

STATA IN INCH

# Beaver Habitat Effects and Mortality Monitoring Report

TEMP-2019-13





124



2

KEEYASK

Manitoba Sustainable Development Client File 5550.00 Manitoba Environment Act Licence No. 3107

### 2018-2019

## **KEEYASK GENERATION PROJECT**

### **TERRRESTRIAL EFFECTS MONITORING PLAN**

REPORT #TEMP-2018-13

### **BEAVER HABITAT EFFECTS AND MORTALITY 2018**

Prepared for

Manitoba Hydro

By Wildlife Resource Consulting Services MB, Inc. June 2019 This report should be cited as follows:

Wildlife Resource Consulting Services MB Inc. 2019. Keeyask Generation Project Terrestrial Effects Monitoring Plan Report #TEMP-2019-13: Beaver Habitat Effects and Mortality 2018. A report prepared for Manitoba Hydro by Wildlife Resource Consulting Services MB Inc., June 2019.



### SUMMARY

#### Background

Construction of the Keeyask Generation Project (the Project) at Gull Rapids began in July 2014. The Keeyask Hydropower Limited Partnership (KHLP) was required to prepare a plan to monitor the effects of construction and operation of the generating station on the terrestrial environment. Monitoring results will help the KHLP, government regulators, members of local First Nation communities, and the general public understand how construction and operation of the generating station will affect the environment, and whether more needs to be done to reduce harmful effects.

This report describes the results of beaver lodge monitoring conducted during the fall of 2018, the fifth year of Project construction. Monitoring occurred along the shorelines of waterbodies in the Keeyask Beaver Regional Study Area (Study Zone 4; see map below).

#### Why is the study being done?

The Project has the potential to affect beaver populations through alteration and loss of habitat, as well as sensory disturbance. As reservoir impoundment will flood beaver lodges, beaver are being humanely trapped out of affected areas by the local registered trapper to prevent the potential for starvation and drowning deaths of these animals after flooding. Results of beaver lodge aerial surveys will guide efforts to humanely remove beaver from lodges in the future reservoir area and monitor the regional beaver population to verify Project effects.

#### What was done?

Helicopter surveys of the study area were conducted to determine the abundance and distribution of active and inactive beaver lodges in the future reservoir area and the Beaver Regional Study Area. Characteristics of a sample of beaver lodges observed in the aerial survey were also measured to establish a regional baseline and will be used to explore whether the Project is affecting beaver lodges during construction and operation. Lodge characteristics in Study Zones 1 through 3 were compared with lodges in Study Zone 4.

Beaver were trapped in the future reservoir area in the winter of 2018/19. Various body measurements were used to estimate the age of all removed beaver. Lodges were considered successfully trapped out if two adults (*i.e.*, a breeding pair) were removed from a lodge. Beaver meat was distributed by the trapper to Split Lake community members and some muscle tissue and internal organs were removed and stored for the Keeyask mercury in wildlife monitoring study.





#### What was found?

During the aerial survey a total of 316 beaver lodges, including 284 standard lodges and 32 bank burrows, were observed. Of the 32 bank burrows, 19 were active, and 124 of the standard lodges were active. The number of active lodges in the future Project reservoir area decreased from 34 in fall 2016, to 15 in fall 2017, to four in fall 2018, while the regional density of active beaver lodges remained similar during the same period. Although beaver lodge density differed among Study Zones, lodge characteristics were consistent.

#### What does it mean?

The reduction of suitable habitat, and to a lesser extent, beaver removals through Project-based trapping efforts, reduced beaver lodge abundance in the future Project reservoir in 2018 from numbers observed from 2016-2017. The reduction in available food and lodge materials due to tree clearing in the future reservoir area likely encouraged beaver to relocate to more suitable habitat outside of the cleared area and may have resulted in the relatively high overall active lodge density in the surrounding area (Study Zone 3).

At active lodges where lodge characteristics were measured, differences in lodge and cache size were not detectable in any of the Study Zones. This suggests that the availability of trees and shrubs near all active lodges was adequate to support a small number of beaver lodges in the future reservoir area.



#### What will be done next?

One more year of aerial surveys during the construction period will occur in 2019 to provide information on the total number of active beaver lodges remaining prior to reservoir impoundment and to monitor the regional beaver population. Future Project-based trapping efforts within the future reservoir area will be guided by the results of the 2019 fall aerial survey.



### **STUDY TEAM**

We would like to thank Sherrie Mason, Rachel Boone, Brian Crockatt, Brian Fournier, and Michelle Ewacha of Manitoba Hydro and Ron Bretecher of North/South Consultants Inc. for logistical assistance in the field. We would also like to thank Dr. James Ehnes of ECOSTEM Ltd. for GIS cartographic services. Biologists and other personnel who designed, participated in trapping, and drafted the survey results included:

- Robert Berger (M.N.R.M.) Design and reporting
- Nicholas LaPorte (M.N.R.M.) Data analysis and reporting
- Kevin McCrae (B.Env.) Aerial survey personnel
- Tera Edkins (M.Sc.) Aerial survey personnel
- Jonathan Saunders Licensed trapper, Tataskweyak Cree Nation (TCN)
- Mark Saunders Trapping assistant, TCN
- Anthony Jacobs Trapping assistant, TCN



### TABLE OF CONTENTS

1.0	INTRODUCTION1					
2.0	Меті	HODS	3			
	2.1	AERIAL SURVEYS	3			
	2.2	BEAVER LODGE CHARACTERISTICS	8			
	2.3	BEAVER REMOVALS AND BODY MEASUREMENTS	10			
3.0	Resu	JLTS	11			
	3.1	AERIAL SURVEY	11			
	3.2	BEAVER LODGE CHARACTERISTICS	11			
	3.3	BEAVER REMOVALS AND BODY MEASUREMENTS	15			
4.0	Disc	USSION	18			
5.0	SUM	MARY AND CONCLUSIONS				
6.0	LITERATURE CITED					



## LIST OF TABLES

Table 1:	Length of Shorelines Surveyed for Beaver Lodges in Fall 2018	6
Table 2:	Number of Beaver Lodges in all Study Zones and Waterbody Types in Fall           2018	12
Table 3:	Characteristics of Beaver Lodges in the Keeyask Beaver Regional Study Area in Fall 2018. Note: sample sizes in parentheses	14
Table 4:	Comparisons Between Active Standard Lodge Characteristics in Study Zones 1-3 to Active Standard Lodges in Study Zone 4 in Fall 2018	15
Table 5:	Comparisons Between Inactive Standard Lodge Characteristics in Study Zones 1-3 to Inactive Standard Lodges in Study Zone 4 in Fall 2018	15
Table 6:	Trapping Effort, Body Measurements and Estimated Age of Animals Removed in 2018	17
Table 7:	Locations and Status of Beaver Lodges Observed During the Fall 2018 Aerial Survey	29
Table 8:	Characteristics of Beaver Lodges and Food Caches in Fall 2018	41

### LIST OF MAPS

Map 1:	Shorelines Surveyed for Beaver Lodges in Fall 2018	5
Map 2:	Beaver Lodge Survey Areas and Locations of Sampled Lodges in Fall 2018	9
Map 3:	Locations of Beaver Trapping in the Future Reservoir Area in 2018/19	16
Map 4:	Locations of beaver Lodges in the Split Lake Area in Fall 2018	24
Map 5:	Locations of Beaver Lodges in the Gull Lake Area in Fall 2018	25
Map 6:	Locations of Beaver Lodges in the North Arm of Stephens Lake in Fall	
	2018	26
Map 7:	Locations of Beaver Lodges in East Stephens Lake in Fall 2018	27

## LIST OF PHOTOS

Photo 1:	Active Standard Beaver Lodge with Large Food Cache	7
Photo 2:	Inactive Standard Beaver Lodge	7
Photo 3:	Active Beaver Bank Burrow with Food Cache	8



### LIST OF APPENDICES

Appendix 1: Location of Beaver Lodges Maps	23
Appendix 2: Aerial Survey Observations 2018	28
Appendix 3: Beaver Lodge and Food Cache Characteristics 2018	40



## 1.0 INTRODUCTION

Construction of the Keeyask Generation Project (the Project), a 695 megawatt hydroelectric generating station (GS) and associated facilities, began in July 2014. The Project is located at Gull Rapids on the lower Nelson River in northern Manitoba where Gull Lake flows into Stephens Lake, 35 km upstream of the existing Kettle GS.

The Keeyask Generation Project Response to EIS Guidelines, completed in June 2012, provides a summary of predicted effects and planned mitigation for the Project. Technical supporting information for the terrestrial environment, including a description of the environmental setting, effects and mitigation, and a summary of proposed monitoring and follow-up programs is provided in the Keeyask Generation Project Environmental Impact Statement Terrestrial Supporting Volume (KHLP 2012). The Keeyask Generation Project Terrestrial Effects Monitoring Plan (KHLP 2015) was developed as part of the licensing process for the Project. Monitoring activities for various components of the terrestrial environment were described, including the focus of this report, beaver (Castor canadensis), during the construction phase.

Beaver are medium-sized aquatic furbearers that inhabit waterbodies in forested areas. Beaver are common in the Keeyask region (Study Zone 5) and are an important furbearer species, having cultural, economic, and ecological value (KHLP 2012). As a keystone species (Baker and Hill 1982), by building dams and through their feeding activities, beaver alter aquatic ecosystems, increase the diversity of species and habitat on a landscape, and create habitat for other species that use wetlands. On the Nelson River, beaver habitat is not commonly found along the main channel due to strong currents (KHLP 2012). However, the creeks, ponds, and lakes adjacent to the Nelson River provide habitat for beaver.

The main drivers of change and stressors of beaver in the Keeyask region include food availability and physiographic and hydrologic factors. Changes to any of these factors have the potential to affect the local and regional beaver populations, primarily through habitat change. Other drivers and stressors that could influence habitat quality, or individuals to a lesser degree, include mortality due to harvest and predation, accidents, and parasites and disease. The availability of suitable habitat is expected to have the greatest influence on beaver distribution and abundance in the Keeyask region.

