



Keeyask Generation Project
Aquatic Effects Monitoring Plan

Zebra Mussel Monitoring Report
ZMMP-2021-01



KEEYASK GENERATION PROJECT

ZEBRA MUSSEL MONITORING PLAN

REPORT #ZMMP-2021-01

ANNUAL REPORT

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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. A key component of the ZMMP is to ensure that Keeyask employees and visitors are aware of zebra mussels and the provincial regulations for cleaning

watercraft, water-related equipment, trailers, and motor vehicles to prevent them from spreading. Zebra mussel education and awareness was promoted in 2020 at Keeyask in the site orientation session, by displaying aquatic invasive species posters in lunchrooms across the Project site, and by distributing electronic information bulletins to all parties on site.

A hot water decontamination unit is used at site to prevent the spread of zebra mussels to or from Keeyask. All incoming and outgoing watercraft and water-related equipment (anchors, nets, paddles, etc.) were inspected for the presence of zebra mussels and decontaminated, if they were leaving the Nelson River Control Zone.

In 2020, 42 inspections were conducted, and 2 hot water decontaminations were performed. At the main entrance to Keeyask off PR 280, a sign remains posted reminding site users to report watercraft and water-related equipment for inspection and decontamination. Additionally, the main gate security documented all watercraft and water-related equipment, using a red tagging system and email notification for all arriving equipment.

Zebra mussel “veligers” (microscopic mussel larvae) were first found in Gull Lake in 2019. During 2020, three samples were collected from the Keeyask reservoir and a total of 28 veligers were found.

2020 marked the first year when adult zebra mussels were found on monitoring substrate and various, submerged equipment/surfaces located in and around the project site. Scientific monitoring equipment, anchors, docks, and even the concrete walls within Unit 1 were all showing signs of colonization.

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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.

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 2020 to March 2021 in accordance with the ZMMP.

2.0 ZEBRA MUSSEL MONITORING 2020

The ZMMP methodology is designed to assess zebra mussel presence using four approaches, as follows:

1. Education and awareness;
2. Water quality sampling;
3. Colonization/adult sampling;
4. Visual inspections of in-water infrastructure.

The work undertaken to implement each of these approaches is summarized below.

2.1 EDUCATION AND AWARENESS

In fall 2019, the *Keeyask Watercraft Transport Procedure* was sent to all Manitoba Hydro staff and contractors on site to ensure all aquatic invasive species regulatory requirements are met. This document was updated and re-distributed in July of 2020 to all project personnel.

Site Environmental Inspectors received refresher training regarding requirements related to aquatic invasive species legislation, as well as provincially approved inspection and decontamination techniques for zebra mussels and other common aquatic invasive species (AIS). The site orientation session given to all Keeyask employees, contractors, and visitors includes a section on AIS and outlines the regulatory requirements for decontaminating watercraft and water-related equipment. Aquatic invasive species information posters are also displayed in Main Camp as well as Manitoba Hydro and contractor lunchrooms around the construction site; this helps familiarize people regarding what to look for, and how they can follow up if they find something. An information bulletin on zebra mussels and other aquatic invasive species was distributed to all contractors on site beginning in May 2018 and continues to be distributed annually in the spring. A sign posted at the main gate in 2018 remains in place to notify site users that Keeyask is in the Nelson River Control Zone and to remind personnel to report for inspection/decontamination of watercraft and water-related equipment when entering and leaving Keeyask (Figure 2).

A decontamination unit was constructed at Keeyask in September 2016 to prevent the transfer of zebra mussels from boats and equipment used elsewhere to Gull and Stephens lakes, as well as to prevent the spread of zebra mussels or veligers from the Keeyask site. The unit consists of a hot water (≥ 60 °C) sprayer and a drain pad designed to allow wash water to rapidly infiltrate the ground and prevent it from flowing off the pad. The unit meets the Provincial requirements for AIS decontamination.

Watercraft and equipment users were informed that whenever watercraft/equipment are removed from the Nelson River (including Gull Lake and Stephens Lake), general provisions (*i.e.*, clean, drain, dry) should be performed. In addition, when leaving Keeyask, any watercraft or equipment

leaving the Nelson River Control Zone needs to be decontaminated prior to departure unless they can 1) provide proof of an exemption permit issued from Manitoba Sustainable Development or 2) the party has access to decontamination facilities and agrees to provide records to Manitoba Hydro after decontamination in accordance with the provincial *Aquatic Invasive Species Regulation*.



Figure 2: A sign is located at the main gate to remind site users to report for inspection of watercraft and water-related equipment.

2.1.1 RESULTS

From April 2020 to March 2021, all watercraft and water-related equipment was inspected for AIS upon arrival and departure from Keeyask. In total, forty-two inspections were conducted, and two hot water decontaminations were performed on incoming and outgoing watercraft and water-related equipment.

