

CULTURAL HERITAGE IMPACT ASSESSMENT

CALABOGIE GS REDEVELOPMENT PROJECT MADAWASKA RIVER TOWNSHIP OF GREATER MADAWASKA COUNTY OF RENFREW, ONTARIO



April 2019

**Prepared for:
Ontario Power Generation
and
ARCADIS Canada Inc.**

Prepared by:



UNTERMAN McPHAIL ASSOCIATES
HERITAGE RESOURCE MANAGEMENT CONSULTANTS

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EXECUTIVE SUMMARY

ARCADIS Canada Inc. (Arcadis) retained Unterman McPhail Associates (UMcA) to undertake a Cultural Heritage Impact Assessment (CHIA) for the proposed redevelopment of the Calabogie Generating Station (GS) on behalf of Ontario Power Generation (OPG). OPG is undertaking a Class Environmental Assessment (Class EA) process to replace the existing hydroelectric generating station with a new 11 to 12 MW facility for the Calabogie GS Redevelopment Project. The work will result in the replacement of the existing powerhouse, the removal of the forebay inlet structure and the construction of a new powerhouse with integral intake structure and tailrace. The project is being carried out under the Class EA for Waterpower Projects prepared by the Ontario Waterpower Association (OWA) (February 2018, Eighth Edition).

The Cultural Heritage Evaluation Report (CHER) for the subject property completed in March 2017 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. This CHIA assesses 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. The following six (6) conservation recommendations are provided to OPG to address the effects of the identified impacts to the Calabogie GS.

1) Powerhouse and headworks

OWA Mitigation Option 8 (b), *Undertake full recording and documentation of existing building*, i.e., the existing powerhouse and headworks, is not feasible due to safety issues as a result of the tornado damage. Therefore, 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 in good standing with the Canadian Association of Heritage Professionals (CAHP) and with demonstrated experience in the preparation of documentation reports. 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 drawings to fulfill the requirements of OWA Mitigation Option 8 (b).

2) *Equipment*

OWA Mitigation Option 6, *Retain built heritage attributes as a monument or remnant for viewing purposes only*, will be implemented. 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 that would incorporate original plant equipment and a plaque describing the original development of Calabogie GS and its role in the community. An appropriate location for the installation is at the junction of Generating Station Lane and County Road 511 and in proximity to the K&P Trail.

The 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.

3) *Entrance or cutoff dam removal*

Photographs of the site showing the cutoff dam have been taken and they will serve as the documentation requirement for OWA Mitigation Option 8 (b), *Undertake full recording and documentation*. No other conservation measures are recommended.

4) *Access road realignment*

Photographs of the site showing access road alignment have been taken and with historical information will serve as the documentation requirement for OWA Mitigation Option 8 (b), *Undertake full recording and documentation*. No other conservation measures are recommended.

5) *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 OWA Mitigation Option 8 (b) should be implemented to assess and document these features as required.

6) *Allocation of 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.

1.0 INTRODUCTION

1.1 Purpose of Study

ARCADIS Canada Inc. (Arcadis) retained Unterman McPhail Associates, Heritage Resource Management Consultants, to undertake a Cultural Heritage Impact Assessment (CHIA) for the proposed redevelopment of the Calabogie Generating Station (GS) on behalf of Ontario Power Generation (OPG). OPG has commenced an environmental assessment process to replace the existing 4-megawatt (MW)¹ hydroelectric generating station with a new 11 to 12 MW facility. The Calabogie GS Redevelopment Project will result in the replacement of the existing powerhouse, the removal of the forebay inlet structure and the construction of a new powerhouse with integral intake structure and tailrace. The project is being carried out under the Class Environmental Assessment (Class EA) for Waterpower Projects prepared by the Ontario Waterpower Association (OWA) (February 2018, Eighth Edition).

The Calabogie Light and Power Company, under the leadership of Michael John O'Brien, developed the existing Calabogie GS in 1917 to provide power during the First World War. Designed by Kerry & Chace, Limited, Engineers of Toronto, the station was completed in seven months and supplied power to O'Brien's munitions factories in Renfrew as well as to the Renfrew Molybdenum Mines, the village of Calabogie and the O'Brien farm at Barryvale. The facility comprises dams with sluiceways, inlet sluices, forebay, powerhouse and tailrace. The existing brick masonry powerhouse is integral with the headworks and historically contained two units with an installed capacity of 2.0 MW each.

The Hydro-Electric Power Commission (HEPC), later Ontario Hydro and now OPG, acquired the generating station from the M.J. O'Brien, Limited in 1929. The Calabogie GS received regular maintenance and remained in active use until 2018. On September 21, 2018, a tornado in the Calabogie area resulted in significant damage to the generating station, notably to the powerhouse. The facility has not operated since that time.

The Calabogie GS has been evaluated under the Ministry of Tourism, Culture and Sport (MTCS) *Standard and Guidelines for Conservation of Provincial Heritage Properties (Standards & Guidelines)* dated 2010. Unterman McPhail Associates undertook the cultural heritage evaluation of the property on behalf of OPG. The three-part Cultural Heritage Evaluation Report (CHER) was finalized in March 2017. The CHER concluded the Calabogie GS fulfilled the evaluation criteria for determining the cultural heritage value or interest set out in Ontario Regulation 9/06 under the *Ontario Heritage Act* (OHA) for local significance; however, it was determined the property did not meet the criteria for provincial significance in Ontario Regulation 10/06. Therefore, the Calabogie

¹ Glenys Biggar, *Ontario Hydro's History and Description of Hydro-Electric Generating Stations* (Toronto: Ontario Hydro, 1991) 45. Some current material, e.g., Notice of Commencement of the Proposed Undertaking cites 5 MW as the installed capacity.

GS meets the criteria to be considered a Provincial Heritage Property (PHP) but not a Provincial Heritage Property of Provincial Significance (PHPPS). As a PHP the provisions of the MTCS *Standards & Guidelines* apply to the subject property. No formally recognized heritage properties have been identified in proximity to the Calabogie GS in the Township of Greater Madawaska.

This CHIA provides an assessment of the impacts to the Calabogie GS as a result of the proposed redevelopment of the property. It sets out conservation recommendations that summarize how the Calabogie GS Redevelopment Project should proceed in order to best protect and enhance the cultural heritage value and the heritage attributes of the identified cultural heritage resources. The report draws upon the site review undertaken in August 2016 as part of the CHER. No additional fieldwork was undertaken as part of the CHIA. OPG and Arcadis provided updates on changes to the Calabogie GS since 2016. In addition, the community input included in the evaluation process of the CHER forms the basis of the community engagement contained in this report. MTCS and the Township of Greater Madawaska were contacted during the preparation of the CHIA to ensure the information is current.

1.2 Description of the Property

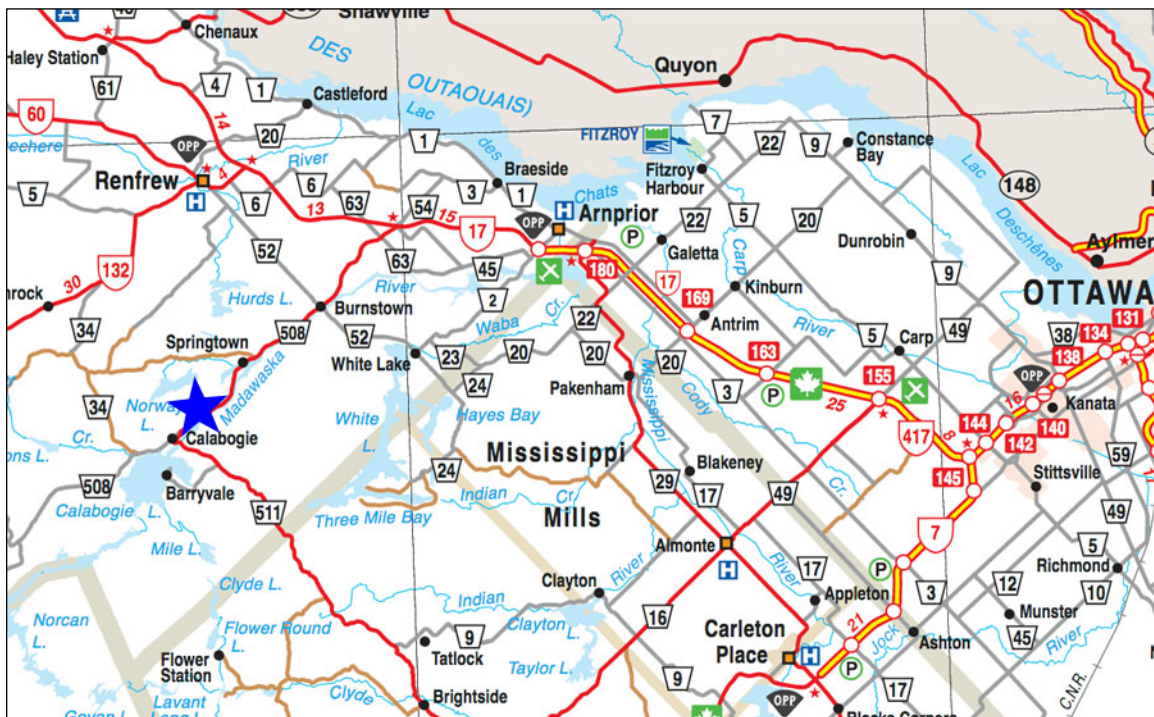


Figure 1. The Calabogie GS is accessed from Arnprior via Highways 17 and 508, a distance of approximately 38 km. The blue star highlights the location of Calabogie village [Official Road Map of Ontario, 2016].

The hydroelectric facility known as the Calabogie GS is located on the Madawaska River within Calabogie village in the Township of Greater Madawaska (**Figure 1**). The community of Calabogie is situated to the northwest of the generating station.

Specifically, the generating station is situated on Lot 17, Concessions 9 and 10 in the geographic Township of Bagot and Blythfield in the County of Renfrew. The Madawaska River splits into two channels at the outlet of Calabogie Lake. The Calabogie GS is located approximately 800 m downstream from Calabogie Lake on the South Branch of the river. By road, the facility is accessed via Generating Station Lane from Renfrew County Road 511, also known as Lanark Road and formerly, as Highway 511.

1.3 Report Format

This CHIA follows the ministry's *Information Bulletin 3: Heritage Impact Assessments for Provincial Heritage Properties* (January 31, 2017). This CHIA also draws upon experience of the consultants in the preparation of HIAs for provincial ministries, prescribed public bodies and municipalities.

The report includes the following information:

- Introduction to the property (Section 1)
- Statement of cultural heritage value or interest (Section 2);
- Description of the existing conditions (Section 3);
- Description and purpose of the proposed activity (Section 4);
- Assessment of the impacts of the proposed activity (Section 5);
- Identification of considered alternatives and mitigation measures (Section 6);
- Discussion of community engagement (Section 7);
- Recommendation of preferred conservation strategies (Section 8); and,
- Sources.

Generally graphic material illustrating the text is included at the end of the relevant section. All photographs are attributed to Unterman McPhail Associates and date to August 2016 unless noted otherwise. For the purposes of this report, the Madawaska River is considered to flow from west to east and the powerhouse is oriented north to south.

2.0 CULTURAL HERITAGE VALUE OR INTEREST

2.1 Heritage Recognition

The Calabogie GS is recognized as a PHP as set out under the MTCS *Standards & Guidelines* (2010). The description of the PHP, the statement of cultural heritage value or interest and the identification of heritage attributes as set out in Sections 2.2, 2.3 and 2.4, respectively were developed initially for the 2017 CHER.

