Keeyask Generation Project

Terrestrial Effects Monitoring Plan

Waterfowl Habitat Effects Monitoring Report

TEMP-2016-02

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KEEYASK

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KEEYASK GENERATION PROJECT

TERRESTRIAL EFFECTS MONITORING PLAN

REPORT #TEMP-2016-02

WATERFOWL HABITAT EFFECTS MONITORING REPORT

Prepared for

Manitoba Hydro

By

Wildlife Resource Consulting Services MB Inc.

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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 waterfowl. 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 or not more needs to be done to reduce harmful effects.

Canada geese and mallard are identified as Valued Environmental Components in the Project's Terrestrial Effects Monitoring Plan due to their abundance in the area and importance as a food source for local First Nations harvesters. Canada geese, mallard, and other species of waterfowl are relatively abundant in the Keeyask area during the spring migration. Waterfowl habitat is provided by numerous waterbodies, including the Nelson River and Gull Lake, which often support migrating waterfowl in the spring and fall. Nesting and brood-rearing habitat occurs in wetlands, and along the shorelines of many ponds, creeks, rivers and lakes.

WHY IS THE STUDY BEING DONE?

According to the environmental assessment done for the Project, change to habitat availability is the main pathway of effects for the Canada goose and mallard. Project construction is anticipated to cause an indirect loss of habitat due to the noise and disturbance caused by construction sites. Project operation is anticipated to reduce the amount and quality of waterfowl habitat in the Nelson River and Gull Lake due to flooding of the reservoir. In order to assess the Project impacts of habitat loss and alteration on Canada geese, mallard, and other waterfowl species, the relative abundance and distribution of waterfowl during construction and operation will be monitored.

WHAT WAS DONE?

A series of aerial waterfowl surveys were conducted in 2015, starting in early spring and continuing into the fall. These surveys were done along shorelines of the Nelson River between the Kelsey Generating Station (GS) and the Limestone GS and in areas that are not affected by Keeyask or other hydroelectric development (off-system), but are in this regional study area (Study Zone 5). The surveys were timed to correspond with major waterfowl life-cycle events (*i.e.,* staging, breeding, brood-rearing). Surveys for staging waterfowl occurred on April 27-29 and September 10-15, 2015; breeding pair surveys were conducted on May 20-25 and June 17-

22, 2015; and brood surveys were conducted on July 13-19, 2015. The survey route consisted of 2,641 km of shoreline on various waterbody types. Waterfowl densities observed in this study were compared to the densities observed during pre-construction surveys. The presence of hunting parties was also recorded during the spring waterfowl surveys to estimate the amount of harvest pressure in Study Zone 5.

WHAT WAS FOUND?

Waterfowl abundance was variable throughout the survey period. Staging Canada geese were most abundant during the earliest surveys in April, while the abundance of mallard and other waterfowl species peaked in May. Waterfowl abundance declined in the June and July surveys due to staging waterfowl leaving the region for their nesting grounds further north. July was the peak of nest hatching and Canada goose and mallard were the most common species of brood observed. The greatest number of waterfowl was observed in the September survey. Large numbers of diving ducks were observed during the fall survey, highlighting how important the area surveyed is to staging waterfowl.

Waterfowl densities observed in this study were higher than those observed during the pre-construction surveys. This may have been attributed to natural variation over time, or in part, to improved waterfowl detection due to slight differences in survey methods.

A total of 16 hunting parties were observed during the 2015 waterfowl surveys, seven of which were located near York Landing on the south end of Split Lake.

Canada goose observed in the spillway area

WHAT DOES IT MEAN?

Surveys conducted in 2015 appeared to provide sufficient construction-phase numbers for future comparison and did not indicate any unexpected effects of Project construction on waterfowl abundance or distribution to date. The relatively high variability of waterfowl abundance during the different survey periods highlighted the need for multiple surveys from spring to fall in order to monitor habitat use of waterfowl during major life-cycle events. Hunter access did not appear to be increased by Project construction developments. Most hunting parties observed were near existing towns or communities, or near previously established hunting camps.

WHAT WILL BE DONE NEXT?

Aerial waterfowl surveys will be conducted again beginning in the spring of 2017. Data from the 2015 and 2017 surveys will be used to further refine the habitat selection model previously developed. The habitat selection model can then be used to predict the amount of habitat disturbance as a result of the Project and its potential impact on Canada goose, mallard, and other waterfowl species.

STUDY TEAM

We would like to thank Sherrie Mason and Rachel Boone of Manitoba Hydro for editorial comments, and Caroline Walmsley and Megan Anger of Manitoba Hydro, Ben Hofer of Custom Helicopters, and Ron Bretecher of North/South Consultants Inc., for logistical assistance in the field. We would also like to thank Dr. James Ehnes, ECOSTEM Ltd., for GIS supported study design and cartography.

Biologists and other personnel who designed, participated in, and drafted the survey results included:

- Robert Berger (M.N.R.M) – Design, analysis, and reporting
- Mark Baschuk (M.Sc.) – Crew leader, analysis, and reporting
- Nicholas LaPorte (M.N.R.M) – Survey personnel
- Eugene Spence (TCN) – 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, 35 km upstream of the existing Kettle GS.

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 Supporting Volume* (TE SV). 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. The *Terrestrial Effects Monitoring Plan* (TEMP) was developed for the Project. Monitoring activities for various components of the terrestrial environment were described, including the focus of this report, waterfowl habitat effects, during the construction and operation phases.

Waterfowl surveys focused on Canada geese (*Branta canadensis*) and mallard (*Anas platyrhynchos*), which were identified as Valued Environmental Components (VECs) during the environmental assessment for the Project. These species were chosen as VECs based on their importance to local communities and their protection under the *Migratory Birds Convention Act*.

The objectives of Canada goose and mallard monitoring during Project construction are to identify changes in abundance or distribution due to construction activities. The main concerns of construction activities on Canada geese and mallard are sensory disturbance, loss of habitat, and increased hunter access. To identify potential construction effects, several components that influence waterfowl populations will be monitored, including habitat, mortality, and habitat enhancement efficacy. As 2015 was the first year of construction monitoring for waterfowl, this report presents general findings of the waterfowl surveys conducted in 2015 and basic habitat use patterns for lakes, rivers and watercourses. Monitoring focusing on waterbird mortality and habitat enhancement efficacy were not done in 2015, as these studies are focused on Project components not yet in place; as such, they will be presented at a later date.

2.0 METHODS

2.1 AERIAL SURVEYS

Aerial surveys for waterfowl were conducted five times from April to September 2015 within Study Zone 5. The survey route consisted of 2,641 km of shoreline of various waterbody types (Map 2.1-1). Typically, each survey required five days to complete, in the absence of any bad weather. A random, stratified design (a sample of waterbody types and size classes) was used to select waterbodies to be surveyed. Waterbodies were classified broadly as either on-system (influenced by existing or future hydroelectric operations) or off-system (unaffected by hydroelectric operations), grouped into three basic categories (lake, river, or watercourse), and grouped into five different size classes (<0.5, 0.5-1, 1-10, 10-100, 100-1,000, >1,000 ha). Lakes are defined as non-linear waterbodies with minimal water flow, rivers are large, linear water bodies with flow, and watercourses are narrow, linear waterbodies with flow (creeks and streams). The total shoreline lengths and distribution of waterbodies are presented in Table 2.1-1 and Map 2.1-1.

Table 2.1-1: Shoreline Length (km) of Waterbody Types and Size Classes Surveyed in 2015

System	Waterbody Type	Size Class (ha)						Total Shoreline Length (km)
		<0.5	0.5-1	1-10	10-100	100-1,000	>1,000	
On-system	Lake	0	0	0	0	0	668	668
	River	0	0	0	0	0	740	740
	Watercourse[1]	NA	NA	NA	NA	NA	NA	0
Off-system	Lake	2	4	9	33	125	420	593
	River	0	0	0	15	98	217	331
	Watercourse[1]	NA	NA	NA	NA	NA	NA	309
Total		2	4	9	48	223	2,045	2,641

