APPENDIX E

2014 FRESHWATER BIOTA CREMP MONITORING REPORT

Mary River Project

March 2015

Description of Biological Sampling Completed in the Mine Area: 2014

North/South Consultants Inc.
Aquatic Environment Specialists

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For

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1.0 INTRODUCTION AND BACKGROUND

The Aquatic Effects Monitoring Plan (AEMP; Baffinland Iron Mines Corporation [BIM] 2014) includes monitoring of phytoplankton, benthic macroinvertebrates (BMI), and Arctic Char (*Salvelinus alpinus*) as part of the Core Receiving Environment Monitoring Program (CREMP). Biological studies were conducted in mine area lakes and streams in the open-water season of 2014 to provide additional baseline data in support of the CREMP.

This report presents the methods employed, a summary of sampling completed, and a description of results, where available, for biological studies conducted in the mine area for the open-water season of 2014. The studies, which included sampling of phytoplankton, zooplankton, BMIs, and Arctic Char, were conducted in selected mine area streams and lakes in summer and fall. Stream sampling, described herein, was limited to collection of samples for analysis of chlorophyll *a* (as an indicator of phytoplankton biomass), BMIs at selected sites, and a hoopnetting program in Camp Lake tributaries 1 and 2 and Sheardown Lake NW Tributary 1. Lake sampling included the following:

- Sampling for analysis of chlorophyll *a*;
- Sampling for phytoplankton biomass and taxonomy;
- Sampling for enumeration and taxonomic identification of zooplankton;
- Sampling for enumeration and taxonomic identification of BMIs; and
- Sampling of Arctic Char populations.

Of all lower trophic level samples collected in 2014, only chlorophyll *a* samples were submitted to an analytical laboratory for immediate analysis; all remaining lower trophic level samples (i.e., taxonomic samples for phytoplankton, zooplankton, and BMIs) were collected and archived for potential future analysis. Basic metrics were recorded from live released Arctic Char (i.e., fork length, weight, sex and maturity using gamete extrusion, and age from pectoral fin ray clips) and detailed information was obtained from mortalities and a subsample of fish retained for ageing. The following presents an overview of sampling methods and results (where available), by component, for the 2014 field program conducted in mine area waterbodies.

2.0 PHYTOPLANKTON AND ZOOPLANKTON

2.1 METHODS

Phytoplankton and zooplankton were generally sampled from the same sites and times where water quality was measured in the open-water season of 2014 to provide complementary, supporting data. The sampling program was conducted by Knight Piésold Ltd. Sampling sites are indicated in Figures 2-1 and 2-2 and a brief description of sampling methods is provided below. Sampling site coordinates, date, time, and observations were recorded at each site.

2.1.1 CHLOROPHYLL *a*

Chlorophyll *a* samples were collected from near surface (approximately 1 m below the water surface) at lake sites in the same manner as water quality samples (i.e., with a Kemmerer water sampler) and transferred to the sample bottle provided by the analytical laboratory (1 L glass amber bottle). Chlorophyll *a* samples were collected as surface grab samples from stream sites by directly filling the sample bottle provided by the analytical laboratory. Samples were kept cool and in the dark until submission to Exova Environmental (Ottawa, ON) as soon as possible following sample collection.

2.1.2 PHYTOPLANKTON TAXONOMY AND BIOMASS

Secchi disk depth was measured (average of two measurements) and used to calculate the euphotic zone depth for each site (Secchi disk depth x 3). Samples for phytoplankton taxonomy and biomass were collected from across the calculated euphotic zone, as follows:

- Where the euphotic zone depth was ≤ 10 m and water depth was ≥ 10 m, an integrated sample spanning the entire calculated euphotic zone depth was collected. For example, where Secchi disk depth = 3 m and site water depth = 12 m, the euphotic zone sample was collected across 0-9 m;
- Where the euphotic zone depth was ≥ 10 m and water depth was also ≥ 10 m, two samples were collected from across the calculated euphotic zone depth: (1) upper 0-10 m of water column; and (2) from the 10 m water depth to the depth of the euphotic zone. For example, where Secchi disk depth = 5 m and total water depth = 20 m, the sample was collected from across 15 m of the water column (euphotic zone depth), but split into two sub-samples (0-10 m interval and 10-15 m interval);
- Where the euphotic zone depth was greater than site depth and water depth was < 10 m, an integrated sample was collected from the water surface to 1 m above the sediments. For

example, where Secchi disk depth = 3 m and site water depth = 6 m, the euphotic zone sample was collected across 0-5 m.

Depth-integrated samples of water were collected from across the euphotic zone (as estimated from above) using a tube sampler. The tube sampler was lowered to the desired depth, the foot valve was triggered, and the sampler was retrieved to the surface. The sample was transferred to a secondary vessel large enough to contain the full sample volume in the tube and the sample bottle provided by the analytical laboratory was then filled.

Samples were preserved by adding a sufficient quantity of Lugol's solution to render the sample "tea coloured". The samples were mixed after addition of Lugol's and checked periodically to ensure they were still tea coloured shortly after sample processing, at the end of the day, and before shipping.

The following information was recorded for each sample:

- Sample date;
- Sample time;
- Site ID;
- Waterbody;
- Sampling depth;
- Replicates (where applicable);
- Site Universal Transverse Mercator (UTM) coordinates; and
- Secchi disk depth.

Samples were transported to the laboratory at North/South Consultants Inc. (NSC) in Winnipeg, MB, for long-term storage. Samples were catalogued and archived for potential future analysis.

2.1.3 ZOOPLANKTON

Zooplankton samples were collected in vertical, bottom-to-surface tows using a 63 µm conical net. The net, complete with a weighted PVC codend attached to a single steel hoop frame, was lowered to the bottom, codend first, and then slowly retrieved by hand. Upon lowering of the net, care was taken to not disturb bottom sediments as suspended sediments may introduce benthic species into the sample. The UTMs, number of tows and water depth were recorded for each site. The number of tows, tow depth, and diameter of the opening were used to calculate the volume of water filtered. Two different nets were used for the 2014 sampling program and the

dimensions of the codend and hoop frame varied between the two. Net specifications associated with each sample were recorded and are provided in Appendix 1.

Upon removal from the water, zooplankton captured in the net were rinsed into the codend collecting cup, washed into a labeled plastic jar, and fixed in 10% formalin. A sufficient number of tows were collected at each site until at least 100 individuals were visible in the sample jar. Samples were then transported to the laboratory at NSC (Winnipeg, MB), catalogued, and transferred to 70 % ethanol with a few drops of glycerin for long-term storage.

2.1.4 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

The QA/QC program included collection of replicate samples for analysis of phytoplankton biomass and taxonomy, and zooplankton enumeration and taxonomy.

2.1.5 DATA ANALYSIS

Measurements of chlorophyll *a* 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.

Chlorophyll *a* concentrations measured in mine area lakes in 2014, as well as in previous years of study (2007, 2008, 2009, and 2013), were compared to the benchmark (3.7 µgL) identified in the AEMP (BIM 2014). Mean concentrations measured in each of summer and fall, as well as for the entire open-water season, were compared to the benchmark. In addition, statistical comparisons were made for each mine area lake over the years of baseline studies (i.e., 2007-2014) to evaluate inter-annual variability. Statistical analyses were performed using the non-parametric Kruskal-Wallis test followed by the Dunn's multiple pairwise comparisons procedure (two-tailed; $\alpha = 0.05$). These analysis included near-surface samples for the open-water season. For Sheardown Lake NW, nearshore data collected in 2008 were omitted. In addition, results of two sampling events conducted in summer (i.e., July and early August) 2008 in both Sheardown Lake NW and SE were averaged prior to analysis to standardize the datasets for sampling season.

2.2 OVERVIEW OF SAMPLING COMPLETED

Tables 2-1 and 2-2 provide an inventory of sampling completed at mine area lakes and streams in 2014, respectively. Figure 2-1 presents the locations of phytoplankton and zooplankton sampling sites and Figure 2-2 shows the sites where chlorophyll *a* sampling was completed in 2014. An inventory of phytoplankton and zooplankton sampling and associated metadata is provided in Appendix 1. Zooplankton and phytoplankton samples have been archived at NSC (Winnipeg, MB). Detailed chlorophyll *a* results are presented in Appendix 2.

2.3 RESULTS

The following provides an overview of chlorophyll *a* data collected from the mine area waterbodies in 2014.

2.3.1 LAKES

With one exception (Camp Lake in summer), a minimum of five sites were sampled for chlorophyll *a* in each of the four mine area lakes in summer and fall, 2014 (Table 2-1). Chlorophyll *a* measurements collected from mine area lakes in 2014 are presented in Appendix 2 and summarized in Table 2-3. Seasonal (i.e., summer and fall) mean concentrations for each mine area lake were below the benchmark of 3.7 µg/L specified in the AEMP (BIM 2014). Statistical evaluations of temporal variability in chlorophyll *a* concentrations indicated few significant inter-annual differences within each of the lakes (Figure 2-3).

2.3.2 STREAMS

Stream sampling for chlorophyll *a* was completed at a total of 28 sites in June, July, and August 2014. Detailed results for sampling completed in 2014 are presented in Appendix 2. Figure 2-4 presents chlorophyll *a* concentrations measured in the Mary River in 2007, 2008, 2013, and 2014. Data collected in 2014 were similar to the ranges observed over the period of 2007-2013.

Table 2-1. Number of sites sampled for phytoplankton and zooplankton in mine area lakes: 2014.

Waterbody	Season	Phytoplankton		Zooplankton
		Chlorophyll *a*	Biomass & Taxonomy	
Camp Lake	Summer	1	1	1
	Fall	5	5	5
Sheardown Lake NW	Summer	6	6	6
	Fall	6	6	6
Sheardown Lake SE	Summer	5	5	5
	Fall	5	5	5
Mary Lake South	Summer	7	7	7
	Fall	7	7	7
Mary Lake North	Summer	3	3	3
	Fall	3	3	3

Table 2-2. Number of samples collected for chlorophyll *a* in mine area streams: 2014.

Stream	June	July	August
Mary River	12	12	12
North Tributary of Mary River, Downstream of Falls	1	1	1
Sheardown Lake Tributary 1	2	2	2
Tom River	1	1	1
Camp Lake Tributary 1	5	5	5
Stream north of airstrip - confluence with Camp Lake Tributary 1	1	1	1
Camp Lake Tributary 2	1	1	1
Outlet channel of Camp Lake	1	1	1
Proposed Camp Lake Tributary Reference stream No. 3	1	1	1
Proposed Camp Lake Tributary Reference stream No. 4	1	1	1
Proposed Mary River Reference stream No. 2	1	1	1
Proposed Mary River Reference stream No. 3	1	1	1

Table 2-3. Summary statistics for chlorophyll *a* measured in mine area lakes: 2014.

	Chlorophyll *a* (µg/L)														
	Camp Lake			**Sheardown Lake NW**			**Sheardown Lake SE**			**Mary Lake South**			**Mary Lake North**		
	Summer	**Fall**	**Summer + Fall**	**Summer**	**Fall**	**Summer + Fall**	**Summer**	**Fall**	**Summer + Fall**	**Summer**	**Fall**	**Summer + Fall**	**Summer**	**Fall**	**Summer + Fall**
Mean	<0.20	2.12	1.80	1.43	0.50	0.97	<0.20	1.78	0.99	0.99	0.79	0.88	1.63	0.50	1.07
Median	-	2.50	1.85	1.40	0.40	1.10	<0.20	0.40	0.20	1.00	0.55	0.80	1.60	0.20	0.65
Minimum	-	0.70	<0.20	0.90	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Maximum	-	3.40	3.40	2.00	1.30	2.00	<0.20	6.50	6.50	1.80	2.00	2.00	3.10	1.10	3.10
SD	-	1.13	1.28	0.36	0.41	0.61	-	2.70	1.98	0.64	0.69	0.65	1.45	0.52	1.16
SE	-	0.51	0.52	0.15	0.17	0.18	-	1.21	0.63	0.24	0.24	0.17	0.84	0.30	0.47
n	1	5	6	6	6	12	5	5	10	7	8	15	3	3	6
# detects	0	5	5	6	4	10	0	3	3	5	5	10	2	1	3
% Detects	0	100	83	100	67	83	0	60	30	71	63	67	67	33	50

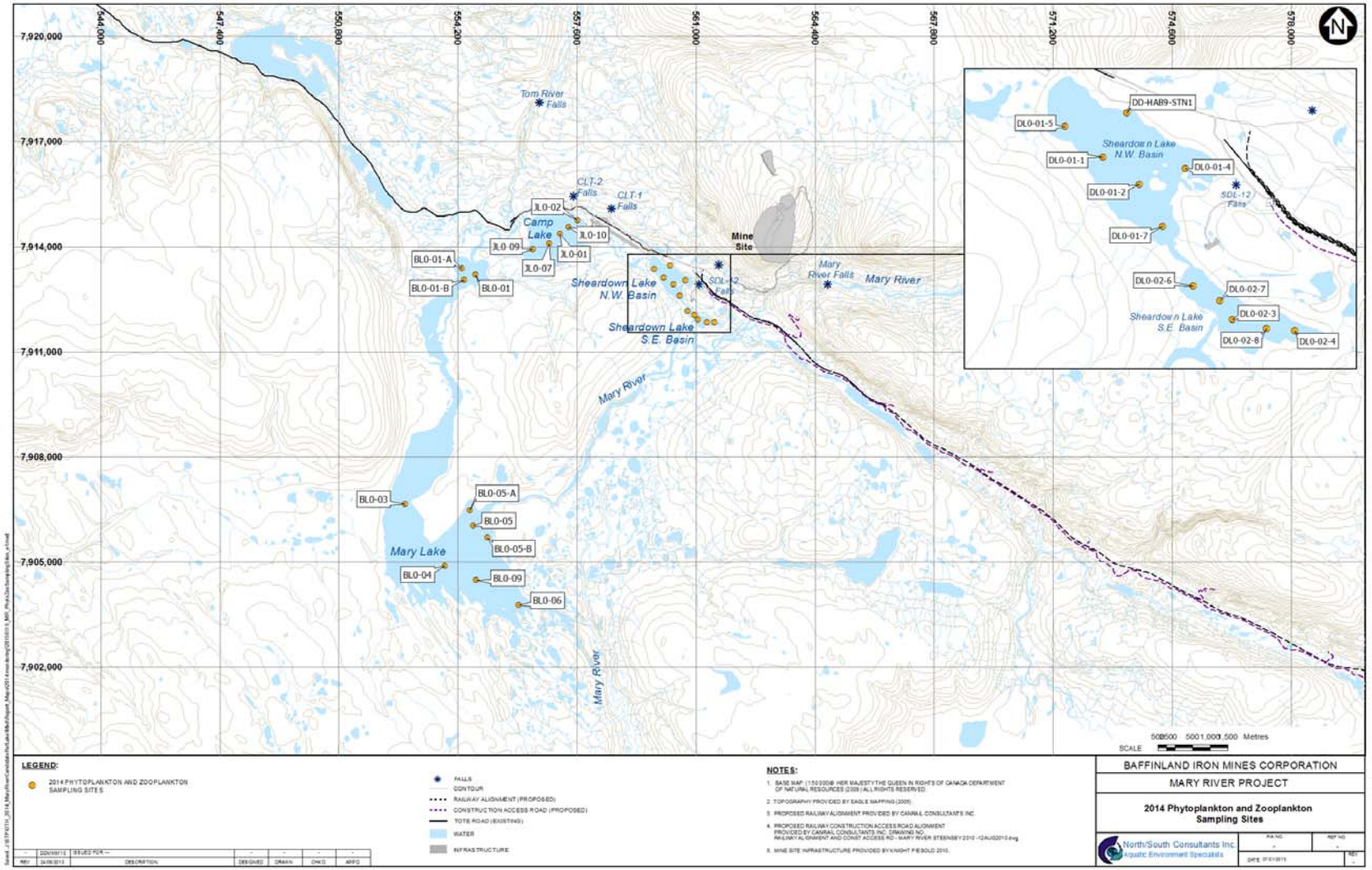

Figure 2-1. Phytoplankton and zooplankton sampling sites in the mine area: 2014.

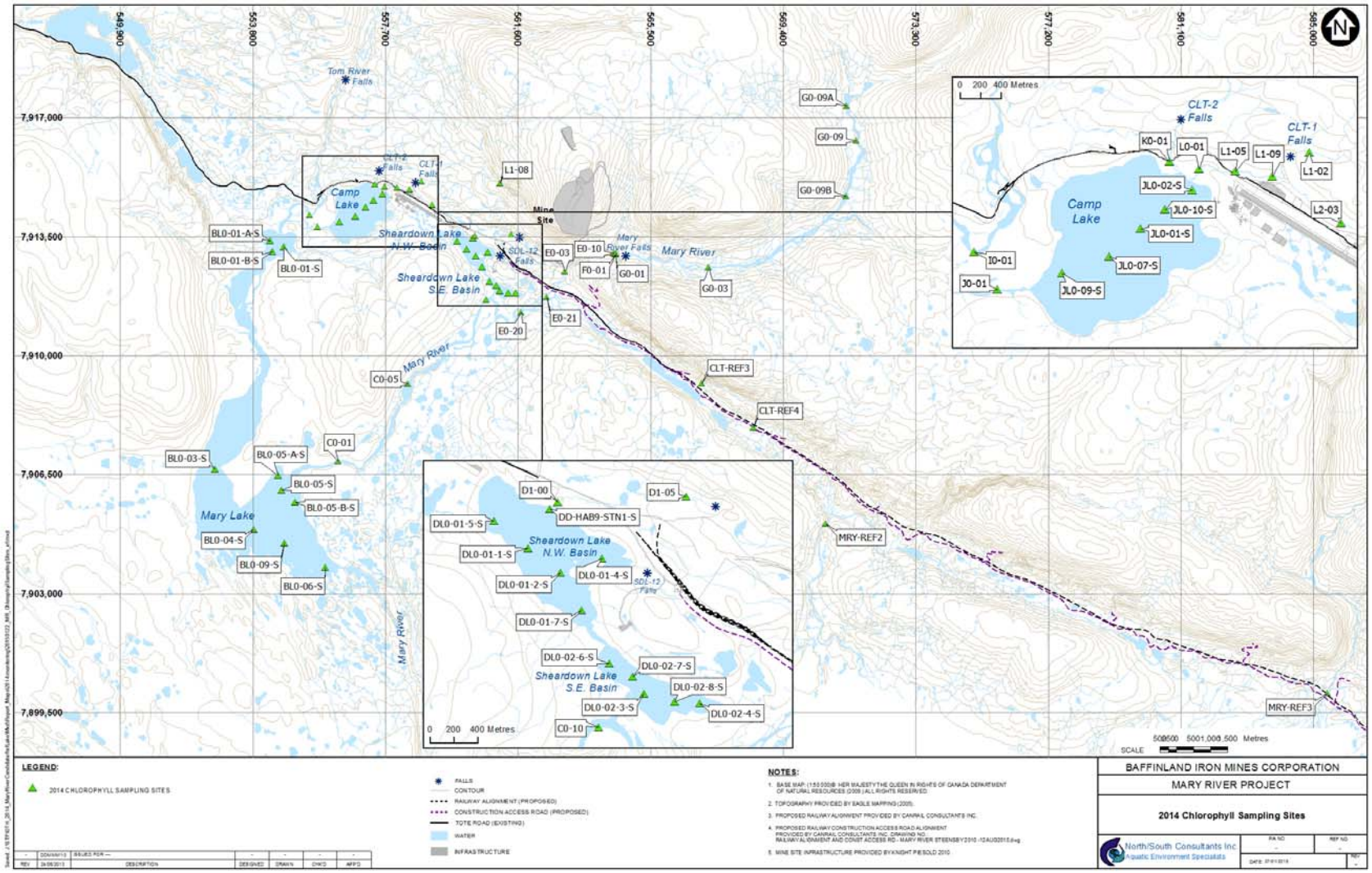

Figure 2-2. Chlorophyll *a* sampling sites in the mine area: 2014.

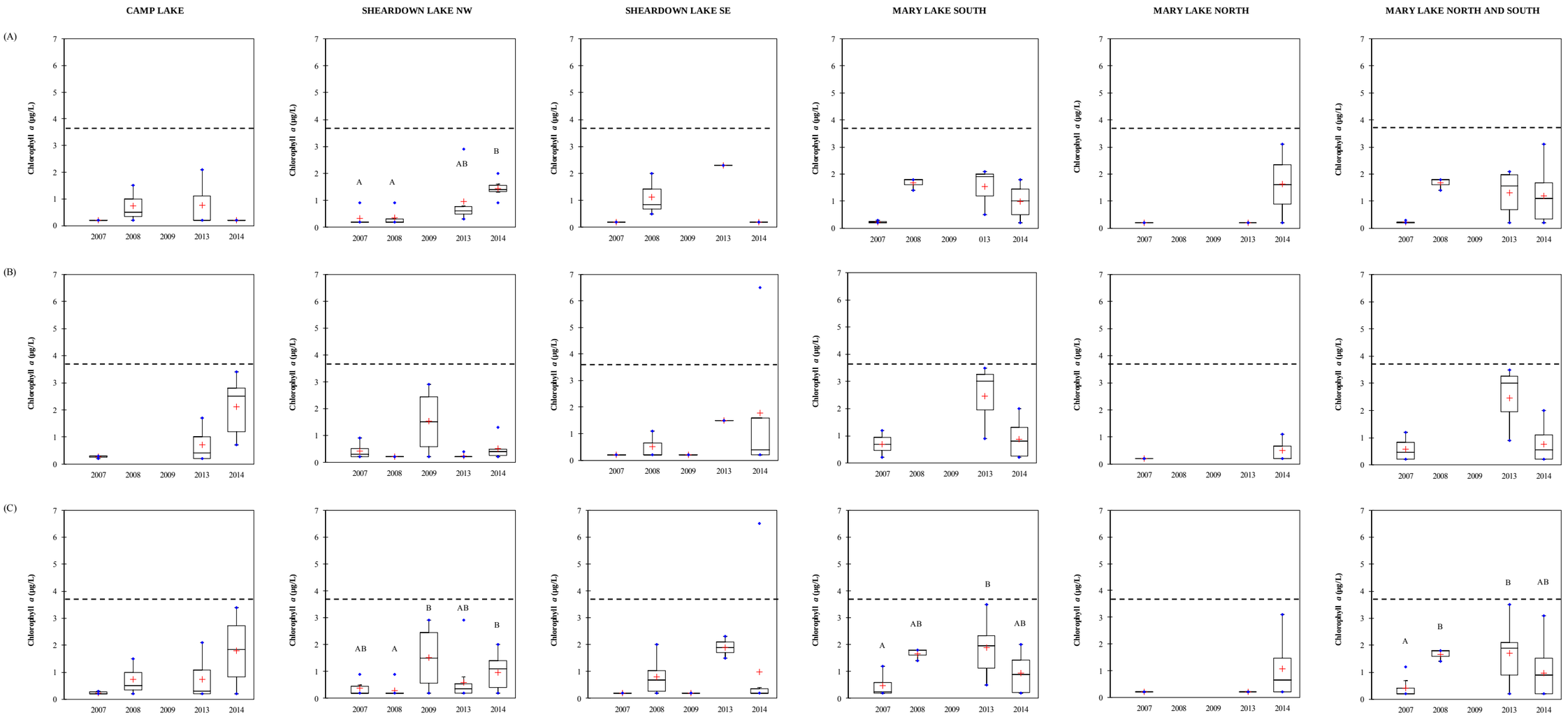

Figure 2-3. Boxplots of chlorophyll *a* in mine area lakes: (a) summer; (b) fall; and (c) summer and fall. Statistically significant differences between years within a lake are denoted with different superscripts. The dashed line indicates the benchmark identified in the AEMP (BIM 2014).