In 2011, the number of beaver lodges in the future Project reservoir area was 23 active lodges and seven inactive lodges (KHLP 2012). Density of lodges was greatest in streams and ponds, and only one active lodge was located in the Nelson River (KHLP 2012). Predicted Project effects on beaver include habitat loss or alteration, sensory disturbance, and increased mortality. The loss or alteration of approximately 5% of the beaver habitat in Study Zone 4 is anticipated as a result of reservoir creation (KHLP 2012). Reservoir impoundment will result in a permanent loss of beaver habitat as creeks, tributaries, and small ponds and lakes are flooded. Long-term habitat losses are associated with reservoir impoundment, shoreline erosion, and peatland disintegration. Fluctuations in water levels in the future reservoir will make any



potential habitat along the shorelines unsuitable. However, the formation of floating peatlands in the reservoir could attract beaver to these habitats, and temporarily increase the abundance of beaver in the reservoir. Once these peatlands break down, beaver will most likely abandon the reservoir and seek alternate habitat in the surrounding area.

As reservoir impoundment will flood beaver lodges, beaver will continue to be humanely trapped out of affected areas by the registered trapper to prevent the potential for prolonged exposure and displacement deaths of these animals (KHLP 2015). The results of fall aerial surveys within the future reservoir area, conducted in 2016 and 2017, guided efforts to remove beaver from lodges in this area and to monitor the beaver population in portions of Study Zone 2 during the winters of 2016/17 and 2017/18. Results of the fall 2018 regional aerial survey will be used to guide Project-based trapping efforts in the winter of 2018/19. These data will also form part of the baseline for assessing the effects of the Project after the infrastructure is constructed.



## 2.0 METHODS

### 2.1 AERIAL SURVEYS

Aerial surveys for beaver lodges were conducted from October 2-6, 2018, along shorelines in waterbodies and waterways in the Keeyask Beaver Regional Study Area (Study Zone 4; Map 1). Densities of beaver lodges along the survey route (lodges/km) were compared in the different Study Zones to explore potential Project effects and the effectiveness of the trapping program in the future reservoir. The Direct Project effects zone (*i.e.*, habitat loss and alteration) includes Study Zone 1, while Study Zone 2 and 3 includes direct (*i.e.*, habitat alteration) and indirect Project effects (*e.g.*, sensory disturbances). Study Zone 4 is the regional reference area for the beaver population.

A Bell 206 Jet Ranger helicopter was used rather than a fixed-wing aircraft as it has been found to be more efficient to detect beaver lodges and food caches while using a helicopter (Payne 1981). Detection probabilities of 0.89 from helicopters were reported for boreal forests in Newfoundland (Payne 1981), on rivers in central Wyoming (Swenson et al. 1983), and in Montana (Osmundson and Bursick 1993). Surveys were conducted during clear weather conditions, after leaf fall, and before freeze-up to maximize detections of beaver lodges. Pontoons were used primarily to facilitate landing the helicopter at lodges and for increased safety in the case of an emergency landing over water.

Survey routes were flown following a predetermined pathway of water bodies and watercourses, at a speed of approximately 100 km/hr at approximately 50 m above ground level. Observers were stationed on the left side of the helicopter. Beaver lodge locations were recorded with a handheld GPS unit and photographed. The presence of food caches and whether lodges were active or inactive was recorded. Typically, active beaver lodges in fall are characterized by signs of lodge maintenance (*i.e.*, fresh mud and timber), nearby recent foraging, and the presence and condition of a food cache (Photo 1). Inactive lodges typically lack these characteristics (Photo 2).

A complete census of beaver lodges was conducted along shorelines within Study Zone 3, while a sample of beaver lodges was conducted in Study Zone 4. Within Study Zone 4 waterbodies were classified by size with a hybrid dataset created from shorelines produced by ECOSTEM Ltd. for the Nelson River and a few nearby lakes; and the National Topographic Data Base (NTDB) 1:50,000 dataset (Natural Resources Canada Centre 1998) for the remainder of the study area. For this report, waterbodies larger than 0.5 km<sup>2</sup> were classified as lakes and those smaller than 0.5 km<sup>2</sup> were categorized as ponds. Watercourses appearing as dual polyline sections on a 1:50,000 topographic map were classified as rivers, whereas those appearing as single polyline sections were classified as creeks with the NTDB 1:50,000 dataset (NAD83; Natural Resources Canada Centre 1998). In all Study Zones (excluding the small areas



sampled within Zone 5) a total of 1,532.19 km of shoreline was surveyed (Table 1).

Some waterbodies and watercourses outside Study Zone 4 were also surveyed for beaver lodges. However, unlike waterbodies and watercourses within Study Zone 4, those outside of Study Zone 4 have not yet been classified to type. Classification of waterbodies and watercourses outside Study Zone 4 is planned to be completed for the Beaver Habitat Effects Synthesis Report, after Project construction is complete. Out of 14,500 km of shoreline in Study Zone 5 (excluding Study Zone 4), approximately 100 km of shoreline was surveyed in fall 2018. Approximately 20% of beaver lodge observations in 2018 were outside Study Zone 4 and are treated separately in this report. Additionally, some lodges in fall 2018 were observed off the survey route and are treated as incidental observations but are included in the list of beaver lodge locations in the Keeyask Beaver Regional Study Area (Appendix 1; Appendix 2). Some waterbodies are categorized to waterbody type as 'Both' (river and stream) or 'Unknown (River or lake) These waterbodies were assessed using orthophotography and temporarily classified into streams, rivers, ponds or lakes for the analysis.









Study Zone	Waterbody Type	Total		
Zone 1 (Project Footprint)	Lake	25.83		
	Pond	0.63		
	River	184.94		
	Stream	23.81		
	Zone 1 Total	235.20		
Zone 2	Lake	24.71		
	Pond	0.53		
	River	34.63		
	Stream	13.06		
	Zone 2 Total	72.93		
Zone 3	Lake	113.63		
	Pond	7.32		
	River	30.95		
	Stream	68.70		
	Zone 3 Total	220.60		
Zone 4	Lake	803.50		
	Pond	6.20		
	River	121.50		
	Stream	72.25		
	Zone 4 Total	1,003.45		
Grand Total (Zones 1 to 4)	1,532.19	1,532.19		
Portions of Zone 5*	Lake	63.88		
	Pond	1.35		
	Stream	34.75		
	Zone 5 Total	99.98		
Grand Total		1,632.17		

#### Table 1: Length of Shorelines Surveyed for Beaver Lodges in Fall 2018

\*Additional surveyed areas beyond Study Zone 4.





Photo 1: Active Standard Beaver Lodge with Large Food Cache



Photo 2: Inactive Standard Beaver Lodge



### **2.2 BEAVER LODGE CHARACTERISTICS**

To explore whether the Project is affecting beaver lodges during construction, lodge characteristics in Study Zones 1 through 3 were compared with lodges in Study Zone 4 using a Student's *t*-test. A random sample of active lodges from Study Zones 1 to 3 and Study Zone 4 were selected for measurement of lodge characteristics (Map 1). Some data were collected in Study Zone 5 but are considered incidental at this time, and are not included in the analysis.

Beaver lodges were classified as either standard lodges or bank burrows. Standard lodges (Photo 1; Photo 2) are commonly freestanding conical mounds of branches and logs plastered with mud with one or more underwater openings to tunnels that meet at a cavity in the center of the mound (Novak 1987). Bank burrows (Photo 3) are dug into shoreline banks where the water is deep or fast, are often covered in sticks and mud and are occasionally connected to an extensive underground network of tunnels (Novak 1987). Based on the condition of the structure, signs of ongoing maintenance, nearby recent foraging and the presence and condition of a food cache, lodges were categorized as being either active (Photo 1) or inactive (Photo 2).



Photo 3: Active Beaver Bank Burrow with Food Cache





Map 2: Beaver Lodge Survey Areas and Locations of Sampled Lodges in Fall 2018



Standard lodge and bank burrow dimensions of length, width, depth, and height were taken and recorded at each lodge using a measuring tape. Water depth at lodges was measured from the surface of the water to the point at which the lodge met the bottom of the water body. To calculate height, the measured water depth at the lodge was added to the height of the exposed portion of the lodge. Size measurements taken for beaver lodges are approximate due to the irregular shape of lodges. Lodge volume was calculated based on a cubic structure for standard lodges by multiplying the length, width and height measurements, which is not a precise measure of actual lodge size but does allow relative comparisons among lodges. Volume of bank burrows is difficult to determine accurately due to their subterranean construction.

The width and length of the portion of food caches visible above the water were estimated from their associated lodges. Depth of food caches could not be measured as food caches were not close enough to lodges for the field crew to directly measure them.

The shoreline at bank burrows was measured for slope. As standard lodges are often far from shore, shoreline slope was not assessed at standard lodges. Shoreline slope was measured by means of a clinometer in degrees from the edge of the water, up the bank, in the immediate area of the burrow.

The distance to nearest bank was measured for standard lodges from the shoreline over open water to the nearest portion of the beaver lodge. Bank burrows were, by definition, on the banks of shorelines.

### 2.3 BEAVER REMOVALS AND BODY MEASUREMENTS

The licensed trapper's efforts were guided by the results of the aerial surveys. Trapping activities occurred from January 5 to March 2, 2019. All traps were set in accordance with provincial humane trapping standards (Manitoba 2018). Although all beaver were intended to be removed from lodges, if two adults (*i.e.*, a breeding pair) are removed from a lodge, the lodge will likely be abandoned after the dispersal of subadults. The family can also disband if the female is removed (Beer 1955; Miller 1960). Lodges were considered successfully trapped out if two adults were removed from a lodge.

For each removed beaver, weight (kg) was measured using a spring scale, while body length, skull width and skull length (cm) were measured using a fabric measuring tape. To separate beaver into subadults and adults, beaver that weighed 14 kg or greater were considered as potential adults (Flemming 1977). Although skull width and length have both been shown to be reliable predictors of beaver age, skull length is superior at estimating beaver age (Rosell et al. 2010). Beaver with skull length greater than 13 cm (Rosell et al. 2010) were considered as potential adults. Used in conjunction, beaver were assessed as adults only when both body length and skull width measurements met the criteria of Flemming (1977) and Rosell *et al.* (2010). All other beaver were assessed as subadults (juveniles).



