



Keeyask Generation Project Terrestrial Effects Monitoring Plan

Colonial Waterbird Habitat Effects Monitoring Report

TEMP-2023-13



KEYYASK GENERATION PROJECT

TERRESTRIAL EFFECTS MONITORING PLAN

REPORT #TEMP-2023-13

COLONIAL WATERBIRD

HABITAT EFFECTS MONITORING

YEAR 1 OPERATION

2022

Prepared for
Manitoba Hydro

By
Wildlife Resource Consulting Service MB Inc.

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SUMMARY

Background

Construction of the Keeyask Generation Project (the Project) began in July 2014 and was fully operational in March 2022. The Keeyask Hydropower Limited Partnership (KHLP) was required to prepare a plan to monitor the effects of construction and operation of the generating station on the terrestrial environment. Monitoring results will help the KHLP, government regulators, members of local First Nation communities, and the general public understand how construction and operation of the generating station are affecting the environment, and whether or not more needs to be done to reduce harmful effects.

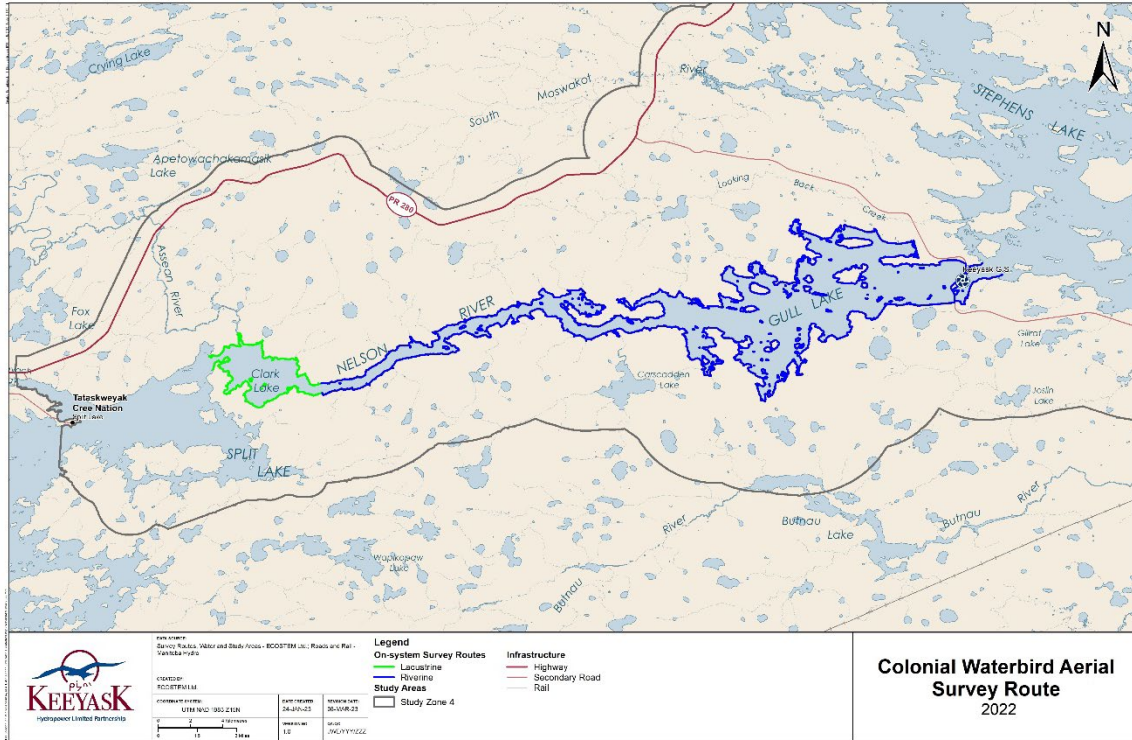
This report describes the results of colonial waterbird (gulls and terns) habitat effects monitoring conducted during the summer of 2022, the first year of Project operation. Previous surveys were conducted during Project construction from 2015 to 2021 using similar methods.

Why is the study being done?

Reservoir creation and Project operation was predicted to reduce the quality and quantity of colonial waterbird habitat in the former Gull Rapids area and reservoir. The alteration of the water regime was anticipated to make most of the traditional nesting islands and reefs in the former Gull Rapids area unsuitable for colonial waterbird breeding. In the reservoir, peatland disintegration and erosion were expected to increase water turbidity, possibly reducing the ability of colonial waterbirds to forage over the short term. Monitoring is being done to evaluate Project effects on the number and location of ring-billed gulls and common terns and their breeding habitats. Other colonial waterbird populations (e.g., American white pelican, Bonaparte's gull) are also being documented during this study.

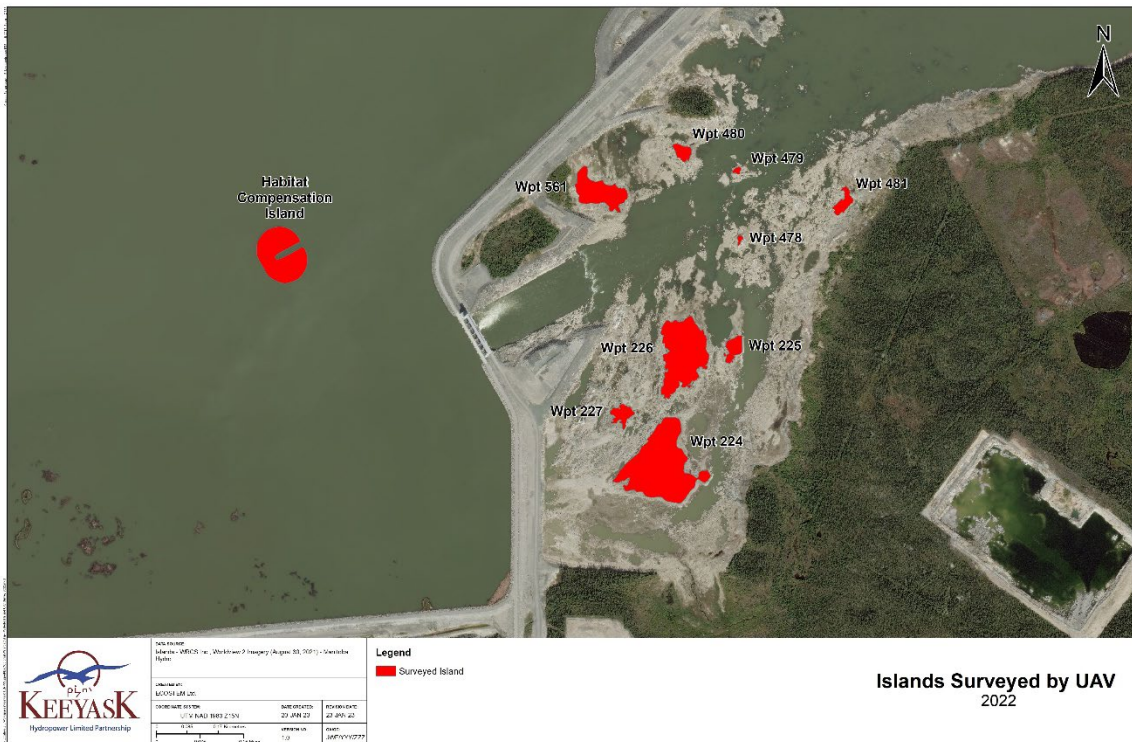
What was done?

Helicopter surveys of the reservoir and surrounding area (including the former Gull Rapids area and upstream to Clark Lake) and unmanned aerial vehicle (UAV or drone) surveys focused on the former Gull Rapids area were conducted in summer 2022 to determine the numbers of gulls and terns present, where they are found, and what kinds of habitat they are using. UAV surveys allowed the observation of gull and tern nests and chicks, from which productivity (number of chicks produced per nest) could be determined. This is the first year of colonial waterbird habitat effects monitoring during the operation period; surveys were also conducted from 2015 to 2021, during Project construction.



Colonial Waterbird Aerial Survey Route 2022

Helicopter Survey Route for Colonial Waterbirds in 2022



Islands Surveyed by UAV 2022

Islands Surveyed by an Unmanned Aerial Vehicle (Drone) for Colonial Waterbirds in 2022

What was found?

The first year of Project operation resulted in a shift of gull and tern habitat use away from the islands in the former Gull Rapids area to the constructed Habitat Compensation Island upstream of the Project. The Habitat Compensation Island supported relatively large numbers of nesting common terns and ring-billed gulls, similar in number to what was observed in the region during Project construction. Ring-billed gulls were frequently observed nesting against the woody debris (placed on the island in 2021). Other species including herring gull and American white pelican did not appear to be affected by Project operation and their numbers were consistent with previous observations.

The number of ring-billed gull chicks observed on the Habitat Compensation Island appeared to be low in comparison to the number of nests that were present and may have been a result of the structure of rocks on the island, sheltering chicks from view, and/or the relatively high number of bald eagles also present on the island.



Colonial Waterbirds on the Habitat Compensation Island, June 2022

What does it mean?

Project operation and water regime alteration appeared to reduce the quality and quantity of colonial waterbird habitat in the former Gull Rapids area, as anticipated. High water levels in the Nelson River also affected nesting colonial waterbirds in the region. The Habitat Compensation Island successfully mitigated these habitat changes and supported a relatively large number of nesting common terns and ring-billed gulls. The woody debris placed on the Habitat Compensation Island appeared to enhance the gull nesting habitat and helped attract birds to the island.

What will be done next?

The 2022 colonial waterbird survey was the first operation-phase survey for the Project. The next colonial waterbird survey is scheduled for 2023.

It is recommended that additional woody debris be added to the Habitat Compensation Island to further enhance the nesting habitat and provide shelter for chicks.

STUDY TEAM

We would like to thank Sherrie Mason and Rachel Boone of Manitoba Hydro for reviewing the report. We would also like to thank Dr. James Ehnes, ECOSTEM Ltd., for GIS supported study design, cartography, and the Unmanned Aerial Vehicle (UAV) operations and photography.

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

- Robert Berger, Wildlife Resource Consulting Services MB Inc. (WRCS), Design, analysis, and reporting
- Mark Baschuk, WRCS, Survey personnel, analysis, and reporting
- Thomas Wood, WRCS, Survey personnel
- Alex Snitowski, ECOSTEM Ltd., UAV photography

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1.0 INTRODUCTION

The Keeyask Generation Project (the Project) is a 695-megawatt hydroelectric generating station (GS), located at the former Gull Rapids on the lower Nelson River in northern Manitoba where Gull Lake flows into Stephens Lake. Project construction began in July 2014 and the generating station was fully operational in March 2022.

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

Reservoir creation and Project operation was predicted to reduce the quality and quantity of habitat in the Gull Rapids area and within the reservoir for ring-billed gull (*Larus delawarensis*), herring gull (*Larus argentatus*), common tern (*Sterna hirundo*), and other species of colonial waterbirds (KHLP 2012). The alteration of the water regime was anticipated to make most of the islands and reefs in the Gull Rapids area unsuitable for colonial waterbird breeding, and it was unclear if it would result in the exposure of additional islands or reefs (KHLP 2012). Additionally, during the short term, peatland disintegration and mineral erosion processes in the reservoir were expected to increase water turbidity, potentially causing decreased foraging efficiency of colonial waterbirds. This potential effect may be offset by the foraging opportunities created in the tailrace area and are anticipated to decrease over time as sediment settles (KHLP 2012). To mitigate the loss of nesting habitat in the Gull Rapids area, a Habitat Compensation Island (HCI), just over 1 ha in size, was constructed upstream of the Project (Photo 1).

Previous habitat effects monitoring for colonial waterbirds, conducted during Project construction from 2015-2021, indicated that colonial waterbird populations were primarily affected by water levels in the Nelson River and to a lesser degree by sensory disturbance from Project construction (WRCS 2017; WRCS 2018; WRCS 2019; WRCS 2020; WRCS 2021). The water levels in the Nelson River influenced the amount of available habitat for colonial waterbirds, and as a result, their distribution in the area.

During construction-phase surveys (2015-2021), colonial waterbirds, including ring-billed gull, herring gull, and common tern, preferred to nest and congregate on the islands within Gull Rapids. Occasionally, high water levels caused nesting islands to become inundated, or alternatively, low water levels caused islands to become connected to the mainland, making them unsuitable for nesting. When this habitat was unsuitable, birds relocated to nearby islands that were directly upstream (WRCS 2018; WRCS 2020). In 2021, this included the HCI, which supported common tern nests and congregating ring-billed gulls. To attract more nesting colonial waterbirds to the

HCI and naturalize the area, woody debris removed from the reservoir by Manitoba Hydro's Waterways Management Program was placed on the surface of the HCI in a random, scattered manner in the fall of 2021.

Colonial waterbird habitat effects monitoring during Project operation will use similar methods to monitoring conducted during the construction phase to evaluate how ring-billed gull, herring gull, and common tern breeding habitat distribution and abundance change due to Project operation. This report contains the results of the first year of the operation-phase Colonial Waterbird Habitat Effects study.



Photo 1: Habitat Compensation Island, June 2022

2.0 METHODS

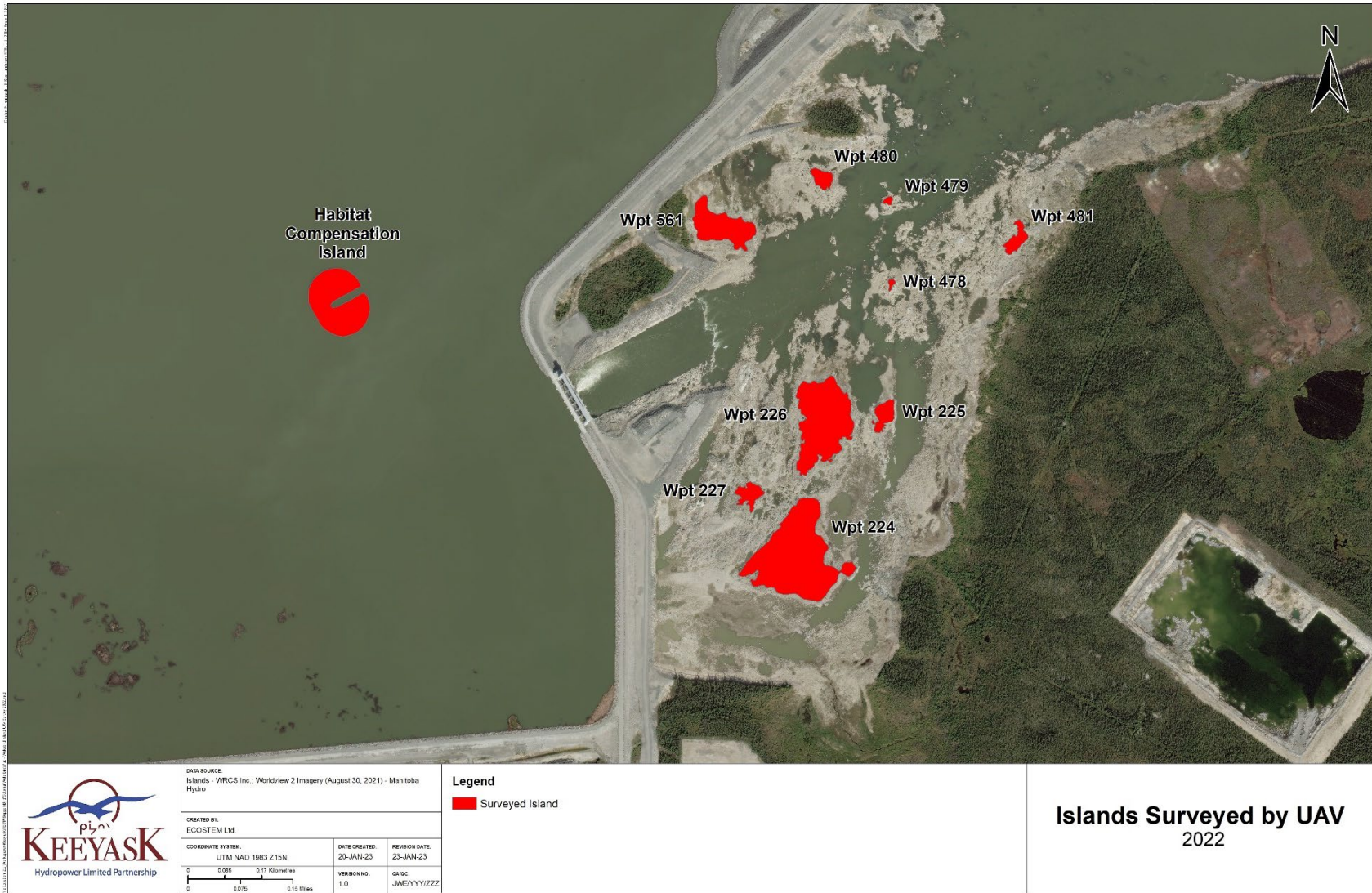
2.1 UNMANNED AERIAL VEHICLE SURVEYS

The distribution and abundance of colonial waterbirds in the former Gull Rapids area was monitored using photographs taken from an Unmanned Aerial Vehicle (UAV or drone). ECOSTEM Ltd. was contracted to conduct UAV flights and produce high-resolution images of colonial waterbird colonies and potential nesting areas in the former Gull Rapids area. The survey used similar methods and survey locations as previous surveys conducted from 2017-2021.

