Ontario Power Generation Inc.

PROPOSED CALABOGIE GENERATING STATION REDEVELOPMENT PROJECT ENVIRONMENTAL REPORT

Environmental Report
Final

March 2020

PROPOSED CALABOGIE STATION REDEVELOPMENT PROJECT

Environmental Report – Final

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Appendix A – Disposition Report

EXECUTIVE SUMMARY

Ontario Power Generation (OPG) is proposing to redevelop the existing Calabogie Generating Station (GS). Constructed in 1917, the original station had an installed capacity of 5 megawatts (MW). The existing Calabogie GS is over one hundred years old and was at the end of its life prior to the tornado that hit the GS in September 2018. The GS has not operated since that time. OPG intends to redevelop the site and increase the station's capacity to approximately 11 MW.

The Project is located in the Village of Calabogie, Township of Greater Madawaska, Renfrew County, Ontario. The Project involves the demolition of the existing powerhouse and forebay inlet structure and the construction of a new powerhouse with integral intake structure and tailrace. Other ancillary facilities will also be constructed. The Project may also involve the construction of additional sluiceway capacity.

In Ontario, proposed waterpower facilities are subject to the *Environmental Assessment Act* (*EA Act*). The Ontario Waterpower Association (OWA, 2018) developed the Class Environmental Assessment for Waterpower Projects (OWA Class EA) process which was approved by the Ontario Minister of the Environment and the Lieutenant Governor in Council in 2008. The *EA Act* formally recognizes the OWA Class EA process which outlines the requirements for Environmental Assessment (EA) approval. The proposed Calabogie Station Re-Development Project (CSRP) is being carried out according to the eight edition of the OWA Class EA.

Under the Ontario Waterpower Association (OWA) Class EA, the proposed Project is classified as a "Project Associated with Existing Infrastructure". Provided the requirements of the OWA Class EA planning process are met and a Part II Order request for a "bump-up" to an Individual EA is not made (or denied), a project is considered approved under the *EA Act*. This Environmental Report (ER) was prepared as part of this Class Environmental Assessment process. The ER provides a description of the proposed Project, summarizes the overall baseline environmental setting and anticipated environmental effects, recommends appropriate mitigation measures to minimize or obviate these effects, and describes Indigenous peoples, agency and public consultation.

A number of Technical Support Documents have also been prepared that address the aquatic environment, terrestrial environment, socio-economic environment, archaeology, built heritage, public and agency consultation and Indigenous consultation.

OPG will continue to operate the Calabogie GS and the other plants on the Madawaska River in full accordance with all flow and water level targets and compliance conditions in the Madawaska River Water Management Plan (WMP), including the summer conditions. Daily flow and water level conditions will remain unchanged from the existing situation. The new GS at Calabogie will have an increased flow capacity, which will allow OPG to produce more energy from the existing water. So additional water will be flowing through the GS rather than being spilled through the South Dam Sluiceway. This will not increase the daily flow. There will still be conditions and situations where a greater range at Stewartville GS is needed to meet Ontario grid requirements and maintain compliance with the other aspects of the WMP. However, there may be some conditions where the new Calabogie GS could match flow patterns at Barrett Chute GS and Stewartville GS to reduce water level fluctuations in the Calabogie to Stewartville reach of the River. This is an interest that has been expressed by some property owners downstream of Calabogie. If this occurs, it will be done in compliance with the WMP. Overall, the proposed GS will not result in significant changes to recreational use upstream or downstream on the River.

Aquatic Environment

During Project construction, potential effects on the aquatic environment may occur due to dewatering, soil erosion causing turbidity and sedimentation in surface waters, waste generation, incidental spills, hazardous materials usage, blasting, in-water construction activities and fish habitat enhancement/creation. Based on assessment of the available baseline information and potential effects, as well as the implementation of the recommended mitigation measures, it is concluded that effects during construction will be minimal, localized and short-term with no adverse residual effects.

OPG will provide a detailed assessment of habitat changes associated with the new project as part of the DFO review process. The assessment will account for both temporary and permanent changes and opportunities to balance habitat productivity will be investigated. The goal of the fish habitat design process is to balance the effects from the project so there is a no-net-loss of fish habitat.

During the operation of the proposed Project, potential effects on the aquatic environment may occur due to incidental spills, increased flow through the generation station and commensurately less flow through the south channel spillway, fish habitat loss/gain, and fish entrainment. Based on assessment of the baseline information and potential effects, and implementation of recommended mitigation measured, it is concluded that the operation of the proposed Project will have no adverse residual effects on the aquatic environment.

The proposed Calabogie Project will not have a negative effect upon the fish communities of the Madawaska River. There will be no significant changes to river conditions upstream or downstream of the plant as a result of the Project with the exception of the South Channel Spillway and the GS forebay and tailrace. Net changes in the area of fish habitat will be minor. More of the total river flow will pass through the forebay, GS and tailrace, and less will pass through the South Channel Spillway. This transfer of flow is expected to result in less extreme flows in the spill channel in high flow years, potentially creating better conditions for spawning Walleye and other spring-spawning fishes (e.g. White Sucker) and will result in zero flow through the spill channel more frequently (i.e. in more years) during the spring spawning season, which will render the area unsuitable for spawning by those same species. Flow through the South Channel Spillway will be zero for longer each year. This area experiences no flow for part of the year under the current conditions. Most of the area remains submerged due to the backwater effect from downstream and the area effected is primarily bedrock and very large boulders. No significant effect on the fish communities is expected.

OPG is committed to supporting the recovery of American Eel in consultation with Indigenous Peoples and in accordance with provincial recovery strategies and policy direction. On the Madawaska River, there are no known occurrences of American Eel, including at or in the immediate area of Arnprior GS, Stewartville GS and Calabogie GS. Therefore, these facilities are currently compliant with the *Endangered Species Act*. Over time, and as recovery strategies advance and succeed, American Eel may once again be present in the Madawaska River. This will signal that recovery strategies are working. OPG is using this redevelopment project to make the redeveloped Calabogie GS American Eel ready. Eel ready means that the redevelopment will be planned, designed and executed in anticipation of adaptive management strategies that can be applied to allow Eel passage. The proposed project represents an improvement over the existing situation of a GS that is not able to pass American Eel and therefore represents an overall net benefit.

Terrestrial Environment

During proposed Project construction, potential effects on the terrestrial environment may occur due to fugitive dust, combustion emissions, noise, blasting, soil erosion, incidental spills, hazardous materials use, waste generation, vegetation clearing, partial plantation loss, increased human activity and displacement of nesting birds and turtles. Based on an assessment of the available baseline information and potential effects, as well as the implementation of the recommended mitigation measures, it is concluded that effects during construction can be effectively mitigated, and most of them will be localized and short-term.

During the operation of the proposed Project, potential effects on the terrestrial environment may occur due to noise, incidental spills, etc. Based on assessment of the baseline information and potential effects, it is concluded that the operation of the proposed Project will have negligible long-term effects on the terrestrial environment.

Environmental protection of the terrestrial environment during proposed project construction and operation will be ensured by adherence to the site-specific Environmental Management Plan, as well as compliance with regulatory standards and guidelines.

Socio-Economics

The proposed Project will result in an increase of slightly over 6 MW of power over the old station. In total approximately 11 MW of power would provide energy for slightly over 11,000 homes in Ontario.

The proposed Project is expected to result in the creation of approximately 162 to 185 person years of work over an approximately two-year construction period. This employment will be distributed across a wide variety of professions and trades typically associated with a heavy construction project. Recent OPG experience in constructing hydroelectric projects in Northeastern Ontario demonstrated that approximately 60% of the total labour requirement would be met locally or regionally.

Economic and business activity effects will be associated with sub-contracting and spending opportunities to the DB Contractor. This also includes the indirect and induced economic effect associated with the proposed Project on existing local businesses and the regional economy. These opportunities will develop via contracting work, as well as local project purchasing and expenditures by workers in the local and regional economy. OPG and its DB Contractor, a joint venture between SNC Lavalin and M. Sullivan & Son (SNC-Sullivan) are also facilitating economic opportunities for the Algonquins of Ontario and Pikwakanagan First Nation through training, employment and sub-contracting opportunities. Opportunities will also be considered for Williams Treaty First Nation communities.

OPG anticipates that the re-developed GS will result in payment of $18 million (in 2019 dollars) to the Province in Gross Revenue Charges over the course of the proposed Project or $52.5 million (nominal dollars with inflation).

The proposed Project is consistent with the existing land use direction and OPG and SNC-Sullivan have been working co-operatively with the Township and the County on issues of mutual interest including traffic management, heritage and the re-use of materials from the project. As the proposed Project merely replaces the existing 100-year old GS it results in no changes to the character of the area or any nearby land and resource uses. The Project has also received a letter of support from the Township.

Cultural Resources

Stage 1 and 2 archaeological assessments have been conducted at the Calabogie GS including fieldwork participation from a representative of the AOO. Following the Stage 1 assessment, areas of archaeological potential were identified within the study area on both sides of the Madawaska River. The Stage 2 portion of this assessment subjected all areas of identified archaeological potential to a Stage 2 sub-surface survey. As no archaeological resources were located during the Stage 2 sub-surface survey of the areas of archaeological potential at the Calabogie Generating Station, no further archaeological resource assessment work was recommended.

With respect to built heritage, the Cultural Heritage Evaluation Report (CHER) for the subject property concluded the property fulfilled the evaluation criteria for determining the cultural heritage value or interest set out for local significance in Ontario Regulation 9/06 under the *Ontario Heritage Act* (OHA) and it is a Provincial Heritage Property (PHP). It did not meet the criteria for provincial significance in Ontario Regulation 10/06. The existing powerhouse, headworks and inlet structure will not be retained but the majority of the site will remain as is. A series of recommendations has been made with respect documenting and commemorating the facility. As well, equipment is being considered for retention by both OPG and by the Township of Greater Madawaska.

Indigenous Interests and Consultation

At the start of this Class EA process, the then Ontario Ministry of the Environment and Climate Change (MoECC) identified that consultation was to be undertaken with the Algonquins of Ontario (AOO). Subsequently in April of 2019 four Williams Treaty First Nations communities were added to the consultation list including: Alderville, Curve Lake, Hiawatha and Scugog.

The proposed Project lies within the AOO Land Claim and engagement has occurred with the AOO and their various member communities. While the Algonquins of Pikwakanagan (AoPFN) First Nation are part of the AOO there has been additional engagement with them separately, as per their request. Extensive efforts have been made to work with both the AOO and AoPFN, and in accordance with their consultation policies, funding has been provided for them to participate. More recently, consultation has occurred with the four Williams Treaty First Nation communities.

Arcadis and OPG are of the opinion that no traditional activities will be impacted by the proposed project. The rationale for this is described in this Report but is premised on the fact that the proposed Project merely replaces an existing GS that has operated for over one hundred years. A Water Management Plan has been in place on the Madawaska River that contains a variety of compliance requirements that OPG must follow. No changes are proposed to that Plan. Furthermore, the implementation of the various mitigation measures proposed should result in negligible impact on the natural environment upon which traditional activities are based.

OPG has also been trying to enhance potential benefits associated with the proposed Project. OPG has designed American Eel passage into the facility so that should the species appear on the Madawaska River, the GS can allow for its movement. The AOO have previously identified to OPG the spiritual importance of the American Eel to them as a people.

An extensive review of the environmental assessment was undertaken by AOO and AoPFN which resulted in a disposition table of comments and responses. This was worked at extensively throughout the fall of 2019. OPG is undertaking more discussions with AOO and AoPFN on archaeology and traditional plants and resources on the site.

OPG is also facilitating potential training, employment and contracting opportunities for Algonquins, and if interested the identified Williams Treaty First Nation communities as well.

In summary, OPG is of the opinion that all Indigenous interests are being adequately engaged on the proposed Project in a respectful manner and by addressing common issues of concern and interest. OPG will continue to work with all Indigenous interests on many fronts throughout the project as described in this Report.

Public and Agency Consultation

The consultation program included two rounds of open houses held in Calabogie (2018 and 2019), public notices, a Project website, and the provision of opportunities for on-going consultation. Generally, public interest has been modest with approximately thirty people attending each round of open house.

The two open houses demonstrated that no one is opposed to the proposed Project. The only issue that is of interest to multiple stakeholders is the issue of fluctuating water levels in the Calabogie GS to Stewartville GS reach of the Madawaska River. This issue has already been mentioned in this Executive Summary. As already indicated, there may be some conditions where the new Calabogie GS could match flow patterns at Barrett Chute GS and Stewartville GS to reduce water level fluctuations in the Calabogie to Stewartville reach of the River. Overall, the proposed Project will slightly improve the existing situation.

Government agency consultation was formally initiated in 2017. Consultation has been on-going throughout the proposed Project and OPG has appreciated the background, guidance and direction offered by the Ministries on the proposed project.

OPG has recently completed an Agreement with the Township of Greater Madawaska that will give the Township rock that will be excavated as part of the project at no cost for use for the Township's roads in the future. The proposed agreement is a win-win-win agreement as it will help to offset future Township costs, provide OPG a location to place excess rock and reduce the number of vehicles and hauling involved in moving the rock elsewhere. OPG appreciates the co-operation of the Township on this matter.

It is our opinion that all public comments raised have been addressed and that comprehensive consultation has taken place with relevant agency and government regulators.

Summary

Environmental protection during proposed Project construction and operation will be ensured by adherence to the site-specific Environmental Management Plan to be developed by the SNC-Sullivan, as well as compliance with regulatory standards and guidelines.

The Environmental Management Plan ensures that environmental protection will be achieved during construction by describing government agency requirements, proposed Project commitments and recommended mitigation measures to be undertaken. The Environmental Management Plan will include the Erosion and Sediment Control Plan, Spills Emergency Preparedness and Response Plan, Hazardous Materials Management Plan and Waste Management Plan.

During operation, environmental protection will be achieved by adherence to the Spills Emergency Preparedness and Response Plan and the WMP and on-going deployment of public safety measures and environmental monitoring. The requirements of the WMP minor amendment process will be met and be supported by the EA process.

The proposed project will produce a wide variety of benefits for local and regionally based populations and in general the people of Ontario.

The proposed Project will benefit Ontario in terms of the gross revenue charges (water rental) that would be paid to the Province, and by providing a long-term, renewable and reliable energy source that supports provincial green energy, climate change and Indigenous policies, and aligns well with the needs (flexibility) of the provincial electrical system. The Province would also benefit by the related taxes and charges that result from all aspects of the proposed Project.

The investment in a new and somewhat larger GS at Calabogie will help OPG better match flows with the upstream and downstream plants and result in increased utilization of the available water resources. The project will also allow for an investment into the infrastructure at the facility which would be advantageous in addressing future catastrophic events and climate change. Finally, the investment will also allow OPG the opportunity to make the GS “eel ready” so that facility could safely pass future American Eel populations.

Any negative environmental effects associated with the proposed Project are minor and/or temporary and most if not all can be addressed through appropriate mitigation and monitoring measures.

Finally, this ER presents the view that developing a new approximately 11 MW hydroelectric GS at the site of the existing Calabogie GS represents a positive net benefit for the people of Ontario..

1 INTRODUCTION

1.1 Regulatory Framework and Environmental Assessment Process

In Ontario, proposed waterpower facilities are subject to the *Environmental Assessment Act* (*EA Act*). The Ontario Waterpower Association (OWA, 2018) developed the Class Environmental Assessment for Waterpower Projects (OWA Class EA) process which was approved by the Ontario Minister of the Environment and the Lieutenant Governor in Council in 2008. The *EA Act* formally recognizes the OWA Class EA process which outlines the requirements for Environmental Assessment (EA) approval. The proposed Calabogie Station Re-Development Project (CSRP) is being carried out according to the eight edition of the OWA Class EA.

Under the OWA Class EA, the proposed CSRP is classified as a "Project Associated with Existing Infrastructure". Provided the requirements of the OWA Class EA planning process are met and a Part II Order request for a "bump-up" to an Individual EA is not made (or denied), a project is considered approved under the *EA Act*.

1.2 Other Environmental Approvals

Other permits, approvals and clearances will be sought as the proposed Project moves into the construction stage. Section 7.2.4 and Table 7.2 of this Environmental Report (ER) identify a range of possible approvals required; however, specific permits and approvals will likely be required under the provincial *Lakes and Rivers Improvement Act* (*LRIA*), *Environmental Protection Act* (*EPA*) and *Ontario Water Resources Act* (*OWRA*). It is also noted that at the time of the writing of this ER both the provincial and federal governments are making changes to legislation and policy which may add, eliminate, or modify the types of permits and approvals required.

1.3 Overview of the Environmental Report and Technical Support Documents

This ER is the product of over two years of extensive study and consultation with Indigenous communities, the general public and government agencies. This ER and the associated Technical Support Documents (TSDs) were prepared by Arcadis Canada Inc. and its sub-consultant team of C. Portt & Associates (aquatic and fisheries), Beacon Environmental (terrestrial), Woodland Heritage Northeast (archaeology) and Unterman McPhail (built heritage). It was also done with the assistance of OPG, KGS Group and SNC-Sullivan.

Data sources used to document the existing environment included published and unpublished literature, government files, personal interviews, public open houses and field studies. Where possible, existing data sources were used; however, extensive field studies were required to complete the study.

Study areas were selected for each major component of the natural and socio-economic environment. This selection was based on a preliminary assessment of the areas that were expected to be affected directly or indirectly by the proposed Project. Therefore, the geographic study areas vary among the disciplines and environmental components.

This ER is organized into seven main chapters:

- Chapter 1.0 – introduces the Proposed Project, outlines the EA process and other environmental approvals, and lists the TSDs;
- Chapter 2.0 – provides a detailed project description;
- Chapter 3.0 – provides a description of the existing environment;
- Chapter 4.0 – provides an overview of environmental effects and mitigation measures during construction and operations and discusses the significance of effects;
- Chapter 5.0 – summarizes Indigenous Peoples consultation;
- Chapter 6.0 – provides an overview of public and government agency consultation; and
- Chapter 7.0 – provides an overall summary evaluation of the proposed project.

Chapters 8.0, 9.0 and 10.0 provide the References, Acronyms/Abbreviations and Glossary, respectively.

This ER is supported by several TSDs covering the following topics:

- Aquatic Environment;
- Terrestrial Environment;
- Socio-Economic Environment;
- Public and Agency Consultation;
- Indigenous Interests and Consultation;
- Stage 1 and 2 Archaeological Assessment; and,
- Cultural Heritage Impact Assessment (i.e. built heritage).

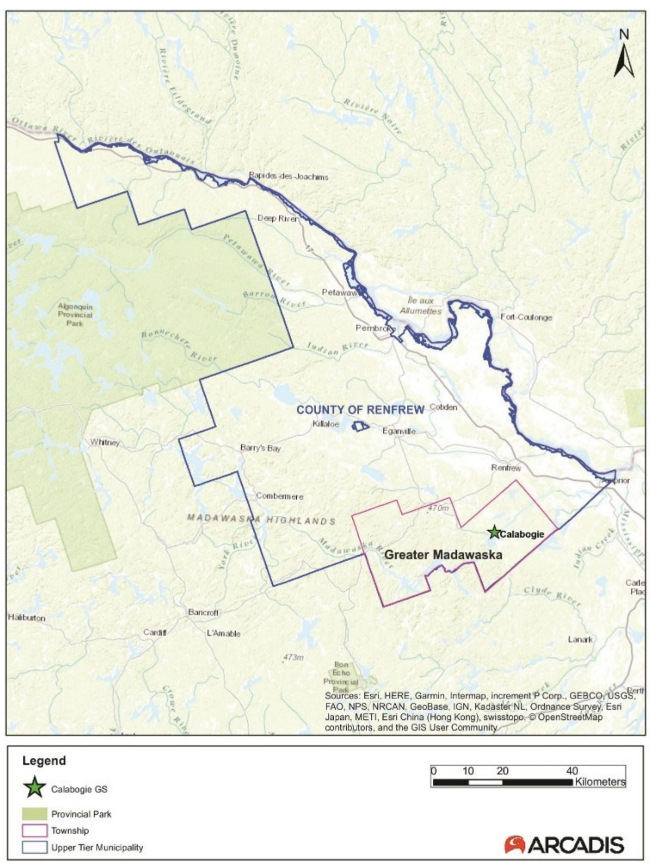
2 PROJECT DESCRIPTION

Ontario Power Generation (OPG) is proposing to redevelop the existing Calabogie Generating Station (GS). Constructed in 1917, the original station had an installed capacity of 5 megawatts (MW). The existing Calabogie GS is over one hundred years old and was at the end of its life prior to the tornado that hit the GS in September 2018. The GS has not operated since that time. OPG intends to redevelop the site and increase the station's capacity to approximately 11 MW. The Project involves the demolition and removal of the existing powerhouse and its structures including the forebay retaining walls and the forebay inlet structure and the subsequent construction of a new powerhouse and forebay embankment, with integral intake structure and tailrace. The Project will be constructed by a joint venture consisting of SNC-Lavalin and M. Sullivan and Son (the Contractor). OPG is advised by KGS Consultants (the Owner's Engineer) and Arcadis (the Environmental Consultant).

2.1 Project Location

The existing Calabogie GS is located within the Village of Calabogie, in the municipality of Greater Madawaska, Renfrew County, Ontario (Figure 2-1). It is located approximately 80 km northwest of Ottawa and 20 km southwest of Renfrew.

Figure 2-1. Location of the Calabogie Generating Station



The Calabogie GS, located on the Madawaska River is approximately 10 km downstream of Barrett Chute GS and 20 km upstream of Stewartville GS, both OPG-owned hydroelectric facilities. Calabogie GS is part of OPG's Eastern Operations Group. The location of Calabogie GS relative to OPG's hydroelectric facilities on the Madawaska, Ottawa and St. Lawrence Rivers is shown on Figure 2-2.

Figure 2-2. Calabogie Generating Station within OPG's Eastern Operations

Source: https://www.opg.com/building-strong-and-safe-communities/our-communities/eastern-ontario/

2.2 Existing Calabogie Generating Station

2.2.1 History and Operations

Calabogie Generating Station was constructed in 1917 with an installed capacity of 4 MW utilizing two quadruple-Francis horizontal turbines operating at a gross head of just under 9 metres. With a maximum total turbine outflow of 66 cubic metres per second (cms), and only limited storage available in Calabogie Lake, the plant is significantly undersized in comparison to either typical mean flows or to both the upstream and downstream hydroelectric stations on the river, which have daily peaking flows up to 458 cms. Over the last 50 years several studies have investigated redeveloping the site or increasing generation at the existing plant.

As noted in the 2009 Madawaska River Water Management Plan:

> *"The Calabogie GS operates as a peaking plant in conjunction with the four other OPG owned GS on the Madawaska River. Although the generating units at the station have limited flow capacity, the units and sluice gates are integrated with the rest of the peaking system on the Madawaska River. Calabogie is a generation bottleneck on the Madawaska River. The small turbine capacity results in frequent spill past the station.*
>
> *The operation of the GS is based on a daily/weekly cycle. The inflow is passed through the GS over a daily or weekly period. Operation of the GS takes into consideration energy demands, recreational opportunities as well as walleye spawning activities."*

The average historical inflow for the period between 1965 and 2017 at Calabogie is approximately 90 m^3/s with a median of 72 m^3/s. The flow duration curve and historic daily discharge record is presented below.

Figure 2-3. Calabogie Flow Duration Curve 1968 – 2018

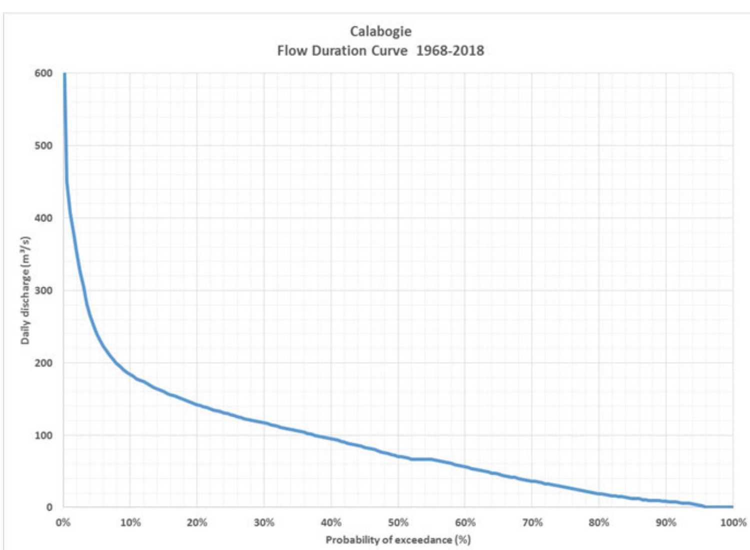
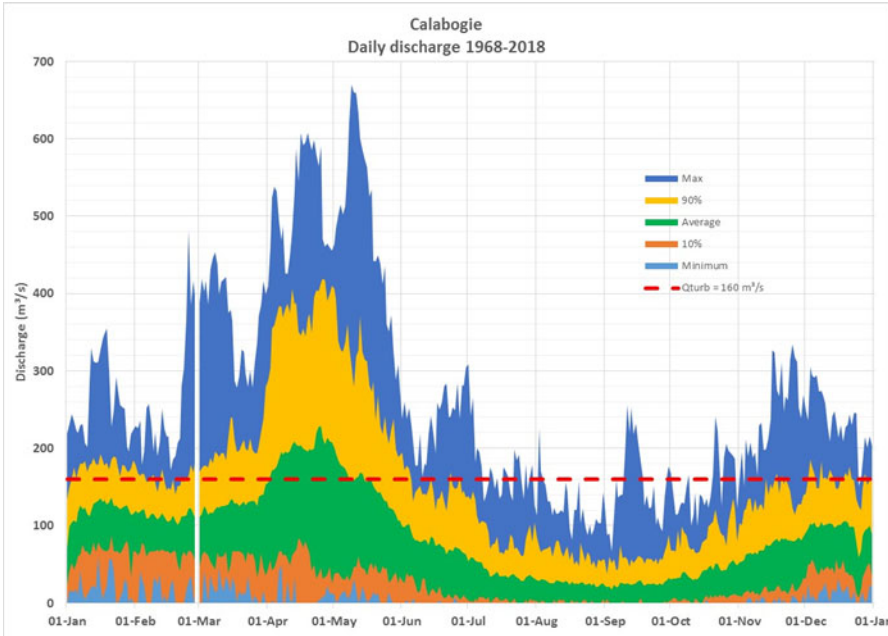


Figure 2-4. Calabogie Daily Discharge 1968 – 2018



The existing Calabogie GS is considered at end of life and OPG intends to redevelop the site with an increased capacity in order to take advantage of the existing water resources.

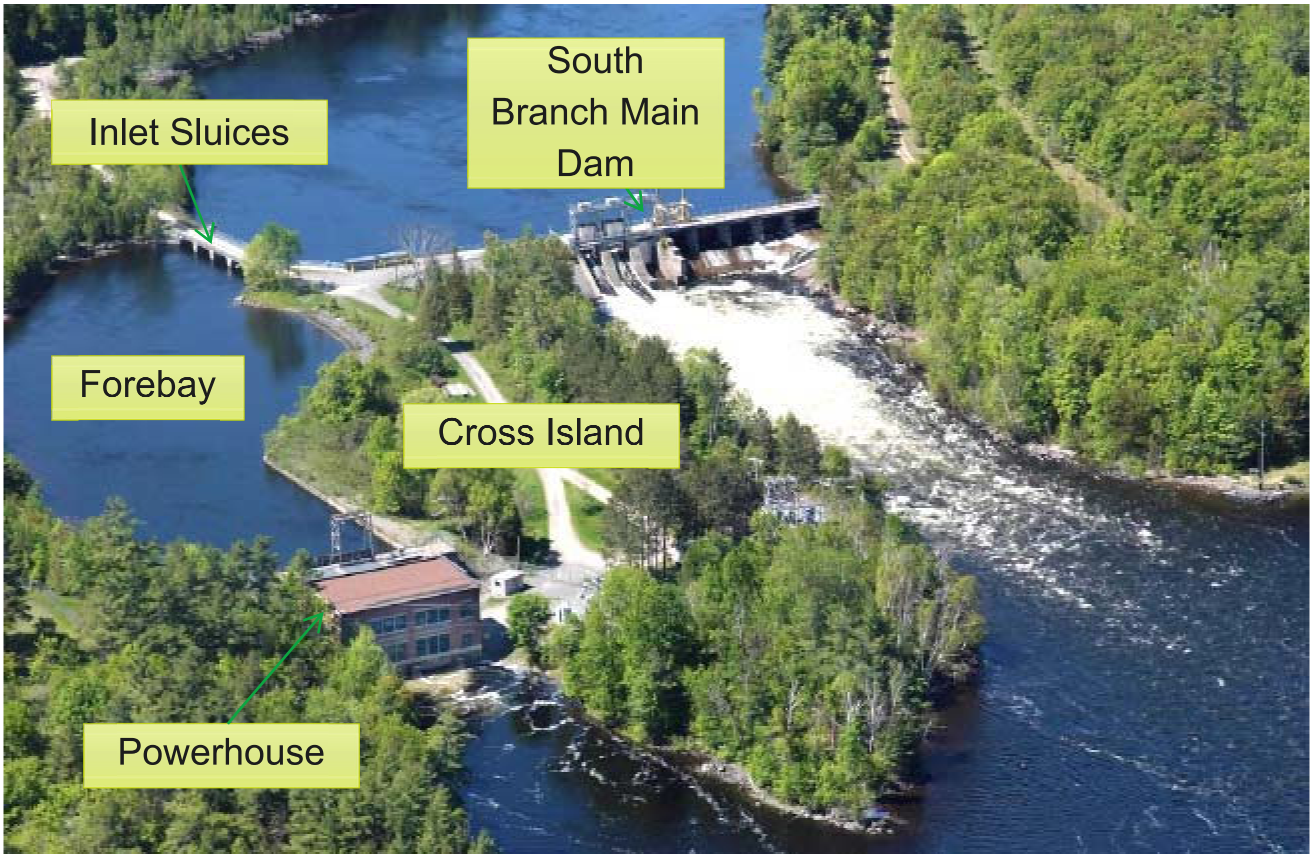
In September 2018, a tornado swept through the Calabogie area that resulted in significant damage to the GS. OPG began immediate repairs to the sluiceway to make it operable but the powerhouse roof was removed, rendering it unsafe. Calabogie GS has not operated since that time and will not be returning to services until completion of the redevelopment project.

2.2.2 Description of the Existing Calabogie Generating Station

While OPG intends to re-develop the power production component of the Calabogie GS, most of the other features and equipment at the site pertaining to water management will remain as is. Figure 2-5 below shows an aerial image of the Calabogie GS and key surrounding features. Figure 2-6 is a colour air photo focusing on the south branches of the River including the South Branch Main Dam.

Figure 2-5. Calabogie Generating Station Site Map

Figure 2-6. Calabogie Generating Station Colour Air Photo: Inlet, South Dam and Powerhouse



As shown in Figure 2-5, the Madawaska River immediately downstream of Calabogie Lake is characterized by three separate channels.

The northernmost channel is the North Channel that connects directly to Calabogie Lake. The North Channel is a natural river channel with flows controlled by the North Channel Sluiceway (owned and operated by OPG). The North Channel is not used for regular water management operations, however there is a compliance minimum flow of 0.8 cms. This flow has not been measured since the replacement of the wooden stop logs with steel stop logs. The 0.8 cms is an estimated flow. During the walleye spawn and incubation period the minimum flow is 5 cms subject to temperature conditions (described in more detail in Table 9.16 of the Madawaska River Water Management Plan).

The middle channel of the Madawaska River is the South Channel Sluiceway. This is the channel used to control the water management operations along with the Calabogie GS. There is no minimum flow requirement in the South Channel Sluiceway.

The southernmost channel of the Madawaska River is the forebay, powerhouse and tailrace of the existing and proposed GS. It is believed that this channel was excavated at the time of the original GS construction.

The Calabogie GS powerhouse is situated about 800 metres downstream of the outlet at Calabogie Lake.

As shown in Figure 2-5, two islands were formed by the three channels in this reach of the Madawaska River, the southern island (Cross Island) which is shown in greater detail and in full in Figure 2-6 and the larger northern island (Calabogie Island).

Cross Island is the hub of the Calabogie GS. It is accessed via Generating Station Lane, a private OPG owned gravel road that is accessible from Lanark Road, which is also known as Renfrew County Road 511 (formerly Highway 511). This road follows the southern channel of the River and then crosses over the entrance to the forebay. The OPG Bridge/Inlet Structure in this location serves two purposes: it first acts as a bridge to Cross Island; and second, it also integrates the inlet structure to the forebay with several sluices that control water flowing to the existing powerhouse. Cross Island also includes a trailer that serves as an office and washroom facilities. A Hydro One Networks Distribution Station (Calabogie DS) is also located on the island and connects to the powerhouse. Except for the eastern tip, Cross Island is largely cleared of trees. Along with all the infrastructures mentioned above, Cross Island included a cul-de-sac type road with parking areas and grassed areas for storage of equipment and materials. The tornado of September 2018 snapped a large percentage of the remaining trees on the island, which were subsequently cleared by OPG.

As shown in Figures 2-5 and 2-6 the South Branch Main Dam connects Calabogie and Cross Islands. The South Branch Main Dam provides the primary water management function at the GS and water in excess of the powerhouse discharge is passed through the dam.

Calabogie Island was also impacted by the September 2018 tornado, but the Island remains largely forest covered. The Island can be accessed by foot across the South Branch Main Dam or by vehicle on an OPG owned private gravel road that is also accessible from County Road 511. Near the South Branch Main Dam, and south of it, the Island has been disturbed by the dam construction and on-going operations. Calabogie Island is also bisected by HONI's connection line to the Calabogie GS. OPG maintains a boat launch with access to the Madawaska River downstream of the South Branch Main Dam sluiceway. The boat launch allows for operations and maintenance activities that need to occur by water on the downstream side of the facility.

Figure 2-5 also shows safety booms placed and maintained by OPG on both the upstream and downstream sides of the River.

2.3 Alternatives Analysis

Over the last 50 years several studies have investigated redeveloping the site or increasing generation at the existing plant. Studies from 1960 through to 2016 considered refurbishment and expansion of the existing plant or complete replacement with generating capacities that ranged from approximately 6 MW to 15 MW.

The latest plant redevelopment options were optimized through a multi-stage refinement process, with an initial optimization by KGS Group for OPG, followed by more detailed project refinement by the Contractor. While numerous alternatives were considered through the re-development process, three primary alternatives emerged for final consideration. These were:

- Alternative #1 – Refurbishment of the existing powerhouse with minimal civil work.
- Alternative #2 – Refurbishment, expansion and redesign of the existing powerhouse.
- Alternative #3 – Construction of a new powerhouse.

Based on the analysis completed, Alternative #3 was selected as the preferred alternative to complete the Calabogie GS redevelopment. Alternative #3 will make best use of the available water resource at site and will result in the highest estimated annual energy generation. It also better addresses qualitative risk factors than the other alternatives.

Some of the qualitative benefits of this alternative over the other two included the following:

- Alternative #3 allows for the largest addition of green, carbon free capacity and energy to OPG's portfolio. This aligns with OPG's Strategic Direction.
- Alternative #3 is better equipped to manage the possibility of higher water quantities that are expected with future climate change.
- Alternative #3 allows for the safe removal of hazardous materials in the existing powerhouse, including, but not limited to, lead paint and asbestos. The new powerhouse will be free of these designated substances.
- Alternative #3 utilizes traditional turbine equipment, of which OPG has extensive operating experience.
- Alternative #3 with its larger plant flow capacity makes better use of available water in the Madawaska River to use more efficiently the resource and generate more energy and hydroelectric power.
- Alternative #3 with a new powerhouse allows the constructors to optimize design for constructability.
- Alternative #3 allows for optimal design to ensure accessibility and modern equipment.
- Alternative #3 will also be entirely new, leading to higher degree of reliability of operation with potentially less forced outages due to failures in the immediate future. Following the tornado of September 2018, significant damage occurred to the powerhouse rendering it inoperable and unsafe. Given that Alternative 3 will demolish the existing station, only minimal safe state investment is required to ensure safety and mitigate the risk of environmental spills/releases.

As the above analysis indicates, the preferred option is to construct a new powerhouse together with associated ancillary features. The existing water control facilities for both the north and south channels has been recently upgraded and is not considered part of this project.

2.4 General Layout and Description

2.4.1 General Layout

A new powerhouse will be constructed, approximately 50 metres upstream of the existing powerhouse within the existing forebay. The existing powerhouse will be demolished. The new station will have two horizontal-axis Kaplan type turbines and be rated at approximately 10.7 megawatts while both units are running. Implementation of this alternative will involve the following:

- Construction of a new powerhouse with all new turbine generator equipment.
- Removal of all existing power equipment and demolition of the existing powerhouse.
- Removal of the inlet structure to the forebay and widening of the inlet section, along with excavation in the forebay and tailrace, to allow for increased flow conditions.
- Construction of a new substation and interconnection to the existing transmission line.

The new powerhouse location was selected to be upstream of the existing powerhouse in the forebay to optimize the increased station flow and hydraulic conditions.

The re-developed GS will have the following characteristics:

- Effective Capacity of 10.7 MW;
- Estimated Annual Energy Generation with 98 % of availability – (on the order of 44 GWh to 47 GWh depending on operation);
- Number of Units – 2 horizontal turbines capable of producing approximately 5.4 MW each;
- Station Flow – 160 m^3/s;
- Minimum Operating Flow – 20 m^3/s;
- Average Annual Flow – 90.5 m^3/s; and
- Average head of 8.6 m (range of 6.6 m to 9.9 m).

The proposed site plan for the new GS is shown below in Figure 2-7, while the powerhouse arrangement is presented in Figure 2-8. As already described, the proposed new powerhouse will be located in the forebay approximately 50 metres upstream of the existing one. The proposed undertaking will remove the current bridge and inlet structure over the forebay with access to the new powerhouse and existing sluiceway provided on the east side of the forebay.

Figure 2-7. Proposed Site Plan for the Calabogie GS

Figure 2-8. Proposed Powerhouse Arrangement for Calabogie

2.4.2 Construction Sequencing

The construction of the new GS will be undertaken sequentially in the following stages as shown below.

Stage #1

In Stage #1 of the demolition and construction, the construction facilities and laydown areas will be set up, site trailers mobilized, access roads upgraded where necessary and the rock and overburn stockpile areas cleared. As of the fall of 2019, the existing inlet structure (located at the bridge) has been closed and the existing forebay channel de-watered. The following summer, the forebay sediment, soil and rock will be excavated in the dry for construction of the new intake forebay channel and new powerhouse substructure. During this time the existing powerhouse will be used as a downstream cofferdam.

While the existing powerhouse overburden is excavated out, hazardous material abatement will be completed within the existing powerhouse. The existing equipment will be removed, preparing for the powerhouse superstructure to be demolished. Throughout all stages of demolition, hazardous and recyclable materials will be separated from general waste and any potential waste requiring specialized treatment.

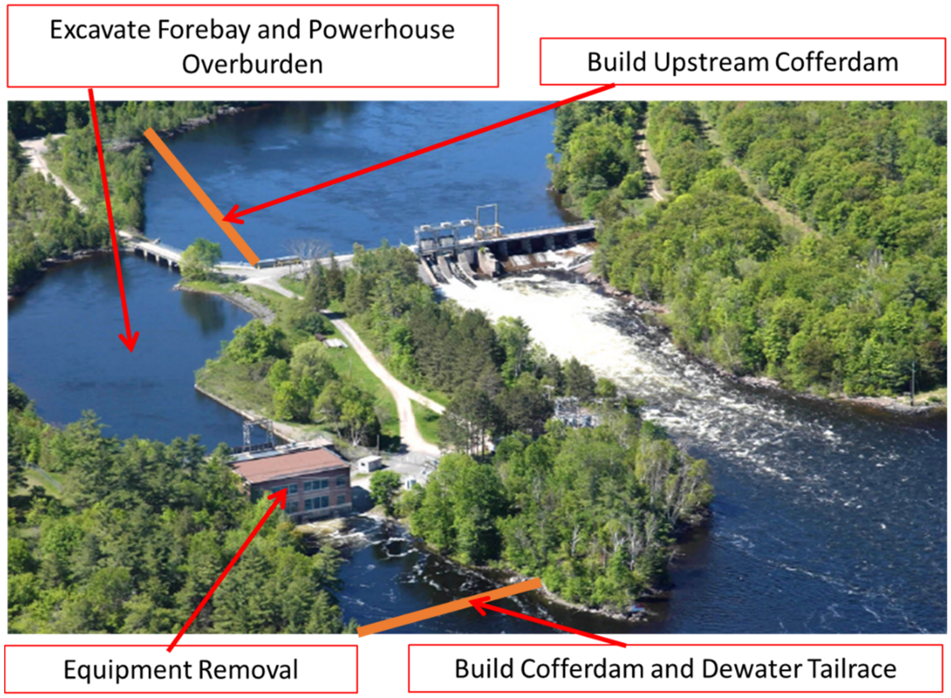
Prior to demolition of the existing Powerhouse, a cofferdam will be constructed downstream of the existing powerhouse and the existing tailrace de-watered. At the same time the downstream cofferdam is constructed, an upstream cofferdam will be constructed upstream of the inlet structure. The section between the upstream cofferdam and the inlet structure will be dewatered allowing overburden excavation to continue preparing for the rock excavation in Stage 2.

The existing inlet structure/sluices will allow the forebay to be isolated and excavation work to begin in the forebay at the start of construction. Following the July 15th fish window, the cofferdam will be constructed upstream of the inlet structure (as shown in Figure 2-9) to allow for removal of the existing inlet structure in the dry and rock excavation to continue. The upstream cofferdam will be constructed from blasted rock that has been excavated to accommodate the new powerhouse. Clean blast rock will be used to construct a 5.8 metres wide cofferdam, with a slope of 1.5H:1V up to elevation 155.17 masl. The upstream face of the cofferdam will be lined with a heavy-duty cofferdam membrane and sealed to the riverbed with a bentonite clay seal. Upon completion of the powerhouse, the liner, blasted rock and overburden will be removed, and the channel will be graded with rockfill.

The downstream cofferdam is required to isolate the downstream side of the construction and allow for the demolition of the existing powerhouse and construction of the new powerhouse and tailrace. The proposed cofferdam is a rockfill dam with an impervious geomembrane on the water side of the cofferdam. Seepage through the cofferdam will be collected and directed to a settling pond prior to discharge back into the river.

The bed material in the area where the downstream cofferdam will be constructed is primarily cobble/boulder/gravel across the main channel with some sand/gravel/cobble and bedrock/boulder/cobble distributed proximate to the river bank.

Figure 2-9. Work Sequence – Stage #1 – Excavation, Removals and Cofferdam Construction

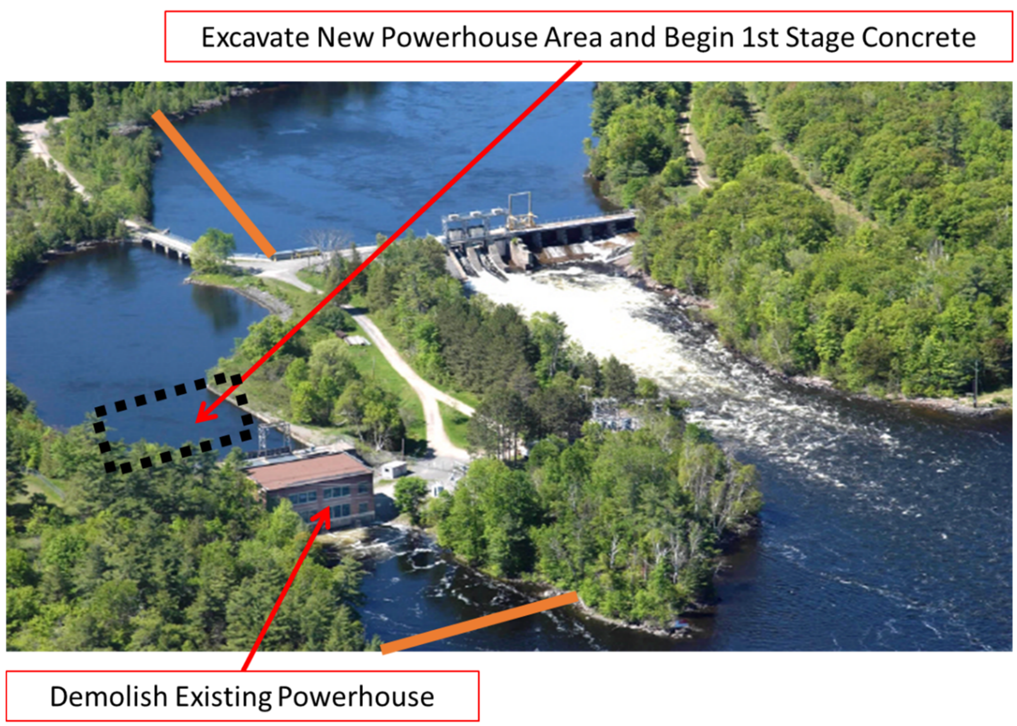


Stage #2

In Stage #2 the existing powerhouse superstructure will be demolished, followed by the existing powerhouse concrete substructure. Rock excavation for the foundation of the new powerhouse will be completed and the left embankment works will start.

Hazardous and recyclable materials will continue to be separated from general waste and any potential waste requiring specialized treatment. First stage concrete work will begin for the new powerhouse and the new embankments within the forebay and downstream of the existing forebay inlet structure will be constructed.

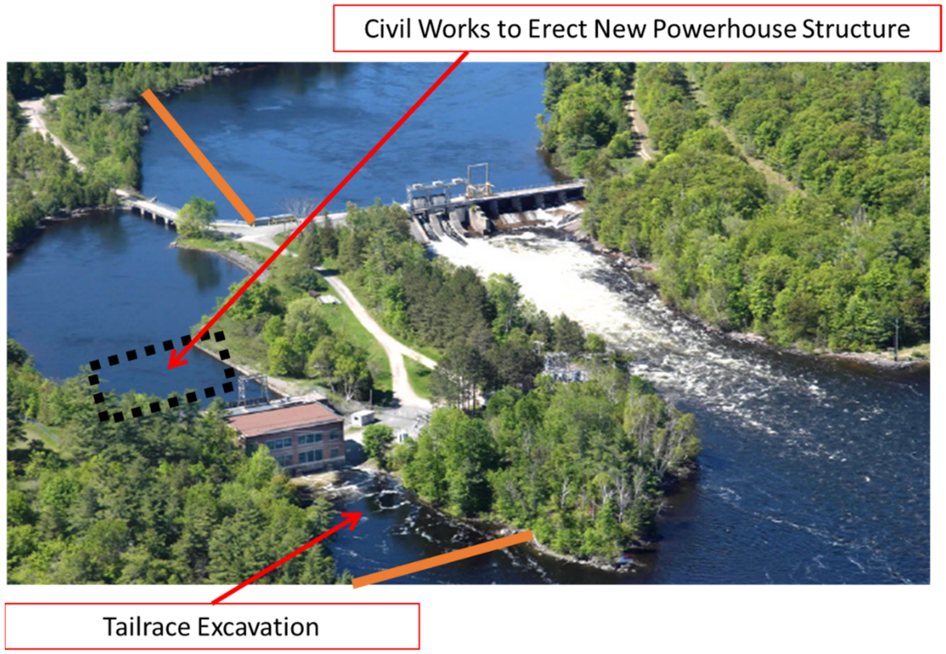
Figure 2-10. Work Sequence – Stage #2 – Powerhouse Demolition and Excavation of New Powerhouse



Stage #3

In Stage #3, the new powerhouse construction will include the remainder of 1st stage concrete works for the new powerhouse, installation of the embedded parts for hydro-mechanical equipment including gates and stoplogs, secondary concrete works, construction of the powerhouse superstructure, installation of the powerhouse crane and enclosure of the powerhouse. On the downstream side, the tailrace will be excavated down to the new elevation. The new substation equipment installation will commence, and the existing substation will be removed.

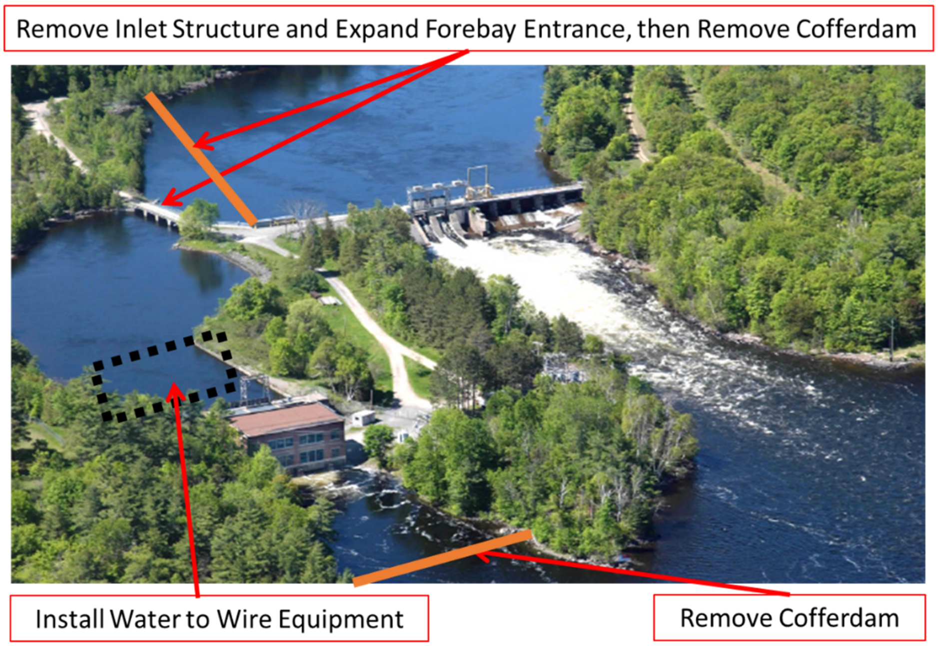
Figure 2-11. Work Sequence – Stage #3 – Construct Powerhouse and Excavate Tailrace



Stage #4

In Stage #4 the associated mechanical and electrical components for the Water to Wire turbines and generators will be installed as well as the balance of plant equipment. Sufficient work will have been completed in the new forebay and new tailrace. The entrance to the new forebay channel will have been widened to improve flow conditions to the new powerhouse and the tailrace will have been excavated as such to produce the required flow conditions specified. Once the existing forebay inlet structure is demolished and removed, the upstream and downstream cofferdams will be removed, and the systems commissioned.

Figure 2-12. Work Sequence – Stage #4 – Remove Inlet Structure and Cofferdams, Finish Powerhouse Installation



Stage #5

In Stage #5 the new units for the GS will be tested, commissioned and finally, put into commercial operation and transferred to OPG for operation.

Figure 2-13. Work Sequence – Stage #5 – Commission New Generating Station

2.4.3 Major Components

2.4.3.1 Forebay and Intake

Once the existing forebay inlet structure is removed, the forebay inlet will be slightly widened (by approximately 20 to 25 m) in order to improve the hydraulic conditions of the flow to the GS. The anticipated change to the forebay inlet is shown in Figure 2-8.

The existing forebay is shallow and contains simple fish habitat (this was defined as 'simple' due to the absence of shoreline features, bathymetric complexity, absence of aquatic macrophytes or coarse woody debris, and the absence of any unique or limiting habitat) and is shown in Figure 2-14 below.

Figure 2-14. Existing Forebay Substrate

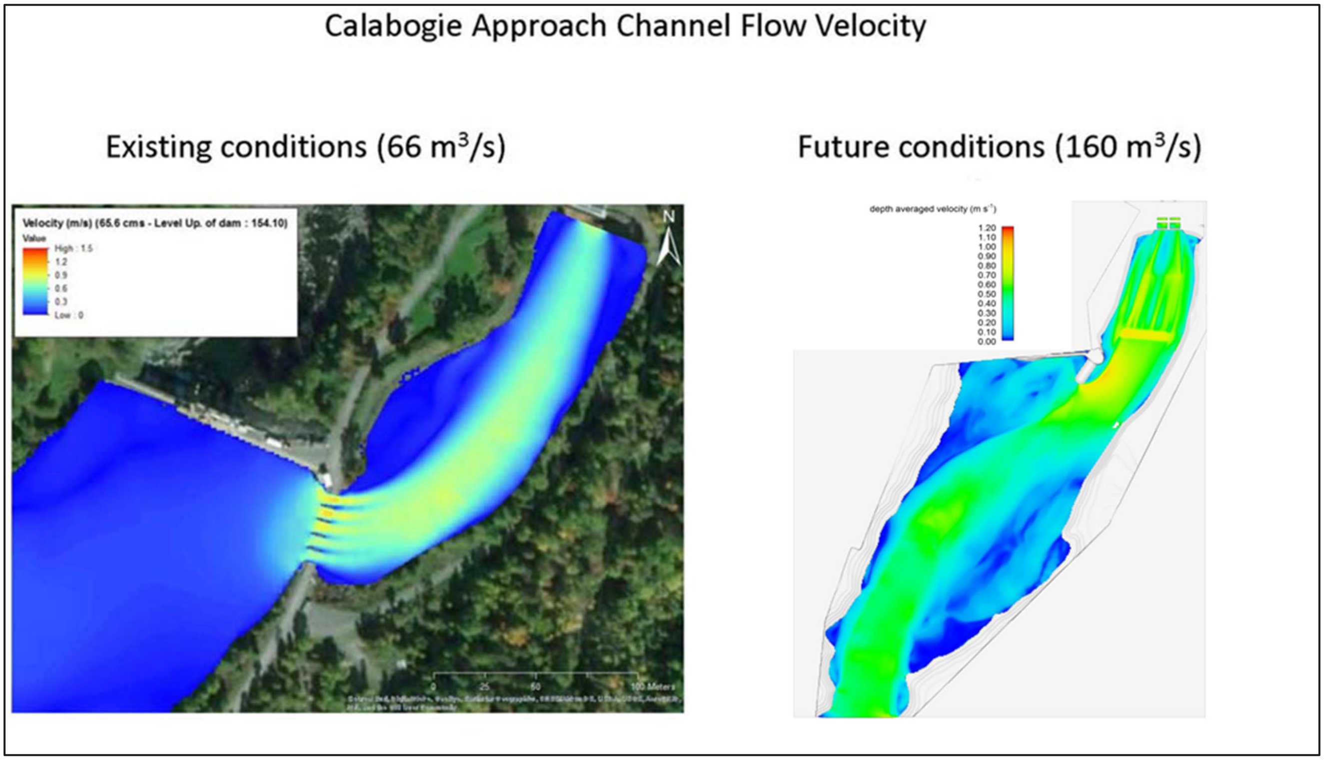
Sediment, soil and excavated rock will be removed from the existing forebay to also improve flow and to allow for construction of the new GS. Forebay hydraulic optimization has dictated the extent of excavation upstream of the new powerhouse. Bedrock will be excavated in vertical cuts and overburden will be sloped and protected against erosion and sloughing. The new intake will have training walls on either side of it to contain the new embankments away from the intake structure. Upon completion of the forebay channel, the embankments will be provided with suitably sized rock protection to ensure bank stability against the forces of erosion and ice action.

The new powerhouse intake will be integrated with the new powerhouse and will be constructed of reinforced concrete. The intake will be equipped with trashracks, suitably sized and with bar spacing to mitigate in as much as possible, fish entrainment. The trashracks will cover the complete area of the turbine water passage intakes. The new trashrack bar spacing will remain consistent with the trashrack spacing at the existing Calabogie GS, with 50 mm clear space between the trashrack bars.

The new trashracks will be periodically cleaned with rakes as well as using mobile crane, with space provided on the intake deck for a future trash rack cleaning machine, however, a trash rack cleaning machine will not be provided at this time. The trashrack slots will also be used interchangably for stoplogs, to provide a means to perform periodic inspections and eventual repairs and servicing of the downstream emergency closure gates in the future. The intake will also include emergency close vertical lift intake gates operated from the intake deck.

The intake and the trashrack of the new powerhouse have been designed to minimize potential entrainment of fish with a trashrack velocity of less than 0.9 m/s (at a distance of 75 mm in front of screen). While the future conditions will increase the plant flows through the new powerhouse from 66 m^3/s to 160 m^3/s, the velocities in the approach channel will be similar with velocities under 1 m/s as demonstrated by numerical flow modelling and as shown in Figure 2-15.

Figure 2-15. Comparison of Velocities – Existing and Proposed GSs



As shown above the proposed velocities in the approach channel at full flow are generally under 1 m/s and will vary along and across the channel between 0.25 and 1.0 m/s.

2.4.3.2 Powerhouse

The proposed new powerhouse will be situated approximately 50 metres upstream of the existing one. The powerhouse will be approximately 25 metres by 45 meters structure and will be 28 metres tall from the invert of the excavation to the top of the superstructure roof. The powerhouse will be excavated to a depth of approximately 12 metres to allow for proper submergence settings of the turbines. Hydraulic passages, both upstream and downstream of the units, will be appropriately sized to maintain machine performance.

It is currently anticipated that the powerhouse structure will be comprised of a cast-in-place concrete substructure and a metal clad steel superstructure. The switchyard will be constructed in close proximity to the new powerhouse on the left side of the new structure. Parking and a laydown area will also be provided in the same general vicinity.

2.4.3.3 Turbines

As previously indicated, the powerhouse will include the installation of two horizontal-axis Kaplan type turbines. Specifically, the turbines will be installed in an open pit, direct drive configuration. Each turbine will be capable of producing approximately 5.4 MW for a combined total capacity of 10.7 MW. The station will be capable of passing a flow of 160 cms with a minimum operating flow of 20 cms. Each turbine runner will have four blades and will operate at 156.5 rpm.

2.4.3.4 Tailrace

The existing channel downstream of the new powerhouse will be excavated to form the new tailrace. This new tailrace will be similar in width to the existing one as shown in Figure 2-8. A series of Figures below portray the existing and proposed tailrace hydraulic conditions (i.e. velocities) under various flow conditions.

The new tailrace channel is anticipated to be in the order of 25 m wide and will connect the powerhouse within the downstream river reach. The upstream portion of the tailrace channel (between the new powerhouse and the existing powerhouse) will be excavated in overburden for the first 5 to 7 m and in bedrock below. The downstream portion of the channel (downstream of the new powerhouse) will be excavated mostly in rock. Limited overburden excavations are expected in this portion of the channel. Bedrock will be excavated in vertical cuts and overburden will be sloped and protected against erosion and sloughing. For the purpose, the area will be dewatered using a downstream cofferdam.

Figures 2-16 and 2-17 depict the existing and proposed Calabogie GS Tailrace hydraulic conditions with no flow (velocity scale (meters per second) is shown in the bottom right of each figure).

Figures 2-18 and 2-19 depict the existing and proposed Calabogie GS Tailrace hydraulic conditions at flows of 66 cms, which is the capacity of the existing powerhouse. These two figures demonstrate that at this flow rate the proposed new powerhouse will eliminate the areas of high velocity that occur under the existing situation and instead disperse more moderate velocities over a wider area.

A tailrace water level survey program will be completed during the detailed design phase of the project to further define the hydraulic conditions downstream of the Calabogie site.

Figure 2-16. Existing Calabogie GS Tailrace Hydraulic Conditions. No Flow

Figure 2-17. Future Calabogie GS Tailrace Hydraulic Conditions. No Flow

Figure 2-18. Existing Calabogie GS Tailrace Hydraulic Conditions. 66 cms Flow (no spill)

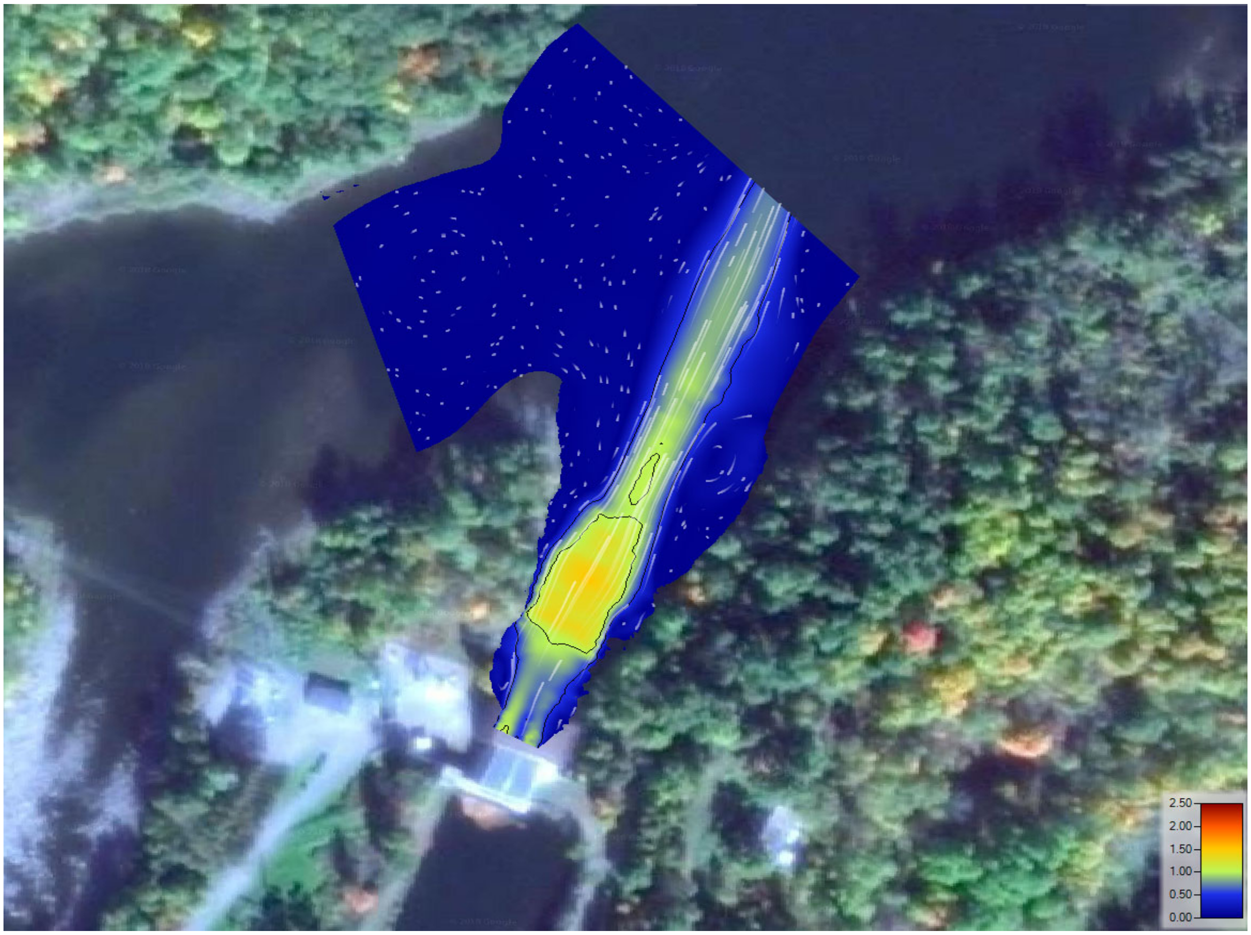


Figure 2-19. Future Calabogie GS Tailrace Hydraulic Conditions. 66 cms Flow (no spill)

Figures 2-20 and 2-21 depict the existing and proposed Calabogie GS Tailrace hydraulic conditions at flows of 160 cms, which is the capacity of the proposed powerhouse. Figure 2-20 representing the existing conditions shows moderate flows at both the tailrace and to a lesser extent through the South Branch Main Dam. Figure 2-21 shows higher velocities through the central portion of the tailrace.

Figure 2-20. Existing Calabogie GS Tailrace Hydraulic Conditions. 160 cms Total Flow: 66 cms Flow through Powerhouse and 94 cms through the South Branch Main Dam

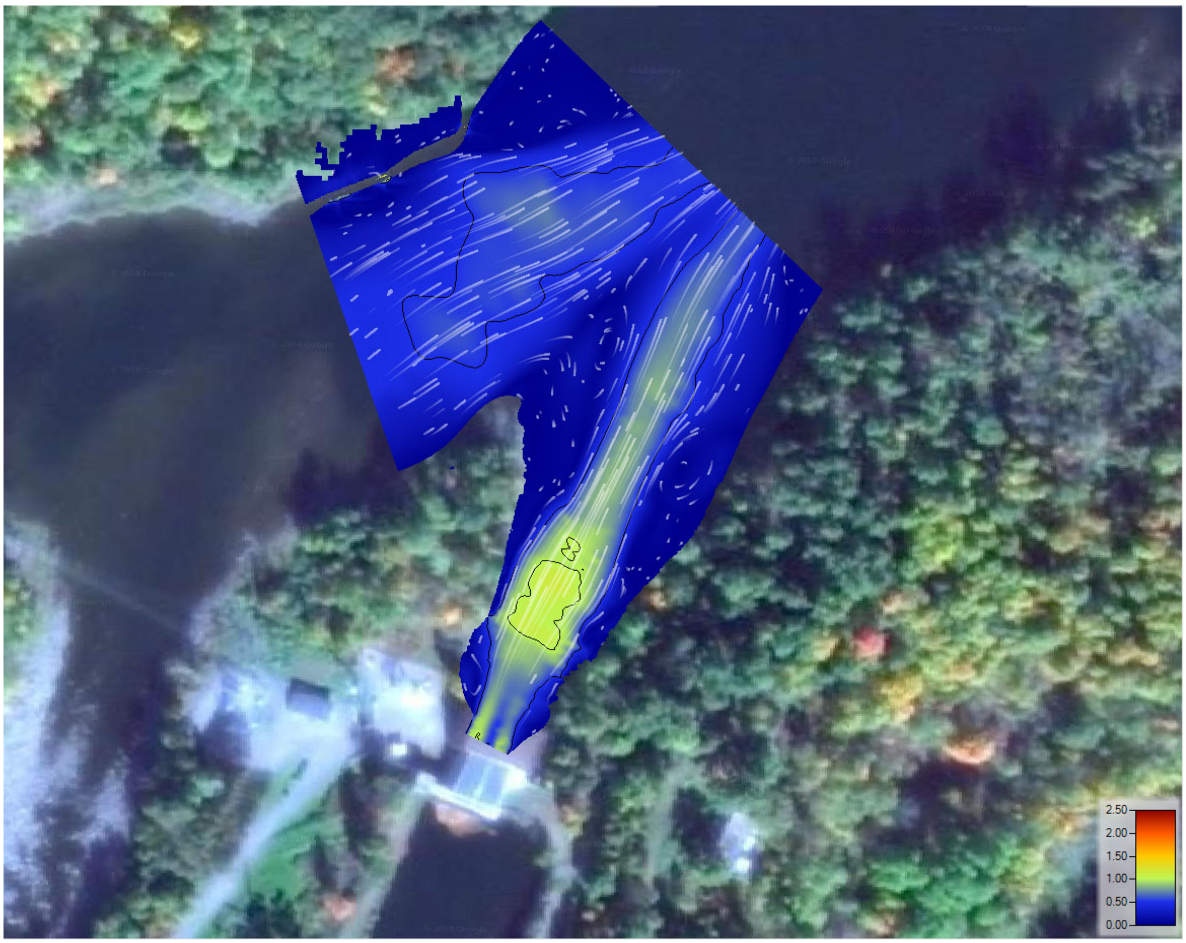
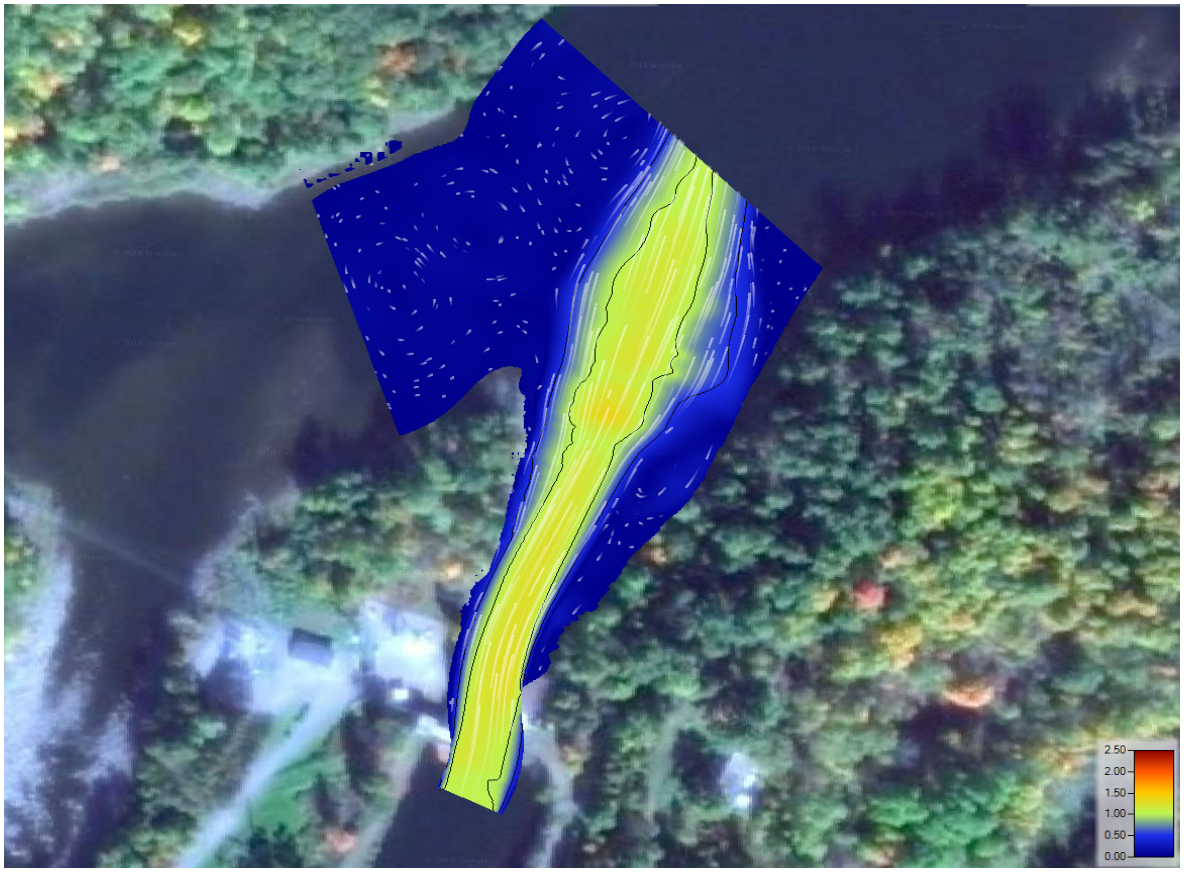


**Figure 2-21. Future Calabogie GS Tailrace Hydraulic Conditions.
160 cms Total Flow, All Through the Powerhouse**



The construction of much of the new tailrace will be undertaken in the “dry” by using a cofferdam. The tailrace area may require riprap to locally protect against erosion and sloughing of the overburden encountered, however, it is currently envisaged that the bulk of the tailrace excavation will be rock. Portions of the Madawaska River riverbank in the immediate vicinity of the tailrace area may also require erosion protection.

The shift of moving the powerhouse 50 meters upstream will increase the amount of tailrace habitat while reducing the amount of forebay habitat.

OPG will pursue more in-depth discussions with DFO as part of the request for review process and provide all information DFO requires to determine whether an Authorization is required and if so, what off-setting measures would be considered.

2.4.3.5 Structures for the American Eel

OPG is committed to supporting the recovery of American eel in consultation with Indigenous People and in accordance with provincial recovery strategies and policy direction. On the Madawaska River, there are no known occurrences of American Eel, including at or in the immediate area of Arnprior GS, Stewartville GS and Calabogie GS. As such, these facilities are currently compliant with the ESA.

Over time and as recovery strategies advance and succeed, the Madawaska River may become a focus of interest. This will signal that recovery strategies are working. OPG is using this redevelopment project to make the redeveloped Calabogie GS “eel ready”.

Eel ready means that the redevelopment will be planned, designed and executed in anticipation of adaptive management strategies that can be applied as circumstances change around the presence of American eel in the vicinity of the station.

Specific measures have been scoped into the design of the station to accommodate potential future needs for upstream and downstream passage, including:

- designing attractive flow at an eel trap/ladder at the plant tailrace;
- including a temporary trap and transport system at the plant tailrace to help monitor for early signs of eels showing up below the station;
- leaving room for permanent upstream and downstream passage infrastructure to be retrofitted on a long-term basis (OPG’s research suggests that upstream passage should likely occur in the plant tailrace and that is the proposed location for the temporary trap and transport system. Should eels return to the Madawaska River in this reach of the River, consideration could be given for another location);
- intake velocities and bar exclusion screen layouts designed to facilitate implementation of future effective safe passage of eels downstream through the GS;
- provision for future inclined screen and downstream flow bypass for downstream passage with bar spacing in the screen at a maximum of 19 mm during periods of downstream movement; and,
- early consideration of the pros and cons of operational variations that may support eel passage.

An adaptive management approach will be applied during operations to determine the best course of action to implement or install specific measures to support recovery as circumstances change.

2.4.3.6 Transmission Line

The existing GS is connected to Hydro One’s transmission network via a 44 kV transmission line that is connected to the Calabogie GS to the north. The existing transformer yard was extensively damaged during the 2018 tornado.

A new switchyard for the main step-up transformer will be constructed in close vicinity to the new powerhouse and will connect to the HONI transmission line at a pre-determined location.

2.4.3.7 Off-Site Communication

The new Calabogie GS will require a communication link with Stewartville TS for tele-protection signals and with Eastern Operation Control Center [EOCC] for remote SCADA.

To achieve this, a new microwave link between Calabogie GS and Stewartville GS will be constructed. The link will consist of two 150 ft Microwave towers, one at each end. The location of the two towers will require the construction of new access roads. Wood poles to carry the power cables and Fiber Optic cables will be constructed to connect the MW towers to their respective Generating stations.

2.4.3.8 Water Control Features

The Ontario Ministry of Natural Resources and Forestry (MNRF) has in place Lakes and Rivers Improvement Act Technical Bulletins that detail the Ministry requirements for the safe operations of dams. The Technical Bulletins were initially issued in 2011. Based on the “Classification and Inflow Design Flood Criteria” Technical Bulletin, Ontario Power Generation (OPG) is evaluating whether additional spill capacity is required at Calabogie GS. While no decision has yet been made on whether any spill capacity alterations will be required for the site, OPG anticipates additional spill capacity will be required and achieved through a combination of channel improvements and constructing additional sluices.

OPG is only at the early stages of assessing the potential additional spill capacity requirements and options. As such, the review of environmental effects associated with the construction of additional spill capacity has not yet been initiated and are not discussed in this Report.

Environmental approval for the work could be considered per Section 8.8 of the OWA Class EA Process, “Addendum Provisions for Environmental Reports.” That assessment work could be carried out as modification to the project or Addendum provision. Alternatively, the approval could be undertaken through a separate process.

2.4.3.9 Other Features

Other features of the Calabogie GS that will remain unchanged from the current situation. Safety devices such as buoys, signage and booms will remain unchanged from the current situation. The existing office and washroom in the trailer are expected to remain but may be re-located closer to the new powerhouse.

2.5 Construction

Figure 2-7 shows the Calabogie site with a variety of construction stage features. These are each described below.

2.5.1 Site Access, Roads and Parking Areas

The primary access road to the site will remain as Generating Station Lane, a gravel road that is sufficiently wide to accommodate passing passenger vehicles. The Lane provides access to Lanark Road/County Road 511.

At this point no modifications are anticipated to the site entrance at County Road 511 (Lanark Road). However, should modifications be required these would be subject to review and approval by the County's Public Works Department. The Department has indicated that a traffic management plan will be required to describe the proposed traffic and how any impacts can be mitigated. The plan will likely need to ensure that signs are erected on the County Road to advise the other road users of turning traffic and a traffic control person may be needed during periods of high turning movements to/from the site.

A secondary access road currently exists from County Road 511 to Calabogie Island that is labelled as "Calabogie Island Road" on Figure 2-7. This is an existing single lane gravel road that provides access to the north side of OPG's South Branch Main Dam and to an OPG boat launch that is situated slightly further downstream. This road will be used for two purposes during construction. First, it is anticipated that some or most of the workers will park their vehicles on the island and access the main construction site by walking across the South Branch Main Dam. A parking lot is proposed in close proximity to the South Branch Main Dam to allow for this. This parking lot would be capable of accommodating approximately 50 vehicles. Second, excess rock and sediment are proposed to be placed on Calabogie Island so dump (or tipper) trucks will utilize the road. Imported engineered aggregates will be used to improve the roads should they be considered acceptable.

OPG, SNC-Sullivan and the Township of Greater Madawaska have entered into a Memorandum of Understanding to provide excavated rock from the project and deposit this on adjacent Township lands. This is described in more detail in 2.5.4 and 2.5.5. That arrangement will require SNC-Sullivan to construct a 200 to 300 meter length road on to the adjacent Township lands and also temporarily use the Township access to County Road 511 for the project (see Section 2.5.5).

2.5.2 Laydown and Storage Areas

During construction laydown and storage areas are required in order to facilitate demolition, excavation and construction. Most of Cross Island will be available at various times for temporary laydown and storage areas. Cross Island has historically had large cleared and flat areas that are suitable for such work. With the 2018 tornado the cleared area has expanded. Figure 2-7 shows one laydown area slightly west of the proposed powerhouse, however another large cleared area south of the powerhouse will be used to: allow equipment to work and turn around; park vehicles; store materials and equipment in an environmentally safe fashion; place trailers for worker use; etc.

2.5.3 Cofferdams and In-Water Works

The existing inlet structure/sluices will allow the forebay to be isolated and excavation work to begin in the forebay at the start of construction. Following the July 15th fish window, a cofferdam will be constructed upstream of the inlet structure to allow for removal of the existing inlet structure in the dry and rock excavation to continue. The upstream cofferdam will be constructed from blasted rock that has been excavated to accommodate the new powerhouse. Blast rock will be used to construct a 5.8 metres wide cofferdam, with a slope of 1.5H:1V up to elevation 155.17 masl. The upstream face of the cofferdam will be lined with a heavy-duty cofferdam membrane and sealed to the riverbed with a bentonite clay seal. Upon completion of the powerhouse, the liner, blasted rock and overburden will be removed, and the channel will be graded with rockfill.

A downstream cofferdam is required to isolate the downstream side of the construction and allow for the demolition of the existing powerhouse and construction of the new powerhouse and tailrace. The proposed cofferdam is a rockfill dam with an impervious geomembrane on the water side of the cofferdam. Seepage through the cofferdam will be collected and directed to a settling pond prior to discharge back into the river.

A small amount of tree and vegetation clearing is required on the east end of Cross Island to allow for access to construct this cofferdam. Similar to the upstream cofferdam, the downstream cofferdam will be constructed from blasted rock that has been excavated to accommodate the new powerhouse. Blast rock will be used to construct a 5.8 metres wide cofferdam across the width of the tailrace, with a slope of 1.5H:1V up to elevation 148.00 masl. The downstream face of the cofferdam will be lined with a heavy-duty cofferdam membrane and sealed to the riverbed with a bentonite clay seal. Upon completion of the powerhouse, the liner and blasted rock will be removed, and the area will be graded to align with the tailrace channel profile.

Should any in-water construction activities be required, they will be timed to avoid the spawning and egg incubation period of spring spawning fishes, such as Walleye. The exclusion period is from March 15 to July 15.

2.5.4 Excavation

The construction of the new powerhouse will require a significant amount of sediment and rock to be removed from the construction area. It is estimated that approximately 60,000 cubic meters of sediment/overburden and 66,800 cubic meters of rock would need to be removed. The sediment and rock have been tested. The rock can be re-used and the sediment/overburden will be disposed of on OPG property.

Blasting will be required to remove the rock for the new powerhouse, in the forebay and in the tailrace. A third-party firm will be hired to implement a vibration monitoring program, provide engineered blast designs, and consult in all blasting operations as required.

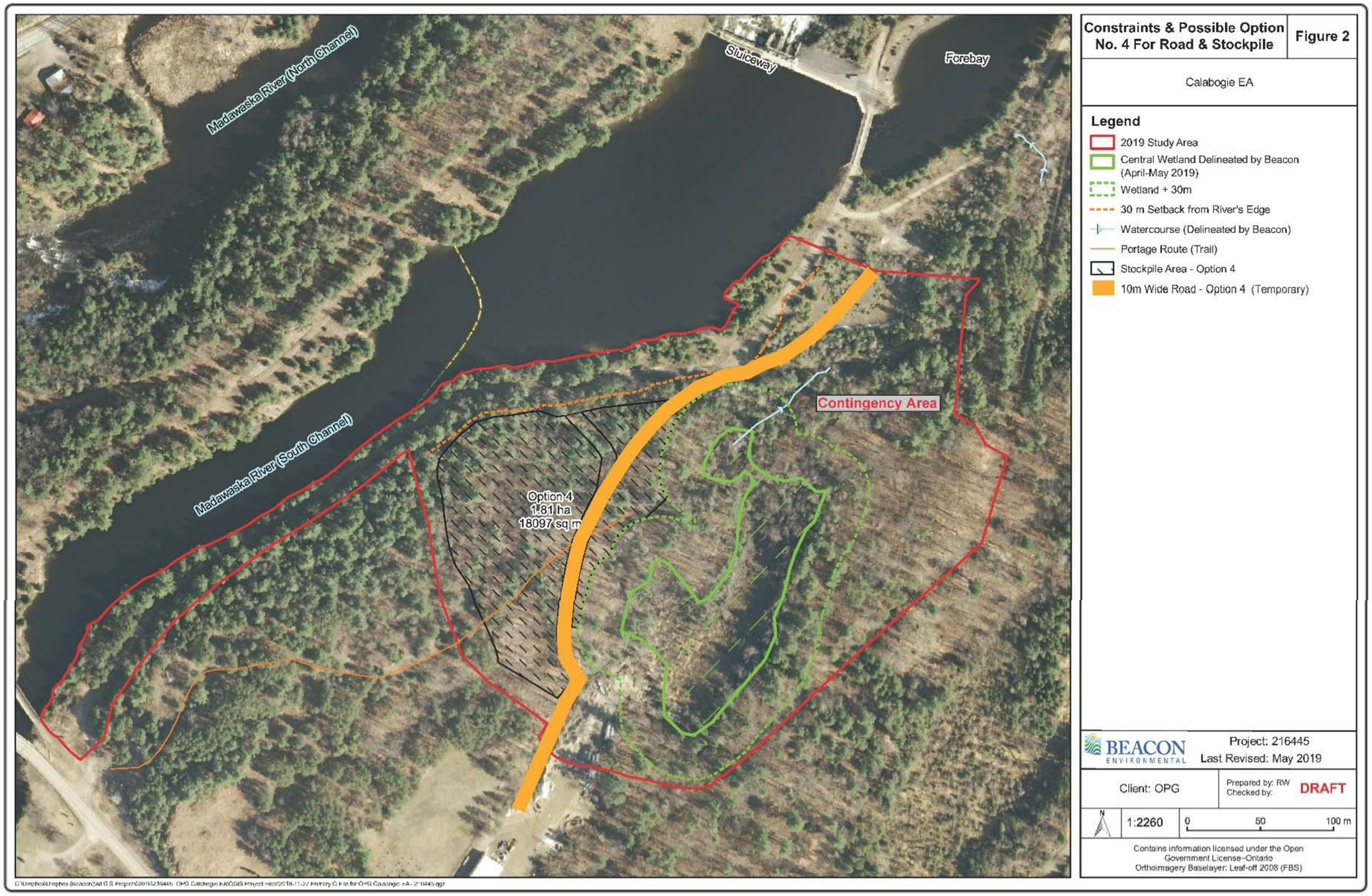
Prior to any blasting or rock excavation, the sediment in the forebay will be excavated down to either rock or the required hydraulic elevations and disposed of on OPG Property. Once the sediment has been removed and blasting is underway, excavation of the rock will begin. The rock will either be used as cofferdam material, stockpiled for later use as embankment treatment, or disposed of on Township Property (see section 2.5.5 Rock and Soil Deposition Areas where this is further discussed).

It is expected that groundwater infiltration or surface water runoff (including cofferdam leakage) could require pre-treatment prior to discharge. To collect water infiltration, sumps will be excavated at key locations of the excavation and pumps will be installed to dewater the area. If necessary, the water will be pumped into settling pond(s), silt treatment bags, and vegetated areas to mitigate any environmental issues that may arise from the dewatering. Should the water require secondary treatment for dissolved metals, proper measures will be taken including necessary permits and approvals.

2.5.5 Rock and Soil Deposition Areas

As previously indicated, an Agreement has been entered into among the Township of Greater Madawaska, OPG and SNC-Sullivan for the latter two to provide the Township with excavated rock for its future use. Excavated rock would be delivered to the rear of the Township's Works Yard which is situated approximately 200 metres away from the excavated area (see Figure 2-22 below). The Township has also indicated that it can take the demolished powerhouse (save for the exterior structure that has lead paint on it) as well. This Project will require Sullivan to construct an approximately 200 to 300 meter long temporary road spanning from OPG to Township property creating a direct access to a storage area at the back of the Township's lands. The Project would also involve decommissioning of this road following completion of the transfer of the rock. Figure 2-22 shows the likely area of rock placement based on archaeological, biological and engineering investigations and consultation with the Township. This area may be slightly further refined. This area is also shown as Area #3 on Figure 2-7.

Figure 2-22. Proposed Road and Possible Rock Placement Areas



As previously indicated, the Township has agreed to take most of the rock associated with the structure along with the demolished powerhouse. However, the Township is only interested in the rock and is not interested in the soil, sediment or co-mingled rock and soil. As such, OPG will still have extra material it will need to deposit on site.

As such, two different areas have been proposed on site to place the remaining excavated rock and soil. The two proposed areas are shown in Figure 2-7. These areas were selected based on their location and physical and environmental conditions. In general, the emphasis has been made to place the material close to the original excavation and/or use and in sites that have been historically disturbed.

Area #1 is located on the northeastern tip of Cross Island. This Area would be used to place the material left over from the downstream cofferdam. This will eliminate most of the need for truck traffic for this material. It is possible that some of the cofferdam material might be used for fish habitat pending further discussions with the DFO. Area #2 is located on Calabogie Island immediately adjacent and northeast of the South Branch Main Dam. This area was previously disturbed by the original construction of the Calabogie GS and is a lower lying area. Given that this is a lower area, excavated material can be placed here with fewer potential concerns with respect to visual effects from residents located on the north side of the North Channel. A section of this area may also be potentially used for parking or other purposes during construction. Both of these areas are considered to be of lower ecological value. The placement of the rock and sediment will occur above the high-water mark to ensure there is no loss of riparian habitat.

OPG has been in recent discussions with the AOO and AoPFN about minor adjustments to the sediment and rock pile stockpile areas (Areas #2 and #3 in Figure 2-7) to address AOO and AoPFN questions and concerns. OPG will make best efforts to place the sediment pile beyond 30 meters from the high-water mark.

Following construction, the areas will be revegetated to suit the surrounding environment. This may involve seeding, planting or natural re-generation by placement of topsoil and with an appropriate seeding or planting. Discussions could be held with the AOO and AoPFN as to possible plantings.

