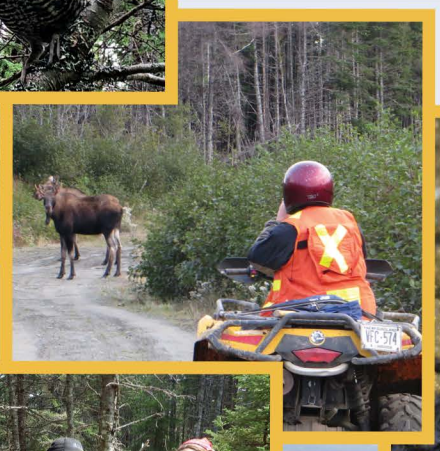
MARATHON GOLD

Valentine Gold Project Baseline Study Appendix 2: Woodland Caribou

September 2020



Valentine Gold Project
Environmental Impact Statement

Final Report

Baseline Study Appendix 2: Woodland Caribou (BSA.2)

Prepared for:

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September 25, 2020

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Abbreviations and Acronyms

ARD/ML	Acid Rock Drainage / Metal Leaching
BSA	Baseline Study Appendix
EIS	Environmental Impact Statement
km	kilometres
km^2	square kilometres
LiDAR	Light Detection and Ranging
Marathon	Marathon Gold Corporation
NL	Newfoundland and Labrador
NLDFFA–WD	Newfoundland and Labrador Department of Fisheries, Forestry and Agriculture – Wildlife Division
NLDECCM	Newfoundland and Labrador Department of Environment, Climate Change and Municipalities
NLEPA	Newfoundland and Labrador *Environmental Protection Act*
SAR	Species at Risk
SOCC	Species of Conservation Concern
TMF	tailings management facility
VC	Valued Component
ZOI	Zone of Influence

1.0 INTRODUCTION

Marathon Gold Corporation (Marathon) is planning to develop an open pit gold mine south of Valentine Lake, located in the Central Region of the Island of Newfoundland, approximately 60 kilometres (km) southwest of the town of Millertown, Newfoundland and Labrador (NL) (Figure 1-1). The Valentine Gold Project (the Project) will consist primarily of open pits, waste rock piles, crushing and stockpiling areas, conventional milling and processing facilities (the mill), a tailings management facility, personnel accommodations, and supporting infrastructure including roads, on-site power lines, buildings, and water and effluent management facilities. The mine site is accessed by an existing public access road that extends south from Millertown approximately 88 km to Marathon's existing exploration camp. Marathon will upgrade and maintain the access road from a turnoff approximately 8 km southwest of Millertown to the mine site, a distance of approximately 76 km.

The Minister of the NL Department of Environment, Climate Change and Municipalities (NLDECCM) has determined that the Project will require preparation of an Environmental Impact Statement (EIS) under the provincial *Environmental Protection Act* (NLEPA). The Provincial EIS Guidelines require the preparation of a number of baseline studies to describe and provide data on specific components of the environment; to address baseline data requirements to support the assessment of one or more Valued Components (VCs); and to support the development of mitigation measures and follow-up monitoring programs. Each has been prepared as a stand-alone Baseline Study Appendix (BSA) to the EIS:

- BSA.1: Dam Safety
- BSA.2: Woodland Caribou
- BSA.3: Water Resources
- BSA.4: Fish, Fish Habitat and Fisheries
- BSA.5: Acid Rock Drainage / Metal Leaching (ARD/ML)
- BSA.6: Atmospheric Environment
- BSA.7: Avifauna, Other Wildlife and Their Habitats
- BSA.8: Species at Risk / Species of Conservation Concern (SAR / SOCC)
- BSA.9: Community Health, Services and Infrastructure / Employment and Economy
- BSA.10: Historic Resources

Table 1.1 outlines the organization for BSA.2: Woodland Caribou.

Table 1.1 BSA.2: Woodland Caribou

Number	Baseline Study Appendix	Attachment Number	Attachment Name
BSA.2	Woodland Caribou	2-A	Fall 2019 Caribou Survey – Remote Cameras (2019)
		2-B	Spring 2020 Caribou Survey – Remote Cameras (2020)
		2-C	2020 Post-Calving Aerial Survey (2020)

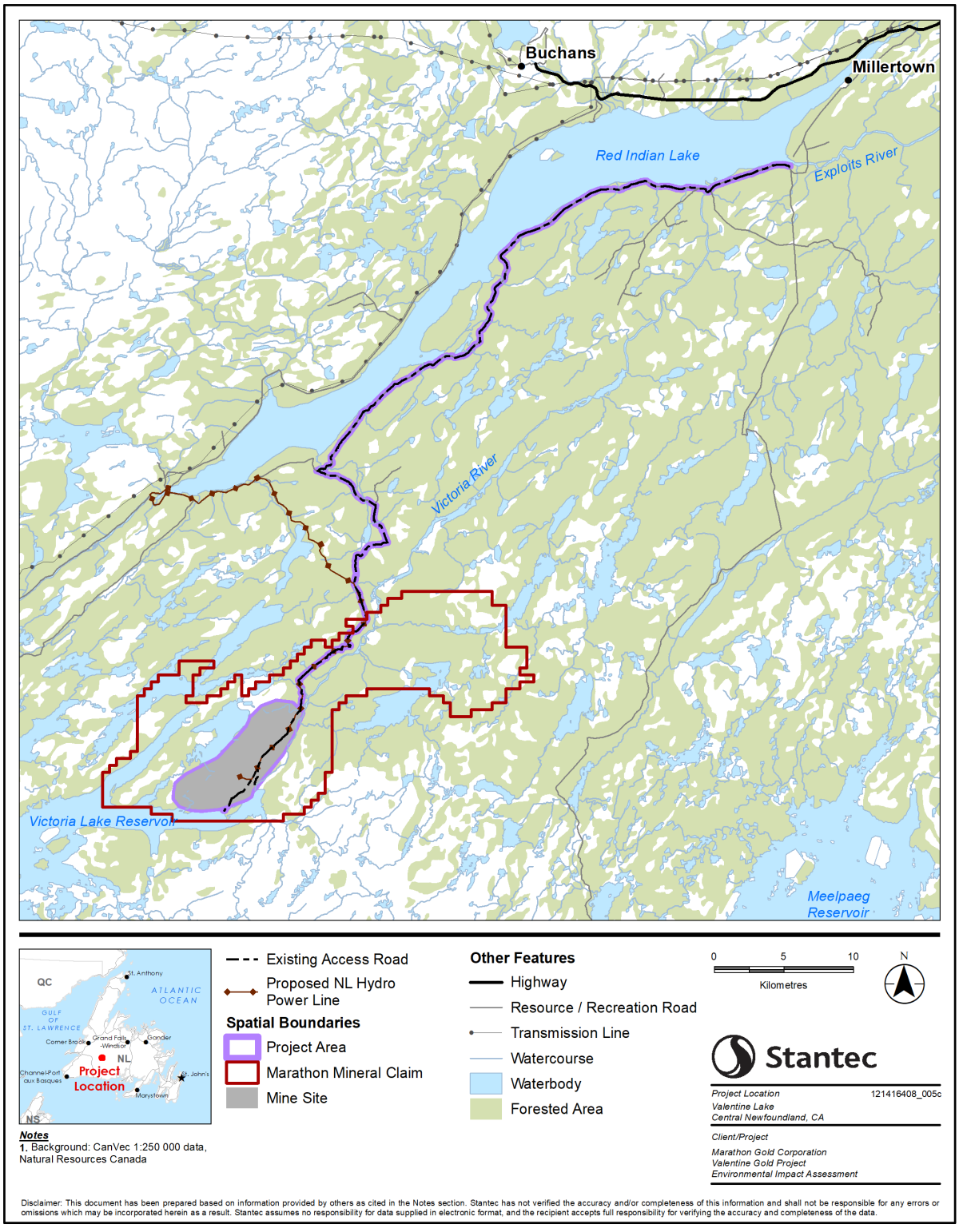

Figure 1-1 Project Area

Note that the BSAs consist of data reports that have been prepared for Marathon over several years (i.e., 2011 to 2020), during which the Project has gone through a series of refinements. The study areas and Project references in these data reports reflect the Project description at the time of preparation of these reports. The current Project description for the purposes of environmental assessment is found in Section 2 of the EIS.

2.0 SUMMARY OF WOODLAND CARIBOU BSA ATTACHMENTS

Three field programs were completed by Stantec Consulting Inc. (Stantec) in support of the assessment of woodland caribou for the Project:

- 2019 caribou survey field program as reported in *Fall 2019 Caribou Survey – Remote Cameras* (2019)
- 2020 caribou survey field program as reported in *Spring 2020 Caribou Survey – Remote Cameras* (2020)
- 2020 post-calving aerial survey of the Buchans and resident caribou (i.e., within the predicted zone of influence [ZOI] of the Project) as reported in *2020 Post-Calving Aerial Survey* (2020)

Table 2.1 provides a summary of the objectives, study area, methods and results of each of these programs and studies.

Table 2.1 Summary of Woodland Caribou BSA Attachments

Rationale / Objectives	Study Area	Methods	Results
Attachment 2-A - Fall 2019 Caribou Survey – Remote Cameras (2019)			
The main objectives were to: • Refine the location of the fall caribou migration routes though the mineral claim area • Estimate the dates of the fall migration period	The Study Area was within the Marathon Mineral Claim Area (Figure 1-1) between Valentine Lake and Victoria River.	**Remote Camera Deployment** Light Detection and Ranging (LiDAR) data of the mineral claim area was systematically reviewed to identify prominent wildlife trails. Based on trails identified from LiDAR data and information provided from the Newfoundland and Labrador Department of Fisheries, Forestry and Agriculture – Wildlife Division (NLDFFA–WD), 12 camera deployment sites were selected. Cameras were deployed following Stantec's standard camera deployment process (Stantec 2015). Cameras were deployed October 5, 2019; retrieval occurred between December 18, 2019 and February 11, 2020. **Remote Camera Data Analysis** Remote camera photos were reviewed and the number of events (distinct group of one or more caribou) noted. Group composition metrics were calculated (i.e., group sizes, sex ratios, and age classes).	Ten of the twelve remote cameras detected caribou, with the greatest number of detections from near the Marathon pit. In total, 157 caribou events were recorded, totaling 2,071 caribou. Mean group size was 13 caribou (range: 1-164). The cameras that detected the caribou were situated near Marathon pit, the main road, and Valentine Lake. The peak of caribou movement occurred from November 9-12, 2019. The male:female ratio was 30 males:100 females with 10% calves.

Rationale / Objectives	Study Area	Methods	Results
Attachment 2-B - Spring 2020 Caribou Survey – Remote Cameras (2020)			
The main objectives were to: • Refine the location of the spring caribou migration routes though the mineral claim area • Estimate the dates of the spring migration period	The Study Area was within the Marathon Mineral Claim Area (Figure 1-1) between Valentine Lake and Victoria River.	**Remote Camera Deployment** As a continuation of the Fall 2019 Caribou Survey, cameras were deployed at 11 of the 12 sites (one site could not be accessed due to field conditions). Cameras were deployed following Stantec's standard camera deployment process (Stantec 2015). Cameras were deployed March 26, 2020 and were retrieved between June 12 and18, 2020. **Remote Camera Data Analysis** Remote camera photos were reviewed and the number of events (distinct group of one or more caribou) noted. Group composition metrics were calculated (i.e., group sizes, sex ratios, and age classes).	All of the deployed cameras detected caribou. The camera sites near Valentine Lake and Marathon pit detected the greatest number of caribou. In total, 205 caribou events were recorded totalling 701 caribou. Mean group size was 6 caribou (range: 10-84). The majority of individual caribou detections were between April 30 and May 17, 2020. The peak of female caribou movement through the mineral claim area was between April 25 and May 7, 2020; peak movement for males was between May 15 and 27, 2020. The male:female ratio was 53 males:100 females.

Rationale / Objectives	Study Area	Methods	Results
Attachment 2-C - 2020 Post-Calving Aerial Survey (2020)			
The objectives were to: • Determine caribou group size and composition on the calving grounds within the ZOI, including the number of calf:female pairs (i.e., classification) • Determine caribou group size and composition on the Buchans herd calving grounds, including the number of calf:female (i.e., classification) • Complete a population estimate of the entire calving grounds for the Buchans herd	Total survey area including area of overlap was approximately 6,101 km^2, located between Hind's Lake, Grand Lake and Victoria Lake. The total survey area included two smaller areas: the calving grounds for the Buchans herd, and a survey area for caribou that calve in the Project ZOI. The survey area was delineated based on telemetry data for the Buchans calving range, discussion with NLDFFA-WD, and the inclusion of a conservative 17-km ZOI surrounding the mine site. It also included a 4-km ZOI surrounding the access road.	**Survey Methods** Transects were established within the survey area at 3-km interval. The transects were overflown by helicopter and all observed caribou were classified. Distance sampling techniques were used during the survey to estimate the perpendicular distance of the caribou from the transect lines (Buckland et al. 2015). **Analysis Methods** Group composition metrics were calculated for observed caribou in both survey areas. For the population estimate, distance sampling methods were used to estimate the relative abundance of caribou within the western section of the survey area. A half-normal detection function was selected based on Akaike Information Criterion.	Classification results were determined for the Buchans calving area, and for caribou that calve in the ZOI. In the Buchans calving area, 1,700 caribou were observed with 10% males and 30% neonate calves. In the ZOI, 212 caribou were observed with 32% males and 11% calves. Population estimate on the Buchans herd calving ground was 1,703 caribou (95% CI: 1,064-2,725).

3.0 REFERENCES

Buckland S.T., E.A. Rexstad, T.A. Marques, and C.S. Oedekoven. 2015. Distance Sampling: Methods and Applications. Springer International Publishing, Switzerland.

Stantec Consulting Ltd. (Stantec) 2015. Remote Camera Monitoring Standard Operating Procedure. 24pp + appendices.

ATTACHMENT 2-A

Fall 2019 Caribou Survey – Remote Cameras (2019)

Valentine Gold Project: Fall 2019 Caribou Survey – Remote Cameras

Final Report

April 1, 2020

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Executive Summary

Marathon Gold Corporation (Marathon) is planning to develop the Valentine Gold Project (the Project), located in the Central Region of the Island of Newfoundland. The Project overlaps with woodland caribou (*Rangifer tarandus*) range in the central portion of the Island of Newfoundland. The Newfoundland and Labrador Department of Fisheries and Land Resources (NLDFLR) has identified seasonal caribou migration paths within Marathon's mineral claim area (Government NL 2019a; Doucet and Morgan 2007 in Wells et al. 2011). Information on the use of these migration paths by caribou was limited to telemetry data provided by NLDFLR.

Stantec Consulting Ltd. (Stantec) undertook a fall caribou migration survey to better understand the timing, distribution and relative use of the migration paths within the Project area. The survey was completed using 12 remote cameras that were deployed in October 2019 at identified migration paths within Marathon's mineral claim area. The cameras were retrieved between December 18, 2019 and February 11, 2020.

The cameras captured more than 2,000 caribou detections during the deployment period. The peak of caribou detections was November 9-12, 2019, although a few detections were captured before and after the peak. Ten of the 12 remote cameras detected caribou, and most detections were from cameras near the Marathon pit.

This report provides a summary of the fall caribou migration monitoring survey within Marathon's mineral claim area.

Abbreviations

cm	Centimeter
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
ESA	*Endangered Species Act*
GIS	Geographic Information System
GPS	Geographic Positioning System
IR	Infrared
km	Kilometre
LiDAR	Light Detection and Ranging
m	Meter
NLDFLR	Newfoundland and Labrador Department of Fisheries and Land Resources
SARA	*Species at Risk Act*

1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec) was retained by Marathon Gold Corporation (Marathon) to conduct a number of environmental studies at the Valentine Gold Project site (the Project), including analysis of woodland caribou (*Rangifer tarandus*) migration and use of the Project site. The results of the baseline studies will be used to support the environmental assessment (EA) of the Project.

At the time of this study (summer 2019), the Project includes four near-surface, mainly pit-shell constrained gold deposits: Marathon Deposit, Leprechaun Deposit, Sprite Deposit and Victory Deposit (Figure 1-1). Additional gold-mineralized zones have been identified immediately to the southwest of the Leprechaun Deposit (J. Frank zone) and approximately 1 km northeast of the Victory deposit. The overall site includes a gold system approximately 20 km long, covering an area of 240 km². The Project is located in central Newfoundland, approximately 57 km south of Buchans.

The Project overlaps woodland caribou (*Rangifer tarandus*) range in the central portion of the Island of Newfoundland. Woodland caribou have been identified as a Valued Component (VC) in the environmental impact statement (EIS) guidelines (CEA Agency 2019; Government NL 2019b). In consideration of the guidelines, Marathon is undertaking research into the movement of caribou within the Project Area using remote cameras. The cameras have been strategically positioned along identified caribou migration routes, and will be used to estimate the timing of caribou movement through mine site. The remote camera data will also provide group composition, or classification data, for caribou captured by the camera traps. This is the first report from the remote camera survey and summarizes the findings of the remote cameras deployed for the fall 2019 migration season.

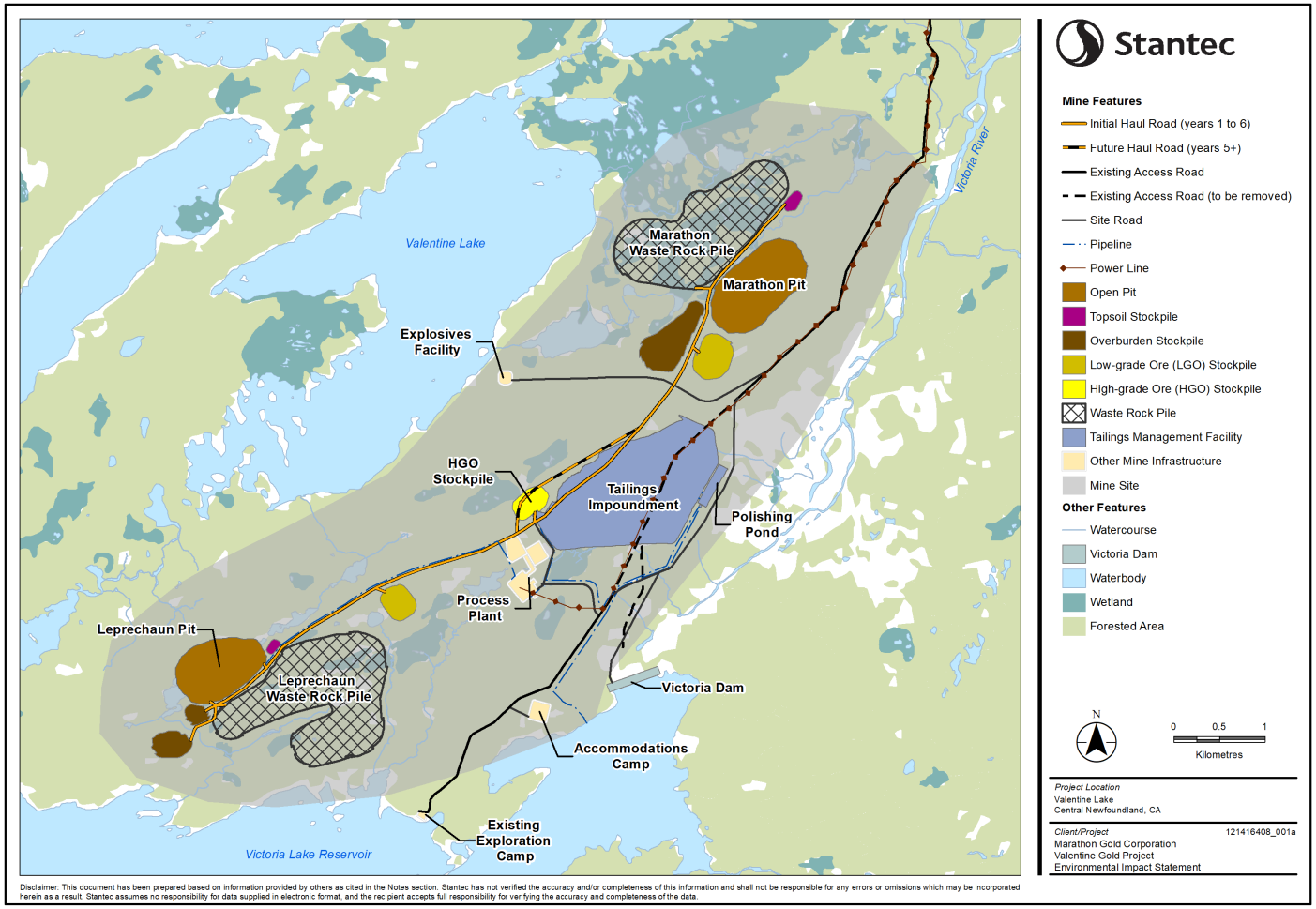

Figure 1-1 Valentine Gold Project Site Plan

2.0 BACKGROUND AND CONTEXT

2.1 PROJECT OBJECTIVES

The objectives of the Fall 2019 Caribou Survey were to:

- Refine the location of the fall caribou migration routes though the Project Area area
- Estimate the dates of the fall migration period

2.2 CONTEXT

The caribou population on the Island of Newfoundland is comprised of several sub-populations differentiated by annual movement patterns, spatial affiliations and genetic structure (Wilkerson 2010; Government NL 2015). The caribou population on the Island of Newfoundland has decreased by approximately 60% since the late 1990s (Soulliere et al. 2010; COSEWIC 2014; Government NL 2015). While woodland caribou on the Island of Newfoundland is not listed under the federal *Species at Risk Act* (SARA) or the provincial *Endangered Species Act* (ESA), it is considered a species of 'Special Concern' by COSEWIC (Committee on the Status of Endangered Wildlife in Canada) (COSEWIC 2014).

The Project overlaps with, or is near, five herd ranges within the South Coast sub-population: Buchans, Grey River, Gaff Topsails, La Poile and Pot Hill (Government NL 2019a, 2019b). Recent surveys of some herds in this area (i.e., Buchans, Grey River, Gaff Topsails, La Poile) indicate that population trends may be stabilizing (Government NL 2019a). The South Coast caribou sub-population herds share winter range near the southern shore between Burgeo and the Connaigre Peninsula (Weir et al. 2014), but have separate calving areas and summer ranges. The Newfoundland and Labrador Department of Fisheries and Land Resources (NLDFLR) has identified seasonal migration paths within the Project Area area (Government NL 2019a; Doucet and Morgan 2007 in Wells et al. 2011). The generalized dates for caribou seasons on the Island of Newfoundland (Table 2.1) indicate that caribou movement through the Project Area is most likely between April 1 – May 19 (spring migration) and November 1 – December 15 (fall migration). Information from the remote camera program, and analysis of telemetry data from NLDFLR will help identify peak movement times within these migration periods.

Table 2.1 General Seasons for Island Caribou in NL

Season	Seasonal Dates
Winter	Dec 16 – Mar 31
Spring Migration/Pre-calving	**Apr 1 – May 19**
Calving	May 20 – Jun 10
Post-calving Migration/Dispersal	Jun 11 – Jun 30
Post-calving Rearing	Jul 1 – Aug 31
Fall Rut	Sep 1 – Oct 31
Fall Migration/Dispersal	**Nov 1 – Dec 15**

Notes: Bold text indicates migratory periods where caribou migrate through Marathon Project Area area
Source: Emera (2013)

3.0 METHODS

3.1 REMOTE CAMERA DEPLOYMENT

Twelve remote cameras were deployed within the Project Area area on October 5, 2019 by members of the study team (Table 3.1; Figure 3-1). Two camera models were deployed: *Reconyx HS2X Hyperfire 2 Security Covert IR* and *Browning Dark Ops HD Pro X*. Both models have similar settings, which include infrared (IR) night vision illuminators to allow photography at night. Camera settings were selected to increase the probability of wildlife detection and identification (Stantec 2015). Specific settings are included in Table 3.2. Lithium batteries and 64GB memory cards were used in the cameras.

Table 3.1 Study Team

Team Members	Role
Barry Wicks, B. Sc.	Project Manager
Michael Preston, M.Sc., R.P.Bio.	Technical Advisor, Quality Review
Rebecca Jeffery, M.Sc.	Data Analysis and Report Preparation
Tony Parr, B.Sc.	Field Team Lead
Megan Blackwood, B.Sc., Dip. GIS	GIS
Nic Capps, B.Sc., P.Geo.	Field Support, Marathon

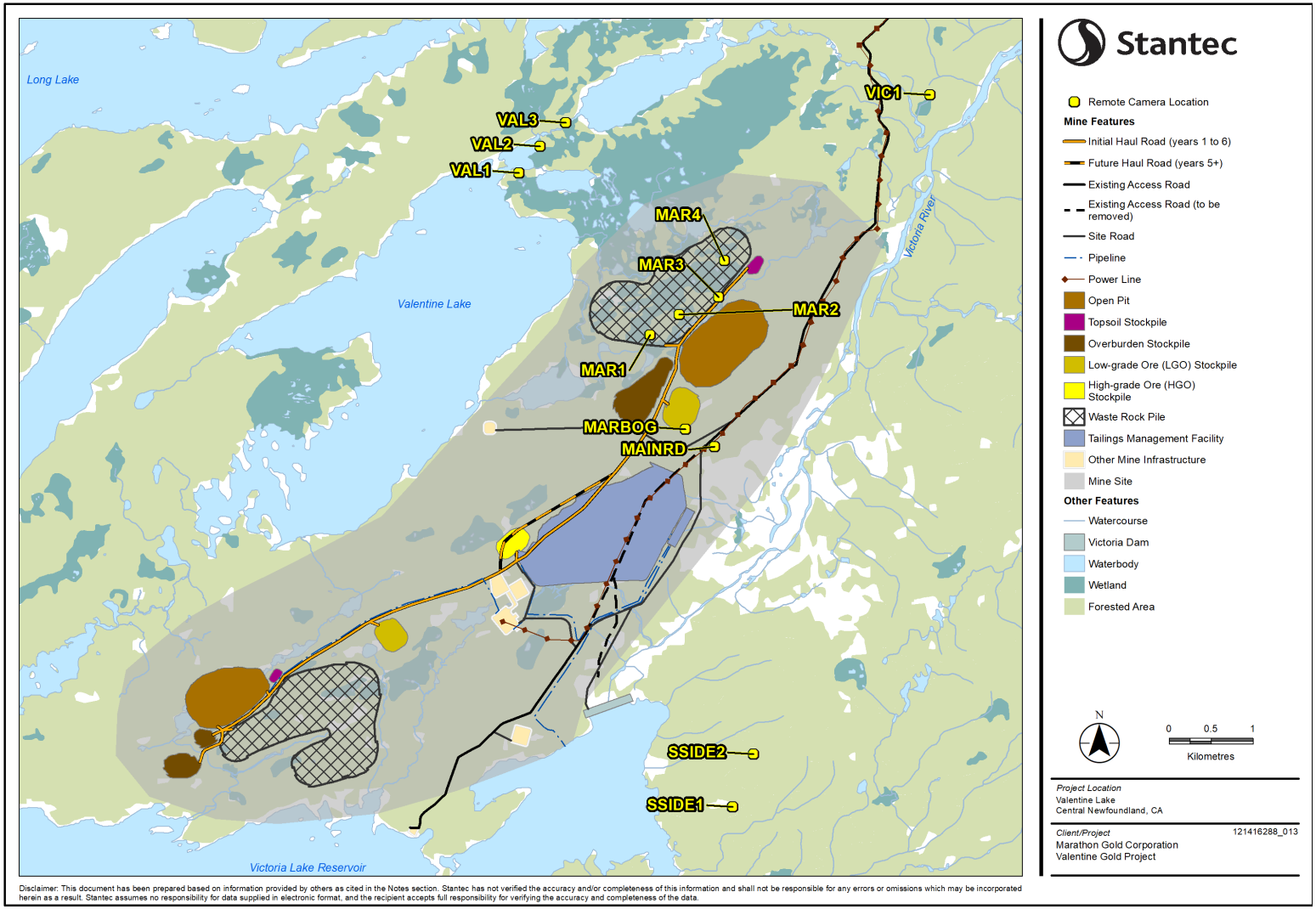

Figure 3-1 Remote Camera Deployment for Fall 2020 Caribou Survey

Table 3.2 Specific Remote Camera Settings

Brand	Mode	Pictures/ Trigger	Picture Interval	Additional Settings Information
Reconyx HS2X Hyperfire 2 Security Covert IR	Motion sensor "On" with med/high* sensitivity	5	Rapidfire - no quiet period, no delay	Night mode (Balanced) resolution (3.1 MP)
Browning Dark Ops HD Pro X	"Trail"- pics in day and night medium sensitivity	5	Rapidfire - no delay	Capture delay – 1 sec (lowest available)
Note: * - only set to high if a clear field of view				

Stantec delineated wildlife trails using Light Detection and Ranging (LiDAR) data to gather more information about caribou migration paths through the mineral claim area. A grid was applied to the LiDAR data and observed wildlife trails were marked. Several prominent wildlife trails were identified using LiDAR. The two most distinct trails were located: 1) between the north end of Valentine Lake and the Victoria River, and 2) between the southern end of Valentine Lake and the eastern arm of Victoria Lake (Figure 3-2). Placement of these two generalized wildlife trails were used to inform the camera deployment locations.

