Keeyask Generation Project

Terrestrial Effects Monitoring Plan

Bald Eagle Habitat Effects Monitoring Report

TEMP-2020-11

KEEYASK

Manitoba Conservation and Climate Client File 5550.00
Manitoba Environment Act Licence No. 3107

2019 - 2020

KEEYASK GENERATION PROJECT

TERRESTRIAL EFFECTS MONITORING PLAN

REPORT #TEMP-2019-11

BALD EAGLE HABITAT EFFECTS MONITORING 2019

Prepared for

Manitoba Hydro

By

Wildlife Resource Consulting Services MB Inc.

June 2020

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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, including bald eagles. 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 bald eagles, and whether more needs to be done to reduce potentially harmful effects.

Previous studies for bald eagles between 2001 and 2011 for the Project's environmental impact statement, found that the highest density of bald eagles in the region occurred between, and including, Split Lake and Birthday Rapids. In 2016/2017, in preparation for reservoir filling, some bald eagle nests were removed during the winter when no bald eagles were present and replaced with artificial nesting structures to mitigate the loss. Three additional nests that had been retained during clearing in the future reservoir area were removed in the fall of 2019 (when they were no longer being used by bald eagles) in advance of planned impoundment in 2020.

This report describes the results of bald eagle habitat effects monitoring conducted during the summer of 2019, the sixth summer of Project construction. Surveys for bald eagle nests occurred along the shorelines of the Nelson River from the Kelsey Generating Station downstream to the Limestone Generating Station, including Split Lake and Stephens Lake, and along waterbodies off the Nelson River system.

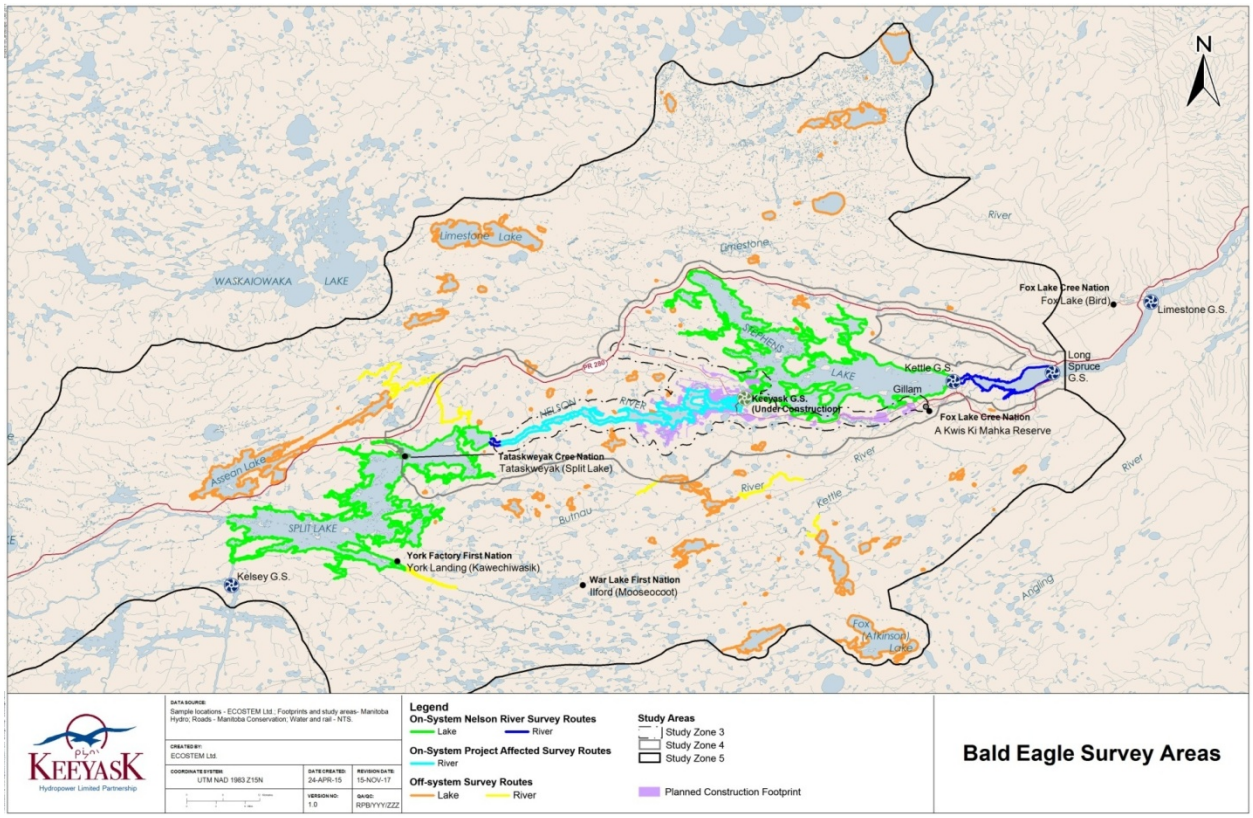
Bald Eagles Attending a Nest in June 2019

Why is the study being done?

Bald eagle habitat effects monitoring is being done to evaluate Project effects on the number and location of bald eagles and their breeding habitats.

What was done?

Helicopter-based aerial surveys took place in May, June, and July 2019 to determine the abundance, distribution, and habitat use of bald eagles in Project-affected areas and in reference areas. Bald eagle nests were also monitored for eggs and nestlings to monitor productivity.