2.5.6 Construction Schedule and Strategy

Construction will be initiated in early 2020 with the intention of the GS being operational in 2023. Vegetation clearing at the site is anticipated to occur in the early months of 2020 ahead of the spring breeding bird season. The placement of cofferdams will adhere to any fisheries windows.

2.6 Proposed Calabogie GS Operations

As outlined in the 2009 Madawaska River Water Management Plan, Calabogie GS operated (prior to the September 2018 tornado) to support the peaking operations of the four other OPG owned GSs on the Madawaska River. The generating units at the station had limited flow capacity (66 m^3/s), but the operation of the units and sluice gates are integrated with the rest of the system on the Madawaska River. Calabogie was a generation bottleneck on the Madawaska River, and the small turbine capacity results in frequent spill past the station.

The operation of the existing plant is based on a daily/weekly cycle, with the inflow passed through the plant over a daily or weekly period. The 2009 WMP notes that operation of the plant takes into consideration energy demands, recreational opportunities as well as walleye spawning activities.

OPG does not propose to alter the existing water management compliance requirements associated with this facility. The redevelopment of Calabogie GS will continue to be operated in full accordance with all of the flow and water level targets and compliance conditions identified in the WMP. Daily flows will remain unchanged, but additional portion of river flow will pass through the plant to generate electricity rather than just passing through the spillway gates.

In terms of mandatory and conditional water level targets, for Calabogie G.S. Table 9.15 of the 2009 WMP defines the following:

Table 2-1. Water Management Plan – Calabogie GS Mandatory and Condition Level Limits

Table 9.15: Calabogie GS Mandatory and Conditional Level Limits

Parameter	Limit Type, Conditions and Notes
Absolute Maximum 154.17 m	Type: Mandatory Maximum level
Absolute Minimum 153.56 m	Type: Mandatory Minimum level
Summer Minimum 153.80 m	Type: Conditional Requirement The specified minimum level is the applicable limit provided the following condition outlined below is fulfilled. 1.The date is within the summer period. The summer period starts on Saturday 00:00 EST of the Victoria Day weekend and ends on the Monday at 24:00 EST of the Thanksgiving Weekend. The summer minimum can be suspended when the following conditions are fulfilled. 1. Declaration of an "Emergency Operating State" by the IESO. 2. IESO requests market participants to seek approval for environmental variances. 3. Implementation of a "3% Voltage Reduction" by the IESO. 4. Within 24 hours after the end of an Emergency Operating State, the level will be returned to the summer minimum level. 5. Walleye spawn/incubation flow limits at Calabogie are not active. 6. OPG will notify MNR once there is a reasonable probability that energy emergency flexibility will be used.
Walleye Spawn & Incubation Maximum 154.05 m	Type: Conditional Requirement The maximum level is applicable provided all the four conditions outlined below are fulfilled. The maximum level is to protect spawning grounds in Constant Creek. 1.The water temperature measured in the Barrett Chute tailrace or an agreed-upon location has reached 6 ^{0}C. 2.MNR has confirmed significant walleye activity at the Barrett Chute spawning shoal. 3.MNR has provided 24 hours notice of the start of the walleye spawning period. 4.The water temperature degree days since the start of the incubation period is less than 205 ^{0}C.
Walleye Spawn & Incubation Minimum 153.80 m	Type: Conditional Requirement The minimum level is applicable provided all the four conditions outlined below have been met. 1. The water temperature measured in the Barrett Chute tailrace or an agreed-upon location has reached 6 ^{0}C. 2. MNR has confirmed significant walleye activity at the Barrett Chute spawning shoal. 3. MNR has provided 24 hours notice of the start of the walleye spawning period. 4. The water temperature degree days since the start of the incubation period is less than 205 ^{0}C.

In terms of mandatory and conditional water flow targets, for Calabogie G.S. Table 9.16 of the 2009 WMP defines the following:

Table 2-2. Water Management Plan – Calabogie GS Mandatory and Condition Flow Limits

Table 9.16: Calabogie GS Mandatory and Conditional Flow Limits

Parameter	Limit Type, Conditions and Notes
Minimum Flow 0.8 m^3/s	Type: Mandatory Minimum Level Note:This flow has not been measured since the replacement of the wooden stop logs with steel stop logs. The 0.8 m^3/s is an estimated flow.
Walleye Spawn & Incubation 5 m^3/s.	Type: Conditional Requirement The minimum walleye spawn flow is applicable provided all the three conditions outlined below are fulfilled. 1. The water temperature measured in the North Channel at Calabogie or an agreed-upon location has reached 6 ^{0}C. 2. MNR has provided 24 hours notice of the start of the walleye spawning period. 3. The water temperature degree days since the start of the incubation period is less than 205 ^{0}C.This flow limit is an instantaneous flow that must be maintained throughout the walleye spawning period.

The annual variation of the mandatory and conditional limits are shown in Figure 9.08.

OPG will continue to operate the Calabogie GS and the other plants on the Madawaska River in full accordance with all flow and water level targets and compliance conditions in the Madawaska River Water Management Plan.

The Calabogie GS is a generating station on the Madawaska River, located between Barrett Chute GS and Stewartville GS. The existing turbine capacity of Calabogie is lower than the other stations on the Madawaska River, which becomes a constraint in the operation of the system. The present discharge capacity at Calabogie GS is 66 m^3/s, but the upstream and downstream capacity at Barrett Chute GS and Stewartville GS is exceeding 450 m^3/s. Under these conditions, Calabogie Lake is used as a daily reservoir to regulate the discharge and to maximize the energy production.

The average historical inflow for the period between 1965 and 2017 at Calabogie is approximately 90 m^3/s with a median of 72 m^3/s. The Barrett Chute and Stewartville GS are peaking plants whereas the existing Calabogie GS was used to support these operations with combinations of continuous turbine flow and gate operations. These operations modes can cause daily fluctuations of the water elevation at Calabogie Lake and Stewartville headpond. This form of operations for Calabogie GS has existed since peaking plants with larger discharge capacity than Calabogie were commissioned on the river.

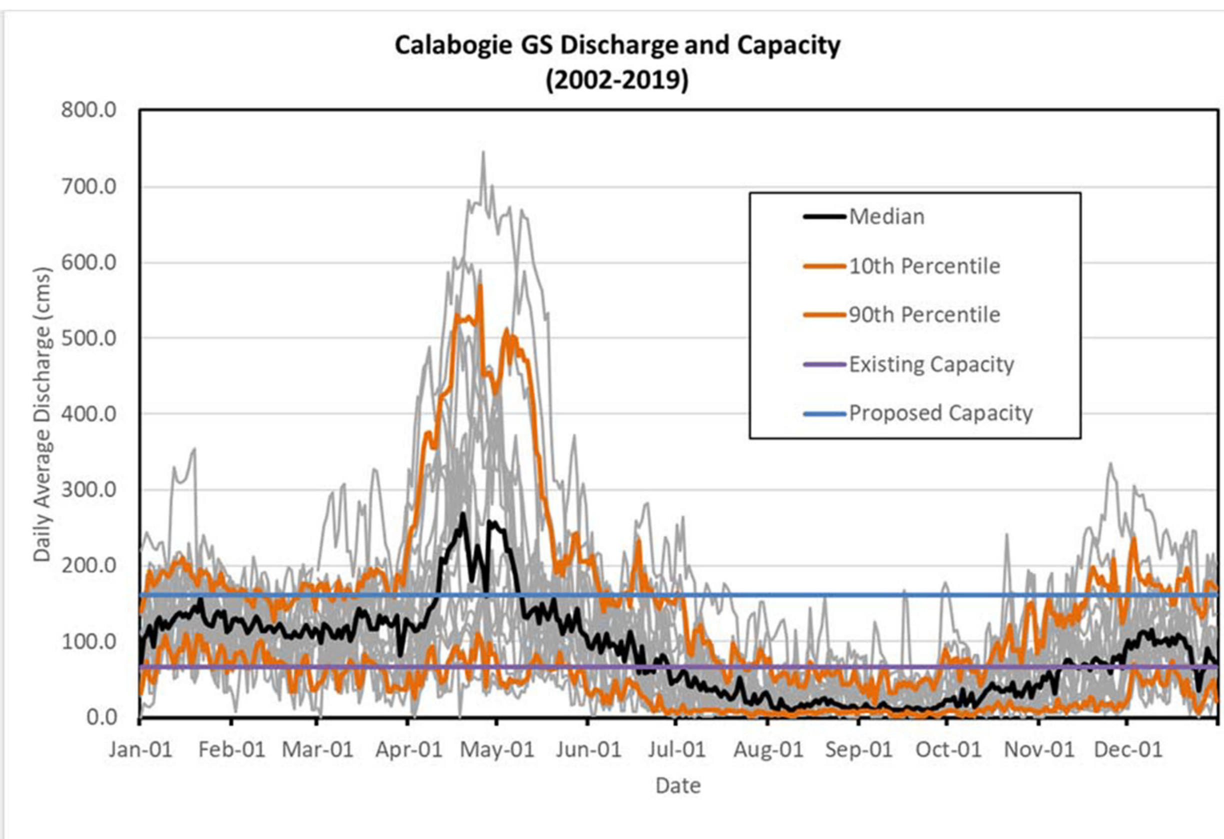
With the redevelopment of the Calabogie GS site and the increase of the generating and discharge capacity, there is the opportunity to more accurately shape the daily discharge from the facility. Regardless of the mode of operation, the turbine discharge capacity at Calabogie GS will remain lower than the discharge capacity at the other adjacent stations on the Madawaska River. Therefore, the priority in the operation of the hydro system will be for the Calabogie GS to continue to support the peaking operation of the downstream power plant at Stewartville with the possibility to minimize the fluctuations in the headpond to the extent practicable.

Figure 2-23 shows the historic total daily discharge (turbine flow & main control dam sluice flow) since the opening of the energy market, where each grey line is one year of data. The discharge past the Calabogie facility often exceeded the existing stations turbine capacity in the November to July period and was passed through sluiceways. The redevelopment will allow a greater amount of water to be passed through the turbines, which will allow OPG to produce more renewable energy from the existing water. The North Channel Control Dam sluiceway conditions will be maintained in accordance with the existing water management plan.

There will still be conditions and situations where a greater range at Stewartville GS is needed to meet Ontario grid requirements and maintain compliance with the other aspects of the Water Management Plan (WMP). However, there may be some conditions where the redeveloped Calabogie GS could match flow patterns at Barrett Chute GS and Stewartville GS to reduce water level fluctuations. If this occurs it will be done in compliance with the WMP. As a result, the redeveloped generating station will allow OPG to reduce the fluctuations in water level in Calabogie Lake and Stewartville more often than the current situation, but the impact will not be substantial.

Given the above, OPG does not plan to propose any formal changes to the compliance requirements in the WMP, however a Minor Amendment will be required to make administrative updates.

Figure 2-23. Calabogie GS Discharge and Capacity 2002 – 2019



There will be no permanent operating staff at the new station. Normal operation of the station and sluiceways will be carried out remotely by OPG. Normal maintenance activities at Calabogie GS will be carried out by OPG staff on an "as-required" basis. They will visit the station regularly.

Annual maintenance and overhauls for the redeveloped plant may require shut down of the units and will normally be scheduled when the flows are lowest and the loss of generation can be minimized. Minor overhauls require the units to be out of service for a minimum of 1 to 2 months and would likely only be required every 10 to 15 years. Major overhauls every 25 to 30 years could require a unit to be out of service for approximately 8 to 12 months. Unlike with the existing station, dewatering of the forebay will not be required to conduct maintenance on the new powerhouse.

2.7 Proposed Decommissioning

Decommissioning involves the permanent removal of the hydroelectric facilities, with the resultant loss of the site as a renewable source of electricity generation. Rather than decommissioning, redevelopment of a facility that is at the end of its designed service life could be a viable option. A number of OPG owned hydroelectric facilities that were built in the early 1900s have been redeveloped in the last 10 years, e.g., Wawaitin GS, Sandy Falls GS and Lower Sturgeon GS on the Upper Mattagami River, and Hound Chute GS on the Montreal River.

Once the Calabogie GS Redevelopment Project has reached the end of its service life in 90 years or more, additional redevelopment, rather than decommissioning, would be an option that should be considered again to further extend the life of this plant.

3 DESCRIPTION OF THE EXISTING ENVIRONMENT

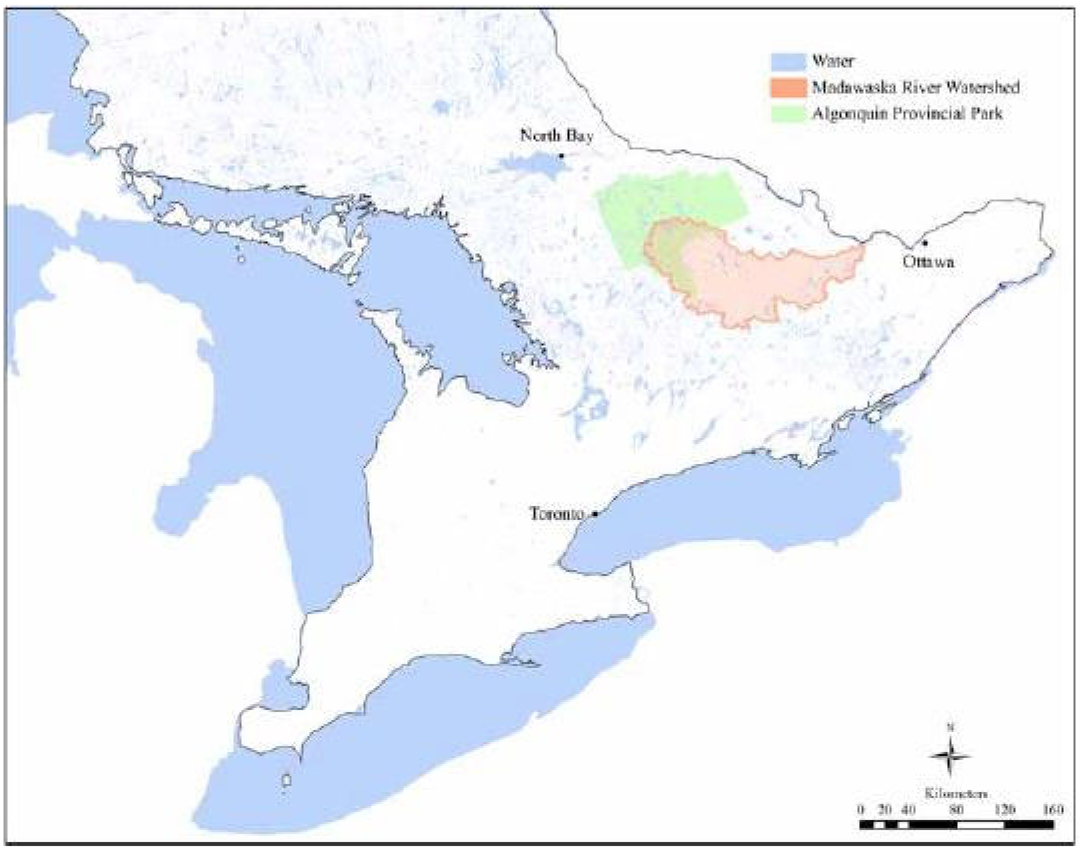
3.1 Aquatic Environment

This section is a description of the aquatic environment near the Calabogie GS. A more detailed description of the aquatic environment can be found in the Aquatic Environment TSD.

3.1.1 Madawaska River

The Madawaska River flows 270 km from its headwaters in Algonquin Provincial Park (see Figure 3-1 below) to the Ottawa River at Arnprior. Its drainage area covers over 8,500 square kilometres (OPG, 2009).

Figure 3-1. Madawaska River Watershed

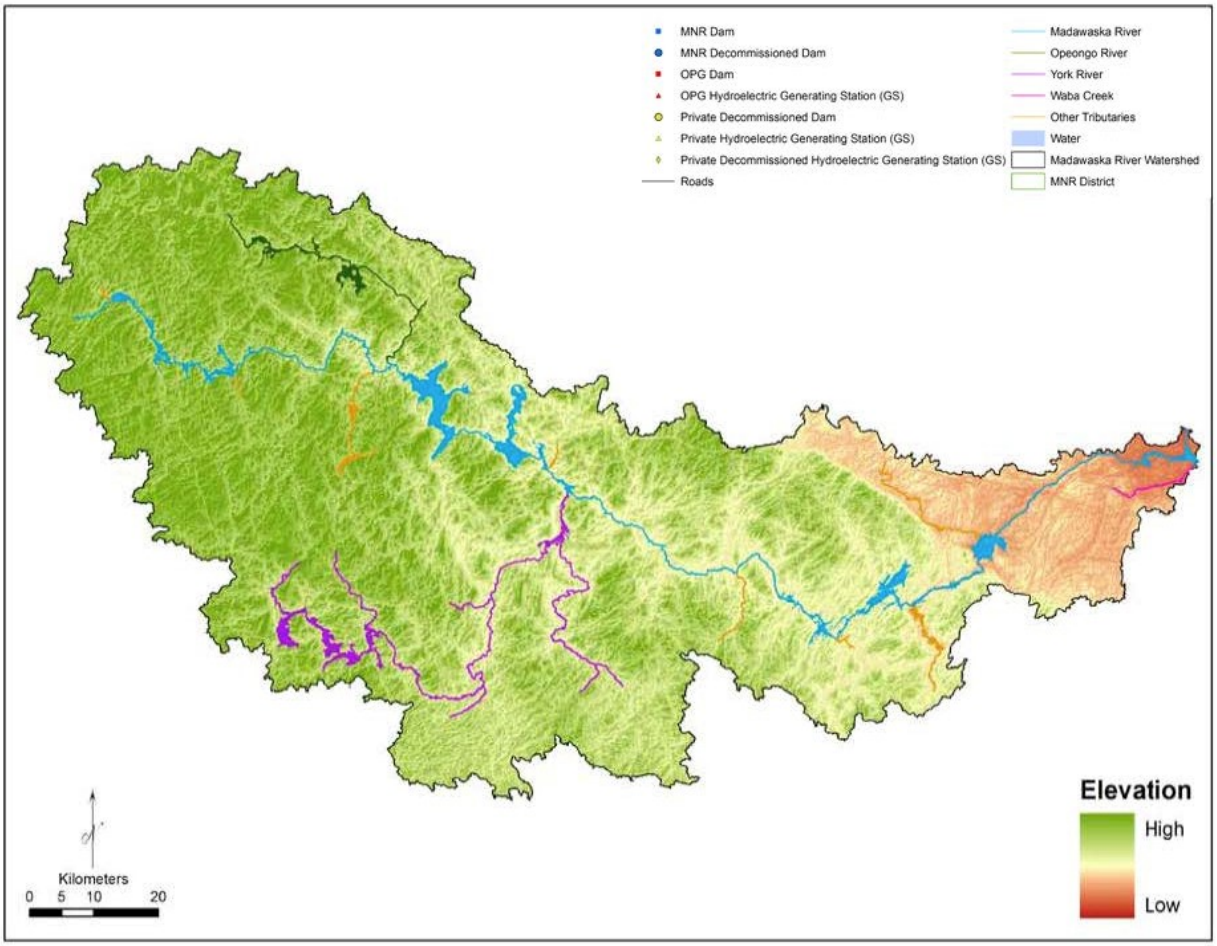


Source: OPG, 2009

The headwaters of the Madawaska River originate from a network of streams and lakes in the southeast corner of Algonquin Provincial Park (OPG, 2009). Most of the River occurs in the Laurentian Sub-Region of the Canadian Shield.

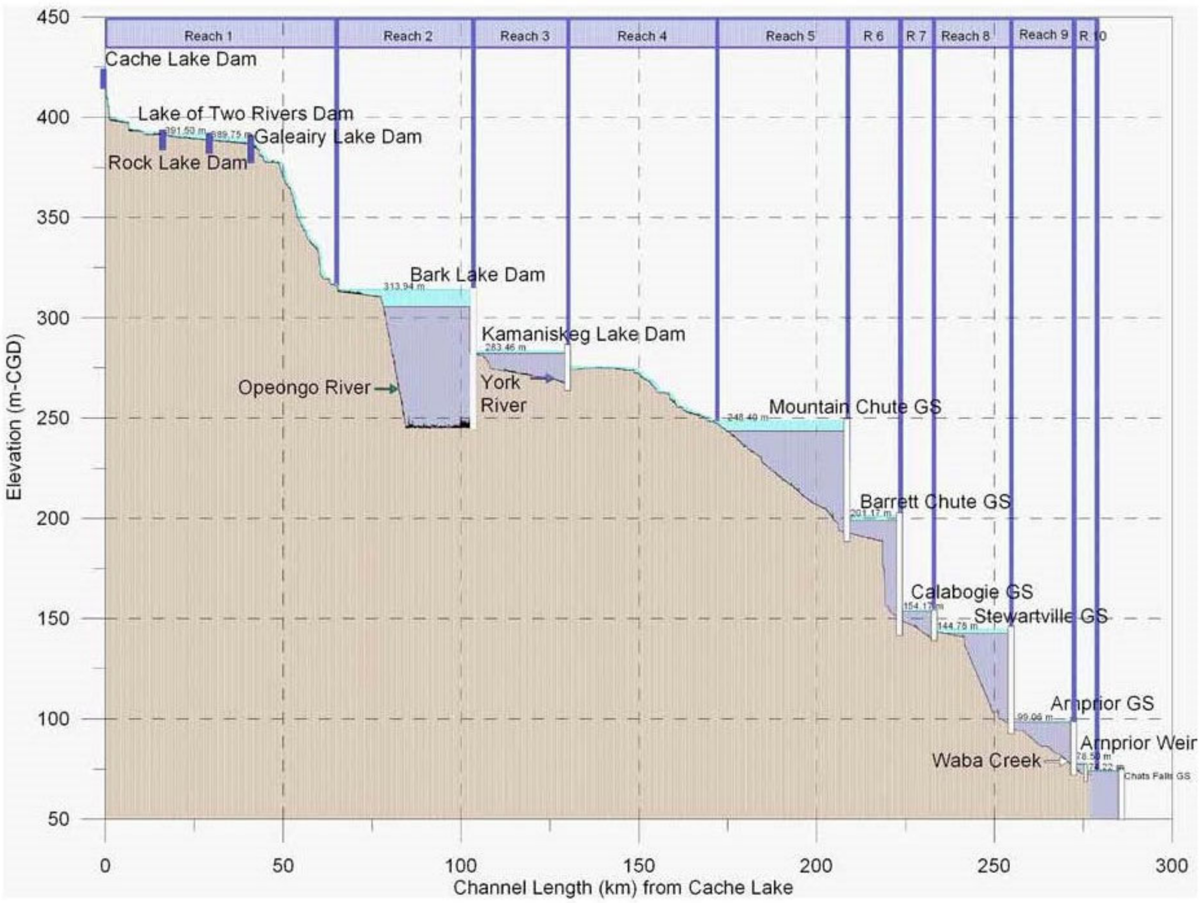
Over its entire course, the Madawaska River drops 350 meters. Most of the vertical drop occurs between Bark Lake and Arnprior. The change in relief from higher elevations in the upstream part of the watershed to the lower elevations in the downstream can be visualized through two Figures below (3-2 and 3-3).

Figure 3-2. Madawaska River Watershed Relief Map



Source: OPG, 2009

Figure 3-3. Madawaska River Watershed Elevation Profile



Source: OPG, 2009

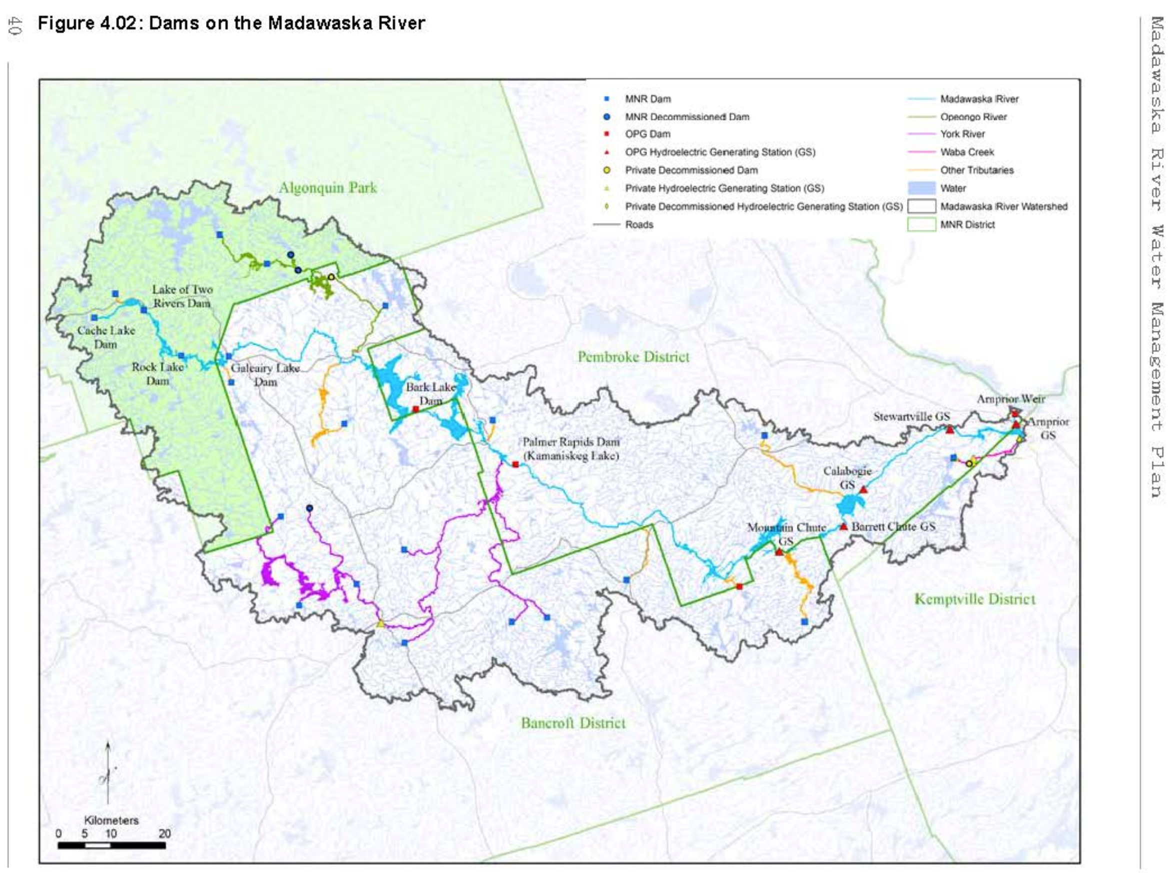
The main tributaries of the Madawaska are the Madawaska, Opeongo and York Rivers as well as Waba Creek (OPG, 2009). There are a total of forty-one dams on the Madawaska River of which OPG owns and controls seven: Bark Lake Dam, Kamaniskeg (Palmer Rapids) Lake Dam, Mountain Chute GS, Barrett Chute GS, Calabogie GS, Stewartville GS and Arnprior GS. OPG also has two weirs on the Madawaska River at Arnprior and on Mackie Creek.

The flows and levels on the Madawaska River are the product of a series of complex interactions between the unique characteristics of the watershed and the evolving direct human interventions at dams and hydroelectric facilities and additional human-induced indirect changes to the landscape (OPG, 2009).

Flows and levels on the Madawaska watershed have been impacted and manipulated by people since the mid 1800s. The general operating pattern of dams and hydroelectric facilities on the Madawaska River can be found in section 2.3.2 of the Madawaska River Water Management Plan. As indicated in this section, similar to other Rivers in areas of Ontario the hydrology of the River is influenced by a variety of factors in the watershed that is driven by complex interactions of climate, geology, land use, physiography, vegetation and soils, combined with direct human intervention at dams and hydroelectric facilities.

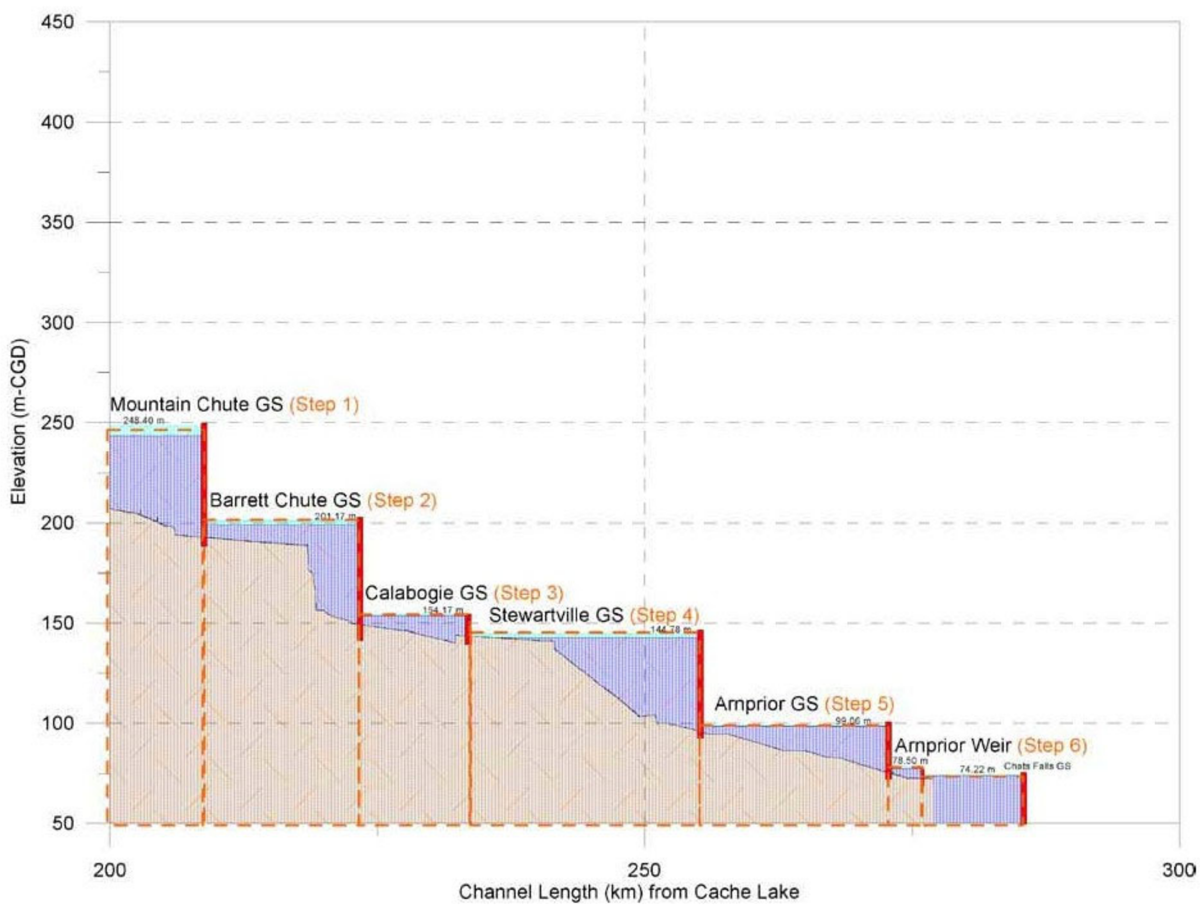
As previously indicated, there are forty-one dams within the Madawaska River watershed and these are graphically pictured in Figure 3-4 below (OPG, 2009).

Figure 3-4. Dams on the Madawaska River



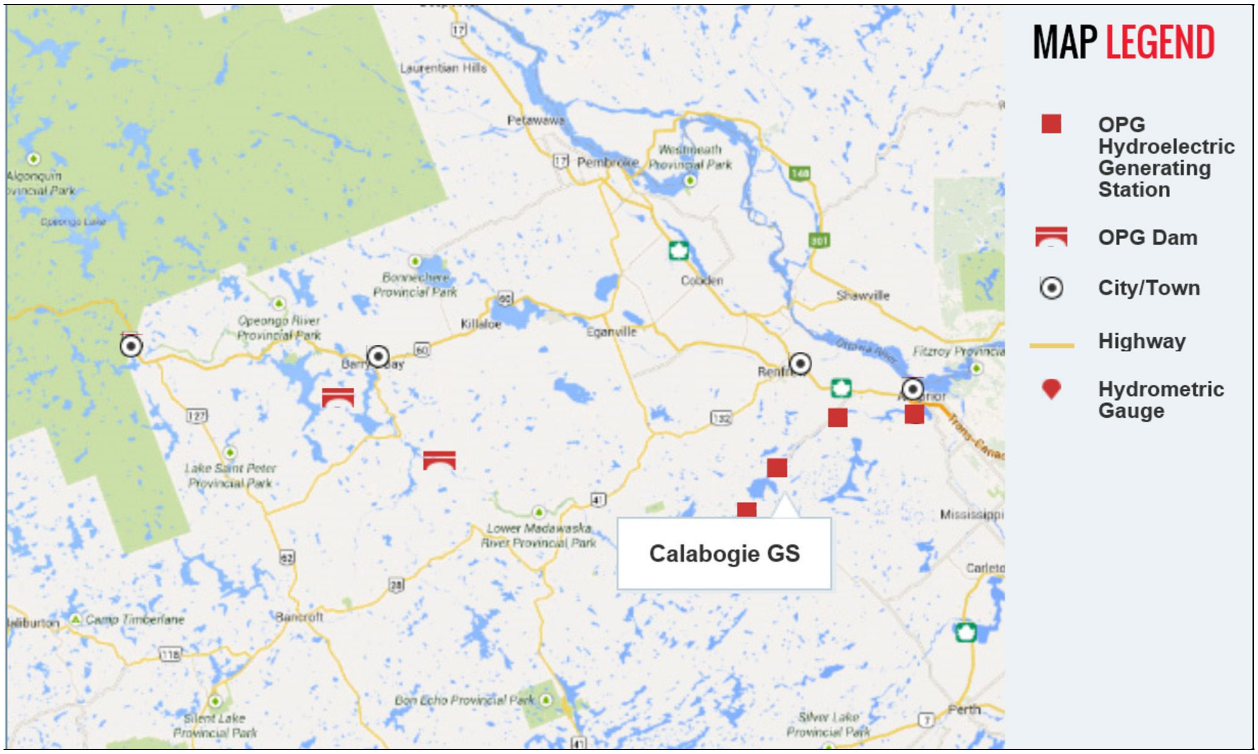
The OPG generating facilities on the Madawaska River are considered a cascade river system. Figure 3-5 below is Figure 2.05 of the MRWMP and graphically depicts the River as a series of cascading waterfalls that can be considered a series of steps in which the water travels over. As indicated in the MRWMP, at each of the facilities the water level upstream of the facility is fairly flat and then falls vertically at the dam into the next facility. The level downstream of each facility is essentially the same as the upstream level of the next facility in the cascade.

Figure 3-5. Madawaska River Cascade System



The only large water storage facilities on the Madawaska River are Bark Lake and Centennial Lake. Bark Lake is the largest flood storage reservoir on the River. The lake has a winter drawdown of approximately 9 m providing 339 million m^3 of storage. Centennial Lake which is the Mountain Chute GS forebay has a winter drawdown of approximately 4.0 m and provides 104 million m^3 of storage. These reservoirs are used to store water during the spring and reduce peak flows in the river. The other OPG facilities have some storage but are insignificant for flood control use. Bark Lake is normally emptied by the end of February. Once the Bark Lake drawdown is complete, Mountain Chute GS is emptied during March (OPG, 2009).

Figure 3-6. OPG Dams and Generating Stations along the Madawaska River System



Calabogie GS is approximately 10 km downstream of Barrett Chute GS and 20 km upstream of Stewartville GS, both OPG hydroelectric facilities.

The powerhouse is situated on the South Branch of the Madawaska River about 800 metres downstream of the outlet at Calabogie Lake.

The drainage area for the Calabogie GS is 7,647 square kilometers (OPG, 2009).

Calabogie Lake is situated approximately 1 km upstream of the Calabogie GS. Water from Calabogie Lake has three paths downstream: through the North Channel, which is one of the original natural river channels; the South Channel Sluiceway, and; the GS (Figure 3-7).

Figure 3-7. Madawaska River in the Vicinity of the Calabogie GS

As outlined in the 2009 Madawaska River Water Management Plan, Calabogie GS presently operates as a peaking plant in conjunction with the four other OPG owned GSs on the Madawaska River. The generating units at the station have limited flow capacity (66 m^3/s), but the operation of the units and sluice gates are integrated with the rest of the peaking system on the Madawaska River. Calabogie is a generation bottleneck on the Madawaska River, and the small turbine capacity results in frequent spill past the station.

The operation of the existing plant is based on a daily/weekly cycle, with the inflow passed through the plant over a daily or weekly period. The 2009 WMP notes that operation of the plant takes into consideration energy demands, recreational opportunities as well as walleye spawning activities.

Other than the Madawaska River there are no other watercourses or water features within the Calabogie GS.

3.1.2 Water Quality

3.1.2.1 Groundwater

The MoECP has requested specifically to assess whether the project site is in an area of source water protection. Examination of the MoECP's Source Protection Information Atlas website (https://www.gisapplication.lrc.gov.on.ca/SourceWaterProtection/Index.html?viewer=SourceWaterProtection.SWPViewer&locale=en-US) identified that the Calabogie GS is not located within a source water protection area near Calabogie GS (retrieved July 10, 2018). It appears the closest one is near Almonte to the southeast by over 20 km. It should be noted there is no Conservation Authority for the Madawaska River watershed.

Previous groundwater investigations at the site have been undertaken by both Golder (2001) and more recently WSP (2016). Both Golder and WSP have inferred that groundwater similar to surface water drains towards the Madawaska River. WSP has determined that groundwater levels and gradients at the site are generally controlled by the Madawaska River with the overburden appearing to be the pathway for the groundwater flow. The stable groundwater level was measured between 2 meters and 3.5 meters above the overburden-bedrock interface. Water infiltration occurs within the unsaturated overburden, and increased horizontal flow is to be expected within the overburden with precipitation, snow melting and other climatic events.

WSP carried out sampling and analysis of the groundwater quality. The metals and inorganics chemical test results for the submitted groundwater samples were below the MoECP 2011 Table 1 SCSs, except for Copper in Monitoring Well (MW) 15-2 during the second sampling event. The results are reported in Table 3-2 of the Aquatic TSD.

WSP compared the results to the PWQO standards. Several parameters were detected at concentrations above the PWQOs during both sampling events. Table 3-3 of the Aquatic TSD shows the reported exceedances.

3.1.2.2 Surface Water

Communications with MoECP identified that water quality data would not need to be obtained for the environmental assessment stage of the project but that water quality data would be obtained prior to construction to assist in construction monitoring (Orpana, MoECP, 2018). On page 5 of that letter it was stated that:

> *"I just wanted to confirm that the MOECC will not require water quality assessment or fish tissue monitoring as part of the Environmental Assessment. This is based on the understanding that the inundation area is not affected by the project (which is my*

understanding at this time). Water quality monitoring will most likely be required during construction, which can be addressed through the Permit to Take Water."

3.1.3 Substrate and Sediments

Detailed substrate mapping and photographs of these areas are presented in Chapter 3 of the Aquatic TSD. The spillway is scoured bedrock at the upstream end, immediately downstream of the South Channel Sluiceway, changing to large boulders farther from the sluiceway (Figure 3-9), and grading to smaller boulders and cobble with a small portion of sand and gravel where the spillway ends and the velocities are lower. Figure 3-9 also illustrates the effect of flow velocity on substrate composition. Bedrock and large boulders dominate in the upper South Channel spillway where the bulk of the high river flows are passed. Areas sheltered from the flows, such as the embayment to the west of the downstream end of the South Channel spillway and the downstream end of Cross Island (Figure 3-9), have finer substrates.

The downstream riffle/rapids section of the North Channel (Figure 3-10) has substrates of boulder and bedrock with some cobble. Substrate downstream of the rapids is also primarily boulders and cobble, but there are finer substrates in sheltered locations closer to shore. The upstream riffle/rapids section of the North Channel (Figure 3-11) is mainly bolder/cobble, but there is a sizeable section at the downstream end of this set of rapids, with substrates of cobble/boulder/gravel.

Limited observations, downstream of the mapped substrates to Cherry Point (Figure 3-8), suggest a patchwork of substrates in this portion of the river, including bedrock, sand, and large areas with various proportions of cobble, boulder and gravel. Sandy areas tended to be in deeper sections, or in small sheltered shoreline locations.

Figure 3-19 of the Aquatic TSD shows the forebay when it was dewatered in October of 2018. The substrate is cobble over a lot of the forebay but ranges from silt to boulder.

Figure 3-8. Madawaska River in the Vicinity of the Calabogie GS, Showing the Location of the Following Three Substrate Maps (note in this Figure 2-9 is 3-9, 2-10 is 3-10 and 2-11 is 3-11)

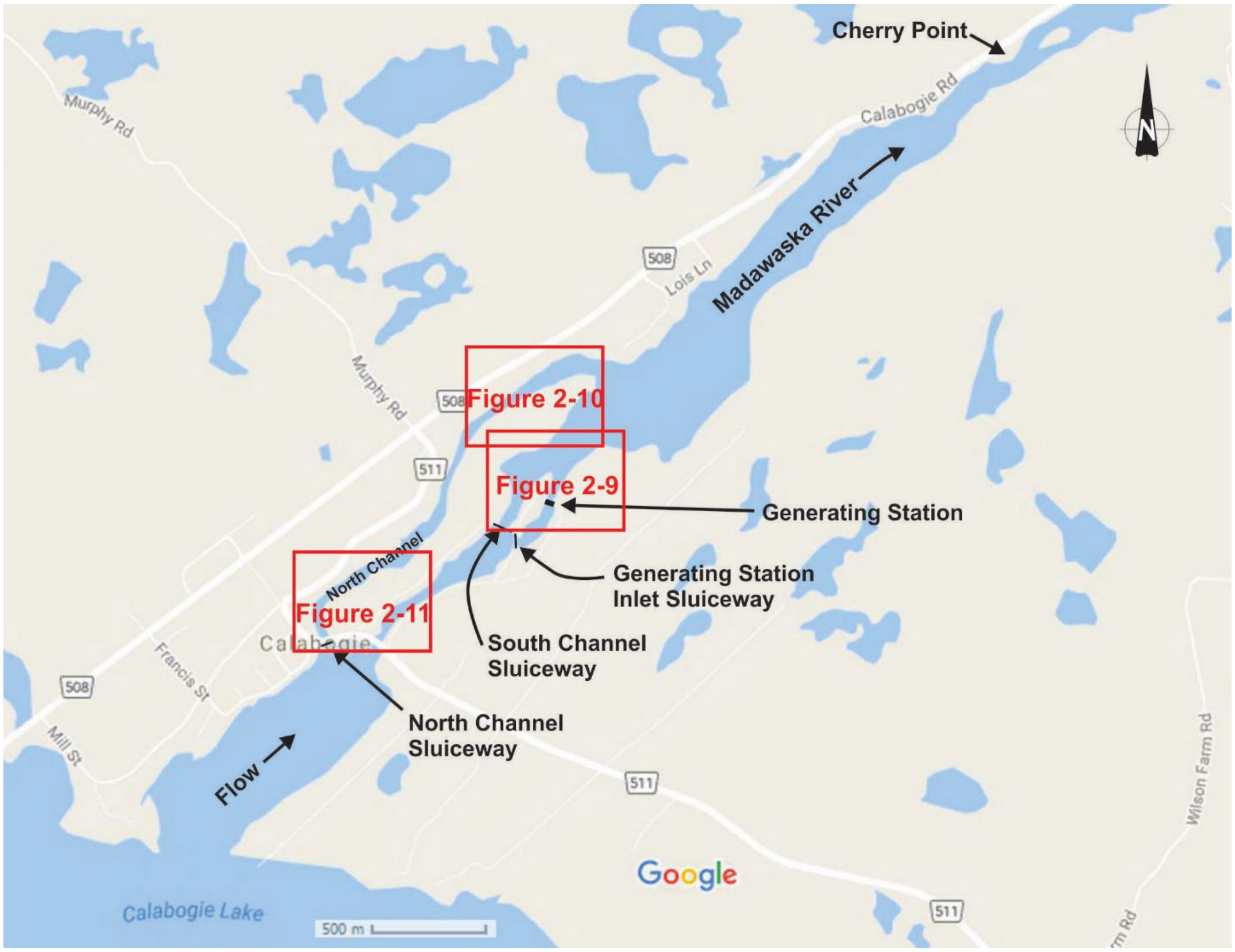


Figure 3-9. Substrate in the Vicinity of the Calabogie GS

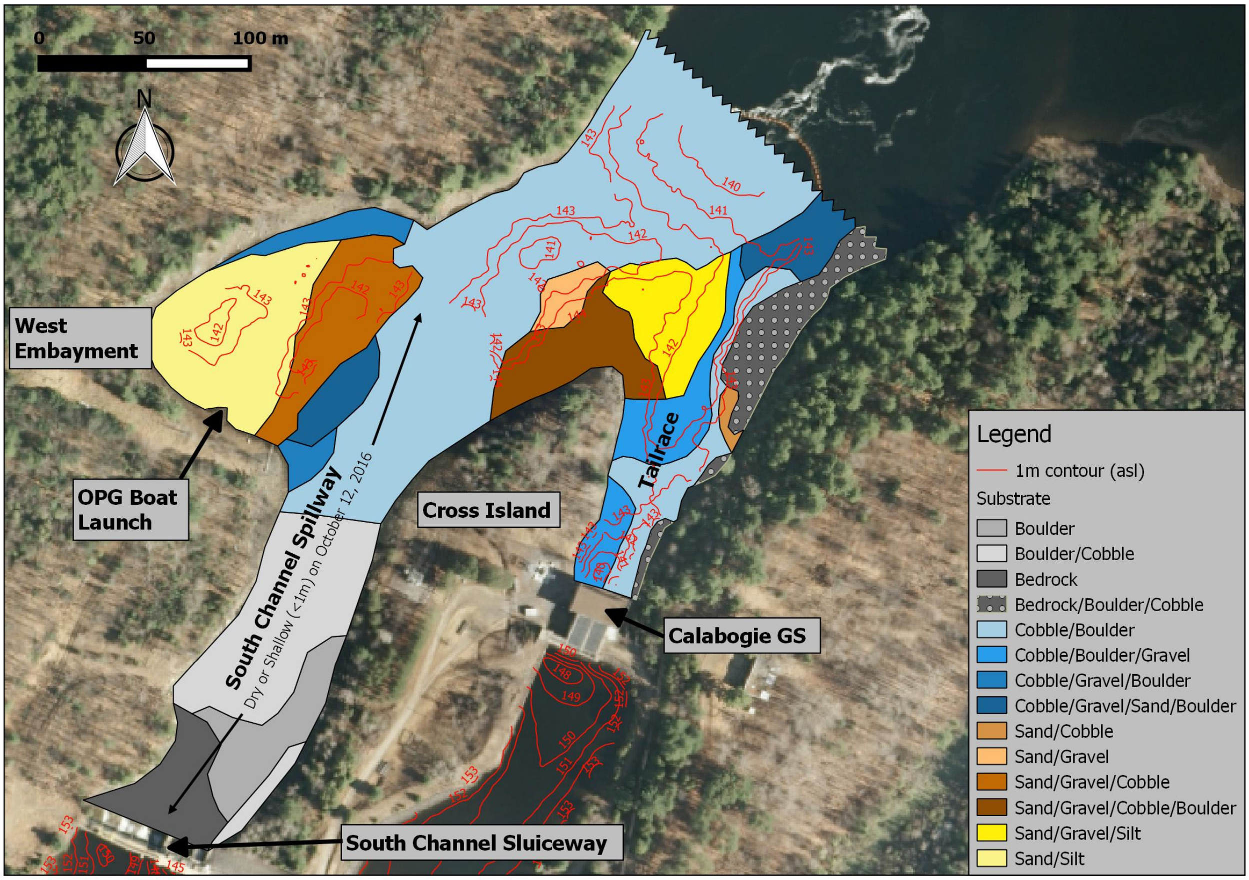


Figure 3-10. Substrate in the Downstream Portion of the North River Channel

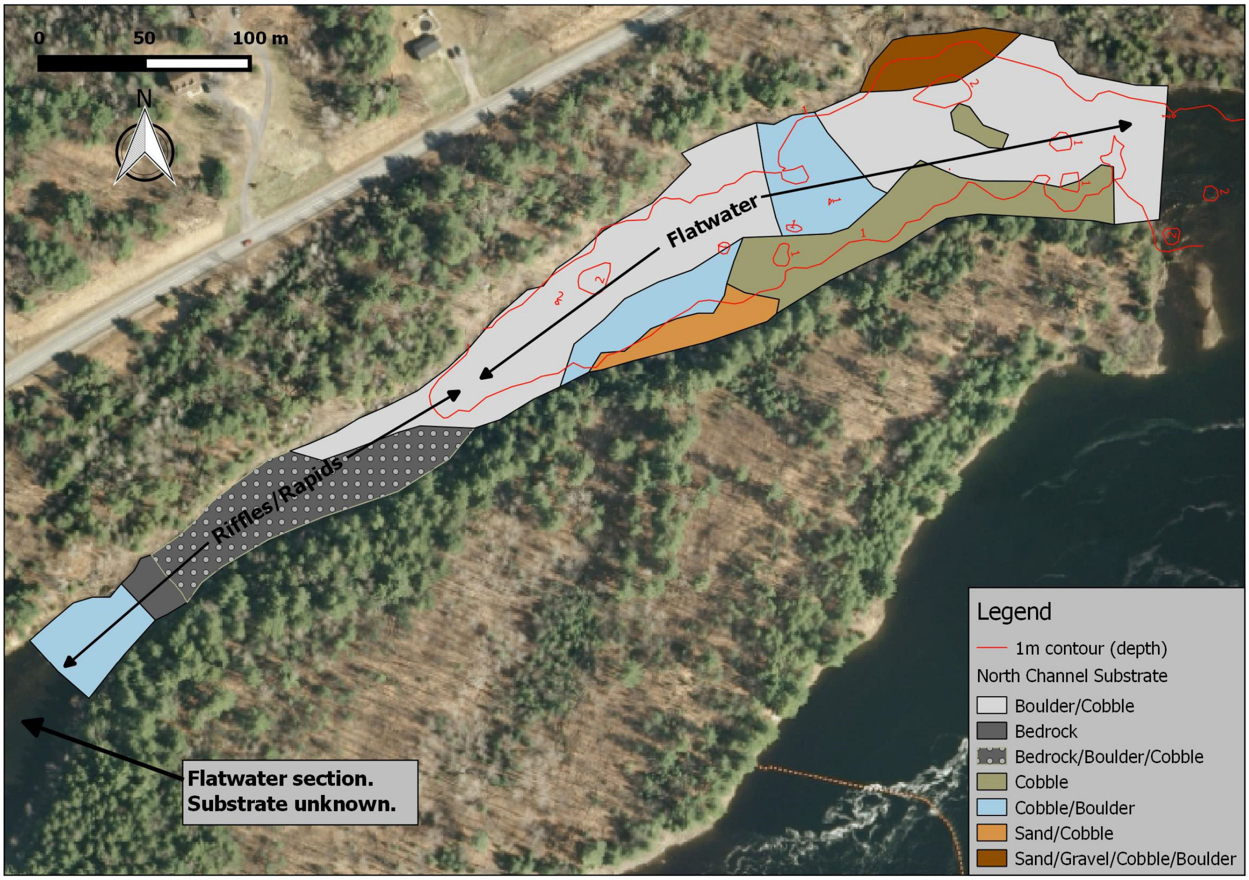
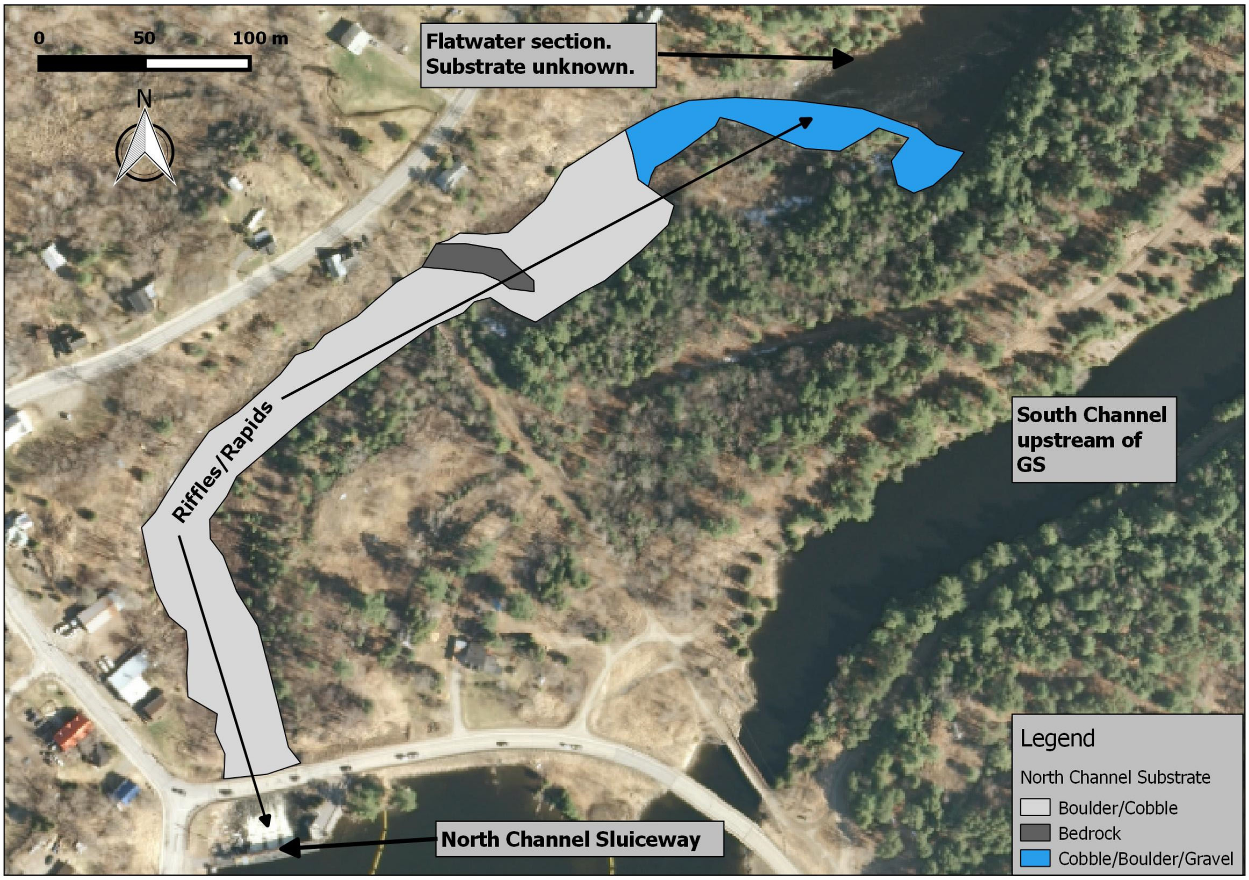


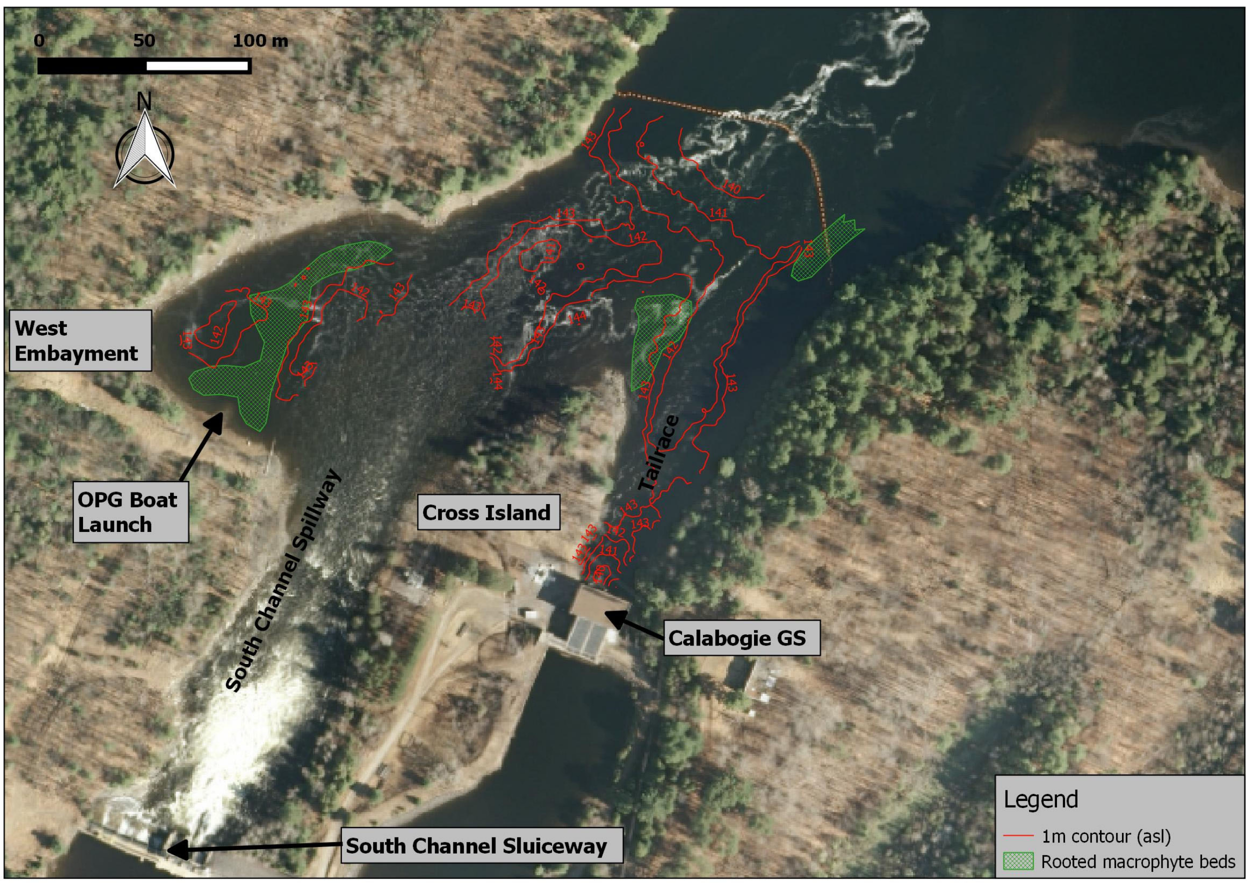
Figure 3-11. Substrate in the Upstream Portion of the North River Channel



3.1.4 Aquatic Vegetation

Rooted aquatic macrophytes (plants) were mapped in the areas that were also mapped for substrate. Dense plant beds were observed in the vicinity of the GS (Figure 3-12), coincident with deposits of finer substrates, though there were widely scattered individual plants in most locations where there was little flow velocity. Limited observations, downstream of the mapped areas near the GS to Cherry Point (Figure 3-8), also found widely scattered individual plants, but unobserved dense aquatic plant beds may also occur in small sheltered shoreline locations with finer substrates.

Figure 3-12. Rooted Aquatic Macrophyte Beds in the Vicinity of the Calabogie GS. October 12, 2016



There are no known at-risk aquatic plants or aquatic plants that are harvested in the vicinity of the project.

3.1.5 Benthic Macroinvertebrates

No benthic macroinvertebrate studies or collections were undertaken during the field component of this study. However, during fish and fish habitat investigations, mussels were observed at various densities in areas of finer substrates, and crayfish were observed in places with hard coarse substrates. The nets of Caddisflies were observed in the tailrace and the North Channel, likely somewhat due to the consistent flows in these areas. Other Caddisflies were observed clinging to stones adjacent to the South Channel Spillway. Generally, the coarse substrates in the faster-flowing sections of the river and tailrace are likely occupied by a variety of Caddisfly species, as well as stoneflies, mayflies, Simuliidae and others, while the finer substrates in the slower-flowing sections are likely occupied by a variety of Chironomidae (midges), Oligochaetes (worms), and others.

3.1.6 Fisheries Resources

3.1.6.1 Existing Aquatic Habitat

The results of the habitat mapping are presented in Figures 3-8 to 3-12. Due to the safety requirement to shut down the flow through the GS and the South Channel Sluiceway during the habitat mapping for the location shown in Figure 3-9, the sloped spillway downstream of the South Channel Sluiceway had only leakage flow, resulting in some areas of the spillway being dry and the remainder shallow (Figures 3-12, 3-13 and 3-14 of the Aquatic TSD). Flow in the spillway is highly variable, due to the fact that the Madawaska River has a managed flow regime with consistent set flows in the North Channel (for Walleye spawn and incubation: 5 m^3/s; and, minimum flow: 0.8 m^3/s) to maintain habitat there, and then through the GS and tailrace up to the maximum GS capacity to generate electricity, with whatever remains, after further allotment of water for the maintenance of upstream and downstream water levels, discharged through the South Channel Spillway. The high flows that occur at times in the South Channel Spillway have affected the substrate composition with scoured bedrock at the upstream end, immediately downstream of the South Channel Sluiceway (Figure 3-12), changing to large boulders farther from the sluiceway (Figure 3-13), and grading to smaller boulders and cobble with a small portion of sand and gravel where the spillway ends and the velocities are lower. The range of flow, and the sometimes short period of time between high and low flow, likely reduces the diversity of aquatic organisms that would be found in the South Channel Spillway. Areas sheltered from the flows, such as the embayment to the west of the downstream end of the South Channel spillway and the downstream end of Cross Island (Figure 3-9), have finer substrates and aquatic macrophyte beds. These different habitats will attract/support different assemblages of fish and invertebrate species.

In contrast to the South Channel Spillway, the GS tailrace is at a lower elevation and remains wetted at all water levels within the typical range of the Madawaska River (Figure 3-14). Flow in the tailrace is also quite consistent, only trending lower once the total river flow drops below the small amount of flow allotted to the North Channel plus the capacity of the GS. Consequently, the flow velocity is also less variable, without the extreme high velocities that can occur in the South Channel Spillway. A much greater number and variety of aquatic organisms, therefore, can become established in and occupy the tailrace, as compared to the spillway, making the tailrace more productive and better general fish habitat.

Figure 3-13. South Channel Spillway with Spring Flows. April 25, 2017

Figure 3-14. Calabogie GS Tailrace. April 27, 2016

The downstream riffle/rapids section of the North Channel (Figure 3-10) has substrates of boulder and bedrock with some cobble and would likely not be considered high quality fish habitat because of the reduced substrate structure due to the significant bedrock component. Structural habitat such as boulders and cobble and gravel provide interstitial spaces and complex currents for small fishes and diverse communities of invertebrates upon which fish feed, as well spawning substrates that protect the eggs and young of larger fishes, while bedrock does not. In the deeper water downstream of the rapids, the substrate is primarily boulders and cobble, but there are finer substrates in sheltered locations closer to shore, together providing lots of habitat structure and some habitat variability to provide good general fish habitat. The upstream riffle/rapids section of the North Channel (Figure 3-11) is mainly bolder/cobble, which provides habitat for the above-mentioned invertebrates and small riffle-dwelling fishes, but there is a sizeable section at the downstream end of this set of rapids, with substrates of cobble/boulder/gravel, that could also be the best potential Walleye and White Sucker spawning habitat in the North Channel.

3.1.6.2 Fish Community Composition

A diverse community of fish is known to exist in the vicinity of the Calabogie GS (Table 3-1). The part of the Madawaska River between the Calabogie GS and the Stewartville GS is managed as a coolwater fishery (MNR, 2008), with Northern Pike, Smallmouth Bass, Largemouth Bass, Walleye, Rock Bass, Pumpkinseed, Yellow Perch, White Sucker, and Redhorses. Historically, three species at-risk were present in the system: River Redhorse, American Eel, and Lake Sturgeon. Sturgeon has not been known from this portion of the Madawaska River for many years (Kirby Punt, MNRF Management Biologist, Pembroke District. Pers. comm. September 9, 2016), nor has American Eel (Kirby Punt, MNRF Management Biologist, Pembroke District. Pers. Comm. April 26, 2017). River Redhorse still occur in the system.

Small-bodied fish collections were undertaken as part of the investigations undertaken at this site in 2016 and 2017 (Table 3-2). The species found during these small-bodied fish collections are typical for the habitats sampled in this part of Ontario. The South Channel Spillway and Cross Island collections are typical for the shoreline areas of larger rivers, where there is a broad range in flow velocity adjacent to areas of faster water. The presence of Longnose Dace and Stonecat in the upper portion of the North Channel, reflect the fast flowing rocky riffles at that location. The four Smallmouth Bass collected at that location were captured at the downstream end of the riffles in much slower velocity flow.

Table 3-1. Fish Species Found in the Vicinity of the Calabogie GS (MNR, 2008)

Common Name (*Scientific Name*)	Upstream of Calabogie to Barrett Chute	Downstream of Calabogie to Stewartville
Lake Sturgeon (*Acipenser fulvescens*)		x
Splake (*Salvelinus namaycush* x *Salvelinus fontinalis*)	x	
Cisco (*Coregonus artedi*)	x	
Northern Pike (*Esox lucius*)	x	x
White Sucker (*Catostomus commersonii*)	x	x
River Redhorse (*Moxostoma carinatum*)	x	x
Shorthead Redhorse (*Moxostoma macrolepidotum*)	x	x
Fallfish (*Semotilus corporalis*)	x	
Northern Redbelly Dace (*Chrosomus eos*)	x	
Golden Shiner (*Notemigonus crysoleucas*)	x	x
Bluntnose Minnow (*Pimephales notatus*)	x	x
Common Shiner (*Luxilus cornutus*)		x
Spottail Shiner (*Notropis hudsonius*)		x
Brown Bullhead (*Ameiurus nebulosus*)	x	
Channel Catfish (*Ictalurus punctatus*)	x	
Banded Killifish (*Fundulus diaphanus*)		x
Trout-Perch (*Percopsis omiscomaycus*)	x	
Smallmouth Bass (*Micropterus dolomieu*)	x	x
Largemouth Bass (*Micropterus salmoides*)	x	x
Rock Bass (*Ambloplites rupestris*)	x	x
Pumpkinseed (*Lepomis gibbosus*)	x	x
Walleye (*Sander vitreus*)	x	x
Yellow Perch (*Perca flavescens*)	x	x
Logperch (*Percina caprodes*)		x
Johnny Darter (*Etheostoma nigrum*)		x

Note: During this study, Channel Catfish were observed downstream of the Calabogie GS (Table 3-8); Mimic Shiner (*Notropis volucellus*) and Iowa Darter (*Etheostoma exile*) were captured downstream of the Calabogie GS by seine (Table 3-5); and Longnose Dace (*Rhinichthys cataractae*) and Stonecat (*Noturus flavus*) were captured in the North Channel by electrofishing (Table 3-5).

Table 3-2. Results of Small-Bodied Fish Collections in the Vicinity of the Calabogie GS in 2016 and 2017

	South Channel Spillway, North Side. Oct. 12, 2016	**South Channel Spillway, North Side. Jun. 10 and 11, 2017**	**Cross Island, Between the Tailrace and the South Channel Spillway. Aug. 16, 2017**	**North Channel, Downstream Portion. Aug. 16, 2017**	**North Channel, Upstream Portion. Aug. 16, 2017**	**South Channel Spillway, North Side. Aug. 16, 2017**
Collection method	Electrofisher	Electrofisher	Electrofisher	Electrofisher	Electrofisher	Sein
Effort	1223 s	1222 s	928 s	434 s	990 s	8 hauls
Smallmouth Bass	-	-	4 YOY	2 Juvenile	1 Juv, 3 YOY	15 YOY
Largemouth Bass	-	1	-	-	-	-
Rock Bass	-	-	2	2	-	8 YOY
Pumpkinseed	2	-	-	-	-	3 YOY
Mimic Shiner	-	1	-	-	-	-
Bluntnose Minnow	2 YOY	7	-	-	-	11 YOY
Golden Shiner	-	-	-	-	-	5
Longnose Dace	-	-	-	1 Juvenile	13	-
Logperch	10	1	4	1	-	2
Johnny Darter	7	-	-	-	-	19
Iowa Darter	-	-	-	-	-	1
Yellow Perch	-	-	-	-	-	5 YOY
Stonecat	-	-	-	-	1	-

3.1.6.3 Fish Movement

The Madawaska River is a managed river system with a number of dams that have fragmented the river into discrete sections, with little opportunity for upstream fish movement between them, though fish can be washed downstream. The Calabogie GS is the division between two of these sections. Upstream there is a short section of river and Calabogie Lake, with the Barrett Chute hydro-electric station blocking fish movement upstream from Calabogie Lake. The natural barrier to upstream movement past Barrett Chute is High Falls. Downstream is a 21.4 km section of river that has its downstream end at the Stewartville GS that also blocks upstream fish movement. At Calabogie, the North Channel has a relatively short stoplog dam at its upstream end that may be of a construction that might allow American Eel to move over the dam into Calabogie Lake, if eels are able to find their way upstream through this channel.

Fish that migrate from deeper general habitat to shallow flowing habitats to spawn, such as Walleye and White Suckers, move into the flowing waters of the tailrace, spillway, and North Channel.

3.1.6.4 Fish Spawning Habitat

To the best of OPGs knowledge no fall-spawning fishes are known to occur in the reach of the Madawaska River between the Calabogie GS and the Stewartville GS. The fish species that are present in the Madawaska River are listed, by reach, in *Fisheries Management in Renfrew County: A State of the Resource Report and a Focused Review of Fisheries Issues* (MNRF. 2008. 101 p). This document indicates that Lake Whitefish and Cisco are not present in the reach between Calabogie Dam and Stewartville Dam. Lake Whitefish and Cisco occur in the reach upstream, between Calabogie and Barrett Chute. Lake Whitefish occur in the reach downstream, between the Stewartville Dam and Arnprior. C. Portt and Associates staff (consultants to OPG) confirmed that fall spawning investigations were not required for the project with MNRF staff prior to conducting field investigations.

3.1.6.5 American Eel

American Eel is listed as Endangered under the *Endangered Species Act* (Ontario), but is not listed at this time under the *Species At Risk Act* (Federal). Recent dramatic declines in American Eel abundance have occurred in the Ottawa River (COSEWIC, 2012). COSEWIC (2012) reported that eel were now only being found in low numbers below the last dam in the Ottawa River (Carillon Dam), suggesting that they may be close to extirpation there. However, while MNRF does not believe American Eel currently occur in the vicinity of the Calabogie GS, more recent sampling by the MNRF has found some eel in the Ottawa River and in the tailwater of the Arnprior GS (Kirby Punt, MNRF Management Biologist, Pembroke District. Pers. Comm. April 26, 2017).

Habitat use by eels is very diverse, and eels are frequently reported as habitat generalists in freshwater (MacGregor *et al.*, 2013). Wiley *et al.* (2004) evaluated the importance of 17 physical habitat, chemical, and biological variables on the density of American Eels in 5 major Maryland river basins. While the results of Wiley *et al.* (2004) were generally consistent with other studies suggesting a general lack of significant stream habitat associations, velocity-depth diversity was identified as the only important habitat variable positively correlated with eel density (Wiley *et al.*, 2004). American Eels also exhibit daily, seasonal, and ontogenetic (e.g. size/age) variation in habitat use (Johnson and Nack, 2013). Vegetation and interstitial spaces such as found in rock piles, logs and other complex structures, as well as deciduous leaf litter, are important to eels as cover, especially during daylight hours (MacGregor *et al.*, 2013). Given the fact that American Eel is not known to display any significant stream habitat associations, it is assumed that if they were to regain their former range, they could be found in any of the habitats in the vicinity of the Calabogie GS.

The primary concern for American Eel at the Calabogie GS is whether or not they could effectively migrate upstream, and whether or not they would be able to safely pass downstream. While the South Channel Sluiceway and the GS are likely impassible to up-migrating American Eel, the North Channel has a relatively short stoplog dam (Figure 3-7: North Channel Sluiceway) at its upstream end that may be of a construction that might allow American Eel to move over this dam into Calabogie Lake. However, the North Channel conveys a small portion of the total Madawaska River flow, and the downstream confluence with the mainstream is approximately 750 m downstream from the South Channel Sluiceway and, therefore, it is believed that few eel could find their way into the North Channel. Similarly, for down-migrating American Eel the small amount of flow passing into the North Channel likely results in them following the mainstream through the spillway (during higher flows only) or, more likely, through the GS where there is a reasonably good chance that large adult eels will be killed or injured in the turbines.

3.1.6.6 Walleye

Walleye are found in lakes and streams in a wide variety of coolwater habitats (Holm *et al*. 2009). Because its eyes are light sensitive, in clear water it is typically found in deeper areas during the day, or in the shelter of sunken logs, weed beds or boulder shoals, and feeds mainly in twilight or dark periods (Scott and Crossman, 1973). In more turbid water it feeds throughout the day (Scott and Crossman, 1973).

Walleye normally spawn at temperatures of 6.7 to 8.9°C over boulder to coarse gravel (Scott and Crossman, 1973), generally in water less than 1.2 m deep (Smith, 1985), and in velocities from 0.3-1.0 m/s (McMahon *et al.*, 1984). Interpretation of the graphs in Gillenwater *et al*. (2006), indicate that water velocity is optimal for Walleye spawning at 0.3 to 0.95 m/s, and marginal below 0.3 m/s or between 0.95 and 1.2 m/s. They have been known to spawn at temperatures as low as around 2ºC (Coad *et al*. 1995; Holm *et al.* 2009), and as high as 17.2ºC (Becker, 1983). Male Walleye arrive on the spawning grounds first (Scott and Crossman, 1973).

The results of the 2016 and 2017 Walleye spawning observations at Calabogie are summarized in Tables 3-6 and 3-7 of the Aquatic TSD. Numbers of Walleye observed in the vicinity of the Calabogie GS were low relative to the numbers observed at the reference site below Barrett Chute, even though only a small proportion of the potential spawning area at the reference location could be examined.

In the vicinity of the Calabogie GS the North Channel appears to offer the most suitable flow velocities and water depths for Walleye spawning, but where suitable flow velocities occur in the downstream portion of this area the substrate in many places is either bedrock or boulders (Figure 3-24; Figure 3-10; Figure 3-16 of the Aquatic TSD), and therefore would provide only limited potential spawning habitat. In the upper portion of the North Channel, from the North Channel Sluiceway to the downstream end of Walleye spawning observation Area 2 (Figure 3-23, Aquatic TSD), the presence of some cobble and gravel substrates (Figures 3-11, 3-17 and 3-18, Aquatic TSD), combined with suitable water depths and flow velocities, provides better potential Walleye spawning habitat. The flatwater sections of the North Channel, though they may have suitable substrates, do not have flow velocities suitable for Walleye spawning. In 2016, one group of four large female Walleye was observed on one night in the North Channel (Area 4, Figure 3-23, Aquatic TSD), while no Walleye were observed in Areas 1, 2 and 3 (Figure 3-23, Aquatic TSD). In 2017, a single Walleye was observed in each of Areas 2 and 4 during the first night of observation, and in Areas 1 and 2 during the second night of observation (Figure 3-23, Aquatic TSD).

The spill channel below the South Channel Sluiceway was passing the majority of spring flow at the time of the Walleye spawning observations in both 2016 and 2017, and the high turbulent flows and bedrock and large boulder substrate made this area generally unsuitable for Walleye spawning. However, there are small areas of potential Walleye spawning habitat immediately downstream from the South Channel

Spillway, where the flow velocity slows and the substrate contains some patches of gravel and sand, which could be suitable in some years if there was significantly less flow through the spillway than was observed in 2016 and 2017. These locations could not be fully examined at night for spawning Walleye, due to safety concerns with the high flows. In 2016, a few individual Walleye were observed near shore at the extreme downstream end of the spillway (Figure 3-23: Area 7, Aquatic TSD), but they appeared to be resting in slack-water areas. In 2017 a single Walleye was observed in Area 5 (Figure 3-23, Aquatic TSD) on the first night of observation and none were observed on the second night.

Most of the tailrace of the Calabogie GS is considered to be deeper than typical Walleye spawning habitat, even though substrates in the tailrace might be suitable. A few areas of suitable substrate were observed in a narrow band of shallow water along the north side of the tailrace, but the flow velocity there was too slow to be optimal for Walleye spawning at the time of the field observations. Regardless, low numbers of Walleye were observed in the tailrace in 2016 and 2017, indicating that they are attracted to it.

The South Spillway does not reliably provide habitat suitable for Walleye spawning under current conditions. The volume of flow through the South Spillway during the walleye spawning period varies from zero (except for dam leakage) in dry springs to >400 cms (refer to graph in response to comment 41) in a wet year. At zero flow through the spillway there is abundant suitable spawning substrate (Rosien, 1999) but velocities would not be conducive to walleye spawning except at the very base of the dam where leakage would result in higher velocities than in most of the spillway. At high spill rates velocities in most of the South Spillway are too high for walleye to spawn there (Tarandus, 1991, 1992; this study).

Tarandus conducted a Walleye spawning study in 1992 that included the South Spillway and reported that "minimal suitable walleye spawning habitat exists in the spillway" mainly due to the substrate and relatively high water velocities and no walleye eggs were found there post-spawning (Tarandus 1992, cited in Pope, 1999). Tarandus (1992) did find walleye eggs in the North Channel. Pope (1999) reported that local residents regarded the North Channel to be the main spawning area. A spawning study conducted by Rosien in 1999, when spring flow was low and there was no spill through the South Spillway, found that numbers of Walleye observed during the spawning season were higher downstream at Cherry Beach Rapids than in either the South Spillway or the tailrace at Calabogie (see Table 3-8 in the Aquatic TSD). Rosien (1999) stated that the due to adverse conditions at this site during high flow freshets, the South Spillway is dependent upon low flow freshets that warrant reduced spilling in order to be suitable for spawning.

With the existing generating station conditions in the south spillway range from extremely high flows and velocities during peak flows, typically during spring freshet, to zero flow and velocity during periods when there is no flow through the spillway. At peak flows the upper portion of the South Spillway has velocities so high that it is probably not occupied by fish; if it is it will be by species that are tolerant of high water velocities (i.e. longnose dace) that can shelter among boulder. At low flows and velocities that area is suitable for a wide range of species (walleye, centrarchids, catostomids, most cyprinids), but less so for species that prefer higher velocities (i.e. longnose dace).

3.1.6.7 River Redhorse

River Redhorse has been found in recent years in the vicinity of the Calabogie GS. This species is listed as Special Concern under the ESA and as Special Concern on Schedule 1 of SARA.

Adult River Redhorse have been reported from both rivers and lakes, but it relies on rivers for spawning (DFO, 2016). The River Redhorse is primarily an inhabitant of the deeper portions of moderate to large rivers, where the water is relatively clear and fast flowing, substrates are clean stones, rubble, and bedrock, and where siltation is at a minimum (Trautman 1981; Parker, 1988; Smith, 1979). Like most *Moxostoma* species, it is reportedly intolerant of turbidity, siltation, and pollution (Trautman, 1981; Smith, 1979; Parker and McKee, 1984).

Parker (1988) reported that River Redhorse is not often captured in sluggish environments with an abundance of macrophytes and/or soft sediments such as sand and silt. However, young-of-the-year in the Richelieu River, Quebec, are found along vegetated shores with substrates of silt, clay and sand, at an average depth of 1.5 m (3 m maximum), and age 1+ specimens are found in greater abundance in vegetated areas in the early spring (COSEWIC, 2006). Jenkins and Burkhead (1993) reports that adults apparently avoid the shallow portions of pools, but young and small juveniles often are found there and in backwaters. Yoder and Beaumier (1986) reported that in the Sandusky River the highest numbers of River Redhorse were found in habitats with moderate to swift current, riffle/run structure, and convoluted bedrock, boulder, rubble, and gravel substrates. Similar habitat attributes are present in the Mississippi River, Ontario, where they were captured in fast-flowing pools in a 300 m long chute and in the plunge-pool of a waterfall (Parker and McKee, 1984).

An aggregation of spawning River Redhorse (Figure 3-26, Aquatic TSD) was observed at the downstream end of Area 9 (Cherry Point about 1 km downstream of the Calabogie GS (Figure 3-23, Aquatic TSD) on June 11 and 12, 2017, at water temperatures of 18.2-18.3°C. These fish were in a limited, somewhat protected location adjacent to a set of rapids, where complex currents result in a deposit of gravel/sand among protruding boulders. The River Redhorse were observed spawning in the gravel/sand deposit at water depths of 1-2 m, in the current. No River Redhorse were observed at any other location in Area 9 searched by direct observation from the water surface, either from shore or from the boat, on June 11 (Figure 3-23, Aquatic TSD). Areas where it was thought that habitat similar to this spawning area was present were re-examined on June 12, including the downstream portion of Area 4, areas of sand and gravel deposits on the north side of Area 5, and the downstream portions of Areas 7 and 8 (Figure 3-23, Aquatic TSD). None of these locations proved to have the same habitat conditions as were observed at the spawning location in Area 9, and no spawning fish of any type were observed. Therefore, the only known spawning location for River Redhorse in the vicinity of the Calabogie GS is in the small location within Area 9 (Figure 3-23, Aquatic TSD). No young-of-the-year River Redhorse (or of any other sucker species) were captured in the small-bodied fish collections undertaken in these areas in 2016 and 2017.

More details on River Redhorse investigations can be found in Chapter 3 of the Aquatic TSD.

3.2 Terrestrial Environment

This section is a description of the terrestrial environment surround the Calabogie GS. A more detailed description can be found in the Terrestrial Environment TSD.

3.2.1 Physical Conditions

According to the Ontario Geological Survey, surficial materials in the vicinity of the site comprise primarily of bedrock with a thin drift thickness. In the area of the GS the overburden and the soils of the site can be characterized as a human disturbed area.

Based on the Ecoclimatic Region classification system (Ecoregions Working Group, 1989), the proposed Calabogie Generating Station Redevelopment Project occurs in the Humid High Cool Temperate that covers most of central Ontario and into Quebec.

3.2.2 Vegetation

Ecological communities were mapped and described according to the ELC system for Southern Ontario (Lee *et al.,* 1998). For the wetland communities, ecosite classifications from the provincial Ecological Land Classification Working Group (Banton *et al*., 2009; Wester *et al.,* 2015) were also provided. The ELC communities are described in detail in the Terrestrial Environment TSD but are summarized here below.

Eleven ecological communities were delineated within the study area and representative photographs of the ecological communities are provided in Appendix A of the Terrestrial Environment TSD. Most of the photographs were taken prior to September 2018 when a tornado moved through the study area; however, additional post-tornado photographs have been included to illustrate the damage to the treed communities. ELC communities have been organized in three broad categories: anthropogenic and cultural communities; forest communities; and aquatic and wetland communities.

Anthropogenic and cultural vegetation communities are those that are created or maintained through anthropogenic disturbances. Some anthropogenic land uses eliminate vegetation (e.g., paved parking lots), whereas others such as dirt roads retain large numbers of non-native species along the periphery. The anthropogenic features consist of buildings, bridges, gravel/dirt roads, municipal fill area and a hydro corridor. Anthropogenic and cultural vegetation communities include: anthropogenic, turf, cultural meadow and, cultural thicket/cultural woodland complex.

Forest communities include: Dry – Fresh White Pine - Red Pine Coniferous Forest; Fresh – Moist Hemlock Coniferous Forest; Deciduous Forest; and, Mixed Forest.

Tree species present in the canopy and sub canopy of the Dry Fresh White Pine – Red Pine Conferous forest units included: Eastern Hemlock, Balsam Fir, Eastern White Cedar, and Eastern White Pine, along with Paper Birch, Yellow Birch, Sugar Maple, Northern Red Oak and Large-toothed Aspen, young American

Beech, Red Pine, Eastern White Cedar, Eastern White Pine, Balsam Fir, Paper Birch, American Basswood, Eastern Hemlock and young Eastern Hop-hornbeam.

Tree species in the *Moist Hemlock Coniferous Forest included:* Eastern Hemlock, Balsam Fir and Eastern White Cedar were dominant canopy species along with Eastern White Pine, Red Pine and Yellow Birch. This community covers most of the lands west of the study area. Species in the ground layer included Bunchberry, Bracken Fern, Large-leaved Aster, Wild Sarsaparilla and Eastern Leatherwood.

Tree species present in the deciduous forest included American Beech, Trembling Aspen, Large-toothed Aspen, Paper Birch, Eastern Hemlock, Sugar Maple, Northern Red Oak, Eastern White Pine, Staghorn Sumac and Eastern Hop-hornbeam.

Tree species present in the Mixed Forest: included Eastern Hemlock, Balsam Fir, Eastern White Cedar, Eastern White Pine, Red Pine, Yellow Birch, Northern Red Oak, Large-toothed Aspen, Sugar Maple, Paper Birch, American Elm and Eastern Hop-hornbeam.

Aquatic and wetland communities included: open aquatic; deciduous swamp and *Cattail Organic Shallow Marsh.* Only a small portion of the deciduous swamp community extends into the study area (i.e., approximately 50 m^2). As such, the community was not examined in detail.

Woodland Pinedrops (*Pterospora andromedea*), a provincially rare plant (S2: "usually between 5 and 20 occurrences in the province, or few remaining hectares") was documented in several locations (multiple stalks at each location) along Generating Station Lane and Calabogie Island Road during the August 2018 surveys (see Figure 3-7 in the Terrestrial Environment TSD). MNRF staff have also previously documented this plant along Generating Station Lane. During the August site visit, the proposed laydown areas, stockpile area and haul road were surveyed and Woodland Pinedrops were not observed in these areas. The conditions in these latter areas suggest that Woodland Pinedrops is unlikely to be present (i.e., the ecological communities and species compositions are different). However, along the laneways where conditions are suitable, it is possible that Woodland Pinedrops may be present in additional locations because the species does not produce above-ground inflorescences every year. As such, the proposed mitigation measures have been tailored to respond to any newly documented locations of Woodland Pinedrops as the project goes forward.

3.2.3 Wildlife and Wildlife Habitat

Based on an assessment of habitat potential for species at risk completed in 2015 (Beacon, 2016), several wildlife surveys have been conducted at the Calabogie site since 2016. Surveys conducted in 2016 focused on species at risk deemed most likely to occur on site, whereas the scope of surveys conducted in 2017 and 2018 was expanded to include additional species. The specific surveys have included:

- Eastern Whip-poor-will (*Antrostomus vociferus*), auditory surveys at dusk with Common Nighthawk (*Chordeiles minor*) secondarily assessed during the surveys);
- Bat exit surveys at generating station, (visual and auditory with active detectors);
- Barn Swallow (*Hirundo rustica*) nesting survey (visual and auditory);

- Deployment of two remote ultrasonic detectors to survey for bats;
- Deployment of remote acoustic detector to survey for Eastern Whip-poor-will and other birds;
- Dawn breeding bird surveys (visual and auditory);
- Bat habitat assessment for maternity roosts (snag trees) during leaf-off conditions; and,
- Turtle surveys (basking, visual).

Incidental observations of wildlife species, including mammals were made during field investigations that were primarily for other purposes. Evidence for the presence of a species or use of an area was determined from visual and/or auditory observation (e.g., song, call) and observation of nests, tracks, burrows, browse, skins, and scats.