Camera placement locations were selected based on the identification of caribou trails in the mineral claim area from helicopter and ground field work, and from the LiDAR analysis, and from information provided by the Forestry and Wildlife Branch of NLDFLR (Government NL 2019a). Potential camera locations were identified based on a search for evidence of caribou use such as tracks, pellets, or antler sheds. Once installed, the camera locations were photographed and georeferenced using a handheld geographic positioning system (GPS). At each site, the direction (degrees) that the camera faced was recorded, as was information on tree and shrub composition and evidence of caribou or wildlife use (Appendix A).

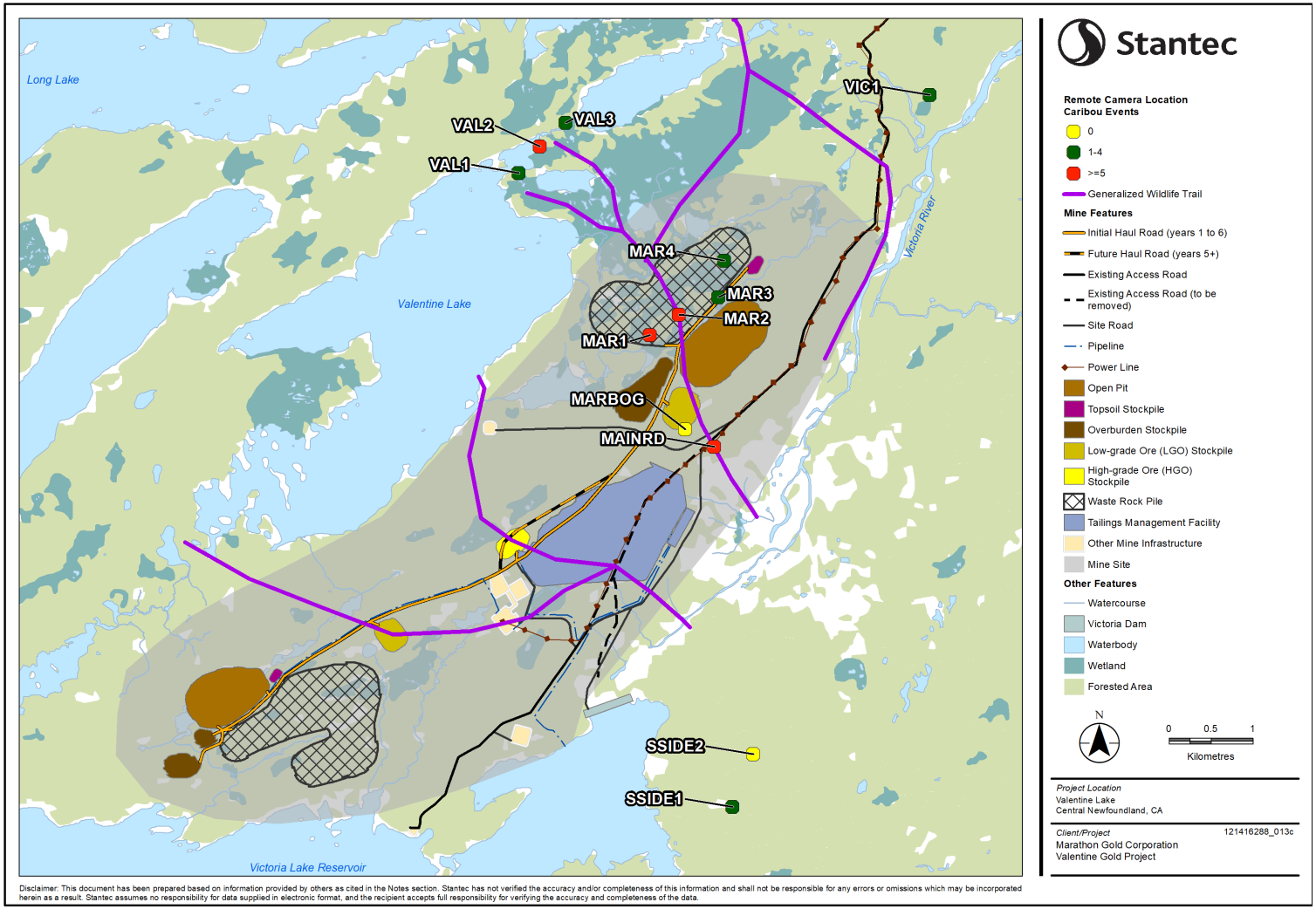

Figure 3-2 Generalized Wildlife Trails Digitized from LiDAR Data and Fall 2019 Caribou Survey Deployment Locations

The cameras were deployed at each site using standardized set-up procedures to allow for consistency among sites, and to reduce potential effects of camera placement or setup on wildlife detection. Five areas were selected for camera deployment: Valentine Outlet (VAL1, VAL2, VAL3), Marathon Pit (MAR1, MAR2, MAR3, MAR4), Main Road (MAINRD, MARBOG), South Side of Victoria River (SS1, SS2), and Victory Pit (VIC1). These areas were separated by more than 500 m to maintain independence (Stantec 2015), although cameras within these areas were less than 500 m apart. The cameras were mounted on trees with diameters of approximately 20 cm or larger. At sites where the camera mount needed additional stability, trees were braced with logs to reduce movement from the wind. At sites with no suitable trees, tripods were installed as camera mounts. Cameras were placed approximately 1 m above ground for large mammal detection (Stantec 2015) and were positioned facing the game trail to increase the path length of animals through the frame (Rovero et al. 2010). The cameras were positioned in a northerly direction where possible to limit false triggers from solar glare due to the sensitivity of passive infrared sensor systems to solar temperature and movement (Brown and Gehrt 2009). To reduce the incidence of false positives (e.g., camera is triggered by something other than wildlife such as branches or grasses moving in the wind), visible branches within the camera's field of view were trimmed where necessary. A walk test was completed before leaving the site to assess camera angle, position, and path length along the game trail to improve likelihood of detection. Camera placement information is found in Appendix A

Cameras were checked on October 30, 2019 and data was downloaded to a computer in the field. At that time, camera batteries were at 100% power and were not replaced. Camera placement was also assessed and cameras that recorded a high number of false positives were repositioned, or additional supports were added to reduce excessive movement from wind. Branches within the camera's field of view were also cut back as needed. Additionally, the settings on some cameras were adjusted to reduce trigger sensitivity in cases of excessive false positives.

Weather and ice conditions on the bogs affected when the cameras could be retrieved. Camera retrieval dates were:

- December 18, 2019 – MAR1, MAR2, MAR3, MAR4, MAIN RD, MARBOG, VIC1
- December 26, 2019 – VAL1
- January 11, 2020 – SS1
- January 26, 2020 – VAL2, and VAL3
- February 11, 2020 – SS2

3.2 REMOTE CAMERA DATA ANALYSIS

Remote camera photos were reviewed using the program Timelapse, an image analysis software program that extracts photograph metadata and facilitates the management of photo results (Greenberg 2019). Photos were analyzed based on independent events identified from a photo series. For the analysis, an event was defined as beginning when an animal or group of animals (i.e., one or more animals) entered the frame and ending when the animal or group had exited the frame for more than two minutes (Stantec 2015, Rowcliffe et al. 2008). Collared caribou captured in the photos were noted. Group composition metrics were calculated (i.e. group sizes, sex ratios and age classes). Observed caribou were classified as follows: calves < 1 year; yearlings = 1 to 2 years; adults > 2 years. "Unknown" included caribou of all age classes

whose sex could not be determined. The category of “total caribou” included adults, yearlings, calves and unknown. “Total adults” included adults of known sex only (i.e., “unknown” were not included). The following values were calculated: male:100 females ratio, calf:100 females ratio, percent calves (calves/total caribou x 100), and percent yearlings (yearlings/total caribou x 100). These metrics are not intended for population census purposes but may provide future insight on avoidance behaviours between sexes or age classes if such effects are evident.

4.0 RESULTS

Cameras were deployed at twelve sites within the mineral claim area. Deployment locations and additional information about the deployment sites is provided in Appendix A. Caribou were detected at 10 of the 12 camera locations. The cameras at VAL2, MAR1, MAR2 and MAINRD had the greatest number of caribou detections and individual caribou (Table 4.1; Figure 4-1).

Table 4.1 Number of Caribou Events and Caribou Detected at Remote Camera Sites

Camera ID	Retrieval Date	Number of Days Deployed	Number of Caribou Events	Number of Caribou Observed
VAL1	December 26, 2019	82	3	3
VAL2	January 26, 2020	113	30	212
VAL3	January 26, 2020	113	1	1
MAR1	December 18, 2019	74	64	1,228
MAR2	December 18, 2019	74	14	122
MAR3	December 18, 2019	74	1	1
MAR4	December 18, 2019	74	3	3
MARBOG	December 18, 2019	74	0	0
MAINRD	December 18, 2019	74	39	499
VIC1	December 18, 2019	74	1	1
SSIDE1	January 11, 2020	98	1	1
SSIDE2	February 11, 2020	129	0	0

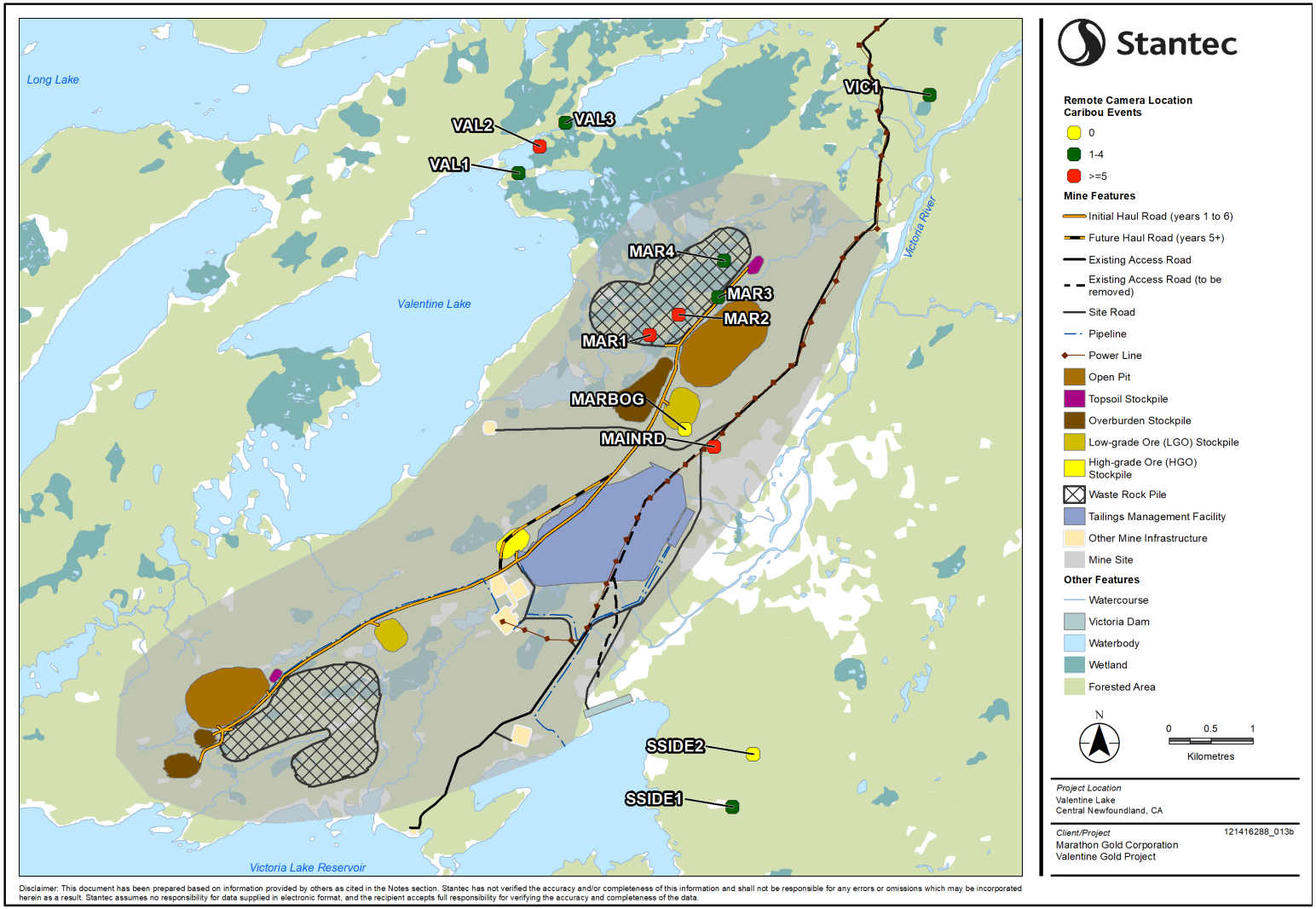

Figure 4-1 Number of Caribou Events (Group of One or More Caribou) Captured at Remote Camera Sites

The number of caribou observed per day is illustrated in Figure 4-2. Single caribou, or groups of two caribou, were observed from October 6 to November 8, 2019. The peak of caribou movement occurred from November 9 to 12, 2019 with the greatest number of caribou events observed on November 10, 2019 (Figure 4-2); more than 81% of total caribou detections were recorded during this 4-day period. Between November 9-12, 2019, single caribou as well as groups ranging from two to 164 animals were observed. After November 13, 2019, caribou observed were either single, or in groups of two. The last caribou detection was recorded on November 20, 2019.

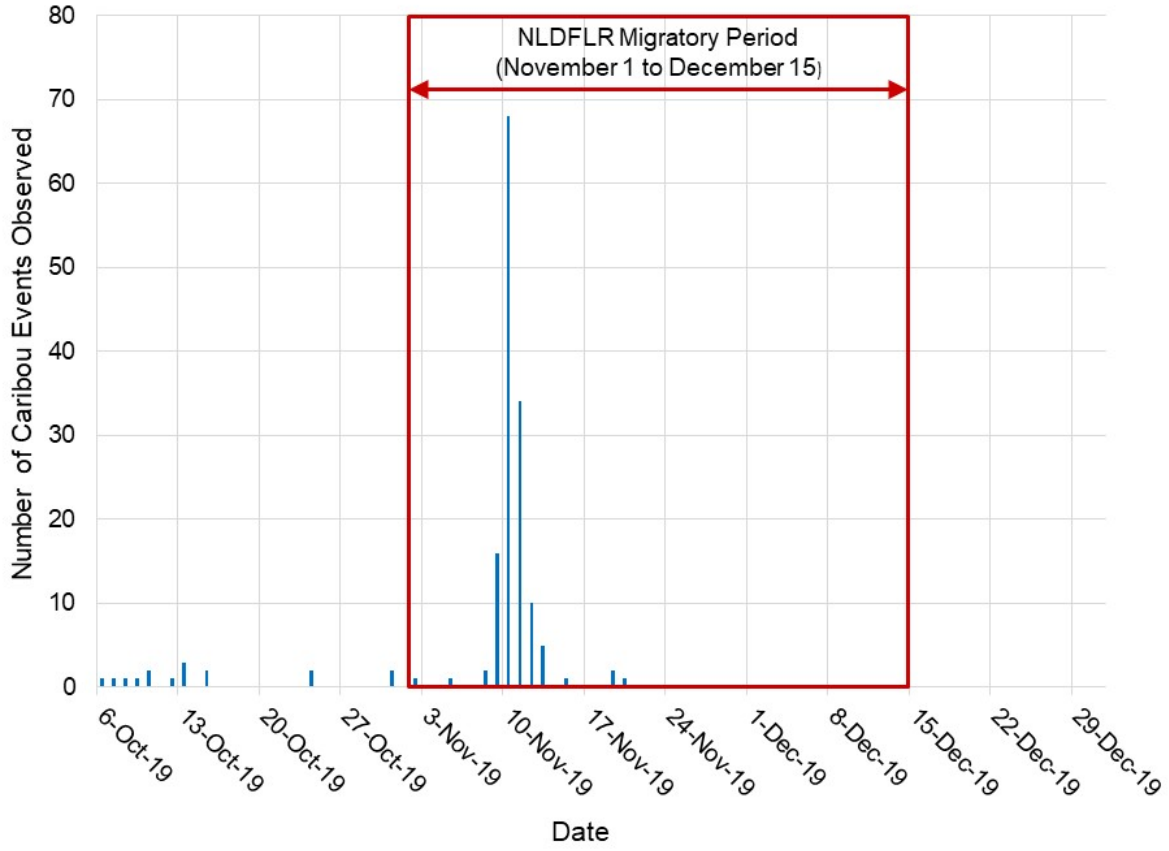

Figure 4-2 Number of Caribou Events (Group of One or More Caribou) Observed per Day at Remote Cameras Sites

The remote cameras were deployed to provide additional information to the telemetry data, such as group composition, and were not intended to provide a population sex and age ratio estimate. The values presented in this report describe the fall 2019 camera results and may be included in future discussions about changes to observations of caribou migration over time.

There were 2,071 caribou detected during the 2019 Fall Caribou Survey (Table 4.2). Group size ranged from 1 to 164 caribou, with a mean group size of 13. The ratio of males to females was 30 males:100

females (Table 4.2). There were 16 calves per 100 females, and calves accounted for 10% of caribou detected. Yearlings made up less than 1% of total caribou detected, and 220 caribou were classified as unknown. Three caribou with collars were detected, and one caribou had a single pink ear tag but no collar.

Table 4.2 Caribou Group Composition based on Remote Camera Results from the Mineral Claim Area

	Total
Total Caribou	2,071
Total Adults[A]	1,641
Adult Females	1,260
Adult Males	381
Yearlings	7
Calves	203
Unknown[B]	220
Male:100 Females	30
Calf:100 Females	16
Percent Calves (%)	10
Percent Yearlings (%)	<1
Mean Group Size[C] (range in brackets)	13 (1-164)
Number of Collared Caribou	3

Notes:
Numbers rounded to the nearest whole number
[A] – Total adults = adult females + adult males
[B] – Unknown includes caribou of unknown sex and/or age class
[C] – Mean group size based on all cameras

Other wildlife species detected by the remote cameras were moose (*Alces alces*), black bear (*Ursus americanus)*, lynx (*Lynx canadensis)*, snowshoe hare (*Lepus americanus)*, marten (*Martes americana atrata)*, coyote (*Canis latrans)*, red fox (*Vulpes Vulpes*), red squirrel (*Tamiasciurus hudsonicus*) and bald eagle (*Haliaeetus leucocephalus)*. Additional information on incidental sightings is provided in Appendix B.

5.0 DISCUSSION

The Buchans, Grey River and Gaff Topsails caribou herds overlap with the mineral claim area (Government NL 2019b). Information from the Wildlife Division of NLDFLR (Government NL 2019a) indicated a caribou migration path through the Marathon Pit, and Stantec's identification of wildlife trails from LiDAR data indicated a well-used wildlife path between the north end of Valentine Lake and the Victoria River. Use of this migratory path by caribou was confirmed as cameras VAL2, MAR2, and MAINRD recorded the highest number of caribou and overlap with the wildlife trail identified from LiDAR data. Remote camera data

showed that during the fall migration period, caribou entered the mineral claim area at VAL2 and moved through the proposed waste rock pile location near Marathon Pit as they travelled south to their winter range. The topography in this area, with a narrow land bridge between portions of Valentine Lake, seems to act as a natural narrow corridor that may limit the width of the caribou migration path. It is less clear where caribou are exiting the Project Area. The cameras at SSIDE1 and SSIDE2 recorded a single animal, which suggests the primary migration path is north of this point and possibly through a large bog which is south of the access road. Caribou will select migration paths that provide adequate forage and resting habitat (Saher 2005), are less energetically demanding (e.g., less rugged, open terrain) (Saher and Schmigelow 2005), and have relatively low predation risk compared to other potential paths (Ferguson and Elkie 2004). As cameras near the south side of Victoria River (SS1 and SS2) did not capture the migration path, caribou may be migrating through the boggy areas north of the Victoria River cameras. Camera placement in this area was discussed during deployment but the area was not easily accessible and there were concerns about difficulties retrieving cameras in December.

Caribou were observed between October 6-November 20, 2019, although the primary movement period was limited to November 9-12, 2019. This indicates that the fall migration period for caribou in this area may be narrower than the Island-wide migration period (i.e., November 1-December 15) (Emera 2013).

Classification results show more females were observed than males. On the Island of Newfoundland, the caribou sex ratio is generally more females to males, with a decreasing trend in males observed (Weir et al. 2014). The previously observed decline in sex ratio may have slowed, as a higher number of males has been observed since 2006 (Weir et al. 2014). The observed proportion of calves (10%) is lower than that required for a stable population (Bergerud 1995). Low calf recruitment (<10%) has been documented as one of the factors in the recent decline of the caribou population on the Island of Newfoundland (Mahoney and Weir 2009; Weir et al. 2014).

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APPENDIX A

Remote Camera Site Metadata

Table A.1 Remote Camera Site Metadata

Camera Name	**Valentine Outlet 1 (VAL1)**
Camera Type	Reconyx HS2X Hyperfire 2 Security Covert IR
Deployment Date	October 5, 2019
Retrieval Date	December 26, 2019
Team Members	Tony Parr and Nic Capps (Marathon)
Temperature	5ºC
Winds	Calm
Study Area	Valentine Gold Project Mineral Claim Area
UTM Zone	21
UTM Easting	490083
UTM Northing	5362269
Habitat Composition (Tree and Shrub)	Tree: Black spruce and larch with interspersed barrens and bogs. Shrubs: mountain alder, leather leaf, common juniper, pitcher plant and bog rosemary. Ground cover was red-stemmed feather moss and lichens with sphagnum in bogs.
Camera Height	~110 cm
Camera Orientation (degrees)	~25
Evidence of Caribou Use	Well-used game trail, fresh caribou and moose tracks
Photo of Camera Location	

Table A.1 Remote Camera Site Metadata

Camera Name	**Valentine Outlet 2 (VAL2)**
Camera Type	Reconyx HS2X Hyperfire 2 Security Covert IR
Deployment Date	October 5, 2019
Retrieval Date	January 26, 2020
Team Members	Tony Parr and Nic Capps (Marathon)
Temperature	5ºC
Winds	Calm
Study Area	Valentine Gold Project Mineral Claim Area
UTM zone	21
UTM Easting	490332
UTM Northing	5362584
Habitat Composition (Tree and Shrub)	Open lake edge habitat with grasses interspersed with black spruce and larch. Bogs and ribbed wetland areas to the east and north. Shrubs: leather leaf, common juniper, bog rosemary, and pitcher plant. Ground cover was sedges and lichens with sphagnum in bogs.
Camera Height	~110 cm
Camera Orientation (degrees)	~315
Evidence of Caribou Use	Well-used game trail, fresh caribou and moose tracks
Photo of Camera Location	 

Table A.1 Remote Camera Site Metadata

Camera Name	**Valentine Outlet 3 (VAL3)**
Camera Type	Reconyx HS2X Hyperfire 2 Security Covert IR
Deployment Date	October 5, 2019
Retrieval Date	January 26, 2020
Team Members	Tony Parr and Nic Capps (Marathon)
Temperature	5ºC
Winds	Calm
Study Area	Valentine Gold Project Mineral Claim Area
UTM zone	21
UTM Easting	490640
UTM Northing	5362867
Habitat Composition (Tree and Shrub)	Open lake edge habitat with grasses interspersed with black spruce alder and larch. Bogs and ribbed wetland areas to the east. Shrubs: leather leaf, common juniper, bog rosemary, and sedges.
Camera Height	~105 cm
Camera Orientation (degrees)	~330
Evidence of Caribou Use	Well-used game trail, fresh caribou and moose tracks
Photo of Camera Location	

Table A.1 Remote Camera Site Metadata

Camera Name	**Marathon 1 (MAR1)**
Camera Type	Browning Dark Ops HD Pro X
Deployment Date	October 5, 2019
Retrieval Date	December 18, 2020
Team Members	Tony Parr and Nic Capps (Marathon)
Temperature	5ºC
Winds	Calm
Study Area	Valentine Gold Project Mineral Claim Area
UTM zone	21
UTM Easting	491644
UTM Northing	5360343
Habitat Composition (Tree and Shrub)	Open treed bog and ribbed wetland areas with black spruce and larch. Shrubs: leather leaf, common juniper, bog rosemary, pitcher plant and sedges.
Camera Height	~90 cm
Camera Orientation (degrees)	~345
Evidence of Caribou Use	Well-used game trail, fresh caribou and moose tracks
Photo of Camera Location	

Table A.1 Remote Camera Site Metadata

Camera Name	**Marathon 2 (MAR2)**
Camera Type	Reconyx HS2X Hyperfire 2 Security Covert IR
Deployment Date	October 5, 2019
Retrieval Date	December 18, 2019
Team Members	Tony Parr and Nic Capps (Marathon)
Temperature	5ºC
Winds	Calm
Study Area	Valentine Gold Project Mineral Claim Area
UTM zone	21
UTM Easting	491990
UTM Northing	5360583
Habitat Composition (Tree and Shrub)	Located in a tree line between two bog complexes. Trees: Black spruce, balsam fir, and larch. Open treed bog and ribbed wetland areas with black spruce and larch. Shrubs: leather leaf, common juniper, bog rosemary, pitcher plant and sedges.
Camera Height	~110 cm
Camera Orientation (degrees)	~360
Evidence of Caribou Use	Well-used game trail, fresh caribou and moose tracks
Photo of Camera Location	

Table A.1 Remote Camera Site Metadata

Camera Name	**Marathon 3 (MAR3)**
Camera Type	Reconyx HS2X Hyperfire 2 Security Covert IR
Deployment Date	October 5, 2019
Retrieval Date	December 18, 2019
Team Members	Tony Parr and Nic Capps (Marathon)
Temperature	5ºC
Winds	Calm
Study Area	Valentine Gold Project Mineral Claim Area
UTM zone	21
UTM Easting	492456
UTM Northing	5360791
Habitat Composition (Tree and Shrub)	Trees: Black spruce, balsam fir, and larch. Open treed bog and ribbed wetland areas with black spruce and larch. Shrubs: sweet gale, common juniper, bog rosemary, pitcher plant and sedges.
Camera Height	~115 cm
Camera Orientation (degrees)	~350
Evidence of Caribou Use	Well-used game trail, fresh caribou and moose tracks
Photo of Camera Location	

Table A.1 Remote Camera Site Metadata

Camera Name	**Marathon 4 (MAR4)**
Camera Type	Browning Dark Ops HD Pro X
Deployment Date	October 5, 2019
Retrieval Date	December 18, 2019
Team Members	Tony Parr and Nic Capps (Marathon)
Temperature	7ºC
Winds	Moderate
Study Area	Valentine Gold Project Mineral Claim Area
UTM zone	21
UTM Easting	492525
UTM Northing	5361227
Habitat Composition (Tree and Shrub)	Trees: Black spruce, balsam fir, and larch. Sloped bog with ribbed wetland areas with black spruce and larch. Shrubs: leather leaf, bog laurel, common juniper, bog rosemary, pitcher plant and sedges.
Camera Height	~110 cm
Camera Orientation (degrees)	~350
Evidence of Caribou Use	Moderately used game trail, fresh tracks evident
Photo of Camera Location	

Table A.1 Remote Camera Site Metadata

Camera Name	Marathon BOG (MARBOG)
Camera Type	Browning Dark Ops HD Pro X
Deployment Date	October 5, 2019
Retrieval Date	December 18, 2019
Team Members	Tony Parr and Nic Capps (Marathon)
Temperature	7ºC
Winds	Moderate
Study Area	Valentine Gold Project Mineral Claim Area
UTM zone	21
UTM Easting	492062
UTM Northing	5359217
Habitat Composition (Tree and Shrub)	Trees: Balsam fir, black spruce white birch and larch. Shrubs: speckled alder, Labrador tea, bog laurel, common juniper, bog rosemary, pitcher plant and sedges.
Camera Height	~130 cm
Camera Orientation (degrees)	~325
Evidence of Caribou Use	Well-used game trail, fresh tracks evident
Photo of Camera Location	N/A

Table A.1 Remote Camera Site Metadata

Camera Name	**Main Road (MAINRD)**
Camera Type	Reconyx HS2X Hyperfire 2 Security Covert IR
Deployment Date	October 5, 2019
Retrieval Date	December 18. 2019
Team Members	Tony Parr and Nic Capps (Marathon)
Temperature	7ºC
Winds	Moderate
Study Area	Valentine Gold Project Mineral Claim Area
UTM zone	21
UTM Easting	492409
UTM Northing	5359013
Habitat Composition (Tree and Shrub)	Open wetland bog: Black spruce, balsam fir, and larch around periphery. Scattered black spruce and larch throughout. Shrubs: speckled alder, leather leaf, Labrador tea and sedges.
Camera Height	~150 cm
Camera Orientation (degrees)	~45
Evidence of Caribou Use	Well-used game trail
Photo of Camera Location	

Table A.1 Remote Camera Site Metadata

Camera Name	**Victory Southwest (VIC1)**
Camera Type	Browning Dark Ops HD Pro X
Deployment Date	October 5, 2019
Retrieval Date	December 18, 2019
Team Members	Tony Parr and Nic Capps (Marathon)
Temperature	7ºC
Winds	Moderate
Study Area	Valentine Gold Project Mineral Claim Area
UTM zone	21
UTM Easting	494971
UTM Northing	5363195
Habitat Composition (Tree and Shrub)	Open wetland bog: Black spruce and larch around periphery. Scattered black spruce and larch throughout. Shrubs: leather leaf, Labrador tea, sheep laurel and sedges.
Camera Height	~125 cm
Camera Orientation (degrees)	~50
Evidence of Caribou Use	Well-used game trail
Photo of Camera Location	

Table A.1 Remote Camera Site Metadata

Camera Name	**South Side Victoria River 1 (SSIDE1)**
Camera Type	Browning Dark Ops HD Pro X
Deployment Date	October 5, 2019
Retrieval Date	January 11, 2020
Team Members	Tony Parr and Nic Capps (Marathon)
Temperature	7ºC
Winds	Moderate
Study Area	Valentine Gold Project Mineral Claim Area
UTM zone	21
UTM Easting	492625
UTM Northing	5354727
Habitat Composition (Tree and Shrub)	Stepped bog complex: Black spruce, balsam fir, and larch around periphery. Black spruce and larch throughout. Shrubs: black spruce, larch, speckled alder, leather leaf, Labrador tea and sedges.
Camera Height	~110 cm
Camera Orientation (degrees)	~50
Evidence of Caribou Use	Well-used game trail
Photo of Camera Location	

Table A.1 Remote Camera Site Metadata

Camera Name	South Side Victoria River (SSIDE2)
Camera Type	Browning Dark Ops HD Pro X
Deployment Date	October 5, 2019
Retrieval Date	February 11, 2020
Team Members	Tony Parr and Nic Capps (Marathon)
Temperature	7ºC
Winds	Moderate
Study Area	Valentine Gold Project Mineral Claim Area
UTM zone	21
UTM Easting	492873
UTM Northing	5355355
Habitat Composition (Tree and Shrub)	Black spruce, balsam fir, and larch around periphery. Scattered black spruce and larch throughout. Shrubs: black spruce, speckled alder, leather leaf, Labrador tea and sedges.
Camera Height	~110 cm
Camera Orientation (degrees)	~50
Evidence of Caribou Use	Well-used game trail
Photo of Camera Location	

APPENDIX B

Caribou Photos from Remote Cameras

Figure B-1 Male Caribou from MAR4 Remote Camera, October 7, 2019

Figure B-2 Caribou from MAR1 Remote Camera, November 10, 2019

Figure B-3 Caribou from VAL2 Remote Camera, November 9, 2019

Figure B-4 Male Caribou from MAR2 Remote Camera, November 11, 2019

Figure B-5 Female Caribou and Calf from MAR2 Remote Camera, November 11, 2019

Figure B-6 Caribou Including Female with Telemetry Collar from MAINRD Remote Camera, November 10, 2019

APPENDIX C

Incidental Wildlife Observations

INCIDENTAL WILDLIFE OBSERVATIONS

Incidental wildlife observations for moose are provided in separately in C.1. The remainder of wildlife species observed are included in C.2.