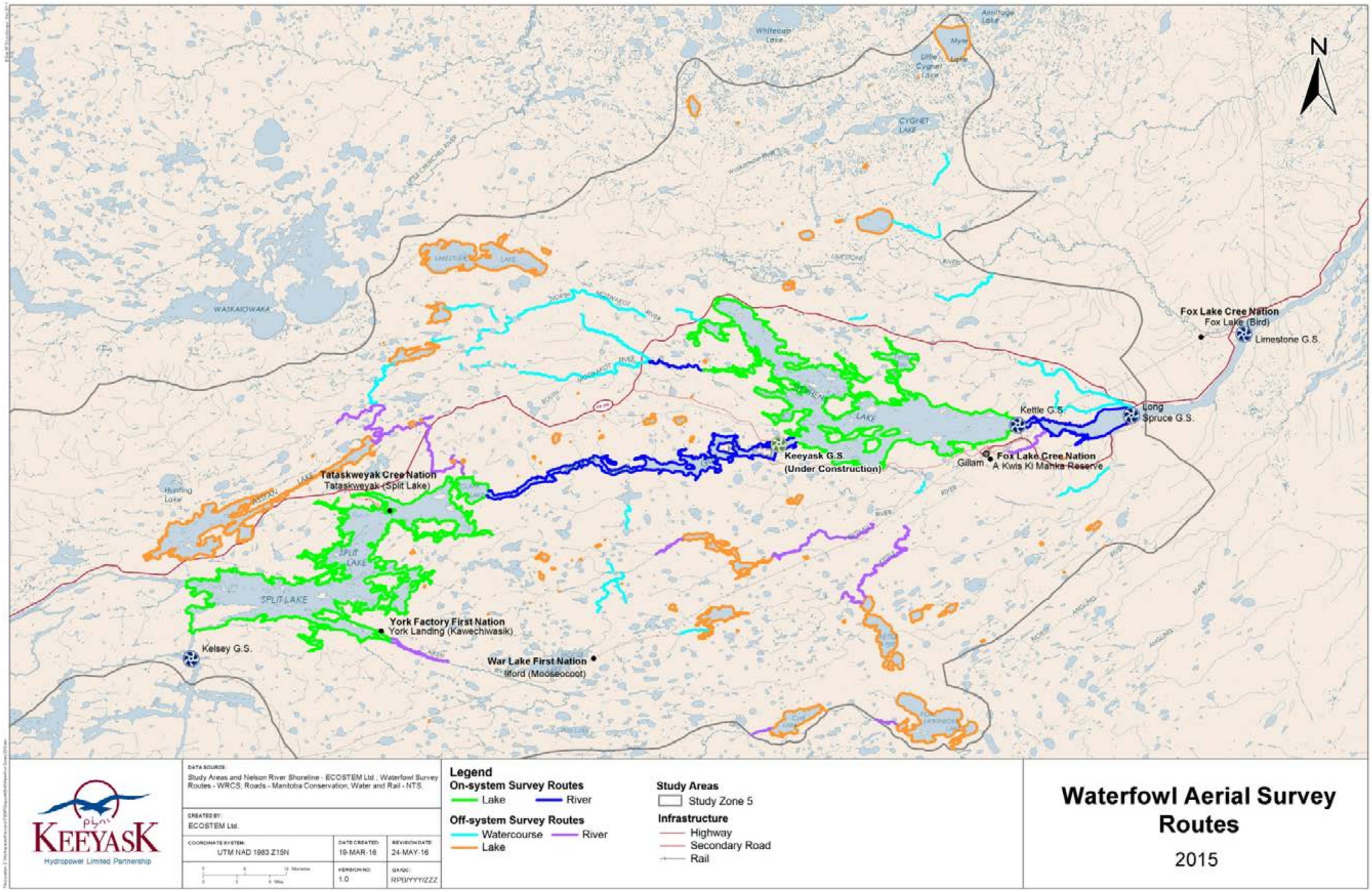
[1] Size class (area) of watercourses are not available

Surveys were timed to correspond with major waterfowl life-cycle events (*i.e.,* staging, breeding, brood-rearing). Surveys for staging waterfowl occurred on April 27-29 and September 10-15, 2015; breeding pair surveys were conducted on May 20-25 and June 17-22, 2015; and brood surveys were conducted on July 13-19, 2015.

Surveys were not conducted if winds exceeded 25 km/hr or if inclement weather (rain, fog, etc.) obscured visibility. All surveys were conducted from a helicopter equipped with bubble windows in the rear that travelled approximately 80 km/hr at an altitude of approximately 20-30 m, following the general contours of waterbodies (Appendix A). Two observers, on the left side of the aircraft (front and rear seats), recorded all waterfowl observed using a dependent double-observer technique (Koneff *et al.* 2008). The front-seat observer recorded all waterfowl observed and indicated this through the aircraft's communication system to the rear-seat observer. The rear-seat observer recorded all waterfowl not observed by the front-seat observer. An additional third observer was present on the right side (rear seat) of the aircraft and recorded waterfowl opportunistically. Observations by the third observer typically occurred when the aircraft was unable to follow relatively small shoreline contours and small bays or inlets were "cut-off" from the left side of the aircraft. Bird species, sex, and flock arrangement (*e.g.,* pair [drake and hen], flock of three drakes and two hens, etc.) were recorded, as well as opportunistic observations of other waterbird species (*e.g.*, loons, grebes, cranes, etc.).

All swans observed were classified as "unknown swans" due to the difficulty distinguishing between the trumpeter swan (*Cygnus buccinator*) and tundra swan (*Cygnus columbianus*) from a distance. Despite a relatively low probability of observing trumpeter swans in northern Manitoba, there are several areas within Study Zone 5 containing possible breeding evidence of trumpeter swans (Manitoba Breeding Bird Atlas 2015). Similarly, greater scaup (*Aythya marila*) and lesser scaup (*Aythya affinis*) were recorded as "unknown scaup" due to the difficulty in distinguishing between the two species from a distance.

The number of hunting parties observed was recorded opportunistically in April, when local resource harvesters are actively pursuing Canada geese and other waterfowl species. A hunting party was recorded when blinds, decoys, hunters, etc. were observed. Care was taken to avoid flying too near active hunting parties in order to minimize disturbance.



Map 2.1-1: Overview of Aerial Survey Routes in 2015

2.2 DATA ANALYSIS

2.3 WATERFOWL DENSITIES

Total waterfowl densities within different waterbody types were calculated by first assigning each waterfowl observation to the nearest waterbody type. The total number of waterfowl observed and shoreline length of the waterbody type were then used to calculate the number of birds per kilometre surveyed (birds/km). Common loon, grebe, and sandhill crane observations were not included in the calculations.

To provide a comparison for the waterfowl densities observed during pre-construction environmental studies for the Project, waterfowl densities were calculated for this monitoring study using data from the May, July, and September surveys. Similar to pre-construction surveys, only observations of ducks, geese, and swans were included (all merganser, common loon, grebe, and sandhill crane observations were removed). Observations were assumed to fall within 200-m of the helicopter, and this distance was used to estimate the total area (km^2) surveyed and the waterfowl density (birds/km^2).

To assess the potential effects of construction on waterfowl, waterfowl densities (birds/km^2) from Gull Lake and Gull Rapids were compared between this survey and pre-construction surveys conducted from 2001-2003 and in 2011 (KHLP 2012). Gull Lake and Gull Rapids were chosen as comparison areas as these areas were exposed to active construction in 2015.

2.4 INDICATED BREEDING PAIRS

Data from the May and June breeding surveys were used to determine the number of indicated breeding pairs (IBPs) of waterfowl, as a measure of the number of breeding waterfowl in Study Zone 5. Data from the May survey were used to determine the number of indicated breeding pairs of early-nesting species, including mallard, northern pintail (*Anas acuta*), and Canada goose. Data from the June survey were used to determine the number of indicated breeding pairs for all other species, including American wigeon (*Anas americana*), ring-necked duck (*Aythya collaris*), lesser scaup, and common loon.

The definition of an IBP was based on work conducted by Lemelin *et al.* (2010) and Messmer *et al.* (2015). Indicated breeding pairs of Canada geese were defined as observations of one to three birds. For dabbling ducks (*e.g.,* mallard, America wigeon, etc.), IBPs were classified as the number of males observed singly or in groups up to four individuals, including females and unsexed individuals, with the exception of groups consisting of three males and one female. For diving ducks, IBPs were classified based on the number of males observed singly or in groups up to four, including females and unsexed individuals (Lemelin *et al.* 2010; Messmer *et al.* 2015). Observations of one or two common loons were considered one IBP (Lemelin *et al.* 2010; Messmer *et al.* 2015).

Indicated breeding pair density was calculated using the same method that was used for calculating total waterfowl density.

2.5 WATERFOWL BROODS

The dates of brood observations were used to determine the approximate dates of the beginning of the nesting period. By subtracting the age of the brood in days, the days required for egg incubation (28 days for mallard and Canada goose), and one day for each egg laid (number of ducklings/goslings observed) from the observation date, the approximate time of nest initiation was determined for individual broods. This information is useful for determining the timing of future breeding surveys, which ideally occur at the start of the incubation period after most migrants have left (Lemelin *et al.* 2010).

Brood density was calculated using the same method that was used for calculating total waterfowl density.