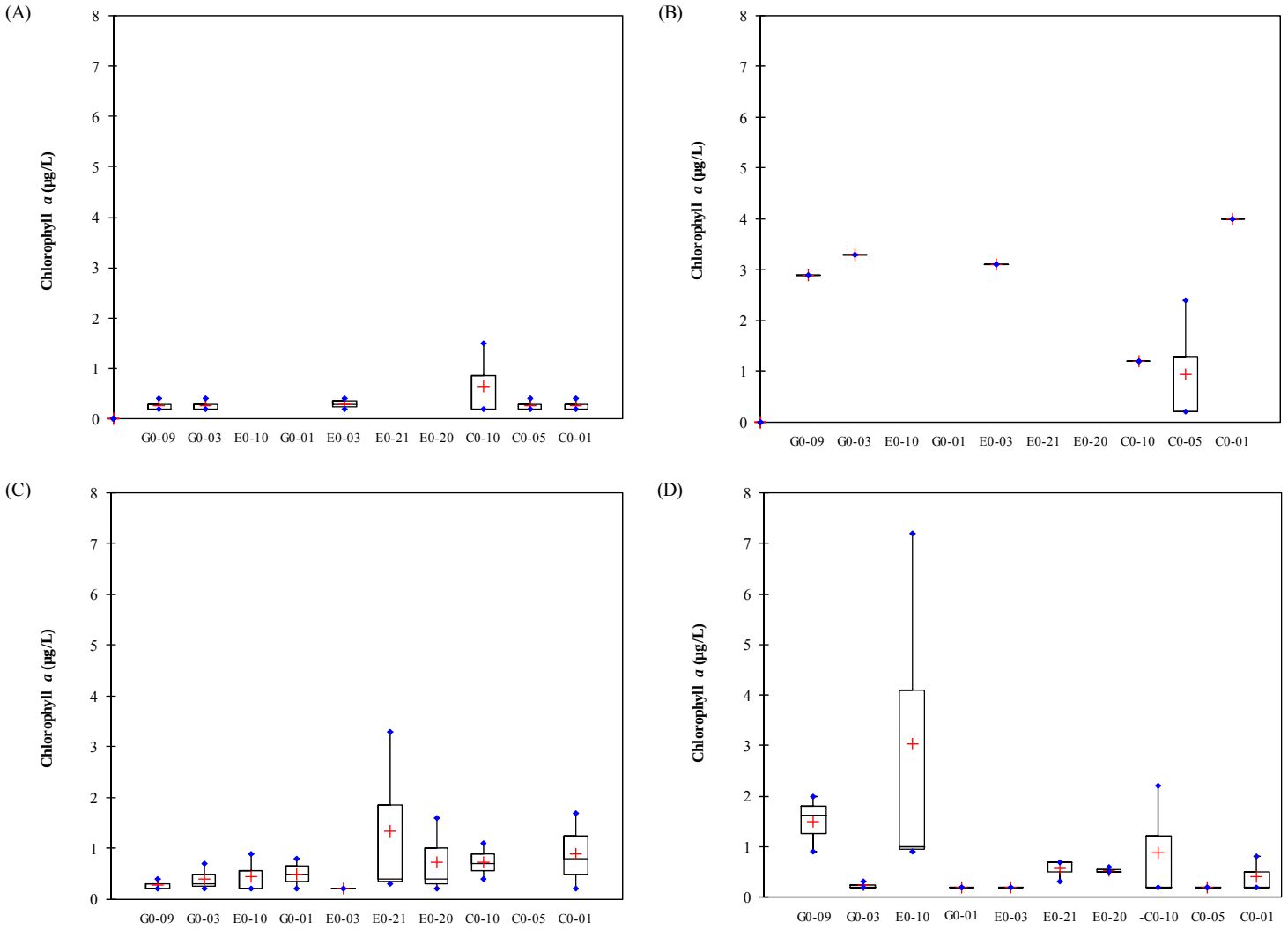

Figure 2-4. Boxplots of chlorophyll *a* measured in the open-water season in the Mary River: (A) 2007; (B) 2008; (C) 2013; and (D) 2014.

3.0 BENTHIC MACROINVERTEBRATES

3.1 METHODS

The BMI sampling program was habitat-based and focused upon predominant habitats within mine area lakes. Lake sampling completed in 2014 was restricted to Mary Lake, where planned sampling could not be completed in 2013. Sampling was also conducted at selected stream sites that had been previously sampled in the mine area. The following provides an overview of the sampling methods and an inventory of sampling completed under the 2014 program.

3.1.1 LAKE AQUATIC HABITAT CLASSIFICATION

Aquatic habitat in the mine area lakes was surveyed during previous field studies and mapped with Geographic Information System (GIS)-based techniques. Key characteristics included: relative water level and level fluctuations; the maximum depth of light penetration (i.e., depth of the euphotic zone estimated using Secchi disk depth); substrata type; and aquatic macrophyte (vascular, non-vascular) occurrence and distribution. Classification of lacustrine habitats for mine area lakes based on the key characteristics described above is presented in Table 3-1.

Aquatic habitats of lakes were classified into three zones with respect to relative water depth and the maximum depth of light penetration:

- Shoreline Zone (≤ 2 m water depth) – the shore zone bounded by the highest water level fluctuation recorded (staff gauge measurements) and lower extent of average ice depth. This area represents a band along the edge of a lake that experiences water level fluctuations (approximately ±0.2 m), ice scour (average ice depth of 2 m), and wind/wave exposure.
- Littoral/ Euphotic Zone (> 2-12 m water depth) – the shore zone that is wetted all the time, is beyond the lower extent of average ice depth, and receives sufficient light penetration for photosynthesis. The upper border of the zone corresponds to the lower extent of the average ice depth (2 m) and the lower border was identified visually (the selected depth separated most shallow water areas and bays from the main basin of the lake) and defined by the extent of the euphotic zone (estimated to be at approximately 12 m water depth based on Secchi disk depth measurements for mine area lakes).
- Profundal Zone (> 12 m water depth) – all areas of a lake deeper than the euphotic zone, defined as 12 m.

Each of the above zones was divided into categories of substrata type present. Substrata information was generally combined into four classifications:

- Cobble/Boulder;
- Gravel/Pebble;
- Sand;
- Fine Sand, Silt/Clay.

The shoreline in Sheardown Lake is primarily sand or gravel/pebble with a few areas of cobble/boulder. Substrate in the NW basin consists largely of sand or gravel/pebble with some cobble/boulder areas (typically in the nearshore zone) and a few, smaller areas of fine substrates (typically in the offshore zone). The SE basin has a greater proportion of sand than the NW basin and a lower proportion of fine substrates

In general, the shoreline in Camp Lake consists primarily of gravel/pebble (or smaller-sized substrate, particularly in the southwest), with small, isolated areas of cobble/boulder shoreline in the east, southeast, and northwest sections of the lake. Sand is the dominant substrate in Camp Lake and it is found throughout the nearshore and offshore zones. Small areas of finer substrates are observed primarily in the offshore zone while patches of cobble/boulder substrate are found primarily in the nearshore zone. Gravel/pebble substrates are dispersed throughout the lake.

Nearshore areas in the south basin of Mary Lake, like other surveyed lakes, consist primarily of sand and gravel/pebble substrate classes with areas of cobble/boulder throughout.

3.1.2 SAMPLING

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). BMI sampling conducted in Mary Lake targeted sampling in these habitat types.

Lake sites were sampled with a petite Ponar dredge (sampling area of 0.023 m^2). For each habitat type in Mary Lake, five replicate stations were targeted. Each replicate station consisted of five sub-samples/grabs. The geographic extent of each replicate station was at least 10 m x 10 m (i.e., the five grabs were collected from a 10 m x 10 m quadrat) and replicate stations were separated by at least 20 m. All BMI samples collected were sieved through a 500 µm mesh and fixed in formalin.

At each sub-sample/grab site, water depth (using a hand-held sonar unit), presence/absence of macrophytes, substrate composition (visual description) and compaction, and depth of

penetration of successful grabs were recorded. 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 freezer bags and frozen at NSC (Winnipeg, MB) for potential future analyses.

Stream BMI sampling was conducted using a 500 µm mesh Surber sampler. One replicate station, consisting of five sub-samples, was sampled in each stream reach (i.e., site). Sub-samples were collected moving in an upstream direction and, whenever possible, collected from representative microhabitats across the stream. Each sub-sample was collected by placing the Surber sampler on a flat area of the streambed, facing upstream. The surface area sampled by the Surber sampler is equivalent to 0.097 m^2. BMIs were collected over a two minute time period by rubbing the rocks and disturbing the sediment in the substrate area framed by the Surber net. All sub-samples were rinsed from the netting into a 500 µm sieve and any macroinvertebrates remaining on the netting after rinsing were removed with forceps. The sample was washed, transferred into a sample jar, and fixed in formalin. Supporting variables collected during the sampling program included UTM coordinates, water depth, and substrate composition (visual description).

Following collection and preservation, BMI samples were shipped to NSC (Winnipeg, MB) for archiving. Samples were catalogued and transferred to 70% ethanol with a few drops of glycerin for long-term storage.

3.2 OVERVIEW OF SAMPLING COMPLETED

Table 3-2 provides an overview of sampling completed in 2014. Sites are illustrated in Figures 3-1 and 3-2. Benthic macroinvertebrate sampling was conducted in Mary Lake from 23-26 August, 2014 and in streams on 24 and 27 August and 1 September by NSC (Tables 3-3 and 3-4). Appendix 3 presents field data collected during the benthic macroinvertebrate sampling program, 2014.

A total of 10 replicate stations (five sub-samples or grabs taken at each replicate station) were sampled in the south (n = 9) and north (n = 1) basins of Mary Lake during fall 2014 (Table 3-2; Figure 3-1). Three replicate stations were sampled in Habitat Type 9 (two in the south basin and one in the north) and seven in Habitat Type 14 (all in the south basin). One Habitat Type 9 replicate station sampled in the south basin may be re-categorized to Habitat Type 10 pending identification of aquatic vegetation present in the sample. Although Habitat Type 9 was targeted for five replicate stations in total, water depth at two stations was > 12 m (Habitat Type 14); classification may be revised pending sample analysis. Sediment samples were collected at each

benthic invertebrate replicate station for analysis of supporting variables (TOC and particle size); these samples are currently archived (i.e., frozen).

Benthic macroinvertebrates were collected from 13 replicate stations (five sub-samples collected per site or stream reach) in Sheardown Lake tributaries 1, 9, and 12, Camp Lake tributaries 1 and 2, and the Mary River during fall 2014 (Table 3-2; Figure 3-2).

All BMI and associated sediment samples have been preserved and frozen, and archived at NSC (Winnipeg, MB) for potential future analysis.

Table 3-1. Classification of lacustrine habitats in the mine area.

Classification of Lacustrine Habitats			Type
Zone	**Substrata Type/ Aquatic Macrophytes**		
Shoreline Zone	Cobble/Boulder		1
	Gravel/Pebble		2
	Sand		3
	Fine Sand, Silt/Clay	Macrophytes Absent	4
		Macrophytes Present	5
Littoral/Euphotic Zone	Cobble/Boulder		6
	Gravel/Pebble		7
	Sand		8
	Fine Sand, Silt/Clay	Macrophytes Absent	9
		Macrophytes Present	10
Profundal Zone	Cobble/Boulder		11
	Gravel/Pebble		12
	Sand		13
	Fine Sand, Silt/Clay	Macrophytes Absent	14

Table 3-2. Overview of benthic macroinvertebrate sampling completed in Mary Lake and mine area streams: 2014.

Waterbody	HabitatType/ Site (Stream Reach)	Number of Replicate Stations
Mary Lake South	Habitat Type 9	2 [1]
	Habitat Type 14	7 [2]
Mary Lake North	Habitat Type 9	1
Camp Lake Tributary 1	L1-09	1
	L0-01	1
Camp Lake Tributary 2	Downstream	1
	Upstream	1
Sheardown Lake Tributary 1	Reach 1	1
Sheardown Lake Tributary 9	Upstream	1
Sheardown Lake Tributary 12	Downstream	1
	Upstream	1
Mary River	G0-09	1
	G0-03	1
	E0-20	1
	C0-05	1
	C0-01	1

[1] Habitat type for one replicate station may be changed to Habitat Type 10 pending identification of aquatic vegetation present in the sample.

[2] Although Habitat Type 9 was targeted, water depth at two replicate stations was > 12 m (Habitat Type 14); classification may be revised pending sample analysis.

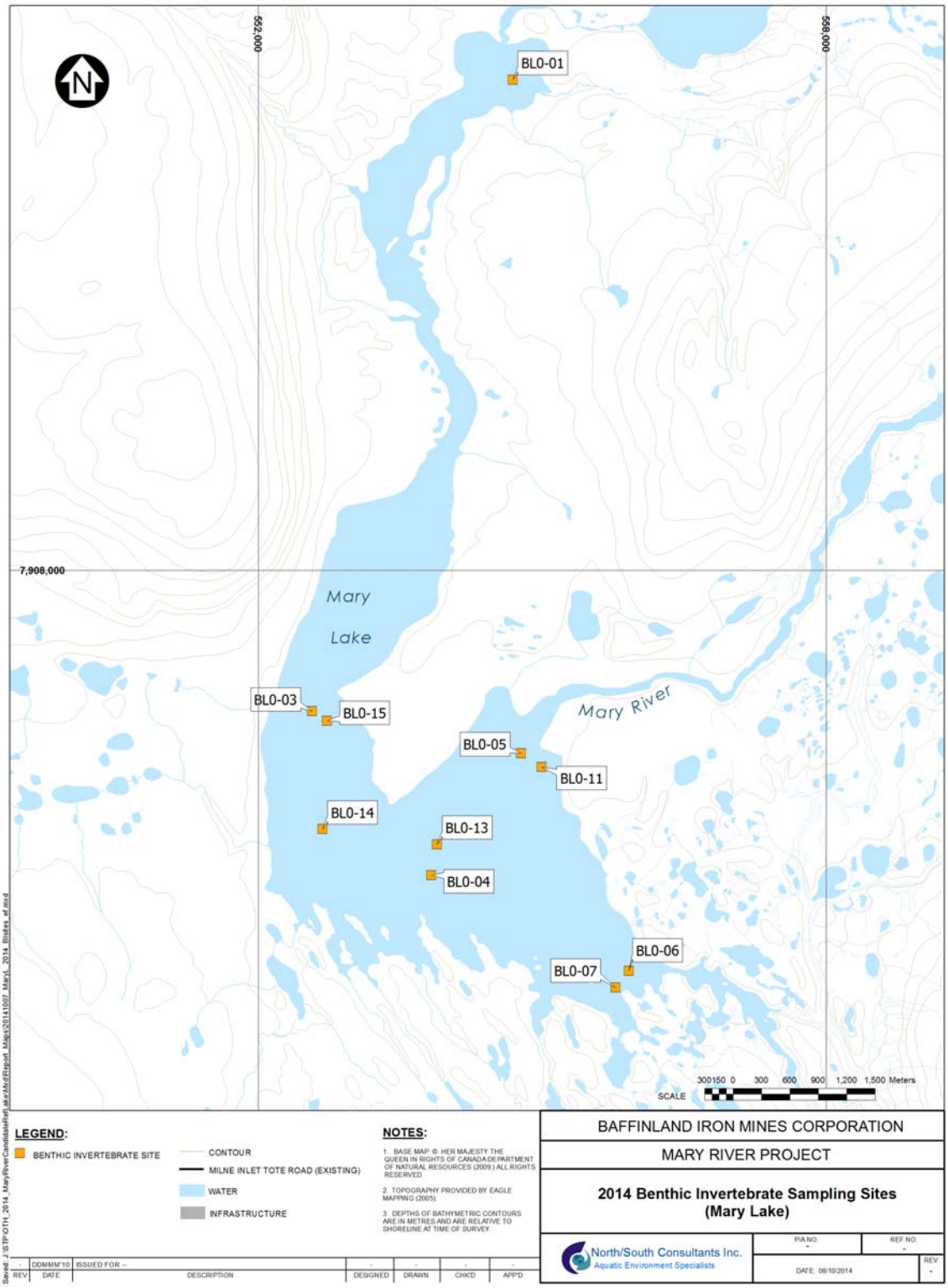

Figure 3-1. Benthic macroinvertebrate sampling sites in Mary Lake, fall 2014.

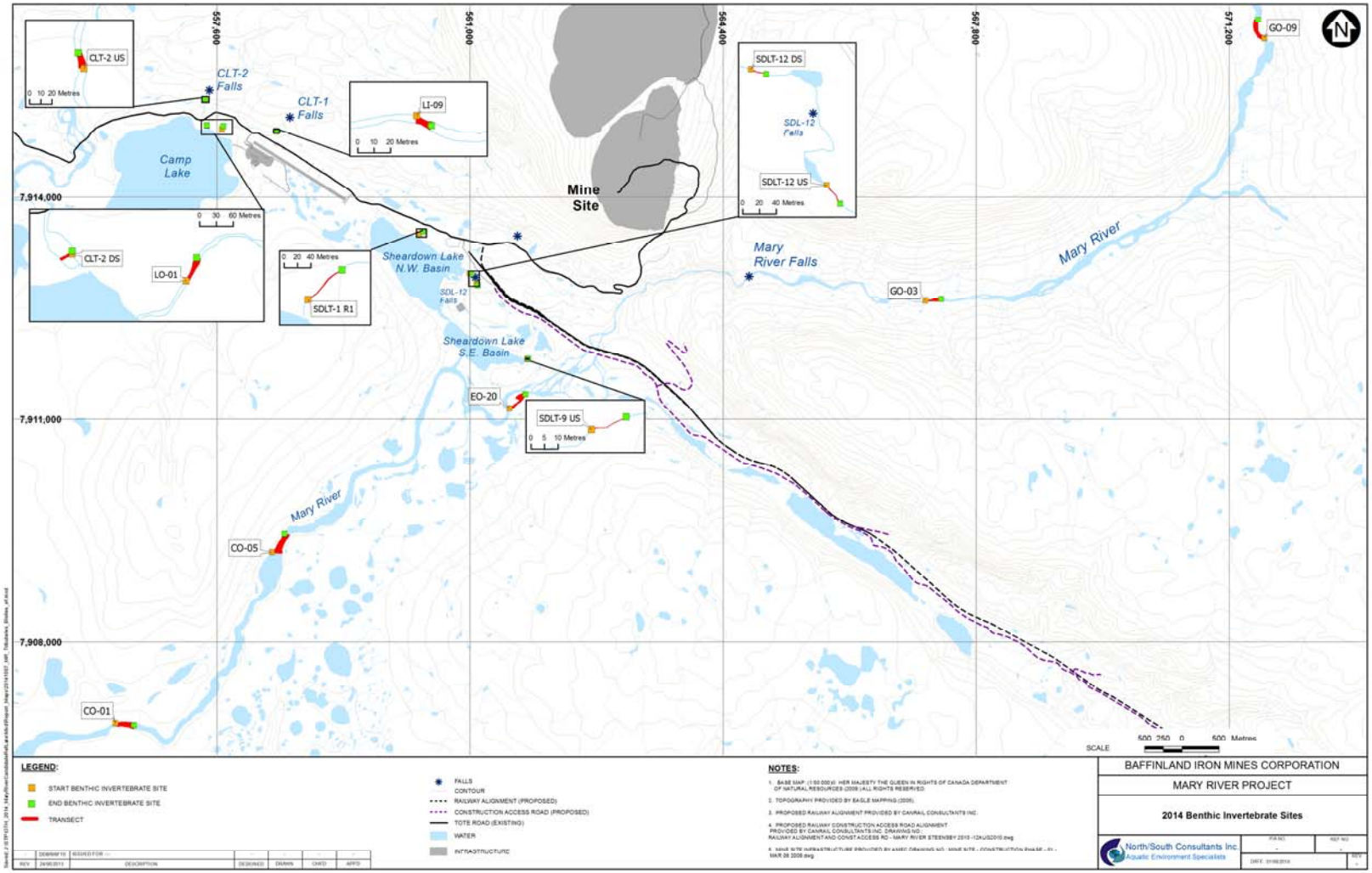

Figure 3-2. Benthic macroinvertebrate sampling sites in mine area tributaries, fall 2014.

4.0 ARCTIC CHAR

Arctic Char have previously (2006-2008 and 2013) been sampled in mine area lakes using gill nets and backpack electrofishing. Earlier studies conducted in the mine area lakes were intended to provide baseline information to support the production of the Environmental Impact Statement (EIS). The AEMP was subsequently developed, which includes an Arctic Char monitoring program in mine area lakes under the CREMP (BIM 2014). The program, while similar to early baseline studies, is to be conducted in late summer/fall in each mine area lake, with the objective to collect 100 individuals of 1+ age and 100 young-of-the-year (YOY). The program conducted in 2014 was intended to provide baseline data in support of the CREMP portion of the AEMP.

Standard index gill nets are used to capture adult and large juvenile Arctic Char in each lake. Past attempts to employ small mesh nets to capture small juvenile fish proved to be ineffective. Backpack electrofishing has, over the years, proven to be the most effective method of capturing small fish in mine area waterbodies and will continue to be used during conduct of the AEMP and CREMP. The combination of sampling techniques allows for the live capture of multiple size classes of Arctic Char and detailed analysis of population metrics.

The Arctic Char sampling program undertaken in the open-water season of 2014 included sampling in Mary Lake, Camp Lake, and Sheardown Lakes SE and NW. In addition, a hoopnetting program was undertaken at Camp Lake tributaries 1 and 2 during summer and Sheardown Lake Tributary 1 during fall to supplement baseline data.