Incidental Moose Observations

Table C.1 Moose Observations from Remote Cameras Sites

Camera ID	Number of Events	Total Number of Moose	Number of Males	Number of Females	Number of Calves	Number of Unknown
Val1	2	2	1	1		
Val2	4	6	1	3	1	1
Val3	2	2		1		1
Mar1	4	4	1	3		
Mar2	6	6	1	5		
Mar3	12	12	1	9	2	
Mar4	2	2		2		
MainRd	7	7	3	4		
MarBog	13	15	4	11		
Vic1	9	10	6	3	1	
SS1	1	1				1
SS2	1	2		2		
Note: Moose were observed from October 5-December 18, 2019.						

Figure C-1 Female Moose and Calf from MAR3 Remote Camera, November 14, 2019

Other Incidental Wildlife Observations

Table C.2 Other Incidental Wildlife Observations from Remote Cameras Sites

Species	Camera ID	Date	Number Observed
Bald Eagle	VAL3	November 10, 2019	1
Black Bear	SS2	October 11, 2019	1
Coyote	MAINRD	November 2, 2019	1
Fox	SS2	January 7, 2020	1
		January 24, 2020	1
Lynx	VIC1	December 14, 2019	1
Marten	MAINRD	November 16, 2019	1
Red Squirrel	MARBOG	October 11, 2019	1
		October 21, 2019	1
Showshoe Hare	MAINRD	October 27, 2019	1
		October 29, 2019	1
		November 13, 2019	1
		December 9, 2019	1
		December 14, 2019	1

Figure C-2 Bald Eagle from VAL3 Remote Camera, November 10, 2019

Figure C-3 Black Bear from SS2 Remote Camera, October 11, 2019

Figure C-4 Coyote from MAINRD Remote Camera, November 2, 2019

Figure C-5 Fox from SS2 Remote Camera, January 7, 2020

Figure C-6 Lynx from VIC1 Remote Camera, December 14, 2019

Figure C-7 Marten from MAINRD Remote Camera, November 16, 2019

Figure C-8 Red Squirrel from MARBOG Remote Camera, October 11, 2019
Note: Red circle indicates red squirrel.

Figure C-9 Snowshoe Hare from MAINRD Remote Camera, December 14, 2019

ATTACHMENT 2-B

Spring 2020 Caribou Survey – Remote Cameras (2020)

Valentine Gold Project: Spring 2020 Caribou Survey – Remote Cameras

Final Report

September 21, 2020

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Executive Summary

Marathon Gold Corporation (Marathon) is planning to develop the Valentine Gold Project (the Project), located in the Central Region of the Island of Newfoundland. The Project overlaps with woodland caribou (*Rangifer tarandus*) range in central Newfoundland. The Wildlife Division of the Newfoundland and Labrador Department of Fisheries, Forestry and Agriculture has identified seasonal caribou migration paths within the Project Area (Government of Newfoundland and Labrador [NL] 2019; Doucet and Morgan 2007 in Wells et al. 2011). Preliminary analysis of telemetry data confirms the use of migration paths through the Project Area (Stantec 2019).

Stantec Consulting Ltd. (Stantec) undertook a spring caribou migration survey to better understand the timing, distribution, and relative use of the migration paths within the Project Area. This work builds on a similar caribou migration survey that was completed in fall 2019. The spring survey was completed using 11 remote cameras deployed in March 2020 along identified migration paths in the study area. Cameras were retrieved between June 12–18, 2020. Photos of caribou moving past the remote camera were analyzed by counting and classifying the caribou.

The cameras detected more than 700 caribou during the spring deployment period. The peak of movement period for females was April 25–May 7, 2020, and for males was May 15–27, 2020; caribou detections generally were made throughout the deployment period. Of the 11 cameras deployed, one malfunctioned shortly after deployment and returned no data. All ten functioning cameras detected caribou with most detections occurring immediately north of the proposed location of the Marathon pit.

This report provides a summary of the Spring 2020 Caribou Survey for migration within the Project Area. This information, in concert with ongoing statistical analysis of telemetry data, will inform the Environmental Impact Statement.

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Abbreviations

cm	Centimetre
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
EA	Environmental Assessment
EIS	Environmental Impact Statement
GPS	Geographic Positioning System
IR	Infrared
km	Kilometre
LiDAR	Light Detection and Ranging
m	Metre
NL	Newfoundland and Labrador
NLDFFA-WD	Newfoundland and Labrador Department of Fisheries, Forestry and Agriculture – Wildlife Division
NL ESA	Newfoundland and Labrador *Endangered Species Act*
SARA	*Species at Risk Act*

1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec) was retained by Marathon Gold Corporation (Marathon) to undertake several environmental studies for the Valentine Gold Project (the Project), including analysis of woodland caribou (*Rangifer tarandus*) migration and use of the Project Area (Figure 1-1). As woodland caribou have been identified as a valued component in the Environmental Impact Statement (EIS) Guidelines for the Project issued by both the federal and provincial governments (Impact Assessment Agency of Canada 2019; Government of Newfoundland and Labrador [NL] 2020), the results of the analyses will be used to support the EIS for the Project.

The Project will consist primarily of two open pits, waste rock piles, crushing and stockpiling areas, conventional milling and processing facilities, a tailings management facility, personnel accommodations, and supporting infrastructure including roads, on-site power lines, buildings, and water and effluent management facilities. The mine site is accessed by an existing gravel road, approximately 82 km in length, which extends south from Millertown. Approximately 73 km of this existing access road will be upgraded and maintained by Marathon as part of the Project.

The Project overlaps woodland caribou range in central Newfoundland. Stantec, on behalf of Marathon, is undertaking research into the movement of caribou within the Project Area using remote cameras. The cameras have been strategically positioned along identified caribou migration routes in the Project Area and will be used to estimate the timing of caribou movement through the mine site. The remote camera data will also provide information on group composition, or classification data, for caribou captured by the camera traps. Cameras were previously deployed for the fall 2019 migration (Stantec 2020a). This is the second report from the remote camera survey program and summarizes the findings of the remote cameras deployed for the spring 2020 migration season.

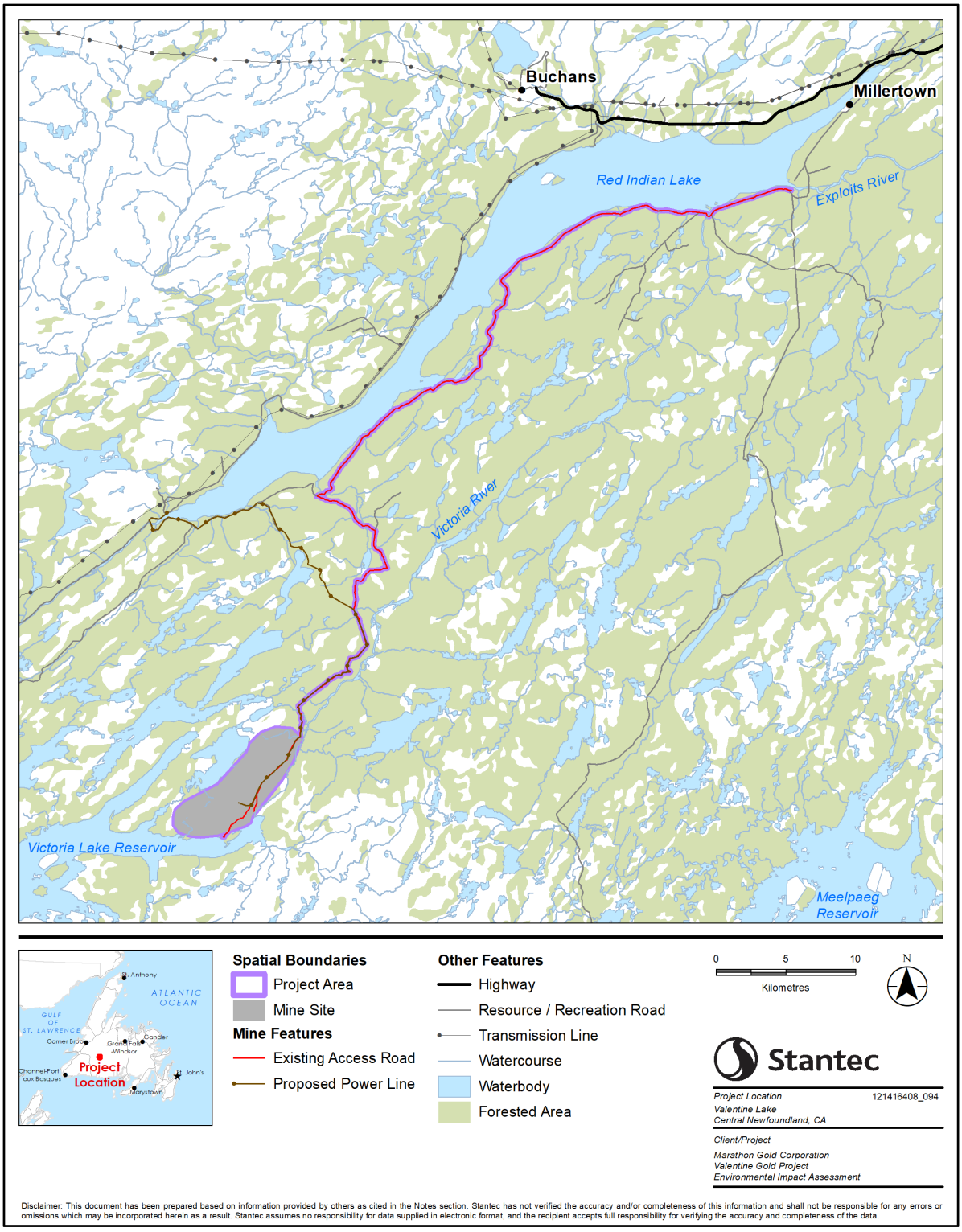

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Figure 1-1 Project Area

2.0 BACKGROUND AND CONTEXT

2.1 PROJECT OBJECTIVES

The objectives of the Spring 2020 Caribou Survey were to:

- Refine the location of the spring caribou migration routes though the Project Area
- Estimate the dates of the spring migration period

2.2 CONTEXT

The caribou population on the Island of Newfoundland is comprised of several sub-populations differentiated by annual movement patterns, spatial affiliations, and genetic structure (Wilkerson 2010; Government of NL 2015). The caribou population on the Island of Newfoundland has decreased by approximately 60% since the late 1990s (Soulliere et al. 2010; COSEWIC 2014; Government of NL 2015). While woodland caribou on the Island of Newfoundland is not listed under the federal *Species at Risk Act* (SARA) or the provincial *Endangered Species Act* (NL ESA), it is considered 'Special Concern' by COSEWIC (Committee on the Status of Endangered Wildlife in Canada) (COSEWIC 2014).

The Project overlaps with or is near ranges of the following herds within the South Coast sub-population: Buchans, Grey River, Gaff Topsails, and La Poile (Government of NL 2019). Recent surveys of some of the South Coast herds (i.e., Buchans, Grey River, Gaff Topsails, La Poile) indicate that population trends may be stabilizing (Government of NL 2019). The South Coast caribou sub-population herds share winter range near the southern shore between Burgeo and the Connaigre Peninsula (Weir et al. 2014) but have separate calving areas and summer ranges. The Wildlife Division of the Newfoundland and Labrador Department of Fisheries, Forestry and Agriculture (NLDFFA-WD) has identified seasonal migration paths within the Project Area (Government of NL 2019; Doucet and Morgan 2007 in Wells et al. 2011). The generalized dates for caribou seasons on the Island of Newfoundland (Table 2.1) indicate that caribou movement through the mine site is most likely between April 1–May 19 (spring migration) and November 1–December 15 (fall migration). Cameras deployed for the Fall 2019 Caribou Survey identified peak caribou movement through the study area between November 9–12, 2019. Information from the remote camera program combined with analysis of telemetry data from NLDFFA-WD will help identify peak movement times through the mine site within these migration periods.

Table 2.1 General Seasons for the Island Caribou Population in NL

Season	Seasonal Dates
Winter	Dec 16–Mar 31
Spring Migration/Pre-calving	**Apr 1–May 19**
Calving	May 20–Jun 10
Post-calving Migration/Dispersal	Jun 11–Jun 30
Post-calving Rearing	Jul 1–Aug 31
Fall Rut	Sep 1–Oct 31
Fall Migration/Dispersal	**Nov 1–Dec 15**

Notes:
Bold text indicates migratory periods where caribou migrate through Marathon mine site
Source: Emera 2013

3.0 METHODS

3.1 MIGRATION TRAIL IDENTIFICATION AND REMOTE CAMERA DEPLOYMENT

Prior to the Fall 2020 Caribou Survey, Stantec identified wildlife trails using Light Detection and Ranging (LiDAR) data to gather more information about caribou migration paths through the mine site. A grid was applied to the LiDAR data, and observed wildlife trails were marked. Several prominent wildlife trails were identified using LiDAR. The two most distinct trails were located: 1) between the north end of Valentine Lake and the Victoria River, and 2) between the southern end of Valentine Lake and the eastern arm of Victoria Lake Reservoir (Figure 3-1). Placement of the wildlife trails identified from the LiDAR data informed the camera deployment locations selected for the Fall 2019 and Spring 2020 Caribou Surveys. Details on camera placement and results for the Fall 2019 migration survey are provided in Stantec (2020a).

For the spring 2020 remote camera survey, eleven remote cameras were deployed in the study area on March 26, 2020 by the study team (Figure 3-2). Two camera models were deployed: *Reconyx HS2X Hyperfire 2 Security Covert IR* and *Browning Dark Ops HD Pro X*. Both models have similar settings which include infrared (IR) night vision illuminators to allow photography at night. Camera settings were selected to increase the probability of wildlife detection and identification (Stantec 2015). Specific settings are included in Table 3.1. Lithium batteries and 64 gigabyte memory cards were used in the cameras.

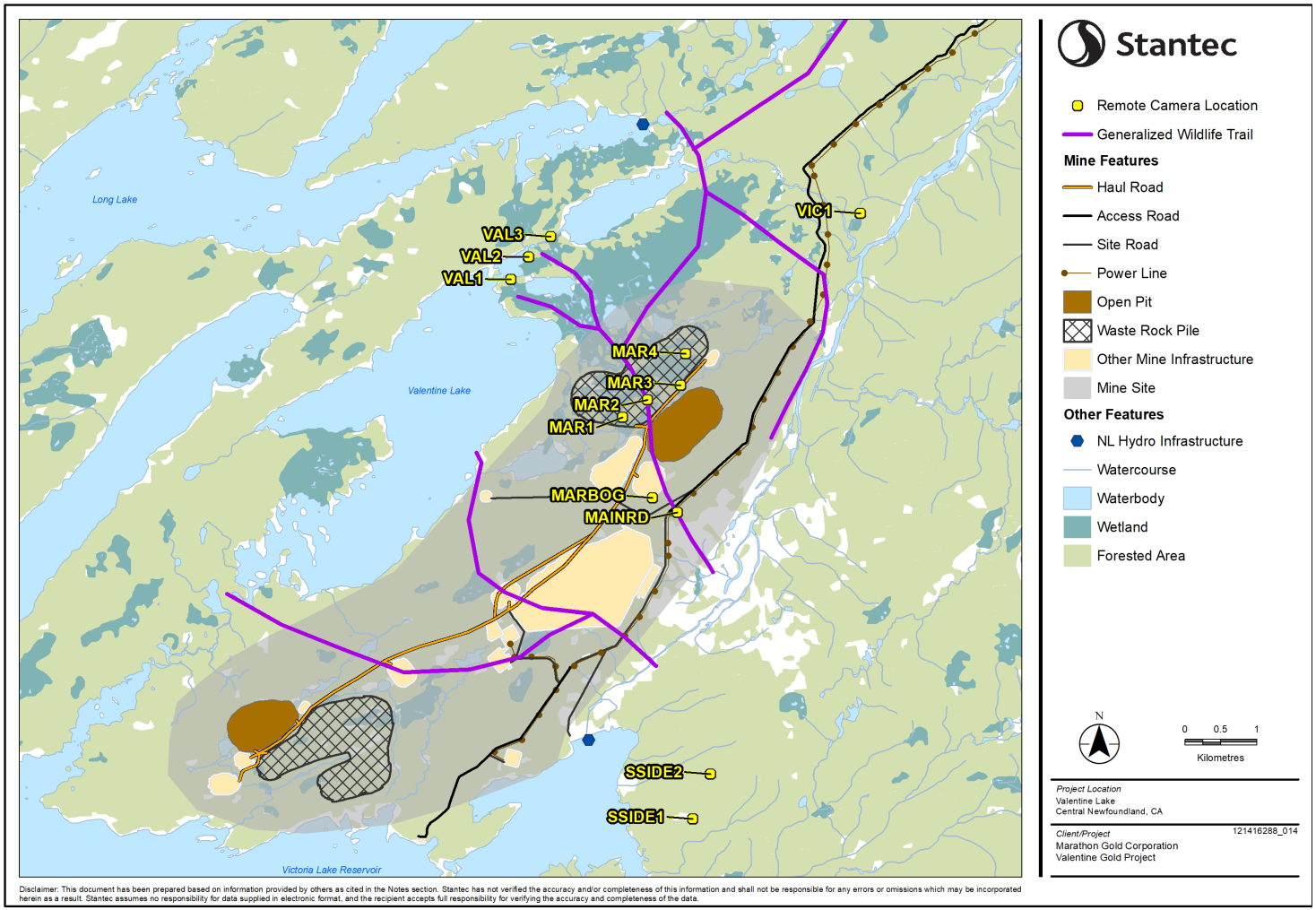

Figure 3-1 Generalized Wildlife Trail Digitized from LiDAR Data and Fall 2019 Caribou Survey Camera Deployment Locations

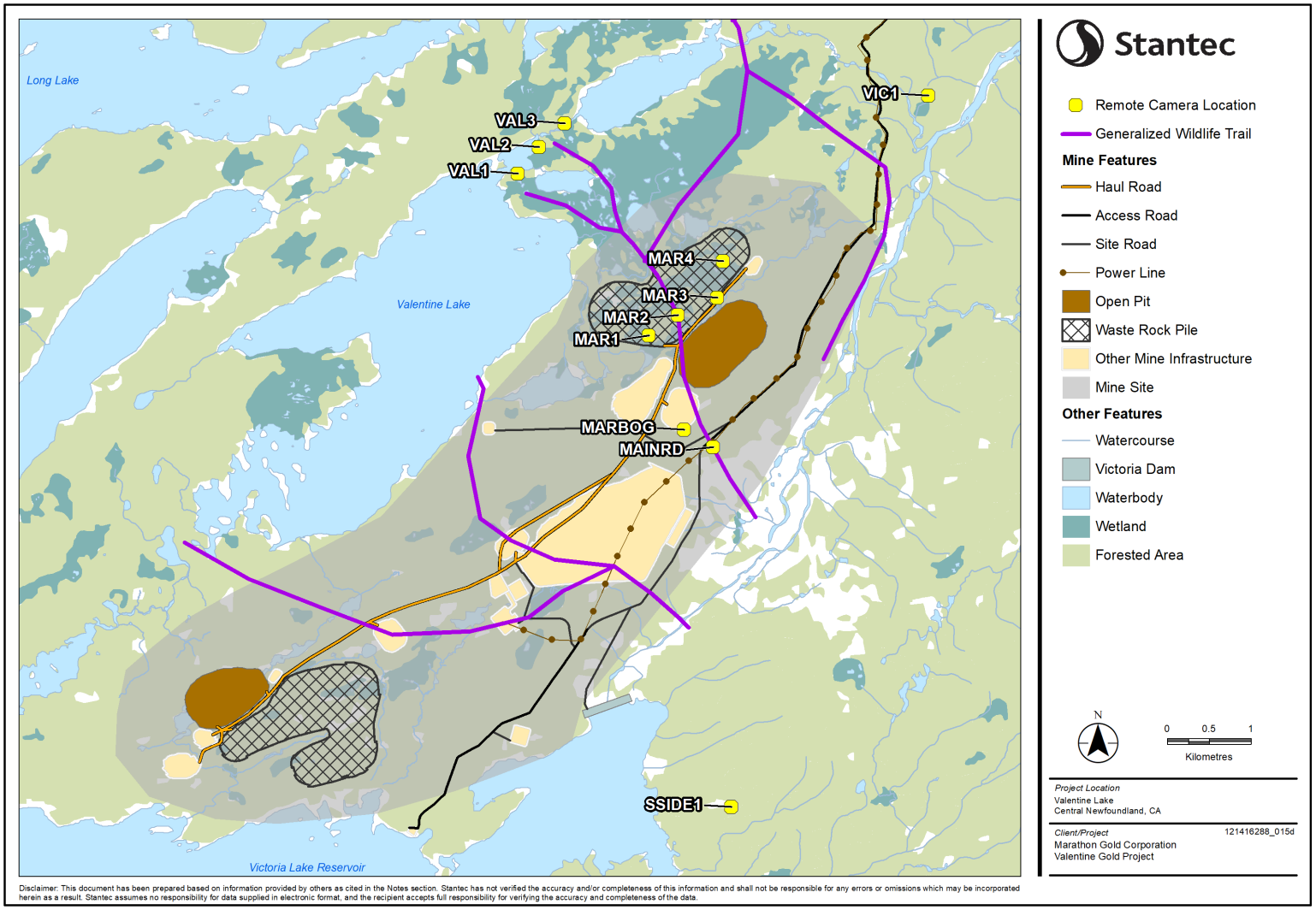

Figure 3-2 Remote Camera Deployment for Spring 2020 Caribou Survey (Study Area)

Table 3.1 Remote Camera Settings

Brand	Mode	Pictures/ Trigger	Picture Interval	Additional Settings Information
Reconyx HS2X Hyperfire 2 Security Covert IR	Motion sensor "On" with med/high sensitivity[A]	5	Rapidfire - no quiet period, no delay	Night mode (Balanced) resolution (3.1 MP)
Browning Dark Ops HD Pro X	"Trail"- pics in day and night medium sensitivity	5	Rapidfire - no delay	Capture delay – 1 sec (lowest available)
Note: [1.] - only set to high if a clear field of view				

The cameras were deployed at each site using standardized set-up procedures to allow for consistency among sites and to reduce potential effects of camera placement or setup on wildlife detection. The sites used for the Fall 2019 Caribou Survey (Stantec 2020a) were reused for the Spring 2020 Caribou Survey (with the exception of SS2) to facilitate a direct comparison (Appendix A). Camera SS2 was not used for the Spring 2020 Caribou Survey because there was concern about being able to access the area in June to retrieve it .The five areas that were selected for camera deployment were: Valentine Outlet (VAL1, VAL2, VAL3), Marathon pit (MAR1, MAR2, MAR3, MAR4), Main Road (MAINRD, MARBOG), South Side of Victoria River (SSIDE1) and Victory pit (VIC1). These areas were separated by at least 500 m to maintain independence (Stantec 2015), although cameras within these areas were less than 500 m apart.

The cameras were mounted on trees with diameters of approximately 20 cm or larger. At sites where the camera mount needed additional stability, trees were braced with logs to reduce movement from the wind. At sites with no suitable trees, tripods were installed as camera mounts. Cameras were placed approximately 1 m above the snow pack to increase the probability of large mammal detection (Stantec 2015). Cameras were positioned facing the game trail to increase the path length of animals through the frame (Rovero et al. 2010). The cameras were positioned in a northerly direction where possible to limit false triggers from solar glare due to the sensitivity of passive IR sensor systems to solar temperature and movement (Brown and Gehrt 2009).

To reduce the incidence of false positives (i.e., camera is triggered by something other than wildlife such as branches, grasses moving in the wind, falling snow), visible branches within the camera's field of view were trimmed where necessary. A walk test was completed before leaving the site to assess camera angle, position and path length along the game trail to improve likelihood of detection. At each camera deployment location, site specific information was recorded including location (recorded by a Geographic Positioning System (GPS) device), camera height and orientation (Appendix A). Cameras were retrieved between June 12–18, 2020.

Of the caribou herds identified in the Provincial EIS Guidelines (Government of NL 2020), the Buchans herd has greatest amount of overlap with the Project Area, predominantly during the spring and fall migration periods. Based on telemetry data provided by NLDFFA-WD, the range of the Gaff Topsails herd occurs north of the Project Area, although there may be individual resident animals within the Project Area. The Gaff Topsails, Grey River and La Poile herds do not have the same degree of overlap with the Project Area and do not demonstrate large scale movements through the area. The majority of the caribou detected by the remote cameras are mostly likely Buchans caribou migrating to the calving grounds. However, there is

the possibility that single caribou or small groups (e.g., two or three) could be resident caribou, which would mostly likely be Grey River animals.

3.2 REMOTE CAMERA DATA ANALYSIS

Remote camera photos were reviewed using the program Timelapse v.2.2.3.6, which is an image analysis software program that extracts photograph metadata and facilitates the management of photo results (Greenberg 2020). Photos were analyzed based on independent events identified from a photo series. For the analysis, an event was defined as beginning when an animal or group of animals (i.e., one or more animals) entered the frame and ending when the animal or group had exited the frame for more than two minutes (Stantec 2015, Rowcliffe et al. 2008). Collared caribou captured in the photos were noted. Group composition metrics were calculated (i.e., group sizes, sex ratios and age classes).

Observed caribou were classified as follows: calves = born in spring 2020; yearlings = approximately one year (i.e., born spring 2019); and adults > two years. The category of “Unknown” included caribou of all age classes whose sex could not be determined. The category of “total caribou” included adults, yearlings, calves and unknown. Caribou were classified based on presence of vulvae or penis, head and body size, and antler characteristics (e.g. present or absent, shape, hard or in velvet). “Total adults” included adults of known and unknown sex.

The following values were calculated: male:100 females ratio, percent males (males/total caribou x 100) and percent yearlings (yearlings/total caribou x 100). The classification data collected from the remote cameras is not intended to provide a population sex and age ratio estimate. The values presented in this report describe results of the remote camera survey program and may be included in future discussions about changes to observations of caribou migration over time if such effects are evident.