3.0 RESULTS

3.1 WATERFOWL DENSITIES

A total of 3,386 birds, consisting of seven species, were observed during the first survey conducted in April (Table 3.1-1). The majority of observations (82%) consisted of Canada geese, while mallard was the next most common species observed (13% of all observations). A relatively small number of northern pintail, bufflehead (*Bucephala albeola*), unknown swan, and unknown ducks were also observed (Table 3.1-1).

Most waterbodies were still frozen during the April survey. The majority of waterfowl observations were concentrated at areas of open water, which occurred at creek mouths or in areas where water flow was sufficiently fast to prevent freezing (Appendix A). Most of these areas occurred within off-system rivers and watercourses, which supported the greatest densities of waterfowl in April (Table 3.1-2; Map 3.1-1).

A total of 9,404 birds, consisting of 23 species, were observed during the survey in May (Table 3.1-1). There was a substantial decrease (90% decrease) in the number of Canada geese present in Study Zone 5 compared to April and fewer northern pintails were also observed (90% decrease). Unknown diving ducks were the most common bird observed and a relatively large number of common goldeneye (*Bucephala clangula*), mallard, ring-necked duck, and unknown scaup were also observed (Table 3.1-1).

Most waterbodies were free of ice during the May survey, with the exception of Stephens Lake and some other large waterbodies (*e.g.,* Assean Lake, Limestone Lake), which only contained an approximately 30-m wide strip of open water along the shore (Appendix A). Split Lake was predominantly ice-free in May. Due to the preference of large waterbodies by diving ducks, which were the most common waterfowl group observed, on-system lakes supported the greatest densities of waterfowl in May (Table 3.1-2; Map 3.1-2).

In the June survey, the number of total waterfowl observed decreased to numbers similar to the April survey. A total of 3,288 birds, consisting of 23 species, were observed (Table 3.1-1). Most species declined in numbers, particularly diving duck species. A noticeable number of common merganser (*Mergus merganser*) were observed during the survey, almost doubling in number from the May to June survey (Table 3.1-1). Densities of waterfowl were relatively low on all waterbody types (Table 3.1-2; Map 3.1-3).

In the July survey, a total of 4,401 waterfowl, consisting of 19 species, were observed (Table 3.1-1). Mallard, ring-necked duck, unknown diving ducks, and unknown ducks were the species that had the largest increases from the June survey (Table 3.1-1). Off-system lakes and rivers supported the greatest densities of waterfowl in July (Table 3.1-2; Map 3.1-4).

The greatest number of waterfowl were observed during the September survey. In total, 16,677 waterfowl, consisting of 19 different species, were observed (Table 3.1-1). A relatively large increase in common goldeneye, mallard, ring-necked duck, unknown scaup, and unknown diving ducks was the source of much of the overall increase (Table 3.1-1). Off-system lakes and rivers supported the greatest densities of waterfowl in September (Table 3.1-2; Map 3.1-5).

Average waterfowl densities in 2015 were higher than those observed during pre-construction surveys conducted from 2001-2003 and in 2011 (KHLP 2012). Average waterfowl densities observed during the pre-construction period ranged from 8-16, 3-6, and 12-15 birds/km^2 in the spring (May), summer (July), and fall (September), respectively (KHLP 2012). In this monitoring study, waterfowl densities were 18, 8, and 31 birds/km^2 in the spring, summer, and fall, respectively.

In Gull Lake, waterfowl densities in 2015 were similar to densities observed during pre-construction surveys. Pre-construction waterfowl densities on Gull Lake ranged from 20-37, 0.4-11, and 13-58 birds/km^2 in the spring (May), summer (July), and fall (September), respectively (KHLP 2012). In this study, waterfowl densities were 31, 5, and 13 birds/km^2 in the spring, summer, and fall, respectively.

In Gull Rapids, waterfowl densities in 2015 were lower than those observed during the pre-construction surveys. Pre-construction waterfowl densities on Gull Rapids ranged from 1-11, 3-5, and 29 birds/km^2 in the spring (May), summer (July), and fall (September), respectively (KHLP 2012). In this study, waterfowl densities were 1, 1, and 2 birds/km^2 in the spring, summer, and fall, respectively.

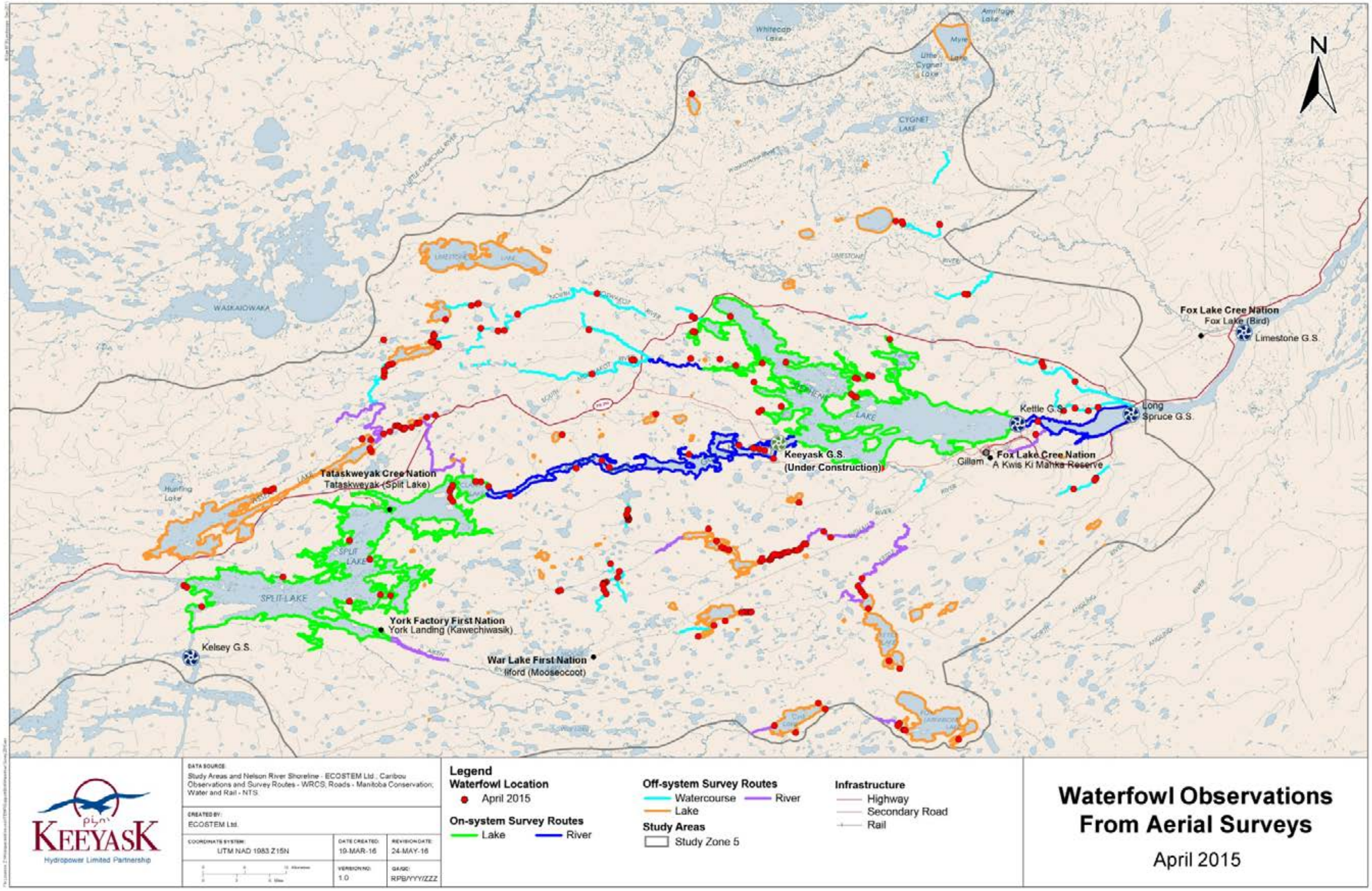
The number of waterfowl species observed (n=20 plus swans and scaups) during this monitoring survey was similar to pre-construction surveys (n=23) conducted from 2001-2003 and in 2011 (KHLP 2012). Differences included pacific loon (*Gavia pacifica*), which was not observed in 2015, and greater and lesser scaup, which were not differentiated in 2015.

