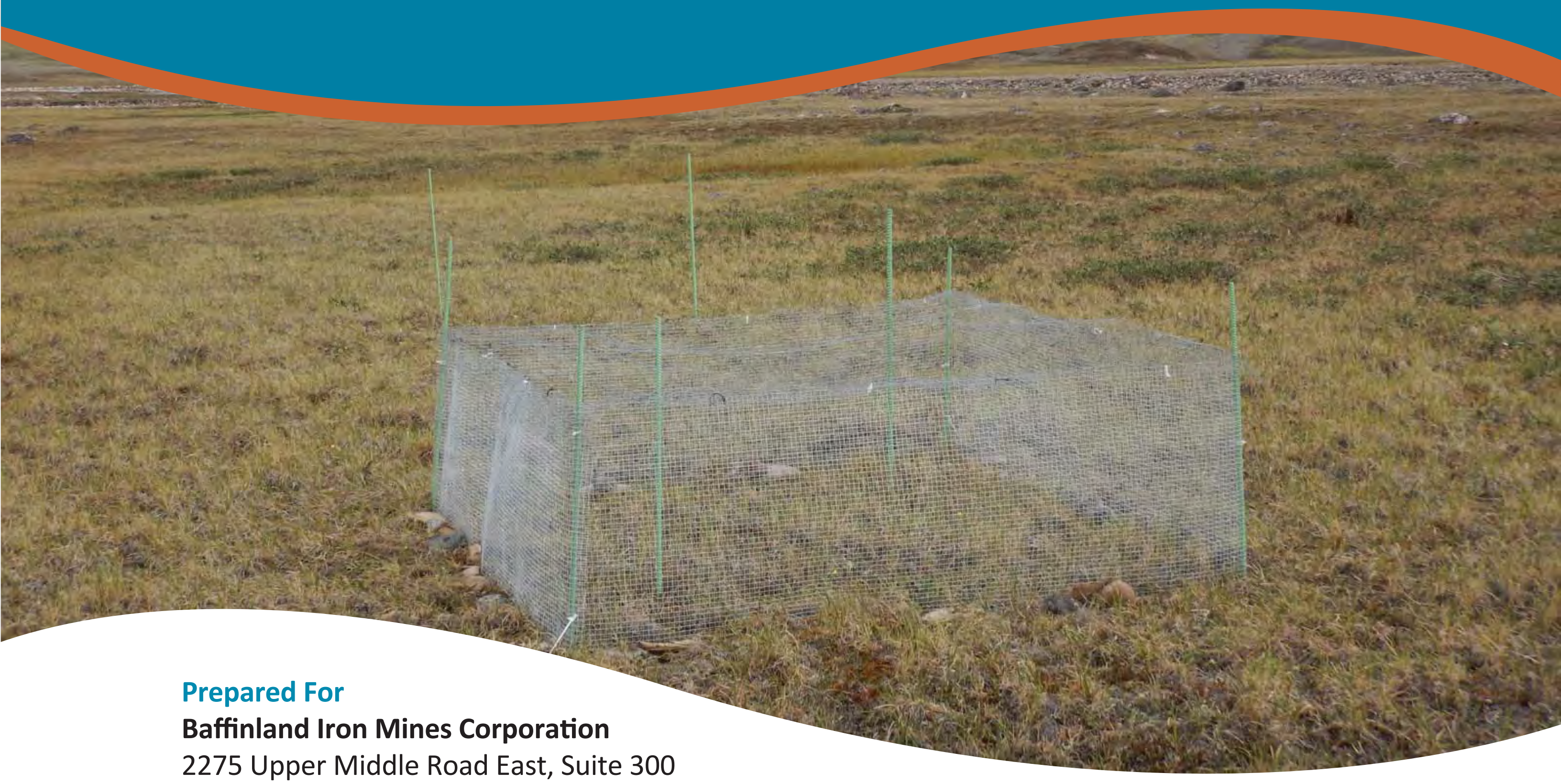
2016 Terrestrial Environment Annual Monitoring Report



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Down to Earth Biology

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EXECUTIVE SUMMARY

The Mary River Project is an iron ore mine located in the Qikiqtaaluk Region on North Baffin Island, Nunavut. The Approved Project involves the construction, operation, closure, and reclamation of a 22.2 million tonne per annum (mtpa) open pit mine that will operate for 21 years. The high grade iron ore to be mined is suitable for international shipment after crushing and screening with no chemical processing facilities. Construction started in 2013, and mining started in September 2014. Currently, up to 4.2 mtpa of the crushed and screened iron ore is trucked to Milne Inlet year round, stockpiled, and shipped during the open water season. Also approved is a railway system that will transport 18 mtpa of the ore from the mine area to an all season deep water port and ship loading facility at Steensby Port where the ore will be loaded into ore carriers for overseas shipment through Foxe Basin. A dedicated fleet of cape sized ice breaking ore carriers and some non-icebreaking ore carriers and conventional ships will be used during the open water season to ship the iron ore to markets. The Project was issued Amendment # 1 to Project Certificate No. 005 by the Nunavut Impact Review Board on May 28, 2014. At this time the project only trucks iron ore to Milne Port for open water shipping.

The NIRB Project Certificate for the Mary River Project includes a number of conditions that require Baffinland to collect baseline data for terrestrial environment as well as additional information required for conducting effects monitoring. The terrestrial environment monitoring program began in 2012 and has continued through 2016 with adaptations to the programs over the years. A number of studies conducted in previous years were not completed in the 2016 survey season including:

- Exotic invasive vegetation monitoring and natural revegetation;
- Den Surveys;
- Roadside waterfowl surveys; and
- Staging waterfowl surveys

Baffinland anticipates that programs will continue in the future. However, all carnivore monitoring programs completed in the past were discontinued in 2015 as the Terrestrial Ecosystem Working Group consider these surveys to no longer be required due to low abundance. However, the surveys will be conducted in the future should changes occur in carnivore abundance.

This report summarizes the data collection and monitoring activities conducted in 2016 for the Project, including the following survey programs (summaries provided in Table 1):

- Dust fall monitoring program;
- Vegetation abundance monitoring;
- Vegetation and soil base metals monitoring;
- Rare plant observations (incidental findings);
- Helicopter flight height analysis;

- Snow track surveys;
- Snow bank height monitoring;
- Height of land caribou surveys;
- Pre clearing nest surveys; and
- Cliff nesting raptor occupancy and productivity surveys.

Table 1. Terrestrial baseline, monitoring and research activities conducted in 2016 for the Mary River Project.

Survey	Reason for survey[1]	Work completed, effects observed, required mitigation and recommendations for future work
Dust fall monitoring program	Addresses Project Conditions 36, 50, 54d, 58c, and Project Commitment 60	33 dust fall collectors are distributed around the Project area, some of which are further away from the Potential Development Area (PDA) and are controls. Three years of monitoring from August 2013 to August 2016 are now complete. Future monitoring will continue to investigate dust fall at the 33 sites through the summer season and a subset of 16 year round sites. Improvements were made to the traffic logs to better quantify road traffic.
Vegetation abundance monitoring	Addresses Project Conditions 36 & 50, and Project Commitment 67	Sample size was increased to 15 balanced transects and six reference sites to improve statistical power to detect changes in ground, canopy and lichen cover. An additional 39 sites were established within the Project area at varying distances from the PDA, while accounting for the potential effect of herbivory (open vs. closed plots) for a total of 66 vegetation abundance monitoring sites. The initial average percent plant cover of caribou forage across all plant groups is not different between plots at varying distances from the PDA. Future monitoring will consider trends in percent plant cover and plant composition with the relationship of distance to Project infrastructure and treatment effect between open and closed plots.
Vegetation and soil base metals monitoring	Addresses Project Conditions 34, 36 & Project Commitment 50	The study design was improved in 2016 to include 100 additional samples (50 soil and 50 lichen). Increased sample size and enhanced spatial distribution increased the power to detect a change in metal concentrations between the 'before' period (i.e., baseline sampling) and the 'after' period (i.e., post-construction sampling) for all chemicals of potential concern (CoPC) before threshold levels are exceeded. All soil and lichen samples were below thresholds with the exception of two sites which are suspected sampling errors. Future monitoring will consider changes in metal concentrations for soil and vegetation (i.e., lichen) and compare these concentrations to Project specific thresholds identified for chemicals of potential concern.
Helicopter flight height analysis	Addresses Project Conditions 59, 71 and 72	Prior to flying for Baffinland, all employees and contractors are made aware of flight height requirements to reduce stress to the wildlife of Baffin Island, particularly during sensitive times (e.g. staging, calving etc.). Ensuring that aircraft maintain, whenever possible (except for specified operational purposes such as drill moves, take offs and landings), and subject to pilot discretion regarding aircraft and human safety, a cruising altitude of at least 650 metres during point to point travel when in areas

[1] Project Conditions and Project Commitments as per: Project Certificate No. 005.

Table 1. Terrestrial baseline, monitoring and research activities conducted in 2016 for the Mary River Project.

Survey	Reason for survey[1]	Work completed, effects observed, required mitigation and recommendations for future work
		likely to have migratory birds, and 1,100 metres vertical and 1,500 metres horizontal distance from observed concentrations of migratory birds. Flight corridors are also used to avoid areas of significant wildlife importance. In 2016, overall flight heights did not comply with the project conditions. The flight heights' greatest level of compliance within the snow goose area was in July, at 28%, and 37% compliance in June. During the four months, the lowest level of compliance was 2% in August within the snow goose area and 4% in September for all the areas.
Snow track surveys	Addresses Project Condition 54dii, 58f Addresses QIA concerns about snow bank heights and the effects on wildlife crossings	Snow track surveys were completed along the Tote Road to investigate the movement of caribou in April — Arctic fox and Arctic hare were the only species detected; no evidence of caribou was observed during the survey. As part of the survey, at all locations where tracks crossed the Tote Road, snowbank depths were recorded, and tracks were followed to see if the individual was deterred by road crossing conditions. Future monitoring will continue to look for caribou and other wildlife tracks and indications of their interaction with the Tote Road.
Snow bank height monitoring	Addresses Project Conditions 53ai and 53c Addresses QIA concerns about snow bank heights and the effects on wildlife	Snow bank height monitoring was conducted to ensure compliance with recommended snowbank heights no greater than 1 m in depth. The management of snow bank height allows for wildlife, specifically caribou, to cross the transportation corridor without being blocked by steep snow banks, as well as allowing drivers greater visibility to help reduce wildlife-vehicle collisions. In 2016, snow bank heights were found to exceed the maximum snow depth of 100 centimetres on 13 separate occasions with a maximum recorded depth twice the suggested maximum height. Often where snow bank heights exceeded the guideline, the snow was being piled according to landscape limitations. It was clear that snow bank height management has been maintained throughout the season, with piles of snow pushed back to reduce the overall height.
Height-of-land caribou surveys	Addresses Project Condition 53a, 53b, 54b, 58b	All 24 HOL stations were visited at least once in 2016. Just over 12.5 hours of surveys were conducted at these station in April (late winter), and early June (caribou calving) when EDI biologists were on site. No caribou were observed during any of these surveys. In 2016, viewshed mapping was completed to demonstrate how far and to what extent surveyors could actively observe while conducting HOL surveys. Monitoring is expected to be conducted annually. The 2016 observations will add to a larger database as monitoring efforts continue through the life of the Project.
Pre-clearing nest surveys	Addresses Project Conditions 66, 70	In 2016 nine pre clearing surveys were conducted, a total of 9.52 person hours and 85,666 m² (8.7 ha) of area were nest searched in the Mine Site, Tote Road and Milne Port development areas. No nests were detected and therefore no buffers were required. Additionally in 2016, 63% of the area cleared and developed for project infrastructure was completed outside of the breeding bird window. Surveys will continue to be required whenever clearing vegetation within the nesting season.

Table 1. Terrestrial baseline, monitoring and research activities conducted in 2016 for the Mary River Project.

Survey	Reason for survey[1]	Work completed, effects observed, required mitigation and recommendations for future work
Cliff-nesting raptor occupancy and productivity surveys	Addresses Project Conditions 50, 73, 74, and Project Commitment 75	Program is a continuation of work conducted since 2011, to date 415 raptor nest sites have been documented within the regional study area. In 2016, 147 sites were surveyed; approximately 47% of those sites were occupied. Occupied nest sites included 45 sites occupied by peregrine falcon, 17 sites occupied by rough-legged hawk, 2 sites occupied by gyrfalcon and 2 sites occupied by other species. 2016 surveys focused on checking occupancy of known sites within the PDA.

ACKNOWLEDGEMENTS

Jim Millard and Allan Knight at Baffinland Environment were instrumental in coordinating the field work and providing logistical support. The Terrestrial Environment Working Group provided direction and technical review of the monitoring programs and draft reports.

Field crews included Dawn Hansen (EDI), Sherri Elwell (EDI), Brett Pagacz (EDI) and Ezra Arreak (Baffinland), Katie Babin (Baffinland), Karen Martens (Baffinland), Jennifer Amagoalik (Baffinland), Brenden Peachey (Baffinland), and Bruce Bennett (Botanist). The Baffinland environmental staff conducted the dust fall monitoring through the year and were instrumental in providing ground based transportation and field support. Raptor surveys were conducted by Philippe Galipeau of Arctic Raptors Inc.

AUTHORSHIP

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ACRONYMS AND ABBREVIATIONS

ARInc.. Arctic Raptors Inc.

Baffinland.. Baffinland Iron Mines Corporation

CCME.. Canadian Council of Ministers of the Environment

CoPC.. Metals/Metalloids of Potential Concern

COSEWIC.. Committee on the Status of Endangered Wildlife in Canada

CWS.. Canadian Wildlife Service

EC.. Environment Canada

EDI.. Environmental Dynamics Inc.

ERP.. Early Revenue Program

FEIS.. Final Environmental Impact Statement

GIS.. Geographic Information System

GN.. Government of Nunavut

GPS.. Global Positioning System

HOL.. Height of Land

Mt/a.. Million Tonnes per Year

NIRB.. Nunavut Impact Review Board

NLC.. Northern Land Cover

PDA.. Potential Development Area

PRISM.. Program for Regional and International Shorebird Monitoring

Project.. Mary River Project

QIA.. Qikiqtani Inuit Association

RSA.. Regional Study Area

SARA.. Species at Risk Act

TEMMP.. Terrestrial Environment Management and Monitoring Plan

TEWG.. Terrestrial Environment Working Group

TSP.. Total Suspended Particles

US EPA.. US Environmental Protection Agency

VEC.. Valued Ecosystem Component

1 OVERVIEW OF TERRESTRIAL ENVIRONMENT MONITORING

As a condition of Project approval, the Nunavut Impact Review Board (NIRB) Project Certificate #005 includes numerous conditions that require Baffinland to gather additional information to enhance the baseline data and to conduct effects monitoring for the terrestrial environment, as well as ensure compliance with Project conditions. Work conducted for the terrestrial environmental monitoring program is guided by traditional knowledge and by the Terrestrial Environment Mitigation and Monitoring Plan (TEMMP; Baffinland 2014) and is overseen by the Terrestrial Environment Working Group (TEWG) which includes members from Baffinland, the Qikiqtani Inuit Association (QIA), the Government of Nunavut (GN), and Environment Canada and Climate Change (ECCC). Several data collection and monitoring programs have been conducted as part of the terrestrial environmental monitoring program and include the following inventories:

- Dust fall monitoring (2013–2016);
- Height-of-land caribou surveys (2013–2016);
- Cliff-nesting raptor occupancy and productivity surveys (2011–2016);
- Vegetation abundance monitoring (2014, 2016)
- Vegetation and soil base metals monitoring (2012–2016);
- Exotic invasive vegetation monitoring and natural revegetation (2014);
- Caribou fecal pellet collection (2011, 2012, 2013, 2014);
- Caribou water crossing surveys (2014);
- Height-of-land caribou surveys (2013-2016);
- Helicopter flight height analysis (2015-2016);
- Snow track surveys and snow bank height monitoring (2014–2016);
- Carnivore den survey (2014);
- Communication tower surveys (2014, 2015);
- Roadside waterfowl surveys (2012–2014);
- Red knot surveys (2014);
- Staging water fowl surveys (2015);
- Active migratory bird nest surveys (2013–2016);
- Raptor occupancy and productivity surveys (2011-2016);
- Tundra breeding bird PRISM (Program for Regional and International Shorebird Monitoring) plots (2012, 2013);
- Bird encounter transects (2013); and
- Coastline nesting and foraging habitat surveys along Steensby Inlet (2012) and Milne Inlet (2013).

The results of the 2012 to 2015 surveys are described in the completed and reviewed Annual Terrestrial Monitoring Reports (EDI 2012, 2014, 2015, 2016). The 2016 terrestrial environment monitoring program summarized in this report includes details and updates about the following programs:

- Dust fall monitoring program;
- Vegetation abundance monitoring;
- Vegetation and soil base metals monitoring;
- Exotic invasive vegetation monitoring and natural revegetation (incidental findings);
- Helicopter flight height analysis;
- Snow track surveys;
- Snow bank height monitoring;
- Height-of-land caribou surveys;
- Pre-clearing nest surveys; and
- Raptor occupancy and productivity surveys.

2 DUST FALL MONITORING PROGRAM

Dust deposition on soil and vegetation was identified as a concern during the Project review process. Dust deposition can have adverse effects on vegetation health and ultimately on wildlife and humans that consume vegetation. Baffinland is therefore committed to establishing a monitoring program investigating the extent of dust fall generated from Project activities. Several of the Project Conditions (e.g. Project Conditions 36, 50, 54d and 58c) address dust fall concerns or relate to reporting requirements for the dust fall program.

To meet these requirements, the Mary River dust fall monitoring program was initiated in the summer of 2013. The three main objectives of the dust fall monitoring program are to:

1. Quantify the extent and magnitude of dust fall generated by Project activities;
2. Determine seasonal variations in dust fall; and
3. Determine if annual changes in dust fall exceed identified thresholds associated with the dust fall dispersion models (Volume 6, Section 3; Baffinland 2013).

To address Project Condition 57g, weather summaries including an overview of the 2016 weather conditions, timing of snowmelt, and green-up are provided under Section 2.2.1.

2.1 METHODS

In addition to the collection of dust fall data, the monitoring program also reviewed supporting data that may affect the magnitude and extent of dust fall over the 2016 time period. This supporting data includes weather conditions and traffic on the Tote Road.

2.1.1 REVIEW OF SUPPORTING DATA

Overview of Weather Conditions — Climate data for 2016 collected from on-site meteorological stations at Mary River and Milne Inlet were compared with baseline data for the area (2005–2010; Baffinland 2012). The following parameters were assessed and considered in relation to dust fall: air temperature, precipitation as rainfall, wind speed and wind direction.

Traffic on the Tote Road — All non-haul vehicle traffic on the Tote Road, linking the Mary River mine site and Milne Port, is recorded by Baffinland security. Ore hauling began in September 2014 and the number of trucks hauling ore on the Tote Road each day is tracked by Mine Operations Dispatch. Data from both sources were collected, reviewed and compiled, and are presented on a 'vehicle transits per day' basis; further, this data is compared with the projected ore haul and non-haul vehicle transits (Volume 3, Appendix 3B, Baffinland 2013b).

While the ore haul truck traffic data provides a clear picture of the number of ore haul trucks travelling the full length of the Tote Road, there are limitations associated with 'other traffic' vehicle transits. These data are collected from the Mary River and Milne Port security staff for purposes of ensuing employee safety while travelling the Tote Road. The data includes date and time of travel, the number of vehicles, road closures, etc. (but not ore haul), and does not include complete data regarding the length of travel of each vehicle along the Tote Road. For the purpose of this reporting, the non-haul ('other') vehicle transits are therefore generally over-estimated as it is assumed that all vehicles complete the full travel distance from Mary River to Milne Port. Much of the non-ore haul traffic on the Tote Road ventures distances less than 50 km along the road, completes work on the road, and then returns to camp without completing the full trip. This type of vehicle traffic includes road maintenance mobile equipment, mechanical maintenance/fueling trucks, pick-up trucks, etc.

2.1.2 DUST FALL SAMPLING

The dust fall monitoring program began in July 2013 with 26 dust fall monitoring sites across the Regional Study Area (RSA). In August 2014 one site at Milne Port (DF-P-02) was discontinued as it needed to be re-located to allow for port infrastructure, and an additional eight sites were added at the mine and port areas (Map 1; Table 2). Dust fall sampling locations were chosen to represent areas of various expected dust fall deposition rates based on isopleth dispersion models and the direction of prevailing winds within the RSA, excluding areas of future infrastructure development. Since August 2014, there have been no changes in the number of dust fall samplers; the 33 dust fall sample sites for the 2016 season include:

- Nine (9) dust fall samplers located at the Mine Site (three within the Mine Site, four outside the mine footprint, but within low to moderate isopleth areas and two references sites; one to the northeast, and one to the south);
- Six dust fall samplers located at Milne Port (five active sites on the port footprint; DF-P-5 replaced DF-P-2) and one (1) reference site located northeast of the port site; and
- Sixteen (16) dust fall samplers divided between two sites along the Tote Road (the North site and South site). These two sites are organized into transects, each composed of eight dust fall samplers distributed perpendicular to the Tote Road centreline at 30 m, 100 m, 1,000 m, and 5,000 m on either side of the road. The prevailing wind direction is variable, often parallel to the Tote Road as opposed to perpendicular; therefore 'upwind' and 'downwind' directions from the road are not identified. The two reference dust fall samplers are located 14 km southwest of the Tote Road.

Each dust fall sampler comprises one sampling apparatus including a hollow post, approximately two metres in height, and a terminal bowl shaped holder for the dust collection vessel. The terminal bowl is topped with "bird spikes" to prevent birds perching and contaminating samples with feces. Each sampling apparatus was installed by pounding rebar posts into the ground, placing the post over the rebar, and then stabilizing with guy wires. Dust collection vessels were placed in the holder; these containers were pre-charged with 250 mL of algaecide in summer and 250 mL of alcohol in winter. Collection vessels were changed out approximately every month and shipped to ALS Environmental Laboratory (ALS) in Waterloo, Ontario, for analysis of total suspended particulates (TSP; units of $mg/dm^2 \cdot day$). In addition to the analysis of TSP, the dust fall samples were analyzed for total metal concentrations to help inform potential trends in soil and vegetation tissues, collected as part of vegetation health monitoring.

Table 2. Dust fall sample sites within the Project RSA.

Site ID	Location	Sample period	Distance to PDA[1] (m)	Dust isopleth zone	Latitude	Longitude
DF-M-01	Mine Site	year round	Within PDA	High	71.3243	-79.3747
DF-M-02	Mine Site	year round	Within PDA	High	71.3085	-79.2906
DF-M-03	Mine Site	year round	Within PDA	High	71.3072	-79.2433
DF-M-04	Mine Site	variable	9,000	Nil	71.2197	-79.3277
DF-M-05	Mine Site	variable	9,000	Nil	71.3731	-78.9230
DF-M-06	Mine Site	variable	1,000	Moderate	71.3196	-79.1560
DF-M-07	Mine Site	variable	1,000	Moderate	71.3000	-79.1953
DF-M-08	Mine Site	variable	4,000	Moderate	71.2945	-79.1002
DF-M-09	Mine Site	variable	2,500	Low	71.2936	-79.4127
DF-RS-01	Tote Road - south	variable	5,000	Nil	71.3275	-79.8001
DF-RS-02	Tote Road - south	variable	1,000	Low	71.3893	-79.8324
DF-RS-03	Tote Road - south	year round	100	Moderate	71.3967	-79.8228
DF-RS-04	Tote Road - south	year round	30	Moderate	71.3975	-79.8222
DF-RS-05	Tote Road - south	year round	30	Moderate	71.3980	-79.8228
DF-RS-06	Tote Road - south	year round	100	Moderate	71.3986	-79.8234
DF-RS-07	Tote Road - south	variable	1,000	Nil	71.4077	-79.8182
DF-RS-08	Tote Road - south	variable	5,000	Nil	71.4489	-79.7106
DF-RN-01	Tote Road - north	variable	5,000	Nil	71.6883	-80.5363
DF-RN-02	Tote Road - north	variable	1,000	Low	71.7145	-80.4704
DF-RN-03	Tote Road - north	year round	100	Moderate	71.7186	-80.4473
DF-RN-04	Tote Road - north	year round	30	Moderate	71.7189	-80.4456
DF-RN-05	Tote Road - north	year round	30	Moderate	71.7185	-80.4414
DF-RN-06	Tote Road - north	year round	100	Moderate	71.7189	-80.4397
DF-RN-07	Tote Road - north	variable	1,000	Nil	71.7226	-80.4165
DF-RN-08	Tote Road - north	variable	5,000	Nil	71.7435	-80.2898
DF-P-01	Milne Port	year round	Within PDA	Moderate	71.8802	-80.9072
DF-P-02	Milne Port	decommissioned	Within PDA	Moderate	71.8850	-80.8912
DF-P-03	Milne Port	variable	3,000	Nil	71.8996	-80.7884
DF-P-04	Milne Port	year round	Within PDA	Low	71.8710	-80.8828
DF-P-05	Milne Port	year round	Within PDA	Moderate	71.8843	-80.8945
DF-P-06	Milne Port	year round	Within PDA	Low	71.8858	-80.8790
DF-P-07	Milne Port	year round	Within PDA	High	71.8838	-80.9160
DF-RR-01	Reference – Road	summer only	14,000	Nil	71.2805	-80.2450
DF-RR-02	Reference – Road	summer only	14,000	Nil	71.5189	-80.6923

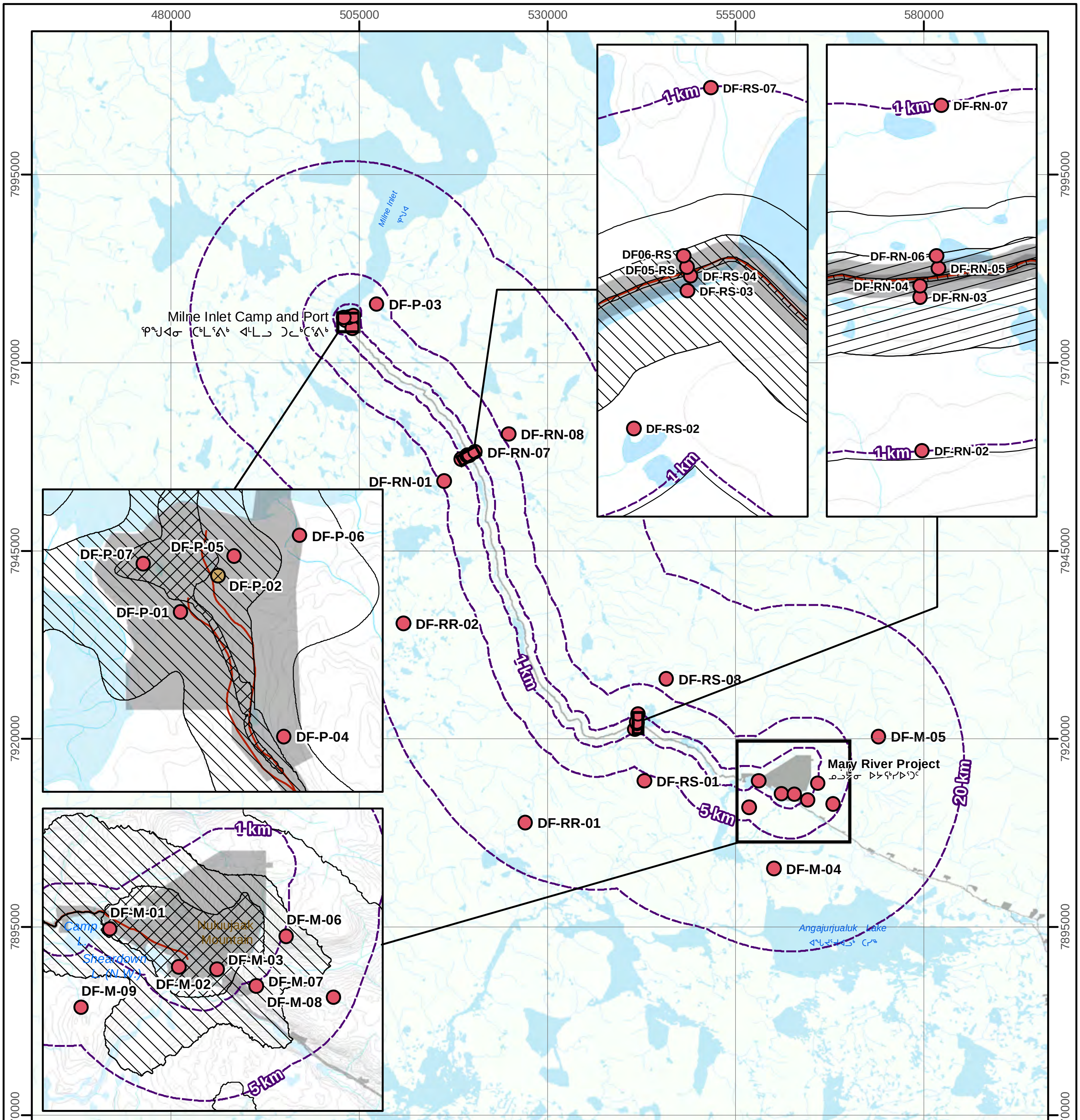
1. PDA = Potential Development Area

Dust fall sampling was conducted year-round; however, the winter sampling program was limited to a subset of the sample sites (16 out of 33 in the 2016 season) because access to remote sites is restricted and unsafe during the winter months. Those sites exposed to the highest dust fall, i.e., those samplers located within one kilometre of the Potential Disturbance Area (PDA) were sampled throughout the 2016 season (Table 3). The sites not visited over the winter months are generally those located at a distance one kilometre or greater from the PDA, and therefore exposed to the least amount of Project-initiated dust fall.

For data analysis and reporting purposes, summer includes sampling data from June, July and August, and winter includes data collected September through May. This seasonal delineation was determined after reviewing site weather data, indicating that in September through May the average daily temperature is below 0°C, and more than 50% of the monthly precipitation falls as snow. It is predicted that less dust is mobilized under frozen, snow-covered conditions.

Table 3. Record of sampling associated with the 2016 dust fall monitoring program.

Sampling session	Start date	End date	Number of days	Number of canisters deployed	Number of canisters analyzed	Sampling solution
1	21-Dec-15	17-Jan-16	27	23	23	Alcohol
2	18-Jan-16	16-Feb-16	29	24	24	Alcohol
3	17-Feb-16	14-Mar-16	27	16	16	Alcohol
4	15-Mar-16	10-Apr-16	26	16	16	Alcohol
5	11-Apr-16	09-May-16	28	16	16	Alcohol
6	10-May-16	11-Jun-16	32	33	33	Algaecide
7	12-Jun-16	13-Jul-16	31	32	32	Algaecide
8	14-Jul-16	15-Aug-16	33	33	33	Algaecide
9	17-Aug-16	21-Sep-16	38	33	33	Algaecide
10	22-Sep-16	18-Oct-16	27	16	16	Alcohol
11	19-Oct-16	18-Nov-16	31	16	16	Alcohol
12	19-Nov-16	19-Dec-16	30	16	16	Alcohol



LEGEND ᑐᑭᓯᔾᖏᑦ

- Active Dust Fall Monitoring Site
- Decommissioned Dust Fall Monitoring Site
- Milne Tote Road
- Potential Development Area ᓄᓇ ᐊᒃᑐᕐᑕᐅᑐᐃᓇᕆᐊᓕᒃ ᓴᕕᒃᓴᕐᓯᐅᕐᑐᓐᓂᑦ

TSP Annual Deposition

- High
- Moderate
- Low

Dust Fall Sample Locations for the Project Area

NOTES ᖃᐅᔨᒪᔭᒃᓴᐃᑦ

TSP isopleths provided by RWDI Air Inc (2010/2014). These data were modified by EDI for the purpose of map display.

Updated PDA provided by Hatch (25 April 2013).

Scale ᐊᖏᓂᖓ

0 5 10 20 30

Km ᑭᓛᒥᑕ

Map Scale ᐊᖏᓂᖓ: 1:750,000 (printed on 8.5 x 11)
Map Projection: NAD 1983 UTM Zone 17N

Drawn:	Checked:	Date:	
MP	MAS/DH	3/20/2017	MAP 1

Baffinland EDI

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2.1.3 ANALYTICAL METHODS

The RSA was divided into four areas for the purposes of reviewing dust fall data:

1. The Mine Site;
2. Milne Port;
3. The Tote Road South crossing; and
4. The Tote Road North crossing.

Seasonal Variations in Dust Fall — We used generalized least squares regression to test for effects of season (summer and winter) and sample site on daily dust fall accumulation for each project area (mine site, Milne Inlet port, north road and south road), for sites that were sampled throughout the year. Each model included main effects of season and sample site, with an interaction term between sample site and season. All dust fall data were log transformed prior to analysis and results were back-transformed to the original scale. Models included a first order autocorrelation structure, based on sampling period within a site, to account for the possibility that dust fall in one sampling period was more similar to samples from the preceding period than other samples from the same site (Zuur 2009). Fixed model weights based on the number of days in each sampling period were used to give more weight to dust samples collected over a longer time (Zuur 2009).

Residual plots were examined to confirm assumptions of normality and equality of variance in the residuals. Significance of model terms was tested using marginal F-tests; terms were considered significant at $\alpha <0.05$. If there was no evidence that daily dust fall was related to season or site, then median dust fall ± 95% confidence intervals was reported across all sites and seasons. If there was evidence of an effect of season on daily dust fall we used least squared means to estimate the median effect of season after accounting for the effect of sample site (Lenth 2014). Statistical analysis was conducted using R version 3.3.1 (R Core Team 2016).

Extent and Magnitude of Dust Fall at Various Sites — Dust fall deposition rates (as Total Suspended Particles — TSP) for each site were compiled for the 2016 season and reviewed to determine which sites in each sampling area are most affected by dust fall, and if any reference sites were recording high deposition rates of dust fall.

We used daily dust fall from summer sampling periods (June, July, and August) to look at the relationship between dust fall and distance from the road for the mine, road north and road south sites. Mixed effects models were used to test for a relationship between distance from the road and daily dust fall. Distance from the mine was treated as a categorical variable with three classes – Near (within footprint), Far (1000 m – 5000 m), and Reference (>5000 m). Distance from the road was treated as a categorical variable with four classes – 30 m, 100 m, 1000 m, and 5000 m. Sample site was included as a random effect in all models. Daily dust fall values were log transformed prior to analysis.

Residual plots were examined to confirm assumptions of normality and equality of variance in the residuals. Significance of model terms was tested using F-tests; terms were considered significant at $\alpha < 0.05$. If there was an effect of distance class on dust fall, we used pairwise comparisons of means with a Tukey correction to determine which distance classes were different. Linear combinations of means and t-tests were used to report differences in group means. All estimates were back transformed to the original scale and reported as medians ± 95% confidence intervals.

Statistical analysis was conducted using R version 3.3.1 (R Core Team 2016).

Annual Dust Fall — Annual total suspended particulates (TSP) thresholds were developed for the Mary River Project (Appendix B.4-3 of the Terrestrial Environment Mitigation and Monitoring Plan; TEMMP). These thresholds were developed with input from the results of the dust dispersion models, existing literature related to air quality guidelines and dust deposition, and similar dust monitoring programs in place at other northern mines:

- **Low:** 1–4.5 $g/m^2/year$;
- **Moderate**: 4.6–50 $g/m^2/year$; and
- **High:** ≥50 $g/m^2/year$.

The results of dust fall 2016 sampling were converted from units of $mg/dm^2 \cdot day$ to $g/m^2/year$ and were compared with the modelled dust deposition isopleths for the Project to determine if deposition rates exceed the applicable indicator threshold.

Sites in the nil and low isopleth zones were not sampled during winter months, so annual accumulation was not calculated for those sites. Very low dust fall accumulation, often below laboratory detection, was observed at these sites during the summer months.

2.2 RESULTS AND DISCUSSION

2.2.1 OVERVIEW OF THE 2016 WEATHER CONDITIONS

North Baffin Island has a semi-arid climate with relatively little precipitation and few frost-free days (FEIS, Appendix 5A, 2012). Generally, snowmelt occurs in late June and frost-free conditions last until late August. In 2016, the onset of snowmelt was around the second week in June where temperatures above zero were consistent and as high as 11°C. Maximum temperature recorded for June was on June 29, 2016 with a high of 18°C. Green-up was expected to occur shortly after the onset of snowmelt between mid to late June 2016. On-site staff reported an abundance of flowering purple saxifrage (*Saxifraga oppositifolia*) across the landscape in late June and early July.

Climate data for 2016 was collected from on-site meteorological stations at Mary River and Milne Inlet and compared to available baseline data (2005–2010; Baffinland 2012). Baffinland established an on-site meteorological station at Mary River Camp on June 13, 2005 and at Milne Inlet in June 2006. Parameters measured include air temperature, precipitation as rainfall, wind speed, and wind direction.

Air Temperature — In general, air temperatures for Baffin Island tend to be coldest in February and warmest in July. At Milne Inlet, the baseline monthly minimum air temperature was somewhat lower than 2016 air temperatures while baseline maximum air temperature was similar to 2016 air temperatures. Monthly minimum air temperature during baseline was -46.9°C in February 2008 and -41.1°C in February 2016. Monthly maximum air temperature during baseline was 22.3°C in July 2009 and 22.3°C in July 2016.

At the Mine Site, the baseline monthly minimum air temperature was much lower than 2016 air temperatures while baseline maximum air temperature was similar to 2016 air temperatures. Monthly minimum air temperature during baseline was -70.0°C in April 2010 and -43.2°C in February 2016. Monthly maximum air temperature during baseline was 22.8°C in July 2009 and 22.6°C in July 2016.

Precipitation (Rainfall) — In general, July and August tend to be the wettest months on Baffin Island. During baseline the highest daily average precipitation at Milne Inlet was 40.2 mm recorded on September 02, 2006. The second highest daily average precipitation was recorded on July 04, 2006 at 22.8 mm. These values represent relatively high averages for precipitation compared to the rest of the baseline dataset. In 2016, the highest daily average precipitation was 5.2 mm on August 01, 2016. This value appears to be average to low compared to baseline daily precipitation data. Baseline monthly maximum precipitation was 7.4 mm in July 2008, which is also higher than the 2016 monthly maximum precipitation recorded on August 2016 at 0.05 mm. Discrepancies between short-term baseline values and current data could be due to a small data set.

During baseline the highest daily average precipitation at the Mine Site was 32.8 mm recorded on August 13, 2006. The second highest daily average precipitation was recorded on July 17, 2005 at 30.2 mm and July 16, 2005 at 21.4 mm. These values represent relatively high averages for precipitation compared to the rest of baseline dataset. In 2016, the highest daily average precipitation was 18.2 mm on September 8, 2016, which appears to be on the high end of average baseline precipitation data. Baseline monthly maximum precipitation was 5.3 mm in July 2007, which is also higher than 2016 monthly maximum precipitation recorded on September 2016 at 0.14 mm. Again, discrepancies between baseline and 2016 data could be due to a small data set.

Wind Direction and Speed — Baseline wind direction data at Milne Inlet is consistent with current wind direction data from the Baffinland weather station where prevailing north and south southeast winds occur most frequently. The range in baseline minimum and maximum wind speeds was lower than 2016 with 0–29.5 m/s, which is considered "calm" to "storm" on the Beaufort scale. The maximum wind speed recorded at the Baffinland weather station was 40.4 m/s on April 2016.

This is categorized as "hurricane" winds on the upper end of the Beaufort scale, indicating strong, violent winds at Milne Inlet.

At the Mine Site, baseline wind direction data is mostly consistent with previously reported wind direction data from the Baffinland weather station where prevailing south southeast winds occur most frequently, followed by strong north winds. Minimum and maximum wind speeds reported during baseline and 2016 conditions were similar ranging from 0–27.8 m/s and 0–28.4 m/s, respectively. This range is categorized as "calm" to "whole gale" winds on the Beaufort scale, indicating that winds are strong, but less violent at the Mine Site relative to Milne Inlet.

2.2.2 OVERVIEW OF 2016 VEHICLE TRANSITS ON THE TOTE ROAD

The numbers of ore haul trucks per day remained relatively steady from January through April 2016, with monthly averages of between 60 to 89 haul trucks per day resulting in 120 to 178 ore haul transits. In May there was an average of only 43 trucks per day (86 transits); haul traffic is generally lower through May due to spring melt conditions that affect road quality. The number of haul trucks transits per day increased through June, July and August, with the average monthly number of haul trucks transits per day of 128, 136 and 166, respectively (Figure 1). The average annual number of ore haul truck transits was 151 transits per day, which equalled the projected maximum haul truck transits (152 ore haul transits per day, as per Volume 3, Appendix 3B, Baffinland 2013b). Other, non-haul truck traffic had an annual average of 28 vehicle transits per day.

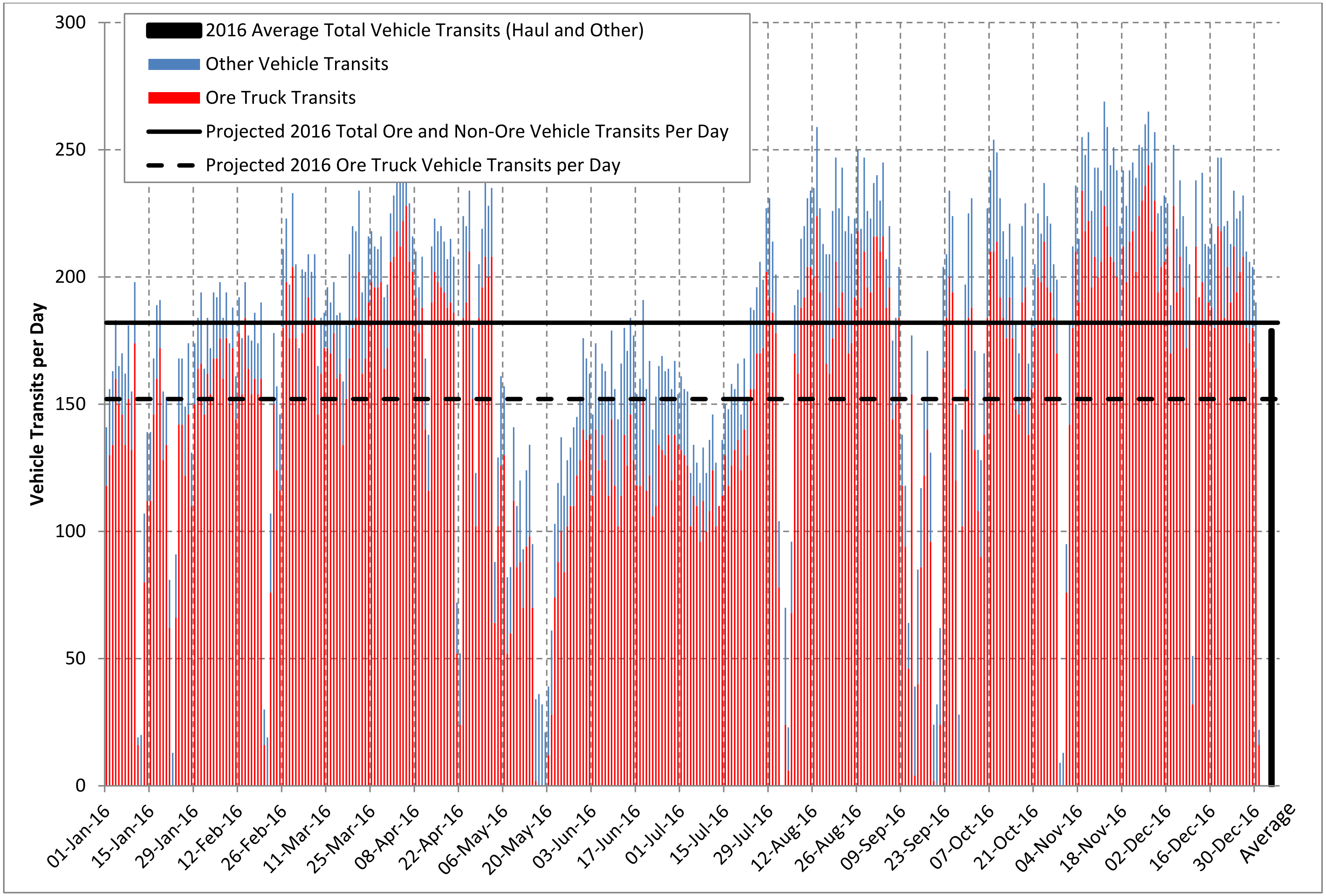


Figure 1. Vehicle transits per day on the Tote Road, including both full ore trucks (red), and all other traffic (blue).
Also included is the projected maximum number of vehicle passes per day on the Tote Road, and the projected maximum number of Ore Haul Trucks per day on the Tote Road.

2.2.3 MAGNITUDE AND EXTENT OF 2016 DUST FALL

Mine Site — The 2016 monitoring included nine dust fall samplers associated with the Mine Site — three within the mine footprint, four outside the mine footprint but within the five km buffer, and two reference sites located more than 5 km distant (Table 2). The highest recorded dust fall at the Mine Site was at sample site DF-M-02, located between the airstrip and the land fill site (Map 1); deposition rates ranged from below detection (<0.10 mg/dm²·day) in October 2016 to a high of 13.80 mg/dm²·day in May 2016 (Table 4). At DF-M-03, located just south of the road to the pit, the dust deposition rates ranged from below detection (<0.10 mg/dm²·day) to 7.89 mg/dm²·day. At site DF-M-01, located near the weather station, the dust fall deposition rates ranged from 0.31 mg/dm²·day to a high of 6.82 mg/dm²·day.

Sites DF-M-06, 07, 08, and 09, all located outside the mine footprint but within 5 km radius, had detectable, but low dust fall throughout the year; all had mean monthly dust fall less than 0.5 mg/dm²·day (Table 4). Dust fall deposition rates at both Mine Site reference locations (DF-M-04 and DF-M-05) as well at DF-M-08 were below detection in all samples collected. Therefore the data suggests that the rate of dust fall at the Mine Site is increased by Project activities and was detectable by the near site collectors; the rate of dust fall at the reference sites (12 km distant) was unaffected.

There was strong evidence of differences in distance class for mine sites during the summer sampling period (p<0.001; Figure 2). Median daily dust fall was highest in the 'Near' distance class at 2.1 (CI = 1.5 – 2.9) mg/dm²·day, this was significantly higher than the other two distances classes (p<0.001). There was no difference in dust fall between the 'Far' and 'Reference' distance classes (p = 0.96), where daily dust fall was less than 0.1 (CI = 0.1 – 0.2) and 0.1 (CI = 0.1 – 0.2) mg/dm²·day, respectively.

Milne Port — Six dust fall samplers were associated with Milne Port for 2015 (refer to Table 2, Map 1); five active sites on the port footprint; DF-P-5 replaced DF-P-2 and one reference site located northeast of the port site. Dust fall deposition rates at Milne Port were highest at DF-P-01 and DF-P-05. Dust fall ranged from below detection (<0.10 mg/dm²·day) to 17.50 mg/dm²·day at DF-P-01, and from 0.48 mg/dm²·day to 5.57 mg/dm²·day at DF-P-05 (Table 4). Dust fall data collected at sites DF-P-04, 06 and 07 were all low, below 1.0 mg/dm²·day. Dust fall deposition rates at the Milne Port reference site, DF-03-P were below detection in all samples.

Tote Road Crossings — Eighteen dust fall samplers were associated with the Tote Road; eight at each of two sample sites consisting of transects perpendicular to the road (the North site and South site), and two reference samplers located approximately 14 km from the road.

South Crossing — There was strong evidence of an effect of distance from the south road on daily dust fall during the summer sampling period (p = 0.002; Figure 3). Median daily dust fall was highest in the 30 m distance class at 32.0 (CI = 15.2 – 67.3) mg/dm²·day, this was significantly higher than all other distance classes ($p < 0.001$). Daily dust fall in the 100 m distance class was 4.7 (CI = 2.2 - 9.9) mg/dm²·day, which was also higher than the two farther distance classes ($p<0.001$). There was no difference in dust fall between the 1000 m and 5000 m distance classes ($p = 0.20$), where daily dust fall was less than 0.4 (CI = 0.2 – 1.0) and 0.1(CI = 0.1 - 0.3) mg/dm²·day, respectively.

North Crossing — There was strong evidence of an effect of distance from the north road on daily dust fall during the summer sampling period ($p = 0.001$; Figure 4). Median daily dust fall was highest in the 30 m distance class at 9.3 (CI = 5.5 – 15.7) mg/dm²·day, this was significantly higher than all other distances classes (p = <0.001). Daily dust fall in the 100 m distance class was 2.8 (CI = 1.6 – 4.7) mg/dm²·day, which was also higher than the two farther distance classes ($p<0.001$). There was no difference in dust fall between the 1000 m and 5000 m distance classes ($p = 0.57$), where daily dust fall was 0.2 (CI = 0.1 – 0.4) and 0.1 (CI = 0.1 – 0.2) mg/dm²·day, respectively. The majority of the dust fall data collected at DF-RN-01 and -08 was below laboratory detection limits.

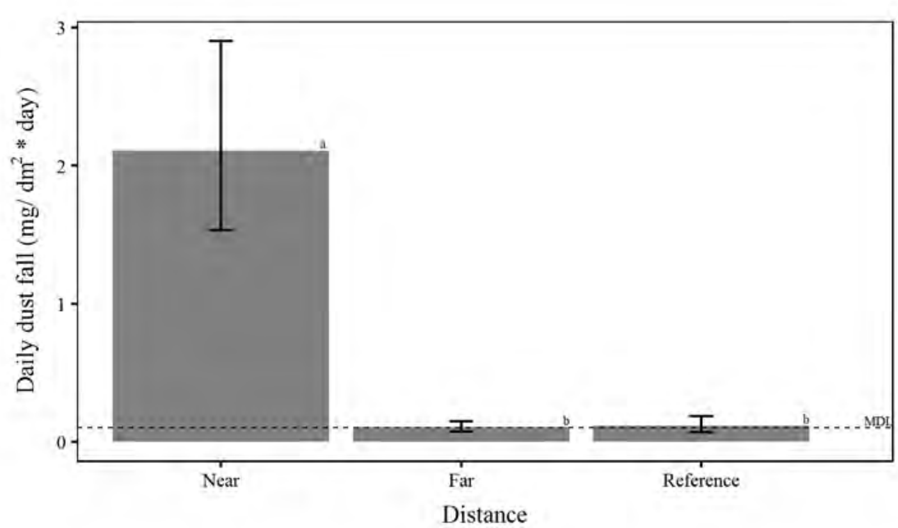


Figure 2. Median daily dust fall (mg/dm²·day) during summer sampling (June, July and August) for mine sites by distance class.

Bar heights show median daily dust fall with 95% confidence intervals. Letters at the top of each bar indicate group differences in median daily dust fall, bars that share the same letter have overlapping estimates for median dust fall. The dashed horizontal line indicates the minimum detection limit (MDL) for dust samples.

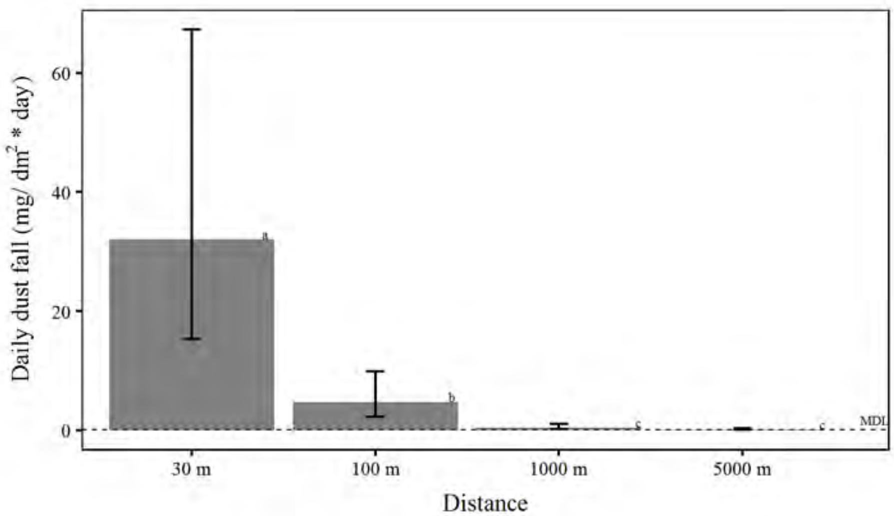


Figure 3. Median daily dust fall (mg/dm²·day) during summer sampling (June, July and August) for south road sites as a function of distance from the Tote Road.

Bar heights show median daily dust fall with 95% confidence intervals. Letters at the top of each bar indicate group differences in median daily dust fall, bars that share the same letter have overlapping estimates for median dust fall. The dashed horizontal line indicates the minimum detection limit (MDL) for dust samples.

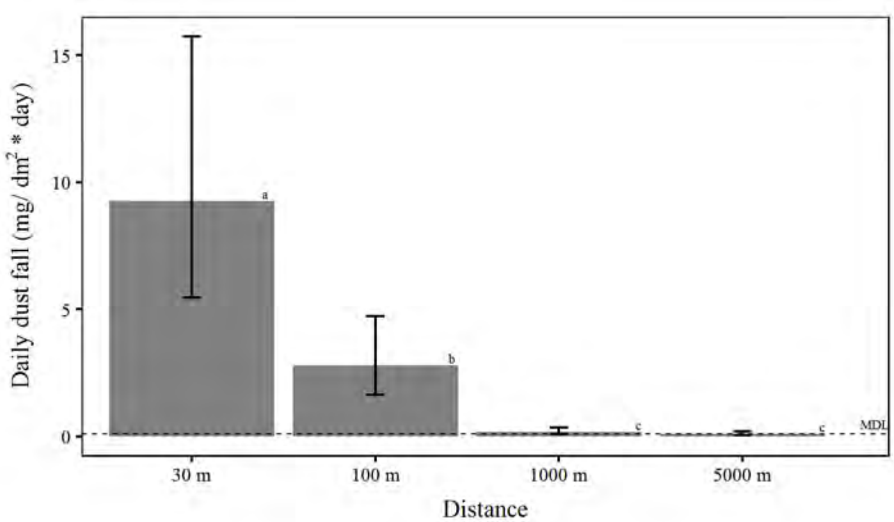


Figure 4. Median daily dust fall (mg/dm²·day) during summer sampling (June, July and August) for north road sites as a function of distance from the Tote Road.

Bar heights show median daily dust fall with 95% confidence intervals. Letters at the top of each bar indicate group differences in median daily dust fall, bars that share the same letter have overlapping estimates for median dust fall. The dashed horizontal line indicates the minimum detection limit (MDL) for dust samples.

Table 4. Dust fall, as total suspended particulate matter (mg/dm²·day), collected at all sample sites during the 2016 monitoring year.

