2022 Lake Whitefish Spawning and Habitat Investigations in the vicinity of the Matabitchuan GS, Matabitchuan River

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Table of Contents

List of Tables

List of Figures

1 Introduction

C. Portt and Associates was retained by Ontario Power Generation Inc. (OPG) to conduct a Lake Whitefish (*Coregonus clupeaformis*) spawning and spawning habitat assessment in 2022 at the Matabitchuan Generating Station (GS) on the Matabitchuan River, approximately 37 km south of Haileybury, Ontario (Figure 1-1). This investigation is in support of the assessment of options for development opportunities at this site, which considers overhaul, refurbishment, and redevelopment. This document presents the results of the first Lake Whitefish spawning field investigations undertaken in November 2022.

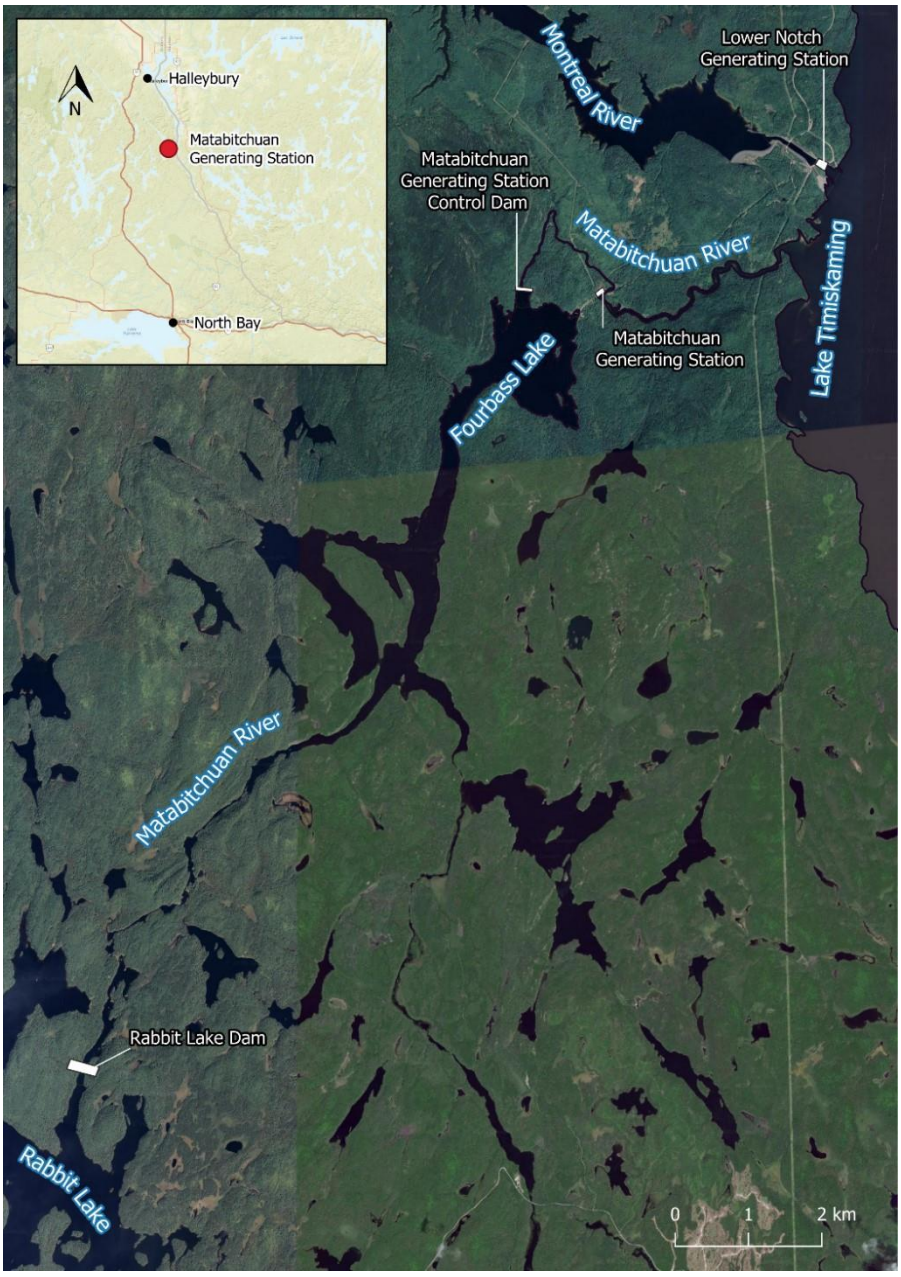

Figure 1-1. Location of the Matabitchuan Generating Station.