Table 3.1-1: Total Number of Waterfowl Observed During Aerial Surveys in 2015

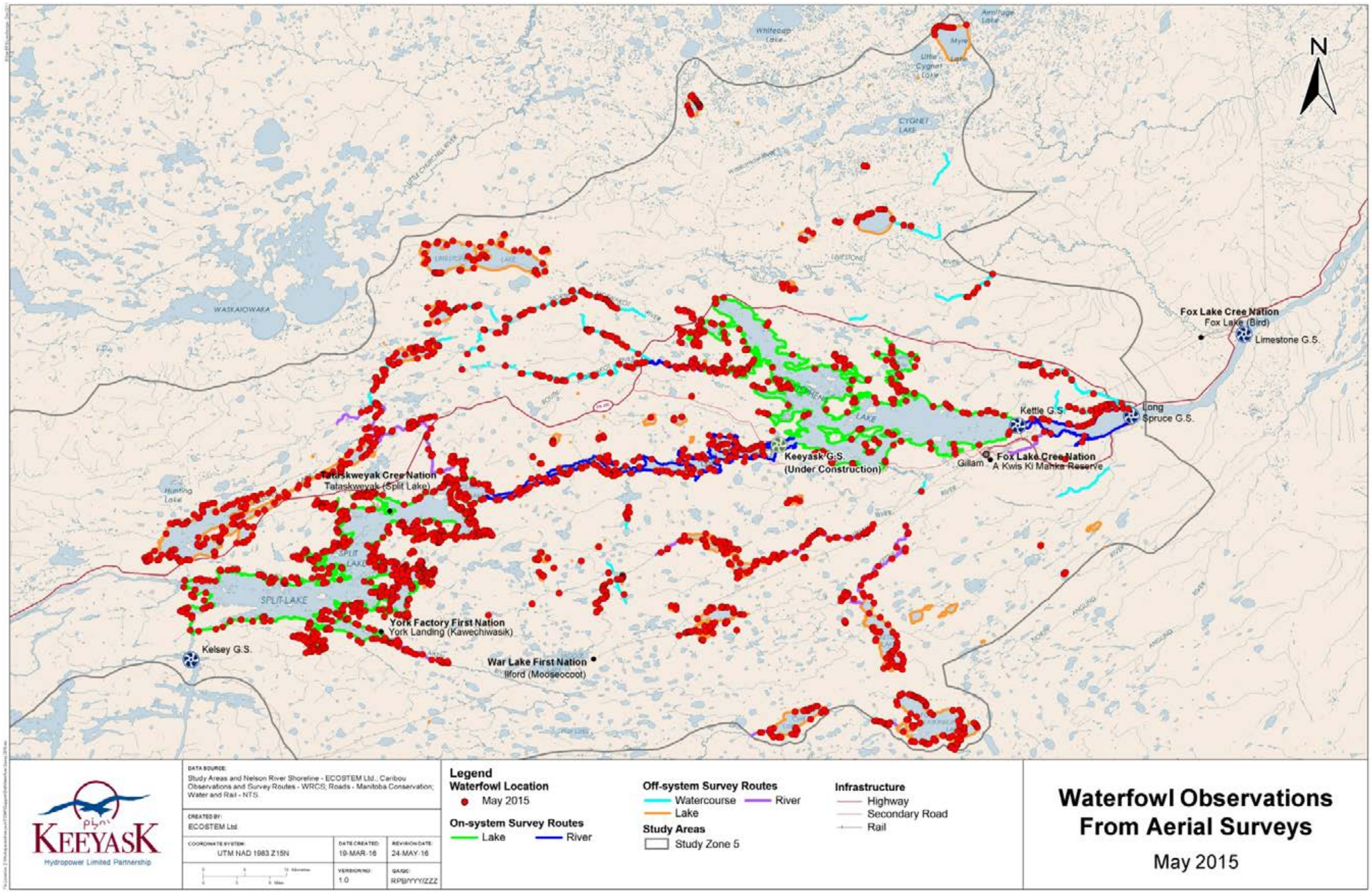
Species	Month					Total
	April	May	June	July	September	
American Wigeon (*Anas americana*)	0	375	183	112	260	930
American Black Duck (*Anas rubripes*)	0	0	0	6	2	8
Black Scoter (*Melanitta americana*)	0	1	4	0	0	5
Bufflehead (*Bucephala albeola*)	2	386	48	23	213	672
Blue-winged Teal (*Anas discors*)	0	15	8	1	0	24
Canada Goose (*Branta canadensis*)	2,765	270	350	306	703	4,394
Common Goldeneye (*Bucephala clangula*)	19	1,154	417	44	1,304	2,938
Common Loon (*Gavia immer*)	0	203	126	189	91	609
Common Merganser (*Mergus merganser*)	0	259	409	120	327	1,115
Green-winged Teal (*Anas carolinensis*)	0	261	93	40	271	665
Hooded Merganser (*Lophodytes cucullatus*)	0	9	1	0	0	10
Mallard (*Anas platyrhynchos*)	455	1,287	454	1,020	2,431	5,647
Northern Pintail (*Anas acuta*)	60	6	1	0	25	92
Northern Shoveler (*Anas clypeata*)	0	22	3	0	0	25
Red-breasted Merganser (*Mergus serrator*)	0	4	0	0	0	4
Ring-necked Duck (*Aythya collaris*)	0	961	424	788	4,739	6,912
Red-necked Grebe (*Podiceps grisegena*)	0	0	0	3	0	3
Sandhill Crane (*Grus canadensis*)	0	61	50	15	2	128
Surf Scoter (*Melanitta perspicillata*)	0	2	4	0	0	6
Unknown Dabbling Duck	0	51	21	60	134	266
Unknown Diving Duck	0	1,682	308	999	5,402	8,391
Unknown Duck	82	335	13	523	137	1,090
Unknown Grebe	0	0	1	0	0	1
Unknown Scaup (*Aythya affinis/marila*)	0	1,449	218	85	554	2,306
Unknown Swan (*Cygnus buccinator/columbianus)*	3	474	8	12	68	565
Unknown Scoter	0	0	0	0	5	5
White-winged Scoter (*Melanitta deglandi*)	0	137	144	55	9	345
Total	3,386	9,404	3,288	4,401	16,677	37,156

Table 3.1-2: Waterfowl Density (birds/km) within Waterbody Types in 2015

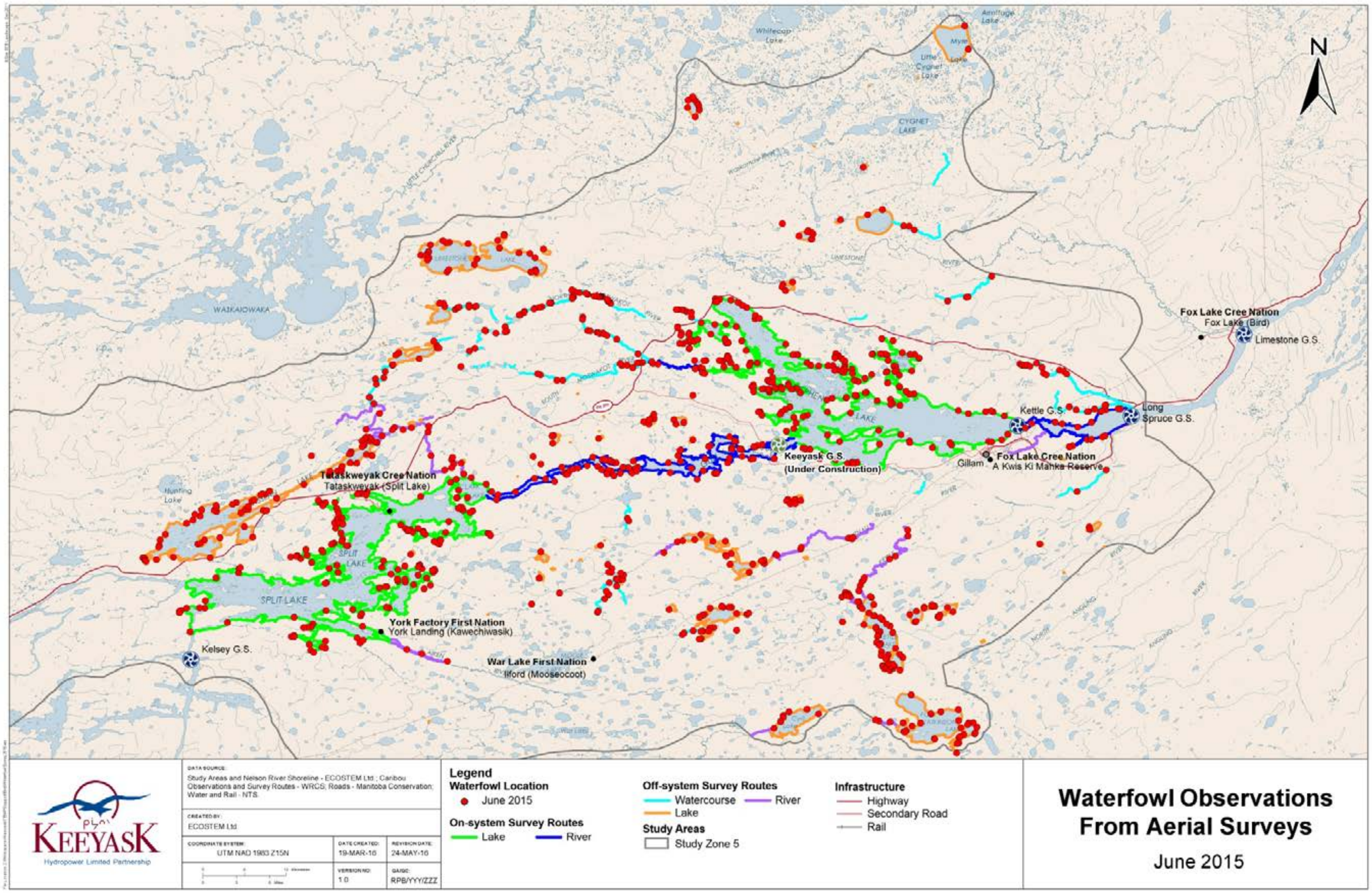
System	Waterbody Type	Survey Month				
		April	May	June	July	September
On-system	Lake	0.3	5.7	0.7	0.9	3.6
	River	0.7	2.8	1.7	0.9	2.3
	Watercourse	NA	NA	NA	NA	NA
Off-system	Lake	1.4	3.1	1.3	3.0	13.2
	River	3.5	2.2	1.0	3.1	13.0
	Watercourse	2.1	1.9	0.9	0.3	1.0



