Appendix V6-4A

2015 Goose Lake Hydrodynamic Modelling Report: Arsenic Predictions

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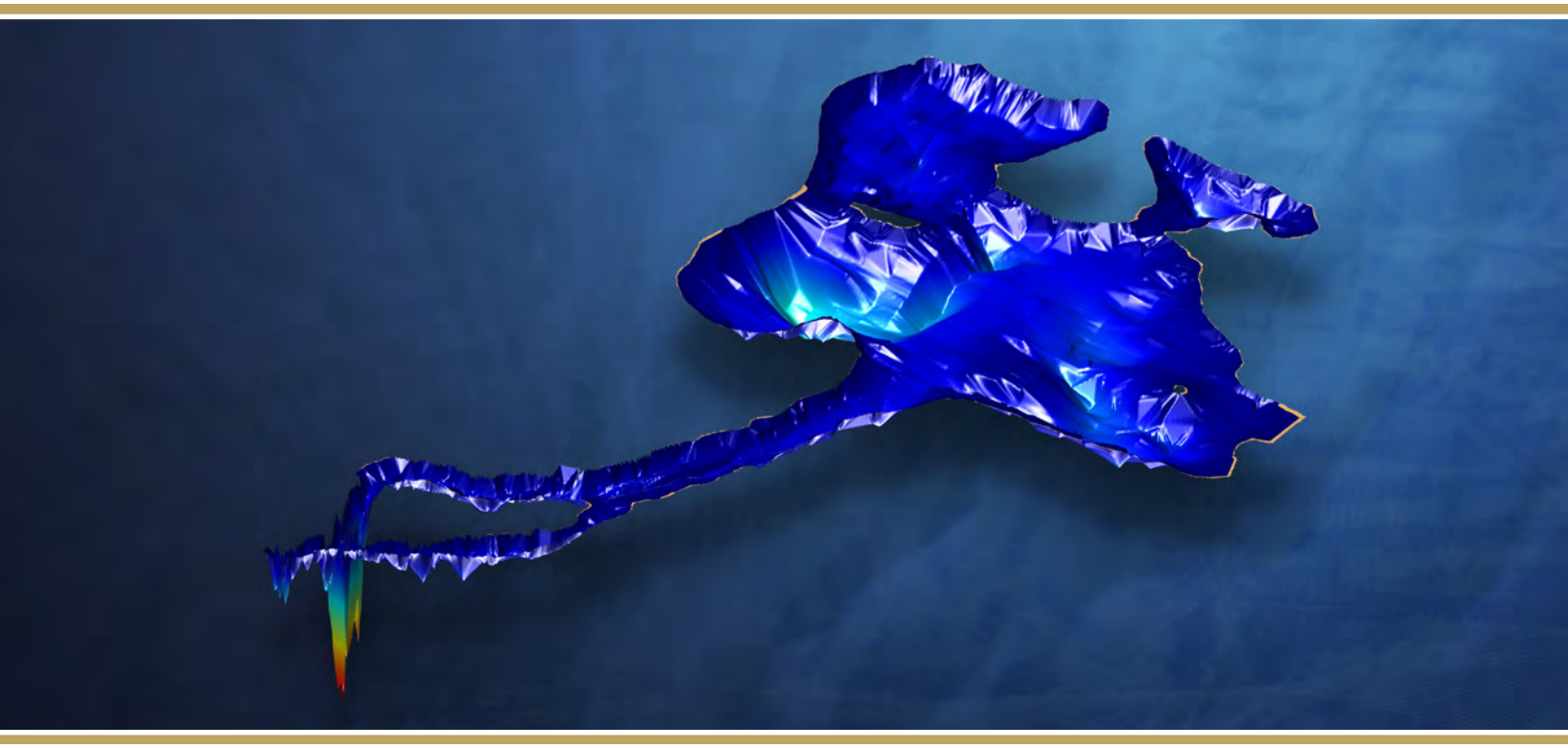
2015 Goose Lake Hydrodynamic Modelling Report: Arsenic Predictions



October 2015

Prepared by:
Rescan
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BACK RIVER PROJECT

2015 GOOSE LAKE HYDRODYNAMIC MODELLING REPORT: ARSENIC PREDICTIONS

October 2015
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Prepared for:

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Executive Summary

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Executive Summary

This report presents the modelling study that was completed to predict arsenic concentrations in Goose Lake for the Back River Project (the Project).

Goose Lake is a fish-bearing, medium-sized lake that is centrally located within the proposed Project Potential Development Area (PDA). Results from the Goose Lake arsenic predictions were used for the effects assessment of the Valued Ecosystem Components Freshwater Water Quality, Freshwater Sediment Quality, Freshwater Fish/Aquatic Habitat, and Freshwater Fish Community (see Volume 6, Chapters 4, 5, 6, 7 of the FEIS).

Arsenic concentrations were predicted over the temporal scale of all Project phases and the spatial scale of all of Goose Lake (all depths and locations). Both open-water (May to October) and under-ice (November to April) seasons were included in the modelling.

In order to develop a hydrodynamic model for Goose Lake, an Advection Dispersion Module was coupled to the MIKE3 Flow model to predict the fate of arsenic within Goose Lake for the duration of available input data. Input flows and loading data were obtained from the SRK Water and Load Balance Report.

A total of six point sources were included for potential arsenic loading to Goose Lake. Of the input sources to Goose Lake, the locations that have varying flows and arsenic concentrations due to Project activities include the Llama/Umwelt system, the Goose Main Pit/TSF system, Echo Outflow, and the water treatment plant discharge (during construction). The two remaining inputs were unaffected by Project activities (Giraffe Inflow and Gander Inflow) based on the data provided in the SRK Water and Load Balance Report.

Results from the Goose Lake arsenic predictions model are presented in two main formats. Results are first presented for arsenic concentrations throughout the lake for the 'worst-case' year for each Project phase. These results are presented as 2D 'heat' diagrams covering four different seasonal time periods. Results are then presented as concentration graphs with time for three locations in Goose Lake (including a known Lake Trout spawning location and fish overwintering location), as well as for Goose Outflow.

Predicted Lake-Wide Arsenic Concentrations with Project Phase

For the Construction and Operations phases, results indicate that predicted arsenic concentrations remain below the CCME guideline for the protection of freshwater aquatic life (0.005 mg/L) in all parts of the lake at all times. Predicted arsenic concentrations at the known Lake Trout Spawning Habitat area and the Fish Overwintering Habitat area are predicted to remain below the CCME during these Project phases.

For the Closure phase, results indicate that predicted arsenic concentrations remain below the CCME guideline in the main basin of the lake. However, small, localized areas in the western and southern parts of the lake are predicted to have arsenic concentrations above the CCME guideline but at or below the site specific Water Quality Objective (WQO) for Goose Lake (0.01 mg/L). These localized elevated concentrations are a result of arsenic inputs from the Llama/Umwelt system (where the Llama and Umwelt open pits, waste rock storage areas, water management ponds, and saline storage pond are located) and the Goose Main Pit overflow and upstream tailings facility/waste rock storage facility system. These localized areas are predicted to dilute rapidly and arsenic concentrations in the main basin remain below the CCME guideline. Predicted arsenic concentrations at the known Lake

Trout Spawning Habitat area and the Fish Overwintering Habitat area are predicted to remain below the CCME guideline for the protection of freshwater aquatic life (0.005 mg/L).

For the Post-Closure phase, the 'worst-case' year is presented, along with the last year of available modelled information. This is to provide predicted results for the expected long-term concentrations in the lake. The highest predicted arsenic concentrations occur at the beginning of the Post-Closure phase (year 2038). For the 'worst-case' year, predicted arsenic concentrations are greater than the CCME guideline throughout the lake during all seasons and at all depths. However, predicted concentrations remain below the WQO (0.01 mg/L) for the main basin of the lake. The main input of arsenic contributing to the Goose Lake concentrations is the overflow of the closed Goose Main Pit and the closure of the upstream tailings facility/waste rock storage area. The Llama/Umwelt system also continues to contribute to arsenic loading during this period.

However, for the Late Post-Closure phase, predicted arsenic concentrations return to levels at or below the CCME guideline in the majority of the lake during the open-water season. The exception is localized, slightly elevated concentrations in the western end of the lake as a result of slight loadings from the Llama/Umwelt system. Overall, Goose Lake is predicted to have arsenic concentrations close to or below the CCME guideline for the protection of freshwater aquatic life (0.005 mg/L) for the long-term.

Predicted Arsenic Concentrations for Goose Lake and Goose Outflow

For Goose Lake, predicted arsenic concentrations with time are presented for the following locations:

- Goose Lake Main Basin, near the Outflow (at 3 m depth);
- a known Lake Trout Spawning Habitat area (at 5 m depth); and
- a Fish Overwintering Habitat area (10 m depth).

In general, predicted arsenic concentrations remain uniform with depth in the main basin of the lake. At all three locations in the main basin of the lake, predicted arsenic concentrations remain low and below the CCME guideline during the Construction and Operations phases. During the Closure phase, predicted concentrations start to rise, with concentrations peaking during the beginning of the Post-Closure phase.

The elevated concentrations at the beginning of the Post-Closure phase are mainly due to the input of arsenic from the overflow of the closed Goose Main Pit and the closure of the upstream tailings facility/ waste rock storage area. The Llama/Umwelt system also continues to contribute to arsenic loading during this time. Peak concentrations in the main basin are predicted to be above the CCME guideline for protection of freshwater aquatic life (0.005 mg/L), but below the WQO for Goose Lake (0.01 mg/L).

During Post-Closure, predicted arsenic concentrations decline each year, with concentrations stabilizing approximately six years after the peak year. Once the input sources have stabilized, predicted arsenic concentrations remain at or below the CCME guideline for the majority of the year, but temporarily increase during the winter months due to cryoconcentration.

For Goose Outflow, similar to the Goose Lake predictions, arsenic concentrations are predicted to remain low and below the CCME guideline during the Construction and Operations phases. During the Closure phase, predicted concentrations start to rise slightly but remain below the CCME guideline. Predicted concentrations during the Post-Closure phase are slightly above the CCME guideline for the first two years of Post-Closure. However, predicted concentrations decline quickly and return to at or below the CCME guideline level three years into the Post-Closure period. Subsequent years have predicted arsenic concentrations below the CCME guideline for as long as the model was run (to year 2059).

Acknowledgements

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2015 GOOSE LAKE HYDRODYNAMIC MODELLING REPORT: ARSENIC PREDICTIONS

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1. Introduction

1. Introduction

The Back River Project (the Project) is a proposed gold mine owned by Sabina Gold & Silver Corp. (Sabina) located in the West Kitikmeot region of Nunavut. The majority of infrastructure associated with the mine will be located in the vicinity of Goose Lake. Drainage from the watersheds that will contain the open pits, underground mines, waste rock storage areas, and tailings facility will ultimately flow in to Goose Lake. The permanent camp will also be located next to Goose Lake. Figure 1-1 shows the proposed infrastructure that will be located near Goose Lake, as well as the local watersheds.

Geochemical studies conducted for the Project have indicated that arsenic is an element that is naturally enriched in host rock and ore in the Project area. A Water and Load Balance Report was prepared for the Back River Project FEIS (SRK 2015; see Appendix V2-7H of the FEIS), and this prediction report indicated that arsenic was an element that required mitigation measures in order to keep concentrations entering receiving waters within appropriate levels. The Site Water Monitoring and Management Plan (see Volume 10, Chapter 7 of the FEIS) contains details of specific mitigation measures for arsenic for the Project.

Because of the potential for arsenic to enter the receiving waterbody of Goose Lake, Sabina contracted ERM Canada to conduct a lake-wide hydrodynamic model of Goose Lake in order to predict potential arsenic concentrations within the lake. Goose Lake is a fish-bearing, medium-sized lake that is centrally located within the proposed Project Potential Development Area (PDA). Results from the Goose Lake arsenic predictions were used for the effects assessment of the Valued Ecosystem Components Freshwater Water Quality, Freshwater Sediment Quality, Freshwater Fish/Aquatic Habitat, and Freshwater Fish Community (see Volume 6, Chapters 4, 5, 6, and 7 of the FEIS).

This report presents the modelling study that was completed to predict arsenic concentrations in Goose Lake. Arsenic concentrations were predicted over the temporal scale of all Project phases and the spatial scale of all of Goose Lake (all depths and locations). Both open-water (May to October) and under-ice (November to April) seasons were included in the modelling. A total of six point sources were included for potential arsenic loading to Goose Lake.

Results are presented for arsenic concentrations throughout the lake for the ‘worst-case’ year for each Project phase. In addition, arsenic concentrations with time are presented for three locations in Goose Lake (including a known Lake Trout spawning location and fish overwintering location), as well as for Goose Outflow.

Chapters 2 and 3 of this report present the background and methodology used for the construction of the hydrodynamic numerical model, Chapter 4 presents the simulation results, and Chapter 5 presents an overall summary of the results.

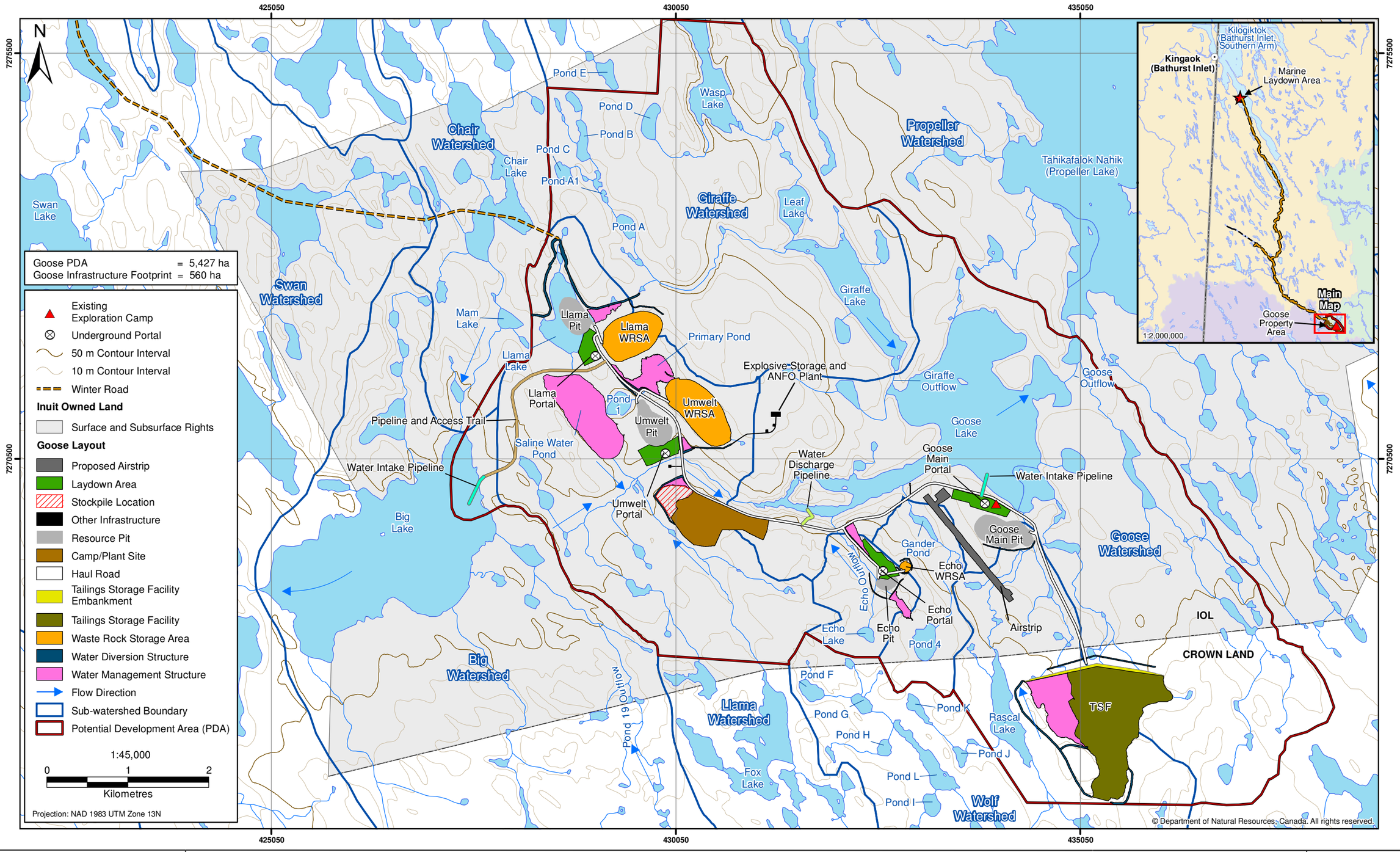

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Figure 1-1

Back River Project: Site Layout around Goose Lake

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2. Goose Lake Flow Model

2. Goose Lake Flow Model

In order to develop a hydrodynamic model for Goose Lake, an Advection Dispersion Module (DHI 2009) was coupled to the MIKE3 Flow model (DHI 2012a, 2012b) to predict the fate of arsenic within Goose Lake during all Project phases. The details of the MIKE3 Flow Model are presented in this chapter. Details of the DHI Advection Dispersion Module are included in Chapter 3.

The scenario modelled was based on the load balance model found in the SRK Water and Load Balance Report (see Volume 2, Appendix V2-7H of the FEIS).

2.1 NUMERICAL MODEL DESCRIPTION

Goose Lake was modelled using the DHI MIKE3 Flow Model. MIKE3 is a three-dimensional baroclinic fluid model that can simulate unsteady discretized flows while accounting for density variations, bathymetry, and external forcings such as riverine inputs and wind. Other built-in features of the model include flooding and drying of coastal land, sediment bed resistance, turbulence modelling, sources/sinks of external waters, and heat exchange with the atmosphere.

The MIKE3 model is based on the numerical solution of the three-dimensional Reynolds-averaged Navier-Stokes fluid equations (Gill 1982; Kundu 1990), including the effects of turbulence (using the Boussinesq approximation), variable density, and the conservation equations for salinity and temperature. MIKE3 Flow Model can solve the fluid equations using two different algorithmic modules: the hydrodynamic module (DHI 2012a), which incorporates water compressibility and the full vertical momentum equation, and the hydrostatic module (DHI 2012b) that assumes water incompressibility and invokes hydrostatic assumptions (i.e., vertical velocities are presumed negligible compared to horizontal currents; Gill 1982; Kundu 1990).

The spatial discretization of the primitive equations is performed using a cell-centered finite volume method (e.g., see Patankar 1980). The spatial domain is discretized by subdivision of the fluid continuum into non-overlapping elements or cells. A structured or unstructured grid can be used in the horizontal plane while a structured mesh is used in the vertical.

The model solves the pertinent time-dependent hydrodynamic and thermodynamic equations over the discretized regional grid. It therefore produces computed values of variables, such as temperature or current, in each grid cell throughout the model domain for each time step. The model's physical system is driven by environmental inputs comprised of time-series of winds, air temperatures, and freshwater discharges. Other inputs, such as incoming solar radiation, are derived from the latitude of the domain.

The utility of a sophisticated modelling tool like MIKE3 is after the initial model setup, when it is possible to evaluate different scenarios such as different wind or discharge magnitudes.

2.2 MODEL DEVELOPMENT FOR GOOSE LAKE

The model was developed using baseline data collected from Goose Lake in 2013. This section provides a summary of the baseline measurements that were used to calibrate the numerical model, and describes the assumptions for the numerical model.

2.2.1 Physical Limnology and Bathymetry

Goose Lake (65°33.10' N, 106°26.01' W) is a medium-sized Arctic lake approximately 100 km south of Bathurst Inlet, Nunavut (Figure 1-1). The lake is relatively shallow, with an average mean depth of 3.25 m. Deeper areas (i.e., > 5 m) exist in the central portion of the lake, and deeper holes are present in the western arm of the lake (the maximum depth is > 30 m in the western arm). The bathymetry of the lake is shown in Figure 2.2-1.

Detailed baseline water quality studies have been conducted in Goose Lake since 2010 (Rescan 2011, 2012a, 2012c, 2014a). These baseline studies have included the collection of physical limnological water column data (i.e., vertical profiles of temperature, salinity, and dissolved oxygen) at multiple sampling stations in the lake. The hydrodynamic model was constructed using the 2013 baseline sampling results collected from four sampling stations within the lake (see Figure 2.2-1; Rescan 2014a).

Temperatures near the ice-water interface during winter (April) sampling were between 0°C and 1°C and were generally warmer at depth (2.5°C and 4°C), with temperatures stabilizing a few metres below the ice. During the open-water season, sampling locations within Goose Lake were well-mixed, likely due to the shallow bathymetry and strong wind mixing. One exception was on July 2013, where a sampling location in the main basin of the lake near the outflow to Propeller Lake (Goose Tail station) had a temperature difference of approximately 2°C between the surface and the bottom at 7 m.

2.2.2 Model Usage

The first step for the modelling was to simulate the 2013 conditions in Goose Lake using the observed meteorological measurements collected in 2013 (Rescan 2014c). The following assumptions were used in the 3D hydrodynamic model:

- The ice-covered period was modelled between November and May at each simulation year. Since MIKE3 does not contain an ice-formation module, the following simplifications were applied for the winter period:
  - a 2-m ice slab was applied to the model region, isolating the waters from the winds and limiting heat exchange with the atmosphere; and
  - all freshwater inputs and outputs of the model were stopped for the duration of the ice-covered period as streams in the Project area are typically frozen to the streambed during winter.

Actual measured baseline data, whenever available, were used within the model, and included: winds, freshwater discharges, atmospheric temperatures, and relative humidity (Rescan 2011, 2012a, 2012b, 2012c, 2012d, 2012e, 2013, 2014a, 2014b; ERM Rescan 2014). All other variables were taken as constants or were modelled using physical models.

2.3 SPECIFIC MODEL DETAILS

This section provides additional information on the input parameters used in the Goose Lake numerical model. Table 2.3-1 summarizes the model inputs, with the rationale provided below.

2.3.1 Bathymetry

Depths within the model domain were digitized with bathymetric data from field surveys (Rescan 2012c, 2014a). Figure 2.3-1 shows the model region and the bathymetric data used for the simulations, as well as the locations of important sites and the inflow/outflows used in the model.

GIS # **BAC-01-099**

October 8, 2015

Lake Morphometry	Goose
Surface Area (m²)	3,292,828
Max Depth (m)	29
Volume (m³)	10,669,403
Shoreline Length (m)	18,603
Mean Depth (m)	3.25

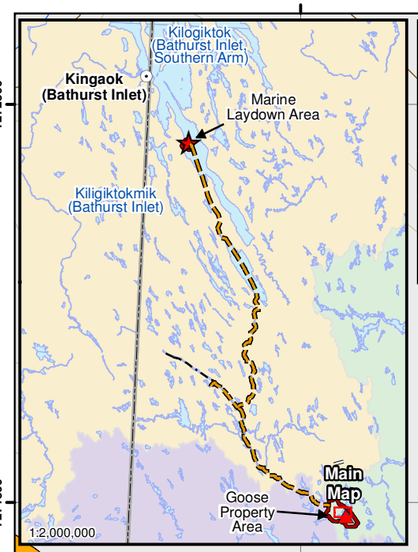

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Figure 2.2-1

Baseline Stations and Bathymetric Data Used for Model Calibration

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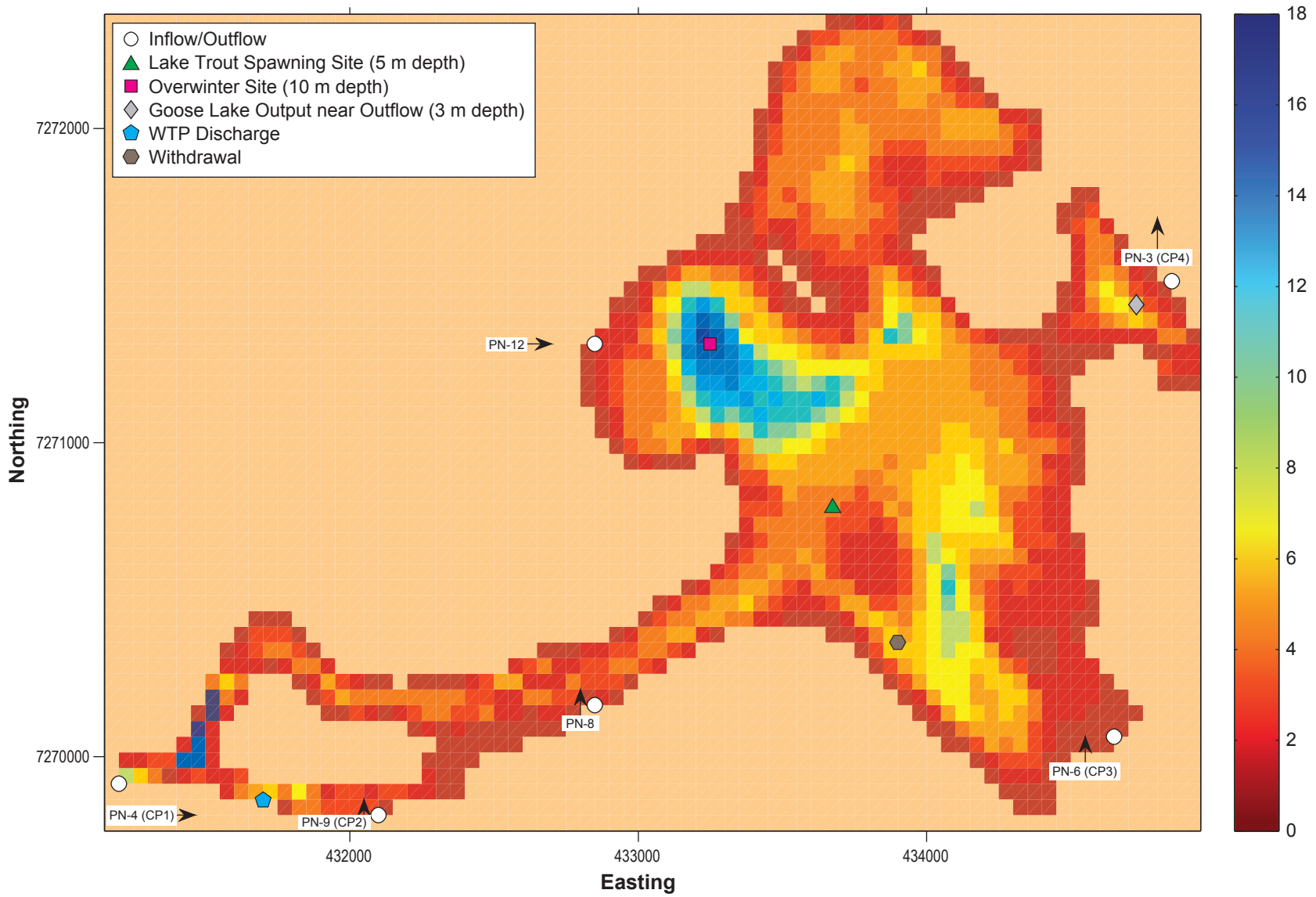

Figure 2.3-1

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Goose Lake 50m Bathymetric Model Grid

Figure 2.3-1

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Table 2.3-1. Important Model Input Parameters

Parameter Name	Values	Comment
Horizontal Grid Size	50 m	
Vertical Grid Size	1 m	Bottom layer varies
Number of Layers	13	
Average Model Lake Volume	10.418 Mm^3	
Time Step	40 s	
Simulation Duration	43 years	
Open-water Season	May to October	
Ice-covered Season	November to April	
Ice Thickness	2 m	Applied November to April
Bed Roughness Length	0.05 m	
Vertical Density Damping Coefficient	10	
Horizontal Eddy Viscosity Limits	0.001 to 8.3 m^2/s	k-ε formulation
Vertical Eddy Viscosity Limits	0.0001 to 0.003 m^2/s	k-ε formulation
Wind Friction	0.0026	Drag coefficient
Initial Background Salinity	0	
Initial Background Temperature	4°C	January 1st start

For the Goose Lake simulation, a three-dimensional rectilinear grid was used that covered the entire lake area. The grid cells were selected at 50-m square dimensions; preliminary tests using 20-m grid sizes yielded similar results while taking significantly longer to complete simulations. The bathymetry of the lake was smoothed accordingly to fit the model grid. The mean effective lake volume used in the model was 10.418 Mm^3, which was slightly lower than the total measured lake volume of 10.669 Mm^3. This bathymetric arrangement worked best in resolving the numerical simulation in due time and also contributed to the conservative predictions of arsenic.

Vertical layering of the model was designed to emphasize the top 13 m of the water column, which covered the vast majority of the lake and most areas important for fish spawning. Hence, 13 parallel vertical layers were used to represent the water column—the first 12 vertical grid points from the surface were set 1 m apart whereas the lowest layer depth thickness was permitted to vary. This arrangement was the best configuration found that reproduced the available limnological data while maximizing computational efficiency.

2.3.2 Winds

Wind speed and direction are available since 2004 and have been recorded continuously near Goose Lake since 2007; the records for these baseline data are described in detail in the *Back River Project: 2004 to 2014 Meteorology Baseline Report* (ERM Rescan 2014). Winds measured at this site on the southern shore of Goose Lake were applied across the entire model domain. During the model calibration/baseline simulation, only the winds available during 2013 were used. For the complete 43-year simulation across all Project phases, each simulation year was randomly assigned to a measured wind year recorded between 2004 and 2014, with each of the measured years being used at least once. Preliminary tests done using a 10-year average of the winds yielded unrealistic wind vectors and lake currents, thus randomizing the wind years resulted in more natural variability of the climate. Wind roses and selected wind years are presented in Appendices A and B.

2.3.3 Freshwater Influx

The freshwater discharge within the numerical model was a critical component for the reproduction of realistic flows and concentration distributions for Goose Lake. The combination of freshwater inputs and wind forcing creates the horizontal pressure gradients in the surface waters of the lake, which in turn drives the three-dimensional mixing and outflow currents.

The following freshwater inflow points were included in the model and are detailed in Table 2.3-2: PN-4 (Western Goose Lake Inflow from Llama/Umwelt system); PN-6 (Goose Pit Diversion Inflow; this is where overflow from the closed Goose Main Pit will enter Goose Lake, as well as the upstream tailings facility and waste rock storage area); PN-8 (Gander Outflow); PN-9 (Echo Outflow); and PN-12 (Giraffe Outflow). Additionally, the discharge from the proposed water treatment plant (WTP; see the Site-Wide Water Management Report in Volume 10, Chapter 7 of the FEIS) was included in the model, although this was only active during the Project construction phase in the model. PN-3 was the only outflow implemented in the model, which is the main outflow of the lake and discharges into Propeller Lake (see Figure 2.2-1). All flows are shown in the model grid of Figure 2.3-1, whereas the average discharge daily flow of each source is shown in Figure 2.3-2.

Table 2.3-2. Freshwater Inputs and Outputs to Model

Name[a]	Rescan Nomenclature[b]	Description	Easting	Northing
PN-3	PL-H2	Goose Outflow	434920	7271479
PN-4	GL-H1	Goose Inflow from Llama/Umwelt System	431063	7269934
PN-6	WL-H1	Goose Pit Diversion Inflow-from Goose Main Pit and tailings facility/waste rock storage area	434733	7269708
PN-8	GL-H3	Gander Outflow	432907	7270016
PN-9	EL-H1	Echo Outflow	431994	7269754
PN-12	GI-H1	Giraffe Outflow	432754	7271545
WTP	*	Location of WTP Discharge	431682	7769869

[a] *Based on names provided by SRK in the Water and Load Balance Report (see Volume 2, Appendix V2-7H of the FEIS.*
[b] *Based on information from Rescan (2014b).*
** Only active during the Project construction phase.*

2.3.4 Other Meteorological Inputs

Relative humidity, air temperatures, and solar intensity were also continuously recorded near Goose Lake as part of the meteorological baseline program (ERM Rescan 2014). These parameters were implemented as time-varying components in the model.

2.3.5 Water Temperature

Background temperatures were assumed to be initially constant for each layer (see values in Table 2.3-1). Once a simulation was started, temperatures were set to vary spatially and temporally with the meteorological conditions.

2.3.6 Model Time: Calibration and Simulation Periods

The model was first set to run at a 40 s time step for 365 days between January 1 and December 31, 2013. This range was defined as the calibration period, where the calculated model temperatures during the open-water season could be compared to the measured field data. For the full Project simulation run, the model was run from 2017 to 2059 at a 40 s time step.

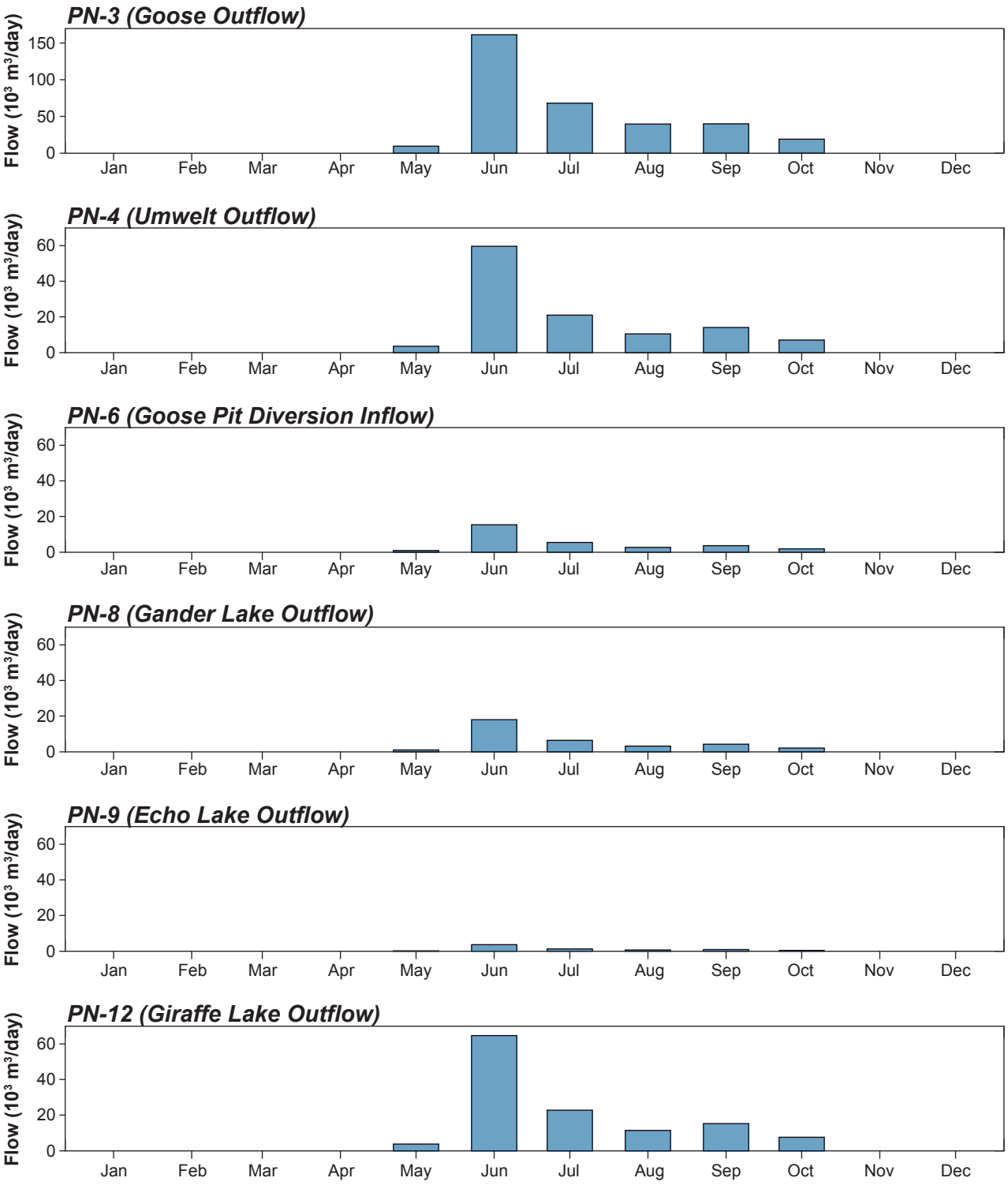

Figure 2.3-2

Goose Lake Model Average Monthly Flows, 2013 Baseline Simulation

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2.3.7 Module Selection

Testing runs were done using either the hydrodynamic or hydrostatic module for the numerical model. Given that the model architecture was a priori built-up to simulate horizontal currents within the lake's surface mixed layer, differences in current magnitudes between both modules were usually less than 5%. Therefore, the hydrostatic module was chosen for most runs as it yielded slightly better computational times and more conservative salinity variations.

2.3.8 Turbulence Closure Scheme

In many numerical simulations, the small-scale turbulence cannot be resolved with the chosen spatial resolution, thus it needs to be approximated through other methods. The turbulence in MIKE3 is parameterized using an eddy viscosity concept (i.e., the Boussinesq approximation), which is described separately for the vertical and the horizontal transport. The standard k-ε formulation (Rodi 1984) was used in the simulations for this work, which determines the velocity scale from a transport equation based on the isotropic energy dissipation rate, ε.

2.3.9 Other Model Parameters

Table 2.3-1 summarizes the inputs and model parameters used in the hydrodynamic model. Additional meteorological data used in the baseline simulation is presented in Appendix B.

2.4 2013 BASELINE SIMULATION

2.4.1 Thermohaline Structure

The comparison of predicted water column temperatures for the four available baseline stations (Goose Neck, Goose Central, Goose Tail, and Goose South; see Figure 2.2-1) is depicted in Figure 2.4-1 for the July 2013 sampling period. The modelled values tracked the baseline conditions, with modelled temperatures on average within ~ 0.2 to 0.5°C of measured profiles. A small difference in mixed-layer depth was seen for the Goose Tail site, where the modelled mixed layer was roughly 2 m deeper than the observed mixed layer.

2.4.2 Currents and Circulation

No measurements of water currents were available for Goose Lake. The predicted current velocities were much higher in the central lake stations than in the Goose Tail and Goose Neck stations (i.e., maximum velocities two to three times higher), which was expected because the larger surface area of the lake's center region provides a greater fetch for winds to drive lake currents (Figure 2.4-2). The predicted current velocities were similar to observed currents in other Arctic lakes (ASL 2012). Southern currents dominated the spectrum at the Central, South, and Tail stations, which was the result of the dominant northern winds observed in 2013. In contrast, the Goose Neck station currents followed the northern boundary of the neck. Overall, the circulation was counter-clockwise within the lake, which was expected for a large northern hemisphere lake.

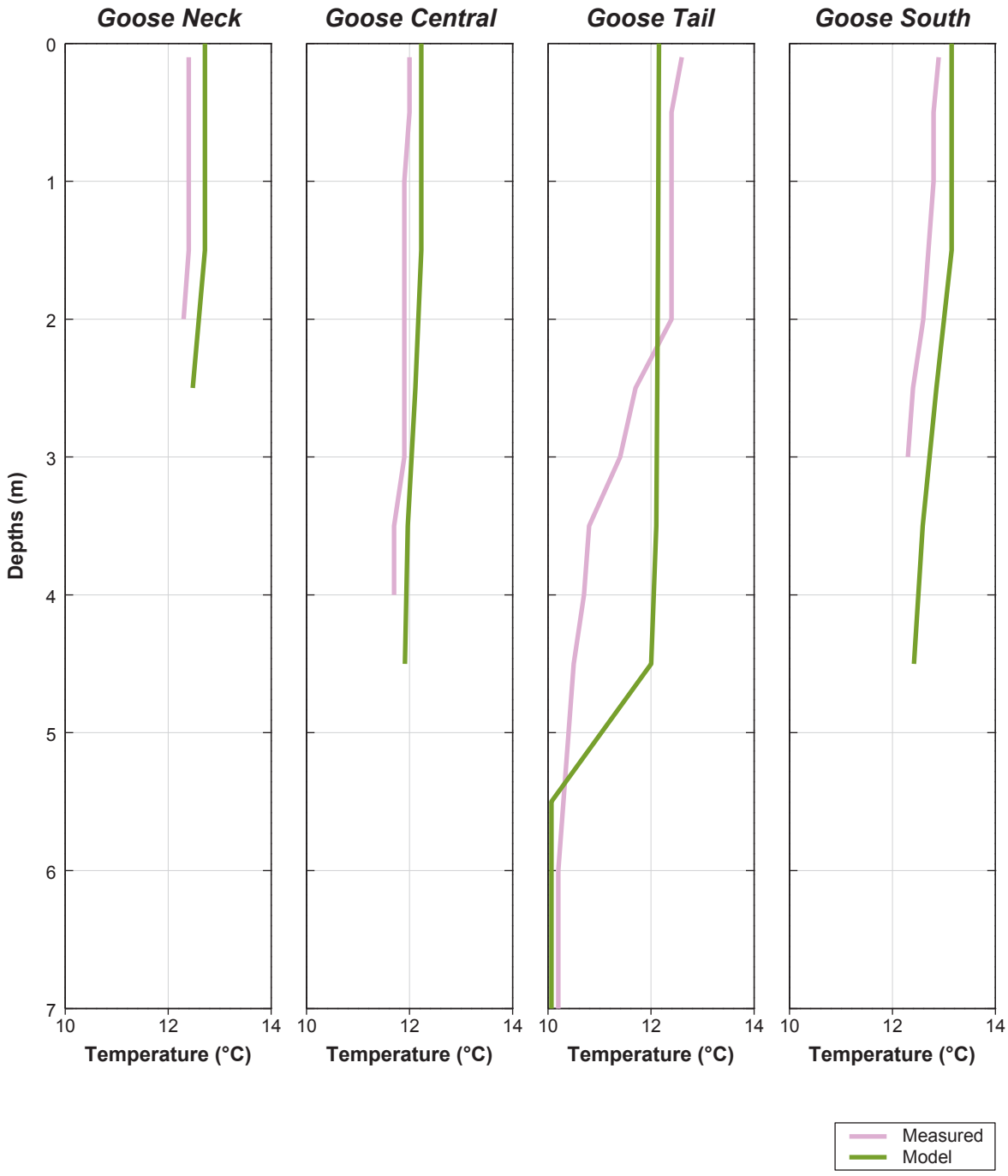

Figure 2.4-1

Temperature Profile Comparisons between Modelled and Measured Waters, Selected Goose Lake Stations

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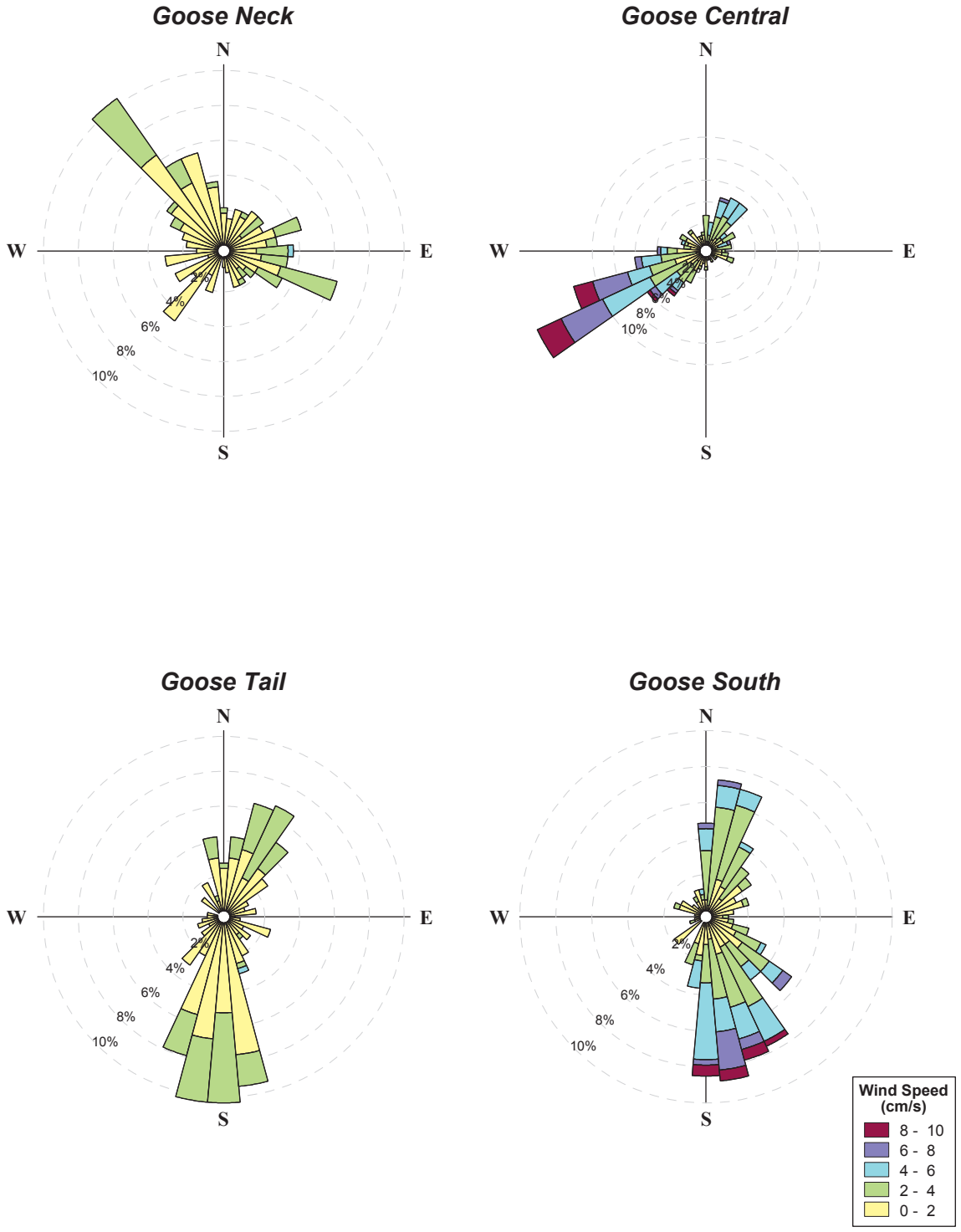

Figure 2.4-2

Model Surface Water Current Roses from 2013 Baseline Simulation, Selected Goose Lake Stations

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3. Goose Lake Arsenic Model

3. Goose Lake Arsenic Model

3.1 MODEL DESCRIPTION

The DHI Advection Dispersion module (DHI 2009) was coupled to the MIKE3 Flow model output (see Chapter 2) to predict the concentrations of arsenic in Goose Lake. The model was a Lagrangian model of advection/diffusion (see Kundu 1990) that runs decoupled from the fluid dynamics simulated by the MIKE3 model. The baseline value for arsenic in Goose Lake for all model runs was set at 0.000195 mg/L, as this was the concentration used in the SRK Water and Load Balance Report (see Volume 2, Appendix V2-7H of the FEIS).

For the purposes of the Goose Lake arsenic predictions, the model considered arsenic as a passive tracer in the lake. This ensured that the predicted arsenic concentrations were conservative in nature because burial and sequestration were not considered. Two threshold values of arsenic concentrations are presented in graphs for the interpretation of the numerical simulations results: the CCME Water Quality Guideline for the Protection of Freshwater Aquatic Life (0.005 mg/L; CCME 2015), and a Site Specific Water Quality Objective (SS WQO) for arsenic in Goose Lake (0.01 mg/L; please refer to the Freshwater Water Quality chapter of the FEIS for additional information; Volume 6, Chapter 4).

3.2 UNDER-ICE CRYOCONCENTRATION

In order to determine an appropriate factor for under-ice cryoconcentration of arsenic, baseline data from Goose Lake were analyzed (Rescan 2011, 2012a, 2012c, 2014a). A comparison of under-ice and open-water concentrations shows a non-negligible increase in the winter concentrations. Examples for several years of baseline measurements for Goose Lake are shown in Figure 3.2-1. Overall, there was an average 35% increase in winter baseline arsenic concentrations compared to summer measurements within a calendar year. This “cryo-increase” in winter concentrations was likely due to the rejection of solutes during ice formation, and potentially from the enhanced efflux of arsenic from the sediments due to decreased winter oxygen.

To replicate the field observations recorded in Goose Lake, post-processing of the winter concentration model data was applied for every simulated year to add 35% of the arsenic contained within the top two model layers (i.e., the 2-m ice layer in winter) to the bottom waters of the lake. The transfer was modelled non-linearly such that 90% of the arsenic transfer occurred within the first 45 days of winter, and the remaining 10% slowly occurred during the following 105 days. Ice melting was assumed to occur during the last 30 days of winter, with rapid mixing of the excess arsenic back into the surface layer of the lake. This procedure was implemented to meet the conservative assumption that the maximum arsenic concentrations in Goose Lake would occur during winter. This approach avoided potentially complicating assumptions associated with the implementation of sorption, sequestration, or liberating mechanisms.

3.3 GOOSE LAKE INFLOWS AND ASSOCIATED ARSENIC CONCENTRATIONS

All Goose Lake inflow data including flow volumes and predicted concentrations were from the load and balance model found in the SRK Water and Load Balance Report (see Volume 2, Appendix V2-7H of the FEIS).

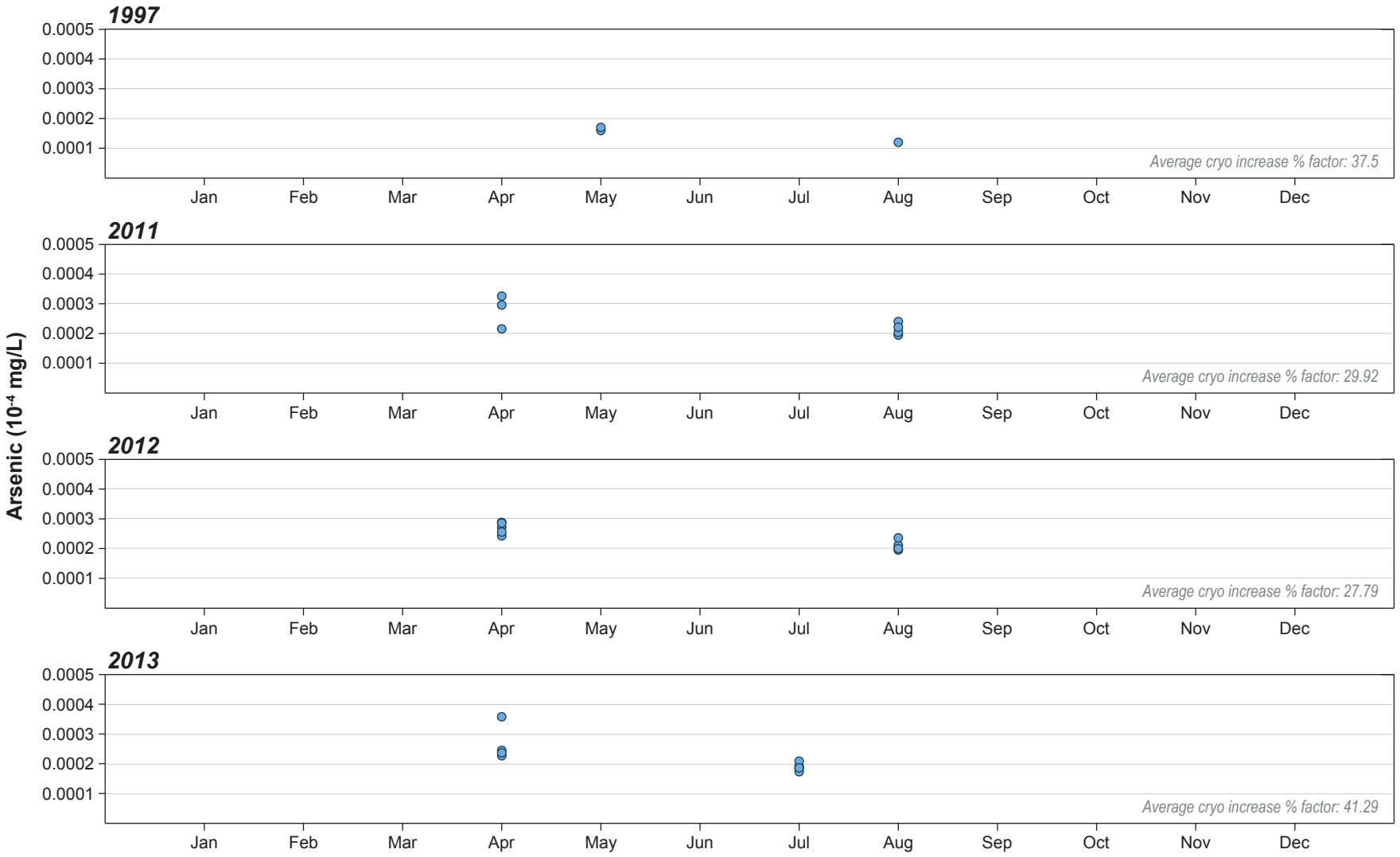

Figure 3.2-1

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Selected Baseline Arsenic Concentrations with Cryoconcentration Increases, Goose Lake

Figure 3.2-1

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The flow volumes and associated arsenic concentrations for each modelled inflow into Goose Lake (Table 2.3-1) are shown in Figures 3.3-1 to 3.3-5. The water treatment plant discharge characteristics are presented in Table 3.3-1 because they only occur during the 2017 construction year. The inflows from PN-8 (Gander Inflow; Figure 3.3-3) and PN-12 (Giraffe Inflow; Figure 3.3-5) remained at baseline flows and baseline arsenic concentrations through all Project phases.

Table 3.3-1. Water Treatment Plant Discharge Volumes and Arsenic Concentrations

Date	Discharge Volume (m^3/day)	Arsenic Concentration (mg/L)
Jul-17	11,250	0.015
Aug-17	11,250	0.015
Sep-17	1,875	0.015

Note: Data from the SRK Water and Load Balance Report (see Volume 2, Appendix V2-7H of the FEIS.

3.4 PROJECT PHASES

Table 3.4-1 presents the Project phases and durations that were used for the Goose Lake arsenic predictions. Of note is that the water and load balance model (see Water and Load Balance Report in Volume 2, Appendix V2-7H of the FEIS) extended beyond the Project life included in the FEIS. Results for the Goose Lake arsenic predictions were run for the entire time period that input data were available (until year 2059, for a 43 year duration).

Table 3.4-1. Project Phases

Phase	Description	Start	End	Project Activities
1	Construction	1/1/2017	12/31/2018	Building infrastructure, Umwelt open pit mining, underground mining
2	Operation	1/1/2019	12/31/2028	Milling and tailings deposition
3	Closure	1/1/2029	12/31/2036	Water treatment and removal of site infrastructure
4	Post-Closure	1/1/2037	12/31/2059	Site officially closed, passive discharges

The Project phase years indicated on figures in this report are as follows: Construction (2017-2018), Operation (2019-2028), Closure (2029-2036), and Post-Closure (2037-2059).

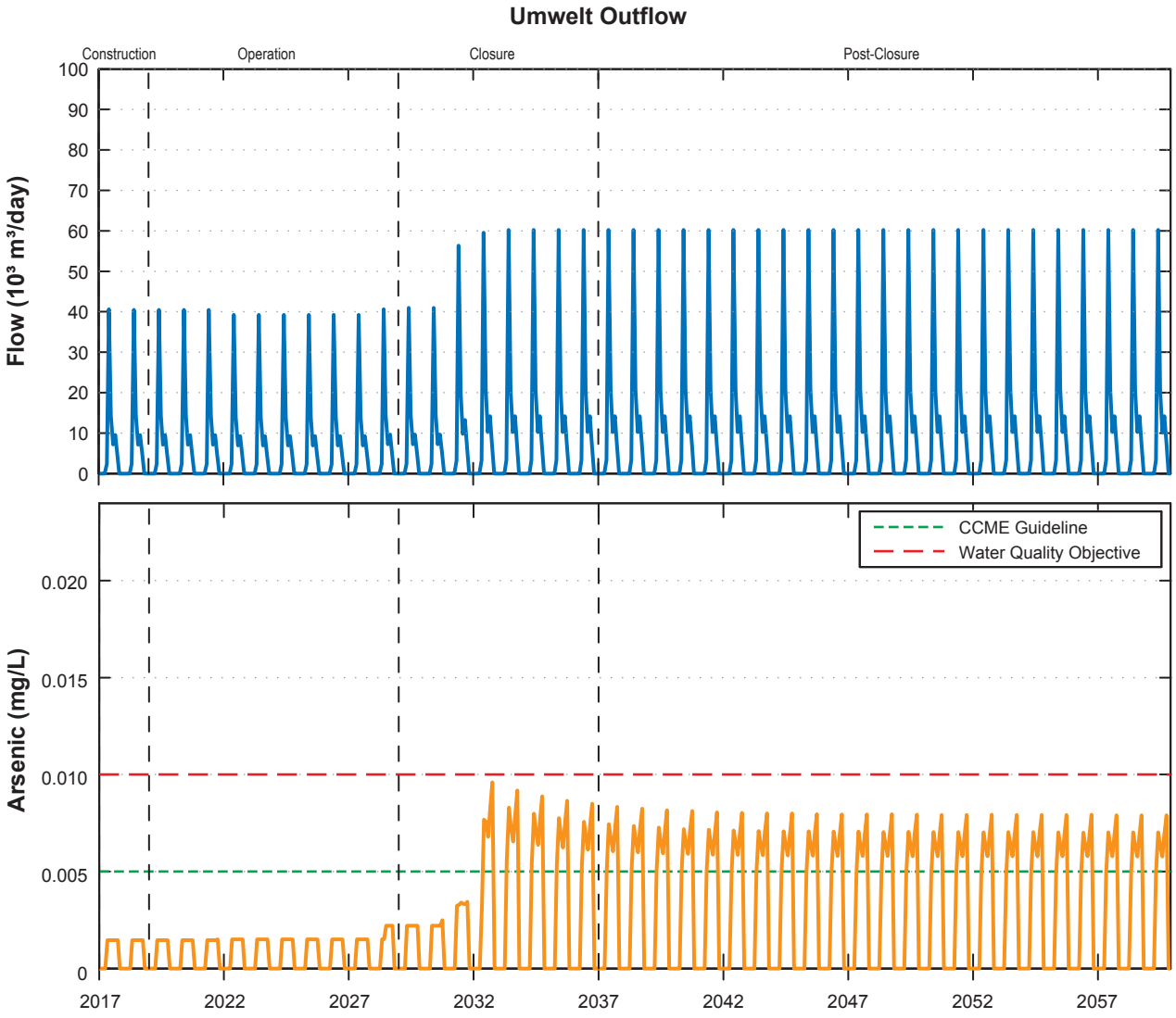

Figure 3.3-1

Discharge Volumes and Arsenic Concentrations: PN-4 (Umwelt Outflow)

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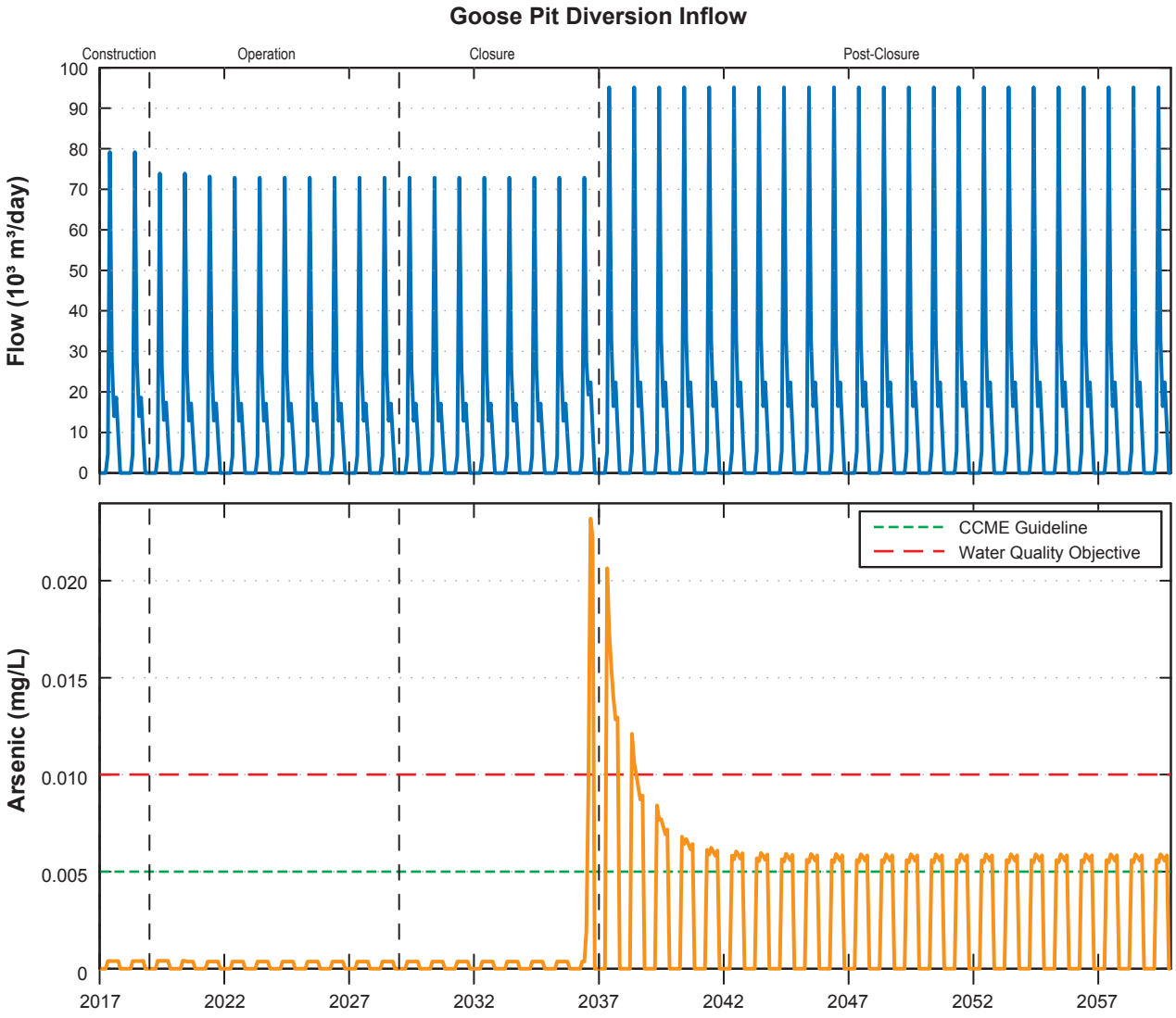

Figure 3.3-2

Discharge Volumes and Arsenic Concentrations: PN-6 (Goose Pit Diversion Inflow)

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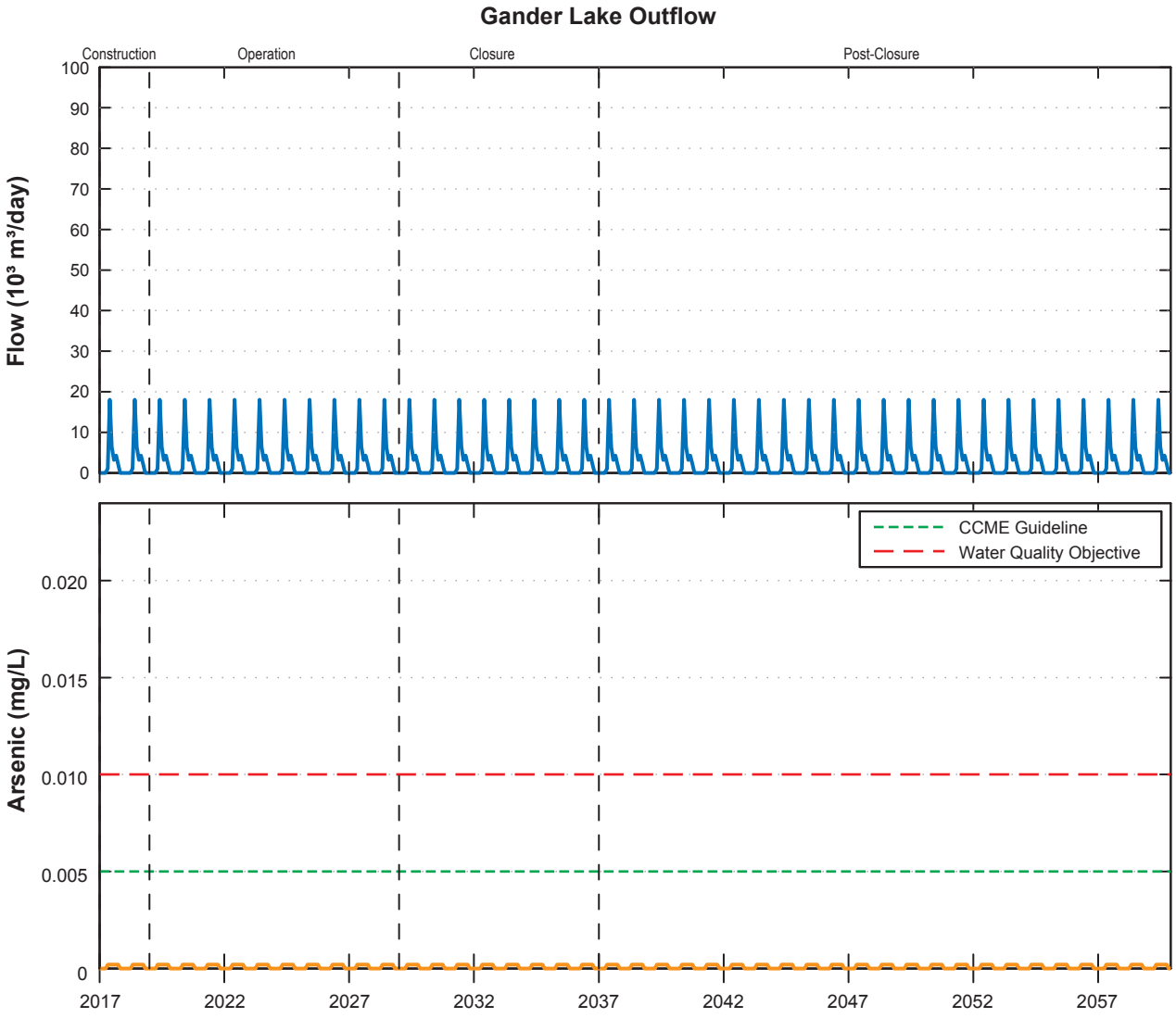

Figure 3.3-3

Discharge Volumes and Arsenic Concentrations: PN-8 (Gander Outflow)

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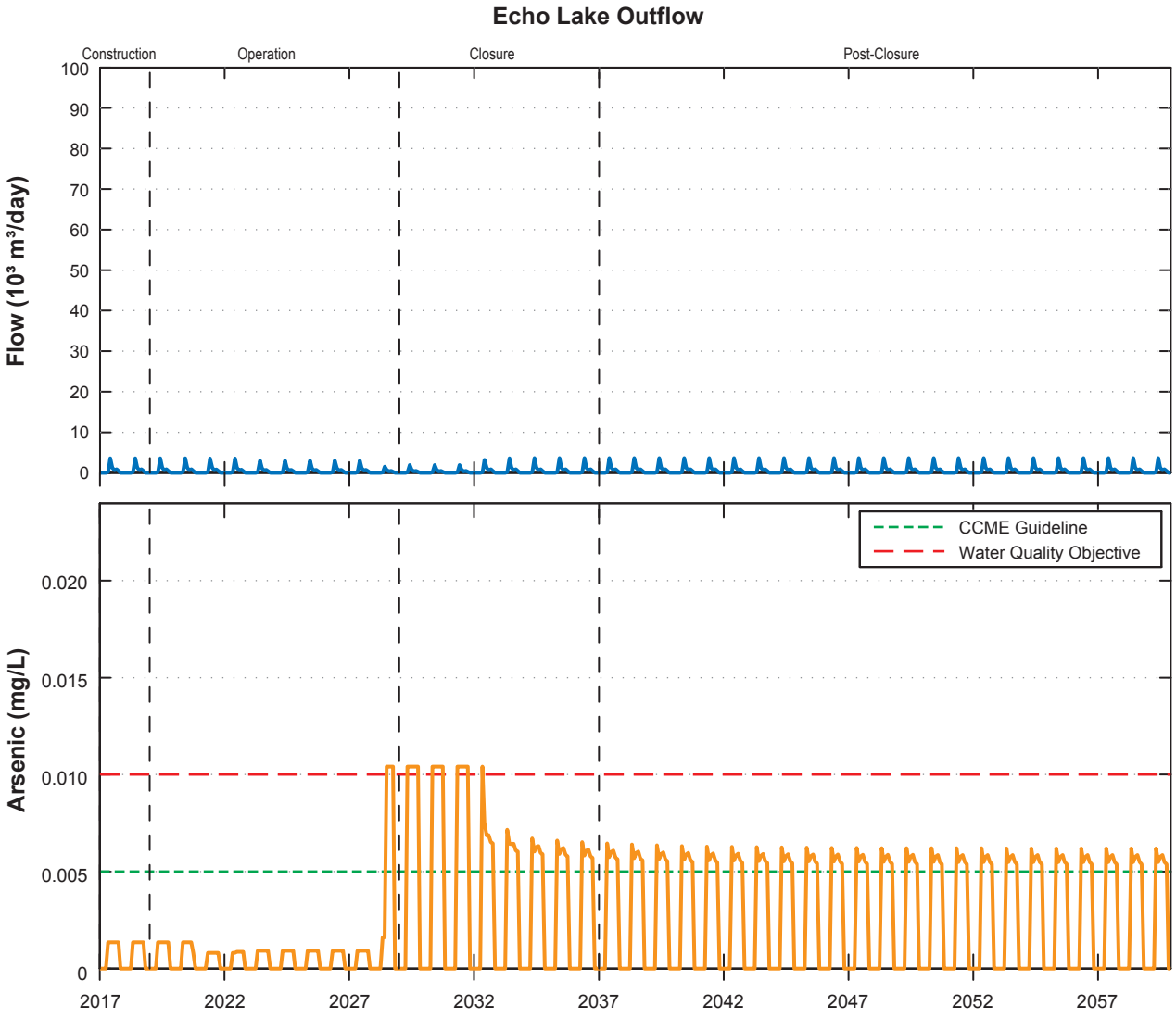

Figure 3.3-4

Discharge Volumes and Arsenic Concentrations: PN-9 (Echo Lake Outflow)

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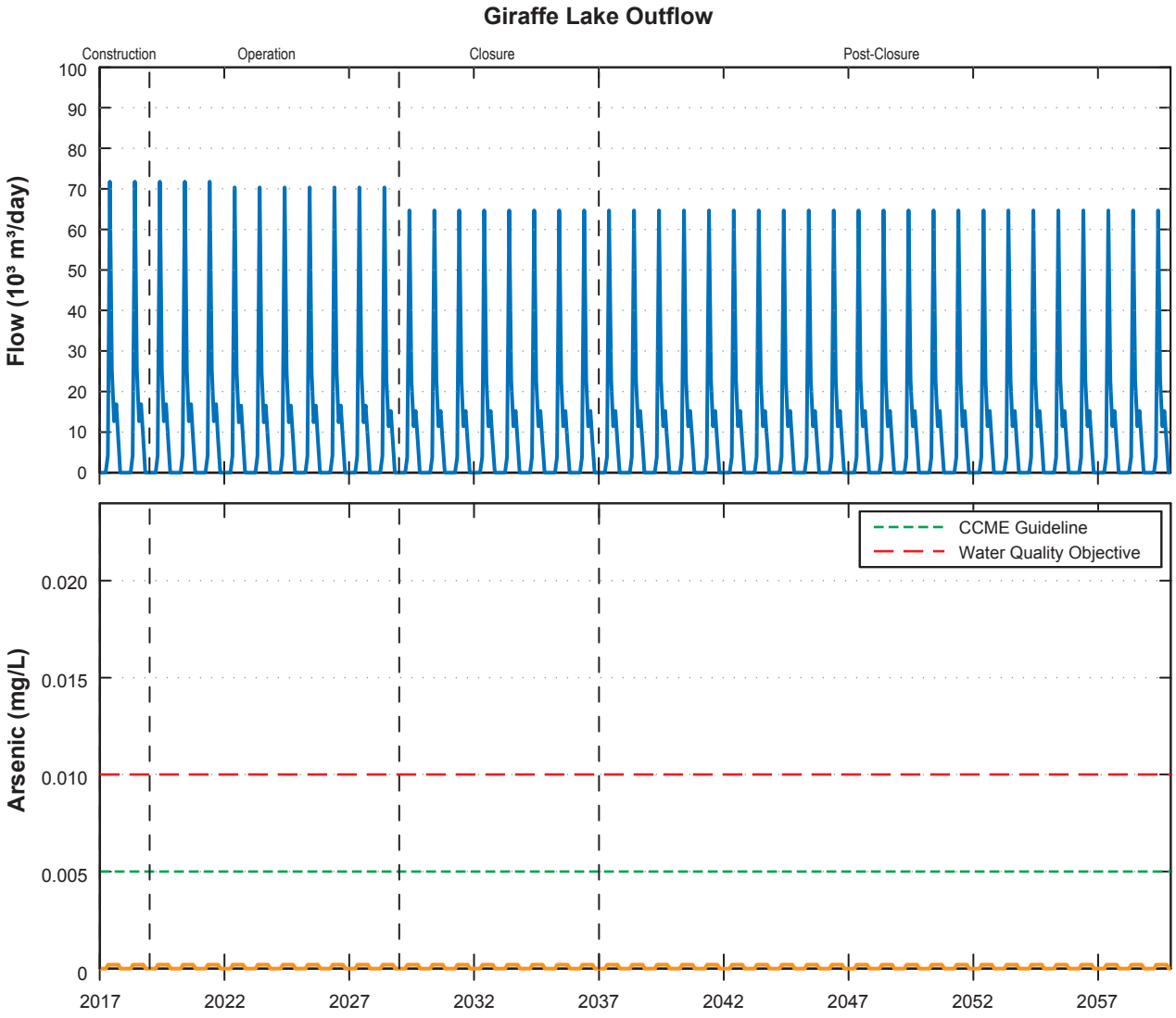

Figure 3.3-5

Discharge Volumes and Arsenic Concentrations: PN-12 (Giraffe Outflow)

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4. Results of Goose Lake Arsenic Predictions

4. Results of Goose Lake Arsenic Predictions

Arsenic concentrations were predicted over the temporal scale of all Project phases and the spatial scale of all of Goose Lake (all depths and locations). Both open-water (May to October) and under-ice (November to April) seasons were included in the modelling.

A total of six point sources were included for potential arsenic loading to Goose Lake. Of the input sources to Goose Lake, the locations that have varying flows and arsenic concentrations due to Project activities are:

- Umwelt Outflow (Llama/Umwelt System; PN-4) – This location represents the flows and arsenic concentrations leaving the Llama/Umwelt area which contains the Llama Pit, Umwelt Pit, Llama and Umwelt waste rock storage areas, the associated water management structures, and the Umwelt saline holding pond;
- Goose Pit Diversion Inflow (PN-6) – This location represents the flows and arsenic concentrations resulting from the operations and closure of the upstream Tailings Storage Facility (TSF), waste rock storage area, and Goose Main Pit. When the Goose Main Pit is closed, the overflow water will enter Goose Lake via this location;
- Echo Outflow (PN-9) – This location represents the flows and arsenic concentrations resulting from upstream Project activities including the Echo Pit, water management structures, waste rock storage area, and laydown area; and
- WTP discharge (WTP) – The discharge from the WTP will be located in the far western portion of Goose Lake. Treated water from this location will enter Goose Lake during a construction year only (2017).

The two remaining modelled inputs to Goose Lake were unaffected by Project activities (Giraffe Inflow PN-12, and Gander Inflow (PN-8) based on the data provided in the SRK Water and Load Balance Report (see Volume 2, Appendix V2-7H of the FEIS).

This chapter presents the modelling results in two main formats. Results are first presented for arsenic concentrations throughout the lake for the 'worst-case' year for each Project phase. These results are presented as 2D 'heat' diagrams covering four different seasonal time periods. Results are then presented as concentration graphs with time for three locations in Goose Lake (including a known Lake Trout spawning location and fish overwintering location), as well as for Goose Outflow.

4.1 PREDICTED LAKE-WIDE ARSENIC CONCENTRATIONS WITH PROJECT PHASE

Figures 4.1-1 through 4.1-5 present modelled lake-wide arsenic concentrations for each Project phase. For each Project phase, the 'worst-case' year is presented when average monthly arsenic concentrations are predicted to be the highest in the lake. For each year, the following four scenarios are presented:

1. April (5 m depth). Under-Ice Arsenic Concentrations (Winter). The arsenic concentrations presented are from the 5 m water layer. During April the top 2 m of the lake is frozen as ice. The 5-6 m layer was chosen for illustration in order to provide information on as much as the lake as possible, while representing a depth below the ice and above the small pockets in the lake that

are deeper. The winter concentrations represent concentrations that were essentially trapped in the lake from the previous year's freeze-up, and include the maximum cryoconcentration.

2. June (1 m depth). The arsenic concentrations presented are from the top 1 m water layer of the lake. June is when the highest inflows occur naturally (due to snow melt/freshet) and the lake could be influenced by high inflow volumes and runoff.
3. August (1 m depth). The arsenic concentrations presented are from the top 1 m water layer of the lake. August is typically when flows are at their natural low, but the active layer has begun to warm so runoff concentrations could be higher, but with low flows.
4. September (1 m depth). The arsenic concentrations presented are from the top 1 m water layer of the lake. September can see an increase in natural flows due to rain/storm events. September is also when the active layer will be at its maximum extent so arsenic concentrations in runoff could be highest during this time period.

4.1.1 Construction Phase

Figure 4.1-1 presents the predicted arsenic concentrations in Goose Lake for year 2018 during the Construction phase. Concentrations throughout the lake remain below the CCME guideline for the protection of freshwater aquatic life (0.005 mg/L) at all times.

Predicted arsenic concentrations at the known Lake Trout Spawning Habitat area and the Fish Overwintering Habitat area are predicted to remain below the CCME guideline for the protection of freshwater aquatic life (0.005 mg/L).

4.1.2 Operations Phase

Figure 4.1-2 presents the predicted arsenic concentrations in Goose Lake for year 2028 during the Operations phase. Similar to the Construction phase, predicted arsenic concentrations throughout the lake remain below the CCME guideline for the protection of freshwater aquatic life (0.005 mg/L) at all times.

Predicted arsenic concentrations at the known Lake Trout Spawning Habitat area and the Fish Overwintering Habitat area are predicted to remain below the CCME guideline for the protection of freshwater aquatic life (0.005 mg/L).

4.1.3 Closure Phase

Figure 4.1-3 presents the predicted arsenic concentrations in Goose Lake for year 2036 during the Closure phase. Predicted arsenic concentrations remain below the CCME guideline for the protection of freshwater aquatic life (0.005 mg/L) in the main basin of the lake.

A small, localized area in the western part of the lake is predicted to have arsenic concentrations slightly above the CCME guideline for the protection of freshwater aquatic life (0.005 mg/L) in June. This is a result of arsenic input from the Llama/Umwelt system (where the Llama and Umwelt open pits, waste rock storage areas, water management ponds, and saline storage pond are located). Once in the lake, the arsenic is predicted to dilute and return to below the CCME guideline west of the Goose 'neck'.

Another small, localized area in the southern part of the lake is predicted to have arsenic concentrations above the CCME guideline for the protection of freshwater aquatic life (0.005 mg/L). Predicted concentrations are at or near the site specific Water Quality Objective (WQO) for Goose Lake of 0.01 mg/L at this location. This is a result of arsenic input from the Goose Main Pit overflow and upstream tailings facility/waste rock storage facility. The inflow is predicted to dilute rapidly and arsenic concentrations in the main basin remain below the CCME guideline.

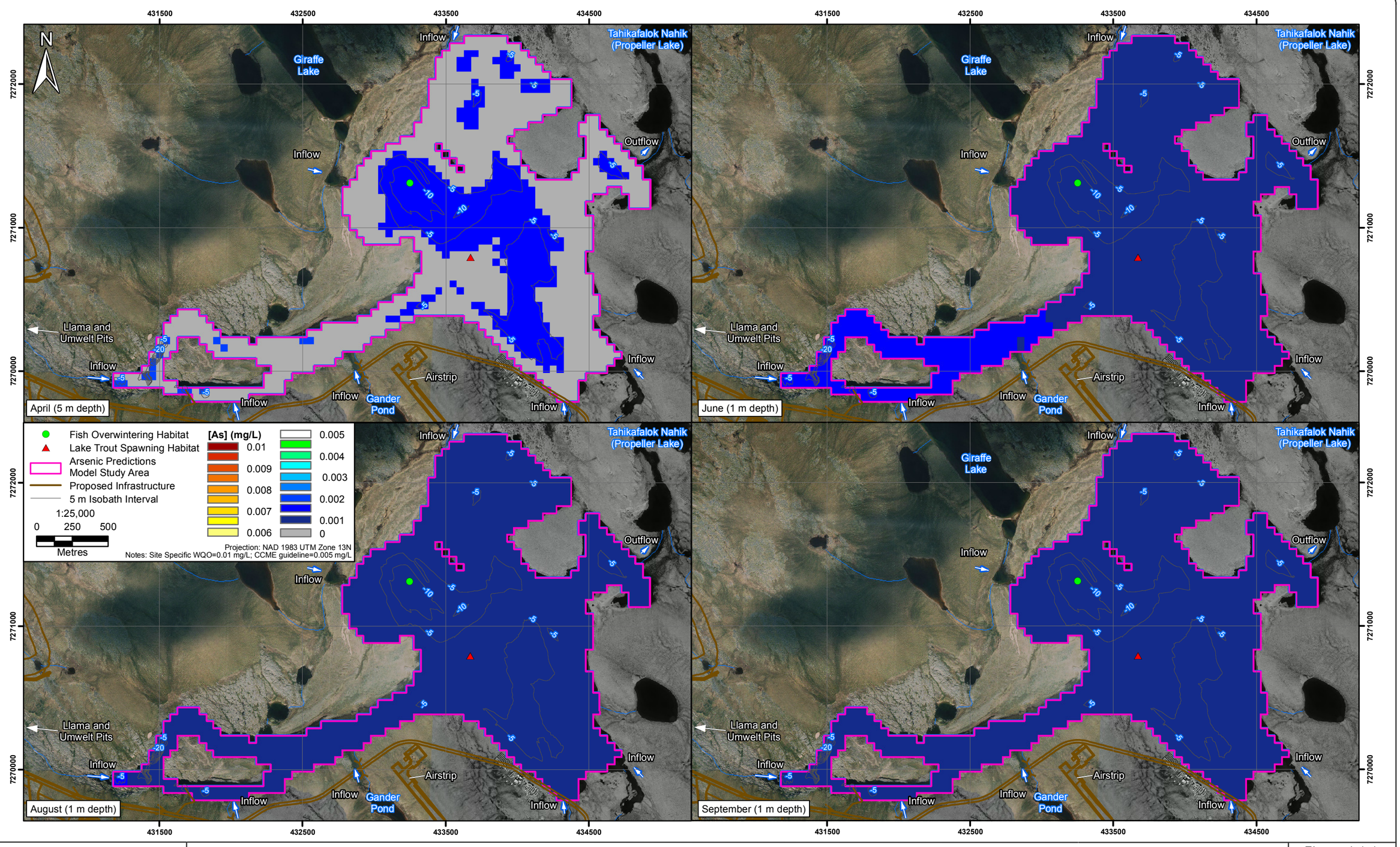

Figure 4.1-1

Arsenic Predictions for Goose Lake: Construction Phase (2018)

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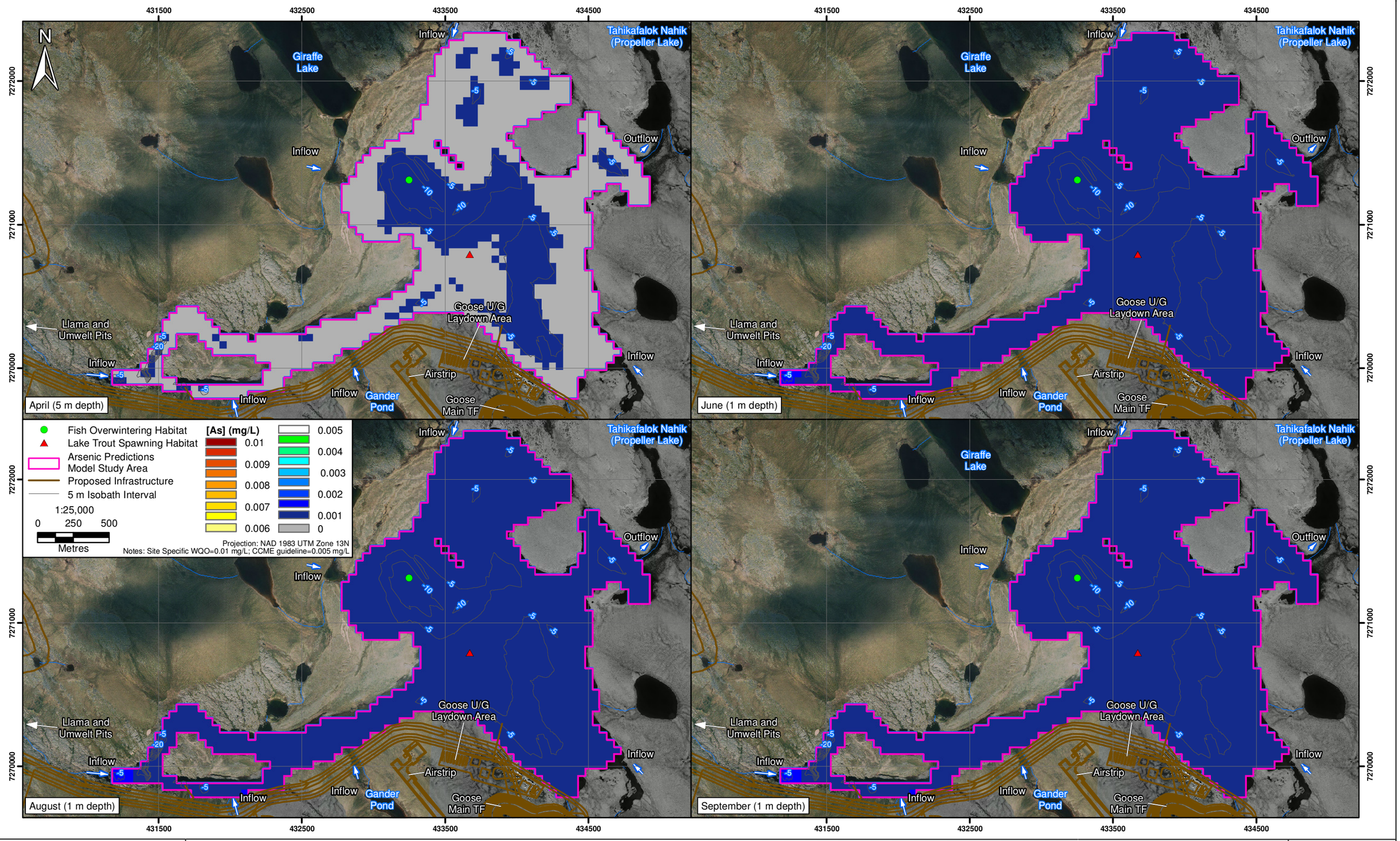

Sabina GOLD & SILVER CORP.

Figure 4.1-2

Arsenic Predictions for Goose Lake: Operations Phase (2028)

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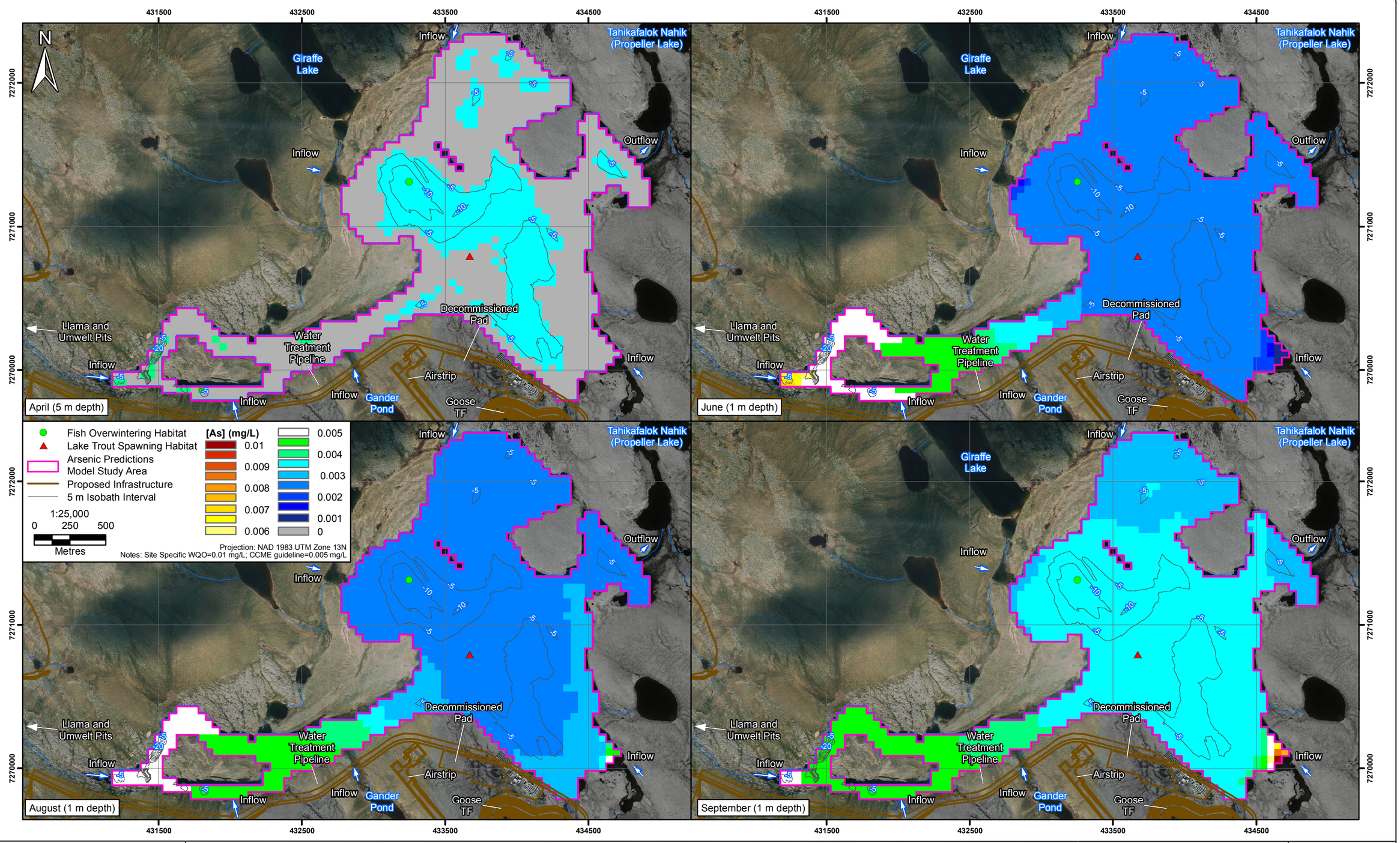

Figure 4.1-3

Arsenic Predictions for Goose Lake: Closure Phase (2036)

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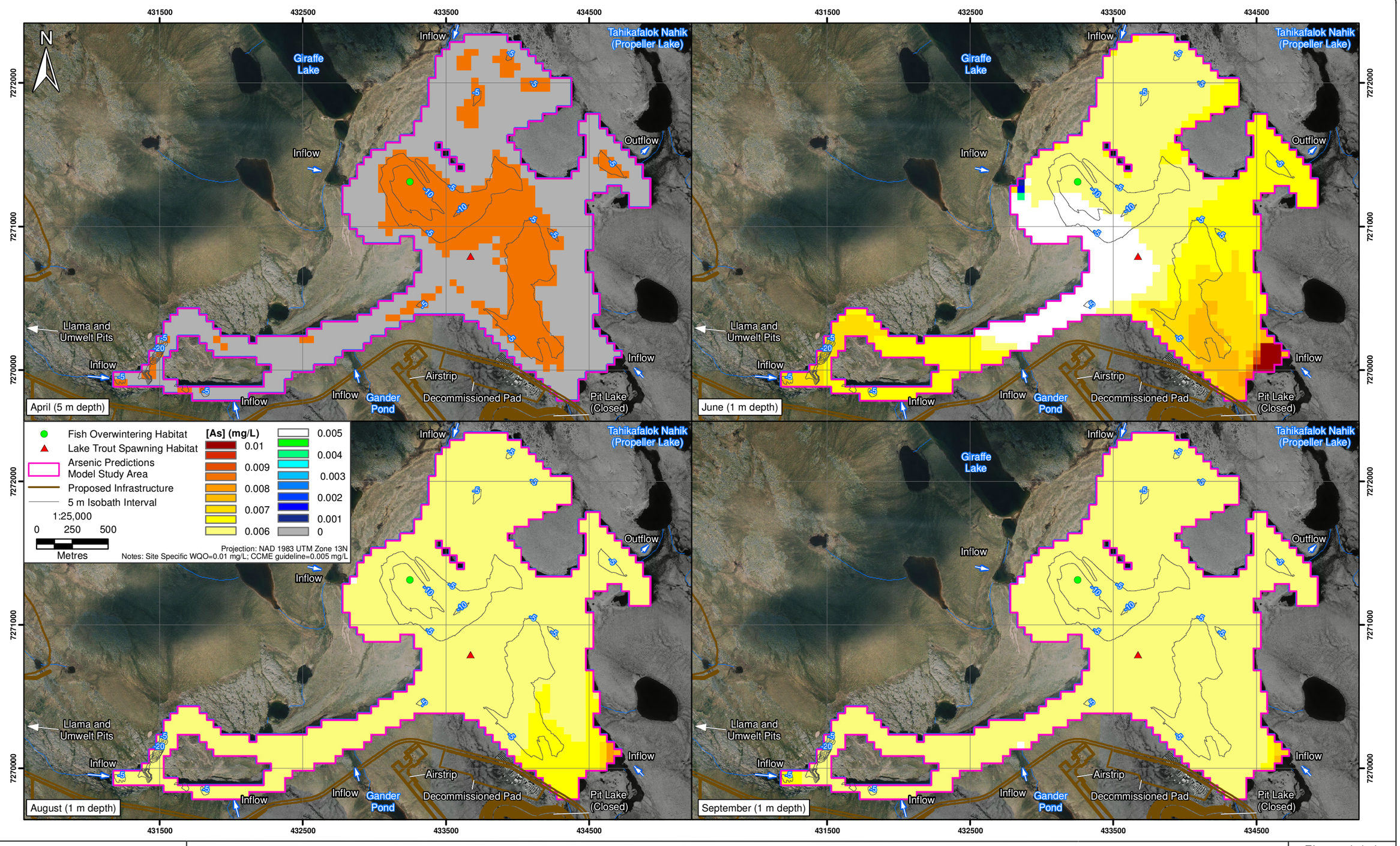

Figure 4.1-4

Arsenic Predictions for Goose Lake: Post-Closure Phase (2038)

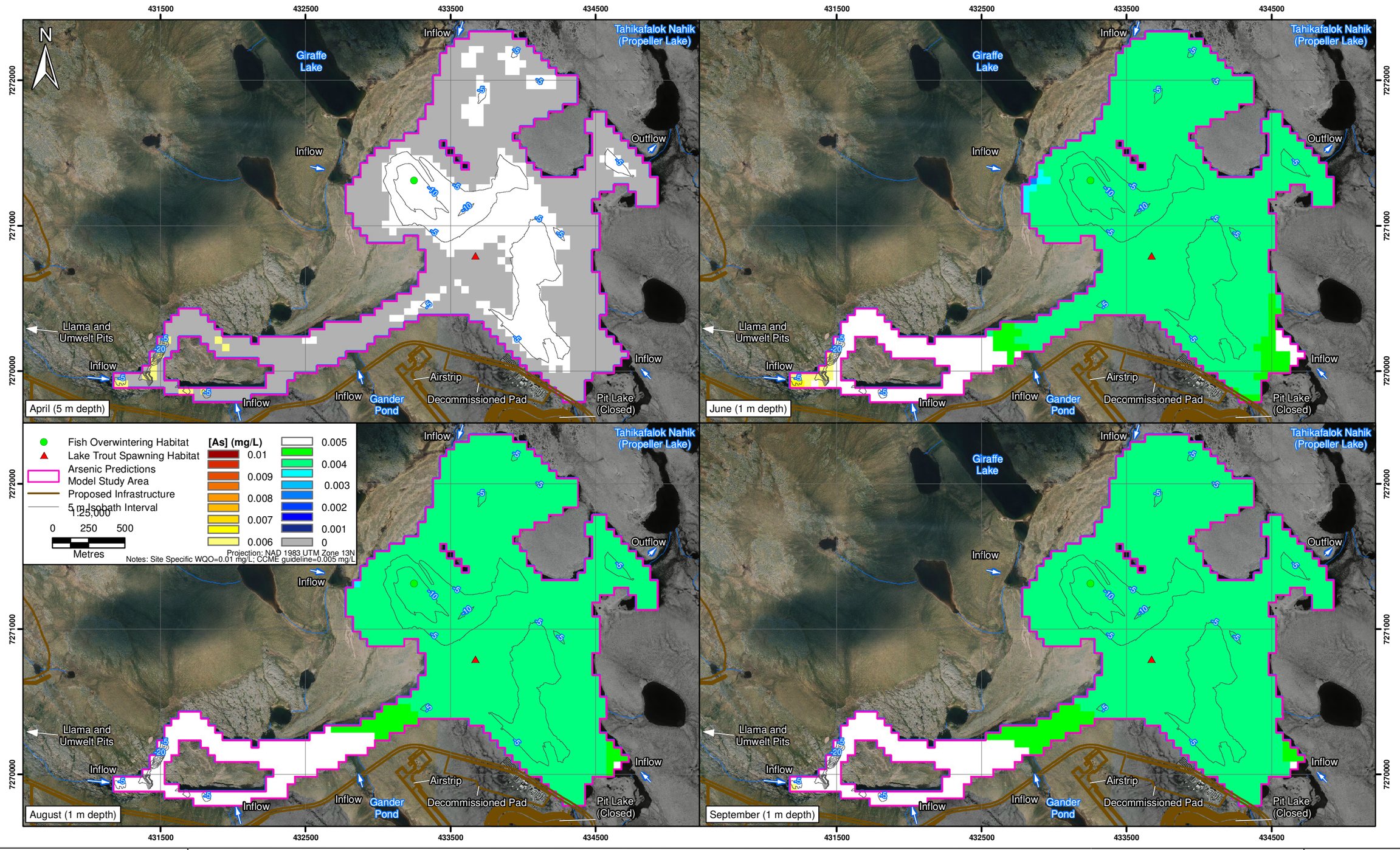

Figure 4.1-5

Arsenic Predictions for Goose Lake: Late Post-Closure Phase (2059)

Predicted arsenic concentrations at the known Lake Trout Spawning Habitat area and the Fish Overwintering Habitat area are predicted to remain below the CCME guideline for the protection of freshwater aquatic life (0.005 mg/L).

4.1.4 Post-Closure Phase

Figure 4.1-4 presents the predicted arsenic concentrations in Goose Lake for the 'worst-case year', year 2038, during the Post-Closure period. In order to present the predictions over a longer time period once some of the inputs have stabilized, Figure 4.1-5 presents the predicted arsenic concentrations for the last year that the model was run, year 2059.

4.1.4.1 Worst-Case Year (2038)

For the 'worst-case' year (2038), predicted arsenic concentrations in Goose Lake are higher than any other time during the Project life. Predicted arsenic concentrations are greater than the CCME guideline for the protection of freshwater aquatic life (0.005 mg/L) throughout the lake during all seasons and at all depths. However, predicted concentrations remain below the WQO of 0.01 mg/L for the main basin of the lake.

The main input of arsenic contributing to the Goose Lake concentrations is the overflow of the closed Goose Main Pit and the closure of the upstream tailings facility/waste rock storage area. The Llama/Umwelt system also continues to contribute to arsenic loading.

A small localized area in the southern part of the lake is predicted to have arsenic concentrations at or above the site specific Water Quality Objective (WQO) for Goose Lake (0.01 mg/L) during freshet (June) at this location. This is a result of arsenic input from the Goose Main Pit overflow and upstream tailings facility/waste rock storage facility. The inflow is predicted to dilute rapidly and arsenic concentrations in the main basin remain below the WQO but above the CCME guideline.

The elevated concentrations in April of 2038 are a result of the previous year's loading combined with the cryoconcentration of arsenic during the winter months. Once the ice melts the lake will mix and dilute the majority of water column resulting in the main basin having concentrations below the WQO but above the CCME guideline.

4.1.4.2 Long-Term Post-Closure (2059)

Figure 4.1-5 presents the predicted arsenic concentrations in Goose Lake for year 2059-the last year for which water flow and loading predictions were available.

Predicted arsenic concentrations return to levels at or below the CCME guideline for the protection of freshwater aquatic life (0.005 mg/L) in the majority of the lake during the open-water season. The exception is localized, slightly elevated concentrations in the western end of the lake as a result of slight loadings from the Llama/Umwelt system.

Winter arsenic concentrations are predicted to be slightly above the CCME guideline due to cryoconcentration and the previous year's loadings from the Llama/Umwelt system (and to a lesser extent the Goose Main Pit/TSF system). Once the ice melts the lake will mix and dilute the majority of the water column resulting in the majority of the lake having concentrations below the CCME guideline for the protection of freshwater aquatic life (0.005 mg/L).

Overall, Goose Lake is predicted to have arsenic concentrations close to or below the CCME guideline for the protection of freshwater aquatic life (0.005 mg/L) for the long-term.

4.2 PREDICTED ARSENIC CONCENTRATIONS FOR GOOSE LAKE AND GOOSE OUTFLOW

4.2.1 Goose Lake

Figure 4.2-1 presents the predicted arsenic concentrations with time in Goose Lake at 3 main areas:

- Goose Lake Main Basin, near the Outflow (at 3 m depth);
- a known Lake Trout Spawning Habitat area (at 5 m depth); and
- a Fish Overwintering Habitat area (10 m depth).

All three of these areas are located within the main basin of the lake. The locations of the Lake Trout Spawning Area and the Fish Overwintering Area can be seen on all of the 2D Figures presented above (Figures 4.1-1 through 4.1-5).

As can be seen, there is very little difference in predicted arsenic concentrations among the three main areas shown in the graph. The deeper areas in the main basin (e.g., 10 m depth, at the Fish Overwintering Area) may have slightly lower arsenic concentrations compared to the other sites during the open-water season, but in general the predicted arsenic concentrations remain uniform with depth in the main basin of the lake.

For the overall predicted arsenic concentrations, concentrations remain low and below the CCME guideline for the protection of freshwater aquatic life (0.005 mg/L) during the Construction and Operations phases. During the Closure phase, predicted concentrations start to rise, with concentrations peaking during the beginning of the Post-Closure phase.

The elevated concentrations at the beginning of the Post-Closure phase are mainly due to the input of arsenic from the overflow of the closed Goose Main Pit and the closure of the upstream tailings facility/waste rock storage area. The Llama/Umwelt system also continues to contribute to arsenic loading during this time. Peak concentrations are predicted to be above the CCME guideline for the protection of freshwater aquatic life (0.005 mg/L), but below the WQO for Goose Lake (0.01 mg/L).

During Post-Closure, predicted arsenic concentrations decline each year, with concentrations stabilizing approximately six years after the peak year. Once the input sources have stabilized, predicted arsenic concentrations remain at or below the CCME guideline for the protection of freshwater aquatic life (0.005 mg/L) for the majority of the year, but temporarily increase during the winter months due to cryoconcentration.

4.2.2 Goose Outflow

Figure 4.2-2 presents the predicted arsenic concentrations with time at Goose Outflow. These concentrations reflect the predicted concentrations in the outflow itself, not the stream. Based on years of on-site baseline data (e.g., Rescan 2011, 2012a, 2012b, 2012c, 2012d, 2014a, 2014b) this stream freezes to the streambed every winter from November to May.

Similar to the Goose Lake predictions, arsenic concentrations are predicted to remain low and below the CCME guideline for the protection of freshwater aquatic life (0.005 mg/L) during the Construction and Operations phases. During the Closure phase, predicted concentrations start to rise slightly but remain below the CCME guideline.

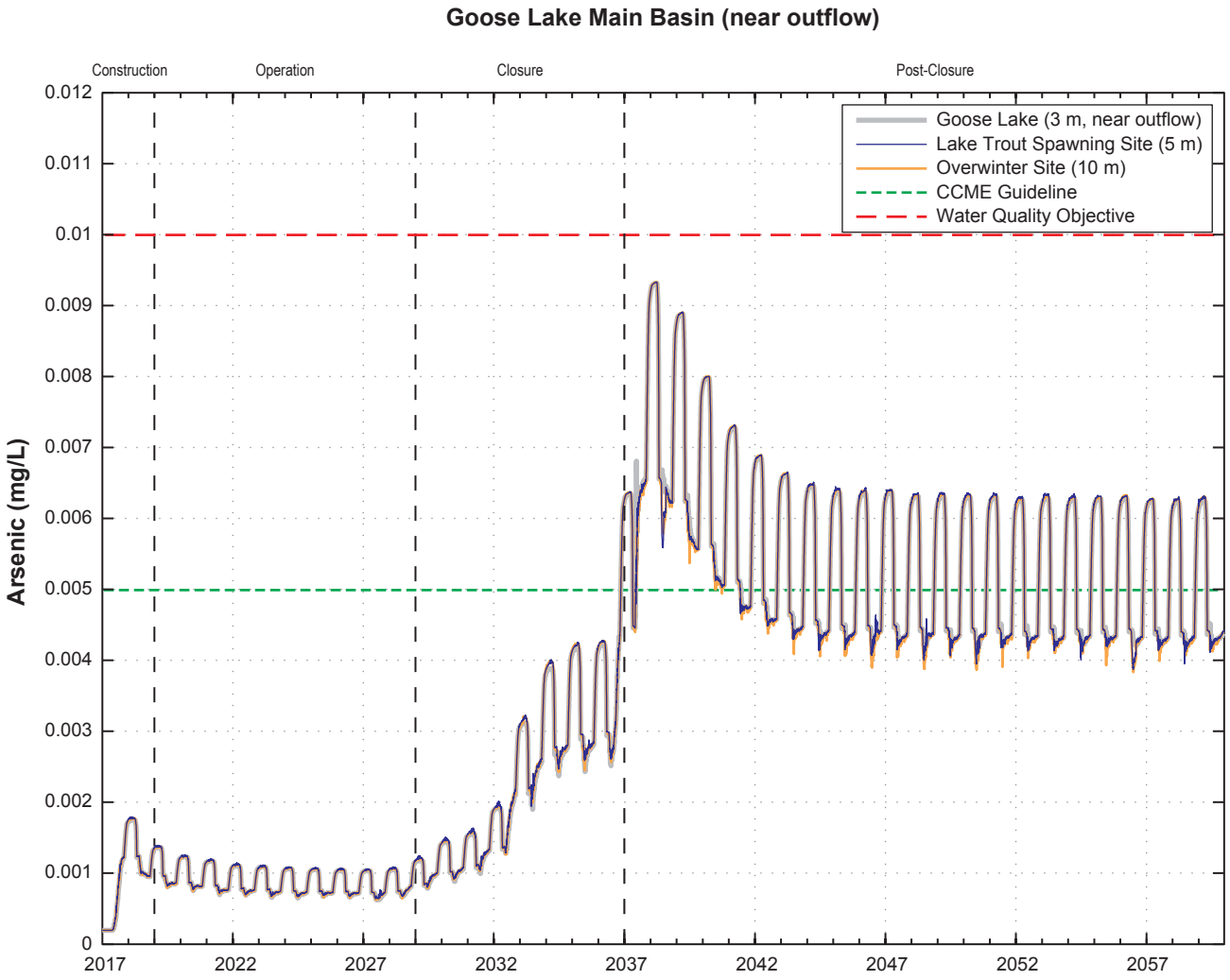

Figure 4.2-1

Predicted Arsenic Concentrations for Goose Lake with Time

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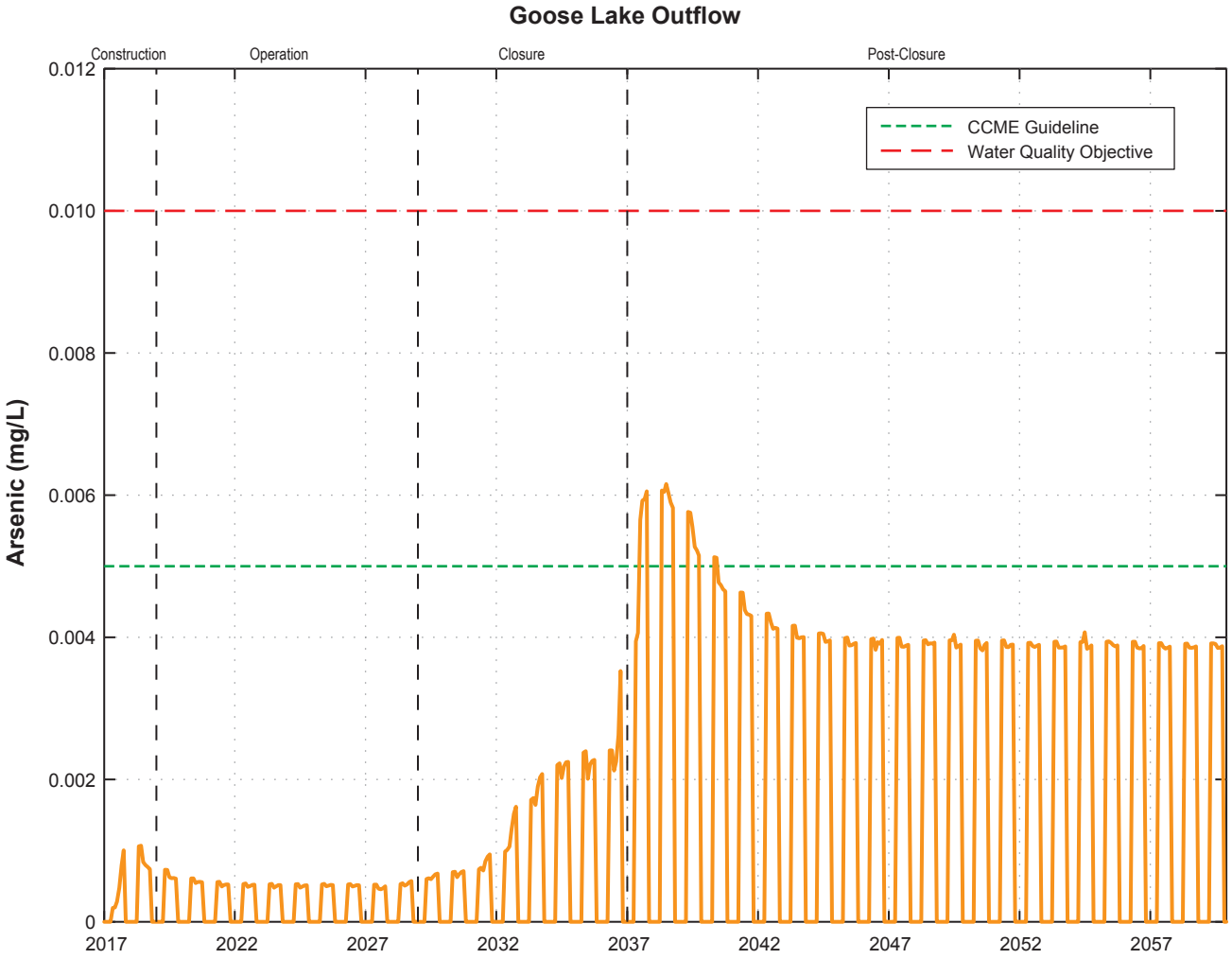

Figure 4.2-2

Predicted Arsenic Concentrations at Goose Outflow with Time

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Predicted concentrations during the Post-Closure phase are slightly above the CCME guideline for the protection of freshwater aquatic life (0.005 mg/L) for the first two years of Post-Closure. However, predicted concentrations decline quickly and return to at or below the CCME guideline level three years into the Post-Closure period. Subsequent years have predicted arsenic concentrations below the CCME guideline for as long as the model was run (to year 2059).

5. Summary and Conclusions

5. Summary and Conclusions

Arsenic concentrations were predicted over the temporal scale of all Project phases and the spatial scale of all of Goose Lake (all depths and locations). Both open-water (May to October) and under-ice (November to April) seasons were included in the modelling.

A total of six point sources were included for potential arsenic loading to Goose Lake. Of the input sources to Goose Lake, the locations that have varying flows and arsenic concentrations due to Project activities include the Llama/Umwelt system, the Goose Main Pit/TSF system, Echo Outflow, and the water treatment plant discharge during construction. The two remaining inputs were unaffected by Project activities (Giraffe Inflow and Gander Inflow) based on the data provided in the SRK Water and Load Balance Report.

Results from the Goose Lake arsenic predictions model are presented in two main formats. Results are first presented for arsenic concentrations throughout the lake for the 'worst-case' year for each Project phase. These results are presented as 2D 'heat' diagrams covering four different seasonal time periods. Results are then presented as concentration graphs with time for three locations in Goose Lake (including a known Lake Trout spawning location and fish overwintering location), as well as for Goose Outflow.

Predicted Lake-Wide Arsenic Concentrations with Project Phase

For the Construction and Operations phases, results indicate that predicted arsenic concentrations remain below the CCME guideline for the protection of freshwater aquatic life (0.005 mg/L) in all parts of the lake at all times. Predicted arsenic concentrations at the known Lake Trout Spawning Habitat area and the Fish Overwintering Habitat area are predicted to remain below the CCME guideline for the protection of freshwater aquatic life (0.005 mg/L) during these Project phases.

For the Closure phase, results indicate that predicted arsenic concentrations remain below the CCME guideline for the protection of freshwater aquatic life (0.005 mg/L) in the main basin of the lake. However, small, localized areas in the western and southern parts of the lake are predicted to have arsenic concentrations above the CCME guideline but at or below the site specific Water Quality Objective (WQO) for Goose Lake (0.01 mg/L). These localized elevated concentrations are a result of arsenic inputs from the Llama/Umwelt system (where the Llama and Umwelt open pits, waste rock storage areas, water management ponds, and saline storage pond are located) and the Goose Main Pit overflow and upstream tailings facility/waste rock storage facility system. These localized areas are predicted to dilute rapidly and arsenic concentrations in the main basin remain below the CCME guideline. Predicted arsenic concentrations at the known Lake Trout Spawning Habitat area and the Fish Overwintering Habitat area are predicted to remain below the CCME guideline for the protection of freshwater aquatic life (0.005 mg/L).

For the Post-Closure phase, the 'worst-case' year is presented, along with the last year of available modelled information. This is to provide predicted results for the expected long-term concentrations in the lake. The highest predicted arsenic concentrations occur at the beginning of the Post-Closure phase (year 2038). For the 'worst-case' year, predicted arsenic concentrations are greater than the CCME guideline for the protection of freshwater aquatic life (0.005 mg/L) throughout the lake during all seasons and at all depths. However, predicted concentrations remain below the WQO of 0.01 mg/L for the main basin of the lake. The main input of arsenic contributing to the Goose Lake concentrations is the overflow of the closed Goose Main Pit and the closure of the upstream tailings facility/waste rock storage area. The Llama/Umwelt system also continues to contribute to arsenic loading.

However, for the Late Post-Closure phase, predicted arsenic concentrations return to levels at or below the CCME guideline for the protection of freshwater aquatic life (0.005 mg/L) in the majority of the lake during the open-water season. The exception is localized, slightly elevated concentrations in the western end of the lake as a result of slight loadings from the Llama/Umwelt system. Overall, Goose Lake is predicted to have arsenic concentrations close to or below the CCME guideline for the protection of freshwater aquatic life (0.005 mg/L) for the long-term.

Predicted Arsenic Concentrations for Goose Lake and Goose Outflow

For Goose Lake, predicted arsenic concentrations with time are presented for the following locations:

- Goose Lake Main Basin, near the Outflow (at 3 m depth);
- a known Lake Trout Spawning Habitat area (at 5 m depth); and
- a Fish Overwintering Habitat area (10 m depth).

In general, predicted arsenic concentrations remain uniform with depth in the main basin of the lake. At all three locations in the main basin of the lake, predicted arsenic concentrations remain low and below the CCME guideline for the protection of freshwater aquatic life (0.005 mg/L) during the Construction and Operations phases. During the Closure phase, predicted concentrations start to rise, with concentrations peaking during the beginning of the Post-Closure phase.

The elevated concentrations at the beginning of the Post-Closure phase are mainly due to the input of arsenic from the overflow of the closed Goose Main Pit and the closure of the upstream tailings facility/waste rock storage area. The Llama/Umwelt system also continues to contribute to arsenic loading during this time. Peak concentrations are predicted to be above the CCME guideline for protection of freshwater aquatic life (0.005 mg/L), but below the WQO for Goose Lake (0.01 mg/L).

During Post-Closure, predicted arsenic concentrations decline each year, with concentrations stabilizing approximately six years after the peak year. Once the input sources have stabilized, predicted arsenic concentrations remain at or below the CCME guideline for protection of freshwater aquatic life (0.005 mg/L) for the majority of the year, but temporarily increase during the winter months due to cryoconcentration.

For Goose Outflow, similar to the Goose Lake predictions, arsenic concentrations are predicted to remain low and below the CCME guideline for the protection of freshwater aquatic life (0.005 mg/L) during the Construction and Operations phases. During the Closure phase, predicted concentrations start to rise slightly but remain below the CCME guideline.

Predicted concentrations during the Post-Closure phase are slightly above the CCME guideline for the protection of freshwater aquatic life (0.005 mg/L) for the first two years of Post-Closure. However, predicted concentrations decline quickly and return to at or below the CCME guideline level three years in to the Post-Closure period. Subsequent years have predicted arsenic concentrations below the CCME guideline for as long as the model was run (to year 2059).

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Appendix A

Goose Lake Wind Roses, 2004 to 2014

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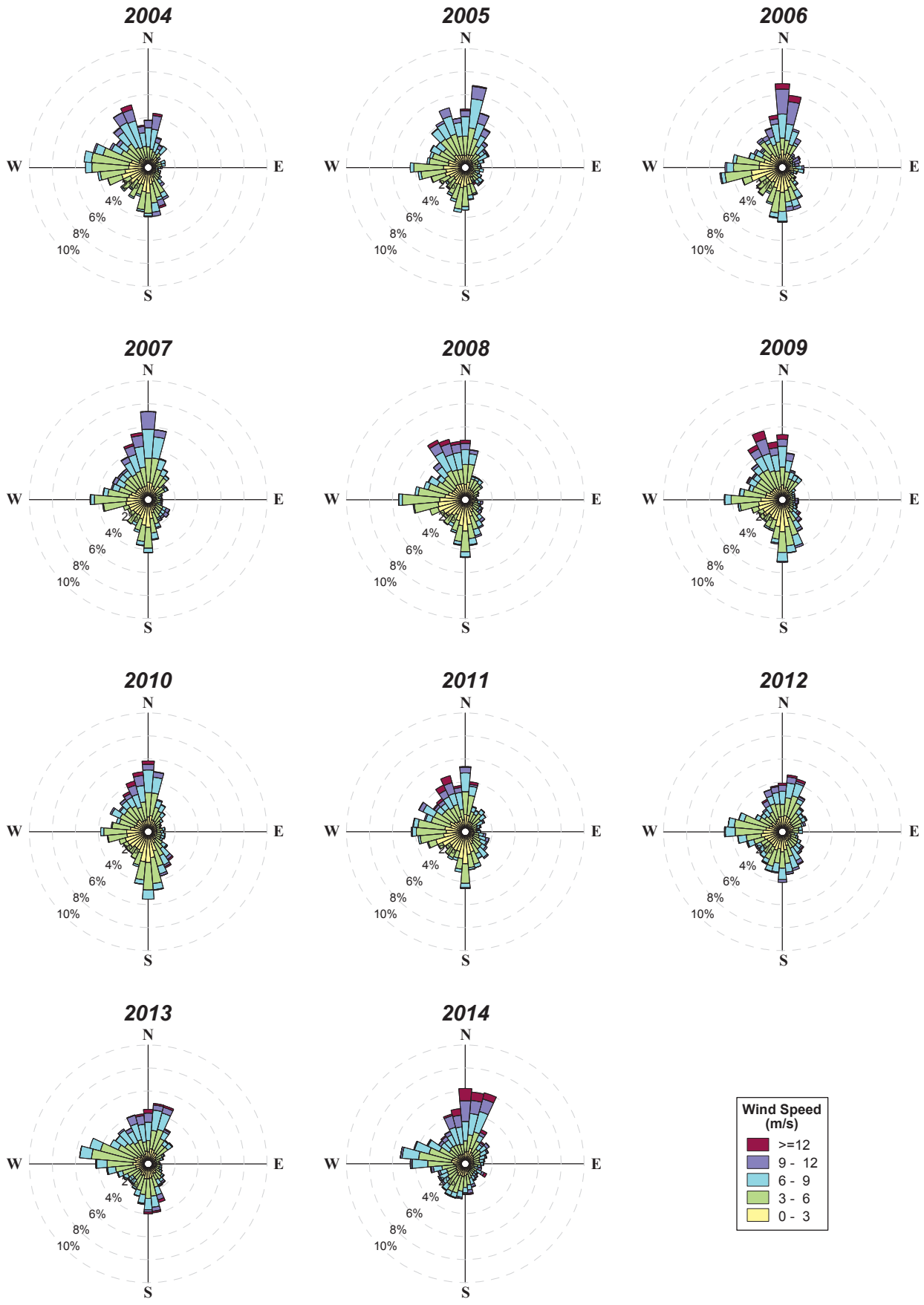

Appendix A

Goose Lake Wind Roses, 2004 to 2014

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Appendix B

Randomized Yearly Winds Used per Model Year

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Appendix B. Randomized Yearly Winds Used per Model Year

Model Year	Wind Year
2017	2012
2018	2013
2019	2005
2020	2013
2021	2010
2022	2005
2023	2007
2024	2009
2025	2014
2026	2014
2027	2006
2028	2014
2029	2014
2030	2009
2031	2012
2032	2005
2033	2008
2034	2013
2035	2012
2036	2014
2037	2011
2038	2004

Model Year	Wind Year
2039	2012
2040	2013
2041	2011
2042	2012
2043	2011
2044	2008
2045	2011
2046	2006
2047	2011
2048	2004
2049	2007
2050	2004
2051	2005
2052	2012
2053	2011
2054	2007
2055	2014
2056	2004
2057	2008
2058	2008
2059	2012

Appendix V6-4B

Back River Project: 2013 Freshwater Baseline Report

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BACK RIVER PROJECT
2013 Freshwater Baseline Report

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BACK RIVER PROJECT
2013 FRESHWATER BASELINE REPORT

February 2014
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Prepared for:

Sabina Gold & Silver Corp.

Prepared by:

Rescan Environmental Services Ltd., an ERM company
Vancouver, British Columbia

Executive Summary

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Executive Summary

The Back River Project (the Project) is an exploration gold project owned by Sabina Gold & Silver Corp. (Sabina) located in the West Kitikmeot region of Nunavut. For 2013, Sabina contracted Rescan ERM (Rescan) to conduct a comprehensive freshwater baseline sampling program to support the freshwater environment portions of the draft Environmental Impact Statement (DEIS; Rescan 2013).

The 2013 freshwater baseline program included the sampling of lakes and streams in the Goose and George properties and at two far-field reference locations. Information on lake bathymetry, lake water quality and physical limnology (under-ice and open water), lake sediment quality, lake phytoplankton, lake benthic macroinvertebrates, stream water quality (freshet and summer), stream sediment quality, stream periphyton, and stream benthic macroinvertebrates was collected.

Twenty-two lakes and 16 streams were sampled in the Goose and George properties as part of the 2013 freshwater baseline program. Water quality data from two additional ponds and two potential water source lakes for the Marine Laydown Area (MLA) were also collected and presented in the appendices of this report. Additional bathymetric information is included in the 2013 Freshwater Fish and Fish Habitat Baseline Report (Rescan, 2014).

Lakes tended to be partially stratified in April and well mixed in July. The water quality of lakes and streams was soft and slightly acidic to slightly basic, with generally low concentrations of suspended solids, dissolved solids, and low conductivity. In April, dissolved oxygen concentrations near the bottom of some lakes were less than the Canadian Council of Ministers of the Environment (CCME) dissolved oxygen guidelines for early life stages and below CCME guidelines for all life stages at some of the Goose Property lake sites. In July, lakes were generally well-oxygenated but some streams had dissolved oxygen concentrations less than the CCME guideline for early life stages. Nutrient concentrations in lakes and streams were generally low, particularly bioavailable forms, and lake trophic status was usually ultra-oligotrophic to oligotrophic.

Water samples from approximately half of the sampled lakes and all sampled streams had naturally occurring concentrations greater than the CCME guidelines for at least one of the following metals: total aluminum, total cadmium, total copper, total iron, and total lead. Most lake and stream sites had at least one sample with concentrations greater than the hardness-dependent copper guideline.

Lake and stream sediments had naturally elevated concentrations of arsenic, cadmium, chromium, copper, and zinc, which often were greater than their respective CCME Interim Sediment Quality Guideline (ISQG). Sediment metal concentrations greater than the CCME ISQG guidelines were observed more frequently in George Property waterbodies than in Goose Property waterbodies. All lakes had at least one sediment sample greater than the CCME ISQGs for at least one metal, with most lakes having naturally elevated arsenic or copper. Over half the lake sites, including all George Property lakes, had naturally elevated arsenic concentrations that were greater than the CCME PEL and copper concentrations were naturally higher than the CCME PELs at seven of the twenty six lake sites.

Phytoplankton communities in lakes were dominated by Myxophyceae (cyanobacteria), Cryptophyceae (a class of flagellated algae) and Chrysophyceae (golden algae) with compositions and densities varying among lakes. Lakes had low phytoplankton biomass (as chlorophyll *a*), with mean concentrations below 1 µg chl *a*/L at all lakes during both sampling sessions. Periphyton communities in streams were dominated by cyanobacteria in varying densities. All streams had mean periphyton biomass less than 1.25 µg chl *a*/cm^2.

Benthic macroinvertebrate communities in both lakes and streams were dominated by chironomid dipterans (non-biting midge flies), and densities varied at least five-fold among sites. Mean benthos densities ranged from a mean of 274 to 27,900 individuals/m^2 in lakes, and a mean of 330 organisms/m^2 to 3,180 individuals/m^2 in streams.

A comprehensive summary table of results from all lake and streams sampled in 2013 is included in Chapter 4 of this report.

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This report was prepared for Sabina Gold & Silver Corp. (Sabina) by Rescan Environmental Services Limited (Rescan). The 2013 freshwater fieldwork was conducted by Ben Beall (Ph.D., M.Sc.), Fiona Hodge (M.Sc.), Annette Muttray (Ph.D.), Elizabeth Boyle (M.Sc.), Adam Chateauvert (M.Sc.) and Rebecca D'Onofrio (B.Sc.) with assistance of Doyle Kavanna, Robert Maksagak and Mark Wasiuta of Sabina. Data analysis and report writing was conducted by Fiona Hodge and Ben Beall. This report was reviewed by Erin Forster (B.Sc.), Mike Henry (Ph.D.) and Deborah Muggli (Ph.D., M.Sc., R.P.Bio.). The project was managed by Deborah Muggli and co-ordinated by Korina Houghton (B.Sc.).

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Glossary and Abbreviations

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Glossary and Abbreviations

Terminology used in this document is defined where it is first used. The following list will assist readers who may choose to review only portions of the document.

°C	Degrees Celsius
$CaCO_3$	Calcium carbonate
CCME	Canadian Council of Ministers of the Environment
Chl *a*	Chlorophyll *a*
DDI	Double de-ionized water
DEIS	Draft Environmental Impact Statement
DGPS	Differential Global Positioning System
EPT	Ephemeroptera, Plecoptera and Trichoptera
EZD	Euphotic Zone Depth
IF	Inflow
ISQG	Interim Sediment Quality Guideline
LSA	Local Study Area
mALS	Metres above sea level
NWT	Northwest Territories
NTU	Nephelometric Turbidity Unit
OF	Outflow
PDA	Potential Development Area
PEL	Probable Effects Level
QA/QC	Quality Assurance and Quality Control
RDL	Realized Detection Limit
RPD	Relative Percent Difference
RSA	Regional Study Area
RTK	Real Time Kinematic
sp.	Refers to a single species in a genus
spp.	Refers to multiple species within a genus
Thermocline	A section of the water column where the temperature changes rapidly with depth
TIN	Triangular Irregular Network
TKN	Total Kjeldahl Nitrogen
TDS	Total Dissolved Solids
TSS	Total Suspended Solids

TOC	Total Organic Carbon
WAD Cyanide	Weak Acid Dissociable Cyanide
WRSA	Waste Rock Storage Area

1. Introduction

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1. Introduction

The Back River Project (the Project) is a proposed gold project owned by Sabina Gold & Silver Corp. (Sabina) located in the West Kitikmeot region of Nunavut (Figure 1-1). This report presents the results of the 2013 freshwater baseline sampling program developed to support the freshwater environment portions of the draft Environmental Impact Statement (DEIS; Rescan 2013) and to provide baseline information for future monitoring programs should the Project be approved.

The freshwater baseline program included the sampling of lakes and streams in the Goose and George Potential Development Areas (PDAs) and at two far-field reference locations.

For lakes, the sampling program included bathymetry, physical limnology and water transparency, water quality, sediment quality, phytoplankton communities and benthic macroinvertebrate communities. For streams, the sampling program included temperature and dissolved oxygen, water quality, sediment quality, periphyton communities and benthic macroinvertebrate communities.

Chapter 2 of this report presents the study design and methods used during the 2013 freshwater baseline program. Chapter 3 presents the results and chapter 4 provides a short summary of the results. Complete data are presented in the appendices.

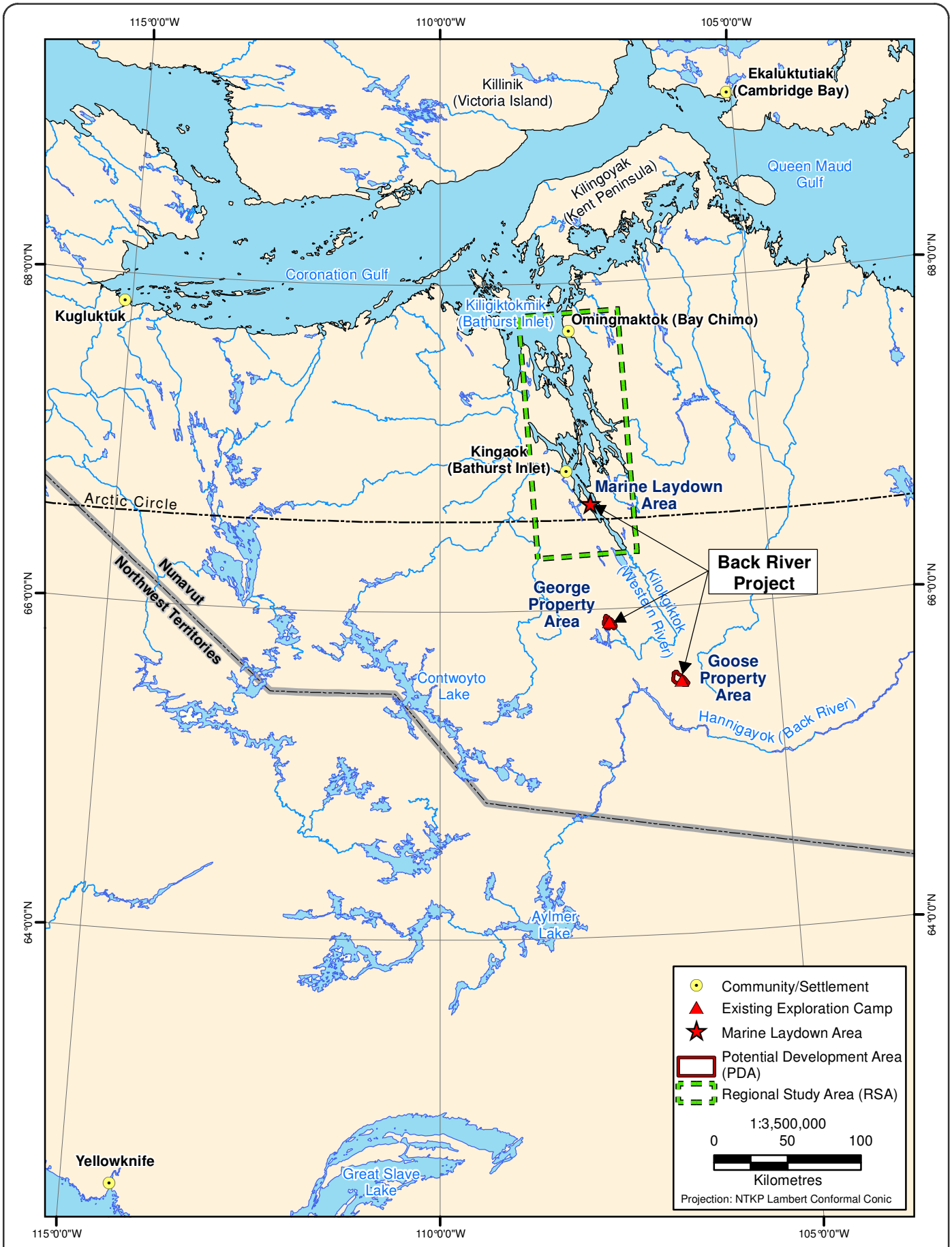

Figure 1-1

Back River Project Location

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2. Methods

2. Methods

2.1 SAMPLING DESIGN

In 2013, baseline data were collected from lakes and streams within the Goose and George properties. Sampling sites were selected based on the proposed infrastructure and known deposits as shown in Figure 2.1-1. The freshwater environment study areas included a Potential Development Area (PDA), Local Study Area (LSA) and Regional Study Area (RSA) for each of the Goose and George properties (Figure 2.1-1). The PDAs included the local sub-watersheds that contained infrastructure and activities. The LSAs were defined as the immediate sub-watersheds within each Property Area where Project activities and infrastructure may occur. Each Property RSA included the LSA and additional areas within which there is the potential for indirect or cumulative effects from Project activities. Beechey Lake, a lake of cultural significance approximately 20 km south west of the existing Goose exploration camp, and two reference lakes and streams well away from potential infrastructure, were also sampled.

2.1.1 Lakes

The following components were sampled for lakes, with sampling components for each site depending on the proximity to proposed infrastructure and the existing data available (Rescan 2011, 2012a, 2012b).

- Bathymetry
- Physical limnology and light penetration
- Water quality
- Sediment quality
- Phytoplankton communities
- Benthic macroinvertebrate communities

Sampling locations for lakes are presented in Table 2.1-1 and on Figures 2.1-2 and 2.1-4 for the Goose and George properties, respectively. Arrows show the direction of water flow. Figures 2.1-6 through 2.1-21 show sampling locations on lakes with available bathymetry. The dates when each component was sampled are provided in Table 2.1-3. The frequency and replication of sampling as well as the types of equipment used are outlined in Table 2.1-5, and Table 2.1-7 outlines the sampling plan and rationale for each lake site.

Lakes were selected that could potentially be affected by proposed infrastructure or were well away from proposed infrastructure and were selected as reference lakes. Within each lake, sampling locations were selected either where historical data existed, in the deepest section in the lake, or in a spatially significant location (i.e., a central location where water from multiple inflows mix). Under-ice sampling in April occurred near the middle of the lake, or in the middle of any obvious basins as estimated by the topography if no bathymetric information or prior sampling history was available. July sampling locations were moved when new bathymetric information collected in July found deeper or more suitable sites.

Twenty-two lakes were sampled in the Goose and George properties as part of the 2013 freshwater baseline program. On some of the larger lakes, multiple sites were sampled for a total of 26 lake sites. This included one reference lake in the Goose Property (Reference B), a distant but culturally important lake 23 km southwest from the existing Goose exploration camp (Beechey/Hanningayuk), and one reference in the George Property (Reference Q). Some additional data, including under ice water quality data from two potential water source lakes for the Marine Laydown Area near Bathurst Inlet (Ekalokhiokvik and Potential Water Source SE), and shore grab water quality data from two ponds (Pond 1 and Pond 2), are included in the appendices.

Table 2.1-1. Sampling Locations in Lakes, Back River Project, 2013

Lake	Lake Site Name	Site Code	Site Co-ordinates (zone 13 N)		Sampling Location Notes
Goose Property Area					
Wasp Lake	Wasp	WASPLK	430474	7275181	April sampling at Wasp Lake was 200 m north, selected without bathymetry.
Leaf Lake	Leaf	LEAFLK	431406	7273641	April sampling at Leaf Lake was 100 m south east, selected without bathymetry.
Giraffe Lake	Giraffe North	GIRNORTH	432210	7272642	
	Giraffe South	GIRSOUTH	432730	7271819	
Umwelt Lake	Umwelt	UMWLK	428927	7270960	
Pond 1	Pond 1	POND1	429311	7271341	Shore grab. Not part of the freshwater baseline program. Data is included in appendices.
Pond 2	Pond 2	POND2	429710	7271415	Shore grab. Not part of the freshwater baseline program. Data is included in appendices.
Rascal Lake	Rascal	RASCLK	434107	7267369	
Goose Lake	Goose Neck	GOOSENECK	432944	7270323	
	Goose Central	GOOSECENT	433887	7270990	April sampling at the Goose Lake Central was moved 200 m south east to avoid ice airstrip.
	Goose Tail	GOOSETAILNEW	434645	7271418	
	Goose South	GOOSESTH	434229	7270039	
Arrow Lake	Arrow	ARRLK	435630	7270490	
Tahikafalok Nahik / Propeller Lake	Propeller	PROLK	435154	7274437	
Wolf Lake	Wolf	-	434218	7264148	Only bathymetry completed, coodinates are approximate center of lake
Pond A	Pond A	-	429443	7273369	Only bathymetry completed, coodinates are approximate center of lake
Reference B Lake	Reference B	REFBLK	442019	7258465	
Hanningayuk / Beechey Lake	Beechey	BEECHLK	413662	7258447	
George Property Area					
Upper Long Lake	Upper Long	UPLONGLK	385553	7317768	
Lower Long Lake	Lower Long	LOWLONGDP	387337	7316748	
Fold Lake	Fold	FOLDLK	388780	7314053	
George Lake	George Central	GEORGCENT	388076	7313844	
Bob Lake	Bob	BOBCENT	387379	7314208	
Occurrence Lake	Occurrence	OCCLK	387692	7313112	
Slave Lake	Slave	SLAVELK	389809	7313318	
Esker Pond	Esker	ESKERLK	389860	7310592	
Dragon Lake	Dragon	DRAGLK	390729	7310736	
Komatic Lake	Komatic	KOMALK	391575	7308605	
McCoy Lake	McCoy	MCCOYLK	386573	7311633	
Mosquito Lake	Mosquito	-	428468	7276383	Only bathymetry completed, coodinates are approximate center of lake
Reference Q Lake	Reference Q	REFQLK	385176	7305112	
Marined Laydown Area					
Ekalokhiokvik Lake	Ekalokhiokvik	EKALOLK	373010	7393858	Data is included in appendices.
Potential Water Source SE	Potential Water Source SE	WATSE	377564	7392999	Data is included in appendices.

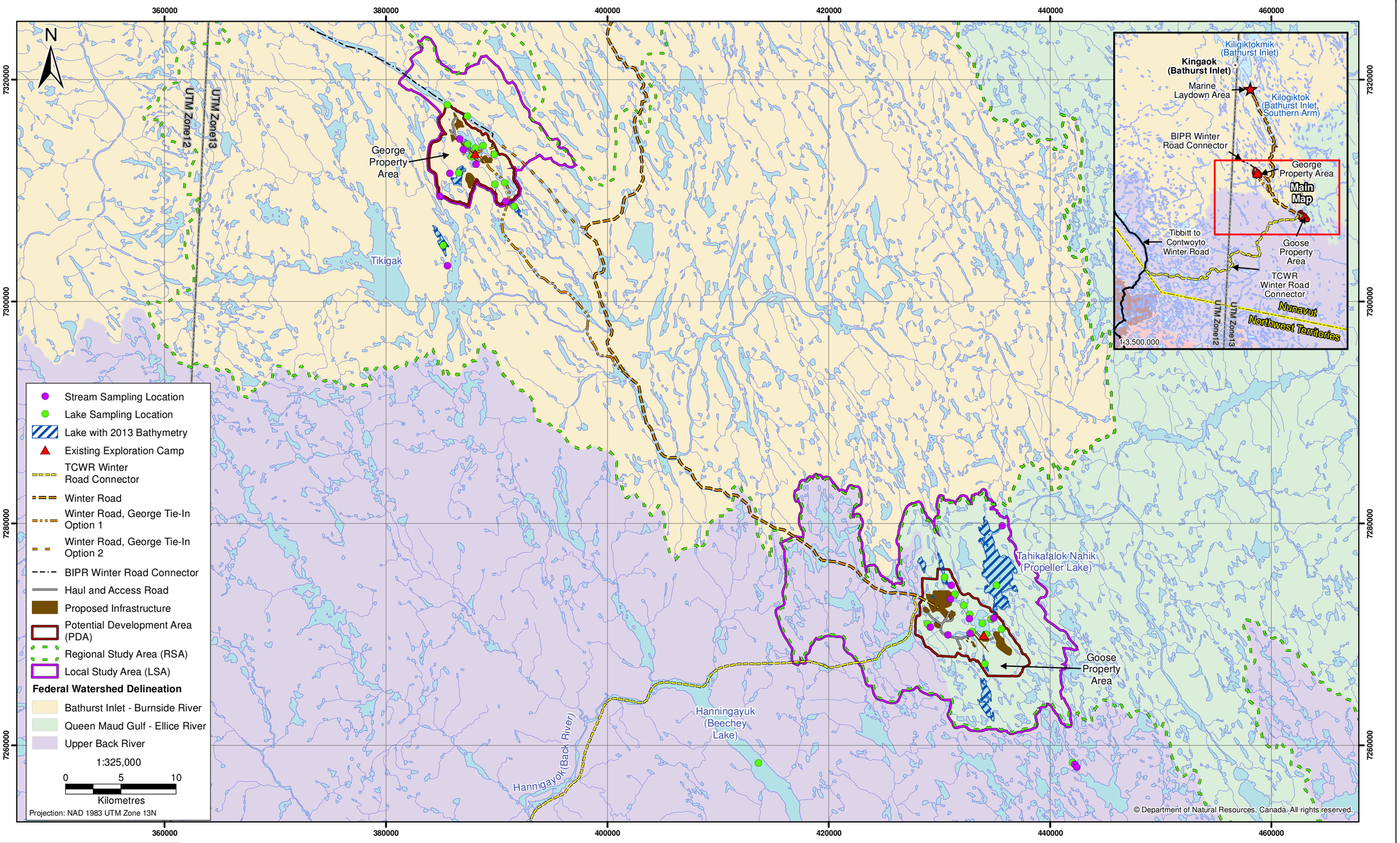

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Figure 2.1-1

Freshwater Study Areas and Sampling Locations, Back River Project, 2013

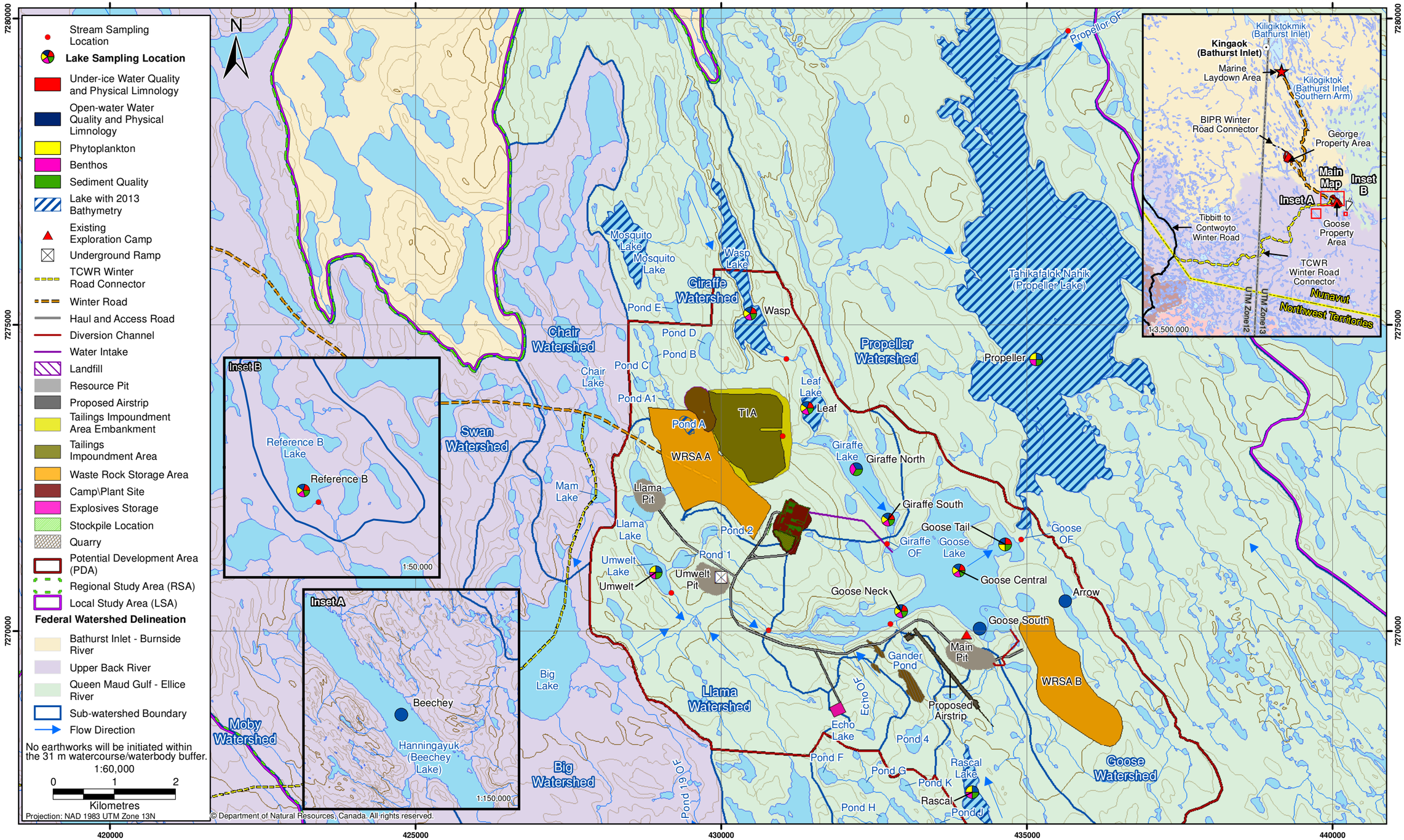

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Figure 2.1-2

Lake Sampling Locations in the Goose Property Area, Back River Project, 2013

2.1.2 Streams

Sampling components for each site were dependent on the proximity to proposed infrastructure, existing data available, and water levels, stream morphology or substrate composition in streams which limited sampling at some planned sampling locations. The following components were sampled depending on the above criteria:

- Temperature and dissolved oxygen;
- Water quality;
- Sediment quality;
- Periphyton communities; and
- Benthic macroinvertebrate communities.

The sampling locations for streams are presented in Table 2.1-2 and on Figures 2.1-3 and 2.1-5 for the Goose and George properties, respectively. Arrows show the direction of water flow. The dates when each component was sampled are provided in Table 2.1-4. Tables 2.1-2 and 2.1-4 include notes describing sampling limitations that occurred at the various stream sites during June and/or July sampling. The frequency and replication of sampling as well as the types of equipment used are outlined in Table 2.1-6, and Table 2.1-8 outlines the sampling plan and rationale for each stream site.

Sampling locations in streams were selected at the outflows of the major watersheds and lakes in the area, and in areas upstream and downstream of proposed infrastructure (Figure 2.1-1). At a local scale, sites were chosen to be close to hydrometric stations and in areas of laminar flow to avoid suspended sediments. Overall, 16 stream sites were sampled. Streams were sampled during June (freshet) and July (open water). June sampling locations occasionally differed slightly from July sampling locations (see Table 2.1-2 notes). Some sampling components (i.e., water quality, sediment quality, periphyton or benthic macroinvertebrates) could not be collected at certain sites or during certain time periods due to lack of flow, bedrock stream bottoms, stream morphology (shallow/narrow streams or deep pooling streams), or lack of rocks suitable for periphyton sampling (see Table 2.1-4 notes and Plates 2.1-1 through 2.1-13 below).

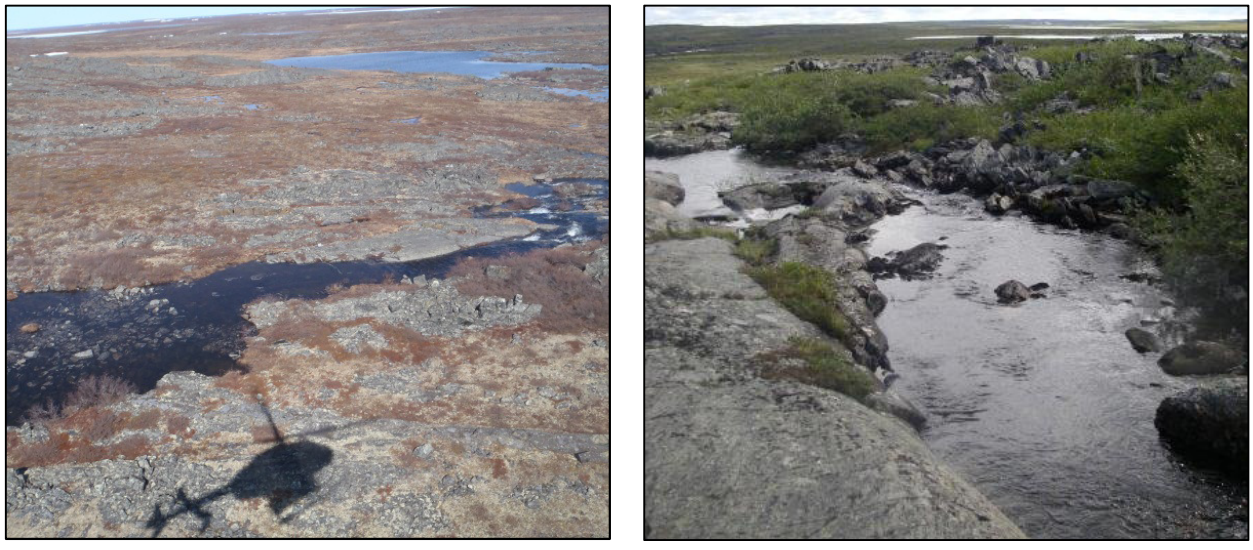


Plate 2.1-1. Wasp OF runs over large bedrock. Left, from air in June; right, looking downstream in July.

Table 2.1-2. Sampling Locations in Streams, Back River Project, 2013

Stream	Stream Site Name	Site Code	Site Co-ordinates (zone 13 N)		Sampling Location Notes
Goose Property Area					
Wasp Outflow	Wasp OF	WASPOF	431065	7274451	
Giraffe Inflow	Giraffe IF	GIRIF / TIAOF	431001	7273192	Sampled 250 m upstream in June, moved to be near the hydrometric station in July. Listed in field sheets and sample names as TIAOF.
Giraffe Outflow	Giraffe OF	GIROF	432709	7271427	
Umwelt Outflow	Umwelt OF	UMWOF	429183	7270626	Sampled 150 m downstream in June, moved to be near the hydrometric station in July.
Llama Outflow	Llama OF	LLAMAOF	430776	7270012	Sampled 400 m upstream in June.
Goose Neck Inflow	Goose Neck IF	GOONECKIF	432766	7270115	Sampled 250 m upstream in July due to low water levels downstream.
Goose Outflow	Goose OF	GOOSEOF	434908	7271500	
Tahikafalok Nahik / Propeller Outflow	Propeller OF	PROOF	435671	7279808	
Reference B Outflow	Reference B OF	REFBOFWET	442226	7258310	In June, additional samples were collected 300 m downstream (site code REFBOFMID).
George Property Area					
George Outflow	George OF	GEORGEOF	386671	7314688	
Lytle Outflow	Lytle OF	LYTLEOF	386998	7313729	Sampled 300 m downstream in June. Moved to outflow in July.
Sleigh Outflow	Sleigh OF	SLEIGHOF	388141	7312386	
Komatic Inflow	Komatic IF	KOMAIF	390823	7309071	
McCoy Inflow	McCoy IF	MCCOYIF	385790	7311592	
McCoy Outflow	McCoy OF	MCCOYWOF	384881	7309530	
Reference Q Outflow	Reference Q OF	REFQOF	385565	7303270	

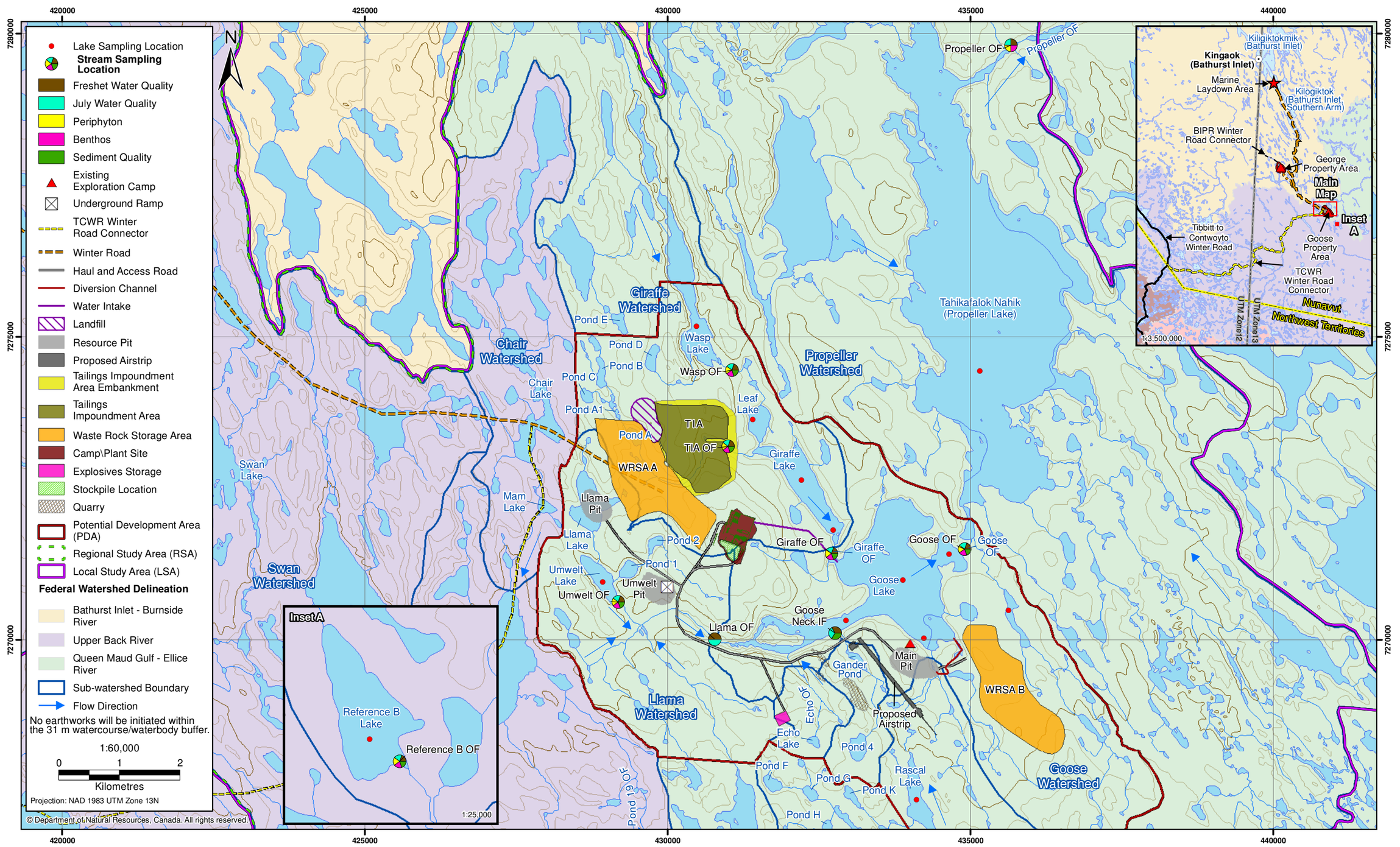
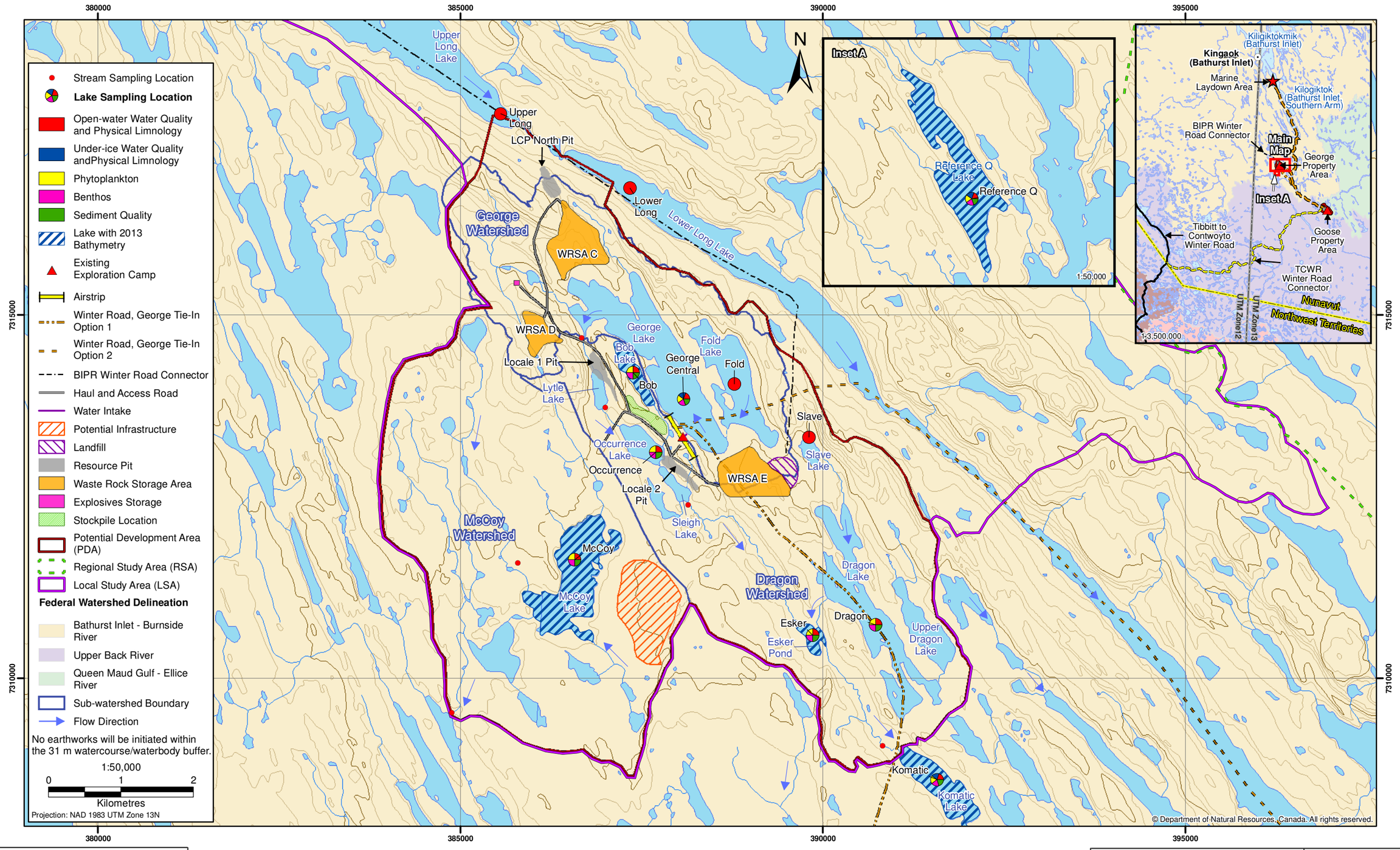


Figure 2.1-3

Stream Sampling Locations in the Goose Property Area, Back River Project, 2013



Sabina GOLD & SILVER CORP.

Rescan an ERM company

Figure 2.1-4

Lake Sampling Locations in the George Property Area, Back River Project, 2013

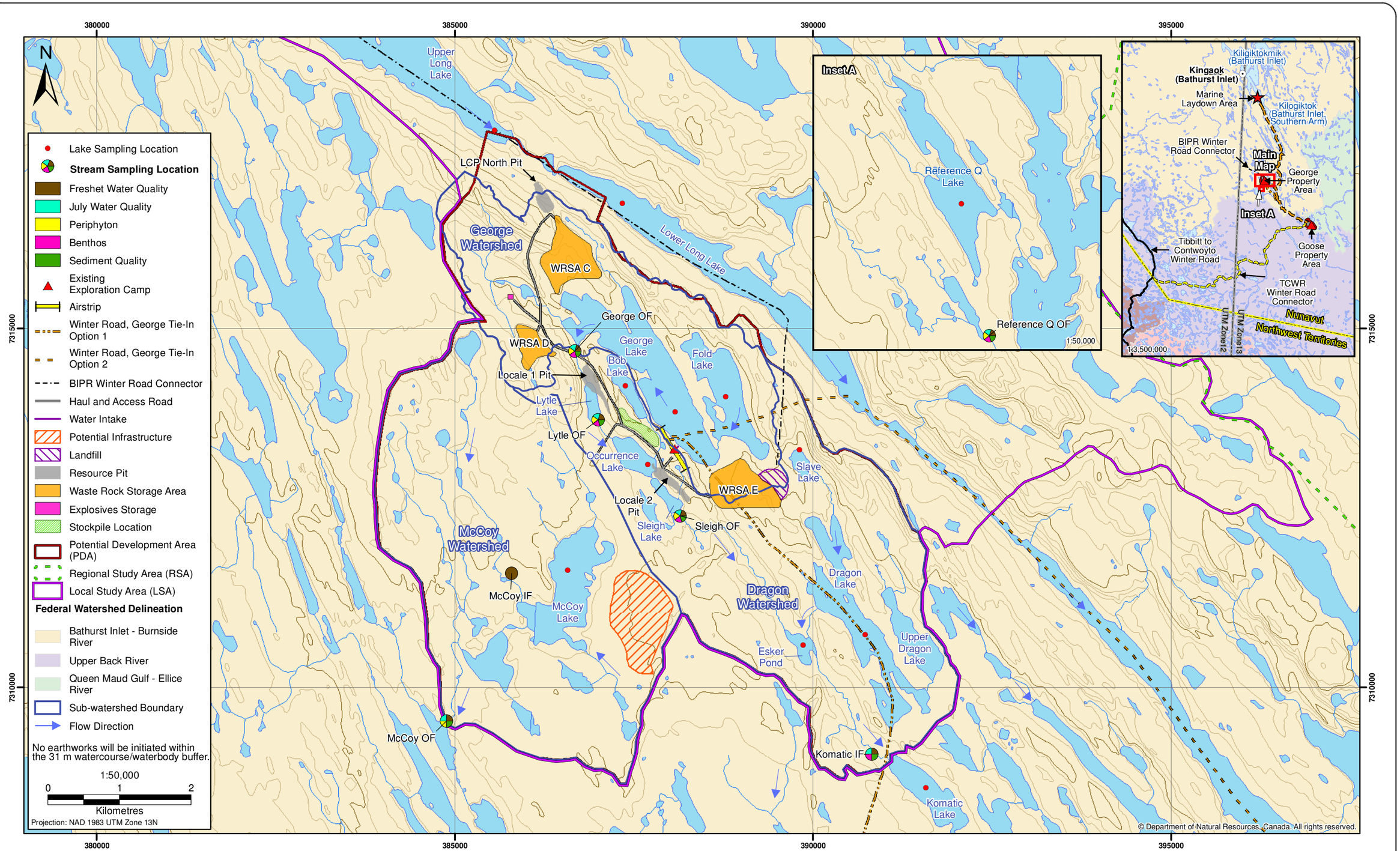


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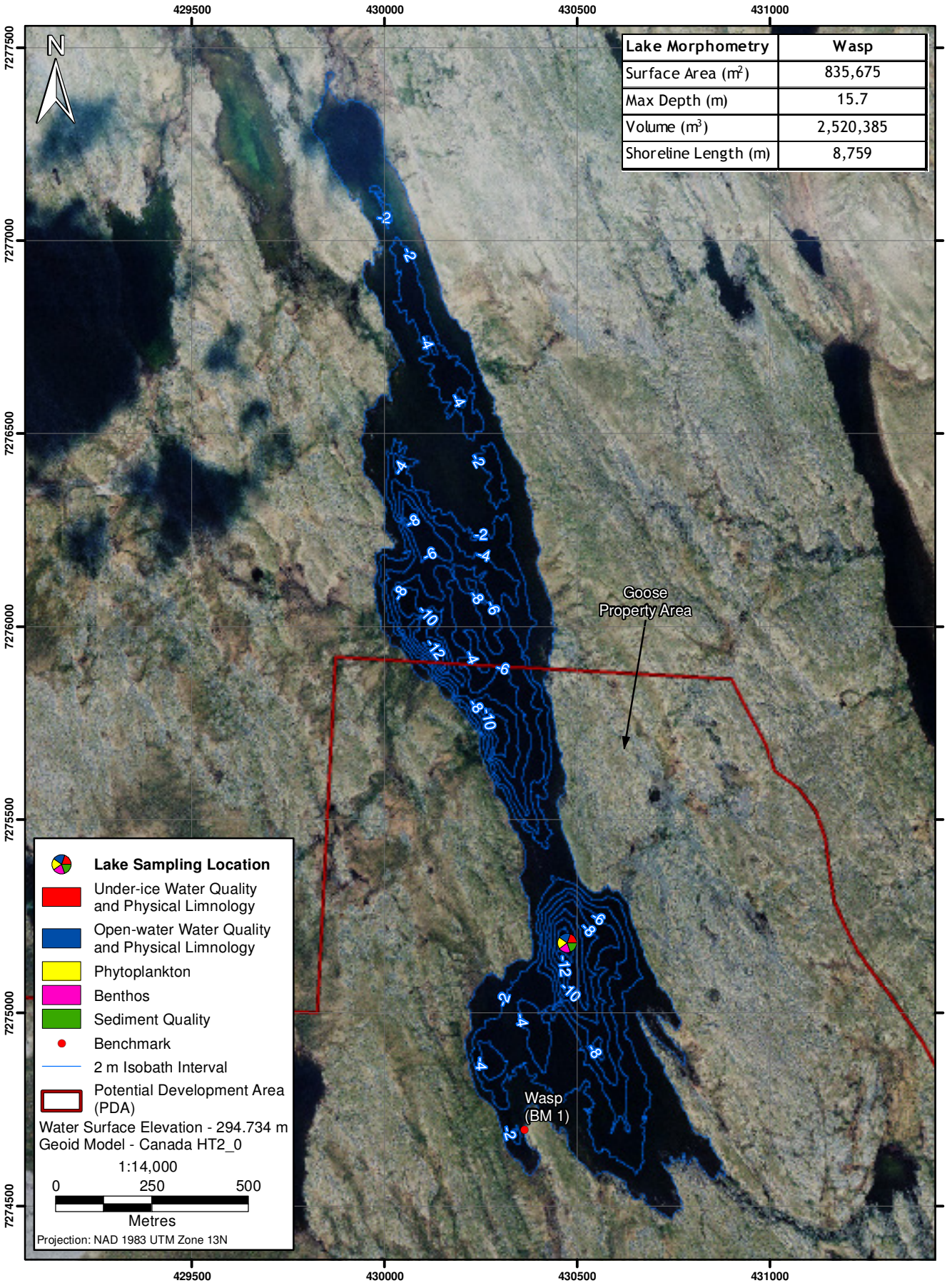
Figure 2.1-5

Stream Sampling Locations in the George Property Area, Back River Project, 2013



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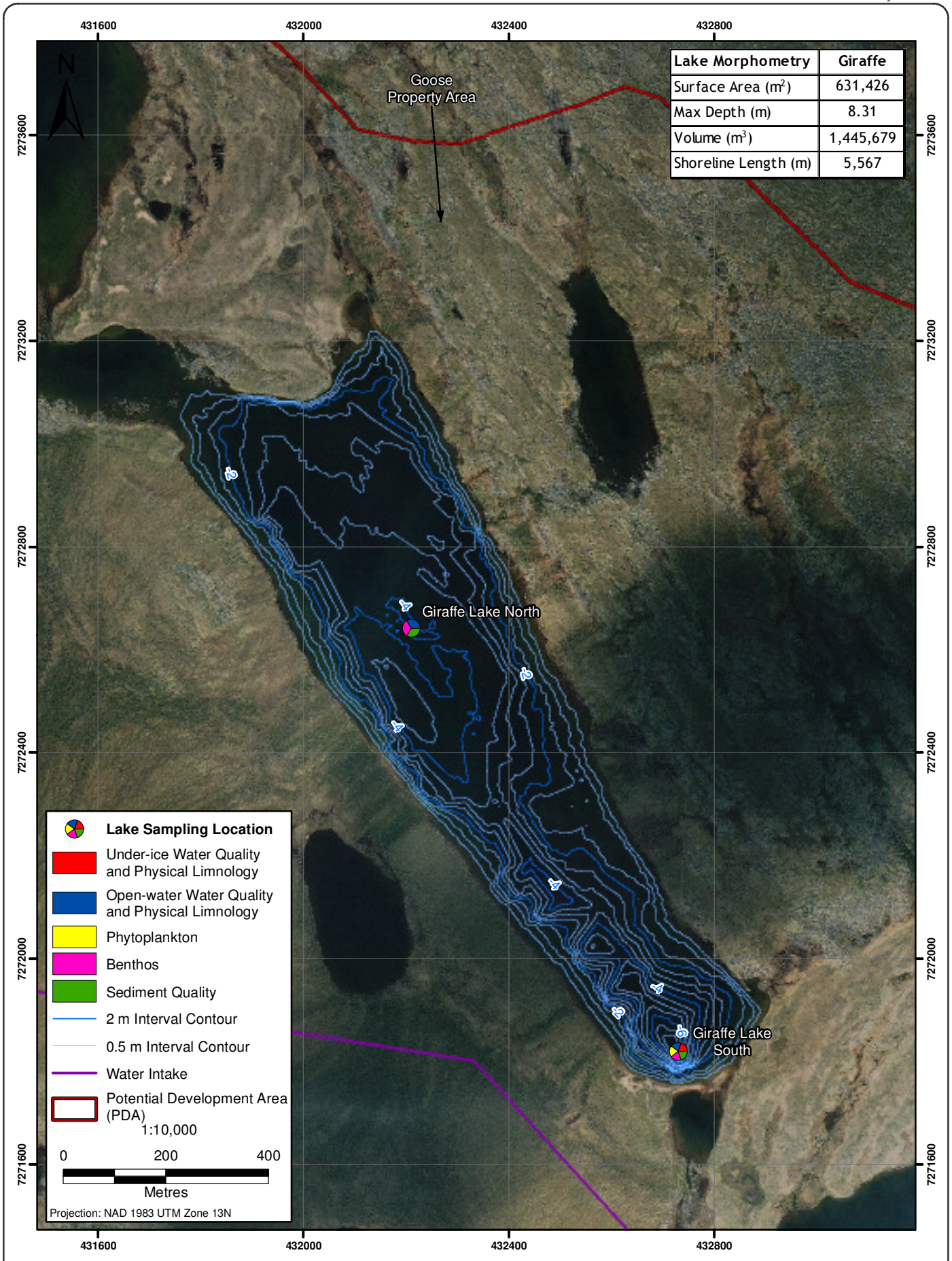
Bathymetry and Sampling Locations in Wasp Lake, Back River Project, 2013

Figure 2.1-6

Rescan an ERM company



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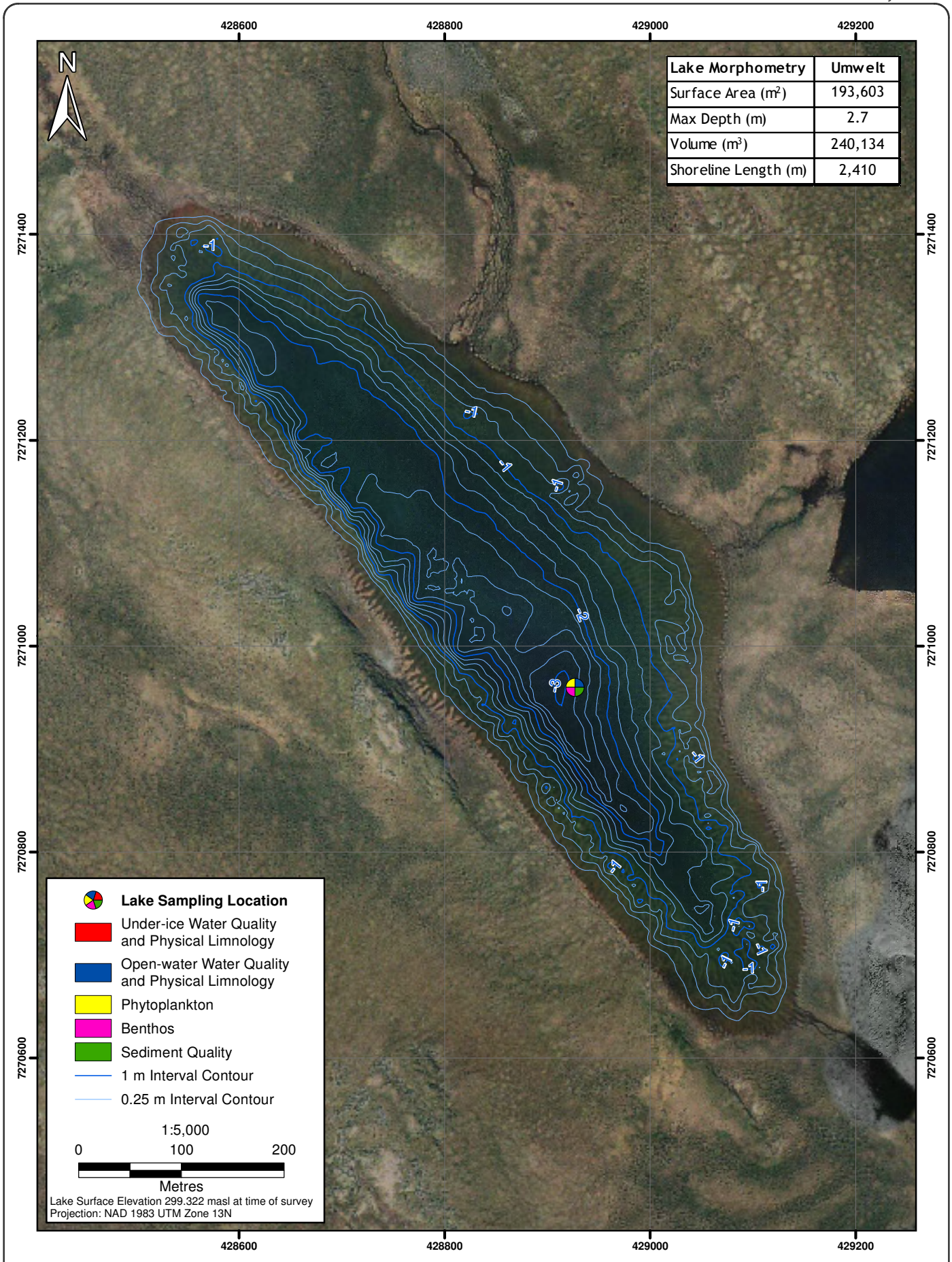
Bathymetry and Sampling Locations in Giraffe Lake, Back River Project, 2013

Figure 2.1-7

Rescan an ERM company

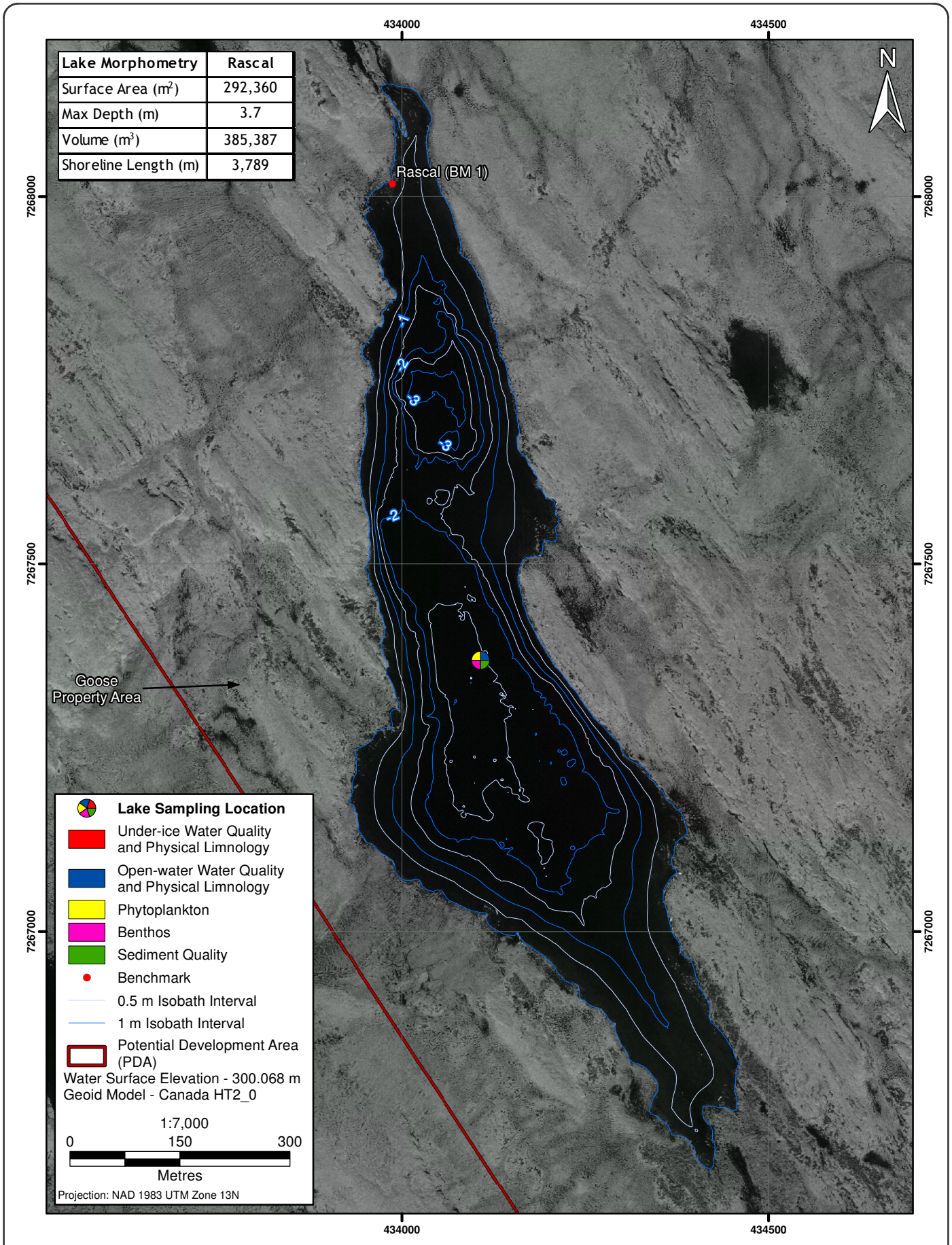


Sabina GOLD & SILVER CORP.

Bathymetry and Sampling Locations in Umwelt Lake, Back River Project, 2013

Figure 2.1-8

Rescan an ERM company

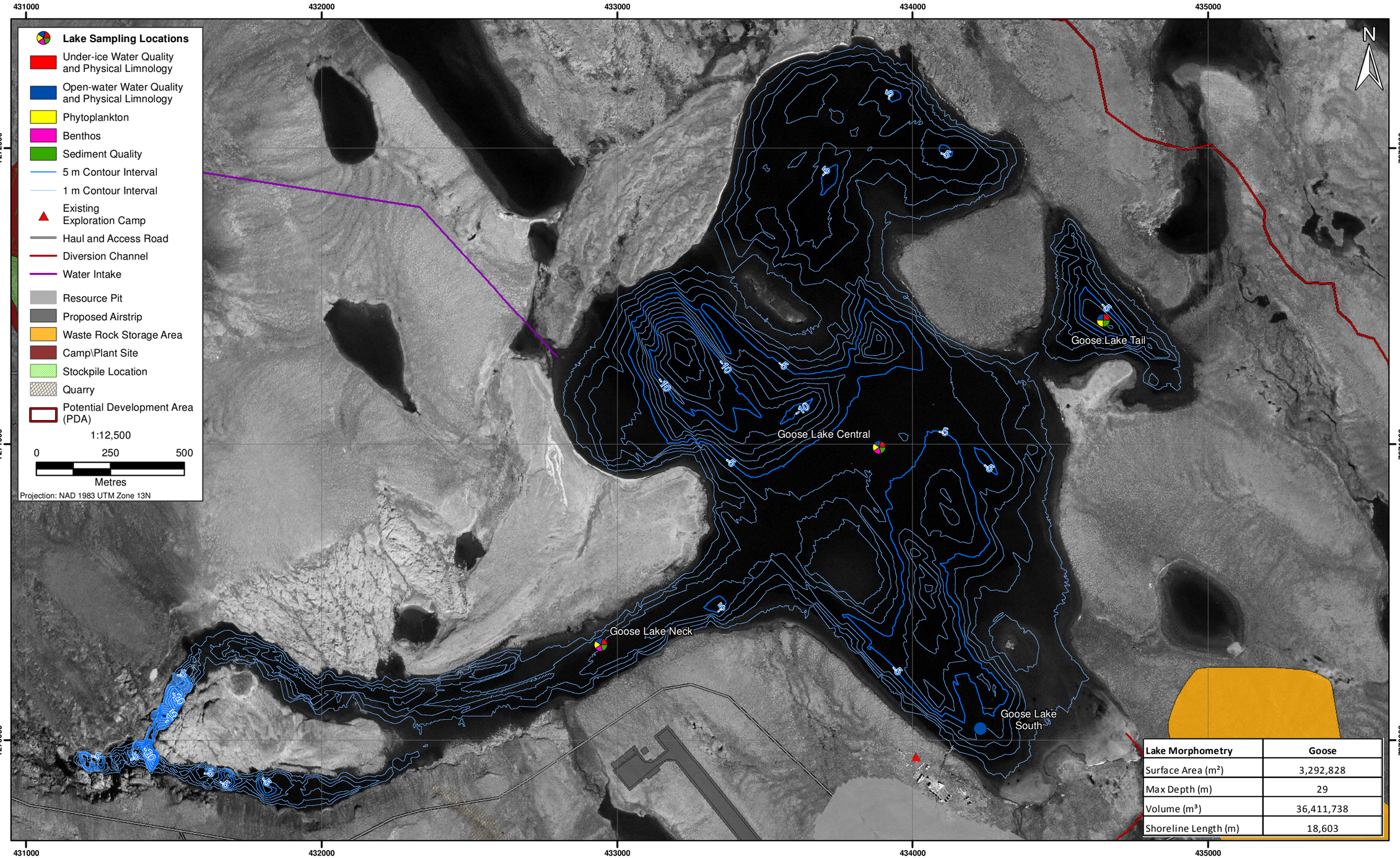


Sabina GOLD & SILVER CORP.

Bathymetry and Sampling Locations in Rascal Lake, Back River Project, 2013

Figure 2.1-9

Rescan an ERM company



Lake Morphometry	Goose
Surface Area (m^2)	3,292,828
Max Depth (m)	29
Volume (m^3)	36,411,738
Shoreline Length (m)	18,603

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Figure 2.1-10

Bathymetry and Sampling Locations in Goose Lake, Back River Project, 2013

*PROJECT #*0194096-0003 *GIS #* BAC-01-080f *February 19 2014*

Lake Morphometry	Propeller
Surface Area (m^2)	12,647,951
Max Depth (m)	17.1
Volume (m^3)	52,652,320
Shoreline Length (m)	34,351

433000 434000 435000 436000 437000 438000

7280000 7279000 7278000 7277000 7276000 7275000 7274000 7273000

Lake Sampling Location
Under-ice Water Quality and Physical Limnology
Open-water Water Quality and Physical Limnology
Sediment Quality
Phytoplankton
Benthos
5 m Interval Isobath
1 m Interval Isobath
Potential Development Area (PDA)
Local Study Area (LSA)

1:24,000

0 500 1,000
Metres

Projection: NAD 1983 UTM Zone 13N

Goose Property Area

Figure 2.1-11

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Bathymetry and Sampling Locations in Propeller Lake, Back River Project, 2013

Figure 2.1-11

Rescan an ERM company

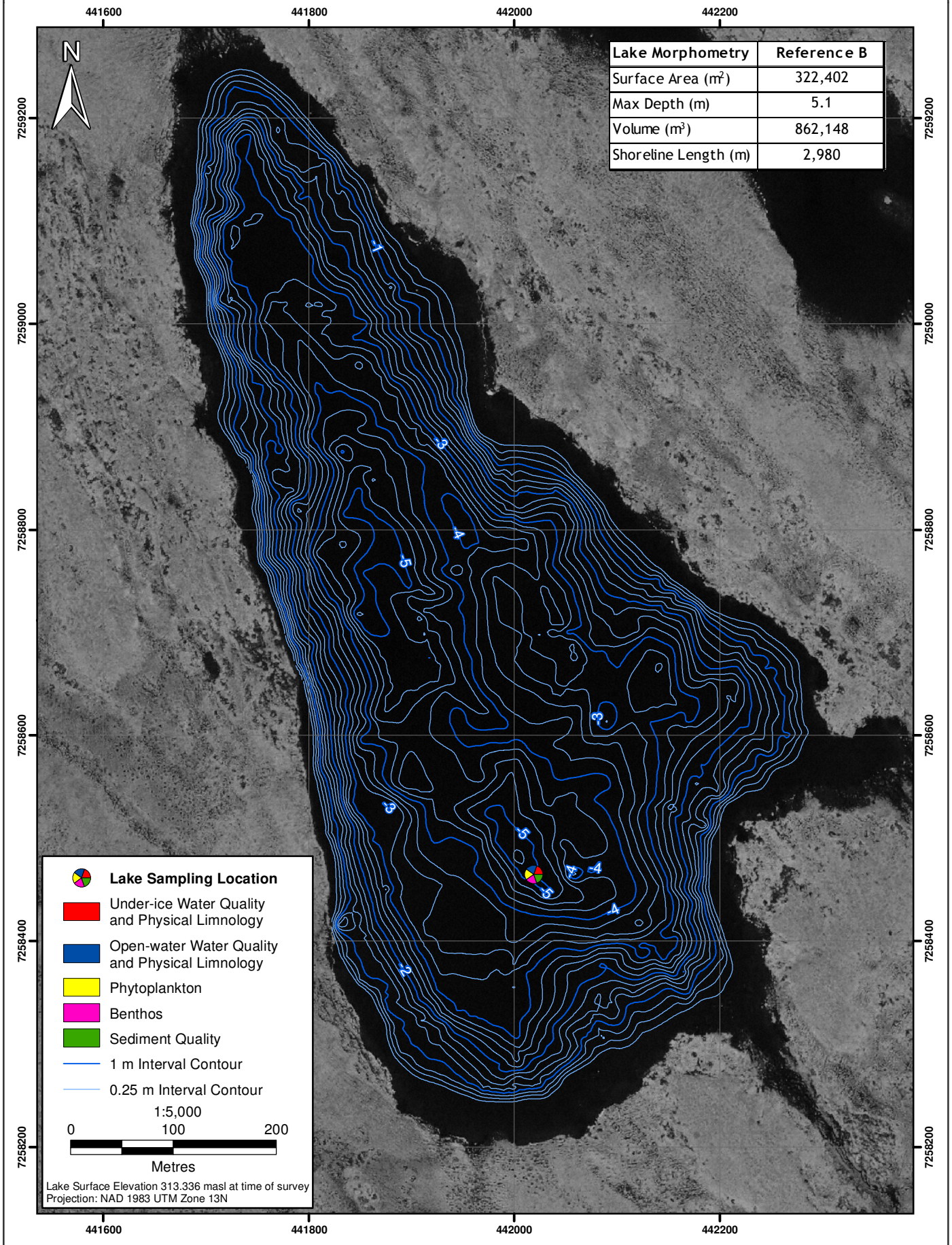

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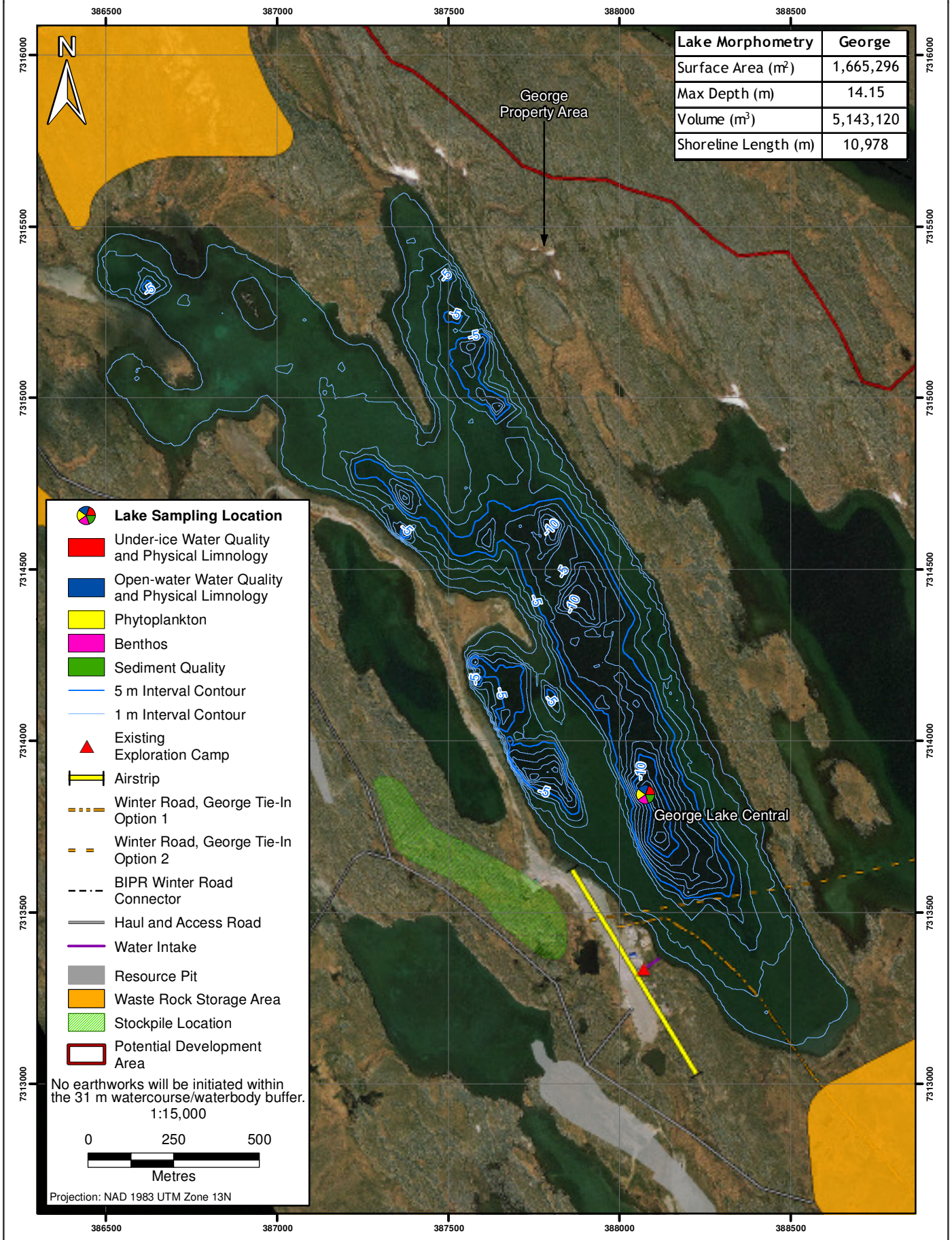
Figure 2.1-12

Bathymetry and Sampling Locations in Reference B Lake, Back River Project, 2013

Rescan an ERM company



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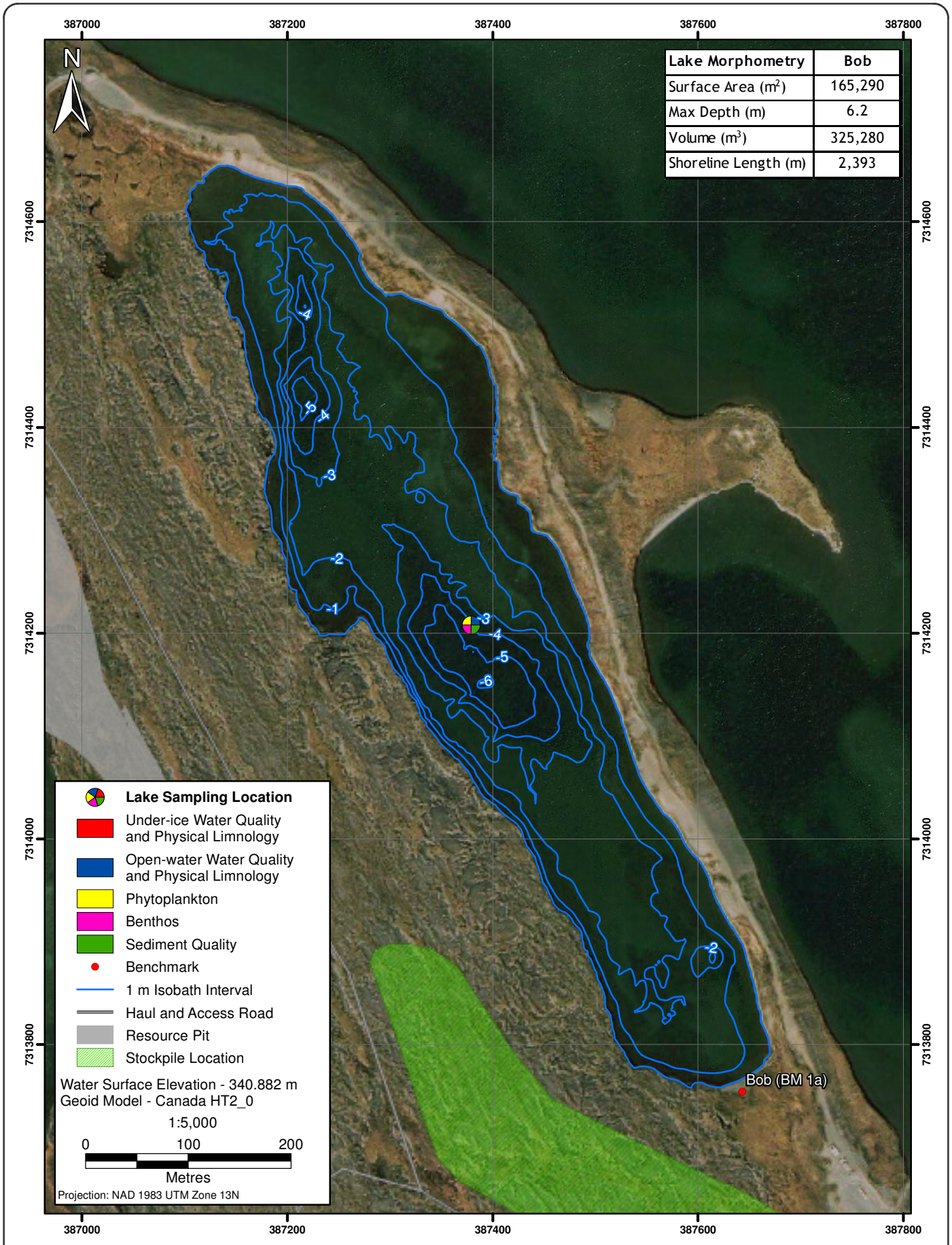
Bathymetry and Sampling Locations in George Lake, Back River Project, 2013

Figure 2.1-13

Rescan an ERM company



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Bathymetry and Sampling Locations in Bob Lake, Back River Project, 2013

Figure 2.1-14

Rescan an ERM company

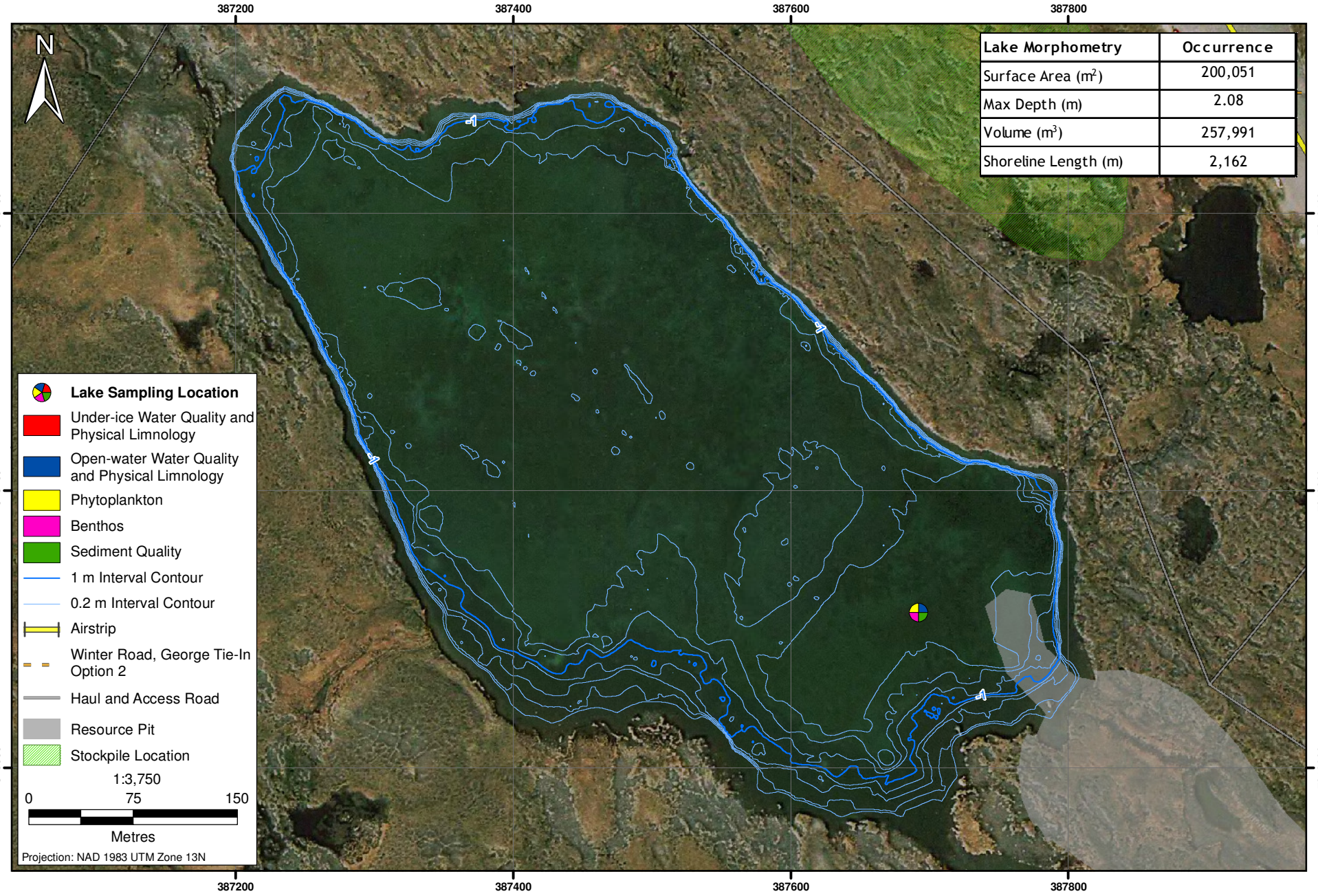


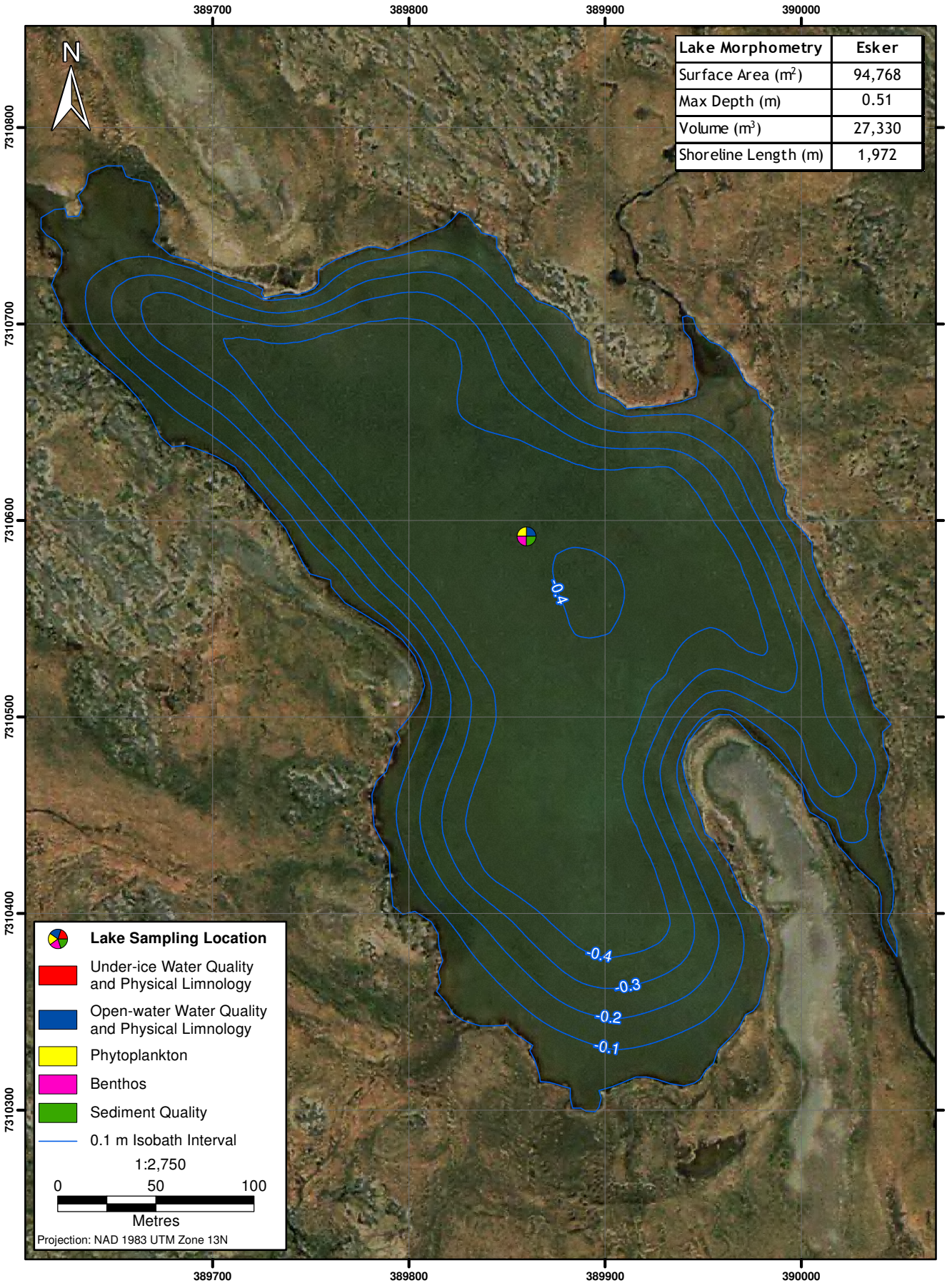
Figure 2.1-15

Sabina GOLD & SILVER CORP.