## 3.0 RESULTS

### 3.1 AERIAL SURVEY

During the fall 2018 beaver lodge aerial survey, a total of 316 beaver lodges, including 284 standard lodges and 32 bank burrows, were observed along the survey route (Table 2). Of these 316 lodges, 143 were active and 173 were inactive. Of the 32 bank burrows, 19 were active, and 124 of the standard lodges were active. An additional five bank burrows and 89 standard lodges were observed off the survey route. Of these five bank burrows, four were active, and 34 of the standard lodges were active. The overall density of all active beaver lodges (excluding lodges in Study Zone 5) was 0.07 lodges/km. All beaver lodges observed during the fall aerial survey are shown in Appendix 1 and detailed in Appendix 2.

In Study Zone 4, overall density of active beaver lodges was 0.06 lodges/km. By Study Zone, active beaver lodge density was greatest in Study Zone 3 followed in descending order by Study Zones 4, 2, and 1 (Table 2).

In Study Zone 1 (the Project footprint), active lodge density was greatest in lakes and streams followed by rivers. No active lodges were observed in ponds. In Study Zone 2, active lodge density was greatest in ponds followed in descending order by streams and rivers. No active lodges were observed in lakes. In Study Zone 3, active lodge density was greatest in streams followed in descending order by rivers, and lakes. No active lodges were observed in ponds. In Study Zone 4, active lodge density was greatest in ponds followed in descending order by streams, rivers, and lakes (Table 2).

### **3.2 BEAVER LODGE CHARACTERISTICS**

During the fall 2018 beaver lodge ground survey, characteristics of 46 beaver lodges in Study Zones 1 through 4 were measured and described (Appendix 2). Of the 46 lodges, 41 were standard lodges and five were bank burrows. Of the 41 standard lodges, 35 were active and six were inactive. Of the five bank burrows, four were active and one was inactive.

No lodges in Study Zone 1 (the Project footprint) were measured. In Study Zone 2, characteristics of one active bank burrow and one active standard lodge was measured. In Study Zone 3, characteristics of two active bank burrows, 22 active standard lodges and three inactive standard lodges were measured. In Study Zone 4, characteristics of one active bank burrow, one inactive bank burrow, 12 active standard lodges and three inactive standard lodges were measured.



Study Zone	Waterbody Type	Lodge Status	Number of Lodges	Density* (lodges/km)
Zone 1	Lake	Active	1	0.04
		Inactive	11	0.43
	Pond	Active	0	0.00
		Inactive	0	0.00
	River	Active	1	0.01
		Inactive	7	0.04
	Stream	Active	2	0.08
		Inactive	10	0.42
	Study Zone 1 Total	Active	4	0.02
	-	Inactive	28	0.12
Zone 2	Lake	Active	0	0.00
		Inactive	3	0.12
	Pond	Active	1	1.90
		Inactive	0	0.00
	River	Active	1	0.03
		Inactive	2	0.06
	Stream	Active	2	0.15
		Inactive	1	0.08
	Zone 2 Total	Active	4	0.05
		Inactive	6	0.08
Zone 3	Lake	Active	15	0.13
		Inactive	14	0.12
	Pond	Active	0	0.00
		Inactive	0	0.00
	River	Active	7	0.23
		Inactive	4	0.13
	Stream	Active	25	0.36
		Inactive	25	0.36
	Zone 3 Total	Active	47	0.21
		Inactive	43	0.19
Zone 4	Lake	Active	21	0.03
		Inactive	28	0.03
	Pond	Active	3	0.48
		Inactive	0	0.00
	River	Active	7	0.06
		Inactive	3	0.02
	Stream	Active	28	0.39
		Inactive	30	0.42
	Zone 4 Total	Active	59	0.06
		Inactive	60	0.06

#### Table 2: Number of Beaver Lodges in all Study Zones and Waterbody Types in Fall 2018



Study Zone	Waterbody Type	Lodge Status	Number of Lodges	Density* (lodges/km)		
Grand Total (excluding Study Zone 5)		Active	114	0.07		
		Inactive	137	0.09		
Zone 5	Lake	Active	16	NA		
		Inactive	21	NA		
	Pond	Active	0	NA		
		Inactive	0	NA		
	River	Active	2	NA		
		Inactive	1	NA		
	Stream	Active	11	NA		
		Inactive	13	NA		
	Zone 5 Total	Active	29	NA		
		Inactive	35	NA		
Grand Total Active Lodges			143	NA		
Grand Total Inactiv	re Lodges		172	NA		
Grand Total			316	NA		

In addition to soil and peat moss, active lodges were primarily constructed of black spruce and willow and supplemented with birch, jack pine, aspen, and alder. On average, characteristics of active standard lodges in Study Zones 1-3 were not significantly different from active standard lodges in Study Zone 4 (Table 4: ). Characteristics of inactive standard lodges also did not significantly differ between Study Zones 1-3 and Study Zone 4 (Table 5: ). Statistically significant differences could not be determined for active or inactive bank burrows due to small sample sizes; characteristics of only one active and one inactive bank burrows were measured in Study Zone 4 (Table 3: ).



Study Zone	Lodge type	Lodge status	Number of lodges	Average lodge volume (m3)	Average distance to nearest shore (m)	Average shoreline slope (°)	Average tree height (m)	Average shrub height (m)	Average distance lodge to food (m)	Average cache size (m2)
Zones 1-3	Standard	Active	23	77.22 (23)	27.0 (23)	NA	6.90 (21)	1.66 (16)	22.7 (23)	15.7 (22)
		Inactive	3	101.70 (3)	46.0 (3)	NA	10.67 (3)	0.50 (1)	42.0 (3)	8.0 (3)
	Bank	Active	3	32.58 (3)	NA	27 (3)	8.00 (3)	1.67 (3)	1.3 (3)	10.5 (3)
		Inactive	0	NA	NA	NA	NA	NA	NA	NA
Zone 4	Standard	Active	12	64.44 (12)	38.17 (12)	NA	7.9 (10)	1.25 (2)	23.64 (11)	13.55 (11)
		Inactive	3	79.06 (3)	46 (3)	NA	7.67 (3)	1 (1)	11.67 (3)	6 (3)
	Bank	Active	1	62.14 (1)	NA	40 (1)	2 (1)	2 (1)	2 (1)	15 (1)
		Inactive	1	36.08 (1)	NA	35 (1)	NA	0.5 (1)	10 (1)	24 (1)
All (Zones 1-4)	Standard	Active	35	72.84 (35)	30.86 (35)	NA	7.23 (31)	1.61 (18)	23 (34)	14.98 (33)
		Inactive	6	90.38 (6)	46 (6)	NA	9.17 (6)	0.75 (2)	26.83 (6)	7 (6)
	Bank	Active	4	39.99 (4)	NA	30 (4)	6.5 (4)	1.75 (4)	1.5 (4)	11.63 (4)
		Inactive	1	36.08 (1)	NA	35 (1)	NA	0.5 (1)	10 (1)	24 (1)

Table 3:Characteristics of Beaver Lodges in the Keeyask Beaver Regional Study Area in Fall 2018. Note: sample sizes in<br/>parentheses



	Zon	es 1-3	Zone 4			
Lodge characteristics	X	SD (n)	X	SD (n)	t	p
Lodge volume (m3)	77.22	62.12 (23)	64.44	51.39 (12)	0.6107	0.5456
Distance to nearest shore (m)	27	18.67 (23)	38.17	17.15 (12)	1.7256	0.0938
Tree height (m)	6.9	3.03 (21)	7.9	2.33 (10)	0.9193	0.3655
Shrub height (m)	1.66	0.57 (16)	1.25	0.35 (2)	0.9783	0.3425
Distance lodge to food (m)	22.7	29.90 (23)	23.64	24.64 (11)	0.0904	0.9285
Food cache size (m2)	15.7	7.90 (22)	13.55	7.97 (11)	0.7349	0.4679

### Table 4:Comparisons Between Active Standard Lodge Characteristics in Study Zones1-3 to Active Standard Lodges in Study Zone 4 in Fall 2018

Table 5:Comparisons Between Inactive Standard Lodge Characteristics in Study Zones1-3 to Inactive Standard Lodges in Study Zone 4 in Fall 2018

	Zon	es 1-3	Zone 4				
Lodge characteristics	X	SD (n)	X	SD (n)	t	p	
Lodge volume (m <sup>3</sup> )	101.7	75.20 (3)	79.06	57.3 (3)	0.4148	0.6996	
Distance to nearest shore (m)	46	28.93 (3)	46	29.05 (3)	0	1	
Tree height (m)	10.67	1.16 (3)	7.67	1.53 (3)	2.7063	0.0537	
Shrub height (m)	0.5	NA	1	NA	NA	NA	
Distance lodge to food (m)	42	43.09 (3)	11.67	9.29 (3)	1.1918	0.2992	
Food cache size (m <sup>2</sup> )	8	4.0 (3)	6	2 (3)	0.7746	0.4818	

### 3.3 BEAVER REMOVALS AND BODY MEASUREMENTS

Trapping efforts in 2018/19 focused on four active beaver lodges located in the Nelson River in the future reservoir (Map 3). From these lodges six beaver were trapped, as well as five muskrats (Table 6). Two beaver were captured from two lodges (four beaver at two lodges) and single beavers were caught from the remaining lodges. Based on their measurements, two beaver were classified as adults and the remaining were classified as juveniles. No pairs of adult beaver were removed from a single lodge.





