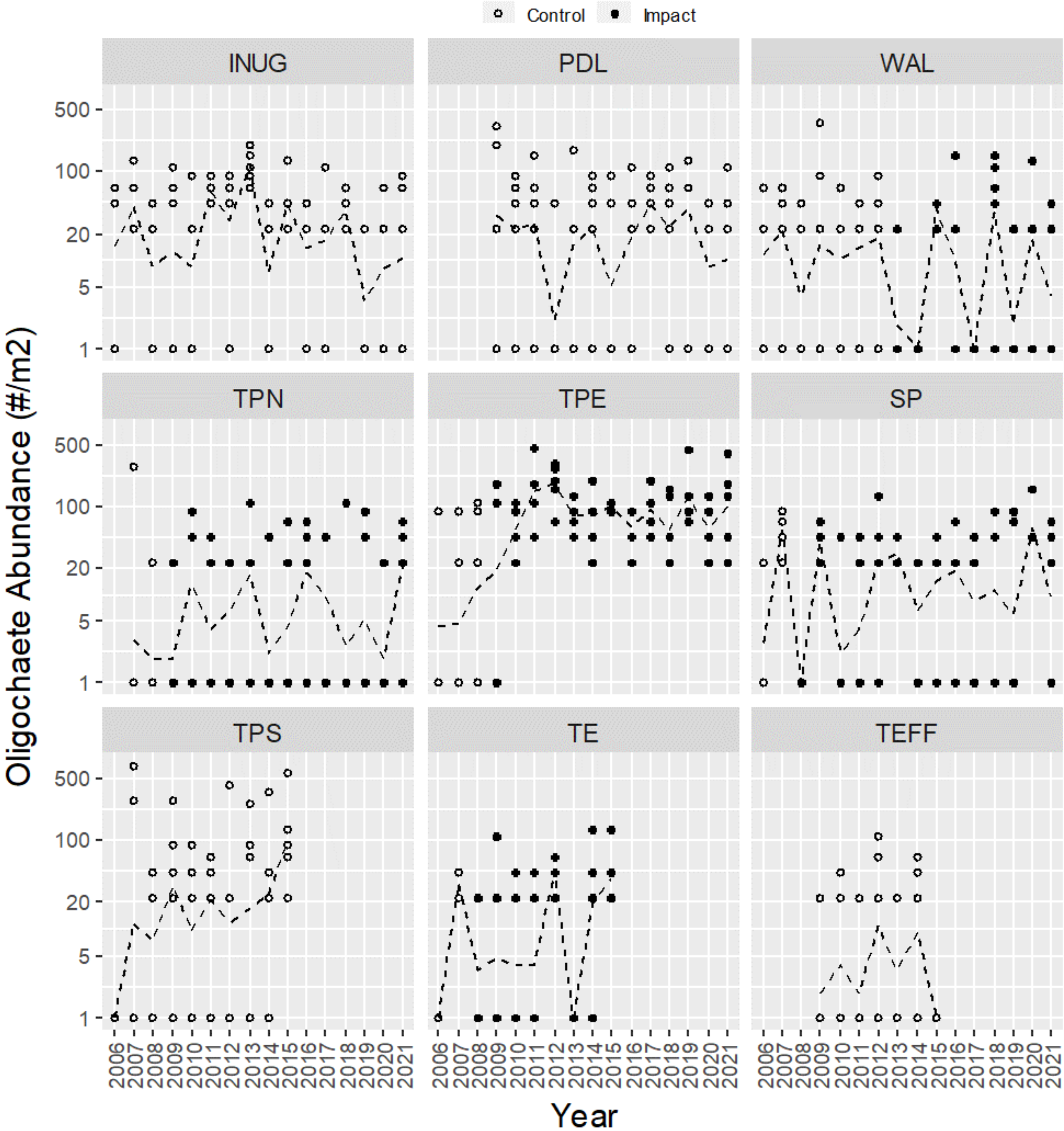


Figure E1-2. Insect abundance (#/m²) from Meadowbank study lakes since 2006.

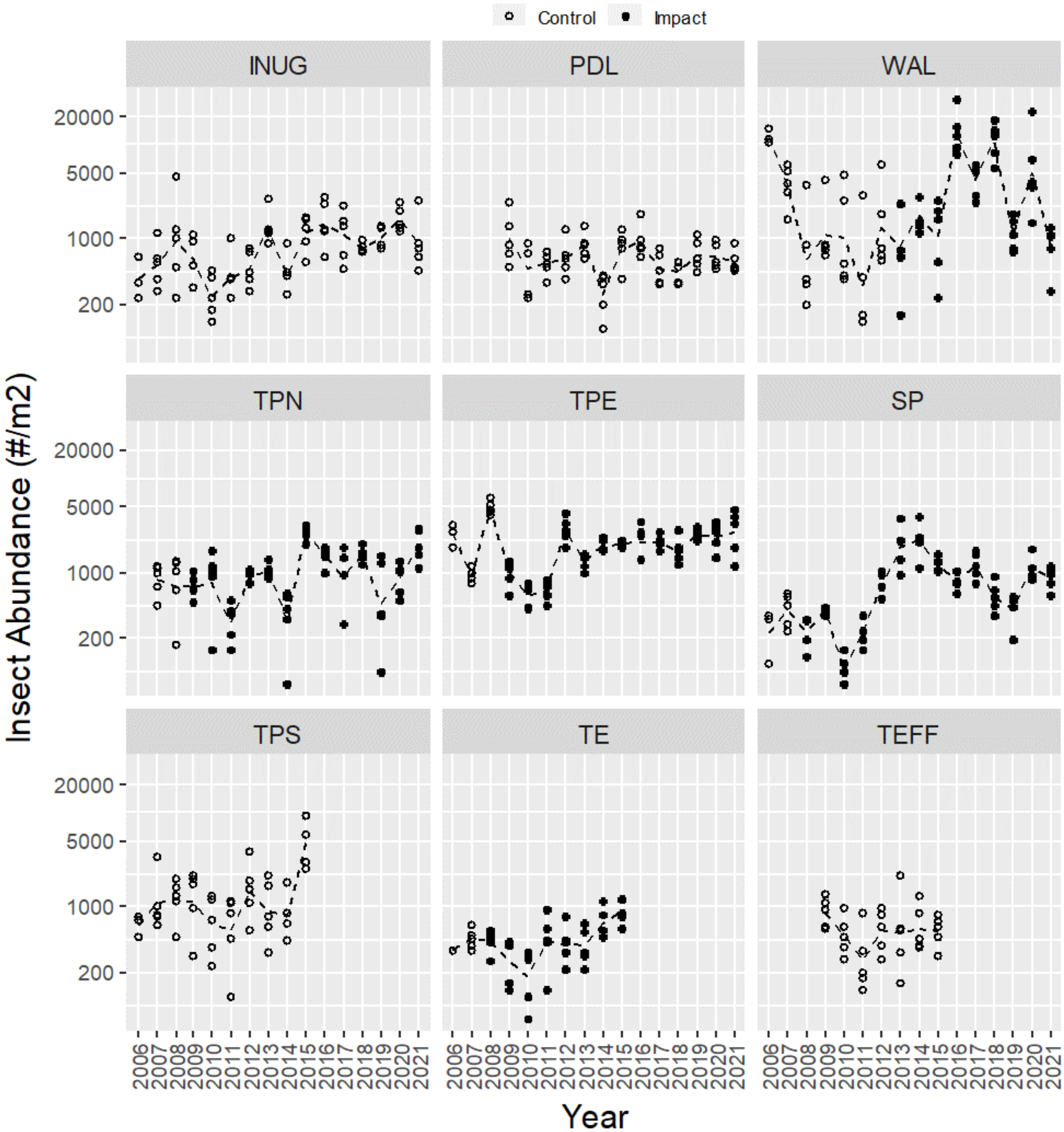


Figure E1-3. Mollusc abundance (#/m²) from Meadowbank study lakes since 2006.

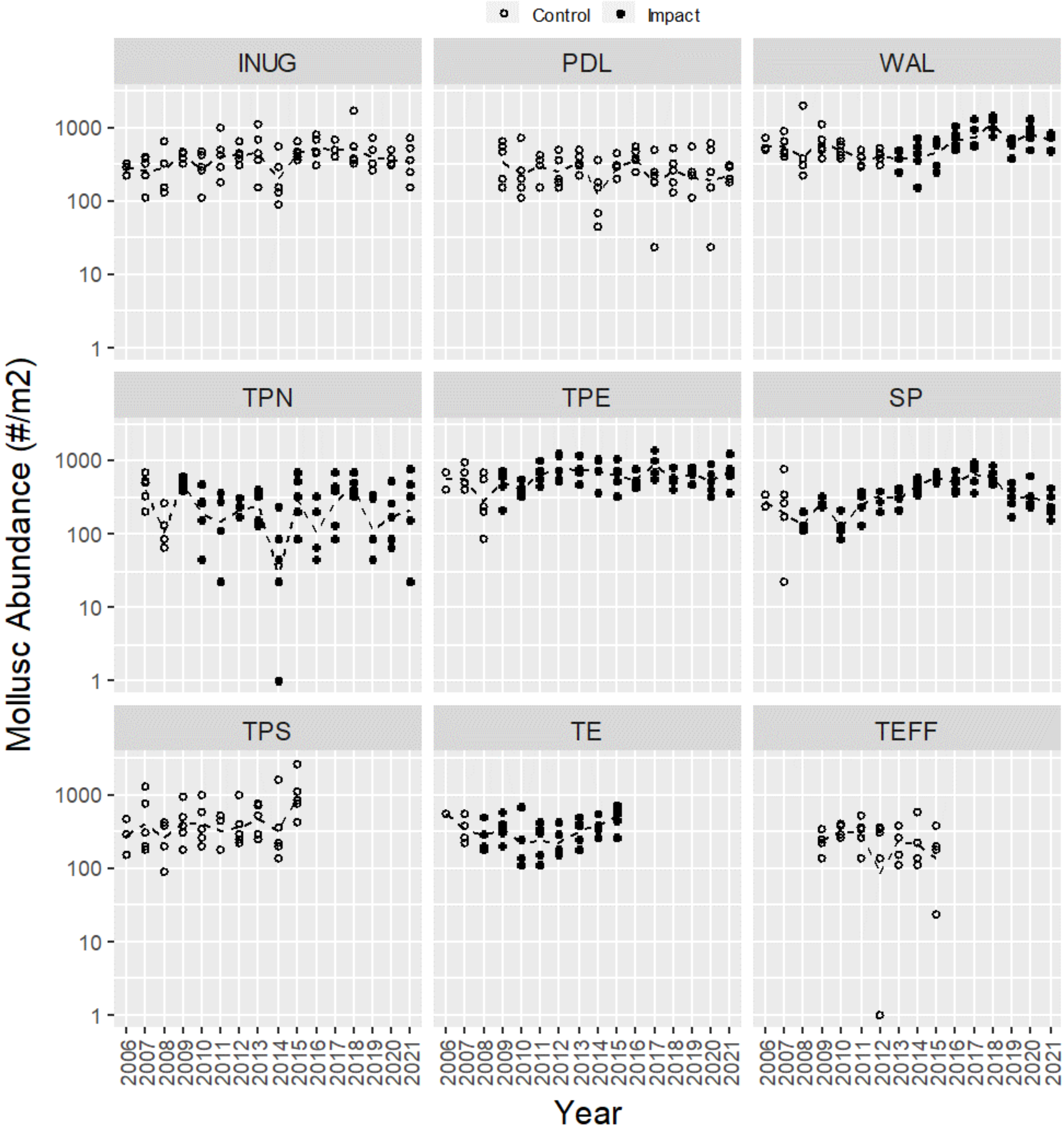


Figure E1-4. Other taxa abundance (#/m²) from Meadowbank study lakes since 2006.

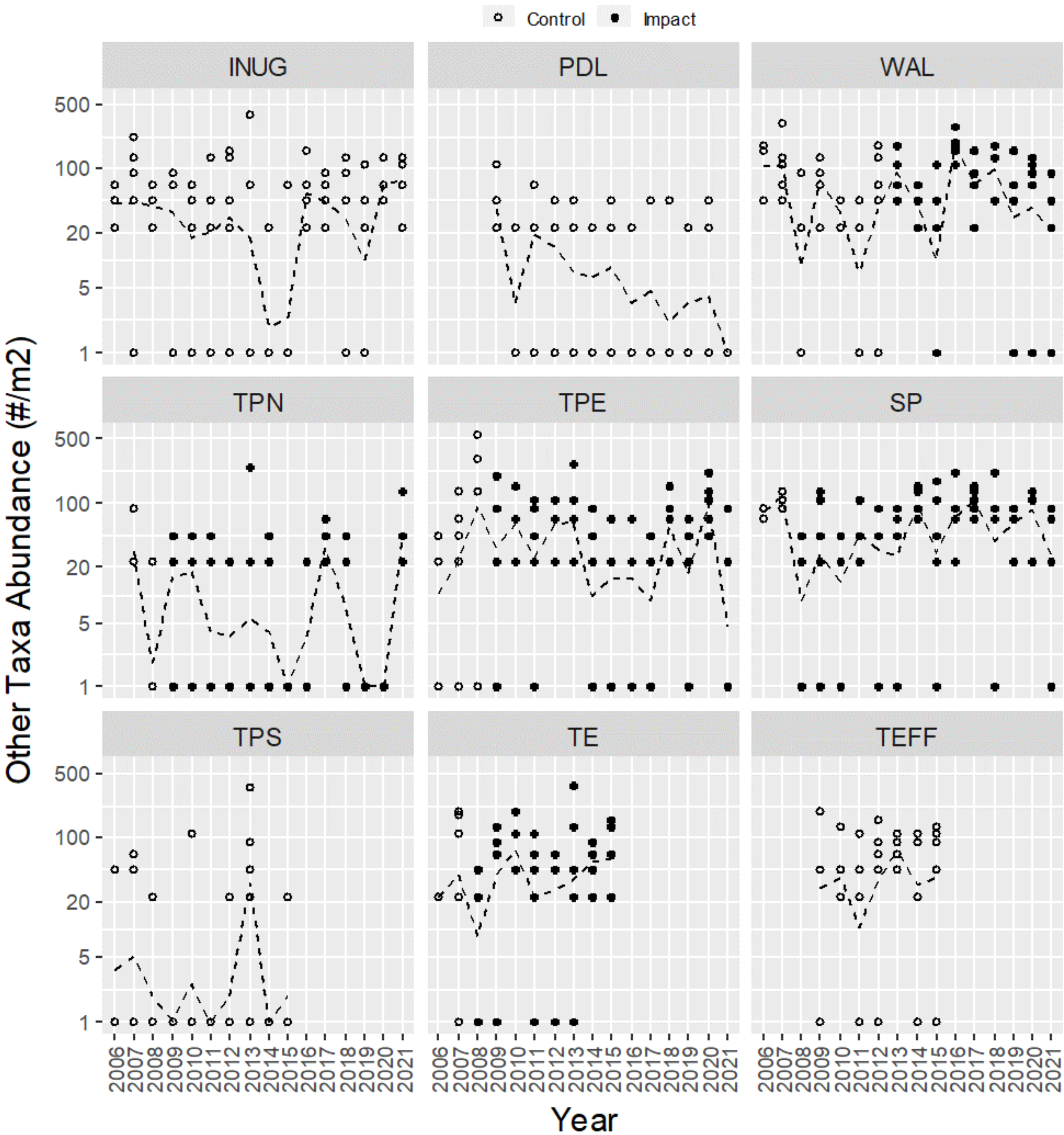


Figure E1-5. Oligochaete richness (# of taxa) from Meadowbank study lakes since 2006.

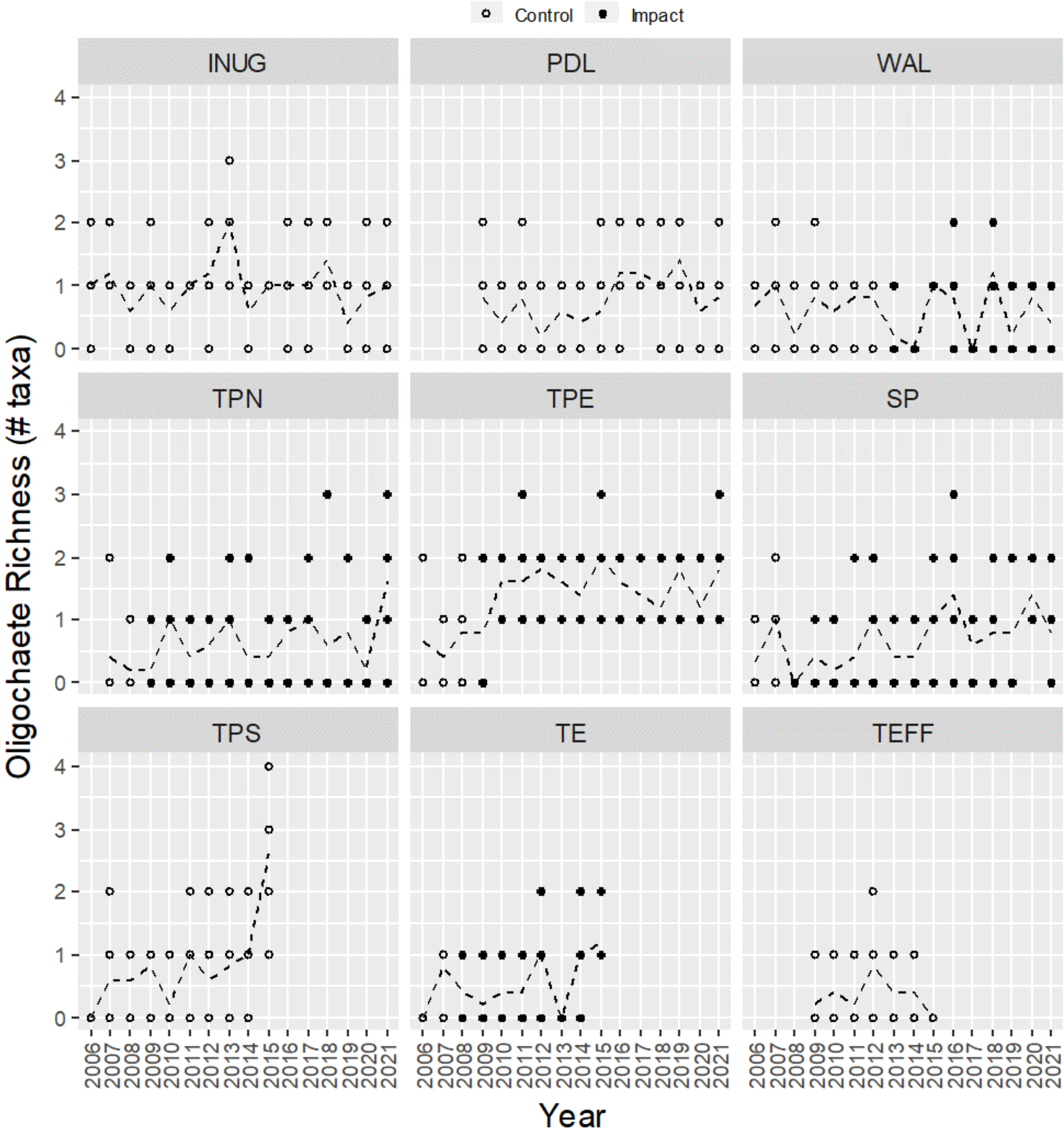


Figure E1-6. Insect richness (# of taxa) from Meadowbank study lakes since 2006.

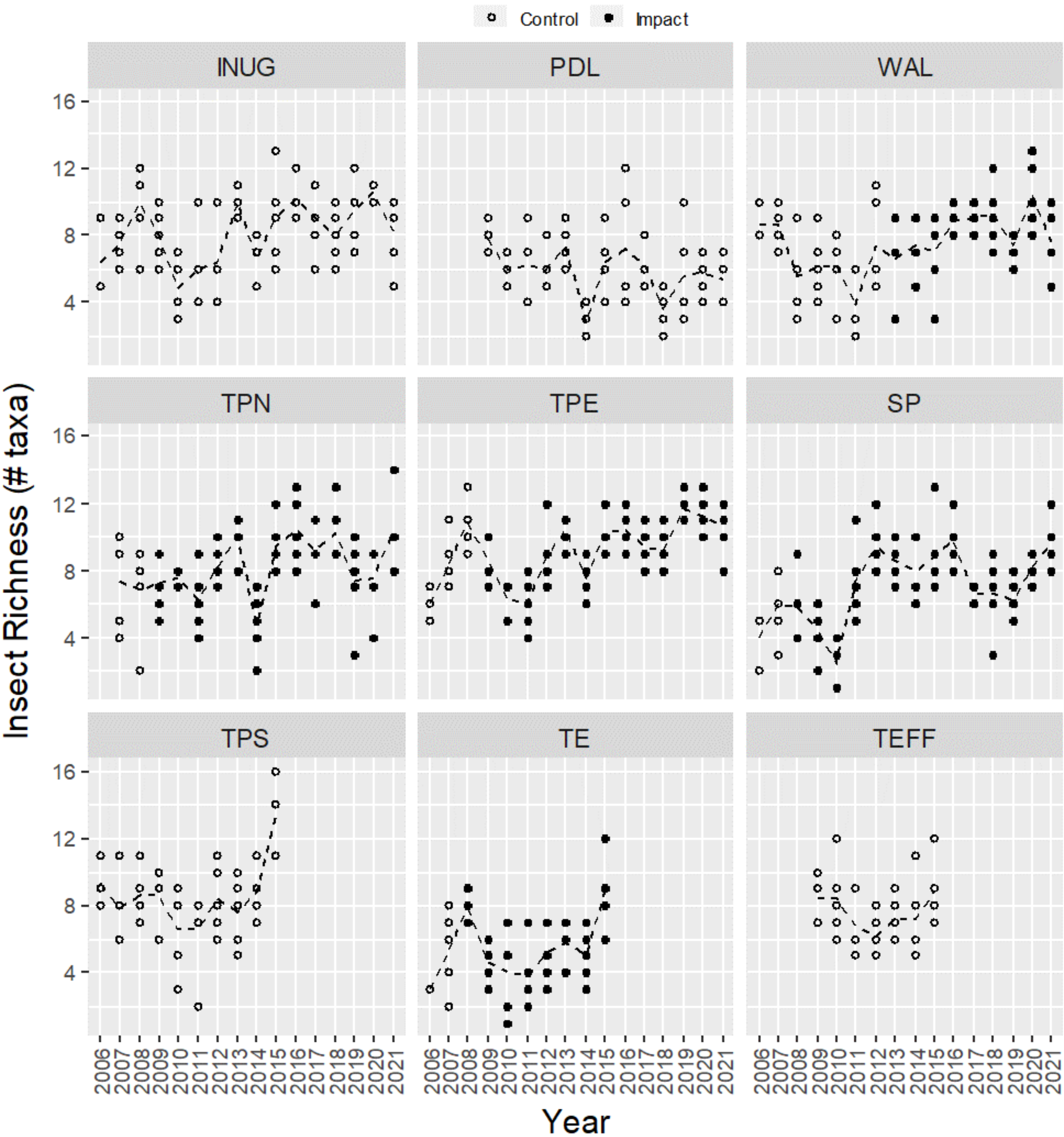


Figure E1-7. Mollusc richness (# of taxa) from Meadowbank study lakes since 2006.