4.1 METHODS

4.1.1 FIELD METHODS

During fall 2014, standard gang index gill nets were used to sample fish in mine area lakes. Gillnetting sites were selected from areas in each lake most likely to optimize catches during fall surveys (e.g., probable spawning areas).

Standard gang index gillnet gangs consisted of six 22.9 m long by 1.8 m deep twisted nylon or monofilament panels of 1.5, 2.0, 3.0, 3.75, 4.25, and 5.0 inch (38, 51, 76, 95, 108, and 127 mm, respectively) stretched mesh. Nets were set on the bottom and initially were left in place for short periods of time (average of 2.5 hours each) to minimize fish mortality. However, longer duration sets (4-8 hours) were used to improve catch totals when it became apparent that numbers insufficient to meet program requirements would be captured with short-duration sets.

Backpack electrofishing was conducted to meet target catch totals for small juvenile fish (particularly for YOY). A Smith-Root Model LR-24 backpack electrofisher was used during fall

2014 to capture small fish in nearshore, rocky lake habitat. Approximately 50-100 m long sections of rocky shoreline were electrofished in Sheardown Lake NW, Sheardown Lake SE, and Mary Lake.

A single, small mesh hoop net was set as close as possible to the tributary-lake confluences in each of Camp Lake tributaries 1 and 2 during late July 2014 and Sheardown Lake NW Tributary 1 during late August 2014. Hoop nets were constructed of fine-mesh beach seine material, were 0.6 m in diameter, and had 5 m long wings. Hoop nets deployed in summer were set to capture fish moving both upstream and downstream while those deployed in fall were set to only capture fish moving downstream towards the lake. All hoop nets provided complete blockage of the channels. Camp Lake tributary hoop nets were deployed on 26 July and were checked daily for three days. The Sheardown Lake tributary 1 hoop net was installed and checked approximately daily from 21-29 August.

Biological data were collected for most fish captured in all gear types; however, the amount of data collected varied by gear type, and size and condition of fish (i.e., live or moribund). Fish were identified to species, enumerated by location, and measured for fork length (± 1 mm). Fish captured during gillnetting were weighed to an accuracy of ± 25 g. 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 and hoopnetted fish. Otoliths, the preferred ageing structure, were also collected from incidental mortalities in 2014 and from a length-stratified subsample of small juvenile fish from electrofishing and hoopnetting surveys.

4.1.2 LABORATORY METHODS

Frozen mortalities were returned to the NSC laboratory for collection of detailed biological data. Each fish was measured for fork length (nearest 1 mm) and total weight (nearest 1 g for fish larger than 250 mm and 0.1 g for fish smaller than 250 mm). Fish were examined internally to determine sex and state of sexual maturity (i.e., had never spawned, preparing to spawn in the current year, had just completed spawning in the current year, or had spawned in a previous year but would not be spawning in the current year), where possible. Otoliths and left pectoral fin rays were removed for ageing. Stomach contents and general parasite load (low, moderate, high, very high) were assessed. A sample of dorsolateral muscle tissue (or whole fish for the small juveniles) was removed and frozen for potential future stable isotope analysis.

Otoliths were aged by thin sectioning. The 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 (essentially creating

a straight line through the nucleus). 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 annuli were enumerated. Pectoral fins rays collected in 2014 were archived for potential future ageing analyses.

4.1.3 DATA ANALYSIS METHODS

All catches were tabulated by lake/stream 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. Hoopnetting CPUE was expressed as the number of fish captured per 24 hours.

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):

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

Length data for Arctic Char were analysed and presented as length-frequency distributions when sample sizes were larger than 15. The gillnetting catches, which include large size ranges of fish, were grouped into 25 mm length intervals (e.g., 250-74 mm). Because char captured during electrofishing were mostly small fish, the length interval for producing length-frequency distributions was 10 mm (e.g., 10-19 mm).

Incidental mortality was low in 2014 and, consequently, only a small number of otoliths were collected for ageing purposes. Due to the small sample sizes of otoliths and the necessity of analysing each lake separately, ages from the 2014 gillnetting catch were combined with ages from previous catches (2006, 2007 and 2013) to obtain a more robust data set.

To supplement the age data from the 2014 electrofishing catch, two additional data sets were included in analyses. The first set included fish for which ages were estimated based on fork length and length-at-age data. Only probable YOY (30-49 mm in length) and age 1+ (70-89 mm in length) fish were included in this data set. As described in Section 4.2.1, due to the potential confounding factor of sympatric Arctic Char populations with different growth rates, fish 50-69 mm in length were estimated as either YOY or 1+. Extrapolation of ageing data to the full catch was not undertaken for the 2014 data set due to the observed presence of two potential morphotypes in Sheardown lakes SE and NW, and, insufficient information to predict growth rates beyond early life history stages (see Section 4.2.1 for details).

All estimated ages were included in analysis of 2014 data. The second data set is a sample of Arctic Char captured during summer electrofishing in the Mary River, which are provided for comparison. Mean age, age-frequency and length-at-age data were analysed and tabulated by lake and gear type.

4.2 RESULTS

During summer 2014, two Camp Lake tributaries were fished with small mesh hoop nets to identify movements of juveniles between the lake and tributaries. More extensive fish surveys were conducted in four lakes (Camp Lake, Sheardown Lake NW, Sheardown Lake SE, and Mary Lake) from 20 August – 1 September, 2014. A combination of logistical issues (e.g., boat motor and helicopter availability) prevented extensive sampling of each of the four lakes in late August/early September, 2014. Instead, effort was focussed on maximizing daily catch rates in each lake (e.g., longer duration sets) to obtain a sample size as close to the target (100 fish) as possible.

4.2.1 SHEARDOWN LAKE SE

Gillnetting

Effort and Abundance

Six standard index gillnet gangs were set in Sheardown Lake SE from 20-21 August, 2014 (Table 4-1; Figure 4-1). Net set durations ranged from 1.8-2.4 hours and nets were set at depths ranging from 0.8-13.4 m. A total of 43 Arctic Char were captured with a CPUE of 59.25 fish/100 m/24 hours (Table 4-2).

Size and Maturity

Mean size and condition factor of Arctic Char captured during 2014 gillnetting surveys are presented in Table 4-3. Fish captured in Sheardown Lake SE had a higher mean size than those captured in Sheardown Lake NW, which may be due to increased numbers of large, spawning adults in Sheardown Lake SE. The length-frequency distribution for fish captured in this lake was broad with 15 different size classes comprising at least 2% of the total catch (Figure 4-2). The modal length interval for fish captured in this lake was 350-374 mm. Nineteen (11 females and eight males) of the Arctic Char captured in this lake were identified as current year spawners. Spawning activity had also been identified in Sheardown Lake SE during previous fall surveys (2007 and 2008).

Age

The mean age of Arctic Char captured in gill nets during 2014 sampling was smaller than for the 2007 catch, but age ranges were similar and sample sizes were small (Table 4-4). Length-at-age data (all years combined) for Arctic Char captured in Sheardown Lake SE are presented in Table 4-5 and the age-frequency distribution is presented in Figure 4-3.

Although limited, maturity data from the aged fish provide evidence to suggest the occurrence of sympatric populations of Arctic Char within Sheardown Lake SE; a slower growing population that reaches maturity at an earlier age and smaller size (possible "small" or "stunted" morphotype) and a faster-growing population that is larger and older at maturity (possible "large" or "normal" morphotype). For example, a 224 mm long fish from Sheardown Lake SE in 2014 was determined to be a sexually mature female that was 9 years of age. The length of this mature female suggests it may belong to the small morphotype. Typically, sexual maturity for Arctic Char within the mine area lakes is not reached until fish are 300-400 mm in length. Males tend to be younger and smaller than females when they first spawn. Four other fish of similar age (8-10 years) captured in 2007 and 2014 ranged in size from 257-331 mm and were all immature (three males, one unknown sex).

Backpack Electrofishing

Effort and Abundance

Two electrofishing runs were conducted in Sheardown Lake SE from 20-21 August (Table 4-6, Figure 4-4). The runs were conducted in rocky, nearshore habitat and ranged in duration from 285-297 seconds. One-hundred-and-two fish were captured in Sheardown Lake SE (9.9-11.2 fish/minute), including four Ninespine Stickleback Table 4-7).

Size and Maturity

Mean size of the electrofishing catches are presented in Table 4-8. Of these, 44 fish were confirmed (based on age data) or believed (based on length data) to be YOY. The YOY had a mean length of 45 mm with a broad size range of 33-73 mm. Only four fish were believed to be 1+ years. These had a mean fork length of 67 mm and a length range of 62-72 mm. Another 34 fish, based on fork length (50-69 mm) may be either YOY or age 1+, but the potential presence of sympatric populations with differing growth rates makes prediction at this size range uncertain. The fork-length frequency for the electrofishing catch (all measured fish combined) had a modal interval of 60-69 mm, but more than 50% of the catch was smaller than 60 mm (Figure 4-5). The presence of a large proportion of small fish in Sheardown Lake SE electrofishing catches may likely be due to the presence of confirmed spawning activity in the

vicinity, resulting in greater proportions of recently hatched fish (YOY and 1+ age classes) using local habitat.

Age

The mean age of a subsample of the Sheardown Lake SE electrofishing catch was 0.1 years (Table 4-9) and the age-frequency distribution showed that almost 90% of the aged fish were YOY (Figure 4-6). Length-at-age data are provided in Table 4-10. An examination of fork length frequency for only the YOY captured in Sheardown Lake SE showed a nearly bimodal distribution (Figure 4-7) with fish 30-39 mm and 60-69 mm both abundant in the catch. Though sample size is small (n = 17), this distribution may provide additional evidence to suggest the presence of sympatric populations in the lake and could indicate differences in the timing of spawning, length of egg incubation periods, or different growth rates. The collection of additional length data for known YOY Arctic Char would be required to evaluate this suggestion.

4.2.2 SHEARDOWN LAKE NW

Gillnetting

Effort and Abundance

Seven standard index gillnet gangs were set in Sheardown Lake NW; four on 21 August and three on 31 August (Table 4-1; Figure 4-8). Net set durations ranged from 2.1-2.8 hours and nets were set at depths ranging from 1.2-16.9 m. A total of 23 Arctic Char were captured with a mean CPUE of 23.00 fish/100 m/24 hours (Table 4-2), which was less than half the CPUE observed for Sheardown Lake SE.

Size and Maturity

Mean size and condition factor of Arctic Char captured during gillnetting surveys in Sheardown Lake NW are presented in Table 4-3. The mean length of fish captured in Sheardown Lake NW (355 mm) was smaller than for those captured in Sheardown Lake SE, which may be due to increased numbers of large, spawning adults in the latter. The modal length interval for fish captured in Sheardown Lake NW was 300-324 and the overall distribution was relatively narrow (Figure 4-9). Only four spawners (two males and two females) were identified from the catch. Spawning activity has not yet been confirmed in Sheardown Lake NW.

Age

The mean age of Arctic Char captured in gill nets during 2014 sampling (13.4 years) was generally consistent with previous years (Table 4-4). Length-at-age data (all years combined) for Arctic Char captured in Sheardown Lake NW are presented in Table 4-11 and the age-frequency distribution is presented in Figure 4-10.

Backpack Electrofishing

Effort and Abundance

Two electrofishing runs were conducted in Sheardown Lake NW on 21 August (Table 4-6, Figure 4-11). Duration of these runs ranged from 269-272 seconds and they were conducted in rocky, nearshore habitat. Sixty-four fish were captured in Sheardown Lake NW (CPUE = 4.9-9.4 fish/minute) (Table 4-7).

Size and Maturity

Mean size of the electrofishing catches are presented in Table 4-8. None of the Arctic Char captured during electrofishing surveys in Sheardown Lake NW (based on age or length data) were thought to be YOY. Eleven fish are believed or confirmed to be 1+ years with a mean length of 73 mm and a range of 55-85 mm. Another eleven fish, based on fork length (50-69 mm) may be either YOY or age 1+, but the potential presence of sympatric populations with differing growth rates makes prediction at this size range uncertain. The overall mean length for all measured fish from the Sheardown Lake NW catch was 64 mm. The fork-length frequency for the electrofishing catch (all measured fish combined) has a modal interval of 60-69 mm, but more than 70% of the catch was larger than 69 mm (Figure 4-12). The suspected absence of YOY from the catch in this lake may be due to the lack of nearby spawning and the relatively short movements typical of recently hatched fish or possibly differences in spatial distribution between smaller and larger juveniles in nearshore habitat. Areas fished in Sheardown Lake NW consisted primarily of large cobble/boulder, which would provide better cover for larger juveniles than small cobble or gravel (the main habitat types fished in Sheardown Lake SE).

Age

The mean age of a subsample of the Sheardown Lake NW electrofishing catch was 2.4 years (Table 4-9) and the age-frequency distribution had a modal interval of two years (Figure 4-13). Length-at-age data for Sheardown Lake NW are provided in Table 4-12 and, for comparison, data for Mary River from 2008, which had a similar mean age, are provided in Table 4-13. The small sample size of fish aged 1+ precludes detailed analysis; however, of the four Arctic Char in that age cohort, two were 55-57 mm and two were 70-76 mm.

As observed in Sheardown Lake SE, there is some preliminary evidence to suggest the presence of sympatric populations in the lake. Three mature females (likely preparing to spawn later during fall 2014) ranging in size from 120-163 mm were identified during laboratory examination of mortalities from Sheardown Lake NW. These fish ranged in age from 4-6 years. For comparison, similarly sized immature fish from the same lake were 2-3 years old.

Observations from both Sheardown Lake NW and Sheardown Lake SE are based on detailed examination of only a small number of fish. Additional data would be required to confirm the presence of two populations in either or both lakes, to identify specific characteristics of each (e.g., growth rates, meristics and morphometrics, diet), and whether either population moves between waterbodies in the Mary Lake watershed via the Mary River. Further, it is not known if other waterbodies have resident sympatric morphotypes of Arctic Char.

4.2.3 MARY LAKE

Gillnetting

Effort and Abundance

Twelve standard index gillnet gangs were set in the south basin of Mary Lake from 22-23 August, 2014 (Table 4-1; Figure 4-14). Net set durations ranged from 2.0-7.9 hours and nets were set at depths ranging from 1.8-30.1 m. A total of 70 Arctic Char were captured with a CPUE of 22.32 fish/100 m/24 hours (Table 4-2).

Size and Maturity

Mean size and condition factor of Arctic Char captured during gillnetting surveys are presented in Table 4-3. Fish captured in Mary Lake had a larger mean size than in any other lake surveyed in 2014. The modal length interval for these fish was 350-374 mm and more than 60% of the catch was 350-399 mm (Figure 4-15). Ten of these fish (nine females and one male) ranging in size from 334-680 mm were identified as current year spawners.

Age

Mean age (13.8 years) and age range (8-21 years) for Arctic Char captured in Mary Lake in 2014 was similar to previous years (Table 4-4). Length-at-age (all years combined) for captured Arctic Char are presented in Table 4-14. Although there was some overlap between age classes, mean fork length generally increased with age. There were also no small mature fish identified from the 2014 catch. The smallest sexually mature fish in the catch was a 334 mm, 15-year-old female. The age-frequency distribution (all years combined) is relatively uniform with a modal interval of 15 years (Figure 4-16).

Backpack Electrofishing

Effort and Abundance

Two electrofishing runs were conducted in Mary Lake on 25 August (Table 4-6, Figure 4-17). Runs, which ranged in duration from 637-876 seconds, were conducted in rocky, nearshore habitat. A total of 68 fish were captured with CPUE ranging from 1.8-4.0 fish/minute (Table 4-7).

Size and Maturity

Mean size of fish captured is presented in Table 4-8. Twenty-five fish were confirmed (based on age data) or believed (based on length data) to be YOY with a mean fork length of 54 mm. Another 29 are believed to be 1+ with a mean length of 65 mm and a range of 55-79 mm. More than 70% of the catch was 50-69 mm in length and available data do not show differing growth rates that may be indicative of the presence of more than one morphotype (Figure 4-18).

Age

The mean age of the electrofishing catch in 2014 was 0.8 years with a range of 0-3 years (Table 4-9). The length-at-age data for Mary Lake show a consistent increase in mean size with increasing age and little overlap between cohorts (Table 4-15). The age frequency distribution for the Mary Lake electrofishing catch had a modal interval of 0 years (Figure 4-19). The fork-length frequency for YOY fish (Figure 4-20) does not indicate the presence of two distinct populations with different growth rates. Although sample size is small, there is no evidence to date to suggest that multiple Arctic Char morphotypes may occur in Mary Lake.

4.2.4 CAMP LAKE

Gillnetting

Effort and Abundance

Four standard index gillnet gangs were set in Camp Lake on 1 September, 2014 (Table 4-1; Figure 4-21). Net set durations ranged from 6.0-6.4 hours and nets were set at depths ranging from 1.3-15.8 m. A total of 21 Arctic Char were captured with a CPUE of 14.63 fish/100 m/24 hours, the lowest of any mine area lake surveyed in 2014 (Table 4-2).

Size and Maturity

Mean size and condition factor of Arctic Char captured during gillnetting surveys in 2014 are presented in Table 4-3. Fish captured in Camp Lake were, on average, smaller than those

captured in other lakes. The majority of Arctic Char captured in Camp Lake were 325-349 mm (Figure 4-22). No current year spawners were identified from the catch. Based on previous surveys, spawning activity is thought to occur in the lake, but specific locations have not been confirmed.

Age

The mean age of Camp Lake fish analysed in 2014 was higher than in surveys from other years, but sample sizes have been small (Table 4-4). Length-at-age and age frequency (all years combined) data for captured Arctic Char are presented in Table 4-16 and Figure 4-23, respectively.

Backpack Electrofishing

Electrofishing was not conducted in Camp Lake during fall 2014 due to time constraints.

4.2.5 TRIBUTARY STREAMS

A single hoop net was set in Camp Lake Tributary 1 to capture fish moving upstream from the lake and two hoop nets were set in Camp Lake Tributary 2 to capture fish moving in both directions from 26-29 July (Table 4-17, Figure 4-24). Water temperatures during monitoring were consistently above 10°C. A total of 812 Arctic Char and two Ninespine Stickleback were captured moving upstream into Camp Lake Tributary 1 (Table 4-18). In Camp Lake Tributary 2, 629 Arctic Char and 13 Ninespine Stickleback were captured, with the majority of char (n = 483) moving upstream from the lake. Daily catches of Arctic Char in both tributaries and in hoop nets deployed in both directions peaked on 28 July (Figure 4-25). Hoopnetting surveys had not previously been conducted during summer. These data, though somewhat limited, indicate that upstream movements initiated during spring continue into the summer, and, movement out of the streams over summer is substantive (i.e., approximately 23% of the catch was captured moving downstream into Camp Lake). Significant numbers of juvenile char appear to use stream habitat for feeding and as refuge from larger, potentially piscivorous char. More than 50% of the juvenile Arctic Char captured in Camp Lake tributaries were 125-174 mm in length (Figure 4-26).

A single hoop net was set in Sheardown Lake Tributary 1 to capture fish moving downstream into the lake from 21-31 August (Table 4-17, Figure 4-24). Water temperature ranged from 5.5°C at the start of sampling to a peak of 9.0°C on 26 August. A total of 348 fish were captured moving downstream (319 Arctic Char and 29 Ninespine Stickleback; Table 4-19). Daily catches decreased as water temperature increased until the last day of the program when the catch was more than double that of any previous day (Table 4-19, Figure 4-27). In previous years, Arctic

Char catches increased as water temperature decreased to 4°C as the fish moved to the lake for overwintering. The unexpected increase in water temperature from the start of the program in 2014 appeared to delay downstream movements. It is suspected that large numbers of juvenile Arctic Char had not yet moved into Sheardown Lake NW by the end of the monitoring period in fall 2014. The fork-length frequency of the Arctic Char catch is presented in Figure 4-28. More than 40% of the catch was 50-74 mm in length.

Table 4-1. Gillnetting information for waterbodies in the mine area: 2014.

Waterbody	Site ID	Start UTM Coordinates		End UTM Coordinates		Sample Date	Duration (dec.hrs)	Depth (m)	
		Easting	Northing	Easting	Northing			Start	End
Sheardown Lake SE	SLSE-14-01	561641	7911801	561508	7911893	20-Aug-14	1.9	5.0	2.4
	SLSE-14-02	561441	7911788	561382	7911938	20-Aug-14	2.3	9.0	7.9
	SLSE-14-03	561267	7911768	561110	7911951	21-Aug-14	1.8	1.6	10.0
	SLSE-14-04	560974	7911832	561064	7911951	21-Aug-14	2.0	1.9	13.4
	SLSE-14-05	561002	7912101	560864	7912005	21-Aug-14	2.3	1.6	0.8
	SLSE-14-06	561272	7911781	561268	7911951	21-Aug-14	2.4	2.5	11.6
Sheardown Lake NW	SLNW-14-01	560453	7912861	560520	7912737	21-Aug-14	2.1	2.8	12.2
	SLNW-14-02	560454	7912988	560386	7913129	21-Aug-14	2.3	2.6	8.8
	SLNW-14-03	560530	7913094	560496	7913249	21-Aug-14	2.5	1.8	8.0
	SLNW-14-04	560327	7913442	560204	7913339	21-Aug-14	2.7	5.2	13.0
	SLNW-14-05	560439	7912981	560347	7913100	31-Aug-14	2.7	1.9	16.9
	SLNW-14-06	560526	7913080	560419	7913184	31-Aug-14	2.8	1.2	6.8
	SLNW-14-07	560525	7913272	560419	7913184	31-Aug-14	2.8	4.1	9.2
Mary Lake South	MLS-14-01	554946	7903776	554951	7903621	22-Aug-14	2.0	2.0	1.8
	MLS-14-02	554813	7903820	554825	7903971	22-Aug-14	2.3	1.6	18.4
	MLS-14-03	554644	7903917	554630	7904064	22-Aug-14	2.7	2.2	30.1
	MLS-14-04	554059	7904136	554206	7904144	22-Aug-14	2.8	1.4	4.9
	MLS-14-05	555018	7903787	555150	7903730	22-Aug-14	2.9	2.1	10.2
	MLS-14-06	555551	7903609	555601	7903462	22-Aug-14	2.6	2.0	1.8
	MLS-14-07	554275	7904136	554411	7904055	22-Aug-14	2.4	2.7	5.8
	MLS-14-08	555114	7903509	555063	7903630	22-Aug-14	2.2	1.6	8.5
	MLS-14-09	555059	7905987	555052	7905839	23-Aug-14	7.9	1.7	6.2
	MLS-14-10	555245	7905456	555192	7905325	23-Aug-14	7.1	1.2	3.8
	MLS-14-11	555698	7904470	555564	7904391	23-Aug-14	6.2	2.1	16.4
	MLS-14-12	554133	7906103	554200	7905969	23-Aug-14	7.5	1.7	14.1
Camp Lake	CL-14-01	557673	7914428	557515	7914486	01-Sep-14	6.0	2.2	13.9
	CL-14-02	557321	7914892	557255	7914764	01-Sep-14	6.2	1.6	15.1
	CL-14-03	557574	7914832	557486	7914708	01-Sep-14	6.3	2.2	15.8
	CL-14-04	557786	7914653	557635	7914603	01-Sep-14	6.4	1.3	13.4

Table 4-2. Catch totals and catch-per-unit-effort (CPUE) for gillnetting surveys in mine area lakes, fall 2014.