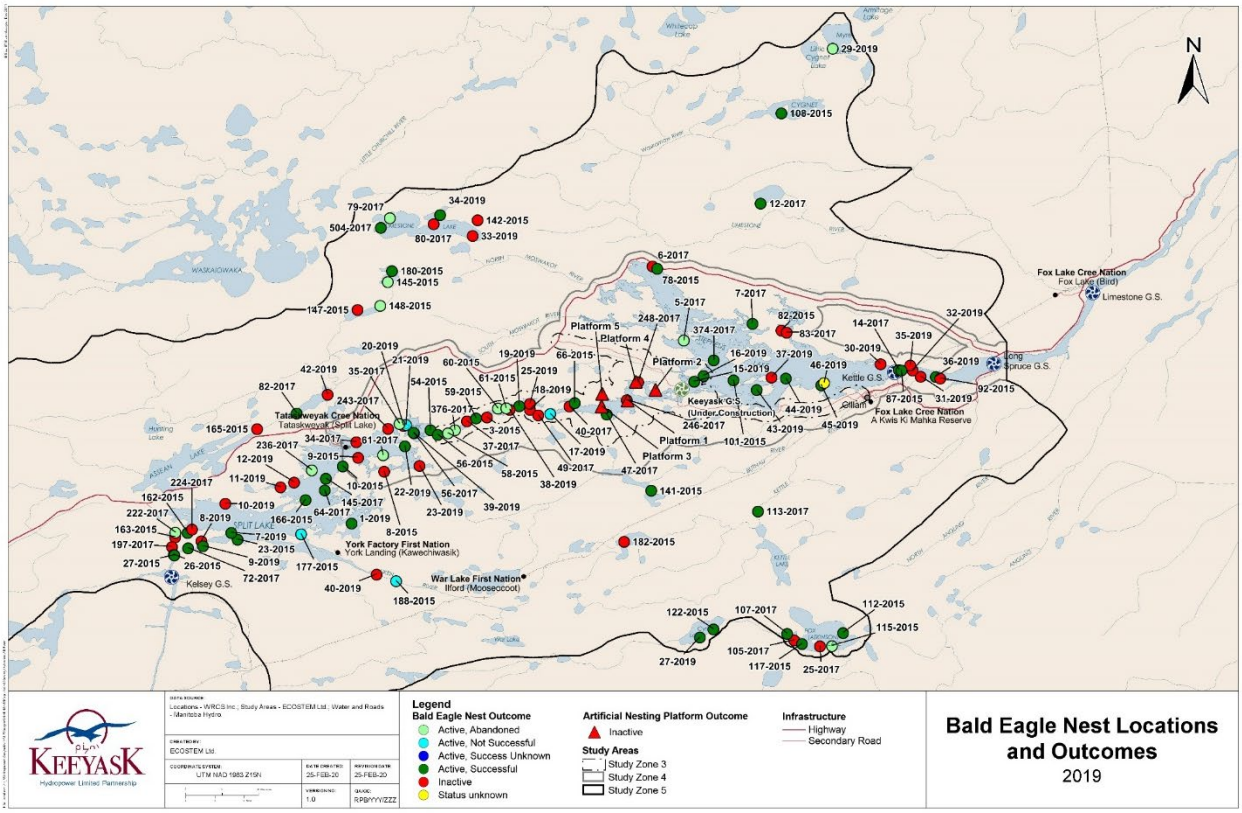


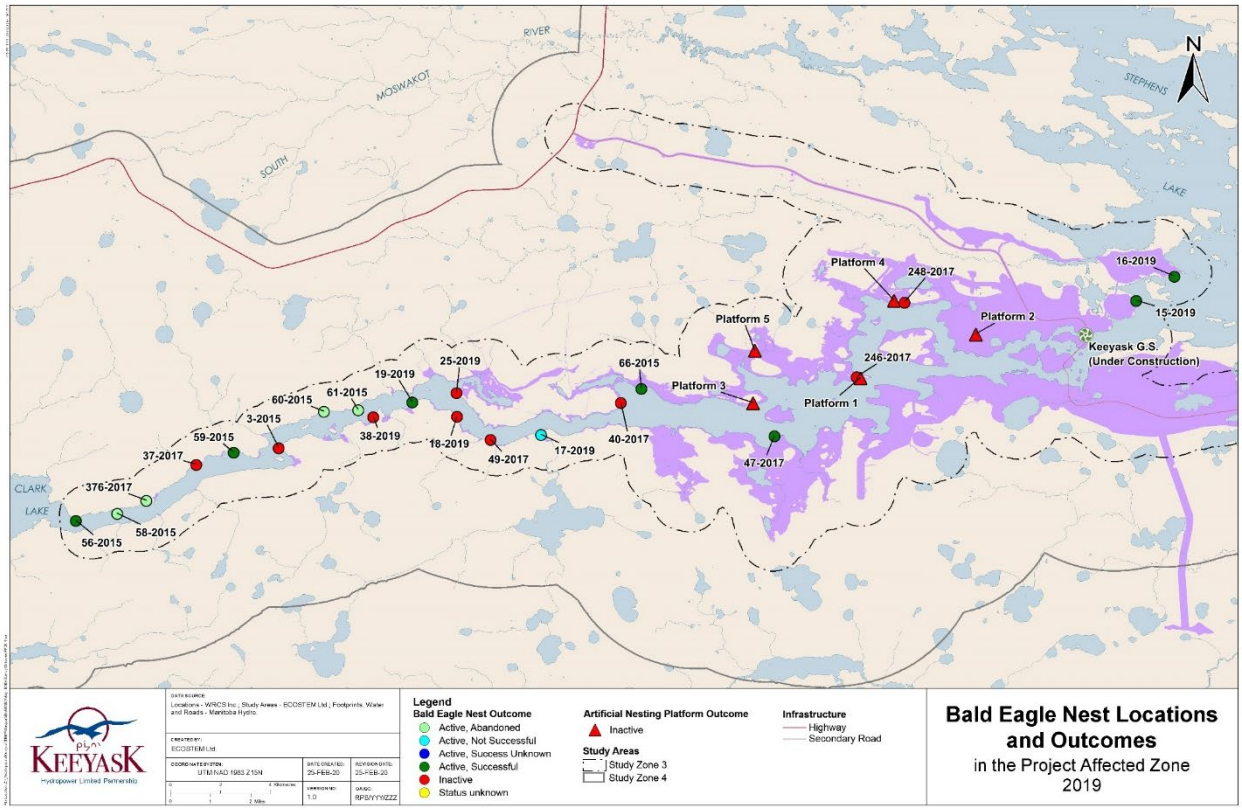
Shorelines Surveyed for Bald Eagles and Nests in 2019

What was found?

A total of 106 bald eagle nests were identified and monitored in 2019, along the surveyed shorelines. Of the 106 nests identified, 62 were occupied by a breeding pair of bald eagles and 44 nests successfully produced 75 late-stage nestlings (young that are almost ready to leave the nest). Breeding pairs produced an average of 1.21 late-stage nestlings per nest and successful nests produced an average of 1.70 late-stage nestlings per nest.

In the Project-affected hydraulic zone (all areas within 200 m of the actual Project footprint at the time of the survey), the number of active nests (9) remained the same as in 2017 and decreased by a single nest from 2015. This is also similar to the number of active nests observed during the pre-construction period in 2011 (8) and 2014 (8).


N
29-2019
108-2015
12-2017
79-2017
34-2019
504-2017
142-2015
80-2017
33-2019
6-2017
180-2015
145-2015
78-2015
147-2015
148-2015
7-2017
5-2017
248-2017
374-2017
82-2015
83-2017
14-2017
32-2019
35-2019
Platform 5
Platform 4
Platform 2
16-2019
37-2019
30-2019
46-2019
Kettle G.S.
36-2019
Long Spruce G.S.
92-2015
Fox Lake Cree Nation
Fox Lake (Bird)
Limestone G.S.
20-2019
21-2019
60-2015
19-2019
66-2015
25-2019
42-2019
35-2017
54-2015
61-2015
18-2019
82-2017
59-2015
243-2017
376-2017
Tataskweyak Cree Nation
Tataskweyak (Split Lake)
3-2015
Keeyask G.S.
(Under Construction)
44-2019
Gillam
87-2015
31-2019
Fox Lake Cree Nation
A Kwis Ki Manka Reserve
165-2015
34-2017
61-2017
40-2017
246-2017
43-2019
45-2019
236-2017
37-2017
17-2019
Platform 1
101-2015
12-2019
9-2015
56-2015
58-2015
49-2017
Platform 3
47-2017
11-2019
10-2015
22-2019
56-2017
38-2019
224-2017
145-2017
141-2015
162-2015
10-2019
64-2017
39-2019
222-2017
8-2019
166-2015
1-2019
23-2019
113-2017
163-2015
8-2015
7-2019
182-2015
197-2017
23-2015
York Factory First Nation
York Landing (Kawechiwasik)
27-2015
26-2015
9-2019
177-2015
72-2017
Kelsey G.S.
40-2019
War Lake First Nation
Ilford (Mooseocoot)
188-2015
122-2015
107-2017
112-2015
115-2015
27-2019
105-2017
117-2015
25-2017
Legend
Bald Eagle Nest Outcome
Active, Abandoned
Active, Not Successful
Active, Success Unknown
Active, Successful
Inactive
Status unknown
Artificial Nesting Platform Outcome
Inactive
Study Areas
Study Zone 3
Study Zone 4
Study Zone 5
Infrastructure
Highway
Secondary Road
KEEYASK
Hydropower Limited Partnership
Bald Eagle Nest Locations and Outcomes
2019


N
RIVER
MOSWAKOT
SOUTH
STEPHENS
LAKE
Platform 4
248-2017
16-2019
Platform 5
Platform 2
15-2019
Keeyask G.S.
(Under Construction)
246-2017
66-2015
Platform 3
Platform 1
25-2019
19-2019
61-2015
60-2015
3-2015
59-2015
38-2019
18-2019
17-2019
40-2017
49-2017
47-2017
37-2017
376-2017
CLARK
LAKE
58-2015
56-2015
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Active, Success Unknown
Active, Successful
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Status unknown
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Highway
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KEEYASK
Hydropower Limited Partnership
Bald Eagle Nest Locations and Outcomes
in the Project Affected Zone
2019

Bald Eagle and Two Young Chicks

What does it mean?

The Project does not appear to be affecting breeding bald eagles in the study area. The bald eagle population in the Project-affected hydraulic zone appears to be stable and sustainable, while the population in the overall study area is increasing.

Two Late-stage Bald Eagle Nestlings

What will be done next?

The construction-phase monitoring for bald eagle is now complete. Additional aerial surveys will be conducted during the operation phase to continue monitoring bald eagles and their breeding habitats. Habitat association data for bald eagle nests will be used to update the existing bald eagle habitat quality model. Since the conditions created within the future Keeyask reservoir may create new breeding habitat types, the habitat quality model will also be confirmed using the data collected during the construction phase.

STUDY TEAM

We would like to thank Derek Longley of Prairie Helicopters, and Sherrie Mason and Rachel Boone of Manitoba Hydro for their assistance. We would also like to thank Dr. James Ehnes, of ECOSTEM Ltd. for GIS supported study design and cartography.

Biologists, technicians and other personnel who designed, participated in, and drafted the study included:

- Robert Berger, M.N.R.M., Design, analysis, and reporting
- Mark Baschuk, M.Sc., Survey personnel, analysis, and reporting
- Stefano Strapazzon, B.Sc., Survey personnel

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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.

The *Keeyask Generation Project: Response to EIS Guidelines* (the EIS), 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 Environment Supporting Volume* (TESV). The *Terrestrial Effects Monitoring Plan* (TEMP) 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, bald eagle (*Haliaeetus leucocephalus)* habitat effects monitoring, for the construction phase of the Project.

Bald eagles receive protection under the Manitoba *Wildlife Act*. The availability of nesting habitat is the driver expected to have the greatest impact on bald eagle abundance and distribution in the Keeyask Region. The loss of habitat within the Project footprint and loss of effective habitat near the Project footprint may cause changes in bald eagle distribution and/or result in reduced abundances. Other factors that may affect abundance and distribution to a lesser degree include:

- accidental mortality resulting from vehicle collisions, collision with towers, etc.;
- disease and parasites;
- predation of nests and young; and,
- mortality resulting from extreme weather events.

The effects of collisions and predation are expected to be very low. Extreme weather events, and disease and parasites, which are not monitored under the TEMP, may have an intermediate effect on bald eagle populations.

The bald eagle is a generalized predator and scavenger adapted to aquatic habitats (Buehler 2000). Bald eagles have only one brood per season, lay one to three eggs, two to four days apart (Stalmaster 1987), and require approximately 35 days of incubation to hatch (Buehler 2000). Egg laying is synchronous, with 90% of breeding pairs laying within a 10-day period in mid-April in north-central Saskatchewan (Gerrard and Bortolotti 1988). On average, juvenile male bald eagles in Saskatchewan depart from their nests at 78 days and females at 82 days (Bortolotti 1986). During their potentially long lifespan in the wild, up to 28 years, (Schempf 1997), bald eagles typically produce one or two young each year and occasionally three. It is also common for pairs to not breed in some years (Buehler 2000).