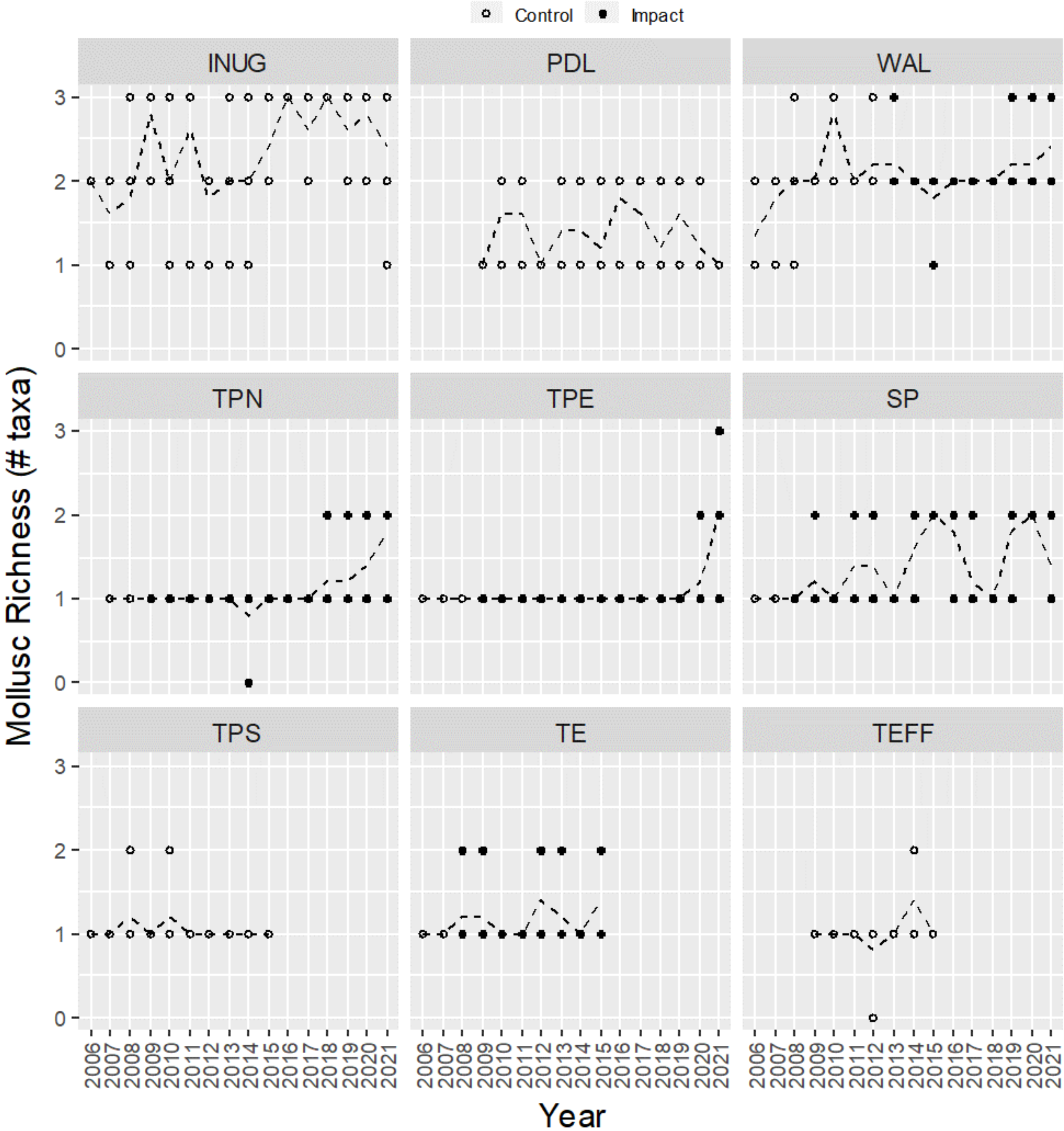


Figure E1-8. Other taxa richness (# of taxa) from Meadowbank study lakes since 2006.

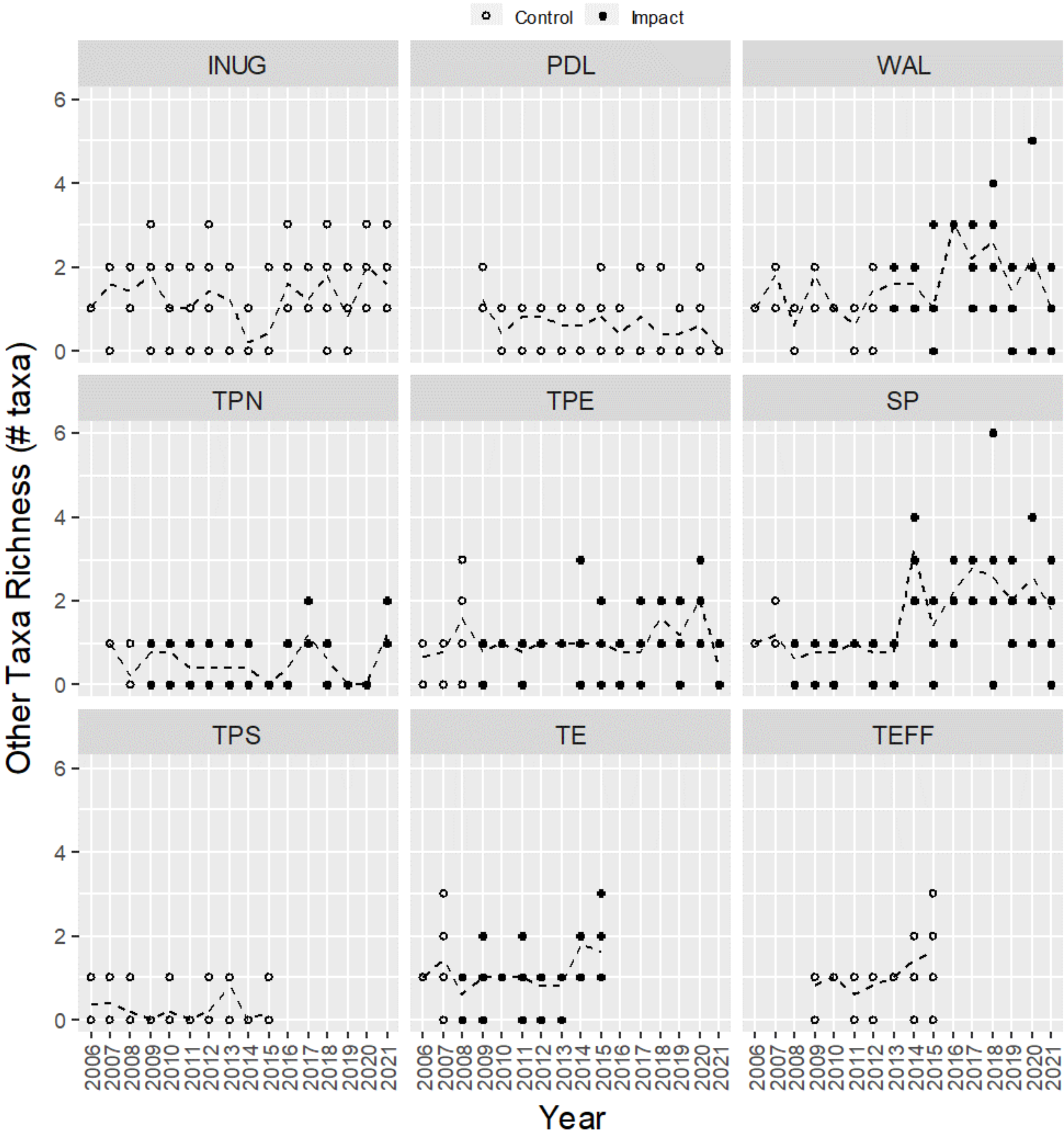


Figure E1-9. Simpsons' Diversity for the benthic invertebrate community at the Meadowbank study lakes since 2006.

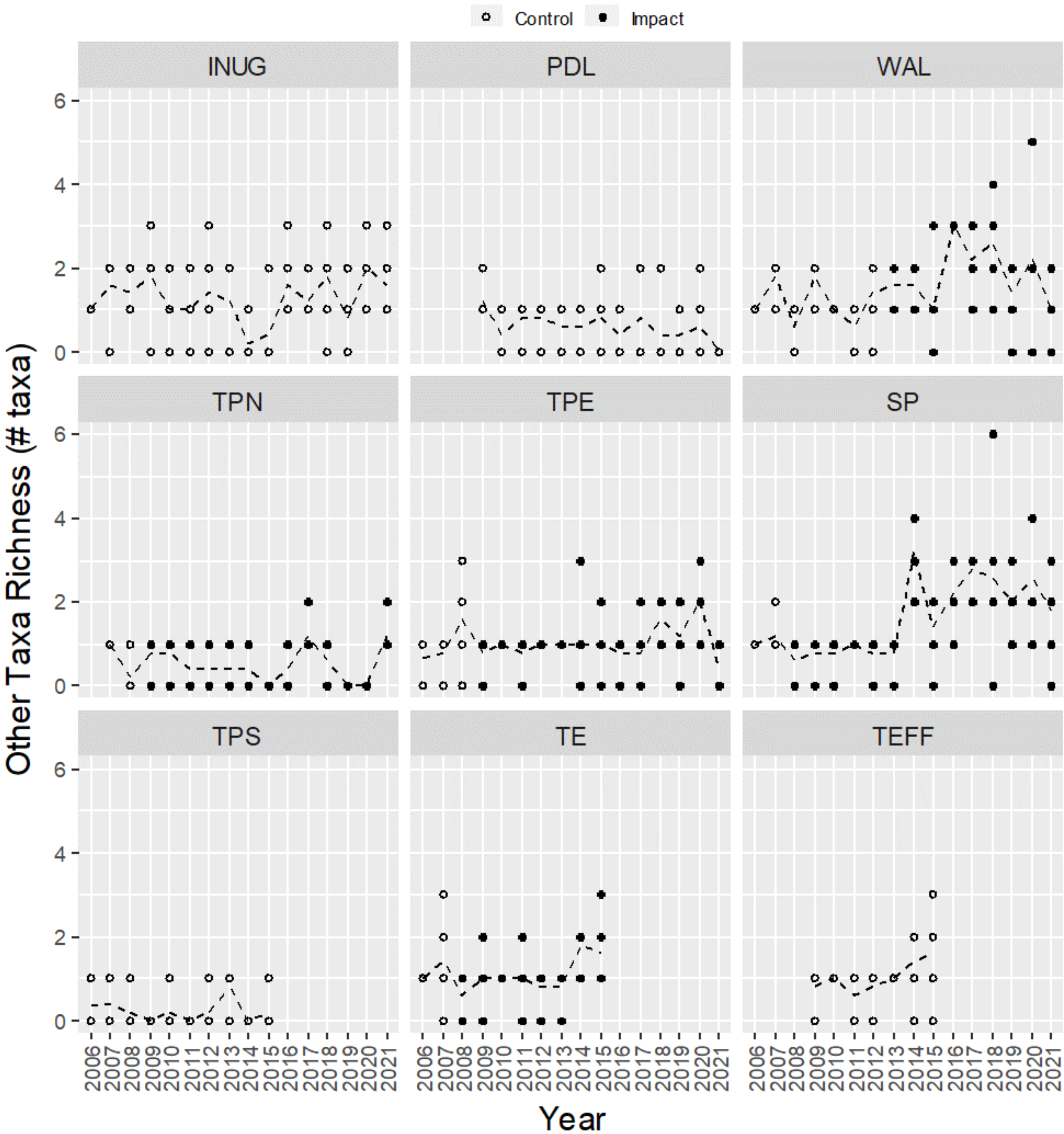
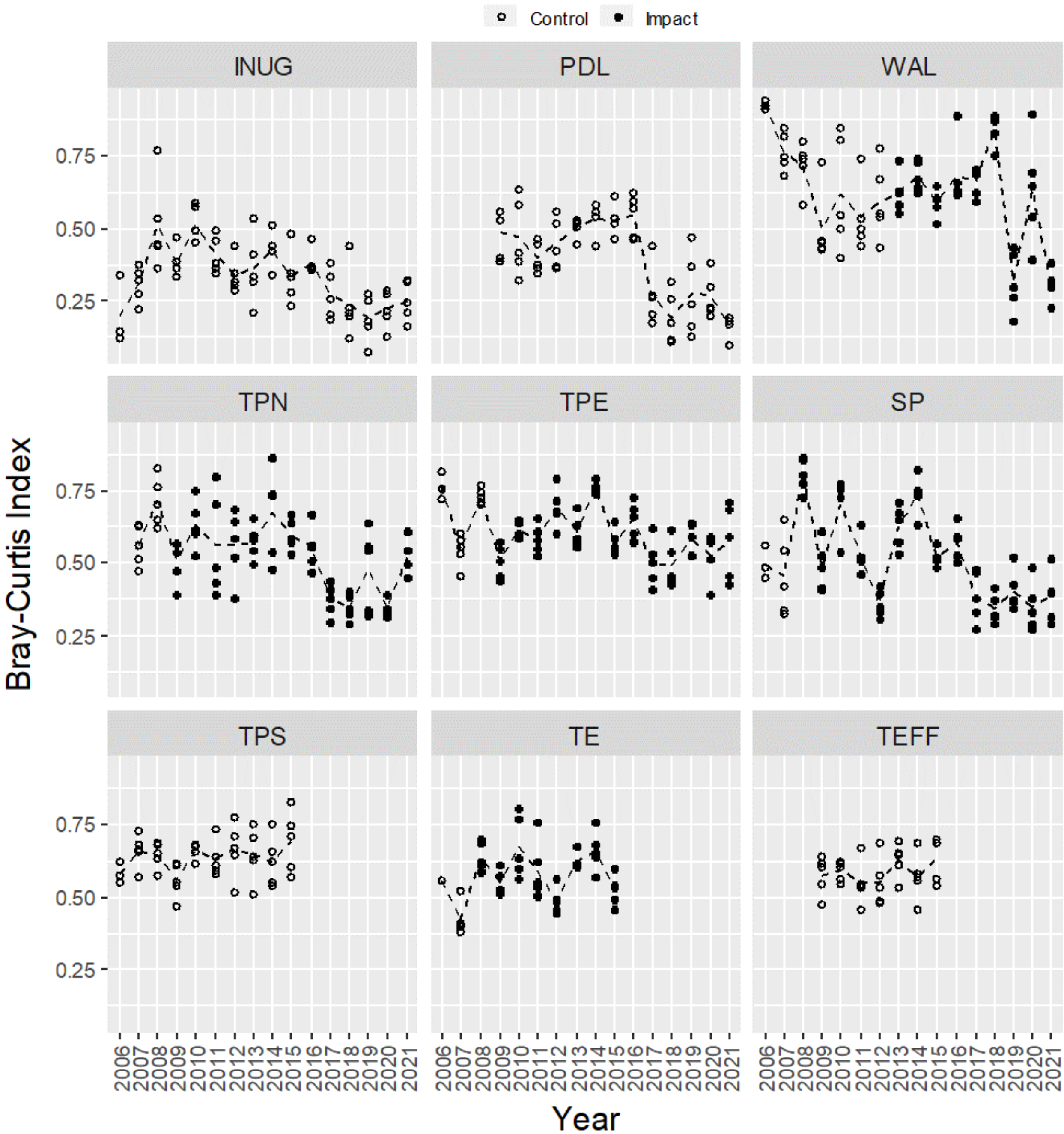


Figure E1-10. Bray-Curtis Index for the benthic invertebrate community at the Meadowbank study lakes since 2006.



Appendix E2
Benthos Data – Whale Tail Study Area Lakes

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LIST OF FIGURES – APPENDIX E2

Table E1-1. Benthic invertebrate abundance (#/m2) and richness (# taxa) by major taxa group, Meadowbank study area lakes, 2021.

Area-Replicate	Date	Depth (m)	Abundance (#/m^2)					Richness (# taxa)					Simpson's Diversity	Bray-Curtis Index
			Oligochaetes	Insects	Molluscs	Other Taxa[1]	TOTAL	Oligochaetes	Insects	Molluscs	Other Taxa[1]	TOTAL		
Inuggugayualik Lake														
INUG-1	14-Aug-21	8.2	65	457	239	65	826	2	10	3	1	16	0.94	0.21
INUG-2	14-Aug-21	8.4	22	2,587	696	22	3,326	1	7	3	1	12	0.79	0.32
INUG-3	14-Aug-21	8.5	0	804	152	130	1,087	0	10	1	3	14	0.92	0.31
INUG-4	14-Aug-21	8.6	0	652	348	109	1,109	0	5	2	2	9	0.78	0.25
INUG-5	14-Aug-21	8.8	87	891	522	109	1,609	2	9	3	1	15	0.87	0.16
Area Mean			***35***	***1,078***	***391***	***87***	***1,591***	***1.0***	***8.2***	***2.4***	***1.6***	***13.2***	***0.86***	***0.25***
Pipedream Lake														
PDL-1	16-Aug-21	7.7	22	457	283	0	761	1	4	1	0	6	0.77	0.18
PDL-2	16-Aug-21	8.0	0	609	304	0	913	0	7	1	0	8	0.82	0.17
PDL-3	16-Aug-21	8.1	109	891	196	0	1,196	1	6	1	0	8	0.79	0.19
PDL-4	16-Aug-21	8.0	0	500	174	0	674	0	4	1	0	5	0.71	0.10
PDL-5	16-Aug-21	8.1	43	478	174	0	696	2	6	1	0	9	0.81	0.17
Area Mean			***35***	***587***	***226***	***0.0***	***848***	***0.8***	***5.4***	***1.0***	***0.0***	***7.2***	***0.78***	***0.16***
Second Portage Lake														
SP-1	6-Aug-21	9.2	0	1,022	239	65	1,326	0	12	1	2	15	0.89	0.31
SP-2	6-Aug-21	8.9	43	957	435	87	1,522	1	9	1	3	14	0.86	0.40
SP-3	6-Aug-21	9.0	65	761	326	87	1,239	2	10	2	3	17	0.89	0.29
SP-4	6-Aug-21	9.3	22	1,196	152	22	1,391	1	9	1	1	12	0.83	0.51
SP-5	5-Aug-21	8.8	0	587	196	0	783	0	8	2	0	10	0.86	0.40
Area Mean			***26***	***904***	***270***	***52***	***1,252***	***0.8***	***9.6***	***1.4***	***1.8***	***13.6***	***0.87***	***0.38***
Third Portage Lake - East Basin														
TPE-1	8-Aug-21	8.1	130	3,348	630	0	4,109	3	11	2	0	16	0.89	0.59
TPE-2	8-Aug-21	9.2	391	4,652	1,261	87	6,391	2	12	3	1	18	0.86	0.71
TPE-3	8-Aug-21	9.3	174	3,913	696	0	4,783	1	12	1	0	14	0.88	0.69
TPE-4	8-Aug-21	9.0	22	1,174	370	22	1,587	1	8	2	1	12	0.88	0.42
TPE-5	8-Aug-21	9.3	43	1,826	783	0	2,652	2	10	2	0	14	0.87	0.46
Area Mean			***152***	***2,983***	***748***	***22***	***3,904***	***1.8***	***10.6***	***2.0***	***0.4***	***14.8***	***0.88***	***0.57***
Third Portage Lake - North Basin														
TPN-1	7-Aug-21	8.7	22	1,130	22	22	1,196	1	14	1	1	17	0.90	0.49
TPN-2	7-Aug-21	8.3	65	2,826	478	130	3,500	3	10	2	2	17	0.85	0.49
TPN-3	7-Aug-21	8.3	65	3,000	761	22	3,848	2	10	2	1	15	0.84	0.54
TPN-4	7-Aug-21	7.4	43	1,826	326	43	2,239	2	10	2	1	15	0.85	0.45
TPN-5	7-Aug-21	7.5	0	1,543	152	22	1,717	0	8	2	1	11	0.83	0.61
Area Mean			***39***	***2,065***	***348***	***48***	***2,500***	***1.6***	***10.4***	***1.8***	***1.2***	***15.0***	***0.85***	***0.52***
Wally Lake														
WAL-1	10-Aug-21	8.9	22	1,065	826	43	1,957	1	10	3	2	16	0.83	0.32
WAL-2	10-Aug-21	7.4	43	1,109	717	87	1,957	1	7	2	1	11	0.85	0.32
WAL-3	10-Aug-21	8.9	0	1,283	848	43	2,174	0	9	2	1	12	0.82	0.38
WAL-4	10-Aug-21	8.6	0	283	478	22	783	0	5	2	1	8	0.77	0.23
WAL-5	10-Aug-21	8.4	0	804	457	0	1,261	0	7	3	0	10	0.82	0.30
Area Mean			***13***	***909***	***665***	***39***	***1,626***	***0.4***	***7.6***	***2.4***	***1.0***	***11.4***	***0.82***	***0.31***

Notes:

1. "Other taxa" includes flatworms (Turbellaria) and arthropods (Acalyptonotidae, Hygrobatidae, Lebertiidae, Oxidae, Pionidae, Harpacticoida, O. Notostraca, and Gammaracanthidae).

Table E1-2. Raw benthic invertebrate data from the Meadowbank Study Lakes 2021.

Program	Meadowbank									
Location	Inuggugayualik Lake					Pipedream Lake				
Station	INUG					PDL				
Control/Impact?	Control					Control				
Replicate	1	2	3	4	5	1	2	3	4	5
Date	14-Aug-21	14-Aug-21	14-Aug-21	14-Aug-21	14-Aug-21	16-Aug-21	16-Aug-21	16-Aug-21	16-Aug-21	16-Aug-21
Sample Depth (m)	8.2	8.4	8.5	8.6	8.8	7.7	8.0	8.1	8.0	8.1
ROUNDWORMS										
P. Nemata	2	-	-	1	3	1	1	2	1	1
FLATWORMS										
P. Platyhelminthes										
Cl. Turbellaria										
indeterminate	3	-	3	4	-	-	-	-	-	-
ANNELIDS										
P. Annelida										
WORMS										
Cl. Oligochaeta										
F. Enchytraeidae	-	-	-	-	-	-	-	-	-	-
F. Naididae	-	-	-	-	-	-	-	-	-	-
S.F. Tubificinae										
Limnodrilus hoffmeisteri	-	-	-	-	-	-	-	-	-	-
Potamothrix bavaricus	-	-	-	-	-	-	-	-	-	-
Slavina appendiculata	-	-	-	-	-	-	-	-	-	-
Tasserkidrilus americanus	1	-	-	-	-	-	-	2	-	-
immatures with hair chaetae	-	-	-	-	-	-	-	3	-	1
immatures without hair chaetae	-	-	-	-	-	-	-	-	-	-
S.F. Rhyacodrilinae										
Rhyacodrilus coccineus	2	-	-	-	2	-	-	-	-	-
Rhyacodrilus montana	-	-	-	-	-	-	-	-	-	-
F. Lumbriculidae										
Lumbriculus	-	1	-	-	2	1	-	-	-	1
ARTHROPODS										
P. Arthropoda										
MITES										
Cl. Arachnida										
O. Acarina	-	-	-	-	-	-	-	-	-	-
F. Acalyptonotidae										
Acalyptonotus	-	-	1	-	-	-	-	-	-	-
F. Hygrobatidae										
Hygrobates	-	-	-	-	-	-	-	-	-	-
F. Lebertiidae										
Lebertia	-	-	-	1	5	-	-	-	-	-
F. Oxidae										
Oxus	-	1	2	-	-	-	-	-	-	-
F. Pionidae										
indeterminate	-	-	-	-	-	-	-	-	-	-
HARPACTICOIDS										
O. Harpacticoida	-	-	-	-	-	-	-	-	-	-
SEED SHRIMPS										
Cl. Ostracoda	-	-	-	1	11	1	3	6	1	5
FAIRY SHRIMP										
O. Notostraca										
Lepidurus arcticus	-	-	-	-	-	-	-	-	-	-
WATER SCUDS										
O. Amphipoda										
F. Gammaracanthidae										
Gammaracanthus	-	-	-	-	-	-	-	-	-	-
INSECTS										
Cl. Insecta										
CADDISFLIES										
O. Trichoptera										
F. Apataniidae										
Apatania	-	-	-	-	-	-	-	-	-	-
F. Limnephilidae										
Grensia praeterita	-	-	-	-	-	-	-	-	-	1
TRUE FLIES										
O. Diptera										
MIDGES										
F. Chironomidae										
chironomid pupae	-	**-**	**5**	**1**	**3**	**2**	**3**	**2**	**1**	**1**
S.F. Chironominae										
Chironomus	-	-	-	-	-	-	-	-	-	-
Cladotanytarsus	-	-	-	-	-	-	-	-	-	-
Constempellina	-	-	-	-	-	-	-	-	-	-
Corynocera ambigua	-	-	-	-	-	-	-	-	-	-
?Corynocera oliveri	-	-	-	-	-	-	-	-	-	-
Dicrotendipes	1	-	1	-	-	-	-	-	-	-
Micropsectra	1	1	5	-	3	-	3	-	-	-
Microtendipes	-	-	2	-	2	-	-	-	-	-
Parachironomus	-	-	-	-	-	-	-	-	-	-
Paracladopelma	-	-	-	-	-	-	-	-	-	-
Paratanytarsus	2	-	7	-	1	-	-	-	-	-
Polypedilum	-	-	-	-	-	-	-	-	-	-
Sergentia	-	-	-	-	-	-	-	-	-	-
Stempellinella	-	-	2	-	-	-	1	1	-	-
Stictochironomus	5	46	3	21	20	9	10	22	14	11
Tanytarsus	2	22	2	1	3	-	1	-	-	-
S.F. Diamesinae										
Pagastia	-	-	-	-	-	-	-	-	-	-
Protanypus	-	-	-	-	-	-	-	-	-	-
Potthastia	-	-	-	-	-	-	-	-	-	-
Pseudodiamesa	-	-	-	-	-	-	-	-	-	-
S.F. Orthocladiinae										
Abiskomyia	-	-	-	-	-	-	4	-	-	1
Corynoneura	-	42	-	-	-	-	-	-	-	-
Cricotopus	-	-	-	-	-	-	-	-	-	-
Cricotopus/Orthocladius	-	-	-	-	-	-	-	-	-	-
Heterotrissocladius	1	-	7	2	2	2	1	3	1	1
Hydrobaenus	-	-	-	-	-	-	-	-	-	-
Mesocricotopus	-	-	-	-	-	-	-	-	-	-
Nanocladius	-	-	-	-	-	-	-	-	-	-
Paracladius	-	-	-	-	-	-	-	-	-	-
Parakiefferiella	-	-	-	-	-	-	-	-	-	-
Psectrocladius	2	2	2	-	1	-	-	2	1	-
Zalutschia	-	-	-	-	-	-	-	-	-	-
Orthocladiinae *Genus "Greenland"*	-	-	-	-	-	-	-	-	-	-
indeterminate	-	-	-	-	-	-	-	-	-	-
S.F. Prodiamesinae										
Monodiamesa	2	1	-	3	3	1	-	2	-	5
S.F. Tanypodinae										
Ablabesmyia	1	-	-	-	-	-	-	-	-	-
Procladius	4	5	1	2	3	7	5	9	6	2
Thienemannimyia complex	-	-	-	-	-	-	-	-	-	-
F. Empididae										
Chelifera/Metachela	-	-	-	-	-	-	-	-	-	-
Clinocera	-	-	-	-	-	-	-	-	-	-
pupae	-	-	-	-	-	-	-	-	-	-

Table E1-2. Raw benthic invertebrate data from the Meadowbank Study Lakes 2021.