Bathymetry and Sampling Locations in Occurrence Lake, Back River Project, 2013

Figure 2.1-15

Rescan an ERM company

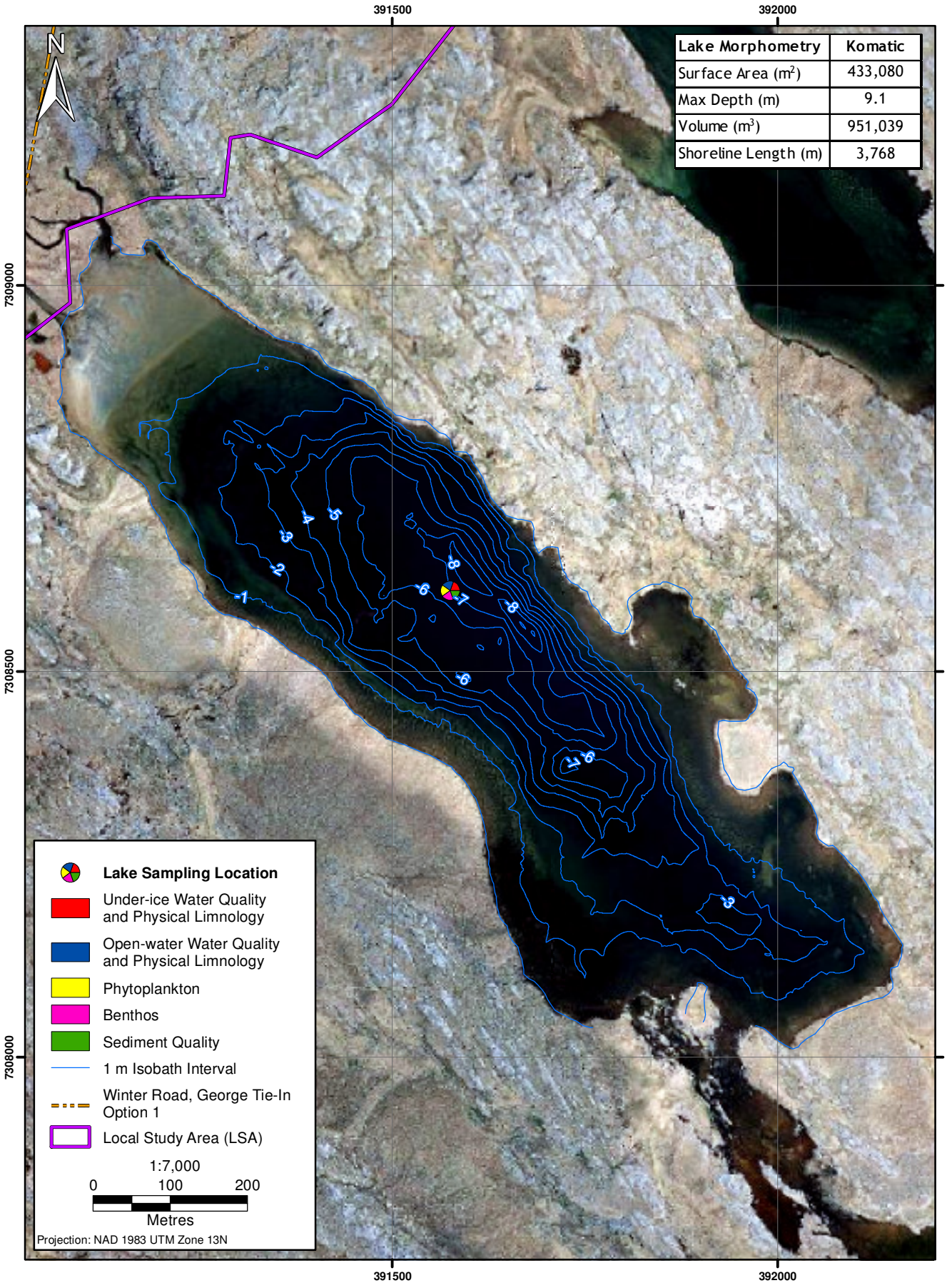


Sabina GOLD & SILVER CORP.

Bathymetry and Sampling Locations in Esker Pond, Back River Project, 2013

Figure 2.1-16

Rescan an ERM company



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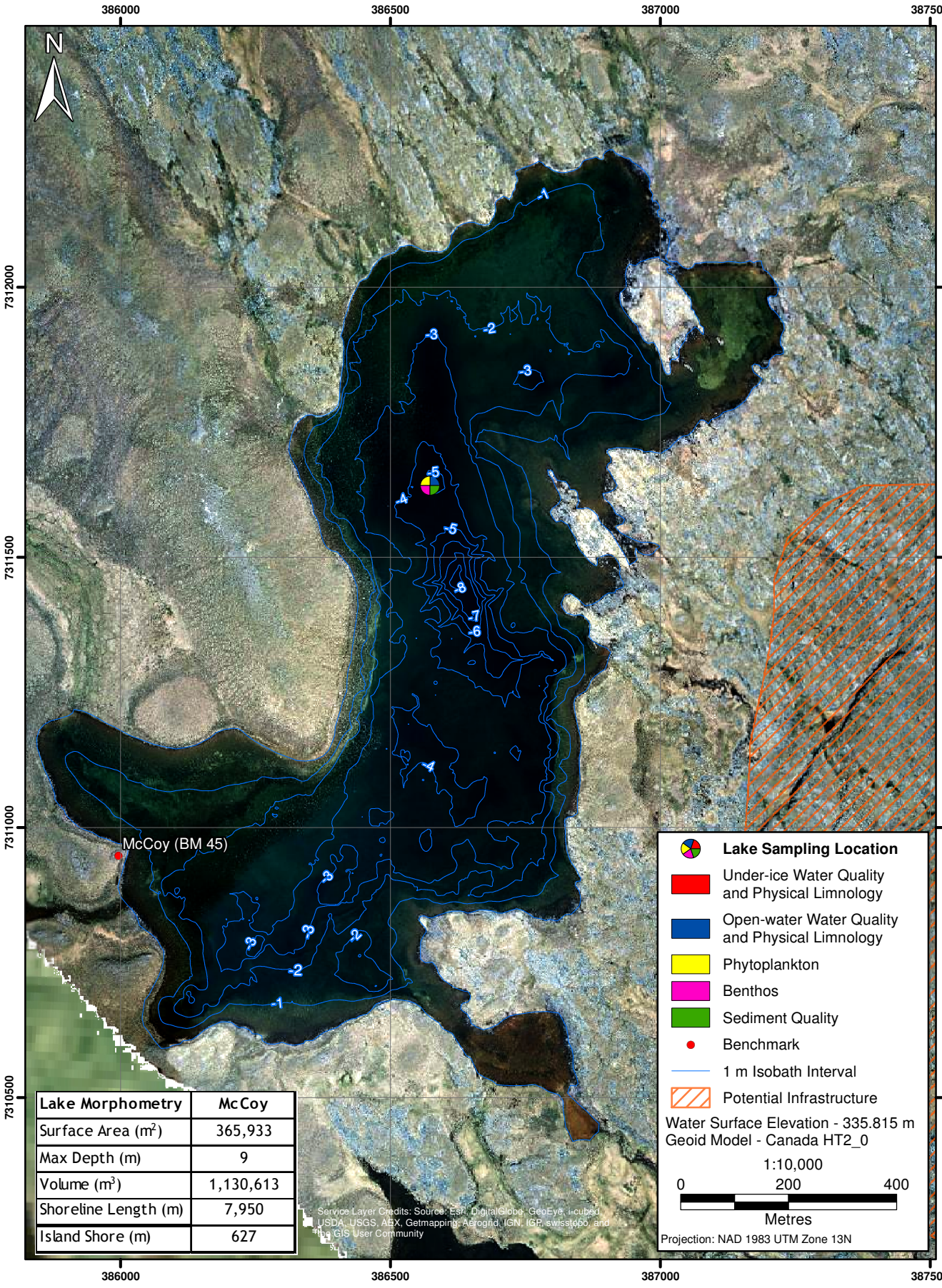
Bathymetry and Sampling Locations in Komatic Lake, Back River Project, 2013

Figure 2.1-17

Rescan an ERM company



Lake Morphometry	McCoy
Surface Area (m^2)	365,933
Max Depth (m)	9
Volume (m^3)	1,130,613
Shoreline Length (m)	7,950
Island Shore (m)	627

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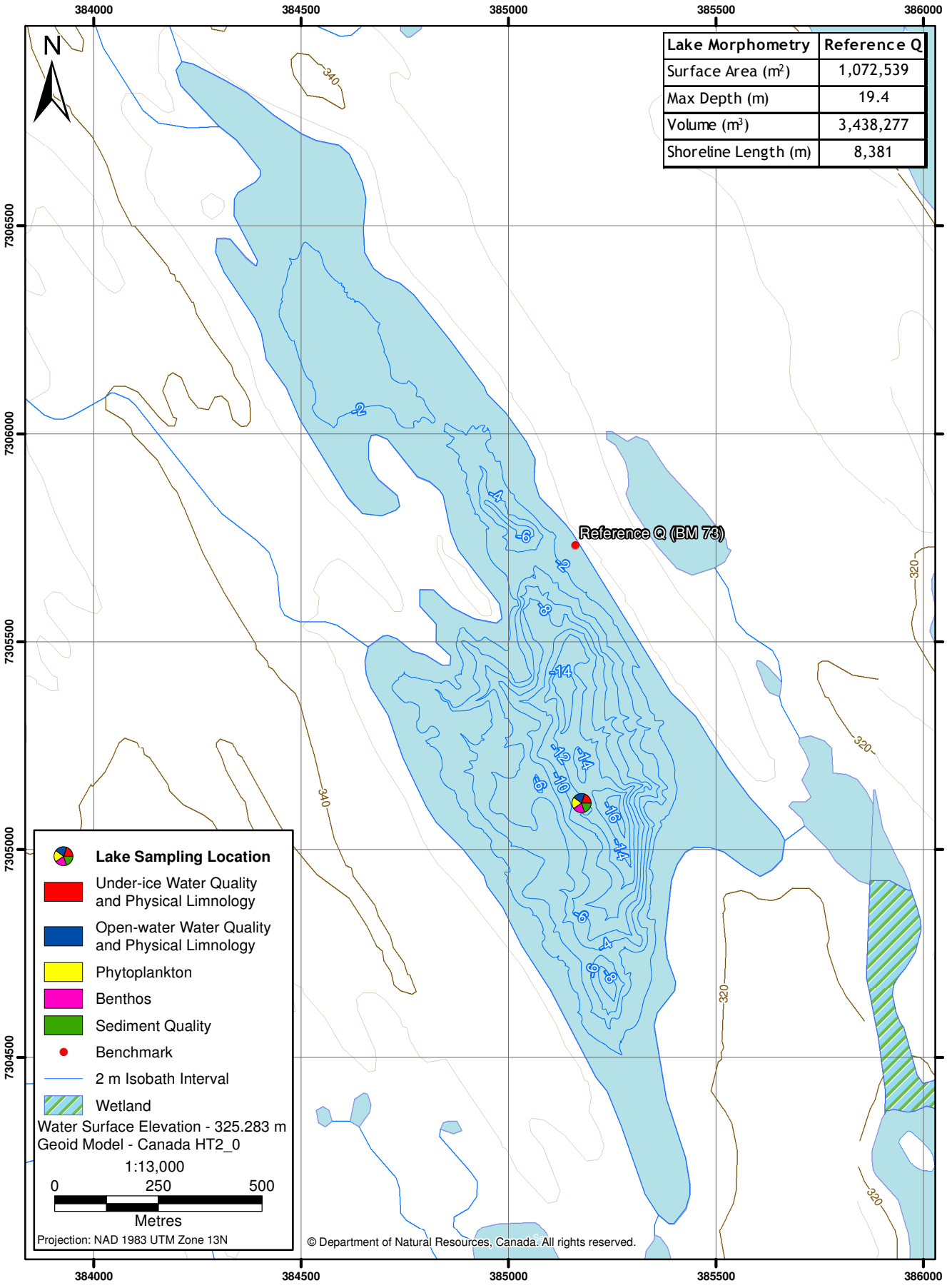
Bathymetry and Sampling Locations in McCoy Lake, Back River Project, 2013

Figure 2.1-18

Rescan an ERM company



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Bathymetry and Sampling Locations in Reference Q Lake, Back River Project, 2013

Figure 2.1-19

Rescan an ERM company

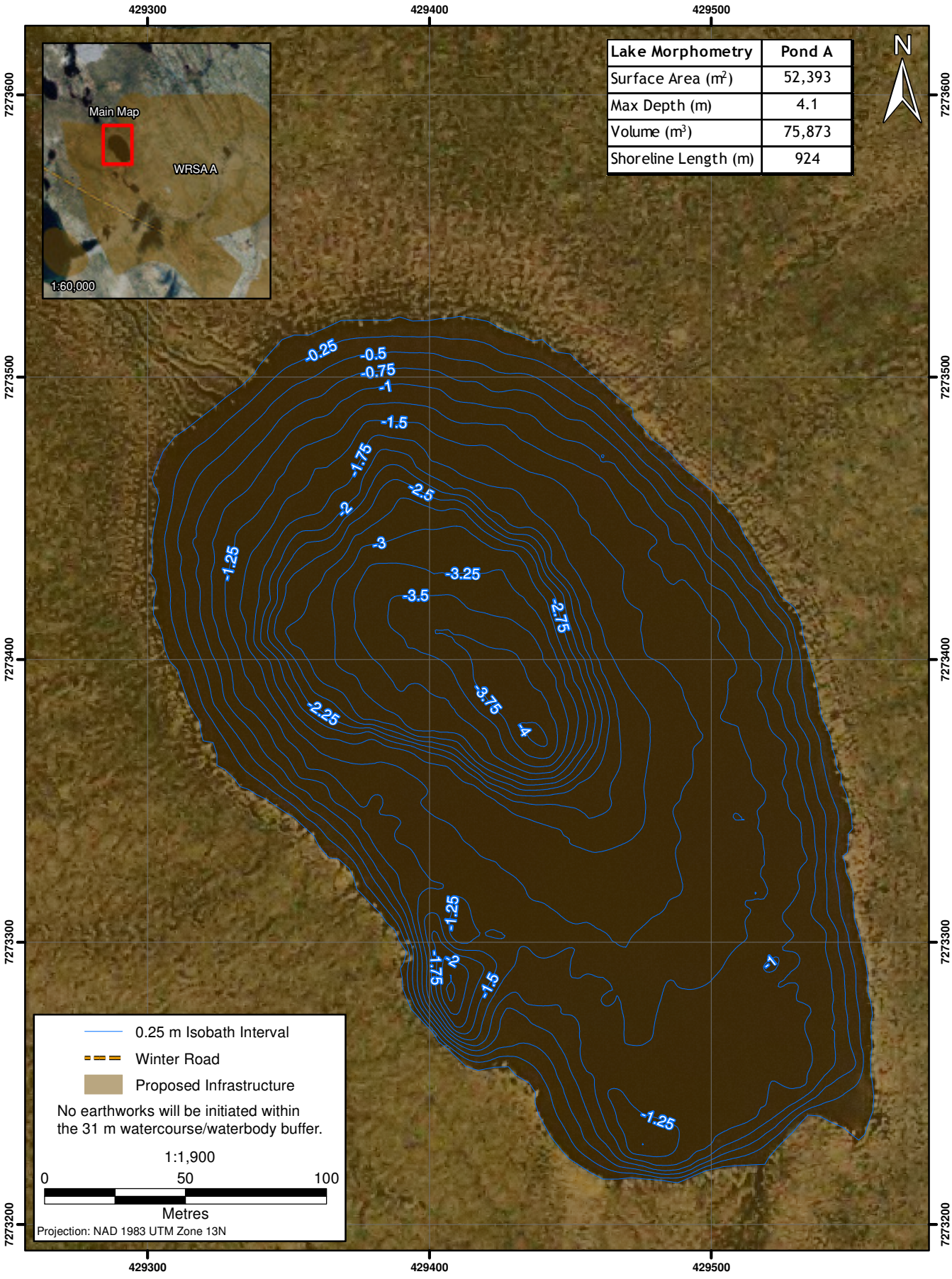
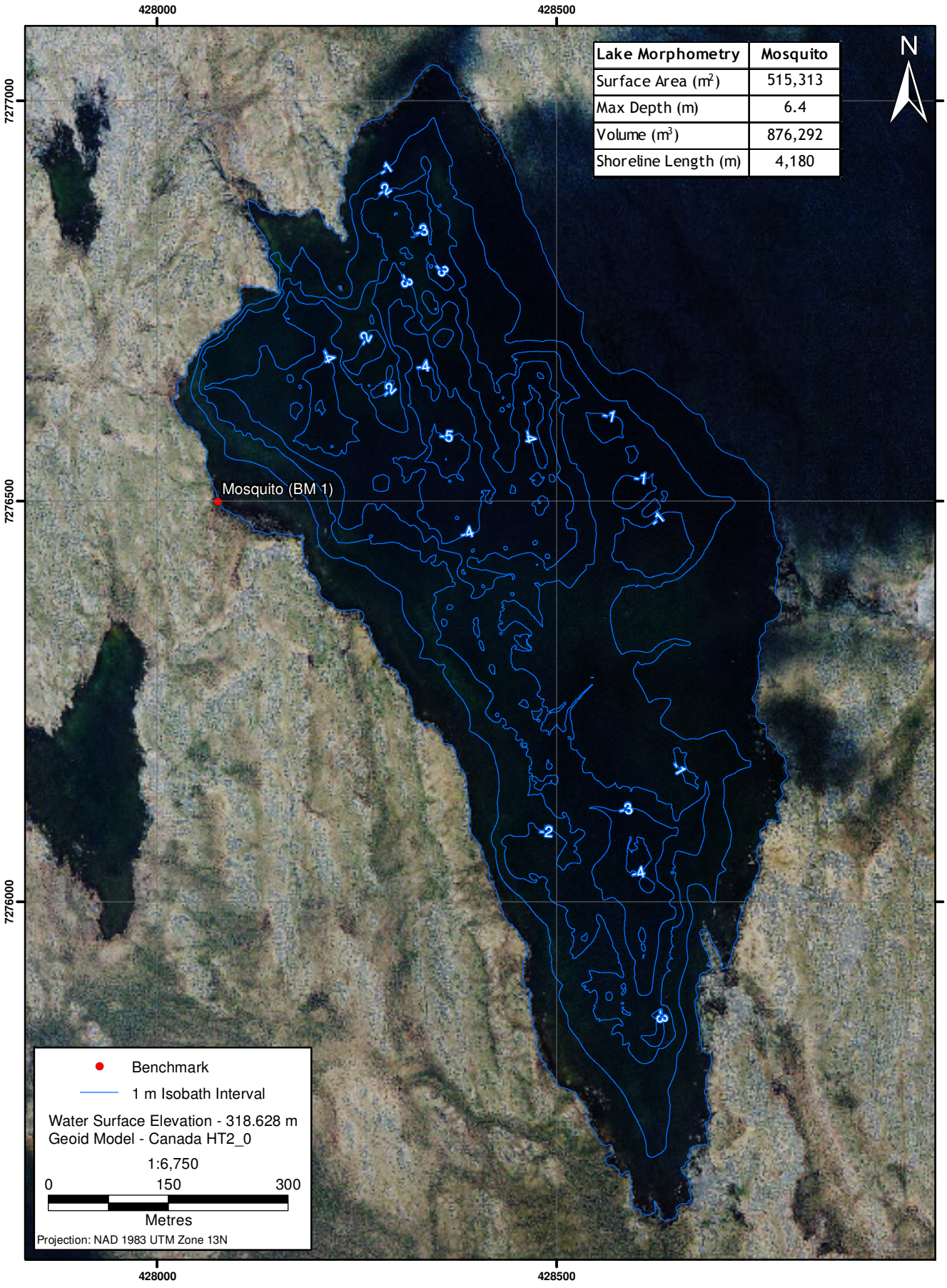


Figure 2.1-20

Bathymetry of Pond A, Back River Project, 2013

Sabina GOLD & SILVER CORP.

Rescan an ERM company



Sabina GOLD & SILVER CORP.

Bathymetry of Mosquito Lake, Back River Project, 2013

Figure 2.1-21

Rescan an ERM company

Table 2.1-3. Sampling Dates for Lakes, Back River Project, 2013

Lake Site Name	Bathymetry	Water Quality and Limnology		Sediment Quality	Phytoplankton Biomass	Phytoplankton Biomass and Taxonomy	Benthic Macro-invertebrates	Sampling Notes
Goose Property Area								
Wasp	2013	9-Apr	16-Jul	16-Jul	9-Apr	16-Jul	16-Jul	
Leaf	2013	9-Apr	16-Jul	16-Jul	nc	16-Jul	16-Jul	Only 5 cm fluid under-ice water in April, so no April WQ or phytoplankton biomass samples. Bathymetry completed by EBA, see EBA (2013).
Giraffe North		-	14-Jul	14-Jul	-	-	14-Jul	
Giraffe South		9-Apr	14-Jul	14-Jul	9-Apr	14-Jul	14-Jul	
Umwelt		-	15-Jul	15-Jul	-	15-Jul	15-Jul	Water and phytoplankton samples collected from surface grabs due to shallow depth.
Pond 1		-	28-Jul	-	-	-	-	Shore grab. Not part of the freshwater baseline program. Data is included in appendices.
Pond 2		-	28-Jul	-	-	-	-	Shore grab. Not part of the freshwater baseline program. Data is included in appendices.
Rascal	2013	-	13-Jul	13-Jul	-	13-Jul	13-Jul	
Goose Neck		10-Apr	21-Jul	21-Jul	nc	21-Jul	21-Jul	April water samples colected as grab samples. No April phytoplankton biomass samples collected as too shallow for the Niskin to sample under ice. July water and phytoplankton samples collected from surface grabs due to shallow depth.
Goose Central		13-Apr	21-Jul	21-Jul	13-Apr	21-Jul	21-Jul	
Goose Tail		14-Apr	20-Jul	20-Jul	14-Apr	-	-	
Goose South		-	20-Jul	-	-	-	-	Water and phytoplankton samples collected from surface grabs due to shallow depth.
Arrow		-	15-Jul	-	-	-	-	Water and phytoplankton samples collected from surface grabs due to shallow depth.
Propeller	2013	-	19-Jul	19-Jul	-	19-Jul	19-Jul	
Wolf	2013	-	-	-	-	-	-	Bathymetry completed by EBA, see EBA (2013).
Pond A	2013	-	-	-	-	-	-	
Reference B		13-Apr	17-Jul	20-Jul	13-Apr	17-Jul	20-Jul	
Beechey		-	19-Jul	-	-	-	-	
George Property Area								
Upper Long		-	11-Jul	-	-	-	-	
Lower Long		-	12-Jul	-	-	-	-	
Fold		-	12-Jul	-	-	-	-	
George Central		12-Apr	8-Jul	8-Jul	12-Apr	8-Jul	8-Jul	Sediment quality replicates were composites of two Ekman grabs.
Bob	2013	-	11-Jul	11-Jul	-	11-Jul	11-Jul	
Occurrence		-	9-Jul	9-Jul	-	9-Jul	9-Jul	Water and phytoplankton samples collected from surface grabs due to shallow depth.
Slave		-	12-Jul	-	-	-	-	Water and phytoplankton samples collected from surface grabs due to shallow depth.
Esker	2013	-	12-Jul	12-Jul	-	12-Jul	12-Jul	Water and phytoplankton samples collected from surface grabs due to shallow depth. Sediment quality replicates were composites of three Ekman grabs.
Dragon		-	11-Jul	11-Jul	-	11-Jul	11-Jul	
Komatic	2013	12-Apr	10-Jul	10-Jul	12-Apr	10-Jul	10-Jul	
McCoy	2013	-	10-Jul	10-Jul	-	10-Jul	10-Jul	
Mosquito	2013	-	-	-	-	-	-	
Reference Q	2013	12-Apr	9-Jul	9-Jul	12-Apr	9-Jul	9-Jul	
Marine Laydown Area								
Ekalokhiokvik		11-Apr	-	-	-	-	-	Data is included in appendices.
Potential Water Source SE		11-Apr	-	-	-	-	-	Data is included in appendices.

Notes:

"-" not sampled as per workplan

Table 2.1-4. Sampling Dates for Streams, Back River Project, 2013

Stream Site Name	Water Quality		Sediment Quality	Periphyton	Benthic Macroinvertebrates	Sampling Notes
Goose Property Area						
Wasp OF	11-Jun	23-Jul	23-Jul	26-Jul	26-Jul	
Giraffe OF	11-Jun	23-Jul and 28-Jul	23-Jul	28-Jul	28-Jul	Only one sediment quality sample could be collected due to the bedrock substrate.
Giraffe OF	11-Jun	28-Jul	28-Jul	28-Jul	28-Jul	
Umwelt OF	11-Jun	24-Jul	24-Jul	28-Jul	28-Jul	
Llama OF	11-Jun	23-Jul	-	-	-	
Goose Neck IF	11-Jun	23-Jul	23-Jul	nc	nc	July biology samples could not be collected due to low flow, and either shallow/narrow stream or deep pooling habitat
Goose OF	12-Jun	23-Jul	23-Jul	24-Jul	24-Jul	
Propeller OF	12-Jun	24-Jul	nc	26-Jul	26-Jul	No sediment quality samples could be collected due to the bedrock substrate.
Reference B OF	11-Jun and 13-Jun	24-Jul	24-Jul	26-Jul	26-Jul	Additional sample collected 300 m downstream in June to capture stream variability, graphed and analyzed as Reference B OF. Downstream sample listed as REFBOFMID in appendix to allow distinguishing.
George Property Area						
George OF	13-Jun	25-Jul	25-Jul	25-Jul	25-Jul and 27-Jul	
Lytle OF	13-Jun	27-Jul	27-Jul	27-Jul	27-Jul	
Sleigh OF	12-Jun	27-Jul	27-Jul	27-Jul	27-Jul	
Komatic IF	12-Jun	27-Jul	27-Jul	nc	27-Jul	No rocks within 200 m of sampling site; therefore, no periphyton was collected.
McCoy IF	12-Jun	nc	nc	nc	nc	All July samples could not be collected due to low water levels and flow.
McCoy OF	13-Jun	25-Jul	25-Jul	27-Jul	nc	Only one sediment quality sample could be collected due to the bedrock substrate.
Reference Q OF	12-Jun	25-Jul	25-Jul	25-Jul	25-Jul	

Notes:

"-" not sampled as per workplan

nc - not collected due to site specific field constraints (see notes)

Table 2.1-5. Sampling Details for Lakes, Back River Project, 2013

Monitoring Parameter	Sampling Frequency	Sampling Replication	Equipment/Method	Sampling Dates/Timing
Bathymetry	1 x	n/a	Lake specific, see Section 2.2	Lake specific, see Section 2.2
Winter Physical Limnology				
Dissolved oxygen/temperature profile	1 x	n=1	ODO Probe	April
Summer Physical Limnology				
Dissolved oxygen/temperature profile; Secchi depth	1 x	n=1	ODO Probe	July
Winter Lake Water Quality				
Physical, cyanides, total and dissolved metals, nutrients and total organic carbon	1 x	n=1 at 1 m below the ice and at 1.5 m to 2 m above the water-sediment interface in lake sites deeper than approximately 6 m, + 20% replication.	Modified 2.5 L Niskin bottle; preservatives	April
Summer Lake Water Quality				
Physical, cyanides, total and dissolved metals, nutrients and total organic carbon	1 x	n=1 at 1 m depth and at mid depth in lake sites deeper than approximately 6 m, + 20% replication. Surface grabs at lake sites shallower than 2 m.	5 L GO-FLO bottle; preservatives	July
Lake Sediment Quality				
Physical, nutrients, cyanide, and metals	1 x	n=3, each replicate was from a single grab with exceptions where volume from a single grab was insufficient for analysis.	Ekman Grab, bowl and spoon	July
Phytoplankton				
Biomass (as chlorophyll *a*)	2 x	n=3 at 1 m below surface. Surface grabs at lake sites shallower than 2 m.	5 L GO-FLO bottle; filtration with 0.45 μm filters	April, July
Abundance and taxonomy	1 x	April, n=1 at 1 m below surface; July n=3 at 1 m below surface. Surface grabs at lake sites shallower than 2 m.	5 L GO-FLO bottle; Lugol's solution to preserve	July
Lake Benthos				
Density and taxonomy	1 x	n=3, each sample was a composite samples of three Ekman grabs.	Ekman grab and 500 μm seive bucket; formalin to preserve	July

Table 2.1-6. Sampling Details for Streams, Back River Project, 2013

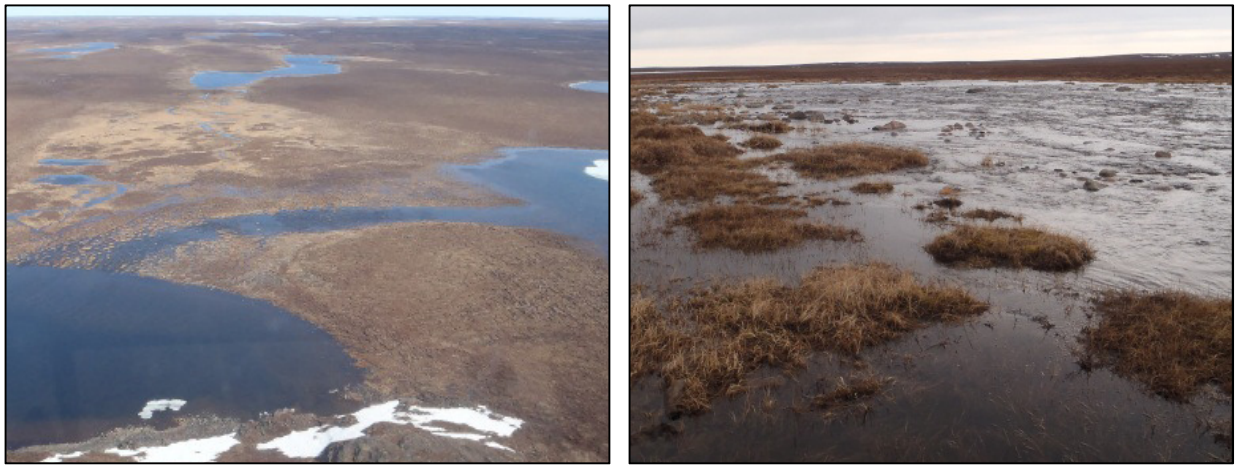
Monitoring Parameter	Sampling Frequency	Sampling Replication	Equipment/Method	Sampling Dates/Timing
Stream Water Quality				
Dissolved oxygen and temperature	2 x	n=1	ODO Probe	June, July
Physical, cyanides, total and dissolved metals, nutrients and total organic carbon	2 x	n=2	grab samples; preservatives	June, July
Stream Sediment Quality				
Physical, nutrients, cyanide, metals	1 x	n=3	Bowl and spoon	July
Periphyton				
Biomass (as chlorophyll *a*)	1 x	n=3, periphyton collected from 4.5 cm diameter circle templates. For one replicate, periphyton from six circles from two rocks were pooled and a subsample was filtered for biomass with the rest preserved for density/taxonomy.	4.5 cm diameter template and scrubber; filtration with 0.45 µm filters	July
Density and taxonomy	1 x		4.5 cm diameter template and scrubber; Lugols solution to preserve	July
Stream Benthos				
Density and taxonomy	1 x	n=3; each a composite of three Hess samples	Hess sampler; 500 µm seive bucket; formalin to preserve	July

Plate 2.1-2. Giraffe IF runs over bedrock. Left, the June sampling site looking downstream; right, the substrate at July sampling site (moved to be near the hydrometric station). This site was confirmed to be non fish-bearing.

Plate 2.1-3. Giraffe OF is a short broad stream connecting Giraffe Lake to Goose Lake, looking downstream in June (left) and July (right).

Plate 2.1-4. Llama OF runs through a boulder field, sampling site in June (left) and further downstream in July (right).

Plate 2.1-5. Goose Neck IF runs through swamp land, with low flow and water levels. Left, in June; right sampling site was moved upstream due to low water levels, sampled around this pool habitat.



a) b)

c)

Plate 2.1-6. Goose OF drains Goose Lake into Propeller Lake. It is a broad shallow stream with cobble substrate. a) and b) in June; and c) looking upstream in July.

Plate 2.1-7. Propeller OF runs through broken bedrock. From above in June (left) and right with 20 cm ruler for scale showing the distinctive substrate Propeller OF runs through.

Plate 2.1-8. Reference B OF is a small stream running through grasslands.

2.2 BATHYMETRY

Bathymetric maps display the topography of lake bottoms in a similar manner to terrestrial topographic contour maps. Bathymetric maps are based on systematic depth soundings that are taken from a boat across the water body. These maps are used to calculate surface area and water volumes, as well as determine maximum depths and the relative size of the littoral zone.

Bathymetric data for Leaf Lake and Wolf Lake were collected by EBA Engineering Consultants Limited (EBA; a Tetra Tech Company) using ground penetrating radar while the lake was ice covered (EBA 2013). Bathymetric surveys of Wasp Lake, Rascal Lake, Bob Lake, Pond A, Esker Pond, Komatic Lake, McCoy Lake, Mosquito Lake, and Reference Q Lake were conducted in July 2013. Methods for these lakes are detailed below. Propeller Lake was surveyed in September 2013 in conjunction with fish habitat assessments using hydroacoustic techniques. Full details of the methods and equipment used at Propeller Lake can be found in the 2013 Freshwater Fish and Fish Habitat Baseline Report (Rescan 2014).

Bathymetric maps for the lakes surveyed in 2013 are shown in Figures 2.1-6 through to 2.1-21. Leaf Lake and Wolf Lake bathymetry are available in Appendices 2.2-1 and 2.2-2.

Plate 2.1-9. George OF is a small stream running through broken bedrock. Above, an aerial shot of George OF in June showing George Lake, and the beginning of the George OF stream channel.

Plate 2.1-10. Lytle OF is a small stream running through broken bedrock. Looking upstream (left) and downstream (right) in June.

2.2.1 Data Collection

Bathymetric surveys consisted of two parts:

1. The collection of continuous depth measurements along perpendicular and perimeter transects on the lake and pond surfaces using a Differential Global Positioning System (DGPS) and a single beam hydroacoustic echo sounder; and
2. Establishing on-land benchmarks to reference the elevation of the water level at the time of the survey.

Plate 2.1-11. Sleigh OF is a small stream running through willows and grassland. Left, an aerial shot in June; right, looking downstream in July.

Plate 2.1-12. Komatic IF is a relatively wide and deep stream, with sand and silt substrate. Left, in June; right, view of sediment substrate in July.

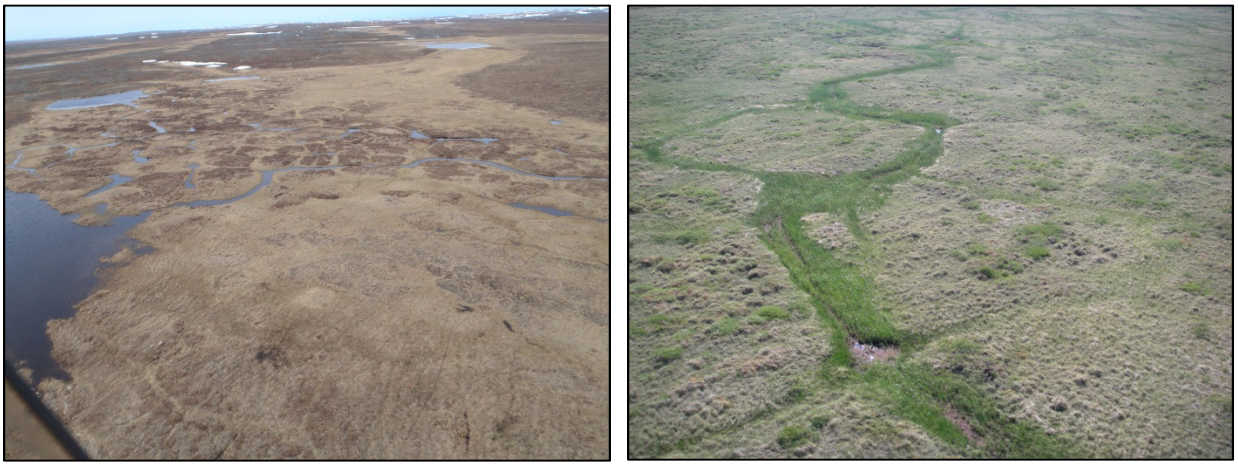


Plate 2.1-13. McCoy IF is an ephemeral multi-channeled small stream running across grassland. Left, an aerial view in June; right, a close up aerial view in July showing particularly low water levels.

A Trimble® GeoXT DGPS was used for positioning during the depth survey, and a Hydrolite-TM Single beam echo sounder consisting of a 200 kHz Ohmex transducer connected to an SCS900 SonarMite data logger were used to collect and store the depth data in electronic files. The hydrographic equipment was mounted along the gunnel of an aluminium boat that completed transects along the lake surfaces (Plate 2.2-1).

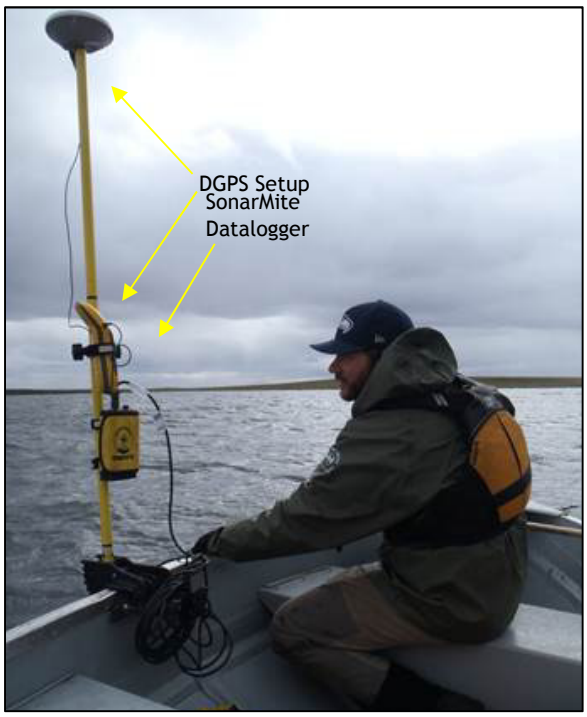


Plate 2.2-1. Sounder, GPS receiver and GPS antennae in its typical configuration, July 2013.

Depth surveys were carried out by navigating a course of regularly spaced transects across the width of each lake, along with a perimeter survey and a longitudinal transect through the long axis of the lake (i.e., e-line). A hand-held GPS, pre-loaded with transect tracks, was used to maintain the correct course with the boat. In areas that were too shallow for reliable depth readings using the echo sounder, personnel waded through the waterbody using a stadia rod and hand-held GPS to collect lake depths and associated GPS coordinates (Plate 2.2-2).

2.2.2 Data Management and Analysis

Bathymetry data had sensor depth and water density corrections applied to the depth values. Additional data collected with a hand-held GPS delineated sections of shoreline and was used to evaluate the GPS data relative to available high resolution air photo imagery for the area. Any significant offset of GPS data from imagery based shorelines was determined and the digitized shoreline was shifted after being created to match the GPS data.

The digitized shoreline and sounding depth points were then used to create a triangular irregular network (TIN). Some lakes had additional depth data measured by manual probing with a stadia rod and recording points with a hand-held GPS. In these cases, these data were incorporated into the TIN along with any data created based on observations from imagery regarding shallow areas where neither sounding or manual depth measurements had been collected. These data included points and break lines where rock outcrops and underwater shelves could be seen in imagery.

Plate 2.2-2. Manual soundings taken by wading with a stadia rod at Esker Pond, July 2013.

The TIN was converted to a raster with a 5 m cell size. The values from the raster were then interpolated back to the sounding points and compared to the sensors recorded depth. Any reading with a variation greater than 0.5 m was individually assessed against other points adjacent to determine if it was likely an erroneous point or simply in an area of high variability. Sounding data that seemed likely to be in error was removed from the dataset, and the TIN was recreated using the corrected data, and the points were reassessed against the generalized average.

A grid of fill points was then created and values from the corrected TIN transferred back to the point grid. The corrected sounding data, the densified TIN grid points, the shoreline, and a polygon boundary of the lake shoreline were then used as inputs in an interpolation to a raster dataset that was then used to produce depth contours.

2.3 PHYSICAL LIMNOLOGY AND LIGHT PENETRATION

Dissolved oxygen and temperature profiles were collected in lakes during April and July. Secchi depth measurements were recorded for lakes in July. Surface temperature and dissolved oxygen concentrations were measured at each stream in June and July.

2.3.1 Lake Under Ice

2.3.1.1 Temperature and Dissolved Oxygen Measurements

Lakes were sampled in April 2013 during the ice-covered season. These sites were accessed by helicopter or snowmobile. Before collecting the physical profiles (and later water samples), an ice auger was used to drill a 25-cm diameter hole through the ice (Plate 2.3-1). Snow and loose ice were cleared from the hole with a slotted spoon and ice thickness was measured.

Temperature and dissolved oxygen profiles were recorded at 0.5 m intervals down the water column using a calibrated YSI Pro-ODO optical dissolved oxygen meter. The profiles ended at approximately 0.5 m above the sediment surface to avoid suspension of bottom sediments.

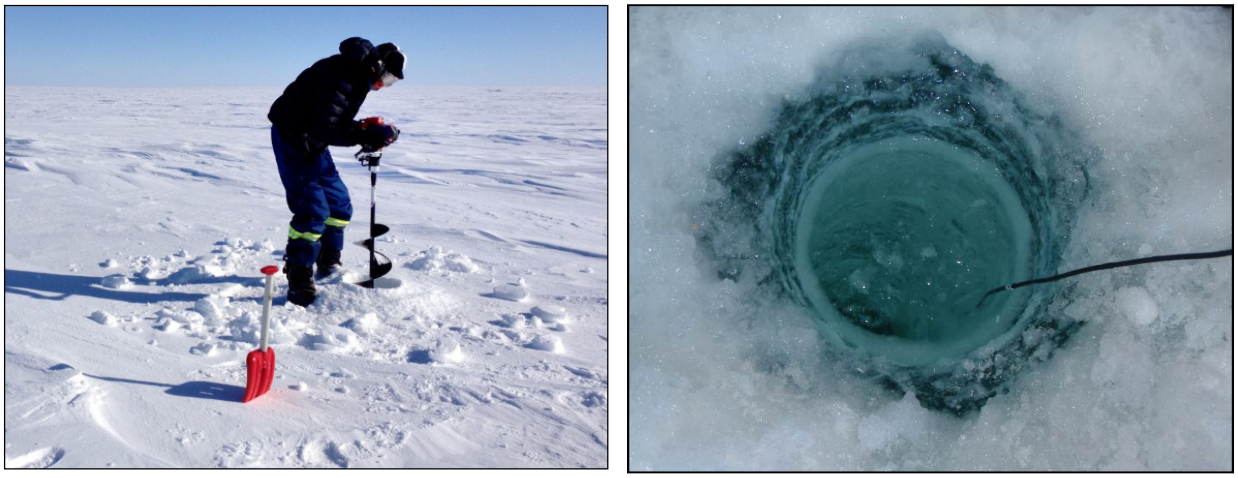


Plate 2.3-1. Left, auguring through the ice; right, measuring dissolved oxygen and temperature through the augered hole.

2.3.2 Lake Open Water

2.3.2.1 Temperature and Dissolved Oxygen Measurements

Open-water temperature and dissolved oxygen profiles were collected from a boat in July 2013 at the same locations that under-ice samples were collected, unless new bathymetric information prompted relocation to a more suitable location (see Figures 2.1-6 through 2.1-19). Data was collected using a calibrated YSI Pro-ODO optical dissolved oxygen meter as described above in the under-ice sampling.

2.3.2.2 Light Penetration

Light penetration was estimated in each lake using a 20-cm, black and white Secchi disk. Measurements were collected at each site by lowering the disk on a metred line through the water column on the shaded side of the boat until it disappeared from sight. The depth of disappearance was identified as the Secchi depth.

2.3.3 Streams

2.3.3.1 Temperature and Dissolved Oxygen Measurements

Surface temperature and dissolved oxygen concentrations were measured using a calibrated YSI Pro-ODO optical dissolved oxygen meter. The probe was placed in the stream and allowed to stabilize before measurements were recorded.

2.3.4 Quality Assurance/Quality Control (QA/QC)

The YSI Pro-ODO optical dissolved oxygen probes were stored in a moist environment as per manufacturer direction. The optical dissolved oxygen meters were calibrated daily during sampling to ensure accurate readings.

2.3.5 Data Management and Analysis

Dissolved oxygen and temperature profiles were graphed for each lake. Canadian Council for Ministers of the Environment (CCME) dissolved oxygen guidelines for the protection of aquatic life were included on graphs (CCME 2014). Stream data are presented in table format and compared against CCME guidelines.

Secchi depths were used to calculate the euphotic zone depth (EZD), which is defined in this report as the depth at which 1% of surface radiation occurs. This generally represents the zone in a waterbody where integrated photosynthesis equals the integrated respiration (i.e., compensation depth). Above this depth net primary production is possible given sufficient nutrients. The EZD was calculated as follows:

$$k' = 1.7/D_s ;$$

where k' = light extinction coefficient, D_s is the Secchi depth, and 1.7 is a constant derived from experimental data (Parsons, Maita, and Lalli 1984).

$$EZD = 4.6/k'$$

2.4 LAKE WATER QUALITY

The 2013 baseline lake water quality sampling focused on characterizing the natural variation in water quality with water column depth, time of year (under ice and open water), and geographical location. Key sites were sampled during the ice-covered season (April) (based on available potential infrastructure at the time), and all sites were sampled during the open-water season (July). Water quality data from the two ponds (Pond 1 and Pond 2) and the two potential water source lakes (Ekalokhiokvik and Potential Water Source SE) are included in the appendices of this report.

2.4.1 Under Ice Sampling

Under-ice water quality samples were collected in April from the ice hole augered for the physical limnology measurements. Samples were collected from 1 m below the base of the ice layer and from 2 m above the sediments where lake sites had enough fluid water (> 6 m). One sample was collected at each depth with 20% replication for QA/QC purposes.

A modified, 2.5 L Niskin bottle was used for April sampling as GO-FLO sampling bottles (generally preferred for sampling waters with low metal concentrations) are prone to freezing open in cold waters. At the shallow Goose Lake Neck site, water quality samples were collected as grab samples to avoid disturbing sediments and inducing sample contamination.

The Niskin bottles were acid-cleaned at ALS Environmental (ALS), Burnaby, British Columbia (BC), and contained acid-cleaned clear silicone tubing in the interior of the bottle to reduce potential metal contamination. A dual rope system was used for bottle closure (Plate 2.4-1).

Plate 2.4-1. Under-ice water quality samples were collected with a modified Niskin bottle, using a dual rope triggering system instead of a messenger.

The water collected in the Niskin was used to fill the appropriate laboratory-provided sample containers (Plate 2.4-2). Preservatives were added in the field to the cyanide (sodium hydroxide), nutrient/total organic carbon (sulphuric acid), and total metals (ultra-pure nitric acid) sample containers. Dissolved metals samples were filtered by ALS in their Burnaby laboratory to avoid contamination issues related to field filtration.

Plate 2.4-2. Labeled sample containers (from back to front: routine, total metals, dissolved metals, cyanides, nutrients/total organic carbon and preservatives).

All water samples were analyzed for general physical parameters, cyanides, nutrients, total organic carbon (TOC), and total and dissolved metals at the lowest feasible detection limits by ALS (Table 2.4-1). Realized detection limits were occasionally greater than the method detection limits, and are indicated on all relevant figures in this report.

All water samples were kept cold, but above freezing, and sent to ALS in Yellowknife, Northwest Territories (NT) on the first available flight from camp. Samples were then sent to ALS's Burnaby laboratory where the lowest metal detection limits were available.

2.4.2 Open Water Sampling

Open-water season water quality samples were collected by boat in July, using an acid-washed 5 L Teflon-lined GO-FLO sampling bottle. The GO-FLO was lowered on a metred line to a depth 0.5 m lower than the desired sampling depth, before being raised to the sampling depth and closed using a weighted Teflon-coated messenger. The water collected was used to fill the laboratory-provided sample containers.

Water quality samples were collected from 1 m below the surface and from 2 m above the sediments at deeper lake sites (> 6 m). One sample was collected at each depth with 20% replication for QA/QC purposes.

Table 2.4-1. Water Quality Parameters and Method Detection Limits, Back River Project, 2013

Parameter	Detection Limit	Parameter	Detection Limit
Physical Tests		***Metals (Total and Dissolved; cont'd)***	
Conductivity	2 µS/cm	Barium (Ba)	0.00005
Hardness (as $CaCO_3$)	0.5	Beryllium (Be)	0.0002
pH	0.01 pH	Bismuth (Bi)	0.0005
Alkalinity, Bicarbonate (as $CaCO_3$)	2	Boron (B)	0.005
Alkalinity, Carbonate (as $CaCO_3$)	2	Cadmium (Cd)	0.00001
Alkalinity, Hydroxide (as $CaCO_3$)	2	Calcium (Ca)	0.02
Alkalinity, Total (as $CaCO_3$)	2	Chromium (Cr)	0.0001
Total Suspended Solids	3	Cobalt (Co)	0.0001
Total Dissolved Solids	10	Copper (Cu)	0.0005
Turbidity	0.1 NTU	Iron (Fe)	0.01
Nutrients		Lead (Pb)	0.00005
Ammonia (as N)	0.005	Lithium (Li)	0.005
Nitrate (as N)	0.005	Magnesium (Mg)	0.005
Nitrite (as N)	0.001	Manganese (Mn)	0.00005
Total Kjeldahl Nitrogen	0.05	Mercury (Hg)	0.00001
Ortho Phosphate (as P)	0.001	Molybdenum (Mo)	0.00005
Total Phosphorus (as P)	0.002	Nickel (Ni)	0.0001
Major Anions		Phosphorus (P)	0.3
Bromide (Br)	0.05	Potassium (K)	0.05
Chloride (Cl)	0.5	Selenium (Se)	0.0001
Fluoride (F)	0.02	Silicon (Si)	0.05
Sulphate (SO_4)	0.5	Silver (Ag)	0.00001
Organic Carbon		Sodium (Na)	0.01
Total Organic Carbon	0.5	Strontium (Sr)	0.0001
Cyanides		Thallium (Tl)	0.00005
Free Cyanide	0.001	Tin (Sn)	0.0001
Total Cyanide	0.001	Titanium (Ti)	0.01
Metals (Total and Dissolved)		Uranium (U)	0.00001
Aluminum (Al)	0.003	Vanadium (V)	0.00005
Antimony (Sb)	0.00005	Zinc (Zn)	0.003
Arsenic (As)	0.00003		

Note:
Detection limits are mg/L unless otherwise indicated.

Water quality samples were taken from the surface (0.1 m) at the shallow Umwelt Lake, Goose Lake Neck, Goose Lake South, Arrow Lake, Occurrence Lake, Slave Lake and Esker Pond.

Water quality samples were preserved, handled, transported and analyzed as described in the under-ice water quality samples.

2.4.3 Quality Assurance/Quality Control (QA/QC)

A QA/QC program was incorporated into the design of the freshwater baseline program to account for within-site variability and any contamination that originated from sampling equipment, field sampling, or sample transportation. This included the use of replicates and blanks. Chain of custody forms were used to track samples handling and condition upon receipt at the laboratory.

Twenty percent of the water samples were collected in duplicate to assess the magnitude and potential causes of variability among samples.

Equipment blanks, field blanks, and travel blanks comprised approximately 10% of the total number of lake water quality samples collected. Equipment blanks were designed to detect contamination from the sampling equipment, including the sampling bottle (GO-FLO or Niskin). Field blanks measured potential contamination from sample exposure to air, while travel blanks were designed to detect potential contamination from travel and storage during sampling.

Equipment blanks were collected in the field by first rinsing an acid-washed GO-FLO with double de-ionized water (DDI water; provided by ALS) then filling the GO-FLO bottle with DDI water, allowing the water to sit for approximately one minute (as would occur with a field sample) and then drawing sub-samples from the bottle. Equipment blanks were preserved and handled in the same fashion as field samples.

Field blanks were processed in the field by opening the bottles provided by ALS (containing DDI water) and exposing the sample to air for approximately one minute. The bottles were preserved and handled the same as the field samples.

Travel blanks were provided by ALS and were never opened, but were otherwise handled in the same way as the regular samples.

All samples, including blanks, were recorded on a chain of custody form and sent to ALS Burnaby via ALS Yellowknife. Blanks were tested for general parameters, TOC, nutrients, anions, cyanides and total metals.

2.4.4 Data Management and Analysis

Parameters of interest, including parameters with CCME water quality guidelines for the protection of aquatic life, were graphed unless values were consistently below detection limits (CCME 2014). Values below analytical detection limits were replaced with half of the realized sample detection limit for graphing and analysis. Duplicate samples were included in graphing and analysis.

Water quality at each lake was compared to the CCME guidelines. Tables were produced showing the frequency and mean factor by which water quality parameters were greater than CCME guidelines at each lake site. Samples below detection limits that were greater than CCME guidelines were excluded from the table calculations. The factor by which parameters were greater than CCME guidelines were calculated for each sample greater than a guideline and the means for each site were then calculated.

The water sample duplicates were assessed for the magnitude of variability among samples using relative percent difference (RPD) as calculated by:

$$RPD = | [(dupeA - dupeB) / ((dupeA + dupeB) / 2)]| \times 100$$

The results of RPD calculations were examined to detect patterns of sampling heterogeneity, sample contamination, or analytical errors. For example, duplicate samples having several water quality parameters with RPDs greater than 20% could suggest one sample had higher particulate matter than the other sample leading to elevated concentrations of several parameters; thus, indicating *in situ* sampling variability or contamination. On the other hand, duplicate samples having only one or a few parameters with RPDs above 20% could suggest analytical inconsistencies.

Water quality parameters where one or both values were less than five times the detection limit were not included in the RPD calculations because analytical results near the detection limit are increasingly unreliable (Clark 2003). Field duplicates with RPD values greater than 20% were noted and all duplicates and RPDs are listed in Appendix 3.3-2.

2.5 STREAM WATER QUALITY

The 2013 stream baseline water quality sampling focused on characterizing the potential natural variation both seasonally and geographically. Samples were collected during June (freshet) and July (low-flow period)). Sixteen stream sites within the Goose and George properties were sampled, including one reference stream from the Goose Property and one from the George Property. Nine of these stream sites were in the Goose Property and seven were in the George Property.

2.5.1 Sampling

Stream water samples were collected from each site using clean techniques. Where flow was low, samples were collected from banks or rocks to prevent contamination from sediments. Where flow was high, the field sampler stood in the stream facing upstream being careful not to disturb sediments. Samples were collected by submersing a sample bottle below the water surface. Water quality samples were preserved immediately in the field (as described in lakes water quality section).

In July, water quality samples could not be collected for McCoy IF as it was mainly dry. The deepest point observed was 7 cm in a small puddle, but this location had a deep organic sediment layer that would have likely contaminated any samples collected.

Stream water samples were analyzed for the same parameters as lake water quality samples, and handled and transported identically.

2.5.2 Quality Assurance/Quality Control (QA/QC)

As with the lake water quality component, QA/QC measures were included with stream water quality sampling. The program included the use of duplicates, blanks, and chain of custody forms.

Twenty percent of the water samples were collected in duplicate to assess the magnitude and potential causes of variability among samples.

Field blanks and travel blanks comprised approximately 10% of the total number of stream water quality samples. Field blanks and travel blanks were collected as described in the lake water quality section.

2.5.3 Data Management and Analysis

Streams water quality data was managed and analyzed identically to the lake water quality data. RPDs were calculated as described in the lake water quality data management section.

2.6 LAKE SEDIMENT QUALITY

The 2013 sediment quality sampling focused on characterizing the natural variation in lake sediments with depth and by lake. Samples were collected in July from 19 lake sampling sites, 11 in the Goose Property and 8 in the George Property including a reference lake in each area.

2.6.1 Sample Collection

Triplicate sediment quality samples were collected using an Ekman grab sampler (surface area: 0.0225 m^2). The Ekman was lowered to the sediment layer, trigged shut with a weighted messenger, and then brought gently to the surface, with care taken to not agitate the collected sediments. At the surface, the sediment was carefully transferred onto a white plastic tray, photographed, and described for colour, texture, and

other characteristics. The top 2 cm of sediment was collected, homogenized, and analyzed for particle size and sediment chemistry. Plate 2.6-1 shows the collection of sediment samples.

a) b)

c)

Plate 2.6-1. Sediment quality samples were collected using an Ekman grab. A) ready to release the sediment; b) the sediment from the grab; c) the top 2 cm of sediment are homogenized.

Due to the nature of sediments at George Lake and Esker Pond, the Ekman grab did not bring up enough sediment for analysis. At George Lake, each replicate was a composite of two Ekman grabs, while at Esker Lake each replicate was a composite of three Ekman grabs. Surface sediment was sampled and homogenized the same as described above.

Sediment samples were kept cold and sent to ALS in Yellowknife, NT on the first available flight from camp. Samples were then sent to ALS's Burnaby laboratory where they were analyzed for grain size, moisture, nutrients, cyanide, and solid-phase metals.

Table 2.6-1 presents the sediment quality parameters that were analyzed and their method detection limits. Note that realized detection limits may differ from these theoretical values. The realized detection limit ranges are indicated on all relevant figures.

Table 2.6-1. Sediment Quality Parameters and Method Detection Limits, Back River Project, 2013

Parameter	Units	Detection Limit
Physical Tests		
% Moisture	%	0.25
pH	pH	0.1
Particle Size		
% Gravel (>2 mm)	%	0.1
% Sand (2.0 mm - 0.063 mm)	%	0.1
% Silt (0.063 mm – 4 µm)	%	0.1
% Clay (<4 µm)	%	0.1
Organic Carbon		
Total Organic Carbon	%	0.1
Leachable Nutrients		
Total Nitrogen	%	0.02
Plant Available Nutrients		
Available Ammonium (as N)	mg/kg	1
Available Nitrate (as N)	mg/kg	2
Nitrite (as N)	mg/kg	0.4
Available Phosphate (as P)	mg/kg	2
Cyanides		
Total Cyanide	mg/kg	0.05
Weak-acid dissociable Cyanide	mg/kg	0.05
Metals		
Aluminum (Al)	mg/kg	50
Antimony (Sb)	mg/kg	0.1
Arsenic (As)	mg/kg	0.05
Barium (Ba)	mg/kg	0.5
Beryllium (Be)	mg/kg	0.2
Bismuth (Bi)	mg/kg	0.2
Metals (cont'd)		
Cadmium (Cd)	mg/kg	0.05
Calcium (Ca)	mg/kg	50
Chromium (Cr)	mg/kg	0.5
Cobalt (Co)	mg/kg	0.1
Copper (Cu)	mg/kg	0.5
Iron (Fe)	mg/kg	50
Lead (Pb)	mg/kg	0.5
Lithium (Li)	mg/kg	5
Magnesium (Mg)	mg/kg	20
Manganese (Mn)	mg/kg	1
Mercury (Hg)	mg/kg	0.005
Molybdenum (Mo)	mg/kg	0.5
Nickel (Ni)	mg/kg	0.5
Phosphorus (P)	mg/kg	50
Potassium (K)	mg/kg	100
Selenium (Se)	mg/kg	0.2
Silver (Ag)	mg/kg	0.1
Sodium (Na)	mg/kg	100
Strontium (Sr)	mg/kg	0.5
Sulphur (S)	mg/kg	500
Thallium (Tl)	mg/kg	0.05
Tin (Sn)	mg/kg	2
Titanium (Ti)	mg/kg	1
Uranium (U)	mg/kg	0.05
Vanadium (V)	mg/kg	0.2
Zinc (Zn)	mg/kg	1

Note: mg/kg is dry weight mg/kg.

2.6.2 Quality Assurance/Quality Control (QA/QC)

Triplicate samples were collected at each site. All sediment quality samples were recorded on a chain of custody form and sent to ALS in Yellowknife. Samples were then sent to ALS's Burnaby laboratory for analysis, where lower detection limits could be obtained.

2.6.3 Data Management and Analysis

All parameters that have CCME sediment quality guidelines for the protection of aquatic life and other parameters of interest were graphed.

Values below analytical detection limits were replaced with half the realized detection limit for graphing and analysis. All sediment samples collected were compared to CCME guidelines for the protection of aquatic life, including the interim sediment quality guidelines (ISQGs) and the

probable effects levels (PELs; CCME 2014). The more conservative ISQGs are levels below which adverse biological effects are rarely observed, whereas the higher PELs correspond to concentrations above which negative effects frequently occur. The frequency and factor that guidelines were surpassed was calculated for each lake and each parameter, as described in the Section 2.4.4.

2.7 STREAM SEDIMENT QUALITY

Thirteen stream sites were sampled for sediment quality in July 2013 (Table 2.1-2). Seven of these stream sites were in the Goose Property and six were in the George Property. Three replicate samples were collected per stream site.

2.7.1 Sample Collection

Stream sediments were collected with a plastic spoon from depositional areas within streams. Each replicate sample was a composite of multiple spoonfuls from a single reach, homogenized in a plastic bowl, and collected in a Whirl-pak bag (Plate 2.7-1). All sediment quality samples were transported and analyzed as described in the lake sediment section above.

Plate 2.7-1. Samples were homogenized in a plastic bowl. Left, Goose OF; right, Reference Q OF.

Due to the nature of the substrate, sediments could not always be collected. For example, sediments could not be collected at Propeller OF, and only one sediment sample could be collected at Giraffe IF and McCoy OF due to the bedrock substrate (Plate 2.7-2).

2.7.2 Quality Assurance/Quality Control (QA/QC)

As with lake sediment quality samples, stream sediment samples were recorded on chain of custody forms and sent to ALS in Yellowknife. Samples were then sent to ALS's Burnaby laboratory for analysis where lower detection limits could be obtained.

2.7.3 Data Management and Analysis

Streams sediment quality data were managed and analyzed identically to the lake sediment quality data.

Plate 2.7-2. Fine depositional sediments could not be collected from Propeller OF (top), and only one sample could be collected from Giraffe IF (centre) and McCoy OF (bottom).

2.8 PRIMARY PRODUCERS

2.8.1 Phytoplankton

Phytoplankton are free-floating photosynthetic algae that play an important role in many aquatic systems as primary producers and prey for higher trophic levels. Phytoplankton have short generation

times and can respond rapidly to environmental change. These characteristics make them useful indicators of water quality and ecosystem health.

Phytoplankton samples were collected from 18 lake sites during April and/or July 2013, with 10 sites in the Goose Property and eight sites in the George Property.

2.8.2 Phytoplankton Sample Collection

In April, three phytoplankton biomass samples were collected from all lakes sampled for water quality. Under-ice samples were collected from 1 m below the ice-water interface using a Niskin bottle. Leaf Lake and Goose Lake Neck were too shallow for the Niskin, so were not sampled for phytoplankton. In July, triplicate biomass and taxonomy samples were collected from 1 m below the lake surface using a 5 L GO-FLO bottle.

For each biomass sample, 1 L was collected in an opaque plastic bottle to ensure chlorophyll did not degrade and phytoplankton did not multiply before being filtered. For each density/taxonomy sample, 250 mL was collected and preserved in the field with Lugol's iodine solution.

Phytoplankton biomass samples were filtered onto 0.45 µm pore size filters back in camp and kept dark and frozen until analysis by ALS in Burnaby. Density/taxonomic samples were sent to EcoAnalysts, Idaho, USA for enumeration and identification.

2.8.3 Periphyton

Periphyton are algae that grow on the surfaces of rocks or larger plants and are an important food item for many benthic invertebrates, which are in turn the main food source for fish in streams and rivers. Periphyton are among the first organisms to respond to environmental stressors or nutrients due to their rapid generation rates, and can exhibit taxon-specific changes making them good indicators of current environmental conditions. Three stream periphyton samples were collected from 12 stream sites during July 2013; seven in the Goose Property and five in the George Property.

2.8.4 Periphyton Sample Collection

Periphyton were collected from rocks with flat upper surfaces. For each replicate, two rocks were selected. A circular template with a foam base was used to seal a known area of rock from the rest of the rock. Periphyton within the template were collected using tweezers, a modified toothbrush, a syringe, and distilled water. The periphyton were sampled from three circles on each of the two rocks for each replicate (i.e., a total of six circles; Plate 2.8-1).

No periphyton samples could be collected at Goose Neck IF due to low flow. This created environments that were both too shallow and narrow or had deep pooling habitat with no suitable stones/rocks for periphyton sampling (Plate 2.8-2). Substrate at Komatic IF was entirely soft sediments, with no rocks within 200 m for periphyton sampling.

The volume of periphyton samples were measured back at the lab. For biomass, each sample was homogenized, and a known volume (usually from 5 to 10%) was sampled using a syringe. This subsample was filtered onto 0.45 µm pore size filters back in camp and kept dark and frozen until analysis by ALS in Burnaby. The remaining volume was used for the density/taxonomy sample and was preserved with Lugol's iodine solution and sent to EcoAnalysts, Idaho, USA for enumeration and identification.

Plate 2.8-1. Periphyton were collected from a known area using a circular template. Top left, template on a periphyton-covered rock at Reference Q OF; top right, each replicate is a composite of the periphyton from three template areas on two different rocks. Bottom, a filter after a known subsample of a periphyton sample has been filtered (Goose OF).

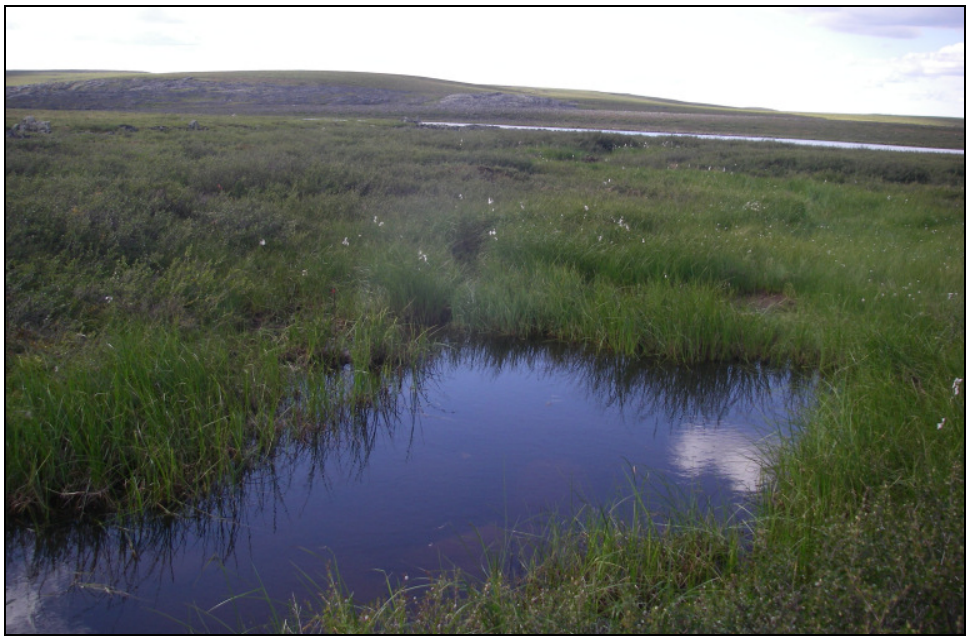


Plate 2.8-2. Goose Neck IF had extremely low flow in most sections, with a large deep pool. Substrate was deep organic sediment, with no rocks apparent for periphyton sampling.

2.8.5 Quality Assurance/Quality Control (QA/QC)

Primary producer samples had triplicate replication at each site and chain of custody forms were used. EcoAnalysts have their own internal QA/QC protocols including creating a digital image library of every taxon encountered for future reference, and having an independent phycologist analyze 10% of samples to ensure taxonomic accuracy and reproducibility in the analysis methods.

2.8.6 Data Management and Analysis

The number of organisms per sample was converted to density (cells/L for phytoplankton; cells/cm^2 for periphyton) by dividing each sample by the volume or area sampled.

Density, genus richness, and genus diversity were calculated from the taxonomic analysis. Richness is the simplest measure of biodiversity and is a count of the number of taxa (in this case genera) in a given area or volume. Diversity indices are quantitative measures of how evenly the taxon richness is distributed within a known area or volume.

For the calculation of richness and diversity, taxa were grouped by genera. Plankton and periphyton not identifiable to the genus level were excluded from the richness and diversity analysis. The Simpson's diversity index (D) was used as the measure of diversity, and takes into account dominance, the number of taxa present, and relative abundance of each taxa (evenness). This was calculated by:

$$\textit{Simpson's Diversity Index (}D\textit{)} = 1 - \sum_{i=1}^{G} p_i^2$$

where G is the number of genera present, and p_i is the relative density of each genus calculated as n_i/N, where n_i is the number of individuals in genus i, and N is the total number of all individuals. Note that this formula for the Simpson's diversity index produces values that range from 0 (lowest diversity) to 1 (maximum diversity), and represents the probability that two genera taken randomly from a sample are from two different genera.

For the calculation of dominance tables, abundances converted to percentages for each sample, and then mean percentages were calculated for each site and used to determine the three most dominant genera.

2.9 BENTHIC MACROINVERTEBRATES

Benthic macroinvertebrates (benthos) are organisms that inhabit lake and stream sediments, and can be important indicators of environmental change as these organisms are in close contact with the sediments and feed on algae, bacteria, and detritus. Benthic invertebrates tend to have low mobility, making them good indicators of local conditions.

2.9.1 Lake Benthic Macroinvertebrate Collection

Lake benthic macroinvertebrate (benthos) samples were collected from 18 lake sites during July 2013, with 10 sites in the Goose Property and eight in the George Property. Three replicate samples, each a composite of three Ekman grab samples, were collected at each lake site. Samples were gently sieved in the field using a 500 µm sieve bucket (Plate 2.9-1). Samples were preserved in 10% buffered formalin back at camp and then sent to EcoAnalysts, Idaho, USA, for enumeration and identification.

2.9.2 Stream Benthic Macroinvertebrate Collection

Benthos samples were collected from 12 stream sites during July 2013, seven in the Goose Property and five in the George Property. A 500 µm mesh size Hess sampler with a sampling surface area of 0.096 m^2 was used to collect stream benthos samples (Plate 2.9-2). Three replicate samples, each a composite of three Hess samples, were collected from each stream site. Most streams had limited flow and volume during July. Consequently, replicate samples were collected where depth and substrate

allowed. Notes were taken on depth and flow in the area. When required, flow was created by the sampler to ensure all benthic invertebrates were swept into the Hess sampler's cod end.

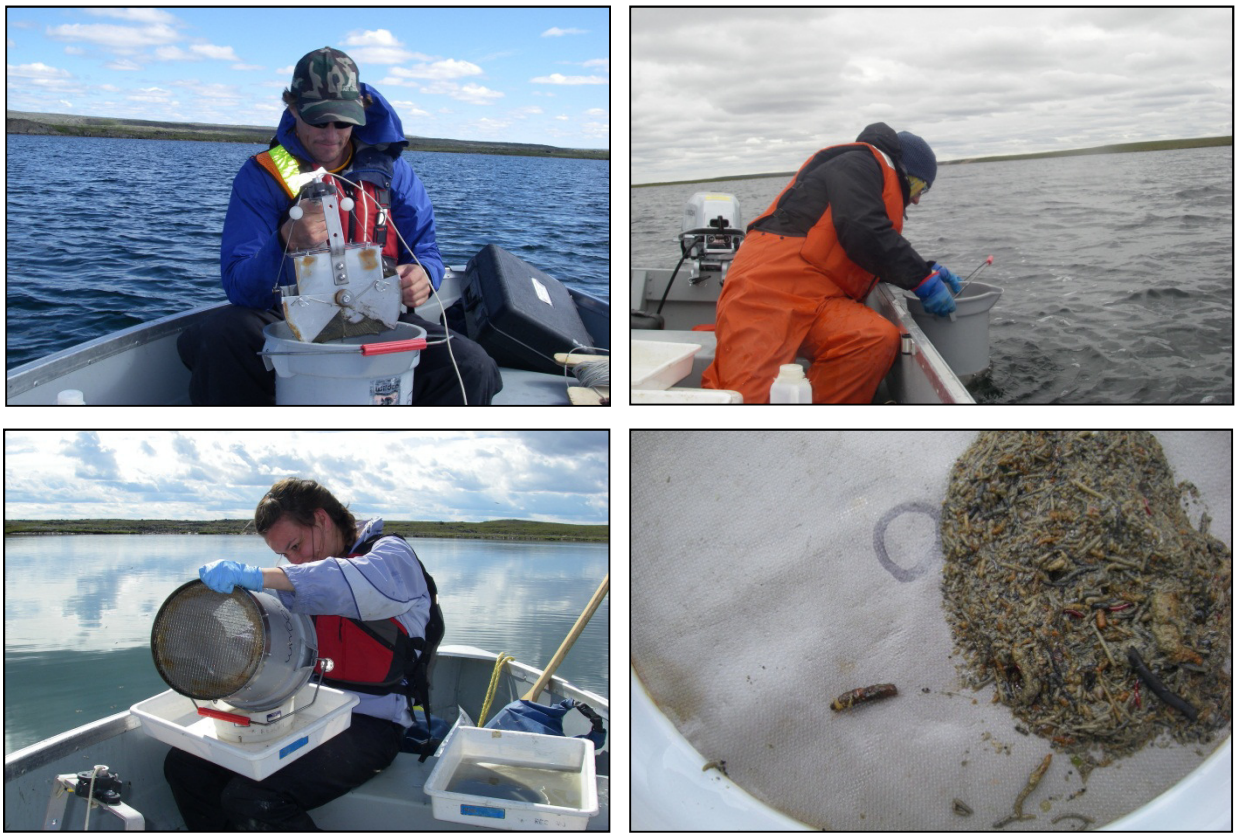


Plate 2.9-1. Each benthos sample was a composite of three sieved Ekman grabs. Top left, emptying Ekman into 500 µm wash bucket; top right, sieving out fine sediments; bottom left, transferring sample from wash bucket into hand sieve; bottom right, sieved benthos sample at McCoy Lake.

Plate 2.9-2. Benthos samples were collected from streams using a Hess Sampler (left). Right, a benthos sample at bottom of plastic sample jar from Goose OF.

Samples were preserved in 10% buffered formalin and sent to EcoAnalysts, Idaho, USA for enumeration and identification.

2.9.3 Quality Assurance/Quality Control (QA/QC)

Each lake and stream benthos sample was a composite of three subsamples. Three benthos replicate samples were collected at each site, and all samples were recorded on chain of custody forms. EcoAnalysts have their own internal QA/QC protocols including having an independent taxonomist analyze 10% of samples to ensure taxonomic accuracy and reproducibility in the analytical methods, and assessing their sorting efficiency.

To ensure consistent and accurate sorting of benthos samples (sorting efficacy), a quality assurance (QA) sort of benthic sample residues was conducted on a randomly selected 10% of the benthos samples. The criterion for an acceptable sort was that more than 90% of the total number of organisms found in both the initial and QA sort were recovered during the initial sort, as required by Environment Canada for invertebrate community surveys (Environment Canada 2002). Any sample not meeting the 90% removal criterion was re-sorted a third time.

This was calculated by the following equation:

$$\text{SortingEfficacy} = \frac{\text{OriginalCount}}{\text{OriginalCount} + \left(\frac{\text{QACount} * \text{QASquares}}{\text{QTSquares}} \right)} * 100$$

where OriginalCount = the number of organisms picked up by the first sorter; QACount = the number of organisms found in the Quality Assurance sort; QASquares = the number of grids sorted during the QA process; QTSquares = the total number of grids in the QA Caton sampling tray.

2.9.4 Data Management and Analysis

The number of individuals per sample was converted to density (individuals/m^2) by dividing each sample by the volume/area sampled.

Richness and diversity were calculated as outlined in the primary producer section, but at the family level instead of the genus level. Organisms unidentified to family level were excluded from analyses. Branchiopoda, Cladocera, Collembola, Copepoda, Nematodes, copepods and cladocerans were excluded from the analyses following Environment Canada (2011).

Dominance tables were calculated as outlined in the primary producer section, except at the family level.

3. Results and Discussion

3. Results and Discussion

3.1 BATHYMETRY

Bathymetric data collected is shown on the sampling location maps (Figures 2.1-6 to 2.21). Some of the data presented on the sampling location maps in Chapter 2 were collected in historical years. A summary of bathymetric data for lakes for which data were collected in 2013 are presented below in Table 3.1-1.

Table 3.1-1. 2013 Bathymetric Data Summary

Waterbody	Max Depth (m)	Volume (m^3)	Surface Area (m^2)	Shoreline Length (m)
Goose Property Area				
Wasp Lake	15.7	2,520,390	835,680	8,760
Leaf Lake*	3.9*	367,700*	156,000*	n/a
Rascal Lake	3.7	385,390	292,360	3,790
Propeller Lake	17.1	52,652,320	12,647,950	34,350
Wolf Lake*	2.3*	5,148,320*	2,270,000*	n/a
Pond A	4.1	75,870	52,393	924
George Property Area				
Bob Lake	6.2	325,280	165,290	2,390
Esker Pond	0.5	27,700	94,760	1,970
Komatic Lake	9.1	951,040	433,080	3,770
McCoy Lake	9.0	1,130,610	365,933	7,950
Mosquito Lake	6.4	876,290	515,310	4,180
Reference Q Lake	19.4	3,438,280	1,072,540	8,380

** Obtained in the winter by GPR methods (EBA 2013; Appendices 2.2-1 and 2.2-2).*

3.2 PHYSICAL LIMNOLOGY

3.2.1 Lake under Ice

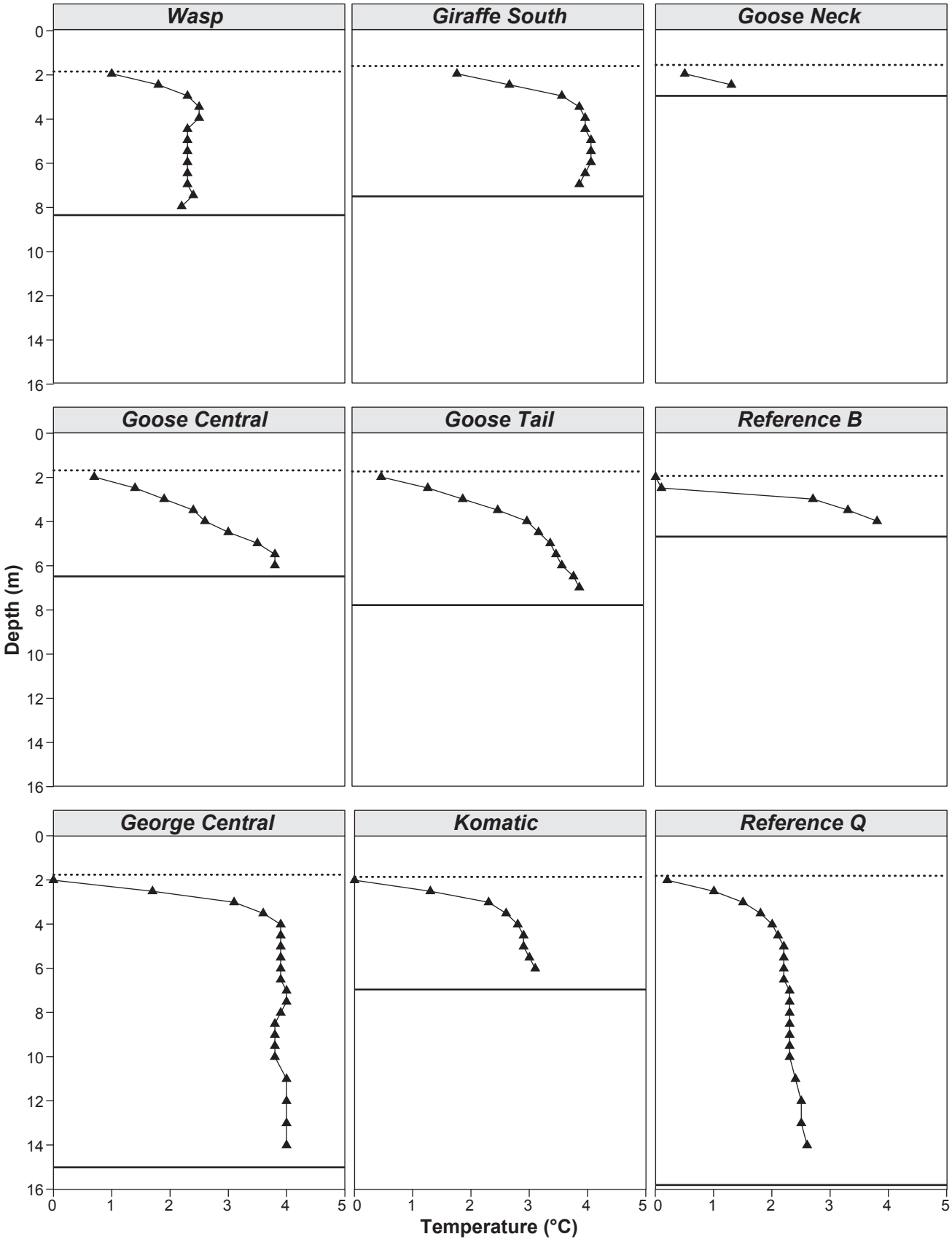
Ice thickness, temperature, and dissolved oxygen concentrations were measured in April 2013 (Figures 3.2-1 to 3.2-3; Appendix 3.2-1). All lakes had similar ice thickness during April 2013 sampling, ranging from 1.65 m to 2.0 m. This was similar to thicknesses observed in 2011 and 2012 (Rescan 2012a, 2012b).

3.2.1.1 Temperature

Temperatures near the ice-water interface during April sampling were between 0°C to 1°C, and tended to warm by depth with most lakes stabilizing a few metres below the ice between 2.5°C and 4°C. The three deeper lake sites, Wasp, George Central and Reference Q, had very stable bottom layers.

3.2.1.2 Dissolved Oxygen

Dissolved oxygen concentrations were highest near the ice-water interface (10.0 mg/L to 17.5 mg/L) and were over 90% oxygen saturated, except in Komatic Lake where saturation levels were less than 80%. Well-oxygenated surface water suggested higher primary productivity at the surface because photosynthesis is the main oxygen source during the under-ice period when no atmospheric exchange is possible.



Note: Solid line represents the measured lake bottom.
Dotted line represents the ice thickness.
As Leaf Lake was 1.65 m of ice above 5 cm fluid water, no physical limnology data was collected.

Figure 3.2-1

Under-Ice Temperature Profiles in Lakes, Back River Project, April 2013

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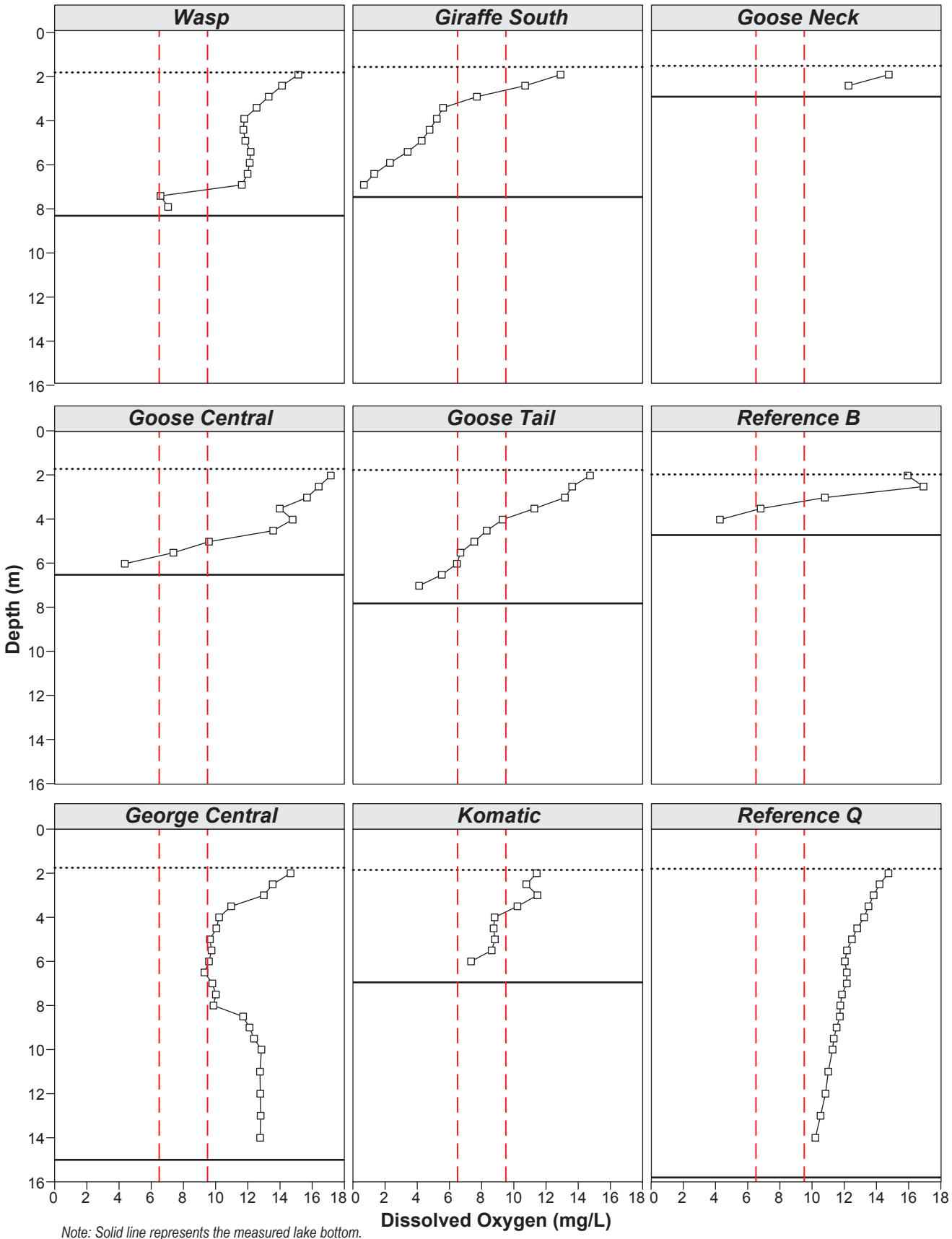


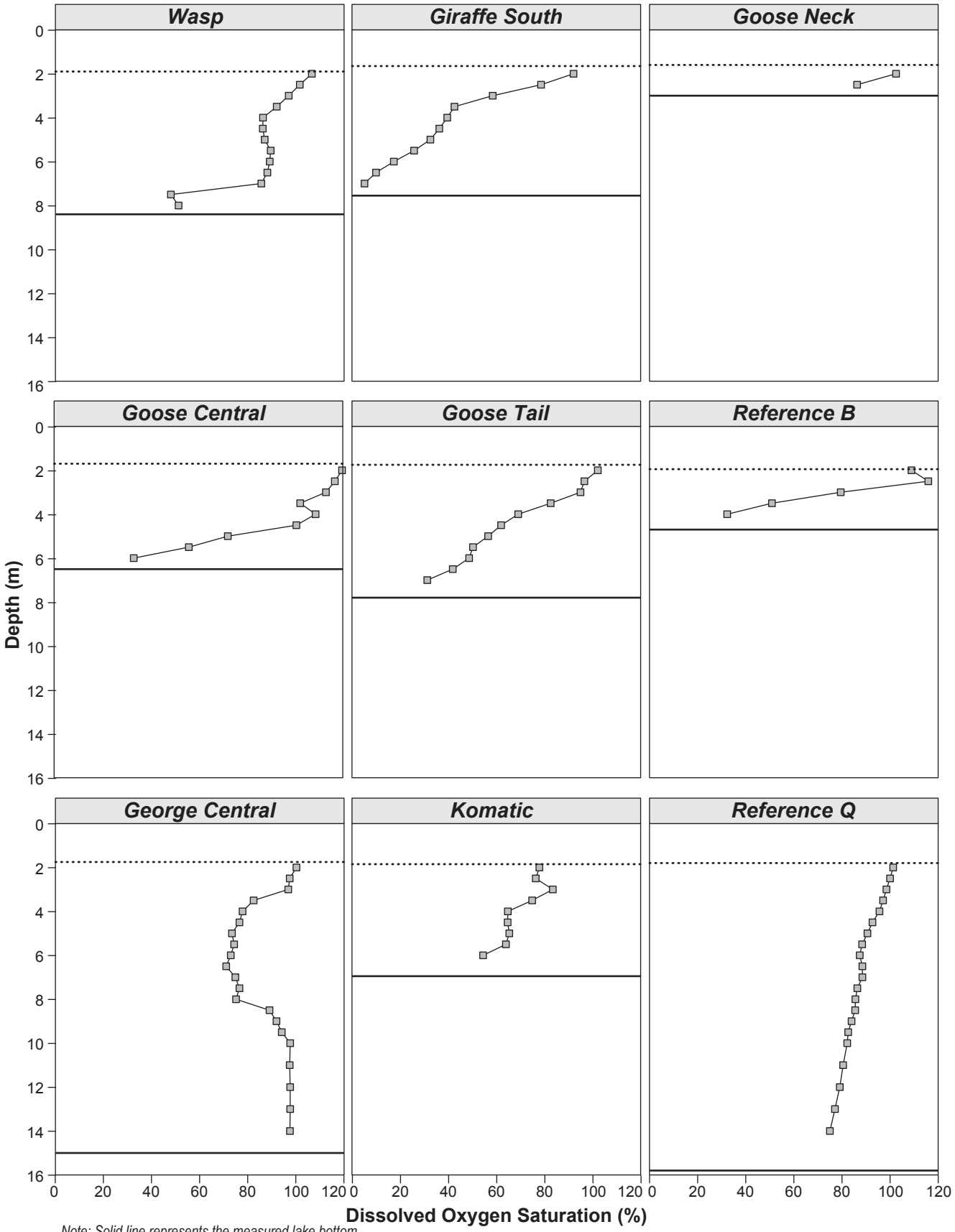
Note: Solid line represents the measured lake bottom.
Dotted line represents the ice thickness.
CCME guideline for dissolved oxygen is life stage−dependent: 9.5 mg/L for early life stages; 6.5 mg/L for other life stages.
As Leaf Lake was 1.65 m of ice above 5 cm fluid water, no physical limnology data was collected.

Figure 3.2-2

Under-Ice Dissolved Oxygen Concentration Profiles in Lakes, Back River Project, April 2013

Sabina GOLD & SILVER CORP.

Rescan an ERM company



Note: Solid line represents the measured lake bottom.
Dotted line represents the ice thickness.
As Leaf Lake was 1.65 m of ice above 5 cm fluid water, no physical limnology data was collected.

Figure 3.2-3

Under-Ice Dissolved Oxygen Saturation Profiles in Lakes, Back River Project, April 2013

Sabina GOLD & SILVER CORP.

Rescan an ERM company

Generally, dissolved oxygen concentrations declined gradually throughout the water column to minimum concentrations at the sediment-water interface. Low levels of dissolved oxygen near the sediment-water interface are common in Arctic lakes over April, and are a result of oxygen depletion from respiration and decomposition of sinking organic material and a lack of atmospheric exchange due to ice cover (CCME 2014).

Many lakes had minimum dissolved oxygen concentrations below the CCME guidelines in their deeper waters during April sampling; below the guideline for early life stages (9.5 mg/L) at Wasp, Giraffe South, Goose Central, Goose Tail, Reference B and Komatic, and below the guideline for all life stages (6.5 mg/L) at Giraffe South, Goose Central, Goose Tail and Reference B. Low oxygen concentrations were present in the bottom portion of the water column at Giraffe South, Goose Tail and Komatic lakes.

3.2.2 Lake Open Water

Limnological characteristics were measured during the open-water season in July 2013, including temperature and dissolved oxygen profiles (Figures 3.2-4 to 3.2-6) and Secchi depths (Table 3.2-1).

3.2.2.1 Temperature

Temperatures were higher in July than in April, by an average of 10°C. Most lakes in the Goose and George properties were well mixed with fairly uniform temperatures and dissolved oxygen concentrations through the water column in July. Some of the deeper lakes had a deeper cold layer with higher dissolved oxygen concentrations and lower dissolved oxygen saturations. Temperature differences by depth observed at Goose Tail, Lower Long, Fold and George Central were between 2°C and 3°C, while greater stratification was observed at Reference Q with an 8°C difference in surface and bottom water temperature.

Lake surface temperatures varied from 9°C to 16°C among lakes during the July sampling, with surface temperatures in the George Property lakes averaging 2.9°C warmer than temperatures in the Goose Property lakes (Figure 3.2-4). Deep-water temperatures were above 9°C, except the stratified Reference Q where bottom temperatures of 6.4°C were observed.

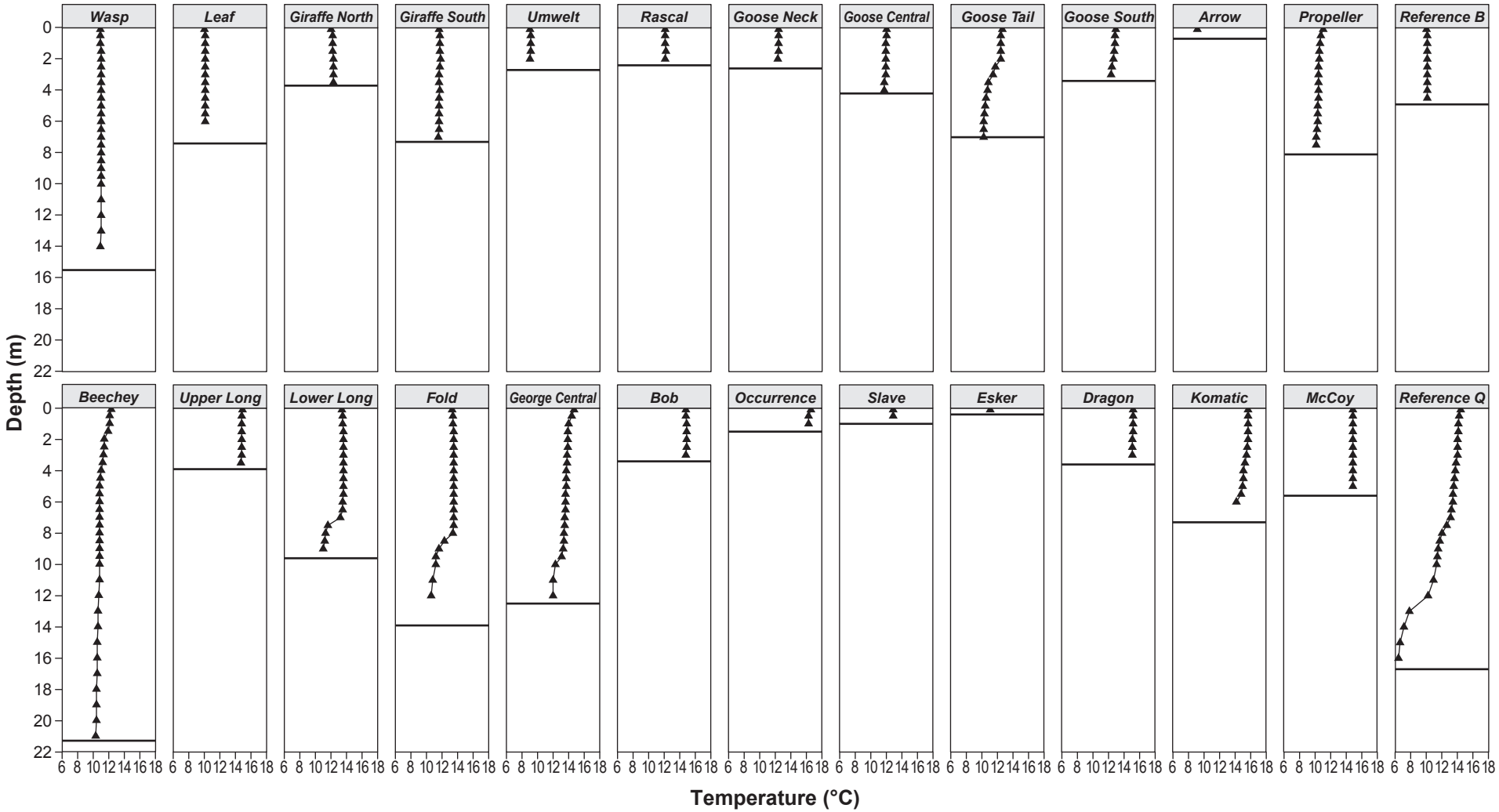
3.2.2.2 Dissolved Oxygen

Dissolved oxygen concentrations were similar among Goose and George Property lakes. There was no clear trend in dissolved oxygen saturation, which is affected by dissolved oxygen concentrations as well as lake temperature. All lakes at all depths had over 93% dissolved oxygen saturation; this minimum concentration was higher than saturations observed in many Goose Property lakes and all George Property lakes in August 2012 (Rescan 2012b).

Dissolved oxygen concentrations were above the CCME guidelines for the protection of aquatic life at all sites during the open-water sampling (9.5 mg/L for early life stages, 6.5 mg/L for other life stages), indicating atmospheric exchange and increased wind-driven mixing enhance the oxygen concentration through the Project lakes during the open-water season.

3.2.2.3 Light Penetration

Secchi depth, a measure of water clarity or light penetration, reached the sediment layer at most lakes, and was between 6.2 m to 11.2 m in several deeper lakes (Table 3.2-1). The euphotic depth, the depth with sufficient sunlight for net photosynthesis, extended throughout the water column in all lakes, except the deep Beechey Lake. This indicates that net photosynthesis could occur throughout the entire water column as well as in the benthic habitat at all lakes, except Beechey Lake. Beechey Lake had a euphotic depth of 19 m, close to the site depth of 21.3 m, meaning benthic primary production would be increasingly possible as the waters became shallower than 19 m.



Note: Solid line represents the measured lake bottom.

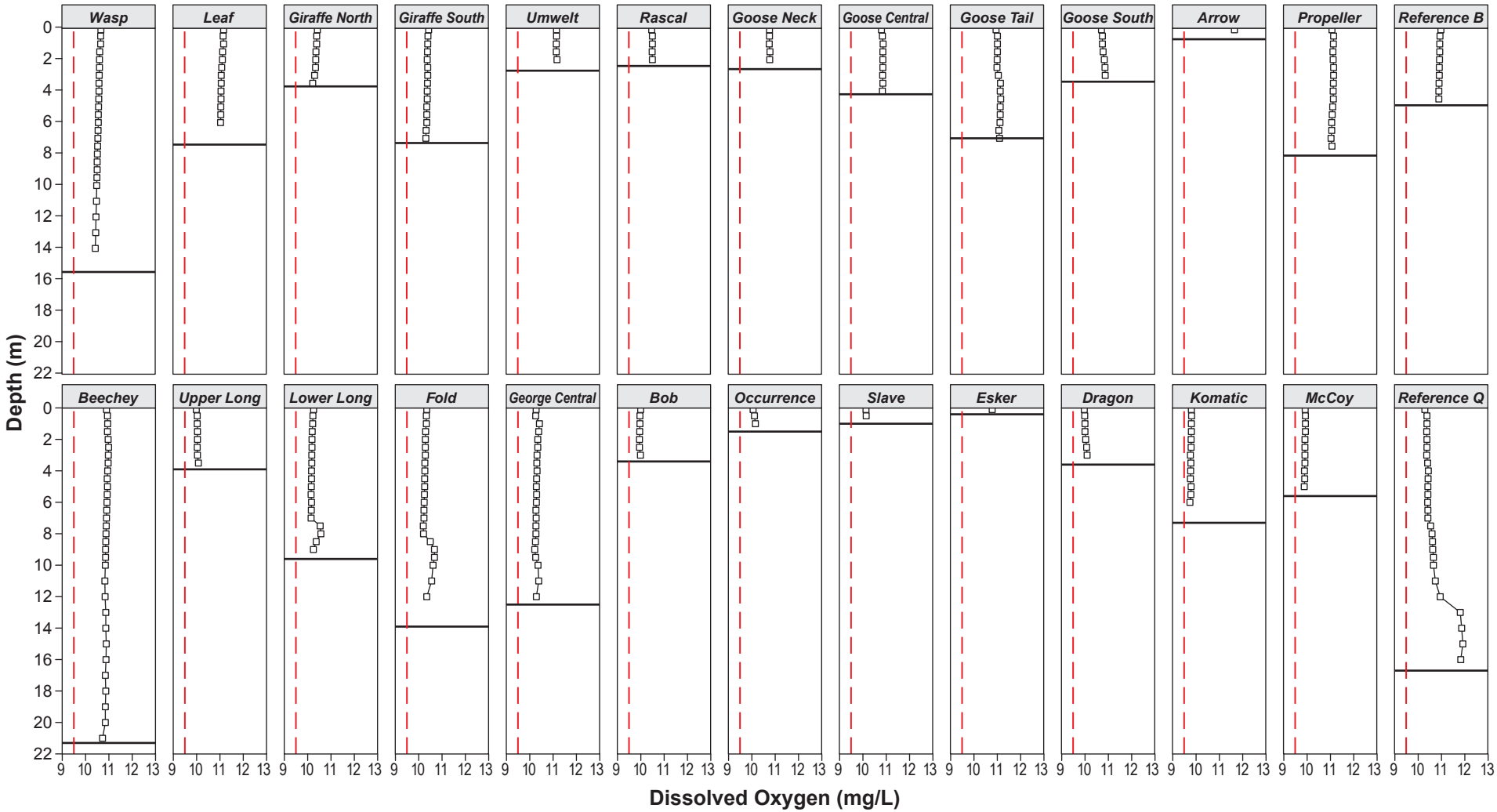
Figure 3.2-4

Sabina GOLD & SILVER CORP.

Open-Water Temperature Profiles in Lakes, Back River Project, July 2013

Figure 3.2-4

Rescan an ERM company



Note: Solid line represents the measured lake bottom.
CCME guideline for dissolved oxygen is life stage−dependent: 9.5 mg/L for early life stages; 6.5 mg/L for other life stages.

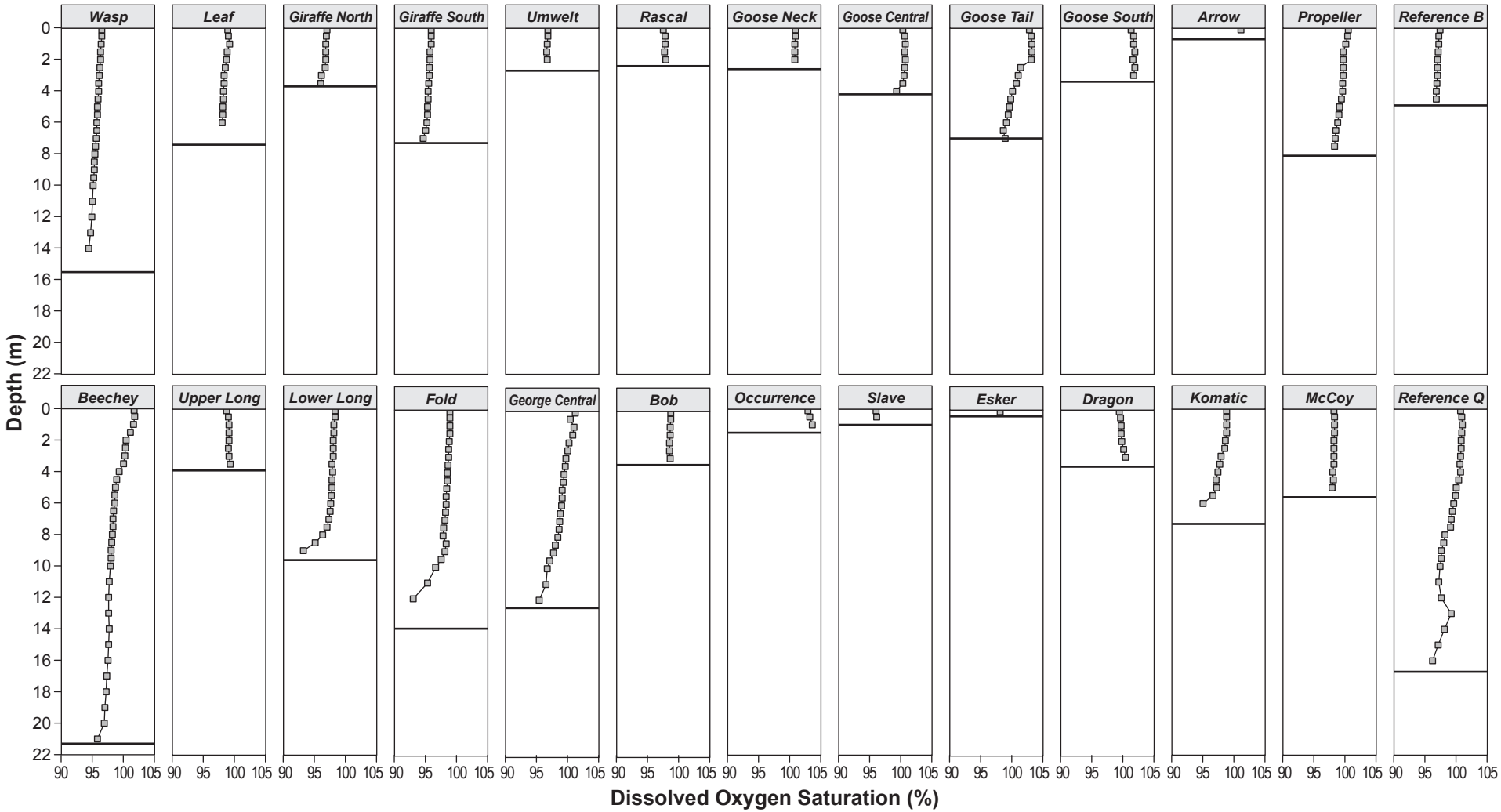
Figure 3.2-5

Sabina GOLD & SILVER CORP.

Open-Water Dissolved Oxygen Concentration Profiles in Lakes, Back River Project, July 2013

Figure 3.2-5

Rescan an ERM company



Note: Solid line represents the measured lake bottom.

Figure 3.2-6

Sabina GOLD & SILVER CORP.

Open-Water Dissolved Oxygen Saturation Profiles in Lakes, Back River Project, July 2013

Figure 3.2-6

Rescan an ERM company

Table 3.2-1. Lake Secchi and Euphotic Zone Depths, July 2013

Lake	Sampling Site Depth (m)	Secchi Depth D_s (m)	Euphotic Zone Depth EZD (m)
Goose Property Area			
Wasp	15.5	6.7	bottom
Leaf	7.4	bottom	bottom
Giraffe North	3.7	bottom	bottom
Giraffe South	7.3	6.2	bottom
Umwelt	2.7	bottom	bottom
Rascal	2.4	bottom	bottom
Goose Neck	2.6	bottom	bottom
Goose Central	4.2	bottom	bottom
Goose Tail	7.0	bottom	bottom
Goose South	3.4	bottom	bottom
Arrow	0.7	bottom	bottom
Propeller	8.1	7.5	bottom
Reference B	4.9	bottom	bottom
Beechey	21.3	7.0	19.0
George Property Area			
Upper Long	3.9	bottom	bottom
Lower Long	9.6	7.0	bottom
Fold	13.9	8.0	bottom
George Central	12.5	11.2	bottom
Bob	3.4	bottom	bottom
Occurrence	1.5	bottom	bottom
Slave	1.0	bottom	bottom
Esker	0.4	bottom	bottom
Dragon	3.6	bottom	bottom
Komatic	7.3	bottom	bottom
McCoy	5.6	bottom	bottom
Reference Q	16.7	10.0	bottom

Note:
Euphotic Zone Depth is the depth at which light penetration is 1% of the surface irradiance.

3.2.3 Streams

Stream temperatures and dissolved oxygen measurements were collected in June 2013, shortly after ice thaw, and during the lower flow period in July (Table 3.2-2).

Stream temperatures also appeared to vary considerably spatially and temporally due to their shallow depth, varying substrates, and variation in daily solar irradiation and air temperatures. During June, temperatures measured 300 m and two days apart at Reference B OF differed by 4°C, with the warmer temperature observed in the lower water volume/flow downstream site. During July, temperatures recorded five days apart at Giraffe IF varied by 6°C.

Table 3.2-2. Temperature and Dissolved Oxygen in Streams, Back River Project, 2013

Stream	June (Freshet)			July		
	Temperature (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen Saturation (%)	Temperature (˚C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen Saturation (%)
Goose Property Area						
Wasp OF	6.8	12.64	103.6	11.9	10.13	93.7
Giraffe IF[1]	7.4	12.52	104.2	14.6 (8.6)	10.67 (10.36)	104.9 (88.4)
Giraffe OF	7.2	12.90	106.8	12.6	10.04	94.4
Umwelt OF	8.9	12.67	109.3	17.8	10.90	114.6
Llama OF	6.3	11.77	95.2	8.3	8.24	70.1
Goose Neck IF	8.9	11.32	97.6	16.5	11.12	113.9
Goose OF	4.6	12.84	99.5	12.7	10.83	100.1
Propeller OF	4.1	12.76	97.6	12.1	9.64	89.7
Reference B OF[2]	10.1 (14.6)	11.74 (11.33)	104.2 (111.4)	13.6	9.16	87.9
George Property Area						
George OF	6.4	13.32	108.0	19.4	9.71	105.5
Lytle OF	8.8	11.10	95.5	11.1	10.55	96.2
Sleigh OF	6.7	12.80	104.7	10.6	10.70	96.1
Komatic IF	10.4	11.52	103.0	10.2	10.20	91
McCoy IF	13.5	10.80	103.6	nc	nc	nc
McCoy OF	8.1	11.16	94.5	11.3	9.45	86.1
Reference Q OF	10.1	11.50	102.2	13.9	8.10	79.3

Note: Shaded values show concentrations below the CCME guidelines for freshwater aquatic life; light grey for early life stages (9.5 mg/L) and dark grey for all life stages (6.5 mg/L).
nc = not collected due to low water levels.
[1]Data in brackets were recorded five days later on second site visit.
[2]Data in brackets were recorded two days earlier at a downstream location.

3.2.3.1 Dissolved Oxygen

Dissolved oxygen concentrations in streams were greater during the freshet June sampling than the low-flow July sampling, ranging from 10.8 mg/L to 13.3 mg/L in June compared to 8.1 mg/L to 11.1 mg/L in July. During July sampling, Llama OF, Reference B OF, McCoy OF and Reference Q OF had dissolved oxygen concentrations below the CCME guideline for the protection of freshwater aquatic life for early life stages (9.5 mg/L; CCME 2014) possibly related to low water flow.

During freshet sampling in June, all streams were close to or fully saturated with dissolved oxygen (with 95% or greater saturation). Saturation became more variable among streams in July (see Table 3.1-3), ranging from 70% at Llama OF to 114.6% at Umwelt OF.

3.3 LAKE WATER QUALITY

Lake water quality samples were collected in April (under ice) and July (open water) 2013. Lake water quality data collected in 2013 are presented graphically in Figures 3.3-1 to 3.3-12. Complete water

quality data for lakes are presented in Appendices 3.3-1 to 3.3-3. Cumulative graphs for all water quality data collected from 2010 to 2013 are presented in Appendices 3.3-4 to 3.3-35.

3.3.1 Physical Parameters

The lakes were slightly acidic to slightly alkaline, with mean pH values ranging from 6.6 at Goose Tail to 7.52 at Dragon Lake (Figure 3.3-1). Goose Property lakes tended to be slightly acidic, while George Property lakes tended to be slightly more alkaline. All lakes had pH levels within the CCME guideline range for the protection of aquatic life (CCME 2014).

Total alkalinity is an indication of the buffering capacity (i.e., ability to neutralize acids) of a lake, with greater alkalinity having greater buffering ability and a more stable pH. Similar to patterns observed in 2012, total alkalinities in the lakes varied both seasonally and spatially with higher alkalinities observed in April than in July. Total alkalinities also tended to be higher in George Property lakes than in Goose Property lakes. Overall, lakes were poorly buffered, with total alkalinity below 25 mg $CaCO_3$/L at all lakes and as low as 2.5 mg $CaCO_3$/L at Umwelt Lake in July (Figure 3.3-1).

Hardness, conductivity and total dissolved solids (TDS) displayed similar patterns, with higher concentrations in April than in July, and higher mean concentrations in George Property lakes than in Goose Property lakes (Figure 3.3-2). These patterns were also observed in 2012. The sampled lakes generally had soft water (hardness less than 60 mg $CaCO_3$/L), low conductivity (≤ 100 µS/cm), and low levels of total dissolved solids, below 80 mg/L. The exceptions were Umwelt Lake in July (sampled in July only), and George Lake Central and Komatic Lake in April, which had slightly elevated hardness, conductivity and TDS concentrations.

3.3.2 Major Anions

Sulphate was the dominant measured major anion, with low concentrations (<50 mg/L) that tended to be greater in April than in July, and greater in George Property lakes than Goose Property lakes (Figure 3.3-3). Sulphate concentrations were less than 20 mg/L at most lakes, except in George Lake Central, Komatic and Reference Q during April sampling which had mean concentrations between 27 mg/L and 45 mg/L, and Slave Lake in July with a mean of 35.2 mg/L.

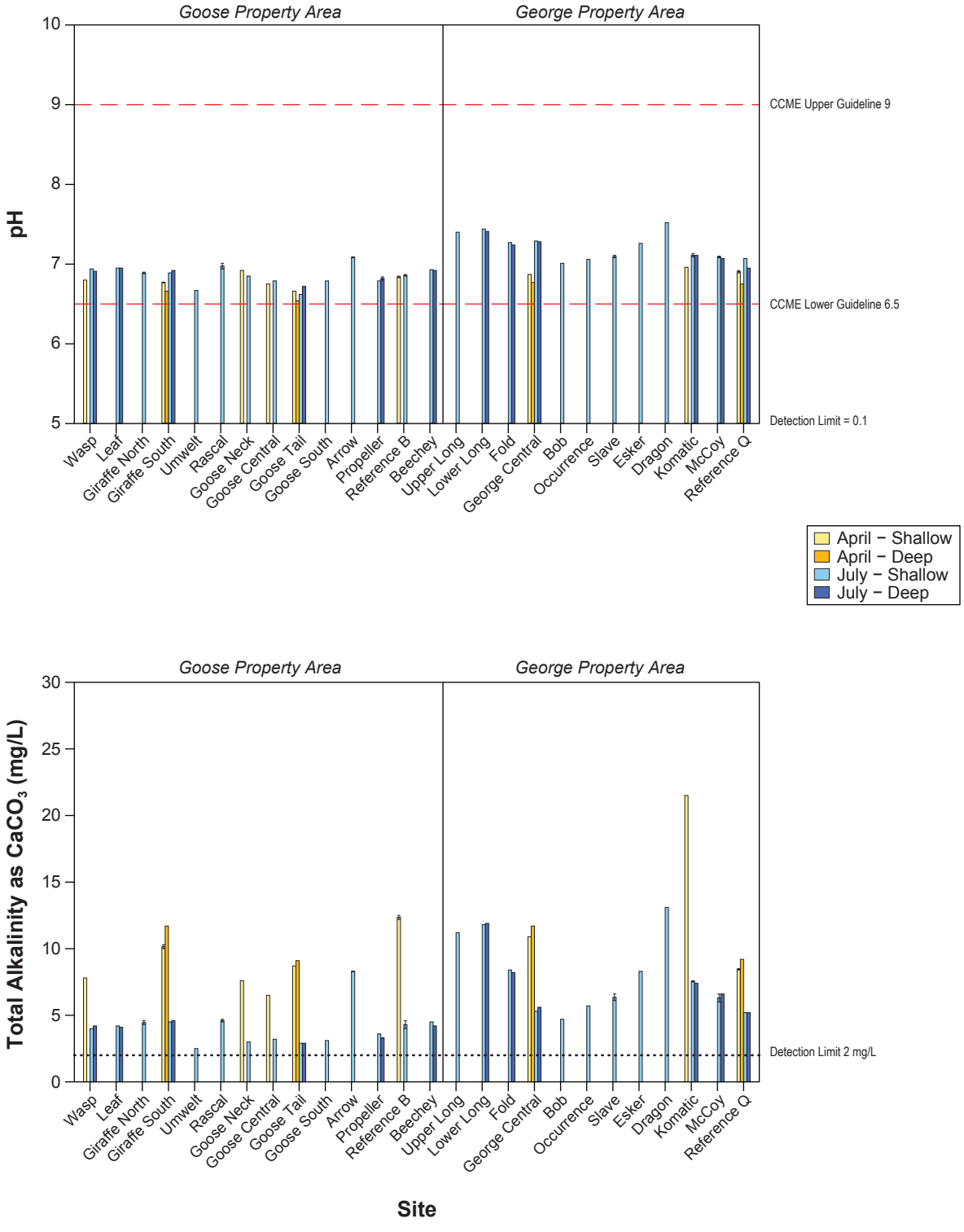
Mean chloride concentrations ranged from below detection limit (0.5 mg/L) to 27 mg/L in Umwelt Lake (July; Figure 3.2-3). Chloride concentrations were well below the short-term (120 mg/L) and long-term CCME guidelines (620 mg/L; CCME 2014).

Lake fluoride concentrations were also low, ranging from below detection levels (<0.02 mg/L) to 0.05 mg/L, and tended to be higher in April than in July (Figure 3.3-3). The highest mean fluoride concentration was observed at Arrow Lake with a mean of 0.045 mg/L, still well below the CCME interim guideline of 0.12 mg/L (CCME 2014).

3.3.3 Suspended Material

Sampled lakes were clear with low levels of turbidity and total suspended solids (TSS; Figure 3.3-4). Turbidity tended to be slightly greater at Goose Property lakes compared to George Property lakes. Lake turbidity levels varied between April and July with no clear overall seasonal trend. Lakes had low levels of TSS, with concentrations below detection limits (3 mg/L) at all lakes.

The low turbidity and TSS allowed greater light penetration into the water column, creating the high water clarity observed in the Secchi depths.



Note: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Figure 3.3-1

pH and Total Alkalinity in Lakes, Back River Project, 2013

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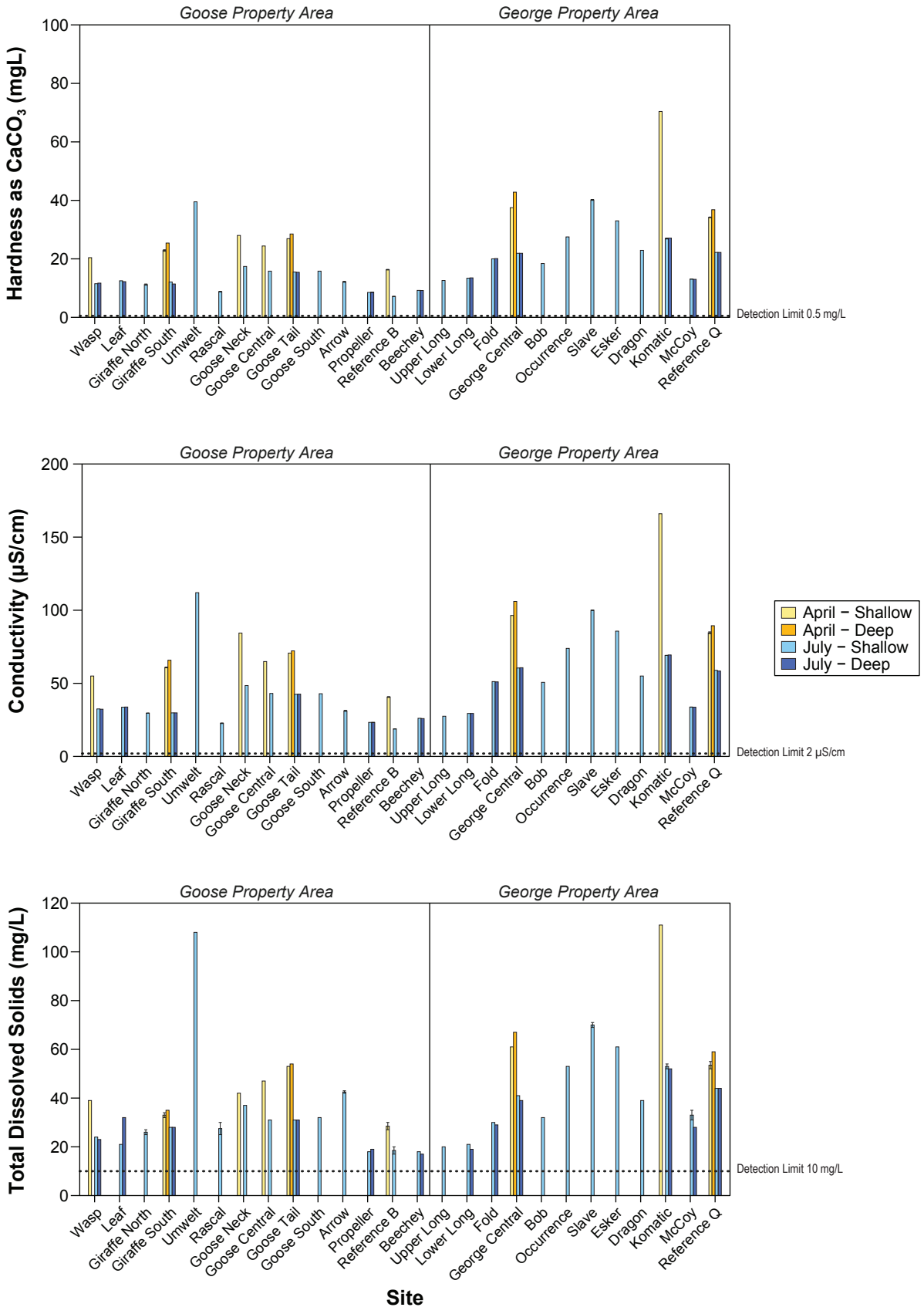

Note: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Figure 3.3-2

Hardness, Conductivity and Total Dissolved Solid Concentrations in Lakes, Back River Project, 2013

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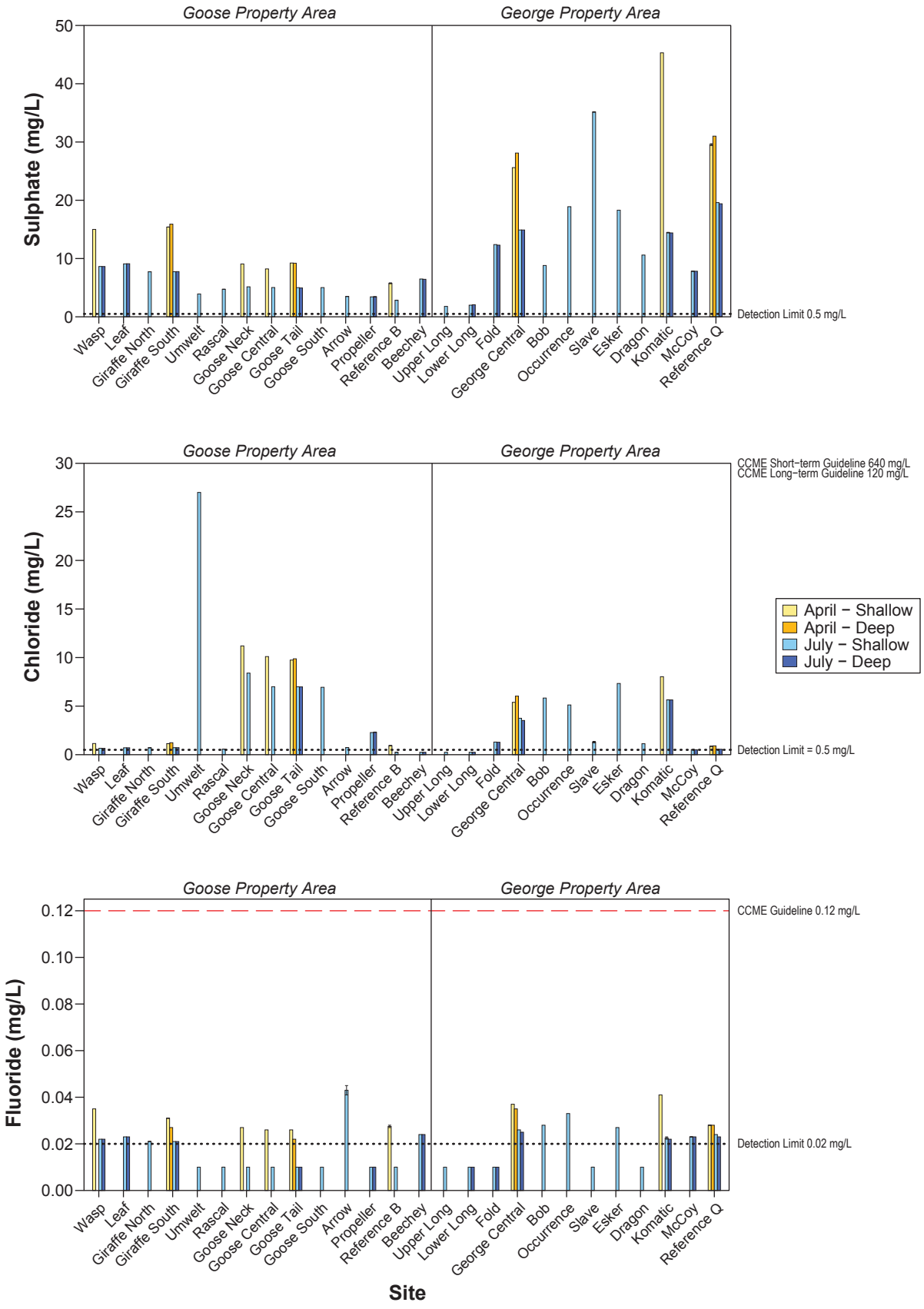

Note: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
The fluoride CCME guideline is an interim guideline.

Figure 3.3-3

Sulphate, Chloride and Fluoride Concentrations in Lakes, Back River Project, 2013

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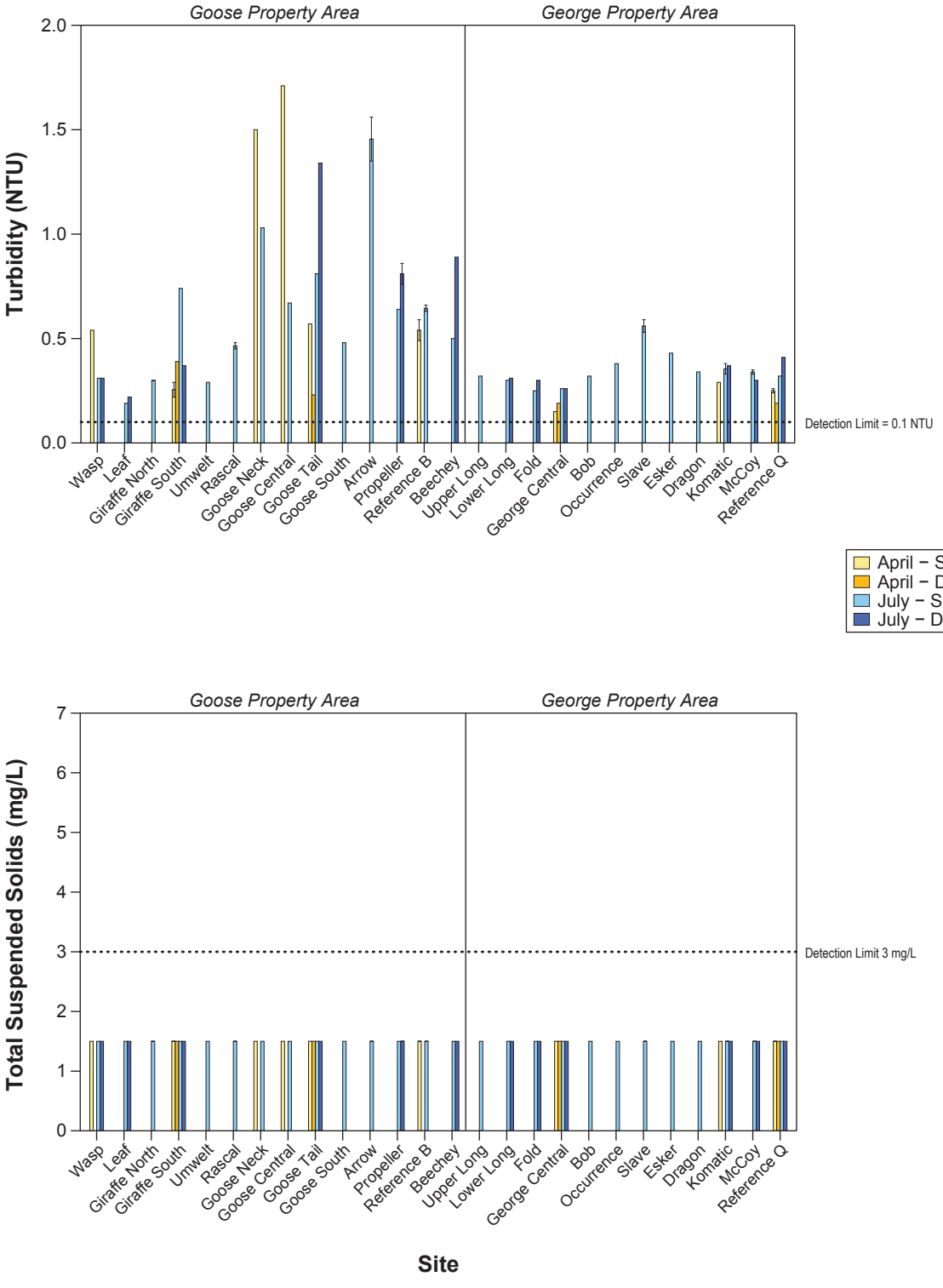

Note: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME guideline for turbidity is dependent on background levels.
CCME guideline for total suspended solids is dependent on background levels.

Figure 3.3-4

Turbidity and Total Suspended Solids Concentrations in Lakes, Back River Project, 2013

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3.3.4 Nutrients

Overall, nitrogen and phosphorous concentrations were low in sampled lakes and were frequently below detection limits (Figures 3.3-5 and 3.3-6).

Inorganic nitrogen (ammonia, nitrate and nitrite) was present in greater concentrations in lakes during April sampling possibly due to increased biological uptake during the open-water season (Figure 3.3-5). Ammonia concentrations ranged from below the detection limit (0.005 mg/L) at most sites during July sampling to a maximum of 0.0763 mg/L at Giraffe South during April sampling. All samples had concentrations well below relevant pH- and temperature-dependent CCME guidelines for ammonia (CCME 2014). Nitrate concentrations were usually below the detection limit (0.005 mg/L) during July sampling, with the highest concentration observed at Komatic Lake in April (0.06 mg/L; Figure 3.3-5). Nitrite concentrations were also usually below detection limit (0.001 mg/L). Nitrate and nitrite were consistently well below CCME guidelines.

Concentrations of total Kjeldahl nitrogen (TKN), a measure of both ammonia and the organic nitrogen, were an order of magnitude greater than inorganic forms of nitrogen indicating that the vast majority of nitrogen in these lakes was associated with organic compounds (Figure 3.3-5).

Total phosphate occurred in low but detectable concentrations in sampled lakes, while orthophosphate, the most readily available form of phosphorus for biological uptake, was below detection limits in all samples (Figure 3.3-6).

Based on the CCME trigger ranges for phosphorus in freshwater systems (CCME 2014), most lakes sampled can be classified as ultra-oligotrophic (< 0.004 mg/L) to oligotrophic (0.004 to 0.01 mg/L; see Table 3.3-1). The exceptions to this were Arrow Lake and Upper Long Lake which would be classified as mesotrophic (0.01 to 0.02 mg/L) during July sampling. Total phosphorous concentrations were particularly variable in Goose Lake Neck and Lower Long Lake as they ranged from ultra-oligotrophic during one sampling session and eutrophic (0.035 to 0.1 mg/L) in the other (Goose Neck in April, Lower Long in July).

TOC concentrations in lakes were generally higher in Goose Property lakes than in George Property lakes, as observed in 2012 (Figure 3.3-6). Lakes had mean TOC concentrations below 5 mg/L at all lakes, except the shallow Arrow Lake with TOC concentrations of 14. 5 mg/L in July.

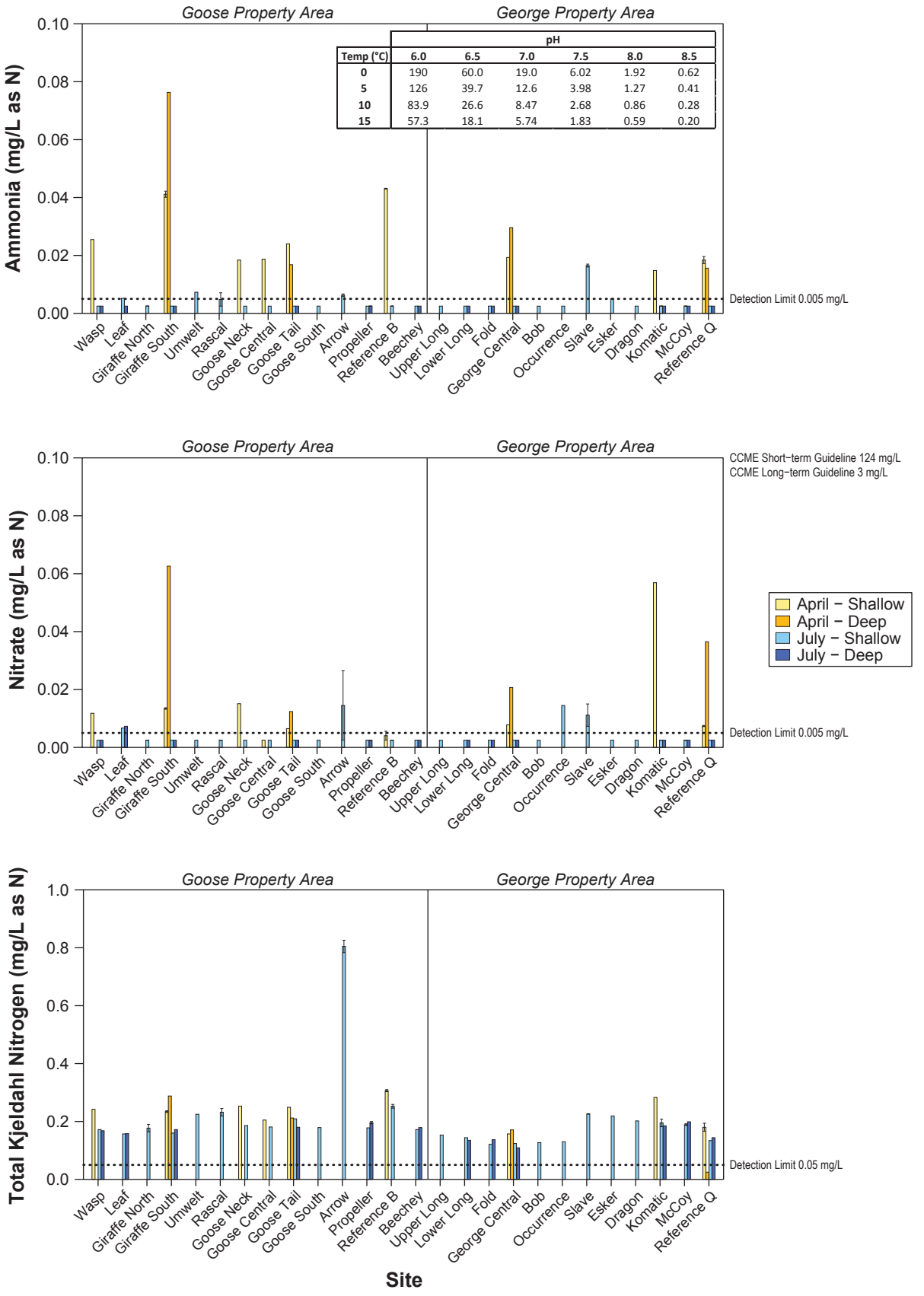
3.3.5 Total Metals

Graphs for all metals with CCME guidelines are presented in Figures 3.3-7 to 3.3-12, except total mercury, molybdenum, selenium, silver and thallium concentrations, which were below analytical detection limits in more than 95% of samples.

Total aluminum concentrations were below 0.025 mg/L in all lake samples, except the shallow Goose Lake Neck in April (0.067 mg/L) and Arrow Lake in July (0.042 mg/L). All samples were below the pH-dependent CCME guideline (0.1 mg/L mg/L for pH ≥ 6.5; CCME 2014; Figure 3.3-7).

Lakes had total arsenic concentrations well below the CCME guideline (0.005 mg/L; CCME 2014), with lower arsenic in Goose Property lakes (overall mean of 0.00023 mg/L) than George Property lakes (overall mean of 0.00054 mg/L; Figure 3.3-7).

Boron concentrations were low, with most samples below the detection limit (0.005 mg/L) and all well below the CCME guidelines (long-term 1.5 mg/L; short-term 29 mg/L).



Temp (°C)	pH 6.0	6.5	7.0	7.5	8.0	8.5
0	190	60.0	19.0	6.02	1.92	0.62
5	126	39.7	12.6	3.98	1.27	0.41
10	83.9	26.6	8.47	2.68	0.86	0.28
15	57.3	18.1	5.74	1.83	0.59	0.20

Note: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME guideline for ammonia is pH− and temperature−dependent.

Figure 3.3-5

Ammonia, Nitrate, and Total Kjeldahl Nitrogen Concentrations in Lakes, Back River Project, 2013

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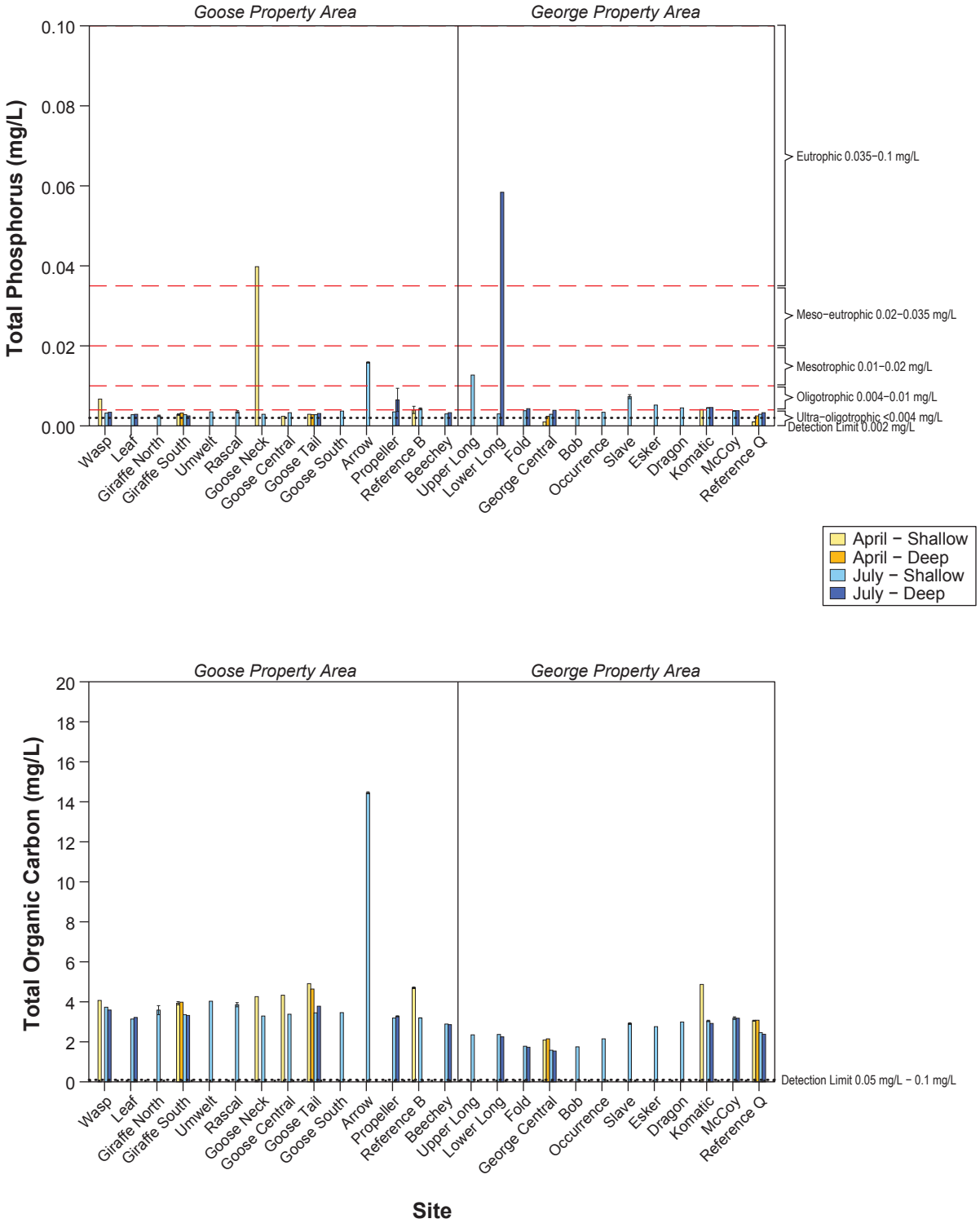
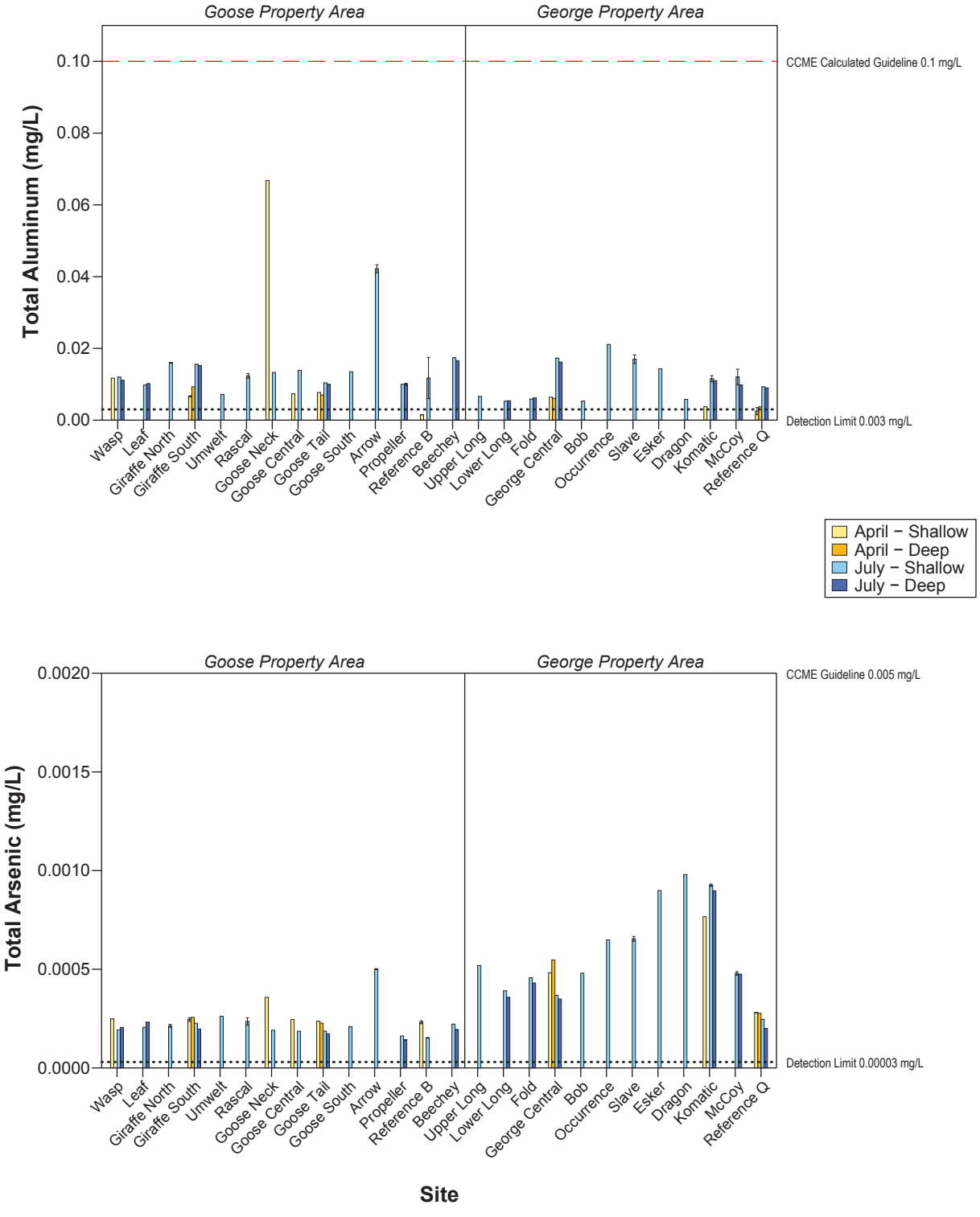


Note: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
Dashed lines represent CCME trigger ranges for total phosphorus.

Figure 3.3-6

Total Phosphorus and Total Organic Carbon Concentrations in Lakes, Back River Project, 2013



Note: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME guideline for aluminum is pH−dependent: if pH < 6.5, then guideline = 0.005 mg/L;
if pH≥6.5 then guideline = 0.1 mg/L. All 2013 Back River lake samples had pH≥6.5.

Figure 3.3-7

Aluminum and Arsenic Concentrations in Lakes, Back River Project, 2013

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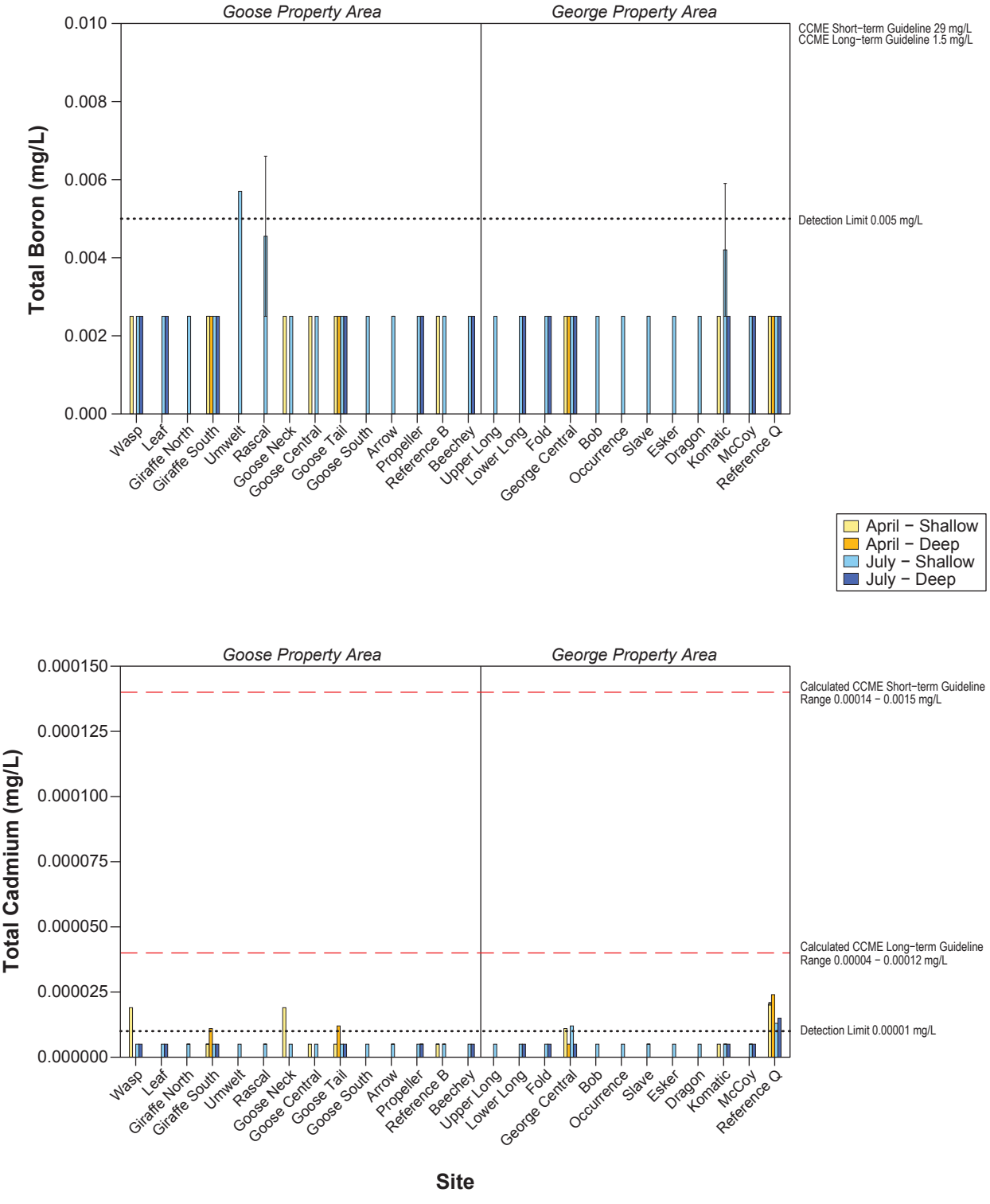

Note: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME short−term cadmium guideline is hardness−dependent (mg/L) = $10^{(1.016(\log10(\text{hardness}))-1.71)}$/1000, with a minimum of 0.00011 mg/L.
CCME long−term cadmium guideline is hardness−dependent (mg/L) = $10^{(0.83(\log10(\text{hardness}))-2.46)}$/1000, with a minimum of 0.00004 mg/L.

Figure 3.3-8

Boron and Cadmium Concentrations in Lakes, Back River Project, 2013

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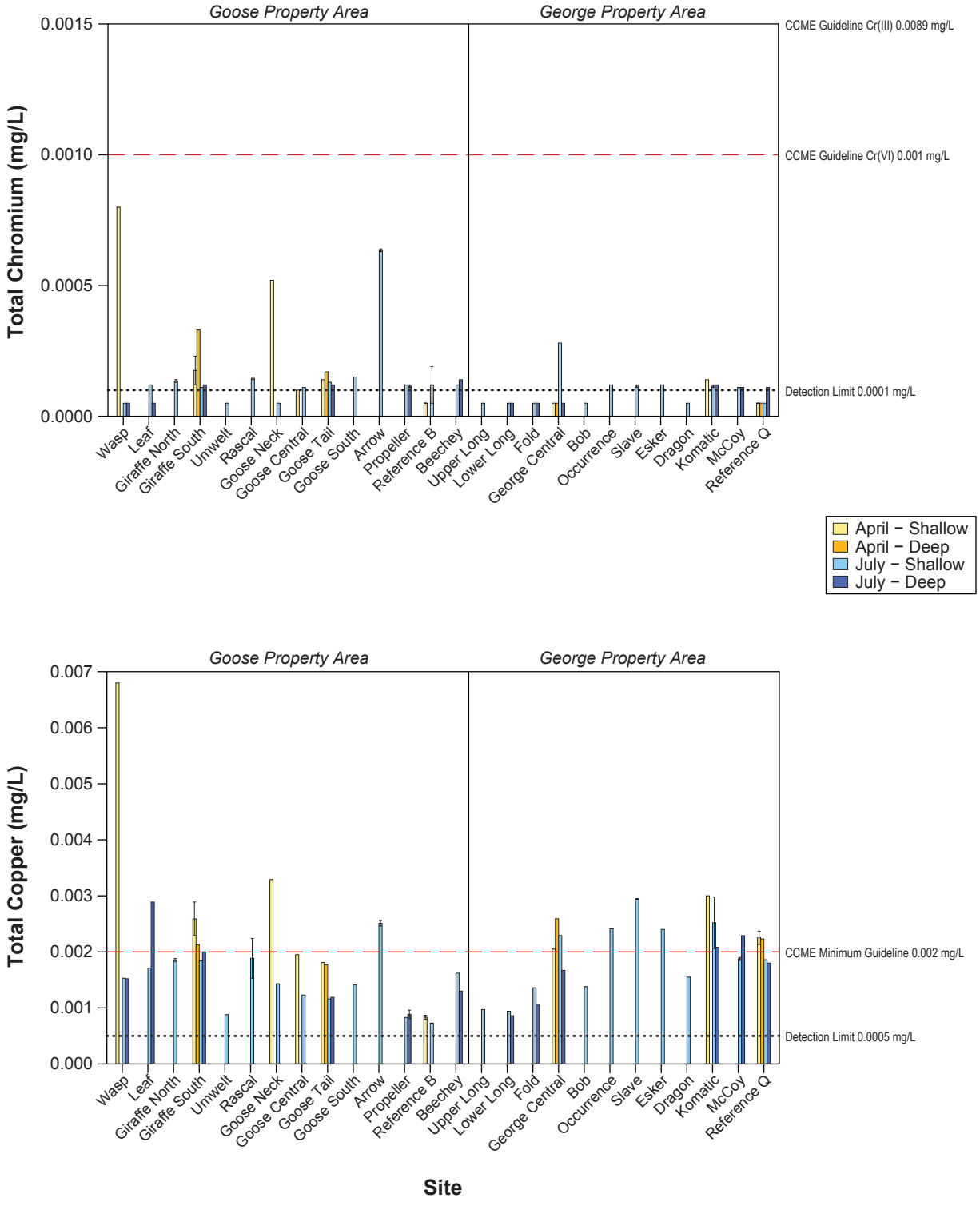

Note: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME copper guideline is hardness−dependent (mg/L) = $e^{(0.8545[\ln(\text{hardness})]-1.465)x0.0002}$,
with a minimum of 0.002 mg/L and a maximum of 0.004 mg/L.
The trivalent chromium CCME guideline is an interim guideline.

Figure 3.3-9

Chromium and Copper Concentrations in Lakes, Back River Project, 2013

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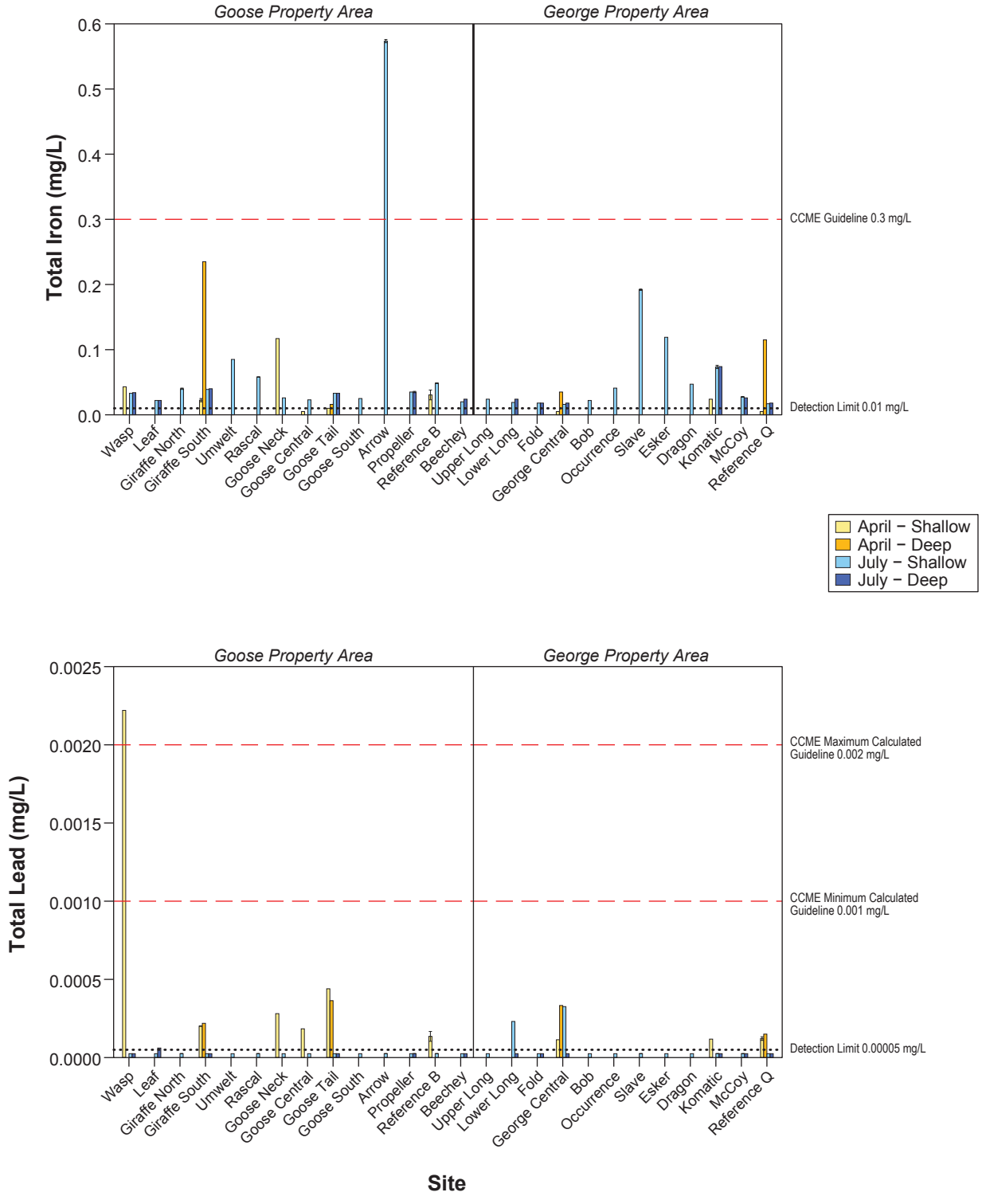

Note: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME lead guideline is hardness−dependent (mg/L) = $e^{(1.273(\ln(\text{hardness}))-4.705)}/1000$, with a minimum of 0.001 mg/L and a maximum of 0.007 mg/L.

Figure 3.3-10

Iron and Lead Concentrations in Lakes, Back River Project, 2013

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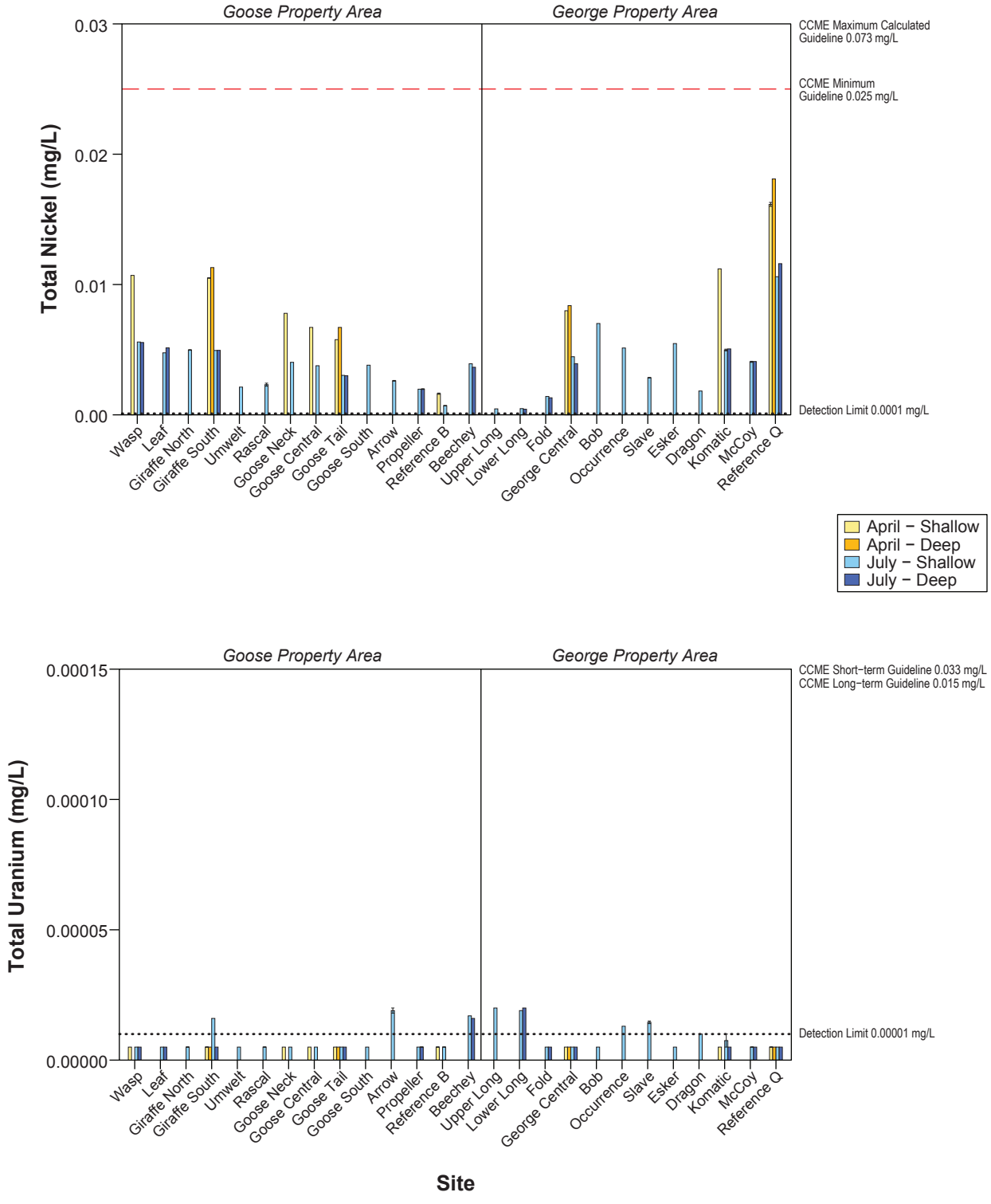

Note: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME nickel guideline is hardness−dependent (mg/L) = $e^{(0.76(\ln(\text{hardness}))+1.06)}/1000$ with a minimum of 0.025 mg/L and maximum of 0.15 mg/L.

Figure 3.3-11

Nickel and Uranium Concentrations in Lakes, Back River Project, 2013

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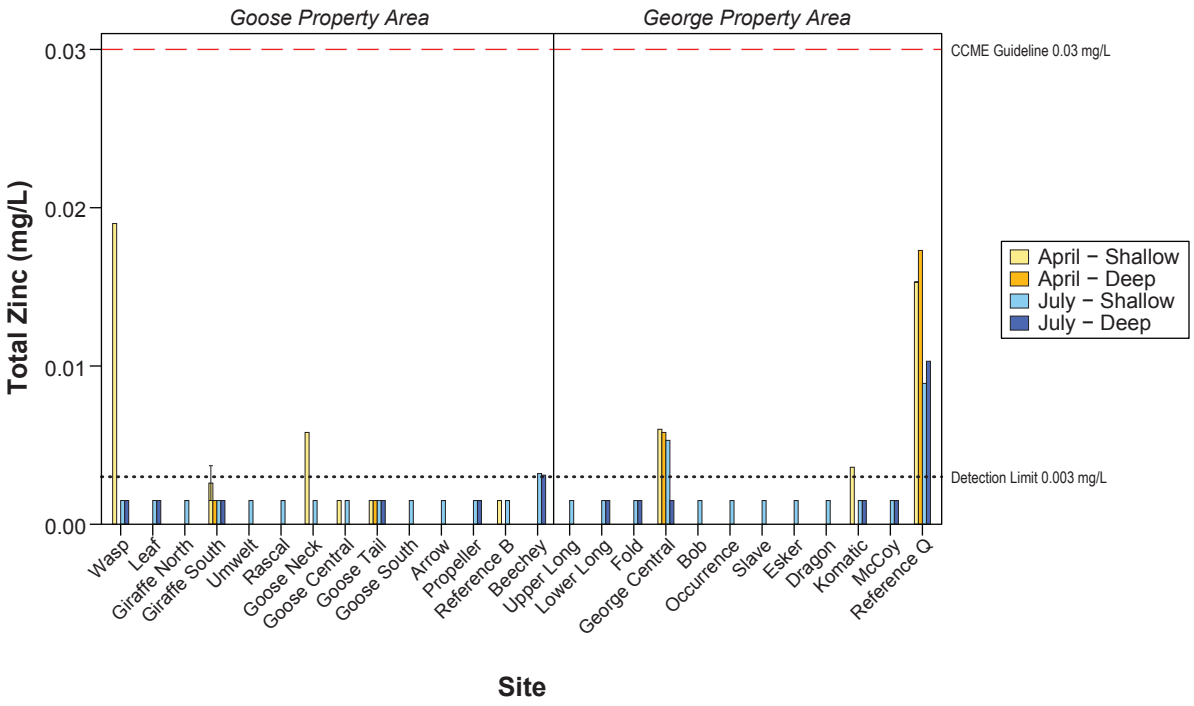

Note: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Figure 3.3-12

Zinc Concentrations in Lakes, Back River Project, 2013

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Total cadmium concentrations were usually below analytical detection limits in most lakes, and when detectable, were more so in April than in July (Figure 3.3-8). Only Reference Lake Q had concentrations above detection limits in all samples (April, July, shallow and deep). All samples were below the hardness-dependent CCME cadmium guideline (CCME, 2014).

Overall, lakes had chromium concentrations near or below the detection limit (0.0001 mg/L), with a few exceptions (Figure 3.3-8). Wasp Lake, Giraffe South and Goose Neck in April and Arrow Lake and George Lake Central in July had greater concentrations although the maximum observed concentration (0.0008 mg/L at Wasp Lake) was still below any chromium CCME guideline level (Cr(IV) 0.001 mg/L; Cr(III) 0.0089 mg/L).

As observed in 2011 and 2012, Goose Property and George Property lakes had naturally elevated total copper concentrations. More than half of the lakes sampled in April, and a quarter of the lakes sampled in July, had mean copper concentrations above the CCME hardness-dependent guideline (0.002 mg/L for all lake samples; Figure 3.3-9). Copper concentrations were greatest in Wasp Lake in April having a mean concentration of 0.0068 mg/L.

Total iron concentrations in lakes ranged from below the detection limit (0.01 mg/L) to 0.25 mg/L. All samples were below the CCME guideline of 0.3 mg/L, except the shallow Arrow Lake in July which had a mean concentration of 0.57 mg/L (Figure 3.3-10).

Lakes generally had low concentrations of total lead, with over two thirds of the samples having concentrations below the detection level (0.00005 mg/L; Figure 3.3-10). The exception was Wasp Lake, which had a concentration of 0.0022 mg/L in April. This was greater than the CCME hardness-dependent guideline for lead (CCME 2014).

Total nickel concentrations in all lakes were below the hardness-dependent CCME guideline (ranging from 0.025 mg/L to 0.073 mg/L for lake data). The greatest nickel concentrations were measured in Reference Lake Q (Figure 3.3-11).

Lakes had low total uranium concentrations, with most below or near the 0.00001 mg/L detection limit, and all were well below the long-term CCME guideline level of 0.015 mg/L (Figure 3.3-11).

Generally, total zinc concentrations were below the detection limit (0.003 mg/L), with some exceptions (Figure 3.3-12). Elevated zinc concentrations were observed in Wasp Lake in April (0.019 mg/L), and both April and July in Reference Q Lake (mean of 0.013 mg/L). All samples were below the CCME guideline of 0.03 mg/L (CCME 2014).

3.3.6 Cyanides

Total and free cyanide concentrations measured in lakes were all below the detection limit (0.001 mg/L), and well below the CCME guideline for free cyanide (0.005 mg/L; CCME 2014).

3.3.7 Comparison with CCME Guidelines

The trophic status of lakes, using the CCME trigger ranges for total phosphorus, is shown in Table 3.3-1. Table 3.3-2 gives the percentage of lake water quality samples that were above their respective CCME guideline level, and the average factor they were higher than the guideline.

All lakes had water quality within the CCME guidelines for pH (6.5 to 9), and below CCME guidelines for chloride, fluoride, ammonia, nitrate, nitrite and free cyanide. Thirteen of the 26 lake sites sampled had copper concentrations greater than the hardness-dependent CCME guideline in a sample. In addition, Wasp Lake had a sample which exceeded the CCME lead guideline and Arrow Lake had samples which exceeded the CCME iron guideline. Exceedances of guidelines tended to be by less than a factor of two, with the exception being Wasp Lake copper and lead.

Table 3.3-1. Lake Trophic Status using CCME Trigger Ranges for Total Phosphorus, Back River Project, 2013

Lake Site	Total Number of Samples Collected	Total Phosphorus Trophic Status[ab] Range
Goose Property Area		
Wasp	3	Ultra-oligotrophic to Oligotrophic
Leaf	2	Ultra-oligotrophic
Giraffe North	2	Ultra-oligotrophic
Giraffe South	5	Ultra-oligotrophic
Umwelt	1	Ultra-oligotrophic
Rascal	2	Ultra-oligotrophic
Goose Neck	2	Ultra-oligotrophic to Eutrophic
Goose Central	2	Ultra-oligotrophic
Goose Tail	4	Ultra-oligotrophic
Goose South	1	Ultra-oligotrophic
Arrow	2	Mesotrophic
Propeller	3	Ultra-oligotrophic to Oligotrophic
Reference B	4	Ultra-oligotrophic to Oligotrophic
Beechey	2	Ultra-oligotrophic
George Property Area		
Upper Long	1	Mesotrophic
Lower Long	2	Ultra-oligotrophic to Eutrophic
Fold	2	Ultra-oligotrophic to Oligotrophic
George Central	4	Ultra-oligotrophic
Bob	1	Ultra-oligotrophic
Occurrence	1	Ultra-oligotrophic
Slave	2	Oligotrophic
Esker	1	Oligotrophic
Dragon	1	Oligotrophic
Komatic	4	Oligotrophic
McCoy	3	Ultra-oligotrophic
Reference Q	5	Ultra-oligotrophic

Notes:
[a] *Canadian water quality guidelines for the protection of aquatic life (CCME, accessed February 2014).*
[b] *< 0.004 mg/L = ultra-oligotrophic; 0.004 - 0.01 mg/L = oligotrophic; 0.01 - 0.02 mg/L = mesotrophic; 0.02 - 0.035 mg/L = mesoeutrophic; 0.035 - 0.1 mg/L = eutrophic; > 0.1 mg/L = hypereutrophic.*

3.3.8 Lake Water Quality Assurance/Quality Control

In total, two equipment blanks, two field blanks, and two travel blanks were processed as part of the 2013 lake water quality program.

Blanks were below detection limits in almost all cases (Appendix 3.3-3). The exception was the July equipment blank, where the barium and tin concentrations were detectable. Based on the dominance of below detection values observed in blanks, the lake water quality data were considered to be highly reliable and of excellent quality.

Table 3.3-2. Lake Water Quality and CCME Guidelines, Back River Project, 2013

			Copper (Cu)		Iron (Fe)		Lead (Pb)	
		CCME Guideline Values[a]	Hardness- dependent ≥ 0.002 mg/L[b]		0.3 mg/L		Hardness- dependent ≥ 0.001 mg/L[c]	
Lake Site	Total Number of Samples Collected	Number of parameters greater than CCME guidelines	Mean factor by which parameter was greater than CCME guideline	Percent of samples greater than CCME guideline	Mean factor by which parameter was greater than CCME guideline	Percent of samples greater than CCME guideline	Mean factor by which parameter was greater than CCME guideline	Percent of samples greater than CCME guideline
Goose Property Area								
Wasp	3	2	3.40	33%	-	0%	2.22	33%
Leaf	2	1	1.45	50%	-	0%	-	0%
Giraffe North	2	0	-	0%	-	0%	-	0%
Giraffe South	5	1	1.22	60%	-	0%	-	0%
Umwelt	1	0	-	0%	-	0%	-	0%
Rascal	2	1	1.12	50%	-	0%	-	0%
Goose Neck	2	1	1.65	50%	-	0%	-	0%
Goose Central	2	0	-	0%	-	0%	-	0%
Goose Tail	4	0	-	0%	-	0%	-	0%
Goose South	1	0	-	0%	-	0%	-	0%
Arrow	2	2	1.26	100%	1.91	100%	-	0%
Propeller	3	0	-	0%	-	0%	-	0%
Reference B	4	0	-	0%	-	0%	-	0%
Beechey	2	0	-	0%	-	0%	-	0%
George Property Area								
Upper Long	1	0	-	0%	-	0%	-	0%
Lower Long	2	0	-	0%	-	0%	-	0%
Fold	2	0	-	0%	-	0%	-	0%
George Central	4	1	1.16	75%	-	0%	-	0%
Bob	1	0	-	0%	-	0%	-	0%
Occurrence	1	1	1.21	100%	-	0%	-	0%
Slave	2	1	1.47	100%	-	0%	-	0%
Esker	1	1	1.20	100%	-	0%	-	0%
Dragon	1	0	-	0%	-	0%	-	0%
Komatic	4	1	1.27	100%	-	0%	-	0%
McCoy	3	1	1.15	33%	-	0%	-	0%
Reference Q	5	1	1.12	60%	-	0%	-	0%

Notes:

a) Canadian water quality guidelines for the protection of aquatic life (CCME, accessed February 2014).

b) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ x 0.0002. Copper guideline is a minium of 0.002 mg/L regardless of hardness. At hardness >180 mg/L copper guideline is 0.004 mg/L.

c) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ /1000. Lead guideline is a minimum of 0.001 mg/L regardless of hardness. At hardness >180 mg/L lead guideline is 0.007 mg/L.

Eleven pairs of field duplicates for sampled lakes were compared for each water quality parameter (Appendix 3.3-2). A total of 28.6% (280/979) of the duplicate concentrations were at least five times greater than their detection limits and used in RPD calculations. Of these RPD calculations, only 2.1% (6/280) had an RPD above 20% and only 1.1% (3/280) had an RPD equal or greater than 50%. This likely reflected the lower environmental heterogeneity at lakes, although could have also resulted from lab errors or sample handling. The low proportion of high RPDs suggests the lake water quality data are highly reliable and of excellent quality.

3.4 STREAM WATER QUALITY

Stream water quality samples were collected in June (freshet) and July (summer) 2013. Stream water quality data collected in 2013 are presented graphically in Figures 3.4-1 to 3.4-11. The complete dataset for stream water quality is presented in Appendices 3.4-1 and 3.4-2. Cumulative graphs for all water quality data collected from 2010 to 2013 are presented in Appendices 3.4-4 to 3.4-34.

3.4.1 Physical Parameters

The streams in the Goose and George properties were largely near neutral, poorly buffered, with soft water. The surveyed streams ranged in pH from an average of 6.47 (Umwelt OF) to 7.15 (McCoy OF; Figure 3.4-1). The lowest pH levels were slightly below the lower CCME pH guideline limit (pH 6.5) and were observed in June at Giraffe IF (6.48) and Umwelt OF (6.37).

Streams were poorly buffered, with low total alkalinity levels that were less than or equal to 10 mg/L at all streams during sampling in both June and July (Figure 3.4-1).

Streams were soft, with mean hardness levels below 45 mg/L at all sites during June and July sampling (Figure 3.4-2). Streams in the Goose Property tended to be softer than those in the George Property, except Llama OF and Umwelt OF that had some of the highest hardness concentrations observed (mean of 35.3 mg/L and 41.4 mg/L, respectively). Sleigh OF and Komatic IF had similar hardness to Llama and Umwelt during July sampling.

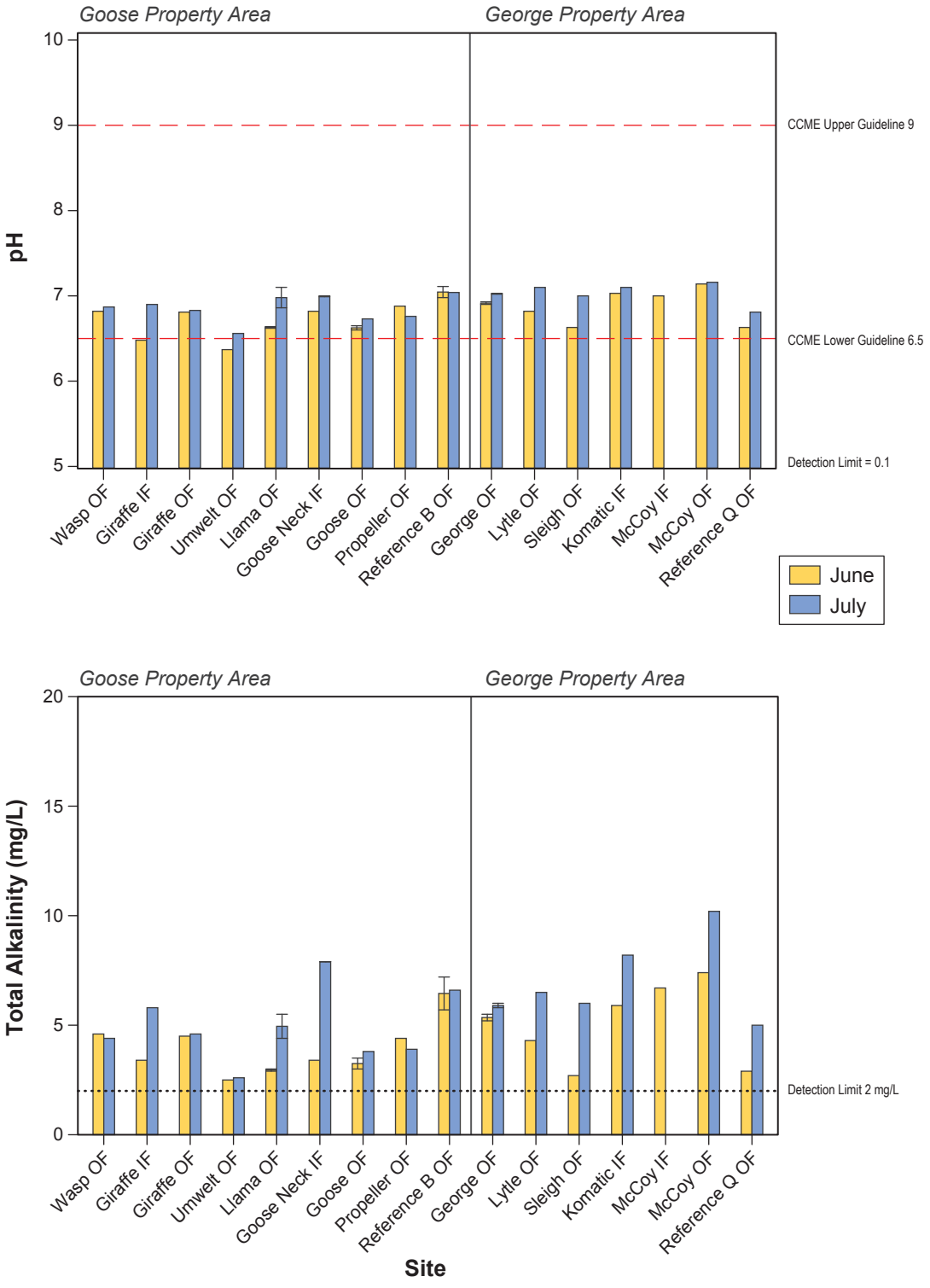
Conductivity and TDS were low in all streams, with means less than 125 µS/cm and 120 mg/L, respectively (Figure 3.4-2). Concentrations of these parameters followed the same patterns observed in hardness, with lower concentrations generally observed in Goose Property streams than in George Property streams. As well, the highest concentrations were observed in Llama OF and Umwelt OF during June and July sampling and Sleigh OF and Komatic IF during July sampling.

3.4.2 Major Anions

Sulphate was usually the dominant anion at stream sites, except for at Umwelt OF and Llama OF which had higher concentrations of chloride. Concentrations varied seasonally and geographically, tending to be highest in July and in the George Property streams (Figure 3.4-3). All streams had low sulphate concentrations (<25 mg/L), with lowest concentrations observed at Reference B OF which had an average concentration of 3 mg/L.

Low chloride concentrations were also present in most streams, with concentrations usually below 15 mg/L (Figure 3.4-3). Umwelt OF and Llama OF had the highest mean chloride concentrations approaching 30 mg/L.

Fluoride concentrations were near or below the detection limit (0.02 mg/L) in all streams, with a maximum observed concentration of 0.03 mg/L at Sleigh OF in July (Figure 3.4-3). All streams were below CCME guidelines for chloride and fluoride (CCME 2014).



Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
McCoy IF could not be sampled in July due to low water levels.

Figure 3.4-1

pH and Total Alkalinity in Streams, Back River Project, 2013

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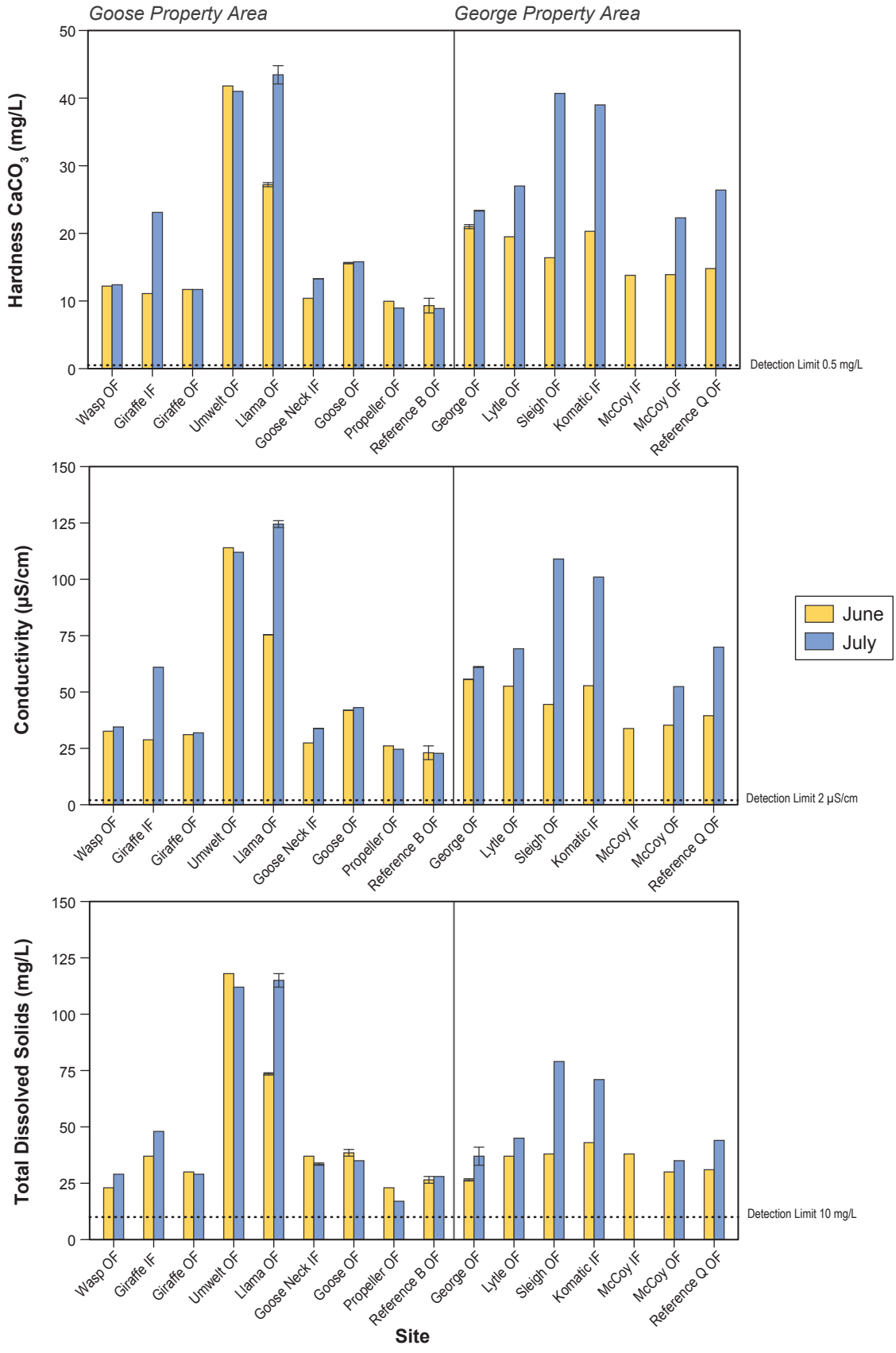

Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
McCoy IF could not be sampled in July due to low water levels.

Figure 3.4-2

Hardness, Conductivity and Total Dissolved Solids Concentrations in Streams, Back River Project, 2013

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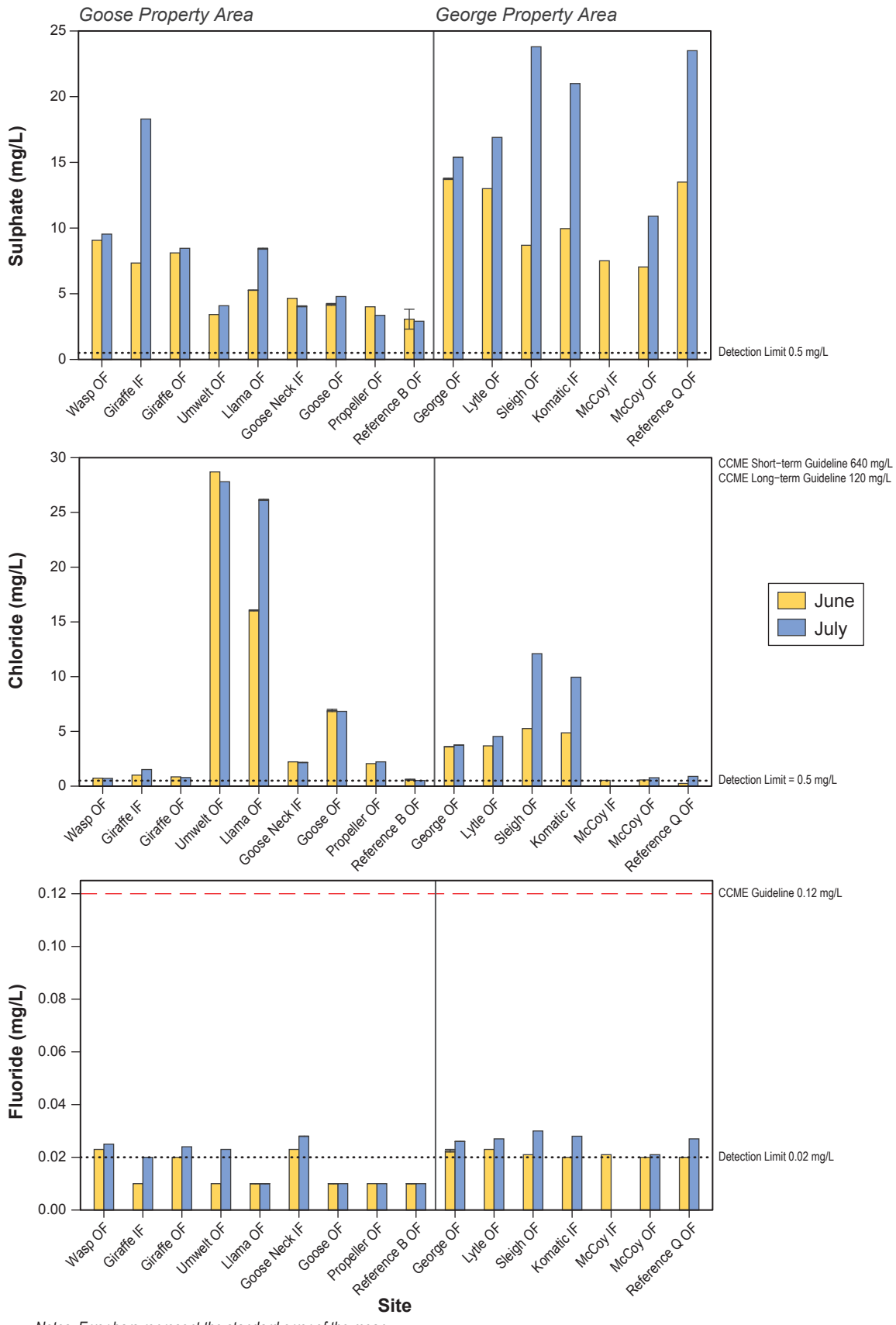

Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
The fluoride CCME guideline is an interim guideline.
McCoy IF could not be sampled in July due to low water levels.

Figure 3.4-3

Sulphate, Chloride and Fluoride Concentrations in Streams, Back River Project, 2013

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3.4.3 Suspended Material

In general, streams had clear water. Turbidity levels were low, ranging from 0.15 to 2 NTU. Most streams had TSS concentrations below the detection limit (3 mg/L) and the maximum concentration observed was 4.3 mg/L at Lytle OF in July (Figure 3.4-4).

3.4.4 Nutrients

Streams surveyed had low nutrient concentrations overall, with no clear trend between Goose Property and George Property streams.

Like the surveyed lakes, streams tended to have low concentrations of inorganic nitrogen (ammonia, nitrate and nitrite) with most of the nitrogen organically bound (seen in higher TKN concentrations; Figure 3.4-5). Most stream sites had ammonia concentrations near or below the analytical detection limit (0.005 mg/L). Exceptions were Giraffe OF in June, Goose Neck IF, Komatic IF and McCoy OF in July that had concentrations greater than three times the detection limit (0.015 mg/L) to a maximum concentration of 0.025 mg/L at Goose Neck IF (Figure 3.4-5).

Nitrate concentrations were higher in July than June, and most streams had concentrations lower than 0.1 mg/L nitrate as N (Figure 3.4-5). Llama OF (0.26 mg/L) and McCoy OF (0.33 mg/L) had the highest nitrate concentrations occurring in July. Nitrite concentrations were below the detection limit (0.001 mg/L) at all stream sites during both sampling events. TKN concentrations were similar across streams, generally between the detection limit (0.05 mg/L) and 0.4 mg/L, except at the low flow streams, Goose Neck IF and Reference B OF in July (mean of 0.62 mg/L and 0.70 mg/L, respectively). All streams had ammonia, nitrate and nitrite concentrations well below their CCME guideline levels (CCME 2014).

Total phosphorus concentrations below 0.02 mg/L in all streams (Figure 3.4-6) and would be considered either ultra-oligotrophic (< 0.004 mg/L) or oligotrophic (0.004 to 0.01 mg/L) based on the CCME trigger ranges for total phosphorus (CCME 2014). McCoy OF (June) and Goose Neck IF and Reference B OF (July) had higher total phosphorus concentrations and would be considered mesotrophic (0.01 mg/L to 0.02 mg/L) during these periods.

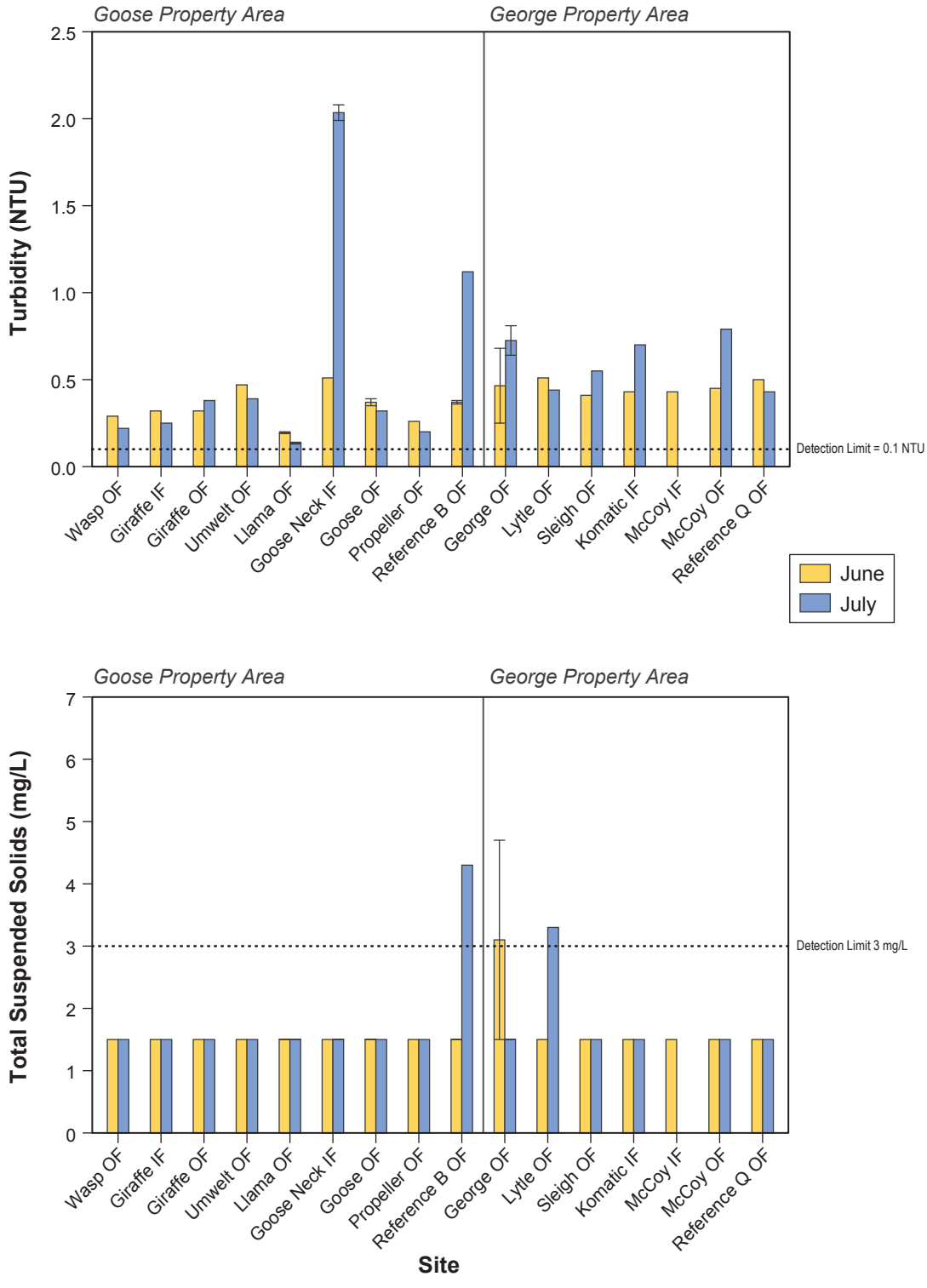
TOC ranged from 1.67 at Llama OF during July sampling to 9.0 mg/L at GIRAFFE IF during June sampling, with most streams having concentrations less than 6 mg/L (Figure 3.4-6).

3.4.5 Total Metals

Overall metal concentrations in streams were low, often near or below their detection limits (Figures 3.4-7 to 3.4-11). All streams had total mercury, molybdenum, selenium, silver and thallium concentrations below their respective detection limits. Total lead concentrations were below analytical detection limits in more than 95% of samples. These parameters are not discussed or graphed below.

Aluminum concentrations ranged from 0.00057 mg/L at Propeller OF in July to 0.13 mg/L at Giraffe IF in June, with most below 0.06 mg/L (Figure 3.4-7). The CCME guideline for aluminum is pH-dependent, with a lower guideline for water with pH less than 6.5 (0.005 mg/L; CCME 2014). Both of the samples with pH below 6.5 were greater than the 0.005 mg/L CCME aluminum guideline (Giraffe IF and Umwelt OF in June).

Overall, streams had low total arsenic levels, with all concentrations below 0.00125 mg/L and the CCME guideline of 0.005 mg/L (Figure 3.4-7). As observed in 2012, average concentrations tended to be higher in George Property streams than in Goose Property streams. The highest arsenic concentrations were observed in Komatic IF and McCoy IF in the George Property.



Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME guideline for turbidity and total suspended solids is dependent on background levels.
McCoy IF could not be sampled in July due to low water levels.

Figure 3.4-4

Turbidity and Total Suspended Solids in Streams, Back River Project, 2013

Sabina GOLD & SILVER CORP.

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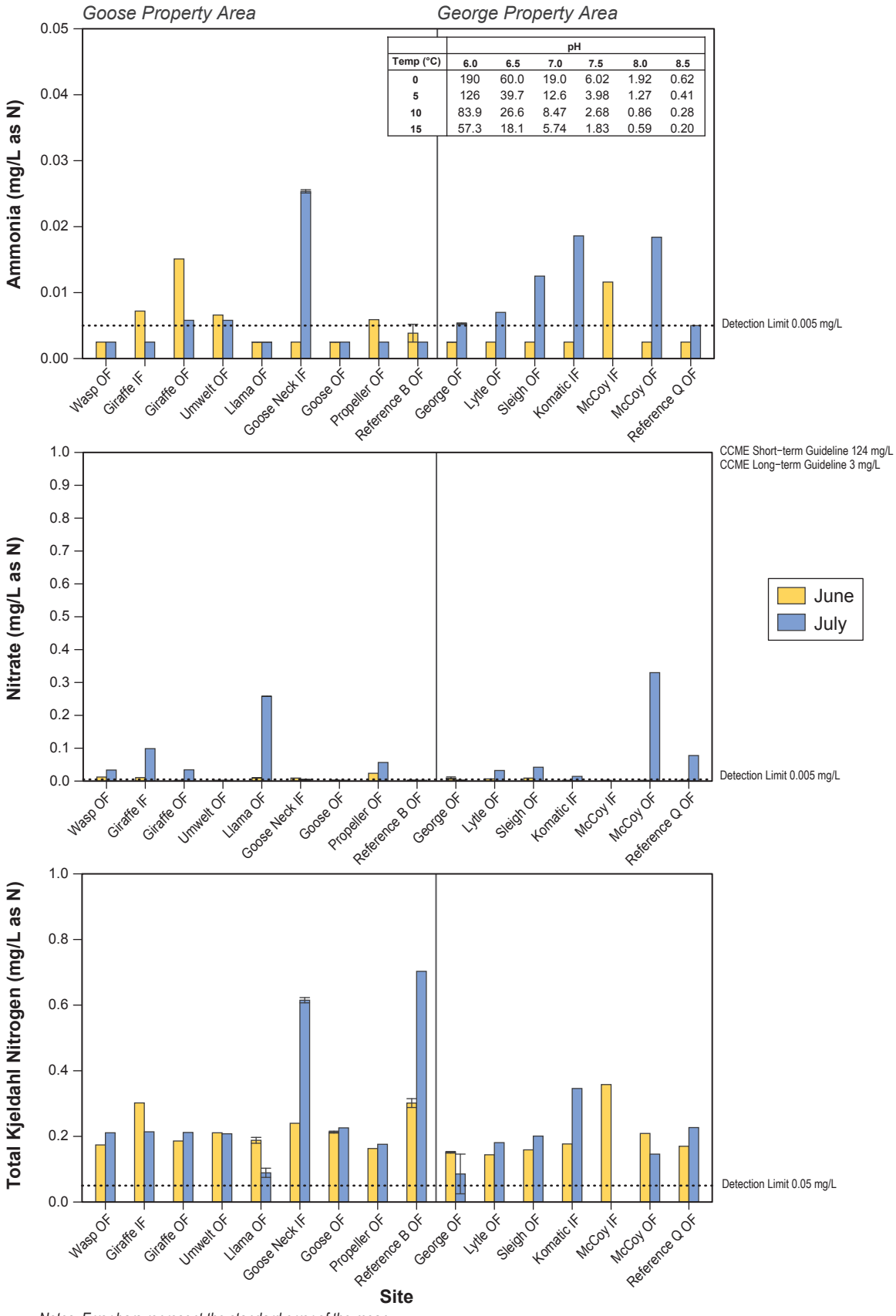

Temp (°C)	pH 6.0	6.5	7.0	7.5	8.0	8.5
0	190	60.0	19.0	6.02	1.92	0.62
5	126	39.7	12.6	3.98	1.27	0.41
10	83.9	26.6	8.47	2.68	0.86	0.28
15	57.3	18.1	5.74	1.83	0.59	0.20

Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME guideline for ammonia is pH− and temperature−dependent.
McCoy IF could not be sampled in July due to low water levels.

Figure 3.4-5

Ammonia, Nitrate and Total Kjeldahl Nitrogen Concentrations in Streams, Back River Project, 2013

Sabina GOLD & SILVER CORP.

