



Keeyask Generation Project
Zebra Mussel Monitoring Plan

Zebra Mussel Monitoring Report
ZMMP-2023-01



KEYYASK GENERATION PROJECT

ZEBRA MUSSEL MONITORING PLAN

REPORT #ZMMP-2023-01

ANNUAL REPORT

APRIL 2022 TO MARCH 2023

Prepared by

Manitoba Hydro

&

North/South Consultants, Inc.

June 2023

This report should be cited as follows:

Manitoba Hydro & North/South Consultants, Inc. 2023. Annual Report April 2022 to March 2023.
Keeyask Generation Project Zebra Mussel Monitoring Plan Report # ZMMP-2023-01. June 2023.

SUMMARY

Zebra mussels are an aquatic, invasive species that grow on hard materials in the water, such as rocks and pipes, and can become so prolific they cause major problems for utilities. They were first introduced to North America in the 1980s from Europe and/or Asia, where they were carried in the bilge water of oceangoing ships that was released into North American waterways. They are a major problem because they do not have predators in North America and therefore, grow freely on submerged surfaces (Figure 1). The first zebra mussel was found in Lake Winnipeg in 2013 and they have made their way to the Nelson River since that time.



Figure 1: Once present, zebra mussels grow on hard surfaces that are in the water, as shown on this boat propeller. Each mussel is approximately the size of a fingernail.

The *Zebra Mussel Monitoring Plan (ZMMP)* was developed and is being implemented in accordance with the *Keeyask Environment Act Licence* to monitor and manage the impacts of zebra mussels on the Keeyask Project.

Now that construction is complete, in-water activity is mostly limited to boat traffic associated with ongoing operation phase monitoring and mitigation work by personnel who are familiar with preventative measures required to prevent zebra mussels from spreading. For this reason, the focus of zebra mussel monitoring during the operation phase is tracking the number of “veligers” (microscopic mussel larvae) and adult mussels found around Keeyask over time.

Veligers were first found in Gull Lake in 2019 and monitoring is ongoing. During 2022, three samples were collected from the Keeyask reservoir. Each sample contained veligers and a total of 603 veligers were found. The number has increased substantially over the last three years; 28 and 89 veligers were found in 2020 and 2021, respectively.

2022 marked the third year when adult zebra mussels were found on monitoring substrate located in and around the project site and the numbers have increased. Similar to what was found in 2021, in 2022, substrate monitoring in Clark Lake, the Keeyask reservoir and Stephen Lake showed most zebra mussels were found on substrates in Stephens Lake (6,028). There were no mussels found on the substrates in Clark Lake and 887 were found growing on substrates in the reservoir.

Zebra mussels will be monitored again at the same locations in 2023.

TABLE OF CONTENTS

1.0	INTRODUCTION.....	1
2.0	ZEBRA MUSSEL MONITORING 2022	2
2.1	VELIGER SAMPLING	2
2.1.1	Results	3
2.2	COLONIZATION/ADULT SAMPLING.....	3
2.2.1	Results	5
3.0	CONCLUSIONS	7
4.0	LITERATURE CITED.....	8

LIST OF TABLES

Table 2.1: Site specific data collected at zebra mussel veliger sampling sites upstream of the Keeyask GS construction site during September 2022. 3

LIST OF FIGURES

Figure 1: Once present, zebra mussels grow on hard surfaces that are in the water, as shown on this boat propeller. Each mussel is approximately the size of a fingernail. iii

Figure 2: Sampling sites for zebra mussel veliger monitoring in the Keeyask Study Area, September 14, 2022. 2

Figure 3: Adult zebra mussel sampler set in the Keeyask area, 2022. 3

Figure 4: Sampling sites for adult zebra mussel monitoring in Clark Lake and the Keeyask reservoir, 2022..... 4

Figure 5: Sampling sites for adult zebra mussel monitoring in Stephens Lake, 2022. 4

Figure 6: Adult zebra mussels attached to plate of a sampler at site ZM-09 at the end of the 2022 sampling period. 6

Figure 7: Adult zebra mussels attached to plate of a sampler at site ZM-09 at the end of the 2021 sampling period. 6

1.0 INTRODUCTION

The Keeyask Generation Project (the Project) is a 695-megawatt (MW) hydroelectric generating station at Gull (Keeyask) Rapids on the lower Nelson River in northern Manitoba. The Project is approximately 725 kilometres (km) northeast of Winnipeg, 35 km upstream of the existing Kettle Generating Station, where Gull Lake flows into Stephens Lake, 60 km east of the community of Split Lake, 180 km east-northeast of Thompson and 30 km west of Gillam. Construction of the Project began in July 2014. The reservoir impoundment took place in 2020 and the generating station and spillway are fully operational as of March 2022.