Program	Meadowbank									
Location	Inuggugayualik Lake					Pipedream Lake				
Station	INUG					PDL				
Control/Impact?	Control					Control				
Replicate	1	2	3	4	5	1	2	3	4	5
Date	14-Aug-21	14-Aug-21	14-Aug-21	14-Aug-21	14-Aug-21	16-Aug-21	16-Aug-21	16-Aug-21	16-Aug-21	16-Aug-21
Sample Depth (m)	8.2	8.4	8.5	8.6	8.8	7.7	8.0	8.1	8.0	8.1
MOLLUSCS										
P. Mollusca										
SNAILS										
Cl. Gastropoda										
F. Valvatidae										
Valvata	-	-	-	-	-	-	-	-	-	-
CLAMS										
Cl. Bivalvia										
F. Sphaeriidae										
Pisidium/Cyclocalyx	5	26	-	5	14	-	-	-	-	-
Pisidium (Cyclocalyx/Neopisidium)	5	4	7	11	8	13	14	9	8	8
Sphaerium nitidum	1	2	-	-	2	-	-	-	-	-
R (Richness) - totals [2,3]										
Total	16	12	14	9	15	6	8	8	5	9
Oligochaete	2	1	0	0	2	1	0	1	0	2
Insect	10	7	10	5	9	4	7	6	4	6
Mollusc	3	3	1	2	3	1	1	1	1	1
Other[4]	1	1	3	2	1	0	0	0	0	0
Abundance (raw) - totals [5,6]										
Total	38	153	50	51	74	35	42	55	31	32
Oligochaete	3	1	0	0	4	1	0	5	0	2
Insect	21	119	37	30	41	21	28	41	23	22
Mollusc	11	32	7	16	24	13	14	9	8	8
Other[4]	3	1	6	5	5	0	0	0	0	0
N (Abundance) - #/m^2										
Total	826	3,326	1,087	1,109	1,609	761	913	1,196	674	696
Oligochaete	65	22	0	0	87	22	0	109	0	43
Insect	457	2,587	804	652	891	457	609	891	500	478
Mollusc	239	696	152	348	522	283	304	196	174	174
Other[4]	65	22	130	109	109	0	0	0	0	0

Notes:

1. Benthic invertebrate count data shown in this table are from composite of two grabs sieved to 500 µm.
2. Richness totals exclude P. Nemata, Cl. Ostracoda, indeterminates (O. Acarina, F. Lumbriculidae), immatures (S.F. Tubificinae, O. Acarina), and pupae.
3. Pupae and immatures (bolded values) are excluded from the richness totals if other life stages are present in the replicate sample.
4. Other Taxa include: Cl. Turbellaria, F. Acalyptonotidae, F. Hygrobatidae, F. Lebertiidae, F. Oxidae, F. Pionidae, O. Harpacticoida, O. Notostraca, and F. Gammaracanthidae.
5. Abundance totals exclude P. Nemata and Cl. Ostracoda.
6. Raw abundance from two grabs (grab area = 0.023 m^2).

Table E1-2. Raw benthic invertebrate data from the Meadowbank Study Lakes 2021.

Program	Meadowbank									
Location	Second Portage Lake					Third Portage Lake - East Basin				
Station	SP					TPE				
Control/Impact?	Impact					Impact				
Replicate	1	2	3	4	5	1	2	3	4	5
Date	6-Aug-21	6-Aug-21	6-Aug-21	6-Aug-21	5-Aug-21	8-Aug-21	8-Aug-21	8-Aug-21	8-Aug-21	8-Aug-21
Sample Depth (m)	9.2	8.9	9.0	9.3	8.8	8.1	9.2	9.3	9.0	9.3
ROUNDWORMS										
P. Nemata	9	5	6	11	2	1	4	6	7	11
FLATWORMS										
P. Platyhelminthes										
Cl. Turbellaria										
indeterminate	-	1	1	-	-	-	-	-	-	-
ANNELIDS										
P. Annelida										
WORMS										
Cl. Oligochaeta										
F. Enchytraeidae	-	-	-	-	-	-	-	-	-	-
F. Naididae	-	-	-	-	-	-	-	-	-	-
S.F. Tubificinae										
Limnodrilus hoffmeisteri	-	-	-	-	-	-	-	-	-	-
Potamothrix bavaricus	-	-	-	-	-	-	-	-	-	-
Slavina appendiculata	-	-	-	-	-	-	-	-	-	-
Tasserkidrilus americanus	-	-	-	-	-	-	-	-	-	-
immatures with hair chaetae	-	2	1	-	-	1	-	-	-	-
immatures without hair chaetae	-	-	-	-	-	-	-	-	-	-
S.F. Rhyacodrilinae										
Rhyacodrilus coccineus	-	-	-	-	-	1	16	8	-	1
Rhyacodrilus montana	-	-	-	-	-	-	-	-	-	-
F. Lumbriculidae										
Lumbriculus	-	-	2	1	-	4	2	-	1	1
ARTHROPODS										
P. Arthropoda										
MITES										
Cl. Arachnida										
O. Acarina	-	-	-	-	-	-	-	-	-	-
F. Acalyptonotidae										
Acalyptonotus	-	-	-	1	-	-	-	-	-	-
F. Hygrobatidae										
Hygrobates	-	-	-	-	-	-	-	-	-	-
F. Lebertiidae										
Lebertia	1	1	1	-	-	-	-	-	1	-
F. Oxidae										
Oxus	2	2	2	-	-	-	4	-	-	-
F. Pionidae										
indeterminate	-	-	-	-	-	-	-	-	-	-
HARPACTICOIDS										
O. Harpacticoida	-	-	-	-	-	-	-	-	-	-
SEED SHRIMPS										
Cl. Ostracoda	4	5	3	1	-	118	122	32	27	19
FAIRY SHRIMP										
O. Notostraca										
Lepidurus arcticus	-	-	-	-	-	-	-	-	-	-
WATER SCUDS										
O. Amphipoda										
F. Gammaracanthidae										
Gammaracanthus	-	-	-	-	-	-	-	-	-	-
INSECTS										
Cl. Insecta										
CADDISFLIES										
O. Trichoptera										
F. Apataniidae										
Apatania	-	-	-	-	-	-	-	-	-	-
F. Limnephilidae										
Grensia praeterita	1	-	-	-	-	-	-	-	-	-
TRUE FLIES										
O. Diptera										
MIDGES										
F. Chironomidae										
chironomid pupae	**15**	**15**	**4**	**21**	**6**	**16**	**24**	**28**	**14**	**16**
S.F. Chironominae										
Chironomus	-	-	-	-	-	-	-	-	-	-
Cladotanytarsus	-	-	-	-	-	-	-	-	-	-
Constempellina	-	-	-	-	-	-	-	-	-	-
Corynocera ambigua	-	-	-	-	-	-	-	-	-	-
?Corynocera oliveri	-	-	-	-	-	-	-	-	-	-
Dicrotendipes	-	-	-	-	-	-	-	-	-	-
Micropsectra	3	3	-	4	1	8	18	14	7	5
Microtendipes	1	-	2	-	-	-	-	-	-	-
Parachironomus	-	-	-	-	-	-	-	-	-	-
Paracladopelma	-	-	-	-	-	-	-	-	-	-
Paratanytarsus	-	1	-	1	-	40	76	48	15	29
Polypedilum	-	-	-	-	-	-	-	-	-	-
Sergentia	-	-	-	-	-	-	-	-	-	-
Stempellinella	1	4	4	11	1	-	-	-	-	1
Stictochironomus	6	4	11	1	2	16	12	28	4	9
Tanytarsus	4	4	-	6	-	6	2	6	5	2
S.F. Diamesinae										
Pagastia	-	-	-	-	-	-	-	-	-	-
Protanypus	1	-	1	1	-	-	-	-	-	-
Potthastia	-	-	-	-	-	-	-	-	-	-
Pseudodiamesa	-	-	-	-	-	-	-	-	-	-
S.F. Orthocladiinae										
Abiskomyia	-	-	-	-	-	7	2	-	-	-
Corynoneura	-	-	-	-	-	-	-	-	-	-
Cricotopus	-	-	-	-	-	-	-	-	-	-
Cricotopus/Orthocladius	-	-	-	-	-	-	-	-	-	-
Heterotrissocladius	-	-	1	-	1	-	14	8	1	4
Hydrobaenus	-	-	-	-	1	-	-	-	-	-
Mesocricotopus	-	-	-	-	-	-	2	-	-	-
Nanocladius	-	-	-	-	-	-	-	-	-	-
Paracladius	-	-	-	-	-	-	4	2	-	-
Parakiefferiella	-	-	-	-	-	-	-	-	-	-
Psectrocladius	2	2	1	1	2	20	14	20	1	5
Zalutschia	1	-	3	1	-	-	-	-	-	-
Orthocladiinae *Genus "Greenland"*	-	-	-	-	-	2	-	2	-	-
indeterminate	-	-	-	-	-	-	-	-	-	-
S.F. Prodiamesinae										
Monodiamesa	3	2	1	-	3	4	2	2	2	1
S.F. Tanypodinae										
Ablabesmyia	3	2	1	-	-	-	-	-	-	-
Procladius	6	7	6	8	10	31	42	18	5	11
Thienemannimyia complex	-	-	-	-	-	1	2	2	-	-
F. Empididae										
Chelifera/Metachela	-	-	-	-	-	3	-	2	-	1
Clinocera	-	-	-	-	-	-	-	-	-	-
pupae	-	-	-	-	-	-	-	-	-	-

Table E1-2. Raw benthic invertebrate data from the Meadowbank Study Lakes 2021.

Program	Meadowbank									
Location	Second Portage Lake					Third Portage Lake - East Basin				
Station	SP					TPE				
Control/Impact?	Impact					Impact				
Replicate	1	2	3	4	5	1	2	3	4	5
Date	6-Aug-21	6-Aug-21	6-Aug-21	6-Aug-21	5-Aug-21	8-Aug-21	8-Aug-21	8-Aug-21	8-Aug-21	8-Aug-21
Sample Depth (m)	9.2	8.9	9.0	9.3	8.8	8.1	9.2	9.3	9.0	9.3
MOLLUSCS										
P. Mollusca										
SNAILS										
Cl. Gastropoda										
F. Valvatidae										
Valvata	-	-	-	-	-	-	2	-	-	-
CLAMS										
Cl. Bivalvia										
F. Sphaeriidae										
Pisidium/Cyclocalyx	-	-	1	-	2	7	4	-	5	15
Pisidium (Cyclocalyx/Neopisidium)	11	20	14	7	7	22	52	32	12	21
Sphaerium nitidum	-	-	-	-	-	-	-	-	-	-
R (Richness) - totals [2,3]										
Total	15	14	17	12	10	16	18	14	12	14
Oligochaete	0	1	2	1	0	3	2	1	1	2
Insect	12	9	10	9	8	11	12	12	8	10
Mollusc	1	1	2	1	2	2	3	1	2	2
Other[4]	2	3	3	1	0	0	1	0	1	0
Abundance (raw) - totals [5,6]										
Total	61	70	57	64	36	189	294	220	73	122
Oligochaete	0	2	3	1	0	6	18	8	1	2
Insect	47	44	35	55	27	154	214	180	54	84
Mollusc	11	20	15	7	9	29	58	32	17	36
Other[4]	3	4	4	1	0	0	4	0	1	0
N (Abundance) - #/m²										
Total	1,326	1,522	1,239	1,391	783	4,109	6,391	4,783	1,587	2,652
Oligochaete	0	43	65	22	0	130	391	174	22	43
Insect	1,022	957	761	1,196	587	3,348	4,652	3,913	1,174	1,826
Mollusc	239	435	326	152	196	630	1,261	696	370	783
Other[4]	65	87	87	22	0	0	87	0	22	0

Notes:

1. Benthic invertebrate count data shown in this table are from composite of two grabs sieved to 500 µm.
2. Richness totals exclude P. Nemata, Cl. Ostracoda, indeterminates (O. Acarina, F. Lumbriculidae), immatures (S.F. Tubificinae, O. Acarina), and pupae.
3. Pupae and immatures (bolded values) are excluded from the richness totals if other life stages are present in the replicate sample.
4. Other Taxa include: Cl. Turbellaria, F. Acalyptonotidae, F. Hygrobatidae, F. Lebertiidae, F. Oxidae, F. Pionidae, O. Harpacticoida, O. Notostraca, and F. Gammaracanthidae.
5. Abundance totals exclude P. Nemata and Cl. Ostracoda.
6. Raw abundance from two grabs (grab area = 0.023 m^2).

Table E1-2. Raw benthic invertebrate data from the Meadowbank Study Lakes 2021.

Program	**Meadowbank**									
Location	**Third Portage Lake - North Basin**					**Wally Lake**				
Station	**TPN**					**WAL**				
Control/Impact?	Impact					Impact				
Replicate	1	2	3	4	5	1	2	3	4	5
Date	7-Aug-21	7-Aug-21	7-Aug-21	7-Aug-21	7-Aug-21	10-Aug-21	10-Aug-21	10-Aug-21	10-Aug-21	10-Aug-21
Sample Depth (m)	8.7	8.3	8.3	7.4	7.5	8.9	7.4	8.9	8.6	8.4
ROUNDWORMS										
P. Nemata	4	8	1	5	2	4	1	-	3	2
FLATWORMS										
P. Platyhelminthes										
Cl. Turbellaria										
indeterminate	-	-	1	-	-	1	4	2	-	-
ANNELIDS										
P. Annelida										
WORMS										
Cl. Oligochaeta										
F. Enchytraeidae	-	-	-	-	-	-	-	-	-	-
F. Naididae	-	-	-	-	-	-	-	-	-	-
S.F. Tubificinae										
Limnodrilus hoffmeisteri	-	-	-	-	-	-	-	-	-	-
Potamothrix bavaricus	-	-	-	-	-	-	-	-	-	-
Slavina appendiculata	-	-	-	-	-	-	-	-	-	-
Tasserkidrilus americanus	-	-	-	-	-	-	-	-	-	-
immatures with hair chaetae	-	1	2	1	-	-	-	-	-	-
immatures without hair chaetae	-	-	-	-	-	-	-	-	-	-
S.F. Rhyacodrilinae										
Rhyacodrilus coccineus	-	1	1	1	-	-	-	-	-	-
Rhyacodrilus montana	-	-	-	-	-	-	-	-	-	-
F. Lumbriculidae										
Lumbriculus	1	1	-	-	-	1	2	-	-	-
ARTHROPODS										
P. Arthropoda										
MITES										
Cl. Arachnida										
O. Acarina	-	-	-	-	-	-	-	-	-	-
F. Acalyptonotidae										
Acalyptonotus	-	5	-	2	-	1	-	-	-	-
F. Hygrobatidae										
Hygrobates	-	-	-	-	-	-	-	-	-	-
F. Lebertiidae										
Lebertia	-	1	-	-	1	-	-	-	-	-
F. Oxidae										
Oxus	1	-	-	-	-	-	-	-	1	-
F. Pionidae										
indeterminate	-	-	-	-	-	-	-	-	-	-
HARPACTICOIDS										
O. Harpacticoida	-	-	-	-	-	-	-	-	-	-
SEED SHRIMPS										
Cl. Ostracoda	18	14	11	21	18	2	1	10	4	6
FAIRY SHRIMP										
O. Notostraca										
Lepidurus arcticus	-	-	-	-	-	-	-	-	-	-
WATER SCUDS										
O. Amphipoda										
F. Gammaracanthidae										
Gammaracanthus	-	-	-	-	-	-	-	-	-	-
INSECTS										
Cl. Insecta										
CADDISFLIES										
O. Trichoptera										
F. Apataniidae										
Apatania	-	-	-	-	-	-	-	-	-	-
F. Limnephilidae										
Grensia praeterita	3	-	-	-	-	1	-	-	-	-
TRUE FLIES										
O. Diptera										
MIDGES										
F. Chironomidae										
chironomid pupae	**11**	**21**	35	**34**	19	7	13	12	-	**11**
S.F. Chironominae										
Chironomus	-	-	-	-	-	-	-	-	-	-
Cladotanytarsus	-	-	-	-	-	2	-	2	-	-
Constempellina	-	-	-	-	-	-	-	-	-	-
Corynocera ambigua	-	-	-	-	-	8	4	6	-	-
?Corynocera oliveri	-	-	-	-	-	-	-	-	-	-
Dicrotendipes	-	-	-	-	-	-	-	-	-	-
Micropsectra	7	6	8	6	10	1	-	1	-	1
Microtendipes	-	-	-	-	-	-	-	-	-	-
Parachironomus	-	-	-	-	-	-	-	-	-	-
Paracladopelma	-	-	-	-	1	-	-	-	-	-
Paratanytarsus	1	2	3	3	6	1	-	1	-	-
Polypedilum	-	-	-	-	-	-	-	-	-	-
Sergentia	1	-	-	-	-	-	-	-	-	-
Stempellinella	-	-	-	-	2	-	1	-	-	2
Stictochironomus	4	53	52	11	-	18	20	28	8	16
Tanytarsus	3	18	21	8	6	4	-	1	1	-
S.F. Diamesinae										
Pagastia	-	-	-	-	-	-	-	-	-	-
Protanypus	-	-	-	-	-	-	1	-	-	-
Potthastia	-	-	-	-	-	-	-	-	-	-
Pseudodiamesa	-	-	-	-	-	-	-	-	-	-
S.F. Orthocladiinae										
Abiskomyia	-	-	-	-	-	-	-	-	-	-
Corynoneura	-	-	-	-	-	-	-	-	-	-
Cricotopus	-	-	-	-	-	-	-	-	-	-
Cricotopus/Orthocladius	-	-	-	-	-	-	-	-	-	-
Heterotrissocladius	9	6	4	3	23	-	1	-	-	1
Hydrobaenus	-	-	-	1	-	-	-	-	-	-
Mesocricotopus	-	1	-	-	-	-	-	-	-	-
Nanocladius	-	-	-	-	-	-	-	-	-	-
Paracladius	1	-	-	-	-	-	-	-	-	-
Parakiefferiella	-	3	-	-	-	-	-	-	-	-
Psectrocladius	1	-	4	-	-	-	-	-	-	1
Zalutschia	1	10	-	5	-	-	-	-	1	-
Orthocladiinae *Genus "Greenland"*	-	-	1	-	-	-	-	-	-	-
indeterminate	1	-	-	-	-	-	-	-	-	-
S.F. Prodiamesinae										
Monodiamesa	1	1	2	1	-	2	4	3	1	1
S.F. Tanypodinae										
Ablabesmyia	-	-	-	-	-	1	-	1	-	-
Procladius	7	9	6	7	3	4	7	4	2	4
Thienemannimyia complex	1	-	2	5	1	-	-	-	-	-
F. Empididae										
Chelifera/Metachela	-	-	-	-	-	-	-	-	-	-
Clinocera	-	-	-	-	-	-	-	-	-	-
pupae	-	-	-	-	-	-	-	-	-	-

Table E1-2. Raw benthic invertebrate data from the Meadowbank Study Lakes 2021.

Program	Meadowbank									
Location	Third Portage Lake - North Basin					Wally Lake				
Station	TPN					WAL				
Control/Impact?	Impact					Impact				
Replicate	1	2	3	4	5	1	2	3	4	5
Date	7-Aug-21	7-Aug-21	7-Aug-21	7-Aug-21	7-Aug-21	10-Aug-21	10-Aug-21	10-Aug-21	10-Aug-21	10-Aug-21
Sample Depth (m)	8.7	8.3	8.3	7.4	7.5	8.9	7.4	8.9	8.6	8.4
MOLLUSCS										
P. Mollusca										
SNAILS										
Cl. Gastropoda										
F. Valvatidae										
Valvata	-	-	-	-	-	-	-	-	-	-
CLAMS										
Cl. Bivalvia										
F. Sphaeriidae										
Pisidium/Cyclocalyx	1	10	12	4	1	7	11	13	8	5
Pisidium (Cyclocalyx/Neopisidium)	-	12	23	11	6	30	22	26	14	15
Sphaerium nitidum	-	-	-	-	-	1	-	-	-	1
R (Richness) - totals [2,3]										
Total	17	17	15	15	11	16	11	12	8	10
Oligochaete	1	3	2	2	0	1	1	0	0	0
Insect	14	10	10	10	8	10	7	9	5	7
Mollusc	1	2	2	2	2	3	2	2	2	3
Other[4]	1	2	1	1	1	2	1	1	1	0
Abundance (raw) - totals [5,6]										
Total	55	161	177	103	79	90	90	100	36	58
Oligochaete	1	3	3	2	0	1	2	0	0	0
Insect	52	130	138	84	71	49	51	59	13	37
Mollusc	1	22	35	15	7	38	33	39	22	21
Other[4]	1	6	1	2	1	2	4	2	1	0
N (Abundance) - #/m²										
Total	1,196	3,500	3,848	2,239	1,717	1,957	1,957	2,174	783	1,261
Oligochaete	22	65	65	43	0	22	43	0	0	0
Insect	1,130	2,826	3,000	1,826	1,543	1,065	1,109	1,283	283	804
Mollusc	22	478	761	326	152	826	717	848	478	457
Other[4]	22	130	22	43	22	43	87	43	22	0

Notes:

1. Benthic invertebrate count data shown in this table are from composite of two grabs sieved to 500 µm.
2. Richness totals exclude P. Nemata, Cl. Ostracoda, indeterminates (O. Acarina, F. Lumbriculidae), immatures (S.F. Tubificinae, O. Acarina), and pupae.
3. Pupae and immatures (bolded values) are excluded from the richness totals if other life stages are present in the replicate sample.
4. Other Taxa include: Cl. Turbellaria, F. Acalyptonotidae, F. Hygrobatidae, F. Lebertiidae, F. Oxidae, F. Pionidae, O. Harpacticoida, O. Notostraca, and F. Gammaracanthidae.
5. Abundance totals exclude P. Nemata and Cl. Ostracoda.
6. Raw abundance from two grabs (grab area = 0.023 m^2).

Figure E2-1. Oligochaete abundance (#/m²) from the Whale Tail Pit study lakes since 2015.