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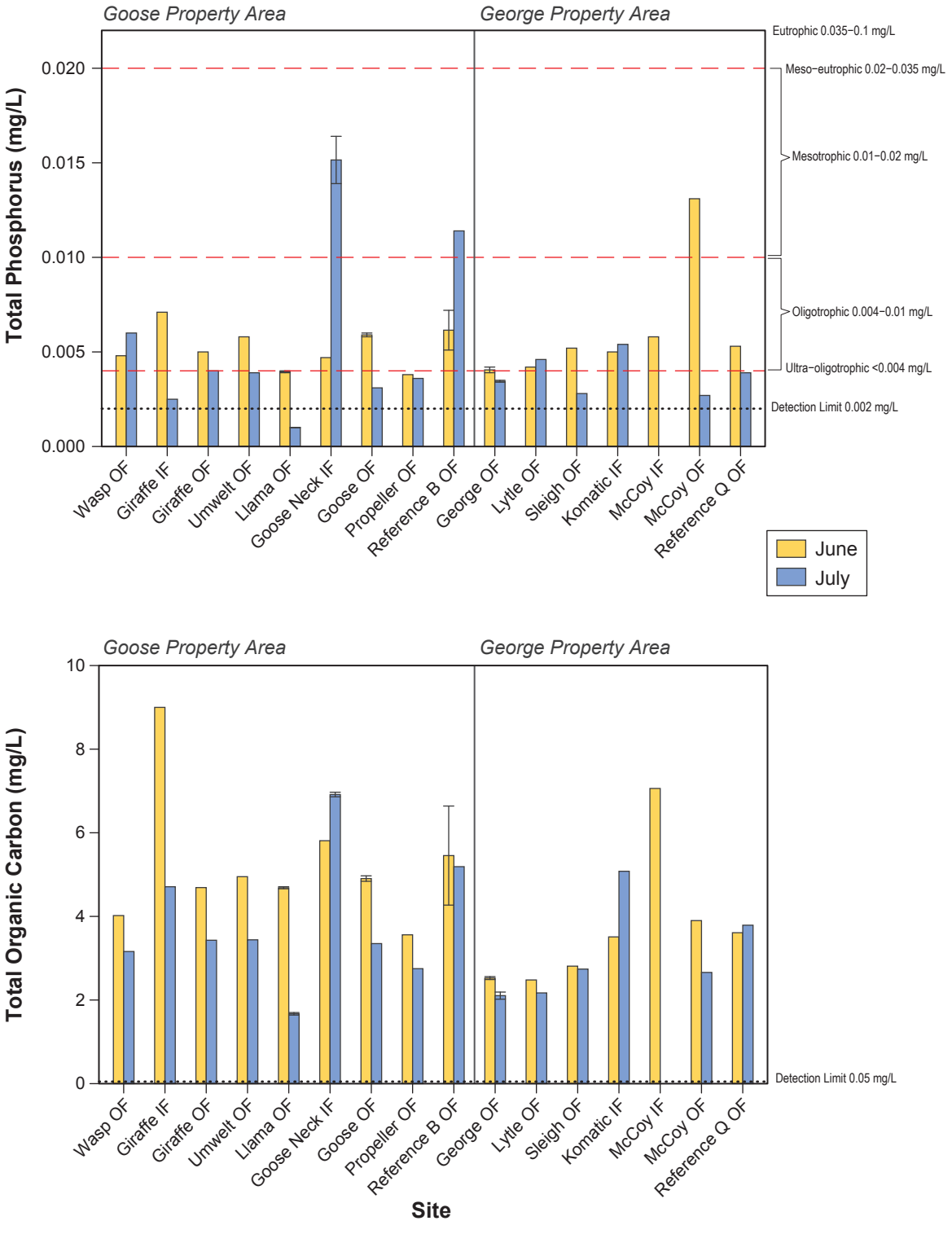

Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
Dashed lines represent CCME trigger ranges for total phosphorus.
McCoy IF could not be sampled in July due to low water levels.

Figure 3.4-6

Total Phosphorus and Total Organic Carbon Concentrations in Streams, Back River Project, 2013

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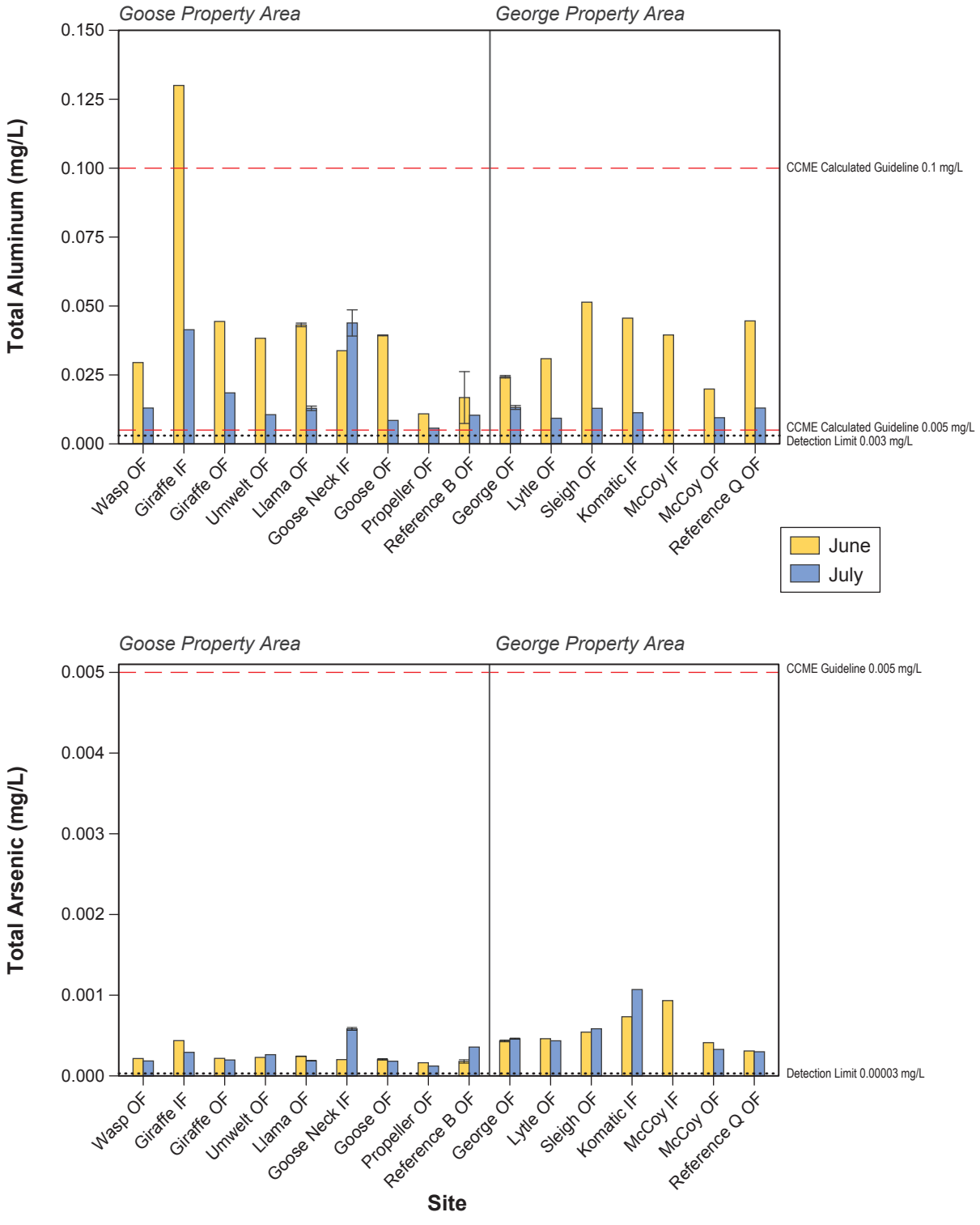

Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME guideline for aluminum is pH−dependent: if pH < 6.5, then guideline = 0.005 mg/L;
if pH ≥ 6.5 then guideline = 0.1 mg/L. Only the freshet TIA OF and Umwelt OF samples had pH <6.5.
McCoy IF could not be sampled in July due to low water levels.

Figure 3.4-7

Aluminum and Arsenic Concentrations in Streams, Back River Project, 2013

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Boron concentrations were similar across stream sites, and were always less than three times the detection limit (0.005 mg/L; Figure 3.4-8). The lowest concentrations were observed during June sampling, where all but Wasp OF had total boron concentrations below the detection limit.

Most stream samples had total cadmium concentrations below 0.000025 mg/L, with the highest concentrations found in Llama OF (0.000055 mg/L) and Propeller OF (0.00115 mg/L) in July (Figure 3.4-8). The July Propeller OF cadmium concentration was anomalously high given corresponding undetectable dissolved concentrations in July and undetectable total concentrations in June. Only this anomalously high July Propeller OF sample had total cadmium concentrations above the hardness-dependent CCME guideline (CCME, 2014).

Average total chromium concentrations ranged from below the detection limit of 0.0001 mg/L at George OF (both June and July) to 0.000425 mg/L at Goose Neck IF during July sampling (Figure 3.4-9). All streams had chromium concentrations below the most conservative CCME guideline for the protection of freshwater aquatic life (0.001 mg/L for hexavalent chromium).

Streams sampled had naturally elevated total copper concentrations, with most streams having concentrations greater than the hardness-dependent CCME guideline in at least one sample (Figure 3.4-9). Exceptions were Umwelt OF, Propeller OF, Reference B OF and George OF where mean total copper concentrations were below guidelines in all June and July samples.

Most streams had total iron concentrations below 0.2 mg/L and the CCME guideline for freshwater aquatic life of 0.3 mg/L (Figure 3.4-10). Exceptions were the low flow Goose Neck IF (0.83 mg/L) and Reference B OF (0.71 mg/L) during July sampling, where mean concentrations were about twice the guideline level.

Total nickel concentrations were below 0.02 mg/L at all streams and below the CCME minimum guideline of 0.025 mg/L (Figure 3.4-10). The highest concentrations were observed at Giraffe IF during July sampling (0.0157 mg/L) and Reference Q OF during June (0.0170 mg/L) and July sampling (0.0159 mg/L).

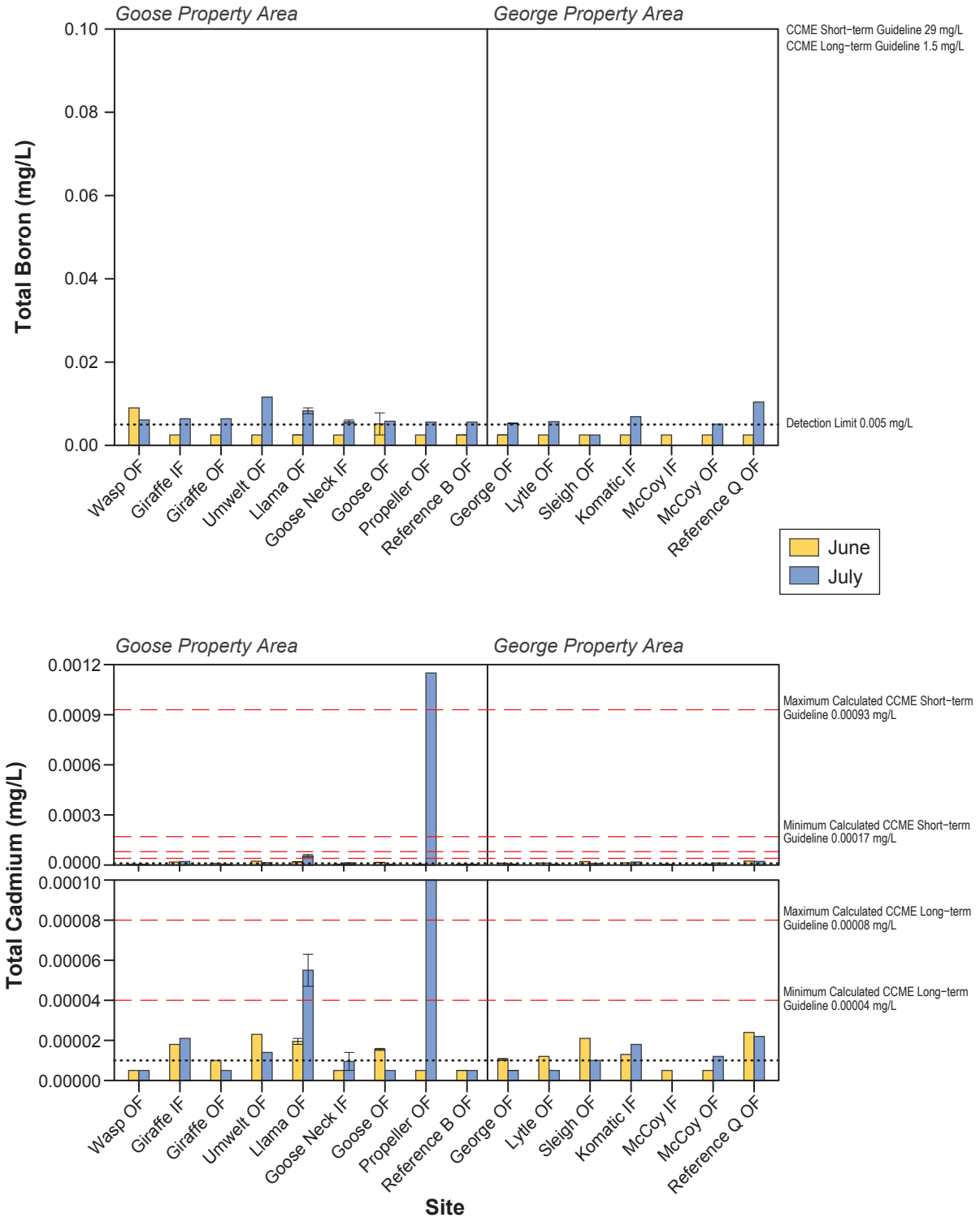
Streams mostly had total uranium and zinc concentrations below or near the detection limits (Figure 3.4-11). The exceptions were at Giraffe IF where uranium concentrations were above the detection limit (0.00001 mg/L) during both June (0.000039 mg/L) and July (0.000021 mg/L) sampling and Reference Q OF where zinc concentrations were over four times the detection limit (0.003 mg/L). All uranium and zinc measurements were below their respective CCME guideline limit.

3.4.6 Cyanides

Total and free cyanide concentrations were below the detection limit of 0.001 mg/L and the free cyanide CCME guideline of 0.005 mg/L (CCME 2014) in all 2013 stream samples.

3.4.7 Comparison with CCME Guidelines

The trophic status of streams using the CCME trigger ranges for total phosphorus is shown in Table 3.4-1. Table 3.4-2 gives the percentage of stream water quality samples that were above their respective CCME guidelines, and provides the average factor they were higher than CCME guidelines.



Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
McCoy IF could not be sampled in July due to low water levels.
CCME short-term cadmium guideline is hardness-dependent (mg/L) = $10^{(1.016(\log10(\text{hardness}))-1.71)}/1000$, with a minimum of 0.00011 mg/L.
CCME long-term cadmium guideline is hardness-dependent (mg/L) = $10^{(0.83(\log10(\text{hardness}))-2.46)}/1000$, with a minimum of 0.00004 mg/L.

Figure 3.4-8

Boron and Cadmium Concentrations in Streams, Back River Project, 2013

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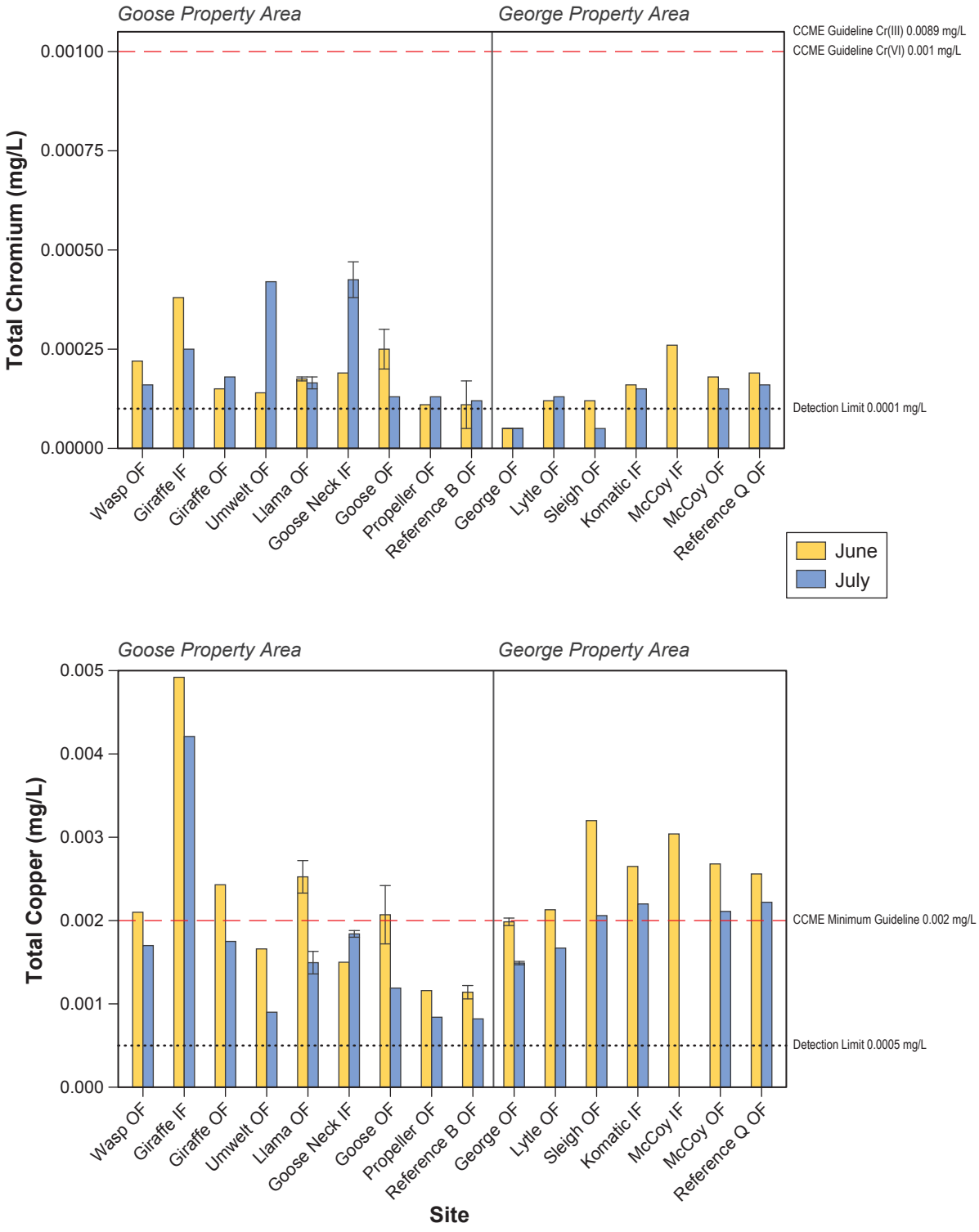

Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
The trivalent chromium CCME guideline is an interim guideline.
CCME copper guideline is hardness−dependent (mg/L) = e $^{(0.8545[\ln(\text{hardness})]-1.465)x0.0002}$, with a minimum of 0.002 mg/L and a maximum of 0.004 mg/L.
McCoy IF could not be sampled in July due to low water levels.

Figure 3.4-9

Chromium and Copper Concentrations in Streams, Back River Project, 2013

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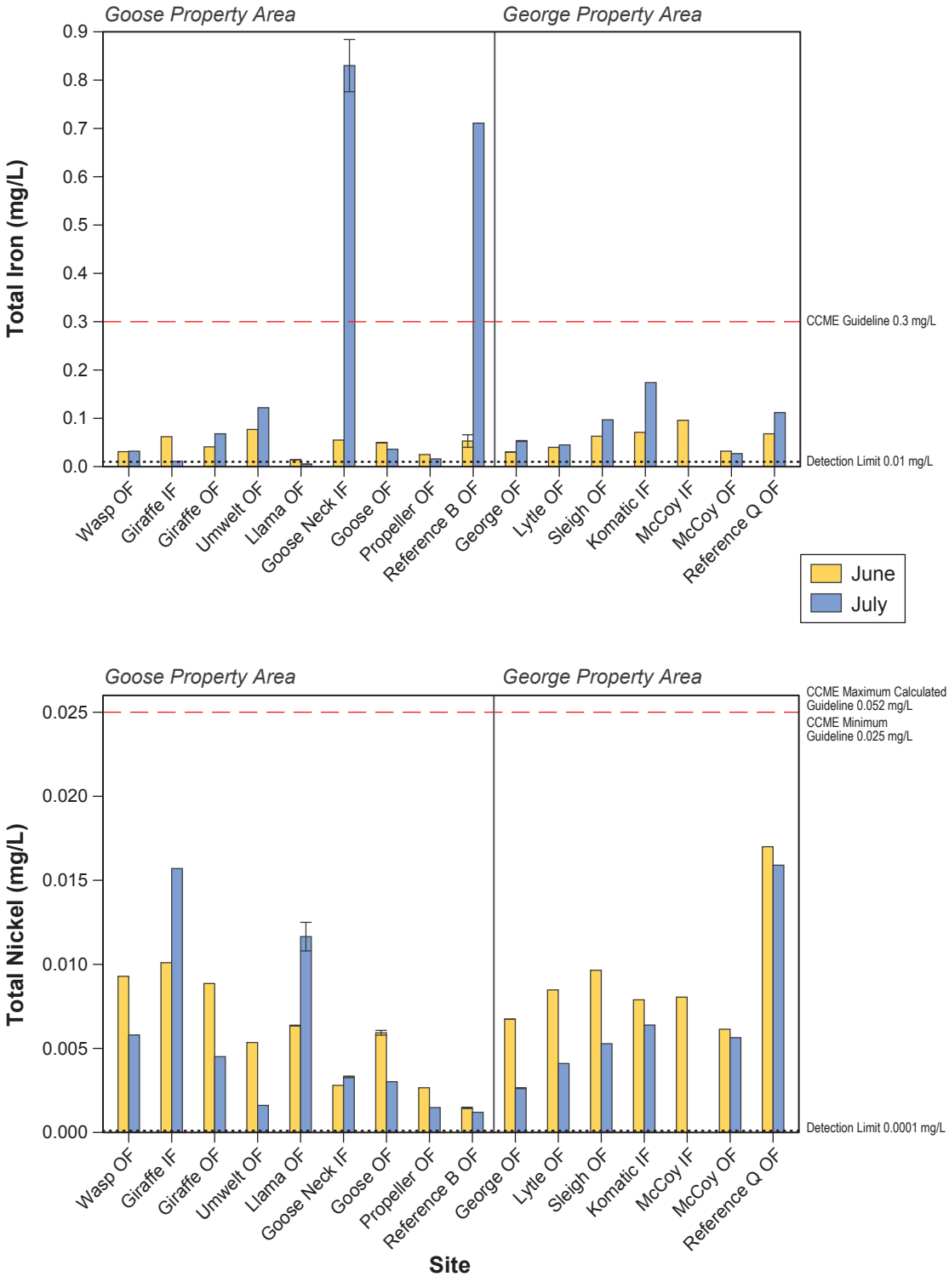

Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME nickel guideline is hardness−dependent (mg/L) = e $^{(0.76[\ln(\text{hardness})]+1.06)}$ /1,000 with a minimum of 0.025 mg/L and a maximum of 0.15 mg/L.
McCoy IF could not be sampled in July due to low water levels.

Figure 3.4-10

Iron and Nickel Concentrations in Streams, Back River Project, 2013

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Table 3.4-1. Stream Trophic Status using CCME Trigger Ranges for Total Phosphorus, Back River Project, 2013

Stream Site	Total Number of Samples Collected	Total Phosphorus Trophic Status[ab] Range
Goose Property Area		
Wasp OF	2	Oligotrophic
Giraffe IF	2	Ultra-oligotrophic to Oligotrophic
Giraffe OF	2	Oligotrophic
Umwelt OF	2	Ultra-oligotrophic to Oligotrophic
Llama OF	4	Ultra-oligotrophic to Oligotrophic
Goose Neck IF	3	Oligotrophic to Mesotrophic
Goose OF	3	Ultra-oligotrophic to Oligotrophic
Propeller OF	2	Ultra-oligotrophic
Reference B OF	3	Oligotrophic to Mesotrophic
George Property Area		
George OF	4	Ultra-oligotrophic to Oligotrophic
Lytle OF	2	Oligotrophic
Sleigh OF	2	Ultra-oligotrophic to Oligotrophic
Komatic IF	2	Oligotrophic
McCoy IF	1	Oligotrophic
McCoy OF	2	Ultra-oligotrophic to Mesotrophic
Reference Q OF	2	Ultra-oligotrophic to Oligotrophic

Notes:
a) Canadian water quality guidelines for the protection of aquatic life (CCME, accessed February 2014).
b) < 0.004 mg/L = ultra-oligotrophic; 0.004 - 0.01 mg/L = oligotrophic; 0.01 - 0.02 mg/L = mesotrophic; 0.02 - 0.035 mg/L = mesoeutrophic; 0.035 - 0.1 mg/L = eutrophic; > 0.1 mg/L = hypereutrophic.

All streams had water quality within the CCME guidelines for pH, (6.5 to 9), except June samples from Giraffe IF (6.48) and Umwelt OF (6.37). All streams had water quality below CCME guidelines for chloride, fluoride, ammonia, nitrate, nitrite and free cyanide. All streams had naturally elevated metal concentrations that were greater than CCME guidelines in at least one sample for at least one of the following metals: total aluminum, total cadmium, total copper and total iron (Table 3.4-2). Giraffe IF had the greatest number of parameters that were naturally elevated, with pH, aluminium and copper outside of CCME guidelines for at least one sample.

3.4.8 Stream Water Quality Assurance/Quality Control

One field and two travel blanks were collected during stream sampling, representing 8% of the regular stream samples collected (Appendix 3.4-3). All blanks for all parameters were below detection limits.

Six pairs of field duplicates for sampled streams were compared for each water quality parameter. The RPD value was used as a measure of the variability inherent in field sampling (Appendix 3.4-2). A total of 29% (167/570) of the duplicate concentrations were at least five times greater than their detection limits and were used in the RPD calculations. Of these, 2.4% (4/167) had an RPD above 20%, with the maximum observed RPD being 49.3%.

These QA/QC procedures indicated the stream water quality samples were of high quality, and sampling heterogeneity was minimal during the stream sampling.

Table 3.4-2. Stream Water Quality and CCME Guidelines, Back River Project, 2013

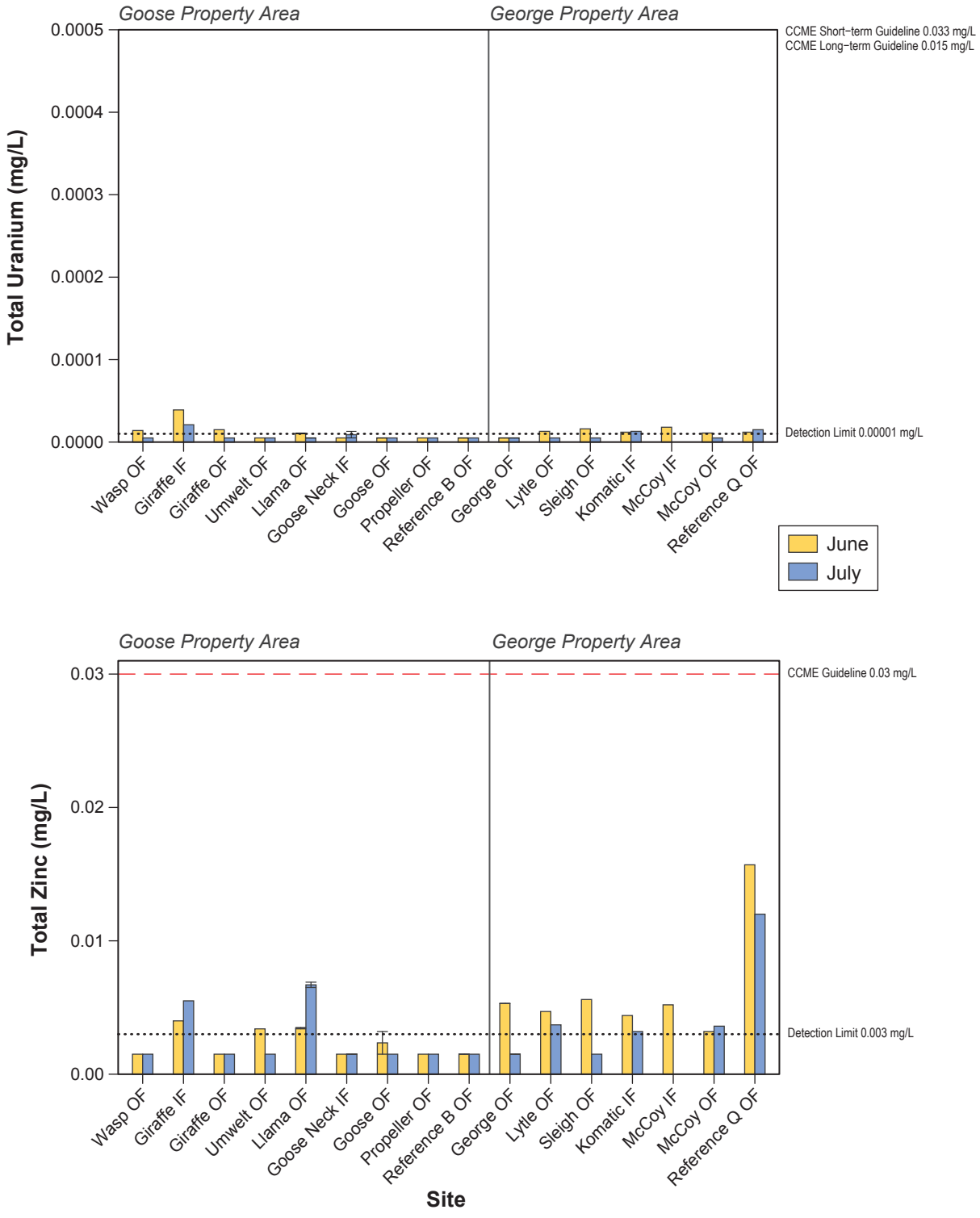
			pH		Aluminum		Cadmium (Cd)		Cadmium (Cd)		Copper (Cu)		Iron (Fe)	
		CCME Guideline Values[a]	6.5 to 9.0		pH-dependent; 0.005 mg/L at pH < 6.5; 0.1 mg/L at pH ≥ 6.5.		Hardness- dependent[b] short-term guideline		Hardness- dependent[b] long-term guideline		Hardness- dependent ≥ 0.002 mg/L[c]		0.3 mg/L	
Stream Site	Total Number of Samples Collected	Number of parameters greater than CCME guidelines	Mean factor by which parameter was greater than CCME guideline	Percent of samples greater than CCME guideline	Mean factor by which parameter was greater than CCME guideline	Percent of samples greater than CCME guideline	Mean factor by which parameter was greater than CCME guideline	Percent of samples greater than CCME guideline	Mean factor by which parameter was greater than CCME guideline	Percent of samples greater than CCME guideline	Mean factor by which parameter was greater than CCME guideline	Percent of samples greater than CCME guideline	Mean factor by which parameter was greater than CCME guideline	Percent of samples greater than CCME guideline
Goose Property Area														
Wasp OF	2	1	-	0%	-	0%	-	-	-	-	1.05	50%	-	0%
Giraffe IF	2	3	1.00	50%	26.00	50%	-	-	-	-	2.28	100%	-	0%
Giraffe OF	2	1	-	0%	-	0%	-	-	-	-	1.22	50%	-	0%
Umwelt OF	2	2	1.02	50%	7.66	50%	-	-	-	-	-	0%	-	0%
Llama OF	4	1	-	0%	-	0%	-	-	-	-	1.26	50%	-	0%
Goose Neck IF	3	1	-	0%	-	0%	-	-	-	-	-	0%	2.77	67%
Goose OF	3	1	-	0%	-	0%	-	-	-	-	1.21	33%	-	0%
Propeller OF	2	2	-	0%	-	0%	6.36	50%	28.75	50%	-	0%	-	0%
Reference B OF	3	1	-	0%	-	0%	-	-	-	-	-	0%	2.37	33%
George Property Area														
George OF	4	1	-	0%	-	0%	-	-	-	-	1.02	25%	-	0%
Lytle OF	2	1	-	0%	-	0%	-	-	-	-	1.07	50%	-	0%
Sleigh OF	2	1	-	0%	-	0%	-	-	-	-	1.32	100%	-	0%
Komatic IF	2	1	-	0%	-	0%	-	-	-	-	1.21	100%	-	0%
McCoy IF	1	1	-	0%	-	0%	-	-	-	-	1.52	100%	-	0%
McCoy OF	2	1	-	0%	-	0%	-	-	-	-	1.20	100%	-	0%
Reference Q OF	2	1	-	0%	-	0%	-	-	-	-	1.20	100%	-	0%

Notes:

a) Canadian water quality guidelines for the protection of aquatic life (CCME, accessed February 2014).

b) Guidelines are hardness-dependent; cadmium short-term guideline (mg/L) = $10^{\{1.016[\log(\text{hardness})]-1.71\}}$ /1000 with a minimum of 0.00011 mg/L, cadmium long-term guideline (mg/L) = $10^{\{0.83[\log(\text{hardness})]-2.46\}}$ /1000 with a miniumum of 0.00004 mg/L.

c) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ x 0.0002. Copper guideline is a minium of 0.002 mg/L regardless of hardness. At hardness >180 mg/L copper guideline is 0.004 mg/L



Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
McCoy IF could not be sampled in July due to low water levels.

Figure 3.4-11

Uranium and Zinc Concentrations in Streams, Back River Project, 2013

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3.5 LAKE SEDIMENT QUALITY

Lake sediment quality samples were collected in July 2013, and the data are presented graphically in Figures 3.5-1 to 3.5-8. The complete sediment quality dataset for lakes is presented in Appendix 3.5-1. The variability in colour, texture, and sample volume of the sediment samples is shown in Figure 3.5-9. Cumulative graphs for all sediment quality data collected from 2010 to 2013 are presented in Appendices 3.5-2 to 3.5-14.

3.5.1 Particle Size

Most lake sediments were composed of over 50% silt, with lesser amounts of sand and clay (Figure 3.5-1). A few lakes in the Goose Property, including Wasp, Leaf and Umwelt lakes and Reference B Lake were made up mainly of sand (> 50%). Clay made up over 15% of sediments at Goose Tail, Occurrence, and McCoy lake sites. Gravel was generally below detection limits, with the greatest proportion observed at Leaf Lake (6%).

3.5.2 Nutrients

Available ammonium, nitrogen and TOC concentrations followed similar patterns with greatest concentrations occurring at Giraffe North and lowest concentrations at Wasp Lake, Leaf Lake and George Lake Central. Lake with the sandiest sediments often had lower concentrations of available ammonium, nitrogen and TOC.

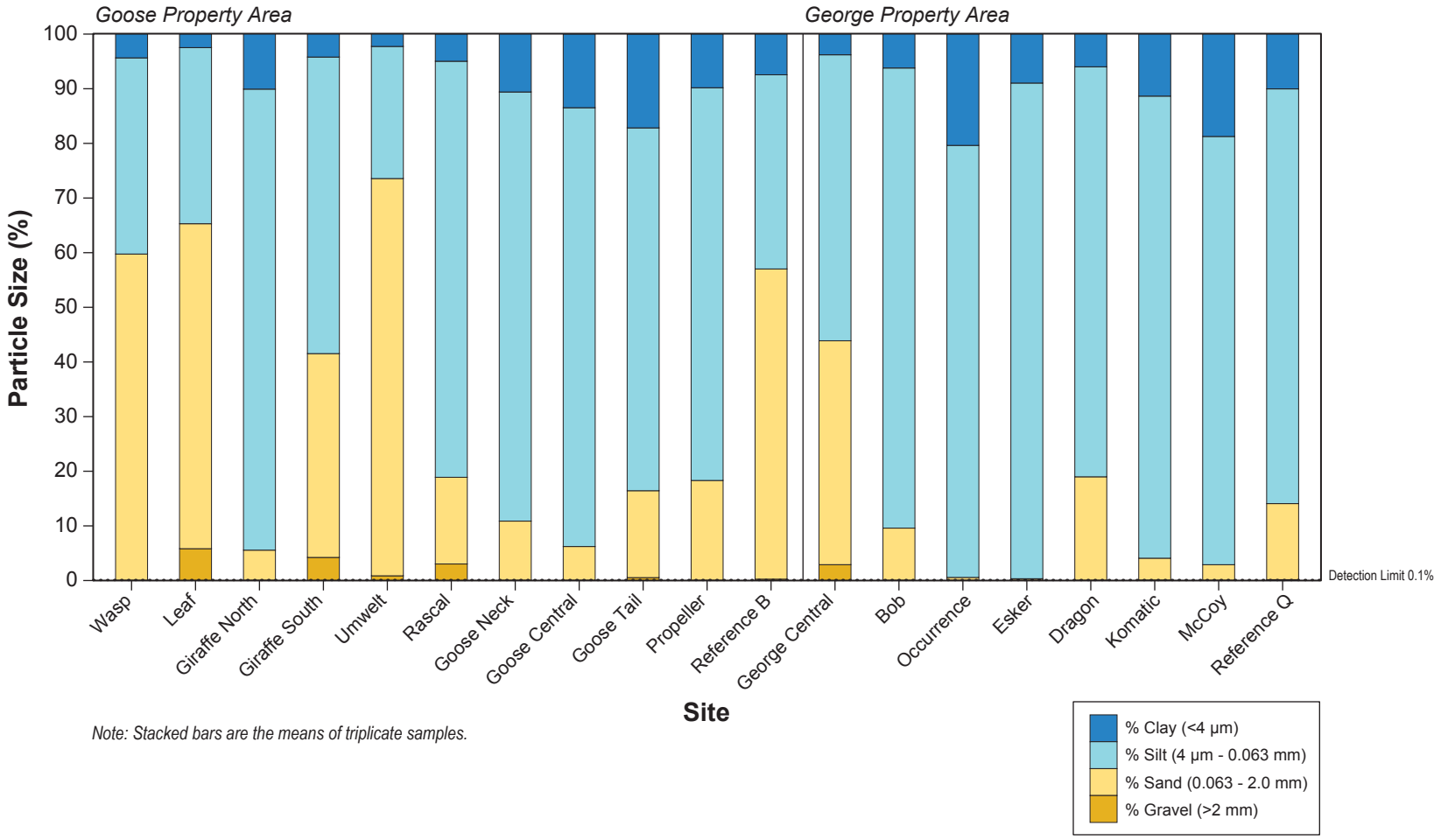
Mean available ammonium concentrations largely ranged from 1.8 mg/kg in Leaf Lake to 31 mg/kg in Goose Lake Central and Bob Lake (Figure 3.5-2). The highest concentrations occurred at Giraffe Lake, where the shallower north site had mean ammonium concentrations of 77 mg/kg and the deeper south site had mean concentrations of 55 mg/kg. Total nitrogen was similarly variable, ranging from 0.06% at George Lake Central to 0.91% at Giraffe North (Figure 3.5-2). Lake sediments contained between 0.6% and 12% TOC (Figure 3.5-3), following very closely the patterns observed among sites for total nitrogen.

Available phosphate (as P) was less than 13 mg/kg for all lake sites, except Propeller Lake, where mean concentrations were several fold greater at 52 mg/kg (Figure 3.5-3). Relatively high phosphorus concentrations were also observed at Propeller Lake in 2011 and 2012, with mean values of 61 mg/kg and 48 mg/kg, respectively.

3.5.3 Metals

Metal concentrations varied considerably among lake sites, with differences often on the scale of an order of magnitude. George Property lakes tended to have higher concentrations of metals than Goose Property lakes. As observed in 2012, Komatic Lake, which had mainly silt/clay sediments, tended to have the highest concentrations of metals. Leaf Lake, Umwelt Lake and Reference B Lake all had greater than 50% sand in their sediments and tended to have the lowest metal concentrations. Metal concentrations in sediments are often related to particle size composition. The high surface area to volume ratio and surface active qualities of silt and clay drive the tendency for other elements to adsorb to these particles. Conversely, sand has a relatively low surface area to volume ratio and is comparatively inert. Sediments with higher proportions of sand tend to have lower metal concentrations than sediments with high proportions of silt and clay.

Average arsenic concentrations were naturally elevated in lake sediments and were extremely variable among lakes, generally ranging from 4.5 mg/kg to 97 mg/kg (Figure 3.5-4). There were exceptionally high mean concentrations at Komatic Lake (649 mg/kg), although with high variability among samples. Elevated levels were also observed in Komatic Lake in 2012 (mean of 354 mg/kg). All lakes except Propeller Lake had arsenic concentrations in at least one sediment replicate that were greater than the CCME ISQG of 5.9 mg/kg. Over half of the Goose Property lakes, and all of the George Property lakes had at least one sample above the CCME PEL (17 mg/kg).



Note: Stacked bars are the means of triplicate samples.

Figure 3.5-1

Sabina GOLD & SILVER CORP.

Sediment Grain Size Composition in Lakes, Back River Project, July 2013

Figure 3.5-1

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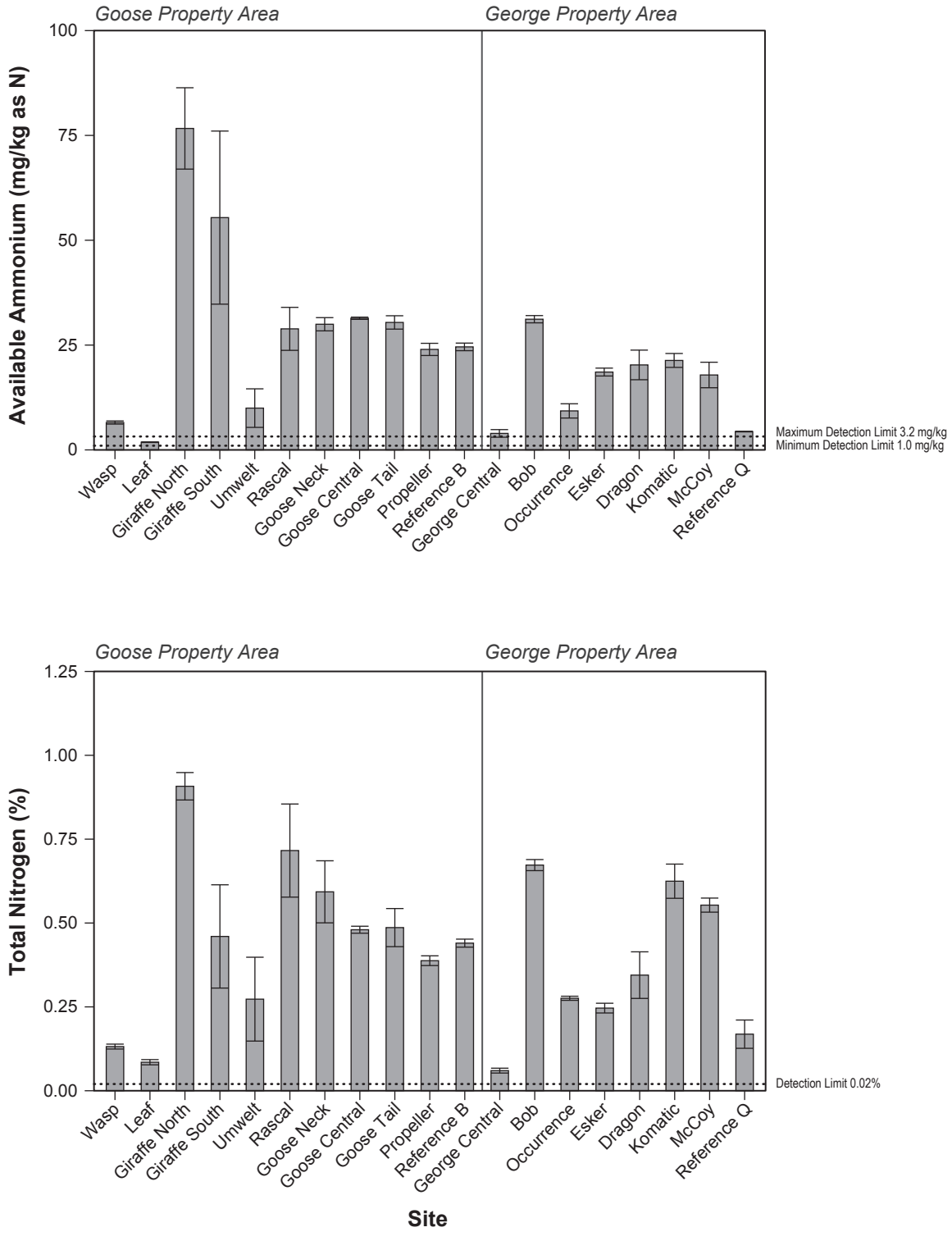

Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit;
values below the detection limit were plotted as half the detection limit.

Figure 3.5-2

Available Ammonium and Total Nitrogen Concentrations in Lake Sediments, Back River Project, July 2013

Sabina GOLD & SILVER CORP.

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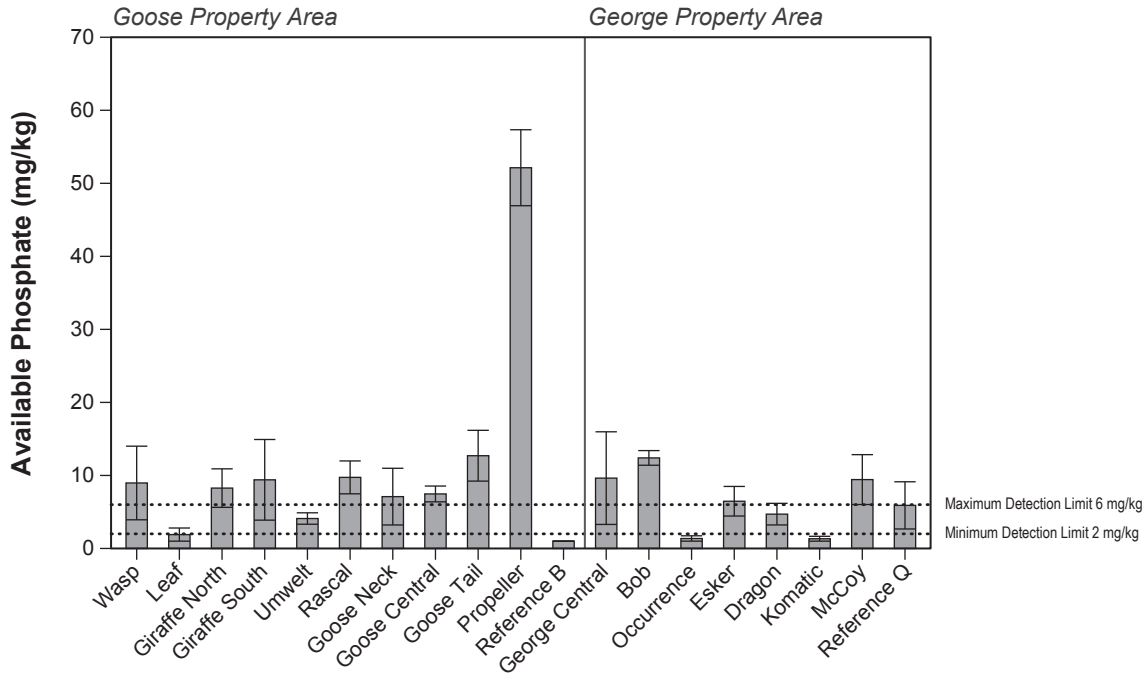

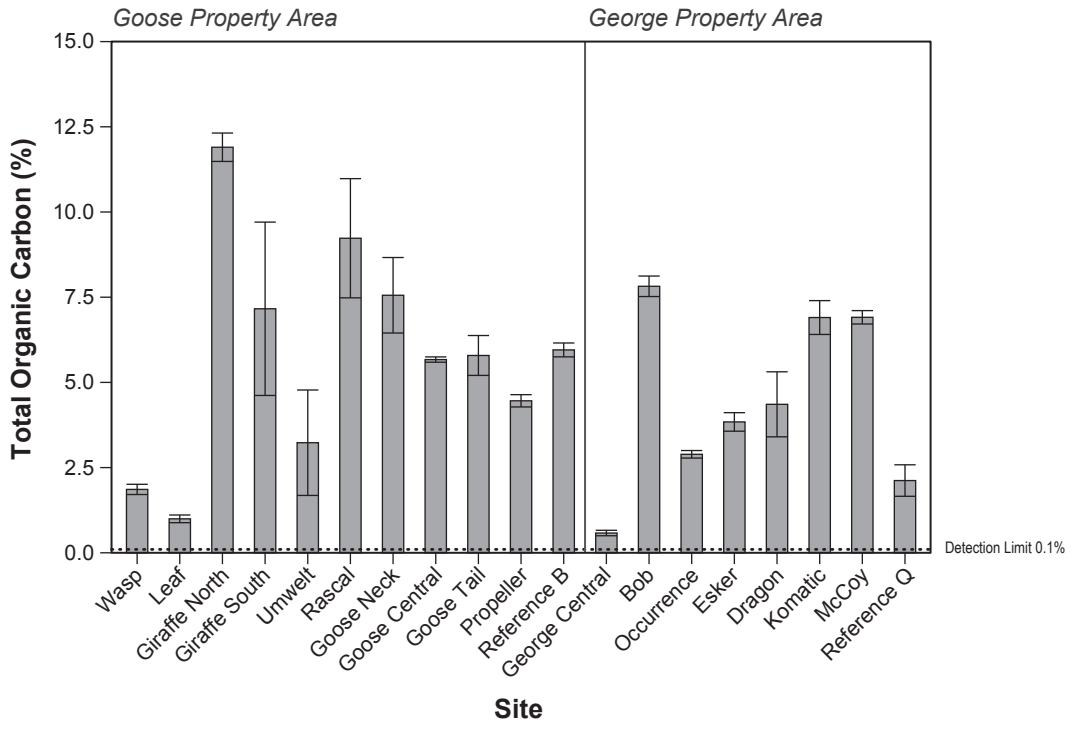

Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit;
values below the detection limit were plotted as half the detection limit.

Figure 3.5-3

Available Phosphate and Total Organic Carbon in Lake Sediments, Back River Project, July 2013

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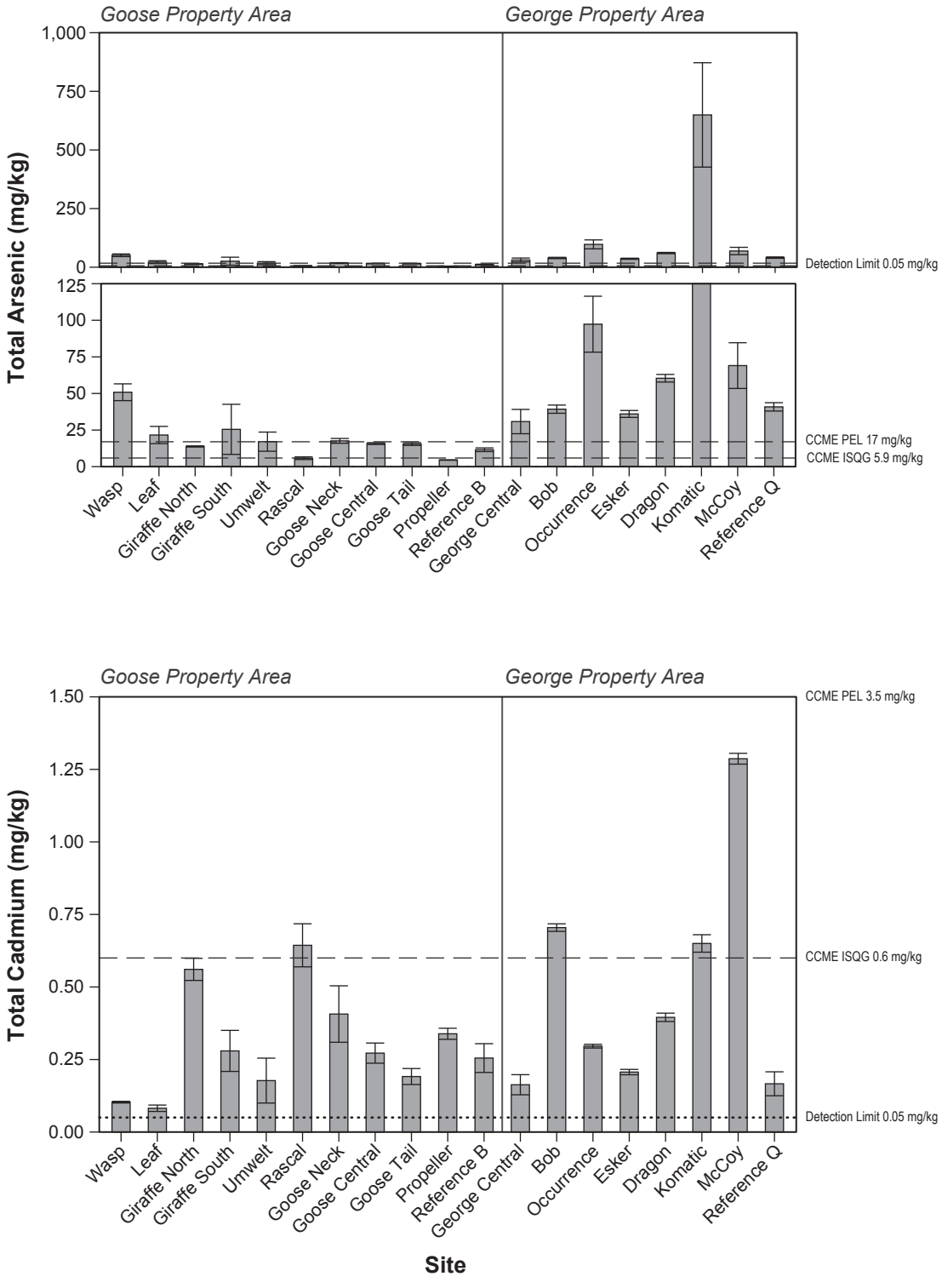

Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit;
values below the detection limit were plotted as half the detection limit.
CCME sediment quality guideline: PEL = probable effect level; ISQG = interim sediment quality guideline.

Figure 3.5-4

Arsenic and Cadmium Concentrations in Lake Sediments, Back River Project, July 2013

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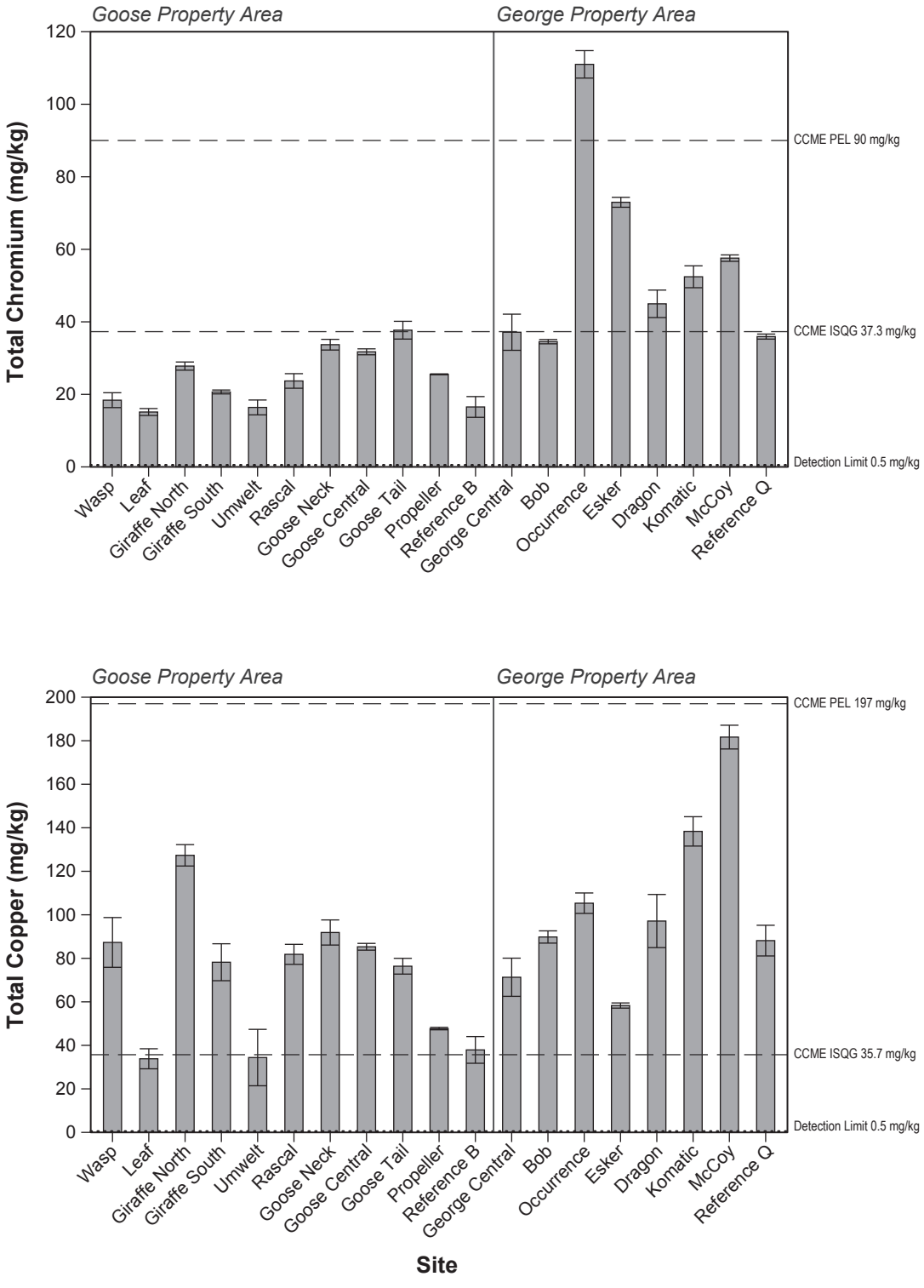


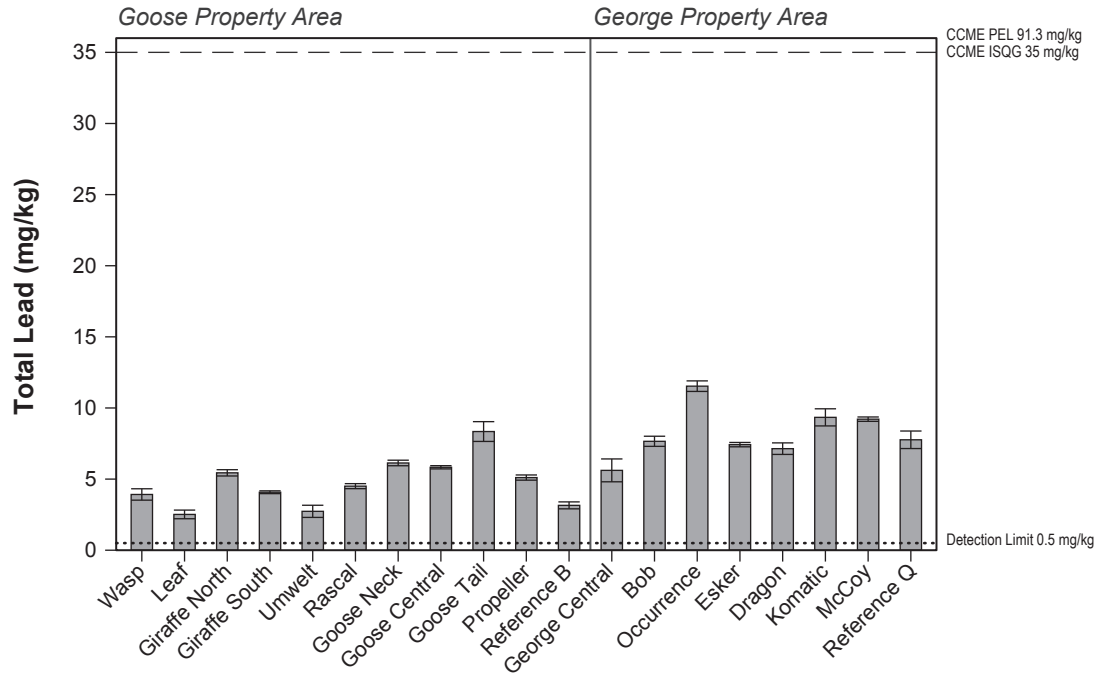
Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit;
values below the detection limit were plotted as half the detection limit.
CCME sediment quality guideline: PEL = probable effect level; ISQG = interim sediment quality guideline.

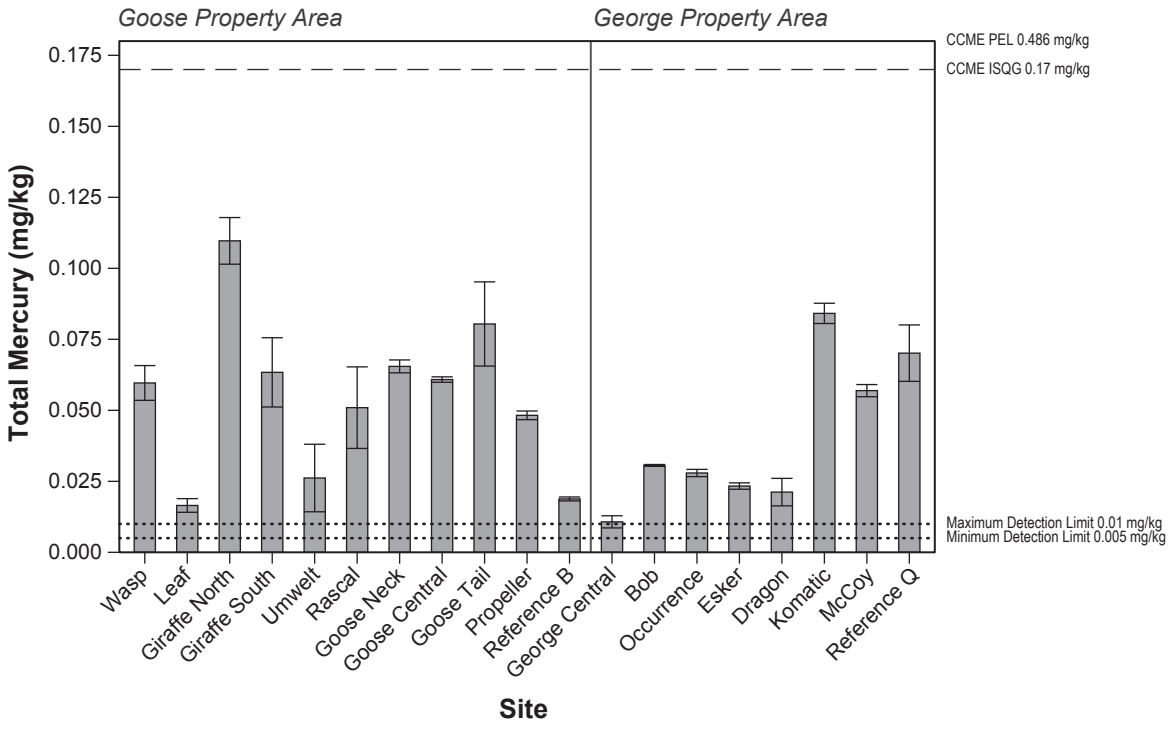
Figure 3.5-5

Chromium and Copper Concentrations in Lake Sediments, Back River Project, July 2013

Sabina GOLD & SILVER CORP.

Rescan an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit;
values below the detection limit were plotted as half the detection limit.
CCME sediment quality guideline: PEL = probable effect level; ISQG = interim sediment quality guideline.

Figure 3.5-6

Lead and Mercury Concentrations in Lake Sediments, Back River Project, July 2013

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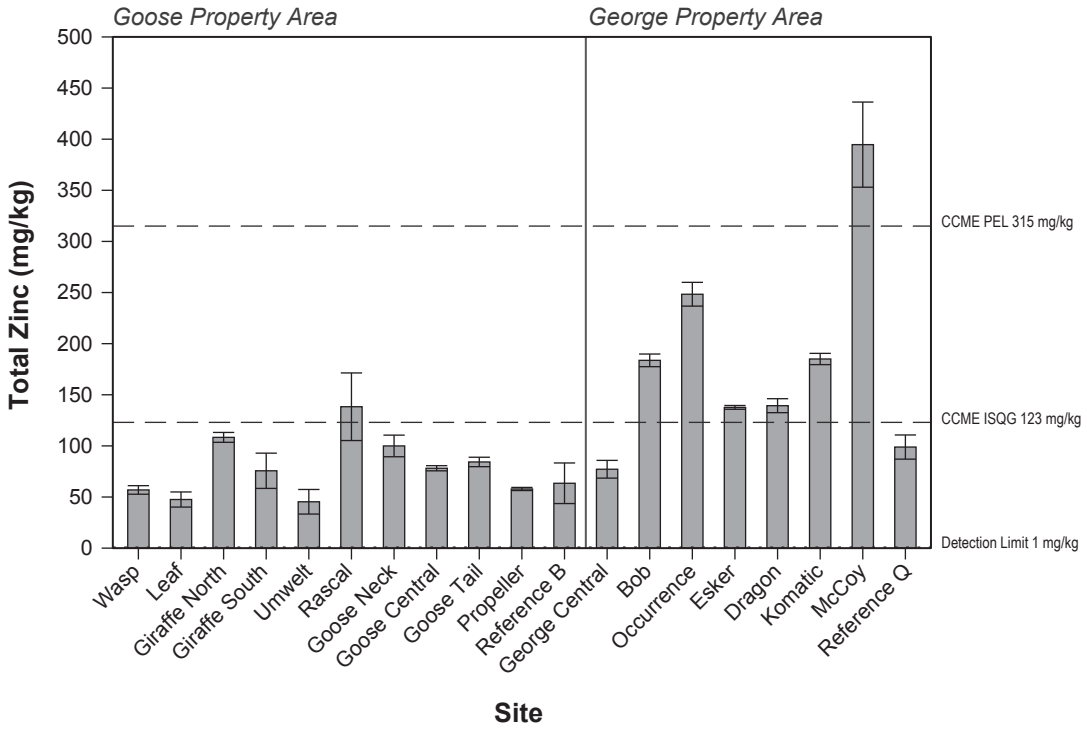


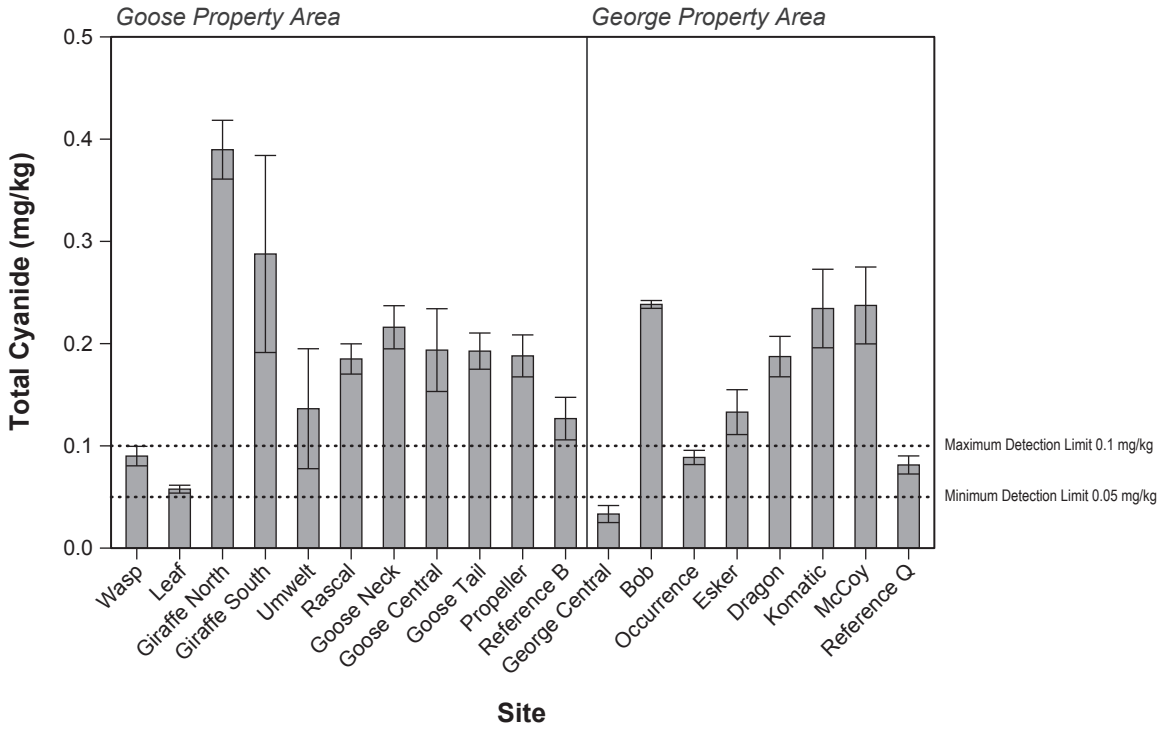
Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit;
values below the detection limit were plotted as half the detection limit.
CCME sediment quality guideline: PEL = probable effect level; ISQG = interim sediment quality guideline.

Figure 3.5-7

Zinc Concentrations in Lake Sediments, Back River Project, July 2013

Sabina GOLD & SILVER CORP.

Rescan an ERM company



Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit;
values below the detection limit were plotted as half the detection limit.

Figure 3.5-8

Total Cyanide Concentrations in Lake Sediments, Back River Project, July 2013

Sabina GOLD & SILVER CORP.

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Figure 3.5-9

Examples of the Diversity in Sediment Samples Collected in July

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Cadmium concentrations ranged over an order of magnitude from close to the detection limit of 0.05 mg/kg at Leaf Lake to near the CCME ISQG guideline of 0.6 mg/kg at Giraffe North, Rascal, Bob and Komatic lakes (Figure 3.5-4). McCoy Lake had considerably higher mean cadmium concentrations (1.3 mg/kg) than observed in other lakes. Five of the 19 lake sites had at least one sediment sample above CCME ISQG (0.6 mg/kg). No samples were greater than the CCME PEL sediment guideline level of 3.5 mg/kg.

As observed in 2012, Goose Property lakes tended to have lower concentrations of chromium in their sediments than George Property lakes (Figure 3.5-5). Chromium concentrations were naturally elevated in many lake sediments, with mean concentrations in Goose Tail Lake (37.7 mg/kg) greater than the CCME ISGQ of 37.3 mg/kg, and all of the George Property lakes, except Bob and Reference Q lakes, also greater than the CCME ISQG. As observed in 2012, all samples at Occurrence Lake were greater than the CCME PEL of 90 mg/kg.

Lake sediments had naturally high concentrations of copper (Figure 3.5-5), with all sites having at least one sample above the CCME ISQG of 35.7 mg/kg and mean concentrations at McCoy Lake (182 mg/kg) approaching the CCME PEL of 197 mg/kg.

Lead concentrations were low, with mean concentrations at all lakes less than a third of the CCME ISQG (35 mg/kg; Figure 3.5-6). George Property lakes tended to have higher lead concentrations than Goose Property lakes. The highest concentrations were observed at Occurrence Lake (average 11.5 mg/kg).

Mercury concentrations in sediments ranged widely among lakes, from a mean of 0.01 mg/kg at George Lake Central to 0.11 mg/kg at Giraffe Lake North (Figure 3.5-6). Mercury concentrations were below the CCME ISQG and PEL at all sites (CCME 2014).

Goose Property lakes tended to have lower zinc concentrations than George Property lakes. Except one sample at Rascal Lake, zinc concentrations in the Goose Property lakes were below the CCME ISQG guideline of 123 mg/kg. Six out of the eight George Property lakes had mean zinc concentrations above the CCME ISQG, and all samples at McCoy Lake were greater than the CCME PEL (315 mg/kg; Figure 3.5-7).

3.5.4 Cyanides

Total cyanide concentrations ranged from below detection limits (0.05 and 0.1 mg/kg) in George Lake Central to 0.39 mg/kg in Giraffe Lake North (Figure 3.5-8). Weak acid dissociable (WAD) cyanide concentrations followed a similar trend but were lower, with almost half (46%) of the samples below analytical detection and the maximum concentration observed was 0.213 mg/kg in Giraffe Lake South (replicate 2).

3.5.5 Comparison with CCME Guidelines

Table 3.5-1 gives the percentage of lake sediment quality samples that were above their respective CCME guidelines, and provides the average factor they were greater than CCME guidelines.

Arsenic and copper concentrations were naturally elevated in lake sediments as every site had samples above the arsenic and copper CCME ISQG and arsenic levels were frequently above the PEL. Lake sediments also had high concentrations of cadmium, chromium and zinc that were often greater than CCME ISQGs and occasionally PELs. As observed in 2012, George Property lakes had higher sediment metal concentrations than Goose Property lakes with more samples greater than CCME sediment quality guidelines and by greater factors. McCoy Lake and Komatic Lake had samples that were greater than ISQG guidelines for the greatest number of parameters, including arsenic, copper, cadmium, chromium and zinc. Propeller Lake had the fewest parameters that were greater than sediment quality guidelines (copper ISQG).

Table 3.5-1. Lake Sediment Quality and CCME Guidelines, Back River Project, 2013

				Arsenic				Cadmium		Chromium				Copper		Zinc			
				ISQG[b]		PEL[c]		ISQG		ISQG		PEL		ISQG		ISQG		PEL	
			CCME Guideline Values[a]	5.9 mg/kg		17 mg/kg		0.6 mg/kg		37.3 mg/kg		90 mg/kg		35.7 mg/kg		123 mg/kg		315 mg/kg	
Lake Site	Total Number of Samples Collected	Number of parameters greater than CCME ISQG	Number of parameters greater than CCME PEL	Mean factor by which parameter was greater than CCME guideline	Percent of samples greater than CCME guideline	Mean factor by which parameter was greater than CCME guideline	Percent of samples greater than CCME guideline	Mean factor by which parameter was greater than CCME guideline	Percent of samples greater than CCME guideline	Mean factor by which parameter was greater than CCME guideline	Percent of samples greater than CCME guideline	Mean factor by which parameter was greater than CCME guideline	Percent of samples greater than CCME guideline	Mean factor by which parameter was greater than CCME guideline	Percent of samples greater than CCME guideline	Mean factor by which parameter was greater than CCME guideline	Percent of samples greater than CCME guideline	Mean factor by which parameter was greater than CCME guideline	Percent of samples greater than CCME guideline
Goose Property Area																			
Wasp	3	2	1	8.62	100%	2.99	100%	-	0%	-	0%	-	0%	2.45	100%	-	0%	-	0%
Leaf	3	2	1	3.66	100%	1.51	67%	-	0%	-	0%	-	0%	1.20	33%	-	0%	-	0%
Giraffe North	3	3	0	2.34	100%	-	0%	1.06	33%	-	0%	-	0%	3.57	100%	-	0%	-	0%
Giraffe South	3	2	1	4.32	100%	3.51	33%	-	0%	-	0%	-	0%	2.19	100%	-	0%	-	0%
Umwelt	3	2	1	3.98	67%	1.38	67%	-	0%	-	0%	-	0%	1.33	67%	-	0%	-	0%
Rascal	3	4	0	1.28	33%	-	0%	1.32	33%	-	0%	-	0%	2.29	100%	1.66	33%	-	0%
Goose Neck	3	2	1	2.98	100%	1.22	33%	-	0%	-	0%	-	0%	2.57	100%	-	0%	-	0%
Goose Central	3	2	0	2.67	100%	-	0%	-	0%	-	0%	-	0%	2.39	100%	-	0%	-	0%
Goose Tail	3	3	1	2.62	100%	1.01	33%	-	0%	1.08	67%	-	0%	2.14	100%	-	0%	-	0%
Propeller	3	1	0	-	0%	-	0%	-	0%	-	0%	-	0%	1.34	100%	-	0%	-	0%
Reference B	3	2	0	1.96	100%	-	0%	-	0%	-	0%	-	0%	1.39	33%	-	0%	-	0%
George Property Area																			
George Central	3	3	1	5.22	100%	1.81	100%	-	0%	1.25	33%	-	0%	2.00	100%	-	0%	-	0%
Bob	3	4	1	6.66	100%	2.31	100%	1.17	100%	-	0%	-	0%	2.52	100%	1.49	100%	-	0%
Occurrence	3	4	2	16.50	100%	5.73	100%	-	0%	2.98	100%	1.23	100%	2.95	100%	2.02	100%	-	0%
Esker	3	4	1	6.10	100%	2.12	100%	-	0%	1.96	100%	-	0%	1.63	100%	1.12	100%	-	0%
Dragon	3	4	1	10.24	100%	3.55	100%	-	0%	1.21	100%	-	0%	2.72	100%	1.13	100%	-	0%
Komatic	3	5	1	110.06	100%	38.20	100%	1.13	67%	1.41	100%	-	0%	3.87	100%	1.50	100%	-	0%
McCoy	3	5	2	11.70	100%	4.06	100%	2.14	100%	1.54	100%	-	0%	5.09	100%	3.21	100%	1.25	100%
Reference Q	3	2	1	6.92	100%	2.40	100%	-	0%	-	0%	-	0%	2.47	100%	-	0%	-	0%

Values represent the percent of samples that were greater than CCME guidelines and the mean factor by which those samples were greater than CCME guidelines.

a) Canadian sediment quality guidelines for the protection of aquatic life (CCME, accessed September 2013).

b) ISQG = Interim sediment quality guideline.

c) PEL = Probable Effects Level.

3.6 STREAM SEDIMENT QUALITY

Stream sediment samples were collected in July 2013, and Figures 3.6-1 to 3.6-8 present the stream sediment quality results. The complete sediment quality dataset for streams is presented in Appendix 3.6-1. Cumulative graphs for all sediment quality data collected from 2010 to 2013 are presented in Appendices 3.6-2 to 3.6-14.

3.6.1 Particle Size

Silt made up the majority of sediments at Wasp OF, Giraffe IF, Goose Neck IF, Reference B OF, George OF and Lytle OF, while sand and gravel dominated Giraffe OF, Umwelt OF, Goose OF and Sleigh OF (Figure 3.6-1). Reference Q OF was mainly gravel and silt; two replicates were almost entirely composed of gravel and one sample was almost entirely silt. Clay made up 12% of Wasp OF sediments, the site with the largest clay component.

3.6.2 Nutrients

Patterns in sediment nutrient concentrations tended to follow the proportions of fine sediments (clay and silt), with higher nutrient concentrations in areas with higher proportions of fine sediments. The highest nutrient levels were observed in sediments from Wasp OF, Goose Neck IF, Reference B OF, George OF, Lytle OF, McCoy OF and Reference Q OF. The lowest nutrient levels were observed in Giraffe OF, Umwelt OF, Goose OF, Sleigh OF, and Komatic IF. Reference B OF had the highest mean concentrations for all nutrients, and had the lowest flow of all sites at the time of sampling.

Available ammonium, total nitrogen and TOC followed similar patterns with high variability among streams. Sediment ammonium concentrations varied by two orders of magnitude among streams (Figure 3.6-2), with lowest ammonium concentrations at Sleigh OF (mean of 1.5 mg/kg) and highest at Reference B OF (mean of 117 mg/kg). Total nitrogen in sediments ranged from near detection limits (0.02%) at several sites, with the highest concentrations at Reference B OF (mean of 1.9 %). Available phosphate tended to be low and was near or below the detection limits (2 mg/kg to 8 mg/kg; Figure 3.6-3) at all stream sites.

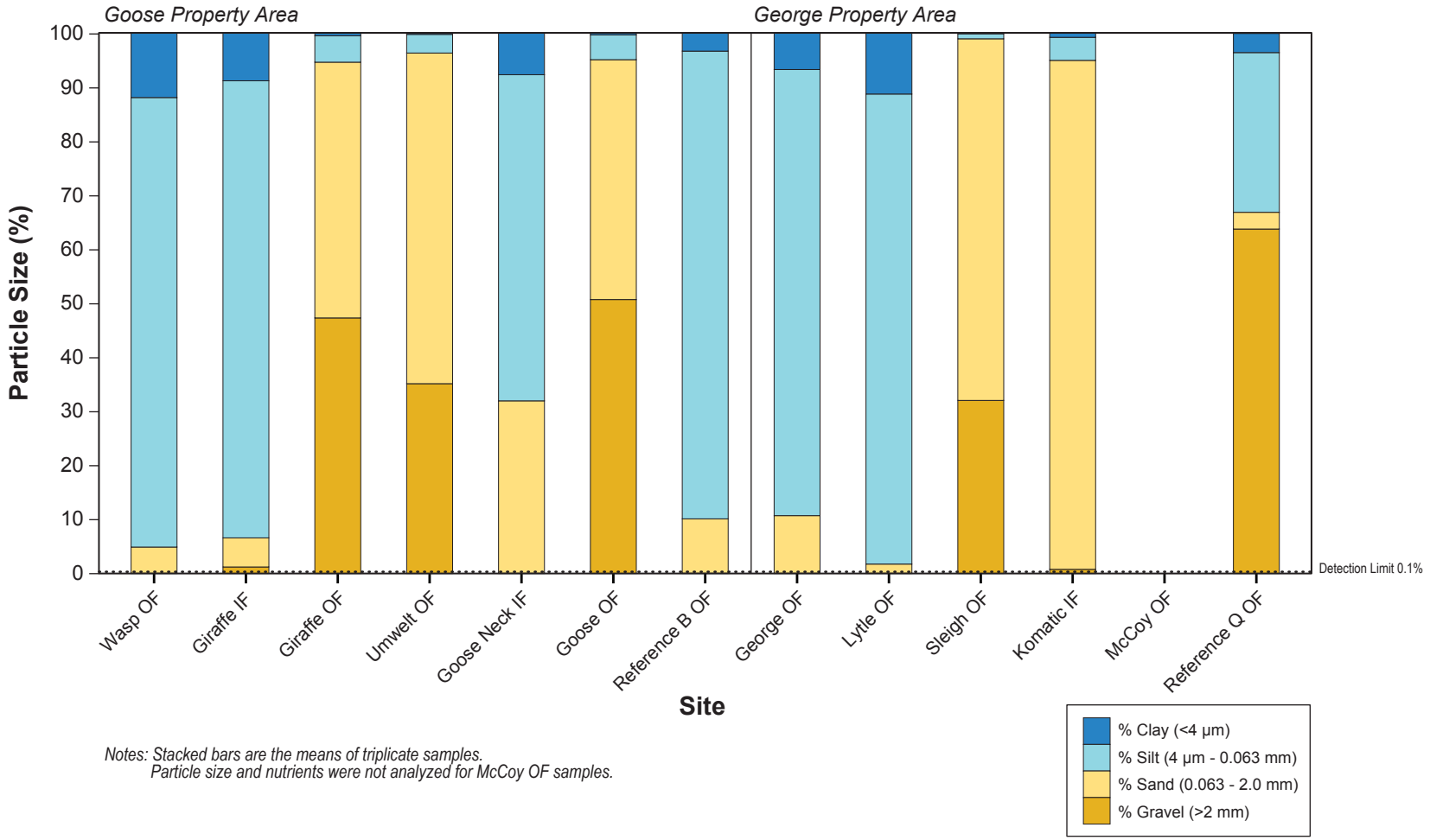
TOC content followed the same trends among sites observed for ammonium and nitrogen, with maximum percentages observed at Reference B OF (mean of 28.7%) (Figure 3.6-3).

3.6.3 Metals

Metal concentrations in stream sediments tended to correspond with proportion of fine silts and clays (Figure 3.6-4 to 3.6-7). Giraffe OF, Umwelt OF, Goose OF, Sleigh OF and Komatic IF had the lowest metal concentrations, and the lowest proportions of silt and clay. The highest metal concentrations and proportions of silt and clay were found at Wasp OF, Giraffe IF, Goose Neck IF, Reference B OF, George OF, Lytle OF, McCoy OF and Reference Q OF.

Like lakes, arsenic concentrations were naturally elevated in stream sediments (Figure 3.6-4), with four out of seven of the Goose Property streams having at least one sample greater than the CCME ISQG (5.9 mg/kg), and all George Property stream samples being greater than the CCME ISQG. Over half of the streams had mean arsenic concentrations that were greater than the CCME PEL (17 mg/kg). The highest mean concentrations were observed at Goose Neck IF and George OF, with a single replicate at Goose Neck IF having a concentration over 12 times the PEL (205 mg/kg).

Stream sediments had cadmium levels ranging from below analytical detection limits (0.05 mg/kg) at Giraffe OF, Umwelt OF and Komatic IF to a mean of 0.50 mg/kg at George OF (Figure 3.6-4). Mean concentrations were below the cadmium guideline for all sites, with single replicates at Wasp OF and George OF being greater than the cadmium CCME ISQG (0.6 mg/kg).



Notes: Stacked bars are the means of triplicate samples.
Particle size and nutrients were not analyzed for McCoy OF samples.

Figure 3.6-1

Sabina GOLD & SILVER CORP.

Sediment Grain Size Composition in Streams, Back River Project, July 2013

Figure 3.6-1

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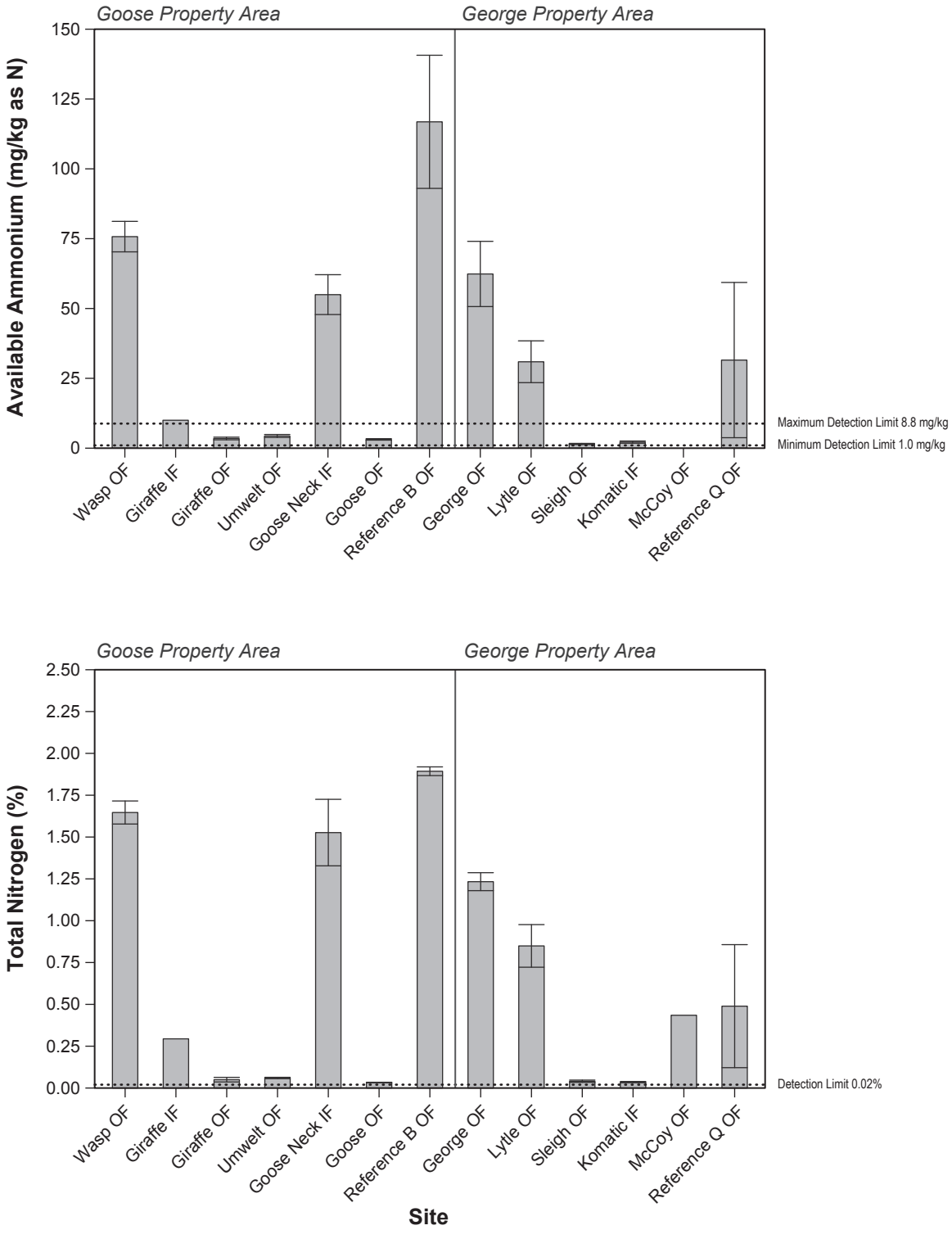


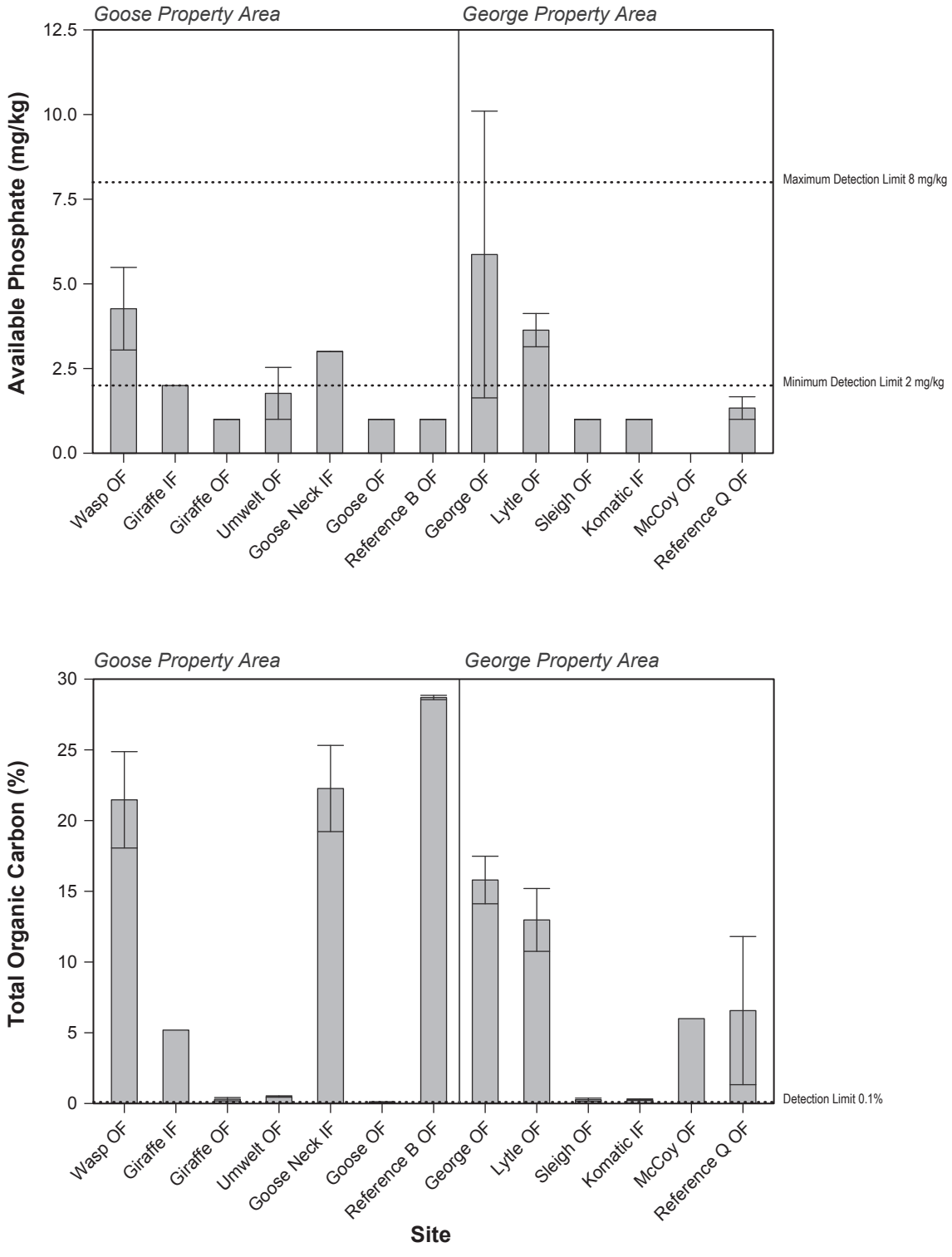
Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
Particle size and nutrients were not analyzed for McCoy OF samples.

Figure 3.6-2

Available Ammonium and Total Nitrogen Concentrations in Stream Sediments, Back River Project, 2013

Sabina GOLD & SILVER CORP.

Rescan an ERM company



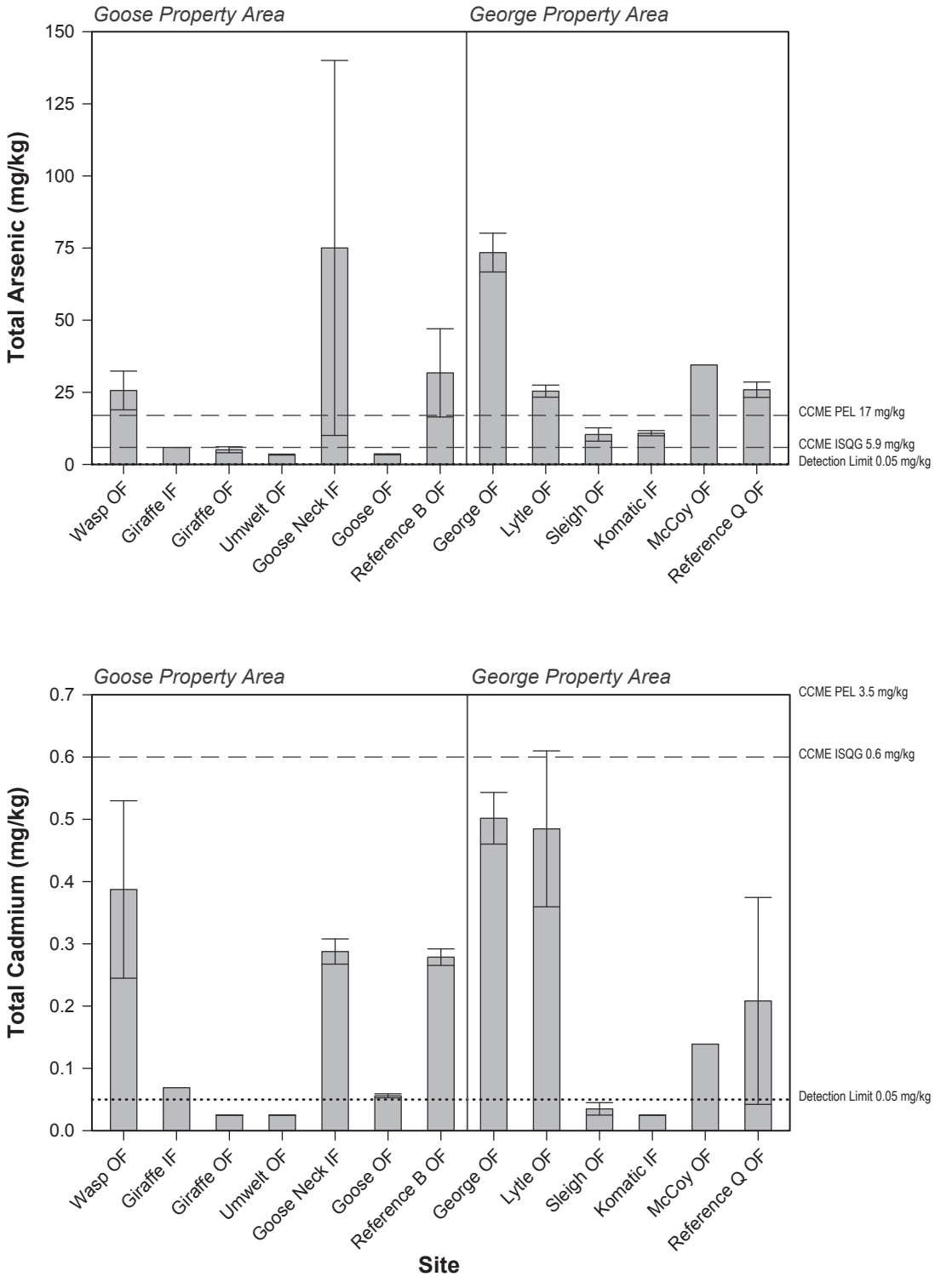
Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
Particle size and nutrients were not analyzed for McCoy OF samples.

Figure 3.6-3

Available Phosphate and Total Organic Carbon Concentrations in Stream Sediments, Back River Project, 2013

Sabina GOLD & SILVER CORP.

Rescan an ERM company



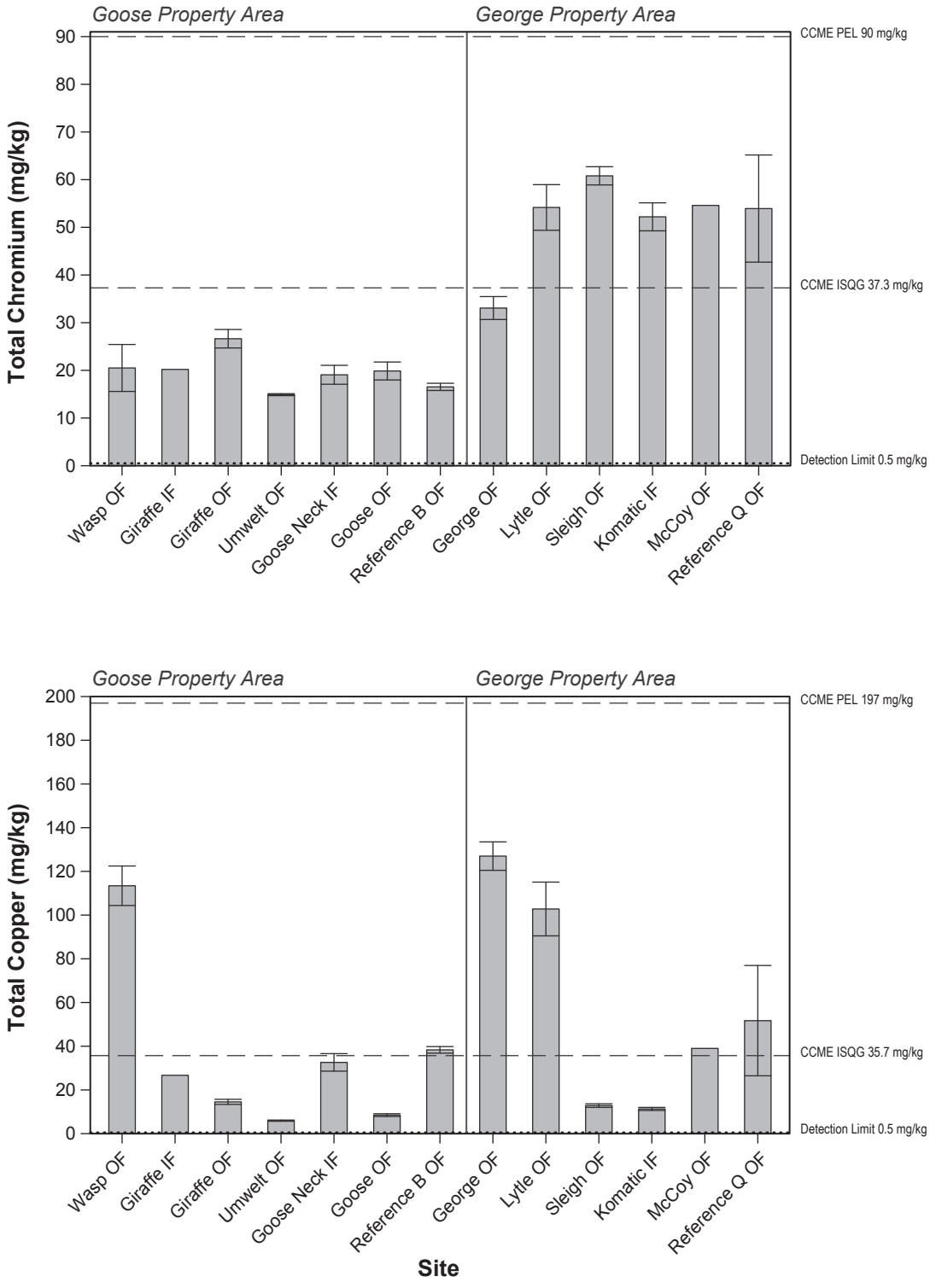
Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
Particle size and nutrients were not analyzed for McCoy OF samples.
CCME sediment quality guideline: PEL = probable effect level; ISQG = interim sediment quality guideline.

Figure 3.6-4

Arsenic and Cadmium Concentrations in Stream Sediments, Back River Project, July 2013

Sabina GOLD & SILVER CORP.

Rescan an ERM company



Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME sediment quality guideline: PEL = probable effect level; ISQG = interim sediment quality guideline.

Figure 3.6-5

Chromium and Copper Concentrations in Stream Sediments, Back River Project, July 2013

Sabina GOLD & SILVER CORP.

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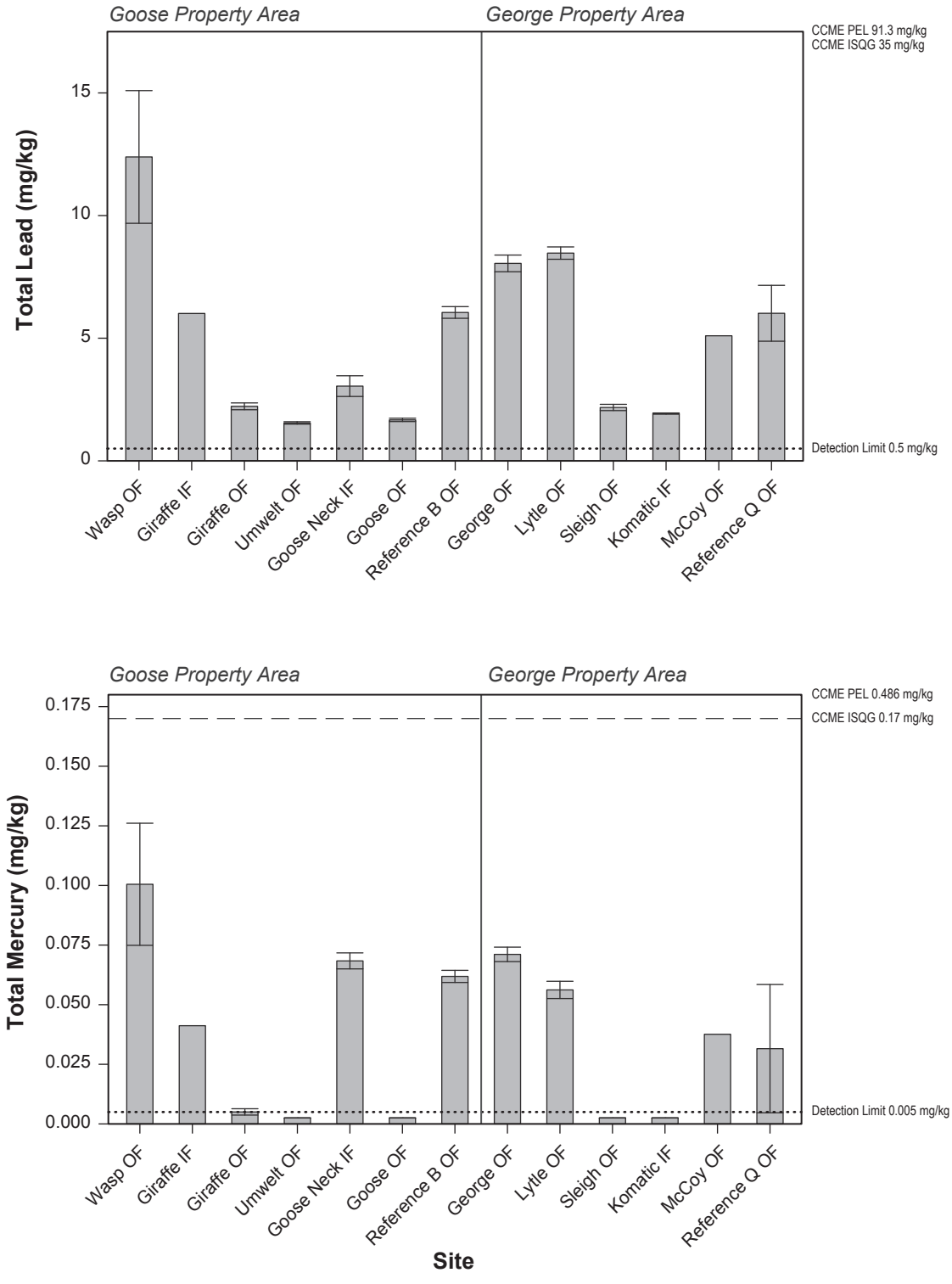

Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME sediment quality guideline: PEL = probable effect level; ISQG = interim sediment quality guideline.

Figure 3.6-6

Lead and Mercury Concentrations in Stream Sediments, Back River Project, July 2013

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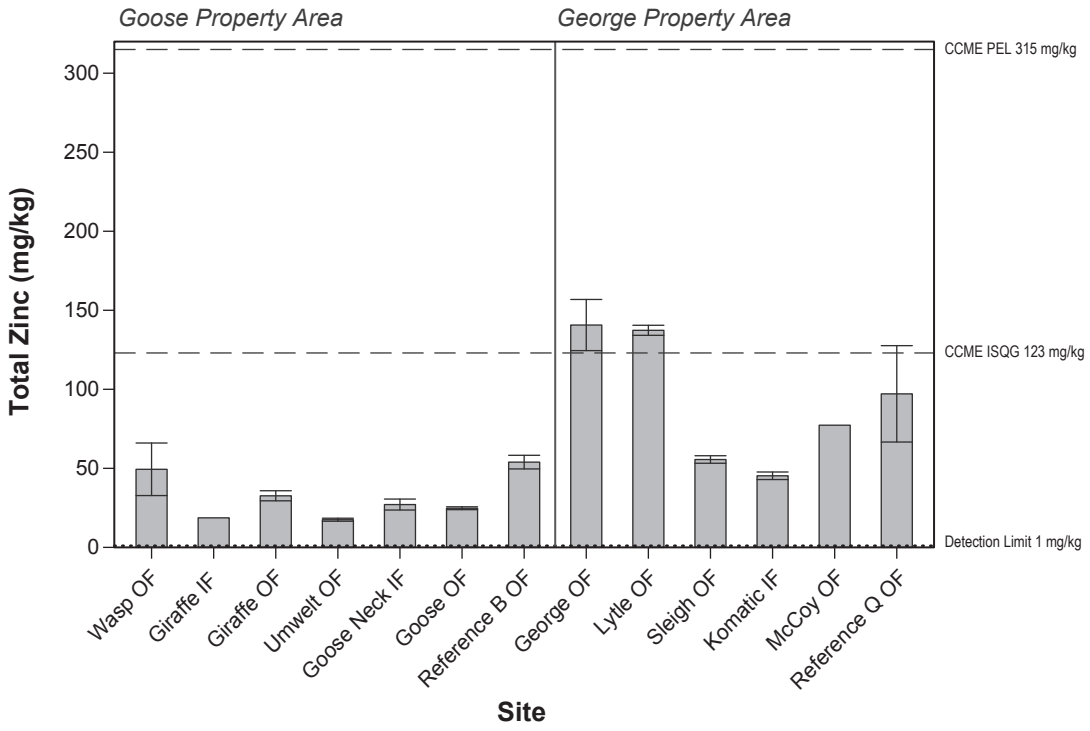

Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME sediment quality guideline: PEL = probable effect level; ISQG = interim sediment quality guideline.

Figure 3.6-7

Zinc Concentrations in Stream Sediments, Back River Project, July 2013

Sabina GOLD & SILVER CORP.

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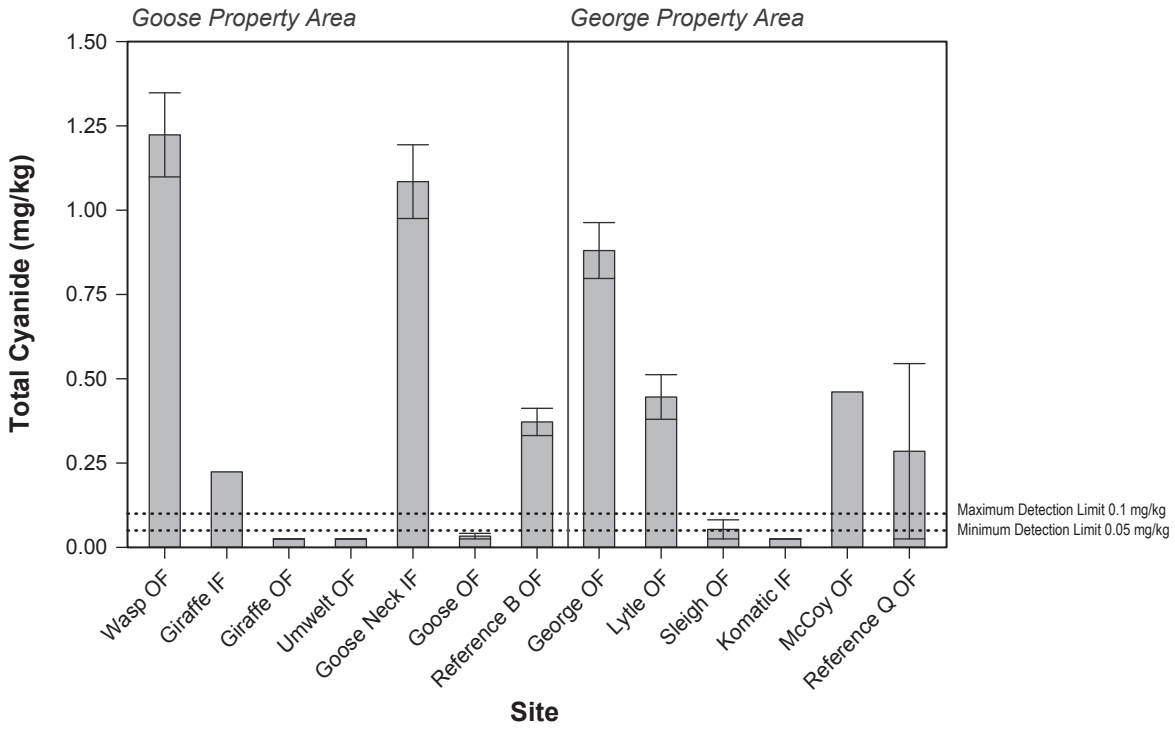


Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Figure 3.6-8

Total Cyanide Concentrations in Stream Sediments, Back River Project, July 2013

Sabina GOLD & SILVER CORP.

Rescan an ERM company

Goose Property streams had lower mean chromium concentrations than George Property streams (Figure 3.6-5). All Goose Property streams were below the CCME ISQG (37.3 mg/kg) for chromium, while five of the six George Property streams had at least one sample that was greater than the CCME ISQG. Except for George OF, George Property streams mean chromium concentrations ranged from 54 to 61 mg/kg, which was 1.4 to 1.7 times greater than the CCME guideline.

Copper was naturally elevated (above the ISQG of 35.7 mg/kg) in the sediments of Wasp OF and Reference B OF in the Goose Property and George OF, Lytle OF, McCoy OF, and Reference Q OF in the George Property ranging from 38.3 mg/kg to 127 mg/kg. Copper concentrations at Giraffe OF, Umwelt OF, Goose OF, Sleigh OF and Komatic IF were considerably lower, ranging from a mean of 5.9 mg/kg to 14.5 mg/kg (Figure 3.6-5).

Stream sediments had mean lead concentrations that ranged from 1.5 mg/kg at Umwelt OF to 12.4 mg/kg at Wasp OF, and showed similar spatial patterns among sites as observed in copper and arsenic (Figure 3.6-6). Concentrations of lead in all stream sediments were below the CCME ISQG (35 mg/kg).

Mercury concentrations were near or below detection limits (0.005 mg/kg) for sediments at Giraffe OF, Umwelt OF, Goose OF, Sleigh OF and Komatic IF (Figure 3.6-6). Other streams had mean sediment mercury concentrations ranging from 0.03 mg/kg to 0.10 mg/kg. All stream sediments were below the CCME ISQG for mercury (0.17 mg/kg).

Goose Property streams had lower zinc concentrations, ranging from a mean of 17.5 mg/kg to 53.9 mg/kg, compared to George Property streams, which ranged from a mean of 45.3 mg/kg to 140.7 mg/kg. Mean zinc concentrations were greater than the zinc CCME ISQG (123 mg/kg) at George OF and Lytle OF in the George Property (Figure 3.6-7).

3.6.4 Cyanides

Total cyanide concentrations ranged from below detection limits (0.05 and 0.1 mg/kg) at Giraffe OF, Umwelt OF, Goose OF and Komatic IF to 1.22 mg/kg at Wolf OF (Figure 3.6-8). WAD cyanide concentrations followed a similar trend but were lower, and the maximum average concentration observed was 0.51 mg/kg at Wasp OF.

3.6.5 Comparison with CCME Guidelines

Table 3.6-1 gives the percentage of stream sediment quality samples that were above their respective CCME guideline, and provides the average factor they were higher than CCME guidelines.

As with lakes, stream sediment arsenic levels were naturally elevated, with ten of 13 streams having sediments above the CCME ISQG. Several streams also had concentrations of cadmium, chromium, copper and zinc that were greater than their respective CCME ISQG levels. Only Giraffe IF, Umwelt OF and Goose OF had all metal concentrations below all CCME ISQG levels. As observed in the lake sediments, George Property streams generally had greater proportions of sediment replicates that were above CCME sediment guidelines and were greater by larger factors. Most George Property stream sites (five of the six) had at least one sample that was greater than the chromium ISQG, and over half of all sites had at least one sample that was greater than the copper ISQG. The CCME PELs were only surpassed for arsenic at Wasp OF, Goose Neck IF, Reference B OF, George OF, Lytle OF, McCoy OF, Reference Q OF.

Table 3.6-1. Stream Sediment Quality and CCME Guidelines, Back River Project, 2013

				Arsenic				Cadmium		Chromium		Copper		Zinc	
				ISQG[b]		PEL[c]		ISQG		ISQG		ISQG		ISQG	
			CCME Guideline Values[a]	5.9 mg/kg		17 mg/kg		0.6 mg/kg		37.3 mg/kg		35.7 mg/kg		123 mg/kg	
Lake Site	Total Number of Samples Collected	Number of parameters greater than CCME ISQG	Number of parameters greater than CCME PEL	Mean factor by which parameter was greater than CCME guideline	Percent of samples greater than CCME guideline	Mean factor by which parameter was greater than CCME guideline	Percent of samples greater than CCME guideline	Mean factor by which parameter was greater than CCME guideline	Percent of samples greater than CCME guideline	Mean factor by which parameter was greater than CCME guideline	Percent of samples greater than CCME guideline	Mean factor by which parameter was greater than CCME guideline	Percent of samples greater than CCME guideline	Mean factor by which parameter was greater than CCME guideline	Percent of samples greater than CCME guideline
Goose Property Area															
Wasp OF	3	3	1	4.34	100%	1.87	67%	1.05	33%	-	0%	3.18	100%	-	0%
Giraffe IF	1	-	-	-	0%	-	0%	-	0%	-	0%	-	0%	-	0%
Giraffe OF	3	1	-	1.21	33%	-	0%	-	0%	-	0%	-	0%	-	0%
Umwelt OF	3	-	-	-	0%	-	0%	-	0%	-	0%	-	0%	-	0%
Goose Neck IF	3	2	1	12.72	100%	12.06	33%	-	0%	-	0%	1.14	33%	-	0%
Goose OF	3	-	-	-	0%	-	0%	-	0%	-	0%	-	0%	-	0%
Reference B OF	3	2	1	5.38	100%	2.44	67%	-	0%	-	0%	1.11	67%	-	0%
George Property Area															
George OF	3	3	1	12.45	100%	4.32	100%	-	0%	-	0%	3.56	100%	1.26	67%
Lytle OF	3	5	1	4.31	100%	1.49	100%	1.23	33%	1.45	100%	2.88	100%	1.12	100%
Sleigh OF	3	2	-	1.76	100%	-	0%	-	0%	1.63	100%	-	0%	-	0%
Komatic IF	3	2	-	1.84	100%	-	0%	-	0%	1.40	100%	-	0%	-	0%
McCoy OF	1	3	1	5.85	100%	2.03	100%	-	0%	1.46	100%	1.09	100%	-	0%
Reference Q OF	3	4	1	4.39	100%	1.52	100%	-	0%	1.74	67%	2.86	33%	1.28	33%

Values represent the percent of samples that were greater than CCME guidelines and the mean factor by which those samples were greater than CCME guidelines.

a) Canadian sediment quality guidelines for the protection of aquatic life (CCME, accessed September 2013).

b) ISQG = Interim sediment quality guideline.

c) PEL = Probable Effects Level.

3.7 PRIMARY PRODUCERS

3.7.1 Phytoplankton

Lake phytoplankton biomass samples were collected from 18 lakes in April and/or July 2013, and phytoplankton taxonomy samples were collected from 17 lakes in July. Figures 3.7-1 to 3.7-3 present 2013 phytoplankton results, and the complete phytoplankton dataset is presented in Appendices 3.7-1 to 3.7-3. A variety of phytoplankton were observed in the July samples, with some of the more abundant taxa shown in Plate 3.7-1.

3.7.1.1 Biomass, Density and Community Composition

Lakes had low phytoplankton biomass (as chlorophyll *a*), with mean concentrations below 1 µg chl *a*/L at all lakes during both sampling sessions. This can be considered ultra-oligotrophic (Vollenweider and Kerekes 1982; Figure 3.7-1). Chlorophyll *a* levels were highest in Komatic Lake during the under-ice sampling in April, with a mean of 0.92 µg chl *a*/L. All other sites had mean biomass levels of 0.51 µg chl *a*/L or less during each sampling season. The lowest biomass was observed in George Central during April sampling, with a mean of 0.051 µg chl *a*/L.

Phytoplankton densities were also low in lakes, with site mean densities less than 3,000 cells/mL (Figure 3.7-1). The highest densities were found in Wasp, Rascal, Propeller, and Reference B lakes, with mean densities between 1,659 cells/mL and 2,711 cells/mL, and mean densities below 1,360 cells/mL in the remaining lakes. Differences in the patterns observed for biomass and density among the lakes may reflect changing community compositions (large compared to small phytoplankton species) or varying levels of intracellular chlorophyll *a* in different phytoplankton cells.

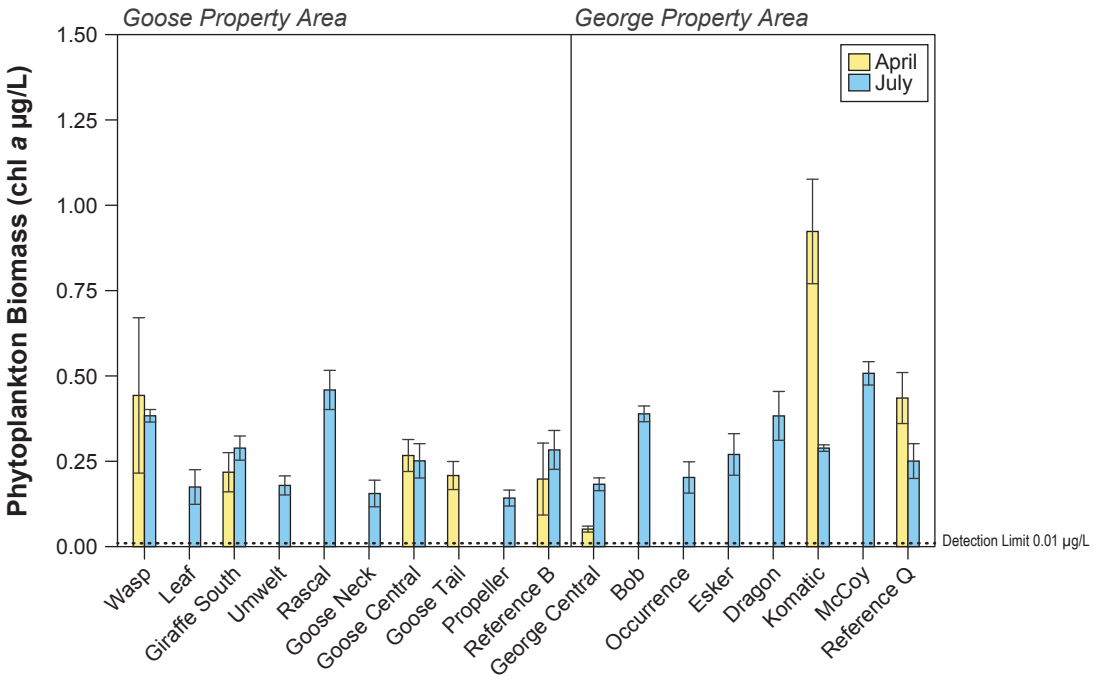
Lakes in the study area contained a diverse assemblage of phytoplankton taxa (Figure 3.7-2). Major phytoplankton classes observed were Myxophyceae (cyanobacteria) and Chrysophyceae (golden algae), with Cryptophyceae (a class of flagellated algae), Chlorophyceae (green algae), Bacillariophyceae (diatoms) and Dinophyceae (dinoflagellates) also present.

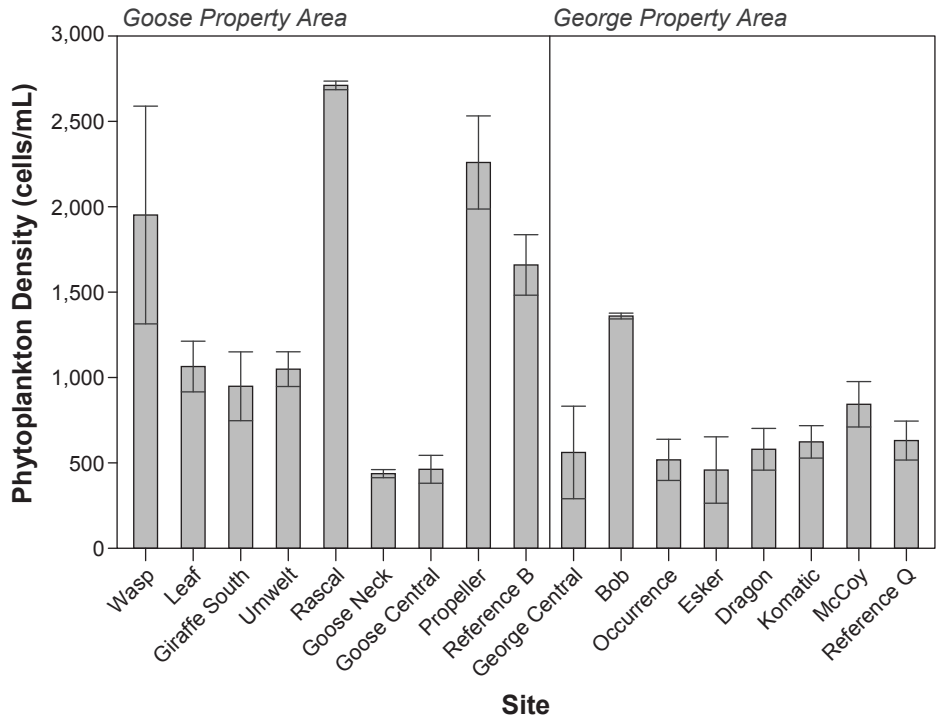
Goose Property lakes tended to have greater proportions of cyanobacteria in their phytoplankton communities than George Property lakes, with four of the nine sampled lake phytoplankton communities being over 50% cyanobacteria. George Property lakes tended to have greater proportions of cryptophytes than Goose Property lakes. Bob Lake, which had the greatest phytoplankton density, had a particularly distinct phytoplankton community composition with 90% chrysophytes and no cyanobacteria observed.

Phytoplankton communities were dominated by a few taxa, with the three most abundant genera comprising between 38% and 96% of phytoplankton sampled (Table 3.7-1). The most dominant genera were usually myxophycean or cryptophycean classes. The myxophycean genus *Aphanocapsa* was one of the top three genera present in 14 of the 17 lake sites. Other dominant genera common among several lakes (at least five of the 17 lake sites) were the diatom *Cyclotella*, the chrysophytes *Dinobryon* and *Ochromonas-Chromulina*, and the small cryptophyte *Rhodomonas* (Table 3.7-1; Plate 3.7-1).

3.7.1.2 Richness and Diversity

Genera richness tended to be lower in the George Property lakes than in the Goose Property lakes, as observed in 2012 (Figure 3.7-3; Rescan 2012b). Richness averaged from 6.3 genera/sample (Bob Lake) to 31 genera/sample (Wasp Lake). Bob Lake had the lowest phytoplankton diversity, with a mean Simpson's D of 0.19, likely due to the dominance of the chrysophyte *Dinobryon* that made up 90% of the community composition (Figure 3.6-3). All other lakes had moderately to highly diverse phytoplankton communities, with mean Simpson's D ranging from 0.60 to 0.90.





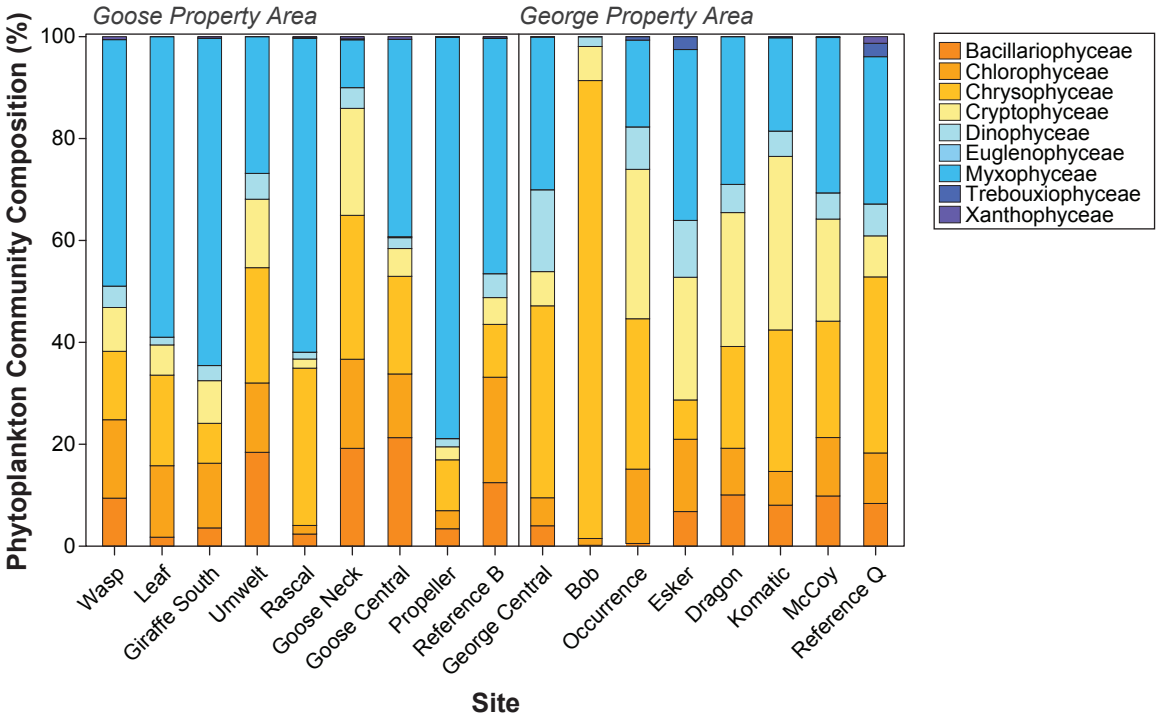
Note: Error bars represent the standard error of the mean.

Figure 3.7-1

Phytoplankton Biomass and Density in Lakes, Back River Project, July 2013

Sabina GOLD & SILVER CORP.

Rescan an ERM company



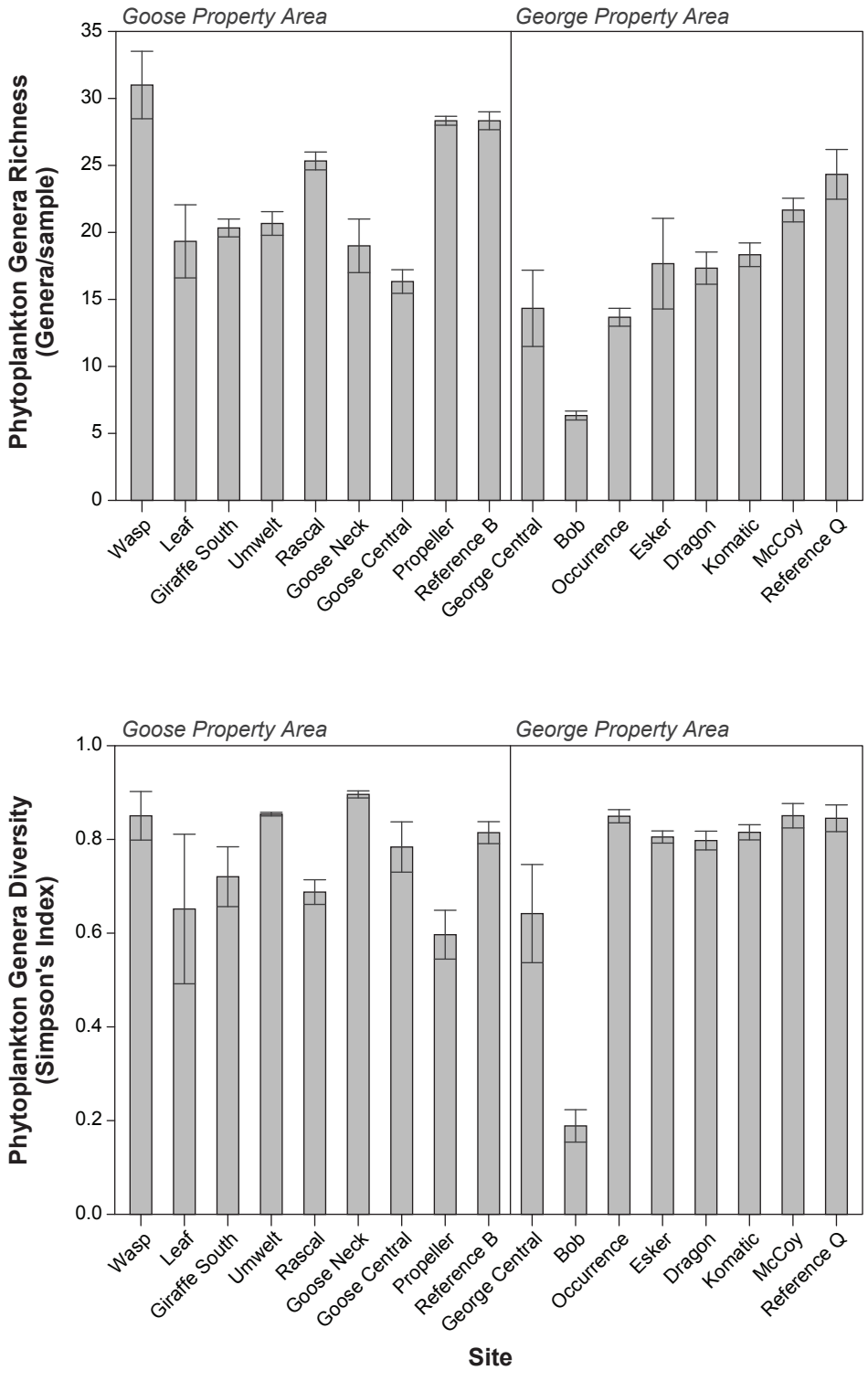
Note: Community composition values represent the mean of replicates.

Figure 3.7-2

Phytoplankton Community Composition in Lakes, Back River Project, July 2013

Sabina GOLD & SILVER CORP.

Rescan an ERM company



Note: Error bars represent the standard error of the mean.

Figure 3.7-3

Phytoplankton Richness and Diversity in Lakes, Back River Project, July 2013

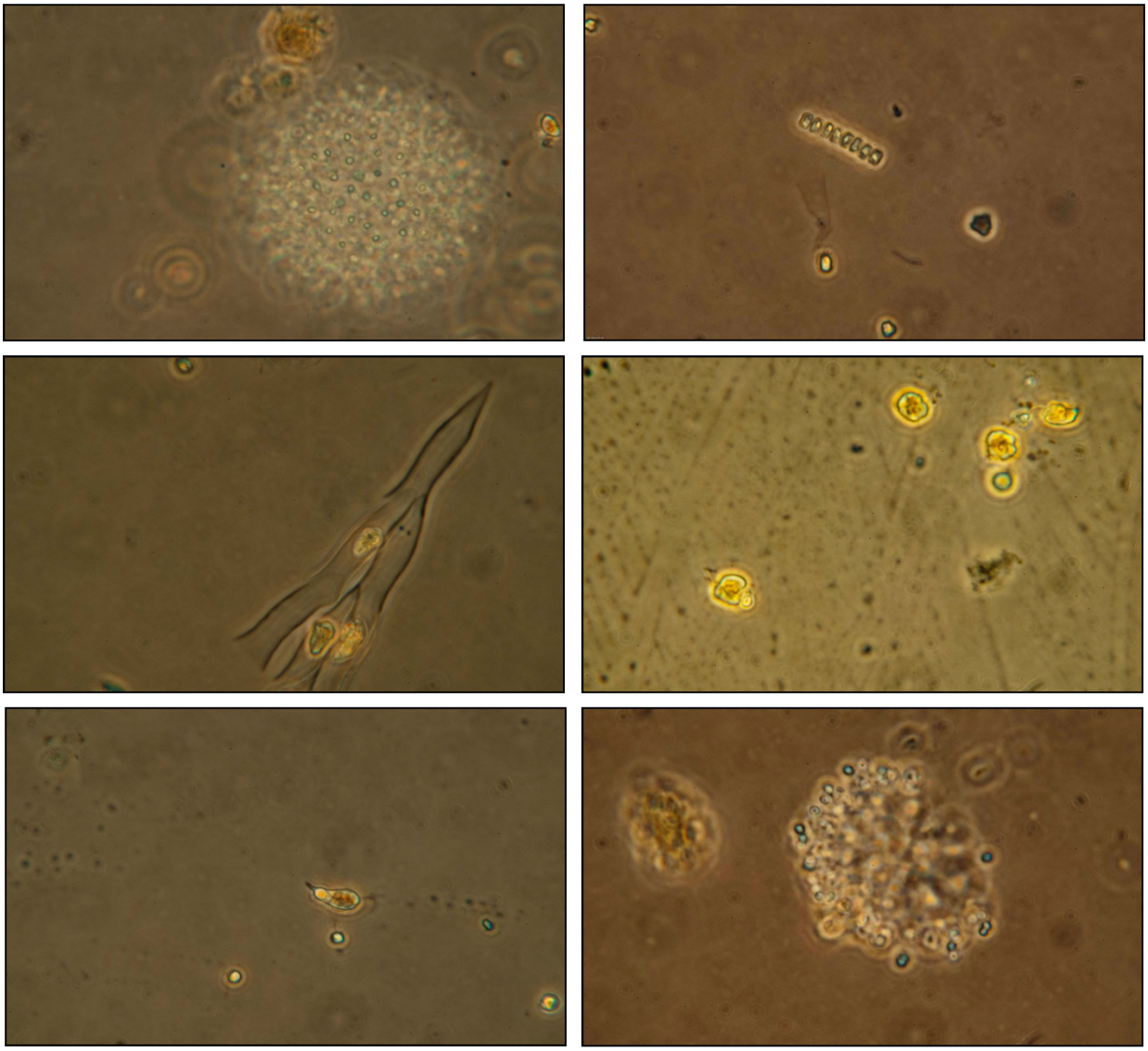


Plate 3.7-1. The most abundant phytoplankton genera observed. From top left to bottom right; Aphanocapsa planktonica *(Myxophyceae),* Cyclotella glomerata *(Bacillariophyceae),* Dinobryon sociale *(Chrysophyceae),* Ochromonas-Chromulina *(Chrysophyceae),* Rhodomonas minuta *(Cryptophceae) and* Snowella fennica *(Myxophyceae).*

Table 3.7-1. Most Abundant Phytoplankton Genera in Lakes, Back River Project, July 2013

Area	Site	Major Taxonomic Group	Genus	% Relative Abundance
Goose Property Area				
	Wasp	Myxophyceae	*Aphanocapsa*	26.4%
		Myxophyceae	*Snowella*	9.9%
		Chlorophyceae	*Botryococcus*	8.3%
	Leaf	Myxophyceae	*Aphanocapsa*	49.7%
		Chrysophyceae	*Chrysocapsa*	10.2%
		Chrysophyceae	*Ochromonas-Chromulina*	5.6%
	Giraffe South	Myxophyceae	*Aphanocapsa*	47.1%

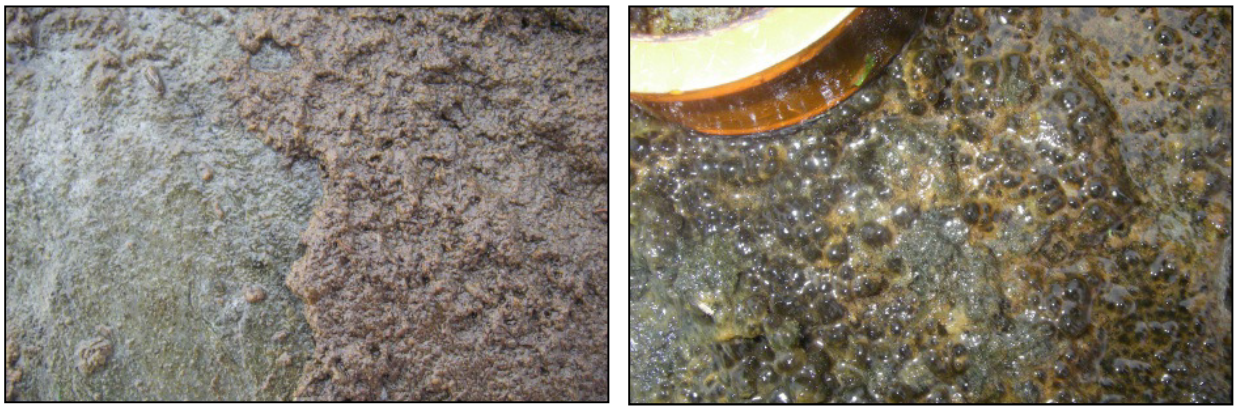
(continued)

Table 3.7-1. Most Abundant Phytoplankton Genera in Lakes, Back River Project, July 2013 (completed)

Area	Site	Major Taxonomic Group	Genus	% Relative Abundance
Goose Property Area *(cont'd)*				
	Giraffe South *(cont'd)*	Myxophyceae	*Coelosphaerium*	9.7%
		Chlorophyceae	*Elakatothrix*	6.5%
	Umwelt	Bacillariophyceae	*Cyclotella*	17.9%
		Chrysophyceae	*Ochromonas-Chromulina*	17.9%
		Myxophyceae	*Chroococcus*	16.6%
	Rascal	Myxophyceae	*Aphanocapsa*	30.4%
		Myxophyceae	*Aphanothece*	28.5%
		Chrysophyceae	*Prymnesium*	27.5%
	Goose Neck	Chrysophyceae	*Dinobryon*	13.4%
		Bacillariophyceae	*Cyclotella*	12.7%
		Cryptophyceae	*Rhodomonas*	12.3%
	Goose Central	Myxophyceae	*Aphanocapsa*	29.2%
		Bacillariophyceae	*Cyclotella*	12.6%
		Chrysophyceae	*Dinobryon*	10.1%
	Propeller	Myxophyceae	*Aphanocapsa*	60.9%
		Myxophyceae	*Aphanothece*	10.4%
		Chrysophyceae	*Dinobryon*	5.2%
	Reference B	Myxophyceae	*Aphanocapsa*	35.6%
		Chlorophyceae	*Botryococcus*	13.0%
		Bacillariophyceae	*Cyclotella*	12.3%
George Property Area				
	George Central	Chrysophyceae	*Dinobryon*	32.7%
		Myxophyceae	*Aphanocapsa*	24.7%
		Dinophyceae	*Gymnodinium*	14.5%
	Bob	Chrysophyceae	*Dinobryon*	89.9%
		Cryptophyceae	*Rhodomonas*	3.3%
		Cryptophyceae	*Cryptomonas*	3.1%
	Occurrence	Chrysophyceae	*Ochromonas-Chromulina*	22.3%
		Cryptophyceae	*Rhodomonas*	18.0%
		Myxophyceae	*Aphanocapsa*	15.1%
	Esker	Cryptophyceae	*Rhodomonas*	15.2%
		Myxophyceae	*Aphanocapsa*	13.4%
		Myxophyceae	*Snowella*	12.9%
	Dragon	Cryptophyceae	*Rhodomonas*	21.4%
		Myxophyceae	*Snowella*	14.2%
		Myxophyceae	*Aphanocapsa*	13.5%
	Komatic	Cryptophyceae	*Rhodomonas*	26.6%
		Myxophyceae	*Aphanocapsa*	18.2%
		Chrysophyceae	*Ochromonas-Chromulina*	13.0%
	McCoy	Myxophyceae	*Aphanocapsa*	22.3%
		Cryptophyceae	*Rhodomonas*	14.6%
		Chrysophyceae	*Dinobryon*	10.2%
	Reference Q	Myxophyceae	*Aphanocapsa*	21.9%
		Chrysophyceae	*Ochromonas-Chromulina*	18.9%
		Bacillariophyceae	*Cyclotella*	7.2%

3.7.2 Periphyton

Stream periphyton samples were collected in July 2013. Figures 3.7-4 to 3.7-6 present the periphyton biomass and taxonomic results, and the raw data are presented in Appendices 3.7-4 to 3.7-6. A variety of primary producers were observed in streams during field sampling, with selected examples shown in Plate 3.7-2.



a) b)

Plate 3.7-2. Examples of benthic primary producers observed in streams. a) biofilm mats at Reference B OF; b) periphyton cover at McCoy OF.

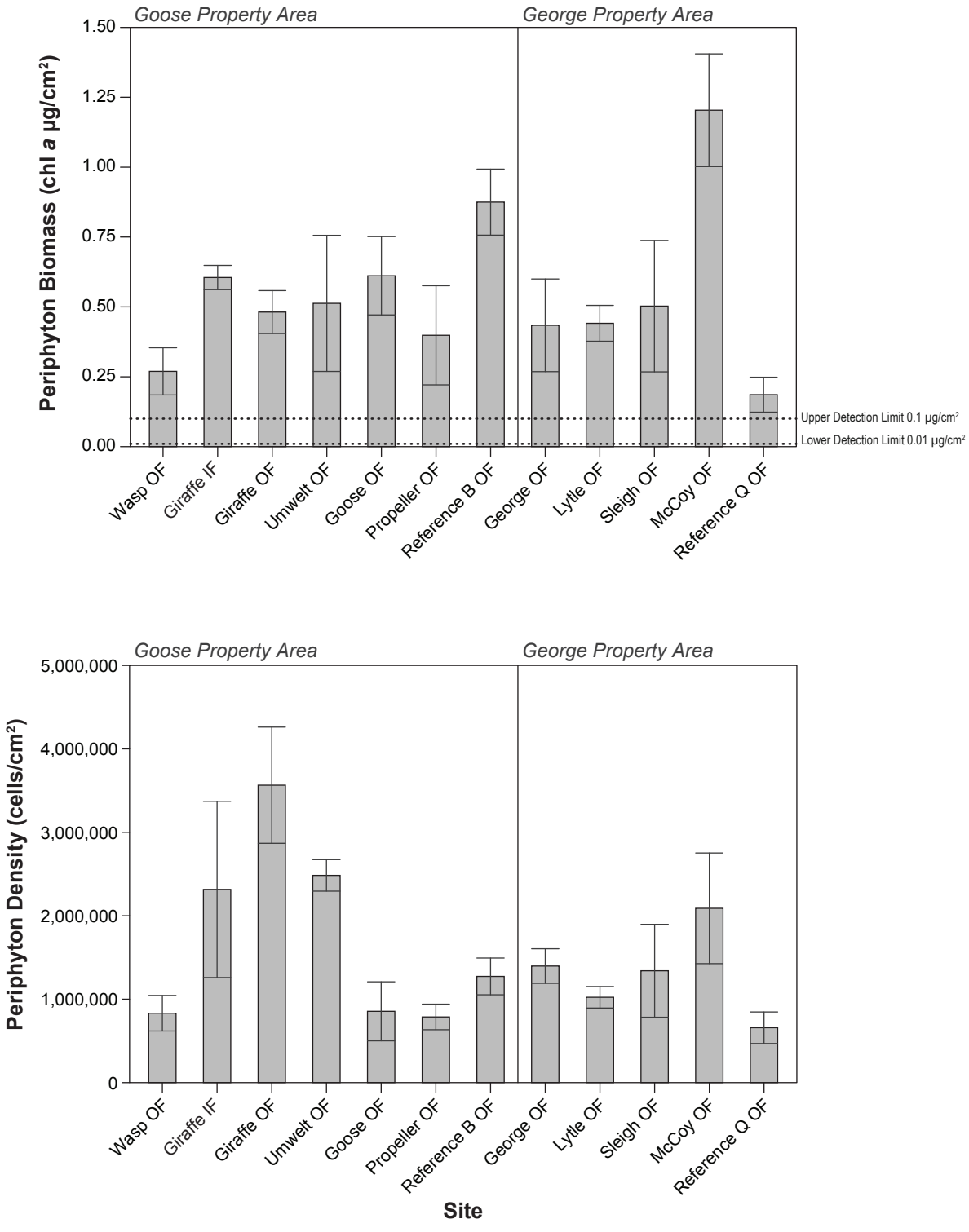
3.7.2.1 Biomass, Density and Community Composition

Mean periphyton biomass (as chlorophyll *a*) ranged from 0.19 µg chl *a*/cm^2 at Reference Q OF to 1.2 µg chl *a*/cm^2 at McCoy OF (Figure 3.7-4). Most streams had mean periphyton biomass between 0.40 and 0.61 µg chl *a*/cm^2. Spatial patterns in biomass did not closely follow densities, which may have reflected variation in the size of the dominant algae and the chlorophyll *a* content in different taxa.

Periphyton densities ranged five-fold over the sampled streams (Figure 3.7-4). Mean periphyton densities ranged from 658,000 cells/cm^2 at Reference Q OF to 3,560,000 cells/cm^2 at Giraffe OF, and tended to be greater in July 2013 than in August 2012 (Rescan 2012b).

Periphyton communities were dominated by Myxophyceae (cyanobacteria), with Bacillariophyceae (diatoms) making an important contribution to the communities (Figure 3.7-5). Chlorophyceae (green algae), Chrysophyceae (golden algae) and Dinophyceae (dinoflagellates) were also present at some sites. The highest proportions of cyanobacteria were observed at Umwelt OF, Wasp OF, Reference B OF, George OF, Sleigh OF and Reference Q OF (>95%), while highest proportions of diatoms were observed at GIRAFFE IF, Lytle OF and McCoy OF (>14%).

The three most dominant genera made up between 24% and 32% of stream periphyton community composition (Table 3.7-2). The cyanobacteria genera *Calothrix* and *Homeothrix* were among the top three dominant genera at all sites, while the diatom genera *Tabellaria* was among the top three dominant genera at seven of the 12 sites. Plate 3.7-3 contains images of these three dominant genera.



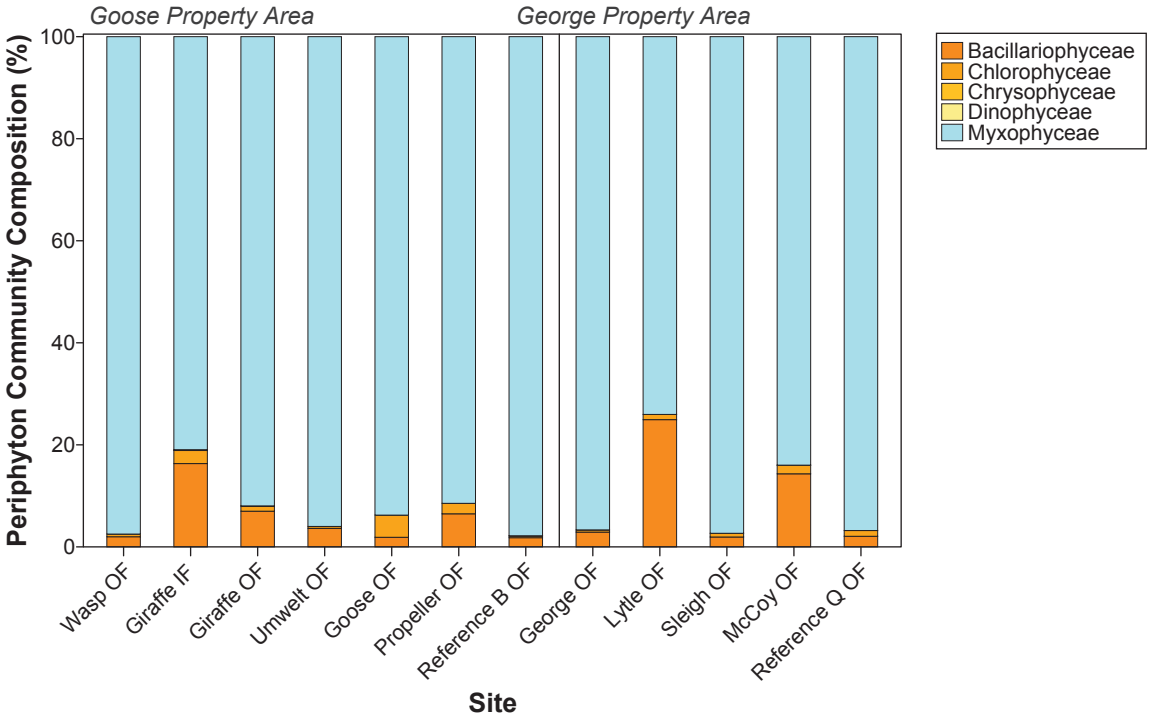
Note: Error bars represent the standard error of the mean.

Figure 3.7-4

Periphyton Biomass and Density in Streams, Back River Project, July 2013

Sabina GOLD & SILVER CORP.

Rescan an ERM company



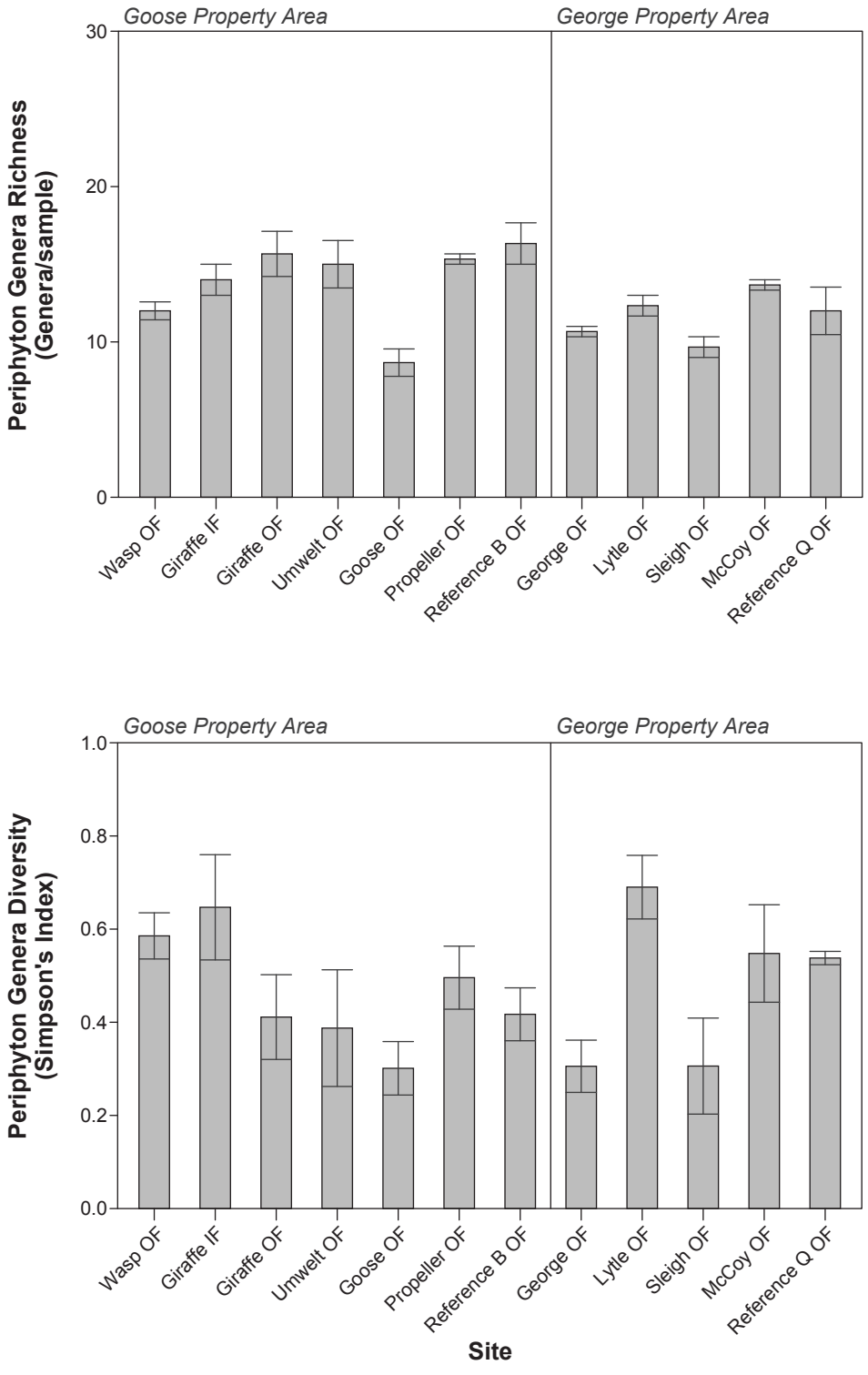
Note: Community composition values represent the mean of replicates.

Figure 3.7-5

Periphyton Community Composition in Streams, Back River Project, July 2013

Sabina GOLD & SILVER CORP.

Rescan an ERM company



Note: Error bars represent the standard error of the mean.

Figure 3.7-6

Periphyton Richness and Diversity in Streams, Back River Project, July 2013

Sabina GOLD & SILVER CORP.

Rescan an ERM company

Table 3.7-2. Most Abundant Periphyton Genera in Streams, Back River Project, 2013

Area	Site	Major Taxonomic Group	Genus	% Relative Abundance
Goose Property Area				
	Wasp OF	Myxophyceae	*Homoeothrix*	45.2%
		Myxophyceae	*Calothrix*	40.5%
		Myxophyceae	*Stigonema*	8.4%
	Giraffe IF	Myxophyceae	*Homoeothrix*	51.0%
		Myxophyceae	*Calothrix*	16.3%
		Bacillariophyceae	*Tabellaria*	8.8%
	Giraffe OF	Myxophyceae	*Homoeothrix*	74.6%
		Myxophyceae	*Calothrix*	12.0%
		Bacillariophyceae	*Tabellaria*	4.2%
	Umwelt OF	Myxophyceae	*Homoeothrix*	74.9%
		Myxophyceae	*Calothrix*	14.1%
		Myxophyceae	*Dichothrix*	2.7%
	Goose OF	Myxophyceae	*Homoeothrix*	82.8%
		Myxophyceae	*Calothrix*	7.8%
		Chlorophyceae	*Bulbochaete*	2.9%
	Propeller OF	Myxophyceae	*Homoeothrix*	62.6%
		Myxophyceae	*Calothrix*	22.3%
		Bacillariophyceae	*Tabellaria*	5.5%
	Reference B OF	Myxophyceae	*Homoeothrix*	74.0%
		Myxophyceae	*Calothrix*	17.1%
		Myxophyceae	*Chroococcus*	2.3%
George Property Area				
	George OF	Myxophyceae	*Homoeothrix*	81.8%
		Myxophyceae	*Calothrix*	13.1%
		Bacillariophyceae	*Tabellaria*	1.4%
	Lytle OF	Myxophyceae	*Homoeothrix*	32.7%
		Myxophyceae	*Calothrix*	26.8%
		Bacillariophyceae	*Navicula*	13.6%
	Sleigh OF	Myxophyceae	*Calothrix*	80.7%
		Myxophyceae	*Homoeothrix*	15.3%
		Bacillariophyceae	*Phormidium*	1.4%
	McCoy OF	Myxophyceae	*Homoeothrix*	63.4%
		Myxophyceae	*Calothrix*	13.0%
		Bacillariophyceae	*Tabellaria*	7.1%
	Reference Q OF	Myxophyceae	*Homoeothrix*	48.2%
		Myxophyceae	*Calothrix*	47.8%
		Bacillariophyceae	*Tabellaria*	1.0%

Plate 3.7-3. Calothrix *(top left),* Tabellaria *(top right) and* Homoeothrix *were the dominant genera in most streams.*

3.7.2.2 Richness and Diversity

Goose OF had the lowest periphyton richness and diversity of all sites though the reason for this is not clear. Periphyton genera richness ranged from a mean of 8.7 genera/sample at Goose OF to 16.3 genera/sample at Reference B OF (Figure 3.7-6). Periphyton diversity at the genus level was low to moderate ranging from a mean of 0.30 at Goose OF to 0.69 at Lytle OF (Simpson's D).

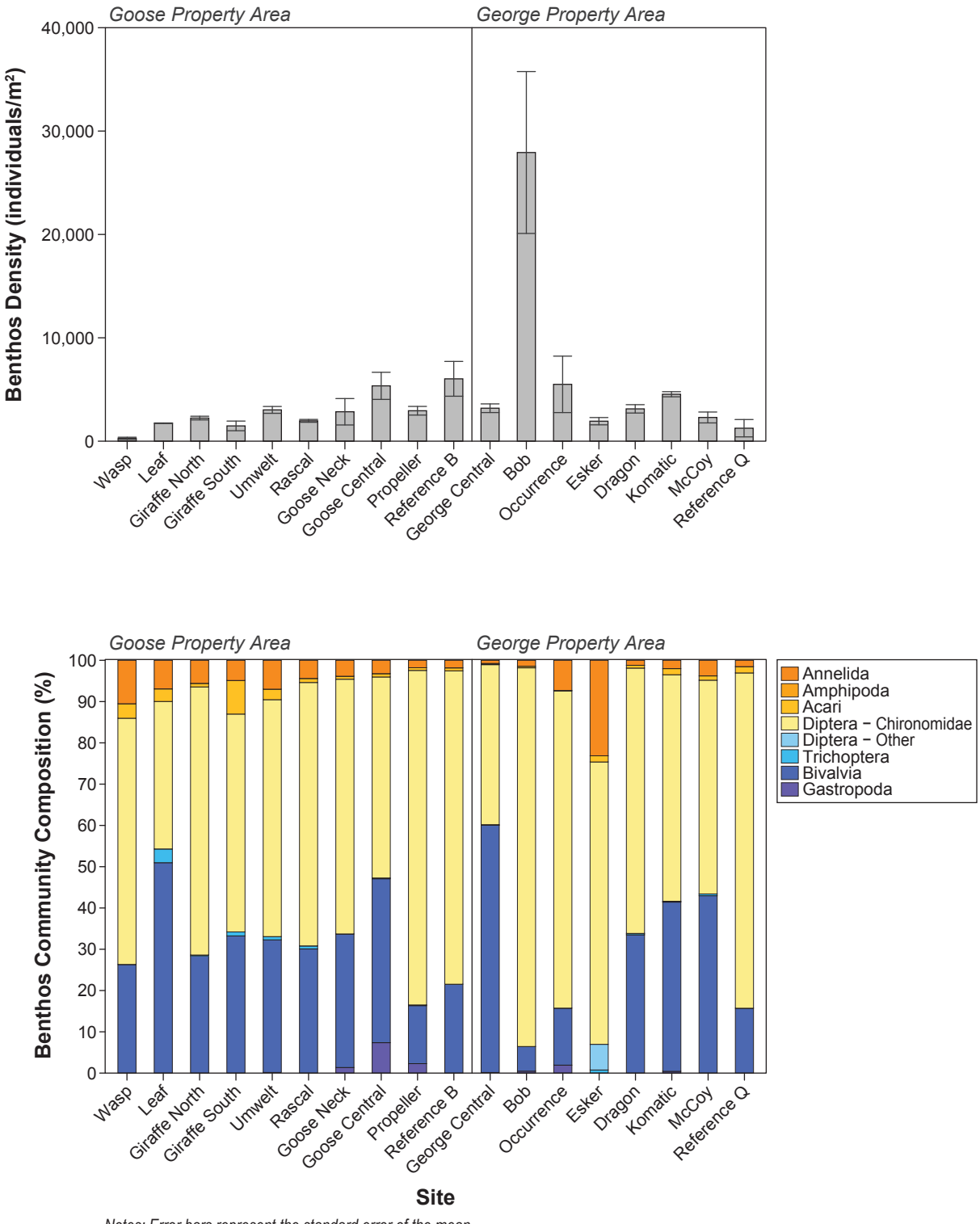
3.8 BENTHIC MACROINVERTEBRATES

3.8.1 Lake Benthic Macroinvertebrates

Lake benthic macroinvertebrate (benthos) samples were collected in July 2013. Figures 3.8-1 and 3.8-2 present the lake benthos results, and the complete dataset is presented in Appendices 3.8-1 to 3.8-3. Sorting efficiencies for lake benthos samples were above 90% on the first sort for all samples, suggesting robust data free of sorting bias.

3.8.1.1 Density and Community Composition

Mean benthos densities varied considerably among lakes, ranging from 274 to 6,030 individuals/m^2 in most lakes (Figure 3.8-1). The exception was the small Bob Lake, which had a mean density of 27,900 individuals/m^2.



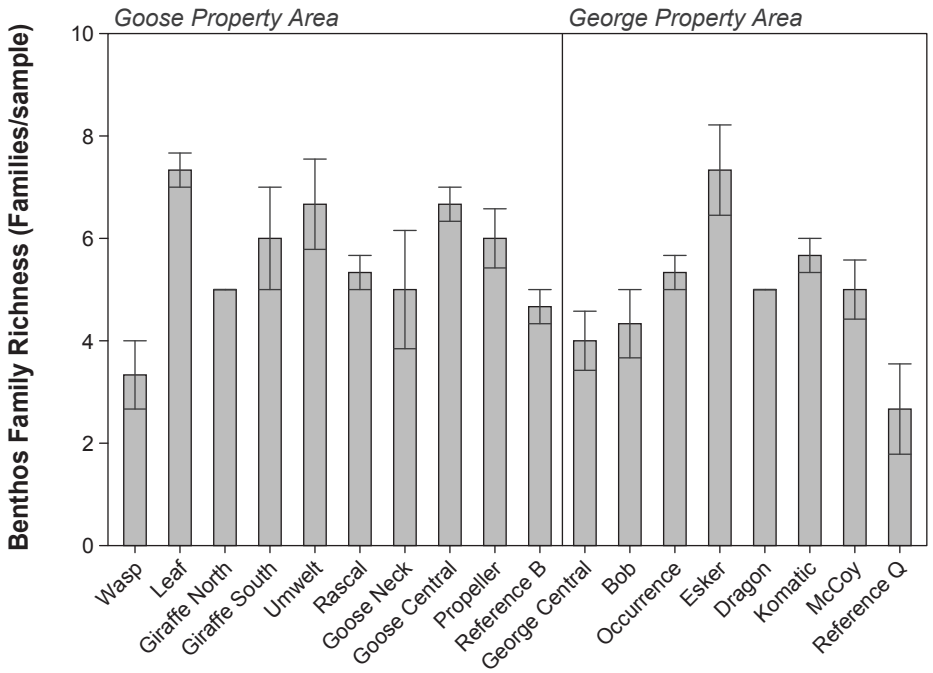
Notes: Error bars represent the standard error of the mean.
Community composition values represent the mean of replicates.
Immature, damaged and unidentified individuals were excluded from all analyses except density calculations.
Branchiopoda, Cladocera, Collembola, Copepoda, Nematoda, Ostracoda, Platyhelminthes and terrestrial invertebrates were excluded from all calculations.

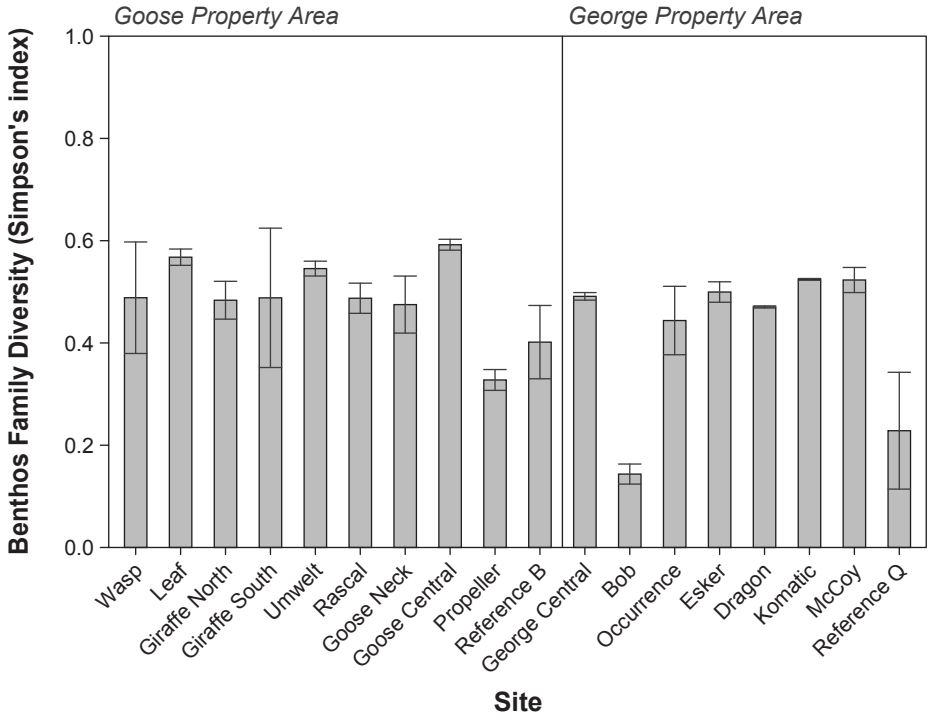
Figure 3.8-1

Benthos Density and Community Composition in Lakes, Back River Project, July 2013

Sabina GOLD & SILVER CORP.

Rescan an ERM company





Notes: Community composition values represent the mean of replicates.
Immature, damaged and unidentified individuals were excluded from all analyses except density calculations.
Branchiopoda, Cladocera, Collembola, Copepoda, Nematoda, Ostracoda, Platyhelminthes and terrestrial invertebrates were excluded from all calculations.

Figure 3.8-2

Benthos Richness and Diversity in Lakes, Back River Project, July 2013

Sabina GOLD & SILVER CORP.

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Benthic communities at all lake sites were dominated by chironomid dipterans (non-biting midge flies) and bivalves from the family Sphaeriidae (small to tiny pea clams; Plate 3.8-1). Chironomids and bivalves made up over 85% of the benthos community at the sites sampled, except the shallow Esker Pond (68%; Figure 3.8-1). Other benthic invertebrates found in lakes included acari (mites and ticks), amphipods (scuds), annelids (ringed worms), other dipterans (non-chironomid), gastropods (freshwater snails) and trichopterans (caddisflies).

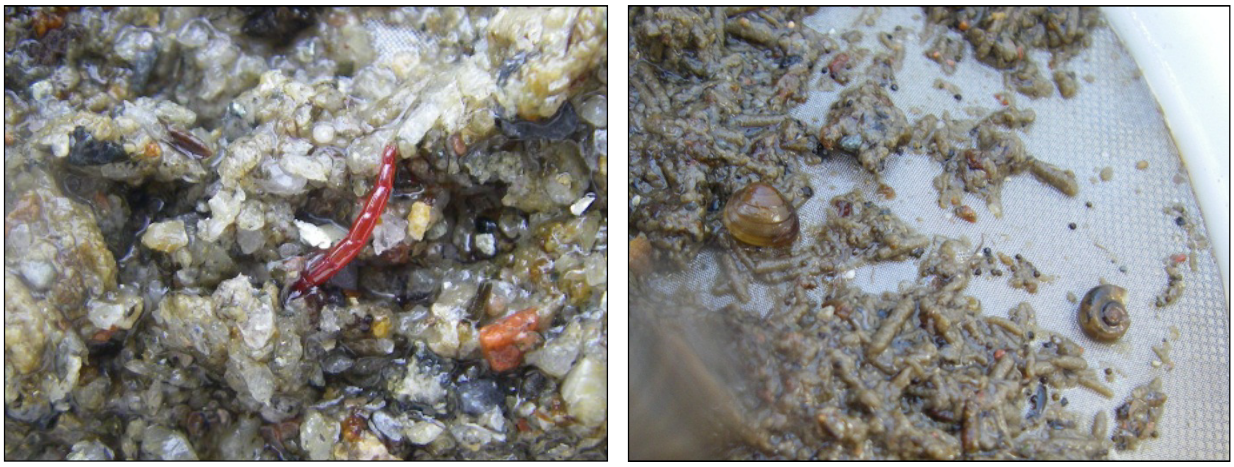


Plate 3.8-1. Chironomids and bivalves (from family Sphaeriidae) were common in lake benthic communities. Left, a chironomid collected from Goose Lake Neck; right, a bivalve collected from Propeller Lake.

Lake benthos communities were often dominated by a few highly abundant genera. The three most abundant genera made up between 25% and 68% of the mean benthic community composition at each lake site (Table 3.8-1). The chironomid dipteran genera *Procladius, Psectrocladius* and *Stictochironomus* were common at all sites, and frequently within the top three most abundant genera. Other common genera in the top three taxa for approximately a quarter of lakes sampled included the chironomid dipteran *Tanytarsus,* and the pea clam *Psidium*. The lake with the greatest benthos densities, Bob Lake, had particularly high concentrations of the chironomid genera *Paratanytarsus, Corynocera* and *Tanytarsus* which made up 68% of total individuals.

Table 3.8-1. Most Abundant Benthic Macroinvertebrate Genera in Lakes, Back River Project, 2013

Area	Site	Major Taxonomic Group	Genus	% Relative Abundance
Goose Property Area				
	Wasp	Diptera - Chironomidae	*Stictochironomus*	33.4
		Diptera - Chironomidae	*Monodiamesa*	10.4
		Diptera - Chironomidae	*Tanytarsus*	9.8
	Leaf	Diptera - Chironomidae	*Stictochironomus*	13.0
		Diptera - Chironomidae	*Heterotrissocladius*	8.9
		Bivalvia	*Pisidium*	6.1
	Giraffe North	Diptera - Chironomidae	*Psectrocladius*	14.5
		Bivalvia	*Pisidium*	13.5
		Diptera - Chironomidae	*Tanytarsus*	10.7
	Giraffe South	Diptera - Chironomidae	*Stictochironomus*	20.0
		Bivalvia	*Pisidium*	11.4
		Diptera - Chironomidae	*Psectrocladius*	6.3

(continued)

Table 3.8-1. Most Abundant Benthic Macroinvertebrate Genera in Lakes, Back River Project, 2013 (completed)

Area	Site	Major Taxonomic Group	Genus	% Relative Abundance
Goose Property Area *(cont'd)*				
	Umwelt	Diptera - Chironomidae	*Procladius*	21.6
		Diptera - Chironomidae	*Polypedilum*	17.1
		Diptera - Chironomidae	*Corynocera*	5.2
	Rascal	Diptera - Chironomidae	*Cryptochironomus*	14.0
		Diptera - Chironomidae	*Procladius*	13.9
		Diptera - Chironomidae	*Ablabesmyia*	8.9
	Goose Neck	Diptera - Chironomidae	*Stictochironomus*	19.8
		Diptera - Chironomidae	*Pagastiella*	16.0
		Diptera - Chironomidae	*Procladius*	11.2
	Goose Central	Diptera - Chironomidae	*Stictochironomus*	12.2
		Diptera - Chironomidae	*Procladius*	8.7
		Diptera - Chironomidae	*Psectrocladius*	8.2
	Propeller	Diptera - Chironomidae	*Zalutschia*	53.2
		Diptera - Chironomidae	*Psectrocladius*	6.5
		Diptera - Chironomidae	*Stictochironomus*	6.5
	Reference B	Diptera - Chironomidae	*Tanytarsus*	43.6
		Diptera - Chironomidae	*Procladius*	8.2
		Diptera - Chironomidae	*Psectrocladius*	7.1
George Property Area				
	George Central	Diptera - Chironomidae	*Heterotrissocladius*	14.3
		Diptera - Chironomidae	*Psectrocladius*	5.6
		Diptera - Chironomidae	*Mesocricotopus*	5.4
	Bob	Diptera - Chironomidae	*Paratanytarsus*	35.4
		Diptera - Chironomidae	*Corynocera*	18.8
		Diptera - Chironomidae	*Tanytarsus*	14.1
	Occurrence	Diptera - Chironomidae	*Paratanytarsus*	33.8
		Diptera - Chironomidae	*Psectrocladius*	9.9
		Diptera - Chironomidae	*Tanytarsus*	8.3
	Esker	Diptera - Chironomidae	*Procladius*	43.2
		Diptera - Chironomidae	*Paratanytarsus*	10.2
		Diptera - Chironomidae	*Psectrocladius*	3.4
	Dragon	Diptera - Chironomidae	*Psectrocladius*	29.9
		Diptera - Chironomidae	*Stictochironomus*	11.3
		Bivalvia	*Pisidium*	8.1
	Komatic	Diptera - Chironomidae	*Stictochironomus*	20.1
		Diptera - Chironomidae	*Microtendipes*	9.4
		Bivalvia	*Pisidium*	6.6
	McCoy	Bivalvia	*Pisidium*	17.0
		Diptera - Chironomidae	*Stictochironomus*	14.6
		Diptera - Chironomidae	*Procladius*	13.9
	Reference Q	Diptera - Chironomidae	*Procladius*	32.8
		Diptera - Chironomidae	*Heterotrissocladius*	12.6
		Diptera - Chironomidae	*Microtendipes*	12.1

3.8.1.2 Richness and Diversity

Lake benthos family richness ranged from a mean of 2.7 to 7.3 families/site, with the lowest found at Bob Lake and the greatest at Leaf (Goose Property) and Esker (George Property) lakes. Benthos communities in most lakes were moderately diverse (between 0.40 and 0.60), although lower diversity communities such as those in Propeller, Bob and Reference Q lakes were present. Because of the overwhelming dominance of chironomids, Bob Lake had the lowest benthos diversity (0.14) in the Project area.

3.8.2 Stream Benthic Macroinvertebrates

Stream benthos samples were collected in July 2013. No benthos samples could be collected at Goose Neck IF, McCoy IF or McCoy OF due to low water levels during July sampling. Figures 3.8-3 and 3.8-4 present the 2013 results, and the complete taxonomic dataset is presented in Appendices 3.8-4 to 3.8-6. Sorting efficiencies for stream benthos samples were above 90% on the first sort for 35 of the 36 resorted samples, suggesting robust data free of sorting bias.

3.8.2.1 Density and Community Composition

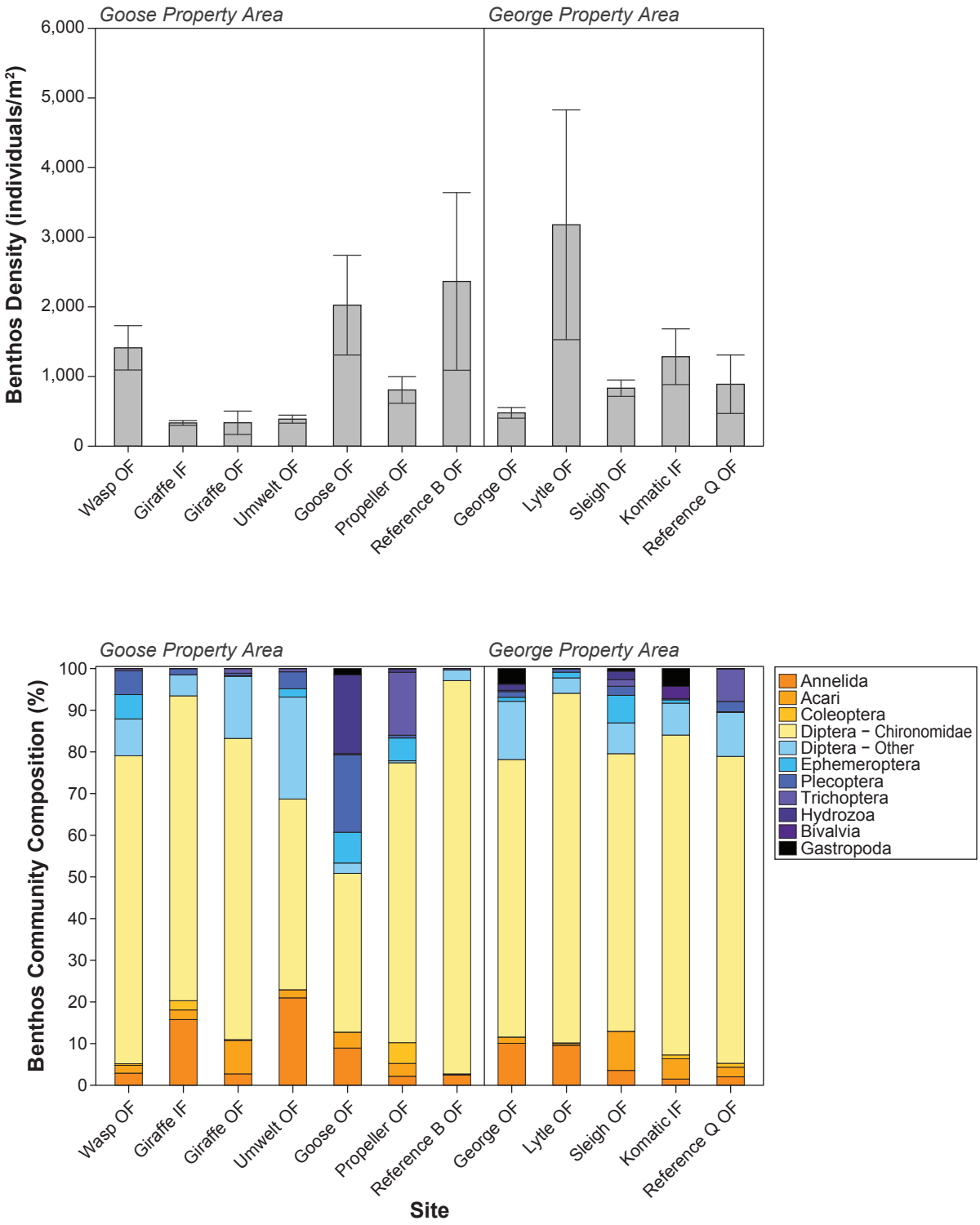
Benthos densities ranged from a mean of 330 organisms/m^2 (Giraffe IF) to 3,180 individuals/m^2 (Lytle OF; Figure 3.8-3), and was similar to ranges found in the 2011 and 2012 (Rescan 2012a, 2012b). Wasp OF, Goose OF, Reference B, Komatic IF, and Lytle OF had mean densities above 1,000 individuals/m^2. There were no clear spatial patterns between Goose and George Property stream benthos densities or community composition in 2013.

Stream benthos communities were dominated by chironomid dipterans (non-biting midges), which averaged over 65% of the benthic organisms sampled at most streams, chironomids were less prevalent at Umwelt OF and Goose OF (46% and 38% of these communities, respectively) (Figure 3.8-3). Other dipterans, Acari (arachnid mites and ticks) and annelid worms were also present and combined made up 18% of all benthos individuals collected. The pollution sensitive orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies; EPT) were also present, with each order making up a mean of 2 to 3% of the stream benthos community in the sampled streams. Highest proportions of EPT were observed at Goose OF (8.8%) and Propeller OF (7.1%). The remainder of the stream benthos communities were made up of hydrozoans (in the same phylum as jellies), Gastropoda (snails), Coleoptera (beetles) and bivalves (in the pea clam family Sphaeriidae). Examples of some of the stream benthic invertebrates observed during sampling are shown in Plates 3.8-2 to 3.8-4.

The most abundant three genera made up a mean of between 33% and 67% of stream benthic communities among sites (Table 3.8-2). In most streams, a single genus made up over 30% of the benthic community, with the most dramatic example being the chironomid *Euryhapsis* at Sleigh OF that made up 48%. Abundant genera were mainly chironomid dipterans (non-biting midges), with the chironomid *Thienemannimyia* as the most common dominant genus being in the top three genera for over half of all stream benthic communities sampled. *Thienemannimyia w*as also one of the most dominant genera observed in 2012 (Rescan 2012b). Other abundant genera were *Lebertia and Sperchon* (Acari) at (Giraffe OF and Sleigh OF, respectively), *Bezzia/Palpomyia* (Diptera) at Umwelt OF, *Hydra* (Hydrozoa) and *Nemoura* (Plecoptera) at Goose OF, *Brachycentrus* (Trichoptera) at Propeller OF and Tipula (Diptera) at George OF and Reference Q OF.

3.8.2.2 Richness and Diversity

Family richness ranged from a mean of 5.3 at Reference B OF to 12 families/sample at Wasp OF (Figure 3.8-4). The lowest richness was observed in the Goose Property streams Giraffe IF, Giraffe OF, and Reference B OF. Stream benthos communities had low to moderately high diversities, ranging from a mean of 0.10 at Reference B OF to 0.75 at Goose OF. The lowest richness and diversity in stream benthos communities were observed at the shallow low flow Reference B OF.



Notes: Error bars represent the standard error of the mean.
Community composition values represent the mean of replicates.
Immature, damaged and unidentified individuals were excluded from all analyses except density calculations.
Branchiopoda, Cladocera, Collembola, Copepoda, Nematoda, Ostracoda, Platyhelminthes and terrestrial invertebrates were excluded from all calculations.

Figure 3.8-3

Benthos Density and Community Composition in Streams, Back River Project, July 2013

Sabina GOLD & SILVER CORP.

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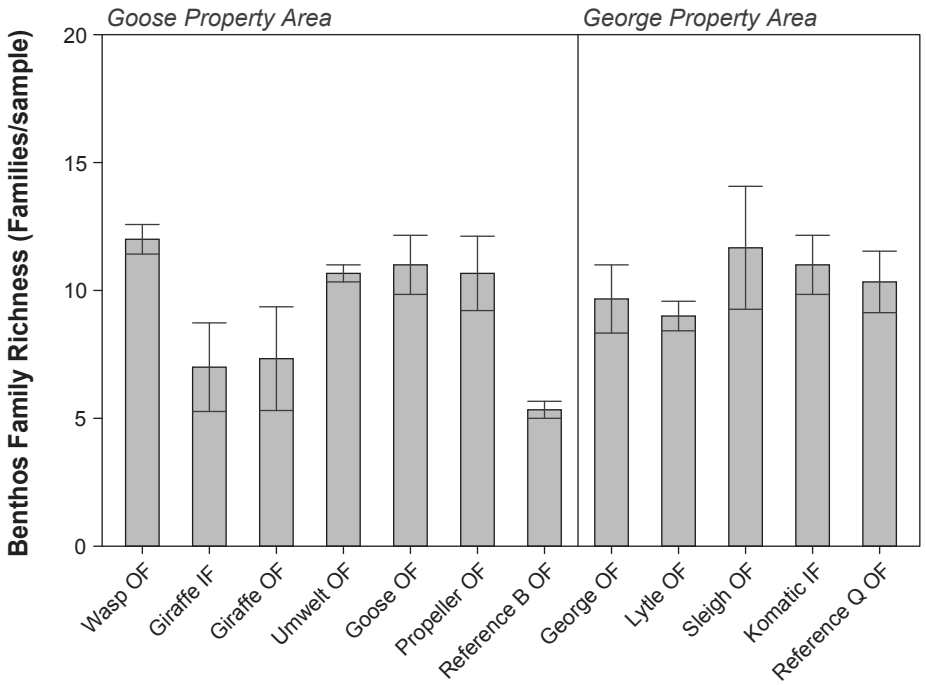

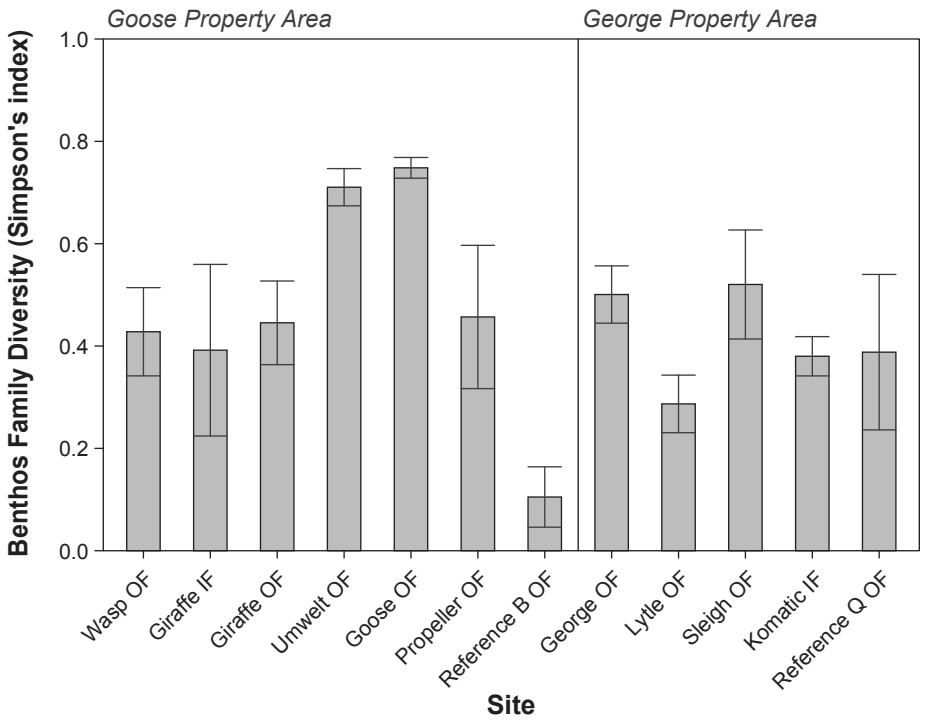

Notes: Error bars represent the standard error of the mean.
Immature, damaged and unidentified individuals were excluded from all analyses except density calculations.
Branchiopoda, Cladocera, Collembola, Copepoda, Nematoda, Ostracoda, Platyhelminthes and terrestrial invertebrates were excluded from all calculations.

Figure 3.8-4

Benthos Richness and Diversity in Streams, Back River Project, July 2013

Sabina GOLD & SILVER CORP.

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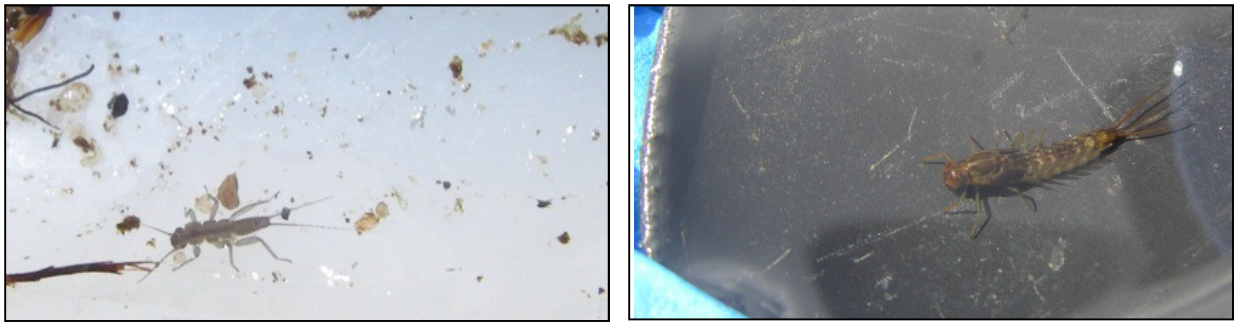
Plate 3.8-2. Black fly larvae attached to bedrock.



a) b)

c)

Plate 3.8-3. Examples of aquatic invertebrates observed during sampling. A) a stonefly (Plecoptera); b) a mayfly (Ephemeroptera); and c) an aquatic beetle (Coleoptera).

a) b)

c)

Plate 3.8-4. Examples of various caddisflies (Trichoptera) observed during sampling. a) and b) from Umwelt OF; c) from Giraffe OF.

Table 3.8-2. Most Abundant Benthic Macroinvertebrate Genera in Streams, Back River Project, July 2013

Area	Site	Major Taxonomic Group	Genus	% Relative Abundance
Goose Property Area				
	Wasp OF	Diptera - Chironomidae	*Cricotopus*	13.6
		Diptera - Chironomidae	*Paratanytarsus*	12.9
		Diptera - Chironomidae	*Pseudokiefferiella*	12.8
	Giraffe IF	Diptera - Chironomidae	*Psectrocladius*	44.1
		Diptera - Chironomidae	*Thienemannimyia* gr.	11.1
		Diptera - Chironomidae	*Procladius*	6.3
	Giraffe OF	Diptera - Chironomidae	*Dicrotendipes*	43.0
		Diptera - Chironomidae	*Thienemannimyia* gr.	11.1
		Acari	*Lebertia*	8.0
	Umwelt OF	Diptera - Other	*Bezzia/Palpomyia*	14.0
		Diptera - Chironomidae	*Thienemannimyia* gr.	9.6
		Diptera - Chironomidae	*Procladius*	9.0
	Goose OF	Hydrozoa	*Hydra*	18.9
		Plecoptera	*Nemoura*	18.3
		Diptera - Chironomidae	*Thienemannimyia* gr.	8.5

(continued)

Table 3.8-2. Most Abundant Benthic Macroinvertebrate Genera in Streams, Back River Project, July 2013 (completed)

Area	Site	Major Taxonomic Group	Genus	% Relative Abundance
Goose Property Area *(cont'd)*				
	Propeller OF	Diptera - Chironomidae	*Paratanytarsus*	39.2
		Trichoptera	*Brachycentrus*	14.1
		Diptera - Chironomidae	*Cricotopus*	9.4
	Reference B OF	Diptera - Chironomidae	*Procladius*	29.0
		Diptera - Chironomidae	*Tanytarsus*	20.0
		Diptera - Chironomidae	*Psectrocladius*	11.8
George Property Area				
	George OF	Diptera - Chironomidae	*Thienemannimyia* gr.	31.6
		Diptera - Other	*Tipula*	12.1
		Diptera - Chironomidae	*Paratanytarsus*	10.2
	Lytle OF	Diptera - Chironomidae	*Paratanytarsus*	37.0
		Diptera - Chironomidae	*Tanytarsus*	10.8
		Diptera - Chironomidae	*Stictochironomus*	7.4
	Sleigh OF	Diptera - Chironomidae	*Euryhapsis*	47.6
		Diptera - Chironomidae	*Thienemannimyia* gr.	11.6
		Acari	*Sperchon*	8.1
	Komatic IF	Diptera - Chironomidae	*Polypedilum*	33.9
		Diptera - Chironomidae	*Saetheria*	15.7
		Diptera - Chironomidae	*Procladius*	14.5
	Reference Q OF	Diptera - Chironomidae	*Thienemannimyia* gr.	36.4
		Diptera - Chironomidae	*Cladotanytarsus*	7.5
		Diptera - Other	*Tipula*	6.8

4. Summary

4. Summary

The 2013 freshwater baseline program involved collecting information for the following: bathymetry, physical limnology (under-ice and open-water), lake water quality, lake sediment quality, lake phytoplankton, lake benthos, stream water quality (freshet and summer), stream sediment quality, stream periphyton, and stream benthos.

Twenty-two lakes and 16 streams were sampled in the Goose and George properties as part of the 2013 freshwater baseline program. Bathymetric surveys were completed on three additional waterbodies, and water quality data from two additional ponds and two potential water source lakes for the Marine Laydown Area near Bathurst Inlet were also collected and presented in the appendices of this report. Lakes sampled in the Goose Property and included in the results analysis and discussion of this report were Wasp, Leaf, Giraffe, Umwelt, Rascal, Goose, Arrow, Propeller, Reference B and Beechey lakes. Lakes included in the George Property area were Upper Long, Lower Long, Fold, George, Bob, Occurrence, Slave, Esker, Dragon, Komatic, McCoy and Reference Q. Streams sampled in the Goose Property were Wasp Outflow, Giraffe Inflow, Giraffe Outflow, Umwelt Outflow, Llama Outflow, Goose Neck Inflow, Goose Outflow, Propeller Outflow and Reference B Outflow. Streams sampled within the George Property were George Outflow, Lytle Outflow, Sleigh Outflow, Komatic Inflow, McCoy Inflow, McCoy Outflow and Reference Q Outflow.

Lakes tended to be partially stratified in April and well mixed in July. In April, dissolved oxygen concentrations at bottom depths of some lakes were below CCME dissolved oxygen guidelines for early life stages, and below CCME guidelines for all life stages at four Goose Property lake sites. All lakes at all depths were above CCME dissolved oxygen guidelines in July.

Sampled lakes were slightly acidic to slightly basic, poorly buffered (low alkalinity), soft (low hardness), and had low conductivity levels. Nutrients were generally low, particularly bioavailable forms, and lake trophic status was usually classified as ultra-oligotrophic or oligotrophic.

Thirteen of the 26 lake sites had samples that were naturally greater than CCME water quality guidelines for total copper. Additionally Wasp Lake had one sample which exceeded CCME total lead guidelines, and both Arrow Lake samples exceeded CCME total iron guidelines. Samples tended to exceed guidelines by a factor of less than two, with the exception of Wasp Lake.

Lake sediments were generally composed of fines (silts and clays) and were naturally elevated in arsenic, cadmium, chromium, copper, and zinc that often were greater than their respective CCME ISQG. The lake sediments in the George Property had more metals above their respective CCME sediment quality guideline levels than the Goose Property lakes. All lakes had at least one sample greater than the CCME ISQGs for at least one metal, with most lakes having naturally elevated arsenic or copper. All sampled lakes, except Propeller Lake, had mean lake sediment arsenic concentrations that were greater than the CCME ISQG. Over half of the lake sites, including all George Property lakes, were greater than the arsenic CCME PEL. Copper concentrations were greater than the CCME ISQG at all sites, and the PEL at seven of the 26 lake sites.

Phytoplankton biomass levels were low in all sampled lakes (less than 1 µg chl *a*/L) and communities were dominated by Myxophyceae (cyanobacteria), Cryptophyceae (a class of flagellated algae) and Chrysophyceae (golden algae). Bob Lake, the only site where chrysophytes were not observed, had the lowest genus richness and diversity. Benthic communities at all lake sites were dominated by

chironomid dipterans (non-biting midge flies) and bivalves (small to tiny clams from the family Sphaeriidae), and densities varied among lake sites. Bob Lake had relatively high benthos densities, with a mean over four times greater than other sites.

McCoy Inflow in the George Property was dry during July sampling, and many of the other streams in both the Goose Property and George Property were dry or water flowed underground. Streams in July had high dissolved oxygen concentrations (up to 11.0 mg/L); only at Llama Outflow, Reference B Outflow, McCoy Outflow and Reference Q Outflow were measured dissolved oxygen concentrations below the CCME guideline for the protection of freshwater aquatic life for early life stages (9.5 mg/L).

Sampled streams had slightly acidic to slightly basic pH. The lowest pH values measured were at Giraffe Inflow and Umwelt Outflow in June, which were outside of the CCME guideline range for freshwater aquatic health (pH range 6.5 to 9). Like lakes, hardness, conductivity and total dissolved solids were low in most streams, with the greatest levels in Llama Outflow and Umwelt Outflow. Nitrate, nitrite and ammonia concentrations were generally low, often near or below detection limits, with most sites reflecting ultra-oligotrophic to oligotrophic conditions.

All streams had at least one metal that was above respective CCME water quality guideline levels including the following metals: total aluminum, total cadmium, total copper and total iron. Most streams were greater than the hardness-dependent copper guidelines. Giraffe Inflow had the greatest number of parameters that were naturally elevated, with pH, aluminium and copper outside of CCME guidelines for at least one sample.

Stream sediments had metal concentrations that were greater than the CCME ISQGs at most sites. Arsenic and copper were the most commonly naturally elevated metal, with almost half of streams having average concentrations that were greater than the ISQG. Cadmium, chromium and zinc were also frequently surpassed. George Property stream sediments were greater than CCME sediment quality guideline levels in more cases than seen in the Goose Property streams. The most CCME sediment guidelines were surpassed in Komatic and McCoy streams in the George Property.

Periphyton communities were dominated by cyanobacteria, and densities varied by more than an order of magnitude among streams. The highest densities were observed at Giraffe Outflow and lowest densities at Reference Q Outflow. Stream benthos densities also ranged over an order of magnitude among streams and communities were mainly composed of chironomid dipterans (non-biting midges).

A comprehensive summary table of results from all lakes sampled in 2013 is provided in Table 4-1 and a summary table of results from all streams sampled is provided in Table 4-2.

Table 4-1. Summary of 2013 Freshwater Baseline Results for Lakes

		Dissolved Oxygen	Water Quality		Sediment Quality	Aquatic Biology	
Lake	Summer Sampling Max Depth (m)	Seasons and Depths that Exceed CCME Guidelines	Nutrient Status	CCME Guideline Exceedances	CCME Guideline Exceedances	Phytoplankton	Benthos
Goose Property Area							
Wasp	15.5	early life stages: Apr, bottom depths	Ultra-oligotrophic to Oligotrophic	Cu, Pb	ISQG: As, Cu; PEL: As	Dominant group = cyanobacteria. Highest genera richness.	Dominant group = chironomids. Lowest mean benthos densities.
Leaf	7.4	none	Ultra-oligotrophic	Cu	ISQG: As, Cu; PEL: As	Dominant group = cyanobacteria.	Dominant group = bivalves. Highest mean family richness.
Giraffe North	3.7	none	Ultra-oligotrophic	none	ISQG: As,Cd, Cu	nc	Dominant group = chironomids.
Giraffe South	7.3	early life stages: Apr mid water column; all life stages: Apr bottom half of water column	Ultra-oligotrophic	Cu	ISQG: As, Cu; PEL: As	Dominant group = cyanobacteria.	Dominant group = chironomids.
Umwelt Lake	2.7	none	Ultra-oligotrophic	none	ISQG: As, Cu; PEL: As	Dominant groups = cyanobacteria and Chrysophytes.	Dominant group = chironomids.
Rascal Lake	2.4	none	Ultra-oligotrophic	Cu	ISQG: As, Cd, Cu, Zn	Dominant group = cyanobacteria. Highest mean	Dominant group = chironomids.
Goose Neck	2.6	none	Ultra-oligotrophic to Eutrophic	Cu	ISQG: As, Cu; PEL: As	Dominant group = Chrysophytes. Lowest mean densities. Highest mean diversity.	Dominant group = chironomids.
Goose Central	4.2	early life stages: Apr, bottom depths; all life stages: Apr, bottom depth	Ultra-oligotrophic	none	ISQG: As, Cu	Dominant group = cyanobacteria.	Dominant group = chironomids. Highest mean family diversity.
Goose Tail	7	early life stages: Apr, mid water column; all life stages: Apr, bottom half of water column	Ultra-oligotrophic	none	ISQG: As, Cr, Cu; PEL: As	Only biomass collected.	nc
Goose South	3.4	none	Ultra-oligotrophic	none	nc	nc	nc
Arrow	0.7	none	Mesotrophic	Cu, Fe	nc	nc	nc
Propeller	8.1	none	Ultra-oligotrophic to Oligotrophic	none	ISQG: Cu	Dominant group = cyanobacteria.	Dominant group = chironomids.
Reference B	4.9	early life stages: Apr, mid water column; all life stages: Apr, bottom half of water column	Ultra-oligotrophic to Oligotrophic	none	ISQG: As, Cu	Dominant group = cyanobacteria.	Dominant group = chironomids.
Beechey	21.3	none	Ultra-oligotrophic	none	nc	nc	
George Property Area							
Upper Long	3.9	none	Mesotrophic	none	nc	nc	nc
Lower Long	9.6	none	Ultra-oligotrophic to Eutrophic	none	nc	nc	nc
Fold	13.9	none	Ultra-oligotrophic to Oligotrophic	none	nc	nc	nc
George Central	12.5	early life stages: Apr, mid water column	Ultra-oligotrophic	Cu	ISQG: As, Cr, Cu; PEL: As	Dominant group = Chrysophytes. Lowest biomass (in April).	Dominant group = bivalves.
Bob	3.4	none	Ultra-oligotrophic	none	ISQG: As, Cd, Cu, Zn; PEL: As	Dominant group = Chrysophytes. Cyanobacteria not observed. Lowest genus richness and diversity.	Dominant group = chironomids. Highest mean benthos densities, mean densities 4.6 times higher than all other lake sites. Lowest mean family diversity.
Occurrence	1.5	none	Ultra-oligotrophic	Cu	ISQG: As, Cr, Cu, Zn; PEL: As, Cr	Dominant groups = Chrysophytes and Cryptophytes. Relatively low proportion of cyanobacteria.	Dominant group = chironomids.
Slave	1	none	Oligotrophic	Cu	nc	nc	nc
Esker	0.4	none	Oligotrophic	Cu	ISQG: As, Cr, Cu, Zn; PEL: As	Dominant group = cyanobacteria.	Dominant group = chironomids. Highest mean family richness.
Dragon	3.6	none	Oligotrophic	none	ISQG: As, Cr, Cu, Zn; PEL: As	Dominant groups = Chrysophytes and cyanobacteria.	Dominant group = chironomids.
Komatic	7.3	early life stages: Apr, bottom half of water column	Oligotrophic	Cu	ISQG: As, Cd, Cr, Cu, Zn; PEL: As	Dominant group = Cryptophytes. Relatively low proportion of cyanobacteria. Highest biomass (in	Dominant group = chironomids.
McCoy	5.6	none	Ultra-oligotrophic	Cu	ISQG: As, Cd, Cr, Cu, Zn; PEL:As, Zn	Dominant group = cyanobacteria.	Dominant group = chironomids.
Reference Q	16.7	none	Ultra-oligotrophic	Cu	ISQG: As, Cu; PEL: As	Dominant group = Chrysophytes.	Dominant group = chironomids. Lowest mean family richness.

nc = not collected

Table 4-2. Summary of 2013 Freshwater Baseline Results for Streams

			Dissolved Oxygen	Water Quality		Sediment Quality	Aquatic Biology	
Stream	General Description	Substrate	Seasons that Exceed CCME Guidelines	Nutrient Status	CCME Guideline Exceedances	Parameters that Exceed CCME Guidelines	Periphyton	Benthos
Goose Property Area								
Wasp OF	Small stream running over bedrock.	Bedrock, cobble	none	Oligotrophic	Cu	ISQG: As, Cd, Cu; PEL: As	Dominant group = cyanobacteria.	Dominant group = chironomids. Highest family richness.
Giraffe IF	Small stream running over bedrock.	Bedrock, cobble	none	Ultra-oligotrophic to Oligotrophic	pH, Al, Cu	none	Dominant group = cyanobacteria.	Dominant group = chironomids. Lowest mean density.
Giraffe OF	Short, medium-sized stream, cobbles.	Cobbles, large stones, boulders	none	Oligotrophic	Cu	ISQG: As	Dominant group = cyanobacteria. Highest mean density.	Dominant group = chironomids.
Umwelt OF	Small stream running through flood plain.	Cobbles, silt	none	Ultra-oligotrophic to Oligotrophic	pH, Al	none	Dominant group = cyanobacteria.	Dominant group = chironomids.
Llama OF	Medium stream through large boulder field.	Cobbles, large stones, boulders	early life stages: July	Ultra-oligotrophic to Oligotrophic	Cu	nc	nc	nc
Goose Neck IF	Small stream running through flood plain. Some relatively deep pools.	Silt, clay, no stones	none	Oligotrophic to Mesotrophic	Fe	ISQG: As, Cu; PEL: As	nc	nc
Goose OF	Short, medium-sized stream, cobbles.	Cobbles, large stones, boulders	none	Ultra-oligotrophic to Oligotrophic	Cu	none	Dominant group = cyanobacteria. Lowest genus richness. Lowest genus diversity.	Dominant group = chironomids. Highest family diversity.
Propeller OF	Large stream draining largest lake in the area. Runs through boulder field.	Large stones, boulders	none	Ultra-oligotrophic	Cd	nc	Dominant group = cyanobacteria.	Dominant group = chironomids.
Reference B OF	Outflow of Reference B Lake, broad multi-channeled shallow stream through flood plain.	Mainly silt, gravel, some large stones	early life stages: July	Oligotrophic to Mesotrophic	Fe	ISQG: As, Cu; PEL: As	Dominant group = cyanobacteria. Highest genus richness.	Dominant group = chironomids. Highest mean proportion of chironomids (94%). Lowest family richness and diversity.
George Property Area								
George OF	Short, small-sized stream, cobbles. Split into two channels.	Cobbles, gravel, sand	none	Ultra-oligotrophic to Oligotrophic	Cu	ISQG: As, Cu, Zn; PEL: As	Dominant group = cyanobacteria.	Dominant group = chironomids.
Lytle OF	Small creek running over bedrock.	Bedrock, cobble	none	Oligotrophic	Cu	ISQG: As, Cd, Cr, Cu, Zn; PEL: As	Dominant group = cyanobacteria. Smallest proportion of cyanobacteria. Highest genus	Dominant group = chironomids. Highest mean density.
Sleigh OF	Small stream running through flood plain.	Cobbles, silt	none	Ultra-oligotrophic to Oligotrophic	Cu	ISQG: As, Cr	Dominant group = cyanobacteria.	Dominant group = chironomids.
Komatic IF	Medium stream meandering through flood plain. No rocks present.	Mainly silt, no stones present	none	Oligotrophic	Cu	ISQG: As, Cr	nc	Dominant group = chironomids.
McCoy IF	Ephemeral stream running through flood plain.	Silt	nc	Oligotrophic	Cu	nc	nc	nc
McCoy OF	Small stream running over bedrock, with underground flow in some parts.	Bedrock, cobbles	early life stages: July	Ultra-oligotrophic to Mesotrophic	Cu	ISQG: As, Cr, Cu; PEL: As	Dominant group = cyanobacteria. Highest mean biomass.	nc
Reference Q OF	Small stream, note this stream does not drain Reference Q Lake	Boulders, cobbles, gravel, silt	early life stages: July	Ultra-oligotrophic to Oligotrophic	Cu	ISQG: As, Cr, Cu, Zn; PEL: As	Dominant group = cyanobacteria. Lowest mean biomass and density.	Dominant group = chironomids.

nc = not collected

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Definitions of the acronyms and abbreviations used in this reference list can be found in the Glossary and Abbreviations section.