2.1.2 NEXT STEPS

AIS inspections and decontamination will continue in 2021. Signs will be posted at the upstream and downstream boat launches to notify site users that Keeyask is in the Nelson River Control

Zone, and to remind personnel to report for inspection/decontamination of watercraft and water-related equipment when entering and leaving Keeyask. The signs will also list the Keeyask standard AIS requirements when launching or removing watercraft/equipment from the Nelson River.

2.2 VELIGER SAMPLING

Zebra mussel veligers (larval mussels) were sampled upstream of the Keeyask GS construction site on September 23, 2020. One sample (tow) was collected from three locations between Birthday Rapids and the Keeyask GS construction site (Figure 3). Samples were collected with a plankton net consisting of a 30 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 at two sites (GUL-01 and GUL-02). 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 two or three times to retrieve a single sample. Due to shallower water depth (5.4 m), the horizontal tow method was used at site GUL-03. The net was released, allowed to sink ~3 m, and tied to the stern of the boat. The boat was driven slowly (travelling approximately 1 m every 3 seconds) for a total of 20 m.

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 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.

2.2.1 RESULTS

Zebra mussel veligers were found in all three samples collected in September 2020. A total of 12 veligers were collected at GUL-01, ten at GUL-02, and six at GUL-03. Zebra mussel veligers were previously recorded in the area in 2019.

2.2.2 NEXT STEPS

Annual sampling for zebra mussel veligers will continue. Sampling will be conducted in August/September 2021.