ECOSTEM Ltd. deployed a Autel EVO 2 Pro quadcopter, equipped with 20-megapixel camera to survey islands in the former Gull Rapids area and the Habitat Compensation Island (HCI) immediately upstream of the Project. Nine islands within the former Gull Rapids area, known to support colonial waterbirds, and the constructed HCI were photographed by the UAV in a grid pattern to produce overlapping photographs (Map 1). All flights were conducted at approximately 25 m above ground level (agl) to minimize disturbance to waterbird colonies.

UAV surveys were conducted during three periods in 2022: June 4 & 5, June 21-23, and July 28, to capture the nesting and brood rearing periods. During each of the survey periods, islands 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 survey 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.



Map 1: Islands Surveyed by UAV in the Former Gull Rapids Area in 2022

2.2 HELICOPTER SURVEY

Helicopter surveys were conducted to monitor the abundance, distribution, and habitat use of colonial waterbirds within and around the Project reservoir during the breeding season (Map 2). The survey methods used were identical to the methods used in previous surveys from 2016-2021. The survey area was consistent with the previous survey in 2021, and included the reservoir, the former Gull Rapids area immediately downstream of the Project, and upstream to Clark Lake.

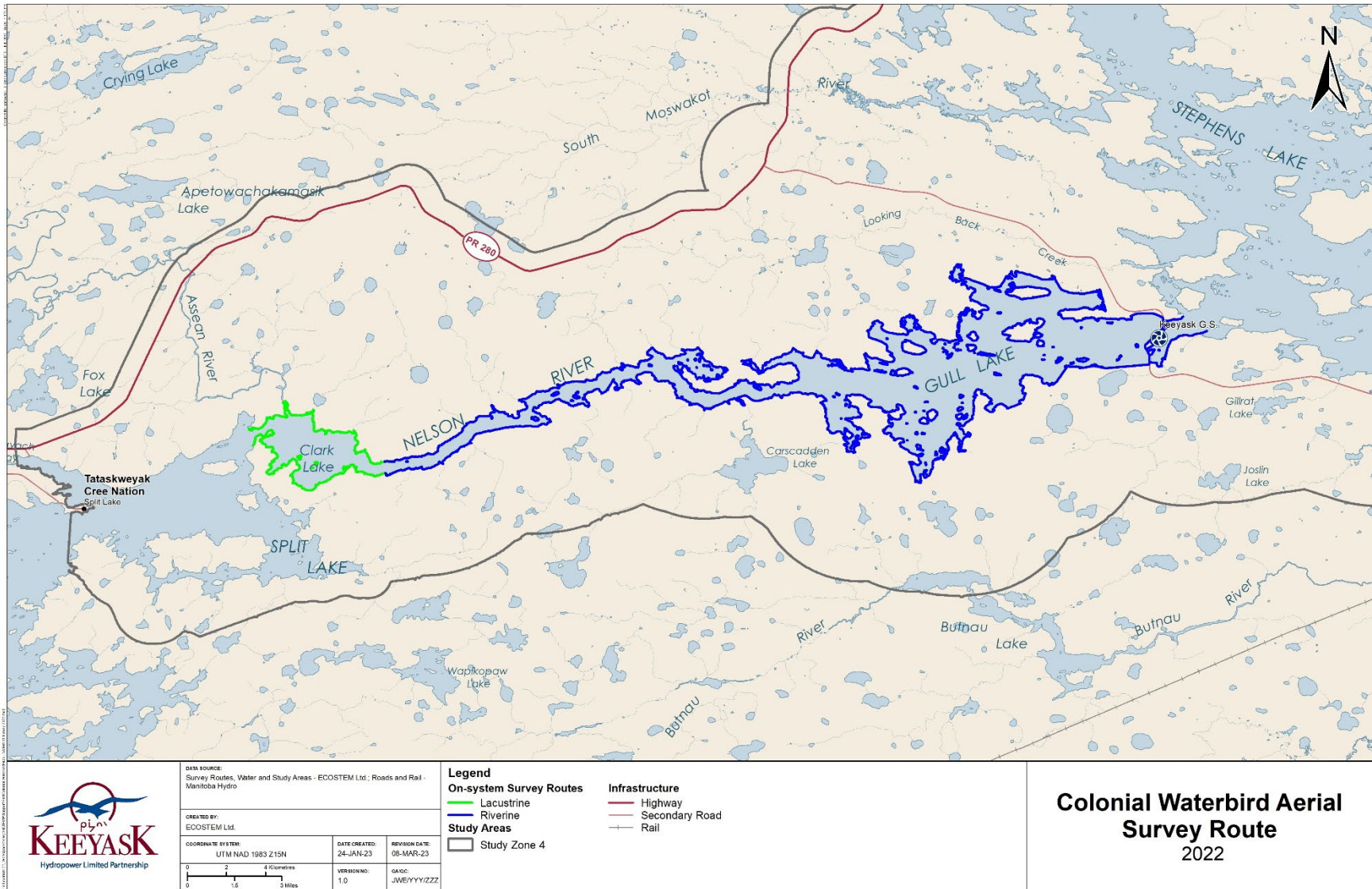
The first survey occurred on June 18, 2022 when gull and tern nests are typically initiated and most gulls and terns are incubating eggs, and the second survey occurred during the typical chick-rearing period on July 19, 2022.

The surveys 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 two observers and the helicopter pilot. The observers were seated in the front left and rear left seats and were responsible for preliminary counts of colonial waterbirds and photographing congregations using a Canon Rebel T6i, 24.2-megapixel camera. 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 congregation sites 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 disturbance to birds. All observations were georeferenced with a Garmin GPS 64 global positioning system (GPS). 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 individuals in small congregations of colonial waterbirds could be counted during the aerial survey, their numbers were determined with the in-flight photographs. Photographs were marked-up 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. 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.



Map 2: Colonial Waterbird Helicopter Survey Route and Waterbody Classification in 2022

3.0 RESULTS

3.1 UNMANNED AERIAL VEHICLE SURVEY

As observed in previous years, ring-billed gulls were the most common species of colonial waterbird observed in the former Gull Rapids area in 2022 (Table 1; Figure 1). The number of ring-billed gulls observed in the former Gull Rapids area during the early spring survey was within the ranges observed previously during the construction-phase surveys from 2015-2021. During the late-spring survey in 2022, the number of ring-billed gulls observed was the highest seen compared to all previous surveys. The subsequent summer 2022 survey indicated the lowest number of ring-billed gulls observed compared to previous surveys (Table 1; Figure 1). The relatively low number of ring-billed gulls during the summer survey was likely affected by the presence of up to seven immature, bald eagles on the HCI.

In 2022, the majority of habitat use of ring-billed gulls had shifted from island Wpt 226 to the constructed HCI, upstream of the Project. The HCI supported 92-99% of congregating and 97-98% of nesting ring-billed gulls in the former Gull Rapids area in 2022 (Map 3; Map 4). Relatively few birds were observed on islands downstream of the Project in comparison to previous surveys (Map 3; Map 4).

Relatively large numbers of ring-billed gulls nested in the former Gull Rapids area in 2022, mainly on the HCI (Map 3; Map 4). The number of ring-billed gull nests (2,656) was the third highest number of nests observed from previous surveys conducted during construction (2015-2021; see Appendix A). This was the first year that a large number of gulls had nested on the HCI. Only three other islands in the former Gull Rapids area supported ring-billed nests, with island Wpt 225 supporting the most with 40 nests (Map 3; Map 4).

Up to 296 ring-billed gull chicks were observed in the former Gull Rapids area in July 2022, with the majority (261) observed on the HCI (Table 1; Map 5). This was the first year that ring-billed gulls were observed to successfully raise young on the HCI. The number of chicks observed in 2022 is within the range observed during previous surveys from 2015-2021 (Appendix A).

Common terns were the second most abundant species of colonial waterbird observed in the former Gull Rapids area in 2022, which is consistent with previous years (Table 1; Figure 1). Common terns were only observed congregating and nesting on the HCI, which supported up to 67 nests (Map 3; Map 4).

The number of herring gulls, nests, and chicks observed in the former Gull Rapids area in 2022 were the highest observed in comparison to previous surveys from 2015-2021 (Table 1; Figure 1). Herring gulls were observed congregating on six islands and nesting on seven islands in the former Gull Rapids area, including one nest on the HCI (Map 3; Map 4). Herring gull nests and chicks were primarily found on the smaller islands in the former Gull Rapids area, downstream of the Project (Map 4; Map 5). Two Islands, Wpt 478 and Wpt 480, supported 28 of the 47 herring gull nests observed in June 2022 (Map 3; Map 4).

Several flocks of American white pelicans were observed in the former Gull Rapids area in 2022, and included birds observed on the HCI. No signs of nesting were observed, and the greatest number (30) was observed during the July survey, which was in the range observed during previous surveys from 2015-2021 (Table 1; Figure 1).

Table 1: Maximum Number (Standard Deviation) of Colonial Waterbirds, Nests, and Chicks Observed by UAV in the Morning/Afternoon on Islands in the Former Gull Rapids Area in 2022 for Each Survey Period

Observation	June 4-5	June 21-23	July 28
American White Pelican	0 (0)	10 (7)	30 (12)
Common Tern	28 (20)	41 (8)	160 (50)
Common Tern w. Nest	1 (1)	67 (14)	0 (0)
Common Tern Chick	0 (0)	0 (0)	0 (0)
Herring Gull	19 (4)	45 (2)	69 (9)
Herring Gull w. Nest	47 (4)	23 (3)	1 (1)
Herring Gull Chick	0 (0)	45 (11)	33 (9)
Ring-billed Gull	2,602 (103)	3,080 (605)	491 (34)
Ring-billed Gull w. Nest	1,009 (325)	2,656 (242)	0 (0)
Ring-billed Gull Chick	0 (0)	0 (0)	296 (18)