Site Name	Sample Collection Date											
	18-Jan-16	16-Feb-16	14-Mar-16	11-Apr-16	09-May-16	11-Jun-16	12-Jul-16	15-Aug-16	23-Sep-16	17-Oct-16	19-Nov-16	19-Dec-16
DF-M-01	0.38	0.31	1.26	1.09	6.82	2.52	3.14	1.99	0.92	4.70	2.79	0.53
DF-M-02	2.61	2.17	6.59	3.32	13.80	4.45	1.31	0.57	0.89	<0.1	6.60	0.91
DF-M-03	1.07	1.12	1.73	7.89	3.53	2.58	5.02	1.09	1.35	<0.1	1.22	0.54
DF-M-04	--	--	--	--	--	--	<0.1	<0.1	<0.1	--	--	--
DF-M-05	--	--	--	--	--	--	<0.1	<0.1	<0.1	--	--	--
DF-M-06	--	--	--	--	--	--	<0.1	<0.1	<0.1	--	--	--
DF-M-07	0.46	<0.1	--	--	--	--	0.16	<0.1	0.11	--	--	--
DF-M-08	--	--	--	--	--	--	<0.1	<0.1	<0.1	--	--	--
DF-M-09	<0.1	<0.1	--	--	--	--	0.17	<0.1	0.13	--	--	--
DF-P-01	11.90	1.18	6.87	17.50	10.30	2.18	6.38	5.26	2.63	<0.1	6.20	1.76
DF-P-03	--	--	--	--	--	--	<0.1	<0.1	<0.1	--	--	--
DF-P-04	<0.1	<0.1	0.25	0.27	0.60	0.63	0.28	0.23	0.41	<0.1	0.16	0.28
DF-P-05	0.48	2.03	1.85	4.12	5.57	3.22	5.46	2.42	3.00	1.80	2.69	1.28
DF-P-06	<0.1	0.17	0.34	0.57	0.37	0.14	0.14	<0.1	0.18	<0.1	0.12	0.24
DF-P-07	<0.1	0.27	0.66	0.47	0.98	0.13	0.45	0.42	0.34	<0.1	0.76	0.34
DF-RN-01	--	--	--	--	--	--	<0.1	<0.1	<0.1	--	--	--
DF-RN-02	<0.1	<0.1	--	--	--	--	0.20	<0.1	<0.1	--	--	--
DF-RN-03	<0.1	<0.1	0.28	0.40	1.11	1.17	5.25	1.70	0.49	<0.1	0.48	0.43
DF-RN-04	0.46	2.52	1.83	1.88	3.67	4.40	31.40	9.92	2.62	2.80	3.46	6.07
DF-RN-05	0.17	0.66	0.56	2.23	3.80	12.00	8.56	4.15	1.78	<0.1	1.47	2.03
DF-RN-06	<0.1	0.21	0.22	1.06	1.78	4.49	5.65	1.57	0.77	0.10	0.58	0.98
DF-RN-07	<0.1	<0.1	--	--	--	--	0.50	<0.1	<0.1	--	--	--
DF-RN-08	--	--	--	--	--	--	<0.1	<0.1	<0.1	--	--	--
DF-RS-01	--	<0.1	--	--	--	--	0.16	<0.1	<0.1	--	--	--
DF-RS-02	<0.1	<0.1	--	--	--	--	1.87	0.38	0.42	--	--	--
DF-RS-03	<0.1	<0.1	0.10	0.29	0.94	7.12	12.20	1.37	3.00	<0.1	0.14	0.16
DF-RS-04	0.15	0.25	0.36	1.23	3.66	53.50	109.00	12.40	22.50	2.20	0.47	0.79
DF-RS-05	0.14	0.20	0.28	1.13	3.19	56.60	27.80	8.27	8.79	1.40	<0.1	0.47
DF-RS-06	<0.1	<0.1	0.13	0.33	0.63	10.40	5.14	1.47	2.04	0.10	0.27	0.12
DF-RS-07	<0.1	<0.1	--	--	--	--	0.30	<0.1	0.11	--	--	--
DF-RS-08	<0.1	<0.1	--	--	--	--	<0.1	<0.1	<0.1	--	--	--
DF-RR-01	--	--	--	--	--	--	--	<0.1	<0.1	--	--	--
DF-RR-02	--	--	--	--	--	--	<0.1	<0.1	<0.1	--	--	--

Note: 1. "-" indicates that no data were collected.

2.2.4 SEASONAL COMPARISONS OF 2016 DUST FALL

Mine Site — There was no evidence for an effect of season ($p = 0.42$) or sample site ($p = 0.75$) on daily dust fall for the mine site (Figure 5). Median daily dust fall for the mine sites across seasons and sample sites was 1.5 $mg/dm^2 \cdot day$ (95% CI = 0.9 – 2.4).

Port Site — There was no support for a seasonal effect ($p = 0.50$) or an interaction between season and sample site ($p = 0.62$). There was strong evidence of a difference in dust fall among sample sites for the Milne Port ($p<0.001$; Figure 6). DF-P-01 and DF-P-05 had significantly higher median daily dust fall than the other three sites (p-values <0.001). After accounting for season, median daily dust fall at DF-P-01 and DF-P-05 was 3.8 (CI = 3.0 – 3.8) times higher than the other three port sites.

Tote Road, South Crossing — There was a significant seasonal effect on dust fall for the south road sites ($p < 0.001$; Figure 7). After accounting for sample site, median daily dust fall was 24.9 (CI = 12.2 – 51.1) times higher in the summer than in winter. There was also a significant difference among sample sites ($p<0.001$). After accounting for seasonal affects, median daily dust fall at DF-RS-04 and DF-RS-05 was 31.4 (CI = 7.1 – 137.6) times higher than the other two south road sites.

Tote Road, North Crossing — There was a significant seasonal effect on dust fall for the north road sites ($p = 0.003$; Figure 8). After accounting for sample site, median daily dust fall was 9.2 (CI = 2.9 – 29.3) times higher in the summer than in winter. There was also a significant difference among sample sites ($p = 0.007$). After accounting for seasonal affects, median daily dust fall at DF-RN-04 and DF-RN-05 was 13.7 (CI = 6.3 – 29.8) times higher than the other two north road sites.

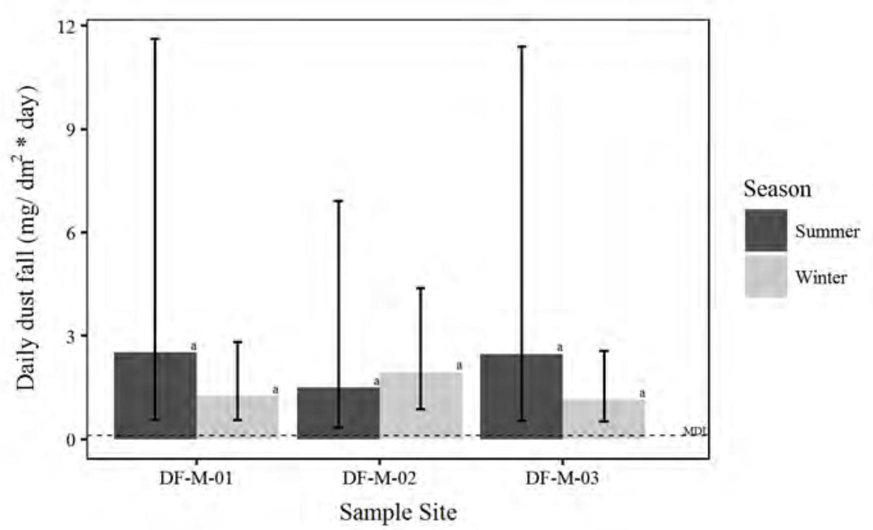


Figure 5. Median daily dust fall by site and season for the Mine sample sites.
Bar heights show median daily dust fall with 95% confidence intervals. Letters at the top of each bar indicate group differences in median daily dust fall, bars that share the same letter have overlapping estimates for median dust fall. The dashed horizontal line indicates the minimum detection limit (MDL) for dust samples.

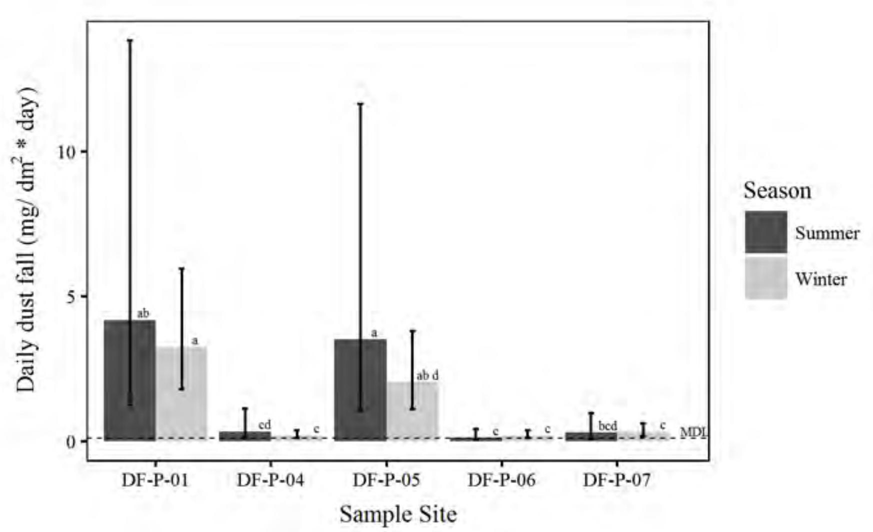


Figure 6. Median daily dust fall by site and season for the Milne Port sample sites.
Bar heights show median daily dust fall with 95% confidence intervals. Letters at the top of each bar indicate group differences in average daily dust fall, bars that share the same letter have overlapping estimates for median dust fall. The dashed horizontal line indicates the minimum detection limit (MDL) for dust samples.

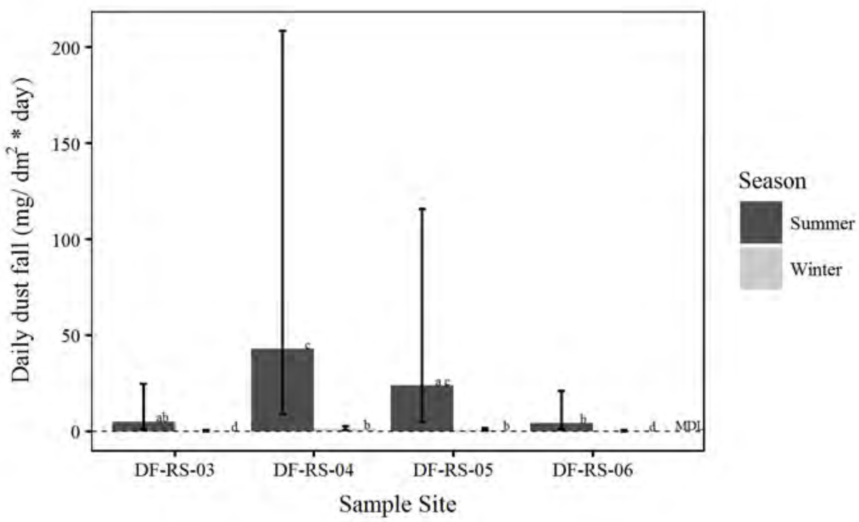


Figure 7. Median daily dust fall by site and season for the Tote Road south sample sites.
Bar heights show median daily dust fall with 95% confidence intervals. Letters at the top of each bar indicate group differences in average daily dust fall, bars that share the same letter have overlapping estimates for median dust fall. The dashed horizontal line indicates the minimum detection limit (MDL) for dust samples.

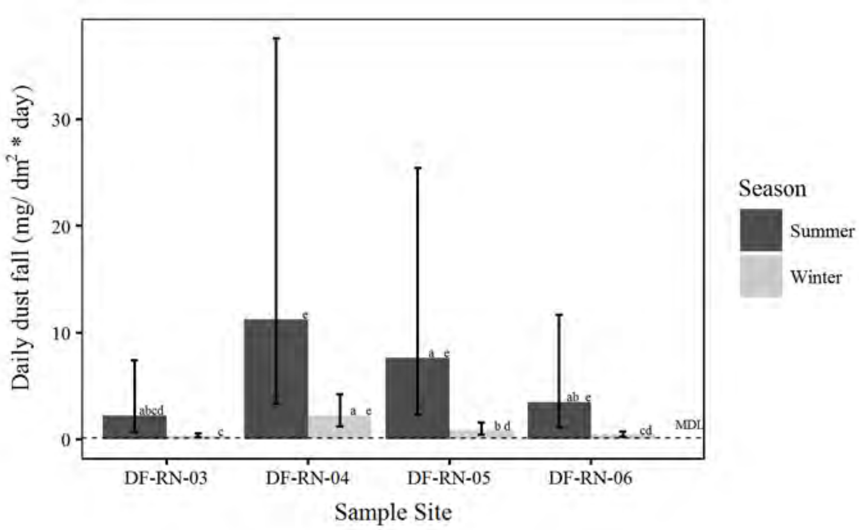


Figure 8. Median daily dust fall by site and season for the Tote Road north sample sites.
Bar heights show median daily dust fall with 95% confidence intervals. Letters at the top of each bar indicate group differences in average daily dust fall, bars that share the same letter have overlapping estimates for median dust fall. The dashed horizontal line indicates the minimum detection limit (MDL) for dust samples.

2.2.5 2016 ANNUAL DUST FALL

Total annual dust fall was reviewed at all sites that were sampled year round for the 2016 calendar year. Sites in the nil and low isopleth zones were not sampled during winter months; therefore, annual accumulation was not estimated for these sites because there was no data available for a number of sampling periods. However, very low dust fall accumulation was observed at these sites during the summer months.

Annual dust fall in samplers at the Mine Site were all predicted to be in the 'high' isopleth (≥ 50 g/m²/year). As predicted, dust fall from sample locations DF-M-01, -02, and -03 all indicated annual dust fall that was between 77.9 and 128.23 g/m²/year (Table 5; Figure 8).

Year-round dust fall samplers at Milne Inlet Port sites DF-P-01 and 05 had annual dust fall deposition rates that fell into the high isopleth threshold (≥ 50 g/m²/year), though both were modelled to be in the moderate threshold. The total annual deposition rates at DF-P-01 and DF-P-05 were 204.12 and 102.55 g/m²/year, respectively (Table 5; Figure 10). Milne Port sites DF-P-04, 06 and 07 all fell into the moderate isopleth threshold with annual dust fall rates of 10.50, 7.48 and 14.93 g/m²/year, respectively; therefore sites DF-P-04 and 06 were higher than the low threshold predicted, while DF-P-07 was lower than the high threshold predicted.

Annual dust fall at the north and south Tote Road crossing locations within 100 m of the road centreline fell within the high isopleth, which was higher than predicted (Table 5; Figure 11, Figure 12). Dust fall at the sites located closest to the Tote Road centreline at both the north and south crossing transects was higher than observed at any sampling locations at Mine Site and Milne Inlet Port.

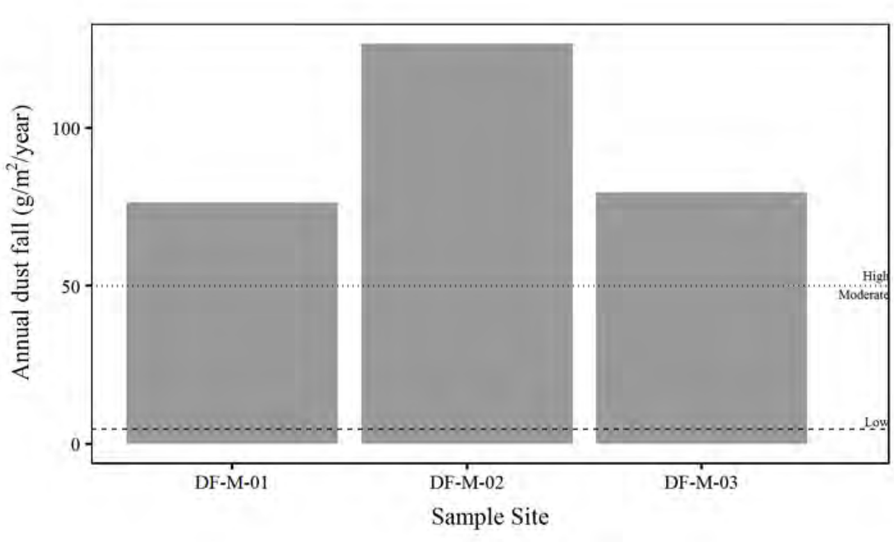


Figure 9. Mine Site annual dust fall for high isopleth sampling stations that were sampled year-round.
Dashed horizontal lines show low, moderate, and high dust isopleth threshold upper limits.

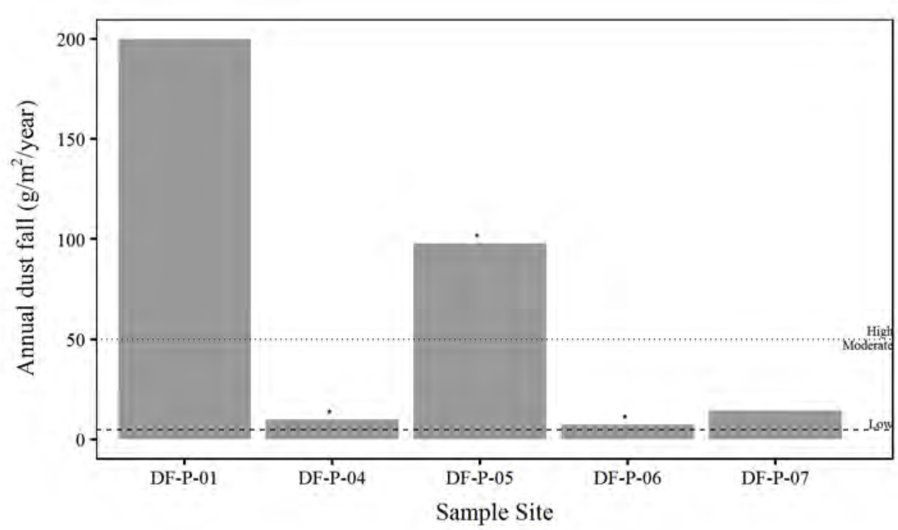


Figure 10. **Milne Port annual dust fall for sampling stations that were sampled year round.**
Dashed horizontal lines show low, moderate, and high dust isopleth threshold upper limits. The asterisk (*) denotes that the annual dust fall was greater than projected by the predicted isopleth.

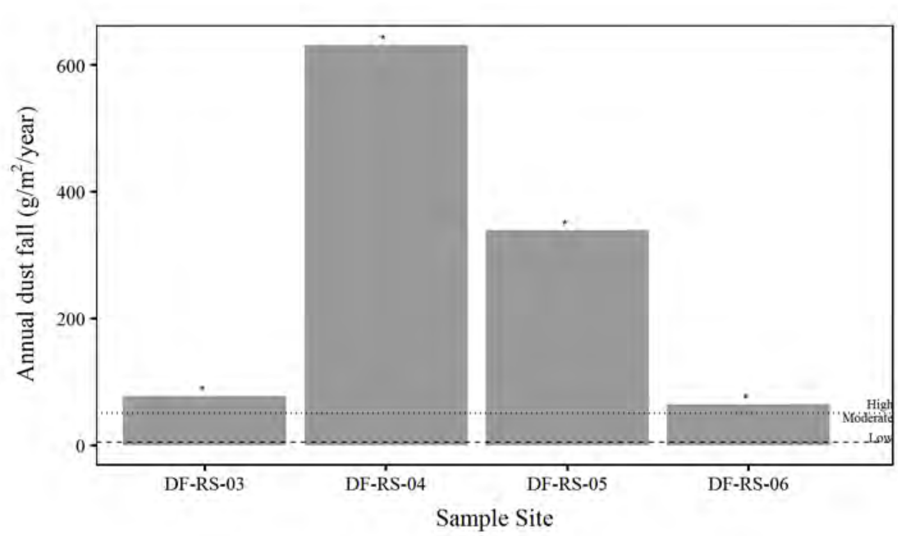


Figure 11. **Tote Road south crossing annual dust fall for sampling stations that were sampled year-round.**
Dashed horizontal lines show low, moderate, and high dust isopleth threshold upper limits. The asterisk (*) denotes that the annual dust fall was greater than projected by the predicted isopleth.

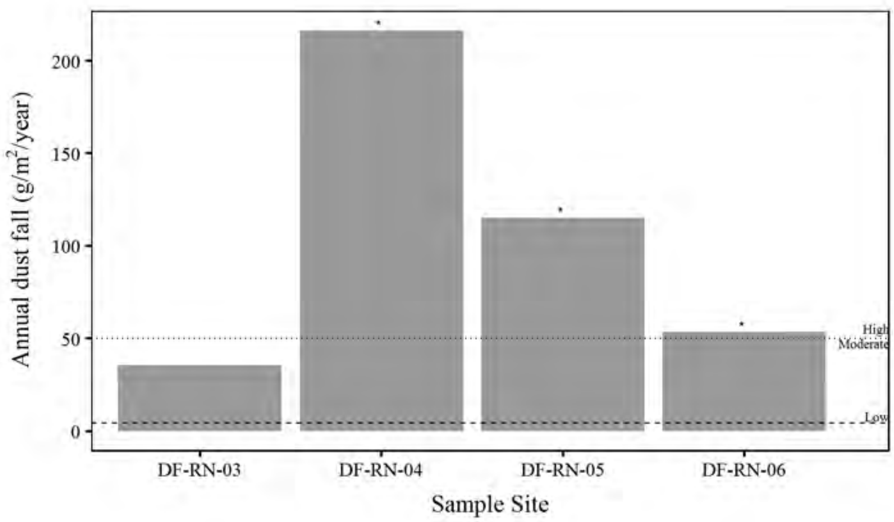


Figure 12. Tote Road north crossing annual dust fall for sampling stations that were sampled year-round.
Dashed horizontal lines show low, moderate, and high dust isopleth threshold upper limits. The asterisk (*) denotes that the annual dust fall was greater than projected by the predicted isopleth.

Table 5. Annual dust fall accumulation for sites sampled throughout the year. Annual accumulations are reported for the period 21 Dec 2015* to 17 Dec 2016. Sample sites that exceeded the predicted annual dust fall are shaded.

Site	Area	Distance	Threshold	Threshold Upper Limit	$g/m^2/year$
DF-M-01	Mine Site	0	High	N/A[1]	77.99
DF-M-02	Mine Site	0	High	N/A	128.23
DF-M-03	Mine Site	0	High	N/A	81.90
DF-P-01	Milne Inlet Port	0	Moderate	50	204.12
DF-P-04	Milne Inlet Port	0	Low	4.5	10.50
DF-P-05	Milne Inlet Port	0	Moderate	50	102.55
DF-P-06	Milne Inlet Port	0	Low	4.5	7.48
DF-P-07	Milne Inlet Port	0	High	N/A	14.93
DF-RS-03	Road South	100	Moderate	50	82.90
DF-RS-04	Road South	30	Moderate	50	667.54
DF-RS-05	Road South	30	Moderate	50	353.74
DF-RS-06	Road South	100	Moderate	50	68.11
DF-RN-03	Road North	100	Moderate	50	36.37
DF-RN-04	Road North	30	Moderate	50	220.53
DF-RN-05	Road North	30	Moderate	50	118.07
DF-RN-06	Road North	100	Moderate	50	54.83

Notes

* Mine and Road South sites visited on Dec 21st, Road North sites on Dec 27th, and Port sites on either Dec 27th or 28th.

1. The high threshold does not have an upper limit; sites modelled in the high threshold are predicted to have >50 $g/m^2/year$ of total suspended particulate matter (dust fall).

2.2.6 DUST FALL SUPRESSION IN 2016

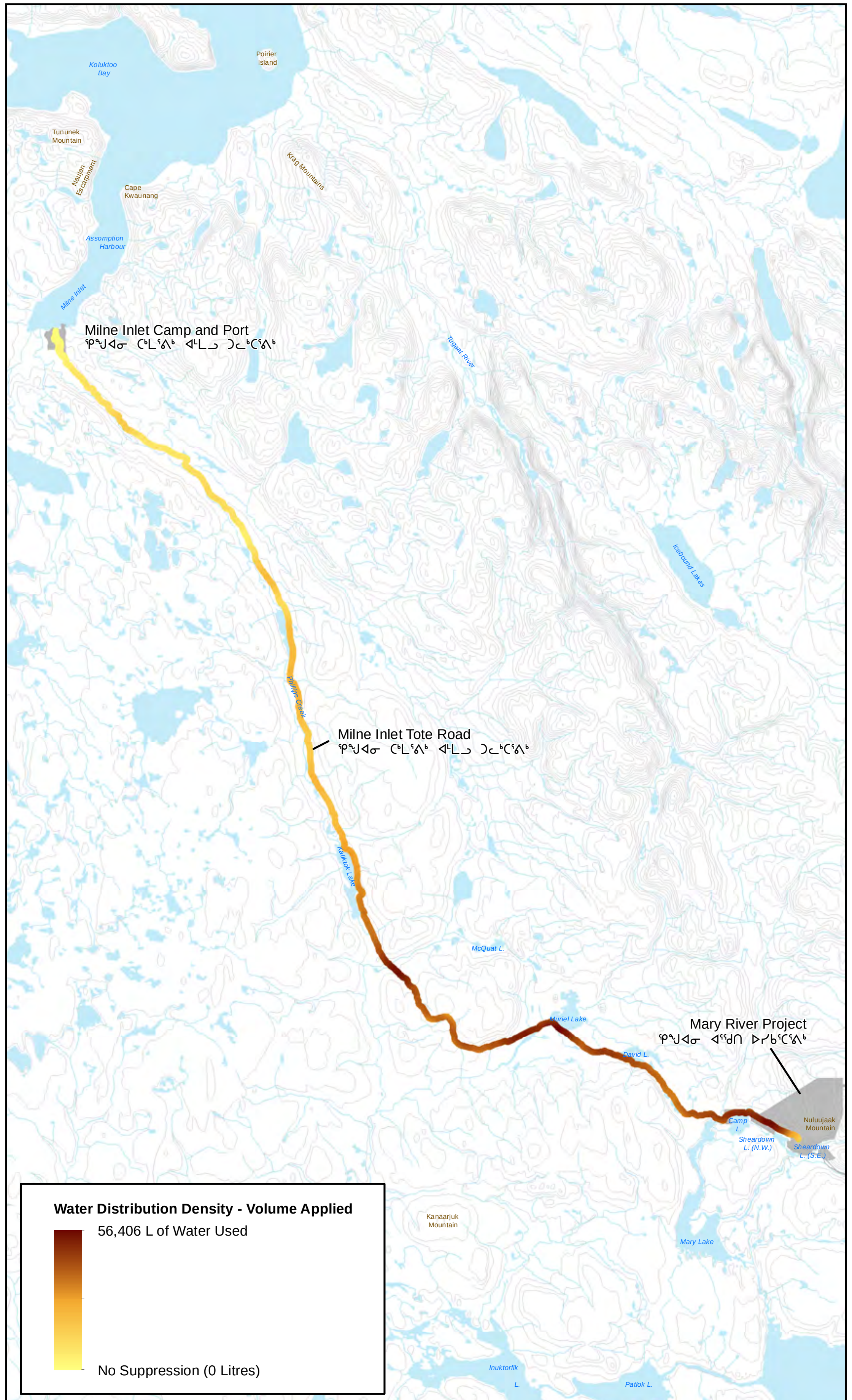
Water and calcium chloride were used for dust suppression from June 2 to August 30 throughout the Project footprint. Water was used to suppress dust on all Project areas including the Tote Road, Milne Port, and the Mine Site. It was used on 69 events in the Mine Site area, spread among the mine haul road, the mine site laydown, the meteorological station and the air strip, three events in the Milne Port area, 111 events along the North Tote Road, and 218 events along the South Tote Road (Table 6; Map 2). The total amount of water used in each area was 3667 m^3 in the Mine Site area, 51 m^3 at Milne Port, 2110 m^3 along the North Tote Road, and 6448 m^3 along the South Tote Road.

Calcium chloride was used mostly on the Tote Road and on one occasion in the Milne Port area. Along the North Tote Road there were 34 events where calcium chloride was spread, with an average of 3,771 kg per event, for a total of 128,200 kg used. Along the South Tote Road there were 32 events where calcium chloride was spread with an average of 2,914 kg per event, for a total of 93,240 kg used (Table 6; Map 3)

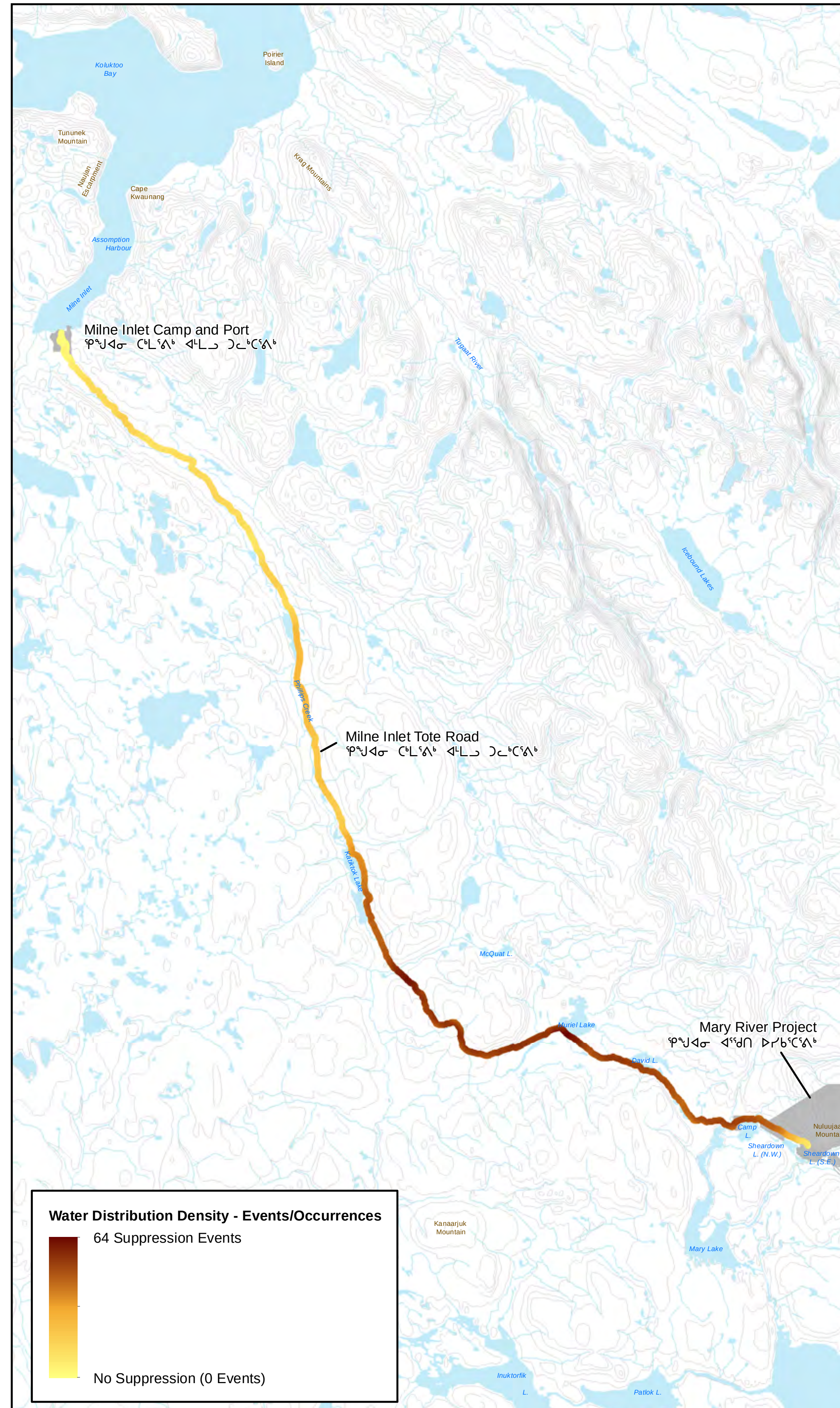
Table 6. Summary of dust fall suppression activities throughout the Project Area, June 02–August 30, 2016.

Area	Type of Dust Suppression	Number of Application Events[1]	Average Quantity of Suppressant per Event	Total Quantity of Suppressant Used
Mine Site	Calcium Chloride	0	-	-
	Water	69	51.6 m^3	3667.7 m^3
Milne Port	Calcium Chloride	1	4,000 kg	4,000 kg
	Water	3	17.0 m^3	51.1 m^3
North Tote Road	Calcium Chloride	34	3,771 kg	128,200 kg
	Water	111	19.0 m^3	2110.7 m^3
South Tote Road	Calcium Chloride	32	2,914 kg	93,240 kg
	Water	218	29.6 m^3	6448.1 m^3

[1] 'Events' refers to each truck carrying either calcium chloride or water for dust suppression activities; there may be more than one event per day.



Density of Water Distribution by Volume



Density of Water Distribution by Occurrence

LEGEND ᑐᑦᑎᔭᕐᑦ

- Topographic contour (20m interval)
- Potential Development Area
- Regional Study Area

NOTES ᖃᐅᔨᒪᔭᕐᕕᑦ

Map Projection: North American Datum UTM Zone 17N.

Updated PDA provided by Hatch (25 April 2013).

Suppression data provided by Baffinland Iron Mines (January 2017). Data includes suppression events from June to August, 2016

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale: 0, 2.5, 5, 10, 15, 20, 25 Km

Baffinland Iron Mines Corporation

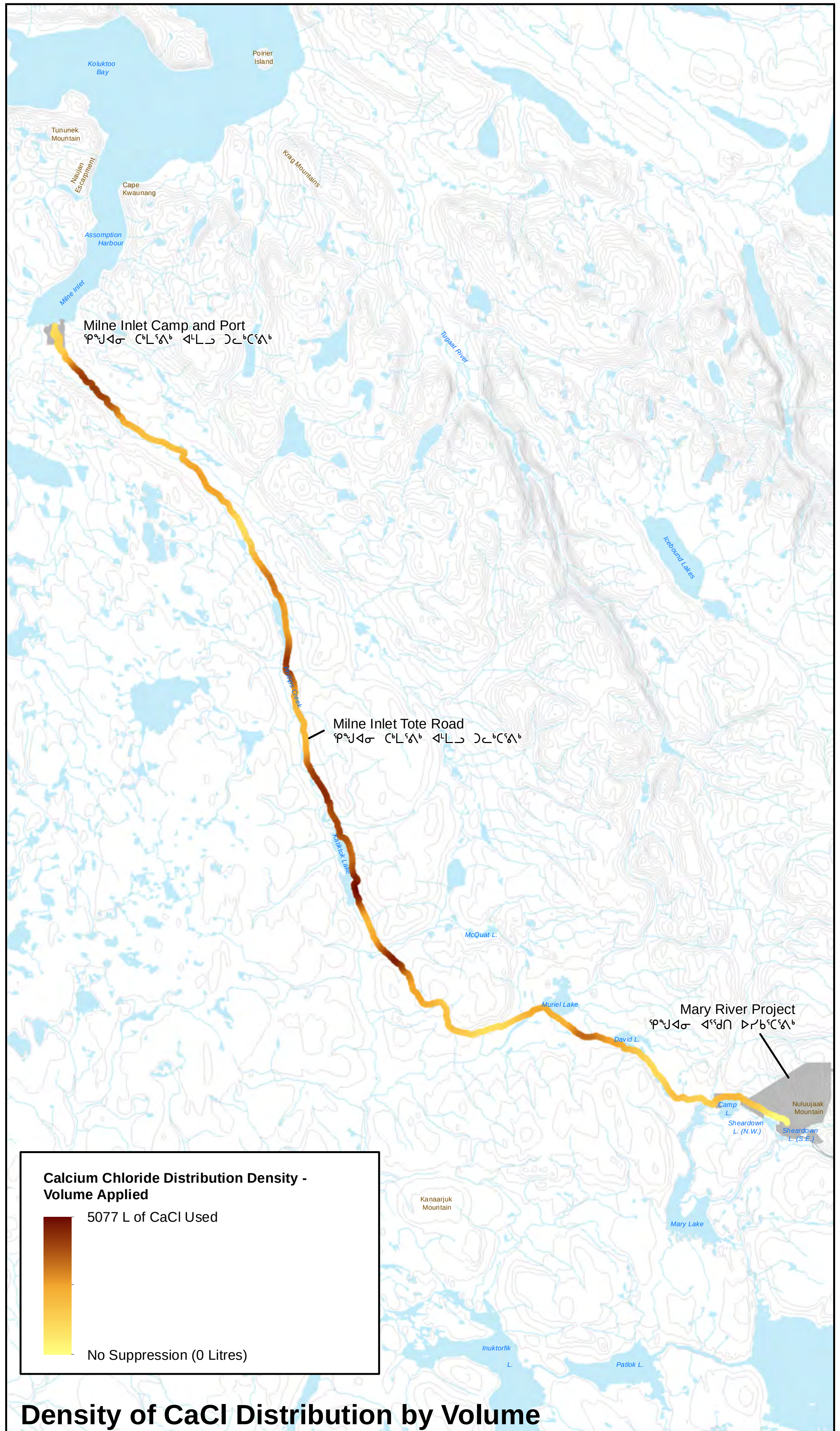
Dust Fall Suppression Using Water Along the Tote Road

EDI

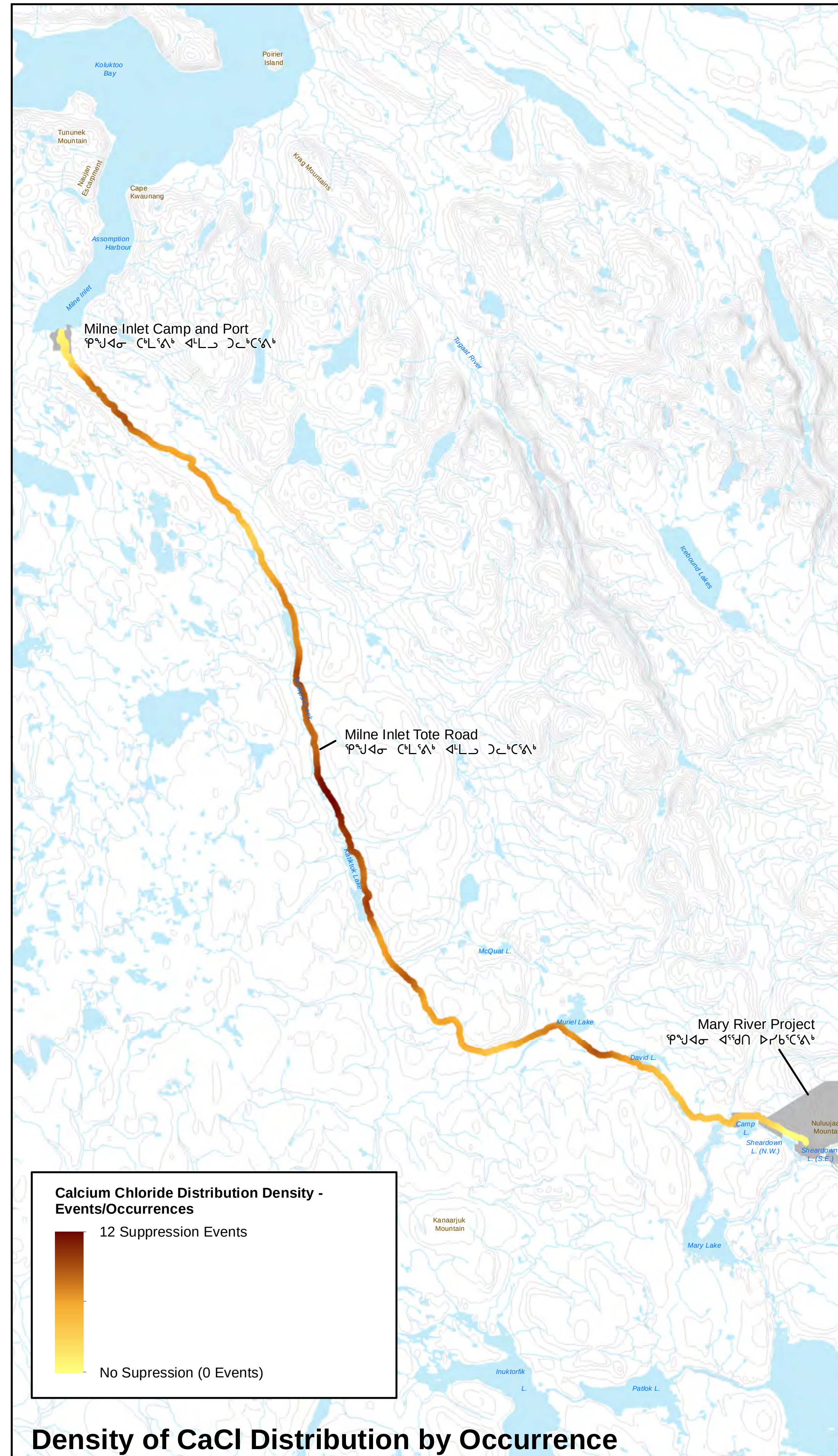
Date: 3/7/2017

MAP 2

Path: O:\2016\16Y0076_BIM\Mapping\Monitoring\AnnualReportMaps_04032017\Map2_SuppressionWater.mxd



Density of CaCl Distribution by Volume



Density of CaCl Distribution by Occurrence

LEGEND

- Topographic contour (20m interval)
- Potential Development Area
- Regional Study Area

NOTES

Map Projection: North American Datum UTM Zone 17N.

Updated PDA provided by Hatch (25 April 2013).

Suppression data provided by Baffinland Iron Mines (January 2017). Data includes suppression events from June to August, 2016

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale: 0 – 2.5 – 5 – 10 – 15 – 20 – 25 Km

Baffinland Iron Mines Corporation

Dust Fall Suppression Using Calcium Chloride Along the Tote Road

EDI

Date: 3/7/2017

MAP 3

Path: O:\2016\16Y0076_BIM\Mapping\Monitoring\AnnualReportMaps_04032017\Map3_SuppressionCaCl.mxd

2.3 SUMMARY

- Climate data collected in 2016 was compared with climate data collected as part of the project baseline data collection (2005–2010). These data indicate that conditions were similar with regard to air temperature, but considerably drier in 2016 when compared to baseline data. This may have contributed to increased dust fall at both the Mine Site and Milne Port.
- The total number of vehicle passes on the Tote Road in all months, save late May, which represents spring melt, regularly exceeded the projected maximum traffic volume; this vehicle activity is a contributor to dust fall as measured at both the south and north Tote Road crossing sample locations.
- Dust fall associated with the Tote Road was measured within one kilometre on either side of the road centreline. Outside the one kilometre range the dust fall deposition rates decreased to just at or below laboratory detection limits, which is similar to background conditions.
- Seasonal trends were not detected at the Mine Site. There were, however, significant seasonal variations at Milne Port and the Tote Road south and north crossings. Dust fall in these areas was higher during the summer months.
- Annual dust fall at the Mine Site falls within predicted levels.
- There are some exceedances of annual dust fall predictions at Milne Port:
    - Site DF-P-01 was 4X the predicted threshold upper limit;
    - Sites DF-P-04 and -05 were 2X the predicted threshold upper limit; and
    - Site DF-P-06 was 1.5X the predicted threshold upper limit.
- Annual dust fall along the Tote Road at the 30 m and 100 m distance from the centreline at both Tote Road south and north crossings exceeded predictions.

3 VEGETATION

The Project's FEIS identified potential effects on vegetation abundance, diversity and health (Volume 6, Section 3; Baffinland 2012). Overall effects to vegetation abundance and diversity were predicted to be "not significant" with a high level of confidence, while effects on vegetation health were predicted to be limited, with moderate confidence due to uncertainties on the effects of dust, metals and emissions on local vegetation. To address these limitations, data collection for long-term vegetation monitoring was completed for the following programs:

- Dust fall monitoring (Section 2);
- Vegetation abundance monitoring; and
- Vegetation and soil base metal monitoring.

3.1 VEGETATION ABUNDANCE MONITORING

To meet the terms and conditions required under the NIRB Project Certificate, Baffinland committed to establishing a long-term monitoring program to study potential changes to vegetation abundance used as caribou forage within the RSA. This commitment directly relates to the following conditions:

- Project Condition #36 — The Proponent shall establish an on-going monitoring program for vegetation species used as caribou forage (such as lichens) near Project development areas, prior to commencing operations.
- Project Condition #50 and Project Commitment #67 also address these limitations or relate to the reporting requirements for the vegetation abundance monitoring program.

To meet these monitoring commitments, a long-term vegetation monitoring program was initiated in 2014. The objective of the vegetation abundance monitoring program is to:

- Measure percent plant cover and plant group composition of available caribou forage within the RSA to track potential changes at varying distances from the edge of the PDA through long-term monitoring.

Vegetation monitoring data was collected under the initial study design for two years. In 2016, the vegetation monitoring program was revised to address recommendations from the Government of Nunavut. Revisions to the vegetation abundance monitoring program included:

- Increasing sample size to 15 balanced transects and six reference sites to improve statistical power to detect changes in ground, canopy and lichen cover.
- Replacing the 1 x 1 m enclosures with 2 x 2 m enclosures to reduce the influence of edge effects associated with the cages.

Future vegetation monitoring will be compared to baseline data to assess potential changes in percent plant cover and plant group composition.

3.1.1 METHODS

The study design and sample site selection were based on a review of relevant literature. Information considered when developing the vegetation monitoring program included dust fall modeling (Baffinland 2013), northern Canadian vegetation habitat types (Olthof et al. 2009), preferred caribou forage (summarized in Baffinland 2012) and other literature (Auerbach et al. 1997; Spatt and Miller 1981; Walker and Everett 1987; Walker 1996). Where feasible, recommendations from the Government of Nunavut (2014) and Parks Canada (Hudson and Ouimet 2011) were included in the study design.

A distance gradient approach was used based on the premise that vegetation close to Project disturbance would likely be more affected than vegetation further from disturbance areas. To assess potential changes in vegetation associated with Project disturbance (e.g. dust and emissions), vegetation sampling occurred at specific distances (30, 100, 750 and 1,200 m) from the edge of the PDA. The four distance classes were chosen based on a review of relevant available literature and dust isopleth modeling (Baffinland 2013).

The monitoring program follows a Before-After-Control-Impact-design (BACI) (Bernstein and Zalinski 1983; Stewart-Oaten et al. 1992) with a stratified random paired/block design. The BACI design is common for impact assessments where the goal is to determine whether there is a statistically significant and biologically meaningful difference between baseline and disturbance conditions (e.g., changes to abundance of a species). This design involves pairing control and impacted sites where samples are taken simultaneously at both sites before and after a disturbance occurs.

To reduce natural variability in vegetation cover associated with differing habitat types and to allow for meaningful statistical comparisons, all sites were located within one habitat type. The habitat type chosen was based on the following factors:

- Relative abundance of habitat type (as summarized in the Project's wildlife baseline report —Appendix 6F, Baffinland 2012);
- Relative habitat use by caribou (a mixture of the Resource Selection Probability Function model results in the Project's wildlife baseline report and the energetics model presented in Russell (2014); and
- Likelihood of habitat type containing high quality caribou forage (Appendix 6F, Baffinland 2012).

The habitat type selected for vegetation abundance monitoring was the Moist to Dry Non-Tussock Graminoid/Dwarf Shrub type (Northern Land Cover, Olthof et al 2009), one of the more common habitats in the RSA (Photo 1). The North Baffin Island Caribou herd does not appear to select one habitat type over another, but do exclude areas where vegetation cover is relatively low (Russell 2014). The Moist to Dry Non-Tussock Graminoid/Dwarf Shrub vegetation habitat type is considered high quality caribou forage, given that it contains lichen, grasses, sedges, forbs and deciduous shrubs. These plant groups are considered important food items for caribou in summer when plant nutritional value and digestibility is high, as well as in winter when food availability is mainly limited to lichen.

The vegetation abundance monitoring program involved the establishment of long-term vegetation plots. Plots were situated along 15 transects radiating out from the Mine Site (six transects), Tote Road (five transects) and Milne Inlet (four transects). In addition, six control (reference) sites were established within the RSA, approximately 20 km from the Project footprint. In total, 66 sample sites were located within the RSA (Map 4). Some pre-selected site locations had to be moved to locate the site within the selected habitat type. To prevent pseudo-replication and ensure independence between sites, all transects were spaced a minimum of 200 m apart with the majority of transects spaced 500 m apart. Each transect extended perpendicular from the Project disturbance footprint. Along each transect, four sample sites were located at 30 m, 100 m, 750 m and 1,200 m from the edge of the Project footprint.

To exclude potentially confounding effects of grazing (e.g., from caribou and small mammals) exclosure (i.e., closed plots) and open plots were used to account for herbivory effects. Each sample site consisted of one closed plot and one open plot. To account for within-site variability in vegetation cover, some sites included a second open plot, for a total of three plots at one site. Of the 66 sample sites, 47 sample sites had one closed plot associated with an open plot and 19 sites had one closed plot associated with two open plots (all three control sites had three plots each). In total, 151 1 x 1 m plots were sampled. To reduce bias, individual plots at each site were located close to the center of the polygon. Plots within a site were spaced 3 m apart to provide replication and reduce within site variability. At sites where 1 x 1 m cages were replaced with 2 x 2 m cages, plots were spaced 2.5 m apart. Figure 13 provides a schematic illustration of sample site and plot locations along a transect. At the time of plot establishment none of the sites selected for this study showed signs of herbivory. A table of all plots, transects, distances, treatments and coordinates is provided in Appendix A — Vegetation Abundance Monitoring Site Locations.

Closed plot cages were constructed from sturdy, weather resistant materials for long-term durability and to prevent caribou grazing from above and small mammal grazing at ground level. Galvanized rebar was used to mark the measuring plot and corner posts for the cage, half-inch galvanized hex wire along all four sides and one-inch galvanized poultry netting for the roof. Galvanized wire was used to secure the roof and galvanized nails with weather resistant rope were used to secure and stake the cage to the ground. Completely enclosed, the cage stands approximately 1 m in height and 2 x 2 m. The hex wire was flanged at the base and piled with rocks to exclude small mammals from entering the cage from the edges. The roofs of the cages were designed to be removable along three sides to allow for vegetation monitoring at plots inside the cages during future sampling events. The roof can be re-secured using galvanized wire. A typical site in terms of plot lay-out, topography, vegetation characteristics and closed plot cage construction is illustrated in Photo 2.

Each monitoring plot was given a unique identifier code. The plot labelling scheme was based on the transect number, distance class, and type and number of plots at a given site. Closed plots were denoted with an "X". The first open plot at a site was represented by an "A"; the second, if present, was labelled with a "B". For example, plot T1D30X represents transect 1, distance class 30 m and it is a closed plot.

Vegetation abundance monitoring plots (both open and closed) were 1 x 1 m square and were sampled using the point quadrat method. Plot dimensions and design were based on standards used by the International Tundra Experiment (ITEX; Walker 1996). The point quadrat method is considered one of the most objective and repeatable methods for monitoring vegetation (Bonham 2013; Goodall 1952; Levy and Madden 1933) and is the recommended method for assessing vegetation changes in tundra plant communities (Molau and Molgaard 1996). It is a quantitative method that has been widely recommended for measuring vegetation abundance and is suitable for long-term monitoring (Elzinga et al. 1998; Hudson and Henry 2009; Stampfli 1991).

The point quadrat method involves a square 1 x 1 m metal plot frame with 100 fixed measurement locations spaced 10 cm apart across the frame (Figure 14). In traditional studies, a long pin is dropped through the frame at each of the 100 locations; however the quadrat frame in this study uses lasers instead of pins. The laser was moved and shot vertically downwards at each of the 100 marked locations along the frame. The first plant species that was touched or "hit" by the laser in the canopy layer and in the ground layer were tallied. Figure 15 provides a schematic illustration of the laser "hitting" the first plant in the canopy layer and then the first plant in the ground layer within a sampling plot. Percent plant cover was determined by summing the total number of "hits" for each species in each of the canopy and ground layers. Plant species were also categorized into respective plant groups to determine percent plant group cover.

The quadrat (i.e., plot) frame was set above the ground on four legs, two of which were permanent rebar posts marking the plot location (Photo 3). The rebar corner posts allow the frame to be set up in the same location year after year for repeatable measurements. All measurements began at the corner of the frame with the thicker of the two rebar pieces, moving from one side of the frame to the other and ended on the side of the plot with the skinny rebar post. The frame was leveled and positioned above the ground from 15–45 cm depending on the slope. The height of the frame had no effect on the diameter of the laser projecting onto the vegetation (~2 mm) (Photo 4).

Percent plant cover by plant group was used as the measure of vegetation abundance. Percent plant cover was measured using the point quadrat method with a total of 100 sampling points each for canopy cover and ground cover per plot. This method is widely used by ITEX for measuring various vegetation abundance measures (Walker 1996). Plant composition was assessed by tallying all species encountered and then grouped into broad vegetation groups (Molles and Cahill 2008). The plant groups selected for this study coincide with those used in the caribou energetics model (Russell

2014) and include deciduous shrubs, evergreen shrubs, forbs, graminoids, moss and lichen. Standing dead litter was also included as important winter forage that provides nutritional balance to caribou winter diet (Heggberget et al. 2002). Dead ground litter, un-vegetated substrates including bare ground, rock or gravel and cryptobiotic soil crusts were recorded but excluded from the percent cover values because these do not represent useable forage for caribou.

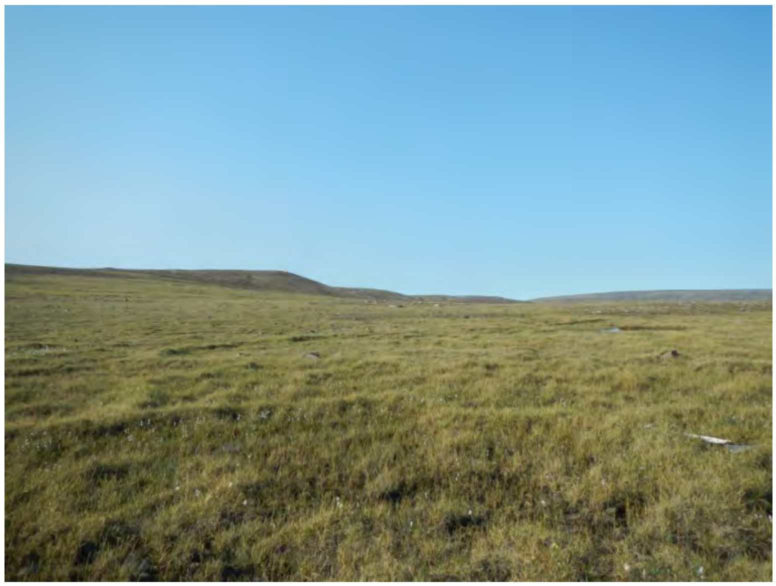
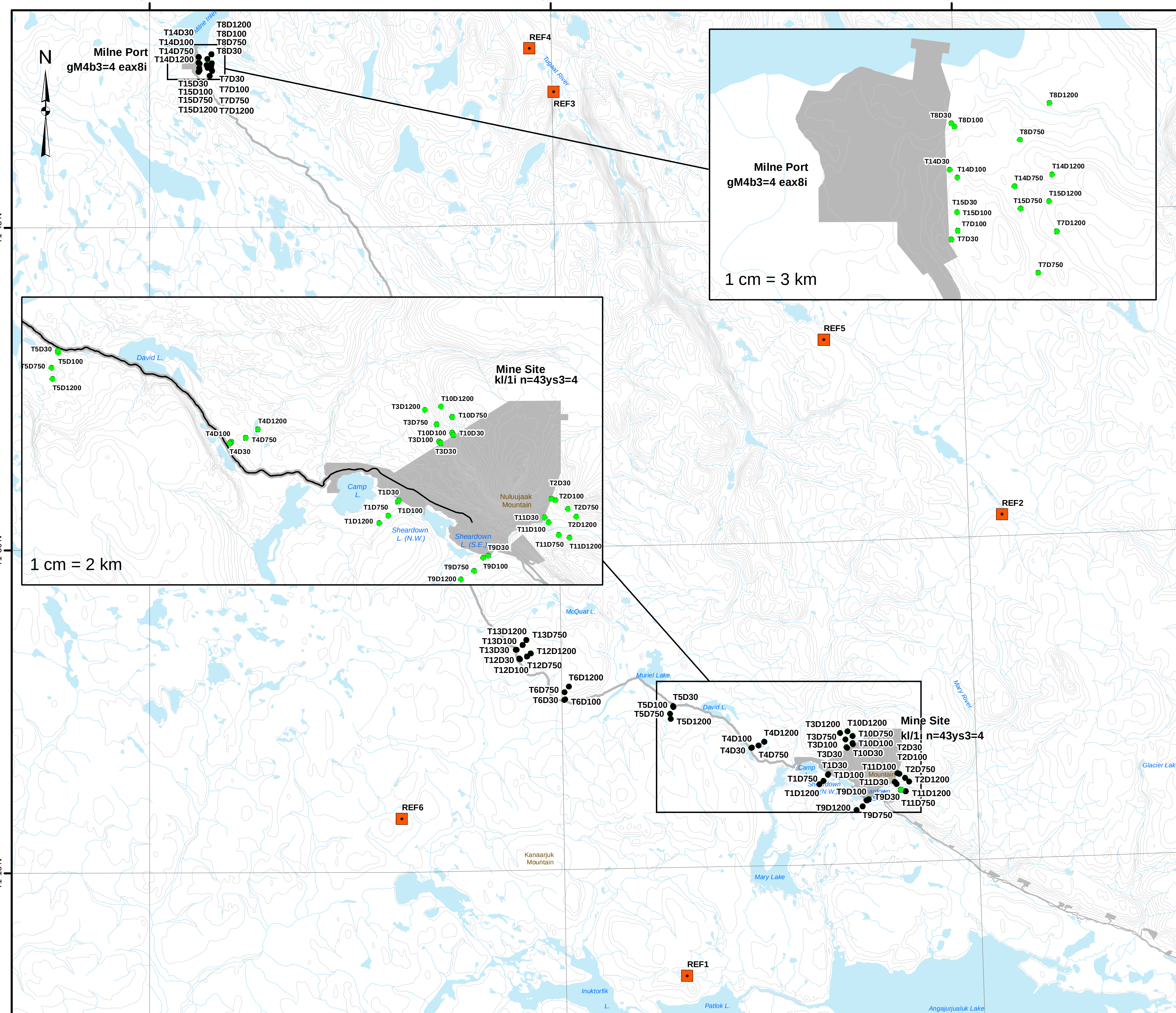


Photo 1. Example of the Moist to Dry Non-Tussock Graminoid/Dwarf Shrub vegetation habitat type in the Mary River RSA selected for the vegetation abundance monitoring program.