Although none of the aquatic invertebrate species identified during the environmental assessment of the Project were listed as invasive in accordance with the Invasive Species Council of Manitoba's listing at the time (KHLP 2012), the Project's *Environment Act* Licence #3107 (Clause 18) indicated the Keeyask Hydropower Limited Partnership (KHLP) must develop a Zebra Mussel Monitoring Plan to "*monitor and adaptively manage impacts to the Development (Project) associated with zebra mussels and participate with the Government of Manitoba on treatment programs within the Keeyask reservoir.*"

The *Zebra Mussel Monitoring Plan* (ZMMP) was submitted by the KHLP in December 2015 (KHLP 2015) and was subsequently approved by Manitoba Sustainable Development. This report summarizes the results and activities conducted from April 2022 to March 2023 in accordance with the ZMMP.

2.0 ZEBRA MUSSEL MONITORING 2022

The ZMMP in 2022 was comprised of water quality sampling and colonization by adult mussels. The collection of biological samples described in this report was authorized by Manitoba Conservation and Water Stewardship, Fisheries Branch, under terms of the Scientific Collection Permit #41767128 (SCP 08-2022) and Aquatic Invasive Species (AIS) permit 10-2022.

2.1 VELIGER SAMPLING

Zebra mussel veligers (larval mussels) were sampled at three locations upstream of the Keeyask GS on September 14, 2022 (Figure 2). Samples were collected with a plankton net consisting of a 27 cm diameter ring with bridle; a 1 meter long, 63-micron mesh net; and a removable weighted cod end for sample retrieval. Samples were collected using the vertical tow (used in areas of water 6 meters or more in depth) method. The net was released, allowed to sink to ~1 m above the bottom. It was allowed to sit for 30 seconds and pulled up at a rate of approximately 0.5 m/s. This was repeated between two and three times to retrieve a single sample over 1,000 L.