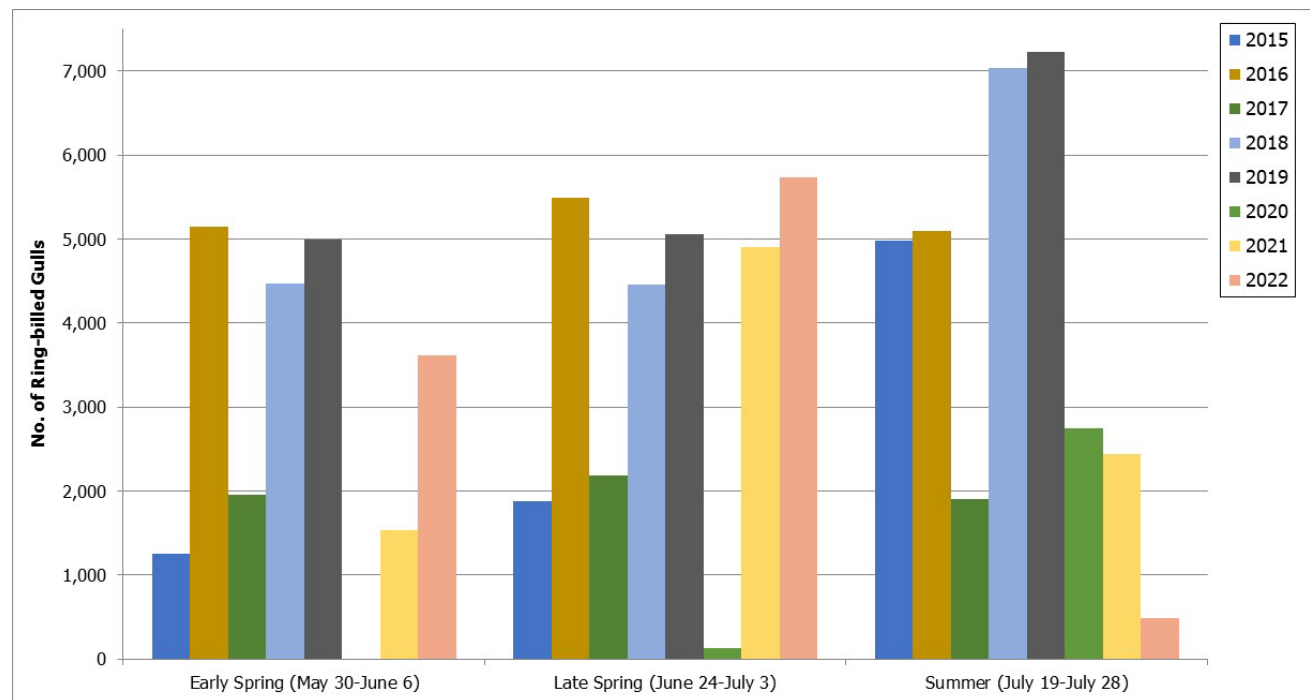
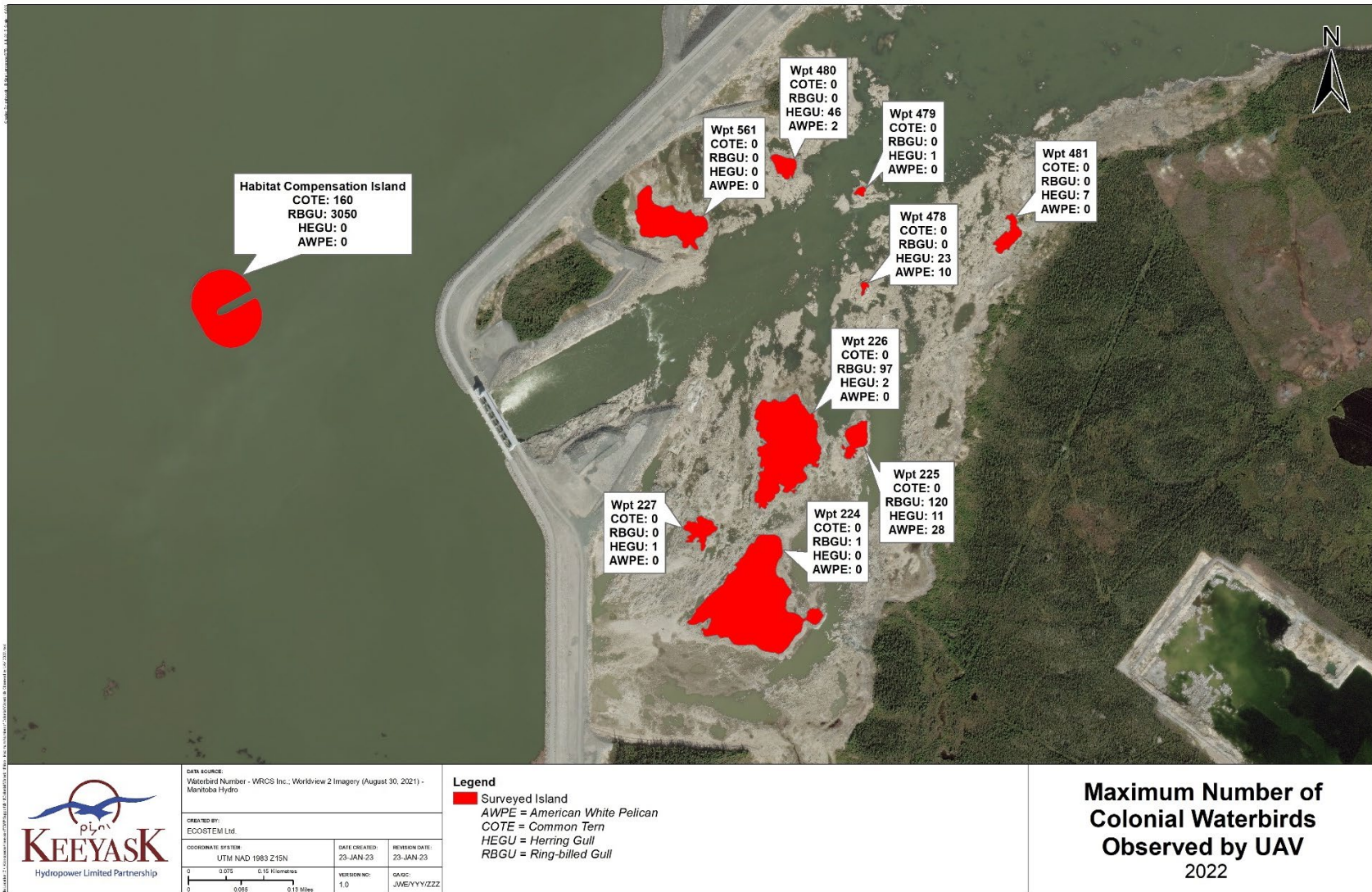
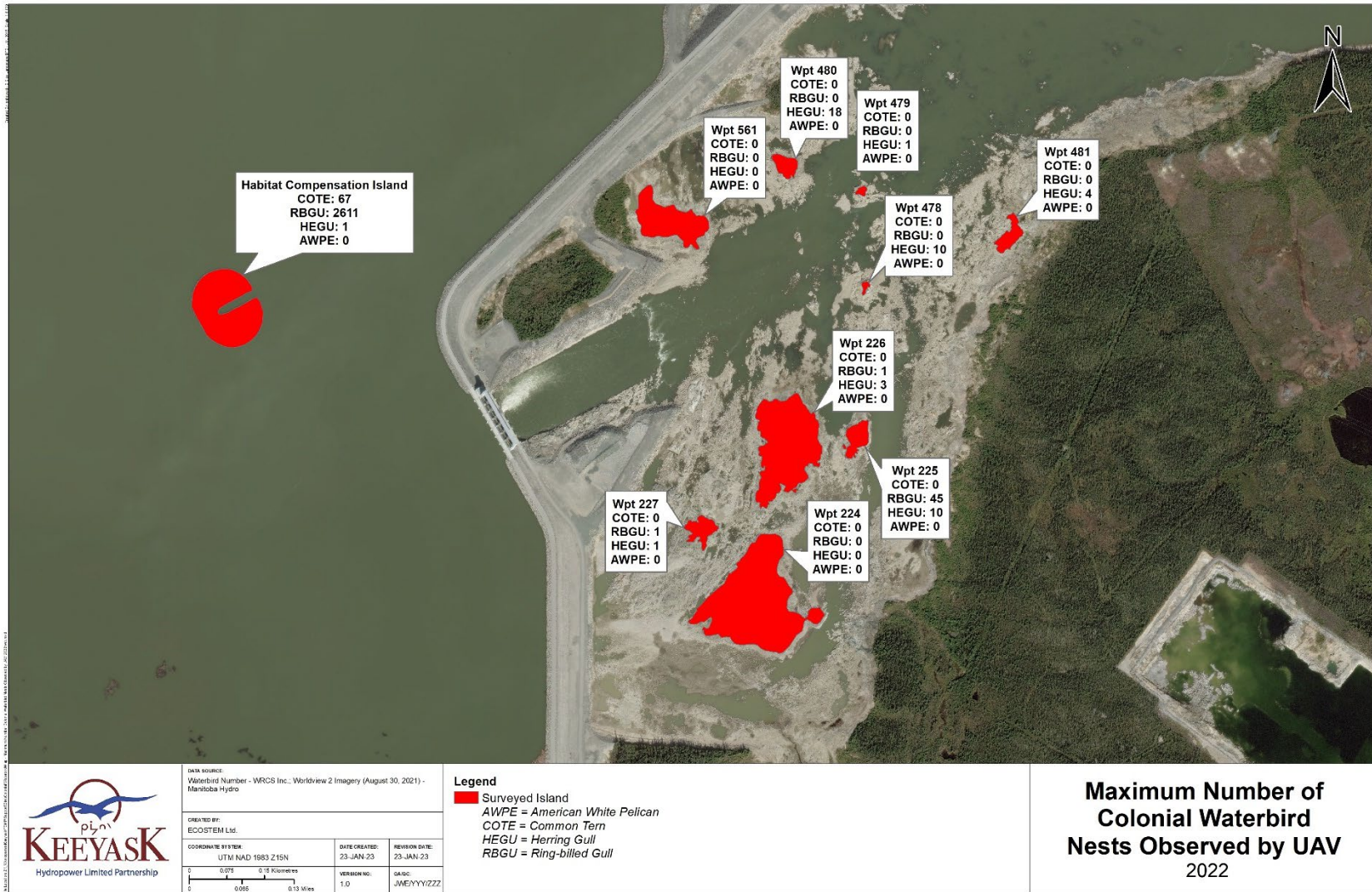


Figure 1: Total Number of Ring-billed Gulls (With and Without Nests) Observed in the Former Gull Rapids Area by UAV During Early Spring, Late Spring, and Summer Surveys from 2015-2022. *Note that the early spring survey was not conducted in 2020.



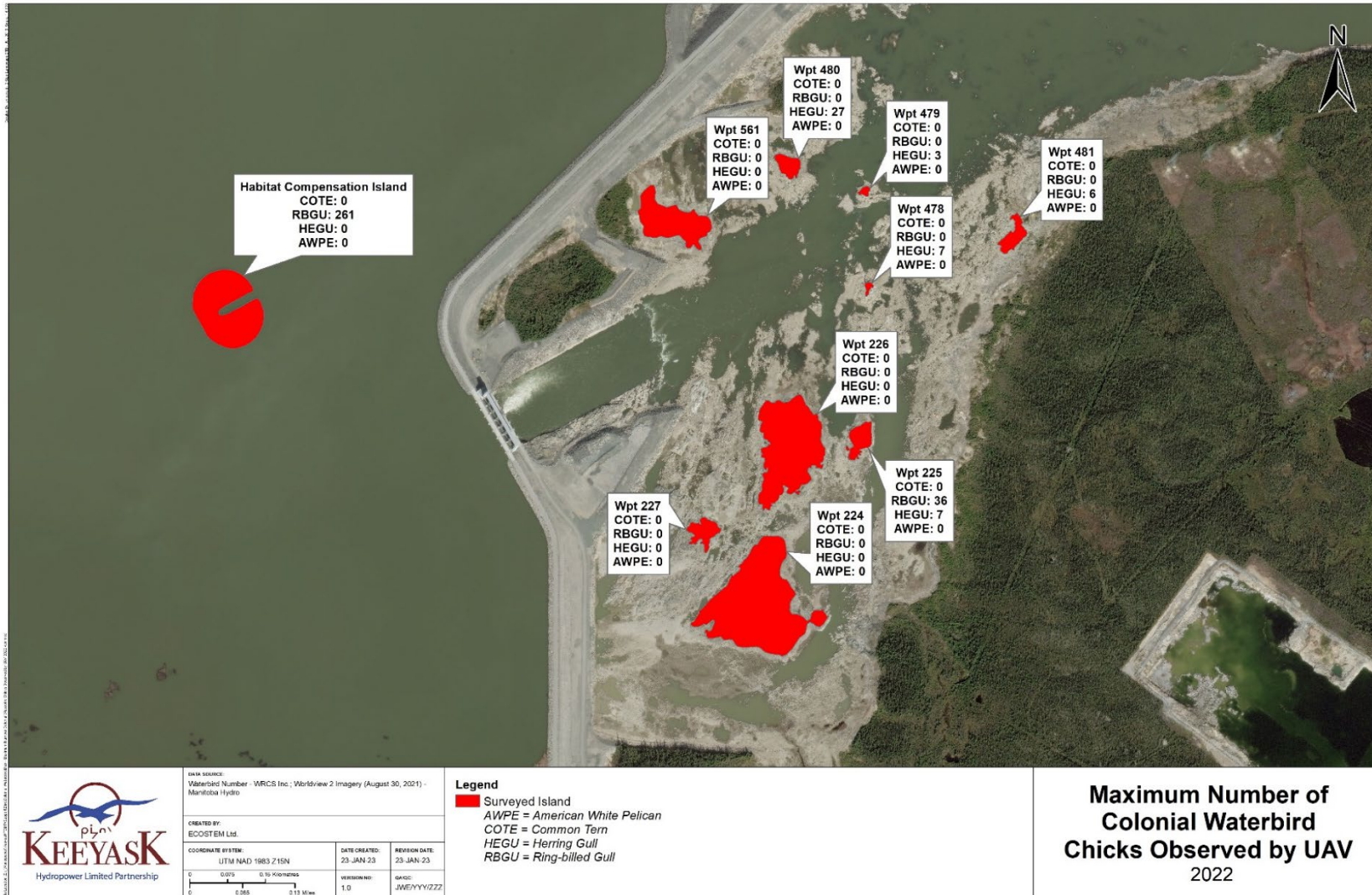
Note: the maximum number of colonial waterbirds was selected from pooled data from all survey periods (June 4-5, June 21-23, July 28) and morning/afternoon periods.

Map 3: Maximum Number of Colonial Waterbirds Observed on Each Island by UAV in the Former Gull Rapids Area in 2022



Note: the maximum number of colonial waterbird nests was selected from pooled data from all survey periods (June 4-5, June 21-23, July 28) and morning/afternoon periods.

Map 4: Maximum Number of Colonial Waterbird Nests Observed on Each Island by UAV in the Former Gull Rapids Area in 2022



Note: the maximum number of colonial waterbird nests was selected from pooled data from all survey periods (June 4-5, June 21-23, July 28) and morning/afternoon periods.

Map 5: Maximum Number of Colonial Waterbird Chicks Observed on Each Island by UAV in the Former Gull Rapids Area in 2022

3.2 HELICOPTER SURVEY

Four species of colonial waterbirds were observed during the 2022 helicopter surveys of the reservoir and surrounding area (Table 2). During both helicopter surveys, in June and July, ring-billed gulls were the most abundant colonial waterbird, with common terns being the second most abundant, which is consistent with previous surveys conducted from 2015-2021 (Table 2). American white pelican and herring gull were less abundant, which was consistent with the findings from previous construction monitoring surveys. No Bonaparte's gulls were observed in 2022.

Table 2: Colonial Waterbird Abundance Observed During Helicopter Surveys in 2022

Observation	June 18				July 19			
	Colony	Congregation	Dispersed	Total	Colony	Congregation	Dispersed	Total
Ring-billed Gull	1,516	6,192	191	7,899	0	3,496	614	4,110
Ring-billed Gull Chick	0	0	0	0	0	43	0	43
Herring Gull	25	37	0	62	2	47	0	49
Herring Gull Chick	0	0	0	0	0	8	0	8
Common Tern	310	658	112	1,080	54	35	114	203
American White Pelican	0	159	7	166	0	161	24	185
Total	1,851	7,046	310	9,207	56	3,739	752	4,547

3.2.1 RING-BILLED GULL

Ring-billed gulls were the most common species of colonial waterbird observed in the reservoir and surrounding area in 2022. The total number of ring-billed gulls decreased from June to July, which differed from the previous findings of the surveys conducted from 2015-2019 but was consistent with the findings from 2020 and 2021 (Figure 2; Table 3; Appendix B).

In June 2022, ring-billed gulls were observed congregating at 13 sites and nesting at two sites in and around the reservoir (Map 6). Most of the nesting occurred on the HCI and a small colony was observed on island Wpt 225 in the former Gull Rapids area where nesting ring-billed gulls have been observed during previous construction-phase surveys (Map 6). Unlike previous years, the HCI supported the majority of ring-billed gulls, rather than island Wpt 226, which had previously. The HCI supported 69% and 62% of the total adult ring-billed gulls observed in June and July, respectively (Table 3).

In July 2022, ring-billed gulls were observed congregating at seven sites and no nesting was observed (Table 3; Map 7). The total number of ring-billed gulls observed on the HCI in July may be an underestimate, as four, immature bald eagles were also present on the island and noticeably disturbing the birds (Photo 2).

Ring-billed gull chicks were only observed in the former Gull Rapids area on the HCI and on island Wpt 225 (Table 3; Map 7).

Of the 13 islands where ring-billed gulls were observed in June 2022, all (100%) had been used at least once in previous construction years (2015-2021) (Table 4). In July, of the seven islands used, all (100%) were used at least once in previous construction years (2015-2021), and six were located in the former Gull Rapids area (Table 4).