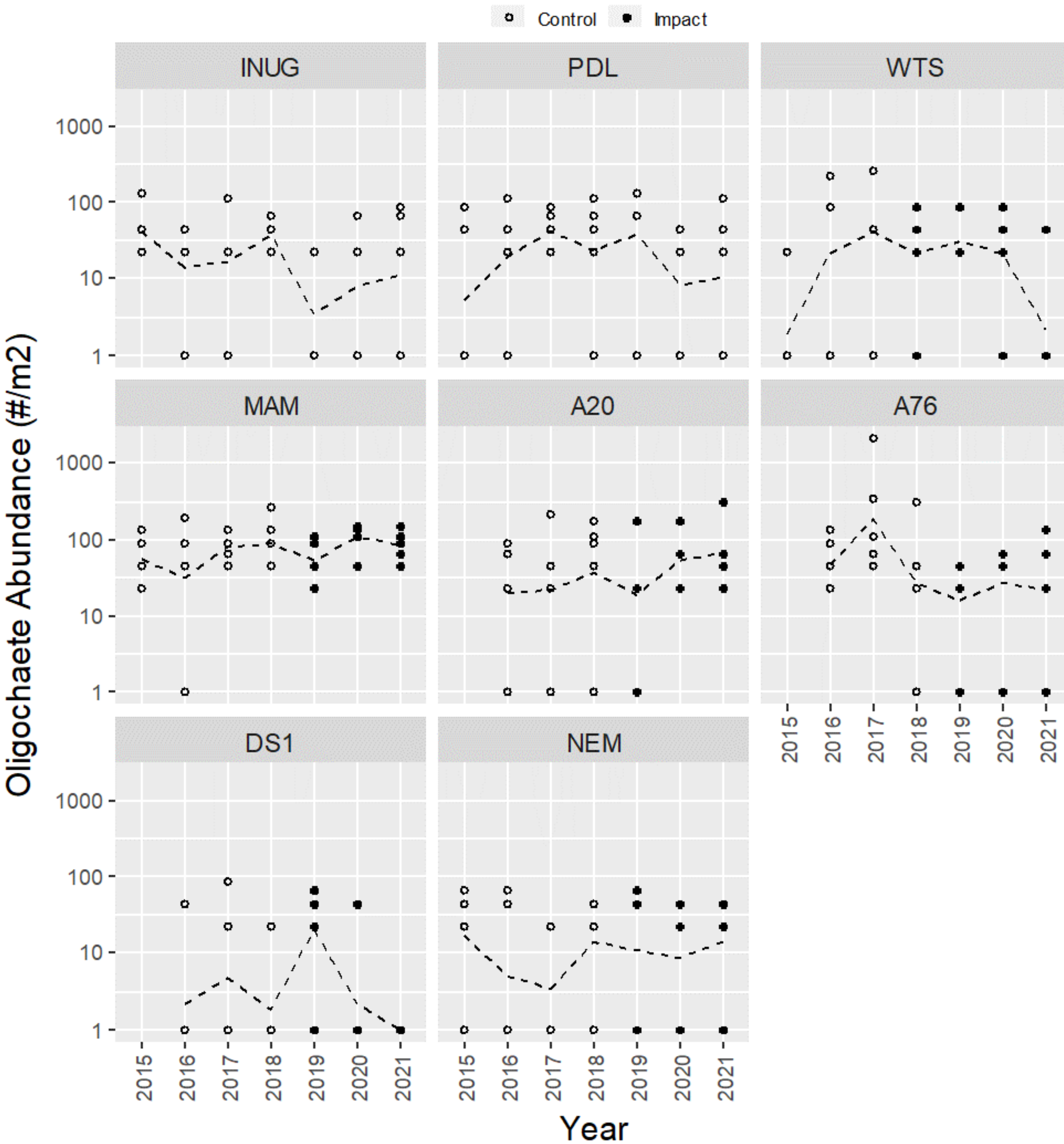


Figure E2-2. Insect abundance (#/m²) from the Whale Tail Pit study lakes since 2015.

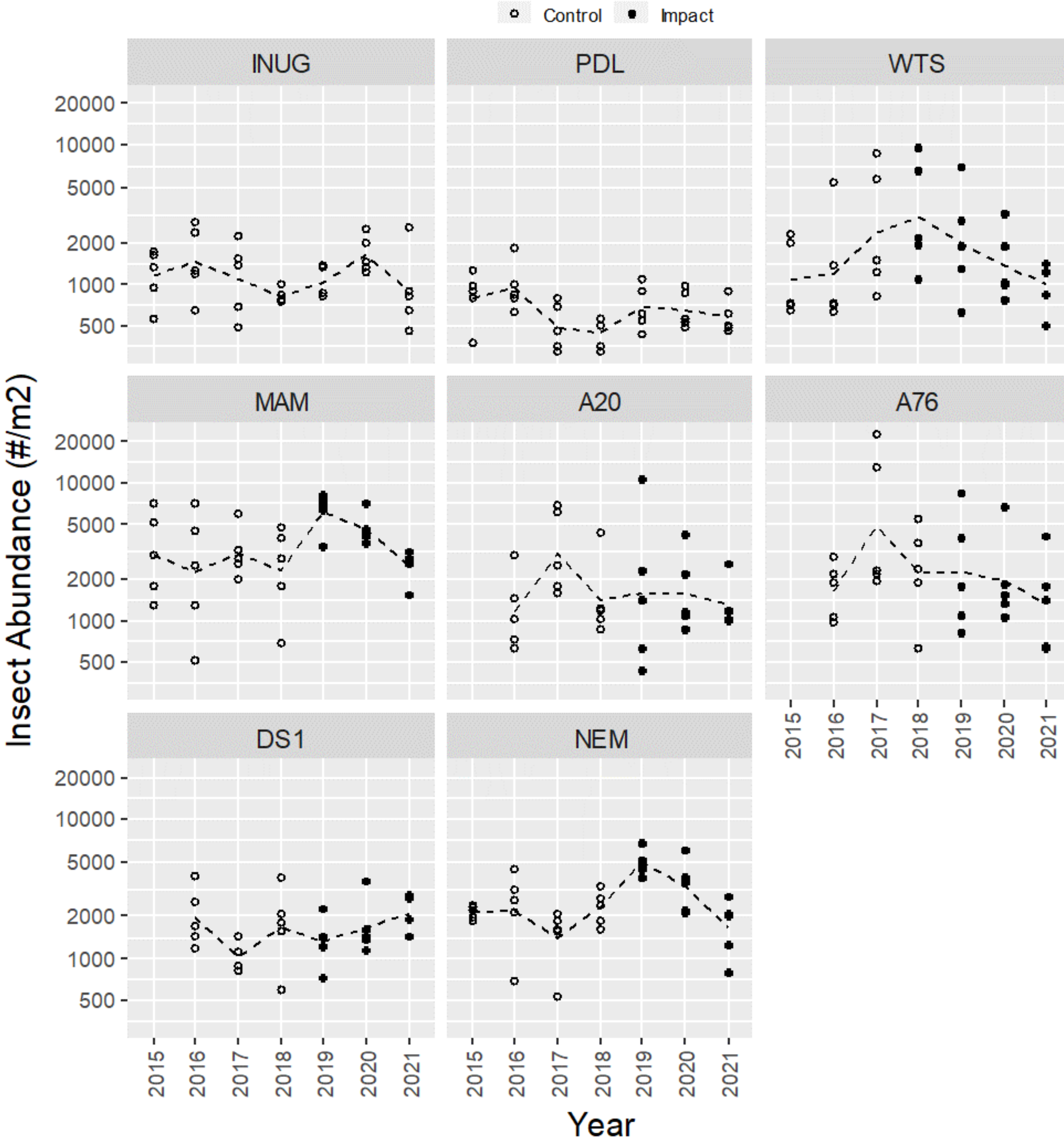


Figure E2-3. Mollusc abundance (#/m²) from the Whale Tail Pit study lakes since 2015.

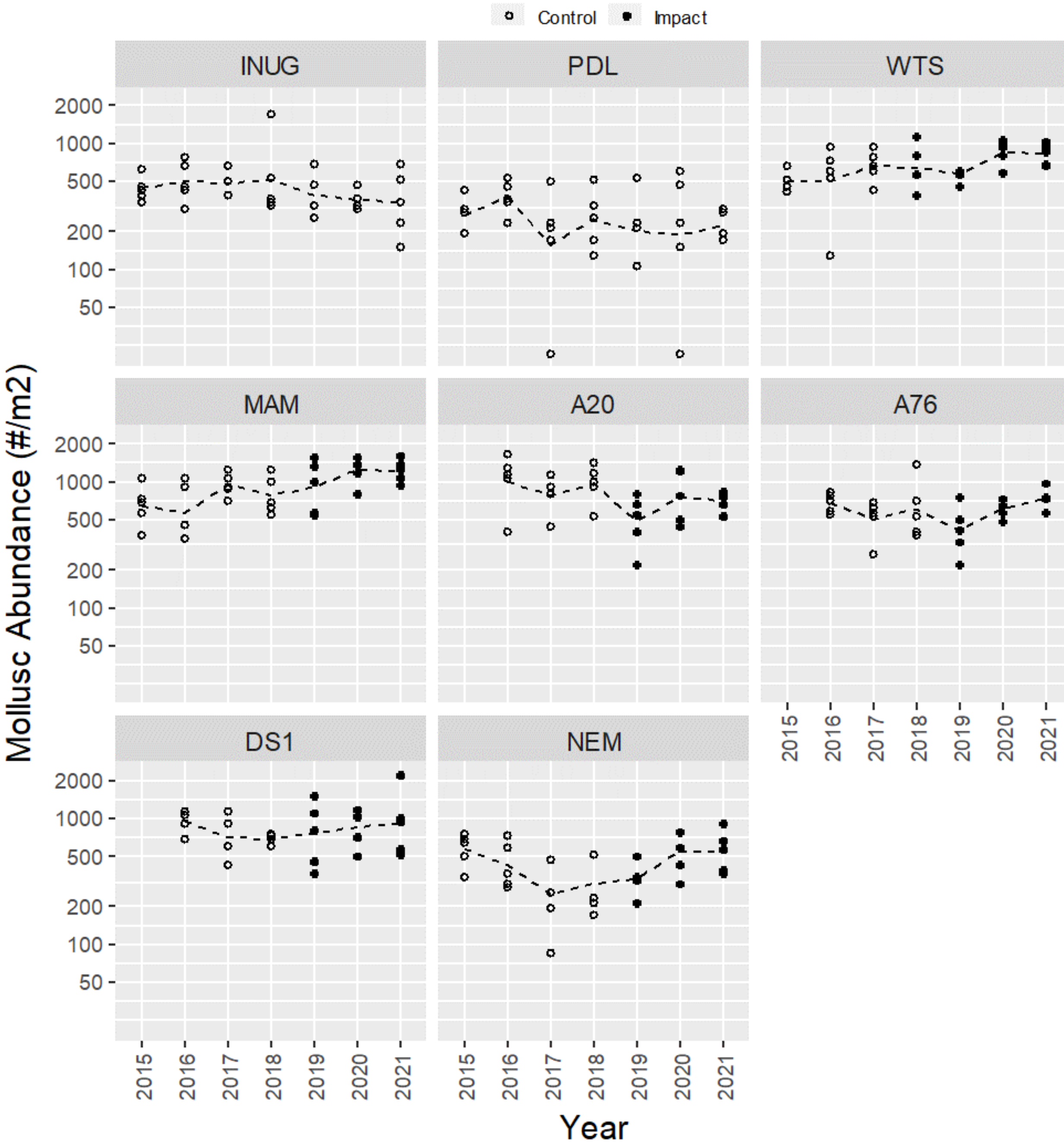


Figure E2-4. Other taxa abundance (#/m²) from the Whale Tail Pit study lakes since 2015.

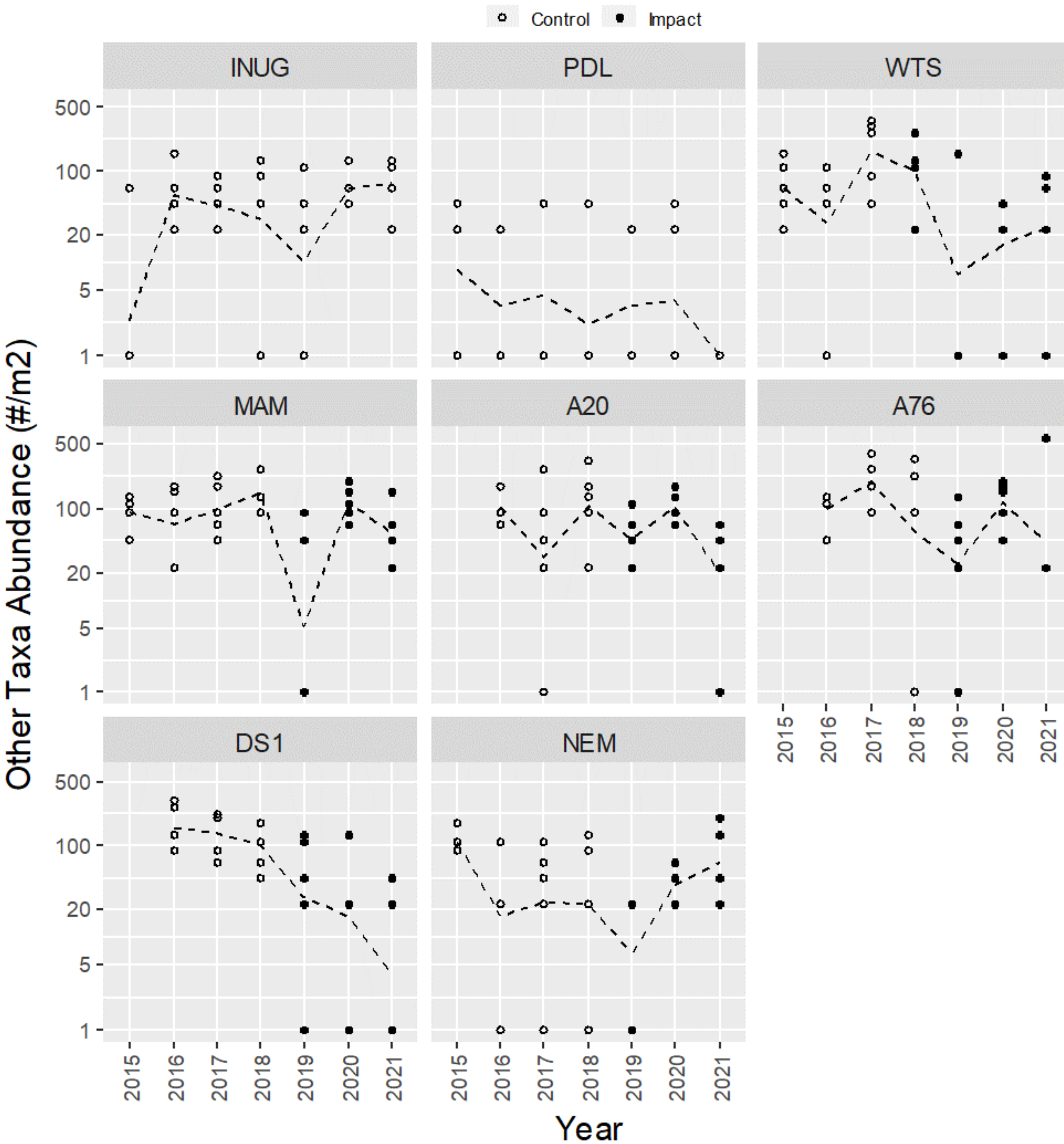


Figure E2-5. Oligochaete richness (# of taxa) from the Whale Tail Pit study lakes since 2015.

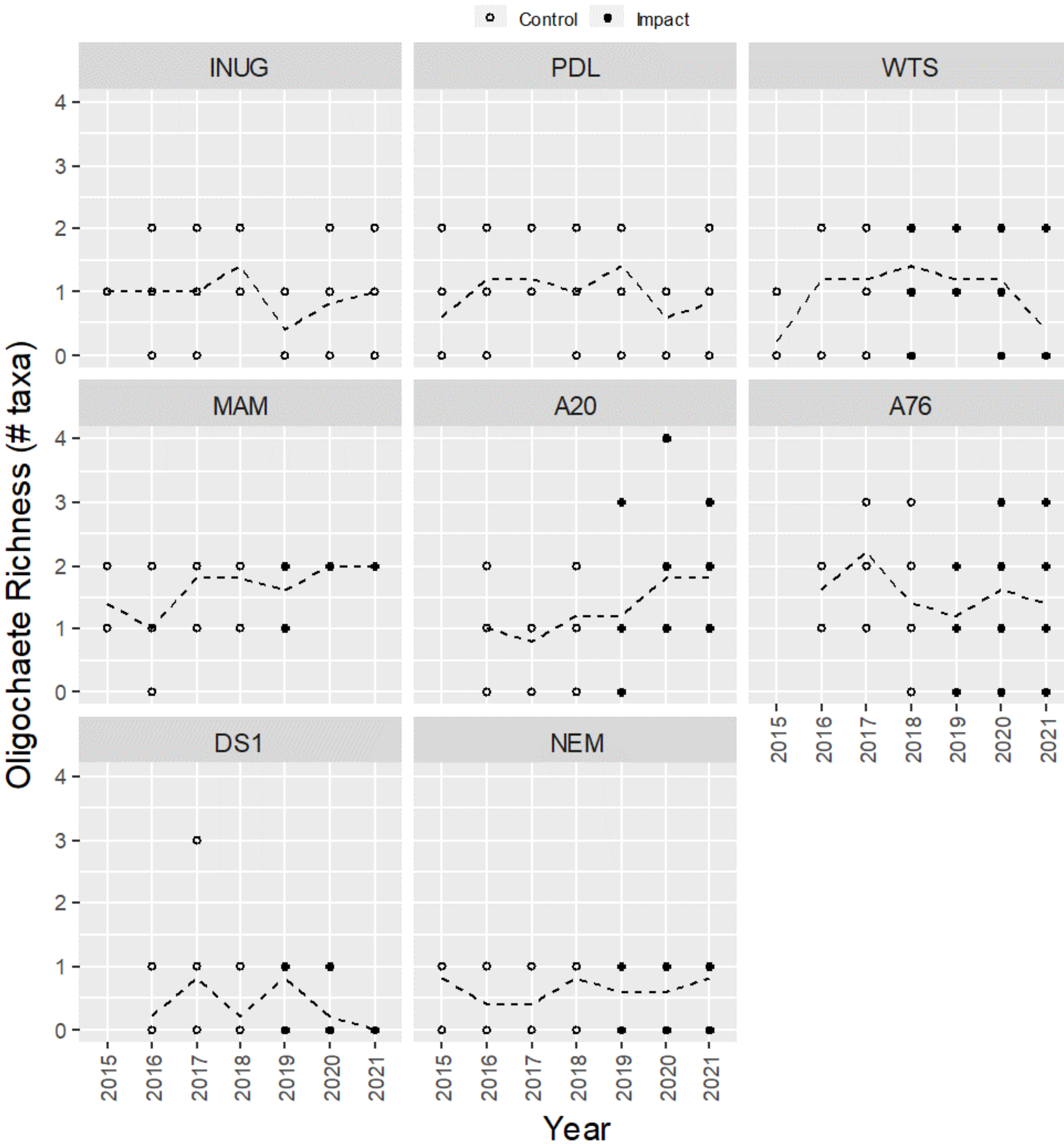


Figure E2-6. Insect richness (# of taxa) from the Whale Tail Pit study lakes since 2015.

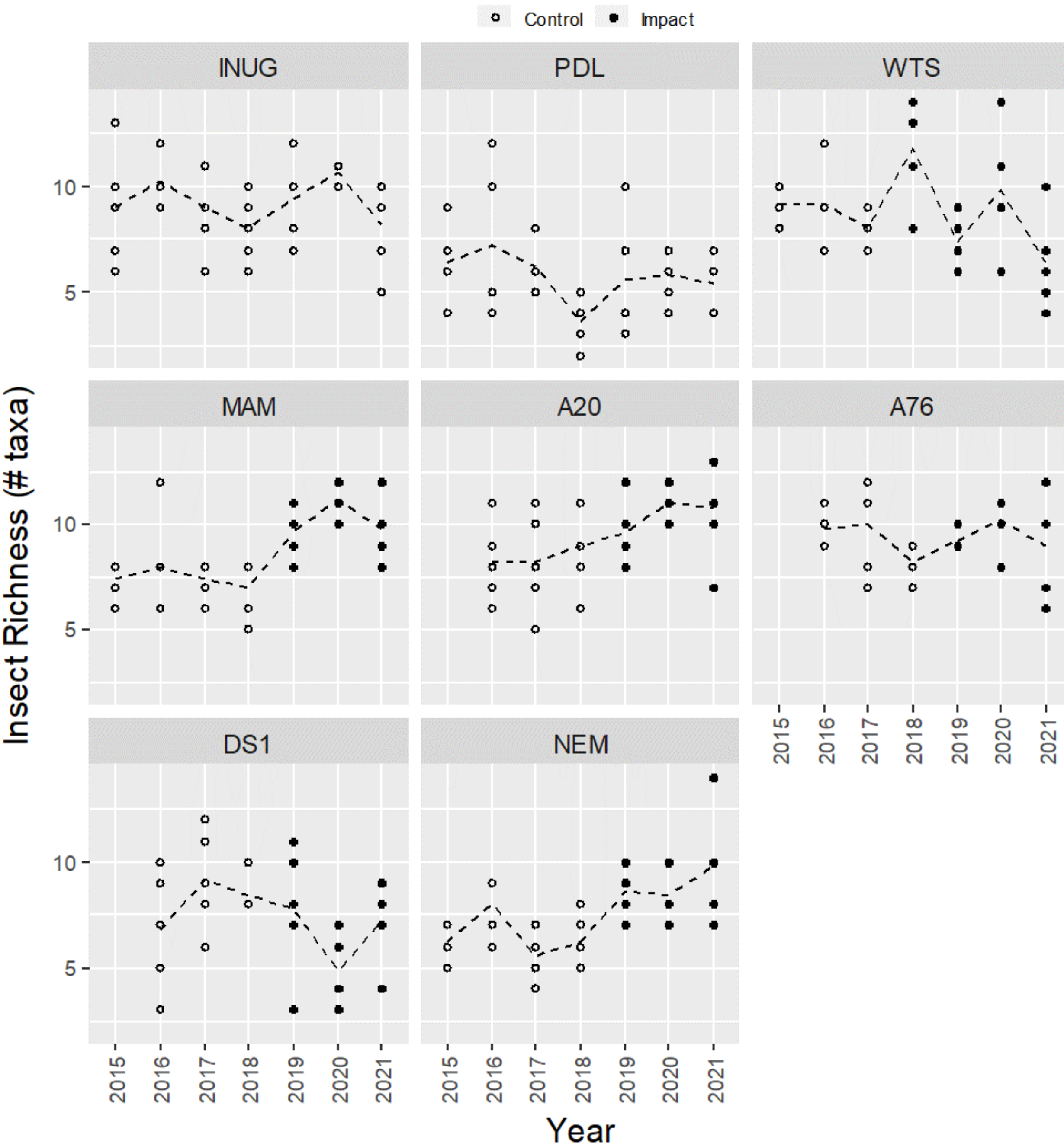


Figure E2-7. Mollusc richness (# of taxa) from the Whale Tail Pit study lakes since 2015.

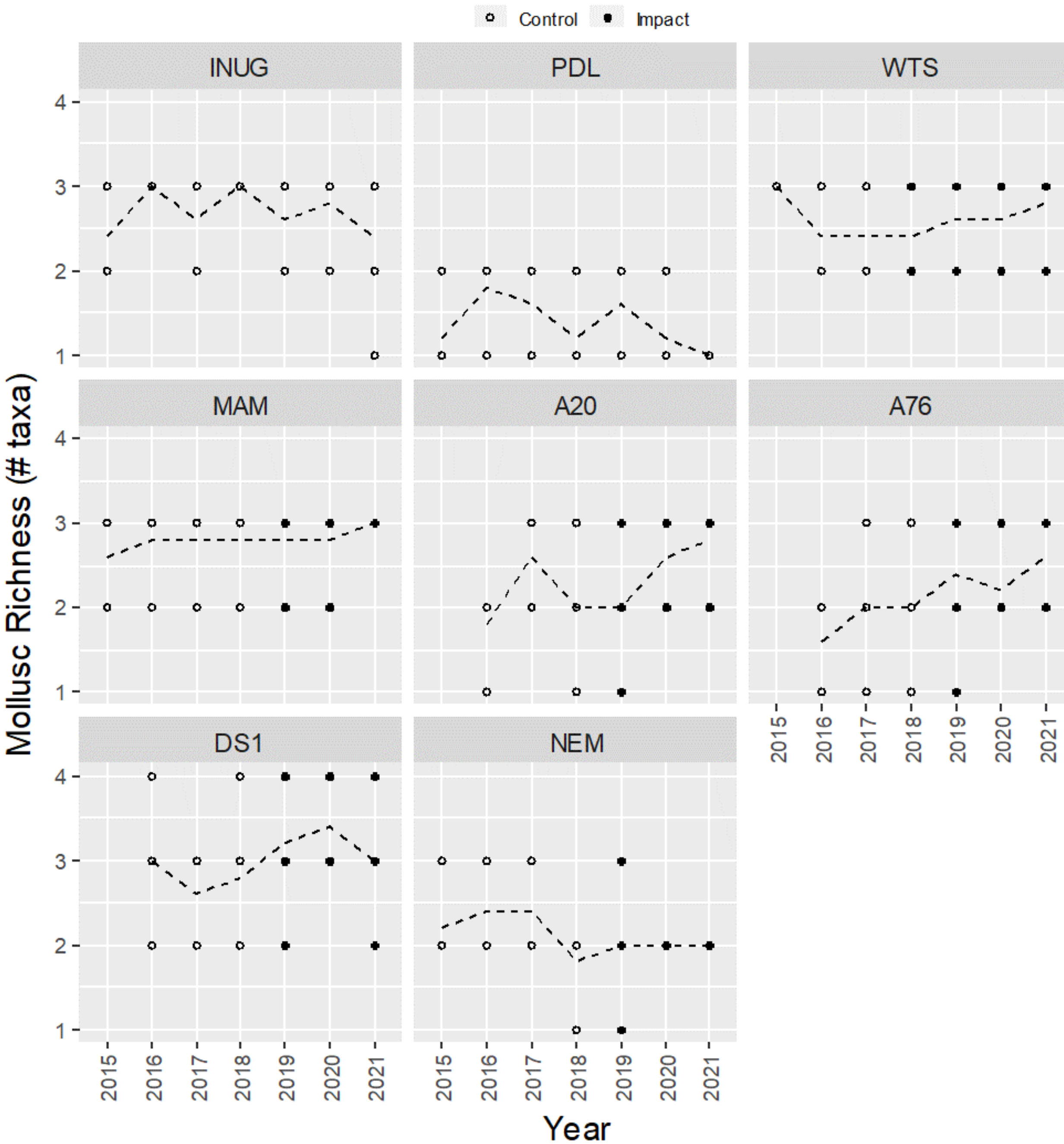


Figure E2-8. Other taxa richness (# of taxa) from the Whale Tail Pit study lakes since 2015.