Waterbody	Site ID	Set Duration (dec.hrs)	Catch Total (ARCH)	CPUE [1]
Sheardown Lake SE	SLSE-14-01	1.9	7	63.79
	SLSE-14-02	2.3	6	46.58
	SLSE-14-03	1.8	6	58.77
	SLSE-14-04	2.0	7	62.70
	SLSE-14-05	2.3	3	22.46
	SLSE-14-06	2.4	14	101.19
	Total		*43*	*59.25*
Sheardown Lake NW	SLNW-14-01	2.1	1	8.38
	SLNW-14-02	2.3	7	54.34
	SLNW-14-03	2.5	3	20.68
	SLNW-14-04	2.7	8	52.08
	SLNW-14-05	2.7	2	13.02
	SLNW-14-06	2.8	0	0.00
	SLNW-14-07	2.8	2	12.48
	Total		*23*	*23.00*
Mary Lake South	MLS-14-01	2.0	3	25.77
	MLS-14-02	2.3	4	29.73
	MLS-14-03	2.7	4	25.88
	MLS-14-04	2.8	1	6.16
	MLS-14-05	2.9	1	6.06
	MLS-14-06	2.6	3	20.15
	MLS-14-07	2.4	3	21.83
	MLS-14-08	2.2	1	8.12
	MLS-14-09	7.9	11	24.37
	MLS-14-10	7.1	11	27.00
	MLS-14-11	6.2	16	44.84
	MLS-14-12	7.5	12	27.95
	Total		*70*	*22.32*
Camp Lake	CL-14-01	6.0	3	8.69
	CL-14-02	6.2	6	16.90
	CL-14-03	6.3	4	11.09
	CL-14-04	6.4	8	21.83
	Total		*21*	*14.63*

[1] CPUE calculated as #fish/100 m/24 hours for standard index nets

Table 4-3. Summary of length, weight and condition factor of Arctic Char captured during gillnetting surveys of mine area 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
Sheardown Lake SE	43	378	85	224 - 575	40	616	459	100 - 1800	40	0.95	0.12	0.65 - 1.18
Sheardown Lake NW	22	355	54	290 - 521	22	450	230	200 - 1150	22	0.93	0.09	0.80 - 1.12
Mary Lake South	67	394	73	234 - 680	66	658	510	250 - 3250	66	0.94	0.09	0.71 - 1.17
Camp Lake	20	349	31	318 - 464	20	395	99	300 - 750	20	0.92	0.07	0.75 - 1.07

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

Table 4-4. Summary of ageing analyses for Arctic Char captured during gillnetting surveys of mine area lakes, 2006-2014.

Waterbody	Year	Otolith Age			
		n [1]	Mean	SD [2]	Range
Sheardown Lake SE	2007	9	13.2	2.8	8 - 17
	2014	10	10.6	2.8	7 - 16
	Total	*19*	*11.8*	*3.0*	*7 - 17*
Sheardown Lake NW	2006	8	11.9	4.6	6 - 19
	2007	17	13.6	4.9	5 - 21
	2013	4	14.5	1.9	12 - 16
	2014	5	13.4	2.7	10 - 17
	Total	*34*	*13.3*	*4.3*	*5 - 21*
Mary Lake South	2006	59	13.3	3.8	8 - 24
	2007	26	13.5	3.4	8 - 23
	2014	14	13.8	3.6	8 - 21
	Total	99	13.4	3.6	8 - 24
Camp Lake	2006	21	9.0	4.0	4 - 19
	2007	7	11.0	2.3	8 - 14
	2013	4	12.0	0.8	11 - 13
	2014	5	13.5	2.1	11 - 16
	Total	*37*	*10.3*	*3.6*	*4 - 19*

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

Table 4-5. Length-at-age for Arctic Char captured during gillnetting surveys of Sheardown Lake SE, 2006-2014.

Age Class	Fork Length (mm)			
	n [1]	Mean	SD [2]	Range
0	0	-	-	-
1	0	-	-	-
2	0	-	-	-
3	0	-	-	-
4	0	-	-	-
5	0	-	-	-
6	0	-	-	-
7	1	330	-	-
8	2	308	33	285 - 331
9	3	298	66	224 - 350
10	1	257	-	-
11	2	329	8	323 - 335
12	1	350	-	-
13	3	350	53	300 - 405
14	2	337	22	321 - 352
15	1	405	-	-
16	2	414	65	368 - 460
17	1	401	-	-
18	0	-	-	-
19	0	-	-	-
20	0	-	-	-
21	0	-	-	-
22	0	-	-	-
23	0	-	-	-
24	0	-	-	-
Total	*19*	*340*	*55*	*224 - 460*

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

Table 4-6. Backpack electrofishing information for waterbodies in the mine area, fall 2014.

Waterbody	Site ID	Start UTM Coordinates		End UTM Coordinates		Sample Date	Duration (sec)
		Easting	Northing	Easting	Northing		
Sheardown Lake SE	SDLSE-EF01	561741	7911788	561726	7911825	20-Aug-14	297
	SDLSE-EF02	561709	7911731	561672	7911742	21-Aug-14	285
Sheardown Lake NW	SDLNW-EF01	560294	7913479	560259	7913488	21-Aug-14	269
	SDLNW-EF02	560318	7913475	560337	7913447	21-Aug-14	272
Mary Lake South	MLS-EF01	554898	7903592	554886	7903715	25-Aug-14	876
	MLS-EF02	554898	7903592	554979	7903521	25-Aug-14	637

Table 4-7. Catch totals and catch-per-unit-effort (CPUE) for backpack electrofishing surveys in mine area lakes, fall 2014.

Waterbody	Site ID	Duration (s)	Catch Total [1]	CPUE [2]
Sheardown Lake SE	SDLSE-EF01	297	49	9.9
	SDLSE-EF02	285	53	11.2
Sheardown Lake NW	SDLNW-EF01	269	42	9.4
	SDLNW-EF02	272	22	4.9
Mary Lake	MLS-EF01	876	26	1.8
	MLS-EF02	637	42	4.0

[1] The Sheardown Lake SE total catch includes four Ninespine Stickleback
[2] CPUE calculated as #fish/minute of electrofishing

Table 4-8. Summary of length, weight and condition factor of Arctic Char captured during electrofishing surveys of mine area lakes, fall 2014. Data for young-of-the-year (YOY) and age 1+ fish are emphasized separately.

Waterbody	Age Class	Fork Length (mm)				Weight (g)				Condition Factor			
		n [1]	Mean	SD [2]	Range	n	Mean	SD	Range	n	Mean	SD	Range
Sheardown SE [3]	YOY	44	45	10	33 - 73	15	1.1	1.2	0.3 - 4.0	15	0.87	0.14	0.59 - 1.07
	1+	4	67	5	62 - 72	2	3.0	0.0	3.0 - 3.0	2	1.23	0.04	1.20 - 1.26
	YOY or 1+	34	63	4	55 - 69	0	-	-	-	0	-	-	-
	All fish	*82*	*53*	*12*	*33 - 73*	*17*	*1.4*	*1.3*	*0.3 - 4.0*	*17*	*0.91*	*0.18*	*0.59 - 1.26*
Sheardown NW [3]	YOY	0	-	-	-	0	-	-	-	0	-	-	-
	1+	11	73	10	55 - 85	4	2.8	0.9	1.5 - 3.6	4	1.03	0.28	0.75 - 1.40
	YOY or 1+	11	63	4	55 - 68	1	1.5	-	-	1	0.90	-	-
	All fish	*48*	*91*	*26*	*55 - 163*	*18*	*13.4*	*12.8*	*1.5 - 51.0*	*18*	*0.99*	*0.15*	*0.75 - 1.40*
Mary Lake [4]	YOY	25	54	4	41 - 64	12	1.6	0.7	0.6 - 3.0	12	0.99	0.24	0.64 - 1.34
	1+	29	65	6	55 - 79	11	2.6	0.9	2.0 - 4.0	11	1.04	0.15	0.84 - 1.22
	All fish	*60*	*64*	*16*	*41 - 124*	*29*	*4.3*	*5.1*	*0.6 - 21.0*	*29*	*1.02*	*0.18*	*0.64 - 1.34*

[1] n = number of fish measured; may not equal total number captured
[2] SD = standard deviation
[3] Age class YOY includes confirmed ages and fish likely to be YOY in Sheardown lakes SE and NW based on observed growth rates at a fork length range of 30-49 mm; Age class 1+ includes confirmed ages and fish likely to be age 1+ based on fork length range of 70-89 mm; YOY or 1+ category includes all unaged fish 50-69 mm in length which could be either due to the potential presence of two sympatric populations with different growth rates
[4] Age class YOY includes confirmed ages and fish likely to be YOY in Mary Lake based on observed growth rates at a fork length range of 40-59 mm; Age class 1+ includes confirmed ages and fish likely to be age 1+ based on fork length range of 60-79 mm; no evidence of sympatric populations in Mary Lake

Table 4-9. Summary of age data for Arctic Char captured during electrofishing surveys of mine area lakes, fall 2014 and of the Mary River, summer 2008.

Waterbody	Otolith Age (years)			
	n [1]	Mean	SD [2]	Range
Sheardown Lake SE	19	0.1	0.3	0 - 1
Sheardown Lake NW	17	2.4	1.4	1 - 6
Mary Lake South	27	0.8	0.9	0 - 3
Mary River	29	2.6	0.9	2 - 5

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

Table 4-10. Length-at-age for Arctic Char captured during backpack electrofishing surveys of Sheardown Lake SE, fall 2014.

Age Class	Fork Length (mm)			
	n[1]	Mean	SD[2]	Range
0	17	50	15	33 - 73
1	2	63	1	62 - 63
2	0	-	-	-
3	0	-	-	-
4	0	-	-	-
5	0	-	-	-
6	0	-	-	-
7	0	-	-	-
8	0	-	-	-
9	0	-	-	-
10	0	-	-	-
Total	*19*	*51*	*14*	*33 - 73*

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

Table 4-11. Length-at-age for Arctic Char captured during gillnetting surveys of Sheardown Lake NW, 2006-2014.

Age Class	Fork Length (mm)			
	n [1]	Mean	SD [2]	Range
0	0	-	-	-
1	0	-	-	-
2	0	-	-	-
3	0	-	-	-
4	0	-	-	-
5	1	240	-	-
6	1	180	-	-
7	2	243	50	207 - 278
8	0	-	-	-
9	2	307	1	306 - 307
10	3	306	26	284 - 335
11	5	319	32	262 - 341
12	3	337	17	320 - 354
13	1	323	-	-
14	1	355	-	-
15	1	370	-	-
16	6	438	101	357 - 620
17	3	421	69	354 - 492
18	1	389	-	-
19	2	478	133	384 - 572
20	0	-	-	-
21	2	448	86	387 - 508
22	0	-	-	-
23	0	-	-	-
24	0	-	-	-
Total	*34*	*359*	*93*	*180 - 620*

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

Table 4-12. Length-at-age for Arctic Char captured during backpack electrofishing surveys of Sheardown Lake NW, fall 2014.

Age Class	Fork Length (mm)			
	n[1]	Mean	SD[2]	Range
0	0	-	-	-
1	4	65	10	55 - 76
2	8	108	16	72 - 124
3	2	105	4	102 - 108
4	1	120	-	-
5	1	155	-	-
6	1	163	-	-
7	0	-	-	-
8	0	-	-	-
9	0	-	-	-
10	0	-	-	-
Total	*17*	*104*	*30*	*55 - 163*

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

Table 4-13. Length-at-age for Arctic Char captured during backpack electrofishing surveys of the Mary River, summer 2008.

Age Class	Fork Length (mm)			
	n[1]	Mean	SD[2]	Range
0	0	-	-	-
1	0	-	-	-
2	17	88	12	63 - 108
3	9	106	13	86 - 128
4	1	130	-	-
5	2	150	1	149 - 150
6	0	-	-	-
7	0	-	-	-
8	0	-	-	-
9	0	-	-	-
10	0	-	-	-
Total	*29*	*99*	*21*	*63 - 150*

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

Table 4-14. Length-at-age for Arctic Char captured during gillnetting surveys of Mary Lake South, 2006-2014.

Age Class	Fork Length (mm)			
	n [1]	Mean	SD [2]	Range
0	0	-	-	-
1	0	-	-	-
2	0	-	-	-
3	0	-	-	-
4	0	-	-	-
5	0	-	-	-
6	0	-	-	-
7	0	-	-	-
8	6	242	77	172 - 355
9	7	290	76	215 - 448
10	11	298	89	167 - 496
11	8	355	90	181 - 465
12	10	371	38	335 - 451
13	11	410	112	241 - 658
14	11	408	80	325 - 615
15	12	382	23	334 - 418
16	8	412	39	370 - 490
17	3	507	55	471 - 570
18	4	428	75	385 - 540
19	2	500	95	432 - 567
20	0	-	-	-
21	2	486	84	426 - 545
22	0	-	-	-
23	3	529	93	424 - 602
24	1	685	-	-
Total	*99*	*380*	*102*	*167 - 685*

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

Table 4-15. Length-at-age for Arctic Char captured during backpack electrofishing surveys of Mary Lake South, fall 2014.

Age Class	Fork Length (mm)			
	n[1]	Mean	SD[2]	Range
0	12	53	6	41 - 64
1	10	63	8	55 - 78
2	4	105	14	94 - 124
3	1	120	-	-
4	0	-	-	-
5	0	-	-	-
6	0	-	-	-
7	0	-	-	-
8	0	-	-	-
9	0	-	-	-
10	0	-	-	-
Total	*27*	*67*	*22*	*41 - 124*

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

Table 4-16. Length-at-age for Arctic Char captured during gillnetting surveys of Camp Lake, 2006-2014.

Age Class	Fork Length (mm)			
	n [1]	Mean	SD [2]	Range
0	0	-	-	-
1	0	-	-	-
2	0	-	-	-
3	0	-	-	-
4	1	228	-	-
5	2	204	41	175 - 233
6	3	187	15	170 - 197
7	4	203	25	171 - 230
8	2	246	1	245 - 247
9	5	241	47	192 - 309
10	1	256	-	-
11	6	325	32	280 - 376
12	4	323	8	312 - 330
13	3	348	18	335 - 368
14	2	326	15	315 - 336
15	0	-	-	-
16	2	354	13	345 - 363
17	1	647	-	-
18	0	-	-	-
19	1	751	-	-
20	0	-	-	-
21	0	-	-	-
22	0	-	-	-
23	0	-	-	-
24	0	-	-	-
Total	*37*	*297*	*116*	*170 - 751*

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

Table 4-17. Hoopnetting information for waterbodies in the mine area, summer and fall 2014.

Waterbody & Site	UTM Coordinates		Water Temperature (°C)	Set Date	Set Time	Check Date	Check Time	Duration (dec.hrs)
	Easting	Northing						
Camp Lake Tributary 1 CLT1-HN US	557645	7914878	11.0	26-Jul	8:45	27-Jul	7:30	22.75
			-	27-Jul	7:30	28-Jul	13:28	29.97
			-	28-Jul	13:28	29-Jul	7:33	18.08
Camp Lake Tributary 2 CLT2-HN US	557442	7915000	-	26-Jul	9:00	27-Jul	7:45	22.75
			-	27-Jul	7:45	28-Jul	13:52	30.12
			-	28-Jul	13:52	29-Jul	7:45	17.88
Camp Lake Tributary 2 CLT2-HN DS	557442	7915000	-	26-Jul	9:10	27-Jul	8:06	22.93
			-	27-Jul	8:06	28-Jul	14:05	29.98
			-	28-Jul	14:05	29-Jul	7:57	17.87
Sheardown Lake Tributary 1 SDLT1-HN DS	560394	7913553	5.5	21-Aug	7:45	22-Aug	19:45	36.00
			-	22-Aug	19:45	23-Aug	19:13	23.47
			7.0	23-Aug	19:13	24-Aug	18:55	23.70
			6.5	24-Aug	18:55	25-Aug	16:51	21.93
			8.0	25-Aug	16:51	26-Aug	18:30	25.65
			9.0	26-Aug	18:30	27-Aug	19:18	24.80
			-	27-Aug	19:18	28-Aug	18:43	23.42
			-	28-Aug	18:43	29-Aug	19:12	24.48
			8.5	29-Aug	19:12	31-Aug	17:51	46.65

Table 4-18. Catch totals for hoopnetting surveys in Camp Lake Tributaries, summer 2014.

Site	Check Date	Catch		
		Arctic Char	Ninespine Stickleback	All Species
CLT1-HN US	27-Jul	190	2	192
	28-Jul	582	-	582
	29-Jul	40	-	40
	Total	*812*	*2*	*814*
CLT2-HN US	27-Jul	134	11	145
	28-Jul	299	3	302
	29-Jul	50	2	52
	Total	*483*	*5*	*499*
CLT2-HN DS	27-Jul	41	4	45
	28-Jul	55	6	61
	29-Jul	50	2	52
	Total	*146*	*8*	*158*

Table 4-19. Catch totals for hoopnetting surveys in Sheardown Lake Tributary 1, fall 2014.

Check Date	Deployment Duration (hrs)	Catch		
		Arctic Char	Ninespine Stickleback	All Species
22-Aug	36.00	21	5	26
23-Aug	23.47	50	11	61
24-Aug	23.70	46	2	48
25-Aug	21.93	17	2	19
26-Aug	25.65	15	1	16
27-Aug	24.80	27	5	32
28-Aug	23.42	13	0	13
29-Aug	24.48	18	1	19
31-Aug	46.65	112	2	114
Total		*319*	*29*	*348*

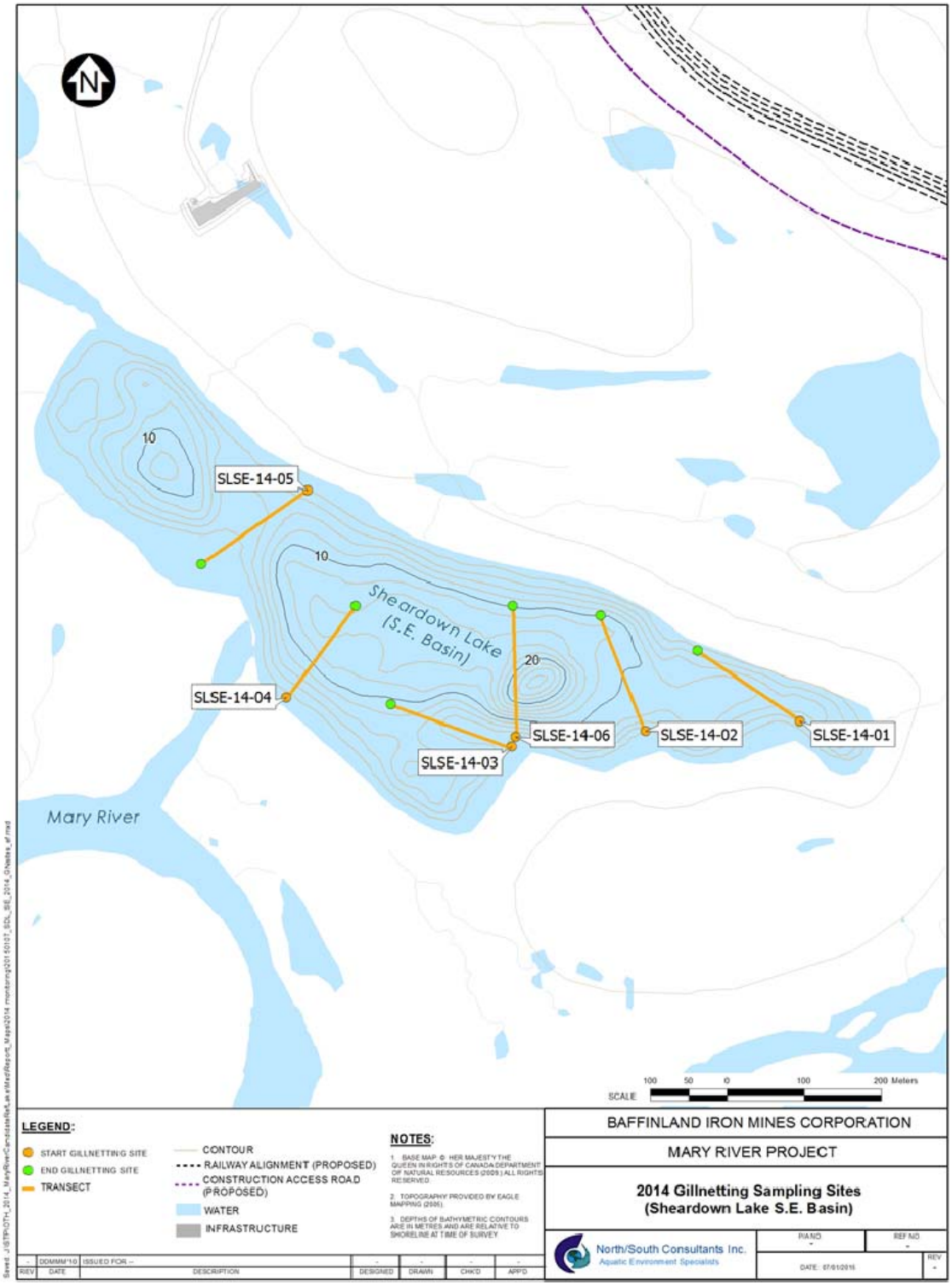

Figure 4-1. Gillnetting sites in Sheardown Lake SE, fall 2014.