4.0 RESULTS

Cameras were deployed at 11 sites in the study area (Figure 3-2). Deployment locations and additional information about the deployment sites is provided in Appendix A. The camera at MAINRD malfunctioned shortly after deployment (possible due to a faulty battery) and ceased to record photos. Caribou were detected by the remaining 10 cameras. The camera at MAR4 recorded wildlife detections only until May 24, 2020. MAR2 recorded over 16,000 false triggers between May 16–25, 2020 when it ceased to function. Results presented exclude MAINRD and only include MAR4 until May 25, 2020, when it ceased to function.

The cameras at VAL1, VAL2, MAR1 and MAR3 detected the greatest number of caribou events and the highest number of individual caribou (Table 4.1; Figure 4-1). VAL1 recorded the most caribou events, followed by VAL2, MAR1 and MAR3. VAL1 recorded 45% of all caribou events, whereas 52% of all caribou events were from SSIDE1, VAL2 and cameras at Marathon pit (Figure 4-2). MARBOG, VAL3 and VIC1 captured the remaining 3% of events (Figure 4-2). This pattern of event captures differed from the Fall 2019 Caribou Survey when MAINRD, MAR1 and VAL2 had the most caribou events (85%) (Figure 4-2). At VAL1, caribou were detected moving across Valentine Lake on the ice between April 27–May 2, 2020 (Appendix B, Figure B-2). However, from May 12–22, 2020, when the lake was open, caribou were observed turning south-west at the shore of the lake rather than crossing (Appendix B, Figure B-3).

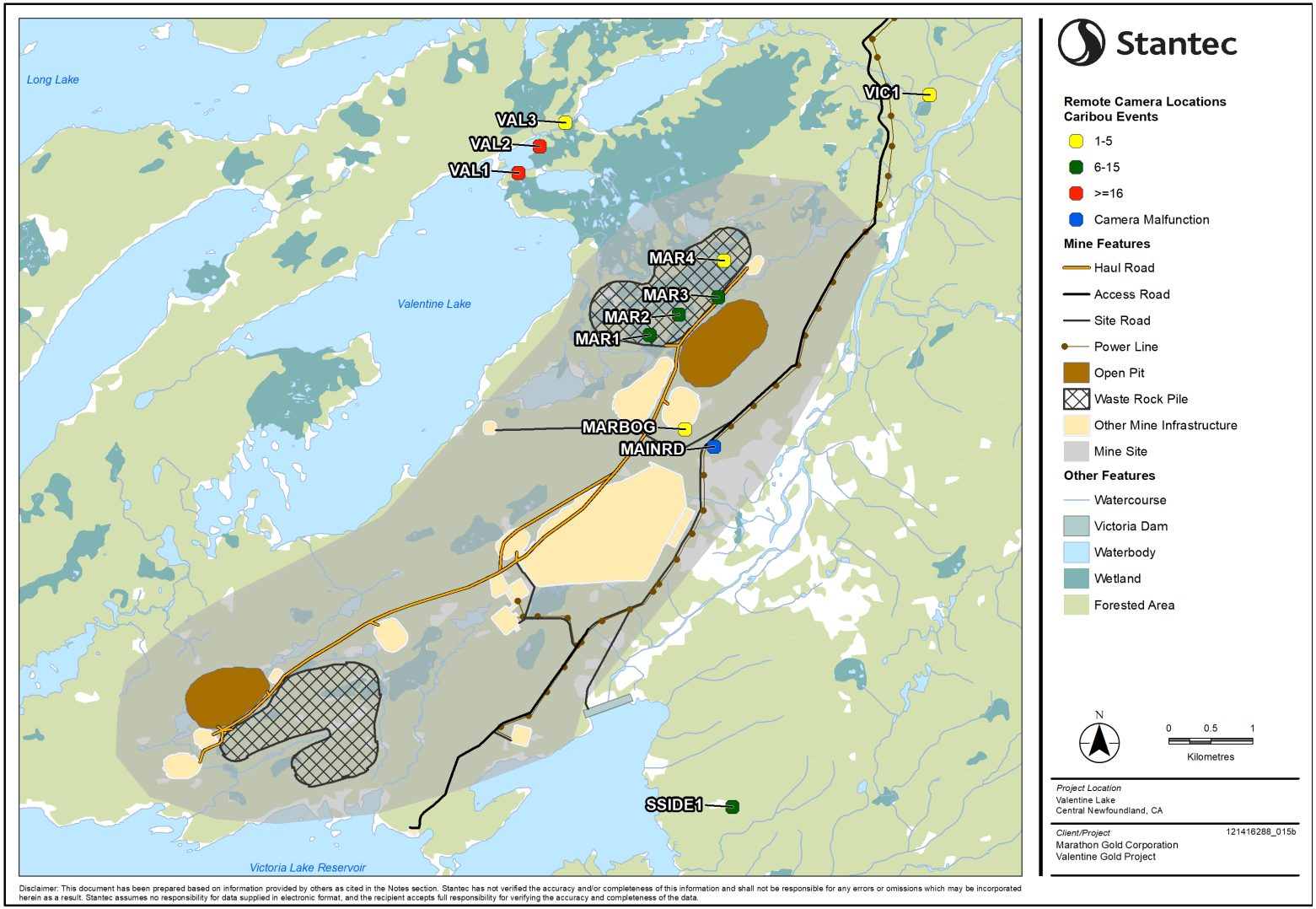

Figure 4-1 Number of Caribou Events Captured at Remote Camera Sites

Table 4.1 Number of Caribou Events and Number of Caribou Detected at Remote Camera Sites

Camera ID	Retrieval Date	Number of Days Deployed	Number of Caribou Events	Number of Caribou Detected
VAL1	June 15, 2020	81	92	442
VAL2	June 16, 2020	82	29	81
VAL3	June 16, 2020	82	1	1
MAR1	June 14, 2020	80	20	86
MAR2	June 18, 2020	84	13	20
MAR3	June 18, 2020	84	20	25
MAR4	June 18, 2020[1]	60	12	20
MARBOG	June 18, 2020	84	1	1
MAINRD[2]	Unknown	-	-	-
VIC1	June 15, 2020	81	4	4
SSIDE1	June 12, 2020	78	13	21

Notes:
1. Possible malfunction – only detected caribou until May 24, 2020
2. Camera malfunction

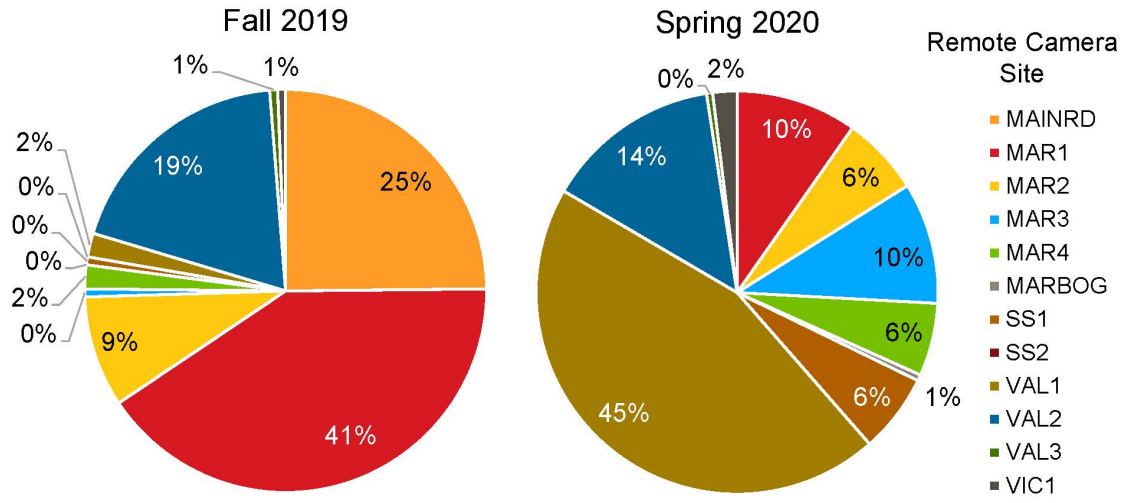

Figure 4-2 Proportion of Caribou Events By Remote Camera Site in Fall 2019 and Spring 2020

Note: Proportions are rounded to the nearest whole number resulting in low proportions to be rounded to 0% despite small numbers of caribou events being detected.

The number of caribou events per day is illustrated in Figure 4-3. Caribou, either singly or in groups, were counted between April 25–June 16, 2020. The largest numbers of events were from May 12–June 1, 2020 (Figure 4-3). However, the greatest number of individual caribou were counted between April 30–May 17, 2020 (Figure 4-3). The mean number of caribou per group was six (range: 1-84). Compared to the May 12–June 1 period, fewer events (i.e., discrete groups of one of more caribou) were recorded between April 30–May 17, but group size was larger.

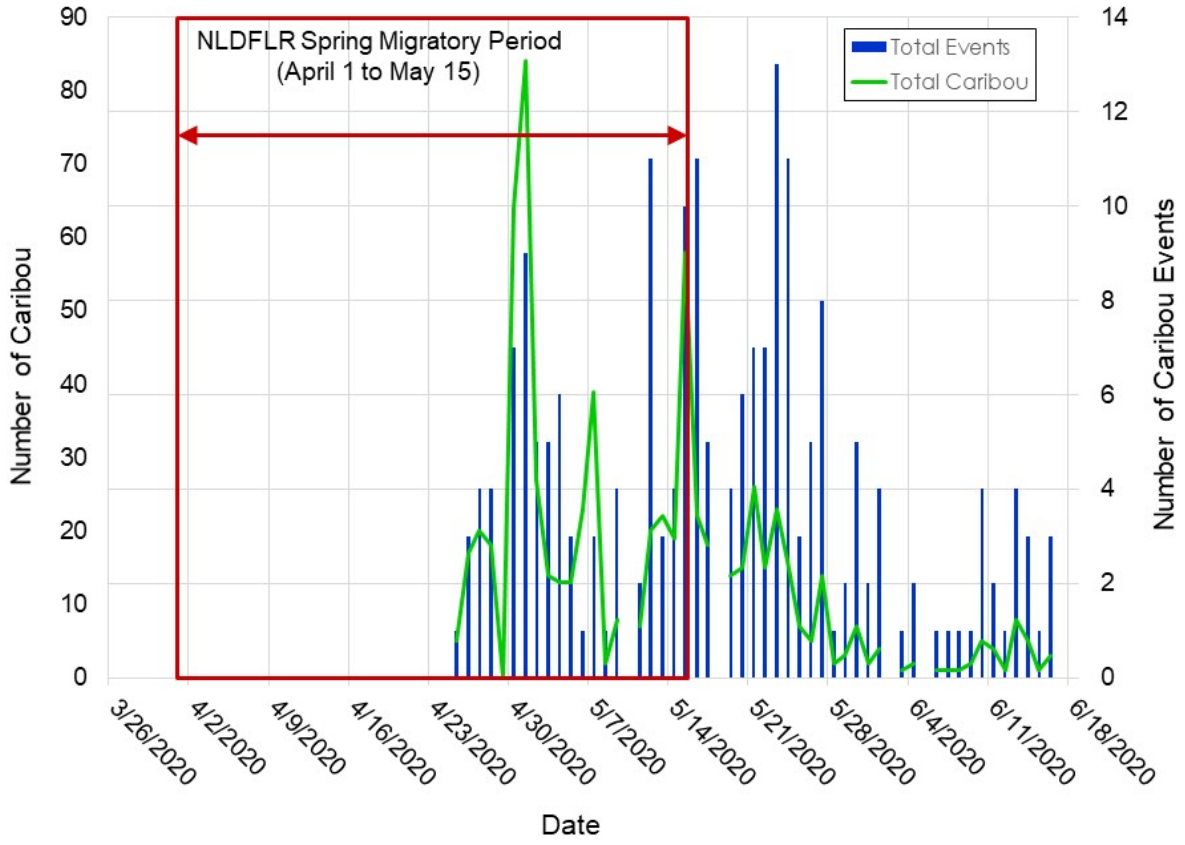

Figure 4-3 Number of Caribou Observed and Number of Caribou Events at Remote Cameras Sites

The peak movement period differed between female and male caribou (Figure 4-4). The peak of female movement captured on the remote cameras was from April 25–May 7, 2020 and the peak of movement for males was between May 15–May 27, 2020 (Figure 4-4). Between May 20–June 18, 2020, a higher percentage of males were detected (mean: 60%, range 0-100%) (Figure 4-5).

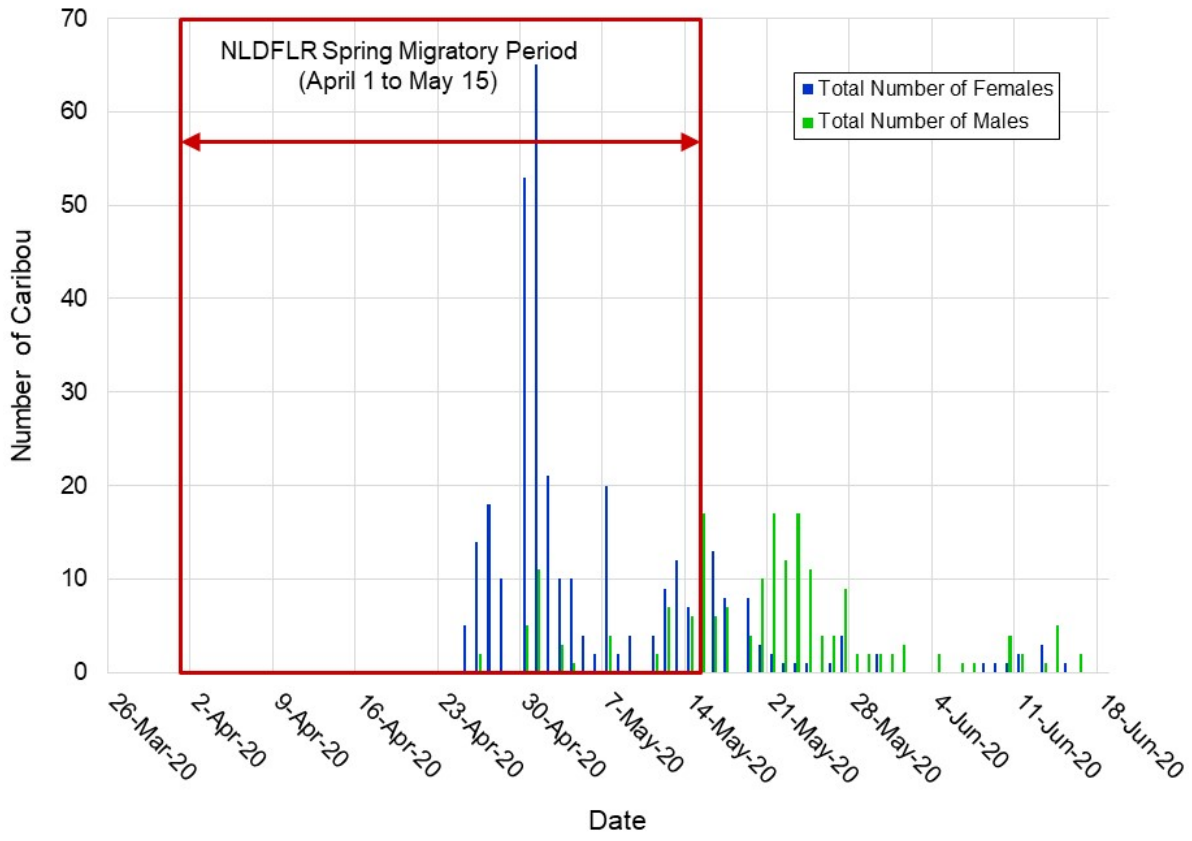

Figure 4-4 Number of Female and Male Caribou Observed at Remote Cameras Sites

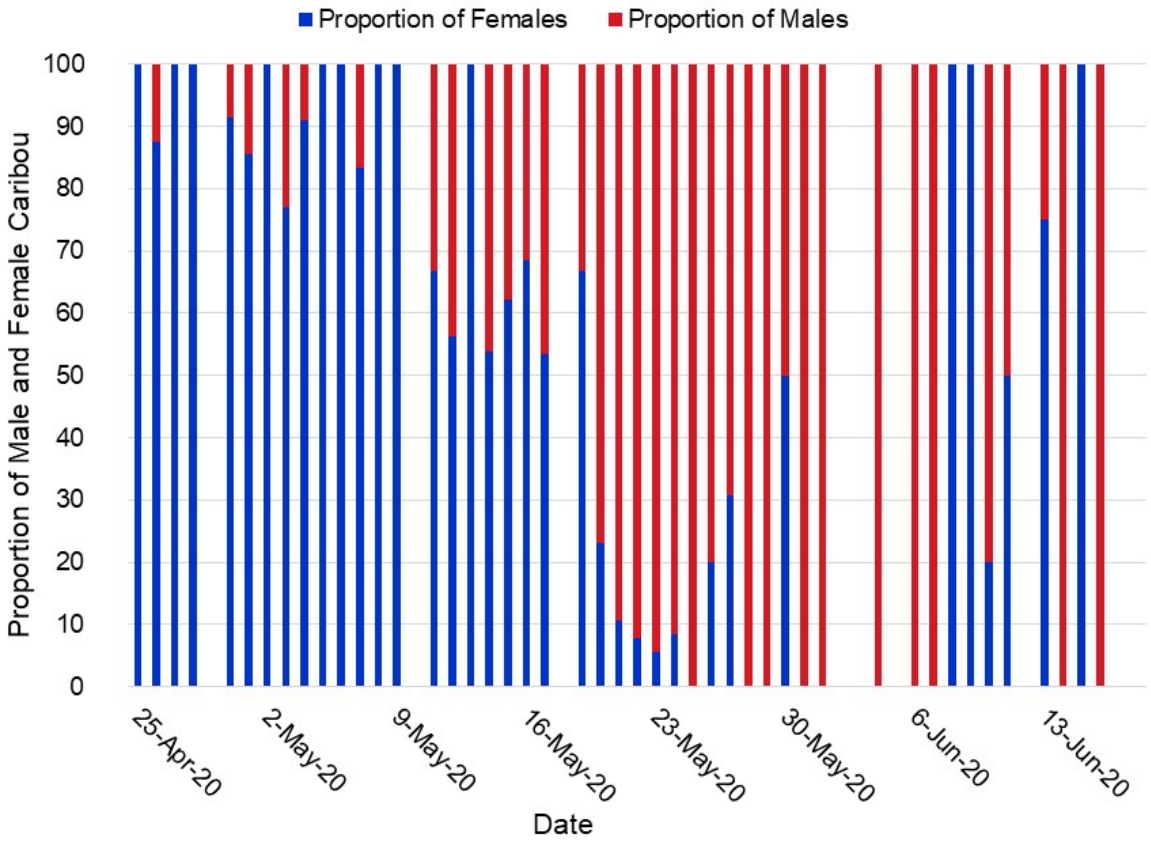

Figure 4-5 Proportion of Female and Male Caribou Counted at Remote Camera Sites

There were 701 caribou detected during the Spring 2020 Caribou Survey (Table 4.2). The ratio of males to females was 53 males:100 females (Table 4.2). Three neonate calves were detected (one on June 9, 2020 and two on July 13, 2020). Yearlings made up 7% of total caribou detected, and 108 caribou were classified as unknown. No caribou with collars were detected, however one caribou had a single yellow ear tag.

Table 4.2 Caribou Group Composition based on Remote Camera Results

	Total
Total Caribou	701
Total Adults[1]	538
Adult Females	351
Adult Males	189
Adult Unknown[2]	98
Yearlings	52
Calves	3
Unknown[3]	8
Male:100 Females[4]	54
Percent Males[4] (%)	27
Percent Yearlings[4] (%)	7
Mean Group Size[5] (range in brackets)	6 (1-84)

Notes:
1. Total adults = adult females + adult males
2. Adult Unknown = adults of unknown sex
3. Unknown includes caribou of unknown sex and/or age class
4. Numbers rounded to the nearest whole number
5. Mean group size and range based on all cameras

Other wildlife species detected by the remote cameras were moose (*Alces alces*), American marten (*Martes americana*), black bear (*Ursus americanus)*, Canada goose (*Branta canadensis*), coyote (*Canis latrans)*, red fox (*Vulpes Vulpes*), and an unidentified species of duck. Additional information on incidental sightings is provided in Appendix B.

4.1 NOTEWORTHY DETECTIONS

Two noteworthy events were recorded by the remote cameras:

- An injured female yearling was detected at MAR3, and then again at MAR4 one hour later. She was distinguishable by her injuries and the blood on her fur. This indicates she had moved northward from MAR3 to MAR4.
- At VAL1, a group of caribou were observed running past the camera at high speed. Six minutes later, a coyote was detected walking in the opposite direction. This suggests that the coyote may have been chasing, or had startled, the caribou.

5.0 DISCUSSION

The Buchans, Gaff Topsails, Grey River and La Poile caribou herds have the potential to interact with the mine site (Government of NL 2020). Preliminary analysis of the telemetry data provided by NLDFFA-WD has indicated that the Buchans herd has the greatest amount of overlap with the Project. The La Poile and Gaff Topsails herds do not overlap the Project Area during spring. It is assumed for this discussion that the caribou detected by the remote cameras were most likely Buchans caribou, with potential for a small number of resident Grey River caribou.

Information from the Wildlife Division (Government of NL 2019) indicated a caribou migration path through the Marathon pit, and Stantec's identification of wildlife trails from LiDAR data indicated a well-used wildlife path between the north end of Valentine Lake and the Victoria River. Use of this wildlife trail identified from LiDAR was confirmed during the Fall 2019 Caribou Survey as cameras VAL2, MAR2 and MAINRD recorded the highest number of caribou. Remote cameras recorded similar patterns of use during the Spring 2020 Caribou Survey with VAL1, VAL2, MAR1 and MAR2 detecting the most caribou.

The Spring 2020 Caribou Survey counted from 20-25 caribou at the MAR3, MAR4 and SSIDE1 site, and more than 400 caribou at VAL1. Comparatively, during the Fall 2019 Caribou Survey, only one to three caribou were counted at each of these sites (Stantec 2020a). Nearly 500 caribou were counted at MAINRD in the Fall 2019 Caribou Survey, however due to malfunction during the Spring 2020 Caribou Survey, no data were recovered from this site. Therefore, the use of this area during the spring migration is unknown. Additionally, MAR4 malfunctioned before the end of the deployment period, so data for this site from May 24 to retrieval were not recorded.

Data from the remaining cameras from the Spring 2020 Caribou Survey indicate that spring migration movements are more dispersed than in fall. This is supported by the preliminary analysis of the initial telemetry data (2005–2012; provided by Emera NL) that indicated that the spring migration corridor, which extends from Valentine Lake to northeast of the Project Area, is broader than in fall (Stantec 2019). The remote camera data from the Spring 2020 Caribou Survey detected 21 caribou moving towards the Project Area at the SSIDE1 site, and over 500 caribou exiting near Valentine Outlet. This suggests that caribou are migrating north using additional paths in addition to that near SSIDE1, possibly through the open boggy areas north of the Victoria River cameras. As a camera was not deployed at SS2 for the Spring 2020 Caribou Survey due to concerns about accessing the site to retrieve the camera, no additional information about caribou moving northward is available for this area.

VAL1 captured caribou moving west across Valentine Lake on the ice (Appendix B, Figure B-2), but following break-up, caribou turned south-west at the shore of the lake (Appendix B, Figure B-3). This indicates that caribou may be crossing at the narrowest point (approximately 8 m) rather than either moving north around Valentine Lake, or swimming across at VAL1. The topography in this area, with a narrow land bridge between portions of Valentine Lake, seems to act as a natural narrow corridor that may limit the width of the caribou migration path. Caribou will select migration paths that provide adequate forage and resting habitat (Saher 2005), are less energetically demanding (e.g., less rugged, open terrain) (Saher and Schmigelow 2005), and have relatively low predation risk compared to other potential paths (Ferguson and

Elkie 2004). Caribou are capable swimmers and Peary Caribou do swim between 1-10 km between Arctic islands within their range (Miller 1995), despite being an energetically inefficient mode of movement (LeBlond et al. 2016). For the Project Area however, it may be more energetically efficient for caribou to swim across the narrow part of Valentine Lake compared to walking on land around the north end of the lake.

Caribou were detected between April 25–June 16, 2020. Although most events were detected between May 12–June 1, 2020, the majority of caribou migrated through the study area between April 30–May 17, 2020. Within that period of peak detections however, it appears that male and female adult caribou migrated at different times through the study area. Most females were detected between April 25–May 7, 2020, while the majority of males were detected between May 15–May 27, 2020. While some studies have found little difference in spring migration dates between sexes (Mahoney and Schaefer 2002), others have found that females start migrating to the calving grounds earlier than males (Edmonds 1988). The seasonal dates for spring migration provided by NLDFFA-WD were April 1–May 15. This period would include movement from the winter range to the calving grounds. By the time caribou reach the Project Area, they are within approximately 20 km of the calving grounds, so it is reasonable that the caribou detections within the study area would occur towards the end of the time period provided by NLDFFA-WD.

Classification results of caribou detected by the remote cameras show more females than males. On the Island of Newfoundland, the caribou sex ratio is generally more females to males, with a decreasing trend in males observed since the 1980s (Weir et al. 2014). However, the previously observed decline in sex ratio may have slowed, as a higher number of males has been observed since 2006 (Weir et al. 2014). During the Spring 2020 Caribou Survey, the majority of caribou detections after May 20, 2020 were of male caribou (mean percentage of males in recorded groups was approximately 60%). Remote cameras recorded 27% males (approximately 53 males:100 females), which is lower than results from the aerial survey of the Buchans herd calving grounds on June 9–13, 2020 when 10% of observed caribou were male (Stantec 2020b). Caribou distribution is segregated by sex at certain times of year (Jakimchuk et al. 1987) and the timing of migration may differ with sex (Edmonds 1988), which may explain the low proportion of males observed in the aerial post-calving survey. A 2019 winter classification survey of the Buchans herd reported approximately 29% males (Government of NL 2019).