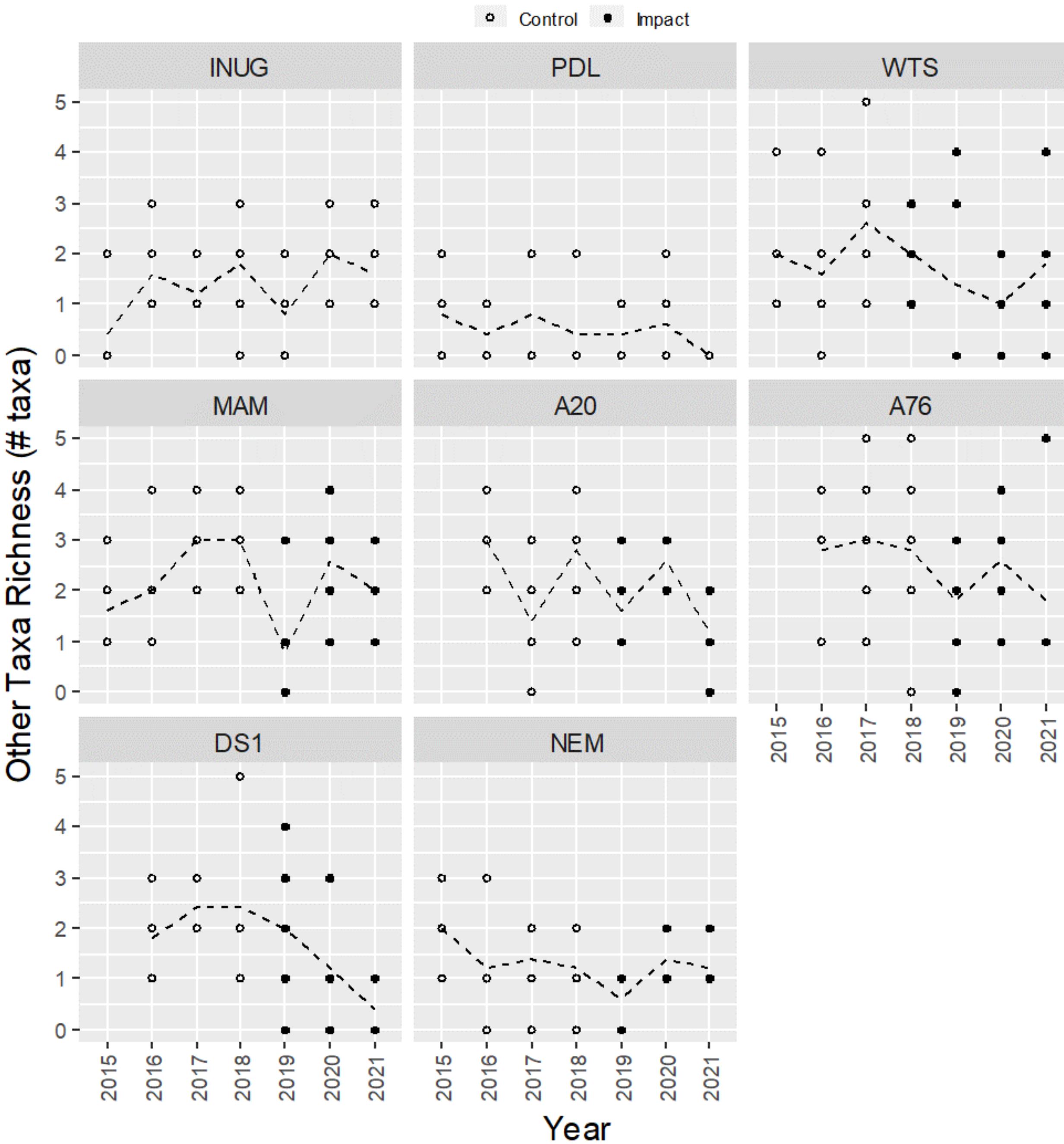


Figure E2-9. Simpson's Diversity for the benthic invertebrate community at the Whale Tail Pit study lakes since 2015.

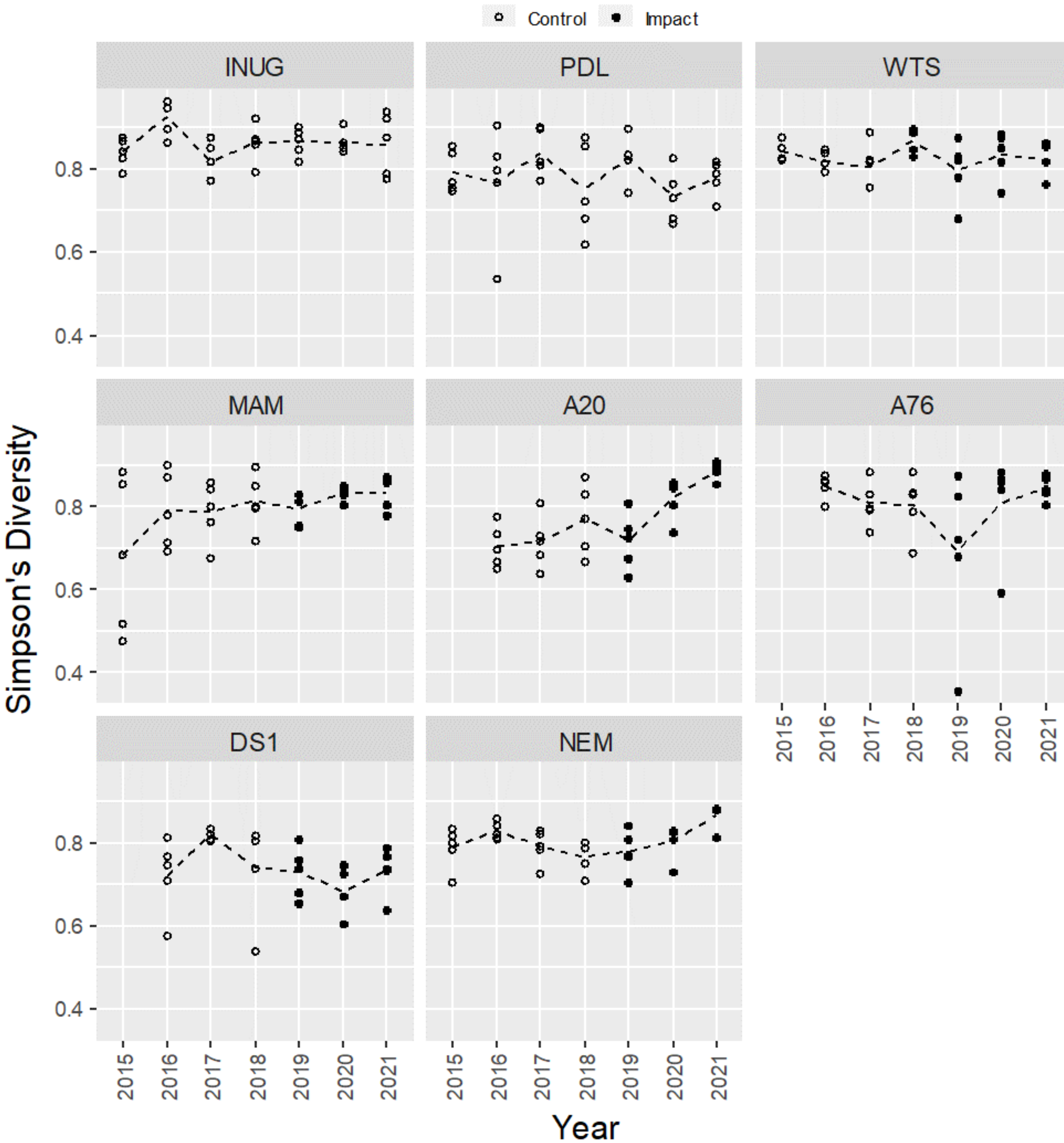
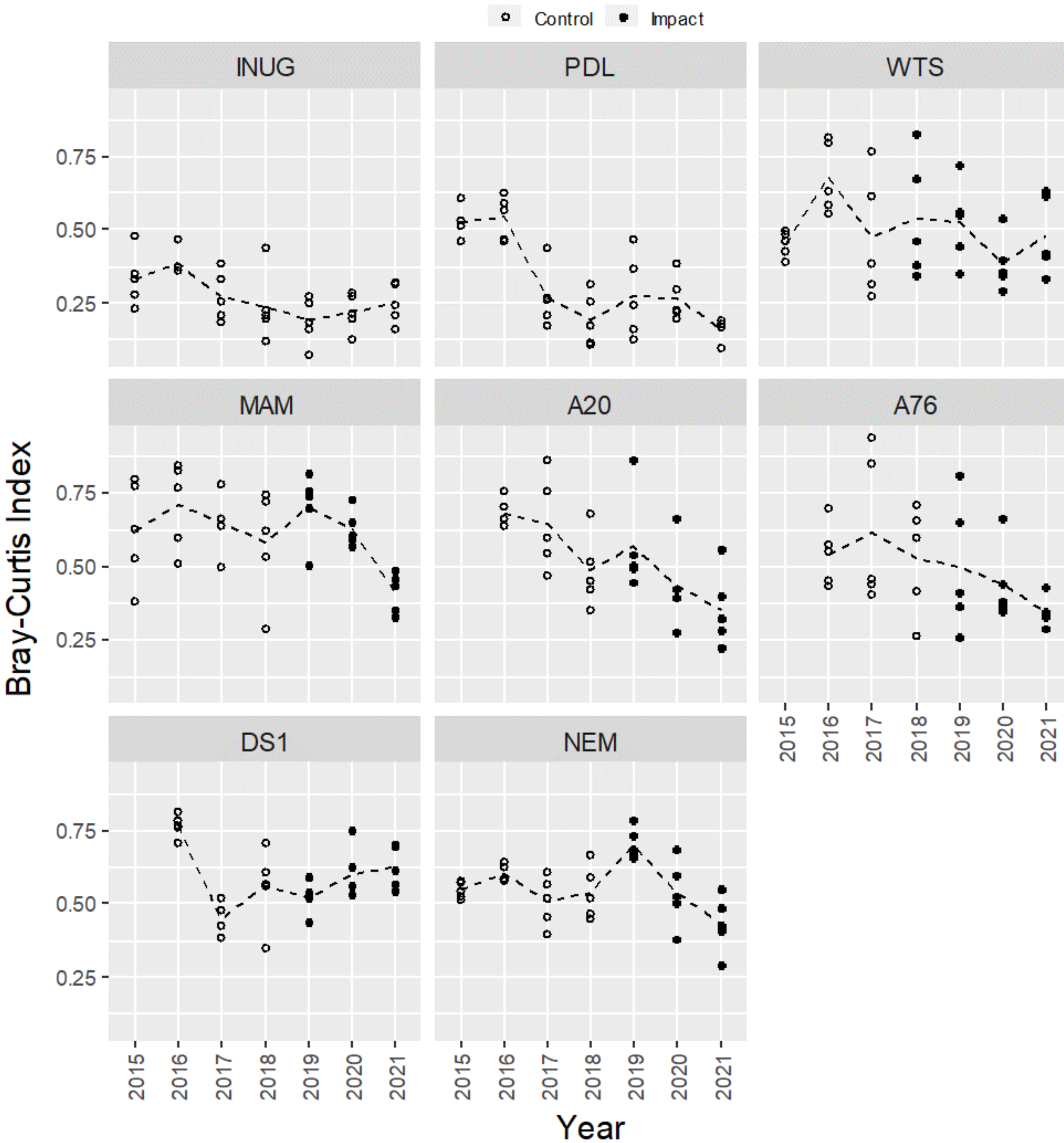


Figure E2-10. Bray-Curtis Index for the benthic invertebrate community at the Whale Tail Pit study lakes since 2015.



Appendix E3
Benthos Data – Baker Lake

LIST OF TABLES – APPENDIX E3

LIST OF FIGURES – APPENDIX E3

Table E3-1. Benthic invertebrate abundance (#/m2) and richness (# taxa) by major taxa group, Baker Lake, 2021.

Area-Replicate	Date	Depth (m)	Abundance (#/m^2)					Richness (# taxa)					Simpson's Diversity	Bray-Curtis Index
			Oligochaetes	Insects	Molluscs	Other Taxa[1]	TOTAL	Oligochaetes	Insects	Molluscs	Other Taxa[1]	TOTAL		
Baker Akilahaarjuk Point														
BAP-1	14-Aug-21	7.1	1,000	3,130	870	304	5,304	6	16	2	5	29	0.93	0.27
BAP-2	14-Aug-21	8.4	826	2,109	435	457	3,826	4	16	2	3	25	0.94	0.13
BAP-3	14-Aug-21	8.9	1,152	3,761	565	239	5,717	6	14	1	5	26	0.92	0.28
BAP-4	14-Aug-21	9.3	10,174	8,783	522	522	20,000	6	9	2	3	20	0.90	0.68
BAP-5	14-Aug-21	9.0	87	1,391	435	87	2,000	2	10	2	2	16	0.81	0.35
Area Mean			***2,648***	***3,835***	***565***	***322***	***7,370***	***4.8***	***13.0***	***1.8***	***3.6***	***23.2***	***0.90***	***0.34***
Baker Barge Dock														
BBD-1	15-Aug-21	9.2	65	6,022	457	43	6,587	1	13	2	1	17	0.75	0.52
BBD-2	15-Aug-21	8.4	0	1,783	0	43	1,826	0	12	0	1	13	0.78	0.32
BBD-3	15-Aug-21	9.2	65	7,630	43	43	7,783	3	12	1	1	17	0.55	0.67
BBD-4	15-Aug-21	9.1	43	8,652	22	22	8,739	2	12	1	1	16	0.59	0.69
BBD-5	15-Aug-21	9.4	217	6,957	1,000	65	8,239	2	11	3	2	18	0.81	0.57
Area Mean			***78***	***6,209***	***304***	***43***	***6,635***	***1.6***	***12.0***	***1.4***	***1.2***	***16.2***	***0.70***	***0.55***
Baker East Shore														
BES-1	16-Aug-21	9.3	43	1,283	196	348	1,870	1	9	1	3	14	0.91	0.15
BES-2	16-Aug-21	9	87	1,609	283	239	2,217	1	11	1	3	16	0.91	0.21
BES-3	16-Aug-21	9.3	43	1,130	261	435	1,870	2	10	1	4	17	0.91	0.25
BES-4	16-Aug-21	8.9	0	783	87	283	1,152	0	8	1	2	11	0.89	0.21
BES-5	16-Aug-21	8.5	0	630	413	435	1,478	0	9	1	3	13	0.85	0.28
Area Mean			***35***	***1,087***	***248***	***348***	***1,717***	***0.8***	***9.4***	***1.0***	***3.0***	***14.2***	***0.89***	***0.22***
Baker Proposed Jetty														
BPJ-1	15-Aug-21	8.8	152	2,957	0	478	3,587	2	13	0	2	17	0.87	0.39
BPJ-2	15-Aug-21	8.5	22	2,804	130	196	3,152	1	16	2	2	21	0.90	0.40
BPJ-3	15-Aug-21	8.1	87	2,370	0	22	2,478	3	10	0	1	14	0.87	0.40
BPJ-4	16-Aug-21	8.6	65	3,087	65	261	3,478	2	14	2	2	20	0.84	0.50
BPJ-5	15-Aug-21	8.4	87	2,283	543	543	3,457	1	12	2	2	17	0.89	0.29
Area Mean			***83***	***2,700***	***148***	***300***	***3,230***	***1.8***	***13.0***	***1.2***	***1.8***	***17.8***	***0.87***	***0.40***

Notes:

1. "Other taxa" includes flatworms (Turbellaria) and arthropods (Acalyptonotidae, Hygrobatidae, Lebertiidae, Oxidae, Pionidae, Harpacticoida, O. Notostraca, and Gammaracanthidae).

Table E3-2. Raw benthic invertebrate data from the Baker Lake, 2021.

Program	Baker Lake									
Location	Baker Akilahaarjuk Point					Baker Barge Dock				
Station	BAP					BBD				
Control/Impact?	Control					Impact				
Replicate	1	2	3	4	5	1	2	3	4	5
Date	14-Aug-21	14-Aug-21	14-Aug-21	14-Aug-21	14-Aug-21	15-Aug-21	15-Aug-21	15-Aug-21	15-Aug-21	15-Aug-21
Sample Depth (m)	7.1	8.4	8.9	9.3	9.0	9.2	8.4	9.2	9.1	9.4
ROUNDWORMS										
P. Nemata	7	11	8	104	1	4	9	6	10	1
FLATWORMS										
P. Platyhelminthes										
Cl. Turbellaria										
indeterminate	3	13	-	-	2	-	-	-	-	-
ANNELIDS										
P. Annelida										
WORMS										
Cl. Oligochaeta										
F. Enchytraeidae	8	-	2	20	3	-	-	1	1	-
F. Naididae										
S.F. Tubificinae										
Limnodrilus hoffmeisteri	6	4	2	-	-	-	-	-	-	-
Potamothrix bavaricus	2	4	-	19	-	-	-	-	-	-
Slavina appendiculata	2	-	-	39	-	-	-	-	-	-
Tasserkidrilus americanus	-	-	2	-	-	-	-	-	-	-
immatures with hair chaetae	8	7	18	192	-	-	-	1	-	1
immatures without hair chaetae	6	-	5	97	-	-	-	-	-	-
S.F. Rhyacodrilinae										
Rhyacodrilus coccineus	-	6	7	39	-	-	-	-	-	-
Rhyacodrilus montana	13	17	15	58	1	3	-	1	1	9
F. Lumbriculidae										
Lumbriculus	1	-	2	4	-	-	-	-	-	-
ARTHROPODS										
P. Arthropoda										
MITES										
Cl. Arachnida										
O. Acarina	1	-	-	-	-	-	-	-	-	1
F. Acalyptonotidae										
Acalyptonotus	3	1	1	4	-	-	-	-	-	-
F. Hygrobatidae										
Hygrobates	-	-	2	-	-	-	-	-	-	1
F. Lebertiidae										
Lebertia	6	7	2	-	2	2	2	2	1	2
F. Oxidae										
Oxus	1	-	3	-	-	-	-	-	-	-
F. Pionidae										
indeterminate	-	-	-	-	-	-	-	-	-	-
HARPACTICOIDS										
O. Harpacticoida	-	-	-	16	-	-	-	-	-	-
SEED SHRIMPS										
Cl. Ostracoda	5	3	11	28	-	21	4	16	5	11
FAIRY SHRIMP										
O. Notostraca										
Lepidurus arcticus	-	-	-	-	-	-	-	-	-	-
WATER SCUDS										
O. Amphipoda										
F. Gammaracanthidae										
Gammaracanthus	1	-	3	4	-	-	-	-	-	-
INSECTS										
Cl. Insecta										
CADDISFLIES										
O. Trichoptera										
F. Apataniidae										
Apatania	-	1	-	-	-	-	-	-	1	1
F. Limnephilidae										
Grensia praeterita	-	-	-	-	-	-	-	-	-	-
TRUE FLIES										
O. Diptera										
MIDGES										
F. Chironomidae										
chironomid pupae	29	16	14	96	35	24	21	40	53	60
S.F. Chironominae										
Chironomus	-	-	-	-	-	-	-	-	-	-
Cladotanytarsus	-	-	-	-	-	-	-	-	-	-
Constempellina	5	6	14	-	1	26	-	4	8	17
Corynocera ambigua	-	-	-	-	-	-	-	-	-	-
?Corynocera oliveri	-	-	-	-	-	-	-	-	-	-
Dicrotendipes	-	-	-	-	-	-	-	-	-	-
Micropsectra	10	3	2	68	2	23	2	16	8	24
Microtendipes	-	-	-	-	-	-	-	-	-	-
Parachironomus	-	-	-	-	-	-	-	-	-	-
Paracladopelma	1	4	5	-	3	2	1	-	-	-
Paratanytarsus	5	4	31	108	-	-	-	-	-	-
Polypedilum	1	-	-	-	-	5	5	-	2	-
Sergentia	-	-	-	-	-	-	1	-	-	-
Stempellinella	-	-	-	-	-	-	-	-	-	-
Stictochironomus	36	21	46	20	1	143	33	236	248	140
Tanytarsus	19	10	23	40	10	9	2	14	21	15
S.F. Diamesinae										
Pagastia	-	-	-	-	-	-	-	-	-	2
Protanypus	-	-	-	-	-	1	-	1	-	1
Potthastia	2	-	1	12	-	-	1	-	-	-
Pseudodiamesa	-	-	-	-	-	-	-	-	-	-
S.F. Orthocladiinae										
Abiskomyia	-	2	-	-	-	19	-	12	10	28
Corynoneura	-	-	-	-	-	-	-	-	-	-
Cricotopus	-	-	-	-	-	-	-	-	-	-
Cricotopus/Orthocladius	-	-	-	-	-	-	-	-	-	-
Heterotrissocladius	7	3	7	-	5	6	3	9	26	6
Hydrobaenus	1	1	1	4	-	-	-	-	-	-
Mesocricotopus	-	3	9	-	2	-	3	2	-	-
Nanocladius										
Paracladius	*2*	1	1	-	-	-	-	-	-	-
Parakiefferiella	-	-	-	-	-	-	1	-	-	-
Psectrocladius	-	-	-	-	-	-	-	-	-	-
Zalutschia	-	-	-	-	-	-	-	-	-	-
Orthocladiinae Genus "Greenland"	-	-	-	-	-	-	-	-	-	-
indeterminate	1	-	-	8	1	-	-	-	-	-
S.F. Prodiamesinae										
Monodiamesa	4	1	1	-	1	2	5	2	6	-
S.F. Tanypodinae										
Ablabesmyia	-	-	-	-	-	-	-	-	-	-
Procladius	16	15	11	44	3	12	4	11	12	24
Thienemannimyia complex	-	-	-	-	-	2	-	2	2	2
F. Empididae										
Chelifera/Metachela	4	4	4	4	-	2	-	2	1	-
Clinocera	-	1	-	-	-	-	-	-	-	-
pupae	1	1	3	-	-	1	-	-	-	-

Table E3-2. Raw benthic invertebrate data from the Baker Lake, 2021.

Program	**Baker Lake**									
Location	**Baker Akilahaarjuk Point**					**Baker Barge Dock**				
Station	**BAP**					**BBD**				
Control/Impact?	Control					Impact				
Replicate	1	2	3	4	5	1	2	3	4	5
Date	14-Aug-21	14-Aug-21	14-Aug-21	14-Aug-21	14-Aug-21	15-Aug-21	15-Aug-21	15-Aug-21	15-Aug-21	15-Aug-21
Sample Depth (m)	7.1	8.4	8.9	9.3	9.0	9.2	8.4	9.2	9.1	9.4
MOLLUSCS										
P. Mollusca										
SNAILS										
Cl. Gastropoda										
F. Valvatidae										
Valvata	-	-	-	-	-	-	-	-	-	1
CLAMS										
Cl. Bivalvia										
F. Sphaeriidae										
Pisidium/Cyclocalyx	21	7	-	8	5	7	-	-	1	15
Pisidium (Cyclocalyx/Neopisidium)	19	13	26	16	15	14	-	2	-	30
Sphaerium nitidum	-	-	-	-	-	-	-	-	-	-
R (Richness) - totals [2,3]										
Total	29	25	26	20	16	17	13	17	16	18
Oligochaete	6	4	6	6	2	1	0	3	2	2
Insect	16	16	14	9	10	13	12	12	12	11
Mollusc	2	2	1	2	2	2	0	1	1	3
Other[4]	5	3	5	3	2	1	1	1	1	2
Abundance (raw) - totals [5,6]										
Total	244	176	263	920	92	303	84	358	402	379
Oligochaete	46	38	53	468	4	3	0	3	2	10
Insect	144	97	173	404	64	277	82	351	398	320
Mollusc	40	20	26	24	20	21	0	2	1	46
Other[4]	14	21	11	24	4	2	2	2	1	3
Abundance - totals (#/m^2) [5]										
Total	5,304	3,826	5,717	20,000	2,000	6,587	1,826	7,783	8,739	8,239
Oligochaete	1,000	826	1,152	10,174	87	65	0	65	43	217
Insect	3,130	2,109	3,761	8,783	1,391	6,022	1,783	7,630	8,652	6,957
Mollusc	870	435	565	522	435	457	0	43	22	1,000
Other[4]	304	457	239	522	87	43	43	43	22	65

Notes:

1. Benthic invertebrate count data shown in this table are from composite of two grabs sieved to 500 µm.
2. Richness totals exclude P. Nemata, Cl. Ostracoda, indeterminates (O. Acarina, F. Lumbriculidae), immatures (S.F. Tubificinae, O. Acarina), and pupae.
3. Pupae and immatures (bolded values) are excluded from the richness totals if other life stages are present in the replicate sample.
4. Other Taxa include: Cl. Turbellaria, F. Acalyptonotidae, F. Hygrobatidae, F. Lebertiidae, F. Oxidae, F. Pionidae, O. Harpacticoida, O. Notostraca, and F. Gammaracanthidae.
5. Abundance totals exclude P. Nemata and Cl. Ostracoda.
6. Raw abundance from two grabs (grab area = 0.023 m^2).