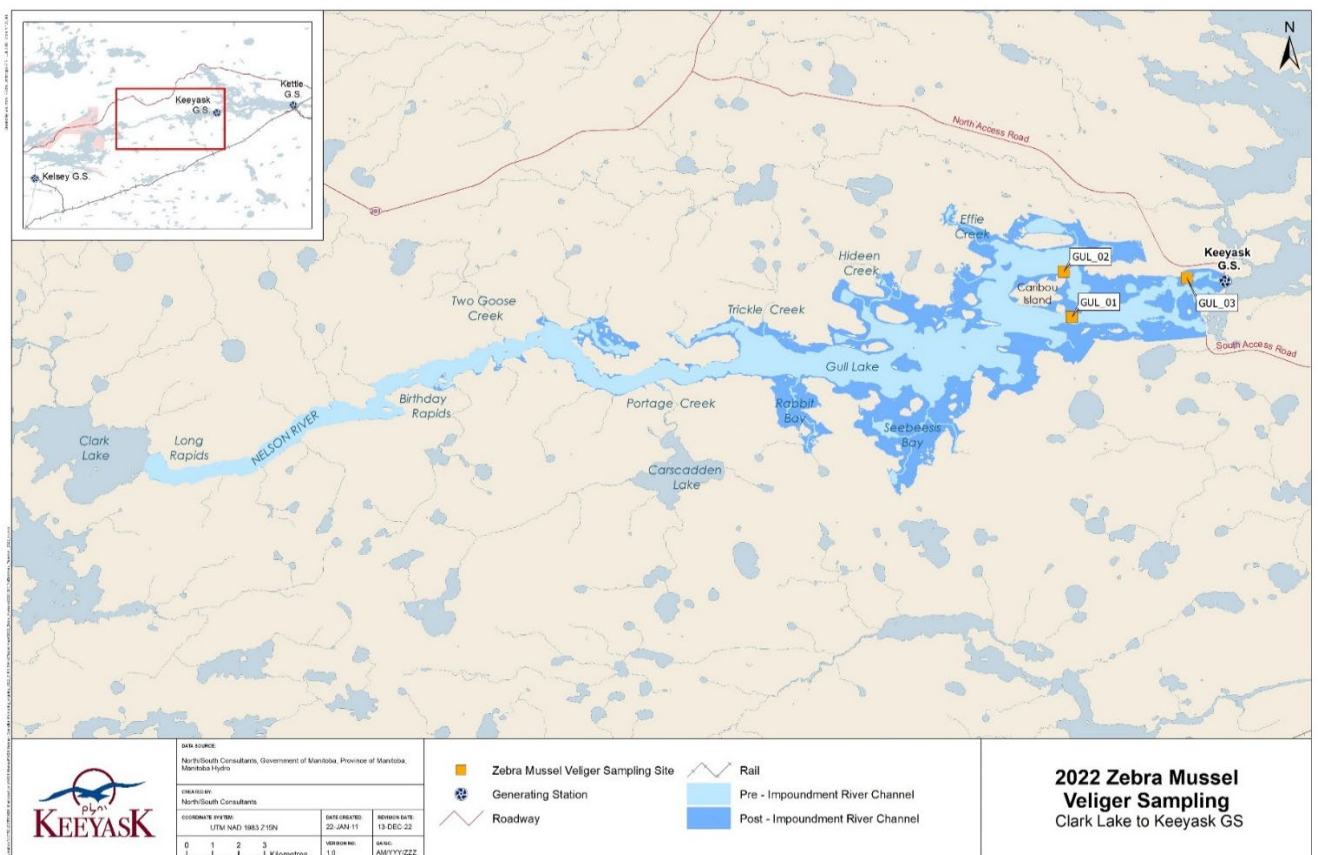


Figure 2: Sampling sites for zebra mussel veliger monitoring in the Keeyask Study Area, September 14, 2022.

All sampling information was recorded onto field data sheets that included sample date and time, sample ID, water temperature (°C), location (UTM), Secchi depth (m), water depth (m), water velocity (m/sec), start time, and tow distance (m). Site specific data are presented in Table 2.1.

After retrieval, the entire net was rinsed from the outside to ensure all of the sample material was washed into the cod end. Contents were thoroughly rinsed into a labelled sample jar. Samples were preserved using 70% denatured ethanol (alcohol to sample ratio = 2:1). All samples were stored for transport in a cooler and sent to ALS Laboratories (Winnipeg, MB) for analysis.

2.1.1 RESULTS

Table 2.1 shows zebra mussel veligers were found in all three samples collected in September 2022. A total of 102 veligers were collected at GUL-01, 335 at GUL-02, and 166 at GUL-03. Zebra mussel veligers have been recorded in the area in each year since 2019.

Table 2.1: Site specific data collected at zebra mussel veliger sampling sites upstream of the Keeyask GS construction site during September 2022.

Sample ID	Sample Date	Water Temperature (°C)	15V (NAD 83)		Water Depth (m)	Secchi Depth (m)	Sample Method	Number of Tows	Number of Veligers
			Easting	Northing					
GUL-01	14-Sep-22	14	358021	6245837	18	0.5	Vertical	2	102
GUL-02	14-Sep-22	14	357711	6247584	10	0.5	Vertical	3	335
GUL-03	14-Sep-22	14	362444	6247336	8	0.5	Vertical	3	166

2.2 COLONIZATION/ADULT SAMPLING

Substrate samplers were used to sample adult zebra mussels in Clark Lake, the Keeyask reservoir, and Stephens Lake. Substrate samplers consisted of a series of four, square plates that are 6, 8, 10 and 12 inches in size, pyramiding from smaller plates at the top down to larger plates at the bottom (Figure 3). The plates were made of 1/8-inch PVC board with 3/4-inch PVC pipe for spacers (1-inch sections) between the plates, held together with rope.



Figure 3: Adult zebra mussel sampler set in the Keeyask area, 2022.