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APPENDIX A

Remote Camera Site Metadata

Table A.1 Remote Camera Site Metadata

Camera Name	**Valentine Outlet 1 (VAL1)**
Camera Type	Reconyx HS2X Hyperfire 2 Security Covert IR
Deployment Date	March 26, 2020
Retrieval Date	June 13, 2020
Team Members	Deployment - Tony Parr and Jamie Meyers (Marathon)
	Retrieval - Tony Parr and Doug Rimmer
Temperature	0-4ºC
Winds	Calm
Study Area	Valentine Gold Project Mineral Claim Area
UTM Zone	21
UTM Easting	490083
UTM Northing	5362269
Habitat Composition (Tree and Shrub) **(data from October 5, 2020)**	Tree: Black spruce and larch with interspersed barrens and bogs. Shrubs: mountain alder, leather leaf, common juniper pitcher plant and bog rosemary. Ground cover was red-stemmed feather moss and lichens with sphagnum in bogs.
Camera Height	~110 cm
Camera Orientation (degrees)	~25
Evidence of Caribou Use	Well-used game trail, fresh caribou and moose tracks in 2019; photos recorded in fall 2019 migration
Photo of Camera Location	 Photo: October 5, 2019

Table A.1 Remote Camera Site Metadata

Camera Name	**Valentine Outlet 2 (VAL2)**
Camera Type	Reconyx HS2X Hyperfire 2 Security Covert IR
Deployment Date	March 26, 2020
Retrieval Date	June 13, 2020
Team Members	Deployment - Tony Parr and Jamie Meyers (Marathon)
	Retrieval - Tony Parr and Doug Rimmer
Temperature	0-4ºC
Winds	Calm
Study Area	Valentine Gold Project Mineral Claim Area
UTM zone	21
UTM Easting	490332
UTM Northing	5362584
Habitat Composition (Tree and Shrub) (data from October 5, 2020)	Open lake edge habitat with grasses interspersed with black spruce and larch. Bogs and ribbed wetland areas to the east and north. Shrubs: leather leaf, common juniper, bog rosemary, and pitcher plant. Ground cover was sedges and lichens with sphagnum in bogs.
Camera Height	~110 cm
Camera Orientation (degrees)	~315
Evidence of Caribou Use	Well-used game trail, fresh caribou and moose tracks in 2019; photos recorded in fall 2019 migration
Photo of Camera Location	 Photo: March 26, 2020

Table A.1 Remote Camera Site Metadata

Camera Name	**Valentine Outlet 3 (VAL3)**
Camera Type	Reconyx HS2X Hyperfire 2 Security Covert IR
Deployment Date	March 26, 2020
Retrieval Date	June 13, 2020
Team Members	Deployment - Tony Parr and Jamie Meyers (Marathon)
	Retrieval - Tony Parr and Doug Rimmer
Temperature	0-4ºC
Winds	Calm
Study Area	Valentine Gold Project Mineral Claim Area
UTM zone	21
UTM Easting	490640
UTM Northing	5362867
Habitat Composition (Tree and Shrub) (data from October 5, 2020)	Open lake edge habitat with grasses interspersed with black spruce alder and larch. Bogs and ribbed wetland areas to the east. Shrubs: leather leaf, common juniper, bog rosemary, and sedges.
Camera Height	~105 cm
Camera Orientation (degrees)	~330
Evidence of Caribou Use	Well-used game trail, fresh caribou and moose tracks in 2019; photos recorded in fall 2019 migration
Photo of Camera Location	 Photo: March 26, 2020

Table A.1 Remote Camera Site Metadata

Camera Name	**Marathon 1 (MAR1)**
Camera Type	Browning Dark Ops HD Pro X
Deployment Date	March 26, 2020
Retrieval Date	June 13, 2020
Team Members	Deployment - Tony Parr and Jamie Meyers (Marathon)
	Retrieval - Tony Parr and Doug Rimmer
Temperature	0-4ºC
Winds	Calm
Study Area	Valentine Gold Project Mineral Claim Area
UTM zone	21
UTM Easting	491644
UTM Northing	5360343
Habitat Composition (Tree and Shrub) (data from October 5, 2020)	Open treed bog and ribbed wetland areas with black spruce and larch. Shrubs: leather leaf, common juniper, bog rosemary, pitcher plant and sedges.
Camera Height	~90 cm
Camera Orientation (degrees)	~345
Evidence of Caribou Use	Well-used game trail, fresh caribou and moose tracks in 2019; photos recorded in fall 2019 migration
	 Photo: March 26, 2020

Table A.1 Remote Camera Site Metadata

Camera Name	**Marathon 2 (MAR2)**
Camera Type	Reconyx HS2X Hyperfire 2 Security Covert IR
Deployment Date	March 26, 2020
Retrieval Date	June 13, 2020
Team Members	Deployment - Tony Parr and Jamie Meyers (Marathon)
	Retrieval - Tony Parr and Doug Rimmer
Temperature	0-4ºC
Winds	Calm
Study Area	Valentine Gold Project Mineral Claim Area
UTM zone	21
UTM Easting	491990
UTM Northing	5360583
Habitat Composition (Tree and Shrub) (data from October 5, 2020)	Located in a tree line between two bog complexes. Trees: Black spruce, balsam fir, and larch. Open treed bog and ribbed wetland areas with black spruce and larch. Shrubs: leather leaf, common juniper, bog rosemary, pitcher plant and sedges.
Camera Height	~110 cm
Camera Orientation (degrees)	~360
Evidence of Caribou Use	Well-used game trail, fresh caribou and moose tracks in 2019; photos recorded in fall 2019 migration
Photo of Camera Location	 Photo: March 26, 2020

Table A.1 Remote Camera Site Metadata

Camera Name	**Marathon 3 (MAR3)**
Camera Type	Reconyx HS2X Hyperfire 2 Security Covert IR
Deployment Date	March 26, 2020
Retrieval Date	June 13, 2020
Team Members	Deployment - Tony Parr and Jamie Meyers (Marathon)
	Retrieval - Tony Parr and Doug Rimmer
Temperature	0-4ºC
Winds	Calm
Study Area	Valentine Gold Project Mineral Claim Area
UTM zone	21
UTM Easting	492456
UTM Northing	5360791
Habitat Composition (Tree and Shrub) (data from October 5, 2020)	Trees: Black spruce, balsam fir, and larch. Open treed bog and ribbed wetland areas with black spruce and larch. Shrubs: sweet gale, common juniper, bog rosemary, pitcher plant and sedges.
Camera Height	~115 cm
Camera Orientation (degrees)	~350
Evidence of Caribou Use	Well-used game trail, fresh caribou and moose tracks 2019; photos recorded in fall 2019 migration
Photo of Camera Location	 Photo: March 26, 2020

Table A.1 Remote Camera Site Metadata

Camera Name	**Marathon 4 (MAR4)**
Camera Type	Browning Dark Ops HD Pro X
Deployment Date	March 26, 2020
Retrieval Date	June 13, 2020
Team Members	Deployment - Tony Parr and Jamie Meyers (Marathon)
	Retrieval - Tony Parr and Doug Rimmer
Temperature	0-4ºC
Winds	Moderate
Study Area	Valentine Gold Project Mineral Claim Area
UTM zone	21
UTM Easting	492525
UTM Northing	5361227
Habitat Composition (Tree and Shrub) (data from October 5, 2020)	Trees: Black spruce, balsam fir, and larch. Sloped bog with ribbed wetland areas with black spruce and larch. Shrubs: leather leaf, bog laurel, common juniper, bog rosemary, pitcher plant and sedges.
Camera Height	~110 cm
Camera Orientation (degrees)	~350
Evidence of Caribou Use	Moderately used game trail, fresh tracks evident in 2019; photos recorded in fall 2019 migration
Photo of Camera Location	 Photo: March 26, 2020

Table A.1 Remote Camera Site Metadata

Camera Name	**Marathon BOG (MARBOG)**
Camera Type	Browning Dark Ops HD Pro X
Deployment Date	March 26, 2020
Retrieval Date	June 13, 2020
Team Members	Deployment - Tony Parr and Jamie Meyers (Marathon)
	Retrieval - Tony Parr and Doug Rimmer
Temperature	0-4ºC
Winds	Moderate
Study Area	Valentine Gold Project Mineral Claim Area
UTM zone	21
UTM Easting	492062
UTM Northing	5359217
Habitat Composition (Tree and Shrub) (data from October 5, 2020)	Trees: Balsam fir, black spruce white birch and larch. Shrubs: speckled alder, Labrador tea, bog laurel, common juniper, bog rosemary, pitcher plant and sedges.
Camera Height	~130 cm
Camera Orientation (degrees)	~325
Evidence of Caribou Use	Well-used game trail, fresh tracks evident in 2019
Photo of Camera Location	 Photo: March 26, 2020

Table A.1 Remote Camera Site Metadata

Camera Name	**Main Road (MAINRD)**
Camera Type	Browning Dark Ops HD Pro X
Deployment Date	March 26, 2020
Retrieval Date	June 13, 2020
Team Members	Tony Parr and Nic Capps (Marathon)
Temperature	0-4ºC
Winds	Moderate
Study Area	Valentine Gold Project Mineral Claim Area
UTM zone	21
UTM Easting	492409
UTM Northing	5359013
Habitat Composition (Tree and Shrub)	Open wetland bog: Black spruce, balsam fir, and larch around periphery. Scattered black spruce and larch throughout. Shrubs: speckled alder, leather leaf, Labrador tea and sedges.
Camera Height	~150 cm
Camera Orientation (degrees)	~45
Evidence of Caribou Use	Well-used game trail in 2019; photos recorded in fall 2019 migration
Photo of Camera Location	 Photo: March 26, 2020

Table A.1 Remote Camera Site Metadata

Camera Name	Victory Southwest (VIC1)
Camera Type	Browning Dark Ops HD Pro X
Deployment Date	March 26, 2020
Retrieval Date	June 13, 2020
Team Members	Deployment - Tony Parr and Jamie Meyers (Marathon)
	Retrieval - Tony Parr and Doug Rimmer
Temperature	0-4ºC
Winds	Moderate
Study Area	Valentine Gold Project Mineral Claim Area
UTM zone	21
UTM Easting	494971
UTM Northing	5363195
Habitat Composition (Tree and Shrub) (data from October 5, 2020)	Open wetland bog: Black spruce and larch around periphery. Scattered black spruce and larch throughout. Shrubs: leather leaf, Labrador tea, sheep laurel and sedges.
Camera Height	~125 cm
Camera Orientation (degrees)	~50
Evidence of Caribou Use	Well-used game trail in 2019; photos recorded in fall 2019 migration
Photo of Camera Location	 Photo: March 26, 2020

Table A.1 Remote Camera Site Metadata

Camera Name	**South Side Victoria River 1 (SSIDE1)**
Camera Type	Reconyx HS2X Hyperfire 2 Security Covert IR
Deployment Date	March 26, 2020
Retrieval Date	June 13, 2020
Team Members	Deployment - Tony Parr and Jamie Meyers (Marathon)
	Retrieval - Tony Parr and Doug Rimmer
Temperature	0-4ºC
Winds	Moderate
Study Area	Valentine Gold Project Mineral Claim Area
UTM zone	21
UTM Easting	492625
UTM Northing	5354727
Habitat Composition (Tree and Shrub) (data from October 5, 2020)	Stepped bog complex: Black spruce, balsam fir, and larch around periphery. Black spruce and larch throughout. Shrubs: black spruce, larch, speckled alder, leather leaf, Labrador tea and sedges.
Camera Height	~110 cm
Camera Orientation (degrees)	~50
Evidence of Caribou Use	Well-used game trail in 2019
Photo of Camera Location	 Photo: March 26, 2020

APPENDIX B

Caribou Photos from Remote Cameras

Figure B-1 Male Caribou from MAR1 Remote Camera, May 24, 2020

Figure B-2 Caribou Crossing Ice on Valentine Lake from VAL1 Remote Camera, May 1, 2020

Figure B-3 Caribou Turning South-West at Shore of Valentine Lake, from VAL1 Remote Camera, May 19, 2020

Figure B-4 Male Caribou from MAR3 Remote Camera, June 16, 2020

Figure B-5 Female Caribou and Neonate Calf from VAL1 Remote Camera, July 9, 2019

Figure B-6 Caribou Including Female with Ear Tag from VAL1 Remote Camera, April 30, 2020

a.)

b.)

Figure B-7 **Injured Female Yearling from: a.) MAR3 Remote Camera, 8:39 am, May 4, 2020, and b.) MAR4 Remote Camera, 9:38 am, May 4, 2020**

a.)

b.)

Figure B-8 a.) Group of Caribou Running, from VAL1 Remote Camera, 00:39 am, April 28, 2020
b.) Coyote, from VAL1 Remote Camera, 00:45 am, April 28, 2020

APPENDIX C

Incidental Wildlife Detections

INCIDENTAL WILDLIFE DETECTIONSS

Incidental wildlife observations for moose are provided in separately in Table C.1. The remainder of wildlife species detected are included in Table C.2.

Incidental Moose Detections

Table C.1 Moose Detections from Remote Cameras Sites

Camera ID	Number of Events	Total Number of Moose	Number of Males	Number of Females	Number of Yearlings	Number of Calves	Number of Unknown
Val1	7	10		6	1		3
Val2	8	10	2	6			2
Val3	12	14	12				2
Mar1	1	1		1			
Mar2	5	5	1	3			1
Mar3	7	8	1	5		1	1
Mar4	3	3	1				2
MainRd[A]							
MarBog	3	4	1	2		1	
Vic1	8	9	1	1			7
SSIDE1	7	7		5			2

Note: Moose were detected from April 1-June 18, 2020
[A] – Camera malfunction

Figure C-1 Female Moose and Calf from MAR3 Remote Camera, June 3, 2020

Figure C-2 Male Moose from VAL2 Remote Camera, June 14, 2020

Other Incidental Wildlife Detections

Table C.2 Other Incidental Wildlife Detections from Remote Cameras Sites

Species	Camera ID	Date	Number of Individuals Detected
American Marten	VAL1	Mar 29, 2020 April 7, 2020	2
Black Bear	MAR1	June 12, 2020	1
Canada Goose	VAL3	April 20, 2020	min. 10
Coyote	VAL1	April 28, 2020	1
	MAR1	April 28, 2020	1
Grey Jay	MAR4	May 8, 2020 May 11, 2020 May 14, 2020 May 16, 2020	5
Red Fox	VAL1	April 13, 2020	1
Unidentified Duck	MAR1	May 7, 2020	2

Figure C-3 American Marten from VAL1 Remote Camera, March 29, 2020

Figure C-4 Black Bear from MAR1 Remote Camera, June 12, 2020

Figure C-5 Canada Geese from VAL3 Remote Camera, April 20, 2020

Figure C-6 Grey Jays from MAR4 Remote Camera, May 16, 2020

Figure C-7 Red Fox from VAL1 Remote Camera, April 13, 2020

Figure C-8 Unidentified Ducks from MAR1 Remote Camera, May 7, 2020

ATTACHMENT 2-C

2020 Post-Calving Aerial Survey (2020)

Valentine Gold Project: 2020 Post-Calving Caribou Survey

Final Report

September 21, 2020

Prepared for:

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Executive Summary

Marathon Gold Corporation (Marathon) is planning to develop the Valentine Gold Project (the Project), located in the Central Region of the Island of Newfoundland. The Project overlaps with woodland caribou (*Rangifer tarandus*) range in central Newfoundland. The Wildlife Division of the Newfoundland and Labrador Department of Fisheries, Forestry and Agriculture identified the need to gather information about the Buchans Herd and resident caribou that calve in the Project's zone of influence (ZOI).

Stantec Consulting Ltd (Stantec) undertook an aerial post-calving survey to obtain herd composition information about the Buchans herd and resident caribou that calve in the ZOI, and to complete a population estimate on the Buchans herd calving ground. The survey was completed between July 9-13, 2020.

More than 1,900 caribou were observed during the survey. The survey area was divided into two portions: a western area for the Buchans herd, and an eastern area for resident caribou that calve within the ZOI. Classifications were completed for each portion of the survey area. Within the area for resident caribou, there were 11% calves and 32% males. Within the Buchans herd survey area, there were 30% calves and 10% males. A population estimate for the Buchans herd indicated approximately 1,700 caribou on the Buchans calving grounds.

This report provides a description of methods and results from the aerial post-calving caribou survey. This information, including the analysis of telemetry data, will inform the Environmental Impact Statement for the Project and may be included in future discussions about caribou group composition and distribution on the calving grounds if change occurs over time.

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Abbreviations

AIC	Akaike Information Criterion
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
EA	Environmental Assessment
EIS	Environmental Impact Statement
GIS	Geographic Information System
GPS	Geographic Positioning System
km	Kilometre
km^2	Square kilometre
m	Metre
NLDFFA-WD	Newfoundland and Labrador Department of Fisheries, Forestry and Agriculture – Wildlife Division
NL ESA	Newfoundland and Labrador *Endangered Species Act*
SARA	*Species at Risk Act*
ZOI	Zone of Influence

1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec) was retained by Marathon Gold Corporation (Marathon) to undertake several baseline environmental studies for the Valentine Gold Project (the Project), including analysis of woodland caribou (*Rangifer tarandus*) migration, distribution and use of the Project Area (Figure 1-1). As woodland caribou have been identified as a valued component in the Environmental Impact Statement (EIS) Guidelines for the Project issued by both the federal and provincial governments (Impact Assessment Agency of Canada 2019; Government of Newfoundland and Labrador [NL] 2020a), the results of these baseline studies will be used to support an environmental assessment (EA) of the Project.

Located in central Newfoundland approximately 57 km south of Buchans, the Project will consist primarily of two open pits, waste rock piles, crushing and stockpiling areas, conventional milling and processing facilities, a tailings management facility, personnel accommodations, and supporting infrastructure including roads, on-site power lines, buildings and water and effluent management facilities. The mine site is accessed by an existing gravel road, approximately 82 km in length, which extends south from Millertown. Approximately 73 km of this existing access road will be upgraded and maintained by Marathon as part of the Project.

The Project overlaps woodland caribou (*Rangifer tarandus*) range in central Newfoundland. Stantec, on behalf of Marathon, undertook an aerial survey to classify and determine the number of calf:female pairs on the calving grounds for both resident caribou that calve within the zone of influence (ZOI) and for the Buchans herd. Additionally, a population estimate was completed for the entire calving grounds of the Buchans herd.

Introduction

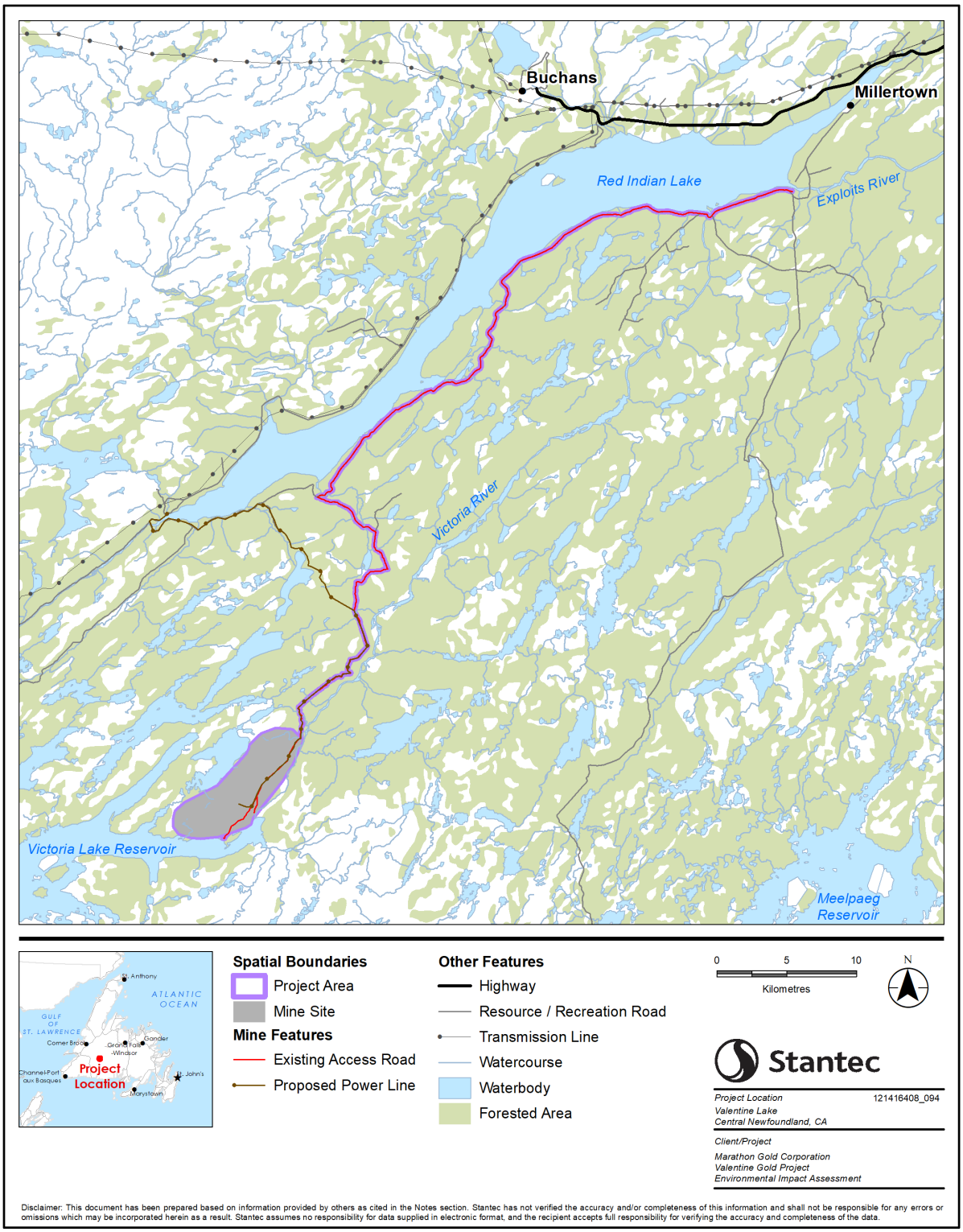

Figure 1-1 Project Area

Note that the BSAs consist of data reports that have been prepared for Marathon over a number of years (i.e., 2011 to 2020), during which the Project has undergone a series of refinements. The study areas and Project references in these data reports reflect the Project description at the time of preparation of these reports. The current Project description for the purposes of environmental assessment is found in Section 2 of the EIS.

2.0 BACKGROUND AND CONTEXT

2.1 PROJECT OBJECTIVES

The objectives of the 2020 Post-Calving Caribou Survey were to:

- Determine caribou group size and composition on the calving grounds within the ZOI, including the number of calf:female pairs s (i.e., classification)
- Determine caribou group size and composition on the Buchans herd calving grounds, including the number of calf:female pairs s (i.e., classification)
- Complete a population estimate of the entire calving grounds for the Buchans herd

2.2 CONTEXT

The caribou population on the Island of Newfoundland is comprised of several sub-populations differentiated by annual movement patterns, spatial affiliations and genetic structure (Wilkerson 2010; Government of NL 2015). The caribou population on the Island of Newfoundland has decreased by approximately 60% since the late 1990s (Soulliere et al. 2010; COSEWIC 2014; Government of NL 2015). While woodland caribou on the Island of Newfoundland is not listed under the federal *Species at Risk Act* (SARA) or the provincial *Endangered Species Act* (NL ESA), it is considered 'Special Concern' by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (COSEWIC 2014).

The Project potentially interacts with the following South Coast sub-population herds: Buchans, Gaff Topsails, Grey River and La Poile (Government of NL 2020a). Recent surveys of some herds in this area (i.e., Buchans, Grey River, Gaff Topsails, La Poile) indicate that population trends may be stabilizing (Government of NL 2019). The South Coast caribou sub-population herds share winter range near the southern shore between Burgeo and the Connaigre Peninsula (Weir et al. 2014), however have separate calving areas and summer ranges. A post-calving survey was undertaken to complete a post-calving classification of both the Buchans herd and resident caribou that calve in the ZOI and to develop a post-calving population estimate for the Buchans herd. While the herd affiliation for caribou that calve within the ZOI is uncertain, their distribution overlaps with the calving range of the Grey River herd. It is assumed therefore that most resident caribou that calve in the ZOI are Grey River caribou. Based on the generalized dates for caribou seasons on the Island of Newfoundland (Table 2.1), the survey of the calving and post-calving areas was scheduled for early June.

Table 2.1 General Seasons for Island Caribou in Newfoundland

Season	Seasonal Dates
Winter	Dec 16 – Mar 31
Spring Migration/Pre-calving	Apr 1 – May 19
Calving	May 20 – Jun 10
Post-calving Migration/Dispersal	Jun 11 – Jun 30
Post-calving Rearing	Jul 1 – Aug 31
Fall Rut	Sep 1 – Oct 31
Fall Migration/Dispersal	Nov 1 – Dec 15
Source: Emera (2013)	

3.0 METHODS

3.1 SURVEY AREAS

3.1.1 Buchans Herd

The survey area for the Buchans herd was delineated based on telemetry data transferred from the Newfoundland and Labrador Department of Fisheries, Forestry and Agriculture – Wildlife Division (NLDFFA–WD) (ARGOS and Geographic Positioning System [GPS] collars from 2007-2012 and 2016-2017) as well as discussion with NLDFFA-WD. Fix-rates for the ARGOS and GPS collars were one and two hours, respectively. The data was quality reviewed to remove locations that were either low quality or faulty (e.g., Fix Status ≥ 2). The calving range (or kernel) was estimated from telemetry data using a geographic information system (GIS). The calculation of calving range included only collared animals with a minimum of 50 locations in the season of interest based on recommendations for wildlife kernel analysis (Seaman et al. 1999; Barg et al. 2005; Tri et al. 2014).

A utilization distribution for the calving season (May 20 - June 10) was determined using the kernel density estimation method in ArcGIS™ v.10.7.1 (ESRI 2017) using Kernel Density in Spatial Analyst Tools in ArcGIS™. Two contour intervals (isopleths) were calculated for each seasonal range. A 50% contour or core area was calculated, which represents a 50% probability that a collared caribou occurs (i.e., areas with higher densities of locations). Additionally, a larger 95% contour was calculated that represents the estimated seasonal home range boundary where there is a 95% probability that a collared caribou occurs. Smoothed cross-validation was used as the smoothing parameter for the calculation. A 5-km buffer was added to the 95% kernel for conservatism. Point telemetry locations from May and June were also used to inform the survey area. The 95% kernel with the buffer was overlaid with survey boundaries suggested by NLDFFA–WD. The final survey area was defined by merging the entirety of the area suggested by NLDFFA–WD with the area of the 95% kernel including the 5-km buffer (Figure 3-1). Transects were established within the survey area in an east-west orientation at 3-km intervals, consistent with NLDFFA-WD survey protocol.

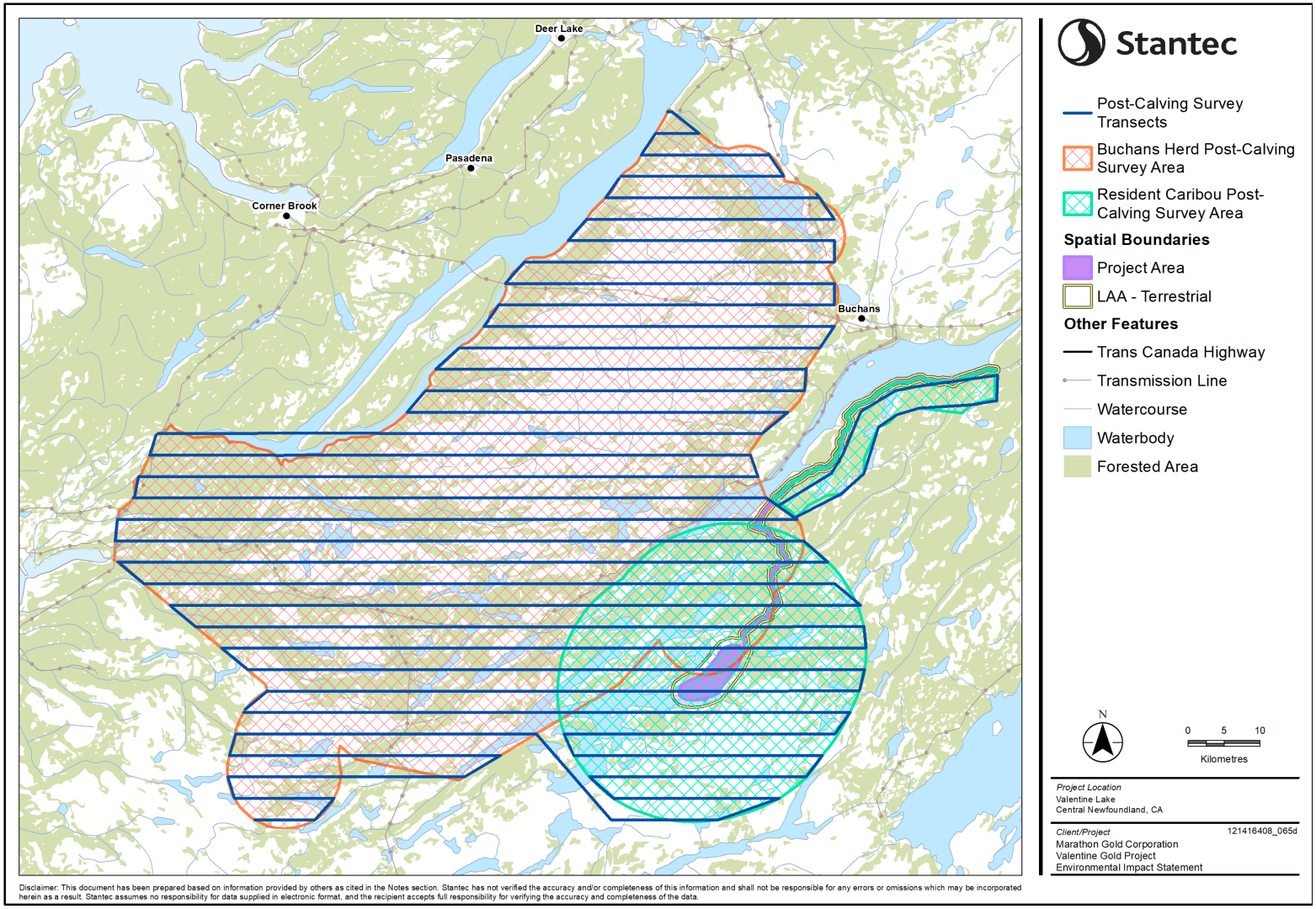

Figure 3-1 Survey Area for 2020 Post-Calving Caribou Survey

3.1.2 Resident Caribou That Calve within the Zone of Influence

The survey area for resident caribou included a 17-km buffer around the mine site, in addition to a 4-km buffer along the south side of the access road (Figure 3-1). The 17-km buffer was selected based on results from noise modelling conducted for the Project, which predicted a return to baseline sound pressure levels 5 km from the mine site; and ZOIs presented in the literature that show caribou avoidance of mines between 2 and 11 km (Weir et al. 2007; Polfus et al. 2011; Boulanger et al. 2012; LeBlond et al. 2014; Johnson et al. 2015; Pigeon et al. 2016; Eftestøl et al. 2019). The determination of the ZOI for the Project will depend on several factors including the intensity and duration of the disturbance, topography, habitat type and the timing of the disturbance (e.g., calving, migration).

The 17-km buffer on the mine site and the 4-km buffer on the road were selected for gathering baseline data on caribou distribution prior to construction such that it may be considered in discussions about potential change in caribou distribution and composition over time. This buffer is considered sufficiently conservative to account for variability in the degree of avoidance described in the literature. Transects were established within the survey area at 3-km intervals, consistent with NLDFFA-WD survey protocol. Additionally, a 4-km survey area was added around the access road. Caribou exhibit avoidance of roads up to 4 km (Dyer et al. 2001; Vistnes and Nellemann 2001; Nellemann et al. 2003; Polfus et al. 2011). Within the survey area of the access road, two transects were established at 3-km intervals (i.e., transects were positioned 1 and 4 km from the road) (Figure 3-1).

3.1.3 Overall Survey Area

The total survey area was created by merging the survey areas for the Buchans herd and for resident caribou that calve in the ZOI. The area of overlap between the Buchans herd and resident caribou survey areas (Figure 3-1) was surveyed only once. Total survey area was approximately 6,101 km^2 and included 2,339 km of transects.