Table E3-2. Raw benthic invertebrate data from the Baker Lake, 2021.

Program	Baker Lake									
Location	Baker East Shore					Baker Proposed Jetty				
Station	BES					BPJ				
Control/Impact?	Control					Impact				
Replicate	1	2	3	4	5	1	2	3	4	5
Date	16-Aug-21	16-Aug-21	16-Aug-21	16-Aug-21	16-Aug-21	15-Aug-21	15-Aug-21	15-Aug-21	16-Aug-21	15-Aug-21
Sample Depth (m)	9.3	9.0	9.3	8.9	8.5	8.8	8.5	8.1	8.6	8.4
ROUNDWORMS										
P. Nemata	10	17	20	3	7	4	14	4	5	10
FLATWORMS										
P. Platyhelminthes										
Cl. Turbellaria										
indeterminate	-	-	-	-	-	1	-	-	-	-
ANNELIDS										
P. Annelida										
WORMS										
Cl. Oligochaeta										
F. Enchytraeidae	2	-	1	-	-	-	-	2	1	-
F. Naididae										
S.F. Tubificinae										
Limnodrilus hoffmeisteri	-	-	-	-	-	-	-	-	-	-
Potamothrix bavaricus	-	-	-	-	-	1	-	-	-	-
Slavina appendiculata	-	-	-	-	-	-	-	-	-	-
Tasserkidrilus americanus	-	-	-	-	-	-	-	-	-	-
immatures with hair chaetae	-	-	-	-	-	3	-	1	-	-
immatures without hair chaetae	-	-	-	-	-	-	-	-	-	-
S.F. Rhyacodrilinae										
Rhyacodrilus coccineus	-	-	-	-	-	-	-	-	-	-
Rhyacodrilus montana	-	4	1	-	-	3	1	1	2	4
F. Lumbriculidae										
Lumbriculus	-	-	-	-	-	-	-	-	-	-
ARTHROPODS										
P. Arthropoda										
MITES										
Cl. Arachnida										
O. Acarina	-	6	-	1	-	4	-	-	1	1
F. Acalyptonotidae										
Acalyptonotus	1	2	2	1	1	-	-	-	-	1
F. Hygrobatidae										
Hygrobates	-	-	-	-	-	-	1	-	1	-
F. Lebertiidae										
Lebertia	14	8	16	12	17	21	8	1	11	24
F. Oxidae										
Oxus	1	1	1	-	2	-	-	-	-	-
F. Pionidae										
indeterminate	-	-	-	-	-	-	-	-	-	-
HARPACTICOIDS										
O. Harpacticoida	-	-	-	-	-	-	-	-	-	-
SEED SHRIMPS										
Cl. Ostracoda	1	4	7	1	-	-	8	-	-	4
FAIRY SHRIMP										
O. Notostraca										
Lepidurus arcticus	-	-	-	-	-	-	-	-	-	-
WATER SCUDS										
O. Amphipoda										
F. Gammaracanthidae										
Gammaracanthus	-	-	1	-	-	-	-	-	-	-
INSECTS										
Cl. Insecta										
CADDISFLIES										
O. Trichoptera										
F. Apataniidae										
Apatania	-	-	-	-	1	-	-	-	-	-
F. Limnephilidae										
Grensia praeterita	-	-	-	-	-	-	-	-	-	-
TRUE FLIES										
O. Diptera										
MIDGES										
F. Chironomidae										
chironomid pupae	12	19	11	7	2	24	31	27	52	29
S.F. Chironominae										
Chironomus	-	-	-	-	-	-	-	-	-	-
Cladotanytarsus	-	-	-	-	-	-	-	-	-	-
Constempellina	5	11	5	6	6	2	1	-	1	1
Corynocera ambigua	-	-	-	-	-	-	-	-	-	-
?Corynocera oliveri	-	-	-	-	-	-	-	-	-	-
Dicrotendipes	-	-	-	-	-	-	-	-	-	-
Micropsectra	-	-	-	-	-	4	18	11	8	14
Microtendipes	-	-	-	-	-	-	-	-	-	-
Parachironomus	-	-	-	-	-	-	-	-	-	-
Paracladopelma	-	-	-	1	1	1	-	-	3	1
Paratanytarsus	-	1	-	-	-	2	-	6	-	-
Polypedilum	-	-	-	-	-	-	-	-	-	-
Sergentia	-	-	-	-	-	-	-	2	-	-
Stempellinella	-	-	-	-	-	-	-	-	-	-
Stictochironomus	-	-	-	-	-	39	8	13	3	22
Tanytarsus	10	11	4	5	5	18	11	23	31	8
S.F. Diamesinae										
Pagastia	-	-	-	-	-	-	-	1	-	-
Protanypus	-	-	-	1	-	-	-	-	-	-
Potthastia	-	-	-	-	-	-	-	-	-	-
Pseudodiamesa	2	-	-	-	-	-	-	-	-	2
S.F. Orthocladiinae										
Abiskomyia	-	-	-	-	-	2	4	-	1	3
Corynoneura	1	-	-	-	-	-	-	-	-	-
Cricotopus	-	-	-	-	-	-	-	-	-	-
Cricotopus/Orthocladius	-	2	5	-	-	1	1	-	3	-
Heterotrissocladius	9	6	6	7	4	16	14	12	8	13
Hydrobaenus	-	-	-	-	-	-	1	-	-	-
Mesocricotopus	9	9	7	4	1	2	7	2	4	2
Nanocladius										
Paracladius	3	6	5	-	2	-	2	-	-	1
Parakiefferiella	-	-	3	-	-	-	1	-	-	-
Psectrocladius	-	-	-	-	-	-	-	-	-	-
Zalutschia	-	-	-	-	-	-	1	-	-	-
Orthocladiinae Genus "Greenland"	-	-	-	-	-	-	-	-	-	-
indeterminate	-	-	-	-	-	-	-	-	4	-
S.F. Prodiamesinae										
Monodiamesa	1	1	1	-	-	-	2	3	2	1
S.F. Tanypodinae										
Ablabesmyia	-	-	-	-	-	-	-	-	-	-
Procladius	7	4	3	4	5	21	21	9	18	8
Thienemannimyia complex	-	1	-	-	-	-	3	-	3	-
F. Empididae										
Chelifera/Metachela	-	2	2	-	2	3	2	-	1	-
Clinocera	-	-	-	-	-	-	-	-	-	-
pupae	-	1	-	1	-	1	1	-	-	-

Table E3-2. Raw benthic invertebrate data from the Baker Lake, 2021.

Program	Baker Lake									
Location	Baker East Shore					Baker Proposed Jetty				
Station	BES					BPJ				
Control/Impact?	Control					Impact				
Replicate	1	2	3	4	5	1	2	3	4	5
Date	16-Aug-21	16-Aug-21	16-Aug-21	16-Aug-21	16-Aug-21	15-Aug-21	15-Aug-21	15-Aug-21	16-Aug-21	15-Aug-21
Sample Depth (m)	9.3	9.0	9.3	8.9	8.5	8.8	8.5	8.1	8.6	8.4
MOLLUSCS										
P. Mollusca										
SNAILS										
Cl. Gastropoda										
F. Valvatidae										
Valvata	-	-	-	-	-	-	1	-	-	-
CLAMS										
Cl. Bivalvia										
F. Sphaeriidae										
Pisidium/Cyclocalyx	-	-	-	4	-	-	-	-	1	4
Pisidium (Cyclocalyx/Neopisidium)	9	13	12	-	19	-	5	-	2	21
Sphaerium nitidum	-	-	-	-	-	-	-	-	-	-
R (Richness) - totals [2,3]										
Total	14	16	17	11	13	17	21	14	20	17
Oligochaete	1	1	2	0	0	2	1	3	2	1
Insect	9	11	10	8	9	13	16	10	14	12
Mollusc	1	1	1	1	1	0	2	0	2	2
Other[4]	3	3	4	2	3	2	2	1	2	2
Abundance (raw) - totals [5,6]										
Total	86	102	86	53	68	165	145	114	160	159
Oligochaete	2	4	2	0	0	7	1	4	3	4
Insect	59	74	52	36	29	136	129	109	142	105
Mollusc	9	13	12	4	19	0	6	0	3	25
Other[4]	16	11	20	13	20	22	9	1	12	25
Abundance - totals (#/m^2) [5]										
Total	1,870	2,217	1,870	1,152	1,478	3,587	3,152	2,478	3,478	3,457
Oligochaete	43	87	43	0	0	152	22	87	65	87
Insect	1,283	1,609	1,130	783	630	2,957	2,804	2,370	3,087	2,283
Mollusc	196	283	261	87	413	0	130	0	65	543
Other[4]	348	239	435	283	435	478	196	22	261	543

Notes:

1. Benthic invertebrate count data shown in this table are from composite of two grabs sieved to 500 µm.
2. Richness totals exclude P. Nemata, Cl. Ostracoda, indeterminates (O. Acarina, F. Lumbriculidae), immatures (S.F. Tubificinae, O. Acarina), and pupae.
3. Pupae and immatures (bolded values) are excluded from the richness totals if other life stages are present in the replicate sample.
4. Other Taxa include: Cl. Turbellaria, F. Acalyptonotidae, F. Hygrobatidae, F. Lebertiidae, F. Oxidae, F. Pionidae, O. Harpacticoida, O. Notostraca, and F. Gammaracanthidae.
5. Abundance totals exclude P. Nemata and Cl. Ostracoda.
6. Raw abundance from two grabs (grab area = 0.023 m^2).

Figure E3-1. Oligochaete abundance (#/m²) from Baker Lake since 2008.

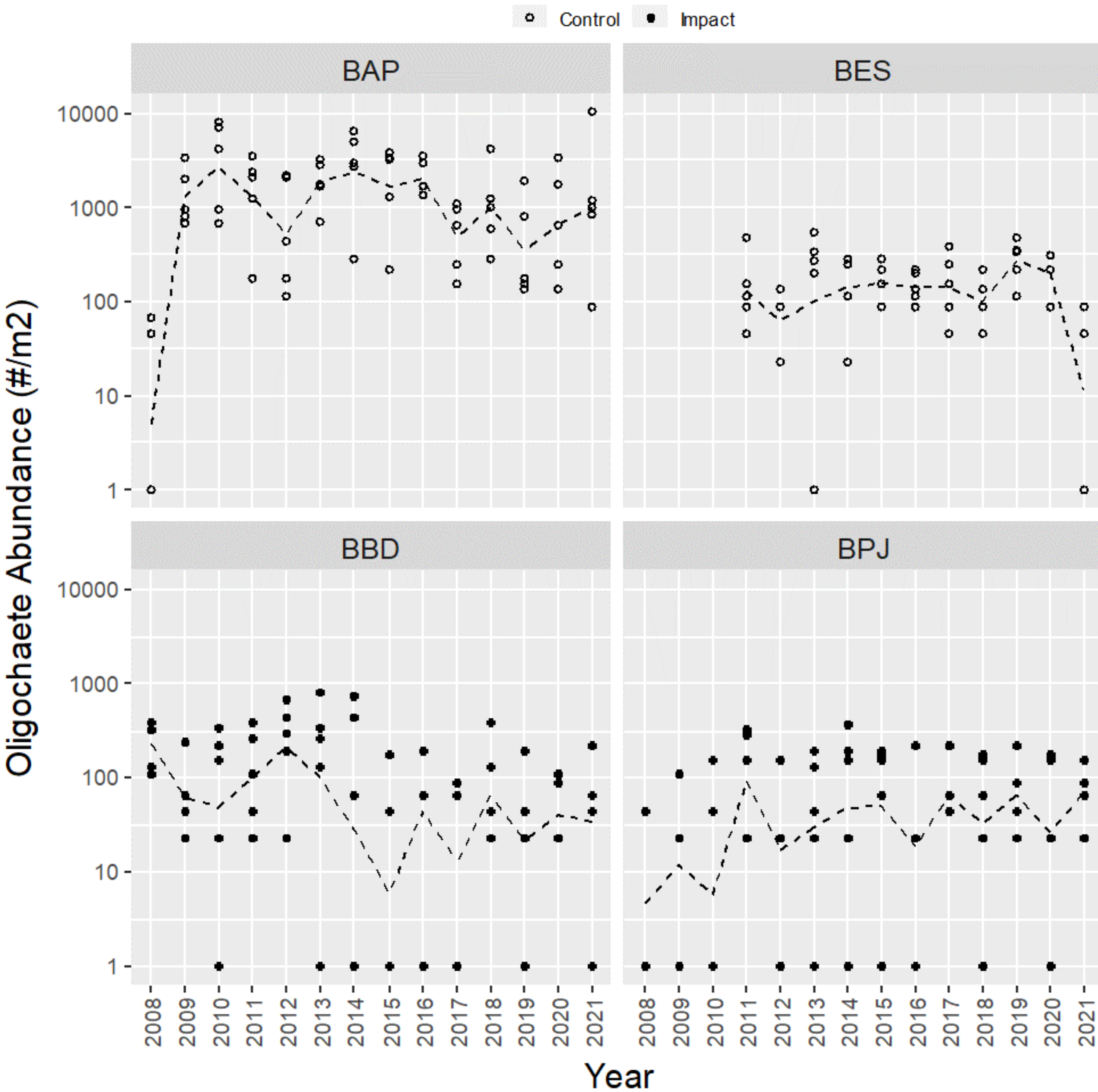


Figure E3-2. Insect abundance (#/m^2) from Baker Lake since 2008.

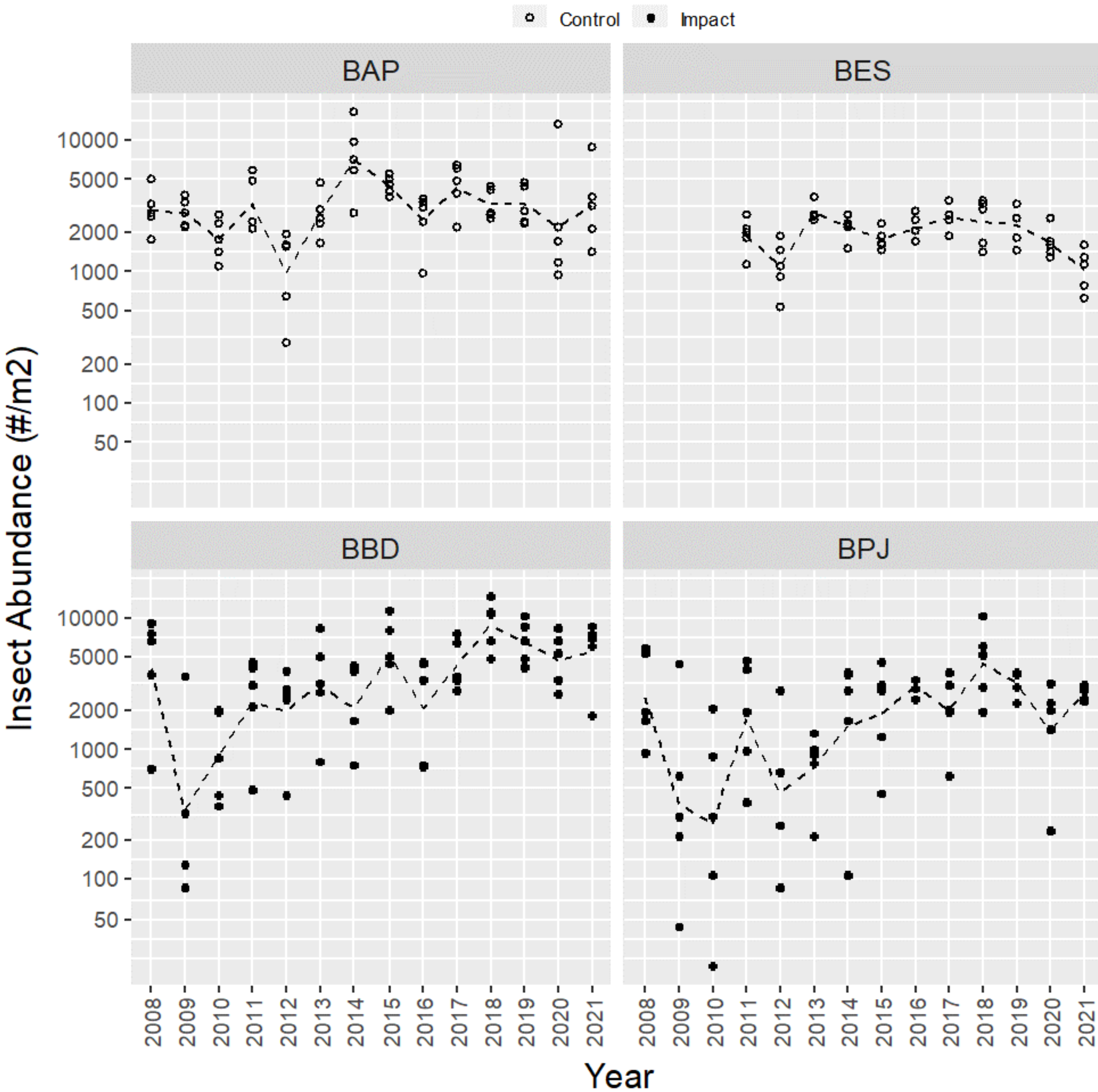


Figure E3-3. Mollusc abundance (#/m²) from Baker Lake since 2008.

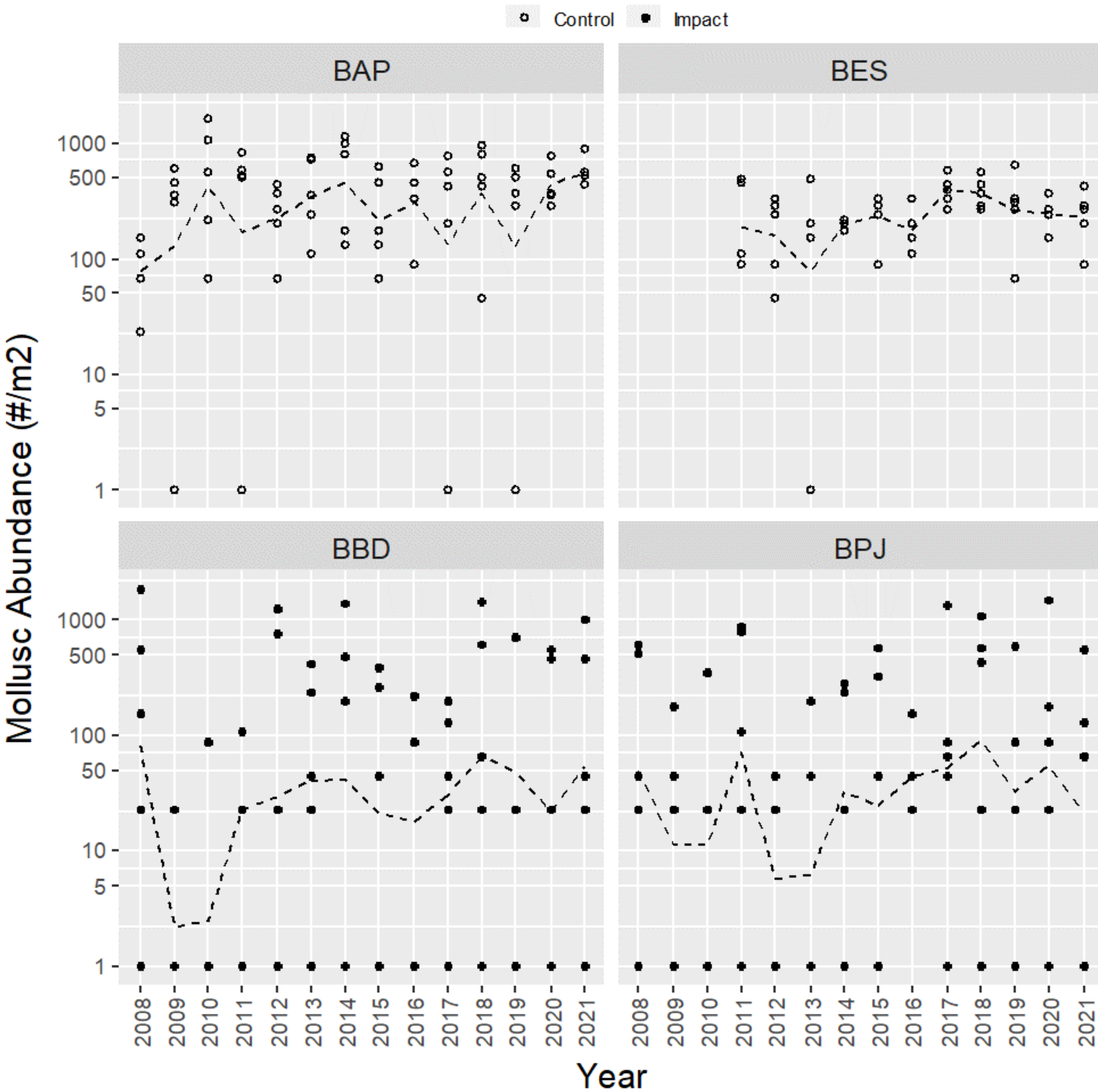


Figure E3-4. Other taxa abundance (#/m²) from Baker Lake since 2008.

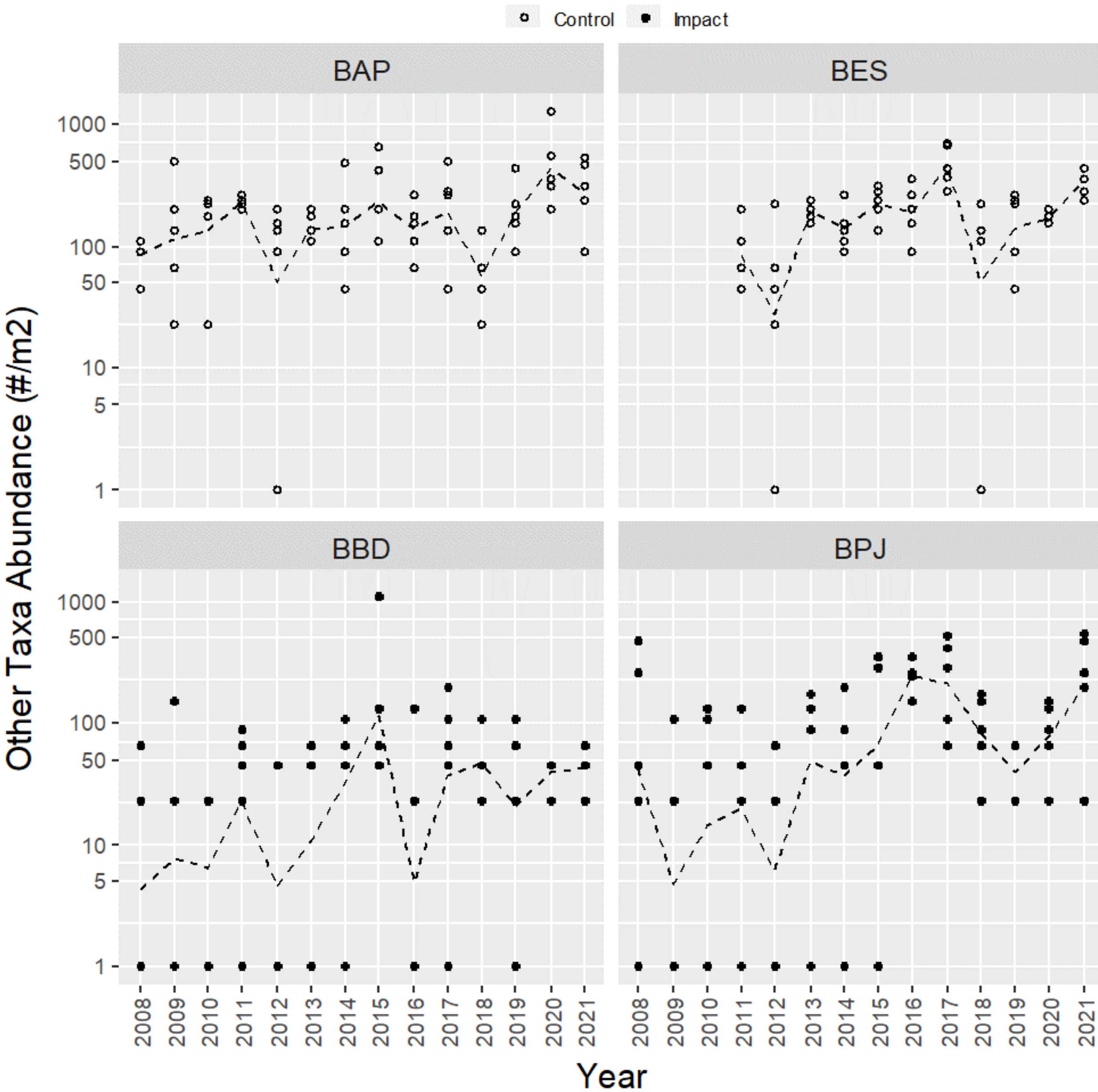


Figure E3-5. Oligochaete richness (# of taxa) from Baker Lake since 2008.