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Appendix 2.2-1

Leaf Lake Bathymetry, EBA Engineering Consultants Ltd.

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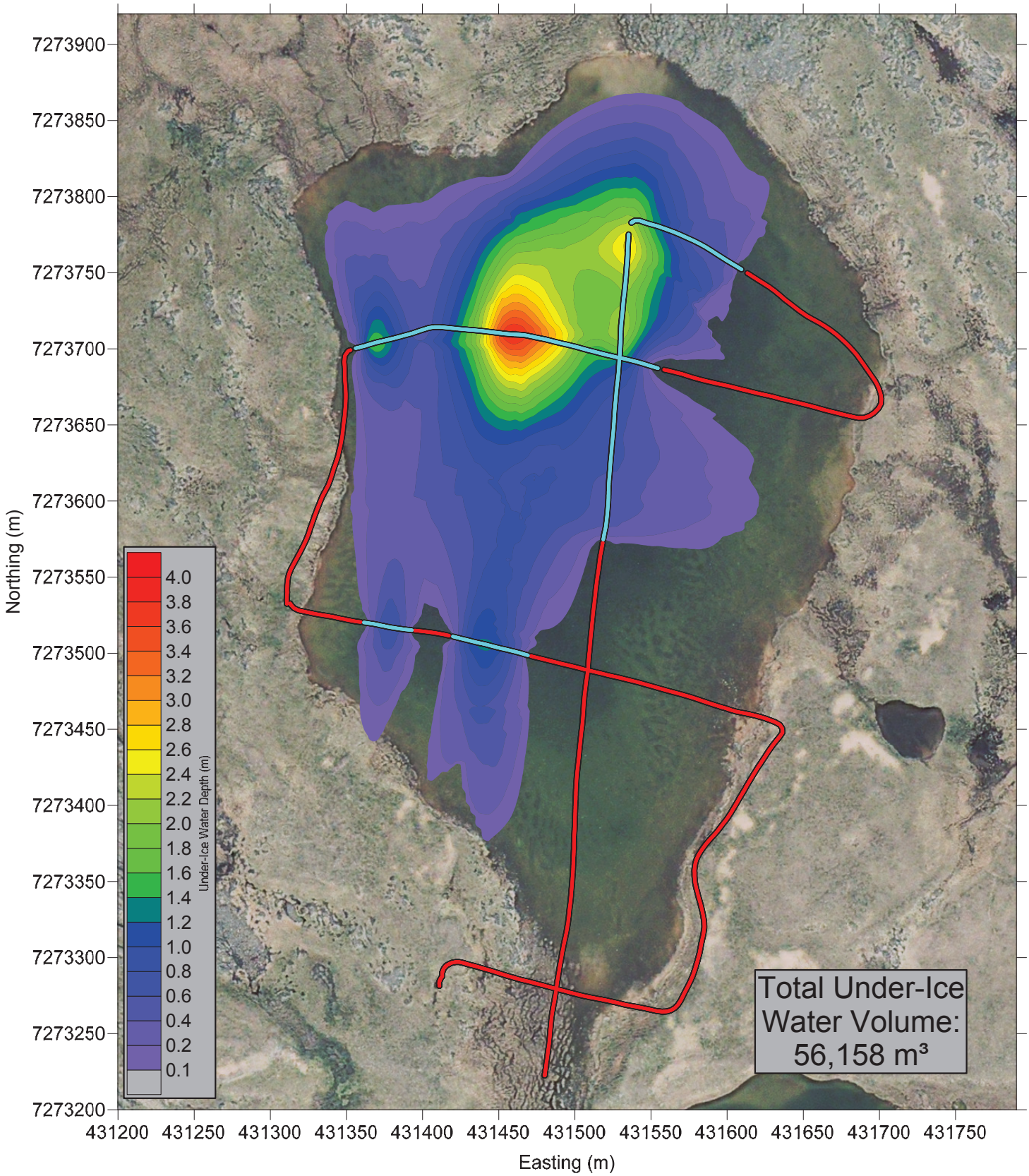

LEGEND

N

Under-Ice Water

Ground / Grounded Ice

SCALE 1:3500
NAD83
UTM z13

CLIENT

Sabina GOLD & SILVER CORP

TETRA TECH

Sabina Gold & Silver
Back River GPR Bathymetry Program

Leaf Lake
GPR DFO Results

PROJECT NO.	DWN	CKD	APVD	REV
704-V33103008-01	RJM	CB	NSP	0

OFFICE	DATE
EBA-EDM	May 13, 2013

Leaf-02
(from EBA 2013)

Appendix 2.2-2

Wolf Lake Bathymetry, EBA Engineering Consultants Ltd.

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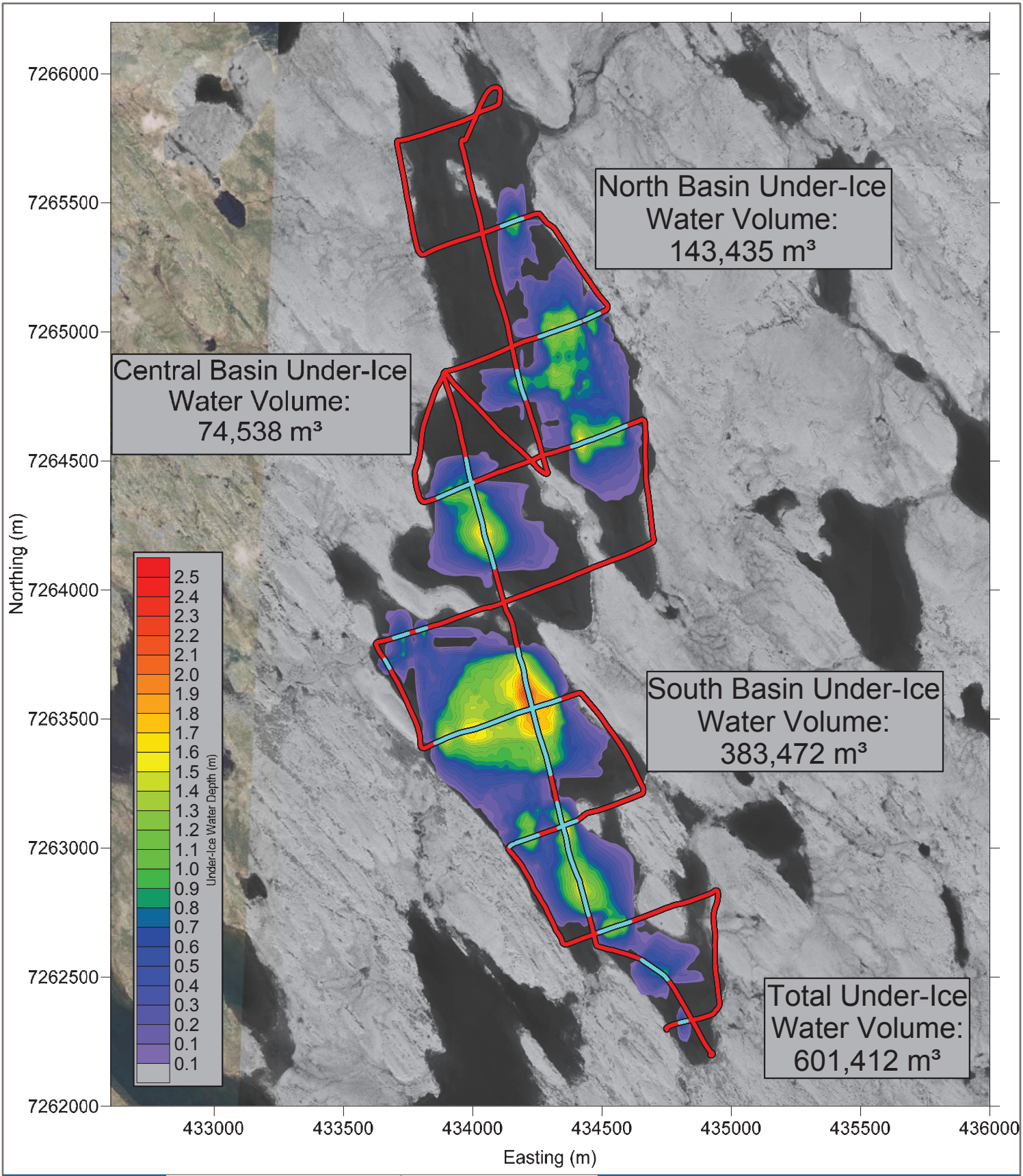

LEGEND

N

Under-Ice Water

Ground / Grounded Ice

SCALE 1:20,000
NAD83
UTM z13

CLIENT

Sabina
GOLD & SILVER CORP.

TETRA TECH

Sabina Gold & Silver
Back River GPR Bathymetry Program

Wolf Lake
GPR DFO Results

PROJECT NO.	DWN	CKD	APVD	REV
704-V33103008-01	RJM	CB	NSP	0

OFFICE	DATE
EBA-EDM	May 13, 2013

Wolf-02
(from EBA 2013)

Appendix 3.2-1

Under-ice Temperature and Dissolved Oxygen Profiles, Back River Project, April 2013

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Appendix 3.2-1. Under-ice Temperature and Dissolved Oxygen Profiles, Back River Project, April 2013

Lake Site Name	Site Code	Date	Season	Ice thickness (m)	Maximum Site Depth (m)	Depth (m)	Temperature (°C)	Dissolved Oxygen Saturation (%)	Dissolved Oxygen Concentration (mg/L)
Wasp	WASPLK	9-Apr-13	under ice	1.9	8.4	2.0	1.0	106.6	15.1
Wasp	WASPLK	9-Apr-13	under ice	1.9	8.4	2.5	1.8	101.6	14.1
Wasp	WASPLK	9-Apr-13	under ice	1.9	8.4	3.0	2.3	97.0	13.3
Wasp	WASPLK	9-Apr-13	under ice	1.9	8.4	3.5	2.5	92.0	12.6
Wasp	WASPLK	9-Apr-13	under ice	1.9	8.4	4.0	2.5	86.3	11.8
Wasp	WASPLK	9-Apr-13	under ice	1.9	8.4	4.5	2.3	86.2	11.7
Wasp	WASPLK	9-Apr-13	under ice	1.9	8.4	5.0	2.3	87.0	11.9
Wasp	WASPLK	9-Apr-13	under ice	1.9	8.4	5.5	2.3	89.5	12.2
Wasp	WASPLK	9-Apr-13	under ice	1.9	8.4	6.0	2.3	89.1	12.1
Wasp	WASPLK	9-Apr-13	under ice	1.9	8.4	6.5	2.3	88.1	12.0
Wasp	WASPLK	9-Apr-13	under ice	1.9	8.4	7.0	2.3	85.6	11.6
Wasp	WASPLK	9-Apr-13	under ice	1.9	8.4	7.5	2.4	48.0	6.6
Wasp	WASPLK	9-Apr-13	under ice	1.9	8.4	8.0	2.2	51.2	7.1
Leaf	LEAFLK	9-Apr-13	under ice	1.65	1.7	-	-	-	-
Giraffe South	GIRSOUTH	9-Apr-13	under ice	1.65	7.55	2.0	1.8	92.1	12.9
Giraffe South	GIRSOUTH	9-Apr-13	under ice	1.65	7.55	2.5	2.7	78.6	10.7
Giraffe South	GIRSOUTH	9-Apr-13	under ice	1.65	7.55	3.0	3.6	58.5	7.7
Giraffe South	GIRSOUTH	9-Apr-13	under ice	1.65	7.55	3.5	3.9	42.6	5.6
Giraffe South	GIRSOUTH	9-Apr-13	under ice	1.65	7.55	4.0	4.0	39.6	5.2
Giraffe South	GIRSOUTH	9-Apr-13	under ice	1.65	7.55	4.5	4.0	36.3	4.8
Giraffe South	GIRSOUTH	9-Apr-13	under ice	1.65	7.55	5.0	4.1	32.6	4.3
Giraffe South	GIRSOUTH	9-Apr-13	under ice	1.65	7.55	5.5	4.1	25.8	3.4
Giraffe South	GIRSOUTH	9-Apr-13	under ice	1.65	7.55	6.0	4.1	17.4	2.3
Giraffe South	GIRSOUTH	9-Apr-13	under ice	1.65	7.55	6.5	4.0	10.0	1.3
Giraffe South	GIRSOUTH	9-Apr-13	under ice	1.65	7.55	7.0	3.9	5.2	0.7
Goose Neck	GOOSENECK	10-Apr-13	under ice	1.6	3	2.0	0.5	102.5	14.8
Goose Neck	GOOSENECK	10-Apr-13	under ice	1.6	3	2.5	1.3	86.3	12.3
Goose Central	GOOSECENT	13-Apr-13	under ice	1.7	6.5	2.0	0.7	119.7	17.2
Goose Central	GOOSECENT	13-Apr-13	under ice	1.7	6.5	2.5	1.4	116.7	16.4
Goose Central	GOOSECENT	13-Apr-13	under ice	1.7	6.5	3.0	1.9	113.0	15.7
Goose Central	GOOSECENT	13-Apr-13	under ice	1.7	6.5	3.5	2.4	102.3	14.0
Goose Central	GOOSECENT	13-Apr-13	under ice	1.7	6.5	4.0	2.6	108.7	14.8
Goose Central	GOOSECENT	13-Apr-13	under ice	1.7	6.5	4.5	3.0	100.7	13.6
Goose Central	GOOSECENT	13-Apr-13	under ice	1.7	6.5	5.0	3.5	72.2	9.6
Goose Central	GOOSECENT	13-Apr-13	under ice	1.7	6.5	5.5	3.8	56.0	7.4
Goose Central	GOOSECENT	13-Apr-13	under ice	1.7	6.5	6.0	3.8	33.1	4.4
Goose Tail	GOOSETAILNEW	14-Apr-13	under ice	1.75	7.8	2.0	0.5	102.2	14.7
Goose Tail	GOOSETAILNEW	14-Apr-13	under ice	1.75	7.8	2.5	1.3	96.6	13.6
Goose Tail	GOOSETAILNEW	14-Apr-13	under ice	1.75	7.8	3.0	1.9	95.0	13.2
Goose Tail	GOOSETAILNEW	14-Apr-13	under ice	1.75	7.8	3.5	2.5	82.6	11.3
Goose Tail	GOOSETAILNEW	14-Apr-13	under ice	1.75	7.8	4.0	3.0	69.1	9.3
Goose Tail	GOOSETAILNEW	14-Apr-13	under ice	1.75	7.8	4.5	3.2	62.0	8.3
Goose Tail	GOOSETAILNEW	14-Apr-13	under ice	1.75	7.8	5.0	3.4	56.6	7.5
Goose Tail	GOOSETAILNEW	14-Apr-13	under ice	1.75	7.8	5.5	3.5	50.3	6.7

Appendix 3.2-1. Under-ice Temperature and Dissolved Oxygen Profiles, Back River Project, April 2013

Lake Site Name	Site Code	Date	Season	Ice thickness (m)	Maximum Site Depth (m)	Depth (m)	Temperature (°C)	Dissolved Oxygen Saturation (%)	Dissolved Oxygen Concentration (mg/L)
Goose Tail	GOOSETAILNEW	14-Apr-13	under ice	1.75	7.8	6.0	3.6	48.7	6.5
Goose Tail	GOOSETAILNEW	14-Apr-13	under ice	1.75	7.8	6.5	3.8	41.9	5.5
Goose Tail	GOOSETAILNEW	14-Apr-13	under ice	1.75	7.8	7.0	3.9	31.3	4.1
Reference B	REFBLK	13-Apr-13	under ice	1.95	4.7	2.0	0.0	108.9	15.9
Reference B	REFBLK	13-Apr-13	under ice	1.95	4.7	2.5	0.1	115.9	16.9
Reference B	REFBLK	13-Apr-13	under ice	1.95	4.7	3.0	2.7	79.5	10.8
Reference B	REFBLK	13-Apr-13	under ice	1.95	4.7	3.5	3.3	50.9	6.8
Reference B	REFBLK	13-Apr-13	under ice	1.95	4.7	4.0	3.8	32.3	4.3
George Central	GEORGCENT	12-Apr-13	under ice	1.75	15	2.0	0.0	100.2	14.7
George Central	GEORGCENT	12-Apr-13	under ice	1.75	15	2.5	1.7	97.4	13.6
George Central	GEORGCENT	12-Apr-13	under ice	1.75	15	3.0	3.1	96.8	13.0
George Central	GEORGCENT	12-Apr-13	under ice	1.75	15	3.5	3.6	82.4	11.0
George Central	GEORGCENT	12-Apr-13	under ice	1.75	15	4.0	3.9	77.8	10.2
George Central	GEORGCENT	12-Apr-13	under ice	1.75	15	4.5	3.9	76.5	10.1
George Central	GEORGCENT	12-Apr-13	under ice	1.75	15	5.0	3.9	73.4	9.7
George Central	GEORGCENT	12-Apr-13	under ice	1.75	15	5.5	3.9	74.3	9.8
George Central	GEORGCENT	12-Apr-13	under ice	1.75	15	6.0	3.9	72.9	9.6
George Central	GEORGCENT	12-Apr-13	under ice	1.75	15	6.5	3.9	71.0	9.3
George Central	GEORGCENT	12-Apr-13	under ice	1.75	15	7.0	4.0	74.8	9.8
George Central	GEORGCENT	12-Apr-13	under ice	1.75	15	7.5	4.0	76.5	10.0
George Central	GEORGCENT	12-Apr-13	under ice	1.75	15	8.0	3.9	75.1	9.9
George Central	GEORGCENT	12-Apr-13	under ice	1.75	15	8.5	3.8	89.0	11.7
George Central	GEORGCENT	12-Apr-13	under ice	1.75	15	9.0	3.8	91.9	12.1
George Central	GEORGCENT	12-Apr-13	under ice	1.75	15	9.5	3.8	94.1	12.4
George Central	GEORGCENT	12-Apr-13	under ice	1.75	15	10.0	3.8	97.6	12.9
George Central	GEORGCENT	12-Apr-13	under ice	1.75	15	11.0	4.0	97.4	12.8
George Central	GEORGCENT	12-Apr-13	under ice	1.75	15	12.0	4.0	97.6	12.8
George Central	GEORGCENT	12-Apr-13	under ice	1.75	15	13.0	4.0	97.6	12.8
George Central	GEORGCENT	12-Apr-13	under ice	1.75	15	14.0	4.0	97.5	12.8
Komatic	KOMALK	12-Apr-13	under ice	1.85	6.95	2.0	0.0	77.9	11.4
Komatic	KOMALK	12-Apr-13	under ice	1.85	6.95	2.5	1.3	76.4	10.8
Komatic	KOMALK	12-Apr-13	under ice	1.85	6.95	3.0	2.3	83.5	11.5
Komatic	KOMALK	12-Apr-13	under ice	1.85	6.95	3.5	2.6	74.9	10.2
Komatic	KOMALK	12-Apr-13	under ice	1.85	6.95	4.0	2.8	64.8	8.8
Komatic	KOMALK	12-Apr-13	under ice	1.85	6.95	4.5	2.9	64.7	8.7
Komatic	KOMALK	12-Apr-13	under ice	1.85	6.95	5.0	2.9	65.4	8.8
Komatic	KOMALK	12-Apr-13	under ice	1.85	6.95	5.5	3.0	64.0	8.6
Komatic	KOMALK	12-Apr-13	under ice	1.85	6.95	6.0	3.1	54.5	7.3
Reference Q	REFQLK	12-Apr-13	under ice	1.8	15.8	2.0	0.2	101.3	14.7
Reference Q	REFQLK	12-Apr-13	under ice	1.8	15.8	2.5	1.0	100.0	14.2
Reference Q	REFQLK	12-Apr-13	under ice	1.8	15.8	3.0	1.5	98.5	13.8
Reference Q	REFQLK	12-Apr-13	under ice	1.8	15.8	3.5	1.8	97.1	13.5
Reference Q	REFQLK	12-Apr-13	under ice	1.8	15.8	4.0	2.0	95.6	13.2
Reference Q	REFQLK	12-Apr-13	under ice	1.8	15.8	4.5	2.1	92.7	12.8

Appendix 3.2-1. Under-ice Temperature and Dissolved Oxygen Profiles, Back River Project, April 2013

Lake Site Name	Site Code	Date	Season	Ice thickness (m)	Maximum Site Depth (m)	Depth (m)	Temperature (˚C)	Dissolved Oxygen Saturation (%)	Dissolved Oxygen Concentration (mg/L)
Reference Q	REFQLK	12-Apr-13	under ice	1.8	15.8	5.0	2.2	90.6	12.5
Reference Q	REFQLK	12-Apr-13	under ice	1.8	15.8	5.5	2.2	88.4	12.2
Reference Q	REFQLK	12-Apr-13	under ice	1.8	15.8	6.0	2.2	87.4	12.0
Reference Q	REFQLK	12-Apr-13	under ice	1.8	15.8	6.5	2.2	88.5	12.1
Reference Q	REFQLK	12-Apr-13	under ice	1.8	15.8	7.0	2.3	88.5	12.1
Reference Q	REFQLK	12-Apr-13	under ice	1.8	15.8	7.5	2.3	86.4	11.8
Reference Q	REFQLK	12-Apr-13	under ice	1.8	15.8	8.0	2.3	85.6	11.7
Reference Q	REFQLK	12-Apr-13	under ice	1.8	15.8	8.5	2.3	85.5	11.7
Reference Q	REFQLK	12-Apr-13	under ice	1.8	15.8	9.0	2.3	84.0	11.5
Reference Q	REFQLK	12-Apr-13	under ice	1.8	15.8	9.5	2.3	82.6	11.3
Reference Q	REFQLK	12-Apr-13	under ice	1.8	15.8	10.0	2.3	82.2	11.3
Reference Q	REFQLK	12-Apr-13	under ice	1.8	15.8	11.0	2.4	80.5	11.0
Reference Q	REFQLK	12-Apr-13	under ice	1.8	15.8	12.0	2.5	79.1	10.8
Reference Q	REFQLK	12-Apr-13	under ice	1.8	15.8	13.0	2.5	77.1	10.5
Reference Q	REFQLK	12-Apr-13	under ice	1.8	15.8	14.0	2.6	75.0	10.2

Appendix 3.2-2

Open Water Secchi Depths and Dissolved Oxygen and Temperature Profiles, Back River Project, July 2013

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Appendix 3.2-2. Open Water Secchi Depths and Dissolved Oxygen and Temperature Profiles, Back River Project, July 2013

Site Name	Site Code	Date	Season	Maximum Site Depth (m)	Secchi Depth (m)	Depth (m)	Temperature (°C)	Dissolved Oxygen Saturation (%)	Dissolved Oxygen Concentration (mg/L)
Wasp	WASPLK	16-Jul-13	open water	15.5	6.7	0.1	10.9	96.5	10.7
Wasp	WASPLK	16-Jul-13	open water	15.5	6.7	0.5	10.9	96.5	10.7
Wasp	WASPLK	16-Jul-13	open water	15.5	6.7	1.0	10.9	96.4	10.7
Wasp	WASPLK	16-Jul-13	open water	15.5	6.7	1.5	11.0	96.3	10.6
Wasp	WASPLK	16-Jul-13	open water	15.5	6.7	2.0	11.0	96.3	10.6
Wasp	WASPLK	16-Jul-13	open water	15.5	6.7	2.5	11.0	96.2	10.6
Wasp	WASPLK	16-Jul-13	open water	15.5	6.7	3.0	11.0	96.1	10.6
Wasp	WASPLK	16-Jul-13	open water	15.5	6.7	3.5	11.0	96.0	10.6
Wasp	WASPLK	16-Jul-13	open water	15.5	6.7	4.0	11.0	96.0	10.6
Wasp	WASPLK	16-Jul-13	open water	15.5	6.7	4.5	11.0	95.9	10.6
Wasp	WASPLK	16-Jul-13	open water	15.5	6.7	5.0	11.0	95.8	10.6
Wasp	WASPLK	16-Jul-13	open water	15.5	6.7	5.5	11.0	95.8	10.6
Wasp	WASPLK	16-Jul-13	open water	15.5	6.7	6.0	11.0	95.7	10.6
Wasp	WASPLK	16-Jul-13	open water	15.5	6.7	6.5	11.0	95.7	10.6
Wasp	WASPLK	16-Jul-13	open water	15.5	6.7	7.0	11.0	95.6	10.5
Wasp	WASPLK	16-Jul-13	open water	15.5	6.7	7.5	11.0	95.5	10.5
Wasp	WASPLK	16-Jul-13	open water	15.5	6.7	8.0	11.0	95.4	10.5
Wasp	WASPLK	16-Jul-13	open water	15.5	6.7	8.5	11.0	95.3	10.5
Wasp	WASPLK	16-Jul-13	open water	15.5	6.7	9.0	11.0	95.3	10.5
Wasp	WASPLK	16-Jul-13	open water	15.5	6.7	9.5	11.0	95.2	10.5
Wasp	WASPLK	16-Jul-13	open water	15.5	6.7	10.0	11.0	95.1	10.5
Wasp	WASPLK	16-Jul-13	open water	15.5	6.7	11.0	11.0	95.0	10.5
Wasp	WASPLK	16-Jul-13	open water	15.5	6.7	12.0	11.0	94.9	10.5
Wasp	WASPLK	16-Jul-13	open water	15.5	6.7	13.0	11.0	94.7	10.5
Wasp	WASPLK	16-Jul-13	open water	15.5	6.7	14.0	10.9	94.4	10.4
Leaf	LEAFLK	16-Jul-13	open water	7.4	bottom	0.1	10.0	98.9	11.2
Leaf	LEAFLK	16-Jul-13	open water	7.4	bottom	0.5	10.1	99.0	11.2
Leaf	LEAFLK	16-Jul-13	open water	7.4	bottom	1.0	10.1	99.2	11.2
Leaf	LEAFLK	16-Jul-13	open water	7.4	bottom	1.5	10.1	98.8	11.1
Leaf	LEAFLK	16-Jul-13	open water	7.4	bottom	2.0	10.1	98.7	11.1
Leaf	LEAFLK	16-Jul-13	open water	7.4	bottom	2.5	10.1	98.5	11.1
Leaf	LEAFLK	16-Jul-13	open water	7.4	bottom	3.0	10.1	98.3	11.1
Leaf	LEAFLK	16-Jul-13	open water	7.4	bottom	3.5	10.1	98.3	11.1
Leaf	LEAFLK	16-Jul-13	open water	7.4	bottom	4.0	10.1	98.2	11.1
Leaf	LEAFLK	16-Jul-13	open water	7.4	bottom	4.5	10.1	98.2	11.1
Leaf	LEAFLK	16-Jul-13	open water	7.4	bottom	5.0	10.1	98.1	11.1
Leaf	LEAFLK	16-Jul-13	open water	7.4	bottom	5.5	10.1	98.1	11.1
Leaf	LEAFLK	16-Jul-13	open water	7.4	bottom	6.0	10.1	98.0	11.0

Appendix 3.2-2. Open Water Secchi Depths and Dissolved Oxygen and Temperature Profiles, Back River Project, July 2013

Site Name	Site Code	Date	Season	Maximum Site Depth (m)	Secchi Depth (m)	Depth (m)	Temperature (°C)	Dissolved Oxygen Saturation (%)	Dissolved Oxygen Concentration (mg/L)
Giraffe North	GIRNORTH	14-Jul-13	open water	3.7	bottom	0.1	12.0	97.0	10.4
Giraffe North	GIRNORTH	14-Jul-13	open water	3.7	bottom	0.5	12.2	96.9	10.4
Giraffe North	GIRNORTH	14-Jul-13	open water	3.7	bottom	1.0	12.2	96.8	10.4
Giraffe North	GIRNORTH	14-Jul-13	open water	3.7	bottom	1.5	12.2	96.8	10.4
Giraffe North	GIRNORTH	14-Jul-13	open water	3.7	bottom	2.0	12.3	96.8	10.4
Giraffe North	GIRNORTH	14-Jul-13	open water	3.7	bottom	2.5	12.3	96.7	10.4
Giraffe North	GIRNORTH	14-Jul-13	open water	3.7	bottom	3.0	12.3	96.1	10.3
Giraffe North	GIRNORTH	14-Jul-13	open water	3.7	bottom	3.5	12.3	96.0	10.2
Giraffe South	GIRSOUTH	14-Jul-13	open water	7.3	6.2	0.1	11.6	95.9	10.4
Giraffe South	GIRSOUTH	14-Jul-13	open water	7.3	6.2	0.5	11.7	95.9	10.4
Giraffe South	GIRSOUTH	14-Jul-13	open water	7.3	6.2	1.0	11.7	95.9	10.4
Giraffe South	GIRSOUTH	14-Jul-13	open water	7.3	6.2	1.5	11.7	95.7	10.4
Giraffe South	GIRSOUTH	14-Jul-13	open water	7.3	6.2	2.0	11.8	95.7	10.4
Giraffe South	GIRSOUTH	14-Jul-13	open water	7.3	6.2	2.5	11.7	95.6	10.4
Giraffe South	GIRSOUTH	14-Jul-13	open water	7.3	6.2	3.0	11.6	95.6	10.4
Giraffe South	GIRSOUTH	14-Jul-13	open water	7.3	6.2	3.5	11.6	95.5	10.4
Giraffe South	GIRSOUTH	14-Jul-13	open water	7.3	6.2	4.0	11.7	95.4	10.4
Giraffe South	GIRSOUTH	14-Jul-13	open water	7.3	6.2	4.5	11.6	95.4	10.4
Giraffe South	GIRSOUTH	14-Jul-13	open water	7.3	6.2	5.0	11.6	95.3	10.4
Giraffe South	GIRSOUTH	14-Jul-13	open water	7.3	6.2	5.5	11.6	95.3	10.4
Giraffe South	GIRSOUTH	14-Jul-13	open water	7.3	6.2	6.0	11.6	95.2	10.4
Giraffe South	GIRSOUTH	14-Jul-13	open water	7.3	6.2	6.5	11.6	95.0	10.3
Giraffe South	GIRSOUTH	14-Jul-13	open water	7.3	6.2	7.0	11.5	94.6	10.3
Umwelt	UMWLK	15-Jul-13	open water	2.7	bottom	0.1	9.0	96.8	11.2
Umwelt	UMWLK	15-Jul-13	open water	2.7	bottom	0.5	9.1	96.8	11.2
Umwelt	UMWLK	15-Jul-13	open water	2.7	bottom	1.0	9.1	96.7	11.2
Umwelt	UMWLK	15-Jul-13	open water	2.7	bottom	1.5	9.1	96.6	11.2
Umwelt	UMWLK	15-Jul-13	open water	2.7	bottom	2.0	9.0	96.7	11.2
Rascal	RASCLK	13-Jul-13	open water	2.4	bottom	0.1	12.1	97.5	10.5
Rascal	RASCLK	13-Jul-13	open water	2.4	bottom	0.5	12.1	97.8	10.5
Rascal	RASCLK	13-Jul-13	open water	2.4	bottom	1.0	12.1	97.8	10.5
Rascal	RASCLK	13-Jul-13	open water	2.4	bottom	1.5	12.2	97.7	10.5
Rascal	RASCLK	13-Jul-13	open water	2.4	bottom	2.0	12.1	97.9	10.5
Goose Neck	GOOSENECK	21-Jul-13	open water	2.6	bottom	0.1	12.4	100.9	10.8
Goose Neck	GOOSENECK	21-Jul-13	open water	2.6	bottom	0.5	12.4	100.9	10.8
Goose Neck	GOOSENECK	21-Jul-13	open water	2.6	bottom	1.0	12.4	100.8	10.8
Goose Neck	GOOSENECK	21-Jul-13	open water	2.6	bottom	1.5	12.4	100.8	10.8
Goose Neck	GOOSENECK	21-Jul-13	open water	2.6	bottom	2.0	12.3	100.8	10.8

Appendix 3.2-2. Open Water Secchi Depths and Dissolved Oxygen and Temperature Profiles, Back River Project, July 2013

Site Name	Site Code	Date	Season	Maximum Site Depth (m)	Secchi Depth (m)	Depth (m)	Temperature (°C)	Dissolved Oxygen Saturation (%)	Dissolved Oxygen Concentration (mg/L)
Goose Central	GOOSECENT	21-Jul-13	open water	4.2	bottom	0.1	12.0	100.3	10.8
Goose Central	GOOSECENT	21-Jul-13	open water	4.2	bottom	0.5	12.0	100.6	10.9
Goose Central	GOOSECENT	21-Jul-13	open water	4.2	bottom	1.0	11.9	100.7	10.9
Goose Central	GOOSECENT	21-Jul-13	open water	4.2	bottom	1.5	11.9	100.6	10.9
Goose Central	GOOSECENT	21-Jul-13	open water	4.2	bottom	2.0	11.9	100.7	10.9
Goose Central	GOOSECENT	21-Jul-13	open water	4.2	bottom	2.5	11.9	100.6	10.9
Goose Central	GOOSECENT	21-Jul-13	open water	4.2	bottom	3.0	11.9	100.5	10.9
Goose Central	GOOSECENT	21-Jul-13	open water	4.2	bottom	3.5	11.7	100.3	10.9
Goose Central	GOOSECENT	21-Jul-13	open water	4.2	bottom	4.0	11.7	99.3	10.9
Goose Tail	GOOSETAILNEW	20-Jul-13	open water	7	bottom	0.1	12.6	102.8	11.0
Goose Tail	GOOSETAILNEW	20-Jul-13	open water	7	bottom	0.5	12.4	103.1	11.0
Goose Tail	GOOSETAILNEW	20-Jul-13	open water	7	bottom	1.0	12.4	103.2	11.0
Goose Tail	GOOSETAILNEW	20-Jul-13	open water	7	bottom	1.5	12.4	103.2	11.0
Goose Tail	GOOSETAILNEW	20-Jul-13	open water	7	bottom	2.0	12.4	103.1	11.0
Goose Tail	GOOSETAILNEW	20-Jul-13	open water	7	bottom	2.5	11.7	101.4	11.0
Goose Tail	GOOSETAILNEW	20-Jul-13	open water	7	bottom	3.0	11.4	101.0	11.1
Goose Tail	GOOSETAILNEW	20-Jul-13	open water	7	bottom	3.5	10.8	100.7	11.2
Goose Tail	GOOSETAILNEW	20-Jul-13	open water	7	bottom	4.0	10.7	100.1	11.1
Goose Tail	GOOSETAILNEW	20-Jul-13	open water	7	bottom	4.5	10.5	99.8	11.2
Goose Tail	GOOSETAILNEW	20-Jul-13	open water	7	bottom	5.0	10.4	99.6	11.1
Goose Tail	GOOSETAILNEW	20-Jul-13	open water	7	bottom	5.5	10.3	99.4	11.1
Goose Tail	GOOSETAILNEW	20-Jul-13	open water	7	bottom	6.0	10.2	99.1	11.1
Goose Tail	GOOSETAILNEW	20-Jul-13	open water	7	bottom	6.5	10.2	98.6	11.1
Goose Tail	GOOSETAILNEW	20-Jul-13	open water	7	bottom	7.0	10.2	98.9	11.1
Goose South	GOOSESTH	20-Jul-13	open water	3.4	bottom	0.1	12.9	101.3	10.7
Goose South	GOOSESTH	20-Jul-13	open water	3.4	bottom	0.5	12.8	101.7	10.8
Goose South	GOOSESTH	20-Jul-13	open water	3.4	bottom	1.0	12.8	101.7	10.8
Goose South	GOOSESTH	20-Jul-13	open water	3.4	bottom	1.5	12.7	101.9	10.8
Goose South	GOOSESTH	20-Jul-13	open water	3.4	bottom	2.0	12.6	101.6	10.8
Goose South	GOOSESTH	20-Jul-13	open water	3.4	bottom	2.5	12.4	101.9	10.9
Goose South	GOOSESTH	20-Jul-13	open water	3.4	bottom	3.0	12.3	101.7	10.9
Arrow	ARRLK	15-Jul-13	open water	0.7	bottom	0.1	9.1	101.1	11.7
Propeller	PROLK	19-Jul-13	open water	8.1	7.5	0.1	11.0	100.5	11.1
Propeller	PROLK	19-Jul-13	open water	8.1	7.5	0.5	10.7	100.4	11.2
Propeller	PROLK	19-Jul-13	open water	8.1	7.5	1.0	10.6	100.1	11.1
Propeller	PROLK	19-Jul-13	open water	8.1	7.5	1.5	10.5	99.7	11.1
Propeller	PROLK	19-Jul-13	open water	8.1	7.5	2.0	10.5	99.7	11.1
Propeller	PROLK	19-Jul-13	open water	8.1	7.5	2.5	10.4	99.7	11.2

Appendix 3.2-2. Open Water Secchi Depths and Dissolved Oxygen and Temperature Profiles, Back River Project, July 2013

Site Name	Site Code	Date	Season	Maximum Site Depth (m)	Secchi Depth (m)	Depth (m)	Temperature (°C)	Dissolved Oxygen Saturation (%)	Dissolved Oxygen Concentration (mg/L)
Propeller	PROLK	19-Jul-13	open water	8.1	7.5	3.0	10.4	99.7	11.2
Propeller	PROLK	19-Jul-13	open water	8.1	7.5	3.5	10.4	99.6	11.1
Propeller	PROLK	19-Jul-13	open water	8.1	7.5	4.0	10.4	99.6	11.1
Propeller	PROLK	19-Jul-13	open water	8.1	7.5	4.5	10.4	99.4	11.1
Propeller	PROLK	19-Jul-13	open water	8.1	7.5	5.0	10.3	99.1	11.1
Propeller	PROLK	19-Jul-13	open water	8.1	7.5	5.5	10.3	99.0	11.1
Propeller	PROLK	19-Jul-13	open water	8.1	7.5	6.0	10.3	98.8	11.1
Propeller	PROLK	19-Jul-13	open water	8.1	7.5	6.5	10.2	98.5	11.1
Propeller	PROLK	19-Jul-13	open water	8.1	7.5	7.0	10.1	98.4	11.0
Propeller	PROLK	19-Jul-13	open water	8.1	7.5	7.5	10.1	98.3	11.1
Reference B	REFBLK	17-Jul-13	open water	4.9	bottom	0.1	10.0	97.4	11.0
Reference B	REFBLK	17-Jul-13	open water	4.9	bottom	0.5	10.1	97.2	11.0
Reference B	REFBLK	17-Jul-13	open water	4.9	bottom	1.0	10.1	97.2	10.9
Reference B	REFBLK	17-Jul-13	open water	4.9	bottom	1.5	10.1	97.1	10.9
Reference B	REFBLK	17-Jul-13	open water	4.9	bottom	2.0	10.1	97.0	10.9
Reference B	REFBLK	17-Jul-13	open water	4.9	bottom	2.5	10.1	97.0	10.9
Reference B	REFBLK	17-Jul-13	open water	4.9	bottom	3.0	10.1	97.0	10.9
Reference B	REFBLK	17-Jul-13	open water	4.9	bottom	3.5	10.1	96.9	10.9
Reference B	REFBLK	17-Jul-13	open water	4.9	bottom	4.0	10.1	96.8	10.9
Reference B	REFBLK	17-Jul-13	open water	4.9	bottom	4.5	10.1	96.8	10.9
Beechey	BEECHLK	19-Jul-13	open water	21.3	7	0.1	12.3	101.7	10.9
Beechey	BEECHLK	19-Jul-13	open water	21.3	7	0.5	12.1	101.8	10.9
Beechey	BEECHLK	19-Jul-13	open water	21.3	7	1.0	12.1	101.6	11.0
Beechey	BEECHLK	19-Jul-13	open water	21.3	7	1.5	11.9	101.1	10.9
Beechey	BEECHLK	19-Jul-13	open water	21.3	7	2.0	11.4	100.4	11.0
Beechey	BEECHLK	19-Jul-13	open water	21.3	7	2.5	11.4	100.3	11.0
Beechey	BEECHLK	19-Jul-13	open water	21.3	7	3.0	11.3	100.2	11.0
Beechey	BEECHLK	19-Jul-13	open water	21.3	7	3.5	11.2	100.0	11.0
Beechey	BEECHLK	19-Jul-13	open water	21.3	7	4.0	11.0	99.3	11.0
Beechey	BEECHLK	19-Jul-13	open water	21.3	7	4.5	10.9	98.9	10.9
Beechey	BEECHLK	19-Jul-13	open water	21.3	7	5.0	10.8	98.7	10.9
Beechey	BEECHLK	19-Jul-13	open water	21.3	7	5.5	10.8	98.6	10.9
Beechey	BEECHLK	19-Jul-13	open water	21.3	7	6.0	10.8	98.6	10.9
Beechey	BEECHLK	19-Jul-13	open water	21.3	7	6.5	10.8	98.4	10.9
Beechey	BEECHLK	19-Jul-13	open water	21.3	7	7.0	10.8	98.3	10.9
Beechey	BEECHLK	19-Jul-13	open water	21.3	7	7.5	10.8	98.3	10.9
Beechey	BEECHLK	19-Jul-13	open water	21.3	7	8.0	10.8	98.2	10.9
Beechey	BEECHLK	19-Jul-13	open water	21.3	7	8.5	10.8	98.1	10.9

Appendix 3.2-2. Open Water Secchi Depths and Dissolved Oxygen and Temperature Profiles, Back River Project, July 2013

Site Name	Site Code	Date	Season	Maximum Site Depth (m)	Secchi Depth (m)	Depth (m)	Temperature (°C)	Dissolved Oxygen Saturation (%)	Dissolved Oxygen Concentration (mg/L)
Beechey	BEECHLK	19-Jul-13	open water	21.3	7	9.0	10.8	98.0	10.9
Beechey	BEECHLK	19-Jul-13	open water	21.3	7	9.5	10.8	98.0	10.9
Beechey	BEECHLK	19-Jul-13	open water	21.3	7	10.0	10.8	97.9	10.9
Beechey	BEECHLK	19-Jul-13	open water	21.3	7	11.0	10.8	97.7	10.8
Beechey	BEECHLK	19-Jul-13	open water	21.3	7	12.0	10.7	97.6	10.8
Beechey	BEECHLK	19-Jul-13	open water	21.3	7	13.0	10.6	97.6	10.9
Beechey	BEECHLK	19-Jul-13	open water	21.3	7	14.0	10.6	97.7	10.9
Beechey	BEECHLK	19-Jul-13	open water	21.3	7	15.0	10.5	97.6	10.9
Beechey	BEECHLK	19-Jul-13	open water	21.3	7	16.0	10.5	97.5	10.9
Beechey	BEECHLK	19-Jul-13	open water	21.3	7	17.0	10.5	97.3	10.9
Beechey	BEECHLK	19-Jul-13	open water	21.3	7	18.0	10.4	97.2	10.9
Beechey	BEECHLK	19-Jul-13	open water	21.3	7	19.0	10.4	97.0	10.9
Beechey	BEECHLK	19-Jul-13	open water	21.3	7	20.0	10.4	96.9	10.9
Beechey	BEECHLK	19-Jul-13	open water	21.3	7	21.0	10.3	95.8	10.7
Upper Long	UPLONGLK	11-Jul-13	open water	3.9	bottom	0.1	14.9	98.7	10.0
Upper Long	UPLONGLK	11-Jul-13	open water	3.9	bottom	0.5	14.8	99.0	10.0
Upper Long	UPLONGLK	11-Jul-13	open water	3.9	bottom	1.0	14.8	99.1	10.0
Upper Long	UPLONGLK	11-Jul-13	open water	3.9	bottom	1.5	14.8	99.1	10.0
Upper Long	UPLONGLK	11-Jul-13	open water	3.9	bottom	2.0	14.8	99.1	10.0
Upper Long	UPLONGLK	11-Jul-13	open water	3.9	bottom	2.5	14.8	99.0	10.0
Upper Long	UPLONGLK	11-Jul-13	open water	3.9	bottom	3.0	14.8	99.1	10.0
Upper Long	UPLONGLK	11-Jul-13	open water	3.9	bottom	3.5	14.7	99.3	10.1
Lower Long (Deep)	LOWLONGDP	12-Jul-13	open water	9.6	7	0.1	13.4	98.3	10.3
Lower Long (Deep)	LOWLONGDP	12-Jul-13	open water	9.6	7	0.5	13.5	98.3	10.2
Lower Long (Deep)	LOWLONGDP	12-Jul-13	open water	9.6	7	1.0	13.5	98.1	10.2
Lower Long (Deep)	LOWLONGDP	12-Jul-13	open water	9.6	7	1.5	13.6	98.1	10.2
Lower Long (Deep)	LOWLONGDP	12-Jul-13	open water	9.6	7	2.0	13.6	98.0	10.2
Lower Long (Deep)	LOWLONGDP	12-Jul-13	open water	9.6	7	2.5	13.6	98.0	10.2
Lower Long (Deep)	LOWLONGDP	12-Jul-13	open water	9.6	7	3.0	13.6	98.0	10.2
Lower Long (Deep)	LOWLONGDP	12-Jul-13	open water	9.6	7	3.5	13.6	97.8	10.2
Lower Long (Deep)	LOWLONGDP	12-Jul-13	open water	9.6	7	4.0	13.6	97.9	10.2
Lower Long (Deep)	LOWLONGDP	12-Jul-13	open water	9.6	7	4.5	13.6	97.8	10.2
Lower Long (Deep)	LOWLONGDP	12-Jul-13	open water	9.6	7	5.0	13.6	97.8	10.2
Lower Long (Deep)	LOWLONGDP	12-Jul-13	open water	9.6	7	5.5	13.6	97.7	10.2
Lower Long (Deep)	LOWLONGDP	12-Jul-13	open water	9.6	7	6.0	13.5	97.6	10.2
Lower Long (Deep)	LOWLONGDP	12-Jul-13	open water	9.6	7	6.5	13.5	97.5	10.2
Lower Long (Deep)	LOWLONGDP	12-Jul-13	open water	9.6	7	7.0	13.2	97.3	10.2
Lower Long (Deep)	LOWLONGDP	12-Jul-13	open water	9.6	7	7.5	11.6	97.0	10.5

Appendix 3.2-2. Open Water Secchi Depths and Dissolved Oxygen and Temperature Profiles, Back River Project, July 2013

Site Name	Site Code	Date	Season	Maximum Site Depth (m)	Secchi Depth (m)	Depth (m)	Temperature (°C)	Dissolved Oxygen Saturation (%)	Dissolved Oxygen Concentration (mg/L)
Lower Long (Deep)	LOWLONGDP	12-Jul-13	open water	9.6	7	8.0	11.3	96.3	10.6
Lower Long (Deep)	LOWLONGDP	12-Jul-13	open water	9.6	7	8.5	11.2	95.1	10.4
Lower Long (Deep)	LOWLONGDP	12-Jul-13	open water	9.6	7	9.0	11.0	93.2	10.3
Fold	FOLDLK	12-Jul-13	open water	13.9	8	0.1	13.3	98.9	10.4
Fold	FOLDLK	12-Jul-13	open water	13.9	8	0.5	13.4	98.9	10.3
Fold	FOLDLK	12-Jul-13	open water	13.9	8	1.0	13.4	98.9	10.3
Fold	FOLDLK	12-Jul-13	open water	13.9	8	1.5	13.5	98.9	10.3
Fold	FOLDLK	12-Jul-13	open water	13.9	8	2.0	13.5	98.8	10.3
Fold	FOLDLK	12-Jul-13	open water	13.9	8	2.5	13.5	98.7	10.3
Fold	FOLDLK	12-Jul-13	open water	13.9	8	3.0	13.5	98.7	10.3
Fold	FOLDLK	12-Jul-13	open water	13.9	8	3.5	13.5	98.6	10.3
Fold	FOLDLK	12-Jul-13	open water	13.9	8	4.0	13.5	98.5	10.3
Fold	FOLDLK	12-Jul-13	open water	13.9	8	4.5	13.5	98.5	10.3
Fold	FOLDLK	12-Jul-13	open water	13.9	8	5.0	13.5	98.4	10.3
Fold	FOLDLK	12-Jul-13	open water	13.9	8	5.5	13.5	98.3	10.3
Fold	FOLDLK	12-Jul-13	open water	13.9	8	6.0	13.5	98.3	10.2
Fold	FOLDLK	12-Jul-13	open water	13.9	8	6.5	13.5	98.2	10.2
Fold	FOLDLK	12-Jul-13	open water	13.9	8	7.0	13.5	98.1	10.2
Fold	FOLDLK	12-Jul-13	open water	13.9	8	7.5	13.5	97.9	10.2
Fold	FOLDLK	12-Jul-13	open water	13.9	8	8.0	13.4	97.8	10.2
Fold	FOLDLK	12-Jul-13	open water	13.9	8	8.5	12.3	98.3	10.5
Fold	FOLDLK	12-Jul-13	open water	13.9	8	9.0	11.6	98.1	10.7
Fold	FOLDLK	12-Jul-13	open water	13.9	8	9.5	11.2	97.5	10.7
Fold	FOLDLK	12-Jul-13	open water	13.9	8	10.0	11.2	96.6	10.6
Fold	FOLDLK	12-Jul-13	open water	13.9	8	11.0	10.8	95.3	10.6
Fold	FOLDLK	12-Jul-13	open water	13.9	8	12.0	10.6	93.0	10.4
George Central	GEORGCENT	8-Jul-13	open water	12.5	11.2	0.1	14.7	101.2	10.3
George Central	GEORGCENT	8-Jul-13	open water	12.5	11.2	0.5	14.4	100.4	10.3
George Central	GEORGCENT	8-Jul-13	open water	12.5	11.2	1.0	14.0	101.0	10.4
George Central	GEORGCENT	8-Jul-13	open water	12.5	11.2	1.5	13.9	100.8	10.4
George Central	GEORGCENT	8-Jul-13	open water	12.5	11.2	2.0	13.9	100.2	10.4
George Central	GEORGCENT	8-Jul-13	open water	12.5	11.2	2.5	13.9	100.0	10.4
George Central	GEORGCENT	8-Jul-13	open water	12.5	11.2	3.0	13.8	99.7	10.3
George Central	GEORGCENT	8-Jul-13	open water	12.5	11.2	3.5	13.8	99.6	10.3
George Central	GEORGCENT	8-Jul-13	open water	12.5	11.2	4.0	13.7	99.4	10.3
George Central	GEORGCENT	8-Jul-13	open water	12.5	11.2	4.5	13.7	99.3	10.3
George Central	GEORGCENT	8-Jul-13	open water	12.5	11.2	5.0	13.7	99.1	10.3
George Central	GEORGCENT	8-Jul-13	open water	12.5	11.2	5.5	13.6	99.1	10.3

Appendix 3.2-2. Open Water Secchi Depths and Dissolved Oxygen and Temperature Profiles, Back River Project, July 2013

Site Name	Site Code	Date	Season	Maximum Site Depth (m)	Secchi Depth (m)	Depth (m)	Temperature (°C)	Dissolved Oxygen Saturation (%)	Dissolved Oxygen Concentration (mg/L)
George Central	GEORGCENT	8-Jul-13	open water	12.5	11.2	6.0	13.6	99.0	10.3
George Central	GEORGCENT	8-Jul-13	open water	12.5	11.2	6.5	13.6	98.8	10.3
George Central	GEORGCENT	8-Jul-13	open water	12.5	11.2	7.0	13.5	98.7	10.3
George Central	GEORGCENT	8-Jul-13	open water	12.5	11.2	7.5	13.5	98.6	10.3
George Central	GEORGCENT	8-Jul-13	open water	12.5	11.2	8.0	13.4	98.4	10.3
George Central	GEORGCENT	8-Jul-13	open water	12.5	11.2	8.5	13.4	98.0	10.3
George Central	GEORGCENT	8-Jul-13	open water	12.5	11.2	9.0	13.3	97.7	10.2
George Central	GEORGCENT	8-Jul-13	open water	12.5	11.2	9.5	13.1	97.1	10.3
George Central	GEORGCENT	8-Jul-13	open water	12.5	11.2	10.0	12.3	96.7	10.4
George Central	GEORGCENT	8-Jul-13	open water	12.5	11.2	11.0	12.0	96.5	10.4
George Central	GEORGCENT	8-Jul-13	open water	12.5	11.2	12.0	12.0	95.4	10.3
Bob	BOBCENT	11-Jul-13	open water	3.4	bottom	0.1	14.8	98.7	10.0
Bob	BOBCENT	11-Jul-13	open water	3.4	bottom	0.5	14.8	98.7	10.0
Bob	BOBCENT	11-Jul-13	open water	3.4	bottom	1.0	14.9	98.6	10.0
Bob	BOBCENT	11-Jul-13	open water	3.4	bottom	1.5	14.9	98.6	10.0
Bob	BOBCENT	11-Jul-13	open water	3.4	bottom	2.0	14.9	98.5	10.0
Bob	BOBCENT	11-Jul-13	open water	3.4	bottom	2.5	14.9	98.5	10.0
Bob	BOBCENT	11-Jul-13	open water	3.4	bottom	3.0	14.8	98.6	10.0
Occurrence	OCCLK	9-Jul-13	open water	1.5	bottom	0.1	16.6	102.9	10.1
Occurrence	OCCLK	9-Jul-13	open water	1.5	bottom	0.5	16.3	103.2	10.1
Occurrence	OCCLK	9-Jul-13	open water	1.5	bottom	1.0	16.3	103.6	10.2
Slave	SLAVELK	12-Jul-13	open water	1	bottom	0.1	12.9	96.0	10.1
Slave	SLAVELK	12-Jul-13	open water	1	bottom	0.5	12.9	96.1	10.2
Esker	ESKERLK	12-Jul-13	open water	0.4	bottom	0.1	11.1	98.1	10.8
Dragon	DRAGLK	11-Jul-13	open water	3.6	bottom	0.1	15.2	99.4	10.0
Dragon	DRAGLK	11-Jul-13	open water	3.6	bottom	0.5	15.2	99.6	10.0
Dragon	DRAGLK	11-Jul-13	open water	3.6	bottom	1.0	15.2	99.7	10.0
Dragon	DRAGLK	11-Jul-13	open water	3.6	bottom	1.5	15.2	99.7	10.0
Dragon	DRAGLK	11-Jul-13	open water	3.6	bottom	2.0	15.1	99.8	10.0
Dragon	DRAGLK	11-Jul-13	open water	3.6	bottom	2.5	15.1	100.1	10.1
Dragon	DRAGLK	11-Jul-13	open water	3.6	bottom	3.0	15.1	100.4	10.1
Komatic	KOMALK	10-Jul-13	open water	7.3	bottom	0.1	15.7	98.8	9.8
Komatic	KOMALK	10-Jul-13	open water	7.3	bottom	0.5	15.7	98.8	9.8
Komatic	KOMALK	10-Jul-13	open water	7.3	bottom	1.0	15.7	98.8	9.8
Komatic	KOMALK	10-Jul-13	open water	7.3	bottom	1.5	15.7	98.8	9.8
Komatic	KOMALK	10-Jul-13	open water	7.3	bottom	2.0	15.7	98.6	9.8
Komatic	KOMALK	10-Jul-13	open water	7.3	bottom	2.5	15.6	98.5	9.8
Komatic	KOMALK	10-Jul-13	open water	7.3	bottom	3.0	15.5	97.9	9.8

Appendix 3.2-2. Open Water Secchi Depths and Dissolved Oxygen and Temperature Profiles, Back River Project, July 2013

Site Name	Site Code	Date	Season	Maximum Site Depth (m)	Secchi Depth (m)	Depth (m)	Temperature (°C)	Dissolved Oxygen Saturation (%)	Dissolved Oxygen Concentration (mg/L)
Komatic	KOMALK	10-Jul-13	open water	7.3	bottom	3.5	15.3	97.7	9.8
Komatic	KOMALK	10-Jul-13	open water	7.3	bottom	4.0	15.1	97.4	9.8
Komatic	KOMALK	10-Jul-13	open water	7.3	bottom	4.5	15.1	97.1	9.8
Komatic	KOMALK	10-Jul-13	open water	7.3	bottom	5.0	15.0	97.2	9.8
Komatic	KOMALK	10-Jul-13	open water	7.3	bottom	5.5	14.8	96.6	9.8
Komatic	KOMALK	10-Jul-13	open water	7.3	bottom	6.0	14.2	95.0	9.8
McCoy	MCCOYLK	10-Jul-13	open water	5.6	bottom	0.1	14.9	98.2	9.9
McCoy	MCCOYLK	10-Jul-13	open water	5.6	bottom	0.5	14.9	98.3	9.9
McCoy	MCCOYLK	10-Jul-13	open water	5.6	bottom	1.0	14.9	98.3	9.9
McCoy	MCCOYLK	10-Jul-13	open water	5.6	bottom	1.5	14.9	98.3	9.9
McCoy	MCCOYLK	10-Jul-13	open water	5.6	bottom	2.0	14.9	98.2	9.9
McCoy	MCCOYLK	10-Jul-13	open water	5.6	bottom	2.5	14.9	98.2	9.9
McCoy	MCCOYLK	10-Jul-13	open water	5.6	bottom	3.0	14.9	98.2	9.9
McCoy	MCCOYLK	10-Jul-13	open water	5.6	bottom	3.5	14.9	98.2	9.9
McCoy	MCCOYLK	10-Jul-13	open water	5.6	bottom	4.0	14.9	98.0	9.9
McCoy	MCCOYLK	10-Jul-13	open water	5.6	bottom	4.5	14.9	98.1	9.9
McCoy	MCCOYLK	10-Jul-13	open water	5.6	bottom	5.0	14.9	97.9	9.9
Reference Q	REFQLK	9-Jul-13	open water	16.7	10	0.1	14.4	100.7	10.3
Reference Q	REFQLK	9-Jul-13	open water	16.7	10	0.5	14.2	100.9	10.4
Reference Q	REFQLK	9-Jul-13	open water	16.7	10	1.0	14.1	101.0	10.4
Reference Q	REFQLK	9-Jul-13	open water	16.7	10	1.5	14.1	100.9	10.4
Reference Q	REFQLK	9-Jul-13	open water	16.7	10	2.0	14.0	100.8	10.4
Reference Q	REFQLK	9-Jul-13	open water	16.7	10	2.5	14.0	100.8	10.4
Reference Q	REFQLK	9-Jul-13	open water	16.7	10	3.0	14.0	100.7	10.4
Reference Q	REFQLK	9-Jul-13	open water	16.7	10	3.5	13.8	100.6	10.4
Reference Q	REFQLK	9-Jul-13	open water	16.7	10	4.0	13.7	100.7	10.5
Reference Q	REFQLK	9-Jul-13	open water	16.7	10	4.5	13.6	100.4	10.4
Reference Q	REFQLK	9-Jul-13	open water	16.7	10	5.0	13.5	100.0	10.4
Reference Q	REFQLK	9-Jul-13	open water	16.7	10	5.5	13.4	99.9	10.4
Reference Q	REFQLK	9-Jul-13	open water	16.7	10	6.0	13.4	99.6	10.4
Reference Q	REFQLK	9-Jul-13	open water	16.7	10	6.5	13.2	99.4	10.4
Reference Q	REFQLK	9-Jul-13	open water	16.7	10	7.0	13.1	99.2	10.4
Reference Q	REFQLK	9-Jul-13	open water	16.7	10	7.5	12.6	99.1	10.6
Reference Q	REFQLK	9-Jul-13	open water	16.7	10	8.0	12.0	98.2	10.6
Reference Q	REFQLK	9-Jul-13	open water	16.7	10	8.5	11.7	98.0	10.6
Reference Q	REFQLK	9-Jul-13	open water	16.7	10	9.0	11.5	97.6	10.6
Reference Q	REFQLK	9-Jul-13	open water	16.7	10	9.5	11.4	97.6	10.7
Reference Q	REFQLK	9-Jul-13	open water	16.7	10	10.0	11.3	97.4	10.7

Appendix 3.2-2. Open Water Secchi Depths and Dissolved Oxygen and Temperature Profiles, Back River Project, July 2013

Site Name	Site Code	Date	Season	Maximum Site Depth (m)	Secchi Depth (m)	Depth (m)	Temperature (°C)	Dissolved Oxygen Saturation (%)	Dissolved Oxygen Concentration (mg/L)
Reference Q	REFQLK	9-Jul-13	open water	16.7	10	11.0	10.9	97.2	10.8
Reference Q	REFQLK	9-Jul-13	open water	16.7	10	12.0	10.2	97.6	11.0
Reference Q	REFQLK	9-Jul-13	open water	16.7	10	13.0	7.8	99.2	11.8
Reference Q	REFQLK	9-Jul-13	open water	16.7	10	14.0	7.1	98.1	11.9
Reference Q	REFQLK	9-Jul-13	open water	16.7	10	15.0	6.6	97.1	11.9
Reference Q	REFQLK	9-Jul-13	open water	16.7	10	16.0	6.4	96.2	11.8

Appendix 3.3-1

Lake Water Quality Analytical Results, Back River Project, 2013

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Appendix 3.3-1. Lake Water Quality Analytical Results, Back River Project, 2013

Lake Site Name				Wasp	Wasp	Wasp	Wasp	Leaf	Giraffe North	Giraffe North	Giraffe South	Giraffe South	Giraffe South	Giraffe South	Giraffe South	Umwelk	Pond 1
Site Code			Realized	WASPLK	WASPLK	WASPLK	LEAFLK	LEAFLK	GIRNORTH	GIRNORTH	GIRSOUTH	GIRSOUTH	GIRSOUTH	GIRSOUTH	GIRSOUTH	UMWLK	POND1
Depth (m)*			Detection	1	13	1	5	1	1	1	5.6	1	1	1	5.5	0.1	shore grab
Replicate			Limit						FDUP			FDUP					
Date Sampled		CCME Guidelines for the Protection of Freshwater Aquatic Life[a]	(RDL) (for freshwater baseline samples)^	9-Apr-13	16-Jul-13	16-Jul-13	16-Jul-13	16-Jul-13	14-Jul-13	14-Jul-13	9-Apr-13	9-Apr-13	9-Apr-13	14-Jul-13	14-Jul-13	15-Jul-13	28-Jul-13
ALS Sample ID #	Units			L1289265-5	L1334948-5	L1334948-4	L1334948-7	L1334948-6	L1332346-6	L1332346-5	L1289265-4	L1289265-3	L1289265-2	L1332346-4	L1332346-2	L1334948-3	L1339503-10
Physical Tests																	
Conductivity	µS/cm		2.0	55.0	32.3	32.5	33.8	33.7	29.6	29.6	65.8	61.1	60.6	29.8	29.8	112.0	129.0
Hardness (as $CaCO_3$)	mg/L		0.50	20.40	11.70	11.50	12.20	12.50	11.40	11.00	25.40	23.10	22.60	12.10	11.40	39.50	49.00
pH	pH	6.5-9.0	0.10	6.80	6.91	6.94	6.95	6.95	6.88	6.90	6.66	6.77	6.77	6.89	6.92	6.67	7.07
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		2.0	7.8	4.2	4.0	4.1	4.2	4.3	4.6	11.7	10.0	10.3	4.5	4.6	2.5	9.5
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		2.0	7.8	4.2	4.0	4.1	4.2	4.3	4.6	11.7	10.0	10.3	4.5	4.6	2.5	9.5
Total Suspended Solids	mg/L	dependent on background levels	3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Total Dissolved Solids	mg/L		10	39	23	24	32	21	27	25	35	32	34	28	28	108	129
Turbidity	NTU	dependent on background levels	0.10	0.54	0.31	0.31	0.22	0.19	0.30	0.30	0.39	0.29	0.22	0.74	0.37	0.29	1.86
Nutrients																	
Ammonia, Total (as N)	mg/L	pH- and temperature-dependent	0.0050	0.0255	<0.0050	<0.0050	<0.0050	0.0052	<0.0050	<0.0050	0.0763	0.0422	0.0401	<0.0050	<0.0050	0.0073	0.0196
Nitrate (as N)	mg/L	short-term: 124; long-term: 3	0.0050	0.0118	<0.0050	<0.0050	0.0073	0.0067	<0.0050	<0.0050	0.0626	0.0137	0.0132	<0.0050	<0.0050	<0.0050	<0.0050
Nitrite (as N)	mg/L	0.06	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L		0.05	0.24	0.17	0.17	0.16	0.16	0.19	0.16	0.29	0.23	0.24	0.16	0.17	0.23	0.61
Ortho-phosphate (as P)	mg/L		0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus (P)	mg/L	Trigger ranges from guidance framework[c]	0.002	0.007	0.003	0.003	0.003	0.003	0.002	0.003	0.003	0.003	0.003	0.003	0.003	0.004	0.008
Anions																	
Bromide (Br)	mg/L		0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.251	0.194
Chloride (Cl)	mg/L	short-term: 640; long-term: 120	0.50	1.15	0.65	0.66	0.71	0.71	0.71	0.72	1.23	1.14	1.13	0.72	0.72	27.00	27.60
Fluoride (F)	mg/L	0.12[b]	0.02	0.04	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.02	0.02	<0.020	0.04
Sulfate (SO_4)	mg/L		0.5	15.0	8.6	8.6	9.1	9.1	7.7	7.7	15.9	15.4	15.4	7.7	7.8	3.9	5.7
Cyanides																	
Cyanide, Total	mg/L		0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0013
Cyanide, Free	mg/L	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic Carbon																	
Total Organic Carbon	mg/L		0.5 - 1.0	4.07	3.59	3.73	3.22	3.14	3.81	3.36	3.98	3.85	4.01	3.36	3.32	4.03	13.50
Total Metals																	
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.0030	0.0117	0.0111	0.0120	0.0102	0.0098	0.0159	0.0161	0.0093	0.0068	0.0065	0.0156	0.0152	0.0072	0.0223
Antimony (Sb)	mg/L		0.00005	0.000803	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000053	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L	0.005	0.000030	0.000249	0.000205	0.000193	0.000232	0.000206	0.000221	0.000206	0.000256	0.000254	0.000236	0.000226	0.000197	0.000262	0.000415
Barium (Ba)	mg/L		0.000050	0.005960	0.003370	0.003600	0.003740	0.003390	0.003710	0.003900	0.010100	0.007860	0.007810	0.003860	0.003910	0.025500	0.039200
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0057	0.0109
Cadmium (Cd)	mg/L	equation[d]	0.000010	0.000019	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000011	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	3.600	2.080	2.150	2.220	2.160	2.080	2.080	4.770	4.200	4.270	2.090	2.100	13.200	11.800
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.00010	0.00080	<0.00010	<0.00010	<0.00010	0.00012	0.00013	0.00014	0.00033	0.00012	0.00023	0.00011	0.00012	<0.00010	0.00027
Cobalt (Co)	mg/L		0.00010	0.00030	0.00021	0.00020	<0.00010	<0.00010	0.00013	0.00014	0.00199	0.00021	0.00023	0.00013	0.00014	<0.00010	0.00026
Copper (Cu)	mg/L	0.002-0.004[e]	0.00050	0.00680	0.00152	0.00153	0.00289	0.00171	0.00183	0.00188	0.00213	0.00289	0.00229	0.00184	0.00200	0.00088	0.00112
Iron (Fe)	mg/L	0.3	0.010	0.043	0.034	0.033	0.022	0.022	0.039	0.041	0.235	0.025	0.020	0.039	0.040	0.085	0.257
Lead (Pb)	mg/L	0.001-0.007[f]	0.000050	0.002220	<0.000050	<0.000050	0.000061	<0.000050	<0.000050	<0.000050	0.000219	0.000200	0.000203	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0059	<0.0050
Magnesium (Mg)	mg/L		0.0050	2.7200	1.5900	1.6000	1.7600	1.6900	1.5700	1.5700	3.2900	2.9400	3.0900	1.5900	1.5800	2.4300	4.8100
Manganese (Mn)	mg/L		0.000050	0.004550	0.003450	0.003590	0.000777	0.000771	0.002200	0.002170	0.046900	0.008950	0.009490	0.002170	0.002100	0.002610	0.007950
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000054	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	0.025-0.15[g]	0.00010	0.01070	0.00555	0.00559	0.00514	0.00476	0.00495	0.00500	0.01130	0.01050	0.01050	0.00494	0.00495	0.00213	0.00160
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.607	0.328	0.326	0.352	0.323	0.331	0.336	0.653	0.606	0.617	0.337	0.334	0.904	0.867
Selenium (Se)	mg/L	0.001	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.608	0.250	0.263	0.298	0.290	0.188	0.181	0.785	0.596	0.598	0.187	0.186	0.164	<0.050
Silver (Ag)	mg/L	0.0001	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	1.120	0.687	0.694	0.735	0.691	0.628	0.634	1.220	1.140	1.170	0.641	0.643	1.120	1.880

Appendix 3.3-1. Lake Water Quality Analytical Results, Back River Project, 2013

Lake Site Name				Wasp	Wasp	Wasp	Wasp	Leaf	Giraffe North	Giraffe North	Giraffe South	Giraffe South	Giraffe South	Giraffe South	Giraffe South	Umwelk	Pond 1
Site Code				WASPLK	WASPLK	WASPLK	LEAFLK	LEAFLK	GIRNORTH	GIRNORTH	GIRSOUTH	GIRSOUTH	GIRSOUTH	GIRSOUTH	GIRSOUTH	UMWLK	POND1
Depth (m)*				1	13	1	5	1	1	1	5.6	1	1	1	5.5	0.1	shore grab
Replicate									FDUP			FDUP					
Date Sampled		CCME Guidelines for the Protection of Freshwater Aquatic Life[a]	Realized Detection Limit (RDL) (for freshwater baseline samples)^	9-Apr-13	16-Jul-13	16-Jul-13	16-Jul-13	16-Jul-13	14-Jul-13	14-Jul-13	9-Apr-13	9-Apr-13	9-Apr-13	14-Jul-13	14-Jul-13	15-Jul-13	28-Jul-13
ALS Sample ID #	Units			L1289265-5	L1334948-5	L1334948-4	L1334948-7	L1334948-6	L1332346-6	L1332346-5	L1289265-4	L1289265-3	L1289265-2	L1332346-4	L1332346-2	L1334948-3	L1339503-10
Total Metals *(cont'd)*																	
Strontium (Sr)	mg/L		0.00020	0.01660	0.00921	0.00949	0.00968	0.00937	0.00899	0.00898	0.02130	0.01870	0.01890	0.00911	0.00906	0.12600	0.07970
Thallium (Tl)	mg/L	0.0008	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000016	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L		0.00005 - 0.001	0.000171	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.000210	0.000165	0.000187	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)	mg/L	0.03	0.0030	0.0190	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0037	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals																	
Aluminum (Al)	mg/L		0.0030	0.0060	0.0059	0.0061	0.0057	0.0060	0.0093	0.0097	0.0038	0.0042	0.0045	0.0105	0.0094	<0.0030	0.0129
Antimony (Sb)	mg/L		0.00005	0.00023	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L		0.000030	0.000218	0.000167	0.000183	0.000197	0.000193	0.000182	0.000193	0.000202	0.000205	0.000214	0.000213	0.000188	0.000215	0.000369
Barium (Ba)	mg/L		0.000050	0.006050	0.003540	0.003450	0.003400	0.003530	0.003660	0.003700	0.009680	0.007880	0.007630	0.004270	0.003760	0.024900	0.039300
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L		0.005	0.0057	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0054	<0.0050	0.0058	0.0051	<0.0050	<0.0050	<0.0050	0.0102
Cadmium (Cd)	mg/L		0.000010	0.000017	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	3.650	2.050	2.060	2.170	2.190	2.030	2.020	4.830	4.240	4.150	2.050	2.050	11.900	11.700
Chromium (Cr)	mg/L		0.00010	0.00016	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00022
Cobalt (Co)	mg/L		0.00010	0.00026	<0.00010	<0.00010	<0.00010	<0.00010	0.00012	0.00011	0.00021	<0.00010	<0.00010	0.00013	0.00012	<0.00010	0.00021
Copper (Cu)	mg/L		0.00050	0.00589	0.00125	0.00126	0.00130	0.00127	0.00203	0.00151	0.00177	0.00198	0.00201	0.00199	0.00151	0.00079	0.00096
Iron (Fe)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.022	<0.010	<0.010	<0.010	<0.010	0.011	0.116
Lead (Pb)	mg/L		0.000050	0.001170	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0054	<0.0050
Magnesium (Mg)	mg/L		0.0050	2.7400	1.5900	1.5400	1.6400	1.7100	1.5300	1.4500	3.2500	3.0400	2.9800	1.6900	1.5300	2.3900	4.8000
Manganese (Mn)	mg/L		0.000050	0.003850	0.001770	0.001740	0.000578	0.000770	0.001740	0.001660	0.008240	0.000591	0.000674	0.001920	0.001610	0.002360	0.006700
Mercury (Hg)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L		0.00010	0.01040	0.00546	0.00533	0.00465	0.00483	0.00463	0.00455	0.01090	0.01000	0.00999	0.00514	0.00469	0.00202	0.00152
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.603	0.336	0.324	0.309	0.343	0.328	0.303	0.649	0.614	0.611	0.376	0.333	0.902	0.856
Selenium (Se)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.591	0.242	0.247	0.286	0.283	0.180	0.176	0.786	0.582	0.580	0.171	0.182	0.160	<0.050
Silver (Ag)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	1.170	0.688	0.670	0.665	0.716	0.624	0.599	1.250	1.180	1.130	0.690	0.623	1.080	1.880
Strontium (Sr)	mg/L		0.00020	0.01620	0.00902	0.00918	0.00974	0.00946	0.00859	0.00893	0.02080	0.01850	0.01830	0.00867	0.00873	0.11900	0.07680
Thallium (Tl)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L		0.00005 - 0.001	<0.000050	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.000058	0.000052	0.000065	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)	mg/L		0.0030	0.0176	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes:

** Depth for shallow samples 1 m or less in April is listed as metres below ice-water interface.*

^ Detection limits varied slightly for the Bathurst Area lakes (EKALOLK and WATSE) which were analyzed for drinking water parameters and detection limits.

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment (accessed February 2014).

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultra-oligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Meso-eutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hyper-eutrophic.

d) Guidelines are hardness-dependent. Cadmium short-term guideline (mg/L) = $10^{\{1.016[\log(\text{hardness})]-1.71\}}$ / 1000 with a minimum of 0.00011 mg/L. Cadmium long-term guideline (mg/L) = $10^{\{0.83[\log(\text{hardness})]-2.46\}}$ / 1000 with a miniumum of 0.00004 mg/L.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness. At hardness >180 mg/L the copper guideline is 0.004 mg/L.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness. At hardness >180 mg/L the lead guideline is 0.007 mg/L.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness. At hardness >180 mg/L the nickel guideline is 0.15 mg/L.

h) RDL = Realized detection limit

Appendix 3.3-1. Lake Water Quality Analytical Results, Back River Project, 2013

Lake Site Name				Pond 2	Rascal	Rascal	Goose Neck	Goose Neck	Goose Central	Goose Central	Goose Tail	Goose Tail (New)	Goose Tail (New)	Goose Tail (New)	Goose South	Arrow	Arrow
Site Code				POND2	RASCLK	RASCLK	GOONECK	GOONECK	GOOCENT	GOOCENT	GOOTAILNEW	GOOTAILNEW	GOOTAILNEW	GOOTAILNEW	GOOSESTH	ARRLK	ARRLK
Depth (m)*				shore grab	1	1	0	0.1	1	1	5.8	1	4.5	1	0.1	0.1	0.1
Replicate						FDUP										FDUP	
Date Sampled				28-Jul-13	13-Jul-13	13-Jul-13	10-Apr-13	21-Jul-13	13-Apr-13	21-Jul-13	14-Apr-13	14-Apr-13	20-Jul-13	20-Jul-13	20-Jul-13	15-Jul-13	15-Jul-13
ALS Sample ID #	Units	CCME Guidelines for the Protection of Freshwater Aquatic Life[a]	Realized Detection Limit (RDL) (for freshwater baseline samples)^	L1339503-11	L1332346-3	L1332346-1	L1289265-7	L1336083-1	L1289789-10	L1336083-6	L1289789-12	L1289789-11	L1336083-8	L1336083-7	L1336083-5	L1334948-2	L1334948-1
Physical Tests																	
Conductivity	µS/cm		2.0	137.0	22.5	22.9	84.4	48.5	64.9	43.1	72.2	70.7	42.6	42.5	42.9	30.9	31.5
Hardness (as $CaCO_3$)	mg/L		0.50	54.60	8.88	8.69	28.00	17.40	24.40	15.80	28.50	26.90	15.40	15.50	15.80	12.30	12.00
pH	pH	6.5-9.0	0.10	7.42	6.94	7.01	6.92	6.85	6.75	6.79	6.54	6.66	6.72	6.62	6.79	7.09	7.08
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		2.0	18.1	4.7	4.5	7.6	3.0	6.5	3.2	9.1	8.7	2.9	2.9	3.1	8.3	8.3
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		2.0	18.1	4.7	4.5	7.6	3.0	6.5	3.2	9.1	8.7	2.9	2.9	3.1	8.3	8.3
Total Suspended Solids	mg/L	dependent on background levels	3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Total Dissolved Solids	mg/L		10	136	25	30	42	37	47	31	54	53	31	31	32	42	43
Turbidity	NTU	dependent on background levels	0.10	1.87	0.45	0.48	1.50	1.03	1.71	0.67	0.23	0.57	1.34	0.81	0.48	1.35	1.56
Nutrients																	
Ammonia, Total (as N)	mg/L	pH- and temperature-dependent	0.0050	0.0257	0.0071	<0.0050	0.0184	<0.0050	0.0187	<0.0050	0.0168	0.0240	<0.0050	<0.0050	<0.0050	0.0067	0.0058
Nitrate (as N)	mg/L	short-term: 124; long-term: 3	0.0050	0.0490	<0.0050	<0.0050	0.0151	<0.0050	<0.0050	<0.0050	0.0124	0.0065	<0.0050	<0.0050	<0.0050	<0.0050	0.0265
Nitrite (as N)	mg/L	0.06	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	<0.0010	0.001
Total Kjeldahl Nitrogen	mg/L		0.05	1.12	0.22	0.25	0.25	0.19	0.21	0.18	0.21	0.25	0.18	0.21	0.18	0.83	0.78
Ortho-phosphate (as P)	mg/L		0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus (P)	mg/L	Trigger ranges from guidance framework[c]	0.002	0.011	0.004	0.003	0.040	0.003	0.002	0.003	0.003	0.003	0.003	0.003	0.004	0.016	0.016
Anions																	
Bromide (Br)	mg/L		0.050	0.210	<0.050	<0.050	0.054	0.065	<0.050	0.050	<0.050	<0.050	0.051	0.052	<0.050	<0.050	<0.050
Chloride (Cl)	mg/L	short-term: 640; long-term: 120	0.50	21.70	0.58	0.57	11.20	8.40	10.10	7.00	9.87	9.74	6.98	6.99	6.94	0.73	0.74
Fluoride (F)	mg/L	0.12[b]	0.02	0.04	<0.020	<0.020	0.03	<0.020	0.03	<0.020	0.02	0.03	<0.020	<0.020	<0.020	0.04	0.05
Sulfate (SO_4)	mg/L		0.5	10.6	4.7	4.7	9.1	5.2	8.2	5.0	9.2	9.2	5.0	5.0	5.0	3.5	3.5
Cyanides																	
Cyanide, Total	mg/L		0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cyanide, Free	mg/L	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic Carbon																	
Total Organic Carbon	mg/L		0.5 - 1.0	17.50	3.96	3.75	4.26	3.29	4.33	3.38	4.64	4.91	3.78	3.45	3.46	14.50	14.40
Total Metals																	
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.0030	0.0315	0.0117	0.0130	0.0668	0.0133	0.0074	0.0139	0.0070	0.0077	0.0100	0.0104	0.0135	0.0411	0.0433
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	0.000059	0.000066	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L	0.005	0.000030	0.000830	0.000217	0.000254	0.000358	0.000191	0.000245	0.000185	0.000227	0.000237	0.000173	0.000186	0.000209	0.000498	0.000503
Barium (Ba)	mg/L		0.000050	0.020100	0.003410	0.003930	0.013600	0.008190	0.011000	0.007450	0.014100	0.012000	0.006570	0.006700	0.007230	0.007780	0.007750
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.005	0.0102	<0.0050	0.0066	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Cadmium (Cd)	mg/L	equation[d]	0.000010	<0.000010	<0.000010	<0.000010	0.000019	<0.000010	<0.000010	<0.000010	0.000012	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	11.600	1.690	1.670	6.570	4.400	6.050	3.840	6.970	6.290	3.770	3.810	3.730	2.380	2.390
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.00010	0.00024	0.00014	0.00015	0.00052	<0.00010	0.00010	0.00011	0.00017	0.00014	0.00012	0.00013	0.00015	0.00063	0.00064
Cobalt (Co)	mg/L		0.00010	0.00034	<0.00010	<0.00010	0.00022	0.00016	0.00013	0.00011	0.00017	<0.00010	<0.00010	<0.00010	0.00011	0.00018	0.00018
Copper (Cu)	mg/L	0.002-0.004[e]	0.00050	0.00220	0.00153	0.00224	0.00329	0.00143	0.00195	0.00123	0.00177	0.00181	0.00119	0.00116	0.00141	0.00256	0.00246
Iron (Fe)	mg/L	0.3	0.010	0.596	0.058	0.058	0.117	0.026	<0.010	0.023	0.016	0.010	0.033	0.033	0.025	0.576	0.571
Lead (Pb)	mg/L	0.001-0.007[f]	0.000050	<0.000050	<0.000050	<0.000050	0.000281	<0.000050	0.000184	<0.000050	0.000364	0.000440	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	0.0053	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	6.2700	1.1600	1.3000	2.8700	1.6300	2.6100	1.4900	3.2200	2.9200	1.5000	1.5100	1.4700	1.5500	1.5200
Manganese (Mn)	mg/L		0.000050	0.007830	0.000837	0.001020	0.004550	0.003270	0.002930	0.002470	0.007950	0.003540	0.002270	0.002260	0.002400	0.002290	0.002150
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	0.025-0.15[g]	0.00010	0.00358	0.00220	0.00243	0.00779	0.00403	0.00671	0.00377	0.00671	0.00577	0.00300	0.00303	0.00381	0.00259	0.00264
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	1.070	0.281	0.329	0.666	0.398	0.588	0.373	0.719	0.670	0.379	0.378	0.368	0.228	0.221
Selenium (Se)	mg/L	0.001	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.069	0.220	0.213	0.467	0.176	0.323	0.146	0.415	0.352	0.139	0.140	0.137	0.168	0.174
Silver (Ag)	mg/L	0.0001	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	2.180	0.555	0.645	1.180	0.662	1.120	0.627	1.410	1.280	0.659	0.640	0.616	1.370	1.340

Appendix 3.3-1. Lake Water Quality Analytical Results, Back River Project, 2013

Lake Site Name				Pond 2	Rascal	Rascal	Goose Neck	Goose Neck	Goose Central	Goose Central	Goose Tail	Goose Tail (New)	Goose Tail (New)	Goose Tail (New)	Goose South	Arrow	Arrow
Site Code			Realized	POND2	RASCLK	RASCLK	GOONECK	GOONECK	GOOCENT	GOOCENT	GOOTAILNEW	GOOTAILNEW	GOOTAILNEW	GOOTAILNEW	GOOSESTH	ARRLK	ARRLK
Depth (m)*			Detection	shore grab	1	1	0	0.1	1	1	5.8	1	4.5	1	0.1	0.1	0.1
Replicate			Limit			FDUP										FDUP	
Date Sampled		CCME Guidelines for the Protection of	(RDL)	28-Jul-13	13-Jul-13	13-Jul-13	10-Apr-13	21-Jul-13	13-Apr-13	21-Jul-13	14-Apr-13	14-Apr-13	20-Jul-13	20-Jul-13	20-Jul-13	15-Jul-13	15-Jul-13
ALS Sample ID #	Units	Freshwater Aquatic Life[a]	(for freshwater baseline samples)^	L1339503-11	L1332346-3	L1332346-1	L1289265-7	L1336083-1	L1289789-10	L1336083-6	L1289789-12	L1289789-11	L1336083-8	L1336083-7	L1336083-5	L1334948-2	L1334948-1
Total Metals *(cont'd)*																	
Strontium (Sr)	mg/L		0.00020	0.06980	0.00701	0.00691	0.03970	0.03050	0.03500	0.02630	0.03670	0.03340	0.02530	0.02570	0.02530	0.01200	0.01210
Thallium (Tl)	mg/L	0.0008	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	0.000010	0.000013	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000020	0.000018
Vanadium (V)	mg/L		0.00005 - 0.001	<0.0010	<0.0010	<0.0010	0.000345	<0.0010	0.000101	<0.0010	0.000115	0.000127	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)	mg/L	0.03	0.0030	<0.0030	<0.0030	<0.0030	0.0058	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals																	
Aluminum (Al)	mg/L		0.0030	0.0156	0.0070	0.0070	0.0076	0.0089	0.0060	0.0094	0.0057	0.0048	0.0060	0.0063	0.0092	0.0122	0.0136
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L		0.000030	0.000752	0.000193	0.000184	0.000255	0.000162	0.000223	0.000162	0.000199	0.000227	0.000149	0.000144	0.000155	0.000378	0.000411
Barium (Ba)	mg/L		0.000050	0.019800	0.003370	0.003360	0.013200	0.008060	0.010400	0.007580	0.013500	0.011800	0.006520	0.006600	0.007230	0.007290	0.007170
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L		0.005	0.0084	<0.0050	<0.0050	<0.0050	<0.0050	0.0076	<0.0050	0.0068	0.0069	<0.0050	<0.0050	<0.0050	<0.0050	0.0145
Cadmium (Cd)	mg/L		0.000010		<0.000010	<0.000010	0.000015	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	11.600	1.650	1.600	6.530	4.300	5.690	3.820	6.510	6.120	3.720	3.760	3.870	2.380	2.320
Chromium (Cr)	mg/L		0.00010	0.00017	<0.00010	<0.00010	0.00016	<0.00010	0.00024	<0.00010	0.00014	0.00018	<0.00010	0.00014	0.00010	0.00044	0.00039
Cobalt (Co)	mg/L		0.00010	0.00030	<0.00010	<0.00010	0.00015	0.00012	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	0.00011
Copper (Cu)	mg/L		0.00050	0.00187	0.00118	0.00143	0.00280	0.00118	0.00158	0.00102	0.00154	0.00160	0.00095	0.00096	0.00103	0.00198	0.00227
Iron (Fe)	mg/L		0.010	0.308	0.016	0.017	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.015	<0.010	0.155	0.163
Lead (Pb)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000117	<0.000050	0.000211	0.000111	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	0.0054	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	6.2500	1.1500	1.1400	2.8400	1.6200	2.4700	1.5200	2.9700	2.8100	1.4900	1.4800	1.5000	1.5300	1.5100
Manganese (Mn)	mg/L		0.000050	0.006800	0.000653	0.000596	0.002470	0.002520	0.001040	0.001390	0.003780	0.002000	0.001570	0.001670	0.001470	0.000630	0.000696
Mercury (Hg)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L		0.00010	0.00343	0.00206	0.00210	0.00745	0.00385	0.00617	0.00380	0.00615	0.00560	0.00283	0.00292	0.00357	0.00238	0.00234
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	1.070	0.285	0.288	0.656	0.395	0.559	0.382	0.673	0.652	0.374	0.376	0.379	0.212	0.215
Selenium (Se)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.060	0.203	0.202	0.356	0.170	0.324	0.135	0.389	0.342	0.124	0.135	0.128	0.087	0.092
Silver (Ag)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	2.190	0.553	0.558	1.190	0.647	1.050	0.631	1.300	1.240	0.628	0.625	0.630	1.370	1.410
Strontium (Sr)	mg/L		0.00020	0.06740	0.00662	0.00639	0.03960	0.02920	0.03230	0.02550	0.03400	0.03220	0.02420	0.02430	0.02530	0.01160	0.01120
Thallium (Tl)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000015	0.000014
Vanadium (V)	mg/L		0.00005 - 0.001	<0.0010	<0.0010	<0.0010	0.000066	<0.0010	<0.000050	<0.0010	<0.000050	<0.000050	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)	mg/L		0.0030	<0.0030	<0.0030	<0.0030	0.0049	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes:

** Depth for shallow samples 1 m or less in April is listed as metres below ice-water interface.*

^ Detection limits varied slightly for the Bathurst Area lakes (EKALOLK and WATSE) which were analyzed for drinking water parameters and detection limits.

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment (accessed February 2014).

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultra-oligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Meso-eutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hyper-eutrophic.

d) Guidelines are hardness-dependent. Cadmium short-term guideline (mg/L) = $10^{\{1.016[\log(\text{hardness})]-1.71\}}$ / 1000 with a minimum of 0.00011 mg/L. Cadmium long-term guideline (mg/L) = $10^{\{0.83[\log(\text{hardness})]-2.46\}}$ / 1000 with a miniumum of 0.00004 mg/L.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness. At hardness >180 mg/L the copper guideline is 0.004 mg/L.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness. At hardness >180 mg/L the lead guideline is 0.007 mg/L.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness. At hardness >180 mg/L the nickel guideline is 0.15 mg/L.

h) RDL = Realized detection limit

Appendix 3.3-1. Lake Water Quality Analytical Results, Back River Project, 2013

Lake Site Name				Propeller	Propeller	Propeller	Reference B	Reference B	Reference B	Reference B	Beechey	Beechey	Upper Long	Lower Long (Deep)	Lower Long (Deep)	Fold	Fold
Site Code			Realized	PROLK	PROLK	PROLK	REFBLK	REFBLK	REFBLK	REFBLK	BEECHLK	BEECHLK	UPLONGLK	LOWLONGDP	LOWLONGDP	FOLDLK	FOLDLK
Depth (m)*			Detection	1	6	6	1	1	1	1	1	16	1	8	1	11	1
Replicate			Limit			FDUP	FDUP		FDUP								
Date Sampled		CCME Guidelines for the Protection of Freshwater Aquatic Life[a]	(RDL) (for freshwater baseline samples)^	19-Jul-13	19-Jul-13	19-Jul-13	13-Apr-13	13-Apr-13	17-Jul-13	17-Jul-13	19-Jul-13	19-Jul-13	12-Jul-13	12-Jul-13	12-Jul-13	12-Jul-13	12-Jul-13
ALS Sample ID #	Units			L1336083-11	L1336083-9	L1336083-4	L1289789-9	L1289789-8	L1336083-3	L1336083-2	L1336083-12	L1336083-10	L1332442-6	L1332442-10	L1332442-9	L1332442-8	L1332442-7
Physical Tests																	
Conductivity	µS/cm		2.0	23.3	23.2	23.3	40.9	40.4	18.8	18.9	26.1	25.9	27.5	29.4	29.4	51.0	51.2
Hardness (as $CaCO_3$)	mg/L		0.50	8.52	8.56	8.61	16.40	16.20	7.11	7.17	9.21	9.17	12.60	13.50	13.40	20.10	20.00
pH	pH	6.5-9.0	0.10	6.79	6.80	6.84	6.85	6.83	6.87	6.85	6.93	6.92	7.40	7.41	7.44	7.24	7.27
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		2.0	3.6	3.3	3.3	12.5	12.2	4.0	4.6	4.5	4.2	11.2	11.9	11.8	8.2	8.4
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		2.0	3.6	3.3	3.3	12.5	12.2	4.0	4.6	4.5	4.2	11.2	11.9	11.8	8.2	8.4
Total Suspended Solids	mg/L	dependent on background levels	3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Total Dissolved Solids	mg/L		10	18	19	19	30	27	17	20	18	17	20	19	21	29	30
Turbidity	NTU	dependent on background levels	0.10	0.64	0.86	0.76	0.59	0.49	0.63	0.66	0.50	0.89	0.32	0.31	0.30	0.30	0.25
Nutrients																	
Ammonia, Total (as N)	mg/L	pH- and temperature-dependent	0.0050	<0.0050	<0.0050	<0.0050	0.0432	0.0429	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrate (as N)	mg/L	short-term: 124; long-term: 3	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0056	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrite (as N)	mg/L	0.06	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L		0.05	0.18	0.20	0.19	0.31	0.30	0.25	0.26	0.17	0.18	0.15	0.14	0.14	0.14	0.12
Ortho-phosphate (as P)	mg/L		0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus (P)	mg/L	Trigger ranges from guidance framework[c]	0.002	0.004	0.009	0.004	0.005	0.003	0.004	0.005	0.003	0.003	0.013	0.058	0.003	0.004	0.004
Anions																	
Bromide (Br)	mg/L		0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	mg/L	short-term: 640; long-term: 120	0.50	2.28	2.29	2.33	0.94	0.93	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	1.28	1.30
Fluoride (F)	mg/L	0.12[b]	0.02	<0.020	<0.020	<0.020	0.03	0.03	<0.020	<0.020	0.02	0.02	<0.020	<0.020	<0.020	<0.020	<0.020
Sulfate (SO_4)	mg/L		0.5	3.4	3.4	3.5	5.8	5.7	2.9	2.9	6.5	6.4	1.8	2.1	2.0	12.3	12.4
Cyanides																	
Cyanide, Total	mg/L		0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cyanide, Free	mg/L	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic Carbon																	
Total Organic Carbon	mg/L		0.5 - 1.0	3.19	3.30	3.25	4.74	4.66	3.20	3.19	2.89	2.86	2.35	2.25	2.37	1.73	1.78
Total Metals																	
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.0030	0.0100	0.0097	0.0103	<0.0030	<0.0030	0.0060	0.0175	0.0174	0.0166	0.0066	0.0054	0.0053	0.0062	0.0059
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000052	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L	0.005	0.000030	0.000162	0.000142	0.000143	0.000224	0.000239	0.000154	0.000151	0.000222	0.000195	0.000519	0.000358	0.000391	0.000430	0.000457
Barium (Ba)	mg/L		0.000050	0.004180	0.004030	0.004100	0.007090	0.007680	0.003110	0.002990	0.003100	0.002960	0.000879	0.000917	0.000956	0.001190	0.001150
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Cadmium (Cd)	mg/L	equation[d]	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	1.870	1.860	1.850	3.140	3.250	1.560	1.280	2.170	2.110	2.600	2.800	2.820	4.470	4.510
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.00010	0.00012	0.00012	0.00011	<0.00010	<0.00010	0.00019	<0.00010	0.00012	0.00014	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Cobalt (Co)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	0.00011	0.00023	<0.00010	<0.00010	0.00021	0.00019	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)	mg/L	0.002-0.004[e]	0.00050	0.00083	0.00081	0.00096	0.00087	0.00080	0.00072	0.00073	0.00162	0.00130	0.00097	0.00086	0.00094	0.00105	0.00136
Iron (Fe)	mg/L	0.3	0.010	0.035	0.034	0.036	0.023	0.038	0.049	0.048	0.020	0.024	0.024	0.024	0.024	0.019	0.018	0.018
Lead (Pb)	mg/L	0.001-0.007[f]	0.000050	<0.000050	<0.000050	<0.000050	0.000104	0.000167	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000231	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	0.9420	0.9540	0.9420	2.2000	2.2300	0.9880	1.0200	1.0200	1.0200	1.5800	1.6600	1.6900	2.1200	2.1400
Manganese (Mn)	mg/L		0.000050	0.003340	0.003440	0.003440	0.010800	0.023600	0.001810	0.001750	0.002140	0.002110	0.001750	0.001570	0.001520	0.002950	0.002860
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	0.025-0.15[g]	0.00010	0.00197	0.00200	0.00195	0.00158	0.00167	0.00070	0.00071	0.00392	0.00365	0.00046	0.00043	0.00048	0.00131	0.00141
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.277	0.288	0.285	0.561	0.567	0.277	0.282	0.522	0.522	0.212	0.212	0.217	0.365	0.366
Selenium (Se)	mg/L	0.001	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.084	0.078	0.084	0.294	0.355	0.084	0.082	0.155	0.143	0.202	0.228	0.226	0.140	0.132
Silver (Ag)	mg/L	0.0001	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.472	0.483	0.475	0.971	0.963	0.491	0.509	0.616	0.616	0.358	0.354	0.390	0.689	0.698

Appendix 3.3-1. Lake Water Quality Analytical Results, Back River Project, 2013

Lake Site Name				Propeller	Propeller	Propeller	Reference B	Reference B	Reference B	Reference B	Beechey	Beechey	Upper Long	Lower Long (Deep)	Lower Long (Deep)	Fold	Fold
Site Code			Realized	PROLK	PROLK	PROLK	REFBLK	REFBLK	REFBLK	REFBLK	BEECHLK	BEECHLK	UPLONGLK	LOWLONGDP	LOWLONGDP	FOLDLK	FOLDLK
Depth (m)*			Detection	1	6	6	1	1	1	1	1	16	1	8	1	11	1
Replicate			Limit			FDUP	FDUP		FDUP								
Date Sampled		CCME Guidelines for the Protection of	(RDL)	19-Jul-13	19-Jul-13	19-Jul-13	13-Apr-13	13-Apr-13	17-Jul-13	17-Jul-13	19-Jul-13	19-Jul-13	12-Jul-13	12-Jul-13	12-Jul-13	12-Jul-13	12-Jul-13
ALS Sample ID #	Units	Freshwater Aquatic Life[a]	(for freshwater baseline samples)^	L1336083-11	L1336083-9	L1336083-4	L1289789-9	L1289789-8	L1336083-3	L1336083-2	L1336083-12	L1336083-10	L1332442-6	L1332442-10	L1332442-9	L1332442-8	L1332442-7
Total Metals *(cont'd)*																	
Strontium (Sr)	mg/L		0.00020	0.00968	0.00964	0.00960	0.01150	0.01190	0.01580	0.00491	0.00941	0.00924	0.00493	0.00523	0.00523	0.01520	0.01530
Thallium (Tl)	mg/L	0.0008	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	0.00015	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000017	0.000016	0.000020	0.000020	0.000019	<0.000010	<0.000010
Vanadium (V)	mg/L		0.00005 - 0.001	<0.0010	<0.0010	<0.0010	0.000103	0.000111	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)	mg/L	0.03	0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0032	0.0031	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals																	
Aluminum (Al)	mg/L		0.0030	0.0061	0.0066	0.0054	<0.0030	<0.0030	<0.0030	<0.0030	0.0092	0.0087	<0.0030	0.0039	<0.0030	<0.0030	<0.0030
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L		0.000030	0.000114	0.000118	0.000114	0.000211	0.000198	0.000132	0.000141	0.000186	0.000168	0.000451	0.000329	0.000344	0.000408	0.000434
Barium (Ba)	mg/L		0.000050	0.004070	0.003980	0.003930	0.007310	0.007330	0.002810	0.002820	0.002860	0.002760	0.000852	0.000874	0.000895	0.001200	0.001170
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L		0.005	<0.0050	0.0051	<0.0050	0.0064	0.006	<0.0050	0.0051	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Cadmium (Cd)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	1.830	1.850	1.850	3.040	3.090	1.260	1.260	2.060	2.030	2.510	2.760	2.730	4.530	4.500
Chromium (Cr)	mg/L		0.00010	<0.00010	0.00011	<0.00010	0.00012	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Cobalt (Co)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)	mg/L		0.00050	0.00067	0.00072	0.00073	0.00072	0.00066	0.00051	0.00055	0.00097	0.00095	0.00093	0.00079	0.00073	0.00091	0.00096
Iron (Fe)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Lead (Pb)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	0.9600	0.9560	0.9670	2.1300	2.0500	0.9650	0.9800	0.9880	0.9940	1.5400	1.6000	1.5900	2.1300	2.1300
Manganese (Mn)	mg/L		0.000050	0.000705	0.000695	0.000937	0.000391	0.002180	0.000137	0.000146	0.000811	0.000801	0.000198	0.000307	0.000412	0.000484	0.000818
Mercury (Hg)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L		0.00010	0.00187	0.00191	0.00187	0.00142	0.00147	0.00065	0.00065	0.00364	0.00345	0.00041	0.00038	0.00037	0.00122	0.00126
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.288	0.285	0.292	0.544	0.522	0.271	0.277	0.505	0.519	0.198	0.209	0.206	0.369	0.367
Selenium (Se)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.074	0.067	0.067	0.286	0.369	0.064	0.065	0.132	0.127	0.184	0.217	0.207	0.126	0.127
Silver (Ag)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.478	0.475	0.485	0.929	0.883	0.482	0.486	0.585	0.598	0.347	0.347	0.371	0.688	0.694
Strontium (Sr)	mg/L		0.00020	0.00927	0.00920	0.00931	0.01100	0.01120	0.00457	0.00462	0.00869	0.00865	0.00458	0.00505	0.00497	0.01480	0.01480
Thallium (Tl)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000015	0.000012	0.000013	0.000015	0.000015	<0.000010	<0.000010
Vanadium (V)	mg/L		0.00005 - 0.001	<0.0010	<0.0010	<0.0010	<0.000050	<0.000050	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)	mg/L		0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes:

** Depth for shallow samples 1 m or less in April is listed as metres below ice-water interface.*

^ Detection limits varied slightly for the Bathurst Area lakes (EKALOLK and WATSE) which were analyzed for drinking water parameters and detection limits.

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment (accessed February 2014).

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultra-oligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Meso-eutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hyper-eutrophic.

d) Guidelines are hardness-dependent. Cadmium short-term guideline (mg/L) = $10^{\{1.016[\log(\text{hardness})]-1.71\}}$ / 1000 with a minimum of 0.00011 mg/L. Cadmium long-term guideline (mg/L) = $10^{\{0.83[\log(\text{hardness})]-2.46\}}$ / 1000 with a miniumum of 0.00004 mg/L.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness. At hardness >180 mg/L the copper guideline is 0.004 mg/L.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness. At hardness >180 mg/L the lead guideline is 0.007 mg/L.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness. At hardness >180 mg/L the nickel guideline is 0.15 mg/L.

h) RDL = Realized detection limit

Appendix 3.3-1. Lake Water Quality Analytical Results, Back River Project, 2013

Lake Site Name				George Central	George Central	George Central	George Central	Bob	Occurrence	Slave	Slave	Esker Pond	Dragon	Komatic	Komatic	Komatic	Komatic
Site Code			Realized	GEORGCENT	GEORGCENT	GEORGCENT	GEORGCENT	BOBCENT	OCCLK	SLAVELK	SLAVELK	ESKERLK	DRAGLK	KOMALK	KOMALK	KOMALK	KOMALK
Depth (m)*			Detection	10	1	10.5	1	1	0.1	0.1	0.1	0.1	1	1	1	6	1
Replicate			Limit							FDUP					FDUP		
Date Sampled		CCME Guidelines for the Protection of Freshwater Aquatic Life[a]	(RDL) (for freshwater baseline samples)^	12-Apr-13	12-Apr-13	8-Jul-13	8-Jul-13	11-Jul-13	9-Jul-13	12-Jul-13	12-Jul-13	12-Jul-13	11-Jul-13	12-Apr-13	10-Jul-13	10-Jul-13	10-Jul-13
ALS Sample ID #	Units			L1289789-7	L1289789-6	L1331765-2	L1331765-1	L1332442-4	L1331765-5	L1332442-5	L1332442-3	L1332442-2	L1332442-1	L1289789-5	L1331765-11	L1331765-10	L1331765-9
Physical Tests																	
Conductivity	µS/cm		2.0	106.0	96.4	60.7	60.5	50.7	73.9	100.0	100.0	85.7	55.0	166.0	69.1	69.4	69.1
Hardness (as $CaCO_3$)	mg/L		0.50	42.80	37.50	21.90	21.90	18.40	27.50	40.30	40.00	33.00	22.90	70.40	27.10	27.10	26.80
pH	pH	6.5-9.0	0.10	6.77	6.87	7.28	7.29	7.01	7.06	7.08	7.11	7.26	7.52	6.96	7.13	7.11	7.09
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		2.0	11.7	10.9	5.6	5.3	4.7	5.7	6.6	6.1	8.3	13.1	21.5	7.6	7.4	7.5
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		2.0	11.7	10.9	5.6	5.3	4.7	5.7	6.6	6.1	8.3	13.1	21.5	7.6	7.4	7.5
Total Suspended Solids	mg/L	dependent on background levels	3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Total Dissolved Solids	mg/L		10	67	61	39	41	32	53	69	71	61	39	111	52	52	54
Turbidity	NTU	dependent on background levels	0.10	0.19	0.15	0.26	0.26	0.32	0.38	0.53	0.59	0.43	0.34	0.29	0.33	0.37	0.38
Nutrients																	
Ammonia, Total (as N)	mg/L	pH- and temperature-dependent	0.0050	0.0296	0.0193	<0.0050	<0.0050	<0.0050	<0.0050	0.0160	0.0170	0.0051	<0.0050	0.0148	<0.0050	<0.0050	<0.0050
Nitrate (as N)	mg/L	short-term: 124; long-term: 3	0.0050	0.0207	0.0078	<0.0050	<0.0050	<0.0050	0.0145	0.0150	0.0073	<0.0050	<0.0050	0.0569	<0.0050	<0.0050	<0.0050
Nitrite (as N)	mg/L	0.06	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L		0.05	0.17	0.16	0.11	0.12	0.13	0.13	0.23	0.23	0.22	0.20	0.28	0.21	0.19	0.18
Ortho-phosphate (as P)	mg/L		0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus (P)	mg/L	Trigger ranges from guidance framework[c]	0.002	0.002	<0.0020	0.004	0.003	0.004	0.003	0.008	0.007	0.005	0.005	0.004	0.005	0.005	0.005
Anions																	
Bromide (Br)	mg/L		0.050	<0.050	<0.050	<0.050	<0.050	0.055	<0.050	<0.050	<0.050	0.058	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	mg/L	short-term: 640; long-term: 120	0.50	6.03	5.39	3.52	3.75	5.83	5.12	1.37	1.22	7.33	1.13	8.03	5.65	5.64	5.64
Fluoride (F)	mg/L	0.12[b]	0.02	0.04	0.04	0.03	0.03	0.03	0.03	<0.020	<0.020	0.03	<0.020	0.04	0.02	0.02	0.02
Sulfate (SO_4)	mg/L		0.5	28.1	25.6	14.9	14.9	8.8	18.9	35.2	35.1	18.3	10.6	45.3	14.5	14.4	14.4
Cyanides																	
Cyanide, Total	mg/L		0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cyanide, Free	mg/L	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic Carbon																	
Total Organic Carbon	mg/L		0.5 - 1.0	2.15	2.09	1.54	1.58	1.75	2.15	2.87	2.95	2.76	2.99	4.87	3.01	2.92	3.08
Total Metals																	
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.0030	0.0061	0.0064	0.0162	0.0173	0.0053	0.0211	0.0158	0.0182	0.0143	0.0058	0.0038	0.0107	0.0110	0.0124
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L	0.005	0.000030	0.000547	0.000482	0.000349	0.000368	0.000480	0.000649	0.000666	0.000642	0.000899	0.000980	0.000766	0.000920	0.000897	0.000932
Barium (Ba)	mg/L		0.000050	0.004980	0.003720	0.002530	0.007160	0.002560	0.003010	0.001940	0.001990	0.003220	0.001070	0.005860	0.002750	0.002800	0.002900
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0059
Cadmium (Cd)	mg/L	equation[d]	0.000010	<0.000010	0.000011	<0.000010	0.000012	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	11.400	9.750	5.440	5.570	4.310	7.020	7.990	7.910	8.210	4.620	16.500	6.630	6.670	6.840
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.00010	<0.00010	<0.00010	<0.00010	0.00028	<0.00010	0.00012	0.00011	0.00012	0.00012	<0.00010	0.00014	0.00012	0.00012	0.00011
Cobalt (Co)	mg/L		0.00010	0.00086	0.00151	0.00065	0.00067	0.00017	0.00020	0.00026	0.00025	0.00034	0.00012	<0.00010	0.00020	0.00021	0.00022
Copper (Cu)	mg/L	0.002-0.004[e]	0.00050	0.00259	0.00205	0.00167	0.00229	0.00138	0.00241	0.00294	0.00295	0.00240	0.00155	0.00300	0.00206	0.00208	0.00298
Iron (Fe)	mg/L	0.3	0.010	0.035	<0.010	0.018	0.016	0.022	0.041	0.191	0.193	0.119	0.047	0.024	0.071	0.074	0.076
Lead (Pb)	mg/L	0.001-0.007[f]	0.000050	0.000333	0.000114	<0.000050	0.000326	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000118	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	4.2100	3.6800	1.9700	2.0200	1.8100	2.4300	5.1800	5.1800	2.9300	2.8800	7.7200	2.5200	2.5400	2.5700
Manganese (Mn)	mg/L		0.000050	0.027800	0.033000	0.005330	0.005370	0.003320	0.003220	0.012600	0.012700	0.005800	0.004620	0.006260	0.004670	0.005110	0.004840
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000055	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	0.025-0.15[g]	0.00010	0.00838	0.00799	0.00393	0.00446	0.00701	0.00513	0.00284	0.00286	0.00547	0.00183	0.01120	0.00491	0.00506	0.00504
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.711	0.628	0.342	0.359	0.298	0.408	0.421	0.417	0.466	0.340	0.896	0.400	0.409	0.416
Selenium (Se)	mg/L	0.001	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.403	0.274	0.097	0.092	0.053	0.142	0.440	0.444	0.108	0.163	1.320	0.173	0.181	0.186
Silver (Ag)	mg/L	0.0001	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	1.550	1.320	0.729	0.768	0.864	0.973	0.677	0.679	0.965	0.581	2.010	0.753	0.754	0.780

Appendix 3.3-1. Lake Water Quality Analytical Results, Back River Project, 2013

Lake Site Name				George Central	George Central	George Central	George Central	Bob	Occurrence	Slave	Slave	Esker Pond	Dragon	Komatic	Komatic	Komatic	Komatic
Site Code			Realized	GEORGCENT	GEORGCENT	GEORGCENT	GEORGCENT	BOBCENT	OCCLK	SLAVELK	SLAVELK	ESKERLK	DRAGLK	KOMALK	KOMALK	KOMALK	KOMALK
Depth (m)*			Detection	10	1	10.5	1	1	0.1	0.1	0.1	0.1	1	1	1	6	1
Replicate			Limit							FDUP					FDUP		
Date Sampled		CCME Guidelines for the Protection of	(RDL) (for freshwater	12-Apr-13	12-Apr-13	8-Jul-13	8-Jul-13	11-Jul-13	9-Jul-13	12-Jul-13	12-Jul-13	12-Jul-13	11-Jul-13	12-Apr-13	10-Jul-13	10-Jul-13	10-Jul-13
ALS Sample ID #	Units	Freshwater Aquatic Life[a]	baseline samples)^	L1289789-7	L1289789-6	L1331765-2	L1331765-1	L1332442-4	L1331765-5	L1332442-5	L1332442-3	L1332442-2	L1332442-1	L1289789-5	L1331765-11	L1331765-10	L1331765-9
Total Metals *(cont'd)*																	
Strontium (Sr)	mg/L		0.00020	0.04210	0.03570	0.02150	0.02200	0.02560	0.03110	0.01740	0.01730	0.04790	0.00991	0.05760	0.03740	0.03790	0.03870
Thallium (Tl)	mg/L	0.0008	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	0.00215	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000013	0.000014	0.000015	<0.000010	0.000010	<0.000010	<0.000010	<0.000010	0.000010
Vanadium (V)	mg/L		0.00005 - 0.001	0.000080	0.000127	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.000126	<0.0010	<0.0010	<0.0010
Zinc (Zn)	mg/L	0.03	0.0030	0.0058	0.0060	<0.0030	0.0053	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0036	<0.0030	<0.0030	<0.0030
Dissolved Metals																	
Aluminum (Al)	mg/L		0.0030	<0.0030	0.0047	0.0102	0.0117	<0.0030	0.0122	0.0036	0.0054	0.0063	<0.0030	<0.0030	0.0060	0.0053	0.0062
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L		0.000030	0.000389	0.000396	0.000298	0.000309	0.000415	0.000547	0.000460	0.000443	0.000701	0.000789	0.000677	0.000731	0.000731	0.000730
Barium (Ba)	mg/L		0.000050	0.004620	0.003570	0.002380	0.013000	0.002420	0.002990	0.001850	0.001790	0.003190	0.001040	0.005690	0.002770	0.002740	0.002840
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L		0.005	0.0073	0.0051	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0074	0.005	<0.0050	<0.0050
Cadmium (Cd)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	10.600	9.290	5.480	5.500	4.320	7.020	7.760	7.730	8.350	4.520	16.100	6.650	6.670	6.610
Chromium (Cr)	mg/L		0.00010	0.00012	<0.00010	<0.00010	0.00014	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00014	<0.00010	<0.00010	<0.00010
Cobalt (Co)	mg/L		0.00010	0.00024	0.00138	0.00057	0.00060	<0.00010	0.00016	0.00011	0.00012	0.00021	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)	mg/L		0.00050	0.00166	0.00177	0.00123	0.00189	0.00102	0.00195	0.00232	0.00230	0.00205	0.00146	0.00264	0.00170	0.00173	0.00167
Iron (Fe)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.059	0.058	0.046	<0.010	<0.010	0.021	0.024	0.019
Lead (Pb)	mg/L		0.000050	0.000076	0.000051	<0.000050	0.000225	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	3.9500	3.4800	2.0000	1.9700	1.8500	2.4200	5.0900	5.0300	2.9600	2.8100	7.3500	2.5400	2.5400	2.4900
Manganese (Mn)	mg/L		0.000050	0.013600	0.030200	0.004450	0.004670	0.002090	0.002580	0.009170	0.009080	0.004330	0.000308	0.001840	0.001910	0.001790	0.002040
Mercury (Hg)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000052	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L		0.00010	0.00771	0.00755	0.00388	0.00418	0.00694	0.00489	0.00263	0.00263	0.00535	0.00162	0.01080	0.00481	0.00470	0.00463
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.669	0.601	0.358	0.353	0.304	0.423	0.406	0.401	0.471	0.334	0.861	0.406	0.412	0.409
Selenium (Se)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.357	0.257	0.079	0.087	<0.050	0.127	0.388	0.397	0.103	0.154	1.290	0.174	0.173	0.175
Silver (Ag)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	1.440	1.250	0.746	0.753	0.875	0.972	0.664	0.654	0.975	0.567	1.920	0.749	0.757	0.757
Strontium (Sr)	mg/L		0.00020	0.03890	0.03380	0.02110	0.02100	0.02500	0.03020	0.01660	0.01650	0.04750	0.00941	0.05520	0.03670	0.03630	0.03650
Thallium (Tl)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	0.00168	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000011	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L		0.00005 - 0.001	<0.000050	<0.000050	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.000050	<0.0010	<0.0010	<0.0010
Zinc (Zn)	mg/L		0.0030	0.0054	0.0053	0.0040	0.0065	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Notes:

** Depth for shallow samples 1 m or less in April is listed as metres below ice-water interface.*

^ Detection limits varied slightly for the Bathurst Area lakes (EKALOLK and WATSE) which were analyzed for drinking water parameters and detection limits.

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment (accessed February 2014).

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultra-oligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Meso-eutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hyper-eutrophic.

d) Guidelines are hardness-dependent. Cadmium short-term guideline (mg/L) = $10^{\{1.016[\log(\text{hardness})]-1.71\}}$ / 1000 with a minimum of 0.00011 mg/L. Cadmium long-term guideline (mg/L) = $10^{\{0.83[\log(\text{hardness})]-2.46\}}$ / 1000 with a miniumum of 0.00004 mg/L.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness. At hardness >180 mg/L the copper guideline is 0.004 mg/L.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness. At hardness >180 mg/L the lead guideline is 0.007 mg/L.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness. At hardness >180 mg/L the nickel guideline is 0.15 mg/L.

h) RDL = Realized detection limit

Appendix 3.3-1. Lake Water Quality Analytical Results, Back River Project, 2013

Lake Site Name				McCoy	McCoy	McCoy	Reference Q	Reference Q	Reference Q	Reference Q	Reference Q	Ekalokhiokvik	Potential Water Source NW
Site Code			Realized	MCCOYLK	MCCOYLK	MCCOYLK	REFQLK	REFQLK	REFQLK	REFQLK	REFQLK	EKALOLK	WATSE
Depth (m)*			Detection	1	4	1	13.8	1	1	14.5	1	13	0
Replicate			Limit	FDUP				FDUP					
Date Sampled		CCME Guidelines for the Protection of Freshwater Aquatic Life[a]	(RDL) (for freshwater baseline samples)^	10-Jul-13	10-Jul-13	10-Jul-13	12-Apr-13	12-Apr-13	12-Apr-13	9-Jul-13	9-Jul-13	11-Apr-13	11-Apr-13
ALS Sample ID #	Units			L1331765-8	L1331765-7	L1331765-6	L1289789-4	L1289789-3	L1289789-2	L1331765-4	L1331765-3	L1289265-8	L1289265-9
Physical Tests													
Conductivity	µS/cm		2.0	33.7	33.7	33.8	89.4	84.0	85.2	58.4	58.9	58.1	1120.0
Hardness (as $CaCO_3$)	mg/L		0.50	13.10	13.00	13.10	36.80	34.10	34.30	22.20	22.20	27.40	306.00
pH	pH	6.5-9.0	0.10	7.08	7.07	7.10	6.75	6.89	6.92	6.95	7.07	7.66	7.67
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		2.0	6.6	6.6	6.0	9.2	8.4	8.5	5.2	5.2	27.3	206.0
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		2.0	6.6	6.6	6.0	9.2	8.4	8.5	5.2	5.2	27.3	206.0
Total Suspended Solids	mg/L	dependent on background levels	3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	12.2
Total Dissolved Solids	mg/L		10	31	28	35	59	52	55	44	44	36	667
Turbidity	NTU	dependent on background levels	0.10	0.35	0.30	0.33	0.19	0.24	0.26	0.41	0.32	0.23	12.60
Nutrients													
Ammonia, Total (as N)	mg/L	pH- and temperature-dependent	0.0050	<0.0050	<0.0050	<0.0050	0.0156	0.0172	0.0196	<0.0050	<0.0050	0.0179	0.0107
Nitrate (as N)	mg/L	short-term: 124; long-term: 3	0.0050	<0.0050	<0.0050	<0.0050	0.0365	0.0076	0.0072	<0.0050	<0.0050	0.0301	<0.050
Nitrite (as N)	mg/L	0.06	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.010
Total Kjeldahl Nitrogen	mg/L		0.05	0.19	0.20	0.19	<0.050	0.17	0.19	0.14	0.13	0.13	1.20
Ortho-phosphate (as P)	mg/L		0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus (P)	mg/L	Trigger ranges from guidance framework[c]	0.002	0.004	0.004	0.004	0.003	<0.0020	<0.0020	0.003	0.003	0.003	0.074
Anions													
Bromide (Br)	mg/L		0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.730
Chloride (Cl)	mg/L	short-term: 640; long-term: 120	0.50	0.51	0.51	0.52	0.91	0.86	0.87	0.56	0.57	1.23	230.00
Fluoride (F)	mg/L	0.12[b]	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.02	0.02	<0.020	<0.20
Sulfate (SO_4)	mg/L		0.5	7.8	7.8	7.8	31.0	29.4	29.7	19.4	19.6	0.8	22.0
Cyanides													
Cyanide, Total	mg/L		0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cyanide, Free	mg/L	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic Carbon													
Total Organic Carbon	mg/L		0.5 - 1.0	3.12	3.18	3.25	3.08	3.03	3.08	2.38	2.46	2.01	18.60
Total Metals													
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.0030	0.0099	0.0098	0.0142	0.0037	<0.0030	0.0035	0.0090	0.0093	0.0032	0.1760
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000071
Arsenic (As)	mg/L	0.005	0.000030	0.000488	0.000475	0.000470	0.000277	0.000281	0.000281	0.000200	0.000246	0.000122	0.000964
Barium (Ba)	mg/L		0.000050	0.001810	0.001760	0.001980	0.003350	0.002990	0.003010	0.002250	0.002250	0.018000	0.018300
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0682
Cadmium (Cd)	mg/L	equation[d]	0.000010	<0.000010	<0.000010	<0.000010	0.000024	0.000020	0.000021	0.000015	0.000013	<0.000010	0.000015
Calcium (Ca)	mg/L		0.020	3.350	3.350	3.320	6.360	5.900	6.070	3.740	3.870	7.690	57.700
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.00010	0.00011	0.00011	0.00011	<0.00010	<0.00010	<0.00010	0.00011	<0.00010	0.00010	0.00054
Cobalt (Co)	mg/L		0.00010	0.00011	0.00012	0.00011	0.00044	0.00025	0.00026	0.00035	0.00029	<0.00010	0.00011
Copper (Cu)	mg/L	0.002-0.004[e]	0.00050	0.00185	0.00229	0.00190	0.00223	0.00213	0.00237	0.00180	0.00186	0.00305	0.00578
Iron (Fe)	mg/L	0.3	0.010	0.027	0.026	0.028	0.115	<0.010	<0.010	0.018	0.017	<0.010	0.182
Lead (Pb)	mg/L	0.001-0.007[f]	0.000050	<0.000050	<0.000050	<0.000050	0.000150	0.000110	0.000133	<0.000050	<0.000050	0.000338	0.000070
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0096
Magnesium (Mg)	mg/L		0.0050	1.2300	1.2300	1.2000	5.3900	4.9800	5.1700	3.0900	3.1600	2.0000	36.3000
Manganese (Mn)	mg/L		0.000050	0.001950	0.001890	0.001720	0.008010	0.001820	0.001920	0.002840	0.002450	0.000379	0.030100
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000073	0.001220
Nickel (Ni)	mg/L	0.025-0.15[g]	0.00010	0.00411	0.00409	0.00403	0.01810	0.01600	0.01630	0.01160	0.01060	0.00017	0.00208
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.249	0.247	0.250	0.516	0.485	0.500	0.315	0.323	0.245	5.700
Selenium (Se)	mg/L	0.001	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00012
Silicon (Si)	mg/L		0.050	0.197	0.195	0.196	0.522	0.377	0.381	0.218	0.211	0.388	5.290
Silver (Ag)	mg/L	0.0001	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.613	0.622	0.607	1.160	1.070	1.120	0.687	0.710	0.780	112.000

Appendix 3.3-1. Lake Water Quality Analytical Results, Back River Project, 2013

Lake Site Name				McCoy	McCoy	McCoy	Reference Q	Reference Q	Reference Q	Reference Q	Reference Q	Ekalokhiokvik	Potential Water Source NW
Site Code			Realized	MCCOYLK	MCCOYLK	MCCOYLK	REFQLK	REFQLK	REFQLK	REFQLK	REFQLK	EKALOLK	WATSE
Depth (m)*			Detection	1	4	1	13.8	1	1	14.5	1	13	0
Replicate			Limit	FDUP				FDUP					
Date Sampled		CCME Guidelines for the Protection of	(RDL)	10-Jul-13	10-Jul-13	10-Jul-13	12-Apr-13	12-Apr-13	12-Apr-13	9-Jul-13	9-Jul-13	11-Apr-13	11-Apr-13
ALS Sample ID #	Units	Freshwater Aquatic Life[a]	(for freshwater baseline samples)^	L1331765-8	L1331765-7	L1331765-6	L1289789-4	L1289789-3	L1289789-2	L1331765-4	L1331765-3	L1289265-8	L1289265-9
Total Metals *(cont'd)*													
Strontium (Sr)	mg/L		0.00020	0.01030	0.01040	0.01030	0.01860	0.01700	0.01750	0.01140	0.01170	0.00841	0.11400
Thallium (Tl)	mg/L	0.0008	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	0.00024	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00020	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000175	0.000747
Vanadium (V)	mg/L		0.00005 - 0.001	<0.0010	<0.0010	<0.0010	0.000126	0.000131	0.000082	<0.0010	<0.0010	0.000145	0.000653
Zinc (Zn)	mg/L	0.03	0.0030	<0.0030	<0.0030	<0.0030	0.0173	0.0153	0.0153	0.0103	0.0089	<0.0030	0.0032
Dissolved Metals													
Aluminum (Al)	mg/L		0.0030	0.0053	0.0050	0.0057	<0.0030	<0.0030	0.0034	0.0051	0.0049	<0.0030	0.0051
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000067
Arsenic (As)	mg/L		0.000030	0.000415	0.000446	0.000409	0.000237	0.000264	0.000239	0.000189	0.000203	0.000099	0.000813
Barium (Ba)	mg/L		0.000050	0.001690	0.001710	0.001820	0.003330	0.002880	0.002860	0.002230	0.002440	0.017300	0.016400
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L		0.005	<0.0050	<0.0050	<0.0050	0.0067	0.007	0.0073	<0.0050	<0.0050	<0.0050	0.0695
Cadmium (Cd)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	0.000019	0.000023	0.000016	0.000013	0.000013	<0.000010	0.000012
Calcium (Ca)	mg/L		0.020	3.260	3.250	3.280	6.180	5.720	5.760	3.760	3.790	7.590	61.800
Chromium (Cr)	mg/L		0.00010	0.00011	0.00010	<0.00010	0.00011	0.00012	0.00012	<0.00010	<0.00010	<0.00010	0.00029
Cobalt (Co)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00014	0.00012	0.00029	0.00025	<0.00010	<0.00010
Copper (Cu)	mg/L		0.00050	0.00158	0.00167	0.00157	0.00195	0.00185	0.00186	0.00150	0.00157	0.00080	0.00517
Iron (Fe)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.030
Lead (Pb)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000096	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0092
Magnesium (Mg)	mg/L		0.0050	1.2200	1.1900	1.2000	5.1800	4.8100	4.8300	3.1100	3.0900	2.0600	36.7000
Manganese (Mn)	mg/L		0.000050	0.000520	0.000548	0.000583	0.002220	0.000698	0.000497	0.002120	0.001880	0.000168	0.020100
Mercury (Hg)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000089	0.001180
Nickel (Ni)	mg/L		0.00010	0.00390	0.00387	0.00388	0.01730	0.01530	0.01540	0.01130	0.01010	0.00015	0.00151
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.249	0.248	0.238	0.498	0.469	0.473	0.321	0.320	0.242	5.560
Selenium (Se)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00012
Silicon (Si)	mg/L		0.050	0.185	0.186	0.186	0.496	0.369	0.351	0.209	0.197	0.393	4.630
Silver (Ag)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.607	0.604	0.601	1.110	1.030	1.040	0.701	0.691	0.787	113.000
Strontium (Sr)	mg/L		0.00020	0.00982	0.00977	0.00974	0.01790	0.01640	0.01650	0.01120	0.01120	0.00808	0.10900
Thallium (Tl)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	0.00015	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000148	0.000724
Vanadium (V)	mg/L		0.00005 - 0.001	<0.0010	<0.0010	<0.0010	<0.000050	<0.000050	<0.000050	<0.0010	<0.0010	0.000055	0.000264
Zinc (Zn)	mg/L		0.0030	<0.0030	<0.0030	<0.0030	0.0161	0.0146	0.0140	0.0117	0.0079	<0.0030	<0.0030

Notes:

** Depth for shallow samples 1 m or less in April is listed as metres below ice-water interface.*

^ Detection limits varied slightly for the Bathurst Area lakes (EKALOLK and WATSE) which were analyzed for drinking water parameters and detection limits.

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment (accessed February 2014).

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultra-oligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Meso-eutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hyper-eutrophic.

d) Guidelines are hardness-dependent. Cadmium short-term guideline (mg/L) = $10^{\{1.016[\log(\text{hardness})]-1.71\}}$ / 1000 with a minimum of 0.00011 mg/L. Cadmium long-term guideline (mg/L) = $10^{\{0.83[\log(\text{hardness})]-2.46\}}$ / 1000 with a miniumum of 0.00004 mg/L.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness. At hardness >180 mg/L the copper guideline is 0.004 mg/L.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness. At hardness >180 mg/L the lead guideline is 0.007 mg/L.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness. At hardness >180 mg/L the nickel guideline is 0.15 mg/L.

h) RDL = Realized detection limit

Appendix 3.3-2

Lake Water Quality Analytical Results of Field Duplicates, Back River Project, 2013

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Appendix 3.3-2. Lake Water Quality Analytical Results of Field Duplicates, Back River Project, 2013

Lake Site Name	Giraffe North				Giraffe South				Rascal				Arrow				Propeller			
Site Code	GIRNORTH	GIRNORTH			GIRSOUTH	GIRSOUTH			RASCLK	RASCLK			ARRLK	ARRLK			PROLK	PROLK		
Depth (m)	1	1			1	1			1	1			0.1	0.1			6	6		
Replicate	Regular	Duplicate			Regular	Duplicate				FDUP				FDUP				FDUP		
Date Sampled	14-Jul-13	14-Jul-13			9-Apr-13	9-Apr-13			13-Jul-13	13-Jul-13			15-Jul-13	15-Jul-13			19-Jul-13	19-Jul-13		
ALS Sample ID #	L1332346-5	L1332346-6	5 x Detection Limit	RPD[a]	L1289265-2	L1289265-3	5 x Detection Limit	RPD[a]	L1332346-3	L1332346-1	5 x Detection Limit	RPD[a]	L1334948-1	L1334948-2	5 x Detection Limit	RPD[a]	L1336083-9	L1336083-4	5 x Detection Limit	RPD[a]
Physical Tests																				
Conductivity	29.6	29.6	10	0.0	60.6	61.1	10	0.8	22.5	22.9	10	1.8	31.5	30.9	10	1.9	23.2	23.3	10	0.4
Hardness (as $CaCO_3$)	11.0	11.4	2.5	3.6	22.6	23.1	2.5	2.2	08.9	08.7	2.5	2.2	12.0	12.3	2.5	2.5	08.6	08.6	2.5	0.6
pH	6.90	6.88	0.5	0.3	6.77	6.77	0.5	0.0	6.94	7.01	0.5	1.0	7.08	7.09	0.5	0.1	6.80	6.84	0.5	0.6
Alkalinity, Bicarbonate (as $CaCO_3$)	4.6	4.3	10	RPD-N/A	10.3	10.0	10	RPD-N/A	4.7	4.5	10	RPD-N/A	8.3	8.3	10	RPD-N/A	3.3	3.3	10	RPD-N/A
Alkalinity, Carbonate (as $CaCO_3$)	1	1	10	RPD-N/A	1	1	10	RPD-N/A	1	1	10	RPD-N/A	1	1	10	RPD-N/A	1	1	10	RPD-N/A
Alkalinity, Hydroxide (as $CaCO_3$)	1	1	10	RPD-N/A	1	1	10	RPD-N/A	1	1	10	RPD-N/A	1	1	10	RPD-N/A	1	1	10	RPD-N/A
Alkalinity, Total (as $CaCO_3$)	4.6	4.3	10	RPD-N/A	10.3	10.0	10	RPD-N/A	4.7	4.5	10	RPD-N/A	8.3	8.3	10	RPD-N/A	3.3	3.3	10	RPD-N/A
Total Suspended Solids	1.5	1.5	15	RPD-N/A	1.5	1.5	15	RPD-N/A	1.5	1.5	15	RPD-N/A	1.5	1.5	15	RPD-N/A	1.5	1.5	15	RPD-N/A
Total Dissolved Solids	25	27	50	RPD-N/A	34	32	50	RPD-N/A	25	30	50	RPD-N/A	43	42	50	RPD-N/A	19	19	50	RPD-N/A
Turbidity	0.30	0.30	0.5	RPD-N/A	0.22	0.29	0.5	RPD-N/A	0.45	0.48	0.5	RPD-N/A	1.56	1.35	0.5	14.4	0.86	0.76	0.5	12.3
Nutrients																				
Ammonia, Total (as N)	0.0025	0.0025	0.025	RPD-N/A	0.0401	0.0422	0.025	5.1	0.0071	0.0025	0.025	RPD-N/A	0.0058	0.0067	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A
Nitrate (as N)	0.0025	0.0025	0.025	RPD-N/A	0.0132	0.0137	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A	0.0265	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A
Nitrite (as N)	0.001	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0012	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A
Total Kjeldahl Nitrogen	0.164	0.19	0.25	RPD-N/A	0.237	0.231	0.25	RPD-N/A	0.219	0.245	0.25	RPD-N/A	0.783	0.826	0.25	5.3	0.2	0.192	0.25	RPD-N/A
Ortho-phosphate (as P)	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A
Total Phosphorus (P)	0.0027	0.0023	0.01	RPD-N/A	0.0030	0.0026	0.01	RPD-N/A	0.0038	0.0032	0.01	RPD-N/A	0.0157	0.0160	0.01	1.9	0.0094	0.0036	0.01	RPD-N/A
Anions																				
Bromide (Br)	0.025	0.025	0.25	RPD-N/A	0.025	0.025	0.25	RPD-N/A	0.025	0.025	0.25	RPD-N/A	0.025	0.025	0.25	RPD-N/A	0.025	0.025	0.25	RPD-N/A
Chloride (Cl)	0.72	0.71	2.5	RPD-N/A	1.13	1.14	2.5	RPD-N/A	0.58	0.57	2.5	RPD-N/A	0.74	0.73	2.5	RPD-N/A	2.29	2.33	2.5	RPD-N/A
Fluoride (F)	0.021	0.021	0.1	RPD-N/A	0.031	0.031	0.1	RPD-N/A	0.010	0.010	0.1	RPD-N/A	0.045	0.041	0.1	RPD-N/A	0.010	0.010	0.1	RPD-N/A
Sulfate (SO_4)	7.74	7.73	2.5	0.1	15.40	15.40	2.5	0.0	4.73	4.72	2.5	0.2	3.51	3.49	2.5	0.6	3.43	3.45	2.5	0.6
Cyanides																				
Cyanide, Total	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A
Cyanide, Free	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A
Organic Carbon																				
Total Organic Carbon	3.36	3.81	2.5	12.6	4.01	3.85	2.5	4.1	3.96	3.75	2.5	5.4	14.40	14.50	5	0.7	3.30	3.25	2.5	1.5
Total Metals																				
Aluminum (Al)	0.0161	0.0159	0.015	1.2	0.0065	0.0068	0.015	RPD-N/A	0.0117	0.0130	0.015	RPD-N/A	0.0433	0.0411	0.015	5.2	0.0097	0.0103	0.015	RPD-N/A
Antimony (Sb)	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000053	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A
Arsenic (As)	0.000206	0.000221	0.00015	7.0	0.000236	0.000254	0.00015	7.3	0.000217	0.000254	0.00015	15.7	0.000503	0.000498	0.00015	1.0	0.000142	0.000143	0.00015	RPD-N/A
Barium (Ba)	0.00390	0.00371	0.00025	5.0	0.00781	0.00786	0.00025	0.6	0.00341	0.00393	0.00025	14.2	0.00775	0.00778	0.00025	0.4	0.00403	0.00410	0.00025	1.7
Beryllium (Be)	0.0001	0.0001	0.001	RPD-N/A	0.0001	0.0001	0.001	RPD-N/A	0.0001	0.0001	0.001	RPD-N/A	0.0001	0.0001	0.001	RPD-N/A	0.0001	0.0001	0.001	RPD-N/A
Bismuth (Bi)	0.00025	0.00025	0.0025	RPD-N/A	0.00025	0.00025	0.0025	RPD-N/A	0.00025	0.00025	0.0025	RPD-N/A	0.00025	0.00025	0.0025	RPD-N/A	0.00025	0.00025	0.0025	RPD-N/A
Boron (B)	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0066	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A
Cadmium (Cd)	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A
Calcium (Ca)	2.08	2.08	0.1	0.0	4.27	4.20	0.1	1.7	1.69	1.67	0.1	1.2	2.39	2.38	0.1	0.4	1.86	1.85	0.1	0.5
Chromium (Cr)	0.00014	0.00013	0.0005	RPD-N/A	0.00023	0.00012	0.0005	RPD-N/A	0.00014	0.00015	0.0005	RPD-N/A	0.00064	0.00063	0.0005	1.6	0.00012	0.00011	0.0005	RPD-N/A
Cobalt (Co)	0.00014	0.00013	0.0005	RPD-N/A	0.00023	0.00021	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00018	0.00018	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A
Copper (Cu)	0.00188	0.00183	0.0025	RPD-N/A	0.00229	0.00289	0.0025	RPD-N/A	0.00153	0.00224	0.0025	RPD-N/A	0.00246	0.00256	0.0025	RPD-N/A	0.00081	0.00096	0.0025	RPD-N/A
Iron (Fe)	0.041	0.039	0.05	RPD-N/A	0.020	0.025	0.05	RPD-N/A	0.058	0.058	0.05	0.0	0.571	0.576	0.05	0.9	0.034	0.036	0.05	RPD-N/A
Lead (Pb)	0.000025	0.000025	0.00025	RPD-N/A	0.000203	0.0002	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A
Lithium (Li)	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A
Magnesium (Mg)	1.57	1.57	0.025	0.0	3.09	2.94	0.025	5.0	1.16	1.30	0.025	11.4	1.52	1.55	0.025	2.0	0.95	0.94	0.025	1.3
Manganese (Mn)	0.0022	0.0022	0.00025	1.4	0.0095	0.0090	0.00025	5.9	0.0008	0.0010	0.00025	19.7	0.0022	0.0023	0.00025	6.3	0.0034	0.0034	0.00025	0.0
Mercury (Hg)	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A
Molybdenum (Mo)	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A
Nickel (Ni)	0.00500	0.00495	0.0005	1.0	0.01050	0.01050	0.0005	0.0	0.00220	0.00243	0.0005	9.9	0.00264	0.00259	0.0005	1.9	0.00200	0.00195	0.0005	2.5
Phosphorus (P)	0.15	0.15	1.5	RPD-N/A	0.15	0.15	1.5	RPD-N/A	0.15	0.15	1.5	RPD-N/A	0.15	0.15	1.5	RPD-N/A	0.15	0.15	1.5	RPD-N/A
Potassium (K)	0.336	0.331	0.25	1.5	0.617	0.606	0.25	1.8	0.281	0.329	0.25	15.7	0.221	0.228	0.25	RPD-N/A	0.288	0.285	0.25	1.0
Selenium (Se)	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A
Silicon (Si)	0.181	0.188	0.25	RPD-N/A	0.598	0.596	0.25	0.3	0.220	0.213	0.25	RPD-N/A	0.174	0.168	0.25	RPD-N/A	0.078	0.084	0.25	RPD-N/A
Silver (Ag)	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A
Sodium (Na)	0.634	0.628	0.05	1.0	1.170	1.140	0.05	2.6	0.555	0.645	0.05	15.0	1.340	1.370	0.05	2.2	0.483	0.475	0.05	1.7
Strontium (Sr)	0.0090	0.0090	0.001	0.1	0.0189	0.0187	0.001	1.1	0.0070	0.0069	0.001	1.4	0.0121	0.0120	0.001	0.8	0.0096	0.0096	0.001	0.4
Thallium (Tl)	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A

Appendix 3.3-2. Lake Water Quality Analytical Results of Field Duplicates, Back River Project, 2013

Lake Site Name	Giraffe North				Giraffe South				Rascal				Arrow				Propeller			
Site Code	GIRNORTH	GIRNORTH			GIRSOUTH	GIRSOUTH			RASCLK	RASCLK			ARRLK	ARRLK			PROLK	PROLK		
Depth (m)	1	1			1	1			1	1			0.1	0.1			6	6		
Replicate	Regular	Duplicate			Regular	Duplicate				FDUP				FDUP				FDUP		
Date Sampled	14-Jul-13	14-Jul-13			9-Apr-13	9-Apr-13			13-Jul-13	13-Jul-13			15-Jul-13	15-Jul-13			19-Jul-13	19-Jul-13		
ALS Sample ID #	L1332346-5	L1332346-6	5 x Detection Limit	RPD[a]	L1289265-2	L1289265-3	5 x Detection Limit	RPD[a]	L1332346-3	L1332346-1	5 x Detection Limit	RPD[a]	L1334948-1	L1334948-2	5 x Detection Limit	RPD[a]	L1336083-9	L1336083-4	5 x Detection Limit	RPD[a]
Total Metals *(cont'd)*																				
Tin (Sn)	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A
Titanium (Ti)	0.005	0.005	0.05	RPD-N/A	0.005	0.005	0.05	RPD-N/A	0.005	0.005	0.05	RPD-N/A	0.005	0.005	0.05	RPD-N/A	0.005	0.005	0.05	RPD-N/A
Uranium (U)	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000018	0.000020	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A
Vanadium (V)	0.0005	0.0005	0.005	RPD-N/A	0.000187	0.000165	0.00025	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A
Zinc (Zn)	0.0015	0.0015	0.015	RPD-N/A	0.0015	0.0037	0.015	RPD-N/A	0.0015	0.0015	0.015	RPD-N/A	0.0015	0.0015	0.015	RPD-N/A	0.0015	0.0015	0.015	RPD-N/A
Dissolved Metals																				
Aluminum (Al)	0.0097	0.0093	0.015	RPD-N/A	0.0045	0.0042	0.015	RPD-N/A	0.0070	0.0070	0.015	RPD-N/A	0.0136	0.0122	0.015	RPD-N/A	0.0066	0.0054	0.015	RPD-N/A
Antimony (Sb)	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A
Arsenic (As)	0.000193	0.000182	0.00015	5.9	0.000214	0.000205	0.00015	4.3	0.000193	0.000184	0.00015	4.8	0.000411	0.000378	0.00015	8.4	0.000118	0.000114	0.00015	RPD-N/A
Barium (Ba)	0.00370	0.00366	0.00025	1.1	0.00763	0.00788	0.00025	3.2	0.00337	0.00336	0.00025	0.3	0.00717	0.00729	0.00025	1.7	0.00398	0.00393	0.00025	1.3
Beryllium (Be)	0.0001	0.0001	0.001	RPD-N/A	0.0001	0.0001	0.001	RPD-N/A	0.0001	0.0001	0.001	RPD-N/A	0.0001	0.0001	0.001	RPD-N/A	0.0001	0.0001	0.001	RPD-N/A
Bismuth (Bi)	0.00025	0.00025	0.0025	RPD-N/A	0.00025	0.00025	0.0025	RPD-N/A	0.00025	0.00025	0.0025	RPD-N/A	0.00025	0.00025	0.0025	RPD-N/A	0.00025	0.00025	0.0025	RPD-N/A
Boron (B)	0.0054	0.0025	0.025	RPD-N/A	0.0051	0.0058	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A	0.0145	0.0025	0.025	RPD-N/A	0.0051	0.0025	0.025	RPD-N/A
Cadmium (Cd)	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A
Calcium (Ca)	2.02	2.03	0.1	0.5	4.15	4.24	0.1	2.1	1.65	1.60	0.1	3.1	2.32	2.38	0.1	2.6	1.85	1.85	0.1	0.0
Chromium (Cr)	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00039	0.00044	0.0005	RPD-N/A	0.00011	0.00005	0.0005	RPD-N/A
Cobalt (Co)	0.00011	0.00012	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00011	0.00011	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A
Copper (Cu)	0.00151	0.00203	0.0025	RPD-N/A	0.00201	0.00198	0.0025	RPD-N/A	0.00118	0.00143	0.0025	RPD-N/A	0.00227	0.00198	0.0025	RPD-N/A	0.00072	0.00073	0.0025	RPD-N/A
Iron (Fe)	0.005	0.005	0.05	RPD-N/A	0.005	0.005	0.05	RPD-N/A	0.016	0.017	0.05	RPD-N/A	0.163	0.155	0.05	5.0	0.005	0.005	0.05	RPD-N/A
Lead (Pb)	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A
Lithium (Li)	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A
Magnesium (Mg)	1.45	1.53	0.025	5.4	2.98	3.04	0.025	2.0	1.15	1.14	0.025	0.9	1.51	1.53	0.025	1.3	0.96	0.97	0.025	1.1
Manganese (Mn)	0.0017	0.0017	0.00025	4.7	0.0007	0.0006	0.00025	13.1	0.0007	0.0006	0.00025	9.1	0.0007	0.0006	0.00025	10.0	0.0007	0.0009	0.00025	29.7
Mercury (Hg)	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A
Molybdenum (Mo)	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A
Nickel (Ni)	0.00455	0.00463	0.0005	1.7	0.00999	0.01000	0.0005	0.1	0.00206	0.00210	0.0005	1.9	0.00234	0.00238	0.0005	1.7	0.00191	0.00187	0.0005	2.1
Phosphorus (P)	0.15	0.15	1.5	RPD-N/A	0.15	0.15	1.5	RPD-N/A	0.15	0.15	1.5	RPD-N/A	0.15	0.15	1.5	RPD-N/A	0.15	0.15	1.5	RPD-N/A
Potassium (K)	0.303	0.328	0.25	7.9	0.611	0.614	0.25	0.5	0.285	0.288	0.25	1.0	0.215	0.212	0.25	RPD-N/A	0.285	0.292	0.25	2.4
Selenium (Se)	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A
Silicon (Si)	0.176	0.180	0.25	RPD-N/A	0.580	0.582	0.25	0.3	0.203	0.202	0.25	RPD-N/A	0.092	0.087	0.25	RPD-N/A	0.067	0.067	0.25	RPD-N/A
Silver (Ag)	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A
Sodium (Na)	0.599	0.624	0.05	4.1	1.130	1.180	0.05	4.3	0.553	0.558	0.05	0.9	1.410	1.370	0.05	2.9	0.475	0.485	0.05	2.1
Strontium (Sr)	0.0089	0.0086	0.001	3.9	0.0183	0.0185	0.001	1.1	0.0066	0.0064	0.001	3.5	0.0112	0.0116	0.001	3.5	0.0092	0.0093	0.001	1.2
Thallium (Tl)	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A
Tin (Sn)	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A
Titanium (Ti)	0.005	0.005	0.05	RPD-N/A	0.005	0.005	0.05	RPD-N/A	0.005	0.005	0.05	RPD-N/A	0.005	0.005	0.05	RPD-N/A	0.005	0.005	0.05	RPD-N/A
Uranium (U)	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000014	0.000015	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A
Vanadium (V)	0.0005	0.0005	0.005	RPD-N/A	0.000065	0.000052	0.00025	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A
Zinc (Zn)	0.0015	0.0015	0.015	RPD-N/A	0.0015	0.0015	0.015	RPD-N/A	0.0015	0.0015	0.015	RPD-N/A	0.0015	0.0015	0.015	RPD-N/A	0.0015	0.0015	0.015	RPD-N/A

Notes:

a) Relative percent difference (RPD).

b) RPD-N/A -Not applicable when the values are less than five times the detection limit.

Appendix 3.3-2. Lake Water Quality Analytical Results of Field Duplicates, Back River Project, 2013

Lake Site Name	Reference B				Reference B				Slave				Komatic				McCoy			
Site Code	REFBLK	REFBLK			REFBLK	REFBLK			SLAVELK	SLAVELK			KOMALK	KOMALK			MCCOYLK	MCCOYLK		
Depth (m)	1	1			1	1			0.1	0.1			1	1			1	1		
Replicate		FDUP				FDUP				FDUP				FDUP				FDUP		
Date Sampled	13-Apr-13	13-Apr-13			17-Jul-13	17-Jul-13			12-Jul-13	12-Jul-13			10-Jul-13	10-Jul-13			10-Jul-13	10-Jul-13		
ALS Sample ID #	L1289789-8	L1289789-9	5 x Detection Limit	RPD[a]	L1336083-2	L1336083-3	5 x Detection Limit	RPD[a]	L1332442-3	L1332442-5	5 x Detection Limit	RPD[a]	L1331765-9	L1331765-11	5 x Detection Limit	RPD[a]	L1331765-6	L1331765-8	5 x Detection Limit	RPD[a]
Physical Tests																				
Conductivity	40.4	40.9	10	1.2	18.9	18.8	10	0.5	100.0	100.0	10	0.0	69.1	69.1	10	0.0	33.8	33.7	10	0.3
Hardness (as $CaCO_3$)	16.2	16.4	2.5	1.2	07.2	07.1	2.5	0.8	40.0	40.3	2.5	0.7	26.8	27.1	2.5	1.1	13.1	13.1	2.5	0.0
pH	6.83	6.85	0.5	0.3	6.85	6.87	0.5	0.3	7.11	7.08	0.5	0.4	7.09	7.13	0.5	0.6	7.10	7.08	0.5	0.3
Alkalinity, Bicarbonate (as $CaCO_3$)	12.2	12.5	10	2.4	4.6	4.0	10	RPD-N/A	6.1	6.6	10	RPD-N/A	7.5	7.6	10	RPD-N/A	6.0	6.6	10	RPD-N/A
Alkalinity, Carbonate (as $CaCO_3$)	1	1	10	RPD-N/A	1	1	10	RPD-N/A	1	1	10	RPD-N/A	1	1	10	RPD-N/A	1	1	10	RPD-N/A
Alkalinity, Hydroxide (as $CaCO_3$)	1	1	10	RPD-N/A	1	1	10	RPD-N/A	1	1	10	RPD-N/A	1	1	10	RPD-N/A	1	1	10	RPD-N/A
Alkalinity, Total (as $CaCO_3$)	12.2	12.5	10	2.4	4.6	4.0	10	RPD-N/A	6.1	6.6	10	RPD-N/A	7.5	7.6	10	RPD-N/A	6.0	6.6	10	RPD-N/A
Total Suspended Solids	1.5	1.5	15	RPD-N/A	1.5	1.5	15	RPD-N/A	1.5	1.5	15	RPD-N/A	1.5	1.5	15	RPD-N/A	1.5	1.5	15	RPD-N/A
Total Dissolved Solids	27	30	50	RPD-N/A	20	17	50	RPD-N/A	71	69	50	2.9	54	52	50	3.8	35	31	50	RPD-N/A
Turbidity	0.49	0.59	0.5	RPD-N/A	0.66	0.63	0.5	4.7	0.59	0.53	0.5	10.7	0.38	0.33	0.5	RPD-N/A	0.33	0.35	0.5	RPD-N/A
Nutrients																				
Ammonia, Total (as N)	0.0429	0.0432	0.025	0.7	0.0025	0.0025	0.025	RPD-N/A	0.0170	0.0160	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A
Nitrate (as N)	0.0056	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A	0.0073	0.0150	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A
Nitrite (as N)	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A
Total Kjeldahl Nitrogen	0.303	0.31	0.25	2.3	0.259	0.246	0.25	RPD-N/A	0.226	0.226	0.25	RPD-N/A	0.182	0.208	0.25	RPD-N/A	0.186	0.192	0.25	RPD-N/A
Ortho-phosphate (as P)	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A
Total Phosphorus (P)	0.0031	0.0049	0.01	RPD-N/A	0.0045	0.0040	0.01	RPD-N/A	0.0068	0.0078	0.01	RPD-N/A	0.0045	0.0045	0.01	RPD-N/A	0.0038	0.0037	0.01	RPD-N/A
Anions																				
Bromide (Br)	0.025	0.025	0.25	RPD-N/A	0.025	0.025	0.25	RPD-N/A	0.025	0.025	0.25	RPD-N/A	0.025	0.025	0.25	RPD-N/A	0.025	0.025	0.25	RPD-N/A
Chloride (Cl)	0.93	0.94	2.5	RPD-N/A	0.25	0.25	2.5	RPD-N/A	1.22	1.37	2.5	RPD-N/A	5.64	5.65	2.5	0.2	0.52	0.51	2.5	RPD-N/A
Fluoride (F)	0.027	0.028	0.1	RPD-N/A	0.010	0.010	0.1	RPD-N/A	0.010	0.010	0.1	RPD-N/A	0.022	0.023	0.1	RPD-N/A	0.023	0.023	0.1	RPD-N/A
Sulfate (SO_4)	5.68	5.83	2.5	2.6	2.85	2.85	2.5	0.0	35.10	35.20	2.5	0.3	14.40	14.50	2.5	0.7	7.83	7.82	2.5	0.1
Cyanides																				
Cyanide, Total	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A
Cyanide, Free	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A
Organic Carbon																				
Total Organic Carbon	4.66	4.74	2.5	1.7	3.19	3.20	2.5	0.3	2.95	2.87	2.5	2.7	3.08	3.01	2.5	2.3	3.25	3.12	2.5	4.1
Total Metals																				
Aluminum (Al)	0.0015	0.0015	0.015	RPD-N/A	0.0175	0.0060	0.015	RPD-N/A	0.0182	0.0158	0.015	14.1	0.0124	0.0107	0.015	RPD-N/A	0.0142	0.0099	0.015	RPD-N/A
Antimony (Sb)	0.000025	0.000025	0.00025	RPD-N/A	0.000052	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A
Arsenic (As)	0.000239	0.000224	0.00015	6.5	0.000151	0.000154	0.00015	2.0	0.000642	0.000666	0.00015	3.7	0.000932	0.000920	0.00015	1.3	0.000470	0.000488	0.00015	3.8
Barium (Ba)	0.00768	0.00709	0.00025	8.0	0.00299	0.00311	0.00025	3.9	0.00199	0.00194	0.00025	2.5	0.00290	0.00275	0.00025	5.3	0.00198	0.00181	0.00025	9.0
Beryllium (Be)	0.0001	0.0001	0.001	RPD-N/A	0.0001	0.0001	0.001	RPD-N/A	0.0001	0.0001	0.001	RPD-N/A	0.0001	0.0001	0.001	RPD-N/A	0.0001	0.0001	0.001	RPD-N/A
Bismuth (Bi)	0.00025	0.00025	0.0025	RPD-N/A	0.00025	0.00025	0.0025	RPD-N/A	0.00025	0.00025	0.0025	RPD-N/A	0.00025	0.00025	0.0025	RPD-N/A	0.00025	0.00025	0.0025	RPD-N/A
Boron (B)	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A	0.0059	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A
Cadmium (Cd)	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A
Calcium (Ca)	3.25	3.14	0.1	3.4	1.28	1.56	0.1	19.7	7.91	7.99	0.1	1.0	6.84	6.63	0.1	3.1	3.32	3.35	0.1	0.9
Chromium (Cr)	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00019	0.0005	RPD-N/A	0.00012	0.00011	0.0005	RPD-N/A	0.00011	0.00012	0.0005	RPD-N/A	0.00011	0.00011	0.0005	RPD-N/A
Cobalt (Co)	0.00023	0.00011	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00025	0.00026	0.0005	RPD-N/A	0.00022	0.00020	0.0005	RPD-N/A	0.00011	0.00011	0.0005	RPD-N/A
Copper (Cu)	0.00080	0.00087	0.0025	RPD-N/A	0.00073	0.00072	0.0025	RPD-N/A	0.00295	0.00294	0.0025	0.3	0.00298	0.00206	0.0025	RPD-N/A	0.00190	0.00185	0.0025	RPD-N/A
Iron (Fe)	0.038	0.023	0.05	RPD-N/A	0.048	0.049	0.05	RPD-N/A	0.193	0.191	0.05	1.0	0.076	0.071	0.05	6.8	0.028	0.027	0.05	RPD-N/A
Lead (Pb)	0.000167	0.000104	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A
Lithium (Li)	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A
Magnesium (Mg)	2.23	2.20	0.025	1.4	1.02	0.99	0.025	3.2	5.18	5.18	0.025	0.0	2.57	2.52	0.025	2.0	1.20	1.23	0.025	2.5
Manganese (Mn)	0.0236	0.0108	0.00025	74.4	0.0018	0.0018	0.00025	3.4	0.0127	0.0126	0.00025	0.8	0.0048	0.0047	0.00025	3.6	0.0017	0.0020	0.00025	12.5
Mercury (Hg)	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A
Molybdenum (Mo)	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A
Nickel (Ni)	0.00167	0.00158	0.0005	5.5	0.00071	0.00070	0.0005	1.4	0.00286	0.00284	0.0005	0.7	0.00504	0.00491	0.0005	2.6	0.00403	0.00411	0.0005	2.0
Phosphorus (P)	0.15	0.15	1.5	RPD-N/A	0.15	0.15	1.5	RPD-N/A	0.15	0.15	1.5	RPD-N/A	0.15	0.15	1.5	RPD-N/A	0.15	0.15	1.5	RPD-N/A
Potassium (K)	0.567	0.561	0.25	1.1	0.282	0.277	0.25	1.8	0.417	0.421	0.25	1.0	0.416	0.400	0.25	3.9	0.250	0.249	0.25	RPD-N/A
Selenium (Se)	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A
Silicon (Si)	0.355	0.294	0.25	18.8	0.082	0.084	0.25	RPD-N/A	0.444	0.440	0.25	0.9	0.186	0.173	0.25	RPD-N/A	0.196	0.197	0.25	RPD-N/A
Silver (Ag)	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A
Sodium (Na)	0.963	0.971	0.05	0.8	0.509	0.491	0.05	3.6	0.679	0.677	0.05	0.3	0.780	0.753	0.05	3.5	0.607	0.613	0.05	1.0
Strontium (Sr)	0.0119	0.0115	0.001	3.4	0.0049	0.0158	0.001	105.2	0.0173	0.0174	0.001	0.6	0.0387	0.0374	0.001	3.4	0.0103	0.0103	0.001	0.0
Thallium (Tl)	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A

Appendix 3.3-2. Lake Water Quality Analytical Results of Field Duplicates, Back River Project, 2013

Lake Site Name	Reference B				Reference B				Slave				Komatic				McCoy			
Site Code	REFBLK	REFBLK			REFBLK	REFBLK			SLAVELK	SLAVELK			KOMALK	KOMALK			MCCOYLK	MCCOYLK		
Depth (m)	1	1			1	1			0.1	0.1			1	1			1	1		
Replicate		FDUP				FDUP				FDUP				FDUP				FDUP		
Date Sampled	13-Apr-13	13-Apr-13			17-Jul-13	17-Jul-13			12-Jul-13	12-Jul-13			10-Jul-13	10-Jul-13			10-Jul-13	10-Jul-13		
ALS Sample ID #	L1289789-8	L1289789-9	5 x Detection Limit	RPD[a]	L1336083-2	L1336083-3	5 x Detection Limit	RPD[a]	L1332442-3	L1332442-5	5 x Detection Limit	RPD[a]	L1331765-9	L1331765-11	5 x Detection Limit	RPD[a]	L1331765-6	L1331765-8	5 x Detection Limit	RPD[a]
Total Metals *(cont'd)*																				
Tin (Sn)	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00024	0.00005	0.0005	RPD-N/A
Titanium (Ti)	0.005	0.005	0.05	RPD-N/A	0.005	0.005	0.05	RPD-N/A	0.005	0.005	0.05	RPD-N/A	0.005	0.005	0.05	RPD-N/A	0.005	0.005	0.05	RPD-N/A
Uranium (U)	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000015	0.000014	0.00005	RPD-N/A	0.000010	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A
Vanadium (V)	0.000111	0.000103	0.00025	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A
Zinc (Zn)	0.0015	0.0015	0.015	RPD-N/A	0.0015	0.0015	0.015	RPD-N/A	0.0015	0.0015	0.015	RPD-N/A	0.0015	0.0015	0.015	RPD-N/A	0.0015	0.0015	0.015	RPD-N/A
Dissolved Metals																				
Aluminum (Al)	0.0015	0.0015	0.015	RPD-N/A	0.0015	0.0015	0.015	RPD-N/A	0.0054	0.0036	0.015	RPD-N/A	0.0062	0.0060	0.015	RPD-N/A	0.0057	0.0053	0.015	RPD-N/A
Antimony (Sb)	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A
Arsenic (As)	0.000198	0.000211	0.00015	6.4	0.000141	0.000132	0.00015	RPD-N/A	0.000443	0.000460	0.00015	3.8	0.000730	0.000731	0.00015	0.1	0.000409	0.000415	0.00015	1.5
Barium (Ba)	0.00733	0.00731	0.00025	0.3	0.00282	0.00281	0.00025	0.4	0.00179	0.00185	0.00025	3.3	0.00284	0.00277	0.00025	2.5	0.00182	0.00169	0.00025	7.4
Beryllium (Be)	0.0001	0.0001	0.001	RPD-N/A	0.0001	0.0001	0.001	RPD-N/A	0.0001	0.0001	0.001	RPD-N/A	0.0001	0.0001	0.001	RPD-N/A	0.0001	0.0001	0.001	RPD-N/A
Bismuth (Bi)	0.00025	0.00025	0.0025	RPD-N/A	0.00025	0.00025	0.0025	RPD-N/A	0.00025	0.00025	0.0025	RPD-N/A	0.00025	0.00025	0.0025	RPD-N/A	0.00025	0.00025	0.0025	RPD-N/A
Boron (B)	0.0060	0.0064	0.025	RPD-N/A	0.0051	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0050	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A
Cadmium (Cd)	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A
Calcium (Ca)	3.09	3.04	0.1	1.6	1.26	1.26	0.1	0.0	7.73	7.76	0.1	0.4	6.61	6.65	0.1	0.6	3.28	3.26	0.1	0.6
Chromium (Cr)	0.00005	0.00012	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00011	0.0005	RPD-N/A
Cobalt (Co)	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00012	0.00011	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A
Copper (Cu)	0.00066	0.00072	0.0025	RPD-N/A	0.00055	0.00051	0.0025	RPD-N/A	0.00230	0.00232	0.0025	RPD-N/A	0.00167	0.00170	0.0025	RPD-N/A	0.00157	0.00158	0.0025	RPD-N/A
Iron (Fe)	0.005	0.005	0.05	RPD-N/A	0.005	0.005	0.05	RPD-N/A	0.058	0.059	0.05	1.7	0.019	0.021	0.05	RPD-N/A	0.005	0.005	0.05	RPD-N/A
Lead (Pb)	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A
Lithium (Li)	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A
Magnesium (Mg)	2.05	2.13	0.025	3.8	0.98	0.97	0.025	1.5	5.03	5.09	0.025	1.2	2.49	2.54	0.025	2.0	1.20	1.22	0.025	1.7
Manganese (Mn)	0.0022	0.0004	0.00025	139.2	0.0001	0.0001	0.00025	RPD-N/A	0.0091	0.0092	0.00025	1.0	0.0020	0.0019	0.00025	6.6	0.0006	0.0005	0.00025	11.4
Mercury (Hg)	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A
Molybdenum (Mo)	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A
Nickel (Ni)	0.00147	0.00142	0.0005	3.5	0.00065	0.00065	0.0005	0.0	0.00263	0.00263	0.0005	0.0	0.00463	0.00481	0.0005	3.8	0.00388	0.00390	0.0005	0.5
Phosphorus (P)	0.15	0.15	1.5	RPD-N/A	0.15	0.15	1.5	RPD-N/A	0.15	0.15	1.5	RPD-N/A	0.15	0.15	1.5	RPD-N/A	0.15	0.15	1.5	RPD-N/A
Potassium (K)	0.522	0.544	0.25	4.1	0.277	0.271	0.25	2.2	0.401	0.406	0.25	1.2	0.409	0.406	0.25	0.7	0.238	0.249	0.25	RPD-N/A
Selenium (Se)	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A
Silicon (Si)	0.369	0.286	0.25	25.3	0.065	0.064	0.25	RPD-N/A	0.397	0.388	0.25	2.3	0.175	0.174	0.25	RPD-N/A	0.186	0.185	0.25	RPD-N/A
Silver (Ag)	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A
Sodium (Na)	0.883	0.929	0.05	5.1	0.486	0.482	0.05	0.8	0.654	0.664	0.05	1.5	0.757	0.749	0.05	1.1	0.601	0.607	0.05	1.0
Strontium (Sr)	0.0112	0.0110	0.001	1.8	0.0046	0.0046	0.001	1.1	0.0165	0.0166	0.001	0.6	0.0365	0.0367	0.001	0.5	0.0097	0.0098	0.001	0.8
Thallium (Tl)	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A
Tin (Sn)	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00015	0.00005	0.0005	RPD-N/A
Titanium (Ti)	0.005	0.005	0.05	RPD-N/A	0.005	0.005	0.05	RPD-N/A	0.005	0.005	0.05	RPD-N/A	0.005	0.005	0.05	RPD-N/A	0.005	0.005	0.05	RPD-N/A
Uranium (U)	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000011	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A
Vanadium (V)	0.000025	0.000025	0.00025	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A
Zinc (Zn)	0.0015	0.0015	0.015	RPD-N/A	0.0015	0.0015	0.015	RPD-N/A	0.0015	0.0015	0.015	RPD-N/A	0.0015	0.0015	0.015	RPD-N/A	0.0015	0.0015	0.015	RPD-N/A

Notes:

a) Relative percent difference (RPD).

b) RPD-N/A -Not applicable when the values are less than five times the detection limit.

Appendix 3.3-2. Lake Water Quality Analytical Results of Field Duplicates, Back River Project, 2013

Lake Site Name	Reference Q			
Site Code	REFQLK	REFQLK		
Depth (m)	1	1		
Replicate		FDUP		
Date Sampled	12-Apr-13	12-Apr-13		
ALS Sample ID #	L1289789-2	L1289789-3	5 x Detection Limit	RPD[a]
Physical Tests				
Conductivity	85.2	84.0	10	1.4
Hardness (as $CaCO_3$)	34.3	34.1	2.5	0.6
pH	6.92	6.89	0.5	0.4
Alkalinity, Bicarbonate (as $CaCO_3$)	8.5	8.4	10	RPD-N/A
Alkalinity, Carbonate (as $CaCO_3$)	1	1	10	RPD-N/A
Alkalinity, Hydroxide (as $CaCO_3$)	1	1	10	RPD-N/A
Alkalinity, Total (as $CaCO_3$)	8.5	8.4	10	RPD-N/A
Total Suspended Solids	1.5	1.5	15	RPD-N/A
Total Dissolved Solids	55	52	50	5.6
Turbidity	0.26	0.24	0.5	RPD-N/A
Nutrients				
Ammonia, Total (as N)	0.0196	0.0172	0.025	RPD-N/A
Nitrate (as N)	0.0072	0.0076	0.025	RPD-N/A
Nitrite (as N)	0.0005	0.0005	0.005	RPD-N/A
Total Kjeldahl Nitrogen	0.194	0.166	0.25	RPD-N/A
Ortho-phosphate (as P)	0.0005	0.0005	0.005	RPD-N/A
Total Phosphorus (P)	0.0010	0.0010	0.01	RPD-N/A
Anions				
Bromide (Br)	0.025	0.025	0.25	RPD-N/A
Chloride (Cl)	0.87	0.86	2.5	RPD-N/A
Fluoride (F)	0.028	0.028	0.1	RPD-N/A
Sulfate (SO_4)	29.70	29.40	2.5	1.0
Cyanides				
Cyanide, Total	0.0005	0.0005	0.005	RPD-N/A
Cyanide, Free	0.0005	0.0005	0.005	RPD-N/A
Organic Carbon				
Total Organic Carbon	3.08	3.03	2.5	1.6
Total Metals				
Aluminum (Al)	0.0035	0.0015	0.015	RPD-N/A
Antimony (Sb)	0.000025	0.000025	0.00025	RPD-N/A
Arsenic (As)	0.000281	0.000281	0.00015	0.0
Barium (Ba)	0.00301	0.00299	0.00025	0.7
Beryllium (Be)	0.0001	0.0001	0.001	RPD-N/A
Bismuth (Bi)	0.00025	0.00025	0.0025	RPD-N/A
Boron (B)	0.0025	0.0025	0.025	RPD-N/A
Cadmium (Cd)	0.000021	0.00002	0.00005	RPD-N/A
Calcium (Ca)	6.07	5.90	0.1	2.8
Chromium (Cr)	0.00005	0.00005	0.0005	RPD-N/A
Cobalt (Co)	0.00026	0.00025	0.0005	RPD-N/A
Copper (Cu)	0.00237	0.00213	0.0025	RPD-N/A
Iron (Fe)	0.005	0.005	0.05	RPD-N/A
Lead (Pb)	0.000133	0.00011	0.00025	RPD-N/A
Lithium (Li)	0.0025	0.0025	0.025	RPD-N/A
Magnesium (Mg)	5.17	4.98	0.025	3.7
Manganese (Mn)	0.0019	0.0018	0.00025	5.3
Mercury (Hg)	0.000005	0.000005	0.00005	RPD-N/A
Molybdenum (Mo)	0.000025	0.000025	0.00025	RPD-N/A
Nickel (Ni)	0.01630	0.01600	0.0005	1.9
Phosphorus (P)	0.15	0.15	1.5	RPD-N/A
Potassium (K)	0.500	0.485	0.25	3.0
Selenium (Se)	0.00005	0.00005	0.0005	RPD-N/A
Silicon (Si)	0.381	0.377	0.25	1.1
Silver (Ag)	0.000005	0.000005	0.00005	RPD-N/A
Sodium (Na)	1.120	1.070	0.05	4.6
Strontium (Sr)	0.0175	0.0170	0.001	2.9
Thallium (Tl)	0.000025	0.000025	0.00025	RPD-N/A

Appendix 3.3-2. Lake Water Quality Analytical Results of Field Duplicates, Back River Project, 2013

Lake Site Name	Reference Q			
Site Code	REFQLK	REFQLK		
Depth (m)	1	1		
Replicate		FDUP		
Date Sampled	12-Apr-13	12-Apr-13		
ALS Sample ID #	L1289789-2	L1289789-3	5 x Detection Limit	RPD[a]
Total Metals *(cont'd)*				
Tin (Sn)	0.00005	0.00005	0.0005	RPD-N/A
Titanium (Ti)	0.005	0.005	0.05	RPD-N/A
Uranium (U)	0.000005	0.000005	0.00005	RPD-N/A
Vanadium (V)	0.000082	0.000131	0.00025	RPD-N/A
Zinc (Zn)	0.0153	0.0153	0.015	0.0
Dissolved Metals				
Aluminum (Al)	0.0034	0.0015	0.015	RPD-N/A
Antimony (Sb)	0.000025	0.000025	0.00025	RPD-N/A
Arsenic (As)	0.000239	0.000264	0.00015	9.9
Barium (Ba)	0.00286	0.00288	0.00025	0.7
Beryllium (Be)	0.0001	0.0001	0.001	RPD-N/A
Bismuth (Bi)	0.00025	0.00025	0.0025	RPD-N/A
Boron (B)	0.0073	0.0070	0.025	RPD-N/A
Cadmium (Cd)	0.000016	0.000023	0.00005	RPD-N/A
Calcium (Ca)	5.76	5.72	0.1	0.7
Chromium (Cr)	0.00012	0.00012	0.0005	RPD-N/A
Cobalt (Co)	0.00012	0.00014	0.0005	RPD-N/A
Copper (Cu)	0.00186	0.00185	0.0025	RPD-N/A
Iron (Fe)	0.005	0.005	0.05	RPD-N/A
Lead (Pb)	0.000025	0.000025	0.00025	RPD-N/A
Lithium (Li)	0.0025	0.0025	0.025	RPD-N/A
Magnesium (Mg)	4.83	4.81	0.025	0.4
Manganese (Mn)	0.0005	0.0007	0.00025	33.6
Mercury (Hg)	0.000005	0.000005	0.00005	RPD-N/A
Molybdenum (Mo)	0.000025	0.000025	0.00025	RPD-N/A
Nickel (Ni)	0.01540	0.01530	0.0005	0.7
Phosphorus (P)	0.15	0.15	1.5	RPD-N/A
Potassium (K)	0.473	0.469	0.25	0.8
Selenium (Se)	0.00005	0.00005	0.0005	RPD-N/A
Silicon (Si)	0.351	0.369	0.25	5.0
Silver (Ag)	0.000005	0.000005	0.00005	RPD-N/A
Sodium (Na)	1.040	1.030	0.05	1.0
Strontium (Sr)	0.0165	0.0164	0.001	0.6
Thallium (Tl)	0.000025	0.000025	0.00025	RPD-N/A
Tin (Sn)	0.00005	0.00005	0.0005	RPD-N/A
Titanium (Ti)	0.005	0.005	0.05	RPD-N/A
Uranium (U)	0.000005	0.000005	0.00005	RPD-N/A
Vanadium (V)	0.000025	0.000025	0.00025	RPD-N/A
Zinc (Zn)	0.014	0.0146	0.015	RPD-N/A

Notes:

a) Relative percent difference (RPD).

b) RPD-N/A -Not applicable when the values are less than five times the detection limit.

Appendix 3.3-3

Lake Water Quality Analytical Results of Blanks, Back River Project, 2013

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Appendix 3.3-3. Lake Water Quality Analytical Results of Blanks, Back River Project, 2013

Lake Site Name			Realized	Equipment Blank	Equipment Blank	Field Blank	Field Blank	Travel Blank	Travel Blank
Site Code			Detection	EBLANKGEO	EBLANKGOO	FBLANKLGEO	FBLANKLGEO	TBLANKLGEO	TBLANKLGOO
Replicate			Limit	QA/QC	QA/QC	QA/QC	QA/QC	QA/QC	QA/QC
Date Sampled		CCME Guidelines for the Protection of	(RDL)	8-Jul-13	8-Apr-13	12-Apr-13	10-Jul-13	10-Jul-13	9-Apr-13
ALS Sample ID #	Units	Freshwater Aquatic Life[a]	(for freshwater baseline samples)^	L1331765-12	L1289265-1	L1289789-1	L1331765-13	L1331765-14	L1289265-6
Physical Tests									
Conductivity	µS/cm		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Hardness (as $CaCO_3$)	mg/L		0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
pH	pH	6.5-9.0	0.10	5.90	6.26	5.41	5.88	6.03	6.06
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Suspended Solids	mg/L	dependent on background levels	3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Total Dissolved Solids	mg/L		10	<10	<10	<10	<10	<10	<10
Turbidity	NTU	dependent on background levels	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Nutrients									
Ammonia, Total (as N)	mg/L	pH- and temperature-dependent	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrate (as N)	mg/L	short-term: 124; long-term: 3	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrite (as N)	mg/L	0.06	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L		0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Ortho-phosphate (as P)	mg/L		0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus (P)	mg/L	Trigger ranges from guidance framework[c]	0.002	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Anions									
Bromide (Br)	mg/L		0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	mg/L	short-term: 640; long-term: 120	0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride (F)	mg/L	0.12[b]	0.02	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Sulfate (SO_4)	mg/L		0.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Cyanides									
Cyanide, Total	mg/L		0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cyanide, Free	mg/L	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic Carbon									
Total Organic Carbon	mg/L		0.5 - 1.0	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Metals									
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L	0.005	0.000030	<0.000030	<0.000030	<0.000030	<0.000030	<0.000030	<0.000030
Barium (Ba)	mg/L		0.000050	0.005290	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.005	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Cadmium (Cd)	mg/L	equation[d]	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010

Appendix 3.3-3. Lake Water Quality Analytical Results of Blanks, Back River Project, 2013

Lake Site Name			Realized	Equipment Blank	Equipment Blank	Field Blank	Field Blank	Travel Blank	Travel Blank
Site Code			Detection	EBLANKGEO	EBLANKGOO	FBLANKLGEO	FBLANKLGEO	TBLANKLGEO	TBLANKLGOO
Replicate			Limit	QA/QC	QA/QC	QA/QC	QA/QC	QA/QC	QA/QC
Date Sampled		CCME Guidelines for the Protection of	(RDL)	8-Jul-13	8-Apr-13	12-Apr-13	10-Jul-13	10-Jul-13	9-Apr-13
ALS Sample ID #	Units	Freshwater Aquatic Life[a]	(for freshwater baseline samples)^	L1331765-12	L1289265-1	L1289789-1	L1331765-13	L1331765-14	L1289265-6
Total Metals *(cont'd)*									
Cobalt (Co)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)	mg/L	0.002-0.004[e]	0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Iron (Fe)	mg/L	0.3	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Lead (Pb)	mg/L	0.001-0.007[f]	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Manganese (Mn)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	0.025-0.15[g]	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Selenium (Se)	mg/L	0.001	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Silver (Ag)	mg/L	0.0001	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Strontium (Sr)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Thallium (Tl)	mg/L	0.0008	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	0.00020	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L		0.00005 - 0.001	<0.0010	<0.000050	<0.000050	<0.0010	<0.0010	<0.000050
Zinc (Zn)	mg/L	0.03	0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals									
Aluminum (Al)	mg/L		0.0030	<0.0030	<0.0030	<0.0030	-	-	-
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	-	-	-
Arsenic (As)	mg/L		0.000030	<0.000030	<0.000030	<0.000030	-	-	-
Barium (Ba)	mg/L		0.000050	0.000710	<0.000050	<0.000050	-	-	-
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	-	-	-
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	-	-	-
Boron (B)	mg/L		0.005	<0.0050	<0.0050	<0.0050	-	-	-
Cadmium (Cd)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	-	-	-
Calcium (Ca)	mg/L		0.020	<0.020	<0.020	<0.020	-	-	-
Chromium (Cr)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	-	-	-
Cobalt (Co)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	-	-	-
Copper (Cu)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	-	-	-
Iron (Fe)	mg/L		0.010	<0.010	<0.010	<0.010	-	-	-
Lead (Pb)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	-	-	-

Appendix 3.3-3. Lake Water Quality Analytical Results of Blanks, Back River Project, 2013

Lake Site Name			Realized	Equipment Blank	Equipment Blank	Field Blank	Field Blank	Travel Blank	Travel Blank
Site Code			Detection	EBLANKGEO	EBLANKGOO	FBLANKLGEO	FBLANKLGEO	TBLANKLGEO	TBLANKLGOO
Replicate			Limit	QA/QC	QA/QC	QA/QC	QA/QC	QA/QC	QA/QC
Date Sampled		CCME Guidelines	(RDL)	8-Jul-13	8-Apr-13	12-Apr-13	10-Jul-13	10-Jul-13	9-Apr-13
ALS Sample ID #	Units	for the Protection of Freshwater Aquatic Life[a]	(for freshwater baseline samples)^	L1331765-12	L1289265-1	L1289789-1	L1331765-13	L1331765-14	L1289265-6
Dissolved Metals *(cont'd)*									
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	-	-	-
Magnesium (Mg)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	-	-	-
Manganese (Mn)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	-	-	-
Mercury (Hg)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	-	-	-
Molybdenum (Mo)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	-	-	-
Nickel (Ni)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	-	-	-
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	-	-	-
Potassium (K)	mg/L		0.050	<0.050	<0.050	<0.050	-	-	-
Selenium (Se)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	-	-	-
Silicon (Si)	mg/L		0.050	<0.050	<0.050	<0.050	-	-	-
Silver (Ag)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	-	-	-
Sodium (Na)	mg/L		0.010	<0.010	<0.010	<0.010	-	-	-
Strontium (Sr)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	-	-	-
Thallium (Tl)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	-	-	-
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	-	-	-
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	-	-	-
Uranium (U)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	-	-	-
Vanadium (V)	mg/L		0.00005 - 0.001	<0.0010	<0.000050	<0.000050	-	-	-
Zinc (Zn)	mg/L		0.0030	<0.0030	<0.0030	<0.0030	-	-	-

Notes:

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment (accessed February 2014).

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultra-oligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Meso-eutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hyper-eutrophic.

d) Guidelines are hardness-dependent. Cadmium short-term guideline (mg/L) = $10^{\{1.016[\log(\text{hardness})]-1.71\}}$ / 1000 with a minimum of 0.00011 mg/L. Cadmium long-term guideline (mg/L) = $10^{\{0.83[\log(\text{hardness})]-2.46\}}$ / 1000 with a miniumum of 0.00004 mg/L.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness. At hardness >180 mg/L the copper guideline is 0.004 mg/L.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness. At hardness >180 mg/L the lead guideline is 0.007 mg/L.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness. At hardness >180 mg/L the nickel guideline is 0.15 mg/L.

h) RDL = Realized detection limit

Appendix 3.3-4

pH in Lakes, Back River Project, 2010 to 2013

Rescan™
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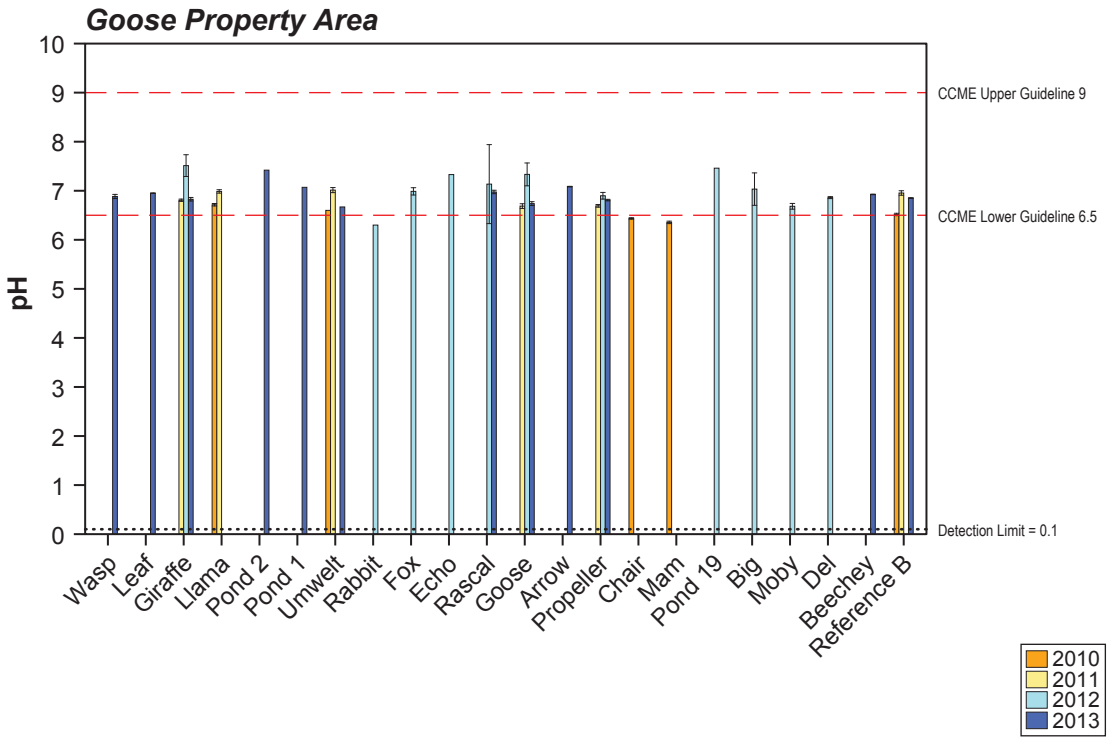
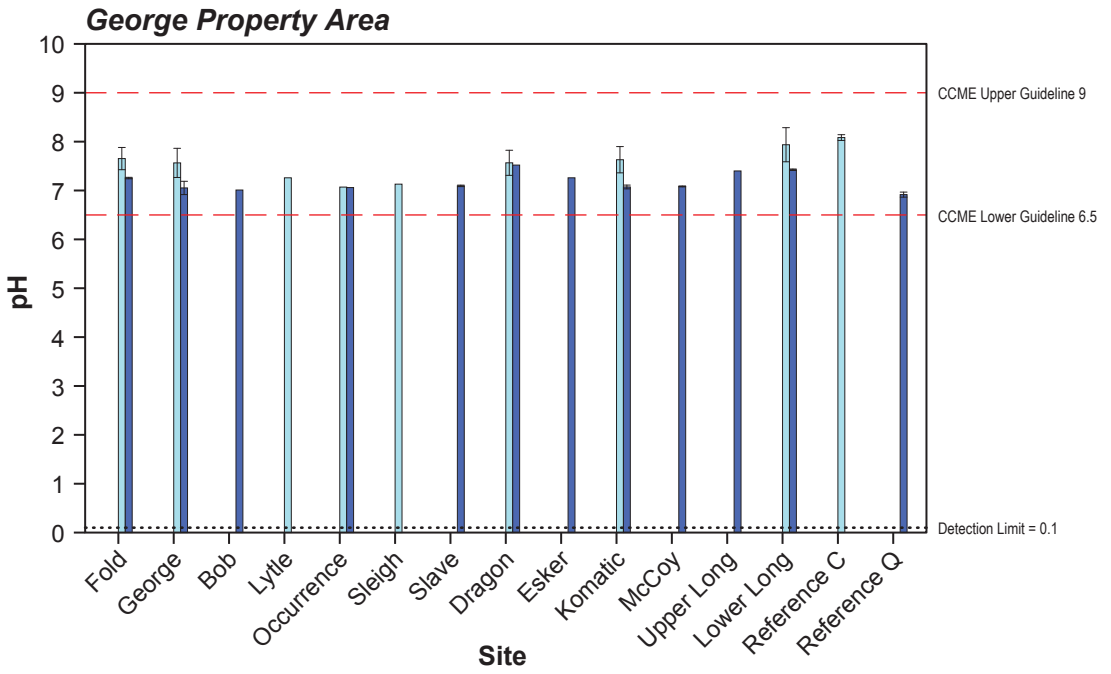




Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

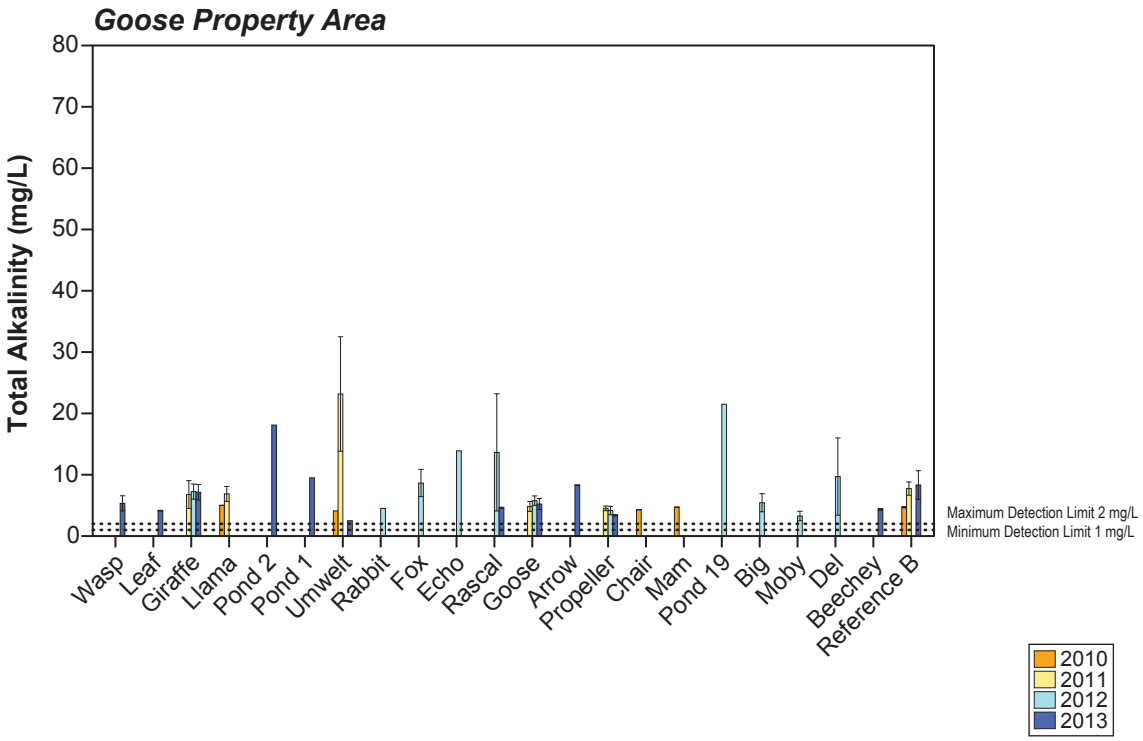
Appendix 3.3-4

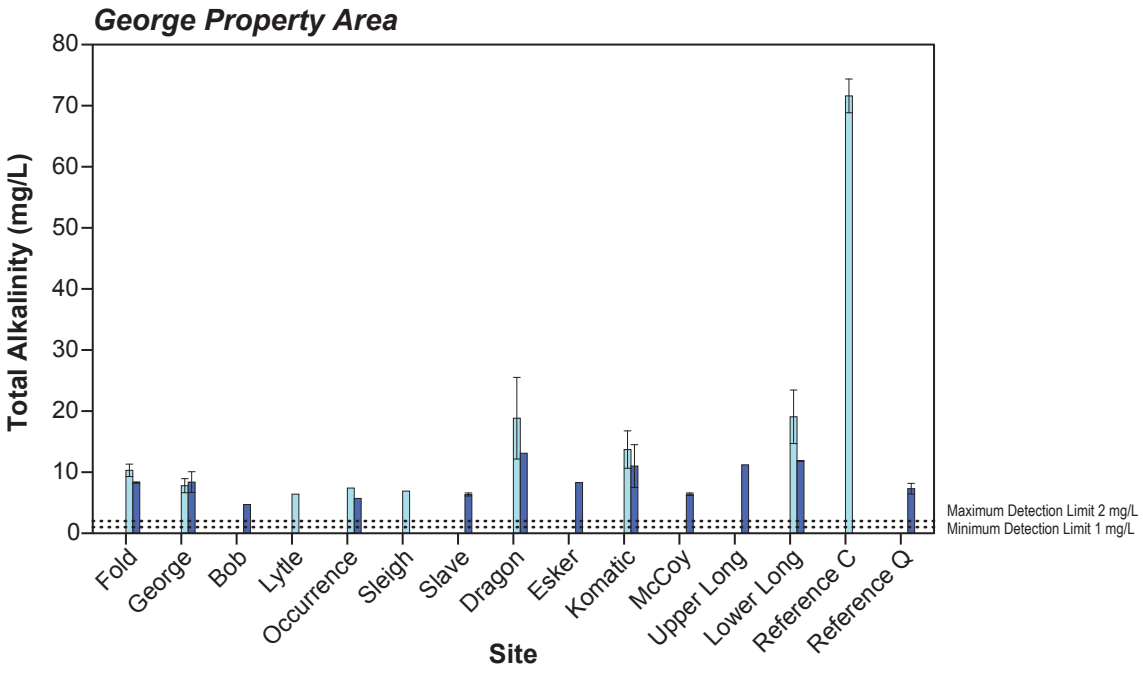
pH in Lakes,
Back River Project, 2010 to 2013

Appendix 3.3-5

Total Alkalinity in Lakes, Back River Project Area, 2010 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Appendix 3.3-5

Sabina GOLD & SILVER CORP.

Total Alkalinity in Lakes, Back River Project, 2010 to 2013

Rescan an ERM company

Appendix 3.3-6

Hardness in Lakes, Back River Project Area, 2010 to 2013

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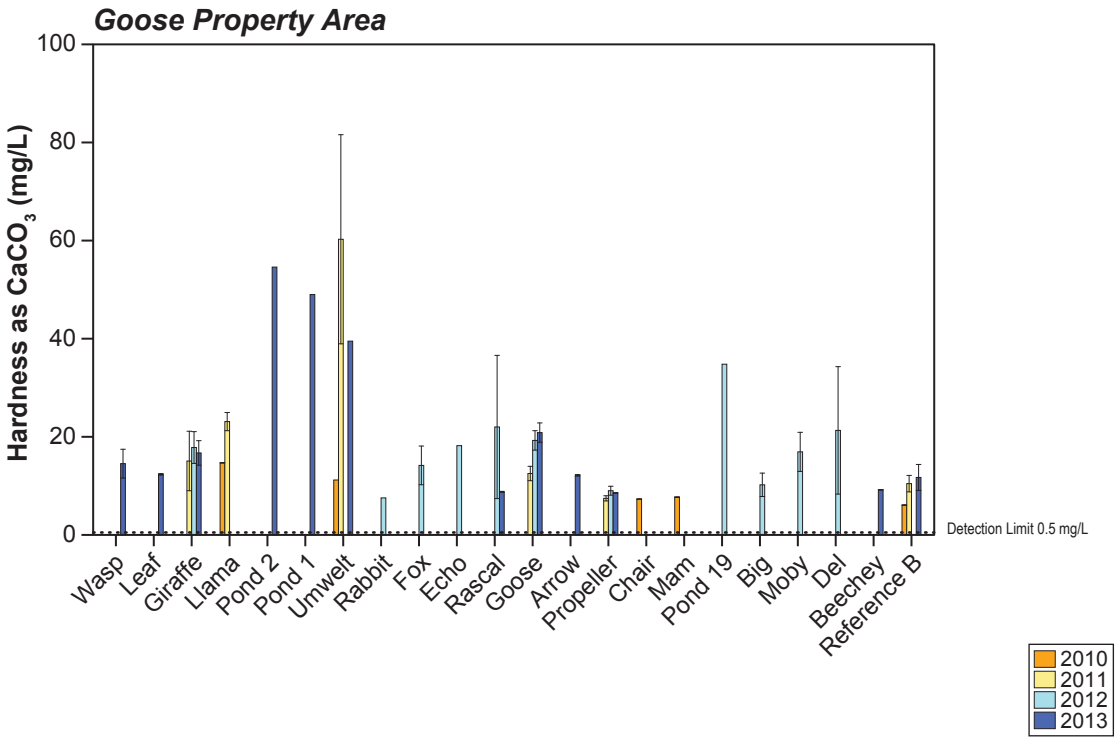
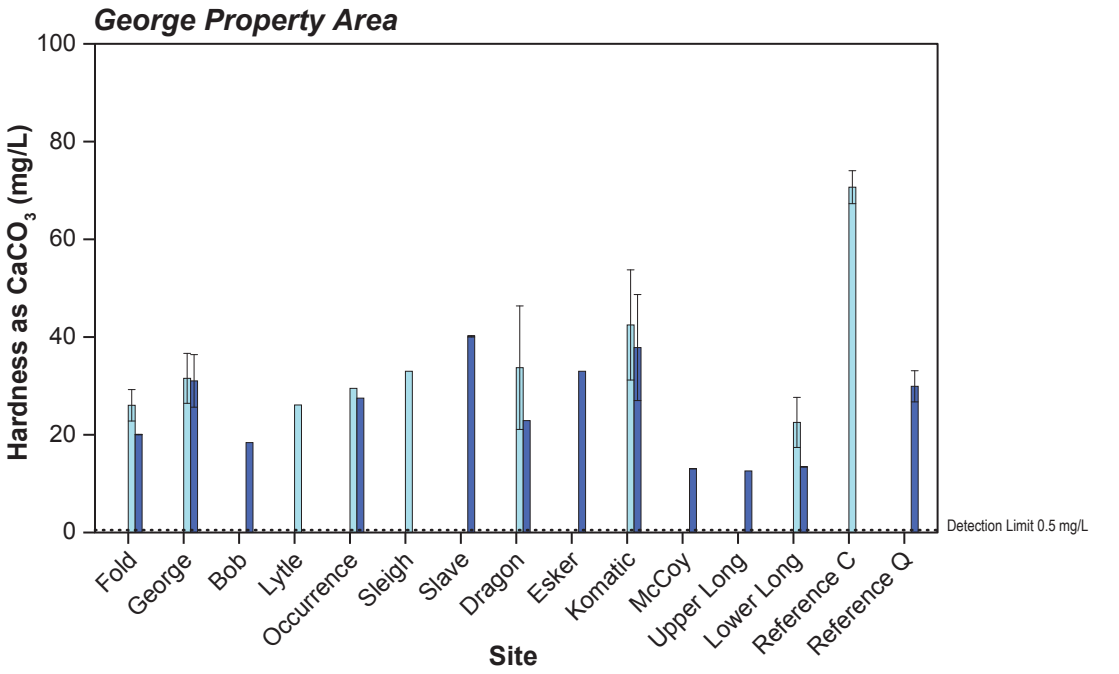
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Appendix 3.3-6

Sabina GOLD & SILVER CORP.

Hardness in Lakes, Back River Project, 2010 to 2013

Rescan an ERM company

Appendix 3.3-7

Conductivity in Lakes, Back River Project Area, 2010 to 2013

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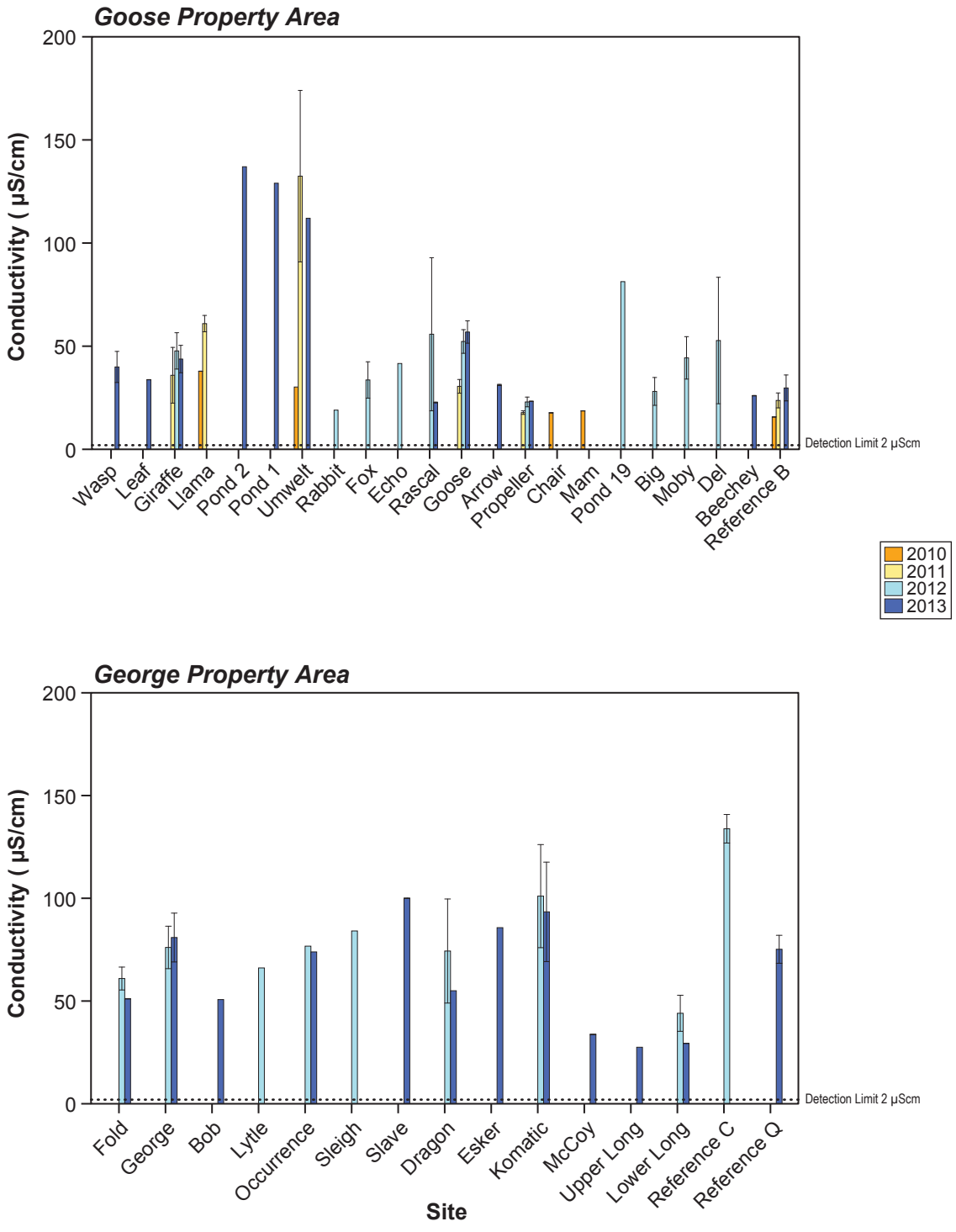
an ERM company



Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Appendix 3.3-7

Sabina GOLD & SILVER CORP.