Targeted surveys for mammals other than bats were not conducted; however, evidence of mammal activity in the study area was documented during the other field investigations. Evidence of White-tailed Deer (*Odocoileus virginianus*), Coyote (*Canis latrans*), Raccoon (*Procyon lotor*), Woodchuck (*Marmota monax*) and Red Squirrel (*Tamiasciurus hudsonicus*) was documented. Additional terrestrial, mammals are almost certainly present in the area of study.

Three provincially endangered bat species were considered to have potential to occur in the study area: Little Brown Myotis (*Myotis lucifugus*), Northern Myotis (*Myotis septentrionalis*) and Tri-colored Bat (*Perimyotis subflavus*).

The analysis showed that there was bat activity at all four detectors that were deployed. Overall three of Ontario's four endangered bat species were present by at least one of the detectors each. Surveys to identify candidate maternity roost for the endangered bat species Little Brown Myotis and Northern Myotis were undertaken during leaf-off conditions in 2018 and 2019.

The bat habitat surveys documented 100 potential bat maternity roost trees/snags. Based on the size of the ELC communities, the calculated snag densities ranged from 0.69 to 28.57 per ha. According to the MNRF's (2016) guidelines, ELC communities with snag densities equal to or greater than 10 snags per ha are considered high quality potential maternity roost habitat. Only ELC Unit 6 exceeded 10 snags per ha and this area would therefore quality as high quality potential maternity roost habitat. Acoustic detectors for bats were not deployed in this community as it only became part of the study area in late 2018; however, the bat species detected in the adjacent ecological community would also be present in ELC Unit 6.

3.2.4 Terrestrial Avifauna

Based on an assessment of habitat potential for species at risk completed in 2015 (Beacon, 2016), two provincially threatened bird species were considered to have the potential to occur within or adjacent to the Calabogie study area: Barn Swallow and Eastern Whip-poor-will. Targeted surveys for these species were therefore conducted as described below (more detail can be found in the Terrestrial Environment TSD).

Surveys for Barn Swallow were conducted in 2016, 2017 and 2018, and involved searching for the species (visual and auditory), as well as searching for nests in areas identified as having potential for nesting.

In all three years, Barn Swallows were confirmed to be nesting under the bridge.

In 2016 and 2017, specific surveys for Eastern Whip-poor-will were conducted. Additionally, in 2017 and 2018, a remote acoustic detector for birds was mounted on trees. No vocalizations of Eastern Whip-poor-will were detecting during the on-site surveys conducted in 2016 and 2017, and no vocalizations of the species were detected from the audio recordings obtained from the SM4 units deployed in 2017 and 2018. These findings provide strong evidence that the species is not breeding within the study area.

General surveys for breeding birds were conducted in 2017 and 2018 in the early mornings of days when air temperatures were within 5 °C of normal. Roving and point count methods were used, and all birds seen or heard within or adjacent to the study area were documented.

A total of 46 species of birds were documented. Based on the habitat types present, as well as observations of bird behaviour, 41 species can be expected to breed or potentially breed within the study area. The most numerous species were the commonly encountered Red-eyed Vireo (*Vireo olivaceus*) and Song Sparrow (*Melospiza melodia*).

No additional endangered or threatened species were documented (i.e., other than the Barn Swallow). One species designated special concern on the provincial SARO List was documented: Eastern Wood-pewee (*Contopus virens*). However, the area where this species was heard was north of the 2018 study area. The evening surveys completed for Eastern Whip-poor-will and bats also provided opportunities to survey for Common Nighthawk (special concern provincially), but none were heard or observed.

Twenty of the bird species documented are listed as area sensitive in the MNRF's Significant Wildlife Habitat Technical Guide (2000). In general, bird species considered to be area sensitive exhibit higher reproductive success in habitats with little or no fragmentation. For example, species that breed in forests/woodlands and are considered area sensitive will have higher reproductive success when their breeding territories are located greater than 200 m from the edge of the treed habitat. These edges are often created by roads and other development activities but can also be the result of a natural transition to non-treed communities such as prairie or rock barrens. With the exception of the two merganser species which are not likely breeding within the study area, all the area sensitive species documented during the surveys use treed or forested habitats for breeding. The observed number of area sensitive bird species that use forested habitats is expected given the extent of forest around the Calabogie site.

3.2.5 Amphibians and Reptiles

Targeted surveys for amphibians were not conducted as suitable breeding habitat was not present within the initially conceived study area (note, ELC Wetland Unit 11 was not initially part of the study area and was only added following the addition of the adjacent township lands). Multiple amphibian species were documented breeding in ELC Unit 11, including: Spring Peeper (*Pseudacris crucifer*), Wood Frog (*Lithobates sylvaticus*) and Northern Leopard Frog (*Lithobates pipiens*) during other fieldwork conducted on site in April 2019. American Toad (*Anaxyrus americanus*) and Green Frog (*Lithobates clamitans*) are also likely present along with several other amphibians that are not of conservation concern. Targeted surveys for snakes were not conducted as no endangered or threatened snakes have the potential to occur at the site. During other on-site investigations, two Northern Watersnakes (*Nerodia sipedon*) were observed near the bridge. Additional snake species such as Eastern Milksnake (*Lampropeltis triangulum*) and Eastern Gartersnake (*Thamnophis sirtalis*) are likely to occur on site and in the general area.

Given the potential for turtles to occur in the study area, basking surveys were conducted on May 15 and 29, 2018 under ideal conditions (MNRF, 2015). Basking surveys were completed for the south channel, forebay and downstream of the spillway. Basking surveys were conducted using binoculars from onshore vantage points that provided good views of the limited number of potential basking areas. The conditions during the May 15 survey (14:50 to 16:45) were excellent as it had rained in the morning and thus when the survey started the sun had just come out and it was 18 C, with 0% cloud cover, Beaufort = 1. For the May 29 survey from 09:00 to 10:30 the temperature was 16 C, 0% Cloud cover, Beaufort = 1. It had been assumed that Blanding's Turtle (*Emydoidea blandingii*), a provincially endangered turtle, had the potential to occur in the study area, but that surveys may not reveal its presence in this part of the river-wetland system because the species occurs at low densities in this part of its geographic range and the study area provides limited basking opportunities (i.e., floating woody debris and hummocks are largely absent from the river and ELC Wetland Unit 11 was not initially part of the study area). Only two basking surveys were conducted because a Blanding's Turtle was observed moving over land on June 11, 2018 at the northeastern edge of the study area, thus confirming presence of the species. Additionally, two Snapping Turtles (*Chelydra serpentina*) and a Snapping Turtle nest excavated by a predator, were observed within the study area in 2018. The Blanding's Turtle and the Snapping Turtles were not observed during the basking surveys; however, seven Northern Map Turtles (*Graptemys geographica*) were observed basking on exposed rocks just downstream of the spillway in late June. The only turtle species likely to occur in the area that was not observed was the Midland Painted Turtle (*Chrysemys picta marginata*); however, it should be assumed that this species occurs in the general area and therefore has the potential to be present within the study area. Although turtles can and do nest along the existing gravel roads on site, there are no areas of highly probable nesting habitat so mitigation strategies for turtles will entail a broad approach to protection rather than protecting a specific area.

3.2.6 Endangered and Threatened Species

Table 3-3 below provides a summary of the provincially endangered and threatened species that were considered to potentially occur on or adjacent to the study area based on the background review.

Table 3-3. Endangered and Threatened Species

Common Name	Scientific Name	Status on SARO List	Were Species and/or Habitat Documented during On-site Assessment?
Blanding's Turtle	*Emydoidea blandingii*	THR	Yes, species observed in study area (more detail is provided in the Terrestrial Environment TSD, Table 3-6)
Barn Swallow	*Hirundo rustica*	THR	Yes, species and nests observed in study area.
Bank Swallow	*Riparia*	THR	No, species not detected during breeding bird surveys.
Bobolink	*Dolichonyx oryzivorus*	THR	No, species not detected during breeding bird surveys.
Eastern Meadowlark	*Sturnella magna*	THR	No, species not detected during breeding bird surveys.
Chimney Swift	*Chaetura pelagica*	THR	No, species not detected during breeding bird surveys.
Northern Myotis	*Myotis septentrionalis*	END	Yes, species detected using remote acoustic monitoring and trees (snags) suitable for roosting documented within study area. Species was not observed emerging from powerhouse during exit surveys.
Little Brown Myotis	*Myotis lucifugus*	END	Yes, species detected using remote acoustic monitoring and trees (snags) suitable for roosting documented within study area. Species was not observed emerging from powerhouse during exit surveys.
Tri-colored Bat	*Perimyotis subflavus*	END	Yes, species detected using remote acoustic monitoring and trees (snags) suitable for roosting documented within study area. Species was not observed emerging from powerhouse during exit surveys.
American Ginseng	*Panax quinquefolius*	END	No, species not observed during floral surveys or other site visits.
Butternut	*Juglans cinerea*	END	No, species not observed during floral surveys or other site visits.
Pale-bellied Frost Lichen	*Physconia subpallida*	END	No, suitable habitat is absent.

SARO: Species at Risk in Ontario List (Ontario Regulation 230/08)
END: Endangered
THR: Threatened

Five species subject to regulations under the provincial ESA were documented to occur within the study area. These were: Blanding's Turtle, Barn Swallow and three bats (Little Brown Myotis, Northern Myotis and Tri-colored).

3.2.7 Species of Conservation Concern

Table 3-4 lists the species of conservation concern that are designated special concern on the provincial SARO list and that were documented in the study area. These species are not subject to the protective requirements under Sections 9 and 10 of the ESA.

Table 3-4. Special Concern Species (Provincial)

Common Name	Scientific Name	Status on SARO List	Were Species and/or Habitat Documented during on-site Assessment?
Snapping Turtle	*Chelydra serpentina*	SC	Yes, species documented during site visits.
Northern Map Turtle	*Graptemys geographica*	SC	Yes, species documented during site visits.
Eastern Wood-pewee	*Contopus virens*	SC	Yes, species documented during breeding bird surveys.

SARO: Species at Risk in Ontario List (Ontario Regulation 230/08)

SC: Special Concern

In addition to these three special concern species, Woodland Pinedrops is considered a species of conservation concern because of its provincial rarity rank of S2. Mitigation measures to protect these species are provided in Chapter 4.

3.3 Socio-Economic Environment

This section is a description of the socio-economic environment surround the Calabogie GS. A more detailed description can be found in the Socio-Economic Environment TSD.

3.3.1 Regional and Local Socio-Economic Environment

The Calabogie Generating Station (Calabogie GS) is located within village of Calabogie, which is part of the Township of Greater Madawaska. The Township of Greater Madawaska is a lower tier municipality within the regional government of Renfrew Country located in eastern Ontario (see Figure 2-1).

The total population of Greater Madawaska in 2016 as 2,518 representing a 1.3% increase from the 2011 population. The demographic characteristic that is most unique about Greater Madawaska is the age of the population. In 2016 the average and median ages of the population were 51.6 and 57.5 respectively. These figures are noticeably higher than average and median ages for the populations of Renfrew County (43.2 and 44.8) and the Province of Ontario (41.9 and 42.4) (Statistics Canada, 2016). Information on household and family characteristics in Greater Madawaska indicate slightly smaller household and family sizes, which suggests that the households and families in the Township are characterized by an older population.

The total number of private dwellings in Greater Madawaska is 2,170. What is unique about Greater Madawaska in relation to Renfrew County and Ontario is the large proportion of dwellings that are “not regularly occupied”. Of the 2,170 total private dwellings, 1,178 were identified as usually occupied indicating 992 are not regularly occupied. This represents 46% of the Township’s dwelling stock in comparison to 14% for Renfrew County as a whole and 8% throughout Ontario (Statistics Canada, 2016). The high proportion of dwellings “not regularly occupied” is a reflection of the large number of seasonal cottages, cabins and other housing stock in the Township. This large proportion does demonstrate the likely economic importance of the cottaging, recreational and tourism industry in Greater Madawaska.

With respect to income, the income characteristics for Greater Madawaska are generally in the same range as Renfrew County and Ontario. Perhaps the broadest measure of income is the median total income of households where for Greater Madawaska it was $64,768 in contrast to $67,683 for Renfrew County and $74,287 for Ontario (Statistics Canada, 2016).

With respect to the composition of total income, the main difference between Greater Madawaska in contrast to Renfrew County and Ontario is the slightly higher reliance on government transfers at 17% for Greater Madawaska versus 12% and 11% respectively for Renfrew County and Ontario. This slightly higher reliance on government transfers may be a result of specific government transfer payments available for senior citizens (Statistics Canada, 2016).

In a similar fashion the participation rate in the economy is slightly lower (50.8%) in Greater Madawaska than it is in Renfrew County (61.2%) and Ontario (60.6%). This is also likely a result of the older population in Greater Madawaska. The unemployment rate at the time of the census in 2016 was higher in Greater Madawaska (8.8%) than in Renfrew County (7.2%) and Ontario (7.4%) (Statistics Canada, 2016).

Major employers in Renfrew County are diverse but include: large public sector employers such as Garrison Petawawa, Renfrew County, Renfrew County School Board, Algonquin Provincial Park and the various hospitals and health services institutions in the region; and, major private sector employers such as Canadian Nuclear Laboratories, aerospace industry firms, call centres and various medium and small sized forest products mills and woodland operations (Renfrew County Economic Development Department, 2018). Along with these major employers, Renfrew County is comprised of a diverse mixture of small cities, towns, villages, rural land and large expanses of public forested crown land, particularly in the northern part of the County. The mixed urban, rural and forested landscape promote various resource-based industries such as the forest industry, aggregate resources, agriculture, tourism and cottaging.

3.3.2 Land, Water and Resource Use

3.3.2.1 Land Use

Renfrew County is comprised of a diverse mixture of small cities, towns, villages, rural land and large expanses of public forested crown land, particularly in the northern part of the County. Some of the larger communities within Renfrew County include the City of Pembroke and towns such as Renfrew, Arnprior, Chalk River, Deep River, Eganville, Barry’s Bay, etc. The mixed urban, rural and forested landscape promote resource-based industries such as the forest industry, aggregate resources, agriculture, tourism and cottaging.

The Township of Greater Madawaska is comprised of a mix of forested crown and private land with agricultural, residential and recreational properties scattered throughout the Township. The village of Calabogie is the commercial and municipal government centre for the Township.

The existing Calabogie GS is over 100 years old and the facility pre-dated any form of municipal land use plan for the area. The most recent version of the Country of Renfrew Official Plan went into force as of April 25, 2018.

According the Official Plan of Renfrew County (see “COUNTY OF RENFREW SCHEDULE “A” Township of Greater Madawaska Enlargement) the OPG lands associated with the Calabogie GS are designated as “Rural”. Most of the lands immediately adjacent to the facility have the same designation except for the Village of Calabogie which is designated as “Village Community”. This same Schedule demonstrates the patchwork tenure of both crown and private rural land throughout much of the Township.

The Zoning By-Law for the Township of Greater Madawaska is Zoning By-Law No. 22-2003. The By-Law was adopted by the Township in 2003 and approved by the Ontario Municipal Board in 2004. According to the Township of Greater Madawaska Zoning By-Law, the Calabogie GS is to be considered as a “Public Service” under section 3.24, where it states:

> *“The provisions of this By-law shall not apply to the use of any land or to the erection or use of any building or structure for the purpose of a public service by the Municipality or any local board thereof defined by the Municipal Affairs Act (R.S.O. 1980), by any telephone, gas, electrical generating or distribution company, communications company, or by any department or agent of the Government of Ontario or Canada, provided that: (a) With the exception of a public utility, the lot coverage, parking and loading, setback and yard requirements prescribed for the Zone in which such land, building or structure is located shall be complied with; and (b) No goods, material, or equipment shall be stored in the open in a Residential Zone; and (c) Any building erected in a Residential Zone or in a Zone which permits residential uses under the authority of this paragraph shall be designed and maintained in general harmony with residential buildings of the type permitted in the Zone.”*

The Calabogie GS would be defined as a building for the purpose of electrical generating and therefore the by-law would not apply. It should be noted that Schedule D of the Zoning By-Law designates the land as “Rural” and “Flooded”.

3.3.2.2 Access, Transportation and Community Infrastructure

The Calabogie GS is located just outside the Village of Calabogie and is accessed by County Road 511 (also known as Highway 511). An OPG private road (Generating Station Lane) connects the GS to Highway

511. That road is about 0.5 km in length and is gated at a point along the road. OPG also has an unnamed road immediately north of Generating Station Lane that accesses Calabogie Island and the north side of the existing spillway.

The Municipality of Greater Madawaska has a winter dry hydrant located between the Inlet Sluices and the South Branch Main Dam of the Calabogie GS that they use to fill up the water pumper trucks in the winter. The hydrant is in this location because the municipality's fire department requires access to open water in the winter.

There is no Conservation Authority for the Madawaska River watershed.

Examination of the Ministry of Environment, Conservation and Parks' (MECP) Source Protection Information Atlas website (https://www.gisapplication.lrc.gov.on.ca/SourceWaterProtection/Index.html?viewer=SourceWaterProtection.SWPViewer&locale=en-US) identified that the Calabogie GS is not located within a source water protection area near Calabogie GS (retrieved July 10, 2018). It appears the closest one is near Almonte to the southeast by over 20 km.

OPG is not aware of any water treatment plants or sewage treatment plants in the Calabogie GS to Stewartville GS reach.

A regional trail, known as the K & P Trail has its southern terminus located just east of the intersection of Highway 511 and OPG's access Road, "Generating Station Lane". The Trail is located on the former railbed of the former Kingston & Pembroke Rail Line. The K & P Trail in this location connects Calabogie to Renfrew and various stakeholders have and are developing the trail on other segments of the former rail right-of-way. There is some parking in this area for trail users, although it is not clearly delineated on the ground. The County has requested that the trail and parking area be kept clear at all times.

In winter, the K & P Trail also serves as a snowmobile trail (referred to as E105A) and connects to the broader network of snowmobile trails in the Province. The snowmobile trail was formerly co-located along Generating Station Lane but the licence has not been renewed by OPG. The snowmobile trail now crosses the adjacent Township Works yard.

3.3.2.3 Water Management and Uses

3.3.2.3.1 Water Management Plan

A Water Management Plan for the Madawaska River System was initially approved in 2000. The current version (2009) of the Water Management Plan (WMP) was signed for approval in 2010. The WMP was the culmination of several years of planning and input from a wide variety of stakeholders.

In Ontario, a water management plan sets out legally enforceable provisions for the management of flows and levels on river within the values and conditions identified within the water management plan. In instances where, due to emergency energy shortages, the Independent Electricity System Operator requests that owners of the waterpower facilities and associated water control structures seek relief from certain provisions of the WMP, the Ministry of Natural Resources and Forests will consider those requests expeditiously and, after consultation with the Independent Electricity System Operator (IESO), may allow short-term relief from certain provisions. The mandatory provisions of the water management plan will be waived, as appropriate, when the dam owners (which may include other dam owners, such as the MNRF are requested to do so by a police service or other emergency organization. In instances of unscheduled facility imperatives (e.g. emergency maintenance etc.), MNRF will consider requests from the owner for temporary relief from the plan expeditiously with consideration to the relative priorities of both MNRF and the owner (OPG, 2009).

As outlined in the Madawaska River WMP (OPG, 2009), Calabogie GS presently operates as a peaking plant in conjunction with the four other OPG owned GSs on the Madawaska River. The generating units at the station have limited flow capacity (66 m^3/s), but the operation of the units and sluice gates are integrated with the rest of the peaking system on the Madawaska River. Calabogie is a generation bottleneck on the Madawaska River, and the small turbine capacity results in frequent spill past the station.

The operation of the existing plant is based on a daily/weekly cycle, with the inflow passed through the plant over a daily or weekly period. The 2009 WMP notes that operation of the plant takes into consideration energy demands, recreational opportunities as well as walleye spawning activities.

The Calabogie GS including the reaches from Barrett Chute GS to Calabogie and Calabogie to Stewartville GS operate according to a series of compliance requirements established in the WMP. These were previously discussed in Chapter 2 of this Report.

It is important to note that there has historically been concern with respect to the fluctuation of water levels in the Calabogie-Stewartville Reach. This was expressed in the WMP in Section 5.2.8.1. OPG already operates this reach of the River with a more narrow compliance range during the summer from the May long weekend to the Thanksgiving Day weekend but it has been suggested in that past by members of the public that this more narrow reach be extended. As a result, OPG prepared Information Need 7.2.8.9 in October 2012 named the Stewartville Flow to Rule Curve. This Information need was carried out to assess the impact of a Rule Curve for Stewartville on the operations of the Madawaska River. The proposed Rule Curve was put forward by a member of the Standing Advisory Committee. The Rule Curve was developed to improve recreational opportunities on the Stewartville Reach. The assessment of the impact of the Rule Curve includes changes to the operating flexibility, revenue and compliance administration. In that Report, OPG recommended against adopting a new rule curve for the reasons outlined below (pp. 17 – 19):

> *"At OPG facilities the existing summer range covers the May long weekend to the Thanksgiving weekend. Non-OPG facilities on the river use a summer range for recreational use only in the months of July and August. OPG will not consider any extension of the summer range outside of the period between the May long weekend and the Thanksgiving weekend. The significant reduction in revenue, compliance administration associated with extending the summer season would result in a significant*

negative impact to operations on the Madawaska River and thus is not a viable change to the MRWMP.

The reduction in the operating flexibility with the proposed Rule Curve further reduces the already limited flexibility that exists between Calabogie, Stewartville and Arnprior. The reductions in the operating flexibility and more specifically the inability to limit generation to the on peak periods at Stewartville are significant. There is also a reasonable reduction in revenue and increased compliance administration associated with the proposed Rule Curve. OPG can not recommend adopting the proposed Rule Curve because of the reduction in operating flexibility, annual reduction in revenue and the increased compliance administration. However, OPG will review the existing study data and explore other alternatives for the users of the reach to consider.

OPG has reviewed the proposed Stewartville Rule Curve. The implementation of the proposed Rule Curve would reduce operating flexibility at Calabogie, Stewartville as well as Arnprior, reduce revenue and requires a significant amount of additional effort to monitor and ensure regulatory compliance. OPG can not recommend adopting the proposed Rule Curve. OPG will review the existing study data and explore other alternatives for the users of the reach to consider. However, OPG will not be considering increasing the length of the Summer period."

3.3.2.3.2 Water Management Uses

Upstream of the Calabogie GS is Calabogie Lake, a large recreational lake. The majority of the perimeter of Calabogie Lake is rimmed by cottages, homes and other recreational properties. Similar to other major cottaging lakes in Ontario, the lake is used for a diverse mix of water based recreational uses such as fishing, boating, water skiing, jet skiing, etc.

Water levels on Calabogie Lake are regulated within a fairly tight operating band, 153.80 -154.17 m (37 cm), through the summer period, to accommodate boating and other recreational concerns.

Downstream of the Calabogie GS is the Madawaska River. Most of the north bank of the Madawaska River from the Calabogie GS to the Burnstown Bridge is populated with cottages and homes, while most of the south bank remains largely undeveloped. Recreational use on the River includes fishing, boating, water skiing, canoeing, jet skiing, etc. A portage around the GS is located on the north side of the North Channel and would be unaffected by the proposed undertaking.

Water levels in this stretch of the River are impacted by the combined operations of Calabogie GS and Stewartville GS. Water levels in the summer period from the Victoria Day Weekend to Thanksgiving are constrained to a more narrow operating range than the balance of the year.

A canoe route currently exists at the Calabogie GS and is located on the south side of the Generating Station. The canoe route will not be impacted by the proposed undertaking.

The issues and concerns with respect to the fluctuation of water levels in the Calabogie to Stewartville Reach were discussed in Section 3.3.2.3.1.

3.4 Cultural Resources

3.4.1 Indigenous Context

The Project occurs within the traditional territory and boundary area of the Algonquins of Ontario Settlement Area. More information on this traditional territory and Algonquins of Ontario Agreement-in-Principle can be found here: http://www.tanakiwin.com/our-treaty-negotiations/overview-of-treaty-negotiation.

In April of 2019, the MoECP informed OPG that consultation with respect to the proposed project is also to occur with four Williams Treaty First Nation communities for the area known as the Treaty 27 area.

More information on the Indigenous Peoples in the region are provided in section 3.5 below.

3.4.2 Archaeological Resources

Stage 1 and 2 archaeological assessments have been conducted at the Calabogie GS including fieldwork participation from a representative of the AOO. Generally, archaeological potential is considered to be land which is undisturbed, well-drained, and low-sloping, proximal to lakes and streams of a sufficient width to allow the passage of watercraft. The archaeological potential of the property was assessed using criteria outlined in Sections 1.3.1 and 1.3.2 of the MTCS *2011 Standards and Guidelines for Consultant Archaeologists* and refined using Section 1.3.3 for properties on the Canadian Shield. Following the Stage 1 assessment, areas of archaeological potential were identified within the study area on both sides of the Madawaska River.

The Stage 2 portion of this assessment subjected all areas of identified archaeological potential to a Stage 2 sub-surface survey in accordance with the Ministry of Tourism, Culture and Sport (MTCS) *2011 Standards and Guidelines for Consultant Archaeologists*. The survey involved the excavation of sub-surface test pits on a five-metre grid with all soils examined for the presence of archaeological materials. At the conclusion of the Stage 2 testing, no archaeological resources were located. As no archaeological resources were located during the Stage 2 sub-surface survey of the areas of archaeological potential at the Calabogie Generating Station, no further archaeological resource assessment work was recommended (Woodland Heritage Northeast, 2019).

In on-going discussions between OPG and the AOO the AOO wanted it to be known that the AOO has "outstanding issues of concern related to archaeological assessments and adverse impacts to potential cultural heritage values that are being pursued under separate correspondence to the Ministry of Heritage, Sport, Tourism and Culture Industries dated February 25, 2020 and copied to OPG."

OPG, AOO and AoPFN have had discussions about additional archaeology work.

3.4.3 Built Heritage

The Calabogie Light and Power Company of Renfrew, owned by M.J. O'Brien, Limited, developed the Calabogie GS primarily for wartime purposes in 1917. A railway siding was constructed to the Calabogie GS site from the K&P main line, which aided in the rapid construction of the plant. Much of the equipment in the plant and the Renfrew Substation was manufactured for other customers; however, they were suitable for the conditions at Calabogie and with few modifications were quickly installed. Typical of the period before 1920, the Calabogie GS was financed and built by private interests to fulfill local demands, in this case, the businesses of O'Brien including the O'Brien Munitions, Limited and the Energite Explosives Company Ltd. in Renfrew and the Renfrew Molybdenum Mines at Mount St. Patrick. Power was also supplied to the communities of Calabogie and Renfrew as well as the O'Brien's farm at Barryvale. O'Brien was also the president of the Galetta Electric Power and Milling Company, Ltd., which owned the Galetta GS and the distribution network in Arnprior that delivered electrical energy to the villages of Carp, Kinburn and Galetta and the surrounding farmland. After the construction of the Calabogie GS, the two systems were linked (Unterman McPhail, 2017)

The Cultural Heritage Evaluation Report (CHER) for the subject property was completed in March 2017 concluded that the property fulfilled the evaluation criteria for determining the cultural heritage value or interest set out for local significance in Ontario Regulation 9/06 under the *Ontario Heritage Act* (OHA) and that it was a Provincial Heritage Property (PHP). It did not meet the criteria for provincial significance in Ontario Regulation 10/06. Subsequently, a Cultural Heritage Impact Assessment (CHIA) assessed potential impacts to the Calabogie GS as a result of the redevelopment project. This is discussed in Chapter 4.

3.5 Indigenous Peoples

3.5.1 Government Direction

Direction with respect to which Indigenous peoples to consult with, was sought from the Ontario Ministry of Environment and Climate Change (MoECC). It is OPG's understanding that the identification of which Indigenous peoples to consult with remains a Crown responsibility and as this is a project being pursued under the *Environmental Assessment Act* in Ontario, the MoECC has lead responsibility.

In a letter dated March 5, 2018 the then MoECC directed OPG to carry out consultation with the Algonquins of Ontario (AOO). No other Indigenous communities were included in the list.

Subsequently, on April 17, 2019 the MoECP added additional Indigenous communities to the consultation list. This additional list is comprised of four Williams Treaty First Nation communities (Williams Treaty communities): Alderville, Curve Lake, Hiawatha and Mississaugas of Scugog Island.

A description of the various Algonquin and Williams Treaty communities and organizations is provided below.

3.5.2 Algonquins

The Algonquins lived in present-day Ontario for thousands of years before Europeans arrived. Algonquin territory originally extended from the St. Lawrence River to the French River in the west, south to the Adirondack mountains in New York State, and north above Lake Abitibi. Over the past several hundred years, the description of Algonquin Territory has changed to be the lands and waters on both sides of the Ottawa River watershed from modern Hawkesbury to Lake Nipissing and north past the headwaters of the Ottawa River.

Algonquin petitions to the Crown seeking recognition and protection for Algonquin land and other rights date back to 1772.

In 1983, the Algonquins of Pikwakanagan First Nation (known at the time as the Algonquins of Golden Lake) commenced the land claim by formally submitting the most recent petition, with supporting research, to the Government of Canada in 1983 and the Government of Ontario in 1985. The Province of Ontario accepted the claim for negotiations in 1991 and the Government of Canada joined the negotiations in 1992.

Today, ten Algonquin communities comprise the Algonquins of Ontario:

- Algonquins of Pikwakanagan First Nation;
- Antoine;
- Kijicho Manito Madaouskarini (Bancroft);
- Bonnechere;
- Greater Golden Lake;
- Mattawa/North Bay;
- Ottawa;
- Shabot Obaadjiwan (Sharbot Lake);
- Snimikobi (Ardoch); and,
- Whitney and Area.

Each of these Algonquin communities is generally located in a certain area and has its own unique history and organization. Some geographical details on each of these communities is provided in this section.

Based on a Protocol signed in 2004, these communities are working together to provide a unified approach to negotiate a modern-day Treaty. The Algonquins of Ontario Settlement Area includes a territory of nine million acres within the watersheds of the Kichi-Sìbì and the Mattawa River in Ontario.

This unceded territory, encompasses most of Eastern Ontario, including the City of Ottawa, and most of Algonquin Provincial Park. More than 1.2 million people live and work within the unceded AOO Settlement Area. There are 84 municipal jurisdictions fully and partially located within the unceded AOO Settlement Area, including 75 lower and single tier municipalities and nine upper tier municipalities.

On October 18, 2016, the AOO and the Governments of Ontario and Canada reached a major milestone in their journey toward reconciliation and renewed relationships with the signing of the Agreement-in-

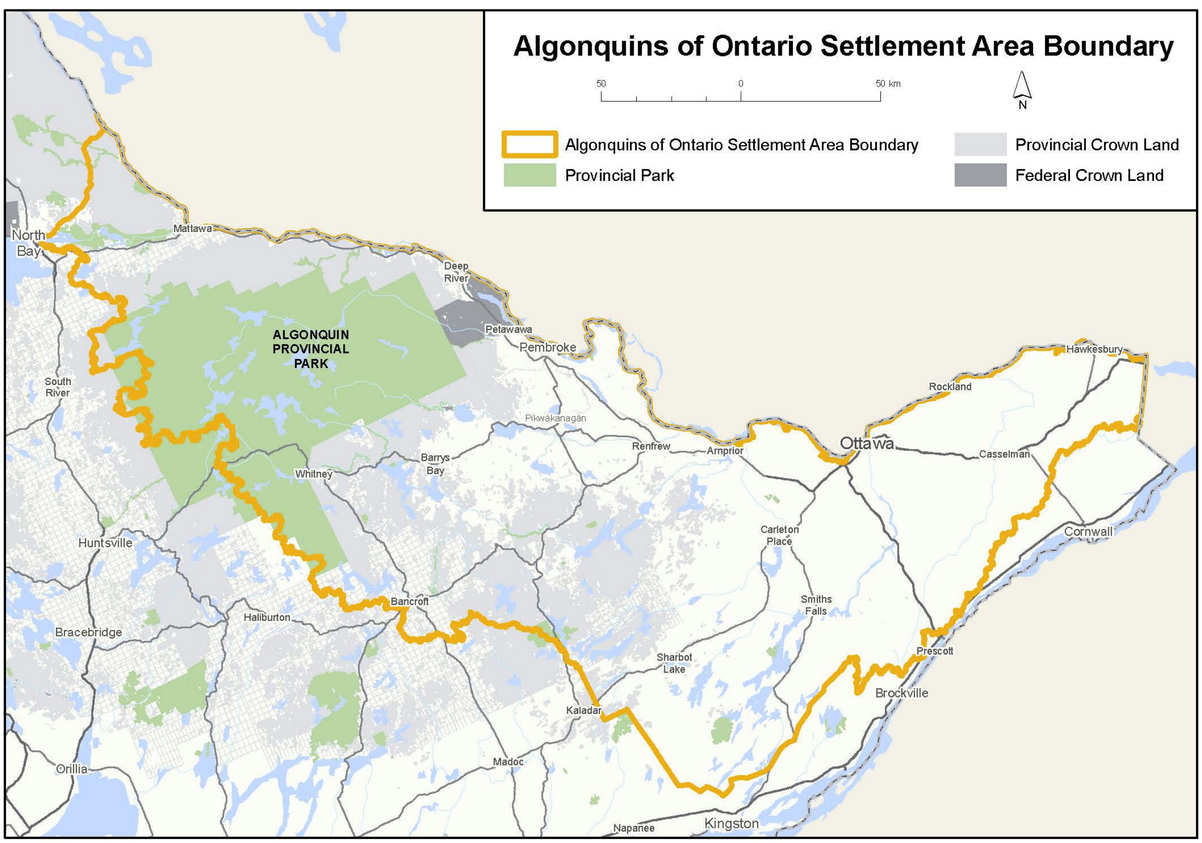
Principle (AIP). The signing of the AIP is a key step toward a Final Agreement, which will clarify the rights of all concerned and open up new economic development opportunities for the benefit of the AOO and their neighbours in the Settlement Area in Eastern Ontario.

Furthermore, by signing the AIP, the AOO and the Crown have expressed, in a formal way, their mutual intention and desire for a lasting partnership. This event signaled the beginning of a new relationship between the AOO and the Crown, one in which the mistakes of the past must be supplanted by a new type of mutual respect and cooperation.

The AIP is not a legally binding document. Rather, it opens the way for continued negotiations toward a Final Agreement that will define the ongoing rights of the Algonquins of Ontario to lands and natural resources within the Settlement Area in Eastern Ontario.

The Negotiation Teams are now hard at work to ensure that the next phase of negotiations towards a Final Agreement will succeed. If a Final Agreement is achieved through this next phase, and if it is ratified by Algonquins and by the federal Parliament and provincial Legislature, it will take the form of a modern-day treaty setting out Algonquin Aboriginal and treaty rights protected under the Constitution.

Figure 3-15. Algonquins of Ontario Settlement Boundary



Source: AOO, 2019c

To our knowledge, consultations by the AOO are to be undertaken according to the *Consultation Process Interim Measures Agreement* dated July 2009, which is signed by the AOO and the governments of Ontario and Canada. This Agreement can be found on the AOO website at: http://www.tanakiwin.com/our-treaty-negotiations/rv/. To our understanding, the *Interim Measures Agreement* helped establish the Algonquins of Ontario Consultation office and identified it as the central point for consultation notices for the Algonquins (see point #6 under Consultation Process). This point is repeated below:

> Where a federal department, provincial ministry or other Crown agency proposes a particular decision or activity that is applicable to the territory as depicted on the map attached as Appendix "A," and where such decision or activity gives rise to a duty to consult with the Algonquins, it shall provide to the Algonquin Consultation Office appropriate notice and information of the proposed decision or activity.

Based on this article of the *Interim Measures Agreement* OPG/Arcadis are of the opinion that notification and initial consultation is to be with the AOO. OPG has had some historic direct communications with the Algonquins of Pikwakanagan First Nation, whom are part of the AOO. As a result of that history, OPG has normally copied the Algonquins of Pikwakanagan on communications with the AOO.

The Agreement-in Principle (AIP) included a large number of "Settlement" lands that would eventually be transferred to the Algonquins. In general, the majority of the acreage of the Settlement lands is in the northern area where there is more provincial crown land. Near Calabogie there is only one "Settlement" parcel close to the GS and potentially affected by it. This Parcel is referred to as "Parcel 129Q" and is a 3.4 hectare property along the south shore of the Madawaska River approximately 2 to 3 km downstream of the GS. According to the AOO website, Interactive Map (AOO, 2019b), the Algonquin community of interest to this site is Bonnechere. The Bonnechere Algonquin Community is located in and around Renfrew. This property is identified as unpatented crown land in Bagot Township (MNR, 2013; AOO, 2019b).

3.5.2.1 Algonquin History

A short history of the Algonquins in Ontario is provided below to help provide historical context. References were provided by the AOO to help assist in putting together this history and the AOO also provided helpful editing.

The term "Algonquin" is part of the broader suite of Algonquian (also spelled Algonkian) languages that includes Cree, Blackfoot, Micmac, Ojibwa, etc. that are or were generally spoken in eastern Norther America but as far west as the Rocky Mountains (Encyclopedia Britannica, 2019).

Information from the AOO website indicates that Algonquin ancestors of the modern day AOO citizens lived in the Ottawa Valley for over 8,000 years before the arrival of the first Europeans (AOO, UD).

The Algonquins have considered the Ottawa River to be at the heart of their traditional territory (Morrison, 2005).

Contact between Algonquins and the French is first believed to have occurred in 1603 at the French Settlement of Tadoussac on the St. Lawrence River. Later in 1610 there was likely further contact when Etiene Brule accompanied other native peoples on his voyages into the interior of what is now Ontario and in 1613 when Champlain paddled the Ottawa River (Canadian Museum of History, 2019).

The Algonquins used and occupied the entire watershed of the Ottawa River. Morisson (2005) noted that the Algonquins were sometimes described as nomadic, but this was only by comparison with the more sedentary Iroquois and Huron who lived in large villages. Morrison (2005) noted:

> "that generally speaking, families remained within their band's territory, following a seasonal round of resource harvesting activities. During the winter, they lived in the bush in extended families, hunting large game like moose and deer, and trapping fur-bearing animals, particularly beaver, which was valued both for its pelt and flesh. Though fishing took place year-round, it was most productive between spring and fall. Champlain mentioned that Muskrat Lake (near Cobden) was an important fishery for all the people in the surrounding area … the Nipissings and the Algonquin bands along the Lower Ottawa also practiced a form of slash and burn agriculture. Champlain saw cornfields at Muskrat Lake and peas, beans and squash, as well as corn, growing on Allumette Island. However, he noted that the soil was relatively poor, and that the Algonquins, unlike the Hurons, relied more on hunting than on tilling the soil."

Trigger and Day (1994) noted that similar to more northern groups they likely dispersed in the winter for survival but congregated along major waterbodies during the summer months to fish. During the early period of the fur trade the Algonquins performed a "middle man" role between the French and First Nations such as the Huron to the west. As noted, "This not only allowed French traders and missionaries to travel to the western Great Lakes, but permitted many of the other Algonquins to begin a gradual return to the Ottawa Valley." (AOO, 2019)

For extended periods from about 1570 to 1667, the Algonquins and their allies fought against the Five Nations Iroquois punctuated by brief periods of peace. Intense warfare led to the destruction of Huronia by the Iroquois in the middle of the 17th century and forced the Algonquins to retreat from their territory. A general peace between the French and the Iroquois in 1667 allowed the Algonquins to gradually return to the Ottawa Valley. The Great Peace of Montreal in 1701 achieved a period of peace among the Indigenous nations and between them and the French.

Morrison (2005) describes the changes that occurred for the Algonquins in the Ottawa Valley in the 18th century:

> "With the passing of the Iroquois threat in 1701, the various bands of the Algonquin Nation would have undisturbed possession of the Ottawa River watershed for more than a century. Several decades of close contact with French officials and missionaries, however, together with the population decline caused by the Iroquois wars and epidemical diseases, had brought about changes in their social organization."

Algonquins and warriors from eight other villages, formerly allied to the French met with the British representative, Sir William Johnson, and signed a treaty in which they agreed to remain neutral as the British marched on Montreal (Morrison 2005). The British took Montreal in September; Quebec City had fallen the previous year. The Treaty of Paris was signed in 1763 formally ending the Seven Years' War.

The Royal Proclamation of 1763 laid out the protocols and process for purchasing Indigenous land which could only be purchased by the Crown in open council with Indigenous nations. The AOO describes well the period following the Royal Proclamation and how the Algonquins never did sign a Treaty:

> "The Algonquin homeland was supposed to be protected from settlement by the Proclamation of 1763, but after the revolution ended in a rebel victory, thousands of British Loyalists (Tories) left the new United States and settled in Upper Canada. To provide land for these newcomers, the British government in 1783 chose to ignore the Algonquin in the lower Ottawa Valley and purchased parts of eastern Ontario from Mynass, a Mississauga (Ojibwe) chief. Despite this, Algonquin warriors fought beside the British during the War of 1812 (1812-14) and helped defeat the Americans at the Battle of Chateauguay. Their reward for this service was the continued loss of their land to individual land sales and encroachment by American Loyalists and British immigrants moving into the valley. The worse blow occurred when the British in 1822 were able to induce the Mississauga near Kingston on Lake Ontario to sell most of what remained of the traditional Algonquin land in the Ottawa Valley. And for a second time, no one bothered to consult the Algonquin who had never surrendered their claim to the area but still received nothing from its sale."

The well-respected historian Joan Holmes (1998) noted:

> "The British Crown never entered into formal treaty relations with the Algonquin and Nipissing, despite the fact that the Algonquin and Nipissing repeatedly petitioned British authorities to compensate them for the loss of their traditional lands and the destruction of the resources upon which they depended for their livelihood."

Holmes in 2005 noted:

> "On several occasions, authorities acknowledged their claims but no action was taken. Finally, under 1851 legislation land was set aside in Lower Canada, now Quebec, at the confluence of the River Desert and the Gatineau River and at Lake Temiskaming for the Algonquin and other tribes of the Upper Ottawa Valley. It took another 20 years to set aside lands on the Ontario side of the Ottawa River. In 1873, years after lands along the Ottawa had been surveyed and opened to white homesteaders, the Golden Lake reserve was purchased for the use of local Algonquins."

Algonquin and Nipissing leaders met in council with Crown representatives and sent petitions to the Crown asking for protection of their land and recognition of their rights in 1772, 1791, 1798, 1820, 1827, 1829, 1830, 1832, 1833, 1835, 1836, 1837, 1838, 1843, 1844, 1847, 1849, 1851, 1862, 1863, 1880, 1886, 1895, and 1897.

With respect to the Algonquins at Golden Lake, Holmes (2005) noted that:

> “Once the land at Golden Lake had been purchased for the Algonquin families living around the Bonnechere River area, Algonquins who petitioned the government seeking to protect the lands where they had gardens and homes were told to move to the established reserve at Golden Lake or to move across the river to the reserve on the River Desert … During the last decades of the 19th century and the beginning of the 20th century, many Algonquin families moved onto the Golden Lake Reserve, at least on a seasonal basis. The on-reserve population at Golden Lake became recognized as status Indians. Thus, although they did not have a treaty with the Crown, they gained official Indian status and their reserve and every aspect of their lives, became managed under *Indian Act* legislation and federal Indian Affairs policy.”

Along with the Algonquins of Pikwakanagan First Nation (referred to above as the Alqonquins at Golden Lake), the Algonquins of Ontario are comprised of nine other Algonquin communities spread throughout the Ottawa Valley: Antoine Algonquin First Nation; Algonquin Nation Kijicho-Manito Madaouskarini; Bonnechere Algonquin First Nation; Algonquins of Greater Golden Lake First Nation; Mattawa/North Bay Algonquin First Nation; Ottawa Algonquin First Nation; Shabot Obaadjiwan First Nation; Snimikobi (Ardoch) (Beaver Creek) Algonquin First Nation; and, Whitney Area Algonquins. The ancestors of these Algonquins communities lived throughout the Ottawa Valley. Holmes (1998) describes their historic situation:

> “The Algonquin/Nipissing families who did not move onto the reserve but continued to live in other parts of the Ottawa Valley were not officially recognized as Indians nor did they hold any reserve lands. As a consequence, their ancestors do not receive any of the benefits that flow from Indian status or on-reserve status such as educational support, community infrastructure support, economic development, or aboriginal hunting and fishing rights. These families form the core of non-status communities.”

The AOO represents Algonquins in Ontario and are politically separated from Algonquins in Quebec. The Algonquins of Quebec are represented by represented by the Algonquin Anishinabeg Tribal Council (ANTC) and include the nine First Nations communities in Quebec that stretch over a very large area in the western part of Quebec near the Ontario border. The Alqonquins of Quebec have previously initiated land claim actions into Ontario in the past and legal counsel for the AOO has indicated that the AOO land claim process does not prejudice such actions (Potts, 2010).

3.5.2.2 Pikwakanagan First Nation

Pikwakanagan First Nation (also referred to as the Algonquins of Pikwakanagan or AoPFN) is the only Algonquin community that is a recognized First Nation.

The Pikwakanagan First Nation occupies No. 06216, situated on the southeast shore of Golden Lake where it flows in to the Bonnechere River, in Renfrew County. The reserve covers an area of 688.8 ha (INAC, 2019c). Pikwakanagan First Nation has a total registered population of 2,784 (as of April, 2019). Roughly 84 percent of the registered population reside off reserve lands (2,327) (INAC, 2019c).

The reserve was established through a Crown patent in 1873 following several petitions from the community.

The Pikwakanagan First Nation have linguistic traditions in the Algonquin language. Within the community, efforts are being taken to revitalize the language and culture through language programs and the community's Algonquin Way Cultural Centre. The Centre is operated by a not-for-profit organization, Omàmiwininì Pimàdjwowin, established by the First Nation's Council in order to foster and preserve the Algonquin cultural traditions, customs, practices, heritage, language and arts. The organization stewards a collection of approximately 600 historical/cultural objects including: ceremonial, hunting and trapping, canoe and water transportation, and military paraphernalia) at the Centre (Algonquins of Pikwakanagan First Nation, 2019a and 2019b).

Traditional activities such as trapping and hunting are also practiced by community members and efforts are made to pass on this traditional knowledge. The Pikwakanagan First Nation notes that it holds approximately nineteen trap-lines within Algonquin Provincial Park situated to the north of the community. Moose, elk and deer are harvested by community members both within and outside of Algonquin Provincial Park, within this First Nation's traditional territory (Algonquins of Pikwakanagan First Nation, 2019a).

The First Nation along with other Algonquin communities manage their own moose, elk and deer harvest under a Harvest Management Plan and total harvest numbers are allocated through agreements to work in conjunction with the MNRF, including taking part in information gathering activities. The current Harvest Management Plan is representative of all ten Algonquin First Nation communities within the Algonquins of Ontario (Algonquins of Pikwakanagan First Nation, 2019a).

The Pikwakanagan First Nation is governed by an elected council comprised of a Chief and six councillors. The types of electoral systems undertaken by First Nations in selecting a chief and councillors falls under one of four processes: a custom system, the Indian Act election system, the First Nations Elections Act, or under the provisions of a self-governing agreement. The electoral system for this community is a Custom Electoral System and council election occurs every three years through voting members of the First Nation (Algonquins of Pikwakanagan First Nation, 2019a; INAC 2019c).

3.5.2.3 Antoine Algonquin First Nation

The Algonquin community of Antoine, also known as the Antoine Algonquin First Nation, is a non-status community centred around Mattawa and areas to the north of Algonquin Provincial Park. The community has an administrative office in Mattawa.

Some research has noted difficulty associated with obtaining information on Antoine Algonquin First Nation based on an absence of historical documentation concerning community organization and leadership, patterns of land use, economic practices, and cultural and linguistic practices. As a means of obtaining government recognition as an aboriginal community, the Antoine have made efforts to document their history (Holmes, 1998).

The importance of hunting and trapping to the Antoine community is documented in the Antoine First Nation Aboriginal Background Information Report to the Nipissing Forest Management Plan. Other resource use activities are described in that report and include: berry picking, the collection of traditional medicines and traditional crafts and skills (Antoine First Nation, 2008).

3.5.2.4 Algonquin Nation Kijicho-Manito Madaouskarini

The Algonquin Nation Kijicho Manito, also members of the Madaouskarini Band, are an Algonquin community situated in the Bancroft area. Because of its close proximity to Algonquin Park the community has interests in Algonquin Park and noted that it is currently working toward identifying cultural and historical sites within Algonquin Park (Algonquin Nation Kijicho Manito, 2017).

The Algonquin Nation Kijicho Manito Madaouskarini, are an Algonquin community situated in North Hastings County, Ontario. Information describing this community is limited, although the community website identifies a Band Council comprised of a Chief and eight council members (Algonquin Nation Kijicho Manito Madaouskarini, 2019). The community site references numerous teachings and workshops associated with traditional culture and language. The community website references traditional harvesting and the community is affiliated with the Algonquins of Ontario represented Harvest Management Plan (AOO, 2016)

3.5.2.5 Bonnechere Algonquin First Nation

Bonnechere Algonquin First Nation claim both status and non-status members within its community (Bonnechere Algonquin First Nation, 2019). The community is located around the Bonnechere River near Golden Lake, and the community administrative office is situated in Renfrew, Renfrew County, Ontario.

Efforts to educate community members in Algonquin cultural traditions are evident through materials presented within the community website, and community cultural workshops (Bonnechere Algonquin First Nation, 2019).

Some research has noted difficulty associated with obtaining information on Algonquins of Bonnechere based on an absence of historical documentation concerning community organization and leadership, patterns of land use, economic practices, and cultural and linguistic practices (Holmes, 1998). Limited information on the history of the Bonnechere was present on the community website at the time this research was undertaken. However, the site does note a well developed political structure and membership of approximately 1200 (Bonnechere Algonquin First Nation, 2019).

Harvesting information presented on the community website relates to harvest of moose, deer and elk and the community is affiliated with the Algonquins of Ontario represented Harvest Management Plan (AOO, 2016).

3.5.2.6 Algonquins of Greater Golden Lake First Nation

The Algonquin community of Greater Golden Lake First Nation is centred around Golden Lake, in Renfrew County. As a non-status community, there is no reserve land specifically associated with the Greater Golden Lake community.

Based on information available on the website, the community presents its members with opportunities to revive and promote traditional cultural teachings through a Cultural Education group (Algonquins of Greater Golden Lake, 2019.

The community mailing address is to the west of Golden Lake in Killaloe, Renfrew County, Ontario. Based on information available on the website, the community presents its members with opportunities to revive and promote traditional cultural teachings through a Cultural Education group (Algonquins of Greater Golden Lake, 2019).

Harvesting information related to moose, deer and elk are presented on the community website and the community is affiliated with the Algonquins of Ontario represented Harvest Management Plan (AOO, 2016). Based on information presented on the community website, the First Nation participated with the Bancroft Minden Forest 2011-2021 Forest Management Plan and the Mazinaw-Lanark Forest 2011-2021 Forest Management Plan.

3.5.2.7 Mattawa-North Bay Algonquin First Nation

The Algonquin community of Mattawa-North Bay is centred around Mattawa, Ontario. A community administrative office is situated in Mattawa. The governing structure of the community is currently through an elected Chief and Council with six acting council members. The community also has an elected board of directors for its Madadjiwan Economic Development Corporation.

The community notes that while hunting or delivering furs, its ancestors used Mattawa as a staging point for resting and canoe repair before and/or after attempting the Mattawa River run. A more permanent settlement of Mattawa arose in the early eighteen-hundreds (Mattawa-North Bay Algonquin First Nation, 2019). The community website notes harvesting information related to harvest of moose, deer and elk. The community is affiliated with the Algonquins of Ontario represented Harvest Management Plan (AOO, 2016).

3.5.2.8 Ottawa Algonquin First Nation

The Ottawa Algonquin First Nation is a community that appears to be based out of Wendover, Ontario, to the east of Ottawa.

The community has been affiliated with the Algonquins of Ontario represented Harvest Management Plan (AOO, 2016).

3.5.2.9 Shabot Obaadjiwan First Nation

The Shabot Obaadjiwan First Nation is a community located in the Sharbot Lake area in the southern area of the Algonquin Land Claim. There is limited information presented in the community website that describes the community although a Chief is identified and some cultural information is present (Shabot Obaadjiwan First Nation, 2019). Some detail is provided on the community website with respect to moose and elk harvesting procedures and protocols (Shabot Obaadjiwan First Nation, 2019). The community is affiliated with the Algonquins of Ontario represented Harvest Management Plan (AOO, 2016).

3.5.2.10 Snimikobi (Ardoch) Algonquin First Nation

The Algonquin community of Snimikobi, also known as the Ardoch Algonquin First Nation or Beaver Creek, resides largely at the headwaters of the Mississippi River and Rideau River, around the Ardoch and Sharbot Lake area, north of Kingston, Ontario (Holmes, 1998).

Some research has noted that based on an absence of historical documentation concerning community organization and leadership, cultural and linguistic practices, economic practices and patterns of land use, it has been noted that there have been difficulties associated with obtaining information on this community (Holmes, 1998).

There is a strong traditional harvesting relationship with a self- seeding aquatic plant (‘wild rice’) known as Manòmin (Ardoch Algonquin First Nation, 2019).

The community is affiliated with the Algonquins of Ontario represented Harvest Management Plan (AOO, 2016).

3.5.2.11 Whitney and Area Algonquins

This Algonquin community resides in and/or around the Town of Whitney, Ontario which is near the Algonquin Park East Gate side of Algonquin Park in Renfrew County.

The community is affiliated with the Algonquins of Ontario represented Harvest Management Plan (AOO, 2016).

3.5.3 Williams Treaty First Nations

As previously indicated in Section 3.5.1 OPG was directed in April 2019 to also consult with four Williams Treaty First Nations communities, specifically: Alderville, Curve Lake, Hiawatha and Mississaugas of Scugog Island. The rationale for the late inclusion of these four communities into the consultation program for the proposed project was provided as follows (MoECP, 2019):

> "This letter is a follow up to our conference call discussion regarding pending changes to your Indigenous Consultation program because of new information and legal settlements which involved the province of Ontario, Canada and the Williams Treaty Communities (WTFN) in your project area which is known as the Treaty 27 area.
>
> Premised on the settlement agreement, the province now recognizes that WTFN communities hold pre-existing treaty rights in the project area. The proponent is directed to reach out to WTFN during this period of the EA process and share project details to determine what if any interests they may have in the area."

OPG seeks to understand the rights and interests of the Indigenous peoples it consults. By better understanding those rights and interests OPG can more accurately explain its projects, activities and possible effects and engage in more meaningful discussions. In the letter from the MoECP there was little detail about exactly what are the rights and interests of the Williams Treaty communities in the Calabogie area. Three of the Williams Treaty communities are located in the Peterborough area (Curve Lake, Alderville and Hiawatha) and Scugog First Nation is located west of Peterborough near Port Perry, Ontario. As such, the closest community (Curve Lake) is approximately 225 km (by road) to Calabogie. All of the four communities are located in different watersheds from the Madawaska River. It is OPG's understanding that the interests of the Williams Treaty First Nation communities are tied to the signing of Treaty #27 (confirmed in 1822) which includes the Calabogie area.

3.5.3.1 Alderville First Nation

The Alderville First Nation is a community of the Mississauga Anishinabeg of the Ojibway Nation, with linguistic traditions in the Ojibway language (Alderville First Nation, 2019) although many within the First Nation do not speak the language and have made efforts more recently to learn and teach it to younger members of the community (MacDonald, 2012). Since the mid-1830s, Mississauga Anishinabeg have resided in Alderville (Alderville First Nation, 2019).

Lands associated with this community include Alderville First Nation Reserve No. 06211 (1,199.8 ha), situated in Roseneath, Northumberland County on the south side of Rice Lake approximately 21 km southwest of Peterborough, Ontario, and Sugar Island 37A Reserve No. 06212 (40.5, located on an island in the north end of Rice Lake, Peterborough County, approximately 14 km southeast of Peterborough. The combined land base is approximately 1,240 ha (INAC 2019b).

The total registered population of this community is 1,197 (as of April 2019) (INAC 2019b). While Alderville First Nation Reserve No.06211 comprises the predominant land base for the community, approximately 73 per cent of the registered population reside off reserve lands (875). Many community members are employed by either the First Nation or by community members with self-owned businesses both in and outside of the community. Community members own most of the homes within the reserve (FNMHF, 2015).

The Alderville First Nation is governed by an elected council comprised of a Chief and four councillors. The electoral system occurs under the Indian Act and council elections occur every two years through ballot vote. The Alderville First Nation is a member Nation of the Ogemawahj Tribal Council and is also associated with the Union of Ontario Indians – Southeast Region (Government of Canada, 2019; INAC, 2019b).

The Alderville First Nation is a signatory of the 1923 Williams Treaties and preceding Southern Ontario Treaties (1764-1862). The community is part of the Anishinabek Nation (Union of Ontario Indians) – Governance – Sectoral Self-Government negotiations which, according to ATRIS, is in a phase of negotiations to finalize an agreement stage.

3.5.3.2 Curve Lake First Nation

The Curve Lake First Nation is a community of the Mississauga Anishinabeg of the Ojibway Nation, with linguistic traditions in the Ojibway language.

Three areas of reserve lands are associated with Curve Lake First Nation. The largest is Curve Lake First Nation 35 No. 06213 (765.7 ha) which is located on a peninsula situated between Buckhorn Lake and Chemong Lake in Peterborough County, Ontario. To the west of this reserve is Curve Lake 35A No. 06214 (202.3 ha) which is situated on Fox Island in Buckhorn Lake. A third area, Islands in the Trent Waters 36A No. 06197 (139.6 ha), comprises a group of several smaller islands in Pigeon, Buckhorn and Stony Lakes, Peterborough County. This reserve area is shared with the Hiawatha First Nation and the Mississaugas of Scugog Island First Nation.

The total registered population of this community is 2,378 (as of April 2019) with approximately 66 per cent (1,575) of the registered population residing off-reserve lands. The population is diverse, including both members and non-members of the First Nation residing on territorial lands (FNMHF, December 2013).

The current government structure employs a large staff of approximately 100 full-time and approximately 18 part-time employees across various administrative departments. A First Nation owned and year-round operated Cultural Centre serves as a draw to tourists into the area, providing additional revenue to the community. Curve Lake First Nation also shares management authority of the nearby Petroglyphs Provincial Park (located east of reserve lands), through an agreement with MNRF Ontario Parks branch. The site is considered sacred by the First Nation (Curve Lake First Nation, 2019) and contains the largest known concentration of petroglyphs within Canada (Ontario Parks, 2016).

The Curve Lake First Nation has an elected Council comprised of a Chief and eight Councillors with band elections held every three years. The First Nation's election system is under the Custom Electoral System that adheres to a Curve Lake First Nation Leadership Selection Code (Curve Lake First Nation, 2019). Curve Lake First Nation is not affiliated with any tribal council but is associated with the Union of Ontario Indians – Southeast Region (Government of Canada, 2019; INAC, 2019d).

The Curve Lake First Nation is a signatory of the 1923 Williams Treaties and preceding Southern Ontario Treaties (1764-1862). The community is part of the Anishinabek Nation (Union of Ontario Indians) – Governance – Sectoral Self-Government negotiations which is in a phase of negotiations to finalize an agreement stage based on information provided in ATRIS (Government of Canada, 2019).

3.5.3.3 Hiawatha First Nation

The Hiawatha First Nation, also known as the Mississaugas of Rice Lake, is a community of the Mississauga with linguistic traditions in the Ojibway language.

This First Nation occupy two areas of reserve lands. Hiawatha First Nation Reserve 06215 is located on the north shore of Rice Lake, east of the Otonabee River in Peterborough County, Ontario. The reserve has an approximate land base of 868.2 ha. A second area, Islands in the Trent Waters 36A No. 06197 (139.6 ha), comprises a group of islands in Pigeon, Buckhorn and Stony Lakes, Peterborough County. This reserve area is shared with the Curve Lake First Nation and the Mississaugas of Scugog Island First Nation. The Hiawatha First Nation has a total registered population of 657 (as of April 2019) with approximately 69 per cent (431) of the registered population residing off-reserve lands (INAC, 2019e).

The First Nation owns Serpent Mounds Park to the east of the community where it previously provided tourism services such as camping, cottage rentals and boating. The park was closed to the public in 2009 due to a decline in the tourism market. The park is the location of the National Historic Site of Serpent Mounds, an ancient Aboriginal historic and burial site, which is currently under the care of the Hiawatha First Nation (Hiawatha First Nation, 2019). First Nation operated businesses include a gas-bar, restaurant, tent and trailer park. Despite the park closure, tourism is considered an important component of economic development for the community with visitors encouraged to attend the annual Pow Wow displaying traditional dancing, singing and drumming (FNMHF, 2011).

The Hiawatha First Nation has an elected Council comprised of a Chief and four council members (Hiawatha First Nation, 2019). The First Nation's election system is under the Indian Act with a council quorum of a minimum of four members of Band Council to pass council decisions. The Hiawatha First Nation is not affiliated with any tribal council but is a member of the Association of Iroquois and Allied Indians (Government of Canada, 2019; INAC, 2019e).

The Hiawatha First Nation is a signatory of the 1923 Williams Treaties and preceding Southern Ontario Treaties (1764-1862).

3.5.3.4 Scugog First Nation

The Mississaugas of Scugog Island First Nation is a descendent of the Mississauga Nation. Efforts are underway to restore the Mississauga language within the community as the population rebounds from smaller numbers (Mississaugas of Scugog Island First Nation, 2019).

Two areas of reserve lands are occupied by the Mississaugas of Scugog Island First Nation. Mississaugas of Scugog Island No. 06196 (334.5 ha) is located approximately 42 km southwest of Peterborough at the north end of Scugog Island in Lake Scugog, Regional Municipality of Durham. The second reserve area, Islands in the Trent Waters 36A No. 06197 (139.6 ha), comprises a group of islands in Pigeon, Buckhorn and Stony Lakes, Peterborough County. This reserve area is shared with the Curve Lake First Nation and the Hiawatha First Nation (INAC, 2019f).

Compared to other communities described above, the Mississaugaus of Scugog Island community is smaller in number. This community has a total registered population of 238 (as of April 2019), with approximately 78 per cent (185) residing off reserve lands. Compared to the 1980's when the population allegedly was fewer than 15 community members (Denby, Date unknown) this population reflects a considerable increase and efforts to revitalize the culture of this First Nation are being undertaken, including Elder teachings and restoration of the traditional Mississauga language within the community. Efforts to support the community have also been made through economic development programs and services leading to local employment opportunities. Included among these is the Great Blue Heron Casino, owned and operated by the First Nation, and which is located on reserve lands on Scugog Island (Mississaugas of Scugog Island First Nation, 2019).

The Mississaugas of Scugog First Nation has an elected Council comprised of a Chief and two Councillors. The First Nation's election system is under the Indian Act. Band elections are held every two years. The Mississaugas of Scugog Island First Nation is a member of the Ogemawahj Tribal Council and is associated with the Union of Ontario Indians – Southeast Region. (Government of Canada, 2019; INAC, 2019f).

The Mississaugas of Scugog Island First Nation is a signatory of the 1923 Williams Treaties and preceding Southern Ontario Treaties (1764-1862). The community is part of the Anishinabek Nation (Union of Ontario Indians) – Governance – Sectoral Self-Government negotiations which, based on information provided through ATRIS, is in a phase of negotiations to finalize an agreement stage.

4 EFFECTS ASSESSMENT AND RECOMMENDED MITIGATION MEASURES

4.1 Potential Environmental Effects and Approach to Mitigation

4.1.1 Potential Environmental Effects

The OWA (2018) Class EA indicates that a proponent should prepare a Potential Effects Identification Matrix that is intended to provide guidance in assessing the relevance of potential impacts and benefits under individual criteria and for a project as a whole. Table 4-1 presents the various criteria outlined in the Class EA document and assigns a potential level of effect without any proposed mitigation measures. The last column is a commentary column on the potential effect on each criterion. The level of effect is scored as: High Negative (-H), Low Negative (-L), Nil, Unknown (UNK), Low Positive (+L) or High Positive (+H). The draft Matrix was circulated to government agencies for comment and discussed effects before and after mitigation.

Table 4-1. Potential Environmental Effects

Criteria	Potential Level of Effect						Comments, Rationale (before mitigation)
	-H	-L	NIL	Unk	+L	+H	
General Natural Environment Considerations							
Air quality		X					• This proposed Project has the potential to have a minor local negative effect on air quality as a result of construction related activities such as the operation of equipment and dust generation. • There will be no atmospheric emissions from the powerhouse during operation.
Facility Resilience to Climate Change					X		• This proposed Project has the potential to enhance resilience to climate change effects. The proposed Project will replace a very old facility that has reached its service end life.
Climate Change Impacts (mitigation of)						X	• The GS itself has the ability to manage water levels and flows that can assist in dealing with the effects of climate change.
Water quality (surface water)		X					• The proposed Project has the potential for negative effects on water quality during construction due to erosion, sedimentation and incidental spills.
Water quantity (surface water)			X				• Water quantity is unchanged with the proposed project. The only difference is that somewhat more water will flow through the GS than through the sluiceway.
Water quality or quantity (groundwater)		X					• The proposed Project has the potential for a negative effect on groundwater quality during construction due to incidental spills (e.g., gasoline, hydraulic fluid). • The proposed Project has the potential for a minor negative effect on local groundwater quantity during construction due to groundwater leakage into excavated areas.
SAR and their habitat	X						• The proposed Project has the potential for negative effect on SAR species including; Barn Swallow, whip-poor-will and bats (little brown myotis and Northern Myotis).

Table 4-1. Potential Environmental Effects (Cont'd)

Criteria	Potential Level of Effect						Comments, Rationale (before mitigation)
	-H	-L	NIL	Unk	+L	+H	
General Natural Environment Considerations							
Significant earth or life science features			X				• The are no significant earth or life science features near the project.
Land subject to natural or human-made hazards					X		• The proposed Project is unlikely going to have a negative effect on lands subject to natural or human-made hazards. However, a re-developed Calabogie GS will ensure a state-of-the-art modern facility to deal with any potential natural or human-made hazard.
Terrestrial wildlife (including numbers, diversity and movement of resident or migratory species)		X					• The proposed Project has the potential for a very minor negative effect on terrestrial wildlife. During the construction period the construction activity will produce a localized disturbance effect on the wildlife and may result in the displacement of a few animals. This effect will be temporary.
Natural vegetation and terrestrial habitat linkages		X					• The proposed Project will result in a minor clearing of land that will have a very minor negative effect on local vegetation communities. But some mitigation would be required.
Soils and sediment quality		X					• The proposed Project could have a negative effect on soils and sediment quality during construction owing to compaction, removal, erosion or the occurrence of incidental spills. This effect would be minor and localized.
Significant natural heritage features and areas			X				• There are no significant natural heritage features and areas in the immediate vicinity and the proposed project merely replaces an existing facility.
Other (specify)			X				• No other identified.

Table 4-1. Potential Environmental Effects (Cont'd)

Criteria	Potential Level of Effect						Comments, Rationale (before mitigation)
	-H	-L	NIL	Unk	+L	+H	
Aquatic and Riparian Ecosystem Considerations							
Shoreline dependent species		X					• The proposed Project would result in only a negligible change in shoreline habitat. Mitigation and planning efforts will need to be made to minimize shoreline alteration.
Wetland dependent species			X				• The proposed Project isn't identified to impact on any wetlands.
Fish habitat			X				• The proposed Project will not significantly change the overall amount of habitat and will not change the critical habitat due to proposed mitigation measures.
Fish migration						X	• The proposed Project is not expected to have any negative effect on fish movement as a GS is already in place. • The proposed project is incorporating a ladder to allow passage for American Eel. While they aren't known to be locally present at this point, the ladder will potentially enhance future access.
Fisheries			X				• The proposed Project will unlikely have a negative effect on the overall fisheries.
Erosion and sedimentation			X				• The proposed Project may have a negative effect because of erosion and sedimentation associated with construction activities.
Fish injury or mortality (impingement and entrainment)		X					• The proposed Project is likely to result in a very minor increase in fish entrainment because more water with flow through the GS than in the historic GS operation.
Water levels, flows and movement (surface or groundwater)			X				• The proposed Project will not alter the existing water management regime identified in the MRWMP. The only change will be that slightly more water will pass through the GS than via the sluiceway.
Drainage, flooding and drought patterns			X				• The proposed Project will occur in essentially the same area as the existing project and drainage at the site will largely remain as is. The proposed Project has the potential to better address rapidly changing precipitation and flooding concerns than the existing situation.

Table 4-1. Potential Environmental Effects (Cont'd)

Criteria	Potential Level of Effect						Comments, Rationale (before mitigation)
	-H	-L	NIL	Unk	+L	+H	
Aquatic and Riparian Ecosystem Considerations							
Water temperature			X				• The proposed Project will not have an effect on the thermal regime as the River will continue to be managed according to the approved MRWMP.
Aboriginal Community Considerations							
First Nation reserves or other Aboriginal communities			X				• The construction and operation of the proposed GS would not have any negative effect on First Nations reserves or Aboriginal communities. The nearest Reserve is the Algonquins of Pikwakanagan which is situated approximately 50 km away on a different River system (Bonnechere).
Spiritual, ceremonial, cultural, archaeological, or burial sites			X				• Stage 1 and 2 Archaeological Assessment indicates that there are none of these sites present.
Traditional land or resources used for harvesting activities					X		• The proposed Project merely replaces an existing facility that is currently in place. The proposed American Eel ladder is being partially driven out of consultations with the Algonquins of Ontario and their desire to see American Eels return to their traditional territory. Should American Eels return to the territory and grown in population this may allow for a potential future harvest.
Employment						X	• The proposed Project would have a positive effect by providing employment opportunities for local and regional based populations.
Lands subject to land claims			X				• The subject lands are within the AOO claim area (as is all of the Ottawa Valley) but are not part of the lands identified for transfer to the Algonquins.
Economic development						X	• The proposed Project could have a positive effect on economic development for the local area by providing up to two years worth of employment, income and contracting services for local and regional populations, businesses and the AOO and AoPFN, etc.
Other (Training and education)					X		• The proposed Project could have positive effect on training opportunities for AOO and AoPFN citizens.

Table 4-1. Potential Environmental Effects (Cont'd)

Criteria	Potential Level of Effect						Comments, Rationale
	-H	-L	NIL	Unk	+L	+H	
Land and Resource Use Considerations							
Access to inaccessible areas (land or water)			X				• The area of the proposed Project is already accessible and this project will not alter accessibility.
Navigation			X				• The proposed Project is going to have no effect on navigation. A GS is already in existence. A portage is provided on the north branch of the River and that will remain in place during construction and operational periods.
Riparian rights or privileges			X				• As a GS is already in place, the proposed Project is not going to have a negative effect on riparian rights or privileges.
Recreational use – (land or water)			X				• The proposed Project will have no negative effect on recreational use as a GS already occurs in this location. There will be no alteration to land or water- based recreation.
Angling and hunting opportunities			X				• The proposed Project will have no effect on angling and hunting opportunities as they won't be restricted by the proposed re-development project.
Trapping activities			X				• No effect is predicted on trapping activities. There is no loss of trapline area and a GS is already in place.
Baitfish harvesting activities			X				• The proposed Project is unlikely going to have a negative effect on baitfish harvesting activities. The GS is currently a restricted site so baitfish collection is not currently allowed.
Views or aesthetics including for transmission		X					• The proposed Project merely replaces an existing GS, which is largely not visible to the public. No effects on views or aesthetics are predicted.
An existing land or resource management plan				X			• The proposed Project is likely not going to have a negative effect on an existing land or resource management plan. OPG is unaware of any such plan for the immediate area and this has not been raised to date by MNRF.
An existing water management plan			X				• The proposed Project is not going to have a negative effect on the existing WMP as OPG intends to operate the new GS according to the same set of operating constraints that are in the current plan. A minor amendment is likely required to the WMP.

Table 4-1. Potential Environmental Effects (Cont'd)

Criteria	Potential Level of Effect						Comments, Rationale
	-H	-L	NIL	Unk	+L	+H	
Land and Resource Use Considerations							
Protected areas			X				• There are no protected areas in close proximity to the GS.
Other (resource industries) (e.g., forest products, mineral, aggregate)				X			• The proposed Project will not negatively impact on any other resource industry. • The proposed Project might have a minor positive effect on local aggregate producers as some materials are likely required.
Other							• No other identified.
Cultural Heritage Resources Considerations							
Archaeological sites			X				• No archaeological sites have been identified on site. • The proposed Project area has been identified as low archaeological potential.
Buildings or structures		X					• A Cultural Heritage Impact Assessment has been conducted on the site with proposed mitigation measures.
Cultural heritage landscapes			X				• There are no known cultural heritage landscapes in or near the footprint of the proposed Project. Overall the Project will not alter the overall appearance of the GS.
Other (specify)							• No other identified.

Table 4-1. Potential Environmental Effects (Cont'd)

Criteria	Potential Level of Effect						Comments, Rationale
	-H	-L	NIL	Unk	+L	+H	
Social and Economic Considerations							
The location of people, businesses, institutions, or public facilities			X				• The proposed Project will not result in the displacement or disruption of people, businesses, institutions or public facilities.
Community character, enjoyment of property, or local amenities		X					• During construction the proposed project will likely result in minor increases in local traffic as well as some minor increases in noise. This may have a slightly negative effect on the enjoyment of properties near the site.
Employment						X	• The proposed Project will have a positive economic benefit for employment in eastern Ontario.
Public health and/or safety					X		• The proposed project replaces a 100+ year old facility and therefore will enhance reliability and therefore have potentially positive effects public health and/or safety.
Local, regional, or provincial economies						X	• The proposed Project will result in a reasonable amount of local and regional and spending.
Tourism values			X				• As the proposed GS merely replaces an existing facility there are no anticipated effects on tourism values.
Water supply			X				• The proposed Project does not occur in a water recharge area and actually occurs in a water discharge area. Given that the project is not anticipated to have any effect on water supplies.
Aesthetic image of the surrounding area			X				• As the proposed project merely replaces the existing GS, there are no proposed effects on the aesthetic images of the surrounding area.
Other							• No other identified.

Table 4-1. Potential Environmental Effects (Cont'd)

Criteria	Potential Level of Effect						Comments, Rationale
	-H	-L	NIL	Unk	+L	+H	
Energy/Electricity Considerations							
Reliability (e.g., voltage support)						X	• The proposed Project will result in increased reliability over the previous facility as majority of the systems will be brand new.
Security (e.g., Black Start)						X	• The proposed Project will improve security over the previous facility since the new facility will have tele-protection capability.
Electricity flow patterns						X	• The proposed Project will improve electricity flow patterns over the previous facility, as it can offer more capacity.
Other (Pulsing)						X	• The proposed Project increases the amount of energy that can be produced at Calabogie.

4.1.2 Approach to Mitigation

The available environmental baseline and site specific information, provided the basis for an assessment of potential construction and operational effects of the proposed Calabogie Generating Station Redevelopment Project on the environment (e.g., due to vegetation clearing, soil erosion, noise, blasting, increased human activity).

Recommended mitigation measures for the potential effects on the environment considered best industry practices and various sources such as OWA (2012b) “Best Management Practices Guide for the Mitigation of Impacts of Waterpower Facility Construction”, standard environmental construction guidelines, e.g., Cheminfo (2005), DFO Ontario Operational Statements, as well as government agency and other organization consultation.

The selection and application of measures to mitigate potential effects of proposed construction and operation are based on the following five principles:

1. Avoidance of sensitive areas, where practicable, through siting of facilities;
2. Appropriate timing of construction activities, whenever practicable, to avoid sensitive time periods, e.g., vegetation clearing outside migratory bird nesting periods;
3. Construction in wetlands or areas too wet to access should be undertaken during frozen or dry conditions;
4. Implementation of conventional, proven mitigation measures during construction, e.g. OWA (2018) Class Environmental Assessment for Waterpower Projects Appendix B – Examples of Typical Mitigation Measures; Environment Canada “Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities” (Cheminfo, 2005); OWA (2012b) “Best Management Practices Guide for the Mitigation of Impacts of Waterpower Facility Construction” and Hydro One (2008) “Environmental Guidelines for the Construction and Maintenance of Transmission Facilities”; and
5. Development of environmental enhancement/compensation measures to offset the unavoidable effects of construction and operation.

The significance of potential impacts was based on their magnitude, duration and extent after the implementation of recommended mitigation measures.

4.2 Proposed Project Construction – Aquatic Environment

4.2.1 Surface and Groundwater Hydrology

Other than the Madawaska River there are no other watercourses or water features within the Calabogie GS property. There is a wetland on the adjacent Township lands that is discussed in more detail in the Terrestrial Environment section.

During construction water will not pass through the powerhouse and therefore all water will flow around the GS through the existing South Channel Sluiceway.

With respect to groundwater quality, Golder, in their Phase II Report (2001), identified that the Madawaska River is considered a regional groundwater discharge area and based on that it is unlikely that the Calabogie site could impact the groundwater of nearby drilled wells.

> "Direct groundwater contact via ingestion (GW-1 pathway for on- and off-site users). There are presently no drinking water wells on site. The Village of Calabogie, located approximately 0.5 km upgradient of the site, receives their water supply from private wells.
>
> It is likely that groundwater from the site flows toward the Madawaska River, and given that the distance to the nearest downgradient groundwater user is greater than 1 km upgradient of the site, it is unlikely that groundwater used as drinking water would be affected. Therefore, off-site ingestion by people would most likely not lead to exposures to chemicals of potential concern present in groundwater." (Golder, Phase II, section 5.5)

As described in the Project Description in Chapter 2, excavation of the new powerhouse and forebay area will be required for the project to occur, consideration will need to be given to groundwater infiltration into this excavated area. Groundwater infiltration into this excavated area is expected and the anticipated flow rate along with the duration of construction, a Permit to Take Water is likely required. To combat the water infiltration, sumps will be blasted into key areas of the excavation and pumps will be installed to dewater the area. If necessary, the water will be pumped into settling pond(s), silt treatment bags, and vegetated areas to mitigate any environmental issues that may arise from the dewatering. Should the groundwater require secondary treatment for dissolved metals, proper measures will be taken.

4.2.2 Water Quality

During construction, water quality in the Madawaska River and groundwater may be affected by soil erosion and turbidity generation, in-water construction activities, blasting, acid rock drainage, incidental spills and/or waste material dispersion, and stormwater.

Overall, based on the mitigation measures described below, the effects of the construction of the proposed Project on water quality are expected to be localized, temporary and negligible.

4.2.2.1 Erosion and Sediment Control

There is a risk to the Madawaska River by sediment loadings due to accelerated soil erosion during construction. Till and gully erosion caused by channelized overland flow can also be a major source of soil erosion to the watercourses. Sheet erosion can be an additional source of sediment.

Erosion and sediment control will be an integral component of the construction planning process. All personnel involved with the proposed works will be briefed on erosion and sediment control including engineers, contractors, inspectors and environmental staff.

Sediment and erosion control measures should be implemented as required prior to work and maintained during the work phase, to prevent entry of sediment into the water. This should include sediment removal from water pumped from within the work areas such as the powerhouse foundation area, draft pit and tailrace excavation. It should also include the use of silt curtains or cofferdams, if appropriate, during any in-water work to prevent deleterious substances from entering fish habitat.

The MoECC has directed to OPG (Orpana, MoECC, 2018) that if and "Where dredging is required, consideration should be given to appropriate storage, handling, dewatering and disposal of excavated material. Excavated materials must be disposed of in accordance with this Ministry's legislation and guidelines. Guidance on nearshore construction and dredging may be obtained from this Ministry's *Guidelines for Evaluating Construction Activities Impacting on Water Resources* dated January 1995 and *Evaluating Construction Activities Impacting on Water Resources, Part III A, Part III B, and Part III C* dated February 1994."

As previously explained, the construction of the new GS at Calabogie will require a significant amount of sediment and rock to be removed from the forebay area.

In the summer of 2018, sediment and soil samples were collected from 13 test pits in the Forebay and in the vicinity of the Powerhouse. Soil sampling was collected from 5 boreholes drilled in various areas across the site. Laboratory analyses were completed by ALS Canada Ltd. in Ottawa, Ontario, for detection of potential contaminants of concern (PCOC). These were compared to soil and sediment site condition standards of Tables 1 and 8 of O. Reg. 153/04. Some sediment in the bed of the forebay contained concentrations of selected metals that exceed the MOE Table 1 and Table 8 site condition standards. As well, some soil in the vicinity of the Powerhouse, the forebay retaining wall and in the forebay contained concentrations of selected metals, PHCs and PAHs that exceed MOE Table 1 and Table 8 site condition standards. Composite soil sample TCLP leachate analyses suggest that soil and sediment at the site would be classified as solid non-hazardous waste if disposed at a landfill.

It is Arcadis' understanding that the rock is uncontaminated and non-acid generating and, therefore, can be re-used on OPG's property without restrictions. However, because of the exceedances with respect to the sediment it is our understanding that OPG can place the sediment on site but it is recommended that it not be placed within 30 meters of any surface waterbody and that actions may be required to mitigate risks to the environment from the emplaced sediment. MoECP provided concurrence with this approach in an e-mail dated May 6, 2019 (MacLeod, 2019). The Site Plan presented in the Project Description as Figure 2-5 depicts the soil/sediment deposition areas. OPG is not aware of any other contaminated soils at the Calabogie site.

Management of dredged material and control of runoff will be addressed by the site-specific Sediment and Erosion Control Plan and Stormwater Management Plan to be prepared by the DBC.

During construction, the removal of natural shoreline vegetation should be minimized, and consideration made to armour potentially affected shoreline proximate to the proposed GS.

In general, the following guidelines will be applied in the development of the Erosion and Sediment Control Plan:

- fitting of proposed works to the terrain (i.e., using the natural topography of the land in the placement and organization of the construction site);
- timing of grading and construction activities to minimize soil exposure;
- retention of existing vegetation where feasible;
- restriction of the use of heavy construction equipment to within the approved work areas to minimize soil disturbance and vegetation destruction;
- storage of stripped soil at upland locations with a minimum of 5 m from the edge of the River;
- implementation of erosion control measures, e.g., rip-rap berms underlain by filter geotextile, straw bales used as filters, silt fencing along the shoreline and/or mulching for interim stabilization;
- diversion of runoff away from exposed areas;
- minimization of the length and steepness of slopes;
- maintenance of low runoff velocities;
- design of drainage works, such as ditches and outfalls, to handle concentrated runoff;
- retention of sediment on site;
- routine inspection and maintenance of erosion and sediment control measures; and
- re-vegetation of disturbed areas by seeding and/or planting following construction as soon as seasonal conditions permit.

The use of settling ponds will require Environmental Compliance Approvals under the *OWRA*. The DBC will be responsible for the final design of the settling ponds, including locations of such works, treatment options, volumes, discharges to the environment, proposed monitoring plans and effluent criteria for parameters of concern (e.g., pH, TSS, turbidity, hydrocarbons, total ammonia).

As indicated in the Terrestrial and Aquatic Environment TSDs, site-specific Erosion and Sediment Control Plans, addressing the construction will be prepared and implemented during construction. The site-specific Erosion and Sediment Control Plans will be part of a broader Environmental Management Plan.

With the implementation of the site-specific Erosion and Sediment Control Plans, the potential effects of soil erosion and turbidity generation will be minimized or obviated.

4.2.2.2 In-Water Construction Activities

As indicated in Chapter 2 (“Project Description”), OPG intends to minimize all in-water works by constructing work in the dry. The forebay area for the new powerhouse has been isolated by closing off the existing inlet structure (carried out under a separate permitting process) (due to tornado damage).

Following the July 15th fish window, an upstream cofferdam will be constructed to allow removal of the existing inlet structure in the dry and rock excavation to continue (see Figure 2-9). A fish salvage plan will be developed for the project and any fish will be collected and liberated into appropriate adjacent habitat. A mussel relocation will occur as part of the fish relocation program if they are present during cofferdam dewatering.

The upstream cofferdam will be constructed from blasted rock that has been excavated to accommodate the new powerhouse. Blast rock will be used to construct a 5.8 metres wide cofferdam, with a slope of 1.5H:1V up to elevation 155.17masl. The upstream face of the cofferdam will be lined with a heavy-duty cofferdam membrane and sealed to the riverbed with a bentonite clay seal. Upon completion of the powerhouse, the liner, blasted rock and overburden will be removed, and the channel will be graded with rockfill.

A downstream cofferdam is required to isolate the downstream side of the construction and allow for: the demolition of the existing powerhouse and construction of the new powerhouse and tailrace. The proposed cofferdam is a rockfill dam with an impervious geomembrane on the water side of the cofferdam. Seepage through the cofferdam will be collected and directed to a settling pond prior to discharge back into the river.

The downstream side of the site can be isolated by the cofferdam shown in Figures 2-7 and 2-9. Cofferdam and other in-water work installation will be undertaken outside the designated in-water construction exclusion period, which is from March 15 to July 15. The area from upstream cofferdam to downstream cofferdam is approximately 22,000 m^2. The duration of the dewatered forebay is 9 months for the upstream side (from upstream cofferdam to intake) and 13.5 months for the downstream side (from tailrace to d/s cofferdam). The 9 month duration for the upstream occurs during the 13.5 month duration downstream.

Temporary cofferdam construction will require the use of heavy equipment along the shoreline and on the rockfill wall as it is built up around the sites. An impervious geotextile will be placed on the cofferdam face to preclude water ingress. The work will also involve dewatering to the area downstream of the cofferdam and as necessary the placement of erosion control structures. Fish within the area to be dewatered will be collected by electrofishing/netting during drawdown and released to the Madawasaka River under a Fish Scientific Collectors Permit obtained from MNR under the *Fish and Wildlife Conservation Act*.

The use of clean rock fill, the placement of rock fill over similar coarse substrate at the intake weir location and judicious selection of the discharge location and water pressure during dewatering will minimize potential effects of in-water construction activities on water quality in the Madawaska River. The placement of rockfill over finer substrate in the Madawaska River will result in resuspension of bottom sediments resulting in temporary and localized increased turbidity prior to redeposition. Similarly, the removal of the cofferdam in the Madawaska River will result in temporary and localized increased turbidity.

Cofferdam installation and removal will comply with the conditions of the Work Permit issued by the MNRF.

4.2.2.3 Use of Explosives

Blasting will be required to remove the rock for the new powerhouse and in the forebay and possibly for the upstream piers. A third-party firm will be hired to implement a vibration monitoring program, provide engineered blast designs, and consult in all blasting operations as required. Any residual by-product of explosive material will be fish friendly.

Explosives used in construction will be closely controlled, with their use restricted to authorized personnel who have been trained in the use of explosives in a manner so as to minimize impacts on the environment. Appropriate government agencies and local residents will be informed of the blasting schedule in advance of construction, as well as just prior to the detonation program. All necessary permits will be obtained by the DBC, who will also comply with all legal requirements in connection with the use, storage and transportation of explosives, including, but not limited to, the *Canada Explosives Act* and the *Transportation of Dangerous Goods Act*. The DBC will be required to retain a consulting engineer with technical expertise in blasting to provide advice on maximum loading of explosives for all blasting, as well as an engineering report indicating recommended charges and blasting methods to be used at specific locations. All blasting will occur in such a way as to be in compliance with federal regulations and directions.