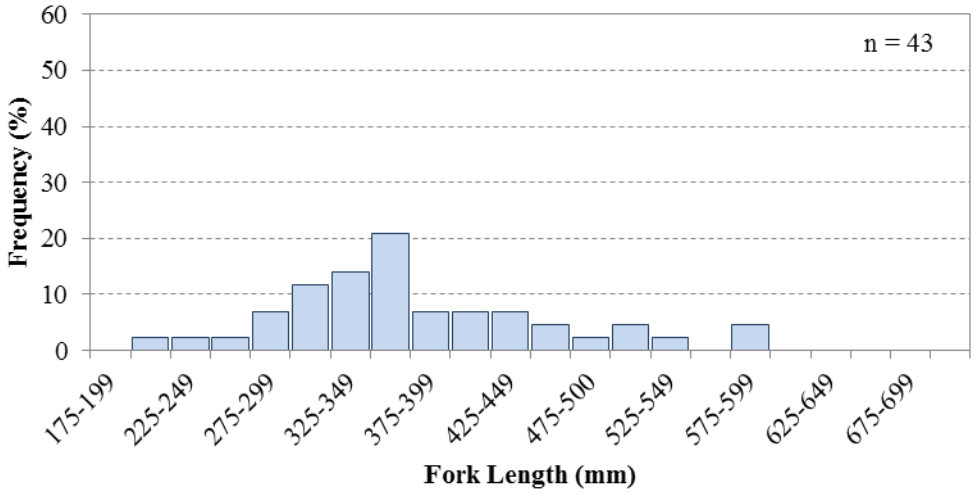

Figure 4-2. Length-frequency distribution for Arctic Char captured during gillnetting in Sheardown Lake SE, fall 2014.

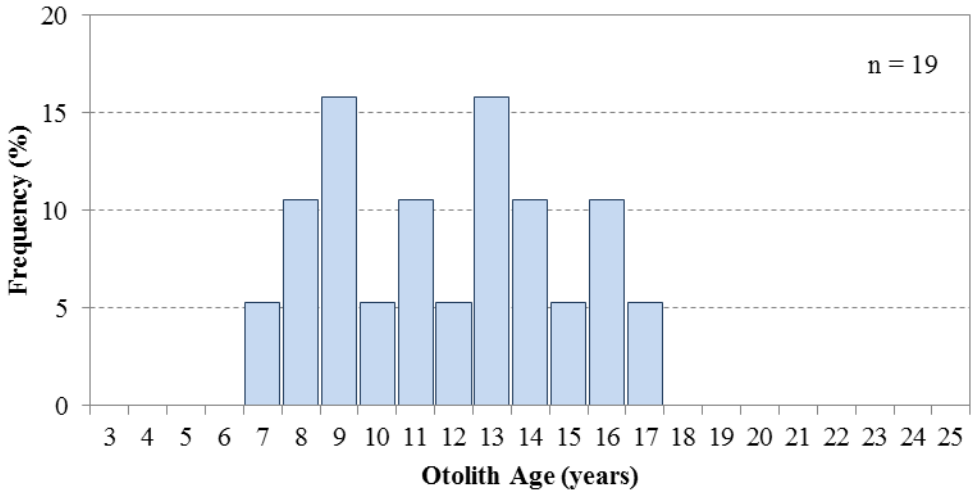

Figure 4-3. Age-frequency distribution for Arctic Char captured during gillnetting in Sheardown Lake SE, 2006-2014.

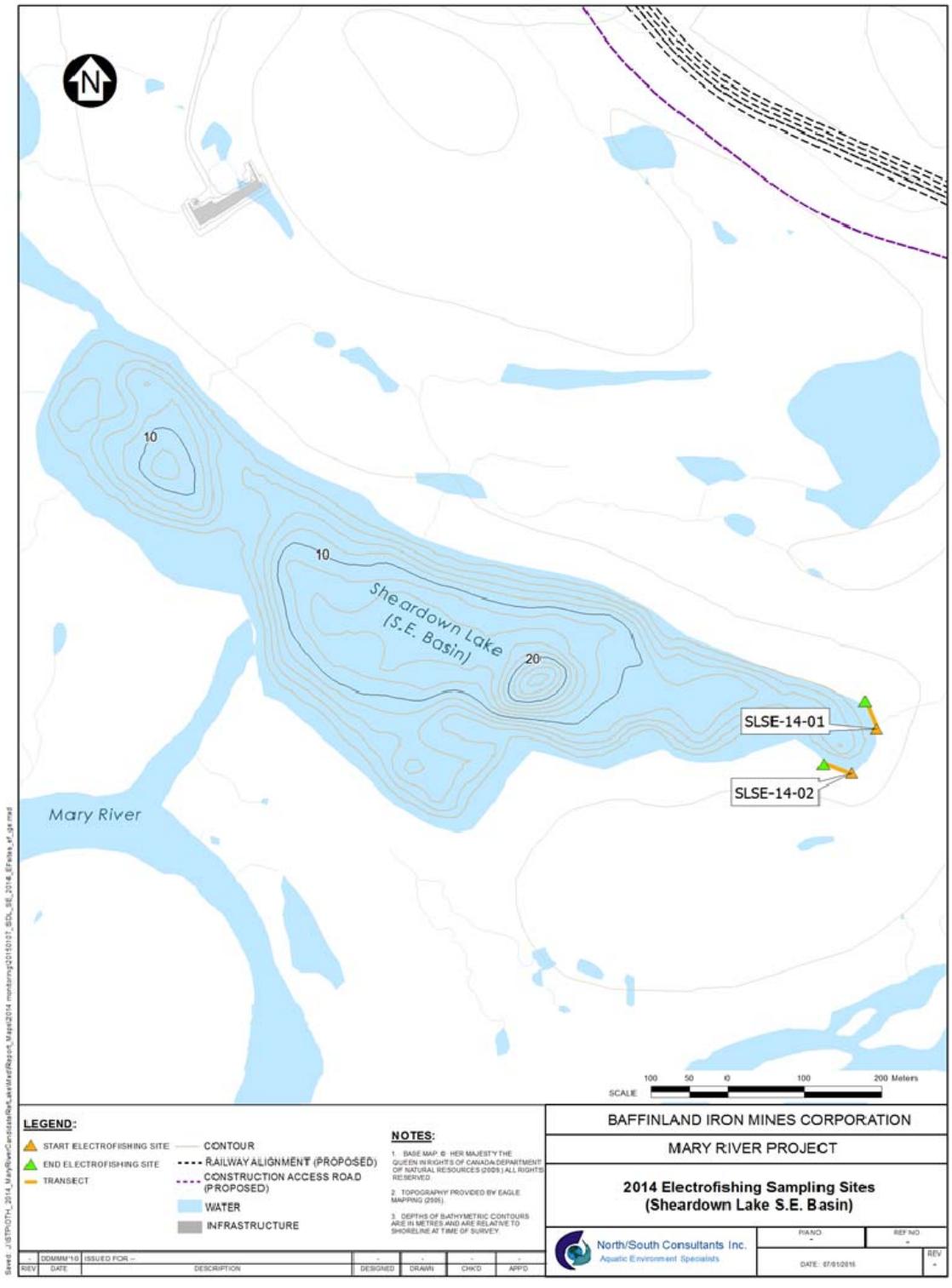

Figure 4-4. Backpack electrofishing sites in Sheardown Lake SE, fall 2014.

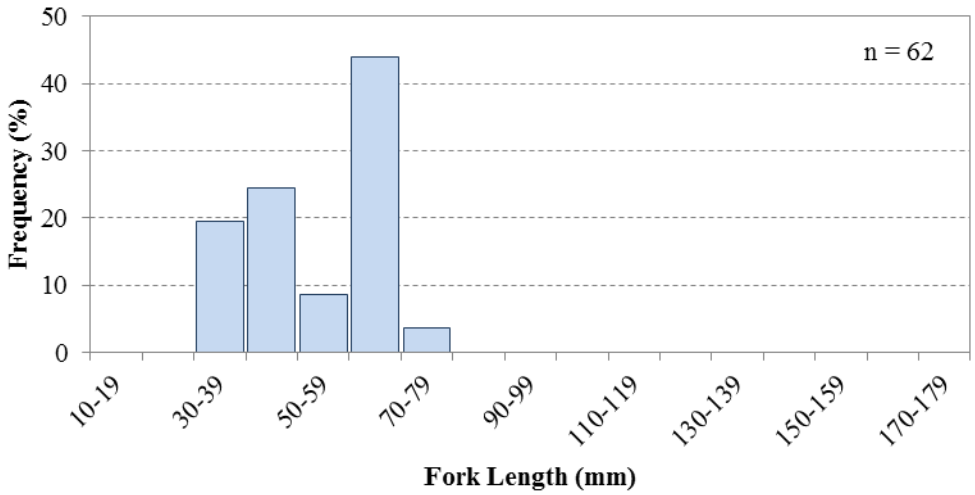

Figure 4-5. Length-frequency distribution for Arctic Char captured during backpack electrofishing surveys in Sheardown Lake SE, fall 2014.

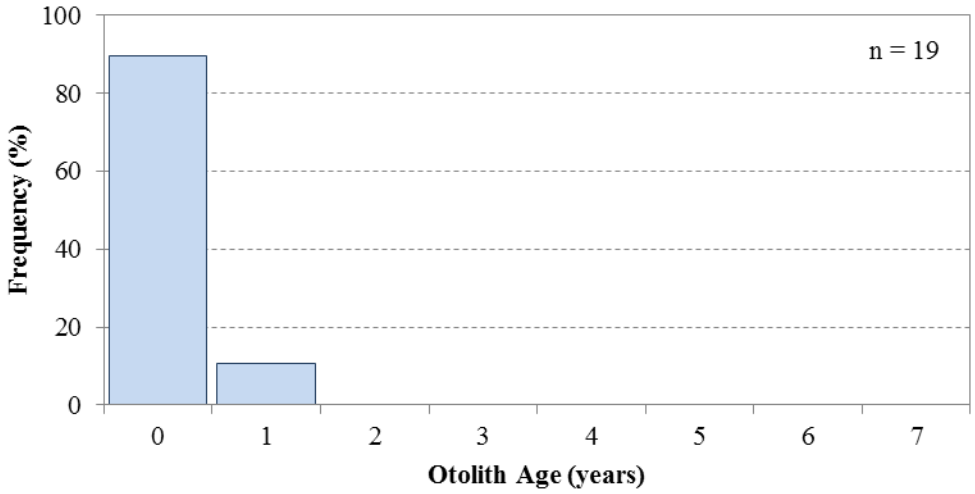

Figure 4-6. Age-frequency distribution for Arctic Char captured during backpack electrofishing surveys in Sheardown Lake SE, fall 2014.

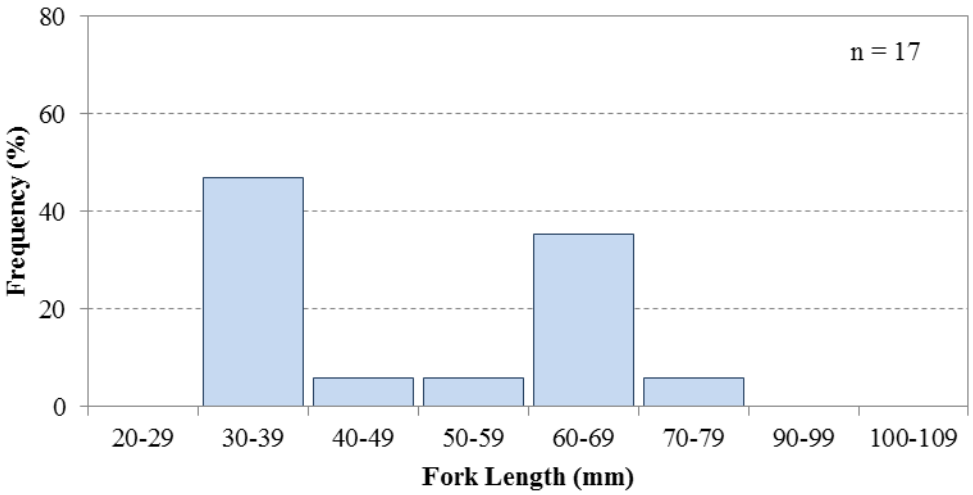

Figure 4-7. Length-frequency distribution for young-of-the-year (YOY) Arctic Char captured during backpack electrofishing surveys in Sheardown Lake SE, fall 2014.

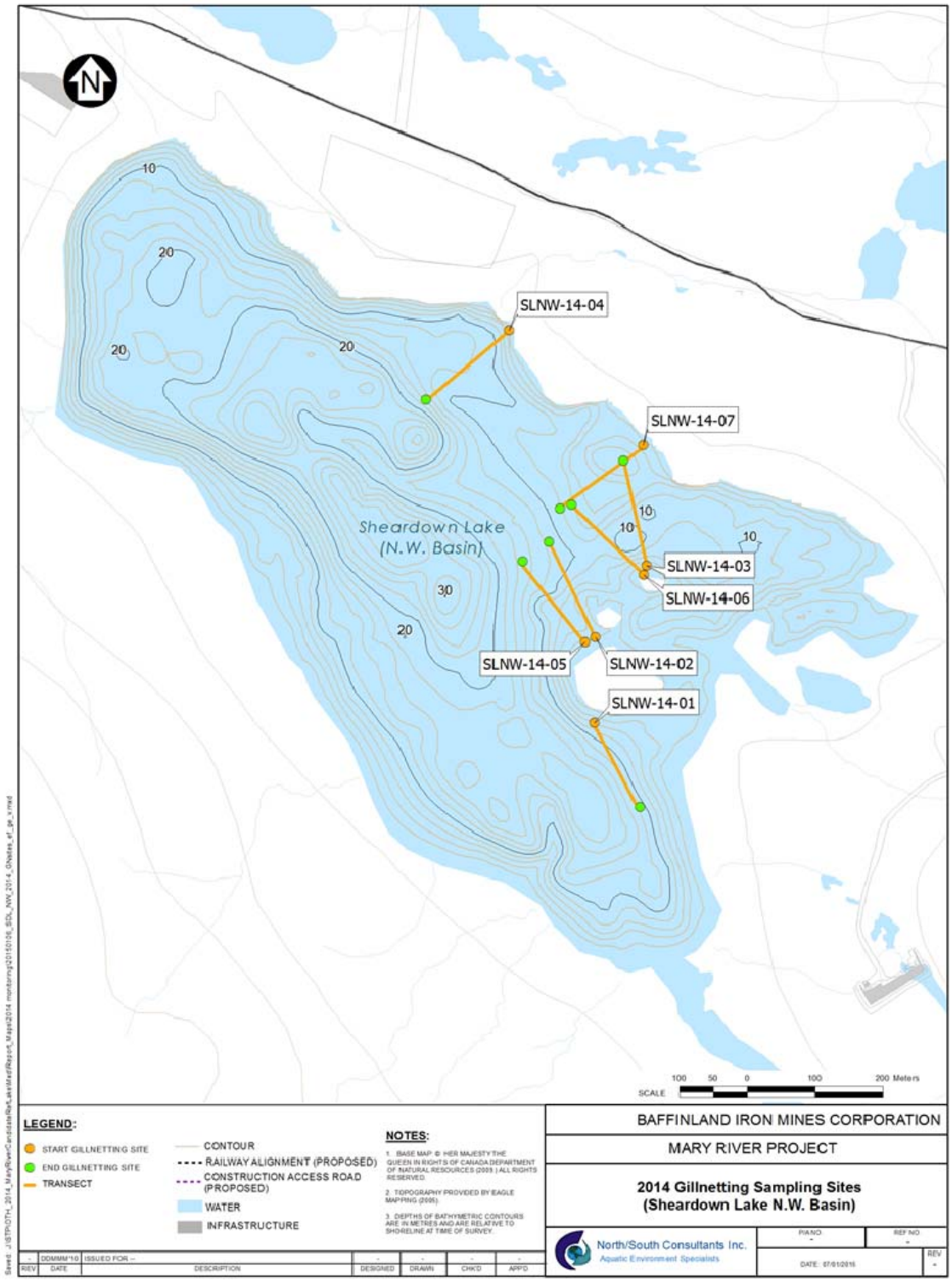

Figure 4-8. Gillnetting sites in Sheardown Lake NW, fall 2014.

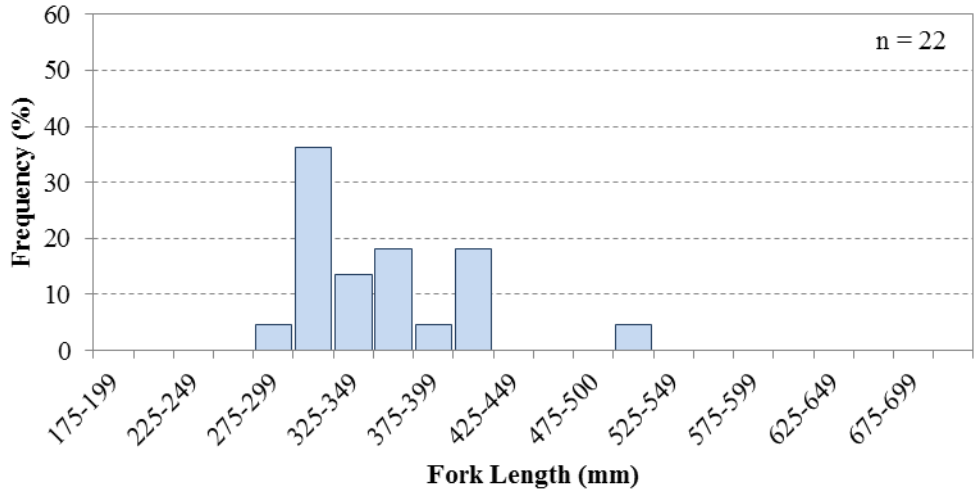

Figure 4-9. Length-frequency distribution for Arctic Char captured during gillnetting in Sheardown Lake NW, fall 2014.

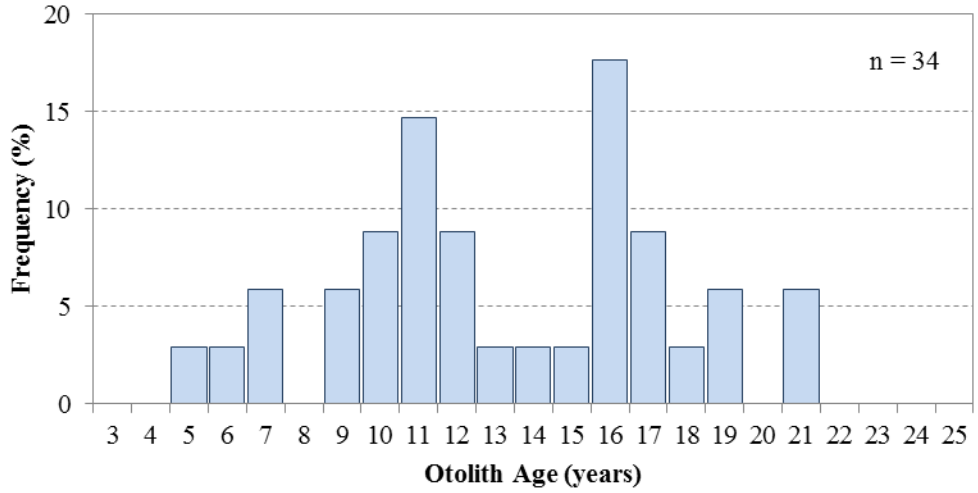

Figure 4-10. Age-frequency distribution for Arctic Char captured during gillnetting in Sheardown Lake NW, 2006-2014.

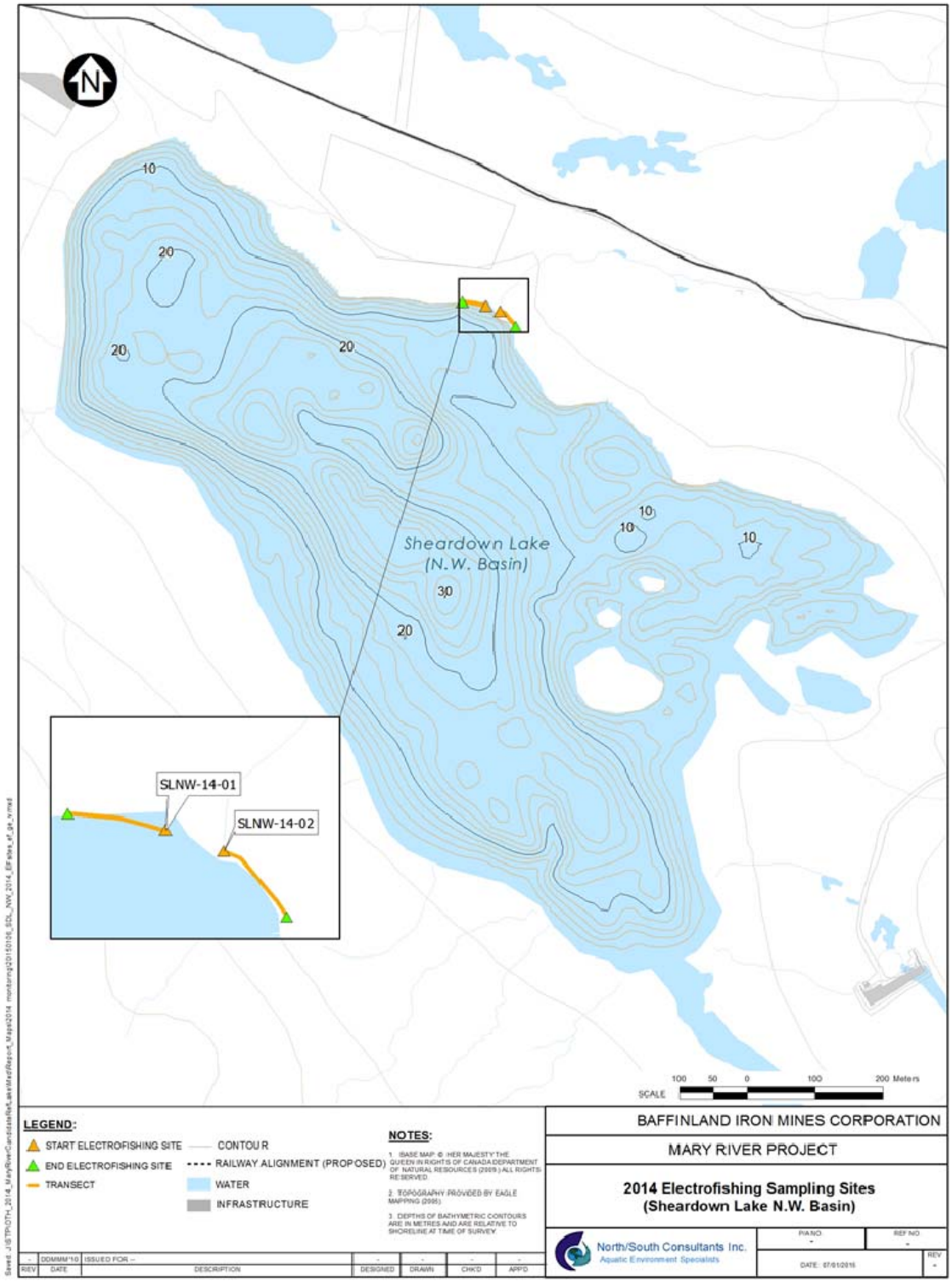

Figure 4-11. Backpack electrofishing sites in Sheardown Lake NW, fall 2014.

