APPENDIX F

2014 REFERENCE LAKE EVALUATION

Mary River Project

March 2015

Candidate Reference Lakes: Results of the 2014 Field Program

North/South Consultants Inc.
Aquatic Environment Specialists

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1.0 INTRODUCTION AND OVERVIEW

The Aquatic Effects Monitoring Plan (AEMP) for the Mary River Project includes monitoring of lakes and streams in the vicinity of the mine site, as well as reference lakes (Baffinland Iron Mines Corporation [BIM] 2014). Preliminary identification of candidate reference lakes comparable to Camp Lake and Sheardown Lake NW in the mine area was accomplished through a series of desktop screening exercises completed in 2013. These screening exercises, described in North/South Consultants Inc. (NSC) and Knight Piésold (2013), identified 12 potential reference lakes for Camp and/or Sheardown lakes within an 80 km radius of the Mary River mine site.

Reconnaissance surveys of these 12 candidate reference lakes were conducted during the open-water season of 2013, with the objective of collecting information on the biota, physical habitat, and chemical conditions (i.e., water quality) at the three most suitable lakes as identified through this initial survey. The field surveys included the determination of the presence/absence of land-locked resident Arctic Char (*Salvelinus alpinus*), completion of coarse aquatic habitat surveys, and collection of water quality, phytoplankton, zooplankton, and benthic macroinvertebrate (BMI) samples (all from a single site) in the open-water season of 2013 in each of three lakes to assist with selection of the final reference lake(s).

The first reconnaissance survey conducted in August 2013 identified two potentially suitable reference lakes (Reference Lake 1 – formerly called Lake CL-P2-13 - and Reference Lake 2 – formerly called Lake CR-P3-11), which were surveyed as indicated above. As the overall objective was to identify three candidate reference lakes, an aerial reconnaissance survey was completed in fall 2013 to identify additional lakes for consideration during 2014 surveys. Results of the 2013 surveys are presented in NSC (2014).

Detailed field sampling of candidate Reference lakes 1 and 2 was undertaken in 2014, to provide water quality, sediment quality, lower trophic level, and Arctic Char data. In addition, a reconnaissance level survey was completed in one of the lakes (Reference Lake 3 – formerly identified as ALT-09) identified during the fall 2013 aerial surveys as being a potentially suitable reference lake. The following provides a description of the methods and results (where available) of the reference lake surveys completed for the three candidate reference lakes in the open-water season of 2014. This report also provides an overall comparison between reference and mine area lakes.

2.0 METHODS

2.1 SUMMER SURVEY

The objective of the 2014 reference lake program was to conduct both summer and fall sampling in each of the three lakes for comparison with data collected from mine area lakes. However, persistent ice cover (into early August) on all three reference lakes prevented the conduct of the summer sampling.

2.2 FALL SURVEY

Fall surveys of the lakes were conducted in late August and included detailed sampling of Reference lakes 1 and 2, as well as a preliminary ground survey of Reference Lake 3 (Figure 1). Physical habitat information for Reference lakes 1 and 2 was collected, and the presence of Arctic Char established, during 2013 surveys. The 2014 surveys primarily included the collection of additional water quality (*in situ* and laboratory measurements), sediment quality, lower trophic level, and juvenile and adult fish population data (Table 1).

Reference Lake 3 was only surveyed aerially in 2013. Reconnaissance level ground surveys were conducted in 2014 and included an aquatic habitat survey, assessment of the presence/absence of Arctic Char, and collection of water quality, sediment quality, phytoplankton, zooplankton, and BMIs from a single site (Table 1).

2.3 FIELD SAMPLING METHODS

As monitoring of reference lakes is a component of the AEMP, specifically a component of the Core Receiving Environment Monitoring Program (CREMP), the sampling programs and methods employed for the reference lake program were consistent with those identified in the AEMP (BIM 2014). Sampling methods for water quality, sediment quality, phytoplankton, BMIs, and fish employed for the reference lake program in 2014 were therefore consistent with those described in detail in the AEMP (BIM 2014). Brief descriptions of these methods are provided below. Detailed descriptions of sampling methods for components that are not described in the AEMP (i.e., aquatic habitat and zooplankton) are also provided below.

2.3.1 AQUATIC HABITAT

Aquatic habitat surveying (i.e., bathymetry and substrate) is not a component of the AEMP. The following therefore provides a detailed description of field methods employed for the aquatic habitat survey completed in candidate Reference Lake 3 in August, 2014.

Boat-Based Hydroacoustic Depth and Bottom-Type Surveys

Hydroacoustic technologies, utilizing Sound Navigation and Ranging (SoNAR) principles, are commonly employed to collect data pertaining to physical aquatic habitat variables (depth, bottom type, and cover). On August 30, 2014 a bathymetric and bottom-typing sonar survey was conducted from a 4 m Zodiac on Reference Lake 3, which had an approximate lake level of 99.1 m above sea level (ASL). Surveys were conducted with a BioSonics Habitat MX 200 kHz single-beam scientific-grade echosounder. Visual Acquisition software was used to log the returned acoustic waveform data measuring depth and bottom characteristics (hardness, roughness), in addition to the differentially corrected positions from an internal global positioning system (GPS) receiver. Surveys were conducted at boat speeds of approximately 5-10 km/hr. The transducer mount was affixed to the gunwale at mid-point side of the vessel. The transducer depth below the water surface was 0.40 m.

Surveys consisted of tracking and recording acoustic data and positions at 1 second intervals along transects spaced 50-500 m apart, depending on the complexity of the area being surveyed. A single long transect or E-Line transect was surveyed across the maximum width of the lake. The survey conformed to the British Columbia Ministry of the Environment's (BCMOE) bathymetric standards for lake inventories (BCMOE 2009). The bathymetric mapping in this study did not follow a specific hydrographic standard and therefore it is advised that the map products should not be relied upon for navigation.

Bottom Type Validation

Substrate validation to support sonar bottom-typing was conducted visually (i.e., where the lake bottom could be visually assessed) or with sediment grabs. Water clarity allowed visual confirmation of substrate composition to depths of at least 5 m throughout the lake. In deeper water, substrate samples were periodically collected using a petite Ponar dredge. At each sample site, depth of penetration of the petite Ponar and relative proportion (%) of each substrate type within the sample was visually estimated and recorded. Substrate size classification was based on Wentworth (1922), and included the following:

- Boulder: > 256 mm
- Cobble: 64-256 mm
- Gravel (aggregate): 2-64 mm
- Sand (aggregate): 62.5 µm – 2 mm
- Silt: 3.9-62.5 µm
- Clay: < 3.9 µm

2.3.2 WATER QUALITY

Water quality sampling was conducted at five sites in Reference lakes 1 and 2 and at a single site in Reference Lake 3 in fall 2014. Sampling included *in situ* measurements of total water depth, Secchi disk depth, and depth profiles (at 1 m intervals) for dissolved oxygen (DO), turbidity, temperature, pH, and specific conductance using a hand-held YSI EXO-2 water quality multimetre. Samples for laboratory analysis were collected at 1 m below the water surface and 1 m above the sediment-water interface with a Kemmerer water sampler. Universal Transverse Mercator units (UTMs) were recorded for each site using a hand-held GPS unit. Samples were transferred to sample bottles provided by the analytical laboratory and preserved where applicable, kept cool (4°C) and in the dark, and submitted to the analytical laboratory (Exova Environmental, Ottawa, ON), which is accredited under the Canadian Association for Laboratory Accreditation (CALA). See BIM (2014) for additional details.

2.3.3 SEDIMENT QUALITY

Sediment quality was sampled at five sites in Lakes 1 and 2 and at a single site in Lake 3 in fall 2014. UTMs were recorded for each site using a hand-held GPS unit. Surficial sediment samples were collected with a petite Ponar dredge (area of opening 0.23 m^2); sediment cores could not be collected due to malfunction of the sediment core sampling device. Due to analytical volume requirements, five grab samples were collected at each site and the samples were homogenized. Depth of penetration of the petite Ponar dredge and relative proportion (%) of each substrate type within the sample was visually estimated and recorded. Substrate size classification was based on Wentworth (1922).

The upper 2 cm of sediment was removed from the dredge sample with a corer, placed in a pre-cleaned stainless steel bowl, and the sample was homogenized. Sediment was then transferred to sample bottles provided by the analytical laboratory, samples were kept cool and in the dark, and shipped to Exova Environmental (Ottawa, ON) for analysis.

2.3.4 LOWER TROPHIC LEVEL BIOTA

Phytoplankton

Phytoplankton samples were collected at each of the water quality sampling sites. Secchi disk depth (average of two measurements) was measured and used to calculate the euphotic zone depth for each site (estimated as Secchi disk depth x 3). Depth-integrated samples of water were collected using a tube sampler from across the euphotic zone (as estimated above) or across the majority of the water column (i.e., to within approximately 1 m of the bottom) where euphotic zone depth exceeded the total water depth. The sample was transferred to a sample bottle

provided by the analytical laboratory, and samples were preserved by adding a sufficient quantity of Lugol's solution to render the sample "tea coloured". See BIM (2014) for additional details.

Zooplankton

Zooplankton samples were collected at each of the water quality sampling sites. Samples were collected in vertical, bottom-to-surface tows using a 63 μm conical net 1.0 m in length with a 0.23 m long codend. The net, complete with a weighted PVC codend attached to a single 0.25 m diameter steel hoop frame, was lowered to the bottom, codend first, and then slowly retrieved by hand. The number of tows and water depth were recorded for each site. The number of tows, tow depth, and diameter of the net opening were used to calculate the volume of water filtered.

Zooplankton captured in the net were rinsed into the codend collecting cup, washed into a labeled jar (250 or 500 mL), and fixed in 10% formalin. A sufficient number of tows were collected at each site until at least 100 individuals are visible in the sample jar; in all instances only one tow was required to meet this target.

Benthic Macroinvertebrates

The BMI lake monitoring program described in the AEMP is a habitat-based program, which focuses upon predominant habitats in mine area lakes. Specifically, monitoring is to be conducted at five replicate stations in two habitat types: Habitat Type 9 (depth of 2-12 meters, fine sand, silt/clay substrate, aquatic macrophytes absent); and Habitat Type 14 (depth > 12 m, fine sand, silt/clay substrate). To provide comparable data, BMI sampling in reference lakes focussed on sampling these same habitat types.

Sampling was completed with a petite Ponar dredge (sampling area of 0.023 m^2) and five sub-samples (i.e., five grabs) were collected and pooled at each of the five stations. Samples were sieved through a 500 μm mesh and fixed in buffered formalin. For sampling sites where sediment quality was not measured, sediment samples for the analysis of supporting variables (sediment total organic content [TOC] and particle size analysis [PSA]) were collected at each replicate station using a petite Ponar dredge, placed in large Zip-loc freezer bags and frozen for long-term storage for potential future analysis. Water depth, site UTMs, sediment description, and the presence/absence of macrophytes were recorded at each site. See BIM (2014) for additional details.

Fish

Fish capture methods differed slightly between reference lakes. There was no pre-existing fish population information for Reference Lake 3, and the objective of the reconnaissance survey was

to determine presence/absence of Arctic Char. Two standard gang index gill nets were set at random locations in Reference Lake 3 for approximately 7.5 hours to meet this objective.

With basic fish population status established during 2013 surveys in Reference lakes 1 and 2, the objective for the 2014 sampling was to collect detailed biological data from approximately 100 fish per lake, sampling multiple size classes, but with an emphasis on smaller juveniles. Standard gang index gill nets and a backpack electrofisher were used to sample the fish population in both lakes. Given the relative lack of detailed fish population information from these lakes, gillnetting sites were selected to provide broad coverage across a range of habitat types. To maximize catches of small juveniles, electrofishing sites focussed on nearshore areas with abundant cobble/boulder habitat.

All captured fish were enumerated, identified to species, and measured for fork length (± 1 mm). Fish captured during the gillnetting program were weighed to an accuracy of ± 25 g (i.e., 1% of total body weight for a fish weighing 2,500 g). Fish captured and released during electrofishing were not weighed in the field. Large, live fish were examined for sex and maturity by gently massaging the abdomen and identifying any extruded gametes. Ageing structures (pectoral fin rays) were collected from all live gillnet-caught fish and from a length-stratified sub-sample of electrofished individuals. All live fish were released following collection of biological data.

All incidental mortalities and a length-stratified subsample of small juvenile fish from electrofishing surveys were retained and frozen for detailed laboratory examination. Fish were shipped to the laboratory at NSC (Winnipeg, MB) for detailed necropsies and removal of otoliths for ageing.

2.4 LABORATORY METHODS

2.4.1 LOWER TROPHIC LEVEL BIOTA

Zooplankton and BMI samples were transported to the laboratory at NSC (Winnipeg, MB), catalogued, and transferred to 70% ethanol with a few drops of glycerin for long-term storage. Phytoplankton samples were checked for adequate preservation (i.e., as indicated by colouration of the samples), catalogued, and archived at NSC.

2.4.2 FISH NECROPSIES

Detailed laboratory necropsies were conducted on all frozen fish. Biological data collected included: fork length (± 1 mm); weight (± 1 g for fish larger than 150 mm, ± 0.1 g for smaller fish); sex and maturity; diet; and general parasite load. Diet items were enumerated (estimated if quantities were large) and identified to the Family level or higher. Parasites were enumerated and

identified to the lowest taxonomic level possible. Otoliths, the only (and preferred) ageing structure collected in past mine area lake surveys, were also collected from necropsied fish and submitted for ageing.

2.4.3 FISH AGEING

Arctic Char were aged using otoliths processed by thin sectioning. Otoliths were placed in Cold Cure™ epoxy and left to set (harden) for 48 hours. The nucleus was marked with a fine tipped marker and two points were marked on either side of the nucleus using a micrometer on the microscope. Using a Struers Minitom™ (low speed sectioning saw) the otolith was sectioned on either side of the line (connecting the two outside dots) leaving the nucleus in the section. The section of otolith was then permanently mounted on a microscope slide with Cytosel-60™. The mounted sections were viewed under a microscope with transmitted light and the numbers of annuli were counted. All fin rays collected from live fish and mortalities were archived for future analysis.

2.5 DATA ANALYSIS METHODS

2.5.1 AQUATIC HABITAT

Depth Data Processing

Biosonics Habitat MX sounding data were processed with Biosonics Visual Habitat software. Bottom depth is detected in the field based on a signal threshold decibel (dB) level. Data were reanalyzed in Visual Habitat MX software and depths were manually edited by interpreting the bottom from the echogram where automated signal threshold detection did not capture the true lake bottom. During the manual editing process the acoustic data were checked for signal error, invalid depths, and acoustic waveform anomalies. Erroneous data were filtered out. The data were exported to a .csv text format and imported into Microsoft® Excel. In Excel, these data were then merged with the Biosonics data and subsequently corrected for transducer to water surface offsets.

Bathymetric Surface Modelling and Mapping

Spatial autocorrelation software was used to interpolate a continuous surface of depths or bed elevations given a set of known measurements. Golden Software's Surfer® 11 was used to develop a linear Kriging spatial interpolation depth model for Reference Lake 3. Kriging is an exact interpolator, in that it honors the input depth data points, but provides a realistic representation of the data-poor areas within an irregularly spaced data set based on trends within the measured input data points.

The corrected depth data points were imported into Surfer 11 from an ESRI shapefile .dbf format. A CanVec 1:50000 scale vector shoreline was selected as the representative shoreline for mapping. Depth points with values of zero were extracted at a 5 m interval along the vector shoreline and used as an additional data input for the depth model. A 10 m grid resolution depth model was produced using the Kriging interpolation technique.

The resulting depth grid was converted to a tiff format and imported into ArcGIS 10.2 software for mapping and calculation of statistics. The depth model was used to produce 2 m interval vector contours. The depth grid was classed into 2 m intervals and symbolized using a light blue (shallow) to dark blue (deep) colour gradient. Depth data were summarized in ArcGIS by running a zonal statistics procedure, which was used to output mean and maximum depth statistics and volume. The depth statistics were then tabulated in Excel.

Bottom-Type Classification and Mapping

BioSonics' Visual Habitat MX software uses multivariate principal component analysis and an unsupervised clustering technique to classify the acoustic data collected in the field into a specified number of bottom type classes. The user-supplied number of clusters informs the algorithm how many bottom types to sort the data into. The initial number of clusters was based on a review and spatial analysis of the validation data collected in the field and was adjusted and re-analyzed based on those results.

The bottom type maps, which depict substrate and cover, were interpreted and digitized in ArcGIS 10.2 using the classified Biosonics acoustic track data. After the substrate class polygons were created, the areas were attributed according to their corresponding bottom type class. All classes were then symbolized and mapped for report presentation. Substrate areas were calculated in ArcGIS and the summary data was tabulated in Excel.

2.5.2 WATER QUALITY

Water quality data were compared to Canadian Council of Ministers of the Environment (CCME 1999; updated to 2015) water quality guidelines for the protection of aquatic life (PAL). Trophic status of reference lakes was assessed through application of trophic classification schemes for total phosphorus (TP), total nitrogen (TN), and chlorophyll *a*, as follows:

- TP: the trophic state categorization scheme based on TP presented in the CCME Canadian phosphorus guidance framework for the management of freshwater systems (CCME 1999; updated to 2015);
- TN: the categorization scheme for TN presented by Nürnberg (1996); and

- Chlorophyll *a*: the benchmark (3.7 µg/L) developed for the AEMP that defines the boundary between oligotrophic and mesotrophic conditions (BIM 2014; Table 2).

Measurements reported as less than the analytical detection limit were set equal to the detection limit for derivation of summary statistics, statistical comparisons, and presentation in figures. Duplicate sample results that exceeded five times the analytical detection limit were evaluated by calculating relative percent mean difference (RPMD) and comparing to the criterion of 25%, in accordance with British Columbia Ministry of Environment, Lands, and Parks (BCMELP 1998) guidance. RPMD was calculated as:

RPMD = (Value 1 – Value 2)/((Value 1 + Value 2)/2) x 100

Water quality results from the reference lakes were compared to water quality data collected from mine area lakes to evaluate their suitability. Analyses were performed using the non-parametric Kruskal-Wallis test followed by the Dunn's multiple pairwise comparisons procedure (two-tailed; $\alpha = 0.05$). Comparisons of reference lake water quality to mine area lakes were based on the period of record (i.e., 2006-2014 for mine area lakes and 2013-2014 for reference lakes), data collected in the open-water season, and near surface measurements. For Sheardown Lake NW, nearshore data collected in 2008 were omitted from the analysis. Some data were removed from the datasets for mine area lakes for statistical analysis purposes. Specifically, measurements made with high analytical detection limits (i.e., primarily associated with the 2006 data sets) and values that qualitatively appeared to be transcription errors and/or outliers were removed from the analysis.

2.5.3 SEDIMENT QUALITY

Sediment quality was compared to CCME interim sediment quality guidelines (ISQGs) and probable effect levels (PELs; CCME 1999; updated to 2015) where available, and to the province of Ontario lowest effect level (LEL) and a severe effect level (SEL) for sediments (Persaud et al. 1993) for parameters not currently included in the CCME (1999; updated to 2015) guidelines.

Measurements reported as less than the analytical detection limit were set equal to the detection limit for derivation of summary statistics, statistical comparisons, and presentation in figures. Duplicate sample results that exceeded five times the analytical detection limit were evaluated by calculating the RPMD and comparing to the criterion of 25%, in accordance with BCMELP (1998) guidance. RPMD was calculated as indicated in Section 2.5.2.

Sediment quality results from the candidate reference lakes were compared to sediment quality data collected from mine area lakes to evaluate their suitability. Analyses were performed using

the non-parametric Kruskal-Wallis test followed by the Dunn's multiple pairwise comparisons procedure (two-tailed; $\alpha = 0.05$). Data employed for comparisons included sediment quality data collected from 2006-2014 for Camp and Mary lakes and Sheardown Lake SE, and data collected in 2007 only from Sheardown Lake NW (Knight Piésold Ltd. 2015).

2.5.4 FISH

The gillnetting and electrofishing catches were tabulated by lake and site. Gillnetting catch-per-unit-effort (CPUE) was calculated as the number of fish caught per 100 m gillnet gang per 24 hours. Electrofishing CPUE was expressed as the number of fish captured per 60 seconds of electrofishing.

Mean fork length (mm), weight (g), age and condition factor (K) were calculated for each species. Condition factor was calculated for fish where fork length and round weight were measured, using the following formula (after Fulton 1911, in Ricker 1975):

$K = \text{round weight (g)} \times 10^5/(\text{fork length})^3$

Fish population results from the reference lakes were qualitatively compared to similar data collected from mine area lakes, to evaluate their suitability.

3.0 RESULTS

The following sections provide a brief summary of the results of the 2014 surveys, based on information currently available.

3.1 REFERENCE LAKE 1

3.1.1 WATER QUALITY

Laboratory and *in situ* water quality data collected in fall 2014 at Reference Lake 1 (formerly called CL-P2-13), and results of duplicate samples analysed in 2014, are provided in Appendix 1. A statistical summary of water quality parameters measured in 2013 and 2014 from this lake is provided in Tables 3 and 4. Sampling sites are indicated in Figure 2.

Reference Lake 1 has high water clarity, is highly oxygenated, and is very soft on the basis of the Canadian Council of Resource and Environment Ministers (CCREM 1987) hardness scale. The dominant cation is calcium, followed by magnesium. Considering all data collected in 2013 and 2014, on the basis of TP, the lake is ultra-oligotrophic, whereas on the basis of TN and chlorophyll *a*, the lake is mesotrophic and oligotrophic, respectively (Figure 3). Quality assurance/quality control (QA/QC) results for total Kjeldahl nitrogen (TKN) in 2013, notably those associated with the summer sampling period, indicate potential issues with precision and accuracy of the data. Considering only the 2014 dataset, TN concentrations indicate oligotrophic conditions. Nutrient ratios indicate strong phosphorus limitation.

A number of metals were not detected in Reference Lake 1 in 2014 including antimony, arsenic, beryllium, bismuth, boron, cadmium, chromium, cobalt, lithium, mercury, molybdenum, nickel, selenium, silver, tin, titanium, thallium, vanadium, and zinc (Appendix 1). All metals, DO, pH, ammonia, nitrate, nitrite, and chloride were within the CCME PAL guidelines (CCME 1999; updated to 2015).

3.1.2 SEDIMENT QUALITY

Sediment quality data collected in fall 2014 at Reference Lake 1 are provided in Appendix 2 and the sampling sites are indicated in Figure 2. A statistical summary of sediment quality conditions measured in Reference Lake 1 is provided in Table 5.

Arsenic, cadmium, mercury, and zinc were below the CCME ISGQs in all samples collected from Reference Lake 1. Copper exceeded the ISQGs in all samples and the majority of samples exceeded the PEL for chromium. The mean concentration of iron and manganese exceeded the Ontario SEL.

3.1.3 LOWER TROPHIC LEVEL BIOTA

Samples of phytoplankton, zooplankton, and BMIs collected from Reference Lake 1 in fall 2014 were preserved and archived at NSC (Winnipeg, MB) for potential future analysis. Metadata associated with this sampling are presented in Appendix 3 and sampling sites are presented in Figures 2 and 4.

Chlorophyll *a* concentrations measured in Reference Lake 1 in 2013 and 2014 indicate oligotrophic conditions (Table 3, Figure 3).

3.1.4 FISH

Preliminary gillnetting surveys conducted in Reference Lake 1 in 2013 captured two Arctic Char with fork lengths of 395 and 558 mm. In addition, the main tributary stream, though providing a connection to other lakes, appeared to be of insufficient depth to allow for passage of fish larger than about 200 mm. These preliminary data suggested that large char were permanent residents of the lake. Five gill nets were set for 4.3-5.0 hours in 2014 (Figure 5); however, no fish were captured (Table 6). If Reference Lake 1 supports a resident population of Arctic Char, available information suggests the population may be relatively small.

Ninety-five juvenile Arctic Char were captured in two electrofishing runs of rocky nearshore habitat in Reference Lake 1 during fall 2014 (Table 7; Figure 6). Mean length of the electrofishing catch was 83 mm (Table 8). Otoliths and left pectoral fin rays were collected from ten mortalities and an additional 20 fin rays were collected from live-released fish (Table 8). Fin rays were not aged and have been archived. Age information obtained from eight otoliths (the preferred ageing structure) indicated a mean of 3.4 years (range of 1-6 years) for fish within a size range of 50-136 mm. Although precise numbers cannot be determined, based on these age and size data, small numbers of YOY (n = 5 or fewer) were captured. The majority of the captured fish were 1 or 2 years old.

Stomach contents were observed in seven of the ten mortalities (i.e., stomachs of three fish were empty). Four stomachs contained invertebrate remains, two contained larval or pupal Chironomidae, and one contained Trichoptera. One individual had small numbers of larval cestode cysts along the gut.

3.2 REFERENCE LAKE 2

3.2.1 WATER QUALITY

Laboratory and *in situ* water quality data collected in fall 2014 at Reference Lake 2 are provided in Appendix 1. A statistical summary of water quality parameters measured in 2013 and 2014 is provided in Tables 3 and 4. Sampling sites are indicated in Figure 7.

Like Reference Lake 1, Reference Lake 2 has high water clarity, is highly oxygenated, and is very soft on the basis of the CCREM (1987) hardness scale. Also like Reference Lake 1, the dominant cation is calcium, followed by magnesium. Considering data collected in 2013 and 2014, Reference Lake 2 is oligotrophic on the basis of TP and chlorophyll *a*, and lies on the oligotrophic-mesotrophic boundary on the basis of TN (Figure 3). As noted in Section 3.1.1, TKN data from 2013 are considered to be suspect. Considering only 2014 results, when the TN concentration was lower, the lake would be classified as oligotrophic. Nutrient ratios indicate strong phosphorus limitation.

A number of metals were not detected in Reference Lake 2 in 2014 including antimony, arsenic, beryllium, bismuth, boron, cadmium, chromium, cobalt, iron, lead, lithium, mercury, nickel, selenium, silver, tin, titanium, thallium, vanadium, and zinc (Appendix 1). All metals, DO, pH, ammonia, nitrate, nitrite, and chloride were within the CCME PAL guidelines (CCME 1999; updated to 2015).

3.2.2 SEDIMENT QUALITY

Arsenic, cadmium, copper, lead, mercury and zinc were below the CCME ISQGs in all samples, whereas chromium exceeded the ISQG in four of the five samples (Appendix 2). On average, manganese, nickel, and TKN exceeded the Ontario LEL and iron exceeded the SEL (Table 5).

3.2.3 LOWER TROPHIC LEVEL BIOTA

Samples of phytoplankton, zooplankton, and BMIs collected during fall from Reference Lake 2 were preserved and archived at the laboratory at NSC (Winnipeg, MB) for potential future analyses. Metadata associated with this sampling are presented in Appendix 3 and sampling sites are presented in Figures 7 and 8.

Chlorophyll *a* concentrations measured in Reference Lake 2 in 2013 and 2014 indicate oligotrophic conditions (Table 3, Figure 3).

3.2.4 FISH

Reference Lake 2 has tributaries suitable for use by juvenile Arctic Char, but of insufficient depth for adult use. Any fish in the lake are, therefore, likely resident and non-migratory. Eight Arctic Char were captured in three standard gang index gill nets set for short duration in the lake (Figure 9), with CPUE ranging from 0.0-17.4 fish/100 m/24 hours (Table 6). The captured fish ranged in size from 211-463 mm (Table 9). Three females and one male, all preparing to spawn, were identified from the catch, indicating that spawning likely occurs within the lake. A single gillnet mortality was frozen and returned to the laboratory at NSC (Winnipeg, MB) for detailed examination of sex, maturity, diet, parasite load, and age. This fish was a 14-year-old pre-spawn female with an empty stomach and 25-100 cestode cysts (likely *Diphyllobothrium* sp.) present along the exterior surface of the digestive tract.

Shallow (< 1.5 m), nearshore areas in Reference Lake 2 are almost 100% sand/silt, which is unsuitable habitat for juvenile Arctic Char rearing. Backpack electrofishing efforts were, therefore, concentrated near the confluence of a small inlet stream (Figure 10). A total of 128 fish (99 Arctic Char and 29 Ninespine Stickleback, *Pungitius pungitius*) were captured during a single electrofishing pass (Table 7). The Arctic Char catch ranged in size from 23-178 mm with a mean of 107 mm (Table 8).

Otoliths and pectoral fin rays were extracted from 19 mortalities while fin rays were collected from an additional 16 fish. Fin rays have not been aged and have been archived. Otoliths from 16 Arctic Char were aged (Table 8) with a mean of 1.6 years (range of 0-4 years) for fish spanning a size range of 44-126 mm. Stomach contents were observed in 13 of 20 total mortalities (i.e., stomachs of seven fish were empty). Chironomidae (62% of stomachs with contents), invertebrate remains (38%), and juvenile Ninespine Stickleback (31%) were the most common diet items. Larval Tipulidae and Collembola were also found.

3.3 REFERENCE LAKE 3

3.3.1 WATER QUALITY

Laboratory and *in situ* water quality data collected in fall 2014 at Reference Lake 3 are provided in Appendix 1 and Tables 3 and 4. Sampling completed at this lake in 2014 represented a single site (Figure 11) and sampling event; as previously noted this lake was not sampled in 2013.

Like Reference lakes 1 and 2, Reference Lake 3 has high water clarity and is highly oxygenated. Also like Reference lakes 1 and 2, the dominant cation is calcium, followed by magnesium. While hardness is still relatively low, Reference Lake 3 is “soft” on the CCREM (1987) hardness scale. Based on a single sample collected in fall 2014, Reference Lake 3 is mesotrophic based on

TN and oligotrophic based on TP and chlorophyll *a* (Figure 3). Like the other reference lakes, the nutrient ratio indicates strong phosphorus limitation.

A number of metals were not detected in Reference Lake 3 in 2014 including antimony, arsenic, beryllium, bismuth, boron, cadmium, chromium, cobalt, iron, lithium, mercury, nickel, selenium, silver, tin, titanium, thallium, vanadium, and zinc (Appendix 1). All metals, DO, pH, ammonia, nitrate, nitrite, and chloride were within the CCME PAL guidelines (CCME 1999; updated to 2015).

3.3.2 SEDIMENT QUALITY

Arsenic, cadmium, chromium, copper, lead, mercury and zinc were below the CCME ISQGs in the single sample collected from Reference Lake 3 in 2014. Iron, manganese, nickel, and TKN exceeded the Ontario LEL in this lake (Appendix 2; Table 5).

3.3.3 LOWER TROPHIC LEVEL BIOTA

Samples of phytoplankton, zooplankton, and BMIs collected during fall 2014 from Reference Lake 3 were preserved and archived at the laboratory at NSC (Winnipeg, MB) for potential future analysis. Metadata associated with this sampling are presented in Appendix 3 and sampling sites are presented in Figures 11 and 12.

Chlorophyll *a* measured in Reference Lake 3 in 2014 indicates oligotrophic conditions (Table 3, Figure 3).

3.3.4 FISH AND FISH HABITAT

Reference Lake 3 has the largest surface area of the three reference lakes under consideration (Figure 11). There are small tributaries suitable for use by juvenile Arctic Char and a major connection to another large lake that would allow for passage of adult fish, similar to the connections between Sheardown Lake NW and Sheardown Lake SE, and Camp and Mary lakes. The shoreline of Reference Lake 3 is predominantly rocky with a frequently steep gradient (Photo 1). Nearshore substrate (to at least 5 m depth) is dominated by cobble/boulder throughout the lake (Photo 2, Figure 13; Table 10), including in the shallow bays (< 1 m depth) that could not be navigated by boat. Sandy loam and silt/clay (often very loosely compacted) were dominant at depths greater than 5 m. The lake is characterized by broad, shallow areas to the north, south and east and two deep (> 30 m) basins separated by a relatively shallow, flat plain (Figure 11). Maximum recorded depth in this lake was 38.3 m with a mean of 11.8 m.

Although backpack electrofishing was not conducted in 2014, juvenile Arctic Char (30-100 mm fork length) were observed in rocky nearshore areas, confirming the presence of smaller size

classes. A single Arctic Char (620 mm fork length) was captured during a preliminary gillnetting survey of the lake (Figure 14; Tables 6 and 9). Sex and maturity could not be confirmed in the field, but the bright orange colouration suggested this fish was a current year spawner. Given this observation and the abundance of preferred spawning habitat (rocky substrate 2-10 m deep) in the lake, the lake is expected to support a resident, spawning char population. Though preliminary, the 2014 survey of habitat and fish populations indicates that this lake is a suitable reference.

4.0 SUMMARY AND COMPARISON TO MINE AREA LAKES

The following provides a discussion of the suitability of the three lakes as reference areas for the CREMP. This discussion is based upon data collected in 2013 and 2014 from the reference lakes and baseline data collected from mine area lakes.