Blasting could have a potential effect on groundwater quality and flow in the immediate vicinity of the blasting operations. It has been estimated that peak particle velocities produced from blasting operations in excess of 600 mm/s will cause cracks and discontinuities in sedimentary rock up to a 5 m radial distance from the blast using the sophisticated techniques and control measures employed in modern blasting practice (L. McAnuff, VME/Explotech Associates Ltd., 1991). Damage (seam creation) will be less and more localized in Precambrian rocks. Minimization of the physical effects of blasting will be ensured by following the recommendations of the blasting engineer.

The DFO has developed a number of Operational Statements on methods and practices which are intended to prevent or avoid the destruction of fish, or any potentially harmful effects to fish habitat that could result from the use of explosives (Wright and Hopky, 1998). The use of temporary cofferdams to permit blasting within the dewatered areas and adherence to the DFO Guidelines and blasting engineer recommendations will avoid the death of fish and/or any permanent alteration to, or destruction of, fish habitat.

4.2.2.4 Acid Rock Drainage Potential

Acid base accounting (ABA) was carried out by WSP as part of the geotechnical investigation in 2016 (WSP, 2016). Three samples were completed in the investigation area and it was determined that there was no potential for acid rock drainage.

4.2.2.5 Management and Control of Hazardous Materials, Construction Wastes and Incident Spills

Management and control of hazardous materials, construction wastes, groundwater and incidental spills is described in detail in the Terrestrial Environment TSD and takes into account best industry practices listed at the beginning of Chapter 4.0.

In summary, all materials and equipment used for the purpose of site preparation and proposed Project completion should be operated and stored in a manner that prevents any deleterious substance (e.g., petroleum products, debris, etc.) from entering the water. Incidental spills of oil, gas, diesel fuel and other liquids to the environment could occur during construction. Fuelling and lubrication of construction equipment should be carried out in a manner that minimizes the possibility of releases to the environment.

Measures for containment and cleanup of contaminant releases should be followed to minimize contamination of the natural environment, e.g., placement of fuel tanks and generators on an appropriate form of containment where possible, monitoring and other measures documented in the Environmental Management Plan. At all times where spills are a risk, appropriate materials for cleanup and approved disposal locations should be available. Spills or other discharges should be reported to the MOE as required by provincial legislation. Interim sanitary waste collection and availability of treatment facilities should be arranged for the duration of the construction period. All construction waste, washwater and wastewater should be disposed of in accordance with regulatory requirements.

During powerhouse construction, there is a potential for accidental loss of cement during surface application. Any dripped cement should be recovered from the river bottom for suitable disposal. All trash and other solid debris should also be collected for appropriate disposal.

As described in Section 3.1.2.1, Groundwater, there were several PWQO exceedances in the existing groundwater quality. As such, groundwater is/may be expected to infiltrate into areas were construction below grade is occurring, WSP recommended the groundwater will need to be properly treated prior to discharge to surface waters unless the MoECP provides approval of elevated concentrations during the construction period. Mitigation options include filtration of discharge water to reduce heavy metals content but also may require further methods such as polymerization/chemical coagulation and filtration or chemical reduction processes specifically designed for the type of groundwater and flow rate (WSP, 2016). Should the groundwater require secondary treatment for dissolved metals, proper measures will be taken. Monitoring of the groundwater will be required as will the efficacy of the treatment system. The DBC will need to review approval requirements with the MoECP which may include an Environmental Compliance Approval or mobile Certificate of Authorization. Other options could be considered.

A Hazardous Materials Management Plan, Waste Management Plan and a Spills Emergency Preparedness and Response Plan will be developed as part of the broader Environmental Management Plan. The implementation of these pollution prevention plans will obviate or minimize the environmental effects of accidental releases to the natural environment that have the potential to affect surface water and groundwater quality in the proposed Project area.

4.2.2.6 Stormwater Management

The final site grading and elevations will be designed to minimize erosion and manage stormwater.

4.2.3 Aquatic Habitat

4.2.3.1 Timing of In-Water Construction

In-water construction activities should be timed to avoid the spawning and egg incubation period of spring spawning fishes, such as Walleye. According to the MNRF in-water work guidelines for the southern region of Ontario (https://www.ontario.ca/document/water-work-timing-window-guidelines), and due to the presence of Walleye, Northern Pike, Smallmouth Bass, Largemouth Bass, and other spring spawning species (e.g. River Redhorse, Shorthead Redhorse, White Sucker) in the Madawaska River, the broadest in-water work exclusion period, from March 15 to July 15, will apply.

The area between the temporary cofferdam at the downstream end of the tailrace and the existing control structure at the upstream end of the forebay will be dewatered during construction. An impervious geotextile will be placed on the cofferdam face to preclude water ingress. Fish within the area to be dewatered will be collected by electrofishing/netting during drawdown and released to the Madawaska River. The temporary unavailability of this habitat during the construction period will have negligible effect on the local fish populations.

4.2.3.2 Use of Explosives

Blasting of bedrock will be required in the areas to be excavated within the dewatered area. Numerous studies have been undertaken to assess fish mortality due to in-water blasting (e.g., Hubbs and Rechnitzer, 1952; Fry and Cox, 1953; Ferguson, 1962; Foye and Scott, 1965; Chamberlain, 1976, 1979; Teleki and Chamberlain, 1978; McAnuff and Booren, 1989; Keevin *et al.,* 1997). The degree of blasting impact on fish will depend on the type of explosive, type of substrate blasted, blasting technique, fish physiology and timing. Injury to fish from in-water blasting will result from physical abrasion from ejected debris and from pressure changes associated with the blast shock waves.

Common blast-induced injuries to fish include haemorrhage in the coelomic or pericardial cavity and rupture of the swim bladder. Differences in species-specific susceptibility to blast injuries are a function of the fish's shape and swim bladder formation (Teleki and Chamberlain, 1978). Physoclistic (with swim bladder isolated from oesophagus) and laterally compressed fish such as the centrarchids, e.g., Smallmouth Bass, are the most sensitive to pressure changes. Mortality within this group varies with orientation of the laterally-compressed body to the pressure front at the time of a blast. Physostomic (with swim bladder connected to the oesophagus by an open duct, which provides pressure release) fish with fusiform shape, such as the White Sucker, are most resistant to pressure changes.

To obviate injury to fish, blasting will be undertaken in the “dry”, i.e., after dewatering and removal of fish, and will adhere to the DFO guidelines for use of explosives in or near fish habitat (Wright and Hopky, 1998). The shockwaves (peak particle velocities) produced from blasting using the sophisticated techniques and control measures employed in modern blasting practice will be attenuated rapidly within the bedrock. With the width of the cofferdam and its sufficient distance from the limit of blasting, no injury to fish from pressure changes associated with the blast shockwaves is expected. Moreover, blasting mats will be used to minimize the occurrence of fly-rock.

4.2.3.3 Sediments

Bottom substrate in the Madawaska River near the powerhouse and in the tailrace is predominantly bedrock, overlain with boulder, cobble and gravel. As previously indicated blasting will be required. The potential use of fragmented rock generated by blasting activities for fish habitat enhancement and/or nearshore/shoreline erosion protection will be discussed with DFO. Otherwise, the excess rock will be removed from the dewatered areas behind the temporary cofferdams for suitable upland disposal.

As indicated in Chapter 2, construction of much of the in-water portion of the tailrace will be undertaken in the "dry" using a cofferdam. The tailrace area will require rip-rap lining to protect against erosion and sloughing of the overburden. Upon completion of tailrace construction, the temporary cofferdam material will be re-used as rip rap. Portions of the Madawaska River bank in the immediate vicinity of the tailrace area may also require shoreline rip-rap protection to minimize toe erosion due to scouring and lower bank sloughing along the river bank.

4.2.4 Plankton and Aquatic Vegetation

Plankton populations will not be affected by construction of the proposed Project. Any plankton confined behind the cofferdams will be returned to the Madawaska River during dewatering.

No aquatic vegetation will be affected by construction activities.

4.2.5 Benthic Macroinvertebrates

The placement of rock fill may have a localized, but temporary, adverse effect on benthic macroinvertebrate communities on the surface and within the substrate. The extent of disruption depends on the type of bottom substrate, the extent of the disturbed area, any resultant turbidity and sedimentation, and the timing of construction. Substrate in the Madawaska River at the proposed cofferdam location is predominantly cobble, boulder and gravel. The placement of rock fill on this substrate will have minimal detrimental effect on the benthic macroinvertebrate communities. With the use of the larger-size rockfill, sufficient interstitial spaces will be available for the survival and migration of mobile benthic fauna.

Recovery after cofferdam removal is expected to be rapid. Recovery is defined as the return of aquatic biotypes after disturbance to an abundance and diversity comparable to that in an adjacent undisturbed control area (Rosenberg and Snow, 1977). The principal mechanism of recolonization by invertebrates is drift (Luedtke and Brusven, 1976; Williams and Hynes, 1977), but other mechanisms, such as lateral migration, vertical migration from within the hyporheic zone (i.e., after burial) and larval recruitment from aerial sources are also important (Luedtke and Brusven, 1976; Williams and Hynes, 1977; Griffiths and Walton, 1978; Hirsch *et al*., 1978). The rate of recovery is dependent on ambient environmental conditions, the type of organisms present and the size of the disturbed area. In general, there will be less impact upon benthic communities associated with a naturally variable, high energy environment. The benthic organisms are adapted to the high-energy, unstable conditions, and have life cycles that allow them to better withstand these stresses (Hirsch *et al*., 1978).

Blasting in the dewatered nearshore areas may result in localized destruction of benthic communities. Benthic mortality will be a function of distance from and intensity of the blast (Schwartz, 1961). However, recovery from blasting is expected to be rapid (see above).

4.2.6 Site-Specific Fish Habitat Considerations

Changes to aquatic habitat will occur directly due to construction of the new station and indirectly as a result of more flow being directed through the powerhouse and less flow through the south sluiceway. The minimum flows through the north channel are not expected to change. This section presents summary information, detailed information is provided in the Aquatic TSD. The anticipated direct changes are described below:

- Powerhouse footprint. The new powerhouse will be located approximately 50 meters upstream from the existing powerhouse. Consequently, the new powerhouse will occupy habitat that is in the forebay under existing conditions and the area occupied by the existing powerhouse will become part of the new tailrace. The footprint inside the existing forebay is approximately 2,400 m^2. The exact foot footprint will be provided in the final design and will be included in the habitat balance for the project as part of the DFO RFR process.
- Tailrace. The new tailrace will be approximately 50 m longer than the existing tailrace, due to the new powerhouse being further upstream. The upstream portion of the new tailrace will be excavated in bedrock. The exact downstream limit of excavation is not yet known, but it may result in a change in the substrate from the existing boulder/cobble to bedrock. The tailrace receiving environment is being modeled to understand the depth and velocity profiles relative to fish preferences. This information will be used to understand the distribution of bed material that could be used as spawning or rearing habitat. SNC-Sullivan are currently exploring a range of habitat variables (Habitat Suitability Indices) that are specific to walleye spawning and rearing (e.g., McMahon 1984 - Habitat Suitability Index Models: Walleye (Depth 0.5 to 1.8 m, Velocity 0.6-0.9 m/s) Figures 4-2 and 4-3 in the Aquatic TSD illustrate existing fish depth and velocity preferences for the existing vs the project conditions at the same discharge.
- Forebay. The forebay will be approximately 50 meters shorter because the new powerhouse will be further upstream than the existing powerhouse. Some excavation will be required in the forebay upstream from the new powerhouse, for hydraulic optimization. This will result in changes in depth and substrate. The intake will have training walls on either side to contain the new embankments away from the intake structure. Upon completion embankments will be provided with suitably sized rock protection to ensure bank stability against the forces of erosion and ice action. The average excavation depth in the upstream side of the powerhouse is 3 m. Excavation is approximately 12 m for the powerhouse and the tailrace varies with average of 1 m. The substrate of the entire forebay will be modified and will mostly be in drilled and blasted rock with riprap on the channel sides. The existing control structure at the upstream end of the forebay will be removed and the forebay inlet will be slightly widened, which will result in an increase in the area of fish habitat. Under existing condition, at full flow the highest velocities, which are approximately 1.0 m/s, occur where water passes through the piers of the structure at the entrance to the forebay. With the removal of that structure and widening and deepening of the inlet, the proposed velocities in the approach channel at full flow would be under 1 m/s, varying between 0.25 and 1.0 m/s across the channel.
- South Channel Sluiceway. With the previous station, flow ceased (except for leakage) through the south sluiceway when total discharge from Calabogie Lake was less than 60 cms plus the flow through the north channel. With the new GS flow through the south sluiceway will cease

once total discharge is less than 160 cms plus the flow through the north channel. Consequently, there will be no flow through the south sluiceway for a greater portion of the year. The South Channel Sluiceway will remain backwatered at a minimum elevation of 144.2 and will not have any periods where there is no water in channel. The flow reduction rates in the spillway will be maintained as in current conditions and are not known to strand fish. Figure 4-4 in the Aquatic shows the expected changes of discharge through the spillway (existing GS vs projected GS). With the existing GS, the spillway was in operation about 24% of the time during the January – March periods and with the projected GS, the spillway will be in operation about 13% of the timed during the January – March period. It should be noted that the overall discharge downstream the junction between the GS tailrace channel and the spillway channel should be the same.

The existing control structure at the upstream end of the forebay will be removed and the forebay inlet will be slightly widened, which will result in an increase in the area of fish habitat.

With the previous station, flow ceased (except for leakage) through the south sluiceway when total discharge from Calabogie Lake was less than 60 cms plus the flow through the north channel. With the new GS flow through the south sluiceway will cease once total discharge is less than 160 cms plus the flow through the north channel. Consequently, there will no flow through the south sluiceway for a greater portion of the year.

Under existing condition, at full flow the highest velocities, which are approximately 1.0 m/s, occur where water passes through the piers of the structure at the entrance to the forebay. With the removal of that structure and widening and deepening of the inlet, the proposed velocities in the approach channel at full flow would be under 1 m/s, varying between 0.25 and 1.0 m/s across the channel.

Once a final design is completed for the GS, it is assumed that further discussions with DFO will be undertaken on these site specific fish habitat alterations.

4.3 Proposed Project Operation – Aquatic Environment

4.3.1 Hydrology and Water Management Operations

As outlined in the 2009 Madawaska River Water Management Plan, Calabogie GS operated (prior to the September 2018 tornado) as a peaking plant in conjunction with the four other OPG owned GSs on the Madawaska River. The generating units at the station had limited flow capacity (66 m^3/s), but the operation of the units and sluice gates are integrated with the rest of the peaking system on the Madawaska River. Calabogie was a generation bottleneck on the Madawaska River, and the small turbine capacity results in frequent spill past the station.

The operation of the existing plant is based on a daily/weekly cycle, with the inflow passed through the plant over a daily or weekly period. The 2009 WMP notes that operation of the plant takes into consideration energy demands, recreational opportunities as well as walleye spawning activities.

OPG does not propose to alter the existing water management compliance requirements associated with this facility. The redevelopment of Calabogie GS will continue to be operated in full accordance with all of the flow and water level targets and compliance conditions identified in the WMP including all fisheries and other aquatic life requirements. Daily flows will remain unchanged, but additional portion of river flow will pass through the plant to generate electricity rather than just passing through the spillway gates.

4.3.2 Groundwater Hydrology and Quality

No effects on groundwater hydrology are anticipated as a result of the operation of the proposed GS; therefore, no mitigation is required.

4.3.3 Surface Water Quality

The re-developed Calabogie Generating Station is not expected to have any negative effects on water quality. Water will go through the powerhouse and be returned to the River in roughly the same locations as presented.

The proposed project does not result in any inundation which might also impair water quality.

All of OPG's powerhouses have an oil-water separator in place that separates an oily substances and presents them from entering the River.

4.3.4 Sediment Erosion and Transport

Once the site is fully re-developed and any unstable areas stabilized, the erosion and sediment control measures will be removed from the site except for any permanent ditches, berms or other features that are recommended to prevent any sediment from entering the River and erosion from occurring.

As the proposed project will be operating according to the requirements of the MRWMP, OPG does not anticipate any changes to localized erosion patterns on the River.

4.3.5 Plankton, Aquatic Vegetation and Benthic Macroinvertebrates

As there is no alteration to seasonal or daily levels and flows there are no anticipated effects on plankton, aquatic vegetation and/or benthic macroinvertebrates.

4.3.6 American Eel Migration

American Eel have historically migrated upstream and downstream in the Madawaska River, but have been extirpated from the vicinity of the Calabogie GS for approximately 40 years (MNR, 2008) and there are dams downstream that currently block the upstream passage of American Eel. However, it hoped that re-establishment of American Eel will occur in the Ottawa River system, including the Madawaska River. Therefore, the generating station will be constructed 'eel-ready' so that of adaptive management strategies that can be applied as circumstances change around the presence of American eel in the vicinity of the station.

Specific measures have been scoped into the design of the station to accommodate potential future needs for upstream and downstream passage of American Eel including:

- including a trap and transport system at the plant tailrace, including the provision of attractant flow, to allow monitoring for eel presence below the station and provision of upstream transport when eels appear;
- intake velocities and bar exclusion screen layouts that facilitate implementation of future effective safe passage of eels downstream through the project;
- provision for retrofitting the station with an inclined screen and downstream flow bypass for downstream passage with bar spacing in the screen at no more than 19 mm during periods of downstream movement; and,
- leaving room for permanent upstream and downstream passage infrastructure to be retrofitted.

Measures to permit downstream migration wouldn't be deployed until eels approaching the downstream phase of their life-history phase are present in the upper portion of the watershed. Putting fine spaced trash rack mitigations in place introduces head losses and negatively affects operations, however OPG specifically designed approach velocities and trash rack spacing to prevent impingement and fish mortality with the understanding that a population of eels will eventually be re-established.

An adaptive management approach will be applied during operations to determine the best course of action to implement or install specific measures to support recovery as circumstances change. It is expected that if American Eel are trapped in the tailrace they will be transported upstream and that retrofitting to permit safe downstream passage will be implemented prior to the first eels that are moved upstream to migrate. The tailrace receiving environment is being modeled to understand the depth and velocity profiles relative to fish preferences. Changes Due to Increased Powerhouse Capacity.

No change is predicted in the flow through the North Channel, where the minimum flow is mandated under the existing operating regime.

The proportion of the flow that passes through the powerhouse will increase as a result of station capacity increasing from 60 cms to 160 cms and there will be a commensurate decrease in the volume of flow through the south sluiceway. An initial assessment of the implications to fish habitat are discussed below. A final assessment will be based on the final design.

4.3.7 Walleye Spawning

As previously stated, large aggregations of spawning Walleye have not been observed in the vicinity of the Calabogie GS. Regardless, there is likely some limited spawning occurring in the tailrace, at the downstream end of the South Channel Spillway, and in the North Channel.

The tailrace receiving environment is being modeled to understand the depth and velocity profiles relative to fish preferences. This information will be used to understand the distribution of bed material that could be used as spawning or rearing habitat. SNC-Sullivan are currently exploring a range of habitat variables (Habitat Suitability Indices) that are specific to walleye spawning and rearing (e.g., McMahon 1984 - Habitat Suitability Index Models: Walleye (Depth 0.5 to 1.8 m, Velocity 0.6-0.9m/s). Figures 4-2 and 4-3 in the Aquatic TSD illustrate exiting fish depth and velocity preferences for the existing vs the project conditions at the same discharge.

The habitat value of the tailrace is not expected to change substantially with the proposed reconstruction of the Calabogie GS. At peak flow of 160 cms through the powerhouse, the maximum flow velocity in the tailrace will be approximately 2 m/s in places along the center of the tailrace with velocities approaching zero along the margins. This range of velocities spans the typical Walleye spawning velocities, so areas with velocities suitable for spawning will be present. Placement of suitable spawning substrate may be required along the tailrace margins. High velocities are likely to mobilize suitable spawning substrate in the centre of the tailrace. Given the limited use of the existing tailrace by spawning Walleye, it is expected that the future tailrace will provide the same or improved habitat opportunities for spawning.

The South Channel Spillway generally has very high spring flows during the typical Walleye spawning period, with fast, turbulent water (Figure 3-21, Aquatic TSD) that limits any possible Walleye spawning to small areas of potential habitat in the periphery of the downstream end of the spillway. When spring spillway flows are reduced by the diversion of a greater amount of flow through the enlarged GS, it is possible that shallow areas at the downstream end of the spillway that have cobble, gravel and sand substrates (Figure 3-14) will become suitable Walleye spawning habitat, providing an overall gain in potential Walleye spawning habitat at the Calabogie GS. If this were to occur it is possible that a seasonally extended minimum flow through the South Channel Spillway may become necessary to maintain proper embryo incubation conditions.

The Flow Duration Curve for the South Channel Sluiceway shown in Figure 4-4 of the Aquatic TSD shows the expected changes of discharge through the spillway (existing GS vs projected GS). With the existing GS, the spillway was in operation about 24% of the time and with the projected GS, the spillway will be in operation about 13% of the time. It should be noted that the overall discharge downstream the junction between the GS tailrace channel and the spillway channel should be the same.

Consistent with the historical operation of the facilities the south spillway channel will remain watered at a minimum elevation of 144.2 masl and there will not be any periods when there is no water in channel. Figure 4-5 in the Aquatic TSD illustrates the receiving environment bed elevations and substrate in environment of the south spillway. The elevations at the end of the South spillway where fish habitat was observed range from 140-143 masl and the upper portion of the spill way will remain backwatered to minimum elevation of 144.2 masl.

Flow velocity in the South Spillway Channel will be lower since more water will go through the projected GS. For the tailrace channel the flow velocity for the projected conditions at 160 m^3/s will be in the same range than the flow velocity for the existing conditions at 66 m^3/s. More discussion on this occurs in the

Aquatic Environment TSD. The South Spillway does not reliably provide habitat suitable for Walleye spawning under current conditions. The volume of flow through the South Spillway during the walleye spawning period varies from zero (except for dam leakage) in dry springs to >400 cms in a wet year. At zero flow through the spillway there is abundant suitable spawning substrate (Rosien, 1999) but velocities would not be conducive to walleye spawning except at the very base of the dam where leakage would result in a small area of potentially suitable velocities. At high spill rates velocities in most of the South Spillway are too high for walleye to spawn there (Tarandus, 1991, 1992; this study). Tarandus conducted a Walleye spawning study in 1992 that included the South Spillway and reported that "minimal suitable walleye spawning habitat exists in the spillway" mainly due to the substrate and relatively high water velocities and no walleye eggs were found there post-spawning (Tarandus 1992, cited in Pope, 1999). Tarandus (1992) did find walleye eggs in the North Channel. Pope (1999) reported that local residents regarded the North Channel to be the main spawning area. A spawning study conducted by Rosien in 1999, when spring flow was low and there was no spill through the South Spillway, found that numbers of Walleye observed were higher downstream at Cherry Beach Rapids than in either the South Spillway or the tailrace at Calabogie. Rosien (1999) stated that the due to adverse conditions at this site during high flow freshets, the South Spillway is dependent upon low flow freshets that warrant reduced spilling in order to be suitable for spawning.

With the existing generating station conditions in the south spillway range from extremely high flows and velocities during peak flows, typically during spring freshet, to zero flow and velocity during periods when there is no flow through the spillway. At peak flows the upper portion of the South Spillway has velocities so high that it is probably not occupied by fish; if it is it will be by species that are tolerant of high water velocities (i.e. longnose dace) that can shelter among boulder. At low flows and velocities that area is suitable for a wide range of species (walleye, centrarchids, catostomids, most cyprinids), but less so for species that prefer higher velocities (i.e. longnose dace). With the new generating station flows in the South Spillway will be lower during periods of high flow and zero for more of the year. This will extend the period that flows are suitable for species that prefer lower velocities but reduce the length of time that it is suitable for species that prefer high velocities. With the new generating stations, changes in flow through the South Spillway will be less frequent.

This increased stability of habitat conditions can be expected to benefit species that utilize the lower velocity habitats, whether it be for spawning, nursery, or foraging,

A monitoring plan could be developed as the discussions with DFO progress, however the current flow reduction rates in the spillway will be maintained as in current conditions and are not known to strand fish. There is little or no potential for fish stranding in the South Spillway because it remains backwatered even when it receives zero flow.

Under current conditions OPG is required to pass a minimum flow through the North Channel, and this is not expected to change under future conditions. The North Channel conditions for spawning Walleye will remain the same with the new GS.

4.3.8 River Redhorse Spawning

The only spawning location of this species was found 2.6 km downstream from the Calabogie GS, at the downstream end of Area 9 (Figure 3-23, Aquatic TSD). Once this spawning location was discovered, locations where similar habitat conditions occurred, or were thought to potentially occur, were examined within or near the North Channel, the South Channel Spillway, and the tailrace of the Calabogie GS. No other spawning aggregations of River Redhorse were found, nor were any habitats that were considered a good match to the habitat in Area 9 within which the spawning River Redhorse were observed. The reconstruction of the Calabogie GS, will not impact any habitats in Area 9 (Figure 3-23, Aquatic TSD) and is not predicted to have any impact on River Redhorse spawning.

4.3.9 Other Fish Species Habitat Utilization

Potential impacts to spawning and general habitat of other fishes, essentially follow the impacts to spawning Walleye and River Redhorse that are detailed above in Sections 4.3.7 and 4.3.8, respectively. The existing flow regime through the North Channel will be maintained, and because the Calabogie GS will remain a run-of-the-river plant and OPG is obligated to maintain the existing water level regimes upstream and downstream of the GS, it is believed that the reconstructed GS will not affect habitat utilization by any fish species, except in the immediate vicinity of the South Channel Spillway and the GS tailrace. As well, a portion of the footprint of the existing intake channel immediately upstream of the old generating station will become the new generating station and will not be fish habitat.

In the future, at total flows above approximately 60 cms, flow velocities in the tailrace will be similar or higher and flow velocities in South Channel Spillway will be lower than they are currently. Flows in the South Channel Spillway are highly variable under existing conditions. The South Channel Spillway has very high spring flows, with fast, turbulent water (Figure 3-21, Aquatic TSD) that limits habitat utilization by fish. If spillway flows are reduced during high flow periods, habitat conditions may improve. It is possible that the shallow areas at the downstream end of the spillway that have cobble, gravel and sand substrates (Figure 3-14, Aquatic TSD), will become suitable as Walleye spawning habitat and may also provide spawning habitat for other species such as White Sucker. There will be no flow in the South Channel Spillway for a longer period each year. When there is no flow through the South Channel Spillway the backwater effect limits the area that is dry to immediately below the sluicegates. This area is primarily bedrock and very large boulders and is unlikely to provide spawning to any fish species under existing of future conditions. However, as previously explained the south spillway channel will remain watered at a minimum elevation of 144.2 masl. This is consistent with the historical and existing operation of the facilities. The elevations at the end of the South spillway where fish habitat was observed range from 140-143 masl and the upper portion of the spill way will remain backwatered to minimum elevation of 144.2 masl.

As previously discussed, the downstream receiving environment is being modeled to understand the depth and velocity profiles relative to fish preferences. This information will be used to understand the distribution of bed material that could be used as spawning or rearing habitat. We are currently exploring a range of habitat variables (Habitat Suitability Indices) that are specific to walleye spawning and rearing (e.g., McMahon 1984 - Habitat Suitability Index Models: Walleye (Depth 0.5 to 1.8 m, Velocity 0.6-0.9 m/s).

Figures 4-2 and 4-3 of the Aquatic TSD illustrate exiting fish depth and velocity preferences for the existing vs the project conditions at the same discharge (i.e. south spillway is spilling).

4.3.10 Fish Habitat Loss and Gain/Enhancement

As detailed above in Section 4.2.6 net changes in habitat area as a result of the demolition of the existing generations station and construction of the new generation station will be small. The area of the tailrace will increase as a result of the new generating station being located approximately 50 meters upstream. This will shorten the forebay, but removal of the piers and widening of the forebay entrance will increase the area of habitat so that, there too, the net change in habitat area will be small.

Areas within the forebay and tailrace that that are excavated to or in bedrock will be mitigated by the placement of 0.5 m of granular material (boulders, cobble, and gravel) over exposed bedrock. This will maintain the habitat function within these areas. The downstream receiving environment is being modeled to understand the depth and velocity profiles relative to fish preferences. This information will be used to understand the distribution of bed material that could be used as spawning or rearing habitat. SNC-Sullivan currently exploring a range of habitat variables (Habitat Suitability Indices) that are specific to walleye spawning and rearing (e.g., McMahon 1984 - Habitat Suitability Index Models: Walleye (Depth 0.5 to 1.8 m, Velocity 0.6-0.9 m/s).

It is thought that the diversion of a portion of the high flow volumes, that presently pass through the South Channel Spillway during the spring, to the GS, will provide better functionality of habitat within the spillway, provided that a seasonal minimum flow is initiated to maintain those habitats through to about the middle of June (the end time could be a fixed date, or determined annually as a function of degree days). The flow reduction will allow more spawning opportunities for Walleye, White Sucker, and other species such as Logperch, while the minimum flow will ensure that any embryos deposited by these species will have sufficient flow to fully develop and swim out from the spawning area.

OPG will provide a detailed assessment of habitat changes associated with the new project as part of the DFO review process. The assessment will account for both temporary and permanent changes and opportunities to balance habitat productivity will be investigated. The goal of the fish habitat design process is to balance the effects from the project so there is a no-net-loss of fish habitat.

The habitat conditions in the South Spillway change markedly as flow varies over the course of a year and between years. At peak flows the upper portion of the South Spillway has velocities so high that it is probably not occupied by fish; if it is it will be by species that are tolerant of high water velocities (i.e. longnose dace) that can shelter among boulder. At low flows and velocities that area is suitable for a wide range of species (walleye, centrarchids, catostomids, most cyprinids), but less so for species that prefer higher velocities (i.e. longnose dace). With the new generating station flows in the South Spillway will be lower during periods of high flow and zero for more of the year. This will extend the period that flows are suitable for species that prefer lower velocities but reduce the length of time that it is suitable for species that prefer high velocities. With the new generating stations, changes in flow through the South Spillway will be less frequent.

This increased stability of habitat conditions can be expected to benefit species that utilize lower velocity habitats and be to the detriment of species that prefer higher velocity spawning, nursery, or foraging habitats.

The average historical inflow for the period between 1965 and 2017 at Calabogie is approximately 90 m^3/s with a median of 72 m^3/s. The freshet level flows are shown in the historical flow calculations in Figure 2-4 and illustrate periods when spring walleye spawning and subsequent incubation occurs. The elevation in the receiving environment is not anticipated change during periods of spring incubation. The seasonality of inflows for the facility is highlighted in the inflow figure below.

As previously explained, the change in operations is not expected to result in in an increased risk to fish stranding as the conditions are expected to continue. The south spillway channel will remain watered at a minimum elevation of 144.2 masl and there will not be any periods where there is no water in channel. This is consistent with the historical and existing operation of the facilities. The elevations at the end of the South spillway where fish habitat was observed range from 140-143 masl and the upper portion of the spill way will remain backwatered to minimum elevation of 144.2 masl.

In summary, it is believed that the proposed development with the suggested mitigation, will not have a negative impact upon the fisheries of the Madawaska River, and there may be a positive impact.

4.3.11 Fish Entrainment and Survival

Potential fish injury and/or mortality due to entrainment at power plants is an issue that has received technical consideration and analysis. Entrainment potential varies with approach velocities and intake screen bar spacing, and also varies among fish species and with fish size. The rate of individual fish injury/mortality varies with turbine design, generating station head, fish species and fish size. The number of fish injured or killed will depend upon the fish abundance and the volume of flow through the generating station.

The powerhouse design incorporates trashracks that cover the entire area of the turbine water passage intakes. The trashrack bar spacing will match the existing Calabogie GS, with 50 mm clear space between bars. An approach velocity of 0.9 m/s has been the design criteria. The current design has velocities no more than 0.9 m/s, modeled 75 mm upstream of trash rack at the normal minimum reservoir elevation.

The powerhouse will house two horizontal-axis Kaplan type turbines. Each turbine runner will have four blades and will operate at 156.5 rpm. Turbine mortality will be modelled using this information so that it can be considered by the regulatory agencies, including DFO, in their determination of whether offsetting will be required for the project.

4.3.12 Summary of Potential Construction and Operation Effects on the Aquatic Environment and Mitigation/Remedial Measures

Table 4-2 summarizes potential construction and operation effects, the recommended mitigation/remedial measures to minimize or obviate these effects and the net effects of the proposed Calabogie Re-Development Project.

Table 4-2. Potential Construction and Operation Effects

Effect/Activity	Recommended Mitigation/Remedial Measures	Net Effect
Construction		
Soil erosion	• Adherence to Erosion and Sediment Control Plan.	No adverse residual effect
Incidental spills	• Adherence to Spills Emergency Preparedness and Response Plan.	No adverse residual effect
Bedrock Excavation resulting in Groundwater Ingress	• Use of sump pumps. If necessary, the water will be directed to settling pond(s), silt treatment bags, and vegetated areas to mitigate any environmental issues that may arise from the dewatering. Should the groundwater require secondary treatment for dissolved metals, proper measures will be taken.	No adverse residual effect
Hazardous Materials/Waste	• Adherence to Hazardous Materials Management Plan and Waste Management Plan. • Waste disposal in accordance with regulatory requirements.	No adverse residual effect
Blasting	• Adherence to DFO guidelines (Wright and Hopky, 1998) and blasting engineer recommendations. • Potential use of blast rock for fish habitat enhancement and/or nearshore/shoreline erosion protection, or removal for suitable upland disposal.	No adverse residual effect
In-water construction activities	• Use of clean rock fill for cofferdam. • Judicious selection of discharge location and water pressure during dewatering. • Adherence to in-water construction timing restrictions. • Transfer of fish stranded behind cofferdam prior to complete dewatering. • The different fish habitat areas that have potential to be affected by the project will be assessed for productive capacity and a habitat balance for the project will be presented for DFO review.	No adverse residual effect
Isolation and dewatering of the forebay and tailrace	• Capture and relocation fish trapped in the area that will be dewatered. • The different fish habitat areas that have potential to be affected by the project will be assessed for productive capacity and a habitat balance for the project will be presented for DFO review.	Eliminates or minimizes fish mortality due to dewatering
Sportfish populations	• As a condition of employment, prohibition of sportfishing by construction workers while working.	No adverse residual effect

Table 4-2. Potential Construction and Operation Effects (Cont'd)

Effect/Activity	Recommended Mitigation/Remedial Measures	Net Effect
Operation		
Incidental spills	• Adherence to Spills Emergency Preparedness and Response Plan.	No adverse residual effect
Water management operations	• None recommended: no changes predicted.	No adverse residual effect
Sediment erosion and transport	• Protect banks where there is erosion potential with suitably sized substrate.	No adverse residual effect
Loss/gain of fish habitat	• Minimize the area of habitat losses and maximize he area of habitat gains that result form result of station reconstruction. • Provide suitable substrate in areas where bedrock is exposed, if possible. • Potential improvement in spawning habitat for Walleye and other species at the downstream end of the South Channel Spillway. • As part of the DFO RFR process a detailed assessment of habitat changes associated with the new project will occur.	Potential net benefit
Fish entrainment and survival	• Fish entrainment and mortality expected to be low. However, a model-based assessment will be required.	To be quantified.

During construction and operation, an Environmental Compliance Monitoring Program will be implemented to ensure that all construction and operation related commitments are met. Details on the Environmental Compliance Program are provided in the ER.

Flow discharge, water levels and water temperature will be monitored throughout proposed Project operation.

Recommended aquatic environment monitoring during plant operation includes:

- Monitoring for American Eel downstream from the tailrace;
- Habitat assessment and monitoring of the enlarged tailrace during early spring (Walleye spawning) and in early June (check for River Redhorse, and general habitat function compared to pre-expansion condition);
- Habitat assessment and monitoring of the South Channel Spillway during early spring (Walleye spawning) and in early June (check adequacy of seasonal minimum flow).

4.4 Proposed Project Construction and Operation – Terrestrial Environment

4.4.1 Atmospheric Environment

4.4.1.1 Climate

Climatic data of relevance to construction activities include the occurrence of wet soils after prolonged wet weather events, the flooding of excavated areas after a period of heavy rainfall and the generation of fugitive dust emissions due to high winds during dry conditions. Soil moisture levels are anticipated to be low during frozen conditions in the winter and the dry summer months.

During periods of excessive rainfall or saturated soil conditions, construction activities will be monitored to ensure that gullying and erosion does not occur and that excavated soils do not migrate off the work area. Eroded areas will be stabilized as soon as sufficiently dry conditions prevail and, where appropriate, excavated soils will be stabilized by the use of silt fencing enhanced with straw bales to be deployed prior to excavation. Additional information on mitigation of soil erosion is provided in Section 4.4.4.

Erosion associated with high winds, resulting in soil loss and nuisance dust, should be reduced or eliminated by stabilizing spoil piles with straw mulch. Dust generation will be controlled by watering dusty roads and the construction sites (Cheminfo, 2005).

The average date of the last spring frost is May 13th and last date of the first fall frost is September 27th and therefore, revegetation/reseeding should occur within this May 13th to September 27th period.

The implementation of the proposed mitigation measures should reduce the effect of inclement weather and is predicted to result in no net effects on the terrestrial environment affected by construction of the proposed Project.

4.4.1.2 Air Quality

The construction of the proposed project will result in typical combustion and dust emissions.

Construction activities have the potential for short-term effects on air quality in the vicinity of the site. Emissions are primarily exhaust emissions (and associated odour) from construction equipment and fugitive dust due to disturbance of dry fine-grained soils. As with any construction site, these emissions will be of relatively short duration and unlikely to have any effect on the surrounding airshed.

During construction, exhaust emissions from construction equipment and fugitive dust emissions will have localized, short-term and transitory effects on the surrounding airshed. Typical combustion emissions include nitrogen oxides (NO_x), CO, SO_2, volatile organic compounds (VOCs) and particulate matter (PM). NO_x can affect vegetation negatively by causing damage or death to leaves, altered photosynthesis, stunting, spindly growth, reduced fruit set and/or reduced yield (Taylor *et al*., 1975). CO is not readily taken up by vegetation (Bennett and Hill, 1975; Mudd, 1975). Soil microorganisms appear to be the major sink for CO (Bennett and Hill, 1975). Sulphur is an essential element for plant metabolism because it is an important component of amino acids, proteins and some vitamins; however, under acute SO_2 levels, foliage symptoms range from chlorosis to necrosis (Malhotra and Blauel, 1980). Elevated VOC levels can also result in foliage chlorosis and necrosis (Malhotra and Blauel, 1980). PM generally does not damage vegetation, possibly because the particles would be removed by rain before any adverse effect could occur (Lerman and Darley, 1975).

During construction, the practices and procedures outlined in the Cheminfo (2005) document "Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities", prepared in conjunction with the Construction and Demolition Multi-Stakeholder Working Group for Environment Canada, will be followed, including:

- plans to minimize dust generation through planning, site layout and the proper use of materials, tools and equipment;
- use of wind fencing;
- compacting disturbed soil;
- activity scheduling;
- storage piles management;
- minimization of drop heights;
- barriers to prevent dispersion of materials;
- avoidance of blasting where feasible;
- work practices for loading debris;
- avoidance of prolonged storage of debris; and
- proper techniques for the use of materials that include VOCs.

The DBC and subcontractors will be required to maintain equipment in good working condition to minimize combustion emissions to the extent practicable (Cheminfo, 2005). To reduce fugitive dust emissions, effective dust suppression techniques, such as on-site and road watering, will be used.

The application of the recommended mitigation measures should minimize combustion emissions and limit fugitive dust emissions to the work area. As a result of the low concentrations of the atmospheric pollutants generated during construction, no adverse effects on terrestrial vegetation due to these emissions are anticipated.

Reseeding (if required) will be undertaken as soon as conditions permit after construction to reduce potential dust generation.

It is anticipated that a concrete batch plant will not be required as concrete can be sourced by local suppliers. Should a plant be required, emissions from the batch plant will need to meet the requirements of the ECA issued by the MOE under the *Environmental Protection Act*.

The existing GS is known to contain some asbestos as well as lead which is in the paint in the powerhouse. The GS will be demolished in a controlled fashion to prevent these substances from getting co-mingled with materials that can be re-used and to ensure that they are sent to the appropriate disposal facility.

There will be no atmospheric emissions from the proposed powerhouse during operation. As ambient air quality will not be affected during the operation of the Project and monitoring is not deemed necessary.

4.4.1.3 Environmental Noise

The construction of the proposed project will be a source of short-term local noise. All work is expected to be completed using conventional construction methods. Construction activities such as site grading, site preparation, pile driving, blasting and foundation work will be sources of noise generation. All of these activities, which are expected to take approximately 24 months, will require the use of various pieces of heavy equipment including bulldozers, front-end loaders, small trucks, backhoes, bobcats, dump trucks, compactors, ready-mix concrete trucks and cranes. Other construction activities, such as those related to the placement of the facility components (e.g., generator) and activities inside the building (once built) are expected to generate less noise.

The proposed project will be constructed using standard construction BMPs (e.g., Cheminfo, 2005). Sound emission standards for various equipment are set according to the date of manufacture of the equipment as defined by the MOE in the NPC-115 publication, listed in the MOE (1978) Model Municipal Noise Control By-Law. This document stipulates specific sound emission standards for various pieces of construction equipment. An environmental management plan will be prepared by the DB contractor which will address the subject of noise.

The primary form of mitigation of noise is adherence to the Township of Greater Madawaska’s Noise By-Law. The nearest human receptors to the construction site are residences approximately 200 meters on the west side of the River. Construction noise will be partially mitigated by the noise associated with the Madawaska River and local traffic.

Potentially susceptible wildlife receptors to noise include amphibians, reptiles, birds and mammals. The construction disturbance should be sufficiently local that there will be little to no permanent displacement of wildlife. However, noise and disturbance associated with construction activities will likely cause susceptible wildlife to vacate the area on at least a temporary basis. No permanent displacement of wildlife is anticipated.

The behavioural response of wild birds to noise is variable. The response varies with species, sex, group, size, season, activities engaged in prior to disturbance, previous exposure to the noise source and distance from the noise source (Fitchko and Lang, 1999). Some species may be very sensitive and may abandon their nests because of anthropogenic noise or activities. Other species habituate to anthropogenic noise or activities, yet others may be attracted to them.

Kaseloo (2004, 2006) reported that a number of studies have indicated that road noise has a negative effect on bird populations (particularly during breeding) of a variety of species. This effect is based on increased bird densities with distance from the road with the effect distances increasing with increased traffic densities. Traffic noise has not been explicitly established as the primary causal factor for avoidance by these species. Moreover, not all species have shown this effect and some species show the opposite response, with increased numbers near roads. As indicated by Kaseloo (2004), there are large gaps in the existing knowledge of the impact of noise on wildlife populations with the need to determine why noise, the presumptive cause, has such variable effects and if the effect is attributable to noise alone or if other factors and/or interactions are present.

While a bird's first reaction to a new noise source appearing in a new ecological niche may be fear and avoidance, if its other sensory systems (optical, chemical) are not stimulated, the organism quickly learns to ignore the noise source (Busnel, 1978). However, avoidance of noise should occur if the organism is approached or chased by humans. For example, it is well known that flocks of crows and gulls will follow a tractor and tilling implement to feed on worms and insect larvae exposed by tilling, ignoring the noise from the tractor; however, they leave immediately if the driver stops the engine and walks away from the tractor.

Drilling activities to facilitate blasting will generate noise and vibration similar to any general construction operation. Potential effects due to noise and vibration will be minimized by proper maintenance and operation of drill rig equipment. In addition, noise baffling equipment can be provided, as recommended by the blasting engineer.

The abrupt loud noise associated with blasting may startle wildlife, including reptiles, birds and bats. In a review of the effects of sonic boom on wildlife, Bell (1972) and Cottereau (1978) reported that wild animals may show behavioural startle when they first experience a sonic boom; however, their reaction is usually slight and they seem to adapt readily to further boom. Lynch and Speake (1978) studied the effect of sonic booms on the nesting behaviour of Wild Turkey (*Meleagris gallopavo silvestris*) and reported that sonic booms did not cause abnormal behaviour that would result in decreased productivity.

Some wildlife species will vacate the area temporarily to avoid noise and disturbance associated with construction activities, whereas others may become habituated to human activities and associated noise. No mitigation is recommended, with the exception of those provided for migratory birds and bats during their nesting and active seasons respectively (see Section 4.4.5 and 4.4.7).

During powerhouse operation, the noise level within the station will be mitigated by the powerhouse walls and rapidly attenuate with distance from the station. It is expected that noise levels will be similar to the existing situation. Local resident wildlife are already habituated to the noise emanating from the station.

4.4.2 Geology

The construction of the new powerhouse will require a significant amount of sediment and rock to be removed from the forebay area.

Blasting will be required to remove the rock for the new powerhouse and in the forebay. A third-party firm will be hired to implement a vibration monitoring program, provide engineered blast designs, and consult in all blasting operations as required.

Prior to any blasting or rock excavation, the sediment in the forebay will be excavated down to either rock or the required hydraulic elevations and disposed of on site.

Once the sediment has been removed and blasting is underway, excavation of the rock will begin. As previously explained in Chapter 2, OPG has made an arrangement with the Township of Greater Madawaska for the Township to receive the rock which it plans to use for road construction and maintenance. Small amounts of rock will also be used cofferdam material or stockpiled for later use as embankment treatment or disposed of on site.

Groundwater infiltration into this excavated area is expected and the anticipated flow rate along with the duration of construction, a Permit to Take Water is likely required. To combat the water infiltration, sumps will be blasted into key areas of the excavation and pumps will be installed to dewater the area. If necessary, the water will be pumped into settling pond(s), silt treatment bags, and vegetated areas to mitigate any environmental issues that may arise from the dewatering. Should the groundwater require secondary treatment for dissolved metals, proper measures will be taken.

Explosives used in construction will be closely controlled in accordance with all government regulations, and their use restricted to authorized personnel who have been trained in the use of explosives in a manner so as to minimize impacts on the environment. Appropriate government agencies and the local residents and business operators will be informed of the blasting schedule in advance of construction, as well as just prior to the detonation program. All necessary permits will be obtained by the DBC, who will also comply with all legal requirements in connection with the use, storage and transportation of explosives, including, but not limited to, the *Canada Explosives Act* and the *Transportation of Dangerous Goods Act*. The DBC will be required to retain a consulting engineer with technical expertise in blasting to provide advice on maximum loading of explosives for all blasting, as well as an engineering report indicating recommended charges and blasting methods to be used at specific locations. All blasting will occur in such a way as to be in compliance with federal regulations and directions. Minimization of the physical effects of blasting will be ensured by following the recommendations of the blasting engineer and the DFO blasting guidelines, “Guidelines for the Use of Explosives in or near Canadian Fisheries Waters” (Wright and Hopky, 1998). Excess rock will be removed for suitable use or disposal. Sampling and analysis of bedrock indicated that it is not acid generating.

A Site Development Plan will be prepared by the DBC, including planning considerations; site and design considerations; site development scheduling; selection of construction equipment; and site development details.

No effects on geology are anticipated beyond footprints already described. As these effects are localized relative to overall geology in the area, no mitigation measures are required beyond those set out in the Site Development Plan.

No effects on geology are anticipated as a result of the operation of the proposed operation; therefore, no mitigation is required.

4.4.3 Physiography

As the proposed project is occurring at the already existing Calabogie Generating Station there is a negligible alteration to the site.

As the effects of site development are expected to be negligible on overall physiography, no mitigation measures are required beyond those set out in the Site Development Plan.

No effects on physiography are anticipated as a result of the operation of the proposed Project; therefore, no mitigation is required.

4.4.4 Soils

4.4.4.1 Soil Erosion

Soils on the proposed Project site are highly disturbed from previous work at the site which has been going on for over one hundred years.

During construction, soil erosion generally results from precipitation and runoff, or wind action on the disturbed terrain surfaces as a result of the removal of vegetative cover, alteration of topography and improper restoration. All construction work should be conducted so as to avoid unnecessary disturbance of the ground by the placement or excavation of materials, the disruption of established natural surface and subsurface drainage, or the disturbance of natural vegetation cover that is to be preserved.

During periods of excessive rainfall or saturated soil conditions, construction activities will be monitored to ensure that gullying does not occur on the any slopes near the Madawaska River and that excavated soils do not migrate off the work area. Exposed areas will be stabilized as soon as sufficiently dry conditions prevail and, where appropriate, excavated soils will be stabilized by the use of silt fencing enhanced with straw bales, stockpile covers, berms, controlled compaction, etc.

Erosion associated with high winds, resulting in soil loss, will be reduced or eliminated by stabilizing spoil piles with straw mulch or more stable materials.

Erosion and sediment control will be an integral component of the construction planning process. All personnel involved with the proposed works will be briefed on erosion and sediment control. In general, the following guidelines will be applied in the development of the Erosion and Sediment Control Plan:

- fitting of proposed works to the terrain (i.e., using the natural topography of the land in the placement and organization of the construction site);
- timing of grading and construction activities to minimize soil exposure;
- retention of existing vegetation where feasible;

- restriction of the use of heavy construction equipment to within the approved work areas to minimize soil disturbance and vegetation destruction;
- storage of stripped soil at upland locations with a minimum of 5 m from the edge of the Madawaska River;
- implementation of erosion control measures, e.g., rip-rap berms underlain by filter geotextile, straw bales used as filters, silt fencing along the shoreline and/or mulching for interim stabilization;
- diversion of runoff away from exposed areas;
- minimization of the length and steepness of slopes;
- maintenance of low runoff velocities;
- design of drainage works, such as ditches and outfalls, to handle concentrated runoff;
- retention of sediment on site;
- routine inspection and maintenance of erosion and sediment control measures; and
- revegetation of disturbed areas by seeding and/or planting following construction as soon as seasonal conditions permit.

The site-specific Erosion and Sediment Control Plan will be part of a broader Environmental Management Plan for the proposed Project.

After construction, the disturbed sites will be rehabilitated. A Site Rehabilitation Plan including planning considerations, soil stabilization and re-vegetation (using only native vegetation and planting of tree species typical of the specific ecosite) will be prepared for the proposed Project.

The implementation of the Erosion and Sediment Control Plan and the Site Rehabilitation Plan during construction and rehabilitation will obviate or minimize potential effects on soils.

4.4.4.2 Management and Control of Hazardous Materials, Construction Wastes and Incidental Spills

Incidental spills of oil, gas, diesel fuel and other liquids to the environment could occur during construction. In addition, sanitary and other wastes will be generated during construction. Fuelling and lubrication of construction equipment should be carried out in a manner that minimizes the possibility of releases to the environment. Measures for containment and cleanup of contaminant releases should be followed to minimize contamination of the natural environment, e.g., placement of fuel tanks and generators on plastic sheets bermed around the edges, and use of suitable hydrocarbon absorbent material for cleanup and approved landfill or other disposal. Any spills with the potential to create an impact to the environment should be reported to the MoECP as required by provincial spills legislation. Interim sanitary waste collection and availability of treatment facilities should be arranged for the duration of the construction period. All construction waste, washwater and wastewater should be disposed of in accordance with regulatory requirements.

As previously explained in Chapter 2 the soils of the areas to be excavated for the project has been tested. Laboratory analyses were completed by ALS Canada Ltd. in Ottawa, Ontario, for detection of potential contaminants of concern (PCOC). These were compared to soil and sediment site condition standards of Tables 3-1 and 4-1 of O. Reg. 153/04. Some sediment in the bed of the forebay contained concentrations of selected metals that exceed the MOE Table 3-1 and Table 4-1 site condition standards. Some soil in the vicinity of the Powerhouse, the forebay retaining wall and in the forebay contained concentrations of selected metals, PHCs and PAHs that exceed MOE Table 3-1 and Table 4-1 site condition standards.

Composite soil sample TCLP leachate analyses suggest that soil and sediment at the site would be classified as solid non-hazardous waste if disposed at a landfill. Because of the exceedances with respect to the sediment it is our understanding that OPG can place the sediment on site but it is recommended that it not be placed within 30 meters of any surface waterbody and that actions may be required to mitigate risks to the environment from the emplaced sediment. This has been confirmed with the MoECP. As previously indicated OPG plans to place this excess soil and sediment on Calabogie Island (see Chapter 2, Project Description).

A Hazardous Materials Management Plan, Waste Management Plan and a Spills Emergency Preparedness and Response Plan will be developed by the DBC for the proposed Project as part of the broader Environmental Management Plan The implementation of these pollution prevention plans will obviate or minimize the environmental effects of accidental releases to the natural environment.

4.4.5 Vegetation and Vegetation Clearing

Eleven different ecological communities were delineated within the study area. Most of the development footprint occurs within communities that are already disturbed as part of the current operations of the generating station. For those communities that are vegetated and are going to be affected by construction activities, BMPs for vegetation management and retention as described above for soils will be implemented.

A Fire Protection Plan should be developed by the DBC. This Plan will provide an inventory of available fire suppressant equipment, response plans and contingency plans. This could be part of an overall Emergency Response Plan.

Woodland Pinedrops occurs in several locations along Generating Station Lane and Calabogie Island Road. Additional measures to protect this plant in the event that road widening or maintenance is required are provided in Terrestrial Environment TSD.

As previously indicated in Chapter 2, a total of up to 10 hectares of land will need to be cleared of vegetation. The vast majority of any vegetation clearing associated with the project will be temporary in nature and the area naturalized following its use. Table 4-3 below identifies the proposed land use, the ELC community in which it is located and identifies the potential loss of vegetation and whether it should be considered a permanent or temporary loss.

The Soil/Rock Deposition Area is an area to place excavated soil and sediment and perhaps rock. This area was identified for placement prior to negotiations with the Township on potentially giving the rock to the Township. As such, the temporary loss area shown below is likely larger than what is actually required. The Additional Parking Area is the area proposed for workers vehicles during the construction stage and following construction topsoil would be added and the area re-vegetated. The Road Upgrades would be for a widening of roads to the site. Generating Station Lane may or may not be widened. Most of the Laydown Area/Temporary Storage Area occurs in areas previously disturbed by construction activities as does most of the Infrastructure Associated with the New Powerhouse. The Temporary Haul Road will be used to transport excavated rock to the adjacent Township lands. The "stockpile" area would be the Township to store the excavated rock until it has been depleted.

Table 4-3. Vegetation Removal

	Proposed Land Use	ELC Community	Permanent Loss (ha)	Temporary Loss (ha)
	Soil/Rock Deposition Area	Forest		1.11
	Additional Parking Area (if Required)	Forest		1.94
	Road Upgrades (if Required)	Forest	0.14	
	---	CUT/CUW: Cultural Thicket/Cultural Woodland Complex	0.07	
	Laydown Area/Temp Storage	Forest		0.73
	---	CUT/CUW: Cultural Thicket/Cultural Woodland Complex		0.21
	---	CUM: Cultural Meadow		0.31
	Infrastructure Associated with New Powerhouse	CUT/CUW: Cultural Thicket/Cultural Woodland Complex	0.26	
	Temporary Haul Road	Forest		0.36
	Stockpile for Township (Primary Area)	Forest		1.80
Total			**0.47**	**6.47**

Vegetation clearing will adhere to standard construction practices as listed below:

- Vegetation clearing should not be conducted during the migratory bird nesting season (see Section 3.9);
- Vegetation clearing should be restricted to the minimum necessary for construction activities;
- Physically delineate the limits of clearing and construction with flagging or staking, ahead of construction, to avoid unnecessary disturbance to surrounding vegetation;
- Sediment control measures be maintained in good working order until vegetation has been established on the exposed soils;
- Brush and trees should be felled into the area to be cleared to prevent damage to adjacent vegetation;
- Branches overhanging the cleared area should be cut (pruned) cleanly and stubs shall not be dressed;
- Use best management practices to ensure that trees being retained adjacent to construction areas are not damaged;
- OPG is of the opinion that it retains the rights to the forest resources on its lease and therefore any merchantable and non-merchantable timber can be sold by it on the open market or used for other purpose. OPG has had discussions with the Algonquins of Ontario and the AOO has indicated that the wood should be offered for utilization by individuals rather than chipped. Alderville FN has also indicated a potential interest in the wood. OPG will make offers for the wood to be directed to parties for utilization should there be interest;
- All remaining slash material will either be burned or chipped according to OPG's objectives and in accordance with any burning restrictions;
- Chipped material should be spread so as to lower the incidence of forest fire; and
- Slash material should not be stored near any water bodies.

To protect the rare plant, Woodland Pinedrops, along Generating Station Lane and Calabogie Island Road, any road widening should:

- Avoid all locations of the plant if possible;
- Physically delineate the limits of a buffer (protection zone) around the plants with flagging and staking;
- Determine the size of the protection zone based on local conditions (e.g., current growing conditions, topography, current road location); and
- If all plants cannot be retained, then retain the plants and locations with the highest long-term viability (e.g., farthest from vehicle travel and/or disturbance).

CRP/OPG will ask the DBC to follow the Ontario Provincial Standard (OPS201) definition of "Close cut clearing", i.e., the cutting of all standing trees, brush, bushes and other vegetation at original ground level and the removal of felled material and windfalls.

Relative to the forest cover in Ecodistrict 5E-11 and along the Madawaska at Calabogie, the permanent loss of 0.47 ha and temporary loss of 6.47 ha of forest/woodland is negligible or low in magnitude, duration and extent.

It should also be noted that phragmites was identified on the Calabogie GS site but not in the development footprint of the project (near the boat launch). As a result of discussions among AOO, AoPFN and OPG, OPG has committed to removing and monitoring it in this location.

4.4.6 Wetlands and Areas of Natural and Scientific Interest

The wetlands within the study area have not been evaluated by the MNRF and as such are not designated as provincially significant wetlands. Nevertheless, development will be set back appropriate distances from the wetlands and mitigation measures will be implemented to protect vegetation and wetland function. The Grassy Bay Provincially Significant Wetland is located approximately 1.3 km upstream of the study area at the eastern end of Calabogie Lake. Balmer Lake Provincially Significant Wetland is approximately 7.3 km downstream of the study area. There are no Areas of Natural and Scientific Interest within a distance where they would be affected by activities within the study area.

Given OPG's intent to comply with the WMP, it is not anticipated that the project will have any adverse effects on these provincially significant wetlands. Regarding the potential for fluctuating water levels on Calabogie Lake to have effects on the flora and fauna within the Grassy Bay Provincially Significant Wetland, the following discussion is provided.

The new generating station will have an increased maximum total turbine outflow over the existing GS (160 m^3/s versus 66 m^3/s). This increased capacity will allow OPG to put through almost 2 ½ times more water. However, given the variety of other requirements and compliance ranges that OPG is required to follow, the possible effects on water levels in Grassy Bay would be limited to slightly quicker drawdowns occasionally. That is, water levels could be lowered to the minimum more quickly in any one day (a few hours until the minimum is reached rather than half a day). The daily minimum and maximum water levels will not change. Additionally, these quicker draw downs will not occur every day because other factors in the system affect the water compliance requirements (as per the Madawaska River Water Management Plan). No seasonal changes are anticipated as OPG will continue to operate the Calabogie GS and the other plants on the Madawaska River in full accordance with all flow and water level targets and compliance conditions in the Madawaska River Water Management Plan, including the summer conditions.

4.4.7 Wildlife

The quicker drawdowns are not expected to have any negative effects on the wildlife likely to be present in Grassy Bay (including Blanding's Turtle, other turtles and amphibians). For example, turtles do not nest or hibernate in the zone between the daily low and high-water marks and these habitat features are the most sensitive. Turtles do, however, bask in the sun on structures at the surface of the water such as rocks, woody debris and vegetation. Beacon has observed turtles basking on rocks down river from the Calabogie spillway that are only available to the turtles (i.e., rocks are above the surface of the water) when the water is not flowing through the spillway. When these basking rocks are not available because water levels are higher, the turtles bask above the water line along the shoreline or use floating woody debris. In fast flowing areas of the river, woody debris and floating vegetation mats are absent and basking habitats for turtles are very limited (e.g., the South Channel). In contrast, woody debris and floating vegetation mats are present along the periphery of Grassy Bay and thus the availability of basking habitat for turtles should not be affected by quicker draw downs. Regarding amphibians, the species breeding in Grassy Bay are not expected to be negatively affected by the quicker drawdowns given that the egg masses of most species are resistant to short term emergence from water. No adverse effects on Northern Map Turtles downstream of the spillway are expected as this species regularly occurs in fast flowing river systems and no areas of potential entrapment have been noted. If turtles move up the spillway when the gate is closed and are then present when the sluice gate is opened, they will be flushed into the area where they were observed basking in 2018.

As per the regulations under the federal *Migratory Birds Convention Act* it is necessary to ensure that breeding birds and/or their nests, eggs or young are not disturbed, damaged or destroyed. Therefore:

- Vegetation clearing should be avoided during the migratory bird nesting season (April to the end of August) (however, it is OPG's intention to clear trees before April 1 to meet the bat cavity tree window); and
- If minor vegetation clearing needs to occur during migratory bird nesting season or if clearing needs to occur in highly disturbed areas with simple vegetative structure, then a qualified avian ecologist should examine the area to be affected to ensure that no nests, eggs or nestlings or indications of nesting are present. However, in almost all circumstances a high risk of nesting birds will occur from May to July inclusive.

Once construction of the proposed Project is completed, any displaced animals could reoccupy the habitat created on the rehabilitated areas, and the habitat not directly affected by construction activities. The steady noise from the proposed Project powerhouse during operation is not expected to elicit an adverse reaction from wildlife due to habituation.

4.4.7.1 Proposed GS Construction and Road Traffic

The potential effects of environmental noise on wildlife are presented in Section 4.4.1.3.

As previously explained in the Project Description in Chapter 2, worker traffic is expected to be directed to the Road on Calabogie Island. The road to the Calabogie GS is to be devoted to large construction equipment and deliveries of equipment and materials. Both roads are less than 400 meters in length and traffic speeds are limited to 20 km/hour for safety purposes which also reduces the likelihood of vehicular-animal incidents. Given the presence of turtles in the study area, including the threatened Blanding's Turtle, mitigation in the form of species at risk information sessions for all site workers is recommended. These worker information sessions, along with low travel speeds should minimize adverse effects on wildlife.

OPG has also agreed to monitor any wildlife mortality caused by construction traffic and alter practices if any patterns have been observed.

4.4.7.2 Proposed Road Construction and Deposition

OPG has indicated that it will have to excavate a significant amount of rock from the forebay to construct the new powerhouse at the Calabogie GS. In discussions with the Township it was realized that this rock could be used by the Township for future road works. The intention of this sub-project is to deliver the excavated rock to municipally owned lands adjacent to the rear of the Township's Works Yard. The Township has also indicated that it can take the demolished powerhouse (save for the exterior structure that has lead paint on it) as well.

4.4.8 Endangered and Threatened Species

As previously indicated, five species subject to regulations under the provincial ESA were documented to occur within the study area.

4.4.8.1 Bats (Little Brown Myotis, Northern Myotis, Tri-colored Bat)

Three endangered bat species were documented within the study area by conducting acoustic surveys and habitat for these species was documented in several locations. As explained previously, bat habitat trees would be removed in several locations. As such, the following is recommended to avoid adverse effects on individuals of the species as per Section 9 of the ESA:

- Any removal of potential bat habitat trees should be completed outside of the active season for bats (no habitat tree removal between April 1 and October 1); and
- In the event that tree clearing must occur between April 1 and October 1, a qualified professional should complete an exit survey at each habitat tree identified for removal a maximum of 24 hours before removal. The exit survey must make use of a bat detector and occur for no less than the time period between sunset and 60 minutes after sunset. In the event that a bat is identified exiting or entering trees during the surveys, MECP should be contacted to obtain further direction prior to removal of the tree.

Based on comments received by MECP as part of the EA review process it is our understanding that "No authorizations [specific to bats under the ESA] would be required if trees were cleared outside of the bat active season (April 1 to October 1)." If these activities cannot be completed during this timing window and tree clearing is proposed between April 1 and October 1, then MECP must be contacted to obtain further direction prior to removal of any trees. OPG is planning to do tree clearing before end of March 2020.

4.4.8.2 Blanding's Turtle

Blanding's Turtles make regular overland movements between wetlands/waterbodies and to and from nesting areas. These movements can be up to 2 km and can occur anytime during the turtle's active season but are more likely during the nesting season. These behavioral characteristics make it difficult to exclude Blanding's Turtles from all work areas that have the potential to injure or kill individuals (i.e., roads and areas where motorized vehicles are operating). That said, mitigation measures that combine species at risk training for on-site workers with temporary exclusion fencing can substantially reduce the likelihood of adverse effects on Blanding's Turtle. The following mitigation measures are recommended:

- Qualified Professional to provide species at risk training for OPG staff and all workers that will be on-site;
- Develop and adhere to site-specific response protocols for turtles and other wildlife encounters;
- Incorporate "tailgate" education material for species at risk developed by Pembroke MNRF;
- Erect three turtle/snake crossing awareness signs (one on Generating Station Lane, one on Calabogie Island Road, and one on the temporary haul road);
- Erect temporary exclusion fencing as shown in Figure 3-10 (Terrestrial Environment TSD) to prevent turtles from moving into areas of active construction and motorized vehicle traffic;
- Exclusion fencing to be installed can double as sediment fencing but must meet the specifications recommended in the most recent version of MNRF's guidance document *Reptile and Amphibian Exclusion Fencing*;
- Exclusion fencing can only be put in once the ground is thawed. Therefore, it is OPG's intention to install the fencing soon after the ground has thawed or by mid-April; and
- The haul road and deposition area should be 30 metres from the boundary of wetlands so that the development footprints are outside of Category 2 Blanding's Turtle habitat.

Based on the implementation of these mitigation measures along with the location of the proposed development footprint as shown in Figure 3-8 (overlaid on Blanding's Turtle habitat mapping) and Figure 3-10 (exclusion fencing) (of the Terrestrial Environment TSD), it is our opinion that the proposed activities will achieve avoidance under the ESA with respect to Blanding's Turtle and thus not require an authorization

4.4.8.3 Barn Swallow

Barn Swallow has a species-specific provision (Section 23.5 of O. Reg. 242/08) under the ESA. Because of previous work at the Calabogie site, an artificial nesting structure has already been constructed and established in the study area. Sufficient nesting cups have been established in this structure to accommodate Barn Swallows that will be displaced from the bridge as per the regulation. These activities by OPG at Calabogie also necessitated a Notice of Assessment be submitted for Barn Swallow.

To ensure compliance with the ESA with respect to Barn Swallow it is recommended that Section 23.5 of the O. Reg. 242/08 be reviewed in its entirety. Key requirements in that regulation are as follows:

- give the Minister notice of the activity by submitting a notice of activity form available on the Registry;
- if any part of the activity is to be carried out during the barn swallow active season, the person must ensure that barn swallow are excluded from any part of the building or structure that is the object of the activity by doing the following before the barn swallow active season begins:
    - removing from the building or structure any existing barn swallow nests that may be impacted by the activity, and
    - installing tarps and netting or taking other such measures to prevent barn swallow from accessing any part of the building or structure that is the object of the activity;

- provide reports to the Ministry as per the timing and details provided in Section 23.5 of the O. Reg. 242/08.

It is our understanding that the Barn Swallow has been registered for this site under the ESA and that mitigation to exclude the species from former nesting locations will be put in place. As such, based on comments received by MECP as part of the EA review process no authorizations will be required.

4.4.8.4 Species of Conservation Concern

The mitigation measures provided above for plants, birds, and endangered and threatened species will prevent adverse effects on the species of conservation concern present in the study area.

4.4.9 Summary of Potential Effects on the Terrestrial Environment and Mitigation/Remedial Measures

The Terrestrial Environment TSD provides a terrestrial environmental baseline, as well as an assessment of the potential environmental effects of the proposed Calabogie GS Redevelopment Project on the terrestrial environment and the recommended mitigation measures to minimize these effects. The report also includes an evaluation of potentially significant natural heritage values to evaluate compliance with federal and provincial legislation and policies.

During proposed Project construction, potential effects on the terrestrial environment may occur due to fugitive dust, combustion emissions, noise, blasting, soil erosion, incidental spills, hazardous materials use, waste generation, vegetation clearing, partial plantation loss, increased human activity and displacement of nesting birds and turtles. Based on an assessment of the available baseline information and potential effects, as well as the implementation of the recommended mitigation measures, it is concluded that effects during construction can be effectively mitigated, and most of them will be localized and short-term.

During the operation of the proposed Project, potential effects on the terrestrial environment may occur due to noise, incidental spills, etc. Based on assessment of the baseline information and potential effects, it is concluded that the operation of the proposed Project will have negligible long-term effects on the terrestrial environment.

Environmental protection during proposed project construction and operation will be ensured by adherence to the site-specific Environmental Management Plan, as well as compliance with regulatory standards and guidelines.

The Environmental Management Plan ensures that environmental protection will be achieved during construction by describing government agency requirements, proposed Project commitments and recommended mitigation measures to be undertaken. The Environmental Management Plan will include the Erosion and Sediment Control Plan, Spills Emergency Preparedness and Response Plan, Hazardous Materials Management Plan, Waste Management Plan and Site Rehabilitation Plan.

During construction and operation, an Environmental Compliance Monitoring Program will be implemented to ensure all construction and operation related commitments are met. Details on the Environmental Compliance Monitoring Program is provided in the Environment Report.

Table 4-4 below summarizes potential construction and operation effects, the recommended mitigation/remedial measures to minimize or obviate these effects and the net effects.

Table 4-4. Summary of Potential Effects and Recommended Mitigation/Remedial Measures

Effect	Recommended Mitigation/Remedial Measure	Net Effect
Construction		
Air quality/fugitive dust	• Use of well-maintained equipment to minimize combustion emissions. • Use of water trucks and/or sprinklers (e.g., Cheminfo, 2005).	Negligible effect
Noise	• Use of well-maintained equipment and noise silencers (as required).	Negligible effect
Blasting	• Adherence to blasting engineer recommendations.	Negligible effect
Soil erosion	• Adherence to Erosion and Sediment Control Plan.	Negligible effect
Incidental spills of oil, gasoline and other liquids during construction	• Adherence to Spills Emergency Preparedness and Response Plan.	Negligible effect
Hazardous materials/ waste	• Adherence to Hazardous Materials Management Plan and Waste Management Plan. • Waste disposal in accordance with regulatory requirements.	Negligible effect
Vegetation clearing	• Adherence to standard construction practices. • Implementation of the Site Rehabilitation Plan.	Negligible effect
Harm rare plant, Woodland Pinedrops	• Avoid all locations of the plant if possible. • Physically delineate the limits of a buffer (protection zone) around the plants with flagging or staking. • Determine the size of the protection zone based on local conditions. • If all plants cannot be retained, then retain the plants and locations with the highest long-term viability.	Negligible effect
Increased human activity	• No harassment of wildlife. • No fishing, hunting or recreational ATV use.	Negligible effect
Traffic	• Monitor numbers of wildlife killed or injured via road traffic. Increase worker education if problem is warranted.	Negligible effect
Disturbance damage or destruction of bird nests, eggs or young	• Use of well-maintained equipment and noise silencers (as required). • Vegetation clearing should not be conducted during the migratory bird nesting season.	Negligible effect

Table 4-4. Summary of Potential Effects and Recommended Mitigation/Remedial Measures (Cont'd)

Effect	Recommended Mitigation/Remedial Measure	Net Effect
Harm/harass endangered Blanding's Turtle and/or damage/destroy habitat	• Qualified Professional to provide species at risk awareness training for OPG staff and all workers that will be on-site. • Develop and adhere to site-specific response protocols for turtles and other wildlife encounters. • Incorporate "tailgate" education material for species at risk developed by Pembroke MNRF. • Erect three turtle/snake crossing awareness signs (one on Generating Station Lane, one on Calabogie the Island Road, and one on the temporary haul road). • Erect temporary exclusion fencing as shown in Figure 3-10 to prevent turtles from moving into areas of active construction and motorized vehicle traffic. • Exclusion fencing to be installed can double as sediment fencing but must meet the specifications recommended in the most recent version of MNRF's guidance document Reptile and Amphibian Exclusion Fencing. • The haul road and deposition area should be 30 metres from the boundary of wetlands so that the development footprints are outside of Category 2 Blanding's Turtle habitat. • Any removal of potential bat habitat trees should be completed outside of the active season for bats (no habitat tree removal between April 1 and October 1). • No authorizations specific to bats under the ESA would be required if trees were cleared outside of the bat active season (April 1 to October 1). If these activities cannot be completed during this timing window and tree clearing is proposed between April 1 and October 1, then MECP must be contacted to obtain further direction prior to removal of any trees.	Negligible effect
Harm/harass threatened Barn Swallow	• Follow Section 23.5 of provincial O. Reg. 242/08.	Negligible effect

Table 4-4. Summary of Potential Effects and Recommended Mitigation/Remedial Measures (Cont'd)

Effect	Recommended Mitigation/Remedial Measure	Net Effect
Harm/harass endangered bat species and/or damage/destroy habitat	• Confirmation from MECP that the proposed activities combined with the mitigation measures described herein will avoid adverse effects on the species and its habitat. • Any removal of potential bat habitat trees should be completed outside of the active season for bats (no habitat tree removal between April 1 and October 1). • In the event that tree clearing must occur between April 1 and October 1, a qualified professional should complete an exit survey at each habitat tree identified for removal a maximum of 24 hours before removal. The exit survey must make use of a bat detector and occur for no less than the time period between sunset and 60 minutes after sunset. In the event that a bat is identified exiting or entering trees during the surveys, MECP should be contacted to obtain further direction prior to removal of the tree.	Negligible effect
Operation		
Noise	• Ambient noise levels will be localized.	Negligible effect
Incidental spills of oil, gasoline and other liquids during operation	• Adherence to Spills Emergency Preparedness and Response Plan.	Negligible effect

4.5 Socio-Economic, Land and Resource Use Impacts

4.5.1 Socio-Economics

The proposed Project will have a positive economic impact on the Province, eastern Ontario and Renfrew County.

The proposed Project is expected to result in the creation of approximately 162 to 185 person years of work over an approximately two-year construction period. This employment will be distributed across a wide variety of professions and trades typically associated with a heavy construction project. Large labour needs will include: engineers; equipment operators, labourers, drillers, cement workers, ironworkers/rodmen, electricians, welders, carpenters, etc.

Recent OPG experience in constructing hydroelectric projects in Northeastern Ontario demonstrated that approximately 60% of the total labour requirement for the on-site work was met by the labour market in northeastern Ontario. Given the greater labour pool in eastern Ontario and that the Design-Build Contractor (DB Contractor) includes participation from a local/regional heavy construction firm, it is anticipated that most of the labour would come from eastern Ontario.

As part of the ongoing commitment to work closely with local Indigenous Communities, and building on OPG's past experience in this area, it has developed a strategy with the AOO and the AoPFN to encourage community members and businesses to capitalize on employment opportunities on the Project, should it receive the necessary approvals to proceed to the construction phase. OPG has already hired a Front End Engineering and Design (FEED) Phase Design Build (DB) contractor who will be responsible for the construction of the Project. This DB contractor is aware of the importance of Indigenous employment and is working with the AOO, AoPFN and any interested Williams Treaty First Nations to facilitate the hiring of individuals and businesses. In addition, the DB contractor is working with the local Unions to ensure that all parties are collaboratively promoting employment of Indigenous individuals and business.

In addition to AOO and AoPFN, Mississaugas of Scugog Island and Alderville First Nations have also indicated interest in employment opportunities and OPG is committed to working with their employment representative to facilitate similar employment opportunities during construction. Once Hiawatha and Curve Lake respond to the request to meet with the Project, they too will be provided employment information as described above. To date Information on anticipated jobs during construction has been provided to AoPFN, AOO, Alderville FN and to the Mississaugas of Scugog Island FN, to help their relevant employment officer work with their community members to get them ready to compete for positions. As well, individuals and business interested in immediate employment opportunities (non-Project opportunities) as well as Project construction opportunities can work directly with a Sullivan contact on the Calabogie team who can introduce community members to Union contact etc.

The Project team will work cooperatively with the relevant Indigenous communities after the EA and into the Construction period should the Project receive its necessary approvals to move forward.

Additional indirect and induced employment and contracting opportunities will also be created as a result of the proposed Project, particularly in sectors associated with the supply of construction materials and the recent provision of goods and services to the Project and associated workforce. Based on other recent OPG hydroelectric projects in northern Ontario, for every direct job associated with the Project another 0.65 person years of employment will be generated elsewhere in northeastern Ontario.[1] This multiplier is likely higher in eastern Ontario because of the more extensive economic base of the region.

Some of the more common businesses or sectors in the local and regional economies that will benefit from the proposed Project include: Other construction and construction supply (e.g., building or aggregate supply) companies; Local accommodation suppliers (e.g., motels) as short-term workers on the Project visit the area; Business, professional and personal services companies that are likely going to experience increased levels of activity; Transportation related companies that are likely to experience an increased level of business; and, Local and regional retail (e.g., convenience stores, grocery stores, drug stores) and food services industries (e.g., restaurants, grocery stores) that will benefit from worker expenditures at these at these businesses.

Little to no effect is excepted on the population, demographic or social composition of local communities such as Calabogie. This is because OPG does not anticipate a large number of workers moving into the region for this temporary work. It is likely most workers will just commute from their existing residences in eastern Ontario. It is possible or likely that the employment opportunities created by the proposed Project might allow some people within one hour’s drive of the Project to secure some employment. Therefore, if anything the Project may somewhat enhance the social stability of some communities near the Project.

As OPG already operates the Calabogie GS, OPG does not anticipate any major changes with respect to staffing for the Plant Group that oversees Calabogie GS.

OPG anticipates that the re-developed GS will result in payment of $18 million (in 2019 dollars) to the Province in Gross Revenue Charges over the course of the proposed Project or $52.5 million (nominal dollars with inflation).

4.5.2 Land Use Planning, Access, Transportation and Municipal Infrastructure

4.5.2.1 Land Use Planning and Building

OPG is planning on using the Calabogie GS, for the same purpose of which it has been used for the last one hundred plus years. As indicated previously, the Township of Greater Madawaska’s Zoning By-Law includes a provision for “Public Uses” including those that generate electricity. According to section 3.24 of the by-law, that exempts such use from the by-law.

[1] These regional multiplier are taken from Arcadis estimates of OPG hydroelectric projects in Northeastern Ontario and were derived from the use of an economic impact model use in Timmins and Kapuskasing.

As the Calabogie GS has been in place for one hundred plus years surrounding land uses and landowners recognize the GS as part of the land use character of the area. No public concerns have been raised with respect to its compatibility.

The Township has in place a Noise By-Law that will need to be adhered to.

A Demolition Permit and a Building Permit will also be required for the proposed Project, with fees paid to the Township.

4.5.2.2 Access and Transportation

As indicated in Chapter 2, the Calabogie GS is accessed from County Road 511, a provincial secondary two-lane paved highway.

OPG anticipates that on average there would be approximately 40 to 75 workers on site on an average day with a peak of 100 workers. SNC-Sullivan is proposing that most of the workers will access the site and park on Calabogie Island and walk across the dam/spillway to access the site. This will allow Generating Station Lane (the main road to the Calabogie GS) to be devoted to construction traffic.

Other than worker traffic, OPG anticipates that there will be fewer than 25 trips into the site per day. There will also be a few large ("oversize") deliveries into the site such as for the turbines. The majority of construction traffic involving tri-axles will only be hauling from the site over to the island. This falls under worker traffic and not considered as trips into the site.

Discussions have been held with the County of Renfrew and the Township Greater Madawaska with respect to access and transportation issues and these are discussed below.

SNC-Sullivan have proposed a traffic management plan that is intended to result in the fewest number of construction vehicle trips on the County Road 511 as possible. This will not only reduce traffic but will lower greenhouse gas emissions and reduce the likelihood of any traffic incidents. As indicated in the Project Description in Chapter 2, SNC-Sullivan are working with the Township for one-way large construction traffic to enter the Township Works Yard and travel to the Calabogie GS and then exist via Generating Station Lane. This will occur for a few months while excavation is underway at the site. Once rock, sediment and soil have been excavated a two-way flow of traffic will occur on Generating Station Lane again.

The County has indicated that any modifications to the site entrance at County Road 511 (Lanark Road) are subject to review and approval by the County's Public Works Department. In this regard the entrance must comply with the County's Entrance By-law and policies that are in effect at the time of construction. All costs associated with any work required at the entrance will be the responsibility of OPG/SNC-Sullivan.

Any loads that are oversize or overweight will require the issuance of a special vehicle permit from the County's Roads Public Works and Engineering Department.

The County and SNC-Sullivan will also be reviewing the load levels for the bridge that crosses the Madawaska River near the entrance to the site.

The County's Public Works and Engineering Department has indicated that a traffic management plan will be required to accommodate the construction traffic entering/exiting the site. The traffic management plan should have considerations for: truck turning signs, turning radiuses, turns on to the bridge, signage, and vegetation clearing. In particular they have indicated that such a plan will need to ensure that signs are erected on the Highway to advise the other road users of turning traffic. In addition, they also indicated that there may be a need to have Traffic Control Person on site during periods of high turning movements to/from the site (Kuiack, 2019).

The County also indicated that any gates at the access to the site shall be setback a sufficient distance from the County Road 511 roadway so as not to interfere with the traffic movements on the roadway. It is recommended that the DB Contractor ensure that entrance (i.e. gate, traffic control persons) into the construction site be specifically designed so that County Road 511 is not blocked.

The County has also asked that any damage to the County's infrastructure as a result of the proposed works shall be repaired to the satisfaction of the County. It is suggested that the DB Contractor may want to take video or photographs of areas of the 511 that are already in poor condition so as not to have such defects attributed to the Project.

During the construction period, OPG's DBC has also agreed to agree to include in their environmental management plan a process for communicating with Indigenous communities and the public. Part of this would include information on how complaints are managed.

4.5.2.2.1 Other Municipal Issues

As indicated in Chapter 3, the Municipality of Greater Madawaska has a winter dry hydrant located between the Inlet Sluices and the South Branch Main Dam of the Calabogie GS that they use to fill up the water pumper trucks in the winter. The hydrant is in this location because the municipality's fire department requires access to open water in the winter. OPG will ensure the hydrant is accessible during construction.

As explained in Chapter 2, the Township of Greater Madawaska, OPG and SNC-Sullivan have entered into a Memorandum of Understanding with respect to the transfer of excavated rock from the OPG property to the Township's Works yard. This has turned out to be a win-win-win agreement with the following benefits:

- Township will receive at no cost the clean rock and the demolished building that can be used for future road works projects in the Township.
- OPG/SNC-Sullivan will not need to dispose of the rock off-site or on-site.
- Re-use of rock is encouraged by the government and all stakeholders, especially Algonquins of Ontario.
- Will reduce risks associated with movement of this material on to public roads and highways.
- Will reduce emissions associated with additional truck traffic associated with the haul.

- Will reduce the amount of material OPG has to place on site which may be of an aesthetic concern to local residents.

OPG is of the opinion that this is a great initiative that benefits all parties and reduces the overall environmental impact of the proposed Project.

On September 16, 2019, the Township of Greater Madawaska passed a Resolution indicating its support for the proposed project. That Resolution appears as Appendix A of the Socio-Economic TSD.

4.5.3 Recreational Uses

4.5.3.1 On-Water Recreational Uses

Given the large number of property holders on Calabogie Lake and on the Madawaska River, OPG considered it a pre-condition of the proposed Project that it would not alter the level and flow requirements in the existing Madawaska River WMP and continue to operate the Calabogie GS in largely a similar fashion as it does now.

In general, there have historically been very few concerns with how Calabogie Lake is managed. As was discussed previously there has been previous public concern about the water level fluctuations in the Calabogie-Stewartville Reach and some interest in having the more narrow summer range extended. As indicated, OPG has not recommended this owing to a variety of other water management considerations.

The redeveloped GS at Calabogie will have an increased flow capacity, which will allow OPG to produce more energy from the existing water. So additional water will be flowing through the GS rather than through the South Dam Sluiceway but this will not increase the daily flow. The north sluiceway conditions will be maintained in accordance with the existing WMP.

There will still be conditions and situations where a greater range at Stewartville GS is needed to meet Ontario grid requirements and maintain compliance with the other aspects of the WMP. However, there may be some conditions where the new Calabogie GS could match flow patterns at Barrett Chute GS and Stewartville GS to reduce water level fluctuations. If this occurs it will be done in compliance with the WMP. Given the above, OPG does not plan to propose any formal changes to the compliance requirements in the WMP, however a Minor Amendment will be required to the WMP to reflect the fact that a new GS has been constructed.

Therefore, OPG is of the opinion that the proposed GS will represent a minor improvement in the existing situation for those riparian landowners concerned about fluctuating water levels in the Calabogie-Stewartville Reach. This will also introduce slightly different conditions than some River users may have experienced in the past. Overall, the opinion is that this will not represent any significant change to recreational use on the River.

4.5.3.2 Other Recreational Uses

As discussed in Chapter 3, the K & P Trail has its southern terminus located just east of the intersection of Highway 511 and OPG's access Road, "Generating Station Lane". There is some parking in this area for trail users, although it is not clearly delineated on the ground. The County has requested that the trail and parking area be kept clear at all times.

The road to access Calabogie Island crosses the start of the K&P Trail. If Calabogie Island is to be used for worker parking it is recommended that signage be placed both on the road and the trail to inform workers and trail users of potential traffic. It is also suggested that some of the vegetation be cut back at this corner to improve sight lines.

The County has also requested that OPG consider providing any surplus materials left over from the construction of the proposed Project for trail maintenance. The County specifically asked for fencing and stonedust/M-gravel. It is unlikely that any fencing will be required for the Project but there may be some excess gravel materials.

As previously indicated, the K & P Trail also serves as a snowmobile trail (referred to as E105A). South of the K & P Trail, the snowmobile trail was previously located on Generating Station Lane. But OPG recognized the public safety concern with having the trail being co-located on its access road and in extremely close proximity to the Madawaska River. As such, OPG no longer provides a licence to the snowmobile club to utilize this area. The snowmobile route continues slightly further south and east on the adjacent municipal land.

At the terminus of the K & P Trail, the snowmobile trail still crosses Generating Station Lane and therefore it is recommended that additional signage or other such safety measures be provided during construction to warn snowmobilers of construction related equipment. Other safety measures may need to be put in place.

As the snowmobile trail is located on the Township's Works Yard where the surplus rock is to be moved there is a need to consider a re-route of the snowmobile trail pending the final placement of rock.

4.5.4 Recreational Uses

The Table below summarizes potential construction and operation effects, the recommended mitigation/remedial measures to minimize or obviate these effects and the net effects of the proposed Calabogie Re-Development Project.