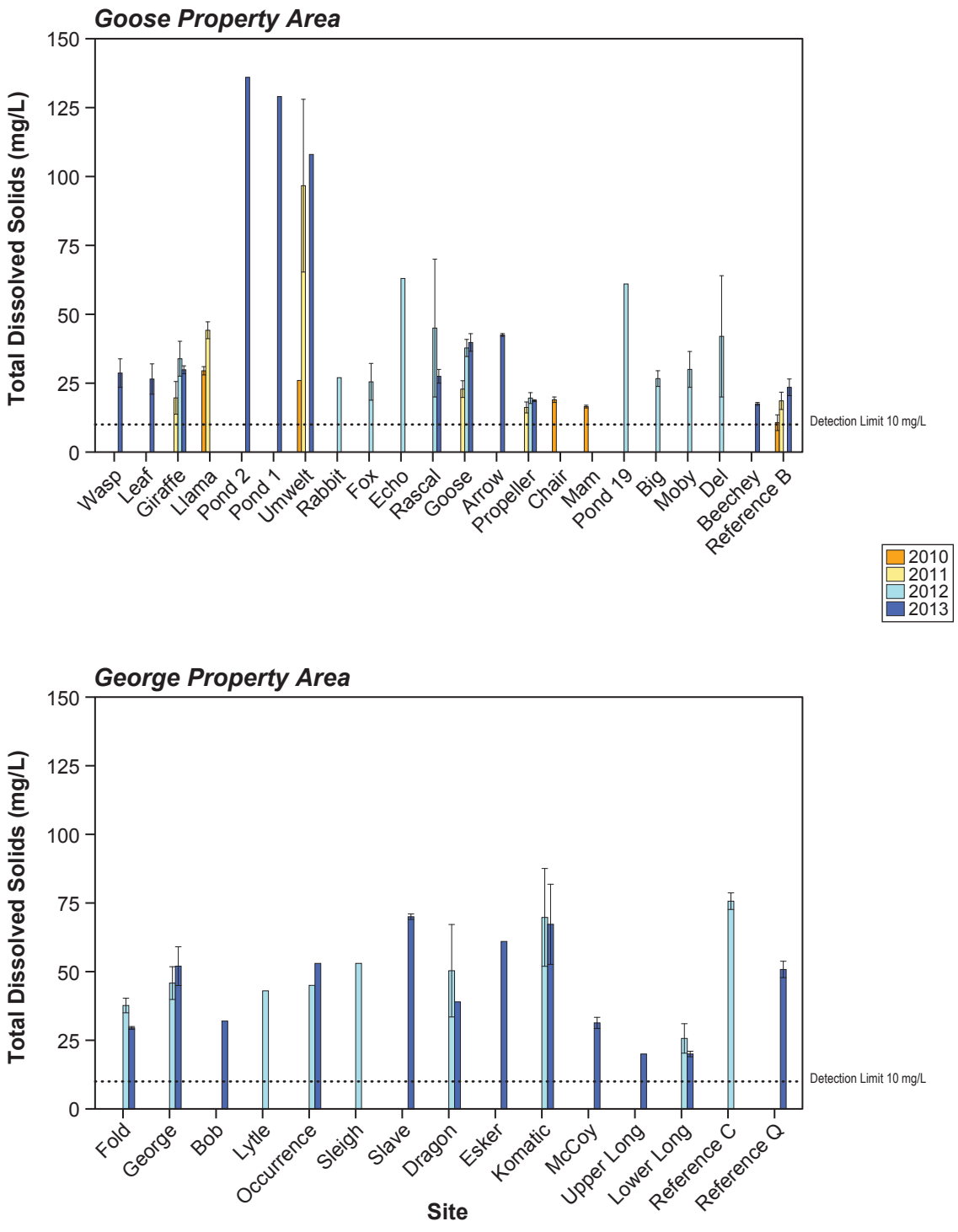
Conductivity in Lakes, Back River Project, 2010 to 2013

Rescan an ERM company

Appendix 3.3-8

Total Dissolved Solids in Lakes, Back River Project Area, 2010 to 2013

Rescan™
an ERM company



Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Appendix 3.3-8

Sabina GOLD & SILVER CORP.

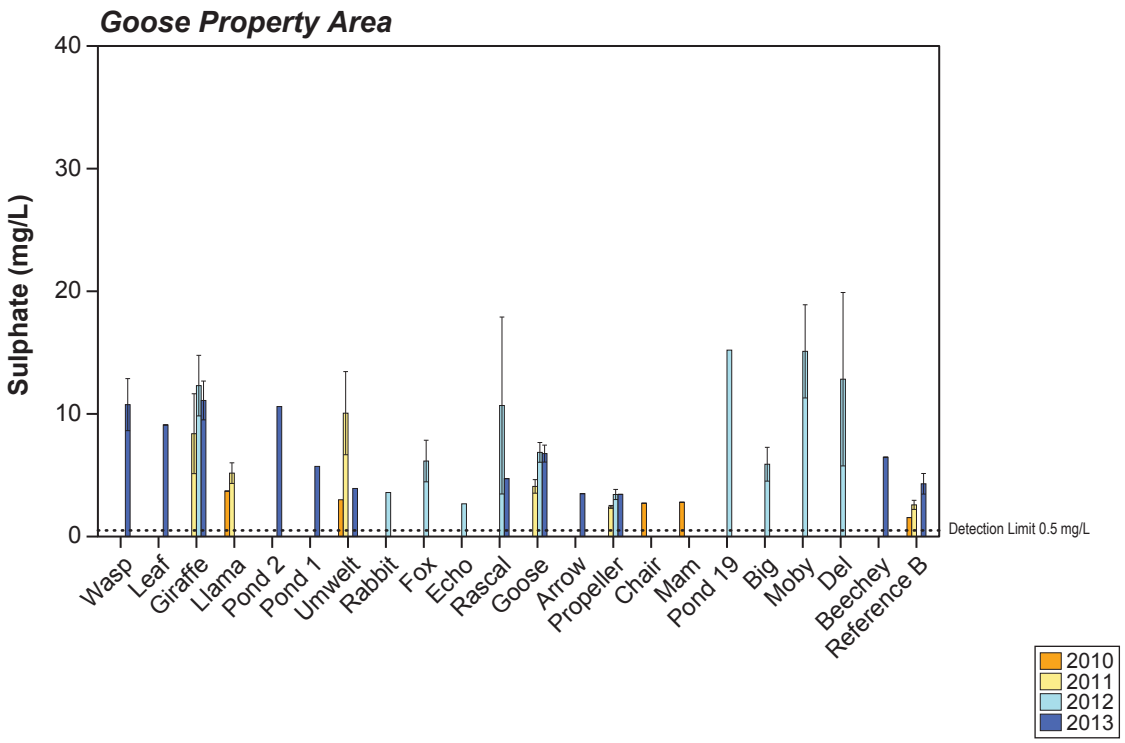
Total Dissolved Solids in Lakes, Back River Project, 2010 to 2013

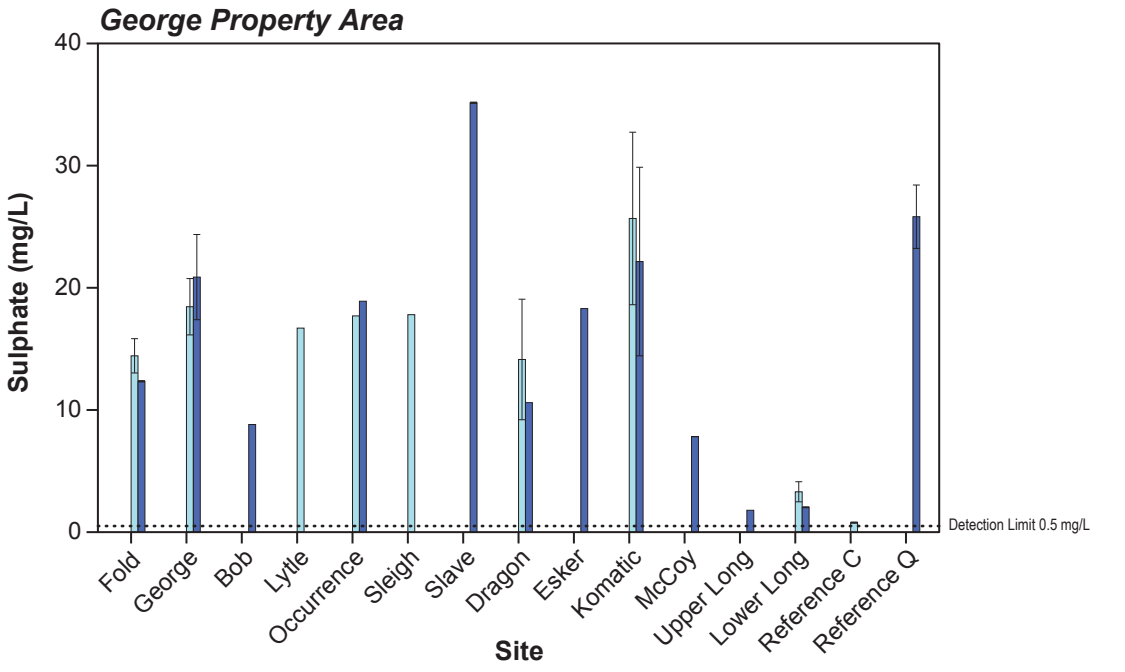
Rescan an ERM company

Appendix 3.3-9

Sulphate in Lakes, Back River Project Area, 2010 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Sabina GOLD & SILVER CORP.

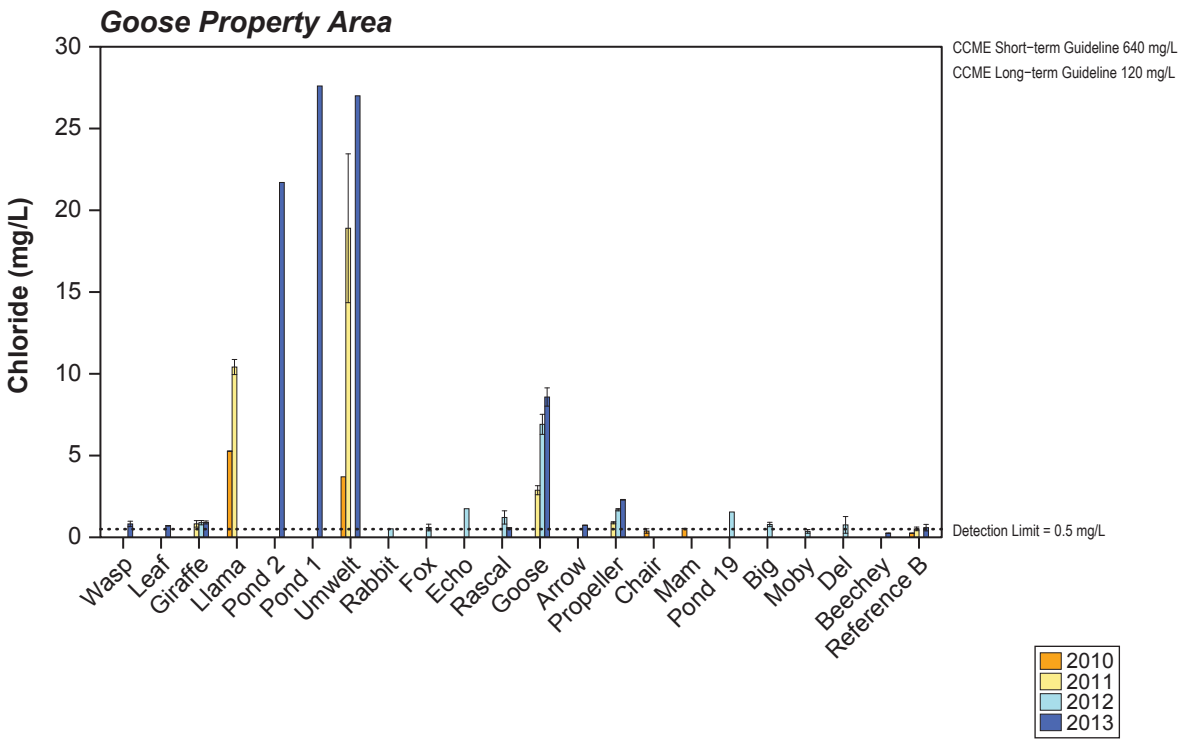
Sulphate in Lakes, Back River Project, 2010 to 2013

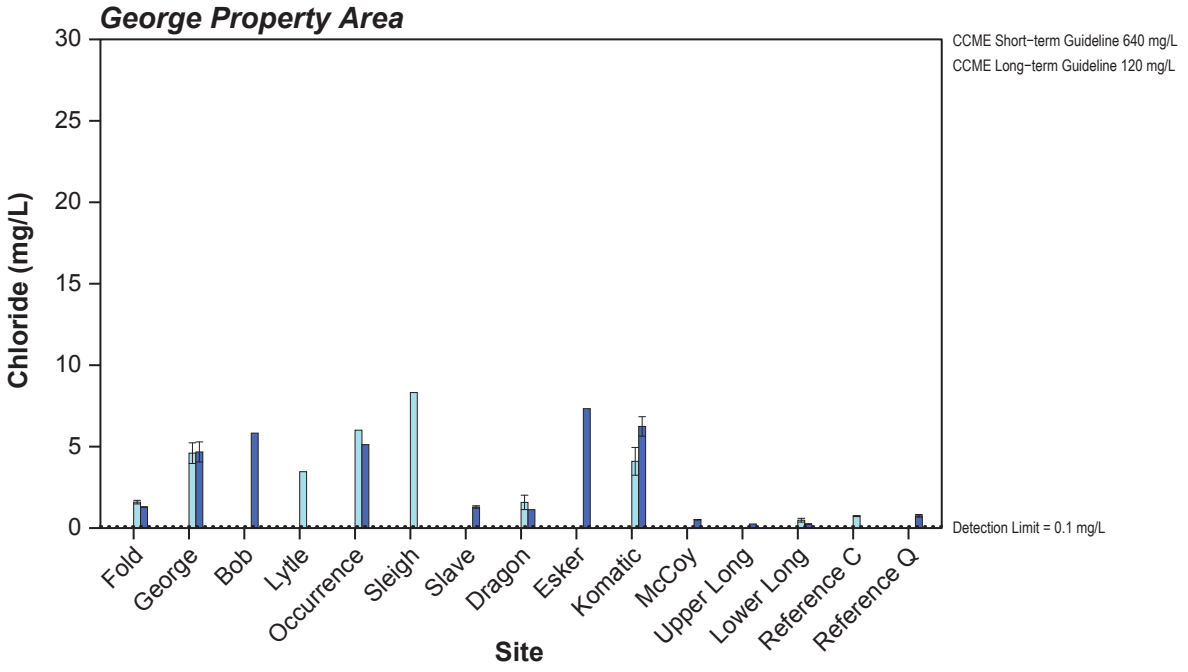
Rescan an ERM company

Appendix 3.3-10

Chloride in Lakes, Back River Project Area, 2010 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Sabina GOLD & SILVER CORP.

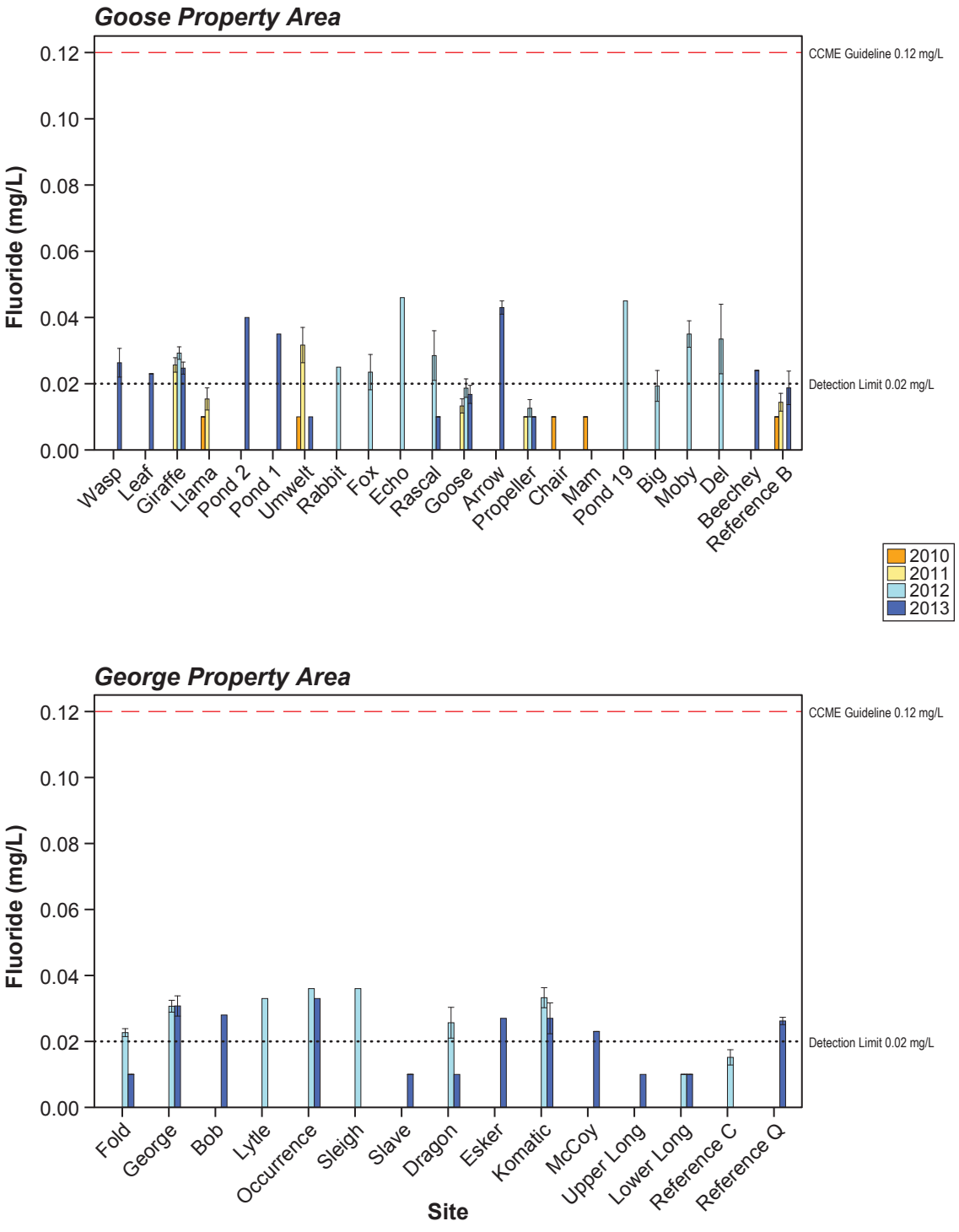
Chloride in Lakes, Back River Project, 2010 to 2013

Rescan an ERM company

Appendix 3.3-11

Fluoride in Lakes, Back River Project Area, 2010 to 2013

Rescan™
an ERM company



Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Sabina GOLD & SILVER CORP.

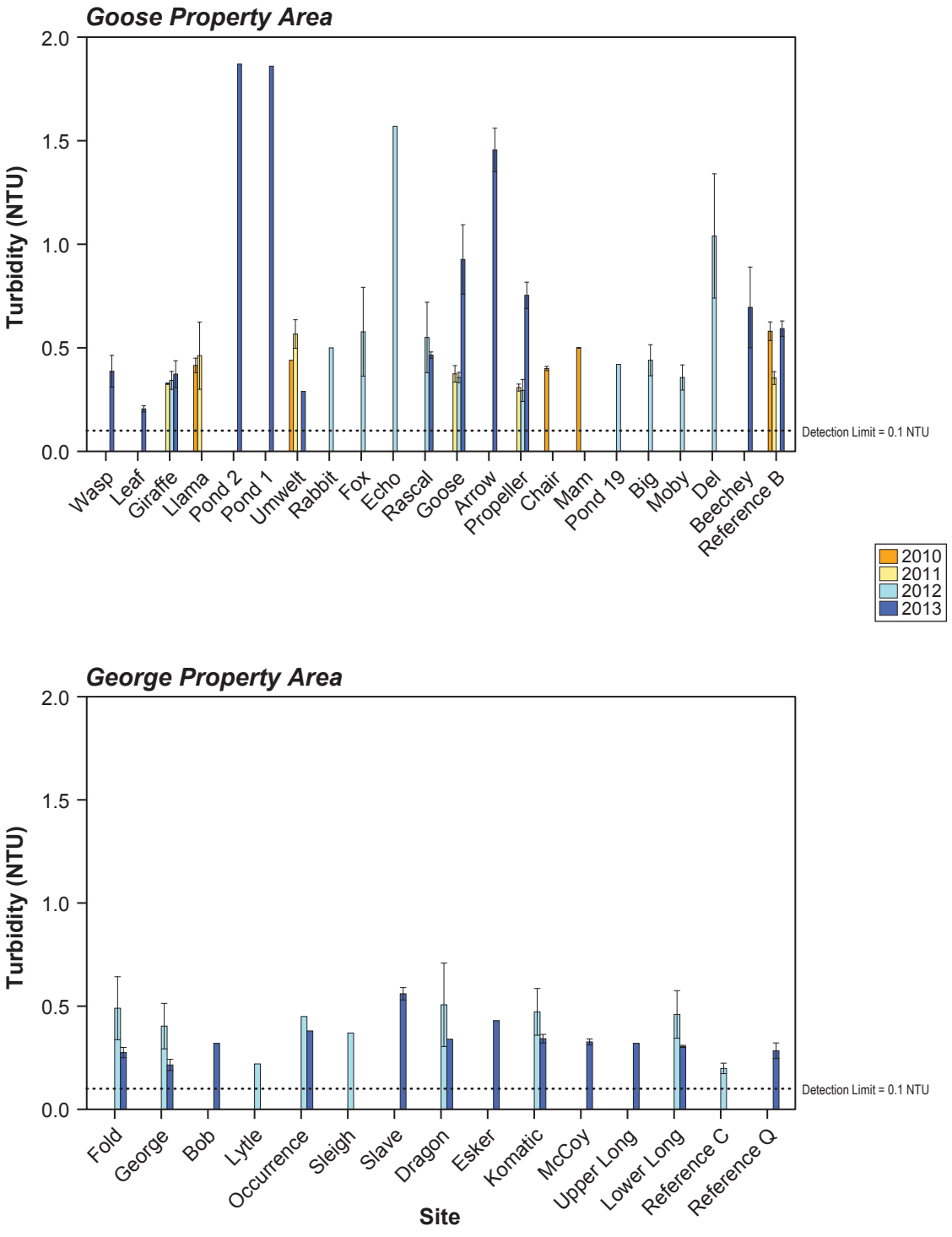
Fluoride in Lakes, Back River Project, 2010 to 2013

Rescan an ERM company

Appendix 3.3-12

Turbidity in Lakes, Back River Project Area, 2010 to 2013

Rescan™
an ERM company



Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME guideline for turbidity is dependent on background levels.

Sabina GOLD & SILVER CORP.

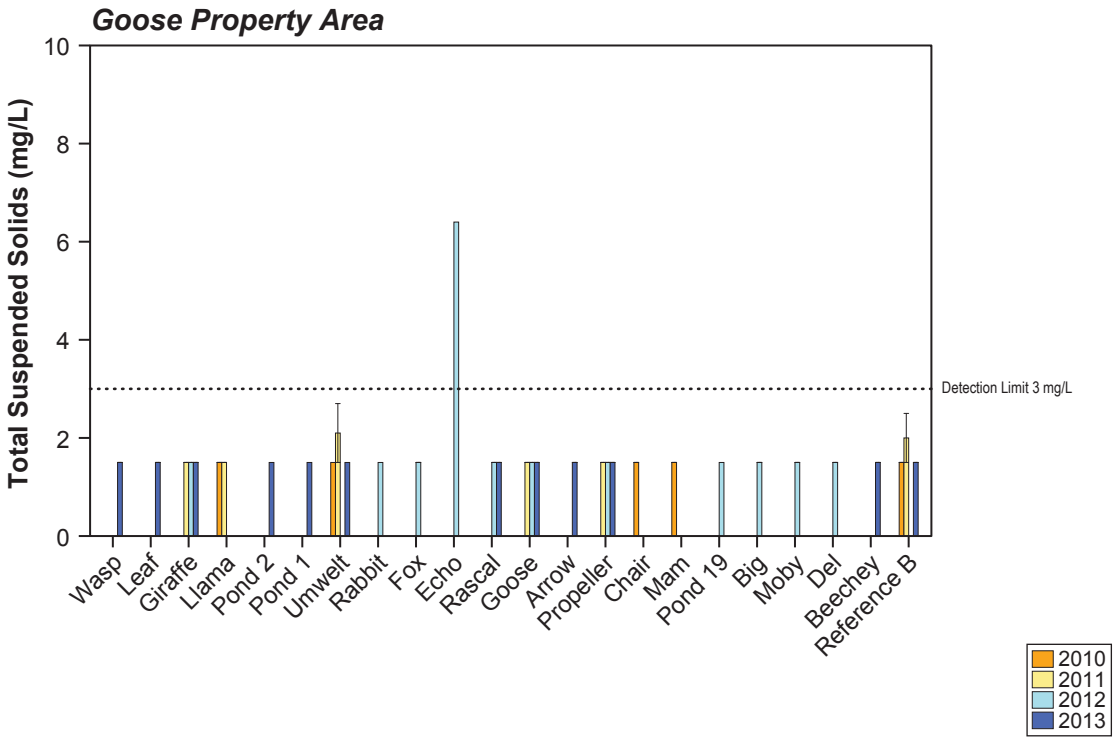
Turbidity in Lakes, Back River Project, 2010 to 2013

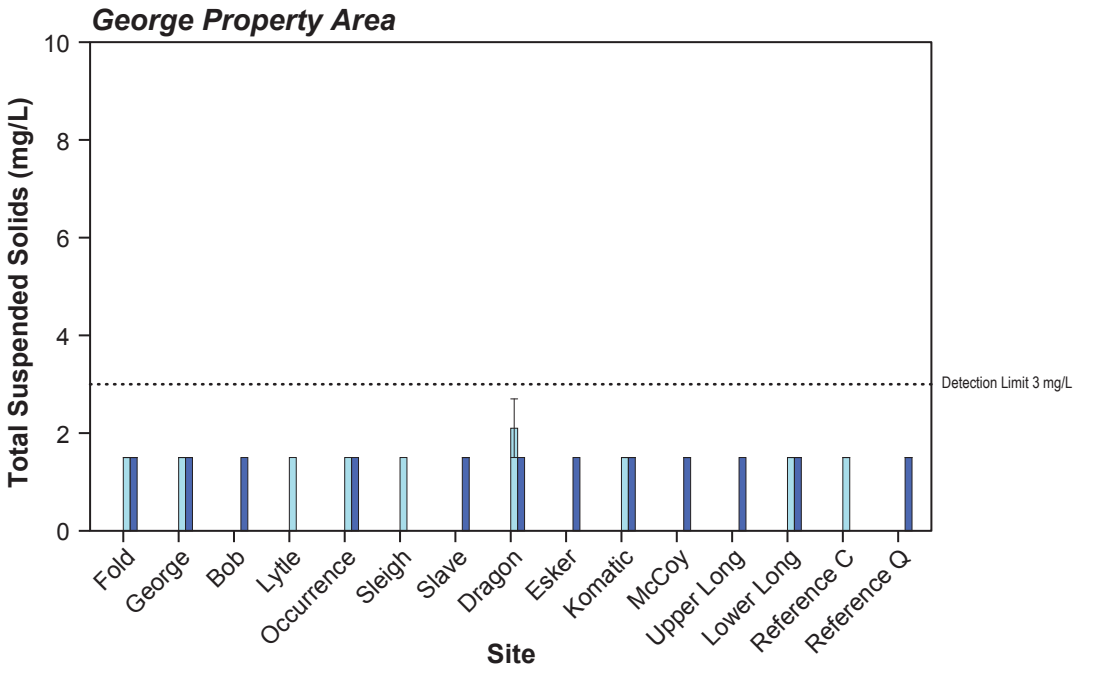
Rescan an ERM company

Appendix 3.3-13

Total Suspended Solids in Lakes, Back River Project Area, 2010 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME guideline for turbidity is dependent on background levels.

Sabina GOLD & SILVER CORP.

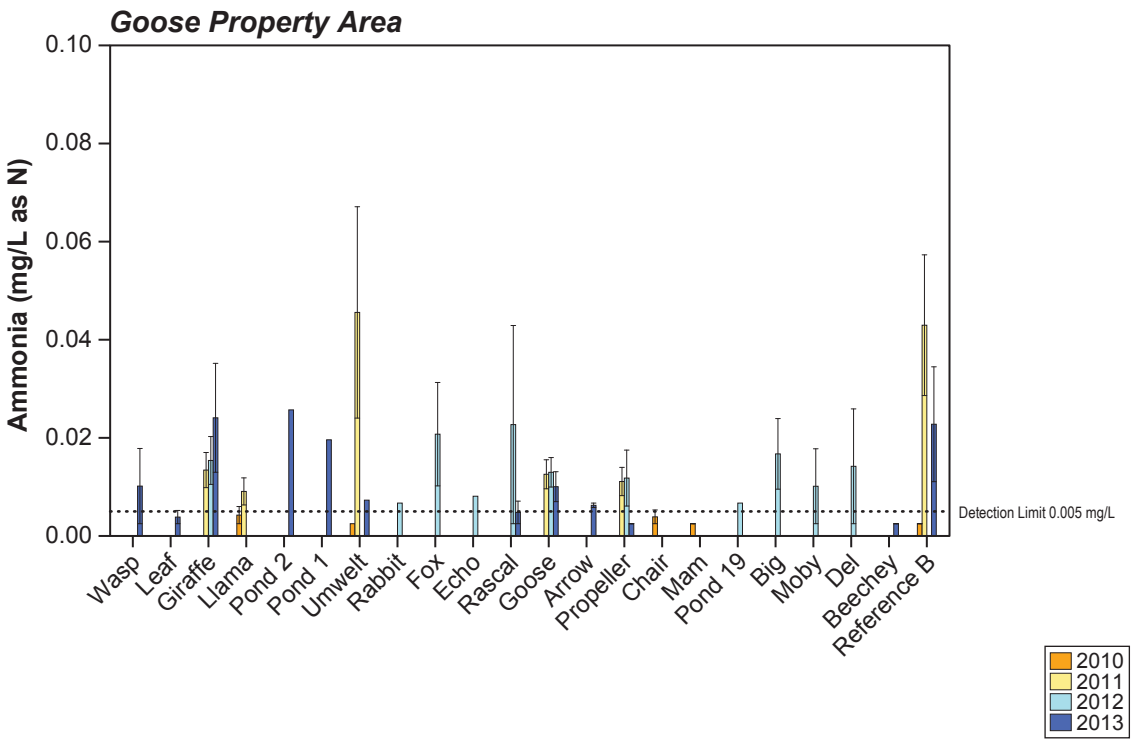
Total Suspended Solids in Lakes, Back River Project, 2010 to 2013

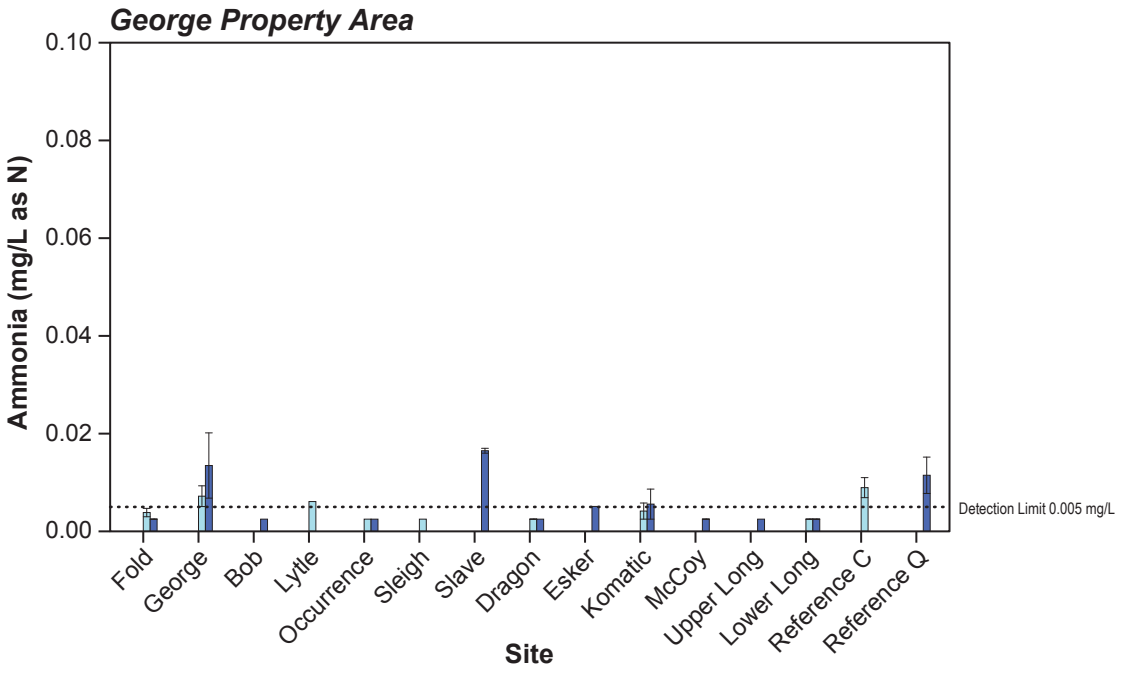
Rescan an ERM company

Appendix 3.3-14

Ammonia in Lakes, Back River Project Area, 2010 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME guideline for ammonia is pH− and temperature−dependent.

Sabina GOLD & SILVER CORP.

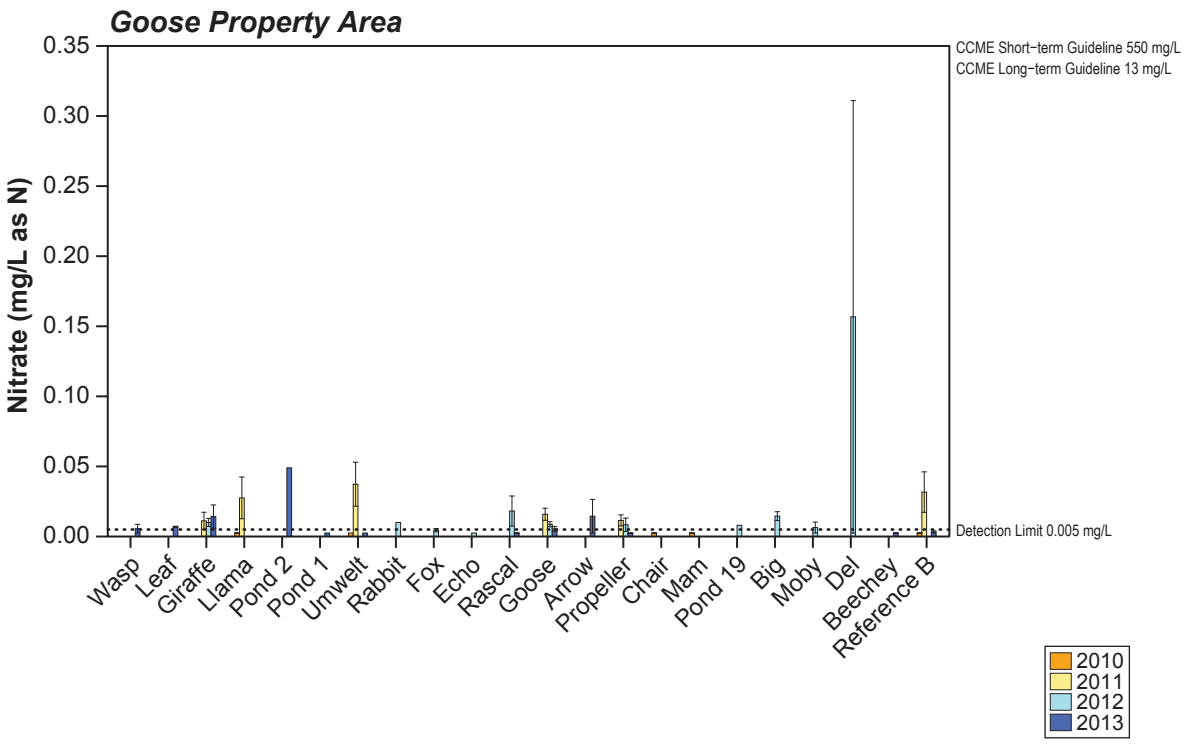
Ammonia in Lakes, Back River Project, 2010 to 2013

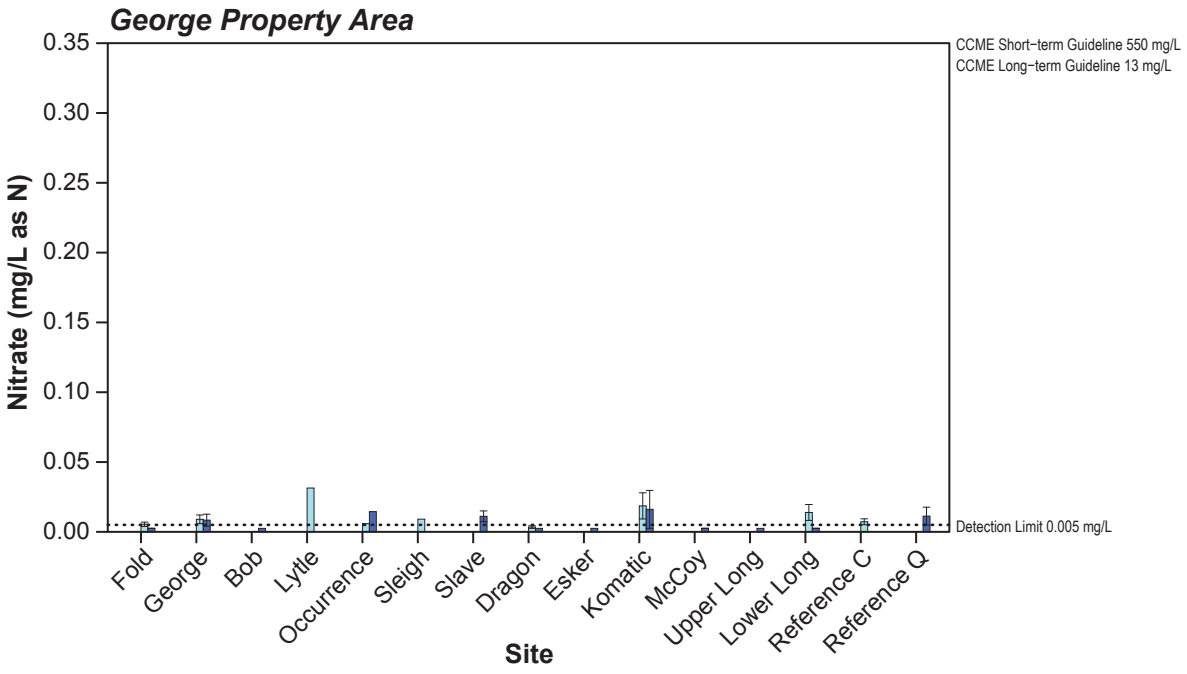
Rescan an ERM company

Appendix 3.3-15

Nitrate in Lakes, Back River Project Area, 2010 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Sabina GOLD & SILVER CORP.

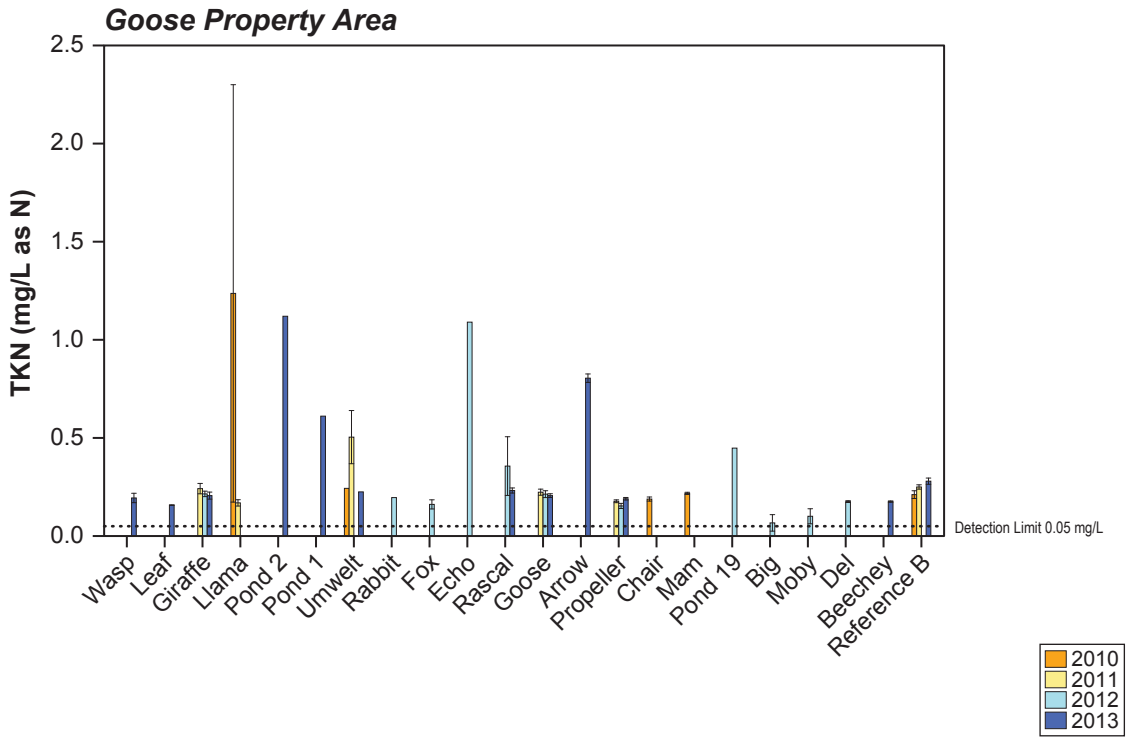
Nitrate in Lakes, Back River Project, 2010 to 2013

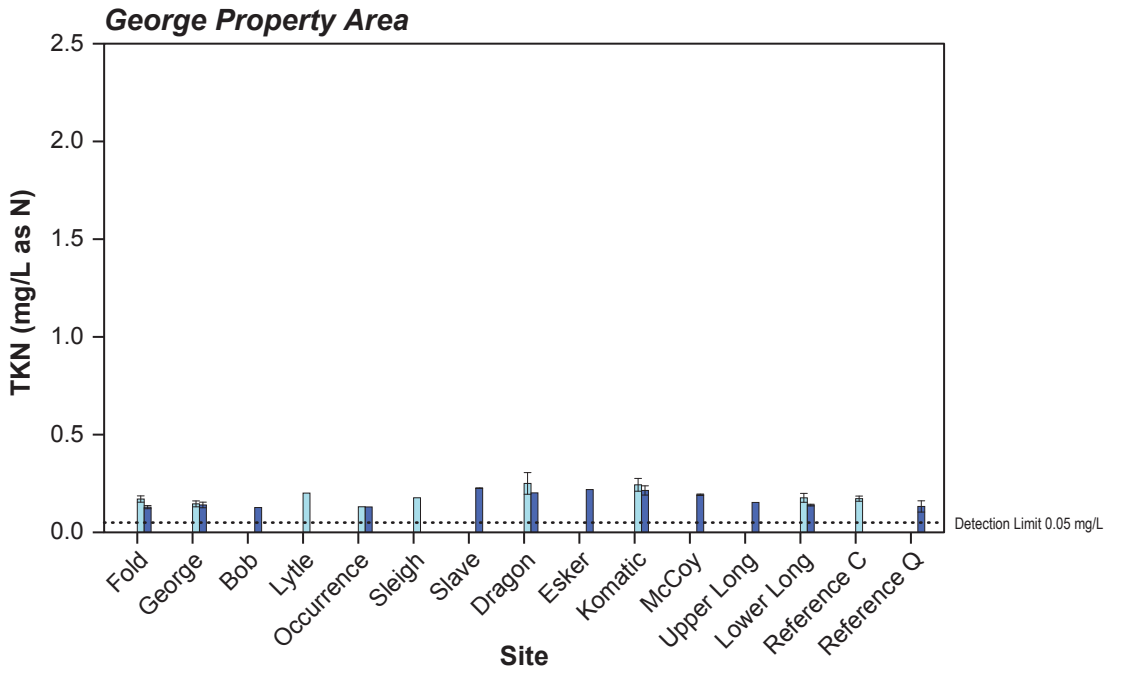
Rescan an ERM company

Appendix 3.3-16

Total Kjeldahl Nitrogen in Lakes, Back River Project Area, 2010 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Sabina GOLD & SILVER CORP.

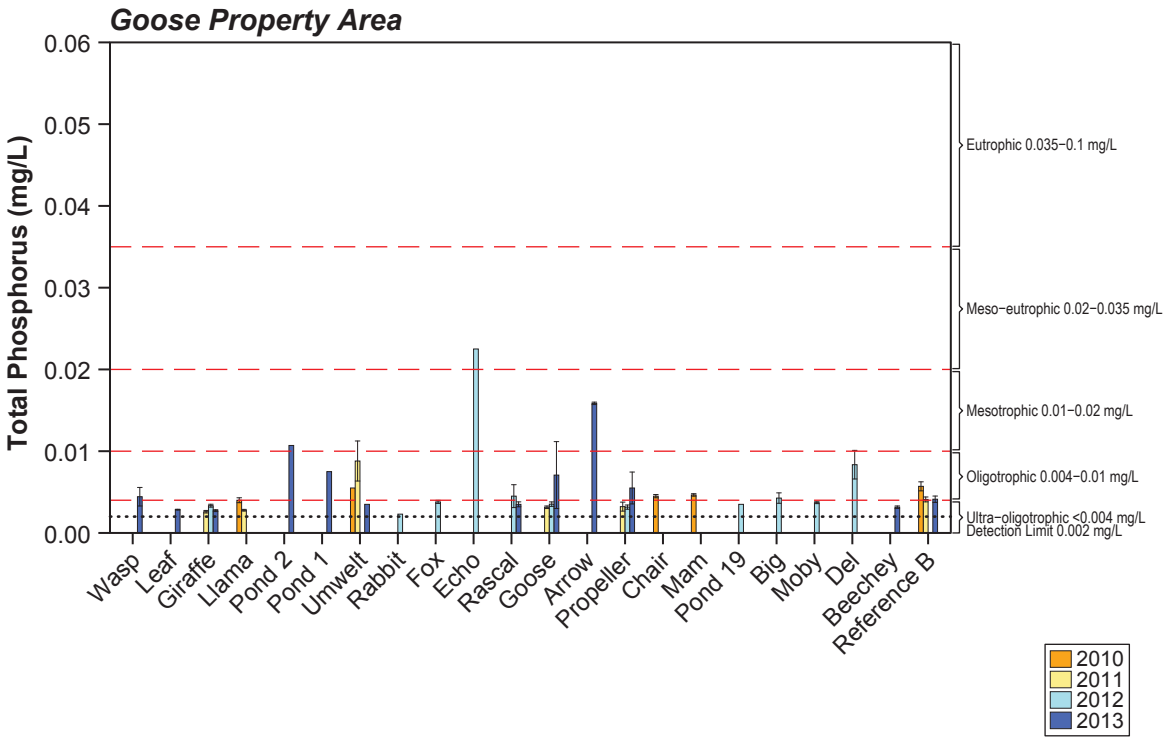
Total Kjeldahl Nitrogen in Lakes, Back River Project, 2010 to 2013

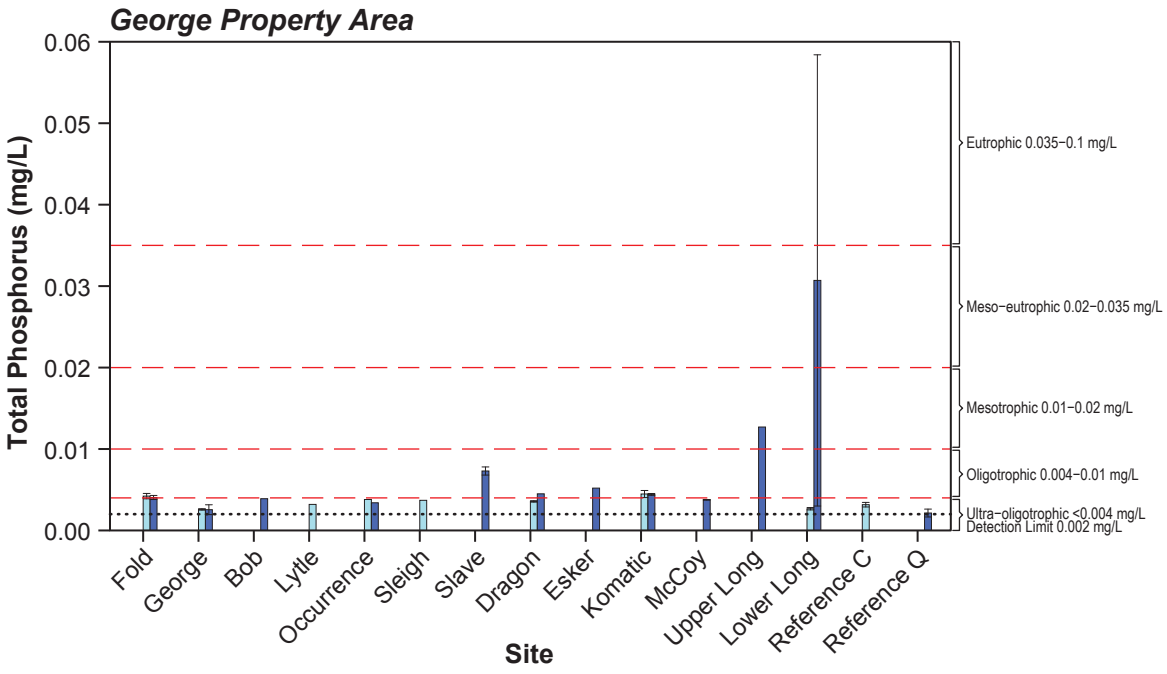
Rescan an ERM company

Appendix 3.3-17

Total Phosphorus in Lakes, Back River Project Area, 2010 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Sabina GOLD & SILVER CORP.

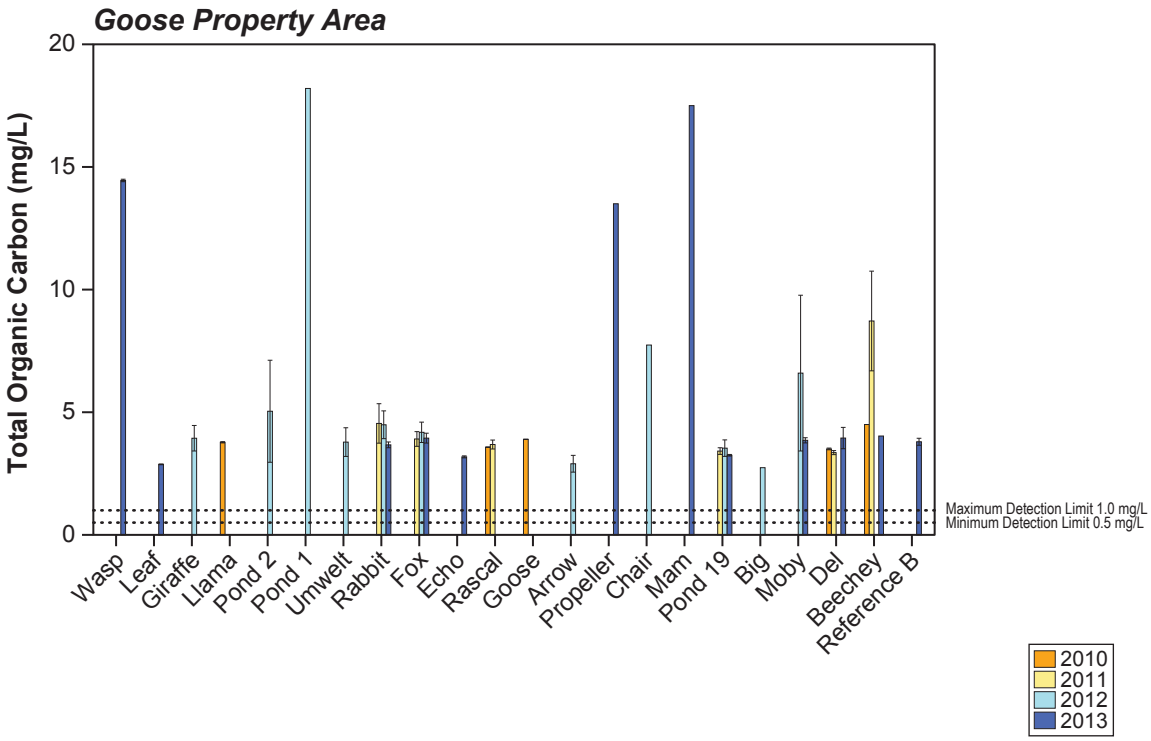
Total Phosphorus in Lakes, Back River Project, 2010 to 2013

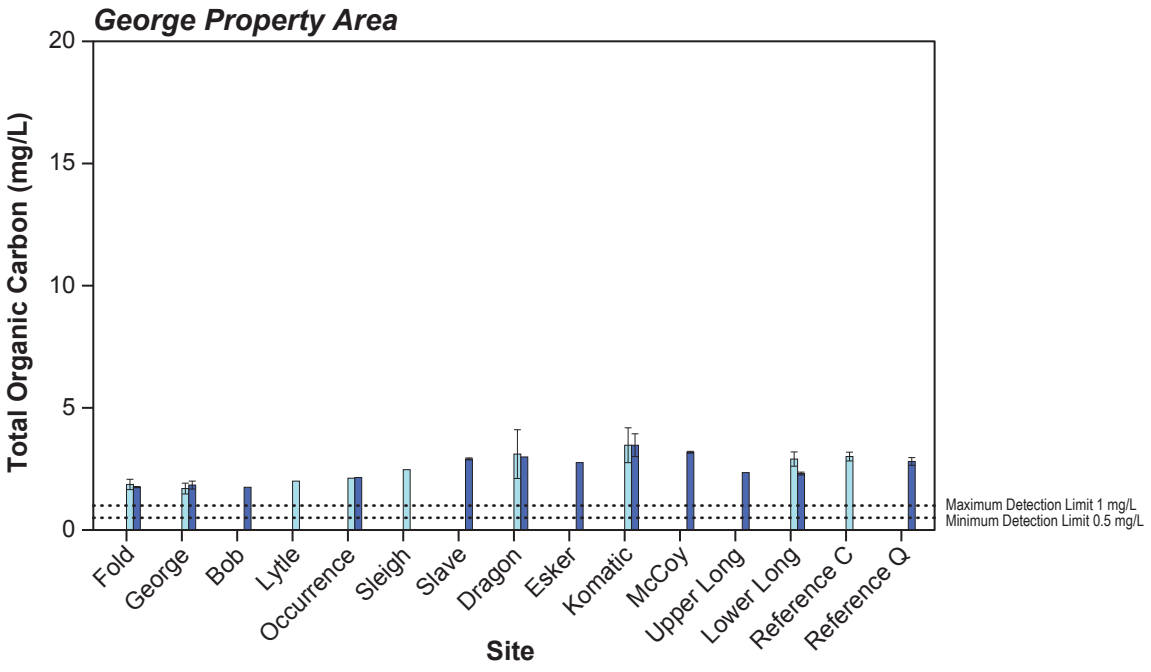
Rescan an ERM company

Appendix 3.3-18

Total Organic Carbon in Lakes, Back River Project Area, 2010 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Sabina GOLD & SILVER CORP.

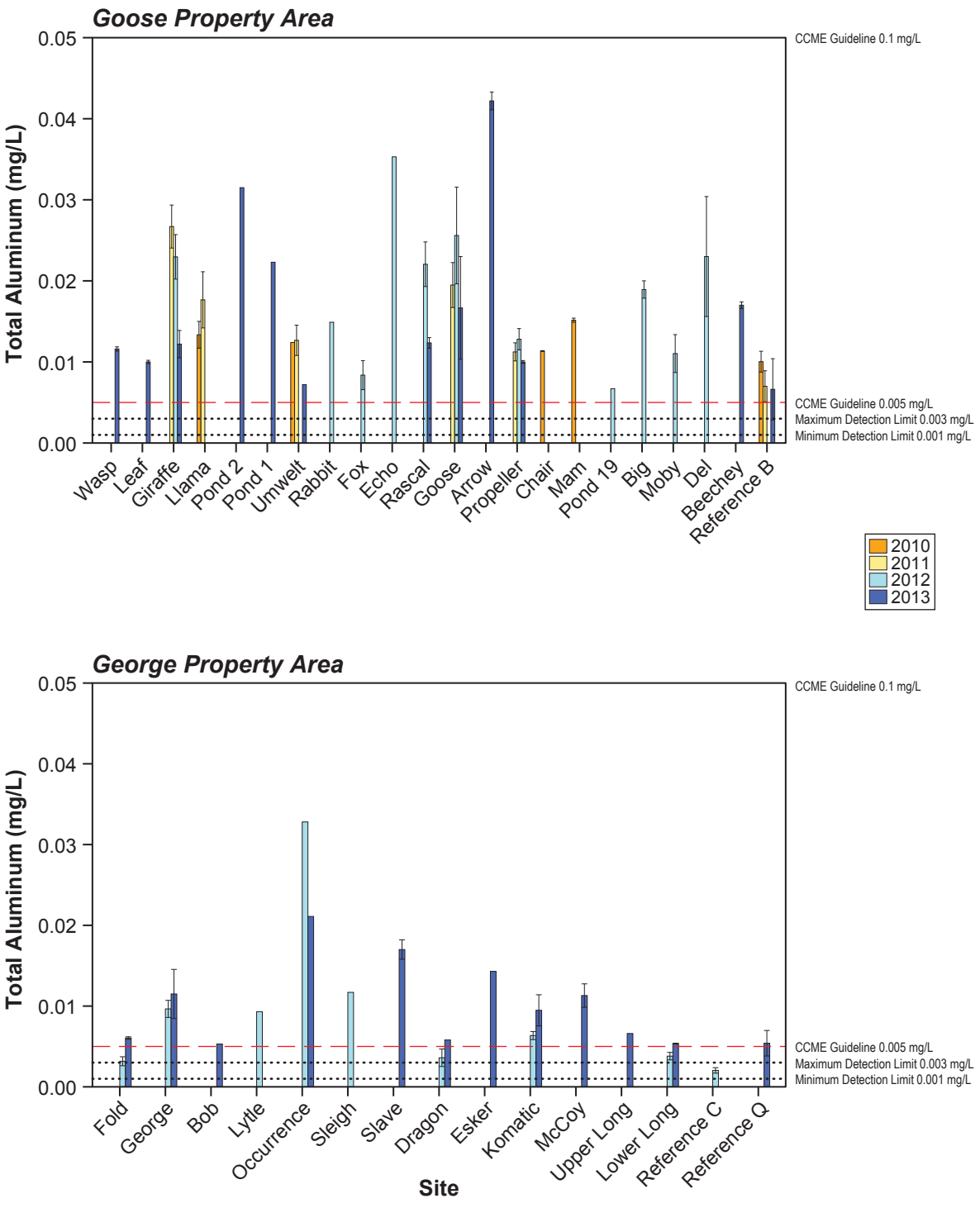
Total Organic Carbon in Lakes, Back River Project, 2010 to 2013

Rescan an ERM company

Appendix 3.3-19

Total Aluminium in Lakes, Back River Project Area, 2010 to 2013

Rescan™
an ERM company



Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME guideline for alumninum is pH−dependent: if pH < 6.5, then guideline = 0.005 mg/L;
if pH ≥ 6.5 then guideline = 0.1 mg/L.

Appendix 3.3-19

Sabina GOLD & SILVER CORP.

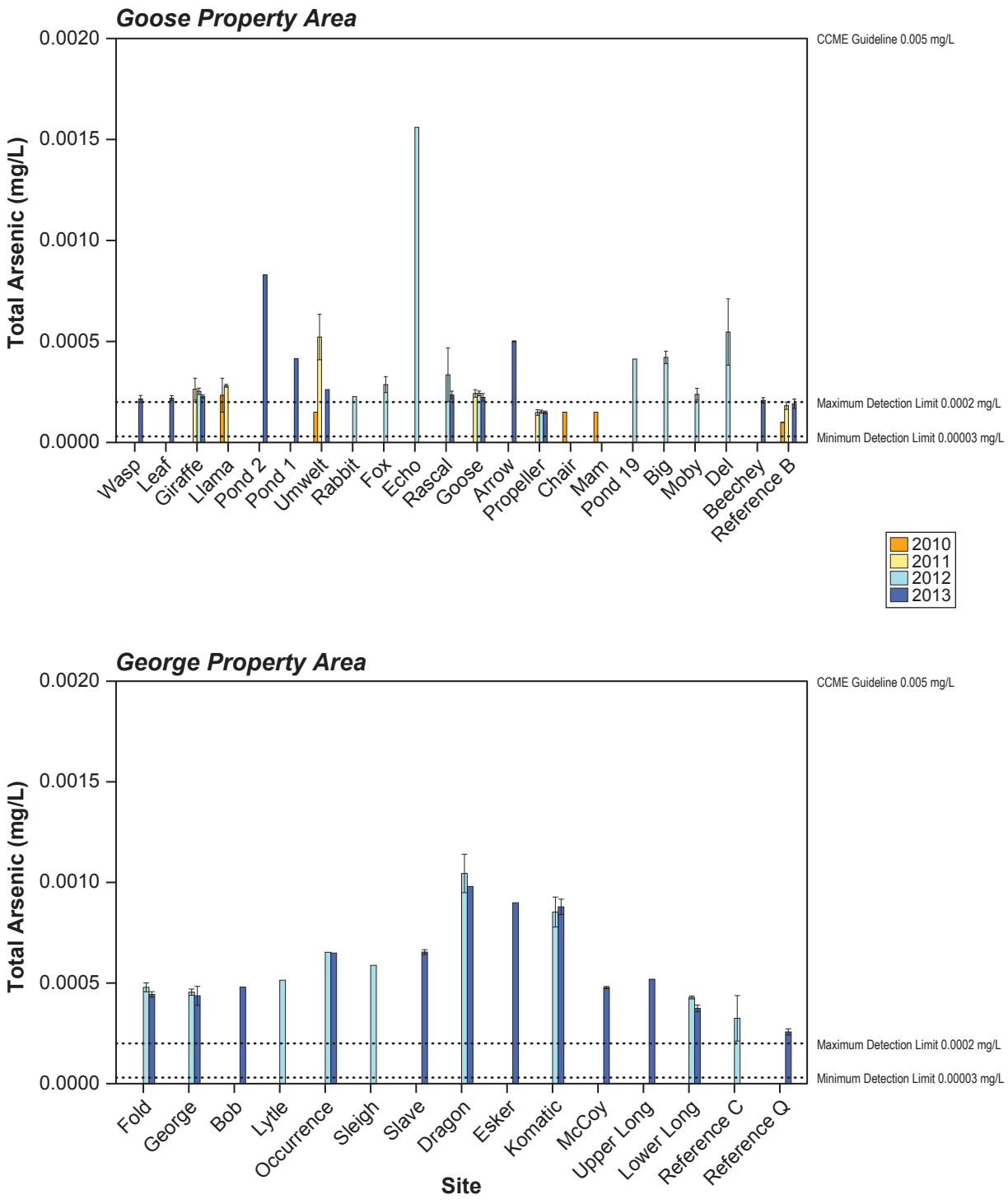
Total Aluminium in Lakes, Back River Project, 2010 to 2013

Rescan an ERM company

Appendix 3.3-20

Total Arsenic in Lakes, Back River Project Area, 2010 to 2013

Rescan™
an ERM company



Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Sabina GOLD & SILVER CORP.

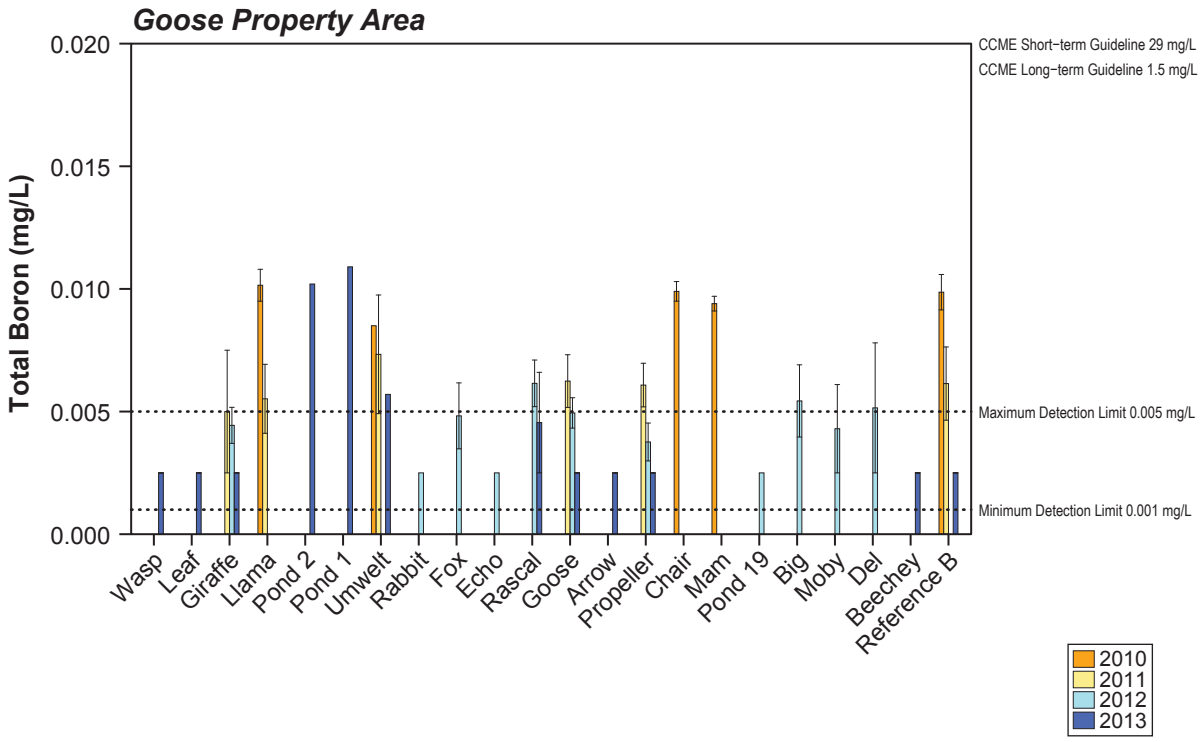
Total Arsenic in Lakes, Back River Project, 2010 to 2013

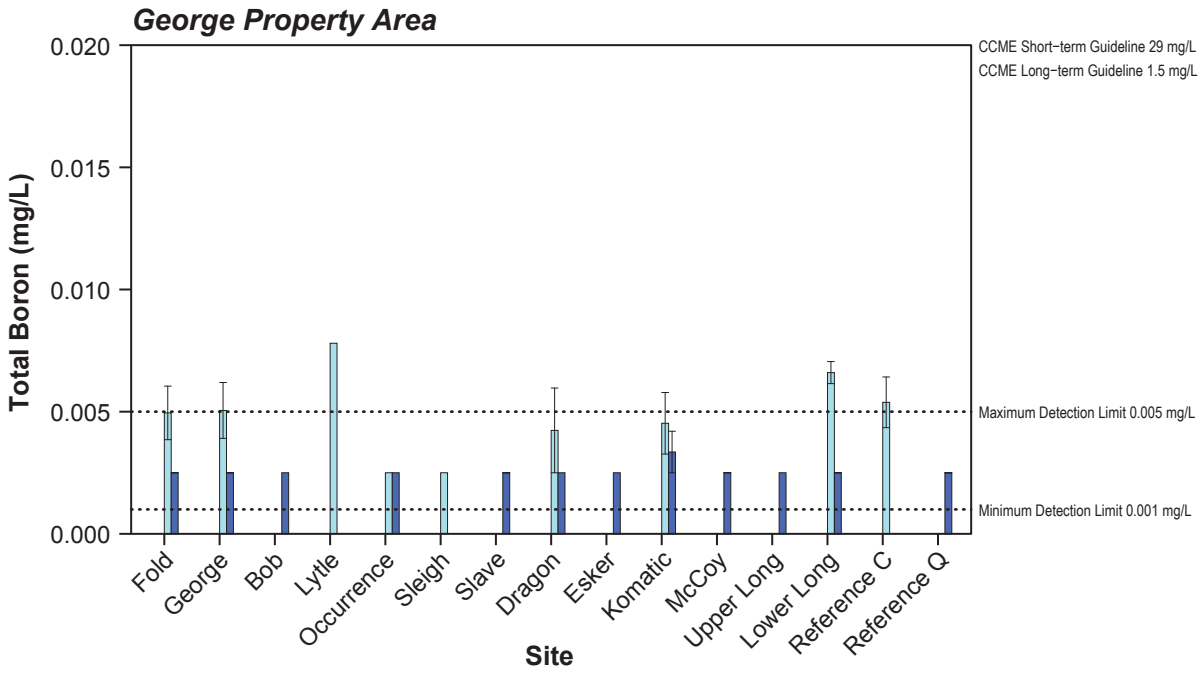
Rescan an ERM company

Appendix 3.3-21

Total Boron in Lakes, Back River Project Area, 2010 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Appendix 3.3-21

Sabina GOLD & SILVER CORP.

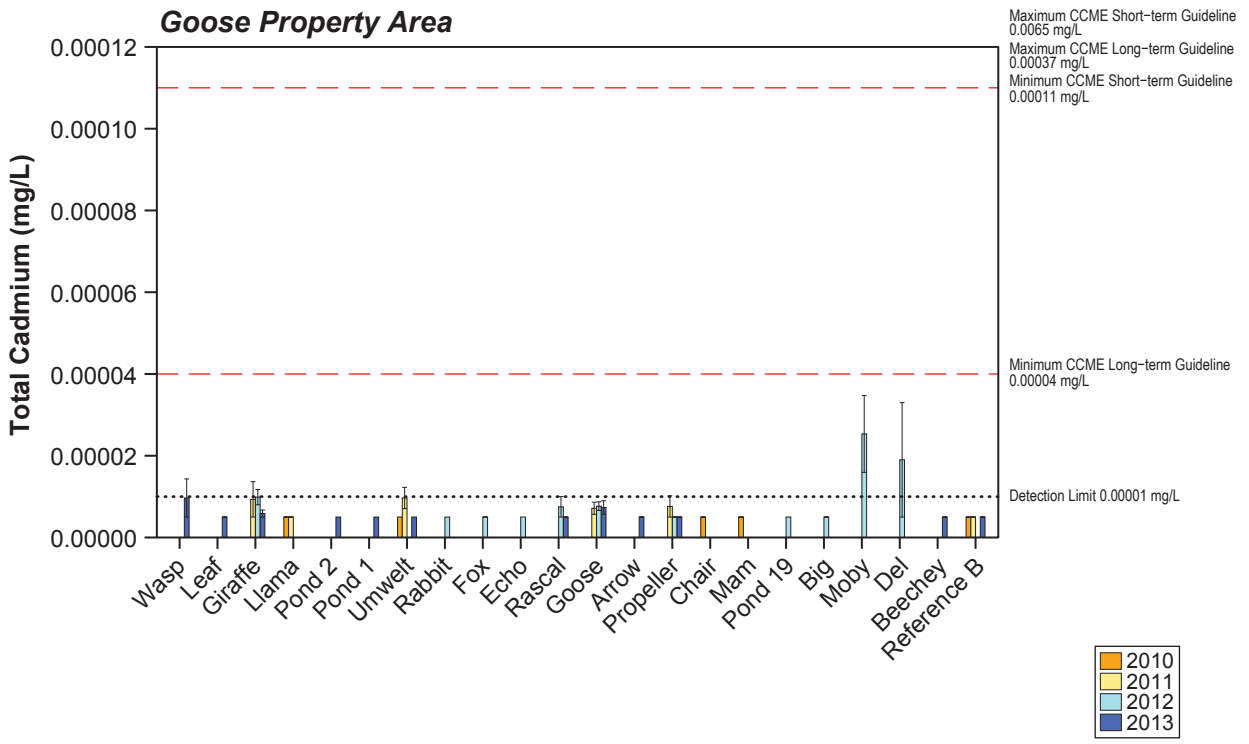
Total Boron in Lakes, Back River Project, 2010 to 2013

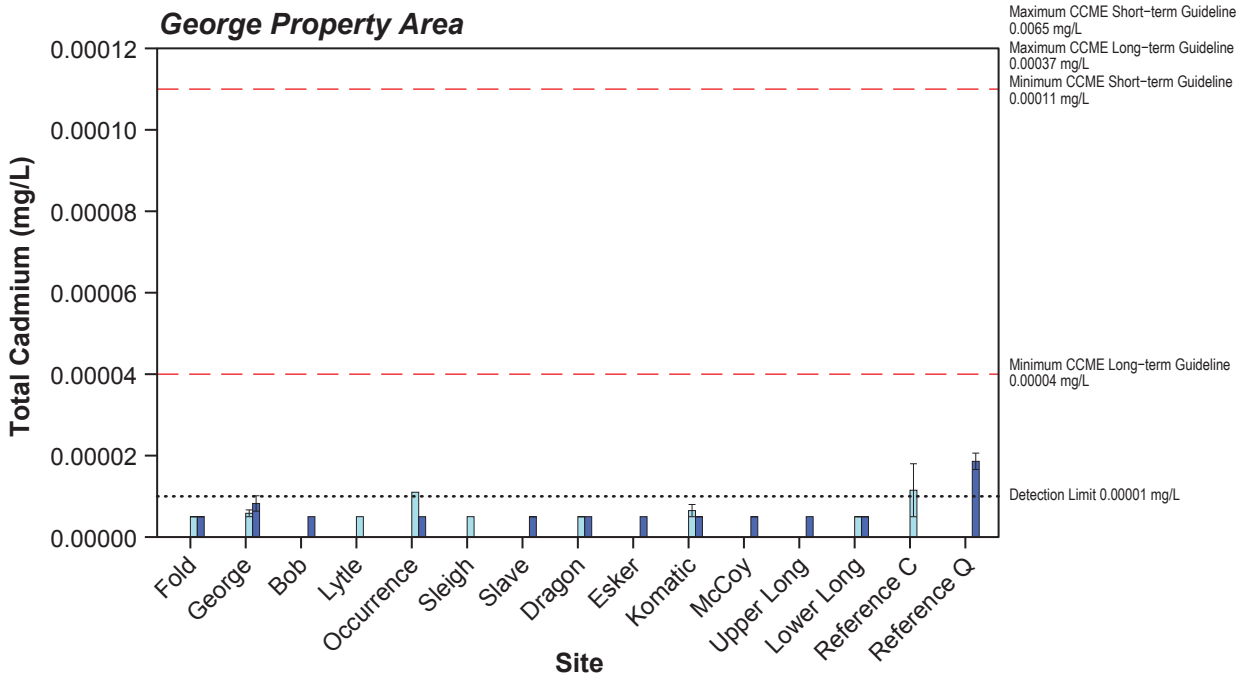
Rescan an ERM company

Appendix 3.3-22

Total Cadmium in Lakes, Back River Project Area, 2010 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME short-term cadmium guideline is hardness-dependent (mg/L) = $10^{(1.016(\log10(\text{hardness}))-1.71)}/1000$, with a minimum of 0.00011 mg/L.
CCME long-term cadmium guideline is hardness-dependent (mg/L) = $10^{(0.83(\log10(\text{hardness}))-2.46)}/1000$, with a minimum of 0.00004 mg/L.

Appendix 3.3-22

Sabina GOLD & SILVER CORP.

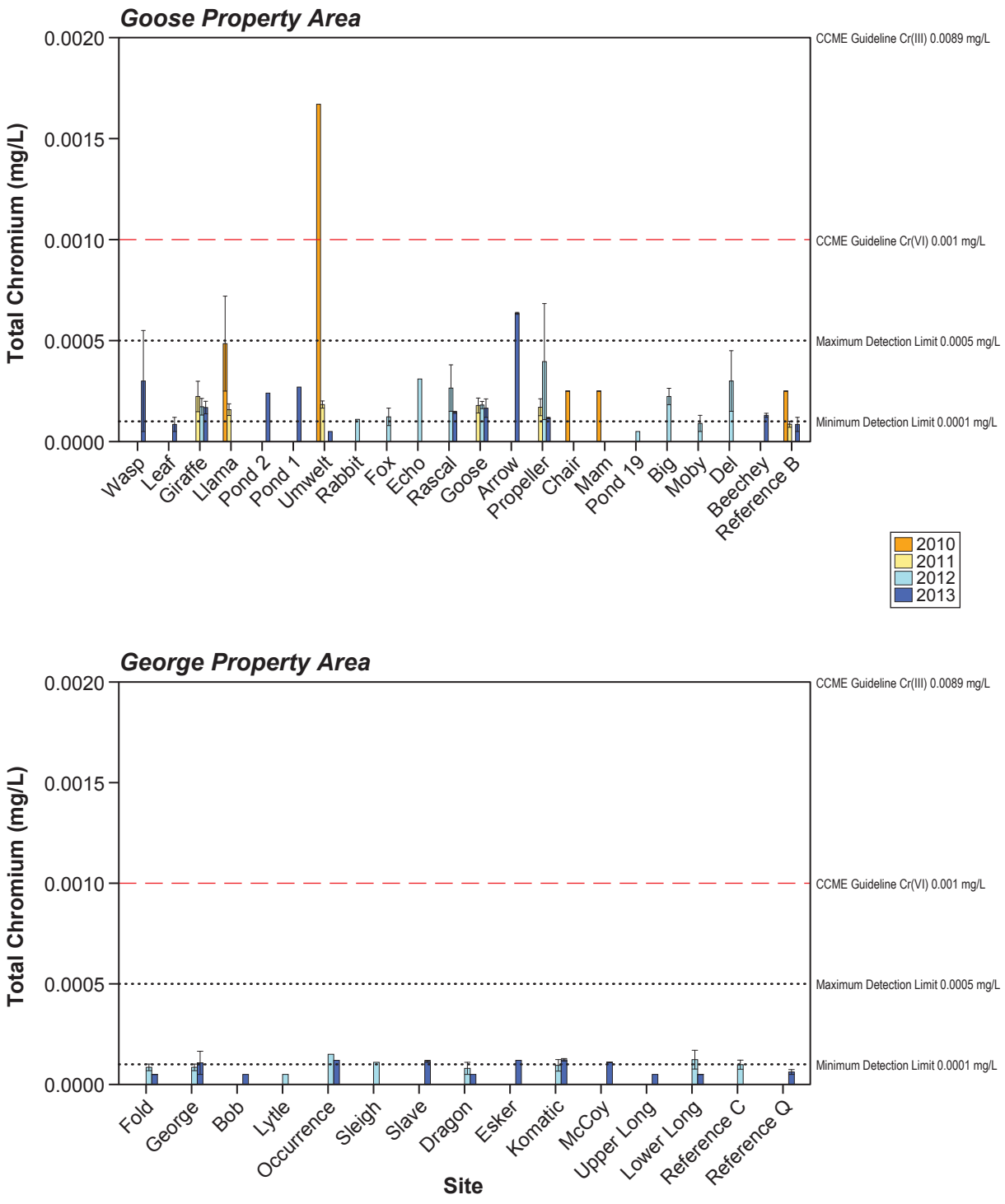
Total Cadmium in Lakes, Back River Project, 2010 to 2013

Rescan an ERM company

Appendix 3.3-23

Total Chromium in Lakes, Back River Project Area, 2010 to 2013

Rescan™
an ERM company



Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Appendix 3.3-23

Sabina GOLD & SILVER CORP.

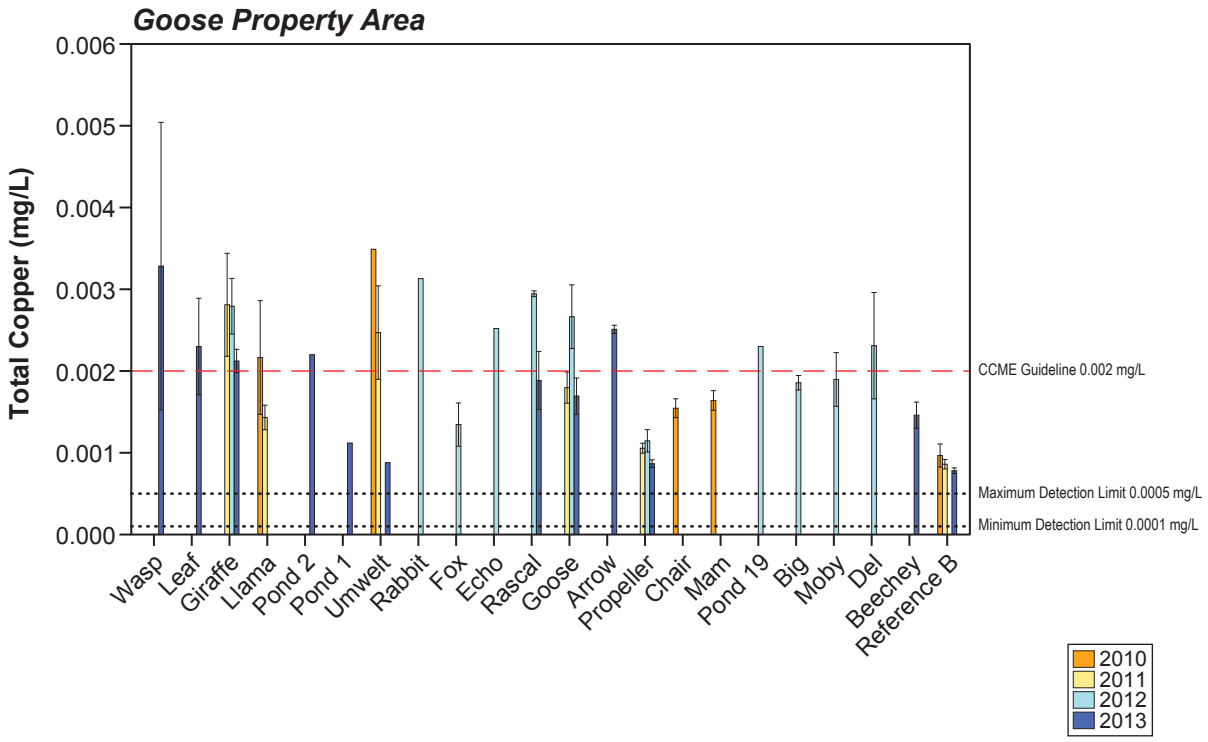
Total Chromium in Lakes, Back River Project, 2010 to 2013

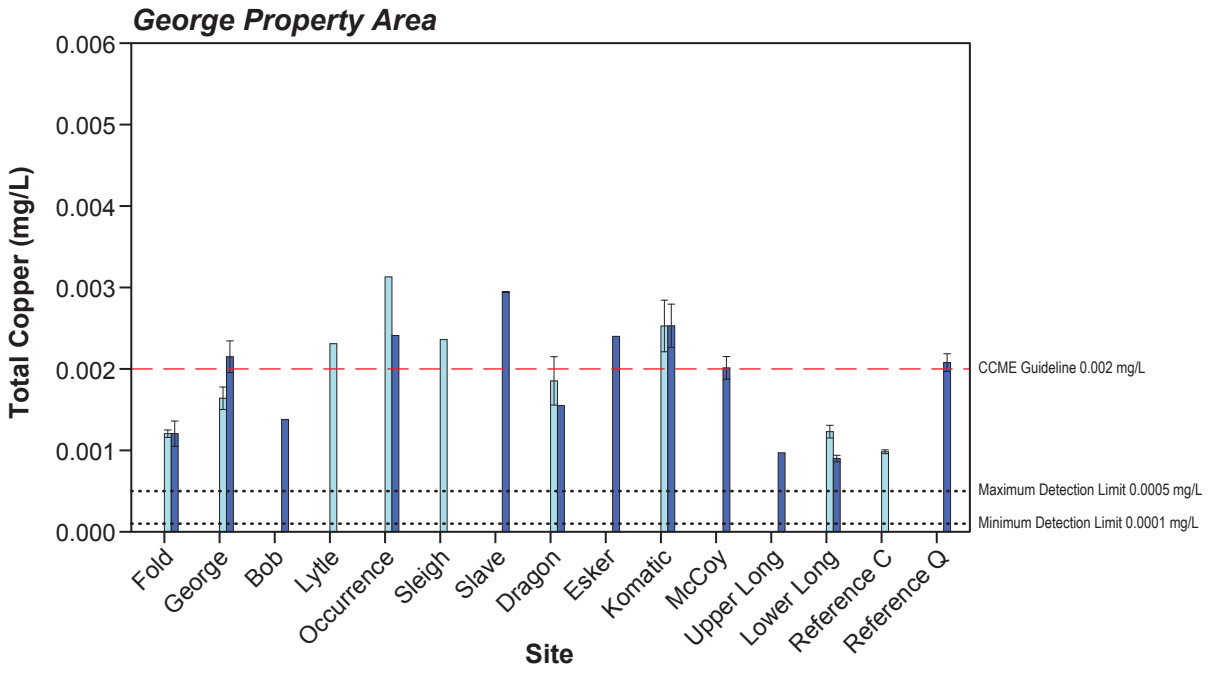
Rescan an ERM company

Appendix 3.3-24

Total Copper in Lakes, Back River Project Area, 2010 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
*CCME copper guideline is hardness−dependent (mg/L) = $e^{(0.8545[\ln(\text{hardness})]-1.465)}$*0.0002*
with a minimum of 0.002 mg/L and a maximum of 0.004 mg/L.

Appendix 3.3-24

Sabina GOLD & SILVER CORP.

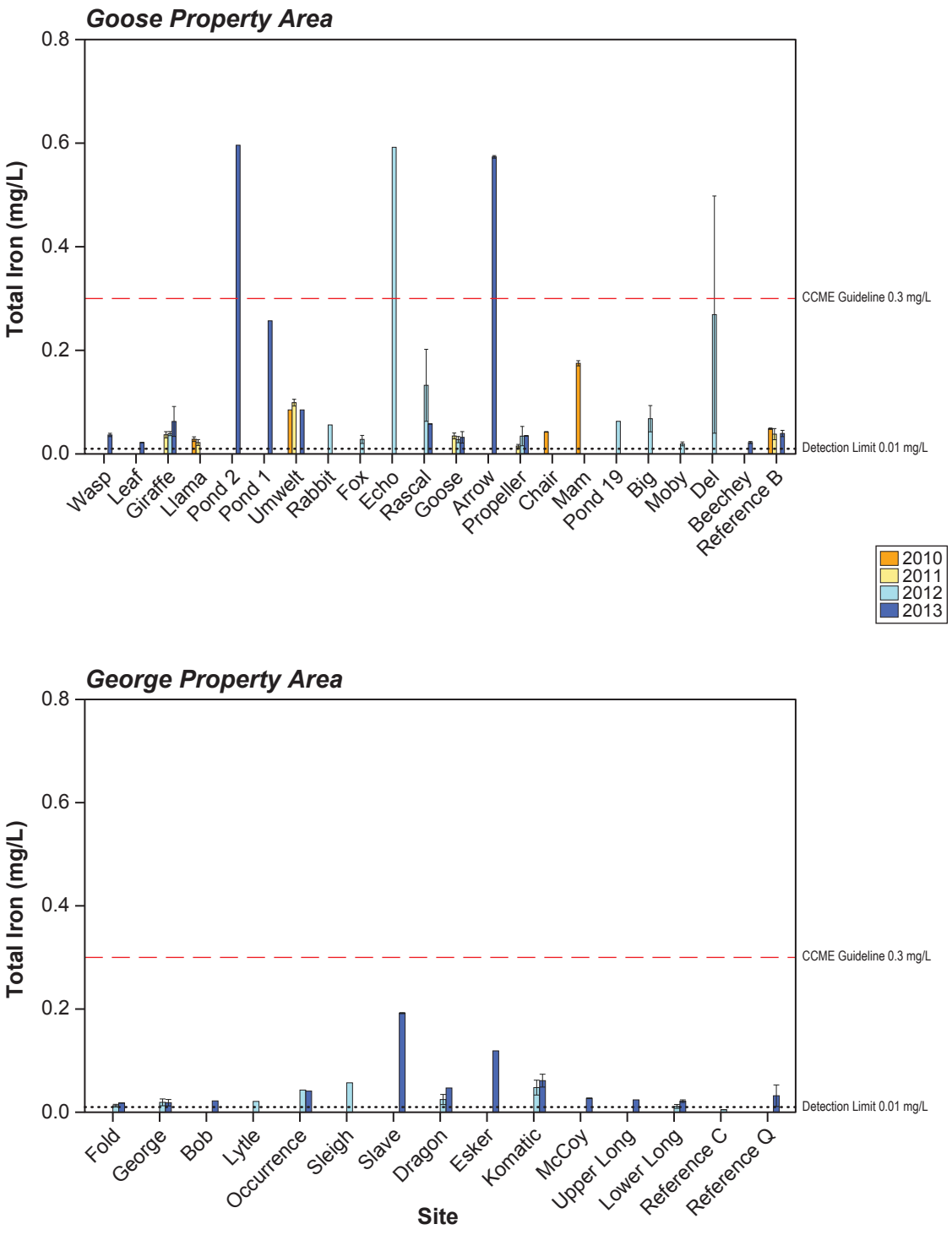
Total Copper in Lakes, Back River Project, 2010 to 2013

Rescan an ERM company

Appendix 3.3-25

Total Iron in Lakes, Back River Project Area, 2010 to 2013

Rescan™
an ERM company



Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Sabina GOLD & SILVER CORP.

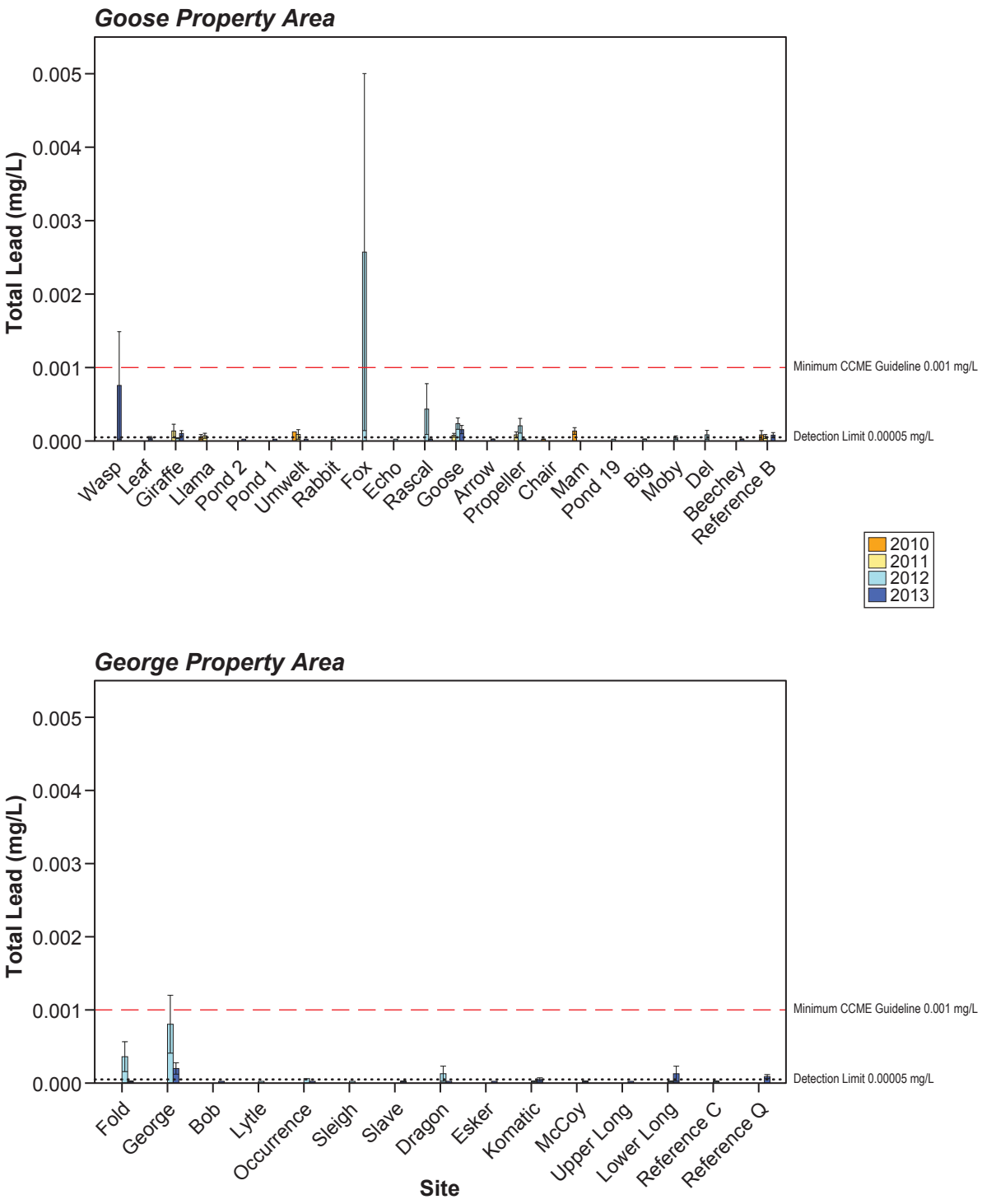
Total Iron in Lakes, Back River Project, 2010 to 2013

Rescan an ERM company

Appendix 3.3-26

Total Lead in Lakes, Back River Project Area, 2010 to 2013

Rescan™
an ERM company



Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME lead guideline is hardness−dependent (mg/L) = $e^{(1.273(\ln(\text{hardness}))-4.705)}$/1000 with a minimum of 0.001 mg/L and a maximum of 0.007 mg/L.

Appendix 3.3-26

Sabina GOLD & SILVER CORP.

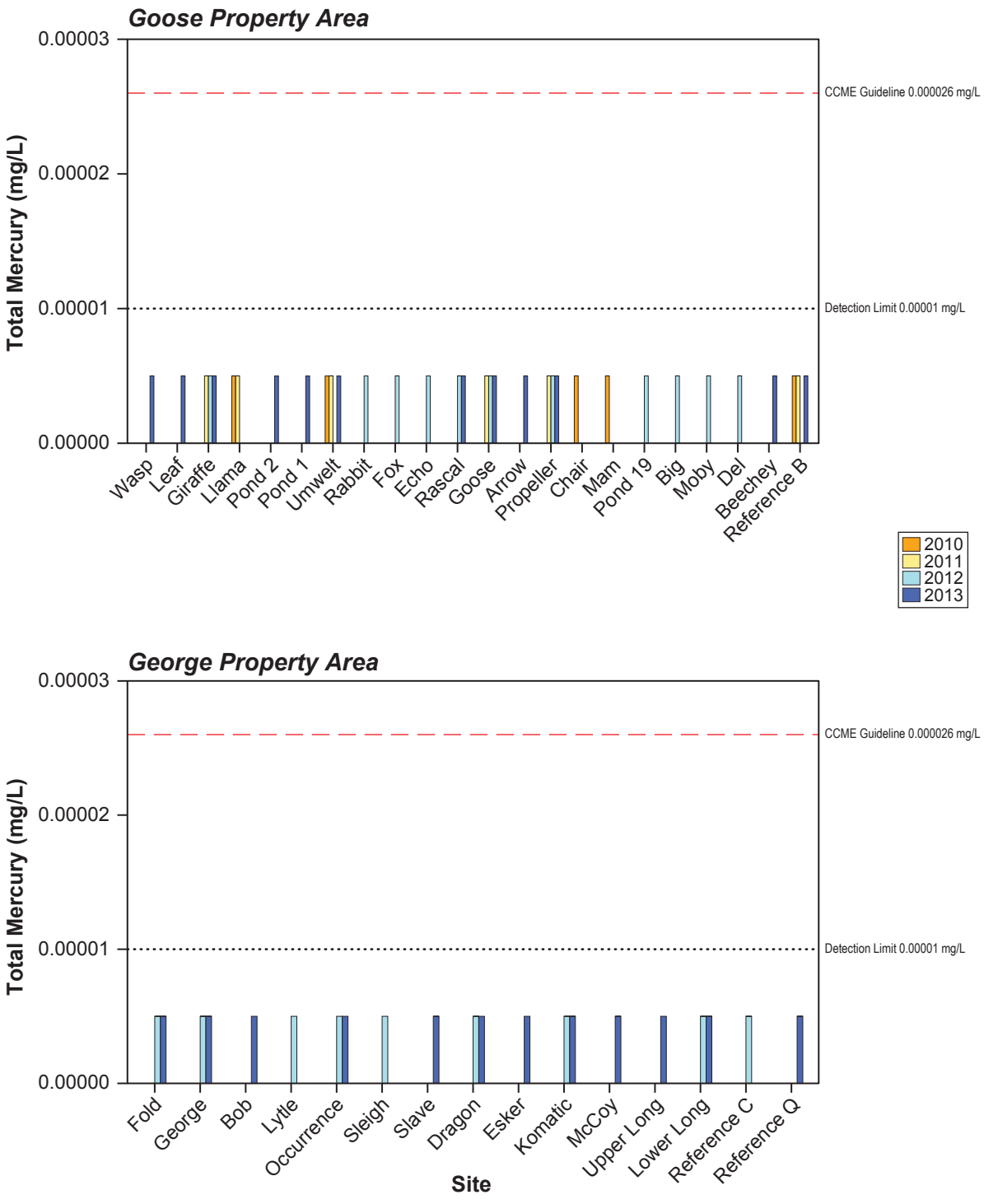
Total Lead in Lakes, Back River Project, 2010 to 2013

Rescan an ERM company

Appendix 3.3-27

Total Mercury in Lakes, Back River Project Area, 2010 to 2013

Rescan™
an ERM company



Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Appendix 3.3-27

Sabina GOLD & SILVER CORP.

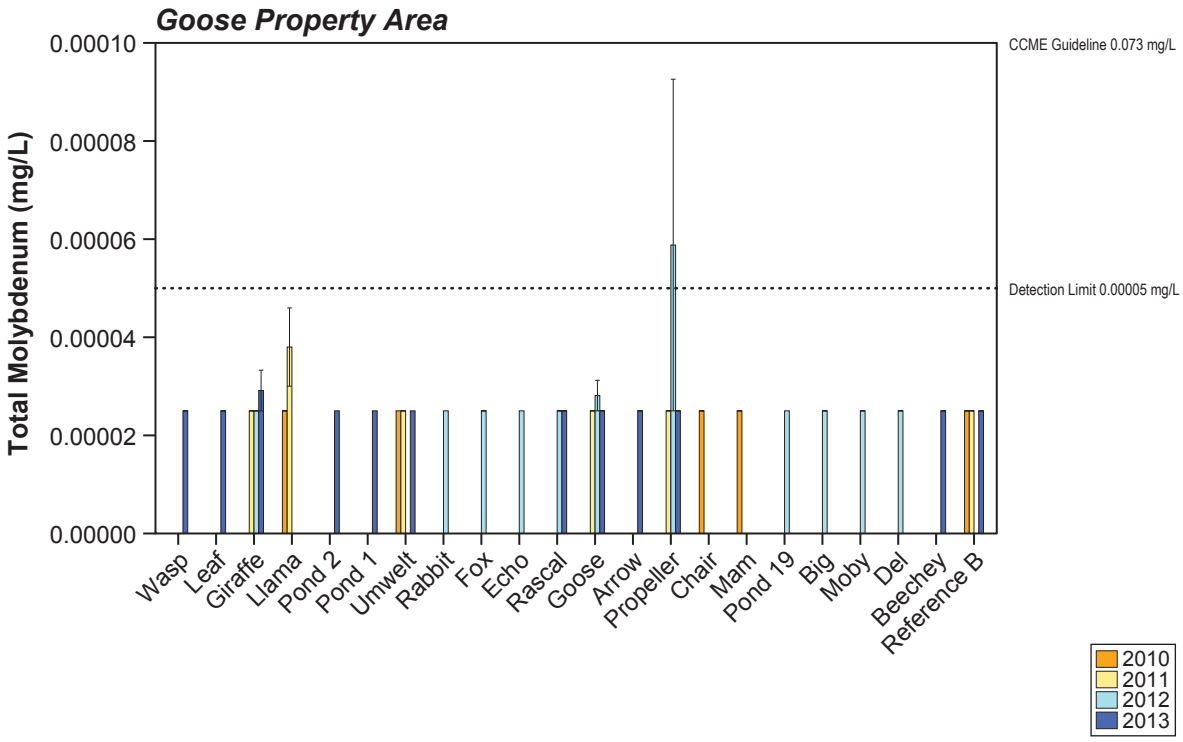
Total Mercury in Lakes, Back River Project, 2010 to 2013

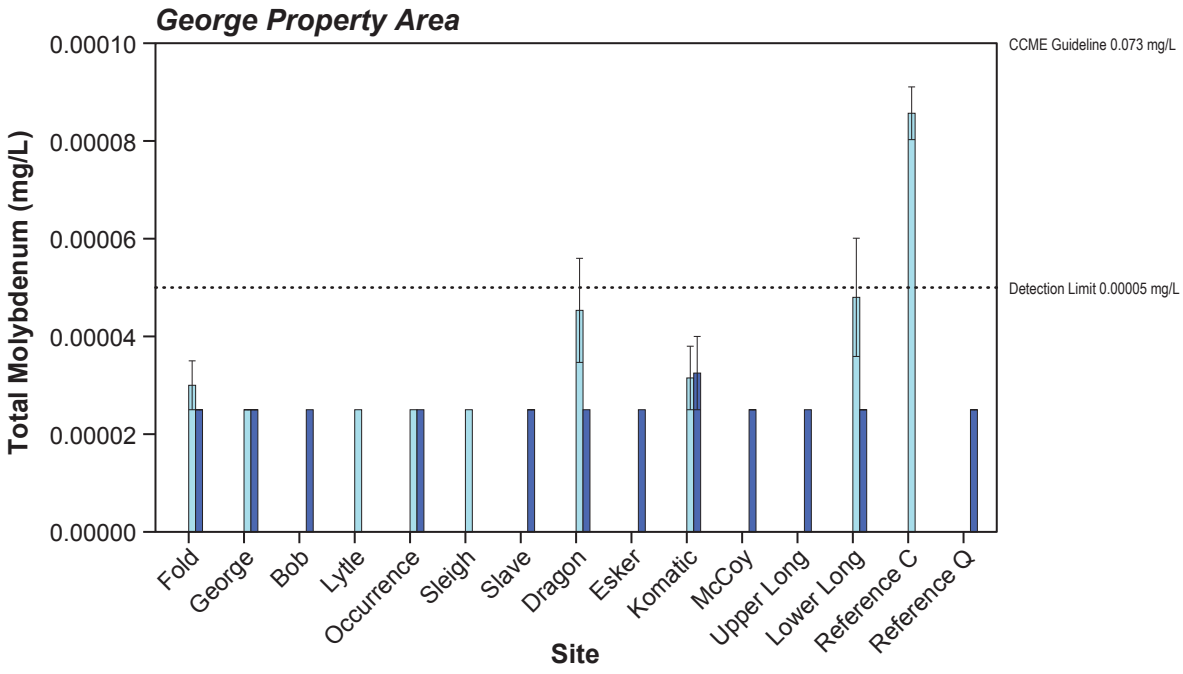
Rescan an ERM company

Appendix 3.3-28

Total Molybdenum in Lakes, Back River Project Area, 2010 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
The CCME guideline is an interim guideline.

Appendix 3.3-28

Sabina GOLD & SILVER CORP.

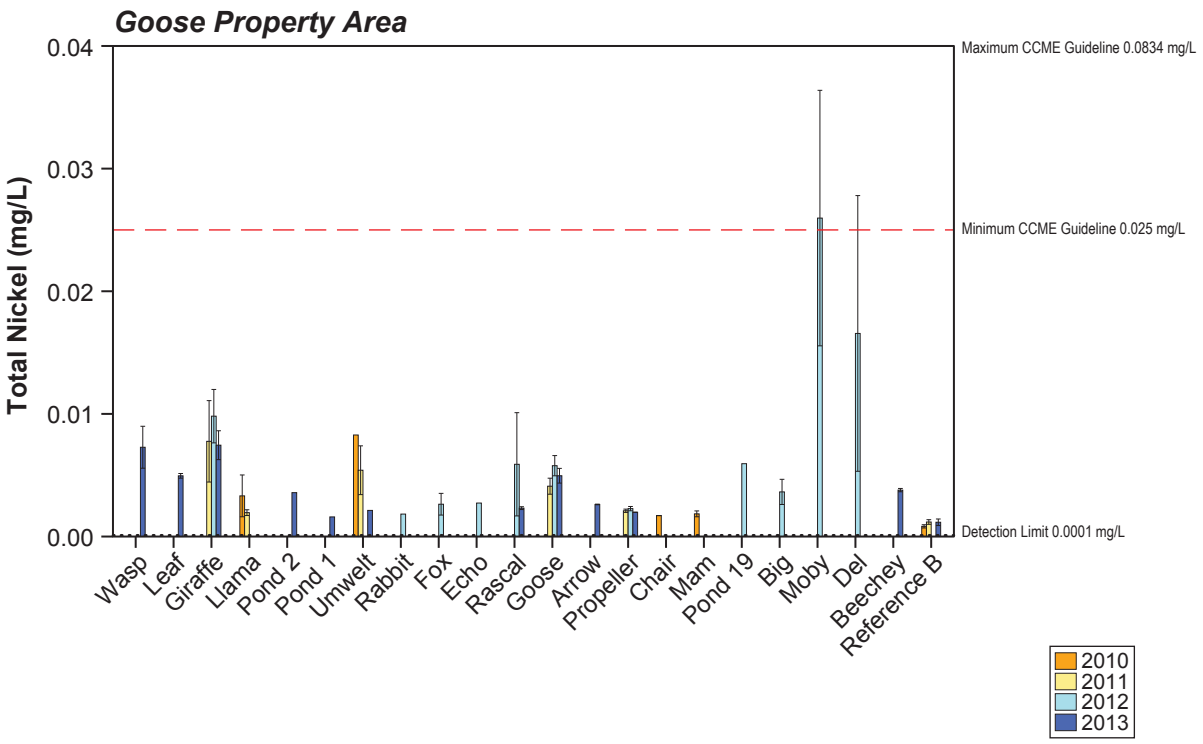
Total Molybdenum in Lakes, Back River Project, 2010 to 2013

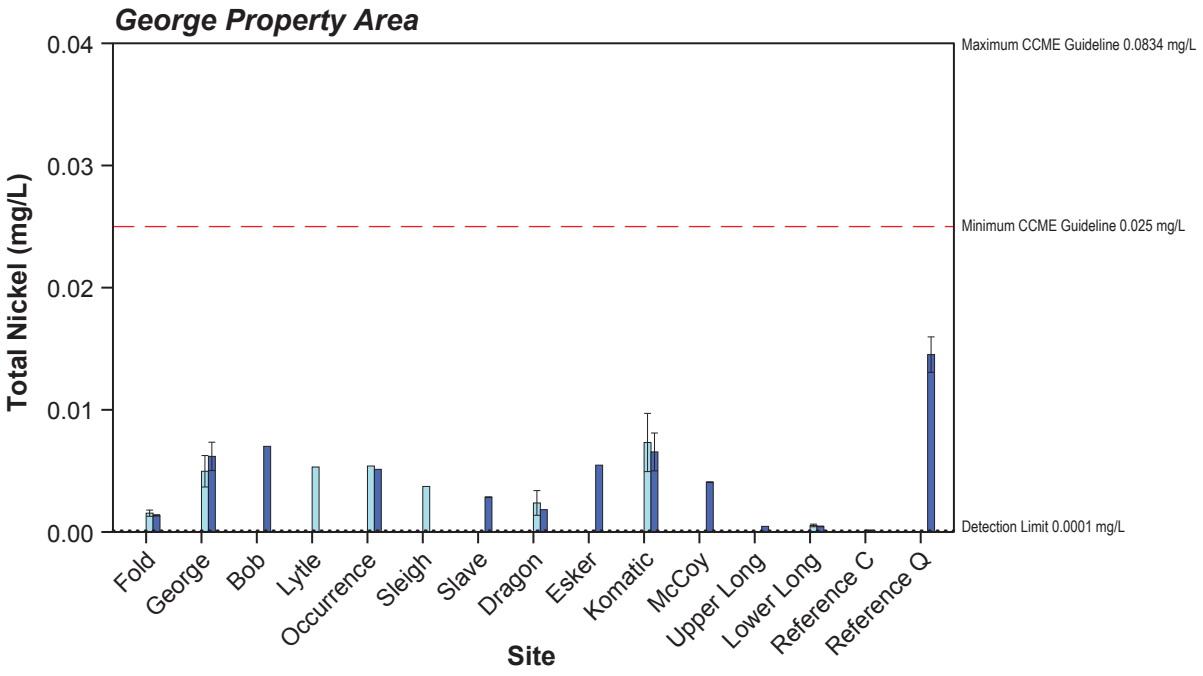
Rescan an ERM company

Appendix 3.3-29

Total Nickel in Lakes, Back River Project Area, 2010 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME nickel guideline is hardness−dependent (mg/L) = $e^{(0.76[\ln(\text{hardness})]+1.06)}/1000$ with a minimum of 0.025 mg/L and maximum of 0.15 mg/L.

Appendix 3.3-29

Sabina GOLD & SILVER CORP.

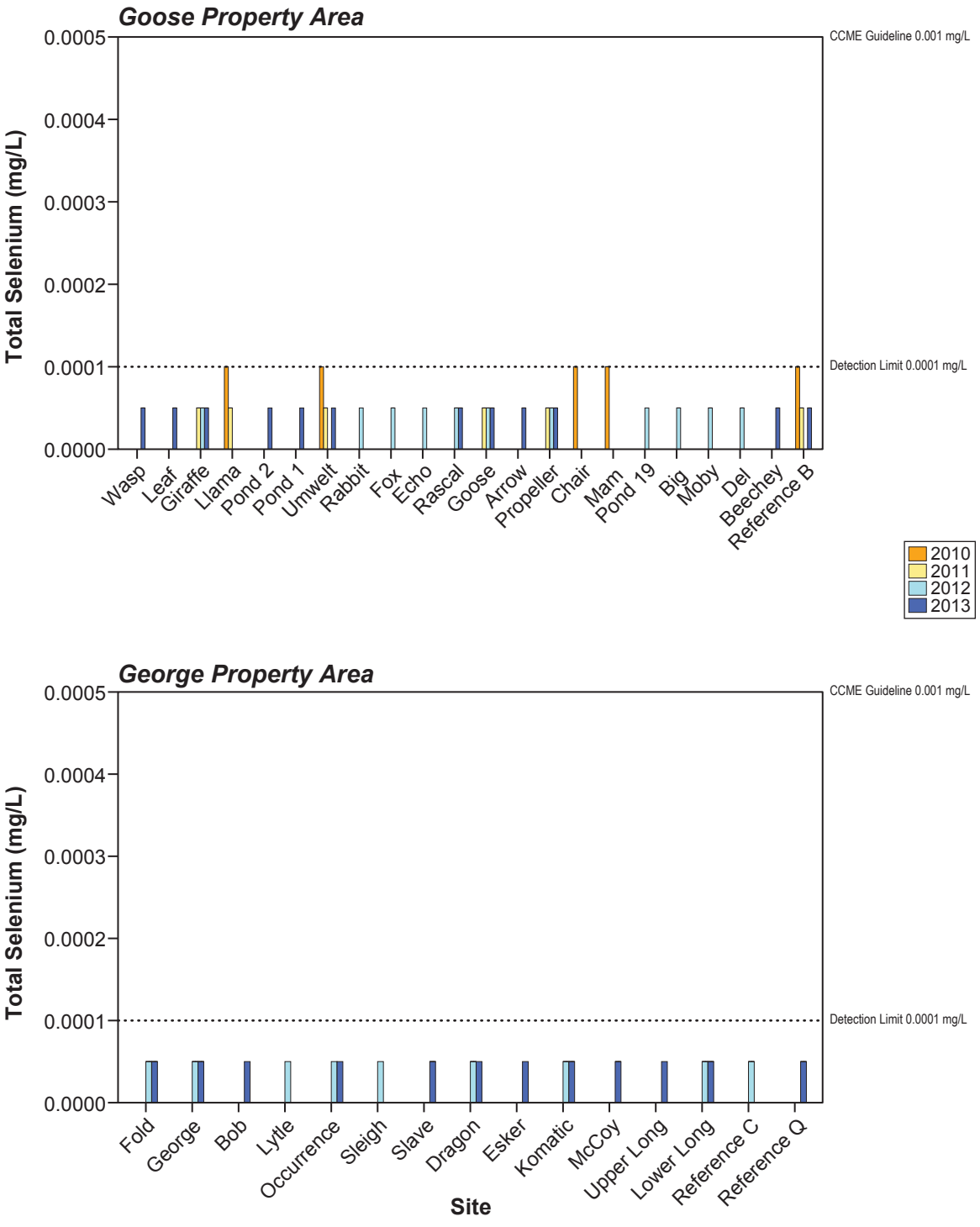
Total Nickel in Lakes, Back River Project, 2010 to 2013

Rescan an ERM company

Appendix 3.3-30

Total Selenium in Lakes, Back River Project Area, 2010 to 2013

Rescan™
an ERM company



Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Appendix 3.3-30

Sabina GOLD & SILVER CORP.

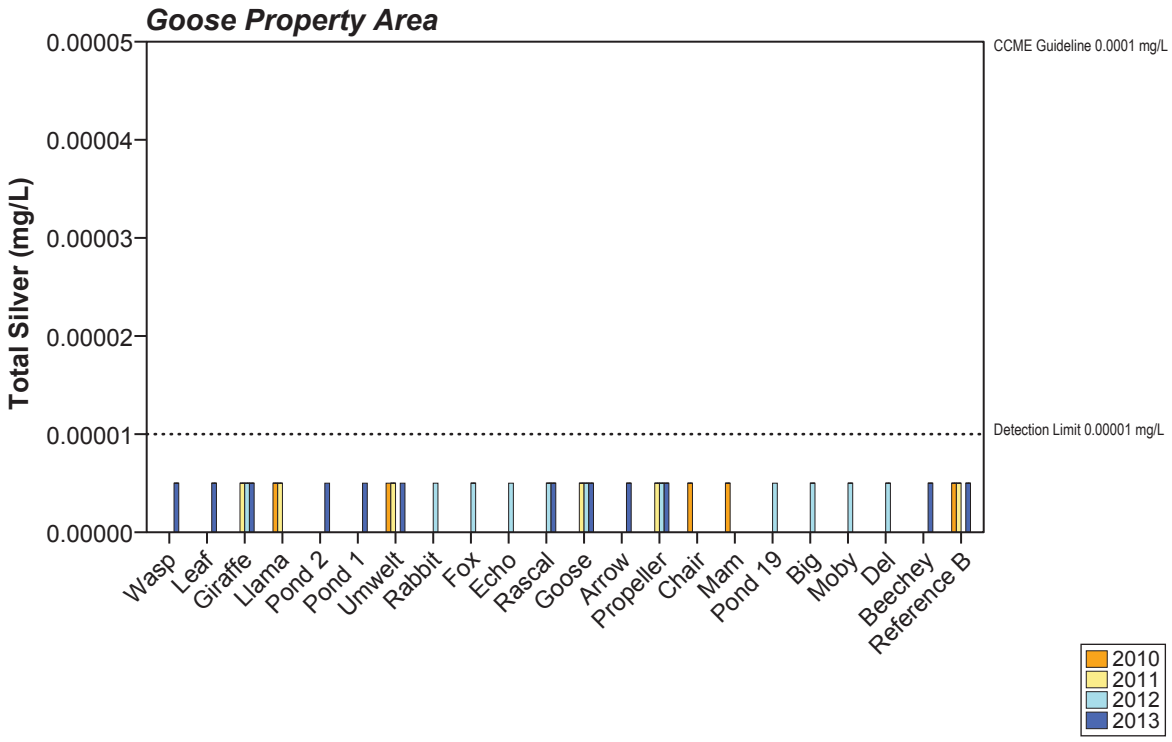
Total Selenium in Lakes, Back River Project, 2010 to 2013

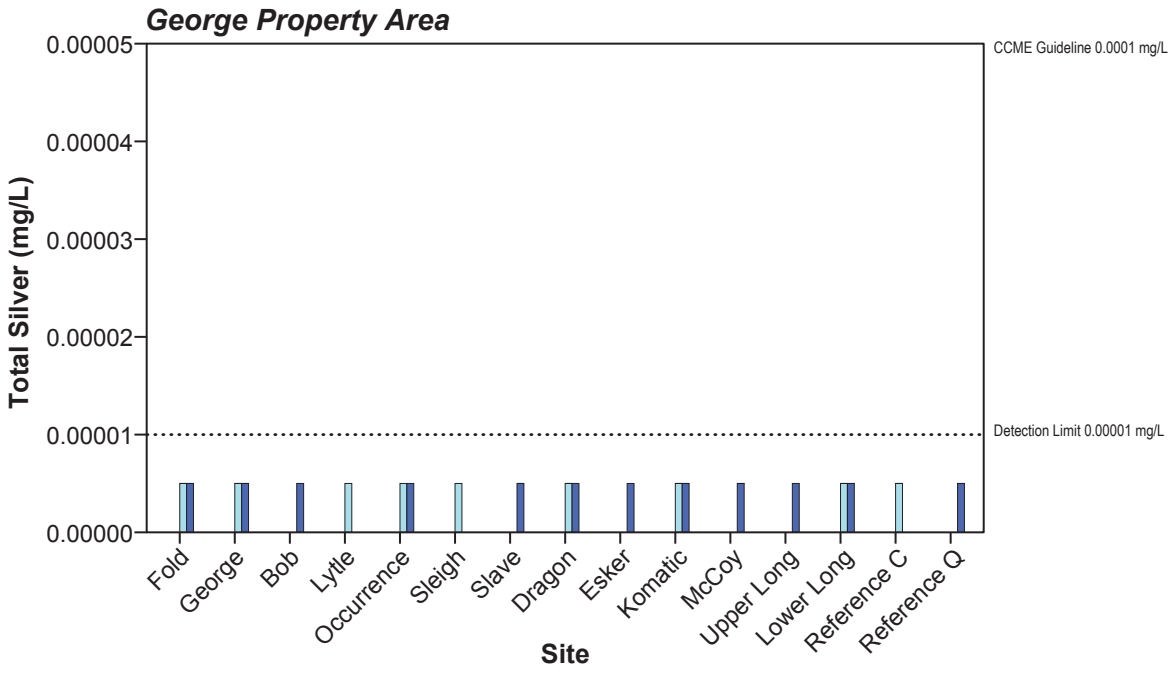
Rescan an ERM company

Appendix 3.3-31

Total Silver in Lakes, Back River Project Area, 2010 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Sabina GOLD & SILVER CORP.

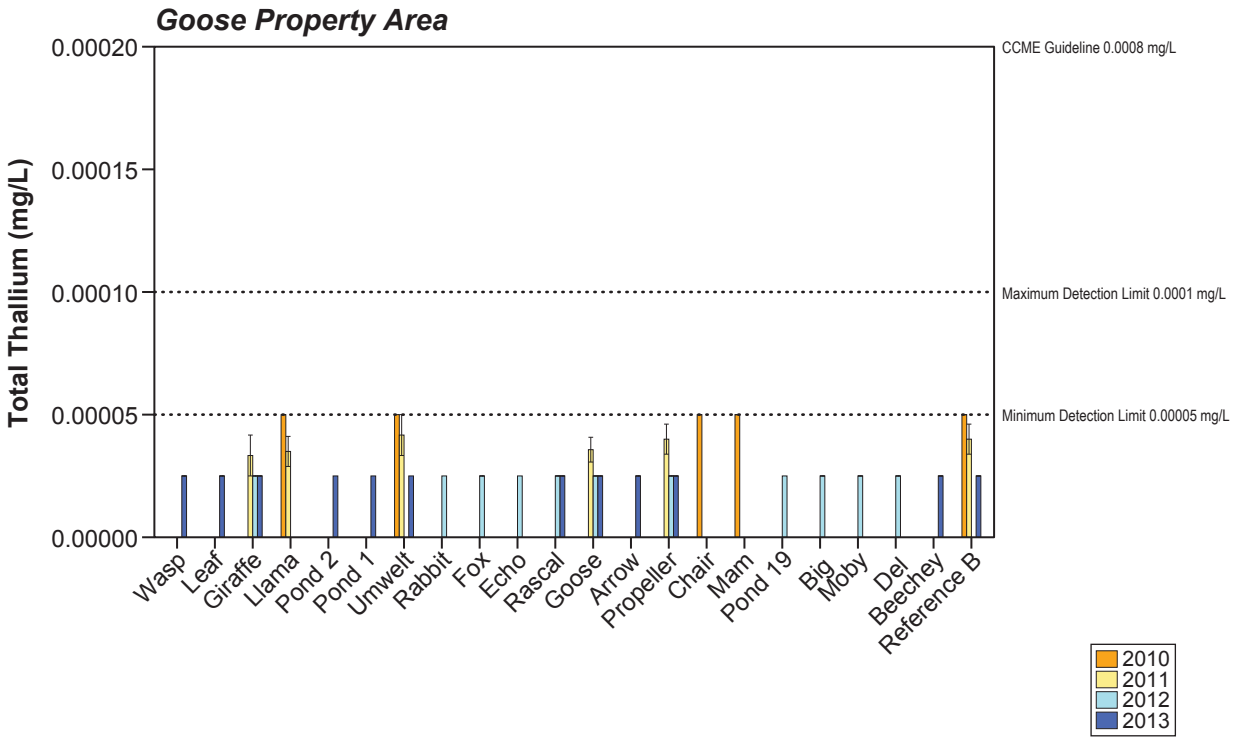
Total Silver in Lakes, Back River Project, 2010 to 2013

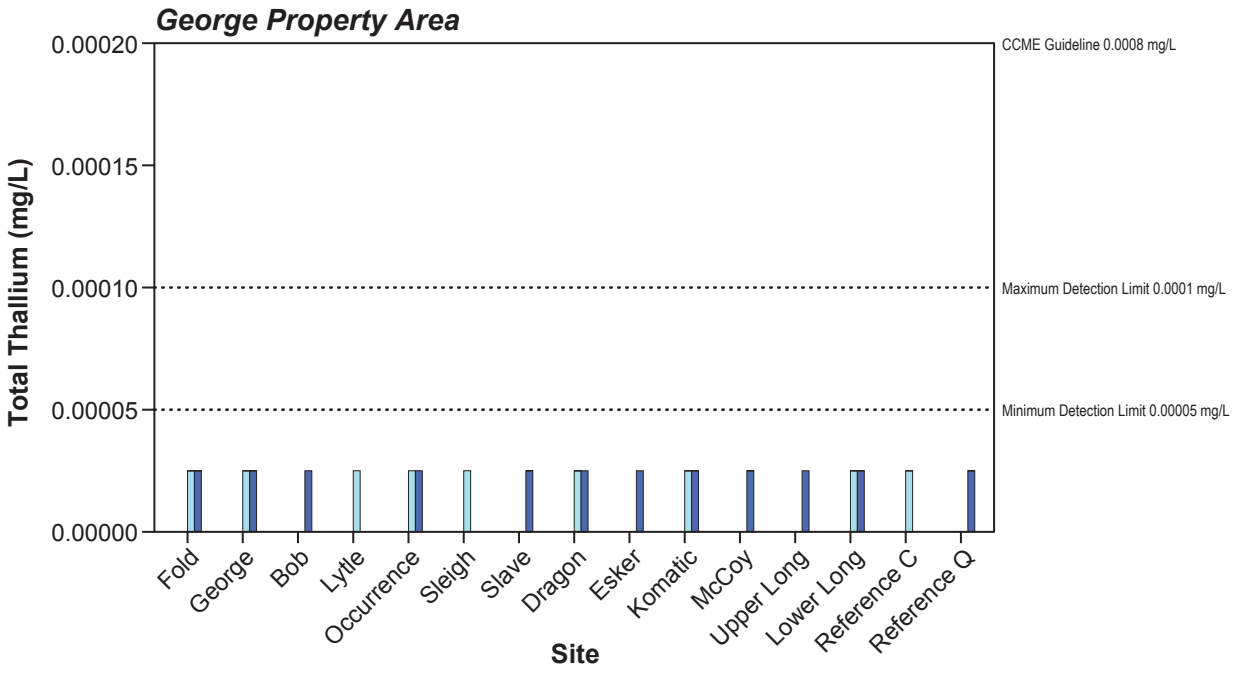
Rescan an ERM company

Appendix 3.3-32

Total Thallium in Lakes, Back River Project Area, 2010 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Appendix 3.3-32

Sabina GOLD & SILVER CORP.

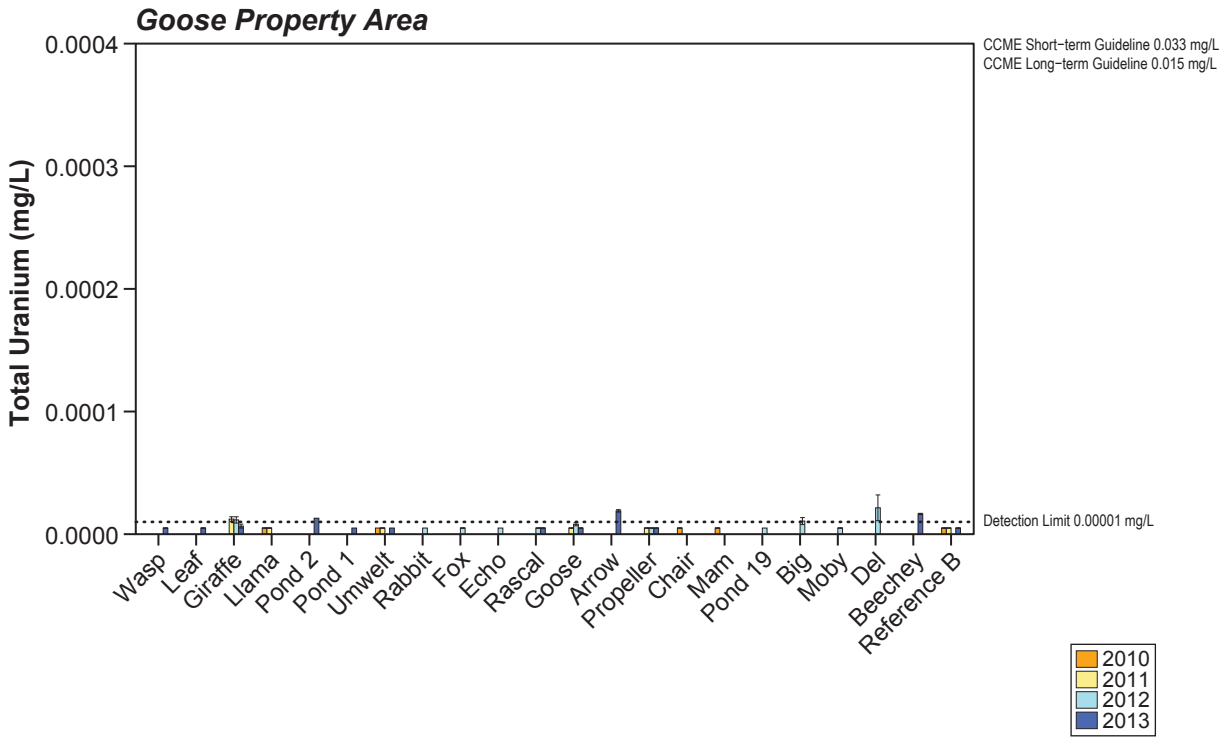
Total Thallium in Lakes, Back River Project, 2010 to 2013

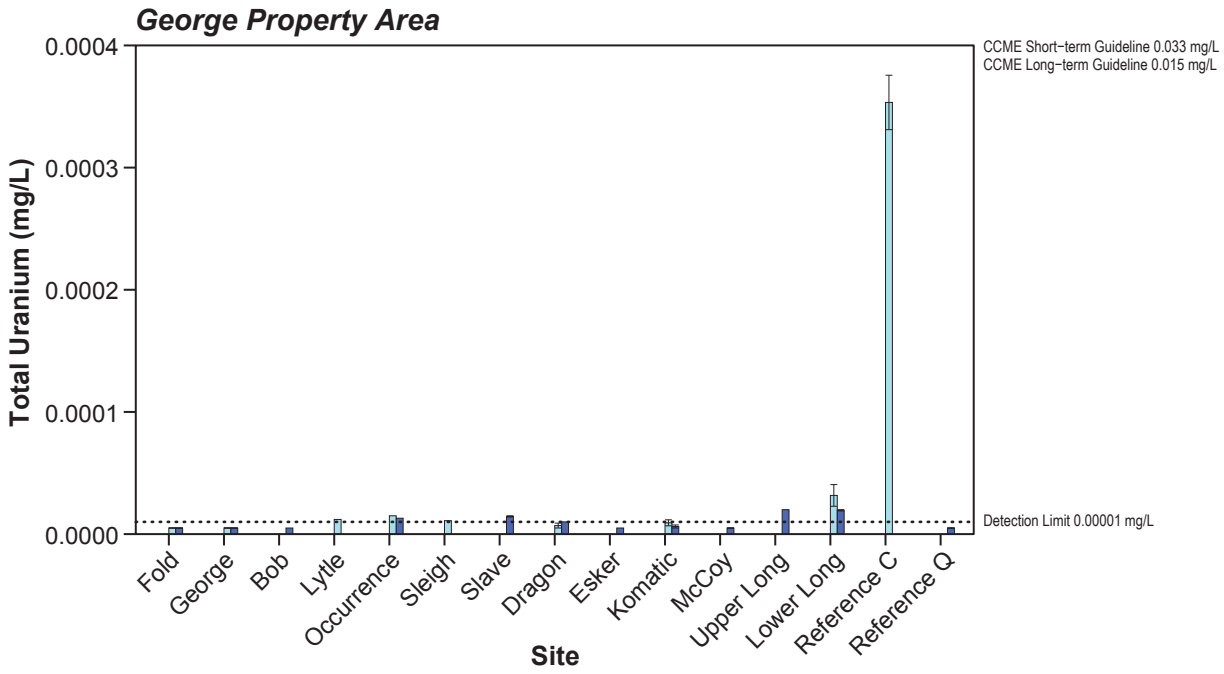
Rescan an ERM company

Appendix 3.3-33

Total Uranium in Lakes, Back River Project Area, 2010 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Appendix 3.3-33

Sabina GOLD & SILVER CORP.

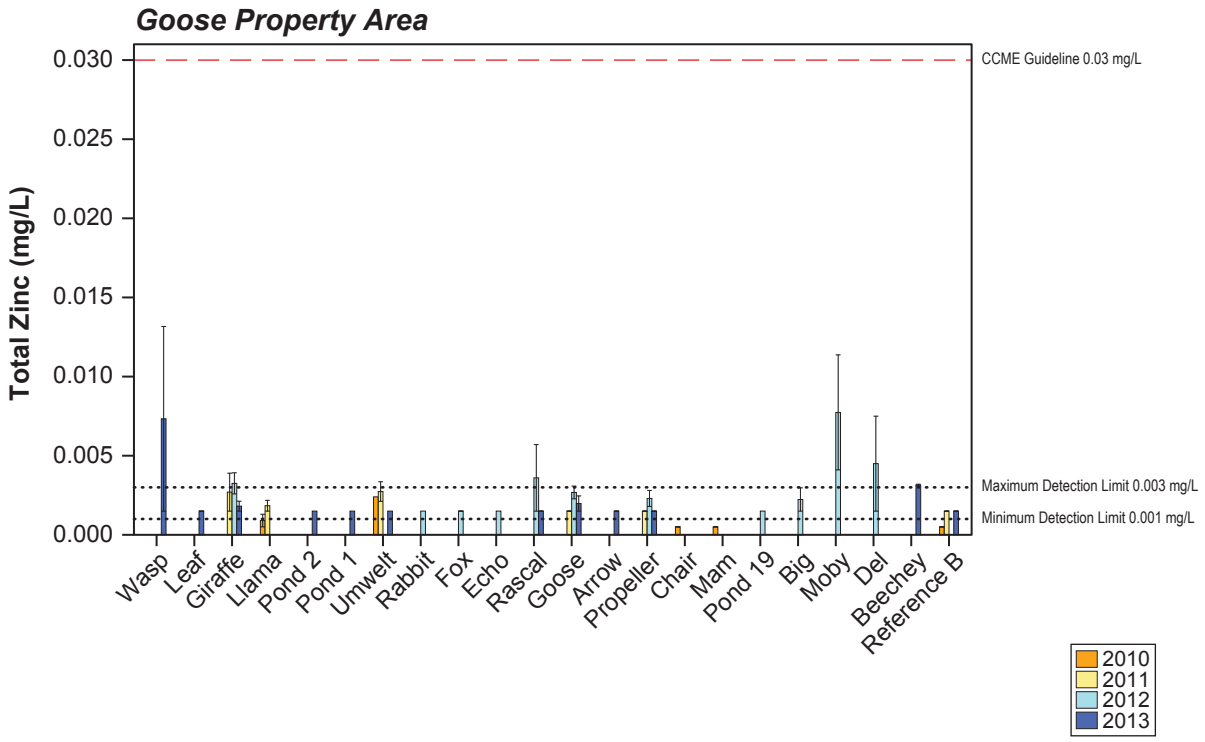
Total Uranium in Lakes, Back River Project, 2010 to 2013

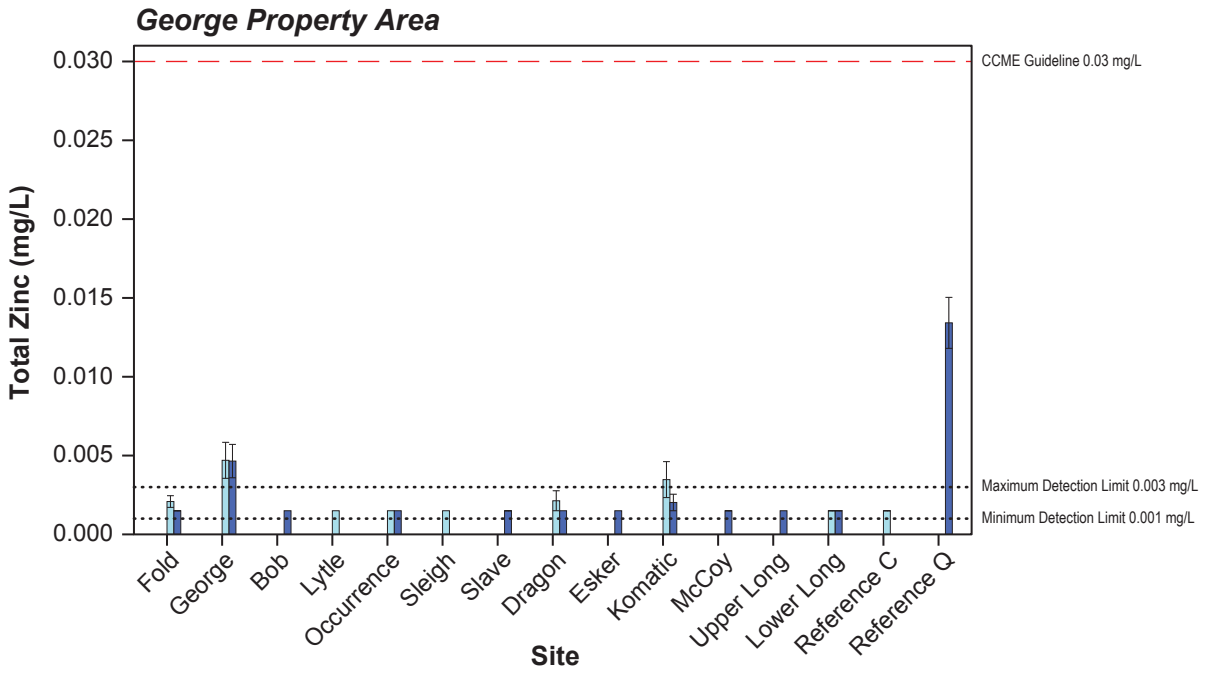
Rescan an ERM company

Appendix 3.3-34

Total Zinc in Lakes, Back River Project Area, 2010 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Appendix 3.3-34

Sabina GOLD & SILVER CORP.

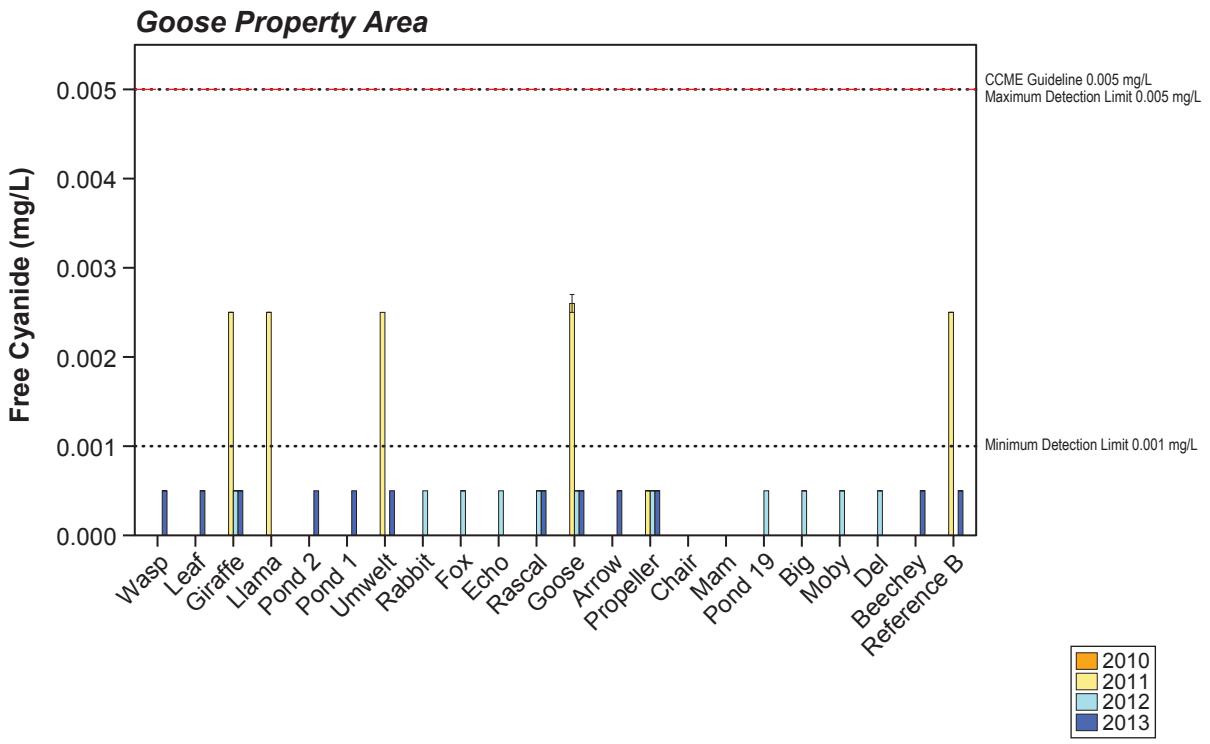
Total Zinc in Lakes, Back River Project, 2010 to 2013

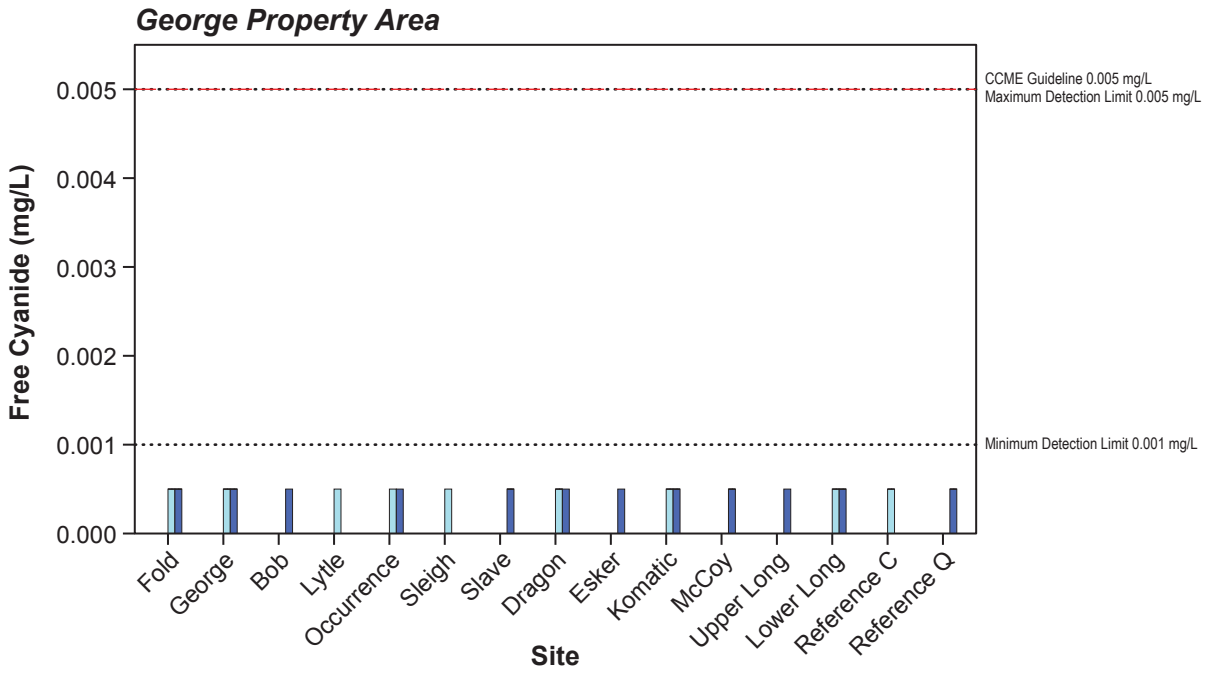
Rescan an ERM company

Appendix 3.3-35

Free Cyanide in Lakes, Back River Project Area, 2010 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
Free cyanide was not measured in the 2010 sampling program.
All samples measured were below detection limits, with the exception of one Goose Lake sample in 2011.

Sabina GOLD & SILVER CORP.

Free Cyanide in Lakes, Back River Project, 2010 to 2013

Rescan an ERM company

Appendix 3.4-1

Stream Water Quality Analytical Results, Back River Project, 2013

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Appendix 3.4-1. Stream Water Quality Analytical Results, Back River Project, 2013

Stream Site Name				Wasp OF	Wasp OF	TIA OF	TIA OF	Giraffe OF	Giraffe OF	Umwelt OF	Umwelt OF	Llama OF	Llama OF	Llama OF	Llama OF	Goose Neck IF	Goose Neck IF
Site Code				WASPOF	WASPOF	TIAOF	TIAOF	GIROF	GIROF	UMWOF	UMWOF	LLAMAOF	LLAMAOF	LLAMAOF	LLAMAOF	GOONECKIF	GOONECKIF
Replicate												FDUP		FDUP			FDUP
Date Sampled		CCME Guidelines for the Protection of	Realized Detection Limit	11-Jun-13	23-Jul-13	11-Jun-13	23-Jul-13	11-Jun-13	24-Jul-13	11-Jun-13	23-Jul-13	11-Jun-13	11-Jun-13	23-Jul-13	23-Jul-13	11-Jun-13	23-Jul-13
ALS Sample ID #	Units	Freshwater Aquatic Life[a]	(RDL)	L1316465-7	L1338239-3	L1316465-6	L1338239-4	L1316465-5	L1338239-8	L1316465-4	L1338239-5	L1316465-3	L1316465-2	L1338239-2	L1338239-1	L1316465-1	L1338239-7
Physical Tests																	
Conductivity	µS/cm		2.0	32.6	34.5	28.8	61.0	31.1	31.9	114.0	112.0	75.4	75.4	126.0	123.0	27.4	33.9
Hardness (as $CaCO_3$)	mg/L		0.50	12.20	12.40	11.10	23.10	11.70	11.70	41.80	41.00	26.90	27.50	44.80	42.10	10.40	13.30
pH	pH	6.5-9.0	0.10	6.82	6.87	6.48	6.90	6.81	6.83	6.37	6.56	6.62	6.64	6.86	7.10	6.82	6.99
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		2.0	4.6	4.4	3.4	5.8	4.5	4.6	2.5	2.6	2.9	3.0	4.4	5.5	3.4	7.9
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		2.0	4.6	4.4	3.4	5.8	4.5	4.6	2.5	2.6	2.9	3.0	4.4	5.5	3.4	7.9
Total Suspended Solids	mg/L	dependent on background levels	3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Total Dissolved Solids	mg/L		10	23	29	37	48	30	29	118	112	73	74	112	118	37	34
Turbidity	NTU	dependent on background levels	0.10	0.29	0.22	0.32	0.25	0.32	0.38	0.47	0.39	0.20	0.19	0.14	0.13	0.51	2.08
Nutrients																	
Ammonia, Total (as N)	mg/L	pH- and temperature-dependent	0.0050	<0.0050	<0.0050	0.0072	<0.0050	0.0151	0.0058	0.0066	0.0058	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0256
Nitrate (as N)	mg/L	short-term: 124; long-term: 3	0.0050	0.0123	0.0336	0.0107	0.0988	<0.0050	0.0344	<0.0050	<0.0050	0.0099	0.0101	0.2580	0.2580	0.0092	0.0058
Nitrite (as N)	mg/L	0.06	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L		0.05	0.17	0.21	0.30	0.21	0.19	0.21	0.21	0.21	0.18	0.20	0.10	0.08	0.24	0.61
Ortho-phosphate (as P)	mg/L		0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus (P)	mg/L	Trigger ranges from guidance framework[c]	0.002	0.005	0.006	0.007	0.003	0.005	0.004	0.006	0.004	0.004	0.004	<0.0020	<0.0020	0.005	0.016
Anions																	
Bromide (Br)	mg/L		0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.288	0.265	0.154	0.153	0.256	0.251	<0.050	<0.050
Chloride (Cl)	mg/L	short-term: 640; long-term: 120	0.50	0.73	0.71	1.01	1.52	0.85	0.79	28.70	27.80	16.00	16.10	26.20	26.10	2.22	2.17
Fluoride (F)	mg/L	0.12[b]	0.02	0.02	0.03	<0.020	0.02	0.02	0.02	<0.020	0.02	<0.020	<0.020	<0.020	<0.020	0.02	0.03
Sulfate (SO_4)	mg/L		0.5	9.1	9.5	7.3	18.3	8.1	8.5	3.4	4.1	5.3	5.3	8.5	8.4	4.7	4.1
Cyanides																	
Cyanide, Total	mg/L		0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cyanide, Free	mg/L	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic Carbon																	
Total Organic Carbon	mg/L		0.50	4.02	3.16	9.00	4.71	4.69	3.43	4.95	3.44	4.66	4.71	1.70	1.64	5.81	6.86
Total Metals																	
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.0030	0.0295	0.0130	0.1300	0.0414	0.0444	0.0185	0.0383	0.0106	0.0425	0.0438	0.0137	0.0121	0.0338	0.0486
Antimony (Sb)	mg/L		0.00005	0.000095	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000074	<0.000050	<0.000050
Arsenic (As)	mg/L	0.005	0.000030	0.000215	0.000185	0.000437	0.000292	0.000217	0.000197	0.000229	0.000263	0.000245	0.000241	0.000188	0.000188	0.000202	0.000600
Barium (Ba)	mg/L		0.000050	0.004380	0.003490	0.006100	0.009550	0.004790	0.004120	0.031700	0.023600	0.016100	0.016100	0.024000	0.021200	0.006820	0.008870
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.005	0.009	0.0061	<0.0050	0.0064	<0.0050	0.0064	<0.0050	0.0116	<0.0050	<0.0050	0.0076	0.009	<0.0050	0.0061
Cadmium (Cd)	mg/L	equation[d]	0.000010	<0.000010	<0.000010	0.000018	0.000021	0.000010	<0.000010	0.000023	0.000014	0.000021	0.000018	0.000063	0.000047	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	2.280	2.170	2.040	4.420	2.240	2.180	13.200	12.200	7.700	7.670	11.600	11.400	2.380	3.250
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.00010	0.00022	0.00016	0.00038	0.00025	0.00015	0.00018	0.00014	0.00042	0.00018	0.00017	0.00018	0.00015	0.00019	0.00047
Cobalt (Co)	mg/L		0.00010	0.00040	0.00067	0.00104	0.00169	0.00049	0.00028	0.00075	<0.00010	0.00031	0.00024	0.00044	0.00038	0.00018	0.00063
Copper (Cu)	mg/L	0.002-0.004[e]	0.00050	0.00210	0.00170	0.00492	0.00421	0.00243	0.00175	0.00166	0.00090	0.00233	0.00272	0.00163	0.00136	0.00150	0.00188
Iron (Fe)	mg/L	0.3	0.010	0.031	0.032	0.062	0.011	0.041	0.068	0.077	0.122	0.014	0.014	<0.010	<0.010	0.055	0.884
Lead (Pb)	mg/L	0.001-0.007[f]	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000066
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0065	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	1.7300	1.6100	1.5500	2.9900	1.5700	1.5700	2.2300	2.5300	2.1800	2.1900	4.5500	3.9900	1.1400	1.3700
Manganese (Mn)	mg/L		0.000050	0.004520	0.007200	0.003390	0.001660	0.005230	0.004600	0.024500	0.003190	0.004160	0.003640	0.004860	0.004270	0.001850	0.016000
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	0.025-0.15[g]	0.00010	0.00929	0.00580	0.01010	0.01570	0.00886	0.00451	0.00535	0.00161	0.00638	0.00633	0.01250	0.01080	0.00280	0.00335
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.383	0.341	0.300	0.419	0.372	0.353	0.854	0.931	0.583	0.580	0.789	0.687	0.301	0.304
Selenium (Se)	mg/L	0.001	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.434	0.244	0.900	1.400	0.407	0.192	0.329	0.097	0.615	0.628	1.150	1.130	0.351	0.115
Silver (Ag)	mg/L	0.0001	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.740	0.685	0.673	1.100	0.630	0.663	0.939	1.160	0.837	0.833	1.290	1.140	0.612	0.712
Strontium (Sr)	mg/L		0.00020	0.01030	0.00985	0.00926	0.01940	0.00978	0.00939	0.13900	0.12700	0.05830	0.05900	0.06860	0.07010	0.01550	0.02370
Thallium (Tl)	mg/L	0.0008	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050

Appendix 3.4-1. Stream Water Quality Analytical Results, Back River Project, 2013

Stream Site Name				Wasp OF	Wasp OF	TIA OF	TIA OF	Giraffe OF	Giraffe OF	Umwelt OF	Umwelt OF	Llama OF	Llama OF	Llama OF	Llama OF	Goose Neck IF	Goose Neck IF
Site Code			Realized	WASPOF	WASPOF	TIAOF	TIAOF	GIROF	GIROF	UMWOF	UMWOF	LLAMAOF	LLAMAOF	LLAMAOF	LLAMAOF	GOONECKIF	GOONECKIF
Replicate			Detection									FDUP		FDUP			FDUP
Date Sampled		CCME Guidelines for the Protection of	Limit	11-Jun-13	23-Jul-13	11-Jun-13	23-Jul-13	11-Jun-13	24-Jul-13	11-Jun-13	23-Jul-13	11-Jun-13	11-Jun-13	23-Jul-13	23-Jul-13	11-Jun-13	23-Jul-13
ALS Sample ID #	Units	Freshwater Aquatic Life[a]	(RDL)	L1316465-7	L1338239-3	L1316465-6	L1338239-4	L1316465-5	L1338239-8	L1316465-4	L1338239-5	L1316465-3	L1316465-2	L1338239-2	L1338239-1	L1316465-1	L1338239-7
Total Metals *(cont'd)*																	
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	0.000010	0.000014	<0.000010	0.000039	0.000021	0.000015	<0.000010	<0.000010	<0.000010	0.000010	0.000011	<0.000010	<0.000010	<0.000010	0.000013
Vanadium (V)	mg/L		0.001000	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)	mg/L	0.03	0.0030	<0.0030	<0.0030	0.0040	0.0055	<0.0030	<0.0030	0.0034	<0.0030	0.0035	0.0034	0.0069	0.0065	<0.0030	<0.0030
Dissolved Metals																	
Aluminum (Al)	mg/L		0.0030	0.0209	0.0043	0.1180	0.0352	0.0349	0.0060	0.0275	<0.0030	0.0386	0.0388	0.0110	0.0108	0.0250	0.0125
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L		0.000030	0.000192	0.000145	0.000423	0.000275	0.000189	0.000164	0.000185	0.000223	0.000219	0.000234	0.000137	0.000153	0.000167	0.000410
Barium (Ba)	mg/L		0.000050	0.004230	0.003500	0.006260	0.009290	0.004700	0.003890	0.031900	0.023300	0.015000	0.015400	0.021200	0.021000	0.006530	0.007950
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L		0.005	<0.0050	<0.0050	<0.0050	0.0053	<0.0050	0.0053	0.0065	0.0054	<0.0050	<0.0050	0.0062	0.0095	<0.0050	<0.0050
Cadmium (Cd)	mg/L		0.000010	<0.000010	0.000014	0.000015	0.000031	<0.000010	<0.000010	0.000026	<0.000010	0.000019	0.000020	0.000047	0.000045	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	2.190	2.190	1.990	4.330	2.200	2.140	13.200	12.300	7.300	7.460	11.500	10.300	2.330	3.090
Chromium (Cr)	mg/L		0.00010	0.00014	<0.00010	0.00035	0.00018	0.00014	0.00011	0.00013	0.00011	0.00016	0.00016	0.00013	<0.00010	0.00018	0.00016
Cobalt (Co)	mg/L		0.00010	0.00030	0.00010	0.00099	0.00164	0.00040	<0.00010	0.00068	<0.00010	0.00025	0.00027	0.00037	0.00036	0.00015	<0.00010
Copper (Cu)	mg/L		0.00050	0.00178	0.00122	0.00454	0.00374	0.00214	0.00142	0.00109	0.00069	0.00209	0.00224	0.00117	0.00117	0.00129	0.00131
Iron (Fe)	mg/L		0.010	<0.010	<0.010	0.025	<0.010	<0.010	<0.010	0.012	<0.010	<0.010	<0.010	<0.010	<0.010	0.016	0.241
Lead (Pb)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0065	0.0056	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	1.6400	1.6800	1.4800	2.9700	1.5200	1.5600	2.1500	2.5100	2.1000	2.1700	3.9300	3.9800	1.1100	1.3600
Manganese (Mn)	mg/L		0.000050	0.003320	0.000621	0.003130	0.001560	0.004070	0.001360	0.022700	0.002740	0.003430	0.003830	0.004140	0.004010	0.001220	0.004250
Mercury (Hg)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L		0.00010	0.00832	0.00554	0.00948	0.01520	0.00834	0.00411	0.00528	0.00156	0.00608	0.00601	0.01070	0.01070	0.00272	0.00299
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.366	0.363	0.289	0.403	0.359	0.356	0.849	0.946	0.567	0.568	0.683	0.684	0.291	0.292
Selenium (Se)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.408	0.243	0.874	1.340	0.379	0.163	0.314	0.086	0.601	0.601	1.120	1.150	0.318	0.050
Silver (Ag)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.685	0.729	0.658	1.080	0.610	0.661	0.933	1.170	0.809	0.832	1.120	1.150	0.598	0.695
Strontium (Sr)	mg/L		0.00020	0.00969	0.00978	0.00876	0.01860	0.00918	0.00900	0.13600	0.12500	0.05480	0.05640	0.06840	0.06130	0.01490	0.02220
Thallium (Tl)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L		0.000010	0.000010	<0.000010	0.000035	0.000017	0.000013	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L		0.001000	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)	mg/L		0.0030	<0.0030	<0.0030	0.0041	0.0043	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0054	0.0049	<0.0030	<0.0030

Notes:

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment (accessed February 2014).

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultra-oligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Meso-eutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hyper-eutrophic.

d) Guidelines are hardness-dependent. Cadmium short-term guideline (mg/L) = $10^{\{1.016[\log(\text{hardness})]-1.71\}}$ / 1000 with a minimum of 0.00011 mg/L. Cadmium long-term guideline (mg/L) = $10^{\{0.83[\log(\text{hardness})]-2.46\}}$ / 1000 with a miniumum of 0.00004 mg/L.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness. At hardness >180 mg/L the copper guideline is 0.004 mg/L.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness. At hardness >180 mg/L the lead guideline is 0.007 mg/L.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness. At hardness >180 mg/L the nickel guideline is 0.15 mg/L.

h) RDL = Realized detection limit

Appendix 3.4-1. Stream Water Quality Analytical Results, Back River Project, 2013

Stream Site Name				Goose Neck IF	Goose OF	Goose OF	Goose OF	Propellor OF	Propellor OF	Reference B OF (Mid)	Reference B OF	Reference B OF	George OF	George OF	George OF	George OF	Lytle OF
Site Code			Realized	GOONECKIF	GOOSEOF	GOOSEOF	GOOSEOF	PROOF	PROOF	REFBOFMID	REFBOFWET	REFBOFWET	GEORGOF	GEORGOF	GEORGOF	GEORGOF	LYTLEOF
Replicate			Detection		FDUP								FDUP		FDUP		
Date Sampled		CCME Guidelines for the Protection of	Limit	23-Jul-13	12-Jun-13	12-Jun-13	24-Jul-13	12-Jun-13	24-Jul-13	11-Jun-13	13-Jun-13	26-Jul-13	13-Jun-13	13-Jun-13	25-Jul-13	25-Jul-13	13-Jun-13
ALS Sample ID #	Units	Freshwater Aquatic Life[a]	(RDL)	L1338239-6	L1316465-11	L1316465-10	L1338239-10	L1316465-8	L1338239-9	L1316465-16	L1317200-5	L1339503-5	L1317200-4	L1317200-3	L1339503-4	L1339503-3	L1317200-2
Physical Tests																	
Conductivity	µS/cm		2.0	33.8	42.0	41.9	43.1	26.1	24.6	20.0	26.1	22.8	55.5	55.7	60.9	61.3	52.6
Hardness (as $CaCO_3$)	mg/L		0.50	13.30	15.50	15.70	15.80	9.96	8.96	8.23	10.40	8.89	20.70	21.30	23.30	23.40	19.50
pH	pH	6.5-9.0	0.10	7.00	6.65	6.60	6.73	6.88	6.76	6.98	7.11	7.04	6.90	6.93	7.02	7.03	6.82
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		2.0	7.9	3.0	3.5	3.8	4.4	3.9	5.7	7.2	6.6	5.2	5.5	6.0	5.8	4.3
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		2.0	7.9	3.0	3.5	3.8	4.4	3.9	5.7	7.2	6.6	5.2	5.5	6.0	5.8	4.3
Total Suspended Solids	mg/L	dependent on background levels	3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	4.3	<3.0	4.7	<3.0	<3.0	<3.0
Total Dissolved Solids	mg/L		10	33	40	37	35	23	17	28	25	28	26	27	33	41	37
Turbidity	NTU	dependent on background levels	0.10	1.99	0.35	0.39	0.32	0.26	0.20	0.38	0.36	1.12	0.68	0.25	0.81	0.64	0.51
Nutrients																	
Ammonia, Total (as N)	mg/L	pH- and temperature-dependent	0.0050	0.0251	<0.0050	<0.0050	<0.0050	0.0059	<0.0050	0.0052	<0.0050	<0.0050	<0.0050	<0.0050	0.0054	0.0052	<0.0050
Nitrate (as N)	mg/L	short-term: 124; long-term: 3	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0237	0.0567	<0.0050	<0.0050	<0.0050	0.0056	0.0128	<0.0050	<0.0050	0.0066
Nitrite (as N)	mg/L	0.06	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L		0.05	0.62	0.21	0.22	0.23	0.16	0.18	0.32	0.29	0.70	0.15	0.15	<0.050	0.15	0.14
Ortho-phosphate (as P)	mg/L		0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus (P)	mg/L	Trigger ranges from guidance framework[c]	0.002	0.014	0.006	0.006	0.003	0.004	0.004	0.007	0.005	0.011	0.004	0.004	0.003	0.004	0.004
Anions																	
Bromide (Br)	mg/L		0.050	<0.050	0.058	0.060	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	mg/L	short-term: 640; long-term: 120	0.50	2.15	6.81	7.02	6.83	2.06	2.22	0.54	0.64	0.52	3.58	3.61	3.75	3.75	3.68
Fluoride (F)	mg/L	0.12[b]	0.02	0.03	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.02	0.02	0.03	0.03	0.02
Sulfate (SO_4)	mg/L		0.5	4.0	4.1	4.3	4.8	4.0	3.4	2.3	3.8	2.9	13.7	13.8	15.4	15.4	13.0
Cyanides																	
Cyanide, Total	mg/L		0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cyanide, Free	mg/L	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic Carbon																	
Total Organic Carbon	mg/L		0.50	6.97	4.97	4.84	3.35	3.56	2.75	6.64	4.27	5.19	2.56	2.49	2.19	2.02	2.48
Total Metals																	
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.0030	0.0391	0.0392	0.0395	0.0085	0.0109	0.0057	0.0262	0.0074	0.0104	0.0239	0.0248	0.0125	0.0139	0.0309
Antimony (Sb)	mg/L		0.00005	<0.000050	0.000054	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L	0.005	0.000030	0.000565	0.000196	0.000213	0.000182	0.000163	0.000122	0.000158	0.000200	0.000357	0.000443	0.000422	0.000468	0.000454	0.000461
Barium (Ba)	mg/L		0.000050	0.008590	0.008970	0.008960	0.007000	0.004810	0.003970	0.005040	0.005400	0.004530	0.002910	0.002990	0.002120	0.002090	0.002940
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.005	0.0053	0.0078	<0.0050	0.0058	<0.0050	0.0056	<0.0050	<0.0050	0.0056	<0.0050	<0.0050	0.0054	0.0052	<0.0050
Cadmium (Cd)	mg/L	equation[d]	0.000010	0.000014	0.000015	0.000016	<0.000010	<0.000010	0.001150	<0.000010	<0.000010	<0.000010	0.000010	0.000011	<0.000010	<0.000010	0.000012
Calcium (Ca)	mg/L		0.020	3.180	4.060	4.090	3.950	2.090	1.920	1.540	1.910	1.610	5.350	5.370	5.770	5.820	5.180
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.00010	0.00038	0.00020	0.00030	0.00013	0.00011	0.00013	0.00017	<0.00010	0.00012	<0.00010	<0.00010	<0.00010	<0.00010	0.00012
Cobalt (Co)	mg/L		0.00010	0.00071	0.00066	0.00071	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00016	0.00128	0.00129	0.00044	0.00046	0.00034
Copper (Cu)	mg/L	0.002-0.004[e]	0.00050	0.00180	0.00242	0.00172	0.00119	0.00116	0.00084	0.00122	0.00106	0.00082	0.00194	0.00203	0.00151	0.00147	0.00213
Iron (Fe)	mg/L	0.3	0.010	0.776	0.050	0.049	0.036	0.025	0.016	0.066	0.040	0.711	0.030	0.030	0.052	0.054	0.040
Lead (Pb)	mg/L	0.001-0.007[f]	0.000050	0.000105	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	1.3200	1.4800	1.4400	1.5600	1.2000	0.9930	1.0500	1.4000	1.1900	1.9300	1.9600	2.1400	2.1200	1.7700
Manganese (Mn)	mg/L		0.000050	0.016500	0.012100	0.012100	0.002520	0.004310	0.001240	0.001330	0.003560	0.007490	0.012500	0.012400	0.006390	0.006620	0.005080
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	0.025-0.15[g]	0.00010	0.00326	0.00607	0.00579	0.00302	0.00266	0.00148	0.00150	0.00142	0.00120	0.00673	0.00674	0.00261	0.00266	0.00848
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.285	0.426	0.422	0.395	0.359	0.324	0.316	0.394	0.333	0.355	0.365	0.385	0.382	0.340
Selenium (Se)	mg/L	0.001	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.108	0.291	0.294	0.128	0.182	0.096	0.267	0.154	0.161	0.179	0.182	0.075	0.075	0.269
Silver (Ag)	mg/L	0.0001	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.684	0.652	0.597	0.665	0.604	0.490	0.594	0.714	0.550	0.755	0.770	0.804	0.800	0.736
Strontium (Sr)	mg/L		0.00020	0.02320	0.03110	0.03040	0.02610	0.01000	0.00940	0.00559	0.00685	0.00602	0.02020	0.02000	0.02230	0.02240	0.02230
Thallium (Tl)	mg/L	0.0008	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050

Appendix 3.4-1. Stream Water Quality Analytical Results, Back River Project, 2013

Stream Site Name				Goose Neck IF	Goose OF	Goose OF	Goose OF	Propellor OF	Propellor OF	Reference B OF (Mid)	Reference B OF	Reference B OF	George OF	George OF	George OF	George OF	Lytle OF
Site Code			Realized	GOONECKIF	GOOSEOF	GOOSEOF	GOOSEOF	PROOF	PROOF	REFBOFMID	REFBOFWET	REFBOFWET	GEORGOF	GEORGOF	GEORGOF	GEORGOF	LYTLEOF
Replicate			Detection		FDUP								FDUP		FDUP		
Date Sampled		CCME Guidelines for the Protection of	Limit	23-Jul-13	12-Jun-13	12-Jun-13	24-Jul-13	12-Jun-13	24-Jul-13	11-Jun-13	13-Jun-13	26-Jul-13	13-Jun-13	13-Jun-13	25-Jul-13	25-Jul-13	13-Jun-13
ALS Sample ID #	Units	Freshwater Aquatic Life[a]	(RDL)	L1338239-6	L1316465-11	L1316465-10	L1338239-10	L1316465-8	L1338239-9	L1316465-16	L1317200-5	L1339503-5	L1317200-4	L1317200-3	L1339503-4	L1339503-3	L1317200-2
Total Metals *(cont'd)*																	
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000013
Vanadium (V)	mg/L		0.001000	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)	mg/L	0.03	0.0030	<0.0030	0.0032	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0053	0.0053	<0.0030	<0.0030	0.0047
Dissolved Metals																	
Aluminum (Al)	mg/L		0.0030	0.0097	0.0293	0.0290	0.0048	0.0084	0.0041	0.0218	0.0046	<0.0030	0.0143	0.0138	0.0079	0.0076	0.0134
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L		0.000030	0.000408	0.000150	0.000173	0.000139	0.000134	0.000098	0.000139	0.000159	0.000271	0.000387	0.000366	0.000389	0.000398	0.000378
Barium (Ba)	mg/L		0.000050	0.008020	0.008800	0.008640	0.006970	0.004780	0.003910	0.004990	0.005060	0.004530	0.002760	0.002870	0.002140	0.002150	0.002800
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L		0.005	0.0055	0.005	<0.0050	0.0055	<0.0050	0.005	<0.0050	<0.0050	<0.0050	<0.0050	0.0051	<0.0050	<0.0050	0.0055
Cadmium (Cd)	mg/L		0.000010	0.000032	0.000014	0.000012	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000012	0.000012	<0.000010	<0.000010	0.000013
Calcium (Ca)	mg/L		0.020	3.130	3.890	3.980	3.840	2.080	1.940	1.570	1.900	1.580	5.150	5.430	5.830	5.830	5.000
Chromium (Cr)	mg/L		0.00010	0.00024	0.00013	0.00013	0.00013	0.00013	<0.00010	0.00019	0.00012	<0.00010	<0.00010	0.00012	0.00010	<0.00010	0.00011
Cobalt (Co)	mg/L		0.00010	0.00014	0.00052	0.00054	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00093	0.00088	0.00036	0.00038	0.00028
Copper (Cu)	mg/L		0.00050	0.00131	0.00163	0.00155	0.00095	0.00098	0.00073	0.00101	0.00059	0.00069	0.00158	0.00161	0.00116	0.00116	0.00171
Iron (Fe)	mg/L		0.010	0.156	0.010	0.010	<0.010	<0.010	<0.010	0.024	<0.010	0.198	<0.010	<0.010	0.018	0.020	<0.010
Lead (Pb)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	1.3300	1.4000	1.4100	1.5200	1.1600	1.0000	1.0500	1.3800	1.2000	1.9100	1.8900	2.1300	2.1400	1.7000
Manganese (Mn)	mg/L		0.000050	0.007030	0.010300	0.010400	0.001650	0.001330	0.000342	0.000936	0.001580	0.003630	0.009020	0.008990	0.005580	0.005710	0.004550
Mercury (Hg)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L		0.00010	0.00288	0.00552	0.00551	0.00278	0.00251	0.00147	0.00144	0.00132	0.00106	0.00620	0.00629	0.00250	0.00253	0.00799
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.285	0.412	0.415	0.386	0.352	0.331	0.320	0.391	0.345	0.352	0.348	0.388	0.391	0.338
Selenium (Se)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.057	0.258	0.260	0.119	0.168	0.096	0.251	0.145	0.162	0.165	0.171	0.070	0.073	0.223
Silver (Ag)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.725	0.579	0.581	0.645	0.588	0.502	0.594	0.698	0.565	0.742	0.733	0.806	0.813	0.715
Strontium (Sr)	mg/L		0.00020	0.02230	0.02850	0.02870	0.02500	0.00960	0.00935	0.00548	0.00680	0.00579	0.01940	0.02050	0.02200	0.02200	0.02150
Thallium (Tl)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L		0.001000	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)	mg/L		0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0045	0.0046	<0.0030	<0.0030	0.0041

Notes:

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment (accessed February 2014).

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultra-oligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Meso-eutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hyper-eutrophic.

d) Guidelines are hardness-dependent. Cadmium short-term guideline (mg/L) = $10^{\{1.016[log(hardness)]-1.71\}}$ / 1000 with a minimum of 0.00011 mg/L. Cadmium long-term guideline (mg/L) = $10^{\{0.83[log(hardness)]-2.46\}}$ / 1000 with a miniumum of 0.00004 mg/L.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[ln(hardness)]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness. At hardness >180 mg/L the copper guideline is 0.004 mg/L.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[ln(hardness)]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness. At hardness >180 mg/L the lead guideline is 0.007 mg/L.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[ln(hardness)]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness. At hardness >180 mg/L the nickel guideline is 0.15 mg/L.

h) RDL = Realized detection limit

Appendix 3.4-1. Stream Water Quality Analytical Results, Back River Project, 2013

Stream Site Name				Lytle OF	Sleigh OF	Sleigh OF	Komatic IF	Komatic IF	McCoy IF	McCoy OF	McCoy OF	Reference Q OF	Reference Q OF
Site Code			Realized	LYTLEOF	SLEIGHOF	SLEIGHOF	KOMAIF	KOMAIF	MCCOYIF	MCCOYWOF	MCCOYWOF	REFQOF	REFQOF
Replicate			Detection										
Date Sampled		CCME Guidelines for the Protection of	Limit	27-Jul-13	12-Jun-13	27-Jul-13	12-Jun-13	27-Jul-13	12-Jun-13	13-Jun-13	25-Jul-13	12-Jun-13	25-Jul-13
ALS Sample ID #	Units	Freshwater Aquatic Life[a]	(RDL)	L1339503-8	L1316465-15	L1339503-7	L1316465-14	L1339503-6	L1316465-13	L1317200-1	L1339503-2	L1316465-12	L1339503-1
Physical Tests													
Conductivity	µS/cm		2.0	69.2	44.5	109.0	52.8	101.0	33.8	35.3	52.4	39.5	69.9
Hardness (as $CaCO_3$)	mg/L		0.50	27.00	16.40	40.70	20.30	39.00	13.80	13.90	22.30	14.80	26.40
pH	pH	6.5-9.0	0.10	7.10	6.63	7.00	7.03	7.10	7.00	7.14	7.16	6.63	6.81
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		2.0	6.5	2.7	6.0	5.9	8.2	6.7	7.4	10.2	2.9	5.0
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		2.0	6.5	2.7	6.0	5.9	8.2	6.7	7.4	10.2	2.9	5.0
Total Suspended Solids	mg/L	dependent on background levels	3.0	3.3	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Total Dissolved Solids	mg/L		10	45	38	79	43	71	38	30	35	31	44
Turbidity	NTU	dependent on background levels	0.10	0.44	0.41	0.55	0.43	0.70	0.43	0.45	0.79	0.50	0.43
Nutrients													
Ammonia, Total (as N)	mg/L	pH- and temperature-dependent	0.0050	0.0070	<0.0050	0.0125	<0.0050	0.0186	0.0116	<0.0050	0.0184	<0.0050	0.0050
Nitrate (as N)	mg/L	short-term: 124; long-term: 3	0.0050	0.0322	0.0091	0.0421	<0.0050	0.0143	<0.0050	<0.0050	0.3300	<0.0050	0.0778
Nitrite (as N)	mg/L	0.06	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L		0.05	0.18	0.16	0.20	0.18	0.35	0.36	0.21	0.15	0.17	0.23
Ortho-phosphate (as P)	mg/L		0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Phosphorus (P)	mg/L	Trigger ranges from guidance framework[c]	0.002	0.005	0.005	0.003	0.005	0.005	0.006	0.013	0.003	0.005	0.004
Anions													
Bromide (Br)	mg/L		0.050	<0.050	<0.050	0.098	<0.050	0.076	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	mg/L	short-term: 640; long-term: 120	0.50	4.54	5.26	12.10	4.87	9.95	0.53	0.57	0.77	<0.50	0.89
Fluoride (F)	mg/L	0.12[b]	0.02	0.03	0.02	0.03	0.02	0.03	0.02	0.02	0.02	0.02	0.03
Sulfate (SO_4)	mg/L		0.5	16.9	8.7	23.8	10.0	21.0	7.5	7.0	10.9	13.5	23.5
Cyanides													
Cyanide, Total	mg/L		0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cyanide, Free	mg/L	0.005	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Organic Carbon													
Total Organic Carbon	mg/L		0.50	2.17	2.81	2.74	3.51	5.08	7.06	3.90	2.66	3.61	3.79
Total Metals													
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.0030	0.0093	0.0514	0.0129	0.0456	0.0113	0.0395	0.0199	0.0095	0.0446	0.0130
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L	0.005	0.000030	0.000435	0.000542	0.000584	0.000733	0.001070	0.000933	0.000412	0.000328	0.000309	0.000299
Barium (Ba)	mg/L		0.000050	0.002790	0.002850	0.004680	0.002750	0.004240	0.003370	0.002330	0.003380	0.003580	0.005210
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.005	0.0057	<0.0050	<0.0050	<0.0050	0.0069	<0.0050	<0.0050	0.0051	<0.0050	0.0104
Cadmium (Cd)	mg/L	equation[d]	0.000010	<0.000010	0.000021	0.000010	0.000013	0.000018	<0.000010	<0.000010	0.000012	0.000024	0.000022
Calcium (Ca)	mg/L		0.020	6.690	4.390	11.300	5.110	10.100	3.600	3.600	5.420	2.420	4.430
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.00010	0.00013	0.00012	<0.00010	0.00016	0.00015	0.00026	0.00018	0.00015	0.00019	0.00016
Cobalt (Co)	mg/L		0.00010	0.00026	0.00103	0.00040	0.00061	0.00072	0.00051	<0.00010	<0.00010	0.00163	0.00066
Copper (Cu)	mg/L	0.002-0.004[e]	0.00050	0.00167	0.00320	0.00206	0.00265	0.00220	0.00304	0.00268	0.00211	0.00256	0.00222
Iron (Fe)	mg/L	0.3	0.010	0.045	0.063	0.097	0.071	0.174	0.096	0.032	0.027	0.068	0.112
Lead (Pb)	mg/L	0.001-0.007[f]	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000079	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	2.4200	1.1900	3.2200	1.8600	3.3700	1.1300	1.2900	1.8000	2.0900	3.5800
Manganese (Mn)	mg/L		0.000050	0.003640	0.012700	0.009550	0.004980	0.011500	0.001390	0.000479	0.000977	0.008640	0.008150
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	0.025-0.15[g]	0.00010	0.00410	0.00965	0.00528	0.00789	0.00639	0.00805	0.00614	0.00564	0.01700	0.01590
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.431	0.318	0.586	0.366	0.543	0.105	0.305	0.323	0.257	0.374
Selenium (Se)	mg/L	0.001	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.095	0.267	0.128	0.317	0.098	0.192	0.341	0.585	0.395	0.198
Silver (Ag)	mg/L	0.0001	0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.909	0.505	1.170	0.571	1.080	0.690	0.672	0.794	0.594	0.995
Strontium (Sr)	mg/L		0.00020	0.02690	0.03320	0.07540	0.03610	0.05770	0.01040	0.01040	0.01530	0.00900	0.01700
Thallium (Tl)	mg/L	0.0008	0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050

Appendix 3.4-1. Stream Water Quality Analytical Results, Back River Project, 2013

Stream Site Name				Lytle OF	Sleigh OF	Sleigh OF	Komatic IF	Komatic IF	McCoy IF	McCoy OF	McCoy OF	Reference Q OF	Reference Q OF
Site Code			Realized	LYTLEOF	SLEIGHOF	SLEIGHOF	KOMAIF	KOMAIF	MCCOYIF	MCCOYWOF	MCCOYWOF	REFQOF	REFQOF
Replicate			Detection										
Date Sampled		CCME Guidelines for the Protection of	Limit	27-Jul-13	12-Jun-13	27-Jul-13	12-Jun-13	27-Jul-13	12-Jun-13	13-Jun-13	25-Jul-13	12-Jun-13	25-Jul-13
ALS Sample ID #	Units	Freshwater Aquatic Life[a]	(RDL)	L1339503-8	L1316465-15	L1339503-7	L1316465-14	L1339503-6	L1316465-13	L1317200-1	L1339503-2	L1316465-12	L1339503-1
Total Metals *(cont'd)*													
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	0.000010	<0.000010	0.000016	<0.000010	0.000012	0.000013	0.000018	0.000011	<0.000010	0.000012	0.000015
Vanadium (V)	mg/L		0.001000	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)	mg/L	0.03	0.0030	0.0037	0.0056	<0.0030	0.0044	0.0032	0.0052	0.0032	0.0036	0.0157	0.0120
Dissolved Metals													
Aluminum (Al)	mg/L		0.0030	0.0034	0.0311	0.0039	0.0197	0.0047	0.0326	0.0122	0.0070	0.0321	0.0046
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L		0.000030	0.000381	0.000437	0.000453	0.000639	0.000800	0.000835	0.000337	0.000342	0.000297	0.000251
Barium (Ba)	mg/L		0.000050	0.002930	0.002770	0.004390	0.002580	0.004200	0.003250	0.002300	0.003930	0.003410	0.005460
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L		0.005	0.0054	0.005	0.0057	<0.0050	0.0057	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Cadmium (Cd)	mg/L		0.000010	<0.000010	0.000016	0.000011	0.000012	0.000015	<0.000010	<0.000010	<0.000010	0.000020	0.000022
Calcium (Ca)	mg/L		0.020	6.540	4.650	11.100	5.210	10.100	3.710	3.510	5.400	2.560	4.510
Chromium (Cr)	mg/L		0.00010	<0.00010	0.00012	<0.00010	0.00014	0.00012	0.00027	0.00016	0.00012	0.00016	<0.00010
Cobalt (Co)	mg/L		0.00010	0.00012	0.00096	0.00033	0.00047	0.00054	0.00045	<0.00010	<0.00010	0.00148	0.00057
Copper (Cu)	mg/L		0.00050	0.00141	0.00273	0.00166	0.00247	0.00174	0.00274	0.00208	0.00217	0.00229	0.00195
Iron (Fe)	mg/L		0.010	<0.010	0.011	0.024	0.013	0.063	0.049	<0.010	<0.010	<0.010	0.032
Lead (Pb)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	2.6000	1.1700	3.1800	1.7700	3.3700	1.1100	1.2400	2.1300	2.0400	3.6700
Manganese (Mn)	mg/L		0.000050	0.002170	0.012100	0.008090	0.003750	0.009760	0.001180	0.000231	0.000746	0.007530	0.007220
Mercury (Hg)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L		0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L		0.00010	0.00419	0.00934	0.00511	0.00738	0.00607	0.00766	0.00561	0.00650	0.01590	0.01590
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	0.465	0.318	0.577	0.349	0.536	0.103	0.286	0.384	0.256	0.430
Selenium (Se)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	0.088	0.249	0.124	0.263	0.096	0.172	0.312	0.569	0.336	0.196
Silver (Ag)	mg/L		0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	0.977	0.499	1.170	0.542	1.080	0.671	0.639	0.944	0.567	1.050
Strontium (Sr)	mg/L		0.00020	0.02580	0.03370	0.07450	0.03490	0.05640	0.01040	0.01010	0.01490	0.00900	0.01690
Thallium (Tl)	mg/L		0.00005	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L		0.000010	<0.000010	0.000014	<0.000010	0.000012	<0.000010	0.000017	<0.000010	<0.000010	0.000011	<0.000010
Vanadium (V)	mg/L		0.001000	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)	mg/L		0.0030	<0.0030	0.0053	<0.0030	0.0040	<0.0030	0.0049	<0.0030	0.0035	0.0147	0.0113

Notes:

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment (accessed February 2014).

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultra-oligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Meso-eutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hyper-eutrophic.

d) Guidelines are hardness-dependent. Cadmium short-term guideline (mg/L) = $10^{\{1.016[\log(\text{hardness})]-1.71\}}$ / 1000 with a minimum of 0.00011 mg/L. Cadmium long-term guideline (mg/L) = $10^{\{0.83[\log(\text{hardness})]-2.46\}}$ / 1000 with a miniumum of 0.00004 mg/L.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness. At hardness >180 mg/L the copper guideline is 0.004 mg/L.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness. At hardness >180 mg/L the lead guideline is 0.007 mg/L.

g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness. At hardness >180 mg/L the nickel guideline is 0.15 mg/L.

h) RDL = Realized detection limit

Appendix 3.4-2

Stream Water Quality Analytical Results of Field Duplicates, Back River Project, 2013

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Appendix 3.4-2. Stream Water Quality Analytical Results of Field Duplicates, Back River Project, 2013

Stream Site Name	Llama OF				Llama OF				Goose Neck IF				Goose OF			
Site Code	LLAMAOF	LLAMAOF			LLAMAOF	LLAMAOF			GOONECKIF	GOONECKIF			GOOSEOF	GOOSEOF		
Replicate		FDUP				FDUP				FDUP				FDUP		
Date Sampled	11-Jun-13	11-Jun-13			23-Jul-13	23-Jul-13			23-Jul-13	23-Jul-13			12-Jun-13	12-Jun-13		
ALS Sample ID #	L1316465-2	L1316465-3	5 x Detection Limit	RPD[a]	L1338239-1	L1338239-2	5 x Detection Limit	RPD[a]	L1338239-6	L1338239-7	5 x Detection Limit	RPD[a]	L1316465-10	L1316465-11	5 x Detection Limit	RPD[a]
Physical Tests																
Conductivity	75.4	75.4	10	0.0	123.0	126.0	10	2.4	33.8	33.9	10	0.3	41.9	42.0	10	0.2
Hardness (as $CaCO_3$)	27.5	26.9	2.5	2.2	42.1	44.8	2.5	6.2	13.3	13.3	2.5	0.0	15.7	15.5	2.5	1.3
pH	6.64	6.62	0.5	0.3	7.10	6.86	0.5	3.4	7.00	6.99	0.5	0.1	6.60	6.65	0.5	0.8
Alkalinity, Bicarbonate (as $CaCO_3$)	3.0	2.9	10	RPD-N/A	5.5	4.4	10	RPD-N/A	7.9	7.9	10	RPD-N/A	3.5	3.0	10	RPD-N/A
Alkalinity, Carbonate (as $CaCO_3$)	1	1	10	RPD-N/A	1	1	10	RPD-N/A	1	1	10	RPD-N/A	1	1	10	RPD-N/A
Alkalinity, Hydroxide (as $CaCO_3$)	1	1	10	RPD-N/A	1	1	10	RPD-N/A	1	1	10	RPD-N/A	1	1	10	RPD-N/A
Alkalinity, Total (as $CaCO_3$)	3.0	2.9	10	RPD-N/A	5.5	4.4	10	RPD-N/A	7.9	7.9	10	RPD-N/A	3.5	3.0	10	RPD-N/A
Total Suspended Solids	1.5	1.5	15	RPD-N/A	1.5	1.5	15	RPD-N/A	1.5	1.5	15	RPD-N/A	1.5	1.5	15	RPD-N/A
Total Dissolved Solids	74	73	50	1.4	118	112	50	5.2	33	34	50	RPD-N/A	37	40	50	RPD-N/A
Turbidity	0.19	0.20	0.5	RPD-N/A	0.13	0.14	0.5	RPD-N/A	1.99	2.08	0.5	4.4	0.39	0.35	0.5	RPD-N/A
Nutrients																
Ammonia, Total (as N)	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A	0.0251	0.0256	0.025	2.0	0.0025	0.0025	0.025	RPD-N/A
Nitrate (as N)	0.0101	0.0099	0.025	RPD-N/A	0.2580	0.2580	0.025	0.0	0.0025	0.0058	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A
Nitrite (as N)	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A
Total Kjeldahl Nitrogen	0.197	0.179	0.25	RPD-N/A	0.075	0.103	0.25	RPD-N/A	0.623	0.607	0.25	2.6	0.216	0.21	0.25	RPD-N/A
Ortho-phosphate (as P)	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A
Total Phosphorus (P)	0.0040	0.0039	0.01	RPD-N/A	0.0010	0.0010	0.01	RPD-N/A	0.0139	0.0164	0.01	16.5	0.0060	0.0058	0.01	RPD-N/A
Anions																
Bromide (Br)	0.153	0.154	0.25	RPD-N/A	0.251	0.256	0.25	2.0	0.025	0.025	0.25	RPD-N/A	0.06	0.058	0.25	RPD-N/A
Chloride (Cl)	16.10	16.00	2.5	0.6	26.10	26.20	2.5	0.4	2.15	2.17	2.5	RPD-N/A	7.02	6.81	2.5	3.0
Fluoride (F)	0.010	0.010	0.1	RPD-N/A	0.010	0.010	0.1	RPD-N/A	0.028	0.028	0.1	RPD-N/A	0.010	0.010	0.1	RPD-N/A
Sulfate (SO^4)	5.26	5.28	2.5	0.4	8.39	8.47	2.5	0.9	4.01	4.08	2.5	1.7	4.26	4.12	2.5	3.3
Cyanides																
Cyanide, Total	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A
Cyanide, Free	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A
Organic Carbon																
Total Organic Carbon	4.71	4.66	2.5	1.1	1.64	1.70	2.5	RPD-N/A	6.97	6.86	2.5	1.6	4.84	4.97	2.5	2.7
Total Metals																
Aluminum (Al)	0.0438	0.0425	0.015	3.0	0.0121	0.0137	0.015	RPD-N/A	0.0391	0.0486	0.015	*21.7*	0.0395	0.0392	0.015	0.8
Antimony (Sb)	0.000025	0.000025	0.00025	RPD-N/A	0.000074	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000054	0.00025	RPD-N/A
Arsenic (As)	0.000241	0.000245	0.00015	1.6	0.000188	0.000188	0.00015	0.0	0.000565	0.000600	0.00015	6.0	0.000213	0.000196	0.00015	8.3
Barium (Ba)	0.01610	0.01610	0.00025	0.0	0.02120	0.02400	0.00025	12.4	0.00859	0.00887	0.00025	3.2	0.00896	0.00897	0.00025	0.1
Beryllium (Be)	0.0001	0.0001	0.001	RPD-N/A	0.0001	0.0001	0.001	RPD-N/A	0.0001	0.0001	0.001	RPD-N/A	0.0001	0.0001	0.001	RPD-N/A
Bismuth (Bi)	0.00025	0.00025	0.0025	RPD-N/A	0.00025	0.00025	0.0025	RPD-N/A	0.00025	0.00025	0.0025	RPD-N/A	0.00025	0.00025	0.0025	RPD-N/A
Boron (B)	0.0025	0.0025	0.025	RPD-N/A	0.0090	0.0076	0.025	RPD-N/A	0.0053	0.0061	0.025	RPD-N/A	0.0025	0.0078	0.025	RPD-N/A
Cadmium (Cd)	0.000018	0.000021	0.00005	RPD-N/A	0.000047	0.000063	0.00005	RPD-N/A	0.000014	0.000005	0.00005	RPD-N/A	0.000016	0.000015	0.00005	RPD-N/A
Calcium (Ca)	7.67	7.70	0.1	0.4	11.40	11.60	0.1	1.7	3.18	3.25	0.1	2.2	4.09	4.06	0.1	0.7
Chromium (Cr)	0.00017	0.00018	0.0005	RPD-N/A	0.00015	0.00018	0.0005	RPD-N/A	0.00038	0.00047	0.0005	RPD-N/A	0.00030	0.00020	0.0005	RPD-N/A
Cobalt (Co)	0.00024	0.00031	0.0005	RPD-N/A	0.00038	0.00044	0.0005	RPD-N/A	0.00071	0.00063	0.0005	11.9	0.00071	0.00066	0.0005	7.3
Copper (Cu)	0.00272	0.00233	0.0025	RPD-N/A	0.00136	0.00163	0.0025	RPD-N/A	0.00180	0.00188	0.0025	RPD-N/A	0.00172	0.00242	0.0025	RPD-N/A
Iron (Fe)	0.014	0.014	0.05	RPD-N/A	0.005	0.005	0.05	RPD-N/A	0.776	0.884	0.05	13.0	0.049	0.050	0.05	RPD-N/A
Lead (Pb)	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000105	0.000066	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A
Lithium (Li)	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A
Magnesium (Mg)	2.19	2.18	0.025	0.5	3.99	4.55	0.025	13.1	1.32	1.37	0.025	3.7	1.44	1.48	0.025	2.7
Manganese (Mn)	0.0036	0.0042	0.00025	13.3	0.0043	0.0049	0.00025	12.9	0.0165	0.0160	0.00025	3.1	0.0121	0.0121	0.00025	0.0
Mercury (Hg)	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A
Molybdenum (Mo)	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A
Nickel (Ni)	0.00633	0.00638	0.0005	0.8	0.01080	0.01250	0.0005	14.6	0.00326	0.00335	0.0005	2.7	0.00579	0.00607	0.0005	4.7
Phosphorus (P)	0.15	0.15	1.5	RPD-N/A	0.15	0.15	1.5	RPD-N/A	0.15	0.15	1.5	RPD-N/A	0.15	0.15	1.5	RPD-N/A
Potassium (K)	0.580	0.583	0.25	0.5	0.687	0.789	0.25	13.8	0.285	0.304	0.25	6.5	0.422	0.426	0.25	0.9
Selenium (Se)	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A
Silicon (Si)	0.628	0.615	0.25	2.1	1.130	1.150	0.25	1.8	0.108	0.115	0.25	RPD-N/A	0.294	0.291	0.25	1.0
Silver (Ag)	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A
Sodium (Na)	0.833	0.837	0.05	0.5	1.140	1.290	0.05	12.3	0.684	0.712	0.05	4.0	0.597	0.652	0.05	8.8
Strontium (Sr)	0.0590	0.0583	0.001	1.2	0.0701	0.0686	0.001	2.2	0.0232	0.0237	0.001	2.1	0.0304	0.0311	0.001	2.3
Thallium (Tl)	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A
Tin (Sn)	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A

Appendix 3.4-2. Stream Water Quality Analytical Results of Field Duplicates, Back River Project, 2013

Stream Site Name	Llama OF				Llama OF				Goose Neck IF				Goose OF			
Site Code	LLAMAOF	LLAMAOF			LLAMAOF	LLAMAOF			GOONECKIF	GOONECKIF			GOOSEOF	GOOSEOF		
Replicate		FDUP				FDUP				FDUP				FDUP		
Date Sampled	11-Jun-13	11-Jun-13			23-Jul-13	23-Jul-13			23-Jul-13	23-Jul-13			12-Jun-13	12-Jun-13		
ALS Sample ID #	L1316465-2	L1316465-3	5 x Detection Limit	RPD[a]	L1338239-1	L1338239-2	5 x Detection Limit	RPD[a]	L1338239-6	L1338239-7	5 x Detection Limit	RPD[a]	L1316465-10	L1316465-11	5 x Detection Limit	RPD[a]
Total Metals *(cont'd)*																
Titanium (Ti)	0.005	0.005	0.05	RPD-N/A	0.005	0.005	0.05	RPD-N/A	0.005	0.005	0.05	RPD-N/A	0.005	0.005	0.05	RPD-N/A
Uranium (U)	0.000011	0.000010	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000013	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A
Vanadium (V)	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A
Zinc (Zn)	0.0034	0.0035	0.015	RPD-N/A	0.0065	0.0069	0.015	RPD-N/A	0.0015	0.0015	0.015	RPD-N/A	0.0015	0.0032	0.015	RPD-N/A
Dissolved Metals																
Aluminum (Al)	0.0388	0.0386	0.015	0.5	0.0108	0.0110	0.015	RPD-N/A	0.0097	0.0125	0.015	RPD-N/A	0.0290	0.0293	0.015	1.0
Antimony (Sb)	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A
Arsenic (As)	0.000234	0.000219	0.00015	6.6	0.000153	0.000137	0.00015	RPD-N/A	0.000408	0.000410	0.00015	0.5	0.000173	0.000150	0.00015	RPD-N/A
Barium (Ba)	0.01540	0.01500	0.00025	2.6	0.02100	0.02120	0.00025	0.9	0.00802	0.00795	0.00025	0.9	0.00864	0.00880	0.00025	1.8
Beryllium (Be)	0.0001	0.0001	0.001	RPD-N/A	0.0001	0.0001	0.001	RPD-N/A	0.0001	0.0001	0.001	RPD-N/A	0.0001	0.0001	0.001	RPD-N/A
Bismuth (Bi)	0.00025	0.00025	0.0025	RPD-N/A	0.00025	0.00025	0.0025	RPD-N/A	0.00025	0.00025	0.0025	RPD-N/A	0.00025	0.00025	0.0025	RPD-N/A
Boron (B)	0.0025	0.0025	0.025	RPD-N/A	0.0095	0.0062	0.025	RPD-N/A	0.0055	0.0025	0.025	RPD-N/A	0.0025	0.0050	0.025	RPD-N/A
Cadmium (Cd)	0.00002	0.000019	0.00005	RPD-N/A	0.000045	0.000047	0.00005	RPD-N/A	0.000032	0.000005	0.00005	RPD-N/A	0.000012	0.000014	0.00005	RPD-N/A
Calcium (Ca)	7.46	7.30	0.1	2.2	10.30	11.50	0.1	11.0	3.13	3.09	0.1	1.3	3.98	3.89	0.1	2.3
Chromium (Cr)	0.00016	0.00016	0.0005	RPD-N/A	0.00005	0.00013	0.0005	RPD-N/A	0.00024	0.00016	0.0005	RPD-N/A	0.00013	0.00013	0.0005	RPD-N/A
Cobalt (Co)	0.00027	0.00025	0.0005	RPD-N/A	0.00036	0.00037	0.0005	RPD-N/A	0.00014	0.00005	0.0005	RPD-N/A	0.00054	0.00052	0.0005	3.8
Copper (Cu)	0.00224	0.00209	0.0025	RPD-N/A	0.00117	0.00117	0.0025	RPD-N/A	0.00131	0.00131	0.0025	RPD-N/A	0.00155	0.00163	0.0025	RPD-N/A
Iron (Fe)	0.005	0.005	0.05	RPD-N/A	0.005	0.005	0.05	RPD-N/A	0.156	0.241	0.05	*42.8*	0.010	0.010	0.05	RPD-N/A
Lead (Pb)	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A
Lithium (Li)	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A
Magnesium (Mg)	2.17	2.10	0.025	3.3	3.98	3.93	0.025	1.3	1.33	1.36	0.025	2.2	1.41	1.40	0.025	0.7
Manganese (Mn)	0.0038	0.0034	0.00025	11.0	0.0040	0.0041	0.00025	3.2	0.0070	0.0043	0.00025	*49.3*	0.0104	0.0103	0.00025	1.0
Mercury (Hg)	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A
Molybdenum (Mo)	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A
Nickel (Ni)	0.00601	0.00608	0.0005	1.2	0.01070	0.01070	0.0005	0.0	0.00288	0.00299	0.0005	3.7	0.00551	0.00552	0.0005	0.2
Phosphorus (P)	0.15	0.15	1.5	RPD-N/A	0.15	0.15	1.5	RPD-N/A	0.15	0.15	1.5	RPD-N/A	0.15	0.15	1.5	RPD-N/A
Potassium (K)	0.568	0.567	0.25	0.2	0.684	0.683	0.25	0.1	0.285	0.292	0.25	2.4	0.415	0.412	0.25	0.7
Selenium (Se)	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A
Silicon (Si)	0.601	0.601	0.25	0.0	1.150	1.120	0.25	2.6	0.057	0.050	0.25	RPD-N/A	0.260	0.258	0.25	0.8
Silver (Ag)	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A
Sodium (Na)	0.832	0.809	0.05	2.8	1.150	1.120	0.05	2.6	0.725	0.695	0.05	4.2	0.581	0.579	0.05	0.3
Strontium (Sr)	0.0564	0.0548	0.001	2.9	0.0613	0.0684	0.001	10.9	0.0223	0.0222	0.001	0.4	0.0287	0.0285	0.001	0.7
Thallium (Tl)	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A
Tin (Sn)	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A
Titanium (Ti)	0.005	0.005	0.05	RPD-N/A	0.005	0.005	0.05	RPD-N/A	0.005	0.005	0.05	RPD-N/A	0.005	0.005	0.05	RPD-N/A
Uranium (U)	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A
Vanadium (V)	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A
Zinc (Zn)	0.0015	0.0015	0.015	RPD-N/A	0.0049	0.0054	0.015	RPD-N/A	0.0015	0.0015	0.015	RPD-N/A	0.0015	0.0015	0.015	RPD-N/A

Notes:

a) Relative percent difference (RPD).

Italicized values exceed the 20% relative percent difference and are more than five times the detection limit.