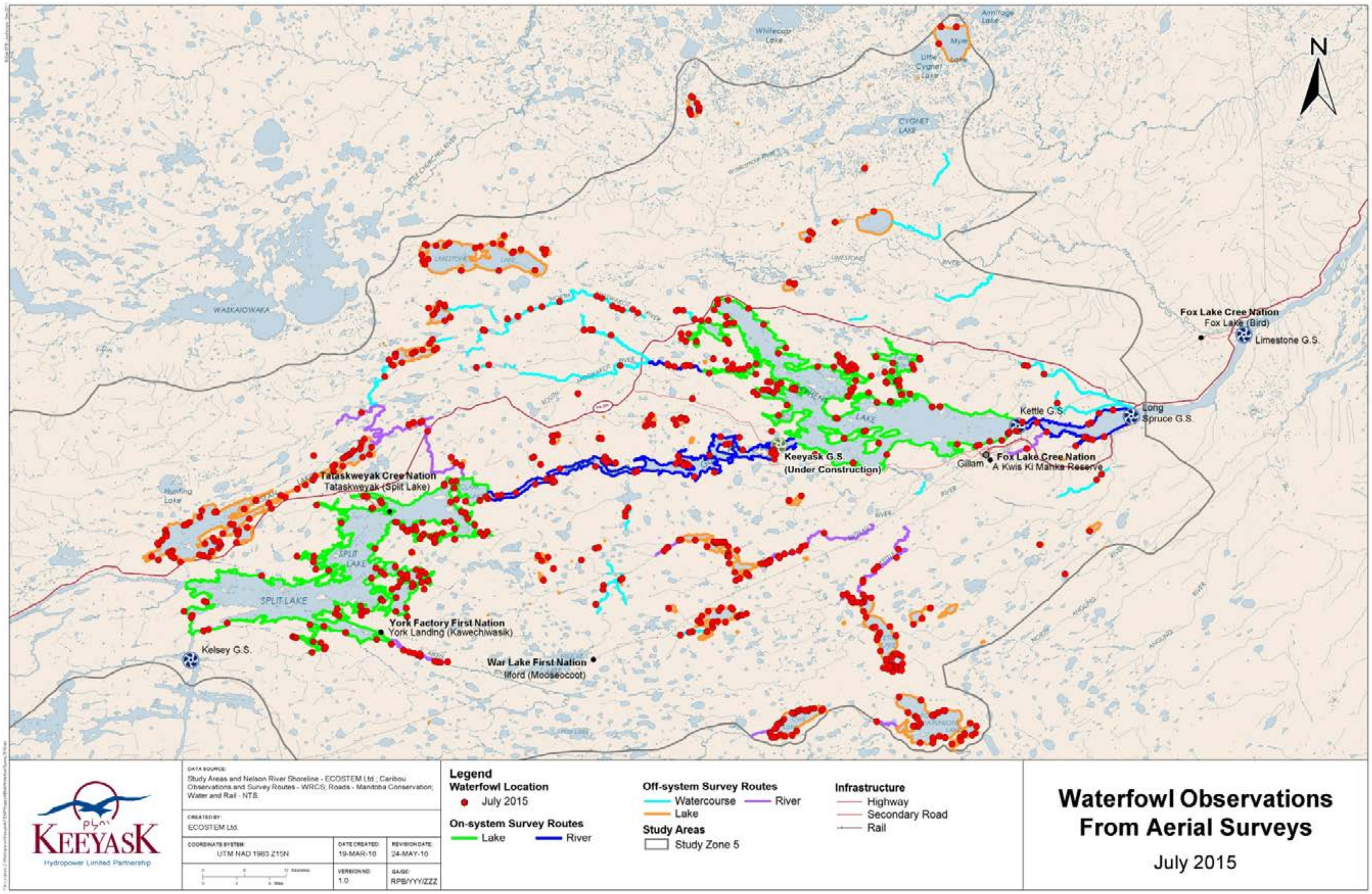
Map 3.1-1: Waterfowl Observations From Aerial Surveys in April 2015



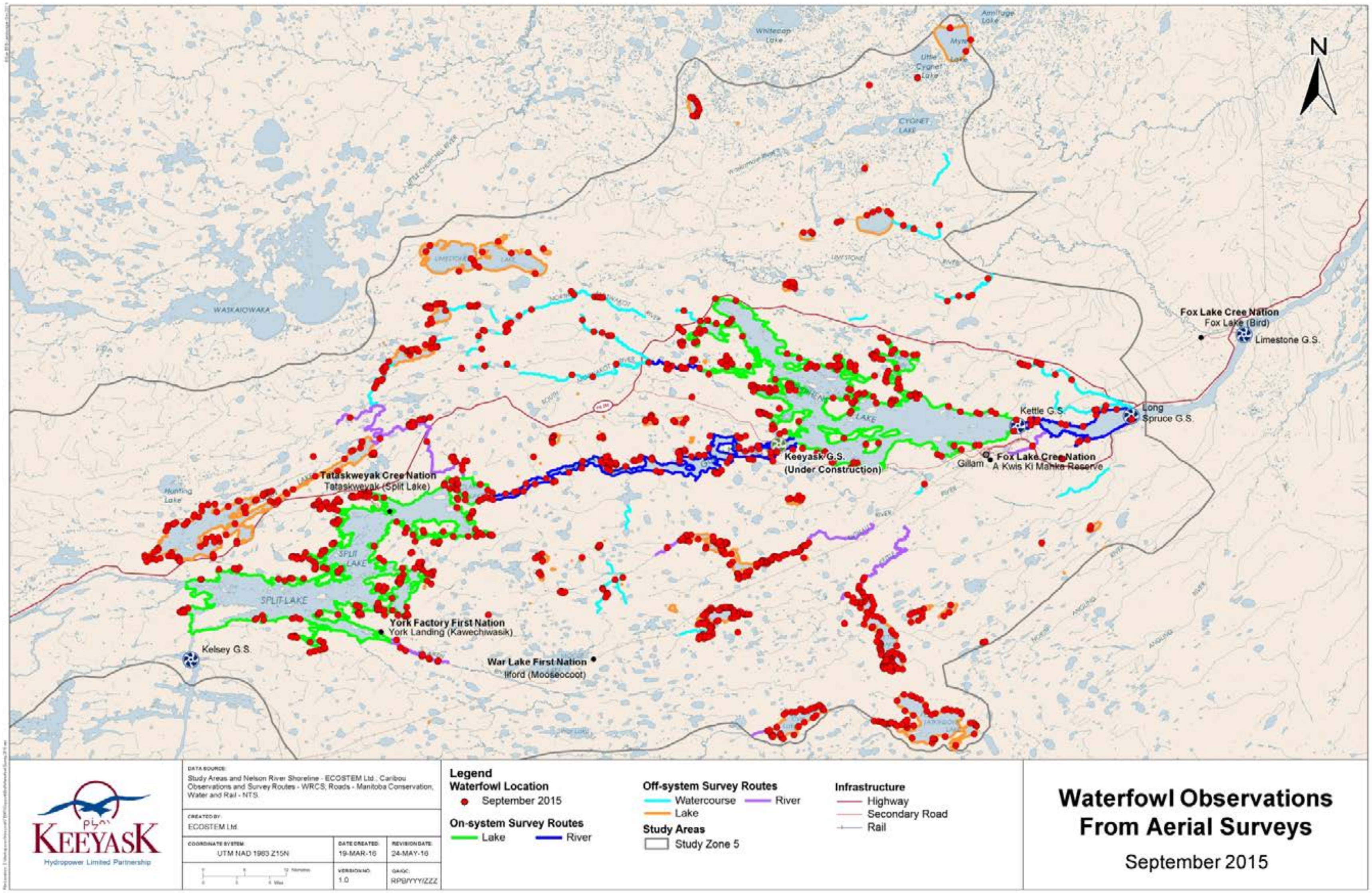
Map 3.1-2: Waterfowl Observations From Aerial Surveys in May 2015