The Calabogie GS has not been evaluated for federal heritage value and is not recognized as a federal government heritage resource. Furthermore, the facility is not commemorated through a local, provincial or federal plaque program. Consultations with the Township of Greater Madawaska confirm the Calabogie GS is not municipally listed and is not designated under the OHA. No formally recognized heritage properties were identified in proximity to the subject property in the Township of Greater Madawaska.

Two former railway bridges over the Madawaska River are part of the County of Renfrew's K&P Trail, a recreational trail that extends roughly 12.4 miles (20 km) between Calabogie and Renfrew. An interpretative plaque in proximity to the trail, Renfrew County Road 511 and Generating Station Lane provides information on the history of the Kingston & Pembroke (K&P) Railway.

A Stage 1 archaeological assessment of the Calabogie GS, which focused on Cross Island and the powerhouse, was undertaken 2016. It was determined the land was previously disturbed and further work was not required. Stage 1 and Stage 2 archaeological assessments were completed on Calabogie Island 2018. On the basis of this work it was concluded no further investigations are required.

2.2 Description of the PHP

The hydroelectric facility known as the Calabogie GS is located on the Madawaska River within the community of Calabogie in the Township of Greater Madawaska. Specifically, the generating station is situated on Lot 17, Concessions 9 and 10 in the geographic Township of Bagot and Blythfield in the County of Renfrew. (**Figures 2 and 3**).

The PHP comprises the Calabogie GS and the dams with sluiceways, inlet sluices, forebay, headworks, powerhouse, tailrace, access roads and the Madawaska River with former railway and road bridges (**Figure 3**). The outdoor transformers, which are not original, and ancillary features including the Calabogie DS, transmission lines and the former operators' colony, which are not within the ownership of OPG do not form part of the PHP.

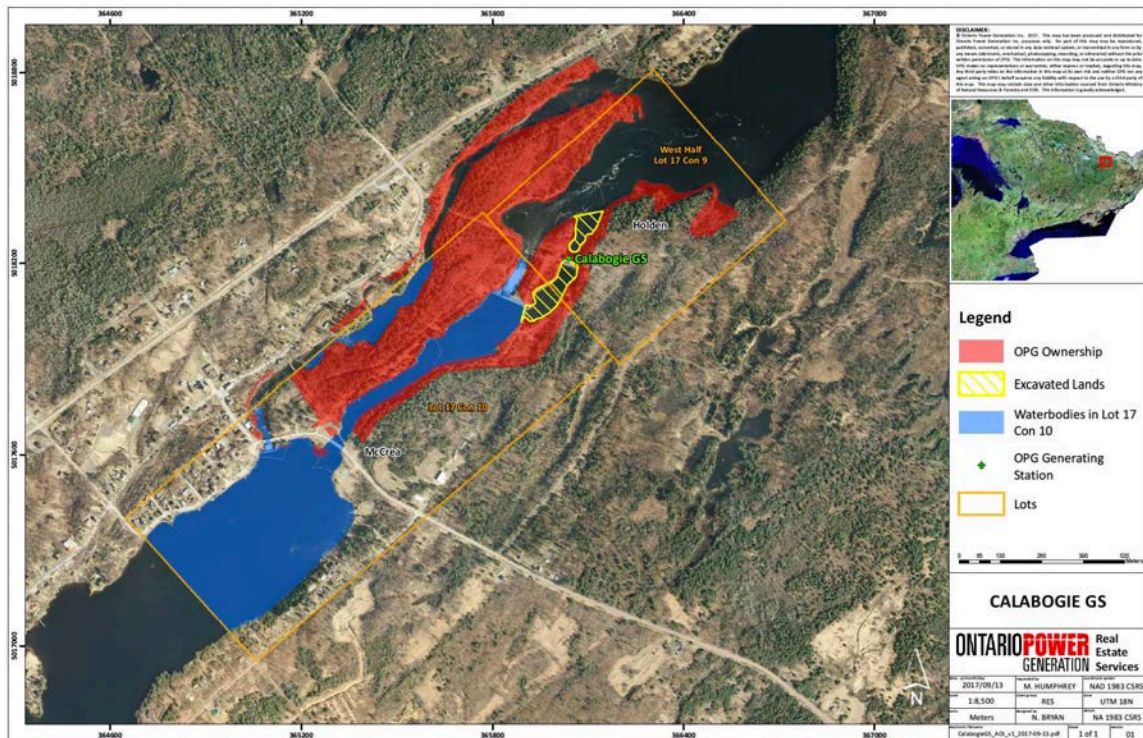


Figure 2. Aerial photograph showing the Calabogie GS location on Lot 17, Concessions 9 and 10 in the geographic Township of Bagot and Blythfield in the County of Renfrew [OPG, Real Estate Service, July 13, 2017].

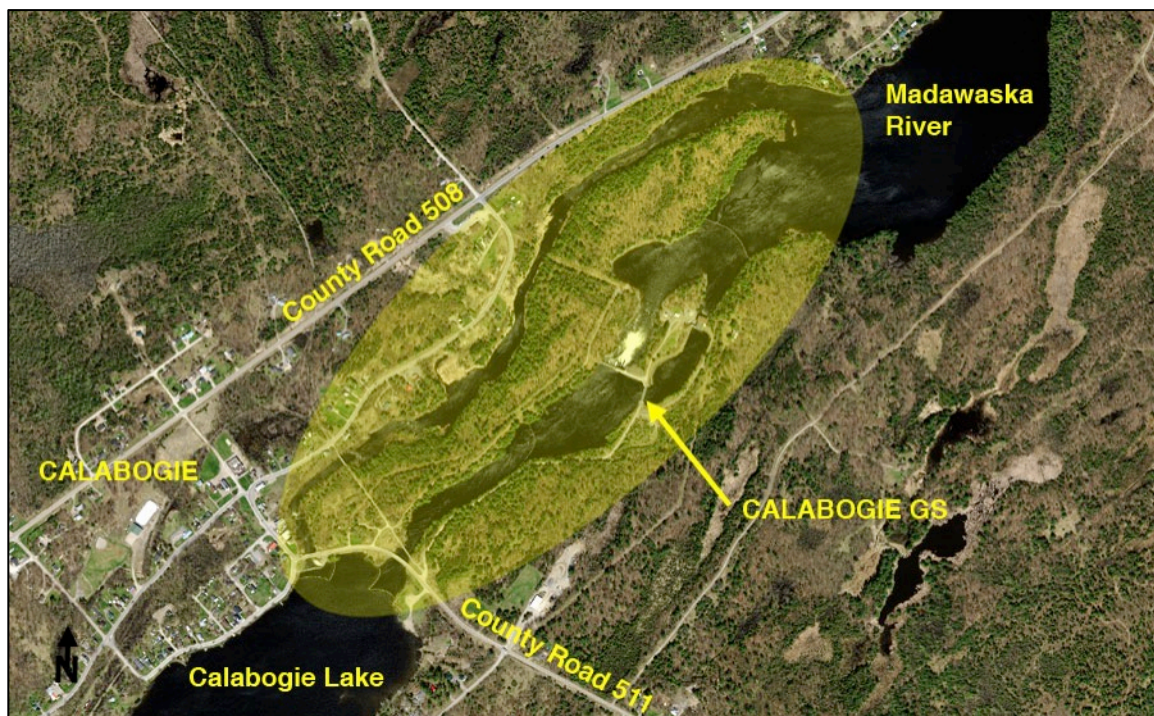


Figure 3. The shaded yellow oval delineates the boundaries of the Calabogie GS Provincial Heritage Property [Google Maps, 2016, as adapted].

2.3 Statement of Cultural Heritage Value or Interest

The Calabogie Light and Power Company, a subsidiary of M.J. O'Brien, Limited developed the Calabogie GS. Preliminary design work was undertaken in 1916 and constructed was carried out in 1917. Michael John O'Brien, a noted industrialist was engaged in a wide range of business activities in the late 1800s and early 1900s in the Renfrew region and across Ontario. O'Brien's involvement in the economic and cultural development of Renfrew and the surrounding region was pervasive and enduring. O'Brien was familiar with Calabogie village as he had met and subsequently married a woman from the area during his work on the construction of the Kingston & Pembroke Railway in the 1880s. Increasing demand for power during the First World War prompted O'Brien to enter into hydroelectric generation to supply his wartime industries in Renfrew. The plant also provided the first electrical power to the Calabogie area.

To undertake the technical aspects of the project, O'Brien retained the consulting engineering firm of Kerry & Chace Limited of Toronto; both partners were accomplished hydraulic engineers. The firm had a depth of experience in the design and construction of hydroelectric generating stations notably through its work along the Trent Canal although it was also involved in plant development in Northern Ontario, other parts of Canada and the United States. The Calabogie GS is an excellent representative example of a hydroelectric generating from the first part of the 20th century. The layout of the plant followed standard engineering technology and its design was well executed as its continued use attests. The rapid construction of the plant in seven months to meet wartime demand is notable. The Calabogie GS retains significant components of its original equipment including two horizontal Francis style turbines manufactured by Allis-Chalmers of Milwaukee, Wisconsin and two alternating current generators manufactured by Canadian General Electric of Toronto. The plant has been modified over the years to maintain operations but it retains its original design character and key components. The HEPC, later Ontario Hydro and now OPG, acquired the generating station from M.J. O'Brien, Limited in 1929.

The Calabogie GS is oldest of five hydroelectric generating stations on the Madawaska River in Eastern Ontario. Its layout, including dams with sluiceways, inlet sluices, forebay, headworks, powerhouse and tailrace clearly conveys its function and age as a hydroelectric complex dating to the early 20th century. There has been little change to the surrounding landscape and the plant retains its traditional relationship with the community of Calabogie and the recreational uses on Lake Calabogie and the Madawaska River. While the Calabogie GS is not considered to be a physical landmark, local residents identify with the site and view it as a symbolic landmark in the community.

2.4 Identification of Heritage Attributes

Heritage attributes, i.e., character defining elements, of the Calabogie GS include, but are not limited to, the following details as identified on the accompanying map (**Figure 4**):

1. Dam on the North Branch constructed of concrete and comprising five sluices.
2. Main control dam on the South Branch constructed of concrete and comprising five sluices.
3. Entrance or cut-off dam constructed of concrete and comprising five sluices.
4. Forebay with a natural high bank to the south and man-made earth embankment to the north;
5. Headworks comprising open flume type wheel pits constructed of concrete and steel trash racks. Wheel pits were provided for three turbines, although only two were ever installed and one water-driven exciter, which is no longer in use. The head block for the former log chute remains clearly identifiable.
6. Powerhouse.
 - a. Exterior comprising a two-storey structure with concrete foundation and brick walls featuring piers and corbelled cornices, shallow sloped roof, large arched opening on the north wall with radiating voussoirs and concrete keystone and springers, entranceway with double leaf, wood doors on the south wall and pattern of rectangular-shaped window openings with concrete sills and lintels fitted with multi-paned metal sashes.
 - b. Interior containing the full height generator hall with timber roof to the west and three-level area to the east with concrete roof.
 - c. Equipment comprising two horizontal Francis type turbines with four runners per unit manufactured by Allis-Chalmers and two alternating current generators manufactured by Canadian General Electric Co. Limited. The turbine for a water-driven exciter remains *in situ* although the exciter itself has been removed. A Woodward governor remains at the plant although it is no longer in use.
7. Tailrace that runs a short distance from below the powerhouse to where it joins the South Branch.
8. North Branch with former railway bridge, now part of the K&P Trail.
9. South Branch with former railway bridge, now part of the K&P Trail and Secondary Highway 511 highway bridge abutments.
10. Access roads on the north and south banks of the South Branch. The road on the south bank of the South Branch comprises the right-of-way of the former railway spur used during the construction of the generating station on the south bank of the South.