#### Map 3: Locations of Beaver Trapping in the Future Reservoir Area in 2018/19



Lodge	Date Trap Set	Species Harvested	Date Harvested	Date Trap Removed	Weight (kg)	Body Length (cm)	Skull Width (cm)	Skull Length (cm)	Estimated Age Category
46	January 5, 2019	Beaver	January 6, 2019	March 2, 2019	14	105	12	14	Adult
26	January 5, 2019	Beaver	January 9, 2019	March 1, 2019	12	100	9	11	Juvenile
55	January 5, 2019	Beaver	January 9, 2019	March 1, 2019	14	102	10	12	Juvenile
46	January 5, 2019	Beaver	January 12, 2019	March 2, 2019	12	103	13	15	Juvenile
43	January 5, 2019	Beaver	January 14, 2019	March 2, 2019	15	106.5	11	13	Adult
55	January 5, 2019	Beaver	January 19, 2019	March 1, 2019	11	94	10	12	Juvenile
26	January 5, 2019	Muskrat	February 13, 2019	March 1, 2019	1	52	4.5	5.5	NA
55	January 5, 2019	Muskrat	February 19, 2019	March 1, 2019	1	47	4.5	5	NA
43	January 5, 2019	Muskrat	February 20, 2019	March 2, 2019	1	52	5	5.5	NA
26	January 5, 2019	Muskrat	February 22, 2019	March 1, 2019	1	48	5	5.5	NA
26	January 5, 2019	Muskrat	February 27, 2019	March 1, 2019	1	54	5.5	6	NA

 Table 6:
 Trapping Effort, Body Measurements and Estimated Age of Animals Removed in 2018



## 4.0 **DISCUSSION**

The main drivers of change and stressors of beaver in the Keeyask region include food availability and physiographic and hydrologic factors. Changes to any of these factors have the potential to affect the local and regional beaver populations, primarily through habitat change. Other drivers and stressors that could influence habitat quality or individuals to a lesser degree include mortality due to harvest and predation, accidents, and parasites and disease. The availability of suitable habitat, and beaver removals through a Project-based trapping program to a lesser extent, influenced beaver distribution and abundance in Study Zones 1 to 3 between 2016 and 2018. Data collected in the region during 2019 will contribute to understanding the potential effects of the Project on beaver during construction and operations.

The density of beaver lodges has remained similar in the Beaver Regional Study Area (*i.e.*, Study Zone 4) since the surveys done for the Project's environmental assessment. In 2001 and 2003, the total density of active beaver lodges within Study Zone 4 was 0.09 lodges/km (KHLP 2012). In 2018, there was 0.07 lodges/km. Since Project construction began, and as expected, the number of active lodges in Study Zone 1 (the Project footprint) decreased. In Study Zone 1, 23 active beaver lodges were observed in fall 2011 (KHLP 2012), 34 in fall 2016, 15 in fall 2017 (WRCS 2018), and four in fall 2018. In the winters of 2015/16, 2016/2017 and 2017/2018, all trees taller than 5 feet were removed from the future reservoir area (within Study Zone 1), which reduced the local availability of beaver food and lodge-building materials. Additionally, Project-based trapping efforts that removed 19 beaver from eight lodges in 2016/2017, 18 beaver from eight lodges in winter 2017/2018, and six beaver from four lodges in 2018/19 also contributed to the decrease. The relatively low number of adults caught in 2019 (two), compared to previous years (seven in 2017 and nine in 2018), suggest that active trapping has been successful at reducing the breeding population of beavers in the future reservoir. Continued trapping efforts in 2020 will target any remaining active lodges found within the future reservoir.

Study Zone 2 is a relatively small area that extends 150 m past the boundary of Study Zone 1 (KHLP 2012). Many of the active lodges in Study Zone 2 were near the boundary between Study Zones 1 and 2. As all large trees have been removed from the future reservoir areas within Study Zone 1, nearby lodges would have experienced a reduction in available food and lodge construction/maintenance materials. This likely encouraged beaver to relocate to areas where beaver habitat was more suitable, outside of the future Project reservoir, thus leading to the relatively high overall active lodge density in Study Zone 3 and possibly in Study Zone 4.

There may have been some displaced beaver that relocated to waterbodies in Study Zone 4 that were not surveyed in 2018. Unlike Study Zones 1 to 3, where all waterbodies and watercourses were surveyed, only 51% of shorelines were surveyed within Study Zone 4. If all waterbodies in Study Zone 4 had been surveyed, an increase in the density of active lodges in Study Zone 4 may have been detected.

Because some waterbodies and watercourses in Study Zone 4 have not yet been verified to type, caution should be used for interpreting lodge densities. Further, because classification of



waterbodies and watercourses outside Study Zone 4 have not yet been classified to type, comparable lodge densities in Study Zone 5 cannot be determined. Further classification of waterbodies and watercourses in Study Zones 4 and 5 should be completed for the Beaver Habitat Effects Synthesis Report, after Project construction is complete.

Although beaver lodge density differed among Study Zones, measured lodge characteristics were not significantly different. This suggests that in locations where characteristics of active lodges were measured, availability of food and lodge construction/maintenance materials were adequate such that differences in lodge and cache size were not detectable. However, because food caches were not measured in three dimensions (only width and length could be measured), it is possible that some food caches were significantly larger than others. Consequently, confidence that food cache size was not statistically different compared between Study Zones 1 through 3 to Study Zone 4 is low.



## 5.0 SUMMARY AND CONCLUSIONS

The density of beaver lodges has remained similar in the Beaver Regional Study Area (Study Zone 4) from 2003 to 2018. In the future reservoir area (within Study Zone 1), tree clearing and beaver removal by trapping in the winters of 2015/16, 2016/2017 and 2017/2018 likely led to the relatively low active lodge density observed in Study Zone 1. Beaver relocating away from the cleared future reservoir area likely built new lodges within Study Zone 3, thus producing the observed high active lodge density in Study Zone 3. These findings are also supported by the small number of beaver trapped from the future reservoir in 2018/19.

Where characteristics of active lodges were measured, differences in lodge and cache size were not detectable among Study Zones. This suggests that food and lodge construction materials were adequate at all sampled active lodges. Waterbodies and watercourses that were temporarily classified using orthophotography need to be verified.

The next regional beaver survey is planned for fall 2019.



## 6.0 LITERATURE CITED

- Baker, B. W. and E. P. Hill. 1982. Beaver Castor canadensis, In Wild Mammals of North America Biology, Management, and Conservation, 2nd Edition. Edited by G.A. Feldhamer, B.C. Thompson, and J.A. Chapman. John Hopkins University Press. Maryland, U.S.A. 1216 pp.
- Beer, J. 1955. Movements of tagged beavers. Journal of Wildlife Management, 19: 492-493.
- Hall, A. M. 1971. Ecology of beaver and selection of prey by wolves in central Ontario. M.S. Thesis, Univ. Toronto, Toronto, Ont. 116 pp.
- KHLP (Keeyask Hydropower Limited Partnership). 2012. Keeyask Generation Project, Environmental Impact Statement, Supporting Volume, Terrestrial Environment. June 2012. 302 pp.
- KHLP (Keeyask Hydropower Limited Partnership). 2015. Keeyask Generation Project Terrestrial Effects Monitoring Plan. Available from http://keeyask.com/wpcontent/uploads/2015/06/KGP-Terrestrial-Effects-Monitoring-Plan-Final.pdf. Accessed on February 18, 2016.
- Manitoba. 2018. 2018/19 Manitoba Trapping Guide. 28 pp. Accessed March 22, 2019 from: <u>https://www.gov.mb.ca/sd/wildlife/trapping/pdf/trapping\_guide.pdf</u>. Access on March 13, 2018.
- Miller, D. 1960. Beaver research in Newfoundland. Unpublished report. Newfoundland Department of Mines, Agriculture, and Resources, St.Johns. 209 pp.
- Novak, M. 1999. Beaver. *In* Wild furbearer management and conservation in North America. Section IV: Species Biology, Management, and Conservation. Ontario Ministry of Natural Resources, Toronto, Canada. 283-312 pp.
- Osmundson, C. L. and S. W. Buskirk. 1993. Size of food caches as a predictor of beaver colony size. Wildlife Society Bulletin, 21: 64–69.
- Payne, N. J. 1981. Accuracy of aerial censusing for beaver colonies in Newfoundland. Journal of Wildlife Management, 45(4): 1014-1016.
- Rosell, F., A. Zedrosser, and H. Parker. 2010. Correlates of body measurements and age in Eurasian beaver from Norway. European Journal of Wildlife Research 56: 43-48.
- Swenson, J. E., S. J. Knapp, P. R. Martin, and T. C. Hinz. 1983. Reliability of aerial cache surveys to monitor beaver population trends on prairie rivers in Montana. Journal of Wildlife Management, 47: 697–703.
- WRCS (Wildlife Resource Consulting Services MB Inc.). 2018. Keeyask Generation Project Terrestrial Effects Monitoring Plan Report #TEMP-2018-19: Beaver Habitat Effects and



Mortality 2016 to 2018. A report prepared for Manitoba Hydro by Wildlife Resource Consulting Services MB Inc., June 2018.



### APPENDIX 1: LOCATION OF BEAVER LODGES MAPS



١









Map 5: Locations of Beaver Lodges in the Gull Lake Area in Fall 2018











Map 7: Locations of Beaver Lodges in East Stephens Lake in Fall 2018



### APPENDIX 2: AERIAL SURVEY OBSERVATIONS 2018



Study Zone	Wpt.	Waterbody Type	Survey Route (On or Off)	Lodge Status	Lodge Type	No. Food Caches	UTM
Zone 1	236	River	On	Active	Standard	1	15 V 334325 6243044
Zone 1	26	Stream	On	Active	Standard	1	15 V 347841 6240827
Zone 1	46	Lake	On	Active	Standard	1	15 V 353123 6249483
Zone 1	40	Lake	On	Inactive	Standard	0	15 V 342770 6245015
Zone 1	61	Lake	On	Inactive	Standard	0	15 V 349496 6244953
Zone 1	10	Lake	On	Inactive	Bank	1	15 V 350341 6241984
Zone 1	42a	Lake	On	Inactive	Standard	0	15 V 350894 6247016
Zone 1	42b	Lake	On	Inactive	Standard	0	15 V 350894 6247016
Zone 1	90	Lake	On	Inactive	Bank	0	15 V 351018 6239886
Zone 1	13	Lake	On	Inactive	Standard	1	15 V 351401 6239811
Zone 1	305	Lake	On	Inactive	Standard	0	15 V 355594 6250486
Zone 1	294	Lake	On	Inactive	Standard	0	15 V 357114 6252728
Zone 1	48	Lake	On	Inactive	Standard	0	15 V 357660 6248976
Zone 1	316	Lake	On	Inactive	Standard	0	15 V 358078 6244725
Zone 1	22	River	On	Inactive	Standard	0	15 V 347054 6242141
Zone 1	52	River	On	Inactive	Standard	0	15 V 347692 6242573
Zone 1	41	River	On	Inactive	Standard	0	15 V 349789 6246611
Zone 1	50	River	On	Inactive	Standard	0	15 V 349836 6243243
Zone 1	423	River	On	Inactive	Standard	0	15 V 350997 6246887
Zone 1	7	River	On	Inactive	Standard	0	15 V 357954 6244917
Zone 1	49	River	On	Inactive	Standard	0	15 V 360821 6245253
Zone 1	23	Stream	On	Inactive	Standard	0	15 V 347619 6241984
Zone 1	25	Stream	On	Inactive	Standard	0	15 V 347887 6241223
Zone 1	27	Stream	On	Inactive	Standard	0	15 V 348054 6240533
Zone 1	89	Stream	On	Inactive	Standard	0	15 V 351561 6240038
Zone 1	88	Stream	On	Inactive	Bank	1	15 V 351619 6240247
Zone 1	21	Stream	On	Inactive	Standard	0	15 V 351673 6240424
Zone 1	21	Stream	On	Inactive	Standard	0	15 V 353469 6240652
Zone 1	20	Stream	On	Inactive	Standard	0	15 V 353487 6240990
Zone 1	18	Stream	On	Inactive	Standard	0	15 V 353521 6241424
Zone 1	17	Stream	On	Inactive	Standard	0	15 V 353523 6241456
Zone 1	19	Stream	On	Inactive	Standard	0	15 V 353530 6241160
Zone 1	43	Stream	Off	Active	Standard	1	15 V 353800 6249400
Zone 1	29	Stream	Off	Inactive	Standard	0	15 V 348739 6241404
Zone 1	14	Stream	Off	Inactive	Standard	0	15 V 351273 6239131
Zone 1	15	Stream	Off	Inactive	Standard	1	15 V 351355 6239079
Zone 1	43	Stream	Off	Inactive	Standard	0	15 V 353800 6249400
Zone 1	315	Stream	Off	Inactive	Standard	0	15 V 360222 6244856