Appendix 3.4-2. Stream Water Quality Analytical Results of Field Duplicates, Back River Project, 2013

Stream Site Name	George OF				George OF			
Site Code	GEORGOF	GEORGOF			GEORGOF	GEORGOF		
Replicate		FDUP				FDUP		
Date Sampled	13-Jun-13	13-Jun-13			25-Jul-13	25-Jul-13		
ALS Sample ID #	L1317200-3	L1317200-4	5 x Detection Limit	RPD[a]	L1339503-3	L1339503-4	5 x Detection Limit	RPD[a]
Physical Tests								
Conductivity	55.7	55.5	10	0.4	61.3	60.9	10	0.7
Hardness (as $CaCO_3$)	21.3	20.7	2.5	2.9	23.4	23.3	2.5	0.4
pH	6.93	6.90	0.5	0.4	7.03	7.02	0.5	0.1
Alkalinity, Bicarbonate (as $CaCO_3$)	5.5	5.2	10	RPD-N/A	5.8	6.0	10	RPD-N/A
Alkalinity, Carbonate (as $CaCO_3$)	1	1	10	RPD-N/A	1	1	10	RPD-N/A
Alkalinity, Hydroxide (as $CaCO_3$)	1	1	10	RPD-N/A	1	1	10	RPD-N/A
Alkalinity, Total (as $CaCO_3$)	5.5	5.2	10	RPD-N/A	5.8	6.0	10	RPD-N/A
Total Suspended Solids	4.7	1.5	15	RPD-N/A	1.5	1.5	15	RPD-N/A
Total Dissolved Solids	27	26	50	RPD-N/A	41	33	50	RPD-N/A
Turbidity	0.25	0.68	0.5	RPD-N/A	0.64	0.81	0.5	*23.4*
Nutrients								
Ammonia, Total (as N)	0.0025	0.0025	0.025	RPD-N/A	0.0052	0.0054	0.025	RPD-N/A
Nitrate (as N)	0.0128	0.0056	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A
Nitrite (as N)	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A
Total Kjeldahl Nitrogen	0.154	0.149	0.25	RPD-N/A	0.146	0.025	0.25	RPD-N/A
Ortho-phosphate (as P)	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A
Total Phosphorus (P)	0.0039	0.0042	0.01	RPD-N/A	0.0035	0.0034	0.01	RPD-N/A
Anions								
Bromide (Br)	0.025	0.025	0.25	RPD-N/A	0.025	0.025	0.25	RPD-N/A
Chloride (Cl)	3.61	3.58	2.5	0.8	3.75	3.75	2.5	0.0
Fluoride (F)	0.022	0.023	0.1	RPD-N/A	0.026	0.026	0.1	RPD-N/A
Sulfate (SO^4)	13.80	13.70	2.5	0.7	15.40	15.40	2.5	0.0
Cyanides								
Cyanide, Total	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A
Cyanide, Free	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A
Organic Carbon								
Total Organic Carbon	2.49	2.56	2.5	RPD-N/A	2.02	2.19	2.5	RPD-N/A
Total Metals								
Aluminum (Al)	0.0248	0.0239	0.015	3.7	0.0139	0.0125	0.015	RPD-N/A
Antimony (Sb)	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A
Arsenic (As)	0.000422	0.000443	0.00015	4.9	0.000454	0.000468	0.00015	3.0
Barium (Ba)	0.00299	0.00291	0.00025	2.7	0.00209	0.00212	0.00025	1.4
Beryllium (Be)	0.0001	0.0001	0.001	RPD-N/A	0.0001	0.0001	0.001	RPD-N/A
Bismuth (Bi)	0.00025	0.00025	0.0025	RPD-N/A	0.00025	0.00025	0.0025	RPD-N/A
Boron (B)	0.0025	0.0025	0.025	RPD-N/A	0.0052	0.0054	0.025	RPD-N/A
Cadmium (Cd)	0.000011	0.00001	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A
Calcium (Ca)	5.37	5.35	0.1	0.4	5.82	5.77	0.1	0.9
Chromium (Cr)	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A
Cobalt (Co)	0.00129	0.00128	0.0005	0.8	0.00046	0.00044	0.0005	RPD-N/A
Copper (Cu)	0.00203	0.00194	0.0025	RPD-N/A	0.00147	0.00151	0.0025	RPD-N/A
Iron (Fe)	0.030	0.030	0.05	RPD-N/A	0.054	0.052	0.05	3.8
Lead (Pb)	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A
Lithium (Li)	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A
Magnesium (Mg)	1.96	1.93	0.025	1.5	2.12	2.14	0.025	0.9
Manganese (Mn)	0.0124	0.0125	0.00025	0.8	0.0066	0.0064	0.00025	3.5
Mercury (Hg)	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A
Molybdenum (Mo)	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A
Nickel (Ni)	0.00674	0.00673	0.0005	0.1	0.00266	0.00261	0.0005	1.9
Phosphorus (P)	0.15	0.15	1.5	RPD-N/A	0.15	0.15	1.5	RPD-N/A
Potassium (K)	0.365	0.355	0.25	2.8	0.382	0.385	0.25	0.8
Selenium (Se)	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A
Silicon (Si)	0.182	0.179	0.25	RPD-N/A	0.075	0.075	0.25	RPD-N/A
Silver (Ag)	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A
Sodium (Na)	0.770	0.755	0.05	2.0	0.800	0.804	0.05	0.5
Strontium (Sr)	0.0200	0.0202	0.001	1.0	0.0224	0.0223	0.001	0.4
Thallium (Tl)	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A
Tin (Sn)	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A

Appendix 3.4-2. Stream Water Quality Analytical Results of Field Duplicates, Back River Project, 2013

Stream Site Name	George OF				George OF			
Site Code	GEORGOF	GEORGOF			GEORGOF	GEORGOF		
Replicate		FDUP				FDUP		
Date Sampled	13-Jun-13	13-Jun-13			25-Jul-13	25-Jul-13		
ALS Sample ID #	L1317200-3	L1317200-4	5 x Detection Limit	RPD[a]	L1339503-3	L1339503-4	5 x Detection Limit	RPD[a]
Total Metals *(cont'd)*								
Titanium (Ti)	0.005	0.005	0.05	RPD-N/A	0.005	0.005	0.05	RPD-N/A
Uranium (U)	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A
Vanadium (V)	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A
Zinc (Zn)	0.0053	0.0053	0.015	RPD-N/A	0.0015	0.0015	0.015	RPD-N/A
Dissolved Metals								
Aluminum (Al)	0.0138	0.0143	0.015	RPD-N/A	0.0076	0.0079	0.015	RPD-N/A
Antimony (Sb)	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A
Arsenic (As)	0.000366	0.000387	0.00015	5.6	0.000398	0.000389	0.00015	2.3
Barium (Ba)	0.00287	0.00276	0.00025	3.9	0.00215	0.00214	0.00025	0.5
Beryllium (Be)	0.0001	0.0001	0.001	RPD-N/A	0.0001	0.0001	0.001	RPD-N/A
Bismuth (Bi)	0.00025	0.00025	0.0025	RPD-N/A	0.00025	0.00025	0.0025	RPD-N/A
Boron (B)	0.0051	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A
Cadmium (Cd)	0.000012	0.000012	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A
Calcium (Ca)	5.43	5.15	0.1	5.3	5.83	5.83	0.1	0.0
Chromium (Cr)	0.00012	0.00005	0.0005	RPD-N/A	0.00005	0.00010	0.0005	RPD-N/A
Cobalt (Co)	0.00088	0.00093	0.0005	5.5	0.00038	0.00036	0.0005	RPD-N/A
Copper (Cu)	0.00161	0.00158	0.0025	RPD-N/A	0.00116	0.00116	0.0025	RPD-N/A
Iron (Fe)	0.005	0.005	0.05	RPD-N/A	0.020	0.018	0.05	RPD-N/A
Lead (Pb)	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A
Lithium (Li)	0.0025	0.0025	0.025	RPD-N/A	0.0025	0.0025	0.025	RPD-N/A
Magnesium (Mg)	1.89	1.91	0.025	1.1	2.14	2.13	0.025	0.5
Manganese (Mn)	0.0090	0.0090	0.00025	0.3	0.0057	0.0056	0.00025	2.3
Mercury (Hg)	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A
Molybdenum (Mo)	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A
Nickel (Ni)	0.00629	0.00620	0.0005	1.4	0.00253	0.00250	0.0005	1.2
Phosphorus (P)	0.15	0.15	1.5	RPD-N/A	0.15	0.15	1.5	RPD-N/A
Potassium (K)	0.348	0.352	0.25	1.1	0.391	0.388	0.25	0.8
Selenium (Se)	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A
Silicon (Si)	0.171	0.165	0.25	RPD-N/A	0.073	0.070	0.25	RPD-N/A
Silver (Ag)	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A
Sodium (Na)	0.733	0.742	0.05	1.2	0.813	0.806	0.05	0.9
Strontium (Sr)	0.0205	0.0194	0.001	5.5	0.0220	0.0220	0.001	0.0
Thallium (Tl)	0.000025	0.000025	0.00025	RPD-N/A	0.000025	0.000025	0.00025	RPD-N/A
Tin (Sn)	0.00005	0.00005	0.0005	RPD-N/A	0.00005	0.00005	0.0005	RPD-N/A
Titanium (Ti)	0.005	0.005	0.05	RPD-N/A	0.005	0.005	0.05	RPD-N/A
Uranium (U)	0.000005	0.000005	0.00005	RPD-N/A	0.000005	0.000005	0.00005	RPD-N/A
Vanadium (V)	0.0005	0.0005	0.005	RPD-N/A	0.0005	0.0005	0.005	RPD-N/A
Zinc (Zn)	0.0046	0.0045	0.015	RPD-N/A	0.0015	0.0015	0.015	RPD-N/A

Notes:

a) Relative percent difference (RPD).

Italicized values exceed the 20% relative percent difference and are more than five times the detection limit.

Appendix 3.4-3

Stream Water Quality Analytical Results of Blanks, Back River Project, 2013

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Appendix 3.4-3. Stream Water Quality Analytical Results of Blanks, Back River Project, 2013

Stream Site Name Site Code Replicate Date Sampled ALS Sample ID #	Units	CCME Guidelines for the Protection of Freshwater Aquatic Life[a]	Realized Detection Limit (RDL)	Travel Blank TRAVELBLANK QAQC 28-Jul-13 L1339503-9	Travel Blank TRAVELBLANK QAQC 11-Jun-13 L1317200-6	Field Blank FIELDBLANK QAQC 12-Jun-13 L1316465-9
Physical Tests						
Conductivity	µS/cm		2.0	<2.0	<2.0	<2.0
Hardness (as $CaCO_3$)	mg/L		0.50	-	-	-
pH	pH	6.5-9.0	0.10	5.92	5.86	5.80
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0
Alkalinity, Carbonate (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as $CaCO_3$)	mg/L		2.0	<2.0	<2.0	<2.0
Total Suspended Solids	mg/L	dependent on background levels	3.0	<3.0	<3.0	<3.0
Total Dissolved Solids	mg/L		10	<10	<10	<10
Turbidity	NTU	dependent on background levels	0.10	<0.10	<0.10	<0.10
Nutrients						
Ammonia, Total (as N)	mg/L	pH- and temperature-dependent	0.0050	<0.0050	<0.0050	<0.0050
Nitrate (as N)	mg/L	short-term: 124; long-term: 3	0.0050	<0.0050	<0.0050	<0.0050
Nitrite (as N)	mg/L	0.06	0.001	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	mg/L		0.05	<0.050	<0.050	<0.050
Ortho-phosphate (as P)	mg/L		0.001	<0.0010	<0.0010	<0.0010
Total Phosphorus (P)	mg/L	Trigger ranges from guidance framework[c]	0.002	<0.0020	<0.0020	<0.0020
Anions						
Bromide (Br)	mg/L		0.050	<0.050	<0.050	<0.050
Chloride (Cl)	mg/L	short-term: 640; long-term: 120	0.50	<0.50	<0.50	<0.50
Fluoride (F)	mg/L	0.12[b]	0.02	<0.020	<0.020	<0.020
Sulfate (SO_4)	mg/L		0.5	<0.50	<0.50	<0.50
Cyanides						
Cyanide, Total	mg/L		0.0010	<0.0010	<0.0010	<0.0010
Cyanide, Free	mg/L	0.005	0.0010	<0.0010	<0.0010	<0.0010
Organic Carbon						
Total Organic Carbon	mg/L		0.50	<0.50	<0.50	<0.50
Total Metals						
Aluminum (Al)	mg/L	0.005 if pH<6.5; 0.1 if pH≥6.5	0.0030	<0.0030	<0.0030	<0.0030
Antimony (Sb)	mg/L		0.00005	<0.000050	<0.000050	<0.000050
Arsenic (As)	mg/L	0.005	0.000030	<0.000030	<0.000030	<0.000030
Barium (Ba)	mg/L		0.000050	<0.000050	<0.000050	<0.000050
Beryllium (Be)	mg/L		0.00020	<0.00020	<0.00020	<0.00020
Bismuth (Bi)	mg/L		0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	short-term: 29; long-term: 1.5	0.005	<0.0050	<0.0050	<0.0050
Cadmium (Cd)	mg/L	equation[d]	0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L		0.020	<0.020	<0.020	<0.020
Chromium (Cr)	mg/L	Cr(VI): 0.001 ; Cr(III): 0.0089[b]	0.00010	<0.00010	<0.00010	<0.00010
Cobalt (Co)	mg/L		0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)	mg/L	0.002-0.004[e]	0.00050	<0.00050	<0.00050	<0.00050
Iron (Fe)	mg/L	0.3	0.010	<0.010	<0.010	<0.010
Lead (Pb)	mg/L	0.001-0.007[f]	0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L		0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L		0.0050	<0.0050	<0.0050	<0.0050
Manganese (Mn)	mg/L		0.000050	<0.000050	<0.000050	<0.000050
Mercury (Hg)	mg/L	Inorganic Mercury: 0.000026	0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.073	0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	0.025-0.15[g]	0.00010	<0.00010	<0.00010	<0.00010
Phosphorus (P)	mg/L		0.30	<0.30	<0.30	<0.30
Potassium (K)	mg/L		0.050	<0.050	<0.050	<0.050
Selenium (Se)	mg/L	0.001	0.00010	<0.00010	<0.00010	<0.00010
Silicon (Si)	mg/L		0.050	<0.050	<0.050	<0.050
Silver (Ag)	mg/L	0.0001	0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L		0.010	<0.010	<0.010	<0.010
Strontium (Sr)	mg/L		0.00020	<0.00020	<0.00020	<0.00020
Thallium (Tl)	mg/L	0.0008	0.00005	<0.000050	<0.000050	<0.000050
Tin (Sn)	mg/L		0.00010	<0.00010	<0.00010	<0.00010

Appendix 3.4-3. Stream Water Quality Analytical Results of Blanks, Back River Project, 2013

Stream Site Name Site Code Replicate Date Sampled ALS Sample ID #	Units	CCME Guidelines for the Protection of Freshwater Aquatic Life[a]	Realized Detection Limit (RDL)	Travel Blank TRAVELBLANK QAQC 28-Jul-13 L1339503-9	Travel Blank TRAVELBLANK QAQC 11-Jun-13 L1317200-6	Field Blank FIELDBLANK QAQC 12-Jun-13 L1316465-9
Total Metals *(cont'd)*						
Titanium (Ti)	mg/L		0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	short-term: 0.033; long-term: 0.015	0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L		0.001000	<0.0010	<0.0010	<0.0010
Zinc (Zn)	mg/L	0.03	0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals						
Aluminum (Al)	mg/L		0.0030	-	-	-
Antimony (Sb)	mg/L		0.00005	-	-	-
Arsenic (As)	mg/L		0.000030	-	-	-
Barium (Ba)	mg/L		0.000050	-	-	-
Beryllium (Be)	mg/L		0.00020	-	-	-
Bismuth (Bi)	mg/L		0.00050	-	-	-
Boron (B)	mg/L		0.005	-	-	-
Cadmium (Cd)	mg/L		0.000010	-	-	-
Calcium (Ca)	mg/L		0.020	-	-	-
Chromium (Cr)	mg/L		0.00010	-	-	-
Cobalt (Co)	mg/L		0.00010	-	-	-
Copper (Cu)	mg/L		0.00050	-	-	-
Iron (Fe)	mg/L		0.010	-	-	-
Lead (Pb)	mg/L		0.000050	-	-	-
Lithium (Li)	mg/L		0.0050	-	-	-
Magnesium (Mg)	mg/L		0.0050	-	-	-
Manganese (Mn)	mg/L		0.000050	-	-	-
Mercury (Hg)	mg/L		0.000010	-	-	-
Molybdenum (Mo)	mg/L		0.000050	-	-	-
Nickel (Ni)	mg/L		0.00010	-	-	-
Phosphorus (P)	mg/L		0.30	-	-	-
Potassium (K)	mg/L		0.050	-	-	-
Selenium (Se)	mg/L		0.00010	-	-	-
Silicon (Si)	mg/L		0.050	-	-	-
Silver (Ag)	mg/L		0.000010	-	-	-
Sodium (Na)	mg/L		0.010	-	-	-
Strontium (Sr)	mg/L		0.00020	-	-	-
Thallium (Tl)	mg/L		0.00005	-	-	-
Tin (Sn)	mg/L		0.00010	-	-	-
Titanium (Ti)	mg/L		0.010	-	-	-
Uranium (U)	mg/L		0.000010	-	-	-
Vanadium (V)	mg/L		0.001000	-	-	-
Zinc (Zn)	mg/L		0.0030	-	-	-

Notes:

a) Canadian water quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment (accessed February 2014).

b) Interim guideline.

c) Total phosphorus trigger ranges for lakes and rivers (mg/L): <0.004 = Ultra-oligotriphic; 0.004-0.01 = Oligotrophic; 0.01-0.02 = Mesotrophic; 0.02-0.035 = Meso-eutrophic; 0.035-0.1 = Eutrophic; >0.1 = Hyper-eutrophic.

d) Guidelines are hardness-dependent. Cadmium short-term guideline (mg/L) = $10^{\{1.016[\log(\text{hardness})]-1.71\}}$ / 1000 with a minimum of 0.00011 mg/L. Cadmium long-term guideline (mg/L) = $10^{\{0.83[\log(\text{hardness})]-2.46\}}$ / 1000 with a miniumum of 0.00004 mg/L.

*e) Guideline is hardness-dependent: copper guideline (mg/L) = $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ * 0.0002. Copper guideline is a minimum of 0.002 mg/L regardless of water hardness. At hardness >180 mg/L the copper guideline is 0.004 mg/L.*

f) Guideline is hardness-dependent: lead guideline (mg/L) = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ / 1000. Lead guideline is a minumum of 0.001 mg/L regardless of hardness. At hardness >180 mg/L the lead guideline is 0.007 mg/L.

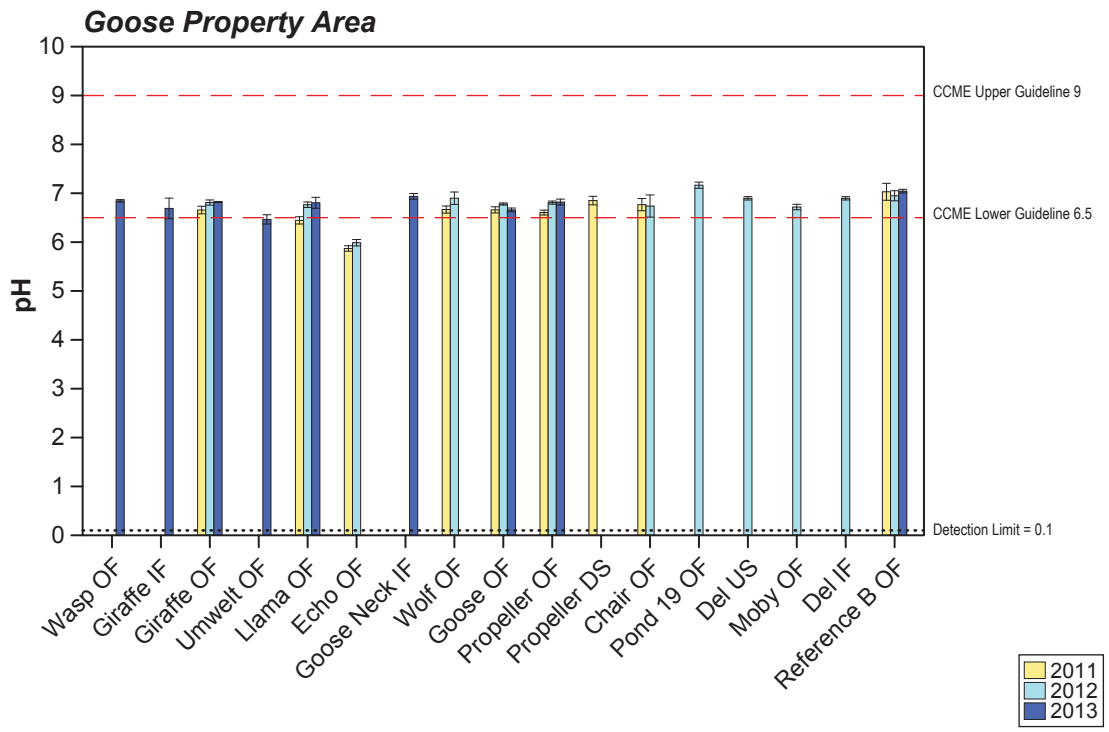
g) Guideline is hardness-dependent: nickel guideline (mg/L) = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ / 1000. Nickel guideline is a minimum of 0.025 mg/L regardless of water hardness. At hardness >180 mg/L the nickel guideline is 0.15 mg/L.

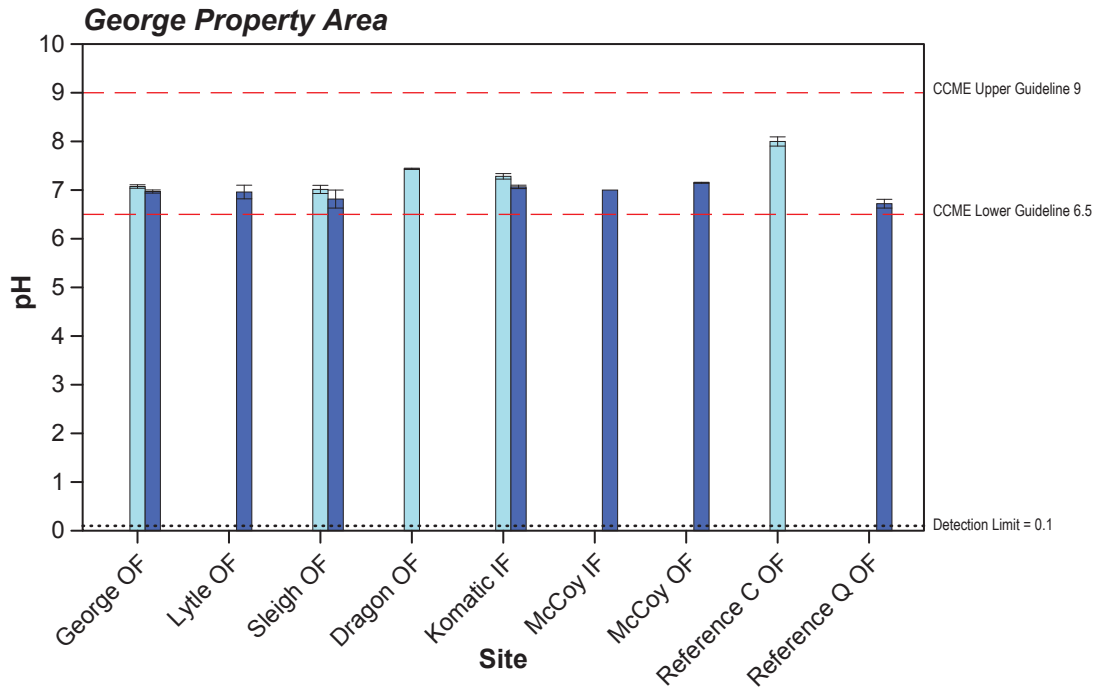
h) RDL = Realized detection limit

Appendix 3.4-4

pH in Streams, Back River Project Area, 2011 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Appendix 3.4-4

Sabina GOLD & SILVER CORP.

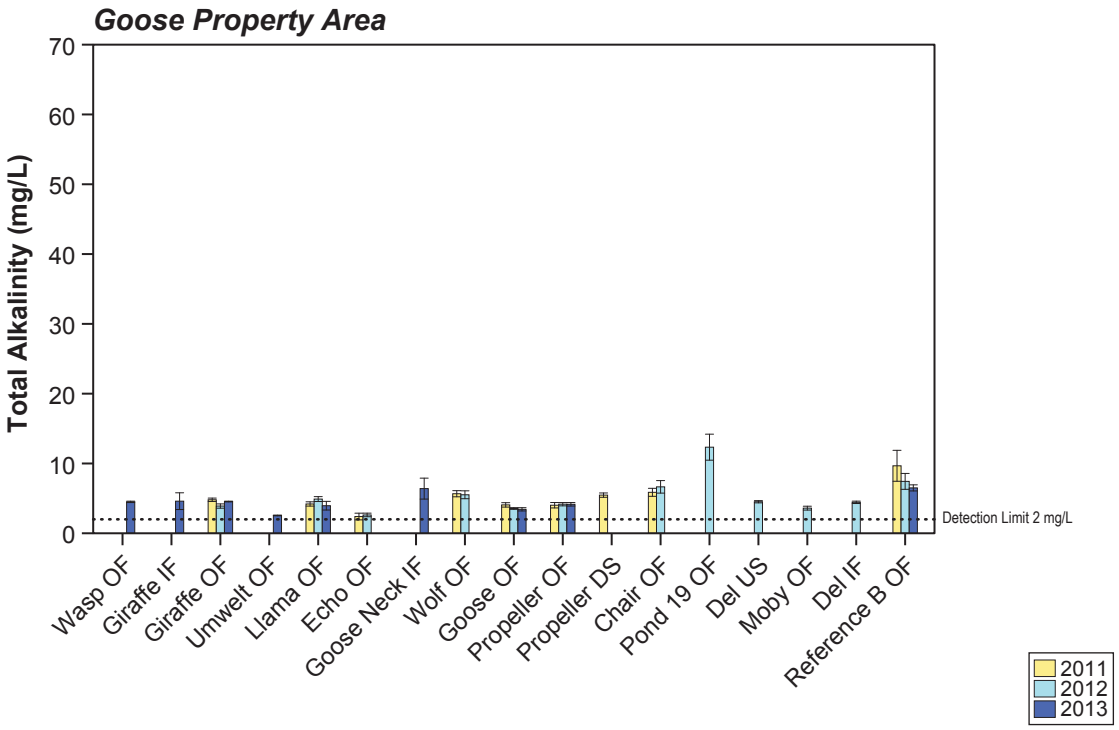
pH in Streams,
Back River Project Area, 2011 to 2013

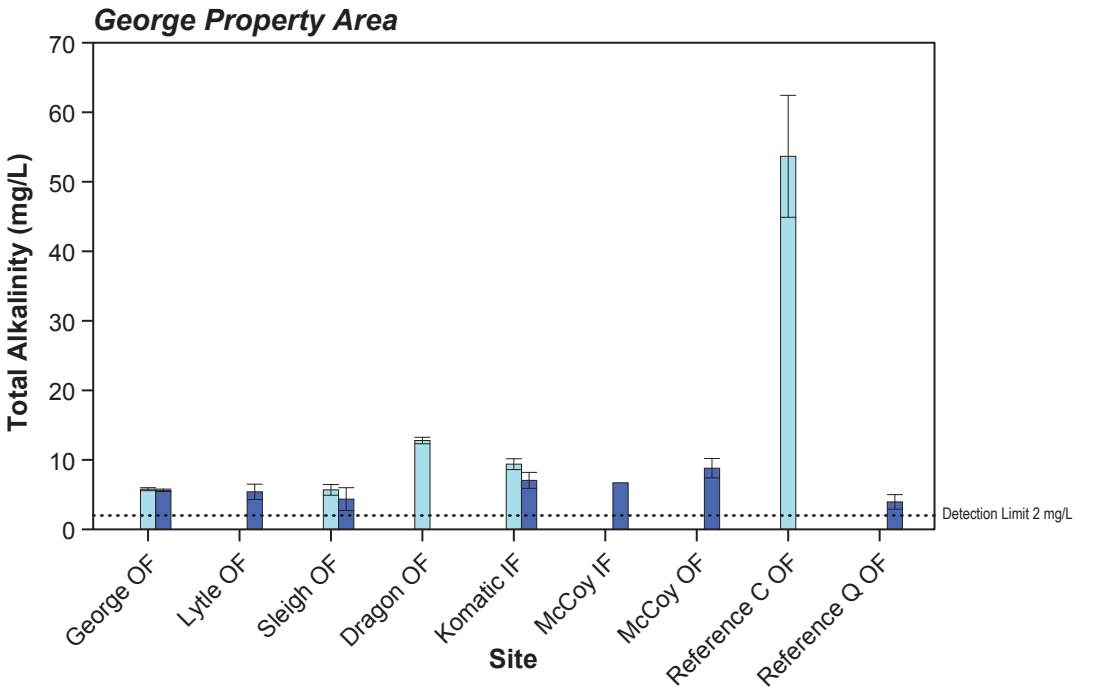
Rescan an ERM company

Appendix 3.4-5

Total Alkalinity in Streams, Back River Project Area, 2011 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Sabina GOLD & SILVER CORP.

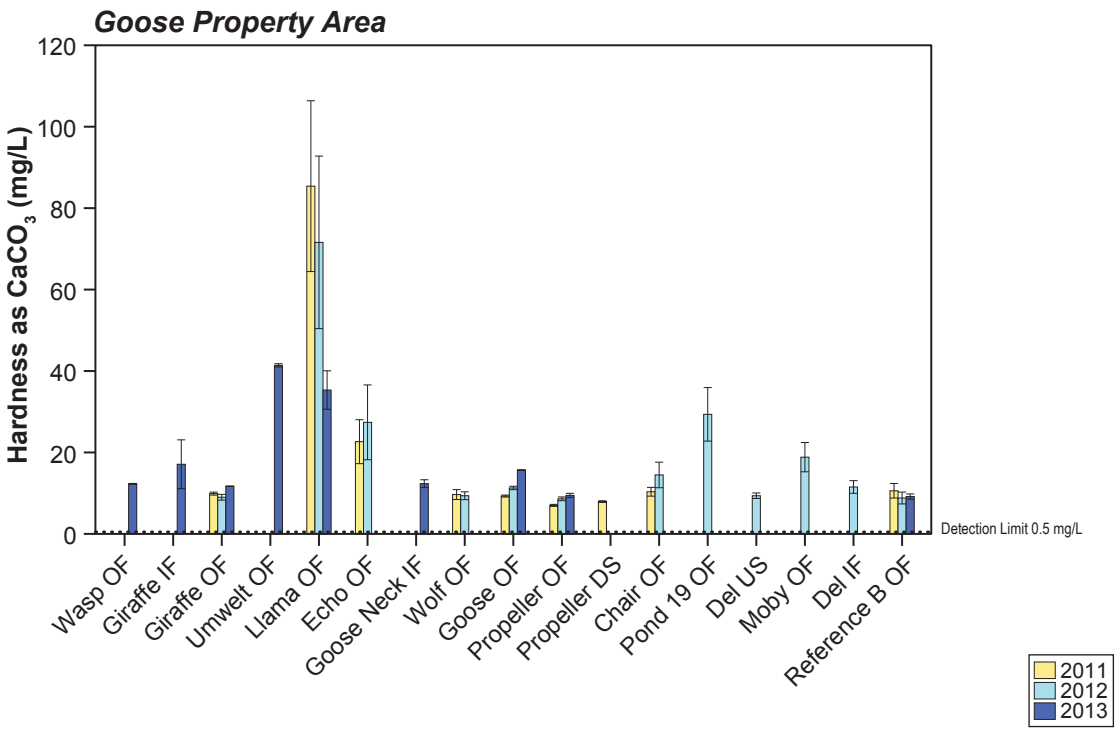
Total Alkalinity in Streams, Back River Project Area, 2011 to 2013

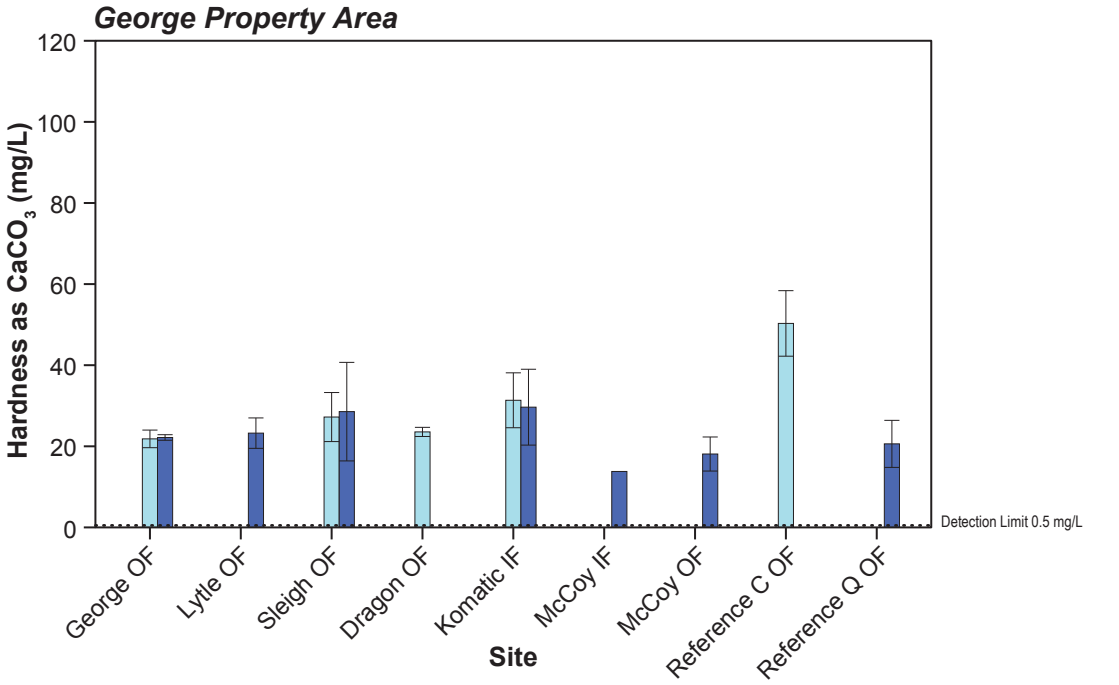
Rescan an ERM company

Appendix 3.4-6

Hardness in Streams, Back River Project Area, 2011 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Sabina GOLD & SILVER CORP.

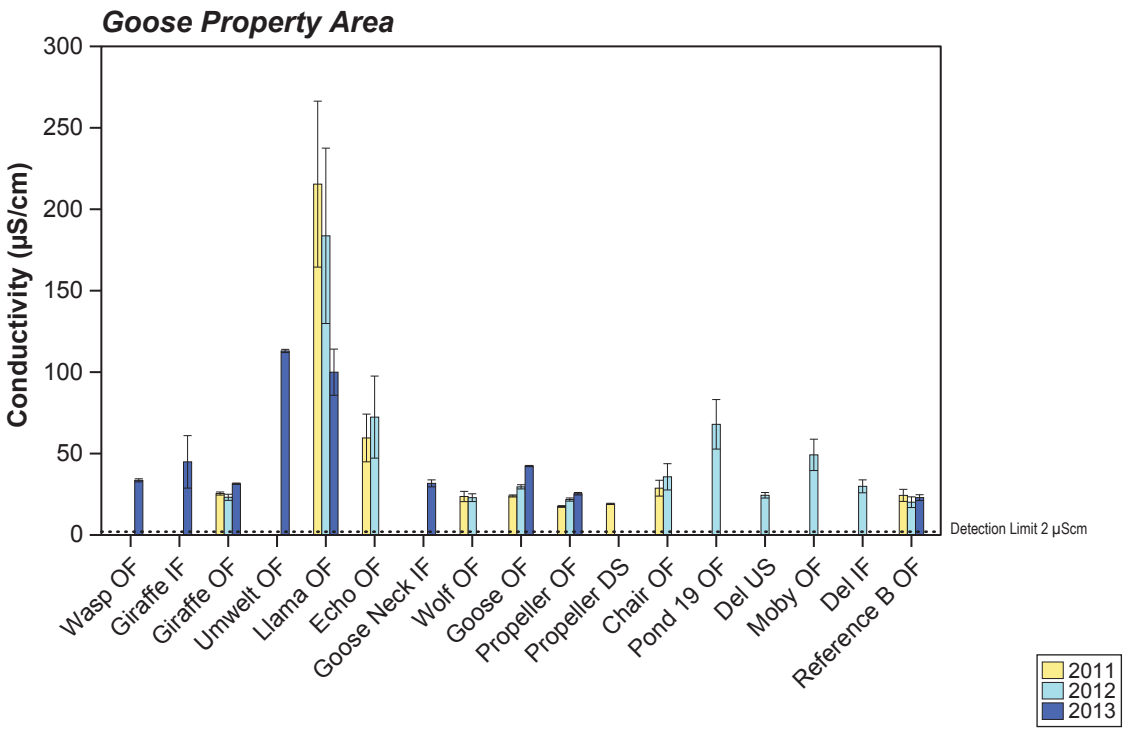
Hardness in Streams, Back River Project Area, 2011 to 2013

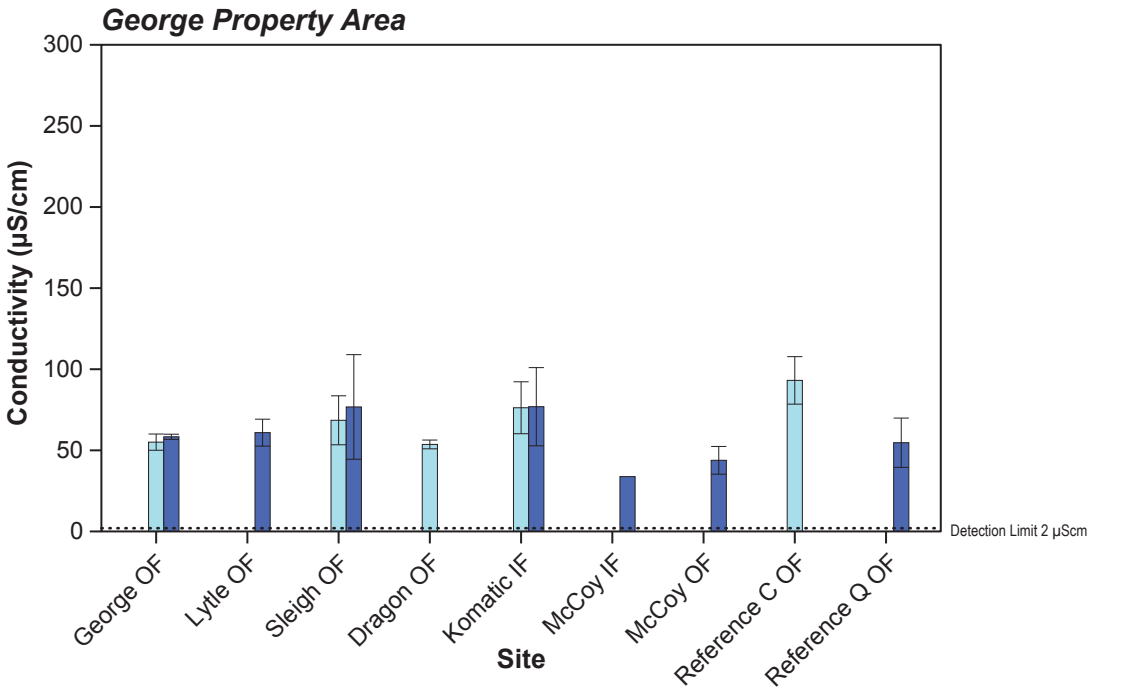
Rescan an ERM company

Appendix 3.4-7

Conductivity in Streams, Back River Project Area, 2011 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Appendix 3.4-7

Sabina GOLD & SILVER CORP.

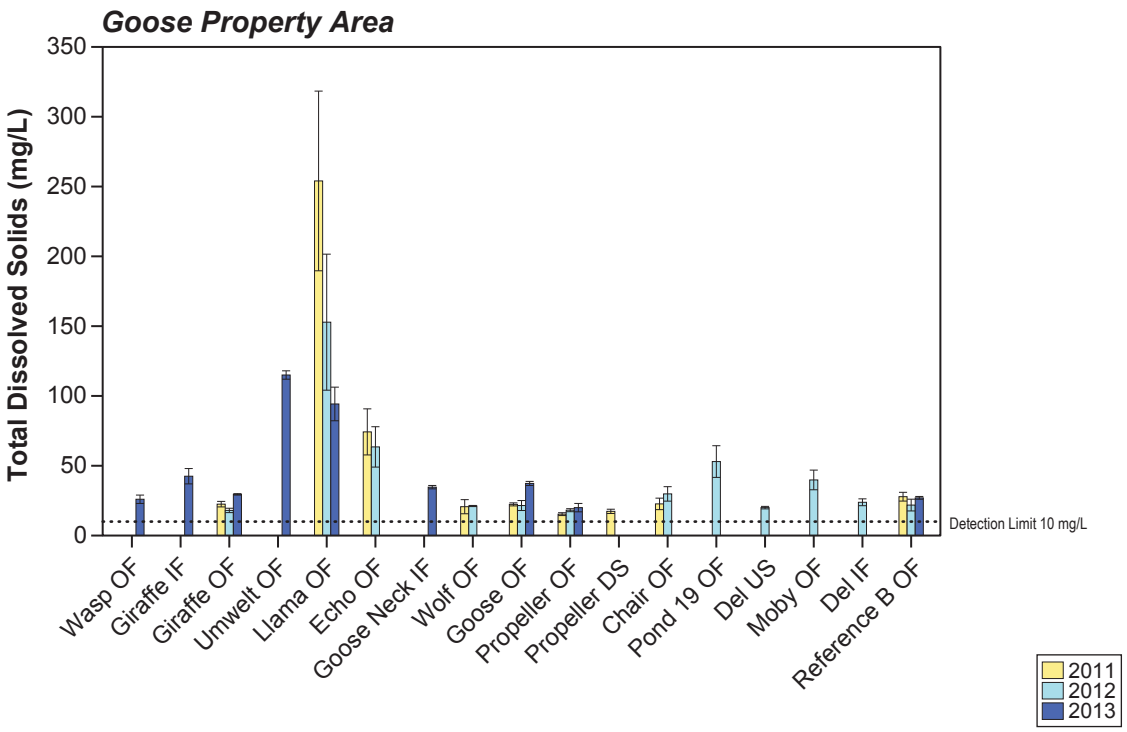
Conductivity in Streams, Back River Project Area, 2011 to 2013

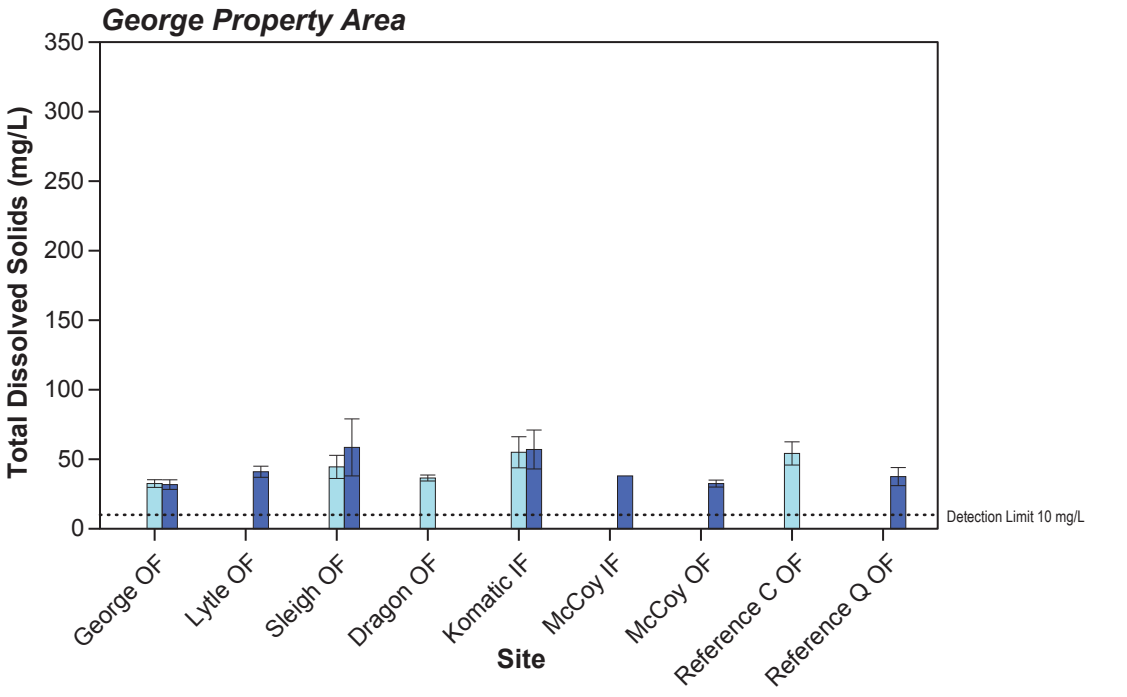
Rescan an ERM company

Appendix 3.4-8

Total Dissolved Solids in Streams, Back River Project Area, 2011 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Sabina GOLD & SILVER CORP.

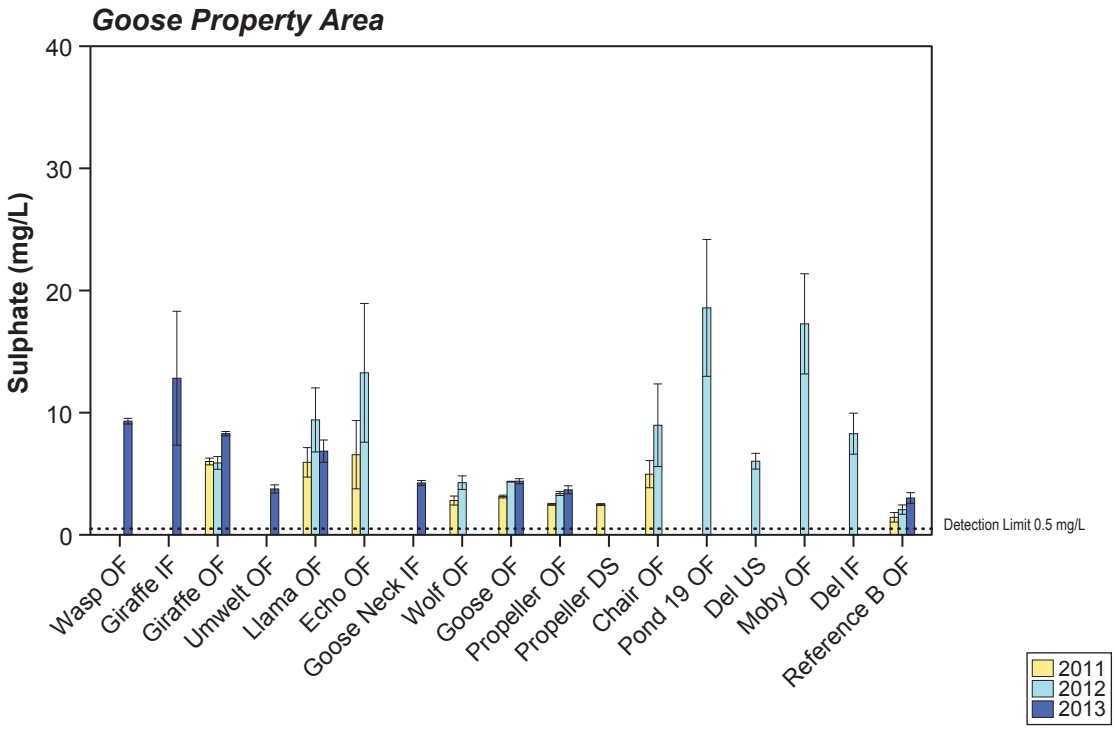
Total Dissolved Solids in Streams, Back River Project Area, 2011 to 2013

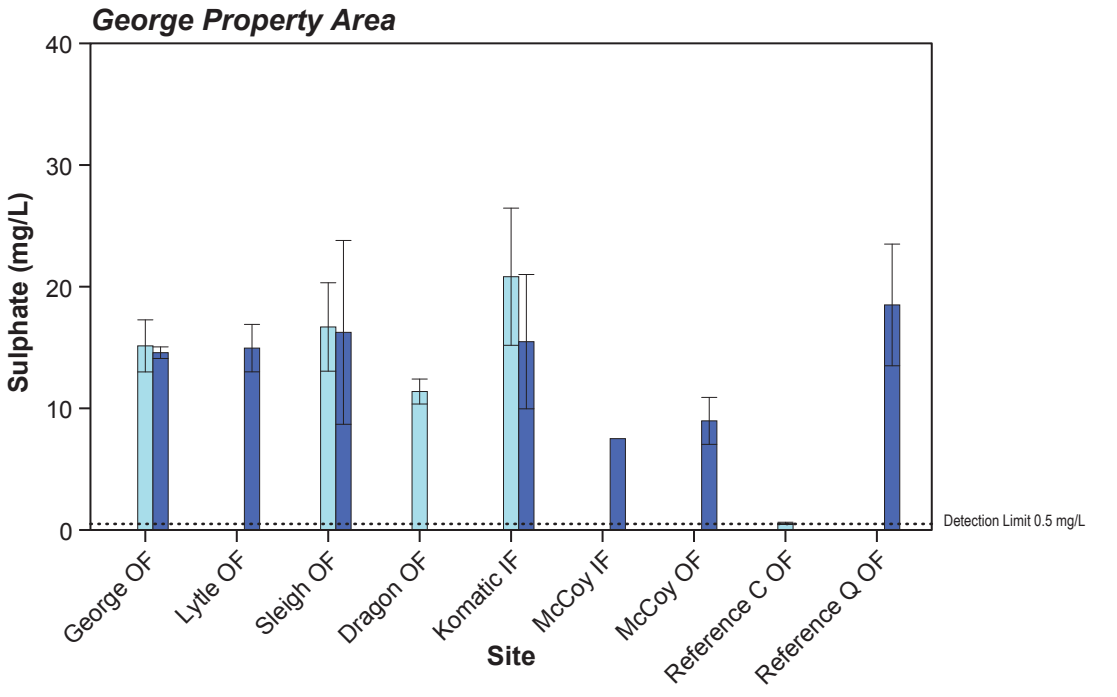
Rescan an ERM company

Appendix 3.4-9

Sulphate in Streams, Back River Project Area, 2011 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Sabina GOLD & SILVER CORP.

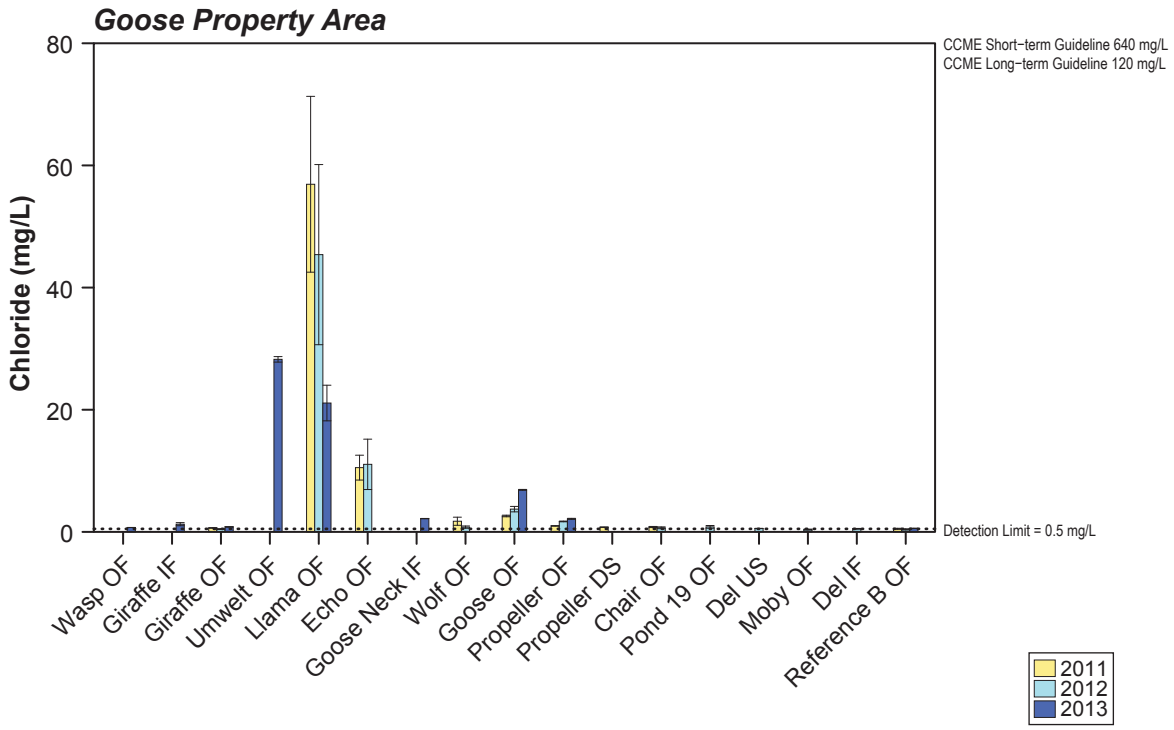
Sulphate in Streams, Back River Project Area, 2011 to 2013

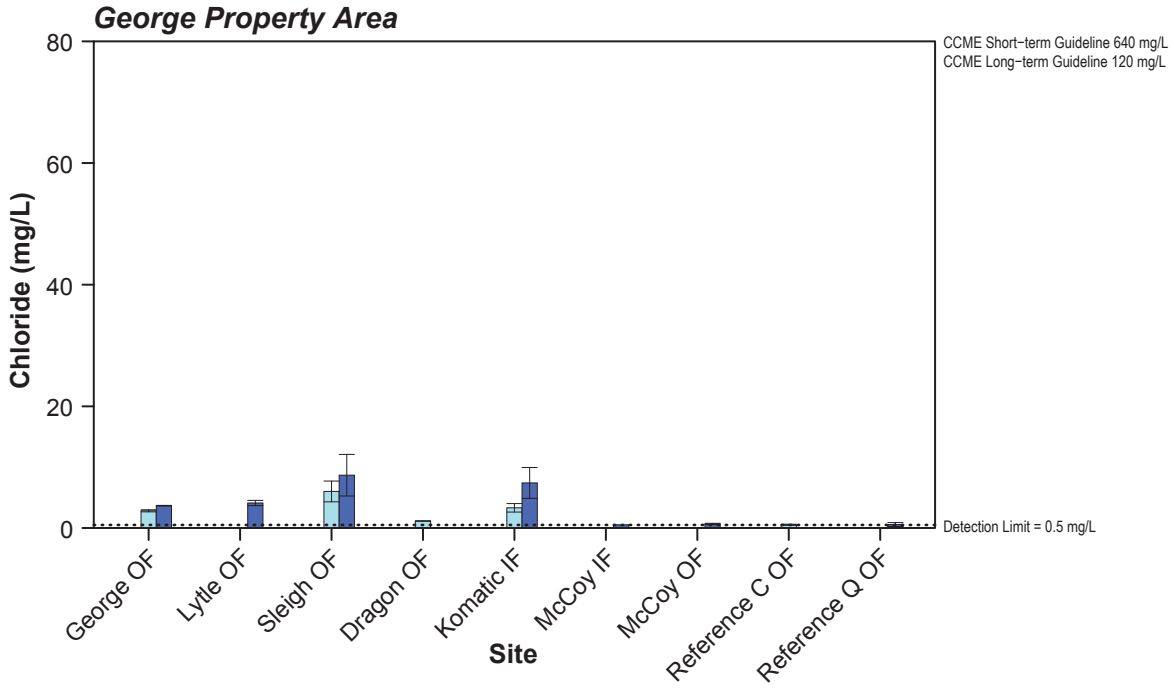
Rescan an ERM company

Appendix 3.4-10

Chloride in Streams, Back River Project Area, 2011 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

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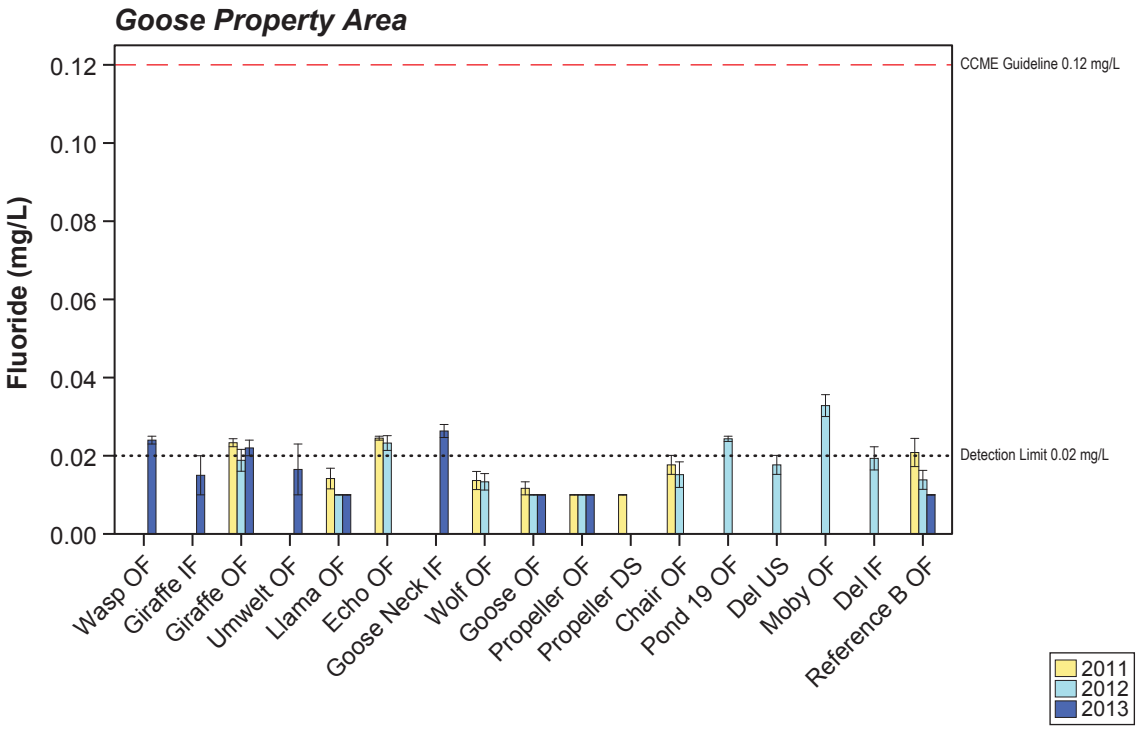
Chloride in Streams, Back River Project Area, 2011 to 2013

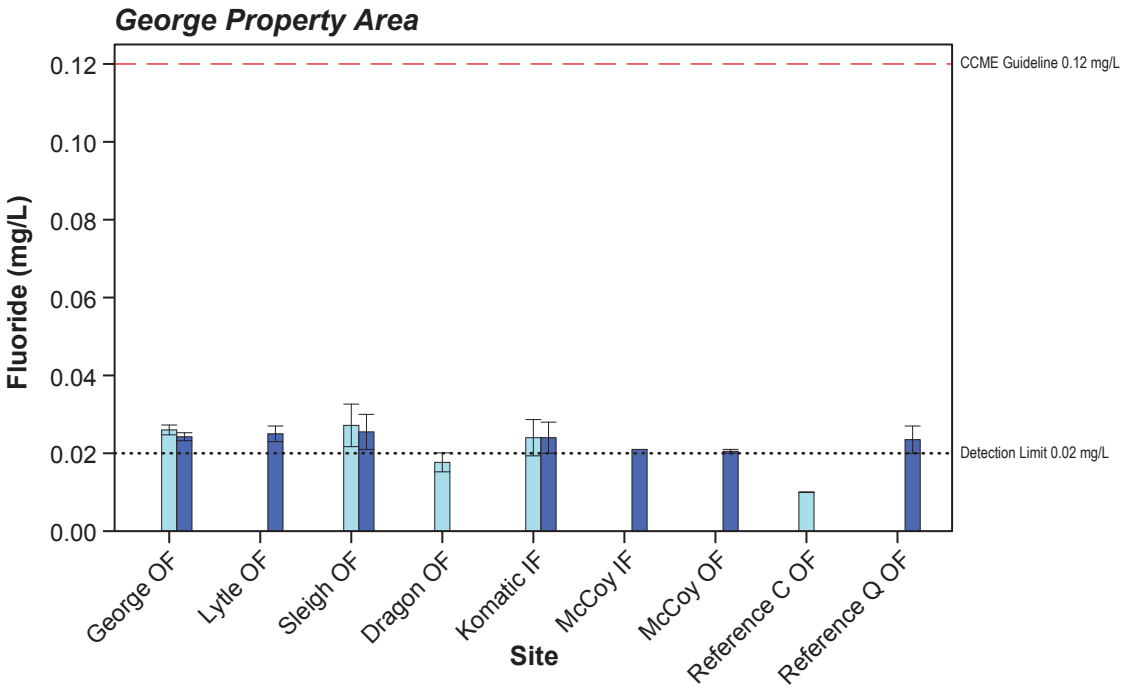
Rescan an ERM company

Appendix 3.4-11

Fluoride in Streams, Back River Project Area, 2011 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
The CCME guideline is an interim guideline.

Sabina GOLD & SILVER CORP.

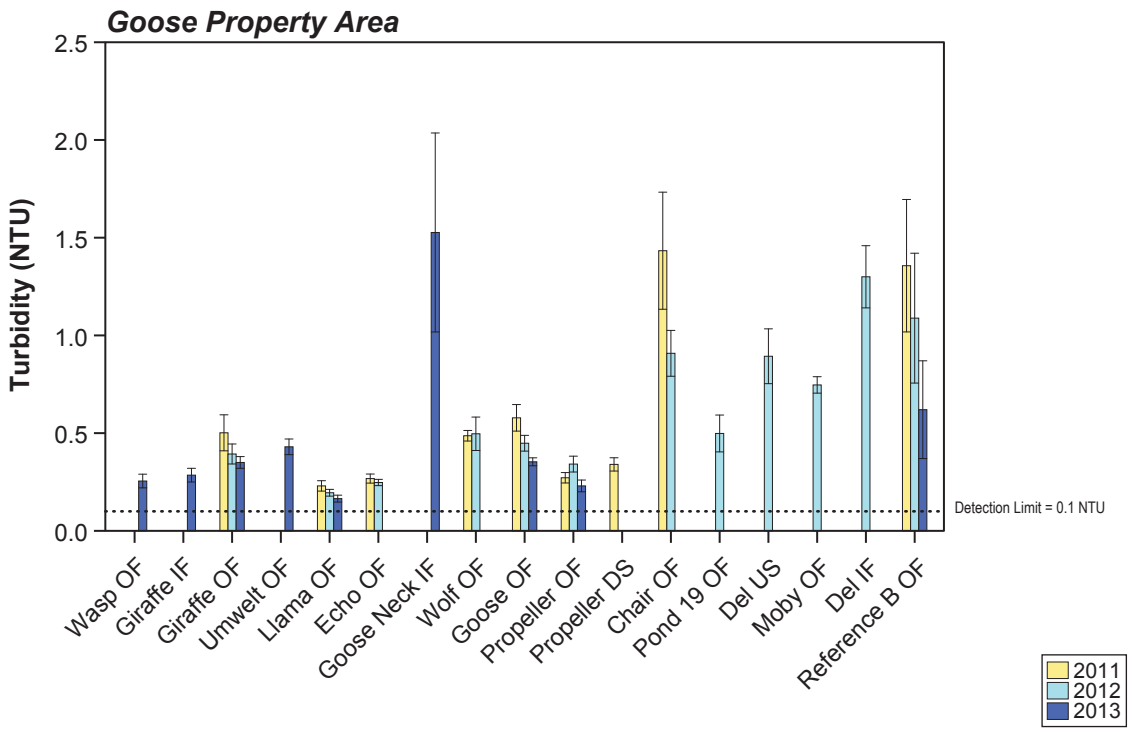
Fluoride in Streams, Back River Project Area, 2011 to 2013

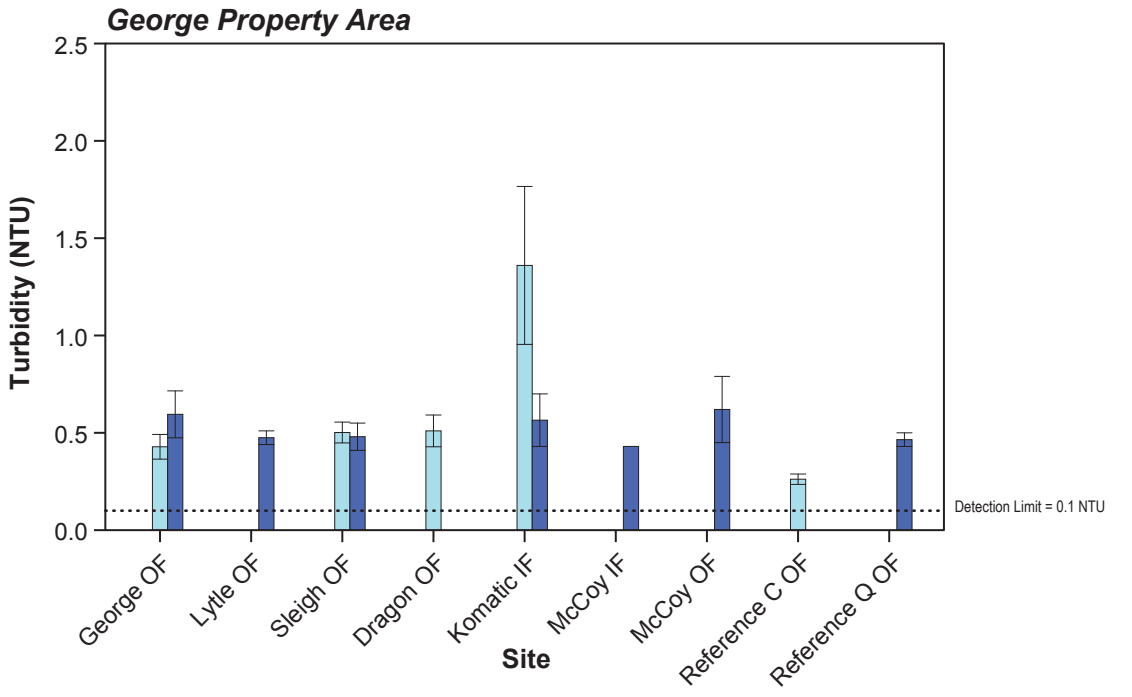
Rescan an ERM company

Appendix 3.4-12

Turbidity in Streams, Back River Project Area, 2011 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME guideline for turbidity is dependent on background levels.

Sabina GOLD & SILVER CORP.

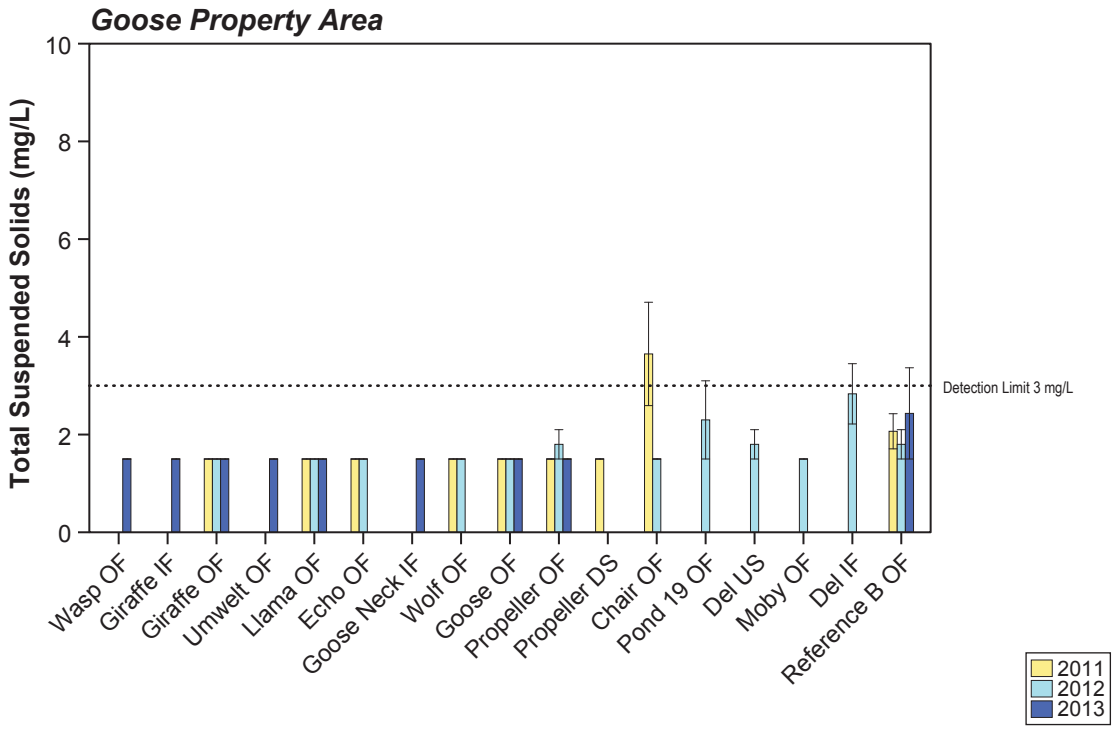
Turbidity in Streams, Back River Project Area, 2011 to 2013

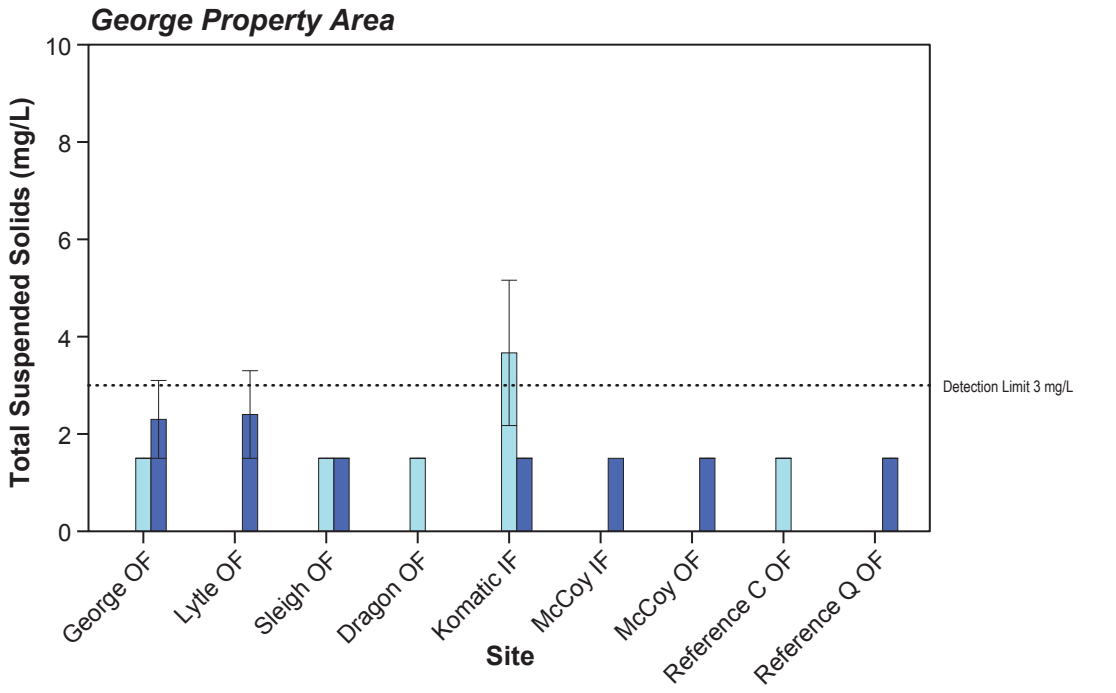
Rescan an ERM company

Appendix 3.4-13

Total Suspended Solids in Streams, Back River Project Area, 2011 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME guideline for total suspended solids is dependent on background levels.

Appendix 3.4-13

Sabina GOLD & SILVER CORP.

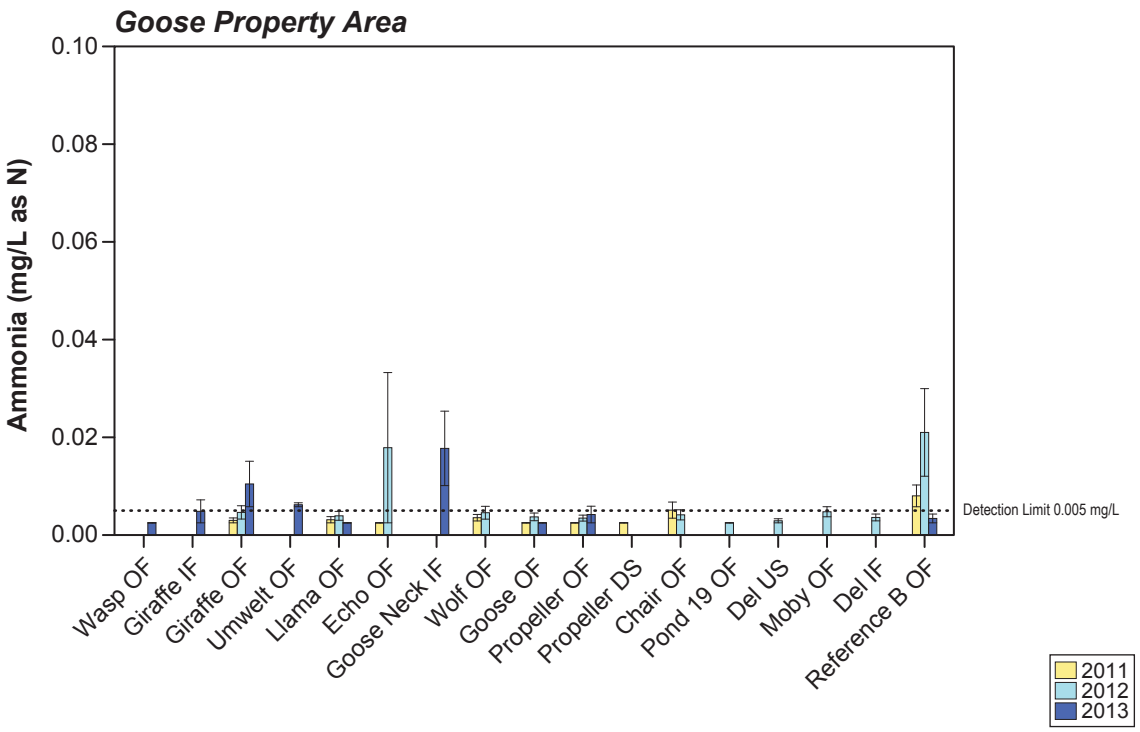
Total Suspended Solids in Streams, Back River Project Area, 2011 to 2013

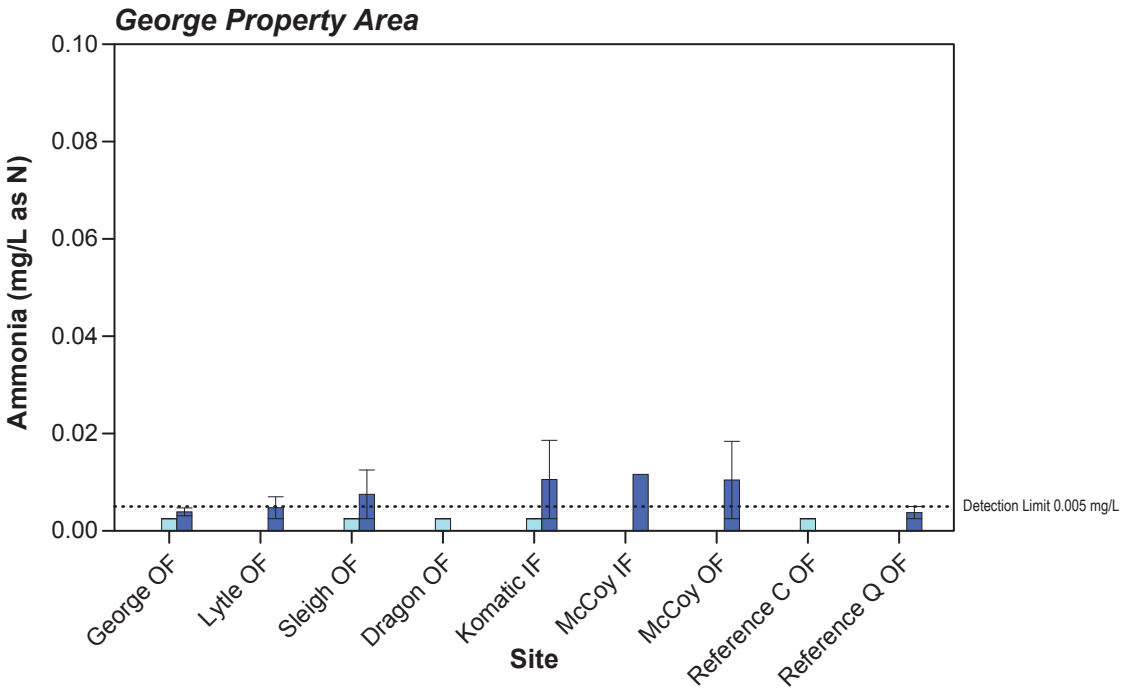
Rescan an ERM company

Appendix 3.4-14

Ammonia in Streams, Back River Project Area, 2011 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME guideline for ammonia is pH– and temperature–dependent.

Sabina GOLD & SILVER CORP.

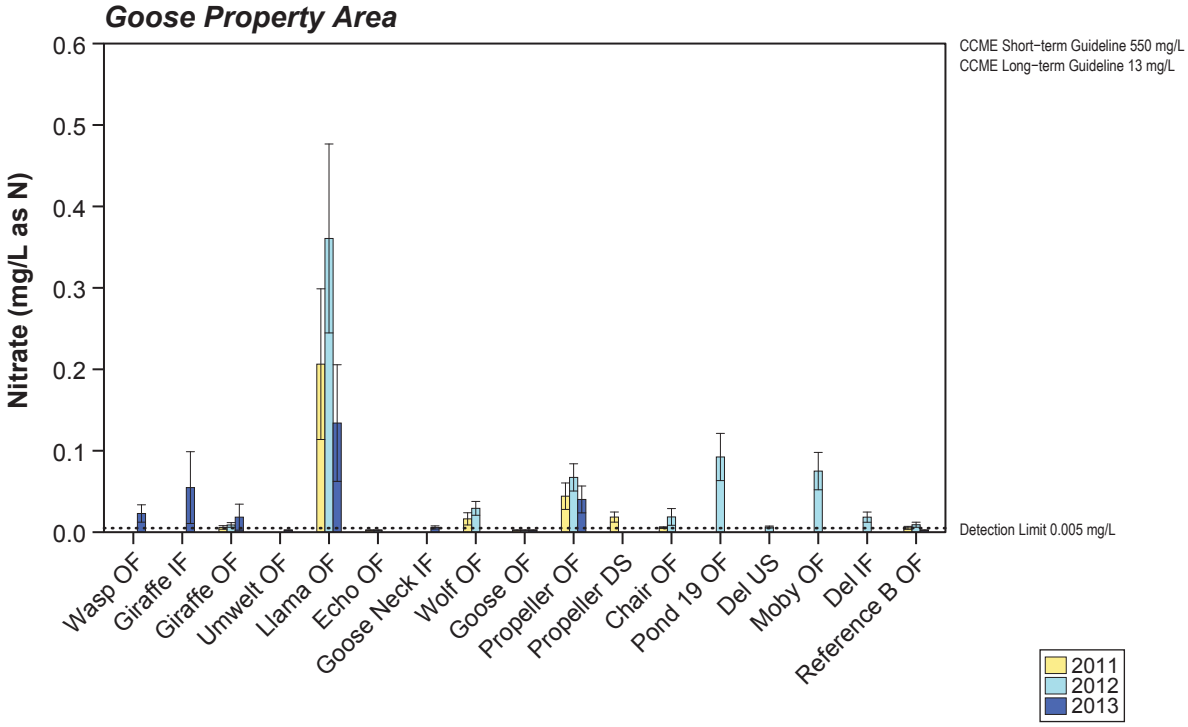
Ammonia in Streams, Back River Project Area, 2011 to 2013

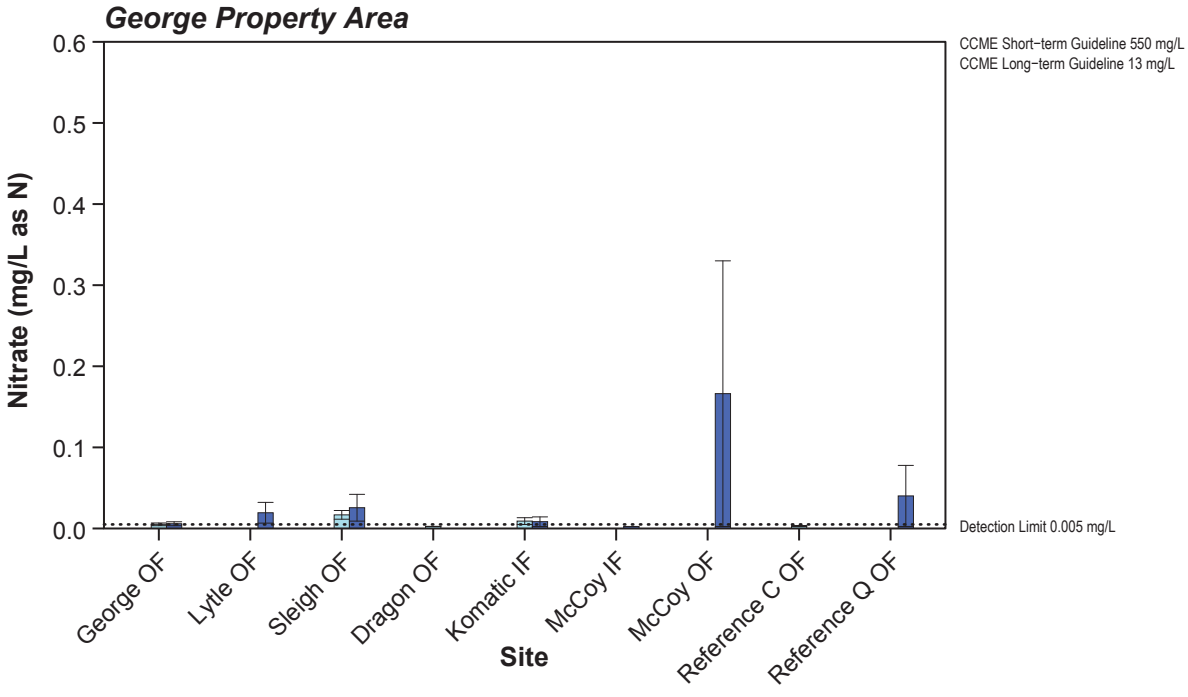
Rescan an ERM company

Appendix 3.4-15

Nitrate in Streams, Back River Project Area, 2011 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Appendix 3.4-15

Sabina GOLD & SILVER CORP.

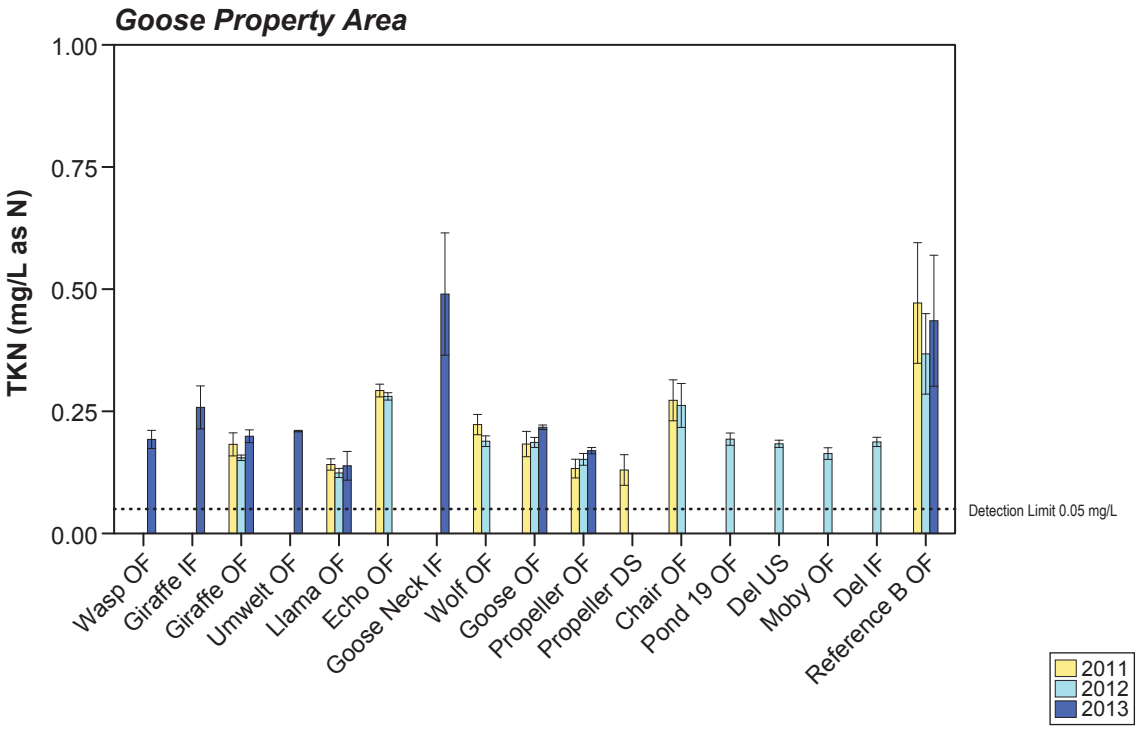
Nitrate in Streams, Back River Project Area, 2011 to 2013

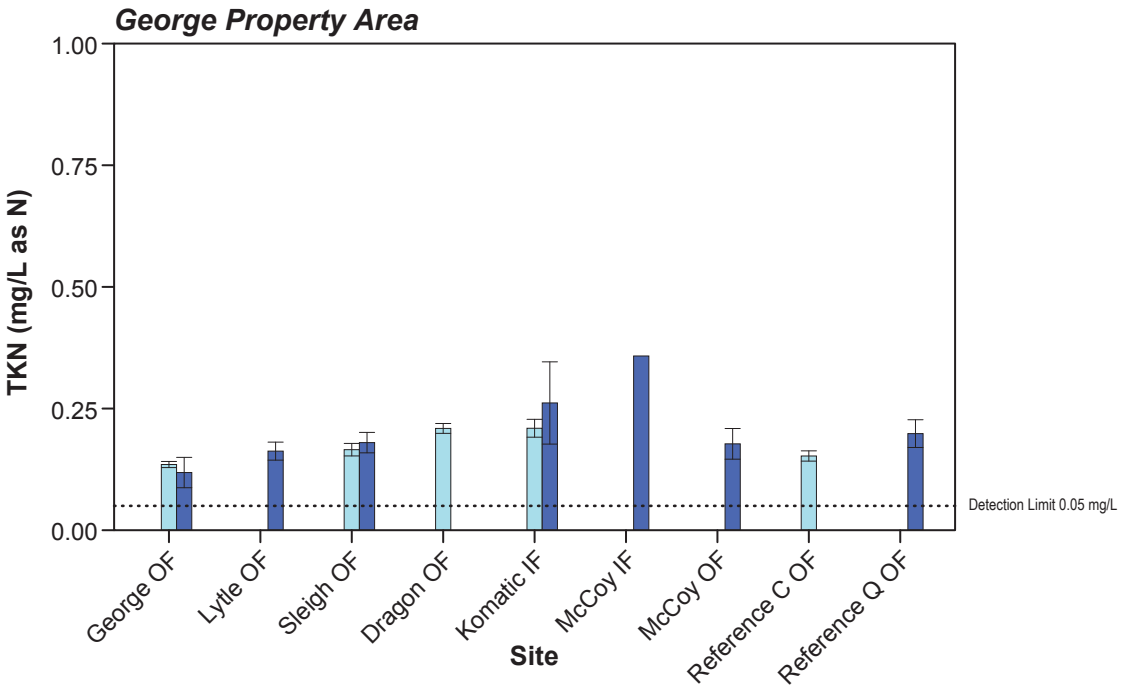
Rescan an ERM company

Appendix 3.4-16

Total Kjeldahl Nitrogen in Streams, Back River Project Area, 2011 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Sabina GOLD & SILVER CORP.

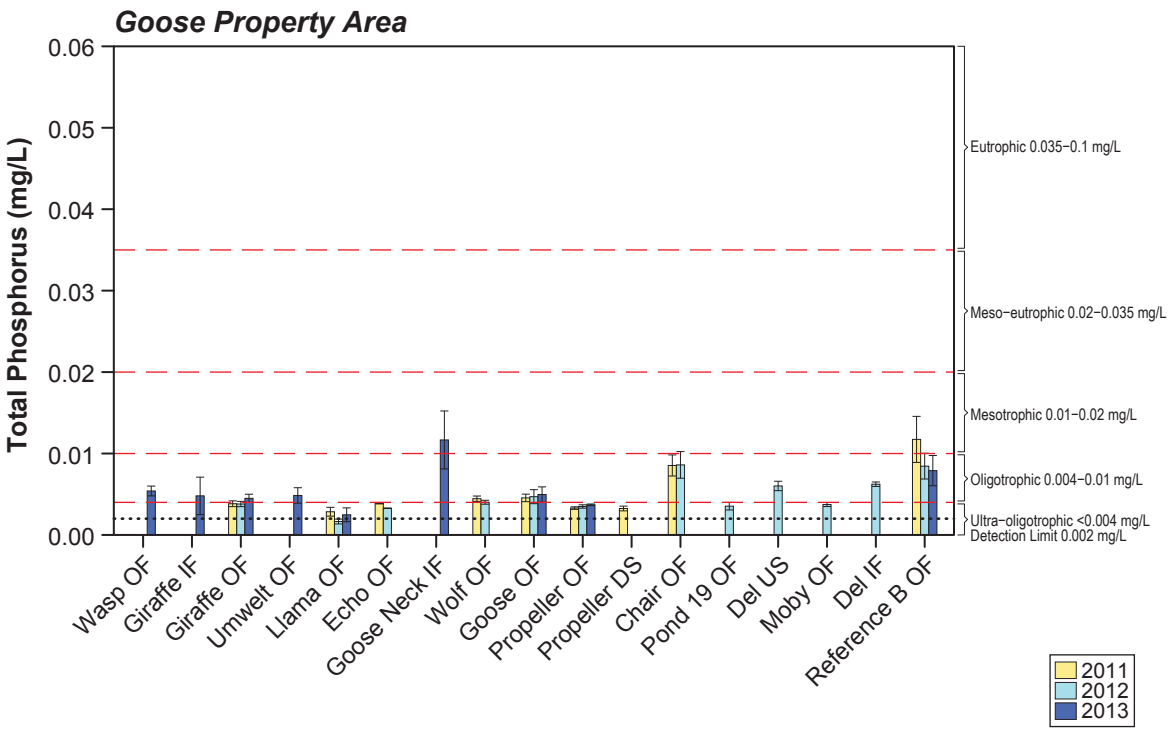
Total Kjeldahl Nitrogen in Streams, Back River Project Area, 2011 to 2013

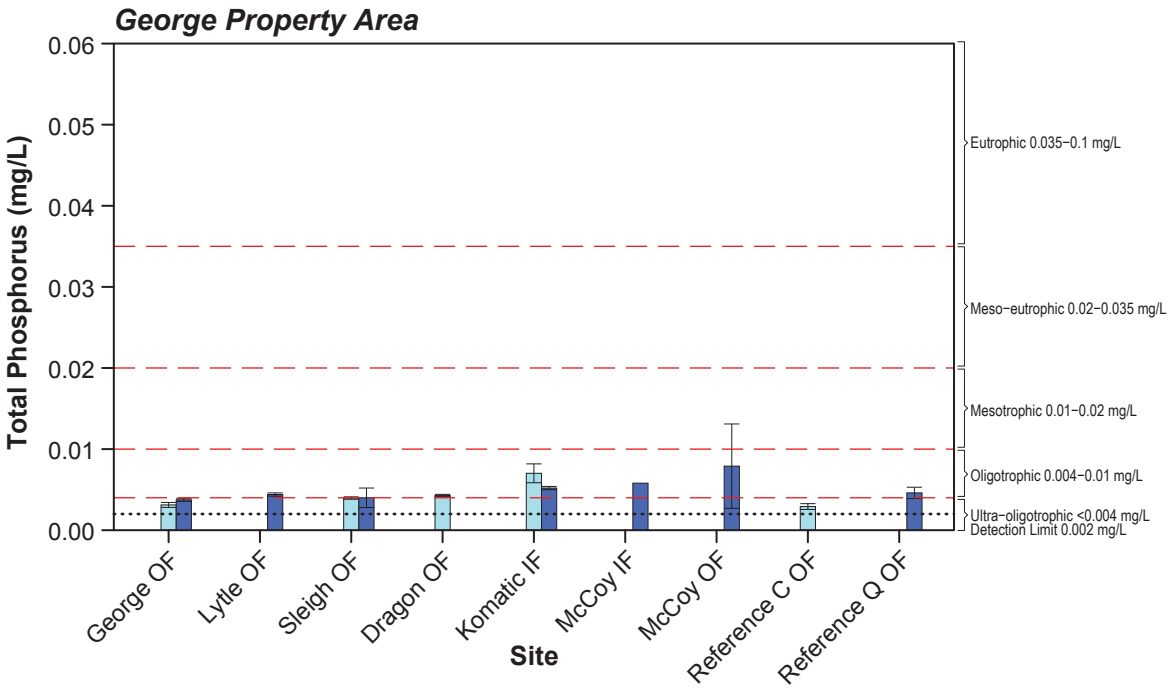
Rescan an ERM company

Appendix 3.4-17

Total Phosphorus in Streams, Back River Project Area, 2011 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Sabina GOLD & SILVER CORP.

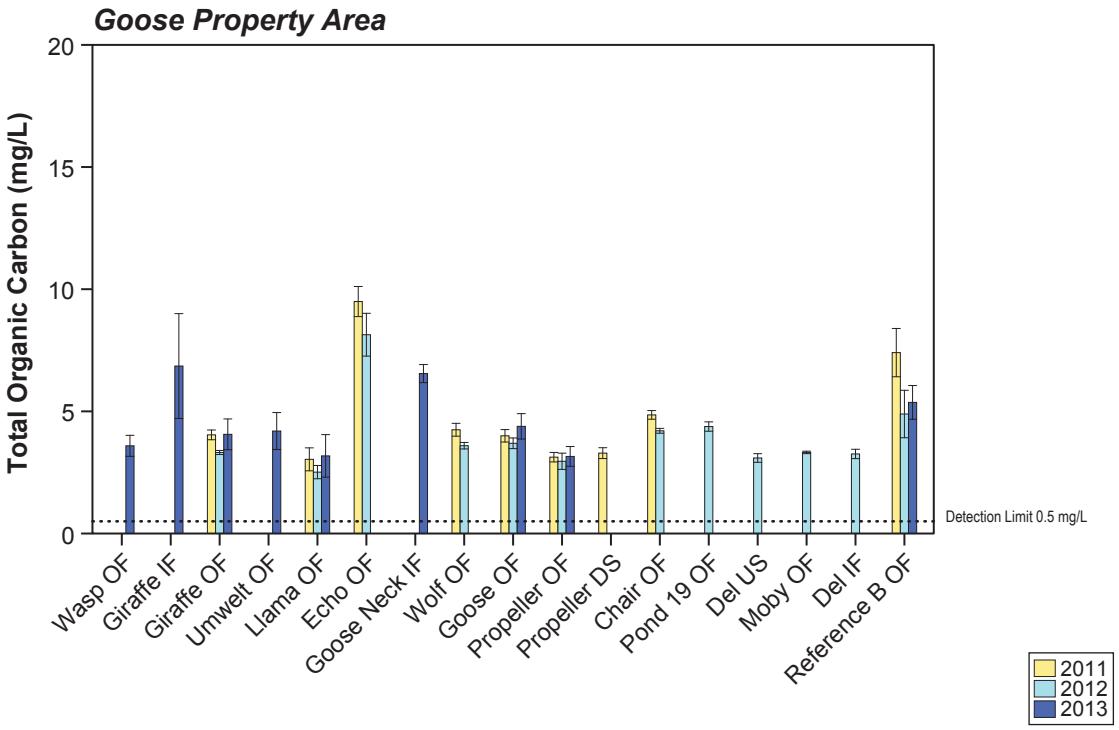
Total Phosphorus in Streams, Back River Project Area, 2011 to 2013

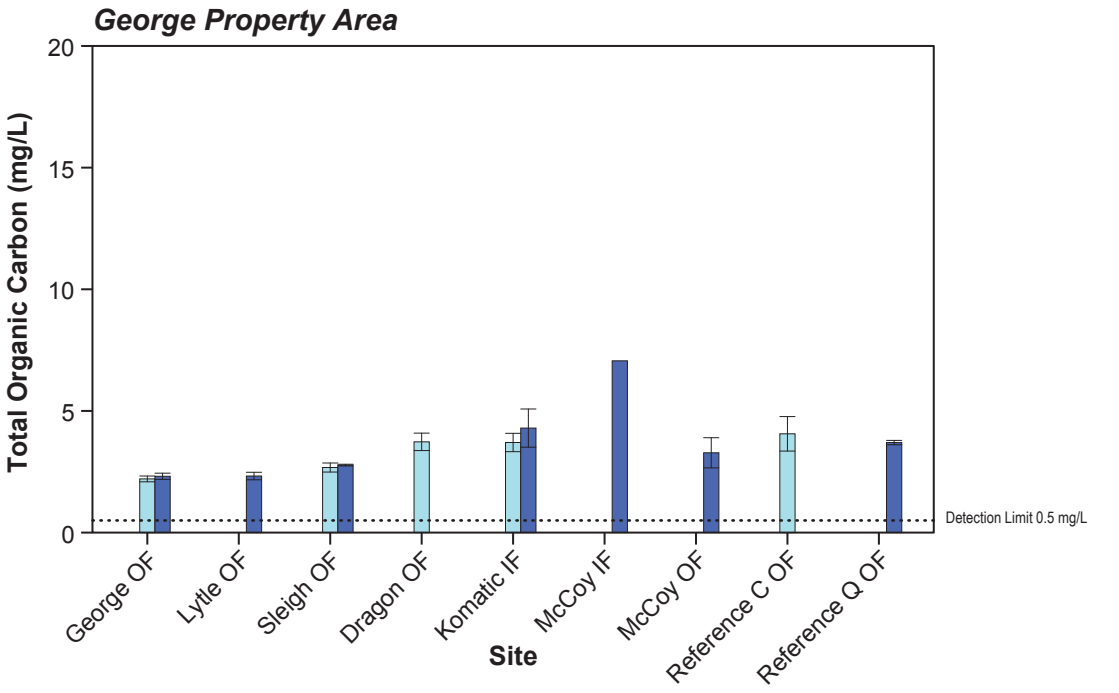
Rescan an ERM company

Appendix 3.4-18

Total Organic Carbon in Streams, Back River Project Area, 2011 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Appendix 3.4-18

Sabina GOLD & SILVER CORP.

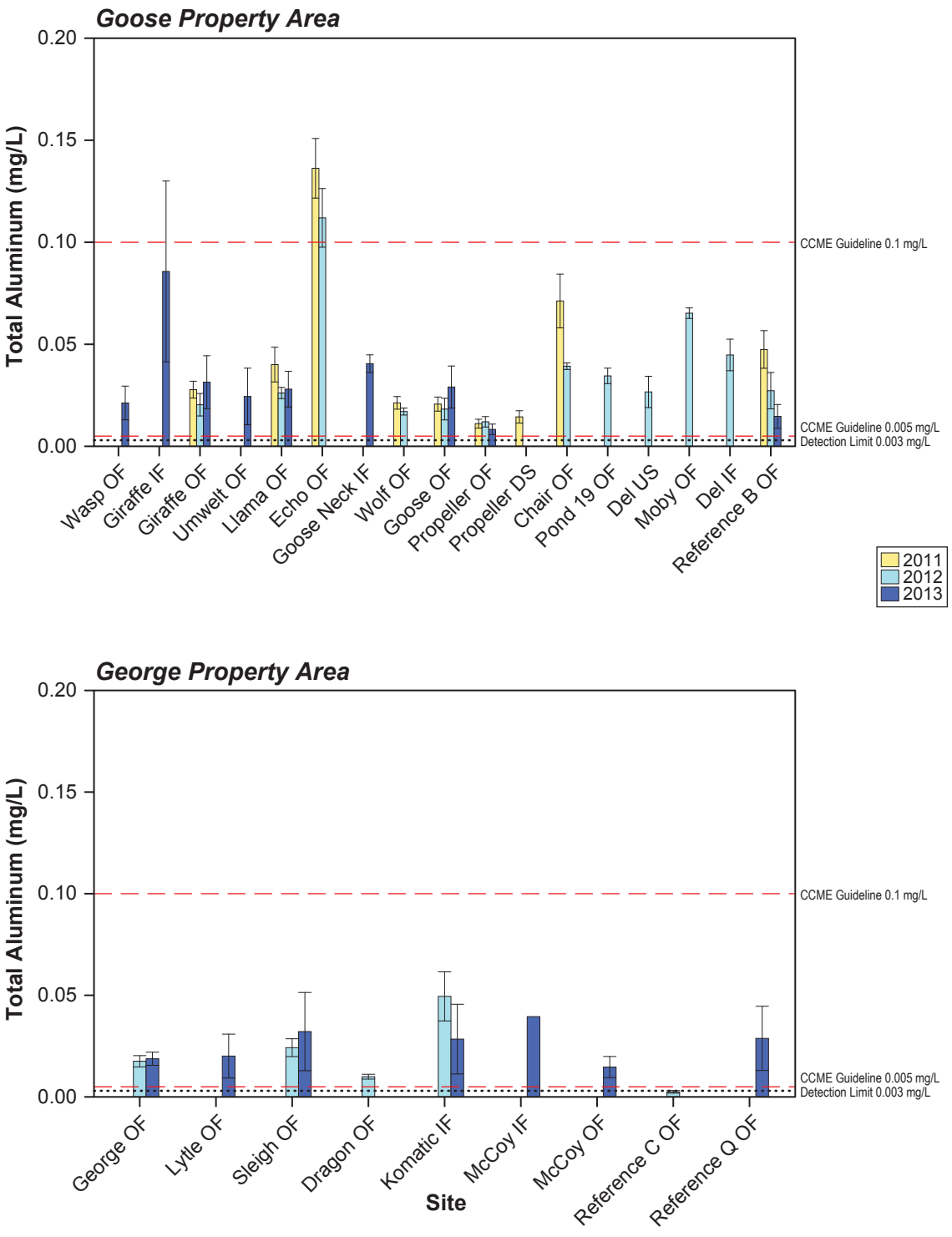
Total Organic Carbon in Streams, Back River Project Area, 2011 to 2013

Rescan an ERM company

Appendix 3.4-19

Total Aluminum in Streams, Back River Project Area, 2011 to 2013

Rescan™
an ERM company



Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME guideline for alumninum is pH−dependent: if pH < 6.5, then guideline = 0.005 mg/L;
if pH ≥ 6.5 then guideline = 0.1 mg/L.

Appendix 3.4-19

Sabina GOLD & SILVER CORP.

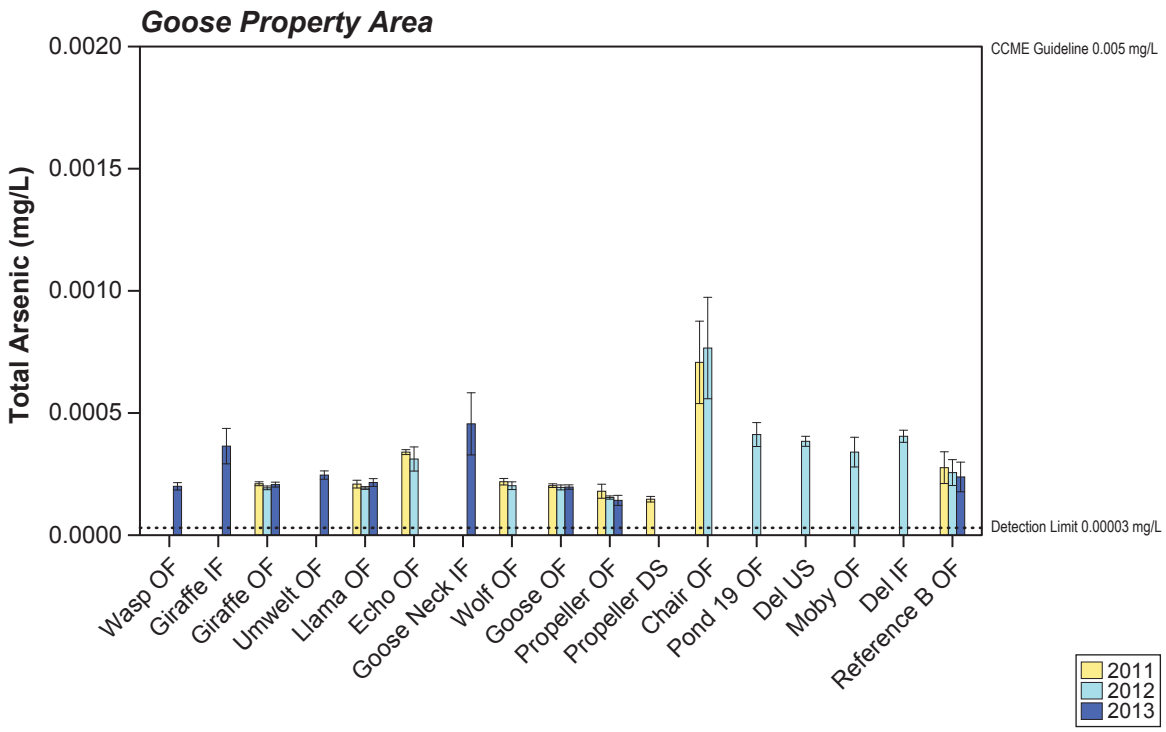
Total Aluminum in Streams, Back River Project Area, 2011 to 2013

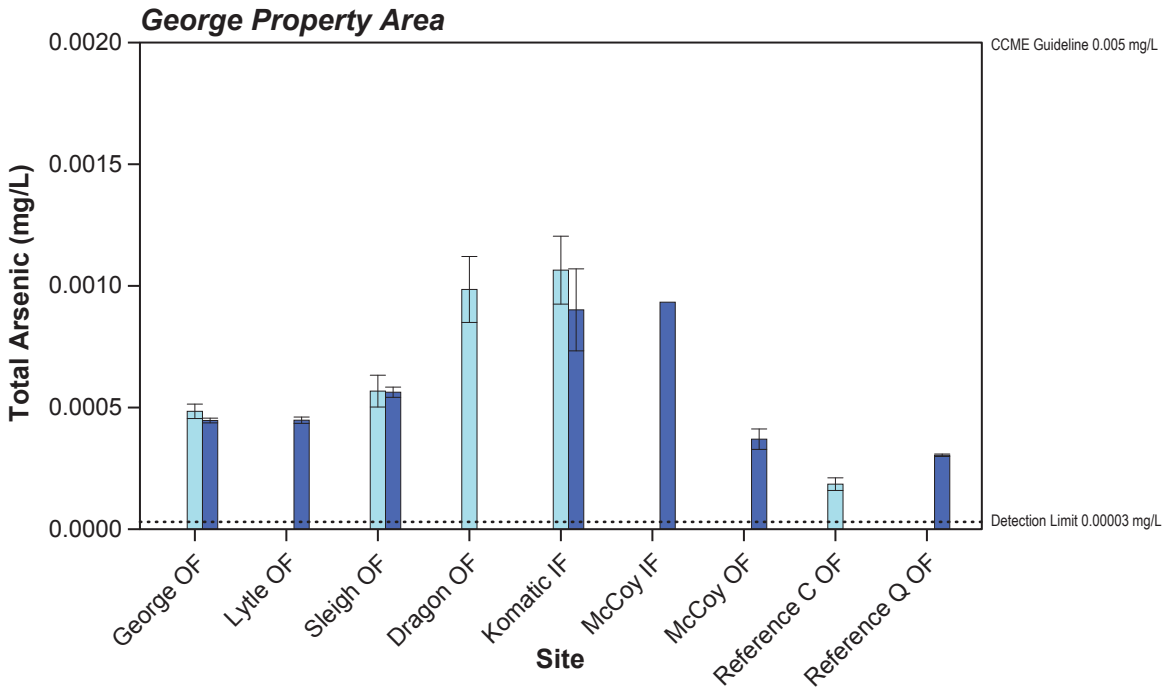
Rescan an ERM company

Appendix 3.4-20

Total Arsenic in Streams, Back River Project Area, 2011 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Sabina GOLD & SILVER CORP.

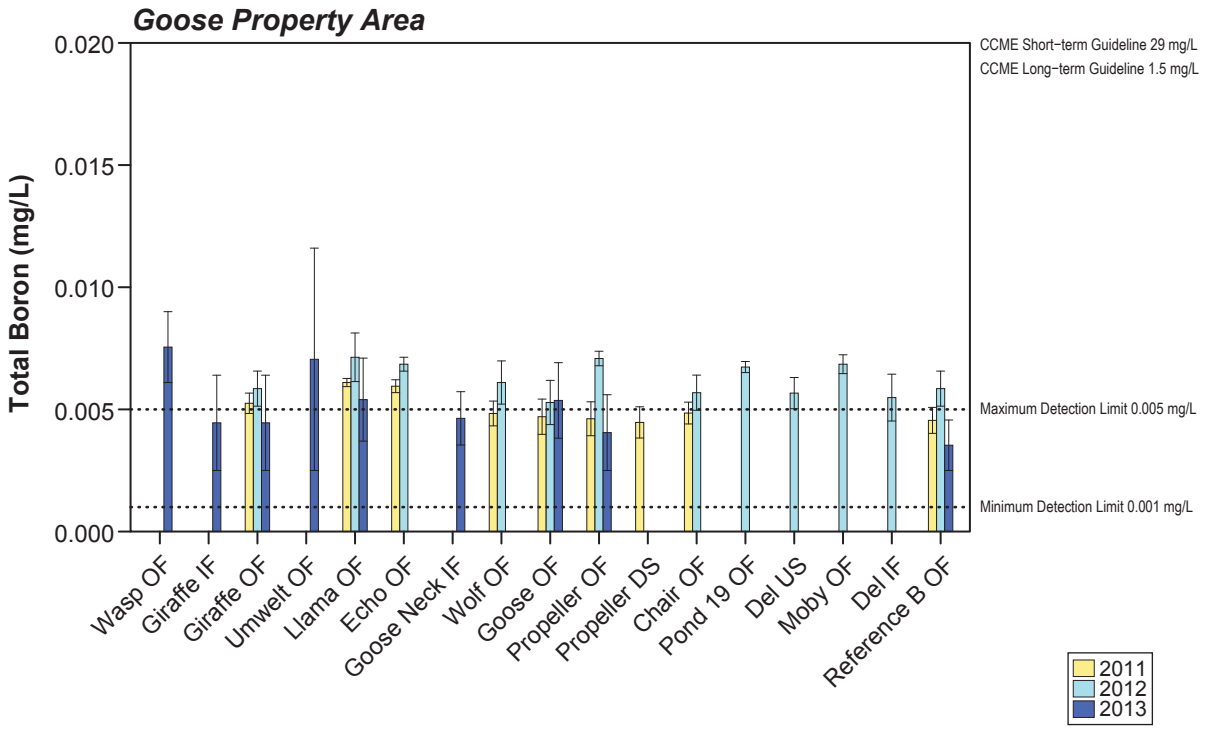
Total Arsenic in Streams, Back River Project Area, 2011 to 2013

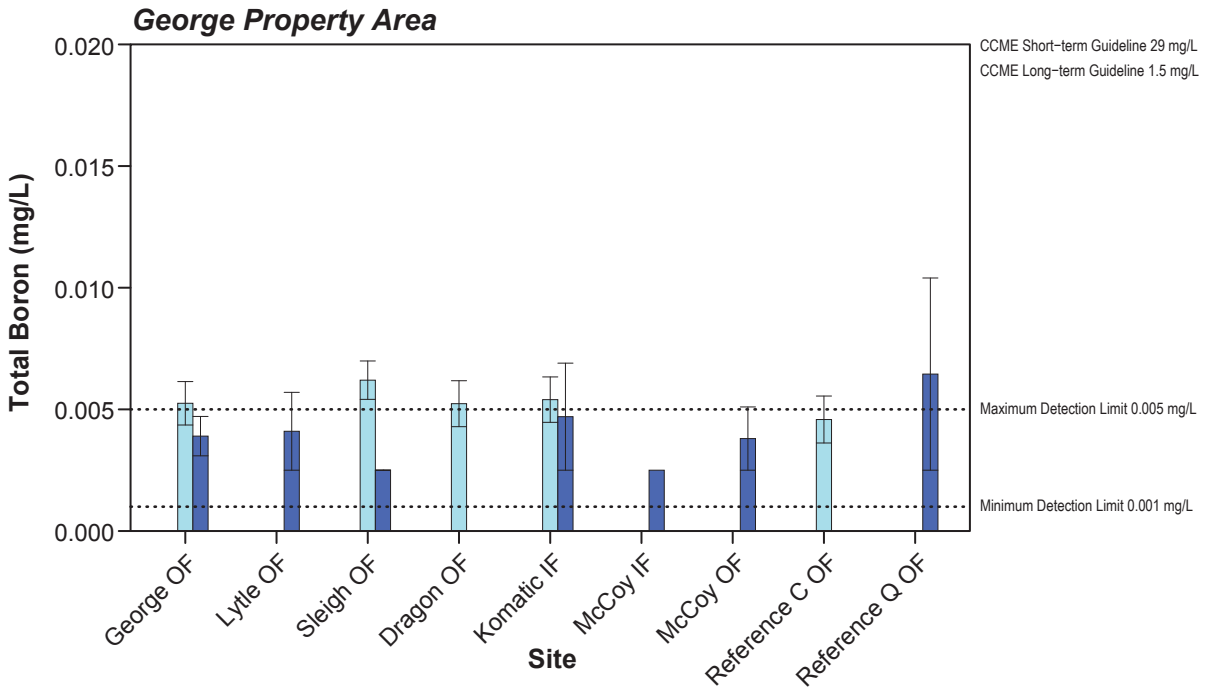
Rescan an ERM company

Appendix 3.4-21

Total Boron in Streams, Back River Project Area, 2011 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Appendix 3.4-21

Sabina GOLD & SILVER CORP.

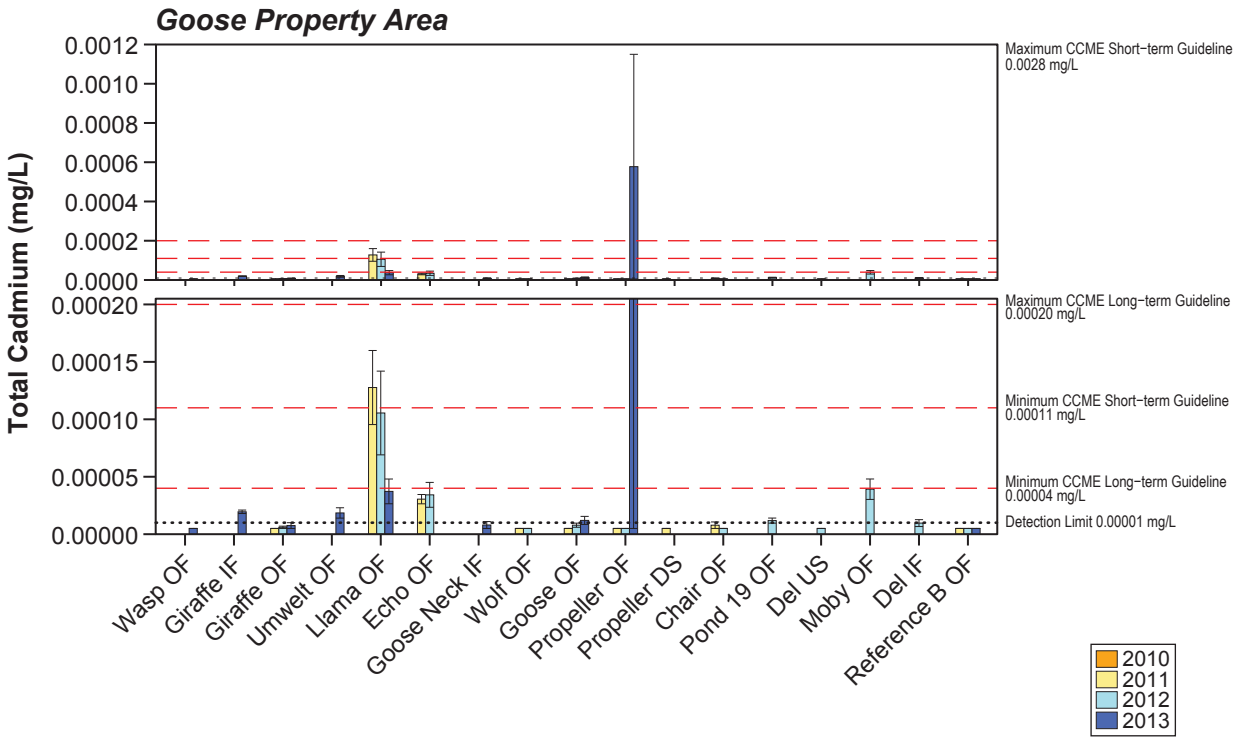
Total Boron in Streams, Back River Project Area, 2011 to 2013

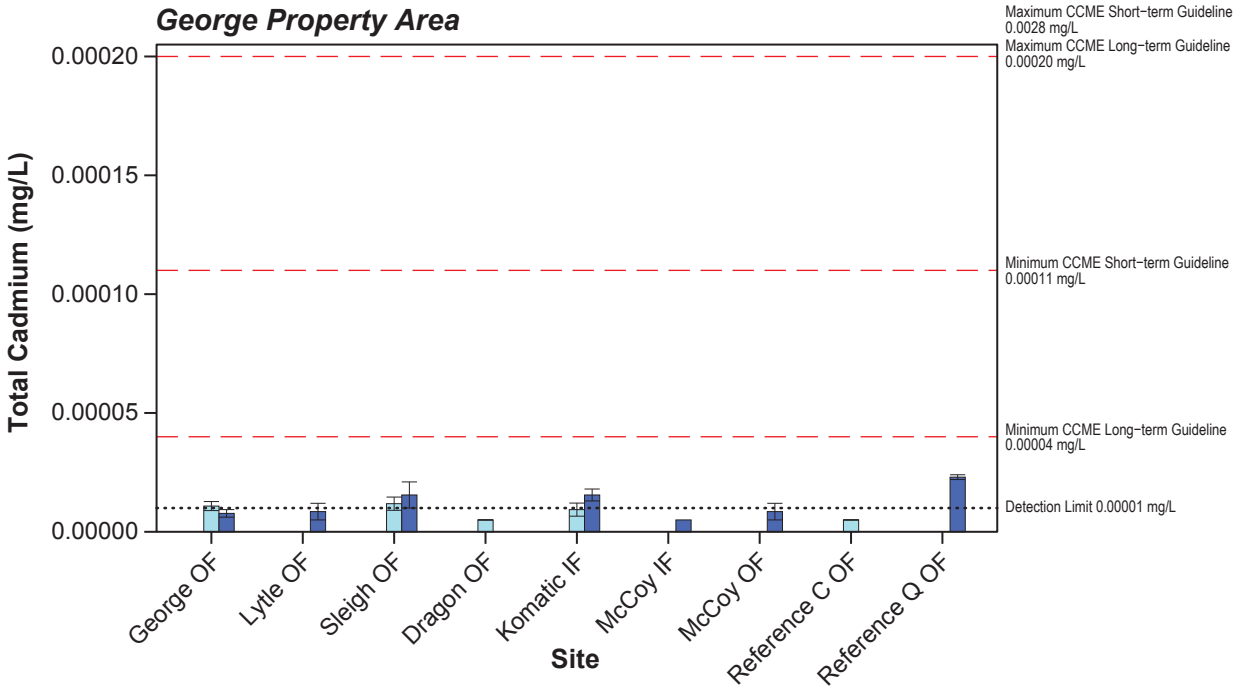
Rescan an ERM company

Appendix 3.4-22

Total Cadmium in Streams, Back River Project Area, 2011 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME short-term cadmium guideline is hardness-dependent (mg/L) = $10^{(1.016(\log10(\text{hardness}))-1.71)}/1000$, with a minimum of 0.00011 mg/L.
CCME long-term cadmium guideline is hardness-dependent (mg/L) = $10^{(0.83(\log10(\text{hardness}))-2.46)}/1000$, with a minimum of 0.00004 mg/L.

Appendix 3.4-22

Total Cadmium in Streams, Back River Project Area, 2011 to 2013

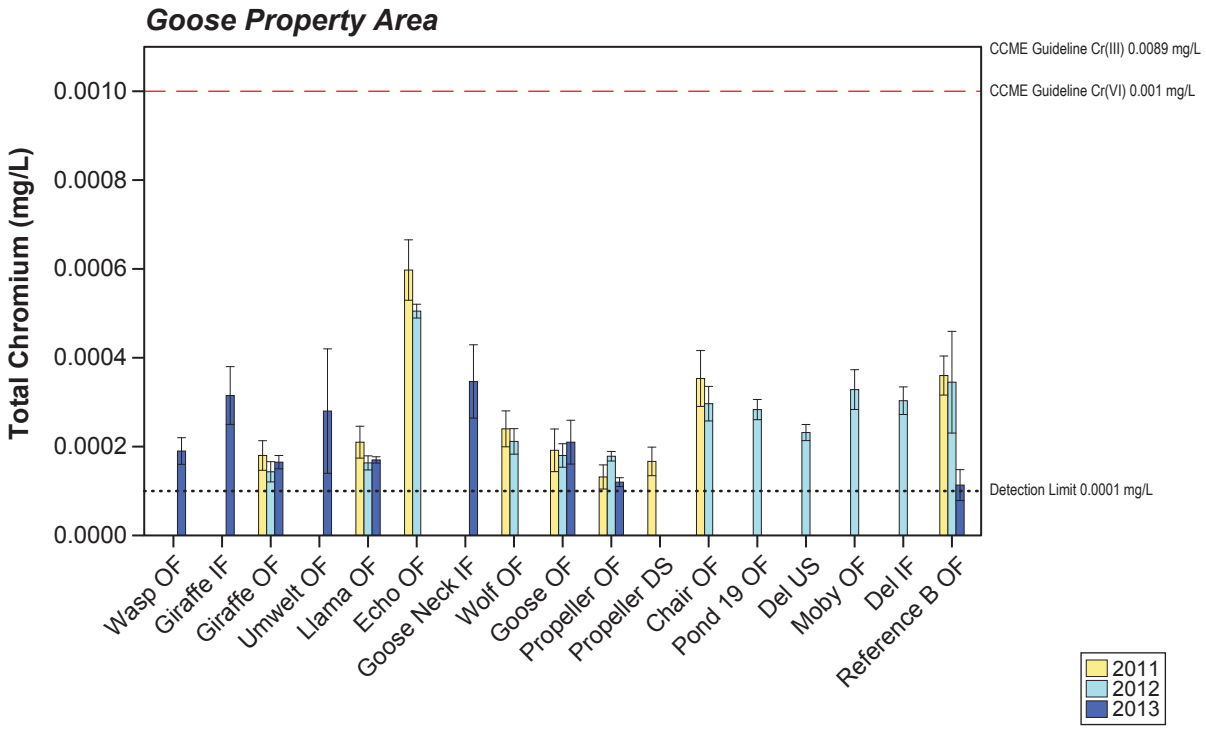
Sabina GOLD & SILVER CORP.

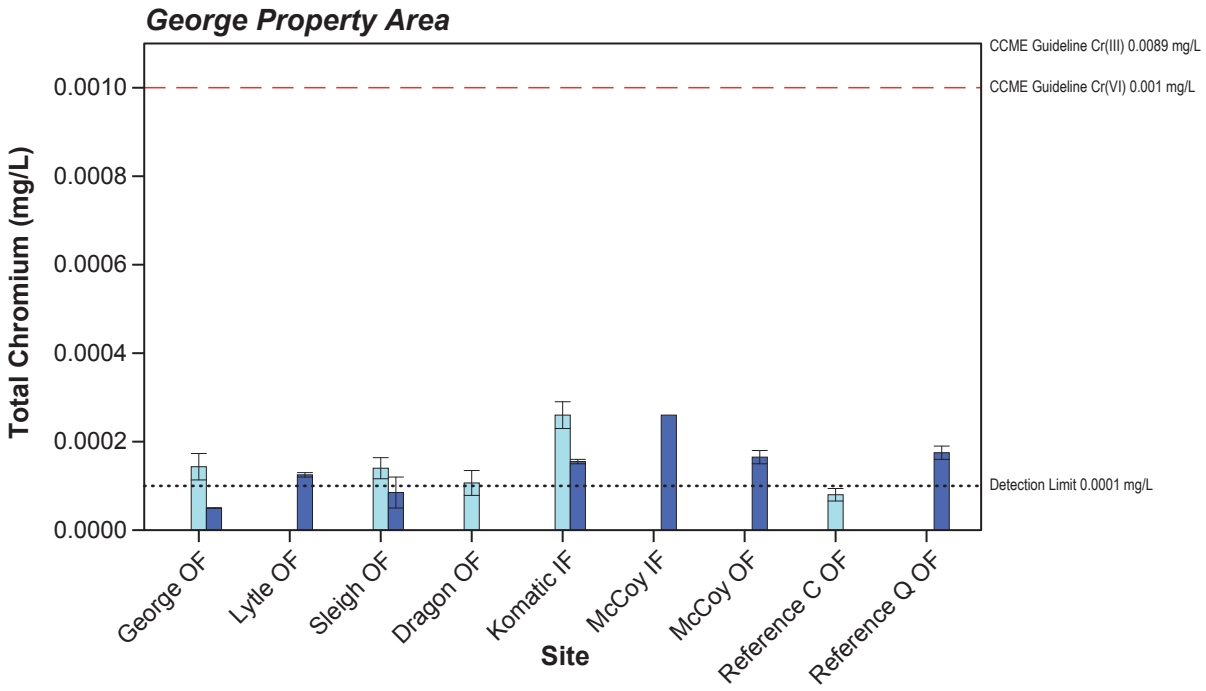
Rescan an ERM company

Appendix 3.4-23

Total Chromium in Streams, Back River Project Area, 2011 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Appendix 3.4-23

Sabina GOLD & SILVER CORP.

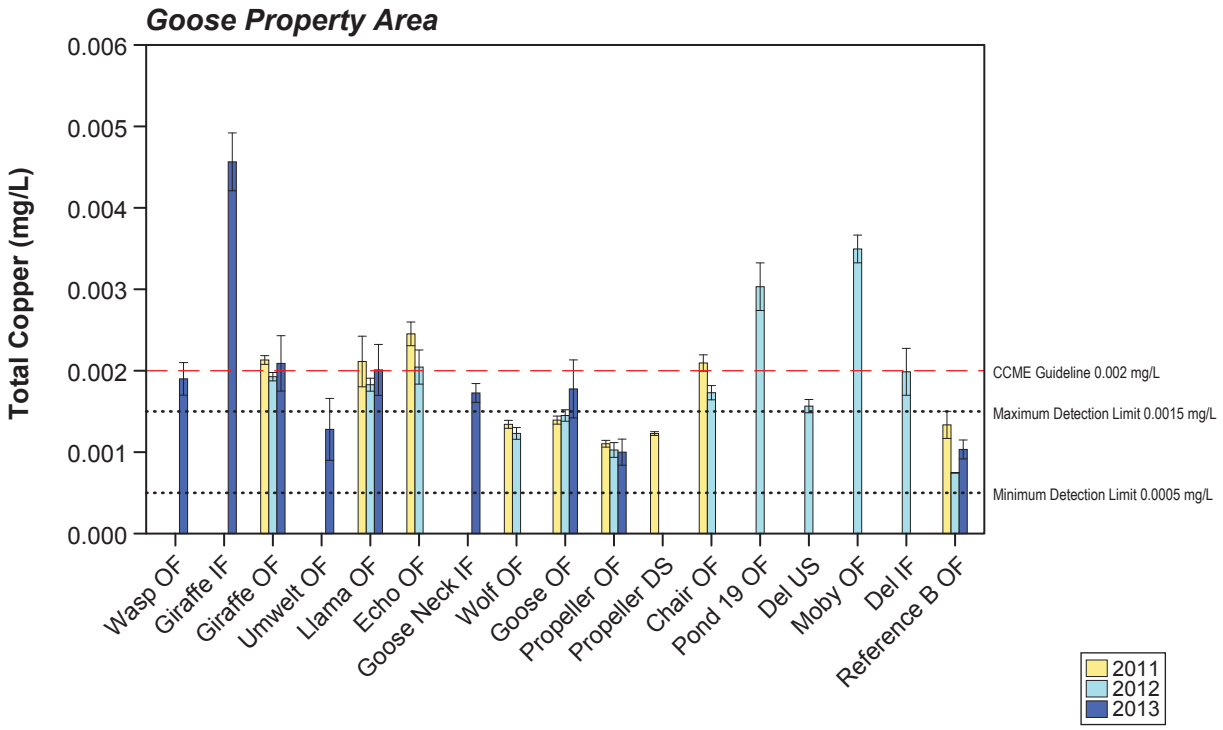
Total Chromium in Streams, Back River Project Area, 2011 to 2013

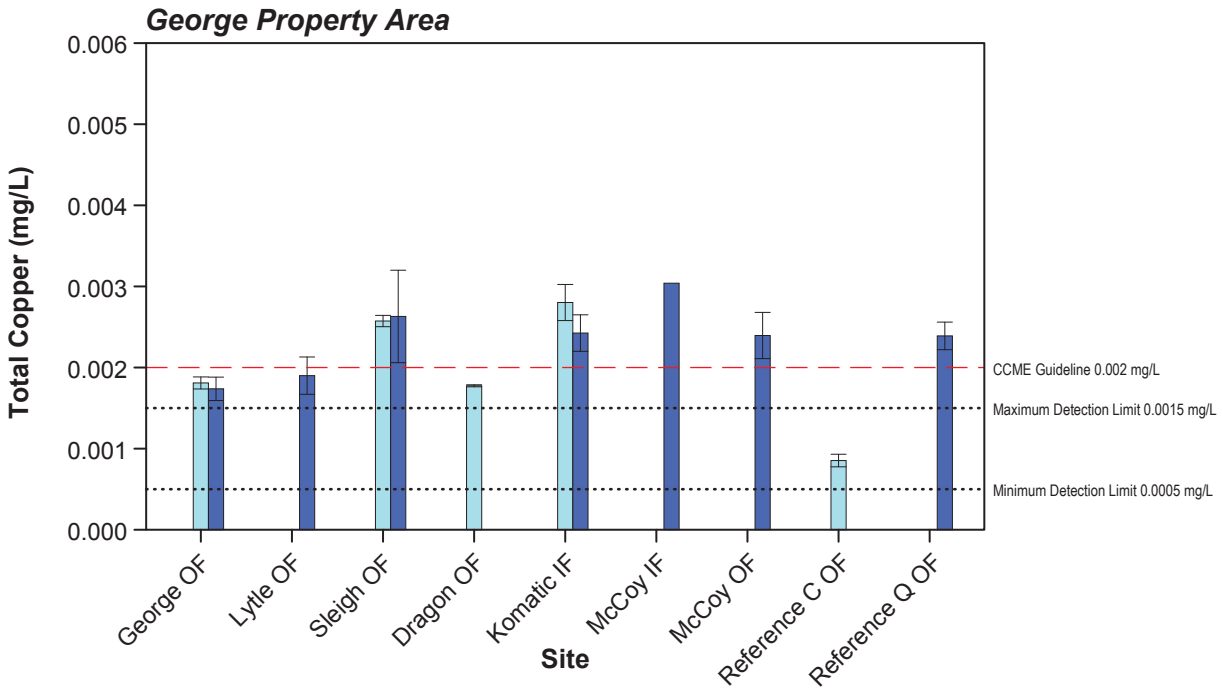
Rescan an ERM company

Appendix 3.4-24

Total Copper in Streams, Back River Project Area, 2011 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
*CCME copper guideline is hardness−dependent (mg/L) = $e^{(0.8545(\ln(\text{hardness}))-1.465)}$*0.0002*
with a minimum of 0.002 mg/L and a maximum of 0.004 mg/L.

Appendix 3.4-24

Sabina GOLD & SILVER CORP.

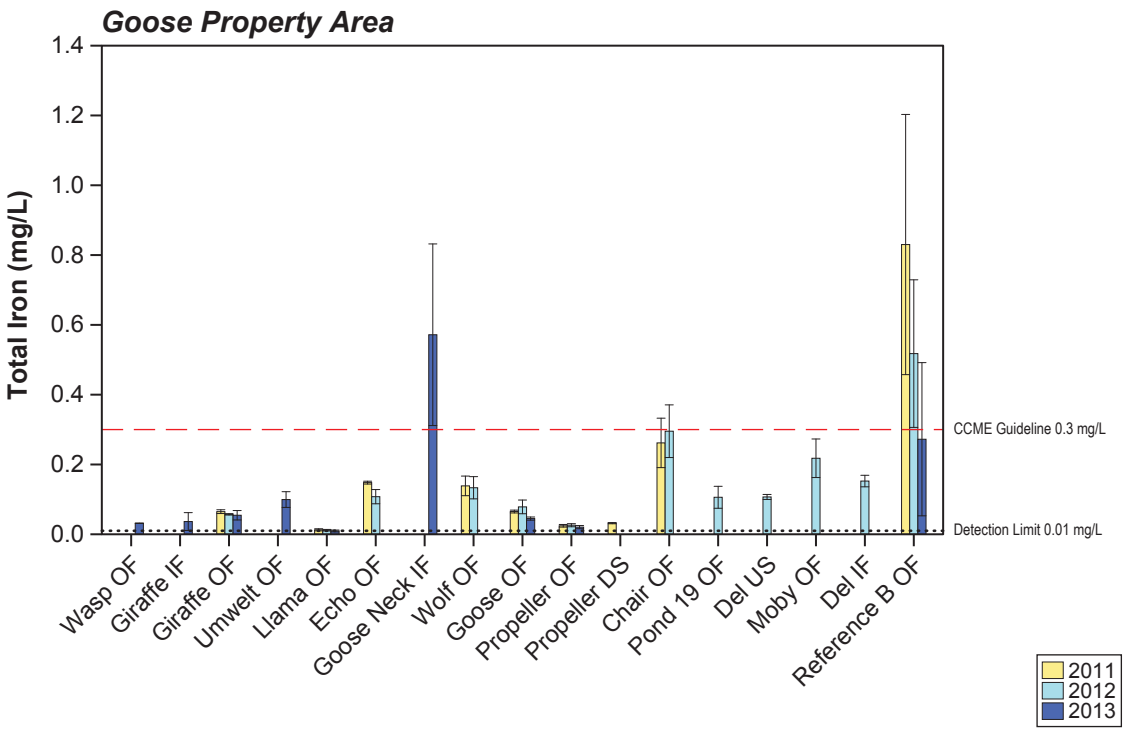
Total Copper in Streams, Back River Project Area, 2011 to 2013

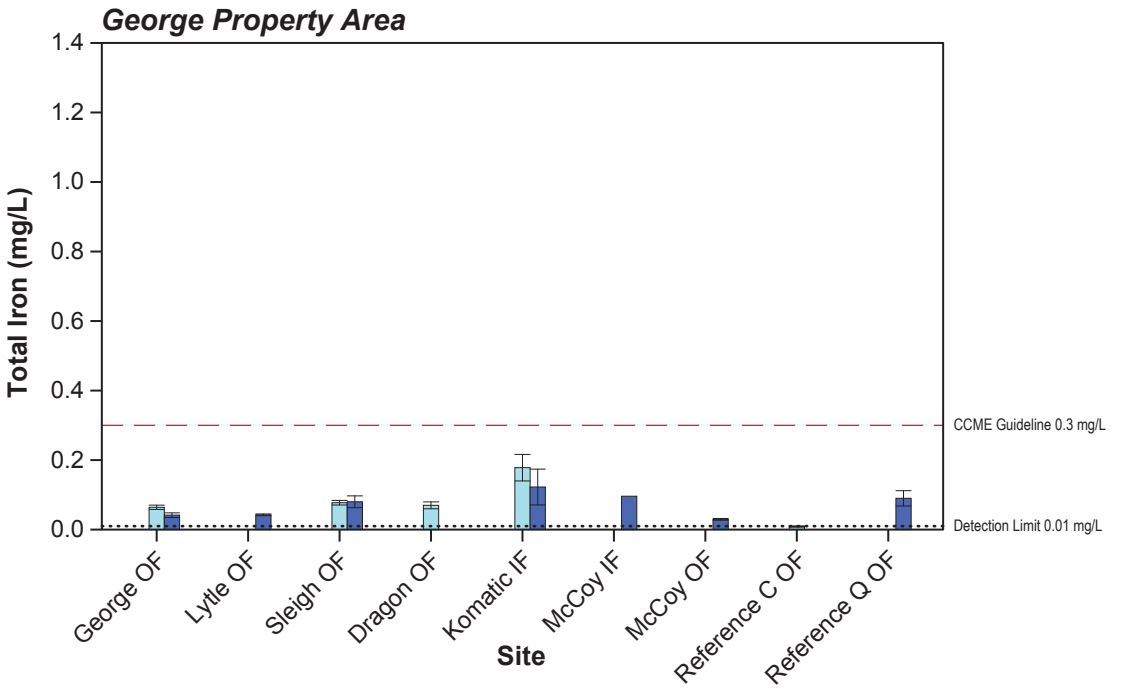
Rescan an ERM company

Appendix 3.4-25

Total Iron in Streams, Back River Project Area, 2011 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Sabina GOLD & SILVER CORP.

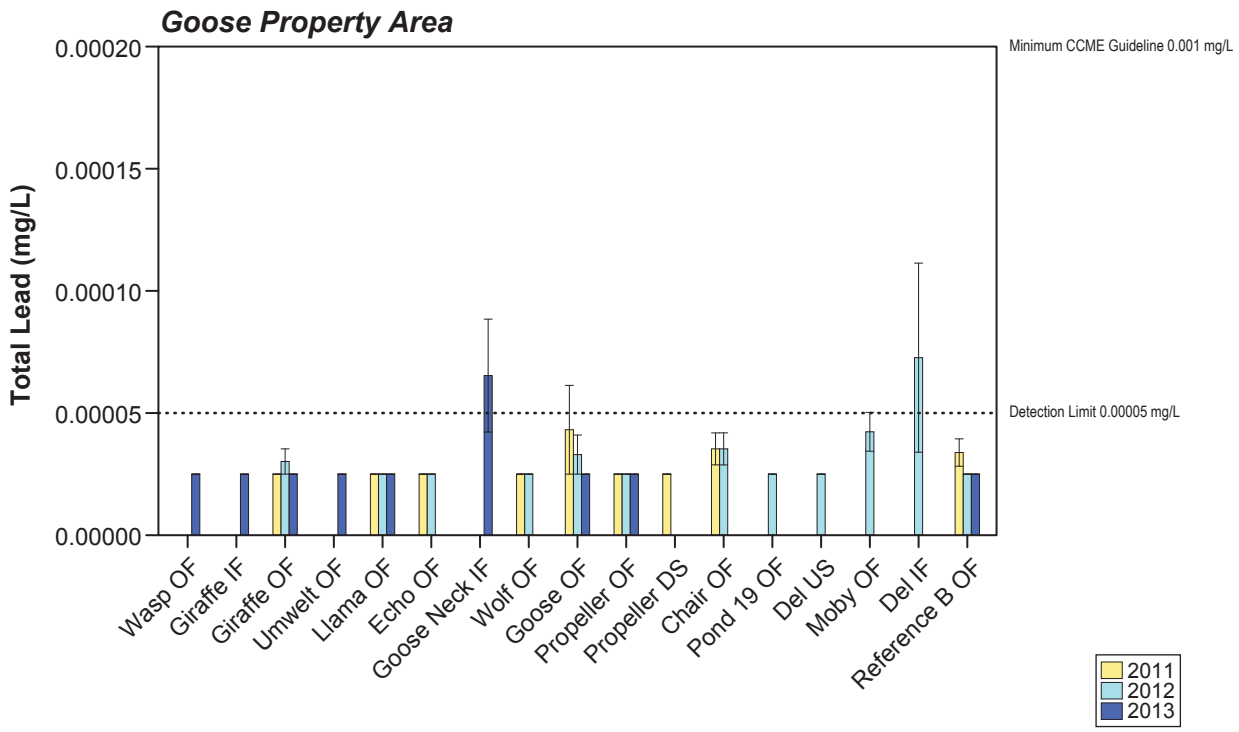
Total Iron in Streams, Back River Project Area, 2011 to 2013

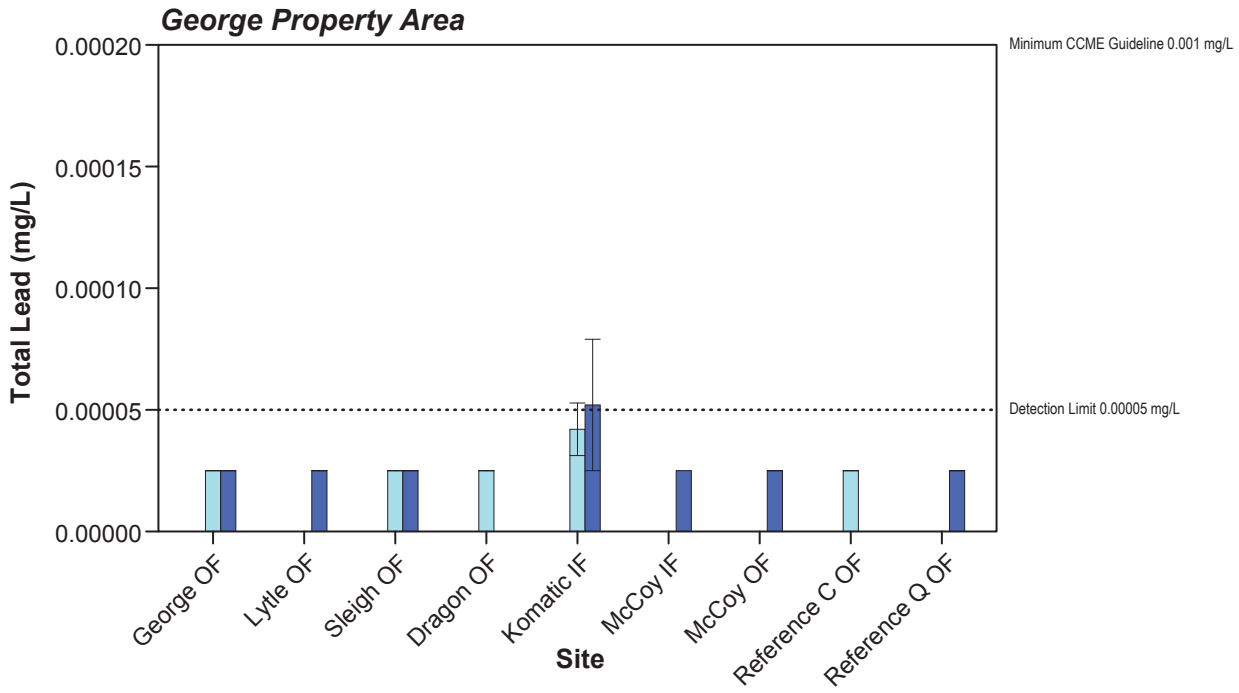
Rescan an ERM company

Appendix 3.4-26

Total Lead in Streams, Back River Project Area, 2011 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME lead guideline is hardness−dependent (mg/L) = $e^{(1.273(\ln(\text{hardness}))-4.705)}/1000$ with a minimum of 0.001 mg/L and a maximum of 0.007 mg/L.

Appendix 3.4-26

Total Lead in Streams, Back River Project Area, 2011 to 2013

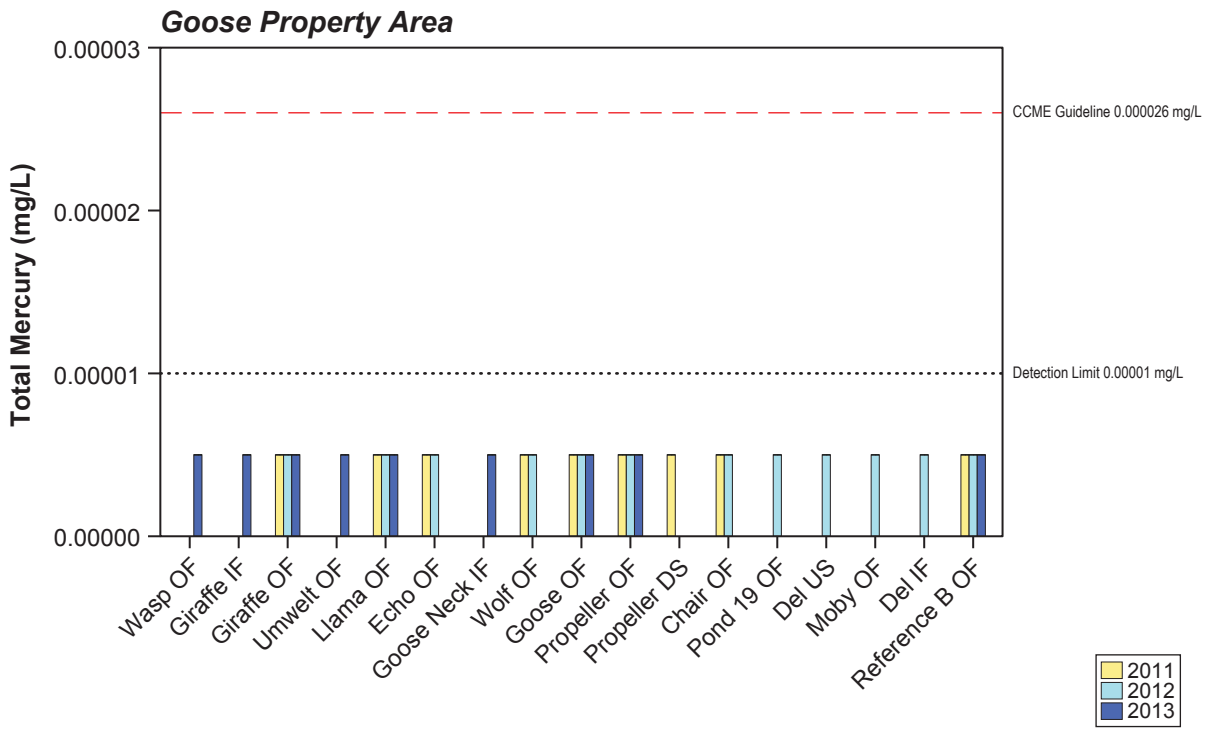
Sabina GOLD & SILVER CORP.

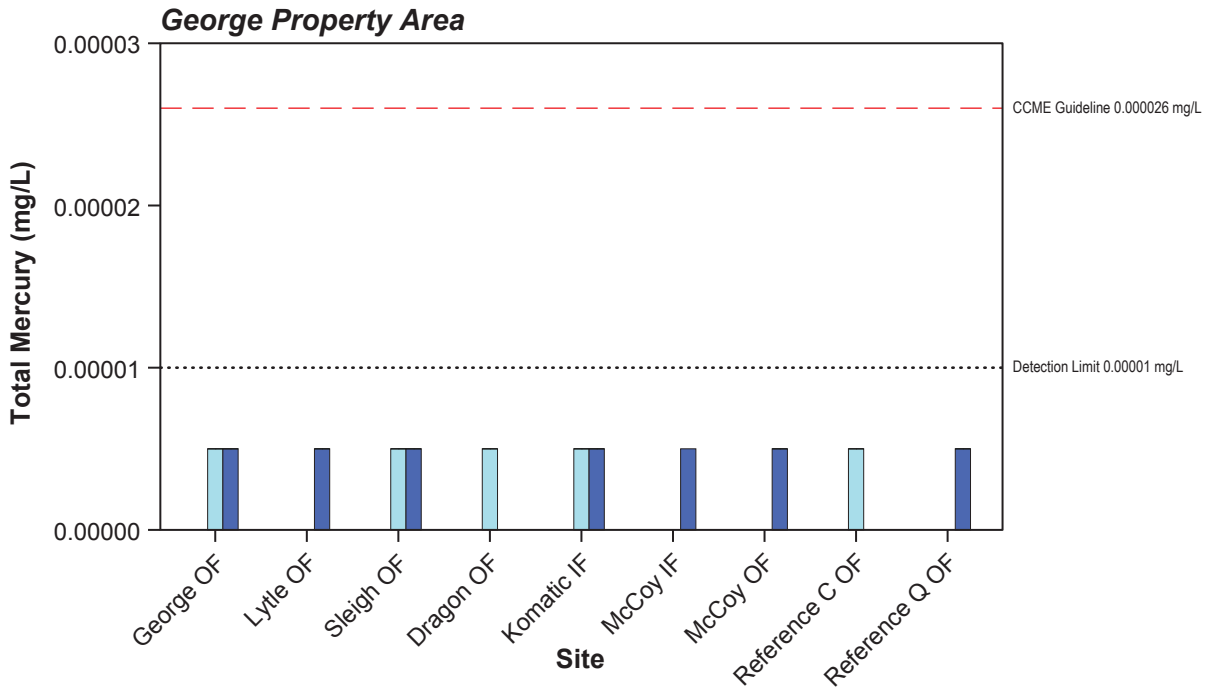
Rescan an ERM company

Appendix 3.4-27

Total Mercury in Streams, Back River Project Area, 2011 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Sabina GOLD & SILVER CORP.

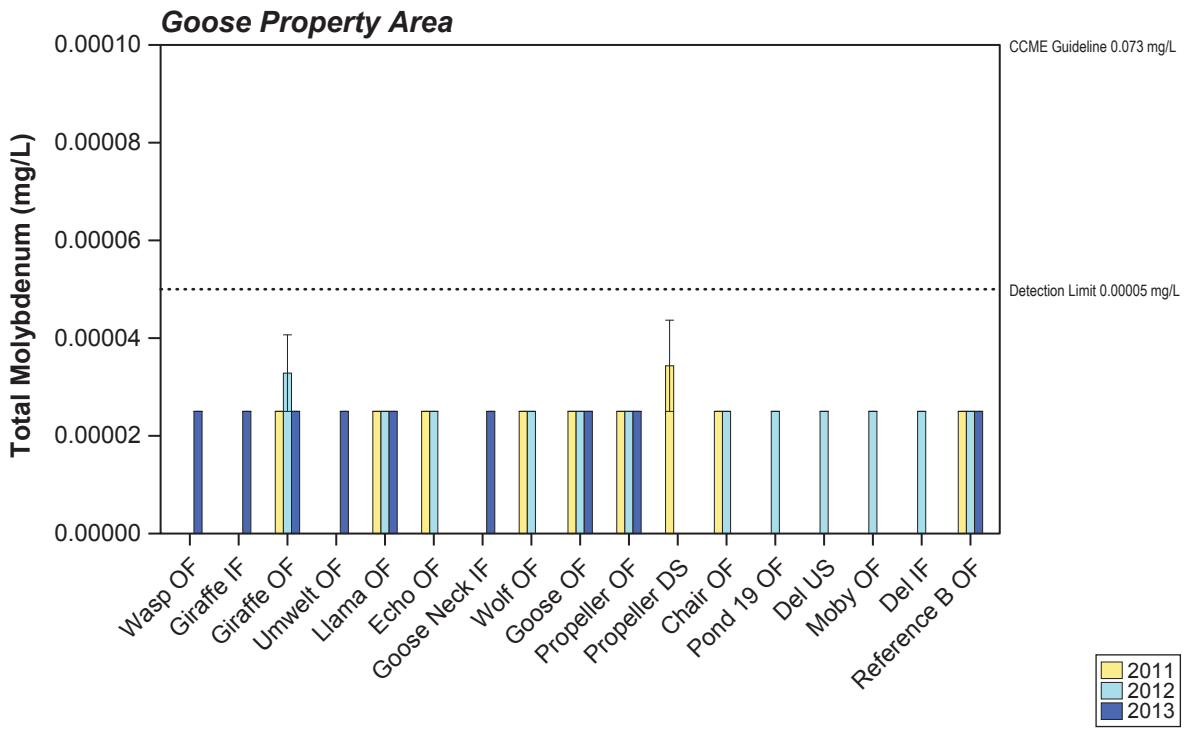
Total Mercury in Streams, Back River Project Area, 2011 to 2013

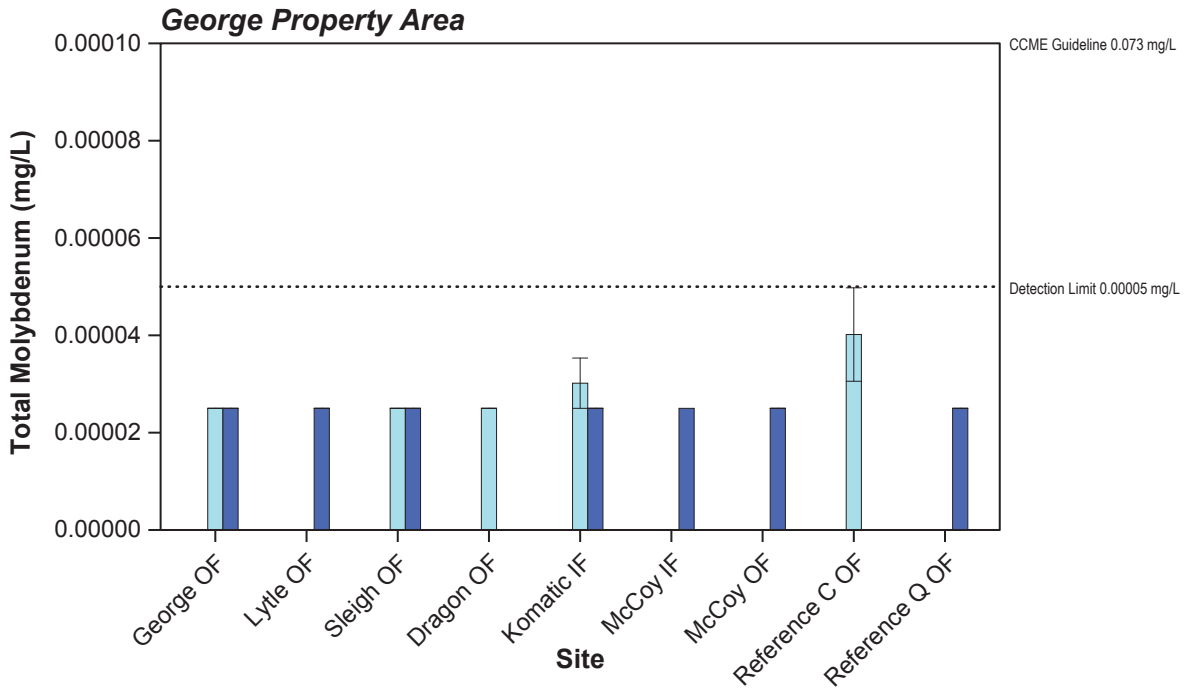
Rescan an ERM company

Appendix 3.4-28

Total Molybdenum in Streams, Back River Project Area, 2011 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
The CCME guideline is an interim guideline.

Sabina GOLD & SILVER CORP.

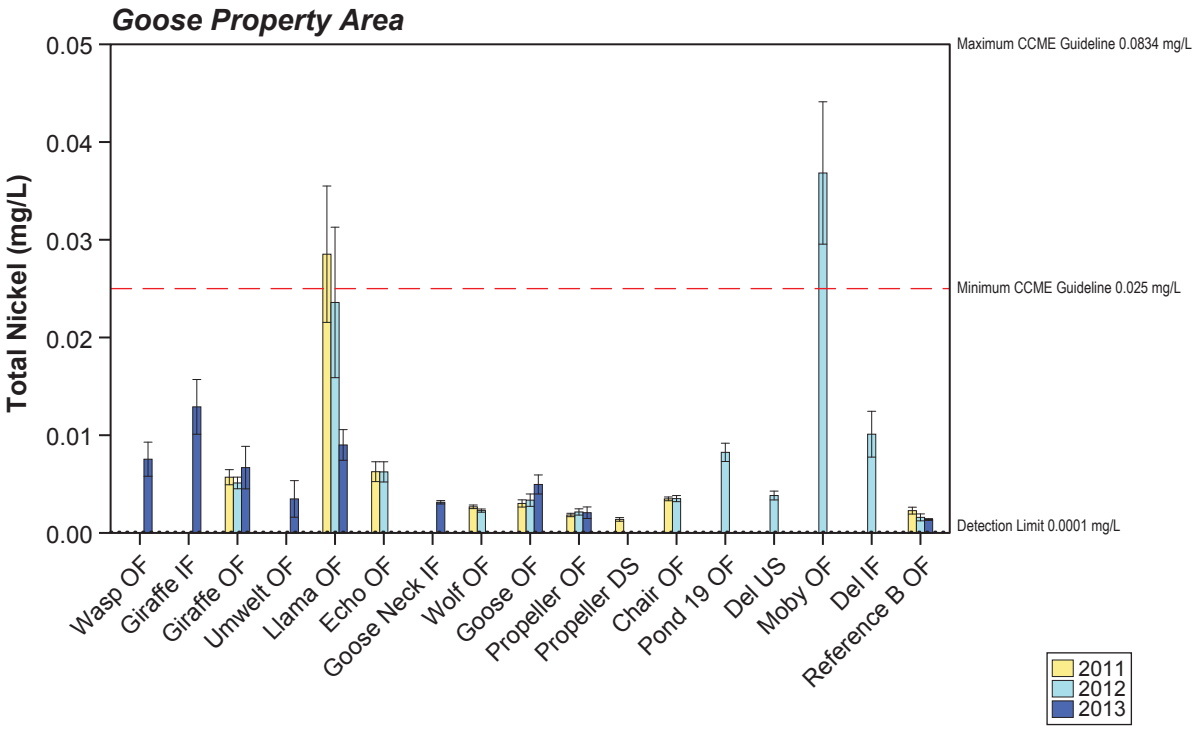
Total Molybdenum in Streams, Back River Project Area, 2011 to 2013

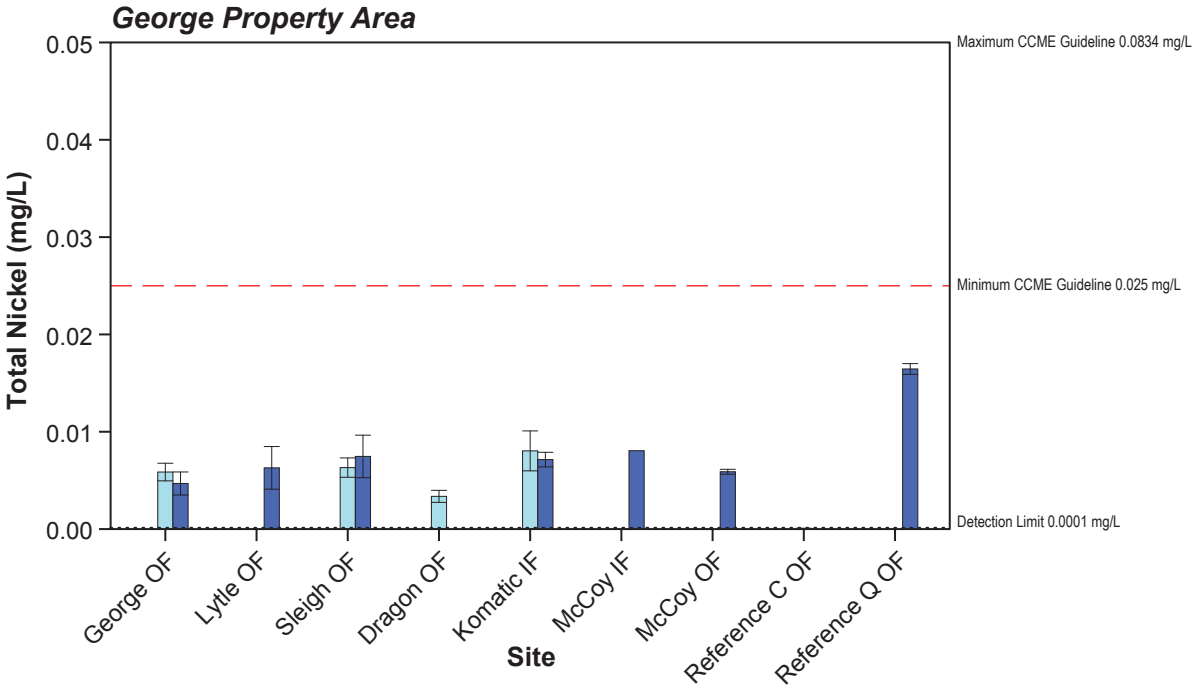
Rescan an ERM company

Appendix 3.4-29

Total Nickel in Streams, Back River Project Area, 2011 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME nickel guideline is hardness−dependent (mg/L) = $e^{(0.76[\ln(\text{hardness})]+1.06)}/1000$ with a minimum of 0.025 mg/L and maximum of 0.15 mg/L.

Appendix 3.4-29

Sabina GOLD & SILVER CORP.

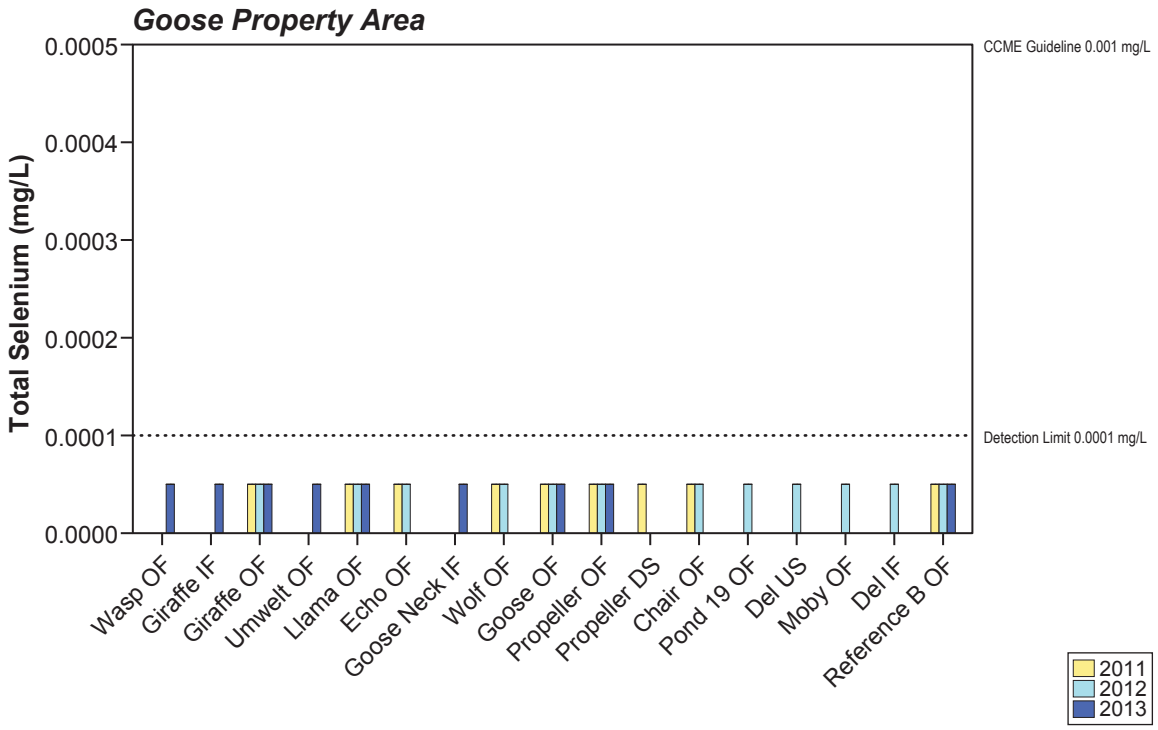
Total Nickel in Streams, Back River Project Area, 2011 to 2013

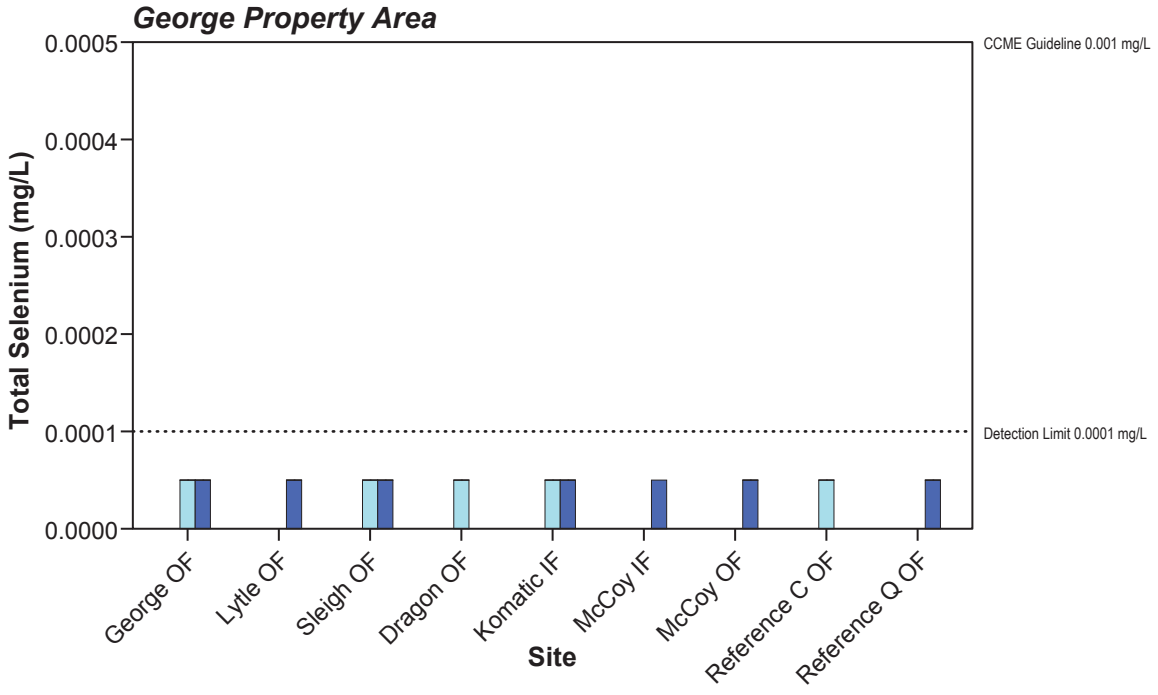
Rescan an ERM company

Appendix 3.4-30

Total Selenium in Streams, Back River Project Area, 2011 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Sabina GOLD & SILVER CORP.

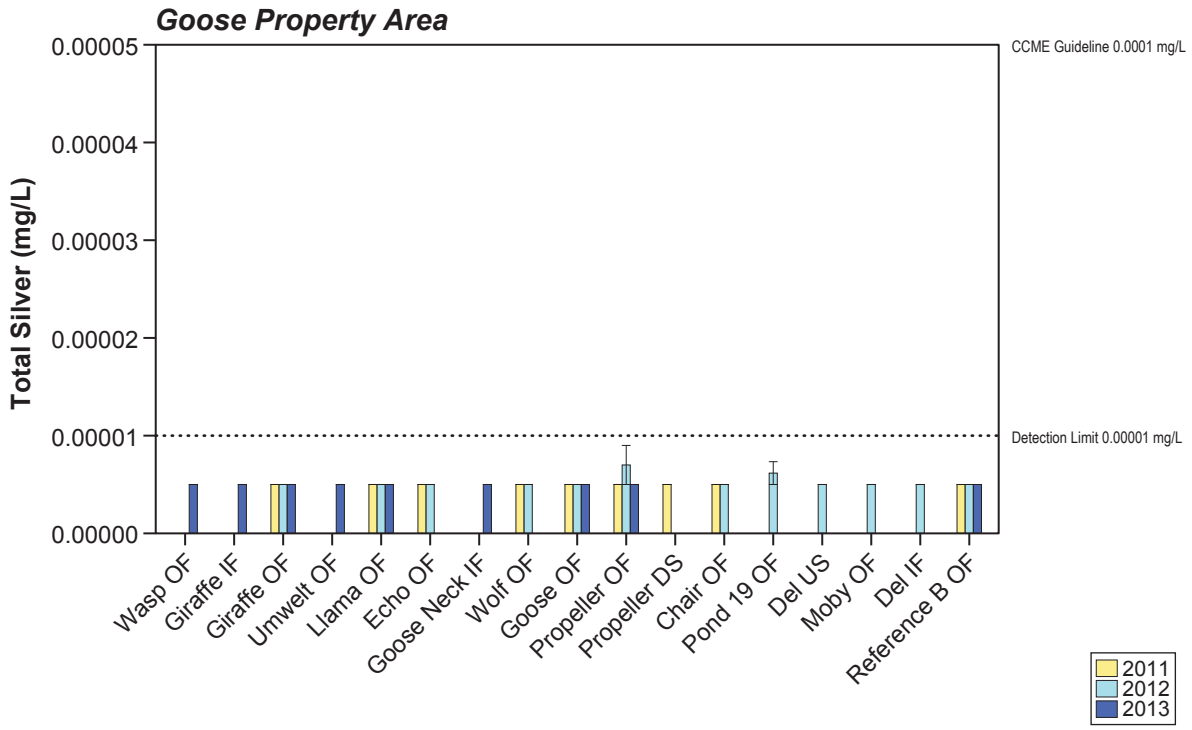
Total Selenium in Streams, Back River Project Area, 2011 to 2013

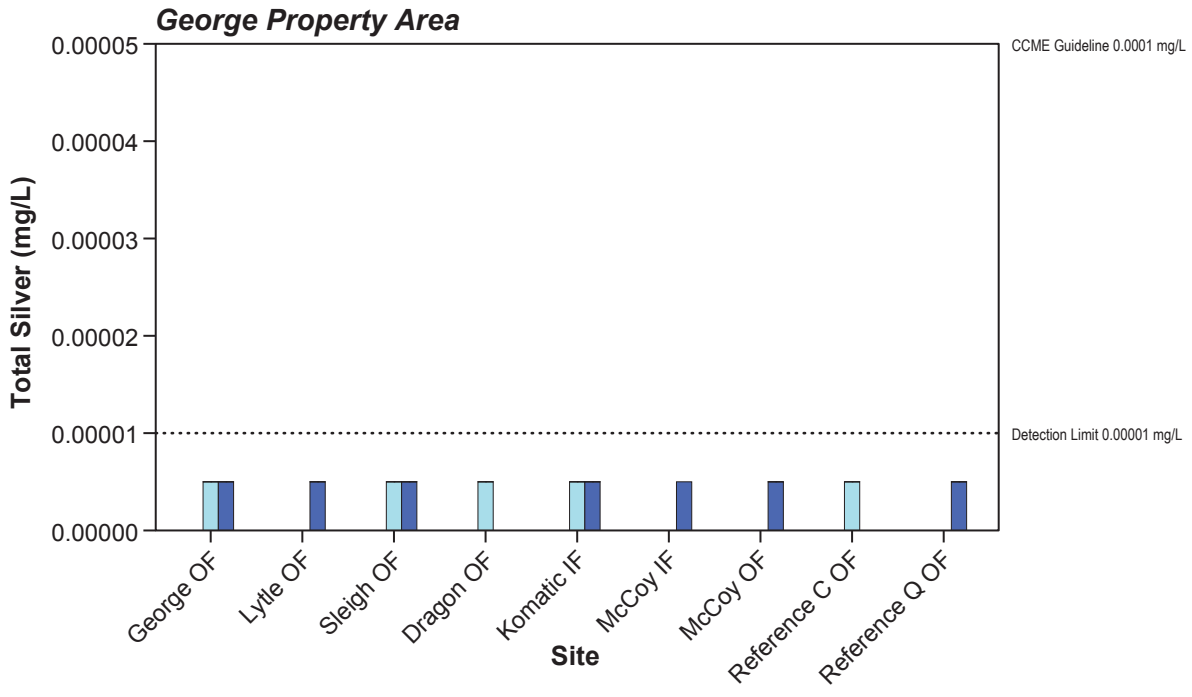
Rescan an ERM company

Appendix 3.4-31

Total Silver in Streams, Back River Project Area, 2011 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Sabina GOLD & SILVER CORP.

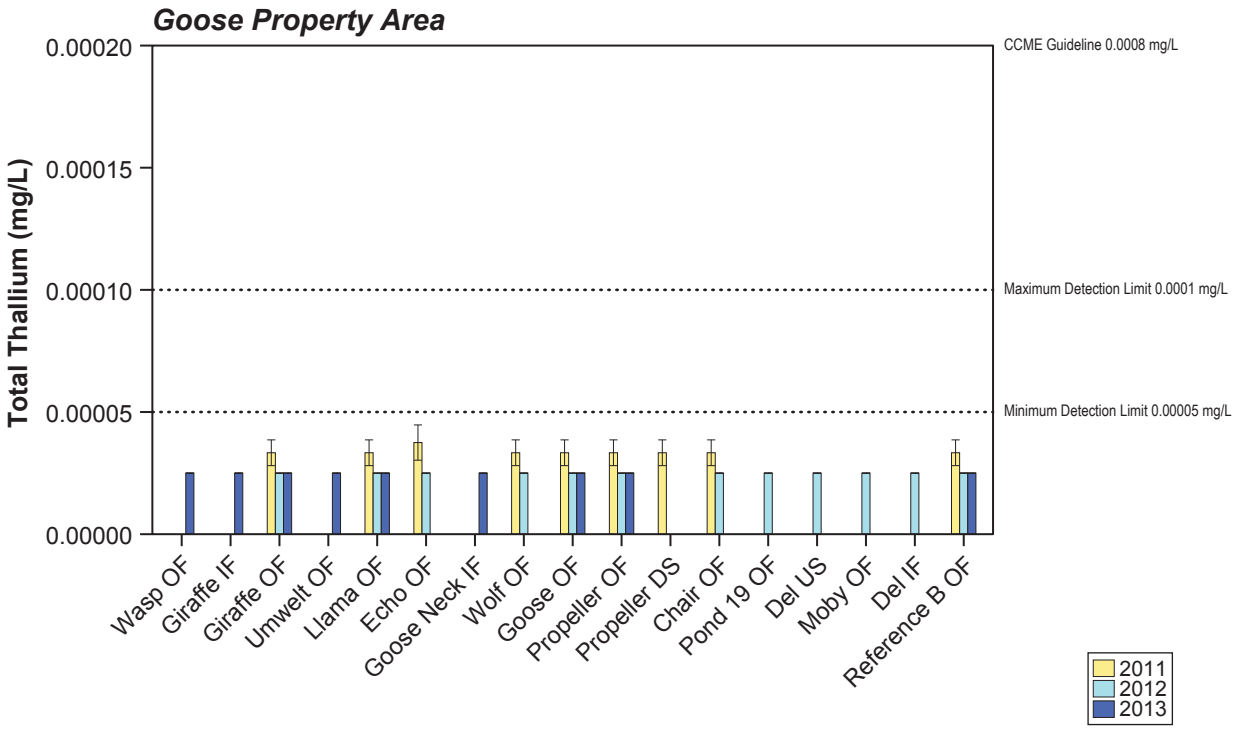
Total Silver in Streams, Back River Project Area, 2011 to 2013

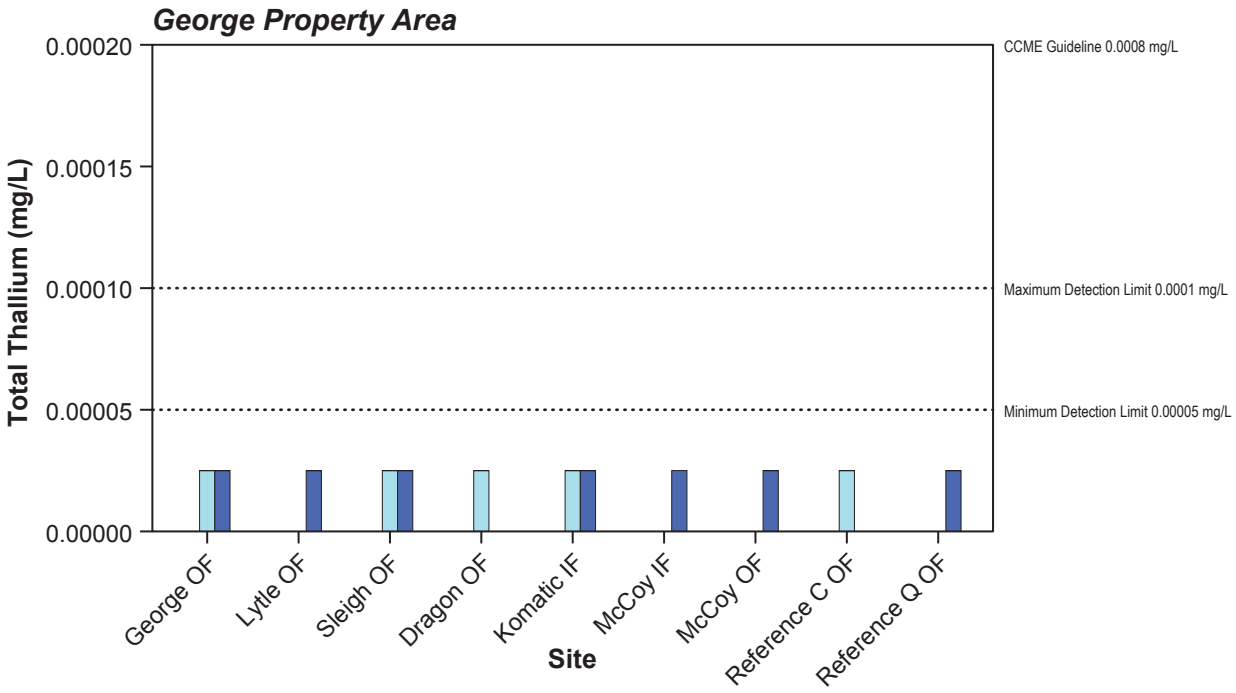
Rescan an ERM company

Appendix 3.4-32

Total Thallium in Streams, Back River Project Area, 2011 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Sabina GOLD & SILVER CORP.

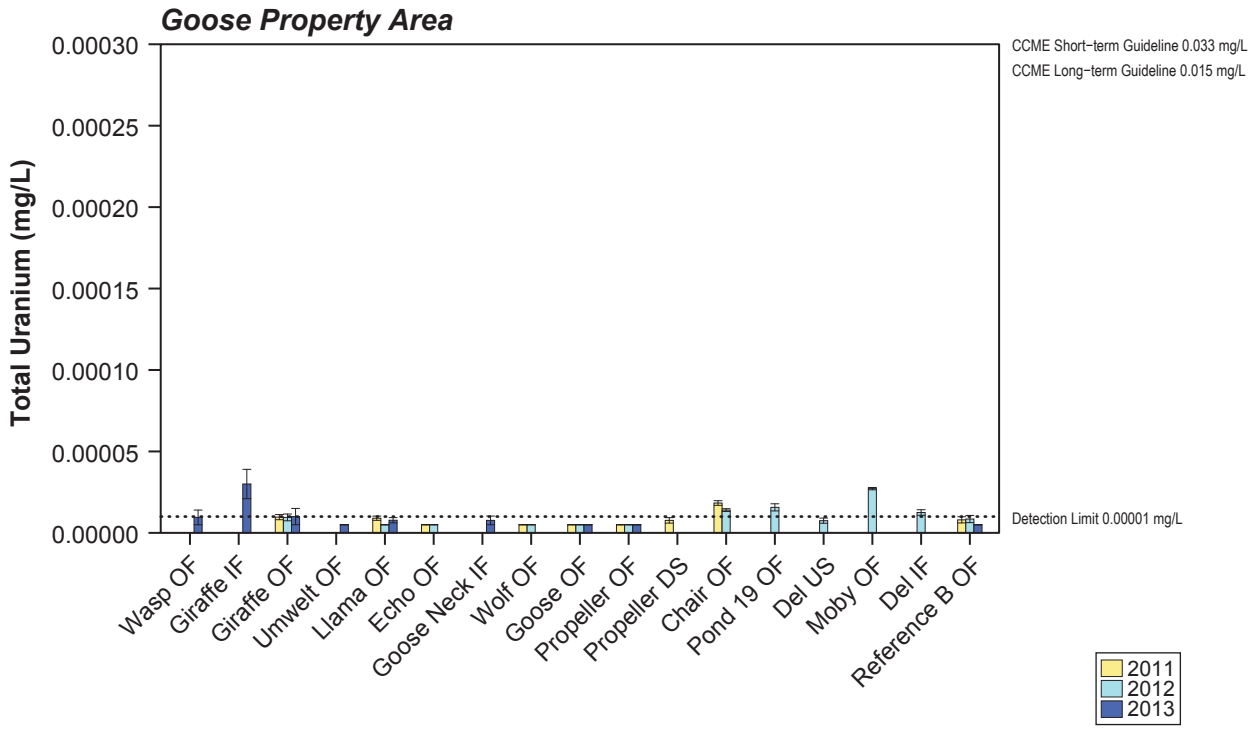
Total Thallium in Streams, Back River Project Area, 2011 to 2013

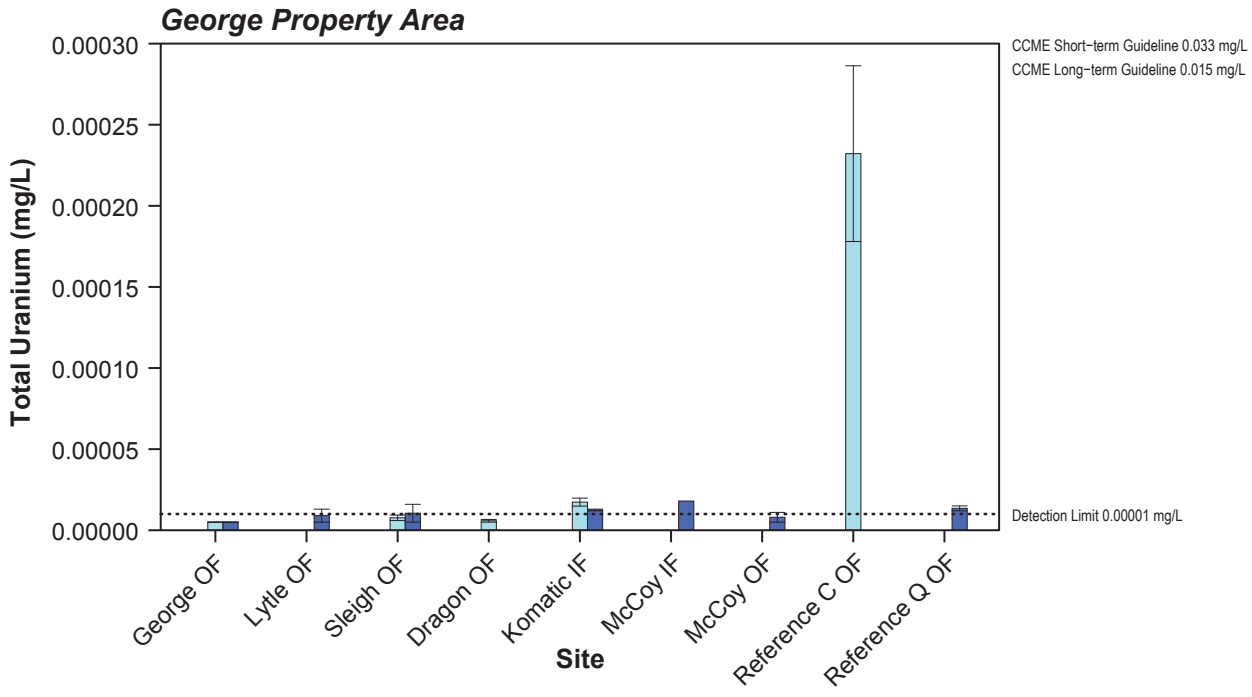
Rescan an ERM company

Appendix 3.4-33

Total Uranium in Streams, Back River Project Area, 2011 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Sabina GOLD & SILVER CORP.

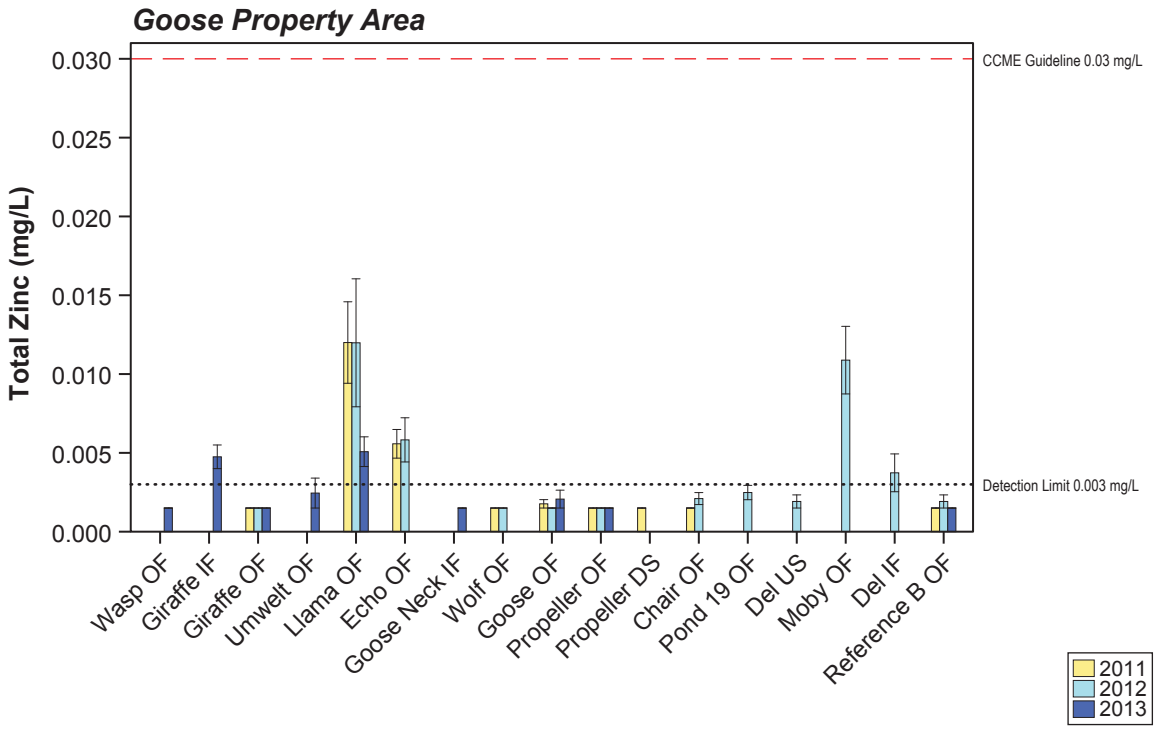
Total Uranium in Streams, Back River Project Area, 2011 to 2013

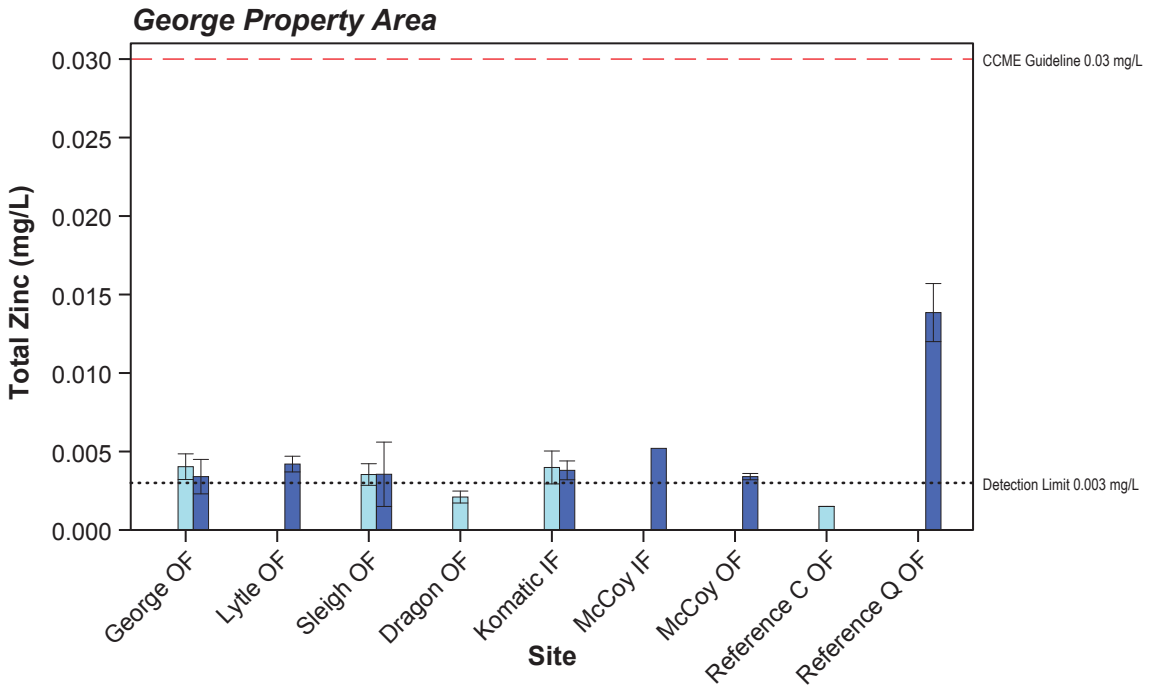
Rescan an ERM company

Appendix 3.4-34

Total Zinc in Streams, Back River Project Area, 2011 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Sabina GOLD & SILVER CORP.