3.2 SURVEY METHODS

A Bell 206L Long Ranger helicopter (with ‘bubble’ rear windows to enhance observer visibility) was used for the survey. Observers were seated on opposite sides of the helicopter (one in the front left seat, one in the rear right seat). The helicopter was flown at 100-120 km/hour at an altitude of approximately 100 m above ground level. Each observer searched an area 500 m wide out their side of the helicopter. Prior to the survey, the survey team (Table 3.1) calibrated their windows at 100 m above ground level to identify a number of distance classes to estimate the perpendicular distance of the caribou from the transect line. Horizontal lines were marked on the helicopter window that corresponded to six distance classes: 1 = 0-100 m; 2 = 100-200 m; 3 = 200-300m; 4 = 300-400 m; 5 = 400-500 m; and 6 > 500m. When caribou were detected, the distance class where the caribou were seen was recorded, as well as whether the habitat was open or closed.

Table 3.1 Aerial Survey Team for Caribou Post-Calving Survey, June 9–13, 2020

Team Member	Role (Position in Helicopter)
Christopher Gosse	Pilot, Newfoundland Helicopters
Tony Parr	Field Team Lead, Biologist (Navigator, Front Left)
Doug Rimmer	Field Team, Biologist (Data Recorder, Rear Right Seat)

The predetermined transect lines were uploaded into a GPS for easy navigation. The transects were uploaded into both the pilot's GPS and into a hand-held GPS device for the surveyors. Transect names and lengths are provided in Appendix A. At the start of each transect, habitat type, weather conditions and visibility were documented. Observations of caribou were geo-referenced using a GPS (Appendix B) and were counted and classified by sex and by age (calves = neonates; yearlings = 1 to 2 years; adults > 2 years). "Adult Unknown" included adult caribou whose sex could not be determined. The category of "Total Caribou" included adults, yearlings, calves and unknown adults. Incidental sightings of other wildlife species (e.g., moose [*Alces alces*], black bear [*Ursus americanus*]) observed on transects were also recorded. Additionally, wildlife observed while ferrying (e.g., caribou or other species such as moose or black bear) were recorded as incidental sightings.

Conditions of the permit from NLDFFA-WD (Appendix D) were followed including limiting the positioning or following of caribou with the helicopter, avoiding hovering and circling around caribou, reducing the amount of time maneuvering over one animal, and recording the number of helicopter passes required to classify the caribou.

The aerial survey included the preparation and review of standard Stantec safety measures, including COVID-19 related protocols, with all members of the survey team prior to the start of the survey.

3.3 ANALYSIS OF SURVEY DATA

3.3.1 Determination of Herd Affiliation

The Buchans and resident caribou survey areas included an area of overlap where caribou from either the Buchans or Grey River herds might be observed. As the objectives identified by NLDFFA-WD included separate classifications of the Buchans and resident caribou, and a population estimate of the Buchans herd only, the area of overlap needed to be divided so that caribou could be placed in their affiliated herd designation. Observed caribou locations were overlaid with the calving ranges for the Buchans and Grey River herds. The Grey River herd calving area was determined using telemetry data transferred from NLDFFA-WD (ARGOS and GPS collars from 2007–2012) and the methods described in Section 3.1. Following the survey, the overall survey area was divided into two portions based on the location of caribou observations and calving range information from the telemetry data. These subdivisions were used to complete separate analyses for the Buchans and resident caribou (Figure 3-2). The observations collected in the western portion of the survey area were used to determine the age and sex structure and a population

estimate for the Buchans herd. The eastern portion of the survey area was used to determine the age and sex structure for resident caribou in the ZOI.

3.3.2 Classification

Group composition metrics were calculated (i.e., group sizes, sex ratios and age classes) including the following values: male:100 females ratio, calf:100 females ratio, percent calves (calves/total caribou x 100) for Buchans and resident caribou. All caribou observed within the survey area were included in the calculations including caribou observed off transect and those observed while in transit within the survey area. These metrics are not intended for population census purposes, though may provide future insight on avoidance behaviours between sexes or age classes if such effects are evident.

3.3.3 Population Estimate

The population estimate was calculated for the Buchans herd only. Caribou sightings data were analyzed using R 3.5.3 (R Core Team 2019) and R package Distance (Miller et al. 2019). Distance sampling methods were used to estimate the relative abundance of caribou within the western section of the survey area. Caribou observations used in the analysis were those binned into distance classes of less than 500 m from the transect line (see Section 3.2). Observations of caribou more than 500 m from the transect line were not binned into distance classes and therefore were not included in the analysis. A half-normal detection function was fit to the data and selected based on Akaike Information Criterion (AIC) (Table 3.2) (Buckland et al. 2001). The detection probability function for the selected model is in Figure 3-3. The inclusion of terrain (open or closed) as a covariate in the detection function was also explored, however this did not improve the AIC value.

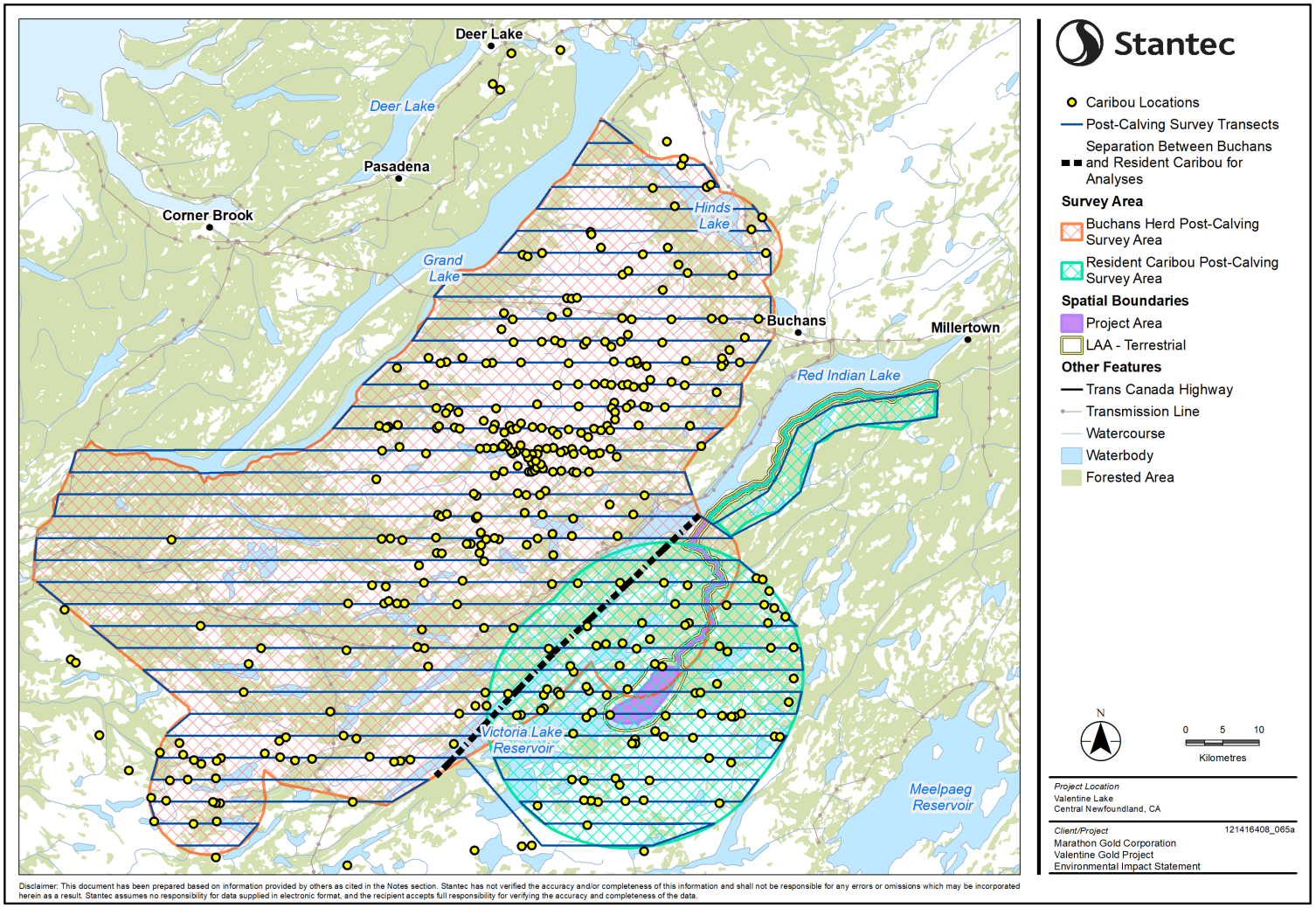

Figure 3-2 Survey Area with Locations of Observed Caribou

Table 3.2 Models for Estimating Caribou Abundance Using R Package Distance

Key Function	Adjustment	ΔAIC
Half-normal	-	0
Half-normal	cosine (2)	2.112
Uniform	cosine (1)	0.123
Uniform	cosine (1,2)	1.993
Hazard rate	-	2.097
Hazard rate	cosine (2)	4.073

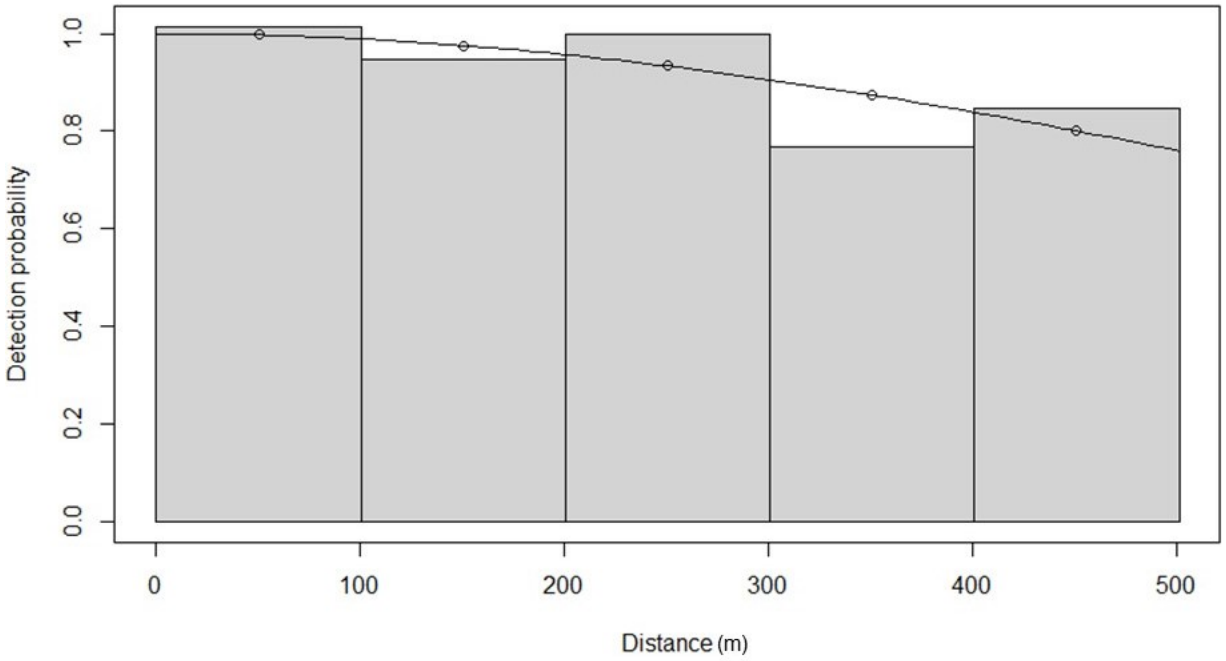

Figure 3-3 Detection Probability Function for Caribou Observations during Aerial Survey, June 9–13, 2020

4.0 RESULTS

The aerial survey was flown from June 9–13, 2020. Thirty-three transects were flown. Conditions were generally suitable for the aerial survey (Appendix E).

4.1.1 Buchans Herd

Within the portion of the survey area for the Buchans herd (western portion), 307 separate groups of caribou totaling 1,700 animals, of which four had collars, were observed (Table 4.1). Average group size was six caribou (range: 1-108). Most caribou observations occurred within the 95% kernel for the calving season (Figure 4-1). The highest concentration of caribou was observed north of the Project Area (Figure 4-1). There was a second, smaller concentration of caribou at the south-west end of the survey area (Figure 4-1).

In the survey area for the Buchans Herd, more female than male caribou were observed with a ratio of 16 males:100 adults and 74 females:100 adults (Table 4.1). Of the 798 females observed, 516 were calf:female pairs. The calf:100 female ratio was 65, with calves accounting for 30% of total caribou observed. In the concentration of caribou north of the Project Area, over 80% of the observed caribou were females and calves (Figure 4-2). In the concentration of caribou in the south-west portion of the survey area, females and calves contributed 75% of observed caribou. The distribution of females (both single and with calves) and yearlings was primarily concentrated in the area north of the Project Area while the distribution of males was more dispersed throughout the survey area (Figure 4-2).

Caribou were classified with a single pass of the helicopter for the majority of observations; however, three groups needed a second pass, and a single group need a third pass to classify the caribou. Incidental observations of species other than caribou (i.e., moose and black bear) are included in Figure 4-3.

Table 4.1 Group Demographics from 2020 Post-Calving Caribou Survey

Classification	Buchans Herd (Western Portion of Survey Area)	Resident Caribou (Eastern Portion of Survey Area)
Total Number of Groups	307	82
Average Group Size (Range in Brackets)	6 (1–108)	3 (1–15)
Total Caribou	1,700	212
Total Adults[1]	1,075	154
Adult Females	798	77
Adult Males	171	67
Unknown Adults	106	10
Yearlings	109	34
Calves	516	24
Calf:Female Pairs	516	24
Male:100 Adults	16	44

Results

Table 4.1 Group Demographics from 2020 Post-Calving Caribou Survey

Classification	Buchans Herd (Western Portion of Survey Area)	Resident Caribou (Eastern Portion of Survey Area)
Calf:100 Females	65	31
Percent Females (%)	50	36
Percent Males (%)	10	32
Percent Calves (%)	30	11
Number of Collars Observed	4	1
Transect Distance (km)	1,765	575
Survey Area (km^2)	4,839	1,261

Notes:
All numbers rounded to the nearest whole number
[1] Total adults = adult females + adult males + unknown adults

Results

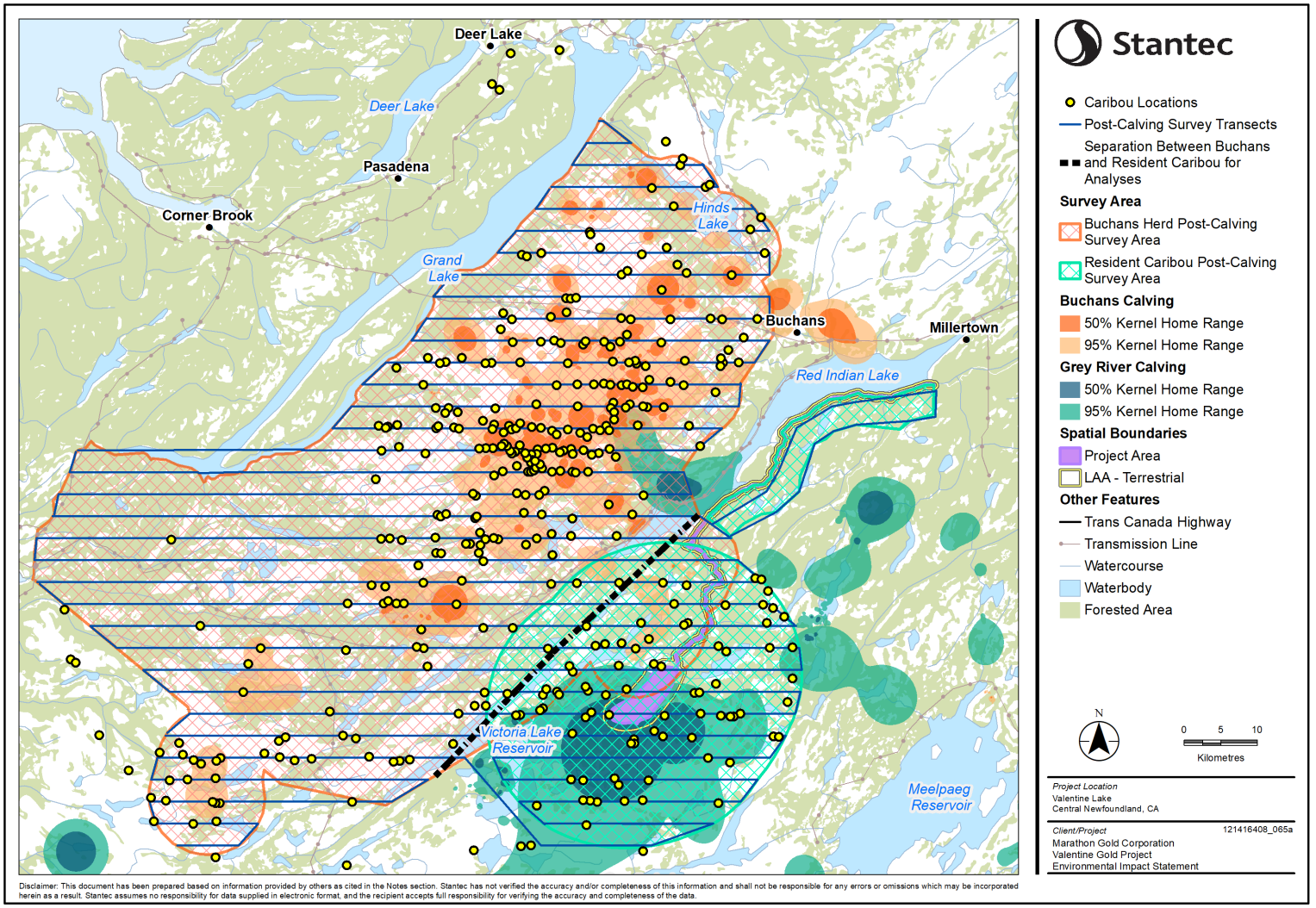

Figure 4-1 Distribution of Observed Caribou from 2020 Post-Calving Caribou Survey in Relation to Calving Range

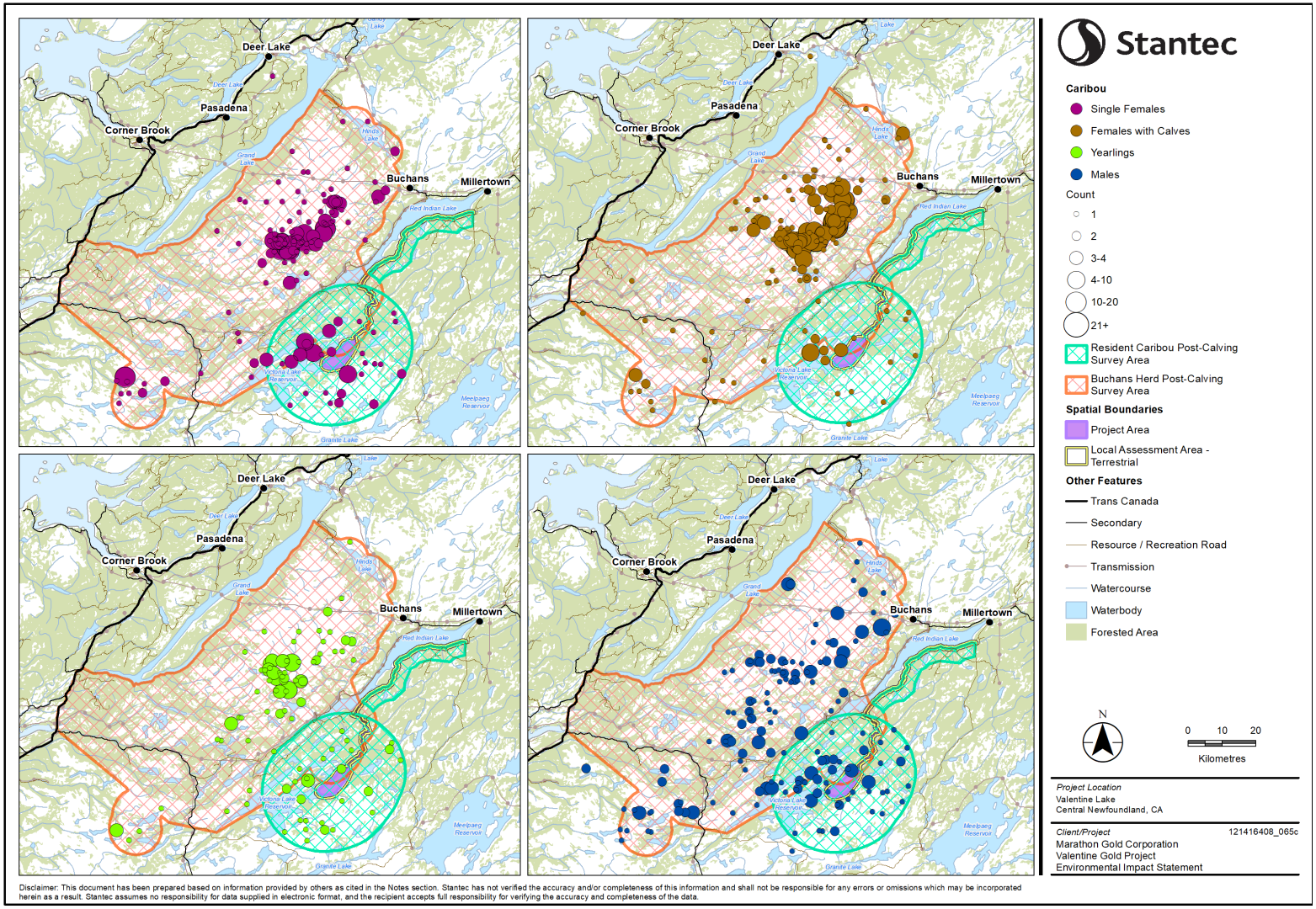

Figure 4-2 Distribution of Caribou Age and Sex Classes from 2020 Post-Calving Caribou Survey

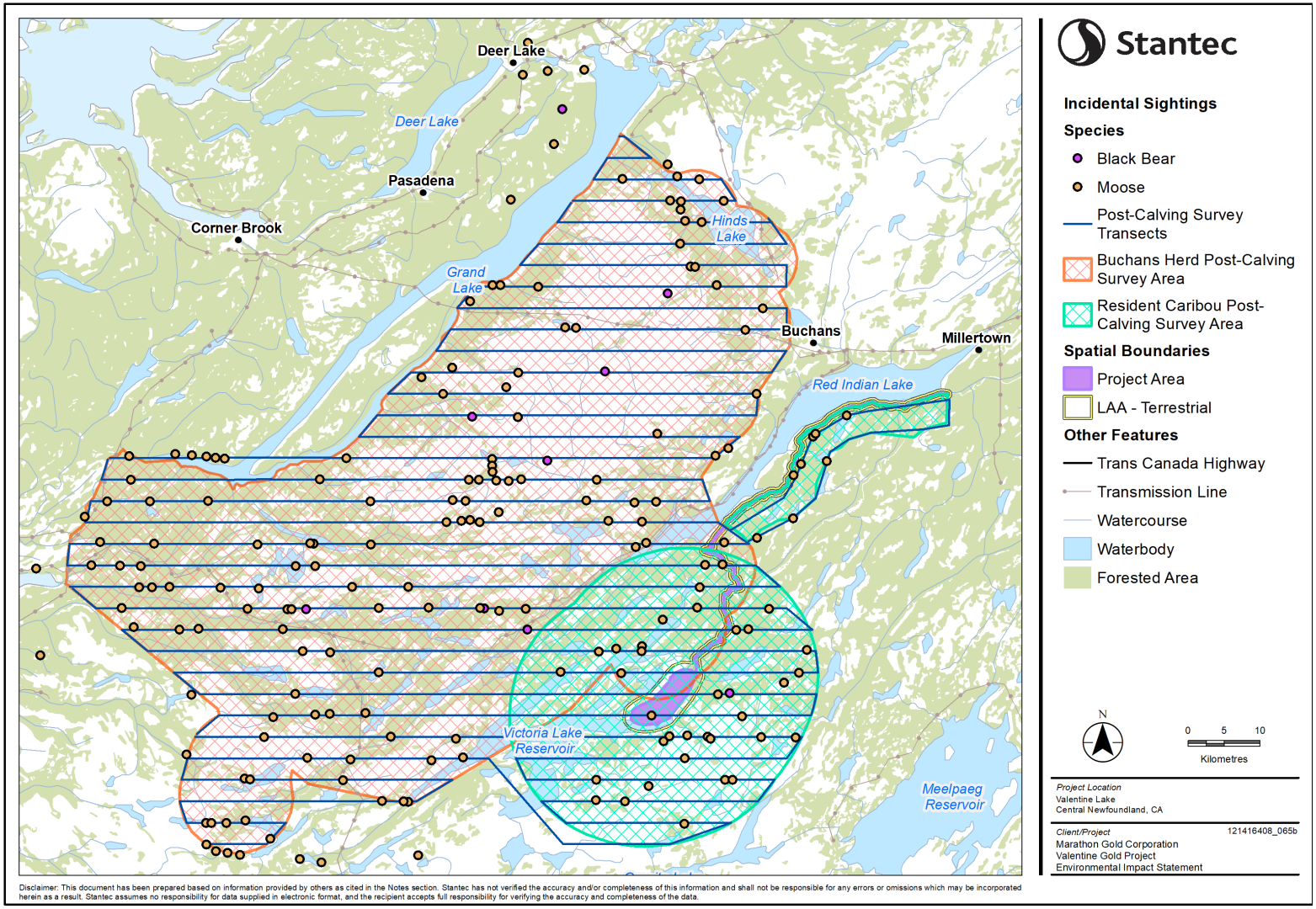

Figure 4-3 Moose and Black Bear Observations from 2020 Post-Calving Caribou Survey

Of the 1,700 caribou observed within the Buchans study area, 869 (51%) were observed within 500 m of the transect. Using this data and the assumptions of distance sampling analysis, the population estimate for the Buchans herd indicated 1,703 caribou (95% CI: 1,064-2,725). Within this population estimate, approximately 10% were male. Based on a winter survey of the Buchans herd in 2019/2020, 28% of caribou were classified as male (Government of NL 2019).

4.1.2 Resident Caribou that Calve within the Zone of Influence

Eighty-two groups of caribou were observed within the ZOI including one collared individual (Table 4.1). Average group size was three and ranged from 1 to 15. Many observations occurred within the 95% kernel for the calving season for the Grey River herd; however, a similar number of caribou were observed north of that area (Figure 4-1). No caribou were observed on the transects along the access road (Figure 4-1). The greatest concentration of caribou occurred west of the Project Area; caribou in this cluster were observed up to approximately 10 km from the Project Area and were approximately 63% females. No caribou were observed in the Project Area and nine were observed within the LAA.

In this study area, males constituted 32% of observed caribou with a ratio of 44 males:100 adults (Table 4.1). The proportion of calves was 11% of total caribou observed with a calf:100 female ratio of 31. Twenty-four calf:female pairs were observed. Within the survey area for resident caribou, the distribution of females (both single and with calves) and yearlings was primarily concentrated in the area directly west of the Project Area, while the distribution of males was more dispersed throughout the survey area (Figure 4-2).

In most instances, a single helicopter pass was needed to classify caribou, however four groups required a second pass. Observations of species other than caribou (i.e., moose and black bear) are included in Figure 4-3.

5.0 DISCUSSION

More females were observed than males in the Buchans herd survey area. On the Island of Newfoundland, the caribou sex ratio is generally more females to males, with a decreasing trend in males observed since the 1980s (Weir et al. 2014). The previously observed decline in sex ratio may have slowed, as a higher number of males has been observed since 2006 (Weir et al. 2014). Weir et al. observed approximately 23 males:100 adult caribou in the fall between 2010 and 2012. This survey observed 16 males:100 females and 10% males in the Buchans survey area. Previous fall and winter surveys identified a higher proportion of males for the Buchans Herd (approximately 28% in 2019) (Government of NL 2019) than observed in this post-calving survey. This difference is mostly likely because the June survey focused on the calving areas, which are expected to include primarily females. Caribou distribution is segregated by sex at certain times of year (Jakimchuk et al. 1987) including calving (Lent 1966; Cameron and Whitten 1979), which may explain the low proportion of males observed in this June survey. Within the survey area for resident caribou, the proportion of males and females was 44 males:100 females. The percent males observed for caribou in the ZOI (32%) was similar to those observed in previous fall and winter surveys of the Grey River herd (approximately 37% in 2019) (Government of NL 2019).

