Keeyask Generation Project

Terrestrial Effects Monitoring Plan

Colonial Waterbird Habitat Effects Monitoring Report

TEMP-2017-06

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

2016 - 2017

KEEYASK GENERATION PROJECT

TERRESTRIAL EFFECTS MONITORING PLAN

REPORT #TEMP-2017-06

COLONIAL WATERBIRD HABITAT EFFECTS

MONITORING REPORT

Prepared for

Manitoba Hydro

By

Wildlife Resource Consulting Service MB Inc.

June 2017

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SUMMARY

Background

Construction of the Keeyask Generation Project (the Project) at Gull Rapids began in July 2014. Before the government issued a licence to construct the Project, 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 colonial waterbirds. 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 colonial waterbirds, and whether or not more needs to be done to reduce harmful effects.

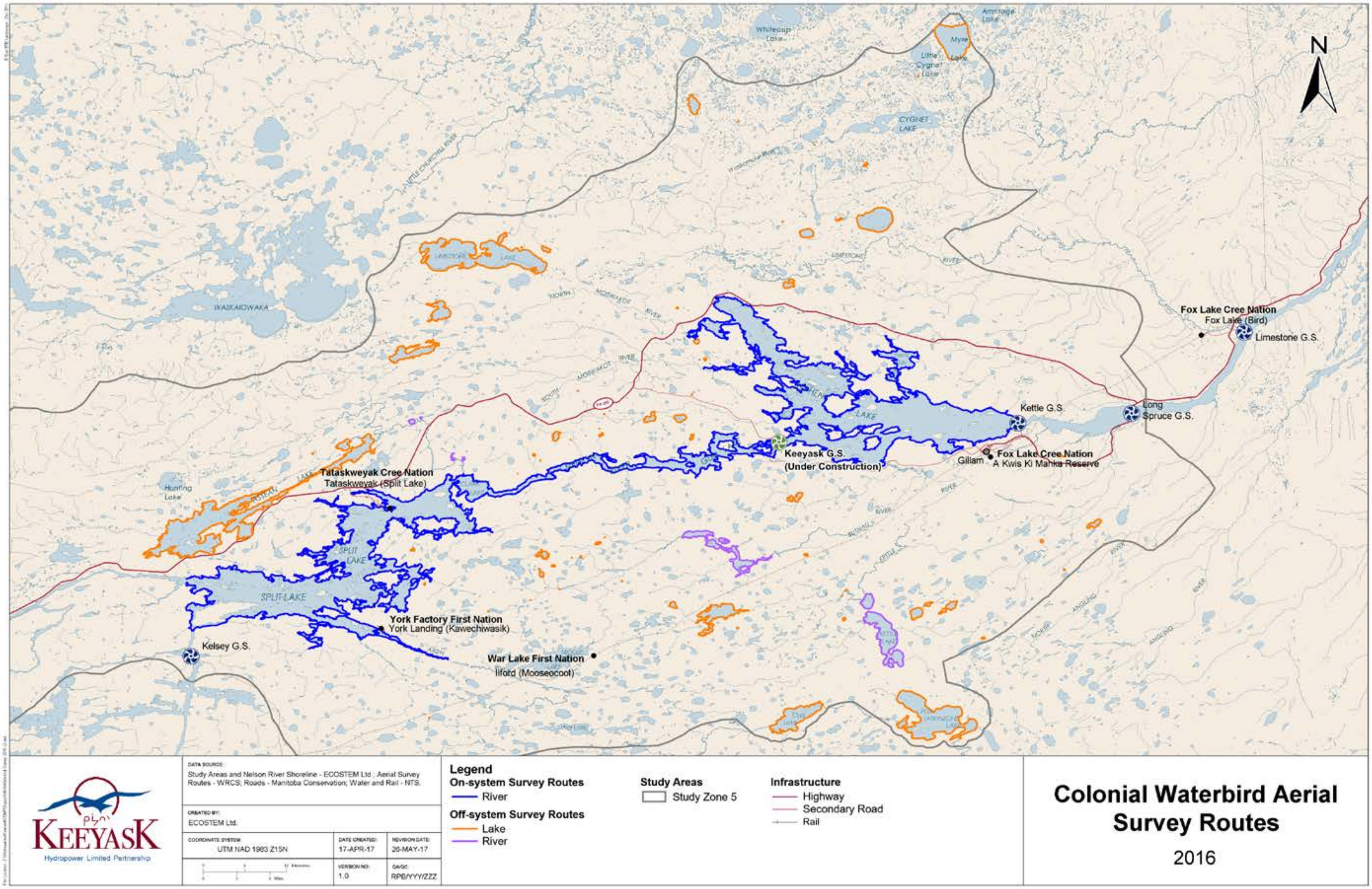
This report describes the results of colonial waterbird habitat effects monitoring conducted during the summer of 2016, the third summer of Project construction. Monitoring occurred along the shorelines of the Nelson River from the Kelsey Generating Station downstream to the Limestone Generating Station, including Split Lake and Stephens Lake, and at reference waterbodies off the Nelson River system.

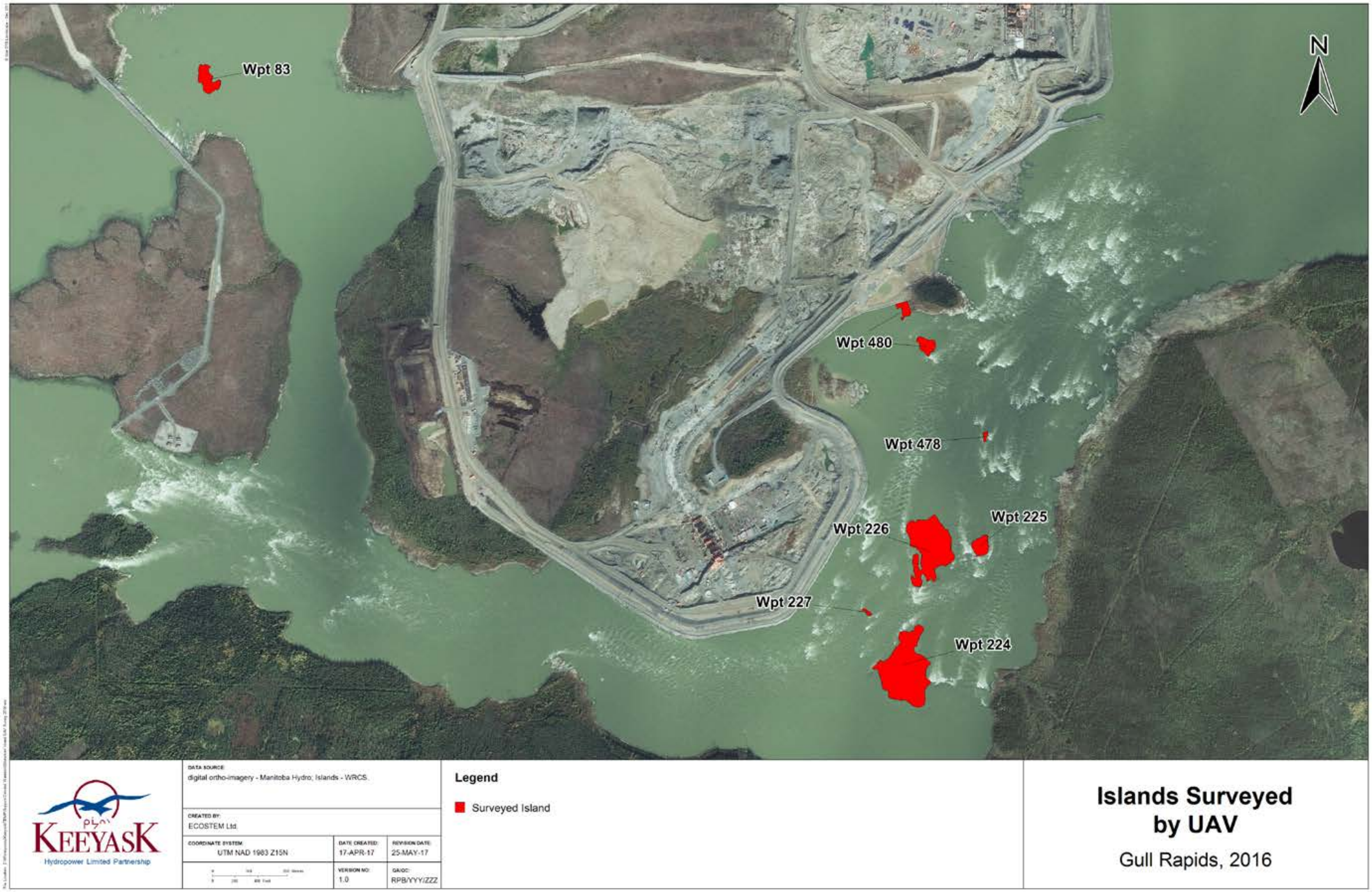
Why is the study being done?

The Project has the potential to affect colonial waterbird populations through alteration and loss of habitat, as well as sensory disturbance. Colonial waterbird habitat effects monitoring is being done to evaluate Project effects on the distribution and relative abundance of ring-billed gulls and common terns and their breeding habitats.

What was done?

Helicopter surveys of the study area and unmanned aerial vehicle (UAV or drone) surveys of Gull Rapids were conducted to determine abundance, distribution, and habitat use of colonial waterbirds in areas expected to be affected by the Project and in areas away from the Project. UAV surveys allowed the observation of colonial waterbird nests and chicks, from which productivity (number of chicks produced per nest) could be determined.


N
Fox Lake Cree Nation
Fox Lake (Bird)
Limestone G.S.
Kettle G.S.
Long Spruce G.S.
Keeyask G.S.
(Under Construction)
Gillam
Fox Lake Cree Nation
A Kwis Ki Mahka Reserve
Tataskweyak Cree Nation
Tataskweyak (Split Lake)
SPLIT LAKE
York Factory First Nation
York Landing (Kawechiwasik)
Kelsey G.S.
War Lake First Nation
Ilford (Mooseocoot)
WASKAIOWAKA
DATA SOURCE:
Study Areas and Nelson River Shoreline - ECOSTEM Ltd.; Aerial Survey Routes - WRCS; Roads - Manitoba Conservation; Water and Rail - NTS.
CREATED BY:
ECOSTEM Ltd.
COORDINATE SYSTEM:
UTM NAD 1983 Z15N
DATE CREATED:
17-APR-17
REVISION DATE:
26-MAY-17
VERSION NO:
1.0
QA/QC:
RPB/YYY/ZZZ
Legend
On-system Survey Routes
River
Off-system Survey Routes
Lake
River
Study Areas
Study Zone 5
Infrastructure
Highway
Secondary Road
Rail
KEEYASK
Hydropower Limited Partnership
Colonial Waterbird Aerial Survey Routes
2016


N
Wpt 83
Wpt 480
Wpt 478
Wpt 226
Wpt 225
Wpt 227
Wpt 224
KEEYASK
Hydropower Limited Partnership
DATA SOURCE:
digital ortho-imagery - Manitoba Hydro; Islands - WRCS.
CREATED BY:
ECOSTEM Ltd.
COORDINATE SYSTEM:
UTM NAD 1983 Z15N
DATE CREATED:
17-APR-17
REVISION DATE:
25-MAY-17
VERSION NO:
1.0
QA/QC:
RPB/YYY/ZZZ
Legend
Surveyed Island
Islands Surveyed by UAV
Gull Rapids, 2016

What was found?

Six species of colonial waterbirds were observed during the surveys. The most common species reported was the ring-billed gull, which was observed in greatest numbers on islands within Gull Rapids. Other waterbird species observed included the common tern, Bonaparte's gull, herring gull, American white pelican, and black tern.

The UAV survey found that the number of colonial waterbirds, mainly ring-billed gulls, remained consistent within the Gull Rapids area as compared to previous years. Ring-billed gull productivity (number of chicks produced) at Gull Rapids was found to be comparable to productivity observed elsewhere in North America.

Herring gull productivity at Gull Rapids was relatively low in comparison to other published studies. The apparent low productivity was likely due to the relatively low numbers of herring gull nests and chicks observed, and the inability to distinguish between herring gull and ring-billed gull chicks, which were often in close proximity to one another.

The use of islands in Gull Rapids by common terns shifted in 2016. The cause of this shift is not believed to be a result of construction activities as the island did support a colony of ring-billed gulls in 2016; but rather, the shift of island use by common terns may be related to the competition with ring-billed gulls for nesting habitat.

Helicopter surveys found that within the broader study area, the number of non-breeding colonial waterbirds observed in 2016 was much higher compared to 2015. The difference in annual numbers of colonial waterbirds may have been due to natural fluctuations in the population. The increase in colonial waterbird numbers may have been a result of an influx of non-breeding individuals, or unsuccessful breeders from elsewhere.

UAV Photo of an Island in Gull Rapids with Ring-billed Gulls and Chicks

What does it mean?

The results of the UAV and helicopter surveys suggest that Project construction is not negatively affecting colonial waterbirds. The consistent number and locations of colonies of colonial waterbirds observed in the Gull Rapids area suggests that Project construction is not discouraging the use of nearby traditional nesting islands.

Additionally, the productivity of ring-billed gulls and herring gulls at Gull Rapids was found to be within published ranges from other studies and suggests that Project construction is not negatively affecting colonial waterbird productivity.

What will be done next?

Additional aerial surveys will be conducted in future years, including the spring and summer of 2017, to continue monitoring the distribution and relative abundance of colonial waterbirds and their breeding habitats. Data that describes the type of habitat chosen by colonial waterbirds during this second year of construction monitoring, and in future years, will be incorporated into an expert information model. The model can then be used to predict the amount of habitat disturbance as a result of the Project and its potential impact on colonial waterbird populations. Since the conditions created by the Keeyask reservoir and water regulation may create novel breeding habitat types, the habitat model will be confirmed during operation.

STUDY TEAM

We would like to thank Sherrie Mason and Rachel Boone of Manitoba Hydro for reviewing the report. Caroline Walmsley and Megan Anger of Manitoba Hydro, Ben Hofer of Custom Helicopters, and Ron Bretecher of North/South Consultants Inc. are acknowledged for logistical assistance in the field. We would also like to thank Dr. James Ehnes, ECOSTEM Ltd., for GIS supported study design and cartography and Unmanned Aerial Imaging Solutions Inc. (UAIS) for Unmanned Aerial Vehicle (UAV) operations and photography.

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

- Robert Berger, M.N.R.M., Design, analysis, and reporting
- Mark Baschuk, M.Sc., Analysis, reporting
- Nicholas LaPorte, M.N.R.M., Reporting
- Kristian Bernjak, UAV photography
- Mike Connellan, UAV photography
- Adam Beverstein, UAV photography

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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*, 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, colonial waterbird habitat effects monitoring, for the construction and operation phases of the Project.

The Project has the potential to affect colonial waterbird populations through alteration and loss of habitat, as well as sensory disturbance. Three species of colonial waterbird - ring-billed gull (*Larus delawarensis*), herring gull (*Larus argentatus*), and common tern (*Sterna hirundo*; hereafter referred to as terns) - commonly breed on rocky islands and reefs in the Nelson River near the Project site. Previous colonial water bird surveys, conducted from 2001-03, 2006, 2011, and 2013-15 have counted between 3,000-6,200 (±1,000) gulls and 100-200 common terns (KHLP 2012; Stantec 2014; Stantec 2015; WRCS 2016) in the Gull Rapids area. Other colonial waterbird species that have been observed to breed in the region include herring gull, Bonaparte's gull (*Chroicocephalus philadelphia*), and Caspian tern (*Sterna caspia*). Colonial waterbirds that occur in the region but for which there is no evidence of breeding include American white pelican (*Pelecanus erythrorhynchos*), black tern (*Chlidonias niger*), and double-crested cormorant (*Phalacrocorax auritus*) (KHLP 2012).

Colonial waterbirds are generally gregarious birds that congregate into conspecific or multi-species groups of nesting birds at colony sites; the congregation of nesting birds is the colony (Kushlan 1986). Waterbird colonies range from a few birds to many thousands, however, two breeding pairs nesting at a site qualify as a colony (Kushlan *et al*. 2002). If nesting is not taking place, the group of birds is not a colony but a congregation. At such sites, if birds are sleeping or resting the site is referred to as a communal roost site. Often confused with roosting, loafing includes activities involved in comfort behaviour (preening, stretching) and digestion; such sites are referred to as loafing sites (Campbell and Lack 1985).

At Gull Rapids, loss of foraging and breeding habitat and habitat avoidance due to Project noise disturbances are anticipated construction-related effects on the local colonial waterbird population. Colonial waterbirds receive regulatory protection under *The Wildlife Act* (2015) of Manitoba and the federal *Migratory Birds Convention Act* (1994). To avoid disturbing breeding colonial waterbirds near Project construction activities, avian control measures to deter colonial waterbirds were implemented in areas affected by construction at Gull Rapids. Permitted control measures included active falconry, pyrotechnics, kites, and egg and/or nest removal. All of these measures were permitted by Environment Canada under Damage and Danger Permit 16-MB-D028. To monitor potential Project construction effects on colonial waterbirds in Gull Rapids, an Unmanned Aerial Vehicle (UAV or drone) was used to determine abundance, distribution, and habitat use of colonial waterbirds.

The primary goal of the colonial waterbird habitat effects monitoring is to evaluate how ring-billed gull and common tern breeding habitat distribution and abundance changes due to the Project. Secondly, this study will evaluate how ring-billed gull and common tern habitat effectiveness changes due to Project sensory disturbance, by measuring changes in the distribution and abundance of ring-billed gulls and common terns in the vicinity of Project disturbances. This report contains the results of the second year (2016) of the Colonial Waterbird Habitat Effects study.