4.1 WATER QUALITY

As discussed in NSC (2014), water quality of Reference lakes 1 and 2 is similar to mine area lakes for some parameters and different for others (Tables 11 and 12). Statistical comparisons of water quality between these lakes using all available data (open-water season only) indicated a number of parameters, including DO, pH (*in situ* and laboratory), Secchi disk depth, ammonia, TKN, TN, TP, chlorophyll *a*, and several metals (iron, lead, sodium, and zinc) were not significantly different between Reference lakes 1 and 2 and Camp Lake or Sheardown Lake NW. Statistical comparisons could not be undertaken for a number of parameters that did not exceed the analytical detection limit in any samples collected from the reference lakes including nitrite, nitrate, nitrate/nitrite, total suspended solids (TSS), bromide, sulphate (Reference Lake 2), phenols, antimony, arsenic, beryllium, bismuth, boron, cadmium, cobalt, lithium, mercury, selenium, silver, thallium, tin, titanium, and vanadium.

Differences between one or both of the reference lakes and one or both of Camp Lake and Sheardown Lake NW were noted for several routine parameters. Alkalinity (Figure 15), total dissolved solids (TDS; Figure 16), conductivity (Figure 17), and hardness (Figure 18) were significantly lower in both reference lakes in comparison to the mine area lakes. In addition, dissolved organic carbon (DOC; Figure 19), TOC (Figure 20), and chloride (Figure 21) were lower than either mine area lake, and turbidity was higher in Reference Lake 1 in comparison to Camp Lake (Figure 22).

In addition, a number of total metals were significantly lower in one or both of the reference lakes in comparison to one or both mine area lakes, including barium (Figure 23), calcium (Figure 24), copper (Figure 25), magnesium (Figure 26), molybdenum (Figure 27), nickel (Figure 28), potassium (Figure 29), silicon (Figure 30), strontium (Figure 31), and uranium (Figure 32). One metal (chromium; Figure 33) was higher in both reference lakes than mine area lakes, aluminum (Figure 34) was higher in Reference Lake 1 than Sheardown Lake NW, and manganese was higher in Reference Lake 2 than Sheardown Lake NW (Figure 35).

Results of statistical analyses for TP (Reference Lake 1), chromium, copper (Reference Lake 2), iron, lead, nickel (Reference Lake 1), and zinc, and possibly other metals, may be artefacts of a high frequency of censured data points and/or varying analytical detection limits.

Overall, available information indicates that Reference lakes 1 and 2 have similar levels of key nutrients (i.e., TN and TP) and chlorophyll *a*, water clarity, pH, DO, and a number of metals to Camp Lake and/or Sheardown Lake NW. The key differences between the reference and mine area lakes relate to the former being more dilute, softer, and containing lower concentrations of some major cations and metals. Reference Lake 1 also contains more organic carbon.

The results of the reconnaissance survey conducted in Reference Lake 3 in 2014 are limited to a single sampling site and sampling event and therefore were not amenable to statistical comparisons. However, qualitative comparison of water quality from Reference Lake 3 to mine area lakes indicates that overall, water quality conditions may be more similar to mine area lakes than Reference lakes 1 and 2. Specifically, water quality parameters that are similar between mine area lakes and Reference lakes 1 and 2, are also similar for Reference Lake 3. However, several water quality parameters that are significantly lower in Reference lakes 1 and/or 2 than mine area lakes, such as major cations (calcium, magnesium, and potassium), alkalinity, TDS, conductivity, and hardness, are more similar to mine area lakes for Reference Lake 3.

4.2 SEDIMENT QUALITY

Sediment quality measured in the three reference lakes in 2014 was compared to sediment quality of mine area lakes collected over the period of 2006-2014 to evaluate similarities among lakes. This analysis was done by comparing exceedances of CCME and Ontario sediment quality guidelines (SQGs), based on mean concentrations, and through statistical comparisons.

Exceedances of either CCME or Ontario SQGs were generally similar between reference and mine area lakes. Specifically, where one or more of the reference lakes exceeded an SQG, this was also observed in one or more mine area lakes (Table 5). This indicates general similarities in sediment quality among the waterbodies.

Regarding statistical comparisons, a number of parameters were either not significantly different between Reference lakes 1 and 2 and mine area lakes, or statistical comparisons could not be made due to a high frequency of censured data points. These parameters include: antimony; arsenic; barium; beryllium; boron; cadmium; cobalt; iron; manganese; mercury; molybdenum; nickel; selenium; silver; sodium; thallium; nitrite; nitrate; and nitrate/nitrite. Four parameters were significantly higher in Reference Lake 1 than Camp Lake: aluminum (Figure 36); chromium (Figure 37); strontium (Figure 38); and, percent clay (Figure 39). No parameters were significantly different between Reference Lake 2 and either Camp Lake or Sheardown Lake NW.

While few statistically significant differences were noted between Reference lakes 1 and 2 and Camp Lake or Sheardown Lake NW, these results may reflect limitations associated with sample sizes. Qualitative comparisons of data suggest several parameters may differ between Reference

Lake 2 and mine area lakes including magnesium (Figure 40), nickel (Figure 41), potassium (Figure 42), TKN (Figure 43), TOC (Figure 44), and percent silt (Figure 45).

Statistical comparisons between Reference Lake 3 and mine area lakes could not be undertaken as the 2014 survey of Reference Lake 3 was a reconnaissance level program and only one sample was collected. However, sediment quality parameters measured in the single sample from Reference Lake 3, fell within the ranges measured in mine area lakes.

Overall, available sediment quality data indicate that conditions are generally similar between the three reference lakes sampled in 2014 and Camp Lake and Sheardown Lake NW in the mine area.

4.3 LOWER TROPHIC LEVEL BIOTA

With the exception of chlorophyll *a*, lower trophic level samples, including phytoplankton (taxonomy and biomass), zooplankton, and BMIs, collected in 2014 from the three reference lakes were archived. Therefore, the following presents a summary of conclusions presented in NSC (2014), supplemented with consideration of chlorophyll *a* data collected in 2014.

4.3.1 PHYTOPLANKTON

As discussed in Section 4.1, chlorophyll *a* concentrations were not significantly different between Reference lakes 1 and 2 and Camp Lake or Sheardown Lake NW. The single sample collected from Reference Lake 3 was also similar to mine area lakes (i.e., within the range of concentrations observed in mine area lakes). Available information therefore indicates similar levels of primary productivity among the lakes.

Based on phytoplankton samples collected in 2013, there is some indication of differences in community composition between the Reference lakes 1 and 2 and mine area lakes (NSC 2014). The former were dominated by dinoflagellates (Dinophyceae) whereas the latter were typically dominated by diatoms.

While the differences in community composition are not ideal, the community composition of all the lakes (candidate reference lakes and mine area lakes) is consistent with nutrient-poor Arctic lakes. Other studies have reported high abundance of dinoflagellates, and specifically the Genus *Gymnodinium*, in other Arctic lakes (e.g., Snap Lake and a reference lake; De Beers 2002; Golder Associates 2012).

4.3.2 ZOOPLANKTON

Densities and composition of the zooplankton communities were similar between mine area lakes (as measured in 2007 and 2008) and Reference lakes 1 and 2 (as measured in 2013; NSC 2014).

4.3.3 BENTHIC MACROINVERTEBRATES

Benthic macroinvertebrate abundance and composition metrics were similar between mine area lakes (as measured in 2006, 2007, 2008, 2011, and 2013) and Reference lakes 1 and 2 (as measured in 2013; NSC 2014).

4.4 FISH AND FISH HABITAT

In terms of lake morphometry, Reference Lake 3 is most similar to mine area lakes, particularly Camp Lake, due its relatively larger volume and surface area, and greater depth (Table 13). Maximum observed depth in Reference Lake 3 was 38.3 m with a mean of 11.8 m, which is similar to Camp Lake. The drainage basin area: lake surface area ratio of Reference Lake 3 is also the most similar to mine area lakes, most notably Camp Lake. Reference Lake 3 also has a higher proportion of sand substrate than Reference lakes 1 and 2, which is more similar to mine area lakes.

Available information regarding Arctic Char populations and aquatic habitat in the three candidate reference lakes indicate all three lakes support what are likely land-locked resident populations and at least two (Reference lakes 1 and 2) are supplied by tributary streams that appear to provide juvenile rearing habitat (similar to mine area lakes). Reference lakes 1 and 3 also provide abundant juvenile rearing habitat in rocky nearshore areas. All three potential reference lakes also appear to provide suitable overwintering and spawning habitat. However, spawning has only been indirectly confirmed (based on extrusion of mature gametes from fall 2014 catches) in Reference Lake 2. Spawning adults have not yet been identified from Reference lakes 1 or 3, though suitable spawning habitat is abundant in both.

Based on available information, the fish population in Reference Lake 1 may be the least suitable of the three for comparison with mine area lakes. Low catch rates suggest the population of large Arctic Char in Reference Lake 1 may be small. Although there are large numbers of small Arctic Char using rocky nearshore habitat in the lake, it is not known if these fish are produced by spawning in the lake or simply move into the lake via a connecting stream. In addition, preliminary age data suggest that growth rates may be lower in Reference Lake 1 relative to mine area lakes. For example, mean otolith age for 25 Arctic Char sampled from the Mary River in

2008 was 2.6 years at a size range of 63-150 mm compared with a mean of 3.4 years for eight fish 50-136 mm in length from Reference Lake 1.

Reference Lake 2, with its lack of rocky habitat, may be the least similar to mine area lakes in terms of habitat, but fish population data (CPUE, size, and age) suggest a good match with either Camp Lake or Sheardown Lake NW. For example, the maximum CPUE for Reference Lake 2 in fall 2014 (17.37 fish/100 m/24 hours) was similar to that observed for gill nets set in Camp Lake (21.8 fish/100 m/24 hours). Captured Reference Lake 2 fish also ranged in size from 211-463 mm, similar to the 318-464 mm observed for Camp Lake fish. A summary of fish population and habitat suitability for all three lakes is provided in Table 14.

5.0 LITERATURE CITED

Baffinland Iron Mines Corporation (BIM). 2014. Aquatic effects monitoring plan. June, 2014.

British Columbia Ministry of Environment (BCMOE). 2009. Bathymetric standards for lake inventories, Version 3. A standards manual prepared by BCMOE Ecosystems Branch for the Aquatic Ecosystems Task Force Resources Information Standards Committee. 50 pp.

British Columbia Ministry of Environment, Lands, and Parks (BCMELP). 1998. Guidelines for interpreting water quality data, version 1. May 1998. Prepared for the Land Use Task Force Resource Inventory Committee.

Canadian Council of Ministers of the Environment (CCME). 1999. Canadian environmental quality guidelines. Canadian Council of Ministers of the Environment, Winnipeg, MB. Updated to 2015.

Canadian Council of Resource and Environment Ministers (CCREM). 1987. Canadian water quality guidelines. Canadian Council of Resource and Environment Ministers, Winnipeg, MB.

De Beers Canada Mining Inc. 2002. Snap Lake Diamond Project Environmental Impact Assessment. Chapter 9.

Knight Piésold Ltd. 2015. Baffinland Iron Mines Corporation – Mary River Project – 2014 Water and Sediment CREMP Monitoring Report. KP Ref. No. NB102-181/34, Rev. A, dated January 30, 2015.

Golder Associates. 2012. Snap Lake aquatic effects re-evaluation report. Submitted to De Beers Canada Inc.

North/South Consultants (NSC). 2014. Candidate reference lakes: Preliminary survey 2013. Report prepared for Baffinland Iron Mines Corporation by NSC, Winnipeg, MB, June 2014.

NSC and Knight Piésold Ltd. 2013. Desktop screening for candidate reference lakes: Mary River Mine Site. Report prepared for Baffinland Iron Mines Corporation by NSC, Winnipeg, MB, July 2013.

Nürnberg. 1996. Trophic state in clear and colored, soft- and hardwater lakes with special consideration of nutrients, anoxia, phytoplankton and fish. Lake Reservoir Manage. 12: 432-447.

Persaud, D., R. Jaagumagi, and A. Hayton. 1993. Guidelines for the protection and management of aquatic sediment quality in Ontario. ISBN 0-7729-9248-7. Ontario Ministry of the Environment, Water Resources Branch, Toronto, ON.

Ricker, W. 1975. Computation and interpretation of biological statistics of fish populations. Technical Report Bulletin 191, Bulletin of the Fisheries Research Board of Canada. 382 pp.

Wentworth, C.K. 1922. A scale of grade and class terms for clastic sediments. The Journal of Geology 30: 377-392.

TABLES, FIGURES, AND PHOTOGRAPHS

Table 1. Sampling programs completed in candidate reference lakes, fall 2014.

Lake	Bathymetry & Substrate	Water Quality			Phytoplankton	Zooplankton	Benthic Macroinvertebrates	Fish	
		In situ	Surface Sample	Bottom Sample				Shoreline Electrofishing	Gillnetting
Reference Lake 1		+	+	+	+	+	+	+	+
Reference Lake 2		+	+	+	+	+	+	+	+
Reference Lake 3	+	+	+	+	+	+	+		+

Table 2. Trophic classification schemes for lakes.

Parameter		Trophic categories						Reference
		Ultra-oligotrophic	Oligotrophic	Mesotrophic	Meso-eutrophic	Eutrophic	Hypereutrophic	
TP	(mg/L)	<0.004	0.004-0.010	0.010-0.020	0.020-0.035	0.035-0.100	> 0.100	CCME (1999; updated to 2015)
Chlorophyll *a*	(µg/L)	-	<3.7	>3.7	-			Mary River Benchmark (BIM 2014)
TN	(mg/L)	-	<0.350	0.350-0.650	-	0.651-1200	>1200	Nurnberg (1996)

Table 3. Routine water quality measured in candidate Reference lakes 1, 2, and 3 (RL1, RL2, and RL3) and mine area lakes in the open-water seasons of 2013 and 2014. Values represent means, minimums, maximums, and samples size (N) of surface water samples. CL = Camp Lake, SDL NW = Sheardown Lake northwest, SDL SE = Sheardown Lake southeast , and ML = Mary Lake.

Parameter	Unit	RL1				RL2				RL3		CL				SDL NW				SDL SE				ML			
		2013-2014				2013-2014				2014		2006-2014				2006-2014				2006-2014				2006-2014			
		Mean	Min	Max	N	Mean	Min	Max	N	Replicate 1	N	Mean	Min	Max	N	Mean	Min	Max	N	Mean	Min	Max	N	Mean	Min	Max	N
***In Situ* Parameters**																											
DO	(mg/L)	12.0	11.5	12.3	7	11.86	11.33	12.05	7	12.09	1	11.78	10.14	14.30	21	14.28	11.70	9.15	39	12.0	9.4	14.5	26	11.3	9.8	12.8	39
pH		7.79	7.42	8.23	7	7.62	7.44	8.10	7	7.82	1	7.86	6.93	8.23	19	7.87	7.90	6.76	50	7.75	6.76	8.32	24	7.73	6.78	8.55	35
Secchi Disk Depth	(m)	4.6	4.3	5.0	7	5.7	5.3	6.5	7	5.8	1	6.0	3.5	10.8	20	5.7	5.5	3.7	39	2.4	1.0	4.4	26	2.7	0.6	4.8	30
Laboratory Parameters																											
pH		7.36	6.69	7.67	7	7.32	6.64	7.62	7	7.73	1	7.67	6.84	8.30	29	7.60	6.85	8.32	66	7.75	7.01	8.20	29	7.56	6.71	8.29	47
Alkalinity as $CaCO_3$	(mg/L)	23	21	31	7	15	14	17	7	31	1	58	50	73	29	57	49	65	66	48	38	61	29	39	24	90	47
Total Dissolved Solids	(mg/L)	28	27	29	7	25	25	27	7	49	1	78	61	99	29	77	61	84	66	67	53	81	29	54	34	123	47
Conductivity	µS/cm	43	41	45	7	39	39	41	7	76	1	118	93	129	28	118	94	130	66	103	82	124	29	83	52	190	47
Ammonia	mg N/L	0.21	<0..02	1.01	7	0.09	0.03	0.17	7	0.18	1	0.09	<0.02	1.41	28	0.05	<0.02	0.18	66	0.05	<0.02	0.20	29	0.09	<0.02	0.38	46
Nitrite	mg N/L	<0.005	<0.005	<0.005	7	<0.005	<0.005	<0.005	-	<0.005	1	<0.1	<0.002	<0.1	29	<0.1	<0.002	<0.1	66	<0.1	<0.002	<0.1	29	<0.1	<0.002	0.1	47
Nitrate	mg N/L	<0.1	<0.1	<0.1	7	<0.1	<0.1	<0.1	-	<0.1	1	<0.1	<0.1	<0.1	29	<0.1	<0.1	0.18	66	<0.1	<0.1	<0.1	29	<0.1	<0.1	0.1	47
Nitrate/nitrite	mg N/L	<0.1	<0.1	<0.1	7	<0.1	<0.1	<0.1	-	<0.1	1	<0.1	<0.005	<0.1	29	<0.1	<0.005	0.18	66	<0.1	<0.005	<0.1	29	<0.1	<0.005	0.1	47
Total Kjeldahl Nitrogen	(mg/L)	0.37	0.10	1.42	7	0.23	<0.10	0.68	7	0.34	1	0.26	<0.1	1.57	27	0.15	<0.10	0.41	64	0.19	<0.10	0.46	27	0.16	<0.10	0.35	42
Total Nitrogen [1]	(mg/L)	0.42	0.15	1.47	7	0.30	<0.20	0.73	7	0.44	1	0.33	<0.11	1.67	27	0.24	<0.11	0.51	64	0.25	<0.11	0.56	27	0.21	<0.105	0.45	42
Total Phosphorus	(mg/L)	0.003	<0.003	0.004	7	0.005	<0.003	0.014	7	0.004	1	0.004	<0.003	0.015	27	0.004	<0.003	0.020	65	0.004	<0.003	0.009	27	0.005	<0.003	0.020	44
TN:TP [1, 2]		567	221	2167	7	189	36	413	7	216	1	215	29	1231	27	143	57	332	64	150	49	391	27	121	31	249	43
Dissolved Organic Carbon	(mg/L)	1.0	0.8	1.3	7	1.9	1.7	2.2	7	3.0	1	1.74	1.00	2.10	27	1.66	1.20	2.10	64	1.39	0.50	1.80	27	1.30	0.80	1.90	43
Total Organic Carbon	(mg/L)	1.2	1.0	1.4	7	2.1	1.7	2.4	7	3.1	1	1.83	1.30	2.20	27	1.79	1.40	2.40	64	1.58	1.20	1.90	26	1.54	1.10	2.80	39
Total Suspended Solids	(mg/L)	<2	<2	<2	7	<2	<2	<2	7	<2	1	<2	<2	2.0	27	3.0	<2.0	42.0	64	2.2	<2.0	5.0	27	2.5	<2	20.0	43
Turbidity	(NTU)	0.8	0.8	0.9	7	0.6	0.3	0.8	7	0.3	1	0.5	0.2	2.6	28	0.5	0.2	1.8	66	1.7	0.4	3.9	29	1.7	0.5	6.3	46
Chlorophyll *a*	(µg/L)	1.3	<0.2	3.4	7	0.4	<0.2	0.7	7	2.3	1	1.1	<0.2	3.6	22	0.6	<0.2	2.9	42	0.8	<0.2	6.5	25	1.1	<0.2	3.5	39
Pheophytin *a*	(µg/L)	1.0	<0.2	2.8	7	<0.2	<0.2	0.2	7	<0.2	1	0.5	<0.2	2.7	22	1.4	<0.2	14.3	42	1.8	<0.2	13.1	25	0.8	<0.2	3.0	39
Phenols	(mg/L)	<0.001	<0.001	<0.001	7	<0.001	<0.001	<0.001	7	<0.001	1	<0.001	<0.001	<0.001	29	<0.001	<0.001	<0.001	66	<0.001	<0.001	0.001	29	<0.001	<0.001	0.001	-
Bromide	(mg/L)	<0.25	<0.25	<0.25	7	<0.25	<0.25	<0.25	7	<0.25	1	<0.25	<0.05	<0.25	29	<0.25	<0.05	<0.25	66	<0.25	<0.05	<0.25	29	<0.25	<0.05	<0.25	47
Chloride	(mg/L)	1	<1	1	7	2	2	2	7	2	1	2	<1	4	29	3	1	4	66	2	2	5	29	2	<1	6	47
Sulphate	(mg/L)	<3	<1	<3	7	<3	1	<3	7	4	1	2	<1	4	24	3	1	4	66	2	<1	4	29	2	<1	5	43
Hardness as $CaCO_3$ (Total)	(mg/L)	20.3	18.2	21.0	7	17.6	16.2	18.0	7	38	1	59.2	50.0	76.5	29	59.2	43.0	65.2	62	49.6	22.0	63.1	26	40.4	24.0	96.1	47
Hardness as $CaCO_3$ (Dissolved)	(mg/L)	20.3	18.5	21.0	7	17.4	15.8	18.0	7	38	1	67.3	62.0	78.1	7	59.3	57.0	62.0	12	48.7	41.0	54.0	10	39.2	26.0	67.0	20

[1] Calculated
[2] Molar ratio

Table 4. Total metals measured in candidate Reference lakes 1, 2, and 3 (RL1, RL2, and RL3) and mine area lakes in the open-water seasons of 2013 and 2014. Values represent means, minimums, maximums, and samples size (N) of surface water samples. CL = Camp Lake, SDL NW = Sheardown Lake northwest, SDL SE = Sheardown Lake southeast , and ML = Mary Lake.

Parameter	Unit	RL1				RL2				RL3		CL				SDL NW				SDL SE				ML			
		2013-2014				2013-2014				2014		2006-2014				2006-2014				2006-2014				2006-2014			
		Mean	Min	Max	N	Mean	Min	Max	N	Replicate 1	N	Mean	Min	Max	N	Mean	Min	Max	N	Mean	Min	Max	N	Mean	Min	Max	N
Aluminum	(mg/L)	0.0312	0.0250	0.0410	7	0.0142	0.0050	0.0218	7	0.004	1	0.0076	0.0010	0.0280	29	0.0143	0.0029	0.1990	66	0.0710	0.0050	0.2170	28	0.0555	0.0030	0.1450	47
Antimony	(mg/L)	<0.0001	<0.0001	<0.0001	7	<0.0001	<0.0001	<0.0001	7	<0.0001	1	<0.0001	<0.0001	0.0002	27	<0.0001	<0.0001	0.0001	64	<0.0001	<0.0001	<0.0001	26	<0.0001	<0.0001	0.0002	43
Arsenic	(mg/L)	0.0001	<0.0001	0.0001	7	<0.0001	<0.0001	<0.0001	7	<0.0001	1	<0.0001	<0.0001	<0.0001	29	<0.0001	<0.0001	0.0001	66	<0.0001	<0.0001	<0.0001	28	<0.0001	<0.0001	0.0004	47
Barium	(mg/L)	0.00222	0.00208	0.00248	7	0.00262	0.00250	0.00284	7	0.00619	1	0.00527	0.00443	0.00666	27	0.00488	0.00423	0.00543	64	0.00490	0.00391	0.00662	26	0.00450	0.00258	0.01000	45
Beryllium	(mg/L)	<0.0005	<0.00002	<0.0005	7	<0.0005	<0.00002	<0.0005	7	<0.0005	1	<0.0005	<0.00002	<0.0005	27	<0.0005	<0.00002	0.0005	64	<0.0001	<0.00002	<0.0001	26	<0.0005	<0.00002	<0.0005	43
Bismuth	(mg/L)	<0.0005	<0.0005	<0.0005	7	<0.0005	<0.0005	<0.0005	7	<0.0005	1	<0.0005	<0.0005	<0.0005	27	<0.0005	<0.0005	0.0005	64	<0.0005	<0.0005	<0.0005	26	<0.0005	<0.0005	0.0005	43
Boron	(mg/L)	<0.01	<0.01	<0.01	7	<0.01	<0.01	<0.01	7	<0.01	1	<0.01	<0.01	<0.01	29	<0.01	<0.01	0.011	66	<0.01	<0.01	0.01	28	<0.01	<0.01	0.01	47
Cadmium	(mg/L)	<0.00001	<0.00001	<0.00001	7	<0.00001	<0.00001	<0.00001	7	<0.00001	1	<0.000017	<0.00001	<0.000017	29	<0.000017	<0.00001	<0.000017	66	<0.000017	<0.00001	<0.000017	28	<0.000017	<0.00001	<0.000017	47
Calcium	(mg/L)	4.09	3.68	4.27	7	3.74	3.47	3.84	7	7.56	1	12.16	10.00	15.50	29	11.87	10.00	13.10	66	10.38	8.21	12.90	28	8.40	5.17	19.70	47
Chromium	(mg/L)	0.0008	<0.0005	0.0028	7	<0.0005	<0.0005	<0.0005	7	<0.0005	1	<0.0005	<0.0001	<0.0005	29	<0.0005	<0.0001	0.0032	66	<0.00067	<0.0001	<0.00067	28	<0.0005	0.0001	<0.0005	43
Cobalt	(mg/L)	<0.0001	<0.0001	<0.0001	7	<0.0001	<0.0001	<0.0001	7	<0.0001	1	<0.0001	<0.0001	<0.0002	29	<0.0002	<0.0001	<0.0002	66	<0.0002	<0.0001	<0.0002	28	<0.0002	<0.0001	<0.0002	47
Copper	(mg/L)	0.00089	0.00050	0.00292	7	<0.0005	<0.0002	0.00050	7	0.0009	1	0.00101	0.00072	0.00324	27	0.00134	0.00073	0.02720	64	0.00092	0.00063	0.00246	26	0.00085	0.00050	0.00429	43
Iron	(mg/L)	0.044	<0.03	0.111	7	<0.03	<0.03	<0.03	7	<0.03	1	<0.03	<0.003	0.044	29	<0.03	0.011	0.037	66	0.082	<0.03	0.221	28	0.064	<0.03	0.180	47
Lead	(mg/L)	0.00007	<0.00005	0.00013	7	<0.00005	<0.00005	<0.00005	7	<0.00005	1	<0.00005	<0.00005	0.00008	27	0.00006	<0.00005	0.00095	64	0.00010	<0.00005	0.00029	26	0.00008	<0.00005	0.00017	43
Lithium	(mg/L)	<0.001	<0.00005	<0.001	7	<0.001	<0.00005	<0.001	7	<0.001	1	<0.005	<0.00056	<0.005	27	<0.005	<0.00005	<0.005	64	<0.005	0.00005	<0.005	26	<0.005	<0.00005	<0.005	43
Magnesium	(mg/L)	2.44	2.19	2.53	7	1.98	1.83	2.04	7	4.56	1	7.13	6.00	9.18	29	7.20	6.00	8.02	66	5.96	4.92	7.27	28	4.77	3.00	11.20	47
Manganese	(mg/L)	0.00207	0.00187	0.00256	7	0.00266	0.00038	0.00534	7	0.00078	1	0.00160	0.00014	0.00288	27	0.00158	0.00082	0.00259	64	0.00334	0.00033	0.00553	26	0.00225	0.00088	0.02000	44
Mercury	(mg/L)	<0.00001	<0.00001	<0.00001	7	<0.00001	<0.00001	<0.00001	7	<0.00001	1	<0.00001	<0.00001	<0.00001	29	<0.00001	<0.00001	0.00017	66	<0.00001	<0.00001	<0.00001	28	<0.00001	<0.00001	0.00001	47
Molybdenum	(mg/L)	0.00016	<0.00005	0.00076	7	<0.00005	<0.00005	0.00006	7	0.00018	1	0.00021	<0.00005	0.00052	27	0.00064	0.00026	0.00093	64	0.00037	0.00010	0.00076	26	0.00010	<0.00005	0.00027	43
Nickel	(mg/L)	0.00062	<0.0005	0.00134	7	<0.0005	<0.0005	<0.0005	7	<0.0005	1	0.00064	0.00050	0.00073	27	0.00066	0.00054	0.00097	64	0.00062	0.00050	0.00085	26	0.00051	<0.00050	0.00068	43
Potassium	(mg/L)	0.30	0.29	0.32	7	0.32	0.20	0.40	7	0.8	1	0.82	0.59	1.07	23	0.83	0.67	0.91	50	0.69	0.50	0.87	22	0.52	0.30	0.81	39
Selenium	(mg/L)	<0.001	<0.00001	<0.001	7	<0.001	<0.00001	<0.001	7	<0.001	1	<0.001	<0.00001	<0.001	29	<0.001	<0.00001	0.001	60	<0.001	<0.00001	<0.001	28	<0.001	<0.00001	<0.001	47
Silicon	(mg/L)	0.39	0.35	0.40	7	0.28	0.20	0.30	7	0.5	1	0.43	0.36	0.57	27	0.63	0.57	0.70	58	0.71	0.49	1.16	26	0.55	0.40	0.90	43
Silver	(mg/L)	<0.00001	<0.000001	0.000016	7	<0.00001	<0.000001	<0.00001	7	<0.00001	1	<0.00001	<0.000001	<0.00001	29	<0.0001	<0.000001	0.00010	60	<0.00001	<0.000001	<0.00001	28	<0.00001	<0.000001	<0.00001	47
Sodium	(mg/L)	0.71	0.65	0.80	7	1.02	0.99	1.09	7	0.73	1	0.91	0.47	1.28	23	0.91	0.48	1.16	49	0.78	0.48	1.30	22	0.87	0.41	1.48	39
Strontium	(mg/L)	0.0036	0.0034	0.0038	7	0.0049	0.0048	0.0050	7	0.0086	1	0.0078	0.0052	0.0111	29	0.0075	0.0064	0.0084	60	0.0080	0.0049	0.0128	28	0.0066	0.0036	0.0144	47
Thallium	(mg/L)	<0.0001	<0.000001	<0.0001	7	<0.0001	<0.000001	<0.0001	7	<0.0001	1	<0.0001	<0.000001	<0.0001	27	<0.0001	<0.000001	0.0001	57	<0.0001	<0.000001	<0.0001	26	<0.0001	<0.000001	<0.0001	43
Tin	(mg/L)	0.00021	<0.0001	0.00077	7	<0.0001	<0.0001	0.00030	7	<0.0001	1	<0.0001	<0.0001	0.0002	27	<0.0001	<0.0001	0.00016	58	0.00012	<0.0001	0.00038	26	<0.0001	<0.0001	0.0006	43
Titanium	(mg/L)	<0.01	<0.01	<0.01	7	<0.01	<0.01	<0.01	7	<0.01	1	<0.01	<0.01	<0.01	27	<0.01	<0.01	0.01	58	<0.01	<0.01	0.02	26	<0.01	<0.01	<0.01	43
Uranium	(mg/L)	0.00014	0.00013	0.00014	7	0.00006	0.00006	0.00008	7	0.00027	1	0.00051	0.00034	0.00071	27	0.00079	0.00036	0.00096	58	0.00063	0.00036	0.00097	26	0.00063	0.00027	0.00235	43
Vanadium	(mg/L)	<0.001	<0.001	<0.001	7	<0.001	<0.001	<0.001	7	<0.001	1	<0.001	<0.001	<0.001	29	<0.001	<0.001	0.001	60	<0.001	<0.001	<0.001	28	<0.001	<0.001	0.004	47
Zinc	(mg/L)	<0.003	<0.003	0.004	7	0.005	<0.003	0.019	7	<0.003	1	<0.003	<0.001	0.004	27	<0.003	<0.001	0.017	58	<0.003	<0.001	0.003	26	<0.003	<0.001	0.005	43

Table 5. Sediment quality measured in candidate Reference lakes 1, 2, and 3 and mine area lakes. Values represent means for Reference lakes 1 and 2 and mine area lakes and results of the single sample collected in Reference Lake 3. Values in blue and red indicate exceedances of CCME (non-italicized) or Ontario SQGs (italicized). CL = Camp Lake; SDL NW = Sheardown Lake northwest; SDL SE = Sheardown Lake southeast; and ML = Mary Lake.