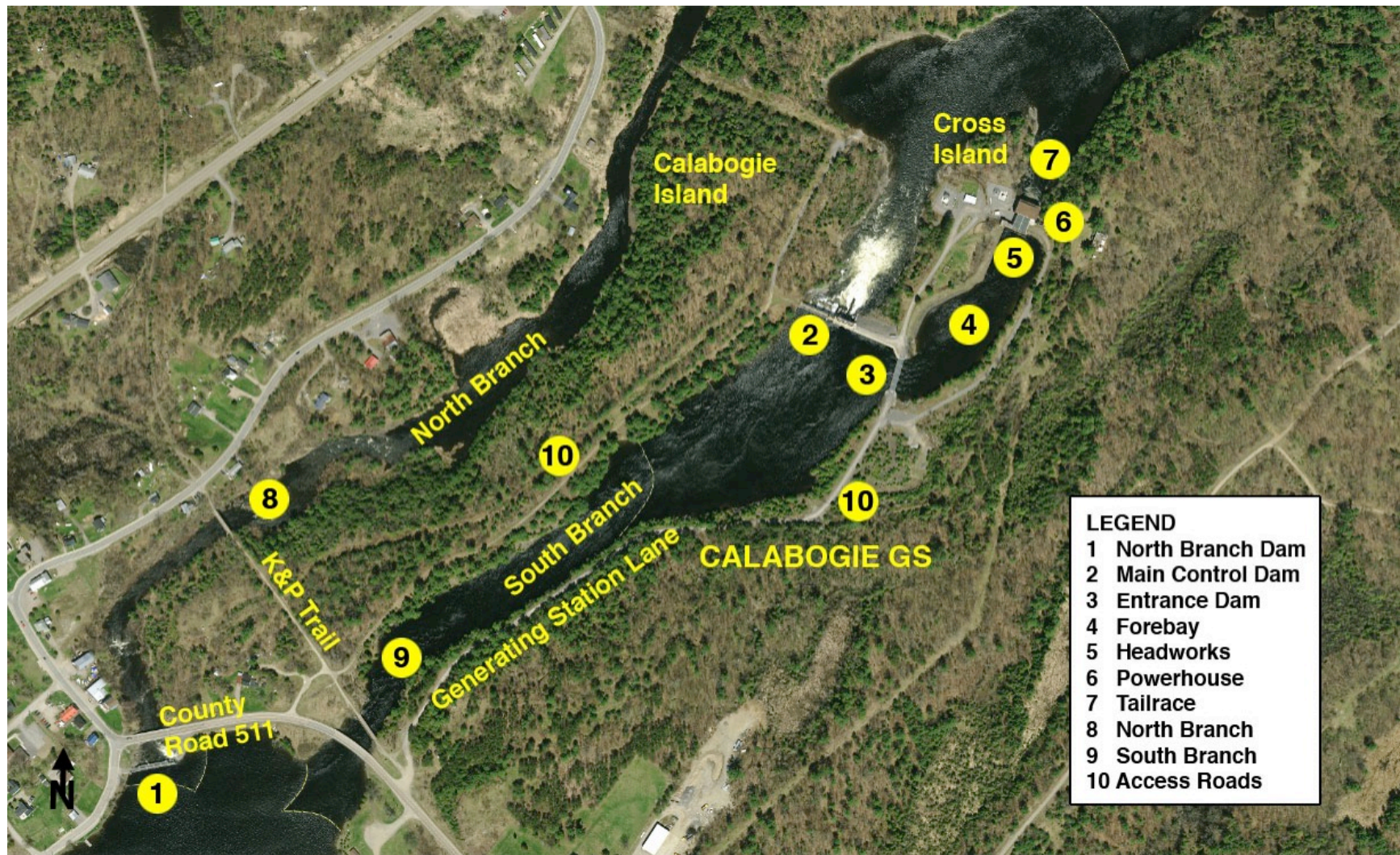


Figure 4. The heritage attributes of the Calabogie GS are identified on an aerial photograph of the site [County of Renfrew Mapping, 2014, as adapted].

3.0 ASSESSMENT OF EXISTING CONDITIONS

Unterman McPhail Associates undertook a site review of the Calabogie GS with OPG staff in August 2016 during the preparation of the CHER. No additional fieldwork was undertaken as part of the CHIA. On September 21, 2018 a tornado in the Calabogie area resulted in significant damage to the site. The following description of the site and built heritage resources reflects changes to the generating station property as a result of the tornado. OPG and Arcadis provided photographs and written accounts of the storm damage, including the “Calabogie GS Storm Damage Inspection Report” prepared by KGS Group, Consulting Engineers for OPG. Photographs provided by OPG (attributed to KGS Group) and Arcadis supplement those of Unterman McPhail Associates and dating to August 2016.

3.1 Site Description

The community of Calabogie is situated on Renfrew County Road 508 to the west of Arnprior. At this location, the Madawaska River widens into a body of water known as Calabogie Lake. At the outlet of Calabogie Lake the Madawaska River splits into two channels, namely the North Branch and the South Branch for a distance of approximately one mile (1.6 km) (**Figures 5 and 6**). Calabogie Island is situated between the North Branch and the South Branch. A series of rapids in both channels have a fall of about 27-ft. (8.23 m). The river is considered to flow west to east in the vicinity of the Calabogie GS.

The North Branch of the Madawaska River is a natural river channel. In the 1880s the South Branch was improved to provide water to a mill located near the site of the present powerhouse. Kerry & Chace also selected the South Channel for the site of the Calabogie GS. A low-lying area on the south side of the South Branch was excavated to form the forebay and the tailrace. The work resulted in the creation of an island identified as Cross Island. The South Branch was further deepened in the 1960s to handle the increased water flow from the expanded upstream Barrett Chute GS and Mountain Chute GS.

Renfrew County Road 511 leads south from Calabogie and crosses over the North Branch and the South Branch of the Madawaska River. Generating Station Lane heads east from Renfrew County Road 511 just south of the South Branch and provides access to the Calabogie GS. Former railway bridges over the river are located to the east of the Renfrew County Road 511 bridges and are part of the Renfrew County K&P Trail (**Figure 7**). The abutments of a former highway bridge are visible at the South Branch to the east of the former railway bridge (**Figure 8**).

A railway siding constructed in 1917 from the K&P main line was later converted to a roadway and it continues to provide access to the plant. Known as Generating Station Lane, the private OPG road follows the curved shoreline of the South Branch of the Madawaska River (**Figure 9**). The narrow roadway divides in two just west of the entrance dam. The left fork crosses over the entrance dam to Cross Island and passes the

main control dam before sloping downhill and terminating at the north side of the powerhouse (**Figures 10 and 11**). A transformer yard is located beside the powerhouse and the Calabogie DS, a switchyard operated by Hydro One is situated to the north of the access road (**Figures 12 and 13**). Hydro One's connection lines extend from the switchyard to the north and west of the station. An ACTO portable office was installed beside the powerhouse in 1992. At the split in the access road, the right fork along the south bank of the South Branch and leads to the former operators' colony that is now privately owned.

A second OPG-owned roadway from Renfrew County Road 511 provides access to Calabogie Island. The dirt road leads along the north bank of the South Branch and extends as far as Hydro One's connection line. The island can also be reached by foot across the Main Control Dam.

The development of the Madawaska River for hydroelectric generation purposes has altered the natural characteristics of the waterway. The existing configuration of the North Branch and the South Branch is the result of human activity (**Figure 14**). OPG manages the water levels in Lake Calabogie and controls the flow of water through the river. Brightly coloured booms on Lake Calabogie at the outlets to the North Branch and South Branch alert boaters to not enter the channels. Additional booms are located on the South Branch above the main dam and below the tailrace.

The 2018 tornado destroyed or damaged much of the forest cover at the Calabogie GS (**Figures 15 and 16**). The loss of trees was much greater on Cross Island than Calabogie Island.

3.2 Built Heritage Resource Description

The Calabogie GS contains the following structures: dams with sluiceways, inlet sluices, forebay, headworks, powerhouse and transformer yard. Together these structures make up the generating station complex. The facility has a normal operating head of 30-ft. (9.1 m). The powerhouse contains two units with an installed capacity of 4 MW. The Calabogie GS operates as a peaking plant in conjunction with four (4) OPG owned generating stations on the Madawaska River. The Calabogie GS has not operated since a tornado swept through the area on September 21, 2018 and resulted in significant damage to the generating station, notably to the powerhouse.

Three concrete dams control the flow of the Madawaska River as part of the Calabogie GS. The concrete dams were constructed directly on bedrock. No reinforcement was used in the concrete construction other than to anchor the concrete to bedrock. The three dams were constructed in 1917 as part of the initial development of the site. A concrete dam (**Figure 17**) located at the foot of Lake Calabogie controls the flow of water through the North Branch. It is 134-ft. 6-in. (41 m) long and comprises five sluiceways; each sluiceway is 20-ft. 0-in. (6.10 m) wide with piers 6-ft. 0-in. (1.83 m) in width. The main control dam (**Figure 18**) is situated on the South Branch approximately ½-mile (0.81 km)

below the outlet of the lake. The gravity dam has an overall length of 390-ft. 6-in. (119 m) and contains five (5) stoplog sluices, 20-ft. 0-in. (6.10 m) wide with piers 6-ft. 0-in. (1.83 m) in width and a concrete spillway. It was modified in 1968. An entrance or cutoff dam (**Figure 19**) controls the flow of water to the forebay. It is 124-ft. (37.8 m) long and contains five (5) sluices with wingwalls at either end. Each sluice is 20-ft. 0-in. (1.60 m) wide with piers that are 4-ft. 0-in. (1.22 m) in width. The top of the entrance dam forms part of the access road to the powerhouse.

The forebay (**Figure 20**) is approximately 1,000-ft. (300 m) long and 300-ft. (90 m) wide. A natural high bank establishes the southern limits of the forebay while a man-made earth embankment encloses the north side.

The headworks (**Figure 21**) are located on the upstream side of the powerhouse. As designed, it contained space for three turbines and one exciter although only two turbines were ever installed and the exciter has been removed from service. The open flume type wheel pits are made of reinforced, cast-in-place concrete. Each pit is 60-ft. 0-in. (18.29 m) long, 23-ft. 0-in. (7.01 m) wide and 27-ft. 0-in. (8.23 m) in height. The walls between pits are 3-ft. 0-in. (0.91 m) thick. Steel tie beams provide rigidity to the wheel pit structure covered in an open steel deck. Steel trash racks are located in front of the wheel pit openings. A log chute has been closed in.

The two-storey powerhouse (**Figure 22**) follows a rectangular floor plan. The brick building measures 70-ft. 0-in. (21.34 m) long, 44-ft. 0-in. (13.41 m) wide and 40-ft. (12.19 m) high. The interior features two horizontal Francis type turbines manufactured by Allis-Chambers Co. of Milwaukee, Wisconsin and two alternating current generators manufactured by the Canadian General Electric Co. Limited of Toronto (**Figure 23**). A Woodward governor that is associated with a water-driven exciter remains at the plant although it is no longer in use (**Figure 24**). The exciter has been removed.

The tailrace (**Figure 25**) forms a short and narrow channel downstream of the powerhouse to where it joins the South Channel of the main river.

Storm damage

The tornado, which touched down in Calabogie on September 21, 2018 caused significant damage to the Calabogie GS generating and flow control equipment. Damage to the transformers and power lines led to the loss of power to the site and resulted in the shut down of the water flow control equipment as well as the powerhouse. In addition a significant portion of the powerhouse roof was dislocated (**Figure 26**) and sections of the parapet collapsed (**Figure 27**). The loss of the roof allowed water to penetrate the interior of the building (**Figure 28**). The generators, including stator and rotor insulation were exposed to heavy precipitation and drying the equipment was not practically feasible. The power distribution and control equipment were also exposed to moisture.