## Table 7: Locations and Status of Beaver Lodges Observed During the Fall 2018 Aerial Survey Survey



Study Zone	Wpt.	Waterbody Type	Survey Route (On or Off)	Lodge Status	Lodge Type	No. Food Caches	UTM
Zone 2	295	Pond	On	Active	Standard	1	15 V 357688 6252665
Zone 2	79	River	On	Active	Standard	1	15 V 329558 6242865
Zone 2	248	Stream	On	Active	Bank	1	15 V 360668 6250126
Zone 2	360	Stream	On	Active	Standard	1	15 V 372671 6243768
Zone 2	66	Lake	On	Inactive	Standard	0	15 V 343099 6244888
Zone 2	65	Lake	On	Inactive	Standard	0	15 V 343105 6244609
Zone 2	373	Lake	On	Inactive	Bank	0	15 V 367594 6244583
Zone 2	80	River	On	Inactive	Standard	0	15 V 329530 6242840
Zone 2	307	River	On	Inactive	Standard	0	15 V 364016 6244849
Zone 2	353	Stream	On	Inactive	Standard	0	15 V 376701 6243223
Zone 2	306	Stream	Off	Active	Standard	1	15 V 355213 6250777
Zone 2	2	Stream	Off	Active	Standard	1	15 V 360254 6244290
Zone 2	359	Stream	Off	Active	Standard	1	15 V 374057 6243540
Zone 3	274	Lake	On	Active	Standard	1	15 V 348138 6253402
Zone 3	282	Lake	On	Active	Standard	1	15 V 348648 6254647
Zone 3	28	Lake	On	Active	Standard	1	15 V 348652 6239894
Zone 3	289	Lake	On	Active	Standard	1	15 V 352816 6254603
Zone 3	297	Lake	On	Active	Standard	1	15 V 358385 6253167
Zone 3	374	Lake	On	Active	Standard	1	15 V 368020 6244890
Zone 3	367	Lake	On	Active	Bank	1	15 V 368539 6243099
Zone 3	370	Lake	On	Active	Standard	1	15 V 371261 6244155
Zone 3	354	Lake	On	Active	Standard	1	15 V 376261 6242454
Zone 3	356	Lake	On	Active	Standard	0	15 V 376852 6242272
Zone 3	357	Lake	On	Active	Standard	1	15 V 377231 6242230
Zone 3	352	Lake	On	Active	Standard	1	15 V 379457 6243797
Zone 3	326	Lake	On	Active	Standard	1	15 V 379932 6244255
Zone 3	340	Lake	On	Active	Standard	1	15 V 385551 6242825
Zone 3	335	Lake	On	Active	Standard	1	15 V 385726 6242804
Zone 3	328	River	On	Active	Standard	1	15 V 380999 6243722
Zone 3	329	River	On	Active	Standard	1	15 V 381284 6243595
Zone 3	331	River	On	Active	Standard	1	15 V 381885 6243448
Zone 3	332	River	On	Active	Standard	1	15 V 382853 6243455
Zone 3	346	River	On	Active	Standard	1	15 V 383688 6243499
Zone 3	239	Stream	On	Active	Standard	1	15 V 326599 6238809
Zone 3	82	Stream	On	Active	Standard	1	15 V 328951 6243756
Zone 3	70	Stream	On	Active	Standard	1	15 V 335822 6245625
Zone 3	232	Stream	On	Active	Standard	1	15 V 338481 6242467
Zone 3	39	Stream	On	Active	Standard	1	15 V 338689 6246044
Zone 3	228	Stream	On	Active	Standard	1	15 V 346322 6240954
Zone 3	226	Stream	On	Active	Standard	1	15 V 347121 6240993
Zone 3	57	Stream	On	Active	Standard	1	15 V 349787 6247922



Study Zone	Wpt.	Waterbody Type	Survey Route (On or Off)	Lodge Status	Lodge Type	No. Food Caches	UTM
Zone 3	58	Stream	On	Active	Standard	0	15 V 349787 6247922
Zone 3	56	Stream	On	Active	Standard	1	15 V 350001 6247788
Zone 3	262	Stream	On	Active	Standard	1	15 V 350943 6252966
Zone 3	261	Stream	On	Active	Standard	1	15 V 351254 6252878
Zone 3	258	Stream	On	Active	Bank	2	15 V 353436 6252532
Zone 3	257	Stream	On	Active	Standard	1	15 V 354000 6252462
Zone 3	256	Stream	On	Active	Standard	1	15 V 354573 6252132
Zone 3	255	Stream	On	Active	Standard	1	15 V 355415 6252003
Zone 3	254	Stream	On	Active	Standard	1	15 V 356440 6251594
Zone 3	253	Stream	On	Active	Standard	1	15 V 357312 6251340
Zone 3	251	Stream	On	Active	Standard	1	15 V 357444 6250894
Zone 3	252	Stream	On	Active	Standard	1	15 V 357684 6251057
Zone 3	250	Stream	On	Active	Bank	1	15 V 358495 6250227
Zone 3	249	Stream	On	Active	Standard	1	15 V 359449 6250277
Zone 3	1	Stream	On	Active	Standard	1	15 V 364034 6244769
Zone 3	343	Stream	On	Active	Standard	1	15 V 384688 6242629
Zone 3	341	Stream	On	Active	Bank	1	15 V 384905 6243221
Zone 3	319	Stream	On	Active	Standard	1	15 V 389232 6244721
Zone 3	36	Lake	On	Inactive	Standard	0	15 V 342528 6242237
Zone 3	37	Lake	On	Inactive	Standard	0	15 V 342532 6242184
Zone 3	60	Lake	On	Inactive	Standard	0	15 V 348847 6248304
Zone 3	287	Lake	On	Inactive	Standard	0	15 V 351859 6254250
Zone 3	91	Lake	On	Inactive	Bank	0	15 V 352068 6238360
Zone 3	288	Lake	On	Inactive	Standard	0	15 V 352816 6254603
Zone 3	309	Lake	On	Inactive	Standard	0	15 V 358571 6243004
Zone 3	308	Lake	On	Inactive	Standard	0	15 V 358706 6243473
Zone 3	372	Lake	On	Inactive	Standard	0	15 V 369001 6244669
Zone 3	368	Lake	On	Inactive	Bank	0	15 V 369322 6243304
Zone 3	369	Lake	On	Inactive	Bank	0	15 V 369911 6243414
Zone 3	355	Lake	On	Inactive	Standard	0	15 V 376203 6242219
Zone 3	358	Lake	On	Inactive	Standard	0	15 V 376446 6243910
Zone 3	333	Lake	On	Inactive	Standard	0	15 V 382912 6243419
Zone 3	342	Lake	On	Inactive	Standard	0	15 V 385002 6243548
Zone 3	317	Lake	On	Inactive	Standard	0	15 V 388722 6245629
Zone 3	327	River	On	Inactive	Standard	0	15 V 380565 6244052
Zone 3	330	River	On	Inactive	Standard	0	15 V 381605 6243596
Zone 3	347	River	On	Inactive	Standard	0	15 V 382192 6243132
Zone 3	334	River	On	Inactive	Standard	0	15 V 383090 6243525
Zone 3	81	Stream	On	Inactive	Standard	0	15 V 329249 6243728
Zone 3	237	Stream	On	Inactive	Standard	0	15 V 334456 6242191
Zone 3	71	Stream	On	Inactive	Standard	0	15 V 335560 6246012