Bald eagles use tall trees along large waterbodies for nesting, roosting, and perching (Buehler 2000). Trees are required to be a minimum of 25 cm in diameter and bald eagle habitat must contain at least six trees per hectare (ha) that are 40 cm in diameter or greater (Ontario Woodlot Association 2006). These large trees serve as platforms for nests and provide perching sites to allow good visibility and easy flight access (Livingston *et al.* 1990).

In the years preceding Project construction, approximately 11 active bald eagle nests were present annually along Nelson River shorelines between Split Lake and Gull Rapids. Some of the nests located between Birthday Rapids and Gull Rapids were removed during vegetation clearing for the future reservoir (KHLP 2012). To mitigate this loss of nests, artificial nesting platforms were installed to offer alternative nesting locations near the future reservoir shoreline (KHLP 2015a). These nesting platforms, installed in February 2017, were monitored in 2019 to verify use and nesting success. Within the cleared area of the future reservoir, three single-standing trees containing previously active bald eagle nests were present and monitored for use in 2019. These single-standing trees were subsequently removed in fall 2019, after any bald eagle use had stopped.

Habitat classification carried out for the Project EIS indicated approximately 34,354 ha of bald eagle breeding and perching habitat within Study Zone 5. Within this area, an average density of 0.8 bald eagles/km^2 was found along the Nelson River between Split Lake and the Kettle GS (KHLP 2012).

The goal of this monitoring study is to evaluate how the Project changes the amount and location of bald eagle nesting habitats. Bald Eagle Habitat Effects monitoring was previously conducted in 2015 and 2017 (WRCS 2016; WRCS 2018). This report provides the results of the third and final year of construction-phase monitoring for the Bald Eagle Habitat Effects study, carried out in 2019.

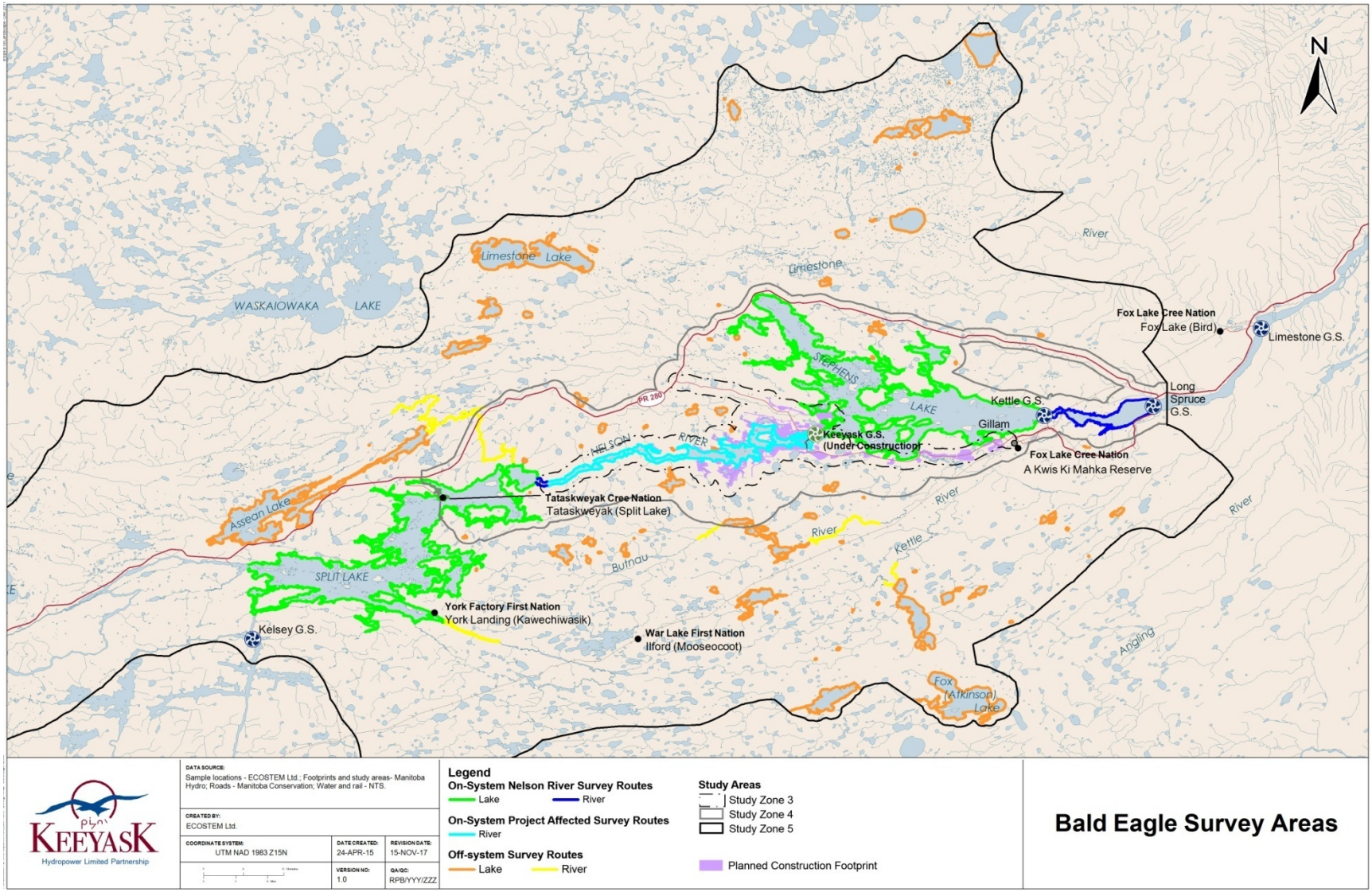
2.0 METHODS

2.1 DATA COLLECTION

Helicopter-based aerial surveys were conducted to monitor the abundance, distribution, reproductive success, and habitat attributes of nesting locations of bald eagle in portions of Study Zone 5 during the 2019 breeding season (Map 1). A random, stratified design was used to select waterbodies to be surveyed. Stratified random sampling is a method of sampling that involves the division of a population into smaller groups. These smaller groups (strata) are formed based on shared characteristics such as size and shoreline length. Waterbodies were classified broadly into either on-system (including Project-affected and Nelson River) or off-system hydraulic zones of influence, grouped into two basic categories (lake or river), and grouped into different size classes (0-10, >10-100, >100-1,000, >1,000-10,000, >10,000-100,000 ha). The Project-affected hydraulic zone includes all areas within 200 m of the actual Project footprint at the time of the survey (KHLP 2015b). The Nelson River zone included other reaches of the regulated Nelson River system from the Kelsey Generating Station (GS) downstream to the Limestone GS, but outside of the Project footprint. The Off-system zone included randomly selected waterways and waterbodies off the Nelson River system that are unaffected by hydroelectric development. The total shoreline lengths and distribution of waterbodies are presented in Table 1 and Map 1.

Table 1: Shoreline Length (km) and Size Class (ha) of Waterbody Types Surveyed in 2019

Hydraulic Zone	Waterbody Type	Waterbody Size Class (ha)					Total Shoreline Length (km)
		>0-10	>10-100	>100-1000	>1,000-10,000	>10,000-100,000	
Project-affected	River	3	0	0	245	0	248
Nelson River	Lake	0	0	0	34	1,789	1,823
	River	0	0	56	87	0	142
Off-system	Lake	6	52	213	598	0	871
	River	0	133	122	0	0	255
Total		9	185	390	963	1,789	3,338



Map 1: Shorelines Surveyed for Bald Eagles and Nests in 2019

Aerial surveys followed protocols adapted from methods employed by the United States Fish and Wildlife Service (Jurek 1990; Jackman and Jenkins 2004) and the British Columbia Ministry of Environment (BCME 2013). Daily flights were conducted when wind speeds were below 25 km/h and when rain or fog did not restrict observers' ability to count birds or nests. The survey was flown at approximately 100 km/h and at elevations greater than 100 m above ground level (agl) to minimize disturbance to nesting bald eagles and avoid collisions with flying birds.

The aerial survey crew consisted of two observers and the helicopter pilot. The helicopter flew 50-100 m from shorelines so the observers had a clear view of the trees along the shoreline. During the surveys, bird of prey observations and large stick nests were recorded along with their locations. Nests were named with a unique identification number ending with the year the nest was first observed (*e.g.*, 14-2015, 105-2017). Tree species, nest height and tree heights were estimated using professional judgement and were verified using photography. All observations were georeferenced with a global positioning system (Garmin GPS 64). When a nest was observed, the helicopter slowed and circled the site once to georeference the nest and photograph the nest with a Canon EOS Rebel T6i camera. Photography was conducted quickly to minimize disturbing birds and observers retreated if the eagles displayed agitated behaviour. Photographs were reviewed to confirm occupancy, and to verify nest contents.

Within the future reservoir area, three trees that had contained bald eagle nests in previous surveys and were left standing following vegetation clearing were also monitored. These single-standing trees were removed in fall 2019, after all bald eagle young had fledged and left the area. Additionally, the five artificial nesting platforms installed during in February 2017 were also surveyed during the bald eagle habitat effects monitoring survey in 2019.