The substrate samplers were deployed in June and removed in October 2022 to sample over the course of the open-water period. Each sampler was attached to a concrete anchor and suspended in the middle of the water column using a submerged float. A surface float was attached to help with retrieval. Each sampler was set in an off-current area with at least 3 meters of water. Sampling locations loosely followed areas used for water quality monitoring. Two samplers were set near each of five mainstem water quality sampling areas: Clark Lake, the Keeyask reservoir

in Gull Lake, the Keeyask reservoir near the upstream side of the GS, nearfield Stephens Lake, and farfield Stephens Lake (Figure 4 & Figure 5).

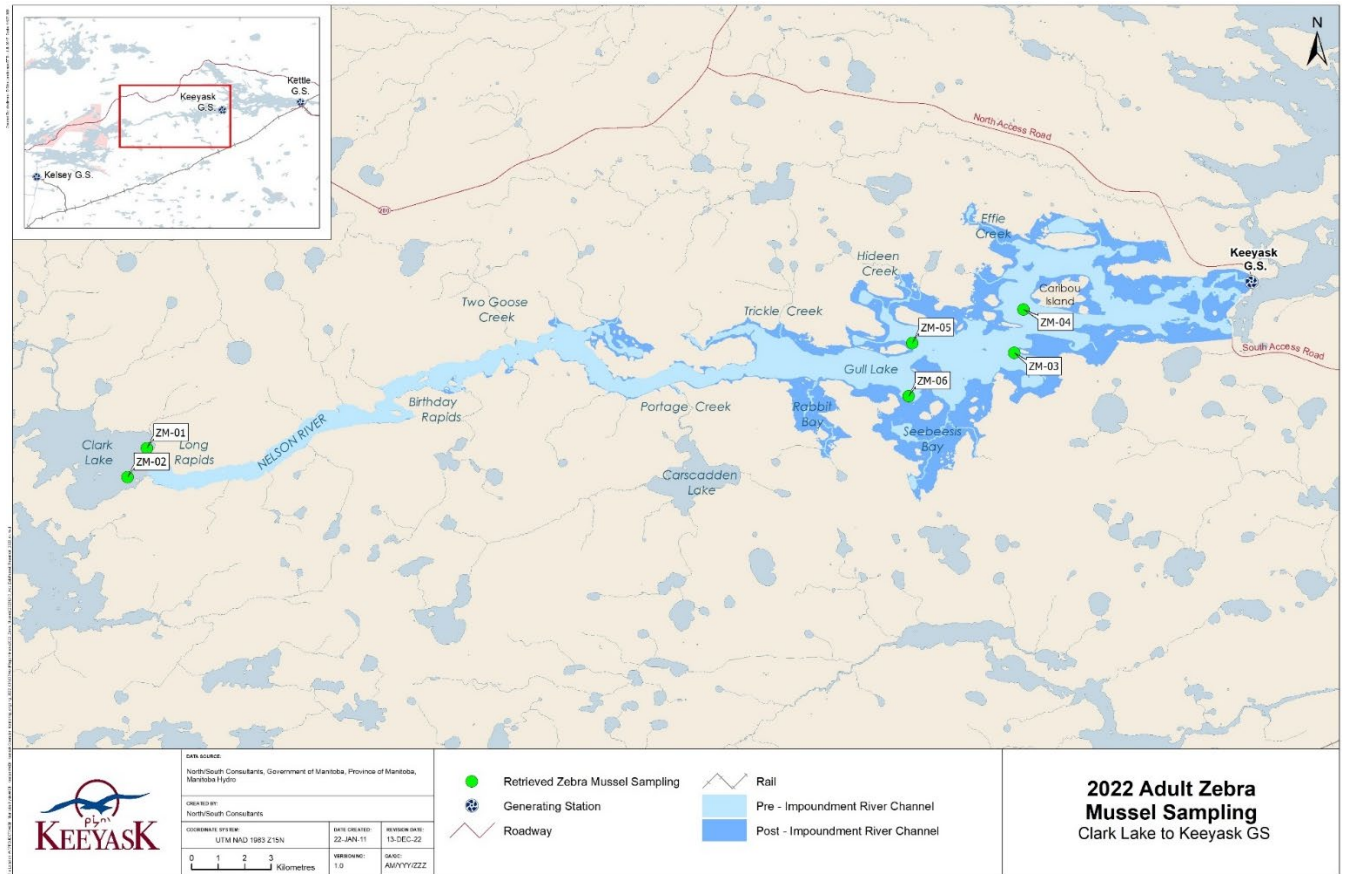


Figure 4: Sampling sites for adult zebra mussel monitoring in Clark Lake and the Keeyask reservoir, 2022.