2 Background

The four unit generating station was constructed in 1910 with an installed capacity of 10,140 kilowatts, a hydraulic head of 95 m, and a maximum flow of 14 m^3/s (OMNR and OPG, 2007; OPG 2020). It is located within the lower portion of the Matabitchuan River watershed, which flows into Lake Timiskaming. There are three water control dams upstream from the Matabitchuan GS. Net Creek Dam and North Milne Dam, owned by the Ontario Ministry of Natural Resources (OMNR), are located in the upper watershed. Rabbit Lake Dam, owned by OPG, is used to control flow from Rabbit Lake into the Matabitchuan River and Fourbass Lake (Figure 1-1; OMNR and OPG, 2007). The Matabitchuan GS is the only hydroelectric facility in the watershed.

Figure 2-1 identifies project infrastructure and illustrates the general habitat and flow conditions in the vicinity of the GS. The Matabitchuan GS control dam (sluicegates) and intake structure are located on Fourbass Lake, approximately 800 m apart. The control dam and intake structure divert water to the powerhouse through penstocks, bypassing approximately 3 km of the Matabitchuan River that is now the spillway. Downstream from the GS the Matabitchuan River winds 3.6 km east to Lake Timiskaming (Figure 1-1; Figure 2-1). The low gradient of the river downstream of the GS means that the GS tailrace and the lower portion of the spill channel are readily accessible to Lake Whitefish from Lake Timiskaming.

Figure 2-1. Matabitchuan River in the vicinity of the Matabitchuan GS.

3 Field Investigations

3.1 Methods

To determine the proper timing and locations for Lake Whitefish spawning observations, knowledge of the environmental conditions required for Lake Whitefish spawning is necessary. These are:

- Lake Whitefish normally spawn when water temperatures drop below 7.8°C in the fall (Scott and Crossman, 1973; Holm *et al.* 2021), but peak at a lower temperature (Scott and Crossman, 1973). Becker (1983) states that shoal temperatures early in a spawning run were 6.1-4.4°C. At an Ontario location that is similar in latitude and physical character (Mattagami Lake Dam between Gogama and Timmins), C. Portt and Associates staff observed Lake Whitefish during their spawning run in the river when water temperatures were 4.7°C (2007) and 5.5°C (2009), but not at 2.0°C (2006) and 2.7°C (2008).

- Lake Whitefish usually spawn over hard or stony bottom or sand (Scott and Crossman, 1973), but have also been known to spawn over mud, clay, and detritus (Stewart and Watkinson, 2004), and silty and weedy bottoms (Coad *et al*. 1995).

- Lake Whitefish usually spawn at water depths less than 8 m (Scott and Crossman, 1973; Holm *et al.* 2021).

- Lake Whitefish are usually restricted to the cool, well oxygenated, regions of lakes and rivers (Coad *et al*. 1995; Nelson and Paetz, 1992; Smith, 1985). During their fall spawning period they move to the usually shallower spawning habitats of shoals and shorelines in lakes or shallow portions of rivers (Becker, 1983; McPhail and Lindsey, 1970).

A temperature logger (Tidbit MX Temp 5000) was deployed in the Matabitchuan River just outside of the safety boom, and on the upstream side, of the tailrace of the Matabitchuan GS by OPG personnel on October 11, 2022. The logger recorded water temperature every hour. The logged temperature data were periodically offloaded by OPG staff and transmitted to C. Portt and Associates for evaluation. The frequency of downloads was increased as the water temperature approached Lake Whitefish spawning temperatures. The water temperature data and monitoring of local weather forecasts were used to determine the time of the field investigations.

Field investigations were conducted on November 14-16, 2022, by C. Portt and Associates staff (G. Coker), accompanied by OPG staff (Louis Belanger, Sean Goddard, Ryan Heidekamp, Grant Robinson, Gillian MacLeod, Javon Bonaby, William Olsen) two members of the Timiskaming First Nation (Mike Laderoute, Keenan Chief), and one member of the Temagami First Nation (Jacob Evans). The study area was examined during daylight on the first day to identify safety hazards, access routes, river conditions, barriers to upstream migration by Lake Whitefish and potential Lake Whitefish spawning habitat.