Parameter	Unit	Reference Lakes			Mine Area Lakes				SQGs			
		RL1	RL2	RL3	CL	SDL NW	SDL SE	ML	CCME		Ontario	
		2014	2014	2014	2007-2014	2007	2007-2014	2006-2014	ISQG	PEL	LEL	SEL
Aluminum	(µg/g)	24140	11200	8450	11200	8450	13020	14443				
Antimony	(µg/g)	<1	<1	<1	<1	<1	<1	<1				
Arsenic	(µg/g)	3	2	<1	2	<1	3	3	5.9	17		
Barium	(µg/g)	103	71	49	71	49	68	76				
Beryllium	(µg/g)	2	<1	<1	<1	<1	1	1				
Boron	(µg/g)	0.7	1.0	<0.5	1.0	<0.5	1.0	3.7				
Cadmium	(µg/g)	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	0.6	3.5		
Calcium	(µg/g)	3120	2260	3200	2260	3200	2950	3061				
Chromium	(µg/g)	98	42	31	42	31	62	66	37.3	90		
Cobalt	(µg/g)	18	11	7	11	7	15	12				
Copper	(µg/g)	45	25	35	25	35	35	40	35.7	197		
Iron	(µg/g)	*48920*	*61020*	*20400*	*61020*	*20400*	*29304*	*30571*			*20000*	*40000*
Lead	(µg/g)	22.4	11	7	11	7	15	17	35	91.3		
Magnesium	(µg/g)	13080	4080	5200	4080	5200	10037	8934				
Manganese	(µg/g)	*1328*	*625*	*483*	*625*	*483*	*987*	*1019*			*460*	*1100*
Mercury	(µg/g)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.170	0.486		
Molybdenum	(µg/g)	<1	2	1	2	1	1	3				
Nickel	(µg/g)	*63*	*24*	*22*	*24*	*22*	*55*	*59*			*16*	*75*
Potassium	(µg/g)	4740	1900	2100	1900	2100	3169	3583				

Table 5. - continued -

Parameter	Unit	Reference Lakes			Mine Area Lakes				SQGs			
		RL1	RL2	RL3	CL	SDL NW	SDL SE	ML	CCME		Ontario	
		2014	2014	2014	2007-2014	2007	2007-2014	2006-2014	ISQG	PEL	LEL	SEL
Selenium	(µg/g)	<1	<1	<1	<1	<1	1	<1				
Silver	(µg/g)	<0.2	<0.2	<0.2	<0.42	<0.42	<0.42	<0.42				
Sodium	(µg/g)	260	180	200	238	357	321	367				
Strontium	(µg/g)	20	16	7	10	11	11	12				
Thallium	(µg/g)	<1	<1	<1	<1	<1	<1	<1				
Vanadium	(µg/g)	71	33	30	49	48	44	52				
Zinc	(µg/g)	84	53	43	57	60	49	74	123	315		
Nitrite	(µg N/g)	<1	<1	<1	<1	<1	<1	<1				
Nitrate	(µg N/g)	<1	<1	<1	1	1	4	2				
Nitrate/nitrite	(µg N/g)	<1	<1	<1	2	2	5	3				
Total Kjeldahl Nitrogen	(µg/g)	*2700*	*4220*	*1500*	*1458*	*2000*	*1142*	*813*			*550*	*4800*
Total Organic Carbon	(%)	*3.34*	*5.00*	*1.91*	*1.35*	*2.04*	*1.23*	*0.95*			*1*	*10*
Sand (>0.050mm)	(%)	38	61	76	57	57	33	40				
Silt (>0.002-0.050mm)	(%)	30	7	18	32	32	51	44				
Clay (<=0.002mm)	(%)	32	33	6	11	10	16	17				
Moisture	(%)	77	81	68	53	-	43	49				

Table 6. Catch totals for Arctic Char and catch-per-unit-effort (CPUE) for gillnetting surveys in potential reference lakes, fall 2014.

Waterbody	Site ID	Set Duration (dec.hrs)	Catch Total (ARCH)	CPUE[1]
Reference Lake 1	RL1-14-01	4.9	0	0.00
	RL1-14-02	5.0	0	0.00
	RL1-14-03	5.0	0	0.00
	RL1-14-04	4.3	0	0.00
	RL1-14-05	4.3	0	0.00
	Total		*0*	*0.00*
Reference Lake 2	RL2-14-01	6.0	6	17.37
	RL2-14-02	6.2	2	5.59
	RL2-14-03	6.3	0	0.00
	Total		*8*	*7.65*
Reference Lake 3	RL3-14-01	7.5	1	2.32
	RL3-14-02	7.6	0	0.00
	Total		*1*	*1.16*

[1] CPUE calculated as #fish/100 m net/24 hours

Table 7. Catch totals and catch-per-unit-effort (CPUE) for backpack electrofishing surveys in potential reference lakes, fall 2014.

Waterbody	Site ID	Duration (s)	Catch Total [1]	CPUE [2]
Reference Lake 1	RL1-14-01	255	36	8.5
	RL1-14-02	308	59	11.5
Reference Lake 2	RL2-14-01	289	128	26.6

[1] RL2-14-01 catch included 29 Ninespine Stickleback
[2] CPUE calculated as #fish/min of electrofishing

Table 8. Summary of size and age data for Arctic Char captured during electrofishing surveys of potential reference lakes, fall 2014.

Waterbody	Fork Length (mm)				Weight (g)				Condition Factor			
	n [1]	Mean	SD [2]	Range	n	Mean	SD	Range	n	Mean	SD	Range
Reference Lake 1	85	83	21	30 - 136	10	8.4	6.4	0.6 - 17.0	10	0.90	0.13	0.68 - 1.16
Reference Lake 2	59	107	33	23 - 178	20	11.7	14.4	0.1 - 60.0	20	0.94	0.16	0.70 - 1.27

Waterbody	Otolith Age			
	n	Mean	SD	Range
Reference Lake 1	8	3.4	2.0	1 - 6
Reference Lake 2	16	1.6	1.0	0 - 4

[1] n = number of fish measured; may not equal total number captured
[2] SD = standard deviation

Table 9. Summary of length, weight and condition factor of Arctic Char captured in gillnetting surveys of potential reference lakes, fall 2014.

Waterbody	Fork Length (mm)				Weight (g)				Condition Factor			
	n [1]	Mean	SD [2]	Range	n	Mean	SD	Range	n	Mean	SD	Range
Reference Lake 2	8	346	88	211 - 463	8	475	345	50 - 1000	8	0.91	0.20	0.53 - 1.14
Reference Lake 3	1	620	-	-	1	1900	-	-	1	0.80	-	-

[1] n = number of fish measured; may not equal total number captured
[2] SD = standard deviation

Table 10. Substrate types in Reference Lake 3.

Substrate Type	Shoreline Zone (0-2 m)		Euphotic Zone (2-12 m)		Profundal Zone (>12 m)		Total	
	(m^2)	%	(m^2)	%	(m^2)	%	(m^2)	%
Boulder/Cobble	239,701	66.0	240,443	27.5	35,803	4.4	515,947	25.1
Sandy Loam	1,614	0.4	517,124	59.2	575,459	70.0	1,094,197	53.1
Silt/Clay	179	0.0	111,016	12.7	206,607	25.1	317,802	15.4
Unclassified	121,787	33.5	5,305	0.6	3,888	0.5	130,980	6.4
Grand Total	363,280	100.0	873,888	100.0	821,757	100.0	2,058,925	100.0

Table 11. Summary of non-parametric statistical comparisons between reference lake routine water quality and Camp Lake and Sheardown Lake NW routine water quality. NS = no significant difference. Dashes indicate where data were not amenable to statistical analysis due to a high frequency of censured data.

Parameter	RL1	RL2
***In Situ* Parameters**		
DO	NS	NS
pH	NS	NS
Secchi Disk Depth	NS	NS
Laboratory Parameters		
pH	NS	NS
Alkalinity as $CaCO_3$	Lower than CL and SDL NW	Lower than CL and SDL NW
Total Dissolved Solids	Lower than CL and SDL NW	Lower than CL and SDL NW
Conductivity	Lower than CL and SDL NW	Lower than CL and SDL NW
Ammonia	NS	NS
Nitrite	-	-
Nitrate	-	-
Nitrate/nitrite	-	-
Total Kjeldahl Nitrogen	NS	NS
Total Nitrogen	NS	NS
Total Phosphorus	NS [1]	NS
Dissolved Organic Carbon	Lower than CL and SDL NW	NS
Total Organic Carbon	Lower than CL and SDL NW	NS
Total Suspended Solids	-	-
Turbidity	Higher than CL	NS
Chlorophyll *a*	NS	NS
Pheophytin *a*	NS	NS
Phenols	-	-
Bromide	-	-
Chloride	Lower than CL and SDL NW	NS
Sulphate	-	NS
Hardness as $CaCO_3$ (Total)	Lower than CL and SDL NW	Lower than CL and SDL NW

[1] Data sets include a high frequency of censured values.

Table 12. Summary of non-parametric statistical comparisons between reference lake total metals and Camp Lake and Sheardown Lake NW total metals in surface water. NS = no significant difference. Dashes indicate where data were not amenable to statistical analysis due to a high frequency of censured data.

Parameter	RL1	RL2
Aluminum	Higher than CL	NS
Antimony	-	-
Arsenic	-	-
Barium	Lower than CL and SDL NW	Lower than CL and SDL NW
Beryllium	-	-
Bismuth	-	-
Boron	-	-
Cadmium	-	-
Calcium	Lower than CL and SDL NW	Lower than CL and SDL NW
Chromium	Higher than CL and SDL NW [1]	Higher than SDL NW [1]
Cobalt	-	-
Copper	Lower than CL and SDL NW	Lower than CL and SDL NW [1]
Iron	NS [1]	NS [1]
Lead	NS [1]	NS [1]
Lithium	-	-
Magnesium	Lower than CL and SDL NW	Lower than CL and SDL NW
Manganese	NS	Higher than SDL NW
Mercury	-	-
Molybdenum	Lower than SDL NW	Lower than SDL NW
Nickel	Lower than CL and SDL NW [1]	-
Potassium	Lower than CL and SDL NW	Lower than CL and SDL NW
Selenium	-	-
Silicon	Lower than SDL NW	Lower than SDL NW
Silver	-	-
Sodium	NS	NS
Strontium	Lower than CL and SDL NW	Lower than CL and SDL NW
Thallium	-	-
Tin	-	-
Titanium	-	-
Uranium	Lower than SDL NW	Lower than SDL NW
Vanadium	-	-
Zinc	NS [1]	NS [1]

[1] Data sets include a high frequency of censured values.

Table 13. Comparison of aquatic habitat and lake characteristics for reference lakes and mine area lakes.

Lake	Drainage Basin Area (km^2)	Lake Area (km^2)	Drainage Basin: Lake Area Ratio	Mean Depth (m)	Maximum Depth (m)	Volume (1,000,000 m^3)	Substrate			
							Cobble/ Boulder (%)	Gravel/ Pebble (%)	Sand (%)	Fine Sand and Silt/Clay (%)
Camp Lake	26.5	2.21	11.98	13.0	35.1	27.5	5.1	28.2	61.1	5.6
Sheardown Lake NW	6.55	0.678	9.66	12.1	30.1	8.18	10.1	41.8	46	2.0
Reference Lake 1	3.39	0.228	14.9	9.4	15.3	2.27	18.1	12.6	8.4	60.9
Reference Lake 2	2.35	0.484	4.86	6.1	11.7	3.01	8.8	1.6	35.8	53.8
Reference Lake 3 [1]	23.2	2.05	11.32	11.8 [2]	38.3	22.6 [2]	25.1	-	53.1	15.4

[1] 6.4% of substrate was unclassified.

[2] Metrics based on area of Reference Lake 3 surveyed in 2014. Actual numbers may differ.

Table 14. Summary of information collected during surveys of three potential reference lakes in 2013 and 2014 and suitability of reference lakes in relation to fish and fish habitat.

Lake	UTM Coordinates		Maximum Depth (m)	Dominant Substrate (0-5 m depth)	Dominant Substrate (> 5 m depth)	Arctic Char				Fish and Fish Habitat Suitability [1]	
	Easting	Northing				Juvenile Rearing	Adult Feeding	Adult Spawning	Overwintering	Similarities	Differences
Reference Lake 1	550244	7938780	15.3	Sand/Cobble/Boulder	Sand/Silt/Clay	Y	Y	Unknown	Probable	Ideal substrate composition; juvenile use of nearshore habitat	Lake is small; only two adult ARCH captured in five gill nets set; spawning not confirmed; growth rates may be lower
Reference Lake 2	568893	7900087	11.7	Sand	Sand/silt	Y	Y	Y	Probable	Resident fish populations of ARCH and NNST present; juvenile use of nearshore areas and tributary streams; spawning likely based on presence of adult in spawning condition	Lake is shallow and large differences in substrate composition and distribution
Reference Lake 3	574427	7852874	38.3	Mainly Cobble	NA	Y	Y	Y	Probable	Presence of adult and juvenile ARCH; ideal, abundant habitat; sufficient depths	Nearshore areas rockier than Camp Lake

[1] ARCH = Arctic Char; NNST = Ninespine Stickleback

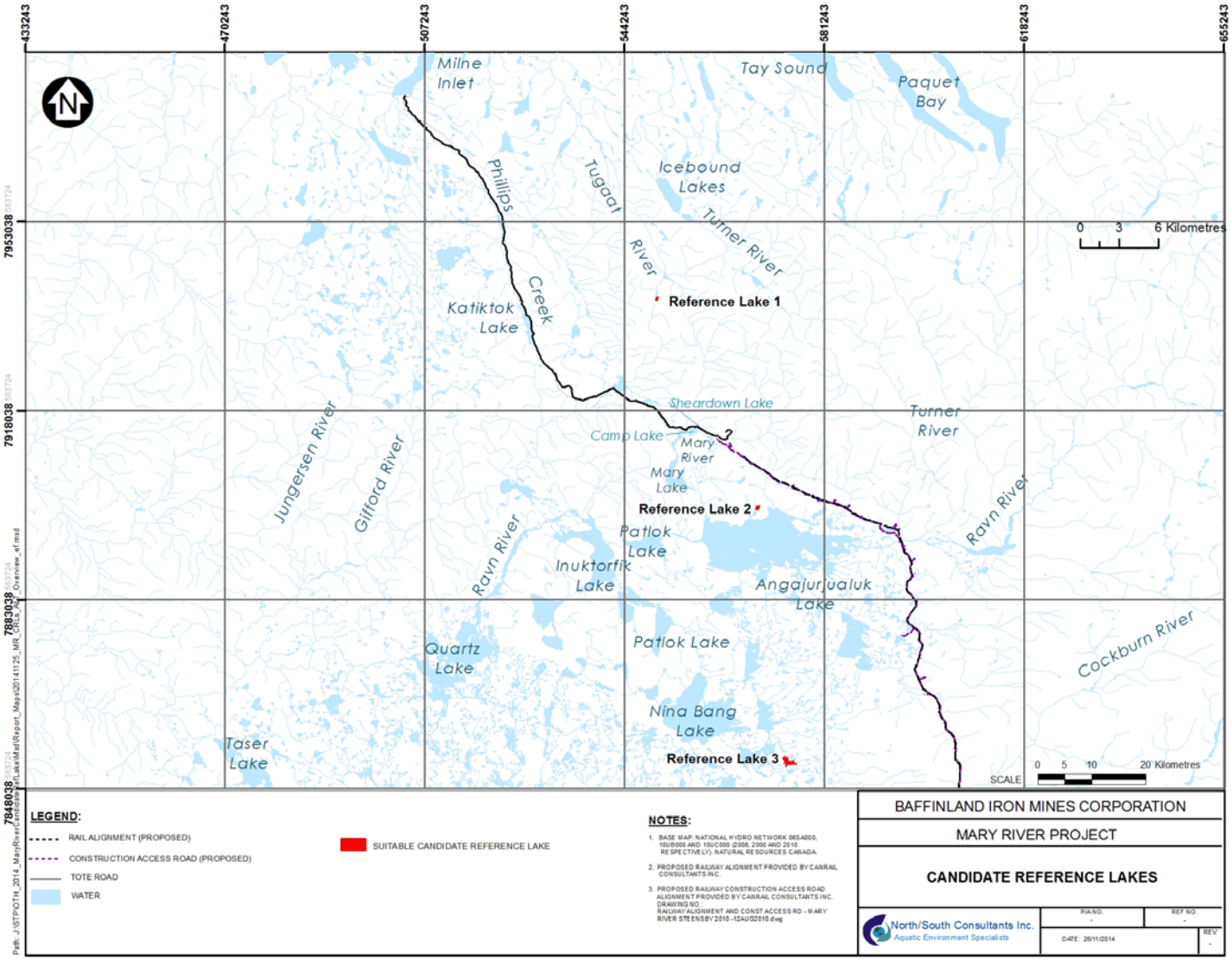

Figure 1. Reference lakes surveyed during fall 2014.

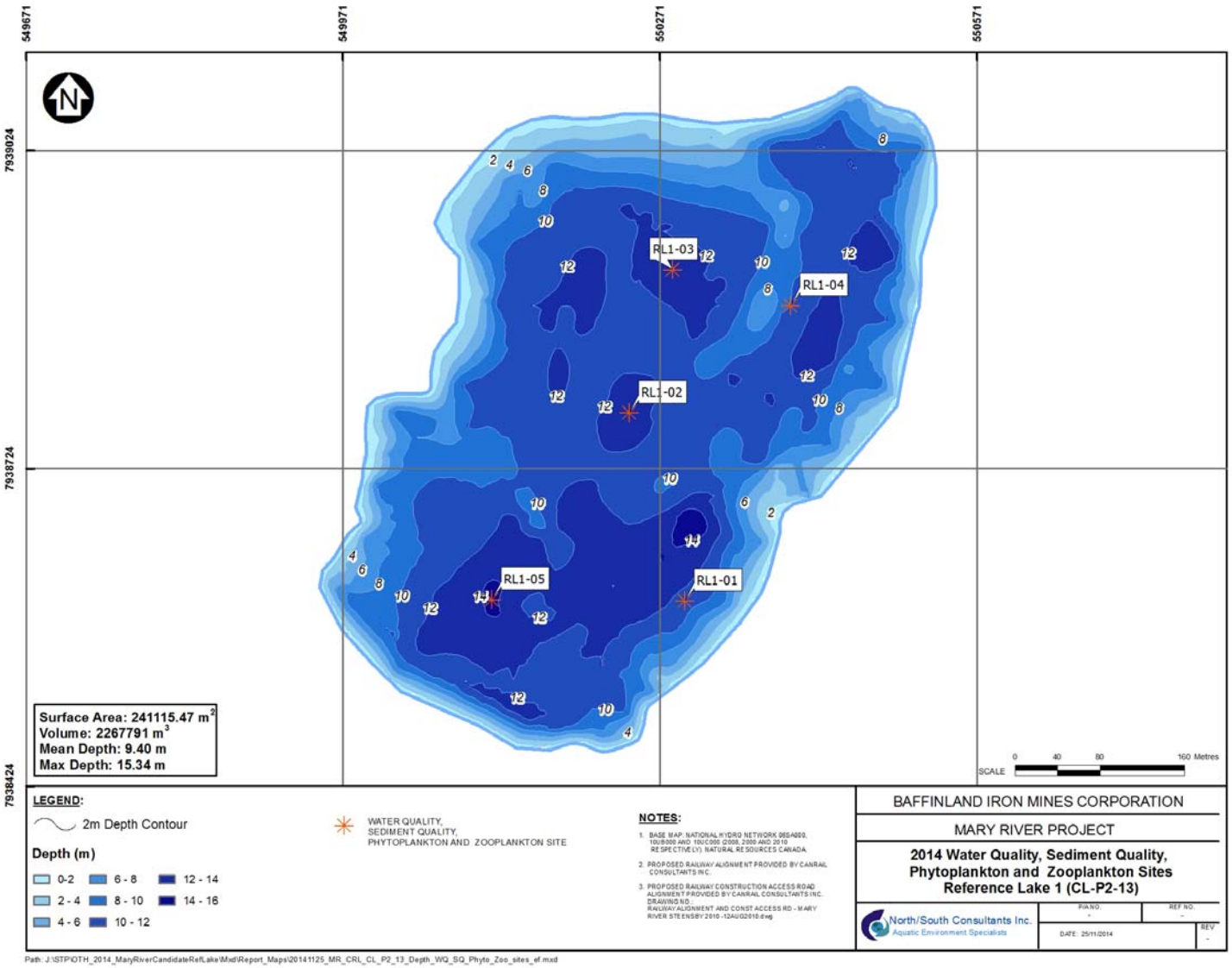

Figure 2. Locations of water quality, sediment quality, phytoplankton, and zooplankton sampling sites in Reference Lake 1, fall 2014.

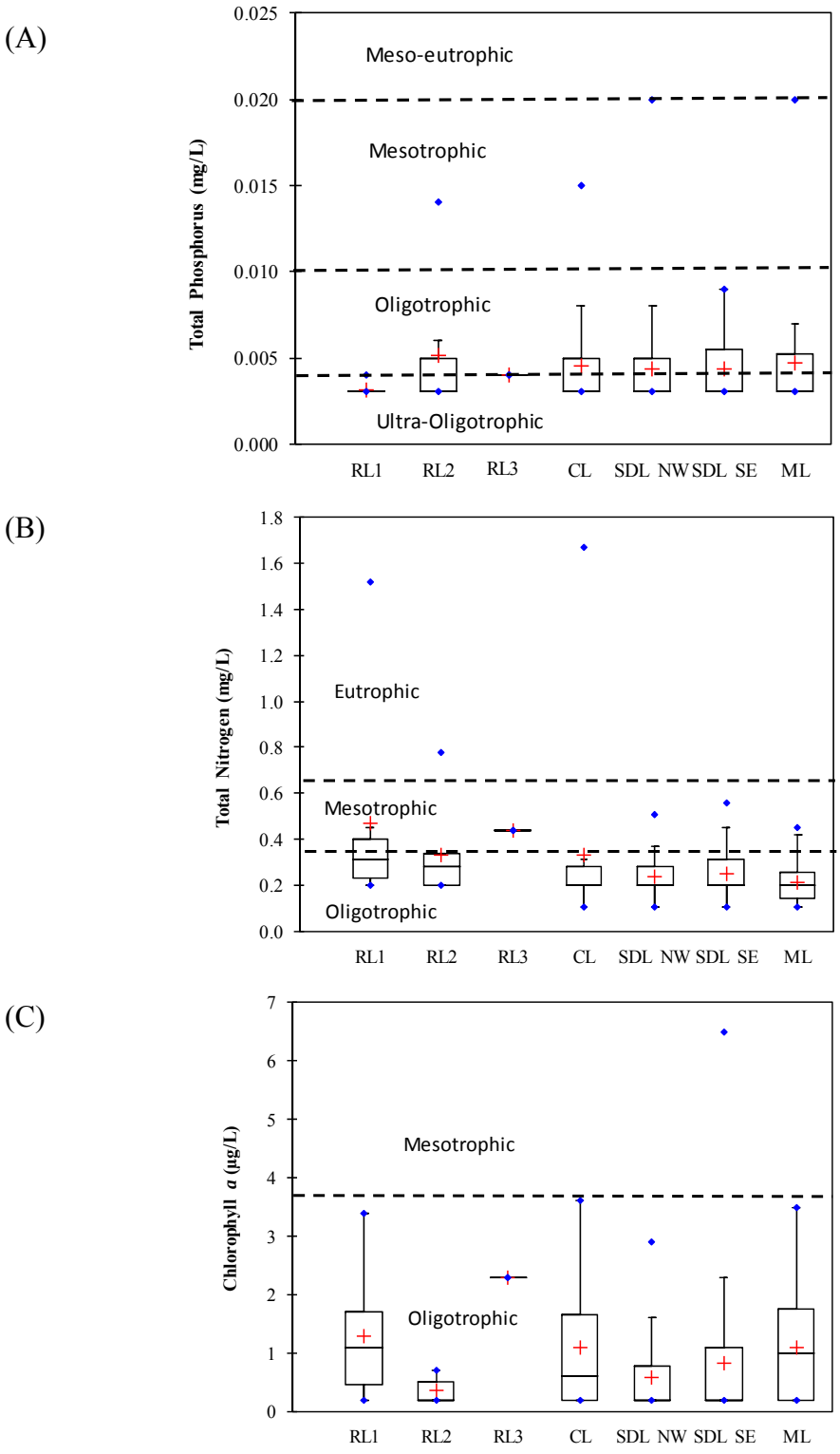

Figure 3. Boxplots of total phosphorus, total nitrogen, and chlorophyll *a* and comparison to trophic classification schemes in reference lakes and mine area lakes. Data represent 2013-2014 data for reference lakes and 2006-2014 for mine area lakes.

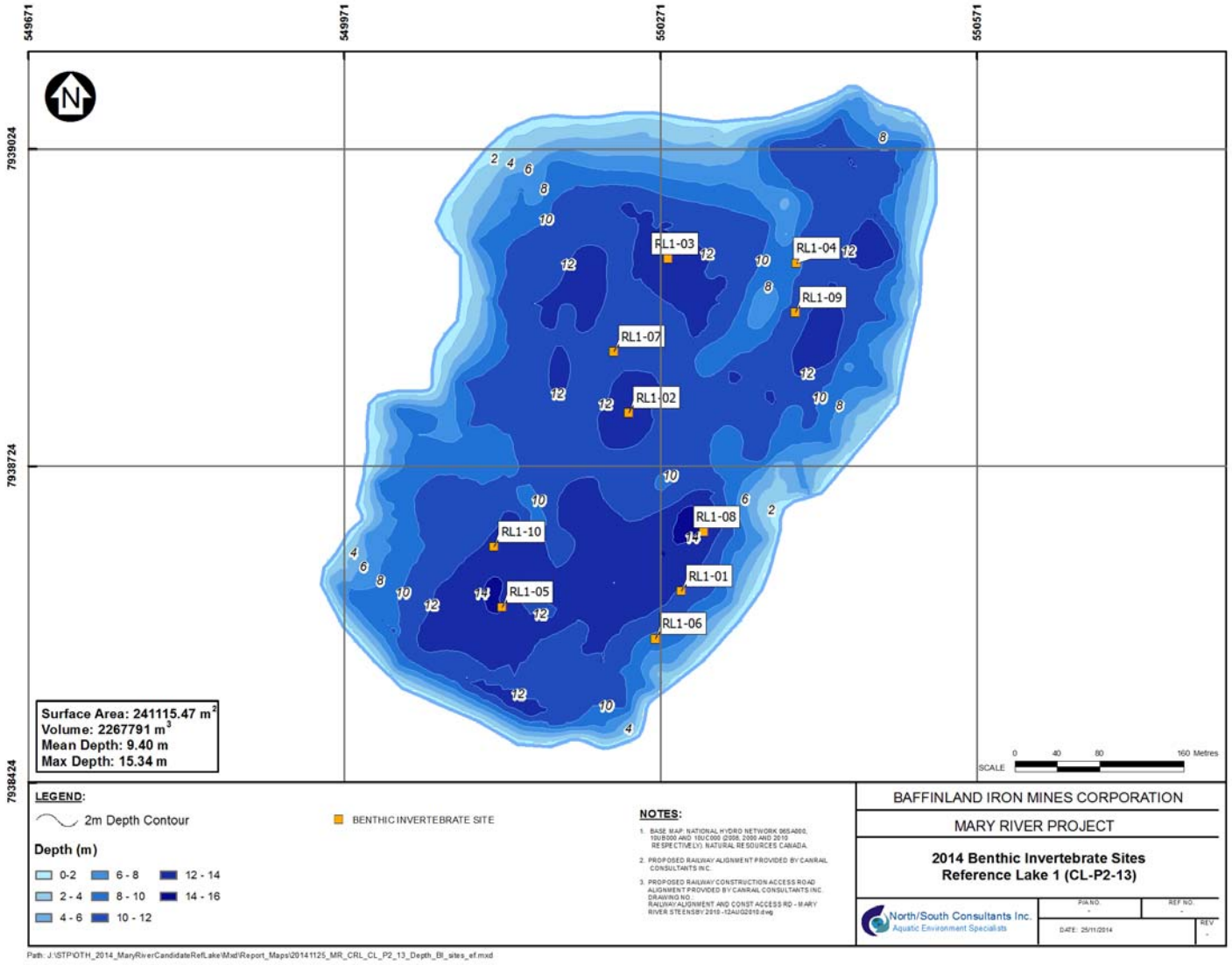

Figure 4. Locations of benthic macroinvertebrate sampling sites in Reference Lake 1, fall 2014.

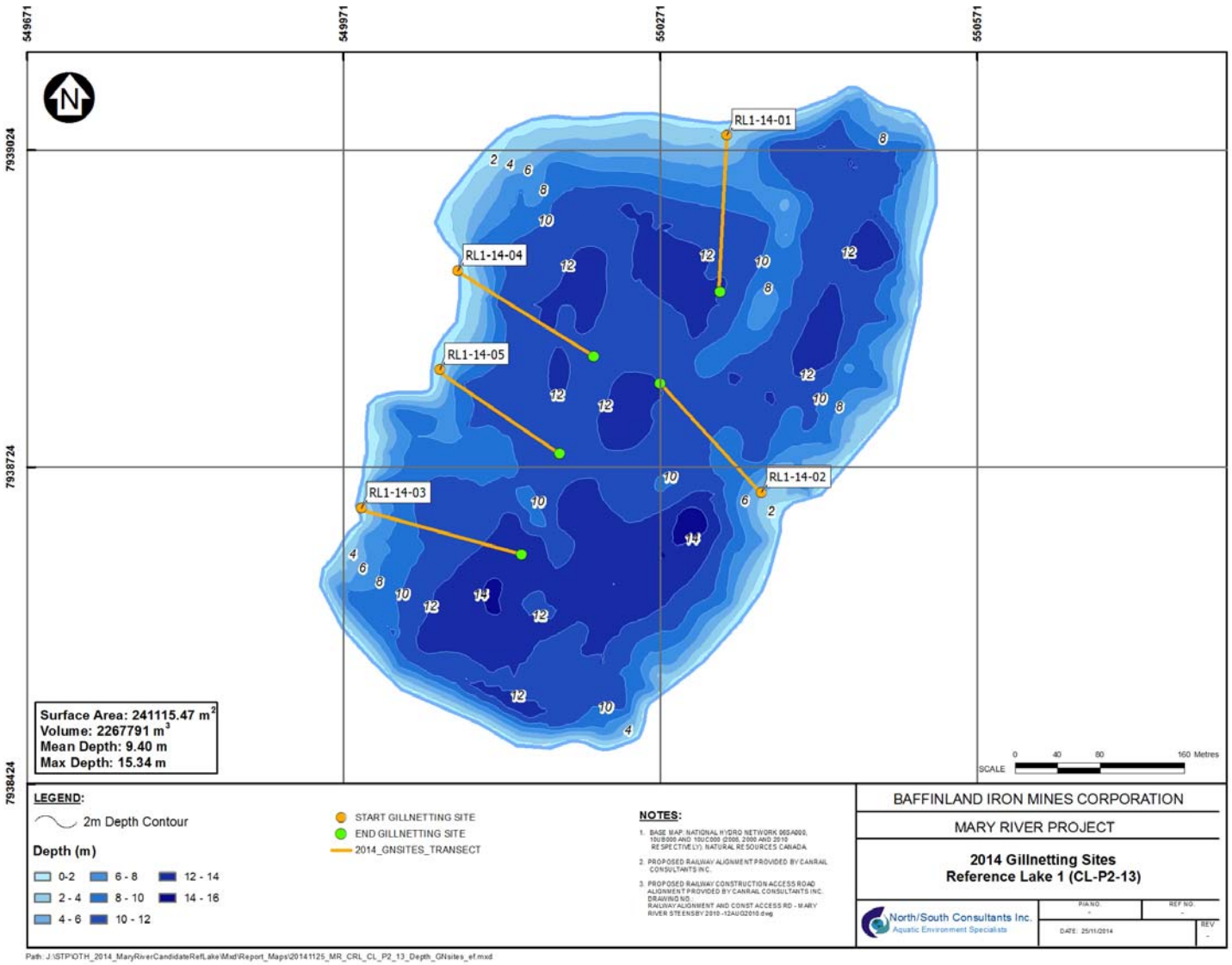

Figure 5. Locations of gillnet sampling sites in Reference Lake 1, fall 2014.