In the aftermath of the storm, OPG undertook emergency repairs at the Calabogie GS. The primary focus was to make the site safe and to restore sluiceway gate operations to manage water flow. Temporary power to site was established and clean up of vegetation debris was undertaken.

Subsequent work included the restoration of a permanent power supply, the recovery of full sluiceway function with de-icing controls, the re-establishment of controls, monitoring and remote communication and the stabilization of the powerhouse.

KGS Group, Consulting Engineers in conjunction with OPG and SNC Lavalin completed a site visit to the powerhouse on September 28, 2018 in order to assess the tornado damage to the building and to identify work required to stabilize the structure prior to winter. Based on the inspection and the KGS Group recommendations² the following work was undertaken,

- Access to the powerhouse is restricted to that required for safe state work and environmental monitoring. No access is permitted during wind events.
- Rubble/debris around the powerhouse including in the immediate forebay upstream and the tailrace was removed to provide a safer environment for future work and site inspections.
- Loose brick and concrete sections of the parapet walls on the sides of the powerhouse were removed.
- The tops of the multi-coursed brick walls where damage or demolition occurred were sealed to eliminate water infiltration into the brick walls and potential frost damage.
- The east and west brick walls were braced with temporary lateral bracing.
- All oil or fluids in the equipment were drained to ensure no leaks occur.
- All batteries remaining in the powerhouse were removed.
- Any remaining live equipment in the powerhouse was addressed.
- Dewatering sumps were pumped to avoid buildup of water and service water lines were drained.
- All equipment remaining in the plant was covered with tarps.
- Water was left in the forebay with stoplogs in place at the forebay inlet structure and a bubbler was installed at the inlet structure and at the powerhouse to prevent ice buildup and ice action on the existing structure.

² KGS Group, Memorandum Re: Calabogie Powerhouse Storm Damage Inspection Summary, November 1, 2018, 3-4.



Figure 5. A view downstream from the dam at the outlet of Calabogie Lake shows the North Branch of the Madawaska River.



Figure 6. Most of the water flows through the South Branch. Engineering works associated with the Calabogie GS are viewed downstream on the South Branch.



Figure 7. A former railway bridge that crosses the South Brank in proximity to Renfrew County Road 511 forms part of the K&P Trail that runs between Calabogie and Renfrew.



Figure 8. The abutments of a former highway bridge are visible to the left (downstream) of the railway bridge.



Figure 9. The private OPG-owned road, known as Generating Station Lane provides access to the Calabogie GS. The narrow roadway with gravel surface passes through a naturalized landscape.



Figure 10. The access road crosses over the top of the entrance dam and onto Cross Island. A glimpse of the red-brick powerhouse is viewed in the background.



Figure 11. The access road terminates in front of the powerhouse on Cross Island.

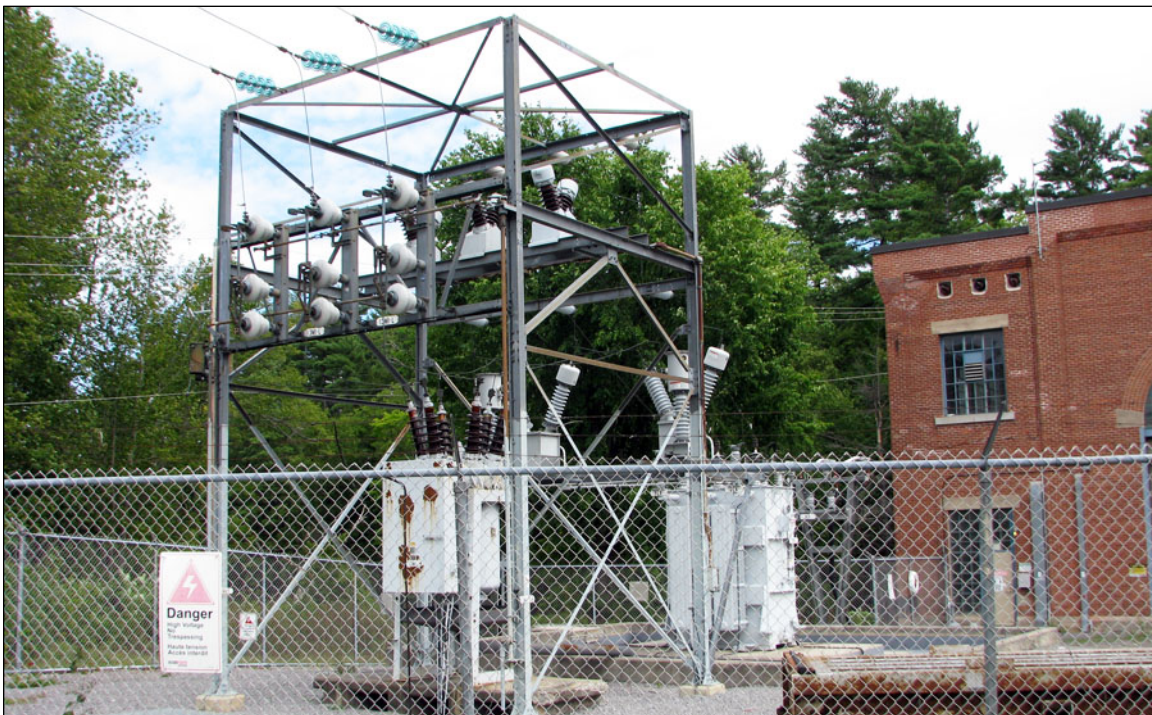


Figure 12. The outdoor transformer yard was established in 1987 when the transformers were relocated from their original location inside the powerhouse.



Figure 13. A Hydro One switchyard identified as the Calabogie DS is situated on banks of the river to the north of the powerhouse.



Figure 14. A view of the channel of the South Branch below the main control dam depicts the waterway as modified for hydroelectric generation purposes.



Figure 15. The 2018 tornado damaged not only the powerhouse but also numerous trees in proximity to the building [Arcadis, 2018].



Figure 16. A view to the west of the powerhouse provides an indication of the extent of loss of the forest cover on Cross Island [KGS Group, 2018].



Figure 17. A concrete dam with five, stoplog sluices controls the flow of water into the North Branch of the Madawaska River.



Figure 18. The main control dam is located on the South Branch of the Madawaska River. Originally containing five, stoplog sluices, an additional three gate sluices were added in 1968.



Figure 19. An entrance dam, also known as a cutoff dam, with five sluiceway controls the flow of water into the forebay.



Figure 20. The forebay extends approximately 1,000-ft. (300 m) between the entrance dam seen to the west in the background and the headworks.



Figure 21. Trash racks extend across the upstream face of the headworks that house the turbine wheel pits.



Figure 22. A view of the north elevation of powerhouse depicts the structure prior to the 2018 tornado.



Figure 23. The Calabogie GS contains generating units connected to quadruple-Francis horizontal turbines.



Figure 24. A Woodward governor (right) and turbine (left) at the plant are associated with a former water-driven exciter.



Figure 25. The tailrace flows a short distance downstream from the powerhouse before joining the South Branch of the Madawaska.



Figure 26. The storm on September 21, 2018 dislodges a significant portion of the powerhouse roof [OPG, 2018].



Figure 27. The brick parapet wall with concrete coping was damaged most severely on the north and south end walls of the powerhouse [KGS Group, 2018].



Figure 28. The loss of the roof exposed the interior of powerhouse and equipment to the elements, notably heavy precipitation associated with the storm [KGS Group, 2018].

4.0 DESCRIPTION AND PURPOSE OF THE PROPOSED ACTIVITY

4.1 Introduction

The following description and purpose of the proposed activity at the Calabogie GS is based on the material provided by OPG and Arcadis to the consultants. Specifically OPG's Calabogie GS Redevelopment, Conceptual Design Alternative Selection (November 20, 2018) and Arcadis' Project Description (February 14, 2019) inform this section.

OPG has determined the existing Calabogie GS has reached the end of its expected service life. As a result of the small capacity of the turbines, the existing facility is unable to use the water resources effectively. The purpose of the project is to redevelop the site and to increase the Calabogie GS capacity from 4 MW to approximately 10 to 11 MW. The intent is to maximize the annual energy generation at the site while achieving an acceptable rate on OPG's investment and addressing qualitative risk factors.

The facility has been a candidate for redevelopment for a number of years and studies from 1960 on have examined retirement, refurbishment, expansion or replacement of the generating station. With its future undefined, the Calabogie GS was operated in a "run-to-fail" mode with little long-term work at the site.

In May 2018 OPG awarded the Front-End Engineering and Design (FEED) of the Calabogie GS Redevelopment Project to SNC-Lavalin in joint venture with M. Sullivan & Son Limited (Sullivan). Initial tasks of the FEED phase of the project included an assessment of 17 redevelopment proposals, the identification of three (3) alternatives that warranted further study and the selection of a preferred alternative.

4.2 Alternatives

A Project team comprising representatives from the Contractor (SNC-Lavalin and M. Sullivan & Son), OPG, KGS Group (OPG's engineer), the environmental consultant met at a workshop in July 2018 to refine the list of redevelopment proposals. The Project team selected the following three (3) alternatives as Conceptual Design Alternatives for detailed evaluation.³

Alternative 1 – Refurbishment of the existing powerhouse with minimal civil work.

The existing powerhouse will be refurbished and fitted with all new electrical and mechanical equipment in the existing intake bays, requiring minimal civil work. Implementation of this alternative would involve the following high-level scope:

- Installation of new turbine/generator equipment into the existing powerhouse, including all new electrical and balance of plant equipment.

³ OPG, Calabogie GS Redevelopment, Conceptual Design Alternative Selection (November 20, 2018) 3-5.

- Upgrade of the powerhouse superstructure to reinforce and upgrade to modern code, including new roof and powerhouse crane.
- Concrete repairs throughout the powerhouse structure.
- Replacement of the forebay retaining wall to stop seepage that is currently occurring and address other dam safety concerns identified at the site.
- Construction of a new substation

Alternative 2 – Refurbishment, expansion and redesign of the existing powerhouse.

Major modification and civil work will occur within the powerhouse to replace the current units with new units in the existing intake bays. Implementation of this alternative will involve the following high-level scope:

- Excavation and civil work to expand the existing intake bays and powerhouse to accommodate new units including works to construct an adjacent third intake and generating unit.
- Installation of new turbine/generator equipment, including all new electrical and balance of plant equipment.
- Upgrade of the powerhouse superstructure to reinforce and upgrade to modern code, including new roof and powerhouse crane.
- Concrete repairs throughout the powerhouse structure.
- Replacement of the forebay retaining wall to stop seepage that is currently occurring and address other dam safety concerns identified at the site.
- Construction of a new substation.

Alternative 3 – Construction of a new powerhouse.

An entirely new station will be constructed, likely upstream of the existing powerhouse within the forebay. The existing powerhouse will be demolished. The new station will have two horizontal units that are expected to produce approximately 11 to 12 MW. Implementation of this alternative will involve the following high-level scope:

- Construction of a new powerhouse with all new water-to-wire 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.
- Construction of a new substation.

The Project team and Arcadis met at a second workshop in October 2018 to compare the alternatives and select a preferred alternative. The Contractor developed each of the alternatives with conceptual layouts (***Figures 29 to 34***) and estimates with input from turbine/generator manufacturers, energy production assessments and schedules. At the same time, OPG and its engineer developed estimates for OPG's costs and long-term operating and maintenance costs.

A financial evaluation of the three alternatives was undertaken that included reviews of the operating and maintenance cost estimates and the indicative design-build cost estimates. Based on OPG's financial model, which was updated throughout the process, a comparative analysis was completed between the three alternatives. As a result of the financial evaluation, Alternatives 1 and 3 were determined to be comparable in terms of the lifecycle costs per energy produced. The costs of Alternative 2: Refurbishment, expansion and redesign of the existing powerhouse were significantly higher and it was excluded from further consideration.