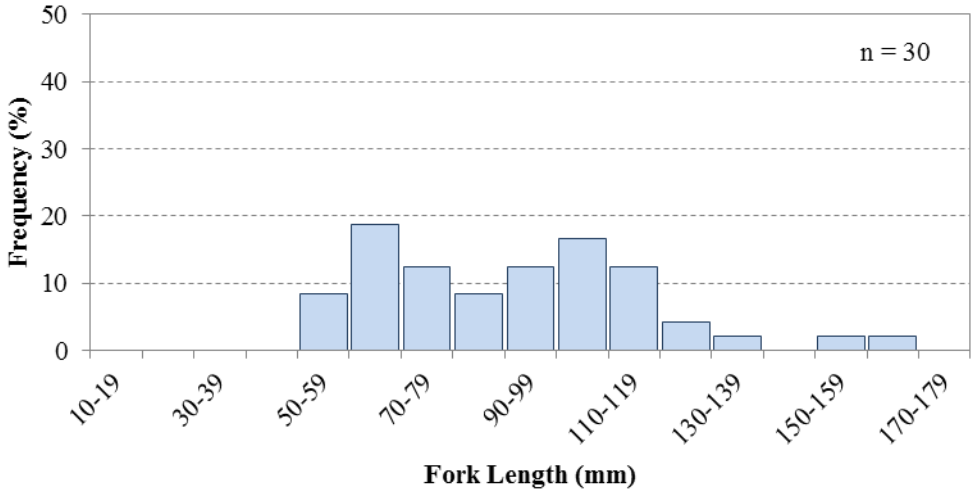

Figure 4-12. Length-frequency distribution for Arctic Char captured during backpack electrofishing surveys in Sheardown Lake NW, fall 2014.

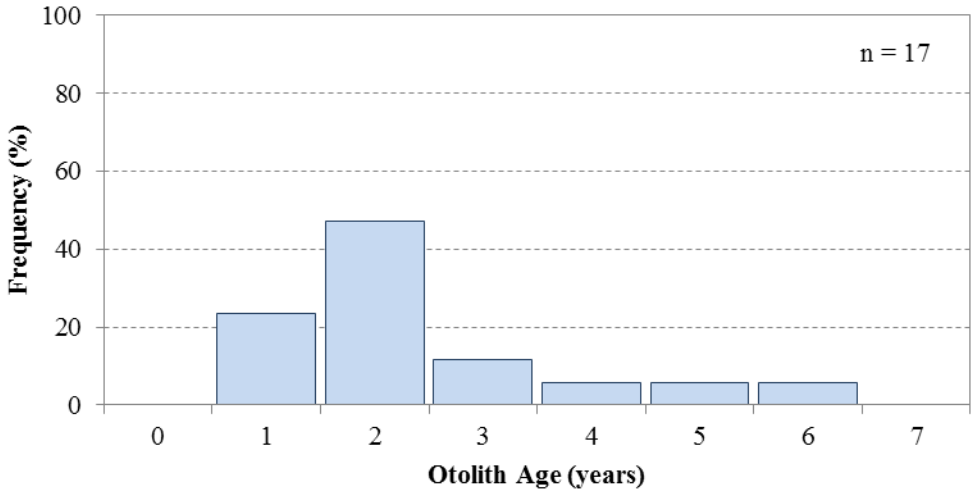

Figure 4-13. Age-frequency distribution for Arctic Char captured during backpack electrofishing surveys in Sheardown Lake NW, fall 2014.

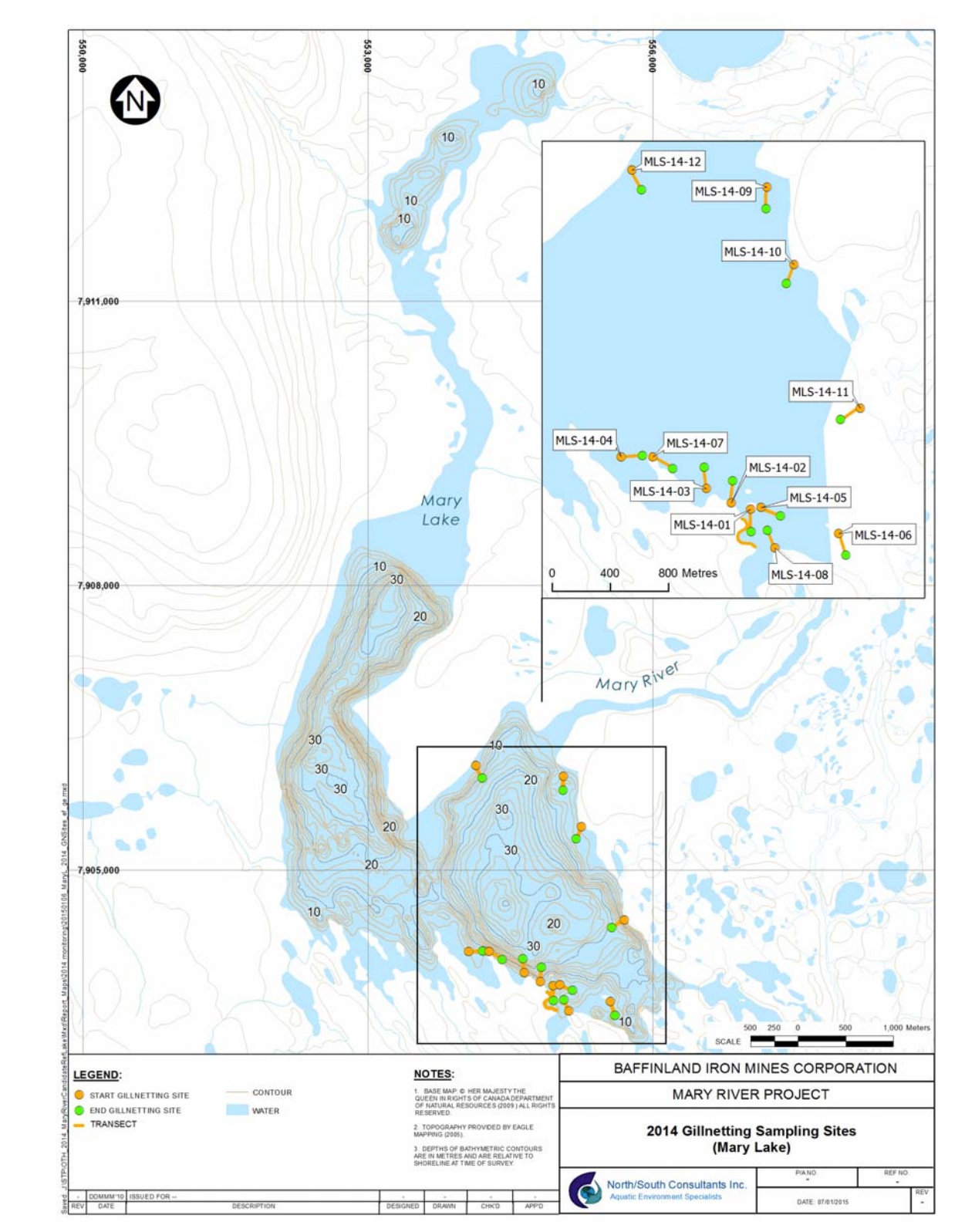

Figure 4-14. Gillnetting sites in Mary Lake, fall 2014.

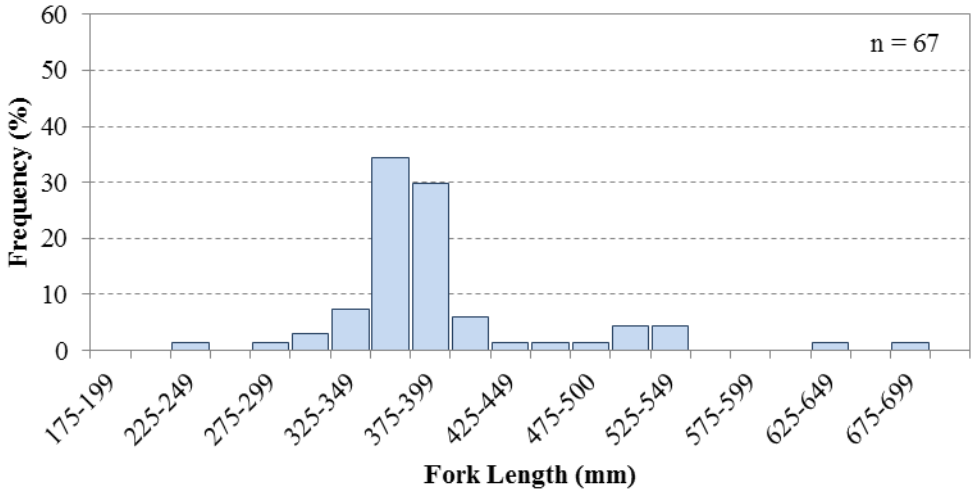

Figure 4-15. Length-frequency distribution for Arctic Char captured during gillnetting in Mary Lake South, fall 2014.

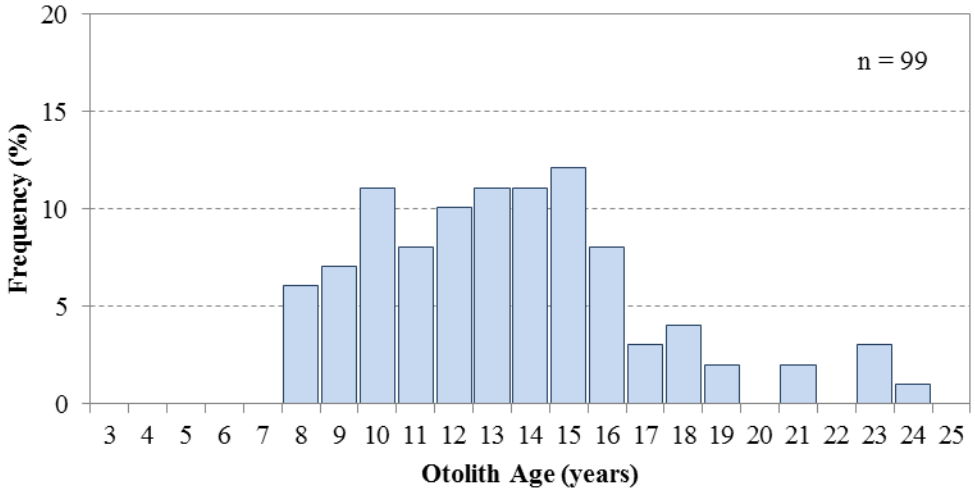

Figure 4-16. Age-frequency distribution for Arctic Char captured during gillnetting in Mary Lake South, 2006-2014.

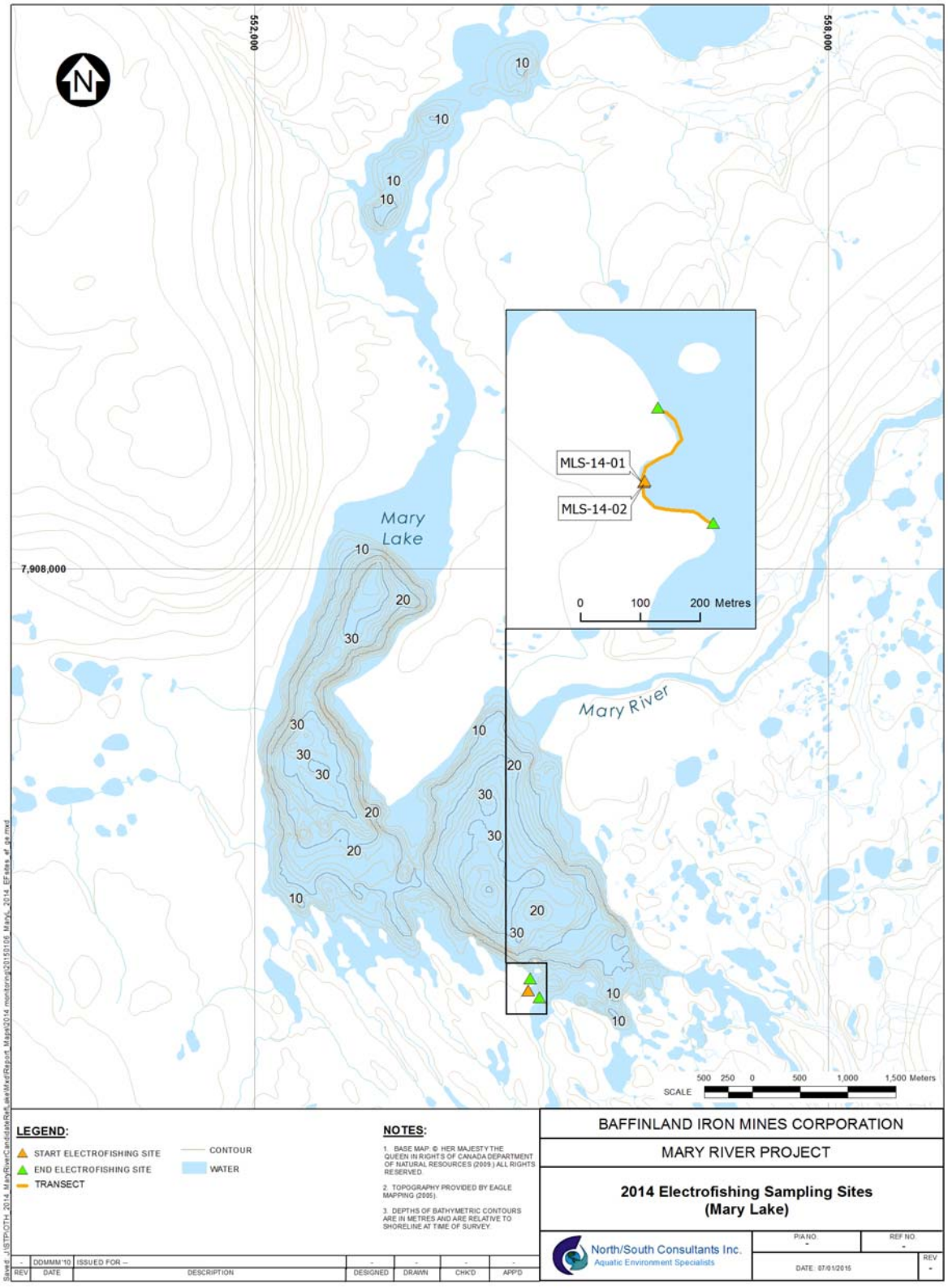

Figure 4-17. Backpack electrofishing sites in Mary Lake, fall 2014.

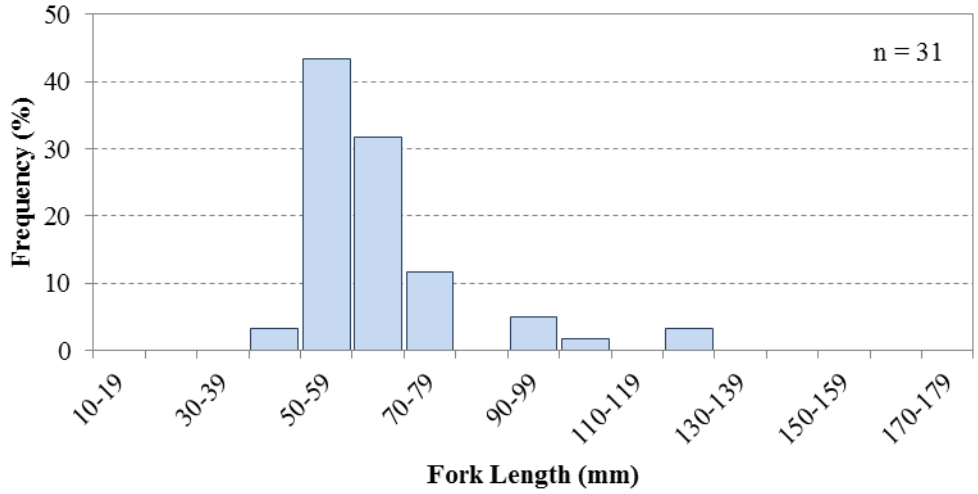

Figure 4-18. Length-frequency distribution for Arctic Char captured during backpack electrofishing in Mary Lake South, fall 2014.

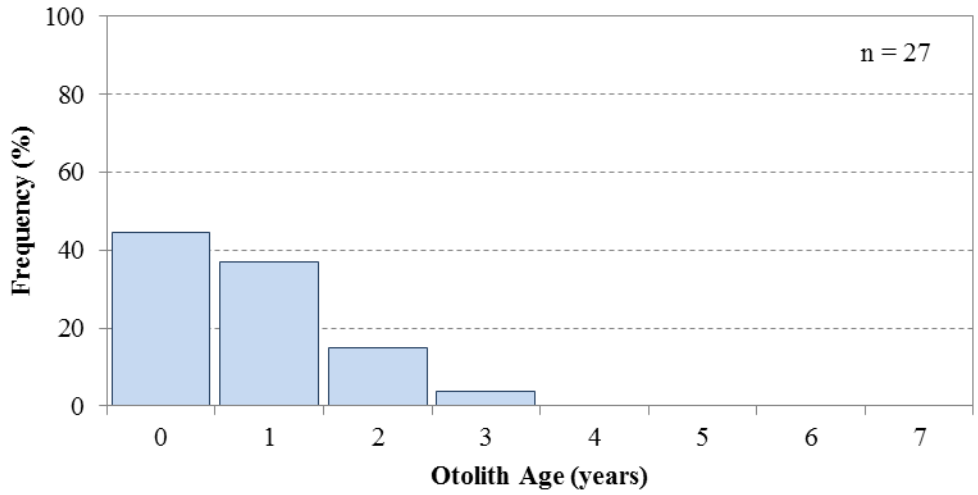

Figure 4-19. Age-frequency distribution for Arctic Char captured during backpack electrofishing in Mary Lake South, fall 2014.

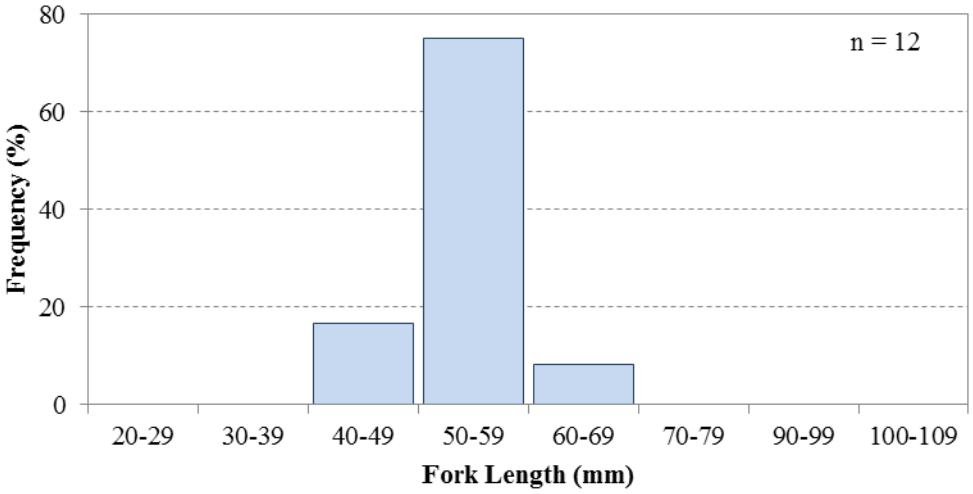

Figure 4-20. Length-frequency distribution for young-of-the-year (YOY) Arctic Char captured during backpack electrofishing in Mary Lake South, fall 2014.

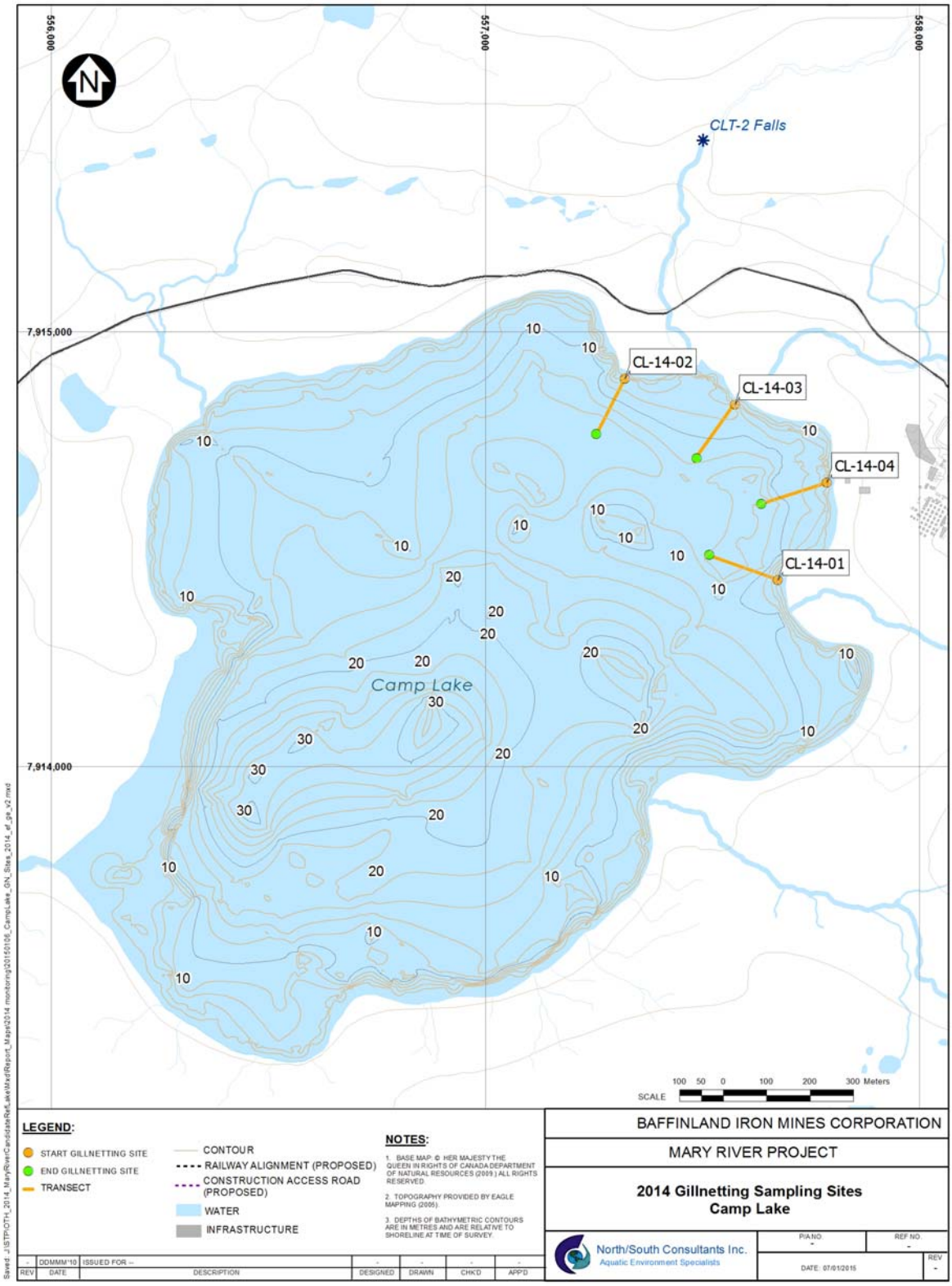

Figure 4-21. Gillnetting sites in Camp Lake, fall 2014.