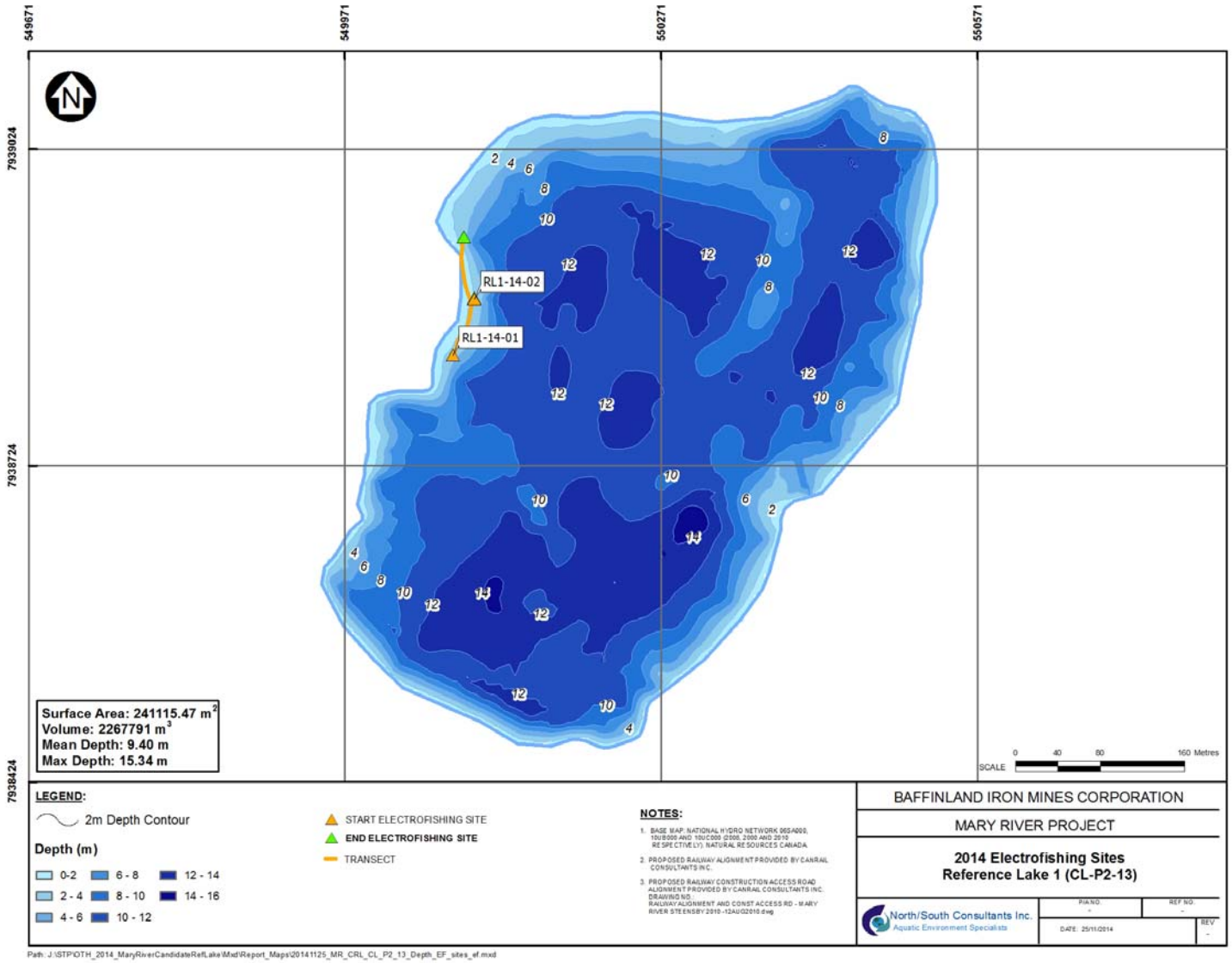

Figure 6. Locations of backpack electrofishing sampling sites in Reference Lake 1, fall 2014.

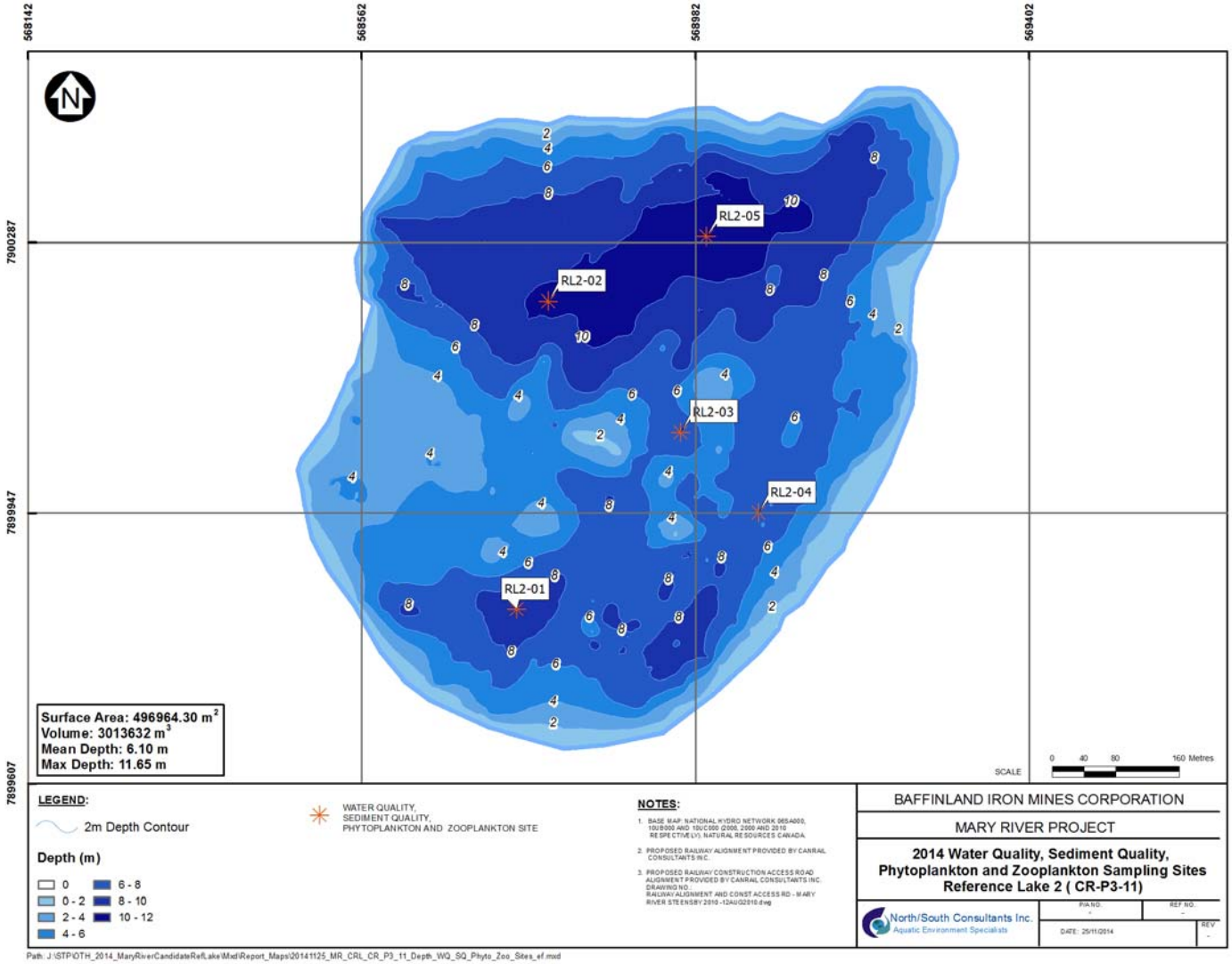

Figure 7. Locations of water quality, sediment quality, phytoplankton, and zooplankton sampling sites in Reference Lake 2, fall 2014.

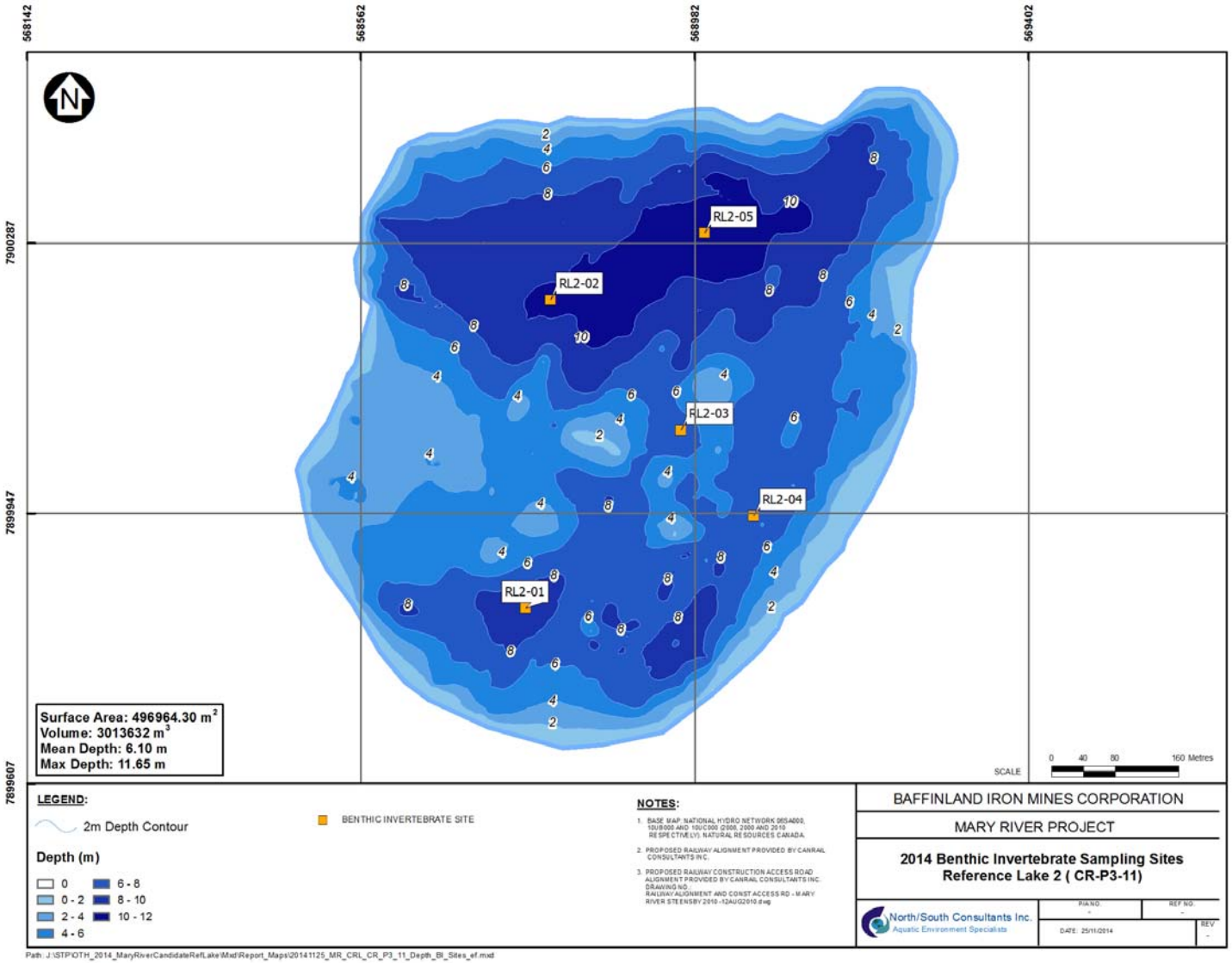

Figure 8. Locations of benthic macroinvertebrate sampling sites in Reference Lake 2, fall 2014.

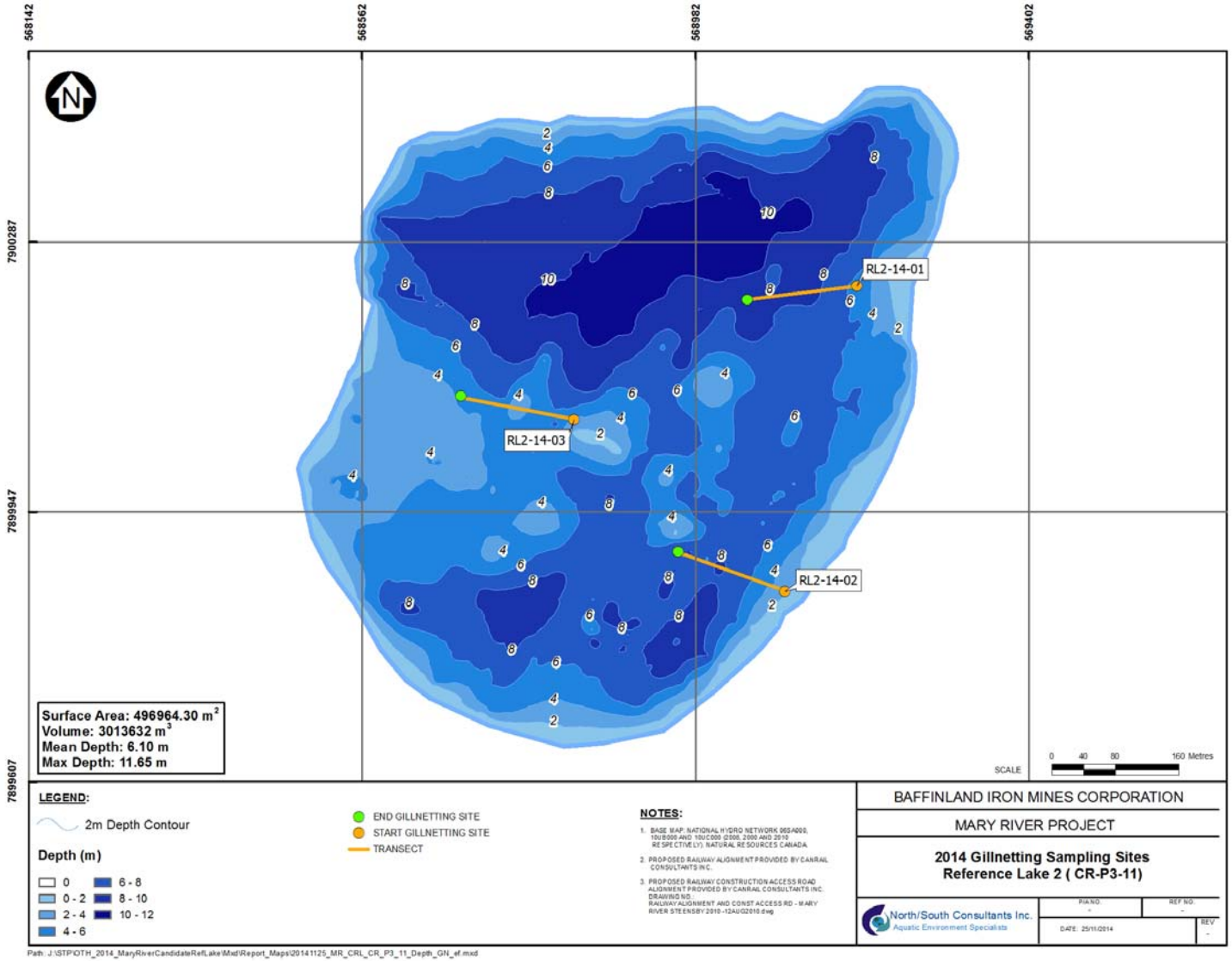

Figure 9. Locations of gillnet sampling sites in Reference Lake 2, fall 2014.

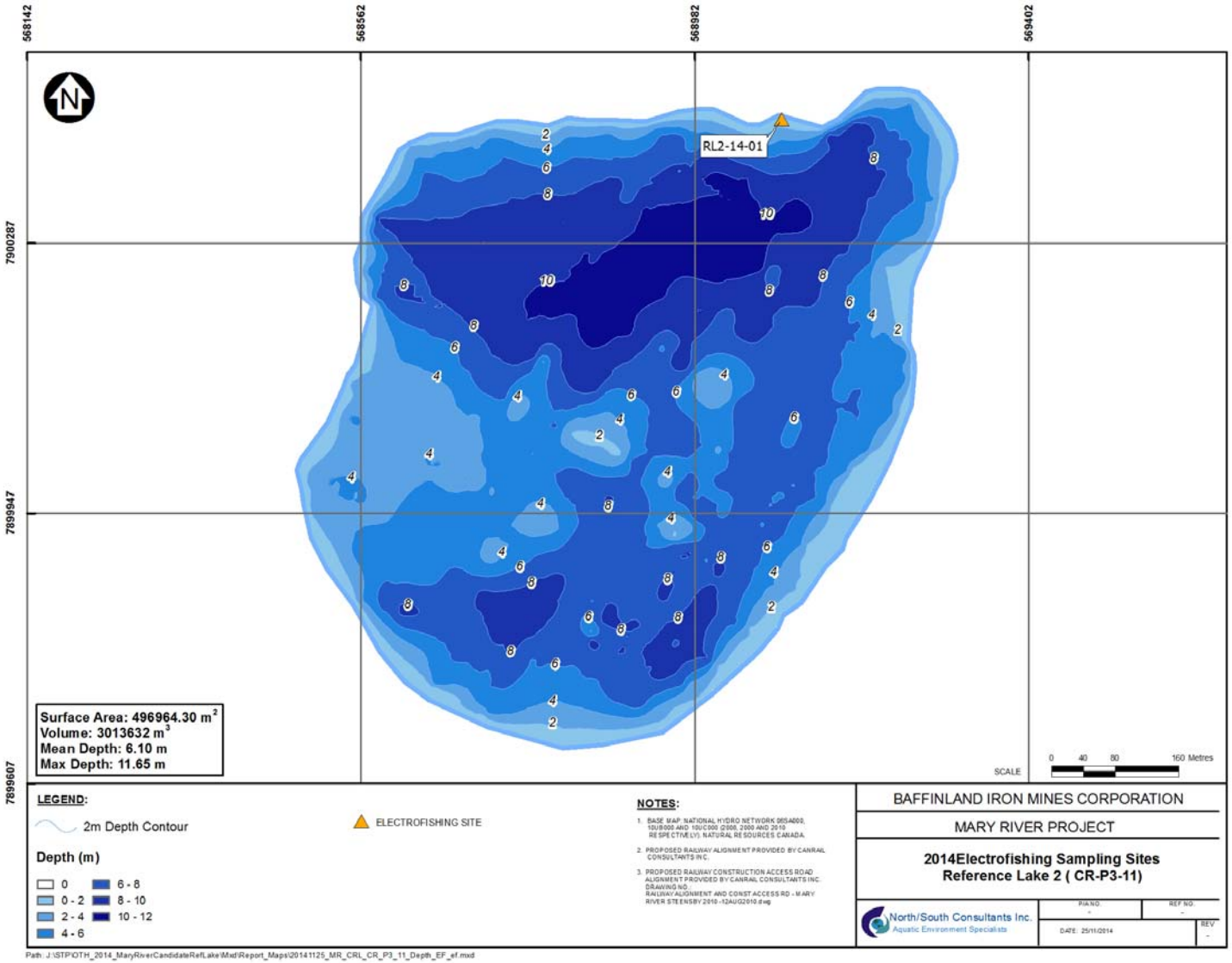

Figure 10. Location of a backpack electrofishing site in Reference Lake 2, fall 2014.

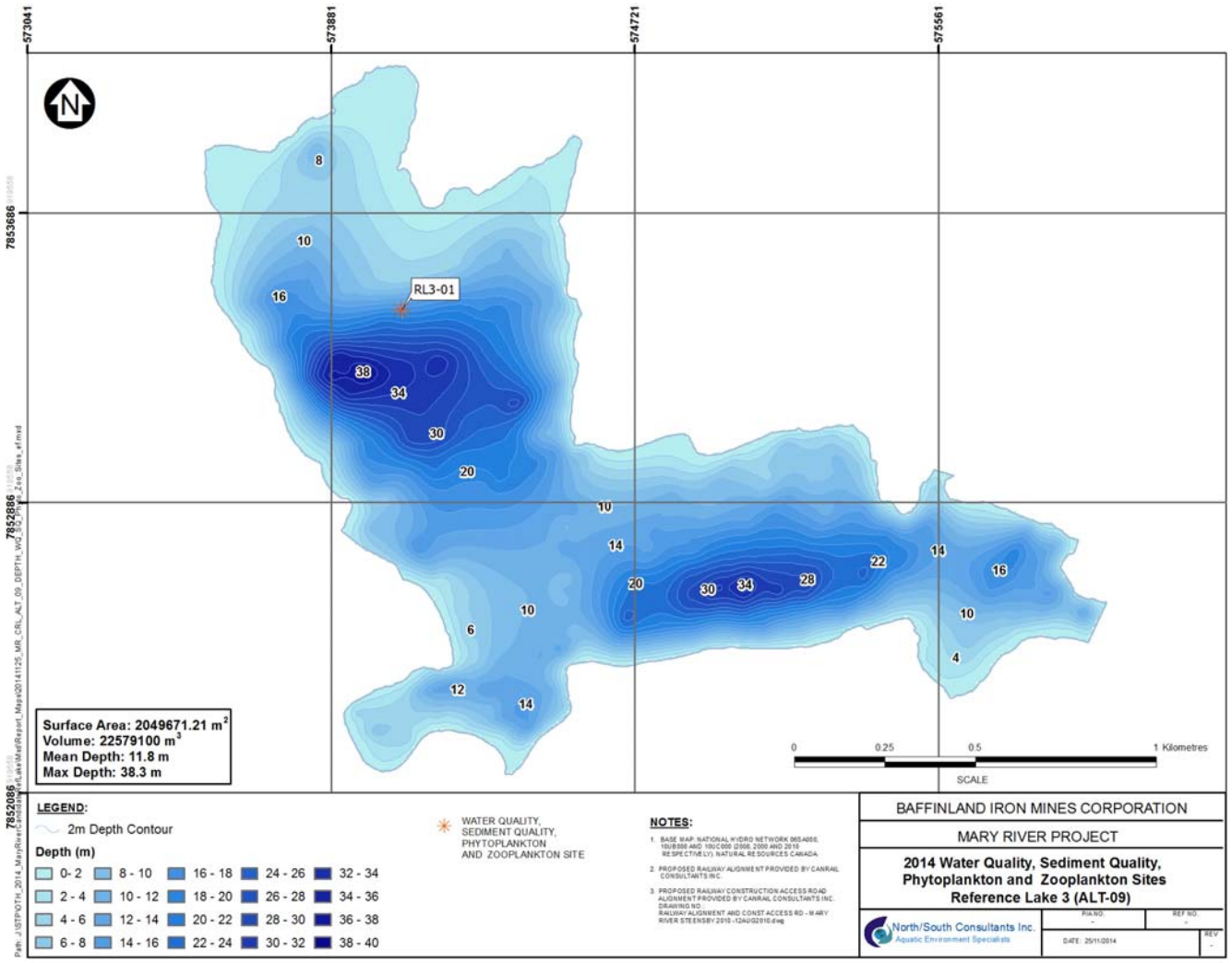

Figure 11. Bathymetry and location of the water quality, sediment quality, phytoplankton, and zooplankton sampling site in Reference Lake 3, fall 2014.

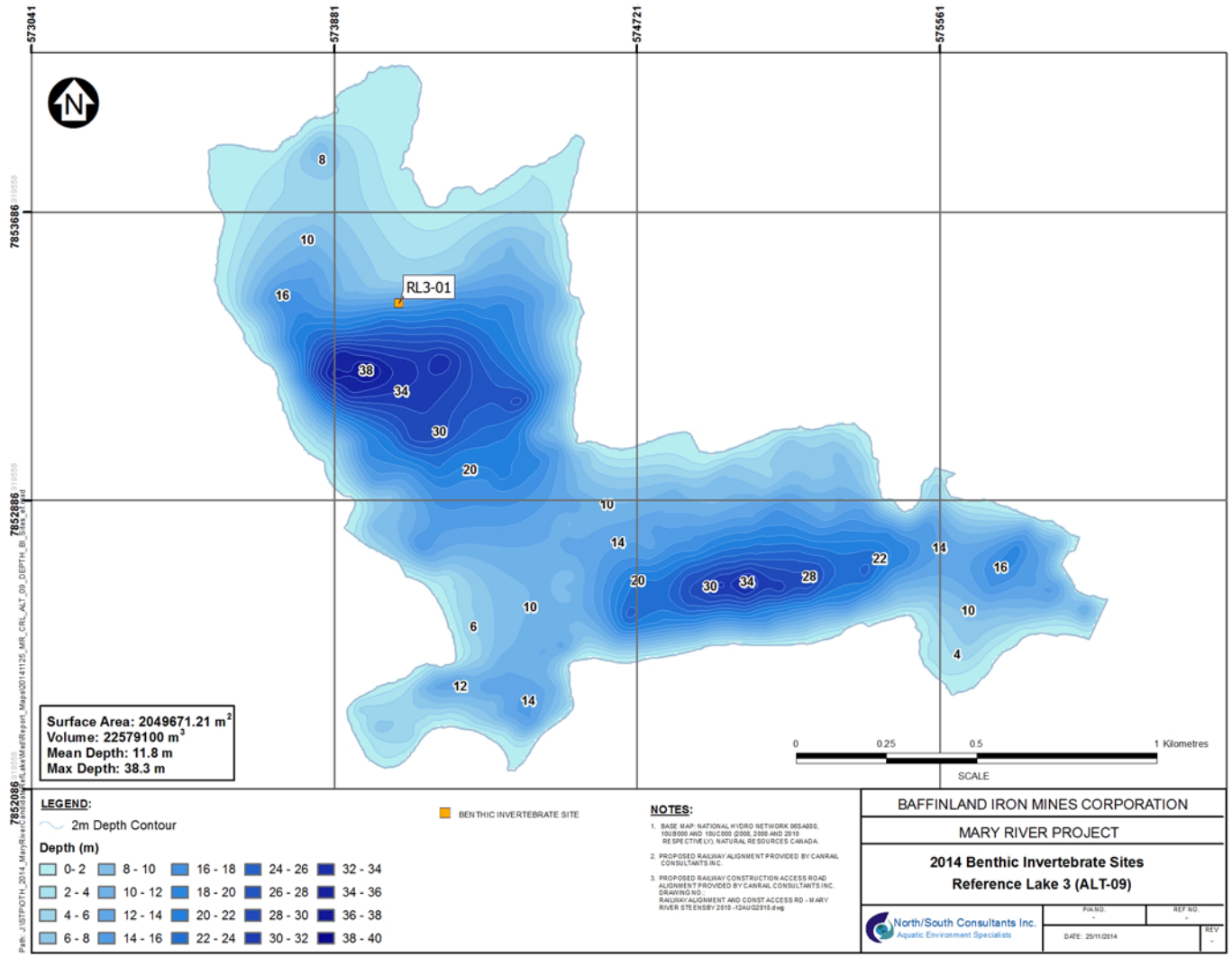

Figure 12. Location of benthic macroinvertebrate sampling site in Reference Lake 3, fall 2014.

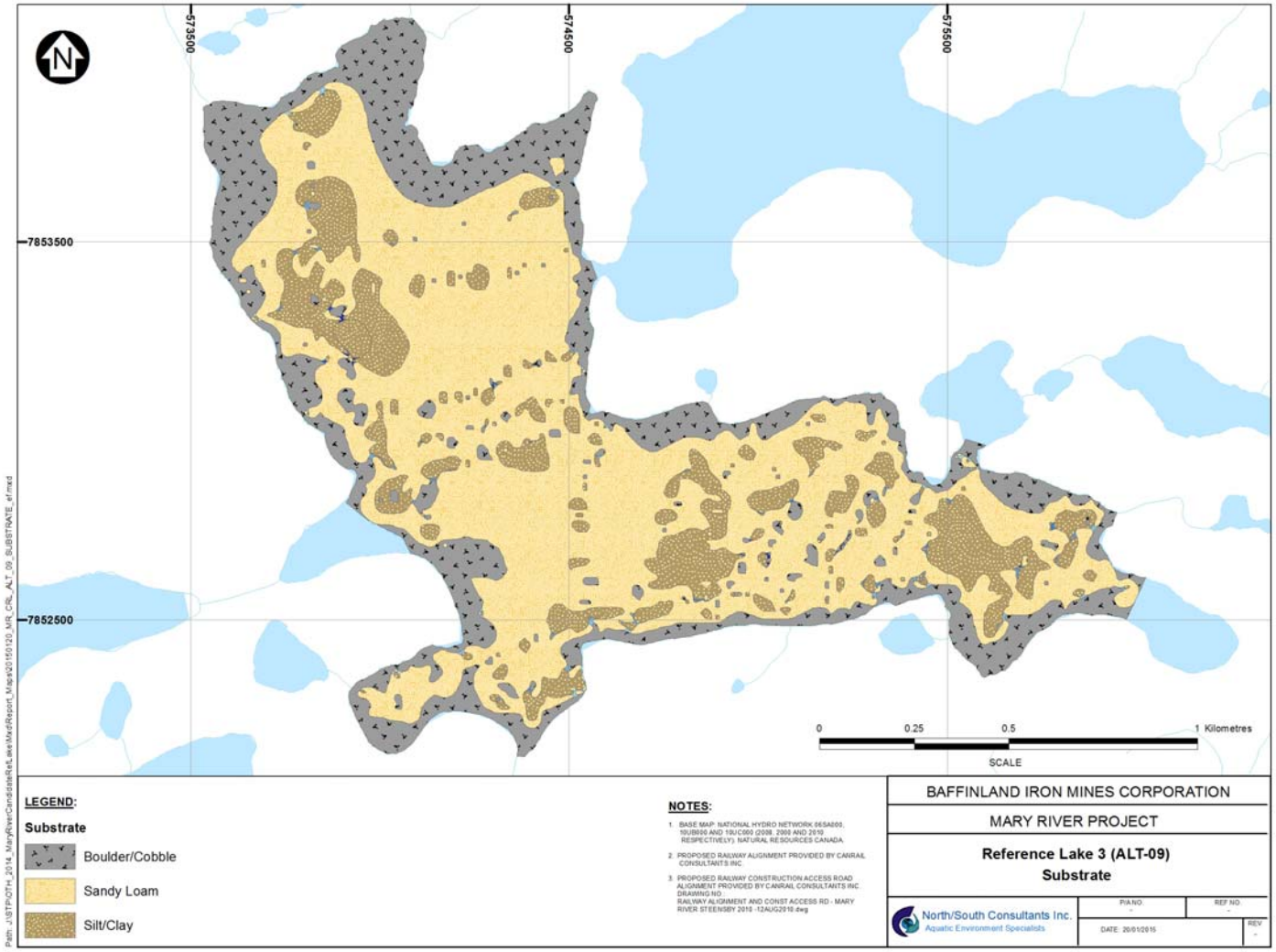

Figure 13. Substrate composition of Reference Lake 3, fall 2014.

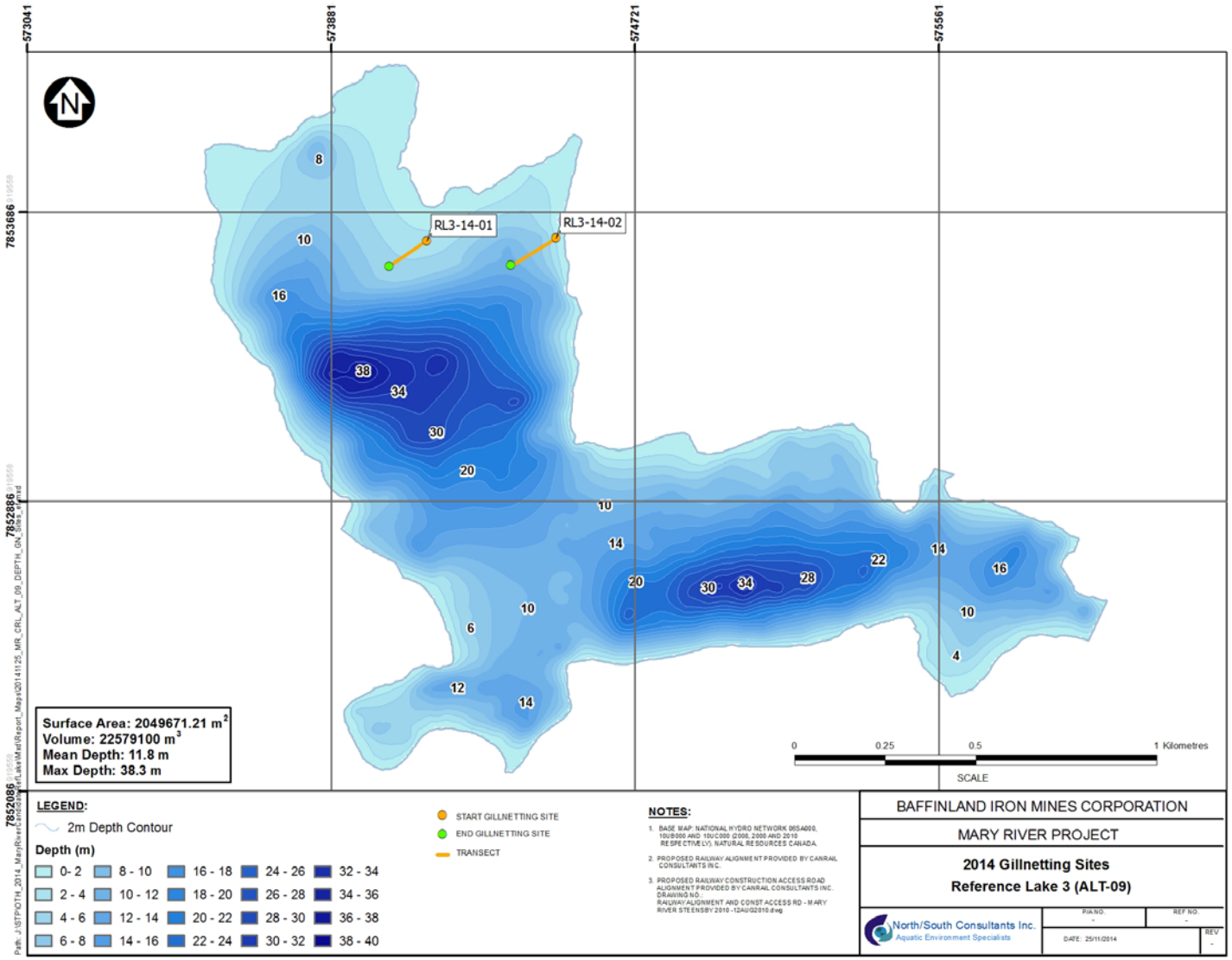

Figure 14. Location of gillnet sampling site in Reference Lake 3, fall 2014.