2.0 METHODS

2.1 UNMANNED AERIAL VEHICLE SURVEYS

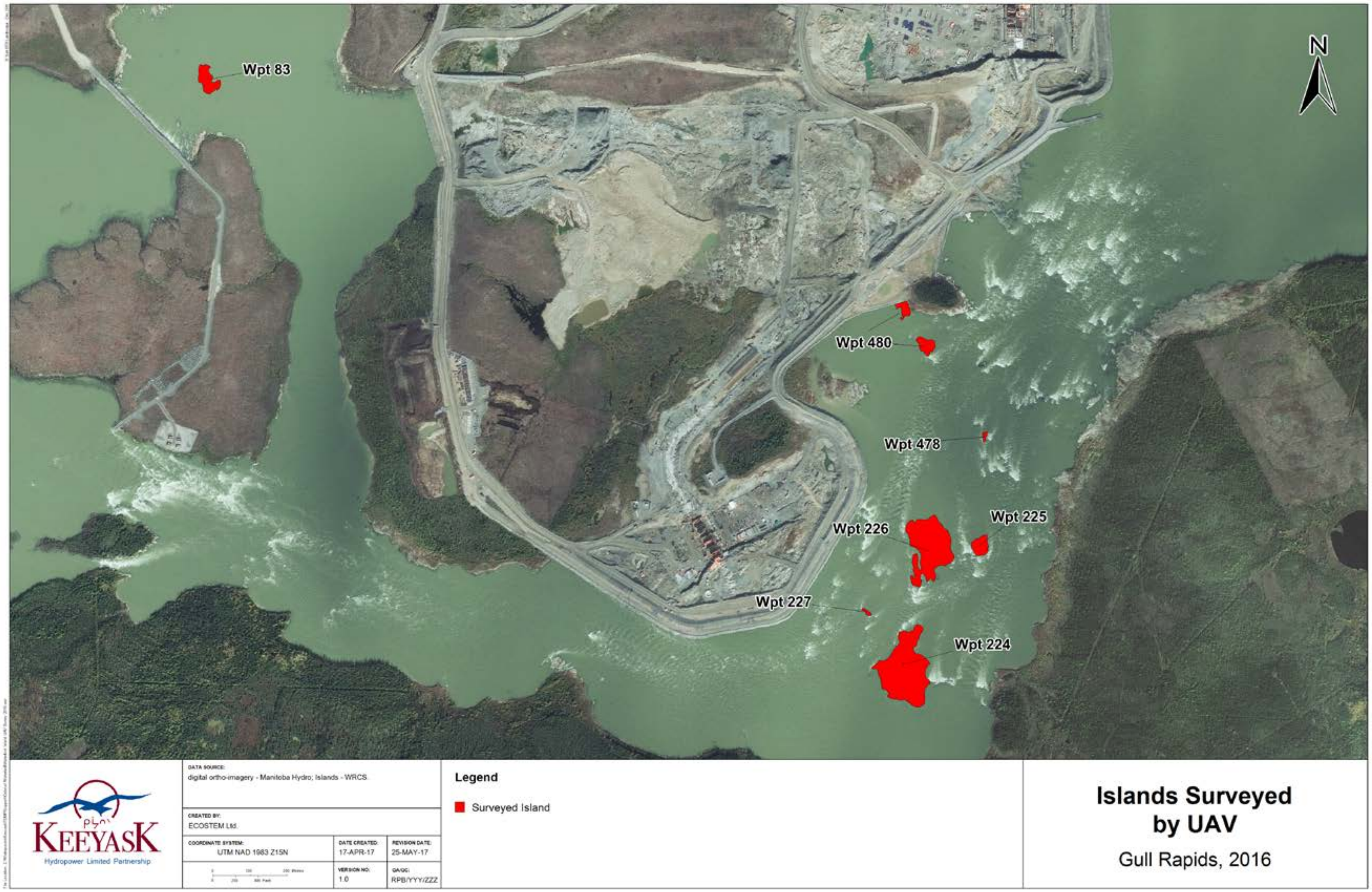
The distribution and abundance of colonial waterbirds at Gull Rapids was monitored using photographs taken from an Unmanned Aerial Vehicle (UAV). Unmanned Aerial Imaging Solutions Inc. (UAIS) was contracted to conduct UAV flights and produce high-resolution images of colonial waterbird colonies and potential nesting areas in the Gull Rapids area.

UAIS deployed a DJI Phantom 3 Professional quad-copter equipped with a 12 mega-pixel camera to survey islands and shorelines in Gull Rapids. Using the software Mission Planner, camera parameters, flight path, speed, and altitude were programmed into the UAV to guide it during each flight mission. Seven islands and a small section of shoreline within the Gull Rapids area, known to support colonial waterbirds, were photographed by the UAV platform in a grid pattern to produce overlapping photographs (Map 2-1). All flights were conducted at approximately 40 m above ground level (agl) to minimize disturbance to waterbird colonies.

UAV surveys were conducted during three periods in 2016: June 3-4, June 27, and July 20-21, in an attempt to capture the nesting and brood rearing periods. During each of these survey periods, islands/shorelines were photographed during the morning (0600-1200 hours) and afternoon (1200-1700 hours). Photographs taken in the morning and afternoon, for each survey period, were examined to determine the number of colonial waterbirds, nests, hatch-year birds (chicks), and species present on each of the nesting islands in the Gull Rapids area. A single observer examined the photographs to maintain a consistent interpretation and reduce subjectivity.

The maximum number of birds/nests/chicks observed from the morning or afternoon photographs was used to determine the potential suitability of islands for nesting colonial waterbirds. To describe the difference between morning and afternoon bird abundances, the standard deviations of bird/nests/chicks were calculated using the morning and afternoon data from the same period.

Photo 2-1: UAIS Employee Launching the UAV Used to Photograph Islands in Gull Rapids in 2016



Map 2-1: Islands Surveyed by UAV in Gull Rapids in 2016

2.1.1 HELICOPTER SURVEY

Helicopter surveys were conducted to monitor the abundance, distribution, and habitat use of colonial waterbirds in portions of Study Zone 5 (the study area) during the breeding season (Map 2-2). A random, stratified design 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 two basic waterbody types (lake or river), and grouped into five different size classes (<1, 1-10, 10-100, 100-1,000, >1,000 ha). Small watercourses (*e.g.*, creeks) were excluded from the design and selection as gulls and terns do not typically use these features as nesting habitat. The total shoreline lengths and distribution of waterbodies are presented in Table 2-1 and Map 2-2. The first survey occurred between June 15-17, 2016 when gull and tern nests are typically initiated and most gulls and terns are incubating eggs, whereas the second survey occurred during the typical chick-rearing period on July 13-15.

Table 2-1: Shoreline Length (km) of Waterbody Size Classes and Types Surveyed in 2016

System	Waterbody	Waterbody Size Class (ha)					
		<1	**1-10**	**10-100**	**100-1,000**	**>1,000**	**Total Shoreline Length (km)**
On-system	River	0	0	0	0	1,229	1,229
Off-system	Lake	6	10	33	132	398	579
	River	0	0	6	4	99	109
Total		6	10	39	136	1,726	1,917

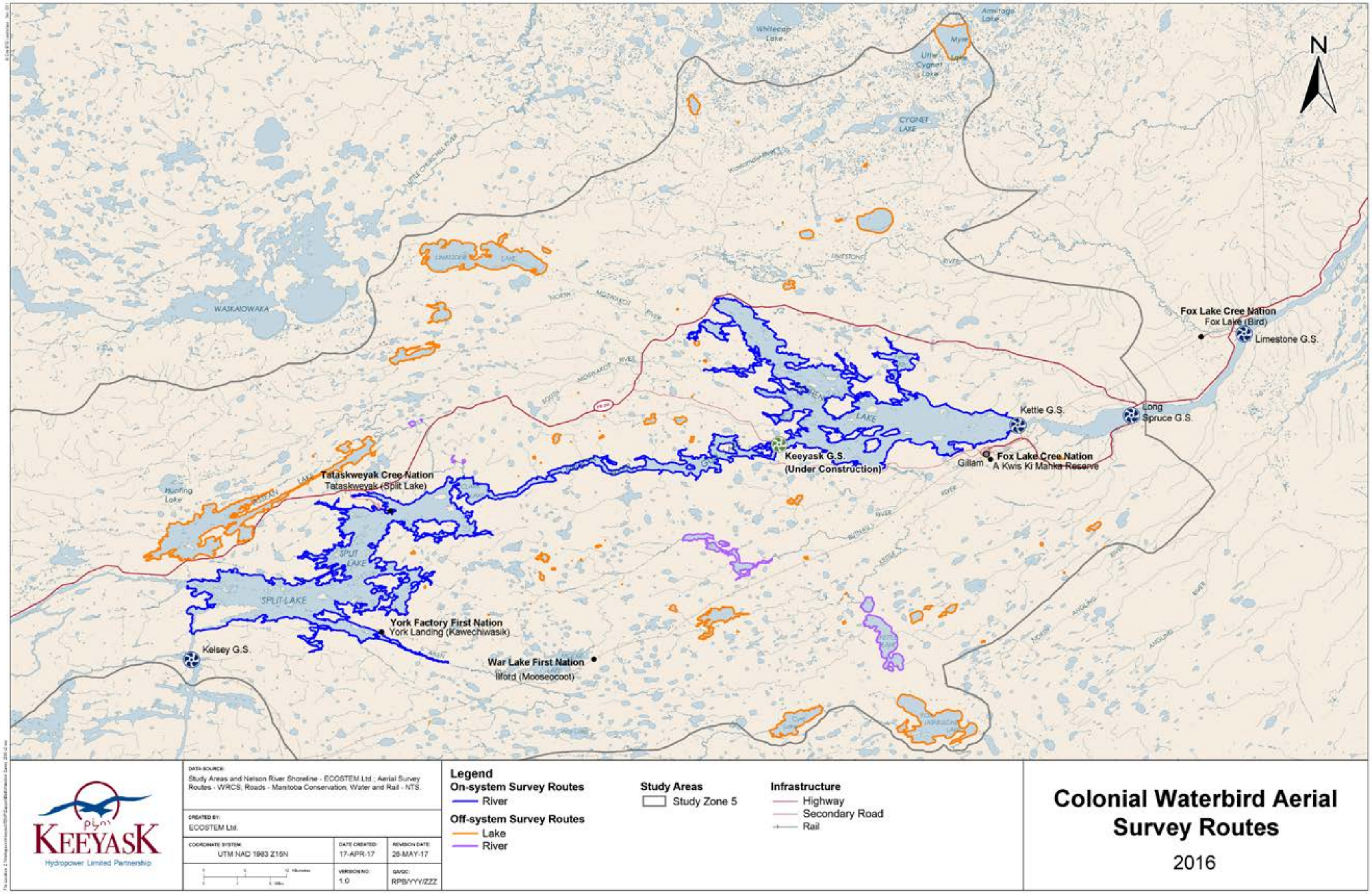
Daily flights were conducted when wind speeds were below 25 km/h and when rain or fog did not restrict observers' ability to count birds. The survey was flown at approximately 100 km/h, at elevations no less than 150 m agl, and at distances no closer than 300 m to minimize disturbance to waterbird colonies and avoid collisions with flying birds.

The aerial survey crew consisted of three observers and the helicopter pilot. The primary observer was seated in the front left seat and was responsible for preliminary counts of colonial waterbirds observed during the survey. The secondary observer, seated in the rear left seat, was responsible for recording observations and photographing congregations using a Nikon Coolpix Aw130, 16.0 megapixel camera. The assistant, seated in the right rear seat, counted all colonial waterbirds and incidental observations inland. The helicopter followed a shoreline transect with open water on the left and terrestrial habitat on the right. When colonial waterbirds were spotted on rocky reefs in open water areas, the helicopter departed from the shoreline transect to investigate.

During the survey, numbers of waterbirds at all colony and loafing sites (Photo 2-2), and all dispersed waterbirds were recorded along with their locations. Dispersed birds were single birds and flocks of waterbirds in flight. Congregated birds were groups of birds that showed no indication of nesting (*i.e.,* nests). A group of birds was considered a colony when there were at least two breeding pairs present and signs of nesting. When a congregation of waterbirds was observed, the helicopter slowed and circled the site briefly for survey personnel to photograph and count individuals and nests. Preliminary abundance estimates were made by counting all nests and individuals. In-flight counts and photography were conducted quickly to minimize disturbing birds. All observations were georeferenced with a Garmin GPS 64. Notes on the terrestrial habitat of congregation sites were recorded and island size (ha) was determined from remotely-sensed data. Island sizes were classified as <0.1 ha, 0.1-0.9 ha, 1.0-1.9 ha, 2.0-2.9, 3.0-3.9 ha, and >4.0 ha.

Although small congregations of colonial waterbirds were easily counted by eye, final abundance estimates were determined through interpretation of the in-flight photographs. Photographs were analysed in Microsoft Paint to permit mark-up of the photo to facilitate the counting of adults sitting tight with no nest visible, birds flying, standing or swimming, and occupied and unoccupied nests in the photographs. Evidence of nesting included presence of visible nests, adults sitting tight, or chicks. Adults sitting tight are likely to be sitting on a nest, but may otherwise be loafing. On a few occasions the in-flight photographs were of insufficient quality for birds to be counted, thus preliminary observer counts were included in lieu of photographic data in the final abundance estimates.

Photo 2-2: Ring-billed Gulls Loafing on an Island in Split Lake, July 13, 2016.



Map 2-2: Colonial Waterbird Helicopter Survey Routes and Waterbody Classification

3.0 RESULTS

3.1 UNMANNED AERIAL VEHICLE SURVEY

Ring-billed gulls were common in the Gull Rapids area during the survey periods compared to other species. Notably, two islands – Wpt 226 and Wpt 225, supported the majority of adults (75% during the July 20-21 survey period), nests (78% during June 3-4), and chicks (85% during July 20-21) in the area (Appendix 1; Map 3-1). An increase in the number of ring-billed gulls at Gull Rapids was observed from June 3-4 to July 20-21. The greatest survey count in 2016 (5,092 ring-billed gulls) was observed on the afternoons of July 20-21 (Table 3-1). The presence of ring-billed gulls varied in the morning and afternoon and relatively large standard deviations of abundance were observed. Ring-billed gull nests were observed on six of the islands surveyed (Map 3-2), and up to 851 nests were observed on June 3-4. Ring-billed gull chicks were observed on six of the islands surveyed (Map 3-3). A relatively small number of ring-billed gull chicks were observed on June 27 (23 chicks), and peaked on July 20-21, when up to 1,774 chicks were observed (Table 3-1).

Common terns were relatively uncommon in the Gull Rapids area compared to other species. Common terns were observed on three islands (Map 3-1). The greatest numbers of common terns observed in the Gull Rapids area was 138, observed on the afternoon of June 27 (Table 3-1). The majority of common terns (87%) were observed on June 27, and all 10 common tern nests were located on one island, Wpt 224 (Map 3-2).

Herring gulls were also relatively uncommon in the Gull Rapids area compared to ring-billed gulls. Herring gulls were observed on five of the islands surveyed (Map 3-1). The greatest number of herring gulls observed in the Gull Rapids area was 11, which occurred during the survey period from July 20-21 (Table 3-1). Herring gull nests were observed on five of the surveyed islands (Map 3-2), and up to 19 nests were observed during the June 3-4 survey period (Table 3-1). Herring gull chicks were observed on three islands (Map 3-3). Up to four herring gull chicks were observed on June 27.

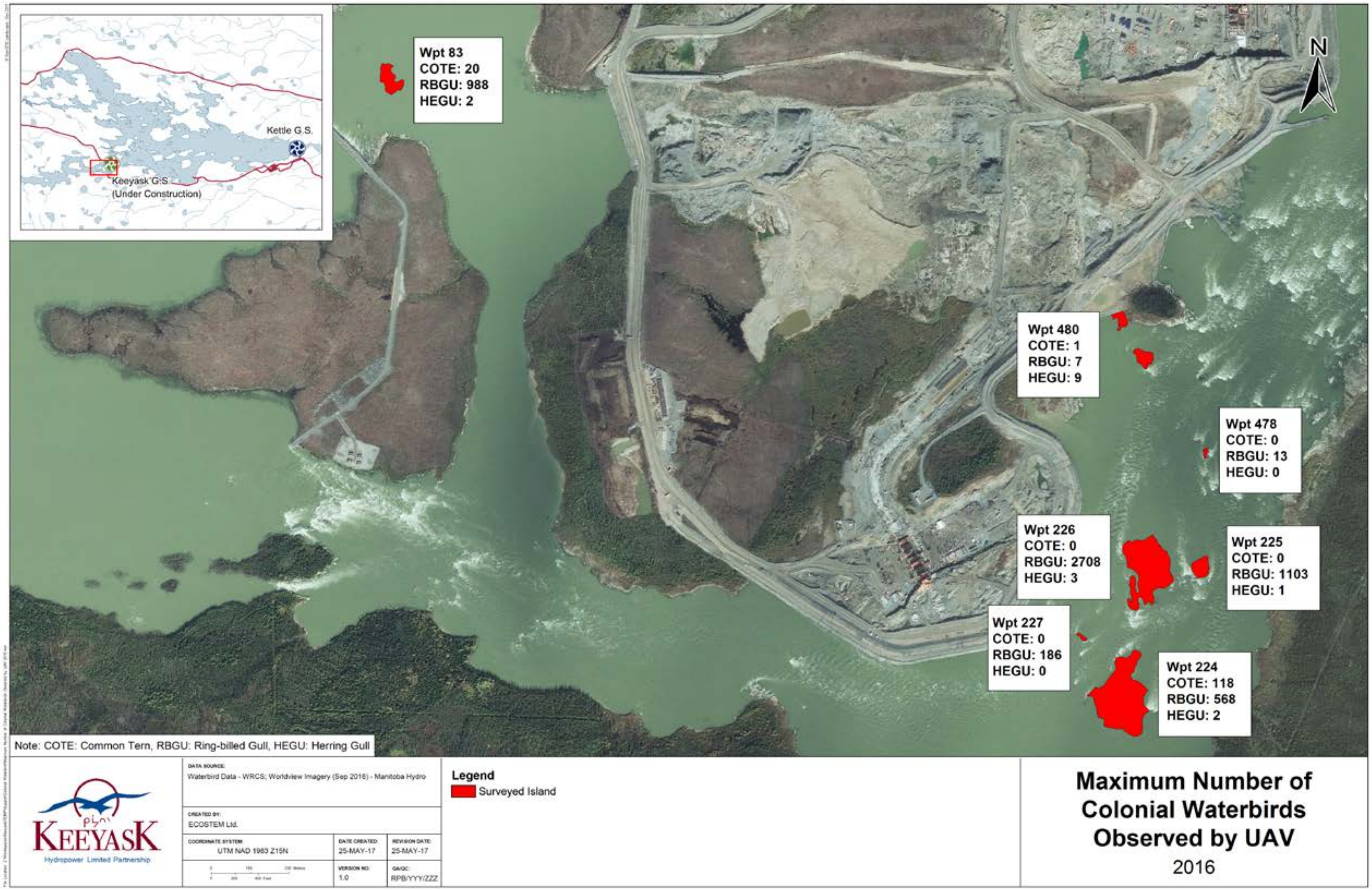
Based on the greatest number of nests and chicks observed, the average number of chicks produced per nest was 2.1 and 0.2 for ring-billed gulls and herring gulls, respectively. The average number of chicks produced per nest could not be calculated for common terns due to a lack of chick observations.

The maximum number of ring-billed gulls observed in the 2016 survey, 5,092, was similar to the maximum number of gulls (ring-billed and herring gulls combined) observed in 2015, 4,976. The number of ring-billed gulls and herring gulls was combined in 2015 due to the difficulty in distinguishing between species due to lower resolution UAV photographs.

Gull numbers were also similar on select islands between 2015 and 2016. Islands that supported relatively large numbers of gulls, including Wpt 226, Wpt 224, and 225, which had a maximum of 2,708, 586, and 1,103 ring-billed gulls respectively in 2016, supported 2,759, 1,200, and 930 gulls, respectively in 2015.