Table 4-5. Potential Construction and Operation Effects

Effect/Activity	Recommended Mitigation/Remedial/ Enhancement Measures	Net Effect
Construction		
Positive Economic and Employment Impacts	• Project team is working with Indigenous communities to maximize employment and economic opportunities. • Project will work with local suppliers to create opportunities wherever possible.	Positive
Positive Gross Revenue Charges	• Project will result in significant gross revenue charges for the Province.	Positive
Noise	• Adherence to noise by-law. • Use of well-maintained equipment and noise silencers (as required) from Terrestrial Environment TSD.	Negligible
Traffic, Access and Transportation	• Design of internal traffic circulation system to reduce potential for incidents. • Compliance with Renfrew County's Entrance By-law and policies. • Oversize or overweight loads will require the issuance of a special vehicle permit from Renfrew County. • Renfrew County and SNC-Sullivan to review the load levels for the bridge that crosses the Madawaska River. • Traffic management plan will be required to accommodate the construction traffic entering/exiting the site. • Any damage to the County's roads as a result of the proposed works shall be repaired to the satisfaction of the County. It is suggested that the DB Contractor may want to take video or photographs of areas of the 511 that are already in poor condition so as not to have such defects attributed to the Project.	Negligible
Complaints	• DBC has also agreed to agree to include in their environmental management plan a process for communicating with Indigenous communities and the public. Part of this would include information on how complaints are managed.	Negligible
Positive Recreational Use	• No proposed measures but there may be some conditions where the new Calabogie GS could match flow patterns at Barrett Chute GS and Stewartville GS to reduce water level fluctuations. This should represent a minor improvement in the existing situation for those riparian landowners concerned about fluctuating water levels in the Calabogie-Stewartville Reach.	Upstream No Change Downstream – Minor Positive Change

Table 4-5. Potential Construction and Operation Effects

Effect/Activity	Recommended Mitigation/Remedial/ Enhancement Measures	Net Effect
Construction		
K&P Snowmobile Trail	• OPG is working with the Township on re-routing the snowmobile trail.	No adverse residual effect
Fire Dry Hydrant	• Access to be maintained.	No adverse residual effect
Surplus Rock	• Agreement developed with Township to give surplus rock to Township for use in roads, etc.	Positive effect

4.6 Cultural Resources

4.6.1 Archaeological Resources

Stage 1 and 2 archaeological assessments have been conducted at the Calabogie GS including fieldwork participation from a representative of the AOO. Following the Stage 1 assessment, areas of archaeological potential were identified within the study area on both sides of the Madawaska River.

The Stage 2 portion of this assessment subjected all areas of identified archaeological potential to a Stage 2 sub-surface survey in accordance with the Ministry of Tourism, Culture and Sport (MTCS) *2011 Standards and Guidelines for Consultant Archaeologists*. The survey involved the excavation of sub-surface test pits on a five-metre grid with all soils examined for the presence of archaeological materials. At the conclusion of the Stage 2 testing, no archaeological resources were located. As no archaeological resources were located during the Stage 2 sub-surface survey of the areas of archaeological potential at the Calabogie Generating Station, no further archaeological resource assessment work was recommended (Woodland Heritage Northeast, 2019).

In on-going discussions between OPG and the AOO the AOO wanted it to be known that the AOO has "outstanding issues of concern related to archaeological assessments and adverse impacts to potential cultural heritage values that are being pursued under separate correspondence to the Ministry of Heritage, Sport, Tourism and Culture Industries dated February 25, 2020 and copied to OPG."

4.6.2 Built Heritage

The Cultural Heritage Evaluation Report (CHER) for the subject property concluded the property fulfilled the evaluation criteria for determining the cultural heritage value or interest set out for local significance in Ontario Regulation 9/06 under the *Ontario Heritage Act* (OHA) and it is a Provincial Heritage Property (PHP). It did not meet the criteria for provincial significance in Ontario Regulation 10/06. The CHIA assessed potential impacts to the Calabogie GS as a result of the redevelopment project. Identified direct impacts for the project include: removal of the following identified heritage attributes of the PHP, the powerhouse and headworks, all powerhouse equipment including the generators and turbines and the entrance or cutoff dam. Identified indirect impacts to identified heritage attributes of the PHP, include: realignment of part of the Generating Station Lane, the main access road, to the south bank of the South Branch resulting in changes to the existing south bank road and the access to Cross Island; and, excavation of the forebay and tailrace. Positive impacts include the continued use of the Calabogie GS site for hydroelectric power generation purposes along the North and South Branches of the Madawaska River as an over 100 year identifiable and defining cultural heritage landscape and its retention for hydroelectric power generation thus reinforcing the significant physical, functional and visual linkages between the GS facility's built heritage resources. The continued use of the GS also maintains important historical linkages between the station and the community of Calabogie.

As a PHP, the MTCS *Standards & Guidelines* provisions apply to the subject property. Six conservation recommendations have been provided to OPG to address the effects of the identified impacts to the Calabogie GS:

- Powerhouse and headworks. It is recommended a Cultural Heritage Documentation Report (CHDR), which draws on the information contained in the CHER and CHIA, be prepared for OPG by a professional heritage consultant. The CHDR should include an historical summary of the development of the Calabogie GS, historical photographs, contemporary photographs of the structures, photographic key plans and available design and drawings.
- Equipment. Some significant pieces of equipment from the powerhouse, such as the turbines and/or generators, will be retained and reused in the commemoration of the original Calabogie GS where safest and feasible. It is recommended OPG develop an Interpretation Plan to commemorate the cultural heritage value of the site. OPG should retain and preserve several smaller pieces of equipment for viewing purposes at its offices and/or facilities. Furthermore, OPG and the Township of Greater Madawaska are discussing the option of removing selected pieces of equipment to preserve and interpret in a municipal park designated by the Township should take place after OPG has determined the equipment it requires for interpretative purposes on-site at the Calabogie GS.
- Entrance or cutoff dam removal. Photographs of the site showing the cutoff dam have been taken and they will serve as the documentation requirement.
- Access road realignment. Photographs of the site showing access road alignment have been taken and with historical information will serve as the documentation requirement
- Excavation of the forebay and tailrace. The forebay and tailrace will remain in situ; however, de-watering and excavation of the forebay and the tailrace may reveal details of the original construction of the Calabogie GS, as well as later modifications. Therefore, mitigation will involve assessing and documenting any such features.
- Cultural Heritage Reports. OPG will retain copies of the CHER, CHIA and CHDR within OPG's official document repository system. Additionally, OPG will provide digital or hard copies of the three (3) reports to the County of Renfrew, the Township of Greater Madawaska and the Greater Madawaska Public Library.

4.7 Climate Change

4.7.1 Introduction

The OWA Class EA mentions the topic of climate change in one place. Specifically, it is mentioned in Table 3 – Potential Effects Matrix. Within the Effect Matrix, proponents are asked to assess the project level of effect against two criteria in terms of potential positive or negative effects:

- Facility Resilience to Climate Change; and,
- Climate Change Impacts (mitigation of).

OPG strives to be a leader in climate change and climate change mitigation by implementing operational and growth strategies that support reductions in greenhouse gas emissions. Moreover, OPG has been an active corporation in better understanding the effects of climate change on its facilities and operations.

4.7.2 Future Climate Assessment for the Madawaska River Watershed

OPG is a member of the Ouranos Corporation a Canadian based Consortium on Regional Climatology and Adaptation to Climate Change. Ouranos includes participation from other utilities including Hydro Quebec and Manitoba Hydro, universities such as McGill, Laval and University of Quebec at Montreal (UQAM) and various government departments and private sector corporations. A central focus of Ouranos is that it provides climate scenarios and the production of regional climate simulations using the Canadian Regional Climate Model 5 (CRCMC5). The CRCM5 was developed by UQAM in collaboration with Environment and Climate Change Canada.

OPG now prepares climate change assessments for the various watersheds in which it has responsibility for water management plans in Ontario. Recently and in support of the Calabogie GS Re-Development Project, OPG has completed a *Climate Change Assessment of the Madawaska River Watershed in support of Calabogie GS Powerhouse Reconstruction* (2018). That assessment includes a streamflow assessment and annual and seasonal air temperature and precipitation projections. These are presented using data from the *OPG Climatic Atlas 1.0* combined with historical reference temperature and precipitation at the Renfrew meteorological station (21 km from Calabogie). The climatic atlas dataset is an ensemble of model-generated projected changes relative to a recent historical reference period, produced by the Ouranos for OPG. Atlas data were extracted from a suite of general circulation models (GCMs). GCM output from two greenhouse gas concentration trajectories were used: representative concentration pathways (RCP) 4.5 and 8.5. RCP4.5 refers to greenhouse gas emissions peaking around 2040, then declining; whereas, RCP8.5 refers to emissions rising through the 21st century. As a result, RCP8.5 simulations produce stronger anthropogenic climate change than RCP4.5 simulations. Output from 39 GCM temperature projections for each of RCP4.5 and RCP8.5 and 35 GCM precipitation projections for each of RCP4.5 and RCP8.5 are summarized.

Streamflow is the climate change consideration of greatest concern for hydroelectric utilities such as OPG because of the need to manage water levels and flows in accordance with regulatory requirements and for public risk and safety. This OPG memo report summarizes current understanding of anticipated climate change impacts on the Madawaska River Watershed. It first analyzes historical changes in streamflow and then projected changes in precipitation and temperature are summarized.

For its climate change assessments of streamflow OPG uses data from natural river systems because regulation hinders the ability to detect climate-driven trends. Daily data from three natural rivers (York and Petawawa Rivers and local inflows on the Madawaska between Mountain Chute at Palmer Rapids) were used with data sourced from Water Survey of Canada (WSC). Data was generated annually and seasonally. Daily projections were also assessed and included temperature (icing days, frost days, summer days and warm spell days) and precipitation (number of days with precipitation >10 cm, number of days with precipitation >20 cm, maximum 5 day precipitation and precipitation intensity) indices.

Using a historical record going back to the 1920s there has been a rise in mean annual flow in all three rivers, of approximately 2% (of historical mean) per decade (and these trends are statistically significant in two of the three rivers). Annual maximum flows have also risen and are 4% to 6% (of historical mean) per decade for the Petawawa and York Rivers. On a monthly basis all three rivers show rising trends in cold season flows (November-April; 4% to 8% per decade) and decline trends in warmer season flows (May-September; 0 to -8%) per decade. There is no apparent indication of changing interannual variability of flows.

With respect to future temperature and precipitation projections, air temperatures are projected to rise in all seasons, more so for RCP8.5 than RCP4.5 projections. Greatest temperature rises are projected furthest ahead, in the 2070 horizon, and most so during winter than other seasons. Average winter temperatures may rise from -10.2°C (1970-1999 baseline) to -5.7°C to -3.4°C for RCP8.5 projections in the 2070 horizon. Average summer temperatures in the 2070 horizon are projected to be 22.0°C to 24.1°C for RCP8.5 (20.9°C to 23.5°C combining both RCPs) compared to 18.4°C in 1970-1999.

Annual precipitation is projected to rise, with greatest precipitation increases projected to occur during winter representing a 12.8% to 31.3% increase from baseline for RCP8.5 in 2070. The greatest uncertainty in projected precipitation changes are for the summer period, with a variety of ±0-8% projected changes from baseline.

With respect to the daily indices, the warming trend is projected to continue, with the number of icing days and frost days declining, and the number of summer days and warm spells days rising throughout horizons. The number of high precipitation days (>10 or >20 mm/day) and precipitation intensity are also projected to rise, but perhaps not as notably as the seasonal changes.

In summary, the Madawaska River Watershed has experienced slight rises in annual flows over the past ~100 years, with rising cold season flows overcompensating for declining warm season flows. Projections (i.e. rising temperatures in all seasons, rising winter precipitation, possible declining summer precipitation) suggest this flow trend may continue and intensify in coming decades.

With respect to Calabogie GS, the climate change signals indicate potential higher inflows than historical during winter and early spring, but potential lower inflows than historical during summer. The rising annual maximum flow trends and projected heavier precipitation than historical indicate potential for having to manage more frequent high flow days in the future. Projections indicate more frequent warmer days i.e. more >25°C days and fewer <0°C days. Combined with the projected rise in winter precipitation, there is likely an increased risk of freezing rain in the future.

4.7.3 Facility Resilience to Climate Change

The OWA criterion, "Facility Resilience to Climate Change" speaks to how capable the Calabogie GS is to withstand potential effects of climate change. The most important consideration in this regard is to understand future climate possibilities in the region. As demonstrated in section 4.6.2 above, OPG has recently completed a comprehensive assessment of future climate change scenarios in the Madawaska River watershed.

A consideration of the possible effects of climate change on the proposed Project was conducted in order to identify the potential sensitivity of this Project to projected changes in specific climate parameters and to assess whether the potential for risks could extend beyond the proposed Project and impact the downstream public or the environment.

A guidance documented titled, *Climate Change Considerations in Environmental Assessment: General Guidance for Practitioners* (FPTCCCEA, 2003) was utilized to help in undertaking this assessment. That document specifies that the first step to determining whether or not climate change impacts need to be evaluated in more detail in an environmental assessment study is to identify if the proposed Project is sensitive to potential changes in climate.

The pre-construction and construction phases of the proposed Project will occur over a relatively short time period (less than four years). Therefore, climate change impacts related to these phases are expected to be minimal and have not been included in this part of the assessment. The operation phase of the proposed Project is the primary focus as the facility will be in place for fifty to one hundred years. As such, the climate change assessment conducted went out to 2070.

There are three aspects of the operation phase of the project that are discussed below. The first is the main dam and spillway structures and the ability to handle future flows. The second is the future operating pattern of the GS. The third is transmission associated with the proposed project.

As described in 2.4.3.7, the MNRF has in place Lakes and Rivers Improvement Act Technical Bulletins that detail the Ministry requirements for the safe operations of dams. Based on the "Classification and Inflow Design Flood Criteria" Technical Bulletin, OPG is currently reviewing the spill capacity requirements associated with safely passing the inflow design flood (IDF). This may result in the need to construct additional flow capacity. At a minimum, it will be OPG's intent to ensure that any construction changes to the structures to increase spill capacity would also address the impacts of climate change.

Four climate change parameters are being used to assess potential interactions with the project: precipitation, temperature, streamflow and frequency and severity of weather events, which are expected to increase in frequency and severity. It should be noted that, storms which are not exclusively precipitation events (e.g., lightning, tornadoes, hurricanes), are expected to be more severe and occur more frequently. As already discussed, the climate change parameter that is of the greatest concern is streamflow as the dam and all the other water control facilities on the Madawaska are used in unison to manage water levels and flows and for safety and protection.

Other climate parameters were considered to have either insignificant interactions with the proposed Project physical structures and systems or were encompassed within other parameters and thus not included in the assessment including the following:

- Wind Velocity – not defined separately because extremes are encompassed within frequency and severity of weather extremes.
- Evaporation and Evapotranspiration – not defined separately because effects are encompassed within precipitation.
- Soil Moisture – potential changes will not affect operations.
- Groundwater – not defined separately because effects are encompassed within streamflow.
- Flood Events – not defined separately because effects are encompassed within streamflow and extreme weather events assessments.

4.7.3.1 Identification of Impact Considerations

To further assess the potential interaction of climate change parameters with the proposed Project physical structures and systems, a screening exercise was undertaken, to evaluate and rank each potential interaction. The Guidance Document (FPTCCCEA 2003) provides a methodology to assist in identifying Project sensitivity to changes in climate parameters.

Each of the proposed Project's key facilities have been evaluated against each climate parameter and assessed for potential sensitivity.

A "Nil" rank was assigned if it was determined that the physical structure or system was not sensitive to a change in the climate parameter.

A "Low" rank was assigned if it was determined that the physical structure or system was unlikely to be sensitive to a change in the climate parameter.

A "Medium" rank was assigned if it was possible that the physical structure or system would be sensitive to a change in the climate parameter.

A "High" rank was assigned if it was likely the proposed Project physical structure or system would be sensitive to a change in the climate parameter.

Table 4-6. Potential Interactions Between the Project and Climate Change Parameters

Project Structure or System	Precipitation	Temperature	Streamflow	Frequency and Severity of Weather Events
Dams	No effect on the integrity of the dams is anticipated. Dams are built to handle extreme precipitation conditions. Nil	No effect on the integrity of the dams is anticipated. Nil	No effect on the integrity of any of the dams is anticipated owing to the fact that the facility will be designed to meet the spill capacity requirements including taking into account climate change effects. Low	Potential for increase and magnitude of floods which could threaten integrity of structure. No likely effect from events associated with climate change. Low
Sluices	No effect on the integrity of the spillways is anticipated. Nil	No effect on the integrity or operation of any of the spillways is anticipated. Nil	An increase in streamflow can require more spill capacity to handle it. The re-development will be designed to meet the spill capacity requirements including taking into account climate change effects. Low	Potential for increase in magnitude of floods which could threaten integrity of structure. No likely effect from other extreme weather as the structures are appropriately designed. Low

Table 4-6. Potential Interactions Between the Project and Climate Change Parameters (Cont'd)

Project Structure or System	Precipitation	Temperature	Streamflow	Frequency and Severity of Weather Events
Operating Pattern	A change in seasonal precipitation could slightly alter the operating regime of the facility. However, OPG staff deal with these variabilities on a daily, weekly, seasonal, etc. basis already. Low	Higher temperatures may lead to a slightly earlier freshet. Potential to slightly alter spawning periods over the long-term. However, OPG monitors actual water temperatures in order to assess spawning periods. Low	As already demonstrated, OPG has carried out a climate change assessment for the Madawaska River watershed to better understand streamflow. From an ecological perspective an increase in streamflow would be more preferred than a decrease as it would further ensure minimum flow requirements (albeit these are minimal relative to total streamflow). A decrease in streamflow would be more of a concern for ecological conditions. Low	Severe weather events could lead to station upsets from lightning strikes or other problems. But back-up systems and generators are in place to address these situations and staff can be immediately dispatched. Increased frequency or magnitude of precipitation events could result in changes to operations but OPG staff are constantly monitoring precipitation and streamflow. Low
Transmission System	No effect on the transmission system. Nil	No direct effect on the transmission system. Higher overall temperatures may increase the likelihood of forest fires. Low	No effect on the transmission system. Nil	Lightning strikes together with overall warmer temperatures may increase the likelihood of forest fires or other incidents. Again, back-up systems are in place to assist in re-starting equipment. Low

4.7.3.2 Assess Impact Considerations

Table 4.6 contains the results of a screening exercise conducted to identify the potential interactions between climate change and the proposed Project. No medium or high risk interactions were identified. Several interactions were identified as having low rank, indicating a possible effect.

The Guidance Document (FPTCCCEA, 2003) specifies that climate parameter-Project component interactions evaluated as being of Medium or High risk should be assessed in more detail. However, because so few components ranked more than Nil, the components that ranked Low will also be carried forward for more detailed assessment. These were:

- Operating pattern – precipitation, streamflow, temperature and extreme weather;
- Dams – extreme weather and streamflow;
- Transmission/distribution lines – temperature and extreme weather; and
- Spillways – streamflow and extreme weather, specifically flooding.

4.7.3.3 Methodology to Assess Risks Related to Climate Change

Each of the above interactions was further assessed to determine:

- The sensitivity of the Project physical structures or systems to the meteorological parameters; and,
- The risk level of any impact to the public or the environment.

This was done following the outline in the Guidance Document which specifies:

> *…the analysis should consider the range of possible outcomes under which the climate parameter may adversely affect the project or one of its components. The practitioner should then determine if there are potential risks to the public or the environment if one or more project components is affected by identified changes to climate parameters.*

The Guidance Document methodology describes four possible cases to be considered:

- Case One: occurs when there is a high confidence level associated with project physical works or activities sensitivity to a climate parameter and a high risk to the public or the environment as a result of the effect of these changes on a project. In this case, the practitioner should proceed with the next steps in the risk assessment and indicate the probable range of changes to the appropriate climate parameters. Appropriate monitoring, follow-up and adaptive management procedures should be implemented.
- Case Two: occurs when there is a high level of confidence associated with project physical works or activities sensitivity to a climate parameter, but a low risk to the public or the environment as a result of these changes on the project. Except to document these findings in the EA, no further action need be taken by the practitioner.
- Case Three: when there is a low confidence level associated with project physical works or activities sensitivity, but a high probability that the public or the environment will be placed at risk due to the effects of these changes on the project. All available climate change information

(including the range of possible changes to the climate parameter) should be provided to the practitioner and public interest decision makers and the next steps in the risk assessment should be conducted. Emphasis should be placed on the probable range of changes to the appropriate climate parameters and the uncertainty associated with this information should be stressed in the EA. Appropriate monitoring, follow-up and adaptive management procedures should be implemented.

- Case Four: when there is a low confidence level associated with project physical works or activities sensitivity, and a low risk to the public or the environment if the project is affected by these changes. In this case, no further action need be taken by the practitioner, other than documenting the findings in the EA.

The methodology in the Guidance Document then relates the relationship between risk and confidence level according to the four cases as described in Table 4-7.

Table 4-7. Possible Cases for Assessing Risks to the Public or Environment

	High Risk of Impacts to the Public or the Environment	**Low Risk of Impacts to the Public or the Environment**
High Confidence Level Of the project's sensitivity to a climate change parameter	Case One • Proceed with risk assessment outlined in Guidance Document. • Implement appropriate monitoring, follow-up and adaptive management measures.	Case Two • Practitioner should provide all relevant climate change information. • Report in EA. • No further action required.
Low Confidence Level Of the project's sensitivity to a climate change parameter	Case Three • Proceed with risk assessment outlined in Guidance document. • Emphasize the uncertainty inherent in climate change data. • Implement appropriate monitoring, follow-up and adaptive management measures.	Case Four • Report in EA. • No further action required.

Each of the proposed Project structures or systems identified as having a Low sensitivity from the screening exercise was further assessed according to the above guidance. Table 4-8 provides the results of this assessment for the proposed Project.

Table 4-8. Assessment of Interactions Related to Climate Change and the Project

Project Structure or System	Climate Parameter	Project's Sensitivity to Climate Change Parameter	Risk Level of Impacts to the Public or Environment	Case	Action
Dams	Extreme weather events	Potential for increase in magnitude of floods which could threaten integrity of structure. No likely effect from other extreme weather due to construction and design. The Calabogie GS will be designed to meet the spill capacity requirements including taking into account climate change effects Low	Dams are designed to withstand flood levels and as such it is unlikely that a failure would result. The risks of extreme events on the public and environment are assessed as part of the Ontario Dam Safety requirements. Low	Four	No further action required.
Spillways	Extreme weather events	Potential for increase in magnitude of floods which could threaten integrity of structure. No likely effect from other extreme weather as a result of being appropriately designed. Low	Dams are designed to withstand flood levels and as such it is unlikely that a failure would result. The risks of extreme events on the public and environment are assessed as part of the MNRF Dam Safety requirements. Low	Four	No further action required.

Table 4-8. Assessment of Interactions Related to Climate Change and the Project (Cont'd)

Project Structure or System	Climate Parameter	Project's Sensitivity to Climate Change Parameter	Risk Level of Impacts to the Public or Environment	Case	Action
Spillways (Cont'd)	Precipitation	Potential for increase in magnitude of floods which could threaten integrity of structure. No likely effect from other extreme weather as a result of being appropriately designed. Low	Spillways are designed to handle maximum events and as such it is unlikely that a failure would result. The risks of extreme events on the public and environment are assessed as part of the MNRF Dam Safety requirements. Low	Four	No further action required.
	Streamflow	Potential for increase in magnitude of floods which could threaten integrity of structure. No likely effect from other extreme weather as a result of being appropriately designed. Low	Spillways are designed to handle maximum events and as such it is unlikely that a failure would result. The risks of extreme events on the public and environment are assessed as part of the MNRF Dam Safety requirements. Low	Four	No further action required.
Operating Pattern	Temperature	Adjustment to operating regime for the facility may be required. Low	OPG continually monitors the watershed conditions and checks temperatures in the river to calculate environmental compliances. Low	Four	No further action required.

Table 4-8. Assessment of Interactions Related to Climate Change and the Project (Cont'd)

Project Structure or System	Climate Parameter	Project's Sensitivity to Climate Change Parameter	Risk Level of Impacts to the Public or Environment	Case	Action
	Precipitation	Potential for change in operating pattern via slightly increased precipitation. However, OPG continually monitors conditions in the watershed to assess potential impacts and adjusts operating patterns of facilities to address compliance requirements. Low	Slight changes to the operating pattern would not result in any increased risks to the public. Possible public risks are already assessed as part of the Ontario Dam Safety requirements. The risk to the environment is low or may be even improved with increased precipitation. More precipitation would increase fish habitat and assist in ensuring adequate supply for minimum flow requirements. Low	Four	No further action required.
	Streamflow	Potential for change in operating pattern via slightly increased streamflow. However, OPG continually monitors conditions in the watershed to assess potential impacts and adjusts operating patterns of facilities to address compliance requirements. Low	Slight changes to the operating pattern would not result in any increased risks to the public. Possible public risks are already assessed as part of the Ontario Dam Safety requirements. The risk to the environment is low or may be even improved with increased precipitation. More streamflow would increase fish habitat and assist in ensuring adequate supply for minimum flow requirements. Low	Four	No further action required.

Table 4-8. Assessment of Interactions Related to Climate Change and the Project (Cont'd)

Project Structure or System	Climate Parameter	Project's Sensitivity to Climate Change Parameter	Risk Level of Impacts to the Public or Environment	Case	Action
Operating Pattern (Cont'd)	Extreme Weather	Potential for increase in magnitude of floods which could result in changes to the operating regime. However, OPG continually monitors conditions in the watershed to assess potential impacts and adjusts operating patterns of facilities to address emergencies. Low	The risks of extreme events on the public and environment are assessed as part of the MNRF Dam Safety requirements. Low	Four	No further action required.
Transmission/Distribution	Temperature	Potential for increase in forest fires which could threaten the integrity of the line. No Likely effect from other extreme weather due to design. Low	While the potential for increased risk of forest fire would be of concern to OPG and its facility the risk of the transmission line burning does not increase the risk to the public or the environment. Fire suppression services are available in the area and the GS has back-up generators to re-start the facility and meet power needs. Low	Four	No further action required.

4.7.3.4 Results of Assessment of Risks Related to Climate Change

The assessment of risks related to climate change for the proposed Project, using the Guidance Document (FPTCCEA, 2003) methodology and the final results, are shown in Table 4-8. These results show that, in spite of projected changes to the future climate parameters, it is expected that these projected changes will not have any significant impact on the Project-related physical structures of the system or operation of its facilities. Therefore, risk of impact to either the downstream public or environment remains low.

Dams and Spillways

The dams and spillways are currently designed for certain reservoir levels that can be managed and maintained, and if required, additional spill capacity will be constructed. The design spill capacity will account for the gradual increase in magnitude or frequency of flooding events associated with extreme weather. As such, no further action is warranted.

Operating Pattern

Projected changes to precipitation patterns do require on-going attention. OPG continually manages weather, water flow, water level and other conditions within the Madawaska River watershed. As such, it is able to handle these possible changes.

Projected higher temperatures may result in mid-winter melts of the snowpack and an earlier spring freshet. Management of an earlier freshet may require that OPG water management engineers and operators adjust normal freshet operations by establishing an earlier spill and drawing down the reservoirs accordingly.

The assessment of the effects of changes of streamflow and extreme precipitation on proposed Project structures and operations suggests that there is likely no risk to either the public or the environment from impacts to the operating patterns. OPG is committed to continuing to meet all requirements of the Madawaska River WMP alleviating any potential effect on the environment. As such, no further action is warranted, however OPG is committed to operating the proposed facility through adaptive management.

Transmission

As a result of increased temperatures, there is the potential for an increase in forest fires which could threaten the integrity of the transmission lines associated with the proposed Project. While the potential for increased risk of forest fire would be of concern to OPG and its facilities, this risk of the transmission line burning does not increase the risk to the public or the environment. The entire area for the proposed transmission line occurs in area of fire management response and OPG has back-up systems in place at the facility to operate water control features.

4.7.3.5 Summary of Climate Change Considerations

Overall, the effects of climate change on the proposed Project are expected to be gradual in occurrence and are considered minimal in effect. Although this analysis has indicated there is likely to be no significant increase in risk to the public or environment, as part of the regular maintenance program to be implemented post construction, all physical structures and systems that could be affected by a change in climate parameters will be monitored and repairs or modifications implemented, if required. Any long-term change to the stream flow pattern in the system is likely to emerge slowly over time and OPG is of the opinion that it can address these changes through normal adaptive water management measures.

As described in Chapter 2 of this ER, the MNRF has in place Lakes and Rivers Improvement Act Technical Bulletins that detail the Ministry requirements for the safe operations of dams. Based on the “Classification and Inflow Design Flood Criteria” Technical Bulletin, OPG is currently reviewing the spill capacity requirements associated with safely passing the inflow design flood (IDF). This may result in the need to construct additional flow capacity. At a minimum, it will be OPG’s intent to ensure that any construction changes to the structures to increase spill capacity would also address the impacts of climate change.

In addition, OPG will continue to engage in the Ouranos consortium on climate change to better characterize specific implications of increase in water availability on future operations to optimize the use of available water for generation and the continued safeguarding of downstream populations and OPG assets.

4.7.4 Climate Change Impacts (Mitigation Of) - Greenhouse Gas Reduction

The proposed Calabogie GS will assist Ontario in mitigating climate changes impacts. It will do this in two ways. First, the generation of hydroelectric power is a sustainable source of power that does not produce greenhouse gases and therefore is an important component of Ontario’s climate change plan. Second, the Calabogie GS together with OPG’s other facilities and those of a couple other private producers provide the primary water control capabilities within the Madawaska River watershed. As such, these facilities provide at no cost to the public, control of water levels and flows on the River. In a future where climate change will result in greater uncertainty with respect to water, this capability allows for the potential mitigation of many deleterious effects of climate change on River flows and levels.

The proposed new GS is being developed to a capacity of approximately 11 megawatts, representing a 6 MW increase. OPG has assumed that natural gas generating plants would be used part of the time to replace the same energy produced at the Calabogie GS. It is estimated that a re-developed Calabogie GS would then displace 15,611 Mg of carbon dioxide per year. Therefore, the proposed undertaking could be assumed to help offset that amount of GHGs.

5 CONSULTATION WITH INDIGENOUS PEOPLES

5.1 Direction from the MoECP

Direction with respect to which Indigenous peoples to consult with, was sought from the Ontario Ministry of Environment and Climate Change (MoECC). It is OPG's understanding that the identification of which Indigenous peoples to consult with remains a Crown responsibility and as this is a project being pursued under the *Environmental Assessment Act* in Ontario, the MoECC has lead responsibility.

In a letter dated March 5, 2018 the then MoECC directed OPG to carry out consultation with the Algonquins of Ontario (AOO). No other Indigenous communities were included in the list. This letter appears as Appendix A of the Indigenous Peoples TSD.

Subsequently, on April 17, 2019 the MECP added additional Indigenous communities to the consultation list (Appendix A of the Indigenous Peoples TSD). This additional list is comprised of four Williams Treaty First Nation communities (Williams Treaty communities): Alderville, Curve Lake, Hiawatha and Mississaugas of Scugog Island.

A description of the consultation with the Algonquins and Williams Treaty communities is provided below. Details about the consultation can be found in the Indigenous Peoples TSD.

5.2 Algonquins of Ontario

As indicated in a letter dated March 5, 2018 the then MoECC directed OPG to carry out consultation with the Algonquins of Ontario (AOO). No other Indigenous communities were included in the list.

OPG has a long history of working with both the AOO and AoPFN.

When OPG first investigated the possibility of pursuing a redevelopment project at Calabogie in 2015 environmental baseline work was initiated to assess aquatic, species at risk, archaeology and built heritage impacts. Prior to commencing this work, the Project team met with AoPFN to explain the work planned during the concept Phase. The environmental work was described, and AoPFN was invited to provide a monitor to work with OPG's Archaeologist. There was no early engagement with the AOO.

In addition to the proposed work, OPG's Eastern Operations has an ongoing relationship with both AOO and AoPFN and meets with them on a regular basis to review maintenance and project work that is planned or underway at the facilities along the Ottawa and Madawaska Rivers. Eastern Operations also engages with the AOO at least twice a year regarding *Endangered Species Act* Mitigation Plan work related to American Eel and Lake Sturgeon on the Ottawa River.

OPG began making efforts to engage with AOO and AoPFN on the proposed project as early as 2015. This is described in detail in the Indigenous Peoples TSD.

OPG had its first formal meeting with the AOO (which included representation from the AoPFN) on December 13, 2017 when OPG staff and consultants met with the AOO. This meeting provided an opportunity for OPG to present the proposed Project. More importantly, OPG asked the AOO how they wished to be involved in the proposed project and how to ensure effective engagement, given that the AOO is a large organization with close to 10,000 spread across different communities in eastern Ontario.

AoPFN requested a separate consultation process from AOO. Starting in early 2018, OPG engaged in separate meetings and discussions with AoPFN. Based on the input from both AoPFN and AOO, some of the engagement activities were done jointly, such as the employment fair, and some individually, such as discussion around funding agreements.

Following this first formal meeting there were numerous phone calls, e-mails and teleconference calls that occurred between the AOO and OPG that helped to define how the AOO was to be involved in the proposed project. These are provided in the Indigenous Peoples Detailed Engagement Log, Appendix B.

While the AOO Funding Agreement and the AoPFN Engagement Protocol negotiations were going on, OPG also continued to engage with both organizations. Other activities that were undertaken and pursued included the following items below:

- Engagement and Funding Agreements;
- Archaeological work;
- Economic, employment and training;
- AoPFN Traditional Knowledge;
- Review of the Environmental Assessment.

Each of these activities is described in more detail in the Indigenous Peoples TSD.

Appendix B of the Indigenous Peoples TSD is a detailed table of all engagement that OPG has undertaken with the Algonquins.

The Indigenous Peoples TSD documents the key consultation activities where OPG has formerly described the proposed project and potential effects.

5.3 Williams Treaty Communities

On April 17, 2019 the Ministry of Environment, Conservation and Parks added additional Indigenous communities to the consultation list. This additional list is comprised of four Williams Treaty First Nation communities (Williams Treaty communities): Alderville, Curve Lake, Hiawatha and Mississaugas of Scugog Island.

Appendix B of the Indigenous Peoples TSD is a detailed table of all engagement that OPG has undertaken with the Williams Treaty communities.

5.4 Indigenous Peoples Interests and Rights

5.4.1 Algonquins

OPG has been operating under the premise that regardless of the state of negotiations, the Algonquins possess rights to engage in traditional activities such as the harvesting of wildlife and fish, and the collection of plants and other materials. In some cases, such as the hunting of wildlife, the AOO and the Province have more detailed arrangements guiding harvests.

OPG is of the view that such traditional harvests will not be impacted by the proposed project, for the reasons outlined below. While OPG has summarized these points in the Reports and in consultation this summary, is not intended to state that there has been agreement to these points with any Indigenous community.

- OPG will continue to operate the Calabogie GS and the other plants on the Madawaska River in full accordance with all flow and water level targets and compliance conditions in the Madawaska River Water Management Plan, including the summer conditions. Daily flow and water level conditions will remain unchanged from the existing situation. Specific compliance requirements regarding fisheries will remain unchanged. For these reasons, OPG is of the view that the fishery on the Madawaska River will not be impacted.
- OPG is of the view that the variety of mitigation measures proposed for the project will eliminate any potential negative effect on the fishery and other aquatic resources (the reader is encouraged to read the Aquatic Environment TSD for the details of such measures).
- The proposed project has incorporated the design of American Eel passage. While American Eels are unlikely in the Madawaska River at present, their restoration has been an important objective for the Algonquins. OPG heard and understood the importance of the American Eel to Algonquin people.
- OPG is of the view that the variety of mitigation measures proposed for the project will eliminate any potential negative effect on wildlife. No impacts are predicted on normal game species and mitigation measures are proposed for other species.
- OPG is not aware that the project would impact on any traplines. The proposed Project is contained to OPG's lands that OPG owns (has rights to) and the adjacent municipal property.
- A very small area of vegetation (less than ten hectares) will be harvested for the project. Almost all of this land disturbance will be temporary and can be re-planted over time. All this area occurs on OPG's property or the adjacent municipal property. However, OPG has provided a plant list to all Indigenous communities (for those interested) in the event there is an interest in harvesting plants prior to any removal. OPG has had further discussions with AOO and AoPFN about providing them opportunities to receive harvested or live plant resources.
- OPG is of the view that the proposed Project occurs in a very small footprint and every effort has been made to contain that footprint to a very small area. As such, OPG is of the opinion that activities nearby such as fishing on the River will not be impacted by the project. Most of the nearby land is not Crown land where traditional activities are more likely to occur, albeit harvest can occur on the Madawaska River proper.
- A portage that currently goes around the GS will be maintained during the construction and operation periods.

For all the reasons above, OPG is of the opinion that no traditional harvest will be impacted by the project upon which rights are based.

That being said, harvest rights have not been the only basis of consultation for the proposed Project. OPG has wanted to respect other Algonquin interests.

One area of interest has been the Algonquins interest in cultural heritage/archaeology. OPG has involved the AOO in the archaeological work by both participating in fieldwork and in reviewing the studies undertaken. No archaeological resources were identified in the area proposed for the project. OPG is undertaking more discussions with AOO and AoPFN on archaeology.

In on-going discussions between OPG and the AOO the AOO wanted it to be known that the AOO has "outstanding issues of concern related to archaeological assessments and adverse impacts to potential cultural heritage values that are being pursued under separate correspondence to the Ministry of Heritage, Sport, Tourism and Culture Industries dated February 25, 2020 and copied to OPG."

As part of the ongoing commitment to work closely with local Indigenous Communities, and building on past experience in this area, OPG has developed a strategy with the AOO and the AoPFN to encourage community members and businesses to capitalize on employment opportunities on the Project, should it receive the necessary approvals to proceed to the construction phase.

OPG has already hired a Front End Engineering and Design (FEED) Phase Design Build (DB) contractor who will be responsible for the construction of the Project. This DB contractor is aware of the importance of Indigenous employment and is working with the AOO and AoPFN to facilitate the hiring of individuals. and businesses. In addition, the DB contractor is working with the local Unions to ensure that all parties are collaboratively promoting employment of Indigenous individuals and business.

To date Information on anticipated jobs during construction has been provided to AOO and AoPFN. As well, the FEED phase constructor has identified a single point of contact to help the relevant employment officer working with their community members to call and get further information on them ready to compete for positions. As well, individuals and business interested in immediate employment opportunities as well as Project construction opportunities can work directly with a Sullivan contact on the Calabogie team who can introduce community members to Union contact etc. AOO and AoPFN hosted an employment fair and interested parties are now working directly with Sullivan and the Carpenters Union to work towards capitalizing on employment opportunities.

The Project team will work cooperatively with the AOO and AoPFN after the environmental and into the construction period should the Project receive its necessary approvals to move forward.

OPG has made extensive efforts to work with AOO and AoPFN. Along with the engagement activities described in this Report, OPG has provided significant funding to both organizations to help them in participating and reviewing reports associated with the environmental assessment. OPG has also funded an AoPFN traditional knowledge and land use study.

An extensive review of the environmental assessment was undertaken by AOO and AoPFN which resulted in a disposition table of comments and responses. That Table has not been included in the environmental assessment report documentation but does represent a detailed and specific set of discussions and commitments on a number of topics. That Table represents OPG's commitments to AOO on the Project.

As a sidenote, whereas based on the review and discussions on the proposed redevelopment of Calabogie Generation Station the AOO have requested OPG to support a proposal for an Algonquin Knowledge and Land Use Study for the Madawaska Watershed.

OPG looks forward to continuing to enhance its relationship with both AOO and AoPFN as they are important partners in eastern Ontario.

5.4.2 Williams Treaty First Nation Communities

Because of the limited information provided by the Crown on the settlement with the Williams Treaty First Nations, OPG is uncertain of what the exact rights of these communities might be in the Calabogie area. That being said, OPG is of the view that no traditional activities will be impacted by the proposed CSRP, for the reasons outlined below:

- OPG will continue to operate the Calabogie GS and the other plants on the Madawaska River in full accordance with all flow and water level targets and compliance conditions in the Madawaska River Water Management Plan, including the summer conditions. Daily flow and water level conditions will remain unchanged from the existing situation. Specific compliance requirements regarding fisheries will remain unchanged.
- OPG is of the view that the variety of mitigation measures proposed for the project will eliminate any potential negative effect on the fishery and other aquatic resources (the reader is encouraged to read the Aquatic Environment TSD for the details of such measures).
- The proposed project has incorporated the design of American Eel passage. This is an improvement over the existing situation.
- OPG is of the view that the variety of mitigation measures proposed for the project will eliminate any potential negative effect on wildlife. No impacts are predicted on normal game species and mitigation measures are proposed for other species.
- OPG is not aware that the project will impact on any traplines. The proposed Project is contained to lands that OPG owns and the adjacent municipal property.
- A very small area of vegetation (less than ten hectares) will be harvested for the project. Almost all of this land disturbance will be temporary and can be re-planted over time. All this area occurs on OPG's property or the adjacent municipal property. However, OPG has provided a plant list to all Indigenous communities (for those interested) in the event there is an interest in harvesting plants prior to any removal.
- OPG is of the view that the proposed Project occurs in a very small footprint and every effort has been made to contain that footprint to a very small area. As such, OPG is of the opinion that activities nearby such as fishing on the River will not be impacted by the project. Most of the nearby land is not Crown land where traditional activities are more likely to occur, albeit harvest can occur on the Madawaska River proper.

- A portage that currently goes around the GS will be maintained during the construction and operation periods.

For all the reasons above, OPG is of the opinion that no traditional harvest will be impacted by the project. Therefore, OPG is of the opinion that no Aboriginal and/or Treaty rights would be impacted.

That being said, harvest rights may not be the only interest of the Williams Treaty First Nation communities.

OPG has shared results of the archaeological assessment with interested Williams Treaty First Nation communities. Should there be further interest or concern, OPG is willing to discuss the archaeological work further.

While the project will involve a very small clearing of land OPG has shared the vegetation list with two of the Williams Treaty communities and is willing to allow First Nations the opportunity to harvest any plants before the area is cleared.

While the Williams Treaty First Nation communities are located a significant distance (over 200 km) from the proposed project, OPG is willing to discuss employment and contractor opportunities with them on the project.

In summary, while OPG is uncertain of what the exact rights of these Williams Treaty First Nation communities might be in the Calabogie area, OPG is of the view that no traditional activities will be impacted by the proposed CSRP. OPG will continue to engage with the Williams Treaty First Nation communities on the project as needed and required.

6 PUBLIC AND AGENCY CONSULTATION

More detailed information on public and agency consultation is provided in the Public and Agency Consultation TSD.

6.1 Overview

The general consultation approach undertaken as part of the proposed Calabogie Generating Station Re-Development Project involved the following components.

Public Consultation Plan

A public consultation plan was prepared for the project with the overall objective, as per the OWA Class EA (2018) (p. 34): "to provide those who may have an interest in the project, or those who may wish to participate with the opportunity to contribute to and inform decisions relating to a project."

The plan was designed to, at a minimum, adhere to the requirements of the OWA Class EA process. The only mandatory public consultation requirements for Projects Associated with Existing Infrastructure are (OWA Class EA, 2018, Table 2, p.27):

- Notice of Commencement;
- Notice of Completion (to parties who have expressed an interest or participated); and,
- Statement of Completion.

The requirements for the above notices are identified within the OWA Class EA document, along with a description of a number of consultation principles, approaches and techniques. OPG's consultation plan and past practices with respect to consultation on hydroelectric projects are consistent with these. Further, based on past experience of Arcadis and OPG, the consultation that was proposed in the plan and subsequently undertaken for the Project exceeds the minimum requirements.

Database

A database of public and agency stakeholders who were to be notified about the proposed Project, open houses and newsletters was developed. The initial database primarily focused on landowners adjacent to the Calabogie GS. The list of adjacent landowner addresses was generated using GeoWarehouse, an on-line service that provides access to land registry and mapping information. Twenty-four addresses were initially identified. The adjacent landowner list was updated and revised through the course of the consultation process.

A list of agency stakeholders was also developed for the Project. A copy of the agency contact list is provided in Appendix B of the Public and Agency Consultation TSD.

Project Website

A website was created for the proposed Project and can be found at www.calabogiegs.com. This website was active in November 2017 for the public and its operation has been on-going. Contact information is provided to facilitate inquiries.

The website pages include:

- Home Page;
- Notices/Decisions;
- Supporting Documents;
- Frequently Asked Questions;
- Open House Information; and
- Contact Page.

Notices

Public notices were prepared and circulated for the commencement and completion of the proposed Project, and prior to each open house. These included the following:

- Notice of Commencement;
- Notice of First Open House;
- Notice of Second Open House; and
- Notice and Statement of Completion.

All Notices are provided in Appendix A of the Public and Agency Consultation TSD.

A Notice of Commencement for the proposed Project was prepared and provided the following information: project title; name of the proponent; a brief project description and project type; a map depicting the project location and anticipated zone of impact; a statement that the project is subject to a defined process under the Class EA for Waterpower projects; an invitation to participate in the process; a tentative schedule; a statement that the project is associated with existing infrastructure; the project website and project contact information, and informed of upcoming public information sessions.

The notice was published in the following newspapers:

- Renfrew Mercury (English) (Thursday November 30th).
- Arnprior Chronicle-Guide (English) (Thursday November 30th).

A Notice of First Open House was prepared and provided the following information: project title; name of the proponent; a brief project description and project type; a map depicting the project location and anticipated zone of impact; a statement that the project is subject to a defined process under the Class EA for Waterpower projects; an invitation to participate in the process; a tentative schedule; a statement that the project is associated with existing infrastructure; the project website and project contact information, and informed of upcoming public information sessions including detailed information on the format, time and location of the first open house.

The notice was published in the following newspapers:

- Renfrew Mercury (English) (February 15 and 22, 2018); and
- Arnprior Chronicle-Guide (English) (February 15 and 22, 2018).

The of Second Open House was prepared and circulated but unforeseen circumstances associated with a natural flooding event along the Madawaska River and several other watercourses in southeastern Ontario, the Township of Greater Madawaska declared a State of Emergency. In the interest of public safety associated with flooding of roads and access to the Open House venue, OPG decided to postpone the scheduled Thursday May 2nd Calabogie Generating Station Redevelopment Open House to June 17, 2019. A revised second notice was distributed as per the process described above and circulated to stakeholders via mail on May 28, 2019 and via email on June 3, 2019.

The rescheduled notice was published in the following newspapers:

- Renfrew Mercury (English) (June 6 and 13, 2019); and
- Arnprior Chronicle-Guide (English) (June 6 and 13, 2019).

6.2 Public and Agency Input

6.2.1 Public Open House #1

The first public open house for the proposed Project was held on March 5, 2018 from 4:00 p.m. to 8:00 p.m. at the Calabogie Community Hall in Calabogie, Ontario.

The open house was designed for informal drop-in with project team representation from OPG and Arcadis. The purpose of the open house was to:

- Introduce the proposed Project and the project team;
- Provide information about the studies undertaken to support the Class EA process;
- Provide attendees the opportunity to ask questions and comment on the Project;
- Respond to questions and comments; and
- Create an opportunity for positive consultation.

A total of 33 individuals attended the Open House. Thirty-two provided contact information on the sign-in sheet. The attendees represented a combination of adjacent landowners, the general public from the surrounding community, and two attendees from the County of Renfrew.

A comment sheet was provided at the Open House giving the public two weeks to return comments. Five comment sheets were returned by the public, all of which were received at the venue.

In general, the most common questions and concerns raised were related to management and mitigation of water level fluctuations and flow rates. There was general positive support for the proposed Project, recognizing benefits associated with management of the Madawaska River. Many of the questions were not related to the proposed Project.

The questions and comments received verbally and via comment sheets from the public are described below in Table 6-1. The comment sheet identified a check box to receive a follow up call from the project team regarding comments and questions. None of the participants that filled out a comment sheet requested this, although one individual noted a discrepancy in mapping regarding land ownership and requested that OPG resolve this.

Table 6-1. Input Received from the Public at Open House #1

Comment/Question from the Public	Response
Interest in the elimination of excessive water level fluctuations. Several noted fluctuations of 3 to 5 feet over short time frame and would like OPG to mitigate this.	The project is being planned so that the fluctuations in water level downstream in Calabogie will not be any greater with the proposed Project. Depending on where the property owner is located in the reach, they may be more influenced by Stewartville operations than Calabogie. OPG will conduct an analysis at some point examining the proposed design and its impacts on water levels and fluctuations of those water levels under various conditions.
Interest in flow rates, noting that while daily flow will not change, hourly flows may, noting that this seems reasonable.	Acknowledged.
How can wakeboarding on the Madawaska River be controlled?	This is not a responsibility of OPG. However, possible solutions may be to contact the Ontario Provincial Police regarding this concern or consult with the Ministry of Natural Resources and Forestry.
Protection of the existing conditions is very important. Improvement of habitat etc. is welcome.	Acknowledged.
If the project facilitates presence of barn swallow this will be beneficial in addressing mosquitoes.	Acknowledged.
Interest in protection of Walleye spawning.	The Madawaska River WMP compliance requirements, such as timing of flows for walleye spawning, will continue to be adhered to.
Will there be any pollution or downstream environmental damage?	Construction is planned so as to prevent chemical or deleterious substances from entering the Madawaska River. This may be achieved by: • Undertaking most of the work ‘in the dry’ and not in the River. • Preparing an environmental management plan requiring the constructor to adhere to a variety of best practices to prevent spills from entering the River. • In the event of a spill on land, mitigation will be implemented to immediately clean up the spill and workers with equipment will have spill kits, etc. on site. It was noted that the downstream side of Calabogie is used for spawning and OPG will want to make sure spawning areas are still available for walleye and other fish such as River Redhorse.

Table 6-1. Input Received from the Public at Open House #1 (Cont'd)

Comment/Question from the Public	Response
OPG was identified as an important member of the community contributing to environmental, social and economic factors. The project is encouraged and there is benefit of preservation and use of the waterway locally and provincially.	Acknowledged.
Identification by two landowners of a discrepancy in OPG mapping and residential versus OPG land ownership.	Project team will review mapping. Property owners to be added to adjacent landowner list and follow up.
One resident didn't get the addressed notice for the meeting, just the Direct Mail notice.	Acknowledged that this was a limitation of the GeoWarehouse database used to generate a list of adjacent landowners. The contact has been added to the Project correspondence list. Property resides within the "Zone of Impact" although there are currently no proposed activities planned on that property. Project related traffic will occur along Lanark Road.
One resident offered the use of their land for parking or as a staging area and provided a photo of their property map.	Acknowledged.
The open house was informative and well executed.	Acknowledged.
What is the construction time frame?	A response was provided of 18 to 24 months.
Where will the construction area be located?	The area was shown on an aerial photo-based map.
Will there be impact or changes to the inlet sluice?	A response was provided that there is potential for this but it depends on the Project option selected.

6.2.2 Public Open House #2

The second public open house for the proposed Project was held on June 17, 2019 from 4:00 p.m. to 8:00 p.m. at the Calabogie Community Hall in Calabogie, Ontario.

Similar to the previous one, the open house was designed for informal drop-in with project team representation from OPG and Arcadis. The purpose of the open house was to:

- Introduce the proposed Project and the project team;
- Describe the proposed project;
- Describe proposed environmental effects and recommended mitigation and monitoring measures;
- Provide further information about the studies undertaken to support the Class EA process;
- Provide attendees the opportunity to ask questions and comment on the Project;
- Respond to questions and comments; and
- Create an opportunity for positive consultation.

Project information was presented through display panels. Printed information regarding the Calabogie GS and the Stewartville GS taken from the Madawaska River Water Management Plan (2009) was available for review.

A project sign-in sheet was available for participants to provide contact information in order to be included in future project correspondence. A comment sheet was also available for participants to submit questions and comments.

A total of 25 individuals attended the second and final Open House. Twenty-four provided contact information on the sign-in sheet. The attendees represented a combination of adjacent landowners, the general public from the surrounding community, a local business operator and one attendee from the Canadian Wildlife Federation.

A total of 30 Information Panels were available for the public to review, with project team members available to respond to questions.

A comment sheet was provided at the Open House giving the public two and a half weeks to return comments. Ten comment sheets were returned by the public, all of which were received at the venue. One additional email from an open house attendee was also received following the open house.

In general, the most common questions and concerns raised were related to management and mitigation of water level fluctuations, aquatic species mitigation measures, potential impacts to electricity bills, and recreational activities. There was general positive support for the proposed project and project team representation of environmental material, as well as recognition of benefits associated with the proposed project.

The questions and comments received verbally and via comment sheets from the public are described below in Table 6-2 below. The comment sheet identified a check box to receive a follow up call from the project team regarding comments and questions. Six (6) of the participants that filled out a comment sheet requested this. The email received following the open house from the attendee is also addressed in the table below.

Table 6-2. Input Received from the Public at Open House #2

Comment/Question from the Public	Response
Comment #1 - Concern over water level and speed of current. Notes inconsistencies in strength of current day to day and impact to safety (e.g. swimming and docking of pontoon). Seeks assurance regarding maintaining normal water level and safe water flow.	OPG will continue to operate the Calabogie GS and the other plants on the Madawaska River in full accordance with all flow and water level targets and compliance conditions in the Madawaska River Water Management Plan, including the summer conditions. Daily flow and water level conditions will remain unchanged from the existing situation. In certain conditions the hourly flow rate may be somewhat different from the existing situation.

Table 6-2. Input Received from the Public at Open House #2 (Cont'd)

Comment/Question from the Public	Response
	There may be some conditions where the new Calabogie GS could match flow patterns at Barrett Chute GS and Stewartville GS to reduce water level fluctuations in the Calabogie to Stewartville reach. For some residents of this reach, this has been an issue in the past and OPG's opinion is that this will slightly improve the historic situation. The individual making this comment provided specific contact information and OPG is following up specifically within this individual. Note that the individual who made this comment is located slightly downstream of the Springtown Bridge. In this reach of the River, the water level flows and levels are more influenced by Stewartville GS than Calabogie GS.
Comment #2 - Concern over loss of shoreline at residence. Noted a loss of 2-3 feet, including property surveyors landmarks. Notes interest in installation of rocks at his property that the Township will obtaining from the project site.	This concern is a historic concern. OPG will contact this individual whom provided their name and contact information to discuss shoreline concerns. Note that the individual who made this comment is located slightly downstream of the Springtown Bridge. In this reach of the River, the water level flows and levels are more influenced by Stewartville than Calabogie GS.
Comment #3 Interest in seasonal flow water level increase impacts to West shore of overflow channel and risk of permanent land loss, if any, from increased dam capacity. Interest in any increase in permanent flow water levels of secondary channel and how this may impact future property development. K-12 school information kits/visitors regarding early warning systems (i.e. sirens) and dam infrastructure along Calabogie-Arnprior dam runs.	The proposed project does not plan to increase flows down the North Channel. The North Channel is only used for spring spawning and for flooding situations in order to pass water downriver. This will be discussed with this individual. OPG followed up with this individual.
Comment #4 - Interested to know if new station will be unmanned, and if so how controls will be coordinated with other stations along Madawaska River.	Both the existing and proposed Calabogie GS are unmanned and are operated remotely from the Saunders Control Center. All the plants on the Madawaska River are operated in a co-ordinated fashion considering requirements and effects throughout the River. OPG has followed up with this individual.

Table 6-2. Input Received from the Public at Open House #2 (Cont'd)

Comment/Question from the Public	Response
Comment #5 - Seeks information on whether the power/electricity generated services Calabogie and if the project will have an impact on monthly electricity bill (e.g. an increase or decrease). Noted the spawning pools by the K&P Trestle Bridge on North Channel and that concerns appear to be addressed.	When in service the Project will be added to the portfolio of all OPG investments. The Calabogie re-development project will not have a discernable or visible impact on rates. The changes in electricity rates are based on Ontario Energy Board (OEB) approval of changes in all cumulative costs across OPG, which can be higher or lower than the previous term. OPG is following up with this individual. Acknowledged. OPG maintains flows during the springtime down the North Channel to allow for walleye spawning.
Comment #6 Seeks a firm statement of compliance to the 2011 Dam Safety Requirements. Notes proposed revisions to federal Fisheries Act and seeks acknowledgement in project planning to these. This individual also asked about questions regarding fish passage, new flows, habitat compensation, etc. as a result of these issues the project team followed up with this individual about his questions some more and he re-submitted a more formal comment about these issues. OPG advised that eel passage would be included in the new GS design but had no design details at this time and look forward to this when made available. I would also appreciate more information from OPG about the tailrace substrates and what will they be comprised of along with which species would be targeted for this enhancement with the removal of the existing GS. The new GS being situated a bit more upstream seems like more spawning habitat could be made available but wondering what mitigation measures may be considered to ensure they remain in place given the understanding that flows could increase from 60 to 160 cms?	The Calabogie Redevelopment Project will be designed and executed in accordance with the Ontario Ministry of Natural Resources and Forestry Lakes and Rivers Improvement Act (LRIA) Technical Bulletin with respect to dam safety and structural integrity; and the Constructor SNC-Sullivan will be obtaining LRIA Approval for this project during the construction phase The proposed project is being reviewed under the Fisheries Act. **American Eel** Section 2.4.3.5 of both the Aquatic TSD and the Environment Report describe the American Eel passage proposed for the facility. As mentioned in that section Specific measures have been scoped into the design of the station to accommodate potential future needs for upstream and downstream passage, including: • designing attractive flow at an eel trap/ladder at the plant tailrace; • including a temporary trap and transport system at the plant tailrace to help monitor for early signs of eels showing up below the station; • leaving room for permanent upstream and downstream passage infrastructure to be retrofitted on a long-term basis; • intake velocities and bar exclusion screen layouts designed to facilitate implementation of future effective safe passage of eels downstream through the GS; • provision for future inclined screen and downstream flow bypass for downstream passage with bar spacing in the screen

Table 6-2. Input Received from the Public at Open House #2 (Cont'd)

Comment/Question from the Public	Response
	20 mm during periods of downstream movement; and, • early consideration of the pros and cons of operational variations that may support eel passage. The DB Contractor has been asked to design the American Eel passage into the facility even though the permanent features of it would not be constructed until eels appear in the system. Normally, OPG does not provide detailed engineering design drawings to members of the public and such drawings aren't included in an environmental assessment report. **Tailrace Habitat** The existing aquatic habitat conditions (i.e. substrate) are shown in Figure 3-9 of the Aquatic TSD and are described in a fair bit of detail in section 3.2.2. The issue as to whether additional spawning habitat will be created is at this point somewhat uncertain but will be discussed with DFO. At this point, DFO has not indicated if an Authorization under the Fisheries Act is required but it is possible. OPG is aware of this and considers habitat compensation to be a fairly pragmatic solution. The commenter is correct in stating that having the powerhouse 50 meters upstream will result in an increase in aquatic habitat. Losing some of the forebay area is not as significant as this would be considered poorer habitat than increasing tailrace habitat area. The commenter may be correct in inferring that with increased flows from the powerhouse, the substrate could be mobilized (i.e. moved) by such water velocities. OPG is aware of this issue and describes the issue in section 2.4.3.4, which describes the existing and proposed tailrace conditions. OPG will be pursuing more in-depth discussions with DFO as part of the request for review process and provide all information DFO requires to determine whether an Authorization is required. At flows of 160 cms through the powerhouse any additional offsetting habitat in the tailrace would have to be designed along the margins of the tailrace and somewhat further downstream in order to prevent the

Table 6-2. Input Received from the Public at Open House #2 (Cont'd)

Comment/Question from the Public	Response
	mobilization of the spawning habitat substrate and to provide velocities conducive to spawning. The issue of the DFO authorization and any potential habitat enhancement will be considered in more detail in future discussions with DFO. If habitat enhancement was to be undertaken it would most likely be targeted towards walleye spawning habitat. OPG is willing to keep this individual informed of DFO discussions and decisions.
Comment #7- Concern about the snowmobile trail over township property.	OPG and the Township of Greater Madawaska will ensure that a snowmobile trail will be in place. Some re-routing may be required. OPG has discussed this with the President of the snowmobile association, and representatives from OPG, the constructor, and the township will meet in January 2020 to flag a section that re-routes the trail.
Comment #8 - New power station is a great addition for the extra electricity that will be developed.	Acknowledged
Comment #9 - Notes aquatic disturbance as something that OPG should be aware of.	Acknowledged
General Comments Several responses indicated positive remarks regarding Project Team representatives, materials presented and the project overall, noting materials and responses were very clear. One individual was also happy to see archeology being addressed in the environmental studies.	Acknowledged

6.2.3 Summary of Open Houses

The two open houses demonstrated that there is no public opposition to the proposed project. There was not a single individual indicating opposition to the project. A number of individuals indicated verbally and in writing that the project appears well planned.

As has already been documented the main public concern has been the historic and existing range of water level fluctuations during certain times of the year in the Calabogie GS to Stewartville GS reach. While this is an existing situation, OPG is of the view that the proposed project should slightly reduce the frequency of such fluctuations on some occasions. OPG continues to communicate with any property owns that raise this concern.

6.2.4 Agency Consultation

6.2.4.1 Consultation: June 2017 – June 2019

Consultation was undertaken with agencies, specifically the MECP, MNRF, MTCS and DFO, as well as both the Township of Greater Madawaska and Renfrew County. Significant consultation was initiated in 2017 with an agency kick-off meeting and continues to the current period. Initial discussions focused on the nature and scope of the proposed project and likely government information requirements.

A summary of agency consultation activities undertaken once the EA commenced in 2017 is provided below. OPG has consulted with various provincial and federal government agencies throughout the environmental assessment process. Some key dates and consultation are summarized below. Meetings notes from some of these meetings can be provided if the government agencies wish them.

- April 26, 2017 – Calabogie Site Visit and Meeting with MECP, MNRF, MTCS and DFO.
- February 26, 2018 – Meeting with the MNRF and Standing Advisory Committee (SAC) of the Madawaska River Water Management Plan (note that the SAC are volunteer representatives).
- February 27, 2018 – Meeting with Township of Greater Madawaska.
- March 12, 2018 – Email correspondence with Renfrew County, Departments of Development and Property and Public Works & Engineering on transportation and traffic issues.
- December 10, 2018 – Site visit with a staff person from the DFO.
- December 11, 2018 – Government Agency Update Meeting with invited representatives from MECP, MNRF, MTCS, DFO and Township of Madawaska Highlands. Limited representation from MNRF and MTCS was available only by phone.
- January 8, 2018 – Meeting with MTCS in Toronto to discuss Cultural Heritage Impact Assessment.
- January 22, 2019 – Meeting with the Township of Madawaska Highlands and Renfrew County.
- February 21, 2019 – Meeting with the MNRF. This meeting was held as most MNRF representatives in the Pembroke District and Peterborough Region office were unable to attend the December 11, 2018 meeting.
- June 17, 2019 – OPG attendance at Township of Greater Madawaska Township Council Meeting and site visit to discuss project, road layout, rock and other related issues.

In addition to the meetings above there has been other less informal communications on-going with all the various federal, provincial and municipal entities.

6.2.4.2 Consultation: July 2019, Review of Reports

In early July 2019, OPG provided the draft TSDs and the Environment Report for government agency review. Comments on those Reports were received from late July to early October 2019. Those comments and OPG responses appear in Appendix A of this Environment Report. Some of those comments necessitated edits to the TSDs and ER and the Reports have been updated accordingly. Other responses from OPG did not require changes to the Reports. Appendix A lists the agency comments and responses (no responses were provided when the agency comments fully accepted the reports as is). The government agency comments have been presented in chronological order as received.

- Appendix A-1 is a letter from the MECP Surface Water Specialist. No response is provided as no changes were required to the Report.
- Appendix A-2 is an e-mail from the MTCS acknowledging the Reports. The e-mail acknowledges that the archaeology report has been submitted for review and that the Heritage Impact Assessment (HIA) is accepted. MTCS made a helpful suggestion on making an addendum to the HIA depending on future changes to sluicegate capacity. No response was provided by OPG as no changes are required to the Reports.
- Appendix A- 3 is a table showing combined comments under the Species-at-Risk Act in Ontario and OPG responses. OPG understands that these comments were a combined effort from MECP and MNRF.
- Appendix A-4 is a table showing MNRF comments and OPG responses. A number of changes to the reports have been undertaken as a result of these comments.
- Appendix A-5 is a table showing DFO comments and OPG responses. A number of changes to the reports have been undertaken as a result of these comments. The comments and responses are also part of a general discussion DFO and OPG will have with respect to the DFO Request for Review process.
- Appendix A-6 is a table showing final MECP comments and OPG responses. A couple changes to the Reports were made as a result of these comments.

OPG appreciated the efforts of government agency staff to review the above documents and provide thoughtful responses.

6.2.5 Water Management Plan

OPG does not plan to propose any formal changes to the compliance requirements in the WMP, however a Minor Amendment will be required to the WMP to reflect the fact that a new GS has been constructed. OPG anticipates that such a Minor Amendment to the WMP would be initiated soon after the Statement of Completion to this environmental assessment is completed.

6.3 Summary

The public and agency consultation process for the proposed Calabogie GS Redevelopment Project has been comprehensive and inclusive of all interested individuals and government representatives. In general, the public has been supportive of the proposed project. OPG is not aware of a single individual that has indicated opposition to the proposed project.

It is our opinion that all public comments raised have or are being addressed including ones unrelated to the undertaking. OPG will continue to address public and agency comments as they come forward.

7 SUMMARY EVALUATION OF THE PROPOSED UNDERTAKING

7.1 Assessment of the Significance of Effects

The OWA (2018) Class EA requires that following the assessment of effects and application of mitigation measures there be an assessment of net effects (i.e. after mitigation) and their significance (Table 7-1). The environmental components are generally the same as those shown in Table 4-1. The assessment of significance is based on:

- value of the resource affected;
- geographic extent of the effect;
- duration and frequency of the effect;
- whether it can be reversed; and
- ecological/social context.

The OWA (2018) Class EA provides some guidance on the definition and meaning of most of these terms:

- value of the resource affected: some values may be given a higher priority than others. For example, an effect on public safety would most often be of more importance than an effect on recreational use.
- geographic extent of the effect: while the categorization of projects is premised on the environmental context within which projects will occur, potential impacts and benefits should nonetheless be considered based on their geographic extent.
- duration and frequency of the effect: longer term or more frequent effects may be greater.
- irreversibility of the effect: some potential effects may not be easily remedied or mitigated. Some effects can be reversed over a period of time. The potential irreversibility of an effect should be considered.
- ecological/social context: all potential effects should be assessed in both an ecological and social context. The potential impacts or benefits of projects may be significant. For example, impacts that occur in areas or regions that are ecologically fragile and have little resilience to imposed stresses that may be of particular importance. Similarly, benefits to local communities (e.g., flood/drought mitigation) may provide value above and beyond electricity production.

Arcadis has also retained the criteria of magnitude and duration in the Table to help better understand the nature of the environmental effects.

As stated in Chapter 4 an effects assessment matrix describing the effects before and after mitigation was submitted to the government agencies for comment.

Table 7-1. Assessment of the Significance of Effects

Environmental Component and Issue	Likelihood of Net Effect (after mitigation)	Value of Resource	Magnitude	Geographic Extent	Duration or Frequency	Irreversibility	Ecological / Social Context	Significance	Overall Assessment & Discussion
General Natural Environment Considerations									
Air quality: exhaust emissions and dust from equipment and vehicles	High	Medium	Low	Primarily localized around construction site	Construction (up to 24 months)	Reversible	Closest receptors are slightly over 200 meters away. Village of Calabogie is approximately 500 meters away.	Not significant	Neutral
Air quality: odour	Low	Medium	Low	Primarily localized around construction site	Construction (up to 24 months)	Reversible	Closest receptors are slightly over 200 meters away. Village of Calabogie is approximately 500 meters away.	Not significant	Neutral
Air quality: GHG offsets	Certain	High	Low	>10,000 km	Life of facility	Reversible	Rural Semi-Wilderness/Cottage Setting	Positive	Positive
Surface water – general construction activities along shoreline of waterway	Low	High	Low	Primarily localized around construction site	Construction (up to 24 months)	Reversible	Rural Semi-Wilderness/Cottage Setting. Some cottages and homes on well water.	Not significant	Neutral

Table 7-1. Assessment of the Significance of Effects (Cont'd)

Environmental Component and Issue	Likelihood of Net Effect (after mitigation)	Value of Resource	Magnitude	Geographic Extent	Duration or Frequency	Irreversibility	Ecological / Social Context	Significance	Overall Assessment & Discussion
General Natural Environment Considerations									
Surface water - in-water works including construction and removal of the cofferdams	Low	High	Low	Primarily localized around construction site	Construction (up to 24 months)	Reversible	Rural Semi-Wilderness/Cottage Setting. Some cottages and homes on well water.	Not significant	Neutral
Contamination from spills or leaks of fuels, hazardous substances, sanitary wastes	Low	High	Low	Primarily localized around construction site	Construction (up to 24 months)	Reversible	Rural Semi-Wilderness/Cottage Setting. Some cottages and homes on well water.	Not significant	Neutral
Soils and sediment quality	Low	Low	Low	Primarily localized around construction site	Construction (up to 24 months)	Reversible	Rural Semi-Wilderness/Cottage Setting.	Not significant	Neutral
SAR and their habitat	Low	High	Low	Local – Variety of Local SAR Species	Construction (up to 24months)	Reversible	Rural Semi-Wilderness/Cottage Setting with some SAR species present	Not significant	Neutral

Table 7-1. Assessment of the Significance of Effects (Cont'd)

Environmental Component and Issue	Likelihood of Net Effect (after mitigation)	Value of Resource	Magnitude	Geographic Extent	Duration or Frequency	Reversibility	Ecological / Social Context	Significance	Overall Assessment & Discussion
General Natural Environment Considerations									
Significant earth or life science features	None	High	Low	None	Construction (up to 24 months)	Reversible	Rural Semi-Wilderness/Cottage Setting.	Not significant	Neutral
Significant natural heritage features and areas	None	-	-	-	-	-	-	-	Neutral
Lands subject to natural or human-made hazards (i.e. erodible lands)	Low (positive and negative)	Medium	Medium	Very limited generally non-erodible shoreline and vegetated	Permanent	Reversible	River that has been managed for over 100 years.	Not significant	Neutral
Permanent terrestrial wildlife habitat loss or transformation	Negligible	Medium	Medium	Permanent loss of habitat may be nil	-	Reversible	Most of this habitat has been previously altered by anthropogenic activities	Not Significant	Neutral

Table 7-1. Assessment of the Significance of Effects (Cont'd)

Environmental Component and Issue	Likelihood of Net Effect (after mitigation)	Value of Resource	Magnitude	Geographic Extent	Duration or Frequency	Reversibility	Ecological / Social Context	Significance	Overall Assessment & Discussion
General Natural Environment Considerations									
Temporary terrestrial habitat loss	Certain	Medium	Medium	Less than 10 hectares	Few Years	Reversible	Most of this habitat has been previously altered by anthropogenic activities	Insignificant	Very minor negative
Loss of significant terrestrial habitat	Low	Medium	Low	Couple HA	Temporary	Reversible	Most of this habitat has been previously altered by anthropogenic activities	Not significant	Neutral
Loss and degradation of vegetation	Certain	Low	Low	Less than 10 ha	Temporary	Reversible	Most of this habitat has been previously altered by anthropogenic activities	Insignificant	Very minor negative
Shoreline dependent species	Low	Medium	Low	Only at very limited points.	Construction (up to 24 months)	Reversible	Shoreline where activities occur is generally not natural and dominated by bedrock and rock.	Insignificant	Neutral

Table 7-1. Assessment of the Significance of Effects (Cont'd)

Environmental Component and Issue	Likelihood of Net Effect (after mitigation)	Value of Resource	Magnitude	Geographic Extent	Duration or Frequency	Reversibility	Ecological / Social Context	Significance	Overall Assessment & Discussion
General Natural Environment Considerations									
Wetland dependent species	Low	Medium	Low	Few hectares	Less than 1 year	Reversible	Area previously impacted	Not significant	Neutral
General disturbance to wildlife	Low	Medium	Low	Approximately 50 ha	Construction (up to 24months)	Reversible	All of the area is already subject to human disturbance	Insignificant	Very minor negative (localized)
Fish habitat	Low	High	High	Very limited	Permanent	Reversible	Madawaska River – Managed River for over 100 years	Not significant (positive $\geq$ negative)	Neutral
Fish movement	None (same as existing situation) Positive for Eels	Low	None at present	None	Permanent	Not reversible	Currently there is no upstream movement	Not significant (positive $\geq$ negative)	Positive
Fisheries	Low	Medium	Low	Localized at GS	Permanent	Not reversible	Madawaska River – Managed River for over 100 years	Not significant (positive $\geq$ negative)	Neutral

Table 7-1. Assessment of the Significance of Effects (Cont'd)

Environmental Component and Issue	Likelihood of Net Effect (after mitigation)	Value of Resource	Magnitude	Geographic Extent	Duration or Frequency	Reversibility	Ecological / Social Context	Significance	Overall Assessment & Discussion
General Natural Environment Considerations									
Fish injury or mortality	Low	Low	Low	Powerhouse	Permanent	Irreversible	Madawaska River – Managed River for over 100 years	Insignificant	Negligible
Erosion and sedimentation	Low	Medium	Low	Around the GS	Permanent	Reversible	Madawaska River – Managed River for over 100 years	Not significant (positive ≥ negative)	Neutral
Water levels, flows and movement	Low (but positive likely greater than negative)	High	High	Madawaska River	Permanent	Irreversible	Madawaska River – Managed River for over 100 years	Not significant (positive ≥ negative)	Positive
Drainage, flooding and drought patterns	Low (more positive than negative)	High	Medium	Madawaska River	Permanent	Irreversible	Madawaska River – Managed River for over 100 years	Not significant	Positive
Water temperature	Certain/Unchanged	High	None	Madawaska River	Permanent	Irreversible	Madawaska River – Managed River for over 100 years	Insignificant	Neutral

Table 7-1. Assessment of the Significance of Effects (Cont'd)

Environmental Component and Issue	Likelihood of Net Effect (after mitigation)	Value of Resource	Magnitude	Geographic Extent	Duration or Frequency	Reversibility	Ecological / Social Context	Significance	Overall Assessment & Discussion
Aboriginal Community Considerations									
Mercury (in fish)	None	-	-	-	-	-	-	-	Neutral
First Nation Reserves or other Communities	None	-	-	-	-	-	-	-	Neutral
Spiritual, ceremonial, cultural, archaeological or burial sites	None	-	-	-	-	-	-	-	Neutral
Traditional land or resources used for harvesting activities	None	-	-	-	-	-	-	-	Neutral
First Nation employment	Medium (positive)	High	High	Ottawa Valley	3 year construction period	Reversible	and population emigration	Significant	Positive
Lands subject to land claims	None	-	-	-	-	-	-	-	Neutral

Table 7-1. Assessment of the Significance of Effects (Cont'd)

Environmental Component and Issue	Likelihood of Net Effect (after mitigation)	Value of Resource	Magnitude	Geographic Extent	Duration or Frequency	Reversibility	Ecological / Social Context	Significance	Overall Assessment & Discussion
Aboriginal Community Considerations									
Economic development	High (positive)	High	High	Renfrew County and Eastern Ontario	3 year construction period and permanent	Reversible	First Nation Communities are economically weaker than the general population	Significant	Positive
Other (training and education)	Low (positive)	High	Low	Renfrew County	Construction Period (24 months)	Reversible	First Nation communities have lower levels of education and training than the general population	Significant	Positive
Access to inaccessible areas (land or water)	None	Medium	Low	Localized around GS	Construction (24 months)	Reversible	Rural Semi-Wilderness/Cottage Setting.	Not Significant	Neutral
Navigation	None	-	-	-	-	-	-	-	Neutral
Riparian rights or privileges	None	-	-	-	-	-	-	-	Neutral

Table 7-1. Assessment of the Significance of Effects (Cont'd)

Environmental Component and Issue	Likelihood of Net Effect (after mitigation)	Value of Resource	Magnitude	Geographic Extent	Duration or Frequency	Reversibility	Ecological / Social Context	Significance	Overall Assessment & Discussion
Aboriginal Community Considerations									
Recreational use – land or water	Low	Medium	Low	Primarily localized around proposed Project footprint	3 year construction period	Reversible	Madawaska River – Managed River for over 100 years	Not significant	Neutral
Land and Resource Use Considerations									
Angling and hunting opportunities (Crown land, not remote tourism)	None	Medium	Low	Very localized around GS	Permanent	Reversible	Rural Semi-Wilderness/Cottage Setting.	Not Significant	Neutral
Trapping activities	None	-	-	-	-	-	-	-	Neutral
Baitfish harvesting activities	None	-	-	-	-	-	-	-	Neutral
Views or aesthetics	Low	Medium	Low	Very localized around GS	Permanent	Non-Reversible	Rural Semi-Wilderness/Cottage Setting.	Not Significant	Neutral
Existing land or resource management plan	None	-	-	-	-	-	-	-	Neutral

Table 7-1. Assessment of the Significance of Effects (Cont'd)

Environmental Component and Issue	Likelihood of Net Effect (after mitigation)	Value of Resource	Magnitude	Geographic Extent	Duration or Frequency	Reversibility	Ecological / Social Context	Significance	Overall Assessment & Discussion
Land and Resource Use Considerations									
Protected areas	None	-	-	-	-	-	-	-	Neutral
Archaeological sites	None	-	-	-	-	-	-	-	Neutral
Building or structures	Low	Local	Medium	Localized to GS	Permanent	Irreversible	100 year old powerhouse	Local	Neutral
Cultural Heritage Landscapes	None	-	-	-	-	-	-	-	Neutral
Social and Economic Considerations									
The location of people, businesses, institutions, or public facilities	None	-	-	-	-	-	-	-	Neutral
Community character, enjoyment of property, or local amenities	None	-	-	-	-	-	-	-	Neutral

Table 7-1. Assessment of the Significance of Effects (Cont'd)

Environmental Component and Issue	Likelihood of Net Effect (after mitigation)	Value of Resource	Magnitude	Geographic Extent	Duration or Frequency	Reversibility	Ecological / Social Context	Significance	Overall Assessment & Discussion
Land and Resource Use Considerations									
Employment	High (positive)	High	High	Renfrew County	Construction (up to 24 months)	Reversible	Slightly higher area of unemployment than Province	Significant	Positive
Public health and/or safety	Low	High	High	Around construction areas	Construction (up to 24 months) and Operations	Reversible	Near Village of Community	Not Significant	Neutral During construction high degree of mitigation to reduce risks. During operations new facility will increase public safety
Local, regional or provincial economies	High	High	High	Primarily Eastern Ontario	3 years and permanent	Irreversible	Slightly higher are of unemployment in Renfrew County	Not Significant	Positive

Table 7-1. Assessment of the Significance of Effects (Cont'd)

Environmental Component and Issue	Likelihood of Net Effect (after mitigation)	Value of Resource	Magnitude	Geographic Extent	Duration or Frequency	Reversibility	Ecological / Social Context	Significance	Overall Assessment & Discussion
Cultural Heritage Resource Considerations									
Tourism values	None	Medium	Low	Proposed Project local study area	Permanent	Reversible	Quaint Village	Not significant	Neutral
Water supply	None	-	-	-	-	-	-	-	Neutral
Reliability (e.g., voltage support)	Positive net effect	-	-		-	-	-	-	Positive
Security (e.g., black start)	Positive net effect	-	-	-	-	-	-	-	Positive
Electricity Flow Patterns	Positive net effect	-	-	-	-	-	-	-	Positive
Cultural Heritage Resource Considerations									
Other									

7.2 Advantages and Disadvantages of the Undertaking and Discussion of the Benefits

As per Section 4.3 of the OWA (2018) Class EA an overall assessment of the advantages and disadvantages of the proposed Project is provided below, including a discussion of any benefits that may offset potential negative environmental effects.

7.2.1 Advantages

The proposed CGSR Project will produce a wide variety of benefits for local and regionally based populations and in general the people of Ontario.

Economic, Employment and Social Advantages

The proposed Project will have an installed capacity of approximately 11 MW and is expected to annually produce approximately 46,030 MWh of clean renewable power. At full capacity, the proposed Project will generate enough electricity to power approximately 11,000 homes (at full capacity). The proposed Project would have an asset life of over 90 years.

OPG anticipates that the re-developed GS will result in payment of $18 million (in 2019 dollars) to the Province in Gross Revenue Charges over the course of the proposed Project or $52.5 million (nominal dollars with inflation).

The proposed Project is expected to result in the creation of approximately 162 to 185 person years of work over an approximately two-year construction period. This employment will be distributed across a wide variety of professions and trades typically associated with a heavy construction project. Recent OPG experience in constructing hydroelectric projects in Northeastern Ontario demonstrated that approximately 60% of the total labour requirement for the on-site work was met by the labour market in northeastern Ontario. Given the greater labour pool and that the Design-Build Contractor (DB Contractor) includes a local/regional heavy construction firm it is anticipated that most of the labour would come from eastern Ontario.

Additional indirect and induced employment will also be created as a result of the proposed Project, particularly in sectors associated with the supply of construction materials and the provision of goods and services to the Project and associated workforce. Based on other recent OPG hydroelectric projects in northern Ontario, for every direct job associated with the proposed Project another 0.65 person years of employment will be generated elsewhere in the same region. OPG would expect that to be the same for the Calabogie Project with a similar multiplier in eastern Ontario. In a similar fashion, based on other socio-economic studies on hydroelectric projects in northern Ontario, it is estimated that that the sales multiplier associated with the proposed Project will be $1.50, i.e., for every dollar expended on the Project an additional $0.50 will be spent within eastern Ontario.

OPG and SNC-Sullivan have also been working directly with the AOO and AoPFN and to create training, employment and sub-contracting opportunities for members of their communities in eastern Ontario. This will be an economic and social benefit to these communities. OPG is also willing to consider Williams Treaty First Nation communities in employment and contracting opportunities.

The proposed project will also allow OPG to provide rock to the Township of Greater Madawaska that it can use for future construction and maintenance of roads. This will be a financial benefit for the Township.

With respect to water management the proposed Project flows will allow OPG to better match flows in the Madawaska River to other Generating Stations and should in some conditions help to reduce the range and frequency of water level fluctuations between Calabogie and Stewartville. This has been an objective of some property owners in the Calabogie to Stewartville-Reach of the Madawaska River.

Environmental Advantages

The utilization of water resources and the establishment of a generating station in an area already manipulated by human influence represent a preferred option over a project proposed on an unaffected watercourse. This Project will allow OPG to take advantage of water resources that have historically been “spilled” around the GS owing to the lack of GS capacity.

Electricity produced by hydroelectric stations in Ontario often displaces power that may otherwise be generated using fossil fuels. The proposed new GS is being developed to a capacity of 11 megawatts, representing a 6 MW increase. OPG has assumed that natural gas generating plants would be used part of the time to replace the same energy produced at the Calabogie GS. It is estimated that a re-developed Calabogie GS would then displace 15,611 Mg of carbon dioxide per year. Therefore, the proposed undertaking could be assumed to help offset that amount of GHGs.

The proposed Project will be designed for upstream and downstream passage of the American Eel. While the American Eels are unlikely in the Madawaska River at this point the proposed Project represents an important step in the future recovery of this species.

The environmental assessment has and will continue to enhance the knowledge level on environmental resources in the local area

7.2.2 Disadvantages and Benefits Offsetting Disadvantages

The OWA Class EA requires that the disadvantages of the proposed Project also be described along with the benefits offsetting such disadvantages.

It is expected that there will negligible aquatic and terrestrial ecological disadvantages associated with the proposed Project once all proposed mitigation and monitoring measures are carried out.

7.2.2.1 Summary of Advantages and Disadvantages

The proposed Project offers advantages to eastern Ontario communities through economic and employment benefits as already described.

The proposed Project will benefit Ontario in terms of the gross revenue charges that would be paid to the Province, and by providing a long-term, renewable and reliable energy source that supports provincial green energy, climate change and Indigenous policies, and aligns well with the needs (e.g., storage) of the provincial electrical system. The Province would also benefit by the related taxes and charges that result from all aspects of the proposed Project.

The investment in a new and somewhat larger GS at Calabogie will help OPG better match flows with the upstream and downstream plants and result in increased utilization of the available water resources. The project will also allow for an investment into the dam infrastructure at the facility which would be advantageous in addressing future catastrophic events and climate change. Finally, the investment will also allow OPG the opportunity to make the GS “eel ready” so that facility could safely pass future American Eel populations.

7.2.3 Summary of Monitoring Programs

This section contains a summary of planned monitoring programs for the proposed Project for both the construction and operation periods. It also provides general information on the mechanisms for their implementation and reporting although these would be expanded as the proposed Project progresses.

Construction

During construction there will be an Environmental Compliance Monitoring Program (Monitoring Program) in effect to ensure all construction related commitments are met. OPG handles this in a multi-faceted way and has been implemented in hydroelectric construction projects that OPG has completed over the last few years (e.g., re-development of generating stations on the Upper Mattagami, Lower Mattagami and Montreal River systems).

OPG has retained SNC-Sullivan for the proposed Project who will have overall responsibility for the proposed Project and environmental management of construction activities. The DBC will be required to ensure that all construction related activities meet all EA commitments, regulatory requirements, permit terms and conditions, and other related environmental guidance. In order to do that the DBC will prepare an Environmental Management Plan (EMP) that will outline how this is to be done, as well as identify all monitoring activities to be undertaken during construction.

This work will require the DBC to monitor the environmental effects of the construction of the proposed Project including among other things adherence to the following:

- EMP in general;
- Erosion and Sediment Control Plan;
- Spills Emergency Preparedness and Response Plan;
- Hazardous Materials Management Plan;
- Waste Management Plan;
- environmental water use;
- noise control;

- any SAR requirements;
- use of explosives;
- requirements outlined in permits such as PTTWs;
- DFO guidelines and blasting engineer recommendations;
- in-water construction timing restrictions;
- Cultural Heritage Monitoring Plan; and
- commitments made in this ER and associated TSDs.

OPG typically will have an oversight program in place to track and assess DBC compliance with such measures. As well, government regulators will require information as per the specific permits. OPG will also ensure it has a monitoring program in place to ensure that all mitigation and compensation measures are being implemented whether they pertain to the DBC or CRP/OPG.

OPG will also require the DBC to have an on-site health and safety coordinator who will review and monitor health and safety issues which arise during the course of construction.

During the construction period three cultural heritage monitoring recommendations have been made:

- Should previously undocumented archaeological resources be discovered, they may be considered a new archaeological site and therefore subject to section 48(1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with section 48(1) of the *Ontario Heritage Act*;
- The *Cemeteries Act* requires that any person discovering human remains must notify the police or coroner and the Registrar of Cemeteries, Ministry of Small Business and Consumer Services; and
- During excavation of the forebay and tail race areas, excavation may reveal details of the original construction and subsequent modifications. If such features are identified they need to be assessed and documented.

Recently the AoPFN has also asked that a discovery protocol be considered. While details of this have yet to be identified this likely means that discovery of any archaeological or cultural resource of significance should result in the immediate halt of work and notifications to AoPFN and AOO.

Operations

Flow discharge, water levels and water temperature will be monitored throughout proposed Project operation. As required by the Madawaska River WMP will collect and maintain hourly water level and flow data which will be provided to the MNR as requested for audit purposes.