The first survey occurred from May 21-23, 2019 and was conducted to locate initial nests and determine occupancy. A nest was considered occupied if at least one adult bald eagle was present at the nest. The second survey in mid-nesting season occurred from June 16-18, 2019 to determine the contents (*e.g.,* perched adult, incubating adult, nestlings, empty) of nests located in May and to locate any additional nests that were not detected during the first survey. The third and final survey, occurred between July 19-21, 2019, and determined the number of nestlings near the fledgling stage of development (late-stage nestlings) and to document any nests that were not detected in the previous surveys. Additionally, the three single-standing trees with nests in the future reservoir were checked several times in fall 2019 to determine if bald eagle young had left the area and the trees could be cleared prior to planned reservoir filling in 2020.

Bald eagle nests located off the survey route while ferrying between refueling stops were recorded as incidental and excluded from the final productivity analysis. Other bird of prey species and large stick nests observed during the survey were recorded as incidental.

2.2 DATA ANALYSIS

Based on the results of the surveys, and using accepted standard methods (Jurek 1990; Jackman and Jenkins 2004), occupancy determinations were made for each monitored nest as follows:

- ***Active***: Nests were defined as *Active* if there were two sexually mature bald eagle present on or near a nest, or there was at least one bald eagle in incubating posture on a nest (Steenhof and Newton 2007) during any of the three survey visits. Bald eagles are capable of breeding in their fifth year and are unmistakable with their completely white head and tail (McCollough 1989). Nests defined as *Active* were further categorized as:
  - ***Active, Successful***: A nest with at least one late-stage nestling (dark plumage, no down) or as a fledged juvenile observed near the nest (Steenhof and Newton 2007).
  - ***Active, Not Successful***: An *Active* nest with two sexually mature bald eagles and where no incubating adult or nestlings were observed.
  - ***Active, Abandoned***: An *Active* nest containing an incubating adult, eggs or nestlings, where the adults ceased to attend the nest and did not successfully raise nestlings to the near fledging stage.
  - ***Active, Success Unknown*****:** An *Active* nest containing an incubating adult, eggs or nestlings, that was not sufficiently monitored to determine reproductive success (*i.e., Active* nests observed in May or June and not observed in July).
- ***Inactive***: Nests were defined as *Inactive* when only one or zero sexually mature bald eagles were observed near a sufficiently monitored nest (*i.e.,* nests observed in May and *Active* nests first observed in June).
- ***Status Unknown***: Nests were defined as *Status Unknown* when an *Inactive* nest was not sufficiently monitored to determine reproductive success (*i.e., Inactive* nests only observed in June or July).

Percentage of *Active* nests is calculated as:

$$\%\ Active\ nests\ = \frac{\text{Total \# } Active \text{ nests}}{\text{\# } Active \text{ nests } +\ \text{\# } Inactive \text{ nests}}$$

Percentage of *Successful* nests is calculated as:

$$\%\ Successful\ nests\ = \frac{\text{Total \# } Active, Successful \text{ nests}}{\text{\# } Active \text{ nests}}$$

Reproductive success was calculated as the number of nestlings per bald eagle breeding pair (*i.e.*, per *Active* nests) and the number of nestlings per successful bald eagle breeding pair. Nest assessed as *Active, Success Unknown* were not included in reproductive success calculations as the number of late stage nestlings in these nests was undetermined. The number of nestlings observed in nests in July was used as the numerator for both calculations.

$$\text{\# Nestlings/Pair}\ = \frac{\text{Total \# late stage nestlings in } Active \text{ nests}}{\text{\# } Active \text{ nests}}$$

$$\text{\# Nestlings/Successful pair}\ = \frac{\text{Total \# late stage nestlings in } Active, Successful \text{ nests}}{\text{\# } Active, Successful \text{ nests}}$$

Because the incubation period for bald eagle eggs is 35 days (Buehler 2000), nests observed to contain nestlings in the June or July survey were either *Active* in May but not detected by the survey team or became active shortly after the May survey. Thus, *Active* nests first observed in June or July were included in occupancy determinations. *Inactive* nests observed for the first time in June or July were deemed *Status Unknown* because, without an observation earlier in the nesting season, there was no way to determine if the nest was used earlier in the season (*i.e.,* it was not known whether a nesting attempt had failed). Nests that did not contain nestlings in July but contained nestlings in June that were less than 10 weeks old, were assessed as *Abandoned*; it is confidently assumed that such nestlings did not survive to the point when they would fledge from the nest.

3.0 RESULTS

A total of 106 bald eagle nests were found and monitored on the shorelines of surveyed waterbodies during the 2019 breeding season (Map 2). Of the monitored nests, 18 were in the Project-affected zone, 59 were in the Nelson River zone, and 29 were observed in the Off-system zone (Appendix A).

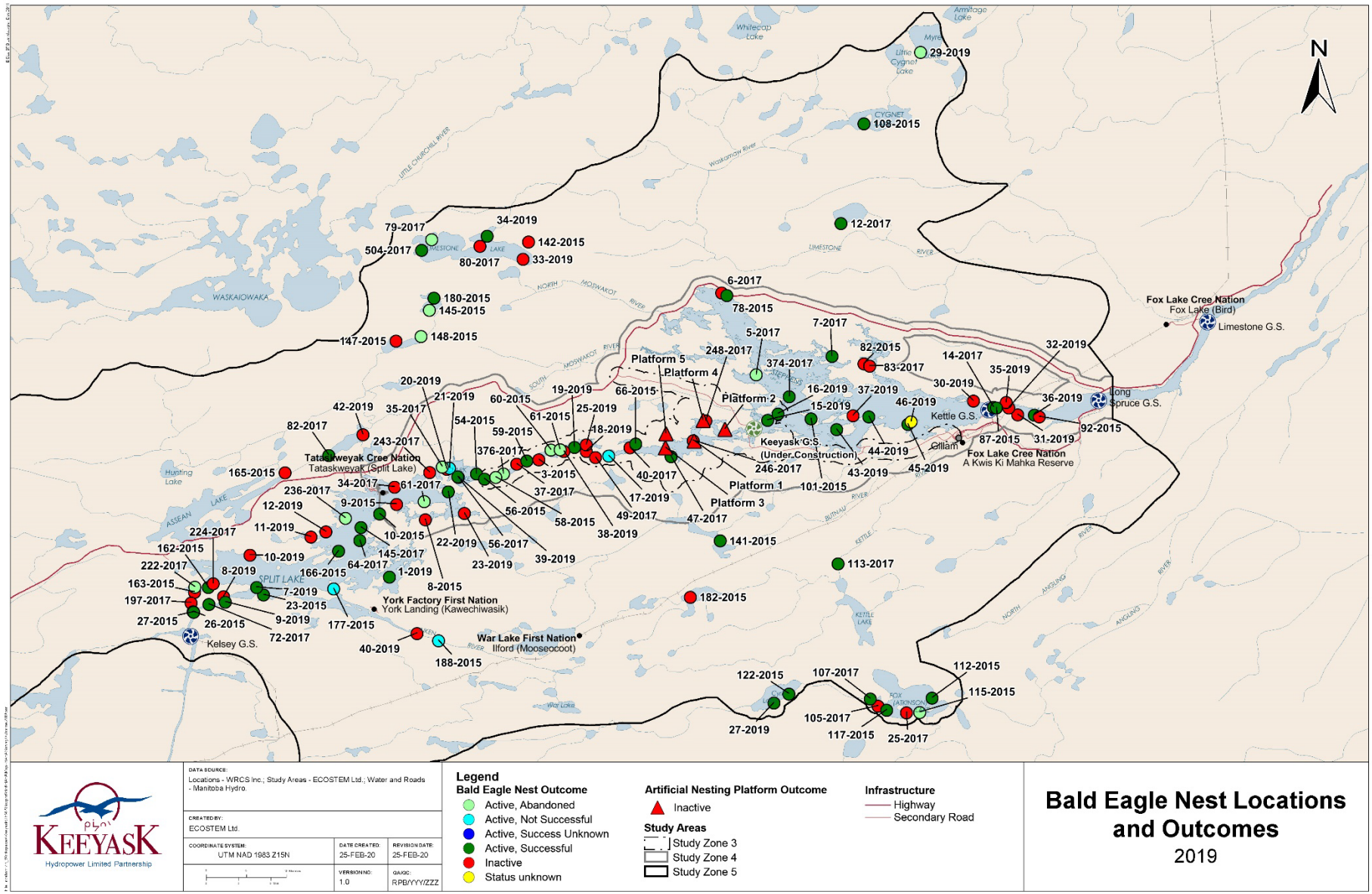
Of the three single-standing trees remaining and monitored in the future reservoir area, two contained active bald eagle nests in 2019. The artificial nesting structures were not used by bald eagles in 2019, but an active, common raven nest containing two to three chicks was observed in Platform 1 and nesting material was present in Platform 3 (Appendix D).

In May 2019, 97 nests were observed, of which 56 were occupied (Appendix B). Of the occupied nests, 51 nests contained an incubating adult and five nests were empty, but had at least one adult perched nearby (Appendix B).

In June 2019, an additional eight nests (six inactive and two active) were observed in the survey area, and two previously identified nests from May were missing (no longer present), bringing the total number of nests monitored to 103. Of these nests, 46 were occupied; 42 nests contained chicks, three occupied nests had no chicks present/visible, and one nest had an adult present that appeared to be incubating eggs (Appendix B). Fourteen nests that had been occupied in May (nine incubating and five with adults present) were inactive in June.

In July 2019, three additional nests (two active and one inactive) were observed in the survey area, and three nests previously observed were missing, keeping the total number of nests monitored to 103. Of these nests, 44 were occupied and all 44 occupied nests contained chicks. Three nests that contained chicks in June and one nest that contained an incubating adult were inactive in July (Appendix B).