Study Zone	Wpt.	Waterbody Type	Survey Route (On or Off)	Lodge Status	Lodge Type	No. Food Caches	UTM
Zone 3	235	Stream	On	Inactive	Standard	0	15 V 336518 6243675
Zone 3	54	Stream	On	Inactive	Standard	0	15 V 338613 6246150
Zone 3	67	Stream	On	Inactive	Standard	0	15 V 338696 6246580
Zone 3	38	Stream	On	Inactive	Standard	1	15 V 338753 6242489
Zone 3	34	Stream	On	Inactive	Standard	0	15 V 342802 6242456
Zone 3	230	Stream	On	Inactive	Standard	0	15 V 343042 6242406
Zone 3	229	Stream	On	Inactive	Standard	0	15 V 346133 6240817
Zone 3	45	Stream	On	Inactive	Standard	0	15 V 346216 6246001
Zone 3	62	Stream	On	Inactive	Standard	0	15 V 346565 6246336
Zone 3	227	Stream	On	Inactive	Standard	0	15 V 346657 6241042
Zone 3	59a	Stream	On	Inactive	Standard	0	15 V 349134 6248086
Zone 3	59b	Stream	On	Inactive	Standard	0	15 V 349134 6248086
Zone 3	59c	Stream	On	Inactive	Standard	0	15 V 349134 6248086
Zone 3	59d	Stream	On	Inactive	Standard	0	15 V 349134 6248086
Zone 3	260	Stream	On	Inactive	Standard	0	15 V 351464 6253094
Zone 3	259	Stream	On	Inactive	Standard	0	15 V 352085 6252840
Zone 3	298	Stream	On	Inactive	Standard	0	15 V 358268 6253419
Zone 3	4	Stream	On	Inactive	Standard	0	15 V 362771 6244448
Zone 3	371	Stream	On	Inactive	Standard	0	15 V 369629 6244854
Zone 3	363	Stream	On	Inactive	Standard	0	15 V 371558 6243232
Zone 3	362	Stream	On	Inactive	Standard	0	15 V 372313 6243567
Zone 3	361	Stream	On	Inactive	Standard	0	15 V 372384 6243640
Zone 3	320	Stream	On	Inactive	Standard	0	15 V 389622 6244788
Zone 3	231	Stream	Off	Active	Standard	1	15 V 343320 6242336
Zone 3	32	Stream	Off	Active	Standard	1	15 V 344840 6242872
Zone 3	304	Stream	Off	Active	Standard	1	15 V 355997 6250443
Zone 3	303	Stream	Off	Active	Standard	1	15 V 356323 6250444
Zone 3	312	Stream	Off	Active	Bank	1	15 V 357539 6242073
Zone 3	275	Stream	Off	Inactive	Standard	0	15 V 343919 6254336
Zone 3	31	Stream	Off	Inactive	Standard	0	15 V 344734 6243126
Zone 3	286a	Stream	Off	Inactive	Standard	0	15 V 351857 6254692
Zone 3	286b	Stream	Off	Inactive	Standard	0	15 V 351857 6254692
Zone 3	290	Stream	Off	Inactive	Standard	0	15 V 355820 6253395
Zone 3	292	Stream	Off	Inactive	Standard	0	15 V 355899 6253130
Zone 3	293	Stream	Off	Inactive	Standard	0	15 V 356226 6253022
Zone 3	313	Stream	Off	Inactive	Standard	0	15 V 357295 6242175
Zone 3	296	Stream	Off	Inactive	Standard	0	15 V 358002 6252607
Zone 4	84	Lake	On	Active	Standard	1	15 V 331812 6248447
Zone 4	86	Lake	On	Active	Standard	1	15 V 333219 6248543
Zone 4	69	Lake	On	Active	Standard	1	15 V 338524 6248007
Zone 4	272	Lake	On	Active	Standard	1	15 V 345267 6250901



Study Zone	Wpt.	Waterbody Type	Survey Route (On or Off)	Lodge Status	Lodge Type	No. Food Caches	UTM
Zone 4	63	Lake	On	Active	Standard	1	15 V 346636 6247655
Zone 4	280	Lake	On	Active	Standard	1	15 V 348922 6255546
Zone 4	407	Lake	On	Active	Standard	1	15 V 349860 6262223
Zone 4	107	Lake	On	Active	Standard	1	15 V 350664 6233778
Zone 4	108	Lake	On	Active	Bank	1	15 V 351945 6234226
Zone 4	109	Lake	On	Active	Standard	1	15 V 354908 6233665
Zone 4	396	Lake	On	Active	Standard	1	15 V 355932 6259401
Zone 4	395	Lake	On	Active	Standard	1	15 V 356559 6259005
Zone 4	398	Lake	On	Active	Standard	1	15 V 357657 6259798
Zone 4	314	Lake	On	Active	Standard	1	15 V 357772 6240997
Zone 4	405	Lake	On	Active	Standard	1	15 V 358800 6262213
Zone 4	310	Lake	On	Active	Standard	1	15 V 359158 6241736
Zone 4	402	Lake	On	Active	Standard	1	15 V 360637 6259619
Zone 4	158	Lake	On	Active	Standard	1	15 V 366998 6239603
Zone 4	364	Lake	On	Active	Standard	1	15 V 368506 6242634
Zone 4	421	Lake	On	Active	Standard	1	15 V 372991 6260487
Zone 4	246	Lake	On	Active	Bank	1	14 V 685932 6234207
Zone 4	276	Pond	On	Active	Standard	1	15 V 346021 6256083
Zone 4	324	Pond	On	Active	Standard	1	15 V 389721 6243939
Zone 4	101	River	On	Active	Bank	1	15 V 314401 6243205
Zone 4	224	River	On	Active	Standard	1	15 V 408089 6247266
Zone 4	223	River	On	Active	Standard	1	15 V 409082 6247827
Zone 4	103	River	On	Active	Bank	1	14 V 684397 6248626
Zone 4	102	River	On	Active	Bank	1	14 V 684775 6246427
Zone 4	76	Stream	On	Active	Standard	1	15 V 334635 6247325
Zone 4	72	Stream	On	Active	Standard	1	15 V 335505 6246161
Zone 4	234	Stream	On	Active	Standard	1	15 V 337821 6241766
Zone 4	279	Stream	On	Active	Bank	1	15 V 344159 6256362
Zone 4	383	Stream	On	Active	Bank	1	15 V 344891 6259144
Zone 4	266	Stream	On	Active	Standard	1	15 V 348466 6251981
Zone 4	263	Stream	On	Active	Standard	1	15 V 349604 6251981
Zone 4	411	Stream	On	Active	Standard	1	15 V 351767 6265870
Zone 4	413	Stream	On	Active	Standard	1	15 V 352368 6265283
Zone 4	344	Stream	On	Active	Bank	2	15 V 384641 6242313
Zone 4	339	Stream	On	Active	Standard	1	15 V 385538 6241706
Zone 4	323	Stream	On	Active	Standard	1	15 V 391002 6244273
Zone 4	198	Stream	On	Active	Standard	1	15 V 399198 6259274
Zone 4	195	Stream	On	Active	Standard	1	15 V 401417 6258969
Zone 4	195	Stream	On	Active	Standard	1	15 V 401417 6258969
Zone 4	191	Stream	On	Active	Standard	1	15 V 401599 6259210
Zone 4	192	Stream	On	Active	Standard	1	15 V 401645 6259028



Study Zone	Wpt.	Waterbody Type	Survey Route (On or Off)	Lodge Status	Lodge Type	No. Food Caches	UTM
Zone 4	190	Stream	On	Active	Standard	1	15 V 402307 6259022
Zone 4	187	Stream	On	Active	Standard	1	15 V 402528 6258476
Zone 4	179	Stream	On	Active	Standard	1	15 V 405068 6258142
Zone 4	178	Stream	On	Active	Standard	1	15 V 405318 6258169
Zone 4	177	Stream	On	Active	Standard	1	15 V 405730 6257861
Zone 4	175	Stream	On	Active	Standard	1	15 V 406031 6257583
Zone 4	174	Stream	On	Active	Standard	1	15 V 406199 6257346
Zone 4	173	Stream	On	Active	Bank	1	15 V 406882 6256611
Zone 4	209	Stream	On	Active	Standard	1	15 V 408746 6251907
Zone 4	210	Stream	On	Active	Standard	0	15 V 408746 6251907
Zone 4	211	Stream	On	Active	Standard	1	15 V 408974 6251901
Zone 4	216	Stream	On	Active	Standard	1	15 V 410431 6252455
Zone 4	170	Stream	On	Active	Bank	1	15 V 410529 6254699
Zone 4	169	Stream	On	Active	Standard	1	15 V 411142 6252790
Zone 4	220	Stream	On	Active	Standard	1	15 V 412209 6252981
Zone 4	245	Lake	On	Inactive	Bank	0	15 V 314707 6233213
Zone 4	100	Lake	On	Inactive	Bank	1	15 V 317344 6244713
Zone 4	96	Lake	On	Inactive	Standard	0	15 V 317608 6244987
Zone 4	244	Lake	On	Inactive	Standard	0	15 V 318627 6234055
Zone 4	95	Lake	On	Inactive	Standard	0	15 V 318769 6245019
Zone 4	240	Lake	On	Inactive	Standard	0	15 V 320083 6236717
Zone 4	105	Lake	On	Inactive	Standard	0	15 V 320485 6242869
Zone 4	83	Lake	On	Inactive	Standard	0	15 V 331851 6248480
Zone 4	85	Lake	On	Inactive	Standard	0	15 V 331919 6248690
Zone 4	53	Lake	On	Inactive	Standard	0	15 V 342380 6241707
Zone 4	64	Lake	On	Inactive	Standard	0	15 V 346672 6247951
Zone 4	273	Lake	On	Inactive	Standard	0	15 V 348372 6252807
Zone 4	116	Lake	On	Inactive	Standard	0	15 V 353859 6233615
Zone 4	376	Lake	On	Inactive	Standard	0	15 V 354900 6257096
Zone 4	404	Lake	On	Inactive	Standard	0	15 V 358800 6262213
Zone 4	406	Lake	On	Inactive	Standard	0	15 V 359030 6263206
Zone 4	311	Lake	On	Inactive	Standard	0	15 V 359046 6241720
Zone 4	403	Lake	On	Inactive	Standard	0	15 V 359454 6261030
Zone 4	375	Lake	On	Inactive	Bank	0	15 V 360021 6256905
Zone 4	160	Lake	On	Inactive	Standard	0	15 V 367478 6238599
Zone 4	159	Lake	On	Inactive	Standard	0	15 V 367811 6240074
Zone 4	365	Lake	On	Inactive	Standard	0	15 V 368506 6242634
Zone 4	417	Lake	On	Inactive	Standard	0	15 V 368796 6259684
Zone 4	419	Lake	On	Inactive	Standard	0	15 V 372941 6258650
Zone 4	426	Lake	On	Inactive	Standard	0	15 V 379186 6262755
Zone 4	325	Lake	On	Inactive	Standard	0	15 V 383266 6247666