LEGEND grQ/q5

Vegetation Abundance Monitoring Samping Site [1]

- REF 1 — Reference site
- T7D1200 — Transect site
- Topographic contour (20m interval)
- Potential Development Area k8N x4g3bsgwNExo4 n=4n3ys3g8i5
- Regional Study Area W?oxJoE=sgwNExo4

[1] Vegetation Abundance: Transect Site Nomenclature

Transect #
T1D30
Distance Class (m)

NOTES cspm/4nw5

Map Projection: North American Datum UTM Zone 17N.

Updated PDA provided by Hatch (25 April 2013).

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale xqiz 0 2 4 8 12 16 20 Km rMub

Baffinland
Iron Mines Corporation

Vegetation Abundance Monitoring Sites within the RSA, 2016

EDI

Date: 3/7/2017

MAP 4

Path: O:\2016\16Y0076_BIM\Mapping\MonitoringAnnualReportMaps_04032017\Map4_VegAbundance_22Sept2016.mxd

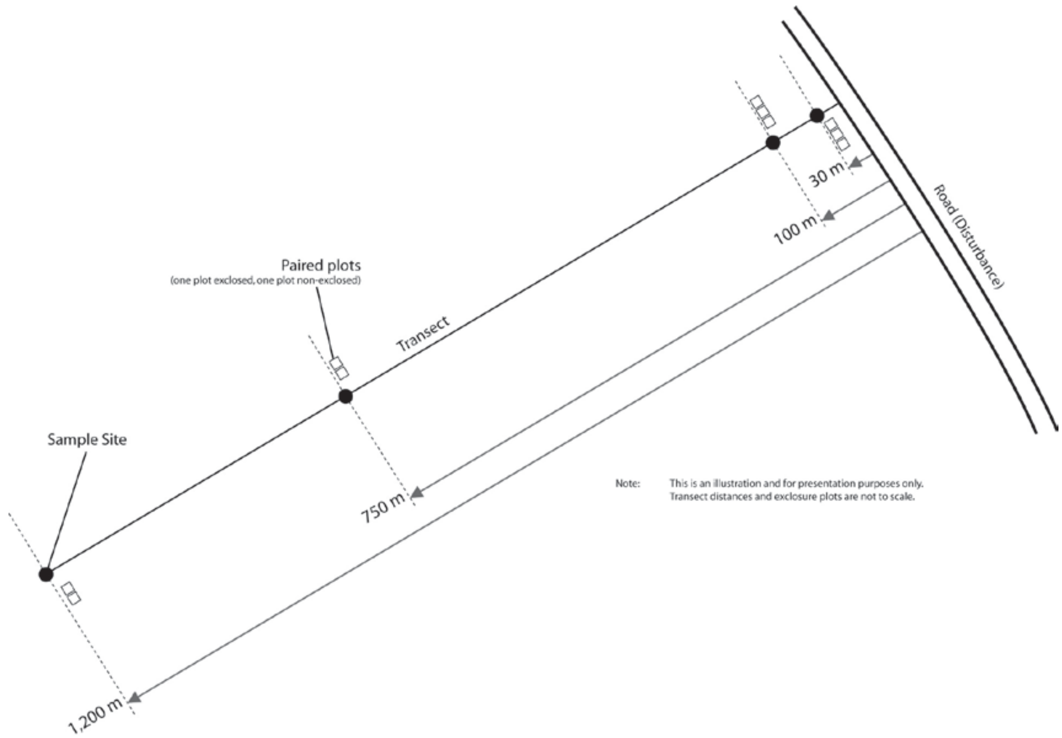


Figure 13. Schematic diagram showing the location of sample sites and plots along a transect.

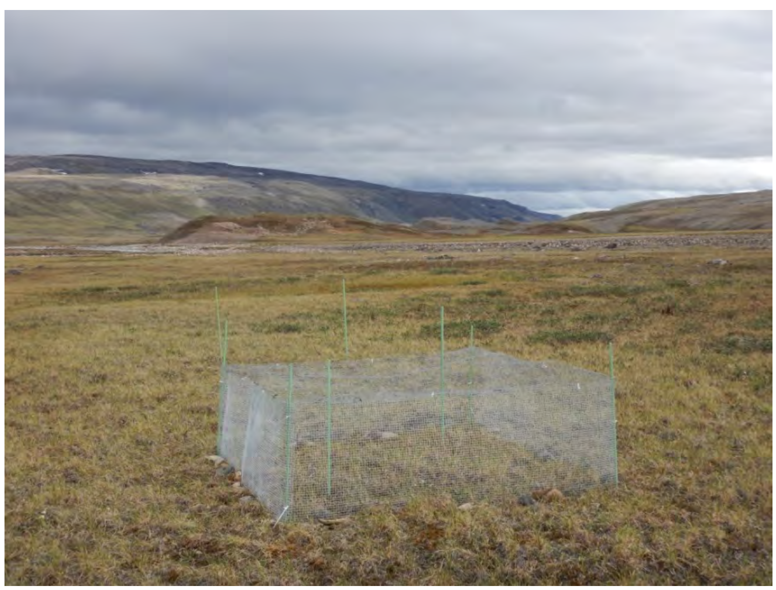


Photo 2. Representative site photo of general plot lay-out and site conditions.
This is site T9D100 with one closed plot and one open plot located south of the emulsion building near the Mine Site, 25 July 2016.

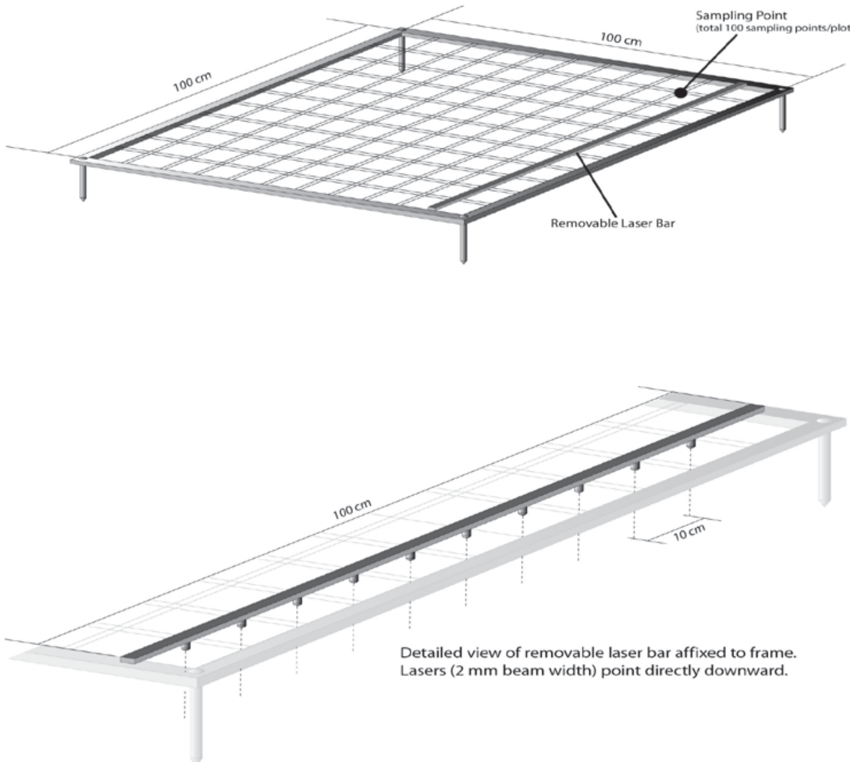


Figure 14. Illustration of the point quadrat frame used to measure percent plant cover.

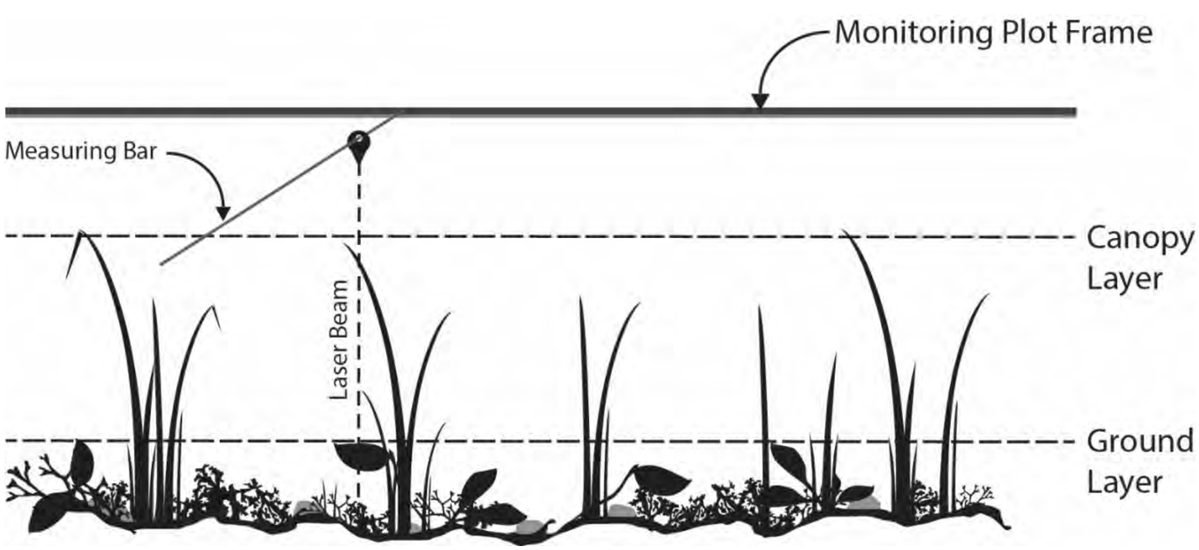


Figure 15. Schematic diagram of canopy and ground cover.
Showing the laser beam of the monitoring plot frame "hitting" the first plant in the canopy layer and then the first plant in the ground layer.

Photo 3. Measuring plot frame erected above the vegetation during sampling, 22 July 2016.

Photo 4. A view showing the diameter of the laser projecting onto the vegetation (2 mm), 27 July 2014.

3.1.1.1 Analytical Methods

Data were analyzed to investigate the relationship of vegetation cover and composition to distance from the PDA, while accounting for the potential effect of herbivory (closed vs. open plots). An emphasis was placed on caribou forage, such as lichen. Data analyzed included 1) total percent ground cover, 2) total percent canopy cover and 3) percent cover by plant group.

Since the variability in the individual species data was high, percent plant cover for ground and canopy layers was divided by general plant groups (i.e., deciduous shrubs, evergreen shrubs, forbs, graminoids, moss and lichen). The percent cover of each plant group was first quantified by adding up all the "hits" from the laser for a plant group within a plot. This was done separately for the ground cover and canopy cover layers. The total number of "hits" within a plot represented overall percent plant cover.

Linear mixed effects models were used to test for differences in total ground cover and total canopy cover relative to distance class or treatment (i.e. closed vs. open plots). Models included the two main effects, distance and plot treatment, and an interaction between distance and plot treatment. All percent cover values were log transformed to create a continuous variable with an approximately normal distribution. Sample site was included as a random effect to account for the possibility that plots from the same sample location were more similar to one another than plots from different sampling locations. A random effect for sample site was included to account for potential autocorrelation among plots measured at the same sample site. An additional random effect for year was nested within sample site to account for differences between the two sample years.

Differences in the plant group composition related to focal area (Mine Site, Tote Road or Milne Inlet), distance class, or closed plot treatment were also explored. Linear mixed effects models were used to test for these differences where the main effects of plant group (deciduous shrub, evergreen shrub, forb, graminoid, moss and lichen) were focal area, distance class and plot treatment. Interactions were included between plant group and each of the other three main effects to determine if there were differences in plant composition related to any of these factors. Analysis was done for ground cover and canopy cover. Percent cover values were log transformed for all analyses to create a continuous variable with an approximately normal distribution. Not all plant groups were present in all plots; therefore, a value of 0.005 was added to all observations prior to transformation (Warton and Hui 2011). A random effect for sample site was included to account for potential autocorrelation among plots measured at the same sample site. An additional random effect for year was nested within sample site to account for differences between the two sample years.

All estimates were back transformed to the original scales and are reported as average plant cover with 95% confidence intervals. Because baseline sampling occurred over two years, results represent average plant cover for all baseline sampling (2014 and 2016). Closed plot treatments from 2014 that were re-measured in 2016 will be included in the analysis once three years of data is collected for trend analysis. F-tests were used to determine the significance of model parameters. Residual plots were visually examined to confirm that models met the assumptions of normality and equality of variance. All analyses were performed using R, version 3.3.1 (R Core Team 2014).

3.1.2 RESULTS AND DISCUSSION

A total of 126 vascular plant species were observed in 2014 and 2016 during vegetation abundance monitoring. Combined, all baseline vegetation surveys (2005-2016) recorded 184 vascular and non-vascular plants species and associated subspecies. This list does not contain all non-vascular species (lichens and mosses) for North Baffin Island; instead, only those that could be identified confidently were included. For a complete list of all species observed and updated 2005–2016 baseline vegetation species list refer to Appendix B — Updated Baseline Vegetation Species List (2005–2016).

3.1.2.1 Total Percent Ground Cover and Canopy Cover

Average ground cover by vegetation was 28.0% (CI = 24.9 – 31.2). There was no evidence of a difference in ground cover by distance class (p = 0.72) or plot treatment (p = 0.53). There was also no support for an interaction between plot treatment and distance class (p = 0.17; Figure 16).

Average canopy cover was 49.8% (CI = 46.5 – 53.1). There was no evidence of a difference in canopy cover by distance class (p = 0.38). There was no support for an interaction between plot treatment and distance class (p = 0.13; Figure 17).

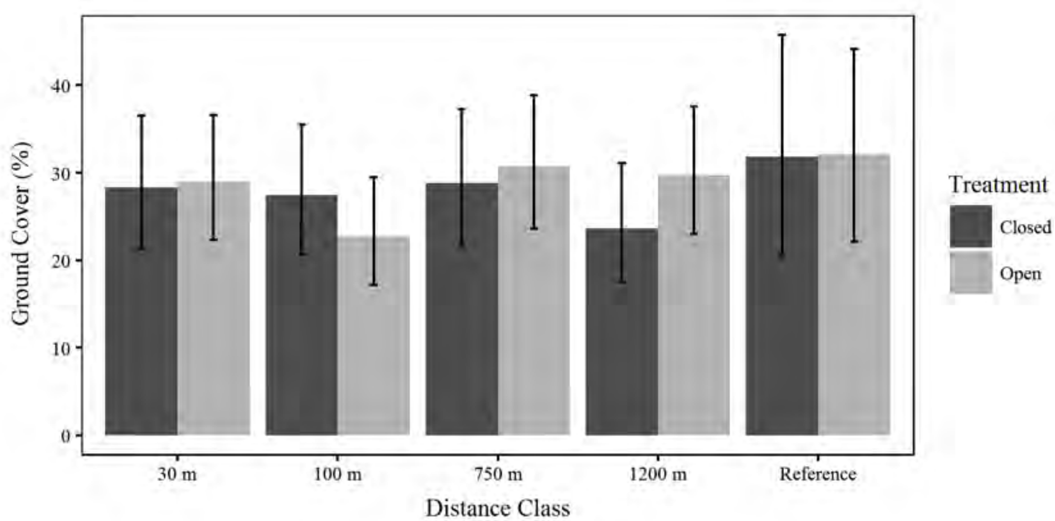


Figure 16. Average ground cover by distance class and plot treatment.
Bar heights show average canopy cover and error bars show 95% confidence intervals.

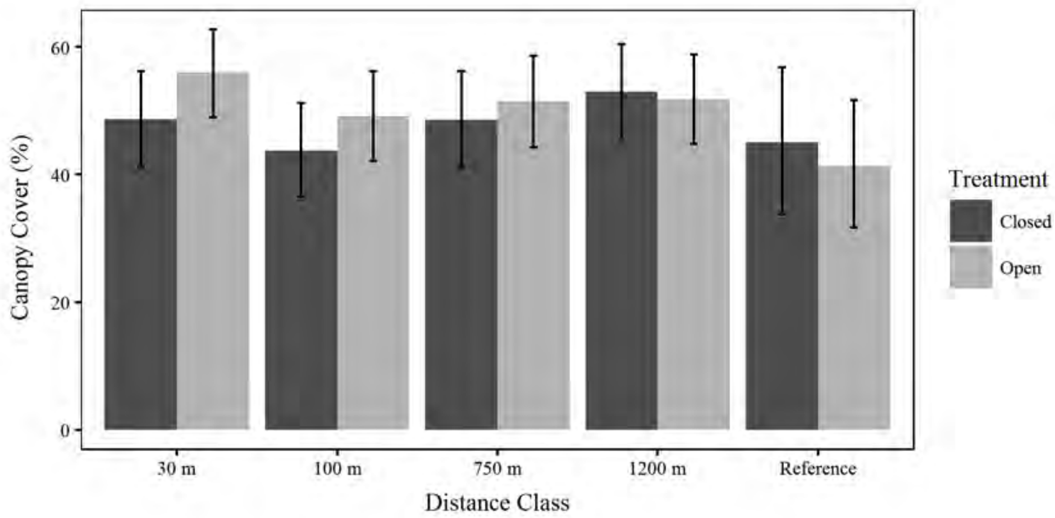


Figure 17. Average canopy cover by distance class and plot treatment.
Bar heights show average canopy cover and error bars show 95% confidence intervals.

3.1.2.2 Composition by Plant Group

There were significant differences in ground cover among plant groups (p<0.001; Figure 18). Moss had the highest ground cover (8.5%; CI = 7.1 – 10.1), followed by evergreen shrubs (4.3%; CI = 3.5 – 5.2), and lichens (1.8%; CI = 1.5 – 2.3). The other three plant groups — deciduous shrubs, forbs and graminoids — had less than 1% ground cover each.

Within the canopy cover layer, there were also significant differences among the plant groups (p<0.001; Figure 19). Standing dead litter was the most common cover type (25.3%; CI = 23.3 - 27.4). Graminoids had the second highest canopy cover (10.5%; CI = 9.5 – 11.6), followed by deciduous shrubs (4.5%; CI = 4.0 – 5.1), evergreen shrubs (3.8%; CI = 3.3 – 4.3), and forbs (2.2%; CI = 9.5 – 11.6).

Lichen represents important forage for caribou and the results from this study were compared to other studies. Lichen cover within the Moist-Dry Tussock Tundra habitat type at Tooklike Lake, Alaska was a minimum of 15% and maximum of 60% in the mid 1990s (Wahren et al. 2005). Within the winter range of the Western Arctic Caribou Herd in northwest Alaska lichen cover was 16.8% (Joly et al. 2007). In Nunavut, within the Bathurst Caribou Herd range, lichen cover was reported around 9% (Henry and Gunn 1991). Without prior studies on lichen abundance for Baffin Island, average lichen cover within our plots (1.8%) was relatively low compared to other Arctic areas.

Low lichen cover within plots may be explained by previously high grazing pressure within the RSA by North Baffin Island Caribou. Despite limited studies on this herd, Inuit Qaujimajatuqangit (IQ) states that current densities of caribou in north Baffin Island are low following population highs in the late 1990s (Baffinland 2012). This knowledge indicates that caribou cycle every 60–70 years, returning to an area once lichen abundance has recovered. One theory is that previously high population levels may have led to overgrazing and subsequent decline in caribou forage leading to herd declines within the RSA.

This hypothesis is supported by studies that provide evidence of caribou grazing and trampling effects on lichen communities where lichen cover was high in conjunction with high caribou numbers followed by low caribou number and a decline in lichen cover (Heggberget et al. 2002; Henry and Gunn 1991; Joly et al. 2007). This decline was largely attributed to high grazing pressure where range deterioration influenced food availability (i.e., lichen). In addition, the data analysis by Brody (1976) presented in the Mary River Project Wildlife Baseline Report (Baffinland 2012), concluded that recent herd declines in the Project area are likely due to high forage pressure leading to reduced food availability. Based on these studies and the knowledge provided by local Inuit, it can be assumed that overall lichen cover in the RSA could have been higher when caribou numbers were also higher prior to recent herd declines.

Focal Area — There was a significant interaction between plant group and focal area, for both ground cover ($p<0.001$, Figure 20) and canopy cover ($p = 0.01$, Figure 21).These results likely indicate that regional differences are present within the RSA with harsher, drier conditions indicated at Milne Inlet than the Mine Site and Tote Road. This is expected given that the study area is large and the comparison of sites across this range is more variable than within a given focal area.

Within the ground cover layer, moss was the dominant plant group at sites located at the Mine Site (10.2%; CI = 7.8 – 13.0) and Tote Road (13.5%; CI = 10.3 – 17.6), but not at Milne Inlet (3.3%; CI = 2.2 – 4.7). At Milne Inlet, evergreen shrubs were the dominant ground cover plant group (10.0%; CI = 7.2 – 13.5); ground cover of evergreen shrubs was significantly lower for the Tote Road (4.5%; CI = 3.3 – 6.2) and the Mine Site (2.2%; CI = 1.6 – 3.0). Forbs were also significantly higher at Milne Inlet (1.2%; CI = 0.7 – 1.9) than the other two focal areas. Average lichen cover was slightly higher at Milne Inlet (2.2%; CI = 1.4 – 3.2) than the Mine Site (1.7%; CI = 1.1 – 2.5) or Tote Road (1.8%; CI = 1.1 – 2.4); however, these differences were not statistically significant (all $p>0.67$). The other plant groups had <1% cover at each focal area.

Standing dead litter was the dominant plant group in the canopy layer for all three focal areas (Mine Site: 24.9%; Tote Road: 25.5%; Milne Inlet: 25.7%), followed by graminoids (Mine Site: 11.2%; Tote Road: 10.5%; Milne Inlet: 9.4%).

Distance to PDA — There was a significant interaction between plant group and distance class for the ground cover layer ($p<0.001$, Figure 22). Moss cover tended to increase in the farther distance classes, from 5.6% (CI = 3.8 – 8.2) in the 30 m class to 19.2% (CI = 12.3 – 28.5) in the reference sites. Moss cover for the reference sites was significantly higher than for all other distance classes. High moss cover at reference sites was due to those sites generally being wetter. There were also differences in evergreen shrub cover, which was highest in the 30 m (5.7%; CI = 3.8 – 8.3) and 750 m (6.9%; CI = 4.7 – 10.0) distance classes. Lichen cover was highest in the 30 m distance class at 3.2% (CI = 2.0 – 4.8), but there were no significant differences in lichen cover among distance classes (all p>0.09).

There was also evidence of differences in plant group cover by distance class in the canopy cover layer (p = 0.01; Figure 23). Standing dead litter was higher in the 30 m distance class (28.2%; CI = 23.9 – 32.9) than the reference plots (18.4%; CI = 14.2 – 23.5). Deciduous shrub cover in the 1,200 m (2.4%; CI = 2.6 - 4.4) was significantly higher than the three closer distance classes, but not the reference plots. There were no differences in evergreen shrub, forb, or graminoid canopy cover among the distance classes.

Closed Plot Treatment — There was no evidence of a relationship between plant group and plot treatment for the ground cover (interaction: p = 0.64; main effect: p = 0.99; Figure 24) or canopy cover layers (interaction: p = 0.85; main effect: p = 0.16; Figure 25). This means that the percent cover of individual plant groups within closed and open plots was similar, making the future comparison of plots valid.

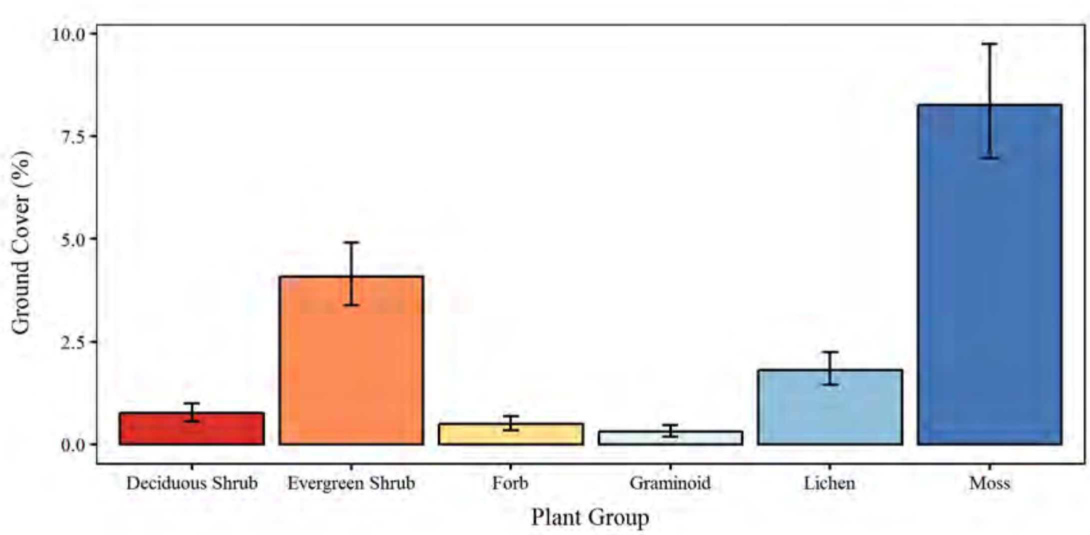


Figure 18. Average ground cover for each of the plant groups.
Bar heights show average canopy cover and error bars show 95% confidence intervals.

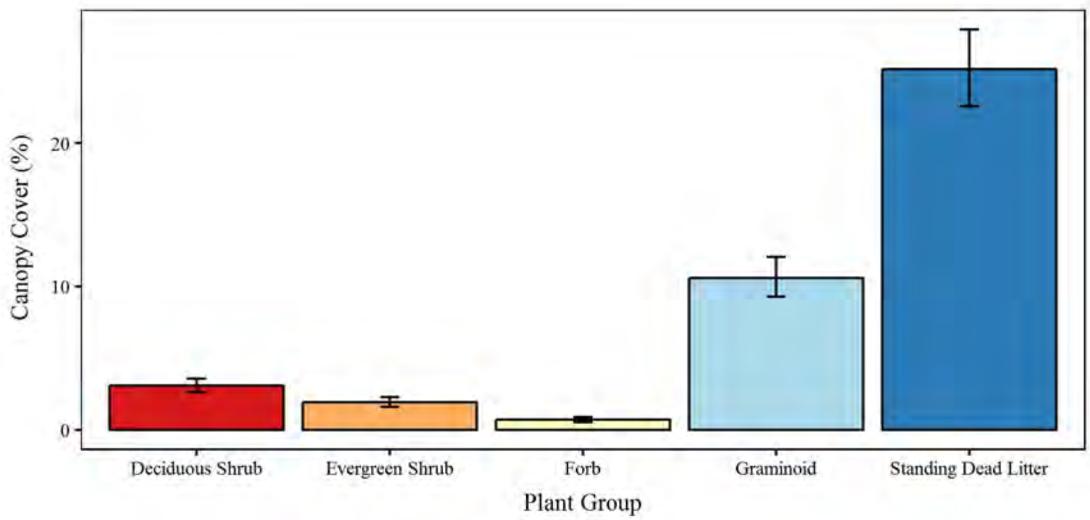


Figure 19. Average canopy cover for each of the plant groups.
Bar heights show average canopy cover and error bars show 95% confidence intervals.

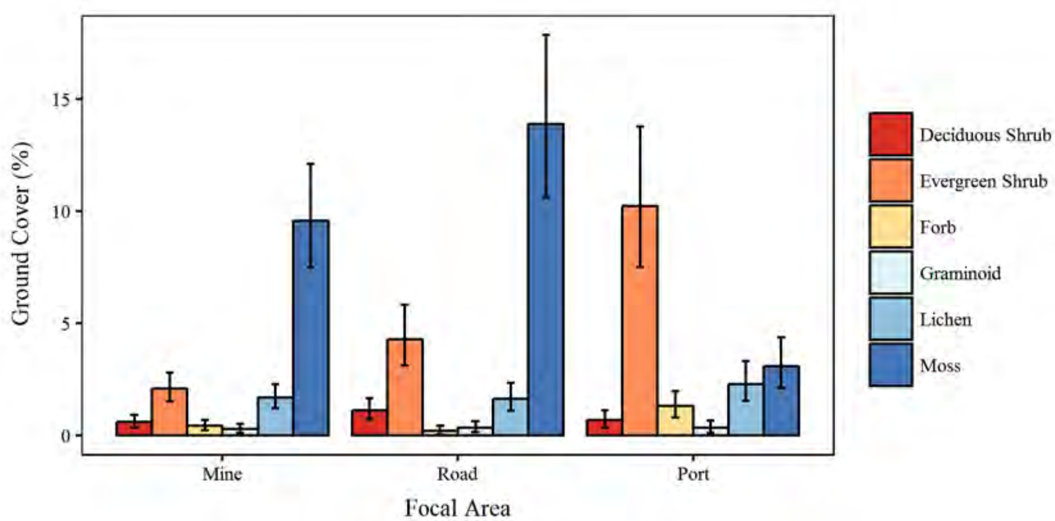


Figure 20. Average ground cover for each of the plant groups within the three focal areas.
Bar heights show average canopy cover and error bars show 95% confidence intervals.

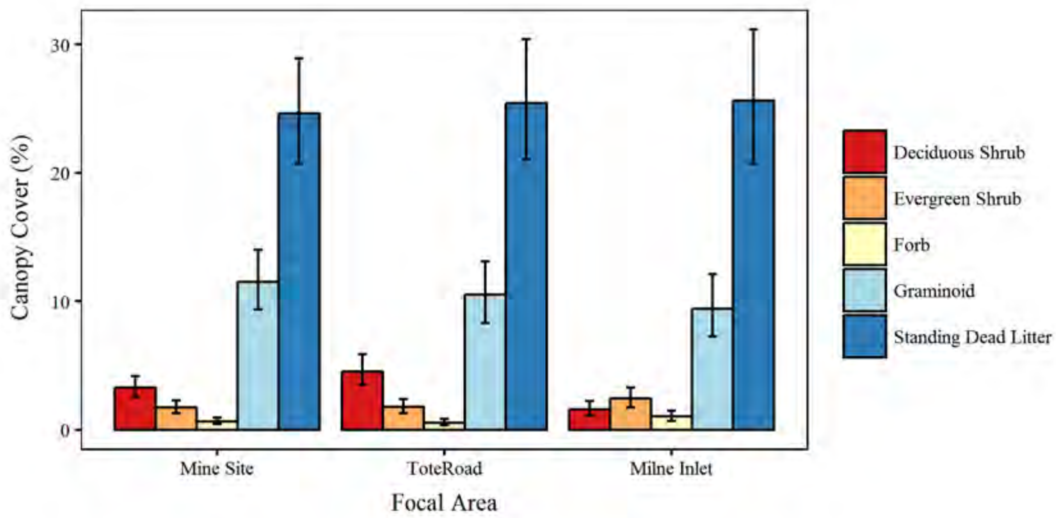


Figure 21. Average canopy cover for each of the plant groups within the three focal areas.
Bar heights show average canopy cover and error bars show 95% confidence intervals.

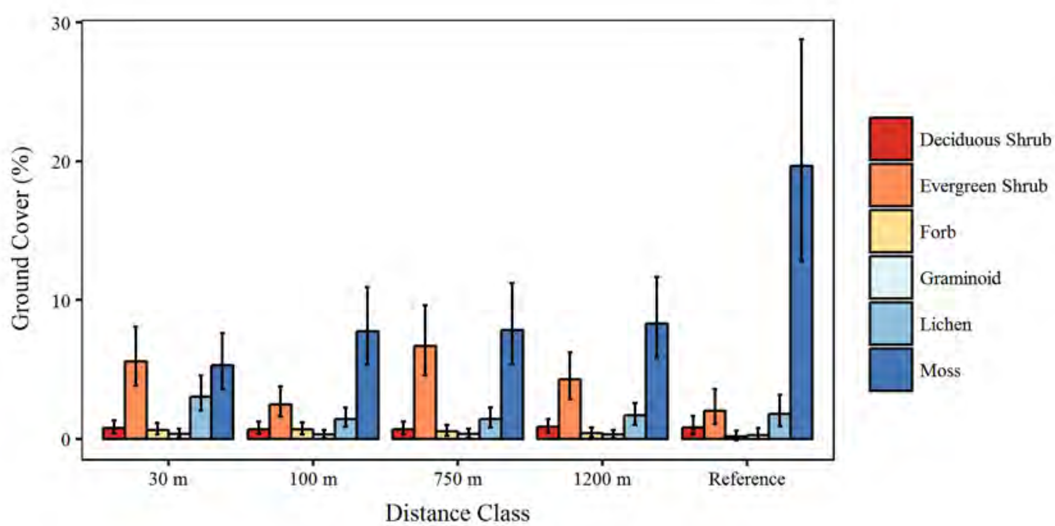


Figure 22. Average ground cover for each of the plant groups by distance class.
Bar heights show average canopy cover and error bars show 95% confidence intervals.

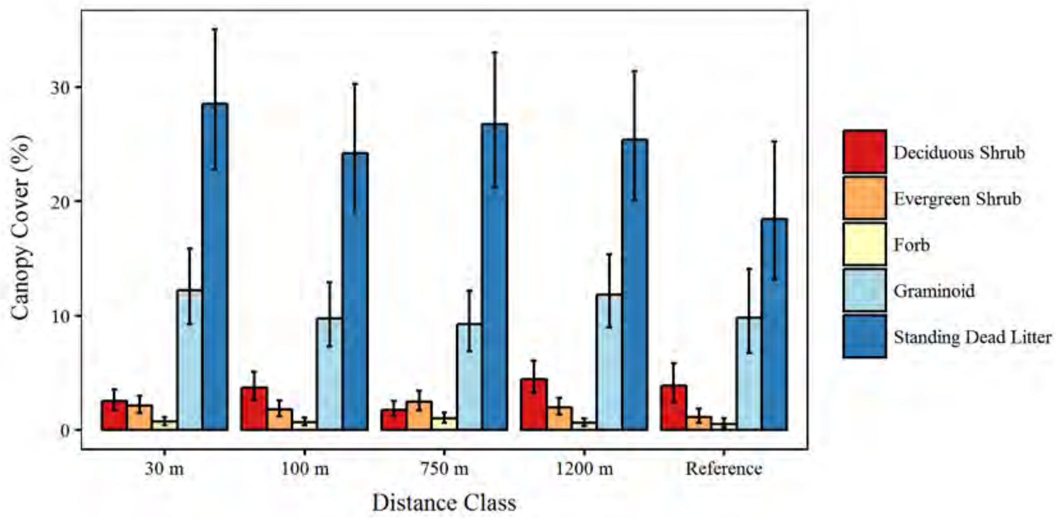


Figure 23. Average canopy cover for each of the plant groups by distance class.
Bar heights show average canopy cover and error bars show 95% confidence intervals.

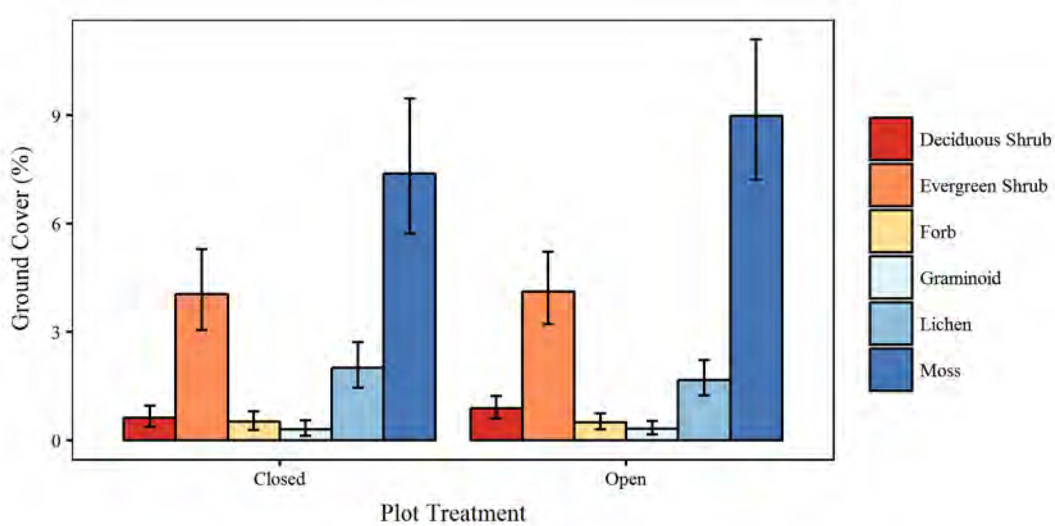


Figure 24. Average ground cover for each of the plant groups by plot treatment.
Bar heights show average canopy cover and error bars show 95% confidence intervals.

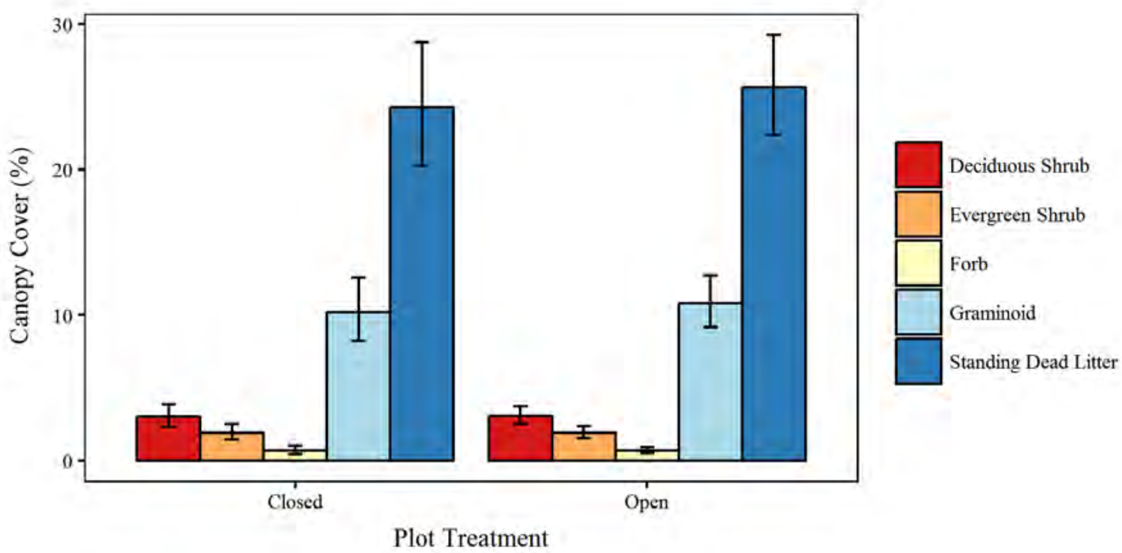


Figure 25. Average canopy cover for each of the plant groups by plot treatment.
Bar heights show average canopy cover and error bars show 95% confidence intervals.

3.2 VEGETATION AND SOIL BASE METALS MONITORING

Potential metals or emissions uptake by vegetation was identified as a concern to the health of vegetation, as well as to wildlife and humans that may consume affected plant material. Conditions under the NIRB Project Certificate were developed to address limitations related to potential increases in vegetation and soil metal concentrations:

- Project Condition #34 — *The Proponent shall conduct soil sampling to determine metal levels of soils in areas with berry-producing plants near any of the potential development areas, prior to commencing operations.*
- Project Condition #36 — *The Proponent shall establish an on-going monitoring program for vegetation species used as caribou forage (such as lichens) near Project development areas, prior to commencing operations.*
- Project Commitment #50 also addresses these limitations or relates to the reporting requirements for the vegetation and soil base metal monitoring program.

To meet these monitoring commitments a long-term vegetation and soil base metals monitoring program was established. The main objectives of the vegetation and soil base metals monitoring program are to:

- Monitor metal concentrations in vegetation and soil, particularly caribou forage (i.e., lichen), near Project infrastructure; and

- Determine if metal concentrations in vegetation and soil exceed available CCME and relevant threshold levels provided in the literature.

Baseline data on vegetation and soil metal concentrations for the Mary River Project were initially collected in August 2008; however, the 2008 data were not used because of substantial discrepancies in the metals results attributed to differences in laboratory methods or minimum detection limits. In addition, the collection methods from 2008 were not available to determine comparability to other data collected.

Additional baseline sampling was conducted in the southern sections of the RSA in 2012 and in the northern portions of the RSA in 2013. Vegetation included in the monitoring program consisted of three focal species/species groups: lichen (*Cladina*, *Cetraria*, and *Flavocetraria* spp.), willow (*Salix* spp.), and blueberry (*Vaccinium uliginosum*). In 2013, the relationship of metal concentrations in vegetation and soils to distance from the PDA was explored for seven metals/metalloids of potential concern (CoPC): aluminum, arsenic, cadmium, copper, lead, selenium, and zinc (EDI 2014). Results were compared to identified Project thresholds and indicated that baseline metal concentrations in soil were well below thresholds, and metal concentrations in vegetation tissues (excluding blueberry due to insufficient sample size) were mostly below thresholds with few baseline CoPC naturally exceeding thresholds. For detailed monitoring results refer to the 2013 Annual Terrestrial Monitoring Report (EDI 2014).

In 2014, additional sample sites were selected at distances of 5–15 km from the PDA to increase the sample size of blueberry and improve overall sampling coverage. Based on the results of the 2014 vegetation and soil base metals monitoring program, as outlined in the 2014 Annual Terrestrial Monitoring Report (EDI 2015), blueberry was removed from the monitoring program due to limited availability on the landscape and willow was removed due to issues regarding metal tolerance. Aluminum was also removed as a CoPC due to its ubiquitous nature and lack of Canadian Council of Ministers of the Environment (CCME) and/or US Environment Protection Agency (US EPA) soil quality guidelines for the protection of environmental and human health.

In 2015, the NIRB 2014–2015 Annual Monitoring Report for the Mary River Project (NIRB File No. 08MN053) included recommendations from the NIRB and GN to improve the vegetation and soil based metals monitoring program. Specifically, the recommended changes were to increase the sample size and extent of sampling to improve coverage of the PDA to adequately detect changes in metal concentrations in lichen and soil over time. To address these recommendations, a power analysis was conducted to determine the number of soil and lichen samples required to detect a change in metal concentrations between the 'before' period (i.e., baseline sampling) and the 'after' period (i.e., post-construction sampling) for all CoPCs before threshold levels are exceeded. The study design was improved to align with the dust fall monitoring program where reasonable to include new sample sites at varying distances from the PDA to compare metal concentrations in soil and lichen between near, far, and control sites. Based on the results of the power analysis, as outlined in the 2015 Annual Terrestrial Monitoring Report (EDI 2016), the revised study design was implemented in 2016 and considers sample size and appropriate spatial distribution of future samples. Future analysis will focus on determining if metal concentrations in soil and lichen have increased relative to baseline concentrations; and/or increased relative to areas further from the PDA.

3.2.1 METHODS

The improved study design for the vegetation and soil base metals monitoring program considers three Project areas (Milne Port, Tote Road, Mine Site) at varying distances from the PDA (0–100 m; 101–1000 m; >1000 m). Control site locations are those that are greater than 1000 m from the PDA. Distance classes were selected based on data from the dust fall monitoring program that indicate differences in dust fall within 100 m from the PDA and between 100–1000 m from the PDA (EDI 2015). Beyond 1000 m, dust fall levels were generally below laboratory detection limits. Soil and lichen samples were collected late-July to early-August following the same procedures as previous vegetation and soil base metals monitoring:

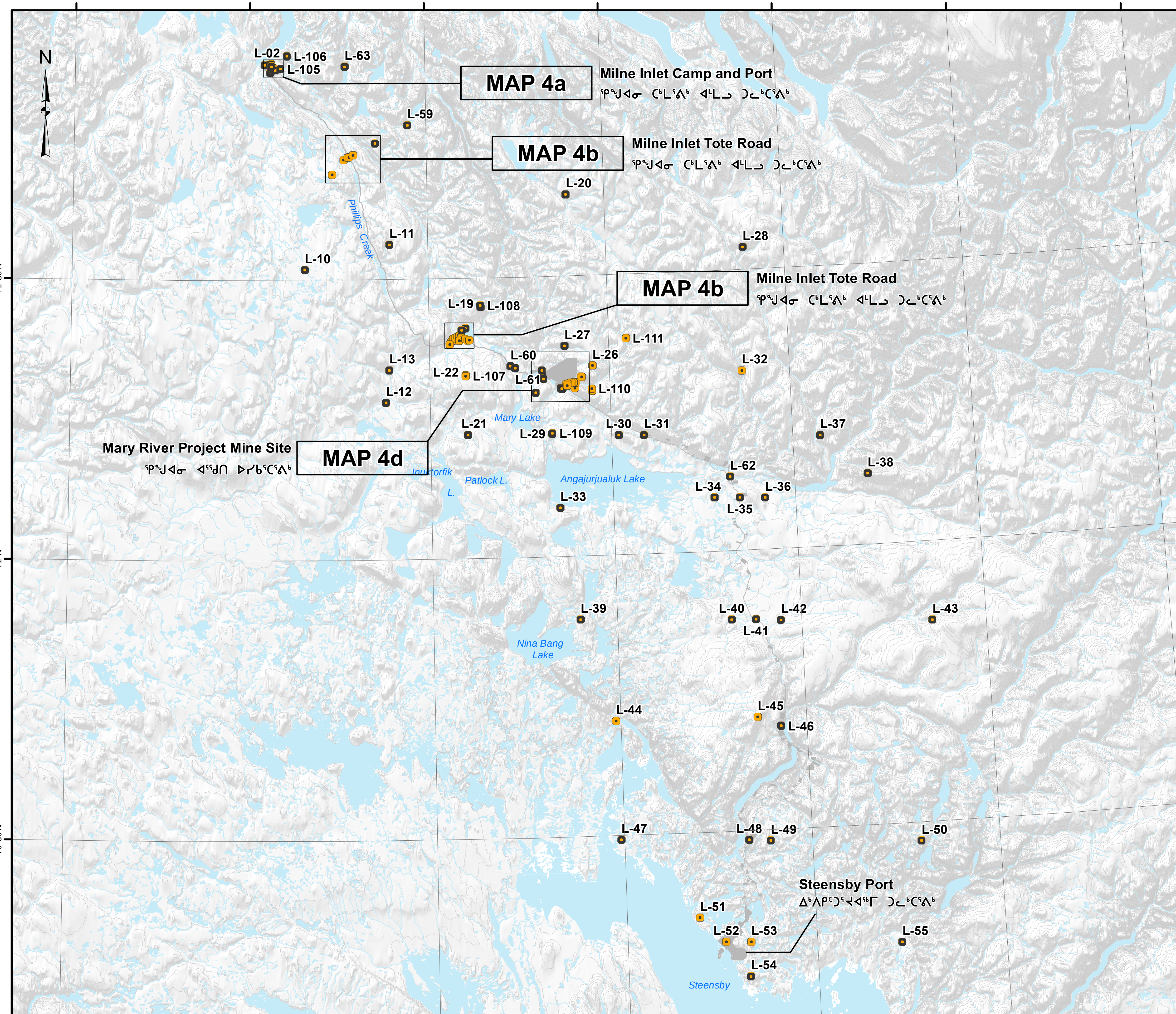
- A new pair of nitrile gloves were worn at each sample site.
- Stainless steel tablespoons used for soil sampling were cleaned with alcohol wipes before and after each sample.
- A minimum of 10 grams of each vegetation sample was collected at each site.
- A minimum of 100 grams of soil from the top A horizon was collected at each site to a depth of ≤10 cm and above permafrost. This reflects the top layer of the rooting zone where the potential for metal uptake in plants is expected to be the greatest.
- Samples were placed in new zip-loc bags, frozen and sent to an accredited laboratory for metals analyses.

From 2012-2016, a total of 117 sites were visited (Map 5 and Map 6). Of that, 50 sites were visited in 2016 (Table 7) as part of the revised study design. A table of all sites, locations, distance from PDA, vegetation species collected, and associated dust fall collector is provided in Appendix C.

Additionally, the NIRB's review of the 2014–2015 Annual Monitoring Report requested a re-investigation of site L-64 where lead concentrations in lichen during 2014 sampling were reported above the threshold (5 mg/kg dry weight).

Table 7. 2016 vegetation and soil samples — vegetation and soil base metals monitoring program

Project Area	Distance Category	Distance from PDA (m)	Number of Samples		Total
			Soil	Lichen	
Milne Port	Near	0–100	10	10	20
Tote Road	Near	0–100	10	10	20
Mine Site	Near	0–100	10	10	20
Any Project area	Far	100–1,000	10	10	20
Any Project area	Control	>1,000	10	10	20
Total	**--**	**--**	**50**	**50**	**100**



LEGEND

- Vegetation and Soil Base Metal Sampling Site
- Topographic Contour
- Potential Development Area

NOTES

Map Projection: North American Datum UTM Zone 17N.

Updated PDA provided by Hatch (25 April 2013).