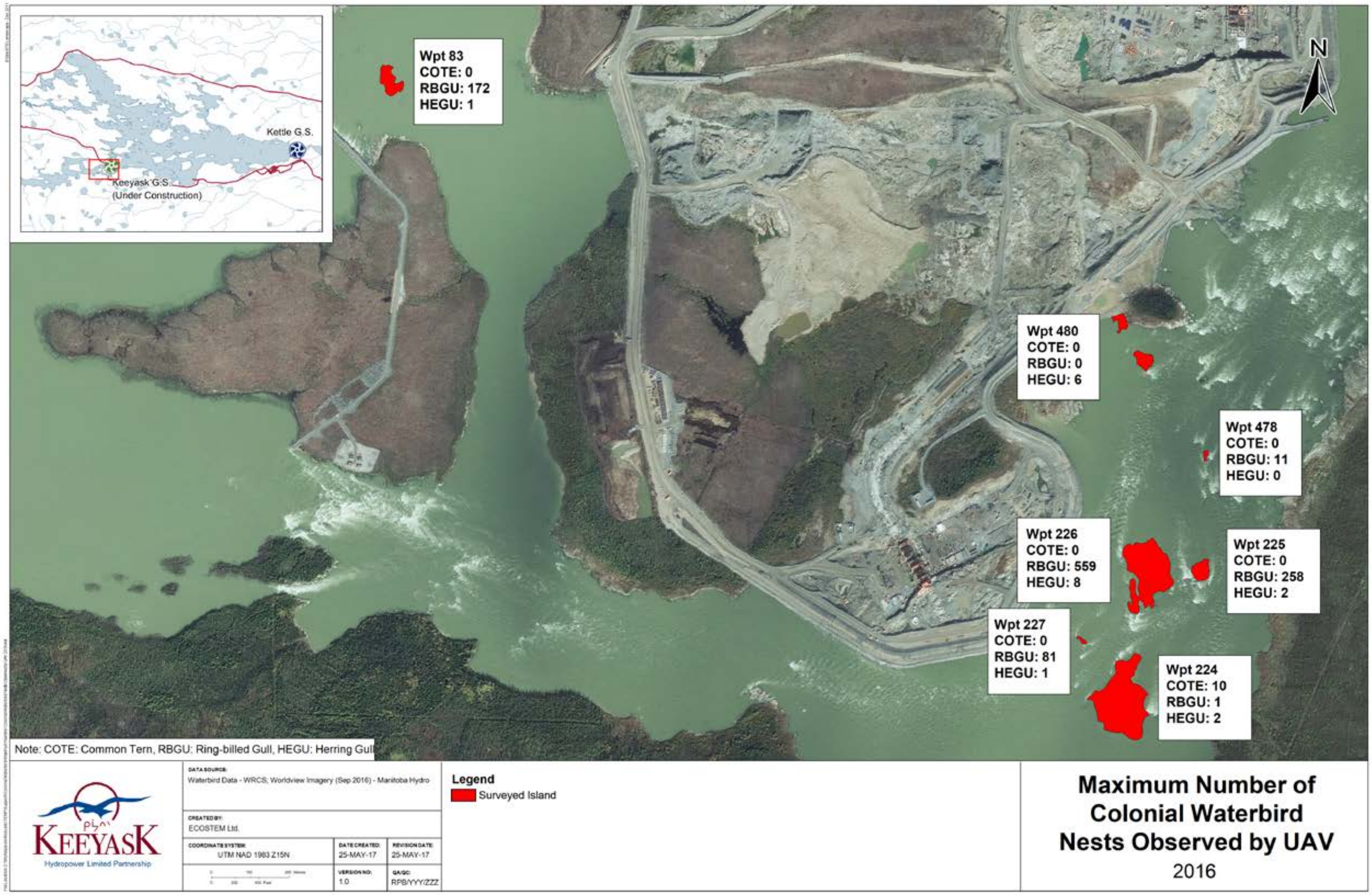
Table 3-1: Maximum Number (Standard Deviation) of Colonial Waterbirds, Nests, and Chicks Observed in the Morning/Afternoon on Islands in the Gull Rapids Area in 2016 for Each Survey Period

Observation	June 3-4	June 27	July 20-21
Ring-billed Gull	4,291 (1,771)	4,730 (412)	5,092 (682)
Ring-billed Gull Chick	0 (0)	52 (18)	1,774 (176)
Ring-billed Gull Nest	851 (42)	759 (19)	0 (0)
Common Tern	47 (4)	138 (69)	25 (4)
Common Tern Nest	0 (0)	10 (7)	0 (0)
Herring Gull	8 (3)	10 (0)	11 (7)
Herring Gull Chick	0 (0)	4 (1)	1 (1)
Herring Gull Nest	19 (4)	8 (3)	0 (0)



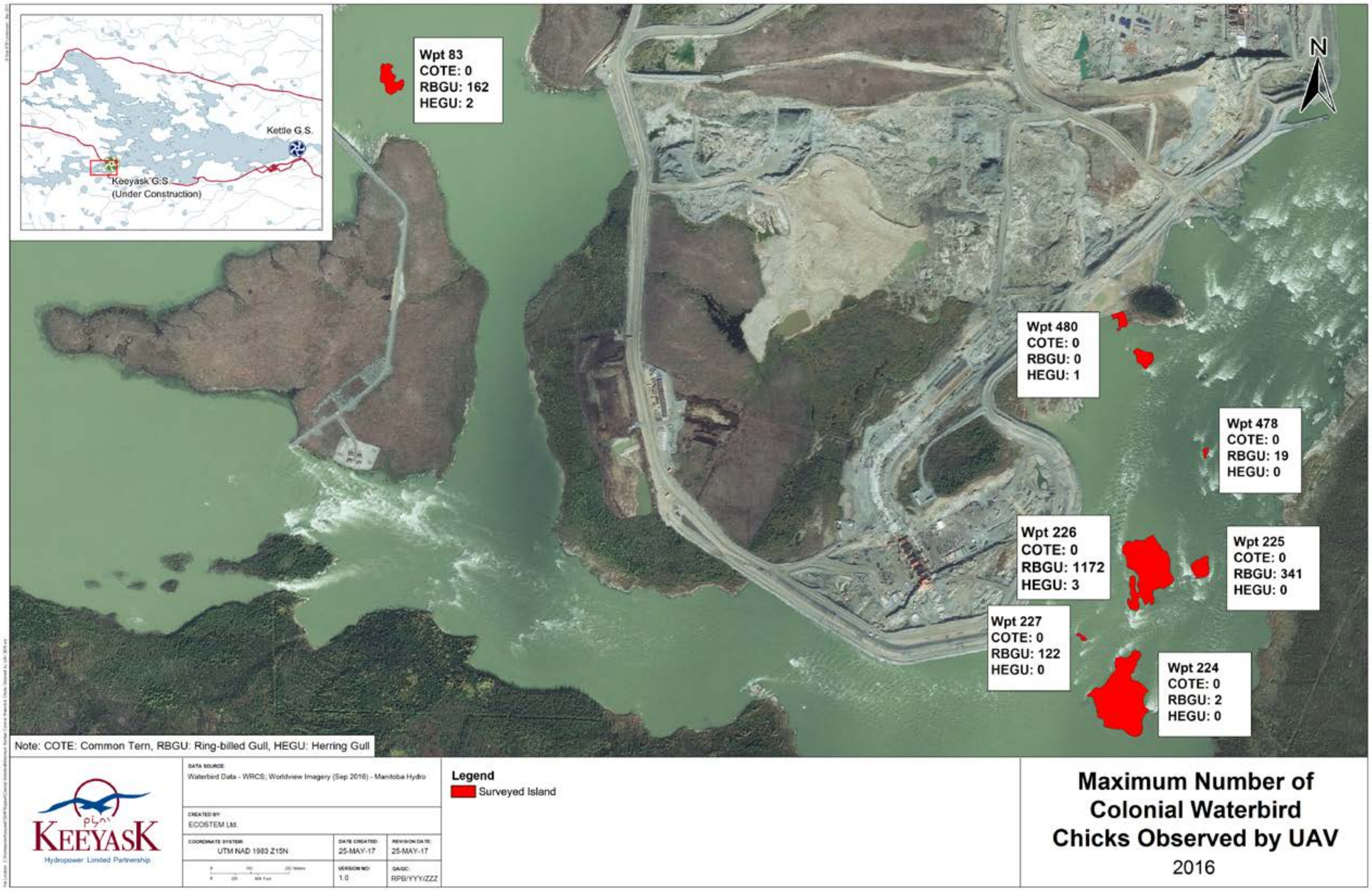
Note: the maximum number of colonial waterbirds was selected from pooled data from all survey periods (June 3-4, June 27, July 20-21) and morning/afternoon periods

Map 3-1: Maximum Number of Colonial Waterbirds Observed on Each Island by the UAV in Gull Rapids in 2016



Note: the maximum number of colonial waterbird nests was selected from pooled data from all survey periods (June 3-4, June 27, July 20-21) and morning/afternoon periods

Map 3-2: Maximum Number of Colonial Waterbird Nests Observed on Each Island by the UAV in Gull Rapids in 2016



Note: the maximum number of colonial waterbird chicks was selected from pooled data from all survey periods (June 3-4, June 27, July 20-21) and morning/afternoon periods.

Map 3-3: Maximum Number of Colonial Waterbird Chicks Observed on Each Island by the UAV in Gull Rapids in 2016.

3.2 HELICOPTER SURVEY

Six species of colonial waterbirds were observed during the 2016 helicopter surveys. During both helicopter surveys, ring-billed gulls were the most abundant colonial waterbird, with common terns being the second most abundant. Bonaparte's gull, herring gull, American white pelican, and black tern were less abundant (Table 3-2).

Table 3-2: Colonial Waterbird Abundance Observed During Helicopter Surveys 2016

Species	June			July		
	Congregated Birds	**Dispersed Birds**	**Total**	**Congregated Birds**	**Dispersed Birds**	**Total**
Ring-billed Gull	5,217	359	5,576	12,087	1,229	13,316
Common Tern	861	54	915	579	218	797
Bonaparte's Gull	55	44	99	58	62	120
Herring Gull	67	5	72	42	3	45
American White Pelican	0	52	52	0	343	343
Black Tern	0	0	0	0	8	8

3.2.1 RING-BILLED GULL

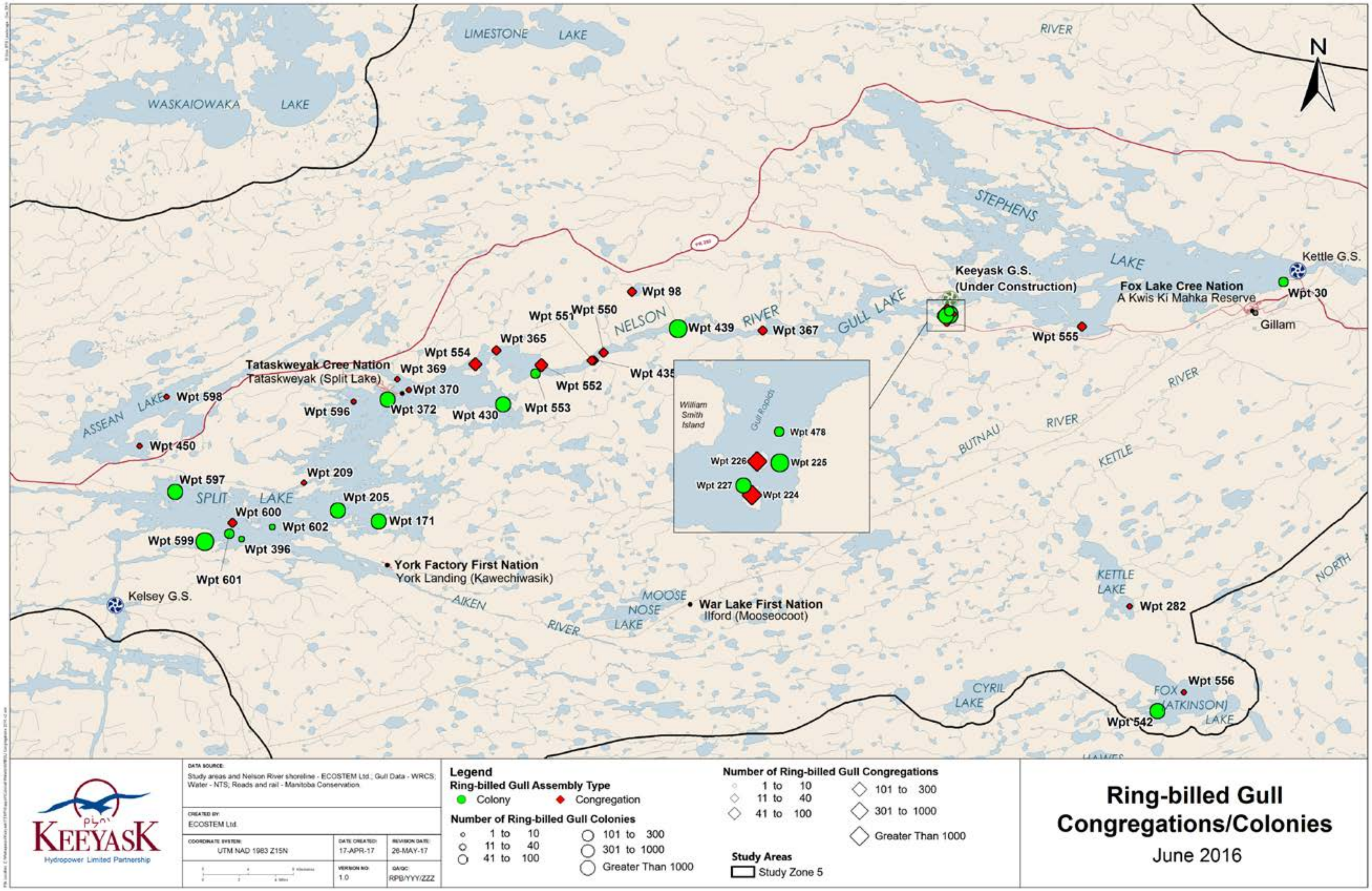
Ring-billed gulls were the most common species of colonial waterbird observed in 2016. The total number of ring-billed gulls more than doubled from June to July (Table 3-2). In June, ring-billed gulls were observed congregating at 20 sites and nesting at 16 sites (Map 3-1). In July, ring-billed gulls were observed congregating at 47 sites and nesting at seven sites (Table 3-2; Map 3-2). The largest concentrations of ring-billed gulls occurred on islands in Gull Rapids, where up to 2,048 birds were observed in a single congregation. The congregations and colonies at Gull Rapids consisted of 56% and 28% of all ring-billed observations from June and July, respectively (Table 3-3).

Ring-billed gull nests or probable nests were observed at 18 unique sites in the study area in June and July 2016 (Map 3-1; Map 3-2). The majority of nesting sites (11) were located within Split Lake and four were concentrated within Gull Rapids. Individual colonies were also observed in the Nelson River, Stephens Lake, and Atkinson Lake.

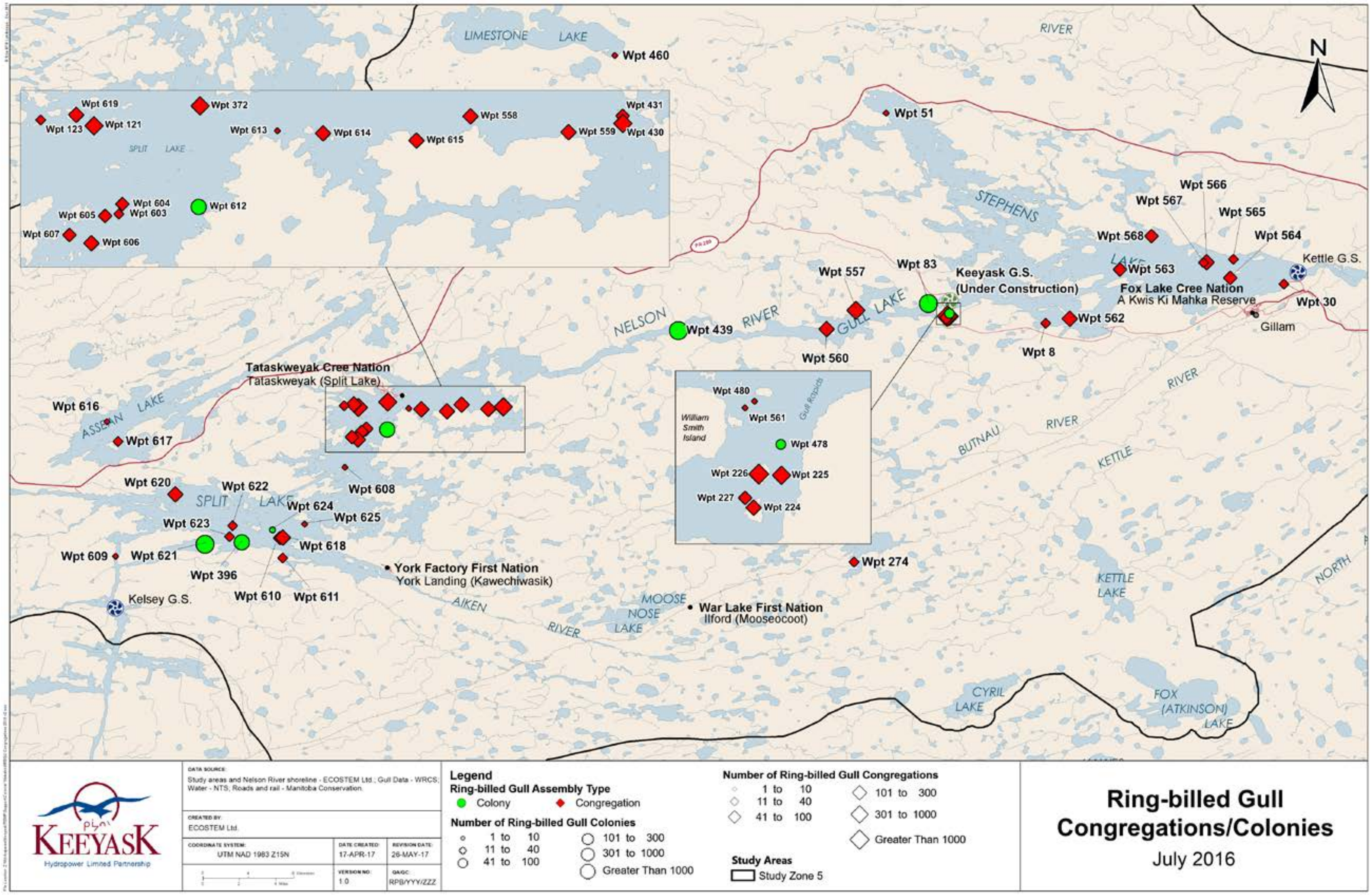
In June, 15 (42%) islands where ring-billed gulls were observed in 2016 were not used by any species of colonial waterbird in 2015 (Table 3-4). In July, the number of islands where ring-billed gulls were observed in 2016 that were not used by colonial waterbirds in 2015 increased to 34 (63%) islands (Table 3-4).

Hatch-year birds were observed at four colonies in 2016. Two sites containing hatch-year birds were located in Gull Rapids and the other two were located in Split Lake.

All but one congregation/colony were observed on islands. A single congregation of ring-billed gulls was observed along the shoreline in June in an unnamed, off-system lake. Most of the islands used consisted of exposed bedrock or boulders, <0.1 ha or 0.1-0.9 ha in size, within on-system rivers (Table 3-4). Several sand/gravel bars also supported congregations of ring-billed gulls.