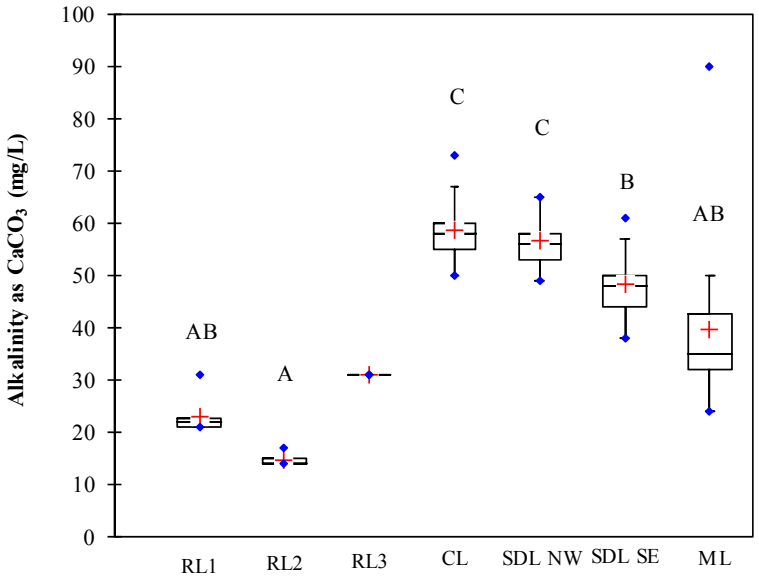

Figure 15. Alkalinity measured in surface water samples from reference and mine area lakes. Data represent 2013-2014 data for reference lakes and 2006-2014 for mine area lakes. Statistically significant differences are denoted with different superscripts.

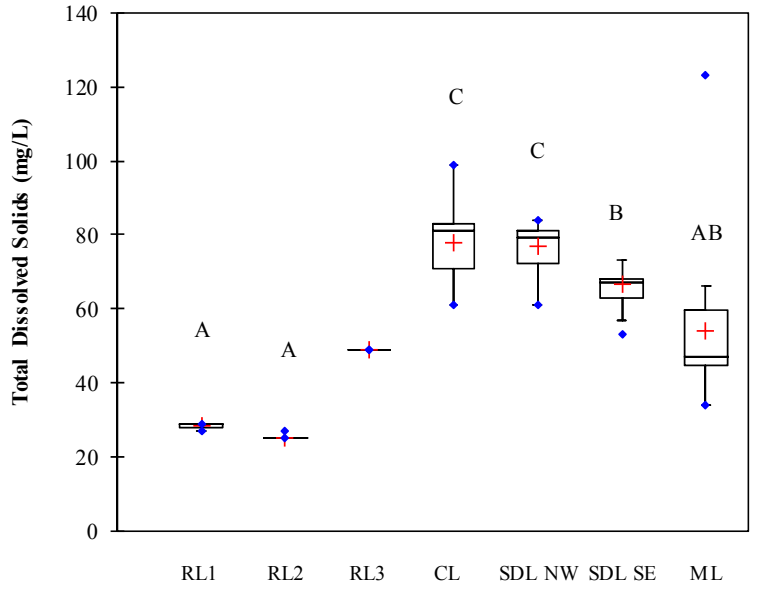

Figure 16. Total dissolved solids measured in surface water samples from reference and mine area lakes. Data represent 2013-2014 data for reference lakes and 2006-2014 for mine area lakes. Statistically significant differences are denoted with different superscripts.

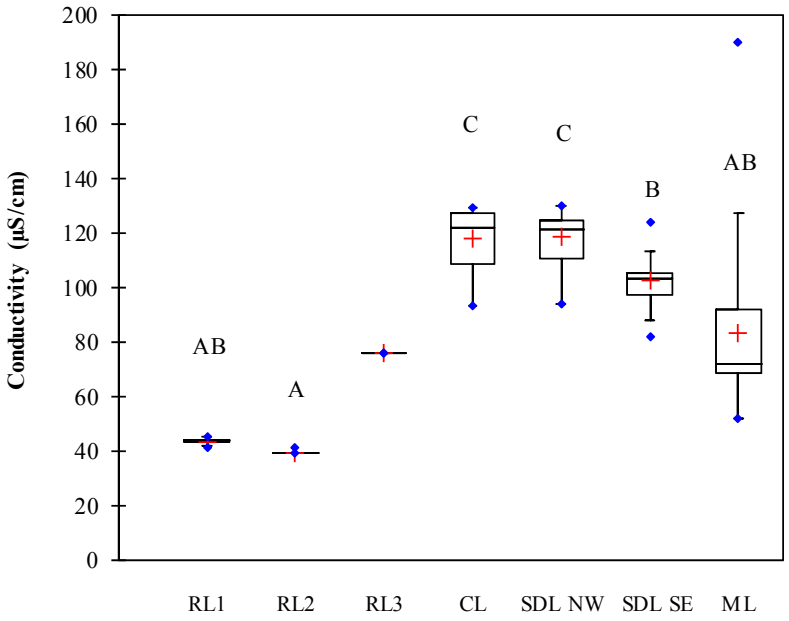

Figure 17. Laboratory conductivity measured in surface water samples from reference and mine area lakes. Data represent 2013-2014 data for reference lakes and 2006-2014 for mine area lakes. Statistically significant differences are denoted with different superscripts.

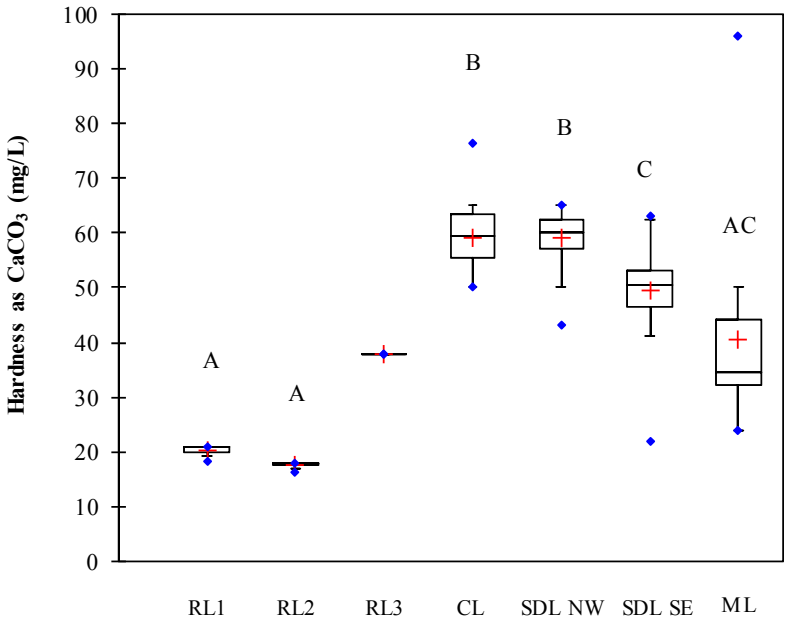

Figure 18. Hardness measured in surface water samples from reference and mine area lakes. Data represent 2013-2014 data for reference lakes and 2006-2014 for mine area lakes. Statistically significant differences are denoted with different superscripts.

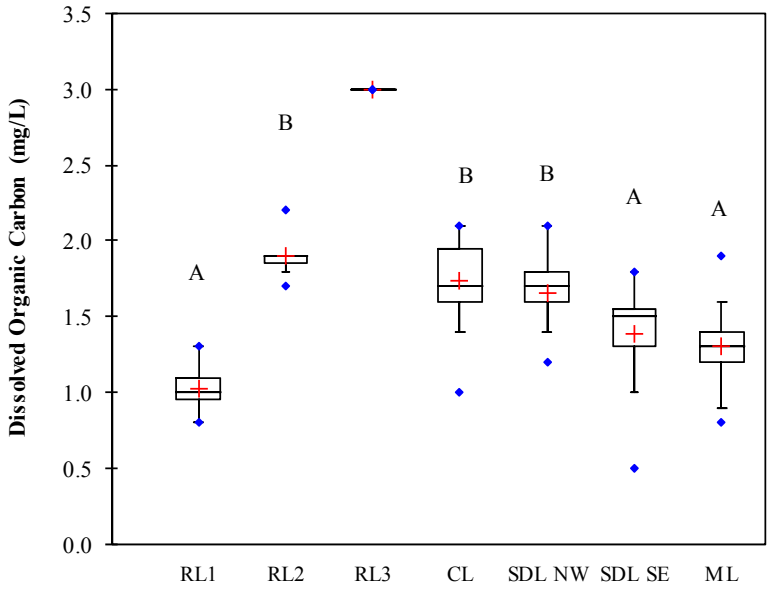

Figure 19. Dissolved organic carbon measured in surface water samples from reference and mine area lakes. Data represent 2013-2014 data for reference lakes and 2006-2014 for mine area lakes. Statistically significant differences are denoted with different superscripts.

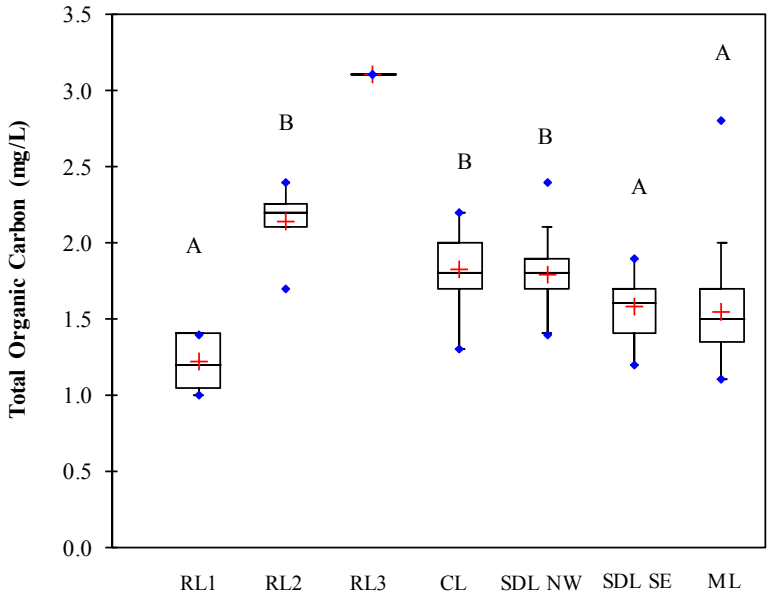

Figure 20. Total organic carbon measured in surface water samples from reference and mine area lakes. Data represent 2013-2014 data for reference lakes and 2006-2014 for mine area lakes. Statistically significant differences are denoted with different superscripts.

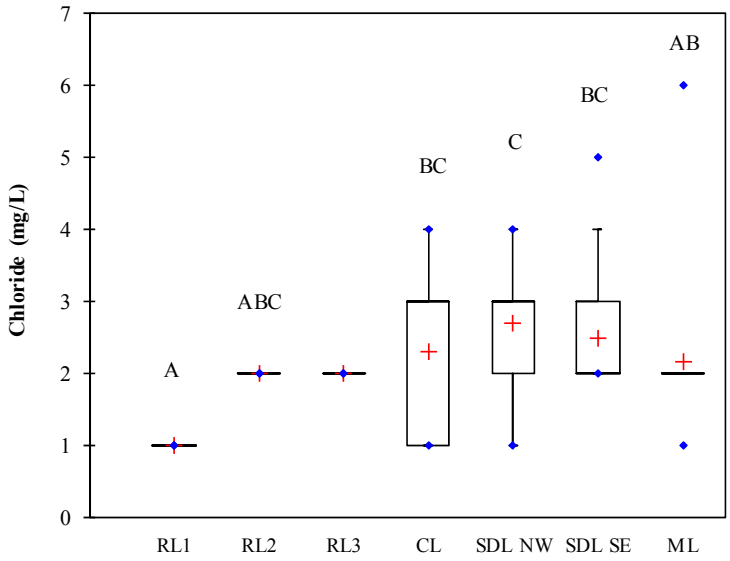

Figure 21. Chloride measured in surface water samples from reference and mine area lakes. Data represent 2013-2014 data for reference lakes and 2006-2014 for mine area lakes. Statistically significant differences are denoted with different superscripts.

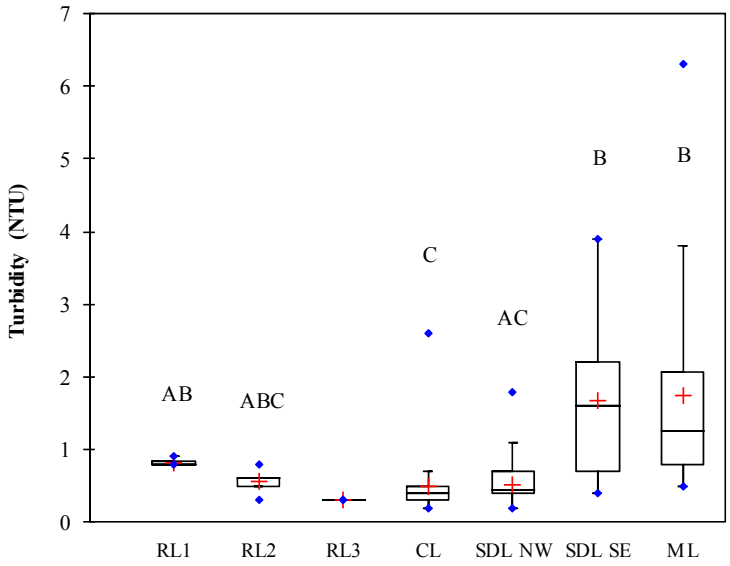

Figure 22. Laboratory turbidity measured in surface water samples from reference and mine area lakes. Data represent 2013-2014 data for reference lakes and 2006-2014 for mine area lakes. Statistically significant differences are denoted with different superscripts.

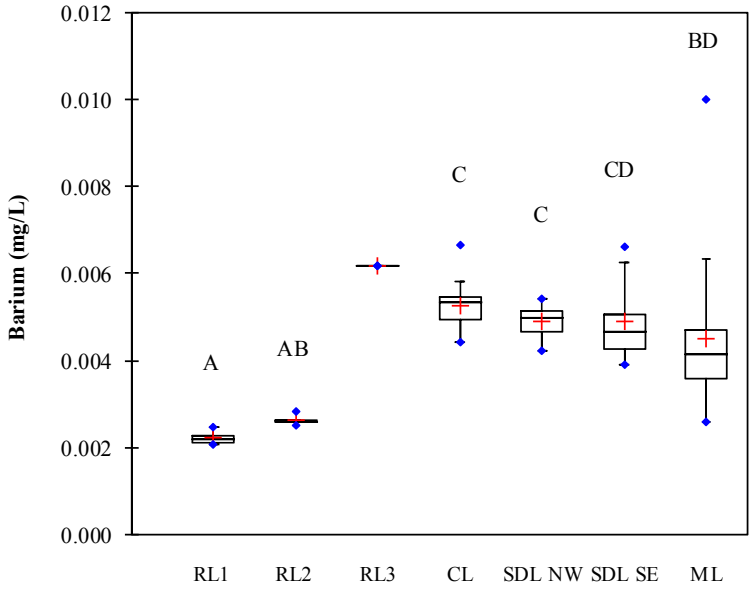

Figure 23. Total barium measured in surface water samples from reference and mine area lakes. Data represent 2013-2014 data for reference lakes and 2006-2014 for mine area lakes. Statistically significant differences are denoted with different superscripts.

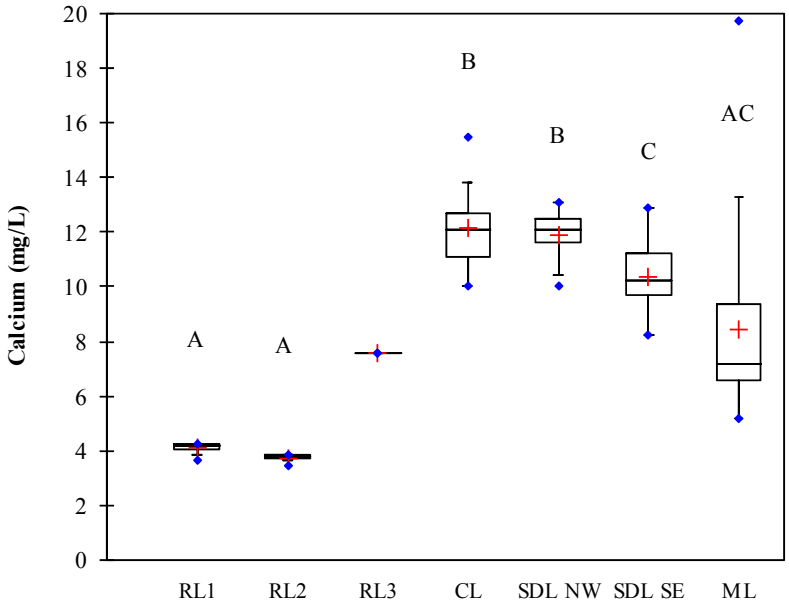

Figure 24. Total calcium measured in surface water samples from reference and mine area lakes. Data represent 2013-2014 data for reference lakes and 2006-2014 for mine area lakes. Statistically significant differences are denoted with different superscripts.

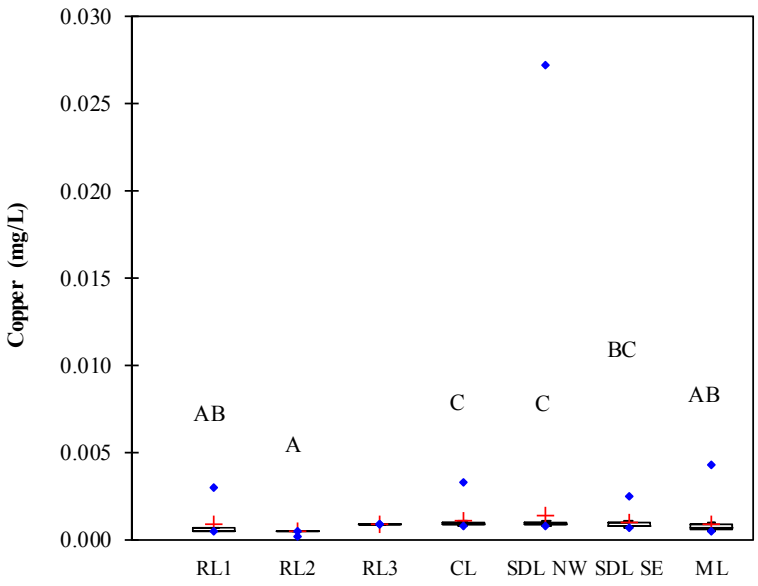

Figure 25. Total copper measured in surface water samples from reference and mine area lakes. Data represent 2013-2014 data for reference lakes and 2006-2014 for mine area lakes. Statistically significant differences are denoted with different superscripts.

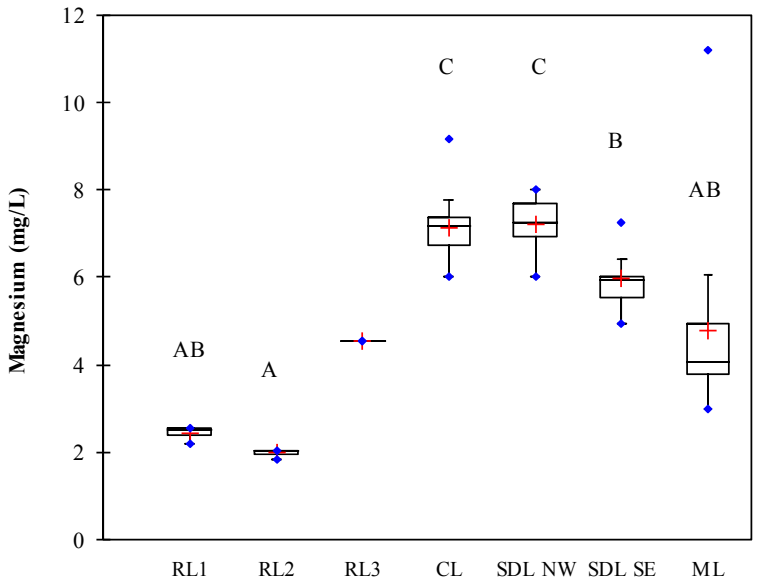

Figure 26. Total magnesium measured in surface water samples from reference and mine area lakes. Data represent 2013-2014 data for reference lakes and 2006-2014 for mine area lakes. Statistically significant differences are denoted with different superscripts.

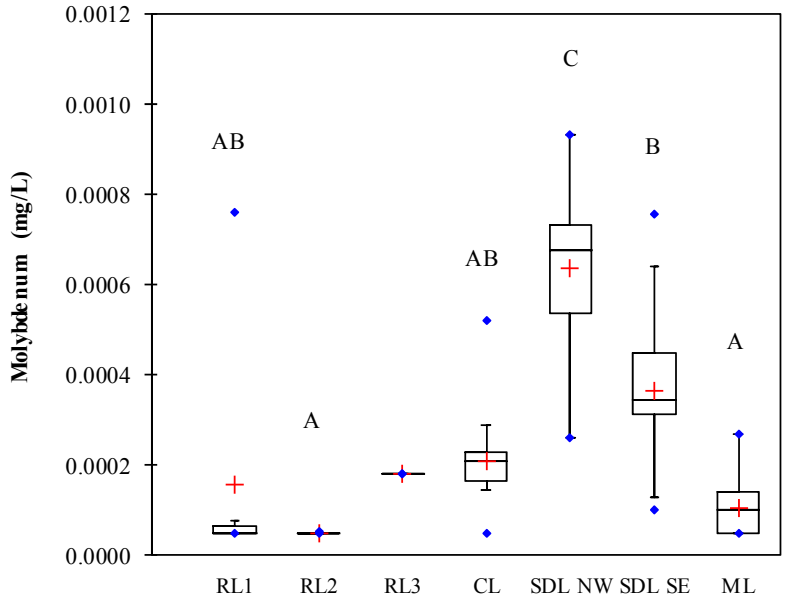

Figure 27. Total molybdenum measured in surface water samples from reference and mine area lakes. Data represent 2013-2014 data for reference lakes and 2006-2014 for mine area lakes. Statistically significant differences are denoted with different superscripts.

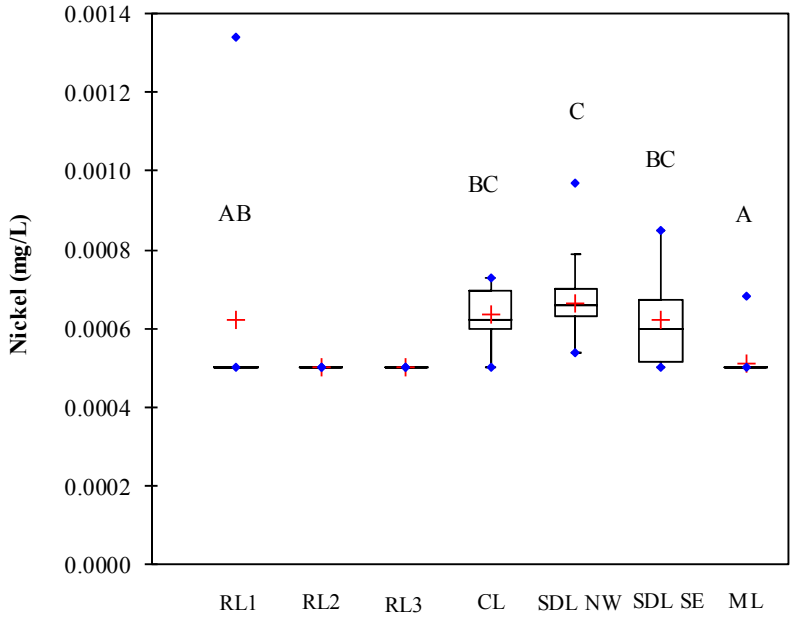

Figure 28. Total nickel measured in surface water samples from reference and mine area lakes. Data represent 2013-2014 data for reference lakes and 2006-2014 for mine area lakes. Statistically significant differences are denoted with different superscripts.

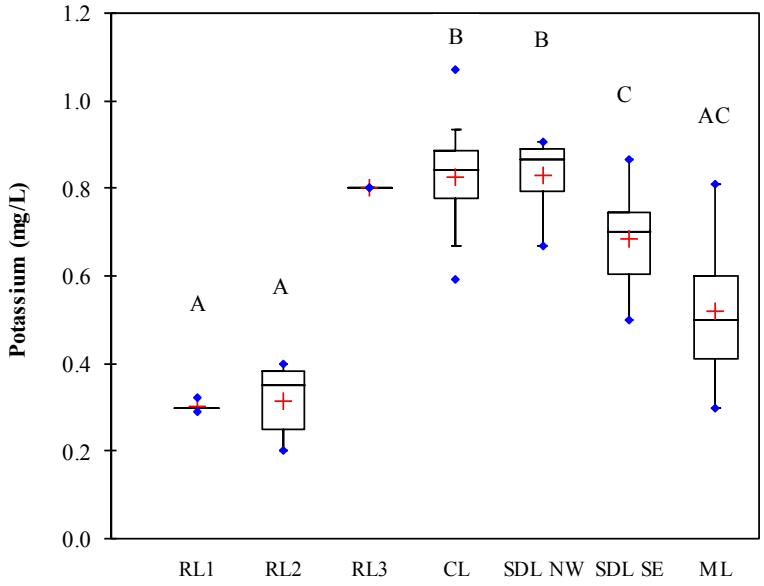

Figure 29. Total potassium measured in surface water samples from reference and mine area lakes. Data represent 2013-2014 data for reference lakes and 2006-2014 for mine area lakes. Statistically significant differences are denoted with different superscripts.

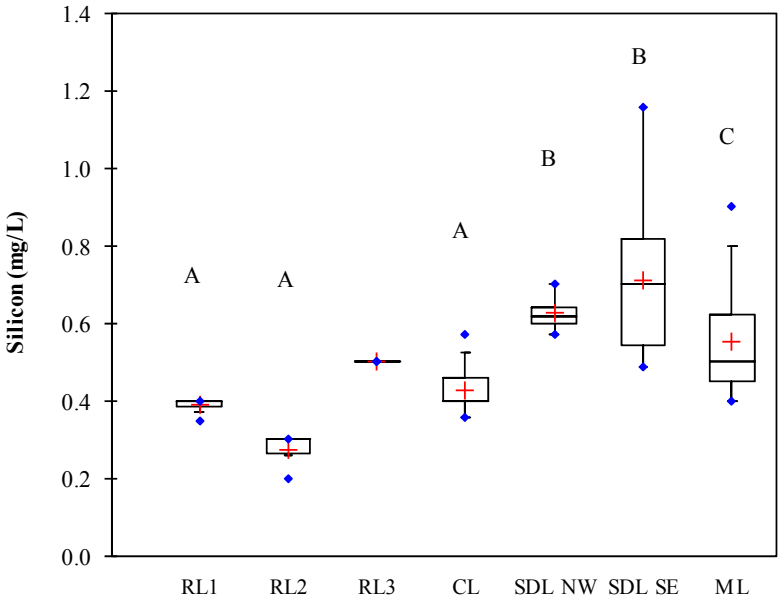

Figure 30. Total silicon measured in surface water samples from reference and mine area lakes. Data represent 2013-2014 data for reference lakes and 2006-2014 for mine area lakes. Statistically significant differences are denoted with different superscripts.

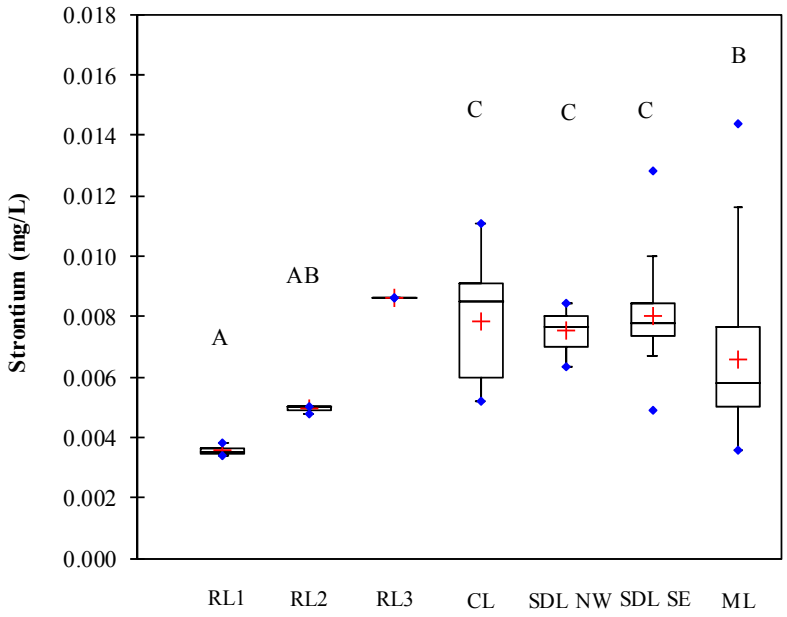

Figure 31. Total strontium measured in surface water samples from reference and mine area lakes. Data represent 2013-2014 data for reference lakes and 2006-2014 for mine area lakes. Statistically significant differences are denoted with different superscripts.

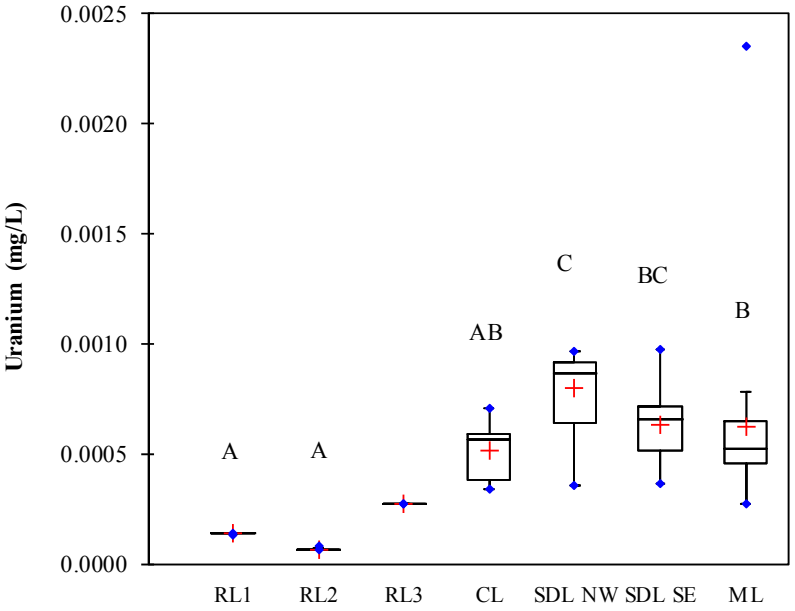

Figure 32. Total uranium measured in surface water samples from reference and mine area lakes. Data represent 2013-2014 data for reference lakes and 2006-2014 for mine area lakes. Statistically significant differences are denoted with different superscripts.

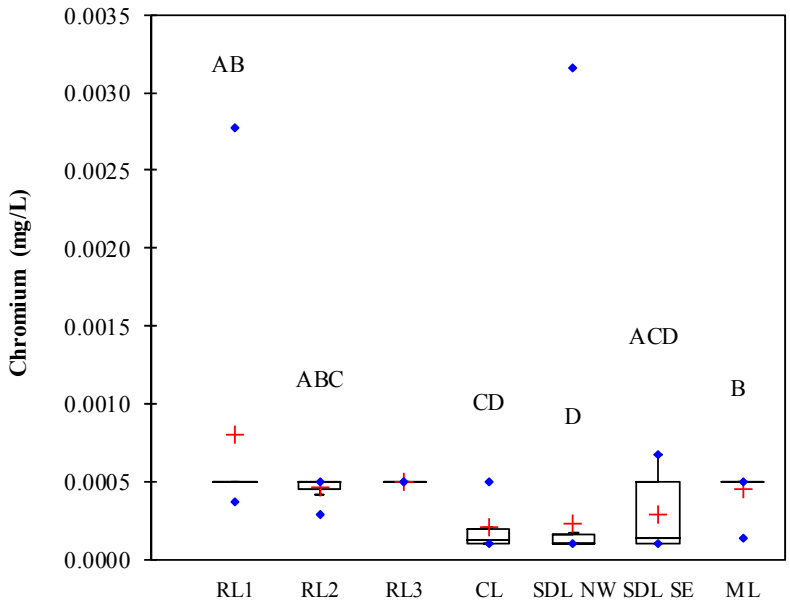

Figure 33. Total chromium measured in surface water samples from reference and mine area lakes. Data represent 2013-2014 data for reference lakes and 2006-2014 for mine area lakes. Statistically significant differences are denoted with different superscripts.