Substrate characteristics observed during this field investigation, and substrate mapping in the study area during 2020 field investigations by C. Portt and Associates, informed the locations examined for spawning Lake Whitefish. A Garmin GPSmap 76CSx Global Positioning System (GPS) unit was used to determine the coordinates of key features and observations, including the locations of digital photographs of habitat. Additional water temperature readings were taken at various locations during the field investigation,

using a hand-held electronic thermometer (Hanna Instruments, Checktemp pocket thermometer. Accuracy = 0.2°C)

On the nights of November 14 (18:00-19:30), 15 (18:45-20:45), and 16 (17:30-18:45), a powerful spotlight (1.5 million candlepower) was used from shore to search for Lake Whitefish, which are differentiated from other fishes by their size, body shape and fin placement, and colour. Typical spawning behaviour, including jumping and otherwise breaking the water surface (Becker, 1983; Scott and Crossman, 1973), was also used to help identify locations of spawning Lake Whitefish.

The locations searched for spawning Lake Whitefish are shown in Figure 3-2. They included the tailrace and approximately 75 m along the northwest bank of the spill channel upstream of the tailrace, upstream and downstream from the road bridge, approximately 230 m along the southeast side of the spill channel upstream of the bridge, and approximately 172 m along the southeast side of the spill channel downstream of the bridge, which includes approximately 130 m of the river downstream of the tailrace.

A fyke net was set overnight approximately 176 m downstream of the tailrace on November 14, 2022, and again approximately 50 m upstream of the tailrace on November 15, 2022. Both net sets were orientated with the net mouth facing downstream and the wings extended at approximately 45 degrees to the mouth of the net.

3.2 Results and Discussion

3.2.1 Water temperature and flow

The logged water temperature decreased slowly in the autumn of 2022 (Figure 3-1), falling below 7.8°C for the first time on November 8. From November 8 through November 13 the water temperature averaged 7.5°C and fluctuated between 5.1 and 8.8°C. During the spawning investigations (November 14-16) the water temperature averaged 5.7°C and fluctuated between 3.6 and 7.2°C.

While typical diurnal temperature fluctuations occurred during parts of the monitoring period, smaller, short-term fluctuations occurred at other times (Figure 3-1). The smaller fluctuations in water temperature were apparently due to the location of the temperature logger, which was situated at the confluence of the tailrace flow and the spill channel flow (Figure 3-2). The water from the tailrace and the spillway could be quite different temperatures depending on the flow in the spillway (Table 3-1). On the first day of the field investigation (November 14) the temperature of the tailrace water, which comes directly from the headpond to the GS via the penstock and is then discharged to the tailrace, was measured at 7.6°C, while the temperature of the spillway water, which comes from the headpond control dam via approximately 3 km of spill channel, was measured at 3.0°C. On November 15 the tailrace flow was 7.2°C and the spill channel flow was 6.7°C, and on November 16 the tailrace flow was 6.7°C and the spillway flow was 6.3°C. On November 14 the spill channel flow was very low (<1 m^3/s) and contributed a very small proportion of the combined riverflow downstream of the GS, while on November 15 and 16 the spillway contributed approximately 24% of the combined riverflow downstream of the GS (Table 3-1).