Map 3-4: Ring-billed Gull Colonies and Congregations Observed During Helicopter Surveys in June 2016



Map 3-5: Ring-billed Gull Colonies and Congregations Observed During Helicopter Surveys in July 2016

Table 3-3: Ring-billed Gull Congregations / Colonies Observed During the Helicopter Surveys in 2016

Waypoint	June						July					
	Unoccupied Nests	Occupied Nests	Birds Sitting Tight (Probable Nest)	Adults (No Nest)	Total Adults	Total Chicks	Unoccupied Nests	Occupied Nests	Birds Sitting Tight (Probable Nest)	Adults (No Nest)	Total Adults	Total Chicks
439	0	49	154	124	327	0	0	0	87	376	463	0
550	0	0	0	14	14	0	0	0	0	0	0	0
435	0	0	0	12	12*	0	0	0	0	0	0	0
551	0	0	0	25	*	0	0	0	0	0	0	0
552	0	0	0	44	44	0	0	0	0	0	0	0
553	0	0	2	33	35	0	0	0	0	0	0	0
365	0	0	0	20	20*	0	0	0	0	0	0	0
554	0	0	0	52	52†	0	0	0	0	0	0	0
369	0	0	0	5	5*	0	0	0	0	0	0	0
370	0	0	0	1	1	0	0	0	0	0	0	0
372	0	14	62	37	113*	0	0	0	0	393	393†	0
121	0	0	0	0	†	0	0	0	0	425	425	0
596	0	0	0	2	2	0	0	0	0	201	201	0
123	0	0	0	0	*	0	0	0	0	20	20	0
209	0	0	0	6	6	0	0	0	0	0	0	0
597	0	45	30	35	110	0	0	0	0	132	132	0
367	0	0	0	17	17	0	0	0	0	0	0	0
98	0	0	0	16	16	0	0	0	0	0	0	0
598	0	0	0	5	5	0	0	0	0	0	0	0
450	0	0	0	5	5	0	0	0	0	0	0	0
599	0	6	247	94	347*	0	0	0	47	472	519*	0
600	0	0	0	36	36	0	0	0	0	19	19	0
601	0	3	3	6	12†	0	0	0	0	17	17†	0

Waypoint	June						July					
	Unoccupied Nests	Occupied Nests	Birds Sitting Tight (Probable Nest)	Adults (No Nest)	Total Adults	Total Chicks	Unoccupied Nests	Occupied Nests	Birds Sitting Tight (Probable Nest)	Adults (No Nest)	Total Adults	Total Chicks
396	0	3	5	2	10*†	0	0	0	30	75	105*†	0
602	1	4	0	5	9	0	3	1	1	6	8	0
614	0	0	0	0	†	0	0	0	0	0	5*†	0
205	0	27	145	48	220	0	0	0	0	0	0	0
171	0	38	46	39	123	0	0	0	0	0	0	0
430	0	26	66	72	164	0	0	0	0	925	925	0
51	0	0	0	0	†	0	0	0	0	7	7	0
30	0	3	0	13	16	0	0	0	0	25	25	0
555	0	0	0	0	13	0	0	0	0	0	0	0
274	0	0	0	0	0	0	0	0	0	14	14	0
224	0	0	0	0	1179	0	0	0	0	234	234	0
225	0	23	413	27	463	0	0	0	0	739	729	0
226	0	0	0	1323	1323	0	0	0	0	2048	2048	0
227	0	45	53	32	130	0	0	0	0	100	100	71
478	1	10	0	4	14	0	4	0	0	14	14	2
542	0	1	76	88	165	0	0	0	0	0	0	0
556	0	0	0	10	10	0	0	0	0	0	*	0
282	0	0	0	4	4	0	0	0	0	0	0	0
557	0	0	0	0	0	0	0	0	0	408	408	0
603	0	0	0	0	0	0	0	0	0	34	34	7
604	0	0	0	0	0	0	0	0	0	54	54	0
605	0	0	0	0	0	0	0	0	0	51	51	0
606	0	0	0	0	0	0	0	0	0	145	145†	0
607	0	0	0	0	0	0	0	0	0	82	82†	0

Waypoint	June						July					
	Unoccupied Nests	Occupied Nests	Birds Sitting Tight (Probable Nest)	Adults (No Nest)	Total Adults	Total Chicks	Unoccupied Nests	Occupied Nests	Birds Sitting Tight (Probable Nest)	Adults (No Nest)	Total Adults	Total Chicks
608	0	0	0	0	0	0	0	0	0	6	6†	0
609	0	0	0	0	0	0	0	0	0	0	5	0
610	0	0	0	0	0	0	0	0	0	67	67	0
611	0	0	0	0	0	0	0	0	0	40	40	0
396	0	0	0	0	0	0	0	0	11	217	228	51
613	0	0	0	0	0	0	0	0	0	10	10	0
614	0	0	0	0	0	0	0	0	0	206	206	0
615	0	0	0	0	0	0	0	0	0	120	120	0
558	0	0	0	0	0	0	0	0	0	217	217	0
559	0	0	0	0	0	0	0	0	0	206	206	0
431	0	0	0	0	0	0	0	0	0	88	88*	0
560	0	0	0	0	0	0	0	0	0	137	137	0
480	0	0	0	0	0	0	0	0	0	10	10	0
561	0	0	0	0	0	0	0	0	0	5	5	0
616	0	0	0	0	0	0	0	0	0	10	10	0
367	0	0	0	0	0	0	0	0	0	21	21	0
460	0	0	0	0	0	0	0	0	0	2	2†	0
8	0	0	0	0	0	0	0	0	0	38	38	0
562	0	0	0	0	0	0	0	0	0	180	180	0
563	0	0	0	0	0	0	0	0	0	46	46	0
564	0	0	0	0	0	0	0	0	0	74	74	0
565	0	0	0	0	0	0	0	0	0	34	34	0
566	0	0	0	0	0	0	0	0	0	139	139	0
567	0	0	0	0	0	0	0	0	0	29	29	0

Waypoint	June						July					
	Unoccupied Nests	Occupied Nests	Birds Sitting Tight (Probable Nest)	Adults (No Nest)	Total Adults	Total Chicks	Unoccupied Nests	Occupied Nests	Birds Sitting Tight (Probable Nest)	Adults (No Nest)	Total Adults	Total Chicks
568	0	0	0	0	0	0	0	0	0	70	70	0
618	0	0	0	0	0	0	0	0	0	120	120	0
83	0	0	0	0	0	0	0	0	284	280	564	0
Total	2	297	1302	2256	5,022	0	7	1	460	9388	9,849	131

*Common terns also present

†Herring gulls also present

Table 3-4: Waterbody Classification and Island Use by Ring-billed Gulls in 2016

Waypoint	Month	System	Waterbody Type	Waterbody Size Class (ha)	Island Habitat	Island Size Class (ha)	Used in 2015?
30	June	On-system	River	>1000	70% tree/shrub, 30% sand/gravel	3.0-3.9	Yes
98	June	Off-system	Lake	100-100	Burned black spruce forest	NA	Yes
171	June	On-system	River	>1000	Exposed bedrock	<0.1	Yes
205	June	On-system	River	>1000	Exposed bedrock	<0.1	Yes
209	June	On-system	River	>1000	Exposed bedrock	<0.1	Yes
224	June	On-system	River	>1000	Exposed bedrock	1.0-1.9	Yes
225	June	On-system	River	>1000	Exposed bedrock	0.1-0.9	Yes
226	June	On-system	River	>1000	Exposed bedrock	1.0-1.9	Yes
227	June	On-system	River	>1000	Exposed bedrock	<0.1	Yes
282	June	Off-system	Lake	>1000	Boulders, 5% grass	0.1-0.9	Yes
365	June	On-system	River	>1000	Boulders	<0.1	Yes
367	June	On-system	River	>1000	Exposed bedrock	<0.1	Yes
369	June	On-system	River	>1000	Boulders	<0.1	Yes
370	June	On-system	River	>1000	Exposed bedrock	0.1-0.9	Yes
372	June	On-system	River	>1000	Exposed bedrock	0.1-0.9	Yes
396	June	On-system	River	>1000	Exposed bedrock, 1% grass	0.1-0.9	Yes
430	June	On-system	River	>1000	Exposed bedrock	0.1-0.9	Yes
435	June	On-system	River	>1000	Exposed bedrock	<0.1	Yes
439	June	On-system	River	>1000	50% bare rock, 50% grass	0.1-0.9	Yes
450	June	Off-system	Lake	>1000	Exposed bedrock, 60% shrub	0.1-0.9	Yes

Waypoint	Month	System	Waterbody Type	Waterbody Size Class (ha)	Island Habitat	Island Size Class (ha)	Used in 2015?
478	June	On-system	River	>1000	Exposed bedrock	<0.1	Yes
542	June	Off-system	Lake	>1000	Boulders	0.1-0.9	No
550	June	On-system	River	>1000	Exposed bedrock	<0.1	No
551	June	On-system	River	>1000	Exposed bedrock	<0.1	No
552	June	On-system	River	>1000	Exposed bedrock	<0.1	No
553	June	On-system	River	>1000	Boulders	<0.1	No
554	June	On-system	River	>1000	Boulders	<0.1	No
555	June	On-system	River	>1000	80% tree/shrub, 20% sand/gravel	0.1-0.9	No
598	June	Off-system	Lake	>1000	Exposed bedrock	<0.1	No
599	June	On-system	River	>1000	Boulders	0.1-0.9	No
601	June	On-system	River	>1000	Boulders	0.1-0.9	No
617	June	Off-system	River	>1000	Boulders, 50% grass	0.1-0.9	No
619	June	On-system	River	>1000	Boulders	<0.1	No
620	June	On-system	River	>1000	Exposed bedrock	0.1-0.9	No
622	June	On-system	River	>1000	Boulders	0.1-0.9	No
624	June	On-system	River	>1000	Exposed bedrock	0.1-0.9	No
8	July	On-system	River	>1000	Sandbar	<0.1	Yes
30	July	On-system	River	>1000	70% tree/shrub, 30% sand/gravel	3.0-3.9	Yes
51	July	On-system	River	>1000	NA	NA	Yes
83	July	On-system	River	>1000	Exposed bedrock	0.1-0.9	Yes
121	July	On-system	River	>1000	NA	NA	Yes
123	July	On-system	River	>1000	NA	NA	Yes
224	July	On-system	River	>1000	Exposed bedrock	1.0-1.9	Yes
225	July	On-system	River	>1000	Exposed bedrock	0.1-0.9	Yes

Waypoint	Month	System	Waterbody Type	Waterbody Size Class (ha)	Island Habitat	Island Size Class (ha)	Used in 2015?
226	July	On-system	River	>1000	Exposed bedrock	1.0-1.9	Yes
227	July	On-system	River	>1000	Exposed bedrock	<0.1	Yes
274	July	Off-system	Lake	>1000	NA	NA	Yes
367	July	Off-system	Lake	>1000	Exposed bedrock	<0.1	Yes
372	July	On-system	River	>1000	Exposed bedrock	0.1-0.9	Yes
396	July	On-system	River	>1000	Exposed bedrock	0.1-0.9	Yes
430	July	On-system	River	>1000	Exposed bedrock	0.1-0.9	Yes
431	July	On-system	River	>1000	Exposed bedrock	0.1-0.9	Yes
439	July	On-system	River	>1000	50% bare rock, 50% grass	0.1-0.9	Yes
460	July	Off-system	Lake	>1000	Sandbar	0.1-0.9	Yes
478	July	On-system	River	>1000	Exposed bedrock	<0.1	Yes
480	July	On-system	River	>1000	Exposed bedrock	1.0-1.9	Yes
557	July	On-system	River	>1000	Burned island	>4.0	No
558	July	On-system	River	>1000	Exposed bedrock	<0.1	No
559	July	On-system	River	>1000	Boulders/gravel	0.1-0.9	No
560	July	On-system	River	>1000	Cleared island	>4.0	No
561	July	On-system	River	>1000	Exposed bedrock	1.0-1.9	No
562	July	On-system	River	>1000	Sandbar	0.1-0.9	No
563	July	On-system	River	>1000	Gravel	<0.1	No
564	July	On-system	River	>1000	50% gravel, 50%treed	0.1-0.9	No
565	July	On-system	River	>1000	Sandbar	1.0-1.9	No
566	July	On-system	River	>1000	Gravel	0.1-0.9	No
567	July	On-system	River	>1000	Gravel	<0.1	No
568	July	On-system	River	>1000	Exposed bedrock	0.1-0.9	No
596	July	On-system	River	>1000	NA	NA	No
597	July	On-system	River	>1000	NA	NA	No
600	July	On-system	River	>1000	Exposed bedrock	0.1-0.9	No
602	July	On-system	River	>1000	Exposed bedrock	0.1-0.9	No
603	July	On-system	River	>1000	Exposed bedrock	<0.1	No
604	July	On-system	River	>1000	Exposed bedrock	<0.1	No
605	July	On-system	River	>1000	Exposed bedrock	<0.1	No
606	July	On-system	River	>1000	Exposed bedrock	<0.1	No
607	July	On-system	River	>1000	Exposed bedrock	<0.1	No
608	July	On-system	River	>1000	Exposed bedrock	<0.1	No
609	July	On-system	River	>1000	Boulders	<0.1	No
610	July	On-system	River	>1000	Exposed bedrock	0.1-0.9	No
611	July	On-system	River	>1000	Exposed bedrock	<0.1	No
612	July	On-system	River	>1000	Exposed bedrock	<0.1	No
613	July	On-system	River	>1000	Exposed bedrock	0.1-0.9	No

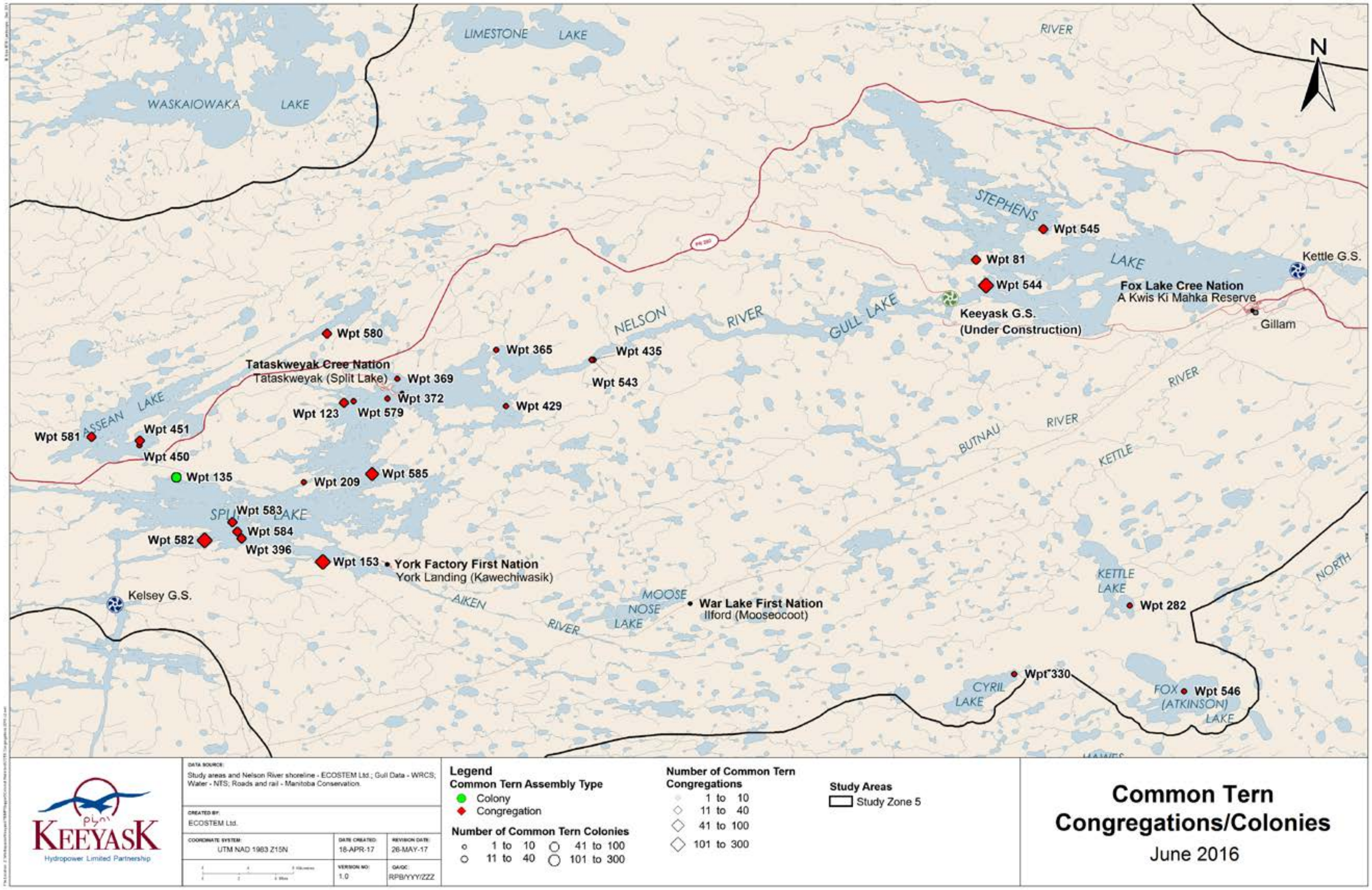
Waypoint	Month	System	Waterbody Type	Waterbody Size Class (ha)	Island Habitat	Island Size Class (ha)	Used in 2015?
614	July	On-system	River	>1000	Exposed bedrock	<0.1	No
615	July	On-system	River	>1000	Exposed bedrock	<0.1	No
616	July	Off-system	Lake	>1000	Exposed bedrock	0.1-0.9	No
618	July	On-system	River	>1000	Boulders/gravel	>4.0	No
621	July	On-system	River	>1000	Exposed bedrock	0.1-0.9	No
623	July	On-system	River	>1000	NA	NA	No
625	July	On-system	River	>1000	Exposed bedrock	0.1-0.9	No

3.2.2 COMMON TERN

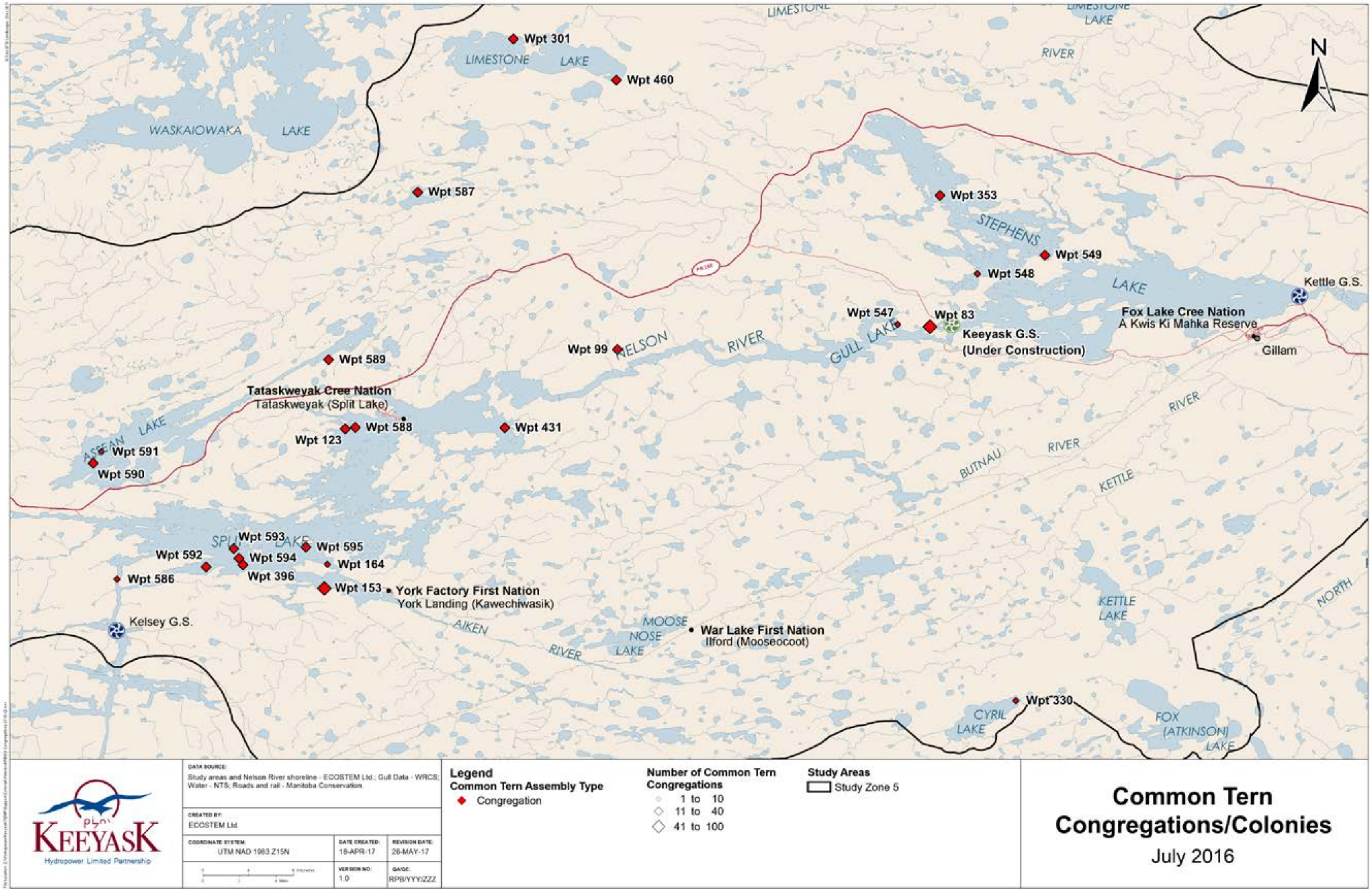
Common terns were the second most common species of colonial waterbird observed in 2016 (Table 3-2). The total number of common terns counted decreased slightly from June (915) to July (797). The number of congregated birds decreased from June to July, while the number of dispersed birds increased. In June, common terns were observed congregating at 25 sites and nesting at a single site (Table 3-5; Map 3-3). In July, 24 common tern congregations were observed and no colonies were observed (Map 3-4). The largest concentration of common terns was observed on an island downstream of Gull Rapids. The majority of other, large congregations of common tern were observed on Split Lake, as well as the one colony observed. A single, relatively large, congregation of common terns were observed at Gull Rapids in 2016, in addition to the colony observed by the UAV survey (Table 3-5; Map 3-3).