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale 0 4 8 16 24 32 40 Km

Baffinland Iron Mines Corporation

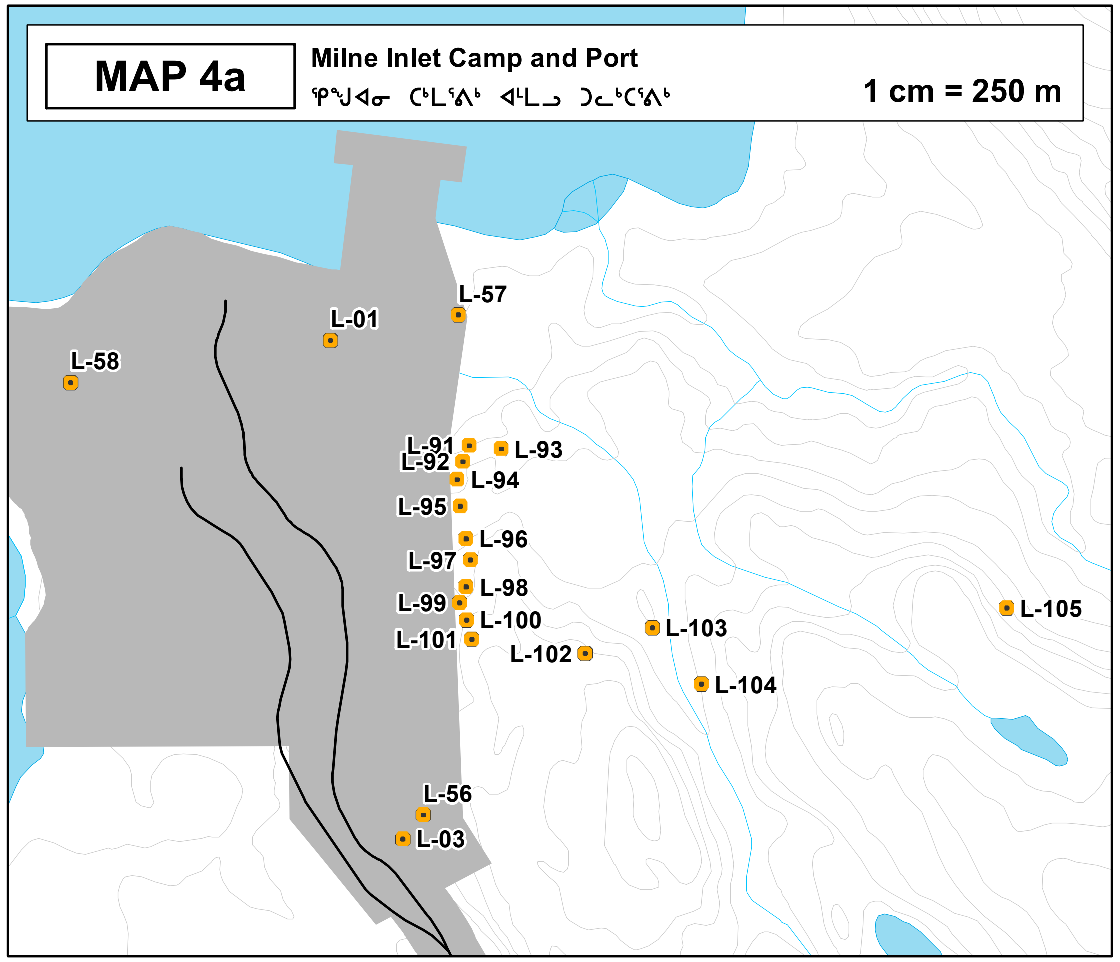
Overview Map of Vegetation and Soil Base Metals Monitoring Sites within the RSA, 2012 – 2016

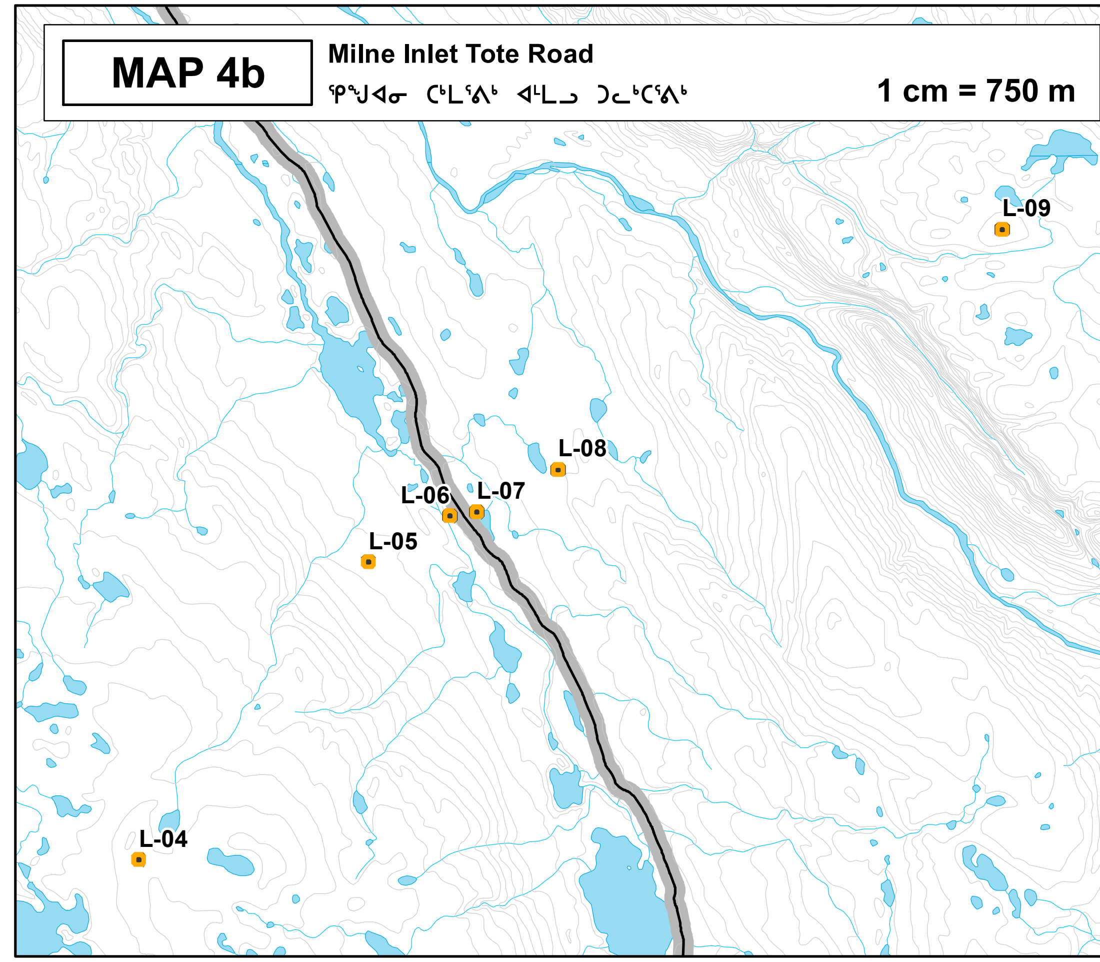
EDI

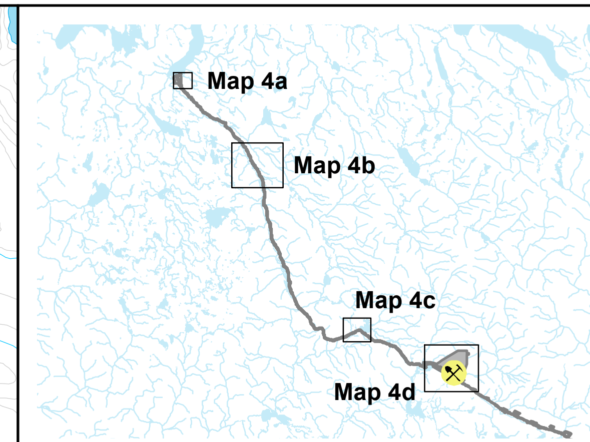
Date: 3/7/2017

MAP 5

Path: O:\2016\16Y0076_BIM\Mapping\MonitoringAnnualReportMaps_04032017\Map5_VegSoils_Overview_13012017.mxd

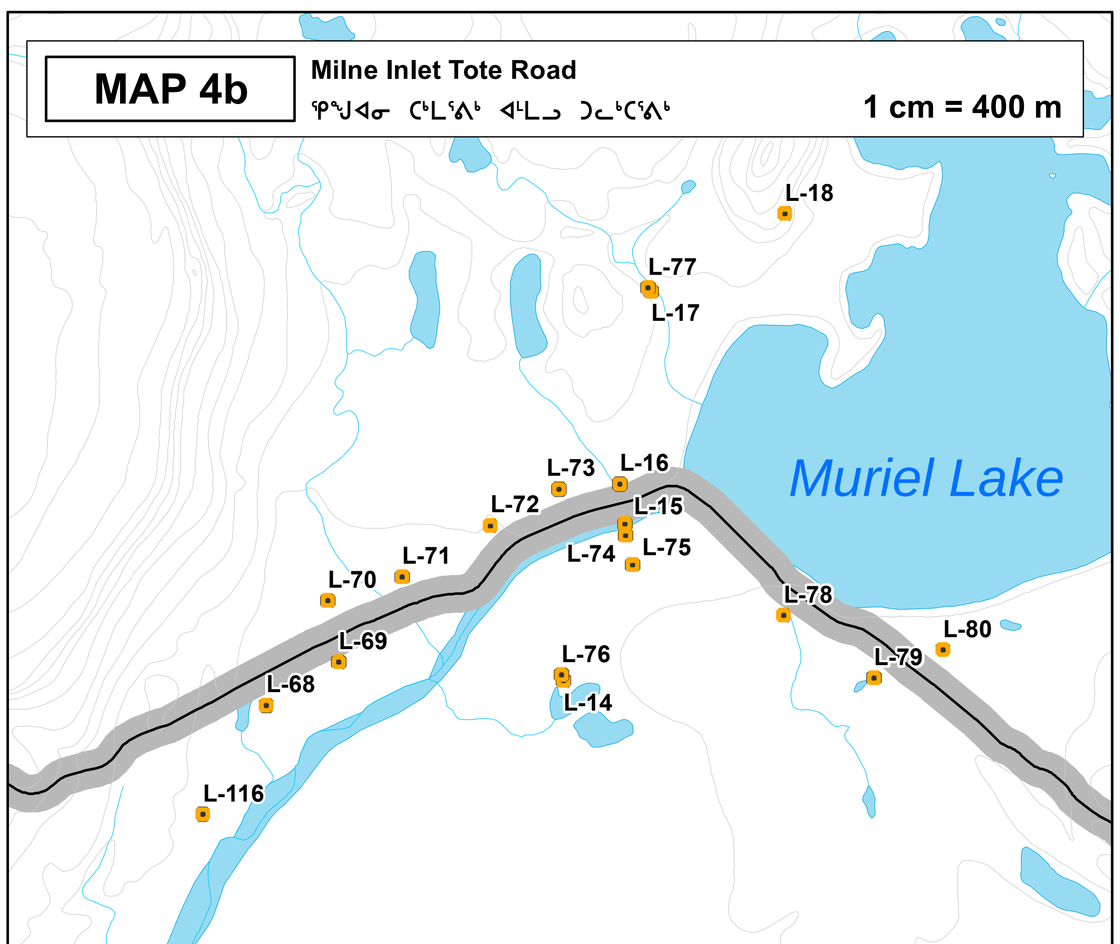


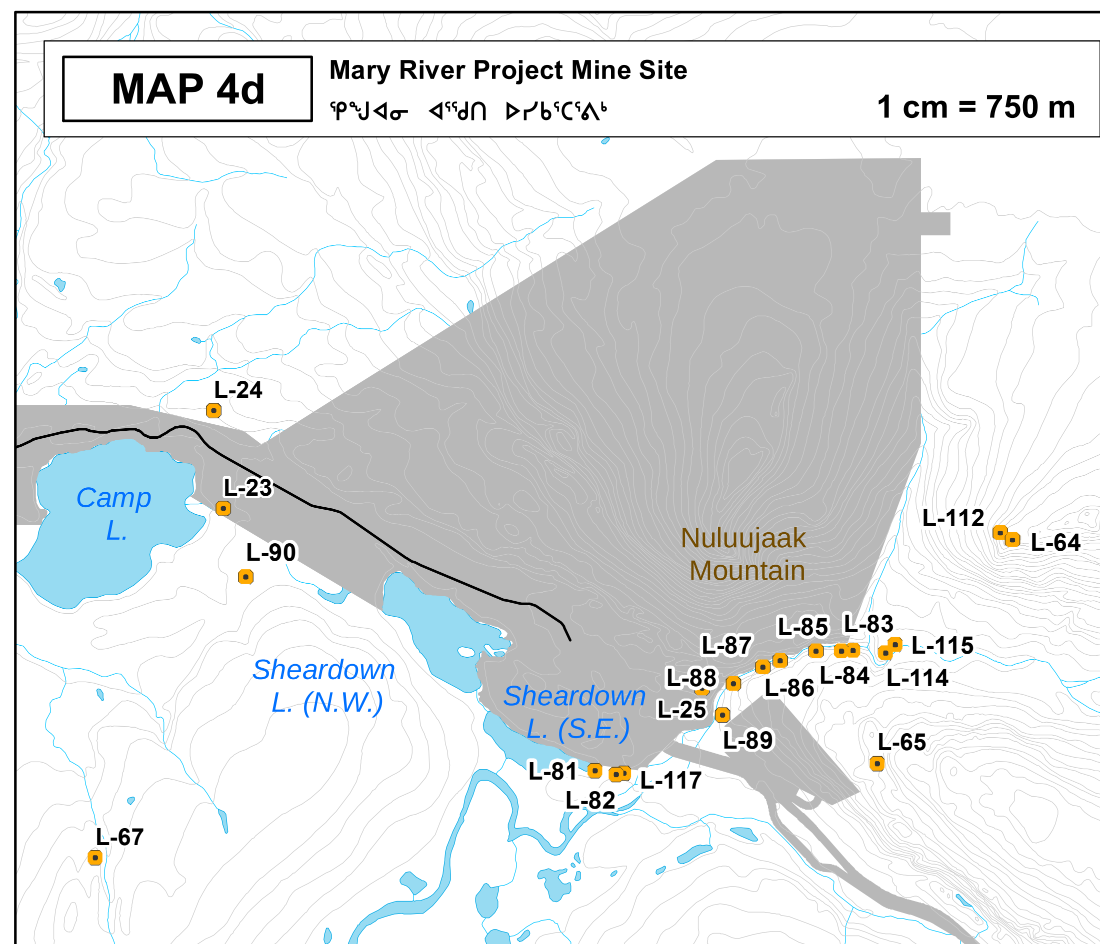




LEGEND

- Vegetation and Soil Base Metal Sampling Site
- Milne Tote Road
- Topographic Contour
- Potential Development Area





NOTES

Map Projection: North American Datum UTM Zone 17N.

Updated PDA provided by Hatch (25 April 2013).

This document is not an official land survey and the spatial data presented is subject to change without notice.

Baffinland Iron Mines Corporation

Detailed Map of Vegetation and Soil Base Metals Monitoring Sites within the RSA, 2012 – 2016

EDI

Date: 3/7/2017

MAP 6

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3.2.1.1 Analytical Methods

The statistical analysis of total metal concentrations in soil and lichen focused on a subset of total metals referred to as CoPC. CoPCs were chosen based on the following considerations:

- Baseline metal concentrations in soils and vegetation (i.e., several metals were not detectable in soil and vegetation samples; therefore, they were not selected as CoPCs;
- Metals present in the Mary River ore — relevant metals include iron (64%), phosphorus, manganese, aluminum (as aluminum oxide) and trace metals (FEIS, Appendix 3D 2012);
- Potential metals in road cover/road-generated dust; and
- The level of risk associated with each element. Several sources were consulted including:
    - Canadian Environmental Quality Guidelines (provided by the Canadian Council of Ministers of the Environment [CCME]) including soil quality guidelines for both agricultural and industrial settings;
    - Relevant studies on the presence, effects, and other aspects of metals in arctic and northern terrestrial biota (e.g. Gamberg 2008; CACAR 2003); and
    - Literature on vegetation and lichen-specific toxicity.

Based on this review, six CoPCs were selected including arsenic, cadmium, copper, lead, selenium, and zinc. For each of the identified CoPCs, toxicity thresholds were identified for soil and lichen (Table 8). For more information on the selection of CoPCs and the determination of Project thresholds for CoPCs, see Appendix B. 4-2 of the TEMMP.

Table 8. Project thresholds identified for CoPCs in soil and vegetation — vegetation and soil base metals monitoring program

CoPC	Thresholds	
	Soils[1] (mg/kg)	Lichens[2] (mg/kg dry weight)
pH	6-8	-
Arsenic	12	-
Cadmium	1.4	30
Copper	63	15
Lead	70	5
Selenium	1	-
Zinc	200	178

1. Thresholds based on CCME Agricultural Soil Quality Guidelines for the Protection of Environmental and Human Health

2 Thresholds based on various sources including: Nash 1975, Tomassini *et al.* 1976, Nieboer *et al.* 1978, Folkeson and Andersson-Bringmark 1987

Soil and vegetation samples were analyzed for total metal concentrations using inductively coupled plasma mass spectrometry (ICP-MS) by an accredited laboratory. To conform to earlier baseline methods, soil and vegetation samples were analyzed for 33 elements. Vegetation was analyzed for the following metals: aluminum, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, molybdenum, nickel, phosphorus, potassium, selenium, silver, sodium, strontium, thallium, tin, titanium, uranium, vanadium, and zinc. Excluding boron, soil analysis included the same suite of metals, with the addition of lithium, zirconium and soil pH. Full data sets of soil and vegetation metal analyses from 2012–2016 sampling are provided in Appendix D.

One-way ANOVA was used to test for differences in metal concentrations based on sampling area. The five sampling areas included:

- Mine Site — within 100 m of the Mine Site;
- Tote Road — within 100 m of the Tote Road;
- Milne Port — within 100 m of the Milne Port;
- Far — between 100 m and 1000 m of planned infrastructure; and
- Control — greater than 1000 m from planned infrastructure.

All soil and lichen samples collected from 2012-2016 were included in the analysis. Metal concentrations were log-transformed prior to analysis to achieve statistical assumptions of normality and equal variance. Samples that were below the minimum detection limit (MDL) were assigned a value of half the MDL for analysis. Medians and 95% confidence intervals were reported on the normal scale and compared to the threshold for each metal. Residual and qq-plots were visually examined to confirm that assumptions were met for each test.

Pearson's correlations were used to test for a relationship between metals in soils and metals in lichen for samples taken from the same location. The correlation analysis was conducted for all sample sites combined. Both values were log transformed prior to analysis. Scatterplot trends were used to interpret the potential relationship between metal concentrations in soil and vegetation.

3.2.2 RESULTS AND DISCUSSION

A total of 50 sites and 100 samples (50 soil and 50 lichen) were collected in 2016 to improve the power to detect a change in metal concentrations for all CoPCs before exceeding threshold levels. All data were combined from 2012–2016 to characterize metal concentrations in soil and lichen with distance to PDA and to assess the potential relationship between metal concentrations in soil and lichen. As discussed in Section 3.2.1., the 2016 analysis focussed on soil, lichen, and six CoPCs including arsenic, cadmium, copper, lead, selenium, and zinc.

The results of the vegetation and soil base metals monitoring analysis determined that all soil and lichen samples were below thresholds with the exception of two sites which are suspected sampling error. Differences were found in soil metal concentrations between sampling areas which indicate higher concentrations for some CoPC within 100 m of Milne Port than other sampling areas, but the small differences are not biologically relevant. Soil metal concentrations were generally higher within the Near distance category (100 m from PDA) than the Far distance category (101-1000 m from PDA). Differences were also found in lichen metal concentrations between sampling areas which indicate higher concentrations within 100 m of Tote Road. Metal concentrations in lichen were generally higher within the Near distance category than at Far and Control sampling areas.

3.2.2.1 Metals in Soil

Medians and 95% confidence intervals for all CoPCs were below thresholds in all sampling areas (Figure 26). No samples were above the MDL for selenium in soil.

The threshold for copper in soil was exceeded at one site (L-91) with a concentration of 116 mg/kg within 100 m of Milne Port (Table 9). The reason for this exceedance is unknown; however, it is expected that a sampling or analytical error may have occurred given that metal concentrations at nearby sample sites L-92 and L-94 had copper concentrations well below the threshold (2.02 and 5.72 mg/kg respectively). Repeat sampling should be conducted at site L-91 during the next round of trace metals monitoring.

Differences were observed in soil metal concentrations between the five sampling areas:

- Median arsenic was higher within 100 m of Milne Port than Tote Road ($p = 0.019$) and the Far sampling area ($p = 0.027$);
- Cadmium concentrations were higher within 100 m of Milne Port and the Control sampling area than within 100 m of Tote Road ($p<0.02$);
- Sites within 100 m of Milne Port and the Control sampling area had the highest median concentrations of copper, significantly higher than Tote Road and the Far sampling area ($p<0.015$);
- Sites within 100 m of the Mine Site, Milne Port, and the Control sampling area had the highest median concentrations of lead, significantly higher than Tote Road and the Far sampling area ($p<0.016$); and
- Sites within 100 m of Milne Port and the Control sampling area had the highest median concentration of zinc, significantly higher than within 100 m of Tote Road and the Far sampling area ($p<0.047$).

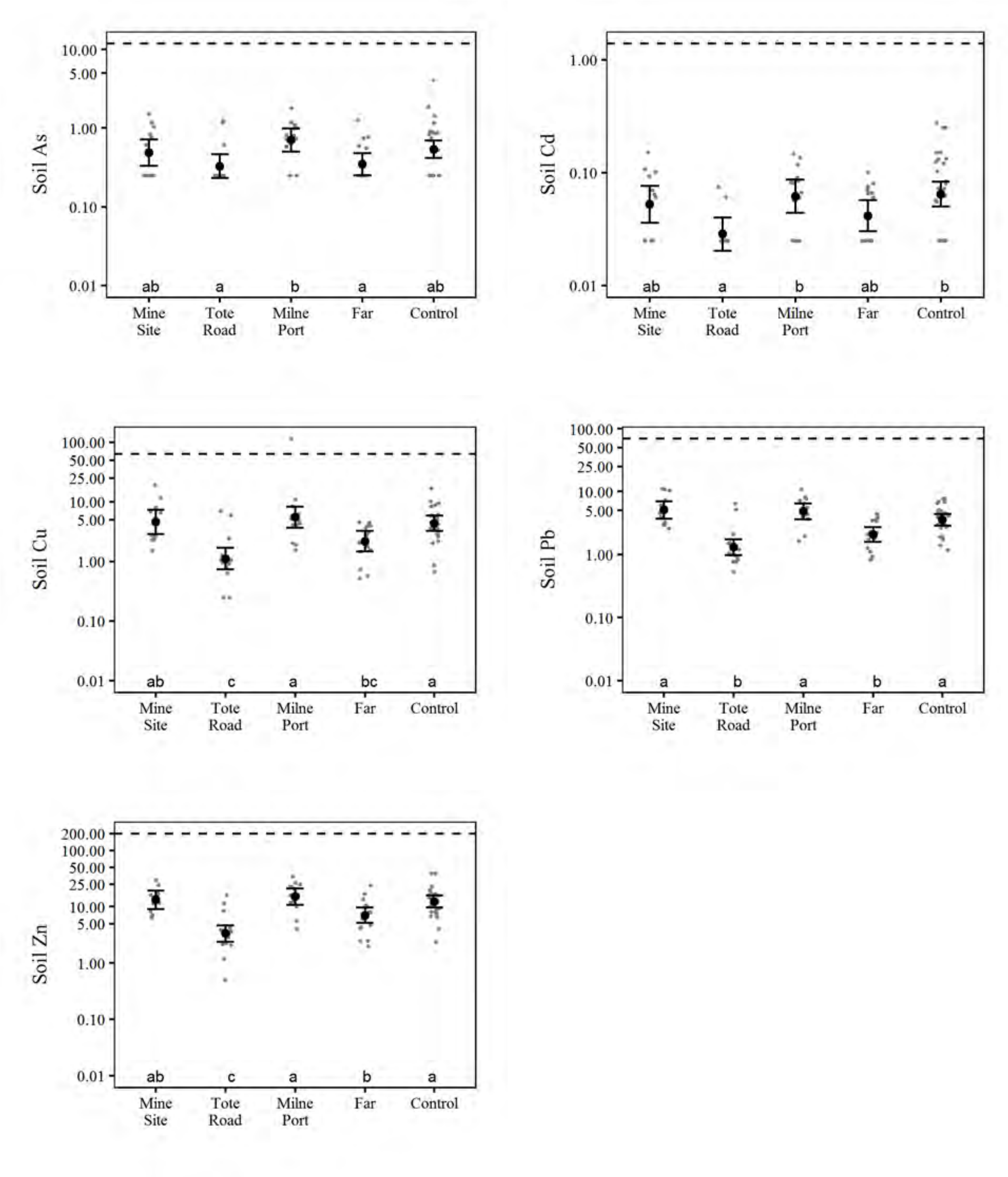


Figure 26. Metal concentrations (mg/kg) in soil samples by sampling area.
Large symbols indicate medians, small symbols indicate individual samples, and error bars are 95% confidence intervals for the median; common letters along the bottom indicate groups with overlapping confidence intervals. The y-axis is displayed on a log-scale. The horizontal line indicates the threshold.

Although statistically significant, these differences are not biologically important, as all concentrations are well below the threshold. Differences in soil metal concentrations between sampling areas highlights natural variability over a large range. Future monitoring will evaluate these differences to see if there is an interaction between near, far, and control sites where changes to baseline conditions may be a result of Project effects.

CCME agricultural guidelines recommend a pH range of 6 – 8. Approximately half of the samples (53%) were either below (25 samples) or above (21 samples) this recommended range. Soil with a pH outside of the identified range can affect the bioavailability of certain metals. The normal pH range for highly productive soils is generally restricted from 5.5 to 8, but can extend from 4 to 9 for all soils in the general environment (Langmuir et al. 2004). Low pH can cause toxicity in soil and vegetation, due to greater bioavailability of certain metals (Braune et al. 1999; Chaney and Ryan 1993; Langmuir et al. 2004). It is known that acidic soils increase plant uptake of zinc and cadmium and increase the potential for phytotoxicity from copper and zinc (Chaney and Ryan 1993). Alternatively, alkaline soil pH increases uptake of selenium while lead is not absorbed to a large extent at any pH.

Table 9. Summary of vegetation and soil base metals monitoring results, 2012-2016.

CoPC	Samples	Below MDL (%)	Median (µg/mg)	Min (µg/mg)	Max (µg/mg)	Threshold (µg/mg)	# Samples Above Threshold
Soil							
As	87	51.7	0.500	0.500	4.140	12	0
Cd	87	47.1	0.057	0.050	0.275	1.4	0
Cu	87	2.30	3.58	0.50	116	63	1
Pb	87	0	3.45	0.54	11.2	70	0
Se	87	100	0.5	0.5	0.5	1	0
Zn	87	1.15	11.4	0.5	39.6	200	0
Lichen							
As	79	25.3	0.122	0.096	0.352	-	-
Cd	79	0	0.042	0.035	0.192	30	0
Cu	79	0	1.220	0.661	5.340	15	0
Pb	79	0	1.020	0.218	6.040	5	1
Se	79	21.5	0.062	0.05	0.142	-	-
Zn	79	0	12.7	6.47	33.2	178	0

3.2.2.2 Metals in Lichen

Medians and 95% confidence intervals for all CoPCs were below thresholds in all sampling areas (Figure 27). The threshold for lead was exceeded at one site (L-71) with a concentration of 6.04 mg/kg within 100 m of Tote Road (Table 9). The reason for this exceedance is unknown; however, it is expected that a sampling or analytical error may have occurred given that metal concentrations at nearby sample sites L-69 (2.58 mg/kg), L-70 (1.43 mg/kg), and L-72 (2.56 mg/kg) had lead concentrations well below the threshold. The median lead concentration among all samples near Tote Road was well below the threshold level (1.02 mg/kg) (Table 9). Repeat sampling should be conducted at site L-71 during the next round of trace metals monitoring. The following differences were observed in lichen metal concentrations between the five sampling areas (Figure 27):

- Median concentrations of arsenic were higher within 100 m of Tote Road than at Milne Port, Far, and Control sampling areas (all $p<0.001$);
- Median copper concentrations within 100 m of Tote Road and the Mine Site were higher than at Milne Port, Far, and Control sampling areas (all $p<0.01$);
- Median lead concentrations within 100 m of Tote Road were higher than the Far and Control sampling areas (all $p<0.001$); and
- Selenium concentrations within 100 m of Tote Road and Milne Port were higher than the Far sampling area (all $p<0.03$), but were not different from the Mine Site and Control sampling area ($p>0.34$).

Although statistically significant, the difference in metal concentrations between sampling areas may not be biologically important. Data collected from 2012-2016 represents baseline sampling and results may indicate natural mineralization of the Mary River area. The sampling area within the RSA is large and it is expected that baseline metal concentrations may be different between sampling areas. Future monitoring will evaluate trends in lichen to see if there is any change from baseline conditions that may be a result of Project effects. With the exception of one sample along the Tote Road, maximum expected values for all CoPCs are still well below threshold levels.

3.2.2.3 Soil-Lichen Relationship

There was a negative relationship between soil and lichen metal concentrations for arsenic, copper, and zinc (Figure 28). There was also suggestive evidence of a negative relationship between soil and lichen concentrations in lead. There was no support for a relationship between soil and lichen concentrations in cadmium. The results suggest that transfer of metals from soil to lichen is limited.

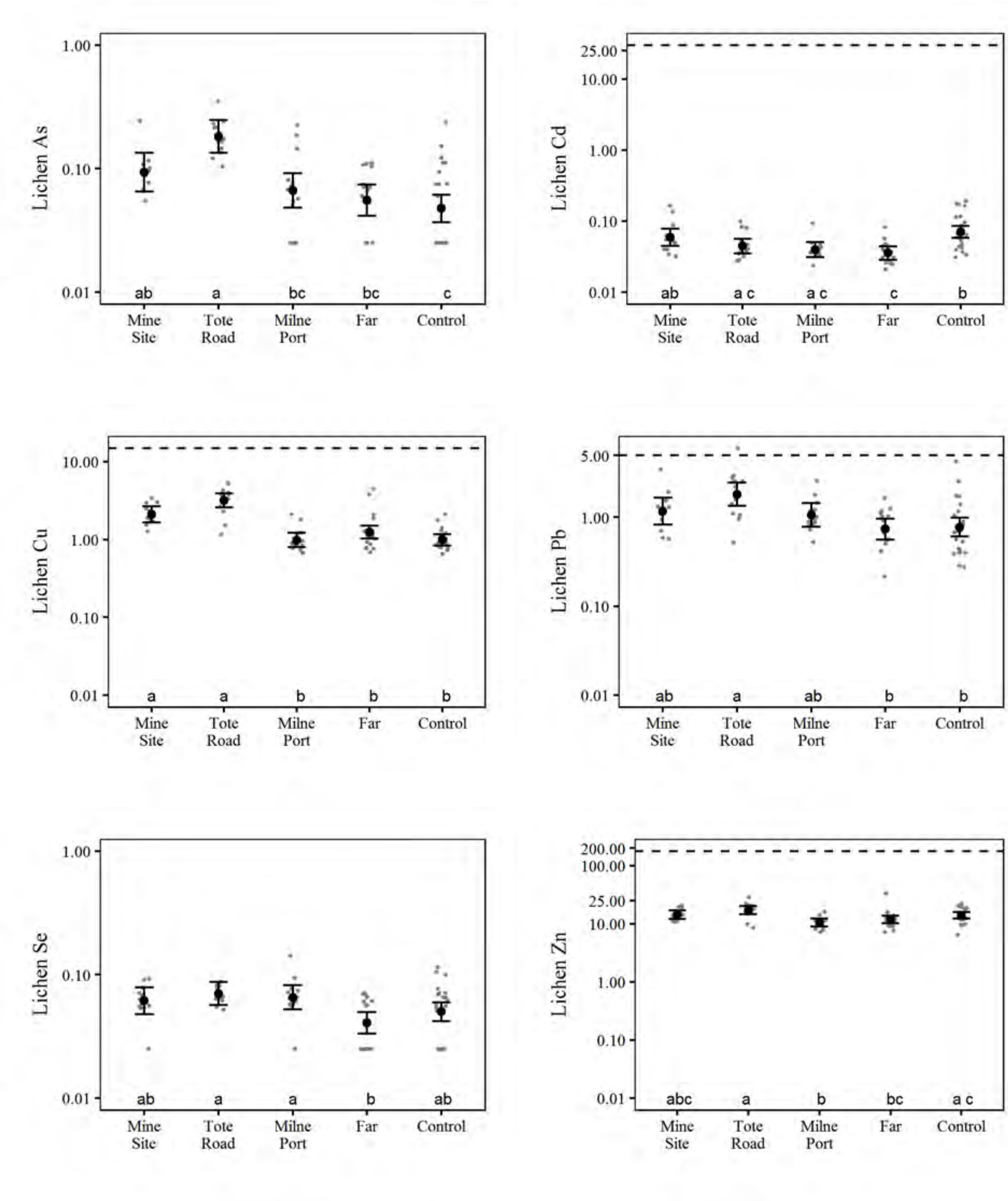


Figure 27. Metal concentrations (mg/kg) in lichen by sampling area.
Large symbols indicate medians, small symbols indicate individual samples, and error bars are 95% confidence intervals for the median. Common letters along the bottom axis indicate groups with overlapping confidence intervals. The y-axis is displayed on a log-scale. The horizontal line indicates the threshold. No horizontal line indicates threshold is well above current concentrations.

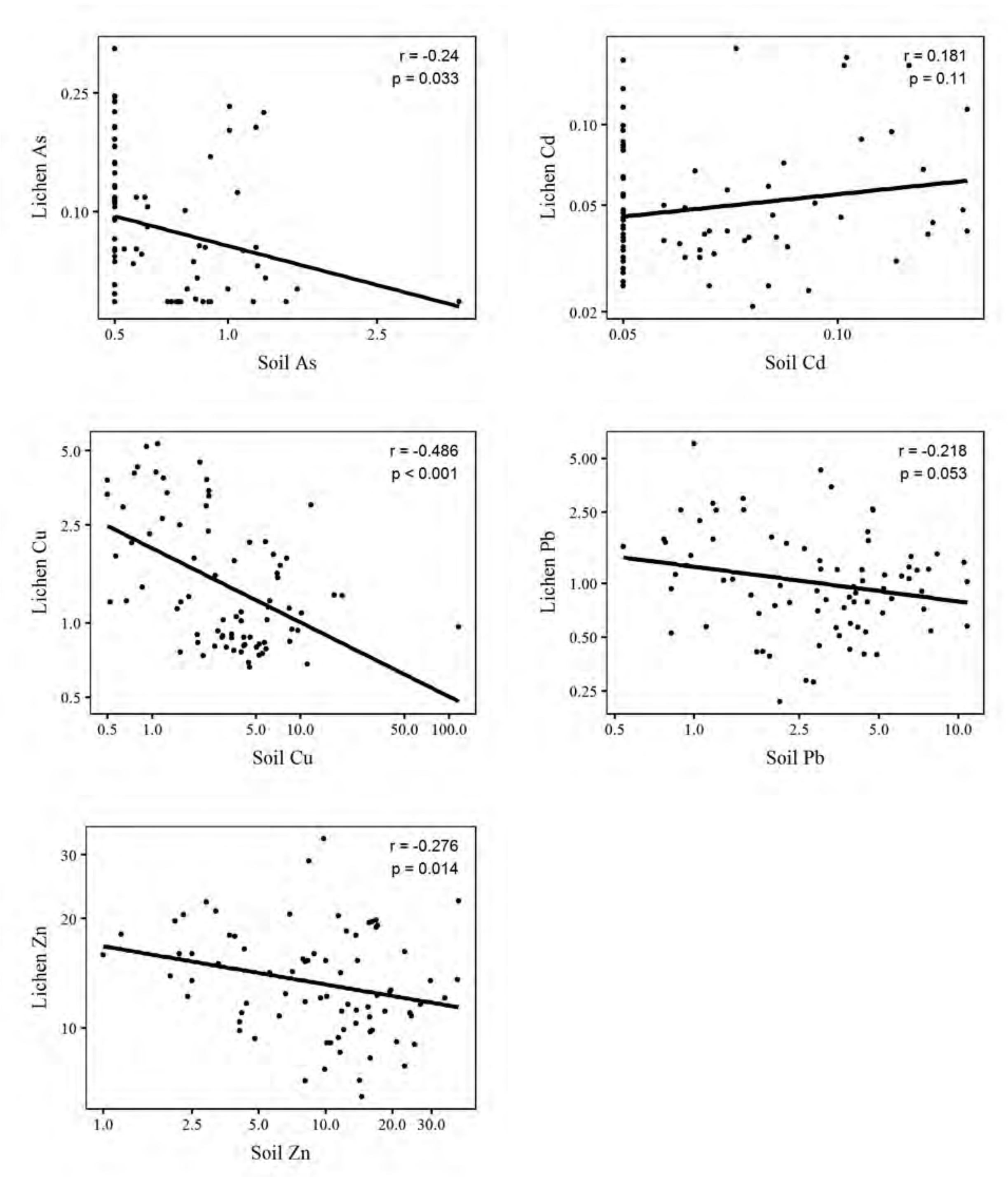


Figure 28. Scatterplots showing the relationship between soil and lichen metal concentrations (mg/kg) in the RSA, 2012-2016.
Note the difference in scale on the x and y axes for each plot.

3.3 RARE PLANT OBSERVATIONS

Although surveys for rare plants are not required as part of the NIRB Project Certificate No. 005, incidental observations of territorial "May Be At Risk" species for Nunavut were recorded in 2016 during other vegetation surveys.

During 2014 vegetation monitoring field crews found a plant species of potential conservation concern — Horned Dandelion (EDI 2015). Horned Dandelion (*Taraxacum ceratophorum*) is a native dandelion species and is listed as "May Be At Risk" for Nunavut (Photo 5; CESCC 2011). This finding represents a large range extension for North Baffin Island and significant contribution to the overall knowledge of the species (Brouillet, pers. comm.). Horned Dandelion was found at two locations close to the Mine Site, consisting of two populations and 31 individuals. In 2016, during other monitoring programs field crews found additional Horned Dandelion locations. Incidental observations of Horned Dandelion were made along Tote Road from KM 84.6 to 85.2. Five sub-populations were found growing along and up to 50 m from the road totalling approximately 750–800 plants. The habitat was open and dominated by sand. All plants were in flower and appeared healthy. Table 10 provides location details for Horned Dandelion occurrences within the RSA.

Table 10. Location details for Horned Dandelion, a "May Be At Risk" species found incidentally during vegetation surveys in 2014 and 2016.

Year	Location Description	Habitat	Latitude	Longitude	Abundance and Distribution
2014	Edge of PDA near KM 93.5, along Tote Road, sea can storage area	Sandy, exposed slope and small drainage leading down to delta	71.32708	-79.45897	25 scattered flowering plants in close vicinity
2014	Near KM 98, along Tote Road	Sandy, exposed soil bank	71.33159	-82.59750	6 scattered flowering plants in close vicinity
2016	South edge of PDA near KM 84.6, along Tote Road	Sandy, exposed soil near stream	71.37605	-79.70719	13 flowering plants in close vicinity
2016	North edge of PDA near KM 84.6, along Tote road	Sandy, exposed soil near stream	71.37662	-79.70661	65 flowering and vegetative plants scattered along slope of tributary
2016	North edge of PDA and on plateau above slope near KM 84.7, along Tote Road	Sandy, exposed plateau	71.37643	-79.70499	96 flowering and vegetative plants scattered on sandy plateau
2016	South edge of PDA near KM 84.7, along Tote Road	Sandy, exposed slope	71.3761	-79.70442	150 flowering and vegetative plants scattered along edge of Tote Road
2016	South edge of PDA from approximately KM 85.1 to 85.2, along Tote Road	Sandy, exposed slope above lake	71.37571	-79.69231	420 flowering and vegetative plants scattered along edge of Tote Road

Photo 5. Horned dandelion

A "May Be At Risk" plant species in Nunavut was found during the exotic invasive survey, summer 2014 and incidentally during other surveys in 2016.

4 MAMMALS

The 2016 monitoring for mammals included a number of surveys designed to enhance baseline data and monitor the effects of construction activities on caribou. Specific surveys included:

- Snow track surveys;
- Snow bank height monitoring;
- Height-of-land caribou surveys; and
- Incidental observations and wildlife log.

4.1 SNOW TRACK SURVEY

During the review of both the original Project application and the Early Revenue Phase proposal, the QIA and other reviewers expressed concerns that the Project activities would have a negative effect caribou movement patterns. Specific concerns included human infrastructure as well as human presence deterring, constraining, or altering the natural movement of wildlife with particular concern for caribou. As a result of concerns that caribou would potentially avoid crossing due to train or vehicle presence and the potential for constraining wildlife movement across roadways, Project conditions were issued to address this concern including:

- Project condition #54dii) "*The Proponent shall provide an updated Terrestrial Environmental Management and Monitoring Plan which shall include…Snow track surveys during construction and the use of video-surveillance to improve the predictability of caribou exposure to the railway and Tote Road. Using the result of this information, an early warning system for caribou on the railway and Tote Road shall be developed for operation.*"
- Project condition #58f) "*Within its annual report to the NIRB, the Proponent shall incorporate a review section which includes….Any updates to information regarding caribou migration trails. Maps of caribou migration trails, primarily obtained through any new collar and snow tracking data, shall be updated (at least annually) in consultation with the Qikiqtani Inuit Association and affected communities, and shall be circulated as new information becomes available.*"

Snow track surveys were conducted in April 2016 to study the movement of caribou and other wildlife in relation to the road and document behavioural reactions to human activities near the Project footprint. Snow bank height monitoring was also conducted within the same week to assess the effectiveness mitigation for movement by keeping snow bank height less than 1 metre high (details provided in Section 4.2).

4.1.1 METHODS

A snow track survey was conducted along the Tote Road on April 15 and 18, 2016. The purpose of the snow track survey was to collect data on caribou response to Project activities based on patterns of movement observed by their tracks. Identical to the survey conducted in 2014 and 2015, observers traveled by light truck with a BIM environmental monitor driving and an EDI biologist as observer. The survey was conducted by driving slowly (30 km/hr) from Mary River to Milne Inlet on the Tote Road. As a result of slow travel and excellent visibility, the driver was also able to detect wildlife tracks at great distances, resulting in surveyors stopping frequently to investigate wildlife movement near the Tote Road. When wildlife tracks were observed, surveyors would park the truck and walk to the tracks to confirm species and then follow the tracks towards and away from the road to observe behaviour, habitat use and possible divergence of travel paths. When tracks were near or crossed the Tote Road surveyors would record the following information:

- Latitude and longitude at the point where the tracks crossed the road;
- Species the tracks were from;
- Number of sets of tracks counted (i.e. group size);
- A designation describing travel in relation to the road (e.g., deflected, travelled along, or crossing the Tote Road); and
- Height of the snow bank measured at either the crossing point, or likely point of deflection.
- Often photos as well as any additional relevant information were recorded.

Snow track surveys were completed a few days after heavy snow and wind drifts that were severe enough to temporarily close the Tote Road. Prior to conducting the survey there were two clear (no snow accumulated) days, however there was wind on both days, resulting in very light dusting of fresh/wind swept snow. The survey was completed in one day in good weather conditions including an air temperature of -17°C, a skiff of fresh snow, calm winds, and a mix of sun and clouds resulting in excellent visibility (>1 km). The crew drove up to Milne and started surveying in the afternoon to allow maximum settling time prior to starting the survey while conditions were ideal. Snow cover was fairly consistent throughout the Tote Road. Some sections of the Tote Road experienced more windswept patches where it was difficult to detect tracks. Throughout the Tote Road, boulders and exposed ridges were visible which were typical conditions experienced in the area.

4.1.2 RESULTS AND DISCUSSION

Surveyors observed over 80 distinct Arctic fox crossings containing 1–5 sets of tracks each. Although many individual tracks were observed, many of the tracks detected were not considered “fresh” and were considered “old” as the tracks were made prior to recent snowfall. At least 10 of the crossings were considered “fresh”. Due to the light wind moving the fresh snow around limited surveyors ability to determine if tracks are recent or relatively old, as a track that was made in less than 24 hours can look older than it may be if it is in a more exposed area.. Crossings containing multiple track sets likely represent one or a few individuals moving back and forth on the same trail. Tracks often followed either side of the road before and after crossing the Tote Road. Surveyors observed one Arctic hare, although it did not cross the road and only one set of hare tracks were encountered. No signs of caribou or other mammal tracks were observed. Typical site conditions and examples of observed tracks are displayed in Photo 6 to Photo 9.

Photo 6. Arctic fox tracks visible from >300 m as a result of excellent visibility, April 15, 2016.

Photo 7. Fresh Arctic fox tracks that cross the Tote, April 15, 2016.

Photo 8. Multiple Arctic fox tracks crossing the Tote Road in the same location although there are no constrictions within 100 m north or south of this crossing, April 15, 2016.

Photo 9. Arctic hare tracks following along the Tote Road before and after crossing, April 15, 2016.

4.2 SNOW BANK HEIGHT MONITORING

During review of the project, QIA and NIRB expressed concerns that Project activities could have a negative effect on caribou movement patterns. Specific concerns included caribou avoiding crossing due to train or vehicle presence and snow bank heights and the potential for constraining wildlife movement across roadways. In conjunction with the snow track survey (Section 4.1), and the concerns expressed by the QIA and other reviewers during the assessment of the original Project application to NIRB and the Early Revenue Phase proposal, the following Project conditions were issued to address these concerns including:

- Project condition #53ai) "*Specific measures intended to address the reduced effectiveness of visual protocols for the Milne Inlet Tote Road and access roads/trails during times of darkness and low visibility must be included.*"
- Project condition #53c) "*The Proponent shall demonstrate consideration for…Evaluation of the effectiveness of proposed caribou crossing over the railway, Milne Inlet Tote Road and access roads as well as the appropriate number.*"

To address these concerns, Baffinland committed to various mitigation measures allowing for effective caribou crossings of the Tote Road. Mitigation measures were developed to reduce the likelihood of a barrier effect on caribou movement which involves snow bank management and maintaining the snow bank heights at less than 1 m along the railway and roadways as well as smoothing the snow banks on the edges of roadways to reduce the probability of drifting snow. These mitigations allow for wildlife, specifically caribou, to cross the transportation corridor without being blocked by steep snow banks, as well as allowing greater visibility for drivers to help reduce wildlife-vehicle collisions.

4.2.1 METHODS

Snow bank height monitoring was developed to be completed in conjunction with snow track surveys, in compliance with the QIA request to increase monitoring requirements. For 2016, snow bank height monitoring was conducted April 14–15 and was completed systematically by surveyors driving the Tote Road and stopping at the same kilometre markers as the 2014 and 2015 surveys. At the set locations, surveyors would measure the height of the east and west snow banks. Snow bank measurements were collected from the solid road surface to the top of the snow bank using folding plastic rulers and were measured in centimetres. Surveyors would record the kilometre post marker number, photo number, bank height measurement (centimetres) for the east and west banks as well as any relevant comments. Snow depth measurements were collected at 45 kilometre post markers along the Tote Road, resulting in a total of 90 measurements (Photo 10 and Photo 11).

4.2.2 RESULTS AND DISCUSSION

Snow depths recorded were as low as zero cm in height and were found to exceed the maximum snow depth of 100 centimetres on 13 separate occasions with a maximum recorded depth twice the suggested maximum height (Figure 29). Of these 13 snow depth exceedances, four of the measurements were slightly over the 100 cm threshold, and only in four locations did the snowbanks exceed the threshold on both the east and west sides simultaneously, two of which exceeded by less than 3 cm on one side. The majority of the sites measured complied with the snow bank height recommendations (Photo 12). Frequently at sites with greater heights, the snow is being piled according to landscape conditions (e.g., down slope), or gathered in larger piles with an abundance of escape routes between piles. During surveys it was apparent that snow bank height management has been maintained throughout the season, with piles of snow pushed back to reduce the overall height (Photo 13). The snow piles are often very solid and could be walked on with ease for crossing as long as they are not too steep.

Photo 10. Snow bank heights measured from the road surface up to the top of the bank on both the east and west banks at set locations, April 14, 2016.

Photo 11. Snow bank heights measured from the road surface up to the top of the bank on both the east and west banks at set locations, April 14, 2016.

Photo 12. Snowbank conditions at km 37 on the Tote Road, April 14, 2016.

Photo 13. An example where snow banks were managed throughout the season and pushed back to ensure they do not exceed the maximum snow depth, April 14, 2016.

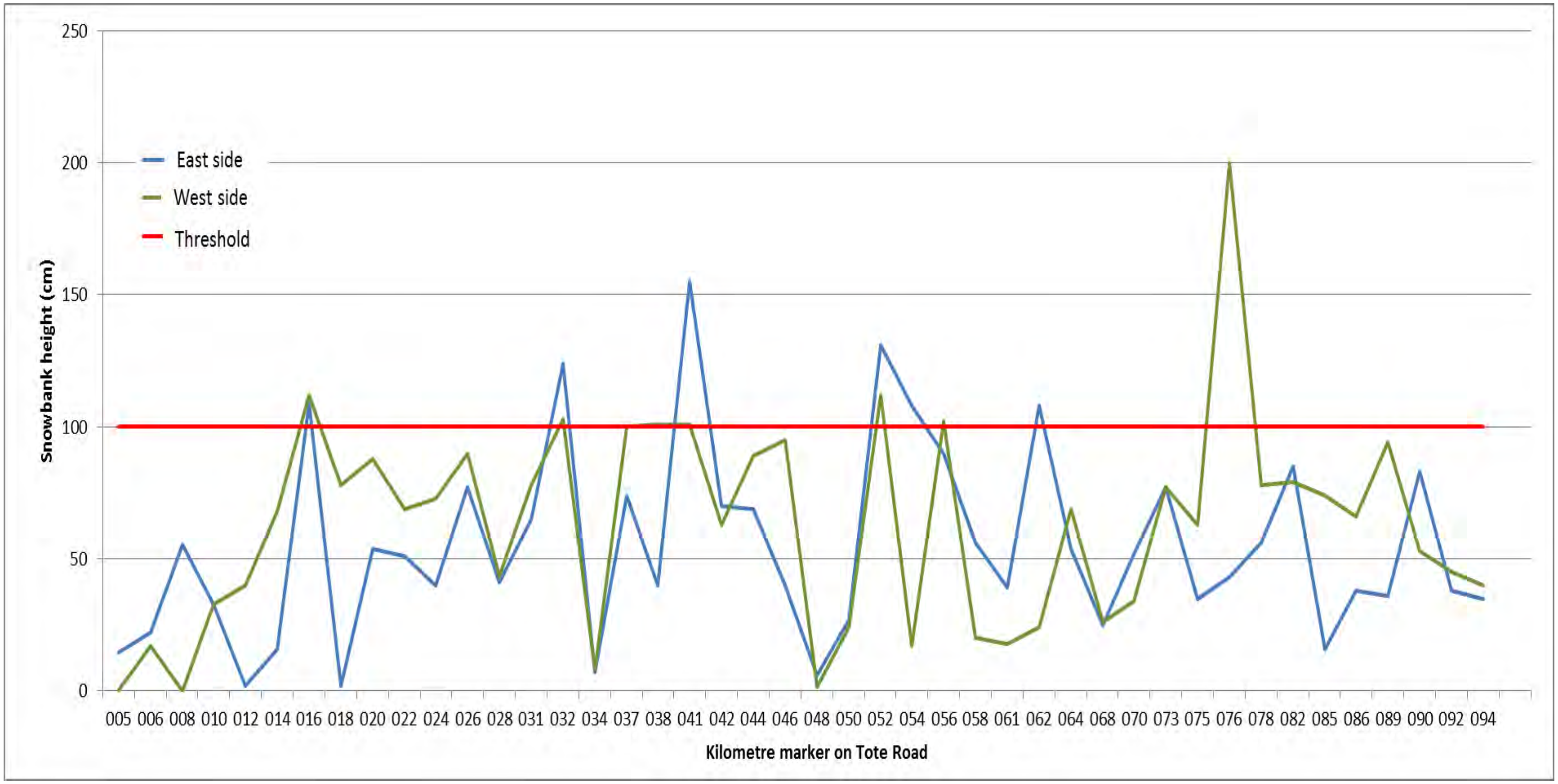


Figure 29. Snowbank heights measured from road surface to top of snow bank at kilometre posts along the Tote Road, April 14–15, 2016

4.3 HEIGHT-OF-LAND SURVEYS

Project conditions 54b requires "*Monitoring for caribou presence and behavior during railway and Tote Road construction*" while Project condition 58b requires "*A detailed analysis of wildlife responses to operations with emphasis on calving and post-calving caribou behaviour and displacements (if any), and caribou responses to and crossing of the railway, the Milne Inlet Tote Road and associated access roads/trails.*" Similarly, #53b requires "*monitoring and mitigation measures at points where the railway, roads, trails, and flight paths pass through caribou calving areas, particularly during caribou calving times.*"

To address the project conditions, height-of-land (HOL) surveys were initiated in 2013 to study caribou use and their behavioural reactions to human activities near the Project footprint, especially during the calving season. The focus of the HOL surveys is to examine how or if caribou, especially cows with calves, respond to Project activities and infrastructure. HOL surveys allow for long-term monitoring and observation of caribou behaviour throughout the life of the Project, providing information to verify and monitor predicted Project effects on caribou movement and habitat use. Among other things, behaviour sampling can provide insight into responses to environmental stimuli (Martin and Bateson 1993).

4.3.1 METHODS

HOL surveys use a basic survey technique that involves observing an area from a high point of land (to increase the amount of observable area) for a prescribed amount of time, using binoculars and/or a spotting scope to detect and record caribou and their proximity to Project infrastructure. The 2016 HOL surveys were conducted in April and June in an effort to observe caribou during the late winter and calving periods. Two observers were present during all HOL surveys in 2016. The surveys followed the 2013 HOL survey design as closely as possible; however, due to resource constraints on site, a vehicle was not available for traveling between stations for the June surveys, necessitating the use of a helicopter to access the sites, however a few stations were accessed by the Tote Road via truck and hiking. Additionally, due to early melt this year, some of the sites were not accessible via hiking due to open water preventing access to the stations. Stations visited in April were accessed via bombardier snowmobiles and hiking from the Tote Road. Surveys included two observers traveling within the Project footprint, stopping at predetermined HOL stations along the way and scanning the landscape for approximately 20 minutes.

All 24 HOL stations were visited at least once in 2016. HOL stations were established at the highest point possible, although a 360 degree view was rarely achievable. Project components (e.g. the road, camp, or deposit) were visible from each station. Stations were chosen based on their location along the road, gain in height (e.g. improved view), and accessibility in spring conditions. A few of the sites would be inaccessible if not for helicopter support due to waterbodies and long travel time by foot.

At each station, the following information was recorded:

- Station number
- Location description (direction from road, aspect, terrain, other identifying features)
- General habitat description (vegetation, soil)
- Photograph numbers (taken in multiple directions)
- Observation start and end time
- Snow cover on landscape

Observations were made with one spotting scope and one set of binoculars (Photo 14 to Photo 17. Generally, observations were made continuously for 20–31 minutes by scanning the viewable landscape. If caribou were observed, the crew would begin monitoring behaviour following protocols established and provided in the 2013 Annual Terrestrial Monitoring Report (EDI 2014). Observations would be made as either a focal or scan sample (depending on the number of caribou; Martin and Bateson 1993) and observations would be recorded on specifically developed field data sheets. For scan sampling, activity categories (i.e., walking, foraging, running, lying, etc.) would be assigned and tallied every two minutes. For the focal sample, activity observations would be recorded every two minutes; however, certain events (e.g. a truck passing by) would also be recorded to document any unique response. The individual's or group's distance to Project infrastructure and directional movement would also be recorded when possible. Distance from the observers would either be estimated by sight or by using a range finder.

In 2016, viewshed mapping was completed to demonstrate how far and to what extent surveyors could actively observe while conducting HOL surveys. In June, each HOL station was visited and through the use of helicopter, radio, GPS and binoculars/spotting scope the detectable distance for wildlife was obtained and refined. One surveyor would stay on the ground at the HOL station, while the other surveyor would fly across the valley in the helicopter to a distance that the on the ground surveyor thought to be at a maximum for viewing cryptic caribou. Once out far enough, the helicopter would land, and the surveyor in the helicopter would temporarily exit to confirm that they were still visually detectable. This process was completed the first few times, after that, the helicopter would fly out to the maximum detectable distance, and the surveyor on the ground would confirm that the helicopter was visible and appeared to be the same relative size as previous assessments. The ground based surveyor would confirm that an object the size of a caribou near the helicopter was still visible through radio and the helicopter would confirm the distance away from the station.

For the purposes of the modelling and ensuring that wildlife would be detected, the maximum detectable distance was scaled back. It was found that observers would be able to detect animals as far out as 5 km, however being able to determine sex or age would be impossible at this distance. The distance category was refined back to 4 km which ensured that anything the size of a caribou would be detected if it was present during the survey

The viewshed was modeled in order to determine the amount of viewable area while conducting HOL surveys. Based on the estimated maximum distance a cryptic caribou could be observed, a viewshed analysis was completed for each HOL survey point to account for non-visible areas due to topography (e.g., blind spots in low topography areas). The viewshed analysis was conducted using Viewshed Tool Spatial Analyst tool in ArcGIS. The inputs for processing included HOL observer points, a 4 km buffer of individual HOL points as a distance limiter, and a digital elevation model (NRCan). The results of the initial analysis were followed using the Focal Statistics Tool to fill gaps. The inputs included Neighbourhood – Circle, Circle Radius – 1 pixel, and statistics type = maximum. A total of 227 km^2 were surveyed within the viewshed area, survey coverage ranging from 5-22 km^2 from each HOL station (Map 7).