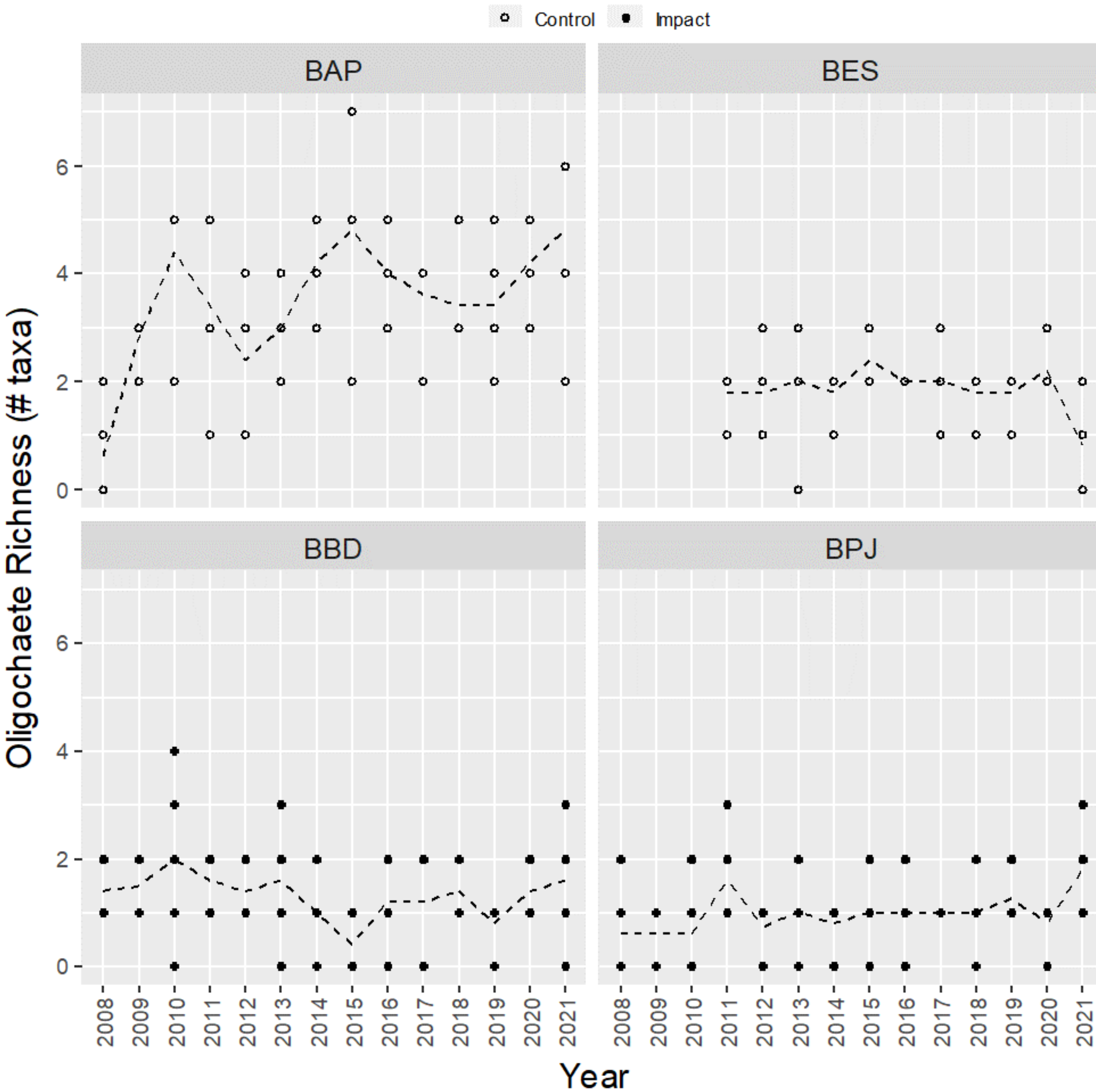


Figure E3-6. Insect richness (# of taxa) from Baker Lake since 2008.

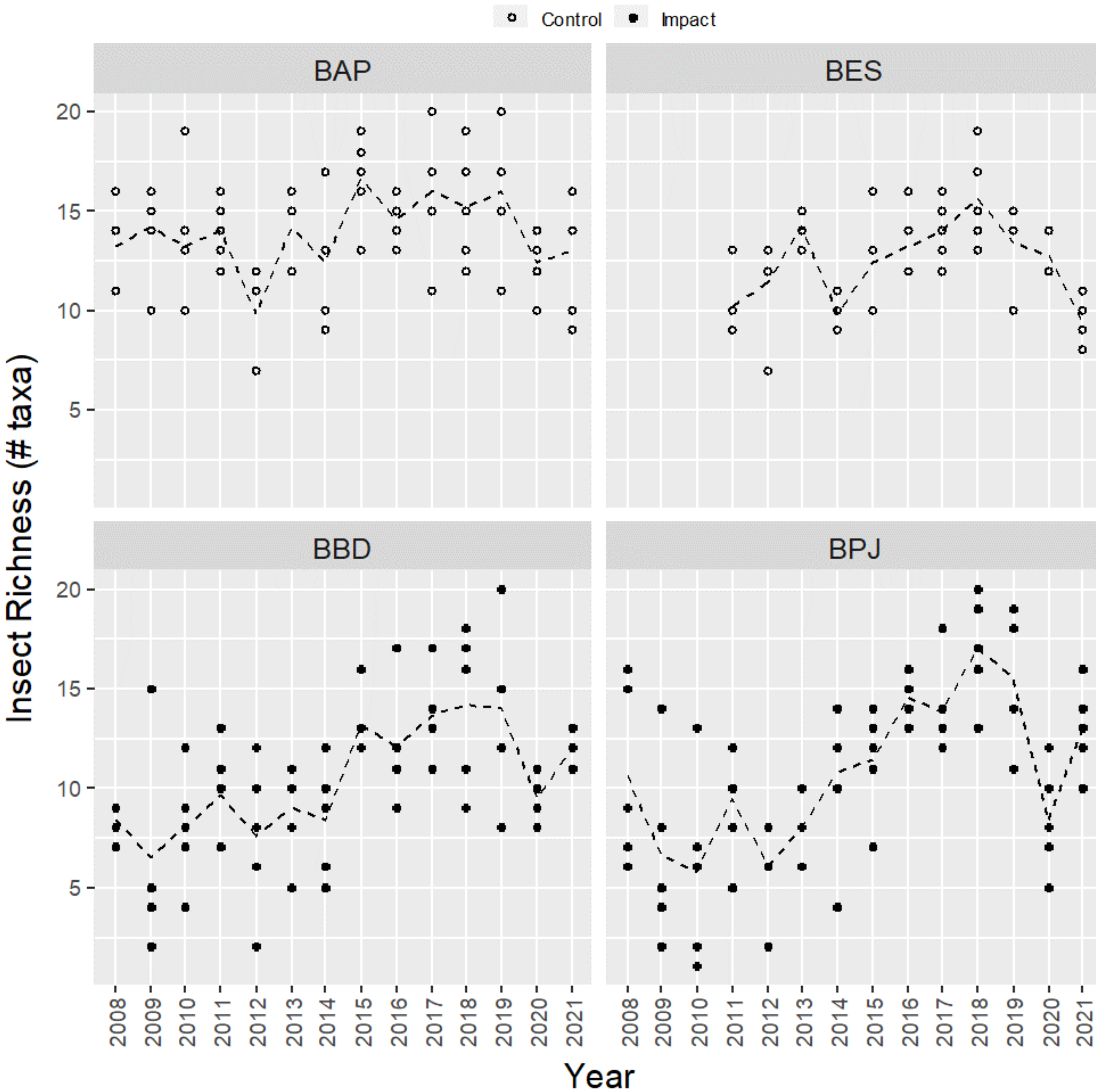


Figure E3-7. Mollusc richness (# of taxa) from Baker Lake since 2008.

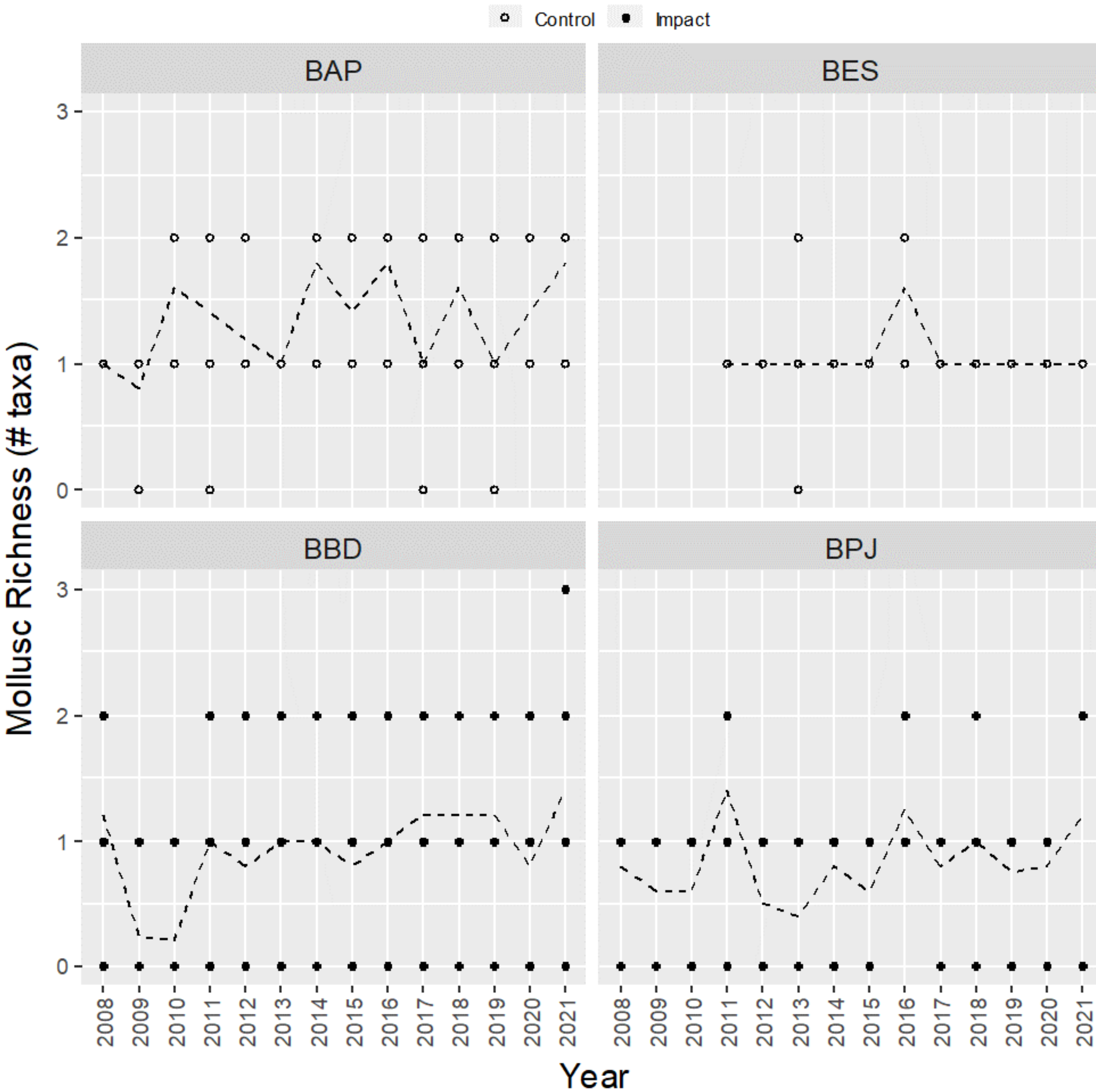


Figure E3-8. Other taxa richness (# of taxa) from Baker Lake since 2008.

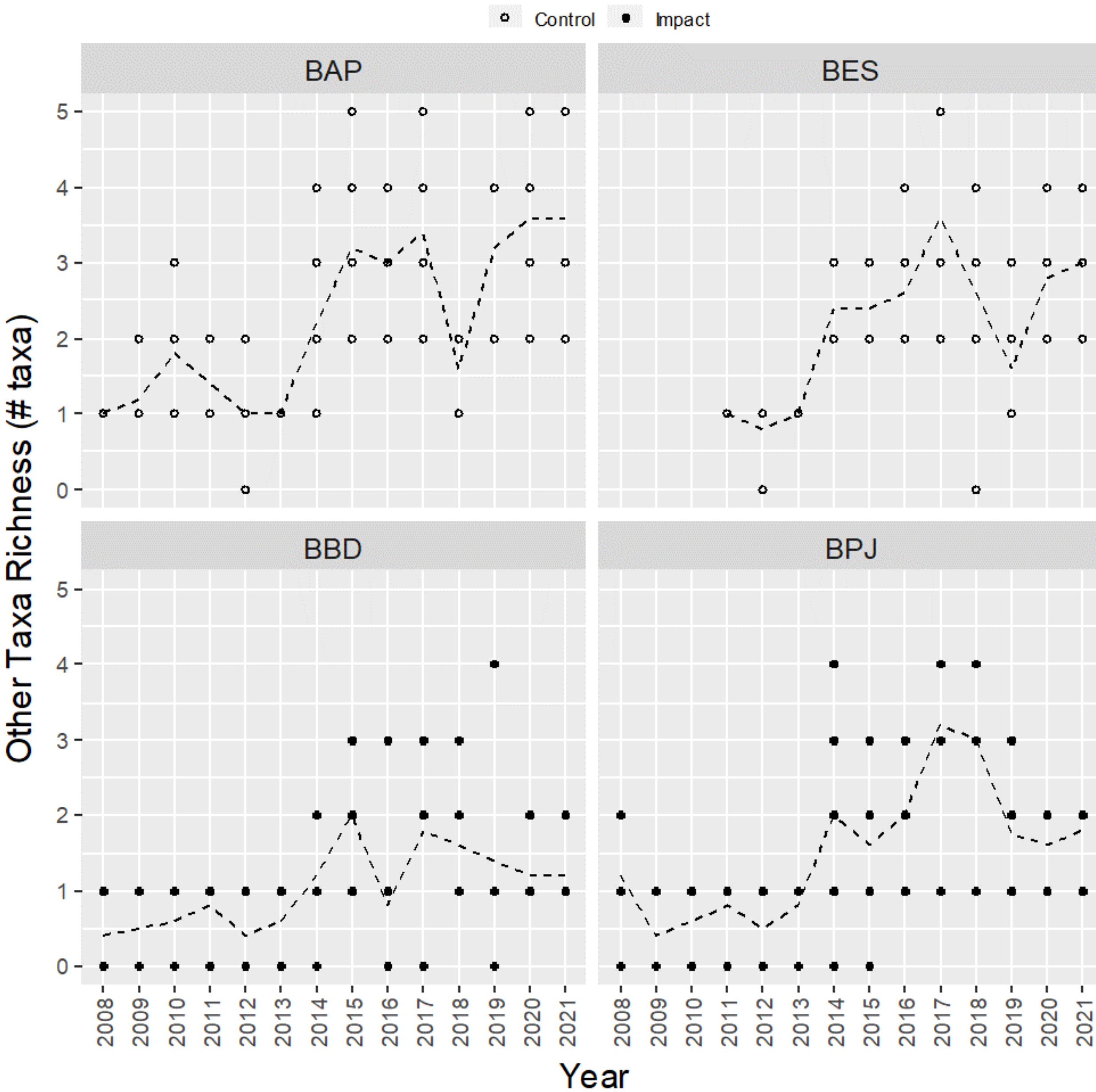


Figure E3-9. Simpsons' Diversity for the benthic invertebrate community at Baker Lake since 2008.

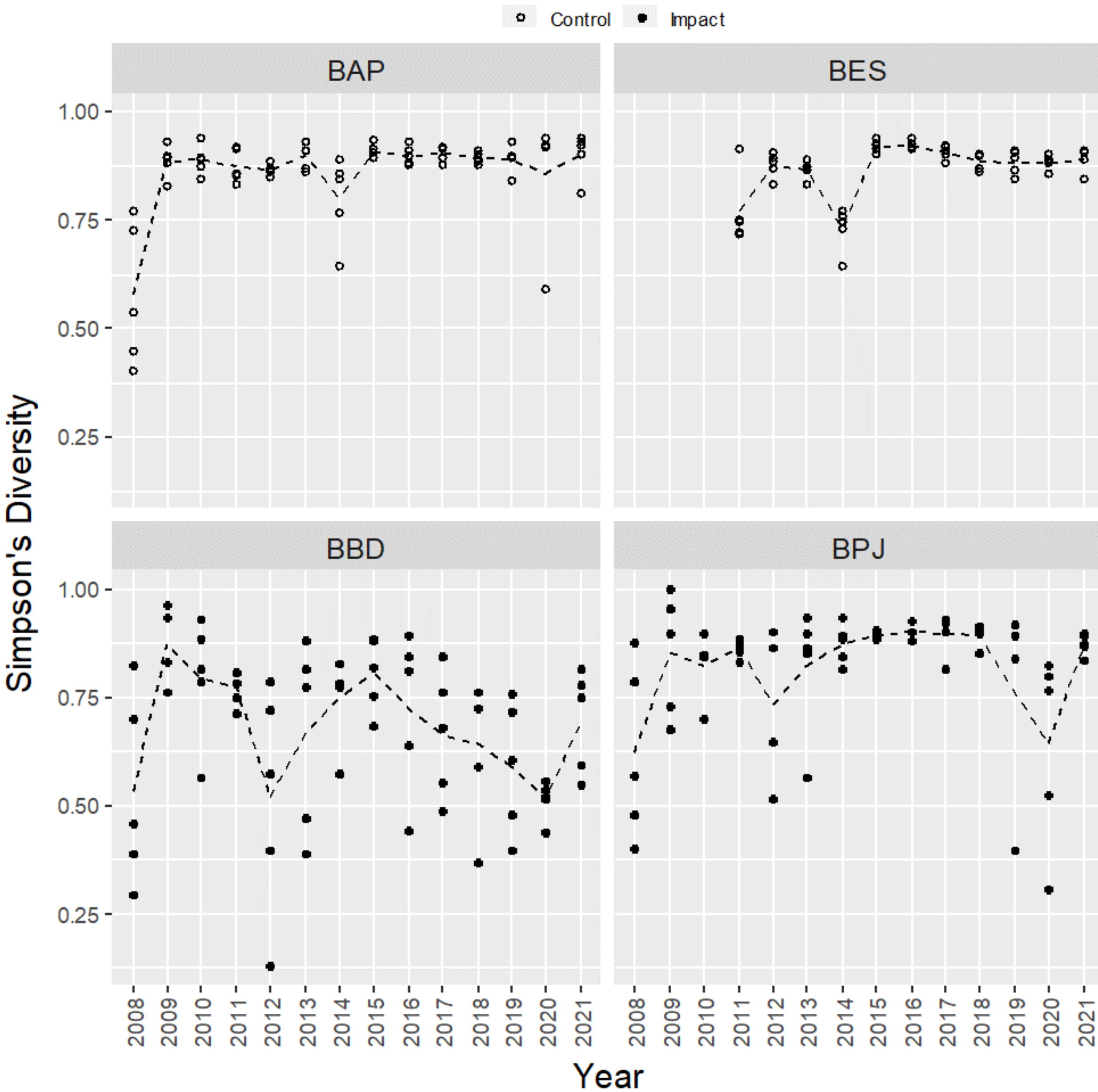
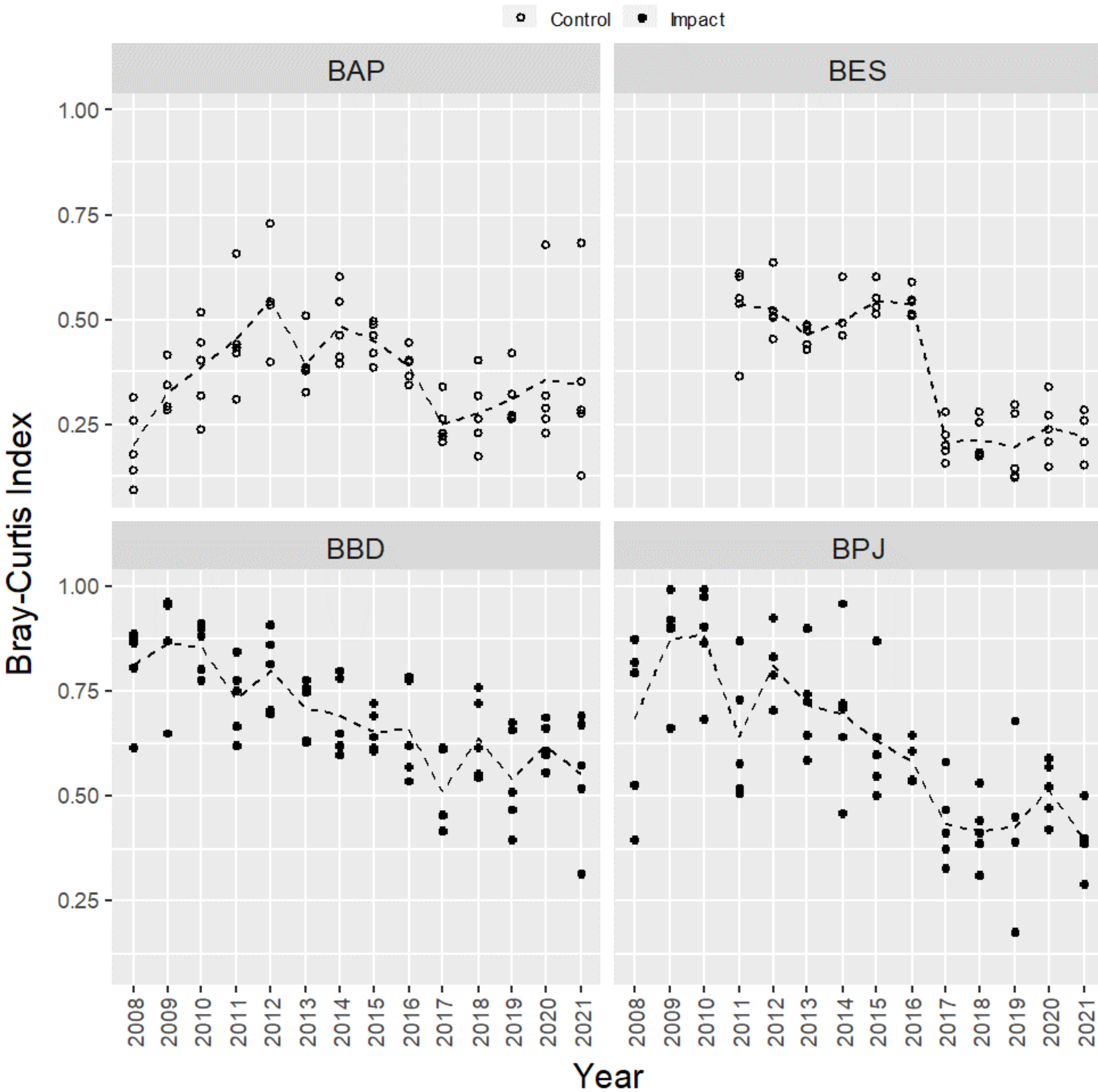


Figure E3-10. Bray-Curtis Index for the benthic invertebrate community at Baker Lake since 2008.



APPENDIX F
2019 WATER QUALITY EFFECTS ASSESSMENT

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F.1 INTRODUCTION

This technical document was prepared by Azimuth Consulting Group Partnership (Azimuth) to provide context on the potential for adverse effects to lower trophic biota (i.e., phytoplankton, zooplankton and benthic invertebrates) due to changes in water parameters that do not have effects-based thresholds (e.g., water quality standards, guidelines or criteria).

F.1.1 Background

The decision framework for the CREMP incorporates the use of *thresholds* (i.e., typically CCME water quality guidelines or effects-based equivalents from other jurisdictions) and *triggers* (i.e., early warning limits typically set between baseline/reference conditions and the threshold for parameters with effects-based guidelines, or set at the 95th percentile of the baseline/reference conditions; see **Appendix I** in the 2020 CREMP report for details). To date, for parameters with effects-based thresholds, CREMP monitoring has shown that receiving environment water quality in the Meadowbank and Whale Tail Pit study lakes meets both the trigger and threshold values (i.e., well below water quality guidelines).