In June, 12 (46%) islands where common terns were observed in 2016 were not used by any species of colonial waterbird in 2015 (Table 3-6). In July, the number of islands where common terns were observed in 2016 that were not used by any species of colonial waterbird in 2015 increased slightly to 12 (50%) islands (Table 3-6)

All congregations/colonies were observed on islands. Most of the islands used consisted of exposed bedrock, either <0.1 ha or 0.1-0.9 ha in size, within large, on-system rivers (Table 3-6). Several islands consisting of boulders or sand/gravel bars also supported congregations of common terns.



Map 3-6: Common Tern Colonies and Congregations Observed During Helicopter Surveys in June 2016



Map 3-7: Common Tern Colonies and Congregations Observed During Helicopter Surveys in July 2016

Table 3-5: Common Tern Congregations/Colonies Observed During the Helicopter Surveys in 2016

Waypoint	June						July					
	Unoccupied Nests	Occupied Nest	Birds Sitting Tight (Probable Nest)	Adults (No Nest)	Total Adults	Total Chicks	Unoccupied Nests	Occupied Nest	Birds Sitting Tight (Probable Nest)	Adults (No Nest)	Total Adults	Total Chicks
435	0	0	0	3	3	0	0	0	0	0	0	0
543	0	0	0	8	8	0	0	0	0	0	0	0
365	0	0	0	5	5*	0	0	0	0	0	0	0
99	0	0	0	0	0	0	0	0	0	11	11	0
369	0	0	0	3	3*	0	0	0	0	0	0	0
372	0	0	0	3	3	0	0	0	0	0	†	0
588	0	1	0	6	7	0	0	0	0	40	40	0
123	0	0	0	45	45	0	0	0	0	20	20*	0
209	0	0	0	1	1*	0	0	0	0	0	0	0
135	0	11	13	13	37	0	0	0	0	0	0	0
589	0	0	0	16	16	0	0	0	0	11	11	0
450	0	0	0	4	4*†	0	0	0	0	0	0	0
586	0	0	0	27	27	0	0	0	0	10	10*	0
590	0	0	0	40	40	0	0	0	0	13	13	0
591	0	0	0	0	†	0	0	0	0	5	5	0
592	0	0	0	113	113	0	0	0	0	30	30	0
593	0	0	0	20	20*	0	0	0	0	15	15*	0
396	0	0	0	26	26*†	0	0	0	1	21	22*†	0
594	0	0	0	36	36	0	0	0	0	30	30	0
595	0	0	0	0	†	0	0	0	0	25	25*†	0
153	0	0	0	132	132	0	0	0	0	45	45	0
585	0	0	0	44	44	0	0	0	0	0	0	0
429	0	0	0	0	2†	0	0	0	0	0	0	0

Waypoint	June						July					
	Unoccupied Nests	Occupied Nest	Birds Sitting Tight (Probable Nest)	Adults (No Nest)	Total Adults	Total Chicks	Unoccupied Nests	Occupied Nest	Birds Sitting Tight (Probable Nest)	Adults (No Nest)	Total Adults	Total Chicks
544	0	0	0	193	193	0	0	0	0	0	0	0
81	0	0	0	11	11	0	0	0	0	0	0	0
353	0	0	0	0	†	0	0	0	0	30	30†	0
549	0	0	0	19	19	0	0	0	0	30	30	0
330	0	0	0	1	1†	0	0	1	0	4	5	0
546	0	0	0	6	6	0	0	0	0	0	0	0
282	0	0	0	6	6*	0	0	0	0	0	0	0
83	0	0	0	0	0	0	0	0	0	100	100*	0
164	0	0	0	0	0	0	0	0	0	9	9	0
431	0	0	0	0	0	0	0	0	0	25	25*	0
587	0	0	0	0	0	0	0	0	0	25	25	0
460	0	0	0	0	0	0	0	0	0	13	13*	0
301	0	0	0	0	0	0	0	0	0	17	17	0
547	0	0	0	0	0	0	0	0	0	2	2	0
548	0	0	0	0	0	0	0	0	0	2	2	0
Total	0	12	13	781	808	0	0	1	1	533	535	0

*Ring-billed gulls also present

†Herring gulls also present

Table 3-6: Waterbody Classification and Island Use by Common Terns in 2016

Waypoint	Month	System	Waterbody Type	Waterbody Size Class (ha)	Island Habitat	Island Size Class (ha)	Used in 2015?
81	June	On-system	River	>1000	100% grass	0.1-0.9	Yes
123	June	On-system	River	>1000	Exposed bedrock	<0.1	Yes
135	June	On-system	River	>1000	Exposed bedrock	<0.1	Yes
153	June	On-system	River	>1000	Exposed bedrock	<0.1	Yes
209	June	On-system	River	>1000	Exposed bedrock	<0.1	Yes
282	June	On-system	River	>1000	Boulders, 50% grass	0.1-0.9	Yes
330	June	On-system	River	>1000	Boulders	<0.1	Yes
365	June	On-system	River	>1000	Exposed bedrock	<0.1	Yes
369	June	On-system	River	>1000	Boulders	<0.1	Yes
372	June	On-system	River	>1000	Exposed bedrock	0.1-0.9	Yes
396	June	On-system	River	>1000	Exposed bedrock	0.1-0.9	Yes
429	June	On-system	River	>1000	NA	NA	Yes
435	June	On-system	River	>1000	Exposed bedrock	<0.1	Yes
450	June	On-system	River	>1000	Exposed bedrock, 60% shrub	0.1-0.9	Yes
543	June	On-system	River	>1000	Exposed bedrock	<0.1	No
544	June	On-system	River	>1000	Exposed bedrock	0.1-0.9	No
545	June	On-system	River	>1000	Sand and driftwood	<0.1	No
546	June	On-system	River	>1000	Boulders, 5% grass	0.1-0.9	No
579	June	On-system	River	>1000	Boulders	<0.1	No
580	June	On-system	River	>1000	Exposed bedrock	0.1-0.9	No
581	June	On-system	River	>1000	Boulders, 10% shrub	<0.1	No
582	June	On-system	River	>1000	Boulders	0.1-0.9	No
583	June	On-system	River	>1000	Boulders	0.1-0.9	No
584	June	On-system	River	>1000	Exposed bedrock, 1% grass	<0.1	No
585	June	On-system	River	>1000	Exposed bedrock	<0.1	No
586	June	On-system	River	>1000	Exposed bedrock, 60% shrub	0.1-0.9	No
83	July	On-system	River	>1000	Exposed bedrock	0.1-0.9	Yes
99	July	On-system	River	<1	Burned black spruce forest	NA	Yes
123	July	On-system	River	>1000	Exposed bedrock	<0.1	Yes
153	July	On-system	River	>1000	Exposed bedrock	<0.1	Yes
164	July	On-system	River	>1000	Exposed bedrock, 10% grass	<0.1	Yes
301	July	On-system	River	>1000	Boulders	<0.1	Yes
330	July	On-system	River	>1000	Boulders	<0.1	Yes
353	July	On-system	River	>1000	Cleared island	>4.0	Yes
396	July	On-system	River	>1000	Exposed bedrock	0.1-0.9	Yes
431	July	On-system	River	>1000	Exposed bedrock	0.1-0.9	Yes

Waypoint	Month	System	Waterbody Type	Waterbody Size Class (ha)	Island Habitat	Island Size Class (ha)	Used in 2015?
451	July	On-system	River	>1000	Boulders	<0.1	Yes
460	July	On-system	River	>1000	Sandbar	0.1-0.9	Yes
547	July	On-system	River	>1000	Tern platform	<0.1	No
548	July	On-system	River	>1000	Gravel	<0.1	No
549	July	On-system	River	>1000	Exposed bedrock	1.0-1.9	No
587	July	On-system	River	100-100	Exposed bedrock	<0.1	No
588	July	On-system	River	>1000	NA	NA	No
589	July	On-system	River	>1000	Exposed bedrock	0.1-0.9	No
590	July	On-system	River	>1000	Exposed bedrock	<0.1	No
591	July	On-system	River	>1000	Exposed bedrock	0.1-0.9	No
592	July	On-system	River	>1000	Exposed bedrock	0.1-0.9	No
593	July	On-system	River	>1000	Exposed bedrock	0.1-0.9	No
594	July	On-system	River	>1000	NA	NA	No
595	July	On-system	River	>1000	Exposed bedrock	<0.1	No

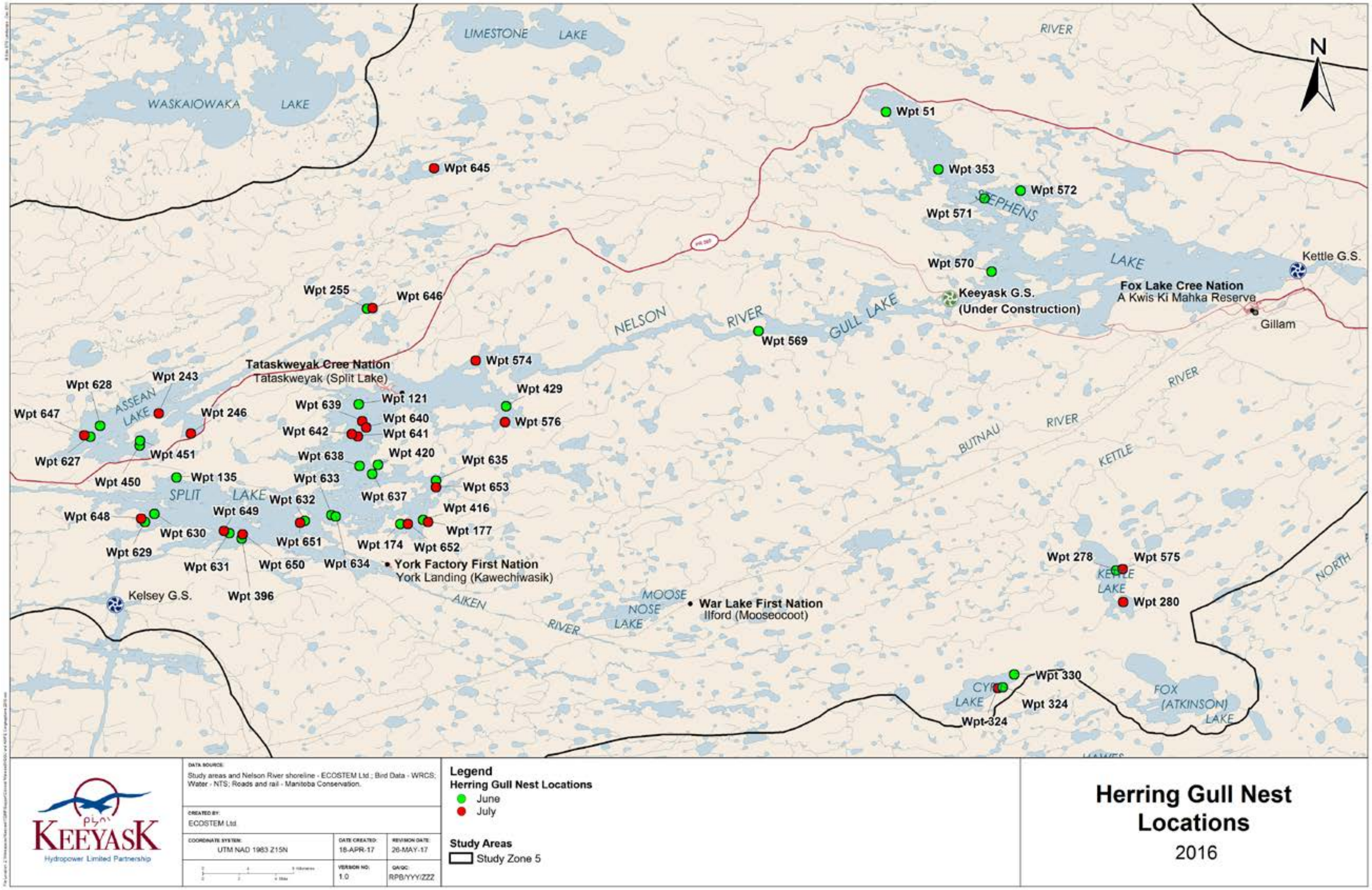
3.2.3 HERRING GULL

Relatively low numbers of herring gull were observed in the study area in 2016 compared to ring-billed gulls. A slight decrease of herring gulls was observed from June to July, mainly due to a decrease of congregated birds (Table 3-2).

Herring gulls nests or probable nests were observed at 42 sites in the study area (Table 3-7). The majority of these sites (22) were located within Split Lake. Numerous colonies were also observed within Assean Lake and the north arm of Stephens Lake (Map 3-5). All but three nesting sites were comprised of a single nest. At one site, two occupied nests were observed, another site contained three unoccupied nests, and one site contained two probable nesting birds (birds sitting tight).

In June, 12 (52%) islands where herring gulls were observed in 2016 were not used by any species of colonial waterbird in 2015 (Table 3-8). In July, the number of islands where herring gulls were observed in 2016 that were not used by colonial waterbirds in 2015 increased to 20 (75%) islands (Table 3-8).

All herring gull nests observed were located on islands. Most islands used consisted of exposed bedrock or boulders, <0.1 ha in size, within large, on-system rivers (Table 3-8). Two nests were located on sand/gravel bars.



Map 3-8: Herring Gull Nests Observed During Helicopter Surveys in 2016

Table 3-7: Herring Gulls and Nest Sites Observed During the Helicopter Surveys in 2016

Waypoint	June						July					
	Unoccupied Nests	Occupied Nests	Birds Sitting Tight (Probable Nest)	Adults (No Nest)	Total Adults	Total Chicks	Unoccupied Nests	Occupied Nests	Birds Sitting Tight (Probable Nest)	Adults (No Nest)	Total Adults	Total Chicks
569	1	0	0	0	1	0	0	0	0	0	0	0
554	0	0	0	0	0*	0	0	1	0	0	1	0
372	0	0	0	0	*†	0	1	0	0	1	1	1
121	0	1	0	1	2	0	0	0	0	0	0*	0
135	0	1	0	0	1†	0	0	0	0	0	0	0
255	0	1	0	0	1	0	1	0	0	0	1	0
246	0	0	0	0	0	0	0	1	0	1	2	0
450	0	1	0	0	1†	0	0	0	0	0	0	0
451	0	1	0	0	1	0	0	0	0	0	0	0
626	0	0	0	0	1	0	0	0	0	0	0	0
650	0	1	0	0	1	0	1	0	0	2	2	0
628	0	1	0	1	2	0	0	0	0	0	†	0
629	0	1	0	1	2	0	1	0	0	0	0	0
630	0	1	0	1	2	0	0	0	0	0	0	0
631	1	0	0	4	4*	0	1	0	0	1	1*	0
396	0	1	1	1	3*†	0	0	1	0	1	2*†	0
632	0	1	0	1	2	0	1	0	0	1	1*†	4
633	0	1	0	1	2	0	0	0	0	0	0	0
634	1	1	2	3	6	0	0	0	0	0	0	0
576	0	1	0	0	1	0	1	0	0	0	1	0
416	3	0	0	3	3	0	1	1	0	3	4	0
635	0	1	0	1	2	0	1	0	0	1	1	0
636	0	0	0	2	2	0	0	0	0	0	0	0

Waypoint	June						July					
	Unoccupied Nests	Occupied Nests	Birds Sitting Tight (Probable Nest)	Adults (No Nest)	Total Adults	Total Chicks	Unoccupied Nests	Occupied Nests	Birds Sitting Tight (Probable Nest)	Adults (No Nest)	Total Adults	Total Chicks
637	0	1	0	1	1†	1	0	0	0	0	0	0
420	0	0	1	0	1	0	0	0	0	0	0	0
638	1	0	0	1	1	0	0	0	0	0	0	0
576	0	0	0	0	0	0	1	0	0	1	1	0
429	0	1	0	1	2	0	0	0	0	0	0	0
570	0	1	0	3	4	0	0	0	0	1	1	0
353	0	1	0	0	1	0	0	0	0	1	1†	0
51	1	0	0	2	3	0	0	0	0	0	0*	0
52	0	0	0	0	3	0	0	0	0	0	0	0
571	0	1	0	1	2	0	0	0	0	0	0	0
572	0	1	0	2	3	0	0	0	0	0	0	0
249	0	1	0	1	2	0	0	0	0	0	0	0
330	0	1	0	1	2	0	0	0	0	0	0	0
278	0	1	0	0	1	0	0	0	0	0	0	0
639	0	0	0	0	0	0	1	0	0	2	2	0
640	0	0	0	0	0	0	0	0	1	0	1	0
641	0	0	0	0	0	0	0	2	0	0	2*	0
642	0	0	0	0	0	0	1	0	0	1	1*	0
643	0	0	0	0	0	0	0	0	0	1	1*	0
644	0	0	0	0	0	0	0	0	0	2	2	0
280	0	0	0	0	0	0	1	0	0	2	2	0
249	0	0	0	0	0	0	0	0	0	2	2	0
243	0	0	0	0	0	0	1	0	0	2	2	0
645	0	0	0	0	0	0	1	0	0	1	1	2

Waypoint	June						July					
	Unoccupied Nests	Occupied Nests	Birds Sitting Tight (Probable Nest)	Adults (No Nest)	Total Adults	Total Chicks	Unoccupied Nests	Occupied Nests	Birds Sitting Tight (Probable Nest)	Adults (No Nest)	Total Adults	Total Chicks
460	0	0	0	0	0	0	0	0	0	3	3*	0
573	0	0	0	0	0	0	0	0	0	1	1	0
Total	8	24	4	33	66	1	15	6	1	31	39	7