Photo 14. Height-of-land surveys conducted in April were accessed by snowmobile or hiking from the Tote Road, April 16, 2016

Photo 15. Remote Height-of-land survey stations were accessed via snowmobile and hiking in April, surveys were completed using binoculars and a spotting scope, April 17, 2016

Photo 16. Height-of-land surveys conducted in June during peak calving were accessed by helicopter or hiking from the Tote Road, June 11, 2016

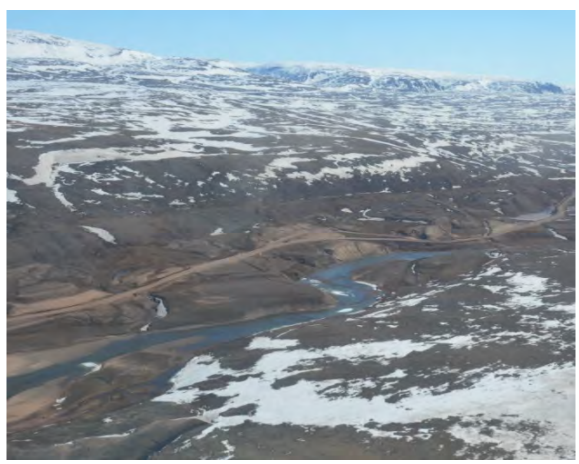
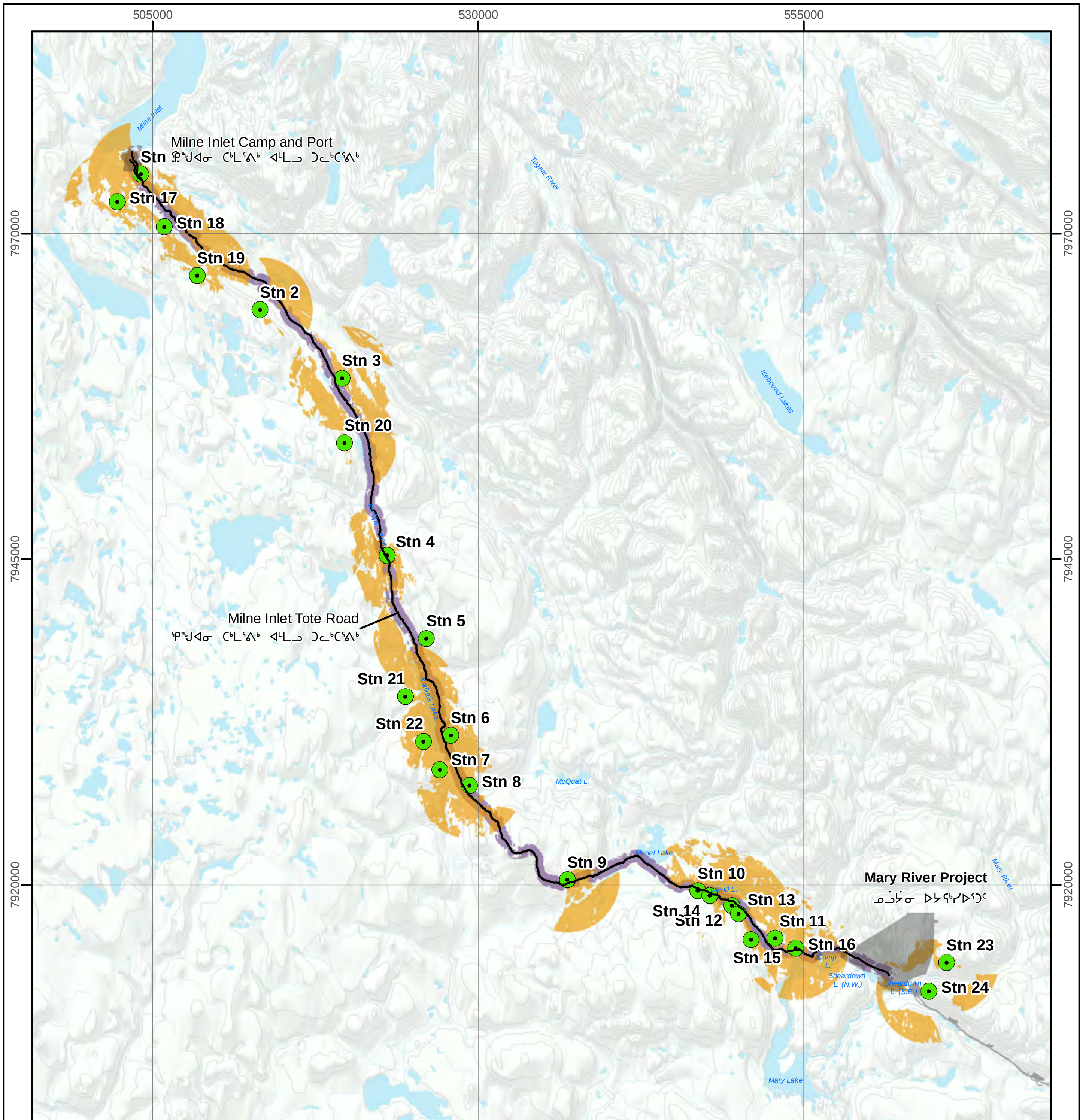


Photo 17. Some HOL stations that were established in 2014 via helicopter were not accessible by hiking due to early melting in 2016, June 09, 2016



LEGEND ᑐᑭᓯᓯᒋᐊᕐᕕᑦ

- Milne Tote Road
- Potential Development Area ᓄᓇ ᐊᒃᑐᕐᑕᐅᑐᐃᓇᕆᐊᓖᒃ ᓴᕕᒃᓴᕐᓯᐅᕐᑐᓂᑦ
- Caribou Height of Land Station
- Viewshed from Tote Road (500 m distance)
- Viewshed from Height of Land Sites (4 km radius)

Caribou Height of Land Survey Locations and Viewshed

NOTES ᖃᐅᔨᒪᔭᒃᓴᐃᑦ

Viewsheds created by EDI Environmental Dynamics Inc. (2016).

Updated PDA provided by Hatch (25 April 2013).

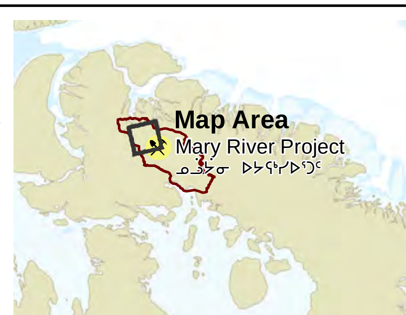
Scale ᐊᖏᓂᖓ

0 5 10 20

Km ᑭᓚᒥᑕ

Map Scale ᐊᖏᓂᖓ: 1:434,708 (printed on 8.5 x 11)
Map Projection: NAD 1983 UTM Zone 17N

Drawn:	Checked:	Date:	
MP	MAS/DH	3/7/2017	**MAP 7**



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4.3.2 RESULTS AND DISCUSSION

There were no caribou observed during HOL surveys completed in April and June 2016. A total of 12 hours and 36 minutes of HOL surveys were conducted, with the majority of the surveys completed in June during peak calving (8 hours and 45 minutes) while 3 hours and 51 minutes were conducted in April (Table 11). All 24 HOL sites were visited at least once and 11 stations were visited twice between the April and June site visits.

Weather conditions during the HOL surveys were variable, ranging from excellent, clear viewing conditions to overcast with poor visibility (snow/rain & fog) and windy. Temperatures during the April surveys ranged from -12°C to -24°C, while June temperature ranged from +1°C – +9°C. During both April and June surveys, snow was still present with 55–97% cover in April and 25–55% in June, allowing for observation of tracks in the snow for many areas. One site in June had a much higher percent of snow cover at 70%, however, this HOL station (station 23) is at a much higher elevation and its viewshed includes area outside of the valley that the Tote Road is located. No caribou tracks or fresh signs of caribou were observed during surveys or on route to survey stations. Survey times ranged from 19 to 31 minutes in duration, and observation time could exceed 20 minutes if observers were attempting to distinguish an unidentifiable object on the landscape (e.g. a suspected animal).

Table 11 Summary details of height of land surveys conducted in the Mary River Project study area in 2016.

Method of transportation to HOL station	Dates of observation	Number of observers per survey	Survey Effort (hh:mm)
Snowmobile; Truck and hiking from Tote Road	April 14, 16, 17, 18, 19	2	3:51
Helicopter; Truck and hiking from Tote Road	June 09, 10, 11, 12, 13, 14	2	8:45
Total	**11 Days**		**12:36**

4.4 INCIDENTAL OBSERVATIONS

Site personnel are asked to record wildlife sightings in the camp's wildlife logs — at both Mary River camp and at Milne Port camp. These logs provide an indication of the wildlife species that occur in proximity to Project infrastructure or areas where exploration may be occurring. Wildlife species recorded in the camps wildlife logs for 2016 are summarized in Table 12. In addition to those species listed, a number of birds were also recorded on the wildlife logs including ducks, common raven, snow buntings, sandhill cranes, snow geese, gulls, ptarmigan, snow owl, gyrfalcon, peregrine falcon, and rough legged hawk. A number of questionable species that were included in the log (e.g., weasel, blue fox and black fox) are not included in this summary.

Table 12 Wildlife species observations recorded in the 2016 Mary River and Milne Port camps wildlife logs.

Species	Number of observations		
	Mary River Camp	Tote Road	Milne Inlet
Arctic hare	11	4	2
Arctic fox	41	8	11
Arctic wolf	-	-	1
Polar Bear	-	-	2
Ringed Seal	-	2	-
Caribou	-	-	1[1]

[1] No additional information available on location of caribou sightings.

4.5 HUMAN USE LOG

Baffinland monitors human use by maintaining a log of visitors to site, with particular notation for those traveling through and hunting within the RSA. However, there is no certainty of a complete data set, as it is not compulsory for individuals to check in with Baffinland security unless they are stopping in and using the Baffinland facilities. A total of 293 individuals stopped and checked in at either Mary River or Milne Port camps, the majority of which stopped at Milne port (278 individuals in 43 groups) while only five groups were recorded at Mary River (3 individuals per visit). Individuals frequenting the area were often passing through, fishing, Canadian Rangers or were hunting, while the activities of the majority of visitors were not recorded. No harvests were recorded on the Baffinland visitation logs.

5 BIRDS

The 2016 Project surveys for birds included pre-clearing nest surveys for birds when necessary, and continued monitoring and baseline data collection for cliff-nesting raptors. Specific surveys included:

- Pre-clearing nest surveys for breeding birds; and
- Cliff-nesting raptor occupancy and productivity surveys.

Project Condition #74 requires that "*The Proponent shall continue to develop and update relevant monitoring and management plans for migratory birds…key indicators for follow up monitoring…will include: peregrine falcon, gyrfalcon, common and king eider, red knot, seabird migration and wintering, and songbird and shorebird diversity.*" During previous years, bird surveys included several surveys for songbirds and shorebirds to meet that portion of Project Condition #74. However, analysis of the survey results from the 2012 and 2013 PRISM plots and the 2013 bird encounter transects indicated that monitoring of Project effects on songbirds and shorebirds was unlikely to detect an effect of disturbance due to the low number of birds present. Subsequent discussions with the Terrestrial Environment Working Group (TEWG) and Canadian Wildlife Service (CWS) concluded that effects monitoring for tundra breeding birds could be discontinued but that Baffinland would:

- Contribute to regional monitoring efforts by conducting 20 PRISM plots every five years (next scheduled for 2018);
- Complete coastline nesting surveys of the identified islet near the proposed Steensby port site prior to construction of the port;
- Conduct pre-clearing nest surveys prior to any clearing of vegetation or surface disturbance during the nesting season; and
- Continue with monitoring programs for cliff-nesting raptors (annual occupancy and productivity) and inland waterfowl survey when qualified biologists are available and onsite (roadside waterfowl survey).

Although red knot specific surveys were not conducted in 2015 or 2016, when qualified biologists were onsite they were aware of the potential for red knot to occupy the area and were vigilant during all other surveys. Additionally all BIM environmental staff were trained in conducting active migratory birds nest surveys (AMBNS) which included recognition of red knot as well as other listed species. A list of all bird species observed within the Project area from 2006–2016 can be found in Appendix E.

5.1 PRE-CLEARING NEST SURVEYS

Project condition #66 states that "*If Species at Risk or their nests and eggs are encountered during Project activities or monitoring programs, the primary mitigation measure must be avoidance. The Proponent shall establish clear zones of avoidance on the basis of the species-specific nest setback distances outlined in the Terrestrial*

Environment Management and Monitoring Plan." And Project condition #70 states "*The Proponent shall protect any nests found (or indicated nests) with a buffer zone determined by the setback distances outlined in its Terrestrial Environment Mitigation and Monitoring Plan, until the young have fledged. If it is determined that observance of these setbacks is not feasible, the Proponent will develop nest-specific guidelines and procedures to ensure bird's nests and their young are protected.*"

In accordance with those Project conditions, pre-clearing nest surveys were done prior to any disturbance to ensure no bird nests were located in areas where any clearing or new area disturbance was scheduled. In 2016, prior to the nesting season, Baffinland anticipated which areas would be developed in the spring and summer, and cleared these areas of all vegetation, therefore reducing the nesting potential and reducing the likeliness of interaction with nesting birds. Protection of all bird migratory bird nests is legally required and it is a federal offence to damage, destroy or disturb an active nest. Within the Project RSA, pre-clearing nest surveys are necessary between May 31st and August 15th while birds are actively nesting (TEMMP Section 3.2).

5.1.1 METHODS

Pre-clearing nest surveys were conducted by Baffinland environmental staff over the 2016 nesting season in areas that had to be disturbed during the nesting season. In early June at the beginning of pre-clearing surveys, EDI biologists provided a refresher-presentation to staff that have previously completed the training, and a more detailed training event with new staff that were on site. Training included refreshing Baffinland environmental staff on methods to conduct nest searching surveys as well as common species found in the areas. EDI provided Baffinland environmental staff with a template for datasheets as well as a database for data entry when nests are located. CWS provided advice to increase detection of nests during surveys at the TEWG meeting in 2015. As a result, EDI staff supplied two rope-drags (For Mary River and Milne environmental offices) to use during 2016 preclearing surveys to increase the likelihood of nest/nesting adult detection. Rope drags were constructed following the template provided by CWS (Rausch 2015)

Pre-clearing surveys were conducted with a minimum of one individual and up to four observers. Observers would conduct this survey by walking slowly through the area, stopping regularly to make note of incidental observations. Areas were surveyed for active nests a maximum of five days prior to clearing. If the area was not developed within the five day window, surveys were conducted again to ensure no birds had started nesting. Nest searching also involved observers looking for signs of nesting bird behavior including feigning a broken wing, alarm calling, or carrying food indicating a nest is within the area. Surveyors recorded all incidental bird observations during nest surveys, but identification was limited to the skills of the individual observers.

5.1.2 RESULTS AND DISCUSSION

To ensure that birds were not nesting in the area during this time, Baffinland Environmental monitors conducted pre clearing active migratory birds nest searches (AMBNS). Nine pre clearing surveys were conducted that included a total of 9.52 person hours and 85,666 m² (8.7 ha) of area in the Mine Site, Tote Road and Milne Port development areas (Table 13). No bird nests were located during any of AMBNS, and therefore no buffers were required. During AMBNS, environmental monitors did note songbirds including snow buntings and horned lark, however there was no indication of nesting behaviours observed (feigning broken wing, carrying food, carrying nesting material, etc.).

In 2016, a total of 78,500 m² of land was disturbed for project infrastructure. Of the areas cleared, 63% of the work was done outside of the breeding bird window. During the breeding bird window, a total of 28,700 m² of land was cleared while 85,800 m² was surveyed through the AMBNS (Table 13).

Table 13 Summary of AMBNS surveys conducted in 2016 during bird nesting season.

Location	Date (dd/mm/yy)	Site Description	Nest located	Birds observed	Surveys effort	Area surveyed (m²)
Milne Port	01/06/16	Milne Port – West of ore stockpile pad	-	-	1 surveyor 0.33 hours	3300
Tote Road	03/06/16	Km 77 Hill	-	Unknown songbird	2 surveyors 0.67 hours	40000
Mary River	05/06/16	Proposed check dam #1 location in valley along mine haul road.	-	-	1 surveyor 0.50 hours	3200
Mary River	05/06/16	Proposed check dam #2 & 3 location in valley along mine haul road.	-	1 snow bunting	1 surveyor 0.50 hours	14000
Mary River	05/06/16	Proposed check dam access location in valley along mine haul road.	-	1 horned lark	1 surveyor 0.50 hours	2100
Mary River	01/07/16	South East adjacent to Mine Site Crusher Pad	-	-	3 surveyors 0.67 hours	2000
Mary River	05/07/16	Landfill Expansion	-	2 snow bunting	2 surveyors 0.50 hours	9700
	25/07/16	Warehouse Expansion – between warehouse and apron.	-	-	2 surveyors 0.33 hours	3200
	24/08/16	Emulsions plant access road, between land fill access road and emulsions plant entrance	-	-	4 surveyors 0.67 hours	8300
Total Survey Effort (Person Hours) and Total Area surveyed (m²)					**9.52**	**85,800**

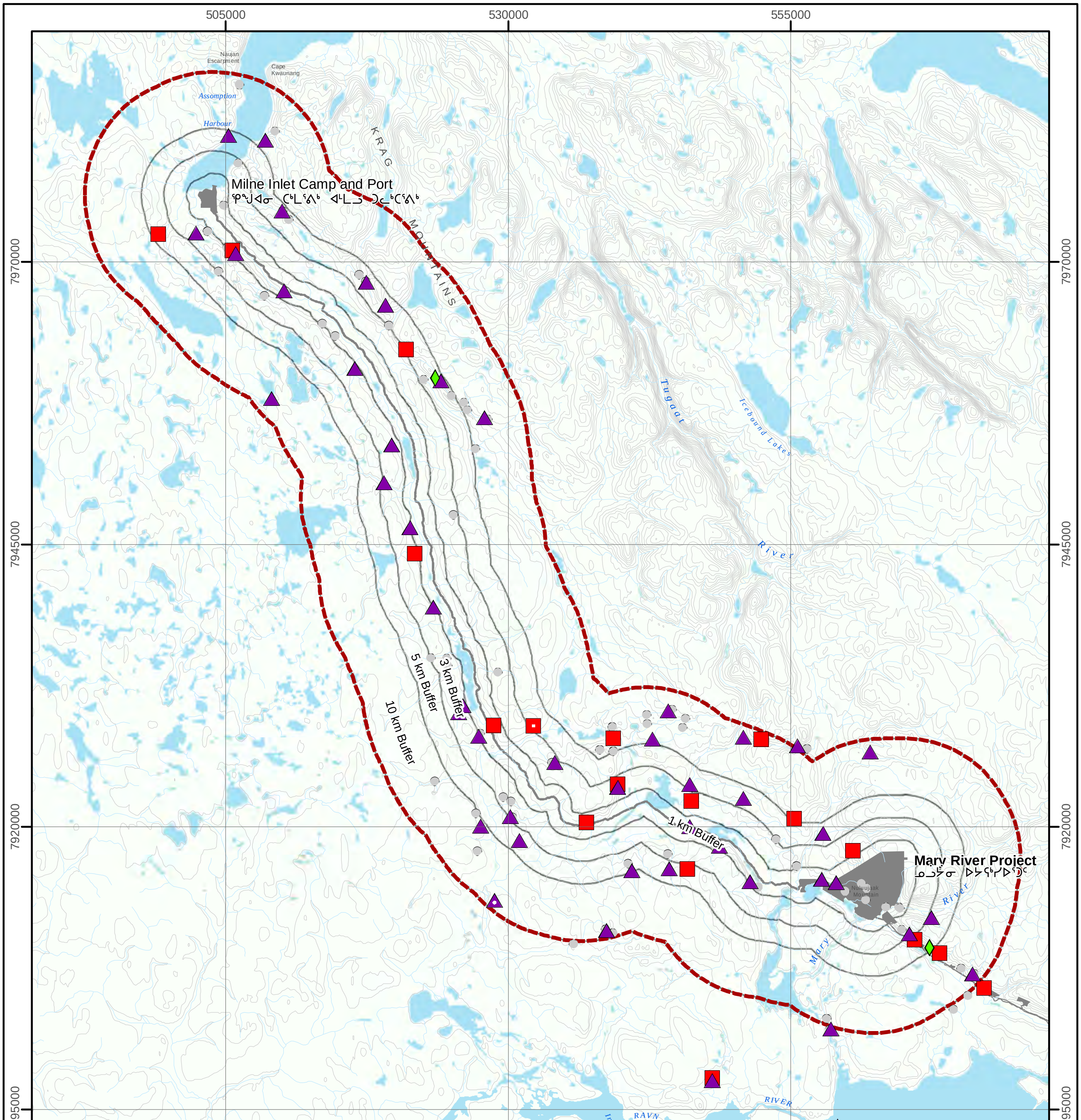
5.2 RAPTOR OCCUPANCY AND PRODUCTIVITY

The Baffinland FEIS states that a monitoring program for raptors will be used to assess the accuracy of predictions by comparing measurable parameters from within the footprint to those documented at appropriate control sites (Section 4.5.4; Baffinland 2012). NIRB Project Condition #74 identifies peregrine falcon and gyrfalcon as key indicators for follow up monitoring of birds (NIRB 2012b). Further, during the final hearing, Baffinland committed to monitoring relevant sections of the project area for peregrine falcon nesting activities (Commitment #75, NIRB 2012a).

Arctic Raptors Inc. (ARInc.) personnel have contributed to monitoring of raptors from 2011 through 2016 as part of the Baffinland Iron Mine terrestrial baseline surveys and terrestrial effects monitoring efforts. ARInc. was initially tasked with conducting extensive surveys of cliff nesting raptors in an effort to substantiate and undertake quality control of monitoring data that had been collected from 2006–2008. In 2014, ARInc. was subsequently tasked to provide a monitoring design program that could differentiate natural variation from project-caused variation using appropriate demographic indicators for cliff-nesting raptors. The 2016 reporting summarizes data collected since 2011 and further reports on monitoring efforts from the monitoring program design from 2015.

5.2.1 STUDY AREA

The spatial extent of 2016 surveys was limited to known peregrine falcon (PEFA) and known rough-legged hawk (RLHA) nesting territories within 10 km of the potential development area (PDA; Map 8). The landscape is generally rugged and elevation varies ranging from sea-level to 685 metres. The area includes a wide valley associated with Philip's Creek surrounded by high plateaus and mountains. The valley extends southward into poorly drained plains and rolling tundra. Vegetation is patchy, and dominated by *Dryas spp*., and arctic willow, along with alpine foxtail, wood rush, and saxifrage. Dry or high elevation sites are very sparsely vegetated, whereas wet areas have a continuous cover of sedge, cottongrass, saxifrage, and moss. Peregrine falcon (*Falco peregrinus tundrius*) and rough-legged hawk (*Buteo lagopus*) are the most common raptor species. Gyrfalcon (*F. rusticolus*), snowy owl (*Bubo scandiacus*) and common raven (*Corvus corax*) are also encountered.



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- Peregrine Falcon Nest Site (46)
- Peregrine Falcon Nest Site (located in 2016) (1)
- Rough-legged Hawk Nest Site (17)
- Rough-legged Hawk Nest Site (located in 2016) (1)
- Gyrfalcon Nest Site
- Unoccupied Nest Site (75)
- 2016 Raptor Study Area
- Potential Development Area ᓄᓇ ᐊᑦᑐᕐᑕᐅᑐᐃᓇᕆᐊᓕᒃ ᓴᐱᒃᓴᕐᓯᐅᕐᑐᓂᑦ

Distribution of nest locations during occupancy surveys in 2016

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Updated PDA provided by Hatch (25 April 2013).

This document is not an official land survey and the spatial data presented is subject to change without notice.

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Map Scale ᐊᖏᓂᖓ: 1:500,000 (printed on 8.5 x 11)
Map Projection: NAD 1983 UTM Zone 17N

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5.2.2 METHODS

Raptor surveys from 2011 through 2014 were extensive and necessary to establish regional-level baseline parameters of distribution and demography. The results of those surveys were reported in previous annual monitoring reports (EDI 2012, 2014, 2015) and baseline information for the ERP. The 2015 and 2016 monitoring efforts shifted to focusing on measuring suitable demographic indicators to monitor and distinguish natural variability from project-related effects. The focus of these surveys was to search for new nesting territories, as well as checking the occupancy status of known nesting territories. The following definitions are provided for clarification:

- Nesting Site — The substrate which supports the nest or the specific location of the nest on the landscape.
- Alternative Nesting Site — One of potentially several nesting sites within a nesting territory that is not being used for laying eggs in current or given year.
- Nesting Territory— An area that contains, or historically contained, one or more nests (or scrapes) within the home range of a mated pair: a confined locality where nests are found, usually in successive years, and where no more than one pair is known to have bred at one time.

Known Nesting Territories — A total of 413 unique raptor (peregrine falcon, gyrfalcon, and rough-legged hawk) nesting territories located from Milne Inlet to Steensby Inlet were documented from aerial surveys conducted from 2006 to 2008, and 2011 to 2015. The spatial extent of 2016 surveys was limited to known peregrine falcon (PEFA), known rough-legged hawk (RLHA) and known gyrfalcon (GYRF) nesting territories within 10 km of the potential development area defined in 2014 (PDA; Map 8). A spatial join in Arc Map (ArcGIS v.10.3.1) was used to identify the 137 nesting territories of the 413 unique raptor nesting territories located within this 10 km buffer around the potential disturbance area. The 137 nesting territories were mapped to be visited in the 2016 occupancy survey. Seven additional sites were just outside of the 10 km buffer, and were also visited during the occupancy survey.

Locating New Nesting Territories — Results from the 2015 report highlighted the necessity to increase search efforts for nests further from the PDA (see Table 19 of the 2015 Terrestrial Environment Annual Monitoring Report). In 2016 the same classification bins were used (0.0 km ≤ 1.0 km, 1.0 km ≤ 3.0 km, 3.0 km ≤ 5.0 km, 5.0 km ≤ 10.0 km; Map 8) to categorize the number of known nesting territories that were near and far from the PDA as an analytical approach comparing "disturbed" nesting territories from "undisturbed" nesting territories. All nesting territories known to have been occupied by PEFA (N = 172) and RLHA (N = 160) within the 10 km buffered PDA were mapped. The two raptor habitat quality models built in 2014 (EDI 2016) were then superimposed. To identify zones within bins 3 and 4 (where density of known nesting territories was lower) where habitat quality was high (relative probability of nesting occurrence > 0.6, (i.e., "high" and "highest" habitat classes) for both species, a raster calculator was used to calculate the probability of co-occurrence only on pixels holding relative probability > 0.6 separately for each species. Areas were also chosen close to the mine site to reduce helicopter time use.

Helicopter survey routes were set in these areas expected to hold unknown nesting pairs. The survey routes were drawn using either elevation lines to target the rough terrain within the zone, or line transects to cover more flat areas.

Occupancy Survey — Known nesting territories and intervening habitat thought to be capable of harboring raptors were surveyed to determine the presence or absence of territorial raptors and to locate new nests (June 23–28). Timing of surveys on Baffin Island was conducted to match the phenology of local breeding birds (described in the 2015 annual report). Median lay date for peregrine falcons in this study area is June 16 ±3.5 days, so occupancy surveys occurred just after laying was completed and made occupancy clear if eggs were located. Planned survey routes which included known nest locations were flown and deviation from pre-determined survey routes was permitted if a raptor or signs of breeding were observed. In addition to the structured surveys, favorable habitat was searched opportunistically when ferrying between known nesting territories. Nesting territories were considered occupied if one or more adults displayed territorial or nest building behavior (e.g. flight behavior associated with defense of breeding territory or presence of nest building) or if sign of breeding was sighted (eggs, chicks). The number of eggs and/or nestlings was recorded by binoculars from the helicopter at the time that each nesting territory was visited. Locations with partial or old nests without presence of breeding aged adults were not considered occupied. Nesting territories that were not visited in June, but were found with eggs or nestlings later in the breeding season were added to the database and noted as occupied in the spring.

Nesting territory occupancy is generally defined as the proportion of known breeding locations occupied by pairs per year. Mearns and Newton (1984) indicated that the proportion of known territories occupied by pairs in any given year can be used to index the size and status of breeding populations. For this report, occupancy was calculated as follows:

$$\text{Occupancy} = N_{\text{Occ}}/N_{\text{Checked}}$$

where N_{Occ} is equal to the count of occupied nesting territories and N_{Checked} equals the count of visited nesting territories

Productivity Survey — In previous annual monitoring reports "productivity" was used in this section, while it is now described as "mean brood size of assumed fledging" to account for nest failures during the pre-laying, incubation phases and early brood-rearing periods.

All nesting territories found occupied during the occupancy surveys were revisited in the first week of August (August 4–11). For nesting territories that were still active, nesting ledges or stick nests were located and the number of nestlings was recorded by binoculars from the helicopter. When the number of nestlings could not be determined from a distance but the nest was thought to be accessible, surveyors accessed the nest by foot to count nestlings. The number of eggs and/or nestlings was recorded at the time that each nesting territory was visited. Mean brood size of assumed fledging was calculated as:

$$\text{Mean brood size of assumed fledging} = N_{Chicks}/N_{NestingTerritoriesOccupied}$$

where N_{Chicks} is equal to the total count of chicks observed in the summer survey and $N_{NestingTerritoriesOccupied}$ is equal to the count of nesting territories occupied in the summer survey (August 4-11, 2016). This approach, however, does not address when nesting territories that are attempted but fail, as they are often missed (not counted) during the survey due to limited time on site. Surveys were conducted in the first week of August when nestlings are expected to range between 15 and 25 days of age, and are conspicuous. August occupancy is used because many known sites are unoccupied in the spring, and are occupied during the summer survey.

Determining Nest Success — Precise determination of the number of young in a nest with certainty is difficult when counting young from a helicopter. Therefore in addition to mean brood size of assumed fledging, we estimated nest success which can also be an informative index of breeding performance. Nest success was estimated from the proportion of occupied territories among monitored nesting territories in which at least one nestling was counted.

$$\text{Nest Success} = N_{NestingTerritoriesChicks}/N_{NestingTerritoriessOccupied}$$

where, $N_{NestingTerritoriesChicks}$ is equal to the count of visited nesting territories where at least one nestling was present and $N_{Nesting\ TerritoriesOccupied}$ is equal to the total count of occupied nesting territories.

Distance to Disturbance — Within the spatial extent of the 2016 study area, ESRI ArcGIS for Desktop was used to calculate the distance from all raptor nesting territories to the nearest mapped disturbance features (e.g., project infrastructure). Shapefiles were derived from CAD drawings provided by HATCH, the onsite procurement and engineering contractors. From the CAD files, the mine site, Milne Port and Tote Road footprints were used to represent current and proposed disturbance as of September 2014. The ArcGIS Near Tool was used to calculate the Euclidian distance for each nesting territory (i.e., point location) to the nearest point of the project footprint. Nesting territories that were located within the spatial extent of the PDA received a distance value of 0 metres.

The probability of nesting territory occupancy, brood size and nest success was modeled for nesting territories located up to 10 km from the PDA using generalized linear mixed effects models in R Statistical Environment version 3.2.2 (R Development Core Team 2015). The probability of nesting territory occupancy and nest success was modeled using a logit link function in the package lme4 (version 1.1-9; Bates et al. 2011) where an occupied nesting territory was coded "1" and unoccupied was coded "0"; similarly, a successful nesting territory was coded "1" and failed nesting territory was code "0". The probability of 0-4 nestlings per nest was modeled using a Poisson link function where number of nestlings was coded 0, 1, 2, 3, or 4.

5.2.3 RESULTS

It is not possible to accurately identify alternate sites in an unmarked population such as the one surveyed in the PDA. Therefore all analysis is conducted at the scale of the "nesting territory", and assumes that alternative nesting sites remain unoccupied. This report acknowledges that occupancy data can be confounded by an increase in the number of alternate sites rather than new sites. The concern is that the increase in the number of alternate sites could potentially result in a decline in occupancy as more alternates are discovered. However, despite this possibility a decline in occupancy has not yet been documented. In 2014-2016, no discernable decrease in occupancy is evident as reported annually (i.e., non-significant P values).

Occupancy surveys

New Nesting Territories — Based on 2016 surveys of habitat selected using habitat modeling, 2 new nest sites were discovered within the study area by helicopter in 2 hours of flying. Habitat quality models, areas targeted within bins 3-4-5, targeted survey routes and new nests found are depicted in Map 9. A third nesting territory discovered during productivity surveys was added as it was discovered in the spring.

Occupancy

There were 144 known nesting territories visited in 2016; of those, 7 were slightly outside the 10 km buffer area. Of the 144 known nesting territories, 45 held peregrine falcons, 17 were occupied by rough-legged hawks, 2 were occupied by gyrfalcons and 2 were occupied by other species. Seventy-eight nesting territories were found unoccupied. Three new nesting territories were located in 2016 within the PDA buffer (Table 14).

Occupancy for peregrine falcons and rough-legged hawks was 0.59 and 0.24 respectively (Table 15). There has been no decline ($P > 0.10$) in occupancy for peregrine falcon or rough-legged hawk from 2011 to 2016 (Figure 30).

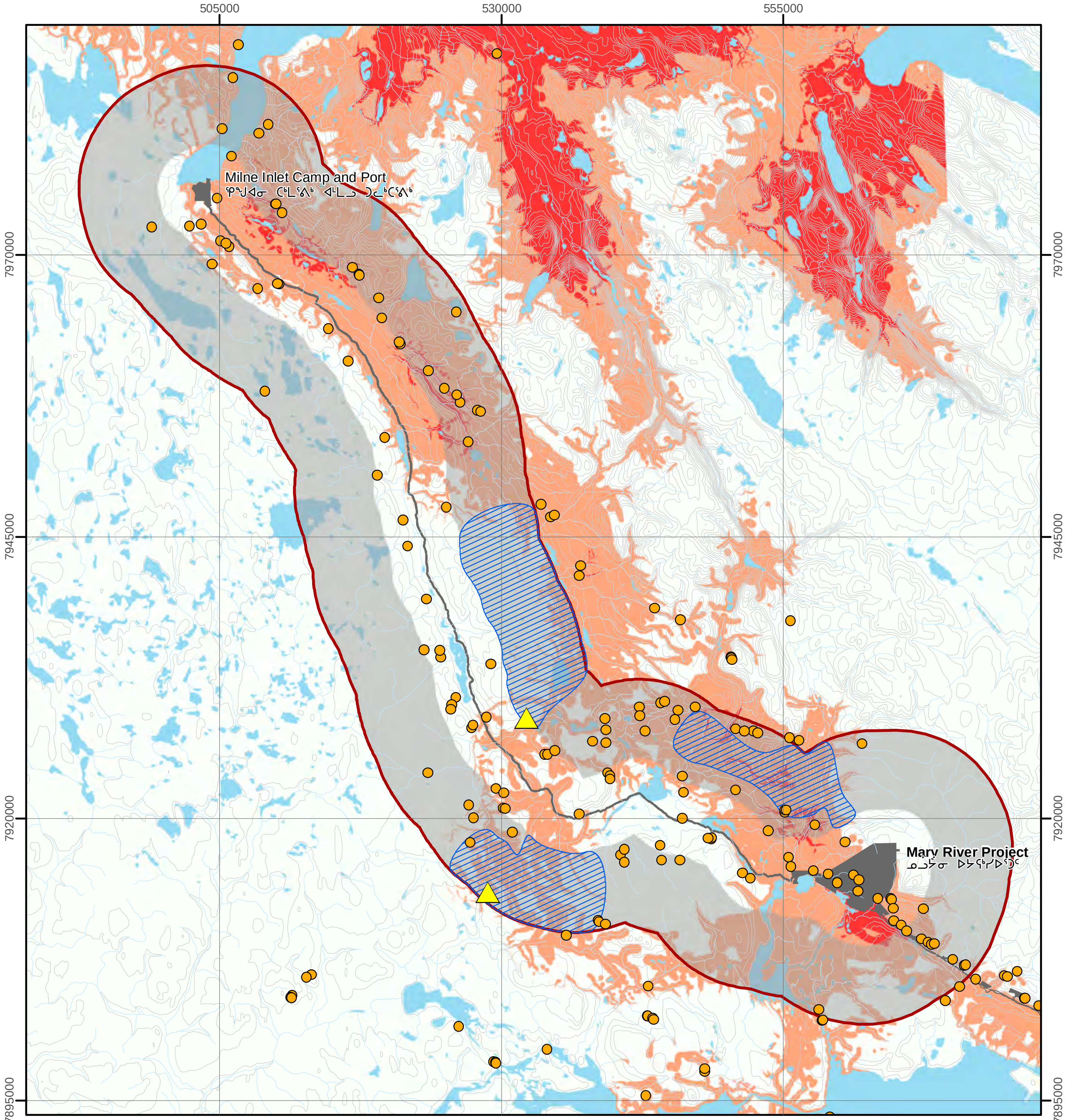
Table 14. Nesting territories visited during occupancy survey in June 23-29 2016

	Occupied nesting territories				Unoccupied nesting territories	**Total**
	PEFA	RLHA	GYRF	Other species		
Known nesting territories within PDA buffer	42	15	2	2	76	137
Known nesting territories outside PDA buffer	3	2	0	0	2	7
New nesting territories	2	1	0	0	0	3
Total	47	18	2	2	78	147

Table 15. Survey effort and occupancy for raptor nesting territories within the Mary River RSA from 2011 to 2016.

Variable		Year					
		2011	2012	2013	2014	2015	2016
Effort	Total nesting territories known by 2016	413					
	# nesting territories checked (Effort)	216	306	287	374	158	143
	% known nesting territories checked	52%	74%	69%	91%	38%	35%
	# checked nesting territories occupied	159	178	87	166	105	69
	% checked nesting territories occupied	74%	58%	30%	44%	66%	48%
Peregrine Falcon	# nesting territories occupied	73	75	82	89	56	47
	Occupancy	0.70	0.51	0.48	0.65	0.67	0.59
Rough-legged Hawk	# nesting territories occupied	79	100	3[1]	72	49	18
	Occupancy	0.69	0.63	0.02	0.59	0.59	0.24

Notes: [1] 3 lone individuals were observed at 3 different nesting territories, but pairs failed to occupy any known nesting territory.



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- New Site Located in 2016
- Historical Site (2006-2015)
- Targeted Areas for 2016 Surveys
- Bin 3 (3-5km) and 4 (5-10km)
- 2016 Raptor Study Area
- Potential Development Area ᓄᓇ ᐊᑦᑐᕐᑕᐅᑐᐃᓇᓂᐊᓕᒃ ᓴᕆᒃᓴᕐᓯᐅᕐᑐᓂᑦ

Relative Probabilities of Co-Occurrence

- 0 - 0.5
- 0.5 - 0.8
- 0.8 - 1

Targeted Survey Areas and New Nests Found in 2016 Surveys

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Updated PDA provided by Hatch (25 April 2013).

This document is not an official land survey and the spatial data presented is subject to change without notice.

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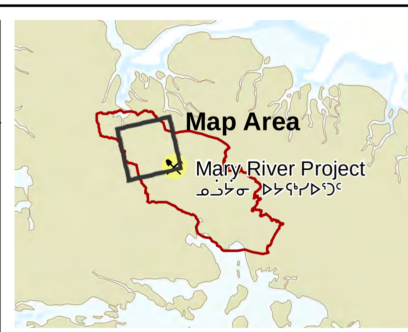
Map Projection: NAD 1983 UTM Zone 17N

Drawn:	Checked:	Date:	
HG/MP	DH/MAS	3/7/2017	**MAP 9**



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5.2.3.1 Reproductive Success

Productivity — Productivity in 2016 for peregrine falcons and rough-legged hawks was 2.44 and 2.67 nestlings per occupied nesting territory that was still active in August, respectively. There has been no decline (P > 0.10) in productivity for peregrine falcons or rough-legged hawks from 2011 to 2016 (Table 16, Figure 30).

Nest success — The percentage of successful nests in 2016 for peregrine falcons and rough-legged hawks was 87% and 100% respectively. There has been no decline (P > 0.10) in nest success for peregrine falcons or rough-legged hawks from 2011 to 2016 (Table 16, Figure 30).

Table 16. Productivity (number of young per successful nesting territory) and Nest Success for raptors in the Mary River Project study area, 2011–2016.

Measure	PEFA						RLHA					
	2011	2012	2013	2014	2015	2016	2011	2012	2013	2014	2015	2016
Total known nesting territorys[1]	233						228					
# nesting territories occupied[2]	54	45	80	67	52	45	63	42	3	47	47	12
Count of nestlings (min)	156	27	80	103	102	110	235	73	0	105	116	32
# nesting territories with >0 nestlings [3]	53	13	70	45	36	39	63	31	0	41	39	12
Nest Success[4]	0.98	0.29	0.88	0.67	0.69	0.87	1.00	0.74	0.00	0.87	0.83	1.0
Productivity (no. of chicks/no. of occupied nesting territories)	2.89	0.60	1.14	1.54	1.96	2.44	3.73	1.74	0.00	2.23	2.47	2.67

Notes:
1 Total number of nesting territories known to have been occupied since surveys began in 2006
2, 3 Summer productivity survey only
4 No. of nesting territories with >0 nestlings/# of nesting territories occupied

5.2.3.2 Distance to Disturbance

There was no evidence that occupancy, nest success or productivity (number of nestlings per occupied nest) was affected by distance from the PDA (Table 17, Figure 31); parameter estimates for both species for all measures (occupancy, nest success, number of nestlings) were not significantly different from zero.

Table 17. Breeding nesting territory estimates in relation to increasing distance from the PDA for peregrine falcon and rough-legged hawk in 2016.

	Peregrine falcon		Rough-legged hawk	
	Estimate[1] (SE)	*p*	Estimate[1] (SE)	*p*
Nesting territory occupancy	0.01 (0.07)	0.89	0.02 (0.05)	0.69
Nesting territory nest success	0.09 (0.12)	0.44	-0.12 (0.12)	0.31
Number of nestlings	0.01 (0.02)	0.60	-0.06 (0.05)	0.23

Note: 1. Poisson regression

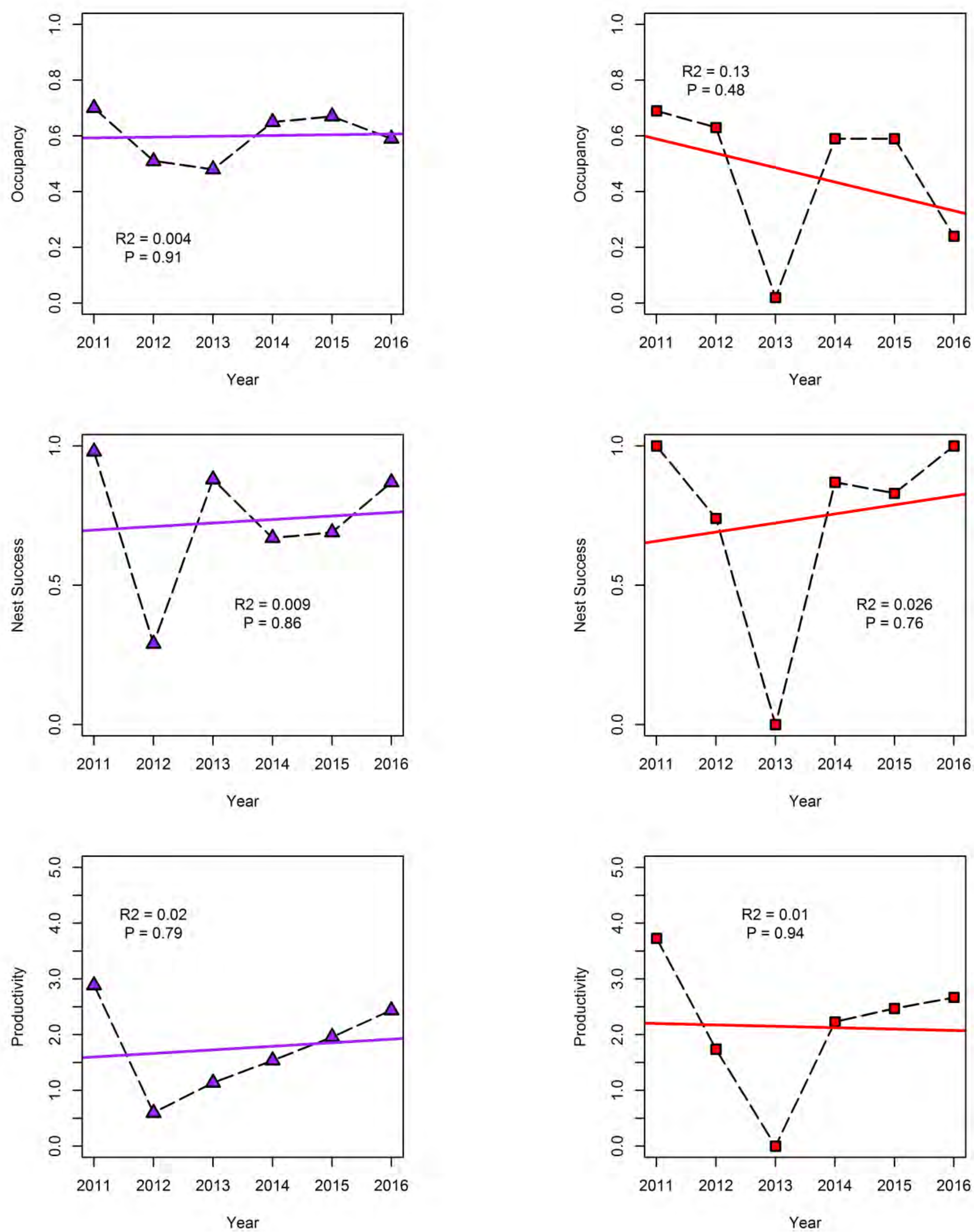


Figure 30. Peregrine falcon (purple, L) and rough-legged hawk (red, R) occupancy (top panel), nest success (middle panel) and productivity (bottom panel) from 2011–2016.
Line represents best fit based on least squares, and is shown for illustrative purposes only

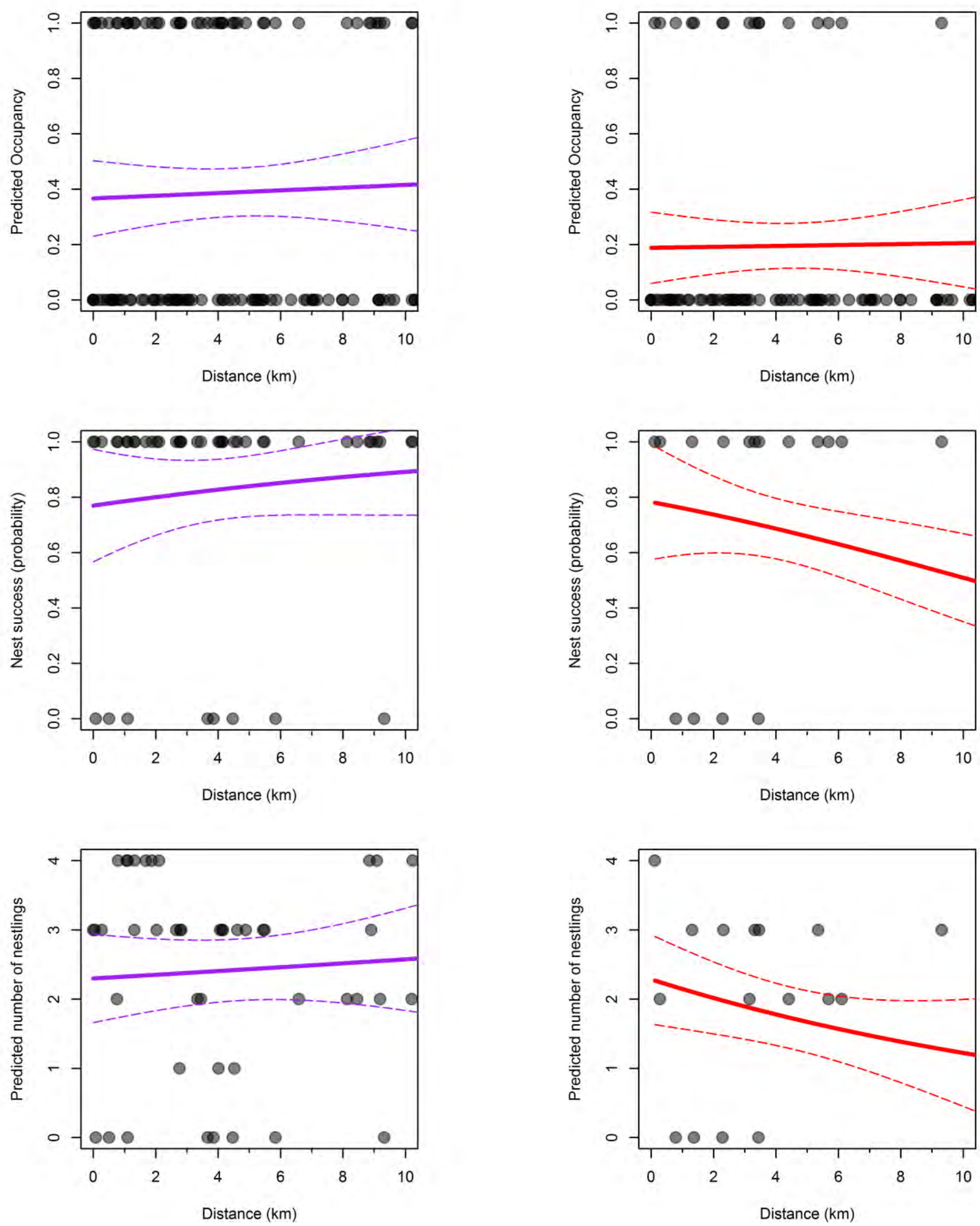


Figure 31. Predicted nesting territory occupancy, nest success and number of nestlings in 2016 with increasing distance from the PDA.

Occupancy: (top panel, 0 = unoccupied, 1 = occupied); Nest success (middle panel, 0 = failed, 1 = one or more nestlings); and number of nestlings (bottom panel, 0, 1, 2, 3, or 4) for PEFA (purple, left) and RLHA (red, right).

5.2.4 DISCUSSION

Analysis to date has shown considerable variability in occupancy and reproductive success among species, and most likely is representative of natural variability associated with variation in prey availability and weather.

On the basis of the distance to disturbance analysis, it appears that there is no negative effect to date on peregrine falcon and rough-legged hawk occupancy, productivity or nest success. However, the necessity to continue searching for nests in distance bins to ensure robust statistical analyses, rather than on repeated visits to the same nests each year may confound results to date. Future monitoring will focus on repeated nest visits once a suitable sample has been located. In that regard intensive searches of habitat within all bins of the buffered PDA to increase the sample size of nesting territories within each bin to at least N = 20 will be considered.

5.3 HELICOPTER FLIGHT HEIGHT

Helicopter flight-height management and monitoring is critical for wildlife (particularly calving and post-calving caribou) and staging waterfowl. All wildlife and bird species can be sensitive to disturbance, and low flying helicopters can be stressful for wildlife resulting in increased activity or reduction in forage time. The following Project conditions were issued to address these concerns including:

- Project Condition 59) "*The Proponent shall ensure that aircraft maintain, whenever possible (except for specified operational purposes such as drill moves, take offs and landings), and subject to pilot discretion regarding aircraft and human safety, a cruising altitude of at least 610 metres during point to point travel when in areas likely to have migratory birds, and 1,000 metres vertical and 1,500 metres horizontal distance from observed concentrations of migratory birds (or as otherwise prescribed by the Terrestrial Environment Working Group) and use flight corridors to avoid areas of significant wildlife importance…*"
- Project Condition 71) "*Subject to safety requirements, the Proponent shall require all project related aircraft to maintain a cruising altitude of at least:*
    - *650 m during point to point travel when in areas likely to have migratory birds*
    - *1,100 m vertical and 1500 m horizontal distance from observed concentrations of migratory birds*
    - *1,100 m over the area identified as a key site for moulting snow geese during the moulting period (July-August), and if maintaining this altitude is not possible, maintain a lateral distance of at least at least 1,500 m from the boundary of this site.*"
- Project Condition 72) "*The Proponent shall ensure that pilots are informed of minimum cruising altitude guidelines and that a daily log or record of flight paths and cruising altitudes of aircraft within*

all Project Areas is maintained and made available for regulatory authorities such as Transport Canada to monitor adherence and to follow up on complaints."

Baffinland in collaboration with the TEWG require "*specific measures to ensure that employees and subcontractors providing aircraft services to the Project are respectful of wildlife and Inuit harvesting that may occur in and around project areas*" (Baffinland 2014). Data from helicopter flight logs were analyzed to determine if there was compliance with the Project Conditions.

5.3.1 METHODS

As per Project Condition 71, the analysis includes the following aircraft cruising altitudes in consideration of migratory birds during specific time periods:

- 1,100 metres above ground level (magl) and 1,500 m horizontal distance while travelling through the key moulting area for snow geese during July and August;
- 650 magl during point to point travel in areas outside of the goose area, and in all other months in all areas; and
- 1,100 magl vertical and 1,500 m horizontal distance from observed concentrations of migratory birds at all times.

EDI was provided with monthly flight tracklog data from Canadian Helicopters. Point data was provided in feet above sea level and were converted to metres above sea level (masl). A Digital Elevation Model (DEM) was used to estimate ground level elevation value above sea level, which provides point elevation data that is used to calculate the helicopter tracklog's altitude above ground level. To find the elevation above ground level in metres, the masl from the DEM was subtracted from the masl from the helicopter track log, resulting in an analysis that provided helicopter's approximate metres above ground level (magl) at each tracklog point.

To assure the calculated values were correct, a Quality Assurance/Quality Control procedure was done on the data by querying the status field of the flight tracklog data. It was assumed that when the helicopter status was "wheels off" or "wheels on", the elevation would be at or close to 0.0 magl. The average values from the query show that accuracy is ~ ±12 m.

Data were split into two categories: 1) those data within the snow goose area in July and August in relation to 1,100 magl elevation requirement and 2) those data within and outside the snow goose area in all months in relation to 650 magl, and were analyzed separately to assess specific flight height allowances using the different areas and elevation values.

5.3.2 RESULTS/DISCUSSION

There is a discrepancy between Project Condition 59, suggesting that minimum flight height should be 610 magl in all areas, and Project Condition 71 prescribes a minimum flight height of 650 magl.

Considering that most, if not all, areas where Baffinland operated in June through September were likely to have migratory birds, the default minimum altitude for the analysis was 650 magl (during point to point travel).

There were no identified "*observed concentrations of migratory birds*", nor areas specifically prescribed by the TEWG to avoid for migratory birds. With exception of the snow goose area, there was no analysis necessary to determine compliance of 1,100 m vertical and 1,500 m horizontal distance of any other location.

The analysis showed that there were helicopter flights that were not compliant with the Project Conditions' requirements. There were 1,182 total transits flown within the analysis time frame, of which 227 (19%) were within the snow goose area and 955 (81%) were outside of the area (Table 18). Of the 1,182 transit flights flown, 201 were in June (Map 10), 399 in July (Map 11), 436 in August (Map 12) and 146 in September (Map 13; Table 18). The flight heights' greatest level of compliance within the snow goose area was in July, at 28% (Table 19). During the four months, the lowest level of compliancy was 2% in August within the snow goose area and 4% in September for all the areas (Table 20).

Flights above the snow goose area increased from 66 in July to 109 in August. Compliance with recommendations for the area in August decreased to 53 % from July (Table 18). The number of transits flown outside of the goose area decreased from 333 in July to 137 in September and compliance followed this pattern with 83% in July and 94% in September (Table 18).

A number of factors such as weather, distance from point to point, exploration and slinging activities contribute to flight altitudes being lower than objectives described in Project Conditions. Although flight altitude compliance was not achieved during the majority of flights, the potential disturbance to birds cannot be described.

There were no known public complaints about helicopter overflights for follow-up as per Project Condition 72.

Table 18. Number of transits flown per month with a breakdown of transits (№ and %) flown over and outside of the snow goose area, June 1 – September 17, 2016.