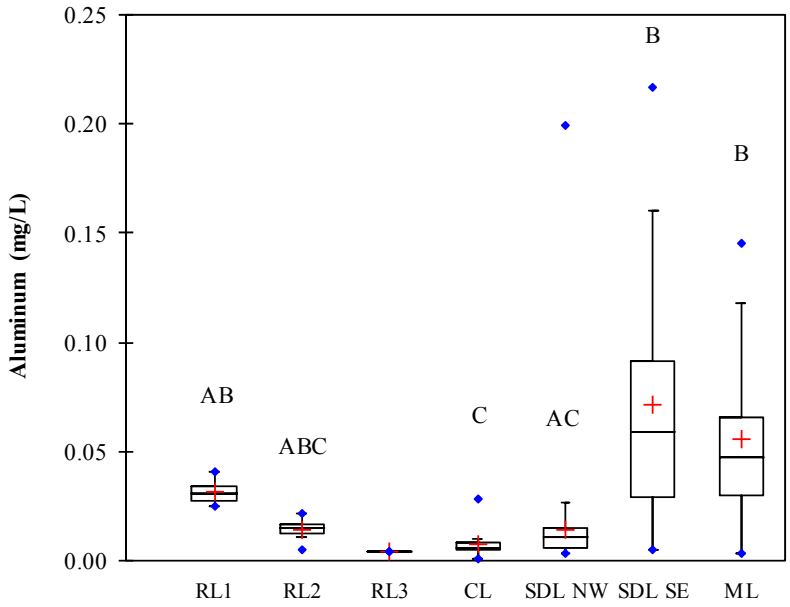

Figure 34. Total aluminum measured in surface water samples from reference and mine area lakes. Data represent 2013-2014 data for reference lakes and 2006-2014 for mine area lakes. Statistically significant differences are denoted with different superscripts.

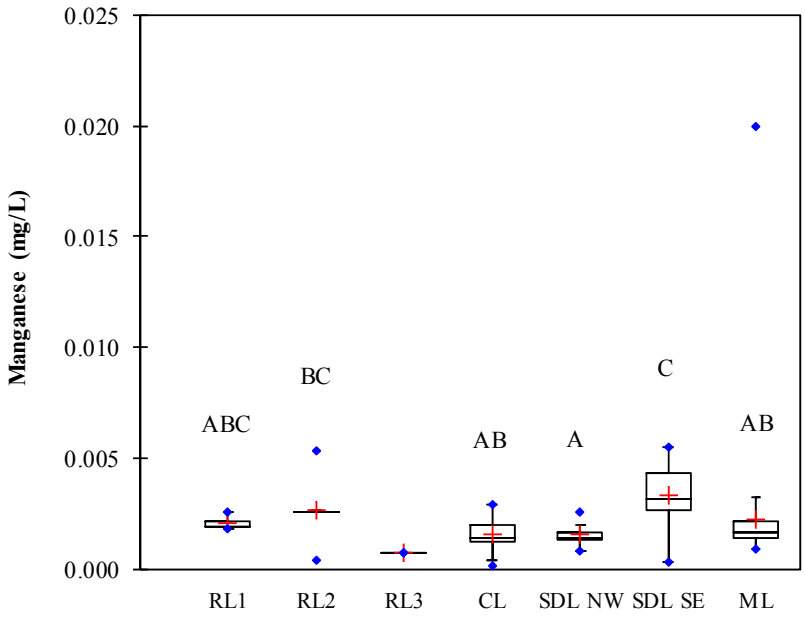

Figure 35. Total manganese measured in surface water samples from reference and mine area lakes. Data represent 2013-2014 data for reference lakes and 2006-2014 for mine area lakes. Statistically significant differences are denoted with different superscripts.

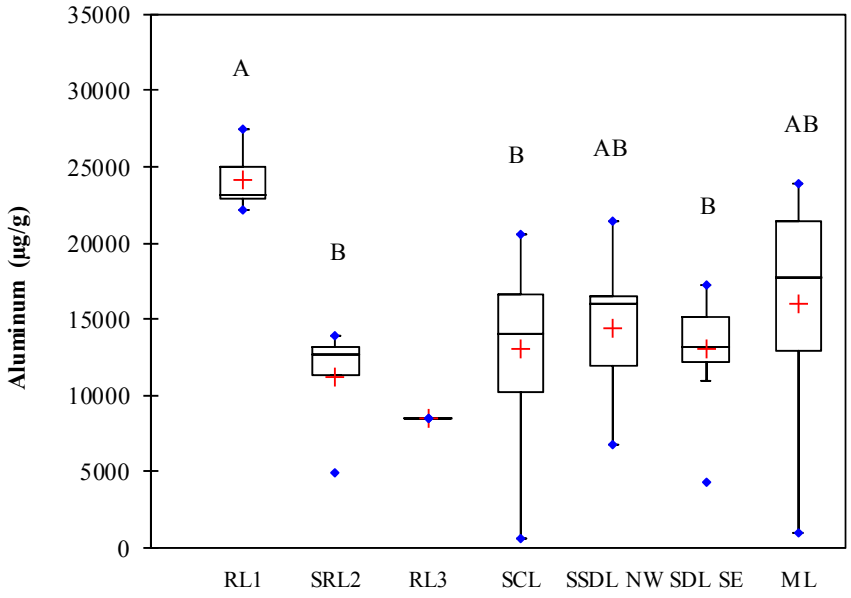

Figure 36. Aluminum measured in reference and mine area lake sediments. Statistically significant differences are denoted with different superscripts.

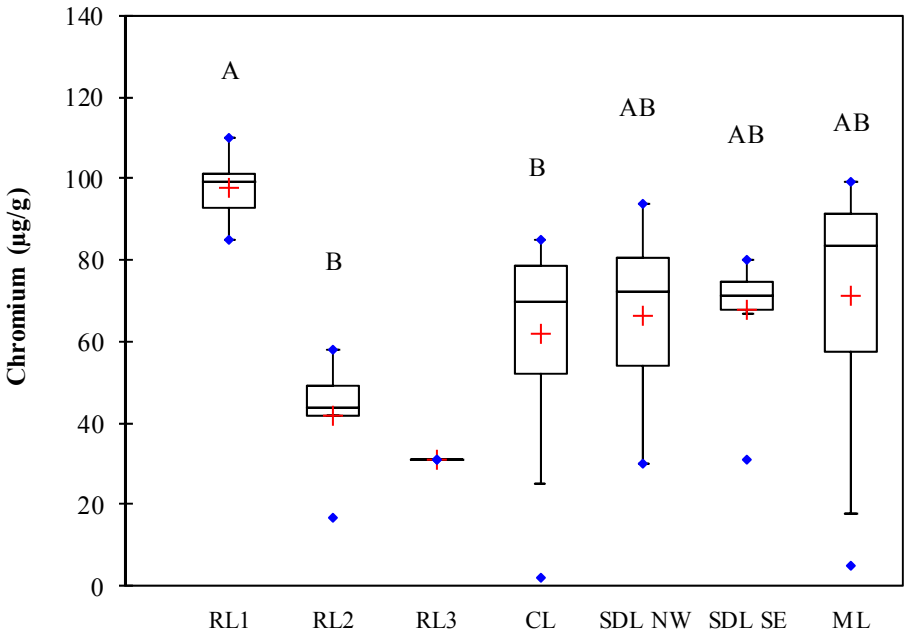

Figure 37. Chromium measured in reference and mine area lake sediments. Statistically significant differences are denoted with different superscripts.

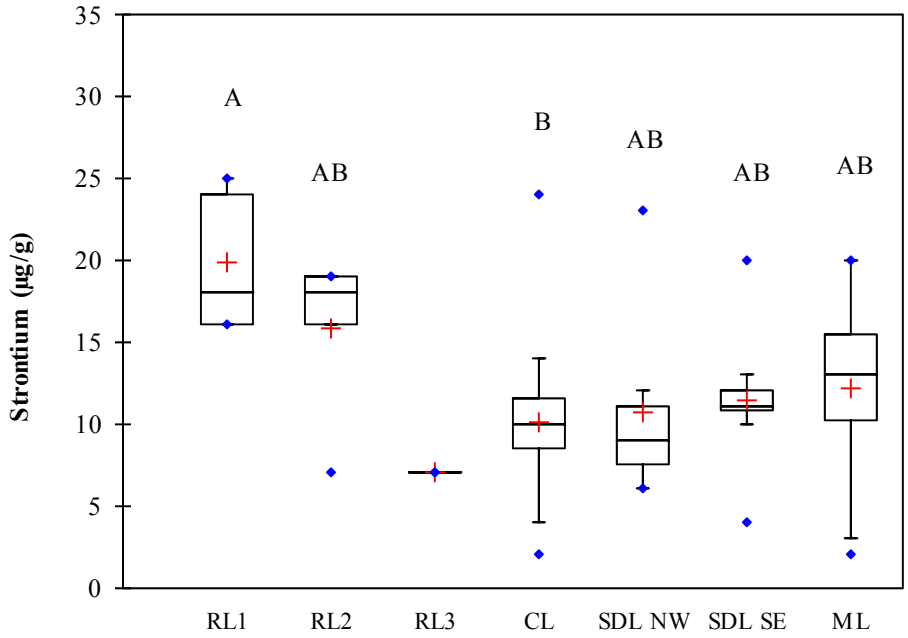

Figure 38. Strontium measured in reference and mine area lake sediments. Statistically significant differences are denoted with different superscripts.

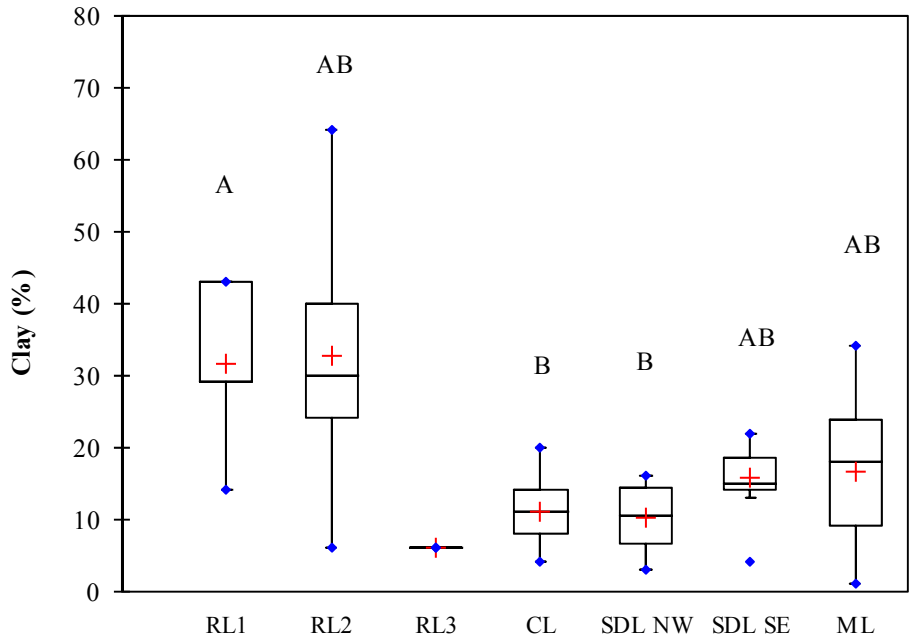

Figure 39. Clay content measured in reference and mine area lake sediments. Statistically significant differences are denoted with different superscripts.

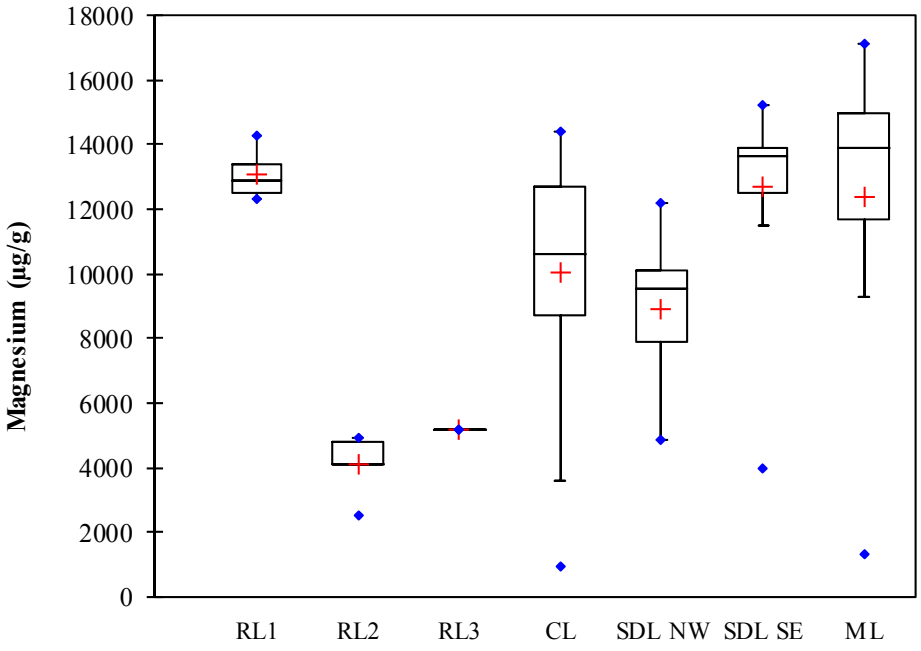

Figure 40. Magnesium measured in reference and mine area lake sediments. No statistically significant differences were noted.

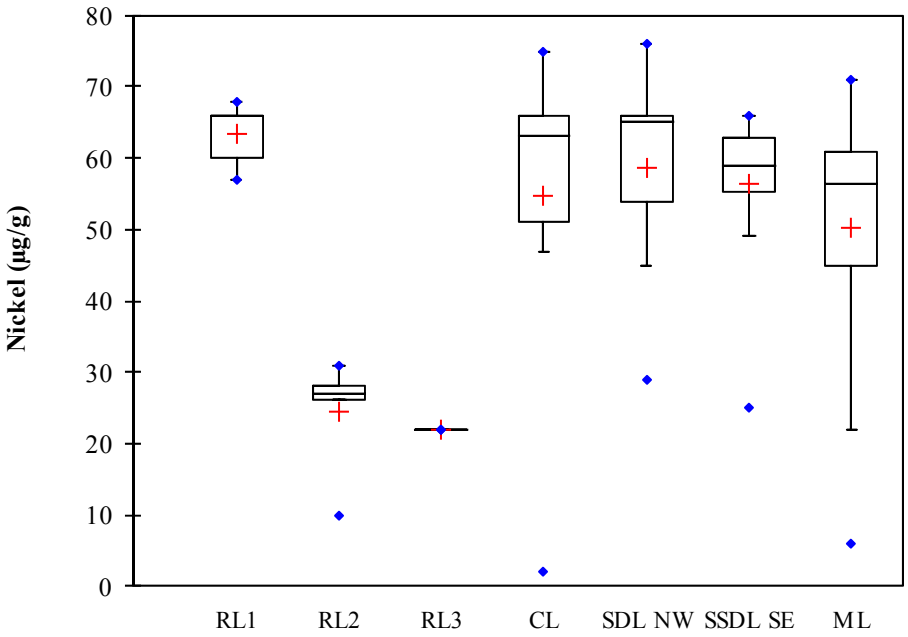

Figure 41. Nickel measured in reference and mine area lake sediments. No statistically significant differences were noted.

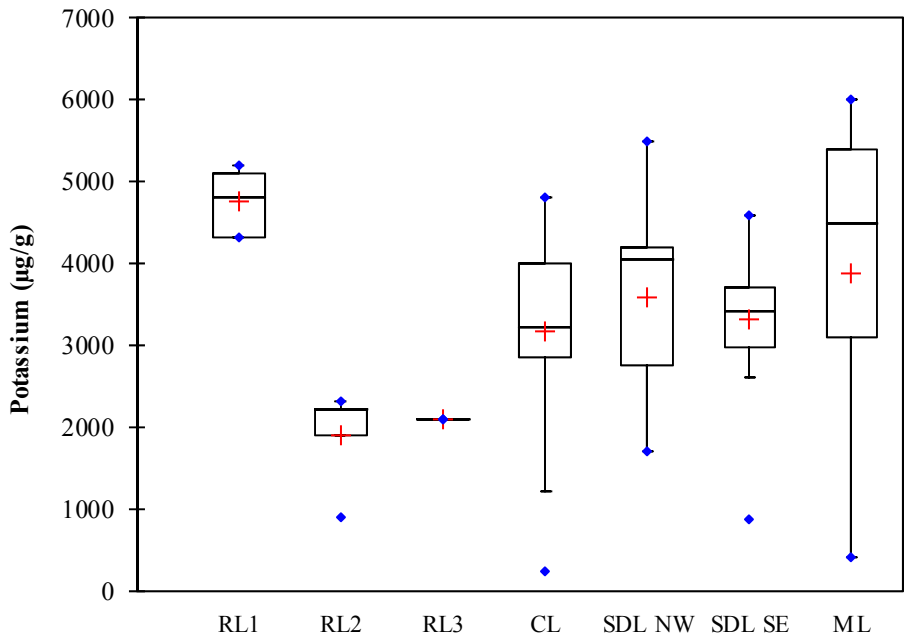

Figure 42. Potassium measured in reference and mine area lake sediments. No statistically significant differences were noted.

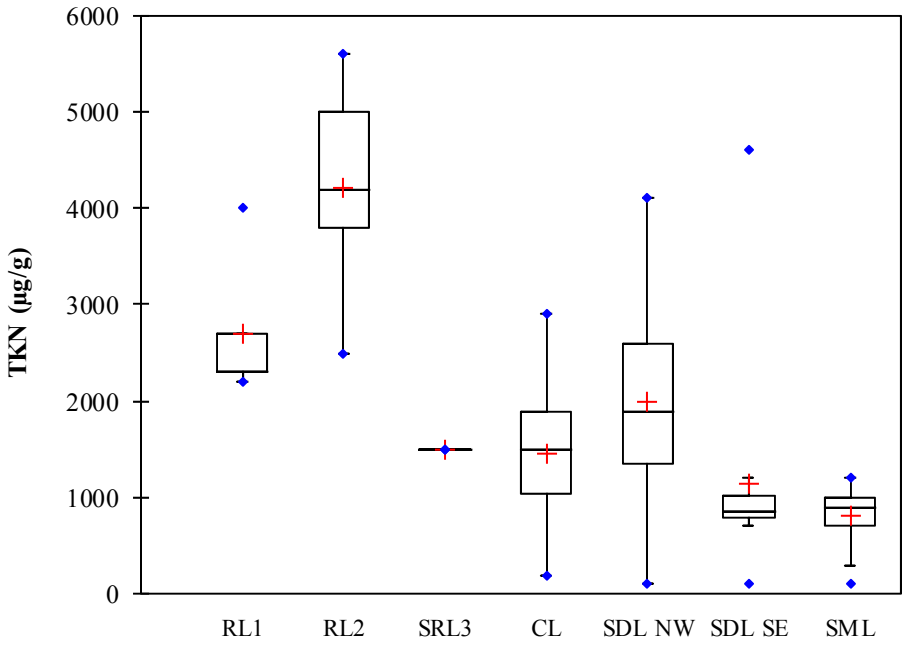

Figure 43. Total Kjeldahl nitrogen (TKN) measured in reference and mine area lake sediments. No statistically significant differences were noted.

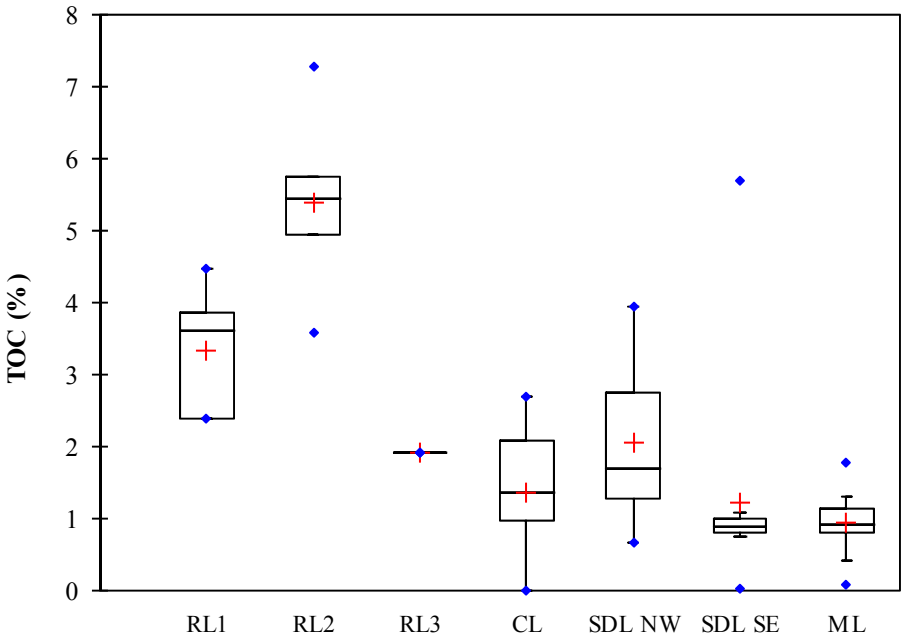

Figure 44. Total organic carbon (TOC) measured in reference and mine area lake sediments. No statistically significant differences were noted.

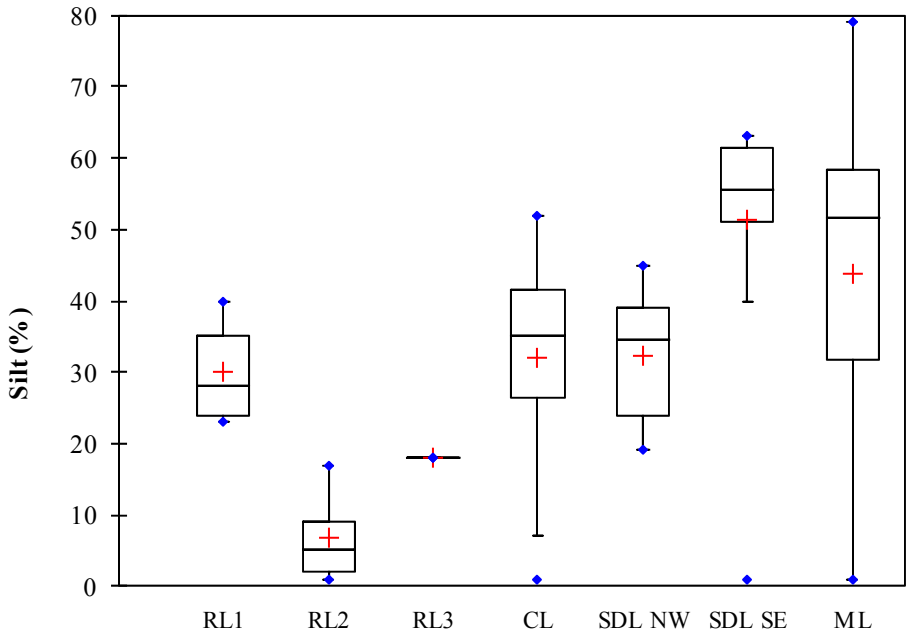

Figure 45. Silt content measured in reference and mine area lake sediments. No statistically significant differences were noted.

Photograp 1. Typical shoreline of Reference Lake 3.

Photograph 2. Typical nearshore substrate in Reference Lake 3.

APPENDIX 1. CANDIDATE REFERENCE LAKE WATER QUALITY DATA, 2014

Table A1-1. Summary of water quality sampling site information in candidate reference lakes, 2014.

Waterbody	Sample ID	Previous Site ID	Site UTM (17W)		Sample Date	Sample Time	Site Depth (m)	Secchi Depth (m)	*In Situ* Sample	Surface Sample	Bottom Sample
			Easting	Northing							
Reference Lake 1	RL1-01	CL-P2-13-1	550295	7938599	27-Aug-14	9:58	10.6	4.5	Y	Y	Y
	RL1-02	CL-P2-13-2	550241	7938777	27-Aug-14	10:30	12.1	4.7	Y	Y	Y
	RL1-03	CL-P2-13-3	550283	7938912	27-Aug-14	11:12	11.7	5.0	Y	Y	Y
	RL1-04	CL-P2-13-4	550395	7938912	27-Aug-14	11:45	6.3	4.9	Y	Y	Y
	RL1-05	CL-P2-13-5	550112	7938600	27-Aug-14	12:22	14.0	4.5	Y	Y	Y
Reference Lake 2	RL2-01	CR-P3-11-1	568757	7899826	29-Aug-14	10:00	8.6	5.7	Y	Y	Y
	RL2-02	CR-P3-11-2	568797	7900214	29-Aug-14	10:55	10.2	5.4	Y	Y	Y
	RL2-03	CR-P3-11-3	568963	7900049	29-Aug-14	11:00	6.6	5.3	Y	Y	Y
	RL2-04	CR-P3-11-4	569061	7899948	29-Aug-14	12:05	5.6	5.4	Y	Y	Y
	RL2-05	CR-P3-11-5	568997	7900295	29-Aug-14	12:40	10.1	5.8	Y	Y	Y
Reference Lake 3	RL3-01	ALT-09-01	574077	7853419	30-Aug-14	16:02	14.6	5.8	Y	Y	Y

Table A1-2. Laboratory water quality results for candidate reference lakes, 2014.

Waterbody	Site ID [1]	Previous Site ID	Sampling Date	pH	Alkalinity as $CaCO_3$	Total Dissolved Solids	Conductivity	Ammonia	Nitrite	Nitrate	Nitrate/ Nitrite	Total Kjeldahl Nitrogen
					(mg/L)	(mg/L)	(µS/cm)	mg N/L	mg/L	mg/L	mg/L	mg/L
Analytical Detection Limit					5	1	5	0.02	0.005	0.1	0.1	0.10
Reference Lake 1	RL1-01-S	CL-P2-13-1S	2014-08-27	7.54	22	29	44	0.10	<0.005	<0.10	<0.10	0.25
	RL1-01-B	CL-P2-13-1B	2014-08-27	7.62	21	29	44	0.05	<0.005	<0.10	<0.10	0.20
	RL1-02-S	CL-P2-13-2S	2014-08-27	7.63	21	29	44	0.09	<0.005	<0.10	<0.10	0.21
	RL1-02-B	CL-P2-13-2B	2014-08-27	7.60	22	29	44	0.07	<0.005	<0.10	<0.10	0.22
	RL1-03-S	CL-P2-13-3S	2014-08-27	7.67	31	29	45	0.10	<0.005	<0.10	<0.10	0.14
	RL1-03-B	CL-P2-13-3B	2014-08-27	7.61	20	29	44	0.07	<0.005	<0.10	<0.10	<0.10
	RL1-04-S	CL-P2-13-4S	2014-08-27	7.60	21	29	44	0.09	<0.005	<0.10	<0.10	0.10
	RL1-04-B	CL-P2-13-4B	2014-08-27	7.62	21	29	44	0.09	<0.005	<0.10	<0.10	0.13
	RL1-05-S	CL-P2-13-5S	2014-08-27	7.62	21	29	44	0.07	<0.005	<0.10	<0.10	0.12
	RL1-05-B	CL-P2-13-5B	2014-08-27	7.65	22	29	45	0.06	<0.005	<0.10	<0.10	<0.10
Reference Lake 2	RL2-01-S	CR-P3-11-1S [3]	2014-08-29	7.53	14	25	39	0.08	<0.005	<0.10	<0.10	<0.10
	RL2-01-B	CR-P3-11-1B [3]	2014-08-29	7.55	14	25	39	0.10	<0.005	<0.10	<0.10	<0.10
	RL2-02-S	CR-P3-11-2S	2014-08-29	7.54	14	25	39	0.11	<0.005	<0.10	<0.10	0.18
	RL2-02-B	CR-P3-11-2B	2014-08-29	7.54	14	25	39	0.11	<0.005	<0.10	<0.10	0.17
	RL2-03-S	CR-P3-11-3S	2014-08-29	7.57	14	25	39	0.17	<0.005	<0.10	<0.10	0.23
	RL2-03-B	CR-P3-11-3B	2014-08-29	7.58	14	25	39	0.06	<0.005	<0.10	<0.10	0.13
	RL2-04-S	CR-P3-11-4S	2014-08-29	7.62	14	25	39	0.14	<0.005	<0.10	<0.10	0.24
	RL2-04-B	CR-P3-11-4B	2014-08-29	7.60	14	25	39	0.06	<0.005	<0.10	<0.10	<0.10
	RL2-05-S	CR-P3-11-5S	2014-08-29	7.60	14	25	39	0.04	<0.005	<0.10	<0.10	<0.10
	RL2-05-B	CR-P3-11-5B	2014-08-29	7.58	14	25	39	0.11	<0.005	<0.10	<0.10	<0.10
Reference Lake 3	RL3-01-S	ALT-09-01S	2014-08-30	7.73	31	49	76	0.18	<0.005	<0.10	<0.10	0.34
	RL3-01-S Dup [4]	ALT-09-01S Dup	2014-08-30	7.81	31	49	76	0.13	<0.005	<0.10	<0.10	0.13
	RL3-01-B	ALT-09-01B	2014-08-30	7.81	31	49	76	0.17	<0.005	<0.10	<0.10	0.12

[1] S = surface; B = bottom
[2] Calculated
[3] Sample bottle labels were reversed on laboratory Chain of custody.
[4] Duplicate sample

Table A1-2. - continued -

Waterbody	Site ID [1]	Previous Site ID	Sampling Date	Total Nitrogen [2]	Total Phosphorus	TN:TP [2]	Dissolved Organic Carbon	Total Organic Carbon	Total Suspended Solids	Turbidity	Chlorophyll *a*	Pheophytin *a*
				(mg/L)	(mg/L)		(mg/L)	(mg/L)	(mg/L)	(NTU)	(µg/L)	(µg/L)
Analytical Detection Limit				-	0.003	-	0.5	0.5	2	0.1	0.2	0.2
Reference Lake 1	RL1-01-S	CL-P2-13-1S	2014-08-27	0.35	<0.003	258	1.3	1.2	<2	0.8	<0.2	2.8
	RL1-01-B	CL-P2-13-1B	2014-08-27	0.30	<0.003	221	1.0	1.0	<2	0.8	2.4	<0.2
	RL1-02-S	CL-P2-13-2S	2014-08-27	0.31	<0.003	229	1.0	1.4	<2	0.9	1.9	<0.2
	RL1-02-B	CL-P2-13-2B	2014-08-27	0.32	<0.003	236	1.0	1.4	<2	0.8	1.9	<0.2
	RL1-03-S	CL-P2-13-3S	2014-08-27	0.24	<0.003	177	1.0	1.4	<2	0.8	1.1	1.6
	RL1-03-B	CL-P2-13-3B	2014-08-27	<0.10	<0.003	74	1.0	1.0	<2	0.8	0.7	1.1
	RL1-04-S	CL-P2-13-4S	2014-08-27	0.20	<0.003	147	0.9	1.0	<2	0.8	3.4	<0.2
	RL1-04-B	CL-P2-13-4B	2014-08-27	0.23	<0.003	170	1.0	1.0	<2	0.9	<0.2	1.5
	RL1-05-S	CL-P2-13-5S	2014-08-27	0.22	<0.003	162	1.0	1.0	<2	0.8	0.7	0.3
	RL1-05-B	CL-P2-13-5B	2014-08-27	<0.10	<0.003	74	0.9	1.0	<2	0.8	<0.2	2.2
Reference Lake 2	RL2-01-S	CR-P3-11-1S [3]	2014-08-29	0.10	<0.003	147	1.8	2.4	<2	0.6	<0.2	<0.2
	RL2-01-B	CR-P3-11-1B [3]	2014-08-29	0.10	0.006	37	2.0	2.3	<2	0.9	0.3	<0.2
	RL2-02-S	CR-P3-11-2S	2014-08-29	0.23	0.014	36	1.9	2.3	<2	0.5	<0.2	<0.2
	RL2-02-B	CR-P3-11-2B	2014-08-29	0.22	0.006	81	1.9	2.4	<2	0.3	0.4	0.4
	RL2-03-S	CR-P3-11-3S	2014-08-29	0.28	<0.003	413	1.9	2.1	<2	0.6	0.7	<0.2
	RL2-03-B	CR-P3-11-3B	2014-08-29	0.23	0.006	85	2.0	2.4	<2	0.7	<0.2	1.1
	RL2-04-S	CR-P3-11-4S	2014-08-29	0.34	0.003	251	1.9	2.2	<2	0.6	<0.2	<0.2
	RL2-04-B	CR-P3-11-4B	2014-08-29	<0.10	<0.003	74	1.9	2	<2	1.1	0.7	<0.2
	RL2-05-S	CR-P3-11-5S	2014-08-29	<0.10	0.003	74	1.9	2.1	<2	0.5	0.3	<0.2
	RL2-05-B	CR-P3-11-5B	2014-08-29	<0.10	0.003	74	2.0	2	<2	0.6	<0.2	0.3
Reference Lake 3	RL3-01-S	ALT-09-01S	2014-08-30	0.44	0.004	243	3.0	3.1	<2	0.3	2.3	<0.2
	RL3-01-S Dup [4]	ALT-09-01S Dup	2014-08-30	0.23	<0.003	170	3.0	3	<2	0.4	0.3	<0.2
	RL3-01-B	ALT-09-01B	2014-08-30	0.22	0.003	162	3.0	3	<2	0.3	<0.2	<0.2