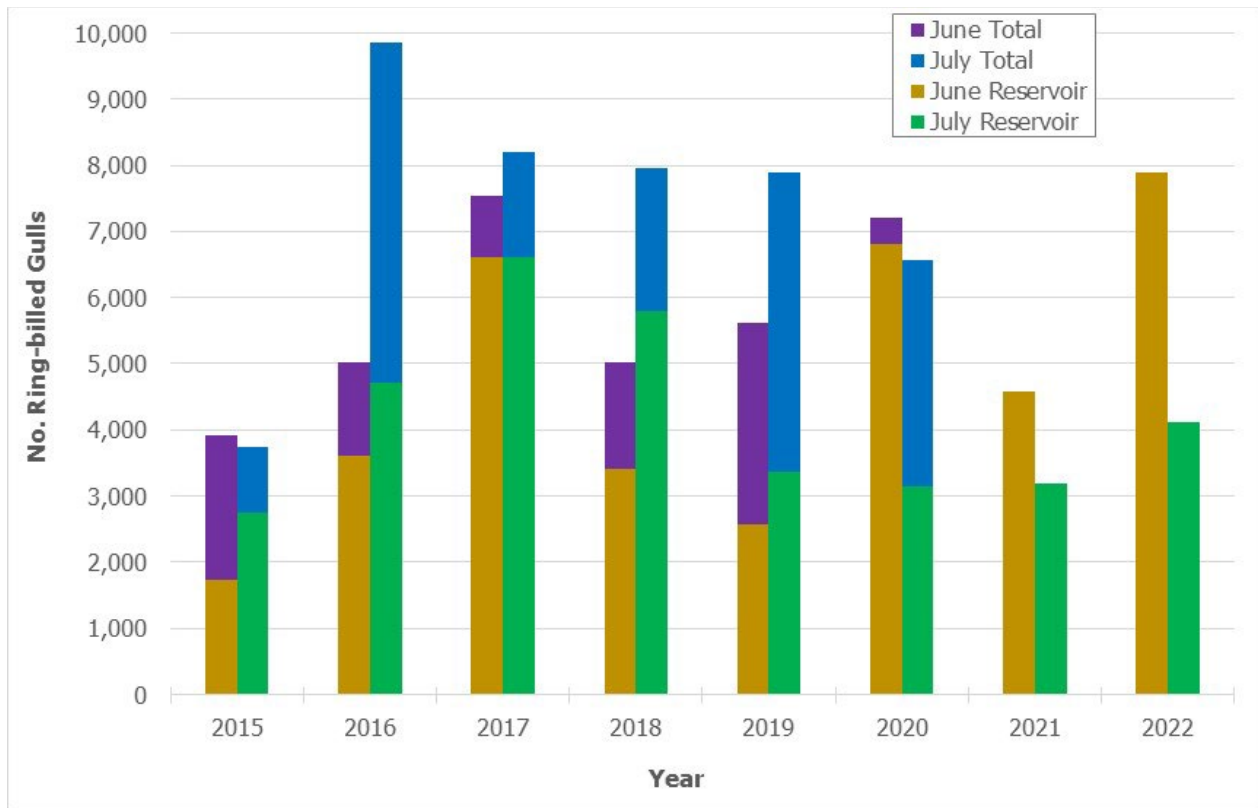
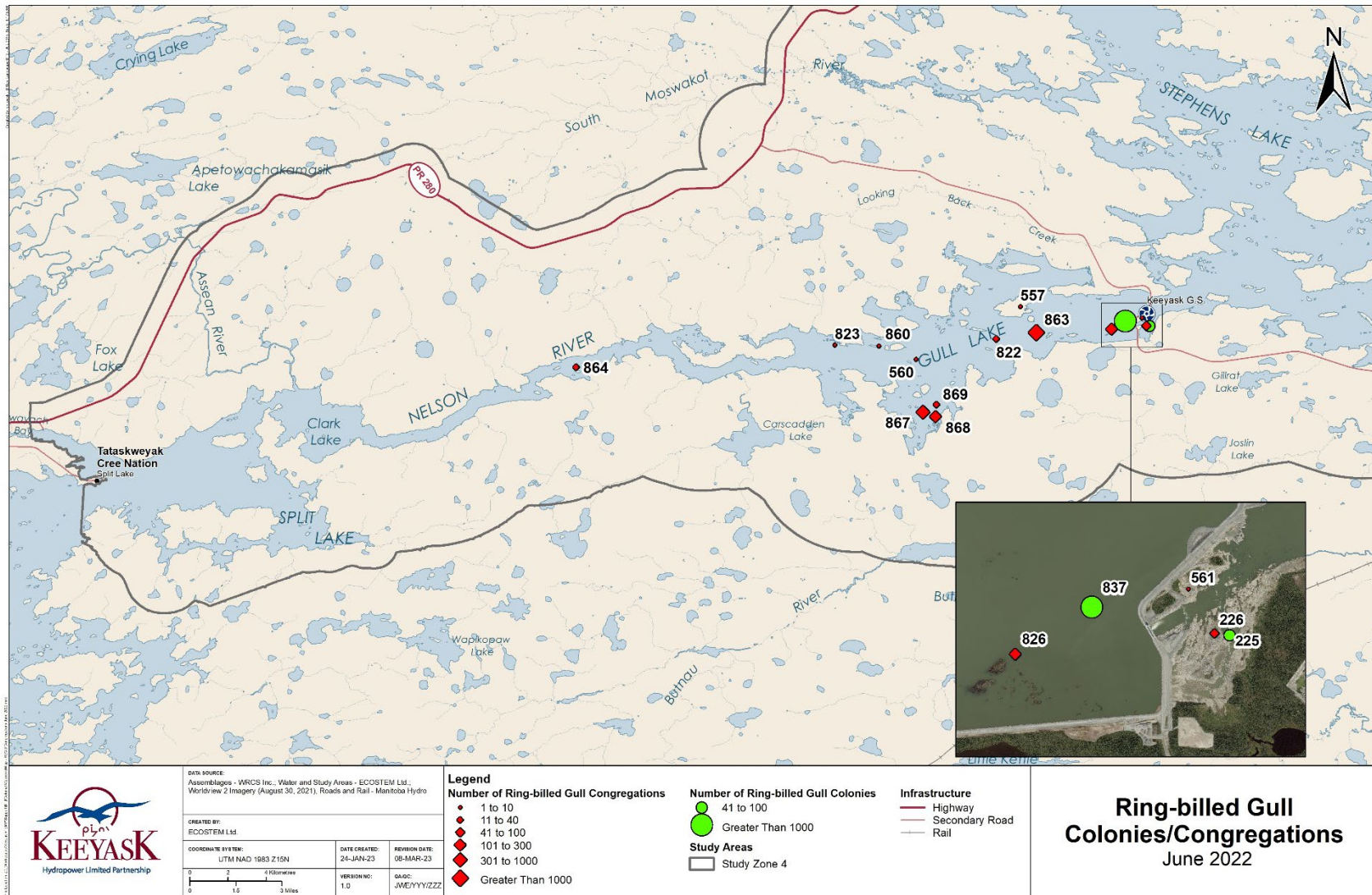
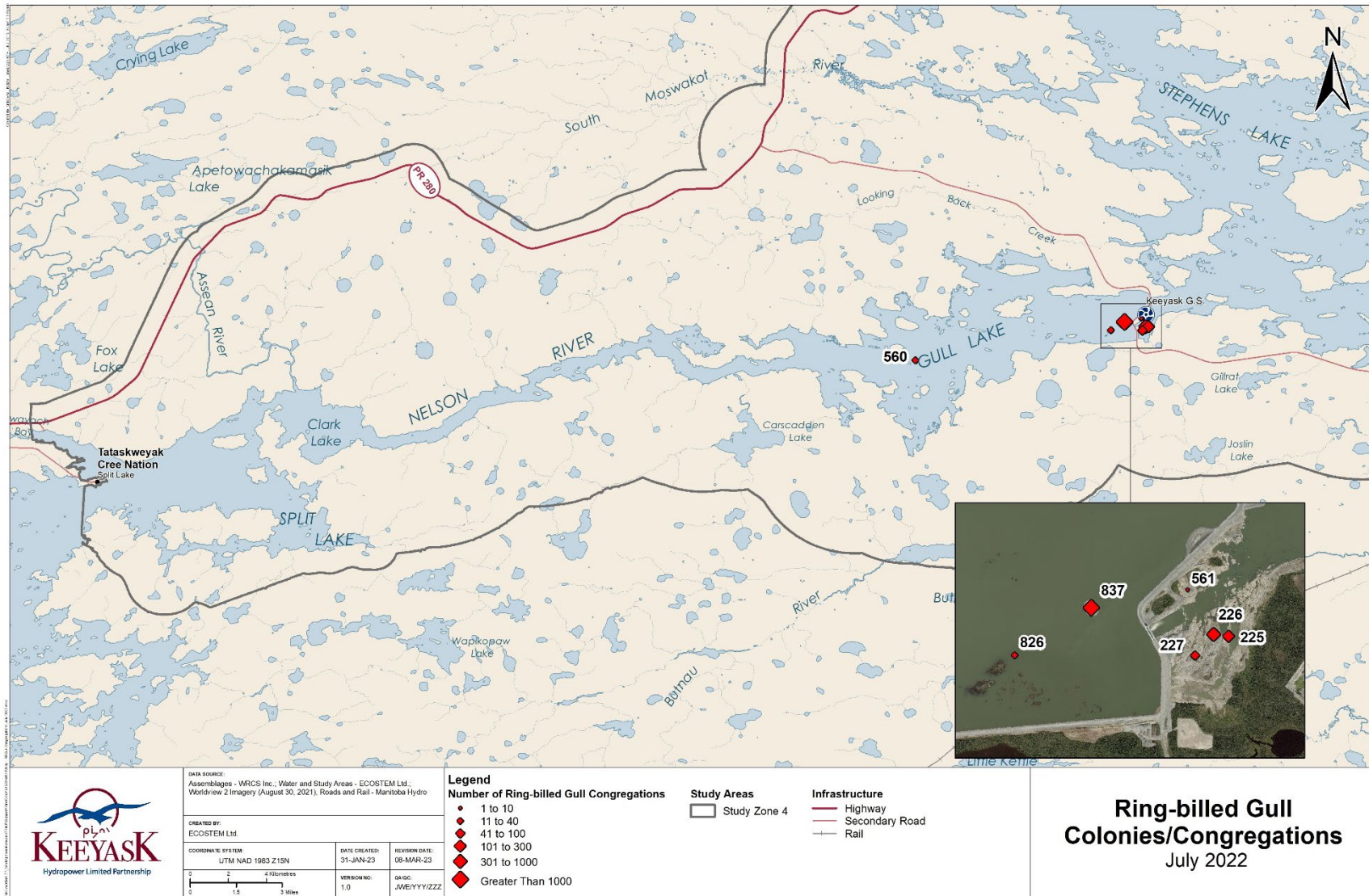


Figure 2: Number of Ring-billed Gulls Observed in the Reservoir (including the Former Gull Rapids Area and Clark Lake) and Total Study Area (Study Zone 5) During Helicopter Surveys in June and July from 2015 to 2022. *Note: Only the reservoir, former Gull Rapids area, and Clark Lake were surveyed in 2021 and 2022.



Map 6: Ring-billed Gull Colonies and Congregations Observed in and around the Reservoir During Helicopter Surveys in June 2022



Map 7: Ring-billed Gull Colonies and Congregations Observed in and around the Reservoir During Helicopter Surveys in July 2022

Table 3: Ring-billed Gull Congregations/Colonies Observed During the Helicopter Surveys in 2022

Waypoint	June				July			
	Adults (No Nest)	Occupied Nests	Total Adults	Total Chicks	Adults (No Nest)	Occupied Nests	Total Adults	Total Chicks
225	19	46	65	0	228	0	228	8
226	54	0	54	0	989	0	989	0
227	0	0	0	0	55	0	55	0
557	3	0	3	0	0	0	0	0
560	2	0	2	0	15	0	15	0
561	2	0	2	0	1	0	1	0
822	20	0	20	0	0	0	0	0
823	4	0	4	0	0	0	0	0
826	133	0	133	0	28	0	28	0
837*	3,839	1,470	5,309	0	2,180	0	2,180	35
860	1	0	1	0	0	0	0	0
863	1,283	0	1,283	0	0	0	0	0
864	14	0	14	0	0	0	0	0
867	600	0	600	0	0	0	0	0
868	200	0	200	0	0	0	0	0
869	18	0	18	0	0	0	0	0
Total	6,192	1,516	7,708	0	3,496	0	3,496	43

* Habitat Compensation Island

Table 4: Waterbody Classification and Island Use by Ring-billed Gulls in June and July 2022

Island	Gathering	Month	System	Flow	Size Class	Island Habitat	Island Size Class (ha)	Years Used 2015-2021
225	Colony	June	On-system	River	>1,000	Exposed bedrock	0.1-0.9	8
837	Colony	June	On-system	River	>1,000	Habitat Compensation Island, gravel	1.0-1.9	3
226	Congregation	June	On-system	River	>1,000	50% rock, 50% shrub/deadfall	1.0-1.9	8
557	Congregation	June	On-system	River	>1,000	Treed/burned	>4.0	3
560	Congregation	June	On-system	River	>1,000	Treed/cleared	>4.0	5
561	Congregation	June	On-system	River	>1,000	Exposed bedrock	1.0-1.9	5
822	Congregation	June	On-system	River	>1,000	Floating peat	<0.1	2
823	Congregation	June	On-system	River	>1,000	Floating peat	<0.1	2
826	Congregation	June	On-system	River	>1,000	Floating peat	<0.1	2
860	Congregation	June	On-system	River	>1,000	Treed	3.0-3.9	2
863	Congregation	June	On-system	River	>1,000	Floating peat	<0.1	2
864	Congregation	June	On-system	River	>1,000	50% shrub, 50% grass	0.1-0.9	2
867	Congregation	June	On-system	River	>1,000	On the water	NA	NA
868	Congregation	June	On-system	River	>1,000	On the water	NA	NA
869	Congregation	June	On-system	River	>1,000	50% peat, 50% grass	<0.1	2
2	Dispersed	June	On-system	River	>1,000	NA	NA	NA
4	Dispersed	June	On-system	River	>1,000	NA	NA	NA
5	Dispersed	June	On-system	River	>1,000	NA	NA	NA
6	Dispersed	June	On-system	River	>1,000	NA	NA	NA
7	Dispersed	June	On-system	River	>1,000	NA	NA	NA
8	Dispersed	June	On-system	River	>1,000	NA	NA	NA
9	Dispersed	June	On-system	River	>1,000	NA	NA	NA
10	Dispersed	June	On-system	River	>1,000	NA	NA	NA
11	Dispersed	June	On-system	River	>1,000	NA	NA	NA
13	Dispersed	June	On-system	River	>1,000	NA	NA	NA
14	Dispersed	June	On-system	River	>1,000	NA	NA	NA
15	Dispersed	June	On-system	River	>1,000	NA	NA	NA
17	Dispersed	June	On-system	River	>1,000	NA	NA	NA
18	Dispersed	June	On-system	River	>1,000	NA	NA	NA
19	Dispersed	June	On-system	River	>1,000	NA	NA	NA
20	Dispersed	June	On-system	River	>1,000	NA	NA	NA
21	Dispersed	June	On-system	River	>1,000	NA	NA	NA
22	Dispersed	June	On-system	River	>1,000	NA	NA	NA
23	Dispersed	June	On-system	River	>1,000	NA	NA	NA

Island	Gathering	Month	System	Flow	Size Class	Island Habitat	Island Size Class (ha)	Years Used 2015-2021
25	Dispersed	June	On-system	River	>1,000	NA	NA	NA
26	Dispersed	June	On-system	River	>1,000	NA	NA	NA
27	Dispersed	June	On-system	River	>1,000	NA	NA	NA
29	Dispersed	June	On-system	River	>1,000	NA	NA	NA
31	Dispersed	June	On-system	River	>1,000	NA	NA	NA
34	Dispersed	June	On-system	River	>1,000	NA	NA	NA
35	Dispersed	June	On-system	River	>1,000	NA	NA	NA
36	Dispersed	June	On-system	River	>1,000	NA	NA	NA
38	Dispersed	June	On-system	River	>1,000	NA	NA	NA
39	Dispersed	June	On-system	Lake	>1,000	NA	NA	NA
40	Dispersed	June	On-system	River	>1,000	NA	NA	NA
43	Dispersed	June	On-system	River	>1,000	NA	NA	NA
45	Dispersed	June	On-system	River	>1,000	NA	NA	NA
51	Dispersed	June	On-system	River	>1,000	NA	NA	NA
55	Dispersed	June	On-system	River	>1,000	NA	NA	NA
56	Dispersed	June	On-system	River	>1,000	NA	NA	NA
57	Dispersed	June	On-system	River	>1,000	NA	NA	NA
61	Dispersed	June	On-system	River	>1,000	NA	NA	NA
62	Dispersed	June	On-system	River	>1,000	NA	NA	NA
63	Dispersed	June	On-system	River	>1,000	NA	NA	NA
225	Congregation	July	On-system	River	>1,000	Exposed bedrock	0.1-0.9	6
226	Congregation	July	On-system	River	>1,000	50% rock, 50% shrub/deadfall	1.0-1.9	6
227	Congregation	July	On-system	River	>1,000	Exposed bedrock	<0.1	7
560	Congregation	July	On-system	River	>1,000	Treed/cleared	>4.0	5
561	Congregation	July	On-system	River	>1,000	Exposed bedrock	1.0-1.9	5
837	Congregation	July	On-system	River	>1,000	Habitat Compensation Island, gravel	1.0-1.9	3
826	Congregation	July	On-system	River	>1,000	Floating peat	<0.1	2
1	Dispersed	July	On-system	River	>1,000	NA	NA	NA
2	Dispersed	July	On-system	River	>1,000	NA	NA	NA
3	Dispersed	July	On-system	River	>1,000	NA	NA	NA
4	Dispersed	July	On-system	River	>1,000	NA	NA	NA
5	Dispersed	July	On-system	River	>1,000	NA	NA	NA
6	Dispersed	July	On-system	River	>1,000	NA	NA	NA
7	Dispersed	July	On-system	River	>1,000	NA	NA	NA
8	Dispersed	July	On-system	River	>1,000	NA	NA	NA
9	Dispersed	July	On-system	River	>1,000	NA	NA	NA
10	Dispersed	July	On-system	River	>1,000	NA	NA	NA
11	Dispersed	July	On-system	River	>1,000	NA	NA	NA