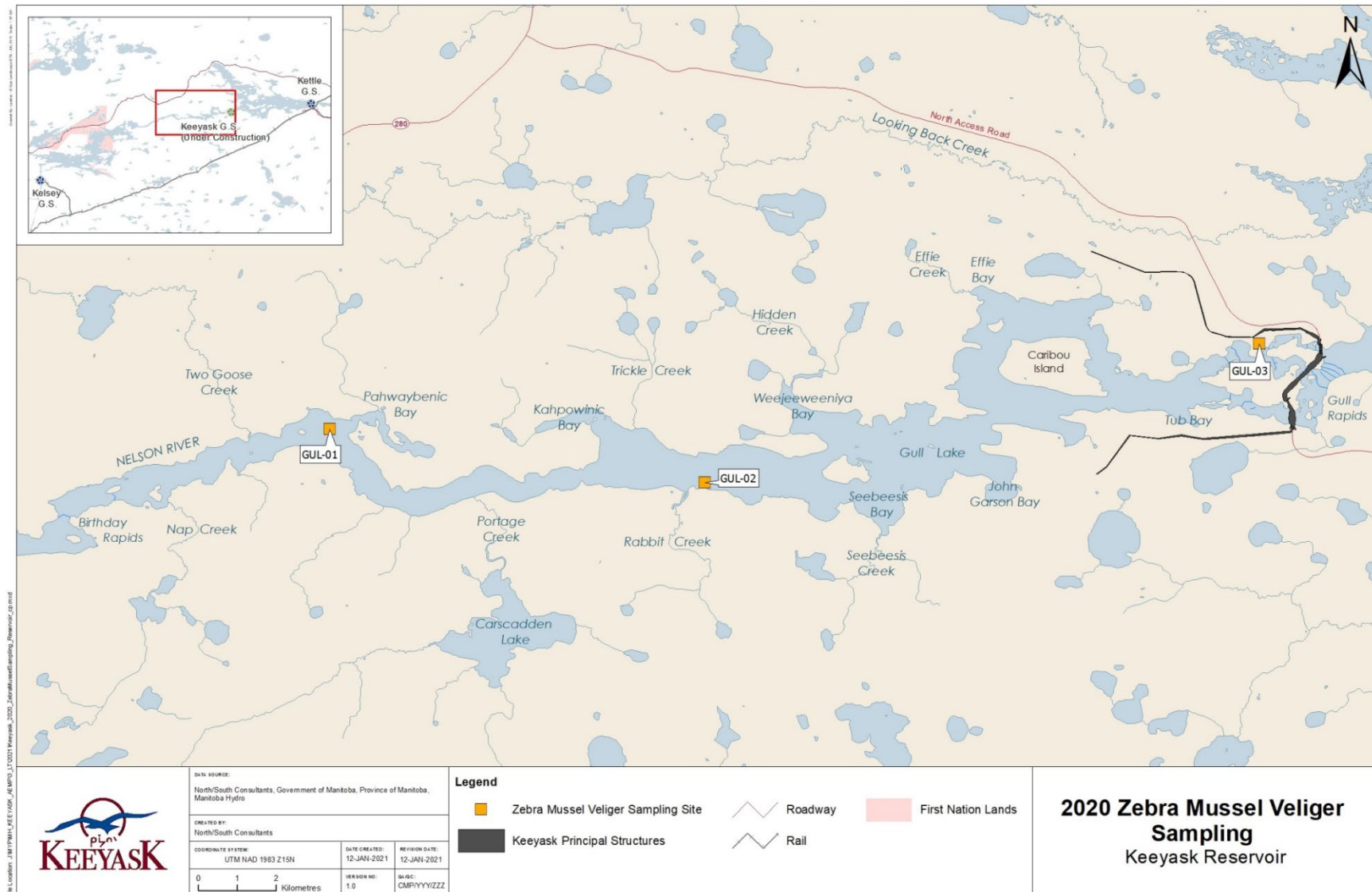


Figure 3: Sampling sites for zebra mussel veliger monitoring in the Keeyask Study Area, September 23, 2020.

Table 1: Site specific data collected at zebra mussel veliger sampling sites upstream of the Keeyask GS construction site during September 2020.

Sample ID	Sample Date	Sample Time	Water Temperature (°C)	15V (NAD 83)		Water Depth (m)	Secchi Depth (m)	Sample Method	Number of Tows	Distance (m)
				Easting	Northing					
GUL-01	23-Sep-20	09:55	9	338333	6245115	12.0	0.5	Vertical	2	-
GUL-02	23-Sep-20	11:20	9	348016	6243737	15.0	0.5	Vertical	3	-
GUL-03	23-Sep-20	17:00	9	362336	6247317	5.4	0.5	Horizontal	-	45

2.3 COLONIZATION/ADULT SAMPLING

Monitoring for adult zebra mussel colonization was done by establishing three sites in the Keeyask reservoir for placement of artificial substrates. Sites were located in low-flow areas (0.1-1.0 m/s) with a depth of approximately 4 m (Figure 4). At each site, terra cotta and plastic flowerpots were used as artificial substrates. These pots were suspended in series along a rope at 1, 2, and 3 m depths, anchored in place with a cinderblock, and kept suspended in the water column by buoys at the surface (Figure 5). The design has gradually evolved since 2017 to use more robust ropes, plastic pots, and an additional buoy to help prevent equipment damage while in the river.

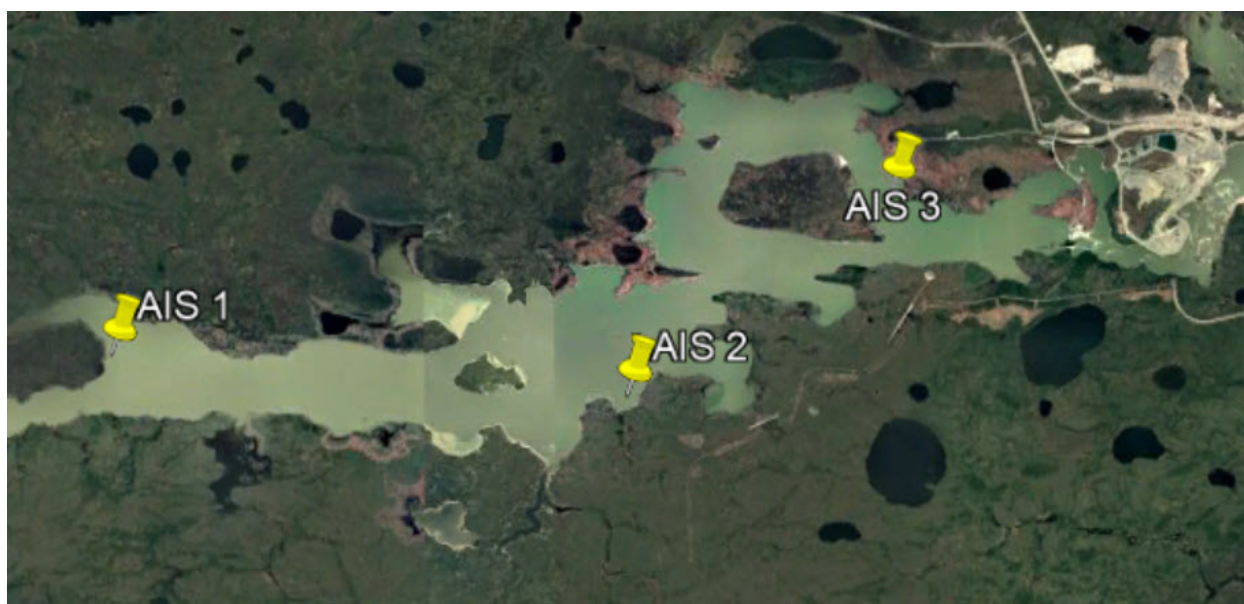


Figure 4: Location of sites in the Keeyask reservoir where artificial substrates were deployed to monitor for zebra mussel colonization.