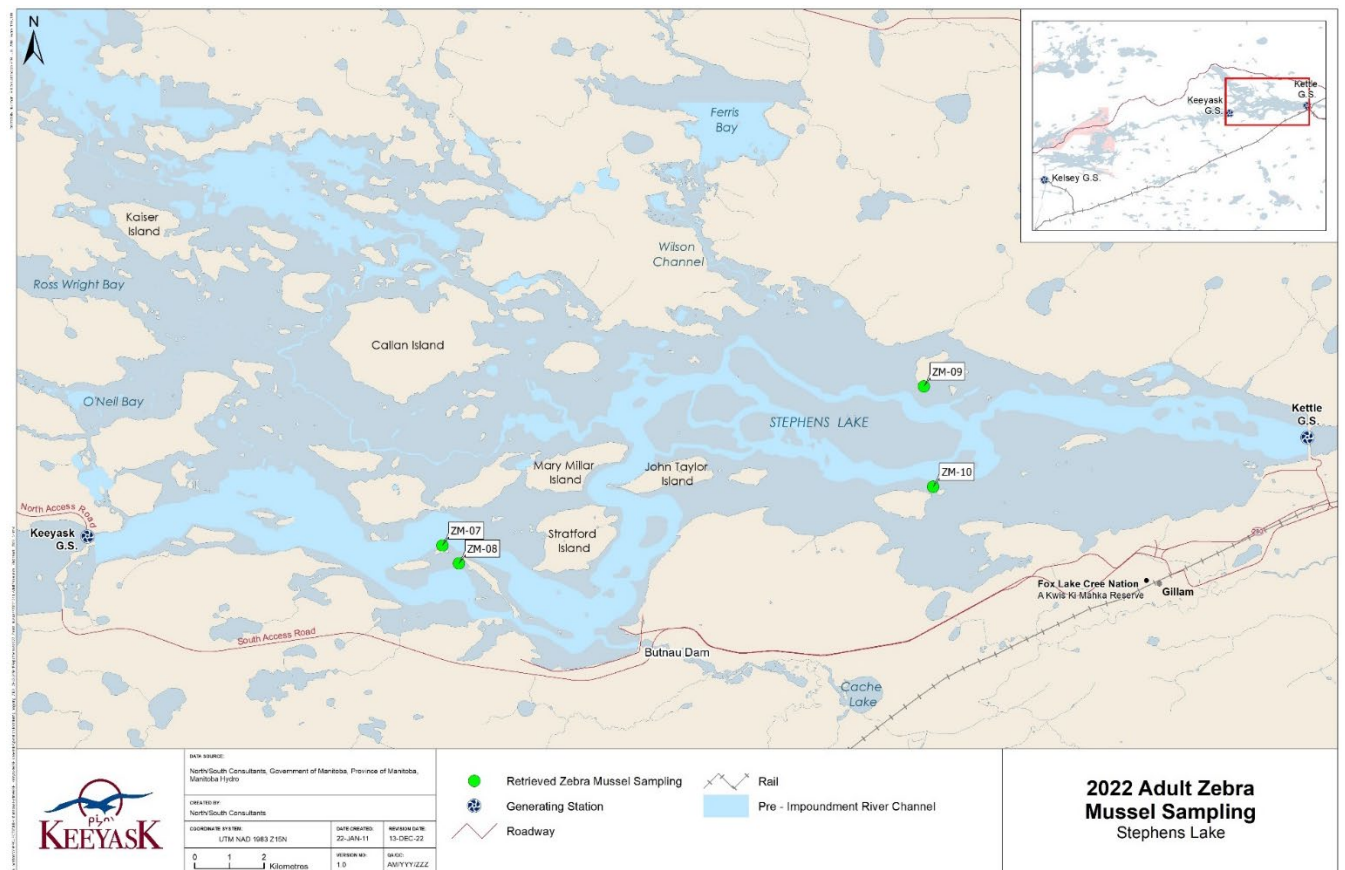


Figure 5: Sampling sites for adult zebra mussel monitoring in Stephens Lake, 2022.