Island	Gathering	Month	System	Flow	Size Class	Island Habitat	Island Size Class (ha)	Years Used 2015-2021
12	Dispersed	July	On-system	River	>1,000	NA	NA	NA
13	Dispersed	July	On-system	River	>1,000	NA	NA	NA
14	Dispersed	July	On-system	River	>1,000	NA	NA	NA
15	Dispersed	July	On-system	River	>1,000	NA	NA	NA
16	Dispersed	July	On-system	River	>1,000	NA	NA	NA
18	Dispersed	July	On-system	River	>1,000	NA	NA	NA
20	Dispersed	July	On-system	River	>1,000	NA	NA	NA
25	Dispersed	July	On-system	River	>1,000	NA	NA	NA
26	Dispersed	July	On-system	River	>1,000	NA	NA	NA
27	Dispersed	July	On-system	Lake	>1,000	NA	NA	NA
28	Dispersed	July	On-system	Lake	>1,000	NA	NA	NA
29	Dispersed	July	On-system	River	>1,000	NA	NA	NA
30	Dispersed	July	On-system	River	>1,000	NA	NA	NA
31	Dispersed	July	On-system	River	>1,000	NA	NA	NA
32	Dispersed	July	On-system	River	>1,000	NA	NA	NA
35	Dispersed	July	On-system	River	>1,000	NA	NA	NA
36	Dispersed	July	On-system	River	>1,000	NA	NA	NA
41	Dispersed	July	On-system	River	>1,000	NA	NA	NA
45	Dispersed	July	On-system	River	>1,000	NA	NA	NA
46	Dispersed	July	On-system	River	>1,000	NA	NA	NA
47	Dispersed	July	On-system	River	>1,000	NA	NA	NA
48	Dispersed	July	On-system	River	>1,000	NA	NA	NA
49	Dispersed	July	On-system	River	>1,000	NA	NA	NA
50	Dispersed	July	On-system	River	>1,000	NA	NA	NA
51	Dispersed	July	On-system	River	>1,000	NA	NA	NA



Photo 2: Four Immature Bald Eagles on the Habitat Compensation Island, July 19, 2022

3.2.2 COMMON TERN

Common terns were the second most abundant species of colonial waterbird observed in and around the reservoir in 2022 (Table 2).

The number of common terns observed in June 2022 were the highest observed in any of the construction-phase surveys conducted from 2015-2021 (Figure 3). In July 2022, the number of common terns decreased substantially, but was the third highest number observed from previous surveys (Figure 3).

In June 2022, common terns were observed congregating at eight sites and nesting at two sites, including on the HCI where 79 nests were observed (Table 5; Map 8). This was the second year that common terns nested on the HCI, which also occurred in 2021. The two largest congregations observed in June 2022 (Wpt 822 and 826) were located on floating peat islands within Gull Lake that were created with the newly formed reservoir and had not been used previously (Map 8; Table 6).

In July 2022, common terns were observed congregating at two sites and nesting was again observed on the HCI (Table 5; Map 9). No common tern chicks were observed on the HCI in 2022 as they were in 2021, but this may have been a result of fireweed (*Epilobium angustifolium*) growth near the nesting area, providing cover for the chicks and making them less visible (Photo 3).

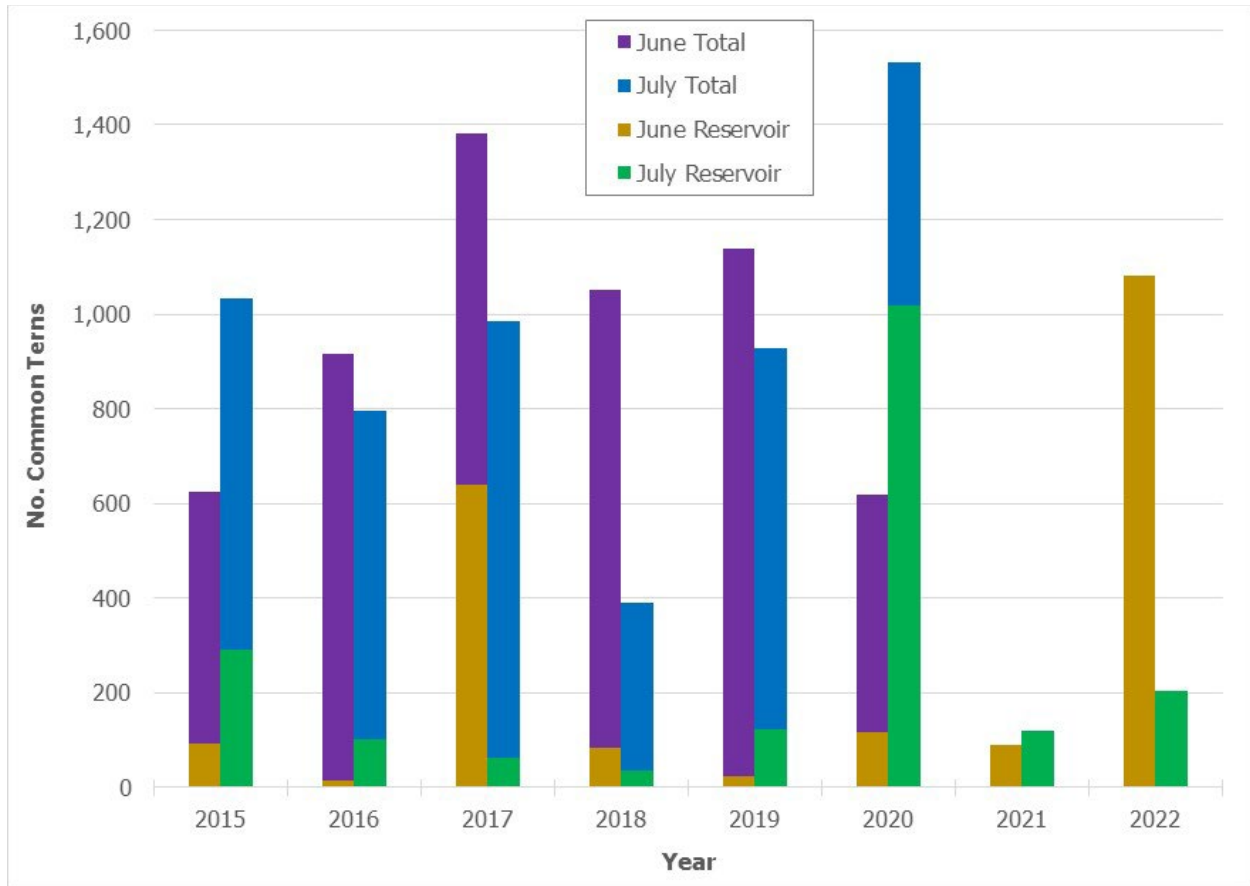
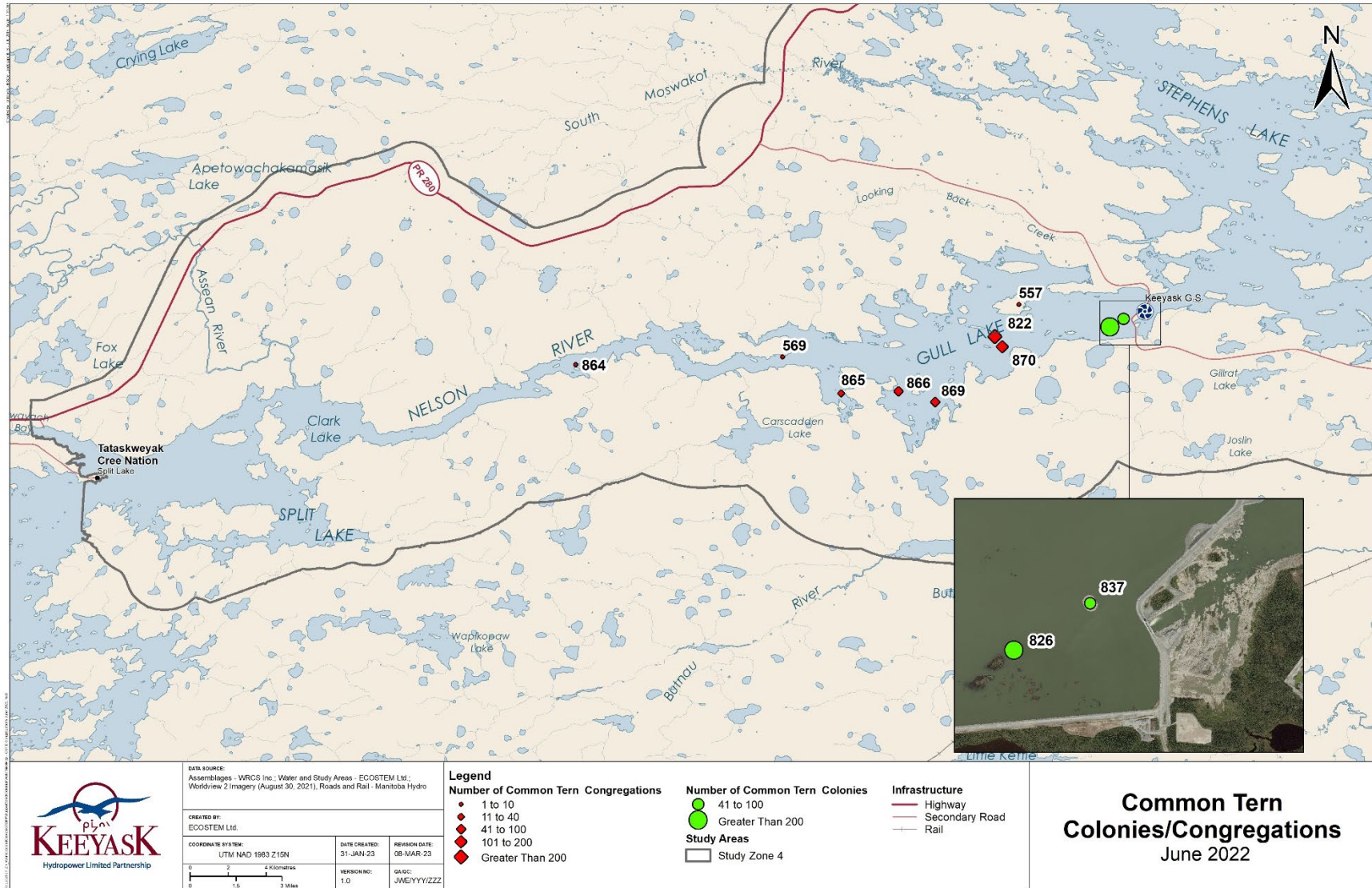
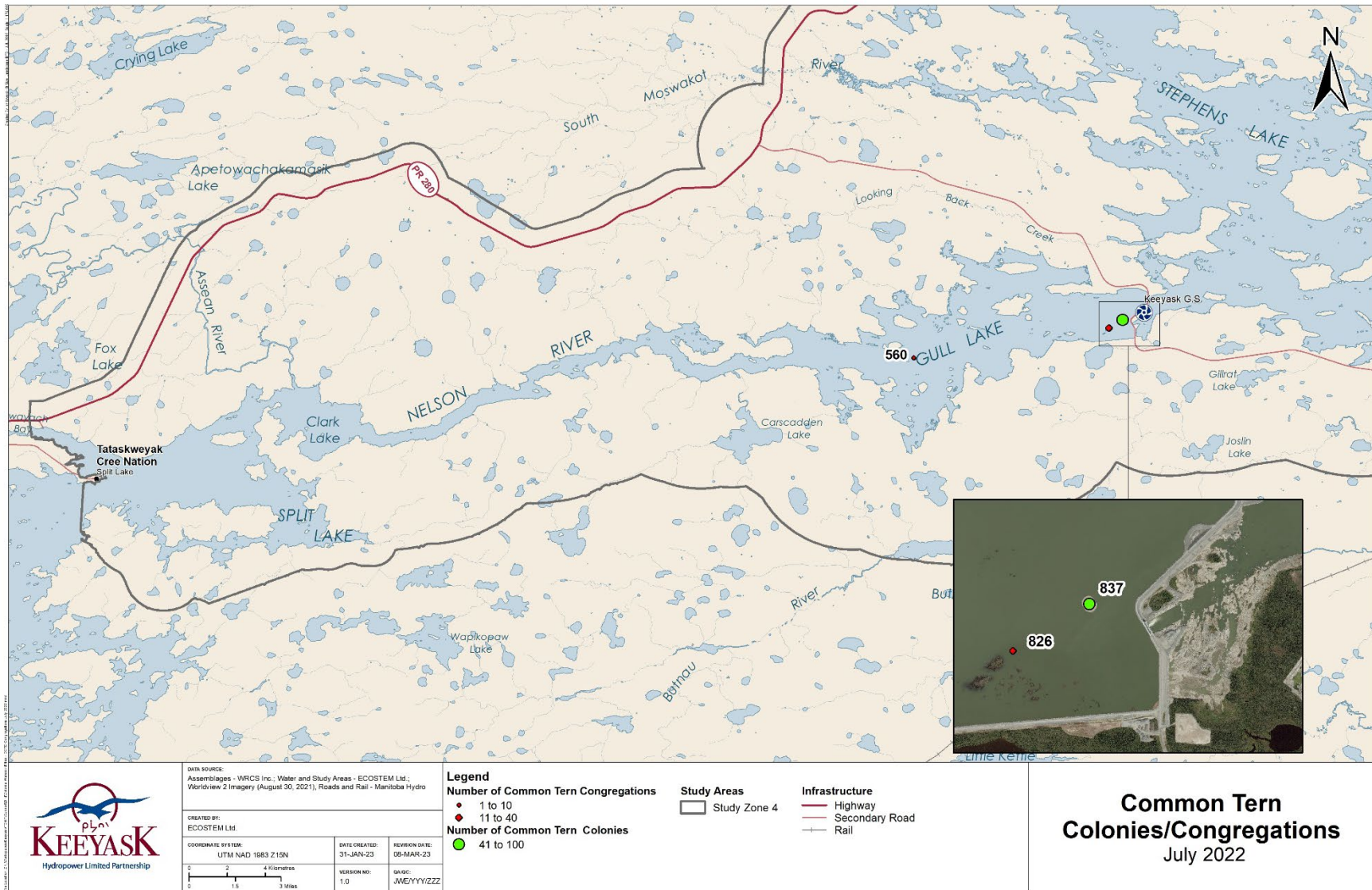


Figure 3: Number of Common Terns Observed in the Reservoir (including the Former Gull Rapids Area and Clark Lake) and Total Study Area (Study Zone 5) During Helicopter Surveys in June and July from 2015 to 2022. *Note: Only the reservoir, former Gull Rapids area, and Clark Lake were surveyed in 2021 and 2022.