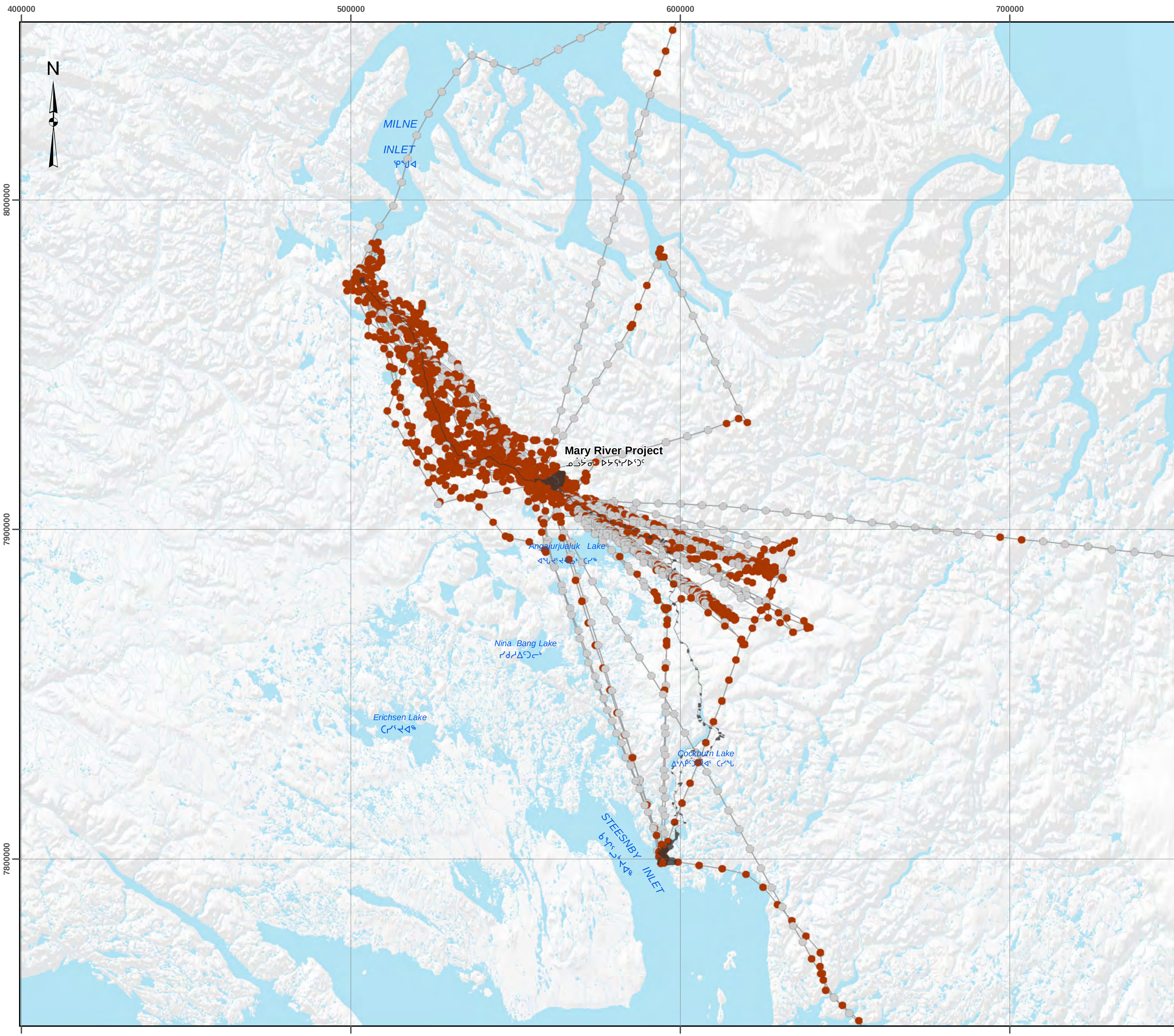
Month	Total № transits	№ transits over snow goose area	% transits over snow goose area	№ transits outside snow goose area	% transits outside snow goose area
June	201	43	21	158	79
July	399	66	17	333	83
August	436	109	25	327	75
September	146	9	6	137	94
Total	1,182	227	19	955	81

Table 19. Elevation points calculated to obtain flight height compliance over the snow goose area, June 1 – September 17, 2016

Month	Area	Total points	Total № compliant points	% compliance	Total № non-compliant points	% non-compliance
June	Not applicable (n/a)			n/a		
July	Within SNGO Area	288	80	28	208	72
August	Within SNGO Area	719	17	2	702	98
September	Not applicable (n/a)			n/a		

Table 20. Elevation points calculated to obtain flight height compliance outside the snow goose area, June 1 – September 17, 2016.

Month	Area	Total points	Total № compliant points	% compliance	Total № non-compliant points	% non-compliance
June	All Areas	3,208	1,192	37	2,016	63
July	Outside SNGO Area	4,742	1,735	37	3,007	63
August	Outside SNGO Area	4,534	1,556	34	2,978	66
September	All Areas	1,205	43	4	1,162	96



LEGEND

- June Flights (GPS points) Above 650 m (agl)
- June Flights (GPS points) Below 650 m (agl)
- Helicopter Flight Path
- Potential Development Area

NOTES

Map Projection: North American Datum UTM Zone 17N.

Helicopter flight data collected by Canadian Helicopters (November, 2016).

Updated PDA provided by Hatch (25 April 2013).

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale 0 10 20 30 40 50 60 Km

Baffinland

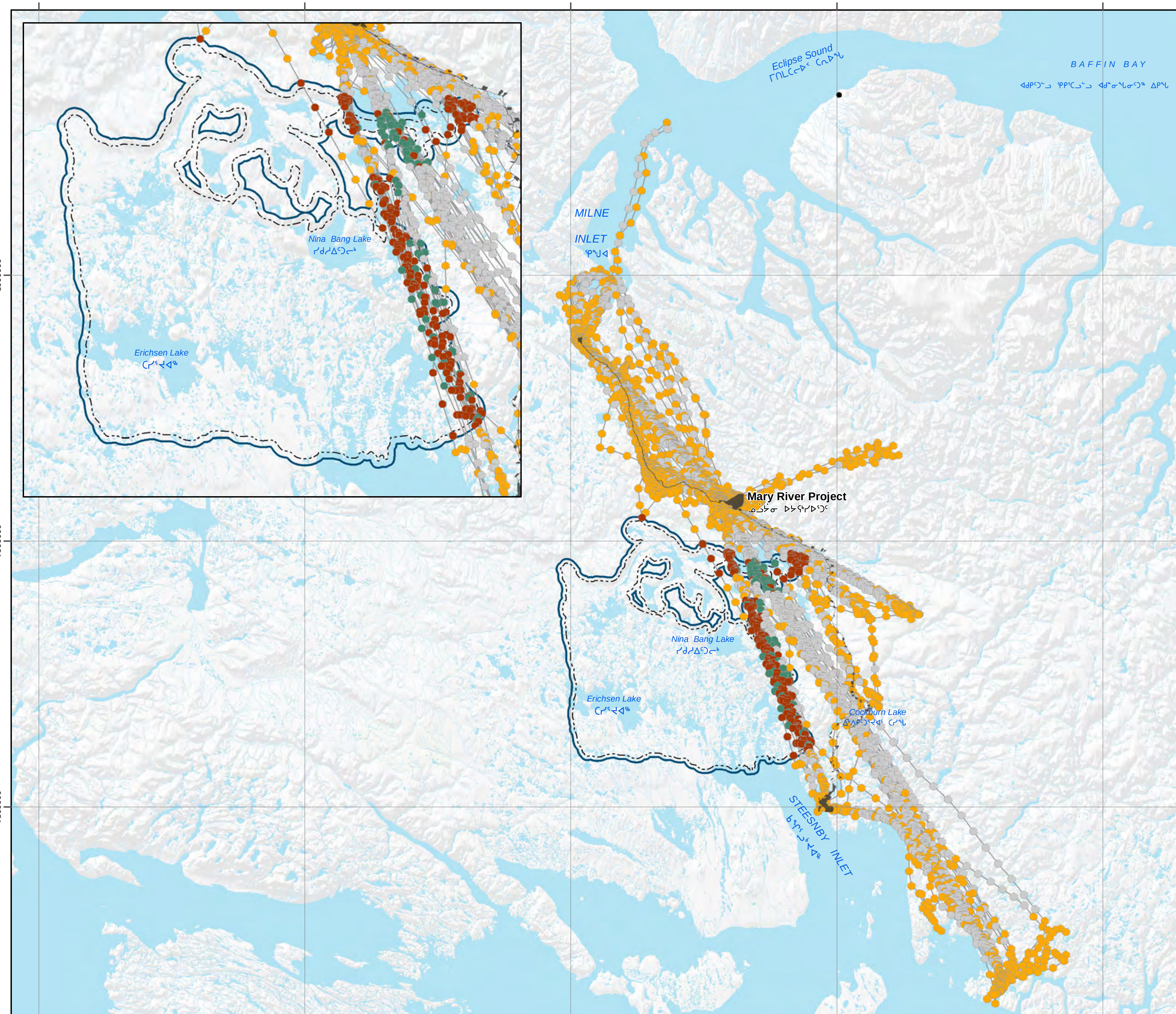
Overview Map of Helicopter Flight Paths for June, 2016

EDI

Date: 3/7/2017

MAP 10

Path: O:\2016\6Y0076_BIM\Mapping\MonitoringAnnualReportMaps_04032017\Map7_June_Overview_25112016.mxd



LEGEND

- Environment Canada Area of Interest (Geese)
- Environment Canada Area of Interest (Geese) 1500 m Buffer
- Potential Development Area
- July Flights (GPS Points) Inside the SGMA and Below 1,100 m (agl)
- July Flights (GPS Points) Inside the SGMA and Above 1,100 m (agl)
- July Flights (GPS Points) Outside the SGMA and Below 650 m (agl)
- July Flights (GPS Points) Outside the SGMA and Above 650 m (agl)
- Helicopter Flight Path

NOTES ᖃᐅᔾᒪᔾᖅᓯᐅᑦ

Map Projection: North American Datum UTM Zone 17N.

Snow goose management area (SGMA) provided by Environment Canada.

Helicopter flight data collected by Canadian Helicopters (November, 2016).

Updated PDA provided by Hatch (25 April 2013).

This document is not an official land survey and the spatial data

Scale 0 10 20 30 40 50 Km

Baffinland

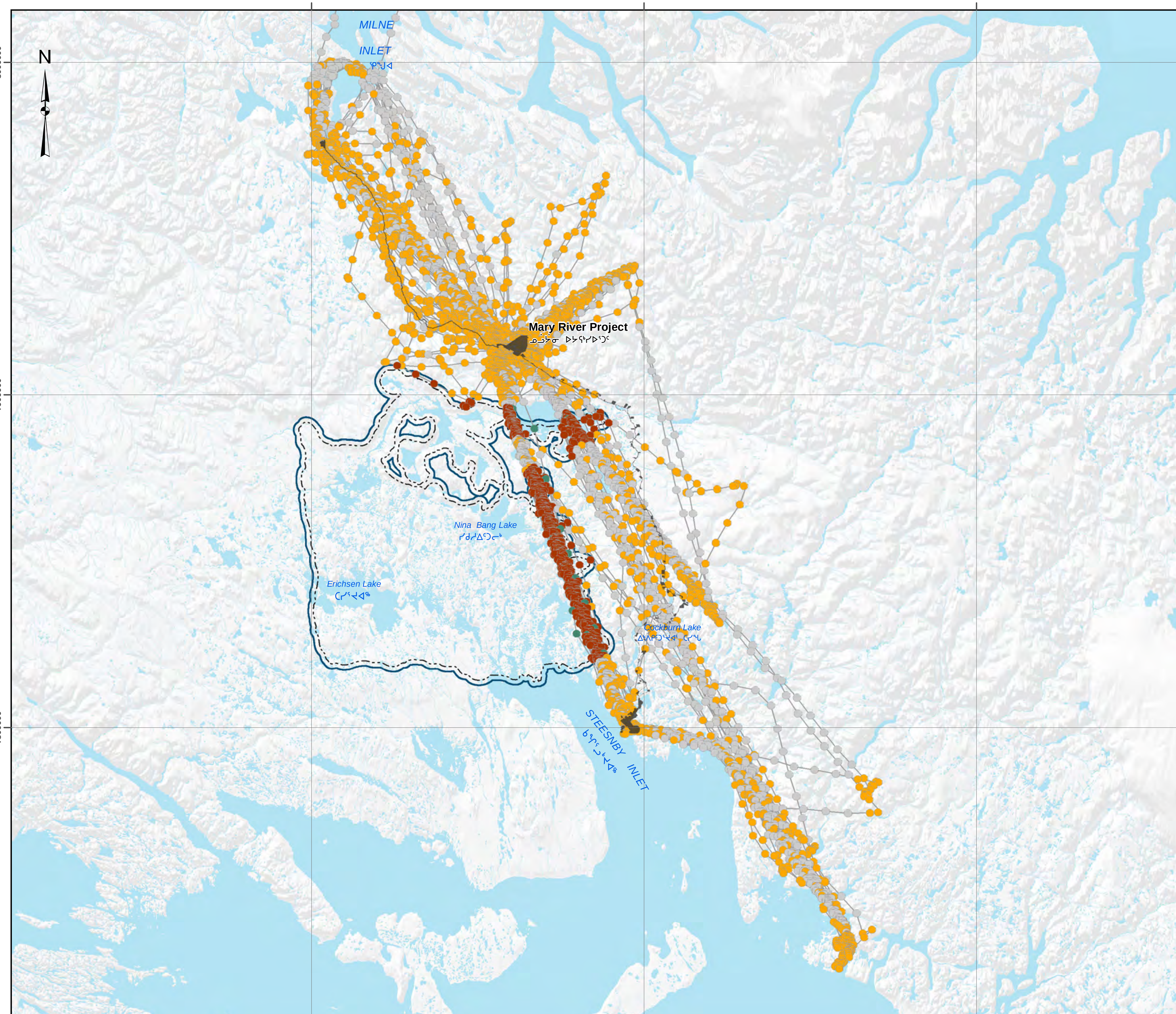
Overview Map of Helicopter Flight Paths for July, 2016

EDI

Date: 3/7/2017

MAP 11

Path: O:\2016\16Y0076_BIM\Mapping\Monitoring\AnnualReportMaps_04032017\Map8_July_Overview_25112016.mxd



LEGEND

- August Flights (GPS points) Outside the SGMA and Below 650 m (agl)
- August Flights (GPS points) Outside the SGMA and Above 650 m (agl)
- August Flights (GPS points) Within the SGMA and Below 650 m (agl)
- August Flights (GPS points) Within the SGMA and Above 650 m (agl)
- Helicopter Flight Path
- Environment Canada Area of Interest (Geese)
- Environment Canada Area of Interest (Geese) 1500 m Buffer
- Potential Development Area

NOTES

Map Projection: North American Datum UTM Zone 17N.

Snow goose management area (SGMA) provided by Environment Canada.

Helicopter flight data collected by Canadian Helicopters (November, 2016).

Updated PDA provided by Hatch (25 April 2013).

This document is not an official land survey and the spatial data

Scale 0 10 20 30 40 50 Km

Baffinland

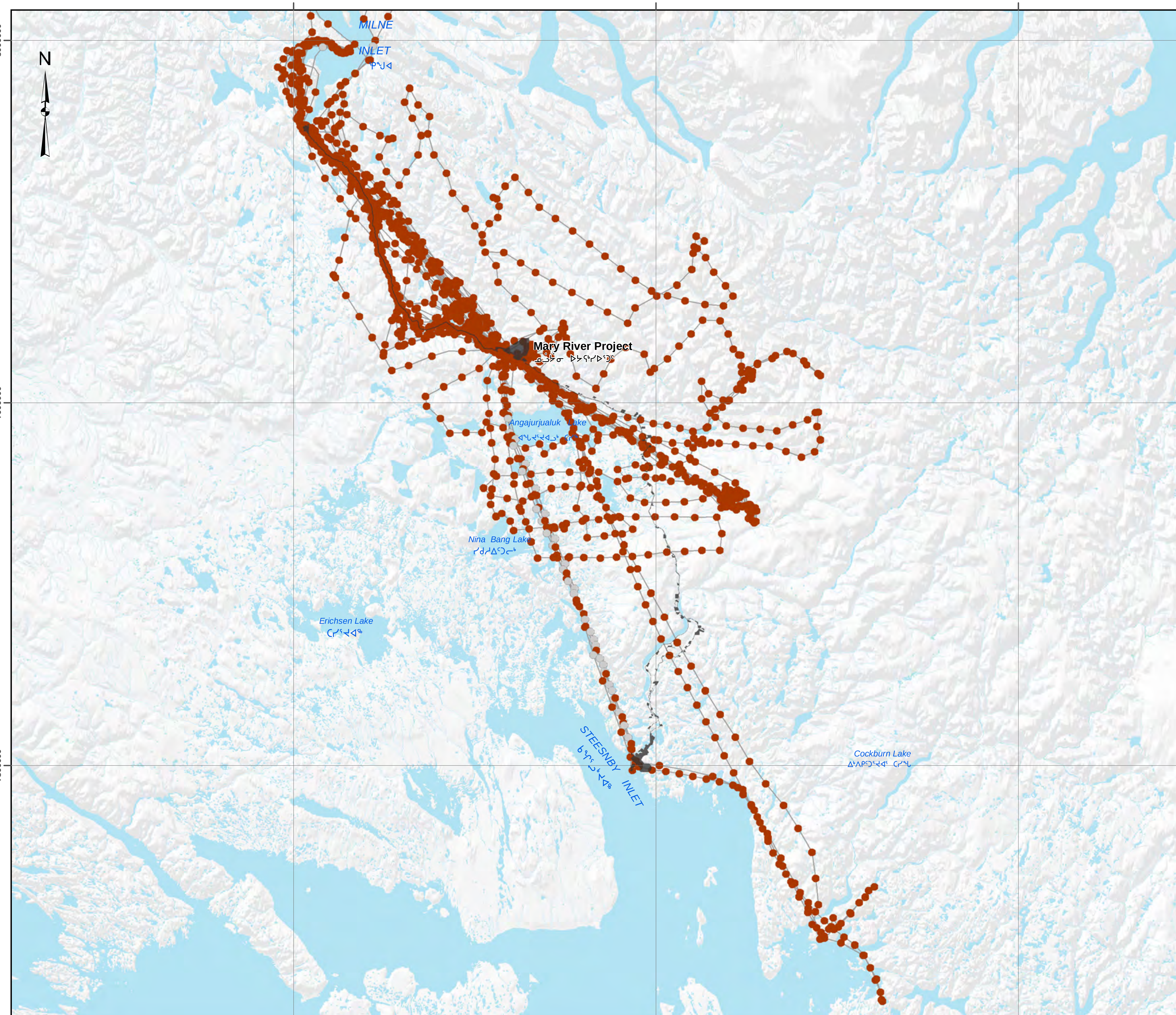
Overview Map of Helicopter Flight Paths for August, 2016

EDI

Date: 3/7/2017

MAP 12

Path: O:\2016\16Y0076_BIM\Mapping\MonitoringAnnualReportMaps_04032017\Map9_August_Overview_25112016.mxd



LEGEND

- September Flights (GPS points) Above 650 m (agl)
- September Flights (GPS points) Below 650 m (agl)
- Helicopter Flight Path
- Potential Development Area

NOTES

Map Projection: North American Datum UTM Zone 17N.

Helicopter flight data collected by Canadian Helicopters November, 2016).

Updated PDA provided by Hatch (25 April 2013).

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale 0 10 20 30 40 50 Km

Baffinland

Overview Map of Helicopter Flight Paths for September, 2016

EDI

Date: 3/7/2017

MAP 13

Path: O:\2016\16Y0076_BIM\Mapping\Monitoring\AnnualReportMaps_04032017\Map10_Sept_Overview_25112016.mxd

6 WILDLIFE MORTALITIES

While wildlife mortalities associated with human presence within the Project area are uncommon and measures are taken to avoid them, incidents did occur in 2016. When a wildlife mortality occurs, an incident report is drafted and an investigation is undertaken to better understand the circumstances. As a result of the investigation, mitigation methods are implemented to address the areas of concern to help prevent further mortalities.

6.1 WILDLIFE MORTALITIES IN 2016

In 2016 a total of 16 wildlife mortality incidents were reported, with a total of 23 individual losses. Most of the mortalities that occurred in 2016 involved Arctic fox (a total of nine individuals) and ducks (total of nine individuals). Additionally, three Arctic hares and one goose were also found dead in 2016. Thirteen of the fatalities were a result of vehicle-wildlife collisions, while a group of eight ducks flew into a building. One Arctic fox died of unknown causes and one Arctic fox was put down as it was aggressively pursuing an employee. All wildlife that is found dead on site is disposed of in the incinerator as soon as possible.

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APPENDIX A VEGETATION ABUNDANCE MONITORING SITES FOR EXCLOSURE (I.E., CLOSED) AND OPEN PLOTS IN THE RSA, 2014 & 2016

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Appendix A. Vegetation Abundance Monitoring Sites for Exclosure (i.e., Closed) and Open Plots in the RSA, 2014 and 2016.

Site Location	Transect/ Control No.	Plot ID[1]	Actual distance to PDA (m)	Treatment type	Latitude	Longitude
Mine Site	1	T1D30A	29	Open	71.32020	-79.35944
Mine Site	1	T1D30X	29	Closed	71.32016	-79.35923
Mine Site	1	T1D100A	102	Open	71.31966	-79.36069
Mine Site	1	T1D100X	102	Closed	71.31964	-79.36049
Mine Site	1	T1D750A	751	Open	71.31495	-79.37126
Mine Site	1	T1D750X	751	Closed	71.31495	-79.37126
Mine Site	1	T1D1200A	1,191	Open	71.31239	-79.38171
Mine Site	1	T1D1200X	1,186	Closed	71.31243	-79.38161
Mine Site	2	T2D30A	19	Open	71.31922	-79.19151
Mine Site	2	T2D30X	16	Closed	71.31921	-79.19163
Mine Site	2	T2D100A	175	Open	71.31862	-79.18756
Mine Site	2	T2D100X	174	Closed	71.31871	-79.18748
Mine Site	2	T2D750A	765	Open	71.31549	-79.17373
Mine Site	2	T2D750X	765	Closed	71.31549	-79.17373
Mine Site	2	T2D1200A	1,178	Open	71.31269	-79.16479
Mine Site	2	T2D1200B	1,177	Open	71.31271	-79.16478
Mine Site	2	T2D1200X	1,179	Closed	71.31264	-79.16482
Mine Site	3	T3D30A	30	Open	71.34010	-79.31164
Mine Site	3	T3D30X	34	Closed	71.34013	-79.31172
Mine Site	3	T3D100A	87	Open	71.34042	-79.31307
Mine Site	3	T3D100B	98	Open	71.34051	-79.31317
Mine Site	3	T3D100X	103	Closed	71.34054	-79.31329
Mine Site	3	T3D750A	734	Open	71.34668	-79.31554
Mine Site	3	T3D750X	730	Closed	71.34664	-79.31550
Mine Site	3	T3D71200A	1,445	Open	71.35172	-79.32806
Mine Site	3	T3D1200X	1,445	Closed	71.35172	-79.32806
Tote Road	4	T4D30A	35	Open	71.34193	-79.54399
Tote Road	4	T4D30X	36	Closed	71.34193	-79.54398
Tote Road	4	T4D100A	95	Open	71.31234	-79.54282

Site Location	Transect/ Control No.	Plot ID[1]	Actual distance to PDA (m)	Treatment type	Latitude	Longitude
Tote Road	4	T4D100X	98	Closed	71.34231	-79.54267
Tote Road	4	T4D750A	830	Open	71.34631	-79.52631
Tote Road	4	T4D750B	831	Open	71.34626	-79.52620
Tote Road	4	T4D750X	832	Closed	71.34362	-79.52609
Tote Road	4	T4D1200A	1,268	Open	71.34653	-79.51250
Tote Road	4	T4D1200X	1,268	Closed	71.34653	-79.51250
Tote Road	5	T5D30A	21	Open	71.37588	-79.73111
Tote Road	5	T5D30X	22	Closed	71.37586	-79.73100
Tote Road	5	T5D100A	86	Open	71.37511	-79.73049
Tote Road	5	T5D100X	89	Closed	71.37508	-79.73042
Tote Road	5	T5D750A	730	Open	71.36990	-79.73830
Tote Road	5	T5D750B	738	Open	71.36984	-79.73837
Tote Road	5	T5D750X	740	Closed	71.36983	-79.73842
Tote Road	5	T5D1200A	1,106	Open	71.36624	-79.73808
Tote Road	5	T5D1200X	1,139	Closed	71.36585	-79.73741
Tote Road	6	T6D30A	42	Open	71.38194	-79.99419
Tote Road	6	T6D30B	44	Open	71.38197	-79.99432
Tote Road	6	T6D30X	41	Closed	71.38196	-79.99448
Tote Road	6	T6D100A	91	Open	71.38248	-79.99201
Tote Road	6	T6D100X	91	Closed	71.38248	-79.99219
Tote Road	6	T6D750A	694	Open	71.38803	-79.99321
Tote Road	6	T6D750X	694	Closed	71.38803	-79.99321
Tote Road	6	T6D1200A	1,225	Open	71.39247	-79.98299
Tote Road	6	T6D1200X	1,226	Closed	71.39249	-79.98305
Milne Inlet	7	T7D30A	26	Open	71.87114	-80.87792
Milne Inlet	7	T7D30X	26	Closed	71.87122	-80.87794
Milne Inlet	7	T7D100A	105	Open	71.87211	-80.87576
Milne Inlet	7	T7D100X	99	Closed	71.87212	-80.87593

Site Location	Transect/ Control No.	Plot ID[1]	Actual distance to PDA (m)	Treatment type	Latitude	Longitude
Milne Inlet	7	T7D750A	884	Open	71.86808	-80.85032
Milne Inlet	7	T7D750B	874	Open	71.86797	-80.85041
Milne Inlet	7	T7D750X	871	Open	71.86788	-80.85025
Milne Inlet	7	T7D1200A	1,136	Open	71.87198	-80.84419
Milne Inlet	7	T7D1200B	1,135	Open	71.87201	-80.84426
Milne Inlet	7	T7D1200X	1,133	Closed	71.87203	-80.84431
Milne Inlet	8	T8D30A	51	Open	71.88273	-80.87804
Milne Inlet	8	T8D30X	54	Closed	71.88277	-80.87793
Milne Inlet	8	T8D100A	90	Open	71.88243	-80.87705
Milne Inlet	8	T8D100X	94	Closed	71.88245	-80.87691
Milne Inlet	8	T8D750A	818	Open	71.88108	-80.85626
Milne Inlet	8	T8D750B	822	Open	71.88110	-80.85614
Milne Inlet	8	T8D750X	826	Closed	71.88111	-80.85604
Milne Inlet	8	T8D1200A	1,098	Open	71.88471	-80.84666
Milne Inlet	8	T8D1200X	1,104	Closed	71.88476	-80.84648
Mine Site	9	T9D30A	32	Open	71.29982	-79.26338
Mine Site	9	T9D30X	32	Closed	71.29981	-79.26321
Mine Site	9	T9D100A	135	Open	71.29912	-79.26827
Mine Site	9	T9D100X	134	Closed	71.29915	-79.26846
Mine Site	9	T9D750A	713	Open	71.29443	-79.27907
Mine Site	9	T9D750B	708	Open	71.29448	-79.27903
Mine Site	9	T9D750X	701	Closed	71.29453	-79.27890
Mine Site	9	T9D1200A	1,186	Open	71.29173	-79.29365
Mine Site	9	T9D1200X	1,182	Closed	71.29176	-79.29358
Mine Site	10	T10D30A	28	Open	71.34274	-79.29750
Mine Site	10	T10D30X	34	Closed	71.34280	-79.29755
Mine Site	10	T10D100A	127	Open	71.34355	-79.29861
Mine Site	10	T10D100B	127	Open	71.34355	-79.29861

Site Location	Transect/ Control No.	Plot ID[1]	Actual distance to PDA (m)	Treatment type	Latitude	Longitude
Mine Site	10	T10D100X	127	Closed	71.34355	-79.29861
Mine Site	10	T10D750A	650	Open	71.34911	-79.29802
Mine Site	10	T10D750X	650	Closed	71.34911	-79.29802
Mine Site	10	T10D1200A	1,219	Open	71.35276	-79.31007
Mine Site	10	T10D1200X	1,219	Closed	71.35276	-79.31007
Mine Site	11	T11D30A	29	Open	71.31259	-79.19954
Mine Site	11	T11D30X	17	Closed	71.31273	-79.19974
Mine Site	11	T11D100A	233	Open	71.31095	-79.19546
Mine Site	11	T11D100X	233	Closed	71.31095	-79.19546
Mine Site	11	T11D750A	804	Open	71.30648	-79.18466
Mine Site	11	T11D750B	805	Open	71.30640	-79.18483
Mine Site	11	T11D750X	802	Closed	71.30642	-79.18486
Mine Site	11	T11D1200A	1,219	Open	71.30536	-79.17309
Mine Site	11	T11D1200X	1,225	Closed	71.30538	-79.17287
Tote Road	12	T12D30A	55	Open	71.41457	-80.1019
Tote Road	12	T12D30X	50	Closed	71.41467	-80.1021
Tote Road	12	T12D100A	113	Open	71.41430	-80.10019
Tote Road	12	T12D100X	113	Closed	71.4143	-80.10019
Tote Road	12	T12D750A	757	Open	71.41617	-80.08279
Tote Road	12	T12D750B	757	Open	71.41617	-80.08279
Tote Road	12	T12D750X	757	Closed	71.41617	-80.08279
Tote Road	12	T12D1200A	1,141	Open	71.41851	-80.07372
Tote Road	12	T12D1200X	1,140	Closed	71.41859	-80.07383
Tote Road	13	T13D30A	35	Open	71.42143	-80.10964
Tote Road	13	T13D30B	35	Open	71.42143	-80.10964
Tote Road	13	T13D30X	35	Closed	71.42143	-80.10964
Tote Road	13	T13D100A	87	Open	71.42149	-80.10794
Tote Road	13	T13D100X	87	Closed	71.42149	-80.10794

Site Location	Transect/ Control No.	Plot ID[1]	Actual distance to PDA (m)	Treatment type	Latitude	Longitude
Tote Road	13	T13D750A	669	Open	71.42509	-80.09329
Tote Road	13	T13D750X	674	Closed	71.42512	-80.09317
Tote Road	13	T13D1200A	1,166	Open	71.42884	-80.08349
Tote Road	13	T13D1200X	1,165	Closed	71.42895	-80.08375
Milne Inlet	14	T14D30A	43	Open	71.87797	-80.87826
Milne Inlet	14	T14D30X	37	Closed	71.87815	-80.87845
Milne Inlet	14	T14D100A	129	Open	71.87736	-80.87571
Milne Inlet	14	T14D100X	118	Closed	71.87738	-80.87601
Milne Inlet	14	T14D750A	756	Open	71.87649	-80.85755
Milne Inlet	14	T14D750X	749	Closed	71.87649	-80.85775
Milne Inlet	14	T14D1200A	1,178	Open	71.87772	-80.84550
Milne Inlet	14	T14D1200B	1,173	Open	71.87770	-80.84564
Milne Inlet	14	T14D1200X	1,170	Closed	71.87766	-80.84573
Milne Inlet	15	T15D30A	48	Open	71.87430	-80.87769
Milne Inlet	15	T15D30X	50	Closed	71.87434	-80.87763
Milne Inlet	15	T15D100A	104	Open	71.87393	-80.87603
Milne Inlet	15	T15D100X	100	Closed	71.87391	-80.87615
Milne Inlet	15	T15D750A	812	Open	71.87411	-80.85563
Milne Inlet	15	T15D750X	806	Closed	71.87427	-80.85583
Milne Inlet	15	T15D1200A	1,130	Open	71.87504	-80.84659
Milne Inlet	15	T15D1200X	1,126	Closed	71.87500	-80.84671
Total	**--**	**133 plots**	--	--	--	--
Control	1	REF1A	19,450	Open	71.16658	-79.71055
Control	1	REF1B	19,448	Open	71.16658	-79.71037
Control	1	REF1X	19,450	Closed	71.16655	-79.71028
Control	2	REF2A	20,409	Open	71.51695	-78.91855
Control	2	REF2B	20,410	Open	71.51694	-78.91845
Control	2	REF2X	20,407	Closed	71.51690	-78.91839

Site Location	Transect/ Control No.	Plot ID[1]	Actual distance to PDA (m)	Treatment type	Latitude	Longitude
Control	3	REF3A	20,595	Open	71.85313	-79.99586
Control	3	REF3B	20,593	Open	71.85307	-79.99581
Control	3	REF3X	20,594	Closed	71.85302	-79.99567
Control	4	REF4A	21,178	Open	71.88674	-80.05467
Control	4	REF4B	21,185	Open	71.88678	-80.05450
Control	4	REF4X	21,190	Closed	71.88680	-80.05435
Control	5	REF5A	33,185	Open	71.65634	-79.34103
Control	5	REF5B	33,184	Open	71.65635	-79.34108
Control	5	REF5X	33,184	Closed	71.65638	-79.34125
Control	6	REF6A	16,435	Open	71.29160	-80.39122
Control	6	REF6B	16,429	Open	71.29161	-80.39097
Control	6	REF6X	16,432	Closed	71.29155	-80.39089
Total	**--**	**18 plots**	--	--	--	--
Total (66 sites)	**--**	**151 plots**	--	--	--	--

APPENDIX B UPDATED BASELINE VEGETATION SPECIES LIST (2005-2016)

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Appendix B. Updated Baseline Vegetation Species List (2005–2016).

Scientific name[1]	Common name[1]	Plant Group	Abundance Rank[2]	General Status Rank[3]	
				Nunavut Rank	National Rank
Alopecurus magellanicus	alpine foxtail	Graminoid	Common	4	4
Androsace septentrionalis	fairy candelabra	Forb	Trace	4	4
Antennaria friesiana	Fries' pussy-toes	Forb	Trace	4	4
Arabidopis arenicola	arctic rockcress	Forb	Uncommon	4	4
Arctagrostis latifolia ssp. *latifolia*	polar grass	Graminoid	Uncommon	4	4
Arctous alpina	black bearberry	Shrub	Trace	4	4
Arenaria humifusa	salt marsh sandwort	Forb	Uncommon	4	4
Armeria scabra	arctic thrift	Forb	Uncommon	4	4
Astragalus alpinus	alpine milk-vetch	Forb	Uncommon	4	4
Bistorta vivipara	alpine bistort, inuit peanuts	Forb	Common	4	4
Braya glabella ssp. *purpurascens*	purple braya	Forb	Common	4	4
Calamagrostis purpurascens	purple reed bentgrass	Graminoid	-	4	4
Campanula uniflora	arctic harebell	Forb	Trace	4	4
Cardamine bellidifolia	alpine bittercress	Forb	Uncommon	4	4
Cardamine pratensis ssp. *angustifolia*	cuckoo-flower	Forb	Trace	4	4
Carex aquatilis ssp. *stans*	aquatic sedge	Graminoid	Uncommon	4	4
Carex atrofusca	dark brown sedge	Graminoid	Uncommon	4	4
Carex bigelowii ssp. *bigelowii*	Bigelow's sedge	Graminoid	Uncommon	-	-
Carex capillaris ssp. *fuscidula*	hair sedge	Graminoid	Trace	-	-
Carex chordorrhiza	creeping sedge	Graminoid	Trace	4	4
Carex fuliginosa ssp. *misandra*	short leaf sedge	Graminoid	Common	4	4
Carex glacialis	glacier sedge	Graminoid	Rare	4	4
Carex glareosa	gravel sedge	Graminoid	-	4	4
Carex holostoma	arctic marsh sedge	Graminoid	-	4	4
Carex marina	seashore sedge	Graminoid	Rare	4	4
Carex maritima	maritime sedge	Graminoid	Uncommon	4	4
Carex membranacea	fragile sedge	Graminoid	Common	4	4
Carex nardina	nard sedge	Graminoid	Uncommon	4	4
Carex norvegica	Norway sedge	Graminoid	-	4	4
Carex rariflora	loose flowered alpine sedge	Graminoid	-	4	4
Carex rupestris	curly sedge, rock sedge	Graminoid	Common	4	4
Carex saxatilis	russet sedge	Graminoid	Common	4	4
Carex scirpoidea	northern singlespike sedge	Graminoid	Common	4	4
Carex supina ssp. *spaniocarpa*	weak arctic sedge	Graminoid	-	4	4
Carex ursina	bear sedge	Graminoid	-	4	4
Cassiope tetragona	mountain heather	Shrub	Common	4	4
Cerastium alpinum	mouse-eared chickweed	Forb	Common	4	4

Scientific name[1]	Common name[1]	Plant Group	Abundance Rank[2]	General Status Rank[3]	
				Nunavut Rank	National Rank
Cerastium arcticum var. *arcticum*	arctic mouse-ear chickweed	Forb	Trace	4	4
Cerastium beeringianum	Bering chickweed	Forb	Uncommon	4	4
Cetraria delisei	snow-bed Iceland lichen	Lichen	Common	4	4
Cetraria islandica ssp. *crispiformis*	Iceland lichen	Lichen	Common	-	-
Cetraria spp.	*Cetraria* species	Lichen	Uncommon	-	-
Chamerion angustifolium	tall fireweed	Forb	-	4	4
Chamerion latifolium	river beauty, broad-leaved willowherb	Forb	Common	4	4
Chrysosplenium tetrandrum	golden saxifrage	Forb	Trace	4	4
Cladina arbuscula	reindeer lichen	Lichen	Trace	4	3
Cladina mitis	green reindeer lichen	Lichen	Trace	4	4
Cladina rangiferina	gray reindeer lichen	Lichen	Trace	4	4
Cladina stellaris	star-tipped lichen	Lichen	Rare	4	4
Cladonia spp.	*Cladonia* species	Lichen	Uncommon	-	-
Cochlearia groenlandica	scurvy-grass	Forb	Uncommon	4	4
Cystopteris fragilis	fragile fern	Fern	-	4	4
Deschampsia brevifolia	tufted hairgrass	Graminoid	Trace	4	4
Diapensia lapponica	pincushion plant	Shrub	-	4	4
Draba alpina	alpine whitlowgrass	Forb	Uncommon	4	4
Draba arctica	arctic draba	Forb	-	-	-
Draba cinerea	greyleaf whitlowgrass	Forb	Uncommon	4	4
Draba corymbosa	flattop whitlowgrass	Forb	Common	4	4
Draba fladnizensis	arctic draba, Austrian draba	Forb	-	4	4
Draba glabella	smooth whitlowgrass	Forb	Trace	4	4
Draba lactea	milky draba	Forb	Common	4	4
Draba nivalis	snow draba	Forb	Uncommon	4	4
Draba pilosa	pilose draba	Forb	Common	4	4
Draba simmonsii	Simmons' draba	Forb	Common	4	4
Draba subcapitata	Ellesmere Island draba	Forb	Rare	4	4
Dryas integrifolia	mountain avens	Shrub	Common	4	4
Dryopteris fragrans	fragrant shield fern	Fern	-	4	4
Dupontia fisheri	Fisher's tundragrass	Graminoid	Common	4	4
Elymus violaceus	violet wheatgrass	Graminoid	-	4	5
Empetrum nigrum	crowberry; black berry	Shrub	Uncommon	4	4
Epilobium arcticum	arctic willowherb	Forb	Trace	4	4
Equisetum arvense	common horsetail	Forb	Uncommon	4	4
Equisetum variegatum	variegated scouring rush	Forb	Common	4	4
Erigeron humilis	arctic alpine fleabane	Forb	Trace	4	4
Erigeron uniflorus ssp. *eriocephalus*	fleabane	Forb	Trace	4	4

Scientific name[1]	Common name[1]	Plant Group	Abundance Rank[2]	General Status Rank[3]	
				Nunavut Rank	National Rank
Eriophorum angustifolium ssp. *triste*	tall cottongrass	Graminoid	Common	-	-
Eriophorum callitrix	arctic cottongrass	Graminoid	-	4	4
Eriophorum russeolum	red cottongrass	Graminoid	Uncommon	4	4
Eriophorum scheuchzeri	Scheuchzer's cotton-grass	Graminoid	Common	4	4
Eriophorum vaginatum	tussock cottongrass	Graminoid	Trace	-	-
Eutrema edwardsii	Edward's mock wallflower	Forb	Trace	4	4
Festuca baffinensis	Baffin fescue	Graminoid	Uncommon	4	4
Festuca brachyphylla	alpine fescue	Graminoid	Uncommon	4	4
Festuca hyperborea	boreal fescue	Graminoid	-	4	4
Festuca rubra ssp. *rubra*	red fescue	Graminoid	-	4	4
Flavocetraria cucullata	whirling dervish	Lichen	Uncommon	4	4
Flavocetraria nivalis	ballroom dervish	Lichen	Uncommon	4	4
Hierochloë alpina	alpine sweet grass	Graminoid	Common	4	4
Hierochloe pauciflora	arctic holy grass	Graminoid	Trace	4	4
Hippuris vulgaris	mare's tail	Aquatic	-	4	4
Honckenya peploides	seabeach sandwort	Forb	Rare	4	4
Hulteniella integrifolia	small arctic daisy	Forb	Common	4	4
Huperzia selago	mountain club-moss	Other	Uncommon	4	4
Juncus arcticus	arctic rush	Graminoid	-	4	4
Juncus biglumis	twoflowered rush	Graminoid	Common	4	4
Juncus castaneus	chestnut sedge	Graminoid	Trace	4	4
Juncus triglumis	northern white rush	Graminoid	-	4	4
Kobresia myosuroides	Bellardi bog sedge	Graminoid	Common	4	4
Kobresia simpliciuscula ssp. *subholarctica*	simple bog sedge	Graminoid	Common	-	-
Koenigia islandica	koenigia, island purslane	Forb	-	4	4
Ledum palustre	Labrador tea	Shrub	-	4	4
Leymus mollis	American dunegrass	Graminoid	Rare	4	4
Luzula confusa	northern wood rush	Graminoid	Uncommon	4	4
Luzula nivalis	arctic woodrush	Graminoid	Trace	4	4
Mertensia maritima	seaside bluebells	Forb	Trace	4	4
Micranthese hieracifolia	hawkweed-leaved saxifrage	Forb	Uncommon	4	4
Micranthes nivalis	snow saxifrage	Forb	Common	4	4
Minuartia biflora	mountain stitchwort	Forb	-	4	4
Minuartia elegans	northern sandwort	Forb	Uncommon	4	-
Minuartia rossii	Ross' sandwort	Forb	Uncommon	4	4
Minuartia rubella	reddish sandwort	Forb	Uncommon	4	4
Minuartia stricta	bog stitchwort	Forb	-	4	4
Moss spp.	moss species	Moss	Common	-	-

Scientific name[1]	Common name[1]	Plant Group	Abundance Rank[2]	General Status Rank[3]	
				Nunavut Rank	National Rank
Mushroom spp.	mushroom species	Mushroom	Trace	-	-
Oxyria digyna	mountain sorrel, sweetleaf	Forb	Common	4	4
Oxytropis maydelliana	Maydell's oxytrope, Inuit carrot	Forb	Common	4	4
Oxytropis nigrescens var. *uniflora*	one-flower blackish locoweed	Forb	Trace	4	4
Papaver dahlianum	polar poppy	Forb	Trace	4	5
Papaver lapponicum	Lapland poppy	Forb	Trace	4	4
Papaver radicatum ssp. *radicatum*	arctic poppy	Forb	Common	-	-
Pedicularis capitata	capitate lousewort	Forb	Common	4	4
Pedicularis hirsuta	hairy lousewort	Forb	Common	4	4
Pedicularis lanata	Woolly lousewort	Forb	Uncommon	4	4
Pedicularis langsdorffii	arctic lousewort	Forb	-	4	4
Pedicularis sudetica ssp. *albolabiata*	Sudetan lousewort	Forb	Trace	4	4
Phippsia algida	icegrass	Graminoid	Trace	4	4
Physaria arctica	arctic bladderpod	Forb	Common	4	4
Pleuropogon sabinei	semaphore grass	Graminoid	Trace	4	4
Poa abbreviata	northern bluegrass	Graminoid	Trace	4	4
Poa alpina	alpine bluegrass	Graminoid	-	4	4
Poa arctica ssp. *arctica*	arctic bluegrass	Graminoid	Common	-	-
Poa arctica ssp. *caespitans*	high arctic bluegrass	Graminoid	-	-	-
Poa glauca	glaucous bluegrass	Graminoid	Common	4	4
Poa pratensis ssp. *alpigena*	Kentucky bluegrass	Graminoid	-	-	-
Poa pratensis ssp. *colpodea*	Kentucky bluegrass	Graminoid	-	-	-
Potentilla hyparctica	arctic cinquefoil	Forb	Trace	4	4
Potentilla pulchella	finely-divided leaves	Forb	Common	4	4
Potentilla rubricaulis	Rocky mountain cinquefoil	Forb	Trace	4	4
Potentilla subahaliana	Vahl's cinquefoil	Forb	Common	4	4
Potentilla villosula	finely villous cinquefoil	Forb	Common	4	-
Puccinellia phryganodes	creeping alkaligrass	Graminoid	-	4	4
Puccinellia tenella ssp. *langeana*	alkaligrass	Graminoid	Trace	-	-
Puccinellia vahliana	Vahl's alkaligrass	Graminoid	-	4	4
Pyrola grandiflora	large-flowered wintergreen	Forb	Uncommon	4	4
Ranunculus aquatilis	white water-buttercup	Forb	-	4	4
Ranunculus hyperboreus	arctic crowfoot, arctic buttercup	Forb	Trace	4	4
Ranunculus nivalis	snow buttercup	Forb	Trace	4	4
Ranunculus pedatifidus	surefoot buttercup	Forb	-	4	4
Ranunculus pygmaeus	pygmy buttercup	Forb	Trace	4	4
Ranunculus sulphureus	sulfur buttercup	Forb	-	4	4
Rhododendron lapponicum	lapland rosebay	Shrub	Trace	4	4
Sagina caespitosa	tufted pearlwort	Forb	-	4	4

Scientific name[1]	Common name[1]	Plant Group	Abundance Rank[2]	General Status Rank[3]	
				Nunavut Rank	National Rank
Sagina nivalis	snow pearlwort	Forb	Common	4	4
Salix arctica	arctic willow	Shrub	Common	4	4
Salix calcicola	woolly willow	Shrub	-	4	4
Salix herbacea	snowbed willow	Shrub	Uncommon	4	4
Salix reticulata	net-vein willow	Shrub	Common	4	4
Salix richardsonii	Richardson's willow	Shrub	Common	4	4
Saxifraga aizoides	yellow mountain saxifrage	Forb	Uncommon	4	4
Saxifraga cernua	nodding saxifrage	Forb	Common	4	4
Saxifraga cespitosa	tufted alpine saxifrage	Forb	Common	4	4
Saxifraga foliolosa	leafystem saxifrage	Forb	-	4	4
Saxifraga hirculus	yellow marsh saxifrage	Forb	Common	4	4
Saxifraga hyperborea	arctic saxifrage	Forb	Uncommon	4	4
Saxifraga oppositifolia	purple saxifrage	Forb	Common	4	4
Saxifraga paniculata	white mountain saxifrage	Forb	-	4	3
Saxifraga rivularis	brooklet saxifrage	Forb	Trace	4	4
Saxifraga tricuspidata	prickly saxifrage	Forb	Common	4	4
Silene acaulis	moss campion	Forb	Common	4	4
Silene involucrata	arctic campion, white bladder campion	Forb	Uncommon	4	4
Silene sorensensis	three-flowered campion	Forb	-	4	4
Silene uralensis ssp. *uralensis*	red bladder campion	Forb	Common	4	4
Stellaria humifusa	seashore chickweed	Forb	-	4	4
Stellaria longipes	long-stalked starwort	Forb	Common	4	4
**Taraxacum ceratophorum*	horned dandelion	Forb	Rare	4	2
Taraxacum hyparcticum	high arctic dandelion	Forb	Trace	4	4
Taraxacum phymatocarpum	northern dandelion	Forb	Trace	4	4
Tephroseris palustris	mastodon flower, marsh ragwort	Forb	Uncommon	4	4
Thamnolia vermicularis	universal whiteworm	Lichen	Common	4	4
Tofieldia coccinea	northern false tofieldia	Forb	Trace	4	4
Tofieldia pusilla	small tofieldia	Forb	Trace	4	4
Tripleurospermum maritimum ssp. *phaeocephala*	seashore chamomile	Forb	Rare	-	-
Trisetum spicatum	spike trisetum	Graminoid	Trace	4	4
Vaccinium uliginosum	blueberry	Shrub	Uncommon	4	4
Woodsia glabella	woodsia	Fern	Uncommon	4	4
Total	**184**	--	--	--	--

Scientific name[1]	Common name[1]	Plant Group	Abundance Rank[2]	General Status Rank[3]	
				Nunavut Rank	National Rank

[1] Primary reference flora used was the online version of the Flora of the Canadian Arctic Archipelago (Aiken et al. 2007). The Secondary reference used was the online version of the Flora of North America (2014, 2016). Lichen species were referenced using Lichens of North America (Brodo et al. 2011).

[2] Species abundance ranks are based on the relative probability of occurrence across the landscape:

Common: > 25% observed occurrence, found in suitable habitat; a common species that is widespread and abundant; occurrence is highest in relation to other species on the landscape.

Uncommon: 5-24% observed occurrence, found in most suitable habitat; a species that is found in low numbers, sporadically or is localized; where it is found it may be prevalent, however, its occurrence is not more than 24% in relation to other species on the landscape.

Trace: < 5% observed occurrence, seen in more than one site but in low numbers; a species that is sometimes encountered, but its occurrence on the landscape is very uncommon; where it is found there are few individuals and its occurrence is 5% or less.

Rare: only seen at one site or in low numbers; a species that occupies uncommon habitats and is either few in number or sporadically abundant; its presence and abundance on the landscape is not often encountered.

"-" indicates a species that was observed prior to 2014 and 2016 monitoring; therefore, an abundance rank cannot be defined.

[3] General Status Ranks for Nunavut and Canada are provided by Wild Species (CESCC 2011). **Ranks**: 0.2=Extinct; 0.1=Extirpated; 1=At Risk; 2=May Be At Risk; 3=Sensitive; 4=Secure; 5=Undetermined; 6=Not Assessed; 7=Exotic; 8= Accidental; "-" indicates a subspecies which are not currently ranked.

* = "May Be At Risk" species for Nunavut (CESCC 2011).

APPENDIX C VEGETATION AND SOIL BASE METALS MONITORING LOCATIONS

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Table C-1. Vegetation and soil base metal sample sites, including control sites (*) within the RSA, 2012–2016.