Map 3.1-3: Waterfowl Observations From Aerial Surveys in June 2015



Map 3.1-4: Waterfowl Observations From Aerial Surveys in July 2015



Map 3.1-5: Waterfowl Observations From Aerial Surveys in September 2015

3.2 INDICATED BREEDING PAIRS

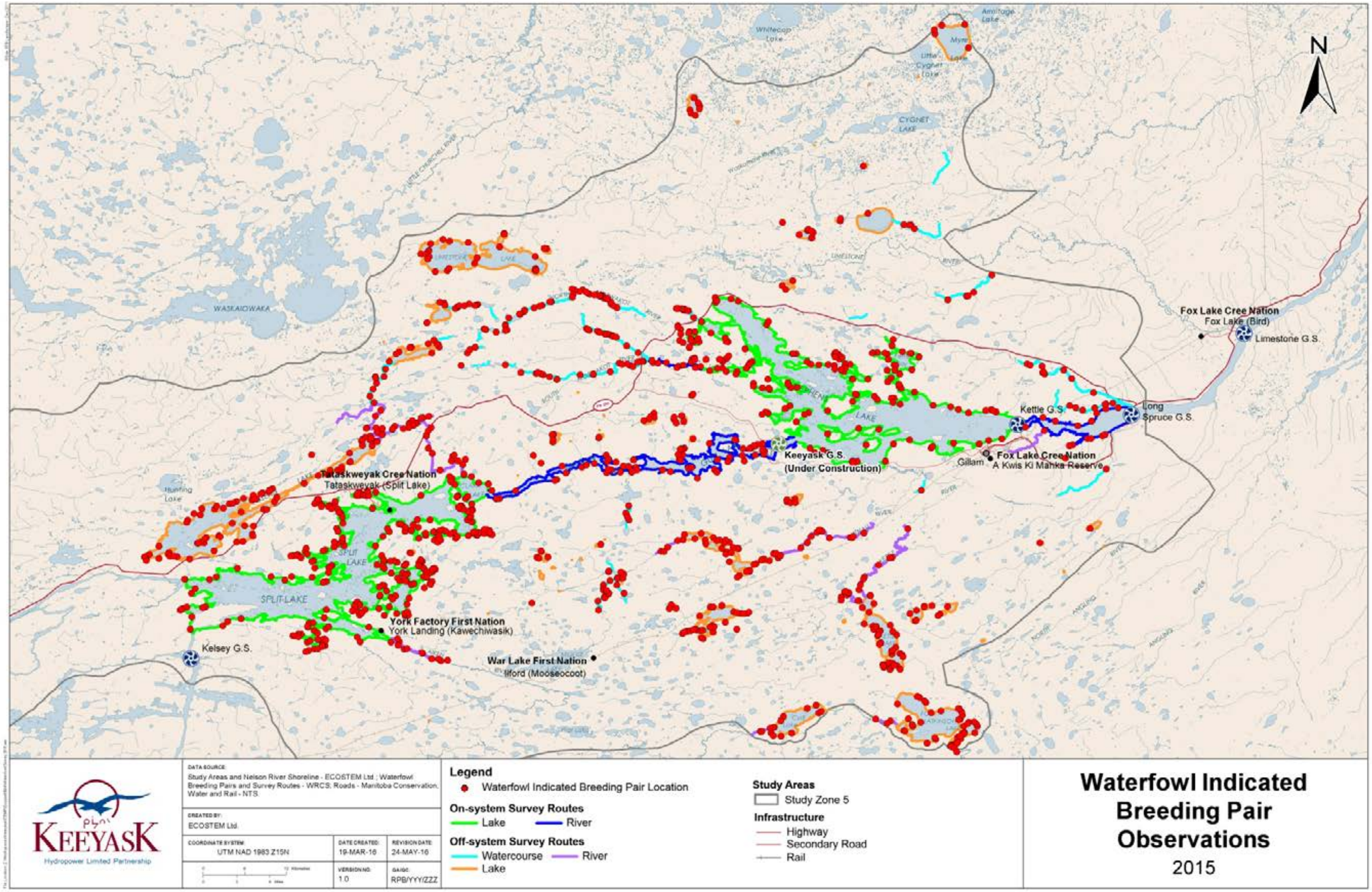
A total of 1,734 IBPs were observed in May/June 2015 (Table 3.2-1; Map 3.2-1). Indicated breeding pairs of mallard were the most common waterfowl species observed in Study Zone 5. Indicated breeding pairs of ring-necked duck, Canada goose, and American wigeon were also relatively common (Table 3.2-1).

Total indicated breeding pair densities were greatest in off-system waterbodies (Table 3.2-2). Off-system watercourses supported the greatest densities of waterfowl of all waterbody types surveyed. Off-system rivers supported higher densities of IBPs compared to on-system rivers, however, on-system lakes supported higher densities of IBPs compared to off-system lakes (Table 3.2-2).

Indicated breeding pair densities of mallard were greatest on on-system lakes and greatest for Canada geese on off-system watercourses (Table 3.2-2). Indicated breeding pairs of other common species of dabbling ducks, including American wigeon and green-winged teal were relatively evenly distributed across on- and off-system waterbody types. Common diving ducks, such as the ring-necked duck and scaup were observed in higher densities in all off-system waterbody types (Table 3.2-2).

Table 3.2-1: Number of Indicated Breeding Pairs Observed in 2015

Species	No. Indicated Breeding Pairs
American Wigeon	111
Black Scoter	2
Bufflehead	24
Blue-winged Teal	5
Canada Goose	123
Common Goldeneye	52
Common Loon	99
Common Merganser	84
Green-winged Teal	58
Hooded Merganser	1
Mallard	838
Northern Pintail	5
Northern Shoveler	2
Ring-necked Duck	190
Surf Scoter	3
Unknown Scaup	100
White-winged Scoter	37
Total	1,734



Map 3.2-1: Indicated Breeding Pair Observations From Aerial Surveys in 2015

Table 3.2-2: Density of Indicated Breeding Pairs (pairs/km) within Waterbody Types in 2015

Species	On-system			Off-system			
	Lake	River	Total	Lake	River	Watercourse	Total
American Wigeon	0.04	0.04	0.04	0.05	0.05	0.03	0.04
Black Scoter	<0.01	<0.01	<0.01	0.00	0.00	0.00	0.00
Bufflehead	<0.01	0.01	0.01	0.01	0.02	0.02	0.01
Blue-winged Teal	0.00	<0.01	<0.01	0.00	<0.01	<0.01	<0.01
Canada Goose	0.03	0.03	0.03	0.06	0.06	0.09	0.06
Common Goldeneye	0.02	0.03	0.03	0.03	0.00	0.00	0.01
Common Loon	0.03	0.04	0.03	0.07	0.02	0.02	0.04
Common Merganser	<0.01	0.05	0.03	0.06	0.02	0.00	0.03
Green-winged Teal	0.03	0.02	0.02	0.02	0.01	0.05	0.02
Hooded Merganser	0.00	0.00	0.00	0.00	0.00	<0.01	<0.01
Mallard	0.53	0.16	0.33	0.25	0.32	0.38	0.30
Northern Pintail	0.00	<0.01	0.00	0.01	<0.01	0.00	<0.01
Northern Shoveler	0.00	<0.01	<0.01	0.00	<0.01	0.00	<0.01
Ring-necked Duck	0.04	0.02	0.03	0.06	0.11	0.23	0.12
Surf Scoter	0.00	0.00	0.00	<0.01	<0.01	0.00	<0.01
Unknown Scaup	0.01	0.01	0.01	0.06	0.05	0.12	0.07
Unknown Swan	0.00	0.00	0.00	<0.01	0.00	<0.01	<0.01
White-winged Scoter	0.01	0.01	0.01	0.02	0.04	0.00	0.02
Total	0.73	0.43	0.57	0.69	0.69	0.94	0.75

3.3 WATERFOWL BROODS

A total of 90 waterfowl broods were observed during the 2015 waterfowl surveys (Map 3.3-1). Twelve broods were observed in June, with most (nine) consisting of Canada goose (Table 2.2-3). The greatest number of broods was observed during the July survey (Table 3.3-1). Mallard was the most common species of brood observed, followed by Canada goose. In September, a single mallard brood was observed (Table 3.3-1). The number of individual Canada goose broods is likely underestimated due to numerous amalgamated broods observed. Of the 19 Canada goose broods observed in July, 12 broods appeared to be amalgamated as they were being attended by more than two adults. Amalgamated broods of other species were not observed.