*Ring-billed gulls also present

†Common terns also present

Table 3-8: Waterbody Classification and Island Use by Herring Gulls in 2016

Waypoint	Month	System	Waterbody Type	Waterbody Size Class (ha)	Island Habitat	Island Size Class (ha)	Used in 2015?
51	June	On-system	River	>1000	Boulders	<0.1	Yes
52	June	On-system	River	>1000	Boulders	<0.1	Yes
121	June	On-system	River	>1000	Exposed bedrock	<0.1	Yes
135	June	On-system	River	>1000	Exposed bedrock	<0.1	Yes
174	June	On-system	River	>1000	Boulders	<0.1	Yes
255	June	Off-system	Lake	>1000	Exposed bedrock	<0.1	Yes
278	June	Off-system	River	>1000	Boulders	<0.1	Yes
324	June	Off-system	Lake	>1000	15% boulders, 85% tree/shrub	<0.1	Yes
330	June	Off-system	Lake	>1000	Boulders	<0.1	Yes
353	June	On-system	River	>1000	Exposed bedrock	<0.1	Yes
396	June	On-system	River	>1000	Exposed bedrock, 1% grass	0.1-0.9	Yes
416	June	On-system	River	>1000	Exposed bedrock, 5% grass	0.1-0.9	Yes
420	June	On-system	River	>1000	Exposed bedrock	<0.1	Yes
429	June	On-system	River	>1000	NA	NA	Yes
450	June	Off-system	Lake	>1000	Exposed bedrock, 60% shrub	0.1-0.9	Yes
451	June	Off-system	Lake	>1000	Exposed bedrock, 60% shrub	0.1-0.9	Yes
569	June	On-system	River	>1000	Exposed bedrock	<0.1	No
570	June	On-system	River	>1000	Boulders	<0.1	No
571	June	On-system	River	>1000	Exposed bedrock	0.1-0.9	No
572	June	On-system	River	>1000	Boulders	<0.1	No
626	June	Off-system	Lake	>1000	NA	NA	No
627	June	Off-system	Lake	>1000	Boulders, 10% shrub	<0.1	No
628	June	Off-system	Lake	>1000	Exposed bedrock, 5% grass	0.1-0.9	No
629	June	On-system	River	>1000	Exposed bedrock, 5% grass	<0.1	No
630	June	On-system	River	>1000	Exposed bedrock	0.1-0.9	No
631	June	On-system	River	>1000	Boulders	0.1-0.9	No
632	June	On-system	River	>1000	Exposed bedrock	<0.1	No
633	June	On-system	River	>1000	Exposed bedrock, 5 % tree/shrub	<0.1	No
634	June	On-system	River	>1000	Exposed bedrock, 5% shrub	<0.1	No
635	June	On-system	River	>1000	Exposed bedrock	0.1-0.9	No
636	June	On-system	River	>1000	NA	NA	No

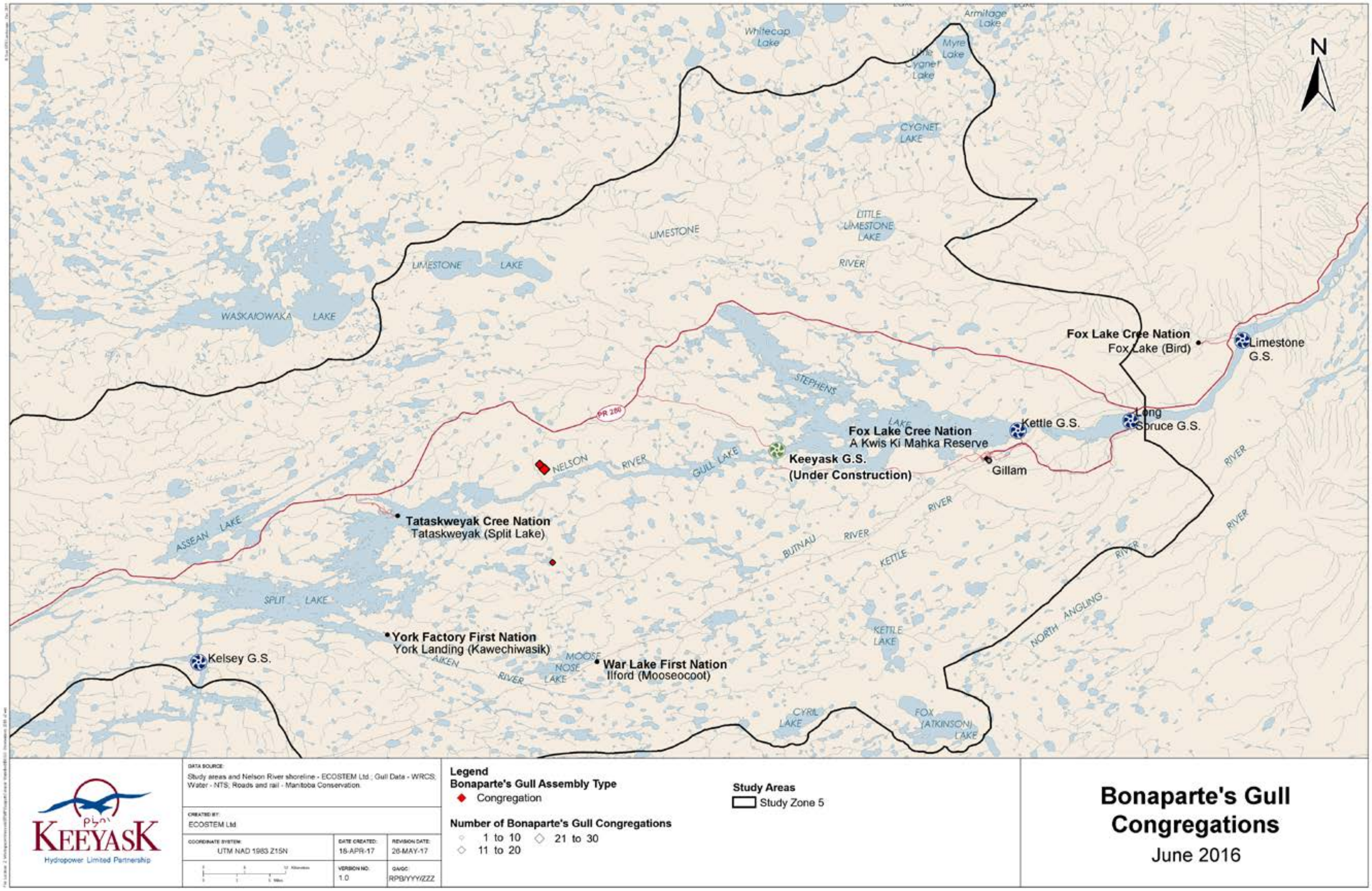
Waypoint	Month	System	Waterbody Type	Waterbody Size Class (ha)	Island Habitat	Island Size Class (ha)	Used in 2015?
637	June	On-system	River	>1000	Exposed bedrock	<0.1	No
638	June	On-system	River	>1000	Exposed bedrock	<0.1	No
177	July	On-system	River	>1000	Exposed bedrock	0.1-0.9	Yes
243	July	Off-system	Lake	>1000	Exposed bedrock	<0.1	Yes
246	July	Off-system	Lake	>1000	Exposed bedrock	0.1-0.9	Yes
249	July	Off-system	Lake	>1000	Exposed bedrock	0.1-0.9	Yes
280	July	Off-system	River	>1000	Boulders	<0.1	Yes
324	July	Off-system	Lake	>1000	Boulders	<0.1	Yes
460	July	Off-system	Lake	>1000	Sandbar	0.1-0.9	Yes
573	July	On-system	River	>1000	Gravel	<0.1	No
574	July	On-system	River	>1000	Exposed bedrock	0.1-0.9	No
575	July	Off-system	River	>1000	Boulders	<0.1	No
576	July	On-system	River	>1000	Exposed bedrock	<0.1	No
577	July	On-system	River	>1000	Boulders	<0.1	No
578	July	On-system	River	>1000	Exposed bedrock	<0.1	No
639	July	On-system	River	>1000	Exposed bedrock	<0.1	No
640	July	On-system	River	>1000	Exposed bedrock	<0.1	No
641	July	On-system	River	>1000	Exposed bedrock	<0.1	No
642	July	On-system	River	>1000	Exposed bedrock	<0.1	No
643	July	On-system	River	>1000	Exposed bedrock	<0.1	No
644	July	On-system	River	>1000	Exposed bedrock	0.1-0.9	No
645	July	Off-system	Lake	100-100	Exposed bedrock	0.1-0.9	No
646	July	Off-system	Lake	>1000	Exposed bedrock	<0.1	No
647	July	Off-system	Lake	>1000	Exposed bedrock	<0.1	No
648	July	On-system	River	>1000	Boulders	<0.1	No
649	July	On-system	River	>1000	Boulders	<0.1	No
650	July	On-system	River	>1000	Exposed bedrock	0.1-0.9	No
651	July	On-system	River	>1000	Exposed bedrock, 20% grass	0.1-0.9	No
652	July	On-system	River	>1000	Boulders	0.1-0.9	No
653	July	On-system	River	>1000	Exposed bedrock	0.1-0.9	No

3.2.4 BONAPARTE'S GULL

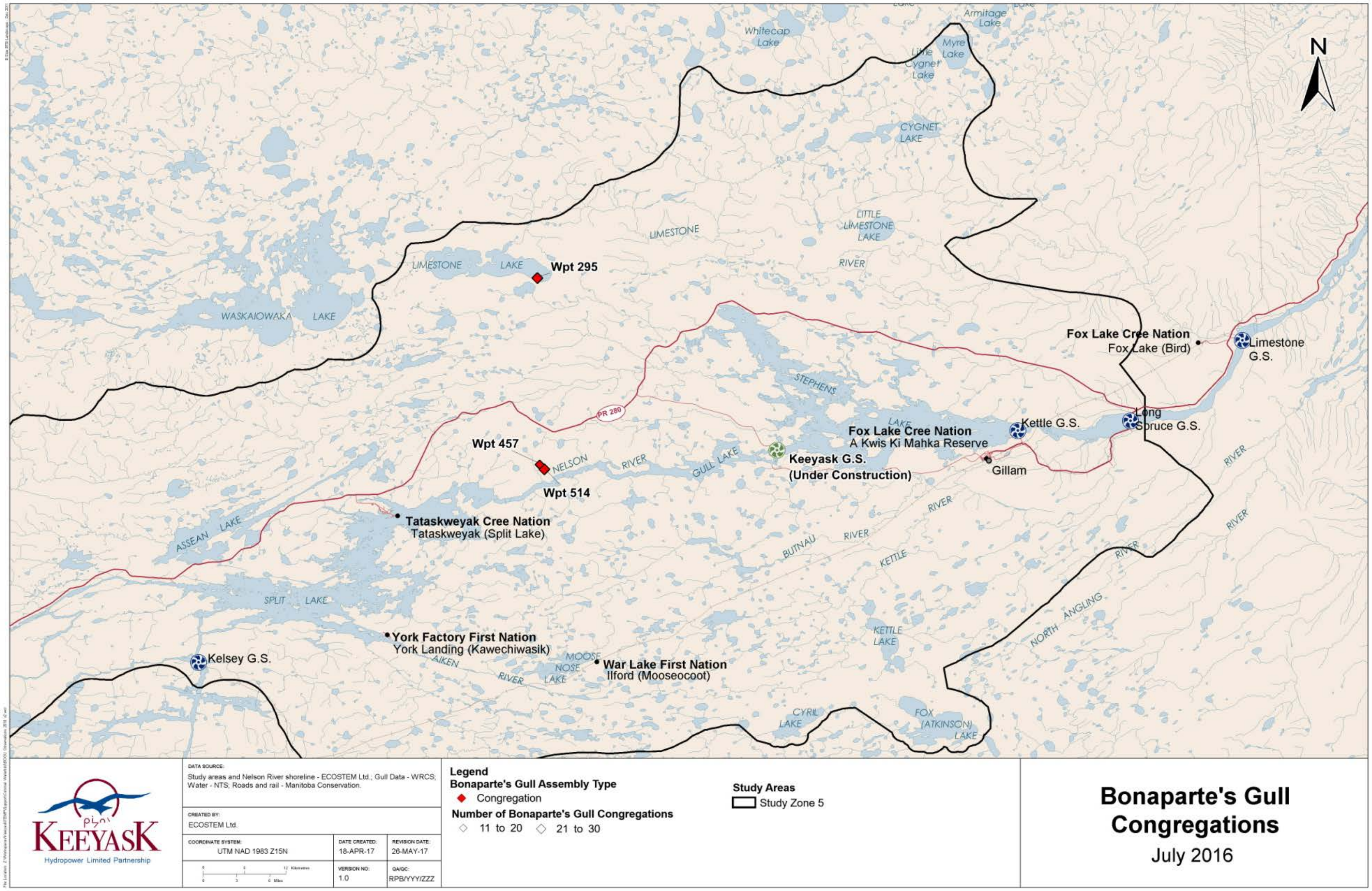
Congregations of Bonaparte's gulls were relatively uncommon in the study area and were observed only at a few locations (Table 3-2). In June, a total of 48 Bonaparte's gulls were observed at three congregations (Table 3-9; Map 3-6). In July, 58 Bonaparte's gulls were observed at two congregations that were previously identified, and one new location. No Bonaparte's gull colonies were observed, and only a single occupied nest was seen in July (Table 3-9; Map 3-7).

Three of the four unique congregations were observed along shorelines of relatively small, unnamed lakes surrounded by burned black spruce forest (Table 3-10). One congregation was observed along the shores of Limestone Lake within black spruce forest habitat.

In June, two of the three lakes where Bonaparte's gulls were observed in 2016 were not used by Bonaparte's gulls in 2015 (Table 3-10). In July, one lake where Bonaparte's gulls were observed in 2016 was not used by Bonaparte's gulls in 2015 (Table 3-10).



Map 3-9: Bonaparte's Gull Congregations Observed During Helicopter Surveys in June 2016



Map 3-10: Bonaparte's Gull Congregations Observed During Helicopter Surveys in July 2016

Table 3-9: Bonaparte's Gull Congregations and Nest Sites Observed During the Helicopter Surveys in 2016

Waypoint	June						July					
	Unoccupied Nests	**Occupied Nest**	**Birds Sitting Tight (Probable Nest)**	**Adults (No Nest)**	**Total Adults**	**Total Chicks**	**Unoccupied Nests**	**Occupied Nest**	**Birds Sitting Tight (Probable Nest)**	**Adults (No Nest)**	**Total Adults**	**Total Chicks**
514	0	0	0	23	23	0	0	1	0	25	26	0
457	0	0	0	18	18	0	0	0	0	11	11	0
493	0	0	0	7	7	0	0	0	0	0	0	0
295	0	0	0	0	0	0	0	0	0	21	21	0
Total	0	0	0	48	48	0	0	1	0	57	58	0

Table 3-10: Waterbody Classification and Habitat Use by Bonaparte's Gulls in 2016

Waypoint	Month	System	Waterbody Type	Waterbody Size Class (ha)	Habitat	Island Size Class (ha)	Used in 2015?
457	June	Off-system	Lake	1-10	Burned black spruce forest	NA	Yes
493	June	Off-system	Lake	100-100	Burned black spruce forest	NA	No
514	June	Off-system	Lake	<1	Burned black spruce forest	NA	No
295	July	Off-system	Lake	>1000	Spruce forest	NA	Yes
457	July	Off-system	Lake	1-10	Burned black spruce forest	NA	Yes
514	July	Off-system	Lake	<1	Burned black spruce forest	NA	No

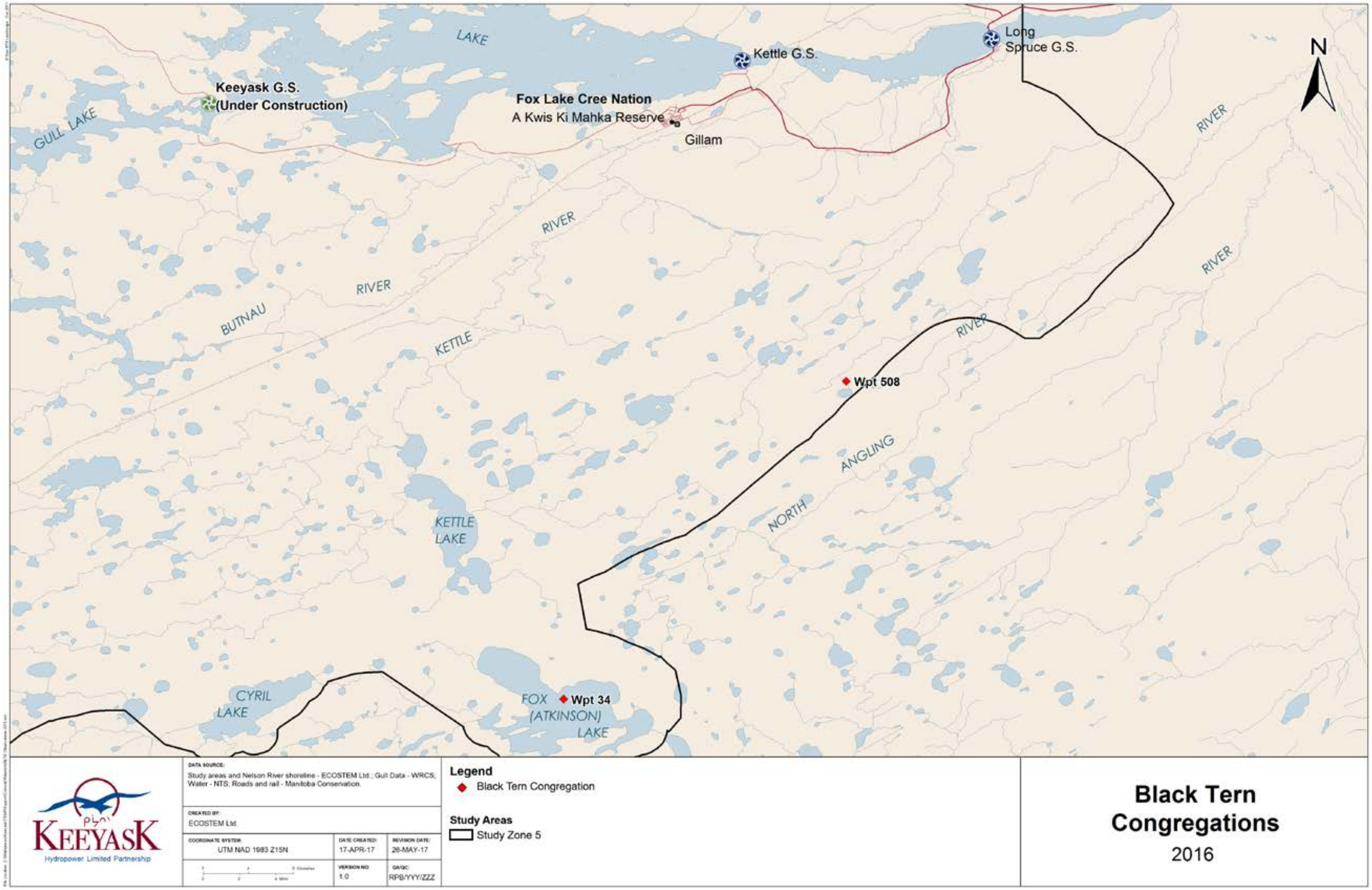
3.2.5 BLACK TERN

Black terns were the least common species observed in 2016 (Table 3-2). A total of eight black terns were observed at two locations in July 2016 (Table 3-11). One congregation, consisting of four individuals, was observed on a small, off-system lake, which did not support any colonial waterbirds in 2015 (Map 3-8; Table 3-11). The other congregation, consisting of four individuals, was observed on a small island in Atkinson Lake, which supported at least one species of colonial waterbird in 2015 (Map 3-8; Table 3-11).