The total number of nests observed in 2019 was similar to the number observed in 2017, but greater than the number observed in 2015 (Table 2). The proportions of different nest outcomes were also similar among years. Over the 2019 breeding season, 62 (59%) of the nests observed along the survey route were assessed as Active, 43 (41%) were Inactive, and one nest (1%) were assessed as Status Unknown (Map 2; Table 3). Of the 62 Active nests, 44 (42%) were Successful, 14 nests (23%) were Abandoned, and four (7%) were Not Successful (Map 2; Table 3).



Map 2: Bald Eagle Nest Locations and Outcomes on Surveyed Waterbodies in 2019

Table 2: Number and Outcomes of Bald Eagle Nests During the 2015, 2017, and 2019 Breeding Seasons

Nest Outcome	Number of Bald Eagle Nests		
	2015	2017	2019
Active, Successful	25	36	44
Active, Not Successful	4	3	4
Active, Nest Abandoned	13	14	14
Active, Success Unknown	0	2	0
Inactive	18	38	43
Status Unknown	4	4	1
Total	**64**	**97**	**106**

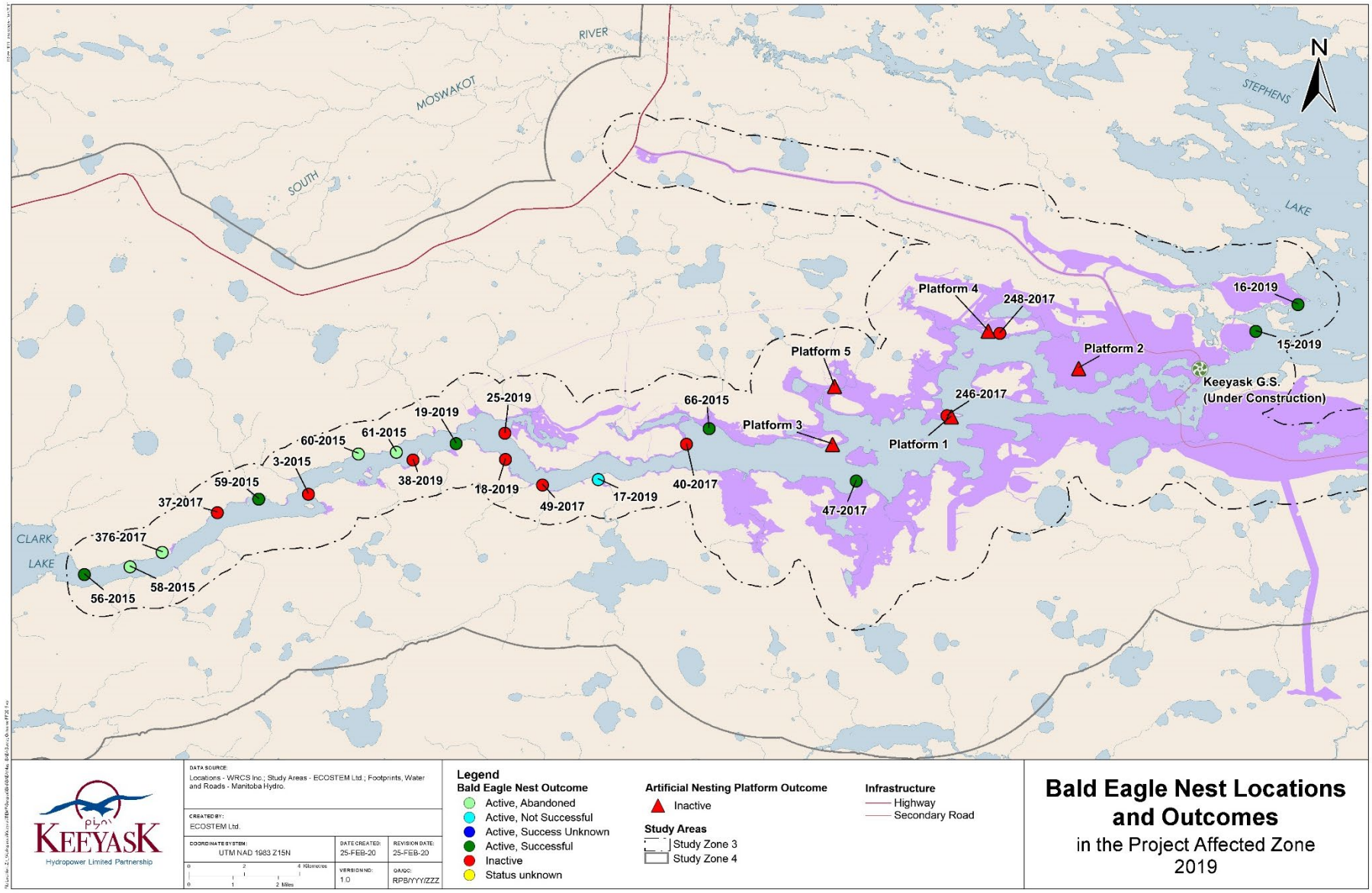
The number of Active nests within the different hydraulic zones, was the same (Project-affected) or slightly higher (Nelson River and Off-system) in 2019, compared to 2017 (Table 3). Overall, the percent of Active, Successful nests was greatest in 2019 compared to other years, but there were some differences. The percent of Active nests in 2019 in the Project-affected zone (44%) appeared lower than that observed in 2017 (78%), but higher than that observed in 2015 (30%). These relatively large differences are likely due to the relatively small sample size in this hydraulic zone (Table 3).

The overall number of late-stage nestlings per Active, Successful nest was also greatest in 2019 compared to other survey years (Table 3). Similar to 2015 and 2017, the number of late-stage nestlings per Active, Successful nest was greatest in the Project-affected zone, slightly lower in the Nelson River zone, and lowest in the Off-system zone (Table 3).

Table 3: Productivity of Bald Eagle Nests During the 2015, 2017, and 2019 Breeding Seasons

	2015				2017				2019			
	Project-affected	**Nelson River**	**Off-system**	**Study Zone 5 (All areas)**	**Project-affected**	**Nelson River**	**Off-system**	**Study Zone 5 (All areas)**	**Project-affected**	**Nelson River**	**Off-system**	**Study Zone 5 (All areas)**
# Nests surveyed	16	26	22	64	23	43	31	97	18	59	29	106
# Active nests	10	16	16	42	9	28	18	55*	9	34	19	62
# Active, Successful nests	3	12	10	25	7	17	12	36	4	27	13	44
% Active, Successful nests	30	75	63	60	78	61	67	67	44	79	68	71
# Late stage nestlings	6	20	16	42	11	26	15	52	7	46	22	75
# Late stage nestlings/ *Active* nests	0.60	1.25	1.00	1.00	1.22	0.93	0.83	0.96	0.78	1.35	1.16	1.21
# Late stage nestlings/ *Active, Successful* nests	2.00	1.67	1.60	1.68	1.57	1.53	1.25	1.44	1.75	1.70	1.69	1.70

*One *Active* nest (145-2017) was not surveyed in July and not included in productivity calculations



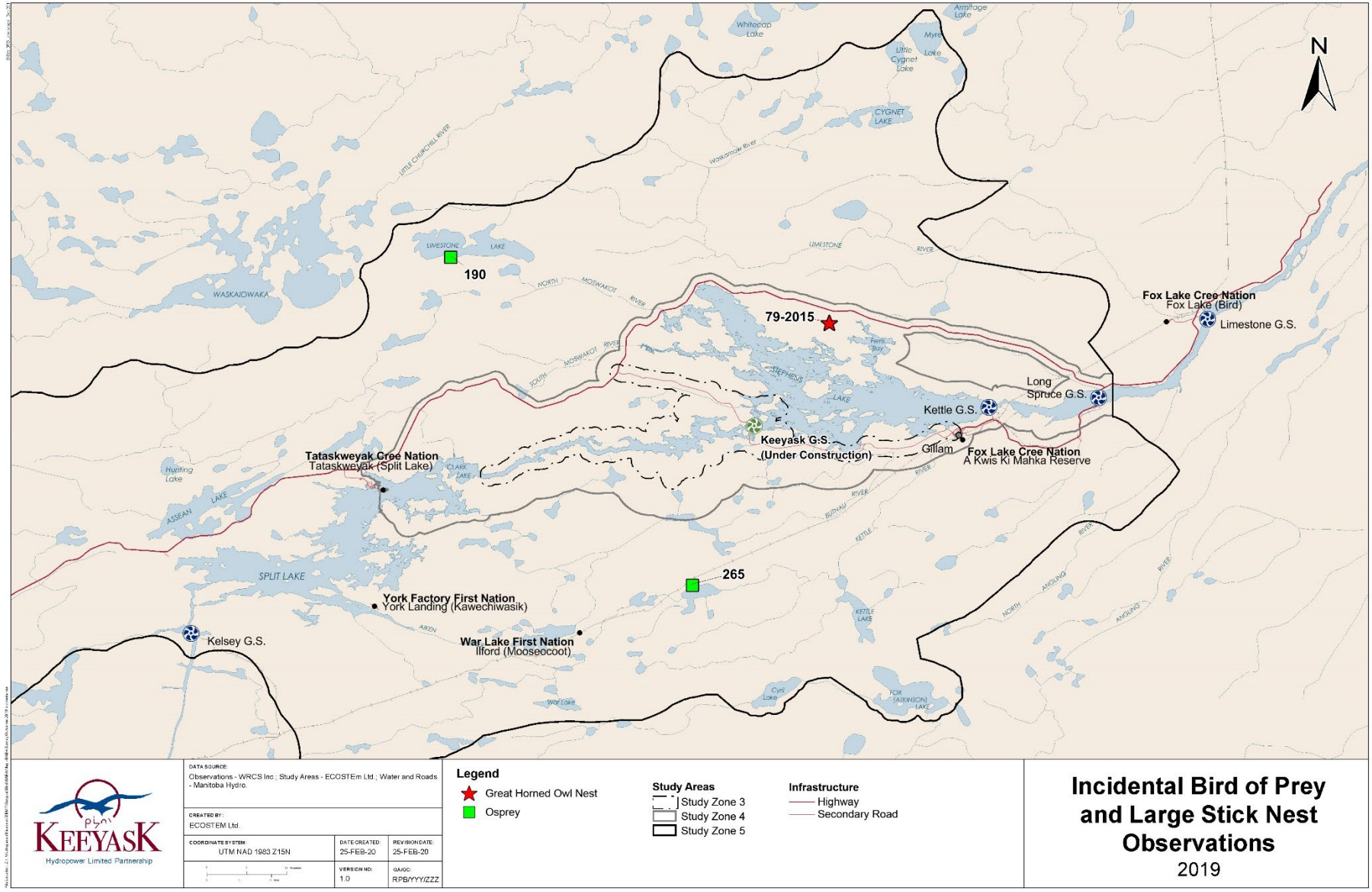
Map 3: Bald Eagle Nest Locations and Outcomes in the Project-Affected Hydraulic Zone in 2019