The earliest mallard broods were observed on June 20, 2015. Back-dating these observations and the age of the broods, indicates that nesting started on approximately May 15, 2015 for mallards in Study Zone 5. The earliest Canada goose broods were observed on June 19, 2015.

Back-dating these observations indicate that nesting started on approximately May 7, 2015 for Canada geese in Study Zone 5.

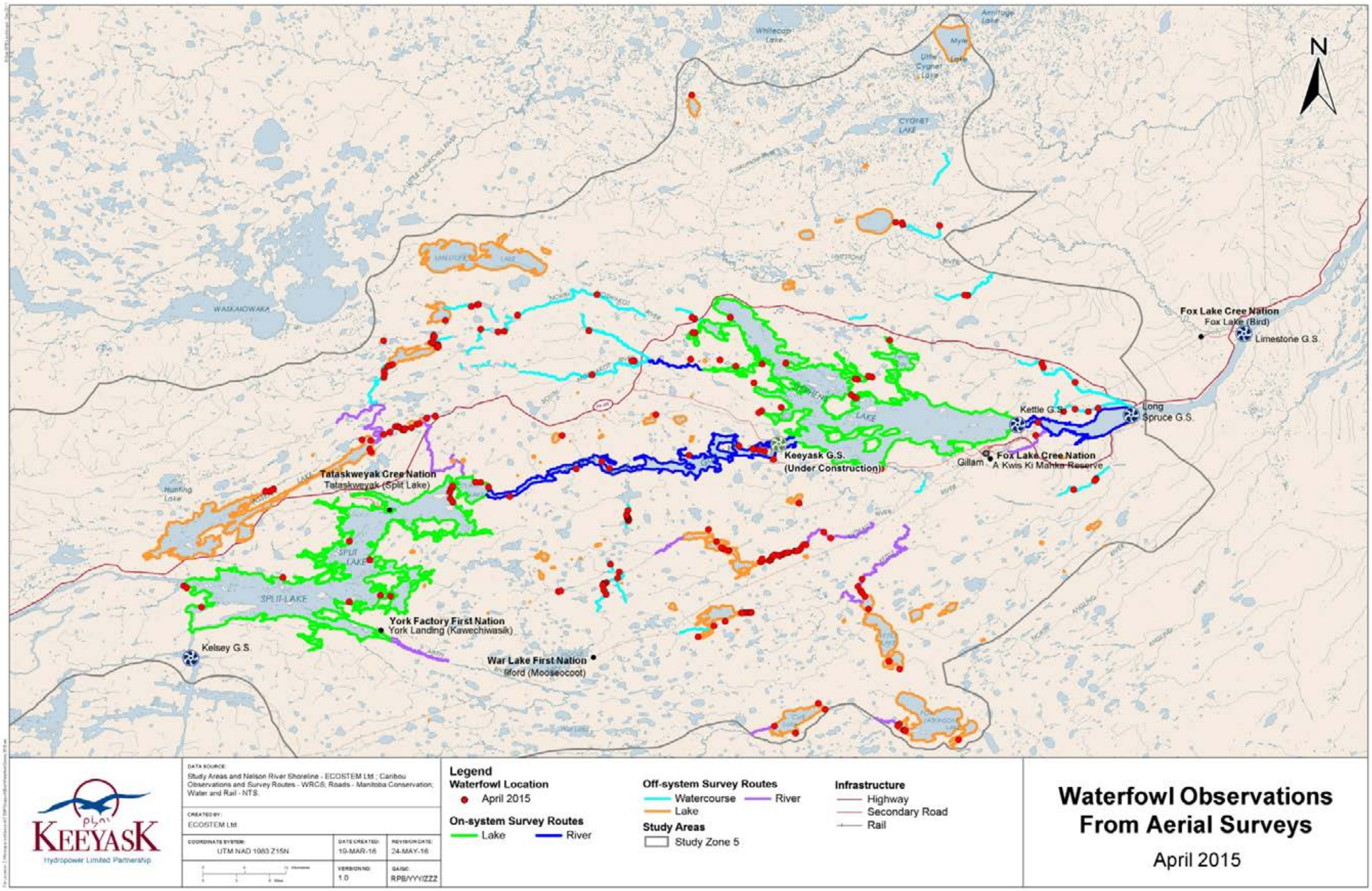
Off-system lakes and rivers contained a greater density of waterfowl broods compared to on-system lakes and rivers (Table 3.3-2). Greater densities of mallard broods were observed on off-system rivers compared to on-system rivers, but were observed at similar densities on off- and on-system lakes. Canada goose broods were observed at greater densities on off-system lakes compared to on-system lakes, but were observed at similar densities on off- and on-system rivers.

Table 3.3-1: Number of Waterfowl Broods Observed Monthly in 2015

Species	Month			Total
	June	July	September	
American Wigeon	0	6	0	6
Bufflehead	0	1	0	1
Canada Goose	9	19	0	28
Common Loon	0	4	0	4
Common Merganser	0	4	0	4
Green-winged Teal	0	1	0	1
Mallard	2	34	1	37
Ring-necked Duck	0	1	0	1
Red-necked Grebe	0	1	0	1
Unknown Diving Duck	0	1	0	1
Unknown Duck	1	5	0	6
Total	12	77	1	90

Table 3.3-2: Density of Waterfowl Broods (broods/km) in Waterbody Types in 2015

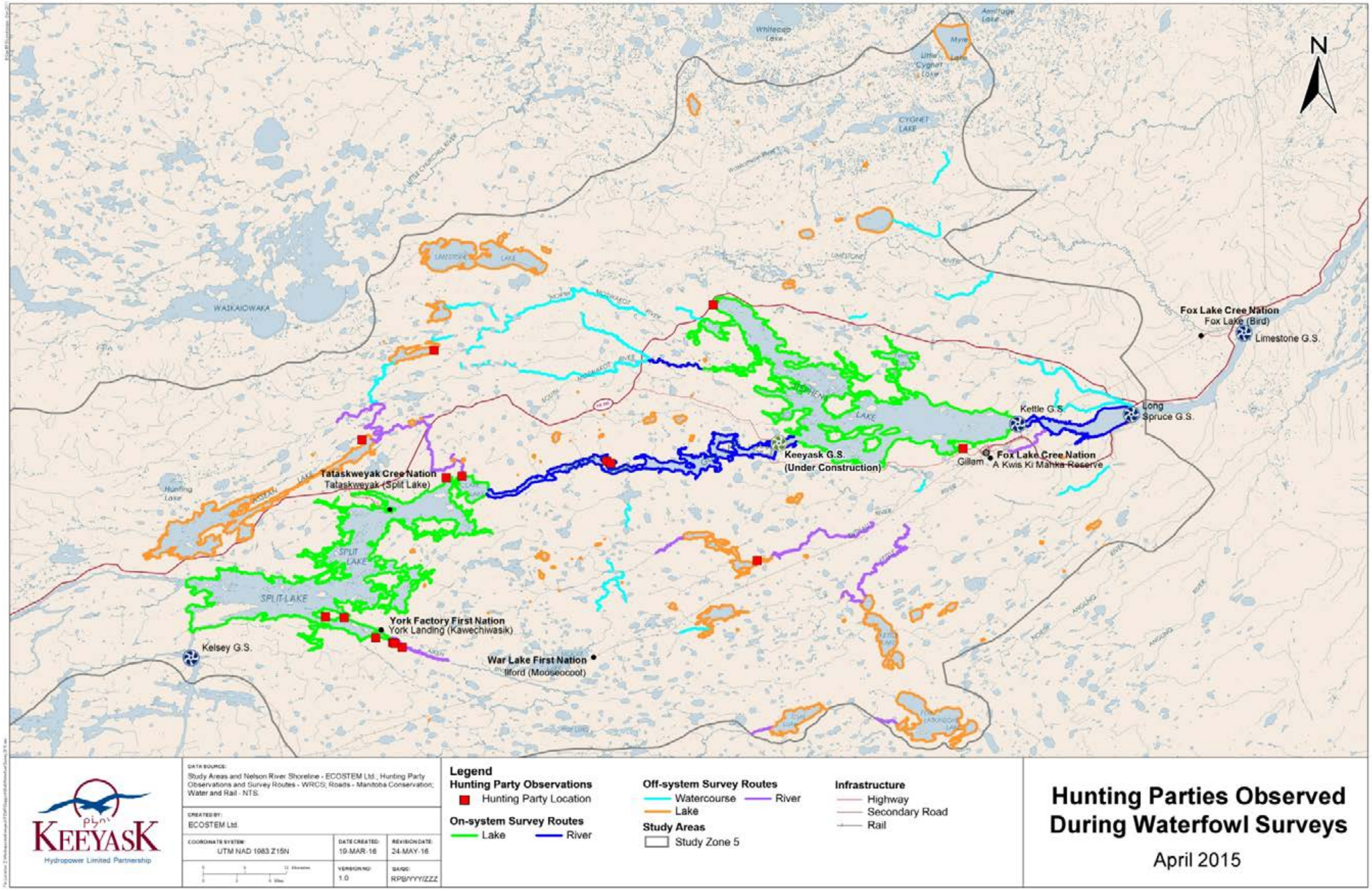
Species	On-system			Off-system				Grand Total
	Lake	River	Total	Lake	River	Watercourse	Total	
American Wigeon	<0.013	<0.011	<0.012	<0.013	0	<0.013	<0.012	<0.012
Bufflehead	<0.011	0	<0.011	0	0	0	0	<0.011
Canada Goose	0	<0.017	<0.014	0.020	<0.019	0.023	0.019	0.011
Common Loon	0	<0.011	<0.011	<0.015	0	0	<0.012	<0.012
Common Merganser	<0.011	0	<0.011	<0.015	0	0	<0.012	<0.012
Green-winged Teal	0	0	0	<0.012	0	<0.010	<0.011	<0.011
Mallard	0.021	<0.015	0.013	0.022	0.015	<0.013	0.015	0.014
Ring-necked Duck	0	0	0	<0.012	0	0	<0.011	<0.011
Red-necked Grebe	0	0	0	<0.012	0	0	<0.011	<<0.011
Unknown Diving Duck	0	0	0	0	0	<0.013	<0.011	<0.011
Unknown Duck	<0.011	<0.011	<0.011	<0.015	0	<0.013	<0.013	<0.012
Total	0.028	0.016	0.022	0.066	0.024	0.036	0.047	0.034