Study Zone	Wpt.	Waterbody Type	Survey Route (On or Off)	Lodge Status	Lodge Type	No. Food Caches	UTM
Zone 4	429	Lake	On	Inactive	Standard	0	15 V 384506 6260386
Zone 4	165	Lake	On	Inactive	Standard	0	15 V 388787 6253299
Zone 4	166	Lake	On	Inactive	Standard	0	15 V 397484 6251928
Zone 4	92	Lake	On	Inactive	Standard	0	14 V 681307 6235670
Zone 4	106	River	On	Inactive	Standard	0	15 V 350340 6233452
Zone 4	167	River	On	Inactive	Standard	0	15 V 406593 6250531
Zone 4	168	River	On	Inactive	Standard	0	15 V 410065 6251191
Zone 4	238	Stream	On	Inactive	Standard	0	15 V 329655 6238878
Zone 4	75	Stream	On	Inactive	Standard	0	15 V 335309 6246575
Zone 4	74	Stream	On	Inactive	Standard	0	15 V 335369 6246487
Zone 4	73	Stream	On	Inactive	Standard	0	15 V 335396 6246194
Zone 4	233	Stream	On	Inactive	Standard	0	15 V 337933 6241860
Zone 4	68	Stream	On	Inactive	Standard	0	15 V 338255 6247592
Zone 4	267a	Stream	On	Inactive	Standard	0	15 V 348282 6251751
Zone 4	267b	Stream	On	Inactive	Standard	0	15 V 348282 6251751
Zone 4	265	Stream	On	Inactive	Standard	0	15 V 348466 6251981
Zone 4	264	Stream	On	Inactive	Standard	0	15 V 348684 6251957
Zone 4	409	Stream	On	Inactive	Standard	0	15 V 351928 6265619
Zone 4	412	Stream	On	Inactive	Standard	0	15 V 352160 6265308
Zone 4	161	Stream	On	Inactive	Standard	0	15 V 367825 6238439
Zone 4	338	Stream	On	Inactive	Standard	0	15 V 385455 6241849
Zone 4	322	Stream	On	Inactive	Standard	0	15 V 390598 6244232
Zone 4	194	Stream	On	Inactive	Standard	0	15 V 401417 6258969
Zone 4	193	Stream	On	Inactive	Standard	0	15 V 401633 6258995
Zone 4	189	Stream	On	Inactive	Standard	0	15 V 402461 6258936
Zone 4	203	Stream	On	Inactive	Standard	1	15 V 405666 6252060
Zone 4	204	Stream	On	Inactive	Standard	0	15 V 405748 6252235
Zone 4	176	Stream	On	Inactive	Standard	0	15 V 405981 6257657
Zone 4	212	Stream	On	Inactive	Standard	0	15 V 409414 6252109
Zone 4	213	Stream	On	Inactive	Standard	0	15 V 409730 6252245
Zone 4	214	Stream	On	Inactive	Standard	0	15 V 410028 6252300
Zone 4	215	Stream	On	Inactive	Standard	0	15 V 410237 6252357
Zone 4	217	Stream	On	Inactive	Standard	0	15 V 411582 6252891
Zone 4	218	Stream	On	Inactive	Standard	0	15 V 411724 6252930
Zone 4	219	Stream	On	Inactive	Standard	0	15 V 411851 6252956
Zone 4	221	Stream	On	Inactive	Standard	0	15 V 412299 6253055
Zone 4	98	Stream	Off	Active	Standard	1	15 V 317447 6246573
Zone 4	270	Stream	Off	Active	Standard	1	15 V 347439 6251574
Zone 4	268	Stream	Off	Active	Standard	1	15 V 348902 6250896
Zone 4	389	Stream	Off	Active	Standard	1	15 V 350992 6259642
Zone 4	284	Stream	Off	Active	Standard	1	15 V 351239 6255169



Study Zone	Wpt.	Waterbody	Survey Route	Lodge Status	Lodge	No. Food	UTM
20110		1960	(On or Off)	otatus	. Jbc	Caches	
Zone 4	382	Stream	Off	Active	Standard	1	15 V 351924 6256186
Zone 4	393	Stream	Off	Active	Bank	1	15 V 353385 6259114
Zone 4	394	Stream	Off	Active	Standard	1	15 V 354614 6258713
Zone 4	377	Stream	Off	Active	Standard	1	15 V 354868 6256547
Zone 4	397	Stream	Off	Active	Standard	1	15 V 354979 6259756
Zone 4	291	Stream	Off	Active	Standard	1	15 V 355491 6254123
Zone 4	416	Stream	Off	Active	Standard	1	15 V 356749 6269200
Zone 4	300	Stream	Off	Active	Standard	1	15 V 358024 6254453
Zone 4	400	Stream	Off	Active	Standard	1	15 V 358264 6260083
Zone 4	401a	Stream	Off	Active	Standard	0	15 V 358264 6260083
Zone 4	401b	Stream	Off	Active	Standard	0	15 V 358264 6260083
Zone 4	418	Stream	Off	Active	Standard	1	15 V 368232 6259979
Zone 4	422	Stream	Off	Active	Standard	1	15 V 373521 6261034
Zone 4	428	Stream	Off	Active	Standard	1	15 V 378499 6263008
Zone 4	351	Stream	Off	Active	Standard	0	15 V 380259 6242271
Zone 4	350	Stream	Off	Active	Standard	1	15 V 380624 6242509
Zone 4	336	Stream	Off	Active	Bank	1	15 V 386632 6241904
Zone 4	99	Stream	Off	Inactive	Standard	0	15 V 317556 6246891
Zone 4	241	Stream	Off	Inactive	Standard	0	15 V 323471 6234152
Zone 4	242	Stream	Off	Inactive	Standard	0	15 V 323638 6234304
Zone 4	243	Stream	Off	Inactive	Standard	0	15 V 323812 6234386
Zone 4	87	Stream	Off	Inactive	Standard	0	15 V 333474 6248590
Zone 4	77	Stream	Off	Inactive	Standard	0	15 V 334605 6247390
Zone 4	78	Stream	Off	Inactive	Standard	0	15 V 334663 6247612
Zone 4	278	Stream	Off	Inactive	Standard	0	15 V 344335 6256699
Zone 4	277	Stream	Off	Inactive	Standard	0	15 V 346243 6256598
Zone 4	271	Stream	Off	Inactive	Standard	0	15 V 347273 6251606
Zone 4	269	Stream	Off	Inactive	Standard	0	15 V 347865 6251699
Zone 4	378	Stream	Off	Inactive	Standard	0	15 V 349278 6257888
Zone 4	379	Stream	Off	Inactive	Standard	0	15 V 349334 6257543
Zone 4	408	Stream	Off	Inactive	Standard	0	15 V 349417 6262234
Zone 4	390	Stream	Off	Inactive	Standard	0	15 V 350823 6259633
Zone 4	380	Stream	Off	Inactive	Standard	0	15 V 351217 6256795
Zone 4	285	Stream	Off	Inactive	Standard	0	15 V 351218 6255395
Zone 4	381	Stream	Off	Inactive	Standard	0	15 V 351714 6256096
Zone 4	391a	Stream	Off	Inactive	Standard	0	15 V 352752 6259385
Zone 4	391b	Stream	Off	Inactive	Standard	0	15 V 352752 6259385
Zone 4	392	Stream	Off	Inactive	Standard	0	15 V 353053 6259274
Zone 4	415	Stream	Off	Inactive	Standard	0	15 V 356847 6269358
Zone 4	414	Stream	Off	Inactive	Standard	0	15 V 356975 6269523
Zone 4	399	Stream	Off	Inactive	Standard	1	15 V 357924 6259886



Study Zone	Wpt.	Waterbody Type	Survey Route (On or Off)	Lodge Status	Lodge Type	No. Food Caches	UTM
Zone 4	299	Stream	Off	Inactive	Standard	0	15 V 358065 6254029
Zone 4	301	Stream	Off	Inactive	Standard	0	15 V 359087 6253764
Zone 4	302	Stream	Off	Inactive	Standard	0	15 V 359418 6253827
Zone 4	366	Stream	Off	Inactive	Standard	0	15 V 368289 6242608
Zone 4	349a	Stream	Off	Inactive	Standard	0	15 V 380959 6242768
Zone 4	349b	Stream	Off	Inactive	Standard	0	15 V 380959 6242768
Zone 4	337	Stream	Off	Inactive	Standard	0	15 V 385370 6242065
Zone 4	321	Stream	Off	Inactive	Standard	0	15 V 390408 6244014
Zone 4	247	Stream	Off	Inactive	Standard	0	14 V 684859 6232159
Zone 5	145	Lake	On	Active	Standard	1	15 V 353925 6232461
Zone 5	110	Lake	On	Active	Standard	1	15 V 355829 6233140
Zone 5	115	Lake	On	Active	Standard	1	15 V 356308 6232667
Zone 5	144	Lake	On	Active	Standard	1	15 V 356454 6231916
Zone 5	114	Lake	On	Active	Standard	1	15 V 357182 6232916
Zone 5	118	Lake	On	Active	Standard	1	15 V 357311 6231562
Zone 5	137	Lake	On	Active	Standard	1	15 V 358445 6227960
Zone 5	138	Lake	On	Active	Standard	1	15 V 358521 6228793
Zone 5	120	Lake	On	Active	Standard	1	15 V 358647 6232151
Zone 5	124	Lake	On	Active	Standard	1	15 V 361814 6230224
Zone 5	125	Lake	On	Active	Standard	1	15 V 362413 6230460
Zone 5	152	Lake	On	Active	Bank	1	15 V 366288 6235205
Zone 5	147	Lake	On	Active	Standard	1	15 V 367960 6235098
Zone 5	150	Lake	On	Active	Bank	0	15 V 369660 6235733
Zone 5	93	Lake	On	Active	Standard	1	14 V 675301 6239200
Zone 5	386	Stream	On	Active	Bank	1	15 V 341073 6262779
Zone 5	385	Stream	On	Active	Bank	1	15 V 342383 6261585
Zone 5	384	Stream	On	Active	Bank	0	15 V 343302 6259285
Zone 5	410	Stream	On	Active	Standard	1	15 V 351906 6266165
Zone 5	156	Stream	On	Active	Standard	1	15 V 366575 6237172
Zone 5	154	Stream	On	Active	Standard	1	15 V 367019 6236326
Zone 5	163	Stream	On	Active	Standard	1	15 V 368011 6237914
Zone 5	164	Stream	On	Active	Standard	1	15 V 368420 6237993
Zone 5	186	Stream	On	Active	Standard	3	15 V 402604 6257982
Zone 5	184	Stream	On	Active	Standard	1	15 V 403855 6257374
Zone 5	183	Stream	On	Active	Standard	1	15 V 404217 6257372
Zone 5	201	Stream	On	Active	Standard	1	15 V 404572 6253330
Zone 5	200	Stream	On	Active	Standard	1	15 V 404686 6253763
Zone 5	172	Stream	On	Active	Standard	1	15 V 407370 6255686
Zone 5	146	Lake	On	Inactive	Bank	0	15 V 353904 6233063
Zone 5	112	Lake	On	Inactive	Standard	0	15 V 355833 6233391
Zone 5	111	Lake	On	Inactive	Standard	0	15 V 356019 6233332