The linear density of all *Active* bald eagle nests along surveyed shorelines in 2019 differed between hydraulic zones and between waterbodies of different size classes (Table 4). Active nest density was greatest along shorelines of >1,000-10,000 ha lakes in the Nelson River hydraulic zone and lowest along shorelines of rivers >100-1,000 ha in the Off-system hydraulic zone (Table 4). This pattern is similar to what was observed in 2017.

Table 4: Linear Density (nests/100 km) of *Active* Bald Eagle Nests Within Study Zone 5 in 2019

Hydraulic Zone	Waterbody Type	Waterbody Size Class (ha)					Total Density
		>0-10	>10-100	>100-1000	>1,000-10,000	>10,000-100,000	
Project-affected	River	0	NA	NA	3.67	NA	3.63
Nelson River	Lake	NA	NA	NA	0	1.79	1.76
	River	NA	NA	0	3.45	NA	2.11
Off-system	Lake	0	0	1.41	2.17	NA	1.84
	River	NA	0	0	NA	NA	0.78
Total		0	0	0.77	2.80	1.79	1.86

Incidental sightings during the 2019 survey included two osprey (*Pandion haliaetus*), and a great horned owl (*Bubo virginianus*) on a nest with at least one chick (Map 4; Appendix D).



Map 4: Incidental Bird of Prey and Large Stick Nest Sightings in 2019

4.0 DISCUSSION

Results of the 2019 survey indicate that Project construction does not appear to be having a negative effect on the bald eagle population in the study area. Within the Project-affected zone, a similar number of active nests were observed in 2019 (9), compared to the other years of construction monitoring in 2015 (10) and 2017 (9). This is also similar to the number of Active nests observed during the pre-construction period in 2011 (8) and 2014 (8) (Stantec 2013; Stantec 2014). However, the percent of successful nests in 2019 in the Project-affected zone (44%) appeared lower in comparison to 2017 (78%), but greater than that observed in 2015 (30%). The relatively small number of nests observed in the Project-affected zone is the reason for the apparent, large changes in nest success.

Productivity of bald eagle nests (number of late-stage nestlings per Active, Successful nest) in the Project-affected zone were comparable to the other zones in 2019 and were slightly higher than those observed in 2017, but slightly lower than those observed in 2015. This suggests that bald eagles in this zone have sufficient resources to support raising young, similar to the other zones.

The bald eagle population appears to be stable or slightly increasing in the study area. For a bald eagle population to be sustainable, more than 50% of nests are required to be successful and 0.7 young must be fledged per breeding pair annually (Sprunt *et al.* 1973; Elliott *et al.* 1998). Within the study area in 2019, 71% of nests were successful and produced 1.70 late-stage nestlings per successful nest. In each hydraulic zone and for each year the survey was conducted, the bald eagle population has met these criteria. There is some fluctuation in the number of successful nests and productivity, but the observed ranges are well within the ranges found in a long-term study by Gerrard *et al.* (1992). In the study, conducted from 1968-2012, nest success range from 42-88% and averaged one fledged young per successful nest.

The absence of bald eagle activity in the nesting platforms in 2019 was not unexpected. It can take many years for bald eagles to use artificial nesting platforms (Hunter *et al.* 1997; Bortolotti *et al.* 1988) and natural sites are typically preferred over artificial ones (Hunter *et al.* 1997*).* Additionally, the nesting platforms are located on the shoreline of the future reservoir, which is scheduled to be filled in 2020. Following the filling of the reservoir, the nesting platforms will be closer to the shoreline and become more attractive to nesting birds. The presence of nesting material from the raven's nest that was present in 2019 may also make one of the platforms more attractive for future bald eagle nesting.

5.0 SUMMARY AND CONCLUSIONS

Bald eagle nest monitoring in 2019 suggests that Project construction is not affecting bald eagle nest numbers or productivity in the study area. The number of Active nests within the Project-affected zone has remained consistent with the pre-construction surveys conducted in 2011 and 2014, as well as the construction-phase surveys conducted in 2015, 2017, and 2019. Fewer of these nests were successful in 2019 compared to 2017, but more were successful compared to 2015, suggesting this is a consistent range.

The total number of late-stage nestlings observed in 2019 was the greatest observed during any of the construction surveys, suggesting that sufficient resources are available for bald eagle to raise young in the study area.

Monitoring of bald eagle nests will continue in 2021, following reservoir filling. This will be the first year of operation monitoring and will occur in identical areas as construction surveys, with the alteration of following the new, reservoir shoreline.

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APPENDIX A: Bald Eagle Nest-Tree Types, Nest Heights, and Location

Nest	Location	UTM Coordinates	Nest Tree Type	Tree Height (m)	Nest Height (m)
101-2015	Stephens Lake	15 V 372381 6248802	Dead Jack Pine	19	19
10-2015	Split Lake	14 V 679877 6234113	Dead Spruce	22	20
10-2019	Split Lake	14 V 661114 6226270	Spruce	10	10
105-2017	Atkinson lake	15 U 382376 6205969	Spruce	8	8
107-2017	Cyril River	15 U 381232 6207044	Spruce	14	14
108-2015	Cygnet Lake	15 V 380284 6292841	Birch	10	10
11-2019	Split Lake	14 V 669963 6229782	Spruce	10	10
112-2015	Atkinson lake	15 U 390456 6207144	Poplar	25	20
113-2017	Kettle River	15 V 376411 6227216	Poplar	12	10
115-2015	Atkinson lake	15 U 388614 6205029	Poplar	25	20
117-2015	Atkinson lake	15 U 383656 6205375	Spruce	20	20
1-2019	Split Lake	14 V 682158 6224858	Poplar	10	10
12-2017	Little Limestone Lake	15 V 376851 6277952	Jack Pine	15	14
12-2019	Split Lake	14 V 672103 6230752	Spruce	12	12
122-2015	Cyril Lake	15 U 369055 6207763	Poplar	5	5
141-2015	Butnau lake	15 V 358778 6230620	Spruce	15	13
14-2017	Nelson River, Kettle GS	15 V 399644 6250541	Jack Pine	24	22
142-2015	Small Unnamed Lake 1 km North of Limestone Lake	15 V 330109 6275194	Poplar	18	18
145-2015	Small Unnamed Lake 1 km North of Limestone Lake	14 V 684630 6265004	Poplar	25	19
145-2017	Split Lake	14 V 677291 6231852	Jack Pine	10	17
147-2015	Crying Lake	14 V 680094 6260013	Spruce	12	18
148-2015	Crying Lake	14 V 683758 6261010	Birch	15	8
15-2019	Stephens Lake, West Shore	15 V 365884 6248604	Spruce	10	10
16-2019	Stephens Lake, West Shore	15 V 367409 6249564	Dead spruce	8	8
162-2015	Split Lake	14 V 655325 6220967	Spruce	16	15
163-2015	Split Lake	14 V 653324 6220054	Jack Pine	20	15
165-2015	Assean Lake	14 V 665241 6238987	Dead Poplar	23	20