A quantitative analysis was completed for the two remaining options, namely, Alternative 1: Refurbishment of the existing powerhouse with minimal civil work and Alternative 3: Construction of a new powerhouse. The analysis considered 15 equally weighted factors, namely, benefit to OPG portfolio, schedule, environment, climate change adaptation, health & safety during construction, health & safety during operations, dam safety, public safety, stakeholder relations, operability, efficiency, constructability, maintainability, technology and effort/coordination for safe state after tornado damage. Alternatives 1 and 3 were considered equal in two (2) factors (public safety and technology) while Alternative 1 was favoured in four (4) factors (schedule, environment, health & safety during construction and stakeholder relations) and Alternative 3 was favoured in the remaining nine (9) factors. As a result, Alternative 3 was identified as the preferred alternative.

While the tornado of September 21, 2018 caused significant damage to the powerhouse, this did not factor into the selection of the preferred alternative in a meaningful way. The plant has not operated since that time.

Implementation of the preferred alternative will entail the following key components,

- Construction of a new powerhouse upstream of the original powerhouse within the forebay. The station will have two horizontal units that will produce between 11 and 12 MW.
- Removal of all the existing power equipment from the existing powerhouse and demolition of the 1917 powerhouse and headworks.
- Removal of the inlet structure to the forebay, widening of the inlet section and excavation in the forebay and tailrace for increased water flow.
- Introduction of new road alignments in proximity to the powerhouse.
- Construction of a new substation and interconnection to the existing transmission line.

A Site Plan prepared by M. Sullivan & Son and SNC-Lavalin to depict the new road realignment plans also identifies the other important aspects of the project listed above (*Figure 35*).

4.3 Draft Final Site Plan

OPG has selected a station configuration that will have two horizontal open pit drive turbines rated at a total of 11.3 in megawatts. **Figure 36** shows the proposed Draft Final Site Design for the Calabogie GS.

OPG is pursuing Environmental Assessment approval, coordination with Hydro One on distribution connections and consultation with stakeholders.

OPG Board approval to move to the Execution Phase is anticipated in the second half of 2019 with construction expected to commence in the first quarter of 2020.

4.4 Additional Sluiceway Capacity

Currently, OPG is evaluating whether additional sluiceway capacity is required at Calabogie GS. The Ministry of Natural Resources and Forestry (MNR) has in place Dam Safety Guidelines to protect the public and the natural and built assets of the Province that were updated in 2011. Presently, the Calabogie GS site has the spill capacity to pass a 1:1,000 year flood event while still maintaining the water level limits established in the MNR Water Management Plan. OPG has assessed the spill capacity in accordance with the 2011 MNR Guidelines and has determined it may be necessary to enhance the spill capacity to accommodate floods significantly exceeding the 1:1,000 year flood. Approval for additional spill capacity would be required under the Lakes and River Improvement Act. At this time no decision has yet been made on whether any alterations will be required to the site. OPG is contemplating three different options for additional sluiceway capacity (**Figure 37**). If OPG refines the sluiceway capacity at the Calabogie GS, it will provide a revised CHIA report to MTCS.

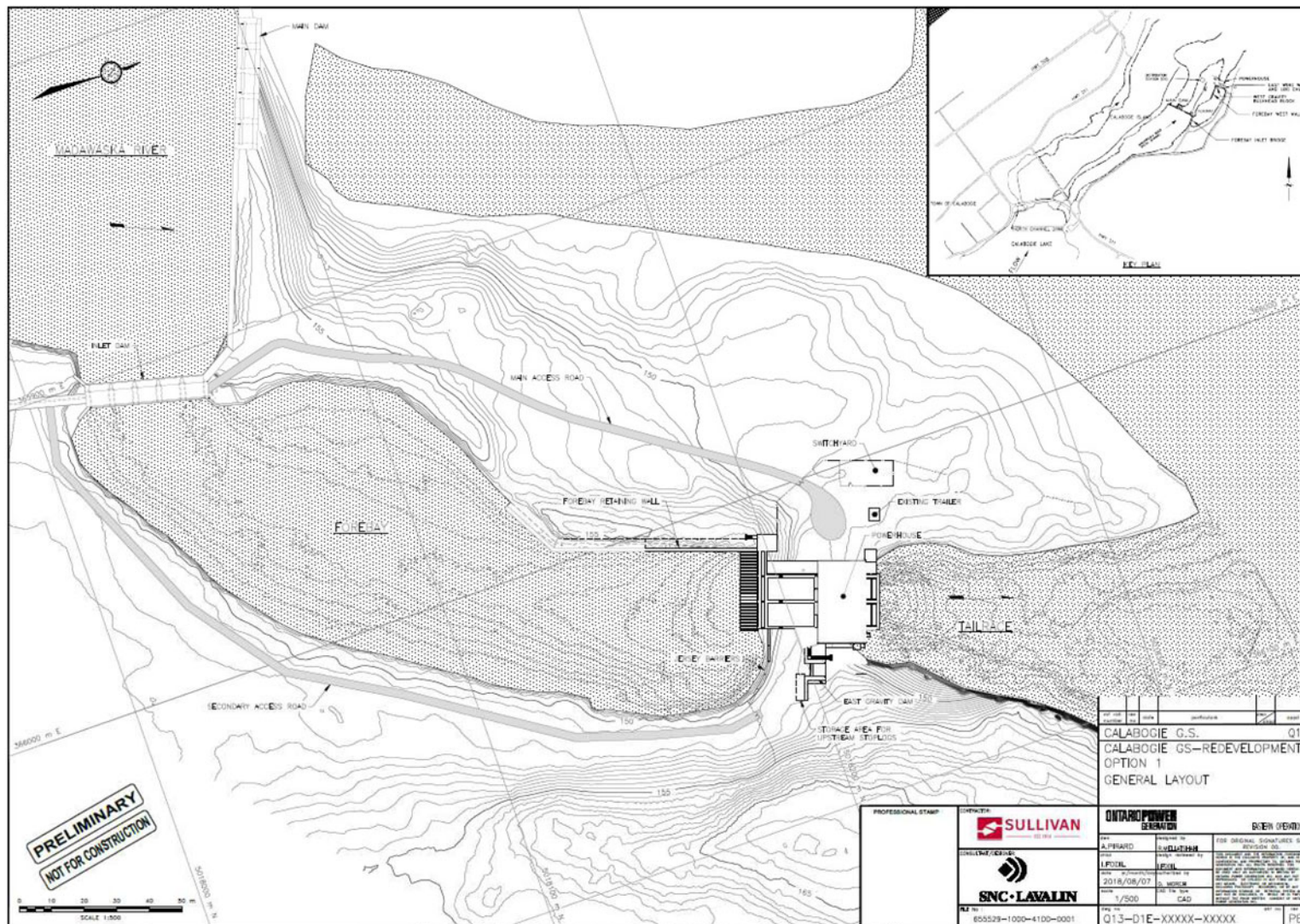


Figure 29. M. Sullivan & Son and SNC-Lavalin, Calabogie GS Redevelopment, Option 1, General Layout [August 2, 2018].

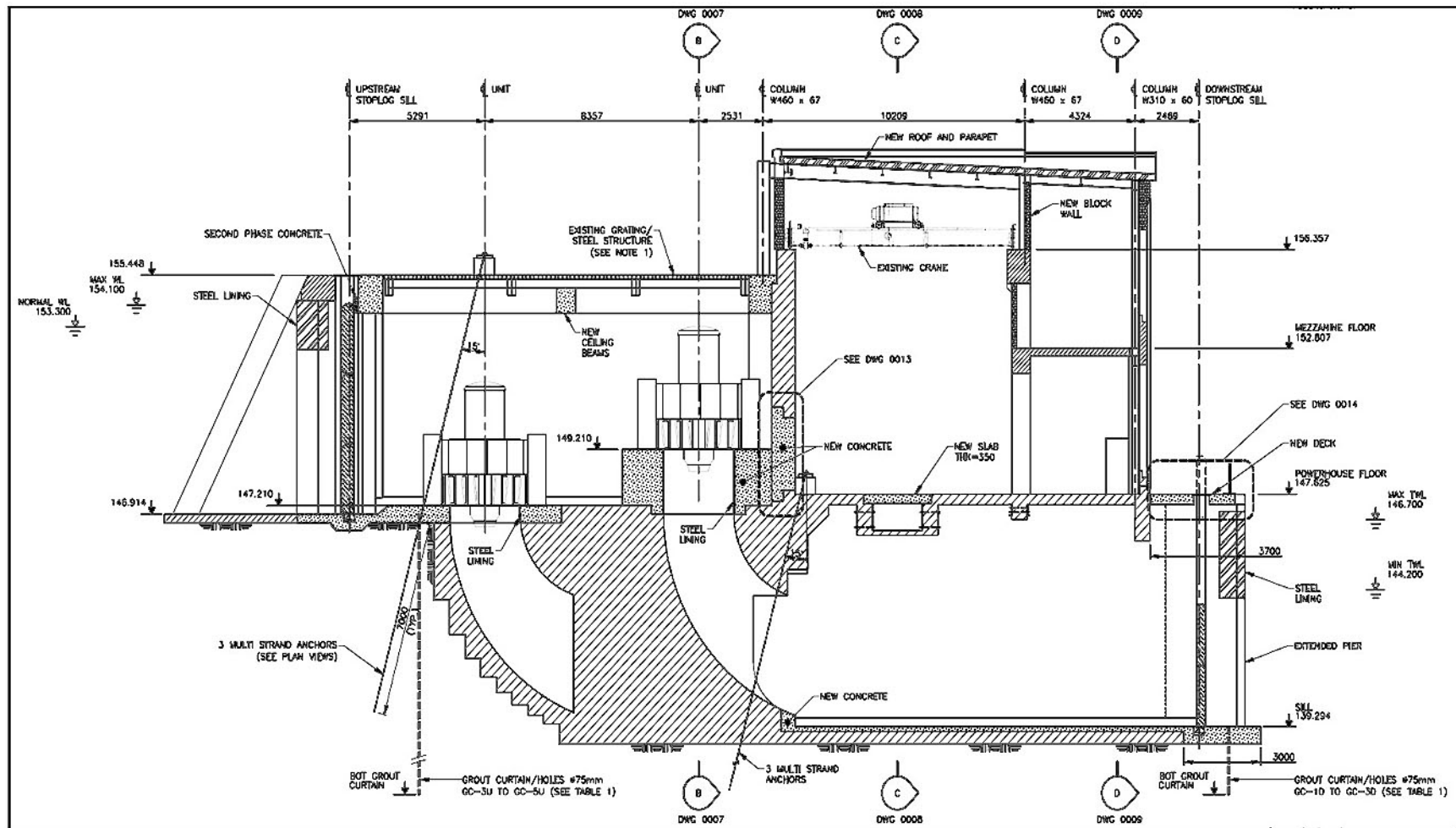


Figure 30. M. Sullivan & Son and SNC-Lavalin, Calabogie GS Redevelopment, Option 1, Powerhouse Section View [no date].