Total Zinc in Streams, Back River Project Area, 2011 to 2013

Rescan an ERM company

Appendix 3.5-1

Lake Sediment Quality Analytical Results, Back River Project, July 2013

Rescan™
an ERM company

Appendix 3.5-1. Lake Sediment Quality Analytical Results, Back River Project, July 2013

Lake Site Name		CCME Guidelines for the Protection of Aquatic Life[a]		Realized Detection Limits (RDL)	Wasp	Wasp	Wasp	Leaf	Leaf	Leaf	Giraffe North	Giraffe North	Giraffe North	Giraffe South	Giraffe South	Giraffe South	Umwelt
Site Code					WASPLK	WASPLK	WASPLK	LEAFLK	LEAFLK	LEAFLK	GIRNORTH	GIRNORTH	GIRNORTH	GIRSOUTH	GIRSOUTH	GIRSOUTH	UMWLK
Depth (m)					15.5	15.5	15.5	7.4	7.4	7.4	3.7	3.7	3.7	7.3	7.3	7.3	2.7
Replicate					3	2	1	3	2	1	3	2	1	3	2	1	3
Date Sampled					16-Jul-13	16-Jul-13	16-Jul-13	16-Jul-13	16-Jul-13	16-Jul-13	14-Jul-13	14-Jul-13	14-Jul-13	14-Jul-13	14-Jul-13	14-Jul-13	15-Jul-13
ALS Sample ID #					L1334978-6	L1334978-5	L1334978-4	L1334978-9	L1334978-8	L1334978-7	L1332352-6	L1332352-5	L1332352-4	L1332352-3	L1332352-2	L1332352-1	L1334978-3
Single Grab or Composite?	Units	ISQG[b]	PEL[c]		Single grab	Single grab	Single grab	Single grab	Single grab	Single grab	Single grab	Single grab	Single grab	Single grab	Single grab	Single grab	Single grab
Physical Tests																	
Moisture	%			0.25	59.50	69.40	55.30	50.00	50.70	53.00	88.20	88.70	89.10	64.20	82.60	81.80	35.90
pH	pH			0.10	5.47	5.56	5.48	6.20	6.13	5.77	5.48	5.59	5.59	5.59	5.21	5.07	7.06
Particle Size																	
% Gravel (>2 mm)	%			0.10	<0.10	<0.10	<0.10	5.85	6.38	5.26	<0.10	<0.10	<0.10	12.60	<0.10	<0.10	2.46
% Sand (2.0 mm - 0.063 mm)	%			0.10	60.70	56.00	62.40	48.00	59.10	71.30	7.15	4.62	4.76	57.00	21.30	33.60	95.00
% Silt (0.063 mm - 4 µm)	%			0.10	34.20	39.80	33.70	42.50	32.30	21.90	82.50	84.50	86.10	28.50	73.70	60.60	2.33
% Clay (<4 µm)	%			0.10	5.08	4.18	3.94	3.71	2.24	1.56	10.40	10.90	9.14	1.94	5.00	5.84	0.26
Texture				-	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Sandy loam	Loamy sand	Silt	Silt	Silt	Sandy loam	Silt loam	Silt loam	Sand
Leachable Nutrients																	
Total Nitrogen by LECO	%			0.020	0.134	0.143	0.118	0.071	0.098	0.086	0.841	0.908	0.982	0.173	0.663	0.507	0.032
Plant Available Nutrients																	
Available Ammonium (as N)	mg/kg			1.0 - 8.8	7.2	6.5	5.9	1.7	1.9	1.9	58.7	79.3	92.0	18.6	57.6	90.0	<1.6
Nitrate and Nitrite (as N)	mg/kg			2.0 - 20	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<6.0	<6.0	<6.0	<4.0	<6.0	<4.0	<4.0
Nitrate (as N)	mg/kg			2.0 - 20	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<6.0	<6.0	<6.0	<4.0	<6.0	<4.0	<4.0
Nitrite (as N)	mg/kg			0.4 - 4.0	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<1.2	<1.2	1.2	<0.80	<1.2	<0.80	<0.80
Available Phosphate (as P)	mg/kg			2.0 - 8.0	<2.0	7.6	18.3	3.7	<2.0	<2.0	<6.0	10.7	11.1	<4.0	20.2	6	2.7
Cyanides																	
Cyanide, Weak Acid Dissociable	mg/kg			0.05 - 0.1	<0.050	0.051	0.053	<0.050	<0.050	<0.050	0.132	0.177	0.196	<0.050	0.213	0.171	<0.050
Cyanide, Total	mg/kg			0.05 - 0.1	0.082	0.109	0.079	0.061	0.062	0.05	0.334	0.405	0.43	0.095	0.388	0.38	<0.050
Organic / Inorganic Carbon																	
Total Organic Carbon	%			0.10	1.99	2.03	1.56	0.79	1.18	1.02	11.10	12.10	12.50	2.53	11.30	7.65	0.27
Metals																	
Aluminum (Al)	mg/kg			50	5980	8800	7250	5650	5500	5220	10700	11600	12300	8640	7480	7890	4690
Antimony (Sb)	mg/kg			0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.12	0.13	0.16	0.12	<0.10	<0.10	<0.10
Arsenic (As)	mg/kg	5.9	17	0.050	40.600	60.400	51.500	13.400	18.400	33.000	13.700	14.500	13.200	59.700	8.410	8.330	4.200
Barium (Ba)	mg/kg			0.50	20.00	31.10	24.40	24.70	22.60	17.70	53.80	60.50	66.40	26.90	62.20	46.10	19.90
Beryllium (Be)	mg/kg			0.20	0.62	0.95	0.79	0.24	0.31	0.34	0.67	0.70	0.76	0.80	0.46	0.41	<0.20
Bismuth (Bi)	mg/kg			0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium (Cd)	mg/kg	0.6	3.5	0.050	0.098	0.108	0.103	0.071	0.071	0.104	0.545	0.633	0.504	0.159	0.404	0.276	<0.050
Calcium (Ca)	mg/kg			50	766	1120	806	1670	1300	1070	2860	3130	3820	1340	4000	2670	1240
Chromium (Cr)	mg/kg	37.3	90	0.50	14.90	22.00	18.30	16.80	15.10	13.50	25.90	27.70	29.80	19.60	21.10	21.30	12.30
Cobalt (Co)	mg/kg			0.10	70.10	85.70	54.80	9.11	17.90	7.23	17.40	18.00	17.90	23.30	18.40	21.50	3.07
Copper (Cu)	mg/kg	35.7	197	0.50	70.20	109.00	82.70	27.90	42.90	30.70	121.00	124.00	137.00	93.10	77.80	63.70	8.49
Iron (Fe)	mg/kg			50	73300	75500	65900	11600	16800	30300	15800	16100	17800	77600	11800	14100	9080
Lead (Pb)	mg/kg	35	91.3	0.50	3.49	4.72	3.54	2.86	2.78	1.91	4.95	5.69	5.63	4.05	4.26	3.92	1.88
Lithium (Li)	mg/kg			5.0	6.5	8.0	7.3	10.5	8.8	8.5	9.8	10.0	11.1	8.3	7.9	9.3	13.3
Magnesium (Mg)	mg/kg			20	1530	2000	1720	2790	2270	2380	2820	2980	3230	2350	2800	2990	3210
Manganese (Mn)	mg/kg			1.0	523.0	937.0	615.0	111.0	209.0	77.6	68.6	74.6	79.9	166.0	88.5	100.0	72.3
Mercury (Hg)	mg/kg	0.17	0.486	0.0050	0.0579	0.0710	0.0500	0.0119	0.0176	0.0203	0.1000	0.1030	0.1260	0.0396	0.0705	0.0751	<0.0050
Molybdenum (Mo)	mg/kg			0.50	0.85	1.44	1.13	1.13	0.78	0.58	1.10	1.04	1.03	0.93	0.54	0.51	<0.50
Nickel (Ni)	mg/kg			0.50	50.10	52.20	46.10	49.60	42.20	38.40	135.00	143.00	143.00	56.70	107.00	86.40	14.70
Phosphorus (P)	mg/kg			50	862	1460	1220	407	420	329	625	613	804	552	714	511	305
Potassium (K)	mg/kg			100	320	420	330	560	470	340	610	690	820	440	550	560	580
Selenium (Se)	mg/kg			0.20	0.55	0.89	0.58	<0.20	0.22	<0.20	0.73	0.75	0.86	0.38	0.52	0.42	<0.20
Silver (Ag)	mg/kg			0.10	0.41	0.43	0.31	<0.10	<0.10	<0.10	0.28	0.29	0.31	0.11	0.12	0.14	<0.10
Sodium (Na)	mg/kg			100	<100	<100	<100	<100	<100	<100	<100	120	150	<100	140	110	<100
Strontium (Sr)	mg/kg			0.50	5.19	6.71	4.81	11.00	8.70	7.12	16.40	18.40	22.30	8.51	18.80	13.50	7.44
Sulphur (S)	mg/kg			500	800	600	600	<500	<500	<500	5000	5100	5000	1000	4600	3400	<500
Thallium (Tl)	mg/kg			0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.108	0.114	0.119	<0.050	0.083	0.079	<0.050
Tin (Sn)	mg/kg			2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	mg/kg			1.0	154.0	183.0	153.0	327.0	258.0	193.0	235.0	264.0	344.0	248.0	300.0	318.0	267.0
Uranium (U)	mg/kg			0.050	1.200	1.780	1.320	0.896	1.070	0.634	1.980	2.190	2.120	1.230	1.230	1.090	0.269
Vanadium (V)	mg/kg			0.20	15.90	22.90	18.80	20.80	19.90	15.50	25.70	27.30	29.60	27.30	28.20	26.20	13.70
Zinc (Zn)	mg/kg	123	315	1.0	65.3	52.7	52.8	39.1	41.3	62.3	104.0	118.0	103.0	110.0	61.2	55.8	21.9

Appendix 3.5-1. Lake Sediment Quality Analytical Results, Back River Project, July 2013

Lake Site Name		CCME Guidelines for the Protection of Aquatic Life[a]		Realized Detection Limits (RDL)	Umwelt	Umwelt	Rascal	Rascal	Rascal	Goose Neck	Goose Neck	Goose Neck	Goose Central	Goose Central	Goose Central	Goose Tail	Goose Tail
Site Code					UMWLK	UMWLK	RASCLK	RASCLK	RASCLK	GOONECK	GOONECK	GOONECK	GOOCENT	GOOCENT	GOOCENT	GOOTAILNEW	GOOTAILNEW
Depth (m)					2.7	2.7	2.4	2.4	2.4	2.6	2.6	2.6	4.2	4.2	4.2	7.1	7.1
Replicate					2	1	3	2	1	3	2	1	3	2	1	3	2
Date Sampled					15-Jul-13	15-Jul-13	13-Jul-13	13-Jul-13	13-Jul-13	21-Jul-13	21-Jul-13	21-Jul-13	21-Jul-13	21-Jul-13	21-Jul-13	20-Jul-13	20-Jul-13
ALS Sample ID #					L1334978-2	L1334978-1	L1332352-9	L1332352-8	L1332352-7	L1336084-3	L1336084-2	L1336084-1	L1336084-15	L1336084-14	L1336084-13	L1336084-9	L1336084-8
Single Grab or Composite?	Units	ISQG[b]	PEL[c]		Single grab	Single grab	Single grab	Single grab	Single grab	Single grab	Single grab	Single grab	Single grab	Single grab	Single grab	Single grab	Single grab
Physical Tests																	
Moisture	%			0.25	78.00	82.90	89.50	87.60	81.40	84.40	89.30	84.10	83.90	84.20	84.10	80.40	77.90
pH	pH			0.10	5.82	6.06	6.19	6.01	5.68	6.06	6.23	5.86	5.88	5.82	5.95	5.70	5.56
Particle Size																	
% Gravel (>2 mm)	%			0.10	<0.10	<0.10	<0.10	8.99	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.42	0.36
% Sand (2.0 mm - 0.063 mm)	%			0.10	54.00	69.10	15.70	16.50	15.40	9.18	7.39	15.90	4.75	7.11	6.66	13.10	15.50
% Silt (0.063 mm - 4 µm)	%			0.10	42.10	28.10	79.10	69.90	79.40	81.70	81.40	72.50	80.00	79.50	81.40	66.20	62.60
% Clay (<4 µm)	%			0.10	3.89	2.86	5.22	4.59	5.18	9.15	11.20	11.60	15.20	13.40	11.90	20.20	21.60
Texture				-	Sandy loam	Sandy loam	Silt loam / Silt	Silt loam	Silt	Silt	Silt	Silt loam	Silt	Silt	Silt	Silt loam	Silt loam
Leachable Nutrients																	
Total Nitrogen by LECO	%			0.020	0.451	0.336	0.896	0.809	0.443	0.514	0.778	0.501	0.457	0.475	0.465	0.428	0.431
Plant Available Nutrients																	
Available Ammonium (as N)	mg/kg			1.0 - 8.8	15.2	13.9	35.1	32.8	18.7	27.7	33.0	29.2	31.3	31.0	31.9	32.6	27.3
Nitrate and Nitrite (as N)	mg/kg			2.0 - 20	<4.0	<4.0	<6.0	<6.0	<4.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<4.0	<6.0
Nitrate (as N)	mg/kg			2.0 - 20	<4.0	<4.0	<6.0	<6.0	<4.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<4.0	<6.0
Nitrite (as N)	mg/kg			0.4 - 4.0	<0.80	<0.80	<1.2	<1.2	<0.80	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<0.80	<1.2
Available Phosphate (as P)	mg/kg			2.0 - 8.0	4.2	5.4	9.8	13.6	5.8	2.4	4.1	14.8	8.5	8.6	5.3	12.1	7
Cyanides																	
Cyanide, Weak Acid Dissociable	mg/kg			0.05 - 0.1	0.071	<0.050	0.078	0.067	0.073	<0.050	0.094	0.055	<0.050	0.053	<0.050	0.058	<0.050
Cyanide, Total	mg/kg			0.05 - 0.1	0.16	0.224	0.212	0.182	0.161	0.179	0.252	0.217	0.114	0.246	0.221	0.164	0.225
Organic / Inorganic Carbon																	
Total Organic Carbon	%			0.10	5.49	3.93	11.50	10.40	5.79	6.54	9.77	6.36	5.56	5.82	5.63	5.18	5.23
Metals																	
Aluminum (Al)	mg/kg			50	6940	6440	6930	6280	8640	10700	11700	12700	12000	11100	11700	16200	15100
Antimony (Sb)	mg/kg			0.10	<0.10	<0.10	0.12	0.11	<0.10	0.10	0.13	<0.10	0.11	0.10	0.10	0.11	0.12
Arsenic (As)	mg/kg	5.9	17	0.050	25.600	21.400	4.970	4.750	7.560	20.700	15.100	17.000	17.000	15.100	15.200	17.100	13.700
Barium (Ba)	mg/kg			0.50	34.50	36.70	56.00	48.20	50.70	68.40	83.20	72.70	65.40	65.30	66.60	83.40	83.20
Beryllium (Be)	mg/kg			0.20	0.28	0.27	0.29	0.25	0.28	0.50	0.66	0.63	0.56	0.55	0.56	0.82	0.81
Bismuth (Bi)	mg/kg			0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.22
Cadmium (Cd)	mg/kg	0.6	3.5	0.050	0.277	0.230	0.791	0.586	0.554	0.351	0.596	0.273	0.215	0.335	0.266	0.138	0.230
Calcium (Ca)	mg/kg			50	2290	2440	3640	3150	2750	3260	3810	2930	2840	2910	3030	2530	2360
Chromium (Cr)	mg/kg	37.3	90	0.50	18.40	18.50	23.20	20.50	27.40	31.80	32.70	36.60	33.00	30.20	32.00	40.20	40.10
Cobalt (Co)	mg/kg			0.10	12.30	8.63	6.85	6.59	12.60	36.10	23.20	18.50	25.00	19.50	16.50	23.80	23.00
Copper (Cu)	mg/kg	35.7	197	0.50	48.20	46.50	91.00	76.70	77.80	82.00	102.00	91.60	87.00	86.70	82.20	73.90	71.70
Iron (Fe)	mg/kg			50	22400	17800	8680	7930	10300	28500	22600	22000	24400	20500	22100	37300	29300
Lead (Pb)	mg/kg	35	91.3	0.50	3.11	3.21	4.84	4.24	4.43	5.83	6.50	6.07	5.99	5.61	5.89	9.30	8.74
Lithium (Li)	mg/kg			5.0	9.4	10.2	8.3	8.1	11.3	11.2	13.1	16.0	11.1	11.1	11.5	20.1	19.3
Magnesium (Mg)	mg/kg			20	2640	2560	2670	2490	3630	3700	3770	4140	3580	3370	3520	5400	5270
Manganese (Mn)	mg/kg			1.0	65.1	63.5	64.5	59.8	90.2	559.0	257.0	131.0	141.0	116.0	146.0	176.0	137.0
Mercury (Hg)	mg/kg	0.17	0.486	0.0050	0.0360	0.0376	0.0704	0.0604	0.0228	0.0633	0.0721	0.0631	0.0592	0.0608	0.0625	0.0669	0.0643
Molybdenum (Mo)	mg/kg			0.50	0.84	0.68	<0.50	0.50	<0.50	1.04	1.14	1.40	1.26	1.07	1.17	1.53	1.13
Nickel (Ni)	mg/kg			0.50	46.80	40.20	63.40	58.60	88.70	69.80	83.60	79.00	66.60	61.90	56.50	86.80	91.20
Phosphorus (P)	mg/kg			50	429	406	521	528	479	701	664	582	720	669	647	1010	963
Potassium (K)	mg/kg			100	560	570	490	490	680	820	920	950	750	780	830	1930	1720
Selenium (Se)	mg/kg			0.20	0.29	0.26	0.56	0.46	0.50	0.47	0.52	0.44	0.52	0.47	0.48	0.49	0.48
Silver (Ag)	mg/kg			0.10	<0.10	<0.10	0.15	0.14	<0.10	0.22	0.19	0.12	0.15	0.18	0.15	0.20	0.21
Sodium (Na)	mg/kg			100	<100	<100	120	110	130	170	140	130	130	140	150	120	<100
Strontium (Sr)	mg/kg			0.50	19.10	21.90	20.60	17.60	15.20	20.40	25.20	19.50	19.00	20.00	21.30	36.80	32.30
Sulphur (S)	mg/kg			500	2600	1700	3500	3400	3100	2300	3100	2600	2600	2600	2600	1900	1900
Thallium (Tl)	mg/kg			0.050	0.071	0.064	0.085	0.098	0.252	0.102	0.114	0.097	0.080	0.083	0.087	0.123	0.134
Tin (Sn)	mg/kg			2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	mg/kg			1.0	243.0	245.0	254.0	246.0	415.0	371.0	333.0	402.0	305.0	324.0	365.0	446.0	400.0
Uranium (U)	mg/kg			0.050	0.692	0.647	0.917	0.826	1.180	1.450	1.700	1.820	1.590	1.460	1.530	2.010	1.960
Vanadium (V)	mg/kg			0.20	28.70	26.50	21.30	19.40	27.20	35.60	34.80	38.10	36.50	33.80	35.40	47.50	44.00
Zinc (Zn)	mg/kg	123	315	1.0	61.6	52.6	98.9	112.0	204.0	78.9	109.0	112.0	82.2	73.5	78.7	89.7	88.1

Appendix 3.5-1. Lake Sediment Quality Analytical Results, Back River Project, July 2013

Lake Site Name					Goose Tail	Propeller	Propeller	Propeller	Reference B	Reference B	Reference B	George Central	George Central	George Central	Bob	Bob	Bob
Site Code					GOOTAILNEW	PROLK	PROLK	PROLK	REFBLK	REFBLK	REFBLK	GEORGCENT	GEORGCENT	GEORGCENT	BOBCENT	BOBCENT	BOBCENT
Depth (m)					6.6	8.1	8.1	8.1	4.9	4.9	4.9	12.5	12.5	12.5	3.4	3.4	3.4
Replicate					1	3	2	1	3	2	1	3	2	1	3	2	1
Date Sampled		CCME Guidelines for the			20-Jul-13	19-Jul-13	19-Jul-13	19-Jul-13	21-Jul-13	21-Jul-13	21-Jul-13	8-Jul-13	8-Jul-13	8-Jul-13	11-Jul-13	11-Jul-13	11-Jul-13
ALS Sample ID #		Protection of Aquatic Life[a]		Realized Detection Limits (RDL)	L1336084-7	L1336084-12	L1336084-11	L1336084-10	L1336084-6	L1336084-5	L1336084-4	L1331770-3	L1331770-2	L1331770-1	L1332437-6	L1332437-5	L1332437-4
Single Grab or Composite?	Units	ISQG[b]	PEL[c]		Single grab	Single grab	Single grab	Single grab	Single grab	Single grab	Single grab	Composite of two grabs	Composite of two grabs	Composite of two grabs	Single grab	Single grab	Single grab
Physical Tests																	
Moisture	%			0.25	82.70	80.00	78.80	80.50	85.00	78.10	80.10	39.20	36.50	47.40	85.10	86.10	85.10
pH	pH			0.10	6.18	5.63	5.75	5.72	4.59	4.50	4.80	6.32	6.33	6.36	6.53	6.75	6.71
Particle Size																	
% Gravel (>2 mm)	%			0.10	0.83	<0.10	<0.10	<0.10	0.66	<0.10	<0.10	1.45	6.97	0.31	<0.10	<0.10	<0.10
% Sand (2.0 mm - 0.063 mm)	%			0.10	19.10	18.20	19.50	17.10	42.60	63.40	64.30	28.90	16.20	77.80	3.53	11.80	13.30
% Silt (0.063 mm - 4 µm)	%			0.10	70.40	70.90	71.00	73.70	53.60	23.80	29.20	64.80	71.20	21.00	90.40	81.30	80.90
% Clay (<4 µm)	%			0.10	9.68	10.90	9.49	9.19	3.11	12.80	6.57	4.94	5.67	0.84	6.12	6.87	5.85
Texture				-	Silt loam	Silt loam	Silt loam	Silt loam	Silt loam	Sandy loam	Sandy loam	Silt loam	Silt loam	Loamy sand	Silt	Silt	Silt
Leachable Nutrients																	
Total Nitrogen by LECO	%			0.020	0.585	0.406	0.359	0.398	0.459	0.418	0.443	0.056	0.050	0.074	0.643	0.700	0.675
Plant Available Nutrients																	
Available Ammonium (as N)	mg/kg			1.0 - 8.8	31.3	25.0	21.1	25.8	25.8	25.1	22.8	2.7	3.4	5.7	32.9	30.3	30.3
Nitrate and Nitrite (as N)	mg/kg			2.0 - 20	<6.0	<6.0	<6.0	<6.0	<4.0	<4.0	<4.0	<2.0	<2.0	<2.0	<6.0	<6.0	<6.0
Nitrate (as N)	mg/kg			2.0 - 20	<6.0	<6.0	<6.0	<6.0	<4.0	<4.0	<4.0	<2.0	<2.0	<2.0	<6.0	<6.0	<6.0
Nitrite (as N)	mg/kg			0.4 - 4.0	<1.2	<1.2	<1.2	<1.2	<0.80	<0.80	<0.80	<0.40	<0.40	<0.40	1.3	1.3	<1.2
Available Phosphate (as P)	mg/kg			2.0 - 8.0	19	42.9	52.6	60.9	<2.0	<2.0	<2.0	22	5.9	<2.0	10.5	12.8	13.9
Cyanides																	
Cyanide, Weak Acid Dissociable	mg/kg			0.05 - 0.1	0.061	<0.050	0.051	0.078	0.069	<0.050	<0.050	<0.050	<0.050	<0.050	0.101	0.092	0.116
Cyanide, Total	mg/kg			0.05 - 0.1	0.189	0.16	0.176	0.228	0.168	0.112	0.102	<0.050	<0.050	<0.10	0.244	0.231	0.24
Organic / Inorganic Carbon																	
Total Organic Carbon	%			0.10	6.96	4.66	4.10	4.62	6.28	5.58	6.00	0.51	0.49	0.74	7.22	8.09	8.15
Metals																	
Aluminum (Al)	mg/kg			50	12100	8600	8390	8510	6800	5070	4540	9590	11100	14200	10900	10900	10300
Antimony (Sb)	mg/kg			0.10	0.11	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.14	0.10	0.18	0.24	0.21	0.33
Arsenic (As)	mg/kg	5.9	17	0.050	15.600	4.720	4.310	4.500	9.610	11.100	13.900	23.000	22.000	47.400	44.300	34.600	38.900
Barium (Ba)	mg/kg			0.50	58.20	53.50	52.40	52.80	39.90	24.90	18.40	21.50	31.80	46.60	50.50	51.60	50.30
Beryllium (Be)	mg/kg			0.20	0.63	0.35	0.32	0.37	0.33	0.25	<0.20	0.33	0.32	0.37	0.44	0.46	0.50
Bismuth (Bi)	mg/kg			0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.24	<0.20	<0.20	<0.20
Cadmium (Cd)	mg/kg	0.6	3.5	0.050	0.206	0.340	0.305	0.371	0.354	0.210	0.201	0.101	0.167	0.221	0.728	0.703	0.683
Calcium (Ca)	mg/kg			50	2850	2610	2510	2600	1600	1010	742	1180	1240	1600	2900	3260	3230
Chromium (Cr)	mg/kg	37.3	90	0.50	32.80	25.60	25.30	25.70	22.10	14.90	12.60	29.70	35.10	46.60	34.80	35.40	33.40
Cobalt (Co)	mg/kg			0.10	17.70	13.00	11.30	11.90	16.30	12.60	13.30	19.00	30.80	75.60	33.10	34.20	32.70
Copper (Cu)	mg/kg	35.7	197	0.50	83.50	48.40	46.60	48.10	49.70	34.90	29.10	54.90	74.10	84.90	92.10	93.10	84.20
Iron (Fe)	mg/kg			50	24600	11500	10700	11200	21800	32300	39500	16600	18700	26900	18500	17000	17300
Lead (Pb)	mg/kg	35	91.3	0.50	6.99	5.07	4.81	5.44	3.64	3.13	2.76	4.18	5.70	6.96	7.45	7.17	8.35
Lithium (Li)	mg/kg			5.0	12.4	9.2	9.2	9.1	7.7	<5.0	<5.0	18.9	21.8	26.5	18.9	18.9	18.5
Magnesium (Mg)	mg/kg			20	3780	2980	2950	3040	2370	1380	963	5110	6610	8320	5800	5930	5560
Manganese (Mn)	mg/kg			1.0	120.0	119.0	116.0	120.0	83.1	61.0	61.2	792.0	1070.0	1770.0	312.0	325.0	389.0
Mercury (Hg)	mg/kg	0.17	0.486	0.0050	0.1100	0.0495	0.0452	0.0495	0.0188	0.0223	0.0176	0.0083	0.0089	0.0150	0.0311	0.0326	0.0307
Molybdenum (Mo)	mg/kg			0.50	1.21	0.62	0.55	0.55	0.90	0.52	<0.50	0.55	0.82	2.42	1.63	1.28	1.50
Nickel (Ni)	mg/kg			0.50	68.70	36.00	33.20	35.00	49.30	35.00	34.80	53.50	73.60	97.30	154.00	156.00	155.00
Phosphorus (P)	mg/kg			50	1120	793	773	848	400	303	260	712	544	550	523	593	503
Potassium (K)	mg/kg			100	950	770	730	700	600	390	330	520	670	1070	760	800	770
Selenium (Se)	mg/kg			0.20	0.62	0.36	0.33	0.38	0.58	0.35	0.27	<0.20	<0.20	0.27	0.41	0.42	0.42
Silver (Ag)	mg/kg			0.10	0.27	0.13	0.11	0.14	<0.10	<0.10	<0.10	<0.10	<0.10	0.20	0.16	0.16	0.15
Sodium (Na)	mg/kg			100	150	160	150	140	<100	<100	<100	<100	<100	150	110	110	120
Strontium (Sr)	mg/kg			0.50	21.20	16.20	15.40	15.70	10.90	8.04	6.23	5.21	6.43	8.95	19.20	21.50	21.00
Sulphur (S)	mg/kg			500	2400	2000	1800	1900	3200	2100	2200	600	<500	<500	2700	2800	2900
Thallium (Tl)	mg/kg			0.050	0.085	0.108	0.091	0.095	0.189	0.076	0.051	0.056	0.109	0.116	0.070	0.066	0.060
Tin (Sn)	mg/kg			2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	mg/kg			1.0	343.0	349.0	340.0	348.0	251.0	170.0	142.0	294.0	397.0	493.0	220.0	246.0	238.0
Uranium (U)	mg/kg			0.050	1.660	1.080	1.050	1.020	0.889	0.495	0.343	0.930	0.975	1.260	1.100	1.090	1.020
Vanadium (V)	mg/kg			0.20	40.20	32.00	30.70	31.10	28.60	21.40	19.30	21.10	25.40	35.60	27.20	26.60	25.80
Zinc (Zn)	mg/kg	123	315	1.0	75.1	59.6	54.8	59.2	103.0	46.9	40.5	63.1	75.4	93.0	196.0	178.0	177.0

Appendix 3.5-1. Lake Sediment Quality Analytical Results, Back River Project, July 2013

Lake Site Name		CCME Guidelines for the Protection of Aquatic Life[a]			Occurrence	Occurrence	Occurrence	Esker Pond	Esker Pond	Esker Pond	Dragon	Dragon	Dragon	Komatic	Komatic	Komatic	McCoy
Site Code					OCCLK	OCCLK	OCCLK	ESKERLK	ESKERLK	ESKERLK	DRAGLK	DRAGLK	DRAGLK	KOMALK	KOMALK	KOMALK	MCCOYLK
Depth (m)					1.5	1.5	1.5	0.4	0.4	0.4	3.6	3.6	3.6	7.3	7.3	7.3	5.6
Replicate					3	2	1	3	2	1	3	2	1	3	2	1	3
Date Sampled					9-Jul-13	9-Jul-13	9-Jul-13	12-Jul-13	12-Jul-13	12-Jul-13	11-Jul-13	11-Jul-13	11-Jul-13	10-Jul-13	10-Jul-13	10-Jul-13	10-Jul-13
ALS Sample ID #				Realized Detection Limits (RDL)	L1331770-9	L1331770-8	L1331770-7	L1332437-3	L1332437-2	L1332437-1	L1332437-9	L1332437-8	L1332437-7	L1331770-12	L1331770-11	L1331770-10	L1331770-15
Single Grab or Composite?	Units	ISQG[b]	PEL[c]		Single grab	Single grab	Single grab	Composite of three grabs	Composite of three grabs	Composite of three grabs	Single grab	Single grab	Single grab	Single grab	Single grab	Single grab	Single grab
Physical Tests																	
Moisture	%			0.25	65.90	64.70	68.70	54.50	56.20	61.70	75.10	68.30	84.30	83.00	80.60	81.80	84.00
pH	pH			0.10	6.17	6.16	6.04	5.58	5.73	5.66	6.38	6.65	6.59	6.08	5.88	6.04	5.89
Particle Size																	
% Gravel (>2 mm)	%			0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.14	<0.10	<0.10	<0.10
% Sand (2.0 mm - 0.063 mm)	%			0.10	0.69	0.45	0.41	0.43	0.20	0.23	18.50	22.00	16.30	4.76	3.32	3.94	3.54
% Silt (0.063 mm - 4 µm)	%			0.10	78.20	78.70	80.30	91.40	90.30	90.40	74.70	71.00	79.40	83.00	85.10	85.60	76.50
% Clay (<4 µm)	%			0.10	21.10	20.80	19.30	8.14	9.52	9.35	6.86	7.02	4.35	12.10	11.60	10.50	20.00
Texture				-	Silt	Silt	Silt	Silt	Silt	Silt	Silt loam	Silt loam	Silt	Silt	Silt	Silt	Silt loam
Leachable Nutrients																	
Total Nitrogen by LECO	%			0.020	0.266	0.274	0.287	0.218	0.255	0.266	0.294	0.258	0.482	0.717	0.616	0.541	0.542
Plant Available Nutrients																	
Available Ammonium (as N)	mg/kg			1.0 - 8.8	12.5	6.7	8.7	19.7	16.7	19.3	19.8	14.4	26.6	24.6	19.2	20.2	11.8
Nitrate and Nitrite (as N)	mg/kg			2.0 - 20	<6.0	<4.0	<6.0	<6.0	<6.0	<4.0	<4.0	<4.0	<4.0	<6.0	<6.0	<4.0	<6.0
Nitrate (as N)	mg/kg			2.0 - 20	<6.0	<4.0	<6.0	<6.0	<6.0	<4.0	<4.0	<4.0	<4.0	<6.0	<6.0	<4.0	<6.0
Nitrite (as N)	mg/kg			0.4 - 4.0	<1.2	<0.80	<1.2	<1.2	<1.2	<0.80	<0.80	<0.80	1.2	<1.2	<1.2	<0.80	<1.2
Available Phosphate (as P)	mg/kg			2.0 - 8.0	<2.0	<2.0	2.1	4.1	4.8	10.5	5	<4.0	7.1	<2.0	<2.0	2	9.9
Cyanides																	
Cyanide, Weak Acid Dissociable	mg/kg			0.05 - 0.1	<0.050	<0.050	<0.050	<0.050	<0.050	0.063	0.13	0.098	0.1	0.07	0.067	0.136	<0.050
Cyanide, Total	mg/kg			0.05 - 0.1	0.093	0.076	0.1	0.099	0.126	0.174	0.219	0.151	0.192	0.208	0.185	0.31	0.17
Organic / Inorganic Carbon																	
Total Organic Carbon	%			0.10	2.76	2.80	3.11	3.32	3.96	4.24	3.61	3.21	6.25	7.76	6.91	6.04	6.84
Metals																	
Aluminum (Al)	mg/kg			50	28300	31900	31500	19400	19900	19200	13900	15500	11800	13100	15800	16100	17900
Antimony (Sb)	mg/kg			0.10	0.18	<0.10	<0.10	<0.10	<0.10	<0.10	0.40	0.37	0.43	0.27	0.30	0.27	0.25
Arsenic (As)	mg/kg	5.9	17	0.050	135.000	73.000	84.000	32.300	35.300	40.400	65.500	58.800	56.900	1050.000	617.000	281.000	42.600
Barium (Ba)	mg/kg			0.50	114.00	134.00	129.00	71.70	73.30	68.40	53.20	65.00	53.70	72.00	72.40	72.00	73.20
Beryllium (Be)	mg/kg			0.20	0.99	1.13	1.04	0.47	0.49	0.47	0.40	0.36	0.46	0.61	0.69	0.64	0.66
Bismuth (Bi)	mg/kg			0.20	0.34	0.38	0.38	0.22	0.22	0.22	<0.20	0.22	0.22	0.30	0.36	0.36	0.25
Cadmium (Cd)	mg/kg	0.6	3.5	0.050	0.284	0.298	0.306	0.189	0.211	0.220	0.381	0.381	0.424	0.600	0.704	0.646	1.250
Calcium (Ca)	mg/kg			50	3360	3560	3340	2750	2750	2790	2880	2910	3250	4160	4160	4510	3240
Chromium (Cr)	mg/kg	37.3	90	0.50	104.00	117.00	112.00	71.60	75.70	71.60	45.40	51.30	38.20	46.40	55.10	55.80	57.00
Cobalt (Co)	mg/kg			0.10	50.90	53.40	50.70	35.40	34.90	37.30	50.80	40.00	28.00	73.80	56.70	54.30	34.50
Copper (Cu)	mg/kg	35.7	197	0.50	96.00	109.00	111.00	56.40	60.50	58.00	89.70	80.70	121.00	128.00	151.00	136.00	189.00
Iron (Fe)	mg/kg			50	51300	51400	49300	30700	32600	32200	24200	25300	22800	132000	87800	59900	24300
Lead (Pb)	mg/kg	35	91.3	0.50	10.80	12.00	11.80	7.44	7.68	7.15	6.78	6.69	7.95	8.14	9.88	10.00	9.08
Lithium (Li)	mg/kg			5.0	57.4	67.8	62.4	41.1	41.4	38.8	25.9	29.6	21.5	21.8	26.7	29.4	28.3
Magnesium (Mg)	mg/kg			20	17300	19100	17900	11900	12400	11700	7870	9000	6330	7000	7960	8030	8110
Manganese (Mn)	mg/kg			1.0	610.0	578.0	544.0	337.0	365.0	413.0	220.0	237.0	196.0	2210.0	797.0	910.0	221.0
Mercury (Hg)	mg/kg	0.17	0.486	0.0050	0.0255	0.0298	0.0285	0.0211	0.0247	0.0242	0.0175	0.0153	0.0308	0.0777	0.0895	0.0847	0.0611
Molybdenum (Mo)	mg/kg			0.50	1.21	1.09	0.98	0.68	0.66	0.66	3.09	2.17	2.13	4.79	4.12	3.40	2.16
Nickel (Ni)	mg/kg			0.50	121.00	135.00	128.00	86.80	87.60	84.70	144.00	145.00	109.00	147.00	146.00	127.00	181.00
Phosphorus (P)	mg/kg			50	550	570	539	522	517	534	537	504	543	1180	1040	887	672
Potassium (K)	mg/kg			100	2640	2960	2810	880	920	880	1110	1360	870	790	880	910	1630
Selenium (Se)	mg/kg			0.20	0.37	0.41	0.38	<0.20	0.23	0.21	0.40	0.36	0.44	0.97	0.93	0.79	0.67
Silver (Ag)	mg/kg			0.10	0.24	0.21	0.20	<0.10	<0.10	<0.10	0.13	0.12	0.18	0.30	0.33	0.32	0.38
Sodium (Na)	mg/kg			100	210	210	220	130	140	140	130	140	100	120	130	160	170
Strontium (Sr)	mg/kg			0.50	22.40	24.50	23.20	15.60	15.80	16.00	10.80	10.90	10.50	21.10	20.00	20.70	14.30
Sulphur (S)	mg/kg			500	1400	1200	1400	1400	1400	1400	3300	3700	3500	2300	2300	1900	2700
Thallium (Tl)	mg/kg			0.050	0.181	0.212	0.205	0.094	0.100	0.095	0.127	0.131	0.101	0.103	0.129	0.130	0.203
Tin (Sn)	mg/kg			2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	mg/kg			1.0	1060.0	1210.0	1160.0	736.0	731.0	684.0	438.0	560.0	301.0	298.0	404.0	440.0	449.0
Uranium (U)	mg/kg			0.050	1.810	2.080	2.100	1.250	1.320	1.250	1.320	1.290	1.520	1.680	2.000	1.950	2.240
Vanadium (V)	mg/kg			0.20	74.40	83.50	80.60	47.40	49.30	46.40	36.00	37.40	29.70	36.60	44.30	44.60	39.70
Zinc (Zn)	mg/kg	123	315	1.0	227.0	267.0	251.0	140.0	139.0	134.0	153.0	132.0	133.0	186.0	194.0	175.0	325.0

Appendix 3.5-1. Lake Sediment Quality Analytical Results, Back River Project, July 2013

Lake Site Name					McCoy	McCoy	Reference Q	Reference Q	Reference Q
Site Code					MCCOYLK	MCCOYLK	REFQLK	REFQLK	REFQLK
Depth (m)					5.6	5.6	16.7	16.7	16.7
Replicate					2	1	3	2	1
Date Sampled		CCME Guidelines for the Protection of Aquatic Life[a]			10-Jul-13	10-Jul-13	9-Jul-13	9-Jul-13	9-Jul-13
ALS Sample ID #				Realized Detection Limits (RDL)	L1331770-14	L1331770-13	L1331770-6	L1331770-5	L1331770-4
Single Grab or Composite?	Units	ISQG[b]	PEL[c]		Single grab	Single grab	Single grab	Single grab	Single grab
Physical Tests									
Moisture	%			0.25	86.50	84.20	72.60	63.60	65.60
pH	pH			0.10	5.56	5.01	5.87	5.96	5.93
Particle Size									
% Gravel (>2 mm)	%			0.10	<0.10	<0.10	<0.10	<0.10	0.40
% Sand (2.0 mm - 0.063 mm)	%			0.10	2.64	2.37	17.20	6.52	18.00
% Silt (0.063 mm - 4 µm)	%			0.10	80.40	78.20	73.40	81.10	73.20
% Clay (<4 µm)	%			0.10	16.90	19.50	9.39	12.40	8.46
Texture				-	Silt	Silt loam	Silt loam	Silt	Silt loam
Leachable Nutrients									
Total Nitrogen by LECO	%			0.020	0.594	0.524	0.251	0.112	0.143
Plant Available Nutrients									
Available Ammonium (as N)	mg/kg			1.0 - 8.8	21.3	20.5	4.5	4.3	4.3
Nitrate and Nitrite (as N)	mg/kg			2.0 - 20	<6.0	<4.0	<2.0	<4.0	<4.0
Nitrate (as N)	mg/kg			2.0 - 20	<6.0	<4.0	<2.0	<4.0	<4.0
Nitrite (as N)	mg/kg			0.4 - 4.0	<1.2	<0.80	<0.40	<0.80	<0.80
Available Phosphate (as P)	mg/kg			2.0 - 8.0	15.1	3.3	12	4.7	<2.0
Cyanides									
Cyanide, Weak Acid Dissociable	mg/kg			0.05 - 0.1	0.09	0.156	<0.050	<0.050	<0.050
Cyanide, Total	mg/kg			0.05 - 0.1	0.242	0.3	0.099	0.072	0.073
Organic / Inorganic Carbon									
Total Organic Carbon	%			0.10	7.28	6.61	3.02	1.49	1.85
Metals									
Aluminum (Al)	mg/kg			50	18300	19000	11800	11100	11700
Antimony (Sb)	mg/kg			0.10	0.31	0.29	0.11	<0.10	<0.10
Arsenic (As)	mg/kg	5.9	17	0.050	67.800	96.700	38.700	37.300	46.500
Barium (Ba)	mg/kg			0.50	65.50	62.80	31.30	26.10	27.80
Beryllium (Be)	mg/kg			0.20	0.77	0.78	0.37	0.35	0.39
Bismuth (Bi)	mg/kg			0.20	0.27	0.30	<0.20	<0.20	<0.20
Cadmium (Cd)	mg/kg	0.6	3.5	0.050	1.300	1.310	0.228	0.088	0.183
Calcium (Ca)	mg/kg			50	3100	2900	1680	1390	1350
Chromium (Cr)	mg/kg	37.3	90	0.50	56.40	59.30	37.30	35.00	35.50
Cobalt (Co)	mg/kg			0.10	68.60	122.00	23.20	36.90	120.00
Copper (Cu)	mg/kg	35.7	197	0.50	185.00	171.00	100.00	75.60	88.80
Iron (Fe)	mg/kg			50	30600	35500	23900	26500	33000
Lead (Pb)	mg/kg	35	91.3	0.50	9.52	9.04	8.93	6.84	7.52
Lithium (Li)	mg/kg			5.0	28.7	30.2	19.2	18.6	19.3
Magnesium (Mg)	mg/kg			20	8130	8550	5490	5080	5490
Manganese (Mn)	mg/kg			1.0	245.0	272.0	284.0	548.0	1640.0
Mercury (Hg)	mg/kg	0.17	0.486	0.0050	0.0540	0.0557	0.0859	0.0581	0.0604
Molybdenum (Mo)	mg/kg			0.50	3.92	7.16	1.09	1.20	1.40
Nickel (Ni)	mg/kg			0.50	223.00	283.00	67.30	48.50	71.00
Phosphorus (P)	mg/kg			50	702	764	685	625	714
Potassium (K)	mg/kg			100	1420	1450	770	770	760
Selenium (Se)	mg/kg			0.20	0.89	1.07	0.55	0.48	0.59
Silver (Ag)	mg/kg			0.10	0.44	0.47	0.45	0.31	0.40
Sodium (Na)	mg/kg			100	160	160	<100	100	<100
Strontium (Sr)	mg/kg			0.50	13.50	13.70	7.38	6.84	6.58
Sulphur (S)	mg/kg			500	4300	5500	1200	4000	700
Thallium (Tl)	mg/kg			0.050	0.276	0.279	0.078	0.059	0.101
Tin (Sn)	mg/kg			2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	mg/kg			1.0	424.0	511.0	300.0	347.0	329.0
Uranium (U)	mg/kg			0.050	2.480	2.540	1.320	1.100	1.310
Vanadium (V)	mg/kg			0.20	41.20	43.20	27.60	25.90	26.70
Zinc (Zn)	mg/kg	123	315	1.0	390.0	469.0	122.0	83.1	91.5

Notes:

a) Canadian sediment quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment (accessed Sept 2013)

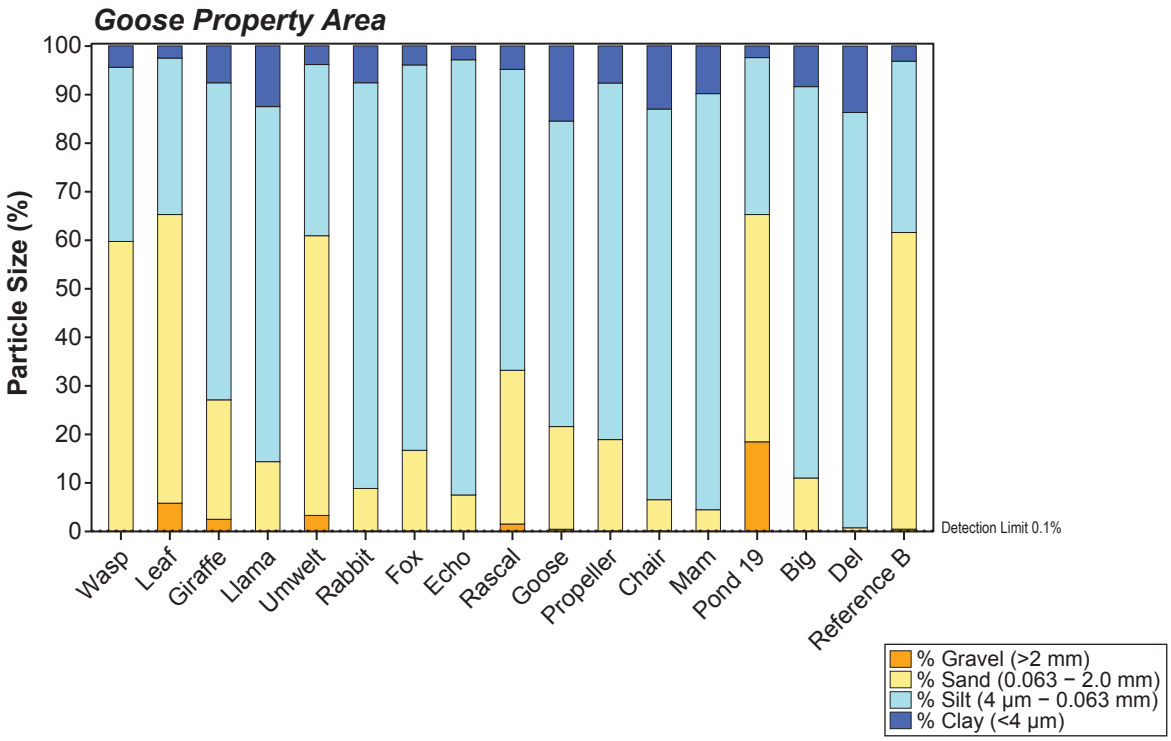
b) ISQG = Interim Sediment Quality Guideline

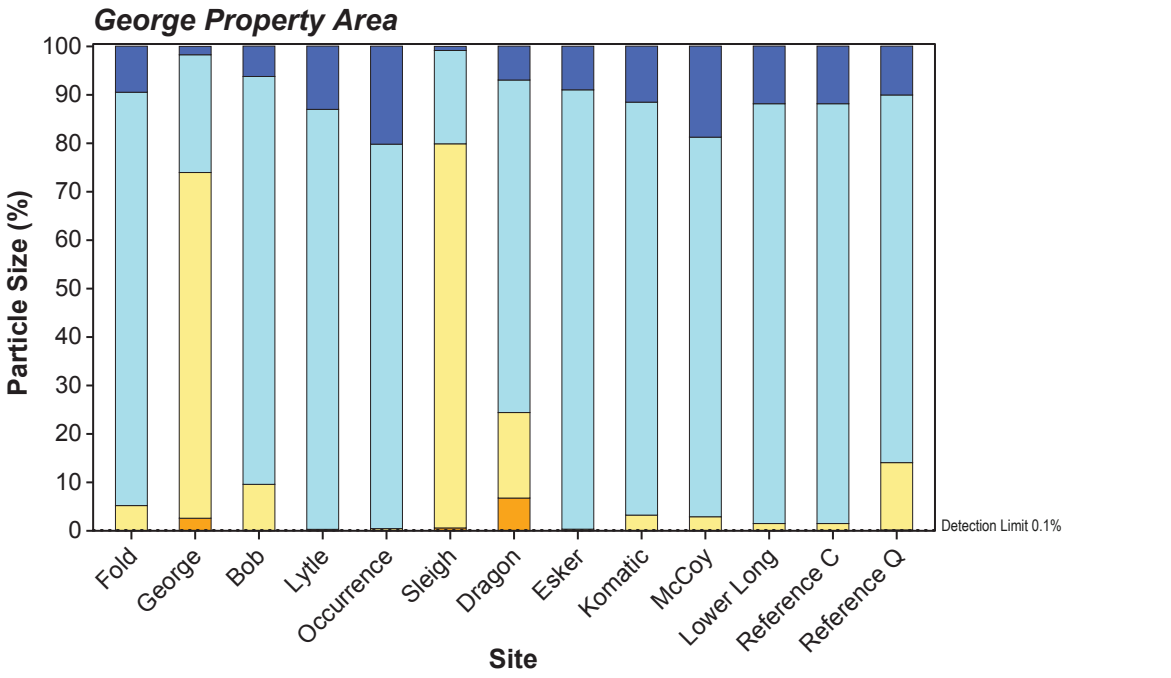
c) PEL = Probable Effects Level

Appendix 3.5-2

Grain Size Composition in Lake Sediments, Back River Project, 2010 to 2013

Rescan™
an ERM company





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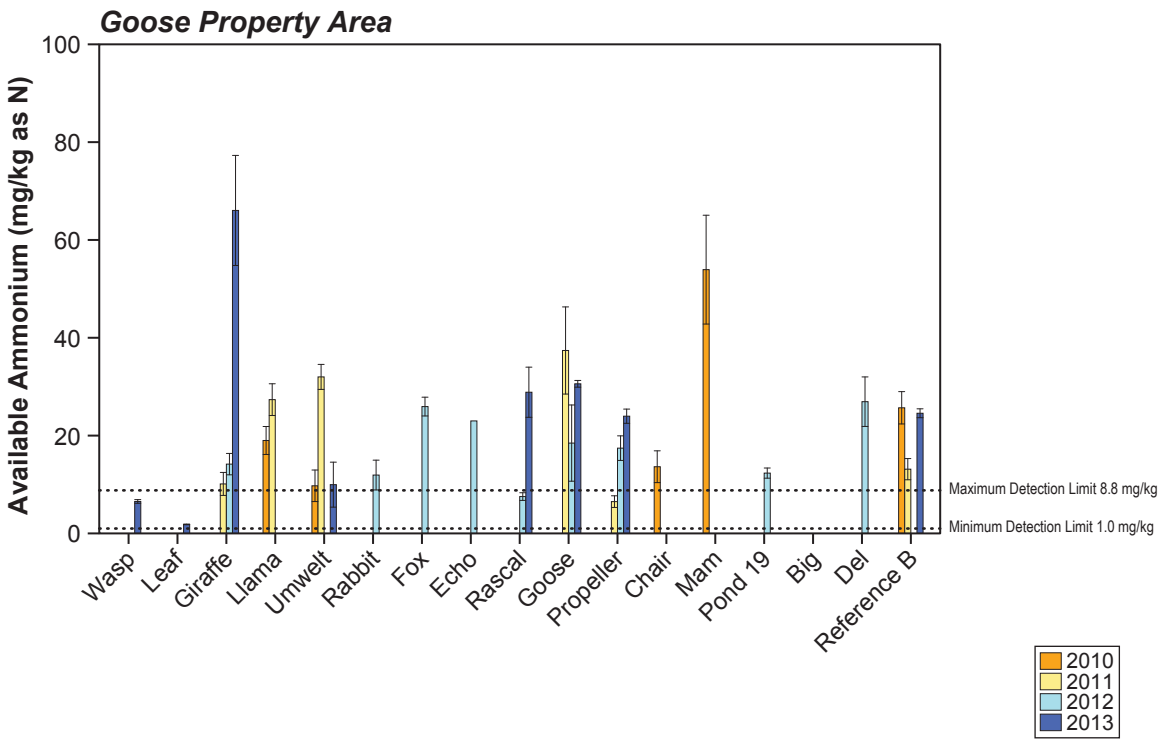
Grain Size Composition in Lake Sediments, Back River Project Area, 2010 to 2013

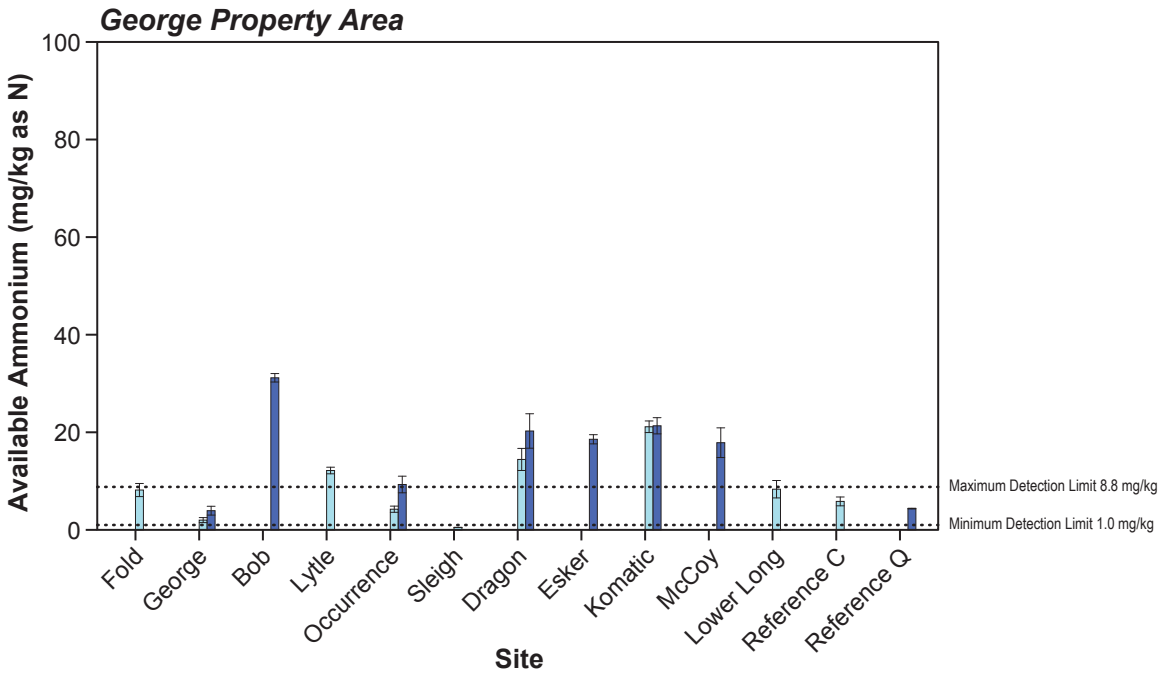
Rescan an ERM company

Appendix 3.5-3

Available Ammonium Concentrations in Lake Sediments, Back River Project, 2010 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Sabina GOLD & SILVER CORP.

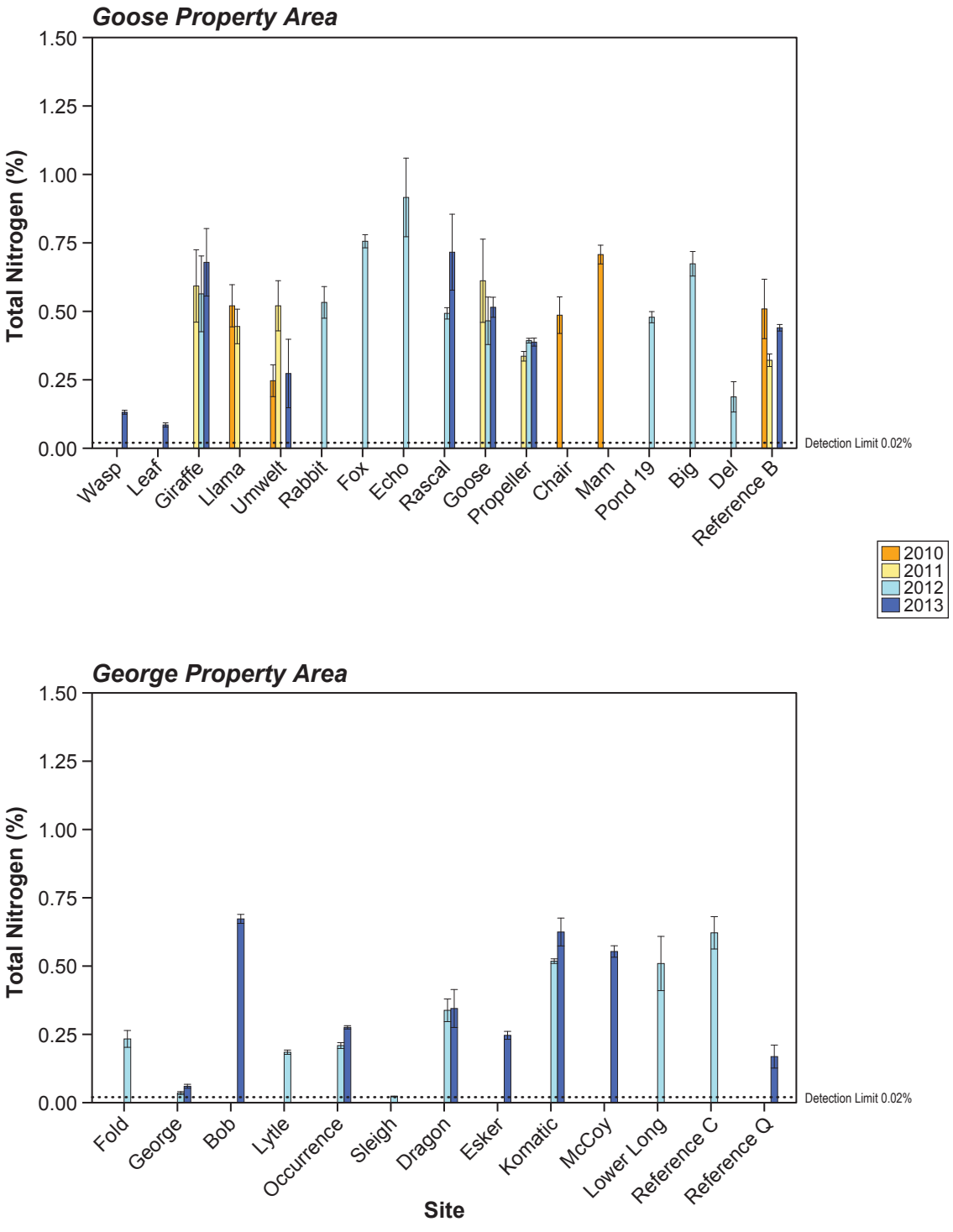
Available Ammonium Concentrations in Lake Sediments, Back River Project, 2010 to 2013

Rescan an ERM company

Appendix 3.5-4

Total Nitrogen Concentrations in Lake Sediments, Back River Project, 2010 to 2013

Rescan™
an ERM company



Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

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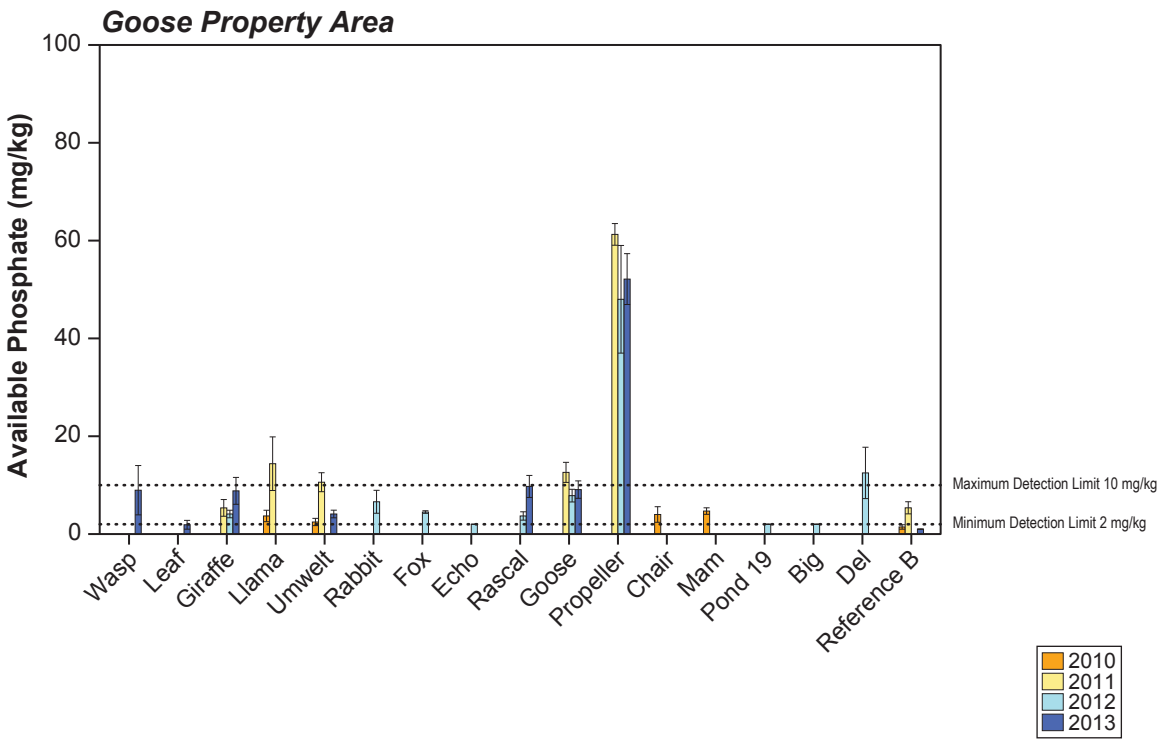
Total Nitrogen Concentrations in Lake Sediments, Back River Project, 2010 to 2013

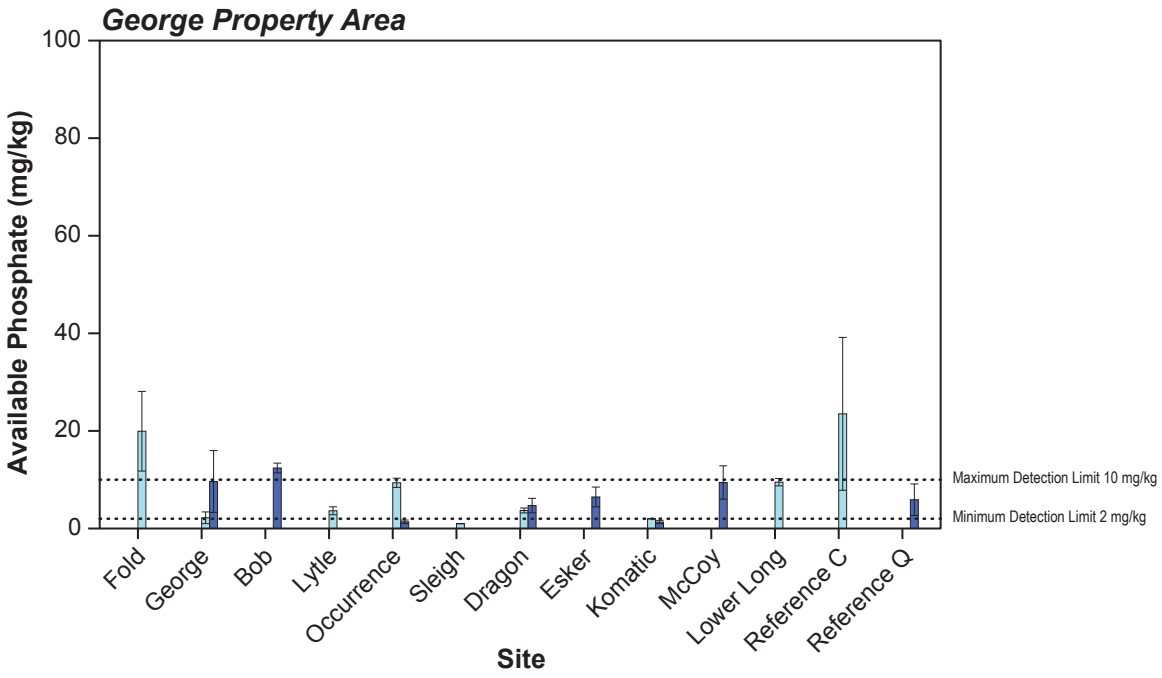
Rescan an ERM company

Appendix 3.5-5

Available Phosphate Concentrations in Lake Sediments, Back River Project, 2010 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Appendix 3.5-5

Available Phosphate Concentrations in Lake Sediments, Back River Project, 2010 to 2013

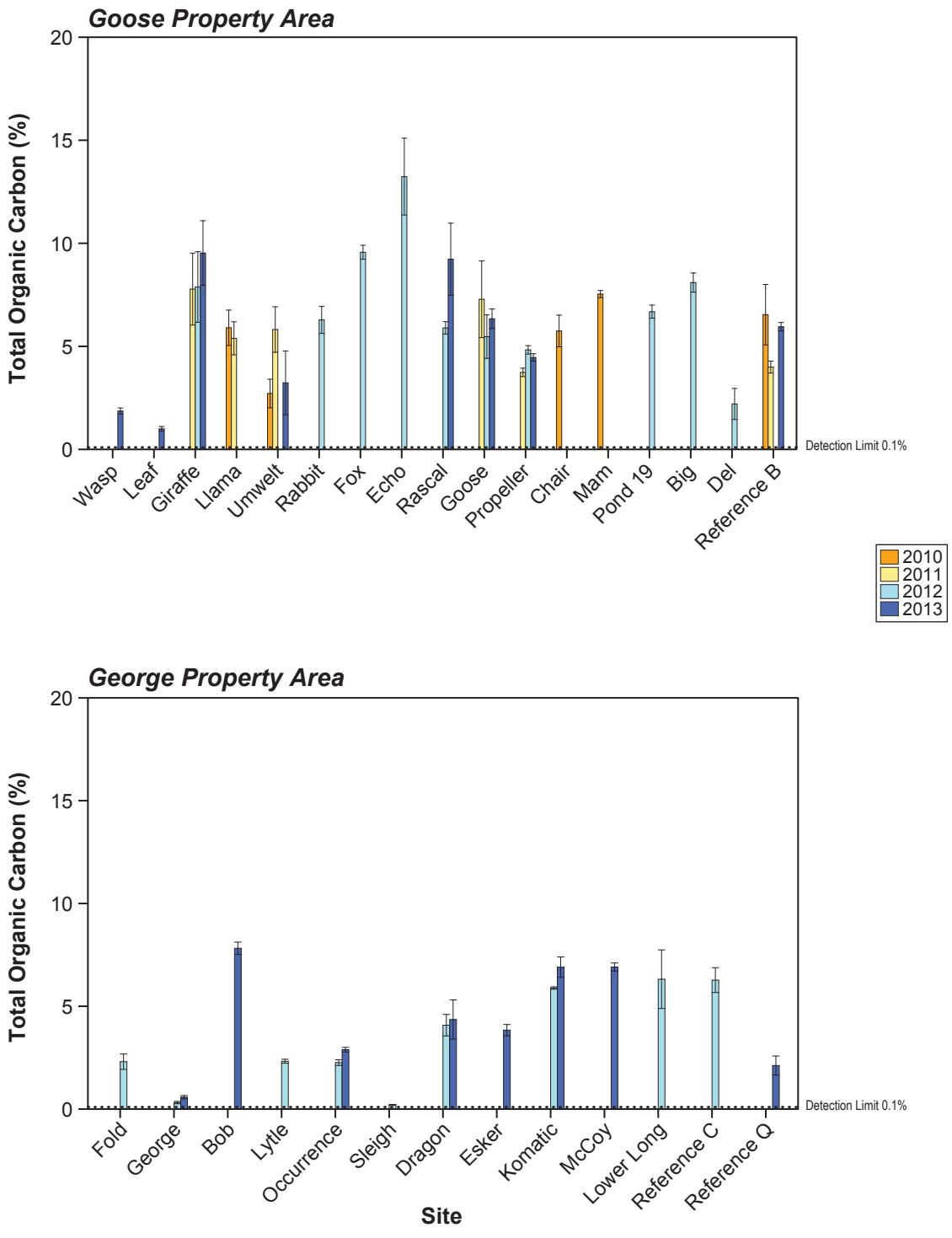
Sabina GOLD & SILVER CORP.

Rescan an ERM company

Appendix 3.5-6

Total Organic Carbon Concentrations in Lake Sediments, Back River Project, 2010 to 2013

Rescan™
an ERM company



Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Appendix 3.5-6

Total Organic Carbon Concentrations in Lake Sediments, Back River Project, 2010 to 2013

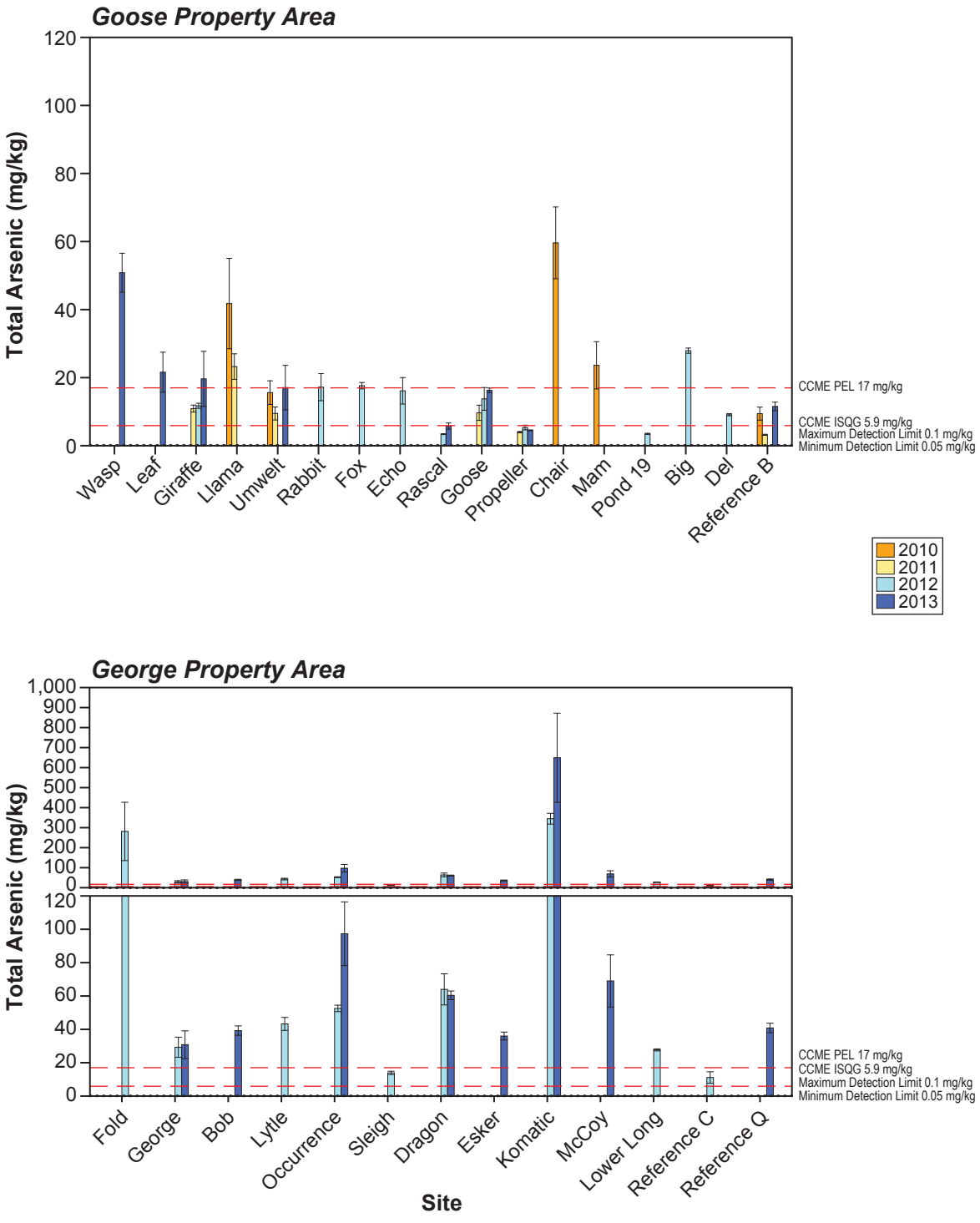
Sabina GOLD & SILVER CORP.

Rescan an ERM company

Appendix 3.5-7

Arsenic Concentrations in Lake Sediments, Back River Project, 2010 to 2013

Rescan™
an ERM company



Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME sediment quality guideline: PEL = probable effect level; ISQG = interim sediment quality guideline.

Appendix 3.5-7

Arsenic Concentrations in Lake Sediments, Back River Project, 2010 to 2013

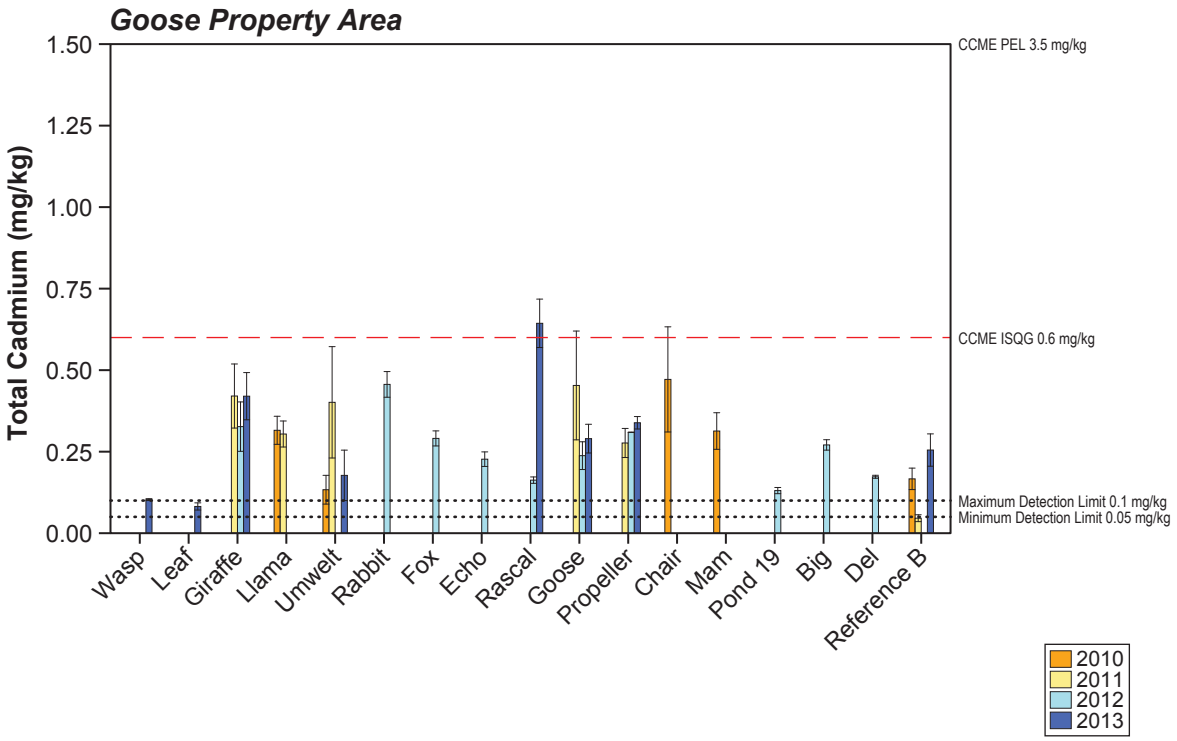
Sabina GOLD & SILVER CORP.

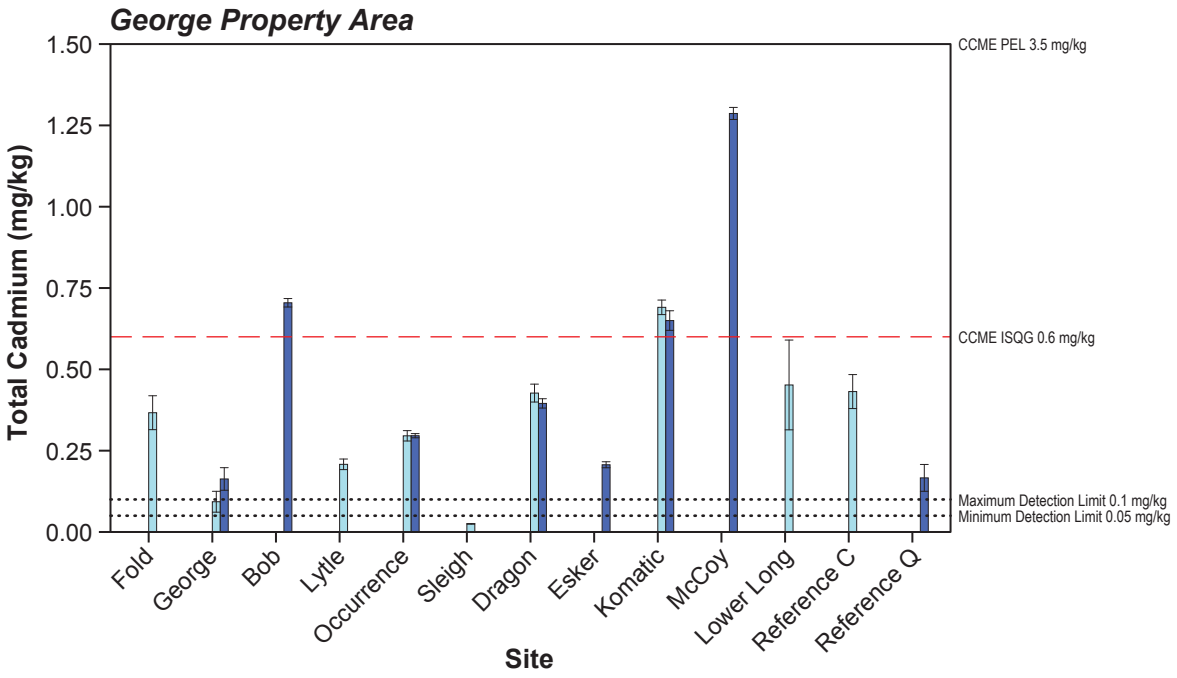
Rescan an ERM company

Appendix 3.5-8

Cadmium Concentrations in Lake Sediments, Back River Project, 2010 to 2013

Rescan™
an ERM company





Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME sediment quality guideline: PEL = probable effect level; ISQG = interim sediment quality guideline.

Appendix 3.5-8

Cadmium Concentrations in Lake Sediments, Back River Project, 2010 to 2013

Sabina GOLD & SILVER CORP.

Rescan an ERM company

Appendix 3.5-9

Chromium Concentrations in Lake Sediments, Back River Project, 2010 to 2013

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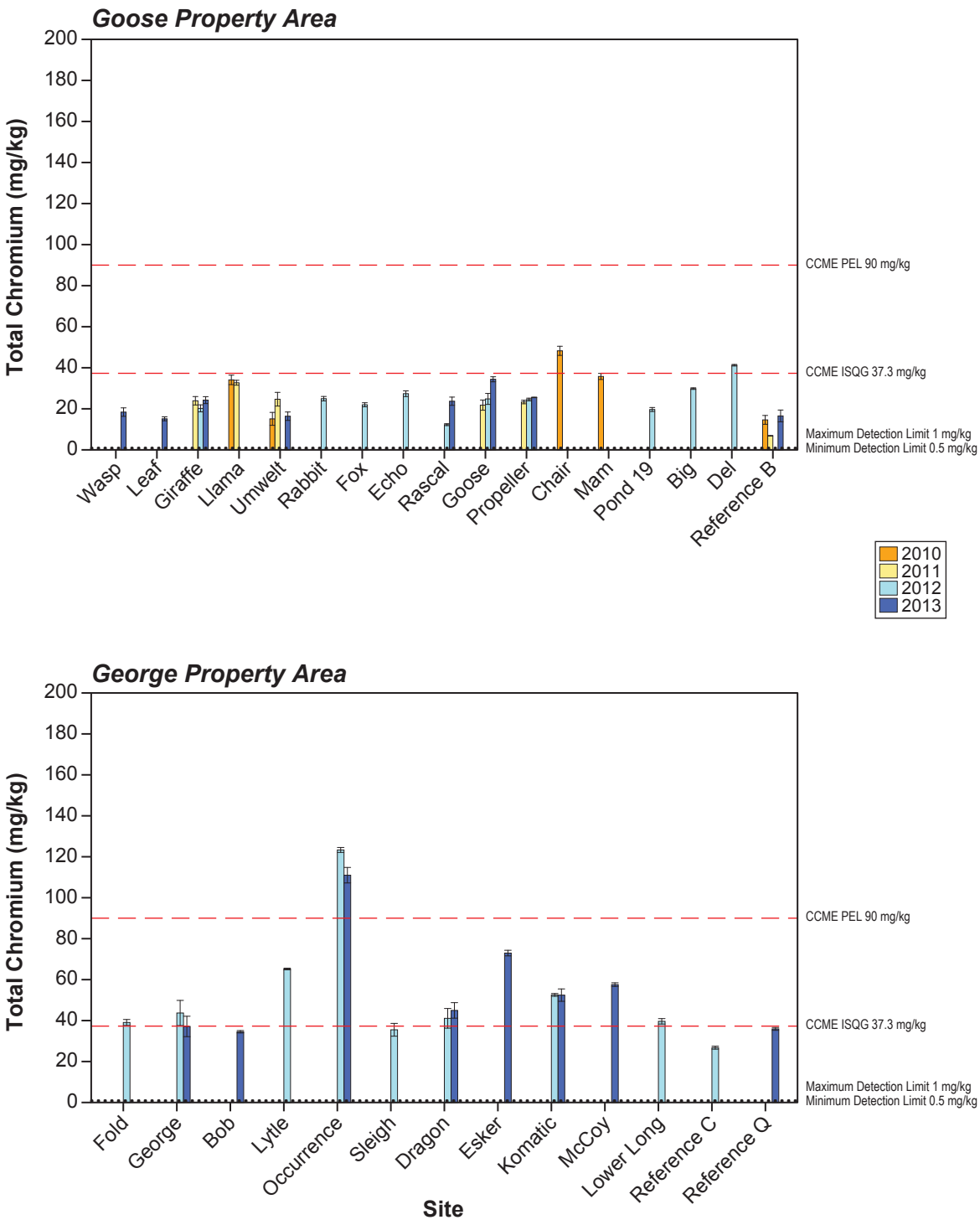
an ERM company



Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME sediment quality guideline: PEL = probable effect level; ISQG = interim sediment quality guideline.

Appendix 3.5-9

Chromium Concentrations in Lake Sediments, Back River Project, 2010 to 2013

Sabina GOLD & SILVER CORP.

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Appendix 3.5-10

Copper Concentrations in Lake Sediments, Back River Project, 2010 to 2013

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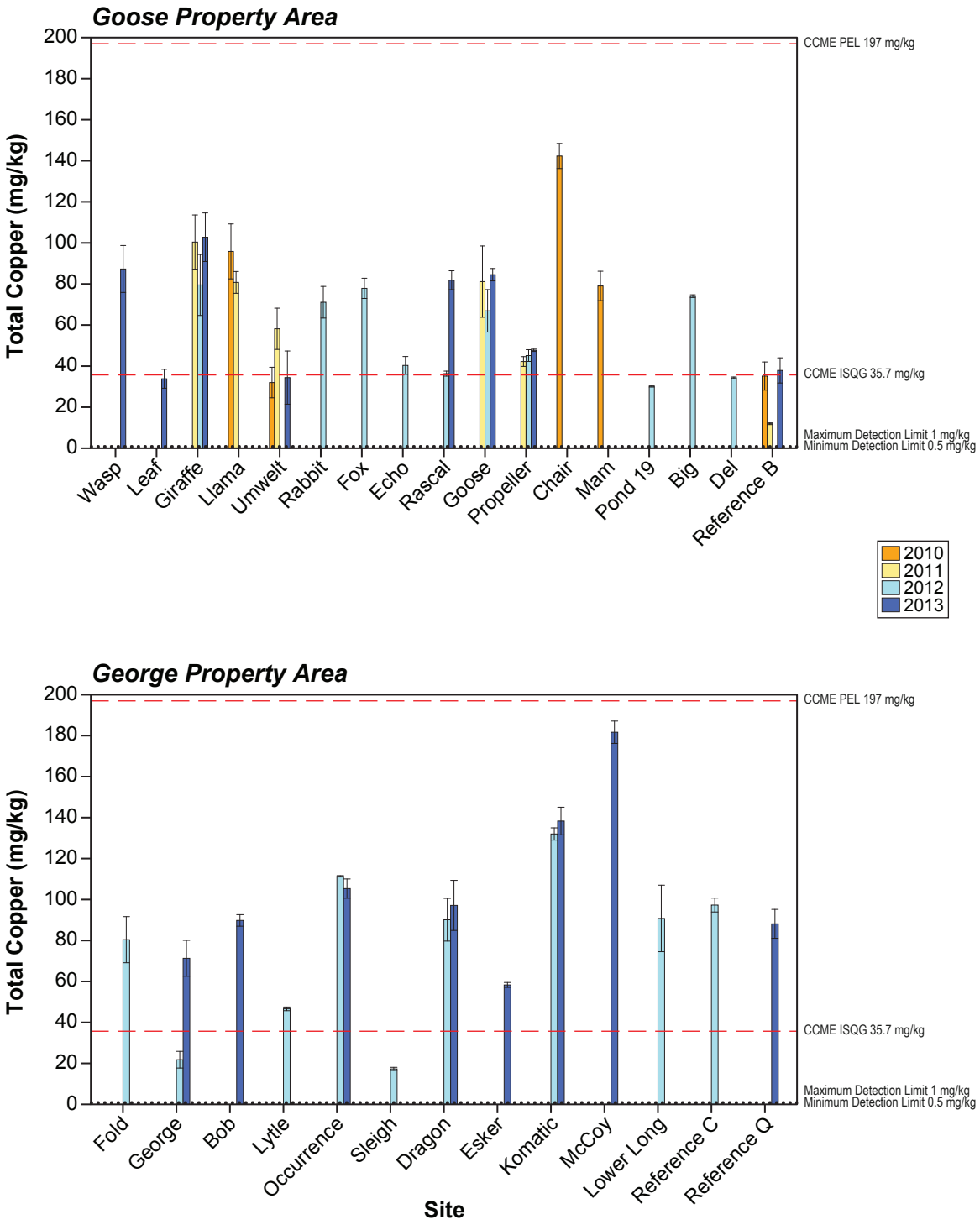

Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME sediment quality guideline: PEL = probable effect level; ISQG = interim sediment quality guideline.

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Copper Concentrations in Lake Sediments, Back River Project, 2010 to 2013

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Appendix 3.5-11

Lead Concentrations in Lake Sediments, Back River Project, 2010 to 2013

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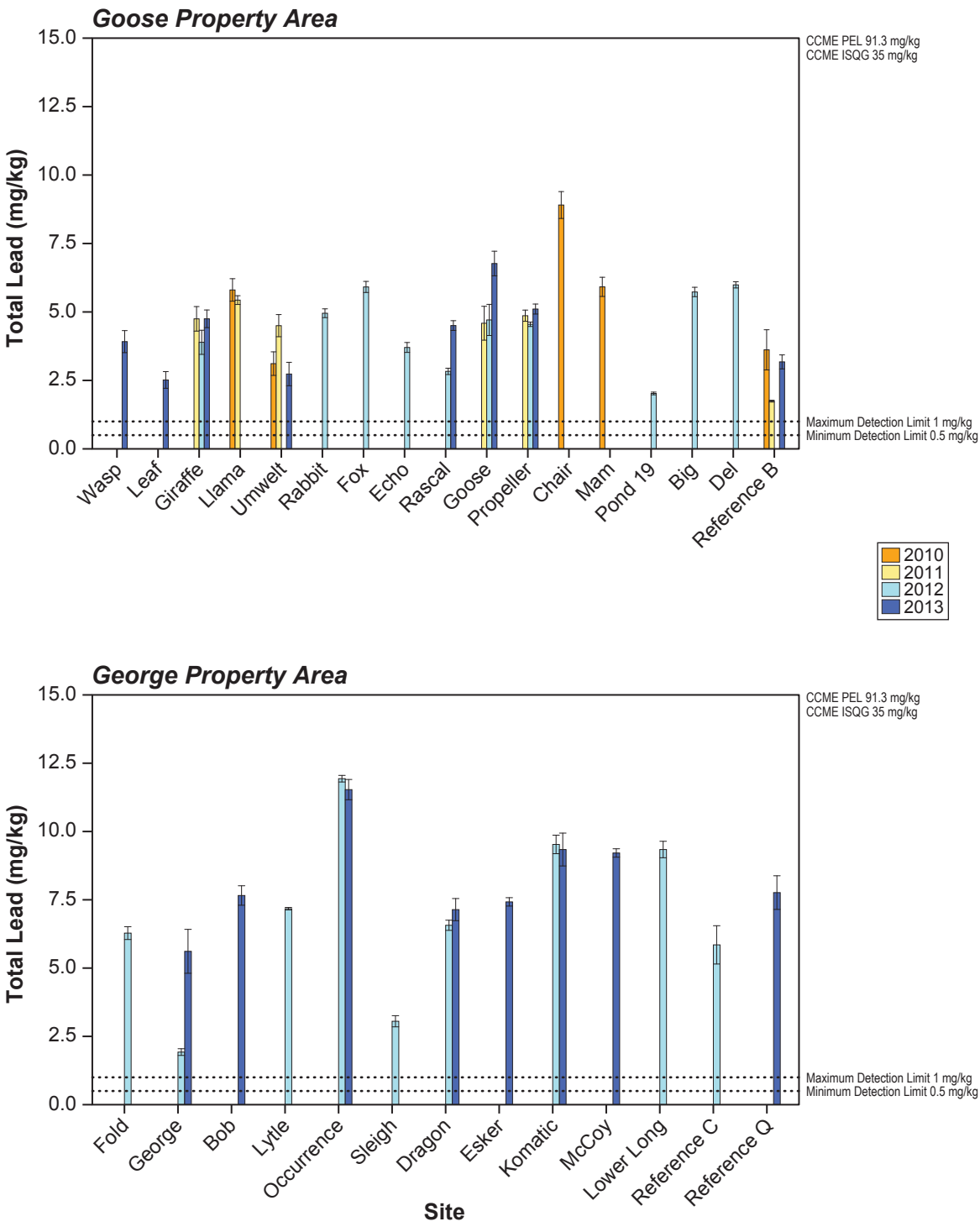

Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME sediment quality guideline: PEL = probable effect level; ISQG = interim sediment quality guideline.

Appendix 3.5-11

Sabina GOLD & SILVER CORP.

Lead Concentrations in Lake Sediments, Back River Project, 2010 to 2013

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Appendix 3.5-12

Mercury Concentrations in Lake Sediments, Back River Project, 2010 to 2013

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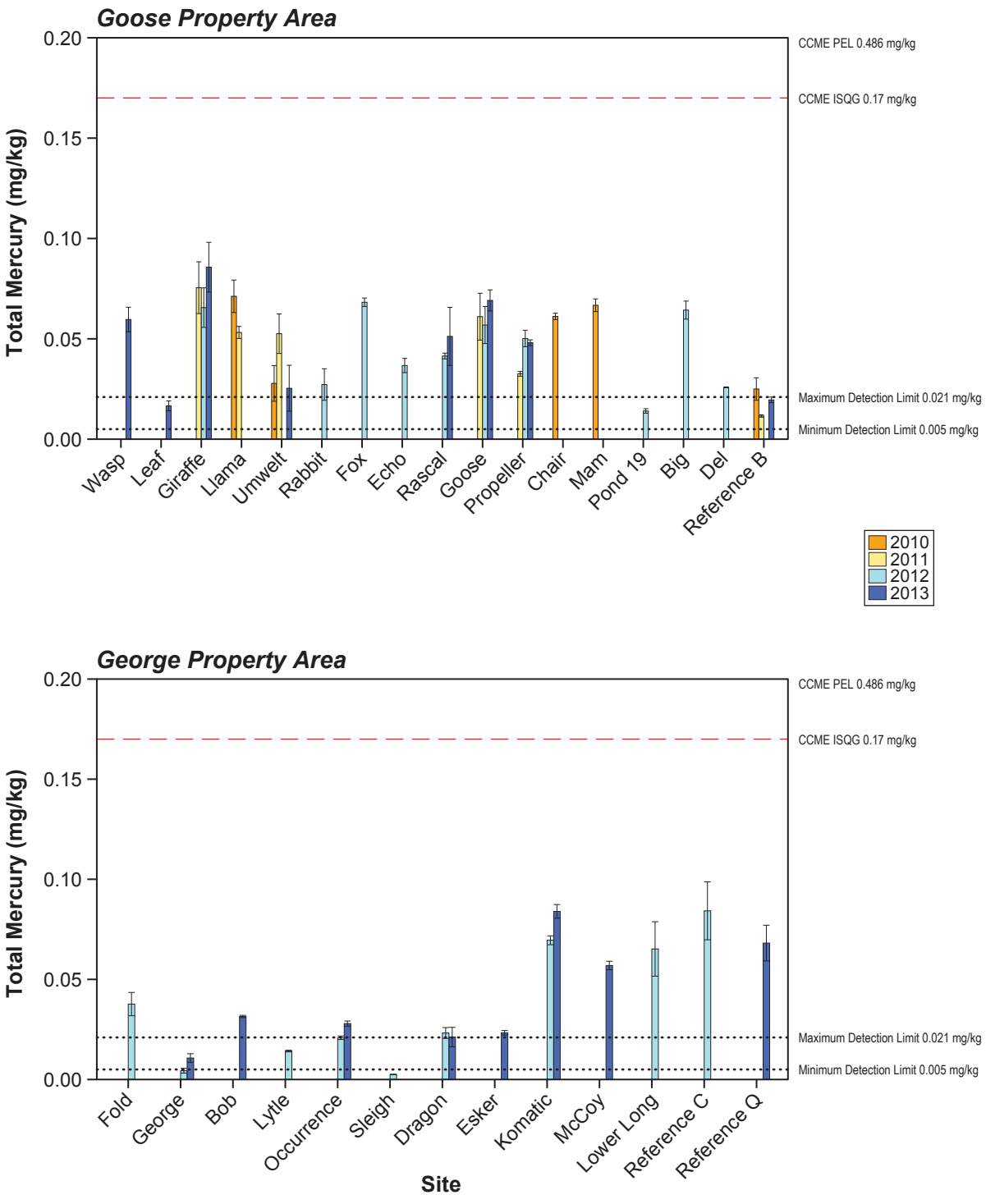

Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME sediment quality guideline: PEL = probable effect level; ISQG = interim sediment quality guideline.

Appendix 3.5-12

Mercury Concentrations in Lake Sediments, Back River Project, 2010 to 2013

Sabina GOLD & SILVER CORP.

Rescan an ERM company

Appendix 3.5-13

Zinc Concentrations in Lake Sediments, Back River Project, 2010 to 2013

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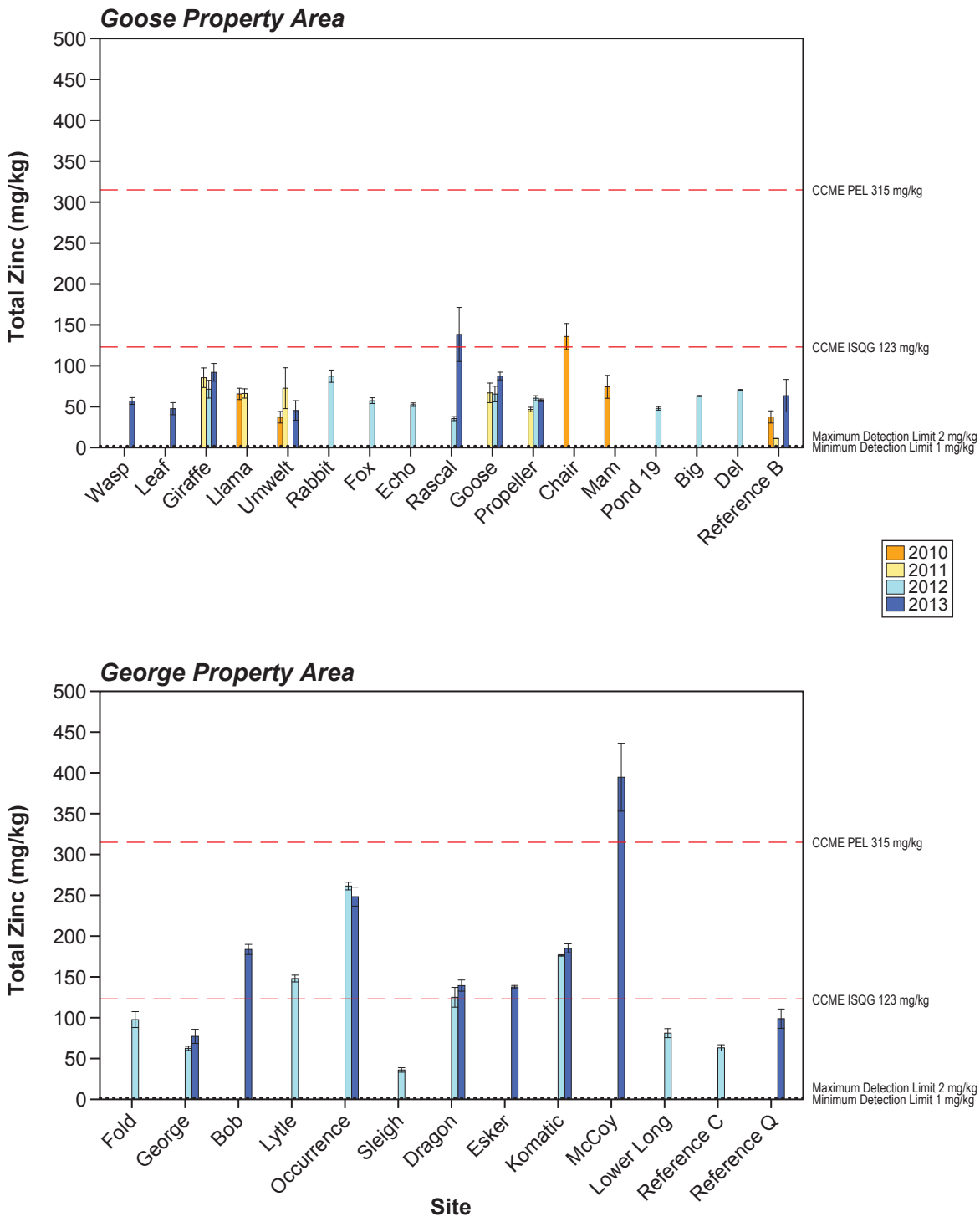
an ERM company



Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME sediment quality guideline: PEL = probable effect level; ISQG = interim sediment quality guideline.

Appendix 3.5-13

Sabina GOLD & SILVER CORP.

Zinc Concentrations in Lake Sediments, Back River Project, 2010 to 2013

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Appendix 3.5-14

Total Cyanide Concentrations in Lake Sediments, Back River Project, 2010 to 2013

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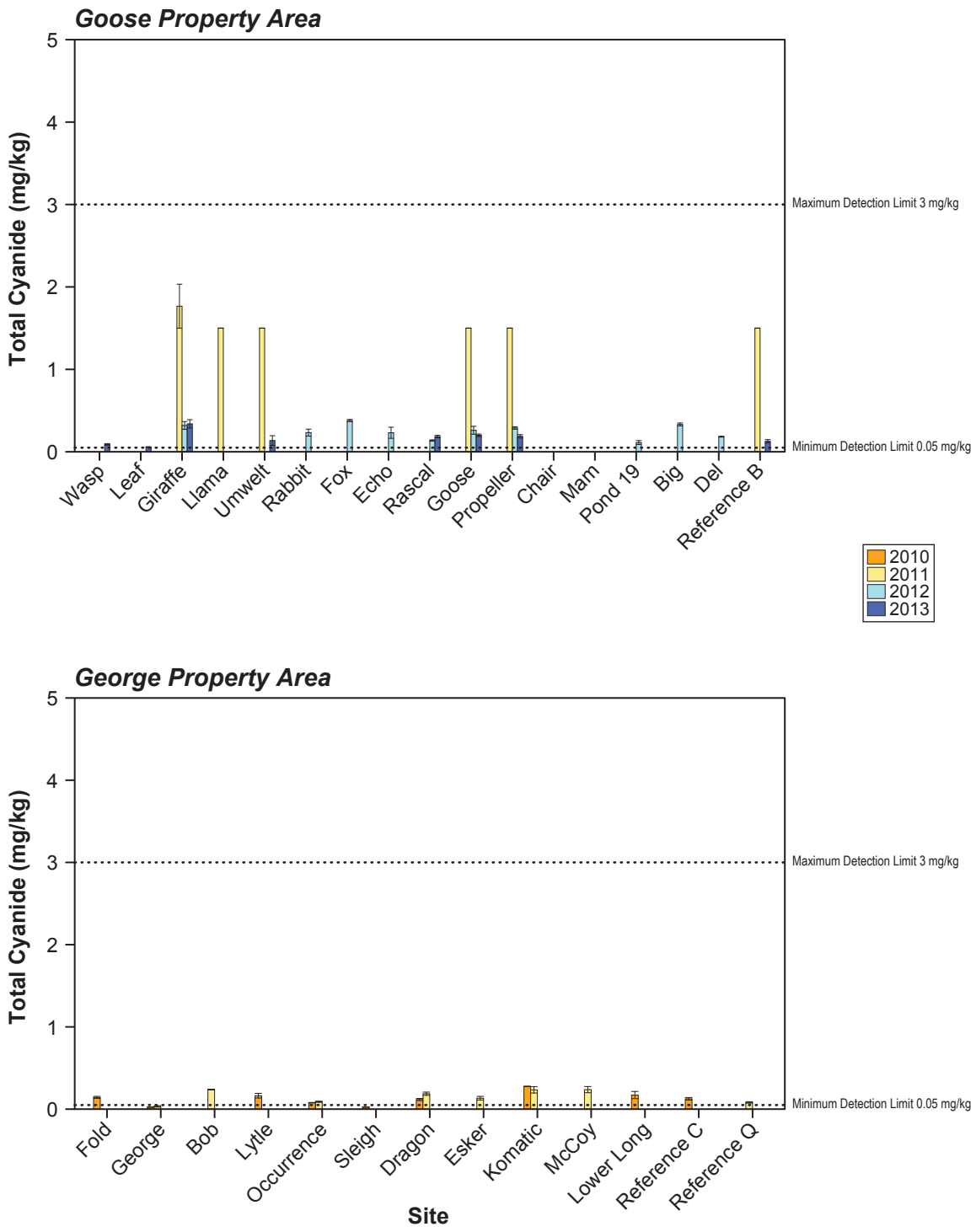
an ERM company



Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

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Total Cyanide Concentrations in Lake Sediments, Back River Project, 2010 to 2013

Rescan an ERM company

Appendix 3.6-1

Stream Sediment Quality Analytical Results, Back River Project, July 2013

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Appendix 3.6-1. Stream Sediment Quality Analytical Results, Back River Project, 2013

Stream Site Name Site Code Replicate: Date Sampled: ALS Sample ID #	Units	CCME Guidelines for the Protection of Freshwater Aquatic Life[a] ISQG[b]	 PEL[c]	Realized Detection Limits	George OF GEORGOF 3 25-Jul-13 L1339510-22	George OF GEORGOF 2 25-Jul-13 L1339510-21	George OF GEORGOF 1 25-Jul-13 L1339510-20	Giraffe OF GIROF 3 24-Jul-13 L1338234-13	Giraffe OF GIROF 2 24-Jul-13 L1338234-12	Giraffe OF GIROF 1 24-Jul-13 L1338234-11	Goose Neck IF GOONECKIF 3 23-Jul-13 L1338234-10	Goose Neck IF GOONECKIF 2 23-Jul-13 L1338234-9	Goose Neck IF GOONECKIF 1 23-Jul-13 L1338234-8	Goose OF GOOSEOF 3 24-Jul-13 L1338234-16	Goose OF GOOSEOF 2 24-Jul-13 L1338234-15	Goose OF GOOSEOF 1 24-Jul-13 L1338234-14	Komatic IF KOMAIF 3 26-Jul-13 L1339510-12	Komatic IF KOMAIF 2 26-Jul-13 L1339510-11	Komatic IF KOMAIF 1 26-Jul-13 L1339510-10	Lytle OF LYTLEOF 3 27-Jul-13 L1339510-18	Lytle OF LYTLEOF 2 27-Jul-13 L1339510-17
Physical Tests																						
Moisture	%			0.25	92.5	89.4	91.5	33.1	22.2	14.2	93.8	95.1	95	9.68	14.8	18.8	27	28.1	29.2	88.8	82.9
pH	pH			0.10	6.45	6.6	6.5	6.59	6.7	7	5.13	5.73	5.77	6.86	6.85	6.99	6.24	6.08	5.95	6.01	6
Particle Size																						
% Gravel (>2 mm)	%			0.10	<0.10	<0.10	<0.10	40.6	45.9	55.4	<0.10	<0.10	<0.10	49.9	46	56.2	1.21	<0.10	1.05	<0.10	<0.10
% Sand (2.0 mm - 0.063 mm)	%			0.10	16.5	10.5	4.97	53.9	46.1	42	12.5	57.3	25.9	47.4	46.8	39	94.2	96.7	91.7	2.31	1.4
% Silt (0.063 mm - 4 µm)	%			0.10	76.3	85.3	86.1	5.39	7.7	1.63	75.4	37.7	68	2.53	6.65	4.62	3.3	3.01	6.49	88.2	86
% Clay (<4 µm)	%			0.10	7.22	4.13	8.9	0.16	0.36	0.92	12.1	4.98	6.05	0.2	0.51	0.21	1.31	0.28	0.8	9.45	12.7
Texture				0.00	Silt loam	Silt	Silt	Sand	Sand	Sand	Silt loam / Silt	Sandy loam	Silt loam	Sand	Sand	Sand	Sand	Sand	Sand	Silt	Silt
Leachable Nutrients																						
Total Nitrogen by LECO	%			0.020	1.17	1.19	1.34	0.077	0.041	0.032	1.64	1.14	1.8	0.031	0.036	0.032	0.038	0.028	0.04	1.1	0.685
Plant Available Nutrients																						
Available Ammonium (as N)	mg/kg			1.0	41	81.2	64.9	4.4	2.9	3.1	68.5	44.3	52.1	3.6	3.1	2.7	2.7	1.4	2.4	45.9	23.4
Nitrate and Nitrite (as N)	mg/kg			2.0	<20	<14	<18	<2.0	<2.0	<4.0	<16	<12	<10	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<10	<8.0
Nitrate (as N)	mg/kg			2.0	<20	<14	<18	<2.0	<2.0	<4.0	<16	<12	<10	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<10	<8.0
Nitrite (as N)	mg/kg			0.4	<4.0	<2.8	<3.6	<0.40	<0.40	<0.80	<3.2	<2.4	<2.0	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<2.0	<1.6
Available Phosphate (as P)	mg/kg			2	<2.0	14.3	2.3	<2.0	<2.0	<2.0	<6.0	<6.0	<6.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	3	4.6
Cyanides																						
Cyanide, Weak Acid Dissociable	mg/kg			0.05	0.342	0.224	0.398	<0.050	<0.050	<0.050	0.175	0.182	0.073	<0.050	<0.050	<0.10	<0.050	<0.050	<0.050	0.29	0.198
Cyanide, Total	mg/kg			0.05	0.944	0.716	0.981	<0.050	<0.050	<0.050	1.01	1.3	0.944	<0.050	<0.050	<0.10	<0.050	<0.050	<0.050	0.57	0.344
Organic / Inorganic Carbon																						
Total Organic Carbon	%			0.10	14.7	13.6	19.1	0.53	0.24	0.13	24.8	16.2	25.8	<0.10	0.1	0.14	0.27	0.17	0.36	17.3	9.93
Metals																						
Aluminum (Al)	mg/kg			50	12600	13600	10200	8820	6880	9050	6580	6330	4980	5150	7140	6280	15300	13300	12600	13700	17100
Antimony (Sb)	mg/kg			0.10	0.13	0.16	0.16	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.16	0.12
Arsenic (As)	mg/kg	5.9	17	0.050	65.5	86.8	68	7.12	3.74	4.39	12.7	205	7.43	3.28	3.44	3.8	12.6	9.88	10	29.2	25
Barium (Ba)	mg/kg			0.50	40.1	42.6	34.6	28.5	38	30.7	60.3	49.3	51.2	28.9	35.2	36.9	10.1	10.2	11.2	63.8	62.4
Beryllium (Be)	mg/kg			0.20	0.83	0.93	0.79	<0.20	<0.20	<0.20	0.23	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.91	0.68
Bismuth (Bi)	mg/kg			0.20	<0.20	0.23	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium (Cd)	mg/kg	0.6	3.5	0.050	0.42	0.53	0.555	<0.050	<0.050	<0.050	0.328	0.265	0.27	0.051	0.055	0.062	<0.050	<0.050	<0.050	0.735	0.363
Calcium (Ca)	mg/kg			50	3970	3700	4130	1490	1350	1680	2690	2330	3180	1200	1580	1450	1390	1320	1330	7620	3820
Chromium (Cr)	mg/kg	37.3	90	0.50	33.5	37	28.7	29.9	23.2	26.8	21.2	20.9	15.1	18.4	23.6	17.6	58	50.1	48.5	44.7	57.7
Cobalt (Co)	mg/kg			0.10	215	271	107	13.4	9.33	11.1	10.7	10.8	10.9	16.6	14.4	13.4	7.32	6.33	6.84	87.7	52.2
Copper (Cu)	mg/kg	35.7	197	0.50	133	134	114	15.9	15.5	12.2	40.6	28.9	28.3	9.72	7.56	8.15	10.5	10.7	12.7	124	81.4
Iron (Fe)	mg/kg			50	25600	30000	22100	18400	12700	17300	20000	18200	17800	12100	15500	14600	24400	21200	20100	21500	22400
Lead (Pb)	mg/kg	35	91.3	0.50	8.2	8.55	7.4	2.43	1.96	2.28	3.72	2.27	3.15	1.55	1.68	1.78	1.94	1.88	1.96	8.1	8.95
Lithium (Li)	mg/kg			5.0	15.8	20.9	14.9	19.4	15.3	19.8	5.7	7	<5.0	12.4	16.5	13.2	35.5	31.8	29.2	24.5	31.5
Magnesium (Mg)	mg/kg			20	5080	5940	4630	6410	5080	6540	2010	2940	1810	4010	5410	4480	11100	9630	9010	7820	9710
Manganese (Mn)	mg/kg			1.0	1290	1900	717	249	166	226	100	154	158	333	304	261	262	222	214	653	255
Mercury (Hg)	mg/kg	0.17	0.486	0.0050	0.0719	0.0759	0.0655	0.007	<0.0050	0.0056	0.0679	0.0628	0.0744	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0627	0.0502
Molybdenum (Mo)	mg/kg			0.50	0.72	1	0.84	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.56	<0.50	0.58	0.74	0.74
Nickel (Ni)	mg/kg			0.50	119	145	99.5	26.5	19.3	25.3	38.7	34.1	30.4	16.8	18.4	16.5	35.3	31	30.8	179	96.7
Phosphorus (P)	mg/kg			50	917	1110	693	371	356	454	750	684	721	328	402	351	464	363	405	664	459
Potassium (K)	mg/kg			100	690	680	540	950	840	1100	360	440	350	710	760	900	320	300	320	950	1010
Selenium (Se)	mg/kg			0.20	1.01	1.15	0.74	<0.20	<0.20	<0.20	0.42	0.35	0.35	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.78	0.45
Silver (Ag)	mg/kg			0.10	0.12	0.15	0.12	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.29	0.21
Sodium (Na)	mg/kg			100	170	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	110	<100	<100	<100	130	120
Strontium (Sr)	mg/kg			0.50	20.7	20	22.8	5.17	4.7	4.63	22.6	16.6	25.1	4.28	6.9	7.02	5.37	5.17	5.23	39.6	20.5
Sulphur (S)	mg/kg			500	3900	3600	4300	700	700	<500	4800	3600	5000	<500	600	<500	<500	<500	<500	4200	3800
Thallium (Tl)	mg/kg			0.050	0.109	0.145	0.079	0.053	0.052	0.056	0.065	<0.050	0.065	<0.050	0.05	0.098	<0.050	<0.050	<0.050	0.119	0.112
Tin (Sn)	mg/kg			2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	mg/kg			1.0	257	216	199	394	398	424	221	212	159	281	278	362	274	268	317	343	475
Uranium (U)	mg/kg			0.050	1.57	1.71	1.43	0.425	0.367	0.289	0.763	0.56	0.614	0.306	0.262	0.299	0.492	0.46	0.494	1.78	1.5
Vanadium (V)	mg/kg			0.20	21.7	25.7	20.8	26.5	23.9	29.5	38.3	24.5	21.6	26.9	28.8	29.5	28.7	25.6	25.3	27.8	37.8
Zinc (Zn)	mg/kg	123	315	1.0	142	168	112	36.4	26.3	35.2	33.1	27.1	21.1	23	25.9	25.4	50	43.6	42.3	143	137

Appendix 3.6-1. Stream Sediment Quality Analytical Results, Back River Project, 2013

Stream Site Name		CCME Guidelines for the Protection of Freshwater Aquatic Life[a]			Reference B OF	Reference B OF	Reference B OF	Reference Q OF	Reference Q OF	Reference Q OF	Sleigh OF	Sleigh OF	Sleigh OF	TIA OF	Umwelt OF	Umwelt OF	Umwelt OF	Wasp OF	Wasp OF	Wasp OF
Site Code					LYTLEOF	MCCOYWOF	REFBOFWET	REFBOFWET	REFBOFWET	REFQOF	REFQOF	REFQOF	SLEIGHOF	SLEIGHOF	SLEIGHOF	TIAOF	UMWOF	UMWOF	UMWOF	WASPOF	WASPOF	WASPOF
Replicate:				Realized	1	1	3	2	1	3	2	1	3	2	1	1	1	3	2	3	2	1
Date Sampled:				Detection	27-Jul-13	27-Jul-13	26-Jul-13	26-Jul-13	26-Jul-13	25-Jul-13	25-Jul-13	25-Jul-13	27-Jul-13	27-Jul-13	27-Jul-13	23-Jul-13	23-Jul-13	23-Jul-13	23-Jul-13	23-Jul-13	23-Jul-13	23-Jul-13
ALS Sample ID #	Units	ISQG[b]	PEL[c]	Limits	L1339510-16	L1339510-19	L1339510-6	L1339510-5	L1339510-4	L1339510-3	L1339510-2	L1339510-1	L1339510-15	L1339510-14	L1339510-13	L1338234-4	L1338234-5	L1338234-7	L1338234-6	L1338234-3	L1338234-2	L1338234-1
Physical Tests																						
Moisture	%			0.25	84.3	90.2	91.1	88.8	91.9	92.7	12.8	7.85	23.8	23.9	22.6	58.5	34.8	27.8	36.9	95.2	93.4	86.7
pH	pH			0.10	6.06	6.45	5.23	5.35	5.13	5.7	5.66	6.83	6.35	6.32	6.54	5.57	6.86	6.55	6.48	6.26	6.18	5.79
Particle Size																						
% Gravel (>2 mm)	%			0.10	<0.10	50*	<0.10	<0.10	<0.10	<0.10	94.6	96.6	63.9	21.2	11	1.21	39.8	37.8	27.8	<0.10	<0.10	<0.10
% Sand (2.0 mm - 0.063 mm)	%			0.10	1.35	31.4*	16.8	7.63	5.76	1.63	4.45	3.22	34.9	77.7	88.2	5.38	56	58.1	69.5	4.64	1.35	8.53
% Silt (0.063 mm - 4 µm)	%			0.10	86.8	7.59*	78.8	89.5	91.4	87.8	0.84	<0.10	1.12	0.91	0.75	84.6	3.88	3.83	2.64	86.7	85	77.9
% Clay (<4 µm)	%			0.10	11.8	11*	4.34	2.84	2.85	10.5	<0.10	<0.10	0.14	0.17	<0.10	8.81	0.41	0.24	<0.10	8.64	13.6	13.6
Texture				0.00	Silt	Sandy clay loam	Silt	Silt	Silt	Silt	Loamy sand	Sand	Sand	Sand	Sand	Silt	Sand	Sand	Sand	Silt	Silt	Silt
Leachable Nutrients																						
Total Nitrogen by LECO	%			0.020	0.763	0.435	1.94	1.85	1.89	1.22	0.194	0.054	0.054	0.033	0.035	0.294	0.055	0.057	0.068	1.73	1.7	1.51
Plant Available Nutrients																						
Available Ammonium (as N)	mg/kg			1.0	23.5		159	76.5	115	87.1	4.7	2.8	1.9	1.4	1.2	10	3.4	4.5	5.2	67.6	86.1	73.5
Nitrate and Nitrite (as N)	mg/kg			2.0	<8.0		<12	<10	<10	<16	<6.0	<4.0	<2.0	<2.0	<2.0	<6.0	<2.0	<2.0	<2.0	<20	<10	<8.0
Nitrate (as N)	mg/kg			2.0	<8.0		<12	<10	<10	<16	<6.0	<4.0	<2.0	<2.0	<2.0	<6.0	<2.0	<2.0	<2.0	<20	<10	<8.0
Nitrite (as N)	mg/kg			0.4	<1.6		<2.4	<2.0	<2.0	<3.2	<1.2	<0.80	<0.40	<0.40	<0.40	<1.2	<0.40	<0.40	<0.40	<4.0	<2.0	<1.6
Available Phosphate (as P)	mg/kg			2	3.3		<2.0	<2.0	<2.0	<2.0	<2.0	<4.0	<2.0	<2.0	<2.0	<4.0	<2.0	3.3	<2.0	<8.0	6.5	2.3
Cyanides																						
Cyanide, Weak Acid Dissociable	mg/kg			0.05	0.202	0.103	0.133	0.154	0.224	0.522	<0.050	<0.050	<0.050	<0.050	<0.10	<0.050	<0.050	<0.050	<0.050	0.349	0.606	0.576
Cyanide, Total	mg/kg			0.05	0.424	0.461	0.322	0.342	0.452	0.805	<0.050	<0.050	<0.050	<0.050	0.11	0.224	<0.050	<0.050	<0.050	1.02	1.45	1.2
Organic / Inorganic Carbon																						
Total Organic Carbon	%			0.10	11.7	6	28.4	28.9	28.8	17	2.14	0.56	0.49	0.14	0.17	5.19	0.49	0.41	0.58	28.2	19	17.2
Metals																						
Aluminum (Al)	mg/kg			50	17800	14700	5190	5720	4740	11100	16800	19000	15900	16300	17500	11000	5100	4920	5220	5060	11100	12600
Antimony (Sb)	mg/kg			0.10	<0.10	<0.10	0.12	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.12	<0.10
Arsenic (As)	mg/kg	5.9	17	0.050	22	34.5	61.9	21	12.3	30.7	21.5	25.5	7.78	8.34	15	5.9	3.63	3.51	3.08	13.3	27.2	36.4
Barium (Ba)	mg/kg			0.50	55.6	24.9	62.3	48.4	48.5	43.4	12.5	14.4	9.35	8.53	9.87	17.1	23.8	24.2	21.5	26	40.1	48.5
Beryllium (Be)	mg/kg			0.20	0.72	0.28	0.28	0.25	0.26	0.63	0.32	0.31	<0.20	<0.20	<0.20	0.32	<0.20	<0.20	<0.20	0.32	0.97	1.03
Bismuth (Bi)	mg/kg			0.20	0.21	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.23	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Cadmium (Cd)	mg/kg	0.6	3.5	0.050	0.356	0.139	0.304	0.273	0.259	0.54	<0.050	0.06	<0.050	<0.050	0.055	0.069	<0.050	<0.050	<0.050	0.134	0.401	0.627
Calcium (Ca)	mg/kg			50	3580	2200	2620	2390	2390	2560	1040	1080	1150	1100	1170	957	1830	1240	1420	2140	2250	1950
Chromium (Cr)	mg/kg	37.3	90	0.50	60.1	54.6	16.4	17.9	15.3	31.7	62.2	67.9	57.9	60.1	64.4	20.2	15.2	15	14.5	10.8	23.9	26.8
Cobalt (Co)	mg/kg			0.10	45.2	29.7	8.36	6.34	6.71	52.1	18.6	58.8	9.26	8.21	21.8	4.78	6.85	4.27	4.53	46.4	127	169
Copper (Cu)	mg/kg	35.7	197	0.50	103	39	40.9	38.4	35.7	102	22.9	30.2	13.6	11.2	13.7	26.7	5.42	6.34	6.07	96.3	117	127
Iron (Fe)	mg/kg			50	23400	31700	59200	34900	39700	32500	33200	38800	25800	26600	29700	13500	10700	10500	9980	6510	25300	26100
Lead (Pb)	mg/kg	35	91.3	0.50	8.36	5.1	6.44	6.09	5.62	8.15	4.26	5.64	2.03	2.07	2.43	6.01	1.47	1.64	1.53	7.07	15.9	14.2
Lithium (Li)	mg/kg			5.0	32.7	32.1	<5.0	<5.0	<5.0	15.8	36.2	39	35.9	37.3	39.2	11.6	9.3	10.8	12.3	<5.0	7.4	10.1
Magnesium (Mg)	mg/kg			20	9940	10200	1640	1840	1530	4550	12300	13800	11600	11800	12500	2200	3690	3380	3350	1570	2390	3080
Manganese (Mn)	mg/kg			1.0	288	579	117	82.1	81.4	268	351	798	291	286	438	60.1	162	98.7	117	388	1020	764
Mercury (Hg)	mg/kg	0.17	0.486	0.0050	0.0557	0.0376	0.0569	0.0634	0.0653	0.0853	0.0069	<0.0050	<0.0050	<0.0050	<0.0050	0.0412	<0.0050	<0.0050	<0.0050	0.0495	0.13	0.122
Molybdenum (Mo)	mg/kg			0.50	0.62	0.98	0.51	<0.50	<0.50	1.19	1	1.2	<0.50	<0.50	0.58	0.6	<0.50	<0.50	<0.50	<0.50	0.8	0.93
Nickel (Ni)	mg/kg			0.50	99.6	67.2	53.6	43.2	44.3	127	43.8	52.4	38.5	37.6	47.6	20.5	10.2	9.73	9.82	51.9	114	138
Phosphorus (P)	mg/kg			50	595	382	719	576	571	758	378	412	386	387	444	269	415	265	270	465	1110	1180
Potassium (K)	mg/kg			100	1050	440	440	370	350	600	320	420	270	250	330	270	470	500	340	290	710	490
Selenium (Se)	mg/kg			0.20	0.59	0.38	0.64	0.58	0.55	0.76	<0.20	<0.20	<0.20	<0.20	<0.20	0.58	<0.20	<0.20	<0.20	0.73	0.95	1.03
Silver (Ag)	mg/kg			0.10	0.22	<0.10	<0.10	<0.10	<0.10	0.15	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.13	0.19	0.17
Sodium (Na)	mg/kg			100	130	<100	<100	<100	<100	120	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Strontium (Sr)	mg/kg			0.50	18.7	8.91	14.6	12.7	12.3	13.2	3.97	3.52	4.59	4.73	4.67	10.5	12.5	7.65	8.14	11.7	12.7	10.8
Sulphur (S)	mg/kg			500	4200	1900	6100	5800	5900	5500	700	<500	<500	<500	<500	2100	700	700	800	6400	5300	10700
Thallium (Tl)	mg/kg			0.050	0.106	0.058	<0.050	<0.050	<0.050	0.102	<0.050	0.052	<0.050	<0.050	<0.050	0.064	<0.050	<0.050	<0.050	<0.050	0.095	0.128
Tin (Sn)	mg/kg			2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	mg/kg			1.0	428	357	160	164	171	273	270	252	239	229	259	292	339	283	340	62.5	131	160
Uranium (U)	mg/kg			0.050	1.63	1.11	0.563	0.583	0.548	1.56	0.511	0.518	0.502	0.516	0.522	0.901	0.198	0.266	0.229	1.93	2.47	2.62
Vanadium (V)	mg/kg			0.20	36	39.5	29	31.6	28.5	31.9	36.9	39.6	27.8	29.2	32.5	26.4	23.4	20.2	20	7.58	20.5	24.1
Zinc (Zn)	mg/kg	123	315	1.0	132	77.3	61.9	52.8	47.1	158	63.5	69.9	53.8	52.7	60.3	18.7	19.4	16.6	16.5	16.8	60	71.4

Notes:

Nutrient data could not be analyzed for some samples due to insufficient volume.

a) Canadian sediment quality guidelines for the protection of freshwater aquatic life, Canadian Council of Ministers of the Environment (accessed Sept 2013)

b) ISQG = Interim Sediment Quality Guideline

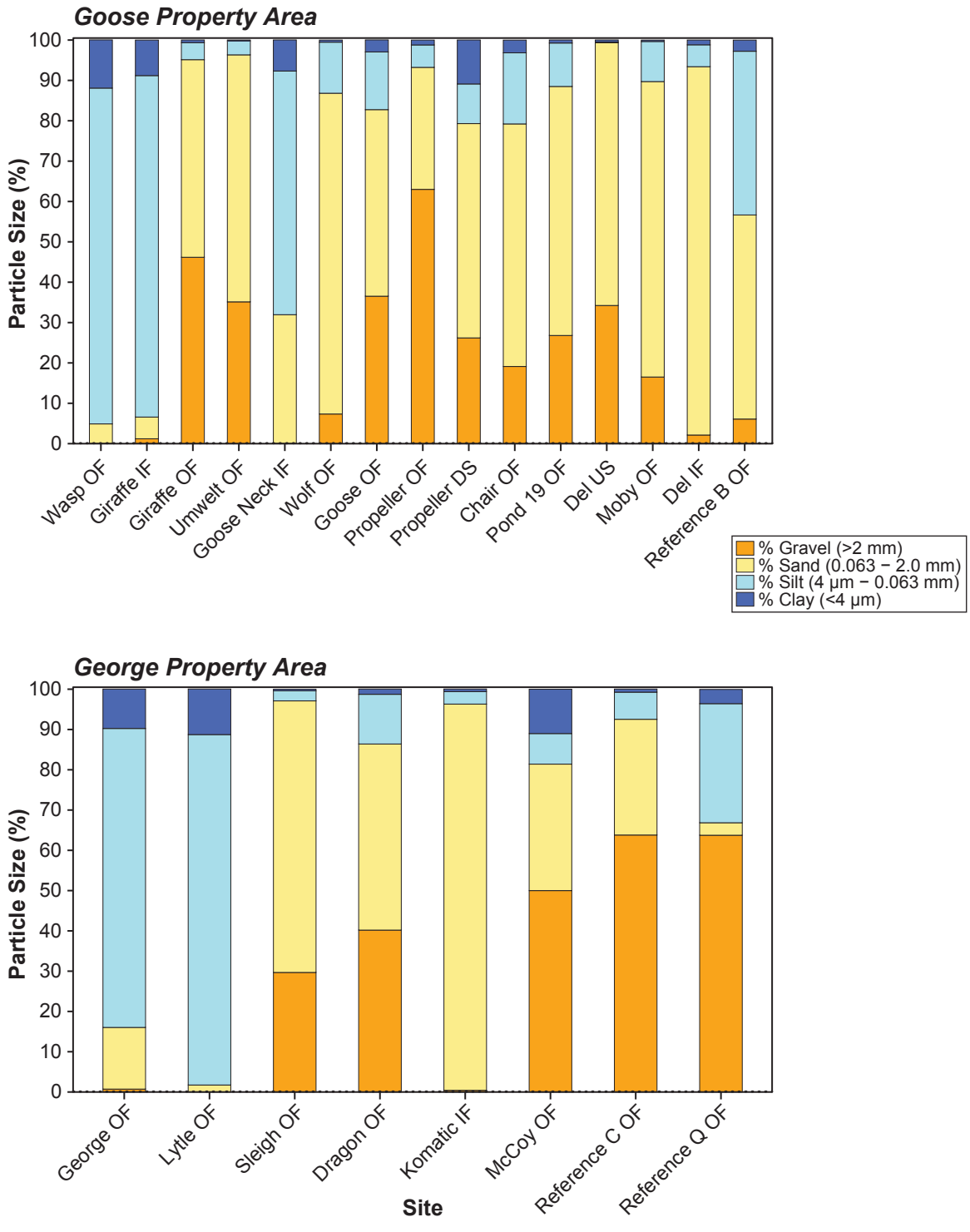
c) PEL = Probable Effects Level

**For McCoy OF sample L1339510-19, ALS lab states partical size results as unreliable due to insufficient soil for analysis.*

Appendix 3.6-2

Grain Size Composition in Stream Sediments, Back River Project, 2011 to 2013

Rescan™
an ERM company



Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

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Grain Size Composition in Stream Sediments, Back River Project, 2011 to 2013

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Appendix 3.6-3

Available Ammonium Concentrations in Stream Sediments, Back River Project, 2011 to 2013

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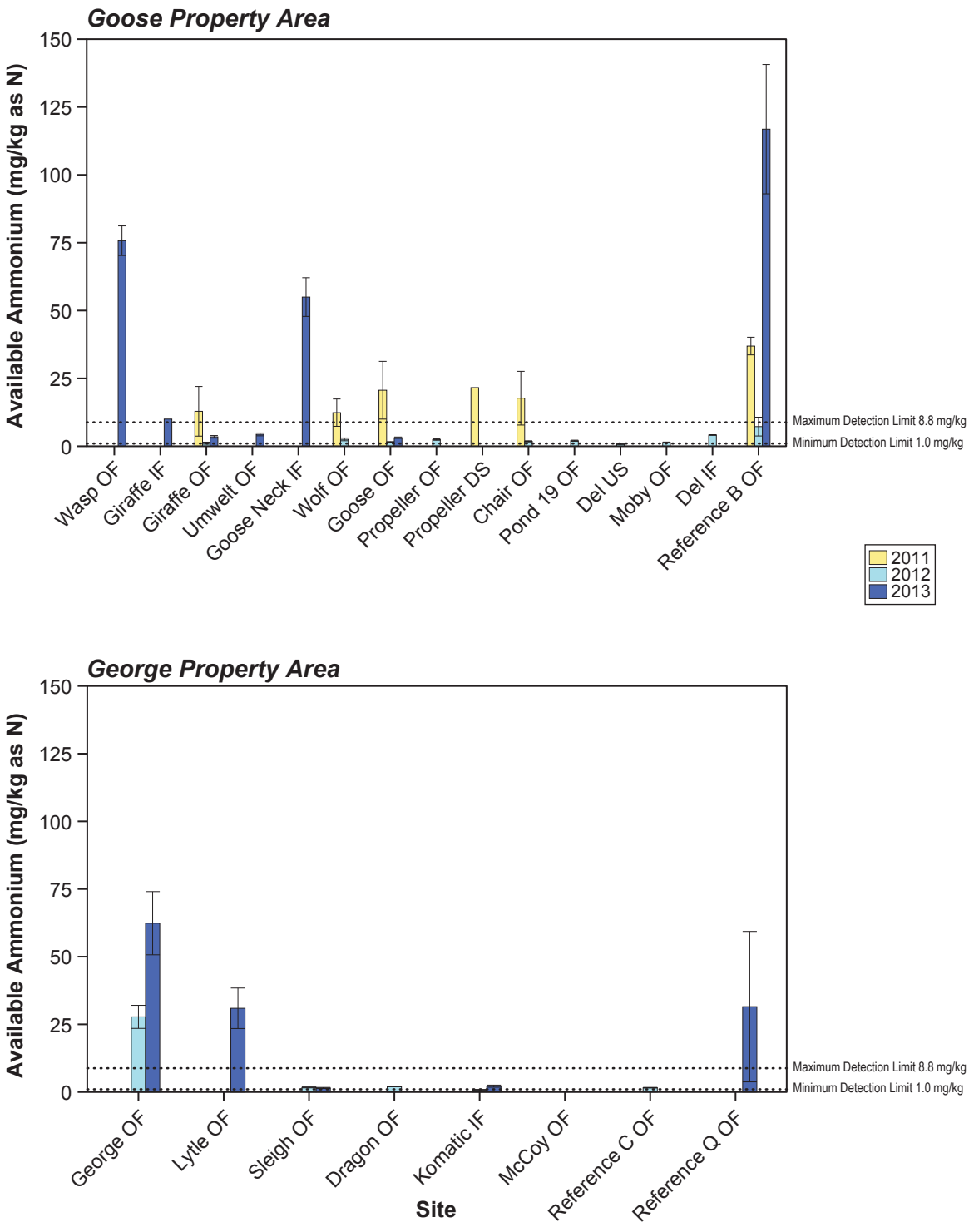

Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Appendix 3.6-3

Available Ammonium Concentrations in Stream Sediments, Back River Project, 2011 to 2013

Sabina GOLD & SILVER CORP.

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Appendix 3.6-4

Total Nitrogen Concentrations in Stream Sediments, Back River Project, 2011 to 2013

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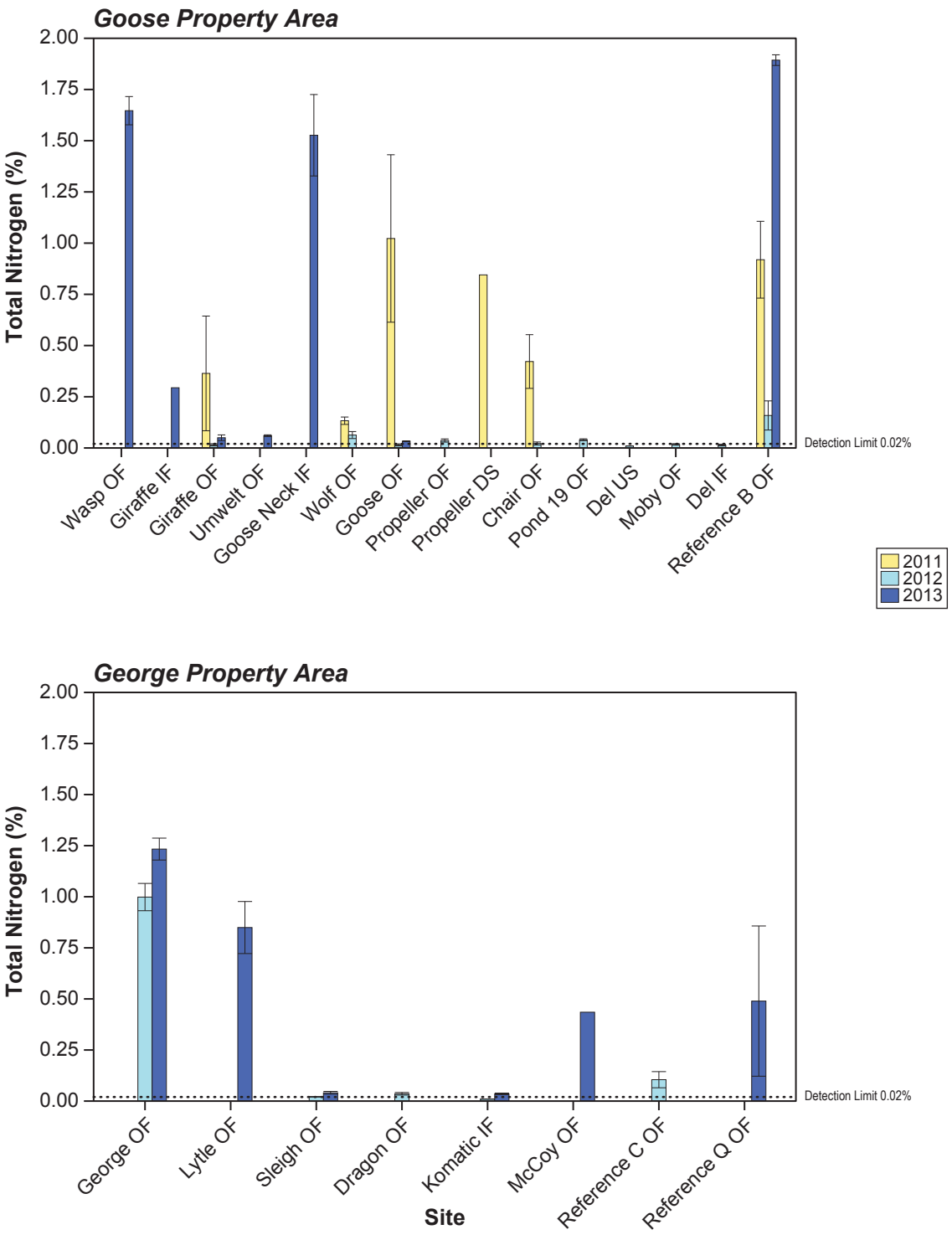

Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Appendix 3.6-4

Total Nitrogen Concentrations in Stream Sediments, Back River Project, 2011 to 2013

Sabina GOLD & SILVER CORP.

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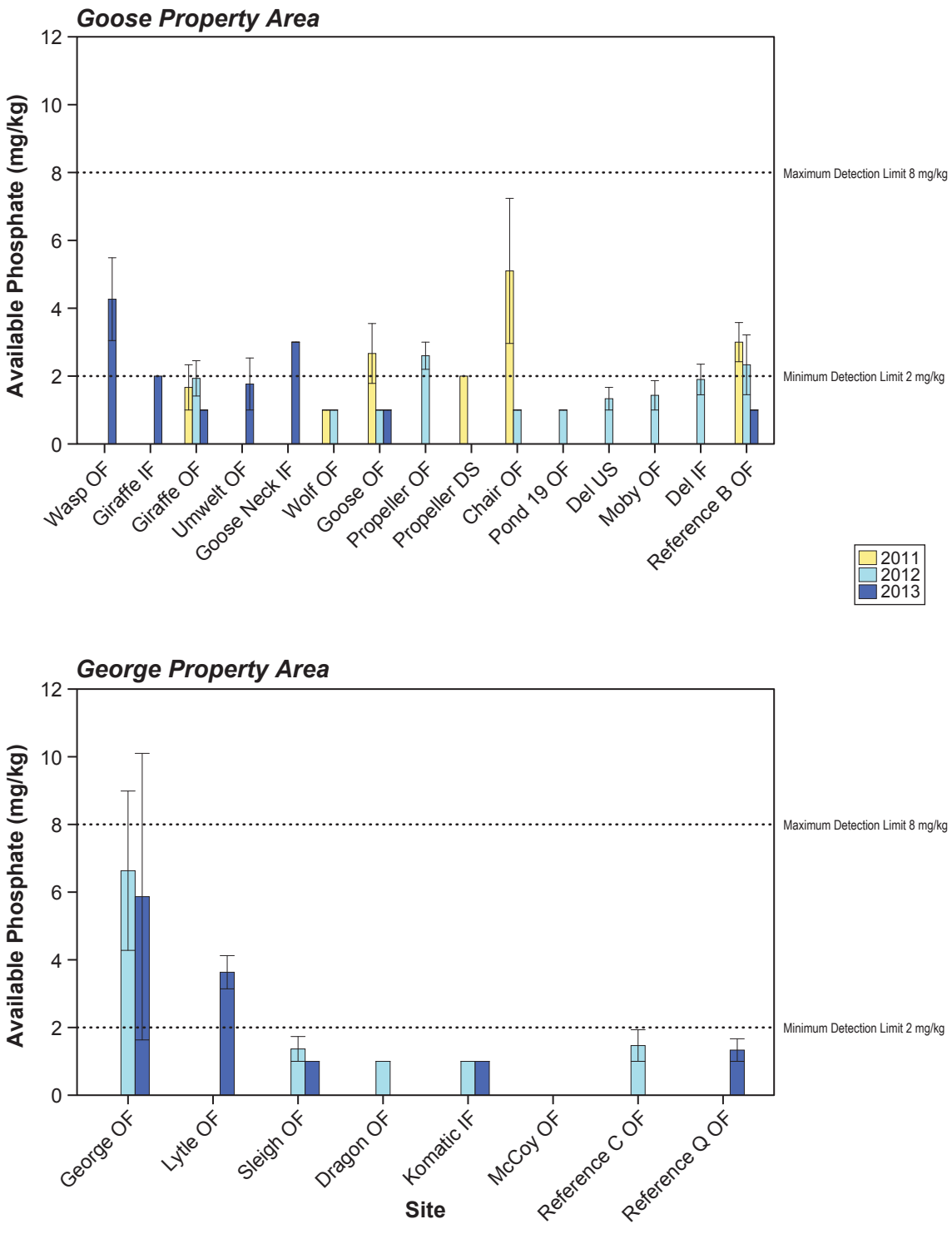
Appendix 3.6-5

Available Phosphate Concentrations in Stream Sediments, Back River Project, 2011 to 2013

Rescan™
an ERM company



Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Appendix 3.6-5

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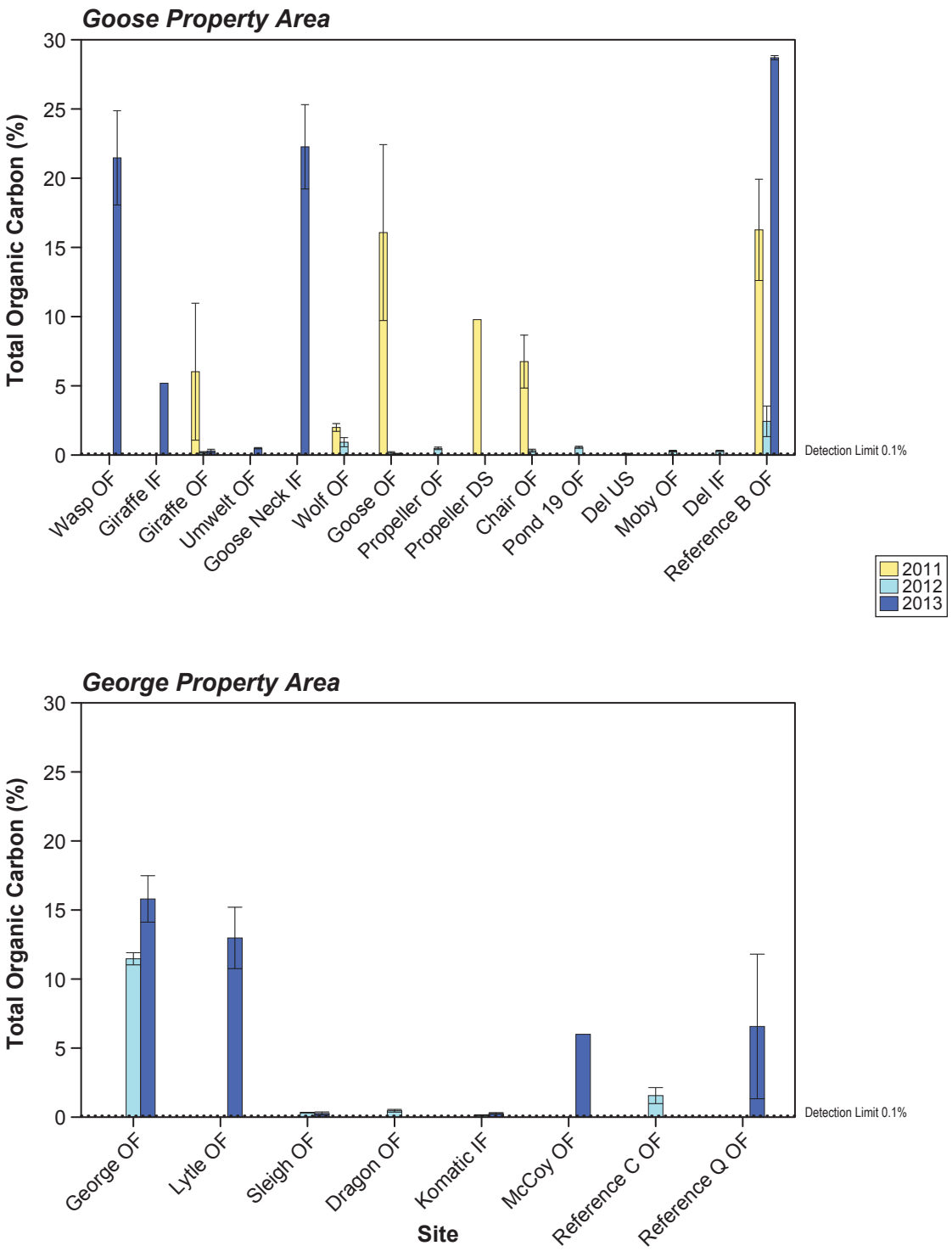
Available Phosphate Concentrations in Stream Sediments, Back River Project, 2011 to 2013

Rescan an ERM company

Appendix 3.6-6

Total Organic Carbon Concentrations in Stream Sediments, Back River Project, 2011 to 2013

Rescan™
an ERM company



Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Total Organic Carbon Concentrations in Stream Sediments, Back River Project, 2011 to 2013

Sabina GOLD & SILVER CORP.

Rescan an ERM company

Appendix 3.6-7

Arsenic Concentrations in Stream Sediments, Back River Project, 2011 to 2013

Rescan™
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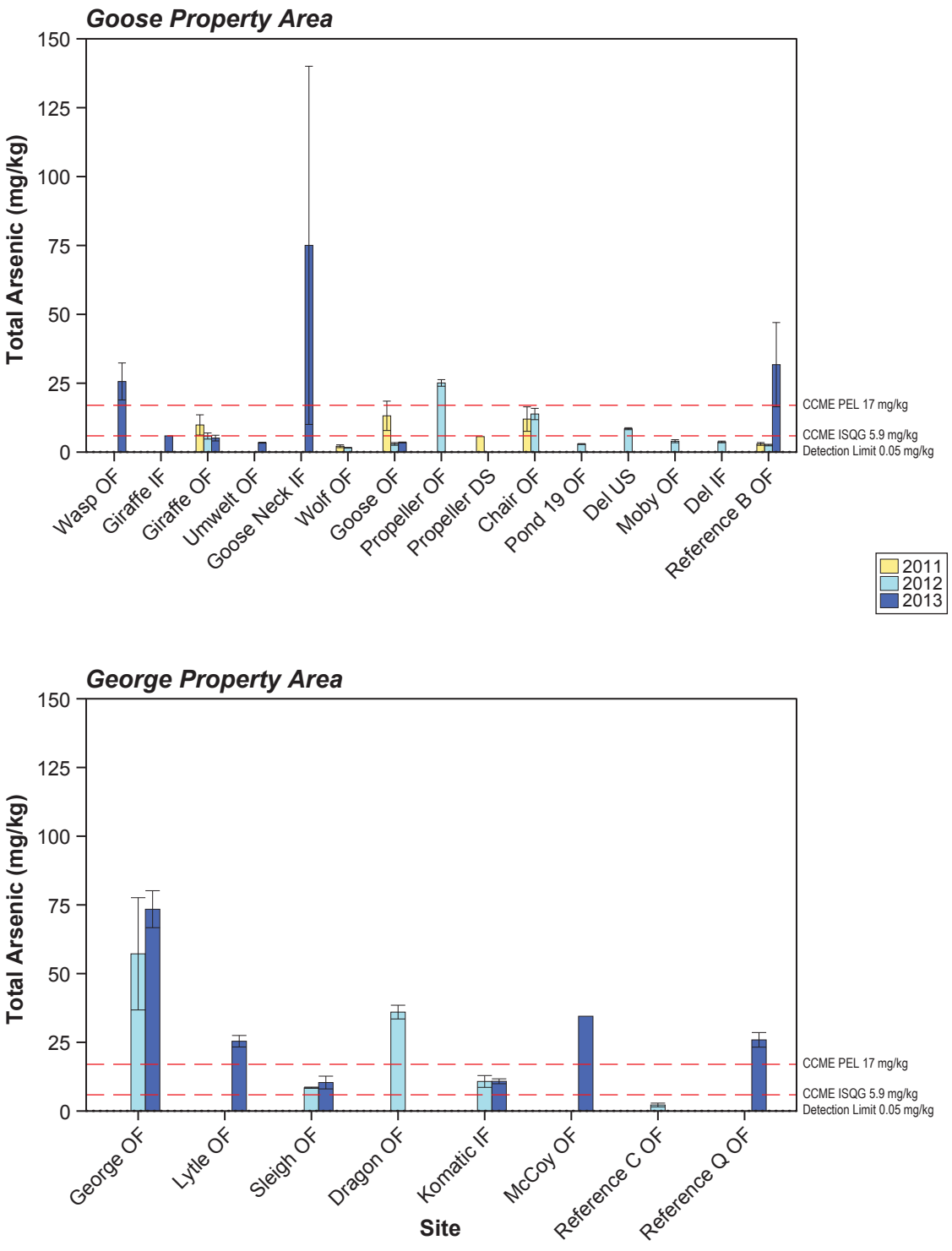

Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME sediment quality guideline: PEL = probable effect level; ISQG = interim sediment quality guideline.

Appendix 3.6-7

Sabina GOLD & SILVER CORP.

Arsenic Concentrations in Stream Sediments, Back River Project, 2011 to 2013

Rescan an ERM company

Appendix 3.6-8

Cadmium Concentrations in Stream Sediments, Back River Project, 2011 to 2013

Rescan™
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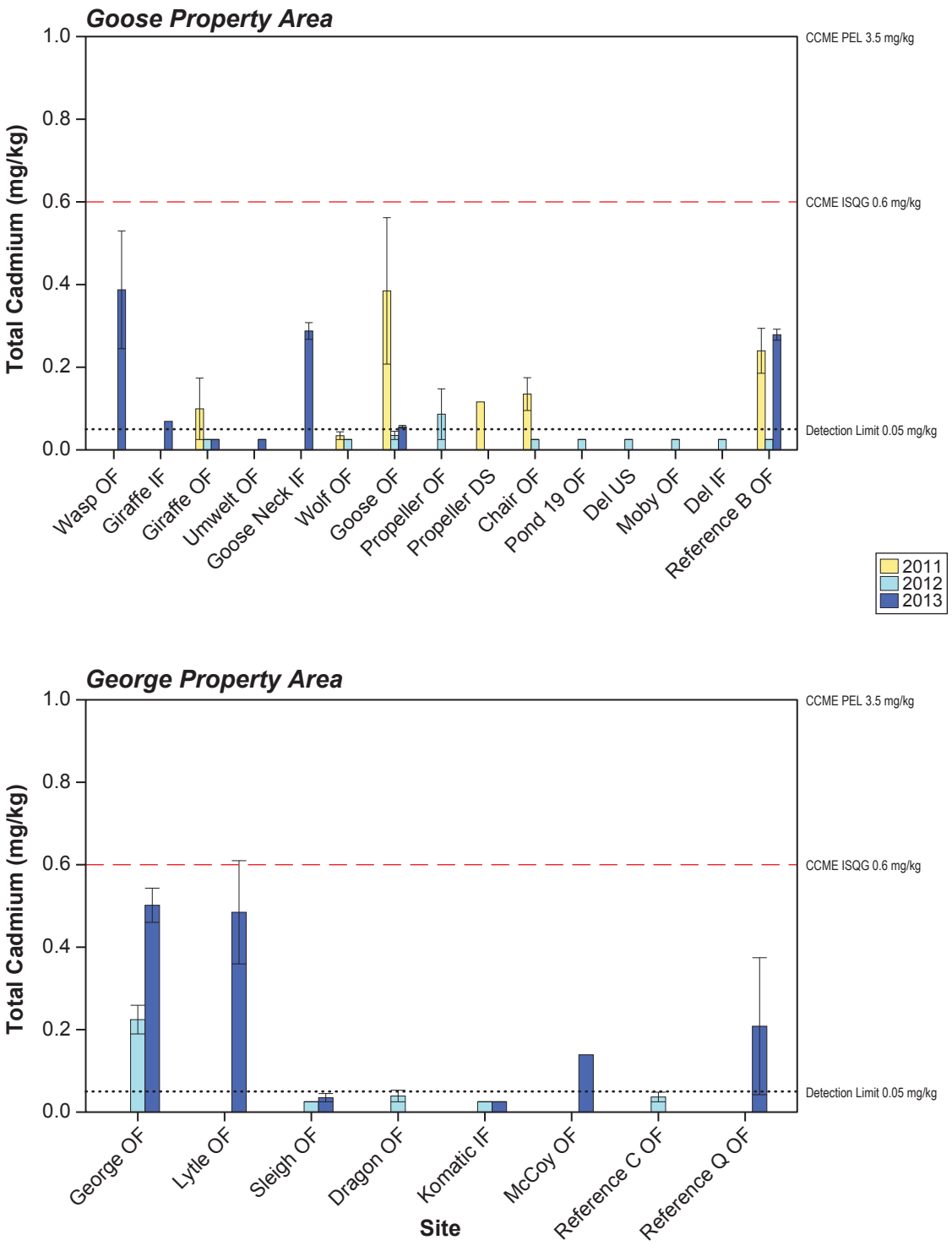

Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME sediment quality guideline: PEL = probable effect level; ISQG = interim sediment quality guideline.

Appendix 3.6-8

Cadmium Concentrations in Stream Sediments, Back River Project, 2011 to 2013

Sabina GOLD & SILVER CORP.

Rescan an ERM company

Appendix 3.6-9

Chromium Concentrations in Stream Sediments, Back River Project, 2011 to 2013

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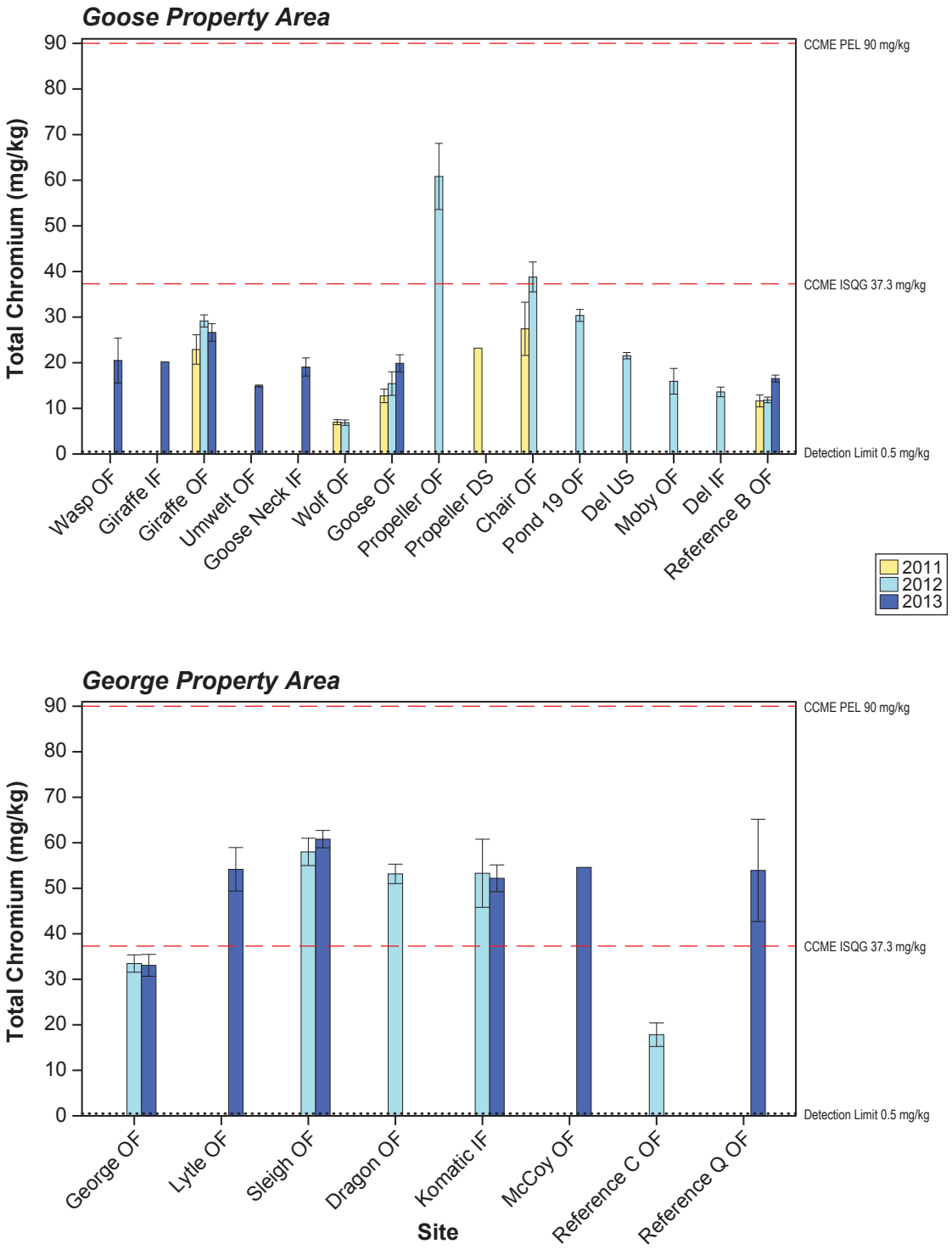

Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME sediment quality guideline: PEL = probable effect level; ISQG = interim sediment quality guideline.

Appendix 3.6-9

Chromium Concentrations in Stream Sediments, Back River Project, 2011 to 2013

Sabina GOLD & SILVER CORP.

Rescan an ERM company

Appendix 3.6-10

Copper Concentrations in Stream Sediments, Back River Project, 2011 to 2013

Rescan™
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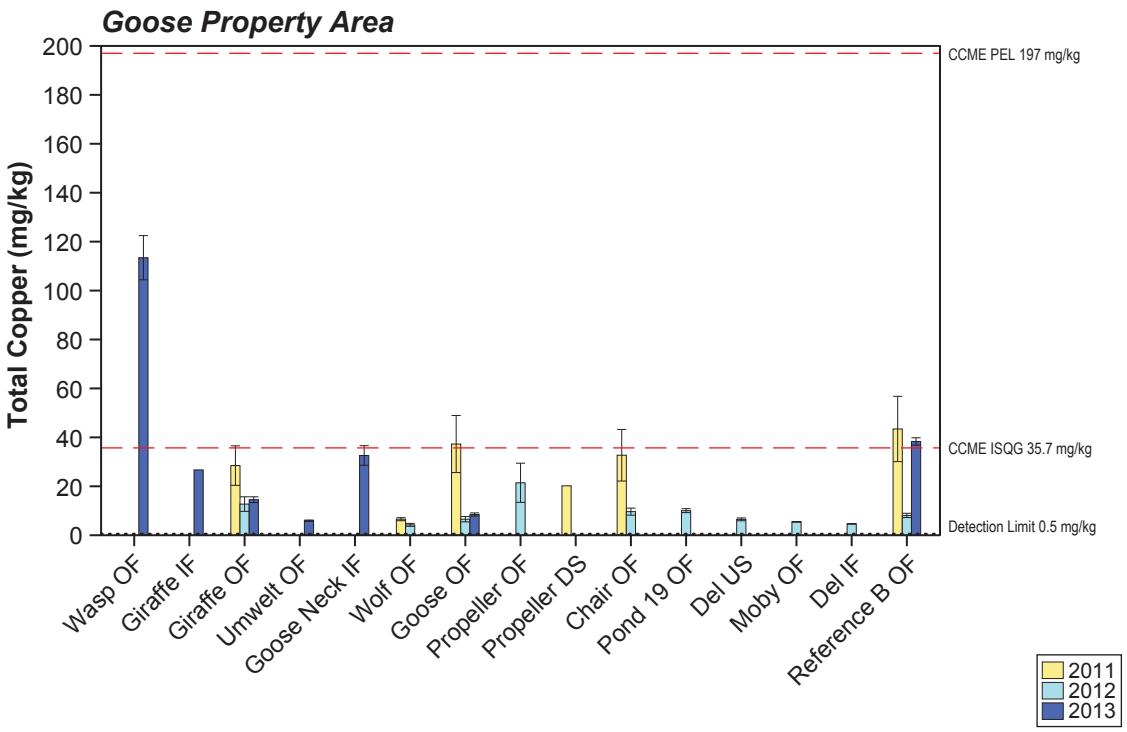

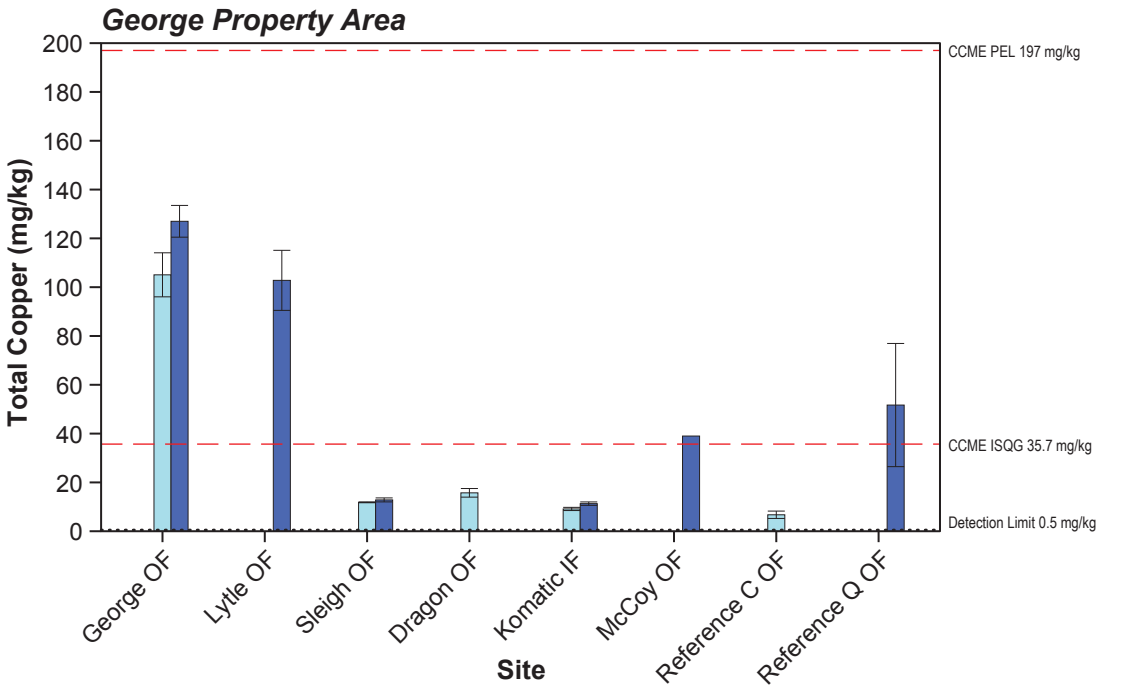

Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME sediment quality guideline: PEL = probable effect level; ISQG = interim sediment quality guideline.

Appendix 3.6-10

Sabina GOLD & SILVER CORP.

Copper Concentrations in Stream Sediments, Back River Project, 2011 to 2013

Rescan an ERM company

Appendix 3.6-11

Lead Concentrations in Stream Sediments, Back River Project, 2011 to 2013

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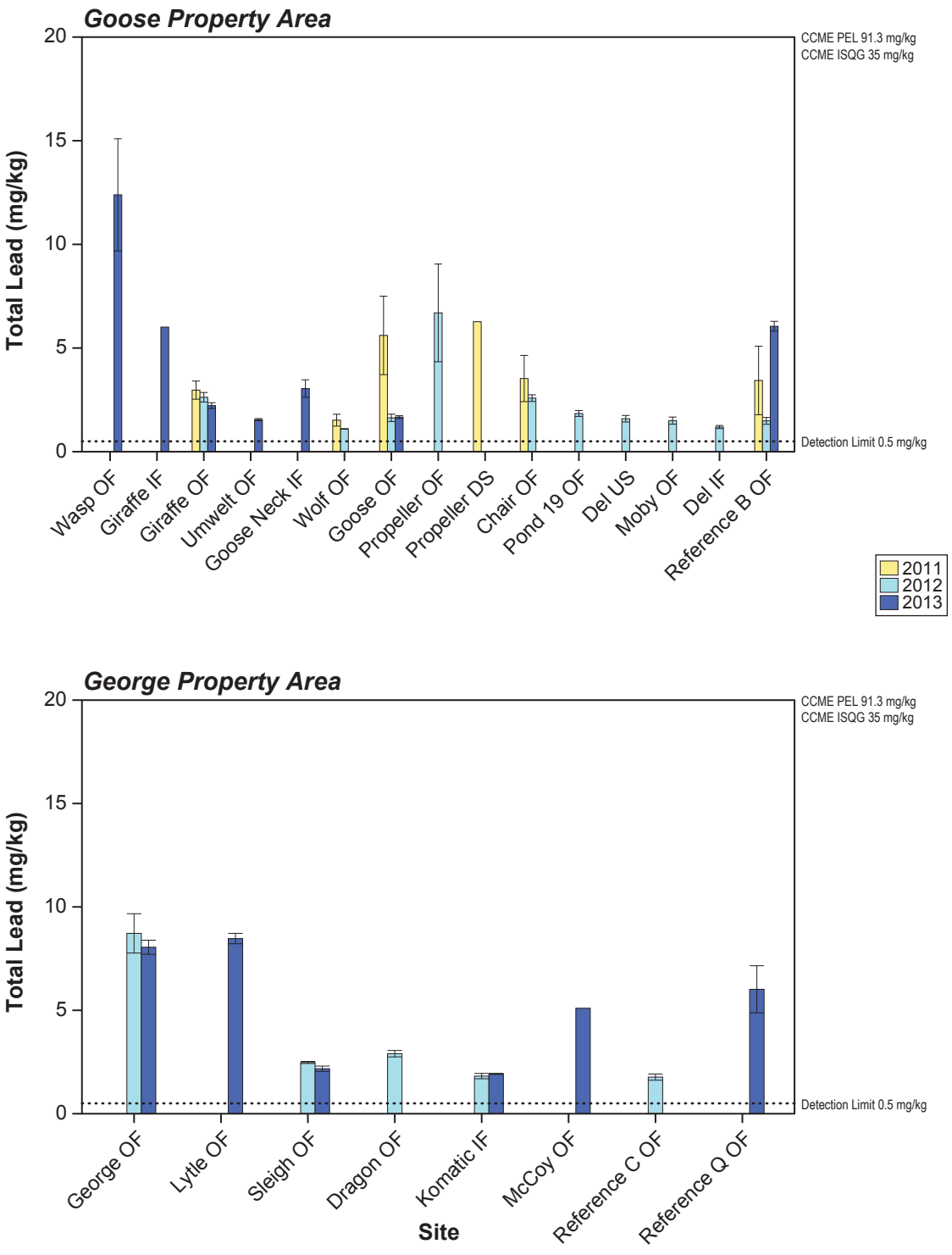

Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME sediment quality guideline: PEL = probable effect level; ISQG = interim sediment quality guideline.

Appendix 3.6-11

Sabina GOLD & SILVER CORP.

Lead Concentrations in Stream Sediments, Back River Project, 2011 to 2013

Rescan an ERM company

Appendix 3.6-12

Mercury Concentrations in Stream Sediments, Back River Project, 2011 to 2013

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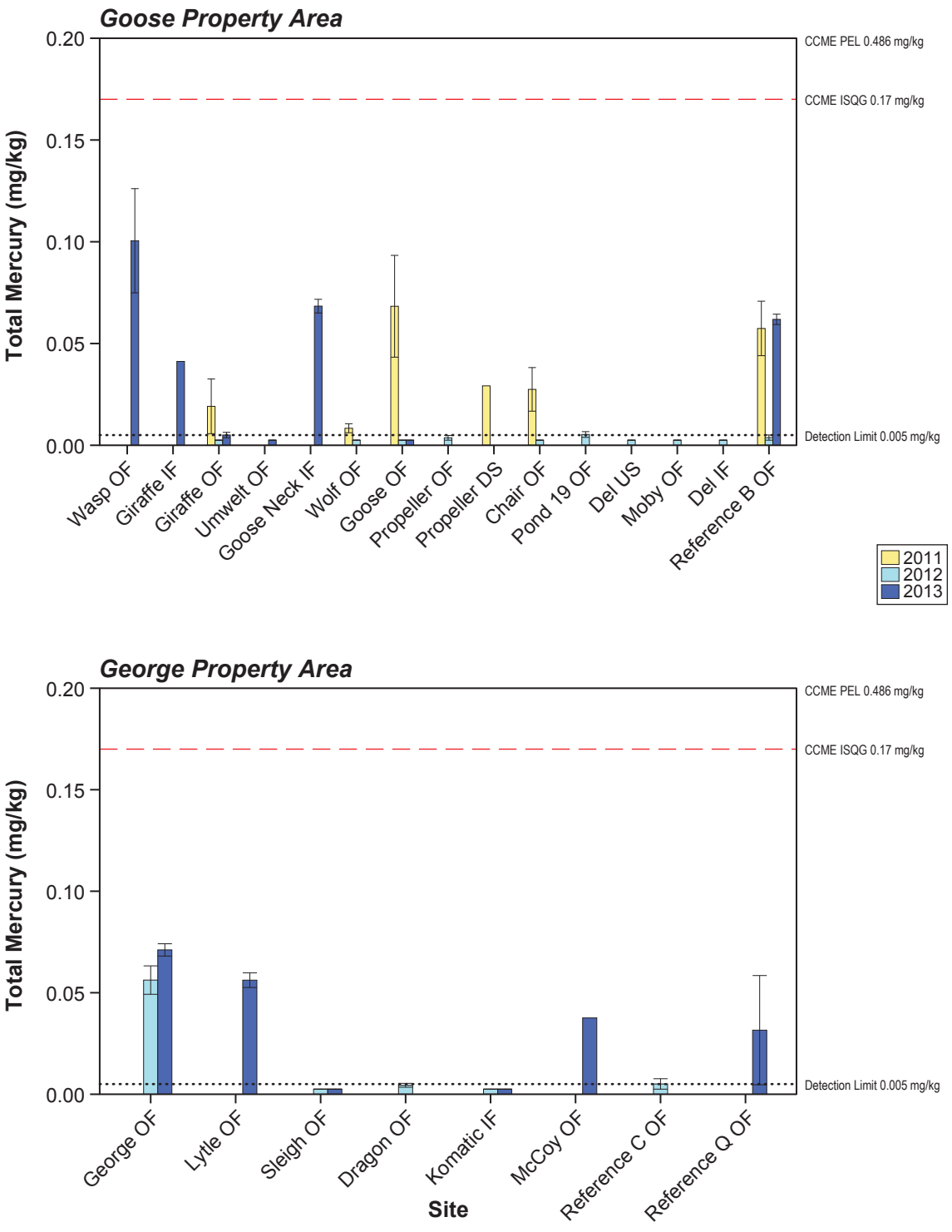

Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME sediment quality guideline: PEL = probable effect level; ISQG = interim sediment quality guideline.

Appendix 3.6-12

Sabina GOLD & SILVER CORP.

Mercury Concentrations in Stream Sediments, Back River Project, 2011 to 2013

Rescan an ERM company

Appendix 3.6-13

Zinc Concentrations in Stream Sediments, Back River Project, 2011 to 2013

Rescan™
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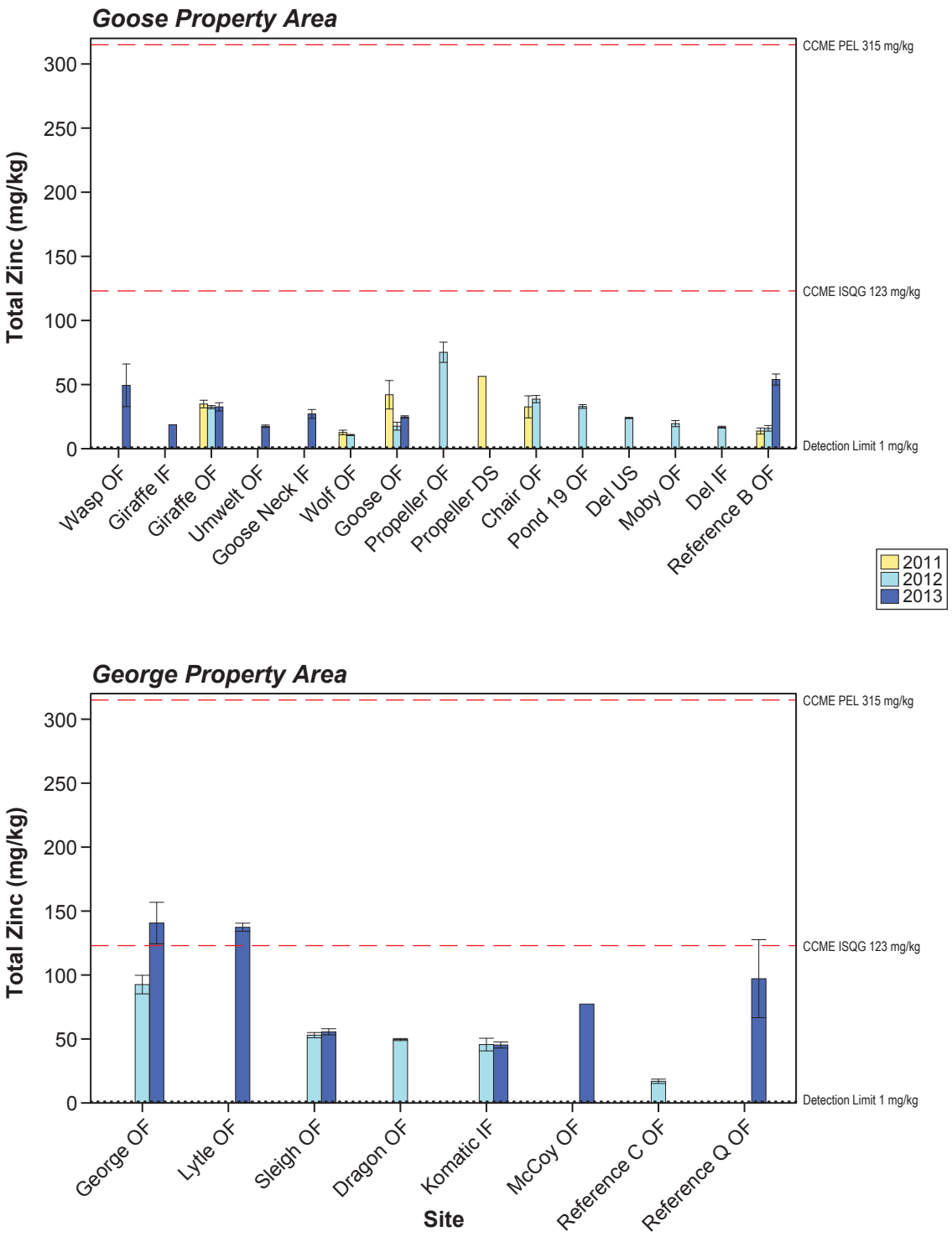


Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.
CCME sediment quality guideline: PEL = probable effect level; ISQG = interim sediment quality guideline.

Appendix 3.6-13

Sabina GOLD & SILVER CORP.

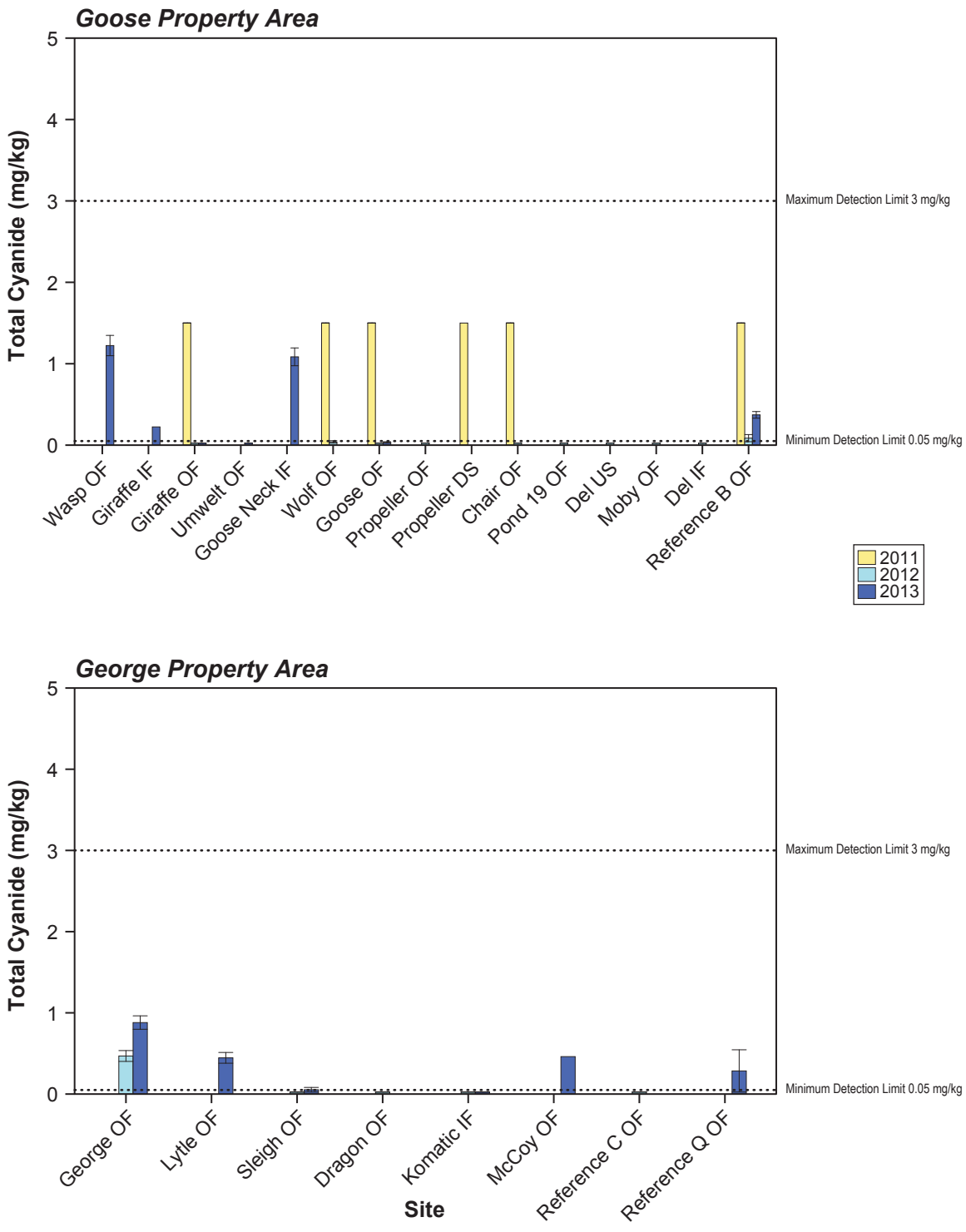
Zinc Concentrations in Stream Sediments, Back River Project, 2011 to 2013

Rescan an ERM company

Appendix 3.6-14

Total Cyanide Concentrations in Stream Sediments, Back River Project, 2011 to 2013

Rescan™
an ERM company



Notes: Error bars represent the standard error of the mean.
Dotted line represents the analytical detection limit; values below the detection limit were plotted as half the detection limit.

Appendix 3.6-14

Sabina GOLD & SILVER CORP.

Total Cyanide Concentrations in Stream Sediments, Back River Project, 2011 to 2013

Rescan an ERM company

Appendix 3.7-1

Lake Phytoplankton Biomass as Chlorophyll *a* Results, Back River Project, July 2013

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Appendix 3.7-1. Lake Phytoplankton Biomass as Chlorophyll *a* Results, Back River Project, July 2013

Lake Site	ALS Sample Name	ALS Sample ID	Date Sampled	Season	Depth (m)	Chlorophyll *a* (µg/L)
Wasp Lake	WASPLK (1M) REP1	L1290297-4	9-Apr-13	under ice	1	0.057
Wasp Lake	WASPLK (1M) REP2	L1290297-5	9-Apr-13	under ice	1	0.427
Wasp Lake	WASPLK (1M) REP3	L1290297-6	9-Apr-13	under ice	1	0.845
Wasp Lake	WASPLK REP1 (1M)	L1344864-34	16-Jul-13	open water	1	0.417
Wasp Lake	WASPLK REP2 (1M)	L1344864-35	16-Jul-13	open water	1	0.379
Wasp Lake	WASPLK REP3 (1M)	L1344864-36	16-Jul-13	open water	1	0.354
Leaf Lake	LEAFLK REP1 (1M)	L1344864-37	16-Jul-13	open water	1	0.074
Leaf Lake	LEAFLK REP2 (1M)	L1344864-38	16-Jul-13	open water	1	0.236
Leaf Lake	LEAFLK REP3 (1M)	L1344864-39	16-Jul-13	open water	1	0.214
Giraffe Lake South	GIRSOUTH (1M) REP1	L1290297-1	9-Apr-13	under ice	1	0.332
Giraffe Lake South	GIRSOUTH (1M) REP2	L1290297-2	9-Apr-13	under ice	1	0.150
Giraffe Lake South	GIRSOUTH (1M) REP3	L1290297-3	9-Apr-13	under ice	1	0.172
Giraffe Lake South	GIRSOUTH REP1 (1M)	L1344864-28	14-Jul-13	open water	1	0.359
Giraffe Lake South	GIRSOUTH REP2 (1M)	L1344864-29	14-Jul-13	open water	1	0.260
Giraffe Lake South	GIRSOUTH REP3 (1M)	L1344864-30	14-Jul-13	open water	1	0.247
Umwelt Lake	UMWLK REP1 (0.1M)	L1344864-31	15-Jul-13	open water	surface	0.234
Umwelt Lake	UMWLK REP2 (0.1M)	L1344864-32	15-Jul-13	open water	surface	0.162
Umwelt Lake	UMWLK REP3 (0.1M)	L1344864-33	15-Jul-13	open water	surface	0.142
Rascal Lake	RASCLK REP1 (1M)	L1344864-25	13-Jul-13	open water	1	0.444
Rascal Lake	RASCLK REP2 (1M)	L1344864-26	13-Jul-13	open water	1	0.368
Rascal Lake	RASCLK REP3 (1M)	L1344864-27	13-Jul-13	open water	1	0.565
Goose Lake Neck	GOOSENECK REP1 (0.1M)	L1344864-49	21-Jul-13	open water	surface	0.109
Goose Lake Neck	GOOSENECK REP2 (0.1M)	L1344864-50	21-Jul-13	open water	surface	0.125
Goose Lake Neck	GOOSENECK REP3 (0.1M)	L1344864-51	21-Jul-13	open water	surface	0.233
Goose Lake Central	GOOSECENT (1M) REP1	L1290297-19	13-Apr-13	under ice	1	0.188
Goose Lake Central	GOOSECENT (1M) REP2	L1290297-20	13-Apr-13	under ice	1	0.350
Goose Lake Central	GOOSECENT (1M) REP3	L1290297-21	13-Apr-13	under ice	1	0.263
Goose Lake Central	GOOSECENT REP1 (1M)	L1344864-46	21-Jul-13	open water	1	0.337
Goose Lake Central	GOOSECENT REP2 (1M)	L1344864-47	21-Jul-13	open water	1	0.254
Goose Lake Central	GOOSECENT REP3 (1M)	L1344864-48	21-Jul-13	open water	1	0.163
Goose Lake Tail	GOOSETAIL (1M) REP1	L1290297-22	13-Apr-13	under ice	1	0.154
Goose Lake Tail	GOOSETAIL (1M) REP2	L1290297-23	13-Apr-13	under ice	1	0.289
Goose Lake Tail	GOOSETAIL (1M) REP3	L1290297-24	13-Apr-13	under ice	1	0.182
Propeller Lake	PROLK REP1 (1M)	L1344864-43	19-Jul-13	open water	1	0.149
Propeller Lake	PROLK REP2 (1M)	L1344864-44	19-Jul-13	open water	1	0.099
Propeller Lake	PROLK REP3 (1M)	L1344864-45	19-Jul-13	open water	1	0.179
Reference B Lake	REFBLK (1M) REP1	L1290297-16	13-Apr-13	under ice	1	0.197
Reference B Lake	REFBLK (1M) REP2	L1290297-17	13-Apr-13	under ice	1	0.381
Reference B Lake	REFBLK (1M) REP3	L1290297-18	13-Apr-13	under ice	1	0.016
Reference B Lake	REFBLK REP1 (1M)	L1344864-40	17-Jul-13	open water	1	0.356
Reference B Lake	REFBLK REP2 (1M)	L1344864-41	17-Jul-13	open water	1	0.171
Reference B Lake	REFBLK REP3 (1M)	L1344864-42	17-Jul-13	open water	1	0.323
George Lake Central	GEORGCENT (1M) REP1	L1290297-13	12-Apr-13	under ice	1	0.035
George Lake Central	GEORGCENT (1M) REP2	L1290297-14	12-Apr-13	under ice	1	0.065
George Lake Central	GEORGCENT (1M) REP3	L1290297-15	12-Apr-13	under ice	1	0.054
George Lake Central	GEORGCENT REP1 (1M)	L1344864-1	8-Jul-13	open water	1	0.219
George Lake Central	GEORGCENT REP2 (1M)	L1344864-2	8-Jul-13	open water	1	0.172
George Lake Central	GEORGCENT REP3 (1M)	L1344864-3	8-Jul-13	open water	1	0.157
Bob Lake	BOBCENT REP1 (1M)	L1344864-16	11-Jul-13	open water	1	0.343
Bob Lake	BOBCENT REP2 (1M)	L1344864-17	11-Jul-13	open water	1	0.409
Bob Lake	BOBCENT REP3 (1M)	L1344864-18	11-Jul-13	open water	1	0.415
Occurrence Lake	OCCLK REP1 (0.1M)	L1344864-4	9-Jul-13	open water	surface	0.212
Occurrence Lake	OCCLK REP2 (0.1M)	L1344864-5	9-Jul-13	open water	surface	0.277
Occurrence Lake	OCCLK REP3 (0.1M)	L1344864-6	9-Jul-13	open water	surface	0.119

Appendix 3.7-1. Lake Phytoplankton Biomass as Chlorophyll *a* Results, Back River Project, July 2013

Lake Site	ALS Sample Name	ALS Sample ID	Date Sampled	Season	Depth (m)	Chlorophyll *a* (µg/L)
Esker Pond	ESKERLK REP1 (0.1M)	L1344864-22	12-Jul-13	open water	surface	0.391
Esker Pond	ESKERLK REP2 (0.1M)	L1344864-23	12-Jul-13	open water	surface	0.198
Esker Pond	ESKERLK REP3 (0.1M)	L1344864-24	12-Jul-13	open water	surface	0.221
Dragon Lake	DRAGLK REP1 (1M)	L1344864-19	11-Jul-13	open water	1	0.438
Dragon Lake	DRAGLK REP2 (1M)	L1344864-20	11-Jul-13	open water	1	0.241
Dragon Lake	DRAGLK REP3 (1M)	L1344864-21	11-Jul-13	open water	1	0.470
Komatic Lake	KOMALK (1M) REP1	L1290297-10	12-Apr-13	under ice	1	0.620
Komatic Lake	KOMALK (1M) REP2	L1290297-11	12-Apr-13	under ice	1	1.040
Komatic Lake	KOMALK (1M) REP3	L1290297-12	12-Apr-13	under ice	1	1.110
Komatic Lake	KOMALK REP1 (1M)	L1344864-13	10-Jul-13	open water	1	0.273
Komatic Lake	KOMALK REP2 (1M)	L1344864-14	10-Jul-13	open water	1	0.287
Komatic Lake	KOMALK REP3 (1M)	L1344864-15	10-Jul-13	open water	1	0.306
McCoy Lake	MCCOYLK REP1 (1M)	L1344864-10	10-Jul-13	open water	1	0.489
McCoy Lake	MCCOYLK REP2 (1M)	L1344864-11	10-Jul-13	open water	1	0.574
McCoy Lake	MCCOYLK REP3 (1M)	L1344864-12	10-Jul-13	open water	1	0.460
Reference Q Lake	REFQLK (1M) REP1	L1290297-7	12-Apr-13	under ice	1	0.290
Reference Q Lake	REFQLK (1M) REP2	L1290297-8	12-Apr-13	under ice	1	0.538
Reference Q Lake	REFQLK (1M) REP 3	L1290297-9	12-Apr-13	under ice	1	0.478
Reference Q Lake	REFQLK REP1 (1M)	L1344864-7	9-Jul-13	open water	1	0.170
Reference Q Lake	REFQLK REP2 (1M)	L1344864-8	9-Jul-13	open water	1	0.345
Reference Q Lake	REFQLK REP3 (1M)	L1344864-9	9-Jul-13	open water	1	0.237

Appendix 3.7-2

Lake Phytoplankton Density and Taxonomic Results, Back River Project, July 2013

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Appendix 3.7-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.

Data in cells/mL

Taxonomic Classification

Class	Order	Family	Genus	Species	Final Designation	Wasp Lake 1 16-Jul-13 6527.03-49	Wasp Lake 2 16-Jul-13 6527.03-50	Wasp Lake 3 16-Jul-13 6527.03-51	Leaf Lake 1 16-Jul-13 6527.03-25	Leaf Lake 2 16-Jul-13 6527.03-26	Leaf Lake 3 16-Jul-13 6527.03-27	Giraffe Lake South 1 14-Jul-13 6527.03-13	Giraffe Lake South 2 14-Jul-13 6527.03-14	Giraffe Lake South 3 14-Jul-13 6527.03-15	Umwelt Lake 1 15-Jul-13 6527.03-46	Umwelt Lake 2 15-Jul-13 6527.03-47
Bacillariophyceae	Centrales	Stephanodiscaceae	*Cyclotella*	*glomerata*	*Cyclotella glomerata*	66.3	35.7	63.75							145.35	153
				sp.	*Cyclotella* sp.	22.95	33.15	45.9	7.65	12.75		28.05	20.4	33.15		38.25
			Stephanodiscus	*astrea*	*Stephanodiscus astrea*						2.55					
				sp.	*Stephanodiscus* sp.	2.55										
	Pennales	Achnanthidiaceae	*Achnanthidium*	*minutissimum*	*Achnanthidium minutissimum*	2.55	7.65								5.1	
				sp.	*Achnanthidium* sp.					7.65						
		Amphipleuraceae	*Frustulia*	sp.	*Frustulia* sp.											
		Bacillariaceae	*Nitzschia*	spp.	*Nitzschia* spp.		2.55									
		Eunotiaceae	*Eunotia*	*incisa*	*Eunotia incisa*											
		Fragilariaceae	*Synedra*	*nana*	*Synedra nana*	15.3										
				sp.	*Synedra* sp.				2.55	2.55						
		Peroniaceae	*Peronia*	sp.	*Peronia* sp.										2.55	
		Tabellariaceae	*Tabellaria*	*fenestrata*	*Tabellaria fenestrata*	22.95	91.8	45.9	2.55	5.1	10.2	5.1				
Chlorophyceae	Chlorococcales	Chlorococcaceae	*Tetraedron*	*minimum*	*Tetraedron minimum*											
				sp.	*Tetraedron* sp.	2.55	7.65	5.1			5.1	7.65	5.1	12.75	5.1	2.55
		Oocystaceae	*Botryococcus*	*ochridiana*	*Botryococcus ochridiana*	163.2	163.2								326.4	
			Monoraphidium	*arcuatum*	*Monoraphidium arcuatum*											
				contortum	*Monoraphidium contortum*		2.55									
				irregulare	*Monoraphidium irregulare*		5.1									
				komarkovae	*Monoraphidium komarkovae*	48.45	45.9	68.85	25.5	15.3	28.05	17.85	17.85	7.65		
			Oocystis	*marssonii*	*Oocystis marssonii*											
				naegeli	*Oocystis naegeli*	2.55										
				pusilla	*Oocystis pusilla*	10.2		15.3		79.05	10.2					2.55
				solitaria	*Oocystis solitaria*				15.3	5.1	2.55	5.1	5.1	5.1		
		Scenedesmaceae	*Crucigeniella*	*rectangularis*	*Crucigeniella rectangularis*				43.35					22.95		
			Scenedesmus	*brasiliensis*	*Scenedesmus brasiliensis*											
				sp.	*Scenedesmus* sp.								5.1			
	Tetrasporales	Coccomyxaceae	*Elakatothrix*	*gelatinosa*	*Elakatothrix gelatinosa*	35.7	33.15	38.25	25.5	15.3		68.85	35.7	56.1		
		Palmellaceae	*Gloeocystis*	*gigas*	*Gloeocystis gigas*				5.1	2.55		5.1	2.55	2.55		
				planctonica	*Gloeocystis planctonica*											
			Sphaerocystis	*schroeteri*	*Sphaerocystis schroeteri*				104.55							102
		Tetrasporaceae	*Paulschulzia*	*pseudovolvox*	*Paulschulzia pseudovolvox*											
	Volvocales	Chlamydomonadaceae	*Chlamydomonas*	sp.	*Chlamydomonas* sp.										2.55	
			Sphaerellopsis	sp.	*Sphaerellopsis* sp.									2.55		
	Zygnematales	Desmidiaceae	*Arthrodesmus*	sp.	*Arthrodesmus* sp.											
			Cosmarium	sp.	*Cosmarium* sp.	15.3	2.55	5.1		2.55		5.1	5.1	7.65	2.55	
			Euastrum	sp.	*Euastrum* sp.			2.55		2.55						
			Spondylosium	sp.	*Spondylosium* sp.											
			Staurastrum	sp.	*Staurastrum* sp.											
			Staurodesmus	sp.	*Staurodesmus* sp.	7.65	5.1		2.55	2.55				2.55		
		Mesotaeniaceae	*Roya*	sp.	*Roya* sp.											
		Zygnemataceae	*Mougeotia*	sp.	*Mougeotia* sp.										10.2	
Chrysophyceae	Chromulinales	Chromulinaceae	*Kephyrion*	sp.	*Kephyrion* sp.	25.5	15.3	20.4	7.65	2.55	2.55		7.65		15.3	2.55
			Ochromonas-Chromulina	spp.	*Ochromonas-Chromulina* spp.	137.7	66.3	153	35.7	71.4	73.95	43.35	17.85	28.05	209.1	158.1
		Chrysocapsaceae	*Chrysocapsa*	*planktonica*	*Chrysocapsa planktonica*	38.25	5.1		160.65	73.95	56.1	38.25	30.6	20.4		5.1
	Chrysomonadales	Dinobryaceae	*Chrysococcus*	sp.	*Chrysococcus* sp.											
			Chrysolykos	*skujae*	*Chrysolykos skujae*			5.1								
			Dinobryon	*bavaricum*	*Dinobryon bavaricum*	12.75	10.2	20.4		7.65	5.1		5.1			
				divergens	*Dinobryon divergens*	10.2	15.3	7.65	2.55			5.1				
				sociale	*Dinobryon sociale*			7.65								
				sp.	*Dinobryon* sp.	15.3	5.1	43.35	12.75	10.2	5.1				2.55	2.55
			Epipyxis	sp.	*Epipyxis* sp.	2.55										
			Pseudokephyrion	sp.	*Pseudokephyrion* sp.		10.2	2.55								2.55

Appendix 3.7-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.

Data in cells/mL

Taxonomic Classification

Class	Order	Family	Genus	Species	Final Designation	Lake Site	Umwelt Lake	Rascal Lake	Rascal Lake	Rascal Lake	Goose Lake Neck	Goose Lake Neck	Goose Lake Neck	Goose Lake Central	Goose Lake Central	Goose Lake Central
						Replicate	3	1	2	3	1	2	3	1	2	3
						Date Sampled	15-Jul-13	13-Jul-13	13-Jul-13	13-Jul-13	21-Jul-13	21-Jul-13	21-Jul-13	21-Jul-13	21-Jul-13	7/21/2013
						EcoAnalysts Sample ID	6527.03-48	6527.03-37	6527.03-38	6527.03-39	6527.03-19	6527.03-20	6527.03-21	6527.03-16	6527.03-17	6527.03-18
Bacillariophyceae	Centrales	Stephanodiscaceae	*Cyclotella*	*glomerata*	*Cyclotella glomerata*		206.55									
				sp.	*Cyclotella* sp.			63.75	45.9	33.15	58.65	51	56.1	53.55	45.9	61.2
			Stephanodiscus	*astrea*	*Stephanodiscus astrea*											
				sp.	*Stephanodiscus* sp.											
	Pennales	Achnanthidiaceae	*Achnanthidium*	*minutissimum*	*Achnanthidium minutissimum*											
				sp.	*Achnanthidium* sp.			7.65								
		Amphipleuraceae	*Frustulia*	sp.	*Frustulia* sp.			2.55								
		Bacillariaceae	*Nitzschia*	spp.	*Nitzschia* spp.						2.55					
		Eunotiaceae	*Eunotia*	*incisa*	*Eunotia incisa*											
		Fragilariaceae	*Synedra*	*nana*	*Synedra nana*					5.1						
				sp.	*Synedra* sp.		2.55					5.1				
		Peroniaceae	*Peronia*	sp.	*Peronia* sp.											
		Tabellariaceae	*Tabellaria*	*fenestrata*	*Tabellaria fenestrata*		5.1	7.65	22.95	5.1	53.55	17.85	5.1	51	15.3	45.9
Chlorophyceae	Chlorococcales	Chlorococcaceae	*Tetraedron*	*minimum*	*Tetraedron minimum*											
				sp.	*Tetraedron* sp.				5.1	2.55	2.55		5.1			
		Oocystaceae	*Botryococcus*	*ochridiana*	*Botryococcus ochridiana*											
			Monoraphidium	*arcuatum*	*Monoraphidium arcuatum*			2.55		2.55						
				contortum	*Monoraphidium contortum*											
				irregulare	*Monoraphidium irregulare*					2.55						
				komarkovae	*Monoraphidium komarkovae*			2.55			5.1				2.55	2.55
			Oocystis	*marssonii*	*Oocystis marssonii*											
				naegeli	*Oocystis naegeli*											
				pusilla	*Oocystis pusilla*			22.95		5.1						
				solitaria	*Oocystis solitaria*			5.1			10.2	2.55		12.75	12.75	2.55
		Scenedesmaceae	*Crucigeniella*	*rectangularis*	*Crucigeniella rectangularis*											
			Scenedesmus	*brasiliensis*	*Scenedesmus brasiliensis*											
				sp.	*Scenedesmus* sp.											
	Tetrasporales	Coccomyxaceae	*Elakatothrix*	*gelatinosa*	*Elakatothrix gelatinosa*			5.1	5.1	15.3	38.25	35.7	73.95	33.15	40.8	33.15
		Palmellaceae	*Gloeocystis*	*gigas*	*Gloeocystis gigas*			5.1	7.65		5.1	2.55		10.2	2.55	
				planctonica	*Gloeocystis planctonica*											
			Sphaerocystis	*schroeteri*	*Sphaerocystis schroeteri*		20.4				40.8					
		Tetrasporaceae	*Paulschulzia*	*pseudovolvox*	*Paulschulzia pseudovolvox*											
	Volvocales	Chlamydomonadaceae	*Chlamydomonas*	sp.	*Chlamydomonas* sp.											
			Sphaerellopsis	sp.	*Sphaerellopsis* sp.											
	Zygnematales	Desmidiaceae	*Arthrodesmus*	sp.	*Arthrodesmus* sp.											
			Cosmarium	sp.	*Cosmarium* sp.			17.85	10.2	15.3		5.1	2.55	2.55		7.65
			Euastrum	sp.	*Euastrum* sp.											
			Spondylosium	sp.	*Spondylosium* sp.											
			Staurastrum	sp.	*Staurastrum* sp.						2.55					
			Staurodesmus	sp.	*Staurodesmus* sp.				5.1							2.55
		Mesotaeniaceae	*Roya*	sp.	*Roya* sp.											
		Zygnemataceae	*Mougeotia*	sp.	*Mougeotia* sp.											
Chrysophyceae	Chromulinales	Chromulinaceae	*Kephyrion*	sp.	*Kephyrion* sp.		7.65	7.65	10.2		20.4	38.25	15.3		5.1	15.3
			Ochromonas-Chromulina	spp.	*Ochromonas-Chromulina* spp.		188.7	30.6	7.65	20.4	5.1	43.35	30.6	12.75	20.4	5.1
		Chrysocapsaceae	*Chrysocapsa*	*planktonica*	*Chrysocapsa planktonica*		35.7			30.6						10.2
	Chrysomonadales	Dinobryaceae	*Chrysococcus*	sp.	*Chrysococcus* sp.											
			Chrysolykos	*skujae*	*Chrysolykos skujae*								2.55			
			Dinobryon	*bavaricum*	*Dinobryon bavaricum*			22.95	22.95	15.3	5.1	28.05	25.5		5.1	33.15
				divergens	*Dinobryon divergens*			12.75	10.2	7.65	10.2	10.2	25.5	10.2	12.75	20.4
				sociale	*Dinobryon sociale*			7.65		5.1						
				sp.	*Dinobryon* sp.		5.1	22.95	20.4		22.95	22.95	25.5		15.3	15.3
			Epipyxis	sp.	*Epipyxis* sp.											
			Pseudokephyrion	sp.	*Pseudokephyrion* sp.		5.1									

Appendix 3.7-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.

Data in cells/mL

Taxonomic Classification

Class	Order	Family	Genus	Species	Final Designation	Propeller Lake	Propeller Lake	Propeller Lake	Reference B Lake	Reference B Lake	Reference B Lake	George Lake Central	George Lake Central	George Lake Central	Bob Lake
Lake Site															
Replicate						1	2	3	1	2	3	1	2	3	1
Date Sampled						19-Jul-13	19-Jul-13	19-Jul-13	17-Jul-13	17-Jul-13	17-Jul-13	8-Jul-13	8-Jul-13	8-Jul-13	11-Jul-13
EcoAnalysts Sample ID						6527.03-34	6527.03-35	6527.03-36	6527.03-40	6527.03-41	6527.03-42	6527.03-10	6527.03-11	6527.03-12	6527.03-01
Bacillariophyceae	Centrales	Stephanodiscaceae	*Cyclotella*	*glomerata*	*Cyclotella glomerata*										
				sp.	*Cyclotella* sp.	40.8	58.65	30.6	193.8	290.7	135.15	12.75	7.65	12.75	
			Stephanodiscus	*astrea*	*Stephanodiscus astrea*	5.1									
				sp.	*Stephanodiscus* sp.							2.55			
	Pennales	Achnanthidiaceae	*Achnanthidium*	*minutissimum*	*Achnanthidium minutissimum*										
				sp.	*Achnanthidium* sp.										
		Amphipleuraceae	*Frustulia*	sp.	*Frustulia* sp.	2.55				2.55					
		Bacillariaceae	*Nitzschia*	spp.	*Nitzschia* spp.			5.1							
		Eunotiaceae	*Eunotia*	*incisa*	*Eunotia incisa*										
		Fragilariaceae	*Synedra*	*nana*	*Synedra nana*		2.55	5.1							
				sp.	*Synedra* sp.						5.1				
		Peroniaceae	*Peronia*	sp.	*Peronia* sp.										
		Tabellariaceae	*Tabellaria*	*fenestrata*	*Tabellaria fenestrata*	48.45	20.4					10.2			6.8
Chlorophyceae	Chlorococcales	Chlorococcaceae	*Tetraedron*	*minimum*	*Tetraedron minimum*										
				sp.	*Tetraedron* sp.	10.2		5.1	17.85	48.45	20.4	2.55		7.65	
		Oocystaceae	*Botryococcus*	*ochridiana*	*Botryococcus ochridiana*				326.4	163.2	163.2				
			Monoraphidium	*arcuatum*	*Monoraphidium arcuatum*										
				contortum	*Monoraphidium contortum*										
				irregulare	*Monoraphidium irregulare*		2.55	2.55							
				komarkovae	*Monoraphidium komarkovae*	7.65	10.2	2.55			5.1	2.55			
			Oocystis	*marssonii*	*Oocystis marssonii*						10.2				
				naegeli	*Oocystis naegeli*	5.1									
				pusilla	*Oocystis pusilla*				5.1	17.85	25.5				
				solitaria	*Oocystis solitaria*		5.1		2.55	2.55	2.55	2.55			
		Scenedesmaceae	*Crucigeniella*	*rectangularis*	*Crucigeniella rectangularis*			20.4							
			Scenedesmus	*brasiliensis*	*Scenedesmus brasiliensis*										
				sp.	*Scenedesmus* sp.										
	Tetrasporales	Coccomyxaceae	*Elakatothrix*	*gelatinosa*	*Elakatothrix gelatinosa*	20.4	30.6	45.9	71.4	7.65	7.65	5.1			
		Palmellaceae	*Gloeocystis*	*gigas*	*Gloeocystis gigas*			2.55	30.6	30.6	17.85	2.55	5.1		
				planctonica	*Gloeocystis planctonica*										
			Sphaerocystis	*schroeteri*	*Sphaerocystis schroeteri*							20.4			
		Tetrasporaceae	*Paulschulzia*	*pseudovolvox*	*Paulschulzia pseudovolvox*		10.2								
	Volvocales	Chlamydomonadaceae	*Chlamydomonas*	sp.	*Chlamydomonas* sp.										
			Sphaerellopsis	sp.	*Sphaerellopsis* sp.										
	Zygnematales	Desmidiaceae	*Arthrodesmus*	sp.	*Arthrodesmus* sp.								2.55	2.55	
			Cosmarium	sp.	*Cosmarium* sp.	15.3	15.3	5.1	5.1	33.15	7.65				
			Euastrum	sp.	*Euastrum* sp.	2.55		2.55				2.55			
			Spondylosium	sp.	*Spondylosium* sp.										
			Staurastrum	sp.	*Staurastrum* sp.							2.55			
			Staurodesmus	sp.	*Staurodesmus* sp.	5.1	7.65	2.55							
		Mesotaeniaceae	*Roya*	sp.	*Roya* sp.				7.65		5.1				
		Zygnemataceae	*Mougeotia*	sp.	*Mougeotia* sp.										
Chrysophyceae	Chromulinales	Chromulinaceae	*Kephyrion*	sp.	*Kephyrion* sp.	5.1	10.2	5.1	17.85	7.65	7.65	7.65			
			Ochromonas-Chromulina	spp.	*Ochromonas-Chromulina* spp.	15.3	91.8	10.2	43.35	33.15	20.4	12.75	12.75	22.95	
		Chrysocapsaceae	*Chrysocapsa*	*planktonica*	*Chrysocapsa planktonica*	17.85	68.85	76.5	15.3	45.9	48.45	5.1			
	Chrysomonadales	Dinobryaceae	*Chrysococcus*	sp.	*Chrysococcus* sp.										
			Chrysolykos	*skujae*	*Chrysolykos skujae*	7.65	5.1	10.2	51	20.4	38.25				
			Dinobryon	*bavaricum*	*Dinobryon bavaricum*	30.6	30.6	25.5	15.3	2.55	2.55				
				divergens	*Dinobryon divergens*	35.7	61.2	89.25	28.05	15.3	10.2	160.65	96.9	119.85	1094.8
				sociale	*Dinobryon sociale*						7.65				64.6
				sp.	*Dinobryon* sp.	17.85	48.45	15.3	5.1	10.2	7.65				
			Epipyxis	sp.	*Epipyxis* sp.						5.1				
			Pseudokephyrion	sp.	*Pseudokephyrion* sp.										

Appendix 3.7-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.

Data in cells/mL

Taxonomic Classification

Class	Order	Family	Genus	Species	Final Designation	Bob Lake	Bob Lake	Occurrence Lake	Occurrence Lake	Occurrence Lake	Esker Pond	Esker Pond	Esker Pond	Dragon Lake	Dragon Lake	Dragon Lake
Lake Site						Bob Lake	Bob Lake	Occurrence Lake	Occurrence Lake	Occurrence Lake	Esker Pond	Esker Pond	Esker Pond	Dragon Lake	Dragon Lake	Dragon Lake
Replicate						2	3	1	2	3	1	2	3	1	2	3
Date Sampled						11-Jul-13	11-Jul-13	9-Jul-13	9-Jul-13	9-Jul-13	12-Jul-13	12-Jul-13	12-Jul-13	11-Jul-13	11-Jul-13	11-Jul-13
EcoAnalysts Sample ID						6527.03-02	6527.03-03	6527.03-31	6527.03-32	6527.03-33	6527.03-07	6527.03-08	6527.03-09	6527.03-04	6527.03-05	6527.03-06
Bacillariophyceae	Centrales	Stephanodiscaceae	*Cyclotella*	*glomerata*	*Cyclotella glomerata*											
				sp.	*Cyclotella* sp.			2.55	2.55		38.25	2.55		38.25	5.1	17.85
			Stephanodiscus	*astrea*	*Stephanodiscus astrea*											
				sp.	*Stephanodiscus* sp.						40.8		2.55	7.65		68.85
	Pennales	Achnanthidiaceae	*Achnanthidium*	*minutissimum*	*Achnanthidium minutissimum*							2.55	5.1	5.1	5.1	
				sp.	*Achnanthidium* sp.											
		Amphipleuraceae	*Frustulia*	sp.	*Frustulia* sp.											
		Bacillariaceae	*Nitzschia*	spp.	*Nitzschia* spp.								2.55			
		Eunotiaceae	*Eunotia*	*incisa*	*Eunotia incisa*						5.1			5.1		
		Fragilariaceae	*Synedra*	*nana*	*Synedra nana*											
				sp.	*Synedra* sp.				2.55		2.55	2.55	5.1	5.1	10.2	
		Peroniaceae	*Peronia*	sp.	*Peronia* sp.											
		Tabellariaceae	*Tabellaria*	*fenestrata*	*Tabellaria fenestrata*				2.55				2.55		10.2	2.55
Chlorophyceae	Chlorococcales	Chlorococcaceae	*Tetraedron*	*minimum*	*Tetraedron minimum*						2.55		5.1		2.55	
				sp.	*Tetraedron* sp.			7.65	15.3				5.1	17.85	5.1	
		Oocystaceae	*Botryococcus*	*ochridiana*	*Botryococcus ochridiana*											
			Monoraphidium	*arcuatum*	*Monoraphidium arcuatum*										7.65	
				contortum	*Monoraphidium contortum*											
				irregulare	*Monoraphidium irregulare*											
				komarkovae	*Monoraphidium komarkovae*											
			Oocystis	*marssonii*	*Oocystis marssonii*											
				naegeli	*Oocystis naegeli*											
				pusilla	*Oocystis pusilla*			33.15		22.95						
				solitaria	*Oocystis solitaria*						7.65			7.65		5.1
		Scenedesmaceae	*Crucigeniella*	*rectangularis*	*Crucigeniella rectangularis*				96.9	22.95						
			Scenedesmus	*brasiliensis*	*Scenedesmus brasiliensis*							38.25	22.95		15.3	
				sp.	*Scenedesmus* sp.									10.2	15.3	5.1
	Tetrasporales	Coccomyxaceae	*Elakatothrix*	*gelatinosa*	*Elakatothrix gelatinosa*	17	37.4	20.4			17.85			5.1		5.1
		Palmellaceae	*Gloeocystis*	*gigas*	*Gloeocystis gigas*					5.1	7.65					
				planctonica	*Gloeocystis planctonica*											
			Sphaerocystis	*schroeteri*	*Sphaerocystis schroeteri*											
		Tetrasporaceae	*Paulschulzia*	*pseudovolvox*	*Paulschulzia pseudovolvox*											
	Volvocales	Chlamydomonadaceae	*Chlamydomonas*	sp.	*Chlamydomonas* sp.											
			Sphaerellopsis	sp.	*Sphaerellopsis* sp.											
	Zygnematales	Desmidiaceae	*Arthrodesmus*	sp.	*Arthrodesmus* sp.											
			Cosmarium	sp.	*Cosmarium* sp.					2.55	5.1		2.55	12.75	5.1	10.2
			Euastrum	sp.	*Euastrum* sp.											
			Spondylosium	sp.	*Spondylosium* sp.											
			Staurastrum	sp.	*Staurastrum* sp.								5.1			
			Staurodesmus	sp.	*Staurodesmus* sp.						5.1					10.2
		Mesotaeniaceae	*Roya*	sp.	*Roya* sp.											
		Zygnemataceae	*Mougeotia*	sp.	*Mougeotia* sp.											
Chrysophyceae	Chromulinales	Chromulinaceae	*Kephyrion*	sp.	*Kephyrion* sp.							5.1	2.55			
			Ochromonas-Chromulina	spp.	*Ochromonas-Chromulina* spp.			89.25	135.15	102	35.7	5.1	2.55	112.2		71.4
		Chrysocapsaceae	*Chrysocapsa*	*planktonica*	*Chrysocapsa planktonica*			7.65		2.55	17.85				5.1	22.95
	Chrysomonadales	Dinobryaceae	*Chrysococcus*	sp.	*Chrysococcus* sp.											
			Chrysolykos	*skujae*	*Chrysolykos skujae*											
			Dinobryon	*bavaricum*	*Dinobryon bavaricum*											
				divergens	*Dinobryon divergens*	1193.4	1111.8	7.65	12.75	2.55	17.85		10.2	48.45		40.8
				sociale	*Dinobryon sociale*	105.4	98.6							12.75		
				sp.	*Dinobryon* sp.			28.05	28.05	10.2					28.05	
			Epipyxis	sp.	*Epipyxis* sp.											
			Pseudokephyrion	sp.	*Pseudokephyrion* sp.											

Appendix 3.7-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.					Lake Site	Komatic Lake	Komatic Lake	Komatic Lake	McCoy Lake	McCoy Lake	McCoy Lake	Reference Q Lake	Reference Q Lake	Reference Q Lake
					Replicate	1	2	3	1	2	3	1	2	3
Data in cells/mL					Date Sampled	20-Jul-13	20-Jul-13	20-Jul-13	10-Jul-13	10-Jul-13	10-Jul-13	9-Jul-13	9-Jul-13	9-Jul-13
Taxonomic Classification					EcoAnalysts Sample ID	6527.03-22	6527.03-23	6527.03-24	6527.03-28	6527.03-29	6527.03-30	6527.03-43	6527.03-44	6527.03-45
Class	Order	Family	Genus	Species	Final Designation									
Bacillariophyceae	Centrales	Stephanodiscaceae	*Cyclotella*	*glomerata*	*Cyclotella glomerata*									
				sp.	*Cyclotella* sp.	71.4	30.6	22.95	107.1	53.55	89.25	73.95	25.5	28.05
			Stephanodiscus	*astrea*	*Stephanodiscus astrea*									
				sp.	*Stephanodiscus* sp.	5.1	2.55	2.55					2.55	
	Pennales	Achnanthidiaceae	*Achnanthidium*	*minutissimum*	*Achnanthidium minutissimum*									
				sp.	*Achnanthidium* sp.									
		Amphipleuraceae	*Frustulia*	sp.	*Frustulia* sp.									
		Bacillariaceae	*Nitzschia*	spp.	*Nitzschia* spp.									
		Eunotiaceae	*Eunotia*	*incisa*	*Eunotia incisa*									
		Fragilariaceae	*Synedra*	*nana*	*Synedra nana*							7.65	7.65	5.1
				sp.	*Synedra* sp.	5.1								
		Peroniaceae	*Peronia*	sp.	*Peronia* sp.									
		Tabellariaceae	*Tabellaria*	*fenestrata*	*Tabellaria fenestrata*									
Chlorophyceae	Chlorococcales	Chlorococcaceae	*Tetraedron*	*minimum*	*Tetraedron minimum*		2.55							
				sp.	*Tetraedron* sp.	7.65	10.2	7.65	40.8	30.6	48.45	10.2	10.2	12.75
		Oocystaceae	*Botryococcus*	*ochridiana*	*Botryococcus ochridiana*									
			Monoraphidium	*arcuatum*	*Monoraphidium arcuatum*									
				contortum	*Monoraphidium contortum*									
				irregulare	*Monoraphidium irregulare*								2.55	
				komarkovae	*Monoraphidium komarkovae*				10.2	7.65	2.55	2.55	15.3	2.55
			Oocystis	*marssonii*	*Oocystis marssonii*									
				naegeli	*Oocystis naegeli*									
				pusilla	*Oocystis pusilla*						2.55			
				solitaria	*Oocystis solitaria*	7.65	2.55		7.65	2.55	12.75			
		Scenedesmaceae	*Crucigeniella*	*rectangularis*	*Crucigeniella rectangularis*			28.05						
			Scenedesmus	*brasiliensis*	*Scenedesmus brasiliensis*									
				sp.	*Scenedesmus* sp.						7.65			
	Tetrasporales	Coccomyxaceae	*Elakatothrix*	*gelatinosa*	*Elakatothrix gelatinosa*	5.1	5.1			5.1	15.3	20.4	5.1	5.1
		Palmellaceae	*Gloeocystis*	*gigas*	*Gloeocystis gigas*		2.55	5.1						
				planctonica	*Gloeocystis planctonica*								40.8	43.35
			Sphaerocystis	*schroeteri*	*Sphaerocystis schroeteri*			40.8	40.8	20.4				
		Tetrasporaceae	*Paulschulzia*	*pseudovolvox*	*Paulschulzia pseudovolvox*									
	Volvocales	Chlamydomonadaceae	*Chlamydomonas*	sp.	*Chlamydomonas* sp.									
			Sphaerellopsis	sp.	*Sphaerellopsis* sp.			2.55						
	Zygnematales	Desmidiaceae	*Arthrodesmus*	sp.	*Arthrodesmus* sp.									
			Cosmarium	sp.	*Cosmarium* sp.		2.55		7.65	7.65	2.55		2.55	2.55
			Euastrum	sp.	*Euastrum* sp.			5.1					2.55	
			Spondylosium	sp.	*Spondylosium* sp.				10.2					
			Staurastrum	sp.	*Staurastrum* sp.									
			Staurodesmus	sp.	*Staurodesmus* sp.									
		Mesotaeniaceae	*Roya*	sp.	*Roya* sp.									
		Zygnemataceae	*Mougeotia*	sp.	*Mougeotia* sp.									
Chrysophyceae	Chromulinales	Chromulinaceae	*Kephyrion*	sp.	*Kephyrion* sp.	5.1	15.3	5.1	10.2	10.2	7.65	12.75	2.55	2.55
			Ochromonas-Chromulina	spp.	*Ochromonas-Chromulina* spp.	61.2	84.15	89.25	61.2	35.7	71.4	132.6	76.5	114.75
		Chrysocapsaceae	*Chrysocapsa*	*planktonica*	*Chrysocapsa planktonica*		5.1		7.65	15.3	20.4	12.75	2.55	7.65
	Chrysomonadales	Dinobryaceae	*Chrysococcus*	sp.	*Chrysococcus* sp.							2.55	2.55	7.65
			Chrysolykos	*skujae*	*Chrysolykos skujae*	12.75	12.75		17.85	10.2		5.1	5.1	7.65
			Dinobryon	*bavaricum*	*Dinobryon bavaricum*		10.2		5.1	2.55	2.55		2.55	7.65
				divergens	*Dinobryon divergens*	2.55	15.3	5.1	40.8	28.05	61.2	12.75	20.4	20.4
				sociale	*Dinobryon sociale*						7.65		20.4	2.55
				sp.	*Dinobryon* sp.	30.6	68.85	48.45	43.35	38.25	22.95	20.4	10.2	7.65
			Epipyxis	sp.	*Epipyxis* sp.					2.55				15.3
			Pseudokephyrion	sp.	*Pseudokephyrion* sp.									