2.2.1 RESULTS

All ten substrate samplers were retrieved following the 2022 open-water period. A total of 6,915 adult zebra mussels were present on the samplers (Table 2.2). No zebra mussels were found on the two samplers set in Clark Lake. A total of 887 were collected from three of the four samplers set in the Keeyask reservoir. The remaining 6,028 were collected on the four samplers in Stephens Lake. At all sites, zebra mussels ranged in size from 1.0 to 10.0 mm.

Table 2.2: Site specific data and results for adult zebra mussel substrate samplers set in Clark Lake, the Keeyask reservoir, and Stephens Lake between June and October, 2022.

Site	Location	Set Depth (m)	Set Date	Pull Date	Sampling Days	Total #	Size Range (mm)	Average Size of 30 Mussels (mm)
ZM-01	Clark Lake	5.9	7-Jun-22	29-Sep-22	114	0	-	-
ZM-02	Clark Lake	5.0	7-Jun-22	29-Sep-22	114	0	-	-
ZM-03	Keeyask reservoir	8.0	5-Jun-22	1-Oct-22	118	0	-	-
ZM-04	Keeyask reservoir	7.4	5-Jun-22	1-Oct-22	118	47	1.0-4.0	2.5
ZM-05	Keeyask reservoir	7.5	5-Jun-22	4-Oct-22	121	307	3.0-7.0	3.9
ZM-06	Keeyask reservoir	6.5	5-Jun-22	4-Oct-22	121	533	3.0-7.0	4.4
ZM-07	Stephens Lake	7.8	5-Jun-22	9-Oct-22	126	201	2.0-6.0	4.0
ZM-08	Stephens Lake	5.4	5-Jun-22	9-Oct-22	126	283	2.0-5.0	3.0
ZM-09	Stephens Lake	3.5	9-Jun-22	8-Oct-22	121	4769	1.0-6.0	2.4
ZM-10	Stephens Lake	5.0	9-Jun-22	8-Oct-22	121	775	1.0-10.0	2.7

Similar to what occurred in 2021, the largest number of zebra mussels (4,769) were collected on the substrate sampler near the north shore in the downstream portion of Stephens Lake (ZM-09 on Figure 5). Figure 6 shows colonization on one of the plates of ZM-09 at the end of the season. The number has increased dramatically from 800 mussels found at the same location in 2021 (Figure 7).



Figure 6: Adult zebra mussels attached to plate of a sampler at site ZM-09 at the end of the 2022 sampling period.



Figure 7: Adult zebra mussels attached to plate of a sampler at site ZM-09 at the end of the 2021 sampling period.

3.0 CONCLUSIONS

The Keeyask ZMMP was implemented in 2022 in accordance with the Keeyask *Environment Act* Licence and included veliger sampling in the Keeyask reservoir and colonization sampling in Clark Lake, the Keeyask reservoir and Stephens Lake.

In 2022, 603 zebra mussel veligers were collected during instream monitoring on Gull Lake. Adult mussels were not found on artificial monitoring substrates in Clark Lake, but 889 were found in the reservoir and 6,028 were growing on substrates from Stephens Lake. When compared to monitoring results obtained in previous years, zebra mussel veligers and adult mussels in the reservoir and Stephens Lake are on the rise.

Annual sampling for veligers and adult mussels will continue next in August/September 2023.

4.0 LITERATURE CITED

Keyyask Hydropower Limited Partnership. 2012. Keyyask Generation Project Environmental Impact Statement: Response to EIS Guidelines, Winnipeg, Manitoba. June 2012. 1,200 pp.

Keyyask Hydropower Limited Partnership (KHLP), 2015. Keyyask Generation Project: Zebra Mussel Monitoring Plan. Winnipeg, Manitoba. June 2015.