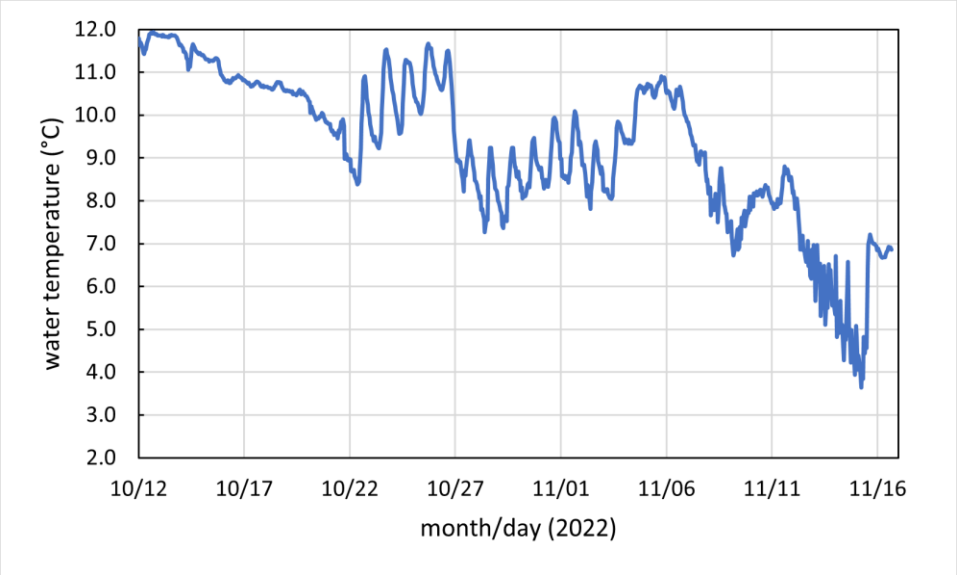

Figure 3-1. Logged water temperature in the Matabichuan River, adjacent to the GS tailrace for the period October 12 – November 16, 2022.

Table 3-1. Water temperatures and discharge through the tailrace and spill channel during the field investigation.

	Tailrace		Spill Channel	
Date (2022)	Temperature (°C)	Discharge (m^3/s)	Temperature (°C)	Discharge (m^3/s)
November 14	7.6° at 16:27	10.3	3.0° at 16:43	<1
November 15	7.2° at 15:18	10.3	6.7° at 15:42	3.4
November 16	6.7° at 16:45	10.3	6.3° at ~16:40	3.2

3.2.2 Spawning Observations at the Matabitchuan GS

The areas examined during the spawning survey at the Matabitchuan GS are shown in Figure 3-2. On all three nights of observations, spawning activity consisting of Lake Whitefish swimming about in pairs, jumping out of the water, and breaking the surface, was observed in the deeper water around a shallow shoal at the mouth of the tailrace (Figure 3-3) and for about 90 m downstream. It was estimated that approximately 20 Lake Whitefish were seen jumping during the November 14 observations, and while no estimates of jumping fish were made on November 15 and 16, fewer jumping fish were observed on each of those nights. No Lake Whitefish were observed in any of the other areas examined. The area in which the spawning activity was observed had the basic attributes of typical Lake Whitefish riverine spawning habitat, with sufficient depth for the rising of paired fish while emitting eggs and sperm, some gentle but complex currents and eddies, and coarse substrates. Downstream from the spawning area the substrate is finer and the current velocities are lower. Upstream from the spawning area the spillway is shallow (Figure 3-4) and soon becomes fast and turbulent (Figure 3-5), which would make it challenging for Lake Whitefish to move upstream. Based upon the examination of upstream spillway habitat characteristics that was undertaken by C. Portt and Associates in 2020, there are no upstream locations that would provide suitable spawning habitat for Lake Whitefish, and there are several bedrock waterfalls, as well as the control dam, that prevent fish from moving upstream.

3.2.3 Fyke Net Catches

As often occurs in the late fall, both fyke net sets became heavily fouled with leaves, filamentous algae and other debris that was being carried downstream, resulting in the collapse of the fyke net and severely affecting its potential to catch fish. Fyke net set #1, was in approximately two meters of water immediately downstream of the observed spawning area (Figure 3-2). One Lake Whitefish was captured, with a fork length of 37 cm and a total length of 46 cm. Fyke net set #2 (Figure 3-2), was in less than 1 meter of water in the spill channel, upstream of the observed spawning area. This set captured only a single Rock Bass (*Ambloplites rupestris*).