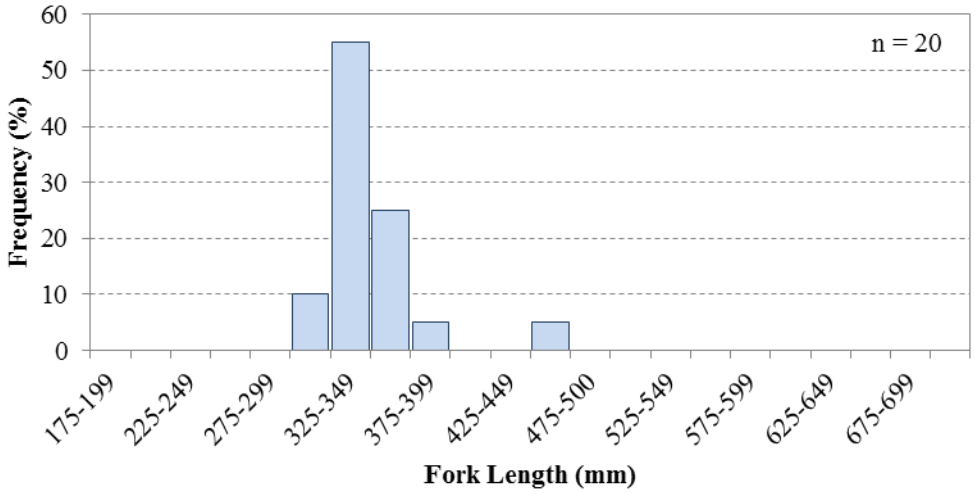

Figure 4-22. Length-frequency distribution for Arctic Char captured during gillnetting in Camp Lake, fall 2014.

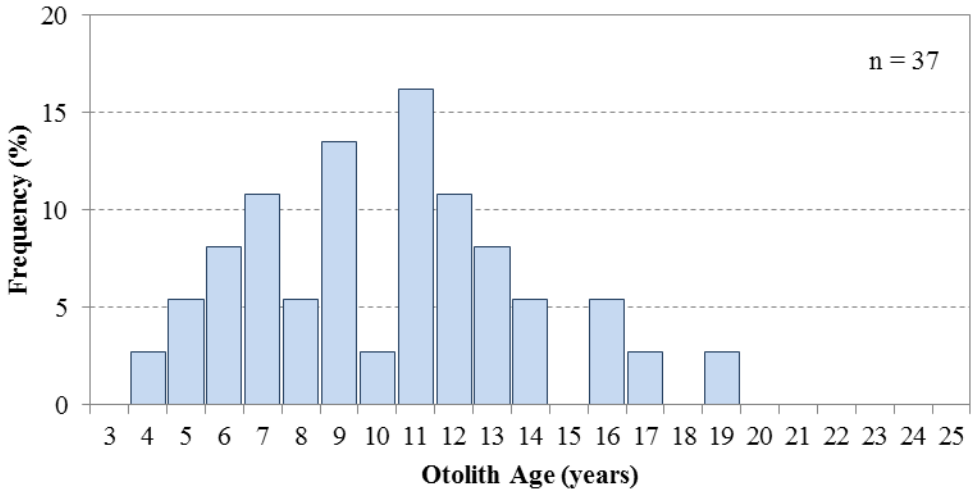

Figure 4-23. Age-frequency distribution for Arctic Char captured during gillnetting in Camp Lake, 2006-2014.

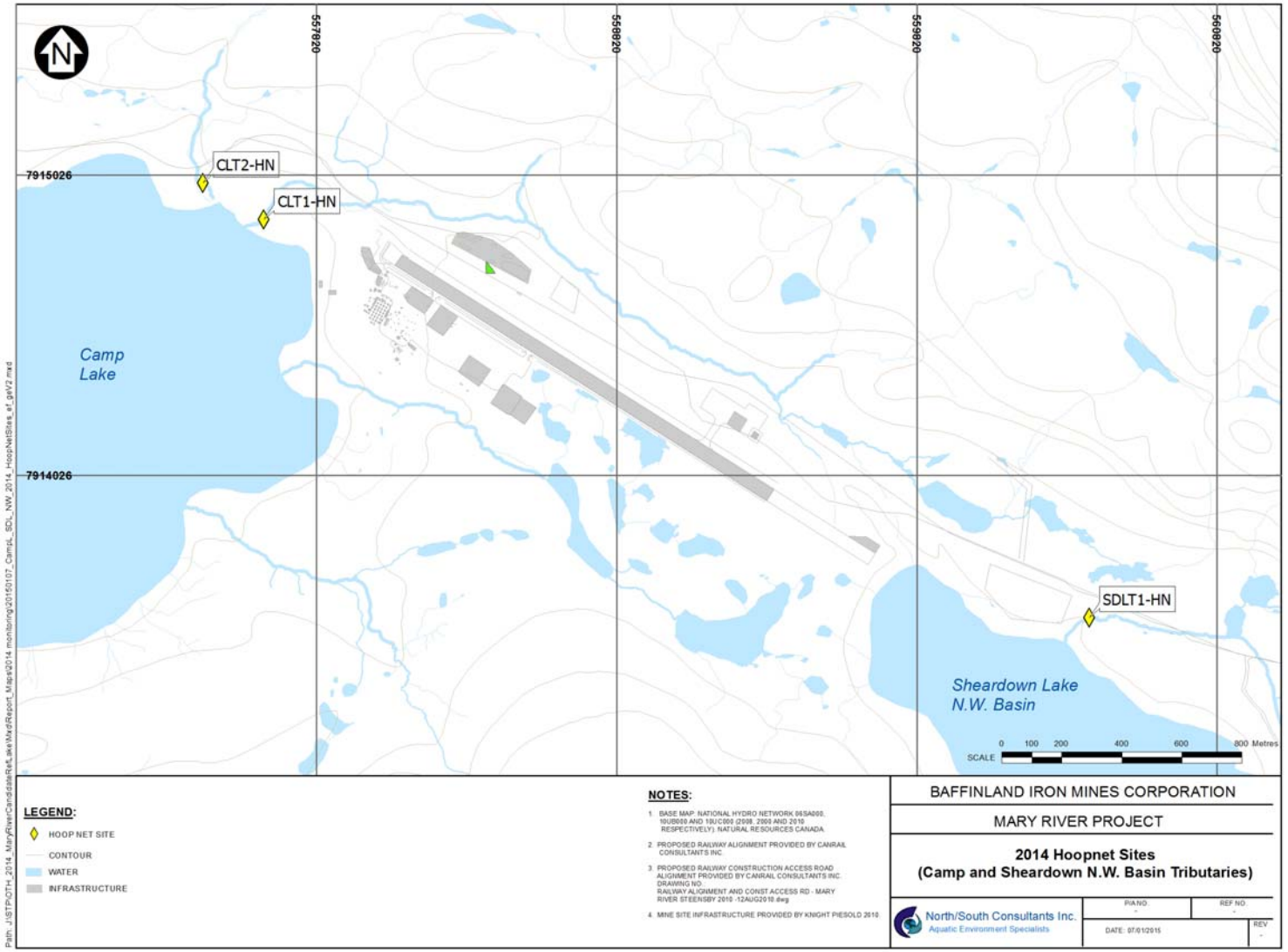

Figure 4-24. Hoopnetting sites in mine area streams, fall 2014.

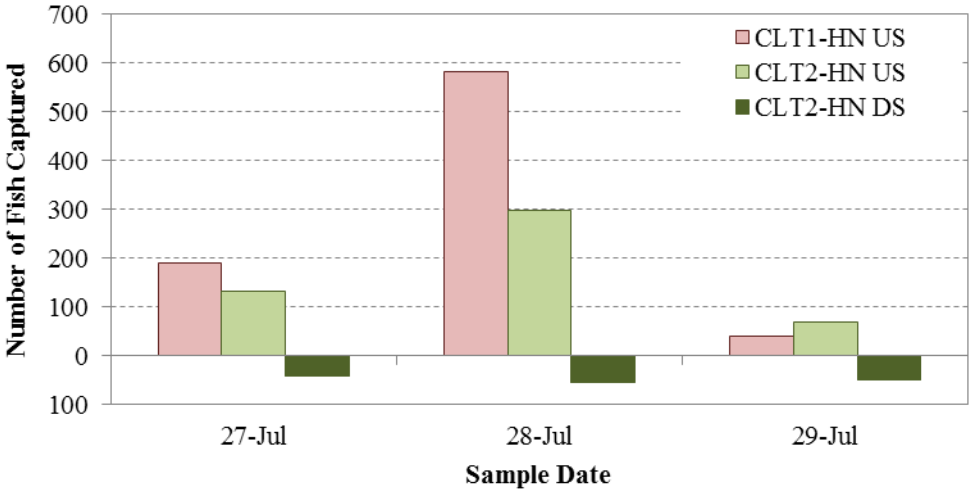

Figure 4-25. Daily catches of Arctic Char in hoop nets set in Camp Lake tributaries, summer 2014.

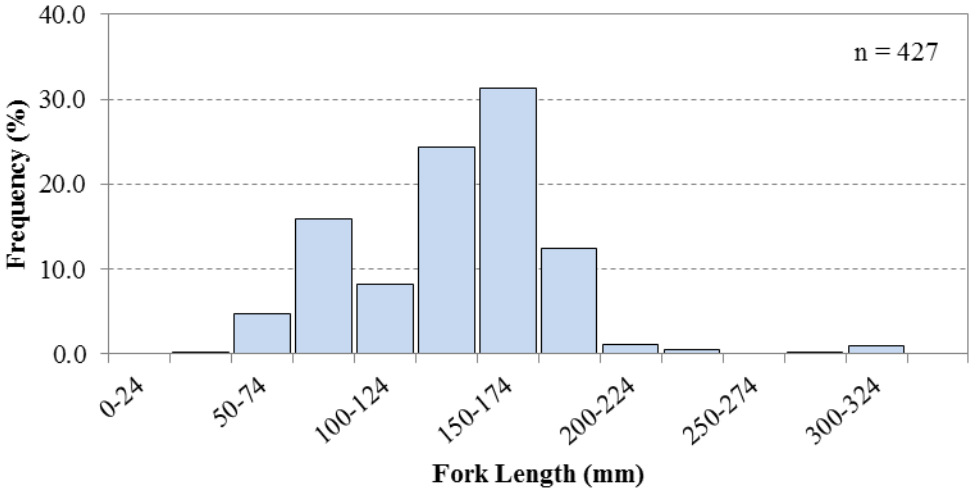

Figure 4-26. Length-frequency distribution for Arctic Char captured during hoopnetting surveys in Camp Lake tributaries, summer 2014.

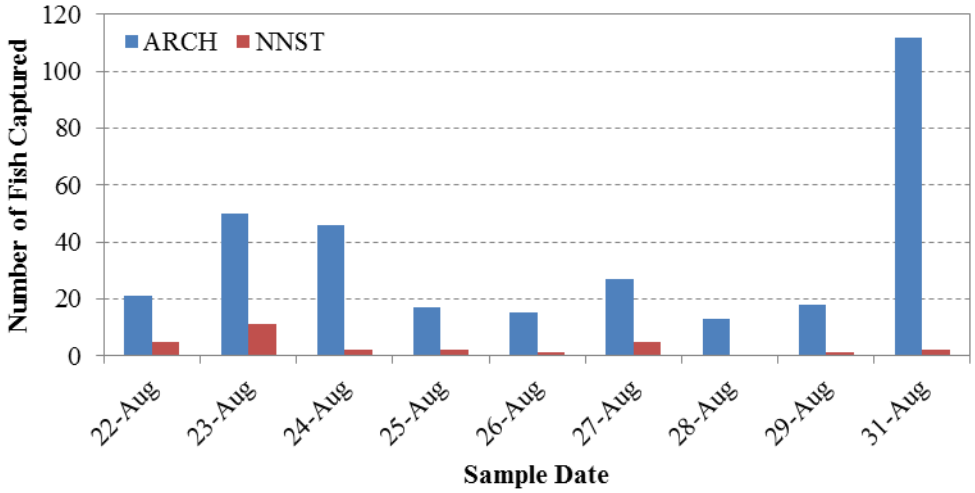

Figure 4-27. Daily catches of Arctic Char and Ninespine Stickleback in hoop nets set in Sheardown Lake Tributary 1, fall 2014.

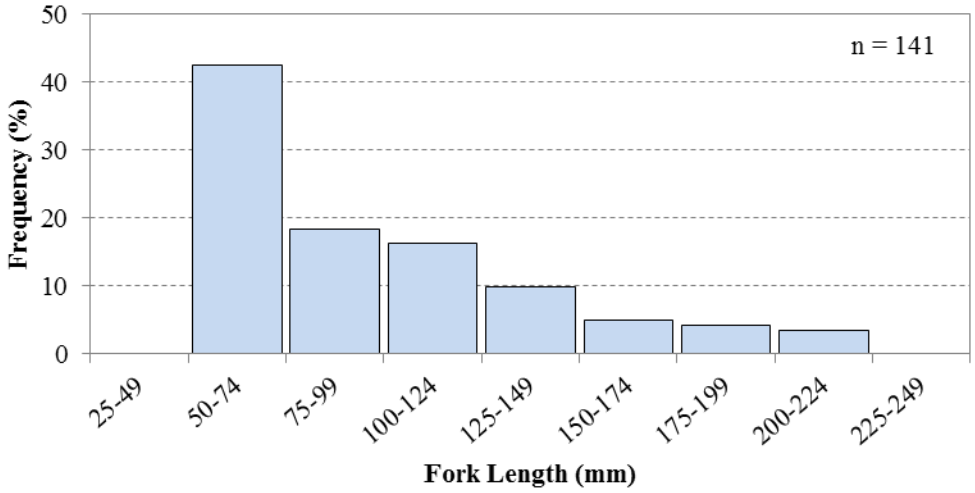

Figure 4-28. Length-frequency distribution for Arctic Char captured during hoopnetting surveys in Sheardown Lake Tributary 1, fall 2014.

5.0 LITERATURE CITED

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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.

APPENDIX 1.

FIELD DATA COLLECTED DURING THE PHYTOPLANKTON AND ZOOPLANKTON SAMPLING PROGRAM: 2014

Table A1-1. Metadata and inventory of phytoplankton taxonomy and biomass sampling conducted in mine area lakes, 2014.

Waterbody	Site ID	UTM Coordinates (Zone 17W)		Sampling Date	Sampling Time	Season	Replicate	Total depth (m)	Secchi Disk Depth (m)	Sample Depth (m)
		Easting	Northing							
Camp Lake	JL0-01	557108	7914369	23-Aug-14	15:50	Fall	REP 1	16.65	3.50	0-10.5
	JL0-02	557615	7914750	27-Jul-14	17:12	Summer	REP 1	12.15	5.25	0-10
	JL0-02	557615	7914750	27-Jul-14	17:12	Summer	REP 2	12.15	5.25	0-10
	JL0-02	557615	7914750	27-Jul-14	17:12	Summer	REP 3	12.15	5.25	0-10
	JL0-02	557615	7914750	27-Jul-14	17:15	Summer	REP 1	12.15	5.25	10-12
	JL0-02	557615	7914750	23-Aug-14	18:50	Fall	REP 1	11.40	5.50	0-10
	JL0-07	556800	7914094	23-Aug-14	14:00	Fall	REP 1	32.30	5.00	0-10
	JL0-07	556800	7914094	23-Aug-14	14:00	Fall	REP 1	32.30	5.00	10-15.0
	JL0-09	556335	7913936	23-Aug-14	12:00	Fall	REP 1	12.80	5.25	0-10
	JL0-10	557346	7914562	23-Aug-14	17:50	Fall	REP 1	8.90	4.70	0-7.9
	JL0-10	557346	7914562	23-Aug-14	17:50	Fall	REP 2	8.90	4.70	0-7.9
	JL0-10	557346	7914562	23-Aug-14	17:50	Fall	REP 3	8.90	4.70	0-7.9
Sheardown Lake NW	DL0-01-1	560080	7913128	25-Jul-14	14:32	Summer	REP 1	21.65	4.10	0-10
	DL0-01-1	560080	7913128	25-Jul-14	14:34	Summer	REP 1	21.65	4.10	10-12.3
	DL0-01-1	560080	7913128	25-Aug-14	10:15	Fall	REP 1	12.10	4.50	0-10
	DL0-01-2	560353	7912924	25-Jul-14	11:25	Summer	REP 1	18.33	4.05	0-10
	DL0-01-2	560353	7912924	25-Jul-14	11:25	Summer	REP 1	18.33	4.05	10-12
	DL0-01-2	560353	7912924	25-Aug-14	11:20	Fall	REP 1	15.70	5.00	0-10
	DL0-01-2	560353	7912924	25-Aug-14	11:20	Fall	REP 1	15.70	5.00	10-15.0
	DL0-01-4	560695	7913043	25-Jul-14	12:12	Summer	REP 1	6.10	4.35	0-6
	DL0-01-4	560635	7913043	25-Aug-14	15:20	Fall	REP 1	7.00	6.00	0-6
	DL0-01-5	559798	7913356	25-Jul-14	13:35	Summer	REP 1	23.60	4.20	0-10
	DL0-01-5	559798	7913356	25-Jul-14	13:40	Summer	REP 1	23.60	4.20	10-12.6
	DL0-01-5	559798	7913356	24-Aug-14	17:50	Fall	REP 1	22.80	5.50	0-10
	DL0-01-5	559798	7913356	24-Aug-14	17:50	Fall	REP 1	22.80	5.50	10-16.5
	DL0-01-7	560525	7912609	25-Jul-14	10:15	Summer	REP 1	12.00	4.10	0-10
	DL0-01-7	560525	7912609	25-Jul-14	10:15	Summer	REP 2	12.00	4.10	0-10
	DL0-01-7	560525	7912609	25-Jul-14	10:15	Summer	REP 3	12.00	4.10	0-10
	DL0-01-7	560525	7912609	25-Jul-14	10:18	Summer	REP 1	12.00	4.10	10-12

Table A1-1. - continued -

Waterbody	Site ID	UTM Coordinates (Zone 17W)		Sampling Date	Sampling Time	Season	Replicate	Total depth (m)	Secchi Disk Depth (m)	Sample Depth (m)
		Easting	Northing							
Sheardown Lake NW	DL0-01-7	560525	7912609	25-Aug-14	16:15	Fall	REP 1	10.70	6.00	0-9.7
	DL0-01-7	560525	7912609	25-Aug-14	16:15	Fall	REP 2	10.70	6.00	0-9.7
	DL0-01-7	560525	7912609	25-Aug-14	16:15	Fall	REP 3	10.70	6.00	0-9.7
	DD-HAB9-STN1	560259	7913455	25-Jul-14	15:28	Summer	REP 1	10.00	4.20	0-9
	DD-HAB9-STN1	560259	7913455	25-Aug-14	17:10	Fall	REP 1	5.50	5.50	0-4.5
Sheardown Lake SE	DL0-02-3	561046	7911915	24-Jul-14	16:20	Summer	REP 1	14.00	1.35	0-4.05
	DL0-02-3	561043	7911915	24-Aug-14	14:15	Fall	REP 1	13.50	2.10	0-6.3
	DL0-02-3	561043	7911915	24-Aug-14	14:15	Fall	REP 1	13.50	2.10	0-6.3
	DL0-02-4	561511	7911833	24-Jul-14	13:15	Summer	REP 1	9.10	1.15	0-3.45
	DL0-02-4	561511	7911832	24-Aug-14	12:05	Fall	REP 1	7.30	2.30	0-6.9
	DL0-02-6	560756	7912167	24-Jul-14	17:50	Summer	REP 1	7.40	1.60	0-4.80
	DL0-02-6	560756	7912167	24-Aug-14	16:05	Fall	REP 1	6.70	2.00	0-6
	DL0-02-7	560952	7912055	24-Jul-14	17:00	Summer	REP 1	4.00	1.50	0-5.50
	DL0-02-7	560952	7912054	24-Aug-14	14:55	Fall	REP 1	4.00	2.00	0-3
	DL0-02-8	561301	7911847	24-Jul-14	14:45	Summer	REP 1	13.15	1.05	0-3.15
	DL0-02-8	561301	7911646	24-Aug-14	13:05	Fall	REP 1	13.05	2.50	0-7.5
Mary Lake South	BL0-03	552680	7906651	26-Jul-14	16:44	Summer	REP 1	15.33	2.45	0-7.35
	BL0-03	552680	7906651	26-Jul-14	16:44	Summer	REP 2	15.33	2.45	0-7.35
	BL0-03	552680	7906651	26-Jul-14	16:44	Summer	REP 3	15.33	2.45	0-7.35
	BL0-03	552680	7906651	25-Aug-14	16:15	Fall	REP 1	17.75	4.50	0-13.5
	BL0-03	552680	7906651	25-Aug-14	16:15	Fall	REP 2	17.75	4.50	0-13.5
	BL0-03	552680	7906651	25-Aug-14	16:15	Fall	REP 3	17.75	4.50	0-13.5
	BL0-04	553817	7904886	27-Jul-14	11:25	Summer	REP 1	21.80	2.90	0-8.7
	BL0-04	553817	7904886	25-Aug-14	17:35	Fall	REP 1	21.46	3.60	0-10.20
	BL0-05	554632	7906031	27-Jul-14	13:25	Summer	REP 1	21.55	1.05	0-3.15
	BL0-05	554632	7906031	26-Aug-14	13:05	Fall	REP 1	18.32	3.16	0-9.5
	BL0-05-A	554530	7906478	27-Jul-14	12:19	Summer	REP 1	12.30	1.50	0-4.5
	BL0-05-A	554530	7906478	26-Aug-14	13:52	Fall	REP 1	12.43	2.27	0-6.8
	BL0-05-B	555034	7905692	27-Jul-14	14:07	Summer	REP 1	8.25	1.25	0-3.75

Table A1-1. - continued -

Waterbody	Site ID	UTM Coordinates (Zone 17W)		Sampling Date	Sampling Time	Season	Replicate	Total depth (m)	Secchi Disk Depth (m)	Sample Depth (m)
		Easting	Northing							
Mary Lake South	BL0-05-B	555034	7905692	27-Jul-14	14:07	Summer	REP 2	8.25	1.25	0-3.75
	BL0-05-B	555034	7905692	27-Jul-14	14:07	Summer	REP 3	8.25	1.25	0-3.75
	BL0-05-B	555034	7905692	26-Aug-14	12:15	Fall	REP 1	8.00	2.87	0-7
	BL0-06	555924	7903760	27-Jul-14	9:00	Summer	REP 1	9.33	2.90	0-9
	BL0-06	555924	7903760	26-Aug-14	11:09	Fall	REP 1	10.15	2.86	0-8.5
	BL0-09	554715	7904480	27-Jul-14	10:25	Summer	REP 1	30.15	2.55	0-7.65
	BL0-09	554715	7904479	25-Aug-14	11:28	Fall	REP 1	29.85	2.43	0-7.3
	BL0-01	554691	7913194	26-Jul-14	14:42	Summer	REP 1	10.15	4.25	0-9.0
	BL0-01	554691	7913194	26-Aug-14	17:24	Fall	REP 1	9.50	4.14	0-8.5
	BL0-01-A	554301	7913379	26-Jul-14	13:48	Summer	REP 1	15.95	4.60	0-10
	BL0-01-A	554301	7913379	26-Jul-14	13:51	Summer	REP 1	15.95	4.60	10-13.8
	BL0-01-A	554300	7913378	26-Aug-14	16:10	Fall	REP 1	15.66	4.42	0-10
	BL0-01-A	554300	7913378	26-Aug-14	16:13	Fall	REP 1	15.66	4.42	10-15
	BL0-01-B	554370	7913059	26-Jul-14	12:45	Summer	REP 1	5.30	4.60	0-5.3
	BL0-01-B	554369	7913058	26-Aug-14	18:01	Fall	REP 1	4.95	3.91	0-4

Table A1-2. Metadata and inventory of zooplankton taxonomy and biomass sampling conducted in mine area lakes, 2014.