7.2.4 Post Environmental Assessment Approvals

Approval under the provincial *EA Act* via the OWA Class EA is the first approval in a series of permits, licences and approvals required for the proposed Project. This EA process concludes the planning stage for the proposed Project.

Following the provincial EA process, the detailed design process may continue. Other legislation will apply that grants authority to designated agencies to review and approve components of the proposed Project prior to its construction and/or operation. This includes the detailed design of the undertaking itself, as well as other activities and facilities that either support construction or supplement the proposed Project.

Table 1, Section 1.3 of the OWA (2018) Class EA lists the other key legislative considerations for waterpower projects. From this list, legislation that is likely to apply to the proposed Project includes the *EPA*, *OWRA*, *LRIA* and *Fisheries Act*. The *EA Act* specifically prohibits granting of these other approvals (except for study/research approvals such as the Fish Collectors Permit) prior to *EA Act* approval.

A preliminary list of known environmental permits, licences, clearances and approvals for this proposed Project is provided in Table 7-2. This list will need to be re-confirmed once the final designs and construction plans are developed by the DBC. The permits will also need to be reflective of any regulatory changes to federal and provincial environmental regimes. Depending on the final design and changes to applicable federal and provincial legislation and policies many of these approvals may or may not be required; however, the list is provided for illustrative purposes.

Table 7-2. List of Permits, Licences and Approvals Possibly Required for the Proposed Calabogie Generating Station Re-Development Project

Agency	Statute	Likely Permits, Licences or Approvals	Applicability
Provincial Approvals			
Ontario Energy Board	*Ontario Energy Board Act*	Section 92 approval	
MoECP	*ESA*		Adhere to ESA requirements. At present permits are not anticipated.
MoECP	*EPA*	Ontario Regulation 347, General Waste Regulation. Transport documentation including Waste Management System	Waste generator registration for hazardous waste generated and ensuring all requirements of Reg. 347 are met during construction. This is not anticipated to be required. <u>Construction of GS:</u> Approvals for carrier and disposal to an approved waste disposal or transfer site. <u>Operation of GS:</u> OPG would complete its own registration for waste disposal.

Table 7-2. List of Permits, Licences and Approvals Possibly Required for the Proposed Calabogie Generating Station Re-Development Project

Agency	Statute	Likely Permits, Licences or Approvals	Applicability
Provincial Approvals			
MoECP	*OWRA*	PTTW	Construction and Operation of GS: A Permit to Take Water for operations and construction will likely not be required for this Project subject to the passage of Bill 132, *Better for People, Smarter for Business Act, 2019*. This Bill proposes to amend section 34 of the *Ontario Water Resources Act* and provide an exception for the taking of water for constructing and operating a dam if the dam is associated with the production of electricity and the activity is done in accordance with an approval or in compliance with a Minister's order under the *Lakes and Rivers Improvement Act*.
MoECP	*OWRA*	Environmental Compliance Approval	Construction of GS: For temporary settling ponds, any cofferdams requiring pump out or water treatment systems prior to release. Operation of GS: For any sewage works such as oil containment systems in the powerhouse. Dry transformer is anticipated. If oil based transformer required a switchyard drainage system for transformer oil will be needed.
MNRF	*LRIA*	Approvals under *LRIA*	In-water work not covered under *Public Lands Act.*
MNRF	*LRIA*	Section 16 approval	Plans and Specifications Approval for works involving the construction of the new GS and any refurbishment work associated with the existing dam.
MNRF	*LRIA*	Section 23 approval	Minor Amendment to the WMP to record changes to the facility from the existing situation.
MNRF	*Public Lands Act*	Section 2(1) Regulation 975	Construction of GS: A Work Permit may be required for various construction related activities such as road construction, trails, water crossings and work on shorelands. Further discussions with OMNRF will be required.

Table 7-2. List of Permits, Licences and Approvals Possibly Required for the Proposed Calabogie Generating Station Re-Development Project

Agency	Statute	Likely Permits, Licences or Approvals	Applicability
Provincial Approvals			
MNRF	*Fish and Wildlife Conservation Act*	Licence to Collect Fish for Scientific Purposes	<u>Construction of GS:</u> For the capture and transfer of fish following construction of cofferdams and during de-watering.
Federal Legislation			
DFO	*Fisheries Act*	Section 35 authorization Section 22(3) authorization	Subsection 35(1) of the Fisheries Act prohibits the carrying on of a work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery or to fish that support such a fishery. However, under Paragraph 35(2)(b) of the Fisheries Act, the Minister of Fisheries and Oceans (the Minister) may issue an authorization with terms and conditions in relation to a proposed work, undertaking or activity that may result in serious harm to fish.
Environment Canada	*Migratory Birds Convention Act*		If tree clearing occurs during bird nesting season, this act must be adhered to and permit required. No breeding bird can be harmed, harassed or agitated during bird nesting season. Objective is to clear outside of the breeding bird season.
Transport Canada	*Transportation of Dangerous Goods Act*	Explosives Transportation Permit	Required if transporting up to 2,000 kg of explosives during construction. This would be DBC's responsibility to assess need and then obtain if required. However, it is likely not required.
Natural Resources Canada	*Explosives Act*	Paragraph 7(1) (a) of the Law List Regulations occurs when the Minister issues licences for factories and magazine.	Licence if the DBC decides to store a certain quantity of explosives on-site. This is unknown at this point but not probable given the limited size of the proposed Project.
Township of Greater Madawaska	*Building Code*		Demolition and Building Permit likely required.

7.2.5 Anticipated Timeline for Project Implementation

OPG anticipates approving the proposed Project by the end of 2019 with construction anticipated to start in 2020 and the plant to be in operation by the end of 2021 or early 2022.

7.2.6 Conclusions

This ER provides a description of the proposed Project, description of the EA approach and methodology, description of the existing environment, an assessment of effects and proposed mitigation and monitoring measures, a description of public and agency consultation, description of Indigenous Peoples consultation, and this summary evaluation of the proposed Project including the overall advantages and disadvantages.

Opportunities have been given for input from government reviewers in the scoping of field studies, the identification of effects, selection of potential mitigation measures and review of technical studies. Over the last two years or so through meetings, discussions and information centres/open houses and website, substantial effort has been made to regularly inform and involve the public on the proposed Project and to address all questions.

The proposed Project lies within the AOO Land Claim and engagement has occurred with the AOO and their various member communities. While the Algonquins of Pikwakanagan are part of the AOO there has been additional engagement with them separately, as per their request. OPG has also recently engaged with four Williams Treaty First Nation communities as a result of the the Province’s recent recognition of these communities holding pre-existing treaty rights (Treaty 27) in the Calabogie area. Arcadis and OPG are of the opinion that no traditional activities or rights of either the Algonquins or Williams Treaty communities will be impacted by the proposed project.

OPG has been facilitating potential training, employment and contracting opportunities for Algonquins, and if interested the identified Williams Treaty First Nation communities as well.

The proposed project will produce a wide variety of benefits for local and regionally based populations and in general the people of Ontario. The Project will provide a moderate sized investment into eastern Ontario that will create significant local and regional employment.

The proposed Project will benefit Ontario in terms of the gross revenue charges (water rental) and from the variety of other related taxes and charges that will result from all aspects of the proposed Project.

The Province will also benefit from the additional 6 megawatts of renewable green energy the project will add resulting in a new station of approximately 11 megawatts.

The investment in a new and somewhat larger GS at Calabogie will help OPG better match flows with the upstream and downstream plants and result in increased utilization of the available water resources. The project will also allow for an investment into the dam infrastructure at the facility which would be advantageous in addressing future catastrophic events and climate change. Finally, the investment will also allow OPG the opportunity to make the GS “eel ready” so that facility could safely pass future American Eel populations.

Any negative environmental effects associated with the proposed Project are minor and/or temporary and most if not all can be addressed through appropriate mitigation and monitoring measures.

Finally, this ER presents the view that developing a new approximately 11 MW hydroelectric GS at the site of the existing Calabogie GS represents a positive net benefit for the people of Ontario.

To the knowledge of OPG there are no outstanding issues with public.

In on-going discussions between OPG and the AOO the AOO wanted it to be known that the AOO has “outstanding issues of concern related to archaeological assessments and adverse impacts to potential cultural heritage values that are being pursued under separate correspondence to the Ministry of Heritage, Sport, Tourism and Culture Industries dated February 25, 2020 and copied to OPG.”

If other outstanding concerns remain or are identified following the submission of this ER, OPG will continue to work with the stakeholders or Indigenous peoples to resolve those issues.

OPG respectfully requests acceptance of the proposed Project as described herein, proposed pursuant to the OWA (2018) Class Environmental Assessment for Waterpower Projects under the Ontario *EA Act*.

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9 ACRONYMS AND ABBREVATIONS

ABA	Acid Base Accounting
AIP	Agreement-in Principle
AOO	Algonquins of Ontario
AoPFN	Algonquins of Pikwakanagan
AFO	Antoine First Nation
ATRIS	Aboriginal and Treaty Rights Information System
CSRP	Calabogie Station Re-Development Project
CRCMC5	Canadian Regional Climate Model 5
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CHER	Cultural Heritage Evaluation Report
CHIA	Cultural Heritage Impact Assessment
DB	Design Build
DBC	Design-Build Contractor
DFO	Department of Fisheries and Oceans
ELC	Ecological Land Classification
EMP	Environment Management Plan
EA	Environmental Assessment
EA Act	*Environmental Assessment Act*
EPA	*Environmental Protection Act*
ER	Environmental Report
ESA	*Endangered Species Act*
FPTCCCEA	Federal-Provincial-Territorial Committee on Climate Change and Environmental Assessment
FNMHF	First Nations Market Housing Fund
FEED	Front End Engineering and Design
GS	Generating Station
HONI	Hydro One Networks Inc.
IESO	Independent Electricity System Operator
INAC	Indigenous and Northern Affairs Canada
LRIA	Lakes and River Improvement Act

MRWMP	Madawaska River Water Management Plan
MoECC	Ministry of Environment and Climate Change
MoECP	Ministry of Environment Conservations and Parks
MNR	Ministry of Natural Resource
MNRF	Ministry of Natural Resources and Forestry
MOE	Ministry of the Environment
MTCS	Ministry of Tourism, Culture and Sport
OHA	*Ontario Heritage Act*
OPG	Ontario Power Generation
OPS201	Ontario Provincial Standard
OWRA	*Ontario Water Resources Act*
OWA	Ontario Waterpower Association
OVF	Ottawa Valley Forest
PHP	Provincial Heritage Property
PWQO	Provincial Water Quality Objectives
SC	Special Concern
SARO	Species at Risk in Ontario
TSDs	Technical Support Documents
UQAM	University of Quebec at Montreal
WMP	Water Management Plan
WSC	Water Survey of Canada
WTFN	Williams Treaty Communities

MEASUREMENT UNITS

°	degree
‘	minute
“	second
cm	centimetre
°C	degree Celsius
ft	foot
FTU	Formazin Turbidity Unit
g	gram
GWh	gigawatt hour
h	hour
ha	hectare
JTU	Jackson Turbidity Unit
kg	kilogram
kg $CaCO_3$/t	kilogram calcium carbonate per tonne
km	kilometre
km^2	square kilometre
KP	Kilometre Post
kV	kilovolt
kW	kilowatt
L	litre
L/s	litre per second
m	metre
m.a.s.l.	metre above sea level
m^2	square metre
m^3	cubic metre
m^3/s	cubic metre per second

mi	mile
µg/g	microgram per gram
µg/L	microgram per litre
µmhos/cm	micromhos per centimetre
µ	micron (micrometre)
µS/cm	microsiemens per centimetre
mg/L	milligram per litre
mm	millimetre
mm/s	millimetre per second
MW	megawatt
NTU	Nephelometric Turbidity Unit
%	percent
rpm	revolution per minute
TCU	True Colour Unit

10 GLOSSARY

Acarina	Mites and ticks.
Aerobic	Denotes the presence of gaseous or dissolved oxygen.
Algae (Algal)	A group of unrelated simple plant organisms that live in aquatic habitats.
Algal bloom	Proliferation of living algae usually due to nutrient enrichment.
Alkalinity	Measure of a water's capacity to neutralize an acid.
Alluvial (alluvium)	Of material deposited by rivers.
Amphibole	A group of double chained inosilicate minerals whose basic chemical unit is the tetrahedron (SiO_4); they are common rock forming minerals and are found in most igneous and metamorphic rocks.
Amphipoda (Amphipods)	Order of crustaceans of the subclass Malacostraca commonly known as scuds.
Anaerobic	Denotes the absence of gaseous or dissolved oxygen.
Anion	A negatively charged ion.
Annelida	A phylum of invertebrates comprising the segmented worms.
Anode Cathodic Protection	Technique use to control corrosion of a metal surface by making it a cathode of an electrochemical cell by connecting the metal to be protected with another more easily corroded metal to act as the anode of the electrochemical cell.
Anoxic	See anaerobic.
Anthropogenic	Human-caused; due to human activities.
AoC Prescription	Mitigation direction prescribed by the MNR to minimize or obviate a potential adverse effect on a habitat value or feature.
Aquatic macrophyte	Rooted, usually vascular, aquatic plants, such as water lily, cattail, coontail, etc.
Arachnida	A class of joint- and eight-legged invertebrates with the body separated into two parts, including spiders, ticks, mites, chiggers and scorpions.
Argillaceous	Describing rocks or sediments containing particles that are silt- or clay-sized, <0.625 mm in size.
Arthropoda (Arthropods)	Highly specialized invertebrates including insects.
Avifauna	Birds.
Basalt	A fine-grained, dark-coloured volcanic rock, the extrusive equivalent of gabbro.
Bedload	The solid debris transported in a stream on or near its bed; because this material is too heavy to be carried in suspension, it is moved by rolling, sliding or saltation (sudden jumps) along the bottom.
Benthic	Pertaining to the bottom of aquatic habitats and the organisms that inhabit the bottom.

Benthic macroinvertebrates	Larger bottom-dwelling organisms, e.g., snails, clams, worms, insect larvae, crustaceans, etc. living on or within the sediment substrate of waterbodies.
Benthivorous (benthivores)	Bottom-feeding.
Biological Oxygen Demand	The amount of oxygen required to oxidize the organic matter by aerobic microbial decomposition to a stable inorganic form.
Biotite	Common rock-forming mineral of the mica group.
Bivalvia	Pelecypoda; clams.
Bog	Peatland with the water table at or near the surface with the surface often raised above the surrounding terrain; strongly acidic and extremely nutrient-poor; ground cover of *Sphagnum*, usually with ericaceous shrubs (of the family Ericaceae).
Breccia	A clastic rock composed of broken, angular rock fragments larger than 2 mm in diameter and enclosed in a fine-grained matrix.
Brownian movement	The random movement of microscopic particles suspended in a gas or liquid.
Bryophyte	Moss.
Bulkhead	A steep or vertical wall retaining an embankment, often used to line shorelines, maintain embankment stability and absorb the energy of waves and currents.
Cambrian Period	The oldest period of the Paleozoic Era; it began about 600 million years ago and lasted perhaps 100 million years; during this time, the seas teemed with primitive invertebrate fish.
Canal	A channel dug or built to carry water.
Capacity	The greatest load which a unit, station or system can supply (usually measured in kilowatts, megawatts, etc.).
Catastomidae (catostomid)	Sucker family.
Cation	A positively charged ion.
Cenozoic Era	The most recent geologic era which began with the end of the Cambrian Period, about 70 million years ago.
Centrarchidae (centrarchid)	Sunfish family.
Cervid	Pertaining to the deer family (Cervidae).
Chaeta	Chitinous bristle or seta found on an insect, arthropod or annelid worms.
Chlorophyll	A class of pigments found in all photosynthetic organisms; chlorophyll molecules are the principal sites of light absorption in the light reaction of photosynthesis.

Chlorosis	Loss or reduction of green plant pigment or chlorophyll; generally, yellowing.
Class	A category used in the classification of organisms that consists of similar or closely related orders.
Clastic	Rock typically composed of broken rock fragments, e.g., conglomerate and sandstone.
Cofferdam	A temporary dam made of concrete, rockfill, sheet-steel piling, timber/timber-crib or other non-erodible material and commonly utilized during construction to exclude water from an area in which work is being executed.
Coldwater habitat	Habitat for fish having a water temperature preference of 10 to 18ºC.
Coleoptera	Beetles.
Conductivity	Numerical expression of a water's ability to conduct an electric current; the conductivity of water is dependent on its ionic concentrations and temperature.
Conglomerate	A clastic sedimentary rock consisting of more or less rounded rock particles at least 2 mm in diameter, embedded in a fine-grained matrix of sand or silt.
Coolwater habitat	Habitat for fish having a water temperature preference of 18 to 25ºC.
Coregonidae (coregonid)	Family of soft-finned fishes comprising the freshwater whitefishes.
Cottidae (cottid)	Sculpin family.
Crepuscular	Appearing (active) in twilight.
Crest gate (Control gate)	The gate that controls water flow into a hydroelectric dam.
Crustacea (crustaceans)	Crustaceans form a very large group of arthropods including crabs, lobsters, crayfish, shrimp and krill.
Cyprinidae (cyprinid)	Minnow or carp family.
Dam	A concrete or earthen barrier constructed across a river and designed to control water flow or create a reservoir.
Deciduous Forest	In the Northern Hemisphere, this forest type occurs to the south of the coniferous forest and is dominated by broadleaved deciduous hardwood trees typically with a five- to six-month growing period.
Diabase	Fine-grained intrusive igneous rock of a composition similar to basalt, but is slightly more coarse-grained.
Diatoms	Unicellular algae, usually microscopic, that are characterized by having a cell wall of silica.
Dike	The vertical veins of igneous rock that form when magma enters and cools in fractures found within the crust.
Diptera	True flies.

Draft tube	The flared passage leading vertically from a turbine to its tailrace.
Drawdown	The release of water from a reservoir for power generation, flood mitigation, irrigation or other water management activity.
Dyke	Embankment against flooding.
Ecodistrict	A subdivision of an ecoregion based on distinct assemblages of relief, geology, landform, soils, vegetation, water and fauna; an ELC system mapping unit usually mapped at a scale of 1:500,000 to 1:125,000.
Ecological Land Classification (ELC)	The Canadian classification of lands from an ecological perspective; an approach that attempts to identify ecologically similar areas.
Ecoregion	An area characterized by a distinctive regional climate as expressed by vegetation; an ELC system mapping unit usually mapped at a scale of 1:3,000.000 to 1:1,000,000.
Ecosite	A landscape area consisting of typical, recurring associations of vegetation types and substrate types combinations; an ELC system mapping unit usually mapped at a scale of 1:50,000 to 1:10,000.
Electric and Magnetic Fields (EMF)	Electric fields are produced by voltage and increase in strength as the voltage increases. Magnetic fields result from the flow of current through wires or electrical devices and increase in strength as current increases.
Endangered	A species facing imminent extirpation (no longer existing in the wild in Canada, but occurring elsewhere) or extinction (no longer exists).
End (Terminus) Moraine	Ridge of till deposited at the terminus of a glacier.
Ephemeroptera	Mayfly nymphs.
Epilithic	Attached to rocks.
Epipelic	Associated with (attached to) bottom sediments in waterbodies.
Epiphytic	Attached to vegetation, e.g., larger filamentous algae, mosses and aquatic macrophytes.
EPT Index	A measure of the diversity of the relatively more sensitive benthic macroinvertebrate groups, Ephemeroptera, Plecoptera and Trichoptera based on the sum of all taxa within these three orders.
Ericaceous	Plants belonging to the Heath (Ericaceae) family; require acidic soil with pH less than 7.
Esker	A long, narrow ridge of poorly stratified glaciofluvial sand and gravel, usually deposited by a subglacial stream between banks of ice.
Extirpation	Elimination of a species in the wild of a particular area (e.g., Ontario), but occurring elsewhere.
Family	A category used in the classification of organisms that consists of one or several similar or closely related genera.
Feldspar	A group of common aluminum silicate minerals that contains potassium, sodium or calcium; the most important group of rock-forming minerals, making up about 60% of the rocks of the earth’s crust.

Feldspathoid	A mineral chemically similar to feldspar but containing less silica.
Felsic Igneous	An igneous rock having abundant light-coloured minerals (quartz, feldspars, feldspathoids, muscovite) in its mode.
Fen	Peatland with water table at or just above the surface and with very slow internal drainage by seepage; more nutrient-rich than bogs; sometimes occurs as a floating mat; vegetation consists of sedges, mosses, shrubs and sometimes a sparse tree layer.
Ferro-humic Podzols	Well and imperfectly drained soils that have developed under coniferous and mixed-forest vegetation and intermediate moisture conditions and usually found in cold to temperate climates on acid parent materials.
Fluvial	Of watercourses.
Forb	A herbaceous flowering plant that is not a graminoid (rushes, grasses and sedges).
Forebay	The part of a dam’s reservoir that is immediately upstream from the powerhouse.
Freshet	High flows caused by snow melt, runoff, heavy rains and/or high inflows.
Fulvic acids	Yellow to yellow-brown humic substances that are soluble in water under all pH conditions.
Gabbro	A coarse-grained plutonic rock containing plagioclase feldspar, most commonly labradorite.
Garnetiferous	Exhibiting a common crystal structure but varying in occurrence and also in chemical and physical properties.
Gastropoda (gastropods)	Snails.
Generator	A machine that changes water power, steam power, or other kinds of mechanical energy into electricity.
Genus	A group of animals and plants having common structural characteristics distinct from those of all other groups and usually containing several species.
Geotechnical	Concerned with the physical properties of soil, rock and groundwater usually in relation to the design, construction and operation of engineered works.
Glaciofluvial	Of glacial watercourses.
Glaciolacustrine	Of glacial lakes.
Gleysol	An order of soils developed under wet conditions and permanent or periodic reduction.
Gneiss	A coarse-grained metamorphic rock commonly composed of quartz and feldspar, with lesser amounts of mica.
Graminoid	Includes rushes (Juncaceae), grasses (Poaceae) and sedges (Cyperaceae).

Granite	Medium to coarse grained igneous rock that is rich in quartz and potassium feldspar.
Granodiorite	A plutonic rock consisting essentially of quartz, sodic plagioclase and lesser amounts of hornblende and biotite.
Granulite complex	Metamorphic rock formation composed of equal-sized interlocking grains.
Habitat	The environment in which the life needs of a plant or animal is supplied.
Hardness	Related to a water's capability to produce lather from soap (the harder the water, the more difficult it is to lather soap), principally determined by the sum of calcium and magnesium.
Head	The difference in elevation between the water surface at the intake and tailrace.
Headpond	The reservoir from which the hydroelectric facility draws water flow for generation.
Headwater	The section of a river or stream with the highest elevation above sea level.
Hemiptera	True bugs.
Herb (Herbaceous)	A non-woody vascular plant.
Hibernacula	A protected area with stable non-freezing temperatures, such as a burrow, where snakes survive the winter.
Holocene Epoch	The last (recent; postglacial) epoch of the Quaternary Period; it began at the end of the Pleistocene Epoch, about 10 million years ago and continues to the present.
Hornblende	Dark green to black rock-forming mineral of the amphibole group found in both igneous and metamorphic rocks.
Humic acids	A mixture of various dark-coloured organic acids that are the principal components of humic substances which are the major organic constituents of soil, peat and many upland streams.
Hydraulic	Of water conveyed through a pipe or channel.
Hydric	Containing water.
Hyporheic	After burial.
Igneous	Rocks formed from the solidification of molten magma either beneath (intrusive igneous rock) or at (extrusive igneous rock) the earth's surface.
Insecta	Insects.
Ion	An atom that is either negatively or positively charged.
Intake	A structure which regulates the flow of water into a water-conveying conduit.
Labradorite	A plagioclase feldspar that is the major constituent of gabbro and basalt.
Lacustrine	Of lakes.
Lentic	Slow flowing or still water, e.g., in ponds and lakes.

Lithification	Process by which sediments are consolidated into sedimentary rock.
Littoral	The shoreward region of a body of water.
Lotic	Flowing water, e.g., in streams and rivers.
Luvisols	Well and imperfectly drained soils that have developed under deciduous or mixed forest cover in moderate and cool climates.
Mafic	Rock that is rich in calcium, magnesium and iron content.
Magma	Molten or fluid material generated from rock deep within the earth that may force its way upward into the crust (as igneous rock) or onto the surface (as lava).
Marsh	Standing or slow-moving water with emergent plant cover >25%, permanently flooded, intermittently exposed, or seasonally flooded.
Megaloptera	Alderflies, dobsonflies and fishflies.
Mesozoic Era	The era of geologic time from the end of the Paleozoic, 225 million years ago, to the beginning of the Cenozoic, about 70 million years ago (called the “Age of Reptiles”).
Metamorphic	A rock that forms from the recrystallization of igneous, sedimentary or other metamorphic rocks through pressure increase, temperature rise, or chemical alteration.
Metamorphism	A process that produces a change in the chemistry, structure or mineralogic composition of solid rock, usually due to temperature and/or pressure changes.
Metasedimentary	Metamorphosed sedimentary rock (despite metamorphism, the original sedimentary rock protolith can be recognized).
Metavolcanic	Metamorphosed volcanic rock (despite metamorphism, the original igneous rock protolith can be recognized).
Mica	Silicate mineral that exhibits a platy crystal structure and perfect cleavage.
Migmatite	A rock of both metamorphic and igneous origin that exhibits characteristics of both rocks, probably formed through the heating (but not melting) of rocks in the presence of abundant fluids.
Mixwoods Forest	A mixture of coniferous and deciduous forests.
Mollusca	Molluscs (snails and clams).
Moraine	A landform generally composed of till and created by glacial action.
Muscovite	A mineral, hydrous potassium aluminum silicate, a member of the mica group of minerals and commonly known as white mica.
Muskeg	A term describing a type of landscape, environment, vegetation and deposit; peatland and organic terrain are equivalent terms generally referring to northern landscapes characterized by a wet environment and vegetation (e.g., Black Spruce) botanically classified as mire (subdivided into bogs and fens).

Necrosis	Death of living tissues, characterized by browning and drying.
Nematoda (nematodes)	A phylum of pseudocoelomate (lacking a true coelum) invertebrates comprising the roundworms, characterized by a smooth narrow cylindrical unsegmented body tapered at both ends.
Odonata	Dragonflies and damselflies.
Oligochaeta (oligochaetes)	Worms.
Oligotrophic	Waters with a small supply of nutrients and therefore a small organic production.
Order	A category used in the classification of organisms that consists of one or several similar or closely related organisms.
Organic	Soils that have developed from accumulations of organic materials such as grasses, reeds, rushes, sedges, mosses and ferns.
Outwash	Detritus and waste materials carried away by the water of melting glaciers.
Overburden	The soil, rock and other material which lie on top of the underlying mineral or other deposit, e.g., bedrock.
Paleozoic Era	The era of geologic time from the end of the Precambrian, 600 million years ago, to the beginning of the Mesozoic Era, about 225 million years ago; the beginning of Paleozoic time, which marks the start of the first accurate records in geologic history, is characterized by the appearance and development of the major types of invertebrates.
Passerines	Perching birds (of the Order Passeriformes).
Peaking	Generating stations that are normally operated only to provide power during maximum load periods.
Peat	Partly decomposed plant material; refers to soils containing >30% organic matter by weight.
Pegmatite	An extremely coarse-grained igneous body closely related genetically to large masses of fine-grained plutonic rocks; it may be present as a vein or a dike in the granular igneous rock, but more commonly is found completely enclosed within the neighbouring country rock.
Pelecypoda	Bivalva; clams.
Peneplain	A low almost featureless surface reflecting a base level of erosion.
Penstock	A structure associated with a hydroelectric station, designed to carry water from the intake to the turbine.
Perennial	Continuing, enduring or growing through the year or through many years.
Periphyton	The organisms, collectively, that live attached to rocks, gravel, aquatic vegetation and other substrate.
pH	Indicates the balance between the acids and bases in water and is a measure of the hydrogen ion concentration in solution.

Photosynthesis	The process which takes place in green plants by which simple sugars are manufactured from CO_2, water and mineral nutrients with the aid of chlorophyll within the plant cells in the presence of light.
Phylum	A major division of the animal kingdom containing classes of animals.
Physoclistic	With swim bladder isolated from the oesophagus.
Physostomic	With swim bladder connected to the oesophagus by an open duct.
Pier	As part of a hydroelectric station, an abutment extending from the station, either upstream or downstream, and lending foundation support and directionality to water passed through the structure.
Piscivorous (piscivores)	Fish-feeding.
Plagioclase	A type of feldspar that is rich in sodium and calcium.
Planform	A body of water’s outline or morphology as viewed from above.
Planktivorous (planktivores)	Plankton-feeding.
Plankton	Minute organisms that drift or float passively with the current of a lake.
Plecoptera	Stonefly nymphs.
Pleistocene Epoch	The earliest epoch of the Quaternary Period; it began 2 to 3 million years ago and lasted until the Holocene Epoch, approximately 10,000 years ago and was a time of widespread continental glaciation.
Pluton	Any rock of molten origin that forms a large body within the earth’s crust when it solidifies.
Pneumatic	Involving the mechanic properties associated with air or other gas pressure.
Potamoplankton	Drift plankton (associated with flowing water, i.e., streams and rivers).
Powerhouse	A primary part of a hydroelectric facility where the turbines and generators are housed and where power is produced by falling water rotating the turbine blades.
Precambrian	Encompasses the time between the origin of the earth and the appearance of complex forms of life about 600 million years ago, and is believed to be equivalent to as much as 90% of the earth’s 405-billion-year history.
Proglacial Lake	Formed either by the damming action of a moraine or ice dam during the retreat of a melting glacier, or one formed by meltwater trapped against an ice sheet due to isostatic depression of the crust around the ice.
Protolith	Pertaining to the previous mineralogical composition/structure.
Pyroxene	One of a group of minerals closely related in structure, chemical composition and physical properties; the pyroxenes are inosilicates in which the SiO_4 tetrahedrons are linked into chains by sharing oxygens.

Quartz	A mineral: an oxide of silicon which is abundant and widespread occurring as an important constituent in many igneous, sedimentary and metamorphic rocks.
Quaternary Period	The second and youngest period of the most recent Cenozoic Era (also called the Age of Mammals); the Quaternary Period began 2 to 3 million years ago and consists of two epochs, the Pleistocene and the Holocene (known also as Recent).
Qualified Person	A person with particular expertise who is trained or qualified in a specific area.
Reservoir	A body of water collected and stored in an artificial lake behind a dam.
Rhizome	Prostrate root like stem emitting roots; rootstock.
Riparian	Of or on a watercourse bank.
Rotifera (rotifers)	Small, usually microscopic, pseudocoelomate (lacking a true coelum) unsegmented animals, with a ciliated region, the corona, at the anterior end, comprising the zooplankton community in waterbodies.
Runner	An enclosed water wheel that transforms the static and kinetic energy of the water into useful work.
Run-of-the-river	Passing all flows as they come.
Sandstone	A type of sedimentary rock that contains a large quantity of weathered quartz grains.
Secchi disc	Circular disc used to measure transparency in lakes; the depth at which the pattern on the disc is no longer visible is taken as a measure of the transparency of the water.
Sedimentary	Rock formed by the deposition, alteration and/or compression and lithification of weathered rock debris, chemical precipitates, or organic sediments.
Shannon-Weiner Diversity Index	A measure of the number of species and individuals present at a given location as well as the distribution of those individuals among the various species.
Sluice	An open channel designed to divert excess water which could be within the structure of a hydroelectric dam or separate of the main dam (see spillway).
Sluice gate	Gate used to regulate the flow of water through an opening usually used to pass water over or around dams.
Sodic	Containing sodium.
Special Concern	A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.
Species	A group of closely related individuals which can and normally do interbreed to produce fertile offspring.

Sphagnum	A genus containing the species of moss responsible for the production of peat – common within bog wetlands.
Spillway	A passageway located near or at the top of a dam through which excess water is released or “spilled” past the dam without going through the turbine(s); as a safety valve for the dam, the spillwall must be capable of discharging major floods without damaging the dam while maintaining the reservoir level below some predetermined maximum level.
Stop log	A gate (sometimes made from squared lumber) which can be placed into an opening to shut off or regulate the flow of water.
Subfamily	Taxonomic category of related organisms ranking between family and genus.
Swamp	Wooded mineral wetland or peatland.
Tailrace	A channel through which the water flows away from a hydroelectric plant following its discharge from the turbine(s).
Tailwater	The water from a generating station after it has passed through the turbine.
Talus	A sloping heap of loose rock fragments lying at the foot of a cliff or steep slope.
Tannins	Large polyphenolic compounds that form strong complexes with proteins and other macromolecules.
Terrestrial	Belonging, living on or growing in the earth or land.
Threatened	A species likely to become endangered if limiting factors are not reversed.
Till	Material derived from bedrock and overlying unconsolidated material and deposited directly by glacial ice with its characteristics dependent upon the source rock.
Threatened	A species likely to become endangered if limiting factors are not reversed.
Total dissolved solids	An index of the amount of dissolved substances in a water.
Total Kjeldahl nitrogen	Measure of both ammonia and organic nitrogen.
Total organic carbon	Composed of both dissolved and particulate organic carbon, with the bulk comprised of humic substances and partly degraded plant and animal materials.
Total suspended solids	Measure of particle weight obtained by separating particles from a water sample using a filter.
Trash rack	Bar screen with larger space openings installed to prevent logs, stumps and other larger solids from penetrating the intake.
Trichoptera	Caddisfly larvae.
Trophic	Level of organization in the food chain, e.g., producers, herbivores, carnivores.

Turbidity	A measure of the suspended particles such as silt, clay, organic matter, plankton and microscopic organisms in water which are usually held in suspension by turbulent flow or Brownian movement.
Turbine	A mechanism in an electrical generation facility which converts the kinetic and potential energy of water (in the case of hydroelectric turbines) into mechanical energy which is then used to drive a generator converting mechanical to electrical energy.
Varved	Characterized by a pair of thin sedimentary layers, one thicker and one thinner, deposited within a one-year period.
Vascular	Made up of vessels or ducts for conveying water.
Weir	A dam in the river to stop and raise the water.

APPENDIX A

Disposition Report

APPENDIX A.1

Ministry of the Environment Conservation and Parks Surface Water

Ministry of the Environment, Conservation and Parks
Eastern Region
1259 Gardiners Road, Unit 3
Kingston ON K7P 3J6
Phone: 613.549.4000
or 1.800.267.0974

Ministère de l'Environnement, de la Protection de la nature et des Parcs
Région de l'Est
1259, rue Gardiners, unité 3
Kingston (Ontario) K7P 3J6
Tél: 613 549-4000
ou 1 800 267-0974

M E M O R A N D U M

July 26, 2019

TO: Jon Orpana
Environmental Coordinator / Planner
Technical Support Section
Eastern Region

FROM: Lauren Forrester
Surface Water Specialist
Technical Support Section
Eastern Region

RE: Calabogie Generating Station Redevelopment
Ontario Power Generation
Lot 9 Concession 17, Bagot Township

As requested I have reviewed the report titled *'Ontario Power Generation Station Inc. Proposed Calabogie Generating Station Redevelopment Project Environmental Redevelopment Project Environmental Report (Draft Final)'* and '*Ontario Power Generation Station Inc. Proposed Calabogie Generating Station Redevelopment Project Environmental Redevelopment Project Aquatic Environment Technical Support Document'*, both dated July 2019 and prepared by Arcadis Canada Inc.

I offer the following comments in relation to surface water matters.

Background

The project proposed by Ontario Power Generation (OPG) is the replacement of an existing 4 megawatt (MW) generating station (GS) with a new 11 MW GS. This includes demolition of the existing powerhouse and forebay and inlet structure and the construction of a new power house with integral intake structure and tailrace. Additional ancillary facilities and a possible additional sluiceway are also included.

Construction is planned to begin in 2020, with the intention of the GS being operational in 2023. Cofferdam placement is proposed

Surface Water Regime

The proposed GS is on the Madawaska River. The Madawaska River flows from Algonquin Park to the Ottawa River, with a total drop of approximately 350 metres and has a total drainage area of 8500 square kilometres. The drainage area for the Calabogie GS is reported as 7647 km^2. Tributaries to the Madawaska River include the Madawaska, Opeongo and York Rivers.

The project location is within the Village of Calabogie, approximately 10 km downstream of the Barrett Chute GS and 20 km upstream of the Stewartville GS, both of which are OPG owned hydroelectric facilities on the Madawaska River. The Calabogie GS is at outlet of Calabogie Lake.

The northernmost channel (North Channel) connects directly to Calabogie Lake. The North Channel is a natural river channel with flows controlled by the North Channel Sluiceway (owned and operated by OPG). Minimum compliance flow in the north channel is 0.8 cubic metres per second (cms), except during walleye spawning and incubation period, when flow of 5 cms is required, subject to temperature conditions.

The middle channel of the Madawaska River (South Channel Sluiceway) is used to control the water management operations and has no minimum flow requirement.

The southernmost channel is the forebay, powerhouse and tailrace of the existing and proposed GS, believed to have been excavated at the time of the original GS construction (1917).

Alternatives Analysis

Alternatives analysis includes refurbishment of the existing powerhouse; refurbishment, expansion and redesign of the existing power house; and construction of a new powerhouse.

Construction of a new powerhouse 50 m upstream of the existing powerhouse, within the existing forebay was selected. The inlet structure will be widened along with excavation in the forebay and tailrace.

Water Level and Flow

The Madawaska River Water Management Plan includes the following statement with respect to the Calabogie GS:

> *The Calabogie GS operates as a peaking plan in conjunction with the four other OPG owned GS on the Madawaska River…the units and sluice gates are integrated with the rest of the peaking system on the Madawaska River. Calabogie is a generation bottleneck on the Madawaska. The small turbine capacity results in frequent spill past the station.*
>
> *Operation of the GS is based on a daily/weekly cycle. The inflow is passed through the GS over a daily or weekly period. Operation of the GS takes into consideration energy demands, recreational opportunities as well as walleye spawning activities.*

Aquatic Environment Assessment

Potential effects during construction were evaluated. Based on an assessment of baseline conditions and implementation of mitigation measures, the potential for effects during construction / demolition will be minimal, localized and short term, with no adverse residual effects.

Operation of the proposed project was found to have no residual effects on the aquatic environment.

No negative effects on fish communities are expected and no significant changes to River conditions upstream or downstream of the GS will occur with the exception of the South Channel Spillway and GS forebay and tailrace. The relative decrease in flow through the South Channel Spillway is expected to improve spawning conditions for Walley and other spring spawning species.

There are currently no occurrences of the American Eel in the are of the Calabogie GS; however, the redevelopment will include adaptive management strategies to permit Eel passage which represents a net benefit.

<u>During Construction</u>

- All water will be directed through the south channel sluiceway;
- Erosion and Sediment Control (ESC) measures are described and will be implemented prior to the start of work;
- Site specific plans will be developed for stormwater, ESC, and management of dredged material;
- In water works will be minimized and coffer dams will be used. Where in water works are required, timing will comply with MNRF timing windows;
- Blasting will be done using fish friendly explosives and in accordance with DFO operational statements;
- Dredged / excavated materials may be reused on site; however, due to exceedances of MECP Table 1 and 8 site condition standards for some metals (sediments), or metals and PHC / PAH (soils), the authors recommend placement of sediments at least 30 metres from any waterbody;
- Approval for water taking and effluent will be required (*OWRA*, Sections 34 and 53).

<u>Proposed Operation</u>

- Operation will continue to as a peaking facility in conjunction with four other OPG owned generating systems, without changes to levels or flows;
- There will be no new inundation associated with the proposed project and no alteration to water as it passes through the system;
- Operation will be in accordance with the Madawaska River Water Management Plan;
- PTTW will be required for operation of the GS;
- ECA may be required for any swage works such as oil containment systems in the powerhouse;

- The proposal is to operate the Calabogie GS in accordance with the flow and water level targets and compliance conditions in the Madawaska River Water Management Plan. No Changes to daily flow / water levels are proposed.
- The new GS is expected to have increased flow capacity, which will be achieved by directing more water through the GS rather than the South Dam Sluiceway (no effect on total daily flow). No significant changes to recreational use of the River are expected either up- or downstream of the GS;
- Environmental monitoring during operation is proposed and includes monitoring of water level, temperature, and flow and assessment of fish / fish habitat.

Reviewers Comments and Recommendations

- The proposed project is for redevelopment of an existing facility, without change to inundation area, water levels or flows, and consistent with the existing Madawaska River Water Management Plan.
- With implementation of mitigation measures proposed, it is reasonable to expect minimal, localized and short term, with no adverse residual effects (construction) and no residual effects on the aquatic environment (operation).
- Approvals under the *Ontario Water Resources Act* will be required for short-term and long-term components of the project, as described within the Environmental Report and Aquatic Environment Technical Support Document.
- The reviewer has no objections to the proposed project with respect to surface water matters.

If you have any questions about these comments, I would be happy to discuss them with you.

Lauren Forrester, M.Sc.
LF

ec: Greg Faaren, Water Resources Unit Supervisor
Peter Taylor, Technical Support Section Manager
Brad Eckert, Senior Environmental Officer

c: File SW RE G 03 15 C9 – Calabogie Generating Station, OPG
File SW 13 03 07 02 MA – Madawaska River
LF / IDS 5561-BEFJMG

APPENDIX A.2

Ministry of Tourism Culture and Sport

From: Zirger, Rosi (MTCS)
To: MACLEOD Gillian -ENVIRONMENT
Cc: HELC Svetlana -NEWBUSVENT; Shantz, Phil
Subject: Calabogie GS EA- Review of Draft ESR and Technical Reports - MTCS comments
Date: August 9, 2019 10:43:55 AM

MTCS File: 0006371
Proponent: Ontario Power Generation (OPG)
Subject: Draft Environmental Study Report and Technical Support Documents

Calabogie Generating Station (GS) Redevelopment – Ontario Waterpower Class EA
Location: Township of Greater Madawaska (Village of Calabogie), County of Renfrew

Dear Gillian MacLeod

Thank you for sending the draft Environmental Study Report and Technical Support documents for the project mentioned above. The Ministry of Tourism, Culture and Sport's (MTCS) interest in this EA project relates to its mandate of conserving Ontario's cultural heritage, which includes:

- Archaeological resources, including land-based and marine;
- Built heritage resources, including bridges and monuments; and,
- Cultural heritage landscapes.

Project Summary

OPG is proposing to re-develop the existing 4 megawatt Calabogie Generating Station (Calabogie GS) and replace it with a new approximately 11 megawatt generating station. The existing Calabogie GS is over one hundred years old and was at the end of its life prior to the tornado that hit the GS in September 2018. The GS has not operated since that time.

As part of the proposed re-development the existing powerhouse, headworks and inlet structure will not be retained but the majority of the site will remain as is.

MTCS has reviewed the draft reports provided to us and offers the following comments and recommendations:

1. **Archaeology**

Our records indicate that a Stage 1-2 Archaeological Assessment - PIF P208-0187-2018 (Stage 1) and P208-0192-2018 (Stage 2) - dated June 27, 2019 prepared by Woodland Heritage Northeast Limited has been submitted to MTCS and is awaiting review. Please note ministry staff may have further comments during their review.

2. **Built Heritage Resources and Cultural Heritage Landscapes**

MTCS records indicate that based on a Cultural Heritage Evaluation Report (CHER) dated Dec 2016 (revised March 2017) prepared by Unterman McPhail, OPG identified the Calabogie Generating Station property as a provincial heritage property (local significance).

MTCS has reviewed Cultural Heritage Impact Assessment (HIA) dated April 2019 prepared by Unterman McPhail Associates undertaken as part of this EA. Overall the HIA provides a robust analysis of project alternatives and potential impacts resulting from the preferred alternative - removal/demolition of existing GS and site components and replacement.

Additionally, Section 8.0 of the HIA provides six conservation recommendations which include full recording and documentation of structural components of the station prior to removal/demolition and retaining some equipment as monuments to serve in the commemoration and interpretation of the site.

We note that section 4.4 Additional Sluicegate Capacity (page 28) states that at this time OPG is considering three options to address the additional capacity (illustration are included). The HIA states that OPG will provide a revised HIA report to MTCS if or when OPG refines the options. **MTCS recommends** that OPG (or it is consultants) prepare an addendum to this HIA instead of revising it.

3. **Draft Environmental Report** dated July 2019 prepared by Arcadis Canada Inc.

Overall the Draft ESR addresses cultural heritage resources in a manner that is consistent with the technical studies.

Archaeology - the ESR states that Stage 1 and 2 archaeological assessments have been conducted at the Calabogie GS including fieldwork participation from a representative of the AOO and that no further archaeological resource assessment work was recommended. As noted above the archaeological assessment report(s) have been submitted to this ministry for review by an archaeological review officer. However, please be aware that ministry staff may have further comments during their review.

Built Heritage - the ESR summarizes the conservation recommendations set out in the HIA. We also note that the executive summary states that the recommendation for the retention of equipment is being considered by both OPG and by the Township of Greater Madawaska.

Section 7.2.3 Summary of Monitoring Programs, outlines how the EA commitments will be met during construction. This section includes a requirement for a Cultural Heritage Monitoring Plan and further articulates specific monitoring recommendations that have been made and must be followed (page 7-17 of ESR).

Thank you for providing MTCS the opportunity to review these draft documents. We also appreciate being provide the opportunity to participate in this EA in a meaningful way.

Please contact me as necessary for clarification or further discussion.

Best regards

Rosi

Rosi Zirger
A/Heritage Advisor
Ministry of Tourism, Culture & Sport
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APPENDIX A.3

Species at Risk

CALABOGIE GENERATING STATION RE-DEVELOPMENT - MECP - SPECIES AT RISK COMMENTS (August 21, 2019)

Below are OPG's responses to MECP's comments with respect to Species at Risk.

Identified in Review	Methods	Species Confirmed	Proposed Actions	MECP Comments	OPG Response
Species at Risk					
Eastern Whip-poor-will	Two surveys 2016 timed according to peak activity periods for Whip-poor-will following lunar cycle for 2016: June 13 and June 20. Two surveys in 2017 timed according to peak activity periods for Whip-poor-will following lunar cycle for 2017: June 6 and June 17. Remote acoustic detector June 6 and 17, 2017 and May 29 and June 25, 2018.	None detected	Vegetation clearing will be avoided during the migratory bird nesting season (April 1 to end of August) If minor vegetation needs to occur during the migratory bird nesting season or if clearing needs to occur in highly disturbed areas with simple vegetation structure, then a qualified avian ecologist would examine the area to be affected to ensure that no nests, eggs, or nestlings or indications of nesting are present.	• Surveys for Whip-poor-will should be conducted using the Draft Survey Protocol for Eastern Whip-poor-will (*Caprimulgus vociferous*) in Ontario (December 2014). In this protocol the survey period is from May 18 to June 30. Survey conditions should be followed according to the protocol. A minimum of three surveys should be completed during the breeding season so that sufficient data is obtained to determine breeding status and interpret territories. Additionally, two of the surveys should be completed in late May or the first week of June during a week preceding or just after a full moon, and a third survey in the next available full moon period which might be middle/end of June.	We agree that the results of the surveys completed from 2016 to 2018 provide strong evidence that the species is not breeding in the study area. Regarding the survey protocol for Whip-poor-will, it should be recognized that the 2016 MNRF protocol was followed and that this protocol requires two surveys be conducted in a particular year if they are completed during the primary survey window for Whip-poor-will (based on that year's lunar cycle). Because of the draft status of the 2014 protocol, we confirmed the suitability of the 2016 protocol with the Pembroke office prior to conducting the 2016 surveys as follows: From: Kruschenske, Lauren (MNRF) [mailto:Lauren.Kruschenske@ontario.ca] Sent: 2016-06-08 09:24 To: Rob Willson <rwillson@beaconenviro.com> Cc: Baker, Tania (MNRF) <tania.baker@ontario.ca>; Coulson, Daryl (MNRF) <daryl.coulson@ontario.ca>; Punt, Kirby (MNRF) <kirby.punt@ontario.ca> Subject: RE: Whip-poor-will survey windows and requirements for 2016 Hi Rob, The survey as proposed is acceptable. If weather conditions are not favourable or other extenuating circumstances which could result in a false negative arise, then I would consider a third visit during a secondary survey window. Thanks, Lauren

Identified in Review	Methods	Species Confirmed	Proposed Actions	MECP Comments	OPG Response
				• Since two sets of surveys were completed in 2016 and 2017 and additional acoustic monitoring was completed in 2017 and 2018 with no vocalizations heard no further survey requirements are needed. • Please keep in mind the survey protocol for the future.	From: Rob Willson [mailto:rwillson@beaconenviro.com] Sent: June-07-16 2:02 PM To: Baker, Tania (MNRF); Coulson, Daryl (MNRF); Punt, Kirby (MNRF); Kruschenske, Lauren (MNRF) Subject: Whip-poor-will survey windows and requirements for 2016 Hi Folks, I am conducting some Whip-poor-will surveys for a landowner near Calabogie and just wanted to check to see if the Pembroke office concurred with the following survey recommendations from the Guelph District. I attached the full document but the key recommendations for 2016 are as follows: • 2 surveys conducted during the 2016 recommended window of June 12-27 Sorry for the blanket email but I wasn't sure who at your office handled these types of questions/requests. Regards, Rob Rob Willson, M.Sc. | Senior Ecologist

Identified in Review	Methods	Species Confirmed	Proposed Actions	MECP Comments	OPG Response
Bats (Little Brown Myotis, Northern Myotis and Tricolored Bat)	• Three types of surveys: exit surveys (to determine if any bats were roosting on the eastern side of the generating station), ultrasonic bat detectors (south of generating station 2017, west of the sluiceway 2018), and bat habitat assessment leaf- off. • Two surveys in 2016: July 20, July 21. • Two surveys in 2017: July 24 and 25. • Ultrasonic bat detectors June 2017 and 2018.	Yes exit surveys including Little Brown Myotis, Tri-colored Bat, Hoary Bat, Eastern red bat, silver haired bat, big brown bat. During exit surveys bats were seen foraging over the forebay and over the water.	Any removal of potential bat habitat trees should be completed outside the active season. If tree clearing needs to occur between April 1 and Oct 1 a qualified professional should complete an exit survey at each habitat tree identified for removal a max of 24 hours before removal. The exit survey must make use of a bat detector and occur no less than the time period between sunset and 60 minutes after sunset. In the event that a bat is identified exiting or entering trees during the surveys, MECP should be	• Was there any acoustic monitoring completed for bats in the area of the tail race or would locations where acoustic and ultrasonic monitoring pick up activity in that area? • Do you have mapping of the area where trees will be cleared to get a sense of the habitat being removed. • No authorizations would be required if trees were cleared outside of the bat active season (April 1 to October 1).	Remote acoustic monitors were not placed in the area adjacent to the tailrace; however, the four exit surveys using active (hand-held) acoustic monitors were conducted directly adjacent to the tailrace at the eastern side of the GS. These surveys would have detected bats foraging in the area of the tailrace. Six bat species, including Little Brown Myotis and Tri-colored Bat, were detected by the monitors during the surveys. Figure B1 (attached) shows the bat habitat trees that could be removed as part of the proposed activities (primarily for sediment and rock deposition). Yes, MECP will be contacted for advice or authorization if trees cannot be cleared outside of the active season. Priority will be placed on clearing outside of the bat active season to maximize avoidance.
	• Maternity roost during lead off conditions May 3 and Dec 12, 2018 and April 24, 2019.	Yes for ultrasonic bat detectors: little brown bat (all 4 locations), tri-colored bat east of south channel in 2017, likely roost close to 18-86, northern myotis detected at 2 locations. Yes high quality potential maternity roost habitat exists	contacted to obtain further direction prior to removal of the tree.	• If trees cannot be cleared outside of the active season, please consult with MECP as an authorization may be required. The mitigation provided may not be suitable as bats may or may not exit the tree, may have moved trees, or pups may be in tree cavities.	Acknowledged
Barn Swallow	June 9, 2016 June 7 and 17, 2017 May 15 and 29 and June 26, 2018	Yes – nest confirmed under bridge 2016 and 2017, 2017 nest confirmed at gauge house	Register Condo built with 10 nests cups already	• No issues as long as mitigation is put in to place to exclude barn swallows and the species is registered.	Yes, species is registered and mitigation to exclude species from former nesting locations on bridge will be in place prior to work being conducted on the structure.

Identified in Review	Methods	Species Confirmed	Proposed Actions	MECP Comments	OPG Response
Turtle surveys	Basking and visual May 15, 29, 2018	Yes. Blanding's Turtle, Snapping turtle, northern map turtles	Species at risk training will include: qualified professional to provide species at risk training for OPG staff and all workers that will be on site, develop and adhere to site-specific response protocols for turtles and other wildlife encounters, incorporate tailgate education material for species at risk developed by Pembroke MNRF, erect three turtle/snake crossing awareness signs (one on Generating Station Lane, on the island, one on the haul road). Mitigation: exclusion fencing on both sides of the temporary haul road, temporary exclusion fencing will be erected around aggregate material deposited in the deposition area if this material is suitable for turtle nesting, haul road and deposition area should be 30 m from the boundary of the wetlands so that it is outside of cat 2 BLTU habitat.	• Were occurrence of SAR turtles submitted to NHIC. If no, please ensure they are as soon as possible. • Require Blanding's Turtle (BLTU) habitat mapping to be able to assess impacts properly and determine if an authorization is required. • Where were basking surveys completed for BLTU? Please describe how basking surveys were completed, location, conditions (time, date, temperature), etc. • Is there a map depicting where the BLTU and other turtle species were found in relation to the study area?	SAR turtle records have been submitted to NHIC. Habitat mapping for Blanding's Turtle has been completed and is provided in Figure B2 (attached). Basking surveys were completed for the South Channel, forebay and downstream of the spillway. Basking surveys were conducted using binoculars from onshore vantage points that provided good views of the limited number of potential basking areas. Surveys were completed by Rob Willson (Beacon) who has considerable herpetological expertise and has been conducting turtle and snake surveys since 1994, including radiotelemetry studies with Blanding's Turtle. The conditions during the May 15 survey were excellent as it had rained in the morning and thus when the survey started (14:50 to 16:45) the sun had just come out and it was 18 C, with 0% cloud cover, Beaufort = 1. For the May 29 survey from 09:00 to 10:30 the temperature was 16 C, 0% Cloud cover, Beaufort = 1. As indicated in the terrestrial report, only two basking surveys were conducted because a Blanding's Turtle was observed moving over land on June 11, 2018 at the northeastern edge of the study area, thus confirming presence of the species. Northern Map Turtle and Snapping Turtle had also been observed on site. The Blanding's Turtle, Northern Map Turtle and Snapping Turtle observations are shown on Figure B2 showing the Blanding's Turtle habitat mapping. Yes, the study site was reviewed for potential nesting or overwintering sites for Blanding's Turtle from a habitat-based perspective. That is, surveys were not completed; however, Figure B2 shows the wetlands and waterbodies within 2 km that are considered to have potential for overwintering based on physical characteristics. Wetlands and waterbodies within the study area were examined directly, whereas those outside the study area were assessed from 2008 and 2014 leaf-off orthoimagery (DRAPE).

Identified in Review	Methods	Species Confirmed	Proposed Actions	MECP Comments	OPG Response
				• Was the study site reviewed for potential nesting or overwintering sites for Blanding's Turtle? Were any specific surveys completed to verify? Can we expect impacts to these types of habitat in terms of the site and how it will be used and in terms of the operation of the generating station (velocities, water level changes, etc.). • Do you have mapping that shows the location of where turtle exclusion fencing will be used to exclude SAR turtles. • It is mentioned that the drawdown of the headpond will be much quicker. How will this impact adjacent habitats for SAR turtles (ex. wetlands such as Grassy Bay PSW that could potentially provide overwintering habitat, refuge areas, feeding areas, etc.).	Regarding the comment below specific to ELC wetland unit 11, this wetland is not considered to be suitable overwintering habitat (Category 1) for Blanding's Turtle. This determination is based on insufficient water levels in spring 2008 and 2014 (assessment from orthoimagery) and 2019 (site visit). That said, as a precautionary measure this wetland is being provided a 30 m buffer to avoid adverse effects. Figure B3 shows the proposed layout of the temporary turtle exclusion fencing. The constructor proposes to use erosion/sediment control fencing that would be dual purposed for turtle exclusion and erosion control (light duty geotextile silt fence) Yes, turtle exclusion fencing and general best practices for turtle exclusion fencing will be designed according to the Species at Risk Branch Best Practices Technical Note Reptile and Amphibian Exclusion Fencing Version 1.1 (July 2013 or most recent guidance document). Although turtles can and do nest along the existing gravel roads on site, there are no areas of highly probable nesting habitat, so no potential nesting areas were identified on Figure B2. The mitigation measures recommended to inform and maintain on-site workers with high levels of awareness regarding species at risk turtles that may nest in work areas, as well as the installation and maintenance of exclusion fencing should avoid any adverse effects on Blanding's Turtle.

Identified in Review	Methods	Species Confirmed	Proposed Actions	MECP Comments	OPG Response
				• Map turtles were identified basking downstream of spillway will they be affected by increased flows/velocities if sluice gate is opened or is there the potential that they could get trapped in areas that they cannot get out of? • Turtle exclusion fencing and general best practices for turtle exclusion fencing should be designed according to the Species at Risk Branch Best Practices Technical Note Reptile and Amphibian Exclusion Fencing Version 1.1 (July 2013 or most recent guidance document. • It is mentioned that ELC wetland unit 11 was not initially part of the study area. Is this area now part of the study area and is it suitable as category 1 BLTU habitat?	Regarding the potential for quicker drawdowns to have impacts on SAR turtles, this possibility was carefully considered and is discussed in Section 4.9 of the terrestrial report. Quicker drawdowns are not expected to have any negative effects on the wildlife likely to be present in Grassy Bay (including Blanding's Turtle, other turtles and amphibians). For example, turtles do not nest or hibernate in the zone between the daily low and high-water marks and these habitat features are the most sensitive. Turtles do, however, bask in the sun on structures at the surface of the water such as rocks, woody debris and vegetation. Beacon has observed turtles basking on rocks down river from the Calabogie spillway that are only available to the turtles (i.e., rocks are above the surface of the water) when the water is not flowing through the spillway. When these basking rocks are not available because water levels are higher, the turtles bask above the water line along the shoreline or use floating woody debris. In fast flowing areas of the river, woody debris and floating vegetation mats are absent and basking habitats for turtles are very limited (e.g., the South Channel). In contrast, woody debris and floating vegetation mats are present along the periphery of Grassy Bay and thus the availability of basking habitat for turtles should not be affected by quicker draw downs. No adverse effects on Map Turtles downstream of the spillway are expected as this species regularly occurs in fast flowing river systems and no areas of potential entrapment have been noted. If turtles move up the spillway when the gate is closed and are then present when the sluice gate is opened, they will be flushed into the area where they were observed basking in 2018.
Eastern Wood-pewee	BBS completed in 2017: June 7 and 17 and 2018 May 29 and June 26	Yes but was heard north of the 2018 study area		• No comments.	

Identified in Review	Methods	Species Confirmed	Proposed Actions	MECP Comments	OPG Response
American Eel	Seine netting and e-fishing completed for fisheries assessment unknown if surveys were done in a way that would capture eels if they did exist in this part of the reach.	Not in this reach of the Madawaska	Proposing to be eel ready in the future with proposed eel passage for upstream and downstream movement	• Were fisheries surveys (e- fish/seine netting) conducted in such a way that they would have captured American eels if they were in this reach of the Madawaska? Can you provide additional details on the methods used and the conditions at the time of surveys (date, time of day, wind, cloud cover, temperature (air/water), etc.). • Have assessments been completed in this part of the reach for American Eel in the past or as part of this study to make the determination that they or other SAR species (Lake Sturgeon) are not in this part of the reach?	**Response to Bullet #1** American Eel are susceptible to backpack electrofishing which was conducted on Oct 12, 2018 (250 v, 60 hz, 1223 electroseconds, 224 m), June 10, 2017 (150 v 60 hz, 1222 electroseconds 105 m), June 11, 2017 (150 v, 60 hz, electroseconds 105 m) and August 16, 2017 (150 v, 60 hz, 1424 electroseconds, 230 m). **Response to Bullet #2** Upstream movement by American Eel is blocked by a series of dams downstream from the Calabogie site that have been in place for many years. American Eel have been the subject of intense interest since their decline in Ontario was observed. COSEWIC (COSEWIC assessment and status report on the American Eel *Anguilla rostrata* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xii + 109 pp. https://wildlife-species.canada.ca/species-risk-registry/document/default_e.cfm?documentID=2452) reported that American Eel were currently only being found in low numbers below the last dam in the Ottawa River (Carillon Dam), suggesting that they may be close to extirpation there. Based on the absence of captures or reports MNRF does not believe American Eel or Lake Sturgeon currently occur in the vicinity of the Calabogie GS, although, more recent sampling by the MNRF has found some eel in the Ottawa River and in the tailwater of the Arnprior GS. Consultation with MNRF occurred regarding the possible presence of American Eel and Lake Sturgeon in the reach between the Calabogie and Stewartville generating stations. In an October 29, 2015, email exchange, Kirby Punt (MNRF) responded to a query from George Coker (C. Portt and Associates) indicating that there had been no recent captures of American Eel and Lake Sturgeon in the reach between Calabogie tailwater and Stewartville headpond, although they may be found further downstream. In response to a follow-up email from George Coker requesting clarification Kirby Punt, in an email dated September 9, 2016, stated "I believe the chances of finding them here in this stretch are almost nil, last recorded eel in Calabogie was around the mid-1970's . . . I believe that the same can be said for sturgeon.".

Identified in Review	Methods	Species Confirmed	Proposed Actions	MECP Comments	OPG Response
				• In the Executive Summary if the Aquatic report it mentions there are no known occurrences of American eel, including at or in the immediate area of the Arnprior GS, Stewartville GS, and Calabogie GS – Please note that there are confirmed eel occurrences below the Arnprior Dam on the Madawaska. Eels have been confirmed upstream and downstream of the weir. This should be reflected in the report. • Can you provide specific details/plans on what is being proposed for Eel passage to determine if it is sufficient? What is being incorporated into this upgrade versus what would be completed later? Does it make sense to complete eel passage upgrades all now while the GS is being rebuilt? Will it not be costlier later?	**Response to Bullet #3** In the 2011 correspondence with OPG, the Ministry of Natural Resources concluded that there were no known occurrence of American Eel, or areas of protected habitat at or in the immediate area of Calabogie Generating Station, the Stewartville Generating Station (downstream) or Mountain Chute Generating Station (upstream). OPG is not aware of any new documented occurrences of American eel since 2011, and the two barriers to eel movement downstream of Calabogie have not been altered (Arnprior and Stewartville GS). In recent years, efforts to recover American Eel in the Ottawa River have been in play, including construction of an eel passage structure on the Ottawa River at Chaudière GS. OPG also complies with the Endangered Species Act for American Eel through its Mitigation Plan activities at Chats and Chenaux GS on the Ottawa River. All of this is to say that as circumstances continue to change and American eel recover further up the system, OPG will be prepared to further support its recovery up the Madawaska River. **Response to Bullet #4** The MECP Comment was: "Can you provide specific details/plans on what is being proposed for Eel passage to determine if it is sufficient? What is being incorporated into this upgrade versus what would be completed later? Does it make sense to complete eel passage upgrades all now while the GS is being rebuilt? Will it not be costlier later?" Section 2.4.3.5 of the Aquatic Environment Project Description does provide some detail about the proposed structure OPG is considering for American Eel passage. There was one mistake in that description that OPG does want to clarify and that is that the maximum bar spacing for downstream passage will be 19 mm at not at 20 mm as indicated in the Reports. At the proposed Calabogie Generating Station Redevelopment to facilitate upstream movement of eels, the Project Team will install a ladder in the tailrace of the proposed new station. The ladder will lead to a trap/tank where any eels can be counted and tagged prior to manually moving the fish upstream of the station. For future downstream passage, if eels are moved upstream of the station, or if there the documented presence of large eels upstream of the proposed station, OPG will procure and install an inclined screen rack with spacing of no more than 19 mm. The inclined screen will lead to a bypass structure that will allow eels to move downstream and prevent entrainment. When installed the inclined screen would be deployed from July through September. The screen would be removed after September to minimize clogging from leaf debris in the fall and ice damage in the winter. The permanent ladder, inclined screen and bypass structure will be constructed at a later date once eels are present. As already indicated OPG has requested that SNC-Sullivan complete the design of the American Eel passage as part of its Design-Build Contract but it is not recommending that the passage be constructed until American Eels are proven to be in the Calabogie reach of the Madawaska River. The primary reason for this is that the deployment of the American Eel passage will have a negative effect on flow and therefore revenue at the Calabogie GS. Therefore, OPG would not be optimizing use of the existing water resources. A secondary reason would be that there is perhaps some possibility that American Eel passage technology may evolve from the present until when the American Eels return to the system. Therefore, it may make some sense to wait in the event that an improved technology is available

Identified in Review	Methods	Species Confirmed	Proposed Actions	MECP Comments	OPG Response
				• Can we be provided with additional details on the proposed adaptive management approach that will be applied to operations that will allow to determine the best course of action to implement or install specific measures to support recovery as circumstances change?	**Response to Bullet #5** MECP indicated that: "Can we be provided with additional details on the proposed adaptive management approach that will be applied to operations that will allow to determine the best course of action to implement or install specific measures to support recovery as circumstances change?" As indicated in Section 2.4.3.5 of the Aquatic Environment Project Description, an adaptive management approach will be applied during operations to determine the best course of action to implement or install specific measures to support recovery as circumstances change. *OPG's Adaptive Management Strategy will be informed by Ontario's Government Response Statement for American eel, which is currently in a draft stage.*
				• Is using the North Channel as a means to move American Eel upstream being considered? Is there enough flow? Eels will be attracted to the tailrace.	**Response to Bullet #6** MECP stated that: Is using the North Channel as a means to move American Eel upstream being considered? Is there enough flow? Eels will be attracted to the tailrace." OPG agrees with this statement and that is why it has indicated in its Design Specification to SNC-Sullivan that that the American Eel passage should be designed for where the greatest flow will be which will be at the GS. OPG realizes that there is some text in the Report that suggests the North Channel might also be considered. OPG did consider this but agrees with the opinion of the MECP reviewer that this not likely a viable alternative. The consultants for the AOO have also considered this location and while OPG might prefer this option it is likely not feasible.

Ministry of the Environment, Conservation and Parks

Species at Risk Branch

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14th Floor
Toronto ON M4V 1M2

Ministère de l'Environnement, de la Protection de la nature et des Parcs

Direction des espèces en péril

40, avenue St. Clair Ouest
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December 12, 2019 Via Email

Gillian MacLeod
Sr. Environmental Advisor
Ontario Power Generation
700 University Avenue
Toronto, ON
M5G 1X6

Re: Response to Ontario Power Generation's comments from December 2, 2019 for the Proposed Calabogie Generating Station Redevelopment Project

Dear Ms. MacLeod,

The Permissions and Compliance Section of the Species at Risk Branch has reviewed Ontario Power Generations comments from December 2, 2019 for the Proposed Calabogie Generating Station Redevelopment Project with respect to Species at Risk and has the following comments:

<u>Blanding's Turtle</u>
It appears from the mapping that you provided (Figure 2B) that some category 2 and 3 habitats for Blanding's Turtle will be removed as a part of the proposed project. Do you have a sense of the amount of habitat that will be impacted or removed due to the proposed activity? An authorization is likely required for Blanding's Turtle and an Information Gathering Form (IGF) should be submitted.

In addition to the mitigation already proposed for Blading's Turtle the Ministry of Environment, Conservation and Parks (MECP) recommends the following additions:

- The ends of the turtle exclusion fencing should include wing backs to redirect turtles away from the area that they are being excluded from. See *Species at Risk Branch Best Practices Technical Note Reptile and Amphibian Exclusion Fencing Version 1.1 July 2013.*
- The work area should be checked prior to the start of the work day by a designated trained staff member to ensure there are no species at risk on site. If a species at risk is found in the work area all work should stop and it should be left to leave on its own accord or if it will not leave the area a qualified professional can relocate the species at risk in conjunction with advice from

MECP. Any occurrences found on site need to be reported to the Natural Heritage Information Centre (NHIC) as soon as possible.

- If a nesting turtle is found on site or there is a suspected nest found on site all work should stop in the area and a 5 m buffer should be applied around the nest. MECP should be contacted as soon as possible. Once the turtle is finished nesting and has started to move away a qualified professional can move the turtle to the nearest core habitat outside the area of activity. Leave buffer in place until nest hatches or a qualified professional can remove the eggs from the nest and bring to an authorized wildlife custodian for incubation until hatching. The qualified professional can collect any hatchlings that emerge while under the care of the wildlife custodian and release back to the core habitat area outside of the area of activity.

With regard to the drawdown activity MECP would like to clarify how far the drawdown will impact on adjacent habitats. There is the potential for Blanding's Turtle to be overwintering in the wetlands associated with the Grassy Bay PSW. Has any work been done to determine how far reaching the impacts of the proposed drawdown of the head pond would be? Will it impact water levels in any of the tributaries or wetlands that are around or adjacent to the head pond?

<u>American Eel</u>
Thank you for providing the date of the electrofishing surveys. Can you also provide the time of day surveys were completed, the length of the surveys and conditions at the time of surveys (temperature, cloud cover, etc.)?

How will OPG be monitoring to determine if and when Eel are present to inform if eel passage needs to be implemented?

If something different is being proposed for eel passage in the future based on new technology or if a different design is being proposed other than what has been described in your response from December 2, 2019 MECP would like to be engaged on the updated design and have the opportunity to provide comments with respect to the updated/new design to ensure that it is appropriate for American Eel.

Please contact me if you have any questions regarding the comments and I would be pleased to discuss them with you.

Sincerely,

Carolyn Hann

Carolyn Hann
Management Biologist
Permissions and Compliance
613-355-7312
carolyn.hann@ontario.ca

RESPONSE TO LETTER FROM MECP, CAROLYN HANN, SPECIES AT RISK BRANCH

Comment #	MECP Comment	Response
1	It appears from the mapping that you provided (Figure 2B) that some category 2 and 3 habitats for Blanding's Turtle will be removed as a part of the proposed project. Do you have a sense of the amount of habitat that will be impacted or removed due to the proposed activity? An authorization is likely required for Blanding's Turtle and an Information Gathering Form (IGF) should be submitted.	No category 1 habitat will be destroyed or damaged. No category 2 habitat will be destroyed. The amount of category 2 habitat that will be damaged (30 m buffer only) is very low (0.5 ha). The amount of category 3 habitat (i.e., movement habitat with the "highest tolerance to alteration") that will be destroyed is 0.27 ha and the amount of category 3 habitat that will be damaged in the short term is 5.73 ha. Given how low the damage and destruction values are, particularly for the category 1 and 2 habitat types, as well as the extensive mitigation measures to be implemented (see Terrestrial Environment Technical Support Document), the project team is confident that an authorization would not be required. The information specific to Blanding's Turtle that has been provided in the Terrestrial Environment Technical Support Document and in the project team's responses to MECP's comments exceed the typical information that would be included in an Information Gathering Form (IGF). As such, it is the project team's opinion that submitting an IGF would not provide MECP with any additional information and would not move the review process forward.
2	In addition to the mitigation already proposed for Blanding's Turtle the Ministry of Environment, Conservation and Parks (MECP) recommends the following addition. The ends of the turtle exclusion fencing should include wing backs to redirect turtles away from the area that they are being excluded from. See *Species at Risk Branch Best Practices*	The project team agrees to use this technique.

Comment #	MECP Comment	Response
	Technical Note Reptile and Amphibian Exclusion Fencing Version 1.1 July 2013.	
3	In addition to the mitigation already proposed for Blanding's Turtle the Ministry of Environment, Conservation and Parks (MECP) recommends the following addition. The work area should be checked prior to the start of the work day by a designated trained staff member to ensure there are no species at risk on site. If a species at risk is found in the work area all work should stop and it should be left to leave on its own accord or if it will not leave the area a qualified professional can relocate the species at risk in conjunction with advice from MECP. Any occurrences found on site need to be reported to the Natural Heritage Information Centre (NHIC) as soon as possible.	The project team agrees to implement this mitigation measure during the turtle active season (mid-April to mid-October).
4	In addition to the mitigation already proposed for Blanding's Turtle the Ministry of Environment, Conservation and Parks (MECP) recommends the following addition. If a nesting turtle is found on site or there is a suspected nest found on site all work should stop in the area and a 5 m buffer should be applied around the nest. MECP should be contacted as soon as possible. Once the turtle is finished nesting and has started to move away a qualified professional can move the turtle to the nearest core habitat outside the area of activity. Leave buffer in place until nest hatches or a qualified professional can remove the eggs from the nest and bring to an authorized wildlife custodian for incubation until hatching. The qualified professional can collect any hatchlings that	The project team agrees to implement this mitigation measure. If the nest is located in an area of active work then the eggs will be excavated by a qualified professional and provided to an authorized wildlife custodian as per the recommendation.

Comment #	MECP Comment	Response
	emerge while under the care of the wildlife custodian and release back to the core habitat area outside of the area of activity.	
5	With regard to the drawdown activity MECP would like to clarify how far the drawdown will impact on adjacent habitats. There is the potential for Blanding's Turtle to be overwintering in the wetlands associated with the Grassy Bay PSW. Has any work been done to determine how far reaching the impacts of the proposed drawdown of the head pond would be? Will it impact water levels in any of the tributaries or wetlands that are around or adjacent to the head pond?	We think these questions are based on an incorrect premise. The new GS will not result in lower drawdowns than the existing GS. The new generating station will have an increased maximum total turbine outflow over the existing GS (160 m3/s versus 66 m3/s). This increased capacity will allow OPG to put through almost 2 ½ times more water. However, given the variety of other requirements and compliance ranges that OPG is required to follow, the possible effects on water levels in Grassy Bay would be limited to slightly quicker drawdowns occasionally (not deeper drawdowns). That is, water levels could be lowered to the minimum more quickly in any one day (a few hours until the minimum is reached rather than half a day). The daily minimum and maximum water levels will not change. Additionally, these quicker draw downs will not occur every day because other factors in the system affect the water compliance requirements (as per the Madawaska River Water Management Plan). No seasonal changes are anticipated as OPG will continue to operate the Calabogie GS and the other plants on the Madawaska River in full accordance with all flow and water level targets and compliance conditions in the Madawaska River Water Management Plan, including the summer conditions.
6	American Eel. Thank you for providing the date of the electrofishing surveys. Can you also provide the time of day surveys were completed, the length of the surveys and	Please refer to the Aquatic TSD, Appendix A (Fish and Fish Habitat Investigations), 3.1, Field Investigations, Methods.

Comment #	MECP Comment	Response
	conditions at the time of surveys (temperature, cloud cover, etc.)?	The electrofishing surveys were conducted during daylight hours. No precipitation at the time of the surveys. Additional weather conditions weren't recorded.
7	American Eel. How will OPG be monitoring to determine if and when Eel are present to inform if eel passage needs to be implemented?	We think your question is answered in section 4.2.6 of the Final Aquatic TSD where the following is stated. American Eel have historically migrated upstream and downstream in the Madawaska River, but have been extirpated from the vicinity of the Calabogie GS for approximately 40 years (MNR, 2008) and there are dams downstream that currently block the upstream passage of American Eel. However, it hoped that re-establishment of American Eel will occur in the Ottawa River system, including the Madawaska River. Therefore, the generating station will be constructed 'eel-ready' so that of adaptive management strategies that can be applied as circumstances change around the presence of American eel in the vicinity of the station. The upstream movement system (trap and transport) is to be constructed at the time of GS construction and will be monitored to determine if upstream migrations are occurring. Downstream movement system wouldn't be deployed until eels approaching the downstream phase of their life-history phase are present in the upper portion of the watershed. Specific measures have been scoped into the design of the station to accommodate potential future needs for upstream and downstream passage of American Eel including: • including a trap and transport system at the plant tailrace, including the provision of attractant flow, to allow monitoring for eel presence below the station and provision of upstream transport when eels appear

Comment #	MECP Comment	Response
		- the trap (i.e.., ladder and tank) will be constructed at the time of GS construction. The tank will be monitored to determine if Eels are present. - intake velocities and bar exclusion screen layouts that facilitate implementation of future effective safe passage of eels downstream through the project; - provision for retrofitting the station with an inclined screen and downstream flow bypass for downstream passage with bar spacing in the screen at no more than19 mm during periods of downstream movement; - leaving room for permanent upstream and downstream passage infrastructure to be retrofitted. Measures to permit downstream migration wouldn't be deployed until eels approaching the downstream phase of their life-history phase are present in the upper portion of the watershed. Putting fine spaced trash rack mitigations in place introduces head losses and negatively affects operations, however OPG specifically designed approach velocities and trash rack spacing to prevent impingement and fish mortality with the understanding that a population of eels will eventually be re-established. An adaptive management approach will be applied during operations to determine the best course of action to implement or install specific measures to support recovery as circumstances change. It is expected that if American Eel are trapped in the tailrace they will be transported upstream and that retrofitting to permit safe downstream passage will be implemented prior to the first eels that are moved upstream migrate. The tailrace receiving environment is being modeled to understand the depth and

Comment #	MECP Comment	Response
		velocity profiles relative to fish preferences. Changes due to increased powerhouse capacity.
8	American Eel. If something different is being proposed for eel passage in the future based on new technology or if a different design is being proposed other than what has been described in your response from December 2, 2019 MECP would like to be engaged on the updated design and have the opportunity to provide comments with respect to the updated/new design to ensure that it is appropriate for American Eel.	Nothing different is being proposed at this time. As indicated above, specific measures have been scoped into the design of the station to accommodate potential future needs for upstream and downstream passage of American Eel including. OPG is incurring these costs are part of the current project. Therefore, the design details as mentioned above will be those going forward.

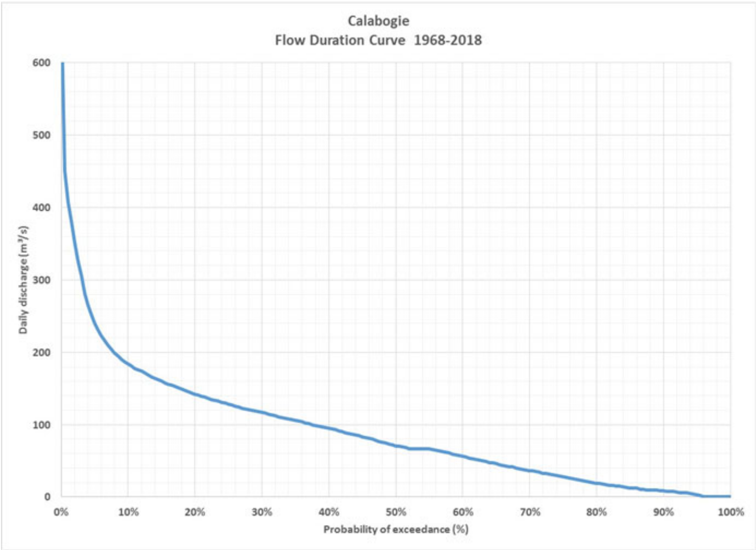
APPENDIX A.4

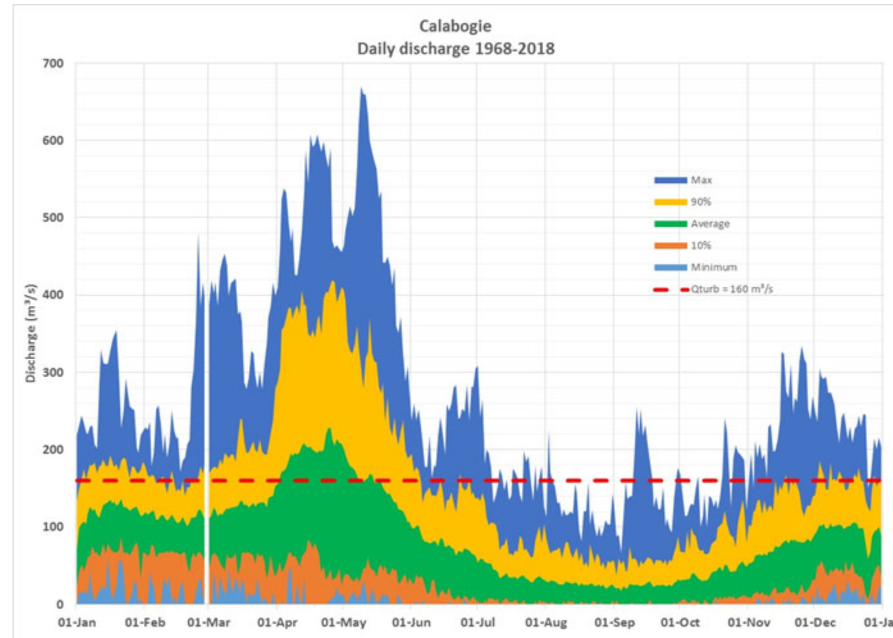
Ministry of Natural Resources and Forestry

MNRF Comments on the "Proposed Calabogie Generating Station Redevelopment Project Environmental Report"

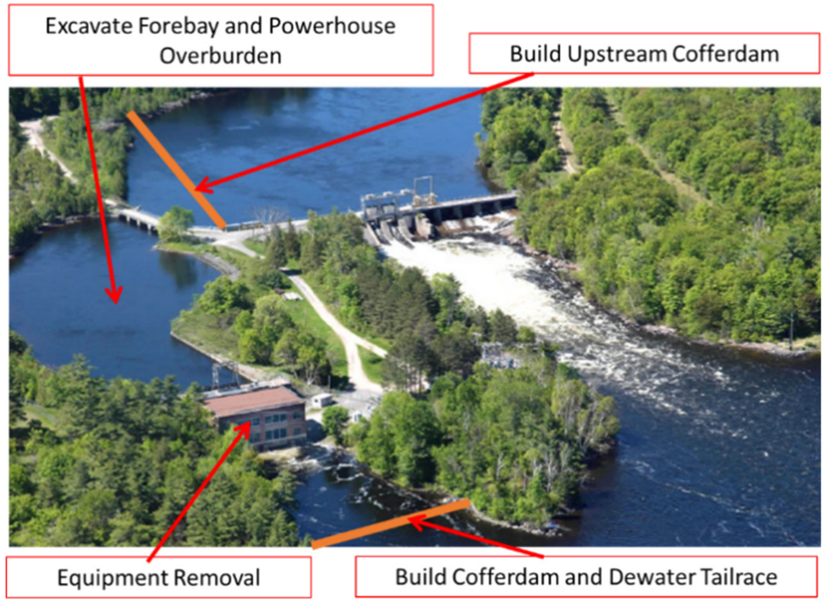
September 2019

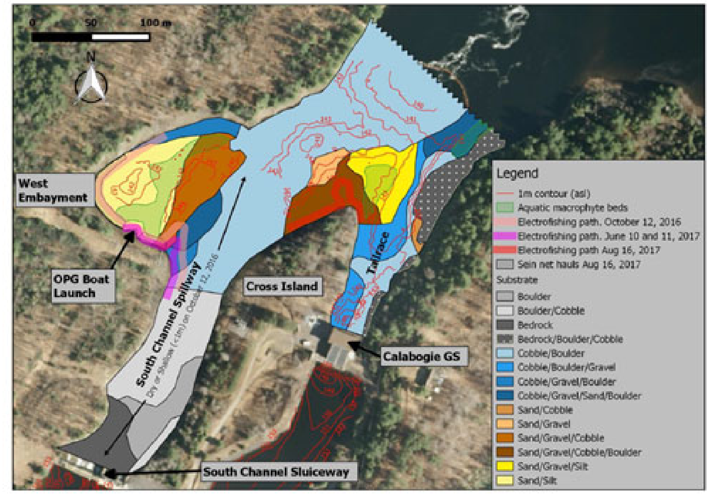
Comment Number	Page and/or Section	Environmental Report Document Wording	MNRF Comment	Response
1	ES-3	The proposed Project is consistent with the existing land use direction and OPG and SNC-Sullivan have been working co-operatively with the Township and the Region on issues of mutual interest including traffic management, heritage and the re-use of materials from the project.	Please clarify who is being referenced as the Region in this sentence.	This should have said "County" (meaning County of Renfrew) which is the regional government body in the area. This will be corrected in the final version.
2	2.1 Project Location (2-1)	The existing Calabogie GS is located within the Village of Calabogie, in the municipality of Greater Madawaska, Renfrew County, Ontario (Figure 2-1). It is located approximately 80 km northwest of Ottawa and 20 km west of Renfrew.	Please clarify that the Calabogie GS is southwest of the Town of Renfrew.	Agreed. This will be corrected in the final version.
3	2.4.1 General Layout (2-8)	Average Annual Flow – 90.5 m^3/s Average head of 8.6 m (range of 6.6 m to 9.9 m).	Please include the Average Summer Flow (July-September) in addition to the Average Annual Flow to better capture the seasonal range of flows.	Thank you for the comment. The average historical inflow for the period between 1965 and 2017 at Calabogie is approximately 90 m^3/s with a median of 72 m^3/s. The flow duration curve and historic daily discharge record is presented below.