Table A1-2. - continued –

Waterbody	Site ID [1]	Previous Site ID	Sampling Date	Phenols	Bromide	Chloride	Sulphate	Hardness as $CaCO_3$ (Total)	Hardness as $CaCO_3$ (Dissolved)	Total		
										Aluminum	Antimony	Arsenic
				(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Analytical Detection Limit				0.001	0.25	1	1	1	1	0.003	0.0001	0.0001
Reference Lake 1	RL1-01-S	CL-P2-13-1S	2014-08-27	<0.001	<0.25	1	<1	21	21	0.035	<0.0001	<0.0001
	RL1-01-B	CL-P2-13-1B	2014-08-27	<0.001	<0.25	1	<1	21	22	0.030	<0.0001	<0.0001
	RL1-02-S	CL-P2-13-2S	2014-08-27	<0.001	<0.25	1	<1	21	21	0.041	<0.0001	<0.0001
	RL1-02-B	CL-P2-13-2B	2014-08-27	<0.001	<0.25	1	<1	21	21	0.025	<0.0001	<0.0001
	RL1-03-S	CL-P2-13-3S	2014-08-27	<0.001	<0.25	1	<1	21	21	0.027	<0.0001	<0.0001
	RL1-03-B	CL-P2-13-3B	2014-08-27	<0.001	<0.25	1	<1	21	21	0.032	<0.0001	<0.0001
	RL1-04-S	CL-P2-13-4S	2014-08-27	<0.001	<0.25	1	<1	21	21	0.031	<0.0001	<0.0001
	RL1-04-B	CL-P2-13-4B	2014-08-27	<0.001	<0.25	1	<1	21	21	0.034	<0.0001	<0.0001
	RL1-05-S	CL-P2-13-5S	2014-08-27	<0.001	<0.25	1	<1	21	21	0.025	<0.0001	<0.0001
	RL1-05-B	CL-P2-13-5B	2014-08-27	<0.001	<0.25	1	<1	22	22	0.025	<0.0001	<0.0001
Reference Lake 2	RL2-01-S	CR-P3-11-1S [3]	2014-08-29	<0.001	<0.25	2	1	18	18	0.005	<0.0001	<0.0001
	RL2-01-B	CR-P3-11-1B [3]	2014-08-29	<0.001	<0.25	2	1	18	18	0.014	<0.0001	<0.0001
	RL2-02-S	CR-P3-11-2S	2014-08-29	<0.001	<0.25	2	1	18	18	0.015	<0.0001	<0.0001
	RL2-02-B	CR-P3-11-2B	2014-08-29	<0.001	<0.25	2	1	18	18	0.017	<0.0001	<0.0001
	RL2-03-S	CR-P3-11-3S	2014-08-29	<0.001	<0.25	2	1	18	18	0.017	<0.0001	<0.0001
	RL2-03-B	CR-P3-11-3B	2014-08-29	<0.001	<0.25	2	1	18	18	0.015	<0.0001	<0.0001
	RL2-04-S	CR-P3-11-4S	2014-08-29	<0.001	<0.25	2	1	18	18	0.014	<0.0001	<0.0001
	RL2-04-B	CR-P3-11-4B	2014-08-29	<0.001	<0.25	2	1	18	18	0.014	<0.0001	<0.0001
	RL2-05-S	CR-P3-11-5S	2014-08-29	<0.001	<0.25	2	1	18	18	0.016	<0.0001	<0.0001
	RL2-05-B	CR-P3-11-5B	2014-08-29	<0.001	<0.25	2	1	17	18	0.017	<0.0001	<0.0001
Reference Lake 3	RL3-01-S	ALT-09-01S	2014-08-30	<0.001	<0.25	2	4	38	38	0.004	<0.0001	<0.0001
	RL3-01-S Dup [4]	ALT-09-01S Dup	2014-08-30	<0.001	<0.25	2	4	38	38	0.005	<0.0001	<0.0001
	RL3-01-B	ALT-09-01B	2014-08-30	<0.001	<0.25	2	4	38	38	0.003	<0.0001	<0.0001

Table A1-2. - continued –

Waterbody	Site ID [1]	Previous Site ID	Sampling Date	Total								
				Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper
				(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Analytical Detection Limit				0.00005	0.0005	0.0005	0.010	0.00001	0.05	0.0005	0.0001	0.0005
Reference Lake 1	RL1-01-S	CL-P2-13-1S	2014-08-27	0.00218	<0.0005	<0.0005	<0.010	<0.00001	4.18	<0.0005	<0.0001	0.0005
	RL1-01-B	CL-P2-13-1B	2014-08-27	0.00216	<0.0005	<0.0005	<0.010	<0.00001	4.20	<0.0005	<0.0001	0.0005
	RL1-02-S	CL-P2-13-2S	2014-08-27	0.00224	<0.0005	<0.0005	<0.010	<0.00001	4.27	<0.0005	<0.0001	0.0007
	RL1-02-B	CL-P2-13-2B	2014-08-27	0.00205	<0.0005	<0.0005	<0.010	<0.00001	4.21	<0.0005	<0.0001	0.0005
	RL1-03-S	CL-P2-13-3S	2014-08-27	0.0021	<0.0005	<0.0005	<0.010	<0.00001	4.2	<0.0005	<0.0001	0.0005
	RL1-03-B	CL-P2-13-3B	2014-08-27	0.00215	<0.0005	<0.0005	<0.010	<0.00001	4.21	<0.0005	<0.0001	0.0006
	RL1-04-S	CL-P2-13-4S	2014-08-27	0.00213	<0.0005	<0.0005	<0.010	<0.00001	4.22	<0.0005	<0.0001	0.0005
	RL1-04-B	CL-P2-13-4B	2014-08-27	0.00208	<0.0005	<0.0005	<0.010	<0.00001	4.22	<0.0005	<0.0001	0.0005
	RL1-05-S	CL-P2-13-5S	2014-08-27	0.00208	<0.0005	<0.0005	<0.010	<0.00001	4.22	<0.0005	<0.0001	0.0005
	RL1-05-B	CL-P2-13-5B	2014-08-27	0.00218	<0.0005	<0.0005	<0.010	<0.00001	4.34	<0.0005	<0.0001	0.0005
Reference Lake 2	RL2-01-S	CR-P3-11-1S [3]	2014-08-29	0.0025	<0.0005	<0.0005	<0.010	<0.00001	3.78	<0.0005	<0.0001	<0.0005
	RL2-01-B	CR-P3-11-1B [3]	2014-08-29	0.00253	<0.0005	<0.0005	<0.010	<0.00001	3.76	<0.0005	<0.0001	<0.0005
	RL2-02-S	CR-P3-11-2S	2014-08-29	0.0026	<0.0005	<0.0005	<0.010	<0.00001	3.8	<0.0005	<0.0001	<0.0005
	RL2-02-B	CR-P3-11-2B	2014-08-29	0.00256	<0.0005	<0.0005	<0.010	<0.00001	3.8	<0.0005	<0.0001	0.0006
	RL2-03-S	CR-P3-11-3S	2014-08-29	0.0026	<0.0005	<0.0005	<0.010	<0.00001	3.84	<0.0005	<0.0001	<0.0005
	RL2-03-B	CR-P3-11-3B	2014-08-29	0.0026	<0.0005	<0.0005	<0.010	<0.00001	3.75	<0.0005	<0.0001	<0.0005
	RL2-04-S	CR-P3-11-4S	2014-08-29	0.00261	<0.0005	<0.0005	<0.010	<0.00001	3.84	<0.0005	<0.0001	<0.0005
	RL2-04-B	CR-P3-11-4B	2014-08-29	0.00258	<0.0005	<0.0005	<0.010	<0.00001	3.77	<0.0005	<0.0001	<0.0005
	RL2-05-S	CR-P3-11-5S	2014-08-29	0.00262	<0.0005	<0.0005	<0.010	<0.00001	3.82	<0.0005	<0.0001	<0.0005
	RL2-05-B	CR-P3-11-5B	2014-08-29	0.00255	<0.0005	<0.0005	<0.010	<0.00001	3.74	<0.0005	<0.0001	<0.0005
Reference Lake 3	RL3-01-S	ALT-09-01S	2014-08-30	0.00619	<0.0005	<0.0005	<0.010	<0.00001	7.56	<0.0005	<0.0001	0.0009
	RL3-01-S Dup [4]	ALT-09-01S Dup	2014-08-30	0.00637	<0.0005	<0.0005	<0.010	<0.00001	7.66	<0.0005	<0.0001	0.0008
	RL3-01-B	ALT-09-01B	2014-08-30	0.00625	<0.0005	<0.0005	<0.010	<0.00001	7.58	<0.0005	<0.0001	0.0008

Table A1-2. - continued –

Waterbody	Site ID [1]	Previous Site ID	Sampling Date	Total							
				Iron	Lead	Lithium	Magnesium	Manganese	Mercury	Molybdenum	Nickel
				(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Analytical Detection Limit				0.03	0.00005	0.001	0.05	0.00005	0.00001	0.00005	0.0005
Reference Lake 1	RL1-01-S	CL-P2-13-1S	2014-08-27	<0.030	<0.00005	<0.001	2.49	0.00195	<0.00001	<0.00005	<0.0005
	RL1-01-B	CL-P2-13-1B	2014-08-27	<0.030	<0.00005	<0.001	2.50	0.00194	<0.00001	<0.00005	<0.0005
	RL1-02-S	CL-P2-13-2S	2014-08-27	0.040	0.00009	<0.001	2.52	0.00243	<0.00001	<0.00005	<0.0005
	RL1-02-B	CL-P2-13-2B	2014-08-27	<0.030	<0.00005	<0.001	2.51	0.00192	<0.00001	<0.00005	<0.0005
	RL1-03-S	CL-P2-13-3S	2014-08-27	<0.030	<0.00005	<0.001	2.53	0.00189	<0.00001	<0.00005	<0.0005
	RL1-03-B	CL-P2-13-3B	2014-08-27	<0.030	<0.00005	<0.001	2.49	0.00199	<0.00001	<0.00005	<0.0005
	RL1-04-S	CL-P2-13-4S	2014-08-27	0.030	<0.00005	<0.001	2.53	0.00190	<0.00001	<0.00005	<0.0005
	RL1-04-B	CL-P2-13-4B	2014-08-27	0.030	<0.00005	<0.001	2.52	0.00192	<0.00001	<0.00005	<0.0005
	RL1-05-S	CL-P2-13-5S	2014-08-27	<0.030	<0.00005	<0.001	2.53	0.00190	<0.00001	<0.00005	<0.0005
	RL1-05-B	CL-P2-13-5B	2014-08-27	<0.030	<0.00005	<0.001	2.58	0.00191	<0.00001	<0.00005	<0.0005
Reference Lake 2	RL2-01-S	CR-P3-11-1S [3]	2014-08-29	<0.030	<0.00005	<0.001	1.99	0.00038	<0.00001	<0.00005	<0.0005
	RL2-01-B	CR-P3-11-1B [3]	2014-08-29	<0.030	<0.00005	<0.001	1.98	0.00254	<0.00001	0.00005	<0.0005
	RL2-02-S	CR-P3-11-2S	2014-08-29	<0.030	<0.00005	<0.001	2.04	0.00257	<0.00001	<0.00005	<0.0005
	RL2-02-B	CR-P3-11-2B	2014-08-29	<0.030	<0.00005	<0.001	2.00	0.00260	<0.00001	<0.00005	<0.0005
	RL2-03-S	CR-P3-11-3S	2014-08-29	<0.030	<0.00005	<0.001	2.04	0.00255	<0.00001	<0.00005	<0.0005
	RL2-03-B	CR-P3-11-3B	2014-08-29	<0.030	<0.00005	<0.001	1.97	0.00257	<0.00001	<0.00005	<0.0005
	RL2-04-S	CR-P3-11-4S	2014-08-29	<0.030	<0.00005	<0.001	2.03	0.00261	<0.00001	<0.00005	<0.0005
	RL2-04-B	CR-P3-11-4B	2014-08-29	<0.030	<0.00005	<0.001	1.98	0.00253	<0.00001	<0.00005	<0.0005
	RL2-05-S	CR-P3-11-5S	2014-08-29	<0.030	<0.00005	<0.001	2.03	0.00255	<0.00001	<0.00005	<0.0005
	RL2-05-B	CR-P3-11-5B	2014-08-29	<0.030	<0.00005	<0.001	1.95	0.00258	<0.00001	<0.00005	<0.0005
Reference Lake 3	RL3-01-S	ALT-09-01S	2014-08-30	<0.030	<0.00005	<0.001	4.56	0.00078	<0.00001	0.00018	<0.0005
	RL3-01-S Dup [4]	ALT-09-01S Dup	2014-08-30	<0.030	<0.00005	<0.001	4.62	0.00060	<0.00001	0.00016	<0.0005
	RL3-01-B	ALT-09-01B	2014-08-30	<0.030	0.00045	<0.001	4.61	0.00061	<0.00001	0.00015	<0.0005

Table A1-2. - continued –

Waterbody	Site ID [1]	Previous Site ID	Sampling Date	Total							
				Potassium	Selenium	Silicon	Silver	Sodium	Tin	Strontium	Titanium
				(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Analytical Detection Limit				0.2	0.001	0.1	0.00001	0.05	0.0001	0.0001	0.010
Reference Lake 1	RL1-01-S	CL-P2-13-1S	2014-08-27	0.3	<0.001	0.4	<0.00001	0.68	<0.0001	0.0036	<0.010
	RL1-01-B	CL-P2-13-1B	2014-08-27	0.3	<0.001	0.4	<0.00001	0.71	<0.0001	0.0036	<0.010
	RL1-02-S	CL-P2-13-2S	2014-08-27	0.3	<0.001	0.4	<0.00001	0.80	<0.0001	0.0037	<0.010
	RL1-02-B	CL-P2-13-2B	2014-08-27	0.3	<0.001	0.4	<0.00001	0.70	<0.0001	0.0035	<0.010
	RL1-03-S	CL-P2-13-3S	2014-08-27	0.3	<0.001	0.4	<0.00001	0.69	<0.0001	0.0034	<0.010
	RL1-03-B	CL-P2-13-3B	2014-08-27	0.3	<0.001	0.4	<0.00001	0.71	<0.0001	0.0035	<0.010
	RL1-04-S	CL-P2-13-4S	2014-08-27	0.3	<0.001	0.4	<0.00001	0.70	<0.0001	0.0035	<0.010
	RL1-04-B	CL-P2-13-4B	2014-08-27	0.3	<0.001	0.4	<0.00001	0.70	<0.0001	0.0034	<0.010
	RL1-05-S	CL-P2-13-5S	2014-08-27	0.3	<0.001	0.4	<0.00001	0.71	<0.0001	0.0034	<0.010
	RL1-05-B	CL-P2-13-5B	2014-08-27	0.3	<0.001	0.4	<0.00001	0.70	<0.0001	0.0034	<0.010
Reference Lake 2	RL2-01-S	CR-P3-11-1S [3]	2014-08-29	0.2	<0.001	0.2	<0.00001	1.01	<0.0001	0.0048	<0.010
	RL2-01-B	CR-P3-11-1B [3]	2014-08-29	0.3	<0.001	0.2	<0.00001	0.97	<0.0001	0.0049	<0.010
	RL2-02-S	CR-P3-11-2S	2014-08-29	0.4	<0.001	0.3	<0.00001	0.99	<0.0001	0.0050	<0.010
	RL2-02-B	CR-P3-11-2B	2014-08-29	0.3	<0.001	0.3	<0.00001	0.98	<0.0001	0.0050	<0.010
	RL2-03-S	CR-P3-11-3S	2014-08-29	0.3	<0.001	0.3	<0.00001	0.99	<0.0001	0.0050	<0.010
	RL2-03-B	CR-P3-11-3B	2014-08-29	0.4	<0.001	0.3	<0.00001	0.98	<0.0001	0.0050	<0.010
	RL2-04-S	CR-P3-11-4S	2014-08-29	0.4	<0.001	0.3	<0.00001	1.00	<0.0001	0.0050	<0.010
	RL2-04-B	CR-P3-11-4B	2014-08-29	0.3	<0.001	0.3	<0.00001	0.97	<0.0001	0.0050	<0.010
	RL2-05-S	CR-P3-11-5S	2014-08-29	0.2	<0.001	0.3	<0.00001	1.00	<0.0001	0.0050	<0.010
	RL2-05-B	CR-P3-11-5B	2014-08-29	0.3	<0.001	0.3	<0.00001	0.99	<0.0001	0.0049	<0.010
Reference Lake 3	RL3-01-S	ALT-09-01S	2014-08-30	0.8	<0.001	0.5	<0.00001	0.73	<0.0001	0.0086	<0.010
	RL3-01-S Dup [4]	ALT-09-01S Dup	2014-08-30	0.7	<0.001	0.5	<0.00001	0.72	<0.0001	0.0083	<0.010
	RL3-01-B	ALT-09-01B	2014-08-30	0.8	<0.001	0.5	<0.00001	0.74	<0.0001	0.0087	<0.010

Table A1-2. - continued –

Waterbody	Site ID [1]	Previous Site ID	Sampling Date	Total				Dissolved			
				Thallium	Uranium	Vanadium	Zinc	Aluminum	Antimony	Arsenic	Barium
				(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Analytical Detection Limit				0.0001	0.00001	0.001	0.003	0.003	0.0001	0.0001	0.00005
Reference Lake 1	RL1-01-S	CL-P2-13-1S	2014-08-27	<0.0001	0.00014	<0.001	<0.003	0.004	<0.0001	<0.0001	0.00201
	RL1-01-B	CL-P2-13-1B	2014-08-27	<0.0001	0.00014	<0.001	<0.003	0.005	<0.0001	<0.0001	0.00203
	RL1-02-S	CL-P2-13-2S	2014-08-27	<0.0001	0.00014	<0.001	<0.003	0.004	<0.0001	<0.0001	0.00227
	RL1-02-B	CL-P2-13-2B	2014-08-27	<0.0001	0.00014	<0.001	<0.003	0.004	<0.0001	<0.0001	0.00204
	RL1-03-S	CL-P2-13-3S	2014-08-27	<0.0001	0.00014	<0.001	<0.003	0.004	<0.0001	<0.0001	0.00207
	RL1-03-B	CL-P2-13-3B	2014-08-27	<0.0001	0.00014	<0.001	<0.003	0.004	<0.0001	<0.0001	0.00210
	RL1-04-S	CL-P2-13-4S	2014-08-27	<0.0001	0.00014	<0.001	<0.003	0.005	0.0002	<0.0001	0.00204
	RL1-04-B	CL-P2-13-4B	2014-08-27	<0.0001	0.00014	<0.001	<0.003	0.007	0.0001	<0.0001	0.00206
	RL1-05-S	CL-P2-13-5S	2014-08-27	<0.0001	0.00014	<0.001	<0.003	0.003	<0.0001	<0.0001	0.00207
	RL1-05-B	CL-P2-13-5B	2014-08-27	<0.0001	0.00015	<0.001	<0.003	0.004	<0.0001	<0.0001	0.00207
Reference Lake 2	RL2-01-S	CR-P3-11-1S [3]	2014-08-29	<0.0001	0.00006	<0.001	<0.003	0.013	0.0001	<0.0001	0.00253
	RL2-01-B	CR-P3-11-1B [3]	2014-08-29	<0.0001	0.00006	<0.001	<0.003	0.006	0.0003	<0.0001	0.00263
	RL2-02-S	CR-P3-11-2S	2014-08-29	<0.0001	0.00006	<0.001	<0.003	0.004	<0.0001	<0.0001	0.00232
	RL2-02-B	CR-P3-11-2B	2014-08-29	<0.0001	0.00006	<0.001	<0.003	0.005	<0.0001	<0.0001	0.00236
	RL2-03-S	CR-P3-11-3S	2014-08-29	<0.0001	0.00006	<0.001	<0.003	0.007	<0.0001	<0.0001	0.00239
	RL2-03-B	CR-P3-11-3B	2014-08-29	<0.0001	0.00006	<0.001	<0.003	0.005	<0.0001	<0.0001	0.00235
	RL2-04-S	CR-P3-11-4S	2014-08-29	<0.0001	0.00006	<0.001	<0.003	0.006	<0.0001	<0.0001	0.00244
	RL2-04-B	CR-P3-11-4B	2014-08-29	<0.0001	0.00006	<0.001	<0.003	0.004	<0.0001	<0.0001	0.00242
	RL2-05-S	CR-P3-11-5S	2014-08-29	<0.0001	0.00006	<0.001	<0.003	0.004	<0.0001	<0.0001	0.00242
	RL2-05-B	CR-P3-11-5B	2014-08-29	<0.0001	0.00006	<0.001	<0.003	0.005	<0.0001	<0.0001	0.00243
Reference Lake 3	RL3-01-S	ALT-09-01S	2014-08-30	<0.0001	0.00027	<0.001	<0.003	0.004	<0.0001	<0.0001	0.00626
	RL3-01-S Dup [4]	ALT-09-01S Dup	2014-08-30	<0.0001	0.00027	<0.001	<0.003	<0.003	<0.0001	<0.0001	0.00628
	RL3-01-B	ALT-09-01B	2014-08-30	<0.0001	0.00027	<0.001	<0.003	<0.003	<0.0001	<0.0001	0.00629

Table A1-2. - continued –

Waterbody	Site ID [1]	Previous Site ID	Sampling Date	Dissolved							
				Beryllium	Bismuth	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper
				(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Analytical Detection Limit				0.0005	0.0005	0.010	0.00001	0.05	0.0005	0.0001	0.0005
Reference Lake 1	RL1-01-S	CL-P2-13-1S	2014-08-27	<0.0005	<0.0005	<0.010	<0.00001	4.28	<0.0005	<0.0001	<0.0005
	RL1-01-B	CL-P2-13-1B	2014-08-27	<0.0005	<0.0005	<0.010	<0.00001	4.32	<0.0005	<0.0001	<0.0005
	RL1-02-S	CL-P2-13-2S	2014-08-27	<0.0005	<0.0005	<0.010	<0.00001	4.30	<0.0005	<0.0001	<0.0005
	RL1-02-B	CL-P2-13-2B	2014-08-27	<0.0005	<0.0005	<0.010	<0.00001	4.31	<0.0005	<0.0001	<0.0005
	RL1-03-S	CL-P2-13-3S	2014-08-27	<0.0005	<0.0005	<0.010	<0.00001	4.33	<0.0005	<0.0001	<0.0005
	RL1-03-B	CL-P2-13-3B	2014-08-27	<0.0005	<0.0005	<0.010	<0.00001	4.30	<0.0005	<0.0001	<0.0005
	RL1-04-S	CL-P2-13-4S	2014-08-27	<0.0005	<0.0005	<0.010	<0.00001	4.30	<0.0005	<0.0001	<0.0005
	RL1-04-B	CL-P2-13-4B	2014-08-27	<0.0005	<0.0005	<0.010	<0.00001	4.30	<0.0005	<0.0001	<0.0005
	RL1-05-S	CL-P2-13-5S	2014-08-27	<0.0005	<0.0005	<0.010	<0.00001	4.30	<0.0005	<0.0001	<0.0005
	RL1-05-B	CL-P2-13-5B	2014-08-27	<0.0005	<0.0005	<0.010	<0.00001	4.46	<0.0005	<0.0001	<0.0005
Reference Lake 2	RL2-01-S	CR-P3-11-1S [3]	2014-08-29	<0.0005	<0.0005	<0.010	<0.00001	3.84	<0.0005	<0.0001	<0.0005
	RL2-01-B	CR-P3-11-1B [3]	2014-08-29	<0.0005	<0.0005	<0.010	<0.00001	3.80	<0.0005	<0.0001	<0.0005
	RL2-02-S	CR-P3-11-2S	2014-08-29	<0.0005	<0.0005	<0.010	<0.00001	3.82	<0.0005	<0.0001	<0.0005
	RL2-02-B	CR-P3-11-2B	2014-08-29	<0.0005	<0.0005	<0.010	<0.00001	3.88	<0.0005	<0.0001	<0.0005
	RL2-03-S	CR-P3-11-3S	2014-08-29	<0.0005	<0.0005	<0.010	<0.00001	3.82	<0.0005	<0.0001	<0.0005
	RL2-03-B	CR-P3-11-3B	2014-08-29	<0.0005	<0.0005	<0.010	<0.00001	3.82	<0.0005	<0.0001	<0.0005
	RL2-04-S	CR-P3-11-4S	2014-08-29	<0.0005	<0.0005	<0.010	<0.00001	3.83	<0.0005	<0.0001	<0.0005
	RL2-04-B	CR-P3-11-4B	2014-08-29	<0.0005	<0.0005	<0.010	<0.00001	3.88	<0.0005	<0.0001	<0.0005
	RL2-05-S	CR-P3-11-5S	2014-08-29	<0.0005	<0.0005	<0.010	<0.00001	3.86	<0.0005	<0.0001	<0.0005
	RL2-05-B	CR-P3-11-5B	2014-08-29	<0.0005	<0.0005	<0.010	<0.00001	3.84	<0.0005	<0.0001	<0.0005
Reference Lake 3	RL3-01-S	ALT-09-01S	2014-08-30	<0.0005	<0.0005	<0.010	<0.00001	7.62	<0.0005	<0.0001	0.0009
	RL3-01-S Dup [4]	ALT-09-01S Dup	2014-08-30	<0.0005	<0.0005	<0.010	<0.00001	7.66	<0.0005	<0.0001	0.0008
	RL3-01-B	ALT-09-01B	2014-08-30	<0.0005	<0.0005	<0.010	<0.00001	7.69	<0.0005	<0.0001	0.0008

Table A1-2. - continued –

Waterbody	Site ID [1]	Previous Site ID	Sampling Date	Dissolved							
				Iron	Lithium	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Lead
				(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Analytical Detection Limit				0.030	0.001	0.05	0.00005	0.00001	0.00005	0.0005	0.00005
Reference Lake 1	RL1-01-S	CL-P2-13-1S	2014-08-27	<0.030	<0.001	2.55	0.00020	<0.00001	<0.00005	<0.0005	<0.00005
	RL1-01-B	CL-P2-13-1B	2014-08-27	<0.030	<0.001	2.60	0.00040	<0.00001	<0.00005	<0.0005	<0.00005
	RL1-02-S	CL-P2-13-2S	2014-08-27	<0.030	<0.001	2.57	0.00022	<0.00001	<0.00005	<0.0005	<0.00005
	RL1-02-B	CL-P2-13-2B	2014-08-27	<0.030	<0.001	2.58	0.00019	<0.00001	<0.00005	<0.0005	<0.00005
	RL1-03-S	CL-P2-13-3S	2014-08-27	<0.030	<0.001	2.56	0.00018	<0.00001	<0.00005	<0.0005	<0.00005
	RL1-03-B	CL-P2-13-3B	2014-08-27	<0.030	<0.001	2.55	0.00019	<0.00001	<0.00005	<0.0005	<0.00005
	RL1-04-S	CL-P2-13-4S	2014-08-27	<0.030	<0.001	2.57	0.00031	<0.00001	<0.00005	<0.0005	<0.00005
	RL1-04-B	CL-P2-13-4B	2014-08-27	<0.030	<0.001	2.57	0.00024	<0.00001	<0.00005	<0.0005	<0.00005
	RL1-05-S	CL-P2-13-5S	2014-08-27	<0.030	<0.001	2.56	0.00023	<0.00001	<0.00005	<0.0005	0.00007
	RL1-05-B	CL-P2-13-5B	2014-08-27	<0.030	<0.001	2.67	0.00023	<0.00001	<0.00005	<0.0005	<0.00005
Reference Lake 2	RL2-01-S	CR-P3-11-1S [3]	2014-08-29	<0.030	<0.001	2.03	0.00261	<0.00001	0.00005	<0.0005	<0.00005
	RL2-01-B	CR-P3-11-1B [3]	2014-08-29	<0.030	<0.001	1.98	0.00050	<0.00001	0.00008	0.0011	0.00007
	RL2-02-S	CR-P3-11-2S	2014-08-29	<0.030	<0.001	1.99	0.00034	<0.00001	0.00006	<0.0005	<0.00005
	RL2-02-B	CR-P3-11-2B	2014-08-29	<0.030	<0.001	2.06	0.00033	<0.00001	0.00006	<0.0005	<0.00005
	RL2-03-S	CR-P3-11-3S	2014-08-29	<0.030	<0.001	2.01	0.00045	<0.00001	0.00005	0.0015	<0.00005
	RL2-03-B	CR-P3-11-3B	2014-08-29	<0.030	<0.001	2.04	0.00036	<0.00001	<0.00005	<0.0005	<0.00005
	RL2-04-S	CR-P3-11-4S	2014-08-29	<0.030	<0.001	2.00	0.00053	<0.00001	<0.00005	<0.0005	<0.00005
	RL2-04-B	CR-P3-11-4B	2014-08-29	<0.030	<0.001	2.09	0.00033	<0.00001	<0.00005	<0.0005	<0.00005
	RL2-05-S	CR-P3-11-5S	2014-08-29	<0.030	<0.001	2.02	0.00038	<0.00001	<0.00005	<0.0005	<0.00005
	RL2-05-B	CR-P3-11-5B	2014-08-29	<0.030	<0.001	2.03	0.00036	<0.00001	<0.00005	<0.0005	<0.00005
Reference Lake 3	RL3-01-S	ALT-09-01S	2014-08-30	<0.030	<0.001	4.60	0.00022	<0.00001	0.00034	<0.0005	<0.00005
	RL3-01-S Dup [4]	ALT-09-01S Dup	2014-08-30	<0.030	<0.001	4.60	0.00019	<0.00001	0.00025	<0.0005	0.00009
	RL3-01-B	ALT-09-01B	2014-08-30	<0.030	<0.001	4.64	0.00014	<0.00001	0.00018	<0.0005	0.00006

Table A1-2. - continued –

Waterbody	Site ID [1]	Previous Site ID	Sampling Date	Dissolved							
				Potassium	Selenium	Silicon	Silver	Sodium	Tin	Strontium	Titanium
				(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Analytical Detection Limit				0.2	0.001	0.1	0.00001	0.05	0.0001	0.0001	0.010
Reference Lake 1	RL1-01-S	CL-P2-13-1S	2014-08-27	0.3	<0.001	0.4	<0.00001	0.73	<0.0001	0.0036	<0.010
	RL1-01-B	CL-P2-13-1B	2014-08-27	0.3	<0.001	0.4	<0.00001	0.71	<0.0001	0.0035	<0.010
	RL1-02-S	CL-P2-13-2S	2014-08-27	0.3	<0.001	0.4	<0.00001	0.72	<0.0001	0.0036	<0.010
	RL1-02-B	CL-P2-13-2B	2014-08-27	0.3	<0.001	0.4	<0.00001	0.72	<0.0001	0.0036	<0.010
	RL1-03-S	CL-P2-13-3S	2014-08-27	0.2	<0.001	0.4	<0.00001	0.71	<0.0001	0.0035	<0.010
	RL1-03-B	CL-P2-13-3B	2014-08-27	0.3	<0.001	0.4	<0.00001	0.72	<0.0001	0.0037	<0.010
	RL1-04-S	CL-P2-13-4S	2014-08-27	0.2	<0.001	0.4	<0.00001	0.74	<0.0001	0.0037	<0.010
	RL1-04-B	CL-P2-13-4B	2014-08-27	0.3	<0.001	0.4	<0.00001	0.73	<0.0001	0.0036	<0.010
	RL1-05-S	CL-P2-13-5S	2014-08-27	0.3	<0.001	0.4	<0.00001	0.71	<0.0001	0.0035	<0.010
	RL1-05-B	CL-P2-13-5B	2014-08-27	0.3	<0.001	0.4	<0.00001	0.72	<0.0001	0.0036	<0.010
Reference Lake 2	RL2-01-S	CR-P3-11-1S [3]	2014-08-29	0.4	<0.001	0.2	<0.00001	1.01	<0.0001	0.0048	<0.010
	RL2-01-B	CR-P3-11-1B [3]	2014-08-29	0.4	<0.001	0.3	0.00001	0.98	<0.0001	0.0049	<0.010
	RL2-02-S	CR-P3-11-2S	2014-08-29	0.2	<0.001	0.2	<0.00001	0.99	<0.0001	0.0046	<0.010
	RL2-02-B	CR-P3-11-2B	2014-08-29	0.3	<0.001	0.2	<0.00001	1.02	<0.0001	0.0045	<0.010
	RL2-03-S	CR-P3-11-3S	2014-08-29	0.3	<0.001	0.2	<0.00001	1.00	<0.0001	0.0045	<0.010
	RL2-03-B	CR-P3-11-3B	2014-08-29	0.4	<0.001	0.2	<0.00001	1.00	<0.0001	0.0046	<0.010
	RL2-04-S	CR-P3-11-4S	2014-08-29	0.2	<0.001	0.2	<0.00001	0.99	<0.0001	0.0046	<0.010
	RL2-04-B	CR-P3-11-4B	2014-08-29	0.2	<0.001	0.2	<0.00001	1.00	<0.0001	0.0046	<0.010
	RL2-05-S	CR-P3-11-5S	2014-08-29	0.4	<0.001	0.2	<0.00001	1.01	<0.0001	0.0046	<0.010
	RL2-05-B	CR-P3-11-5B	2014-08-29	0.4	<0.001	0.2	<0.00001	0.99	<0.0001	0.0048	<0.010
Reference Lake 3	RL3-01-S	ALT-09-01S	2014-08-30	0.9	<0.001	0.5	<0.00001	0.74	<0.0001	0.0085	<0.010
	RL3-01-S Dup [4]	ALT-09-01S Dup	2014-08-30	0.8	<0.001	0.5	<0.00001	0.73	<0.0001	0.0086	<0.010
	RL3-01-B	ALT-09-01B	2014-08-30	0.7	<0.001	0.5	<0.00001	0.75	<0.0001	0.0086	<0.010

Table A1-2. - continued –

Waterbody	Site ID [1]	Previous Site ID	Sampling Date	Dissolved		
				Uranium	Vanadium	Zinc
				(mg/L)	(mg/L)	(mg/L)
Analytical Detection Limit				0.00001	0.001	0.003
Reference Lake 1	RL1-01-S	CL-P2-13-1S	2014-08-27	0.00013	<0.001	<0.003
	RL1-01-B	CL-P2-13-1B	2014-08-27	0.00013	<0.001	<0.003
	RL1-02-S	CL-P2-13-2S	2014-08-27	0.00013	<0.001	<0.003
	RL1-02-B	CL-P2-13-2B	2014-08-27	0.00012	<0.001	<0.003
	RL1-03-S	CL-P2-13-3S	2014-08-27	0.00012	<0.001	<0.003
	RL1-03-B	CL-P2-13-3B	2014-08-27	0.00012	<0.001	<0.003
	RL1-04-S	CL-P2-13-4S	2014-08-27	0.00014	<0.001	<0.003
	RL1-04-B	CL-P2-13-4B	2014-08-27	0.00013	<0.001	<0.003
	RL1-05-S	CL-P2-13-5S	2014-08-27	0.00013	<0.001	<0.003
	RL1-05-B	CL-P2-13-5B	2014-08-27	0.00014	<0.001	<0.003
Reference Lake 2	RL2-01-S	CR-P3-11-1S [3]	2014-08-29	0.00007	<0.001	<0.003
	RL2-01-B	CR-P3-11-1B [3]	2014-08-29	0.00007	<0.001	0.004
	RL2-02-S	CR-P3-11-2S	2014-08-29	0.00006	<0.001	<0.003
	RL2-02-B	CR-P3-11-2B	2014-08-29	0.00006	<0.001	<0.003
	RL2-03-S	CR-P3-11-3S	2014-08-29	0.00006	<0.001	0.005
	RL2-03-B	CR-P3-11-3B	2014-08-29	0.00006	<0.001	<0.003
	RL2-04-S	CR-P3-11-4S	2014-08-29	0.00006	<0.001	<0.003
	RL2-04-B	CR-P3-11-4B	2014-08-29	0.00006	<0.001	<0.003
	RL2-05-S	CR-P3-11-5S	2014-08-29	0.00006	<0.001	<0.003
	RL2-05-B	CR-P3-11-5B	2014-08-29	0.00006	<0.001	<0.003
Reference Lake 3	RL3-01-S	ALT-09-01S	2014-08-30	0.00027	<0.001	<0.003
	RL3-01-S Dup [4]	ALT-09-01S Dup	2014-08-30	0.00027	<0.001	<0.003
	RL3-01-B	ALT-09-01B	2014-08-30	0.00026	<0.001	<0.003

Table A1-3. *In situ* water quality parameters measured in candidate Reference Lake 1, August 27, 2014.