Map 8: Common Tern Colonies and Congregations Observed in and around the Reservoir During Helicopter Surveys in June 2022



Map 9: Common Tern Colonies and Congregations Observed in and around the Reservoir During Helicopter Surveys in July 2022

Table 5: Common Tern Congregations/Colonies Observed in and around the Reservoir During the Helicopter Surveys in 2022

Waypoint	June				July			
	Adults (No Nest)	Occupied Nests	Total Adults	Total Chicks	Adults (No Nest)	Occupied Nests	Total Adults	Total Chicks
557	1	0	1	0	0	0	0	0
560	0	0	0	0	3	0	3	0
569	2	0	2	0	0	0	0	0
822	220	0	220	0	0	0	0	0
826	172	231	403	0	23	0	23	0
837*	11	79	90	0	9	54	63	0
864	5	0	5	0	0	0	0	0
865	22	0	22	0	0	0	0	0
866	55	0	55	0	0	0	0	0
869	50	0	50	0	0	0	0	0
870	120	0	120	0	0	0	0	0
Total	658	310	968	0	35	54	89	0

* Habitat Compensation Island

Table 6: Waterbody Classification and Island Use by Common Terns in June and July 2022

Island	Gathering	Month	System	Flow	Size Class	Island Habitat	Island Size Class (ha)	Years Used 2015-2021
826	Colony	June	On-system	River	>1,000	Floating peat	<0.1	2
837	Colony	June	On-system	River	>1,000	Habitat Compensation Island, gravel	1.0-1.9	3
557	Congregation	June	On-system	River	>1,000	Treed/burned	>4.0	3
569	Congregation	June	On-system	River	>1,000	Exposed bedrock	<0.1	3
822	Congregation	June	On-system	River	>1,000	Floating peat	<0.1	2
864	Congregation	June	On-system	River	>1,000	50% shrub, 50% grass	0.1-0.9	2
865	Congregation	June	On-system	River	>1,000	Floating peat	<0.1	2
866	Congregation	June	On-system	River	>1,000	Floating peat	<0.1	2
869	Congregation	June	On-system	River	>1,000	50% peat, 50% grass	<0.1	2
870	Congregation	June	On-system	River	>1,000	Floating peat	<0.1	2
3	Dispersed	June	On-system	River	>1,000	NA	NA	NA
6	Dispersed	June	On-system	River	>1,000	NA	NA	NA
8	Dispersed	June	On-system	River	>1,000	NA	NA	NA
12	Dispersed	June	On-system	River	>1,000	NA	NA	NA
16	Dispersed	June	On-system	River	>1,000	NA	NA	NA
24	Dispersed	June	On-system	River	>1,000	NA	NA	NA
28	Dispersed	June	On-system	River	>1,000	NA	NA	NA
33	Dispersed	June	On-system	River	>1,000	NA	NA	NA
37	Dispersed	June	On-system	River	>1,000	NA	NA	NA
41	Dispersed	June	On-system	River	>1,000	NA	NA	NA
42	Dispersed	June	On-system	River	>1,000	NA	NA	NA
43	Dispersed	June	On-system	River	>1,000	NA	NA	NA
44	Dispersed	June	On-system	River	>1,000	NA	NA	NA
45	Dispersed	June	On-system	River	>1,000	NA	NA	NA
46	Dispersed	June	On-system	River	>1,000	NA	NA	NA
47	Dispersed	June	On-system	River	>1,000	NA	NA	NA
48	Dispersed	June	On-system	River	>1,000	NA	NA	NA
58	Dispersed	June	On-system	River	>1,000	NA	NA	NA
59	Dispersed	June	On-system	River	>1,000	NA	NA	NA
837	Colony	July	On-system	River	>1,000	Habitat Compensation Island, gravel	1.0-1.9	3
560	Congregation	July	On-system	River	>1,000	Treed/cleared	>4.0	5
826	Congregation	July	On-system	River	>1,000	Floating peat	<0.1	2
3	Dispersed	July	On-system	River	>1,000	NA	NA	NA

Island	Gathering	Month	System	Flow	Size Class	Island Habitat	Island Size Class (ha)	Years Used 2015-2021
11	Dispersed	July	On-system	River	>1,000	NA	NA	NA
13	Dispersed	July	On-system	River	>1,000	NA	NA	NA
17	Dispersed	July	On-system	River	>1,000	NA	NA	NA
19	Dispersed	July	On-system	River	>1,000	NA	NA	NA
27	Dispersed	July	On-system	Lake	>1,000	NA	NA	NA
34	Dispersed	July	On-system	River	>1,000	NA	NA	NA
36	Dispersed	July	On-system	River	>1,000	NA	NA	NA
37	Dispersed	July	On-system	River	>1,000	NA	NA	NA
38	Dispersed	July	On-system	River	>1,000	NA	NA	NA
39	Dispersed	July	On-system	River	>1,000	NA	NA	NA
40	Dispersed	July	On-system	River	>1,000	NA	NA	NA
42	Dispersed	July	On-system	River	>1,000	NA	NA	NA
43	Dispersed	July	On-system	River	>1,000	NA	NA	NA
44	Dispersed	July	On-system	River	>1,000	NA	NA	NA
46	Dispersed	July	On-system	River	>1,000	NA	NA	NA
47	Dispersed	July	On-system	River	>1,000	NA	NA	NA



Photo 3: Common Terns Congregating on Recently formed Peat Islands, June 18, 2022

3.2.3 HERRING GULL

The number of herring gulls observed in June and July 2022 were the second highest number observed in the reservoir and surrounding area during any of the previous construction-phase surveys from 2015-2021 (Figure 4). The number observed during July decreased, as has been observed during previous surveys, and was within the range observed previously (Figure 4).

In June 2022, herring gulls were observed nesting on five islands within the former Gull Rapids area (Map 6). All of the islands used by herring gulls in June were in the former Gull Rapids area and had been used at least once in previous construction years (2015-2021) (Map 10; Table 8).

In July 2022, herring gulls were observed congregating on three islands in the former Gull Rapids area, and two birds were observed nesting on one island (Wpt 480) (Map 10). A total of eight chicks were observed on four islands, which were all located in the former Gull Rapids area (Table 7).

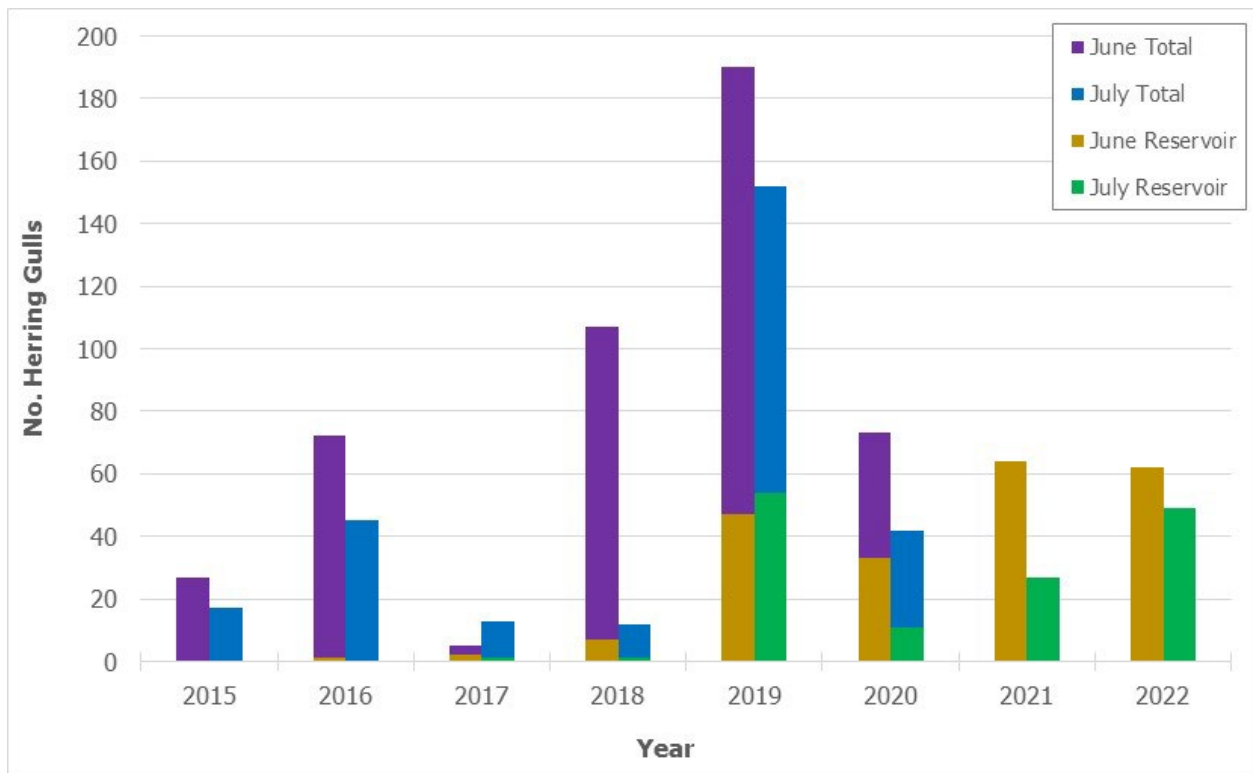
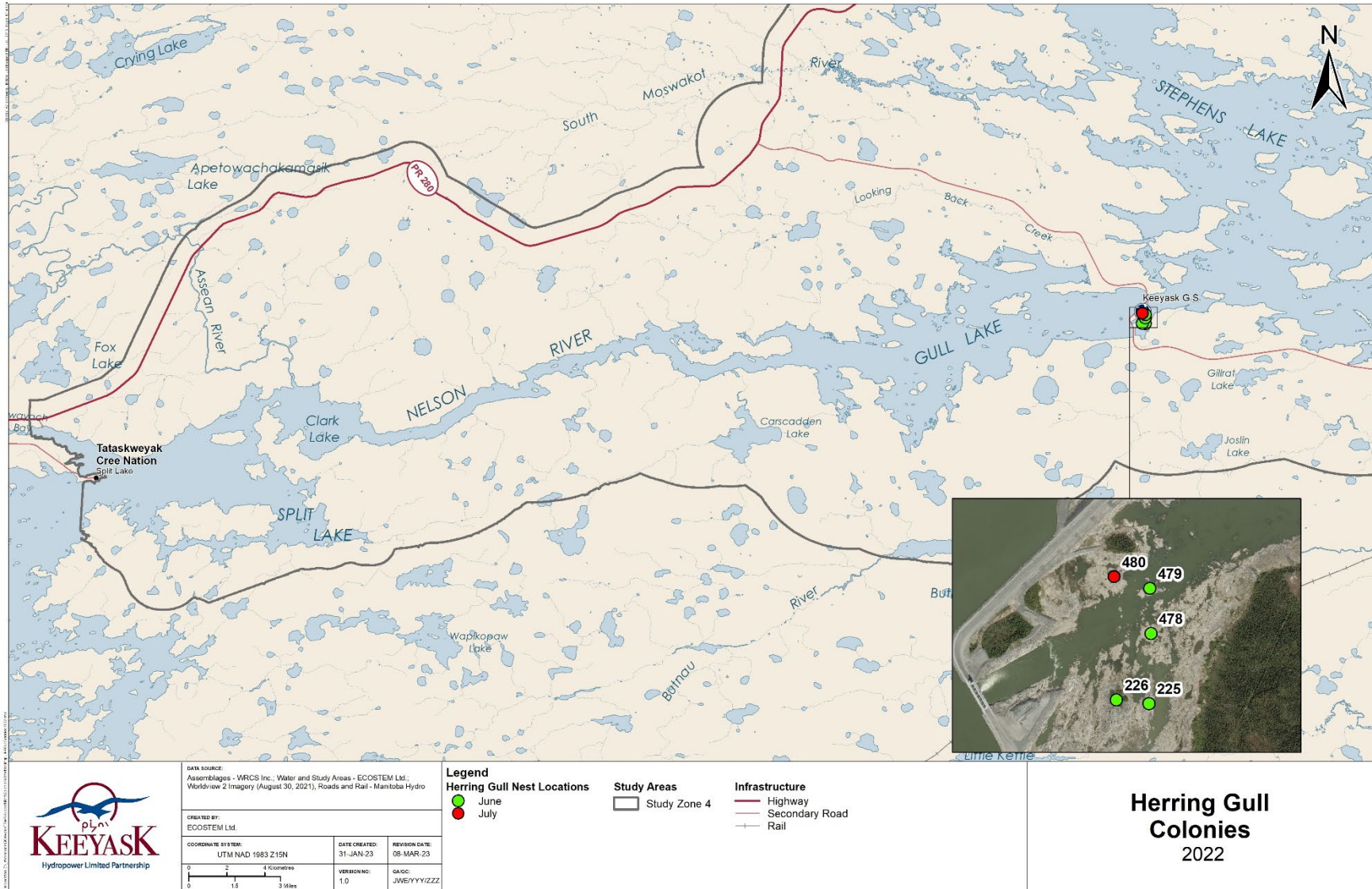


Figure 4: Number of Herring Gulls Observed in the Reservoir (including the Former Gull Rapids Area and Clark Lake) and Total Study Area (Study Zone 5) During Helicopter Surveys in June and July from 2015 to 2022. *Note: Only the reservoir, former Gull Rapids area, and Clark Lake were surveyed in 2021 and 2022.



Map 10: Herring Gull Colonies Observed During Helicopter Surveys in 2022

Table 7: Herring Gulls and Colonies Observed in and around the Reservoir During the Helicopter Surveys in 2022

Waypoint	June				July			
	Adults (No Nest)	Occupied Nests	Total Adults	Total Chicks	Adults (No Nest)	Occupied Nests	Total Adults	Total Chicks
225	2	11	13	0	15	0	15	1
226	0	1	1	0	0	0	0	0
478	9	4	13	0	1	0	1	2
479	3	3	6	0	6	0	6	2
480	23	6	29	0	25	2	27	3
Total	37	25	62	0	47	2	49	8

Table 8: Waterbody Classification and Island Use by Herring Gulls in 2022

Island	Gathering	Month	System	Flow	Size Class	Island Habitat	Island Size Class (ha)	Years Used 2015-2021
225	Colony	June	On-system	River	>1,000	Exposed bedrock	0.1-0.9	8
226	Colony	June	On-system	River	>1,000	50% rock, 50% shrub/deadfall	1.0-1.9	8
478	Colony	June	On-system	River	>1,000	Exposed bedrock	<0.1	8
479	Colony	June	On-system	River	>1,000	Exposed bedrock	<0.1	8
480	Colony	June	On-system	River	>1,000	Exposed bedrock	0.1-0.9	7
480	Colony	July	On-system	River	>1,000	Exposed bedrock	0.1-0.9	7
225	Congregation	July	On-system	River	>1,000	Exposed bedrock	0.1-0.9	6
478	Congregation	July	On-system	River	>1,000	Exposed bedrock	<0.1	8
479	Congregation	July	On-system	River	>1,000	Exposed bedrock	<0.1	8

3.2.4 BONAPARTE’S GULL

No Bonaparte’s gulls were observed in the reservoir or surrounding area in 2022. This is consistent with previous construction surveys (2015-2021) as Bonaparte’s gulls are typically observed in off-system areas (Figure 5).