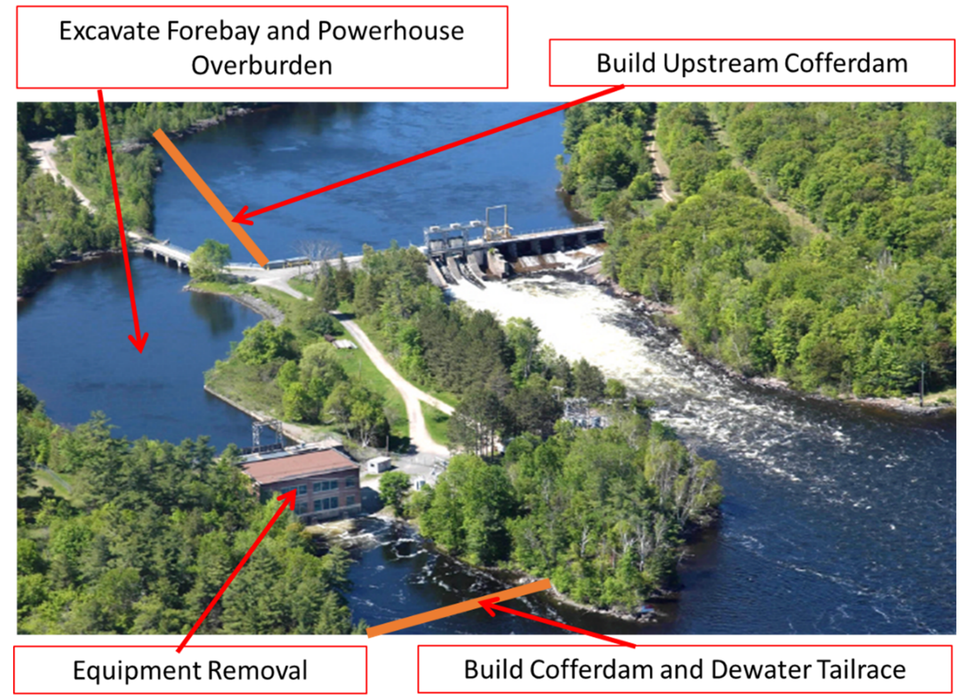
Comment Number	Page and/or Section	Environmental Report Document Wording	MNRF Comment	Response
				

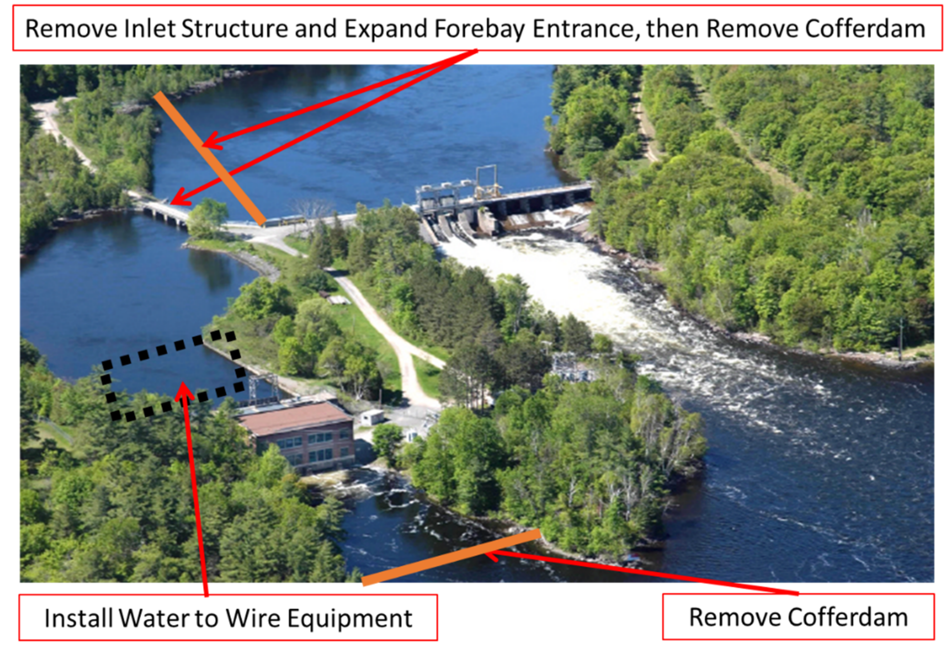
Comment Number	Page and/or Section	Environmental Report Document Wording	MNRF Comment	Response
				

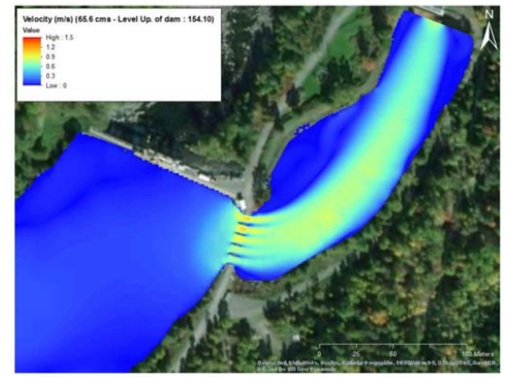
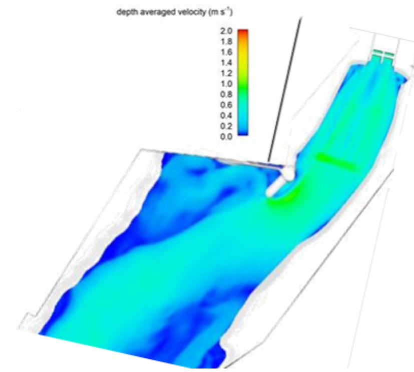
Comment Number	Page and/or Section	Environmental Report Document Wording	MNRF Comment	Response
4	2.4.2 Construction Sequencing (2-11) 4.2.5 Benthic Macroinvertebrates (4-18)	During Phase I, a cofferdam will be constructed downstream of the existing powerhouse and the existing tailrace subsequently dewatered. Substrate in the Madawaska River at the proposed cofferdam location is predominantly bedrock.	Please clarify whether stage #1 and phase 1 are used interchangeably in this section. Please clarify the location of the proposed cofferdam (i.e., length from existing tailrace) and the substrate in the area. Figure 3-9 appears to indicate the proposed cofferdam location is mainly boulder and cobble.	In Section 2.4.2 there was mention of a "Phase 1". This was a mistake and should have been "Stage 1" and therefore yes in this specific instance it was used interchangeably. This will be corrected in the final version. The details of the decommissioning of the existing generating station involve isolating the site within cofferdams and details of the isolation process are outlined below: The existing inlet structure/sluices allows the forebay to be isolated and excavation work conducted. Following the July 15th fish window, an upstream cofferdam will be constructed to allow removal of the existing inlet structure in the dry and rock excavation to continue. The upstream cofferdam will be constructed from blasted rock that has been excavated to accommodate the new powerhouse. Clean blast rock will be placed upstream 5.8 metres wide, with a slope of 1.5H:1V to elevation 155.17masl across the width of the inlet. The upstream face of the cofferdam will be lined with a heavy-duty cofferdam membrane and sealed to the riverbed with a bentonite clay seal. Upon completion of the powerhouse, the liner, blasted rock and overburden will be removed, and the channel will be graded with rockfill. A downstream cofferdam is required to isolate the downstream side of the construction and allow for: the demolition of the existing powerhouse and construction of the new powerhouse and tailrace. The proposed cofferdam is a rockfill dam with an impervious geomembrane on the water side of the cofferdam. Seepage through the cofferdam will be collected and directed to a settling pond prior to discharge back into the river. The bed material in the area where the downstream cofferdam will be constructed is primarily cobble /boulder/ gravel across the main channel with some sand/gravel/cobble and bedrock/boulder/cobble distributed proximate to the river bank. Figure A highlights the locations of upstream and downstream cofferdams and Figure B shows the bed material classification in the downstream receiving environment.

Comment Number	Page and/or Section	Environmental Report Document Wording	MNRF Comment	Response
				Figure A 

Comment Number	Page and/or Section	Environmental Report Document Wording	MNRF Comment	Response
				Figure B 
5	2.4.2 Construction Sequencing (2-13)	The existing forebay inlet structure will be demolished and removed and the entrance of the new forebay channel widened by an additional 20 metres to improve flow conditions to the new powerhouse.	It is our understanding that the existing forebay inlet structure will be used as a cofferdam for the construction of the generating station, tailrace and forebay. There is no discussion on how the forebay inlet structure will be demolished. Please clarify whether the work be completed in the dry. If so, please note that a temporary upstream cofferdam will be required. If not, please clarify how it is proposed to demolish a structure that is currently acting as a dam. Please provide more information/detail with respect to the forebay inlet structure demolition.	In Stage #1 of the demolition and construction, the existing inlet structure (located at the bridge) will be closed by inserting stoplogs and the existing forebay channel will be de-watered. Following the de-watering of the forebay, sediment, soil and rock will be excavated in the dry for construction of the new intake forebay channel as well as excavation for the new powerhouse substructure. To allow for the excavation of the new upstream forebay channel and powerhouse, the existing powerhouse will be used as a downstream cofferdam. Once the Powerhouse superstructure is demolished, a cofferdam will be constructed downstream of the existing powerhouse and the existing tailrace de-watered. At the same time the downstream cofferdam is constructed, an upstream cofferdam will be constructed upstream of the inlet structure. The section between the upstream cofferdam and the inlet structure will be dewatered allowing rock excavation to continue and preparing for the inlet structure removal in Stage 4. (Figures E and F).

Comment Number	Page and/or Section	Environmental Report Document Wording	MNRF Comment	Response
				Figures E and F – Locations of Cofferdams and Water Retaining Structures 

Comment Number	Page and/or Section	Environmental Report Document Wording	MNRF Comment	Response
				
6	2.4.3.1 Forebay and Intake (2-15)	As indicated in the section above the overall footprint of the forebay will remain largely unchanged. However, once the existing forebay inlet structure is removed, the forebay inlet will be slightly widened (by approximately 20 to 25 m) in order to improve the hydraulics of the flow to the GS.	The current wording indicating that "the overall footprint of the forebay will remain largely unchanged" is misleading. Removal of the forebay inlet and widening of the forebay by 20-25 metres represents a significant change to accommodate the increase in flows from 66 m^3/s to 160 m^3/s. Suggest clarifying what work was completed to assess the impact of removing the forebay inlet and widening the forebay on flows particularly below the new tailrace, and hence any impacts on fish and fish spawning.	The forebay inlet will be slightly widened (by approximately 20 to 25 m) in order to improve the hydraulic conditions of the flow to the GS (Figures below) Once the existing forebay inlet structure is demolished and removed, the upstream and downstream cofferdams will be removed, and the systems commissioned.

Comment Number	Page and/or Section	Environmental Report Document Wording	MNRF Comment	Response
			Please clarify the length of widening of the forebay inlet (Page 2-13 indicates 20 m).	Figures: Existing and Proposed Intake Structures (note widening of the intake area) Existing conditions (66 m^3/s) Future conditions (160 m^3/s)  
7	2.4.3.1 Forebay and Intake (2-16)	The new powerhouse intake will be integral with the new powerhouse and will be constructed of reinforced concrete. The intake will be equipped with trashracks, suitably sized and with bar spacing to mitigate in as much as possible, fish entrainment. The trashracks will cover the complete area of the turbine water passage intakes. The new trashrack bar spacing will remain consistent with the trashrack spacing at the existing Calabogie GS, with 50 mm clear space between the trashrack bars.	Suggest aiming to reduce fish entrainment/mortality below existing levels, particularly as the redevelopment proposes to have additional water flowing through the turbines. The proposed increase in flow through the turbines will increase fish movement and could lead to higher entrainment/mortality if the consistent trashrack design of 50 mm is used. Additional mitigation measures could include fish screens and a diversion channel.	The intake design proposed for the Calabogie GS is specifically designed with a slow, fish friendly, approach velocities of 0.9 m/s at a distance of 75 mm in front of screen. These approach velocities minimize the risk of fish entrainment and impingement and are based on guidelines provided by regulators and deliberately designed to allow for the future presence of migratory American Eel. The trashracks will cover the complete area of the turbine water passage intakes and bar spacing will remain consistent with the trashrack spacing at the existing Calabogie GS, with 50 mm clear space between the trashrack bars. The trashracks spacing will be modified to a finer mesh of <20 mm during periods of the year in the future if/when downstream eel migration is anticipated to occur.

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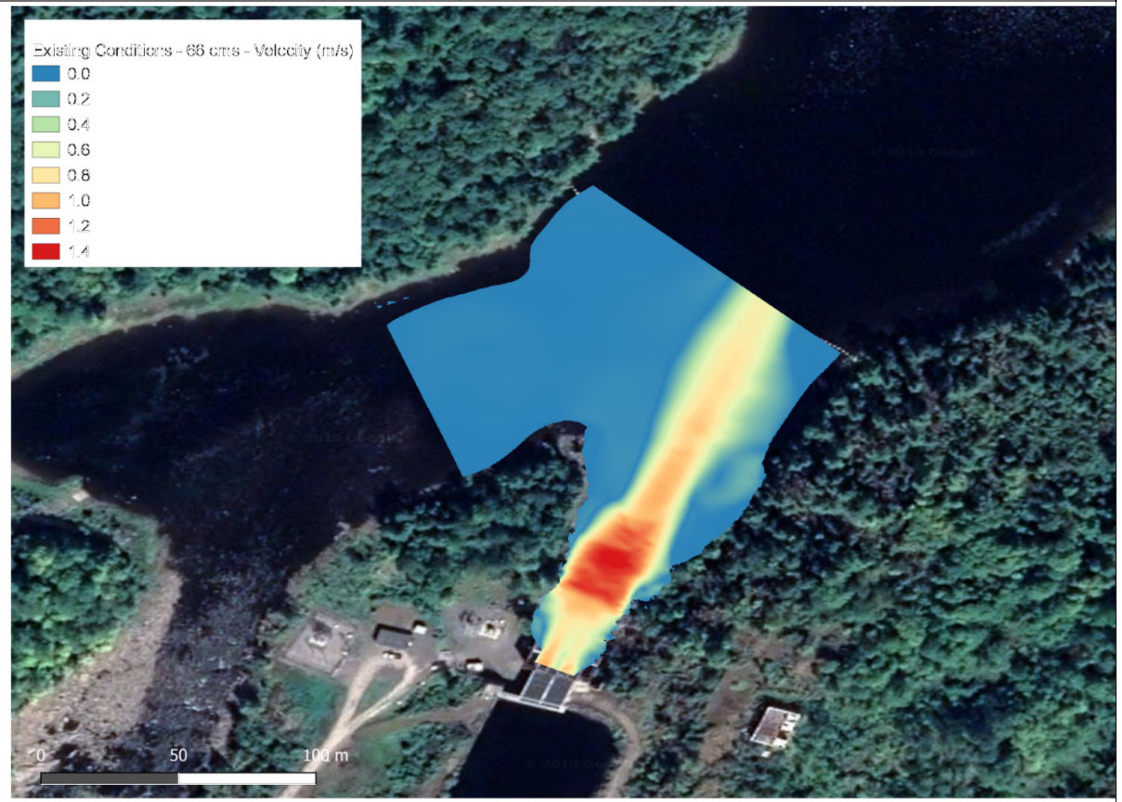
8	2.4.3.4 Tailrace (2-18) Figures 2-18 (2-23) and 2-19 (2-24)	The new tailrace channel is anticipated to be in the order of 25 m wide and will connect the powerhouse within the downstream river reach. The upstream portion of the tailrace channel (between the new powerhouse and the existing powerhouse) will be excavated in overburden for the first 5-7 m and in bedrock below. The downstream portion of the channel (downstream of the new powerhouse) will be excavated mostly in rock. Limited overburden excavations are expected in this portion of the channel. Bedrock will be excavated in vertical cuts and overburden will be sloped and protected against erosion and sloughing. For the purpose, the area will be dewatered using a downstream cofferdam.	As depicted in Figures 2-18 and 2-19, the velocity at the downstream limit of the tailrace will be considerably higher compared to the existing condition. Please provide modelling that extends further downstream to show where the high velocities are dissipated to existing conditions. Please provide information regarding possible impacts to fish and fish spawning as a result of higher velocities in the tailrace.	The tailrace has been deepened and will be excavated to an elevation of 139.0 masl near the generating station and the minimum tailwater elevation will be 144.2 masl to reduce the velocities in the receiving environment. The goal of these changes were to maintain velocity near 0.9 m/s in the tailrace receiving environment. OPG will provide a detailed assessment of habitat changes associated with the new project as part of the DFO review process. The substrate and other biophysical parameters associated with potential walleye habitat will be developed. Currently the tailrace receiving environment is being modeled to understand the depth and velocity profiles. This information will be used to understand the distribution of bed material that could be used as spawning or rearing habitat. We are currently exploring a range of habitat variables (Habitat Suitability Indices) that are specific to walleye spawning and rearing (e.g. McMahon 1984 - Habitat Suitability Index Models: Walleye). The hydraulic model domain is limited to the area shown at this time and is based on the availability of bathymetry in the receiving environment (Figures Below). A HEC-RAS 2D for 2D hydrodynamic analysis. This model is developed by the USACE and is open domain. This model was utilized for the design of the tailrace channel. Existing Calabogie GS Tailrace Hydraulic Conditions. 66 cms – Velocity.

Comment Number	Page and/or Section	Environmental Report Document Wording	MNRF Comment	Response
				 Future Calabogie GS Tailrace Hydraulic Conditions. 160 cms Total Flow, All Through the Powerhouse

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				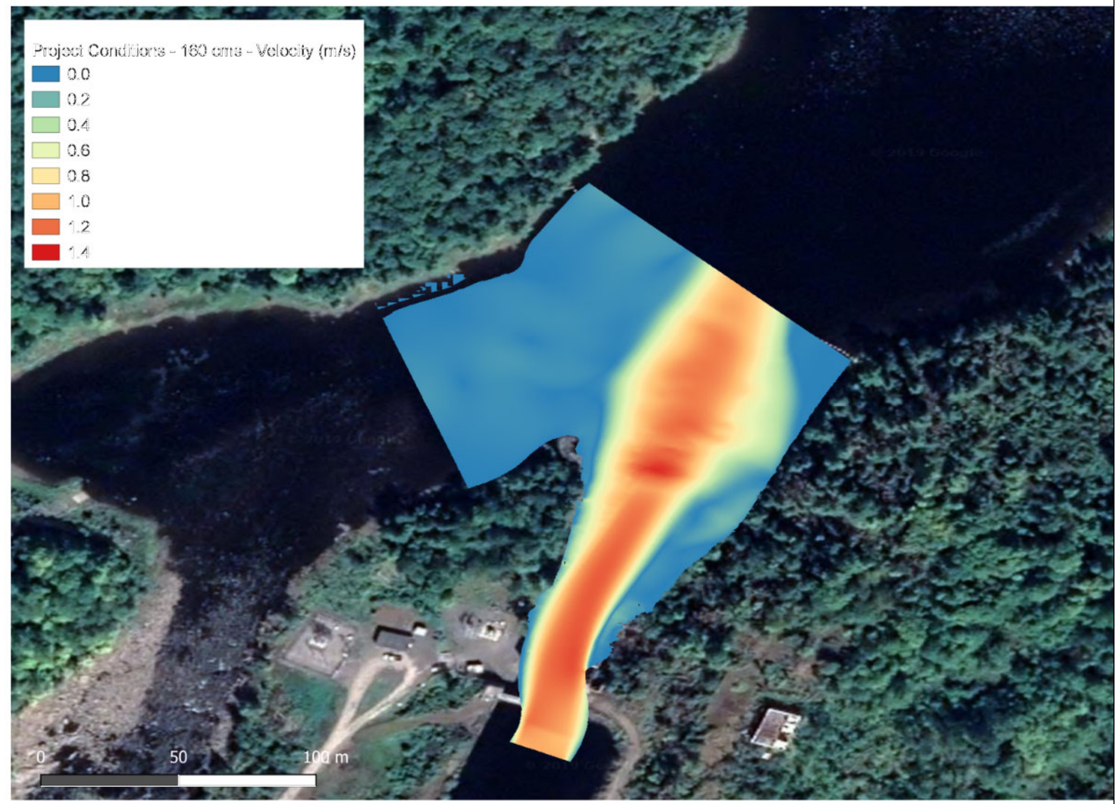
9	2.4.3.4 Tailrace (2-25)	The tailrace area may require riprap to locally protect against erosion and sloughing of the overburden encountered, however, it is currently envisaged that the bulk of the tailrace excavation will be rock. Portions of the Madawaska River riverbank in the immediate vicinity of the tailrace area may also require erosion protection.	Please note that proposed erosion protection of the tailrace area may require a MNRF Work Permit under the Public Lands Act.	Noted – Thank you for the information

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10	2.6 Proposed Calabogie GS Operations (2-34)	There will still be conditions and situations where a greater range at Stewartville GS is needed to meet Ontario grid requirements and maintain compliance with the other aspects of the Water Management Plan (WMP). However, there may be some conditions where the redeveloped Calabogie GS could match flow patterns at Barrett Chute GS and Stewartville GS to reduce water level fluctuations. If this occurs it will be done in compliance with the WMP. As a result, the redeveloped generating station will allow OPG to reduce the fluctuations in water level in Calabogie Lake and Stewartville more often than the current situation, but the impact will not be substantial.	The document mentions that Calabogie GS could match flows at neighbouring facilities to reduce water level fluctuations but indicates that the impact will not be substantial. Please clarify the extent and duration of potential reduced fluctuations in water level in Calabogie Lake/Stewartville, and how impacts of different proposed conditions were assessed.	At all times the new Calabogie GS will operate within the targets identified within the existing WMP. The increased station flow may provide some opportunity to decrease the extent of river level fluctuations between Calabogie and Stewartville on an hourly basis. Study and survey to better quantify the impacts of station operation on the downstream levels is ongoing and will be shared once available.

11	3.1.6.1 Existing Aquatic Habitat (3-15)	Flow in the spillway is highly variable, due to the fact that the Madawaska River has a managed flow regime with consistent set flows preferentially diverted through the North Channel to maintain habitat there, and then through the GS and tailrace up to the maximum GS capacity to generate electricity, with whatever remains, after further allotment of water for the maintenance of upstream and downstream water levels, discharged through the South Channel Spillway.	Suggest revising the statement “flows preferentially diverted through the North Channel” to instead describe the set flows as per the WMP (Walleye spawn and incubation: 5 m^3/s; minimum flow: 0.8 m^3/s).	Revision will be made.
				
				Calabogie anticipated operation in the future:
				
				- 0.8 m^3/s through the north channel at all time (from the WMP);
				- 5 m^3/s for the period 5Apr-21May at north channel for something related to walleyes (from the WMP);
				- from simulation of the future operation using the past 53 years, the average distribution in percentage of the total inflows is:
				    ○ 85.8% passing through the powerhouse;
				    ○ 12.7% passing through the south channel spillway;
				    ○ 1.5% passing through the north channel.

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12	3.1.6.3 Fish Movement (3-19)	The Calabogie GS is the division between two of these sections. Upstream there is a short section of river and Calabogie Lake, with the Barrett Chute hydro-electric station blocking fish movement upstream from Calabogie Lake. Downstream is a 21.4 km section of river that has its downstream end at the Stewartville GS that also blocks upstream fish movement.	Please clarify that the natural barrier to upstream movement past Barrett Chute is High Falls.	Yes, the natural barrier to upstream movement past Barrett Chute is High Falls.
13	3.1.6.6 Walleye (3-21) 4.3.8 Walleye Spawning (4-22)	The results of the 2016 and 2017 Walleye spawning observations at Calabogie are summarized in Tables 3-6 and 3-7 of the Aquatic TSD. Numbers of Walleye observed in the vicinity of the Calabogie GS were low relative to the numbers observed at the reference site below Barrett Chute, even though only a small proportion of the potential spawning area at the reference location could be examined. Most of the tailrace of the Calabogie GS is considered to be deeper than typical Walleye spawning habitat, even though substrates in the tailrace might be suitable (Figure 3-9). A few areas of suitable substrate were observed in a narrow band of shallow water along the north side of the tailrace (see substrate in Figure 3-22), but the flow velocity there was too slow to be optimal for Walleye spawning at the time of the field observations. Regardless, low	Walleye surveys were only conducted for a short period of time early in the spawning season and observations may have been missed due to turbid, deep and fast-moving water. Work completed by local fish and game clubs that was described in the Madawaska WMP indicates that spawning is triggered at a water temperature of 6 degrees Celsius. Suggest that steps are taken to continue to provide suitable walleye spawning habitat in the new tailrace area.	Some of the new tailrace area will have suitable walleye spawning conditions. OPG anticipates that discussions and information sharing will occur with DFO and that quantification of potential walleye spawning habitat in the existing and future tailrace will occur as part of these discussions. OPG will provide a detailed assessment of habitat changes associated with the new project as part of the DFO and MNRF review process. The substrate and other biophysical parameters associated with potential walleye habitat will be developed. Currently the tailrace receiving environment is being modeled to understand the depth and velocity profiles and this information will be used to understand the distribution of bed material that could be used as spawning or rearing habitat. We are currently exploring a range of habitat variables (Habitat Suitability Indices) that are specific to walleye spawning and rearing (e.g. McMahon 1984 - Habitat Suitability Index Models: Walleye Spawning).

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		numbers of Walleye were observed in the tailrace in 2016 and 2017, indicating that they are attracted to it. (3-21). As previously stated, large aggregations of spawning Walleye have not been observed in the vicinity of the Calabogie GS. Regardless, there is likely some limited spawning occurring in the tailrace, at the downstream end of the South Channel Spillway, and in the North Channel. Given the limited use of the existing tailrace by spawning Walleye, it is expected that the future tailrace will provide the same or improved habitat opportunities for spawning (4-22).		
14	3.2.2 Vegetation (3-25)	Woodland Pinedrops (*Pterospora andromedea*), a provincially rare plant (S2: “usually between 5 and 20 occurrences in the province, or few remaining hectares”) was documented in several locations along Generating Station Lane by MNRF staff. To account for the possibility that the laneway may need to be widened in some locations, Beacon staff have scheduled site visits in 2019 to determine if there are additional locations where this species occurs in the study area.	Please update document to reflect whether this site visit occurred and any findings and subsequent action.	Agreed. Beacon (Rob Willson) did conduct surveys for Woodland Pinedrops in early June and late August 2019. Woodland Pinedrops were identified at four different locations (multiple stalks at each location). Three of the locations were along Generating Station Lane, while the fourth was between the river and the road on Calabogie Island (Figure B4). During the August site visit, the proposed laydown areas, stockpile area and haul road were surveyed (Figure B4) and Woodland Pinedrops were not observed in these areas. The conditions in these latter areas suggest that Woodland Pinedrops is unlikely to be present (i.e., the ecological communities and species compositions are different). However, along the laneways where conditions are suitable, it is possible that Woodland Pinedrops may be present in additional locations because the species does not produce above-ground inflorescences every year. As such, mitigation measures will be tailored to respond to newly confirmed locations as the project goes forward. The Project has not identified yet that the roads will need to be widened but that remains a possibility. The Terrestrial Environment TSD and Environment Report will be updated for the final report noting that Woodland Pinedrops were identified and mapped. They will be treated as avoidance areas for the project. So for example, if the road does need to be widened, the other side of the road would be

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				widened versus the side where Woodland Pinedrops are known to be present. Other mitigation measures are also possible.
15	Table 4-1 Potential Environmental Effects		Throughout the table, please note that when the potential level of effect is categorized as “NIL”, description should reference “no effect” instead of “no negative effect”.	Noted – thank you
16	Table 4-1 Potential Environmental Effects (4-4)	Fish Habitat: The proposed Project will not change the overall amount of habitat and likely result in no change to critical habitat.	Suggest clarifying that as outlined in Section 4.3.11 (4-23), there will be no change in critical habitat due to proposed mitigation measures. Otherwise, the statement is misleading.	We can revise the Table based on this comment. Please note however that according to the OWA Class EA process this Table was generated early on in the effects assessment process before the detailed effects assessment and therefore the language used in it will not always align with the final effects assessment. The intention of the Table is not really to be “back-filled” at a later date after all of the effects assessment was completed.
17	Table 4-1 Potential Environmental Effects (4-4)	Erosion and Sedimentation: The proposed Project may have a negative effect because of erosion and sedimentation associated with construction activities.	Suggest this description lines up better with a Low Negative effect than a Nil effect.	Agreed. On review the Comment was correct but the Rating should be Low Negative. This will be revised.
18	4.2.2.1 Sediment and Erosion Control (4-12)	During construction, the removal of natural shoreline vegetation should be minimized, and consideration made to armour potentially affected shoreline proximate to the proposed GS.	Consider including that MNRF Work Permit under the Public Lands Act may be required to armour affected shoreline.	Noted – thank you.
19	4.2.3.1 Timing of In-Water Construction (4-16)	In-water construction activities should be timed to avoid the spawning and egg incubation period of spring spawning fishes, such as Walleye. According to the MNRF in-water work guidelines for the southern region of Ontario (https://www.ontario.ca/document/water-work-timing-window-guidelines), and due to the presence of Walleye, Northern Pike, Smallmouth Bass, Largemouth Bass, and other spring spawning species (e.g.	Through MNRF’s Broadscale Monitoring program and historic lake survey files, fall-spawning fishes such as Cisco (*Coregonus artedi*) have been documented upstream of Calabogie to Barrett Chute, and Lake Whitefish (*Coregonus clupeaformis)* have been documented downstream of Calabogie to Stewartville (information can be accessed through Fish ON-line). For the License to Collect Fish for Scientific Purposes, fish collection should adhere to the in-water	The fish species that are present in the Madawaska River are listed, by reach, in *Fisheries Management in Renfrew County: A State of the Resource Report and a Focused Review of Fisheries Issues* (MNRF. 2008. 101 p). This document indicates that Lake Whitefish and Cisco are not present in the reach between Calabogie Dam and Stewartville Dam. Lake Whitefish and Cisco occur in the reach upstream, between Calabogie and Barrett Chute. Lake Whitefish occur in the reach downstream, between the Stewartville Dam and Arnprior. The purpose of restrictions on the timing of in-water work is to prevent eggs and embryos from being adversely affected, either directly or by sediment transported from the site. There does not appear to be habitat suitable for spawning by Lake Whitefish or Cisco within or immediately upstream from the Calabogie headpond. Coffer dam installations and dewatering at Calabogie would not pose a risk to eggs or embryos located downstream of the Stewartville Dam, which is approximately 20 km downstream. Therefore, it is OPG’s opinion that applying the timing window to prevent spring spawning species is appropriate. A mussel relocation will also occur if they are present during the dewatering process.

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		River Redhorse, Shorthead Redhorse, White Sucker) in the Madawaska River, the broadest in-water work exclusion period, from March 15 to July 15, will apply. The area between the temporary cofferdam at the downstream end of the tailrace and the existing control structure at the upstream end of the forebay will be dewatered during construction. An impervious geotextile will be placed on the cofferdam face to preclude water ingress. Fish within the area to be dewatered will be collected by electrofishing/netting during drawdown and released to the Madawaska River. The temporary unavailability of this habitat during the construction period will have negligible effect on the local fish populations.	work timing window for Fall spawning fishes (fish collection to occur between July 15 and September 30). Mussels should be included in collection. As part of the Environmental Report and application for a License to Collect Fish for Scientific Purposes, OPG should consider including a description of how the water will be lowered and fish removed, and the proposed mitigation measures, particularly if construction is delayed and the cofferdam remains in place for multiple seasons, in which case alternative options may need to be considered. Please provide clearer rationale as to why the impact of unavailable spawning habitat is considered negligible.	A detailed de-watering and salvage plan will be developed for the project and it will describe how the water will be lowered and how any isolated fish will be removed along with other proposed mitigation measures. It is anticipated that DFO will require a detailed Environmental Management Plans and onsite monitoring by a Qualified Environmental Professional team before construction dewatering will occur.
20	4.2.6 Site-specific Fish Habitat Considerations (4-19) 4.3.11 Fish Habitat Loss and Gain/Enhancement (4-23)	The new tailrace will be approximately 50 m longer than the existing tailrace, due to the new powerhouse being further upstream. The upstream portion of the new tailrace will be excavated in bedrock. The exact downstream limit of excavation is not yet known, but it may result in a change in the substrate from the existing boulder/cobble to bedrock (4-19). Areas within the forebay and tailrace that that are excavated to or in bedrock will be mitigated	Suggest that OPG work with DFO to make fish spawning habitat enhancement in the tailrace a priority to mitigate negative impacts to fish, as the proposed construction work will decrease available boulder/cobble spawning habitat and increase bedrock in the new tailrace. Suggest discussing with DFO the possibility that enhancing fish spawning habitat in the forebay could unintentionally increase chances of entrainment.	OPG agrees and will provide a detailed assessment of habitat changes associated with the new project as part of the DFO review process. The substrate and other biophysical parameters associated with potential walleye spawning habitat will be developed. Currently the tailrace receiving environment is being modeled to explore the depth and velocity profiles for optimum substrate placement. This information will be used to understand the distribution of bed material that could be used as spawning or rearing habitat. We are currently exploring a range of habitat variables (Habitat Suitability Indices) that are specific to walleye spawning and rearing (E.G. McMahon 1984 - Habitat Suitability Index Models: Walleye).

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		by the placement of 0.5 m of granular material (boulders, cobble, and gravel) over exposed bedrock. This will maintain the habitat function within these areas (4-23).		
21	4.3.11 Fish Habitat Loss and Gain/Enhancement (4-23)	It is thought that the diversion of a portion of the high flow volumes, that presently pass through the South Channel Spillway during the spring, to the GS, will provide better functionality of habitat within the spillway, provided that a seasonal minimum flow is initiated to maintain those habitats through to about the middle of June (the end time could be a fixed date, or determined annually as a function of degree days). The flow reduction will allow more spawning opportunities for Walleye, White Sucker, and other species such as Logperch, while the minimum flow will ensure that any embryos deposited by these species will have sufficient flow to fully develop and swim out from the spawning area.	It is our understanding that the proposed reductions to the South Channel Spillway's flow regime could lead to faster dewatering and periods of raised water levels due to backwater effects from the tailrace. These changes will impact how fish use this area and may not provide suitable spawning habitat. Please note that establishing a seasonal minimum flow in the South Channel Spillway would require an amendment to the existing WMP. If pursuing a minimum flow, this should be made clear in the Environmental Report document so that the complete details of a future WMP amendment is clear and consulted on appropriately throughout the EA process.	No amendment to the WMP is being proposed. The context here is that, during many years, the spring flow velocities in the South Channel Spillway are too high for it to provide Walleye spawning habitat, or to provide habitat for most other species. Reduced flows will reduce velocities and may create conditions that are more favourable. If monitoring indicates that the South Channel Spillway is supporting Walleye spawning under the new flow regime, then adaptive management might require maintenance of flows during the incubation period.
22	4.4.6 Wetlands and Areas of Natural and Scientific Interest (4-36)	The new generating station will have an increased maximum total turbine outflow over the existing GS (160 m^3/s versus 66 m^3/s). This increased capacity will allow OPG to put through almost 2 ½ times more water. However, given the variety of other requirements and compliance ranges that OPG is required to follow, the	The new GS will have an increased total turbine outflow (160 m^3/s versus 66 m^3/s) and lead to quicker drawdowns in Calabogie Lake and Grassy Bay. Please clarify whether work was done to assess impacts of quicker drawdowns on fish, wildlife, recreational users, and any effects on upper reaches.	The consensus opinion of our team was that the slightly quicker drawdown would not have any substantive effects on fish, wildlife, or recreational users on Calabogie Lake but rather would be of moderate benefit to downstream users who have raised the vast majority (or all) of concerns with respect to the historic operations of the Calabogie GS. So consideration was given to the potential effects of the new operation on fish, wildlife and recreational users but OPG and its various consultants did not see how any field studies could be conducted that would shed any additional light on potentially adverse effects.

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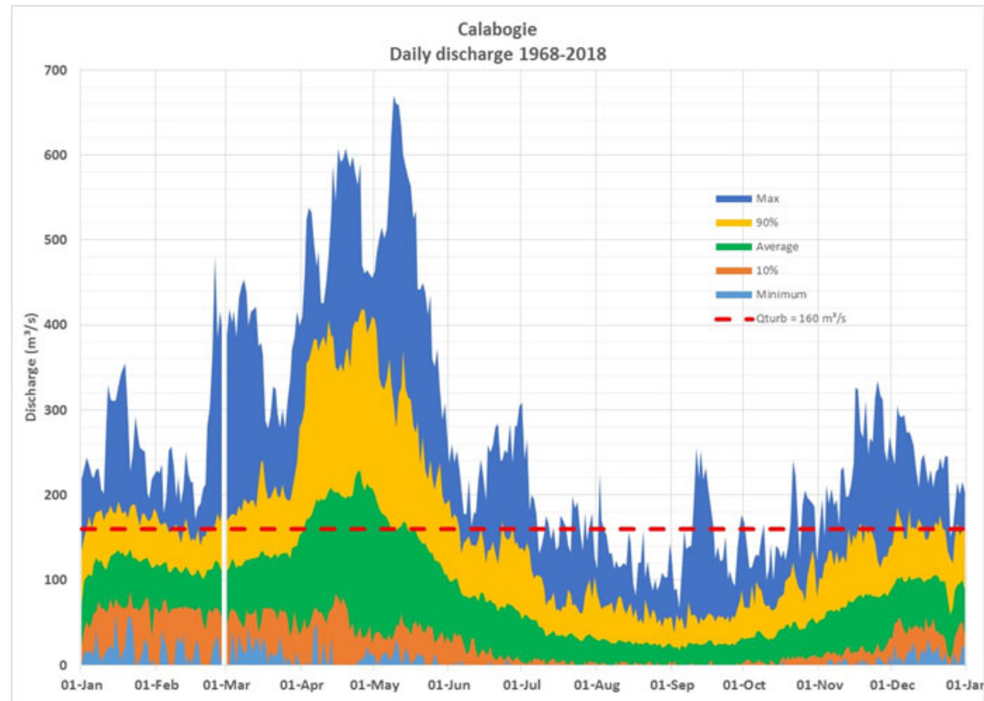
		possible effects on water levels in Grass Bay would be limited to slightly quicker drawdowns occasionally. That is, water levels could be lowered to the minimum more quickly in any one day (a few hours until the minimum is reached rather than half a day). The daily minimum and maximum water levels will not change. Additionally, these quicker draw downs will not occur every day because other factors in the system affect the water compliance requirements (as per the Madawaska River Water Management Plan). No seasonal changes are anticipated as OPG will continue to operate the Calabogie GS and the other plants on the Madawaska River in full accordance with all flow and water level targets and compliance conditions in the Madawaska River Water Management Plan, including the summer conditions.		As MNRF is aware the compliance range for Calabogie Lake during the summer season when the majority of recreational use occurs already operates according to a very narrow range that OPG will continually need to adhere to. OPG will continue to operate the Calabogie GS and the other plants on the Madawaska River in full accordance with all flow and water level targets and compliance conditions in the Madawaska River Water Management Plan, including the summer conditions. Note – when seasonal inflows that are greater than currently turbine capacity of 66 CMS the surplus water had the potential to spilled through the South Spillway. Some of these inflows will now be will be directed through the new generating station. The new turbine capacity is highlighted in the historic inflow figure illustrated below. 

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23	4.5.3.2 Other Recreational Uses (4-48)	As the snowmobile trail is located on the Township's Works Yard where the surplus rock is to be moved there may be a need to consider a re route of the snowmobile trail pending the final placement of rock.	Please note that MNRF should be consulted in advance of any new snowmobile trail re-route involving Crown land.	To OPG's knowledge re- routing the snowmobile trail will not occur on Crown land.
24	Table 6-1 Input Received from the Public at Open House #1 (6-4)	How can wakeboarding on the Madawaska River be controlled? This is not a responsibility of OPG. However, possible solutions may be to contact the Ontario Provincial Police regarding this concern or consult with the Ministry of Natural Resources and Forestry.	Please note that MNRF would not be the appropriate contact for concerns regarding wakeboarding.	Acknowledged. The Report will be modified to reflect this.
25	6.2.5 Water Management Plan (6-11)	OPG does not plan to propose any formal changes to the compliance requirements in the WMP, however a Minor Amendment will be required to the WMP to reflect the fact that a new GS has been constructed. OPG anticipates that such a Minor Amendment to the WMP would be initiated soon after the Statement of Completion to this environmental assessment is completed.	Reminder of the importance of clearly outlining throughout the EA process and in the Environmental Report document how OPG intents to conform with the existing operating conditions in the WMP. By accomplishing this through the EA process, it is MNRF's intent that consultation for a WMP amendment can be deemed complete. Please refer to the Maintaining Water Management Plans Technical Bulletin for more information, particularly Sections 3.2, 3.5 and 3.6 (https://www.ontario.ca/page/maintaining-water-management-plans).	Thank you for the reminder - OPG intends to follow the amendment process for a WMP using the EA process for consultation.

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26	Table 7-2 List of Permits, Licences and Approvals Possibly Required for the Proposed Calabogie Generating Station Re-Development Project (7-19)	MNRF LRIA Section 16 approval Plans and Specifications Approval for works involving the construction of the new dam and GS.	Reference to a new dam is confusing. Please clarify what aspect of the redevelopment is being referred to when stating "construction of the new dam". Section 16 of the LRIA applies to Alterations, Improvements and Repairs to Existing Dams.	This is a mistake and shouldn't have referred to as a new dam. The text should read: "Plans and Specifications Approval for works involving the construction of the new GS and any refurbishment work associated with the existing dam."
27	9 Acronyms and Abbreviations (9-1)	LRIA Lakes and River Improvement Act	Please fix typo – Lakes and Rivers Improvement Act	Acknowledged – Thank you for the information.
28	9 Acronyms and Abbreviations (9-2)	MNR Ministry of Natural Resource MNRF Ministry of Natural Resources and Forestry	Inconsistent use of MNR and MNRF throughout the document. Please use MNRF when referring to the Ministry of Natural Resources and Forestry.	Acknowledged – Thank you for the information.

From: Capelle, Pauline (MNRF) <Pauline.Capelle@ontario.ca>
Sent: Thursday, February 13, 2020 11:54 AM
To: MACLEOD Gillian -ENV H&S <gillian.macleod@opg.com>
Cc: Orpana, Jon (MECP) <Jon.Orpana@ontario.ca>
Subject: RE: Hi , just wondering if /when you are sending in your comments

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Hi Gillian,

Thanks for checking in and providing a project update. Based on our earlier phone call, please find the follow-up comments below that relate to OPG's responses to MNRF's original comment table (attached for reference).

Comment #8 – Modelling in the tailrace

- MNRF reiterates that as part of a LRIA Section 16 authorization, modelling will need to be provided that extends to the point of no change in velocity downstream of the tailrace. This is an important consideration for assessing tailrace design in terms of channel erosion and the associated bank stability.
- As discussed, the LRIA Dam Repair Agreement with Ontario Power Generation came into effect in 2019. As per the Framework for *Lakes and Rivers Improvement Act* agreements for alterations, improvements and repairs to dams, it is the dam owner's responsibility to determine whether a proposed work is in scope of the agreement. Please let us know your assessment and contact us if you have questions or concerns regarding eligibility.

Comment #9 – Potential work permit for erosion protection in the vicinity of the tailrace

- Once OPG determines that erosion protection is required and where the work will occur, OPG should contact MNRF and provide mapping of the location of the proposed work as well as ownership boundaries. This information will aid in determining the need for a MNRF work permit under the PLA. Please note that a work permit is a disposition under MNRF's Class EA for Resource Stewardship and Facility Development (RSFD) projects, and OPG should provide MNRF with evidence of fulfilling EA requirements (i.e. Statement of Completion) prior to applying for a work permit. If the scope of the work permit is beyond what was addressed and adequately consulted on through the EA, the disposition could be subject to assessment under the Class EA-RSFD.

Comment #19 – Timing of in-water construction activities

- Thank you for providing additional information on the instances of fall-spawning fishes in nearby river reaches and rationale for applying the spring timing window. MNRF suggests that OPG continue to use a cautionary approach when applying in-water work timing window guidelines.

Based on the information OPG has provided to date throughout the EA process, MNRF has no further comments.

Thank you and please feel free to contact me with questions.

All the best,

Pauline

From: MACLEOD Gillian -ENV H&S <gillian.macleod@opg.com>
Sent: February 11, 2020 1:59 PM
To: Capelle, Pauline (MNRF) <Pauline.Capelle@ontario.ca>
Cc: Orpana, Jon (MECP) <Jon.Orpana@ontario.ca>
Subject: Hi , just wondering if /when you are sending in your comments

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Hi Pauline,

Hope you are well.

Just to provide a quick update:

The public comment period closed on Jan 31; we did get some comments from ORA –main questions on what OPG is doing about climate change- we are in process of answering-also some clarifications on eel ladder-but NO part II order request from them.

No other comments received from the public, or others; I spoke to DFO and they are not submitting comments at this time, but they are working with our Constructor on a construction authorization – diff to an operations authorization – other than waiting for AOO who we gave extension to Feb 28

I am starting to work with SNC and Sullivan on their permits plan – so last time we chatted you said you has some thought /advise on this . I was wondering if you can send this to us?

Looking forward to hearing back from you

Thanks

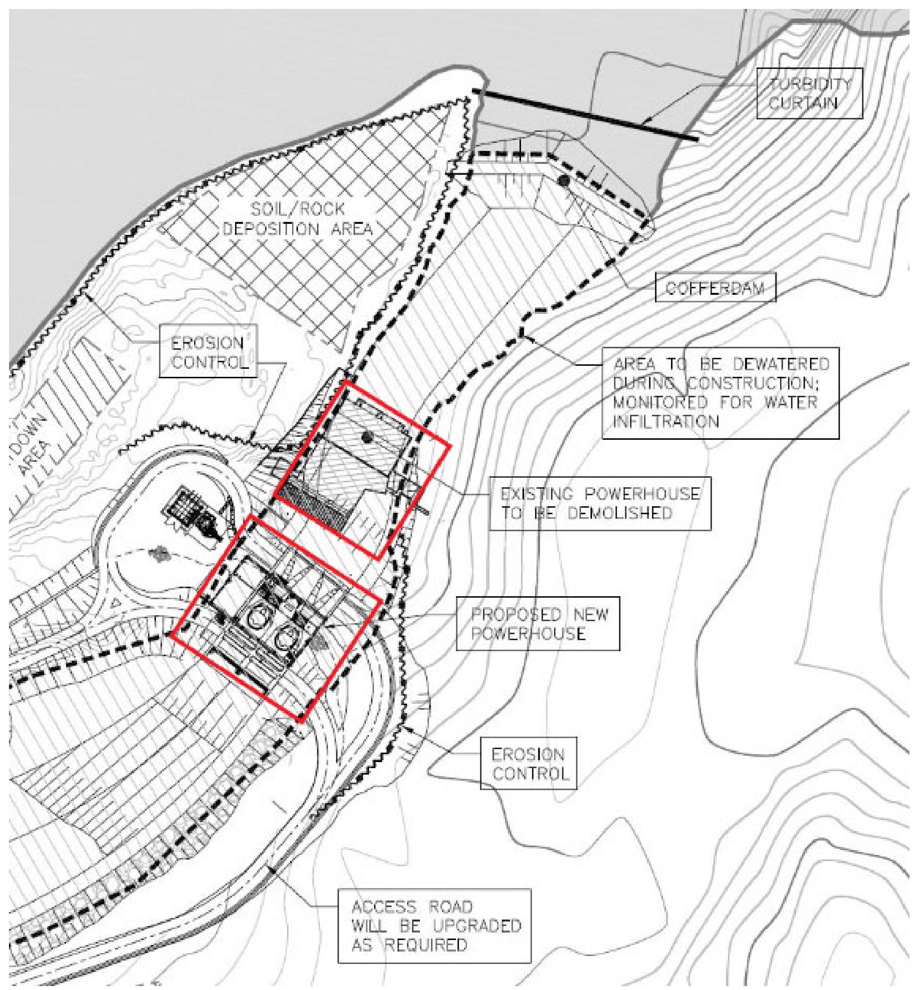
Gill

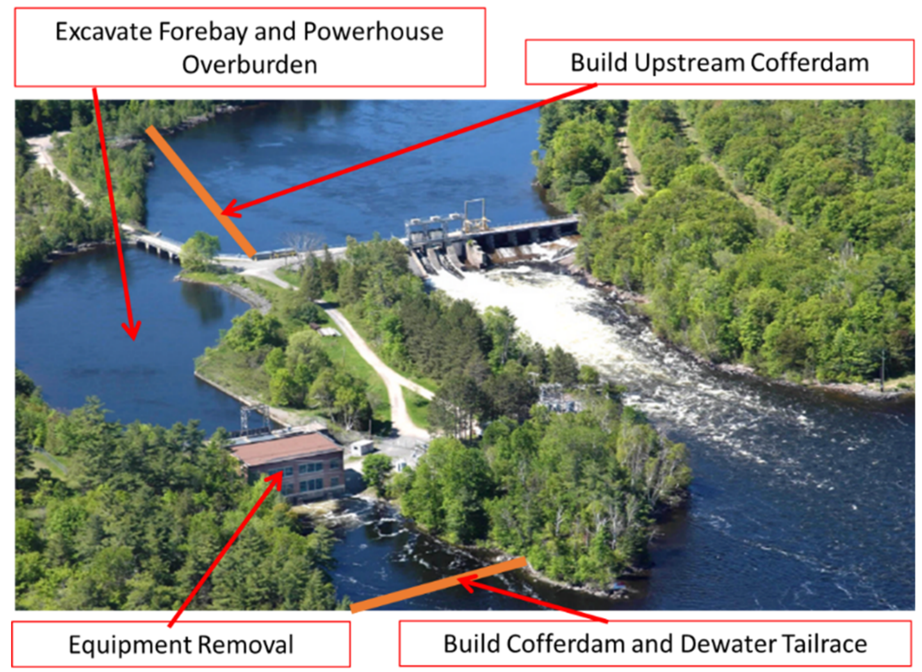
APPENDIX A.5

Department of Fisheries and Oceans

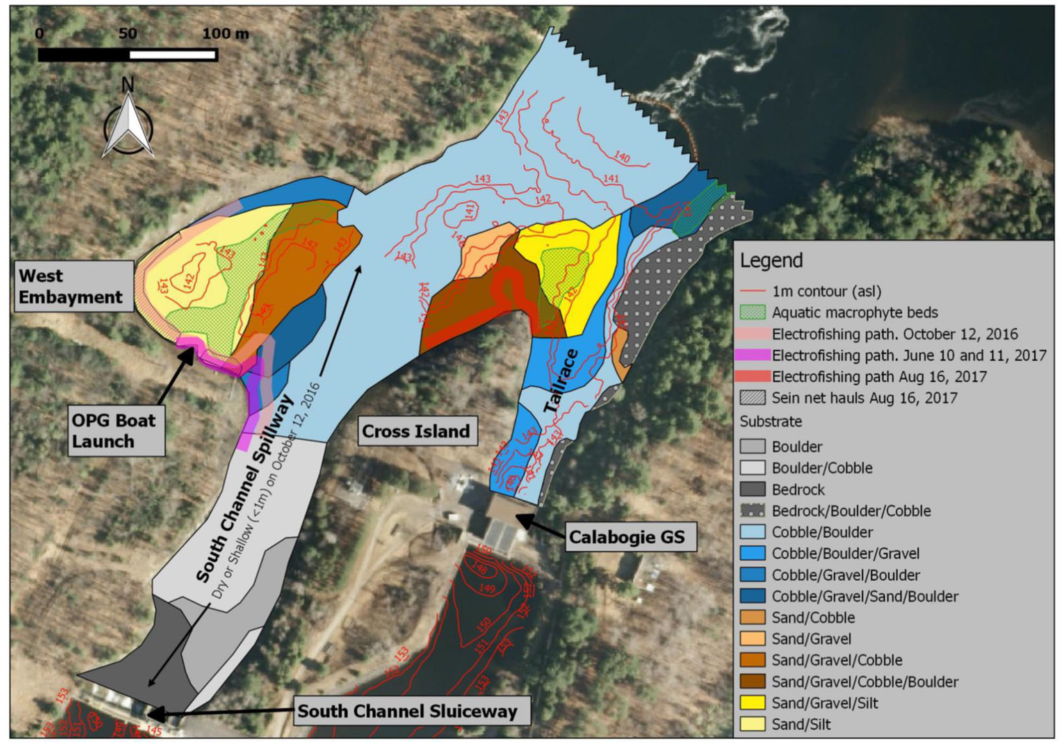
DFO COMMENT AND RESPONSE TABLE

OPG and its contractors have attempted to answer the DFO comments as best as possible at this point in the project. As part of the DFO Request for Review (RFR) process OPG and its contractors will work with DFO to explore and address all necessary questions.

Number	Section, Page Number	DFO Comment	Response
1	Executive Summary, ES-1	Should consider habitat destruction from creation of the new powerhouse. Should also consider duration and extent of site isolation measures.	As part of the DFO Request for Review process, the different fish habitat areas that have potential to be affected by the project will be assessed for productive capacity and a habitat balance for the project will be presented for DFO review. The area from upstream cofferdam to downstream cofferdam is approximately 22,000 m^2 (see figure below for approximate locations of cofferdams). The duration of the dewatered forebay is 9 months for the upstream side (from u/s cofferdam to intake) and 13.5 month for the downstream side (from tailrace to d/s cofferdam). The 9 month duration for the upstream is at the same time as the 13.5 month of the downstream. A new powerhouse will be constructed, approximately 50 metres upstream of the existing powerhouse within the existing forebay. The existing powerhouse will be demolished. The new powerhouse location was selected to be upstream of the existing powerhouse in the forebay to optimize the increased station flow and hydraulic conditions. The locations of the existing powerhouse and new powerhouse are highlighted in the figure below. 

Number	Section, Page Number	DFO Comment	Response
			
2	Executive Summary, ES-1	Can you describe how this will change from current? I.e., zero for how much longer? During what periods? How does this coincide with when fish are using the habitats for various life cycles/periods? Does this change how they might use this area throughout their life cycle? How much area is dewatered as a result of this change in operation?	The DFO reviewer is asking how the fish habitat will change in the South Channel Sluiceway from the present situation, specifically these questions are in response to the paragraph in the Executive Summary that says: "This transfer of flow is expected to result in less extreme flows in the spill channel, potentially creating better conditions for spawning Walleye and other spring-spawning fishes (e.g. White Sucker). Flow through the South Channel Spillway will be zero for longer each year. This area experiences no flow for part of the year under the current conditions. Most of the area remains submerged due to the backwater effect from downstream and the area effected is primarily bedrock and very large boulders. No significant effect on the fish communities is expected." The south spillway channel will remain fully watered at a minimum elevation of 144.2 masl. This is consistent with the historical and existing operation of the facilities. The figure below illustrates the receiving environment bed elevations and substrate in environment of the south spillway. The elevations at the end of the South spillway where fish habitat was observed range from 140-143 masl and the upper portion of the spill way will remain backwatered to minimum elevation of 144.2 masl.

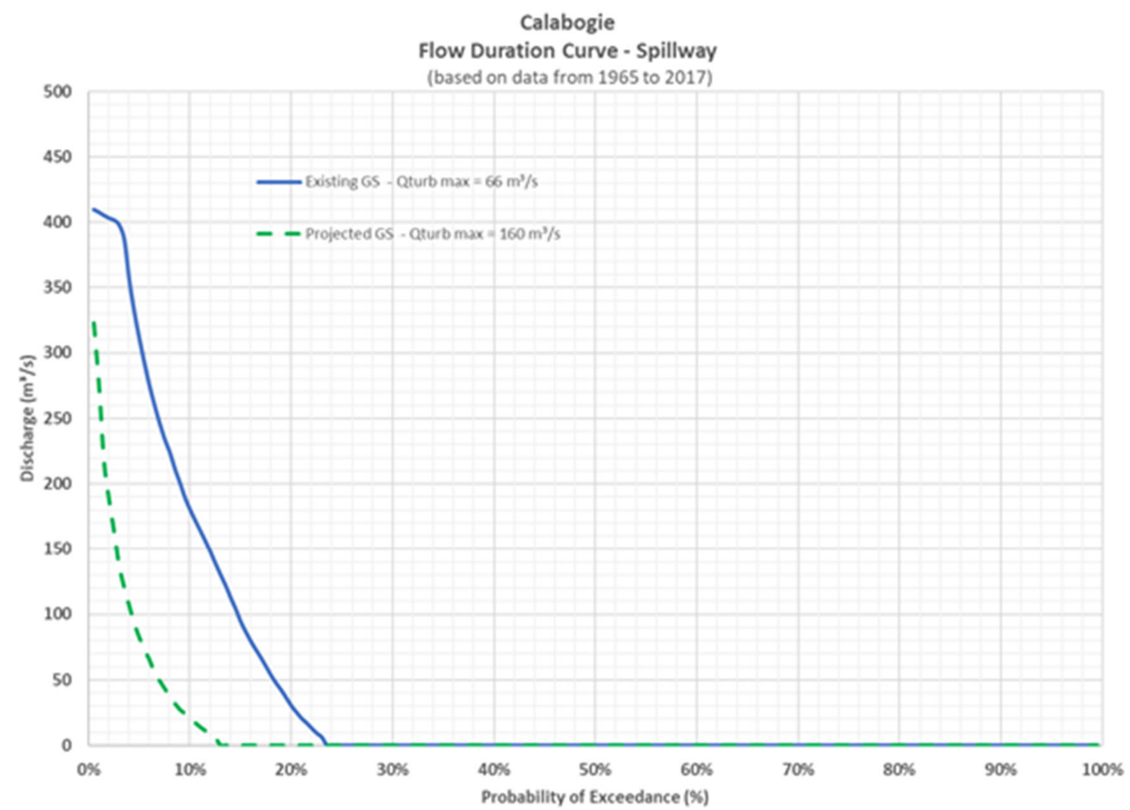
Number	Section, Page Number	DFO Comment	Response
			(see below)

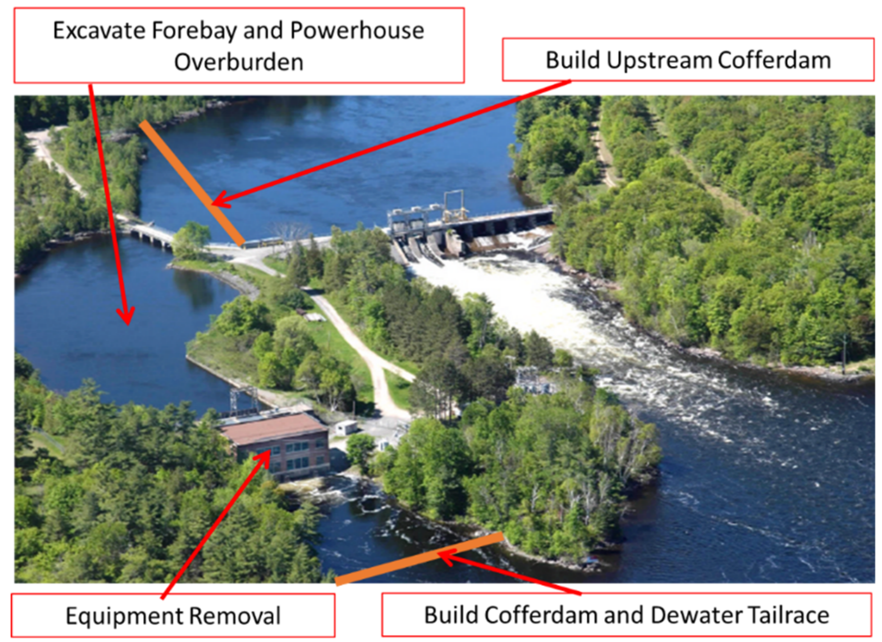


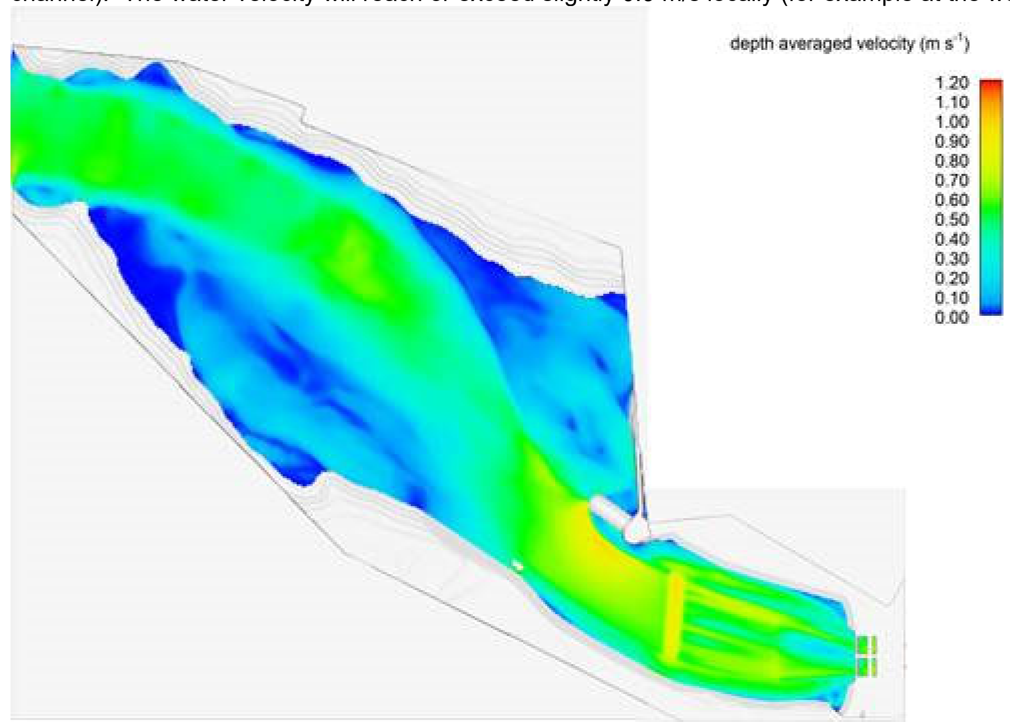
The figure below shows the expected changes of discharge through the spillway (existing GS vs projected GS). With the existing GS, the spillway was in operation about 24% of the time and with the projected GS, the spillway will be in operation about 13% of the time. It should be noted that the overall discharge downstream the junction between the GS tailrace channel and the spillway channel should be the same.

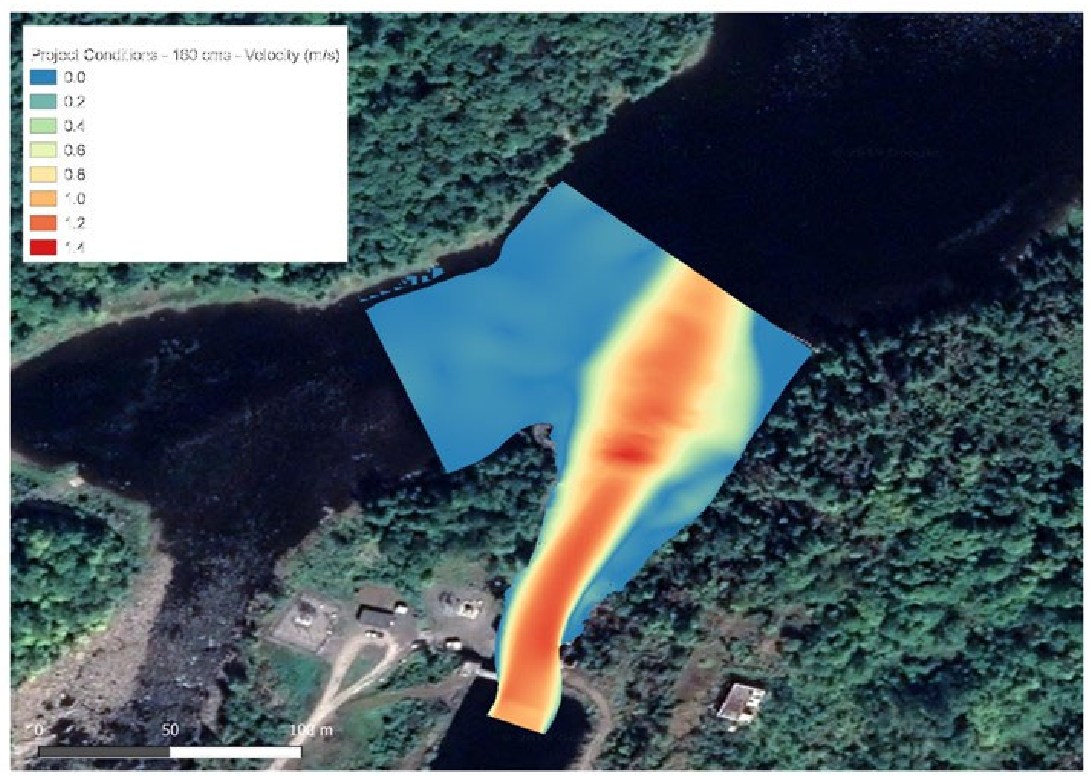
With the existing generating station, conditions in the south spillway range from extremely high flows and velocities during peak flows, typically during spring freshet, to zero flow and velocity during periods when there is no flow through the spillway. As such, the habitat conditions in the South Spillway change markedly as flow varies over the course of a year. At peak flows the upper portion of the South Spillway has velocities so high that it is probably not occupied by fish; if it is it will be by species that are tolerant of high water velocities (i.e. longnose dace) that can shelter amongst boulders. At low flows and velocities that area is suitable for a wide range of species (walleye, centrarchids, catostomids, most cyprinids), but less so for species that prefer higher velocities (i.e. longnose dace). With the new generating station, flows in the South Channel Spillway will be lower during periods of high flow and zero for more of the year. This will extend the period that flows are suitable for species that prefer lower velocities but reduce the length of time that it is suitable for species that prefer high velocities. With the new generating stations, changes in flow through the South Spillway will be less frequent.

This increased stability of habitat conditions can be expected to benefit species that utilize the lower velocity habitats, whether it be for spawning, nursery, or foraging,

Number	Section, Page Number	DFO Comment	Response
			 An application will be submitted to DFO as part of the Request for Review process for the project. As part of that process OPG and SNC-Sullivan would be pleased to investigate this topic more with DFO.
3	Executive Summary, ES-2	Has passage of other fish been considered?	Thank you for the comment. No passage has been considered for species other than American eel at present as Unlike the migratory American Eel, the other fish species will continue to be able to complete their life histories as resident populations within the reach between the Calabogie GS and the Stewartville GS.
4	Executive Summary, ES-2	Are there improvements to reduce eel mortality if they do pass? Could this be retrofitted also?	This comment was made in response to the statement: "not able to pass American Eel and therefore represents an overall net benefit." We believe this question was asked by the DFO reviewer before reading the entire Report. This question is answered later in the Report where there is a discussion on screen spacing and deployment of upstream measures to protect downstream migrating eel once they are present upstream of the station. The goal of the design is to avoid eel mortality once a population becomes established in the watershed upstream of the generating station by the future implementation of screens and a bypass structure.

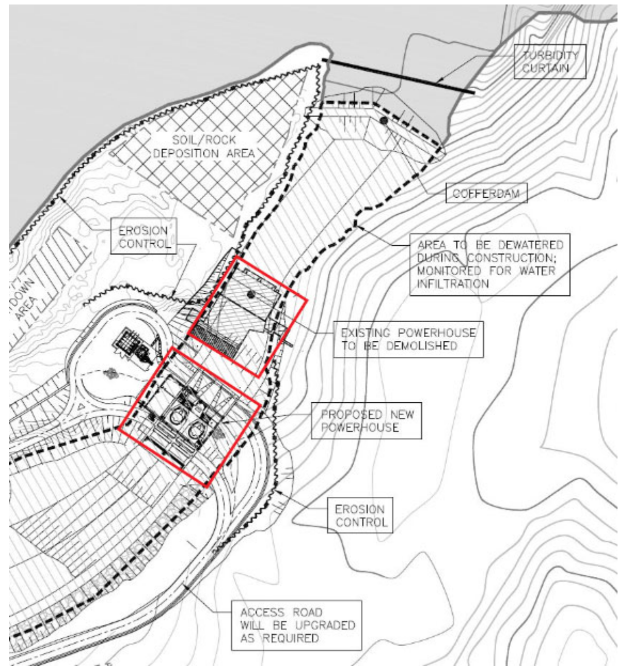
Number	Section, Page Number	DFO Comment	Response
5	2.4.2, 2-11	Are there footprints of the dewatered areas? If these are elsewhere in the document, please ignore.	OPG agrees and will provide a detailed assessment of habitat changes associated with the new project as part of the DFO review process. The assessment will account for both temporary and permanent changes and opportunities to balance habitat productivity will be investigated. The different fish habitat areas that have potential to be affected by the project will be assessed for productive capacity and a habitat balance for the project will be presented for DFO review. The area from upstream cofferdam to downstream cofferdam is approximately 22,000 m^2 (see figure below for approximate locations of cofferdams). The duration of the dewatered forebay is 9 months for the upstream side (from u/s cofferdam to intake) and 13.5 months for the downstream side (from tailrace to d/s cofferdam). The 9 month duration for the upstream is at the same time as the 13.5 month of the downstream. 
6	2.4.2, 2-11	This sounds like it has now been submitted as a separate project, at least to DFO.	OPG has recently dewatered the forebay for the purpose of making the tornado damaged powerhouse safe. The project was already reviewed by DFO.
7	2.4.3.1, 2-15	Not clear what this means.	This comment is in response to the statement: "The existing forebay is shallow and contains simple fish habitat and is shown in Figure 2-12 below." Thank you for the comment. The fish habitat in the forebay was observed as being 'simple' due to the absence of shoreline features, bathymetric complexity, absence of aquatic macrophytes or coarse woody debris, and the absence of any unique or limiting habitat.
8	2.4.3.1, 2-16	Clarify what the trash rack size is suitable for. Have other options been considered?	These two comments are in response to the paragraph: "The new powerhouse intake will be integral with the new powerhouse and will be constructed of reinforced concrete. The intake will be equipped with trashracks, suitably sized and with bar spacing to mitigate in as much as possible, fish entrainment. The trashracks will cover the complete area of the turbine water passage intakes. The new trashrack bar spacing will remain consistent with the trashrack spacing at the existing Calabogie GS, with 50 mm clear space between the trashrack bars." The intake design proposed for the Calabogie GS is specifically designed with a slow, fish friendly, and with maximum approach velocity of 0.9 m/s upstream of the trash racks (velocity measured 75 mm upstream of the trashracks). These approach velocities minimize the risk of fish entrainment and impingement. The trashracks will cover the complete area of the turbine water passage intakes. The new trashrack bar spacing will remain consistent with the trashrack spacing at the existing Calabogie GS, with 50 mm clear space between the trashrack bars. The trashracks spacing will be modified in the future to a finer mesh of <20 mm during periods of the year when eel migration is anticipated to occur when a population is present upstream of the facility.

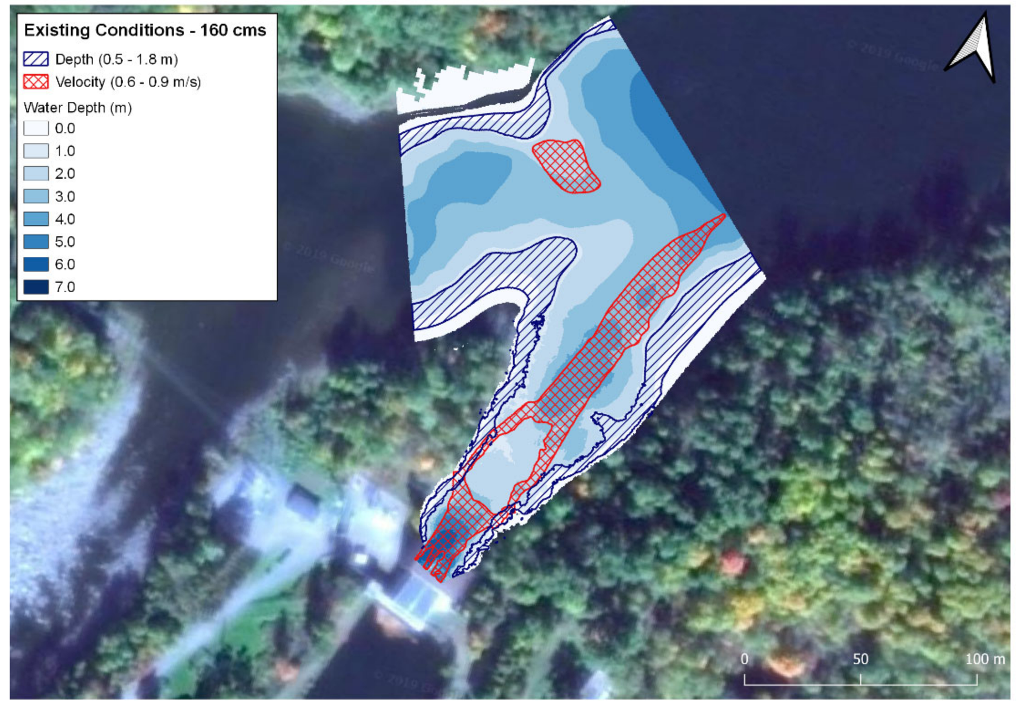
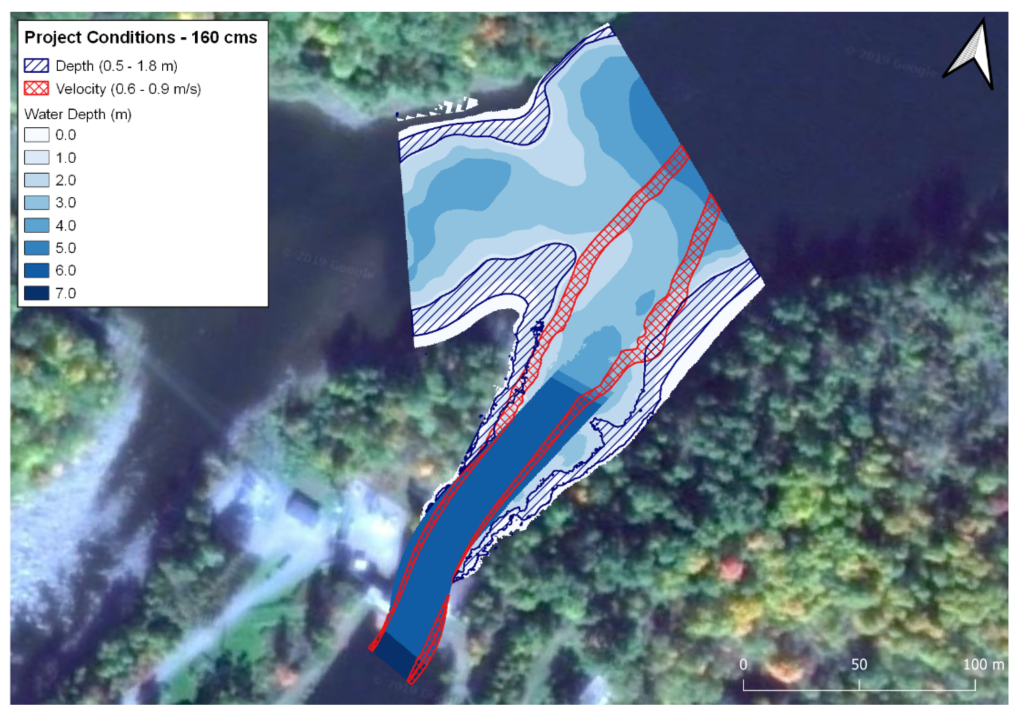
Number	Section, Page Number	DFO Comment	Response
9	2.4.3.1, 2-17	Can you provide details on the type of model, what went into the models, and the resolution of the modeling? Under what flow scenario is being shown here? What is the range of intake velocities that may be experienced given the range of conditions you might find at this site.	Several models were used to design the project. Physical models were used to design the intake, 3D hydro technical models were used for the flow modelling and simulations based on historic inflows where used to understand if there were potential changes to the receiving environment. As shown on the figure below, the average depth velocity in the intake channel for a discharge of 160 m³/s will vary between 0.5 and 1.0 m/s based on our latest modeling (final version of the intake channel). The water velocity will reach or exceed slightly 0.9 m/s locally (for example at the weir located in the approach channel).  The details of the models used include: • Flow3D for 3D hydrodynamic analysis (CFD modeling). This model is developed by Flow Science and is a commercial software. This model was utilized for the design of the approach channel and the intake geometry of the new Calabogie powerhouse. • Physical hydraulic model with scale 1:34 of the approach channel and the intake of the new Calabogie powerhouse. The provider is LaSalle|NHC hydraulic laboratory in Montreal. This model complements the CFD study of the powerhouse approach conditions. • HEC-RAS 2D for 2D hydrodynamic analysis. This model is developed by the USACE and is open domain. This model was utilized for the design of the tailrace channel.
10	2.4.3.4, 2-23	I'm confused on why the velocities are lower through the tailrace in this scenario than in the scenario where there is 66 cms through the powerhouse and 0 cms through the south branch?	We think you may be confusing the Figures. But you may also want to look closer at Figure 2-16 which shows the existing velocities at the current powerhouse at 66 cms and 0 cms through South Branch. The figure below shows the existing velocities at the current powerhouse at 66 cms and 0 cms through South Channel spillway. This figures below show receiving environment flow conditions for existing and future conditions and shows that the existing powerhouse has relatively high exit velocities (>1.4 m/s) downstream of the powerhouse. The new powerhouse receiving environment has bee specifically designed to have lower velocities (>1.0 m/s maximum) despite increased plant flow of 160 m³/s.

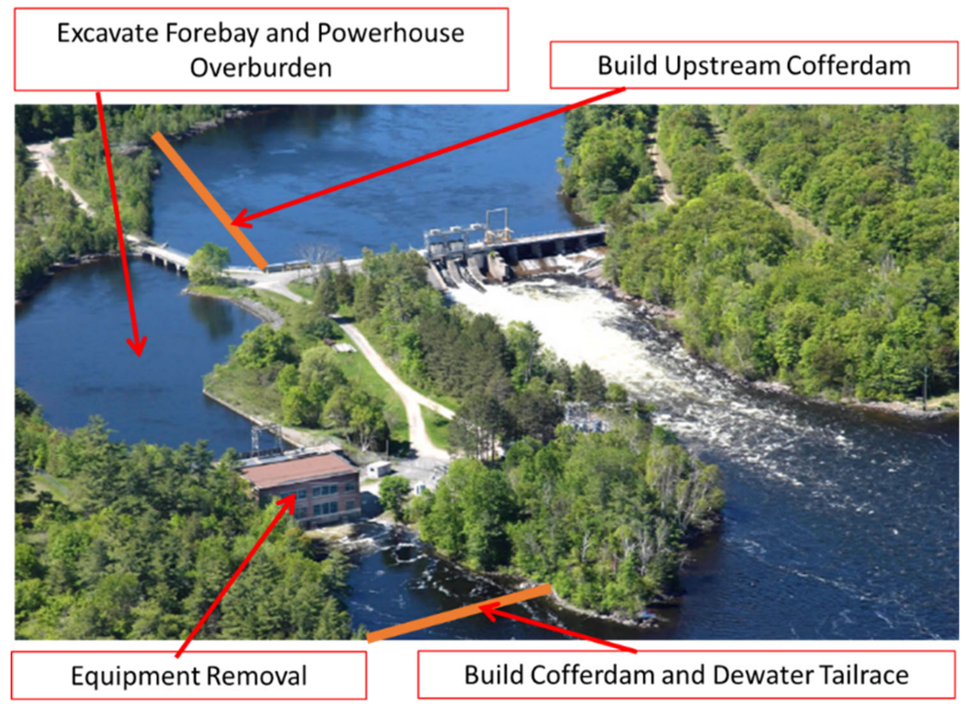
Number	Section, Page Number	DFO Comment	Response
			

Number	Section, Page Number	DFO Comment	Response
10.1	2.4.3.5, 2-25	Can a description of the final tailrace substrate be provided.	OPG agrees and will provide a detailed assessment of habitat changes associated with the new project as part of the DFO review process. The tailrace is being specifically designed to take advantage of opportunities to balance habitat productivity for the project. The tailrace is mostly drill and blasted bedrock channel. We agree that if required, OPG could create and place habitat in the tailrace channel.
11	2.4.3.5, 2-25	Does this mean trash rack spacing?	It is necessary to install a narrow bar spacing to prevent eel from becoming entrained. It will also work as a trash rack but it will be seasonally deployed once an eel population becomes established upstream of the generating station.
12	2.6, 2-35	What are the consequences of shutdowns with regards to fish habitat in the tailrace? will areas be dewatered and will there be stranding of fish? What are the mitigation measures proposed to reduce the impacts of this?	This comment is in response to the paragraph: “Annual maintenance and overhauls for the redeveloped plant may require shut down of the units and will normally be scheduled when the flows are lowest and the loss of generation can be minimized. Major overhauls require the units to be out of service for 1 to 2 months and would likely only be required every 10 to 15 years.” In the future, the forebay will no longer be dewatered for inspection and maintenance activities due to the removal of the forebay inlet structure. The risk of stranding fish is low during shutdowns because units can be dewatered at the powerhouse and the new tailrace and spillway area will remain watered (minimum level of 144.2 masl, with the bottom of the tailrace 139.0 masl). The sides of the tailrace will be specifically designed to avoid horizontal area that could isolate fish. A site inspection will be undertaken if stranding risk is identified, but none is anticipated as there will always be water in the forebay and tailrace when the stations is offline.
13	2.7, 2-36	I was anticipating details on decommission/removal of the existing structure, realizing that a new one will be built?	The details of the decommissioning of the existing generating station involve isolating the site within cofferdams. The existing inlet structure/sluices allows the forebay to be isolated and excavation work to begin. Following the July 15th fish window, an upstream cofferdam will be constructed to allow removal of the existing inlet structure in the dry and rock excavation to continue. The upstream cofferdam will be constructed from blasted rock that has been excavated to accommodate the new powerhouse. Clean blast rock will be placed upstream 5.8 metres wide, with a slope of 1.5H:1V to elevation 155.17 across the width of the inlet. The upstream face of the cofferdam will be lined with a heavy-duty cofferdam membrane and sealed to the riverbed with a bentonite clay seal. Upon completion of the powerhouse, the liner and blasted rock and overburden will be removed, and the channel will be graded with rockfill. A downstream cofferdam is required to isolate the downstream side of the construction and allow for the demolition of the existing powerhouse and construction of the new powerhouse and tailrace. The proposed cofferdam is a rockfill dam with an impervious geomembrane on the water side of the cofferdam. Seepage through the cofferdam will be collected and directed to a settling pond prior to discharge back into the river.
14	3.2.5.4, 3-27	Has anyone done an assessment?	To the best of OPGs knowledge no fall-spawning fishes are known to occur in the reach of the Madawaska River between the Calabogie GS and the Stewartville GS. The fish species that are present in the Madawaska River are listed, by reach, in *Fisheries Management in Renfrew County: A State of the Resource Report and a Focused Review of Fisheries Issues* (MNRF. 2008. 101 p). This document indicates that Lake Whitefish and Cisco are not present in the reach between Calabogie Dam and Stewartville Dam. Lake Whitefish and Cisco occur in the reach upstream, between Calabogie and Barrett Chute. Lake Whitefish occur in the reach downstream, between the Stewartville Dam and Arnprior. C. Portt and Associates staff (consultants to OPG) specifically asked MNRF staff if, based on the fish community, fall spawning investigations were warranted for the project and were told that they were not (email communications between George Coker and Kirby Punt). The purpose of restrictions on the timing of in-water work is to prevent eggs and embryos from being adversely affected, either directly or by sediment transported from the site. There does not appear to be habitat suitable for spawning by Lake Whitefish or Cisco within or immediately upstream from the Calabogie headpond. Cofferdam installations and dewatering at Calabogie would not pose a risk to eggs or embryos located downstream of the Stewartville Dam, which is approximately 20 km downstream. Therefore, it is OPG’s opinion that applying the timing window to prevent spring spawning species is appropriate.
15	3.2.5.6, 3-30	Please provide details of the walleye surveys: Were these night time spotlight surveys? How much effort (i.e., time spent) for each day, for this and reference? How accessible is the site? If the water is deep/turbulent, how feasible is it that you would reflect wae eyes?	Thank you for the comment. The DFO Reviewer found the information they are looking for in the Appendix.
16	3.2.5.7, 3-35	Why isn't the spawning aggregation of River Redhorse included here?	This comment is in response to Table 3-8. Table 3-8 presents the results of underwater video observations. The spawning River Redhorse were observed from the surface.

Number	Section, Page Number	DFO Comment	Response
17	4.1.2.2, 4-4	Please provide an estimate of areas to be dewatered and duration they are dewatered for.	The area from upstream cofferdam to downstream cofferdam is approximately 22,000 m^2. The duration of the dewatered forebay is 9 months for the upstream side (from u/s cofferdam to intake) and 13.5 months for the downstream side (from tailrace to d/s cofferdam). The 9 month duration for the upstream is at the same time as the 13.5 month of the downstream. The existing inlet structure/sluices allows the forebay to be isolated and excavation work to being. Following the July 15th fish window, an upstream cofferdam will be constructed to allow removal of the existing inlet structure in the dry and rock excavation to continue. The upstream cofferdam will be constructed from blasted rock that has been excavated to accommodate the new powerhouse. The upstream face of the cofferdam will be lined with a heavy-duty cofferdam membrane and sealed to the riverbed with a bentonite clay seal. Upon completion of the powerhouse, the liner, blasted rock and overburden will be removed, and the channel will be graded with rockfill. A downstream cofferdam is required to isolate the downstream side of the construction and allow for: the demolition of the existing powerhouse and construction of the new powerhouse and tailrace. The proposed cofferdam is a rockfill dam with an impervious geomembrane on the water side of the cofferdam. Seepage through the cofferdam will be collected and directed to a settling pond prior to discharge back into the river.
18	4.1.2.2, 4-5	What are the details of the dewatering of the area downstream of the cofferdam?	The existing inlet structure/sluices allows the forebay to be isolated and excavation work to begin. A fish salvage plan will be developed for the project and any fish will be collected and liberated into appropriate habitat downstream receiving environment. Following the July 15th fish window, an upstream cofferdam will be constructed to allow removal of the existing inlet structure in the dry and rock excavation to continue. A downstream cofferdam is required to isolate the downstream side of the construction and allow for: the demolition of the existing powerhouse and construction of the new powerhouse and tailrace. The proposed cofferdam is a rockfill dam with an impervious geomembrane on the water side of the cofferdam. Seepage through the cofferdam will be collected and directed to a settling pond prior to discharge back into the river. It is expected that groundwater infiltration or surface water runoff (including cofferdam leakage) could require pre-treatment prior to discharge. To collect water infiltration, sumps will be excavated at key locations of the excavation and pumps will be installed to dewater the area. If necessary, the water will be pumped into settling pond(s), silt treatment bags, and vegetated areas to mitigate any environmental issues that may arise from the dewatering. Should the water require secondary treatment for dissolved metals, proper measures will be taken including necessary permits and approvals.
19	4.1.2.2, 4-5	Mussels were observed. Will there be a mussel rescue?	Thank you for the comment. A mussel relocation will occur as part of the fish relocation program if they are present during cofferdam dewatering.
20	4.1.2.2, 4-5	Is there a restoration plan to restore isolated areas when work is completed?	OPG agrees and will provide a detailed assessment of habitat changes associated with the new project as part of the DFO review process. The assessment will account for both temporary and permanent changes and opportunities to balance habitat productivity will be investigated. The goal of the fish habitat design process is to balance the effects from the project so there is a no-net-loss of fish habitat.
21	4.1.3.1, 4-8	Please provide footprint and duration.	This comment was made in relation to the sentence: "The area between the temporary cofferdam at the downstream end of the tailrace and the existing control structure at the upstream end of the forebay will be dewatered during construction." OPG and SNC Sullivan agree and will provide a detailed assessment of habitat changes associated with the new project as part of the DFO review process. The assessment will account for both temporary and permanent changes and opportunities to balance habitat productivity will be investigated. The area from upstream cofferdam to downstream cofferdam is approximately 22,000 m^2. The duration of the dewatered forebay is 9 month for the upstream side (from u/s cofferdam to intake) and 13.5 month for the downstream side (from tailrace to d/s cofferdam). The 9 month duration for the upstream is at the same time as the 13.5 month of the downstream.
22	4.1.3.3, 4-9	It seems that steps could be taken in design of the new tailrace to offer habitat for fish. Has this been considered?	As previously mentioned OPG will provide a detailed assessment of habitat changes associated with the new project as part of the DFO review process. The assessment will account for both temporary and permanent changes and opportunities to balance habitat productivity will be investigated. The tailrace has been specifically designed for low velocities to improve habitat conditions for fish.
23	4.1.3.6, 4-9	Figure 3-9 it looks like cobble/ boulder/ gravel	Agreed – thank you - cobble/ boulder/ gravel is located at this location.