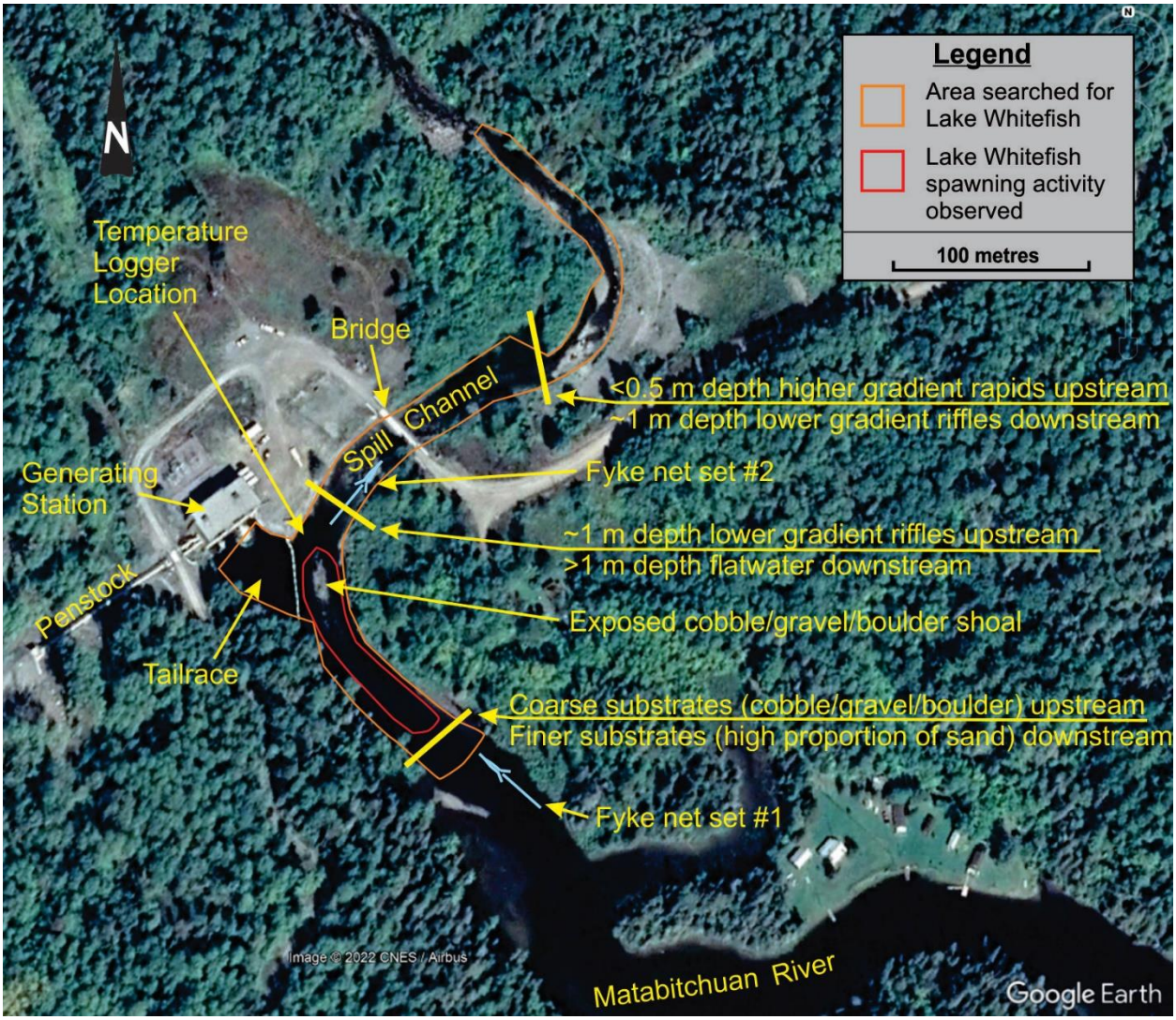

Figure 3-2. Area examined for Lake Whitefish on November 14, 15, and 16, 2022, showing location of observed spawning activity, location of fyke net sets, location of the temperature logger, and general habitat characteristics.

Figure 3-3. View downstream showing the Lake Whitefish spawning area. The tailrace is on the right, and the shallow shoal is indicated by the patches of emergent vegetation and a few exposed rocks in the centre of the channel. November 15, 2022.

Figure 3-4. View upstream from the road bridge, showing the lower gradient portion of the spillway. November 15, 2022.

Figure 3-5. View of the spillway, looking upstream from the farthest upstream location examined for spawning Lake Whitefish. November 15, 2022.

4 Conclusions

Lake Whitefish spawn in the Matabitchuan River immediately downstream of the Matabitchuan GS tailrace. Lake Whitefish were observed displaying spawning behaviour on three consecutive nights. The habitat characteristics in the area where spawning was observed were consistent with those described for Lake Whitefish spawning habitat in the literature, and similar to spawning habitat observed by C. Portt and Associates staff at other Ontario locations.

in the Northeast Region of the Ministry of Northern Development, Mines, Natural Resources and Forestry, in-water work is restricted from September 15 through May 15 where Lake Whitefish spawning may be affected by the in-water activities (https://docs.ontario.ca/documents/2579/stdprod-109170.pdf). Timing restrictions for spring-spawning species are likely to also apply at this location.

Habitat conditions within the spill channel appeared to be unsuitable for Lake Whitefish spawning, under the conditions observed during this investigation.

It is recommended that the spawning location and absence of spawning in the spillway be confirmed with at least one additional year of investigations.

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