Nest	Location	UTM Coordinates	Nest Tree Type	Tree Height (m)	Nest Height (m)
166-2015	Split Lake	14 V 674251 6228054	Spruce	15	15
17-2019	Nelson River	15 V 342113 6243255	Poplar	10	10
177-2015	Split Lake	14 V 674005 6222385	Spruce	18	18
180-2015	Small Unnamed Lake 1 km north of Limestone Lake	15 V 315987 6266847	Spruce	21	17
18-2019	Nelson River	15 V 338766 6243978	Poplar	12	12
182-2015	Little Kettle Lake	15 V 354312 6222230	Birch	4	8
188-2015	Aiken River	15 V 316663 6215706	Dead Spruce	15	15
19-2019	Nelson River	15 V 336976 6244549	Poplar	10	10
197-2017	Nelson River, Downstream of Kelsey GS	14 V 652944 6218419	Jack Pine	11	9
20-2019	Clark Lake	15 V 317912 6241304	Spruce	10	10
21-2019	Clark Lake	15 V 318292 6241456	Spruce	12	12
22-2019	Split Lake	15 V 318126 6237931	Spruce	8	8
222-2017	Nelson River, Downstream of Kelsey GS	14 V 653283 6220828	Jack Pine	10	15
224-2017	Split Lake	14 V 655977 6221555	Spruce	12	14
23-2015	Split Lake	14 V 663636 6220536	Spruce	20	20
23-2019	Split Lake	15 V 320504 6234713	Poplar	10	10
236-2017	Split Lake	14 V 674846 6233002	Poplar	15	12
24-2019	Nelson River	15 V 330747 6242390	Poplar	10	10
243-2017	Split Lake	15 V 315327 6240803	Spruce	12	12
246-2017	Nelson River, Between Birthday Rapids and Gull Rapids	15 V 354727 6245558	Dead spruce	12	8
248-2017	Gull Lake	15 V 356627 6248525	Poplar	12	6
25-2017	Atkinson lake	15 U 386618 6204993	Dead Poplar	10	10
25-2019	Nelson River	15 V 338743 6244928	Spruce	10	10
26-2015	Split Lake	14 V 653365 6217146	Spruce	15	15
27-2015	Split Lake	14 V 653439 6217073	Spruce	15	15

Nest	Location	UTM Coordinates	Nest Tree Type	Tree Height (m)	Nest Height (m)
27-2019	Cyril Lake	15 U 366808 6206441	Birch	8	8
29-2019	Myre Lake	15 V 388732 6303481	Tamarack	8	8
30-2019	Stephens Lake, North Shore	15 V 396635 6251473	Spruce	10	10
31-2019	Nelson River	15 V 403274 6249424	Spruce	12	12
3-2015	Nelson River, Birthday Rapids	15 V 331640 6242724	Poplar	17	15
32-2019	Nelson River	15 V 401947 6250462	Spruce	10	10
33-2019	Limestone Lake	15 V 329283 6272613	Spruce	12	12
34-2017	Split Lake	14 V 681769 6238256	Spruce	21	21
34-2019	Limestone Lake	15 V 323941 6276081	Spruce	10	10
35-2017	Split Lake	15 V 317211 6241629	Spruce	15	15
35-2019	Nelson River	15 V 401555 6251251	Spruce	15	15
36-2019	Nelson River	15 V 405775 6249358	Poplar	15	15
37-2017	Nelson River, Upstream of Birthday Rapids	15 V 328353 6242063	Poplar	15	15
37-2019	Stephens Lake	15 V 378665 6249295	Spruce	10	10
374-2017	Stephens Lake	15 V 369091 6252145	Spruce	10	8
376-2017	Nelson River	15 V 326359 6240629	Poplar	12	10
38-2019	Nelson River	15 V 335418 6243959	Poplar	10	10
39-2019	Clark Lake	15 V 319619 6240109	Spruce	12	12
40-2017	Nelson River, Between Birthday Rapids and Gull Rapids	15 V 345303 6244529	Poplar (Single-standing tree)	18	17
40-2019	Aiken River	15 V 313434 6216803	Transmission Tower	20	20
42-2019	Assean Lake	14 V 676381 6245669	Poplar	10	10
43-2019	Stephens Lake	15 V 376188 6247244	Spruce	10	10
44-2019	Stephens Lake	15 V 381018 6249126	Poplar	15	15
45-2019	Stephens Lake	15 V 386873 6247984	Dead Spruce	8	8
46-2019	Stephens Lake	15 V 387334 6248399	Poplar	15	15

Nest	Location	UTM Coordinates	Nest Tree Type	Tree Height (m)	Nest Height (m)
47-2017	Nelson River, Between Birthday Rapids and Gull Rapids	15 V 351444 6243204	Poplar (Single-standing tree)	15	14
49-2017	Nelson River, Between Birthday Rapids and Gull Rapids	15 V 340108 6243053	Poplar	14	9
504-2017	Limestone Lake	14 V 682700 6273844	Spruce	10	8
5-2017	Stephens Lake, West shore	15 V 364136 6255411	Spruce	12	11
54-2015	Clark Lake	15 V 322348 6240594	Dead Poplar	12	12
56-2015	Nelson River, Upstream of Birthday Rapids	15 V 323548 6239832	Dead Poplar	8	10
56-2017	Clark Lake	15 V 319532 6240180	Dead Spruce	17	12
58-2015	Nelson River, Upstream of Birthday Rapids	15 V 325196 6240113	Spruce	18	18
59-2015	Nelson River, Upstream of Birthday Rapids	15 V 329843 6242553	Poplar	18	16
60-2015	Nelson River, Between Birthday Rapids and Gull Rapids	15 V 333445 6244175	Poplar	15	8
61-2015	Nelson River, Between Birthday Rapids and Gull Rapids	15 V 334823 6244238	Poplar	15	15
61-2017	Split Lake	15 V 314486 6236485	Poplar	24	17
6-2017	Stephens Lake, North shore	15 V 358991 6267595	Poplar	25	22
64-2017	Split Lake	14 V 677277 6229913	Spruce	15	15
66-2015	Nelson River, Between Birthday Rapids and Gull Rapids	15 V 346126 6245094	Poplar (Single-standing tree)	15	15
7-2017	Stephens Lake, North shore	15 V 375496 6258125	Spruce	12	12
7-2019	Split Lake	14 V 662493 6221592	Spruce	12	12
72-2017	Split Lake	14 V 655600 6218443	Poplar	20	17
78-2015	Stephens Lake, North shore	15 V 359753 6267215	Spruce	25	25

Nest	Location	UTM Coordinates	Nest Tree Type	Tree Height (m)	Nest Height (m)
79-2017	Limestone Lake	14 V 684074 6275540	Spruce	19	15
80-2017	Limestone Lake	15 V 322842 6274576	Poplar	16	12
8-2015	Split Lake	15 V 314661 6233773	Poplar	8	8
8-2019	Split Lake	14 V 657695 6219760	Poplar	12	12
82-2015	Stephens Lake, Ferris Bay	15 V 380257 6257025	Spruce	12	12
82-2017	Assean Lake	14 V 671532 6242142	Poplar	15	10
83-2017	Stephens Lake	15 V 381119 6256687	NA	NA	NA
87-2015	Nelson River, Kettle GS	15 V 400115 6250447	Spruce	24	24
9-2015	Split Lake	14 V 682284 6235714	Poplar	12	12
9-2019	Split Lake	14 V 658045 6218971	Spruce	10	10
92-2015	Nelson River, Downstream of Kettle GS	15 V 406511 6249127	Spruce	20	17

APPENDIX B: Nest Contents and Outcomes of Bald Eagle Nests during the 2019 Breeding Season

Nest ID	Hydraulic Zone	May 21-23		June 16-18		July 19-21		Nest Outcome
		No. Adults	No. Chicks	No. Adults	No. Chicks	No. Adults	No. Chicks	
101-2015	Nelson River	1	0	1	1	1	1	Active, Successful
105-2017	Off System	0	0	0	0	0	0	Inactive
107-2017	Off System	1	0	1	1	0	2	Active, Successful
108-2015	Off System	0	0	2	0	0	2	Active, Successful
112-2015	Off System	0	0	1	2	0	1	Active, Successful
113-2017	Off System	0	0	1	2	0	2	Active, Successful
115-2015	Off System	2	0	0	0	0	0	Active, Abandoned
117-2015	Off System	1	0	1	1	1	1	Active, Successful
12-2017	Off System	0	0	1	2	2	1	Active, Successful
122-2015	Off System	1	0	1	2	0	2	Active, Successful
141-2015	Off System	1	0	1	2	0	2	Active, Successful
14-2017	Nelson River	1	0	2	2	1	2	Active, Successful
142-2015	Off System	0	0	0	0	0	0	Inactive
15-2019	Nelson River	1	0	1	1	1	1	Active, Successful
16-2019	Nelson River	1	0	1	1	1	1	Active, Successful
17-2019	Project	2	0	0	0	0	0	Active, Not Successful
180-2015	Off System	1	0	2	1	0	2	Active, Successful
18-2019	Project	0	0	0	0	0	0	Inactive
182-2015	Off System	0	0	0	0	0	0	Inactive
188-2015	Off System	1	0	0	0	0	0	Active, Not Successful
19-2019	Project	1	0	2	1	1	1	Active, Successful
20-2019	Nelson River	0	0	0	0	0	0	Inactive
21-2019	Nelson River	1	0	0	0	0	0	Active, Not Successful
22-2019	Nelson River	1	0	2	1	1	2	Active, Successful
23-2019	Nelson River	0	0	0	0	0	0	Inactive
243-2017	Nelson River	0	0	0	0	0	0	Inactive
246-2017	Project	0	0	0	0	0	0	Inactive
248-2017	Project	0	0	0	0	0	0	Inactive
25-2017	Off System	0	0	0	0	0	0	Inactive
25-2019	Project	0	0	0	0	0	0	Inactive
27-2019	Off System	1	0	1	2	1	2	Active, Successful
29-2019	Off System	1	0	0	0	0	0	Active, Abandoned
30-2019	Nelson River	0	0	0	0	0	0	Inactive
31-2019	Nelson River	0	0	0	0	0	0	Inactive
3-2015	Project	0	0	0	0	0	0	Inactive
32-2019	Nelson River	0	0	0	0	0	0	Inactive
33-2019	Off System	0	0	0	0	0	0	Inactive
34-2019	Off System	1	0	2	2	2	2	Active, Successful
35-2017	Nelson River	1	0	0	0	0	0	Active, Abandoned
35-2019	Nelson River	0	0	0	0	0	0	Inactive
36-2019	Nelson River	0	0	2	2	0	2	Active, Successful
37-2017	Project	0	0	0	0	1	0	Inactive
37-2019	Nelson River	0	0	0	0	0	0	Inactive
374-2017	Nelson River	1	0	1	2	1	2	Active, Successful