Location	Site ID[1]	Soil	Lichen	Willow	Blueberry	Distance to PDA (m)[2]	Distance Category	Distance Class (m)	Associated Dust Fall Site[3]	Latitude	Longitude
2016 Sampling											
Milne Port	L-91	1	1			67	Near	0-100	n/a	71.8819	-80.8780
Milne Port	L-92	1	1			46	Near	0-100	n/a	71.8814	-80.8786
Milne Port	L-93	1	1			173	Far	101-1000	n/a	71.8818	-80.8750
Milne Port	L-94	1	1			24	Near	0-100	n/a	71.8809	-80.8791
Milne Port	L-95	1	1			30	Near	0-100	n/a	71.8801	-80.8789
Milne Port	L-96	1	1			45	Near	0-100	n/a	71.8791	-80.8783
Milne Port	L-97	1	1			57	Near	0-100	n/a	71.8785	-80.8779
Milne Port	L-98	1	1			40	Near	0-100	n/a	71.8777	-80.8783
Milne Port	L-99	1	1			17	Near	0-100	n/a	71.8772	-80.8789
Milne Port	L-100	1	1			37	Near	0-100	n/a	71.8767	-80.8783
Milne Port	L-101	1	1			51	Near	0-100	n/a	71.8761	-80.8778
Milne Port	L-102	1	1			424	Far	101-1000	n/a	71.8757	-80.8670
Milne Port	L-103	1	1			650	Far	101-1000	n/a	71.8765	-80.8606
Milne Port	L-104	1	1			805	Far	101-1000	n/a	71.8748	-80.8559
Milne Port	L-105	1	1			1823*	Control	>1000	n/a	71.8770	-80.8268
Milne Port	L-106	1	1			3218*	Control	>1000	DF-P-03	71.8999	-80.7902
Tote Road	L-68	1	1			55	Near	0-100	n/a	71.3884	-79.8766
Tote Road	L-69	1	1			24	Near	0-100	n/a	71.3904	-79.8657
Tote Road	L-70	1	1			91	Near	0-100	n/a	71.3933	-79.8671
Tote Road	L-71	1	1			52	Near	0-100	n/a	71.3944	-79.8560
Tote Road	L-72	1	1			56	Near	0-100	n/a	71.3967	-79.8428
Tote Road	L-73	1	1			63	Near	0-100	n/a	71.3984	-79.8325
Tote Road	L-74	1	1			71	Near	0-100	DF-RS-03	71.3962	-79.8227
Tote Road	L-75	1	1			231	Far	101-1000	n/a	71.3948	-79.8217
Tote Road	L-76	1	1			546	Far	101-1000	DF-RS-02	71.3896	-79.8326
Tote Road	L-77	1	1			953	Far	101-1000	DF-RS-07	71.4079	-79.8187
Tote Road	L-78	1	1			36	Near	0-100	n/a	71.3922	-79.7995
Tote Road	L-79	1	1			72	Near	0-100	n/a	71.3891	-79.7862
Tote Road	L-80	1	1			77	Near	0-100	n/a	71.3904	-79.7759
Tote Road	L-107	1	1			6121*	Control	>1000	n/a	71.3259	-79.8008
Tote Road	L-108	1	1			6855*	Control	>1000	n/a	71.4515	-79.7117
Tote Road	L-116	1	1			411	Far	101-1000	n/a	71.3833	-79.8862
Mine Site	L-81	1	1			58	Near	0-100	n/a	71.3001	-79.2737
Mine Site	L-82	1	1			72	Near	0-100	n/a	71.2997	-79.2679
Mine Site	L-83	1	1			90	Near	0-100	n/a	71.3101	-79.2012
Mine Site	L-84	1	1			86	Near	0-100	n/a	71.3101	-79.2043
Mine Site	L-85	1	1			68	Near	0-100	n/a	71.3102	-79.2114
Mine Site	L-86	1	1			50	Near	0-100	n/a	71.3094	-79.2215
Mine Site	L-87	1	1			64	Near	0-100	n/a	71.3089	-79.2263
Mine Site	L-88	1	1			59	Near	0-100	n/a	71.3075	-79.2346

Location	Site ID[1]	Soil	Lichen	Willow	Blueberry	Distance to PDA (m)[2]	Distance Category	Distance Class (m)	Associated Dust Fall Site[3]	Latitude	Longitude
Mine Site	L-89	1	1			92	Near	0-100	n/a	71.3047	-79.2379
Mine Site	L-90	1	1			401	Far	101-1000	n/a	71.3182	-79.3691
Mine Site	L-109	1	1			8808*	Control	>1000	DF-M-04	71.2208	-79.3274
Mine Site	L-110	1	1			2449*	Control	>1000	n/a	71.2981	-79.1020
Mine Site	L-111	1	1			10386*	Control	>1000	n/a	71.3860	-78.9034
Mine Site	L-112	1	1			1046*	Control	>1000	DF-M-06	71.3202	-79.1594
Mine Site	L-113	1	1			1185*	Control	>1000	DF-M-06	71.3196	-79.1560
Mine Site	L-114	1	1			390	Far	101-1000	n/a	71.3098	-79.1921
Mine Site	L-115	1	1			451	Far	101-1000	n/a	71.3105	-79.1894
Mine Site	L-117	1	1			50	Near	0-100	n/a	71.2998	-79.2657
2016 Total	50	50	50								
2014 Sampling											
Milne Port	L-56	1	1	1		0	Near	0-100	DF04-P	71.87094399	-80.8824
Milne Port	L-57	1		1		0	Near	0-100	DF06-P	71.88576596	-80.8790
Milne Port	L-58	1	1			0	Near	0-100	DF07-P	71.8837833	-80.9159
Tote Road	L-59	1	1	1		13,177*	Control	>1000	n/a	71.77518301	-80.1047
Tote Road	L-60	1	1	1	1	0	Near	0-100	n/a	71.34229903	-79.5512
Tote Road	L-61	1	1	1	1	417	Far	101-1000	n/a	71.33833104	-79.5246
Tote Road	L-63	1	1	1		10,630*	Control	>1000	n/a	71.88054102	-80.4592
Mine Site	L-64	1	1			1,184*	Control	>1000	DF06-M	71.31956303	-79.1559
Mine Site	L-67	1	1	1	1	3,347*	Control	>1000	DF09-M	71.29357201	-79.4128
Rail	L-62	1	1	1	1	0	Near	0-100	n/a	71.13236102	-78.3563
Rail	L-65	1	1	1		316	Far	101-1000	DF07-M	71.30001199	-79.1953
Rail	L-66	1	1	1		2,141*	Control	>1000	DF08-M	71.29453802	-79.1001
2014 Total	12	12	11	10	4						
2013 Sampling											
Milne Port	L-01	1	1			0	Near	0-100	n/a	71.8850	-80.8911
Milne Port	L-02	1	1	1		3,269*	Control	>1000	DF03-P	71.8996	-80.7884
Milne Port	L-03	1	1		1	0	Near	0-100	n/a	71.8702	-80.8843
Tote Road	L-04	1	1	1		4,491*	Control	>1000	DF01-RN	71.6882	-80.5362
Tote Road	L-05	1	1	1		941	Far	101-1000	DF02-RN	71.6883	-80.5363
Tote Road	L-06	1	1	1		15	Near	0-100	DF03-RN	71.7186	-80.4473
Tote Road	L-07	1	1			25	Near	0-100	DF06-RN	71.7189	-80.4397
Tote Road	L-08	1	1	1		920	Far	101-1000	DF07-RN	71.7226	-80.4165
Tote Road	L-09	1	1	1		5,864*	Control	>1000	DF08-RN	71.7435	-80.2898
Tote Road	L-10	1		1		13,938*	Control	>1000	DF01-RR	71.2805	-80.245
Tote Road	L-12	1	1	1	1	941	Control	>1000	DF02-RN	71.7145	-80.4704
Tote Road	L-14	1	1			571	Far	101-1000	DF02-RS	71.3894	-79.8324
Tote Road	L-15	1	1		1	9	Near	0-100	DF03-RS	71.3967	-79.8228
Tote Road	L-16	1	1	1		1	Near	0-100	DF06-RS	71.3986	-79.8234
Tote Road	L-17	1	1	1		936	Far	101-1000	DF07-RS	71.4077	-79.8182
Tote Road	L-19	1		1		6,628*	Control	>1000	DF08-RS	71.4489	-79.7107

Location	Site ID[1]	Soil	Lichen	Willow	Blueberry	Distance to PDA (m)[2]	Distance Category	Distance Class (m)	Associated Dust Fall Site[3]	Latitude	Longitude
Tote Road	L-22	1		1		5,948*	Control	>1000	DF01-RS	71.3275	-79.8001
Mine Site	L-23	1	1		1	0	Near	0-100	DF01-M	71.3243	-79.3747
Mine Site	L-25	1	1	1		0	Near	0-100	DF03-M	71.3071	-79.2432
Rail	L-29	1	1	1		8,916*	Control	>1000	DF04-M	71.2196	-79.3276
2013 Total	20	20	17	14	4						
2012 Sampling											
Tote Road	L-11	1	1			2,961*	Control	>1000	n/a	71.5627	-80.2147
Tote Road	L-13	1	1			8,595*	Control	>1000	n/a	71.3386	-80.2238
Tote Road	L-18	1	1			1,451*	Control	>1000	n/a	71.4112	-79.7980
Mine Site	L-21	1	1			15,485*	Control	>1000	n/a	71.2215	-79.7947
Mine Site	L-20	1	1			32,532*	Control	>1000	n/a	71.6457	-79.2153
Mine Site	L-24	1	1			129	Far	101-1000	n/a	71.3331	-79.3766
Mine Site	L-26	1	1			2,881*	Control	>1000	n/a	71.3391	-79.0935
Mine Site	L-27	1				2,448*	Control	>1000	n/a	71.3758	-79.2471
Mine Site	L-28	1	1			39,601*	Control	>1000	n/a	71.5403	-78.2296
Rail	L-30	1	1			2,015*	Control	>1000	n/a	71.2143	-78.9602
Rail	L-31	1	1			0	Near	0-100	n/a	71.2128	-78.8212
Rail	L-32	1	1			18,179*	Control	>1000	n/a	71.3204	-78.2655
Rail	L-33	1	1			20,033*	Control	>1000	n/a	71.0874	-79.2945
Rail	L-34	1	1			3,711*	Control	>1000	n/a	71.0966	-78.4454
Rail	L-35	1	1			0	Near	0-100	n/a	71.0946	-78.3073
Rail	L-36	1	1			3,409*	Control	>1000	n/a	71.0926	-78.1692
Rail	L-37	1	1			18,231*	Control	>1000	n/a	71.1990	-77.8488
Rail	L-38	1	1			24,241*	Control	>1000	n/a	71.1262	-77.5989
Rail	L-39	1	1			31,678*	Control	>1000	n/a	70.8877	-79.2012
Rail	L-40	1	1			3,742*	Control	>1000	n/a	70.8777	-78.3815
Rail	L-41	1	1			0	Near	0-100	n/a	70.8763	-78.2491
Rail	L-42	1	1			3,511*	Control	>1000	n/a	70.8733	-78.1138
Rail	L-43	1	1			31,295*	Control	>1000	n/a	70.8590	-77.2928
Rail	L-44	1	1			30,423*	Control	>1000	n/a	70.7046	-79.0277
Rail	L-45	1	1			4,460*	Control	>1000	n/a	70.7023	-78.2643
Rail	L-46	1	1			318	Far	101-1000	n/a	70.6844	-78.1392
Rail	L-47	2	1			23,710*	Control	>1000	n/a	70.4932	-79.0189
Rail	L-48	1	1			198	Control	>1000	n/a	70.4844	-78.3384
Rail	L-49	1	1			3,021*	Far	101-1000	n/a	70.4813	-78.2232
Rail	L-50	1	1			25,141*	Control	>1000	n/a	70.4672	-77.4202
Rail	L-55	1	1			29,266*	Control	>1000	n/a	70.2890	-77.5545
Steensby Port	L-51	1	1			4,727*	Control	>1000	n/a	70.3491	-78.6164
Steensby Port	L-52	1	1			0	Near	0-100	n/a	70.3043	-78.4834

Location	Site ID[1]	Soil	Lichen	Willow	Blueberry	Distance to PDA (m)[2]	Distance Category	Distance Class (m)	Associated Dust Fall Site[3]	Latitude	Longitude
Steensby Port	L-53	1	1			1,944*	Control	>1000	n/a	70.3024	-78.3506
Steensby Port	L-54	1	1			3,588*	Control	>1000	n/a	70.2412	-78.3607
2012 Total	35	36	34	0	0	13					
Total (2012-2016)	**117**	**117**	**112**	**24**	**8**	**49 Control(*)**					

[1] Collection sites for 2012 and 2013 were relabelled following the 2013 field program to provide consistency between years and facilitate mapping; all results reported here are by the new Site ID with the exception of the lab results presented in Appendix B and C (refer to the 2013 Terrestrial Environment Annual Monitoring Report) where samples were sent to the lab under the original label - samples were labelled by the Original site label followed by a label for the sample type: "S" for soil, "L" for lichen, "W" for willow, and "B" for blueberry. For example: the sample label L-13.05-S01 would indicate Original site L-13.05 soil sample 01; the sample label L-13.11-W01 would indicate Original site L-13.11 willow sample 01.

[2] Control sites are labelled with an asterisk (*). Control sites are ≥1000 m to coincide with the dust fall monitoring program.

[3] Sites were considered 'associated' if they were within 60 m or less of each other; most sites were 0-12 m of each other; sites within 150 m of each another may be considered somewhat associated.

APPENDIX D VEGETATIONAND SOIL BASE METALS MONITORING LABORATORY RESULTS

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Table D-1. 2016 Soil metal analysis (n=50), sample sites L-68 to L-79.

Parameter[1]	CCME Agri[2]	CCME Ind[2]	L-68	L-69	L-70	L-71	L-72	L-73	L-74	L-75	L-76	L-77	L-78	L-79	RDL[3]
pH	6-8	6-8	5.47	5.92	5.44	5.54	5.42	5.53	5.48	5.51	5.46	5.78	5.59	5.25	N/A
Aluminum	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Antimony	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Arsenic	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Barium	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Beryllium	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
Bismuth	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Cadmium	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
Calcium	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Chromium	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cobalt	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
Copper	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Iron	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Lead	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Lithium	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Magnesium	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Manganese	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
Mercury	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
Molybdenum	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Nickel	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Phosphorus	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Potassium	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Selenium	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Silver	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
Sodium	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Strontium	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Thallium	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
Tin	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Titanium	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Uranium	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
Vanadium	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

Parameter[1]	CCME Agri[2]	CCME Ind[2]	L-68	L-69	L-70	L-71	L-72	L-73	L-74	L-75	L-76	L-77	L-78	L-79	RDL[3]
Zinc	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Zirconium	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50

[1] Total metals (units mg/kg dry weight) unless otherwise indicated
[2] Agriculture and Industrial Soil Quality Guidelines provided by the Canadian Council of Ministers of the Environment (CCME)
[3] Reportable Detection Limit (RDL)

Table D-2. 2016 Soil metal analysis (n=50), sample sites L-80 to L-91.

Parameter[1]	CCME Agri[2]	CCME Ind[2]	L-80	L-81	L-82	L-83	L-84	L-85	L-86	L-87	L-88	L-89	L-90	L-91	RDL[3]
pH	6-8	6-8	5.47	6.96	6.57	6.99	7.38	7.73	7.91	5.90	5.85	6.55	7.15	7.56	N/A
Aluminum	100	100	480	1640	2580	6330	6110	2900	5680	1840	2040	2340	1720	5410	100
Antimony	0.10	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Arsenic	0.50	0.50	<0.50	<0.50	<0.50	1.53	0.84	0.77	1.06	<0.50	<0.50	<0.50	<0.50	0.82	0.50
Barium	0.10	0.10	2.83	4.67	10.2	34.5	17.3	12.7	20.4	5.38	4.69	8.03	5.36	7.93	0.10
Beryllium	0.40	0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.44	0.40
Bismuth	0.10	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.13	<0.10	<0.10	<0.10	<0.10	0.16	0.10
Cadmium	0.050	0.050	<0.050	<0.050	0.064	0.152	0.070	0.050	0.093	<0.050	<0.050	0.061	<0.050	0.065	0.050
Calcium	100	100	228	726	1030	5700	2560	1760	5690	586	699	854	974	1830	100
Chromium	1.0	1.0	3.2	8.0	22.9	44.3	24.3	21.4	24.6	7.6	9.3	11.0	5.9	11.1	1.0
Cobalt	0.30	0.30	0.32	1.74	3.40	10.1	4.52	3.69	5.01	1.54	1.93	2.19	1.86	3.43	0.30
Copper	0.50	0.50	<0.50	2.76	2.67	19.1	6.94	6.56	11.7	1.54	2.31	2.40	2.09	116	0.50
Iron	100	100	951	7230	10900	14200	11900	6860	11900	3400	6110	6540	4150	10300	100
Lead	0.10	0.10	0.54	11.2	3.91	10.8	7.40	4.02	10.5	2.99	2.61	3.02	2.24	10.8	0.10
Lithium	5.0	5.0	<5.0	<5.0	6.1	13.6	11.1	5.7	13.1	<5.0	<5.0	5.2	<5.0	18.3	5.0
Magnesium	100	100	265	1570	2180	8390	4410	3090	6370	932	1440	1880	1400	5100	100
Manganese	0.20	0.20	3.98	66.4	123	304	126	142	190	52.5	62.6	71.2	40.1	169	0.20
Mercury	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
Molybdenum	0.10	0.10	<0.10	<0.10	0.18	0.18	0.16	<0.10	0.24	<0.10	<0.10	0.11	<0.10	0.55	0.10
Nickel	0.80	0.80	1.96	5.96	11.3	91.5	30.3	23.8	17.1	4.37	6.66	8.48	7.02	6.34	0.80
Phosphorus	10	10	101	182	182	390	309	176	312	161	229	153	287	186	10
Potassium	100	100	<100	166	357	1230	986	521	1100	435	369	449	364	709	100
Selenium	0.50	0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50
Silver	0.050	0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.062	<0.050	<0.050	<0.050	<0.050	<0.050	0.050
Sodium	100	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	100
Strontium	0.10	0.10	1.18	1.79	1.88	4.75	4.18	2.04	4.79	1.64	1.74	1.97	2.87	2.71	0.10
Thallium	0.050	0.050	<0.050	<0.050	0.095	0.192	0.105	0.056	0.136	<0.050	<0.050	<0.050	<0.050	0.084	0.050
Tin	0.10	0.10	<0.10	0.10	0.28	0.36	0.40	0.13	0.33	0.11	0.17	0.21	0.16	0.52	0.10
Titanium	1.0	1.0	37.6	148	318	352	416	233	389	122	184	238	173	353	1.0
Uranium	0.050	0.050	0.101	0.421	0.661	2.04	1.62	0.479	0.896	0.223	0.301	0.357	0.559	2.27	0.050
Vanadium	2.0	2.0	2.3	11.0	16.4	20.1	17.8	11.6	17.4	6.4	8.8	10.5	6.8	15.8	2.0

Parameter[1]	CCME Agri[2]	CCME Ind[2]	L-80	L-81	L-82	L-83	L-84	L-85	L-86	L-87	L-88	L-89	L-90	L-91	RDL[3]
Zinc	1.0	1.0	1.2	6.4	11.8	29.7	24.4	13.8	18.5	7.1	8.3	11.7	7.9	26.7	1.0
Zirconium	0.50	0.50	<0.50	0.51	0.59	2.52	1.25	0.86	1.90	<0.50	<0.50	<0.50	0.96	1.65	0.50

[1] Total metals (units mg/kg dry weight) unless otherwise indicated
[2] Agriculture and Industrial Soil Quality Guidelines provided by the Canadian Council of Ministers of the Environment (CCME)
[3] Reportable Detection Limit (RDL)

Table D-3. 2016 Soil metal analysis (n=50), sample sites L-92 to L-104.

Parameter[1]	CCME Agri[2]	CCME Ind[2]	L-92	L-93	L-94	L-95	L-96	L-97	L-98	L-99	L-100	L-101	L-102	L-103	L-104	RDL[3]
pH	6-8	6-8	7.10	7.57	8.00	8.35	7.17	8.35	8.14	7.03	7.91	8.62	8.74	8.66	8.39	N/A
Aluminum	100	100	2770	5810	3670	3810	5520	4250	3690	6520	5600	4070	3630	2740	1190	100
Antimony	0.10	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Arsenic	0.50	0.50	<0.50	<0.50	0.69	0.74	1.10	0.73	0.59	1.19	0.81	1.00	0.75	<0.50	<0.50	0.50
Barium	0.10	0.10	3.72	9.65	6.91	11.1	14.1	14.4	9.23	16.8	11.3	11.2	10.6	7.02	2.63	0.10
Beryllium	0.40	0.40	<0.40	0.44	<0.40	<0.40	<0.40	<0.40	<0.40	0.50	0.42	<0.40	<0.40	<0.40	<0.40	0.40
Bismuth	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	<0.10	0.10
Cadmium	0.050	0.050	<0.050	0.074	<0.050	0.067	0.082	0.091	0.057	0.136	0.085	0.060	0.101	0.076	<0.050	0.050
Calcium	100	100	666	1480	5870	24700	2270	23600	15400	3930	3220	44000	97100	60400	9600	100
Chromium	1.0	1.0	6.4	15.2	8.5	7.3	13.9	8.4	6.7	18.3	9.4	8.1	8.2	6.6	2.0	1.0
Cobalt	0.30	0.30	1.83	3.62	2.42	2.52	3.46	2.61	2.08	4.15	3.08	2.51	2.36	1.91	0.95	0.30
Copper	0.50	0.50	2.02	3.69	5.72	4.13	5.27	11.1	4.13	8.49	5.85	5.25	4.56	3.17	1.55	0.50
Iron	100	100	6830	10000	7210	6940	10200	7430	6940	12100	10800	7700	7420	5670	2690	100
Lead	0.10	0.10	3.69	3.48	7.72	4.09	6.50	4.46	4.32	8.31	7.27	5.22	4.52	3.55	1.82	0.10
Lithium	5.0	5.0	9.3	23.0	14.4	10.8	19.4	12.9	10.9	18.3	19.9	12.0	13.2	9.4	<5.0	5.0
Magnesium	100	100	2490	5360	5910	15500	3760	14500	9450	4110	4930	19000	22000	21600	5600	100
Manganese	0.20	0.20	85.8	170	110	117	180	122	113	183	155	126	120	106	40.8	0.20
Mercury	0.050	0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.050
Molybdenum	0.10	0.10	<0.10	0.11	0.15	0.18	0.26	0.14	0.12	0.34	0.23	0.17	0.16	0.12	<0.10	0.10
Nickel	0.80	0.80	3.13	7.36	4.58	4.10	7.80	5.03	3.91	10.1	5.47	4.16	4.32	3.27	1.20	0.80
Phosphorus	10	10	94	203	132	162	221	187	183	244	174	157	150	217	80	10
Potassium	100	100	337	919	522	692	869	887	492	905	481	586	594	539	209	100
Selenium	0.50	0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50
Silver	0.050	0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.050
Sodium	100	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	100
Strontium	0.10	0.10	1.64	2.86	4.57	8.82	4.58	10.1	7.09	5.68	3.49	20.2	52.8	26.8	4.08	0.10
Thallium	0.050	0.050	<0.050	0.103	0.087	0.107	0.092	0.123	0.076	0.577	0.103	0.104	0.079	0.056	<0.050	0.050
Tin	0.10	0.10	0.29	0.43	0.40	0.29	0.33	0.31	0.31	0.41	0.50	0.33	0.36	0.19	<0.10	0.10
Titanium	1.0	1.0	182	318	183	245	263	259	193	294	252	250	292	177	65.6	1.0
Uranium	0.050	0.050	1.02	1.52	1.87	0.806	5.15	0.820	1.02	20.6	1.76	0.993	0.928	0.566	0.379	0.050
Vanadium	2.0	2.0	11.5	17.4	11.4	11.9	16.9	11.8	9.5	17.6	15.2	11.7	12.5	8.9	5.0	2.0

Parameter[1]	CCME Agri[2]	CCME Ind[2]	L-92	L-93	L-94	L-95	L-96	L-97	L-98	L-99	L-100	L-101	L-102	L-103	L-104	RDL[3]
Zinc	1.0	1.0	12.1	23.9	15.8	12.6	20.9	15.9	15.5	25.1	22.7	14.2	13.7	9.9	4.2	1.0
Zirconium	0.50	0.50	0.68	0.64	1.33	1.60	1.10	1.74	1.36	1.34	1.50	1.56	2.40	1.33	0.87	0.50

[1] Total metals (units mg/kg dry weight) unless otherwise indicated
[2] Agriculture and Industrial Soil Quality Guidelines provided by the Canadian Council of Ministers of the Environment (CCME)
[3] Reportable Detection Limit (RDL)

Table D-4. 2016 Soil metal analysis (n=50), sample sites L-105 to L-117.

Parameter[1]	CCME Agri[2]	CCME Ind[2]	L-105	L-106	L-107	L-108	L-109	L-110	L-111	L-112	L-113	L-114	L-115	L-116	L-117	RDL[3]
pH	6-8	6-8	7.58	8.68	5.66	6.69	6.56	7.10	7.33	6.70	7.10	8.06	6.99	5.72	6.49	N/A
Aluminum	100	100	5140	3300	2550	4300	2070	2730	2440	15400	4770	2530	2760	626	4160	100
Antimony	0.10	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Arsenic	0.50	0.50	0.89	0.83	1.17	0.53	<0.50	0.75	<0.50	0.87	0.57	0.56	<0.50	<0.50	1.20	0.50
Barium	0.10	0.10	14.0	8.90	7.80	19.4	8.79	9.62	13.3	42.6	16.8	7.97	8.28	2.55	17.6	0.10
Beryllium	0.40	0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.45	<0.40	<0.40	<0.40	<0.40	<0.40	0.40
Bismuth	0.10	0.10	<0.10	<0.10	<0.10	0.11	<0.10	<0.10	<0.10	0.14	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Cadmium	0.050	0.050	0.121	0.064	<0.050	0.057	<0.050	<0.050	0.084	0.152	0.126	<0.050	0.060	0.070	0.108	0.050
Calcium	100	100	1820	36100	484	1930	1090	1030	1880	2090	1330	10100	1970	216	1610	100
Chromium	1.0	1.0	6.9	16.8	9.9	20.2	8.1	10.4	10.6	18.6	19.6	10.8	11.0	3.1	33.7	1.0
Cobalt	0.30	0.30	3.64	2.73	2.00	3.81	1.92	2.75	2.75	7.54	4.05	2.54	2.20	0.38	5.56	0.30
Copper	0.50	0.50	9.60	3.55	2.96	5.53	2.65	3.42	2.99	16.9	5.96	3.97	3.01	0.52	8.05	0.50
Iron	100	100	9910	7120	22800	10800	6570	6510	8160	37900	10200	5960	7820	1870	13800	100
Lead	0.10	0.10	4.41	2.98	2.65	3.86	1.73	4.16	2.83	6.62	4.56	4.34	3.45	0.85	6.09	0.10
Lithium	5.0	5.0	14.2	11.6	5.4	8.6	<5.0	7.5	5.6	23.3	9.7	5.8	5.4	<5.0	6.5	5.0
Magnesium	100	100	4060	13700	1700	3260	1710	1780	2000	8790	2870	6940	1810	350	4680	100
Manganese	0.20	0.20	134	95.7	193	118	58.0	105	90.5	459	134	108	83.4	6.64	135	0.20
Mercury	0.050	0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.050
Molybdenum	0.10	0.10	0.15	0.14	<0.10	0.11	<0.10	<0.10	0.10	0.44	<0.10	<0.10	0.16	<0.10	0.15	0.10
Nickel	0.80	0.80	4.88	12.2	6.28	10.4	4.40	6.36	5.55	18.3	10.4	8.62	5.19	1.26	25.5	0.80
Phosphorus	10	10	133	140	206	298	309	235	472	389	273	230	452	62	261	10
Potassium	100	100	1050	892	297	829	448	581	760	2480	904	508	462	125	715	100
Selenium	0.50	0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50
Silver	0.050	0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.050
Sodium	100	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	100
Strontium	0.10	0.10	3.36	20.0	1.45	4.51	2.12	2.10	4.48	4.27	2.70	4.85	3.70	0.85	2.59	0.10
Thallium	0.050	0.050	0.088	0.071	<0.050	0.065	<0.050	0.060	0.063	0.328	0.128	0.056	0.059	<0.050	0.062	0.050
Tin	0.10	0.10	0.34	0.21	0.19	0.27	0.12	0.16	0.33	0.45	0.31	0.18	0.27	<0.10	0.23	0.10
Titanium	1.0	1.0	401	209	253	306	241	235	496	714	521	202	348	46.3	490	1.0
Uranium	0.050	0.050	1.50	0.400	0.494	0.786	0.484	0.340	0.809	1.49	0.841	0.349	0.981	0.122	0.930	0.050
Vanadium	2.0	2.0	19.1	10.9	9.5	17.0	11.3	11.7	15.8	22.1	16.5	10.4	12.4	3.5	17.4	2.0

Parameter[1]	CCME Agri[2]	CCME Ind[2]	L-105	L-106	L-107	L-108	L-109	L-110	L-111	L-112	L-113	L-114	L-115	L-116	L-117	RDL[3]
Zinc	1.0	1.0	19.6	9.5	10.0	14.5	8.1	13.7	12.4	39.6	15.7	10.1	10.1	2.0	16.2	1.0
Zirconium	0.50	0.50	4.14	1.93	0.53	1.22	0.55	0.68	2.43	3.64	5.22	1.22	2.16	1.84	1.50	0.50

[1] Total metals (units mg/kg dry weight) unless otherwise indicated
[2] Agriculture and Industrial Soil Quality Guidelines provided by the Canadian Council of Ministers of the Environment (CCME)
[3] Reportable Detection Limit (RDL)

Table D-5. 2016 Lichen metal analysis (n=50), sample sites L-68 to L-81.

Parameter[1]	L-68	L-69	L-70	L-71	L-72	L-73	L-74	L-75	L-76	L-77	L-78	L-79	L-80	L-81	RDL[2]
Aluminum	2660	4170	1980	4210	3030	3140	3530	1650	1380	548	3730	2890	2260	861	1.0
Antimony	0.0302	0.0255	0.0219	0.0287	0.0207	0.0200	0.0160	0.0079	0.0080	0.0051	0.0175	0.0157	0.0166	0.0092	0.0050
Arsenic	0.193	0.352	0.166	0.243	0.146	0.191	0.233	0.104	0.110	0.071	0.216	0.165	0.135	0.113	0.050
Barium	20.3	28.8	18.2	30.7	23.3	24.0	24.1	10.9	10.7	4.08	22.8	18.2	15.1	4.37	0.10
Beryllium	0.11	0.13	<0.10	0.13	<0.10	0.10	0.12	<0.10	<0.10	<0.10	0.12	0.10	<0.10	<0.10	0.10
Bismuth	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Boron	4.7	3.9	4.5	4.9	4.9	3.7	3.0	<2.0	2.1	4.5	4.7	3.6	3.1	3.7	2.0
Cadmium	0.054	0.038	0.048	0.080	0.041	0.029	0.035	0.025	0.026	0.026	0.028	0.028	0.042	0.045	0.010
Calcium	3490	3230	2640	3450	2320	2010	2690	1470	1430	1180	2940	2660	2230	1140	10
Chromium	5.58	10.1	4.09	10.0	5.63	7.24	7.14	4.56	3.68	6.00	18.8	11.4	6.93	2.48	0.20
Cobalt	1.53	2.18	1.16	2.36	1.56	1.65	1.78	0.904	0.894	0.394	2.42	1.73	1.34	0.664	0.020
Copper	4.06	5.34	2.96	5.22	3.38	3.87	4.09	2.11	1.87	1.14	4.29	3.80	3.33	2.15	0.050
Iron	4980	7330	3520	7710	4800	5380	5890	2880	2590	1020	8170	5680	4030	2900	10
Lead	2.24	2.58	1.43	6.04	2.56	2.81	2.98	1.26	0.932	0.571	1.70	1.76	1.60	1.25	0.010
Magnesium	3080	4060	2460	3940	3050	3590	3770	2220	1800	787	4270	3260	2910	1210	10
Manganese	75.2	102	65.9	112	89.4	102	100	74.5	77.2	28.4	108	97.2	83.3	44.4	0.10
Mercury	0.037	0.036	0.036	0.041	0.046	0.028	0.033	0.022	0.024	0.035	0.037	0.023	0.034	0.044	0.010
Molybdenum	0.353	0.534	0.298	0.473	0.246	0.433	0.581	0.186	0.207	0.052	0.369	0.401	0.388	0.285	0.050
Nickel	4.24	7.32	3.30	7.28	4.32	5.18	5.39	3.20	2.80	2.78	11.2	6.97	4.80	2.11	0.050
Phosphorus	353	371	342	428	453	390	457	271	371	343	462	350	348	446	10
Potassium	1850	2270	1590	2390	2060	2040	2070	1220	1180	887	1930	1620	1500	1180	10
Selenium	0.071	0.081	0.067	0.088	0.068	0.064	0.078	<0.050	0.061	<0.050	0.083	0.052	0.062	0.074	0.050
Silver	<0.020	0.027	<0.020	0.029	0.024	0.026	0.033	<0.020	<0.020	<0.020	0.025	<0.020	0.020	0.022	0.020
Sodium	45	52	48	55	46	40	50	24	34	37	40	39	48	41	10
Strontium	4.80	5.26	4.36	6.32	4.35	3.96	4.43	2.36	3.02	2.88	5.23	4.25	3.36	1.29	0.10
Thallium	0.0486	0.0651	0.0359	0.0617	0.0503	0.0564	0.0556	0.0256	0.0218	0.0103	0.0423	0.0396	0.0348	0.0185	0.0020
Tin	0.12	0.25	<0.10	0.20	0.12	0.14	0.14	<0.10	<0.10	<0.10	0.13	0.16	0.26	<0.10	0.10
Titanium	144	215	110	215	164	179	175	83.9	70.9	31.3	142	131	118	46.3	1.0
Uranium	0.453	0.538	0.275	0.508	0.347	0.418	0.493	0.214	0.192	0.0803	0.418	0.442	0.353	0.221	0.0020
Vanadium	4.31	6.52	3.32	6.69	4.51	5.07	5.13	2.54	2.25	1.27	6.60	5.03	3.64	1.68	0.20
Zinc	16.0	18.0	15.0	22.2	18.0	16.5	17.9	13.5	16.0	9.35	19.7	15.9	18.1	14.8	0.20

[1] Total metals (units mg/kg dry weight) unless otherwise indicated

Parameter[1]	L-68	L-69	L-70	L-71	L-72	L-73	L-74	L-75	L-76	L-77	L-78	L-79	L-80	L-81	RDL[2]

[2] Reportable Detection Limit (RDL)

Table D-6. 2016 Lichen metal analysis (n=50), sample sites L-82 to L-95.

Parameter[1]	L-82	L-83	L-84	L-85	L-86	L-87	L-88	L-89	L-90	L-91	L-92	L-93	L-94	L-95	RDL[2]
Aluminum	586	385	623	900	1070	1220	1590	1030	1420	230	160	234	165	143	1.0
Antimony	<0.0050	0.0070	0.0052	0.0067	<0.0050	<0.0050	<0.0050	0.0059	0.0127	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050
Arsenic	0.068	0.055	0.077	0.101	0.116	0.108	0.095	0.095	0.107	0.051	0.057	0.074	<0.050	<0.050	0.050
Barium	3.01	3.02	3.41	4.75	5.23	6.73	8.42	8.06	8.50	3.88	4.68	3.51	4.69	3.48	0.10
Beryllium	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Bismuth	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Boron	4.0	3.2	<2.0	<2.0	2.2	2.1	3.8	2.2	3.1	2.9	<2.0	<2.0	<2.0	2.6	2.0
Cadmium	0.032	0.040	0.040	0.034	0.051	0.055	0.063	0.049	0.031	0.039	0.034	0.037	0.037	0.033	0.010
Calcium	1130	1310	1760	2480	1610	1470	1240	1510	2180	24100	17500	21700	31400	21200	10
Chromium	1.76	1.23	2.61	3.17	3.84	4.37	4.68	2.74	3.75	1.74	0.68	1.57	1.32	1.06	0.20
Cobalt	0.427	0.282	0.439	0.574	0.701	0.847	0.966	0.692	0.966	0.145	0.100	0.177	0.108	0.103	0.020
Copper	1.56	1.29	1.59	1.90	3.02	2.50	2.98	2.36	4.49	0.964	0.897	1.06	0.835	0.809	0.050
Iron	2070	757	1940	2540	2300	2840	3270	3020	3470	453	277	696	332	273	10
Lead	0.593	0.576	0.713	0.954	1.31	1.34	1.56	1.20	1.67	1.02	0.730	1.19	1.20	0.881	0.010
Magnesium	1090	887	1290	1500	1510	1680	2030	1500	2360	1080	1160	1590	1230	938	10
Manganese	35.6	24.1	23.4	31.4	37.1	50.1	76.2	44.0	63.3	14.5	14.5	15.9	15.0	14.4	0.10
Mercury	0.033	0.060	0.032	0.039	0.068	0.053	0.048	0.044	0.030	0.053	0.054	0.053	0.046	0.044	0.010
Molybdenum	0.160	0.093	0.118	0.197	0.258	0.331	0.650	0.426	0.299	0.075	0.060	0.073	0.073	0.066	0.050
Nickel	1.42	1.39	2.04	2.46	2.72	3.23	3.51	2.26	3.34	0.854	0.413	0.824	0.628	0.517	0.050
Phosphorus	368	316	240	286	248	415	376	341	291	351	374	388	339	378	10
Potassium	1010	954	791	931	946	1230	1450	1150	1270	1380	1410	1300	1270	1500	10
Selenium	<0.050	0.056	0.071	0.079	0.054	0.068	0.056	0.054	<0.050	0.065	0.061	0.056	0.058	<0.050	0.050
Silver	<0.020	<0.020	<0.020	<0.020	0.023	<0.020	0.036	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.020
Sodium	36	36	51	55	47	37	34	37	55	409	412	591	369	425	10
Strontium	0.90	1.08	1.30	1.53	1.47	1.57	1.30	1.43	1.89	16.0	15.8	29.3	22.0	14.9	0.10
Thallium	0.0122	0.0077	0.0114	0.0149	0.0214	0.0230	0.0276	0.0172	0.0261	0.0066	0.0049	0.0064	0.0050	0.0043	0.0020
Tin	<0.10	<0.10	<0.10	0.13	<0.10	<0.10	0.12	0.11	0.13	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Titanium	31.0	22.1	33.6	46.9	59.4	68.7	90.0	53.1	78.0	12.8	7.5	10.8	9.6	6.6	1.0
Uranium	0.146	0.0911	0.159	0.184	0.228	0.278	0.324	0.254	0.392	0.262	0.109	0.188	0.222	0.287	0.0020
Vanadium	1.06	0.65	1.21	1.65	2.06	2.41	2.87	1.79	2.73	0.43	0.34	0.41	0.29	0.23	0.20
Zinc	11.1	13.5	10.8	11.2	11.1	14.3	15.3	14.2	15.5	11.6	9.90	11.0	10.7	11.6	0.20

[1] Total metals (units mg/kg dry weight) unless otherwise indicated

Parameter[1]	L-82	L-83	L-84	L-85	L-86	L-87	L-88	L-89	L-90	L-91	L-92	L-93	L-94	L-95	RDL[2]

[2] Reportable Detection Limit (RDL)

Table D-7. 2016 Lichen metal analysis (n=50), sample sites L-96 to L-109.

Parameter[1]	L-96	L-97	L-98	L-99	L-100	L-101	L-102	L-103	L-104	L-105	L-106	L-107	L-108	L-109	RDL[2]
Aluminum	225	120	258	284	158	120	138	122	108	143	134	223	413	133	1.0
Antimony	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0060	0.0052	0.0050
Arsenic	0.074	<0.050	0.072	0.076	0.068	0.055	<0.050	<0.050	<0.050	<0.050	0.060	<0.050	0.075	<0.050	0.050
Barium	5.13	4.24	4.97	6.12	5.17	4.98	4.43	3.93	4.10	2.38	3.04	4.04	4.02	5.94	0.10
Beryllium	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Bismuth	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Boron	<2.0	<2.0	3.1	2.4	<2.0	<2.0	<2.0	2.7	<2.0	<2.0	<2.0	2.0	2.2	<2.0	2.0
Cadmium	0.038	0.024	0.050	0.043	0.035	0.036	0.045	0.021	0.031	0.031	0.034	0.044	0.037	0.086	0.010
Calcium	36100	27800	27800	34900	32300	40100	34000	31100	19100	16900	30500	1740	2460	5280	10
Chromium	1.03	0.53	1.27	1.42	0.76	0.48	0.67	0.44	0.64	0.53	0.83	1.36	3.27	0.44	0.20
Cobalt	0.134	0.076	0.168	0.172	0.103	0.083	0.088	0.082	0.075	0.094	0.099	0.171	0.283	0.121	0.020
Copper	0.821	0.680	0.874	0.843	0.785	0.739	0.877	0.797	0.764	0.932	0.772	0.875	0.753	0.806	0.050
Iron	417	196	428	471	246	198	248	232	181	234	211	473	679	281	10
Lead	1.23	0.532	1.19	1.46	0.902	0.931	0.785	0.510	0.414	0.401	0.446	0.286	0.836	0.411	0.010
Magnesium	1380	1340	1620	1190	1100	1030	1060	948	1180	1440	934	874	759	819	10
Manganese	16.9	9.63	16.2	19.2	13.3	11.5	11.4	11.5	12.6	9.68	8.97	24.4	14.6	34.5	0.10
Mercury	0.045	0.047	0.044	0.045	0.051	0.052	0.046	0.039	0.044	0.063	0.057	0.033	0.067	0.045	0.010
Molybdenum	0.085	<0.050	0.062	0.071	0.056	0.071	0.074	<0.050	0.051	0.059	0.051	<0.050	<0.050	<0.050	0.050
Nickel	0.590	0.307	0.751	0.736	0.445	0.329	0.387	0.296	0.331	0.331	0.527	0.768	1.55	0.365	0.050
Phosphorus	351	319	353	325	295	289	342	310	344	370	366	340	240	326	10
Potassium	1260	1280	1290	1240	1250	1180	1270	1220	1440	1400	1310	1030	705	1010	10
Selenium	0.074	0.058	0.058	0.072	0.056	0.077	0.070	0.069	<0.050	0.051	0.051	0.057	<0.050	0.065	0.050
Silver	<0.020	<0.020	<0.020	0.021	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.020
Sodium	437	368	399	352	306	289	370	307	388	384	377	35	47	115	10
Strontium	23.0	16.4	19.0	20.8	19.1	22.8	21.2	19.8	12.6	6.73	14.5	2.50	2.00	4.60	0.10
Thallium	0.0062	0.0037	0.0066	0.0106	0.0054	0.0042	0.0040	0.0035	0.0030	0.0036	0.0031	0.0047	0.0109	0.0038	0.0020
Tin	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Titanium	14.3	7.2	15.5	16.1	10.7	7.6	8.5	6.4	6.2	7.6	7.8	12.5	26.0	8.3	1.0
Uranium	0.467	0.185	0.260	0.430	0.202	0.202	0.235	0.0943	0.0846	0.0680	0.0926	0.0372	0.112	0.0318	0.0020
Vanadium	0.45	<0.20	0.52	0.56	0.31	0.25	0.24	0.22	<0.20	0.25	0.27	0.42	0.93	<0.20	0.20
Zinc	9.16	8.26	11.4	9.00	7.85	7.16	10.3	7.70	11.0	12.7	12.1	15.3	6.47	15.2	0.20

[1] Total metals (units mg/kg dry weight) unless otherwise indicated

Parameter[1]	L-96	L-97	L-98	L-99	L-100	L-101	L-102	L-103	L-104	L-105	L-106	L-107	L-108	L-109	RDL[2]

[2] Reportable Detection Limit (RDL)

Table D-8. 2016 Lichen metal analysis (n=50), sample sites L-110 to L-117.

Parameter[1]	L-110	L-111	L-112	L-113	L-114	L-115	L-116	L-117	RDL[2]
Aluminum	226	166	390	314	286	321	458	623	1.0
Antimony	<0.0050	<0.0050	0.0052	0.0068	0.0055	<0.0050	0.0085	0.0066	0.0050
Arsenic	<0.050	<0.050	0.076	0.112	0.067	<0.050	0.071	0.066	0.050
Barium	3.73	5.45	12.4	16.9	5.29	4.10	10.5	7.82	0.10
Beryllium	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Bismuth	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Boron	2.4	2.5	<2.0	<2.0	<2.0	2.6	3.3	3.3	2.0
Cadmium	0.095	0.072	0.114	0.166	0.039	0.036	0.057	0.088	0.010
Calcium	4860	3500	13000	10900	12400	5630	15100	9720	10
Chromium	1.43	1.18	1.29	1.02	2.12	1.34	1.72	2.70	0.20
Cobalt	0.190	0.162	0.276	0.236	0.344	0.259	0.345	0.471	0.020
Copper	0.900	0.888	1.30	1.03	1.11	1.03	1.22	1.83	0.050
Iron	479	245	857	864	1070	813	858	1810	10
Lead	0.566	0.279	1.41	1.73	1.03	0.563	1.12	1.10	0.010
Magnesium	742	773	1500	995	1150	948	1240	1460	10
Manganese	32.0	15.9	31.5	76.5	21.2	26.2	39.5	50.8	0.10
Mercury	0.058	0.055	0.076	0.092	0.063	0.065	0.046	0.067	0.010
Molybdenum	<0.050	<0.050	0.070	0.070	0.089	0.078	0.091	0.208	0.050
Nickel	0.793	0.660	0.987	1.02	1.39	0.953	1.26	2.06	0.050
Phosphorus	443	391	527	375	449	536	387	585	10
Potassium	1250	1120	2120	1650	1680	1550	1710	1880	10
Selenium	0.071	<0.050	0.115	0.100	0.066	<0.050	0.056	0.063	0.050
Silver	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.020
Sodium	147	113	322	237	319	296	251	314	10
Strontium	2.60	4.46	7.64	16.8	5.27	2.75	6.70	3.26	0.10
Thallium	0.0063	0.0053	0.0113	0.0066	0.0086	0.0082	0.0115	0.0140	0.0020
Tin	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Titanium	18.0	17.4	30.5	21.8	20.6	24.6	26.1	35.9	1.0
Uranium	0.0610	0.0530	0.0751	0.0650	0.122	0.0976	0.123	0.190	0.0020
Vanadium	0.54	0.41	0.66	0.57	0.59	0.66	0.83	1.28	0.20
Zinc	18.0	18.5	22.4	19.5	9.08	12.2	13.9	19.6	0.20

[1] Total metals (units mg/kg dry weight) unless otherwise indicated

Parameter[1]	L-110	L-111	L-112	L-113	L-114	L-115	L-116	L-117	RDL[2]

[2] Reportable Detection Limit (RDL)

Table D-9. 2014 Soil metal analysis (n=12), sample sites L-56 to L-67.

Parameter[1]	CCME Agri[2]	CCME Ind[2]	L-56	L-57	L-58	L-59	L-60	L-61	L-62	L-63	L-64	L-65	L-66	L-67	RDL[3]
pH	6-8	6-8	8.54	8.74	7.97	6.47	5.31	4.94	5.23	8.60	5.49	7.93	6.21	6.89	N/A
Aluminum	NA	NA	5320	3140	1450	4550	2020	2770	5600	4730	3030	3190	6390	1040	100
Antimony	20	40	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.13	<0.10	<0.10	<0.10	0.10
Arsenic	12	12	1.01	1.82	1.01	0.86	0.61	<0.50	0.59	0.90	1.86	0.81	0.83	<0.50	0.50
Barium	750	2000	13.3	8.34	4.45	9.47	7.70	13.7	32.3	12.0	5.41	9.62	36.1	2.81	0.10
Beryllium	4	8	0.45	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.40
Bismuth	NA	NA	<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
Cadmium	1.4	22	0.119	0.147	<0.050	<0.050	<0.050	<0.050	0.098	0.150	<0.050	<0.050	0.158	<0.050	0.050
Calcium	NA	NA	10900	66800	28900	1390	323	344	1980	19100	334	3150	5950	677	100
Chromium	64	87	4.9	11.9	6.6	12.0	26.0	14.2	16.5	13.4	9.0	21.6	12.3	4.8	1.0
Cobalt	40	300	2.46	2.36	1.12	2.85	2.11	1.62	4.17	2.96	2.49	3.38	3.15	0.77	0.30
Copper	63	91	4.55	4.44	1.92	3.43	2.42	2.34	5.31	5.82	5.66	4.85	8.79	0.86	0.50
Iron	NA	NA	9040	7300	4870	9700	14600	8010	11200	9350	90500	7360	7160	3050	100
Lead	70	600	4.73	4.43	1.97	4.91	2.12	1.76	5.58	5.16	2.77	4.84	4.89	1.40	0.10
Lithium	NA	NA	18.7	14.5	7.6	11.9	<5.0	<5.0	8.5	13.8	<5.0	6.3	6.8	<5.0	5.0
Magnesium	NA	NA	7380	37100	15900	3160	1160	1490	3200	11800	1050	5120	2640	817	100
Manganese	NA	NA	181	94.7	50.3	122	72.4	32.8	162	108	227	117	135	19.7	0.20
Mercury	6.6	50	<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
Molybdenum	5	40	0.17	0.32	0.12	0.12	0.10	<0.10	0.34	0.21	0.16	<0.10	0.18	<0.10	0.10
Nickel	50	50	4.33	7.09	3.04	6.66	8.49	6.41	9.52	8.23	9.12	34.7	7.21	2.92	0.80
Phosphorus	NA	NA	170	276	153	465	179	194	547	370	354	257	517	232	10
Potassium	NA	NA	803	1260	500	550	289	622	654	811	236	606	872	248	100
Selenium	1	2.9	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50
Silver	20	40	<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
Sodium	NA	NA	<100	404	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	100
Strontium	NA	NA	6.87	34.1	14.9	3.12	2.40	1.92	6.50	9.51	1.25	2.90	7.87	2.01	0.10
Thallium	1	1	0.127	0.074	<0.050	0.055	<0.050	<0.050	0.110	0.113	<0.050	0.061	0.099	<0.050	0.050
Tin	5	300	0.47	0.22	0.10	0.31	0.15	0.19	0.58	0.50	0.20	0.20	0.24	<0.10	0.10
Titanium	NA	NA	171	200	67.0	238	151	159	609	316	197	208	178	114	1.0
Uranium	23	300	1.39	0.537	0.245	1.16	0.423	0.414	2.07	0.628	0.562	0.507	0.887	0.248	0.050

Parameter[1]	CCME Agri[2]	CCME Ind[2]	L-56	L-57	L-58	L-59	L-60	L-61	L-62	L-63	L-64	L-65	L-66	L-67	RDL[3]
Vanadium	130	130	11.6	13.3	8.0	15.1	14.4	11.5	21.2	15.5	10.9	12.6	12.9	5.3	2.0
Zinc	200	360	22.7	10.2	5.6	19.4	8.4	9.8	23.9	16.9	12.5	12.3	16.3	4.1	1.0
Zirconium	NA	NA	3.50	4.81	0.61	0.99	<0.50	<0.50	1.56	6.87	<0.50	0.78	1.65	0.58	0.50

[1] Total metals (units mg/kg dry weight) unless otherwise indicated
[2] Agriculture and Industrial Soil Quality Guidelines provided by the Canadian Council of Ministers of the Environment (CCME)
[3] Reportable Detection Limit (RDL)

Table D-10. 2014 Vegetation metal analysis (n=25), sample sites L-56 to L-60.

Parameter[1]	L-56 (lichen)	L-56 (willow)	L-57 (willow)	L-58 (lichen)	L-59 (lichen)	L-59 (willow)	L-60 (lichen)	L-60 (willow)	L-60 (blueberry)	RDL[2]
Aluminum	508	32.6	24.9	380	63.8	9.6	713	332	277	1.0
Antimony	0.0183	<0.0050	0.0126	0.0214	<0.0050	0.0156	0.0058	<0.0050	<0.0050	0.0050
Arsenic	0.187	<0.050	<0.050	0.225	<0.050	<0.050	0.104	<0.050	<0.050	0.050
Barium	7.20	2.45	0.91	4.40	4.55	3.81	7.26	13.2	49.2	0.10
Beryllium	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Bismuth	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Boron	3.6	28.5	24.4	4.5	<2.0	23.5	2.7	30.3	22.2	2.0
Cadmium	0.094	0.757	0.515	0.042	0.054	0.533	0.099	0.574	0.265	0.010
Calcium	27200	15800	11300	37400	12300	17400	5170	9280	6440	10
Chromium	2.85	0.24	0.69	2.77	0.26	0.59	3.80	1.02	1.07	0.20
Cobalt	0.334	0.116	0.650	0.272	0.077	0.314	0.666	1.23	0.269	0.020
Copper	2.12	9.36	10.3	1.83	0.870	12.5	3.28	11.2	12.8	0.050
Iron	980	103	156	915	109	94	1510	619	489	10
Lead	2.60	0.090	0.089	1.81	0.399	0.088	0.970	0.279	0.336	0.010
Magnesium	1930	5060	5910	3570	2030	7240	2170	7320	2030	10
Manganese	32.2	39.4	75.6	28.2	11.0	76.2	97.8	226	1600	0.10
Mercury	0.236	0.025	0.012	0.083	0.062	0.011	0.043	0.011	0.016	0.010
Molybdenum	0.098	0.123	0.575	0.134	<0.050	0.177	0.364	<0.050	0.064	0.050
Nickel	1.65	0.414	1.48	1.57	0.242	1.72	3.37	6.96	3.00	0.050
Phosphorus	485	3610	3090	450	493	4330	393	3510	1380	10
Potassium	1870	14200	15900	1720	1860	17800	1640	17600	5260	10
Selenium	0.142	<0.050	<0.050	0.095	<0.050	<0.050	0.055	<0.050	<0.050	0.050
Silver	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.020
Sodium	257	27	145	457	404	31	110	28	20	10
Strontium	19.6	13.8	15.9	39.0	6.13	6.72	4.20	12.9	3.09	0.10
Thallium	0.0159	0.0066	<0.0020	0.0110	0.0024	0.0042	0.0146	0.0106	0.0052	0.0020
Tin	<0.10	<0.10	0.12	<0.10	<0.10	0.50	0.17	0.11	<0.10	0.10
Titanium	31.3	2.2	1.3	22.2	4.0	<1.0	61.5	28.4	17.2	1.0
Uranium	0.502	0.0273	0.0172	0.463	0.0339	0.0033	0.158	0.158	0.111	0.0020
Vanadium	1.41	<0.20	<0.20	1.04	<0.20	<0.20	2.58	1.07	0.76	0.20

Zinc	16.2	74.8	90.2	14.2	12.6	188	28.8	352	118	0.20

[1] Total metals (units mg/kg dry weight) unless otherwise indicated

[2] Reportable Detection Limit (RDL)

Table D-11. 2014 Vegetation metal analysis (n=25), sample sites L-61 to L-63.

Parameter[1]	L-61 (lichen)	L-61 (willow)	L-61 (blueberry)	L-62 (lichen)	L-62 (willow)	L-62 (blueberry)	L-63 (lichen)	L-63 (willow)	RDL[2]
Aluminum	198	32.0	119	1240	20.7	124	121	3.7	1.0
Antimony	0.0055	0.0061	<0.0050	0.0077	<0.0050	<0.0050	<0.0050	<0.0050	0.0050
Arsenic	0.053	<0.050	<0.050	0.104	<0.050	<0.050	<0.050	<0.050	0.050
Barium	9.76	15.4	60.5	26.6	25.6	75.2	5.96	1.32	0.10
Beryllium	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Bismuth	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Boron	2.2	25.4	24.9	2.7	22.6	26.8	3.6	21.1	2.0
Cadmium	0.082	0.441	0.412	0.100	0.488	0.396	0.048	0.231	0.010
Calcium	7390	10200	5770	5050	8540	4640	26700	10500	10
Chromium	0.93	0.81	0.36	4.52	0.26	0.40	0.82	0.32	0.20
Cobalt	0.271	2.19	0.213	1.28	1.72	0.251	0.098	0.162	0.020
Copper	3.82	10.7	10.8	3.67	9.31	11.3	2.14	8.89	0.050
Iron	432	106	82	2320	71	100	218	59	10
Lead	0.675	0.084	0.056	2.19	0.034	0.083	0.681	0.036	0.010
Magnesium	1330	7840	1720	1550	5620	1290	1900	3900	10
Manganese	80.2	147	1070	77.8	201	667	12.2	26.5	0.10
Mercury	0.078	0.015	0.010	0.147	0.011	0.011	0.055	<0.010	0.010
Molybdenum	<0.050	0.066	<0.050	0.170	0.133	0.412	0.189	0.267	0.050
Nickel	1.02	4.47	2.38	3.45	3.01	2.71	0.500	0.719	0.050
Phosphorus	865	5530	2420	883	3300	1800	589	3200	10
Potassium	2060	17900	7110	2130	15900	5680	2070	11900	10
Selenium	0.071	<0.050	<0.050	0.096	<0.050	<0.050	0.069	<0.050	0.050
Silver	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.020
Sodium	351	22	<10	228	<10	13	367	<10	10
Strontium	4.26	15.7	3.76	11.6	22.9	5.39	14.0	5.25	0.10
Thallium	0.0048	0.0057	0.0026	0.0234	0.0068	0.0023	0.0055	0.0052	0.0020
Tin	<0.10	0.16	<0.10	0.11	<0.10	0.14	<0.10	<0.10	0.10
Titanium	16.4	1.6	2.2	125	<1.0	3.6	7.7	<1.0	1.0
Uranium	0.0514	0.0055	0.0101	0.713	0.0033	0.0201	0.135	<0.0020	0.0020
Vanadium	0.60	<0.20	<0.20	3.43	<0.20	<0.20	0.38	<0.20	0.20

Parameter[1]	L-61 (lichen)	L-61 (willow)	L-61 (blueberry)	L-62 (lichen)	L-62 (willow)	L-62 (blueberry)	L-63 (lichen)	L-63 (willow)	RDL[2]
Zinc	33.2	214	77.9	25.4	114	52.6	18.9	188	0.20

[1] Total metals (units mg/kg dry weight) unless otherwise indicated

[2] Reportable Detection Limit (RDL)

Table D-12. 2014 Vegetation metal analysis (n=25), sample sites L-64 to L-67.

Parameter[1]	L-64 (lichen)	L-65 (lichen)	L-65 (willow)	L-66 (lichen)	L-66 (willow)	L-67 (lichen)	L-67 (willow)	L-67 (blueberry)	RDL[2]
Aluminum	991	406	21.3	230	12.9	304	10.7	24.2	1.0
Antimony	0.0637	<0.0050	0.0076	0.0050	0.0053	<0.0050	<0.0050	<0.0050	0.0050
Arsenic	1.10	0.108	<0.050	0.053	<0.050	0.094	<0.050	<0.050	0.050
Barium	18.3	7.46	10.3	7.30	9.17	5.44	3.86	30.4	0.10
Beryllium	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Bismuth	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Boron	<2.0	2.9	27.3	<2.0	12.4	<2.0	18.3	19.6	2.0
Cadmium	0.263	0.095	0.832	0.090	0.342	0.042	0.504	0.277	0.010
Calcium	16300	17100	14300	8770	7680	18300	13700	5180	10
Chromium	5.99	2.16	0.42	0.62	<0.20	1.39	0.86	0.24	0.20
Cobalt	0.558	0.554	0.256	0.168	0.602	0.286	0.180	0.034	0.020
Copper	3.18	2.24	13.4	1.27	7.63	1.40	6.99	11.3	0.050
Iron	8830	760	98	367	62	595	62	71	10
Lead	6.71	1.42	0.089	0.749	0.077	1.05	0.155	0.058	0.010
Magnesium	1280	2200	6450	1080	4190	1440	6540	2170	10
Manganese	87.6	41.0	35.0	32.9	75.4	20.2	58.3	181	0.10
Mercury	0.169	0.068	0.014	0.058	<0.010	0.087	<0.010	<0.010	0.010
Molybdenum	0.087	0.051	2.12	<0.050	<0.050	0.070	0.201	0.072	0.050
Nickel	3.83	3.45	4.87	0.539	1.81	1.18	2.56	0.633	0.050
Phosphorus	509	819	4770	466	3170	456	2720	1440	10
Potassium	1650	2090	21400	1430	10700	1520	10400	5910	10
Selenium	0.197	0.079	<0.050	0.063	<0.050	<0.050	<0.050	<0.050	0.050
Silver	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.020
Sodium	170	366	19	213	<10	273	<10	<10	10
Strontium	14.0	6.80	5.74	5.94	8.56	4.24	5.60	2.41	0.10
Thallium	0.0191	0.0117	0.0079	0.0051	0.0025	0.0098	0.0035	<0.0020	0.0020
Tin	0.13	<0.10	0.14	<0.10	0.38	<0.10	<0.10	<0.10	0.10
Titanium	66.6	35.6	<1.0	17.4	<1.0	28.3	<1.0	1.5	1.0
Uranium	0.231	0.0661	0.0044	0.0516	0.0023	0.0871	0.0036	0.0074	0.0020
Vanadium	2.27	1.15	<0.20	0.65	<0.20	0.92	<0.20	<0.20	0.20

Zinc	23.8	15.9	83.6	19.4	103	9.82	118	83.3	0.20

[1] Total metals (units mg/kg dry weight) unless otherwise indicated

[2] Reportable Detection Limit (RDL)

Table D-13. 2013 Soil metal analysis (n=20), sample sites L-01 to L-10 (new site ID)[1].