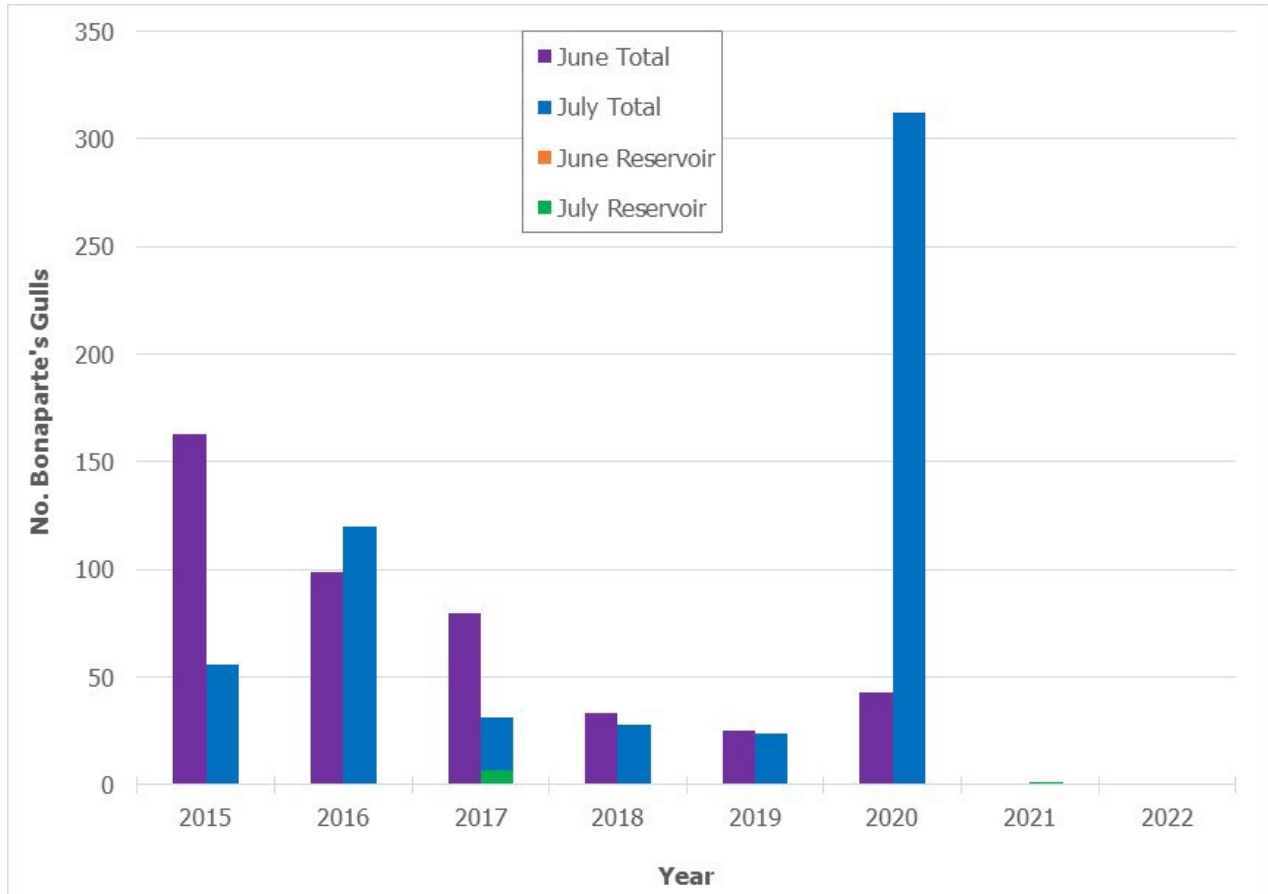


Figure 5: Number of Bonaparte’s Gulls Observed in the Reservoir (including the Former Gull Rapids Area and Clark Lake) and Total Study Area (Study Zone 5) During Helicopter Surveys in June and July from 2015 to 2022. *Note: Only the reservoir, former Gull Rapids area, and Clark Lake were surveyed in 2021 and 2022.

3.2.5 AMERICAN WHITE PELICAN

The number of American white pelicans observed in June 2022 was the highest number that has been observed compared to all previous construction-phase surveys from 2015-2021 (Figure 6). In July 2022, the number of pelicans increased slightly, and was within the range that has been observed during previous surveys (Figure 6).

The largest concentration of American white pelicans observed in June and July were observed in the former Gull Rapids area, including on the HCI (Table 9; Map 11). American white pelicans were also concentrated in areas of fast flowing water on the Nelson River. This is consistent with observations made during previous surveys.

All of the islands used by American white pelicans in June and July 2022 had been used at least once in previous years (2015-2020) (Table 10).

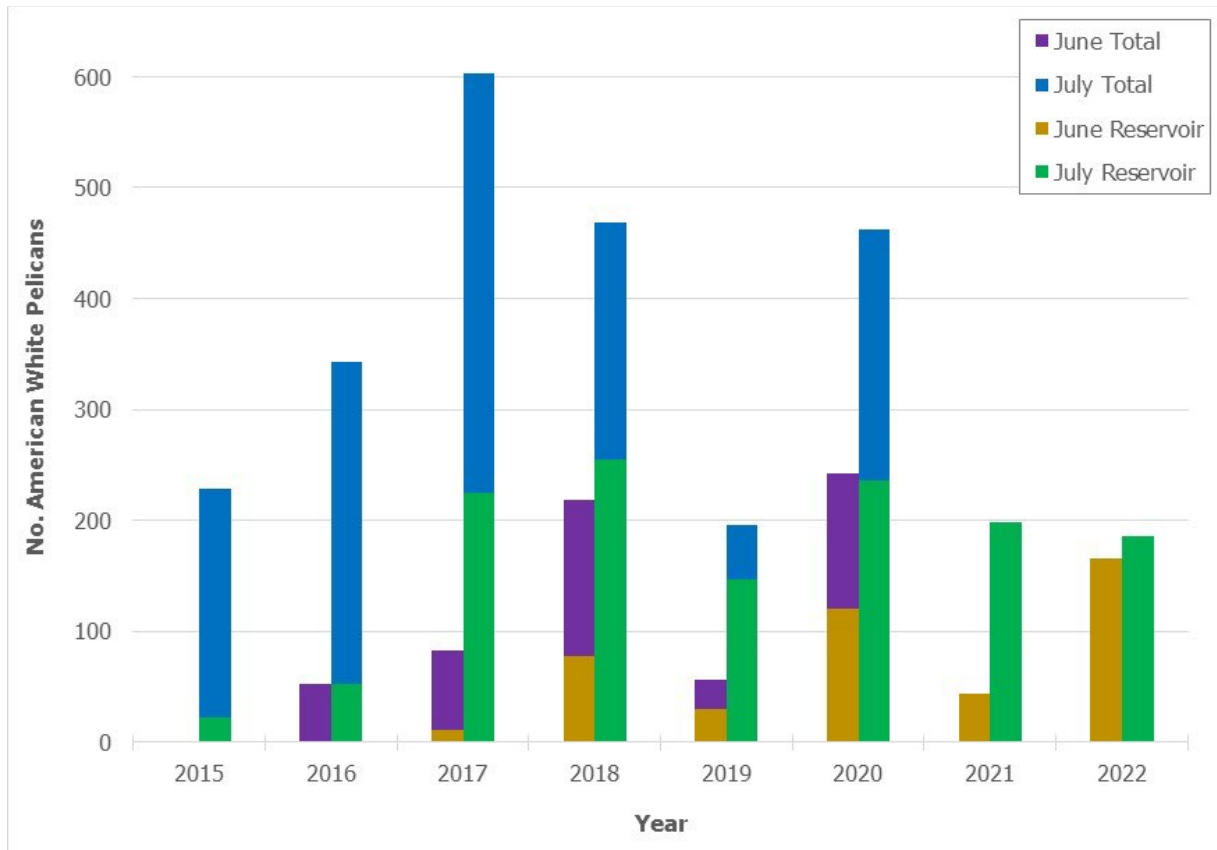
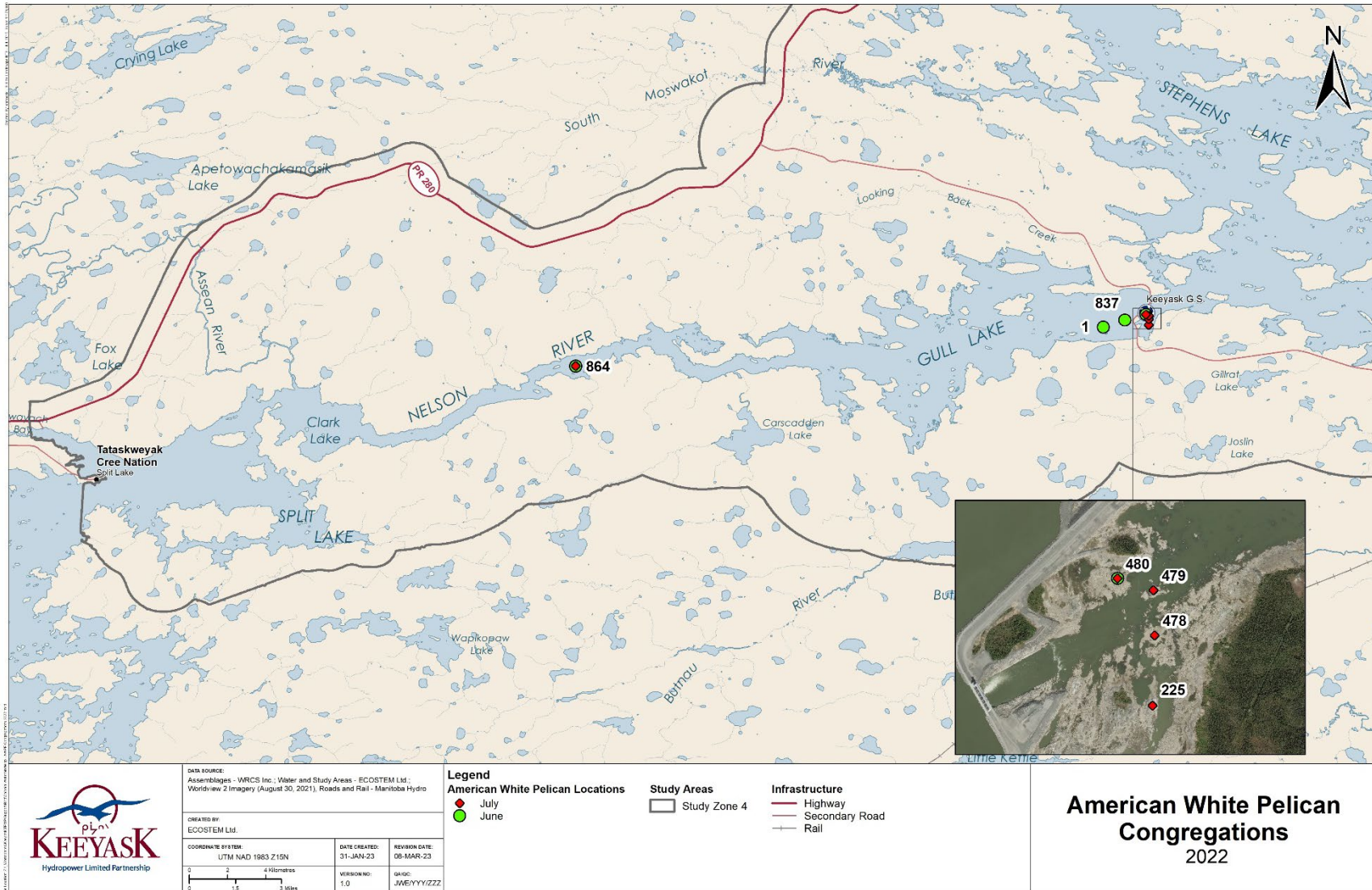


Figure 6: Number of American White Pelicans Observed in the Reservoir (including the Former Gull Rapids Area and Clark Lake) and Total Study Area (Study Zone 5) During Helicopter Surveys in June and July from 2015 to 2022. *Note: Only the reservoir, former Gull Rapids area, and Clark Lake were surveyed in 2021 and 2022.



Map 11: American White Pelican Observations Made During the Helicopter Surveys in 2022

Table 9: American White Pelican Observations Made During the Helicopter Surveys in 2022

Waypoint	June				July			
	Adults (No Nest)	Occupied Nests	Total Adults	Total Chicks	Adults (No Nest)	Occupied Nests	Total Adults	Total Chicks
1	45	0	45	0	0	0	0	0
225	0	0	0	0	34	0	34	0
478	0	0	0	0	50	0	50	0
479	0	0	0	0	21	0	21	0
480	30	0	30	0	10	0	10	0
837*	53	0	53	0	0	0	0	0
864	31	0	31	0	46	0	46	0
Total	159	0	159	0	161	0	161	0

* Habitat Compensation Island

Table 10: Waterbody Classification and Island Use by American White Pelicans in 2022

Island	Gathering	Month	System	Flow	Size Class	Island Habitat	Island Size Class (ha)	Years Used 2015-2021
1	Congregation	June	On-system	River	>1,000	NA	NA	NA
480	Congregation	June	On-system	River	>1,000	Exposed bedrock	0.1-0.9	7
837	Congregation	June	On-system	River	>1,000	Habitat Compensation Island, gravel	1.0-1.9	3
864	Congregation	June	On-system	River	>1,000	50% shrub, 50% grass	0.1-0.9	2
24	Dispersed	June	On-system	River	>1,000	NA	NA	NA
32	Dispersed	June	On-system	River	>1,000	NA	NA	NA
225	Congregation	July	On-system	River	>1,000	Exposed bedrock	0.1-0.9	6
478	Congregation	July	On-system	River	>1,000	Exposed bedrock	<0.1	8
479	Congregation	July	On-system	River	>1,000	Exposed bedrock	<0.1	8
480	Congregation	July	On-system	River	>1,000	Exposed bedrock	0.1-0.9	7
864	Congregation	July	On-system	River	>1,000	50% shrub, 50% grass	0.1-0.9	2
21	Dispersed	July	On-system	River	>1,000	NA	NA	NA
22	Dispersed	July	On-system	River	>1,000	NA	NA	NA
23	Dispersed	July	On-system	River	>1,000	NA	NA	NA
24	Dispersed	July	On-system	River	>1,000	NA	NA	NA
33	Dispersed	July	On-system	River	>1,000	NA	NA	NA

4.0 DISCUSSION

Reservoir creation and Project operation was predicted to reduce the quality and quantity of colonial waterbird habitat in the reservoir and former Gull Rapids area (KHLP 2012). Additionally, erosion along the newly created reservoir shoreline may reduce foraging efficiency of gulls and terns due to increased water turbidity (KHLP 2012). These potential effects were to be offset and mitigated by increased foraging opportunities provided by the tailrace area and the habitat provided by the constructed HCI. These predictions appear to be supported by the observations made in 2022 and mitigation appears to be successful.

Habitat use of ring-billed gulls and common terns in the former Gull Rapids area largely shifted from the islands downstream of the spillway to the HCI in 2022. During the construction period, ring-billed gulls predominately used island Wpt 226 for nesting and other islands in the former Gull Rapids area to a lesser extent. The use of these islands was largely influenced by the water levels in the Nelson River. Generally, high water levels inundated the islands in the former Gull Rapids area or low water levels caused islands to become connected to the mainland, resulting in poor or absent habitat, forcing birds to use alternate habitat located upstream of the Project. With the use of the HCI by nesting colonial waterbirds, the effects of water levels on nesting birds will be minimized. The HCI was constructed to a relatively high elevation within the reservoir area, to eliminate the chances of it being inundated by high water levels or connected to the mainland by low water levels. This will provide colonial waterbirds with stable nesting habitat available during Project operation.

In 2021, the final year of Project construction, colonial waterbirds began successfully using the HCI, which supported nesting common terns and congregating ring-billed gulls. It was predicted that over time as organic material accumulated on the island, the substrate would become more suitable for ring-billed gulls and support a greater number of nests. To naturalize the island more quickly and provide structure for shade and shelter for colonial waterbirds and their chicks, woody debris was added to the island in the fall of 2021. Ring-billed gulls frequently nested against the woody debris that was placed on the islands, suggesting it made the HCI more attractive for nesting (Photo 4). In 2022, the first year of operation, high water levels in the Nelson River and the woody debris added to the HCI, resulted in large numbers of ring-billed gulls and common terns nesting on the island. The high water levels resulted in a reduced amount of habitat available in the region, but islands within the former Gull Rapids area remained available, but had limited use by ring-billed gulls and common terns. The apparent reduced habitat quality of the islands in the former Gull Rapids area appeared to be offset by the HCI.