Figure 5: Installing artificial substrate to monitoring for zebra mussel colonization, June 2020.

All three sites were deployed on June 26, 2020. Terra cotta pots were deployed at site AIS 2, while AIS 1 & 3 were comprised of plastic pots. All three sites were checked on July 20, 2020 for the presence/absence of zebra mussels and a photograph was taken of each side of the substrate. One terra cotta pot had broken at AIS 2, so it was replaced with a plastic pot. Site visits also included visual inspections of adjacent rocks, crevices, woody debris, docks, and vegetation for the presence of zebra mussels. Impoundment of the Keeyask reservoir occurred at the end of August, so the monitoring stations had to be removed earlier in 2020 than previous years. Substrates AIS 2 & 3 were removed for the season on August 22, while AIS 1 remained until it was removed on August 27th. All pots, buoys, rope, and cinder blocks were inspected for the presence of zebra mussels.

In addition to the artificial substrate monitoring, staff also continued to inspect infrastructure that was submerged or in contact with the river/reservoir for zebra mussel growth.

2.3.1 RESULTS

Three pots from the monitoring stations were sent to an external laboratory for analysis and a mature zebra mussel count. The pots sent in were from AIS 2 (top pot), shown in Figure 6, AIS 2 (middle), and AIS 3 (bottom); the zebra mussel counts were 8, 15, and 14 respectively.



Figure 6: Photo of monitoring substrate after removal on August 22, 2020. This pot sat at a depth of 1 m from the surface at AIS 2 and was sent to ALS labs. Eight adult mussels were identified.

All mussels on the remaining hardware and rope were removed and disposed of. The rope itself was also disposed of. The hardware was left outside over the winter to freeze to kill off any remaining mussels that were not visible, if any. The remaining pots were wrapped in plastic bags and placed in a freezer in the event further analysis was required.

Adult zebra mussels were found within the Powerhouse and submerged infrastructure around the project site (Figure 7). Table 2 lists where and when these findings occurred. Mussels were found attached to anchors and hardware used for water quality instruments (Figure 8 & Figure 9), on the underside of docks (Figure 10), and within the Keeyask Powerhouse itself (Figure 11).



Figure 7: Map of incidental findings of adult zebra mussels in and around the Keeyask Project Site.

Table 2: Location and dates of zebra mussel discovery on infrastructure.

Location	15V (NAD 83)		Date
	Easting	Northing	
Sediment monitoring station (SMP-3L)	373086	6246935	20-Sep-24
Hydrometric monitoring station anchor (HOD Clark Lake)	322163	6240270	20-Sep-24
Upstream dock (Keeyask Reservoir)	362229	6247396	20-Oct-22
Downstream dock (Stephens Lake)	364890	6247781	20-Oct-22
Unit 1 Scroll Case (Keeyask Powerhouse)	363889	6247254	20-Nov-28



Figure 8: This substrate anchor held AIS 2 in place and was removed from the water on August 22, 2020. Zebra mussels were found attached to it.



Figure 9: Zebra Mussels colonized a drift sock used at sediment water quality monitoring station located in Stephens Lake. The drift sock is suspended on the anchor line in about 5m of water in the river flow. September 25, 2020.



Figure 10: Zebra mussel colony found on the underside of a downstream dock following removal of the dock for the winter. October 22, 2020.



Figure 11: Following dewatering of the Keeyask Unit 1 Scroll case in the Powerhouse, some adult mussels (circled) were located on the concrete of the inner walls. November 28, 2020.

2.3.2 NEXT STEPS

Now that zebra mussels are present at Keeyask, monitoring will take place in 2021 to detect growth upstream, within the reservoir and downstream to measure the change through the Keeyask area.

3.0 CONCLUSIONS

The Keeyask ZMMP was implemented in 2020 in accordance with the Keeyask *Environment Act* Licence and included education and awareness activities to mitigate the introduction of zebra mussels at the Keeyask site, as well as to conduct veliger sampling, colonization sampling, and visual inspections of in-water infrastructure as the means to locate zebra mussels at the Keeyask site.

In 2020, 28 zebra mussel veligers were collected during instream monitoring and zebra mussels were found on artificial monitoring substrates as well as various in-water infrastructure. 2020 marks the first year of adult zebra mussels being found at Keeyask.

Monitoring for veligers and mussels will continue in 2021 in the Keeyask reservoir, and the substrate monitoring program will be expanded, in concert with the Province's method, to the area upstream and downstream of Keeyask to track them over a broader area to potentially find trends.

4.0 LITERATURE CITED

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

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