Site	Total Depth (m)	Depth (m)	Temperature (°C)	Specific Conductance (µS/cm)	DO (%)	DO (mg/L)	pH	Turbidity (FNU)	Secchi Disk Depth (m)
RL1-01	10.6	1	4.2	60.0	93.0	12.12	7.81	0.53	4.5
		2	4.2	58.8	93.5	12.18	7.81	0.56	
		3	4.2	58.0	93.7	12.21	7.80	0.53	
		4	4.2	57.8	93.9	12.23	7.80	0.55	
		5	4.2	57.8	93.8	12.23	7.80	0.50	
		6	4.2	57.7	93.8	12.23	7.80	0.53	
		7	4.2	57.8	93.8	12.23	7.79	0.55	
		8	4.2	57.7	93.8	12.23	7.79	0.53	
		9	4.2	57.9	93.7	12.23	7.79	0.52	
		10	4.2	57.8	93.7	12.22	7.79	0.60	
RL1-02	12.1	1	4.3	55.4	94.5	12.27	7.80	0.50	4.7
		2	4.3	55.6	94.5	12.29	7.80	0.48	
		3	4.3	55.5	94.4	12.29	7.80	0.51	
		4	4.2	55.5	94.3	12.28	7.80	0.51	
		5	4.2	55.6	94.6	12.28	7.80	0.52	
		6	4.2	55.5	94.1	12.28	7.80	0.51	
		7	4.2	55.7	94.0	12.27	7.80	0.51	
		8	4.2	55.7	94.0	12.27	7.80	0.53	
		9	4.2	55.7	93.9	12.26	7.80	0.52	
		10	4.1	55.5	93.8	12.25	7.80	0.51	
		11	4.1	55.7	93.8	12.25	7.80	0.51	
RL1-03	11.7	1	4.3	55.3	94.5	12.30	7.76	0.50	5.0
		2	4.3	55.1	94.4	12.30	7.76	0.53	
		3	4.2	54.9	94.4	12.30	7.76	0.51	
		4	4.2	55.2	94.3	12.30	7.76	0.56	
		5	4.2	55.3	94.3	12.30	7.76	0.50	
		6	4.2	55.3	94.2	12.30	7.77	0.51	
		7	4.2	55.3	94.2	12.29	7.77	0.51	
		8	4.2	55.3	94.1	12.29	7.77	0.54	
		9	4.1	55.3	94.0	12.28	7.77	0.47	
		10	4.1	55.5	94.0	12.27	7.77	0.48	
		11	4.1	55.5	93.3	12.27	7.77	0.50	
RL1-04	6.3	1	4.3	54.7	94.4	12.28	7.80	0.47	4.9
		2	4.3	54.8	94.5	12.30	7.80	0.50	
		3	4.3	54.8	94.5	12.30	7.80	0.47	
		4	4.3	55.0	94.4	12.30	7.80	0.51	
		5	4.2	54.8	94.4	12.30	7.80	0.50	
		6	4.2	54.7	94.3	12.29	7.80	0.51	
RL1-05	14	1	4.3	55.1	94.8	12.33	7.68	0.54	4.5
		2	4.2	55.2	94.7	12.34	7.68	0.52	
		3	4.2	55.2	94.6	12.34	7.68	0.52	
		4	4.1	55.0	94.3	12.33	7.68	0.47	
		5	4.1	55.1	94.3	12.32	7.68	0.51	
		6	4.1	55.1	94.2	12.32	7.68	0.50	
		7	4.1	55.1	94.1	12.31	7.68	0.51	
		8	4.1	55.2	94.1	12.30	7.68	0.50	
		9	4.1	55.1	94.0	12.29	7.68	0.51	
		10	4.1	55.3	93.9	12.29	7.68	0.51	
		11	4.0	55.7	93.7	12.27	7.68	0.51	
		12	4.0	56.2	93.5	12.26	7.68	0.51	
		13	4.0	56.5	93.4	12.25	7.68	0.48	

Table A1-4. Relative percent mean difference for the duplicate surface water quality samples for parameters that exceeded five times the analytical detection limit. Values in red exceed 25%.

Waterbody	Site ID [1]	Previous Site ID	Sampling Date	pH	Alkalinity as $CaCO_3$	Total Dissolved Solids	Conductivity	Ammonia	Dissolved Organic Carbon	Total Organic Carbon	Hardness as $CaCO_3$ (Total)	Hardness as $CaCO_3$ (Dissolved)
					(mg/L)	(mg/L)	(µS/cm)	mg N/L	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Analytical Detection Limit					5	1	5	0.02	0.5	0.5	1	1
Reference Lake 3	RL3-01-S	ALT-09-01S	2014-08-30	7.73	31	49	76	0.18	3.0	3.1	38	38
	RL3-01-S Dup [3]	ALT-09-01S Dup	2014-08-30	7.81	31	49	76	0.13	3.0	3.0	38	38
Mean				7.77	31	49	76	0.16	3.0	3.1	38	38
RPMD				1	0	0	0	32	0	3	0	0

Waterbody	Site ID [1]	Previous Site ID	Sampling Date	Total							
				Barium	Calcium	Magnesium	Manganese	Silicon	Sodium	Strontium	Uranium
				(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Analytical Detection Limit				0.00005	0.05	0.05	0.00005	0.1	0.05	0.0001	0.00001
Reference Lake 3	RL3-01-S	ALT-09-01S	2014-08-30	0.00619	7.56	4.56	0.00078	0.5	0.73	0.0086	0.00027
	RL3-01-S Dup [3]	ALT-09-01S Dup	2014-08-30	0.00637	7.66	4.62	0.00060	0.5	0.72	0.0083	0.00027
Mean				0.00628	7.61	4.59	0.00069	0.5	0.73	0.0085	0.00027
RPMD				3	1	1	26	0	1	4	0

Waterbody	Site ID [1]	Previous Site ID	Sampling Date	Dissolved							
				Barium	Calcium	Magnesium	Molybdenum	Silicon	Sodium	Strontium	Uranium
				(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Analytical Detection Limit				0.00005	0.05	0.05	0.00005	0.1	0.05	0.0001	0.00001
Reference Lake 3	RL3-01-S	ALT-09-01S	2014-08-30	0.00626	7.62	4.60	0.00034	0.5	0.74	0.0085	0.00027
	RL3-01-S Dup [3]	ALT-09-01S Dup	2014-08-30	0.00628	7.66	4.60	0.00025	0.5	0.73	0.0086	0.00027
Mean				0.00627	7.64	4.60	0.00030	0.5	0.735	0.00855	0.00027
RPMD				0	1	0	31	0	1	1	0

Table A1-5. *In situ* water quality parameters measured in candidate Reference Lake 2, August 29, 2014.

Site	Total Depth (m)	Depth (m)	Temperature (°C)	Specific Conductance (µS/cm)	DO (%)	DO (mg/L)	pH	Turbidity (FNU)	Secchi Disk Depth (m)
RL2-01	8.6	1	6.4	49.5	96.0	11.84	7.47	0	5.7
		2	6.4	49.0	97.9	12.06	7.47	0	
		3	6.4	49.4	98.0	12.07	7.47	0	
		4	6.4	49.1	98.0	12.07	7.47	0	
		5	6.4	49.2	98.1	12.09	7.48	0	
		6	6.4	49.2	98.1	12.08	7.48	0	
		7	6.4	49.3	98.0	12.07	7.49	0	
RL2-02	10.2	1	6.4	49.3	97.8	12.05	7.44	0	5.4
		2	6.4	49.7	97.8	12.05	7.44	0	
		3	6.4	49.5	97.8	12.05	7.44	0	
		4	6.4	49.6	97.8	12.05	7.44	0	
		5	6.5	49.4	97.8	12.05	7.45	0	
		6	6.4	49.6	97.7	12.04	7.45	0	
		7	6.4	49.5	97.7	12.04	7.45	0	
		8	6.4	49.5	97.6	12.04	7.45	0	
		9	6.4	49.5	97.6	12.04	7.45	0	
RL2-03	6.6	1	6.5	48.9	97.9	12.02	7.46	0	5.3
		2	6.5	48.8	97.9	12.03	7.46	0	
		3	6.5	48.7	97.9	12.03	7.46	0	
		4	6.5	48.9	97.9	12.03	7.46	0	
		5	6.5	49.0	97.8	12.03	7.46	0	
		6	6.5	48.9	97.8	12.03	7.46	0	
RL2-04	5.6	1	6.5	48.4	98.0	12.02	7.48	0	5.4
		2	6.5	48.4	98.0	12.03	7.48	0	
		3	6.5	48.7	98.0	12.04	7.48	0	
		4	6.5	48.6	98.0	12.04	7.48	0	
		5	6.5	48.8	98.0	12.04	7.48	0	
RL2-05	10.1	1	6.5	48.3	97.9	12.01	7.48	0	5.8
		2	6.5	48.6	97.8	12.01	7.49	0	
		3	6.5	48.4	97.9	12.02	7.49	0	
		4	6.5	48.5	97.8	12.01	7.49	0	
		5	6.5	48.7	97.8	12.01	7.49	0	
		6	6.5	48.3	97.7	12.01	7.49	0	
		7	6.5	48.6	97.7	12.00	7.49	0	
		8	6.5	48.5	97.6	12.00	7.49	0	
		9	6.5	48.9	97.6	11.99	7.49	0	

Table A1-6. *In situ* water quality parameters measured in candidate Reference Lake 3, August 30, 2014.

Site	Total Depth (m)	Depth (m)	Temperature (°C)	Specific Conductance (µS/cm)	DO (%)	DO (mg/L)	pH	Turbidity (FNU)	Secchi Disk Depth (m)
RL3-01	14.6	1	6.1	80.1	97.3	12.09	7.82	0	5.8
		2	6.1	80.1	97.5	12.11	7.82	0	
		3	6.0	80.0	97.5	12.12	7.82	0	
		4	6.0	80.4	97.5	12.12	7.82	0	
		5	6.0	80.3	97.5	12.13	7.82	0	
		6	6.0	80.6	97.5	12.13	7.82	0	
		7	6.0	80.5	97.4	12.13	7.82	0	
		8	6.0	80.5	97.4	12.12	7.82	0	
		9	6.0	80.6	97.3	12.12	7.82	0	
		10	6.0	80.7	97.3	12.12	7.82	0	
		11	6.0	80.6	97.2	12.11	7.82	0	
		12	6.0	80.8	97.2	12.11	7.82	0	
		13	5.9	80.8	97.1	12.10	7.82	0	

APPENDIX 2. CANDIDATE REFERENCE LAKE SEDIMENT QUALITY DATA, 2014

Table A2-1. Summary of sediment quality sampling site information for candidate reference lakes, 2014.

Lake	Site ID	Previous Site ID	Date Sampled	Year	UTM			Water depth	Depth of Sediment Collected	Sediment Appearance	# Subsamples
					Zone	Easting	Northing	(m)	(cm)		
Reference Lake 1	RL1-01	CL-P2-13-1 [1]	28-Aug-14	2014	17W	550291	7938605	11.0	2	Brown, soft, silt/clay, no vegetation	5
	RL1-01	CL-P2-13-1B [1]	28-Aug-14	2014					2	Brown, soft, silt/clay, no vegetation	5
	RL1-02	CL-P2-13-2	28-Aug-14	2014	17W	550241	7938774	12.2	2	Brown, soft, silt/clay, no vegetation	5
	RL1-03	CL-P2-13-3	28-Aug-14	2014	17W	550278	7938920	11.8	2	Brown, soft, silt/clay with gelatinous consistency after sieving	5
	RL1-04	CL-P2-13-4	28-Aug-14	2014	17W	550400	7938916	7.8	2	Brown, soft, silt/clay, no vegetation	5
	RL1-05	CL-P2-13-5	28-Aug-14	2014	17W	550121	7938590	13.9	2	Brown, firm clay/silt	5
Reference Lake 2	RL2-01	CR-P3-11-1	29-Aug-14	2014	17W	568770	7899828	9.2	2	Brownish grey at surface, black beneath, firm clay/silt	5
	RL2-02	CR-P3-11-2	29-Aug-14	2014	17W	568801	7900216	10.2	2	Greyish brown, soft, silt/sand/clay	5
	RL2-03	CR-P3-11-3	29-Aug-14	2014	17W	568965	7900052	6.7	2	Brown, soft, silt/sand/clay	5
	RL2-04	CR-P3-11-4	29-Aug-14	2014	17W	569057	7899944	6.2	2	Black, soft, clay/silt, occasional macrophytes	5
	RL2-05	CR-P3-11-5	29-Aug-14	2014	17W	568995	7900300	10.0	2	Brown firm clay	5
Reference Lake 3	RL3-01	ALT-09-01	31-Aug-14	2014	17W	574061	7853433	14.6	2	Greyish brown, soft, silt/sand/clay	5

[1] Duplicate samples.

Table A2-2. Sediment quality results for candidate reference lakes, 2014, and comparison to CCME and Ontario sediment quality guidelines.

Lake	Site ID	Previous Site ID	Date	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper
				(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)
Analytical Detection Limit				5	1	1	1	1	0.5	0.5	100	1	1	1
Reference Lake 1	RL1-01	CL-P2-13-1	28-Aug-14	22900	<1	3	116	2	IS [2]	<0.5	5100	93	21	42
	RL1-01B	CL-P2-13-1B [1]	28-Aug-14	23600	<1	4	112	1	0.7	<0.5	2400	90	20	39
	RL1-02	CL-P2-13-2	28-Aug-14	27400	<1	5	99	2	0.8	<0.5	3100	99	16	46
	RL1-03	CL-P2-13-3	28-Aug-14	23200	<1	2	117	2	0.8	<0.5	2700	110	17	51
	RL1-04	CL-P2-13-4	28-Aug-14	25000	<1	2	90	2	<0.5	<0.5	2400	101	21	44
	RL1-05	CL-P2-13-5	28-Aug-14	22200	<1	5	93	1	0.6	<0.5	2300	85	17	43
Reference Lake 2	RL2-01	CR-P3-11-1	29-Aug-14	4900	<1	<1	25	<1	<0.5	<0.5	1900	17	7	11
	RL2-02	CR-P3-11-2	29-Aug-14	12700	<1	<1	68	<1	1.3	<0.5	2800	44	8	24
	RL2-03	CR-P3-11-3	29-Aug-14	13900	<1	3	97	<1	0.8	<0.5	2000	49	15	29
	RL2-04	CR-P3-11-4	29-Aug-14	11300	<1	3	90	<1	IS [2]	<0.5	2300	42	14	34
	RL2-05	CR-P3-11-5	29-Aug-14	13200	<1	2	75	<1	0.7	<0.5	2300	58	10	27
Reference Lake 3	RL3-01	ALT-09-01	31-Aug-14	8450	<1	<1	49	<1	<0.5	<0.5	3200	31	7	35
CCME [3]	ISQG					5.9				0.6		37.3		35.7
	PEL					17				3.5		90		197
OMOE [4]	*LEL*													
	SEL													

[1] Duplicate sample
[2] IS = Insufficient Sample
[3] CCME Interim Sediment Quality Guidelines (ISQGs) and Probable Effect Levels - CCME (1999 updated to 2015)
[4] OMOE Lowest Effect Level (LEL) and Severe Effect Level (SEL) - Persaud et al. (1993)

Table A2-2. - continued -

Lake	Site ID	Previous Site ID	Date	Iron	Lead	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Potassium	Selenium	Silver
				(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)
Analytical Detection Limit					5	1	100	1	0.1	1	1	100	1
Reference Lake 1	RL1-01	CL-P2-13-1	28-Aug-14	*47600*	22	12300	*3690*	<0.1	1	*66*	4300	<1	<0.2
	RL1-01B	CR-P2-13-1B [1]	28-Aug-14	*45500*	20	12300	*3400*	<0.1	1	*60*	4600	<1	<0.2
	RL1-02	CL-P2-13-2	28-Aug-14	*41300*	22	13400	436	<0.1	<1	*60*	5200	<1	<0.2
	RL1-03	CL-P2-13-3	28-Aug-14	*35500*	26	14300	416	<0.1	<1	*68*	5100	<1	0.2
	RL1-04	CL-P2-13-4	28-Aug-14	*52500*	22	12500	*1550*	<0.1	<1	*66*	4300	<1	<0.2
	RL1-05	CL-P2-13-5	28-Aug-14	*67700*	20	12900	*546*	<0.1	<1	*57*	4800	<1	<0.2
Reference Lake 2	RL2-01	CR-P3-11-1	29-Aug-14	*38100*	6	2500	210	<0.1	<1	10	900	<1	<0.2
	RL2-02	CR-P3-11-2	29-Aug-14	*22200*	12	4900	334	<0.1	1	*26*	2300	<1	<0.2
	RL2-03	CR-P3-11-3	29-Aug-14	*109000*	13	4800	*1130*	<0.1	3	*31*	2200	<1	<0.2
	RL2-04	CR-P3-11-4	29-Aug-14	*91900*	12	4100	*836*	<0.1	3	*28*	1900	<1	<0.2
	RL2-05	CR-P3-11-5	29-Aug-14	*43900*	13	4100	*614*	<0.1	2	*27*	2200	<1	<0.2
Reference Lake 3	RL3-01	ALT-09-01	31-Aug-14	*20400*	7	5200	*483*	<0.1	1	*22*	2100	<1	<0.2
CCME [3]	ISQG				35			0.170					
	PEL				91.3			0.486					
OMOE [4]	*LEL*			*20000*			*460*			*16*			
	SEL			*40000*			*1100*			*75*			

Table A2-2. - continued -

Lake	Site ID	Previous Site ID	Date	Sodium	Strontium	Thallium	Vanadium	Zinc	Nitrite	Nitrate	Nitrate/nitrite
				(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)
Analytical Detection Limit				100	1	1	2	2	1	1	1
Reference Lake 1	RL1-01	CL-P2-13-1	28-Aug-14	200	25	<1	69	86	<1	<1	<1
	RL1-01B	CL-P2-13-1B [1]	28-Aug-14	200	17	<1	64	73	<1	2	2
	RL1-02	CL-P2-13-2	28-Aug-14	300	18	<1	69	84	<1	<1	<1
	RL1-03	CL-P2-13-3	28-Aug-14	300	24	<1	82	91	<1	<1	<1
	RL1-04	CL-P2-13-4	28-Aug-14	200	16	<1	71	82	<1	<1	<1
	RL1-05	CL-P2-13-5	28-Aug-14	300	16	<1	63	75	<1	<1	<1
Reference Lake 2	RL2-01	CR-P3-11-1	29-Aug-14	<100	7	<1	19	26	<1	<1	<1
	RL2-02	CR-P3-11-2	29-Aug-14	200	18	<1	32	52	<1	<1	<1
	RL2-03	CR-P3-11-3	29-Aug-14	200	19	<1	37	63	<1	<1	<1
	RL2-04	CR-P3-11-4	29-Aug-14	200	16	<1	36	66	<1	<1	<1
	RL2-05	CR-P3-11-5	29-Aug-14	200	19	<1	40	57	<1	<1	<1
Reference Lake 3	RL3-01	ALT-09-01	31-Aug-14	200	7	<1	30	43	<1	<1	<1
CCME [3]	ISQG							123			
	PEL							315			
OMOE [4]	*LEL*										
	SEL										

Table A2-2. - continued -

Lake	Site ID	Previous Site ID	Date	Total Organic Carbon	Sand (>0.050mm)	Silt (>0.002-0.050mm)	Clay (<=0.002mm)	Moisture
				(%)	(%)	(%)	(%)	(%)
Analytical Detection Limit				0.01	1	1	1	0.1
Reference Lake 1	RL1-01	CL-P2-13-1	28-Aug-14	*2.38*	46	40	14	75.2
	RL1-01B	CL-P2-13-1B [1]	28-Aug-14	*2.30*	37	35	28	75.2
	RL1-02	CL-P2-13-2	28-Aug-14	*4.47*	36	35	29	74.8
	RL1-03	CL-P2-13-3	28-Aug-14	*3.85*	34	23	43	81.1
	RL1-04	CL-P2-13-4	28-Aug-14	*2.38*	29	28	43	77.3
	RL1-05	CL-P2-13-5	28-Aug-14	*3.62*	47	24	29	75.2
Reference Lake 2	RL2-01	CR-P3-11-1	29-Aug-14	*3.57*	89	5	6	68.6
	RL2-02	CR-P3-11-2	29-Aug-14	*5.74*	34	2	64	84.0
	RL2-03	CR-P3-11-3	29-Aug-14	*4.93*	67	9	24	84.6
	RL2-04	CR-P3-11-4	29-Aug-14	*7.28*	60	<1	40	83.4
	RL2-05	CR-P3-11-5	29-Aug-14	*5.44*	53	17	30	83.3
Reference Lake 3	RL3-01	ALT-09-01	31-Aug-14	*1.91*	76	18	6	68.0
CCME [3]	ISQG							
	PEL							
OMOE [4]	*LEL*			*1*				
	SEL			*10*				

Table A2-3. Relative percent mean difference (RPMD) for the duplicate sediment quality samples. Values in red exceed 25%.

Lake	Site ID	Previous Site ID	Date	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt
				(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)
Analytical Detection Limit				5	1	1	1	1	0.5	0.5	100		1
Reference Lake 1	RL1-01	CL-P2-13-1 [1]	28-Aug-14	22900	<1	3	116	2	IS [2]	<0.5	5100	93	21
	RL1-01B	CR-P2-13-1B [1]	28-Aug-14	23600	<1	4	112	1	0.7	<0.5	2400	90	20
Mean				23250	<1	4	114	2	0.7	<0.5	3750	92	21
RPMD				3	-	-	4	-	-	-	72	3	5

Lake	Site ID	Previous Site ID	Date	Copper	Iron	Lead	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Potassium	Selenium
				(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)
Analytical Detection Limit				1	5	1	100	1	0.1	1	1	100	1
Reference Lake 1	RL1-01	CL-P2-13-1 [1]	28-Aug-14	42	47600	22	12300	3690	<0.1	1	66	4300	<1
	RL1-01B	CR-P2-13-1B [1]	28-Aug-14	39	45500	20	12300	3400	<0.1	1	60	4600	<1
Mean				41	46550	21	12300	3545	<0.1	1	63	4450	<1
RPMD				7	5	10	0	8	-	-	10	7	-

Lake	Site ID	Previous Site ID	Date	Silver	Sodium	Strontium	Thallium	Vanadium	Zinc	Nitrite	Nitrate	Nitrate/ nitrite	Total Kjeldahl Nitrogen
				(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)	(µg/g)
Analytical Detection Limit				0.2	100	1	1	2	2	1	1	1	100
Reference Lake 1	RL1-01	CL-P2-13-1 [1]	28-Aug-14	<0.2	200	25	<1	69	86	<1	<1	<1	2200
	RL1-01B	CR-P2-13-1B [1]	28-Aug-14	<0.2	200	17	<1	64	73	<1	2	2	2800
Mean				<0.2	200	21	<1	67	80	<1	2	2	2500
RPMD				-	-	38	-	8	16	-	-	-	24

Table A2-3 - continued –

Lake	Site ID	Previous Site ID	Date	Total Organic Carbon	Sand (>0.050mm)	Silt (>0.002-0.050mm)	Clay (<=0.002mm)	Moisture
				(%)	(%)	(%)	(%)	(%)
Analytical Detection Limit				0.01	1	1	1	0.1
Reference Lake 1	RL1-01	CL-P2-13-1 [1]	28-Aug-14	2.38	46	40	14	75.2
	RL1-01B	CR-P2-13-1B [1]	28-Aug-14	2.30	37	35	28	75.2
Mean				2.34	42	38	21	75.2
RPMD				3	22	13	**67**	0

[1] Duplicate sample

[2] IS = Insufficient Sample

APPENDIX 3. SUMMARY OF LOWER TROPHIC LEVEL SAMPLING CONDUCTED IN CANDIDATE REFERENCE LAKES, 2014

Table A3-1. Summary of phytoplankton sampling completed in candidate reference lakes, 2014.

Waterbody	Sample ID	Site UTM (17W)		Sample Date	Sample Time	Site Depth (m)	Secchi Depth (m)	Euphotic Zone Depth (m)	Sampled Depth Range (m)
		Easting	Northing						
Reference Lake 1	RL1-01	550295	7938599	27-Aug-14	10:17	10.6	4.5	13.50	0-10
	RL1-02	550241	7938777	27-Aug-14	11:03	12.1	4.7	14.10	0-11
	RL1-03	550283	7938912	27-Aug-14	11:12	11.7	5.0	14.85	0-11
	RL1-04	550395	7938912	27-Aug-14	12:14	6.3	4.9	14.55	0-6
	RL1-05	550112	7938600	27-Aug-14	12:50	14.0	4.5	13.50	0-13
Reference Lake 2	RL2-01	568757	7899826	29-Aug-14	10:15	8.6	5.7	17.03	0-7
	RL2-02	568797	7900214	29-Aug-14	10:10	10.2	5.4	16.20	0-9
	RL2-03	568963	7900049	29-Aug-14	11:15	6.6	5.3	15.98	0-6
	RL2-04	569061	7899948	29-Aug-14	12:20	5.6	5.4	16.20	0-5
	RL2-05	568997	7900295	29-Aug-14	13:00	10.1	5.8	17.25	0-9
Reference Lake 3	RL3-01	574077	7853419	30-Aug-14	16:35	14.6	5.8	17.48	0-13

Table A3-2. Summary of zooplankton sampling completed in candidate reference lakes, 2014.

Waterbody	Sample ID	Site UTM (17W)		Sample Date	Sample Time	Replicate	Site Depth (m)	Secchi Disk Depth (m)	Sampled Depth Range (m)	No. of Tows	Codend Length (m)	Mesh Size (µm)	Mouth Diameter (m)
		Easting	Northing										
Reference Lake 1	RL1-01	550295	7938599	27-Aug-14	10:22	REP 1	10.6	4.5	0-10	1	0.23	63	0.25
						REP 2							
						REP 3							
	RL1-02	550241	7938777	27-Aug-14	11:07	REP 1	12.1	4.7	0-11	1	0.23	63	0.25
	RL1-03	550283	7938912	27-Aug-14	11:45	REP 1	11.7	5.0	0-11	1	0.23	63	0.25
	RL1-04	550395	7938912	27-Aug-14	12:18	REP 1	6.3	4.9	0-6	1	0.23	63	0.25
	RL1-05	550112	7938600	27-Aug-14	12:53	REP 1	14.0	4.5	0-13	1	0.23	63	0.25
Reference Lake 2	RL2-01	568757	7899826	29-Aug-14	10:15	REP 1	8.6	5.7	0-7	1	0.23	63	0.25
	RL2-02	568797	7900214	29-Aug-14	10:10	REP 1	10.2	5.4	0-9	1	0.23	63	0.25
	RL2-03	568963	7900049	29-Aug-14	11:15	REP 1	6.6	5.3	0-6	1	0.23	63	0.25
	RL2-04	569061	7899948	29-Aug-14	12:20	REP 1	5.6	5.4	0-5	1	0.23	63	0.25
	RL2-05	568997	7900295	29-Aug-14	13:00	REP 1	10.1	5.8	0-9	1	0.23	63	0.25
Reference Lake 3	RL3-01	574077	7853419	30-Aug-14	16:35	REP 1	14.6	5.8	0-13	1	0.23	63	0.25

Table A3-3. Summary of benthic macroinvertebrate sampling completed in candidate reference lakes, 2014.

Waterbody	Sample ID	Site UTM (17W)		Sample Date	Sample Time	Site Depth (m)	Number of Subsamples	Depth Range of Grabs (m)	Macrophyte Abundance	Dominant Substrate(s)
		Easting	Northing							
Reference Lake 1	RL1-01	550291	7938605	26-Aug-14	11:55	10.9	5	10.6 - 10.9	Absent	Silt/Clay
	RL1-02	550241	7938774	26-Aug-14	12:50	12.6	5	12.3 - 12.6	Absent	Silt/Clay
	RL1-03	550278	7938920	26-Aug-14	13:45	12.3	5	12.1 - 12.3	Absent	Silt/Clay
	RL1-04	550400	7938916	26-Aug-14	14:45	8.7	5	7.8 - 8.7	Absent	Silt/Clay
	RL1-05	550121	7938590	26-Aug-14	16:40	14.0	5	12.5 - 13.1	Absent	Silt/Clay
	RL1-06	550266	7938560	26-Aug-14	12:20	9.9	5	9.4 - 9.9	Absent	Silt/Clay
	RL1-07	550227	7938832	26-Aug-14	13:21	11.7	5	11.5 - 11.7	Absent	Silt/Clay
	RL1-08	550312	7938661	26-Aug-14	14:15	13.1	5	12.9 - 13.1	Absent	Silt/Clay
	RL1-09	550399	7938869	26-Aug-14	15:22	10.5	5	10.4 - 10.5	Absent	Silt/Clay
	RL1-10	550113	7938647	26-Aug-14	17:00	13.0	5	12.6 - 13.0	Absent	Silt/Clay
Reference Lake 2	RL2-01	568770	7899828	28-Aug-14	15:55	9.4	5	9.0 - 9.4	Absent	Clay/Silt
	RL2-02	568801	7900216	28-Aug-14	16:19	10.3	5	10.2 - 10.3	Absent	Clay/Silt
	RL2-03	568965	7900052	28-Aug-14	16:43	6.8	5	6.7 - 6.8	Absent	Clay/Silt
	RL2-04	569057	7899944	28-Aug-14	17:04	6.3	5	6.0 - 6.3	Present	Clay/Silt
	RL2-05	568995	7900300	28-Aug-14	17:26	10.1	5	10.0 - 10.1	Absent	Clay
Reference Lake 3	RL3-01	574061	7853433	31-Aug-14	8:15	14.8	5	12.0 - 14.8	Absent	Silt/Clay