Mining-related increases, particularly at NF study areas, have been observed for some parameters without water quality guidelines, including total dissolved solids (TDS), total alkalinity, conductivity, hardness, and certain major ions (i.e., calcium, magnesium, potassium, and sodium). Most of these parameters also exceed predicted concentrations presented in the Meadowbank Final Environment Impact Statement (FEIS) (Cumberland, 2005). In addition, total silicon, which was not routinely measured during the baseline period and shows little in the way of temporal trends, exceeds FEIS predictions. Because silicon was not routinely included in the suite of analyses in the baseline water chemistry samples, the baseline water quality values for Third Portage Lake, Second Portage Lake, and Wally Lake were set to 0 mg/L. This approach resulted in an underestimate of future concentrations for Third Portage Lake, Second Portage Lake, and Wally Lake. Silicon is not recommended as a parameter for evaluating the accuracy of the water quality model predictions for the Meadowbank study area lakes given the underestimate in baseline water chemistry.

As described in the main report, biological monitoring conducted under the CREMP targets the phytoplankton and benthic invertebrate communities. Results to date indicate that communities in the NF areas are functionally intact, with major indices such as taxonomic richness and abundance remaining relatively stable across the more than a decade of events. Thus, the biological data indicate that current water quality in the NF study areas is not adversely affecting the health of phytoplankton and benthic invertebrate communities compared to baseline or reference conditions.

F.1.2 Rationale

Notwithstanding the evidence showing phytoplankton and benthos communities are similar to baseline/reference conditions, the Kivalliq Inuit Association (KIA), in their review of the 2018 annual report, recommended[1] that Agnico Eagle complete the following:

i. *Investigate the source of these parameter increases, their spatial extent and the reversibility of these trends.*

ii. *Discuss the implications of increased conductivity, calcium, magnesium, potassium, sodium, TDS and alkalinity at the near-field sites on lower trophic levels, specifically in terms of the community composition of phytoplankton, zooplankton and benthic invertebrates.*

iii. *In accordance with AEM Management Response Plan for the Meadowbank Mine Aquatic Environment Monitoring Program, that AEM increase monitoring frequency at the mid-field sites to determine the spatial extent of exceedances observed in the near-field during the open water season.*

iv. *Conduct an investigation of cause study for the observed changes in water chemistry and determine possible management strategies.*

This technical memorandum is meant to address recommendations i) and ii) above by providing a review of available literature on the effects of selected conventional and ionic compounds on lower trophic level community composition. The outcome of this technical review will help determine if increased monitoring frequency (point iii) and/or investigation of cause studies (point iv) should be considered to help inform adaptive management decisions.

F.1.3 Approach

As described in **Section F.1.1**, the following parameters have been shown to be exceeding baseline/reference conditions and/or FEIS predictions: total dissolved solids (TDS), total alkalinity, conductivity, hardness, certain major ions (i.e., calcium, magnesium, potassium, and sodium), and total silicon. Apart from total silicon, the rest of these parameters are inter-related to some extent or are not parameters of toxicological concern. Rationale for the approach used herein to cover the range of parameters is as follows:

[1] Recommendation 22 in the 2018 Annual Report Comments.

- *TDS* – this parameter is a measure of all dissolved constituents in water, but is comprised primarily of inorganic salts (mainly calcium, potassium, magnesium, sodium, bicarbonates, chlorides, and sulphates). Consequently, it essentially includes total alkalinity (the measure of a solution's ability to neutralize acid inputs), hardness (the sum of multivalent ions in solution), conductivity (the measure of a solution's ability to conduct electricity; correlated to dissolved salts), and major ions (concentrations of individual ions in solution). While a site-specific approach that considers the ratios of individual major ions is preferred from a technical perspective, it is not practical for a literature approach due to the sheer number of permutations across these constituents. Consequently, the literature review for the parameters mentioned herein focused on primarily on TDS.
- *Conductivity* – as mentioned above, this parameter is related to TDS and could therefore be excluded for singular focus. However, as there is some effects-based information available (e.g., US EPA 2016), we have included it for additional context.
- *Total silicon* – this parameter plays an important role as an essential dissolved element consumed by the phytoplankton group of algae called diatoms. Relative abundance of this primary producer can have effects on higher trophic level organisms and as community changes occur in response to elevated or reduced silicon.

F.2 LITERATURE REVIEW

A literature review was completed to assess the potential effects of TDS, conductivity and total silicon at different concentrations on fresh water aquatic life (e.g., phytoplankton, zooplankton, benthic invertebrates, and fish species) that may either reasonably be found in the Meadowbank study area lakes or be reasonably comparable. Preference was given to peer-reviewed literature and government sources including articles, studies, effects assessments, published guidance, and literature reviews. Other sources (e.g., unpublished "grey" literature) were also used where relevant.

F.2.1 Total Dissolved Solids

Solids in water can be measured as total solids, total suspended solids (TSS), or total dissolved solids. Total solids is the measure of all both TSS and TDS. TDS is the measure of all dissolved constituents of a solution which may be of anthropogenic origin such as mining activities or road salt-contaminated runoff or natural influences such as soils or geology (Weber-Scannel & Duffy 2007). The measurement of TDS is conducted by the removal of suspended solids by filtration through a 0.7-micron glass fiber filter followed by drying of the filtrate at 180 degrees Celsius. The dried filtrate residue is divided by the volume of water filtered to determine the concentration of TDS which is usually reported in mg/L (APHA 2017). TDS is comprised mainly of inorganic ions but can also include dissolved organic matter. The potential biological effects of TDS are, therefore, related to the specific composition of the ions, their speciation, and other solids present in water. TDS may also exhibit toxicity through osmotic stress (i.e., where cell desiccation occurs due to leakage Davies & Hall 2007). Except in conditions where ratios and speciation of ionic components are fairly stable, TDS may be a poor predictor of toxicity (Chapman & McPherson 2016).

Similar to conductivity, TDS may be used as a surrogate measure for salinity because this measure tends to provide an estimate of the ionic compounds present (USEPA 1999). While elevated concentrations of TDS may change the osmotic conditions whereby elevated concentrations of TDS leads to potential osmotic stress especially in ultra-oligotrophic lakes with naturally low TDS, the ratios of ions present in solution are important due to the presence of essential macro and micro-minerals (EPA 2002). Meadowbank and Whale Tail study areas feature ultra-oligotrophic lakes with naturally low TDS. Increased chemical density influences the osmotic regulation of metabolism and biotic distribution in aquatic communities (BC MOE 2013).

Due to the complex and variable composition of ions and dissolved solids measured as TDS, a generic TDS guideline for the protection of aquatic life must be overly protective to account for the most toxic potential combination to the most sensitive organisms and life stage (Weber-Scannell and Duffy 2007). Assigning a threshold concentration for TDS is difficult because the high site specificity of this parameter. This challenge is reflected in the absence of any federal water quality guideline, with the exception of an aesthetic objective of less than or equal to 500 mg/L, for TDS (Health Canada 1991). Regulation of TDS is also limited in other jurisdictions with few exceptions such as Alaska, where TDS may not exceed 500 mg/L without a special permit and 1,000 mg/L at any time (ADEC 2012).

The presence of dissolved ions in solution is essential for the survival of aquatic organisms and provides the basis for the lowest trophic residents in the form of mineral uptake. Macro-mineral uptake is required for the support of biochemical functions such as magnesium and potassium (EPA 2002). Another example of the important biological role of dissolved ions is the importance of chloride in osmoregulation (Elphick et al. 2010). Many communities have low sensitivity to TDS these may be more readily detected through biological monitoring which can detect the overall impact of changes of water quality in a system (Buikema et al. 1982). Toxicity is highly dependent upon both the composition of the residents of the system and the components, speciation, and ratios of the dissolved analytes.

Weber-Scannell and Duffy (2007) reviewed TDS toxicity to aquatic life and recommend deriving ion-specific limits for aquatic life (i.e., rather than for TDS) although this may not satisfy the potential osmotic regulation concerns. Mount et al. (1997) prepared and tested the toxicity of over 2,900 ionic solutions on Daphnids (*Ceriodaphnia dubia* and *Daphnia magna*). Their results suggested the following descending relative ion toxicity: potassium, bicarbonate and magnesium, chloride, sulphate. Neither sodium nor calcium resulted in significant effects (Mount et al., 1997). However, Mount et al. (1997) also found that the potential toxicity of chloride, sulphate, and potassium were reduced in solutions enriched with more than one cation. The inability to identify to attribute the toxicity of a specific constituent of TDS is inherent to the nature of the complex mixture this parameter measures with potential for effect masking, additive toxic effects, and synergistic toxic effects (Goodfellow et al. 2009). Timpano et al. (2010) examined the relationship between benthic macroinvertebrate community metrics in coal field streams and TDS. They caution that impacts from mine-related TDS is confounded because elevated TDS rarely occurs independently of other stressors. This study indicated several benthic macroinvertebrate richness measures were inversely correlated with TDS. Relative species abundance showed no correlation to TDS. Concentrations of TDS in the study streams ranged from 27.8 to 791.6 mg/L. The dominance of sulphate as a constituent in this study may reduce its relevance given the historically low sulphate concentrations in the Meadowbank study area lakes; in addition, the TDS concentrations are also notably higher than those found in the Meadowbank study area lakes.

The TDS review paper by Weber-Scannel and Duffy (2007) showed effects at concentrations less than 250 mg/L with a reported global mean in rivers of 120 mg/L. A TDS receiving environment benchmark 500 mg/L was adopted at Diavik (WLWB, 2013). Scannell and Jacobs (2001) completed a detailed review on the effects of TDS on aquatic life including fish, aquatic invertebrates, and algae focusing on Alaskan waters and TDS components that would be similar to those found in mine effluent. They found no effects to invertebrate growth and survival at concentrations below 1500 mg/L, that there was no reported range of concentrations that caused a toxic response in algae, and that fertilization and hatching rates in salmonids was the most sensitive life stage with affects at concentrations around 750 mg/L. They also concluded that toxicity was due primarily to ionic properties rather than osmotic effects. Chapman, Bailey, and Canaria (1999) completed an assessment of TDS toxicity associated with two mine effluents on chironomid (midge) larvae and early life stages of rainbow trout. They found no toxicity for rainbow trout at concentrations below 2,000 mg/L but did observe effects on chironomids at concentrations greater than 1,100 mg/L. A 2013 Effects Assessment report for the Snap Lake

Mine for De Beers Canada Inc. included results from a site-specific toxicity testing on phytoplankton, zooplankton, benthic invertebrates, and fish species and concluded that *Ceriodaphnia dubia* (a planktonic flea species) was the most sensitive test species and was affected by concentrations of 560 mg/L. A statistical review of the relationship between TDS in the range of 128 to 1,545 mg/L and phytoplankton (chlorophyll-a) in 25 Canadian Lakes by Prepas (1983) did not find a correlation.

Laboratory analysis for the 2019 CREMP water chemistry was completed by ALS Environmental, Burnaby, BC. As reported in the 2019 CREMP (Azimuth 2020), the maximum reported concentration in 2019 was 52.2 mg/L at WAL in March, consistent with the magnitude of concentrations reported in 2018. TDS concentrations in 2019 at other Meadowbank NF stations were as follows: TPE had a maximum of 23.9 mg/L; TPN a maximum of 24.1 mg/L; and SP had a maximum of 32.6 mg/L. The literature cited above suggests that the concentrations of TDS observed in the Meadowbank study area lakes are well below the concentrations where effects will occur. Furthermore, phytoplankton biomass and taxa richness have remained stable as has benthic invertebrate biomass and taxa richness confirming that primary productivity within the study area lakes is not exhibiting adverse effects from elevated TDS.

F.2.2 Conductivity

Much like TDS, specific conductivity has been used as a measurement of ionic strength (Cormier et al., 2012; USEPA, 2016). Conductivity is measured by passing an electrical current through a solution to determine conductance, or the reciprocal of resistance of a solution; therefore, it serves as an indirect measure of only ionic inorganic constituents. It does not have a relationship to dissolved organic compounds because these rarely dissociate (APHA 2018). The TDS method is applicable to waters that mostly contain calcium, magnesium, sodium, potassium, chlorate, sulphate, and chloride and TDS less than 2500 mg/L (APHA 2018). The concentration of all dissociated ions is inversely correlated to the electrical resistance of a solution. Because of the broad nature of TDS, the toxicity potential of a specific conductivity value depends on the toxicity of the ionic composition (USEPA 2016). There is no threshold for specific conductivity at the Meadowbank study area lakes and no federal guidelines.

Water quality parameters are useful indicators of potential effects of local environmental changes on freshwater ecosystems. Anthropogenic influences to water quality such as decreased dissolved oxygen is often correlated with a change in pH and an increase in conductivity, and nutrient concentrations (Leszczynska et al. 2019). The effects of these changes, especially if measured over time may not be detectable through biological monitoring. This is because aquatic communities acclimate to changes in water quality, especially those featuring natural seasonally or daily variability. Conductivity is an example of a naturally variable parameter that not only includes highly variable toxicity but also varies in measured value in response to natural system input fluctuations (i.e. freshet, rainfall, groundwater influence) (USEPA, 2016; Hood et al. 2006).

As indicated in the 2019 CREMP, some Meadowbank study area lakes have exhibited an increase in conductivity relative to baseline/reference conditions. The mean conductivity in WAL in 2019 was 47.1 µS/cm which was the highest mean value from the Meadowbank study area. The US EPA provided a draft field-based method for developing aquatic life criteria for specific conductivity in 2016. Cormier et al. used this approach and reviewed the relationship between specific conductivity in West Virginia coal field stream systems and macroinvertebrate health to create a species sensitivity distribution and derive a benchmark relationship. The authors determined that a bench mark of 300 µS/cm was appropriate to prevent the extirpation of 95% of invertebrate genera in the study area. These results were confirmed in a separate study by Clements and Kotalik (2015).

Michelutti et al. (2002) examined the limnological conditions in 34 lakes and ponds on Victoria Island (arctic Canada) and provided a mean specific conductance of 96.4 µS/cm. Dranga et al. (2017) reviewed and compiled limnological data from 1489 shallow lakes and ponds in northern Canada and found a range of conductivity with a low of 2.5 µS/cm and a mean specific conductivity of 166 µS/cm. The authors did not find an association between trophic level or vegetation cover and conductivity but did find conductivity was affected by geological area. In comparison, Ruhland et al. (2003) summarized limnological results from 21 Canadian arctic tundra lakes and found specific conductivity ranged from 7.3 to 98.8 µS/cm with a mean of 17.8 µS/cm. The results reported in the 2019 CREMP suggests that although conductivity in the near-field Meadowbank study area lakes may be elevated compared to baseline and reference, the conductivity remains relatively low compared to other arctic lakes.

F.2.3 Silicon

Elemental silicon is highly abundant. It is relative stable and does not occur in its free form in nature but combines with oxygen and other elements to form oxides or silicates (CCME 2008). The term “silica” is often used to refer to silicon in natural waters and is usually represented by the hydrated form of the oxide (CCME 2008). It is also an essential micronutrient, particularly for diatoms. Silicon limitations can play an important role in phytoplankton dynamics (Shatwell et al. 2013; Saros et al. 2013). A change in the silicon concentrations may impact the succession of different phytoplankton species and the ratio of silicon with different nutrients may influence the ratio of cyanobacteria to diatoms. However, phytoplankton dynamics are also heavily influenced by other factors including temperature and photoperiod (Shatwell et al. 2013). As a primary producer, diatom abundance has cascading effects to higher trophic levels and in some aquatic food chains silicon availability plays a significant role in energy transfer through effects on diatom productivity (Krause et al. 2018).

This literature review did not find any reports on potential toxic effects to aquatic receptors from low silicon concentrations similar to the concentrations observed in the Meadowbank study area lakes. In general, the conclusion of this the literature review was that there was little data to suggest potential toxicological effects from silicon to aquatic receptors at the range of concentrations that may reasonably be found in Canadian surface freshwater. There are no Canadian federal or provincial guidelines specifically for silicon in water to protect aquatic life. There are, however, several studies that report on the silica concentrations in Canadian surface waters including arctic regions. Natural silicon concentrations in Canadian surface waters are normally less than 5 mg/L silica but are highly variable ranging from 0.02 mg/L to 40 mg/L depending on region (CCME 2008). Antoniades et al. (2003) reported on chemical limnology of 24 ponds and one arctic lake from the Canadian high arctic. The authors did not report on silicon but did report that concentrations of silica (SiO_2) ranged from 0.01 to 4.05 mg/L with a mean of 1.42 mg/L and a median of 1.18 mg/L. Hamilton et al. (2001) report the physical and chemical limnology of 204 Canadian arctic lakes. They report silicate (SiO_2) concentrations for n=174 ranged from 0.05 to 6.7 mg/L with a mean of 1.1 mg/L.

The mean and median values from the arctic lake studies referenced above are higher than the silicon and silicate (SiO_2) trigger concentrations for the Meadowbank study area lakes. The concentrations in the Meadowbank lakes have remained low despite a statistically significant increase over baseline/reference conditions. The range of silicon concentrations was generally below the trigger of 0.2 mg/L with the exception of SP, which ranged up to 0.23 mg/L, and INUG, which ranged up to 0.21 mg/L. Silicate as SiO_2 was consistently below the trigger of 1.0 mg/L. Importantly, neither silicon nor silicate showed strong temporal trends associated with mining activity (see main report). Thus, the observed differences are more likely due to inherent spatial heterogeneity rather than to actual temporal changes.

The lack of substantial changes in total silicon (or silicate) suggest that changes to lower trophic communities at Meadowbank are unlikely. Based on this literature review the most likely impact from increases in total silicon would be to the phytoplankton assemblage. An increase in concentrations of silicon may favor diatoms whereas a decrease in silicon may favor cyanophytes. The species richness in the Meadowbank study area has remained relatively stable for all sample years, with no obvious changes in diatom biomass. Thus, the results of site-specific biological monitoring support the findings of the literature review that suggest changes to lower trophic communities are unlikely.

F.3 CONCLUSIONS

This literature review was conducted to provide some additional context to help assess the ecological significance of mining-related changes to water quality for parameters without effects-based water quality guidelines. The review results corroborate the findings of site-specific biological monitoring conducted under the CREMP. While changes in the parameters of interest (TDS, conductivity and total silicon) can affect lower trophic level communities, concentrations of these parameters at Meadowbank and Whale Tail remain well below concentrations associated with adverse effects reported in the literature.

F.4 REFERENCES

Antoniades, D., Douglas, M. S., & Smol, J. P. (2003). The physical and chemical limnology of 24 ponds and one lake from Isachsen, Ellef Ringnes Island, Canadian High Arctic. International Review of Hydrobiology: A Journal Covering all Aspects of Limnology and Marine Biology, 88(5), 519-538.

American Public Health Association (APHA). 2017. 2540 Solids. Standard Methods for the Examination of Water and Wastewater. American Water Works Association.

Azimuth. 2015. Core Receiving Environment Monitoring Program (CREMP): 2015 Plan Update. Report prepared by Azimuth Consulting Group, Vancouver, BC for Agnico Eagle Mines Ltd., Baker Lake, NU. November, 2015.

APHA. 2018. 2510 Conductivity. Standard Methods for the Examination of Water and Wastewater. American Water Works Association

British Columbia Ministry of the Environment (BCMOE). 2013. Guidance for the Derivation and Application of Water Quality Guidelines in British Columbia.

Buikema, A., Niederlehner, B., & Cairns, J. (1982). Biological monitoring part IV—Toxicity testing. Water Research, 16(3), 239-262.

Canadian Councils of Ministers of the Environment (CCME). (2008). Canadian Water Quality Guidelines. Retrieved from https://www.ccme.ca/files/Resources/supporting_scientific_documents/cwqg_pn_1040.pdf

Chapman, P. M., Bailey, H., & Canaria, E. (2000). Toxicity of total dissolved solids associated with two mine effluents to chironomid larvae and early life stages of rainbow trout. Environmental Toxicology and Chemistry: An International Journal, 19(1), 210-214.

Chapman, P., & McPherson, C. (2016). Development of a total dissolved solids (TDS) chronic effects benchmark for a northern Canadian lake. Integrated Environmental Assessment and Management, 12(2), 371.

Clements, W. H., & Kotalik, C. (2016). Effects of major ions on natural benthic communities: an experimental assessment of the US Environmental Protection Agency aquatic life benchmark for conductivity. Freshwater Science, 35(1), 126-138.

Cormier, S. M., Suter, G. W., & Zheng, L. (2013). Derivation of a benchmark for freshwater ionic strength. Environmental Toxicology and Chemistry, 32(2), 263-271.

Davies TD, Hall KJ. 2007. Importance of calcium in modifying the acute toxicity of sodium sulphate to *Hyalella azteca* and Daphnia magna. Environ Toxicol Chem 26:1243–1247

Dranga, S. A., Hayles, S., & Gajewski, K. (2017). Synthesis of limnological data from lakes and ponds across Arctic and Boreal Canada. Arctic Science, 4(2), 167-185.

Elphick, J., Bergh, K., & Bailey, H. (2011). Chronic toxicity of chloride to freshwater species: Effects of hardness and implications for water quality guidelines. Environmental Toxicology and Chemistry, 30(1), 239-246.

Hamilton, P. B., Gajewski, K., Atkinson, D. E., & Lean, D. R. (2001). Physical and chemical limnology of 204 lakes from the Canadian Arctic Archipelago. Hydrobiologia, 457(1-3), 133-148.

Health Canada. 1991. Guidelines for Canadian Drinking Water Quality: Guideline Technical Document - Total Dissolved Solids (TDS). Retrieved 27 March 2020 from: https://www.canada.ca/content/dam/canada/health-canada/migration/healthy-canadians/publications/healthy-living-vie-saine/water-dissolved-solids-matieres-dissoutes-eau/alt/water-dissolved-solids-matieres-dissoutes-eau-eng.pdf

Goodfellow, W. L., Ausley, L. W., Burton, D. T., Denton, D. L., Dorn, P. B., Grothe, D. R., ... & Rodgers Jr, J. H. (2000). Major ion toxicity in effluents: A review with permitting recommendations. Environmental Toxicology and Chemistry: An International Journal, 19(1), 175-182.

Leszczyńska, J., Grzybkowska, M., Głowacki, &., & Dukowska, M. (2019). Environmental Variables Influencing Chironomid Assemblages (Diptera: Chironomidae) in Lowland Rivers of Central Poland. Environmental Entomology, 48(4), 988-997.

Michelutti, N., Douglas, M.S., Lean, D.R. et al. Physical and chemical limnology of 34 ultra-oligotrophic lakes and ponds near Wynniatt Bay, Victoria Island, Arctic Canada. Hydrobiologia 482, 1–13 (2002). https://doi.org/10.1023/A:1021201704844

Mount, D. R., Gulley, D. D., Hockett, J. R., Garrison, T. D., & Evans, J. M. (1997). Statistical models to predict the toxicity of major ions to *Ceriodaphnia dubia, Daphnia magna* and *Pimephales promelas* (fathead minnows). Environmental Toxicology and Chemistry: An International Journal, 16(10), 2009-2019.

Prepas, E. E. (1983). Total dissolved solids as a predictor of lake biomass and productivity. Canadian Journal of Fisheries and Aquatic Sciences, 40(1), 92-95.

RÜhland, K. M., Smol, J. P., Wang, X., & Muir, D. C. (2003). Limnological characteristics of 56 lakes in the Central Canadian Arctic treeline region. Journal of Limnology, 62(1), 9-27.

Saros, J.E., Strock, K.E., Mccue, J., Hogan, E., and Anderson, N.J., 2014. Response of Cyclotella species to nutrients and incubation depth in Arctic lakes, Journal of Plankton Research, Volume 36, Issue 2, March/April 2014, Pages 450–460

Scannell, P. W., & Jacobs, L. L. (2001). Effects of total dissolved solids on aquatic organisms. Alaska: Alaska Department of Fish and Game Restoration.

Shatwell, T., Köhler, J. and Nicklisch, A. 2013. Temperature and photoperiod interactions with silicon-limited growth and competition of two diatoms, Journal of Plankton Research, Volume 35, Issue 5, September/October 2013, Pages 957–971

United States Environmental Protection Agency (USEPA). 1999. Water Quality Standards for Salinity Colorado River System.

USEPA. 2002. Short-term methods for estimating the chronic toxicity of effluents and receiving waters to freshwater organisms. United States Environmental Protection Agency, Office of Water; 2002. Washington, DC

USEPA. 2016. DRAFT Field-Based Methods for Developing Aquatic Life Criteria for Specific Conductivity. US Environmental Protection Agency Office of Water, Washington, DC

Weber-Scannell PK, Duffy LK. 2007. Effects of total dissolved solids on aquatic organisms: A review of literature and recommendation for salmonid species. Am J Environ Sci 3:1–6.