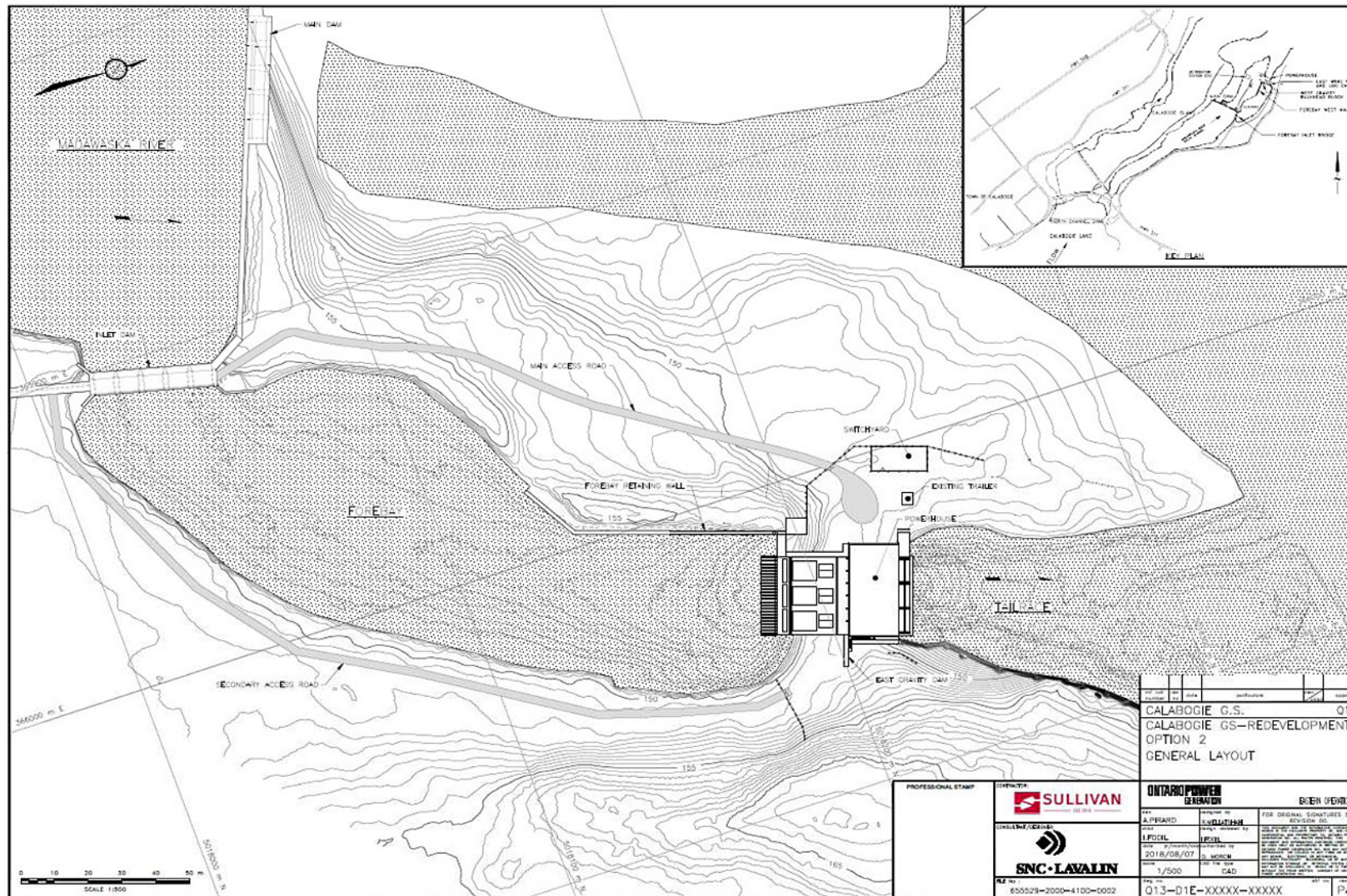


Figure 31. M. Sullivan & Son and SNC-Lavalin, Calabogie GS Redevelopment, Option 2, General Layout [August 7, 2018].

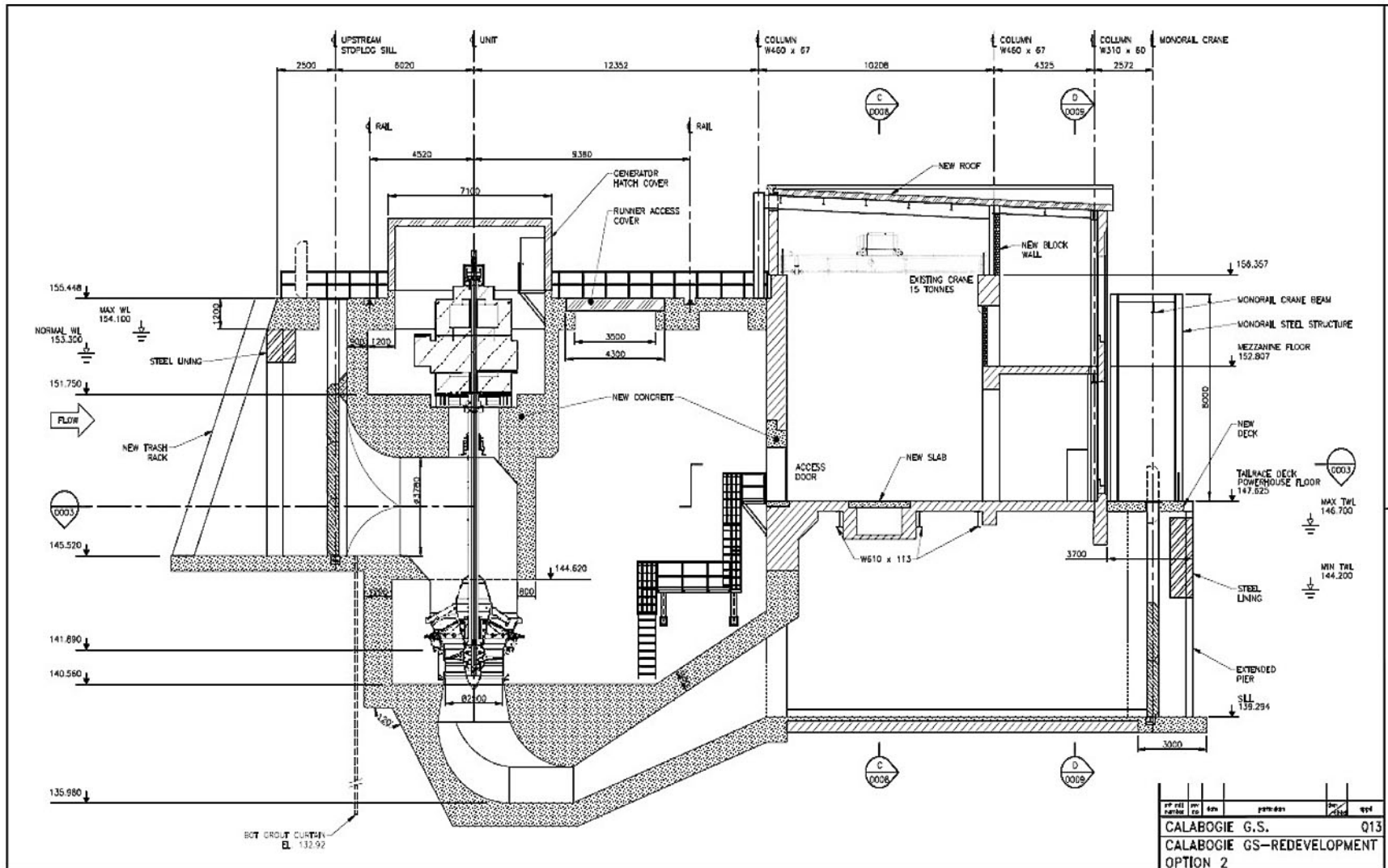


Figure 32. M. Sullivan & Son and SNC-Lavalin, Calabogie GS Redevelopment, Option 2, Powerhouse Section View [no date].

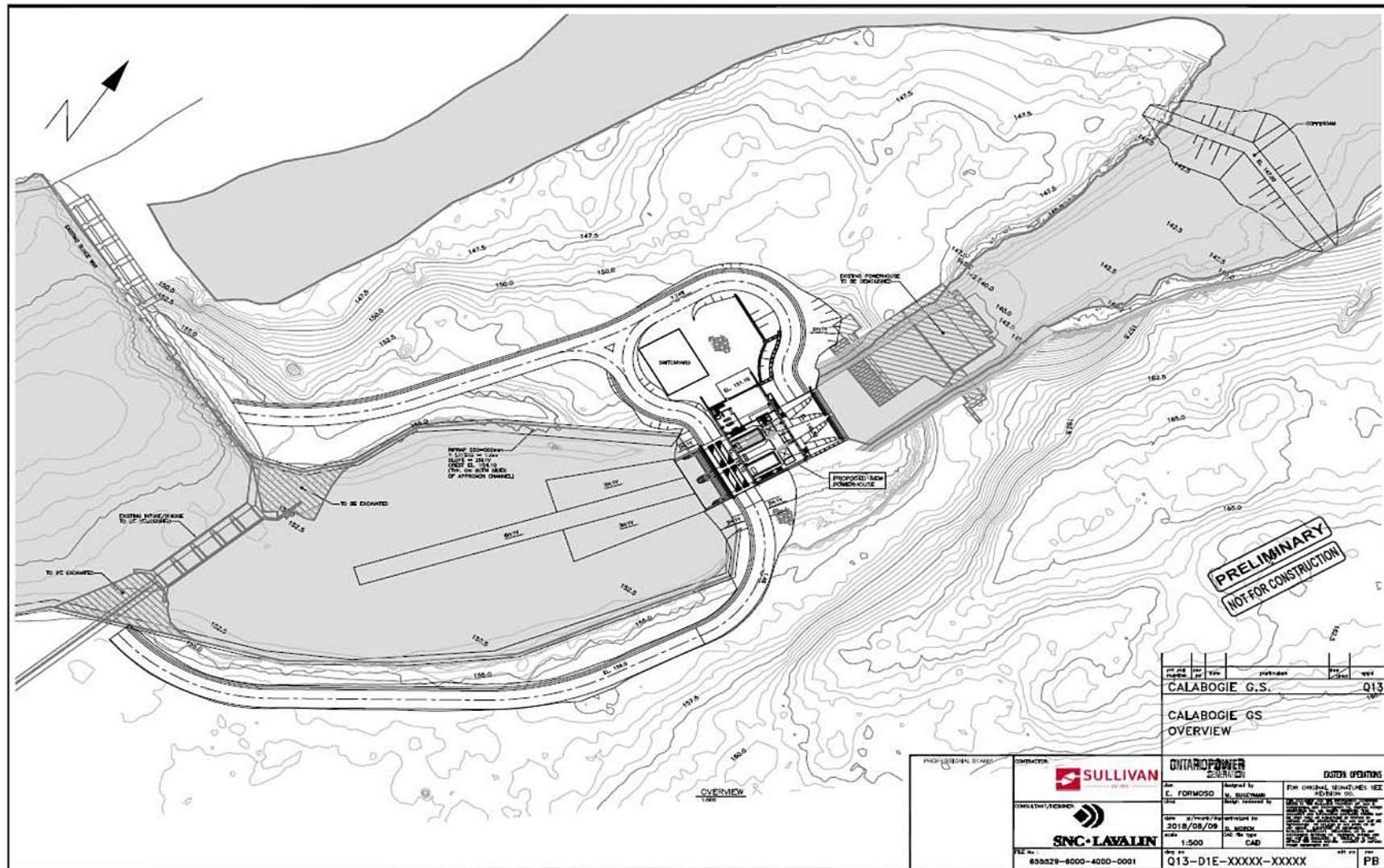


Figure 33. M. Sullivan & Son and SNC-Lavalin, Calabogie GS Redevelopment, Option 3, Overview [August 9, 2018].