3.2.6 AMERICAN WHITE PELICAN

American white pelicans were relatively uncommon in June and increased in abundance in July (Table 3-2). The largest concentration of American white pelicans was observed in the tailrace of the Kelsey Generating Station (Map 3-9). All pelicans observed were located on large, on-system rivers (Table 3-13). Numerous, small congregations and individuals were observed in the Nelson River between Split Lake and Gull Rapids. Two congregations of seven and 16 birds was observed at Gull Rapids in July (Table 3-12; Map 3-9). No American white pelicans were observed nesting in the study area in 2016.

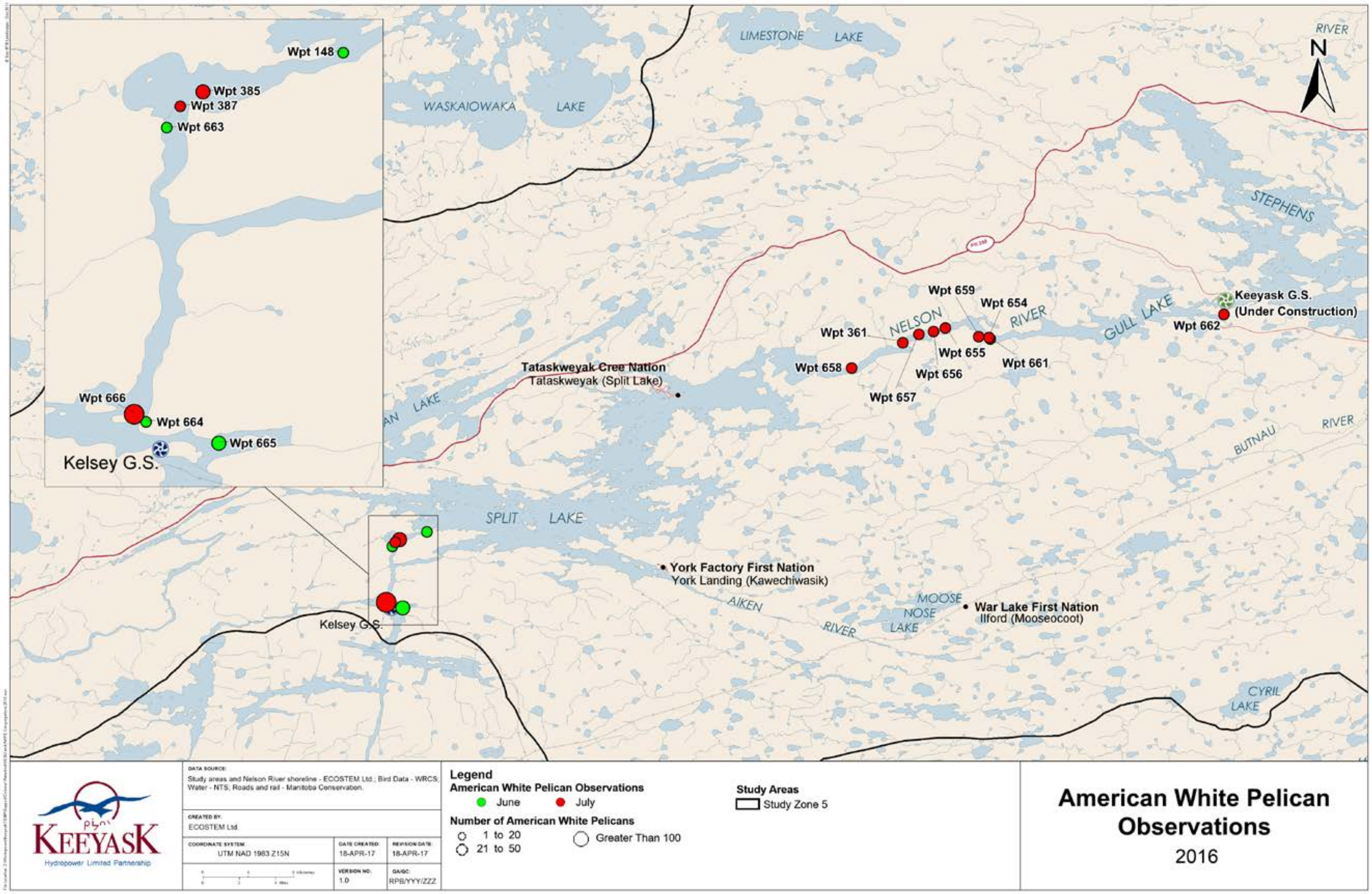
In June, one island where American white pelicans were observed in 2016 was not used by any species of colonial waterbird in 2015 (Table 3-13). In July, three islands where American white pelicans were observed did not support any species of colonial waterbird in 2015 (Table 3-13).



Map 3-11: Black Tern Congregations Observed During Helicopter Surveys in 2016

Table 3-11: Waterbody Classification and Island Use by Black Terns in 2016

Waypoint	Month	System	Waterbody Type	Waterbody Size Class (ha)	Island Habitat	Island Size Class (ha)	Used in 2015?
34	July	Off-system	Lake	>1000	Boulders	0.1-0.9	Yes
508	July	Off-system	Lake	1-10	NA	NA	No



Map 3-12: American White Pelican Observations Made During the Helicopter Surveys in 2016

Table 3-12: American White Pelican Observations Made During the Helicopter Surveys in 2016

Waypoint	June						July					
	Unoccupied Nests	**Occupied Nest**	**Birds Sitting Tight (Probable Nest)**	**Adults (No Nest)**	**Total Adults**	**Total Chicks**	**Unoccupied Nests**	**Occupied Nest**	**Birds Sitting Tight (Probable Nest)**	**Adults (No Nest)**	**Total Adults**	**Total Chicks**
148	0	0	0	13	13	0	0	0	0	0	0	0
663	0	0	0	4	4	0	0	0	0	0	0	0
664	0	0	0	5	5	0	0	0	0	0	0	0
665	0	0	0	30	30	0	0	0	0	0	0	0
654	0	0	0	0	0	0	0	0	0	6	6	0
655	0	0	0	0	0	0	0	0	0	1	1	0
656	0	0	0	0	0	0	0	0	0	3	3	0
657	0	0	0	0	0	0	0	0	0	4	4	0
361	0	0	0	0	0	0	0	0	0	3	3	0
658	0	0	0	0	0	0	0	0	0	3	3	0
666	0	0	0	0	0	0	0	0	0	260	260	0
385	0	0	0	0	0	0	0	0	0	22	22	0
387	0	0	0	0	0	0	0	0	0	9	9	0
659	0	0	0	0	0	0	0	0	0	1	1	0
660	0	0	0	0	0	0	0	0	0	7	7	0
662	0	0	0	0	0	0	0	0	0	16	16	0
661	0	0	0	0	0	0	0	0	0	8	8	0
Total	0	0	0	52	52	0	0	0	0	343	343	0

Table 3-13: Waterbody Classification and Island Use by American White Pelicans in 2016

Waypoint	Month	System	Waterbody Type	Waterbody Size Class (ha)	Island Habitat	Island Size Class (ha)	Used in 2015?
148	June	On-system	River	>1000	Exposed bedrock	<0.1	Yes
663	June	On-system	River	>1000	Exposed bedrock	0.1-0.9	No
385	July	On-system	River	>1000	Boulders	0.1-0.9	Yes
660	July	On-system	River	>1000	Exposed bedrock	1.0-1.9	No
662	July	On-system	River	>1000	Exposed bedrock & shrub/grass	1.0-1.9	No
666	July	On-system	River	>1000	NA	NA	No

4.0 SUMMARY AND CONCLUSIONS

The number of breeding colonial waterbirds remained consistent within Gull Rapids compared to previous years of construction and pre-construction. The number of ring-billed gulls observed at Gull Rapids in 2016 was similar to that observed in previous years during construction (2014 and 2015), and during the pre-construction period between 2001-2013 (KHLP 2012; Stantec 2015; WRCS 2016). The number of common terns observed was also consistent with the number observed during previous construction and pre-construction years (KHLP 2012; Stantec 2015; WRCS 2016). The stability in the number of colonial waterbirds observed in the Gull Rapids area during Project construction suggests that disturbance is not negatively affecting the abundance of colonial waterbirds.

Nesting of ring-billed gulls occurred on similar islands between 2015 and 2016, suggesting that they are not being dissuaded from nesting on islands near active construction sites. The use of islands in Gull Rapids by common terns shifted in 2016. In 2015, the largest congregation of common terns was observed on the island at (Wpt 83 in 2015) (WRCS 2016). In 2016, the largest congregation and the only colony of common terns was observed on an island at waypoint 224. The cause of this shift is not believed to be a result of construction activities as the island did support a colony of ring-billed gulls in 2016; but rather, the shift of island use by common terns may be related to the competition with ring-billed gulls for nesting habitat (Cuthbert *et al.* 2003).

Productivity can also be used as a measure of the potential effects of construction disturbance on colonial waterbirds. Colonial waterbirds exhibit colony site fidelity, and as a result, the effects of construction disturbance may not be apparent immediately, as fewer birds may return to a colony annually if their reproductive success is lowered or they may not initiate nests (Southern 1977; Southern and Southern 1982). Disturbance may also reduce productivity by reducing the amount of time spent incubating eggs, accidental breakage of eggs during takeoff, reducing time foraging, and increasing potential of chicks entering adjacent territories and being killed by conspecific adults (Robert and Ralph 1975).

As 2016 was the first year that an accurate count of nesting gulls and chicks was made, comparisons to earlier construction years are not possible. Counting nests and chicks was attempted in 2015, but success was limited by the overall resolution of the images provided by the fixed-wing UAV. The use of the quad-copter UAV, which provided a more stable platform and increased camera quality in 2016, increased the resolution of the pictures allowing for better determination of nesting gulls and chicks. Photographing islands in both the morning and afternoon also allowed for a more accurate enumeration of chicks due to different lighting conditions at different times of the day, and increased the chances of observing chicks in the open where they could be counted.

The productivity of ring-billed gulls observed in this study is comparable to those observed elsewhere in North America. In this study, the average number of ring-billed gull chicks produced per nest was 2.1. A summary of 11 studies, conducted by Fetterolf (1983) found that the average number of ring-billed gull fledglings per nest was 1.4 and ranged from 0.67-2.05. It is likely that the number of chicks produced per nest in this study is slightly higher as chicks were not followed all the way through the fledgling period.

Other studies measuring ring-billed gull productivity as the number of chicks produced per breeding pair can also be compared to this study by substituting the number of chicks produced per breeding pair with the number of chicks produced per nest, which is presumably attended by a breeding pair. In northern Lake Superior, Ontario, ring-billed gull productivity (number of chicks fledged per breeding pair) ranged from 1.03-1.06 (Ryder and Ryder 1981). Another study from Lake Erie, Ontario found ring-billed productivity to be 1.5 ± 0.8 chicks per pair on disturbed sites (frequently visited by humans) and 1.6 ± 0.8 chicks per pair on undisturbed sites (Brown and Morris 1995). As stated previously, it is likely that the number of chicks produced per nest in this study is slightly higher as they were not followed all the way through the fledgling period. However, it appears that ring-billed gull productivity within Gull Rapids is within the published ranges and suggests that Project construction is not negatively affecting productivity.

Herring gull productivity in Gull Rapids in this study (0.2 chicks per nest) was lower than that observed in at study at Lake Huron, Ontario, which ranged from 1.05-2.39 chicks per nest (Ewins *et al.*1992). However, it was within the range observed in another study conducted in Maine, USA, where the number of chicks per nest ranged from 0.16-1.14 (Hunt Jr. 1972). The reason for the apparent low productivity of herring gulls at Gull Rapids is likely due to the relatively low numbers of herring gull nests and chicks observed, and the difficulty with distinguishing between herring gull and ring-billed gull chicks. In Gull Rapids, herring gulls often nested on the same islands as ring-billed gulls. Due to the absence of distinguishing characteristics of herring gull and ring-billed gull chicks, it is possible that the number of herring gull chicks was underestimated when ring-billed gull chicks were also present. Although herring gull productivity within Gull Rapids is within the lower end of published ranges, this does not suggest that Project construction is negatively affecting productivity.

In July 2016, the number of colonial waterbirds, mainly ring-billed gulls, in the study area was much higher compared to July 2015. Similar to 2015, the largest ring-billed gull colonies occurred at Gull Rapids in 2016. The number of ring-billed colonies in 2016 (16) was similar to the number of colonies observed in 2015 (19). Herring gulls were also more abundant in 2016 compared to 2015, and were observed nesting at more sites in 2016 (42) compared to 2015 (20). The numbers of other species of colonial waterbirds, including common tern, Bonaparte's gull, and American white pelican were relatively consistent with 2015. However, common tern colonies were less abundant in 2016 (2) compared to 2015 (6). The difference in annual numbers of colonial ring-billed gulls and herring gulls in the study area may be due to natural fluctuations in the population and habitat availability. The increase of ring-billed gull colonies and nesting herring gulls may have been a result of better nesting conditions (a greater number of exposed reefs) in 2016 compared to 2015. The increase of these species in the study area in July may be due to an influx of non-breeding individuals, or unsuccessful breeders from elsewhere. These birds, likely due to the abundance of small, unvegetated islands and foraging opportunities, preferred the large, on-system rivers.

Helicopter surveys and UAV surveys will continue in 2017. Data collected by these surveys will provide further insight into the potential effects of construction disturbance on colonial waterbird nesting, productivity and population trends at Gull Rapids and within the broader study area (Study Zone 5).

5.0 LITERATURE CITED

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APPENDIX 1:
UAV SURVEY RESULTS

Table 1: Colonial Waterbirds Enumerated from Images of Islands in Gull Rapids taken by a UAV in 2016

Island	Observation	Morning			Total	Afternoon			Total
		June 3-4	June 27	July 20-21		June 3-4	June 27	July 20-21	
Wpt 478	Common Tern	0	0	0	0	0	0	0	0
	Common Tern Nest	0	0	0	0	0	0	0	0
	Herring Gull	0	0	0	0	0	0	0	0
	Herring Gull Chick	0	0	0	0	0	0	0	0
	Herring Gull Nest	0	0	0	0	0	0	0	0
	Ring-billed Gull	6	13	11	30	3	11	13	27
	Ring-billed Gull Chick	0	8	16	24	0	19	11	30
	Ring-billed Gull Nest	11	1	0	12	11	2	0	13
Wpt 83	Common Tern	13	7	1	21	7	20	3	30
	Common Tern Nest	0	0	0	0	0	0	0	0
	Herring Gull	2	1	0	3	0	0	0	0
	Herring Gull Chick	0	2	0	2	0	0	0	0
	Herring Gull Nest	1	0	0	1	1	1	0	2
	Ring-billed Gull	839	988	475	2302	349	975	619	1943
	Ring-billed Gull Chick	0	0	122	122	0	0	162	162
	Ring-billed Gull Nest	172	41	0	213	66	36	0	102
Wpt 480	Common Tern	0	0	0	0	0	0	1	1
	Common Tern Nest	0	0	0	0	0	0	0	0
	Herring Gull	3	9	0	12	2	4	9	15
	Herring Gull Chick	0	0	0	0	0	1	1	2
	Herring Gull Nest	5	3	0	8	6	4	0	10
	Ring-billed Gull	0	1	2	3	0	7	0	7
	Ring-billed Gull Chick	0	0	0	0	0	0	0	0
	Ring-billed Gull Nest	0	0	0	0	0	0	0	0
Wpt 226	Common Tern	0	0	0	0	0	0	0	0
	Common Tern Nest	0	0	0	0	0	0	0	0
	Herring Gull	2	0	0	2	1	3	0	4
	Herring Gull Chick	0	1	0	1	0	3	0	3
	Herring Gull Nest	5	1	0	6	8	1	0	9
	Ring-billed Gull	2431	2688	2250	7369	1109	2341	2708	6158

Island	Observation	Morning June 3-4	Morning June 27	Morning July 20-21	Total	Afternoon June 3-4	Afternoon June 27	Afternoon July 20-21	Total
	Ring-billed Gull Chick	0	4	1172	1176	0	4	1083	1087
	Ring-billed Gull Nest	410	559	0	969	376	494	0	870
Wpt 224	Common Tern	34	34	19	87	35	118	21	174
	Common Tern Nest	0	10	0	10	0	0	0	0
	Herring Gull	0	0	1	1	1	2	2	5
	Herring Gull Chick	0	0	0	0	0	0	0	0
	Herring Gull Nest	1	0	0	1	2	2	0	4
	Ring-billed Gull	116	125	335	576	0	104	568	672
	Ring-billed Gull Chick	0	0	1	1	0	0	2	2
	Ring-billed Gull Nest	1	0	0	1	0	1	0	1
Wpt 227	Common Tern	0	0	0	0	0	0	0	0
	Common Tern Nest	0	0	0	0	0	0	0	0
	Herring Gull	0	0	0	0	0	0	0	0
	Herring Gull Chick	0	0	0	0	0	0	0	0
	Herring Gull Nest	1	0	0	1	0	0	0	0
	Ring-billed Gull	149	186	71	406	52	133	81	266
	Ring-billed Gull Chick	0	15	122	137	0	29	87	116
	Ring-billed Gull Nest	72	20	0	92	81	25	0	106
Wpt 225	Common Tern	0	0	0	0	0	0	0	0
	Common Tern Nest	0	0	0	0	0	0	0	0
	Herring Gull	1	0	0	1	0	1	0	1
	Herring Gull Chick	0	0	0	0	0	0	0	0
	Herring Gull Nest	1	0	0	1	2	0	0	2
	Ring-billed Gull	750	729	983	2462	273	576	1103	1952
	Ring-billed Gull Chick	0	0	341	341	0	0	180	180
	Ring-billed Gull Nest	185	111	0	296	258	201	0	459

APPENDIX 2: UAV MISSION SUMMARY

Unmanned Aerial Imaging Solutions Inc.

Mission Summary 2016

June 2nd- 4th, 2016

June 26th-28th, 2016

July 20th-21st, 2016

Mission Description, Method, and Execution

Unmanned Aerial Imaging Solutions (UAIS) uses unmanned aerial vehicles (UAVs) which are controlled by remote control, computer software, or a combination of both. The type of UAV that UAIS utilizes is a combination of fixed wing (traditional aircraft type) Mini Talon X-UAV foam body, and rotary wing (helicopter type) DJI Phantom plastic body. All other electrical components are either custom made or custom selected by UAIS. All Wildlife Resource Consulting Service (WRCS) missions flown in 2016 we accomplished using a DJI Phantom rotary wing. Using computer software (Mission Planner), the UAV operator creates a grid over a predetermined area and defines the speeds at which the UAV will fly, the altitude the UAV will fly, and boundaries that the UAV is not to penetrate (both horizontally and vertically). Once the flight plan is created, camera parameters specific to the onboard camera, are entered into the computer software and a grid pattern is created based on camera capability and desired image overlap and sidelap.

Launching of the UAV is accomplished using a small, clear, level and secure site to start the UAV while stationary on the ground and perform basic pre-start and pre-flight checks. The pre-start and pre-flight checks involve checking propeller response to remote control commands, GPS satellite status and acquisition condition and a final site check to ensure the safe launch of the UAV. Launch of the UAV is done in a relatively clear area for this purpose. Once the UAV operator takes control of the UAV, the flight plan is then initiated and the UAV is monitored using line of sight with secondary reference to UAV telemetry displayed on a personal computing device (iPad) mounted directly on the remote control. If at any time the UAV operator needs to terminate the flight plan, a “Return to Home” function immediately brings the UAV back to the mission launch location with no other required input from the UAV operator.