Discussion

On the Island of Newfoundland, caribou populations are limited by poor calf survival (Government of NL 2015) and, subsequently, poor recruitment rates. The calf survival rate (i.e., proportion of calves surviving to six months) between 1979 and 1997 was approximately 66%, decreasing to less than 8% in 2003 (Mahoney et al. 2015). The calf survival rate appears to be increasing gradually (Government of NL 2015) and reached nearly 50% in 2012 (Mahoney et al. 2015). The proportion of calves observed in this survey was 30% for the Buchans herd, and 11% for resident caribou that calve in the ZOI (most likely Grey River caribou). In winter 2019. the proportion of calves in the Buchans and Grey River herds was approximately 8% and 12%, respectively (Government of NL 2020b). Fall and winter surveys between 2007 and 2018 observed proportions of calves from 10-16% for the Buchans herd, and 6-15% for the Grey River herd (Government of NL 2019, 2020b). This survey observed a higher proportion of calves for the Buchans herd than the winter surveys, which is to be expected from a survey of the calving range in June. A similar proportion of calves was observed for caribou within the ZOI. However, nearly 35% of adults observed in this area were females without calves and approximately 43% of adults were males.

The previous survey (2019) of the Buchans herd (mark-resight survey completed in winter) estimated 4,112 caribou. The results of the 2020 Post-Calving Caribou Survey (distance sampling completed post-calving) estimated 1,703 caribou. This post-calving estimate (2020) is less than the previous winter estimate (2019) for the Buchans herd. As the South Coast herds share winter range (Weir et al. 2014), the survey area for the population estimate of the Buchans herd in winter 2019 may have included caribou from other herds. The 2019 winter survey may also have included a greater proportion of males, yearlings and females that were not pregnant.

Caribou are known to show spatial segregation at certain time of year. In Alaska, male and calving females occupy distinct areas during post calving (Jakimchuk et al. 1987), and caribou in British Columbia show segregation following calving, with females selecting habitats with lower predation risk, possibly at the expense of forage availability (Bergerud et al. 1984). The distribution of caribou observations indicated that while the calving females were aggregated in one portion of the range, males would disperse more widely throughout the survey area. The 2019 winter estimate identified 28% males, while the 2020 post-calving survey identified 10% males. This indicates that a proportion of males were not on the calving range at the time of the survey. This is similar to results from an aerial survey of the Middle Ridge calving grounds in early June 2012. which estimated 2,905 caribou (95% CI: 1,893–4,459) (Fifield et al. 2012), while winter surveys of the Middle Ridge herd were estimated at approximately 8,800 caribou (based on 2006 and 2010 surveys) (Dyke 2010 in Fifield et al. 2012).

Distance sampling includes a number of assumptions that must be met to generate an unbiased estimate. One of the assumptions is that all caribou on the transect line are detected. In this survey, the majority of caribou were observed in open habitat (i.e., no tree cover). While this was explored as a covariate in the detection function, it was not included in the final analysis as it did not improve the AIC value. During this survey, the majority of caribou were observed in open habitat which lends uncertainty to the number of caribou not detected in forested areas.

Interestingly, the mean population estimate for the Buchans herd (1,703 caribou) is virtually the same as the total number of caribou observed on the Buchans herd survey area. The observers reported that caribou could be detected at distances more than 500 m from the transect, which led to the exclusion of

observations from the analysis. Generally, when using distance sampling, the likelihood of detecting wildlife decreases with increasing distance from the transect (i.e., observers are less likely to see wildlife the farther they are from the transect). While results from this survey did indicate a decreased detection probability at the larger distances, the detection probability remained relatively high at the larger distances. At the 400-500 m distance class, the detection probability remained higher than 75%. It may be possible to improve the population estimate by using more distance bands in future surveys, however the ability to accurately classify individuals by age and sex would be expected to decrease.

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APPENDIX A

Transect Lengths

Table A.1 Transect Lengths in the Survey Area

Transect Number	Transect Length in West Portion of Survey Area (km[1])	Transect Length in East Portion of Survey Area (km[1])	Total Length (km[1])
1	11.6		11.6
2	21.6		21.6
3	26.7		26.7
4	33.8		33.8
5	38.2		38.2
6	40.9		40.9
7	46.6		46.6
8	49.9		49.9
9	50.3		50.3
10	52.6		52.6
11	54.0		54.0
12	56.3		56.3
13	56.0		56.0
14	57.2		57.2
15	89.4		89.4
16	87.0		87.0
17	89.4		89.4
18	91.2	0.4	91.6
19	91.4	12.8	104.2
20	88.0	11.3	99.3
21	80.9	23.0	103.9
22	78.0	22.4	100.5
23	67.3	34.6	101.9
24	64.6	33.1	97.7
25	53.6	39.5	93.1
26	51.7	39.3	91.0
27	41.1	44.2	85.3
28	46.2	43.0	89.2
29	39.9	59.8	99.8
30	41.3	37.5	78.8
31	38.8	34.4	73.3
32	17.3	37.7	55.1
33	12.1	24.1	36.2
Access Road-N		38.3	38.3
Access Road-S		38.9	38.9
Total Transect Length (km[1])	1,765.2	574.5	2,339.7
Total Survey Area (km2[1])	4,839.5	1,261.5	6,101.0

Notes:
[1] Numbers are rounded to one decimal place. Transects may not add up to total amounts due to rounding.

APPENDIX B

Data Sheet for Aerial Survey

121416288 – Marathon Caribou Post-Calving Aerial Survey Data

Page ____ of _____ for transect_____ Data Recorder/navigator (Front Left): _____Date: _____
Pilot (Company): _____Helicopter:_____ Rear Right: _____

Habitat, Effort, and Survey Conditions

Habitat Description (% open/% closed on transect)	Time		Temperature	Wind Speed/ Direction	Cloud Cover	Visibility	Precipitation	Snow Cover	Date of Last Snow Fall
	Start	End							

Observations

Waypoint	Species	Bin (Perp. Distance)	Open (O) / Closed (C) Habitat	NO CALF		Calf: Female Pairs	Calf - Single	Male (Bald)	Male (Antlered)	Adult – Unknown Sex	Yearling	Collars Observed	Number of Passes	Comments/ Photos
				Female (Bald)	Female (Antlered)									

EXAMPLE

APPENDIX C

Permit Application

APPLICATION TO CONDUCT WILDLIFE RESEARCH IN NEWFOUNDLAND AND LABRADOR

June 5, 2020

APPLICANT: James Powell, Vice-President Regulatory and Government Affairs
Marathon Gold Corporation
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TITLE OF INVESTIGATION: *Aerial Survey of Caribou Calving Grounds for the Valentine Gold Project*

This wildlife research is being completed by Stantec Consulting on behalf of Marathon Gold Corporation in association with the Valentine Gold Project in west-central Newfoundland. The scope of work is based on requirements of the Provincial Environmental Impact Statement (EIS) Guidelines and discussion with the Wildlife Division. This aerial survey is designed to provide a classification and determine the number of cow-calf pairs on the calving grounds for resident caribou that calve within the zone of influence of the Project and the Buchans herd. Additionally, a population estimate will be conducted on the entire calving grounds of the Buchans herd.

SURVEY AREA

The aerial survey of the calving grounds will occur in the area between Grand Lake and Victoria Lake as shown in Figure 1. This survey area was determined based on analysis of telemetry data provided by the Wildlife Division and through discussion with the Wildlife Division.

SURVEY OBJECTIVES

The objectives of the aerial survey are to:

- determine caribou group size and composition on the calving grounds within the zone of influence of the Project, including the number of cow-calf pairs (i.e., classification)
- determine caribou group size and composition on the Buchans herd calving grounds, including the number of cow-calf pairs (i.e., classification)
- complete a population estimate of the entire calving grounds for the Buchans herd

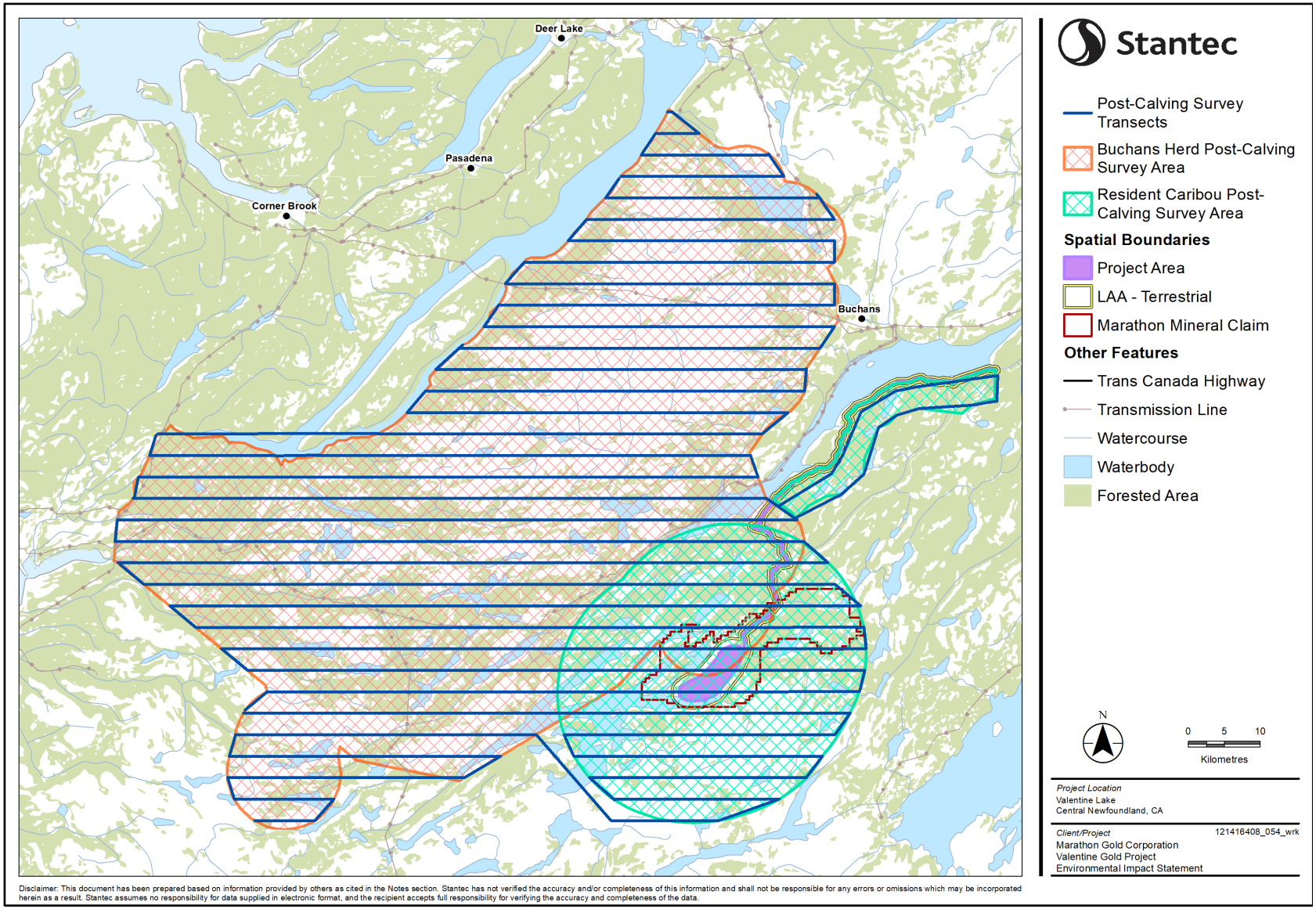

Figure 1 **Survey Area for Aerial Survey of Calving Grounds for the Buchans Herd and Resident Caribou who Calve in the Zone of Influence**

METHODS

The aerial survey will include the preparation and review of standard Stantec safety measures, including COVID-19 related protocols, with all members of the Survey Team prior to the start of the survey.

Survey Area

Buchans Herd

The Buchans Herd survey area was delineated based on telemetry data transferred from the Wildlife Division (Argos and GPS collars from 2007-2012), as well as discussion with the Wildlife Division. Kernels were developed (95% kernels) for the calving season (May 20 – June 10) and a 5-km buffer was added. Point telemetry locations from May and June were also used to inform the survey area. This was overlaid with information from the Wildlife Division that suggested survey boundaries. The final survey area was determined by merging the entirety of the area suggested by the Wildlife Division with the area of the 95% kernel with 5-km buffer (Figure 1). Transects were established within the survey area at a 3-km intervals, consistent with Wildlife Division survey protocol.

Resident Caribou who Calve within the Zone of Influence

The survey area for resident caribou includes a 17-km buffer around the mine site in addition to a 4-km buffer along the south side of the access road (Figure 1). The 17-km buffer was selected based on a literature review. As caribou show avoidance of mines between 2 and 11 km from mines (Weir et al. 2007; Polfus et al. 2011; Boulanger et al. 2012; LeBlond et al. 2014; Johnson et al. 2015; Pigeon et al. 2015; Eftestøl et al. 2019), a 17-km survey area was selected for this survey. This is sufficiently conservative as to account for variability in the degree of avoidance described in the literature. Transects were established within the survey area at a 3-km intervals, consistent with Wildlife Division survey protocol. Additionally, a 4-km survey area was added around the access road. Caribou exhibit avoidance of roads up to 4 km (Dyer et al. 2001; Vistnes and Nellemann 2001; Nellemann et al. 2003; Polfus et al. 2011). Within the survey area of the access road, two transects were established at the 3-km interval (i.e., transects are positioned 1 and 4 km from the road) (Figure 1). While the final routing of the power line has not been confirmed, the proposed survey area encompasses the possible routings.

Note: the area of overlap between the Buchans Herd and resident caribou survey areas (Figure 1) will only be surveyed once.

Aerial Survey

A helicopter with 'bubble' rear windows to enhance observer visibility will be used for the survey. Two participants plus pilot will over-fly the transects at approximately 100 to120 km/hr and approximately 100 m above ground level. Participants roles and positions in the helicopter are provided in Table 1. The transects will be uploaded into both the pilot's GPS and into a hand-held GPS device. The pilot's GPS includes a screen that will project the transect lines for easy navigation. Waypoints of caribou sightings will geo-referenced using GPS and additional

observations recorded on field data sheets. Observed caribou will be classified (e.g., males, females, calves, yearlings, cow-calf pairs). Incidental sightings of other wildlife species observed on transects will also recorded. Additionally, wildlife observed while ferrying will also be recorded. Professional judgment/discretion of experienced staff will be applied in the field to determine if transects need to be modified to accommodate presence/absence of caribou observed while in the field.

Table 1 Aerial Survey Team

Team Member	Role	Position in Helicopter
Pilot	Pilot	Right Front
Tony Parr, Stantec	Navigator/Recorder	Left Front
Doug Rimmer, Stantec	Observer	Right Rear

The survey is planned for June 8 to 15, 2020.

MITIGATION

No significant environmental effects are expected as a result of the aerial surveys, as surveys of this nature have been completed in the past (in Newfoundland and Labrador, as well as other areas) without the detection of significant effects on behavior. Survey mitigation measures include:

- The Study Team will act to reduce disturbances associated with helicopter use
- A minimum flight altitude of 100 m above ground will be maintained in along transects. If animals show signs of stress from the helicopter, the altitude and distance will be increased
- Hovering and circling will be avoided where possible
- Outside of transects, a minimum flight altitude of 200 m above ground will be adhered to

REPORTING

A report will be prepared by Stantec to summarize the findings of the survey and will be submitted to Marathon and approved for further release by Marathon.

SUBMISSION

Blair Adams
Director – Wildlife Division
Dept. of Fisheries and Land Resources
Corner Brook, NL
Email: BlairAdams@gov.nl.ca

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Weir, J.N., S.P. Mahoney, B. McLaren, and S.H. Ferguson. 2007. Effects of mine development on Woodland Caribou *Rangifer tarandus* distribution. Wildlife Biology 13: 66-74.

APPENDIX D

Permit from Wildlife Division

Government of Newfoundland and Labrador
Department of Fisheries and Land Resources
Forestry and Wildlife Branch

Scientific Research Permit

(as under section 86 of the Wildlife Regulations, Consolidated Newfoundland and Labrador Regulation 1156/96)

Permit request #: WLR2020-17

Issued to: James Powell, Vice-President Regulatory and Government Affairs
Marathon Gold Corporation
P.O. Box 4006, Pearlgate PO
Mt. Pearl, NL A1N 0A1

Tel: (709) 730-5046
jpowell@marathon-gold.com

Study Title: Aerial Survey of Caribou Calving Grounds for the Valentine Gold Project

Purpose: Conduct an aerial survey of caribou calving grounds of the Buchans herd and the caribou present within the zone of influence of the proposed mine, to determine caribou group size and composition (i.e. classification of animals present). This work is being completed in relation to the Valentine Gold Project in west-central Newfoundland, as per requirements of the Environmental Impact Statement (EIS) Guidelines.

Location: The aerial survey of the calving grounds will occur in the area between Grand Lake and Victoria Lake as shown in Figure 1 (See schedule 1).

Nominees under this permit include:

i) Stantec Consulting

- Tony Parr, Stantec-Navigator/Recorder
- Doug Rimmer, Stantec Observer

Conditions:

1) This permit authorizes Stantec Consulting to conduct activities on behalf of Marathon Gold Corporation. The permit holder is responsible for ensuring all conditions of the permit are met.

2) This permit authorizes the use of helicopter to search for, locate, classify and count caribou (*Rangifer tarandus*, Newfoundland population) at low flying elevations for the above-stated purpose, and further authorizes that such activities may unavoidably result in disturbance and harassment of caribou. Conditions have been placed on these activities

to minimize harassment and disturbance to the extent possible.

3) Any disturbance or harassment of wildlife by use of helicopter shall be limited to that necessary to locate, count, and classify caribou.

4) If animals show signs of stress from the helicopter, the altitude and distance must be increased. Hovering and circling must be avoided where possible. All mitigation measures outlined in the permit application must be adhered to.

5) Due caution must be taken to minimize the total amount of time involving any one animal (particularly true for dealing with larger groups).

6) Any herding of caribou at higher flying elevation for the purpose of positioning animals onto more optimal terrain prior to low-level approach for conducting classifications shall not exceed five minutes.

7) The methods described in the permit application shall be followed as closely as possible. Any changes to the survey design, methodology or crew outlined in the permit application will require prior approval before implementation.

8) The permit holder shall advise all nominees that their information will be provided to the Forestry and Wildlife Branch. Names and contact information for any additional individuals/nominees participating in the survey shall be provided to the following Forestry and Wildlife Branch staff prior to commencement of field activities:

    Shelley Moores, Senior Manager of Wildlife Research (shelleymoores@gov.nl.ca);

    Jessica Humber, Ecosystem Management Ecologist (jessicahumber@gov.nl.ca).

9) All raw data collected under the authority of this permit (NL provincial lands) shall be provided in digital format to the Forestry and Wildlife Branch (Shelley Moores, Jessica Humber, and Blair Adams) by **July 15, 2020**. Data shall include, but not be limited to flight tracts, number of low level passes per group of classified caribou, mapping of caribou locations, raw caribou classification results, and caribou group size data.

10) Should any wildlife be injured, harmed or display any signs of adverse reactions to the project activities, these observations must be immediately reported to the Forestry and Wildlife Branch (Shelley Moores).

11) This permit is only valid for work within the indicated period below.

12) A copy of this permit shall be retained in the field at all times by at least one person on the permit personnel list and is to be provided to a Newfoundland and Labrador Fish and Wildlife Enforcement Officer or other person of delegated authority upon request.

13) This permit does not absolve or relieve the permit holder from any other laws, permits, regulations or orders, not otherwise specified herein.

14) This permit does not relieve the permit holder from the requirement to acquire permission to access private property.

15) Future requests for scientific research permits will be reassessed based on the outcome of the current undertaking and the submission of findings and data to the Forestry and Wildlife Branch.

16) The Senior Manager of Wildlife Research reserves the right to revise or revoke this permit at any time.

Date of Commencement: June 5, 2020 **Date of Expiration: June 15, 2020**

June 5, 2020
Date

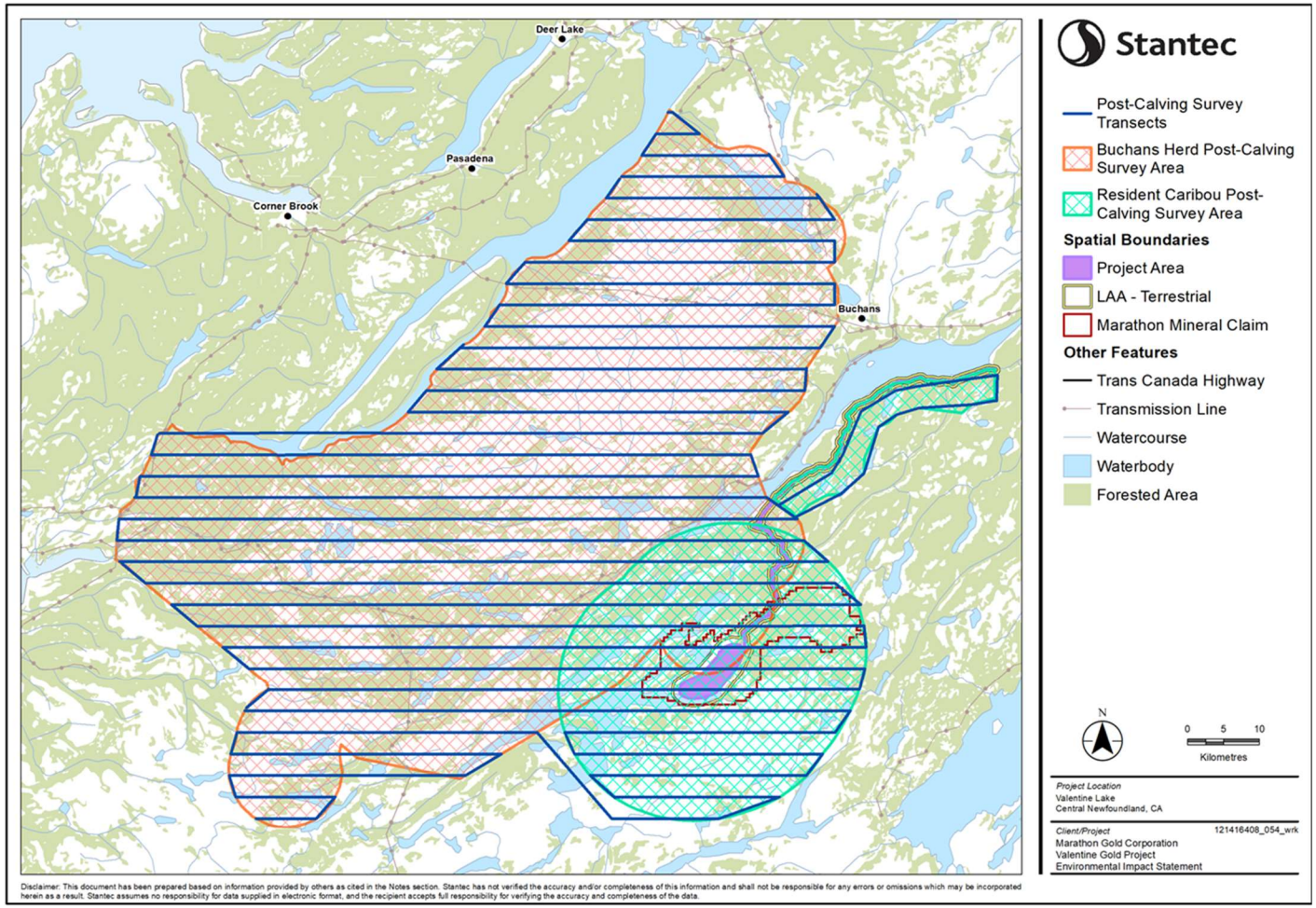
Director, Wildlife Division

Attached: Schedule 1 Survey Area for Aerial Survey of Calving Grounds for the Buchans Herd and Resident Calving Caribou within the "zone of influence" of the Valentine Lake Gold Mine.

Application to Conduct Research

cc: Shelley Moores, Senior Manager of Wildlife Research
Wildlife Division
shelleymoores@gov.nl.ca

Schedule 1



Survey Area for Aerial Survey of Calving Grounds for the Buchans Herd and Resident Calving Caribou within the "zone of influence" of the Valentine Lake Gold Mine.

APPLICATION TO CONDUCT WILDLIFE RESEARCH IN NEWFOUNDLAND AND LABRADOR

June 5, 2020

APPLICANT: James Powell, Vice-President Regulatory and Government Affairs
Marathon Gold Corporation
P.O. Box 4006, Pearlgate PO,
Mt. Pearl, NL, A1N 0A1
Phone: +1 (709) 730-5046
jpowell@marathon-gold.com

TITLE OF INVESTIGATION: *Aerial Survey of Caribou Calving Grounds for the Valentine Gold Project*

This wildlife research is being completed by Stantec Consulting on behalf of Marathon Gold Corporation in association with the Valentine Gold Project in west-central Newfoundland. The scope of work is based on requirements of the Provincial Environmental Impact Statement (EIS) Guidelines and discussion with the Wildlife Division. This aerial survey is designed to provide a classification and determine the number of cow-calf pairs on the calving grounds for resident caribou that calve within the zone of influence of the Project and the Buchans herd. Additionally, a population estimate will be conducted on the entire calving grounds of the Buchans herd.

SURVEY AREA

The aerial survey of the calving grounds will occur in the area between Grand Lake and Victoria Lake as shown in Figure 1. This survey area was determined based on analysis of telemetry data provided by the Wildlife Division and through discussion with the Wildlife Division.

SURVEY OBJECTIVES

The objectives of the aerial survey are to:

- determine caribou group size and composition on the calving grounds within the zone of influence of the Project, including the number of cow-calf pairs (i.e., classification)
- determine caribou group size and composition on the Buchans herd calving grounds, including the number of cow-calf pairs (i.e., classification)
- complete a population estimate of the entire calving grounds for the Buchans herd

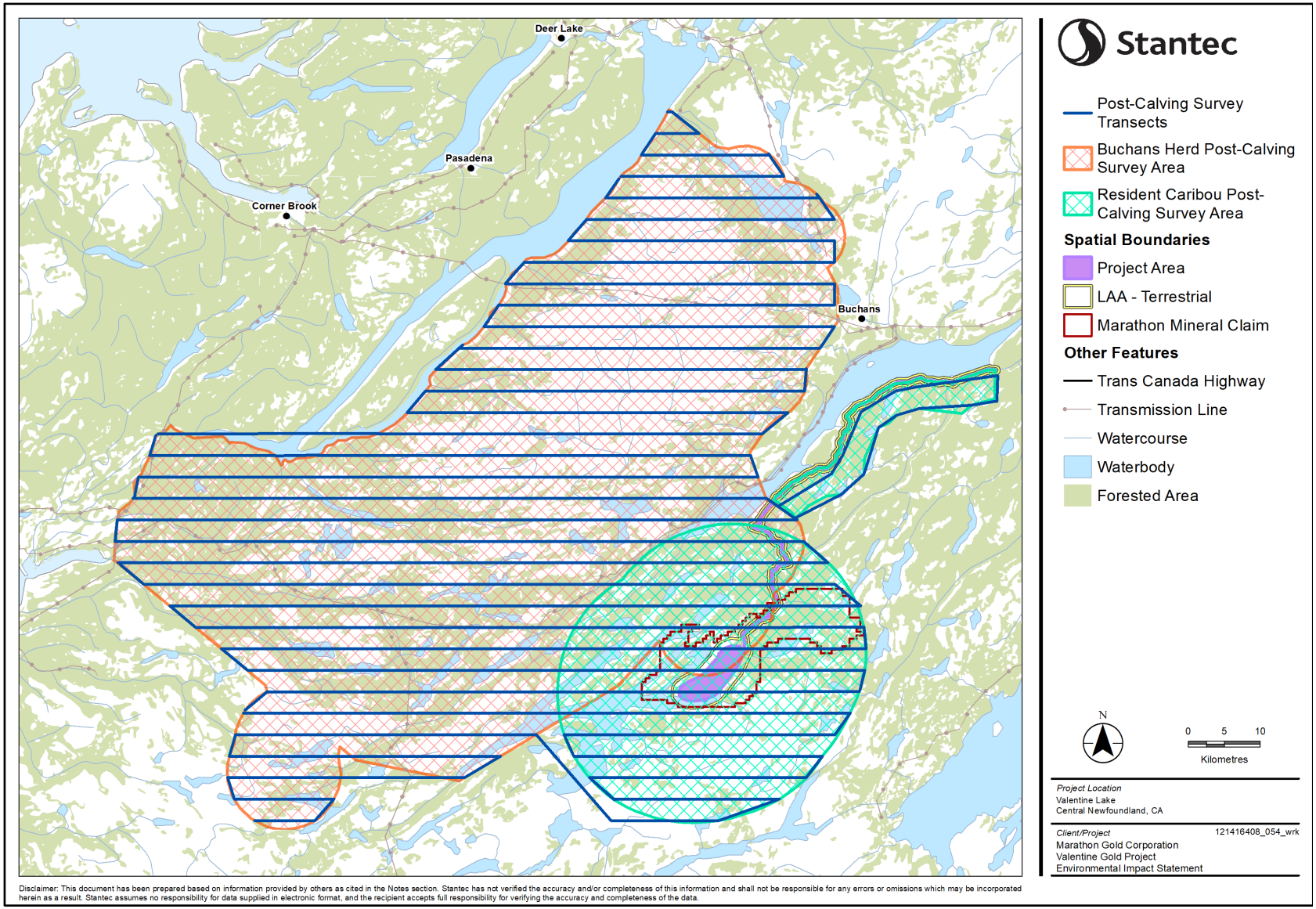


Figure 1 **Survey Area for Aerial Survey of Calving Grounds for the Buchans Herd and Resident Caribou who Calve in the Zone of Influence**

METHODS

The aerial survey will include the preparation and review of standard Stantec safety measures, including COVID-19 related protocols, with all members of the Survey Team prior to the start of the survey.