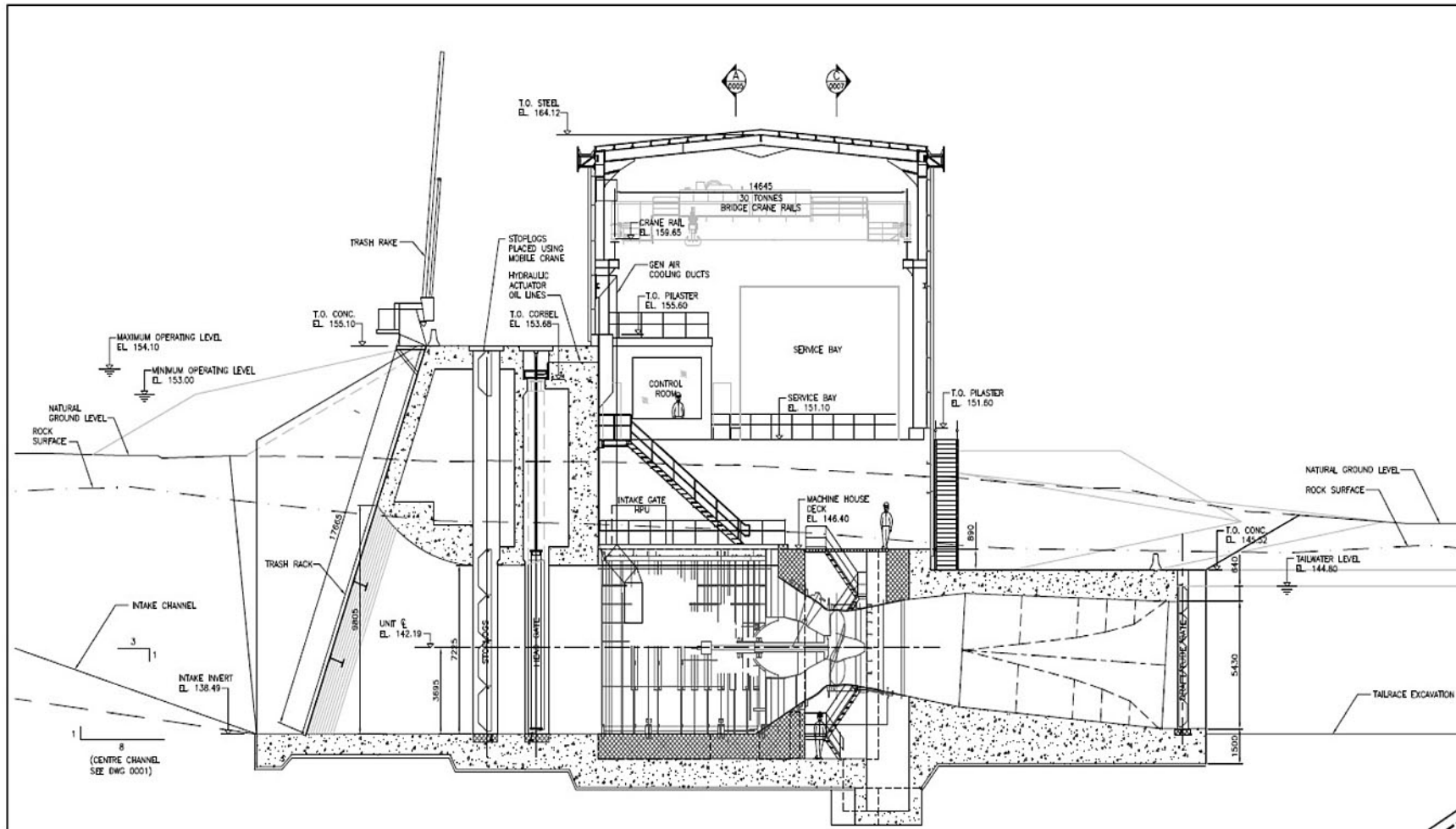


Figure 34. M. Sullivan & Son and SNC-Lavalin, Calabogie GS Redevelopment, Option 3, Powerhouse Section View [no date].

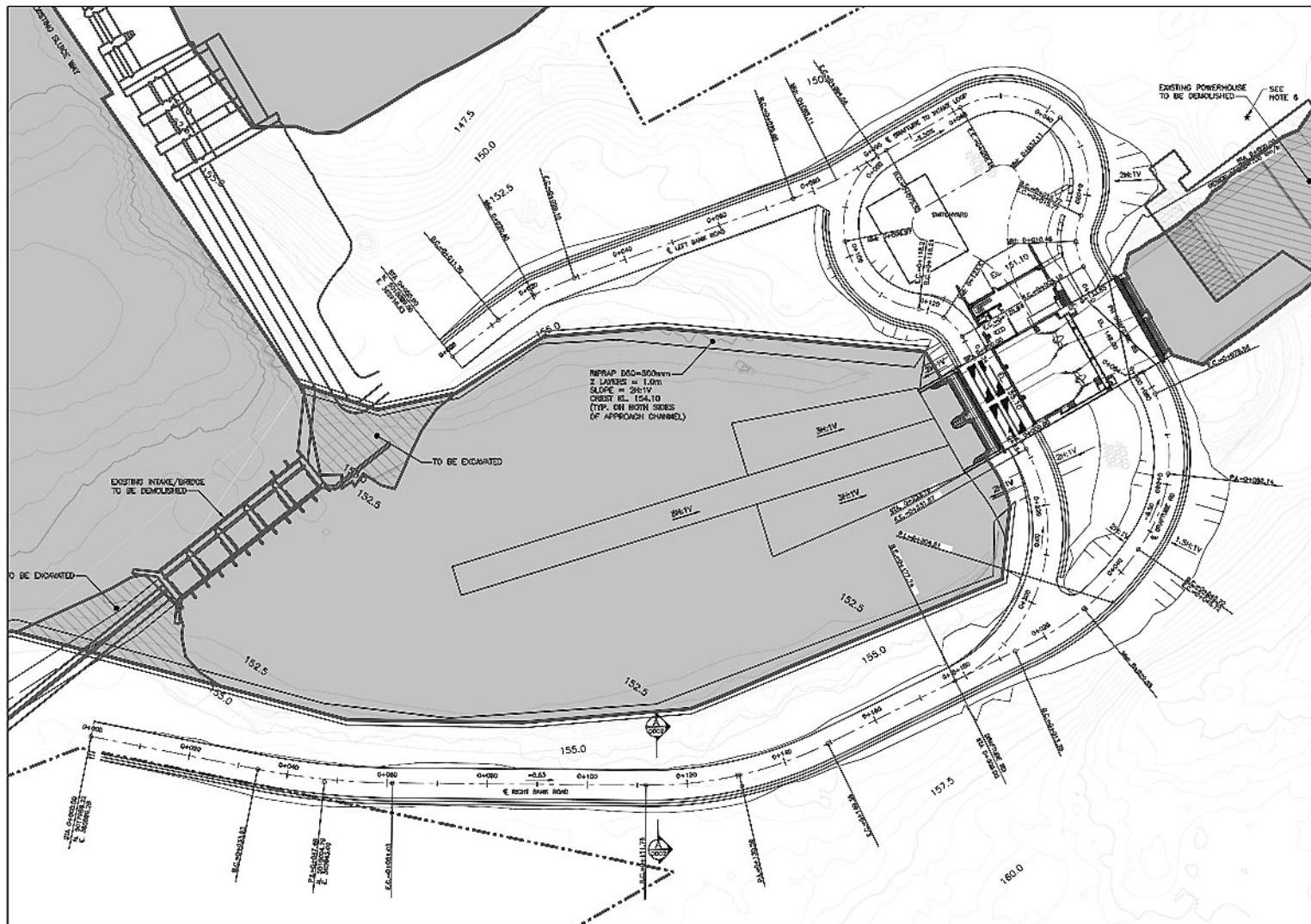


Figure 35. M. Sullivan & Son and SNC-Lavalin, Calabogie GS, New Generating Station Road Alignment Plans [August 9, 2018].



Figure 36. Draft Final Site Design [M. Sullivan & Son and SNC-Lavalin, April 2019].

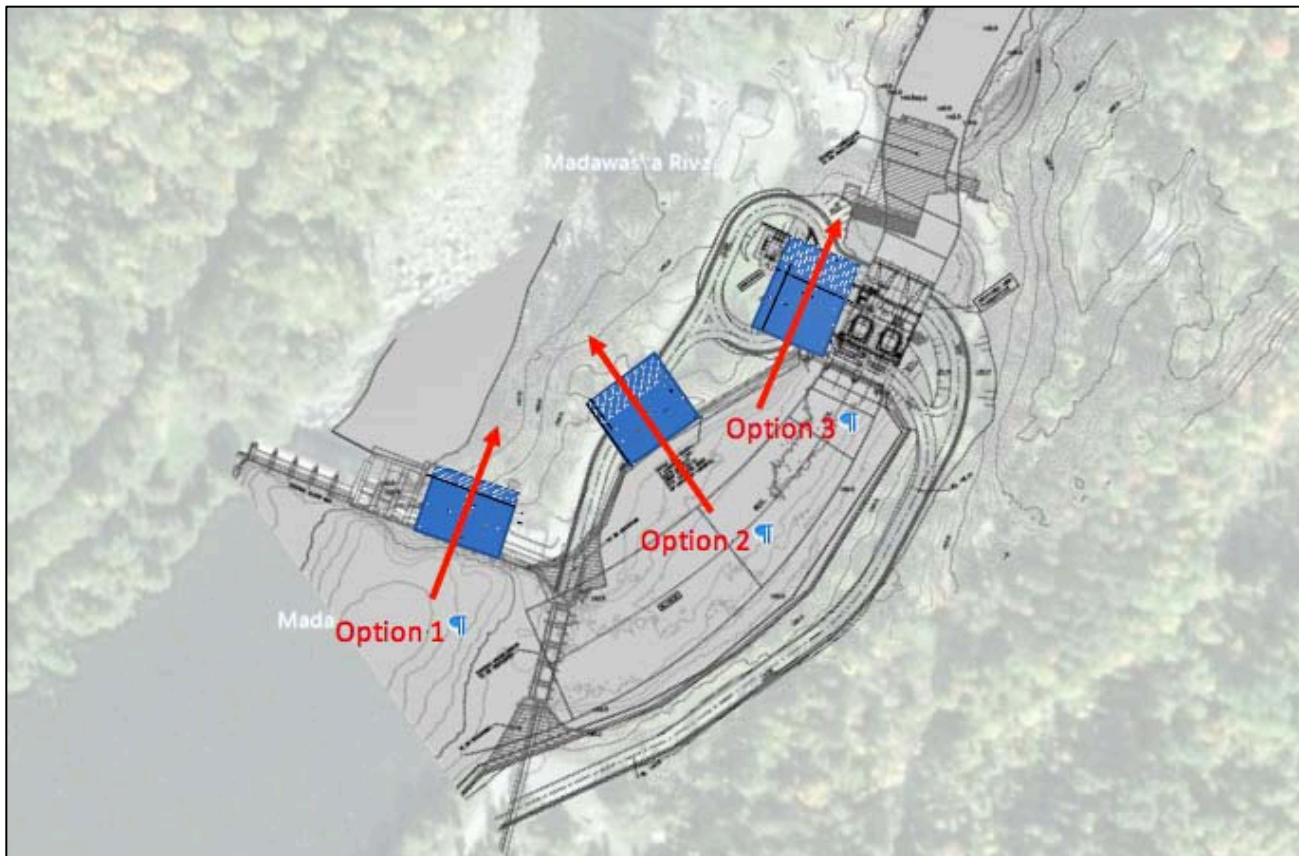


Figure 37. Potential Future Additional Sluiceway Capacity [M. Sullivan & Son and SNC-Lavalin, April 2019].

5.0 IMPACT ASSESSMENT

5.1 Introduction

This section provides an assessment of the potential effects of the proposed redevelopment of OPG's Calabogie GS. The Calabogie GS has been recognized as a PHP as defined under the MTCS *Standards & Guidelines*.