Photo 4: Ring-billed Gulls Nesting Against Woody Debris on the Habitat Compensation Island, June 21, 2022

Relatively large numbers of common terns also used two floating peat islands in the reservoir in June 2022, resulting in the greatest number of common terns observed during any of the previous surveys. These peat islands are expected to disintegrate over time and reduce the amount of temporary available nesting and loafing habitat for common terns in the area.

The number of ring-billed gull chicks observed on the HCI was relatively low compared to the number of nests that were observed. The presence of up to seven immature, bald eagles on the HCI in July 2022 may have affected the number and visibility of ring-billed chicks to count. All the chicks observed on the HCI were located along the edge, where the large, rip-rap rocks are placed for shoreline stability. The crevices and openings provided by these rocks were likely used as shelter from the predators and for thermal cover by the chicks, making them difficult to detect for counting. It is also possible that the bald eagles directly reduced the reproductive success of the ring-billed gulls present on the island by preying on adults, eggs, or chicks, or indirectly, by increasing the amount of time and energy spent by adults being vigilant for predators and less for foraging or caring for eggs or young (Parrish *et al.* 2001; White *et al.* 2006). Small numbers of immature bald eagles (two) have been observed on the islands in the former Gull Rapids area during past surveys. However, the relatively high number observed on the HCI in 2022 suggests

that they may be attracted to the island. The addition of more woody debris is recommended on the HCI to provide chicks with more cover from predators and the elements, as well as increasing the appeal to nesting birds.

Herring gulls in the former Gull Rapids area did not appear to be affected by Project operation. In all of the surveys conducted to date, the greatest number of nesting herring gulls was observed in the former Gull Rapids area in 2022. Herring gull numbers in the former Gull Rapids area have remained consistent throughout the construction period from 2015-2021.

American white pelicans in the study area arrived earlier in comparison to previous years, as indicated by the relatively high number observed in June 2022. The numbers of American white pelicans in July 2022 were within the ranges observed during previous surveys and suggest the local population is stable. No nesting was observed by this species.

No Bonaparte's gulls were observed within the reservoir or surrounding area in 2022, which is consistent with 2021, when a single Bonaparte's gull was observed. Bonaparte's gulls, which typically use off-system lakes, were not affected by the Project operation.

Helicopter surveys and UAV surveys will continue during Project operation. Data collected by these surveys will provide further insight into the potential long-term effects of the Project on colonial waterbird nesting, productivity, and population trends in the Regional Study Area. The next UAV survey for colonial waterbird habitat effects monitoring is scheduled for spring 2023.

5.0 SUMMARY AND CONCLUSIONS

The first year of Project operation resulted in a shift of gull and tern habitat use away from the islands downstream of the Project in the former Gull Rapids area to the HCI upstream of the Project. The HCI supported relatively large numbers of nesting common tern and ring-billed gulls, similar in number to what was observed during Project construction. Other species including herring gull and American white pelican did not appear to be affected by Project operation and their numbers were consistent with previous observations.

Relatively high numbers of common terns were observed in the survey area, mainly due to the use of floating peat islands by this species. These peat islands are anticipated to disintegrate over time and reduce the amount of available habitat.

The number of ring-billed gull chicks observed on the HCI appeared to be low in comparison to the number of nests that were present and may have been a result of the chicks using rocks for cover, making them difficult to detect, and/or the relatively high number of bald eagles also present on the island.

The 2022 colonial waterbird survey was the first operation-phase survey for the Project. The next colonial waterbird survey is scheduled for 2023.

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Appendix A: UAV Survey Results 2015-2022

Table 1: Colonial Waterbirds Enumerated from Images of Islands in Gull Rapids taken by a UAV from 2015-2022. *Note the early spring survey was not conducted in 2020.

Species	04- Jun-22	21- Jun-22	28- Jul-22	03- Jun-21	30- Jun-21	21- Jul-21	03- Jul-20	28- Jul-20	03- Jun-19	24- Jun-19	24- Jul-19	6- Jun-18	29- Jun-18	20- Jul-18	30- May-17	28- Jun-17	19- Jul-17	03- Jun-16	27- Jun-16	20- Jul-16	04- Jun-15	25- Jun-15	27- Jul-15
Ring-billed Gull	2,602	3,080	491	1,541	4,902	2,447	134	2,744	1,628	1,240	7,227	1,565	1,288	7,030	1,884	1,334	1,900	4,291	4,730	5,092	1,210	1,792	4,978
Ring-billed Gull Chick	0	0	296	0	0	42	0	0	0	1	474	0	36	1,009	0	0	0	0	52	1,774	0	10	42
Ring-billed Gull w. Nest	1,009	2,656	0	282	1,566	11	0	0	3,364	3,820	0	2,909	3,171	0	71	852	0	851	759	0	38	81	0
Common Tern	28	41	160	3	57	109	0	0	0	0	0	3	60	49	10	2	1	47	138	25	61	60	3
Common Tern Chick	0	0	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Common Tern w. Nest	1	67	0	0	96	171	0	0	0	0	0	0	105	0	0	21	0	0	10	0	0	0	0
Herring Gull	19	45	69	17	15	29	5	16	8	31	47	25	33	64	5	27	7	8	10	11	0	0	0
Herring Gull Chick	0	45	33	0	8	8	0	0	0	19	20	0	24	24	0	0	0	0	4	1	0	0	0
Herring Gull w. Nest	47	23	1	16	11	0	2	0	41	27	0	34	8	0	4	10	1	19	8	0	0	0	0
American White Pelican	0	10	30	0	20	44	24	113	1	0	69	0	23	52	0	5	36	0	0	0	0	0	0

Table 2: Colonial Waterbirds Enumerated from Images of Islands in Gull Rapids taken by a UAV in 2022.

Island	Observation	June 4-5 2022		June 21-23 2022		July 28 2022	
		Evening	Morning	Evening	Morning	Evening	Morning
Wpt 224	American White Pelican	0	0	0	0	0	0
	Common Tern	0	0	0	0	0	0
	Common Tern w. Nest	0	0	0	0	0	0
	Common Tern Chick	0	0	0	0	0	0
	Herring Gull	0	0	0	0	0	0
	Herring Gull w. Nest	0	0	0	0	0	0
	Herring Gull Chick	0	0	0	0	0	0
	Ring-billed Gull	0	0	0	0	0	0
	Ring-billed Gull w. Nest	0	0	0	0	0	0
	Ring-billed Gull Chick	0	0	0	0	0	0
Wpt 225	American White Pelican	0	0	0	0	13	28
	Common Tern	0	0	0	0	0	0
	Common Tern w. Nest	0	0	0	0	0	0
	Common Tern Chick	0	0	0	0	0	0
	Herring Gull	3	4	2	7	11	6
	Herring Gull w. Nest	10	10	8	9	0	1
	Herring Gull Chick	0	0	6	5	7	0
	Ring-billed Gull	0	7	17	22	39	120
	Ring-billed Gull w. Nest	29	30	45	42	0	0
	Ring-billed Gull Chick	0	0	0	0	35	36
Wpt 226	American White Pelican	0	0	0	0	0	0
	Common Tern	0	0	0	0	0	0
	Common Tern w. Nest	0	0	0	0	0	0
	Common Tern Chick	0	0	0	0	0	0
	Herring Gull	2	2	0	1	1	0
	Herring Gull w. Nest	2	3	3	3	0	0
	Herring Gull Chick	0	0	0	0	0	0
	Ring-billed Gull	11	97	13	0	0	41
	Ring-billed Gull w. Nest	0	1	0	0	0	0
	Ring-billed Gull Chick	0	0	0	0	0	0
Wpt 227	American White Pelican	0	0	0	0	0	0
	Common Tern	0	0	0	0	0	0
	Common Tern w. Nest	0	0	0	0	0	0
	Common Tern Chick	0	0	0	0	0	0
	Herring Gull	1	1	0	0	0	0
	Herring Gull w. Nest	1	1	0	0	0	0
	Herring Gull Chick	0	0	0	0	0	0
	Ring-billed Gull	0	0	0	0	0	0

Island	Observation	June 4-5 2022		June 21-23 2022		July 28 2022		
		Evening	Morning	Evening	Morning	Evening	Morning	
Wpt 478	Ring-billed Gull w. Nest	0	1	0	0	0	0	
	Ring-billed Gull Chick	0	0	0	0	0	0	
	American White Pelican	0	0	0	10	0	0	
	Common Tern	0	0	0	0	0	0	
	Common Tern w. Nest	0	0	0	0	0	0	
	Common Tern Chick	0	0	0	0	0	0	
	Herring Gull	10	6	23	9	6	10	
	Herring Gull w. Nest	10	7	4	2	0	0	
	Herring Gull Chick	0	0	6	7	3	2	
	Ring-billed Gull	0	0	0	0	0	0	
	Ring-billed Gull w. Nest	0	0	0	0	0	0	
	Ring-billed Gull Chick	0	0	0	0	0	0	
Wpt 479	American White Pelican	0	0	0	0	0	0	
	Common Tern	0	0	0	0	0	0	
	Common Tern w. Nest	0	0	0	0	0	0	
	Common Tern Chick	0	0	0	0	0	0	
	Herring Gull	0	1	1	1	0	1	
	Herring Gull w. Nest	1	1	0	0	0	0	
	Herring Gull Chick	0	0	2	3	1	1	
	Ring-billed Gull	0	0	0	0	0	0	
	Ring-billed Gull w. Nest	0	0	0	0	0	0	
	Ring-billed Gull Chick	0	0	0	0	0	0	
	American White Pelican	0	0	0	0	0	2	
	Common Tern	0	0	0	0	0	0	
Common Tern w. Nest	0	0	0	0	0	0		
Common Tern Chick	0	0	0	0	0	0		
Wpt 480	Herring Gull	2	0	15	22	31	46	
	Herring Gull w. Nest	18	15	7	2	0	0	
	Herring Gull Chick	0	0	10	27	18	13	
	Ring-billed Gull	0	0	0	0	0	0	
	Ring-billed Gull w. Nest	0	0	0	0	0	0	
	Ring-billed Gull Chick	0	0	0	0	0	0	
	American White Pelican	0	0	0	0	0	0	
	Common Tern	0	0	0	0	0	0	
	Common Tern w. Nest	0	0	0	0	0	0	
	Common Tern Chick	0	0	0	0	0	0	
	Wpt 481	Herring Gull	1	0	4	2	7	6
		Herring Gull Chick	0	0	6	3	4	4
Herring Gull w. Nest		4	4	1	2	0	0	
Ring-billed Gull		0	0	0	0	0	0	

Island	Observation	June 4-5 2022		June 21-23 2022		July 28 2022	
		Evening	Morning	Evening	Morning	Evening	Morning
Wpt 561	Ring-billed Gull w. Nest	0	0	0	0	0	0
	Ring-billed Gull Chick	0	0	0	0	0	0
	American White Pelican	0	0	0	0	0	0
	Common Tern	0	0	0	0	0	0
	Common Tern w. Nest	0	0	0	0	0	0
	Common Tern Chick	0	0	0	0	0	0
	Herring Gull	0	0	0	0	0	0
	Herring Gull Chick	0	0	0	0	0	0
	Herring Gull w. Nest	0	0	0	0	0	0
	Ring-billed Gull	0	0	0	0	0	0
	Ring-billed Gull w. Nest	0	0	0	0	0	0
	Ring-billed Gull Chick	0	0	0	0	0	0
	American White Pelican	0	0	0	0	0	0
	Common Tern	28	0	41	30	89	160
Common Tern w. Nest	1	0	67	47	0	0	
Common Tern Chick	0	0	0	0	0	0	
Wpt 837 (Habitat Compensation Island)	Herring Gull	0	0	0	0	0	0
	Herring Gull w. Nest	1	1	0	1	0	0
	Herring Gull Chick	0	0	0	0	0	0
	Ring-billed Gull	2,591	2,352	3,050	2,203	452	282
	Ring-billed Gull w. Nest	980	518	2,611	2,272	0	0
	Ring-billed Gull Chick	0	0	0	0	261	234

Appendix B: Colonial Waterbird Abundance Observed during Helicopter Surveys 2015- 2021

Table 1: Colonial Waterbird Abundance Observed During Helicopter Surveys in 2021

Observation	June 19			July 18		
	Congregated Birds	Dispersed Birds	Total	Congregated Birds	Dispersed Birds	Total
Ring-billed Gull	4,305	265	4,570	2,882	300	3,182
Ring-billed Gull Chick	0	0	0	70	0	70
Common Tern	78	13	91	780	140	920
Herring Gull	31	0	64	26	1	27
Herring Gull Chick	0	0	0	2	0	2
American White Pelican	22	21	43	195	3	198
Bonaparte's Gull	0	0	0	0	1	1
Total	4,469	299	4,768	3,955	445	4,400

Table 2: Colonial Waterbird Abundance Observed During Helicopter Surveys in 2020

Species	June			July		
	Congregated Birds	Dispersed Birds	Total	Congregated Birds	Dispersed Birds	Total
Ring-billed Gull	6,477	720	7,197	5,639	929	6,568
Common Tern	552	68	620	1,270	263	1,533
American White Pelican	196	46	242	366	96	462
Bonaparte's Gull	43	0	43	75	237	312
Herring Gull	68	5	73	42	0	42
Total	7,336	839	8,175	7,392	1,525	8,917

Table 3: Colonial Waterbird Abundance Observed During Helicopter Surveys in 2019

Species	June			July		
	Congregated Birds	Dispersed Birds	Total	Congregated Birds	Dispersed Birds	Total
Ring-billed Gull	5,513	103	5,616	7,685	199	7,884
Common Tern	1,072	67	1,139	920	8	928
Herring Gull	184	6	190	152	0	152
Bonaparte's Gull	16	9	25	18	6	24
American White Pelican	41	15	56	146	50	196
Total	6,826	200	7,026	8,921	263	9,184

Table 4: Colonial Waterbird Abundance Observed During Helicopter Surveys in 2018

Species	June			July		
	Congregated Birds	Dispersed Birds	Total	Congregated Birds	Dispersed Birds	Total
Ring-billed Gull	4,597	417	5,014	7,943	3	7,946
Common Tern	1,006	46	1,052	391	0	391
Herring Gull	107	0	107	12	0	12
Bonaparte's Gull	12	21	33	16	12	28
American White Pelican	194	24	218	425	44	469
Total	5,916	508	6,424	8,787	59	8,846

Table 5: Colonial Waterbird Abundance Observed During Helicopter Surveys in 2017

Species	June			July		
	Congregated Birds	Dispersed Birds	Total	Congregated Birds	Dispersed Birds	Total
Ring-billed Gull	5,835	1,708	7,543	7,780	422	8,202
Common Tern	1,377	4	1,381	979	5	984
Bonaparte's Gull	50	30	80	0	31	31
Herring Gull	5	0	5	13	0	13
American White Pelican	37	46	83	393	210	603
Total	7,304	1,788	9,092	9,165	668	9,833

Table 6: Colonial Waterbird Abundance Observed During Helicopter Surveys in 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
Total	6,200	514	6,714	12,766	1,863	14,629

Table 7: Colonial Waterbird Abundance Observed During Helicopter Surveys in 2015

Species	June			July		
	Congregated Birds	Dispersed Birds	Total	Congregated Birds	Dispersed Birds	Total
Ring-billed Gull	3,026	894	3,925	3,439	302	3,741
Common Tern	451	173	624	572	461	1,033
Bonaparte's Gull	26	137	163	0	56	56
Herring Gull	23	4	27	9	8	17
American White Pelican	0	1	1	228	0	228
Total	3,526	1,209	4,740	4,248	827	5,075