Appendix 3.7-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.					Lake Site	Wasp Lake	Wasp Lake	Wasp Lake	Leaf Lake	Leaf Lake	Leaf Lake	Giraffe Lake South	Giraffe Lake South	Giraffe Lake South	Umwelt Lake	Umwelt Lake
					Replicate	1	2	3	1	2	3	1	2	3	1	2
Data in cells/mL					Date Sampled	16-Jul-13	16-Jul-13	16-Jul-13	16-Jul-13	16-Jul-13	16-Jul-13	14-Jul-13	14-Jul-13	14-Jul-13	15-Jul-13	15-Jul-13
Taxonomic Classification					EcoAnalysts Sample ID	6527.03-49	6527.03-50	6527.03-51	6527.03-25	6527.03-26	6527.03-27	6527.03-13	6527.03-14	6527.03-15	6527.03-46	6527.03-47
Class	Order	Family	Genus	Species	**Final Designation**											
		Synuraceae	*Mallomonas*	*heterospina*	*Mallomonas heterospina*		2.55									
				sp.	*Mallomonas* sp.	12.75										
	Hibberdiales	Stylococcaceae	*Bitrichia*	*ochridiana*	*Bitrichia ochridiana*	5.1		5.1		2.55		7.65		5.1		
	Ochromonadales	Ochromonadaceae	*Ochromonas*	*polychrysis*	*Ochromonas polychrysis*	12.75	7.65								17.85	5.1
	Prymnesiales	Prymnesiaceae	*Chrysochromulina*	*parva*	*Chrysochromulina parva*	10.2		25.5							17.85	2.55
			Prymnesium	*parvum*	*Prymnesium parvum*											
Cryptophyceae	Cryptomonadales	Cryptomonadaceae	*Cryptomonas*	spp.	*Cryptomonas* spp.	7.65	10.2	2.55	12.75	17.85	10.2	10.2	10.2	15.3	63.75	53.55
	Cryptophycophyta	Katablepharidaceae	*Katablepharis*	*ovalis*	*Katablepharis ovalis*	17.85	12.75	5.1	5.1		7.65	25.5	10.2		25.5	28.05
	Pyrenomonadales	Pyrenomonadaceae	*Rhodomonas*	*minuta*	*Rhodomonas minuta*	145.35	94.35	124.95	43.35	53.55	28.05	58.65	66.3	35.7	40.8	28.05
Dinophyceae	Gymnodiniales	Gymnodiniaceae	*Amphidinium*	*luteum*	*Amphidinium luteum*											
				sp.	*Amphidinium* sp.	25.5	25.5	30.6		5.1					15.3	15.3
			Gymnodinium	*helveticum*	*Gymnodinium helveticum*	2.55										
				sp.	*Gymnodinium* sp.	43.35	20.4	40.8	5.1	22.95	15.3	40.8	22.95	17.85	28.05	17.85
			Katodinium	*schilleri*	*Katodinium schilleri*	15.3	2.55								10.2	10.2
	Peridiniales	Peridiniaceae	*Glenodinium*	*pulvisulcus*	*Glenodinium pulvisulcus*		2.55	2.55								
				sp.	*Glenodinium* sp.											
			Peridinium	sp.	*Peridinium* sp.											
Euglenophyceae	Euglenales	Euglenaceae	*Euglena*	sp.	*Euglena* sp.											
Myxophyceae	Chroococcales	Chroococcaceae	*Chroococcus*	*dispersus*	*Chroococcus dispersus*					79.05						
				minimus	*Chroococcus minimus*											
				minutus	*Chroococcus minutus*										114.75	283.05
			Eucapsis	*alpina*	*Eucapsis alpina*											40.8
		Merismopediaceae	*Aphanocapsa*	*delicatissima*	*Aphanocapsa delicatissima*		165.75			247.35	821.1		530.4	81.6		
				elachista	*Aphanocapsa elachista*				40.8							
				holsatica	*Aphanocapsa holsatica*		163.2	1160.25								81.6
				planctonica	*Aphanocapsa planctonica*	81.6		331.5	122.4	244.8	265.2	652.8		122.4		
			Coelosphaerium	*kietzingianum*	*Coelosphaerium kietzingianum*								357			
			Merismopedia	*tenuissima*	*Merismopedia tenuissima*	40.8	84.15									
			Snowella	*archonoidea*	*Snowella archonoidea*	244.8		408								
				fennica	*Snowella fennica*											
			Woronichinia	*karelica*	*Woronichinia karelica*			163.2	81.6						163.2	
		Synechococcaceae	*Aphanothece*	*minutissima*	*Aphanothece minutissima*	40.8		326.4	84.15				17.85	20.4		
			Rhabdoderma	*compositum*	*Rhabdoderma compositum*											
				lineare	*Rhabdoderma lineare*	17.85	35.7	5.1				38.25	43.35	43.35		
			Synechococcus	sp.	*Synechococcus* sp.	7.65									5.1	5.1
	Oscillatoriales	Pseudanabaenaceae	*Planktolyngbya*	*limnetica*	*Planktolyngbya limnetica*	20.4	7.65	30.6		2.55		2.55	7.65	7.65		
			Pseudanabaena	*galeata*	*Pseudanabaena galeata*											
				sp.	*Pseudanabaena* sp.			7.65								
Trebouxiophyceae	Prasiolales	Koliellaceae	*Koliella*	*longiseta*	*Koliella longiseta*											
Xanthophyceae	Eustigmatales	Chlorobothryaceae	*Chlorobotrys*	*simplex*	*Chlorobotrys simplex*											
	Heterogloeales	Heterogloeaceae	*Isthmochloron*	*trispinatum*	*Isthmochloron trispinatum*	5.1	10.2									
	Mischococcales	Pleurochloridaceae	*Acanthochloris*	sp.	*Acanthochloris* sp.											
			Nephrodiella	*lunaris*	*Nephrodiella lunaris*	7.65										
			Tetraedriella	*jovetti*	*Tetraedriella jovetti*									5.1		
Grand Total						1425.45	1208.7	3220.65	849.15	994.5	1348.95	1065.9	1224	555.9	1229.1	1040.4

Appendix 3.7-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.					Lake Site	Umwelt Lake	Rascal Lake	Rascal Lake	Rascal Lake	Goose Lake Neck	Goose Lake Neck	Goose Lake Neck	Goose Lake Central	Goose Lake Central	Goose Lake Central
					Replicate	3	1	2	3	1	2	3	1	2	3
Data in cells/mL					Date Sampled	15-Jul-13	13-Jul-13	13-Jul-13	13-Jul-13	21-Jul-13	21-Jul-13	21-Jul-13	21-Jul-13	21-Jul-13	7/21/2013
Taxonomic Classification					EcoAnalysts Sample ID	6527.03-48	6527.03-37	6527.03-38	6527.03-39	6527.03-19	6527.03-20	6527.03-21	6527.03-16	6527.03-17	6527.03-18
Class	Order	Family	Genus	Species	**Final Designation**										
		Synuraceae	*Mallomonas*	*heterospina*	*Mallomonas heterospina*										
				sp.	*Mallomonas* sp.					15.3		2.55	10.2		12.75
	Hibberdiales	Stylococcaceae	*Bitrichia*	*ochridiana*	*Bitrichia ochridiana*		2.55	10.2	5.1	7.65	7.65		10.2	5.1	5.1
	Ochromonadales	Ochromonadaceae	*Ochromonas*	*polychrysis*	*Ochromonas polychrysis*	12.75									
	Prymnesiales	Prymnesiaceae	*Chrysochromulina*	*parva*	*Chrysochromulina parva*	2.55	2.55								
			Prymnesium	*parvum*	*Prymnesium parvum*		731.85	701.25	800.7						
Cryptophyceae	Cryptomonadales	Cryptomonadaceae	*Cryptomonas*	spp.	*Cryptomonas* spp.	61.2	33.15	28.05	25.5	33.15	25.5	28.05	2.55	5.1	12.75
	Cryptophycophyta	Katablepharidaceae	*Katablepharis*	*ovalis*	*Katablepharis ovalis*	35.7	2.55	7.65	17.85	7.65	5.1	15.3	2.55		
	Pyrenomonadales	Pyrenomonadaceae	*Rhodomonas*	*minuta*	*Rhodomonas minuta*	71.4	10.2	10.2	10.2	66.3	58.65	33.15	7.65	20.4	15.3
Dinophyceae	Gymnodiniales	Gymnodiniaceae	*Amphidinium*	*luteum*	*Amphidinium luteum*	5.1									
				sp.	*Amphidinium* sp.	17.85	10.2								
			Gymnodinium	*helveticum*	*Gymnodinium helveticum*										
				sp.	*Gymnodinium* sp.	33.15	30.6	30.6	33.15	20.4	25.5	2.55	12.75	5.1	10.2
			Katodinium	*schilleri*	*Katodinium schilleri*	2.55									
	Peridiniales	Peridiniaceae	*Glenodinium*	*pulvisulcus*	*Glenodinium pulvisulcus*					2.55					
				sp.	*Glenodinium* sp.										
			Peridinium	sp.	*Peridinium* sp.			2.55							
Euglenophyceae	Euglenales	Euglenaceae	*Euglena*	sp.	*Euglena* sp.		2.55							2.55	
Myxophyceae	Chroococcales	Chroococcaceae	*Chroococcus*	*dispersus*	*Chroococcus dispersus*										
				minimus	*Chroococcus minimus*										
				minutus	*Chroococcus minutus*	117.3									
			Eucapsis	*alpina*	*Eucapsis alpina*										
		Merismopediaceae	*Aphanocapsa*	*delicatissima*	*Aphanocapsa delicatissima*		81.6	821.1	981.75				168.3	244.8	
				elachista	*Aphanocapsa elachista*										
				holsatica	*Aphanocapsa holsatica*			326.4							
				planctonica	*Aphanocapsa planctonica*		81.6		163.2				40.8		
			Coelosphaerium	*kietzingianum*	*Coelosphaerium kietzingianum*								163.2		
			Merismopedia	*tenuissima*	*Merismopedia tenuissima*	40.8		81.6				40.8			
			Snowella	*archonoidea*	*Snowella archonoidea*										
				fennica	*Snowella fennica*							81.6			
			Woronichinia	*karelica*	*Woronichinia karelica*										
		Synechococcaceae	*Aphanothece*	*minutissima*	*Aphanothece minutissima*		1473.9	448.8	408						
			Rhabdoderma	*compositum*	*Rhabdoderma compositum*			28.05							
				lineare	*Rhabdoderma lineare*			10.2	10.2	2.55					5.1
			Synechococcus	sp.	*Synechococcus* sp.		22.95	20.4	30.6						
	Oscillatoriales	Pseudanabaenaceae	*Planktolyngbya*	*limnetica*	*Planktolyngbya limnetica*		12.75	2.55		2.55	2.55	2.55			
			Pseudanabaena	*galeata*	*Pseudanabaena galeata*										
				sp.	*Pseudanabaena* sp.		5.1		2.55						
Trebouxiophyceae	Prasiolales	Koliellaceae	*Koliella*	*longiseta*	*Koliella longiseta*			5.1		2.55					
Xanthophyceae	Eustigmatales	Chlorobothryaceae	*Chlorobotrys*	*simplex*	*Chlorobotrys simplex*										
	Heterogloeales	Heterogloeaceae	*Isthmochloron*	*trispinatum*	*Isthmochloron trispinatum*										
	Mischococcales	Pleurochloridaceae	*Acanthochloris*	sp.	*Acanthochloris* sp.										
			Nephrodiella	*lunaris*	*Nephrodiella lunaris*			2.55	5.1						
			Tetraedriella	*jovetti*	*Tetraedriella jovetti*			5.1	5.1		5.1				5.1
Grand Total						877.2	2751.45	2715.75	2664.75	443.7	392.7	474.3	604.35	461.55	321.3

Appendix 3.7-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.					Lake Site	Propeller Lake	Propeller Lake	Propeller Lake	Reference B Lake	Reference B Lake	Reference B Lake	George Lake Central	George Lake Central	George Lake Central	Bob Lake
					Replicate	1	2	3	1	2	3	1	2	3	1
Data in cells/mL					Date Sampled	19-Jul-13	19-Jul-13	19-Jul-13	17-Jul-13	17-Jul-13	17-Jul-13	8-Jul-13	8-Jul-13	8-Jul-13	11-Jul-13
Taxonomic Classification					EcoAnalysts Sample ID	6527.03-34	6527.03-35	6527.03-36	6527.03-40	6527.03-41	6527.03-42	6527.03-10	6527.03-11	6527.03-12	6527.03-01
Class	Order	Family	Genus	Species	**Final Designation**										
		Synuraceae	*Mallomonas*	*heterospina*	*Mallomonas heterospina*										
				sp.	*Mallomonas* sp.	2.55		2.55	10.2		7.65				
	Hibberdiales	Stylococcaceae	*Bitrichia*	*ochridiana*	*Bitrichia ochridiana*			2.55	17.85	2.55	2.55				
	Ochromonadales	Ochromonadaceae	*Ochromonas*	*polychrysis*	*Ochromonas polychrysis*		2.55	5.1							
	Prymnesiales	Prymnesiaceae	*Chrysochromulina*	*parva*	*Chrysochromulina parva*	2.55			2.55	2.55	2.55				
			Prymnesium	*parvum*	*Prymnesium parvum*										
Cryptophyceae	Cryptomonadales	Cryptomonadaceae	*Cryptomonas*	spp.	*Cryptomonas* spp.	5.1	10.2	12.75	17.85	12.75	7.65	5.1	5.1	7.65	57.8
	Cryptophycophyta	Katablepharidaceae	*Katablepharis*	*ovalis*	*Katablepharis ovalis*	12.75	10.2	7.65	22.95	17.85	20.4	12.75	17.85	33.15	13.6
	Pyrenomonadales	Pyrenomonadaceae	*Rhodomonas*	*minuta*	*Rhodomonas minuta*	28.05	35.7	48.45	48.45	58.65	51	2.55	2.55	2.55	61.2
Dinophyceae	Gymnodiniales	Gymnodiniaceae	*Amphidinium*	*luteum*	*Amphidinium luteum*										
				sp.	*Amphidinium* sp.	10.2	5.1	12.75	22.95	12.75	12.75				
			Gymnodinium	*helveticum*	*Gymnodinium helveticum*	2.55		5.1							
				sp.	*Gymnodinium* sp.	20.4	25.5	22.95	45.9	63.75	43.35	43.35	61.2	71.4	27.2
			Katodinium	*schilleri*	*Katodinium schilleri*										
	Peridiniales	Peridiniaceae	*Glenodinium*	*pulvisulcus*	*Glenodinium pulvisulcus*					2.55	2.55	7.65	5.1	2.55	
				sp.	*Glenodinium* sp.										17
			Peridinium	sp.	*Peridinium* sp.				7.65	12.75	5.1				
Euglenophyceae	Euglenales	Euglenaceae	*Euglena*	sp.	*Euglena* sp.		2.55								
Myxophyceae	Chroococcales	Chroococcaceae	*Chroococcus*	*dispersus*	*Chroococcus dispersus*										
				minimus	*Chroococcus minimus*		20.4								
				minutus	*Chroococcus minutus*	40.8				5.1					
			Eucapsis	*alpina*	*Eucapsis alpina*										
		Merismopediaceae	*Aphanocapsa*	*delicatissima*	*Aphanocapsa delicatissima*	1229.1	573.75	489.6		336.6				816	
				elachista	*Aphanocapsa elachista*				326.4	163.2	244.8				
				holsatica	*Aphanocapsa holsatica*		410.55	655.35		163.2					
				planctonica	*Aphanocapsa planctonica*		734.4		163.2		328.95				
			Coelosphaerium	*kietzingianum*	*Coelosphaerium kietzingianum*										
			Merismopedia	*tenuissima*	*Merismopedia tenuissima*	81.6									
			Snowella	*archonoidea*	*Snowella archonoidea*										
				fennica	*Snowella fennica*								40.8		
			Woronichinia	*karelica*	*Woronichinia karelica*		163.2	163.2							
		Synechococcaceae	*Aphanothece*	*minutissima*	*Aphanothece minutissima*	40.8	204	489.6	326.4	163.2					
			Rhabdoderma	*compositum*	*Rhabdoderma compositum*										
				lineare	*Rhabdoderma lineare*		22.95		5.1	20.4	15.3				
			Synechococcus	sp.	*Synechococcus* sp.				17.85	10.2	10.2				
	Oscillatoriales	Pseudanabaenaceae	*Planktolyngbya*	*limnetica*	*Planktolyngbya limnetica*	5.1	7.65	5.1							
			Pseudanabaena	*galeata*	*Pseudanabaena galeata*										
				sp.	*Pseudanabaena* sp.										
Trebouxiophyceae	Prasiolales	Koliellaceae	*Koliella*	*longiseta*	*Koliella longiseta*		5.1			2.55				2.55	
Xanthophyceae	Eustigmatales	Chlorobothryaceae	*Chlorobotrys*	*simplex*	*Chlorobotrys simplex*					10.2					
	Heterogloeales	Heterogloeaceae	*Isthmochloron*	*trispinatum*	*Isthmochloron trispinatum*		5.1								
	Mischococcales	Pleurochloridaceae	*Acanthochloris*	sp.	*Acanthochloris* sp.										
			Nephrodiella	*lunaris*	*Nephrodiella lunaris*				5.1						
			Tetraedriella	*jovetti*	*Tetraedriella jovetti*										
Grand Total						1774.8	2718.3	2284.8	1876.8	1792.65	1308.15	323.85	257.55	1101.6	1343

Appendix 3.7-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.					Lake Site	Bob Lake	Bob Lake	Occurrence Lake	Occurrence Lake	Occurrence Lake	Esker Pond	Esker Pond	Esker Pond	Dragon Lake	Dragon Lake	Dragon Lake
					Replicate	2	3	1	2	3	1	2	3	1	2	3
Data in cells/mL					Date Sampled	11-Jul-13	11-Jul-13	9-Jul-13	9-Jul-13	9-Jul-13	12-Jul-13	12-Jul-13	12-Jul-13	11-Jul-13	11-Jul-13	11-Jul-13
Taxonomic Classification					EcoAnalysts Sample ID	6527.03-02	6527.03-03	6527.03-31	6527.03-32	6527.03-33	6527.03-07	6527.03-08	6527.03-09	6527.03-04	6527.03-05	6527.03-06
Class	Order	Family	Genus	Species	**Final Designation**											
		Synuraceae	*Mallomonas*	*heterospina*	*Mallomonas heterospina*											
				sp.	*Mallomonas* sp.											
	Hibberdiales	Stylococcaceae	*Bitrichia*	*ochridiana*	*Bitrichia ochridiana*						28.05			10.2		10.2
	Ochromonadales	Ochromonadaceae	*Ochromonas*	*polychrysis*	*Ochromonas polychrysis*											
	Prymnesiales	Prymnesiaceae	*Chrysochromulina*	*parva*	*Chrysochromulina parva*			10.2								
			Prymnesium	*parvum*	*Prymnesium parvum*											
Cryptophyceae	Cryptomonadales	Cryptomonadaceae	*Cryptomonas*	spp.	*Cryptomonas* spp.	34	34	25.5	51	35.7	25.5	22.95	22.95	15.3	17.85	28.05
	Cryptophycophyta	Katablepharidaceae	*Katablepharis*	*ovalis*	*Katablepharis ovalis*			25.5	25.5	7.65	10.2		2.55	12.75		10.2
	Pyrenomonadales	Pyrenomonadaceae	*Rhodomonas*	*minuta*	*Rhodomonas minuta*	34	37.4	68.85	117.3	81.6	147.9	25.5	38.25	170.85	61.2	140.25
Dinophyceae	Gymnodiniales	Gymnodiniaceae	*Amphidinium*	*luteum*	*Amphidinium luteum*											
				sp.	*Amphidinium* sp.					12.75						
			Gymnodinium	*helveticum*	*Gymnodinium helveticum*											
				sp.	*Gymnodinium* sp.	6.8	13.6	30.6	56.1	22.95	38.25	22.95	28.05	33.15	15.3	22.95
			Katodinium	*schilleri*	*Katodinium schilleri*											
	Peridiniales	Peridiniaceae	*Glenodinium*	*pulvisulcus*	*Glenodinium pulvisulcus*			2.55			2.55	5.1	7.65			5.1
				sp.	*Glenodinium* sp.										10.2	
			Peridinium	sp.	*Peridinium* sp.	3.4	10.2							2.55		
Euglenophyceae	Euglenales	Euglenaceae	*Euglena*	sp.	*Euglena* sp.											
Myxophyceae	Chroococcales	Chroococcaceae	*Chroococcus*	*dispersus*	*Chroococcus dispersus*					20.4						
				minimus	*Chroococcus minimus*						20.4			20.4		
				minutus	*Chroococcus minutus*											
			Eucapsis	*alpina*	*Eucapsis alpina*											
		Merismopediaceae	*Aphanocapsa*	*delicatissima*	*Aphanocapsa delicatissima*											
				elachista	*Aphanocapsa elachista*											
				holsatica	*Aphanocapsa holsatica*											
				planctonica	*Aphanocapsa planctonica*			81.6	204		326.4					326.4
			Coelosphaerium	*kietzingianum*	*Coelosphaerium kietzingianum*											
			Merismopedia	*tenuissima*	*Merismopedia tenuissima*								81.6			
			Snowella	*archonoidea*	*Snowella archonoidea*											
				fennica	*Snowella fennica*								163.2		163.2	
			Woronichinia	*karelica*	*Woronichinia karelica*											
		Synechococcaceae	*Aphanothece*	*minutissima*	*Aphanothece minutissima*											
			Rhabdoderma	*compositum*	*Rhabdoderma compositum*											
				lineare	*Rhabdoderma lineare*											
			Synechococcus	sp.	*Synechococcus* sp.											
	Oscillatoriales	Pseudanabaenaceae	*Planktolyngbya*	*limnetica*	*Planktolyngbya limnetica*											
			Pseudanabaena	*galeata*	*Pseudanabaena galeata*											
				sp.	*Pseudanabaena* sp.											
Trebouxiophyceae	Prasiolales	Koliellaceae	*Koliella*	*longiseta*	*Koliella longiseta*			7.65	2.55		7.65	7.65	5.1			
Xanthophyceae	Eustigmatales	Chlorobothryaceae	*Chlorobotrys*	*simplex*	*Chlorobotrys simplex*											
	Heterogloeales	Heterogloeaceae	*Isthmochloron*	*trispinatum*	*Isthmochloron trispinatum*											
	Mischococcales	Pleurochloridaceae	*Acanthochloris*	sp.	*Acanthochloris* sp.											
			Nephrodiella	*lunaris*	*Nephrodiella lunaris*											
			Tetraedriella	*jovetti*	*Tetraedriella jovetti*											
Grand Total						1394	1343	448.8	752.25	351.9	810.9	140.25	423.3	553.35	382.5	803.25

Appendix 3.7-2. Lake Phytoplankton Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.					Lake Site	Komatic Lake	Komatic Lake	Komatic Lake	McCoy Lake	McCoy Lake	McCoy Lake	Reference Q Lake	Reference Q Lake	Reference Q Lake
					Replicate	1	2	3	1	2	3	1	2	3
Data in cells/mL					Date Sampled	20-Jul-13	20-Jul-13	20-Jul-13	10-Jul-13	10-Jul-13	10-Jul-13	9-Jul-13	9-Jul-13	9-Jul-13
Taxonomic Classification					EcoAnalysts Sample ID	6527.03-22	6527.03-23	6527.03-24	6527.03-28	6527.03-29	6527.03-30	6527.03-43	6527.03-44	6527.03-45
Class	Order	Family	Genus	Species	**Final Designation**									
		Synuraceae	*Mallomonas*	*heterospina*	*Mallomonas heterospina*									
				sp.	*Mallomonas* sp.	2.55			2.55					
	Hibberdiales	Stylococcaceae	*Bitrichia*	*ochridiana*	*Bitrichia ochridiana*	2.55	2.55	5.1	10.2	2.55	7.65			
	Ochromonadales	Ochromonadaceae	*Ochromonas*	*polychrysis*	*Ochromonas polychrysis*									
	Prymnesiales	Prymnesiaceae	*Chrysochromulina*	*parva*	*Chrysochromulina parva*				5.1	5.1	10.2	17.85	10.2	28.05
			Prymnesium	*parvum*	*Prymnesium parvum*									
Cryptophyceae	Cryptomonadales	Cryptomonadaceae	*Cryptomonas*	spp.	*Cryptomonas* spp.	28.05	33.15	20.4	15.3	7.65	5.1	12.75	7.65	10.2
	Cryptophycophyta	Katablepharidaceae	*Katablepharis*	*ovalis*	*Katablepharis ovalis*	12.75	20.4	15.3	40.8	28.05	38.25	17.85	20.4	33.15
	Pyrenomonadales	Pyrenomonadaceae	*Rhodomonas*	*minuta*	*Rhodomonas minuta*	188.7	145.35	137.7	150.45	76.5	145.35	10.2	12.75	12.75
Dinophyceae	Gymnodiniales	Gymnodiniaceae	*Amphidinium*	*luteum*	*Amphidinium luteum*									
				sp.	*Amphidinium* sp.				7.65	2.55		5.1	2.55	7.65
			Gymnodinium	*helveticum*	*Gymnodinium helveticum*									
				sp.	*Gymnodinium* sp.	43.35	15.3	28.05	40.8	30.6	43.35	40.8	10.2	35.7
			Katodinium	*schilleri*	*Katodinium schilleri*									
	Peridiniales	Peridiniaceae	*Glenodinium*	*pulvisulcus*	*Glenodinium pulvisulcus*	2.55		2.55			2.55			
				sp.	*Glenodinium* sp.									
			Peridinium	sp.	*Peridinium* sp.									
Euglenophyceae	Euglenales	Euglenaceae	*Euglena*	sp.	*Euglena* sp.									
Myxophyceae	Chroococcales	Chroococcaceae	*Chroococcus*	*dispersus*	*Chroococcus dispersus*									
				minimus	*Chroococcus minimus*									
				minutus	*Chroococcus minutus*									
			Eucapsis	*alpina*	*Eucapsis alpina*									
		Merismopediaceae	*Aphanocapsa*	*delicatissima*	*Aphanocapsa delicatissima*						244.8	163.2	326.4	
				elachista	*Aphanocapsa elachista*									
				holsatica	*Aphanocapsa holsatica*									
				planctonica	*Aphanocapsa planctonica*	81.6		326.4		163.2	163.2			
			Coelosphaerium	*kietzingianum*	*Coelosphaerium kietzingianum*									
			Merismopedia	*tenuissima*	*Merismopedia tenuissima*									
			Snowella	*archonoidea*	*Snowella archonoidea*									
				fennica	*Snowella fennica*									
			Woronichinia	*karelica*	*Woronichinia karelica*								163.2	
		Synechococcaceae	*Aphanothece*	*minutissima*	*Aphanothece minutissima*				204					
			Rhabdoderma	*compositum*	*Rhabdoderma compositum*									
				lineare	*Rhabdoderma lineare*									
			Synechococcus	sp.	*Synechococcus* sp.									
	Oscillatoriales	Pseudanabaenaceae	*Planktolyngbya*	*limnetica*	*Planktolyngbya limnetica*			2.55	12.75			2.55	2.55	
			Pseudanabaena	*galeata*	*Pseudanabaena galeata*					2.55				
				sp.	*Pseudanabaena* sp.							2.55	2.55	
Trebouxiophyceae	Prasiolales	Koliellaceae	*Koliella*	*longiseta*	*Koliella longiseta*				2.55		2.55	17.85	12.75	15.3
Xanthophyceae	Eustigmatales	Chlorobothryaceae	*Chlorobotrys*	*simplex*	*Chlorobotrys simplex*									
	Heterogloeales	Heterogloeaceae	*Isthmochloron*	*trispinatum*	*Isthmochloron trispinatum*							2.55	5.1	5.1
	Mischococcales	Pleurochloridaceae	*Acanthochloris*	sp.	*Acanthochloris* sp.								5.1	5.1
			Nephrodiella	*lunaris*	*Nephrodiella lunaris*									
			Tetraedriella	*jovetti*	*Tetraedriella jovetti*			5.1						
Grand Total						576.3	487.05	805.8	902.7	589.05	1037.85	606.9	838.95	446.25

Appendix 3.7-3

Lake Phytoplankton Richness and Diversity Results, Back River Project, July 2013

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Appendix 3.7-3. Lake Phytoplankton Richness and Diversity Results, Back River Project, July 2013

Lake Site	Replicate	Date Sampled	Eco Analysts Sample ID	Density (cells/mL)	Genus Richness (# genera/sample)	Simpson's Diversity Index (at genus level)
Wasp Lake	1	16-Jul-13	6527.03-49	1,425	36	0.92
Wasp Lake	2	16-Jul-13	6527.03-50	1,209	29	0.88
Wasp Lake	3	16-Jul-13	6527.03-51	3,221	28	0.75
Leaf Lake	1	16-Jul-13	6527.03-25	849	21	0.88
Leaf Lake	2	16-Jul-13	6527.03-26	995	23	0.73
Leaf Lake	3	16-Jul-13	6527.03-27	1,349	14	0.35
Giraffe Lake South	1	14-Jul-13	6527.03-13	1,066	19	0.61
Giraffe Lake South	2	14-Jul-13	6527.03-14	1,224	21	0.72
Giraffe Lake South	3	14-Jul-13	6527.03-15	556	21	0.83
Umwelt Lake	1	15-Jul-13	6527.03-46	1,229	22	0.85
Umwelt Lake	2	15-Jul-13	6527.03-47	1,040	21	0.85
Umwelt Lake	3	15-Jul-13	6527.03-48	877	19	0.86
Rascal Lake	1	13-Jul-13	6527.03-37	2,751	26	0.64
Rascal Lake	2	13-Jul-13	6527.03-38	2,716	26	0.73
Rascal Lake	3	13-Jul-13	6527.03-39	2,665	24	0.70
Goose Lake Neck	1	21-Jul-13	6527.03-19	444	23	0.91
Goose Lake Neck	2	21-Jul-13	6527.03-20	393	17	0.89
Goose Lake Neck	3	21-Jul-13	6527.03-21	474	17	0.88
Goose Lake Central	1	21-Jul-13	6527.03-16	604	16	0.79
Goose Lake Central	2	21-Jul-13	6527.03-17	462	15	0.69
Goose Lake Central	3	21-Jul-13	6527.03-18	321	18	0.88
Propeller Lake	1	19-Jul-13	6527.03-34	1,775	28	0.51
Propeller Lake	2	19-Jul-13	6527.03-35	2,718	29	0.59
Propeller Lake	3	19-Jul-13	6527.03-36	2,285	28	0.69
Reference B Lake	1	17-Jul-13	6527.03-40	1,877	27	0.85
Reference B Lake	2	17-Jul-13	6527.03-41	1,793	29	0.81
Reference B Lake	3	17-Jul-13	6527.03-42	1,308	29	0.77
George Lake Central	1	8-Jul-13	6527.03-10	324	20	0.72
George Lake Central	2	8-Jul-13	6527.03-11	258	11	0.77
George Lake Central	3	8-Jul-13	6527.03-12	1,102	12	0.43
Bob Lake	1	11-Jul-13	6527.03-01	1,343	7	0.25
Bob Lake	2	11-Jul-13	6527.03-02	1,394	6	0.13
Bob Lake	3	11-Jul-13	6527.03-03	1,343	6	0.19
Occurrence Lake	1	9-Jul-13	6527.03-31	449	15	0.88
Occurrence Lake	2	9-Jul-13	6527.03-32	752	13	0.84
Occurrence Lake	3	9-Jul-13	6527.03-33	352	13	0.83
Esker Pond	1	12-Jul-13	6527.03-07	811	22	0.79
Esker Pond	2	12-Jul-13	6527.03-08	140	11	0.83
Esker Pond	3	12-Jul-13	6527.03-09	423	20	0.79
Dragon Lake	1	11-Jul-13	6527.03-04	553	19	0.84
Dragon Lake	2	11-Jul-13	6527.03-05	383	15	0.77
Dragon Lake	3	11-Jul-13	6527.03-06	803	18	0.78
Komatic Lake	1	20-Jul-13	6527.03-22	576	18	0.83
Komatic Lake	2	20-Jul-13	6527.03-23	487	17	0.83
Komatic Lake	3	20-Jul-13	6527.03-24	806	20	0.78
McCoy Lake	1	10-Jul-13	6527.03-28	903	23	0.88
McCoy Lake	2	10-Jul-13	6527.03-29	589	22	0.87
McCoy Lake	3	10-Jul-13	6527.03-30	1,038	20	0.80
Reference Q Lake	1	9-Jul-13	6527.03-43	607	22	0.85
Reference Q Lake	2	9-Jul-13	6527.03-44	839	28	0.79
Reference Q Lake	3	9-Jul-13	6527.03-45	446	23	0.89

Appendix 3.7-4

Stream Periphyton Biomass Chlorophyll *a* Results, Back River Project, July 2013

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Appendix 3.7-4. Stream Periphyton Biomass as Chlorophyll *a* Results, Back River Project, July 2013

Stream Site	ALS Sample Name	ALS Sample ID	Date Sampled	Total Area Sampled (cm^2)	Proportion of Sample Filtered (%)	Area Filtrate Represents (cm^2)	Raw Chl *a* Result (µg)	Chlorophyll *a* (µg/cm^2)
Wasp Outflow	WASP OF REP1	L1344876-16	26-Jul-13	95.4	10	9.54	4.18	0.438
Wasp Outflow	WASP OF REP2	L1344876-17	26-Jul-13	95.4	10	9.54	1.79	0.188
Wasp Outflow	WASP OF REP3	L1344876-18	26-Jul-13	95.4	10	9.54	1.74	0.182
Giraffe Inflow	TIA OF REP1	L1344876-31	28-Jul-13	95.4	10	9.54	5.88	0.616
Giraffe Inflow	TIA OF REP2	L1344876-32	28-Jul-13	95.4	10	9.54	5.01	0.525
Giraffe Inflow	TIA OF REP3	L1344876-33	28-Jul-13	95.4	10	9.54	6.43	0.674
Giraffe Outflow	GIR OF REP1	L1344876-28	28-Jul-13	95.4	10	9.54	3.53	0.370
Giraffe Outflow	GIR OF REP2	L1344876-29	28-Jul-13	95.4	10	9.54	4.25	0.445
Giraffe Outflow	GIR OF REP3	L1344876-30	28-Jul-13	95.4	10	9.54	6	0.629
Umwelt Outflow	UMW OF REP1	L1344876-34	28-Jul-13	95.4	10	9.54	5.96	0.625
Umwelt Outflow	UMW OF REP2	L1344876-35	28-Jul-13	95.4	10	9.54	8.27	0.867
Umwelt Outflow	UMW OF REP3	L1344876-36	28-Jul-13	95.4	10	9.54	0.44	0.046
Goose Outflow	GOOSE OF REP1	L1344876-1	24-Jul-13	95.4	10	9.54	4.33	0.454
Goose Outflow	GOOSE OF REP2	L1344876-2	24-Jul-13	95.4	10	9.54	8.5	0.891
Goose Outflow	GOOSE OF REP3	L1344876-3	24-Jul-13	95.4	10	9.54	4.67	0.490
Propeller Outflow	PROOF REP1	L1344876-13	26-Jul-13	95.4	10	9.54	6.57	0.689
Propeller Outflow	PROOF REP2	L1344876-14	26-Jul-13	95.4	10	9.54	4.1	0.430
Propeller Outflow	PROOF REP3	L1344876-15	26-Jul-13	95.4	10	9.54	0.732	0.077
Reference B Outflow	REFBOFWET REP1	L1344876-10	26-Jul-13	95.4	10	9.54	6.31	0.661
Reference B Outflow	REFBOFWET REP2	L1344876-11	26-Jul-13	95.4	10	9.54	8.53	0.894
Reference B Outflow	REFBOFWET REP3	L1344876-12	26-Jul-13	95.4	10	9.54	10.2	1.069
George Outflow	GEORGE OF REP1	L1344876-7	25-Jul-13	95.4	12.6	12.05	9.17	0.761
George Outflow	GEORGE OF REP2	L1344876-8	25-Jul-13	95.4	13.3	12.69	4.02	0.317
George Outflow	GEORGE OF REP3	L1344876-9	25-Jul-13	95.4	10	9.54	2.14	0.224
Lytle Outflow	LYTLEOF REP1	L1344876-22	27-Jul-13	95.4	10	9.54	3.21	0.336
Lytle Outflow	LYTLEOF REP2	L1344876-23	27-Jul-13	95.4	10	9.54	5.32	0.558
Lytle Outflow	LYTLEOF REP3	L1344876-24	27-Jul-13	95.4	10	9.54	4.1	0.430
Sleigh Outflow	SLEIGH OF REP1	L1344876-19	27-Jul-13	95.4	10	9.54	5.44	0.570
Sleigh Outflow	SLEIGH OF REP2	L1344876-20	27-Jul-13	95.4	10	9.54	0.63	0.066
Sleigh Outflow	SLEIGH OF REP3	L1344876-21	27-Jul-13	95.4	10	9.54	8.32	0.872
McCoy Outflow	MCCOY OF REP1	L1344876-25	27-Jul-13	95.4	10	9.54	11.7	1.226
McCoy Outflow	MCCOY OF REP2	L1344876-26	27-Jul-13	95.4	10	9.54	8.05	0.844
McCoy Outflow	MCCOY OF REP3	L1344876-27	27-Jul-13	95.4	10	9.54	14.7	1.541
Reference Q Outflow	REFQ OF REP1	L1344876-4	25-Jul-13	95.4	12.6	12.05	1.34	0.111
Reference Q Outflow	REFQ OF REP2	L1344876-5	25-Jul-13	95.4	13.3	12.70	1.73	0.136
Reference Q Outflow	REFQ OF REP3	L1344876-6	25-Jul-13	95.4	10	9.54	2.96	0.310

Appendix 3.7-5

Stream Periphyton Density and Taxonomic Results, Back River Project, July 2013

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Appendix 3.7-5. Stream Periphyton Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.

Data in cells/cm^2

Taxonomic Classification					Stream Site	Wasp Outflow	Wasp Outflow	Wasp Outflow	Giraffe Inflow	Giraffe Inflow	Giraffe Inflow	Giraffe Outflow	Giraffe Outflow	Giraffe Outflow	Umwelt Outflow	Umwelt Outflow	Umwelt Outflow
					Replicate	1	2	3	1	2	3	1	2	3	1	2	3
					Date Sampled	26-Jul-13	26-Jul-13	26-Jul-13	28-Jul-13	28-Jul-13	28-Jul-13	28-Jul-13	28-Jul-13	28-Jul-13	28-Jul-13	28-Jul-13	28-Jul-13
					Surface Area Sampled (cm^2)	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43
Class	Order	Family	Genus	Species	EcoAnalysts Sample ID	6527.02-13	6527.02-14	6527.02-15	6527.02-28	6527.02-29	6527.02-30	6527.02-34	6527.02-35	6527.02-36	6527.02-31	6527.02-32	6527.02-33
					Final Designation												
Bacillariophyceae	Centrales	Aulacoseiraceae	*Aulacoseira*	sp.	*Aulacoseira* sp.								12035.9				
	Pennales	Achnanthidiaceae	*Achnanthidium*	sp.	*Achnanthidium* sp.	1595.1	2133.5	2081.5	31108.3	33137.1	23951.1	34162.2	20368.5	30861.4	14485.0	17693.0	18777.7
		Bacillariaceae	*Nitzschia*	sp.	*Nitzschia* sp.	3190.1	1493.4	2312.8	11110.1	50319.2	29586.7	14384.1	12961.8	40737.0	12256.5	11174.5	10493.4
		Cymbellaceae	*Cymbella*	sp.	*Cymbella* sp.									2468.9			
		Eunotiaceae	*Eunotia*	sp.	*Eunotia* sp.	319.0	2346.8	1965.9	8147.4	12273.0	12680.0	11687.1		1234.5	557.1	13036.9	2761.4
				spp.	*Eunotia* spp.												
		Fragilariaceae	*Hannaea*	*arcus*	*Hannaea* arcus												
			Synedra	sp.	*Synedra* sp.												
		Naviculaceae	*Navicula*	sp.	*Navicula* sp.	5742.2	2773.5	2544.1	46662.4	44182.8	18315.6	15283.1	23146.0	35799.2	7242.5	11174.5	7179.7
		Pinnulariaceae	*Pinnularia*	sp.	*Pinnularia* sp.												
		Rhoicospheniaceae	*Rhoicosphenia*	sp.	*Rhoicosphenia* sp.								925.8				
		Tabellariaceae	*Tabellaria*	*fenestrata*	*Tabellaria fenestrata*				8147.4			11687.1	8332.6	3703.4		7449.7	
				flocculosa	*Tabellaria flocculosa*	2552.1	4907.0	5550.7	97028.2	150957.7	174702.2	97092.6	91658.3	170354.8	41226.5	57734.9	39764.5
Chlorophyceae	Chlorococcales	Hydrodictyaceae	*Pediastrum*	*duplex*	*Pediastrum duplex*												
		Oocystaceae	*Ankistrodesmus*	*falcatus*	*Ankistrodesmus falcatus*												
			Monoraphidium	*arcuatum*	*Monoraphidium arcuatum*												
		Scenedesmaceae	*Crucigeniella*	*rectangularis*	*Crucigeniella rectangularis*												
			Scenedesmus	sp.	*Scenedesmus* sp.										2228.5		
	Oedogoniales	Oedogoniaceae	*Bulbochaete*	sp.	*Bulbochaete* sp.	4147.2	4907.0	2544.1	31108.3	1227.3	53537.8	9889.1	4629.2	8641.2	6685.4	3724.8	
			Oedogonium	sp.	*Oedogonium* sp.					6136.5			9258.4				
	Tetrasporales	Palmellaceae	*Sphaerocystis*	sp.	*Sphaerocystis* sp.												
	Zygnematales	Desmidiaceae	*Closterium*	sp.	*Closterium* sp.												
			Cosmarium	*quadratum*	*Cosmarium quadratum*							899.0			557.1		
				sp.	*Cosmarium* sp.	319.0					1408.9	3596.0	6480.9	7406.7	1671.3	2793.6	552.3
			Euastrum	sp.	*Euastrum* sp.	319.0					1408.9			1234.5		931.2	
			Hyalotheca	*dissiliens*	*Hyalotheca dissiliens*									22220.2			
			Staurastrum	sp.	*Staurastrum* sp.				740.7			2697.0	1851.7	3703.4	557.1	931.2	
			Staurodesmus	sp.	*Staurodesmus* sp.												552.3
				triangularis	*Staurodesmus triangularis*							899.0					
			Teilingia	*granulata*	*Teilingia granulata*						2817.8		925.8				
		Zygnemataceae	*Mougeotia*	sp.	*Mougeotia* sp.			115.6	2222.0	18409.5	12680.0	2697.0	4629.2		1671.3	2793.6	
			Zygnema	sp.	*Zygnema* sp.												552.3
Chrysophyceae	Chrysomonadales	Dinobryaceae	*Dinobryon*	*cylindricum*	*Dinobryon cylindricum*					7363.8							
Dinophyceae	Peridiniales	Peridiniaceae	*Peridinium*	*cinctum*	*Peridinium cinctum*					1227.3			925.8				
				lomnickii	*Peridinium lomnickii*												
				umbonatum	*Peridinium umbonatum*												
Myxophyceae	Chroococcales	Chroococcaceae	*Chroococcus*	*dispersus*	*Chroococcus dispersus*												
				sp.	*Chroococcus* sp.		9387.2	2544.1		61364.9	185973.3		277752.4	49378.2	22284.6	18624.2	
		Merismopediaceae	*Aphanocapsa*	*delicatissima*	*Aphanocapsa delicatissima*		12800.8										
				elachista	*Aphanocapsa elachista*	23926.0	4266.9		59253.8								
			Coelosphaerium	sp.	*Coelosphaerium* sp.					270005.7	112711.1	67425.4			66853.8	37248.3	
			Merismopedia	sp.	*Merismopedia* sp.					44182.8							
			Woronichinia	*naegeliana*	*Woronichinia naegeliana*											931.2	
		Microcystaceae	*Gloeocapsa*	*rupestris*	*Gloeocapsa rupestris*									18516.8			
		Synechococcaceae	*Aphanothece*	sp.	*Aphanothece* sp.								55550.5	49378.2			
	Nostocales	Nostocaceae	*Nostoc*	sp.	*Nostoc* sp.										44569.2		
		Rivulariaceae	*Calothrix*	sp.	*Calothrix* sp.	416630.5	500083.0	129168.4	203685.1	277369.5	277551.1	431522.5	279604.0	439465.9	372709.8	931.2	629604.2
			Dichothrix	sp.	*Dichothrix* sp.		23468.1										209868.1
	Oscillatoriales	Oscillatoriaceae	*Homoeothrix*	sp.	*Homoeothrix* sp.	715864.4	268175.9	195429.3	214795.2	920474.0	3240444.1	3971805.0	2904363.8	1396168.5	1495853.4	2571997.5	1576219.7
			Oscillatoria	sp.	*Oscillatoria* sp.												
		Phormidiaceae	*Phormidium*	sp.	*Phormidium* sp.		6187.0	4394.3	17035.5				21294.3		15042.1		
	Stigonematales	Stigonemataceae	*Stigonema*	*mamillosum*	*Stigonema mamillosum*		36055.5	92857.8			169066.7				23398.8	16761.8	48601.0
Grand Total						1174604.6	878985.6	441508.4	731044.2	1898631.0	4316835.1	4675726.1	3736695.0	2281272.7	2129850.1	2775932.2	2544926.5

Appendix 3.7-5. Stream Periphyton Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.

Data in cells/cm^2

Taxonomic Classification					Stream Site	Goose Outflow	Goose Outflow	Goose Outflow	Propeller Outflow	Propeller Outflow	Propeller Outflow	Reference B Outflow	Reference B Outflow	Reference B Outflow	George Outflow	George Outflow	George Outflow
					Replicate	1	2	3	1	2	3	1	2	3	1	2	3
					Date Sampled	24-Jul-13	24-Jul-13	24-Jul-13	26-Jul-13	26-Jul-13	26-Jul-13	26-Jul-13	26-Jul-13	26-Jul-13	25-Jul-13	25-Jul-13	25-Jul-13
					Surface Area Sampled (cm^2)	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43
Class	Order	Family	Genus	Species	EcoAnalysts Sample ID	6527.02-01	6527.02-02	6527.02-03	6527.02-16	6527.02-17	6527.02-18	6527.02-10	6527.02-11	6527.02-12	6527.02-07	6527.02-08	6527.02-09
					Final Designation												
Bacillariophyceae	Centrales	Aulacoseiraceae	*Aulacoseira*	sp.	*Aulacoseira* sp.					239.2							
	Pennales	Achnanthidiaceae	*Achnanthidium*	sp.	*Achnanthidium* sp.							3695.3	2552.1	1435.3	2782.4	8487.8	10276.8
		Bacillariaceae	*Nitzschia*	sp.	*Nitzschia* sp.		1913.8		872.2	1435.3	6933.5	739.1	1276.1	2511.8	3825.7	3182.9	1340.5
		Cymbellaceae	*Cymbella*	sp.	*Cymbella* sp.												
		Eunotiaceae	*Eunotia*	sp.	*Eunotia* sp.				290.7	2392.2	1205.8	985.4	3402.8	6100.2	347.8	1768.3	4915.0
				spp.	*Eunotia* spp.												
		Fragilariaceae	*Hannaea*	*arcus*	*Hannaea* arcus												
			Synedra	sp.	*Synedra* sp.				290.7		1808.7	1231.8					
		Naviculaceae	*Navicula*	sp.	*Navicula* sp.	956.4	159.5		290.7	478.4	8139.4	1970.8	3828.2	6817.9	9390.4	7073.2	6702.3
		Pinnulariaceae	*Pinnularia*	sp.	*Pinnularia* sp.									2511.8			
		Rhoicospheniaceae	*Rhoicosphenia*	sp.	*Rhoicosphenia* sp.												
		Tabellariaceae	*Tabellaria*	*fenestrata*	*Tabellaria fenestrata*				9884.6	3827.6	12058.3						
				flocculosa	*Tabellaria flocculosa*	24229.7	13237.0	5917.3	38084.7	28467.6	32858.9	8129.7	16163.3	3947.2	19476.5	13792.7	23234.6
Chlorophyceae	Chlorococcales	Hydrodictyaceae	*Pediastrum*	*duplex*	*Pediastrum duplex*												
		Oocystaceae	*Ankistrodesmus*	*falcatus*	*Ankistrodesmus falcatus*							492.7					
			Monoraphidium	*arcuatum*	*Monoraphidium arcuatum*												
		Scenedesmaceae	*Crucigeniella*	*rectangularis*	*Crucigeniella rectangularis*												
			Scenedesmus	sp.	*Scenedesmus* sp.									1435.3			
	Oedogoniales	Oedogoniaceae	*Bulbochaete*	sp.	*Bulbochaete* sp.	16578.2	16107.7	20147.1	6686.6	6459.0	7536.4	2217.2	2126.8		1043.4	4243.9	4021.4
			Oedogonium	sp.	*Oedogonium* sp.				3779.4		3316.0						
	Tetrasporales	Palmellaceae	*Sphaerocystis*	sp.	*Sphaerocystis* sp.												
	Zygnematales	Desmidiaceae	*Closterium*	sp.	*Closterium* sp.							246.4	850.7				
			Cosmarium	*quadratum*	*Cosmarium quadratum*												
				sp.	*Cosmarium* sp.	956.4		140.9	1453.6	956.9	1205.8	246.4	1276.1	1076.5	3825.7		2680.9
			Euastrum	sp.	*Euastrum* sp.				872.2	239.2	301.5	246.4	425.4				
			Hyalotheca	*dissiliens*	*Hyalotheca dissiliens*												
			Staurastrum	sp.	*Staurastrum* sp.								425.4	358.8		353.7	
			Staurodesmus	sp.	*Staurodesmus* sp.												
				triangularis	*Staurodesmus triangularis*							246.4					
			Teilingia	*granulata*	*Teilingia granulata*				2035.1								
		Zygnemataceae	*Mougeotia*	sp.	*Mougeotia* sp.	11796.0	1116.4		1744.3	1435.3	1507.3	985.4		358.8			1340.5
			Zygnema	sp.	*Zygnema* sp.	22635.6	11482.7		3198.0		6330.6						
Chrysophyceae	Chrysomonadales	Dinobryaceae	*Dinobryon*	*cylindricum*	*Dinobryon cylindricum*												
Dinophyceae	Peridiniales	Peridiniaceae	*Peridinium*	*cinctum*	*Peridinium cinctum*												
				lomnickii	*Peridinium lomnickii*							246.4					
				umbonatum	*Peridinium umbonatum*							492.7					
Myxophyceae	Chroococcales	Chroococcaceae	*Chroococcus*	*dispersus*	*Chroococcus dispersus*	10202.0											
				sp.	*Chroococcus* sp.								68906.7	31218.7		707.3	23234.6
		Merismopediaceae	*Aphanocapsa*	*delicatissima*	*Aphanocapsa delicatissima*												
				elachista	*Aphanocapsa elachista*												
			Coelosphaerium	sp.	*Coelosphaerium* sp.												
			Merismopedia	sp.	*Merismopedia* sp.					1913.8		23650.0			5564.7		
			Woronichinia	*naegeliana*	*Woronichinia naegeliana*									43060.2			
		Microcystaceae	*Gloeocapsa*	*rupestris*	*Gloeocapsa rupestris*				2616.5			2956.3	19566.1	43419.1			
		Synechococcaceae	*Aphanothece*	sp.	*Aphanothece* sp.												
	Nostocales	Nostocaceae	*Nostoc*	sp.	*Nostoc* sp.												
		Rivulariaceae	*Calothrix*	sp.	*Calothrix* sp.	109033.5	22008.6	53819.6	90705.6	40907.2	489566.9	135987.6	338153.4	194488.8	131118.4	337745.1	84448.8
			Dichothrix	sp.	*Dichothrix* sp.			16484.0		29663.7	12962.7						
	Oscillatoriales	Oscillatoriaceae	*Homoeothrix*	sp.	*Homoeothrix* sp.	1349528.6	503964.3	319958.6	657615.6	338262.1	425356.5	871847.7	1240321.2	703317.3	776624.6	1266455.8	1400330.8
			Oscillatoria	sp.	*Oscillatoria* sp.												
		Phormidiaceae	*Phormidium*	sp.	*Phormidium* sp.					8133.6							
	Stigonematales	Stigonemataceae	*Stigonema*	*mamillosum*	*Stigonema mamillosum*	10520.8	11323.2	9721.3	16571.2	35644.3	13264.1	6897.9	14036.6		30953.7		
Grand Total						1556437.2	581313.2	426188.8	836991.7	500455.7	1024352.5	1063511.3	1713310.7	1042057.8	984953.3	1643810.9	1562526.1

Appendix 3.7-5. Stream Periphyton Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.

Data in cells/cm^2

Taxonomic Classification					Stream Site	Lytle Outflow	Lytle Outflow	Lytle Outflow	Sleigh Outflow	Sleigh Outflow	Sleigh Outflow	McCoy Outflow	McCoy Outflow	McCoy Outflow	Reference Q Outflow	Reference Q Outflow	Reference Q Outflow
					Replicate	1	2	3	1	2	3	1	2	3	1	2	3
					Date Sampled	27-Jul-13	27-Jul-13	27-Jul-13	27-Jul-13	27-Jul-13	27-Jul-13	27-Jul-13	27-Jul-13	27-Jul-13	25-Jul-13	25-Jul-13	25-Jul-13
					Surface Area Sampled (cm^2)	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43	95.43
Class	Order	Family	Genus	Species	EcoAnalysts Sample ID	6527.02-22	6527.02-23	6527.02-24	6527.02-19	6527.02-20	6527.02-21	6527.02-25	6527.02-26	6527.02-27	6527.02-04	6527.02-05	6527.02-06
					Final Designation												
Bacillariophyceae	Centrales	Aulacoseiraceae	*Aulacoseira*	sp.	*Aulacoseira* sp.												
	Pennales	Achnanthidiaceae	*Achnanthidium*	sp.	*Achnanthidium* sp.	48282.2	71299.8	108202.7	6258.5	6870.0	2974.5	56455.7	47354.8	32541.3			6258.1
		Bacillariaceae	*Nitzschia*	sp.	*Nitzschia* sp.	15409.2	8503.6	15216.0		1717.5	699.9	18409.5	6499.7	12462.6	1038.6	3703.4	7775.3
		Cymbellaceae	*Cymbella*	sp.	*Cymbella* sp.												
		Eunotiaceae	*Eunotia*	sp.	*Eunotia* sp.	5650.0	3270.6		1738.5	2003.8	3674.4	15954.9	1857.0	3461.8			
				spp.	*Eunotia* spp.												1706.8
		Fragilariaceae	*Hannaea*	*arcus*	*Hannaea* arcus								9285.2	17309.2			
			Synedra	sp.	*Synedra* sp.								928.5				
		Naviculaceae	*Navicula*	sp.	*Navicula* sp.	27736.6	33360.5	426893.3	4520.0	6297.5	4899.2	29455.2	36212.5	37387.9		694.4	3034.3
		Pinnulariaceae	*Pinnularia*	sp.	*Pinnularia* sp.												
		Rhoicospheniaceae	*Rhoicosphenia*	sp.	*Rhoicosphenia* sp.												
		Tabellariaceae	*Tabellaria*	*fenestrata*	*Tabellaria fenestrata*							42955.5	20427.5	15924.5			
				flocculosa	*Tabellaria flocculosa*	17977.4	45134.8	7608.0	2781.5	3435.0	5249.1	126411.8	51997.4	79622.3	2682.9	9489.9	7964.9
Chlorophyceae	Chlorococcales	Hydrodictyaceae	*Pediastrum*	*duplex*	*Pediastrum duplex*							29455.2					
		Oocystaceae	*Ankistrodesmus*	*falcatus*	*Ankistrodesmus falcatus*											462.9	1706.8
			Monoraphidium	*arcuatum*	*Monoraphidium arcuatum*											231.5	
		Scenedesmaceae	*Crucigeniella*	*rectangularis*	*Crucigeniella rectangularis*					3148.8							
			Scenedesmus	sp.	*Scenedesmus* sp.		2616.5	6762.7						2769.5		925.8	758.6
	Oedogoniales	Oedogoniaceae	*Bulbochaete*	sp.	*Bulbochaete* sp.		10466.0	2536.0	3824.6	4580.0	2974.5	35591.7	928.5	5538.9	1298.2	2083.1	9102.8
			Oedogonium	sp.	*Oedogonium* sp.	2568.2							7428.2	5538.9			
	Tetrasporales	Palmellaceae	*Sphaerocystis*	sp.	*Sphaerocystis* sp.										1557.8		
	Zygnematales	Desmidiaceae	*Closterium*	sp.	*Closterium* sp.												
			Cosmarium	*quadratum*	*Cosmarium quadratum*												
				sp.	*Cosmarium* sp.	1540.9		845.3		572.5		2454.6			86.5	231.5	189.6
			Euastrum	sp.	*Euastrum* sp.				695.4							231.5	189.6
			Hyalotheca	*dissiliens*	*Hyalotheca dissiliens*												
			Staurastrum	sp.	*Staurastrum* sp.	1027.3											
			Staurodesmus	sp.	*Staurodesmus* sp.												
				triangularis	*Staurodesmus triangularis*												
			Teilingia	*granulata*	*Teilingia granulata*			845.3								1388.8	948.2
		Zygnemataceae	*Mougeotia*	sp.	*Mougeotia* sp.		2616.5		4520.0						86.5	694.4	
			Zygnema	sp.	*Zygnema* sp.					5152.5				3461.8			
Chrysophyceae	Chrysomonadales	Dinobryaceae	*Dinobryon*	*cylindricum*	*Dinobryon cylindricum*								928.5				
Dinophyceae	Peridiniales	Peridiniaceae	*Peridinium*	*cinctum*	*Peridinium cinctum*												
				lomnickii	*Peridinium lomnickii*												
				umbonatum	*Peridinium umbonatum*												
Myxophyceae	Chroococcales	Chroococcaceae	*Chroococcus*	*dispersus*	*Chroococcus dispersus*												
				sp.	*Chroococcus* sp.	34927.6						29455.2	55711.5	44311.6			
		Merismopediaceae	*Aphanocapsa*	*delicatissima*	*Aphanocapsa delicatissima*												
				elachista	*Aphanocapsa elachista*												
			Coelosphaerium	sp.	*Coelosphaerium* sp.												
			Merismopedia	sp.	*Merismopedia* sp.										1384.7		15550.6
			Woronichinia	*naegeliana*	*Woronichinia naegeliana*		130825.4										
		Microcystaceae	*Gloeocapsa*	*rupestris*	*Gloeocapsa rupestris*												
		Synechococcaceae	*Aphanothece*	sp.	*Aphanothece* sp.												
	Nostocales	Nostocaceae	*Nostoc*	sp.	*Nostoc* sp.		163531.7										
		Rivulariaceae	*Calothrix*	sp.	*Calothrix* sp.	439676.3	260342.5	845.3	2223848.4	909417.6	348541.4	222141.1	473547.6	107317.1	129559.4	456439.7	373213.3
			Dichothrix	sp.	*Dichothrix* sp.												
	Oscillatoriales	Oscillatoriaceae	*Homoeothrix*	sp.	*Homoeothrix* sp.	173610.5	241372.8	659359.9	158200.6	141694.0	139101.6	2000496.8	2024184.0	335798.6	147387.9	420563.4	363541.6
			Oscillatoria	sp.	*Oscillatoria* sp.	16436.5						11045.7					
		Phormidiaceae	*Phormidium*	sp.	*Phormidium* sp.						21521.4	74865.2	70567.9	60928.4			
	Stigonematales	Stigonemataceae	*Stigonema*	*mamillosum*	*Stigonema mamillosum*	21572.9	35977.0	23669.3									
Grand Total						806415.7	1009317.8	1252783.9	2406387.5	1084889.1	529635.9	2695147.8	2807858.9	764374.5	285082.6	897140.1	791940.4

Appendix 3.7-6

Stream Periphyton Richness and Diversity Results, Back River Project, July 2013

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Appendix 3.7-6. Stream Periphyton Richness and Diversity Results, Back River Project, July 2013

Stream Site	Replicate	Date Sampled	Surface Area Sampled (cm^2)	Eco Analysts Sample ID	Density (cells/cm^2)	Genus Richness (# genera/sample)	Simpson's Diversity Index (at genus level)
Wasp Outflow	1	26-Jul-13	95.43	6527.02-13	1,174,605	11	0.50
Wasp Outflow	2	26-Jul-13	95.43	6527.02-14	878,986	13	0.58
Wasp Outflow	3	26-Jul-13	95.43	6527.02-15	441,508	12	0.67
Giraffe Inflow	1	28-Jul-13	95.43	6527.02-28	731,044	12	0.80
Giraffe Inflow	2	28-Jul-13	95.43	6527.02-29	1,898,631	15	0.71
Giraffe Inflow	3	28-Jul-13	95.43	6527.02-30	4,316,835	15	0.43
Giraffe Outflow	1	28-Jul-13	95.43	6527.02-34	4,675,726	13	0.27
Giraffe Outflow	2	28-Jul-13	95.43	6527.02-35	3,736,695	18	0.38
Giraffe Outflow	3	28-Jul-13	95.43	6527.02-36	2,281,273	16	0.58
Umwelt Outflow	1	28-Jul-13	95.43	6527.02-31	2,129,850	17	0.47
Umwelt Outflow	2	28-Jul-13	95.43	6527.02-32	2,775,932	16	0.14
Umwelt Outflow	3	28-Jul-13	95.43	6527.02-33	2,544,926	12	0.55
Goose Outflow	1	24-Jul-13	95.43	6527.02-01	1,556,437	10	0.24
Goose Outflow	2	24-Jul-13	95.43	6527.02-02	581,313	9	0.24
Goose Outflow	3	24-Jul-13	95.43	6527.02-03	426,189	7	0.42
Propeller Outflow	1	26-Jul-13	95.43	6527.02-16	836,992	16	0.37
Propeller Outflow	2	26-Jul-13	95.43	6527.02-17	500,456	15	0.52
Propeller Outflow	3	26-Jul-13	95.43	6527.02-18	1,024,352	15	0.60
Reference B Outflow	1	26-Jul-13	95.43	6527.02-10	1,063,511	19	0.31
Reference B Outflow	2	26-Jul-13	95.43	6527.02-11	1,713,311	15	0.44
Reference B Outflow	3	26-Jul-13	95.43	6527.02-12	1,042,058	15	0.51
George Outflow	1	25-Jul-13	95.43	6527.02-07	984,953	11	0.36
George Outflow	2	25-Jul-13	95.43	6527.02-08	1,643,811	10	0.36
George Outflow	3	25-Jul-13	95.43	6527.02-09	1,562,526	11	0.19
Lytle Outflow	1	27-Jul-13	95.43	6527.02-22	806,416	13	0.65
Lytle Outflow	2	27-Jul-13	95.43	6527.02-23	1,009,318	13	0.82
Lytle Outflow	3	27-Jul-13	95.43	6527.02-24	1,252,784	11	0.60
Sleigh Outflow	1	27-Jul-13	95.43	6527.02-19	2,406,388	9	0.14
Sleigh Outflow	2	27-Jul-13	95.43	6527.02-20	1,084,889	11	0.28
Sleigh Outflow	3	27-Jul-13	95.43	6527.02-21	529,636	9	0.50
McCoy Outflow	1	27-Jul-13	95.43	6527.02-25	2,695,148	13	0.44
McCoy Outflow	2	27-Jul-13	95.43	6527.02-26	2,807,859	14	0.45
McCoy Outflow	3	27-Jul-13	95.43	6527.02-27	764,374	14	0.76
Reference Q Outflow	1	25-Jul-13	95.43	6527.02-04	285,083	9	0.53
Reference Q Outflow	2	25-Jul-13	95.43	6527.02-05	897,140	13	0.52
Reference Q Outflow	3	25-Jul-13	95.43	6527.02-06	791,940	14	0.57

Appendix 3.8-1

Lake Benthic Macroinvertebrate Density and Taxonomic Results, Back River Project, July 2013

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Appendix 3.8-1. Lake Benthic Macroinvertebrate Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.

Data in organisms/m^2

Phylum	Class	Order	Family	Sub-Family	Tribe	Genus	Species	Final Designation	Excluded in Analysis[a]	Wasp Lake 1 16-Jul-13 0.07 6527.1-52	Wasp Lake 2 16-Jul-13 0.07 6527.1-53	Wasp Lake 3 16-Jul-13 0.07 6527.1-54	Leaf Lake 1 16-Jul-13 0.07 6527.1-28	Leaf Lake 2 16-Jul-13 0.07 6527.1-29	Leaf Lake 3 16-Jul-13 0.07 6527.1-30	Giraffe Lake North 1 14-Jul-13 0.07 6527.1-13	Giraffe Lake North 2 14-Jul-13 0.07 6527.1-14	Giraffe Lake North 3 14-Jul-13 0.07 6527.1-15
Annelida	Clitellata	Enchytraeida	Enchytraeidae					Enchytraeidae					14.4	14.4				
		Lumbriculida	Lumbriculidae					Lumbriculidae			28.9		101.0	86.6	115.4	115.4	72.1	115.4
		Tubificida	Naididae			*Uncinais*	*uncinata*	*Uncinais uncinata*										
			Tubificidae			*Rhyacodrilus*	*coccineus*	*Rhyacodrilus coccineus*										14.4
						Tasserkidrilus	*americanus*	*Tasserkidrilus americanus*										14.4
								Tubificidae w/ cap setae sp.			14.4	43.3	28.9				14.4	28.9
Arthropoda	Arachnida							Acari										
		Trombidiformes	Arrenuridae			*Arrenurus*	sp.	*Arrenurus* sp.										
			Lebertiidae			*Lebertia*	sp.	*Lebertia* sp.					28.9	28.9	28.9	28.9		14.4
			Oxidae			*Oxus*	sp.	*Oxus* sp.						43.3	14.4			
			Pionidae			*Piona*	sp.	*Piona* sp.				28.9		14.4		14.4		
	Branchiopoda	Diplostraca						Cladocera	Excluded							14.4	115.4	86.6
	Insecta	Diptera						Diptera	Excluded (terrestrial)									
			Ceratopogonidae	Ceratopogoninae				Ceratopogoninae										
						Bezzia/Palpomyia	sp.	*Bezzia/Palpomyia* sp.										
			Chironomidae	Chironominae	Chironomini			Chironomini										
						Chironomus	sp.	*Chironomus* sp.										
						Cladopelma	sp.	*Cladopelma* sp.								14.4	14.4	57.7
						Cryptochironomus	sp.	*Cryptochironomus* sp.								129.8	86.6	28.9
						Demeijerea	sp.	*Demeijerea* sp.										
						Demicryptochironomus	sp.	*Demicryptochironomus* sp.						43.3	28.9			
						Dicrotendipes	sp.	*Dicrotendipes* sp.								14.4		
						Glyptotendipes	sp.	*Glyptotendipes* sp.										
						Microtendipes	*pedellus* gr.	*Microtendipes pedellus* gr.										
						Pagastiella	sp.	*Pagastiella* sp.								115.4	404.0	202.0
						Parachironomus	sp.	*Parachironomus* sp.										
						Paracladopelma	sp.	*Paracladopelma* sp.										
						Paratendipes	sp.	*Paratendipes* sp.										
						Polypedilum	*halterale* gr.	*Polypedilum halterale* gr.										14.4
						Sergentia	sp.	*Sergentia* sp.										
						Stictochironomus	sp.	*Stictochironomus* sp.		57.7	129.8	14.4	57.7	577.1	43.3	230.8	57.7	86.6
				Tanytarsini				Tanytarsini						14.4				86.6
						Cladotanytarsus	sp.	*Cladotanytarsus* sp.				14.4					14.4	
						Corynocera	sp.	*Corynocera* sp.										
						Micropsectra	sp.	*Micropsectra* sp.										
						Paratanytarsus	sp.	*Paratanytarsus* sp.					14.4	72.1	28.9			
						Stempellinella	sp.	*Stempellinella* sp.					28.9	14.4				14.4
						Tanytarsus	sp.	*Tanytarsus* sp.			14.4	72.1	28.9	14.4		187.6	404.0	144.3
				Diamesinae	Diamesini	*Diamesa*	sp.	*Diamesa* sp.										
					Protanypini	*Protanypus*	sp.	*Protanypus* sp.										
				Orthocladiinae				Orthocladiinae								14.4	14.4	
						Corynoneura	sp.	*Corynoneura* sp.										
						Cricotopus	sp.	*Cricotopus* sp.										
						Heterotanytarsus	sp.	*Heterotanytarsus* sp.								43.3	129.8	86.6
						Heterotrissocladius	*marcidus* gr.	*Heterotrissocladius marcidus* gr.			57.7		158.7	129.8	173.1		14.4	28.9
						Hydrobaenus	sp.	*Hydrobaenus* sp.										
						Krenosmittia	sp.	*Krenosmittia* sp.							14.4	43.3		
						Mesocricotopus	sp.	*Mesocricotopus* sp.										
						Nanocladius	sp.	*Nanocladius* sp.						14.4				
						Orthocladius	sp.	*Orthocladius* (Euorthocladius) sp.										
						Parakiefferiella	sp.	*Parakiefferiella* sp.										
						Psectrocladius	sp.	*Psectrocladius* sp.					57.7	14.4	14.4	346.3	274.1	331.8

Note:
[a] Excluded refers to taxa not included in analysis or graphing. See methods for rationale.

Appendix 3.8-1. Lake Benthic Macroinvertebrate Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.

Data in organisms/m^2

Taxonomic Classification																				
								Lake Site	Giraffe Lake South	Giraffe Lake South	Giraffe Lake South	Umwelt Lake	Umwelt Lake	Umwelt Lake	Rascal Lake	Rascal Lake	Rascal Lake	Goose Lake Neck
								Replicate	1	2	3	1	2	3	1	2	3	1
								Date Sampled	14-Jul-13	14-Jul-13	14-Jul-13	15-Jul-13	15-Jul-13	15-Jul-13	13-Jul-13	13-Jul-13	13-Jul-13	21-Jul-13
								Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
								EcoAnalysts Sample ID	6527.1-16	6527.1-17	6527.1-18	6527.1-49	6527.1-50	6527.1-51	6527.1-40	6527.1-41	6527.1-42	6527.1-22
Phylum	**Class**	**Order**	**Family**	**Sub-Family**	**Tribe**	**Genus**	**Species**	**Final Designation**										
Annelida	Clitellata	Enchytraeida	Enchytraeidae					Enchytraeidae						245.3				
		Lumbriculida	Lumbriculidae					Lumbriculidae	43.3	72.1	57.7	57.7	101.0	202.0	28.9	57.7		57.7
		Tubificida	Naididae			*Uncinais*	*uncinata*	*Uncinais uncinata*										
			Tubificidae			*Rhyacodrilus*	*coccineus*	*Rhyacodrilus coccineus*				14.4			14.4		14.4	14.4
						Tasserkidrilus	*americanus*	*Tasserkidrilus americanus*	14.4		14.4							
								Tubificidae w/ cap setae sp.			14.4			14.4		57.7	86.6	14.4
Arthropoda	Arachnida							Acari							14.4			
		Trombidiformes	Arrenuridae			*Arrenurus*	sp.	*Arrenurus* sp.					72.1					
			Lebertiidae			*Lebertia*	sp.	*Lebertia* sp.	43.3	57.7	187.6	72.1	43.3	14.4	14.4	14.4	14.4	14.4
			Oxidae			*Oxus*	sp.	*Oxus* sp.	14.4		28.9	28.9						
			Pionidae			*Piona*	sp.	*Piona* sp.			28.9							
	Branchiopoda	Diplostraca						Cladocera			14.4				28.9	14.4	14.4	
	Insecta	Diptera						Diptera										
			Ceratopogonidae	Ceratopogoninae				Ceratopogoninae										
						Bezzia/Palpomyia	sp.	*Bezzia/Palpomyia* sp.										
			Chironomidae	Chironominae	Chironomini			Chironomini										
						Chironomus	sp.	*Chironomus* sp.	14.4	28.9	43.3							
						Cladopelma	sp.	*Cladopelma* sp.	14.4	14.4	43.3	72.1	14.4	14.4				
						Cryptochironomus	sp.	*Cryptochironomus* sp.	14.4		14.4	57.7	202.0	72.1	346.3	202.0	259.7	
						Demeijerea	sp.	*Demeijerea* sp.										
						Demicryptochironomus	sp.	*Demicryptochironomus* sp.										
						Dicrotendipes	sp.	*Dicrotendipes* sp.		43.3					86.6	101.0	72.1	
						Glyptotendipes	sp.	*Glyptotendipes* sp.										
						Microtendipes	*pedellus* gr.	*Microtendipes pedellus* gr.				14.4						
						Pagastiella	sp.	*Pagastiella* sp.	14.4									187.6
						Parachironomus	sp.	*Parachironomus* sp.										
						Paracladopelma	sp.	*Paracladopelma* sp.										
						Paratendipes	sp.	*Paratendipes* sp.										
						Polypedilum	*halterale* gr.	*Polypedilum halterale* gr.				432.8	606.0	490.5				
						Sergentia	sp.	*Sergentia* sp.										
						Stictochironomus	sp.	*Stictochironomus* sp.		735.8					14.4	187.6	57.7	490.5
					Tanytarsini			Tanytarsini	14.4	43.3	317.4				14.4	28.9		
						Cladotanytarsus	sp.	*Cladotanytarsus* sp.										
						Corynocera	sp.	*Corynocera* sp.				230.8	115.4	86.6	57.7	144.3	144.3	
						Micropsectra	sp.	*Micropsectra* sp.										
						Paratanytarsus	sp.	*Paratanytarsus* sp.					14.4	14.4	28.9	72.1	86.6	
						Stempellinella	sp.	*Stempellinella* sp.	14.4		43.3							
						Tanytarsus	sp.	*Tanytarsus* sp.			129.8		43.3	28.9			28.9	
			Diamesinae	Diamesini		*Diamesa*	sp.	*Diamesa* sp.										
				Protanypini		*Protanypus*	sp.	*Protanypus* sp.										
			Orthocladiinae					Orthocladiinae										28.9
						Corynoneura	sp.	*Corynoneura* sp.										
						Cricotopus	sp.	*Cricotopus* sp.						28.9				
						Heterotanytarsus	sp.	*Heterotanytarsus* sp.			28.9							
						Heterotrissocladius	*marcidus* gr.	*Heterotrissocladius marcidus* gr.	57.7		72.1	14.4		72.1				
						Hydrobaenus	sp.	*Hydrobaenus* sp.										
						Krenosmittia	sp.	*Krenosmittia* sp.										14.4
						Mesocricotopus	sp.	*Mesocricotopus* sp.										
						Nanocladius	sp.	*Nanocladius* sp.										
						Orthocladius	sp.	*Orthocladius* (Euorthocladius) sp.							14.4			
						Parakiefferiella	sp.	*Parakiefferiella* sp.						57.7				
						Psectrocladius	sp.	*Psectrocladius* sp.	28.9	129.8	115.4		14.4	86.6	173.1	158.7	158.7	

Note:
" Excluded refers to taxa not included in analysis or graphing. See methods for rationale.

Appendix 3.8-1. Lake Benthic Macroinvertebrate Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.

Data in organisms/m^2

Taxonomic Classification								Lake Site	Goose Lake Neck	Goose Lake Neck	Goose Lake Central	Goose Lake Central	Goose Lake Central	Propeller Lake	Propeller Lake	Propeller Lake	Reference B Lake	Reference B Lake
								Replicate	2	3	1	2	3	1	2	3	1	2
								Date Sampled	21-Jul-13	21-Jul-13	21-Jul-13	21-Jul-13	21-Jul-13	19-Jul-13	19-Jul-13	19-Jul-13	20-Jul-13	20-Jul-13
								Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Phylum	Class	Order	Family	Sub-Family	Tribe	Genus	Species	EcoAnalysts Sample ID / Final Designation	6527.1-23	6527.1-24	6527.1-19	6527.1-20	6527.1-21	6527.1-37	6527.1-38	6527.1-39	6527.1-43	6527.1-44
Annelida	Clitellata	Enchytraeida	Enchytraeidae					Enchytraeidae										
		Lumbriculida	Lumbriculidae					Lumbriculidae	28.9	131.9	72.1	14.4	144.3		72.1	14.4	43.3	86.6
		Tubificida	Naididae			*Uncinais*	*uncinata*	*Uncinais uncinata*										
			Tubificidae			*Rhyacodrilus*	*coccineus*	*Rhyacodrilus coccineus*			14.4	28.9	57.7	14.4	14.4			
						Tasserkidrilus	*americanus*	*Tasserkidrilus americanus*					28.9					
								Tubificidae w/ cap setae sp.		82.4	72.1	28.9	57.7	14.4	14.4	14.4	14.4	
Arthropoda	Arachnida							Acari	14.4		14.4							
		Trombidiformes	Arrenuridae			*Arrenurus*	sp.	*Arrenurus* sp.										
			Lebertiidae			*Lebertia*	sp.	*Lebertia* sp.		16.5		43.3	28.9	28.9	14.4		57.7	
			Oxidae			*Oxus*	sp.	*Oxus* sp.		16.5	14.4					14.4		28.9
			Pionidae			*Piona*	sp.	*Piona* sp.				28.9						
	Branchiopoda	Diplostraca						Cladocera										28.9
	Insecta	Diptera						Diptera			14.4							28.9
			Ceratopogonidae	Ceratopogoninae				Ceratopogoninae										
						Bezzia/Palpomyia	sp.	*Bezzia/Palpomyia* sp.										
			Chironomidae	Chironominae	Chironomini			Chironomini										
						Chironomus	sp.	*Chironomus* sp.										28.9
						Cladopelma	sp.	*Cladopelma* sp.	14.4			14.4					28.9	57.7
						Cryptochironomus	sp.	*Cryptochironomus* sp.				14.4		14.4		14.4	43.3	57.7
						Demeijerea	sp.	*Demeijerea* sp.										
						Demicryptochironomus	sp.	*Demicryptochironomus* sp.										
						Dicrotendipes	sp.	*Dicrotendipes* sp.	14.4	98.9	14.4		144.3	14.4		43.3		
						Glyptotendipes	sp.	*Glyptotendipes* sp.										
						Microtendipes	*pedellus* gr.	*Microtendipes pedellus* gr.				14.4	57.7			14.4		28.9
						Pagastiella	sp.	*Pagastiella* sp.	274.1	890.4	72.1		115.4				43.3	86.6
						Parachironomus	sp.	*Parachironomus* sp.										28.9
						Paracladopelma	sp.	*Paracladopelma* sp.										
						Paratendipes	sp.	*Paratendipes* sp.										
						Polypedilum	*halterale* gr.	*Polypedilum halterale* gr.										173.1
						Sergentia	sp.	*Sergentia* sp.						14.4				
						Stictochironomus	sp.	*Stictochironomus* sp.	230.8	824.4	317.4	750.2	750.2	129.8	115.4	360.7	57.7	
				Tanytarsini				Tanytarsini		16.5	72.1	28.9	57.7	14.4	14.4	28.9	303.0	375.1
						Cladotanytarsus	sp.	*Cladotanytarsus* sp.										
						Corynocera	sp.	*Corynocera* sp.			14.4				14.4		72.1	86.6
						Micropsectra	sp.	*Micropsectra* sp.						14.4				
						Paratanytarsus	sp.	*Paratanytarsus* sp.		115.4	230.8	187.6	259.7	28.9	43.3	72.1	14.4	57.7
						Stempellinella	sp.	*Stempellinella* sp.										
						Tanytarsus	sp.	*Tanytarsus* sp.		16.5		14.4		14.4		57.7	2135.3	5309.3
				Diamesinae	Diamesini	*Diamesa*	sp.	*Diamesa* sp.										
					Protanypini	*Protanypus*	sp.	*Protanypus* sp.										
				Orthocladiinae				Orthocladiinae		16.5		14.4	28.9	28.9		28.9		115.4
						Corynoneura	sp.	*Corynoneura* sp.						14.4				
						Cricotopus	sp.	*Cricotopus* sp.					57.7					
						Heterotanytarsus	sp.	*Heterotanytarsus* sp.										28.9
						Heterotrissocladius	*marcidus* gr.	*Heterotrissocladius marcidus* gr.		247.3	461.7	144.3	519.4	72.1	101.0	101.0	14.4	115.4
						Hydrobaenus	sp.	*Hydrobaenus* sp.										
						Krenosmittia	sp.	*Krenosmittia* sp.										
						Mesocricotopus	sp.	*Mesocricotopus* sp.								14.4		
						Nanocladius	sp.	*Nanocladius* sp.										
						Orthocladius	sp.	*Orthocladius* (Euorthocladius) sp.										
						Parakiefferiella	sp.	*Parakiefferiella* sp.										
						Psectrocladius	sp.	*Psectrocladius* sp.	14.4	412.2	245.3	331.8	807.9	129.8	216.4	230.8	259.7	606.0

Note:
" Excluded refers to taxa not included in analysis or graphing. See methods for rationale.

Appendix 3.8-1. Lake Benthic Macroinvertebrate Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.

Data in organisms/m^2

Taxonomic Classification								Lake Site	Reference B Lake	George Lake Central	George Lake Central	George Lake Central	Bob Lake	Bob Lake	Bob Lake	Occurrence Lake	Occurrence Lake
								Replicate	3	1	2	3	1	2	3	1	2
								Date Sampled	20-Jul-13	8-Jul-13	8-Jul-13	8-Jul-13	11-Jul-13	11-Jul-13	11-Jul-13	9-Jul-13	9-Jul-13
								Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
								EcoAnalysts Sample ID	6527.1-45	6527.1-10	6527.1-11	6527.1-12	6527.1-1	6527.1-2	6527.1-3	6527.1-34	6527.1-35
Phylum	**Class**	**Order**	**Family**	**Sub-Family**	**Tribe**	**Genus**	**Species**	**Final Designation**									
Annelida	Clitellata	Enchytraeida	Enchytraeidae					Enchytraeidae									
		Lumbriculida	Lumbriculidae					Lumbriculidae	115.4	43.3	28.9		173.1	346.3	692.5	28.9	138.5
		Tubificida	Naididae			*Uncinais*	*uncinata*	*Uncinais uncinata*									
			Tubificidae			*Rhyacodrilus*	*coccineus*	*Rhyacodrilus coccineus*								43.3	69.3
						Tasserkidrilus	*americanus*	*Tasserkidrilus americanus*								28.9	34.6
								Tubificidae w/ cap setae sp.	72.1							245.3	415.5
Arthropoda	Arachnida							Acari									
		Trombidiformes	Arrenuridae			*Arrenurus*	sp.	*Arrenurus* sp.									
			Lebertiidae			*Lebertia*	sp.	*Lebertia* sp.	43.3	14.4			86.6	230.8			
			Oxidae			*Oxus*	sp.	*Oxus* sp.									
			Pionidae			*Piona*	sp.	*Piona* sp.									
	Branchiopoda	Diplostraca						Cladocera	86.6								34.6
	Insecta	Diptera						Diptera	43.3		43.3	72.1	43.3				
			Ceratopogonidae	Ceratopogoninae				Ceratopogoninae									
						Bezzia/Palpomyia	sp.	*Bezzia/Palpomyia* sp.									
			Chironomidae	Chironominae	Chironomini			Chironomini									
						Chironomus	sp.	*Chironomus* sp.	28.9								
						Cladopelma	sp.	*Cladopelma* sp.	158.7							129.8	346.3
						Cryptochironomus	sp.	*Cryptochironomus* sp.	14.4					115.4	138.5	115.4	69.3
						Demeijerea	sp.	*Demeijerea* sp.									
						Demicryptochironomus	sp.	*Demicryptochironomus* sp.									
						Dicrotendipes	sp.	*Dicrotendipes* sp.					43.3	115.4	277.0	28.9	346.3
						Glyptotendipes	sp.	*Glyptotendipes* sp.								28.9	
						Microtendipes	*pedellus* gr.	*Microtendipes pedellus* gr.			14.4						
						Pagastiella	sp.	*Pagastiella* sp.				14.4					
						Parachironomus	sp.	*Parachironomus* sp.									103.9
						Paracladopelma	sp.	*Paracladopelma* sp.		28.9	14.4	86.6					
						Paratendipes	sp.	*Paratendipes* sp.									
						Polypedilum	*halterale* gr.	*Polypedilum halterale* gr.	72.1								
						Sergentia	sp.	*Sergentia* sp.	14.4								
						Stictochironomus	sp.	*Stictochironomus* sp.					692.5	1269.6	2908.6		
					Tanytarsini			Tanytarsini		14.4			259.7	115.4	277.0	129.8	34.6
						Cladotanytarsus	sp.	*Cladotanytarsus* sp.	14.4		14.4					57.7	103.9
						Corynocera	sp.	*Corynocera* sp.	43.3	14.4	14.4		1558.2	9118.2	6094.2		
						Micropsectra	sp.	*Micropsectra* sp.			14.4	28.9					
						Paratanytarsus	sp.	*Paratanytarsus* sp.	72.1	28.9	28.9		5323.8	9810.7	13157.9	1139.8	3774.2
						Stempellinella	sp.	*Stempellinella* sp.	14.4								
						Tanytarsus	sp.	*Tanytarsus* sp.	1154.2	28.9	28.9	14.4	1385.0	5424.7	5678.7	86.6	2285.3
				Diamesinae	Diamesini	*Diamesa*	sp.	*Diamesa* sp.									
					Protanypini	*Protanypus*	sp.	*Protanypus* sp.			14.4						
				Orthocladiinae				Orthocladiinae					86.6		277.0		34.6
						Corynoneura	sp.	*Corynoneura* sp.									
						Cricotopus	sp.	*Cricotopus* sp.		14.4						14.4	34.6
						Heterotanytarsus	sp.	*Heterotanytarsus* sp.									
						Heterotrissocladius	*marcidus* gr.	*Heterotrissocladius marcidus* gr.	129.8	505.0	418.4	418.4					
						Hydrobaenus	sp.	*Hydrobaenus* sp.									
						Krenosmittia	sp.	*Krenosmittia* sp.								14.4	
						Mesocricotopus	sp.	*Mesocricotopus* sp.		144.3	129.8	230.8					
						Nanocladius	sp.	*Nanocladius* sp.									
						Orthocladius	sp.	*Orthocladius* (Euorthocladius) sp.									
						Parakiefferiella	sp.	*Parakiefferiella* sp.		57.7	57.7	43.3	86.6	230.8		28.9	207.8
						Psectrocladius	sp.	*Psectrocladius* sp.	375.1	230.8	144.3	158.7	1428.3	1385.0	3739.6	303.0	1177.3

Note:
" Excluded refers to taxa not included in analysis or graphing. See methods for rationale.

Appendix 3.8-1. Lake Benthic Macroinvertebrate Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.

Data in organisms/m²

Taxonomic Classification																				
								Lake Site	Occurrence Lake	Esker Pond	Esker Pond	Esker Pond	Dragon Lake	Dragon Lake	Dragon Lake	Komatic Lake	Komatic Lake	Komatic Lake	McCoy Lake
								Replicate	3	1	2	3	1	2	3	1	2	3	1
								Date Sampled	9-Jul-13	12-Jul-13	12-Jul-13	12-Jul-13	11-Jul-13	11-Jul-13	11-Jul-13	10-Jul-13	10-Jul-13	10-Jul-13	10-Jul-13
								Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
								EcoAnalysts Sample ID	6527.1-36	6527.1-7	6527.1-8	6527.1-9	6527.1-4	6527.1-5	6527.1-6	6527.1-25	6527.1-26	6527.1-27	6527.1-31
Phylum	**Class**	**Order**	**Family**	**Sub-Family**	**Tribe**	**Genus**	**Species**	**Final Designation**											
Annelida	Clitellata	Enchytraeida	Enchytraeidae					Enchytraeidae	129.8										
		Lumbriculida	Lumbriculidae					Lumbriculidae		331.8	461.7	216.4	16.5		49.5	129.8	101.0	43.3	
		Tubificida	Naididae			*Uncinais*	*uncinata*	*Uncinais uncinata*		43.3									
			Tubificidae			*Rhyacodrilus*	*coccineus*	*Rhyacodrilus coccineus*		14.4	14.4	14.4		14.4					28.9
						Tasserkidrilus	*americanus*	*Tasserkidrilus americanus*					16.5						
								Tubificidae w/ cap setae sp.	72.1	144.3	57.7	43.3			16.5				
Arthropoda	Arachnida							Acari					33.0				14.4		
		Trombidiformes	Arrenuridae			*Arrenurus*	sp.	*Arrenurus* sp.		28.9	28.9								
			Lebertiidae			*Lebertia*	sp.	*Lebertia* sp.	14.4	28.9				14.4	16.5	72.1	72.1	28.9	43.3
			Oxidae			*Oxus*	sp.	*Oxus* sp.											
			Pionidae			*Piona*	sp.	*Piona* sp.									14.4		
	Branchiopoda	Diplostraca						Cladocera					197.9	57.7	148.4				
	Insecta	Diptera						Diptera								14.4			
			Ceratopogonidae	Ceratopogoninae				Ceratopogoninae			14.4	28.9							
						Bezzia/Palpomyia	sp.	*Bezzia/Palpomyia* sp.		14.4	72.1	14.4							
			Chironomidae	Chironominae	Chironomini			Chironomini								57.7			
						Chironomus	sp.	*Chironomus* sp.											
						Cladopelma	sp.	*Cladopelma* sp.		14.4	14.4	57.7	66.0		49.5			14.4	
						Cryptochironomus	sp.	*Cryptochironomus* sp.	28.9	28.9	14.4	28.9	33.0			28.9	28.9		101.0
						Demeijerea	sp.	*Demeijerea* sp.			43.3								
						Demicryptochironomus	sp.	*Demicryptochironomus* sp.											
						Dicrotendipes	sp.	*Dicrotendipes* sp.	14.4				16.5		16.5		28.9	14.4	
						Glyptotendipes	sp.	*Glyptotendipes* sp.	14.4										
						Microtendipes	*pedellus* gr.	*Microtendipes pedellus* gr.								562.7	404.0	288.6	
						Pagastiella	sp.	*Pagastiella* sp.											
						Parachironomus	sp.	*Parachironomus* sp.	28.9					14.4					
						Paracladopelma	sp.	*Paracladopelma* sp.					33.0						
						Paratendipes	sp.	*Paratendipes* sp.			28.9	14.4							
						Polypedilum	*halterale* gr.	*Polypedilum halterale* gr.											
						Sergentia	sp.	*Sergentia* sp.											
						Stictochironomus	sp.	*Stictochironomus* sp.			43.3	14.4	247.3	331.8	428.7	750.2	995.5	995.5	
				Tanytarsini				Tanytarsini	14.4	28.9	101.0	28.9	16.5		16.5	14.4			
						Cladotanytarsus	sp.	*Cladotanytarsus* sp.		43.3		14.4		14.4					
						Corynocera	sp.	*Corynocera* sp.					66.0	57.7	16.5	43.3	43.3	28.9	
						Micropsectra	sp.	*Micropsectra* sp.											
						Paratanytarsus	sp.	*Paratanytarsus* sp.	721.4	129.8	360.7	129.8	49.5	14.4	98.9		14.4	14.4	14.4
						Stempellinella	sp.	*Stempellinella* sp.					16.5		16.5				
						Tanytarsus	sp.	*Tanytarsus* sp.	28.9			28.9	33.0	57.7	16.5	14.4	57.7		14.4
			Diamesinae	Diamesini	*Diamesa*	sp.	*Diamesa* sp.												
				Protanypini	*Protanypus*	sp.	*Protanypus* sp.										14.4		
			Orthocladiinae					Orthocladiinae					98.9		82.4	28.9			
						Corynoneura	sp.	*Corynoneura* sp.											14.4
						Cricotopus	sp.	*Cricotopus* sp.				14.4	16.5	14.4	33.0		14.4	28.9	14.4
						Heterotanytarsus	sp.	*Heterotanytarsus* sp.											
						Heterotrissocladius	*marcidus* gr.	*Heterotrissocladius marcidus* gr.					33.0	14.4		216.4	375.1	288.6	
						Hydrobaenus	sp.	*Hydrobaenus* sp.				14.4							
						Krenosmittia	sp.	*Krenosmittia* sp.											
						Mesocricotopus	sp.	*Mesocricotopus* sp.											
						Nanocladius	sp.	*Nanocladius* sp.											
						Orthocladius	sp.	*Orthocladius* (Euorthocladius) sp.									14.4		
						Parakiefferiella	sp.	*Parakiefferiella* sp.				28.9					14.4		
						Psectrocladius	sp.	*Psectrocladius* sp.	216.4	28.9	86.6	72.1	989.3	807.9	956.3	86.6	129.8	101.0	72.1

Note:
" Excluded refers to taxa not included in analysis or graphing. See methods for rationale.

Appendix 3.8-1. Lake Benthic Macroinvertebrate Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.

Data in organisms/m^2

Taxonomic Classification								Lake Site	McCoy Lake	McCoy Lake	Reference Q Lake	Reference Q Lake	Reference Q Lake
								Replicate	2	3	1	2	3
								Date Sampled	10-Jul-13	10-Jul-13	9-Jul-13	9-Jul-13	9-Jul-13
								Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07
								EcoAnalysts Sample ID	6527.1-32	6527.1-33	6527.1-46	6527.1-47	6527.1-48
Phylum	Class	Order	Family	Sub-Family	Tribe	Genus	Species	Final Designation					
Annelida	Clitellata	Enchytraeida	Enchytraeidae					Enchytraeidae					
		Lumbriculida	Lumbriculidae					Lumbriculidae	43.3	57.7	43.3	14.4	
		Tubificida	Naididae			*Uncinais*	*uncinata*	*Uncinais uncinata*					
			Tubificidae			*Rhyacodrilus*	*coccineus*	*Rhyacodrilus coccineus*					
						Tasserkidrilus	*americanus*	*Tasserkidrilus americanus*					
								Tubificidae w/ cap setae sp.	72.1	57.7			
Arthropoda	Arachnida							Acari					
		Trombidiformes	Arrenuridae			*Arrenurus*	sp.	*Arrenurus* sp.					
			Lebertiidae			*Lebertia*	sp.	*Lebertia* sp.		14.4		57.7	
			Oxidae			*Oxus*	sp.	*Oxus* sp.	14.4				
			Pionidae			*Piona*	sp.	*Piona* sp.					
	Branchiopoda	Diplostraca						Cladocera					
	Insecta	Diptera						Diptera					
			Ceratopogonidae	Ceratopogoninae				Ceratopogoninae					
						Bezzia/Palpomyia	sp.	*Bezzia/Palpomyia* sp.					
			Chironomidae	Chironominae	Chironomini			Chironomini				14.4	
						Chironomus	sp.	*Chironomus* sp.		14.4			
						Cladopelma	sp.	*Cladopelma* sp.				14.4	
						Cryptochironomus	sp.	*Cryptochironomus* sp.		14.4			
						Demeijerea	sp.	*Demeijerea* sp.					
						Demicryptochironomus	sp.	*Demicryptochironomus* sp.					
						Dicrotendipes	sp.	*Dicrotendipes* sp.				14.4	
						Glyptotendipes	sp.	*Glyptotendipes* sp.					
						Microtendipes	*pedellus* gr.	*Microtendipes pedellus* gr.	14.4		43.3	562.7	28.9
						Pagastiella	sp.	*Pagastiella* sp.				14.4	
						Parachironomus	sp.	*Parachironomus* sp.					
						Paracladopelma	sp.	*Paracladopelma* sp.				14.4	
						Paratendipes	sp.	*Paratendipes* sp.					
						Polypedilum	*halterale* gr.	*Polypedilum halterale* gr.					
						Sergentia	sp.	*Sergentia* sp.					
						Stictochironomus	sp.	*Stictochironomus* sp.	202.0	1096.5		14.4	
					Tanytarsini			Tanytarsini	57.7				
						Cladotanytarsus	sp.	*Cladotanytarsus* sp.					
						Corynocera	sp.	*Corynocera* sp.	57.7	115.4		14.4	
						Micropsectra	sp.	*Micropsectra* sp.				202.0	
						Paratanytarsus	sp.	*Paratanytarsus* sp.	57.7	129.8		28.9	
						Stempellinella	sp.	*Stempellinella* sp.					
						Tanytarsus	sp.	*Tanytarsus* sp.	14.4	14.4		43.3	
				Diamesinae	Diamesini	*Diamesa*	sp.	*Diamesa* sp.		14.4			
					Protanypini	*Protanypus*	sp.	*Protanypus* sp.			28.9	14.4	
				Orthocladiinae				Orthocladiinae				28.9	
						Corynoneura	sp.	*Corynoneura* sp.					
						Cricotopus	sp.	*Cricotopus* sp.					
						Heterotanytarsus	sp.	*Heterotanytarsus* sp.					
						Heterotrissocladius	*marcidus* gr.	*Heterotrissocladius marcidus* gr.	57.7	14.4	86.6	591.5	
						Hydrobaenus	sp.	*Hydrobaenus* sp.				14.4	
						Krenosmittia	sp.	*Krenosmittia* sp.					
						Mesocricotopus	sp.	*Mesocricotopus* sp.					
						Nanocladius	sp.	*Nanocladius* sp.					
						Orthocladius	sp.	*Orthocladius* (Euorthocladius) sp.					
						Parakiefferiella	sp.	*Parakiefferiella* sp.				14.4	
						Psectrocladius	sp.	*Psectrocladius* sp.	72.1	317.4		101.0	14.4

Note:
" Excluded refers to taxa not included in analysis or graphing. See methods for rationale.

Appendix 3.8-1. Lake Benthic Macroinvertebrate Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.

Data in organisms/m²

Taxonomic Classification										Lake Site	Wasp Lake	Wasp Lake	Wasp Lake	Leaf Lake	Leaf Lake	Leaf Lake	Giraffe Lake North	Giraffe Lake North	Giraffe Lake North
										Replicate	1	2	3	1	2	3	1	2	3
										Date Sampled	16-Jul-13	16-Jul-13	16-Jul-13	16-Jul-13	16-Jul-13	16-Jul-13	14-Jul-13	14-Jul-13	14-Jul-13
										Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
										EcoAnalysts Sample ID	6527.1-52	6527.1-53	6527.1-54	6527.1-28	6527.1-29	6527.1-30	6527.1-13	6527.1-14	6527.1-15
Phylum	**Class**	**Order**	**Family**	**Sub-Family**	**Tribe**	**Genus**	**Species**	**Final Designation**	**Excluded in Analysis[a]**										
						Rheocricotopus	sp.	*Rheocricotopus* sp.										14.4	
						Zalutschia	sp.	*Zalutschia* sp.									28.9	57.7	14.4
				Prodiamesinae		*Monodiamesa*	sp.	*Monodiamesa* sp.		14.4	43.3	14.4	43.3	28.9	57.7				
				Tanypodinae	Pentaneurini			Pentaneurini					14.4						
						Ablabesmyia	*monilis*	*Ablabesmyia monilis*					43.3	43.3	43.3	28.9			
							rhamphe gr.	*Ablabesmyia rhamphe* gr.											
							sp.	*Ablabesmyia* sp.											
								Ablabesmyia (Karelia) sp.									14.4	14.4	
						Thienemannimyia gr.	sp.	Thienemannimyia gr. sp.											
					Procladiini	*Procladius*	sp.	*Procladius* sp.			28.9	28.9	43.3				173.1	187.6	187.6
			Empididae					Empididae											
			Tipulidae			*Tipula*	sp.	*Tipula* sp.											
		Trichoptera	Leptoceridae			*Mystacides*	sp.	*Mystacides* sp.								28.9			
			Limnephilidae					Limnephilidae										14.4	
						Grensia	sp.	*Grensia* sp.						72.1	43.3	28.9			
						Limnephilus	sp.	*Limnephilus* sp.											
	Malacostraca	Amphipoda	Gammaridae			*Gammarus*	sp.	*Gammarus* sp.											
	Maxillopoda							Copepoda	Excluded										
		Calanoida						Calanoida	Excluded			72.1	43.3						
		Cyclopoida						Cyclopoida	Excluded			14.4	28.9	28.9			28.9		
	Ostracoda							Ostracoda	Excluded		43.3		72.1	43.3			57.7	14.4	
Mollusca	Bivalvia	Veneroida	Sphaeriidae					Sphaeriidae		14.4	144.3	28.9	952.2	447.3	923.4	230.8	331.8	389.5	
						Pisidium	sp.	*Pisidium* sp.					72.1	101.0	144.3	115.4	389.5	432.8	
						Sphaerium	sp.	*Sphaerium* sp.				28.9	14.4			14.4			
	Gastropoda	Heterostropha	Valvatidae			*Valvata*	*lewisi*	*Valvata lewisi*											
							sp.	*Valvata* sp.											
Nematoda								Nematoda	Excluded	14.4			28.9	43.3	28.9	14.4			
Platyhelminthes	Turbellaria							Turbellaria	Excluded					86.6			57.7		
Grand Total										**101.0**	**505.0**	**360.7**	**1947.7**	**1947.7**	**1716.9**	**1933.3**	**2770.1**	**2395.0**	

Note:

[a] Excluded refers to taxa not included in analysis or graphing. See methods for rationale.

Appendix 3.8-1. Lake Benthic Macroinvertebrate Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.

Data in organisms/m²

Taxonomic Classification																					
								Lake Site	Giraffe Lake South	Giraffe Lake South	Giraffe Lake South	Umwelt Lake	Umwelt Lake	Umwelt Lake	Rascal Lake	Rascal Lake	Rascal Lake	Goose Lake Neck
								Replicate	1	2	3	1	2	3	1	2	3	1
								Date Sampled	14-Jul-13	14-Jul-13	14-Jul-13	15-Jul-13	15-Jul-13	15-Jul-13	13-Jul-13	13-Jul-13	13-Jul-13	21-Jul-13
								Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Phylum	Class	Order	Family	Sub-Family	Tribe	Genus	Species	EcoAnalysts Sample ID / Final Designation	6527.1-16	6527.1-17	6527.1-18	6527.1-49	6527.1-50	6527.1-51	6527.1-40	6527.1-41	6527.1-42	6527.1-22
						Rheocricotopus	sp.	*Rheocricotopus* sp.											
						Zalutschia	sp.	*Zalutschia* sp.			57.7								
				Prodiamesinae		*Monodiamesa*	sp.	*Monodiamesa* sp.		28.9									28.9
				Tanypodinae	Pentaneurini			Pentaneurini											
						Ablabesmyia	*monilis*	*Ablabesmyia monilis*	57.7		57.7	14.4				28.9			
							rhamphe gr.	*Ablabesmyia rhamphe* gr.											
							sp.	*Ablabesmyia* sp.							14.4				14.4
								Ablabesmyia (Karelia) sp.		14.4		43.3	230.8	173.1	129.8	144.3	202.0		
						Thienemannimyia gr.	sp.	Thienemannimyia gr. sp.					14.4						86.6
					Procladiini	*Procladius*	sp.	*Procladius* sp.	14.4	43.3	86.6	649.2	259.7	1038.8	259.7	259.7	288.6	216.4
			Empididae					Empididae											
			Tipulidae			*Tipula*	sp.	*Tipula* sp.											
		Trichoptera	Leptoceridae			*Mystacides*	sp.	*Mystacides* sp.											
			Limnephilidae					Limnephilidae		14.4							14.4		
						Grensia	sp.	*Grensia* sp.	28.9			43.3		28.9	28.9				
						Limnephilus	sp.	*Limnephilus* sp.											
	Malacostraca	Amphipoda	Gammaridae			*Gammarus*	sp.	*Gammarus* sp.											
	Maxillopoda							Copepoda											
		Calanoida						Calanoida						14.4					
		Cyclopoida						Cyclopoida						14.4	28.9	43.3			57.7
	Ostracoda							Ostracoda			72.1	14.4		14.4	86.6	158.7			389.5
Mollusca	Bivalvia	Veneroida	Sphaeriidae					Sphaeriidae	331.8		519.4	606.0	1125.3	678.1	418.4	606.0	317.4		562.7
						Pisidium	sp.	*Pisidium* sp.	101.0		519.4	28.9	72.1	14.4	187.6	86.6	43.3		129.8
						Sphaerium	sp.	*Sphaerium* sp.				14.4	245.3	129.8	28.9	86.6			28.9
	Gastropoda	Heterostropha	Valvatidae			*Valvata*	*lewisi*	*Valvata lewisi*						14.4					
							sp.	*Valvata* sp.											
Nematoda								Nematoda			28.9								57.7
Platyhelminthes	Turbellaria							Turbellaria				14.4		14.4					28.9
Grand Total									**822.4**	**1226.3**	**2496.0**	**2423.8**	**3174.1**	**3563.6**	**2019.9**	**2452.7**	**1803.4**		**2423.8**

Note:

" Excluded refers to taxa not included in analysis or graphing. See methods for rationale.

Appendix 3.8-1. Lake Benthic Macroinvertebrate Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.

Data in organisms/m²

Taxonomic Classification								Lake Site	Goose Lake Neck	Goose Lake Neck	Goose Lake Central	Goose Lake Central	Goose Lake Central	Propeller Lake	Propeller Lake	Propeller Lake	Reference B Lake	Reference B Lake
								Replicate	2	3	1	2	3	1	2	3	1	2
								Date Sampled	21-Jul-13	21-Jul-13	21-Jul-13	21-Jul-13	21-Jul-13	19-Jul-13	19-Jul-13	19-Jul-13	20-Jul-13	20-Jul-13
								Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Phylum	Class	Order	Family	Sub-Family	Tribe	Genus	Species	EcoAnalysts Sample ID / Final Designation	6527.1-23	6527.1-24	6527.1-19	6527.1-20	6527.1-21	6527.1-37	6527.1-38	6527.1-39	6527.1-43	6527.1-44
						Rheocricotopus	sp.	*Rheocricotopus* sp.										
						Zalutschia	sp.	*Zalutschia* sp.		82.4	57.7	72.1	28.9	1211.9	1572.6	1890.0	14.4	
				Prodiamesinae		*Monodiamesa*	sp.	*Monodiamesa* sp.		66.0	57.7			86.6	14.4	28.9		
				Tanypodinae	Pentaneurini			Pentaneurini										
						Ablabesmyia	*monilis*	*Ablabesmyia monilis*	14.4						28.9	115.4		28.9
							rhamphe gr.	*Ablabesmyia rhamphe* gr.			28.9							
							sp.	*Ablabesmyia* sp.										
								Ablabesmyia (Karelia) sp.		16.5		57.7	144.3	14.4		14.4		
						Thienemannimyia gr.	sp.	Thienemannimyia gr. sp.	202.0	98.9	129.8	14.4	144.3				14.4	
					Procladiini	*Procladius*	sp.	*Procladius* sp.	202.0	329.8	389.5	375.1	577.1	43.3	72.1	101.0	259.7	750.2
			Empididae					Empididae										
			Tipulidae			*Tipula*	sp.	*Tipula* sp.										
		Trichoptera	Leptoceridae			*Mystacides*	sp.	*Mystacides* sp.										
			Limnephilidae					Limnephilidae										
						Grensia	sp.	*Grensia* sp.										
						Limnephilus	sp.	*Limnephilus* sp.					28.9		14.4			
	Malacostraca	Amphipoda	Gammaridae			*Gammarus*	sp.	*Gammarus* sp.										
	Maxillopoda							Copepoda										
		Calanoida						Calanoida										
		Cyclopoida						Cyclopoida		16.5	14.4		317.4	14.4				57.7
	Ostracoda							Ostracoda		98.9	202.0	288.6	750.2					173.1
Mollusca	Bivalvia	Veneroida	Sphaeriidae					Sphaeriidae	86.6	1418.0	1356.2	1024.4	2395.0	259.7	173.1	288.6	981.1	1154.2
						Pisidium	sp.	*Pisidium* sp.	173.1	230.8	303.0	202.0	490.5	86.6	86.6	158.7	288.6	173.1
						Sphaerium	sp.	*Sphaerium* sp.		131.9	86.6	173.1	346.3	28.9	57.7	101.0	28.9	
	Gastropoda	Heterostropha	Valvatidae			*Valvata*	*lewisi*	*Valvata lewisi*		115.4		230.8	692.5	72.1	86.6	43.3		
							sp.	*Valvata* sp.			259.7							
Nematoda								Nematoda	57.7	98.9	28.9	101.0		28.9				
Platyhelminthes	Turbellaria							Turbellaria		49.5				28.9			14.4	57.7
Grand Total									**1327.3**	**5639.1**	**4544.7**	**4198.4**	**9031.6**	**2423.8**	**2726.8**	**3751.2**	**4688.9**	**9724.1**

Note:

" Excluded refers to taxa not included in analysis or graphing. See methods for rationale.

Appendix 3.8-1. Lake Benthic Macroinvertebrate Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.

Data in organisms/m²

Taxonomic Classification								Lake Site	Reference B Lake	George Lake Central	George Lake Central	George Lake Central	Bob Lake	Bob Lake	Bob Lake	Occurrence Lake	Occurrence Lake
								Replicate	3	1	2	3	1	2	3	1	2
								Date Sampled	20-Jul-13	8-Jul-13	8-Jul-13	8-Jul-13	11-Jul-13	11-Jul-13	11-Jul-13	9-Jul-13	9-Jul-13
								Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Phylum	Class	Order	Family	Sub-Family	Tribe	Genus	Species	EcoAnalysts Sample ID / Final Designation	6527.1-45	6527.1-10	6527.1-11	6527.1-12	6527.1-1	6527.1-2	6527.1-3	6527.1-34	6527.1-35
						Rheocricotopus	sp.	*Rheocricotopus* sp.									
						Zalutschia	sp.	*Zalutschia* sp.				14.4					
				Prodiamesinae		*Monodiamesa*	sp.	*Monodiamesa* sp.		28.9		14.4					
				Tanypodinae	Pentaneurini			Pentaneurini									
						Ablabesmyia	*monilis*	*Ablabesmyia monilis*					216.4			14.4	
							rhamphe gr.	*Ablabesmyia rhamphe* gr.									
							sp.	*Ablabesmyia* sp.				14.4	43.3				
								Ablabesmyia (Karelia) sp.		72.1	14.4			115.4	138.5	57.7	207.8
						Thienemannimyia gr.	sp.	Thienemannimyia gr. sp.		43.3	14.4	43.3	129.8	461.7	277.0		
					Procladiini	*Procladius*	sp.	*Procladius* sp.	447.3	173.1	115.4	202.0	822.4	1154.2	2493.1	144.3	242.4
			Empididae					Empididae									
			Tipulidae			*Tipula*	sp.	*Tipula* sp.									
		Trichoptera	Leptoceridae			*Mystacides*	sp.	*Mystacides* sp.									
			Limnephilidae					Limnephilidae		14.4							
						Grensia	sp.	*Grensia* sp.									
						Limnephilus	sp.	*Limnephilus* sp.									
	Malacostraca	Amphipoda	Gammaridae			*Gammarus*	sp.	*Gammarus* sp.			14.4						
	Maxillopoda							Copepoda	14.4								
		Calanoida						Calanoida									
		Cyclopoida						Cyclopoida	43.3	28.9	14.4	72.1	86.6	230.8			138.5
	Ostracoda							Ostracoda	129.8			57.7	303.0	1500.5	1385.0	14.4	34.6
Mollusca	Bivalvia	Veneroida	Sphaeriidae					Sphaeriidae	1067.6	2250.7	1327.3	1702.4	216.4	577.1	1939.1	706.9	1108.0
						Pisidium	sp.	*Pisidium* sp.	202.0	245.3	115.4	57.7	43.3	230.8	831.0		
						Sphaerium	sp.	*Sphaerium* sp.		14.4	14.4		129.8	1038.8		14.4	
	Gastropoda	Heterostropha	Valvatidae			*Valvata*	*lewisi*	*Valvata lewisi*				14.4		346.3		57.7	173.1
							sp.	*Valvata* sp.					43.3				
Nematoda								Nematoda			14.4			1500.5	1662.0	43.3	311.6
Platyhelminthes	Turbellaria							Turbellaria	187.6				129.8	230.8	415.5		34.6
Grand Total									**4544.7**	**3996.4**	**2611.4**	**3260.6**	**13331.0**	**35549.4**	**42382.3**	**3477.0**	**11461.2**

Note:

" Excluded refers to taxa not included in analysis or graphing. See methods for rationale.

Appendix 3.8-1. Lake Benthic Macroinvertebrate Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.

Data in organisms/m²

Taxonomic Classification																				
								Lake Site	Occurrence Lake	Esker Pond	Esker Pond	Esker Pond	Dragon Lake	Dragon Lake	Dragon Lake	Komatic Lake	Komatic Lake	Komatic Lake	McCoy Lake
								Replicate	3	1	2	3	1	2	3	1	2	3	1
								Date Sampled	9-Jul-13	12-Jul-13	12-Jul-13	12-Jul-13	11-Jul-13	11-Jul-13	11-Jul-13	10-Jul-13	10-Jul-13	10-Jul-13	10-Jul-13
								Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Phylum	Class	Order	Family	Sub-Family	Tribe	Genus	Species	EcoAnalysts Sample ID / Final Designation	6527.1-36	6527.1-7	6527.1-8	6527.1-9	6527.1-4	6527.1-5	6527.1-6	6527.1-25	6527.1-26	6527.1-27	6527.1-31
						Rheocricotopus	sp.	*Rheocricotopus* sp.												
						Zalutschia	sp.	*Zalutschia* sp.												
				Prodiamesinae		*Monodiamesa*	sp.	*Monodiamesa* sp.						57.7		101.0	57.7	43.3		
				Tanypodinae	Pentaneurini			Pentaneurini					16.5							
						Ablabesmyia	*monilis*	*Ablabesmyia monilis*									346.3	202.0	115.4	
							rhamphe gr.	*Ablabesmyia rhamphe* gr.												
							sp.	*Ablabesmyia* sp.												
								Ablabesmyia (Karelia) sp.	57.7				164.9	144.3	164.9	187.6				
						Thienemannimyia gr.	sp.	Thienemannimyia gr. sp.					16.5							
					Procladiini	*Procladius*	sp.	*Procladius* sp.	288.6	952.2	1125.3	476.1	560.6	129.8		317.4	375.1	129.8	216.4	
			Empididae					Empididae		14.4	72.1	101.0				14.4				
			Tipulidae			*Tipula*	sp.	*Tipula* sp.			28.9									
		Trichoptera	Leptoceridae			*Mystacides*	sp.	*Mystacides* sp.		28.9		14.4								
			Limnephilidae					Limnephilidae					16.5	14.4				14.4		
						Grensia	sp.	*Grensia* sp.												
						Limnephilus	sp.	*Limnephilus* sp.												
	Malacostraca	Amphipoda	Gammaridae			*Gammarus*	sp.	*Gammarus* sp.												
	Maxillopoda							Copepoda												
		Calanoida						Calanoida												
		Cyclopoida						Cyclopoida		14.4	43.3		115.4		66.0	144.3	28.9			
	Ostracoda							Ostracoda	14.4				1286.1		1137.7	86.6		14.4		
Mollusca	Bivalvia	Veneroida	Sphaeriidae					Sphaeriidae	418.4				939.8	461.7	906.9	1139.8	1659.2	1803.4	548.2	
						Pisidium	sp.	*Pisidium* sp.	28.9				395.7	360.7		331.8	202.0	346.3	533.8	
						Sphaerium	sp.	*Sphaerium* sp.					16.5	28.9	33.0	72.1		28.9		
	Gastropoda	Heterostropha	Valvatidae			*Valvata*	*lewisi*	*Valvata lewisi*	86.6								43.3			
							sp.	*Valvata* sp.										14.4		
Nematoda								Nematoda	28.9	43.3	43.3	14.4	16.5	28.9			43.3		14.4	
Platyhelminthes	Turbellaria							Turbellaria							49.5	115.4				
Grand Total									**2207.4**	**1933.3**	**2654.7**	**1370.6**	**5523.7**	**2640.2**	**4320.0**	**4530.2**	**5078.5**	**4458.1**	**1731.3**	

Note:

" Excluded refers to taxa not included in analysis or graphing. See methods for rationale.

Appendix 3.8-1. Lake Benthic Macroinvertebrate Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.

Data in organisms/m²

Taxonomic Classification													
								Lake Site	McCoy Lake	McCoy Lake	Reference Q Lake	Reference Q Lake	Reference Q Lake
								Replicate	2	3	1	2	3
								Date Sampled	10-Jul-13	10-Jul-13	9-Jul-13	9-Jul-13	9-Jul-13
								Surface Area Sampled (m^2)	0.07	0.07	0.07	0.07	0.07
Phylum	Class	Order	Family	Sub-Family	Tribe	Genus	Species	EcoAnalysts Sample ID / Final Designation	6527.1-32	6527.1-33	6527.1-46	6527.1-47	6527.1-48
						Rheocricotopus	sp.	*Rheocricotopus* sp.					
						Zalutschia	sp.	*Zalutschia* sp.			14.4		
				Prodiamesinae		*Monodiamesa*	sp.	*Monodiamesa* sp.			72.1	28.9	28.9
				Tanypodinae	Pentaneurini			Pentaneurini					
						Ablabesmyia	*monilis*	*Ablabesmyia monilis*	14.4	86.6	14.4	72.1	
							rhamphe gr.	*Ablabesmyia rhamphe* gr.					
							sp.	*Ablabesmyia* sp.				57.7	
								Ablabesmyia (Karelia) sp.			14.4		14.4
						Thienemannimyia gr.	sp.	Thienemannimyia gr. sp.			14.4	14.4	43.3
					Procladiini	*Procladius*	sp.	*Procladius* sp.	404.0	230.8	101.0	447.3	216.4
			Empididae					Empididae					
			Tipulidae			*Tipula*	sp.	*Tipula* sp.					
		Trichoptera	Leptoceridae			*Mystacides*	sp.	*Mystacides* sp.					
			Limnephilidae					Limnephilidae					
						Grensia	sp.	*Grensia* sp.	28.9				
						Limnephilus	sp.	*Limnephilus* sp.					
	Malacostraca	Amphipoda	Gammaridae			*Gammarus*	sp.	*Gammarus* sp.					
	Maxillopoda							Copepoda					
		Calanoida						Calanoida					
		Cyclopoida						Cyclopoida				14.4	
	Ostracoda							Ostracoda	303.0			43.3	14.4
Mollusca	Bivalvia	Veneroida	Sphaeriidae					Sphaeriidae	476.1	880.1	57.7	476.1	
						Pisidium	sp.	*Pisidium* sp.	230.8	245.3			
						Sphaerium	sp.	*Sphaerium* sp.		43.3		57.7	
	Gastropoda	Heterostropha	Valvatidae			*Valvata*	*lewisi*	*Valvata lewisi*					
							sp.	*Valvata* sp.					
Nematoda								Nematoda	14.4		14.4	28.9	
Platyhelminthes	Turbellaria							Turbellaria	14.4				
Grand Total									**2149.7**	**3347.2**	**505.0**	**3015.4**	**360.7**

Note:

" Excluded refers to taxa not included in analysis or graphing. See methods for rationale.

Appendix 3.8-2

Lake Benthic Macroinvertebrate Richness and Diversity Results, Back River Project, July 2013

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Appendix 3.8-2. Lake Benthic Macroinvertebrate Richness and Diversity Results, Back River Project, July 2013

Lake Site	Replicate	Date Sampled	Surface Area Sampled (m^2)	Eco Analysts Sample ID	Density (individuals/m^2)	Family Richness (# families/sample)	Simpson's Diversity Index (at family level)
Wasp Lake	1	16-Jul-13	0.07	6527.1-52	86.6	2	0.28
Wasp Lake	2	16-Jul-13	0.07	6527.1-53	461.7	4	0.54
Wasp Lake	3	16-Jul-13	0.07	6527.1-54	274.1	4	0.64
Leaf Lake	1	16-Jul-13	0.07	6527.1-28	1774.6	7	0.58
Leaf Lake	2	16-Jul-13	0.07	6527.1-29	1745.7	8	0.59
Leaf Lake	3	16-Jul-13	0.07	6527.1-30	1688.0	7	0.54
Giraffe Lake North	1	14-Jul-13	0.07	6527.1-13	1904.4	5	0.43
Giraffe Lake North	2	14-Jul-13	0.07	6527.1-14	2510.4	5	0.46
Giraffe Lake North	3	14-Jul-13	0.07	6527.1-15	2294.0	5	0.55
Giraffe Lake South	1	14-Jul-13	0.07	6527.1-16	822.4	7	0.63
Giraffe Lake South	2	14-Jul-13	0.07	6527.1-17	1226.3	4	0.22
Giraffe Lake South	3	14-Jul-13	0.07	6527.1-18	2380.5	7	0.62
Umwelt Lake	1	15-Jul-13	0.07	6527.1-49	2395.0	7	0.52
Umwelt Lake	2	15-Jul-13	0.07	6527.1-50	3174.1	5	0.56
Umwelt Lake	3	15-Jul-13	0.07	6527.1-51	3505.9	8	0.56
Rascal Lake	1	13-Jul-13	0.07	6527.1-40	1875.6	6	0.51
Rascal Lake	2	13-Jul-13	0.07	6527.1-41	2236.3	5	0.52
Rascal Lake	3	13-Jul-13	0.07	6527.1-42	1789.0	5	0.43
Goose Lake Neck	1	21-Jul-13	0.07	6527.1-22	1890.0	5	0.53
Goose Lake Neck	2	21-Jul-13	0.07	6527.1-23	1269.6	3	0.36
Goose Lake Neck	3	21-Jul-13	0.07	6527.1-24	5375.3	7	0.53
Goose Lake Central	1	21-Jul-13	0.07	6527.1-19	4285.0	6	0.59
Goose Lake Central	2	21-Jul-13	0.07	6527.1-20	3808.9	7	0.58
Goose Lake Central	3	21-Jul-13	0.07	6527.1-21	7964.0	7	0.61
Propeller Lake	1	19-Jul-13	0.07	6527.1-37	2351.7	5	0.36
Propeller Lake	2	19-Jul-13	0.07	6527.1-38	2726.8	7	0.34
Propeller Lake	3	19-Jul-13	0.07	6527.1-39	3751.2	6	0.29
Reference B Lake	1	20-Jul-13	0.07	6527.1-43	4674.5	5	0.44
Reference B Lake	2	20-Jul-13	0.07	6527.1-44	9377.9	4	0.26
Reference B Lake	3	20-Jul-13	0.07	6527.1-45	4039.7	5	0.50
George Lake Central	1	8-Jul-13	0.07	6527.1-10	3967.6	5	0.48
George Lake Central	2	8-Jul-13	0.07	6527.1-11	2539.2	4	0.50
George Lake Central	3	8-Jul-13	0.07	6527.1-12	3058.6	3	0.49
Bob Lake	1	11-Jul-13	0.07	6527.1-1	12768.3	5	0.10
Bob Lake	2	11-Jul-13	0.07	6527.1-2	32086.8	5	0.16
Bob Lake	3	11-Jul-13	0.07	6527.1-3	38919.7	3	0.16
Occurrence Lake	1	9-Jul-13	0.07	6527.1-34	3419.3	5	0.50
Occurrence Lake	2	9-Jul-13	0.07	6527.1-35	10907.2	5	0.31
Occurrence Lake	3	9-Jul-13	0.07	6527.1-36	2164.1	6	0.52
Esker Pond	1	12-Jul-13	0.07	6527.1-7	1875.6	9	0.53
Esker Pond	2	12-Jul-13	0.07	6527.1-8	2568.1	7	0.46
Esker Pond	3	12-Jul-13	0.07	6527.1-9	1356.2	6	0.50
Dragon Lake	1	11-Jul-13	0.07	6527.1-4	3907.8	5	0.47
Dragon Lake	2	11-Jul-13	0.07	6527.1-5	2553.7	5	0.47
Dragon Lake	3	11-Jul-13	0.07	6527.1-6	2918.5	5	0.47
Komatic Lake	1	10-Jul-13	0.07	6527.1-25	4169.6	5	0.53
Komatic Lake	2	10-Jul-13	0.07	6527.1-26	5006.3	6	0.52
Komatic Lake	3	10-Jul-13	0.07	6527.1-27	4443.7	6	0.52
McCoy Lake	1	10-Jul-13	0.07	6527.1-31	1716.9	4	0.49
McCoy Lake	2	10-Jul-13	0.07	6527.1-32	1817.9	6	0.57
McCoy Lake	3	10-Jul-13	0.07	6527.1-33	3347.2	5	0.50
Reference Q Lake	1	9-Jul-13	0.07	6527.1-46	490.5	3	0.35
Reference Q Lake	2	9-Jul-13	0.07	6527.1-47	2928.8	4	0.34
Reference Q Lake	3	9-Jul-13	0.07	6527.1-48	346.3	1	0.00

Notes:

See methods for rationale for excluding some taxa in analysis or graphing.

Diversity and richness analyses excluded individuals not identified to the family level.

Appendix 3.8-3

Lake Benthic Macroinvertebrate QA/QC Results, Back River Project, July 2013

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Appendix 3.8-3. Lake Benthic Macroinvertebrate QA/QC Results, Back River Project, July 2013

EcoANALYSTS, INC.

EcoA Sample ID	Lake Site	Sample ID	Replicate	Collection Date	Sorter	Sort Date	% Subsampled	Primary Matrix	Estimated Pre-Rinse Volume (L)	Estimated Post-Rinse Volume (L)	QC Sorter	QC Date	Estimated % Recovery 1	Estimated % Recovery 2	Estimated % Recovery 3
6527.1-1	Bob Lake	BOBCENT	1	11-Jul-13	Steven Little	10/12/2013	33.33	Vegetation	0.15	0.15	Zach Meier	10/15/2013	96.27	N/A	N/A
6527.1-2	Bob Lake	BOBCENT	2	11-Jul-13	Steven Little	10/14/2013	12.5	Vegetation	0.25	0.17	Zach Meier	10/15/2013	98.12	N/A	N/A
6527.1-3	Bob Lake	BOBCENT	3	11-Jul-13	Steven Little	10/14/2013	10.42	Vegetation	0.22	0.1	Zach Meier	10/15/2013	100	N/A	N/A
6527.1-4	Dragon Lake	DRAGLK	1	11-Jul-13	Steven Little	10/15/2013	87.5	Bugs	0.15	<0.01	Zach Meier	10/15/2013	100	N/A	N/A
6527.1-5	Dragon Lake	DRAGLK	2	11-Jul-13	Tobias Sauer	10/15/2013	100	Fine Organic	0.2	0.03	Ben Alexander	10/16/2013	100	N/A	N/A
6527.1-6	Dragon Lake	DRAGLK	3	11-Jul-13	Steven Little	10/15/2013	87.5	Bugs	0.1	<0.01	Zach Meier	10/15/2013	100	N/A	N/A
6527.1-7	Esker Lake	ESKERLK	1	12-Jul-13	Steven Little	10/15/2013	100	Vegetation	0.1	0.02	Ben Alexander	10/16/2013	100	N/A	N/A
6527.1-8	Esker Lake	ESKERLK	2	12-Jul-13	Steven Little	10/16/2013	100	Vegetation	0.15	0.02	Ben Alexander	10/17/2013	100	N/A	N/A
6527.1-9	Esker Lake	ESKERLK	3	12-Jul-13	Tobias Sauer	10/15/2013	100	Fine Organic	0.15	<0.01	Ben Alexander	10/16/2013	100	N/A	N/A
6527.1-10	George Lake Central	GEORGECENT	1	8-Jul-13	Tobias Sauer	10/16/2013	100	Fine Organic	0.15	<0.01	Ben Alexander	10/17/2013	100	N/A	N/A
6527.1-11	George Lake Central	GEORGECENT	2	8-Jul-13	Tobias Sauer	10/16/2013	100	Inorganic	0.15	<0.01	Ben Alexander	10/17/2013	100	N/A	N/A
6527.1-12	George Lake Central	GEORGECENT	3	8-Jul-13	Steven Little	10/16/2013	100	Bugs	0.05	<0.01	Ben Alexander	10/18/2013	100	N/A	N/A
6527.1-13	Giraffe Lake North	GIRNORTH	1	14-Jul-13	Tobias Sauer	10/16/2013	100	Fine Organic	0.3	<0.01	Ben Alexander	10/18/2013	100	N/A	N/A
6527.1-14	Giraffe Lake North	GIRNORTH	2	14-Jul-13	Steven Little	10/16/2013	100	Bugs	0.22	<0.01	Ben Alexander	10/18/2013	100	N/A	N/A
6527.1-15	Giraffe Lake North	GIRNORTH	3	14-Jul-13	Tobias Sauer	10/16/2013	100	Fine Organic	0.3	<0.01	Ben Alexander	10/18/2013	100	N/A	N/A
6527.1-16	Giraffe Lake South	GIRSOUTH	1	14-Jul-13	Tobias Sauer	10/17/2013	100	Fine Organic	0.75	0.25	Ben Alexander	10/18/2013	93.48	N/A	N/A
6527.1-17	Giraffe Lake South	GIRSOUTH	2	14-Jul-13	Tobias Sauer	10/18/2013	100	Fine Organic	1.5	0.3	Ben Alexander	10/20/2013	100	N/A	N/A
6527.1-18	Giraffe Lake South	GIRSOUTH	3	14-Jul-13	Steven Little	10/18/2013	100	Coarse Organic	0.4	0.05	Ben Alexander	10/20/2013	100	N/A	N/A
6527.1-19	Goose Lake Central	GOOSECENT	1	21-Jul-13	Steven Little	10/18/2013	100	Filamentous Algae	0.2	0.02	Ben Alexander	10/20/2013	100	N/A	N/A
6527.1-20	Goose Lake Central	GOOSECENT	2	21-Jul-13	Steven Little	10/19/2013	100	Filamentous Algae	0.2	0.02	Ben Alexander	10/20/2013	100	N/A	N/A
6527.1-21	Goose Lake Central	GOOSECENT	3	21-Jul-13	Steven Little	10/19/2013	50	Vegetation	0.25	0.02	Ben Alexander	10/20/2013	100	N/A	N/A
6527.1-22	Goose Lake Neck	GOOSENECK	1	21-Jul-13	Steven Little	10/20/2013	100	Inorganic	0.1	0.01	Ben Alexander	10/21/2013	100	N/A	N/A
6527.1-23	Goose Lake Neck	GOOSENECK	2	21-Jul-13	Tobias Sauer	10/21/2013	100	Inorganic	0.35	<0.01	Ben Alexander	10/22/2013	100	N/A	N/A
6527.1-24	Goose Lake Neck	GOOSENECK	3	21-Jul-13	Steven Little	10/20/2013	87.5	Inorganic	0.13	0.02	Ben Alexander	10/21/2013	100	N/A	N/A
6527.1-25	Komatic Lake	KOMALK	1	10-Jul-13	Steven Little	10/22/2013	100	Bugs	0.08	<0.01	Ben Alexander	10/23/2013	100	N/A	N/A
6527.1-26	Komatic Lake	KOMALK	2	10-Jul-13	Tobias Sauer	10/21/2013	100	Inorganic	0.1	<0.01	Ben Alexander	10/22/2013	100	N/A	N/A
6527.1-27	Komatic Lake	KOMALK	3	10-Jul-13	Tobias Sauer	10/22/2013	100	Fine Organic	0.25	0.03	Ben Alexander	10/23/2013	100	N/A	N/A
6527.1-28	Leaf Lake	LEAFLK	1	16-Jul-13	Steven Little	10/22/2013	100	Bugs	0.25	<0.01	Ben Alexander	10/23/2013	100	N/A	N/A
6527.1-29	Leaf Lake	LEAFLK	2	16-Jul-13	Steven Little	10/22/2013	100	Bugs	0.2	<0.01	Ben Alexander	10/23/2013	100	N/A	N/A
6527.1-30	Leaf Lake	LEAFLK	3	16-Jul-13	Tobias Sauer	10/22/2013	100	Inorganic	0.25	<0.01	Ben Alexander	10/23/2013	100	N/A	N/A
6527.1-31	McCoy Lake	MCCOYLK	1	10-Jul-13	Tobias Sauer	10/22/2013	100	Inorganic	0.15	<0.01	Ben Alexander	10/23/2013	100	N/A	N/A
6527.1-32	McCoy Lake	MCCOYLK	2	10-Jul-13	Steven Little	10/22/2013	100	Bugs	0.05	<0.01	Ben Alexander	10/23/2013	100	N/A	N/A
6527.1-33	McCoy Lake	MCCOYLK	3	10-Jul-13	Tobias Sauer	10/22/2013	100	Bugs	0.1	<0.01	Ben Alexander	10/23/2013	100	N/A	N/A
6527.1-34	Occurrence Lake	OCCLK	1	9-Jul-13	Amanda Thompson	10/23/2013	100	Fine Organic	0.15	0.03	Ben Alexander	10/24/2013	100	N/A	N/A
6527.1-35	Occurrence Lake	OCCLK	2	9-Jul-13	Steven Little	10/23/2013	41.67	Vegetation	0.2	0.1	Ben Alexander	10/24/2013	98.21	N/A	N/A
6527.1-36	Occurrence Lake	OCCLK	3	9-Jul-13	Tobias Sauer	10/23/2013	100	Fine Organic	0.15	0.05	Ben Alexander	10/24/2013	100	N/A	N/A
6527.1-37	Propeller Lake	PROLK	1	19-Jul-13	Steven Little	10/23/2013	100	Vegetation	0.15	<0.01	Ben Alexander	10/24/2013	100	N/A	N/A
6527.1-38	Propeller Lake	PROLK	2	19-Jul-13	Tobias Sauer	10/23/2013	100	Fine Organic	1.5	<0.01	Ben Alexander	10/24/2013	100	N/A	N/A
6527.1-39	Propeller Lake	PROLK	3	19-Jul-13	Amanda Thompson	10/23/2013	100	Fine Organic	0.05	0.03	Ben Alexander	10/24/2013	100	N/A	N/A
6527.1-40	Rascal Lake	RASCLK	1	13-Jul-13	Steven Little	10/23/2013	100	Bugs	0.25	<0.01	Ben Alexander	10/24/2013	100	N/A	N/A
6527.1-41	Rascal Lake	RASCLK	2	13-Jul-13	Steven Little	10/23/2013	100	Bugs	0.4	<0.01	Ben Alexander	10/24/2013	100	N/A	N/A
6527.1-42	Rascal Lake	RASCLK	3	13-Jul-13	Amanda Thompson	10/23/2013	100	Inorganic	0.3	0.05	Ben Alexander	10/24/2013	100	N/A	N/A
6527.1-43	Reference B Lake	REFBLK	1	20-Jul-13	Amanda Thompson	10/24/2013	100	Inorganic	0.25	0.03	Ben Alexander	10/25/2013	100	N/A	N/A
6527.1-44	Reference B Lake	REFBLK	2	20-Jul-13	Steven Little	10/23/2013	50	Bugs	0.25	<0.01	Ben Alexander	10/24/2013	100	N/A	N/A
6527.1-45	Reference B Lake	REFBLK	3	20-Jul-13	Steven Little	10/24/2013	100	Bugs	0.15	<0.01	Ben Alexander	10/25/2013	100	N/A	N/A
6527.1-46	Reference Q Lake	REFQLK	1	9-Jul-13	Steven Little	10/24/2013	100	Inorganic	0.15	0.1	Ben Alexander	10/25/2013	100	N/A	N/A
6527.1-47	Reference Q Lake	REFQLK	2	9-Jul-13	Steven Little	10/24/2013	100	Bugs	0.1	<0.01	Ben Alexander	10/25/2013	100	N/A	N/A
6527.1-48	Reference Q Lake	REFQLK	3	9-Jul-13	Steven Little	10/24/2013	100	Inorganic	0.1	0.01	Ben Alexander	10/25/2013	100	N/A	N/A
6527.1-49	Umwelt Lake	UMWLK	1	15-Jul-13	Steven Little	10/24/2013	100	Bugs	0.6	<0.01	Ben Alexander	10/25/2013	100	N/A	N/A
6527.1-50	Umwelt Lake	UMWLK	2	15-Jul-13	Tobias Sauer	10/24/2013	100	Inorganic	0.6	<0.01	Ben Alexander	10/25/2013	100	N/A	N/A
6527.1-51	Umwelt Lake	UMWLK	3	15-Jul-13	Steven Little	10/24/2013	100	Inorganic	0.9	0.03	Ben Alexander	10/25/2013	100	N/A	N/A
6527.1-52	Wasp Lake	WASPLK	1	16-Jul-13	Tobias Sauer	10/24/2013	100	Inorganic	0.25	0.15	Ben Alexander	10/25/2013	100	N/A	N/A
6527.1-53	Wasp Lake	WASPLK	2	16-Jul-13	Steven Little	10/24/2013	100	Inorganic	0.17	<0.01	Ben Alexander	10/25/2013	100	N/A	N/A
6527.1-54	Wasp Lake	WASPLK	3	16-Jul-13	Steven Little	10/24/2013	100	Inorganic	0.25	<0.01	Ben Alexander	10/25/2013	100	N/A	N/A

Appendix 3.8-4

Stream Benthic Macroinvertebrate Density and Taxonomic Results, Back River Project, July 2013

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Appendix 3.8-4. Stream Benthic Macroinvertebrate Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.

Data in organisms/m^2

Taxonomic Classification:

										Wasp Outflow	Wasp Outflow	Wasp Outflow	Giraffe Inflow	Giraffe Inflow	Giraffe Inflow	Giraffe Outflow	Giraffe Outflow	Giraffe Outflow
								Stream Site		Wasp Outflow	Wasp Outflow	Wasp Outflow	Giraffe Inflow	Giraffe Inflow	Giraffe Inflow	Giraffe Outflow	Giraffe Outflow	Giraffe Outflow
								Replicate		1	2	3	1	2	3	1	2	3
								Date Sampled		26-Jul-13	26-Jul-13	26-Jul-13	28-Jul-13	28-Jul-13	28-Jul-13	28-Jul-13	28-Jul-13	28-Jul-13
								Surface Area Sampled (m^2)		0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886
								EcoAnalysts Sample ID		6527.4-13	6527.4-14	6527.4-15	6527.4-31	6527.4-32	6527.4-33	6527.4-28	6527.4-29	6527.4-30
Phylum	**Class**	**Order**	**Family**	**Sub-Family**	**Tribe**	***Genus***	**Species**	**Final Designation**	**Excluded in Analysis[a]**									
Annelida	Clitellata	Enchytraeida	Enchytraeidae					Enchytraeidae			16.6		3.5		3.5			
		Lumbriculida	Lumbriculidae					Lumbriculidae		55.4		3.5	3.5	83.2	45.0	38.1		6.9
		Tubificida	Naididae			*Nais*	sp.	*Nais* sp.		5.5	27.7	3.5						
						Paranais	*grandis*	*Paranais grandis*										
						Uncinais	*uncinata*	*Uncinais uncinata*										
			Tubificidae			*Rhyacodrilus*	sp.	*Rhyacodrilus* sp.		5.5								
								Tubificidae w/ cap setae sp.		16.6				3.5				
Arthropoda	Arachnida							Acari										
								Oribatei				3.5						
		Trombidiformes	Hygrobatidae			*Hygrobates*	sp.	*Hygrobates* sp.										
			Lebertiidae			*Lebertia*	sp.	*Lebertia* sp.		38.8	11.1	6.9	3.5	3.5	3.5	10.4	6.9	34.6
			Pionidae					Pionidae							6.9			
			Sperchontidae			*Sperchon*	sp.	*Sperchon* sp.		5.5		6.9			6.9			
	Branchiopoda	Diplostraca						Cladocera	Excluded	33.3								
			Chydoridae					Chydoridae	Excluded					62.4				
	Insecta	Coleoptera	Dytiscidae	Colymbetinae		*Agabus*	sp.	*Agabus* sp.							3.5			
				Hydroporinae				Hydroporinae		16.6				10.4	3.5			
						Hydroporus	sp.	*Hydroporus* sp.							3.5			
						Oreodytes	sp.	*Oreodytes* sp.								3.5		
			Haliplidae			*Haliplus*	sp.	*Haliplus* sp.										
		Collembola						Collembola	Excluded									
		Diptera						Diptera	Excluded (terrestrial)			3.5						
			Ceratopogonidae	Ceratopogoninae				Ceratopogoninae										
						Bezzia/Palpomyia	sp.	*Bezzia/Palpomyia* sp.								3.5		
				Dasyheleinae		*Dasyhelea*	sp.	*Dasyhelea* sp.										
			Chironomidae	Chironominae	Chironomini			Chironomini										
						Chironomus	sp.	*Chironomus* sp.										
						Cryptochironomus	sp.	*Cryptochironomus* sp.										3.5
						Demicryptochironomus	sp.	*Demicryptochironomus* sp.								3.5		3.5
						Dicrotendipes	*fumidus*	*Dicrotendipes fumidus*		94.2		3.5				412.3	34.6	27.7
							sp.	*Dicrotendipes* sp.										
						Parachironomus	sp.	*Parachironomus* sp.										
						Paratendipes	sp.	*Paratendipes* sp.										
						Polypedilum	*halterale* gr.	*Polypedilum halterale* gr.										
							scalaenum gr.	*Polypedilum scalaenum* gr.										
							sordens	*Polypedilum sordens*		5.5								
						Saetheria	*tylus*	*Saetheria tylus*										
						Sergentia	sp.	*Sergentia* sp.										
						Stictochironomus	sp.	*Stictochironomus* sp.		22.2				3.5		3.5	6.9	20.8
					Pseudochironomini	*Pseudochironomus*	sp.	*Pseudochironomus* sp.										
					Tanytarsini			Tanytarsini		11.1		3.5				3.5		3.5
						Cladotanytarsus	sp.	*Cladotanytarsus* sp.		5.5	16.6							
						Constempellina	sp.	*Constempellina* sp.			5.5							
						Micropsectra	sp.	*Micropsectra* sp.		22.2	88.7	10.4						
						Paratanytarsus	sp.	*Paratanytarsus* sp.		371.4	144.1	52.0			6.9	10.4		3.5
						Rheotanytarsus	*exiguus* gr.	*Rheotanytarsus exiguus* gr.										
						Stempellinella	sp.	*Stempellinella* sp.										
						Tanytarsus	sp.	*Tanytarsus* sp.		33.3	127.5	17.3		3.5	10.4			
				Diamesinae	Diamesini	*Potthastia*	*longimana* gr.	*Potthastia longimana* gr.										
						Pseudokiefferiella	sp.	*Pseudokiefferiella* sp.		5.5	609.8	52.0			17.3			
				Orthocladiinae				Orthocladiinae							3.5			
						Acricotopus	sp.	*Acricotopus* sp.										

Note:

[a] Excluded refers to taxa not included in analysis or graphing. See methods for rationale.

Appendix 3.8-4. Stream Benthic Macroinvertebrate Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.

Data in organisms/m^2

Taxonomic Classification:

Phylum	Class	Order	Family	Sub-Family	Tribe	Genus	Species	Final Designation	Umwelt Outflow	Umwelt Outflow	Umwelt Outflow	Goose Outflow	Goose Outflow	Goose Outflow	Propeller Outflow	Propeller Outflow	Propeller Outflow	Reference B Outflow
Stream Site									Umwelt Outflow	Umwelt Outflow	Umwelt Outflow	Goose Outflow	Goose Outflow	Goose Outflow	Propeller Outflow	Propeller Outflow	Propeller Outflow	Reference B Outflow
Replicate									1	2	3	1	2	3	1	2	3	1
Date Sampled									28-Jul-13	28-Jul-13	28-Jul-13	24-Jul-13	24-Jul-13	24-Jul-13	26-Jul-13	26-Jul-13	26-Jul-13	26-Jul-13
Surface Area Sampled (m^2)									0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886
EcoAnalysts Sample ID									6527.4-34	6527.4-35	6527.4-36	6527.4-1	6527.4-2	6527.4-3	6527.4-16	6527.4-17	6527.4-18	6527.4-10
Annelida	Clitellata	Enchytraeida	Enchytraeidae					Enchytraeidae	20.8		6.9							
		Lumbriculida	Lumbriculidae					Lumbriculidae	55.4	110.9	24.3	55.4	13.9	18.5				14.9
		Tubificida	Naididae			*Nais*	sp.	*Nais* sp.	3.5	3.5	13.9	199.6	27.7	240.2	10.4	17.3	24.3	
						Paranais	*grandis*	*Paranais grandis*				11.1		18.5				
						Uncinais	*uncinata*	*Uncinais uncinata*										
			Tubificidae			*Rhyacodrilus*	sp.	*Rhyacodrilus* sp.										
								Tubificidae w/ cap setae sp.		6.9								
Arthropoda	Arachnida							Acari									6.9	
								Oribatei										
		Trombidiformes	Hygrobatidae			*Hygrobates*	sp.	*Hygrobates* sp.										
			Lebertiidae			*Lebertia*	sp.	*Lebertia* sp.	6.9	3.5	10.4		3.5	46.2	3.5		6.9	
			Pionidae					Pionidae								10.4		
			Sperchontidae			*Sperchon*	sp.	*Sperchon* sp.				166.3	17.3	18.5	17.3		34.6	
	Branchiopoda	Diplostraca						Cladocera										5.0
			Chydoridae					Chydoridae										
	Insecta	Coleoptera	Dytiscidae	Colymbetinae		*Agabus*	sp.	*Agabus* sp.										
				Hydroporinae				Hydroporinae										
						Hydroporus	sp.	*Hydroporus* sp.										
						Oreodytes	sp.	*Oreodytes* sp.							38.1	24.3	55.4	
			Haliplidae			*Haliplus*	sp.	*Haliplus* sp.										
		Collembola						Collembola										5.0
		Diptera						Diptera										
			Ceratopogonidae	Ceratopogoninae				Ceratopogoninae										
						Bezzia/Palpomyia	sp.	*Bezzia/Palpomyia* sp.	55.4	103.9	10.4							5.0
				Dasyheleinae		*Dasyhelea*	sp.	*Dasyhelea* sp.	6.9	10.4	10.4							
			Chironomidae	Chironominae	Chironomini			Chironomini									3.5	5.0
						Chironomus	sp.	*Chironomus* sp.										5.0
						Cryptochironomus	sp.	*Cryptochironomus* sp.		3.5								
						Demicryptochironomus	sp.	*Demicryptochironomus* sp.	3.5	3.5	3.5			9.2				
						Dicrotendipes	*fumidus*	*Dicrotendipes fumidus*			3.5		6.9	27.7	13.9	72.8	65.8	
							sp.	*Dicrotendipes* sp.										
						Parachironomus	sp.	*Parachironomus* sp.				44.3	6.9	9.2				
						Paratendipes	sp.	*Paratendipes* sp.										
						Polypedilum	*halterale* gr.	*Polypedilum halterale* gr.										
							scalaenum gr.	*Polypedilum scalaenum* gr.		10.4								
							sordens	*Polypedilum sordens*										9.9
						Saetheria	*tylus*	*Saetheria tylus*										
						Sergentia	sp.	*Sergentia* sp.										
						Stictochironomus	sp.	*Stictochironomus* sp.		13.9	41.6	11.1						9.9
					Pseudochironomini	*Pseudochironomus*	sp.	*Pseudochironomus* sp.		3.5	6.9							
					Tanytarsini			Tanytarsini	17.3	13.9		22.2				3.5	3.5	407.1
						Cladotanytarsus	sp.	*Cladotanytarsus* sp.			3.5							5.0
						Constempellina	sp.	*Constempellina* sp.										
						Micropsectra	sp.	*Micropsectra* sp.										
						Paratanytarsus	sp.	*Paratanytarsus* sp.	13.9	13.9	17.3	166.3	24.3	203.3	69.3	401.9	526.6	44.7
						Rheotanytarsus	*exiguus* gr.	*Rheotanytarsus exiguus* gr.						46.2	27.7		27.7	
						Stempellinella	sp.	*Stempellinella* sp.				22.2						
						Tanytarsus	sp.	*Tanytarsus* sp.		13.9	38.1		17.3	157.1				273.0
				Diamesinae	Diamesini	*Potthastia*	*longimana* gr.	*Potthastia longimana* gr.										
						Pseudokiefferiella	sp.	*Pseudokiefferiella* sp.	3.5								6.9	
				Orthocladiinae				Orthocladiinae						27.7				
						Acricotopus	sp.	*Acricotopus* sp.										

Note:

" Excluded refers to taxa not included in analysis or graphing. See methods for rationale.

Appendix 3.8-4. Stream Benthic Macroinvertebrate Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.

Data in organisms/m^2

Taxonomic Classification:

								Stream Site	Reference B Outflow	Reference B Outflow	George Outflow	George Outflow	George Outflow	Lytle Outflow	Lytle Outflow	Lytle Outflow	Sleigh Outflow	Sleigh Outflow
								Replicate	2	3	1	2	3	1	2	3	1	2
								Date Sampled	26-Jul-13	26-Jul-13	27-Jul-13	27-Jul-13	25-Jul-13	27-Jul-13	27-Jul-13	27-Jul-13	27-Jul-13	27-Jul-13
								Surface Area Sampled (m^2)	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886
								EcoAnalysts Sample ID	6527.4-11	6527.4-12	6527.4-7	6527.4-8	6527.4-9	6527.4-25	6527.4-26	6527.4-27	6527.4-22	6527.4-23
Phylum	**Class**	**Order**	**Family**	**Sub-Family**	**Tribe**	***Genus***	**Species**	**Final Designation**										
Annelida	Clitellata	Enchytraeida	Enchytraeidae					Enchytraeidae				13.9	58.9	16.6	3.5		32.3	
		Lumbriculida	Lumbriculidae					Lumbriculidae	60.3	41.6		3.5	52.0	282.7	10.4	322.2		
		Tubificida	Naididae			*Nais*	sp.	*Nais* sp.									4.6	
						Paranais	*grandis*	*Paranais grandis*										
						Uncinais	*uncinata*	*Uncinais uncinata*						33.3				
			Tubificidae			*Rhyacodrilus*	sp.	*Rhyacodrilus* sp.										
								Tubificidae w/ cap setae sp.					3.5	149.7	3.5	31.2		
Arthropoda	Arachnida							Acari				3.5						
								Oribatei										
		Trombidiformes	Hygrobatidae			*Hygrobates*	sp.	*Hygrobates* sp.										
			Lebertiidae			*Lebertia*	sp.	*Lebertia* sp.		3.5	3.5	3.5	3.5			31.2	4.6	13.9
			Pionidae					Pionidae										
			Sperchontidae			*Sperchon*	sp.	*Sperchon* sp.				10.4				10.4	78.5	86.6
	Branchiopoda	Diplostraca						Cladocera										
			Chydoridae					Chydoridae										
	Insecta	Coleoptera	Dytiscidae	Colymbetinae		*Agabus*	sp.	*Agabus* sp.						33.3				
				Hydroporinae				Hydroporinae		3.5								
						Hydroporus	sp.	*Hydroporus* sp.						16.6				
						Oreodytes	sp.	*Oreodytes* sp.										
			Haliplidae			*Haliplus*	sp.	*Haliplus* sp.										
		Collembola						Collembola										
		Diptera						Diptera										
			Ceratopogonidae	Ceratopogoninae				Ceratopogoninae								10.4		
						Bezzia/Palpomyia	sp.	*Bezzia/Palpomyia* sp.	15.1	48.5	3.5	6.9	3.5	16.6	6.9	52.0		
				Dasyheleinae		*Dasyhelea*	sp.	*Dasyhelea* sp.										
			Chironomidae	Chironominae	Chironomini			Chironomini										
						Chironomus	sp.	*Chironomus* sp.	30.1	3.5								
						Cryptochironomus	sp.	*Cryptochironomus* sp.					17.3					
						Demicryptochironomus	sp.	*Demicryptochironomus* sp.				10.4	10.4			10.4		
						Dicrotendipes	*fumidus*	*Dicrotendipes fumidus*	30.1			17.3	10.4		6.9	10.4		
							sp.	*Dicrotendipes* sp.		3.5								
						Parachironomus	sp.	*Parachironomus* sp.										
						Paratendipes	sp.	*Paratendipes* sp.	15.1	6.9								
						Polypedilum	*halterale* gr.	*Polypedilum halterale* gr.									4.6	
							scalaenum gr.	*Polypedilum scalaenum* gr.									27.7	
							sordens	*Polypedilum sordens*	45.2	17.3								
						Saetheria	*tylus*	*Saetheria tylus*									13.9	10.4
						Sergentia	sp.	*Sergentia* sp.										
						Stictochironomus	sp.	*Stictochironomus* sp.		17.3		10.4	10.4	781.6	3.5	239.1		
					Pseudochironomini	*Pseudochironomus*	sp.	*Pseudochironomus* sp.	30.1									
					Tanytarsini			Tanytarsini	632.9	259.8		13.9	45.0	382.5		10.4		
						Cladotanytarsus	sp.	*Cladotanytarsus* sp.				6.9		49.9		31.2		
						Constempellina	sp.	*Constempellina* sp.										
						Micropsectra	sp.	*Micropsectra* sp.										
						Paratanytarsus	sp.	*Paratanytarsus* sp.	90.4	24.3	69.3	38.1	27.7	2112.0	52.0	1559.1	13.9	
						Rheotanytarsus	*exiguus* gr.	*Rheotanytarsus exiguus* gr.										
						Stempellinella	sp.	*Stempellinella* sp.						16.6				
						Tanytarsus	sp.	*Tanytarsus* sp.	1868.6	17.3			3.5	1031.1		519.7	4.6	
				Diamesinae	Diamesini	*Potthastia*	*longimana* gr.	*Potthastia longimana* gr.			3.5	3.5	3.5					3.5
						Pseudokiefferiella	sp.	*Pseudokiefferiella* sp.										3.5
				Orthocladiinae				Orthocladiinae										
						Acricotopus	sp.	*Acricotopus* sp.								10.4		

Note:
" Excluded refers to taxa not included in analysis or graphing. See methods for rationale.

Appendix 3.8-4. Stream Benthic Macroinvertebrate Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.

Data in organisms/m^2

Taxonomic Classification:

								Stream Site	Sleigh Outflow	Komatic IF	Komatic IF	Komatic IF	Reference Q Outflow	Reference Q Outflow	Reference Q Outflow
								Replicate	3	1	2	3	1	2	3
								Date Sampled	27-Jul-13	27-Jul-13	27-Jul-13	27-Jul-13	25-Jul-13	25-Jul-13	25-Jul-13
								Surface Area Sampled (m^2)	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886
								EcoAnalysts Sample ID	6527.4-24	6527.4-19	6527.4-20	6527.4-21	6527.4-4	6527.4-5	6527.4-6
Phylum	**Class**	**Order**	**Family**	**Sub-Family**	**Tribe**	***Genus***	**Species**	**Final Designation**							
Annelida	Clitellata	Enchytraeida	Enchytraeidae					Enchytraeidae	52.0						
		Lumbriculida	Lumbriculidae					Lumbriculidae		32.3	3.5	31.2	3.5	27.7	10.4
		Tubificida	Naididae			*Nais*	sp.	*Nais* sp.							
						Paranais	*grandis*	*Paranais grandis*							
						Uncinais	*uncinata*	*Uncinais uncinata*							
			Tubificidae			*Rhyacodrilus*	sp.	*Rhyacodrilus* sp.							
								Tubificidae w/ cap setae sp.						6.9	3.5
Arthropoda	Arachnida							Acari					3.5	13.9	
								Oribatei							
		Trombidiformes	Hygrobatidae			*Hygrobates*	sp.	*Hygrobates* sp.		4.6	6.9				
			Lebertiidae			*Lebertia*	sp.	*Lebertia* sp.	10.4	55.4	34.6	41.6	3.5	6.9	6.9
			Pionidae					Pionidae							
			Sperchontidae			*Sperchon*	sp.	*Sperchon* sp.	34.6						
	Branchiopoda	Diplostraca						Cladocera		4.6				48.5	
			Chydoridae					Chydoridae							
	Insecta	Coleoptera	Dytiscidae	Colymbetinae		*Agabus*	sp.	*Agabus* sp.							3.5
				Hydroporinae				Hydroporinae			3.5				
						Hydroporus	sp.	*Hydroporus* sp.							
						Oreodytes	sp.	*Oreodytes* sp.		9.2		10.4	3.5		
			Haliplidae			*Haliplus*	sp.	*Haliplus* sp.		13.9					
		Collembola						Collembola							
		Diptera						Diptera							
			Ceratopogonidae	Ceratopogoninae				Ceratopogoninae							
						Bezzia/Palpomyia	sp.	*Bezzia/Palpomyia* sp.	3.5					13.9	3.5
				Dasyheleinae		*Dasyhelea*	sp.	*Dasyhelea* sp.							
			Chironomidae	Chironominae	Chironomini			Chironomini				26.0			
						Chironomus	sp.	*Chironomus* sp.							
						Cryptochironomus	sp.	*Cryptochironomus* sp.							
						Demicryptochironomus	sp.	*Demicryptochironomus* sp.		18.5		10.4	3.5	6.9	
						Dicrotendipes	*fumidus*	*Dicrotendipes fumidus*					17.3	27.7	34.6
							sp.	*Dicrotendipes* sp.							
						Parachironomus	sp.	*Parachironomus* sp.							
						Paratendipes	sp.	*Paratendipes* sp.							
						Polypedilum	*halterale* gr.	*Polypedilum halterale* gr.							
							scalaenum gr.	*Polypedilum scalaenum* gr.		235.6	242.5	644.4		6.9	6.9
							sordens	*Polypedilum sordens*							
						Saetheria	*tylus*	*Saetheria tylus*	17.3	231.0	34.6	446.9			
						Sergentia	sp.	*Sergentia* sp.		115.5	3.5	36.4			
						Stictochironomus	sp.	*Stictochironomus* sp.		9.2				13.9	24.3
					Pseudochironomini	*Pseudochironomus*	sp.	*Pseudochironomus* sp.							
					Tanytarsini			Tanytarsini		9.2				27.7	13.9
						Cladotanytarsus	sp.	*Cladotanytarsus* sp.		13.9		5.2		145.5	124.7
						Constempellina	sp.	*Constempellina* sp.		23.1					
						Micropsectra	sp.	*Micropsectra* sp.							6.9
						Paratanytarsus	sp.	*Paratanytarsus* sp.	6.9					103.9	58.9
						Rheotanytarsus	*exiguus* gr.	*Rheotanytarsus exiguus* gr.							
						Stempellinella	sp.	*Stempellinella* sp.							
						Tanytarsus	sp.	*Tanytarsus* sp.						145.5	58.9
				Diamesinae	Diamesini	*Potthastia*	*longimana* gr.	*Potthastia longimana* gr.		9.2		5.2			
						Pseudokiefferiella	sp.	*Pseudokiefferiella* sp.							
				Orthocladiinae				Orthocladiinae		60.1				6.9	
						Acricotopus	sp.	*Acricotopus* sp.							

Note:
" Excluded refers to taxa not included in analysis or graphing. See methods for rationale.

Appendix 3.8-4. Stream Benthic Macroinvertebrate Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.

Data in organisms/m^2

Taxonomic Classification:

								Stream Site		Wasp Outflow	Wasp Outflow	Wasp Outflow	Giraffe Inflow	Giraffe Inflow	Giraffe Inflow	Giraffe Outflow	Giraffe Outflow	Giraffe Outflow
								Replicate		1	2	3	1	2	3	1	2	3
								Date Sampled		26-Jul-13	26-Jul-13	26-Jul-13	28-Jul-13	28-Jul-13	28-Jul-13	28-Jul-13	28-Jul-13	28-Jul-13
								Surface Area Sampled (m^2)		0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886
								EcoAnalysts Sample ID		6527.4-13	6527.4-14	6527.4-15	6527.4-31	6527.4-32	6527.4-33	6527.4-28	6527.4-29	6527.4-30
Phylum	Class	Order	Family	Sub-Family	Tribe	*Genus*	Species	Final Designation	Excluded in Analysis[a]									
						Corynoneura	sp.	*Corynoneura* sp.		22.2	27.7	17.3						
						Cricotopus	*bicinctus* gr.	*Cricotopus bicinctus* gr.		5.5								
							sp.	*Cricotopus* sp.		205.1	110.9	173.2			17.3		3.5	
						Doncricotopus	sp.	*Doncricotopus* sp.										
						Euryhapsis	sp.	*Euryhapsis* sp.								6.9		
						Heterotanytarsus	sp.	*Heterotanytarsus* sp.		44.3	122.0	3.5						
						Heterotrissocladius	*marcidus* gr.	*Heterotrissocladius marcidus* gr.										
						Hydrobaenus	sp.	*Hydrobaenus* sp.										
						Limnophyes	sp.	*Limnophyes* sp.										
						Orthocladius	sp.	*Orthocladius* sp.							17.3	3.5		
								Orthocladius Complex							3.5			
						Parakiefferiella	sp.	*Parakiefferiella* sp.										
						Parametriocnemus	sp.	*Parametriocnemus* sp.										
						Psectrocladius	sp.	*Psectrocladius* sp.		5.5		3.5	343.0	86.6	17.3			
						Pseudosmittia	sp.	*Pseudosmittia* sp.		72.1		3.5			34.6	31.2	3.5	
						Tokunagaia	sp.	*Tokunagaia* sp.		5.5	72.1	10.4						
						Tvetenia	*bavarica* gr.	*Tvetenia bavarica* gr.			210.6	103.9			3.5			
				Podonominae	Boreochlini	*Trichotanypus*	sp.	*Trichotanypus* sp.							6.9			
				Tanypodinae	Pentaneurini	*Ablabesmyia*	sp.	*Ablabesmyia* (Karelia) sp.										
						Thienemannimyia gr.	sp.	*Thienemannimyia* gr. sp.		182.9	88.7	55.4	3.5	17.3	97.0	38.1		83.2
					Procladiini	*Procladius*	sp.	*Procladius* sp.		11.1			3.5	45.0	3.5			34.6
			Empididae					Empididae									3.5	
						Clinocera	sp.	*Clinocera* sp.		11.1								
						Trichoclinocera	sp.	*Trichoclinocera* sp.		38.8	11.1	13.9		3.5	45.0	38.1		
			Muscidae					Muscidae							6.9			34.6
			Simuliidae					Simuliidae	Excluded (terrestrial)									
								Simuliidae				3.5						
						Simulium	sp.	*Simulium* sp.			55.4	97.0						
			Tipulidae					Tipulidae										
						Pilaria	sp.	*Pilaria* sp.										
						Tipula	sp.	*Tipula* sp.		49.9	33.3	6.9				20.8	3.5	38.1
		Ephemeroptera	Baetidae			*Baetis*	*bundyae*	*Baetis bundyae*			27.7							
							sp.	*Baetis* sp.		49.9	55.4	62.4						
			Ephemerellidae			*Ephemerella*	sp.	*Ephemerella* sp.			33.3							
			Metretopodidae					Metretopodidae								3.5		
						Metretopus	sp.	*Metretopus* sp.			11.1							
		Hemiptera						Hemiptera	Excluded (terrestrial)									
		Plecoptera	Nemouridae					Nemouridae						3.5				3.5
						Nemoura	sp.	*Nemoura* sp.		55.4	16.6	103.9		3.5	6.9	3.5		
			Perlodidae					Perlodidae										
		Trichoptera						Trichoptera										
			Brachycentridae			*Brachycentrus*	*americanus*	*Brachycentrus americanus*										
			Hydroptilidae			*Agraylea*	sp.	*Agraylea* sp.										
						Oxyethira	sp.	*Oxyethira* sp.		5.5		3.5						
			Leptoceridae			*Ceraclea*	sp.	*Ceraclea* sp.										
						Mystacides	sp.	*Mystacides* sp.								3.5		6.9
			Limnephilidae					Limnephilidae										
						Asynarchus	sp.	*Asynarchus* sp.		5.5								
			Phryganeidae					Phryganeidae										
						Agrypnia	sp.	*Agrypnia* sp.										
			Rhyacophilidae			*Rhyacophila*	*mongolica*	*Rhyacophila mongolica*								3.5		
							sp.	*Rhyacophila* sp.				3.5						

Note:
[a] Excluded refers to taxa not included in analysis or graphing. See methods for rationale.

Appendix 3.8-4. Stream Benthic Macroinvertebrate Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.

Data in organisms/m^2

Taxonomic Classification:									Stream Site	Umwelt Outflow	Umwelt Outflow	Umwelt Outflow	Goose Outflow	Goose Outflow	Goose Outflow	Propeller Outflow	Propeller Outflow	Propeller Outflow	Reference B Outflow
									Replicate	1	2	3	1	2	3	1	2	3	1
									Date Sampled	28-Jul-13	28-Jul-13	28-Jul-13	24-Jul-13	24-Jul-13	24-Jul-13	26-Jul-13	26-Jul-13	26-Jul-13	26-Jul-13
									Surface Area Sampled (m^2)	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886
									EcoAnalysts Sample ID	6527.4-34	6527.4-35	6527.4-36	6527.4-1	6527.4-2	6527.4-3	6527.4-16	6527.4-17	6527.4-18	6527.4-10
Phylum	Class	Order	Family	Sub-Family	Tribe	*Genus*	Species	Final Designation											
						Corynoneura	sp.	*Corynoneura* sp.			10.4				27.7	3.5	10.4	10.4	
						Cricotopus	*bicinctus* gr.	*Cricotopus bicinctus* gr.				44.3	10.4	83.2				48.5	
							sp.	*Cricotopus* sp.	13.9		3.5	144.1	10.4	92.4	86.6	10.4	90.1	
						Doncricotopus	sp.	*Doncricotopus* sp.				66.5		46.2			6.9	
						Euryhapsis	sp.	*Euryhapsis* sp.				22.2	48.5	37.0				
						Heterotanytarsus	sp.	*Heterotanytarsus* sp.								3.5		5.0
						Heterotrissocladius	*marcidus* gr.	*Heterotrissocladius marcidus* gr.										
						Hydrobaenus	sp.	*Hydrobaenus* sp.				11.1		9.2				
						Limnophyes	sp.	*Limnophyes* sp.										
						Orthocladius	sp.	*Orthocladius* sp.				122.0	20.8	120.1		58.9	62.4	
								Orthocladius Complex					3.5					
						Parakiefferiella	sp.	*Parakiefferiella* sp.	3.5	13.9								9.9
						Parametriocnemus	sp.	*Parametriocnemus* sp.				11.1		46.2				
						Psectrocladius	sp.	*Psectrocladius* sp.		3.5	17.3					10.4		163.8
						Pseudosmittia	sp.	*Pseudosmittia* sp.	3.5		10.4							
						Tokunagaia	sp.	*Tokunagaia* sp.							6.9		3.5	
						Tvetenia	*bavarica* gr.	*Tvetenia bavarica* gr.					3.5	73.9	6.9		13.9	
				Podonominae	Boreochlini	*Trichotanypus*	sp.	*Trichotanypus* sp.										
				Tanypodinae	Pentaneurini	*Ablabesmyia*	sp.	*Ablabesmyia* (Karelia) sp.										
						Thienemannimyia gr.	sp.	*Thienemannimyia* gr. sp.	34.6	34.6	38.1	155.2	93.5	138.6	10.4		24.3	5.0
					Procladiini	*Procladius*	sp.	*Procladius* sp.	20.8	86.6	10.4						3.5	397.1
			Empididae					Empididae	3.5									
						Clinocera	sp.	*Clinocera* sp.										
						Trichoclinocera	sp.	*Trichoclinocera* sp.	6.9	6.9	3.5			9.2				5.0
			Muscidae					Muscidae		6.9								
			Simuliidae					Simuliidae				11.1		18.5				44.7
								Simuliidae							3.5			
						Simulium	sp.	*Simulium* sp.										
			Tipulidae					Tipulidae	10.4	13.9	13.9					3.5		
						Pilaria	sp.	*Pilaria* sp.			6.9							
						Tipula	sp.	*Tipula* sp.	3.5	10.4	6.9	155.2		46.2			3.5	
		Ephemeroptera	Baetidae			*Baetis*	*bundyae*	*Baetis bundyae*										
							sp.	*Baetis* sp.			6.9		6.9	64.7	52.0		20.8	
			Ephemerellidae			*Ephemerella*	sp.	*Ephemerella* sp.				44.3	34.6	277.2	27.7		10.4	
			Metretopodidae					Metretopodidae	3.5									
						Metretopus	sp.	*Metretopus* sp.			10.4							
		Hemiptera						Hemiptera										9.9
		Plecoptera	Nemouridae					Nemouridae	3.5									
						Nemoura	sp.	*Nemoura* sp.	10.4		27.7	709.5	97.0	388.0	3.5	3.5	3.5	
			Perlodidae					Perlodidae					6.9		3.5			
		Trichoptera						Trichoptera			3.5			9.2				
			Brachycentridae			*Brachycentrus*	*americanus*	*Brachycentrus americanus*							194.0		103.9	
			Hydroptilidae			*Agraylea*	sp.	*Agraylea* sp.								13.9	10.4	
						Oxyethira	sp.	*Oxyethira* sp.										
			Leptoceridae			*Ceraclea*	sp.	*Ceraclea* sp.										
						Mystacides	sp.	*Mystacides* sp.		3.5								
			Limnephilidae					Limnephilidae										
						Asynarchus	sp.	*Asynarchus* sp.										
			Phryganeidae					Phryganeidae										
						Agrypnia	sp.	*Agrypnia* sp.		3.5								9.9
			Rhyacophilidae			*Rhyacophila*	*mongolica*	*Rhyacophila mongolica*						9.2				
							sp.	*Rhyacophila* sp.										

Note:
" Excluded refers to taxa not included in analysis or graphing. See methods for rationale.

Appendix 3.8-4. Stream Benthic Macroinvertebrate Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.

Data in organisms/m^2

Taxonomic Classification:

								Stream Site	Reference B Outflow	Reference B Outflow	George Outflow	George Outflow	George Outflow	Lytle Outflow	Lytle Outflow	Lytle Outflow	Sleigh Outflow	Sleigh Outflow
								Replicate	2	3	1	2	3	1	2	3	1	2
								Date Sampled	26-Jul-13	26-Jul-13	27-Jul-13	27-Jul-13	25-Jul-13	27-Jul-13	27-Jul-13	27-Jul-13	27-Jul-13	27-Jul-13
								Surface Area Sampled (m^2)	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886
								EcoAnalysts Sample ID	6527.4-11	6527.4-12	6527.4-7	6527.4-8	6527.4-9	6527.4-25	6527.4-26	6527.4-27	6527.4-22	6527.4-23
Phylum	Class	Order	Family	Sub-Family	Tribe	*Genus*	Species	Final Designation										
						Corynoneura	sp.	*Corynoneura* sp.	15.1		13.9	6.9		33.3		20.8	4.6	
						Cricotopus	*bicinctus* gr.	*Cricotopus bicinctus* gr.										
							sp.	*Cricotopus* sp.	15.1		13.9	24.3	6.9	33.3	10.4	145.5	4.6	
						Doncricotopus	sp.	*Doncricotopus* sp.				6.9				10.4		
						Euryhapsis	sp.	*Euryhapsis* sp.			6.9	6.9			20.8	72.8	480.4	498.9
						Heterotanytarsus	sp.	*Heterotanytarsus* sp.						16.6		31.2		
						Heterotrissocladius	*marcidus* gr.	*Heterotrissocladius marcidus* gr.										
						Hydrobaenus	sp.	*Hydrobaenus* sp.										
						Limnophyes	sp.	*Limnophyes* sp.										
						Orthocladius	sp.	*Orthocladius* sp.			6.9							
								Orthocladius Complex									4.6	
						Parakiefferiella	sp.	*Parakiefferiella* sp.	60.3	6.9		3.5		49.9	3.5	20.8		
						Parametriocnemus	sp.	*Parametriocnemus* sp.					3.5					
						Psectrocladius	sp.	*Psectrocladius* sp.	889.1	45.0			3.5	99.8	3.5	31.2		
						Pseudosmittia	sp.	*Pseudosmittia* sp.			3.5				3.5	41.6		
						Tokunagaia	sp.	*Tokunagaia* sp.									18.5	
						Tvetenia	*bavarica* gr.	*Tvetenia bavarica* gr.			6.9	62.4					9.2	
				Podonominae	Boreochlini	*Trichotanypus*	sp.	*Trichotanypus* sp.										
				Tanypodinae	Pentaneurini	*Ablabesmyia*	sp.	*Ablabesmyia* (Karelia) sp.							6.9	41.6		
						Thienemannimyia gr.	sp.	*Thienemannimyia* gr. sp.	30.1	17.3	121.3	242.5	103.9	99.8	17.3	103.9	129.3	58.9
					Procladiini	*Procladius*	sp.	*Procladius* sp.	1039.8	304.9		17.3	10.4	532.2	3.5	62.4		
			Empididae					Empididae										
						Clinocera	sp.	*Clinocera* sp.										
						Trichoclinocera	sp.	*Trichoclinocera* sp.			3.5					31.2	4.6	
			Muscidae					Muscidae	15.1	3.5				16.6				
			Simuliidae					Simuliidae										
								Simuliidae			6.9						27.7	6.9
						Simulium	sp.	*Simulium* sp.									18.5	
			Tipulidae					Tipulidae							3.5			3.5
						Pilaria	sp.	*Pilaria* sp.										
						Tipula	sp.	*Tipula* sp.			72.8	58.9	34.6	33.3		41.6	41.6	6.9
		Ephemeroptera	Baetidae			*Baetis*	*bundyae*	*Baetis bundyae*										
							sp.	*Baetis* sp.				3.5			6.9		46.2	
			Ephemerellidae			*Ephemerella*	sp.	*Ephemerella* sp.			6.9	3.5					41.6	
			Metretopodidae					Metretopodidae										
						Metretopus	sp.	*Metretopus* sp.										
		Hemiptera						Hemiptera										
		Plecoptera	Nemouridae					Nemouridae										6.9
						Nemoura	sp.	*Nemoura* sp.			13.9	3.5			3.5	10.4	18.5	
			Perlodidae					Perlodidae										
		Trichoptera						Trichoptera										
			Brachycentridae			*Brachycentrus*	*americanus*	*Brachycentrus americanus*										
			Hydroptilidae			*Agraylea*	sp.	*Agraylea* sp.										
						Oxyethira	sp.	*Oxyethira* sp.										
			Leptoceridae			*Ceraclea*	sp.	*Ceraclea* sp.									4.6	
						Mystacides	sp.	*Mystacides* sp.										
			Limnephilidae					Limnephilidae									9.2	
						Asynarchus	sp.	*Asynarchus* sp.			3.5							
			Phryganeidae					Phryganeidae						16.6				
						Agrypnia	sp.	*Agrypnia* sp.	15.1									
			Rhyacophilidae			*Rhyacophila*	*mongolica*	*Rhyacophila mongolica*										10.4
							sp.	*Rhyacophila* sp.										

Note:
" Excluded refers to taxa not included in analysis or graphing. See methods for rationale.

Appendix 3.8-4. Stream Benthic Macroinvertebrate Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.

Data in organisms/m^2

Taxonomic Classification:									Stream Site	Sleigh Outflow	Komatic IF	Komatic IF	Komatic IF	Reference Q Outflow	Reference Q Outflow	Reference Q Outflow
									Replicate	3	1	2	3	1	2	3
									Date Sampled	27-Jul-13	27-Jul-13	27-Jul-13	27-Jul-13	25-Jul-13	25-Jul-13	25-Jul-13
									Surface Area Sampled (m^2)	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886
									EcoAnalysts Sample ID	6527.4-24	6527.4-19	6527.4-20	6527.4-21	6527.4-4	6527.4-5	6527.4-6
Phylum	Class	Order	Family	Sub-Family	Tribe	*Genus*	Species	Final Designation								
						Corynoneura	sp.	*Corynoneura* sp.							34.6	24.3
						Cricotopus	*bicinctus* gr.	*Cricotopus bicinctus* gr.		3.5						
							sp.	*Cricotopus* sp.		3.5	4.6				90.1	20.8
						Doncricotopus	sp.	*Doncricotopus* sp.		3.5						
						Euryhapsis	sp.	*Euryhapsis* sp.		200.9		6.9	26.0			
						Heterotanytarsus	sp.	*Heterotanytarsus* sp.							41.6	27.7
						Heterotrissocladius	*marcidus* gr.	*Heterotrissocladius marcidus* gr.			4.6					
						Hydrobaenus	sp.	*Hydrobaenus* sp.								
						Limnophyes	sp.	*Limnophyes* sp.			4.6					
						Orthocladius	sp.	*Orthocladius* sp.		3.5						3.5
								Orthocladius Complex							27.7	3.5
						Parakiefferiella	sp.	*Parakiefferiella* sp.			4.6					
						Parametriocnemus	sp.	*Parametriocnemus* sp.								
						Psectrocladius	sp.	*Psectrocladius* sp.			4.6				13.9	
						Pseudosmittia	sp.	*Pseudosmittia* sp.		3.5				3.5	41.6	31.2
						Tokunagaia	sp.	*Tokunagaia* sp.		10.4					20.8	
						Tvetenia	*bavarica* gr.	*Tvetenia bavarica* gr.		13.9						
				Podonominae	Boreochlini	*Trichotanypus*	sp.	*Trichotanypus* sp.								
				Tanypodinae	Pentaneurini	*Ablabesmyia*	sp.	*Ablabesmyia* (Karelia) sp.								
						Thienemannimyia gr.	sp.	*Thienemannimyia* gr. sp.		103.9	64.7	31.2	31.2	45.0	554.3	398.4
					Procladiini	*Procladius*	sp.	*Procladius* sp.		3.5	346.5	65.8	155.9			
			Empididae					Empididae			4.6	3.5		6.9		
						Clinocera	sp.	*Clinocera* sp.								
						Trichoclinocera	sp.	*Trichoclinocera* sp.						3.5	6.9	20.8
			Muscidae					Muscidae			78.5	17.3	103.9			
			Simuliidae					Simuliidae					10.4		13.9	
								Simuliidae								
						Simulium	sp.	*Simulium* sp.		10.4	4.6					
			Tipulidae					Tipulidae								
						Pilaria	sp.	*Pilaria* sp.								
						Tipula	sp.	*Tipula* sp.		65.8	73.9	3.5	36.4	17.3	97.0	20.8
		Ephemeroptera	Baetidae			*Baetis*	*bundyae*	*Baetis bundyae*								
							sp.	*Baetis* sp.		55.4						
			Ephemerellidae			*Ephemerella*	sp.	*Ephemerella* sp.		27.7						
			Metretopodidae					Metretopodidae				10.4	5.2		6.9	
						Metretopus	sp.	*Metretopus* sp.								
		Hemiptera						Hemiptera							6.9	
		Plecoptera	Nemouridae					Nemouridae								
						Nemoura	sp.	*Nemoura* sp.		27.7				3.5	55.4	13.9
			Perlodidae					Perlodidae								
		Trichoptera						Trichoptera			4.6				20.8	
			Brachycentridae			*Brachycentrus*	*americanus*	*Brachycentrus americanus*								
			Hydroptilidae			*Agraylea*	sp.	*Agraylea* sp.								
						Oxyethira	sp.	*Oxyethira* sp.								
			Leptoceridae			*Ceraclea*	sp.	*Ceraclea* sp.								
						Mystacides	sp.	*Mystacides* sp.								
			Limnephilidae					Limnephilidae						6.9	6.9	
						Asynarchus	sp.	*Asynarchus* sp.		3.5				20.8		6.9
			Phryganeidae					Phryganeidae			9.2					
						Agrypnia	sp.	*Agrypnia* sp.								
			Rhyacophilidae			*Rhyacophila*	*mongolica*	*Rhyacophila mongolica*		10.4					13.9	3.5
							sp.	*Rhyacophila* sp.								

Note:
" Excluded refers to taxa not included in analysis or graphing. See methods for rationale.

Appendix 3.8-4. Stream Benthic Macroinvertebrate Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.

Data in organisms/m^2

Taxonomic Classification:

										Wasp Outflow	Wasp Outflow	Wasp Outflow	Giraffe Inflow	Giraffe Inflow	Giraffe Inflow	Giraffe Outflow	Giraffe Outflow	Giraffe Outflow
								Stream Site										
								Replicate		1	2	3	1	2	3	1	2	3
								Date Sampled		26-Jul-13	26-Jul-13	26-Jul-13	28-Jul-13	28-Jul-13	28-Jul-13	28-Jul-13	28-Jul-13	28-Jul-13
								Surface Area Sampled (m^2)		0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886
								EcoAnalysts Sample ID		6527.4-13	6527.4-14	6527.4-15	6527.4-31	6527.4-32	6527.4-33	6527.4-28	6527.4-29	6527.4-30
Phylum	**Class**	**Order**	**Family**	**Sub-Family**	**Tribe**	***Genus***	**Species**	**Final Designation**	**Excluded in Analysis[a]**									
	Maxillopoda	Cyclopoida						Cyclopoida	Excluded	55.4			24.3	6.9	79.7			
	Ostracoda							Ostracoda	Excluded									3.5
Cnidaria	Hydrozoa	Anthoathecatae	Hydridae			*Hydra*	sp.	*Hydra* sp.										
Mollusca	Bivalvia	Veneroida	Sphaeriidae					Sphaeriidae										
						Pisidium	sp.	*Pisidium* sp.										
	Gastropoda	Basommatophora	Physidae			*Physa*	sp.	*Physa* sp.										
		Heterostropha	Valvatidae			*Valvata*	*lewisi*	*Valvata lewisi*										
							sp.	*Valvata* sp.										
Nematoda								Nematoda	Excluded	66.5	16.6			17.3	55.4	6.9	3.5	3.5
Platyhelminthes	Turbellaria							Turbellaria	Excluded									
Grand Total										**1640.8**	**1940.2**	**831.5**	**384.6**	**353.4**	**509.3**	**647.9**	**65.8**	**311.8**

Note:

[a] *Excluded refers to taxa not included in analysis or graphing. See methods for rationale.*

Appendix 3.8-4. Stream Benthic Macroinvertebrate Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.

Data in organisms/m^2

Taxonomic Classification:

								Stream Site	Umwelt Outflow	Umwelt Outflow	Umwelt Outflow	Goose Outflow	Goose Outflow	Goose Outflow	Propeller Outflow	Propeller Outflow	Propeller Outflow	Reference B Outflow
								Replicate	1	2	3	1	2	3	1	2	3	1
								Date Sampled	28-Jul-13	28-Jul-13	28-Jul-13	24-Jul-13	24-Jul-13	24-Jul-13	26-Jul-13	26-Jul-13	26-Jul-13	26-Jul-13
								Surface Area Sampled (m^2)	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886
								EcoAnalysts Sample ID	6527.4-34	6527.4-35	6527.4-36	6527.4-1	6527.4-2	6527.4-3	6527.4-16	6527.4-17	6527.4-18	6527.4-10
Phylum	**Class**	**Order**	**Family**	**Sub-Family**	**Tribe**	***Genus***	**Species**	**Final Designation**										
	Maxillopoda	Cyclopoida						Cyclopoida			6.9							9.9
	Ostracoda							Ostracoda				11.1		18.5				14.9
Cnidaria	Hydrozoa	Anthoathecatae	Hydridae			*Hydra*	sp.	*Hydra* sp.				809.3	176.7	55.4		13.9	3.5	
Mollusca	Bivalvia	Veneroida	Sphaeriidae					Sphaeriidae										
						Pisidium	sp.	*Pisidium* sp.										
	Gastropoda	Basommatophora	Physidae			*Physa*	sp.	*Physa* sp.				33.3	6.9	55.4				
		Heterostropha	Valvatidae			*Valvata*	*lewisi*	*Valvata lewisi*									3.5	
							sp.	*Valvata* sp.										
Nematoda								Nematoda	48.5	287.6	176.7	122.0	221.7	443.5				104.2
Platyhelminthes	Turbellaria							Turbellaria				277.2		18.5			3.5	
Grand Total									**353.4**	**786.5**	**543.9**	**3448.0**	**859.2**	**2910.3**	**578.6**	**658.3**	**1188.4**	**1568.7**

Note:

" Excluded refers to taxa not included in analysis or graphing. See methods for rationale.

Appendix 3.8-4. Stream Benthic Macroinvertebrate Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.

Data in organisms/m^2

Taxonomic Classification:

								Stream Site	Reference B Outflow	Reference B Outflow	George Outflow	George Outflow	George Outflow	Lytle Outflow	Lytle Outflow	Lytle Outflow	Sleigh Outflow	Sleigh Outflow
								Replicate	2	3	1	2	3	1	2	3	1	2
								Date Sampled	26-Jul-13	26-Jul-13	27-Jul-13	27-Jul-13	25-Jul-13	27-Jul-13	27-Jul-13	27-Jul-13	27-Jul-13	27-Jul-13
								Surface Area Sampled (m^2)	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886
								EcoAnalysts Sample ID	6527.4-11	6527.4-12	6527.4-7	6527.4-8	6527.4-9	6527.4-25	6527.4-26	6527.4-27	6527.4-22	6527.4-23
Phylum	**Class**	**Order**	**Family**	**Sub-Family**	**Tribe**	***Genus***	**Species**	**Final Designation**										
	Maxillopoda	Cyclopoida						Cyclopoida						33.3				
	Ostracoda							Ostracoda	15.1			20.8		33.3		72.8		
Cnidaria	Hydrozoa	Anthoathecatae	Hydridae			*Hydra*	sp.	*Hydra* sp.			17.3						9.2	
Mollusca	Bivalvia	Veneroida	Sphaeriidae					Sphaeriidae										
						Pisidium	sp.	*Pisidium* sp.										
	Gastropoda	Basommatophora	Physidae			*Physa*	sp.	*Physa* sp.										
		Heterostropha	Valvatidae			*Valvata*	*lewisi*	*Valvata lewisi*			3.5	31.2					9.2	
							sp.	*Valvata* sp.			6.9	17.3	3.5					3.5
Nematoda								Nematoda	271.2	41.6	6.9	55.4	83.2	432.4	6.9	72.8	411.1	24.3
Platyhelminthes	Turbellaria							Turbellaria										
Grand Total									**5183.8**	**866.1**	**395.0**	**706.8**	**498.9**	**6352.7**	**176.7**	**3658.6**	**1478.2**	**738.0**

Note:

" Excluded refers to taxa not included in analysis or graphing. See methods for rationale.

Appendix 3.8-4. Stream Benthic Macroinvertebrate Density and Taxonomic Results, Back River Project, July 2013

EcoAnalysts, Inc.

Data in organisms/m^2

Taxonomic Classification:

								Stream Site	Sleigh Outflow	Komatic IF	Komatic IF	Komatic IF	Reference Q Outflow	Reference Q Outflow	Reference Q Outflow
								Replicate	3	1	2	3	1	2	3
								Date Sampled	27-Jul-13	27-Jul-13	27-Jul-13	27-Jul-13	25-Jul-13	25-Jul-13	25-Jul-13
								Surface Area Sampled (m^2)	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886	0.2886
								EcoAnalysts Sample ID	6527.4-24	6527.4-19	6527.4-20	6527.4-21	6527.4-4	6527.4-5	6527.4-6
Phylum	**Class**	**Order**	**Family**	**Sub-Family**	**Tribe**	***Genus***	**Species**	**Final Designation**							
	Maxillopoda	Cyclopoida						Cyclopoida				26.0		13.9	
	Ostracoda							Ostracoda				10.4	3.5	27.7	
Cnidaria	Hydrozoa	Anthoathecatae	Hydridae			*Hydra*	sp.	*Hydra* sp.	38.1					6.9	
Mollusca	Bivalvia	Veneroida	Sphaeriidae					Sphaeriidae		27.7		52.0			
						Pisidium	sp.	*Pisidium* sp.		18.5	6.9	26.0			
	Gastropoda	Basommatophora	Physidae			*Physa*	sp.	*Physa* sp.							
		Heterostropha	Valvatidae			*Valvata*	*lewisi*	*Valvata lewisi*		97.0	3.5	20.8			
							sp.	*Valvata* sp.	3.5	60.1	6.9				
Nematoda								Nematoda	69.3	4.6	6.9	10.4	52.0	526.6	79.7
Platyhelminthes	Turbellaria							Turbellaria							
Grand Total									**786.5**	**1663.0**	**492.0**	**1772.1**	**197.5**	**2231.2**	**1011.7**

Note:

" Excluded refers to taxa not included in analysis or graphing. See methods for rationale.

Appendix 3.8-5

Stream Benthic Macroinvertebrate Richness and Diversity Results, Back River Project, July 2013

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Appendix 3.8-5. Stream Benthic Macroinvertebrate Richness and Diversity Results, Back River Project, July 2013

Stream Site	Replicate	Date Sampled	Surface Area Sampled (m^2)	Eco Analysts Sample ID	Density (individuals/m^2)	Family Richness (# families/sample)	Simpson's Diversity Index (at family level)
Wasp Outflow	1	26-Jul-13	0.2886	6527.4-13	1485.6	13	0.42
Wasp Outflow	2	26-Jul-13	0.2886	6527.4-14	1923.5	11	0.28
Wasp Outflow	3	26-Jul-13	0.2886	6527.4-15	828.0	12	0.58
Giraffe Inflow	1	28-Jul-13	0.2886	6527.4-31	360.3	4	0.06
Giraffe Inflow	2	28-Jul-13	0.2886	6527.4-32	266.8	7	0.56
Giraffe Inflow	3	28-Jul-13	0.2886	6527.4-33	374.2	10	0.56
Giraffe Outflow	1	28-Jul-13	0.2886	6527.4-28	641.0	11	0.35
Giraffe Outflow	2	28-Jul-13	0.2886	6527.4-29	62.4	4	0.38
Giraffe Outflow	3	28-Jul-13	0.2886	6527.4-30	304.9	7	0.61
Umwelt Outflow	1	28-Jul-13	0.2886	6527.4-34	304.9	10	0.77
Umwelt Outflow	2	28-Jul-13	0.2886	6527.4-35	498.9	11	0.71
Umwelt Outflow	3	28-Jul-13	0.2886	6527.4-36	360.3	11	0.65
Goose Outflow	1	24-Jul-13	0.2886	6527.4-1	3026.7	9	0.78
Goose Outflow	2	24-Jul-13	0.2886	6527.4-2	637.5	11	0.74
Goose Outflow	3	24-Jul-13	0.2886	6527.4-3	2411.4	13	0.72
Propeller Outflow	1	26-Jul-13	0.2886	6527.4-16	578.6	11	0.72
Propeller Outflow	2	26-Jul-13	0.2886	6527.4-17	658.3	8	0.24
Propeller Outflow	3	26-Jul-13	0.2886	6527.4-18	1184.9	13	0.41
Reference B Outflow	1	26-Jul-13	0.2886	6527.4-10	1375.1	5	0.05
Reference B Outflow	2	26-Jul-13	0.2886	6527.4-11	4897.5	5	0.04
Reference B Outflow	3	26-Jul-13	0.2886	6527.4-12	824.6	6	0.22
George Outflow	1	27-Jul-13	0.2886	6527.4-7	388.0	11	0.54
George Outflow	2	27-Jul-13	0.2886	6527.4-8	630.6	11	0.39
George Outflow	3	25-Jul-13	0.2886	6527.4-9	415.8	7	0.57
Lytle Outflow	1	27-Jul-13	0.2886	6527.4-25	5853.8	10	0.20
Lytle Outflow	2	27-Jul-13	0.2886	6527.4-26	169.8	8	0.39
Lytle Outflow	3	27-Jul-13	0.2886	6527.4-27	3513.1	9	0.27
Sleigh Outflow	1	27-Jul-13	0.2886	6527.4-22	1067.1	15	0.54
Sleigh Outflow	2	27-Jul-13	0.2886	6527.4-23	713.7	7	0.33
Sleigh Outflow	3	27-Jul-13	0.2886	6527.4-24	717.2	13	0.70
Komatic IF	1	27-Jul-13	0.2886	6527.4-19	1653.8	13	0.46
Komatic IF	2	27-Jul-13	0.2886	6527.4-20	485.0	11	0.35
Komatic IF	3	27-Jul-13	0.2886	6527.4-21	1715.0	9	0.34
Reference Q Outflow	1	25-Jul-13	0.2886	6527.4-4	142.0	8	0.69
Reference Q Outflow	2	25-Jul-13	0.2886	6527.4-5	1593.7	12	0.29
Reference Q Outflow	3	25-Jul-13	0.2886	6527.4-6	932.0	11	0.19

Note:

See methods for taxa not included in analysis or graphing and rationale.

Diversity and richness analyses excluded individuals not identified to the family level.

Appendix 3.8-6

Stream Benthic Macroinvertebrate QA/QC Results, Back River Project, July 2013

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Appendix 3.8-6. Stream Benthic Macroinvertebrate QA/QC Results, Back River Project, July 2013

EcoA ANALYSTS, INC.

EcoA Sample ID	Site	Sample ID	Replicate	Collection Date	Sorter	Sort Date	Primary Matrix	Estimated Pre-Rinse Volume (L)	Estimated Post-Rinse Volume (L)	QC Sorter	QC Date	Estimated % Recovery 1	Estimated % Recovery 2	Estimated % Recovery 3
6527.4-1	Goose OF	Goose OF	1	24-Jul-13	Steven Little	10/25/2013	Vegetation	0.15	0.05	Ben Alexander	10/28/2013	100	N/A	N/A
6527.4-2	Goose OF	Goose OF	2	24-Jul-13	Tobias Sauer	10/25/2013	Fine Organic	0.1	0.02	Ben Alexander	10/28/2013	100	N/A	N/A
6527.4-3	Goose OF	Goose OF	3	24-Jul-13	Steven Little	10/27/2013	Vegetation	0.2	0.1	Ben Alexander	10/28/2013	94.94	N/A	N/A
6527.4-4	Reference Q OF	Ref Q OF	1	25-Jul-13	Tobias Sauer	10/25/2013	Inorganic	0.2	0.05	Ben Alexander	10/28/2013	100	N/A	N/A
6527.4-5	Reference Q OF	Ref Q OF	2	25-Jul-13	Steven Little	10/29/2013	Filamentous Algae	0.3	0.25	Ben Alexander	10/31/2013	97.76	N/A	N/A
6527.4-6	Reference Q OF	Ref Q OF	3	25-Jul-13	Tobias Sauer	10/29/2013	Vegetation	8	0.5	Ben Alexander	11/01/2013	95.22	N/A	N/A
6527.4-7	George OF	George OF	1	27-Jul-13	Amanda Thompson	10/28/2013	Fine Organic	0.08	0.05	Ben Alexander	10/29/2013	100	N/A	N/A
6527.4-8	George OF	George OF	2	27-Jul-13	Amanda Thompson	10/28/2013	Fine Organic	0.38	0.05	Ben Alexander	10/29/2013	100	N/A	N/A
6527.4-9	George OF	George OF	3	25-Jul-13	Amanda Thompson	10/29/2013	Fine Organic	0.77	0.1	Ben Alexander	11/01/2013	95.48	N/A	N/A
6527.4-10	Reference B OF	Ref B OF	1	26-Jul-13	Steven Little	10/31/2013	Vegetation	2.5	0.5	Ben Alexander	11/04/2013	94.48	N/A	N/A
6527.4-11	Reference B OF	Ref B OF	2	26-Jul-13	Amanda Thompson	11/01/2013	Fine Organic	2.55	0.9	Megan Payne	11/15/2013	100	N/A	N/A
6527.4-12	Reference B OF	Ref B OF	3	26-Jul-13	Tobias Sauer	11/04/2013	Vegetation	1.9	0.4	Nora Williams	11/07/2013	69.82	98.53	N/A
6527.4-13	Wasp OF	WASP OF	1	26-Jul-13	Steven Little	11/05/2013	Vegetation	0.3	0.15	Nora Williams	11/05/2013	98.1	N/A	N/A
6527.4-14	Wasp OF	WASP OF	2	26-Jul-13	Amanda Thompson	11/04/2013	Coarse Organic	1.5	1.25	Ben Alexander	11/06/2013	100	N/A	N/A
6527.4-15	Wasp OF	WASP OF	3	26-Jul-13	Tobias Sauer	11/04/2013	Vegetation	0.4	0.25	Ben Alexander	11/06/2013	95.52	N/A	N/A
6527.4-16	Propeller OF	PRO OF	1	26-Jul-13	Amanda Thompson	11/04/2013	Fine Organic	0.05	0.05	Ben Alexander	11/06/2013	98.29	N/A	N/A
6527.4-17	Propeller OF	PRO OF	2	26-Jul-13	Amanda Thompson	11/04/2013	Filamentous Algae	0.03	0.03	Ben Alexander	11/06/2013	100	N/A	N/A
6527.4-18	Propeller OF	PRO OF	3	26-Jul-13	Amanda Thompson	11/05/2013	Fine Organic	0.08	0.05	Ben Alexander	11/06/2013	100	N/A	N/A
6527.4-19	Komatic IF	Koma IF	1	27-Jul-13	Steven Little	11/07/2013	Vegetation	0.5	0.02	Jennifer Bobier	11/11/2013	100	N/A	N/A
6527.4-20	Komatic IF	Koma IF	2	27-Jul-13	Tobias Sauer	11/05/2013	Inorganic	0.2	0.05	Ben Alexander	11/06/2013	100	N/A	N/A
6527.4-21	Komatic IF	Koma IF	3	27-Jul-13	Steven Little	11/07/2013	Vegetation	1.05	0.08	Jennifer Bobier	11/11/2013	94.1	N/A	N/A
6527.4-22	Sleigh OF	Sleigh OF	1	27-Jul-13	Steven Little	11/05/2013	Vegetation	0.2	0.1	Ben Alexander	11/06/2013	96.53	N/A	N/A
6527.4-23	Sleigh OF	Sleigh OF	2	27-Jul-13	Tobias Sauer	11/05/2013	Vegetation	0.35	0.04	Ben Alexander	11/06/2013	100	N/A	N/A
6527.4-24	Sleigh OF	Sleigh OF	3	27-Jul-13	Amanda Thompson	11/05/2013	Fine Organic	0.08	0.05	Ben Alexander	11/06/2013	96.25	N/A	N/A
6527.4-25	Lytle OF	Lytle OF	1	27-Jul-13	Steven Little	11/11/2013	Coarse Organic	0.6	0.3	Jennifer Bobier	11/12/2013	91.49	99.25	N/A
6527.4-26	Lytle OF	Lytle OF	2	27-Jul-13	Amanda Thompson	11/05/2013	Fine Organic	0.05	0.03	Ben Alexander	11/06/2013	100	N/A	N/A
6527.4-27	Lytle OF	Lytle OF	3	27-Jul-13	Amanda Thompson	11/05/2013	Fine Organic	0.22	0.13	Ben Alexander	11/06/2013	100	N/A	N/A
6527.4-28	Giraffe OF	GIR OF	1	28-Jul-13	Tobias Sauer	11/05/2013	Vegetation	0.3	0.05	Ben Alexander	11/07/2013	92.35	N/A	N/A
6527.4-29	Giraffe OF	GIR OF	2	28-Jul-13	Tobias Sauer	11/05/2013	Fine Organic	0.3	<0.01	Ben Alexander	11/07/2013	100	N/A	N/A
6527.4-30	Giraffe OF	GIR OF	3	28-Jul-13	Steven Little	11/05/2013	Inorganic	0.25	0.03	Ben Alexander	11/06/2013	100	N/A	N/A
6527.4-31	Giraffe IF	TIA OF	1	28-Jul-13	Steven Little	11/06/2013	Filamentous Algae	0.1	0.02	Megan Payne	11/06/2013	100	N/A	N/A
6527.4-32	Giraffe IF	TIA OF	2	28-Jul-13	Steven Little	11/06/2013	Vegetation	0.25	0.1	Nora Williams	11/06/2013	100	N/A	N/A
6527.4-33	Giraffe IF	TIA OF	3	28-Jul-13	Steven Little	11/06/2013	Vegetation	0.25	0.1	Nora Williams	11/06/2013	94.52	N/A	N/A
6527.4-34	Umwelt OF	UMW OF	1	28-Jul-13	Amanda Thompson	11/06/2013	Fine Organic	0.22	0.05	Nora Williams	11/06/2013	100	N/A	N/A
6527.4-35	Umwelt OF	UMW OF	2	28-Jul-13	Amanda Thompson	11/06/2013	Fine Organic	0.22	0.05	Nora Williams	11/06/2013	100	N/A	N/A
6527.4-36	Umwelt OF	UMW OF	3	28-Jul-13	Amanda Thompson	11/06/2013	Fine Organic	0.08	0.03	Nora Williams	11/06/2013	100	N/A	N/A