Study Zone	Wpt.	Waterbody Type	Survey Route (On or Off)	Lodge Status	Lodge Type	No. Food Caches	UTM
Zone 5	113	Lake	On	Inactive	Standard	0	15 V 356940 6233166
Zone 5	143	Lake	On	Inactive	Standard	0	15 V 357126 6231238
Zone 5	117	Lake	On	Inactive	Standard	0	15 V 357220 6231926
Zone 5	142	Lake	On	Inactive	Standard	0	15 V 357283 6231319
Zone 5	139a	Lake	On	Inactive	Standard	0	15 V 357445 6230109
Zone 5	139b	Lake	On	Inactive	Standard	0	15 V 357445 6230109
Zone 5	141	Lake	On	Inactive	Standard	0	15 V 357529 6230194
Zone 5	119	Lake	On	Inactive	Standard	0	15 V 357764 6232158
Zone 5	134	Lake	On	Inactive	Standard	0	15 V 359239 6228213
Zone 5	132	Lake	On	Inactive	Standard	1	15 V 359731 6228581
Zone 5	133	Lake	On	Inactive	Standard	0	15 V 360131 6228926
Zone 5	121	Lake	On	Inactive	Standard	1	15 V 360749 6230037
Zone 5	122	Lake	On	Inactive	Standard	0	15 V 361100 6229878
Zone 5	128	Lake	On	Inactive	Standard	0	15 V 362774 6230388
Zone 5	153	Lake	On	Inactive	Standard	0	15 V 367115 6236156
Zone 5	148	Lake	On	Inactive	Bank	0	15 V 368474 6235917
Zone 5	151	Lake	On	Inactive	Bank	0	15 V 369715 6235846
Zone 5	94	Lake	On	Inactive	Bank	1	14 V 674417 6238973
Zone 5	388	Stream	On	Inactive	Standard	0	15 V 341961 6261872
Zone 5	157	Stream	On	Inactive	Standard	0	15 V 366733 6237550
Zone 5	155	Stream	On	Inactive	Standard	0	15 V 366790 6236429
Zone 5	162	Stream	On	Inactive	Standard	0	15 V 368011 6237914
Zone 5	197	Stream	On	Inactive	Standard	0	15 V 399995 6258898
Zone 5	196	Stream	On	Inactive	Standard	0	15 V 400461 6258813
Zone 5	182	Stream	On	Inactive	Standard	0	15 V 404308 6257508
Zone 5	202	Stream	On	Inactive	Standard	0	15 V 404332 6252755
Zone 5	199	Stream	On	Inactive	Standard	0	15 V 404401 6254292
Zone 5	181	Stream	On	Inactive	Standard	0	15 V 404482 6257689
Zone 5	180	Stream	On	Inactive	Standard	0	15 V 404593 6257776
Zone 5	205	Stream	On	Inactive	Standard	0	15 V 406450 6252707
Zone 5	207	Stream	On	Inactive	Standard	0	15 V 407231 6252385
Zone 5	208	Stream	On	Inactive	Standard	0	15 V 407614 6252173
Zone 5	123	Lake	Off	Active	Standard	1	15 V 361173 6230403
Zone 5	131	River	Off	Active	Standard	1	15 V 363960 6231358
Zone 5	225	River	Off	Active	Bank	1	15 V 401358 6247301
Zone 5	104	River	Off	Active	Standard	1	14 V 683291 6250724
Zone 5	129	River	Off	Inactive	Standard	0	15 V 363628 6231174
Zone 5	130	River	Off	Inactive	Standard	0	15 V 364069 6231391
Zone 5	140	Stream	Off	Active	Standard	1	15 V 356910 6230029
Zone 5	136	Stream	Off	Active	Standard	1	15 V 359745 6227870
Zone 5	126	Stream	Off	Active	Standard	1	15 V 362539 6230842



Study Zone	Wpt.	Waterbody Type	Survey Route (On or Off)	Lodge Status	Lodge Type	No. Food Caches	UTM
Zone 5	135	Stream	Off	Inactive	Standard	0	15 V 359506 6227900
Zone 5	127	Stream	Off	Inactive	Standard	0	15 V 362281 6231025
Zone 5	149	Stream	Off	Inactive	Bank	0	15 V 368838 6235645



### APPENDIX 3: BEAVER LODGE AND FOOD CACHE CHARACTERISTICS 2018



Study zone	Wpt.	Lodge Type	Lodge Status	Lodge Material	Lodge volume (m <sup>3</sup> )	Food cache composition	Cache size (m <sup>2</sup> )
Zone 4	193	Standard	Inactive	Willow, mud	37.44	Willow	6
Zone 4	189	Standard	Inactive	Black spruce, alder, mud	55.328	Willow, black spruce	8
Zone 4	178	Standard	Active	Black spruce, alder, mud	Black spruce, alder, mud 84.15 Willow, black spruce, ald		12
Zone 4	170	Standard	Active	Black spruce, willow, mud	24.795	Willow, balsam poplar	18
Zone 4	223	Standard	Active	Black spruce, willow, mud	110.16	Willow, black spruce	24
Zone 3	38	Standard	Inactive	Willow, black spruce, grass, mud	154.496	Willow	8
Zone 3	239	Standard	Active	Black spruce, willow, birch, mud	83.143	Willow, black spruce, alder	18
Zone 3	57	Standard	Active	Willow, black spruce, mud	63.65	Willow, birch, alder	12
Zone 4	280	Standard	Active	Birch, willow, mud	40.848	Willow, birch, black spruce	16
Zone 4	265	Standard	Inactive	Black spruce, willow, mud	144.42	Willow	4
Zone 4	276	Standard	Active	Black spruce, mud	24.024	Willow	15
Zone 4	324	Standard	Active	willow, mud	willow, mud 99.4 Willow, birch		12
Zone 3	357	Standard	Active	Birch, aquatic vegetation, willow, mud	153.171	Willow, birch	18
Zone 3	356	Standard	Active	Birch, willow, grass, black spruce, mud	58.374	Unknown	Unknown
Zone 3	354	Standard	Active	Black spruce, birch, balsam poplar, willow, grass, mud	245.52	Willow, birch	11.25
Zone 4	364	Standard	Active	Birch, willow, grass, mud	27.735	Willow, alder	2
Zone 3	367	Bank	Active	Willow, black spruce, balsam poplar	35.328	Willow	4
Zone 3	288	Standard	Inactive	Willow, balsam poplar, black spruce, mud	135.005	Willow, alder	12
Zone 3	374	Standard	Active	Birch, black spruce, grass, mud	120.96	willow, black spruce, birch	7.5
Zone 3	308	Standard	Inactive	Birch, mud	15.6	Willow, birch	4
Zone 3	252	Standard	Active	willow, mud	47.652	Willow	12.5
Zone 3	256	Standard	Active	Willow, black spruce, mud	3.15	Willow	8
Zone 3	257	Standard	Active	Willow, alder, mud	46.8	Willow, alder	7.5
Zone 3	261	Standard	Active	Willow, black spruce, mud	32.68	Willow	21.25
Zone 3	274	Standard	Active	Black spruce, alder, mud	23.808	Willow	9
Zone 3	282	Standard	Active	Alder, birch, willow, mud	64.077	Willow, alder	32

 Table 8:
 Characteristics of Beaver Lodges and Food Caches in Fall 2018



Study zone	Wpt.	Lodge Type	Lodge Status	Lodge Material	Lodge volume (m <sup>3</sup> )	Food cache composition	Cache size (m²)
Zone 3	297	Standard	Active	Birch, willow, black spruce, mud	41.454	Willow, birch	15
Zone 3	352	Standard	Active	Willow, balsam poplar, mud	36.464	Willow	12.5
Zone 3	326	Standard	Active	Balsam poplar, willow, alder, mud	63.878	Willow, balsam poplar	9
Zone 3	328	Standard	Active	Mud	20.46	Birch, willow	25
Zone 3	340	Standard	Active	Trembling aspen, willow, black spruce, mud	96.579	Willow, tamarack	15
Zone 3	335	Standard	Active	Black spruce, willow, mud, garbage	172.086	Willow, black spruce	10
Zone 3	319	Standard	Active	Black spruce, mud	59.976	Willow	12
Zone 3	332	Standard	Active	Black spruce, willow, birch, sphagnum moss, mud	54.855	Birch, willow, black spruce	26
Zone 3	341	Bank	Active	Willow, black spruce, grass, mud	35.7	Willow	15
Zone 2	248	Bank	Active	Willow, alder, mud	26.714	Willow	12.5
Zone 2	295	Standard	Active	Black spruce, birch, willow, mud	37.44	Black spruce, willow	12
Zone 4	407	Standard	Active	Black spruce, balsam poplar, mud	63.336	Black spruce, willow, balsam poplar	12
Zone 4	396	Standard	Active	Black spruce, birch, willow, mud	186.3	Black spruce, willow	4
Zone 4	395	Standard	Active	Black spruce, alder, mud	23.22	Black spruce, willow, alder	6
Zone 4	398	Standard	Active	Black spruce, alder, willow, mud	82.777	Willow	28
Zone 4	404	Bank	Inactive	Black spruce, willow, mud	36.08	Willow, alder	24
Zone 3	28	Standard	Active	Black spruce, birch, willow, mud	43.12	Willow, alder	16
Zone 4	108	Bank	Active	Black spruce, alder, willow, mud	62.135	Willow, alder	15
Zone 3	331	Standard	Active	Black spruce, willow, mud	206.682	Willow, birch	36
Zone 4	158	Standard	Active	Black spruce, balsam poplar, alder, peat	6.5625	Unknown	NA