Map 3.3-1: All Waterfowl Brood Observations in 2015

3.4 HUNTING PARTIES

A total of 16 hunting parties were observed during the 2015 waterfowl surveys. Seven of the hunting parties were located near York Landing on the south end of Split Lake (Map 3.4-1). The other nine were located throughout Study Zone 5.



Map 3.4-1: Hunting Parties Observed During Waterfowl Surveys in April 2015

4.0 SUMMARY AND CONCLUSIONS

Disturbance of waterfowl caused by Project construction activities likely occurred, but due to the temporal nature of disturbances and waterfowl use of potentially disturbed habitat, it is difficult to quantify without additional data. Waterfowl densities on Gull Lake in 2015 were similar to those observed during pre-construction surveys, but were lower on Gull Rapids. As the Gull Rapids area is relatively small, and pre-construction data are limited to the spring, summer, and fall of 2003 and the spring and summer of 2011, it is difficult to determine if these differences are attributed to construction disturbance or the temporal distribution of waterfowl. Future waterfowl surveys will provide a better understanding of waterfowl use within the construction footprint.

There are several explanations for the differences in the overall waterfowl densities from the pre-construction period to the construction period. While it is possible that waterfowl numbers were higher in 2015 due to natural variation among years, differences in survey methods are likely the reason for the variation. In this study, shorelines were followed with the helicopter, which increases the likelihood of observing waterfowl along the shore, particularly when they are stationary. The presence of two observers on the same side of the helicopter also may have increased the likelihood of waterfowl being detected when present. Furthermore, more area was covered by the 2015 survey compared to previous years, which may have also attributed to observing greater waterfowl densities.

Waterfowl surveys appeared to provide sufficient construction-phase numbers for future comparisons. The relatively large fluctuations in waterfowl numbers from spring to fall highlighted the need for recurring surveys based on major waterfowl life-cycle events (staging, breeding, brood rearing). Based on the back-dating of mallard and Canada goose broods, the surveys conducted in May were ideal timing for observing IBPs of these species, which corresponds with the start of the nesting period.

Based on the April survey, Canada geese, mallard, and northern pintail were the earliest waterfowl migrants in Study Zone 5. Canada geese in particular were abundant and were observed in their greatest densities in April. Habitat use of these early arriving species was largely limited to relatively small areas of open water, as most waterbodies remained ice-covered. Typically, open water occurred within off-system rivers and watercourses, where creek mouths and creek bends created water flow that was sufficient to limit ice formation. The relatively high abundance of Canada geese observed during April highlights the need for surveys in early spring that coincide with the first presence of open water.

The peak of spring waterfowl migration in Study Zone 5 appeared to take place in May as indicated by the greatest number of waterfowl and the greatest number of species observed. Open water on large waterbodies, particularly on-system lakes, supported high densities of waterfowl due to the presence of large flocks of diving ducks and relatively high densities of mallard IBPs. The preference of on-system lakes by waterfowl at this time was likely due to on-system lakes, such as Split Lake being free of ice, whereas other large, off-system lakes were still ice covered.

By June, spring migration had nearly finished and birds had shifted their focus to nesting. The number of many species in Study Zone 5 declined and densities on all waterbody types was relatively low. The decrease was likely due to most breeding waterfowl leaving the area to their nesting grounds further north and waterfowl in Study Zone 5 attending nests, which would have peaked at this time. Nesting birds were less likely to be detected during the survey in June. Indicated breeding pairs of dabbling ducks did not appear to prefer on- or off-system waterbody types, whereas diving waterfowl appeared to prefer off-system waterbodies, particularly watercourses. Off-system watercourses may have been preferred by IBPs of diving waterfowl due to the presence of foraging or nesting opportunities provided by shallower water or aquatic vegetation. However, habitat data were unavailable to explore these findings.

Waterfowl densities increased slightly in July as compared to June likely due to less nest attendance and the immigration of moulting waterfowl into Study Zone 5. Off-system lakes and rivers appeared to be the preferred habitat of waterfowl and broods in July, likely due to the greater productivity of the smaller lakes, wetlands, and creeks, which provide more suitable habitat for broods and moulting birds (Rempel *et al.* 1997; Longcore *et al.* 2006).

Nest hatching appeared to peak in July with Canada goose and mallard being the most common species of brood observed. This was anticipated for Study Zone 5 based on the relatively high number of IBPs. However, broods of other species that had relatively high numbers of IBPs, such as ring-necked ducks and American wigeon, were not as abundant. The reason for this is not apparent, but it could be attributed to study timing (*e.g.,* brood survey did not coincide with hatching), the lack of nesting habitat, potential nest failure, or other factors.

During the fall staging period, the greatest numbers of waterfowl were observed. Diving duck species, particularly ring-necked ducks, were found in large flocks and a relatively large number of unknown diving ducks were also observed during September. The tendency of staging diving ducks to use large water bodies and congregate away from the shoreline contributed to the relatively high number of diving ducks being unidentified in September. Off-system lakes and rivers appeared to be preferred by the large numbers of diving ducks in the fall, likely due to better foraging opportunities provided by these waterbodies (*i.e.,* submersed vegetation and relatively shallow water). However, habitat data were unavailable to support these findings.

Based on the distribution of hunting parties observed in 2015, hunter access did not seem to be increased by construction activities. Most hunting parties observed were near existing towns or communities, or near previously established hunting camps. The South Access Road remained inaccessible to the public in 2015. Monitoring will occur in future years to observe if this development will provide additional access to waterfowl hunters along the southern edge of Stephens Lake.

Aerial waterfowl surveys will be conducted again beginning in the spring of 2017. Data from the 2015 and 2017 surveys will be used to further refine the habitat selection model previously developed. The habitat selection model can then be used to predict the amount of habitat disturbance as a result of the Project and its potential impact on Canada goose, mallard, and other waterfowl species.

5.0 LITERATURE CITED

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Appendix A: Photos

Photo A-1: Helicopter Performing Aerial Waterfowl Surveys

Photo A-2: Rear-seat Observer Looking Through Bubble Window During Waterfowl Survey

Photo A-3: Ice Conditions on Stephens Lake in April 2015

Photo A-4: Open Water Strip Commonly Observed on Stephens Lake and Other Large Waterbodies in May 2015

Photo A-5: Flock of Diving Ducks Observed in September 2015

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