Waterbody	Site ID	UTM Coordinates (Zone 17W)		Sampling Date	Sampling Time	Season	Replicate	Total Depth (m)	Secchi Disk Depth (m)	Number of Tows	Codend Length (m)	Mesh Size (µm)	Mouth Diameter (m)
		Easting	Northing										
Camp Lake	JL0-01	557108	7914369	23-Aug-14	15:50	Fall	REP 1	16.65	3.50	1	0.44	63	0.12
	JL0-02	557615	7914750	27-Jul-14	17:12	Summer	REP 1	12.15	5.25	1	0.44	63	0.12
	JL0-02	557615	7914750	23-Aug-14	18:50	Fall	REP 1	11.40	5.50	1	0.44	63	0.12
	JL0-07	556800	7914094	23-Aug-14	14:00	Fall	REP 1	32.30	5.00	1	0.44	63	0.12
	JL0-09	556335	7913936	23-Aug-14	12:50	Fall	REP 1	12.80	5.25	2	0.44	63	0.12
	JL0-10	557346	7914562	23-Aug-14	17:50	Fall	REP 1	8.90	4.70	1	0.44	63	0.12
Sheardown Lake NW	DL0-01-1	560080	7913128	25-Jul-14	14:32	Summer	REP 1	21.65	4.10	1	0.44	63	0.12
	DL0-01-1	560080	7913128	25-Aug-14	10:15	Fall	REP 1	12.10	4.50	1	0.44	63	0.12
	DL0-01-2	560353	7912924	25-Jul-14	11:25	Summer	REP 1	18.33	4.05	1	0.44	63	0.12
	DL0-01-2	560353	7912924	25-Aug-14	11:20	Fall	REP 1	15.70	5.00	1	0.44	63	0.12
	DL0-01-4	560695	7913043	25-Jul-14	12:12	Summer	REP 1	6.10	4.35	1	0.44	63	0.12
	DL0-01-4	560635	7913043	25-Aug-14	15:20	Fall	REP 1	7.00	6.00	1	0.44	63	0.12
	DL0-01-5	559798	7913356	25-Jul-14	13:35	Summer	REP 1	23.60	4.20	1	0.44	63	0.12
	DL0-01-5	559798	7913356	24-Aug-14	17:50	Fall	REP 1	22.80	16.50	1	0.44	63	0.12
	DL0-01-7	560525	7912609	25-Jul-14	10:15	Summer	REP 1	12.00	4.10	1	0.44	63	0.12
	DL0-01-7 DUP	560525	7912609	25-Jul-14	10:15	Summer	REP 2	12.00	4.10	1	0.44	63	0.12
	DL0-01-7	560525	7912609	25-Aug-14	16:15	Fall	REP 1	10.70	6.00	1	0.44	63	0.12
	DD-HAB9-STN1	560259	7913455	25-Jul-14	15:28	Summer	REP 1	10.00	4.20	1	0.44	63	0.12
	DD-HAB9-STN1	560259	7913455	25-Aug-14	17:10	Fall	REP 1	5.50	5.50	2	0.44	63	0.12
Sheardown Lake SE	DL0-02-3	561046	7911915	24-Jul-14	16:20	Summer	REP 1	14.00	1.35	1	0.44	63	0.12
	DL0-02-3	561043	7911915	24-Aug-14	14:15	Fall	REP 1	13.50	2.10	1	0.44	63	0.12
	DL0-02-4	561511	7911833	24-Jul-14	13:15	Summer	REP 1	9.10	1.15	1	0.44	63	0.12
	DL0-02-4	561511	7911832	24-Aug-14	12:05	Fall	REP 1	7.30	2.30	1	0.44	63	0.12
	DL0-02-6	560756	7912167	24-Jul-14	17:50	Summer	REP 1	7.40	1.60	1	0.44	63	0.12
	DL0-02-6	560756	7912167	24-Aug-14	16:05	Fall	REP 1	6.70	2.00	1	0.44	63	0.12

Table A1-2. - continued –

Waterbody	Site ID	UTM Coordinates (Zone 17W)		Sampling Date	Sampling Time	Season	Replicate	Total Depth (m)	Secchi Disk Depth (m)	Number of Tows	Codend Length (m)	Mesh Size (µm)	Mouth Diameter (m)
		Easting	Northing										
Sheardown Lake SE	DL0-02-7	560952	7912055	24-Jul-14	17:00	Summer	REP 1	4.00	1.50	1	0.44	63	0.12
	DL0-02-7	560952	7912054	24-Aug-14	14:55	Fall	REP 1	4.00	2.00	2	0.44	63	0.12
	DL0-02-8	561301	7911847	24-Jul-14	14:45	Summer	REP 1	13.15	1.05	1	0.44	63	0.12
	DL0-02-8	561301	7911646	24-Aug-14	13:05	Fall	REP 1	13.05	2.50	1	0.44	63	0.12
Mary Lake South	BL0-03	552680	7906651	26-Jul-14	16:44	Summer	REP 1	15.33	2.45	2	0.44	63	0.12
	BL0-03	552680	7906651	25-Aug-14	16:15	Fall	REP 1	17.75	4.50	1	0.23	63	0.25
	BL0-04	553817	7904886	27-Jul-14	11:25	Summer	REP 1	21.80	2.90	2	0.44	63	0.12
	BL0-04	553817	7904886	25-Aug-14	17:35	Fall	REP 1	21.46	3.60	1	0.23	63	0.25
	BL0-04	553817	7904886	25-Aug-14	17:35	Fall	REP 2	21.46	3.60	1	0.23	63	0.25
	BL0-05	554632	7906031	27-Jul-14	13:25	Summer	REP 1	21.55	1.05	2	0.44	63	0.12
	BL0-05	554632	7906031	26-Aug-14	13:05	Fall	REP 1	18.32	3.16	1	0.23	63	0.25
	BL0-05-A	554530	7906478	27-Jul-14	12:19	Summer	REP 1	12.30	1.50	2	0.44	63	0.12
	BL0-05-A	554530	7906478	26-Aug-14	13:50	Fall	REP 1	12.43	2.27	1	0.23	63	0.25
	BL0-05-B	555034	7905692	27-Jul-14	14:07	Summer	REP 1	8.25	1.25	2	0.44	63	0.12
	BL0-05-B DUP	555034	7905692	27-Jul-14	14:07	Summer	REP 2	8.25	1.25	2	0.44	63	0.12
	BL0-05-B	555034	7905692	26-Aug-14	12:15	Fall	REP 1	8.00	2.87	1	0.23	63	0.25
	BL0-06	555924	7903760	27-Jul-14	9:00	Summer	REP 1	9.33	2.90	3	0.44	63	0.12
	BL0-06	555924	7903760	26-Aug-14	11:09	Fall	REP 1	10.15	2.86	1	0.23	63	0.25
	BL0-09	554715	7904480	27-Jul-14	10:25	Summer	REP 1	30.15	2.55	1	0.44	63	0.12
	BL0-09	554715	7904479	25-Aug-14	11:25	Fall	REP 1	29.85	2.43	1	0.23	63	0.25
Mary Lake North	BL0-01	554691	7913194	26-Jul-14	14:42	Summer	REP 1	10.15	4.25	2	0.44	63	0.12
	BL0-01	554691	7913194	26-Aug-14	17:24	Fall	REP 1	9.50	4.14	3	0.23	63	0.25
	BL0-01-A	554301	7913379	26-Jul-14	13:48	Summer	REP 1	15.95	4.60	2	0.44	63	0.12
	BL0-01-A	554300	7913378	26-Aug-14	16:18	Fall	REP 1	15.66	4.42	2	0.23	63	0.25
	BL0-01-B	554370	7913059	26-Jul-14	12:45	Summer	REP 1	5.30	4.60	2	0.44	63	0.12
	BL0-01-B	554369	7913058	26-Aug-14	18:07	Fall	REP 1	4.95	3.91	2	0.23	63	0.25

APPENDIX 2.

CHLOROPHYLL *A* RESULTS FOR THE 2014 SAMPLING PROGRAM

Table A2-1. Chlorophyll *a* results from mine area lakes: 2014.

Waterbody	Site ID	UTM Coordinates (Zone 17W)		Sampling Date	Season	Chlorophyll *a* (µg/L)	Pheophytin *a* (µg/L)
		Easting	Northing				
Camp Lake	JL0-01	557108	7914369	23-Aug-14	Fall	2.8	<0.2
	JL0-02	557615	7914750	27-Jul-14	Summer	<0.2	<0.2
				23-Aug-14	Fall	0.7	0.5
	JL0-07	556800	7914094	23-Aug-14	Fall	1.2	0.3
	JL0-09	556335	7913936	23-Aug-14	Fall	2.5	<0.2
	JL0-10	557346	7914562	23-Aug-14	Fall	3.4	<0.2
Sheardown Lake NW	DL0-01-1	560080	7913128	25-Jul-14	Summer	1.4	<0.2
				25-Aug-14	Fall	0.5	0.8
	DL0-01-2	560353	7912924	25-Jul-14	Summer	1.3	<0.2
				25-Aug-14	Fall	0.4	0.6
	DL0-01-4	560695	7913043	25-Jul-14	Summer	2	<0.2
				25-Aug-14	Fall	0.4	0.6
	DL0-01-5	559798	7913356	25-Jul-14	Summer	0.9	<0.2
				24-Aug-14	Fall	<0.2	2.7
	DL0-01-7	560525	7912609	25-Jul-14	Summer	1.4	<0.2
				25-Aug-14	Fall	<0.2	1.5
	DD-HAB9-STN1	560259	7913455	25-Jul-14	Summer	1.6	<0.2
				25-Aug-14	Fall	1.3	<0.2
Sheardown Lake SE	DL0-02-3	561046	7911915	24-Jul-14	Summer	<0.2	<0.2
				24-Aug-14	Fall	1.6	<0.2
	DL0-02-4	561511	7911833	24-Jul-14	Summer	<0.2	<0.2
				24-Aug-14	Fall	0.4	0.7
	DL0-02-6	560756	7912167	24-Jul-14	Summer	<0.2	<0.2
				24-Aug-14	Fall	<0.2	6
	DL0-02-7	560952	7912055	24-Jul-14	Summer	<0.2	<0.2
				24-Aug-14	Fall	6.5	<0.2
	DL0-02-8	561301	7911847	24-Jul-14	Summer	<0.2	4.7
				24-Aug-14	Fall	<0.2	1.1
Mary Lake South	BL0-03	552680	7906651	26-Jul-14	Summer	<0.2	<0.2
				25-Aug-14	Fall	0.8	0.4
	BL0-04	553817	7904886	27-Jul-14	Summer	1	<0.2
				25-Aug-14	Fall	1.5	<0.2
	BL0-05	554632	7906031	27-Jul-14	Summer	1.8	<0.2
				26-Aug-14	Fall	2	<0.2
	BL0-05-A	554530	7906478	27-Jul-14	Summer	0.8	<0.2
				26-Aug-14	Fall	0.3	2.4

Table A2-1. - continued -

Waterbody	Site ID	UTM Coordinates (Zone 17W)		Sampling Date	Season	Chlorophyll *a* (µg/L)	Pheophytin *a* (µg/L)
		Easting	Northing				
Mary Lake South	BL0-05-B	555034	7905692	27-Jul-14	Summer	<0.2	<0.2
				26-Aug-14	Fall	<0.2	2.1
	BL0-06	555924	7903760	27-Jul-14	Summer	1.2	<0.2
				26-Aug-14	Fall	1.1	0.4
	BL0-09	554715	7904479	27-Jul-14	Summer	1.7	<0.2
				25-Aug-14	Fall	<0.2	1.4
Mary Lake North	BL0-01	554691	7913194	26-Jul-14	Summer	0.2	0.2
				26-Aug-14	Fall	1.1	0.3
	BL0-01-A	554300	7913378	26-Jul-14	Summer	3.1	<0.2
				26-Aug-14	Fall	<0.2	2.2
	BL0-01-B	554369	7913058	26-Jul-14	Summer	1.6	0.2
				26-Aug-14	Fall	<0.2	0.9

Table A2-2. Chlorophyll *a* results from mine area streams: 2014.

Waterbody	Site ID	UTM Coordinates (Zone 17W)		Sampling Date	Season	Chlorophyll *a* (µg/L)
		Easting	Northing			
Mary River	G0-09	571546	7916317	20/06/2014	Spring	1.6
				26/07/2014	Summer	2.0
				21/08/2014	Fall	0.9
	G0-09A	571264	7917344	20/06/2014	Spring	0.9
				26/07/2014	Summer	6.3
				21/08/2014	Fall	<0.2
	G0-09B	571248	7914682	20/06/2014	Spring	0.9
				26/07/2014	Summer	1.5
				21/08/2014	Fall	<0.2
	G0-03	567204	7912587	20/06/2014	Spring	0.3
				24/07/2014	Summer	<0.2
				21/08/2014	Fall	<0.2
	G0-01	564459	7912984	20/06/2014	Spring	<0.2
				26/07/2014	Summer	<0.2
				21/08/2014	Fall	<0.2
	E0-10	564405	7913004	20/06/2014	Spring	1.0
				26/07/2014	Summer	7.2
				22/08/2014	Fall	0.9
	E0-03	562974	7912472	20/06/2014	Spring	<0.2
				24/07/2014	Summer	<0.2
				22/08/2014	Fall	<0.2
	E0-21	562444	7911724	21/06/2014	Spring	0.3
				24/07/2014	Summer	0.7
				22/08/2014	Fall	0.7
	E0-20	561688	7911272	21/06/2014	Spring	0.6
				24/07/2014	Summer	0.5
				22/08/2014	Fall	0.5
	C0-10	560669	7911633	21/06/2014	Spring	<0.2
				24/07/2014	Summer	2.2
				22/08/2014	Fall	<0.2
	C0-05	558352	7909170	21/06/2014	Spring	<0.2
				24/07/2014	Summer	<0.2
				22/08/2014	Fall	<0.2
	C0-01	556305	7906894	21/06/2014	Spring	<0.2
				24/07/2014	Summer	<0.2
				22/08/2014	Fall	0.8

Table A2-2. - continued -

Waterbody	Site ID	UTM Coordinates (Zone 17W)		Sampling Date	Season	Chlorophyll *a* (µg/L)
		Easting	Northing			
North Tributary of Mary River, Downstream of Falls	F0-01	564483	7913015	20/06/2014	Spring	1.1
				26/07/2014	Summer	<0.2
				21/08/2014	Fall	<0.2
Sheardown Lake Tributary 1	D1-05	561397	7913558	25/06/2014	Spring	<0.2
				25/07/2014	Summer	<0.2
				21/08/2014	Fall	<0.2
	D1-00	560329	7913512	25/06/2014	Spring	<0.2
				25/07/2014	Summer	1.2
				21/08/2014	Fall	<0.2
Tom River	I0-01	555470	7914139	24/06/2014	Spring	<0.2
				26/07/2014	Summer	<0.2
				21/08/2014	Fall	<0.2
Camp Lake Tributary 1	L1-08	561076	7915068	24/06/2014	Spring	<0.2
				26/07/2014	Summer	1.5
				22/08/2014	Fall	<0.2
	L1-05	558040	7914935	19/06/2014	Spring	0.8
				25/07/2014	Summer	0.4
				21/08/2014	Fall	<0.2
Camp Lake Tributary 1 - upstream of L2 stream	L1-02	558765	7915121	19/06/2014	Spring	<0.2
				25/07/2014	Summer	1.6
				21/08/2014	Fall	<0.2
Camp Lake Tributary 1 - downstream of L2 stream	L1-09	558407	7914885	19/06/2014	Spring	<0.2
				25/07/2014	Summer	3.6
				21/08/2014	Fall	<0.2
Camp Lake Tributary 1	L0-01	557681	7914959	19/06/2014	Spring	0.5
				24/07/2014	Summer	<0.2
				22/08/2014	Fall	1.3
Stream North of Airstrip	L2-03	559081	7914425	19/06/2014	Spring	<0.2
				25/07/2014	Summer	3.2
				21/08/2014	Fall	<0.2
Camp Lake Tributary 2	K0-01	557390	7915030	19/06/2014	Spring	0.5
				24/07/2014	Summer	<0.2
				21/08/2014	Fall	0.7
Outlet Channel of Camp Lake	J0-01	555701	7913773	21/06/2014	Spring	<0.2
				26/07/2014	Summer	1.7
				21/08/2014	Fall	<0.2

Table A2-2. - continued -

Waterbody	Site ID	UTM Coordinates (Zone 17W)		Sampling Date	Season	Chlorophyll *a* (µg/L)
		Easting	Northing			
Proposed Camp Lake Tributary reference stream No. 3	CLT-REF3	567004	7909174	21/06/2014	Spring	<0.2
				24/07/2014	Summer	<0.2
				22/08/2014	Fall	<0.2
Proposed Camp Lake Tributary reference stream No. 4	CLT-REF4	568533	7907874	21/06/2014	Spring	<0.2
				24/07/2014	Summer	<0.2
				22/08/2014	Fall	0.8
Proposed Mary River reference stream No. 2	MRY-REF2	570650	7905045	21/06/2014	Spring	1.6
				24/07/2014	Summer	<0.2
				22/08/2014	Fall	0.4
Proposed Mary River reference stream No. 3	MRY-REF3	585407	7900061	21/06/2014	Spring	0.3
				24/07/2014	Summer	<0.2
				22/08/2014	Fall	1.4

APPENDIX 3.

FIELD DATA COLLECTED DURING THE BENTHIC MACROINVERTEBRATE SAMPLING PROGRAM: 2014

Table A3-1. Field data collected at benthic macroinvertebrate sampling sites in Mary Lake and mine area streams, 2014.

Waterbody	Site ID/ Replicate Station	Sample Date	Water Depth	Habitat Type	Supporting Replicate Station Data						
					UTM Easting	UTM Northing	Secchi Depth (m)	Macrophyte Abundance	Macrophyte Type	Dominant Substrate	2nd Dominant Substrate
Mary Lake	BLO-07	23-Aug-14	13.1	14 [1]	555775	7903588	2.48	Absent	-	Silt	Clay
	BLO-06	23-Aug-14	10.1	9	555917	7903764	2.50	Absent	-	Silt	Clay
	BLO-04	23-Aug-14	23.0	14	553828	7904775	2.38	Absent	-	Silt	Clay
	BLO-14	23-Aug-14	18.7	14	552679	7905263	3.43	Absent	-	Clay	-
	BLO-15	23-Aug-14	30.2	14	552729	7906411	3.60	Absent	-	Silt	Clay
	BLO-03	25-Aug-14	30.3	14	552567	7906512	2.45	Absent	-	Silt	Clay
	BLO-13	25-Aug-14	22.0	14	553891	7905102	-	Absent	-	Silt	Clay
	BLO-05	25-Aug-14	15.5	14 [1]	554777	7906065	1.50	Absent	-	Silt	Sand
	BLO-11	25-Aug-14	3.5	9 [2]	554995	7905922	-	Present	Unknown	Silt	Clay
	BLO-01	27-Aug-14	10.1	9	554692	7913208	-	Absent	-	Silt	Clay
Mary River	GO-09	1-Sep-14	0.32	-	571564	7916257	-	Absent	-	Cobble	Boulder
	GO-03	1-Sep-14	0.4	-	567225	7912619	-	Absent	-	Cobble	Boulder
	EO-20	1-Sep-14	0.35	-	561643	7911235	-	Absent	-	Cobble	Gravel
	CO-05	1-Sep-14	0.3	-	558412	7909312	-	Absent	-	Cobble	Boulder
	CO-01	1-Sep-14	0.3	-	556362	7906892	-	Absent	-	Boulder	Cobble
Camp Lake Tributary 1	LI-09	24-Aug-14	0.2	-	558407	7914890	-	Absent	-	Cobble	Boulder
	LO-01	24-Aug-14	0.15	-	557677	7914938	-	Absent	-	Cobble	Gravel
Camp Lake Tributary 2	CLT-2 DS	24-Aug-14	0.2	-	557466	7914969	-	Absent	-	Cobble	Gravel
	CLT-2 US	24-Aug-14	0.3	-	557448	7915324	-	Absent	-	Cobble	Gravel
Sheardown Lake Tributary 1	SDLT-01 R1	27-Aug-14	0.25	-	560320	7913504	-	Absent	-	Cobble	Boulder
Sheardown Lake Tributary 9	SDLT-09 US	27-Aug-14	0.25	-	561771	7911813	-	Absent	-	Gravel	Cobble
Sheardown Lake Tributary 12	SDLT-12 DS	27-Aug-14	0.2	-	561000	7912973	-	Absent	-	Cobble	Boulder
	SDLT-12 US	27-Aug-14	0.2	-	561091	7912833	-	Absent	-	Cobble	Boulder

[1] Although Habitat Type 9 was targeted, water depth at two replicate stations was > 12 m (Habitat Type 14); classification may be revised pending sample analysis.
[2] Habitat type for replicate station may be changed to Habitat Type 10 pending identification of aquatic vegetation present in the sample.