Nest ID	Hydraulic Zone	May 21-23		June 16-18		July 19-21		Nest Outcome
		No. Adults	No. Chicks	No. Adults	No. Chicks	No. Adults	No. Chicks	
376-2017	Project	1	0	1	0	0	0	Active, Abandoned
38-2019	Project	0	0	0	0	0	0	Inactive
39-2019	Nelson River	0	0	0	0	0	0	Inactive
40-2017	Project	0	0	0	0	0	0	Inactive
40-2019	Off System	0	0	0	0	0	0	Inactive
43-2019	Nelson River	0	0	2	2	0	2	Active, Successful
44-2019	Nelson River	0	0	0	0	0	1	Active, Successful
45-2019	Nelson River	0	0	0	0	1	2	Active, Successful
46-2019	Nelson River	0	0	0	0	0	0	Unknown
47-2017	Project	2	0	1	2	2	2	Active, Successful
49-2017	Project	0	0	0	0	0	0	Inactive
5-2017	Nelson River	1	0	2	1	1	0	Active, Abandoned
54-2015	Nelson River	1	0	2	2	2	2	Active, Successful
56-2015	Nelson River	1	0	1	3	2	1	Active, Successful
56-2017	Nelson River	1	0	1	1	2	1	Active, Successful
58-2015	Project	2	0	0	0	0	0	Active, Abandoned
59-2015	Project	1	0	1	2	2	2	Active, Successful
60-2015	Project	2	0	0	0	0	0	Active, Abandoned
61-2015	Project	1	0	0	0	0	0	Active, Abandoned
61-2017	Nelson River	1	0	0	0	0	0	Active, Abandoned
6-2017	Nelson River	0	0	0	0	0	0	Inactive
66-2015	Project	0	0	1	2	0	2	Active, Successful
7-2017	Nelson River	0	0	1	2	1	2	Active, Successful
78-2015	Nelson River	1	0	1	2	1	2	Active, Successful
80-2017	Off System	0	0	0	0	0	0	Inactive
8-2015	Nelson River	0	0	0	0	0	0	Inactive
82-2015	Nelson River	0	0	0	0	0	0	Inactive
83-2017	Nelson River	0	0	0	0	0	0	Inactive
87-2015	Nelson River	2	0	2	2	2	2	Active, Successful
92-2015	Nelson River	0	0	0	0	0	0	Inactive
10-2015	Nelson River	1	0	1	2	0	2	Active, Successful
10-2019	Nelson River	0	0	0	0	0	0	Inactive
11-2019	Nelson River	0	0	0	0	0	0	Inactive
1-2019	Nelson River	1	0	2	3	0	2	Active, Successful
12-2019	Nelson River	0	0	0	0	0	0	Inactive
145-2015	Off System	1	0	0	0	0	0	Active, Abandoned
145-2017	Nelson River	2	0	2	0	1	2	Active, Successful
147-2015	Off System	0	0	0	0	0	0	Inactive
148-2015	Off System	1	0	2	1	0	0	Active, Abandoned
162-2015	Nelson River	1	0	1	2	0	2	Active, Successful
163-2015	Nelson River	0	0	0	0	0	0	Inactive
165-2015	Off System	0	0	0	0	0	0	Inactive
166-2015	Nelson River	1	0	1	1	0	2	Active, Successful
177-2015	Nelson River	1	0	0	0	0	0	Active, Not Successful

Nest ID	Hydraulic Zone	May 21-23		June 16-18		July 19-21		Nest Outcome
		No. Adults	No. Chicks	No. Adults	No. Chicks	No. Adults	No. Chicks	
197-2017	Nelson River	0	0	0	0	0	0	Inactive
222-2017	Nelson River	1	0	2	1	0	0	Active, Abandoned
224-2017	Nelson River	0	0	0	0	0	0	Inactive
23-2015	Nelson River	2	0	2	1	0	2	Active, Successful
236-2017	Nelson River	1	0	0	0	0	0	Active, Abandoned
26-2015	Nelson River	0	0	0	0	0	0	Inactive
27-2015	Nelson River	1	0	2	2	2	2	Active, Successful
34-2017	Nelson River	0	0	0	0	0	0	Inactive
42-2019	Off System	0	0	0	0	0	0	Inactive
504-2017	Off System	1	0	2	1	2	2	Active, Successful
64-2017	Nelson River	1	0	1	0	2	2	Active, Successful
7-2019	Nelson River	1	0	2	1	1	1	Active, Successful
72-2017	Nelson River	1	0	1	1	0	1	Active, Successful
79-2017	Off System	1	0	0	0	0	0	Active, Abandoned
8-2019	Nelson River	0	0	0	0	0	0	Inactive
82-2017	Off System	1	0	1	0	2	1	Active, Successful
9-2015	Nelson River	0	0	0	0	0	0	Inactive
9-2019	Nelson River	1	0	1	2	1	2	Active, Successful
Total		60	0	65	67	41	75	

APPENDIX C: Incidental Bird of Prey and Large Stick Nest Observations

Waypoint	UTM Coordinates	Observation	Location	Nest Outcome
79-2015	15 V 375091 6262798	Great Horned Owl Nest	4 km North of Stephens Lake	Active, Successful
190	15 V 318424 6272575	Osprey	Limestone Lake	NA
265	15 V 354583 6223642	Osprey	Little Kettle Lake	NA

APPENDIX D: Photographs

Photo 1: Raven's Nest in Artificial Nesting Platform 1

Photo 2: Nesting Material in Artificial Nesting Platform 3

Photo 3: Bald Eagle Nest in Single-standing Tree in the Future Reservoir

Photo 4: Bald Eagle on Nest with Newly Hatched Chick

Photo 5: Bald Eagle on Nest with Two, Young Chicks

Photo 6: Two Late-stage Bald Eagle Nestlings

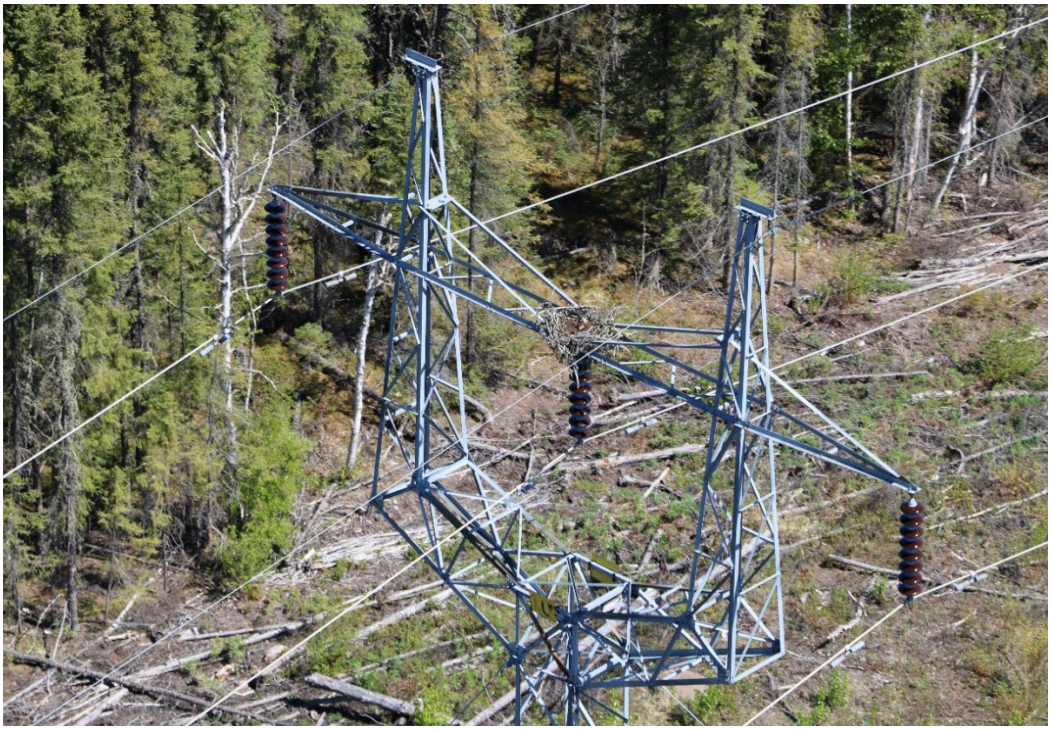

Photo 7: Unknown Species Nest Found on Transmission Tower

Photo 8: Great Horned Owl Nest and Chick

Photo 9: Osprey Observed on Limestone Lake on June 18, 2019