Survey Area

Buchans Herd

The Buchans Herd survey area was delineated based on telemetry data transferred from the Wildlife Division (Argos and GPS collars from 2007-2012), as well as discussion with the Wildlife Division. Kernels were developed (95% kernels) for the calving season (May 20 – June 10) and a 5-km buffer was added. Point telemetry locations from May and June were also used to inform the survey area. This was overlaid with information from the Wildlife Division that suggested survey boundaries. The final survey area was determined by merging the entirety of the area suggested by the Wildlife Division with the area of the 95% kernel with 5-km buffer (Figure 1). Transects were established within the survey area at a 3-km intervals, consistent with Wildlife Division survey protocol.

Resident Caribou who Calve within the Zone of Influence

The survey area for resident caribou includes a 17-km buffer around the mine site in addition to a 4-km buffer along the south side of the access road (Figure 1). The 17-km buffer was selected based on a literature review. As caribou show avoidance of mines between 2 and 11 km from mines (Weir et al. 2007; Polfus et al. 2011; Boulanger et al. 2012; LeBlond et al. 2014; Johnson et al. 2015; Pigeon et al. 2015; Eftestøl et al. 2019), a 17-km survey area was selected for this survey. This is sufficiently conservative as to account for variability in the degree of avoidance described in the literature. Transects were established within the survey area at a 3-km intervals, consistent with Wildlife Division survey protocol. Additionally, a 4-km survey area was added around the access road. Caribou exhibit avoidance of roads up to 4 km (Dyer et al. 2001; Vistnes and Nellemann 2001; Nellemann et al. 2003; Polfus et al. 2011). Within the survey area of the access road, two transects were established at the 3-km interval (i.e., transects are positioned 1 and 4 km from the road) (Figure 1). While the final routing of the power line has not been confirmed, the proposed survey area encompasses the possible routings.

Note: the area of overlap between the Buchans Herd and resident caribou survey areas (Figure 1) will only be surveyed once.

Aerial Survey

A helicopter with 'bubble' rear windows to enhance observer visibility will be used for the survey. Two participants plus pilot will over-fly the transects at approximately 100 to120 km/hr and approximately 100 m above ground level. Participants roles and positions in the helicopter are provided in Table 1. The transects will be uploaded into both the pilot's GPS and into a hand-held GPS device. The pilot's GPS includes a screen that will project the transect lines for easy navigation. Waypoints of caribou sightings will geo-referenced using GPS and additional

observations recorded on field data sheets. Observed caribou will be classified (e.g., males, females, calves, yearlings, cow-calf pairs). Incidental sightings of other wildlife species observed on transects will also recorded. Additionally, wildlife observed while ferrying will also be recorded. Professional judgment/discretion of experienced staff will be applied in the field to determine if transects need to be modified to accommodate presence/absence of caribou observed while in the field.

Table 1 Aerial Survey Team

Team Member	Role	Position in Helicopter
Pilot	Pilot	Right Front
Tony Parr, Stantec	Navigator/Recorder	Left Front
Doug Rimmer, Stantec	Observer	Right Rear

The survey is planned for June 8 to 15, 2020.

MITIGATION

No significant environmental effects are expected as a result of the aerial surveys, as surveys of this nature have been completed in the past (in Newfoundland and Labrador, as well as other areas) without the detection of significant effects on behavior. Survey mitigation measures include:

- The Study Team will act to reduce disturbances associated with helicopter use
- A minimum flight altitude of 100 m above ground will be maintained in along transects. If animals show signs of stress from the helicopter, the altitude and distance will be increased
- Hovering and circling will be avoided where possible
- Outside of transects, a minimum flight altitude of 200 m above ground will be adhered to

REPORTING

A report will be prepared by Stantec to summarize the findings of the survey and will be submitted to Marathon and approved for further release by Marathon.

SUBMISSION

Blair Adams
Director – Wildlife Division
Dept. of Fisheries and Land Resources
Corner Brook, NL
Email: BlairAdams@gov.nl.ca

REFERENCES

Boulanger, J., K.G. Poole, A. Gunn, and J. Wierzchowski. 2012. Estimating the zone of influence of industrial development on wildlife: a migratory caribou *Rangifer tarandus groenlandicus* and diamond mine case study. Wildlife Biology 18: 164-179.

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Weir, J.N., S.P. Mahoney, B. McLaren, and S.H. Ferguson. 2007. Effects of mine development on Woodland Caribou *Rangifer tarandus* distribution. Wildlife Biology 13: 66-74.

APPENDIX E

Aerial Survey Effort and Weather Conditions

Table E.1 Aerial Survey Effort and Weather Conditions

Transect	Date	Habitat Description (% open / % closed)	Start Time / End Time	Temperature (°C)	Wind Direction and Speed (Direction in Degrees / Knots)	% Cloud Cover	Visibility (km)	Precipitation	Snow Cover (approx. %)	Date of Last Snowfall
1	June 9, 2020	60 / 40	9:41 / 9:44	-2	320/8	100	1-2	snow/freezing rain	<1 in high areas	June 9, 2020
2	June 9, 2020	70 / 30	9:45 / 9:54	-2	320/8	100	1-2	snow	<1 in high areas	June 9, 2020
3	June 9, 2020	50 / 50	9:56 / 10:11	0	320/8	100	1	snow	10	June 9, 2020
4	June 9, 2020	70 / 30	10:13 / 10:27	-2	320/8	100 (fog)	<1	snow	20	June 9, 2020
5	June 9, 2020	80 / 20	12:32 / 12:47	8	320/8	90	>5	Broken Cloud	<10	June 9, 2020
6	June 9, 2020	60 / 40	12:49 / 13:10	8	340/7	60	unlimited	none	<1	June 9, 2020
7	June 9, 2020	70 / 30	13:13 / 13:41	8	340/7	60	unlimited	none	<1	June 9, 2020
8	June 9, 2020	70 / 30	13:43 / 14:10	8	340/7	50	unlimited	none	<1	June 9, 2020
9	June 9, 2020	70 / 30	14:12 / 14:50	8	340/7	60	unlimited	none	<1	June 9, 2020
10	June 9, 2020	70 / 30	15:59 / 16:27	8	350/7	90	unlimited	trace	<1	June 9, 2020
11	June 9, 2020	60 / 40	16:29 / 17:07							June 9, 2020
12	June 9, 2020	70 / 30	17:10 / 17:40	0	290/6	100	unlimited	trace	trace	June 9, 2020
13	June 10, 2020	60 / 40	9:54 / 10:32	6	302/20	20	unlimited	none	<1	June 9, 2020
14	June 10, 2020	60 / 40	10:35 / 11:20	6	302/20	20	unlimited	none	<1	June 9, 2020
15	June 10, 2020	60 / 40	11:23 / 11:15	6	302/20	40	unlimited	none	<1	June 9, 2020
			13:43 / 14:15							June 9, 2020
16	June 10, 2020	60 / 40	14:16 / 15:13	10	302/20	70	>10	trace	<1	June 9, 2020
17	June 10, 2020	40 / 60	15:15 / 16:07	10	302/20	90	>10	none	<1	June 9, 2020
	June 11, 2020	40 / 60	8:52 / 9:19	6	070/0	80	>10	none	<1	June 9, 2020
18-W and 18-E	June 11, 2020	50 / 50	9:20 / 10:15	6	070/0	60	>10	none	<1	June 9, 2020
19-W and 19-E	June 11, 2020	40 / 60	10:17 / 11:13	8	190/4	90	>10	none	<1	June 9, 2020

Table E.1 Aerial Survey Effort and Weather Conditions

Transect	Date	Habitat Description (% open / % closed)	Start Time / End Time	Temperature (°C)	Wind Direction and Speed (Direction in Degrees / Knots)	% Cloud Cover	Visibility (km)	Precipitation	Snow Cover (approx. %)	Date of Last Snowfall
20-W and 20-E	June 11, 2020	40 / 60	12:18 / 13:14	12	190/4	100	>10	none	<1	June 9, 2020
21-W and 21-E	June 11, 2020	40 / 60	13:16 / 14:32	12	190/30	100	>10	none	<1	June 9, 2020
22-W and 22-E	June 11, 2020	30 / 70	15:12 / 16:10	10	210/12	100	>10	trace	<1	June 9, 2020
23-W and 23-E	June 11, 2020	30 / 70	16:12 / 17:08	10	210/12	100	>10	none	<1	June 9, 2020
24-W and 24-E	June 11, 2020	30 / 70	17:22 / 17:39	8	210/14	100	>10	none	<1	June 9, 2020
	June 12, 2020	30 / 70	11:10 / 11:48				>10			June 9, 2020
25-W and 25-E	June 12, 2020	40 / 60	11:50 / 12:07	12	270/10	70	>10	none	<1	June 9, 2020
			17:01 / 17:32							June 9, 2020
26-W and 26-E	June 12, 2020	40 / 60	13:02 / 13:48	16	210/18	70	>10	none	<1	June 9, 2020
27-W and 27-E	June 12, 2020	40 / 60	13:55 / 15:01	10	210/20	90	>10	none	<1	June 9, 2020
	June 13, 2020	40/60	10:17 / 10:38	16	220/11	100	approx. 5, hazy	trace	<1	June 9, 2020
28-W	June 12, 2020	50 / 50	10:41 / 11:01	16	220/11	100	> 10, hazy	trace	<1	June 9, 2020
28-E	June 12, 2020	50 / 50	15:04 / 15:27	14	210/20	100	<5	trace	<1	June 9, 2020
29-W	June 13, 2020	50 / 50	11:02 / 11:31	16	220/11	100	>10	trace	nil	June 9, 2020
29-E	June 12, 2020	50 / 50	15:28 / 15:43	12	210/20	100	Approx. 10	trace	nil	June 9, 2020

Table E.1 Aerial Survey Effort and Weather Conditions

Transect	Date	Habitat Description (% open / % closed)	Start Time / End Time	Temperature (°C)	Wind Direction and Speed (Direction in Degrees / Knots)	% Cloud Cover	Visibility (km)	Precipitation	Snow Cover (approx. %)	Date of Last Snowfall
30-W	June 13, 2020	60 / 40	12:38 / 12:54	16	220/3	100	Approx. 5	trace	<1	June 9, 2020
30-E	June 12, 2020	60 / 40	15:45 / 15:58	12	210/20	100	10	none	nil	June 9, 2020
31-W	June 13, 2020	70 / 30	12:56 / 13:15	16	220/3	100	5, hazy	trace	< 1	June 9, 2020
31-E	June 12, 2020	70 / 30	16:00 / 16:16	12	210/20	100	< 5, hazy	none	nil	June 9, 2020
32-W	June 13, 2020	40 / 60	13:17 / 13:23	16	220/3	100	5-10, hazy	trace	nil	June 9, 2020
32-E	June 12, 2020	60 / 40	16:17 / 16:39	12	210/20	90	> 10, hazy	none	< 1	June 9, 2020
33-W	June 13, 2020	60 / 40	13:26 / 13:59	16	220/3	100	5-10, hazy	trace	nil	June 9, 2020
33-E	June 13, 2020	70 / 30	13:45 / 13:53	16	220/3	100	5-10, hazy	trace	nil	June 9, 2020
Access Road-N and -S	June 12, 2020	20 / 80	10:15 / 11:01	10	275/8	100	> 10 in valleys, fog on hills	trace	<1	June 9, 2020

APPENDIX F

Incidental Observations

Table F.1 Incidental Observations from Aerial Survey

Transect by Survey Area	Date	GPS WPT	Species	Latitude	Longitude	Total Observed	Comments
2	June 9, 2020	813	moose	49.03032	-57.2177	1	unknown
2	June 9, 2020	814	moose	49.02994	-57.0709	1	unknown
3	June 9, 2020	815	moose	49.00285	-57.0237	1	unknown
3	June 9, 2020	816	moose	49.00217	-57.1055	1	unknown
3	June 9, 2020	816	moose	49.00217	-57.1055	1	unknown
4	June 9, 2020	818	moose	48.9778	-57.0974	1	unknown
4	June 9, 2020	819	moose	48.97647	-57.0654	1	unknown
5	June 9, 2020	831	moose	48.94933	-57.1068	1	unknown
6	June 9, 2020	837	moose	48.92021	-57.0874	1	unknown
6	June 9, 2020	838	moose	48.92004	-57.0784	2	female and calf
7	June 9, 2020	841	moose	48.89696	-57.0373	2	female and calf
7	June 9, 2020	844	moose	48.8944	-57.378	1	unknown
7	June 9, 2020	845	moose	48.89618	-57.4499	1	unknown
7	June 9, 2020	846	moose	48.89612	-57.4652	1	unknown
8	June 9, 2020	851	moose	48.86784	-56.9491	1	unknown
9	June 9, 2020	853	moose	48.84071	-56.9822	1	unknown
9	June 9, 2020	860	moose	48.84287	-57.3053	1	unknown
9	June 9, 2020	862	moose	48.843	-57.3262	1	unknown
11	June 9, 2020	886	black bear	48.78778	-57.2493	1	unknown
11	June 9, 2020	889	moose	48.78593	-57.415	2	female and calf
12	June 9, 2020	896	moose	48.75849	-57.5578	1	unknown
12	June 9, 2020	910	moose	48.7603	-56.9608	1	unknown
13	June 10, 2020	925	moose	48.73024	-57.4148	1	female
13	June 10, 2020	927	black bear	48.73028	-57.5018	1	unknown
14	June 10, 2020	953	moose	48.7099	-57.1496	4	2 females with calves
15	June 10, 2020	975	black bear	48.67547	-57.3586	1	unknown
15	June 10, 2020	994	moose	48.67681	-57.7404	1	unknown
15	June 10, 2020	995	moose	48.67468	-57.9714	1	unknown
15	June 10, 2020	996	moose	48.67537	-57.9888	4	unknown
15	June 10, 2020	997	moose	48.67667	-58.0066	1	unknown
15	June 10, 2020	998	moose	48.67826	-58.0338	1	unknown
15	June 10, 2020	999	moose	48.67943	-58.0653	2	unknown
15	June 10, 2020	1000	moose	48.67608	-58.153	1	unknown
16	June 10, 2020	1001	moose	48.64618	-58.1493	2	female and calf

Table F.1 Incidental Observations from Aerial Survey

Transect by Survey Area	Date	GPS WPT	Species	Latitude	Longitude	Total Observed	Comments
16	June 10, 2020	1002	moose	48.64995	-57.7905	1	unknown
16	June 10, 2020	1003	moose	48.65099	-57.5072	1	unknown
16	June 10, 2020	1004	moose	48.65076	-57.4887	1	male
16	June 10, 2020	1005	moose	48.64992	-57.4554	2	female and calf
16	June 10, 2020	1006	moose	48.64972	-57.4315	1	unknown
16	June 10, 2020	1008	moose	48.65163	-57.4083	1	unknown
16	June 10, 2020	1020	moose	48.65186	-57.2645	1	unknown
17	June 10, 2020	1023	moose	48.62437	-57.1523	1	unknown
17	June 10, 2020	1024	moose	48.62324	-57.1929	1	unknown
17	June 10, 2020	1026	moose	48.62551	-57.2845	1	unknown
17	June 10, 2020	1032	moose	48.62417	-57.5137	2	female and calf
17	June 10, 2020	1033	moose	48.62526	-57.5382	1	unknown
17	June 11, 2020	1037	moose	48.79188	-57.5403	1	unknown
17	June 11, 2020	1039	moose	48.62261	-57.6936	1	unknown
17	June 11, 2020	1040	moose	48.62081	-58.0017	1	unknown
17	June 11, 2020	1041	moose	48.61957	-58.1125	1	unknown
17	June 11, 2020	1042	moose	48.61887	-58.1936	1	unknown
18-W	June 11, 2020	1044	moose	48.59726	-57.5498	1	male
18-W	June 11, 2020	1045	moose	48.59897	-57.5212	1	unknown
18-W	June 11, 2020	1047	moose	48.60031	-57.5046	1	unknown
18-W	June 11, 2020	1048	moose	48.59774	-57.4865	1	unknown
18-W	June 11, 2020	1054	moose	48.60017	-57.2422	1	unknown
18-W	June 11, 2020	1055	moose	48.5991	-57.1784	1	unknown
19-E	June 11, 2020	1057	moose	48.57326	-57.0226	1	unknown
19-E	June 11, 2020	1058	moose	48.57232	-57.1707	1	unknown
19-W	June 11, 2020	1073	moose	48.56845	-57.6921	1	unknown
19-W	June 11, 2020	1074	moose	48.56879	-57.8009	1	unknown
19-W	June 11, 2020	1075	moose	48.56908	-57.8076	1	unknown
19-W	June 11, 2020	1076	moose	48.56696	-57.9073	1	unknown
19-W	June 11, 2020	1078	moose	48.56629	-58.1031	1	unknown
19-W	June 11, 2020	1079	moose	48.56719	-58.2054	1	unknown
20-E	June 11, 2020	1090	moose	48.54505	-57.0593	1	unknown
20-E	June 11, 2020	1091	moose	48.54565	-57.0259	1	unknown
20-W	June 11, 2020	1080	moose	48.5378	-58.2217	1	unknown

Table F.1 Incidental Observations from Aerial Survey

Transect by Survey Area	Date	GPS WPT	Species	Latitude	Longitude	Total Observed	Comments
20-W	June 11, 2020	1081	moose	48.5378	-58.1668	1	unknown
20-W	June 11, 2020	1082	moose	48.53778	-58.1276	1	unknown
20-W	June 11, 2020	1083	moose	48.54049	-57.8342	1	unknown
20-W	June 11, 2020	1084	moose	48.5405	-57.7971	1	unknown
21-E	June 11, 2020	1094	moose	48.51672	-57.069	1	unknown
21-W	June 11, 2020	1101	moose	48.51559	-57.6206	2	unknown
21-W	June 11, 2020	1102	moose	48.51481	-57.7272	1	unknown
21-W	June 11, 2020	1103	moose	48.51146	-57.9042	1	unknown
21-W	June 11, 2020	1104	moose	48.5122	-57.9761	1	unknown
21-W	June 11, 2020	1105	moose	48.51226	-58.073	1	unknown
21-W	June 11, 2020	1106	moose	48.51142	-58.1058	1	unknown
21-W	June 11, 2020	1107	moose	48.51123	-58.1305	1	unknown
22-E	June 11, 2020	1123	moose	48.48907	-57.3984	1	unknown
22-E	June 11, 2020	1125	moose	48.49084	-57.0741	1	unknown
22-E	June 11, 2020	1127	moose	48.48961	-56.9376	1	unknown
22-W	June 11, 2020	1110	moose	48.48472	-58.1624	1	unknown
22-W	June 11, 2020	1111	moose	48.48563	-57.9247	1	unknown
22-W	June 11, 2020	1112	moose	48.4861	-57.8492	1	unknown
22-W	June 11, 2020	1113	moose	48.48605	-57.8415	1	unknown
22-W	June 11, 2020	1114	black bear	48.48597	-57.8136	1	unknown
22-W	June 11, 2020	1116	moose	48.48839	-57.6764	1	unknown
22-W	June 11, 2020	1120	moose	48.48956	-57.5819	2	unknown
22-W	June 11, 2020	1121	moose	48.48943	-57.4846	1	unknown
22-W	June 11, 2020	1122	black bear	48.48904	-57.4771	1	unknown
23-E	June 11, 2020	1132	moose	48.46415	-56.9769	1	male
23-E	June 11, 2020	1133	moose	48.46285	-56.9998	2	unknown
23-E	June 11, 2020	1139	black bear	48.46284	-57.395	1	unknown
23-W	June 11, 2020	1142	moose	48.46075	-57.8571	1	unknown
23-W	June 11, 2020	1144	moose	48.45975	-58.0171	1	unknown
23-W	June 11, 2020	1145	moose	48.45849	-58.0526	1	unknown
23-W	June 11, 2020	1146	moose	48.46096	-58.1397	2	female and calf crossing pond
24-E	June 12, 2020	1175	moose	48.43753	-56.8665	2	female and calf
24-E	June 12, 2020	1180	moose	48.44222	-57.1784	1	unknown

Table F.1 Incidental Observations from Aerial Survey

Transect by Survey Area	Date	GPS WPT	Species	Latitude	Longitude	Total Observed	Comments
24-E	June 12, 2020	1181	moose	48.43638	-57.1786	1	unknown
24-E	June 12, 2020	1183	moose	48.43915	-57.2267	1	unknown
24-E	June 12, 2020	1184	moose	48.43553	-57.2599	2	female and calf
24-W	June 11, 2020	1148	moose	48.43344	-57.8194	1	unknown
24-W	June 11, 2020	1149	moose	48.4319	-57.7674	1	unknown
25-E	June 12, 2020	1264	moose	48.40911	-56.8811	1	unknown
25-E	June 12, 2020	1268	moose	48.40832	-57.2171	1	unknown
25-E	June 12, 2020	1271	moose	48.40975	-57.332	1	unknown
25-W	June 12, 2020	1188	moose	48.40761	-57.6755	1	unknown
26-E	June 12, 2020	1206	moose	48.3817	-57.0346	1	male
26-E	June 12, 2020	1207	black bear	48.38337	-57.0126	1	unknown
26-W	June 12, 2020	1194	moose	48.37942	-57.8328	1	unknown
27-E	June 12, 2020	1212	moose	48.35426	-56.9888	1	unknown
27-E	June 12, 2020	1216	moose	48.35516	-57.1598	1	unknown
27-W	June 13, 2020	1289	moose	48.35609	-57.7001	1	unknown
27-W	June 13, 2020	1291	moose	48.35481	-57.7671	1	unknown
27-W	June 13, 2020	1292	moose	48.35362	-57.7942	1	unknown
27-W	June 13, 2020	1293	moose	48.35	-57.8733	1	unknown
28-E	June 12, 2020	1231	moose	48.33006	-57.0921	1	male
28-E	June 12, 2020	1232	moose	48.32862	-57.0542	1	unknown
28-E	June 12, 2020	1233	moose	48.32601	-57.0482	1	male
28-E	June 12, 2020	1234	moose	48.32809	-56.9525	1	male
28-E	June 12, 2020	1236	moose	48.32741	-56.8882	1	unknown
28-W	June 13, 2020	1295	moose	48.32492	-57.8908	2	female and calf
28-W	June 13, 2020	1300	moose	48.32667	-57.6516	1	unknown
28-W	June 13, 2020	1301	moose	48.32475	-57.5283	1	unknown
29-E	June 12, 2020	1239	moose	48.30123	-57.0967	2	unknown
29-W	June 13, 2020	1303	moose	48.30119	-57.5147	1	unknown
29-W	June 13, 2020	1305	moose	48.2973	-57.5748	1	unknown
29-W	June 13, 2020	1309	moose	48.29781	-57.7268	2	female and calf
29-W	June 13, 2020	1312	moose	48.2994	-57.8084	2	female and calf with male
29-W	June 13, 2020	1320	moose	48.30166	-58.0366	1	unknown
30-E	June 12, 2020	1241	moose	48.27389	-57.2637	1	unknown

Table F.1 Incidental Observations from Aerial Survey

Transect by Survey Area	Date	GPS WPT	Species	Latitude	Longitude	Total Observed	Comments
30-E	June 12, 2020	1245	moose	48.26649	-57.1646	1	unknown
30-E	June 12, 2020	1247	moose	48.27419	-57.021	1	unknown
30-E	June 12, 2020	1248	moose	48.27448	-57.0072	1	unknown
30-W	June 13, 2020	1326	moose	48.27235	-57.9261	1	unknown
30-W	June 13, 2020	1327	moose	48.271	-57.9162	1	unknown
30-W	June 13, 2020	1328	moose	48.27156	-57.7408	1	unknown
31-E	June 12, 2020	1252	moose	48.24706	-57.2094	1	unknown
31-E	June 12, 2020	1256	moose	48.24819	-57.2645	1	unknown
31-W	June 13, 2020	1329	moose	48.24495	-57.6178	1	unknown
31-W	June 13, 2020	1330	moose	48.24541	-57.6259	1	unknown
31-W	June 13, 2020	1331	moose	48.24577	-57.6673	2	female and calf
32-E	June 12, 2020	1259	moose	48.21893	-57.0979	1	unknown
32-W	June 13, 2020	1339	moose	48.21573	-57.998	1	unknown
32-W	June 13, 2020	1340	moose	48.21574	-57.9879	1	male
32-W	June 13, 2020	1342	moose	48.216	-57.9599	1	unknown
32-W	June 13, 2020	1343	moose	48.21958	-57.9241	1	unknown
33-W	June 13, 2020	1345	moose	48.1884	-57.9965	1	unknown
RN	June 12, 2020	1163	moose	48.6575	-56.891	1	male
RN	June 12, 2020	1164	moose	48.67199	-56.8768	1	unknown
RN	June 12, 2020	1165	moose	48.70632	-56.8541	1	unknown
RN	June 12, 2020	1166	moose	48.71006	-56.8489	1	unknown
RN	June 12, 2020	1167	moose	48.73275	-56.7902	1	unknown
RS	June 12, 2020	1168	moose	48.6755	-56.8282	1	unknown
RS	June 12, 2020	1169	moose	48.6034	-56.8922	1	unknown
RS	June 12, 2020	1170	moose	48.57882	-56.9602	1	unknown
Off Transect	June 9, 2020	812	moose	49.04891	-57.131	1	unknown
Off Transect	June 9, 2020	825	moose	49.16778	-57.2912	2	female and calf
Off Transect	June 9, 2020	827	moose	49.20118	-57.3997	1	unknown, at airport fence
Off Transect	June 9, 2020	828	moose	49.00332	-57.1261	1	unknown
Off Transect	June 9, 2020	829	moose	48.99174	-57.1061	1	unknown

Table F.1 Incidental Observations from Aerial Survey

Transect by Survey Area	Date	GPS WPT	Species	Latitude	Longitude	Total Observed	Comments
Off Transect	June 9, 2020	847	moose	48.8754	-57.5072	2	female and calf
Off Transect	June 9, 2020	864	moose	49.16123	-57.4093	1	unknown
Off Transect	June 9, 2020	895	moose	48.77952	-57.599	2	female and calf
Off Transect	June 10, 2020	913	moose	49.03385	-57.113	1	unknown
Off Transect	June 10, 2020	955	moose	48.69186	-57.0146	1	unknown
Off Transect	June 10, 2020	957	moose	48.68214	-57.039	1	unknown
Off Transect	June 10, 2020	989	moose	48.76763	-57.4373	1	unknown
Off Transect	June 11, 2020	1043	moose	48.59863	-58.2351	2	female and calf
Off Transect	June 11, 2020	1108	moose	48.53248	-58.3258	1	unknown
Off Transect	June 12, 2020	1153	moose	49.16595	-57.3618	1	unknown
Off Transect	June 12, 2020	1154	black bear	49.11797	-57.333	1	unknown
Off Transect	June 12, 2020	1158	black bear	48.88641	-57.1307	1	unknown
Off Transect	June 12, 2020	1192	moose	48.37671	-58.0285	1	unknown
Off Transect	June 12, 2020	1260	moose	48.3289	-57.1263	1	unknown
Off Transect	June 12, 2020	1262	moose	48.39663	-56.9098	1	unknown
Off Transect	June 13, 2020	1276	moose	49.00389	-57.4306	1	unknown
Off Transect	June 13, 2020	1277	moose	48.67716	-57.4633	1	unknown
Off Transect	June 13, 2020	1278	moose	48.66878	-57.4632	1	unknown
Off Transect	June 13, 2020	1279	moose	48.66095	-57.463	1	unknown
Off Transect	June 13, 2020	1281	moose	48.61037	-57.4503	1	unknown

Table F.1 Incidental Observations from Aerial Survey

Transect by Survey Area	Date	GPS WPT	Species	Latitude	Longitude	Total Observed	Comments
Off Transect	June 13, 2020	1285	moose	48.48584	-57.4485	1	unknown
Off Transect	June 13, 2020	1322	moose	48.4233	-58.3153	1	unknown
Off Transect	June 13, 2020	1344	moose	48.19658	-57.8761	1	unknown
Off Transect	June 13, 2020	1346	moose	48.18054	-57.9787	1	unknown
Off Transect	June 13, 2020	1347	moose	48.17833	-57.9567	1	unknown
Off Transect	June 13, 2020	1348	moose	48.17619	-57.9331	2	unknown
Off Transect	June 13, 2020	1350	moose	48.17164	-57.8202	1	unknown
Off Transect	June 13, 2020	1351	moose	48.1676	-57.7797	1	unknown
Off Transect	June 13, 2020	1353	moose	48.1778	-57.5981	1	unknown
Off Transect	June 13, 2020	1358	moose	48.32275	-57.1372	1	unknown
Off Transect	June 13, 2020	1364	moose	48.47588	-57.1386	1	unknown
Off Transect	June 13, 2020	1365	moose	48.56704	-57.1899	1	unknown
Off Transect	June 13, 2020	1370	moose	49.07416	-57.3489	1	unknown