Number	Section, Page Number	DFO Comment	Response
24	4.1.3.7.1, 4-10	Once you have final designs, please provide footprint of new powerhouse.	The footprint inside the existing forebay is approximately 2,400 m^2. The exact foot footprint will be provided in the final design and will be included in the habitat balance for the project. 
25	4.1.3.7.1, 4-10	Thank you for including this part, but will be interested to see the footprints of the excavation, and an analysis of how this change will affect the habitat, and the use of this habitat by fish species present. Particularly, there seems potential for impacts to walleye spawning habitat availability.	The excavation depth varies from in the forebay. The average excavation depth in the upstream side of the powerhouse is 3 m. Excavation is approximately 12 m for the powerhouse and the tailrace varies with average of 1 m. The substrate of the entire forebay will be modified and will mostly be in drilled and blasted rock with riprap on the channel sides. The tailrace receiving environment is being modeled to understand the depth and velocity profiles relative to fish preferences. This information will be used to understand the distribution of bed material that could be used as spawning or rearing habitat. We are currently exploring a range of habitat variables (Habitat Suitability Indices) that are specific to walleye spawning and rearing (E.G. McMahon 1984 - Habitat Suitability Index Models: Walleye (Depth 0.5 to 1.8 m, Velocity 0.6-0.9 m/s). The figures presented below illustrate exiting fish depth and velocity preferences for the existing vs the project conditions at the same discharge.

Number	Section, Page Number	DFO Comment	Response
			

Number	Section, Page Number	DFO Comment	Response
26	4.1.3.7.1, 4-10	Again, would like to see the footprint once design is finalized.	OPG agrees and will provide a detailed assessment of habitat changes associated with the new project as part of the DFO review process. The assessment will account for both temporary and permanent changes and opportunities to balance habitat productivity will be investigated. The different fish habitat areas that have potential to be affected by the project will be assessed for productive capacity and a habitat balance for the project will be presented for DFO review. The area from upstream cofferdam to downstream cofferdam is approximately 22,000 m^2 (see figure below for approximate locations of cofferdams). The duration of the dewatered forebay is 9 month for the upstream side (from u/s cofferdam to intake) and 13.5 month for the downstream side (from tailrace to d/s cofferdam). The 9 month duration for the upstream is at the same time as the 13.5 month of the downstream. 
27	4.1.3.7.1, 4-10	How long will this area not receive flow for in a given year (based on average conditions, low water conditions, and high water conditions)? How does that compare to existing (or previous) operation? How rapidly will flow through this sluiceway be reduced? Is there potential for stranding of fish as a result?	The area will remain backwatered at a minimum elevation of 144.2 and will not have any periods where there is no water in channel. The current flow reduction rates in the spillway will be maintained as in current conditions and are not known to strand fish. The figure below shows the expected changes of discharge through the spillway (existing GS vs projected GS). With the existing GS, the spillway was in operation about 24% of the time during the January – March periods and with the projected GS, the spillway will be in operation about 13% of the timed during the January – March period. It should be noted that the overall discharge downstream the junction between the GS tailrace channel and the spillway channel should be the same.

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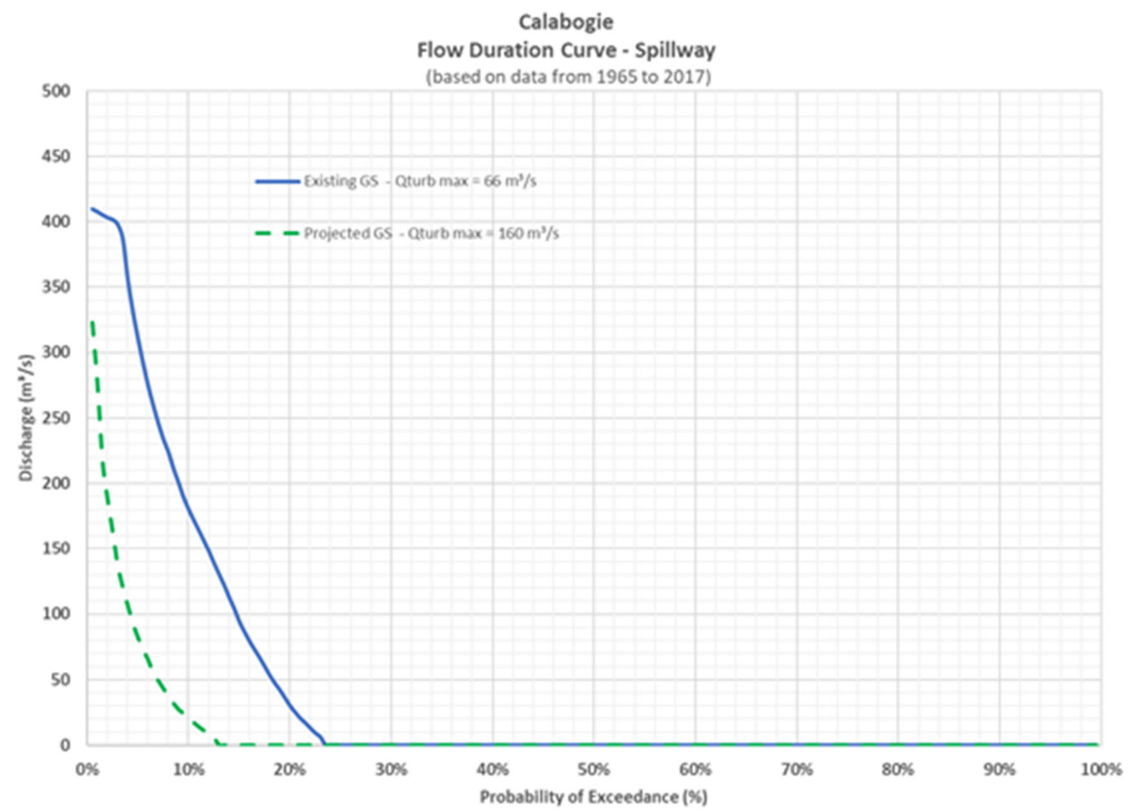
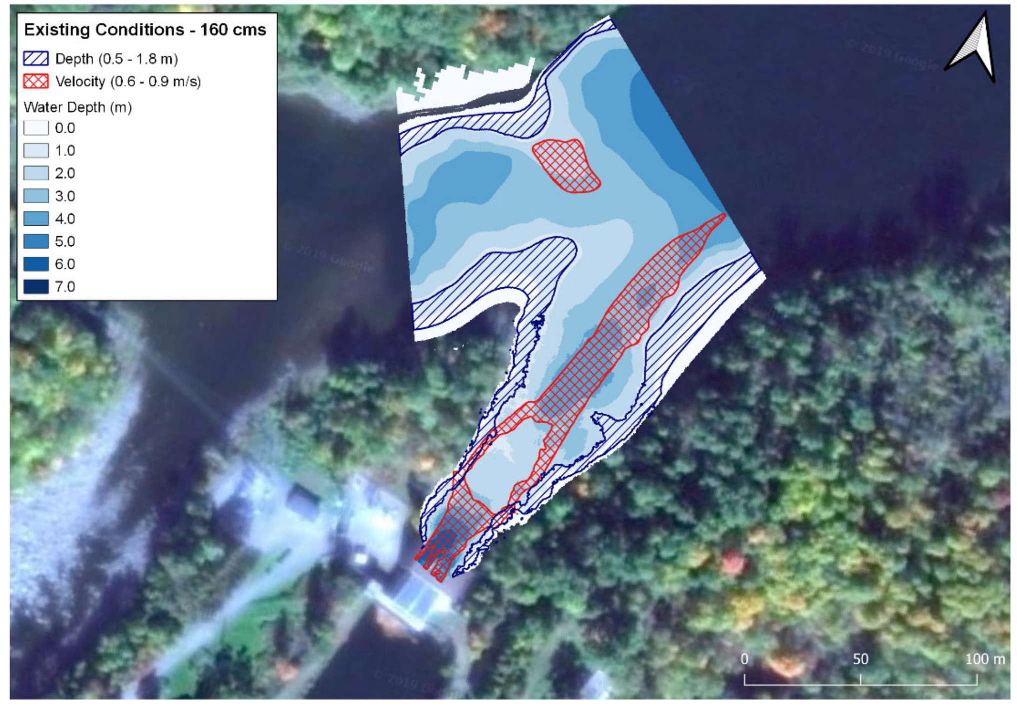
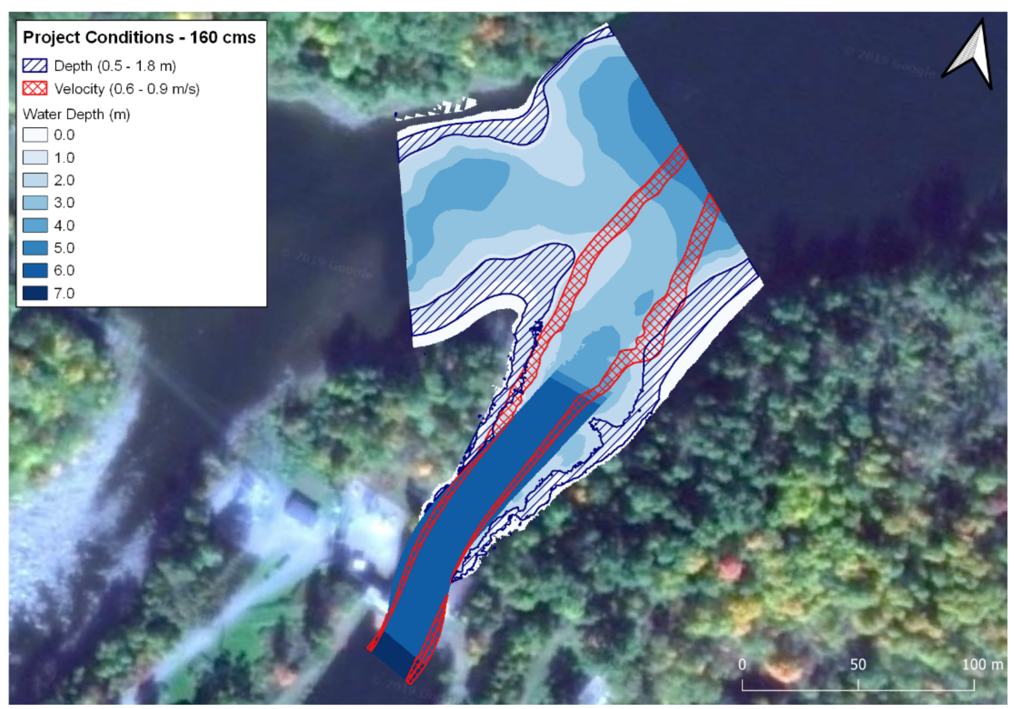
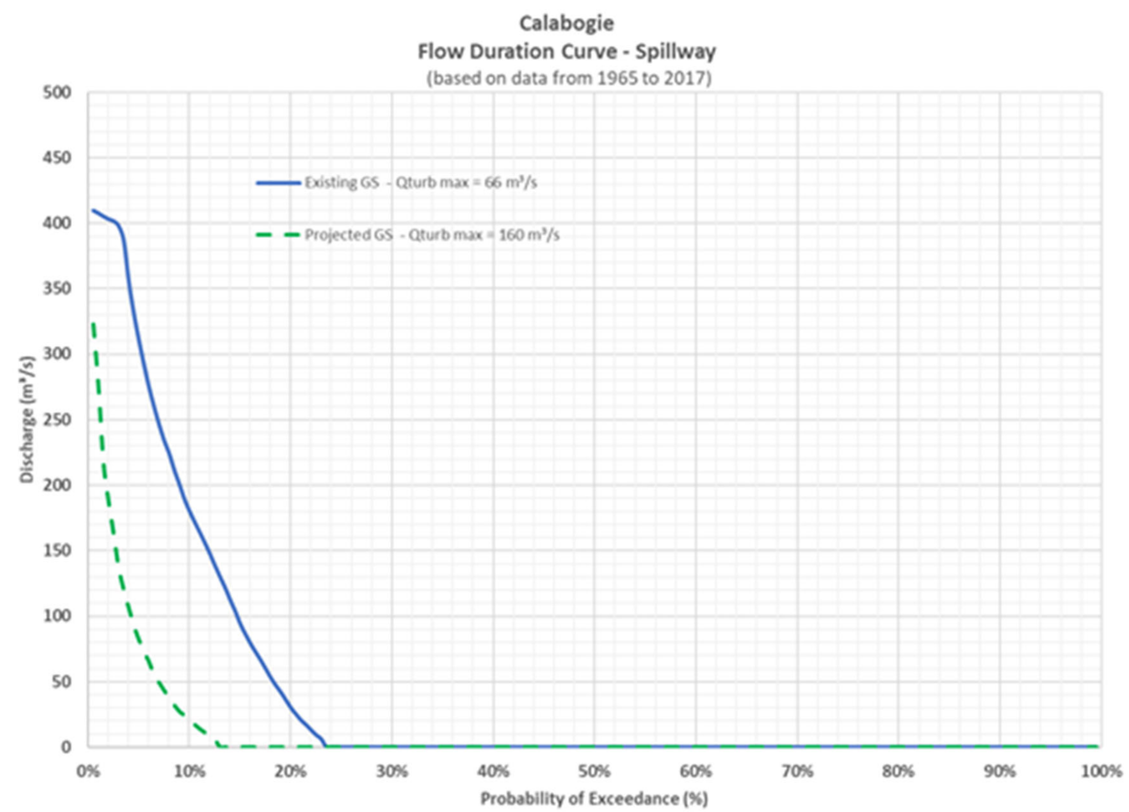
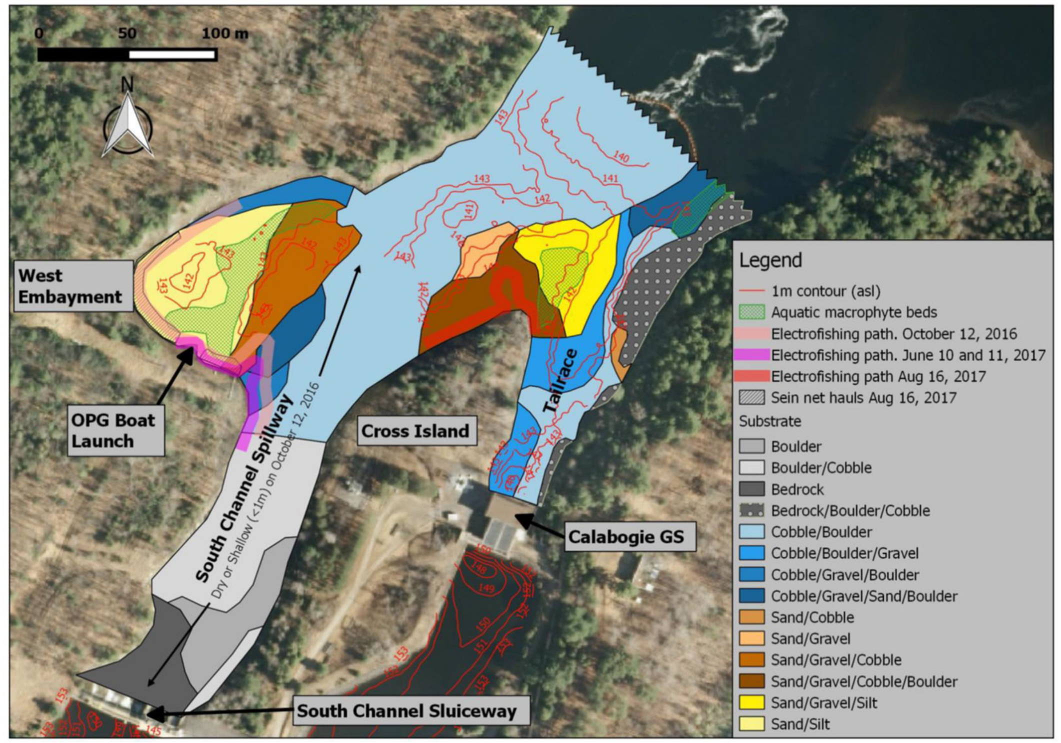
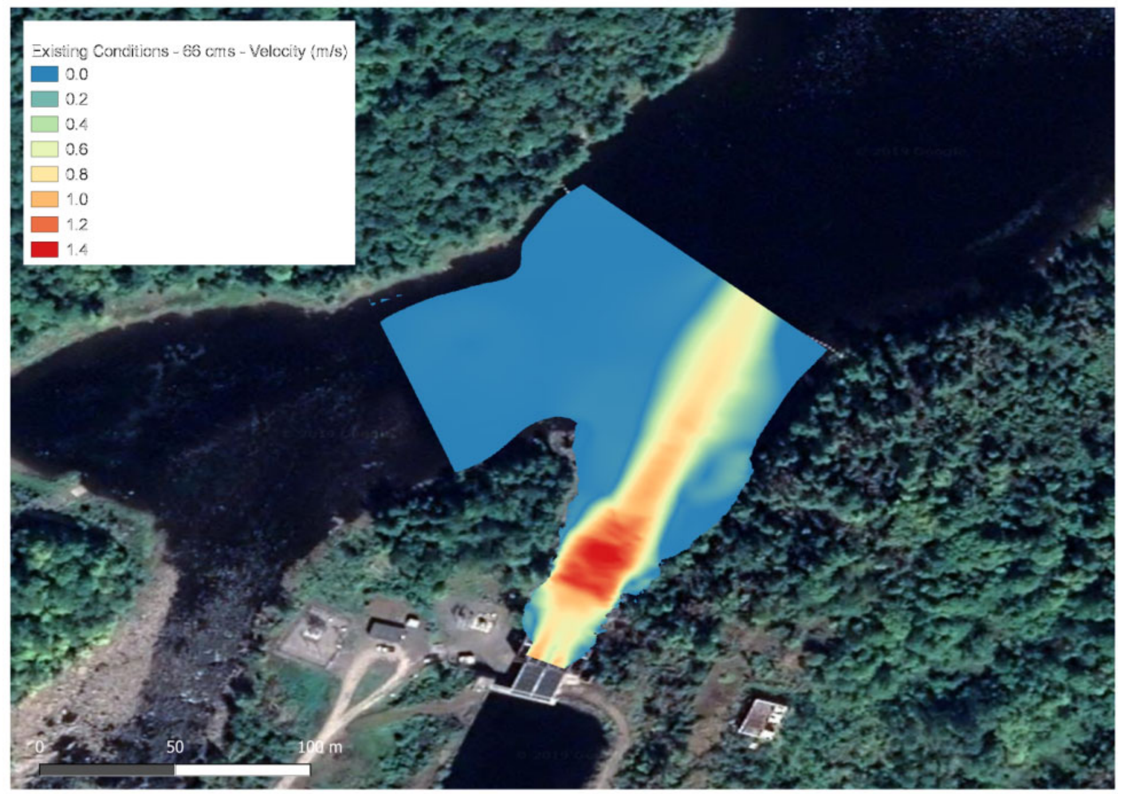
			
28	4.2.6, 4-12	I had an earlier comment in the doc that I think is answered by this if the station is built so that it can be retrofitted in such a way. However, I wonder if this couldn't be done upon construction, instead of retrofitting, because it would reduce fish mortality.	An approach velocity of 0.9 m/s has been the design criteria for an 'eel ready' design. The current design has velocities no more than 0.9 m/s, modeled 75 mm upstream of trash rack at the normal minimal reservoir elevation. Downstream measures wouldn't be deployed until the life-history phase of downstream migratory eels are present in the upper portion of the watershed. Putting fine spaced trash rack mitigations in place introduces head losses and negatively affects operations, however OPG specifically designed approach velocities and trash rack spacing to prevent impingement and fish mortality with the understanding that a population of eels will eventually be re-established.
29	4.2.7.1, 4-13	But above there is a description that it may go from boulder/cobble to bedrock, and as noted in this document, bedrock does not offer as much habitat cover/food + spawning opportunities.	The excavation depth varies from in the forebay. The average excavation depth in the upstream side of the powerhouse is 3 m. Excavation is approximately 12 m for the powerhouse and the tailrace varies with average of 1 m. The substrate of the entire forebay will be modified and will mostly be in drilled and blasted rock with riprap on the channel sides. The tailrace receiving environment is being modeled to understand the depth and velocity profiles relative to fish preferences. This information will be used to understand the distribution of bed material that could be used as spawning or rearing habitat. We are currently exploring a range of habitat variables (Habitat Suitability Indices) that are specific to walleye spawning and rearing (E.G. McMahon 1984 - Habitat Suitability Index Models: Walleye (Depth 0.5 to 1.8 m, Velocity 0.6-0.9 m/s) The figures presented below illustrate exiting fish depth and velocity preferences for the existing vs the project conditions at the same discharge.

Number	Section, Page Number	DFO Comment	Response
			 

Number	Section, Page Number	DFO Comment	Response
30	4.2.7.1, 4-13	How often will the south sluice receive no flow during the walleye spawning period (e.g., 20% of years)?	The figure below shows the expected changes of discharge through the spillway (existing GS vs projected GS). With the existing GS, the spillway was in operation about 24% of the time and with the projected GS, the spillway will be in operation about 13% of the time. It should be noted that the overall discharge downstream the junction between the GS tailrace channel and the spillway channel should be the same. 

Number	Section, Page Number	DFO Comment	Response
31	4.2.7.1, 4-13	How much area will be dry for longer periods of time because of this change?	Consistent with the historical operation of the facilities the south spillway channel will remain watered at a minimum elevation of 144.2 masl and there will not be any periods when there is no water in channel. The figure below illustrates the receiving environment bed elevations and substrate in environment of the south spillway. The elevations at the end of the South spillway where fish habitat was observed range from 140-143 masl and the upper portion of the spill way will remain backwatered to minimum elevation of 144.2 masl. 
32	4.2.7.1, 4-13	This would need to be monitored.	A monitoring plan could be developed as the discussions with DFO progress, however the current flow reduction rates in the spillway will be maintained as in current conditions and are not known to strand fish. There is little or no potential for fish stranding in the South Spillway because it remains backwatered even when it receives zero flow.
33	4.2.7.3, 4-14	Earlier it is described as a peaking plant (pages 16, 45).	This comment is in response to statement: “The existing flow regime through the North Channel will be maintained, and because the Calabogie GS will remain a run-of-the-river plant and OPG is obligated to maintain the existing water level regimes upstream and downstream of the GS, it is believed that the reconstructed GS will not affect habitat utilization by any fish species, except in the immediate vicinity of the South Channel Spillway and the GS tailrace.” The larger capacity plants upstream and downstream of Calabogie G.S. are peaking plants. Based on their design they are capable of passing increased flows over shorter durations of time to align with peak electrical system demands. Calabogie will remain as a smaller capacity plant in comparison. Calabogie has traditionally utilized a combination of generating units and spill to pass water within regulatory limits. With the increased generation capacity of the new facility and the existing limited storage capacity, more water will pass through the generating units and less will be spilled on average, resulting in the same basic operating regime as occurred with the original plant. The result of this is that longer discharge times will generally continue to occur at Calabogie compared to the peaking plants upstream and downstream. Flows and levels will remain unchanged as per the WMP.
34	4.2.7.3, 4-14	And the current GS intake channel, as part of it won't be fish habitat anymore.	This comment is in relation to the sentence: “it is believed that the reconstructed GS will not affect habitat utilization by any fish species, except in the immediate vicinity of the South Channel Spillway and the GS tailrace.” The reviewer is correct. A portion of the footprint of the existing intake channel immediately upstream of the old generating station will become the new generating station and will not be fish habitat.

Number	Section, Page Number	DFO Comment	Response
35	4.2.7.3, 4-14	How will this impact walleye spawning in this area? How will this impact how other fish use this area?	This comment is in relation to the sentence: "In the future, at total flows above approximately 60 cms, flow velocities in the tailrace will be similar or higher and flow velocities in South Channel Spillway will be lower than they are currently." Flow velocity in the South Spillway Channel will be lower since more water will go through the projected GS. For the tailrace channel the flow velocity for the projected conditions at 160 m^3/s will be in the same range than the flow velocity for the existing conditions at 66 m^3/s. The figures below shows the existing velocities at the current powerhouse at 66 cms and 0 cms through South Channel spillway. These figures below show receiving environment flow conditions for existing and future conditions and shows that the existing powerhouse has relatively high exit velocities (>1.4 m/s) downstream of the powerhouse. The new powerhouse receiving environment has been specifically designed to have lower velocities (~1.0 m/s maximum) despite increased plant flow of 160 m^3/s. 

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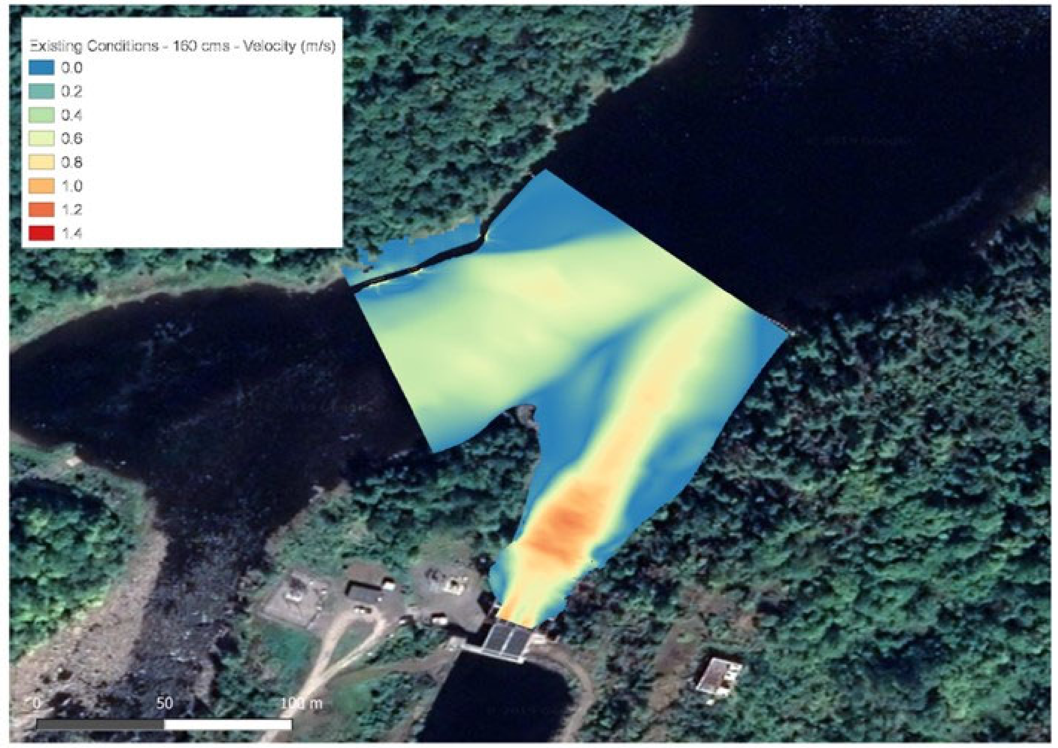
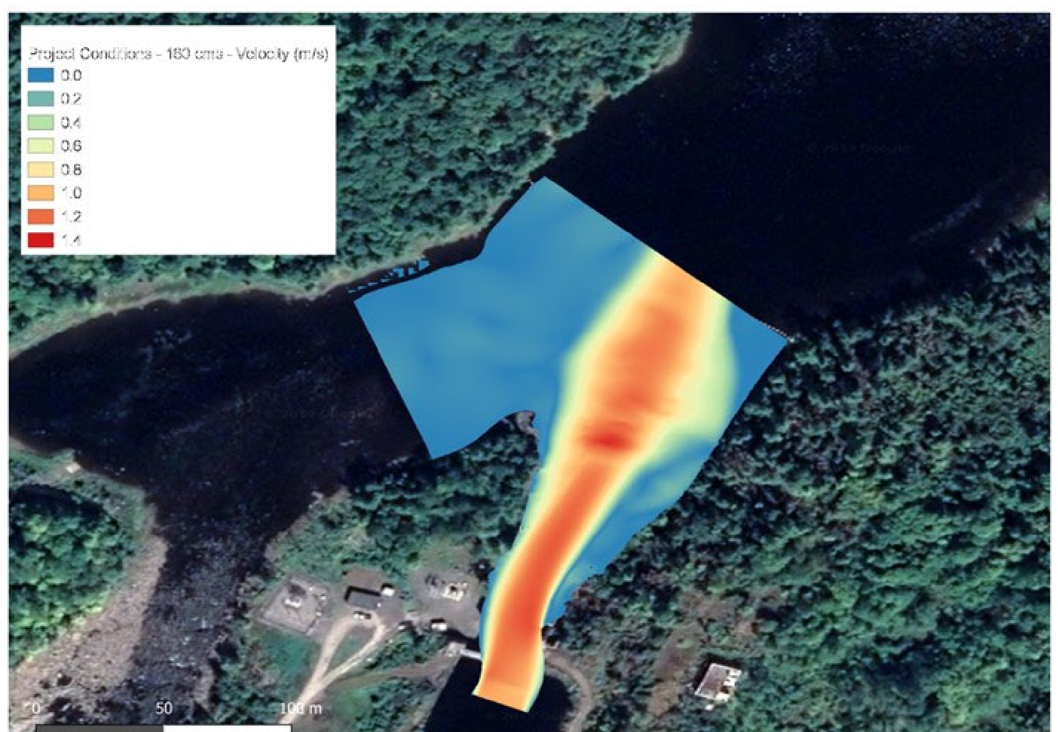
			 

Number	Section, Page Number	DFO Comment	Response
			The South Spillway does not reliably provide habitat suitable for Walleye spawning under current conditions. The volume of flow through the South Spillway during the walleye spawning period varies from zero (except for dam leakage) in dry springs to >400 cms (refer to graph in response to comment 41) in a wet year. At zero flow through the spillway there is abundant suitable spawning substrate (Rosien, 1999) but velocities would not be conducive to walleye spawning except at the very base of the dam where leakage would result in higher velocities than in most of the spillway. At high spill rates velocities in most of the South Spillway are too high for walleye to spawn there (Tarandus, 1991, 1992; this study). Tarandus conducted a Walleye spawning study in 1992 that included the South Spillway and reported that "minimal suitable walleye spawning habitat exists in the spillway" mainly due to the substrate and relatively high water velocities and no walleye eggs were found there post-spawning (Tarandus 1992, cited in Pope, 1999). Tarandus (1992) did find walleye eggs in the North Channel. Pope (1999) reported that local residents regarded the North Channel to be the main spawning area. A spawning study conducted by Rosien in 1999, when spring flow was low and there was no spill through the South Spillway, found that numbers of Walleye observed were higher downstream at Cherry Beach Rapids than in either the South Spillway or the tailrace at Calabogie (Table 1). Rosien (1999) stated that the due to adverse conditions at this site during high flow freshets, the South Spillway is dependent upon low flow freshets that warrant reduced spilling in order to be suitable for spawning.

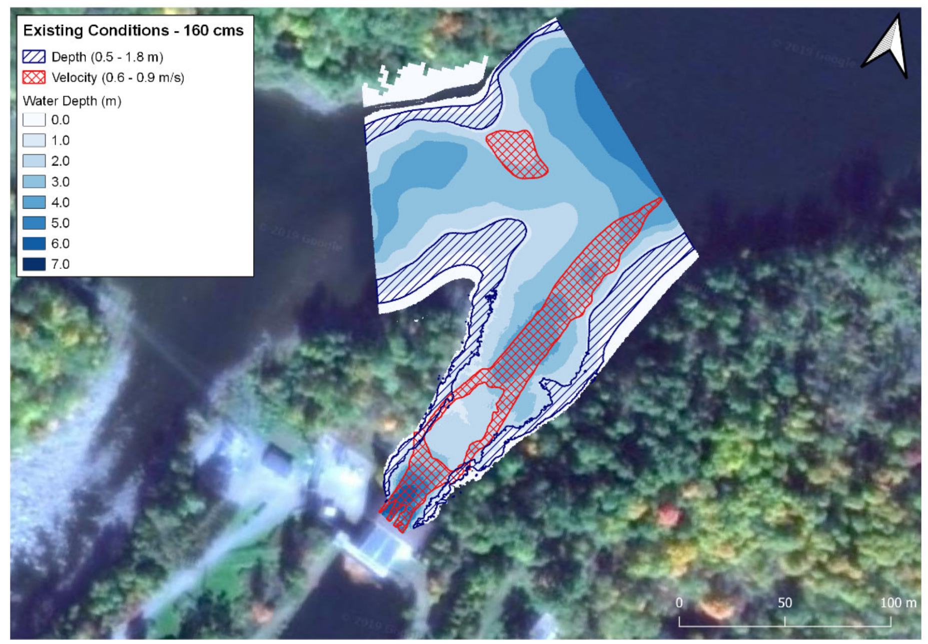
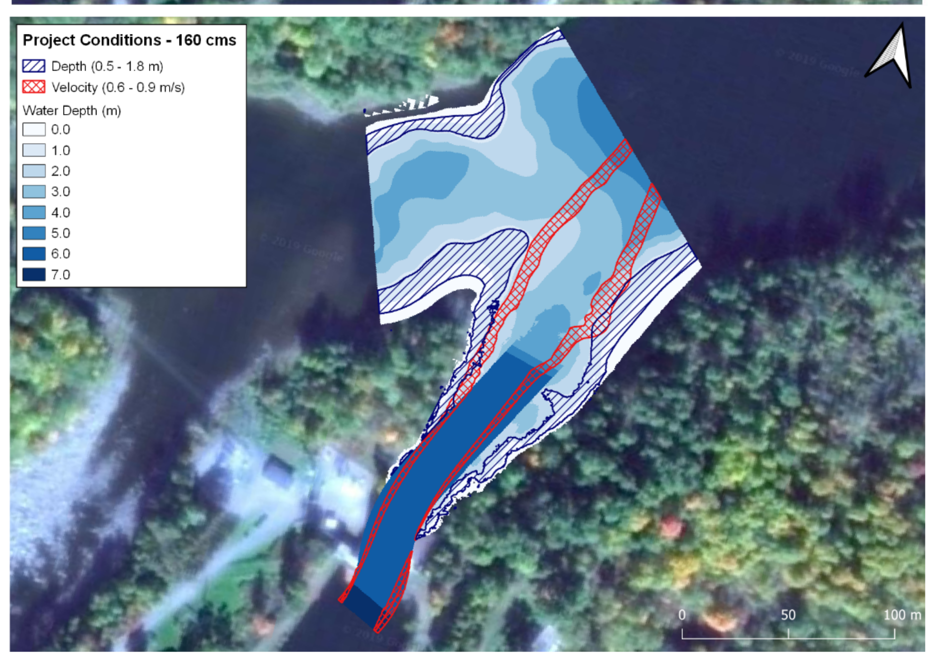
Table 1. Number of Walleye observed during night spawning surveys in 1999 (Rosien, 1999).

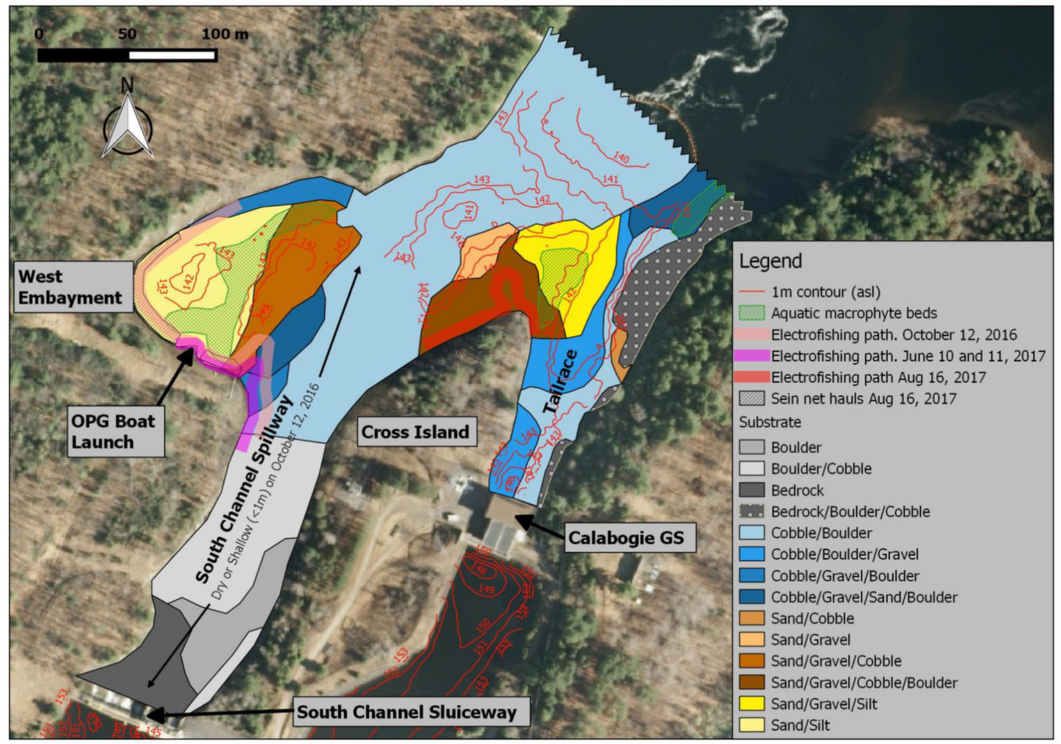
Cherry Beach rapids		Date	Number of Walleye	
Date	Number of Walleye		Calabogie GS spillway	Calabogie GS tailrace
19-Apr-99	3	19-Apr-99	0	2
21-Apr-99	38	22-Apr-99	7	6
24-Apr-99	33	24-Apr-99	0	1
26-Apr-99	41	26-Apr-99	3	1
28-Apr-99	24	28-Apr-99	1	4
2-May-99	6	2-May-99	3	3

With the existing generating station conditions in the south spillway range from extremely high flows and velocities during peak flows, typically during spring freshet, to zero flow and velocity during periods when there is no flow through the spillway. The habitat conditions in the South Spillway change markedly as flow varies over the course of a year. At peak flows the upper portion of the South Spillway has velocities so high that it is probably not occupied by fish; if it is it will be by species that are tolerant of high water velocities (i.e. longnose dace) that can shelter among boulder. At low flows and velocities that area is suitable for a wide range of species (walleye, centrarchids, catostomids, most cyprinids), but less so for species that prefer higher velocities (i.e. longnose dace). With the new generating station flows in the South Spillway will be lower during periods of high flow and zero for more of the year. This will extend the period that flows are suitable for species that prefer lower velocities but reduce the length of time that it is suitable for species that prefer high velocities. With the new generating stations, changes in flow through the South Spillway will be less frequent.

This increased stability of habitat conditions can be expected to benefit species that utilize the lower velocity habitats, whether it be for spawning, nursery, or foraging.

References:
Pope, G. F., 1999. Madawaska River Water Management Review. Effects of hydroelectric operations on Walleye spawning interim report 1997-1998. Report prepared for OMNR/OPG Madawaska River Water Management Review Working Group. xx pp. + appendices.
Tarandus Associates Ltd. 1991. Madawaska River Fisheries Studies at Stewartville, Mountain Chute, and Bells Rapids. Report for OMNR Pembroke District. Pp. 62.
Rosien, D.A., 1999. An Assessment of Hydroelectric Operating Effects on Northern Pike, Muskellunge and Walleye Reproduction in the Madawaska River, Spring 1999. Report prepared for OMNR/OPG Madawaska River Water Management Review Working Group. 69 pp.
Tarandus Associates Ltd. 1992. 1992 walleye spawning surveys in the vicinity of the Calabogie GS. Report prepared for Ontario Hydro Environmental Studies and Assessments.

Number	Section, Page Number	DFO Comment	Response
36	4.2.7.3, 4-14	It's possible that they're suitable now, particularly given that the substrate present implies the water velocities are likely not too high at least in these localized areas.	This comment is in relation to the sentence: “If spillway flows are reduced during high flow periods, habitat conditions may improve. It is possible that the shallow areas at the downstream end of the spillway that have cobble, gravel and sand substrates (Figure 3-14), will become suitable as Walleye spawning habitat and may also provide spawning habitat for other species such as White Sucker.” The locations that are suitable for spawning vary among years now and will vary among years in the future. The general trend will be for velocities to decrease downstream from the south sluiceway. Exact predictions are difficult, but as part of the DFO RFR process these questions can be explored in more detail. The downstream receiving environment is being modeled to understand the depth and velocity profiles relative to fish preferences. This information will be used to understand the distribution of bed material that could be used as spawning or rearing habitat. We are currently exploring a range of habitat variables (Habitat Suitability Indices) that are specific to walleye spawning and rearing (E.G. McMahon 1984 - Habitat Suitability Index Models: Walleye (Depth 0.5 to 1.8 m, Velocity 0.6-0.9 m/s) The figures presented below illustrate exiting fish depth and velocity preferences for the existing vs the project conditions at the same discharge (i.e. south spillway is spilling).   Further discussions on this topic can be carried on with DFO.

Number	Section, Page Number	DFO Comment	Response
37	4.2.7.3, 4-14	Again, what's the period/duration and how does it compare to existing operation?	This comment is in relation to the sentence: “There will be no flow in the South Channel Spillway for a longer period each year.” The south spillway channel will remain watered at a minimum elevation of 144.2 masl and there will not be any periods when there is no water in channel. This is consistent with the historical and existing operation of the facilities. The figure below illustrates the receiving environment bed elevations and substrate in environment of the south spillway. The elevations at the end of the South spillway where fish habitat was observed range from 140-143 masl and the upper portion of the spill way will remain backwatered to minimum elevation of 144.2 masl.  The figure below shows the expected changes of discharge through the spillway (existing GS vs projected GS). With the existing GS, the spillway was in operation about 24% of the time and with the projected GS, the spillway will be in operation about 13% of the time. It should be noted that the overall discharge downstream the junction between the GS tailrace channel and the spillway channel should be the same.

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			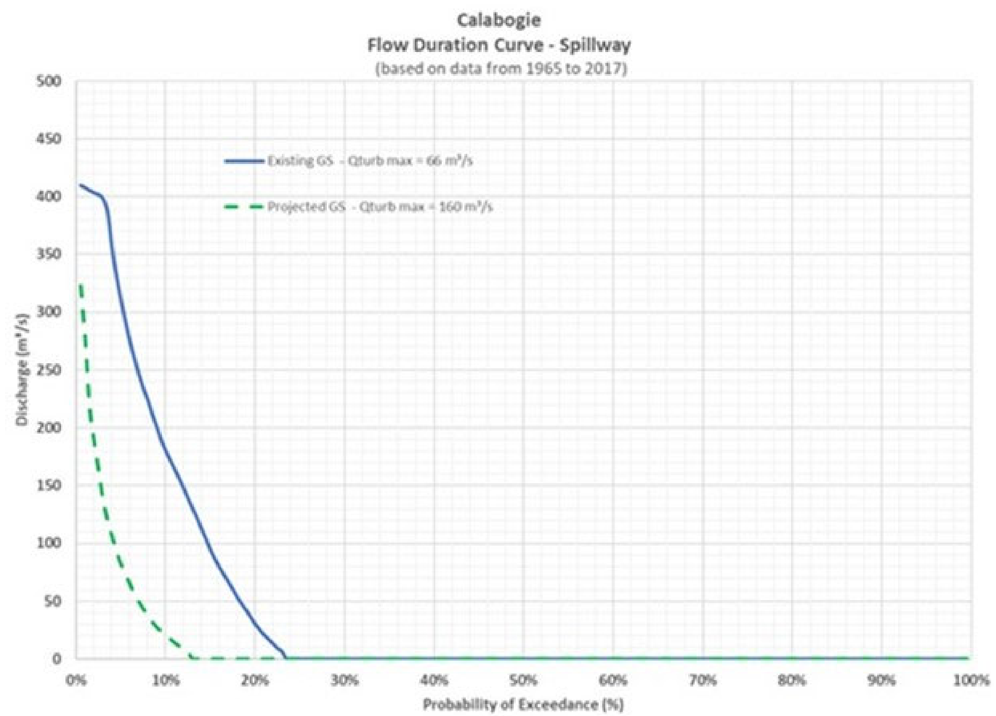
38	4.2.7.3, 4-14	What about other life cycle considerations? I realize that bedrock is likely not high quality habitat for other life processes as well, but in general I've noticed there's a lot of attention given to considerations of spawning, but nursery, rearing, forage, and migration areas are also important and should be considered in the habitat assessment.	The habitat conditions in the South Spillway change markedly as flow varies over the course of a year and between years. At peak flows the upper portion of the South Spillway has velocities so high that it is probably not occupied by fish; if it is it will be by species that are tolerant of high water velocities (i.e. longnose dace) that can shelter among boulder. At low flows and velocities that area is suitable for a wide range of species (walleye, centrarchids, catostomids, most cyprinids), but less so for species that prefer higher velocities (i.e. longnose dace). With the new generating station flows in the South Spillway will be lower during periods of high flow and zero for more of the year. This will extend the period that flows are suitable for species that prefer lower velocities but reduce the length of time that it is suitable for species that prefer high velocities. With the new generating stations, changes in flow through the South Spillway will be less frequent. This increased stability of habitat conditions can be expected to benefit species that utilize lower velocity habitats and be to the detriment of species that prefer higher velocity habitats, spawning, nursery, and foraging.
39	4.2.8, 4-14	As spawning habitat exists in the tailrace, there needs to be further thought into how that habitat function will be maintained beyond placing 0.5 m of granular material over exposed bedrock.	The downstream receiving environment is being modeled to understand the depth and velocity profiles relative to fish preferences. This information will be used to understand the distribution of bed material that could be used as spawning or rearing habitat. We are currently exploring a range of habitat variables (Habitat Suitability Indices) that are specific to walleye spawning and rearing (E.G. McMahon 1984 - Habitat Suitability Index Models: Walleye (Depth 0.5 to 1.8 m, Velocity 0.6-0.9 m/s) The figures presented below illustrate exiting fish depth and velocity preferences for the existing vs the project conditions at the same discharge (i.e. south spillway is spilling).

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			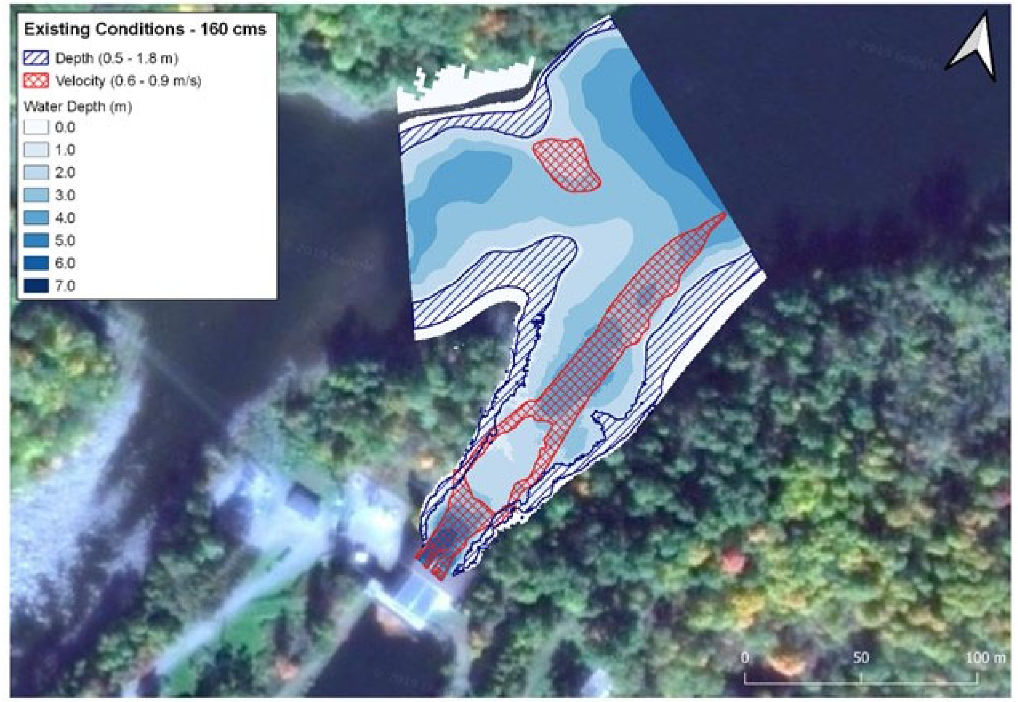 

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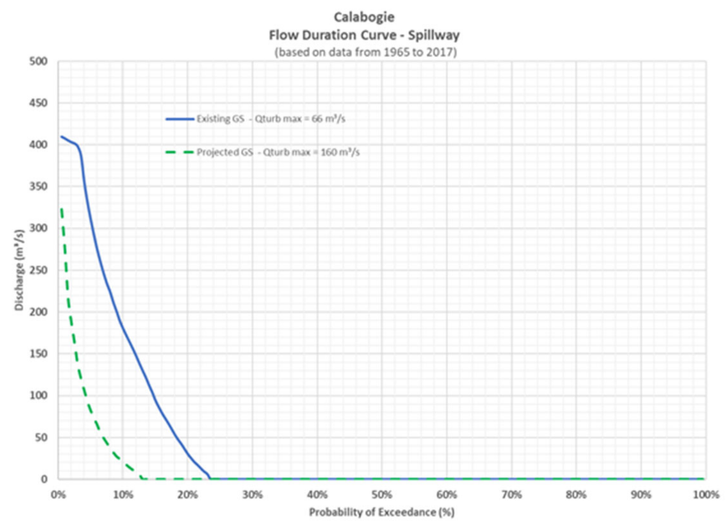
<tr><th>Number</th><th>Section, Page Number</th><th>DFO Comment</th><th>Response</th></tr>
<tr><td>40</td><td>4.2.8, 4-14</td><td>This is an assumption.</td><td>This comment is in relation to the sentence, “The flow reduction will allow more spawning opportunities for Walleye, White Sucker, and other species such as …”
The effect of reductions in flow through the South Spillway will vary between years, depending on the volume of water moving through the system.

Thank you for the comment. A comparison of the frequency of inflow though the spillway under existing and future conditions are shown below. The spillway will receive less frequent operation during the January – March period, but under average inflows it will still be operated during the peak of freshet from April to early June.

The area will remain backwatered at a minimum elevation of 144.2 and will not have any periods where there is no water in channel.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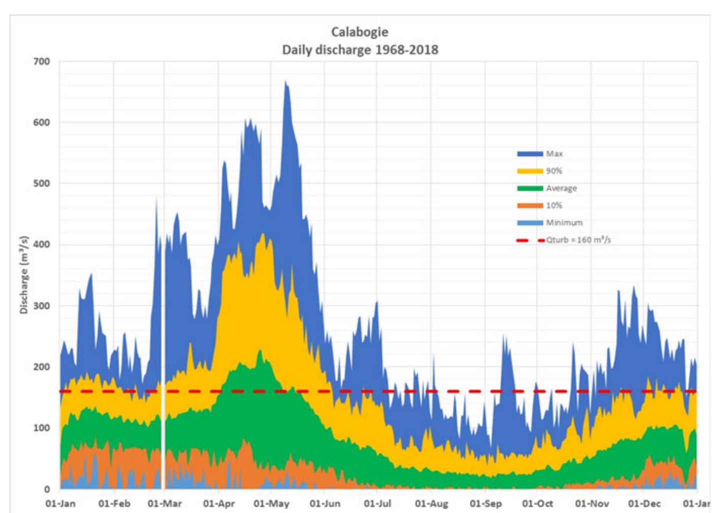
<tr><td>41</td><td>4.2.8, 4-15</td><td>More discussion needed here and some thought/consideration put into possible MIF requirements. Do we know what the flows are anticipated to be during most freshets in this channel? Do we know what wetted areas that results in? Are there concerns that eggs from other species might be dessicated if water levels are dropped after walleye incubation? Again, I think this piece requires closer analysis.</td><td>The average historical inflow for the period between 1965 and 2017 at Calabogie is approximately 90 m^3/s with a median of 72 m^3/s. The freshet level flows are shown in the historical flow calculations below and illustrate periods when spring walleye spawning and subsequent incubation occurs. The elevation in the receiving environment is not anticipated change during periods of spring incubation. The seasonality of inflows for the facility is highlighted in the inflow figure below.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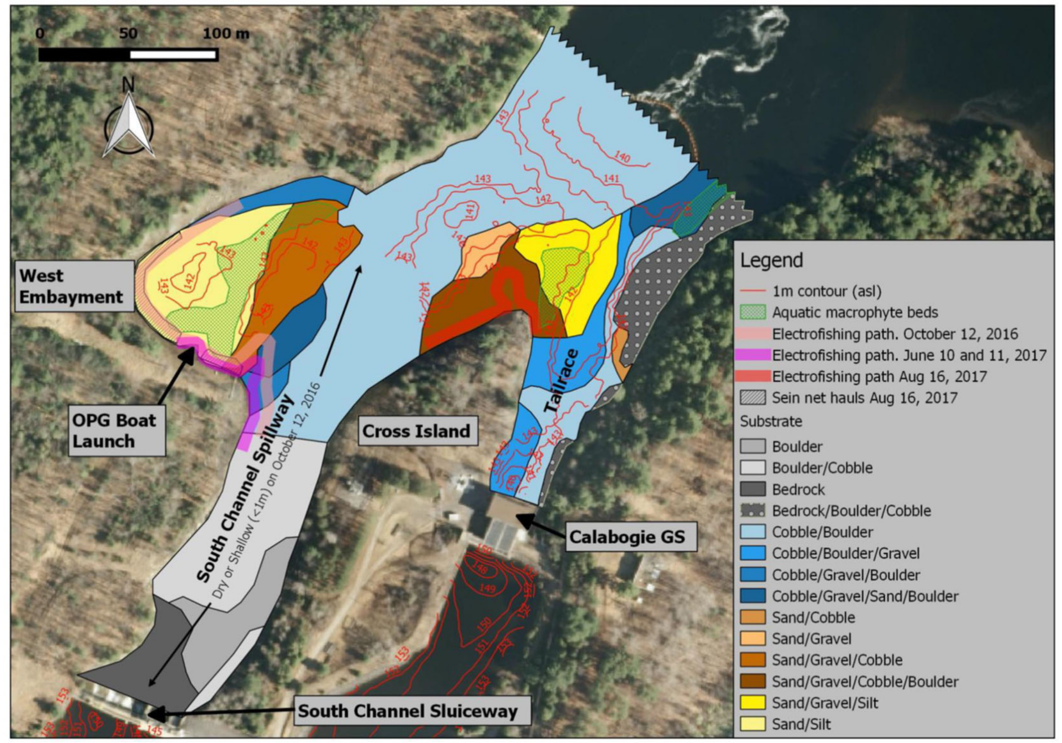
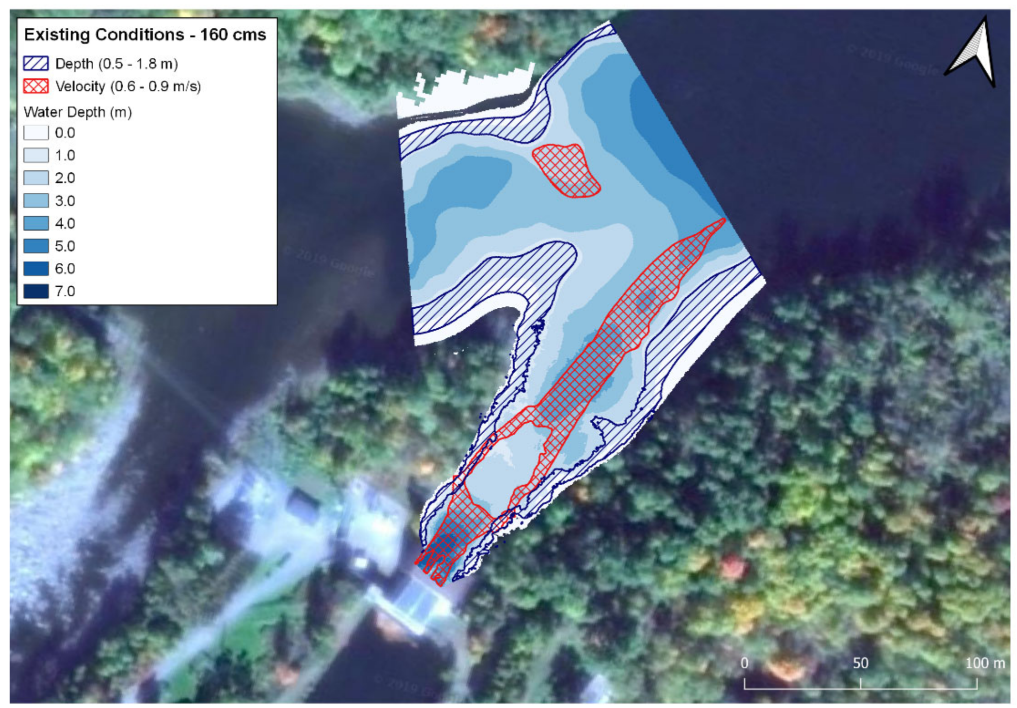
Number	Section, Page Number	DFO Comment	Response
42	4.2.8, 4-15	Any consideration of mortality due to stranding from operation shutdown/maintenance? Stranding in the south channel possible?	Thank you for the comment. The south spillway channel will remain watered at a minimum elevation of 144.2 masl and there will not be any periods where there is no water in channel. This is consistent with the historical and existing operation of the facilities. The figure below illustrates the receiving environment bed elevations and substrate in environment of the south spillway. The elevations at the end of the South spillway where fish habitat was observed range from 140-143 masl and the upper portion of the spill way will remain backwatered to minimum elevation of 144.2 masl. The area does not currently pose a risk to fish standing, and these conditions are expected to continue. 
43	4.2.8, 4-15	Where are these approach velocities estimated to be? Immediately in front of the trash rack? What are velocities like as you get further away? Just wondering how close fish have to be before they're sucked through.	An approach velocity of 0.9 m/s has been the design criteria. The current design has velocities no more than 0.9 m/s, modeled 75mm upstream of trash rack at the normal minimum reservoir elevation. This approach velocity was selected based on comments from the regulatory community for the facility to be able to allow for the downstream passage of eel in the future. Eel are poor swimmers compared to other forms of fish and the intake and eel bypass have been designed with these considerations in mind.
44	4.3, 4-16	An analysis of how these large areas being isolated for multiple years will impact fish use would be helpful. Also, how will habitat downstream of the station be impacted by flow changes as a result of isolation/construction?	The different fish habitat areas that have potential to be affected by the project will be assessed for productive capacity and a habitat balance for the project will be presented for DFO review. The area from upstream cofferdam to downstream cofferdam is approximately 22,000 m^2. The duration of the dewatered forebay is 9 month for the upstream side (from u/s cofferdam to intake) and 13.5 month for the downstream side (from tailrace to d/s cofferdam). The 9 month duration for the upstream is at the same time as the 13.5 month of the downstream An assessment will account for both temporary and permanent changes and opportunities to balance habitat productivity will be calculated. The area of the intake and tailrace area that will be temporarily isolated will be inputted into a habitat balance that takes potential productivity of the existing habitat into account. The duration of time the habitat was not available as fish habitat will be considered in the habitat loss. Based on our permitting experience habitat dewatered for longer than one fish life year will be considered as a permanent alteration.

Number	Section, Page Number	DFO Comment	Response
45	4.3, 4-16	I haven't seen a description of demolition of the existing station and what the state of that area will be like once completed.	Thank you for the comment. The intake for the current generating station will be the footprint for the new generating station and the area where the old generating station stood will become the most upstream portion of the tailrace receiving environment. The existing Generation station will be demolished in the dry.
46	4.3, 4-17	There will be a permanent loss of habitat in the footprint of the new station. There should be some consideration that walleye could be spawning or attempting to spawn below the tailrace under existing conditions; how will that change with the new station location, flow changes, depth changes, and substrate differences?	OPG agrees and will provide a detailed assessment of habitat changes associated with the new project as part of the DFO review process. Currently the tailrace receiving environment is being modeled to understand the depth and velocity profiles relative to fish preferences. This information will be used to understand the distribution of bed material that could be used as spawning or rearing habitat. We are currently exploring a range of habitat variables (Habitat Suitability Indices) that are specific to walleye spawning and rearing (E.G. McMahon 1984 - Habitat Suitability Index Models: Walleye (Depth 0.5 to 1.8 m, Velocity 0.6-0.9 m/s) The figures presented below illustrate exiting fish depth and velocity preferences for the existing vs the project conditions at the same discharge (i.e. south spillway is spilling). 

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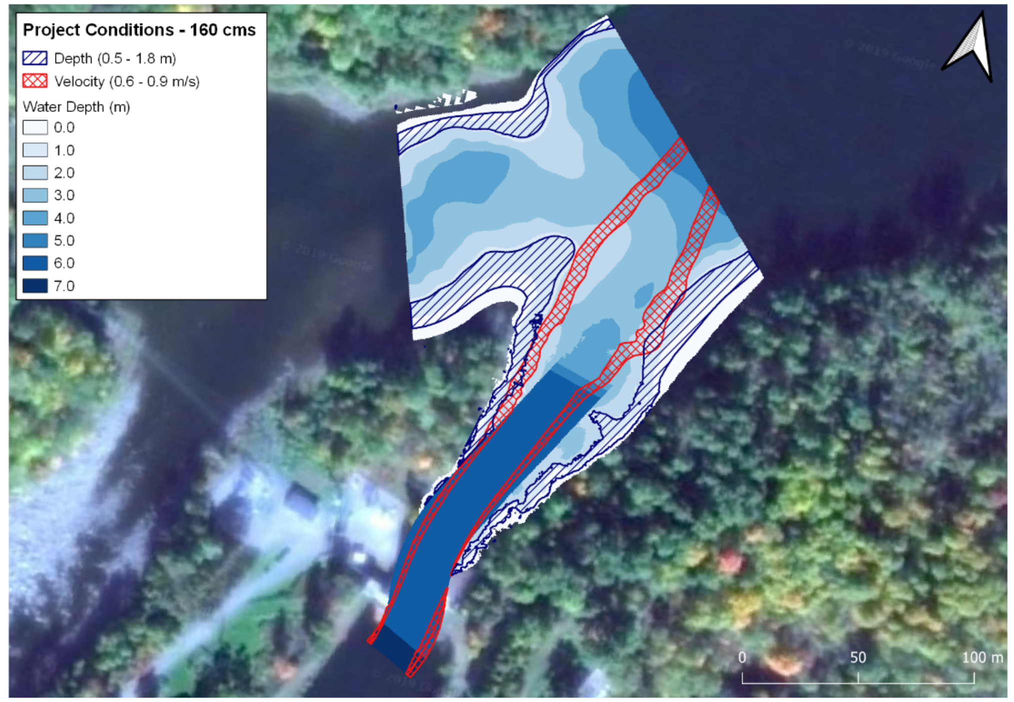
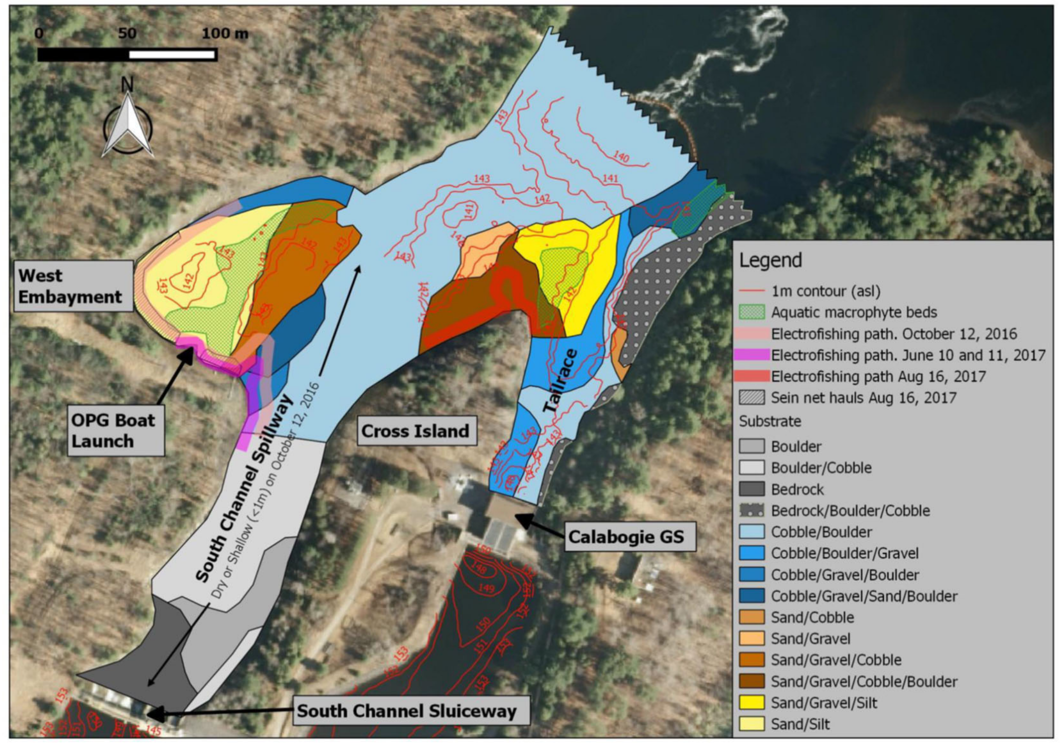
			

Number	Section, Page Number	DFO Comment	Response
47	4.3, 4-17	This is an assumption. Additionally, will some of these areas be dry during the walleye spawn under the proposed operating regime? Consider that areas of the south channel will be dry for greater periods of time.	The south spillway channel will remain watered at a minimum elevation of 144.2 masl and there will not be any periods when there is no water in channel with potential fish habitat. This is consistent with the historical and existing operation of the facilities. The figure below illustrates the receiving environment bed elevations and substrate in environment of the south spillway. The elevations at the end of the South spillway where fish habitat was observed range from 140-143 masl and the upper portion of the spill way will remain backwatered to minimum elevation of 144.2 masl. 

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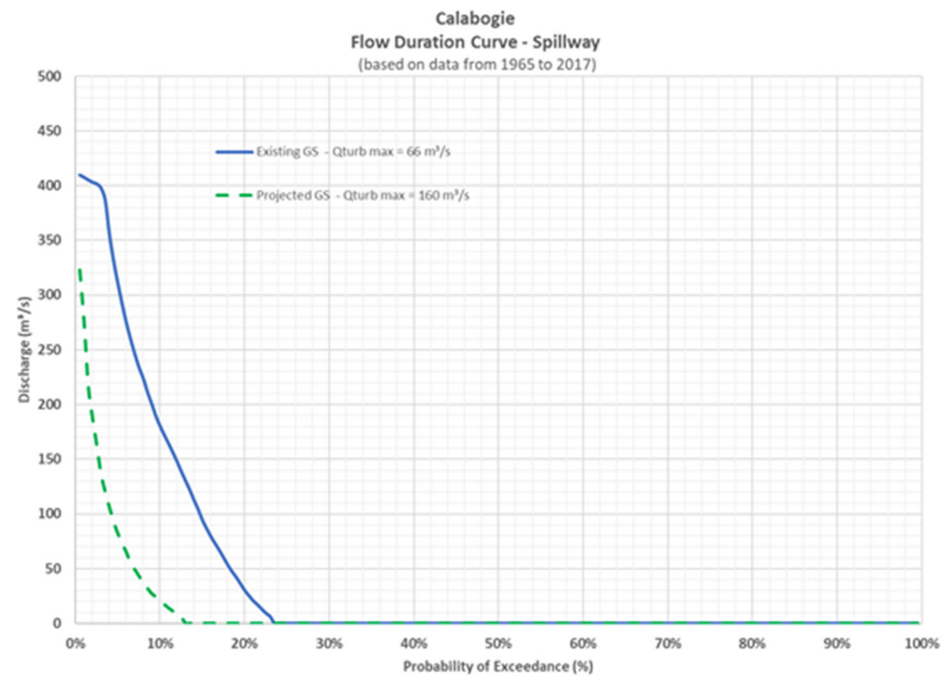
</td></tr>
<tr><td>48</td><td>4.3, 4-18</td><td>I realize this is still early stages, but some details on this would be helpful. e.g., duration, effort, methods.</td><td>Post-construction surveys of substrate and depth will be conducted in the altered areas in the tailrace and forebay. Monitoring of habitat conditions and walleye spawning activity in the generating station tailrace, the South Spillway, the North Spillway and at Cherry Beach rapids will be conducted during the walleye spawning period for a minimum of 5 years post-construction.</td></tr>
<tr><td>49</td><td>5, 5-1</td><td>And fish habitat destruction from the new GS footprint.</td><td>The different fish habitat areas that have potential to be affected by the project will be assessed for productive capacity and a habitat balance for the project will be presented for DFO review. The area from upstream cofferdam to downstream cofferdam is approximately 22,000 m^2 (see figure below for approximate locations of cofferdams). The duration of the dewatered forebay is 9 month for the upstream side (from u/s cofferdam to intake) and 13.5 month for the downstream side (from tailrace to d/s cofferdam). The 9 month duration for the upstream is at the same time as the 13.5 month of the downstream.

A new powerhouse will be constructed, approximately 50 metres upstream of the existing powerhouse within the existing forebay. The existing powerhouse will be demolished. The new powerhouse location was selected to be upstream of the existing powerhouse in the forebay to optimize the increased station flow and hydraulic conditions. The locations of the existing powerhouse and new powerhouse are highlighted in the figure below.</td></tr>
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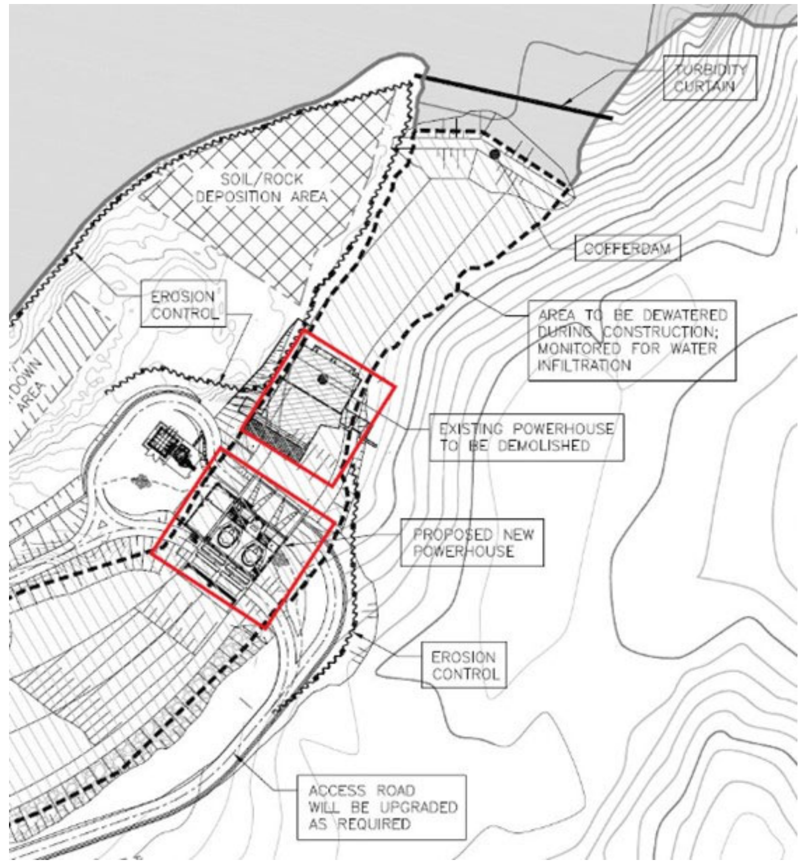
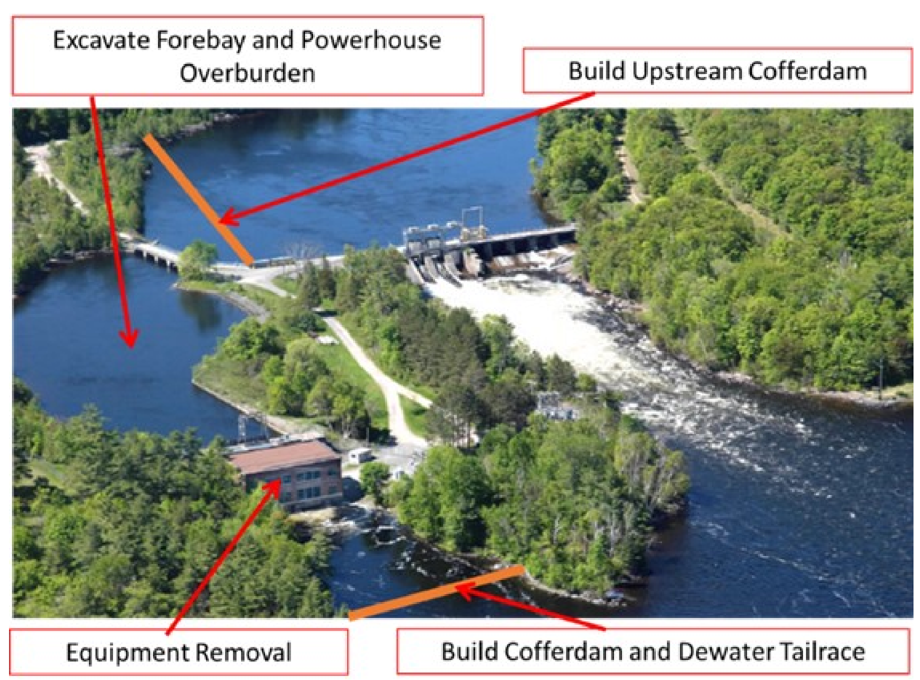
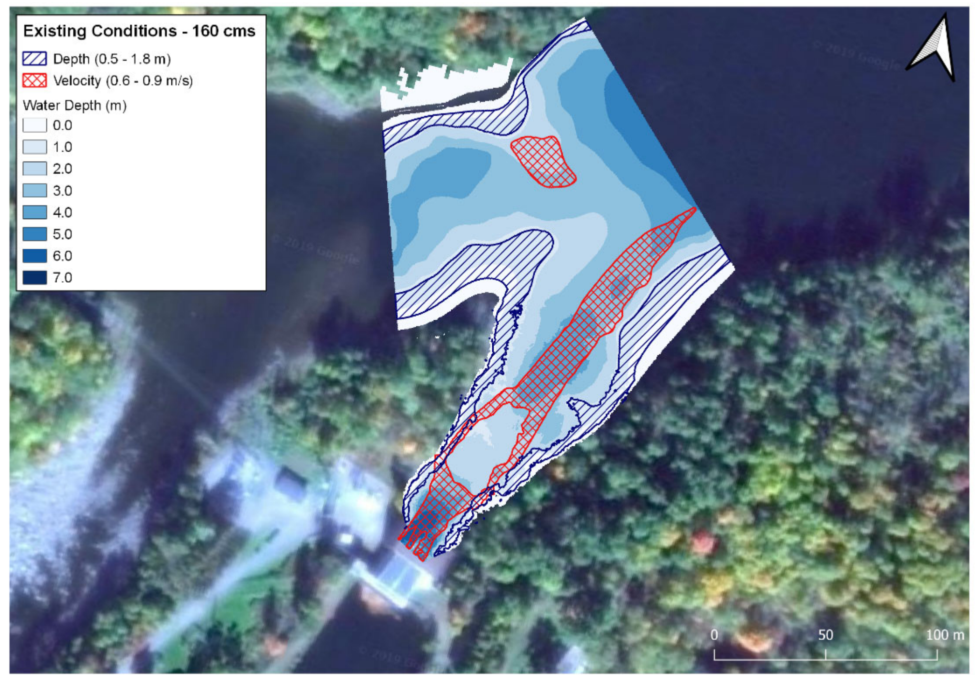
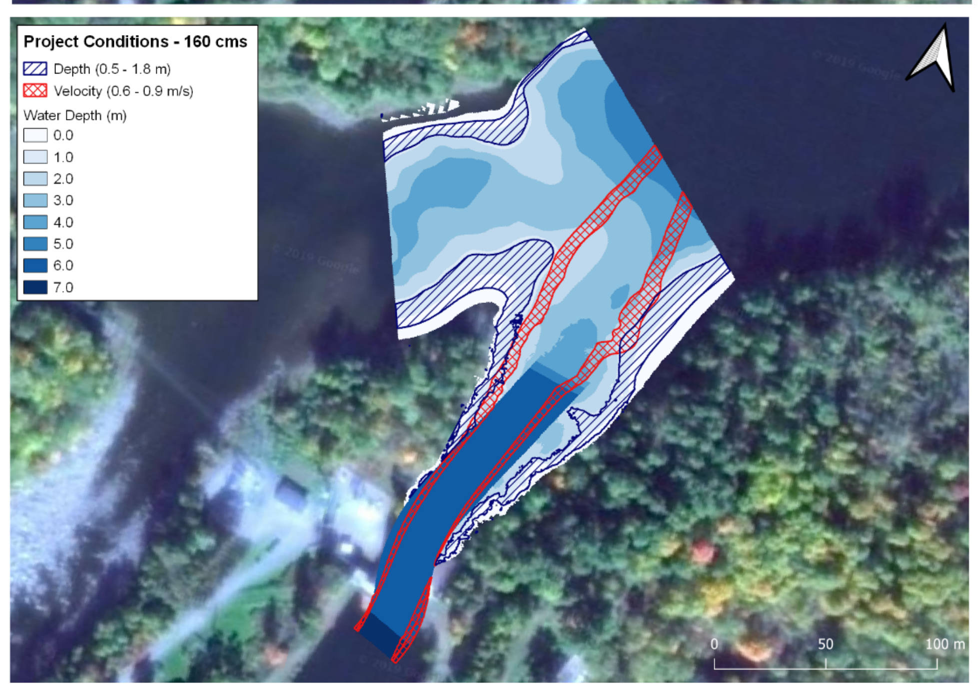
			 

Number	Section, Page Number	DFO Comment	Response
50	5, 5-1	Net changes in the area of fish habitat will be minor.	OPG/SNC Sullivan agrees and will provide a detailed assessment of habitat changes associated with the new project as part of he DFO review process. The tailrace is being designed to take advantage of opportunities to balance habitat productivity for the project The downstream receiving environment is being modeled to understand the depth and velocity profiles relative to fish preferences. This information will be used to understand the distribution of bed material that could be used as spawning or rearing habitat. We are currently exploring a range of habitat variables (Habitat Suitability Indices) that are specific to walleye spawning and rearing (E.G. McMahon 1984 - Habitat Suitability Index Models: Walleye (Depth 0.5 to 1.8 m, Velocity 0.6-0.9 m/s) The figures presented below illustrate exiting fish depth and velocity preferences for the existing vs the project conditions at the same discharge (i.e. south spillway is spilling).  

Number	Section, Page Number	DFO Comment	Response
51	5, 5-1	A contact from MNRF has indicated that there have been several eel occurrences.	OPG's information is that there are no American Eels are reported above the Arnprior Dam.
52	5, 5-1	Has passage of other fish species been considered?	Unlike the migratory American Eel, the other fish species will continue to be able to complete their life histories as resident populations within the reach between the Calabogie GS and the Stewartville GS.
53	Appendix, 3, p. 7	Ah. Thank you. Found the methods for the Walleye surveys.	Thank you for the comment.

APPENDIX A.6

Ministry of Environment Conservation and Parks

MECP Comments (September 26, 2019) and OPG Responses

Comment Number	Comment	Response
1	Land Ownership Proponents are encouraged to address the question of land ownership and possible disposition as early in the EA process as possible. I understand from correspondence of August 19th that there will be no requirement for disposition of Crown Land.	Acknowledged. No further response necessary.
2	Impacts to Surface Water A copy of the Draft ER has been forwarded to Surface Water Staff of our Water Resources Unit, Technical Support Section. As stated these comments have been previously been forwarded for your consideration. As there are no proposed changes to water levels and just a diversion of more water from the bypass reach to the powerhouse there are few concerns regarding impacts to surface water and related water quality. It is my understanding that MNRF may have some concerns regarding increased velocities and speed of drawdown at certain times of the year.	Response to Paragraph #1. Acknowledged. No further response required. Response to Paragraph #2. OPG will be responding directly to all of MNRF comments. MECP can be provided those comments as well.
3	As a result of internal reorganization our ministry has assumed responsibility for species at risk and the Endangered Species Act. Preliminary comments were initially provided by Ministry of Natural Resources and Forestry staff earlier in 2017. MECP has now assumed this responsibility and I understand you have been working with Carolyn Hann on the species at risk aspects of this file. Again, as noted I have also previously forwarded these comments to you as well.	Acknowledged. No further response necessary.
4	With respect to Table 7-2: List of Permits, Licences and Approvals Possibly Required for the Proposed Calabogie Generating Station Re-Development - I have reviewed your list of MECP approval/permits. You note in the table that an Environmental Compliance Approval or an Environmental Activity Sector Registry for emissions or discharge of any contaminants into any part of the Natural Environment other than water. This may include for Air (including noise from backup generators from operational and emergency use) may be needed. Part of this process involves the completion of a "Primary Noise Screening process for S.9 Applications Supplement to Application for Approval". I have included the link below for your reference immediately below. If you need any assistance, please contact approvals staff at (416) 314-8001 if you have questions about air approval requirements. In my scan of the ER I did not find any mention of a noise impact assessment.	Since the completion of the draft Environment Report, OPG has confirmed that backup generators for construction or operations is not required.

Comment Number	Comment	Response
	https://www.ontario.ca/page/primary-noise-screening-method-guide	
5	In your table you indicate that a Permit to Take Water (PTTW) under the OWRA “may” be required for operation of the generating station. It has been determined in discussions with the Eastern Region Permit Director that the indeed a PTTW will be required for the operation of the new facility.	A Permit to Take Water for operations will likely not be required for this Project subject to the passage of Bill 132, *Better for People, Smarter for Business Act, 2019*. This Bill proposes to amend section 34 of the *Ontario Water Resources Act* and provide an exception for the taking of water for constructing and operating a dam if the dam is associated with the production of electricity and the activity is done in accordance with an approval or in compliance with a Minister’s order under the *Lakes and Rivers Improvement Act*. It is also our understanding that a Permit to Take Water for Constructions is also not needed.
6	Table 4-2 outlines an extensive list of potential construction and operation effects on the aquatic environment and recommended mitigation/remedial measures that could be taken in addition to the net effect each would have in addition to related text within the report. Table 4-4 outlines an extensive list of potential construction and operation effects on the aquatic environment and recommended mitigation/remedial measures that could be taken in addition to the net effect each would have in addition to related text within the report. During my review I noticed the summaries of the above Construction and Operation Effects on both the Aquatic and Terrestrial Environments; but I was not able to find a summary listing of the same effects on social or economic environments such as nearest sensitive receptors that are identified at approx. 200 m away or the village of Calabogie. This type of summary and related mitigation measures should be identified in the ER as well if they exist. Mitigation measures that may help to defuse potential public concern over the project include public awareness through signage, flaggers and the use of an environmental inspector to monitor construction operations (which you have asserted will occur in your section on Summary of Monitoring Programs).	Acknowledged, good observation. We will create a socio-economic summary table of effects and mitigation measures for the final ER that will be posted for the Notice of Completion stage.
7	As per our July 27th letter, another suggestion was be to develop complaint response protocols to address reported noise, dust, disturbance or claims of property damage during the project construction/roadbuilding phases. As I understand from our phone conversation of August 21st that this type of	The constructor Sullivan will create a Site Specific Environmental Management Plan (SSEMP) that includes a requirement to create a process for communicating with Indigenous Communities and the

Comment Number	Comment	Response
	program would be best established by the "constructor" subject to audit by OPG. A suggestion may be to mention that a program for complaint response will be established as part of the constructors agreed-too procedures.	Public. Part of this would include information on how complaints are managed. OPG as Owner will audit the Constructor to ensure compliance with the SSEMP.
8	I note that in section 4.7 you have considered climate change in your evaluation for the upgrade of the Calabogie GS. In doing so you have discussed that projected changes in climate will not have any significant impact on the project – related physical structures of the system or operation of its facilities. You have also indicated that the upgraded facility to 11 megawatts will displace 15 611 Mg of carbon dioxide per year estimating that natural gas generating plants would be used part of the time to replace the same energy produced at the Calabogie GS.	Acknowledged. No further response required.
9	The report in section 4.2.2 discusses the construction phase in relation to surface water quality in addition to proposed mitigation measures to protect water quality. Included in this you have also identified work that proposes the stock piling and onsite storage of dredged and/or excavated material as a result of excavation activities. You cite previous MECP guidance (Orpana, MECP 2018) which provided direction to the Ministry's Guidelines for Evaluating Construction Activities Impacting on Water Resources dated January 1995 and Evaluating Construction Activities Impacting on Water Resources, Part *III A, Part III B, and Part III C* dated February 1994." The ER is considering this guidance in dealing with soil in the vicinity of the existing powerhouse that contained some metals which exceeded MECP standards.	Acknowledged. No further response required
10	Your ER speaks to excess material (excavated and blast rock) in a number of areas in the document, particularly 2.5.4 Excavation, 2.5.4 Rock and Soil Deposition Areas. In addition, you have mentioned that the municipality has agreed to accept the majority of this excess rock material for their own use and stockpiling on adjacent municipal lands. You also indicate that it will be a requirement of the DBC that any rock excavated through blasting activity will be subject to a washing procedure.	Acknowledged. The Constructor has made provision that any excavated rock that will be use in or near water will be washed.
11	I also acknowledge that management of dredged material and control of runoff will be addressed by the site-specific Sediment and Erosion Control Plan and Stormwater Management Plan prepared by the design build constructor and that this material is not of interest of the municipality and will be deposited on site subject to the aforementioned Sediment and Erosion Control Plan and Stormwater Management Plan.	Acknowledged. No further response required.

Comment Number	Comment	Response
12	As per my July 27th letter, guidance on nearshore construction and dredging may be obtained from this Ministry's guidelines for Evaluating Construction Activities Impacting on Water Resources dated January 1995, and evaluating Construction Activities Impacting on Water Resources, Part III A, Part III B and Part III C, dated February 1994.	Acknowledged. No further response required.
13	Section 4.2.2.5 on page 4-15 speaks to groundwater in the area where there were several PWQO exceedances in the existing groundwater quality. If, as stated; during construction monitoring that if groundwater is found to be infiltrating into areas where construction below grade is occurring that the DBC will need to ensure that the groundwater will need to be properly treated prior to discharge to surface waters. I confirm that this will involve contacting the Ottawa district office to review approval requirements as stated.	Acknowledged. No further response required.
14	As with all projects going through a Class Environmental Assessment process (Class EA), if a change to the project as outlined in the ER is needed, the change should be assessed to determine the significance of the impacts resulting from the change. Additional environmental assessment work may be necessary as discussed in the provisions of the Class EA.	Acknowledged. No further response required.
15	Any additional discussions and comments to resolve issues raised during the Class EA process should be documented in the Statement of Completion for this project. Please ensure that a copy of the Statement of Completion is sent to both the Director of Environmental Approvals Branch and to the Eastern Region Office in Kingston.	Acknowledged and agreed.
16	For all permits/approvals that are required except the Permit to Take Water your first point of contact would be the District MECP office in Ottawa. You can contact the Acting District Supervisor Emily Tieu to be directed to the Environmental Officer for the Calabogie area. The District's main phone number is 613 521 3450 and her ext. is 235. Your contact for the Permit to Take Water is out of the Kingston Regional Office. His name is Nicholas Murphy and he can be reached at 613 540 6868. Additionally, for any potential Species at Risk authorizations/approvals that you may require you will work with the SAR biologist that has participated in the review of the ER. As discussed during our conference call you are encouraged to take full advantage of pre-submission consultation sessions with respect to the various permits/approvals that you will require for your project.	Acknowledged. Thank you.

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