The “Return to Home” route, altitude, and speed are part of the pre-start checks and are set prior to UAV engine start.

The landing site for the UAV requires a small and relatively clear, and flat area. The UAV operator will fly the UAV using the remote control into the approach phase, slowing the UAV down to landing speed and reducing the UAVs altitude in a controlled manner over the landing site. The UAV is landed on its landing gear in a controlled and stable manner. The data is then downloaded from the UAVs onboard memory and the camera memory card on to a computer and the data is then processed.

Data processing involves using the Mission Planner software to take the images and place “geo-referencing” meta data into the images. Third party software can then be used to arrange the images in a sequential order and then another piece of third party software is used to “stitch” the images together into one large image. The final product is then delivered to the client.

High definition (4k) video is acquired by the UAVs onboard camera and is included in the data package.

All weather as published by Nav Canada for the mission dates can be found in Appendix 1.

The mission areas of interest were located in D11, D12, E11, E12, F11, F12, G11, and G12 (see image located in appendix 2). Each aforementioned grid area was flown to assess and locate nesting areas to focus on. Once all nesting areas were identified, the image acquisition plan was to fly each area three times per day at different times of day. Once all identified nesting areas were flown and all data captured at three different times of the day, the mission was considered complete. This would allow a much more accurate count as well as provide the greatest contrast in lighting and shadow contrast in the images. The flight paths over the nesting areas were all flown at 100 feet above ground and in a grid pattern. The grid pattern was flown three times over each nesting area: once in a north to south grid pattern with a 45 degree camera angle, once in an east to west grid pattern with a 45 degree camera angle, and once in either a south west to north east grid pattern or south east to north west grid pattern and a 90 degree straight down camera angle (refer to appendix 3 – sample images). At least one radial flight (stabilized flight around the entire perimeter of the nesting areas) was flown as well to capture the high definition video of each nesting area. Larger nesting areas with higher concentrations of bird and nesting activity required more flights to capture more images and videos. The two take-off and landing locations were located in the center of the access road in C6 (see attached photo in appendix 2) and on the man-made dam in G11 (dam area not shown on image in appendix 2 due to an out of date image).

Mission 1 (June 2nd – June 4th)

Data acquisition of mission areas took place in the evening of Thursday, June 2th at 1800 local time. The proposed mission area was the nesting island to the North West of the spillway and just east of the sea can access road (B6 and C6 – reference appendix 2). The sky condition was clear and the winds were light (less than 5 knots or 10 kmph). Total flight time was 22 minutes from take-off to landing. The UAV captured 77 images and 6 videos of the proposed mission area successfully during the 22 minute flight. All phases of flight were uneventful. Due to the time of day, only one flight was conducted.

Data acquisition of mission areas B6, C6, D11, D12, E11, E12, F11, F12, and G12 took place on the morning of Friday June 3rd commencing at 0700 local and completing at roughly 1900 local time. The sky condition was clear and the winds were light. Total flight time for all areas was 4 hours and 48 minutes. Over 1600 images and 25 videos were captured in total. All phases of flight were uneventful.

Data acquisition of mission areas D11, D12, E11, E12, F11, F12 and G12 took place on Saturday June 4th at 0630 local time. The sky condition was clear and the winds were light. Total flight time for all areas was 4 hours and 32 minutes from take-off to landing. The UAV captured over 1600 images and 25 videos of the proposed mission area successfully during the flights. All phases of flight were uneventful.

Mission 2 (June 26th – June 28th)

Mission 2 and mission 3 yielded almost twice the images as mission 1 due to revised flight planning software and more efficient and streamlined flight planning and grid patterns. These methods were developed after studying the data acquired from mission 1 (June 2nd – June 4th).

Data acquisition of mission areas B6, C6, D11, D12, E11, E12, F11, F12, and G12 took place on the morning of Sunday June 26th commencing at 0630 local and completing at roughly 1600 local time. The sky condition was clear and the winds were light. Towards mid-afternoon, the winds picked up and all UAV flights were cancelled. Total flight time for all areas was 4 hours and 51 minutes. Over 2400 images and 25 videos were captured in total. All phases of flight were uneventful.

Data acquisition of mission areas B6, C6, D11, D12, E11, E12, F11, F12, and G12 took place on the morning of Monday June 27th commencing at 0630 local and completing at roughly 2015 local time. The sky condition was clear and the winds were light to moderate (10-20kmph). Total flight time for all areas was 4 hours and 41 minutes. Over 2400 images and 25 videos were captured in total. All phases of flight were uneventful.

Data acquisition of mission areas B6, C6, D11, D12, E11, E12, F11, F12, and G12 took place on the morning of Tuesday June 28th commencing at 0600 local and completing at roughly 1300 local time. Only a morning data set was acquired to complete mission 2 requirements. The sky condition was overcast with cloud bases at 5000 feet above ground. The winds were light to moderate. Total flight time for all areas was 2 hours and 38 minutes. Over 1400 images and 25 videos were captured in total. All phases of flight were uneventful.

Mission 3 (July 20th – July 21st)

Data acquisition of mission areas B6, C6, D11, D12, E11, E12, F11, F12, and G12 took place on the morning of Wednesday July 20th commencing at 0700 local and completing at roughly 1945 local time. The sky condition was broken with cloud bases at 10,000 feet above ground. The winds were light to moderate. Total flight time for all areas was 4 hours and 18 minutes. Over 1700 images and 25 videos were captured in total. All phases of flight were uneventful.

Data acquisition of mission areas B6, C6, D11, D12, E11, E12, F11, F12, and G12 took place on the morning of Thursday July 21th commencing at 0630 local and completing at roughly 2000 local time. The sky condition was broken with cloud bases at 1,000 feet above ground. The winds were light to moderate. Flights were occasionally interrupted due to localized light showers. Total flight time for all areas was 4 hours and 18 minutes. Over 2400 images and 25 videos were captured in total. All phases of flight were uneventful.

APPENDIX 1 – WEATHER

Nav Canada Aviation Weather Reports

All weather is reported by a Nav Canada weather reporting station within 5km of the Gillam Airport. Weather appearing in red denotes weather occurring is less than ideal conditions for UAV flights. This weather does not necessarily mean that UAV flights did not occur only that it is being reported as less than ideal.

MISSION 1 (JUNE 2ND TO JUNE 4TH)

June 2 evening

- METAR CYGX 022300Z 14007KT 090V220 15SM SKC 17/01 A2996 RMK SLP153 DENSITY ALT 800FT=
- METAR CYGX 022200Z 13004KT 080V180 15SM SKC 16/01 A2996 RMK SLP155 DENSITY ALT 600FT=
- METAR CYGX 022100Z 16007KT 130V220 15SM FEW210 16/02 A2997 RMK CI1 CI TR CITR SLP157 DENSITY ALT 600FT=
- TAF CYGX 021838Z 0219/0307 12006KT P6SM SKC RMK NXT FCST BY 030100Z=

June 3 morning

- METAR CYGX 031000Z 18007KT 15SM BKN230 06/03 A3001 RMK CI5 SLP169= METAR CYGX 030900Z 17007KT 15SM FEW230 06/03 A3000 RMK CI2 SLP166= METAR CYGX 030800Z 17006KT 15SM FEW230 07/04 A2999 RMK CI1 SLP164= TAF CYGX 030638Z 0307/0319 16008KT P6SM SKC
- RMK NXT FCST BY 031300Z=

June 3 afternoon

- METAR CYGX 032300Z 16005KT 110V200 15SM FEW210 21/04 A2996 RMK CI1 SLP153 DENSITY ALT 1200FT=
- SPECI CYGX 032240Z 15005KT 120V190 15SM FEW210 21/04 A2996 RMK CI1 WSHFT 2223 SLP153 DENSITY ALT 1200FT=
- METAR CYGX 032200Z 13005KT 040V190 15SM FEW210 21/04 A2997 RMK CI1 SLP155 DENSITY ALT 1200FT=
- METAR CYGX 032100Z 15008KT 110V200 15SM FEW210 21/04 A2997 RMK CI1 SLP157 DENSITY ALT 1100FT=

- TAF CYGX 031838Z 0319/0407 18006KT P6SM BKN220 BECMG 0319/0321 15012KT
- FM040300 14008KT P6SM SCT110 BKN220 RMK NXT FCST BY 040100Z=

June 4

- LWIS CYGX 041000Z AUTO 15005KT 08/05 A2996=
- LWIS CYGX 040900Z AUTO 16005KT 08/05 A2997=
- LWIS CYGX 040800Z AUTO 16004KT 09/05 A2998=
- TAF CYGX 040638Z 0407/0419 14005KT P6SM SCT120 BKN220 FM040900 16008KT P6SM BKN120 OVC220
- RMK FCST BASED ON OBS OBTAINED FROM OTHER SOURCES. NXT FCST BY

MISSION 2 (JUNE 26TH – JUNE 28TH)

June 26

- METAR CYGX 262200Z 03015G25KT 15SM FEW240 17/05 A2998 RMK CI1 CI TR SLP158 DENSITY ALT 700FT=
- METAR CYGX 262100Z 03021KT 15SM FEW240 17/04 A2995 RMK CI1 CI TR SLP149 DENSITY ALT 700FT=
- METAR CYGX 262000Z 03017G24KT 15SM FEW240 17/05 A2992 RMK CI1 SLP139 DENSITY ALT 700FT=
- TAF CYGX 261838Z 2619/2702 03015G25KT P6SM FEW080 SCT240 BECMG 2700/2702 VRB03KT
- RMK NXT FCST WILL BE ISSUED AT 271515Z=
- METAR CYGX 271000Z 19004KT 15SM SKC 02/01 A3017 RMK SLP225= METAR CYGX 270900Z 19003KT 15SM SKC 02/01 A3018 RMK SLP227= METAR CYGX 270800Z 17003KT 15SM SKC 02/01 A3017 RMK SLP225= TAF AMD CYGX 270702Z 2707/2719 VRB03KT P6SM SKC
- BECMG 2709/2711 24006KT
- RMK NXT FCST BY 271300Z=

June 27

- METAR CYGX 271600Z 31008KT 250V330 15SM FEW280 17/07 A3018 RMK CI1 SLP226 DENSITY ALT 500FT=
- METAR CYGX 271500Z 26005KT 15SM FEW280 FEW310 16/06 A3019 RMK CI1CC1 CI TR CC TR SLP231=

- METAR CYGX 271400Z 23007KT 15SM FEW280 13/04 A3019 RMK CI1 CI TR SLP231=
- TAF AMD CYGX 271244Z 2713/2801 21006KT P6SM SKC RMK NXT FCST BY 271900Z=

June 28

- METAR CYGX 281200Z 23008KT 15SM BKN050 BKN260 15/10 A2992 RMK SC6CI1 SLP138 DENSITY ALT 600FT=
- METAR CYGX 281100Z 21007KT 15SM FEW050 SCT260 13/09 A2993 RMK SC2CI1 SLP139=
- METAR CYGX 281000Z 21007KT 15SM FEW050 FEW260 13/09 A2994 RMK SC1CI1 SLP143=
- TAF CYGX 280640Z 2807/2819 22008KT P6SM BKN270 FM281200 26008KT P6SM BKN100
- FM281600 26006KT P6SM -SHRA BKN030 BKN100 PROB30 2818/2819 VRB15G25KT 4SM TSRA OVC030CB
- RMK NXT FCST BY 281300Z=

June 29

- METAR CYGX 291700Z 36016G22KT 15SM OVC014 09/06 A3010 RMK ST8 SLP202= METAR CYGX 291600Z 02017G23KT 15SM OVC012 08/05 A3010 RMK ST8 SLP199= METAR CYGX 291500Z 02015KT 15SM OVC014 06/04 A3009 RMK ST8 SLP197= TAF CYGX 291238Z 2913/3001 36015KT 5SM -DZ BR OVC008 TEMPO 2913/2922 P6SM NSW SCT008 OVC015
- FM292200 02015KT P6SM BKN025 BKN050 RMK NXT FCST BY 291900Z=

MISSION 3 (JULY 20TH – JULY 21ST)

July 20

- METAR CYGX 201500Z 24011KT 15SM FEW090 BKN110 BKN280 20/16 A2956 RMK AS2AC3CI1 CI TR SLP014 DENSITY ALT 1600FT=
- METAR CYGX 201400Z 23011G17KT 15SM SCT084 BKN100 19/16 A2957 RMK AS3AC3 SLP017 DENSITY ALT 1400FT=
- METAR CYGX 201300Z 24010KT 15SM SCT030 19/15 A2958 RMK SC4 SLP019 DENSITY ALT 1300FT=
- METAR CYGX 201200Z 25009KT 15SM FEW100 BKN220 18/15 A2957 RMK AS2CC4 SLP017 DENSITY ALT 1300FT=

- METAR CYGX 201100Z 24007KT 15SM FEW100 SCT220 16/14 A2956 RMK AS1CC3 SLP014 DENSITY ALT 1100FT=
- METAR CYGX 201000Z 19008KT 15SM BKN100 16/14 A2956 RMK AS6 SLP013 DENSITY ALT 1100FT=
- METAR CYGX 202000Z 30008KT 15SM FEW042 FEW050CB FEW250 26/16 A2955 RMK CU1CB1CI1 CB TR ANVIL TOP SLP009 DENSITY

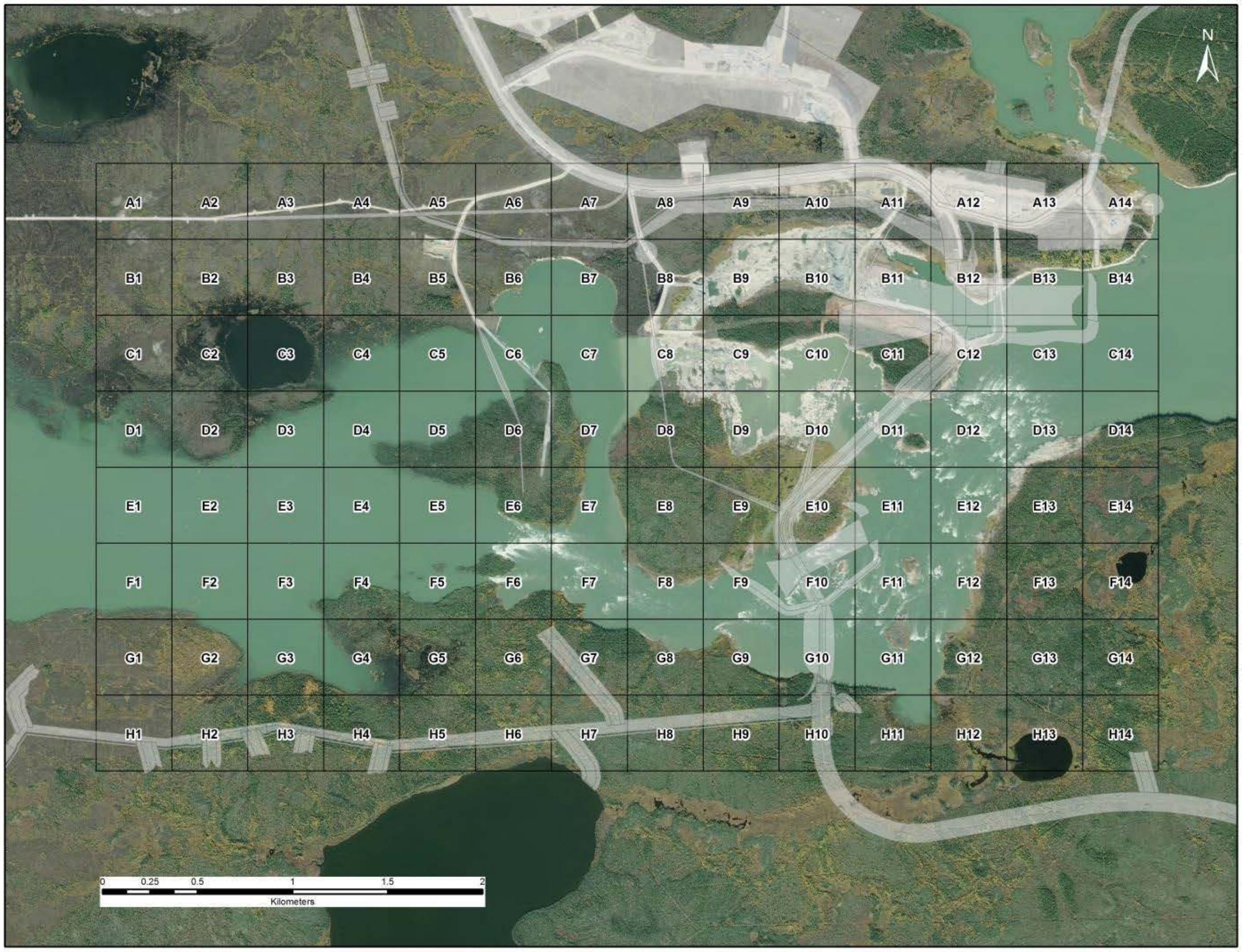
ALT 2200FT=

- METAR CYGX 201900Z 29010KT 15SM FEW040 FEW050CB FEW080 FEW250 26/16 A2955 RMK CU1CB1AC1CI2 CU TR CB TR AC TR
- ANVIL TOP SLP010 DENSITY ALT 2200FT=
- METAR CYGX 201800Z 31006KT 15SM FEW055 FEW076 FEW250 23/17 A2956 RMK CU1AC1CI1 CU TR SLP013 DENSITY ALT 1900FT=
- METAR CYGX 201700Z 25008G16KT 15SM FEW089 SCT260 25/17 A2956 RMK AC1CI2 SLP013 DENSITY ALT 2100FT=

July 21

- METAR CYGX 211700Z 06007KT 030V100 15SM OVC012 11/08 A2974 RMK SC8 SLP078=
- *SPECI CYGX 211652Z 05007KT 010V090 15SM OVC011 10/09 A2974 RMK SC8 SLP077=*
- *SPECI CYGX 211625Z 06005KT 040V110 15SM OVC008 10/08 A2972 RMK SC8 SLP072=*
- METAR CYGX 211600Z 07008KT 020V090 15SM OVC007 10/08 A2972 RMK SC8 SLP071=
- *SPECI CYGX 211529Z 05009KT 15SM OVC006 10/09 A2971 RMK SC8 SLP068=*
- *SPECI CYGX 211516Z 05007KT 15SM OVC008 10/09 A2971 RMK SC8 ST CHGD INTO SC SLP068=*
- METAR CYGX 211500Z 06007KT 020V090 15SM OVC010 10/09 A2971 RMK ST8 SLP067=
- *SPECI CYGX 211445Z 06007KT 020V090 13SM OVC006 10/08 A2970 RMK ST8 SLP065=*
- *SPECI CYGX 211430Z 05007KT 030V110 4SM BR OVC007 10/08 A2970 RMK ST8 SLP063=*
- *SPECI CYGX 211412Z 05006KT 2 1/2SM BR OVC006 09/08 A2969 RMK ST8 SLP062=*

- METAR CYGX 211400Z 04011KT 7SM OVC005 09/08 A2969 RMK ST8 PRESRR SLP062=
- *SPECI CYGX 211348Z 05006KT 020V090 7SM OVC007 09/08 A2968 RMK ST8 SLP057=*



APPENDIX 2 – MISSION AREA

APPENDIX 3: EXAMPLES OF UAV PHOTOGRAPHY

Photo 1: Portion of Island Wpt 225 Photographed by the UAV on the Morning of June 26, 2016

Photo 2: Island Wpt 227 Photographed by the UAV on the Morning of June 26, 2016