Parameter[2]	CCME Agri[3]	CCME Ind[3]	L-01	L-02	L-03	L-04	L-05	L-06	L-07	L-08	L-09	L-10	RDL[4]
pH	6-8	6-8	8.27	8.52	6.35	8.53	8.59	8.60	8.32	7.65	6.05	8.64	0.010
Aluminum	NA	NA	1240	4360	6640	6380	3480	4200	5230	1650	2390	5770	100
Antimony	20	40	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Arsenic	12	12	<0.50	0.57	<0.50	0.90	0.78	1.19	1.25	0.60	<0.50	<0.50	0.50
Barium	750	2000	3.33	8.75	22.6	18.7	8.47	12.8	14.7	9.22	7.44	11.1	0.10
Beryllium	4	8	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.46	<0.40	<0.40	0.40	0.40
Bismuth	NA	NA	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Cadmium	1.4	22	<0.050	0.080	0.081	0.134	0.066	0.075	0.061	<0.050	<0.050	0.250	0.050
Calcium	NA	NA	22200	9660	6060	44100	82200	83500	51000	2710	677	179000	100
Chromium	64	87	6.0	22.4	9.8	20.6	9.1	12.2	17.0	3.6	9.5	15.2	1.0
Cobalt	40	300	1.06	3.27	4.60	4.30	2.18	3.01	3.87	2.09	1.85	3.08	0.30
Copper	63	91	1.56	4.20	6.17	8.38	4.45	6.03	7.03	3.99	2.03	6.14	0.50
Iron	NA	NA	3540	7310	11000	10100	5850	8890	9980	2850	6670	11400	100
Lead	70	600	1.64	2.92	5.60	6.97	3.89	5.26	6.51	2.30	2.94	7.74	0.10
Lithium	NA	NA	6.3	15.0	13.9	24.7	23.8	23.4	27.9	<5.0	6.2	8.1	5.0
Magnesium	NA	NA	12000	7740	4240	21100	36600	41100	28200	880	1400	23100	100
Manganese	NA	NA	55.1	100	349	160	111	183	194	69.0	83.5	251	0.20
Mercury	6.6	50	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.050
Molybdenum	5	40	0.11	0.10	0.26	0.22	0.32	0.55	0.30	0.11	0.13	0.19	0.10
Nickel	50	50	2.66	18.9	6.48	13.0	5.34	6.80	10.1	2.99	4.17	8.58	0.80
Phosphorus	NA	NA	112	172	473	278	173	233	325	132	223	104	10
Potassium	NA	NA	347	903	1020	1690	1230	1160	1260	327	323	317	100
Selenium	1	2.9	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50
Silver	20	40	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.051	0.050
Sodium	NA	NA	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	100
Strontium	NA	NA	11.6	7.42	13.3	25.4	46.3	45.8	25.5	2.75	2.49	83.3	0.10
Thallium	1	1	<0.050	0.084	0.140	0.133	0.062	0.082	0.102	<0.050	<0.050	0.191	0.050
Tin	5	300	<0.10	0.31	0.50	0.34	0.14	0.17	0.26	<0.10	0.20	0.16	0.10
Titanium	NA	NA	61.5	231	391	336	105	90.4	147	42.3	201	78.4	1.0
Uranium	23	300	0.250	0.431	2.62	0.507	0.314	0.401	0.461	0.502	0.473	0.491	0.050
Vanadium	130	130	6.2	11.8	18.6	18.8	10.3	13.5	15.9	5.2	13.0	9.7	2.0

Zinc	200	360	4.1	11.4	34.3	15.9	8.1	11.6	16.2	6.2	6.9	16.4	1.0
Zirconium	NA	NA	<0.50	2.30	1.58	4.36	0.53	0.57	1.51	0.68	<0.50	6.35	0.50

[1] Collection sites were re-labelled following the 2013 field program to provide consistency between years and facilitate mapping; the lab results reported here are by the new Site ID and can be referenced to the Original Site ID in the 2013 Annual Terrestrial Monitoring Report, Table 6, Section 2.2.1

[2] Total metals (units mg/kg dry weight) unless otherwise indicated

[3] Agriculture and Industrial Soil Quality Guidelines provided by the Canadian Council of Ministers of the Environment (CCME)

[4] Reportable Detection Limit (RDL)

Table D-14. 2013 Soil metal analysis (n=20), sample sites L-12 to L-29 (new site ID)[1].

Parameter[2]	CCME Agri[3]	CCME Ind[3]	L-12	L-14	L-15	L-16	L-17	L-19	L-22	L-23	L-25	L-29	RDL[4]
pH	6-8	6-8	7.59	5.29	5.67	6.70	6.28	7.03	7.10	6.54	7.42	5.55	0.010
Aluminum	NA	NA	2270	2020	789	646	1120	2530	5110	2980	3450	3640	100
Antimony	20	40	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Arsenic	12	12	0.71	1.26	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.61	<0.50	0.50
Barium	750	2000	9.79	30.2	2.77	3.04	3.83	11.8	16.5	11.2	12.6	13.7	0.10
Beryllium	4	8	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.40
Bismuth	NA	NA	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Cadmium	1.4	22	0.063	0.080	<0.050	<0.050	<0.050	0.073	0.252	<0.050	0.102	<0.050	0.050
Calcium	NA	NA	1640	1400	195	240	302	636	2120	617	1600	1050	100
Chromium	64	87	7.8	13.8	3.3	3.5	6.5 (1)	9.8	20.2	38.8	14.9	11.8	1.0
Cobalt	40	300	1.88	2.39	0.64	0.70	1.22	2.38	4.22	5.40	3.19	3.14	0.30
Copper	63	91	5.04	3.97	0.96	1.17	1.77	4.51	5.82	2.41	7.27	2.73	0.50
Iron	NA	NA	4760	34500	2110	2020	4610	7180	10100	9620	13200	8790	100
Lead	70	600	3.16	2.11	0.82	0.89	1.29	1.96	4.95	3.31	4.55	3.22	0.10
Lithium	NA	NA	6.4	<5.0	<5.0	<5.0	<5.0	<5.0	10.2	5.7	7.4	10.6	5.0
Magnesium	NA	NA	1910	1120	631	669	794	2160	2760	3860	3150	2670	100
Manganese	NA	NA	65.7	38.1	17.5	18.4	32.3	65.8	145	113	191	96.7	0.20
Mercury	6.6	50	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.050
Molybdenum	5	40	<0.10	0.23	<0.10	<0.10	<0.10	<0.10	0.11	<0.10	0.22	<0.10	0.10
Nickel	50	50	6.45	20.2	2.01	3.11	2.80	7.36	11.1	39.4	19.7	6.76	0.80
Phosphorus	NA	NA	156	528	56	77	102	169	524	221	177	287	10
Potassium	NA	NA	495	177	156	150	195	452	917	375	601	747	100
Selenium	1	2.9	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50
Silver	20	40	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.050
Sodium	NA	NA	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	100
Strontium	NA	NA	2.51	8.04	1.11	1.18	1.53	2.59	3.53	2.27	2.22	3.15	0.10
Thallium	1	1	0.052	<0.050	<0.050	<0.050	<0.050	<0.050	0.122	<0.050	0.062	0.052	0.050
Tin	5	300	0.16	0.11	<0.10	<0.10	<0.10	0.14	0.44	0.27	0.68	0.26	0.10
Titanium	NA	NA	181	82.3	52.7	48.5	97.4	187	539	220	458	424	1.0
Uranium	23	300	0.332	0.636	0.140	0.136	0.168	0.351	0.784	0.545	0.932	0.475	0.050
Vanadium	130	130	9.3	9.1	3.9	3.3	6.1	12.0	16.6	13.3	14.7	16.1	2.0

Zinc	200	360	8.9	17.0	3.2	2.3	4.4	7.5	15.9	11.4	17.1	16.5	1.0
Zirconium	NA	NA	1.23	0.98	<0.50	0.96	<0.50	1.79	9.86	<0.50	1.73	1.51	0.50

[1] Collection sites were re-labelled following the 2013 field program to provide consistency between years and facilitate mapping; the lab results reported here are by the new Site ID and can be referenced to the Original Site ID in the 2013 Annual Terrestrial Monitoring Report, Table 6, Section 2.2.1

[2] Total metals (units mg/kg dry weight) unless otherwise indicated

[3] Agriculture and Industrial Soil Quality Guidelines provided by the Canadian Council of Ministers of the Environment (CCME)

[4] Reportable Detection Limit (RDL)

Table D-15. 2013 Vegetation metal analysis (n=35), sample sites L-01 to L-07 (new site ID)[1].

Parameter[2]	L-01 (lichen)	L-02 (lichen)	L-02 (willow)	L-03 (lichen)	L03 (blueberry)	L-04 (lichen)	L-04 (willow)	L-05 (lichen)	L-05 (willow)	L-06 (lichen)	L-06 (willow)	L-07 (willow)	RDL[3]
Aluminum	177	211	6.5	191	98.1	360	35.3	91.6	3.1	334	8.0	452	1.0
Antimony	0.0127	<0.0050	<0.0050	0.0071	<0.0050	0.0075	<0.0050	<0.0050	<0.0050	0.0070	0.0056	0.0086	0.0050
Arsenic	0.145	0.075	<0.050	0.081	<0.050	0.153	<0.050	0.055	<0.050	0.192	<0.050	0.215	0.050
Barium	1.89	3.08	1.47	5.41	0.87	3.98	2.79	2.52	0.71	3.19	0.59	4.26	0.10
Beryllium	<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
Bismuth	<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
Boron	2.4	<2.0	13.7	<2.0	18.0	<2.0	15.0	<2.0	15.7	<2.0	25.0	2.9	2.0
Cadmium	0.032	0.059	0.447	0.046	0.841	0.039	0.295	0.025	0.227	0.038	0.441	0.032	0.010
Calcium	27900	36300	13500	24400	18100	51100	16300	31700	13400	42500	20800	35800	10
Chromium	0.59	0.77	<0.20	0.48	0.23	1.27	<0.20	0.29	<0.20	0.99	<0.20	1.35	0.20
Cobalt	0.118	0.145	0.579	0.105	1.44	0.237	0.683	0.060	0.497	0.211	0.238	0.299	0.020
Copper	1.22	0.816	5.81	1.23	12.8	1.15	6.85	0.691	4.88	1.16	6.52	1.53	0.050
Iron	310	295	59	293	186	549	104	129	53	567	82	748	10
Lead	0.856	0.906	0.024	0.817	0.119	1.18	0.066	0.427	0.017	1.11	0.029	1.06	0.010
Magnesium	2260	882	3690	1960	5610	1400	4680	1280	4080	1700	6490	2990	10
Manganese	14.7	11.0	72.8	21.6	296	17.3	77.5	10.7	67.0	25.2	122	31.5	0.10
Mercury	0.066	0.031	<0.010	0.069	<0.010	0.046	<0.010	0.038	<0.010	0.071	0.011	0.071	0.010
Molybdenum	0.066	0.069	0.671	0.063	0.101	0.052	0.246	<0.050	0.223	0.054	0.177	0.069	0.050
Nickel	0.365	0.638	1.16	0.375	2.48	0.928	2.45	0.215	0.896	0.667	0.199	0.860	0.050
Phosphorus	708	298	3110	533	7870	380	4720	357	3390	327	4400	395	10
Potassium	2040	1170	11200	1830	17900	1380	14100	1430	11200	1380	19300	1650	10
Selenium	0.066	0.066	<0.050	0.065	<0.050	0.062	<0.050	<0.050	<0.050	0.082	<0.050	0.080	0.050
Silver	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.020
Sodium	651	329	10	524	21	281	15	250	<10	141	24	225	10
Strontium	75.9	15.6	7.11	26.9	7.50	21.8	11.7	14.8	6.47	19.3	10.4	18.5	0.10
Thallium	0.0047	0.0062	0.0040	0.0072	0.0080	0.0090	0.0029	0.0030	0.0027	0.0113	<0.0020	0.0127	0.0020
Tin	<0.10	<0.10	1.76	<0.10	<0.10	<0.10	0.30	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Titanium	10.3	12.8	<1.0	10.0	2.3	20.6	2.1	3.6	<1.0	14.4	<1.0	19.1	1.0
Uranium	0.0779	0.145	0.0031	0.104	0.0079	0.0588	0.0057	0.0167	<0.0020	0.0438	<0.0020	0.0551	0.0020
Vanadium	0.44	0.49	<0.20	0.41	<0.20	0.87	<0.20	<0.20	<0.20	0.82	<0.20	1.11	0.20
Zinc	10.4	9.40	92.9	12.1	251	9.74	82.0	7.14	111	8.57	133	9.84	0.20

[1] Collection sites were re-labelled following the 2013 field program to provide consistency between years and facilitate mapping; the lab results reported here are by the new Site ID and can be referenced to the Original Site ID in the 2013 Annual Terrestrial Monitoring Report, Table 6, Section 2.2.1

[2] Total metals (units mg/kg dry weight) unless otherwise indicated

[3] Reportable Detection Limit (RDL)

Table D-16. 2013 Vegetation metal analysis (n=35), sample sites L-08 to L-16 (new site ID)[1].

Parameter[2]	L-08 (lichen)	L-08 (willow)	L-09 (lichen)	L-09 (willow)	L-10 (willow)	L-12 (lichen)	L-12 (willow)	L-12 (blueberry)	L-14 (lichen)	L-15 (blueberry)	L-15 (lichen)	L-16 (lichen)	RDL[3]
Aluminum	158	3.6	62.6	4.0	54.3	60.5	18.2	197	122	191	482	1140	1.0
Antimony	0.0069	0.0061	<0.0050	<0.0050	<0.0050	0.0142	<0.0050	0.0057	0.0063	0.0371	<0.0050	0.0221	0.0050
Arsenic	0.112	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.060	<0.050	0.121	0.175	0.050
Barium	3.65	0.69	5.34	6.14	36.6	2.55	2.84	63.1	3.08	4.76	3.20	15.0	0.10
Beryllium	<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
Bismuth	<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
Boron	<2.0	16.4	<2.0	10.4	30.9	<2.0	11.5	19.0	<2.0	8.3	<2.0	2.4	2.0
Cadmium	0.045	0.162	0.174	0.464	0.631	0.067	0.380	0.447	0.025	0.764	0.047	0.084	0.010
Calcium	54900	8900	16600	8690	7550	16900	9320	6990	1150	7700	4680	8260	10
Chromium	0.58	<0.20	<0.20	<0.20	<0.20	0.23	<0.20	0.98	0.46	1.35	3.02	3.92	0.20
Cobalt	0.158	0.594	0.068	0.439	0.054	0.042	0.280	0.201	0.173	0.388	0.441	0.930	0.020
Copper	1.02	6.63	0.834	8.38	17.6	0.798	11.6	12.2	0.764	10.6	2.30	2.65	0.050
Iron	245	56	85	69	111	90	67	354	266	432	1080	2170	10
Lead	0.783	0.017	0.699	0.024	0.076	0.809	0.066	0.350	0.218	0.173	0.526	2.57	0.010
Magnesium	2210	4020	1010	4800	2830	1020	5280	1950	840	5100	1280	1880	10
Manganese	14.4	56.2	14.9	80.3	392	12.7	167	488	35.4	306	39.6	40.5	0.10
Mercury	0.048	<0.010	0.068	0.012	0.011	0.049	<0.010	0.011	0.020	0.016	0.046	0.050	0.010
Molybdenum	<0.050	0.159	<0.050	0.063	0.053	<0.050	0.091	<0.050	<0.050	0.088	0.077	0.072	0.050
Nickel	0.430	0.492	0.228	1.36	1.68	0.235	0.447	2.10	0.629	3.94	2.87	3.74	0.050
Phosphorus	323	4760	476	5160	3450	316	3490	1340	289	4880	722	544	10
Potassium	1440	18000	1880	12800	11200	1470	14300	4210	953	10500	2090	1410	10
Selenium	0.061	<0.050	0.055	<0.050	<0.050	0.056	<0.050	<0.050	<0.050	<0.050	0.064	0.065	0.050
Silver	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.020
Sodium	382	31	371	11	30	220	14	13	36	34	164	321	10
Strontium	15.8	2.84	8.83	6.68	9.22	6.36	4.97	4.61	1.92	8.74	4.65	15.3	0.10
Thallium	0.0050	<0.0020	0.0036	0.0047	0.0043	0.0030	<0.0020	0.0091	0.0042	0.0036	0.0091	0.0203	0.0020
Tin	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.11	0.10
Titanium	5.3	<1.0	4.6	<1.0	1.3	4.1	<1.0	13.3	7.9	8.0	33.7	63.4	1.0
Uranium	0.0773	0.0021	0.0174	<0.0020	0.0118	0.0083	<0.0020	0.0158	0.0192	0.0286	0.109	0.230	0.0020
Vanadium	0.39	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.53	0.30	0.55	1.48	3.11	0.20
Zinc	10.8	138	20.6	194	133	16.0	396	121	12.3	369	21.0	20.5	0.20

[1] Collection sites were re-labelled following the 2013 field program to provide consistency between years and facilitate mapping; the lab results reported here are by the new Site ID and can be referenced to the Original Site ID in the 2013 Annual Terrestrial Monitoring Report, Table 6, Section 2.2.1

[2] Total metals (units mg/kg dry weight) unless otherwise indicated

[3] Reportable Detection Limit (RDL)

Table D-17. 2013 Vegetation metal analysis (n=35), sample sites L-16 to L-29 (new site ID)[1]

Parameter[2]	L-16 (willow)	L-17 (lichen)	L-17 (willow)	L-19 (willow)	L-22 (willow)	L-23 (lichen)	L-23 (blueberry)	L-24 (blueberry)	L-25 (lichen)	L-25 (willow)	L-29 (willow)	L-29 (willow)	RDL[3]
Aluminum	91.1	419	93.3	93.2	31.2	898	117	898	268	13.4	36.3	16.7	1.0
Antimony	0.0548	0.0066	0.0052	<0.0050	0.0055	0.0552	0.0138	0.0552	0.0081	0.0052	0.0198	<0.0050	0.0050
Arsenic	<0.050	0.075	<0.050	<0.050	<0.050	0.244	<0.050	0.244	0.089	<0.050	<0.050	<0.050	0.050
Barium	8.76	6.67	4.18	4.94	4.17	13.3	39.1	13.3	9.98	4.99	5.52	5.83	0.10
Beryllium	<0.10	0.14	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Bismuth	<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
Boron	18.6	<2.0	17.7	15.5	10.5	<2.0	28.5	<2.0	<2.0	15.7	<2.0	13.2	2.0
Cadmium	0.312	0.048	0.374	0.772	0.657	0.136	0.940	0.136	0.166	3.65	0.189	1.08	0.010
Calcium	8000	10700	10900	14800	9810	10400	6750	10400	14900	13500	11200	7460	10
Chromium	0.90	2.02	0.98	0.35	<0.20	6.03	0.59	6.03	1.35	<0.20	<0.20	<0.20	0.20
Cobalt	0.870	0.347	0.519	0.385	0.415	1.39	0.267	1.39	0.254	0.385	0.059	1.34	0.020
Copper	12.0	1.28	7.57	8.28	10.0	3.44	15.7	3.44	1.71	9.32	0.975	10.3	0.050
Iron	235	860	340	194	116	2110	244	2110	551	80	53	106	10
Lead	0.151	1.04	0.125	0.093	0.076	3.47	0.274	3.47	1.94	0.041	0.620	0.046	0.010
Magnesium	5450	964	4710	6720	3690	2770	3790	2770	1500	6840	898	4330	10
Manganese	118	20.7	51.2	75.7	114	70.1	411	70.1	29.4	84.9	25.0	220	0.10
Mercury	0.012	0.037	<0.010	0.011	<0.010	0.085	0.023	0.085	0.086	<0.010	0.036	<0.010	0.010
Molybdenum	0.365	<0.050	0.098	0.130	0.130	0.260	0.110	0.260	0.352	1.11	<0.050	0.224	0.050
Nickel	5.00	1.34	2.78	2.06	2.88	12.2	18.9	12.2	1.96	10.7	0.247	1.86	0.050
Phosphorus	8290	327	5010	4510	6020	622	3250	622	473	3410	278	5240	10
Potassium	18700	1180	14600	17200	15700	1690	9770	1690	1910	15400	1570	15800	10
Selenium	<0.050	0.057	<0.050	<0.050	<0.050	0.090	<0.050	0.090	0.093	<0.050	0.058	<0.050	0.050
Silver	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.020
Sodium	41	199	17	14	21	276	<10	276	304	<10	282	20	10
Strontium	10.1	5.74	6.36	4.81	6.58	5.64	3.75	5.64	5.60	4.40	8.33	7.26	0.10
Thallium	0.0051	0.0101	0.0050	0.0040	0.0067	0.0249	0.0042	0.0249	0.0103	0.0051	0.0023	0.0040	0.0020
Tin	<0.10	<0.10	<0.10	<0.10	0.23	0.16	<0.10	0.16	<0.10	<0.10	<0.10	<0.10	0.10
Titanium	5.1	32.4	7.3	5.3	2.1	67.9	6.5	67.9	21.6	1.2	2.6	1.3	1.0
Uranium	0.0242	0.0600	0.0308	0.0092	0.0079	0.405	0.0474	0.405	0.147	0.0047	0.0152	0.0022	0.0020
Vanadium	<0.20	1.23	0.25	0.22	<0.20	2.52	0.22	2.52	0.71	<0.20	<0.20	<0.20	0.20
Zinc	131	11.7	70.0	73.5	208	20.4	65.8	20.4	19.2	242	29.1	221	0.20

[1] Collection sites were re-labelled following the 2013 field program to provide consistency between years and facilitate mapping; the lab results reported here are by the new Site ID and can be referenced to the Original Site ID in the 2013 Annual Terrestrial Monitoring Report, Table 6, Section 2.2.1

[2] Total metals (units mg/kg dry weight) unless otherwise indicated

[3] Reportable Detection Limit (RDL)

Table D-18. 2012 Soil metal analysis (n=36), sample sites L-11 to L-30 (new site ID)[1].

Parameter[2]	CCME Agri[3]	CCME Ind[3]	L-11	L-13	L-18	L-20	L-21	L-24	L-26	L-27	L-28	L-30	RDL[4]
pH	6–8	6–8	8.35	8.57	7.45	5.90	4.83	6.83	6.64	7.59	5.94	5.66	0.010
Aluminum	NA	NA	4390	543	2140	4030	4540	2960	2750	6120	11900	474	100
Antimony	20	40	<0.10	<0.10	0.85	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Arsenic	12	12	1.43	<0.50	4.14	<0.50	<0.50	<0.50	<0.50	0.91	<0.50	<0.50	0.50
Barium	750	2000	17.3	2.07	7.33	15.4	8.26	9.20	7.22	23.1	47.0	1.73	0.10
Beryllium	4	8	<0.40	<0.40	0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.54	<0.40	0.40
Bismuth	NA	NA	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Cadmium	1.4	22	0.132	<0.050	<0.050	0.055	<0.050	0.066	0.072	0.275	0.103	<0.050	0.050
Calcium	NA	NA	20500	5580	1070	1760	398	1310	662	1870	1840	263	100
Chromium	64	87	16.9	3.8	24.3	21.8	13.1	13.1	7.8	36.0	26.8	2.1	1.0
Cobalt	40	300	3.74	0.57	2.48	3.45	2.44	2.71	2.27	5.94	7.11	0.42	0.30
Copper	63	91	8.77	0.67	4.53	4.29	2.21	2.78	3.58	10.2	10.1	0.81	0.50
Iron	NA	NA	8920	2370	49700	19900	8750	7530	4650	13900	18200	1550	100
Lead	70	600	7.85	1.18	1.93	4.13	4.03	2.02	3.02	6.83	4.75	0.65	0.10
Lithium	NA	NA	13.0	<5.0	7.0	9.9	9.2	6.7	<5.0	15.1	13.5	<5.0	5.0
Magnesium	NA	NA	13800	2910	2270	3030	1960	2430	1280	5360	7400	269	100
Manganese	NA	NA	147	18.3	99.3	105	80.3	88.7	78.7	190	213	13.6	0.20
Mercury	6.6	50	<0.050	<0.050	0.097	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.050
Molybdenum	5	40	0.12	<0.10	0.77	<0.10	<0.10	<0.10	<0.10	0.15	0.24	<0.10	0.10
Nickel	50	50	10.2	1.64	14.8	8.88	5.32	7.49	4.97	22.2	15.9	1.07	0.80
Phosphorus	NA	NA	246	178	312	549	181	314	167	325	583	109	10
Potassium	NA	NA	1110	136	301	663	522	484	387	1240	2150	107	100
Selenium	1	2.9	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50
Silver	20	40	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.050
Sodium	500	NA	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	100
Strontium	NA	NA	9.01	3.12	3.22	3.82	1.92	2.60	1.97	3.54	7.11	0.94	0.10
Thallium	1	1	0.129	<0.050	<0.050	0.061	0.068	0.066	<0.050	0.144	0.126	<0.050	0.050
Tin	5	300	0.29	<0.10	0.14	0.37	0.31	0.22	0.16	0.49	0.56	<0.10	0.10
Titanium	NA	NA	291	61.2	157	476	353	363	192	638	929	49.4	1.0
Uranium	23	300	0.476	0.149	0.976	1.19	0.321	0.423	0.291	1.42	1.61	0.151	0.050
Vanadium	130	130	15.1	3.9	8.6	33.8	14.8	13.0	7.6	22.4	31.2	2.2	2.0

Zinc	200	360	13.9	2.4	6.6	15.9	16.9	10.5	8.1	23.1	39.1	2.1	1.0
Zirconium	NA	NA	5.09	0.91	0.99	2.61	<0.50	2.04	1.55	8.69	3.87	<0.50	0.50

[1] Collection sites were re-labelled following the 2013 field program to provide consistency between years and facilitate mapping; the lab results reported here are by the new Site ID and can be referenced to the Original Site ID in the 2013 Annual Terrestrial Monitoring Report, Table 6, Section 2.2.1

[2] Total metals (units mg/kg dry weight) unless otherwise indicated

[3] Agriculture and Industrial Soil Quality Guidelines provided by the Canadian Council of Ministers of the Environment (CCME)

[4] Reportable Detection Limit (RDL)

Table D-19. 2012 Soil metal analysis (n=36), sample sites L-31 to L-40 (new site ID)[1].

Parameter[2]	CCME Agri[3]	CCME Ind[3]	L-31	L-32	L-33	L-34	L-35	L-36	L-37	L-38	L-39	L-40	RDL[4]
pH	6–8	6–8	5.19	6.02	6.62	7.60	8.38	5.21	5.64	5.55	6.05	5.15	0.010
Aluminum	NA	NA	2380	4090	1920	3780	3360	5910	4740	7790	4490	4610	100
Antimony	20	40	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Arsenic	12	12	<0.50	<0.50	<0.50	1.03	1.23	<0.50	<0.50	<0.50	<0.50	<0.50	0.50
Barium	750	2000	17.1	16.2	8.20	19.7	15.3	29.9	16.0	22.0	15.1	10.9	0.10
Beryllium	4	8	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.40
Bismuth	NA	NA	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.11	<0.10	<0.10	0.10
Cadmium	1.4	22	<0.050	0.241	<0.050	<0.050	0.164	0.073	0.180	0.061	0.097	<0.050	0.050
Calcium	NA	NA	397	1960	1080	4700	42300	1590	1790	1580	1720	760	100
Chromium	64	87	6.2	19.4	8.9	9.0	8.7	17.6	11.5	17.4	12.8	11.2	1.0
Cobalt	40	300	1.55	3.78	1.74	2.94	2.64	3.41	2.61	4.44	2.91	2.53	0.30
Copper	63	91	2.00	5.46	1.31	5.22	3.93	8.74	3.95	6.68	3.75	2.82	0.50
Iron	NA	NA	6530	11500	5050	10600	7680	12500	8900	13500	9290	7960	100
Lead	70	600	3.15	5.16	2.27	5.55	6.23	5.42	3.16	5.25	3.91	2.27	0.10
Lithium	NA	NA	5.0	11.2	<5.0	8.0	9.5	10.2	6.8	15.2	8.6	9.7	5.0
Magnesium	NA	NA	1500	3330	1420	3990	26100	3380	2430	3570	2780	3170	100
Manganese	NA	NA	57.1	145	56.7	155	134	105	71.7	125	103	69.6	0.20
Mercury	6.6	50	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.050
Molybdenum	5	40	0.15	0.28	<0.10	0.34	0.16	0.32	0.14	0.21	0.16	<0.10	0.10
Nickel	50	50	4.40	9.67	4.11	5.11	4.55	9.24	6.04	11.5	6.36	6.26	0.80
Phosphorus	NA	NA	130	515	252	391	405	437	539	451	308	308	10
Potassium	NA	NA	418	990	591	1070	1010	598	587	928	863	575	100
Selenium	1	2.9	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50
Silver	20	40	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.050
Sodium	500	NA	<100	<100	<100	121	<100	<100	<100	<100	<100	<100	100
Strontium	NA	NA	2.04	4.76	2.15	5.69	16.8	5.37	3.82	5.21	4.13	2.18	0.10
Thallium	1	1	<0.050	0.120	<0.050	0.098	0.095	0.101	<0.050	0.079	0.095	0.056	0.050
Tin	5	300	0.44	0.46	0.22	0.59	0.43	0.62	0.33	0.57	0.39	0.39	0.10
Titanium	NA	NA	344	621	317	526	392	661	529	935	564	281	1.0
Uranium	23	300	0.940	2.48	0.329	0.920	0.592	2.24	1.07	1.67	0.604	0.605	0.050
Vanadium	130	130	12.0	19.7	9.3	17.3	14.7	21.4	15.2	23.1	17.1	14.0	2.0

Zinc	200	360	10.6	18.2	10.0	18.9	14.1	26.7	15.7	27.5	16.2	17.1	1.0
Zirconium	NA	NA	0.57	10.2	1.74	2.23	5.45	2.24	6.36	2.09	3.16	0.67	0.50

[1] Collection sites were re-labelled following the 2013 field program to provide consistency between years and facilitate mapping; the lab results reported here are by the new Site ID and can be referenced to the Original Site ID in the 2013 Annual Terrestrial Monitoring Report, Table 6, Section 2.2.1

[2] Total metals (units mg/kg dry weight) unless otherwise indicated

[3] Agriculture and Industrial Soil Quality Guidelines provided by the Canadian Council of Ministers of the Environment (CCME)

[4] Reportable Detection Limit (RDL)

Table D-20. 2012 Soil metal analysis (n=36) sample sites L-41 to L-48 (new site ID)[1].

Parameter[2]	CCME Agri[3]	CCME Ind[3]	L-41	L-42	L-43	L-44	L-45	L-46	L-47[4]	L-47[4]	L-48	RDL[5]
pH	6–8	6–8	5.10	5.45	5.41	4.92	5.59	4.89	4.58	7.80	4.80	0.010
Aluminum	NA	NA	3330	7250	2990	2170	3280	39300	951	3450	15700	100
Antimony	20	40	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Arsenic	12	12	<0.50	<0.50	<0.50	<0.50	<0.50	2.93	<0.50	1.06	<0.50	0.50
Barium	750	2000	11.7	12.5	21.3	7.82	15.0	126	16.6	18.2	132	0.10
Beryllium	4	8	<0.40	<0.40	<0.40	<0.40	<0.40	1.78	<0.40	<0.40	0.76	0.40
Bismuth	NA	NA	<0.10	<0.10	<0.10	<0.10	<0.10	0.19	<0.10	<0.10	<0.10	0.10
Cadmium	1.4	22	<0.050	0.060	0.126	<0.050	0.255	<0.050	0.054	<0.050	0.275	0.050
Calcium	NA	NA	1080	1050	951	1040	1380	2750	18800	5320	3760	100
Chromium	64	87	14.0	12.3	7.9	12.5	3.7	55.7	1.6	9.7	29.4	1.0
Cobalt	40	300	1.87	3.03	2.11	2.12	2.14	17.5	0.37	3.03	11.5	0.30
Copper	63	91	1.15	3.96	3.11	1.51	4.16	43.0	10.3	6.65	48.4	0.50
Iron	NA	NA	7450	14300	10500	10900	9140	45900	1910	10200	31300	100
Lead	70	600	2.15	5.12	4.36	4.08	6.06	31.7	1.42	5.41	15.0	0.10
Lithium	NA	NA	6.9	10.9	7.7	<5.0	<5.0	54.3	<5.0	8.0	26.9	5.0
Magnesium	NA	NA	1690	2490	1760	1510	1320	17000	3890	3630	10600	100
Manganese	NA	NA	51.0	68.6	64.8	63.3	57.7	416	7.93	116	259	0.20
Mercury	6.6	50	<0.050	<0.050	<0.050	<0.050	<0.050	0.088	0.152	<0.050	<0.050	0.050
Molybdenum	5	40	<0.10	0.19	0.39	0.12	<0.10	2.53	0.36	0.21	1.39	0.10
Nickel	50	50	5.12	6.95	3.98	4.33	2.33	37.7	1.49	4.77	23.9	0.80
Phosphorus	NA	NA	492	390	367	324	521	847	778	266	876	10
Potassium	NA	NA	618	525	834	281	617	2600	290	535	2620	100
Selenium	1	2.9	<0.50	<0.50	<0.50	<0.50	<0.50	0.51	<0.50	<0.50	<0.50	0.50
Silver	20	40	<0.050	<0.050	<0.050	<0.050	<0.050	0.198	<0.050	<0.050	0.094	0.050
Sodium	500	NA	<100	<100	<100	<100	<100	185	<100	<100	299	100
Strontium	NA	NA	2.58	2.75	2.04	3.17	3.08	20.9	21.9	6.61	15.8	0.10
Thallium	1	1	<0.050	0.059	0.078	<0.050	<0.050	0.431	0.064	0.066	0.435	0.050
Tin	5	300	0.35	0.51	0.31	0.45	0.37	2.66	0.12	0.44	1.80	0.10
Titanium	NA	NA	289	583	411	555	365	2060	86.1	547	1730	1.0
Uranium	23	300	0.525	0.985	1.19	0.665	1.06	5.37	6.13	1.28	5.26	0.050
Vanadium	130	130	11.7	26.2	17.0	19.6	14.3	83.9	2.3	18.7	52.4	2.0

Zinc	200	360	12.1	19.0	16.9	11.7	13.1	118	21.9	18.7	93.4	1.0
Zirconium	NA	NA	0.60	1.77	5.43	0.73	11.0	37.9	1.45	1.41	6.29	0.50

[1] Collection sites were re-labelled following the 2013 field program to provide consistency between years and facilitate mapping; the lab results reported here are by the new Site ID and can be referenced to the Original Site ID in the 2013 Annual Terrestrial Monitoring Report, Table 6, Section 2.2.1

[2] Total metals (units mg/kg dry weight) unless otherwise indicated

[3] Agriculture and Industrial Soil Quality Guidelines provided by the Canadian Council of Ministers of the Environment (CCME)

[4] Two soil samples were taken from sample site L-47

[5] Reportable Detection Limit (RDL)

Table D-21. 2012 Soil metal analysis (n=36) sample sites L-49 to L-55 (new site ID)[1].

Parameter[2]	CCME Agri[3]	CCME Ind[3]	L-49	L-50	L-51	L-52	L-53	L-54	L-55	RDL[4]
pH	6–8	6–8	6.17	5.07	6.40	4.98	5.34	5.38	8.81	0.010
Aluminum	NA	NA	3890	3010	3270	3980	10600	3440	1980	100
Antimony	20	40	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Arsenic	12	12	<0.50	<0.50	<0.50	<0.50	0.51	<0.50	<0.50	0.50
Barium	750	2000	33.5	13.1	34.4	11.3	21.7	21.8	9.28	0.10
Beryllium	4	8	<0.40	<0.40	<0.40	<0.40	0.64	<0.40	<0.40	0.40
Bismuth	NA	NA	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Cadmium	1.4	22	0.150	<0.050	<0.050	<0.050	0.128	<0.050	<0.050	0.050
Calcium	NA	NA	3900	1170	2270	1120	1900	1420	1800	100
Chromium	64	87	21.1	14.7	27.6	13.6	28.2	19.9	8.3	1.0
Cobalt	40	300	4.84	2.55	3.70	3.19	6.22	3.85	1.83	0.30
Copper	63	91	13.0	6.73	8.60	3.04	21.3	9.19	3.10	0.50
Iron	NA	NA	23000	12700	14000	16100	21100	14400	8370	100
Lead	70	600	5.85	4.29	3.36	5.93	8.23	3.22	2.03	0.10
Lithium	NA	NA	8.4	5.2	6.3	6.5	23.5	8.9	5.3	5.0
Magnesium	NA	NA	3310	1890	3330	2770	7230	2460	2220	100
Manganese	NA	NA	100	64.1	80.1	94.8	225	81.3	51.2	0.20
Mercury	6.6	50	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.050
Molybdenum	5	40	0.42	0.19	0.19	0.20	0.28	0.15	<0.10	0.10
Nickel	50	50	7.53	5.90	8.49	5.76	11.5	8.24	3.42	0.80
Phosphorus	NA	NA	1500	303	515	402	610	495	237	10
Potassium	NA	NA	1270	438	633	549	1270	1040	527	100
Selenium	1	2.9	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50
Silver	20	40	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.050
Sodium	500	NA	116	107	134	<100	<100	<100	<100	100
Strontium	NA	NA	7.60	4.06	9.43	2.45	5.08	2.77	3.83	0.10
Thallium	1	1	0.079	<0.050	0.057	0.059	0.123	0.064	<0.050	0.050
Tin	5	300	0.70	0.38	0.43	0.51	0.84	0.36	0.24	0.10
Titanium	NA	NA	586	349	691	707	810	602	271	1.0
Uranium	23	300	1.52	1.32	1.14	0.977	1.72	0.602	0.441	0.050
Vanadium	130	130	47.9	26.5	28.6	28.3	34.7	28.9	15.8	2.0

Zinc	200	360	22.8	13.4	18.4	24.5	46.0	18.1	10.2	1.0
Zirconium	NA	NA	6.08	1.46	1.24	1.13	2.56	0.77	0.85	0.50

[1] Collection sites were re-labelled following the 2013 field program to provide consistency between years and facilitate mapping; the lab results reported here are by the new Site ID and can be referenced to the Original Site ID in the 2013 Annual Terrestrial Monitoring Report, Table 6, Section 2.2.1

[2] Total metals (units mg/kg dry weight) unless otherwise indicated

[3] Agriculture and Industrial Soil Quality Guidelines provided by the Canadian Council of Ministers of the Environment (CCME)

[4] Reportable Detection Limit (RDL)

Table D-22. 2012 Vegetation metal analysis (n=34), sample sites L-11 to L-32 (new site ID)[1].

Parameter[2]	L-11 (lichen)	L-13 (lichen)	L-18 (lichen)	L-20 (lichen)	L-21 (lichen)	L-24 (lichen))	L-26 (lichen)	L-28 (lichen)	L-30 (lichen)	L-31 (lichen)	L-32 (lichen)	RDL[3]
Aluminum	70.5	312	49.9	216	149	106	909	239	58.6	110	562	1.0
Antimony	0.0143	0.0071	<0.0050	0.0085	0.0055	0.0073	0.0064	0.0085	0.0107	0.0057	0.0132	0.0050
Arsenic	<0.050	0.112	<0.050	0.123	<0.050	<0.050	0.234	0.122	<0.050	0.066	0.181	0.050
Barium	3.04	4.65	2.59	20.6	8.16	4.54	13.2	26.0	3.28	15.1	17.0	0.10
Beryllium	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Bismuth	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Boron	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0
Cadmium	0.068	0.064	0.044	0.241	0.116	0.040	0.192	0.178	0.045	0.117	0.182	0.010
Calcium	33300	18700	14100	25700	11200	15500	12700	7040	13100	4120	11300	10
Chromium	0.26	1.47	0.21	0.62	0.36	0.44	4.09	0.59	0.24	0.26	1.84	0.20
Cobalt	0.061	0.282	0.051	0.196	0.146	0.098	0.782	0.288	0.060	0.118	0.475	0.020
Copper	0.941	1.23	0.661	1.14	0.738	0.928	1.79	1.10	0.628	0.750	1.81	0.050
Iron	82	473	67	279	197	183	1310	273	74	122	791	10
Lead	0.539	1.76	0.391	2.93	0.784	0.751	4.29	2.57	0.609	1.38	1.85	0.010
Magnesium	3010	1590	931	1180	755	1400	690	443	911	459	1450	10
Manganese	12.0	26.1	11.6	25.6	46.8	11.1	49.3	25.1	16.2	31.6	46.2	0.10
Mercury	0.059	0.055	0.051	0.094	0.050	0.062	0.059	0.068	0.052	0.041	0.066	0.010
Molybdenum	<0.050	<0.050	<0.050	0.055	0.199	0.078	0.067	<0.050	<0.050	<0.050	0.101	0.050
Nickel	0.238	1.21	0.084	0.972	0.265	0.288	2.46	0.700	0.051	0.435	1.46	0.050
Phosphorus	336	500	394	353	318	389	388	318	422	296	576	10
Potassium	1410	1800	1630	1200	1420	1380	1140	1090	1420	1100	1980	10
Selenium	0.071	<0.050	<0.050	0.075	<0.050	0.050	0.105	0.077	<0.050	0.079	0.061	0.050
Silver	0.045	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.020
Sodium	358	337	330	154	262	196	31	44	291	150	318	10
Strontium	10.8	8.46	4.08	34.3	5.84	5.64	13.6	27.1	4.46	9.80	23.3	0.10
Thallium	0.0033	0.0092	0.0021	0.0067	0.0042	0.0036	0.0194	0.0072	0.0037	0.0045	0.0155	0.0020
Tin	0.50	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.14	0.10
Titanium	3.2	21.5	3.3	16.6	15.3	8.3	73.2	17.1	3.9	9.7	61.6	1.0
Uranium	0.0170	0.0481	0.0085	0.0733	0.0193	0.0392	0.109	0.0549	0.0108	0.0453	0.847	0.0020
Vanadium	<0.20	0.76	<0.20	0.51	0.34	0.24	2.50	0.42	<0.20	<0.20	1.36	0.20
Zinc	15.3	12.2	12.4	14.1	19.8	9.10	11.8	13.6	10.4	13.1	28.3	0.20

[1] Collection sites were re-labelled following the 2013 field program to provide consistency between years and facilitate mapping; the lab results reported here are by the new Site ID and can be referenced to the Original Site ID in the 2013 Annual Terrestrial Monitoring Report, Table 6, Section 2.2.1

[2] Total metals (units mg/kg dry weight) unless otherwise indicated

[3] Reportable Detection Limit (RDL)

Table D-23. 2012 Vegetation metal analysis (n=34), sample sites L-33 to L-43 (new site ID)[1].

Parameter[2]	L-33 (lichen)	L-34 (lichen)	L-35 (lichen)	L-36 (lichen)	L-37 (lichen)	L-38 (lichen)	L-39 (lichen)	L-40 (lichen)	L-41 (lichen)	L-42 (lichen)	L-43 (lichen)	RDL[3]
Aluminum	54.4	37.6	44.2	92.0	311	106	107	102	112	94.0	154	1.0
Antimony	0.0053	<0.0050	0.0071	0.0071	0.0064	<0.0050	0.0100	0.0086	0.0056	0.0092	0.0052	0.0050
Arsenic	<0.050	<0.050	<0.050	<0.050	0.125	0.125	<0.050	<0.050	0.060	0.071	0.154	0.050
Barium	4.42	2.26	4.36	7.73	43.3	15.2	4.51	18.1	16.1	32.0	16.0	0.10
Beryllium	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Bismuth	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Boron	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0
Cadmium	0.054	0.039	0.045	0.046	0.297	0.203	0.046	0.150	0.123	0.240	0.144	0.010
Calcium	6430	13500	14100	5160	11000	4610	7910	7760	7900	11100	10000	10
Chromium	<0.20	<0.20	<0.20	<0.20	0.46	0.26	0.57	<0.20	<0.20	<0.20	0.23	0.20
Cobalt	0.036	0.031	0.036	0.134	0.497	0.167	0.096	0.282	0.188	0.342	0.147	0.020
Copper	0.747	0.589	0.774	0.760	0.951	0.574	0.894	0.740	0.837	0.899	0.935	0.050
Iron	66	47	64	107	252	91	131	121	124	83	130	10
Lead	0.226	0.277	0.302	0.411	4.44	3.19	0.390	1.11	0.882	1.30	2.21	0.010
Magnesium	753	1190	1730	625	527	252	953	815	869	1240	628	10
Manganese	34.3	7.55	9.73	60.4	34.1	16.7	46.2	74.0	60.9	82.9	28.4	0.10
Mercury	0.044	0.044	0.041	0.047	0.069	0.081 (1)	0.062	0.055	0.051	0.025	0.084	0.010
Molybdenum	<0.050	0.087	0.138	<0.050	<0.050	<0.050	0.050	<0.050	<0.050	<0.050	0.055	0.050
Nickel	0.470	0.075	0.166	0.107	0.994	0.393	0.475	0.499	0.292	0.547	0.216	0.050
Phosphorus	288	354	346	375	360	184	557	344	367	318	247	10
Potassium	1190	1410	1560	1410	1320	798	2130	1610	1590	1390	1030	10
Selenium	<0.050	<0.050	<0.050	<0.050	0.106	0.075	<0.050	0.066	0.056	<0.050	0.065	0.050
Silver	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.020
Sodium	188	312	266	339	200	72	552	366	342	361	113	10
Strontium	2.76	4.96	6.16	6.68	38.2	19.7	5.73	18.6	18.8	33.8	44.0	0.10
Thallium	0.0020	<0.0020	0.0027	0.0032	0.0074	0.0040	0.0040	0.0029	0.0041	0.0031	0.0032	0.0020
Tin	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Titanium	4.9	3.7	4.0	10.0	18.0	8.4	9.3	8.8	10.2	6.6	9.6	1.0
Uranium	0.0149	0.0148	0.0383	0.0349	0.0642	0.0230	0.0217	0.0185	0.0327	0.0278	0.102	0.0020
Vanadium	<0.20	<0.20	<0.20	<0.20	0.33	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.20
Zinc	15.7	11.0	15.8	15.4	15.4	11.7	23.8	24.0	21.4	29.5	13.4	0.20

[1] Collection sites were re-labelled following the 2013 field program to provide consistency between years and facilitate mapping; the lab results reported here are by the new Site ID and can be referenced to the Original Site ID in the 2013 Annual Terrestrial Monitoring Report, Table 6, Section 2.2.1

[2] Total metals (units mg/kg dry weight) unless otherwise indicated

[3] Reportable Detection Limit (RDL)

Table D-24. 2012 Vegetation metal analysis (n=34), sample sites L-44 toL-55 (new site ID)[1].

Parameter[2]	L-44 (lichen)	L-45 (lichen)	L-46 (lichen)	L-47 (lichen)	L-48 (lichen)	L-49 (lichen)	L-50 (lichen)	L-51 (lichen)	L-52 (lichen)	L-53 (lichen)	L-54 (lichen)	L-55 (lichen)	RDL[3]
Aluminum	62.9	392	510	20.5	230	38.5	65.4	37.1	56.3	32.3	41.0	185	1.0
Antimony	0.0058	0.0104	0.0053	<0.0050	0.0078	<0.0050	<0.0050	<0.0050	0.0141	0.0054	<0.0050	0.0062	0.0050
Arsenic	0.066	0.092	0.508	0.067	0.109	0.096	0.061	<0.050	0.054	0.091	0.075	0.061	0.050
Barium	9.48	37.1	16.7	1.66	14.8	4.67	8.11	6.59	4.39	2.25	3.99	8.16	0.10
Beryllium	<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
Bismuth	<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
Boron	<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
Cadmium	0.127	0.185	0.234	0.079	0.050	0.107	0.136	0.070	0.079	0.115	0.114	0.050	0.010
Calcium	9620	5880	33500	3350	2360	2410	5410	6940	3620	3020	4280	11000	10
Chromium	0.32	0.38	0.81	<0.20	0.46	<0.20	<0.20	<0.20	<0.20	<0.20	0.73	0.56	0.20
Cobalt	0.109	0.371	0.286	0.048	0.434	0.233	0.147	0.100	0.064	0.070	0.262	0.116	0.020
Copper	0.962	1.28	1.53	0.505	2.03	1.24	0.818	0.992	1.12	0.718	1.13	1.41	0.050
Iron	91	384	526	27	329	52	63	52	69	39	66	307	10
Lead	1.04	1.68	1.71	1.14	0.545	1.57	1.74	0.491	0.793	2.08	1.74	0.695	0.010
Magnesium	523	760	783	206	853	198	268	777	343	195	277	1460	10
Manganese	57.3	64.4	33.2	7.91	34.6	11.6	26.2	35.0	41.8	9.89	13.0	18.8	0.10
Mercury	0.112	0.096	0.036	0.168	0.021	0.084	0.087	0.070	0.035	0.041	0.056	0.087	0.010
Molybdenum	<0.050	<0.050	0.051	<0.050	0.074	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.070	0.050
Nickel	0.356	0.446	0.662	0.086	0.641	0.572	0.266	<0.050	0.531	0.155	0.547	0.468	0.050
Phosphorus	512	357	397	214	441	206	284	491	465	202	250	476	10
Potassium	1500	1100	1610	786	1130	807	949	1490	1320	800	906	1700	10
Selenium	0.102	0.072	0.071	0.088	0.071	0.140	0.075	0.067	0.083	0.111	0.119	0.053	0.050
Silver	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.020
Sodium	222	100	402	27	46	19	57	428	104	21	25	276	10
Strontium	18.8	26.6	68.1	6.21	12.1	5.99	10.9	16.6	6.25	8.24	15.5	10.1	0.10
Thallium	0.0021	0.0058	0.0106	0.0021	0.0073	0.0028	0.0022	0.0027	0.0044	<0.0020	<0.0020	0.0041	0.0020
Tin	<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
Titanium	7.2	26.0	43.1	1.5	18.7	3.5	4.2	3.1	4.5	2.8	4.0	18.8	1.0
Uranium	0.0338	0.0353	0.103	0.0307	0.0836	0.0108	0.0344	0.0203	0.0219	0.0081	0.0131	0.0411	0.0020
Vanadium	<0.20	0.50	0.92	<0.20	0.53	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.50	0.20
Zinc	14.7	20.3	14.9	8.57	15.8	11.1	11.8	18.0	13.6	9.48	11.9	14.7	0.20

[1] Collection sites were re-labelled following the 2013 field program to provide consistency between years and facilitate mapping; the lab results reported here are by the new Site ID and can be referenced to the Original Site ID in the 2013 Annual Terrestrial Monitoring Report, Table 6, Section 2.2.1

[2] Total metals (units mg/kg dry weight) unless otherwise indicated

[3] Reportable Detection Limit (RDL)

APPENDIX E BIRD SPECIES OBSERVED WITHIN THE MARY RIVER PROJECT TERRESTRIAL REGIONAL STUDY AREA, 2006–2016

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Table E-1 Bird species observed within the Mary River Project Terrestrial Regional Study Area, 2006 — 2016.

Species	Latin	2006	2007	2008	2012	2013	2014	2015	2016*
Snow Goose	*Chen caerulescens*	B	B	B	S	S	B	S	S
Brant	*Branta bernicla*	S	-	-	-	-	-	-	-
Cackling Goose	*Branta hutchinsii*	-	-	-	-	B	S	S	-
Canada Goose	*Branta canadensis*	-	-	-	-	B	S	S	S
Canada/Cackling Goose	*Branta* spp.	B	B	B	B	-	-	-	-
Tundra Swan	*Cygnus columbianus*	-	-	B	S	-	-	-	-
King Eider	*Somateria spectabilis*	B	B	B	S	S	-	S	-
Common Eider	*Somateria mollissima*	S	S	S	S	S	-	-	-
Long-tailed Duck	*Clangula hyemalis*	B	B	B	S	B	S	S	S
Red-breasted Merganser	*Mergus serrator*	B	B	B	S	S	-	S	-
Rock Ptarmigan	*Lagopus muta*	-	-	-	S	S	-	S	-
Unspecified Ptarmigan	*Lagopus* spp.	-	-	S	-	-	S	-	S
Red-throated Loon	*Gavia stellata*	B	B	B	S	B	B	S	S
Pacific Loon	*Gavia pacifica*	B	B	B	S	S	S	-	-
Common Loon	*Gavia immer*	B	B	B	S	S	S	S	-
Yellow-billed Loon	*Gavia adamsii*	B	B	B	S	S	B	S	S
Northern Fulmar	*Fulmarus glacialis*	S	-	-	-	-	-	-	-
Rough-legged Hawk	*Buteo lagopus*	B	B	B	B	B	B	B	B
Gyrfalcon	*Falco rusticolus*	B	B	B	B	B	B	B	B
Peregrine Falcon	*Falco peregrinus tundris*	B	B	B	B	B	B	B	B
Sandhill Crane	*Grus canadensis*	B	B	B	S	B	B	S	S
American Golden-Plover	*Pluvialis dominica*	S	S	S	B	S	S	S	-
Semipalmated Plover	*Charadrius semipalmatus*	-	-	-	B	B	B	S	-
Common Ringed Plover	*Charadrius hiaticula*	S	-	-	-	S	B	S	-
Dunlin	*Calidris alpina*	-	-	-	S	-	-	-	-
White-rumped Sandpiper	*Calidris fuscicollis*	-	-	-	-	B	-	-	-
Baird's Sandpiper	*Calidris bairdii*	S	S	S	B	B	B	S	S
Pectoral Sandpiper	*Calidris melanotos*	-	-	-	S	-	-	-	-
Red Phalarope	*Phalaropus fulicarius*	-	-	-	S	S	-	-	-
Unspecified Phalarope	*Phalaropus* spp.	-	-	S	-	-	-	-	-
Herring Gull	*Larus argentatus*	-	-	-	B	-	-	-	S
Glaucous Gull	*Larus hyperboreus*	-	B	B	B	B	B	S	S
Thayer's Gull	*Larus thayeri*	-	-	-	-	B	-	S	-
Arctic Tern	*Sterna paradisaea*	-	S	S	-	-	-	-	-
Long-tailed Jaeger	*Stercorarius longicaudus*	-	-	-	S	-	-	S	-
Unspecified Jaeger	*Stercorarius* spp.	-	-	B	-	-	-	-	-
Snowy Owl	*Bubo scandiacus*	B	B	B	S	S	B	S	S
Short-eared Owl	*Asio flammeus*	-	-	S	-	-	-	-	-
Common Raven	*Corvus corax*	S	S	B	B	S	B	S	S
Horned Lark	*Eremophila alpestris*	S	S	S	B	S	S	S	S
Northern Wheatear	*Oenanthe oenanthe*	-	-	-	-	S	U	S	-
American Pipit	*Anthus rubescens*	S	S	S	B	B	-	S	-
Lapland Longspur	*Calcarius lapponicus*	S	S	S	B	B	S	S	S

Table E-1 Bird species observed within the Mary River Project Terrestrial Regional Study Area, 2006 — 2016.

Species	Latin	2006	2007	2008	2012	2013	2014	2015	2016*
Snow Bunting	*Plectrophenax nivalis*	S	S	S	B	B	S	S	S
Common Redpoll	*Carduelis flammea*	-	-	-	S	-	-	-	-
Hoary Redpoll	*Carduelis hornemanni*	-	-	-	S	-	-	-	-

Symbology: B = Confirmed Breeding; S = Confirmed Present; U = unconfirmed observation

*No formal bird surveys were conducted in 2016, and therefore all observations are incidental; from when qualified biologists were on site.