The conservation of cultural heritage resources is considered to be a matter of public interest. Adverse impacts, as outlined in the MTCS *Information Bulletin 3: Heritage Impact Assessments for Provincial Heritage Properties* (January 31, 2017) can be described as 'direct' when there is a permanent and irreversible impact on the cultural heritage value or interest of a property or result in the loss of a heritage attribute on all or part of the provincial heritage property or 'indirect' when an activity adversely affects a property's cultural heritage value or interest and/or heritage attributes. A discussion of impacts should also consider positive outcomes that may affect a property by conserving or enhancing its cultural heritage value or interest and/or heritage attributes.

Examples of direct adverse impacts on a provincial heritage property may include, but are not limited to:

- Removal or demolition of all or part of any heritage attribute.
- Removal or demolition of any building or structure on the provincial heritage property whether or not it contributes to the cultural heritage value or interest of the property (i.e. non-contributing buildings).
- Any land disturbance, such as a change in grade and/or drainage patterns that may adversely affect a provincial heritage property, including archaeological resources.
- Alterations to the property in a manner that is not sympathetic, or is incompatible, with cultural heritage value or interest of the property. This may include necessary alterations, such as new systems or materials to address health and safety requirements, energy-saving upgrades, building performance upgrades, security upgrades or servicing needs.
- Alterations for access requirements or limitations to address such factors as accessibility, emergency egress, public access, security.
- Introduction of new elements that diminish the integrity of the property, such as a new building, structure or addition, parking expansion or addition, access or circulation roads, landscape features.
- Changing the character of the property through removal or planting of trees or other natural features, such as a garden, that may result in the obstruction of significant views or vistas within, from, or of built and natural features.
- Change in use for the provincial heritage property that could result in permanent, irreversible damage or negates the property's cultural heritage value or interest.
- Continuation or intensification of a use of the provincial heritage property without conservation of heritage attributes.

Examples of indirect adverse impacts on a provincial heritage property may include, but are not limited to:

- Shadows that alter the appearance of a heritage attribute or change the viability of an associated natural feature or plantings, such as a tree row, hedge or garden.
- Isolation of a heritage attribute from its surrounding environment, context or a significant relationship.
- Vibration damage to a structure due to construction or activities on or adjacent to the property.
- Alteration or obstruction of significant view of or from the provincial heritage property from a key vantage point.

Examples of positive impacts may include, but are not limited to:

- Changes or alterations that are consistent with accepted conservation principles, such as those articulated in MTCS's *Eight Guiding Principles in the Conservation of Historic Properties*, *Heritage Conservation Principles for Land Use Planning*, Parks Canada's *Standards and Guidelines for the Conservation of Historic Places in Canada*.
- Adaptive re-use of a property – alteration of a provincial heritage property to fit new uses or circumstances of the property in a manner that retains its cultural value or interest.
- Public interpretation or commemoration of the provincial heritage property.

5.2 Identification of Potential Impacts

The discussion of impacts addresses the potential adverse and positive effects associated with the proposed construction of a new powerhouse at the Calabogie GS. This approach has been identified as the preferred alternative. The potential impacts of this project are principally associated with the removal of the existing powerhouse with integral headworks and removal of the entrance or cutoff dam that relate to the original layout and construction of the generation station in 1917.

5.2.1 Direct Impacts

Powerhouse and headworks removal

OPG is planning to construct a new powerhouse at the Calabogie GS. As a result, the existing powerhouse with integral headworks will become redundant. OPG is proposing to demolish the structures as part of the redevelopment of the site. The powerhouse and headworks that date to 1917 were identified as heritage attributes of the PHP that contribute to the cultural heritage value or interest of the property.

Equipment removal

All equipment will be removed from the powerhouse. Elements of the equipment, such as the generators and turbines, were identified as heritage attributes of the PHP that contribute to the cultural heritage value or interest of the property.

Entrance or cutoff dam removal

To allow for increased water flow the entrance or cutoff dam will be removed as part of the construction of the new powerhouse. The dam was identified as a heritage attribute of the PHP that contributes to the cultural heritage value or interest of the property.

5.2.2 Indirect Impacts

Access road realignment

A portion of the access road from Renfrew County Road 511 known as Generating Station Lane will be realigned. From the location of the entrance or cutoff dam (to be removed) to the new powerhouse the access road will be relocated to the south bank of the South Branch. This realignment will result in the modifications to an existing road on the south bank and will alter the access to Cross Island. The existing access road was identified as a heritage attribute of the PHP that that contributes to the cultural heritage value or interest of the property.

Excavation of the forebay and tailrace

The forebay will be de-watered and soil, sediment and rock excavated to allow for the construction of the powerhouse. A new tailrace will be excavated on the downstream side of the new powerhouse. Both the forebay and the tailrace relate to the development of the site for hydroelectric generating purposes in 1917. They were identified as heritage attributes of the PHP that that contribute to the cultural heritage value or interest of the property.

5.2.3 Positive Impacts

Character

The continued use of the site for hydroelectric power generation purposes will retain a complex of structures and buildings along the North and South Branches of the Madawaska River. Together they form an identifiable cultural heritage landscape that has defined the character of this section of the Madawaska River for more than 100 years.

Linkages

The retention of the site for hydroelectric power generation purposes reinforces significant physical, functional and visual linkages between the buildings and structures that comprise the generating station facility. In addition the continued use of the Calabogie GS maintains important historical linkages between the station and the community of Calabogie.

6.0 ALTERNATIVES AND MITIGATION MEASURES

6.1 Introduction

This section contains a discussion of the three (3) Conceptual Design Alternatives and the types of mitigation measures, including those for heritage resources, considered appropriate for waterpower projects in the OWA's Class EA for Waterpower Projects (February 2018, Eighth Edition).⁴ Conservation recommendations for the project are included in Section 8.0

A proposed site alteration, such as the Calabogie Redevelopment Project should not adversely affect cultural heritage resources and intervention should be managed in such a way that its impact is sympathetic with the value of the resources and that it minimizes or avoids an adverse effect to cultural heritage resources.

When the nature of the site alteration is such that adverse impacts are unavoidable, it may be necessary to implement the management of mitigation measures that alleviate the deleterious effects to the cultural heritage resource. The principal heritage philosophy for the protection of cultural heritage resources is retention *in situ* and the preservation of the material integrity to the maximum extent possible, consistent with public safety. Mitigation measures lessen or negate anticipated adverse impacts to cultural heritage resources.

The MTCS *Information Bulletin 3*, which provides guidance on the preparation of HIA for Provincial Heritage Properties states,

*The Heritage Impact Assessment must describe the alternative options and mitigation measure that were assessed in order to avoid or reduce any negative impacts to the property's cultural heritage value or interest. Further, these should be consistent with the relevant conservation strategies established in the adopted Strategic Conservation Plan where one exists.*⁵

An approved Strategic Conservation Plan is not in place for the Calabogie GS.

Appendix B, Section 2.3 Heritage Resources of the OWA's Class EA for Waterpower Projects includes the following advice:

The following mitigation options are arranged according to level or degree of intervention from minimum to maximum. They are to be applied in rank order such

⁴ OWA, *Class EA for Waterpower Projects*, Appendix B, Examples of Mitigation Measures for Potential Environmental Effects, Section 2.3 Heritage Resources (February 2018, Eighth Edition) 91.

⁵ MTCS, *Information Bulletin 3, Heritage Impact Assessments for Provincial Heritage Properties*, January 31, 2017, 7.

that Option 1 must be shown to be non-viable, before Option 2 can be considered, and so on. It is understood that conservation plans will be integrated into all options.

- 1. Retain existing built heritage attributes with no major change.*
- 2. Restore missing or deteriorated elements where physical or documentary evidence (e.g., photographs or drawings) exist.*
- 3. Retain existing built heritage attributes, but sympathetically modified.*
- 4. Retain existing built heritage attributes with sympathetically designed new structures in proximity.*
- 5. Retain existing built heritage attributes with limitations on use or adapted for a new use.*
- 6. Retain built heritage attributes as a monument or remnant for viewing purposes only.*
- 7. Relocate built heritage attributes to an appropriate new site for continued use or adaptive re-use.*
- 8. Remove and/or replace built heritage attributes with a sympathetically designed structure and*
 - a. Salvage building elements for incorporation into new structure or for future conservation work.*
 - b. Undertake full recording and documentation of existing building.*

6.2 Assessment of Conceptual Design Alternatives and OWA Mitigation Measures

Calabogie GS site

It is noted the overall Calabogie GS site and/or landscape will remain largely unchanged from the existing situation as shown in **Figure 4**. The main landscape features of the site, specifically the North and South Branches of the Madawaska River remain unchanged and will continue to operate as they currently exist. No alterations are proposed to the North Branch. Generating Station Lane will continue to be the primary access point for the site. The South Branch Main Dam will remain as it currently is and there may be alterations to the existing forebay such as additional sluice capacity. As the North Branch and the South Branches of the River and Dams remain the same there is also relatively no alteration to the landscape appearance of the two islands that dominate the channel namely, Calabogie Island and Cross Island. The boom lines will remain in place as well. The focus of the re-development project is the 100 + year powerhouse and approach channel. The Preferred Alternative is a new powerhouse in a location slightly upstream (approximately 100 meters) of the existing one.

It is noted the existing powerhouse is in a location where it is not visible to the public by road or pedestrian access and it is only visible to the public at a significant distance downstream of the generating station and when a boat is operating against the current of the river. Therefore, the public visibility of features retained in the vicinity the powerhouse is limited.

Powerhouse and headworks

The existing powerhouse and headworks will become redundant with the construction of the new facility. The original powerhouse with integral headworks may be retained in the short term and fulfill the function as a cofferdam during the construction phase of the project.⁶

Section 4 of this CHIA includes a description of OPG conceptual alternatives analysis used to arrive at its preferred option of re-developing the Calabogie GS. It is noted while OPG reviewed two alternatives for the re-use of the existing powerhouse both of the alternatives involved all new mechanical and electrical equipment.

There is no possibility to retain or re-use any of the equipment inside the powerhouse. At slightly over 100 years of age, the equipment had been used beyond its engineered life. None of the equipment can be re-purposed for use given its age and condition. It is noted the powerhouse and the civil engineering structures around it including dam walls and dikes are in extremely poor condition with visible signs of leaks and other damage. To repair the powerhouse and all these individual water retaining structures to meet the dam safety requirements it is not considered to be feasible.

Of the two alternatives (Alternatives 1 and 2) that explored the opportunity of re-using the powerhouse, only Alternative 1 proposed minimal civil work. Alternative 2 involved major changes to the powerhouse structure including refurbishment, expansion and re-design. This approach would involve the replacement of building elements that would visually alter the built heritage resources of the facility.

The Conceptual Design Alternatives process largely came down to a selection between Alternatives 1 and 3 (Construction of a New Powerhouse) since the costs for Alternative 2 were deemed significantly higher and this alternative was not considered economically feasible. Alternatives 1 and 2 are considered similar and a qualitative assessment was undertaken.

As indicated in Section 4, Alternatives 1 and 3 are considered equal in two factors (public safety and technology) while Alternative 1 was favoured in four factors (schedule, environment, health and safety during construction and stakeholder relations) and Alternative 3 in the remaining nine factors (benefit to OPG portfolio, climate change adaptation, health and safety during operations, dam safety, operability, efficiency, constructability and maintainability). Although Alternative 1 was considered the preferred from the Environmental Factor perspective, mainly because the facility is of local heritage significance, there were other environmental concerns such as the presence of both lead and asbestos in the existing powerhouse facility. Since Alternative 3 received the highest ranking on the greatest number of factors it was selected as the Preferred Alternative.

⁶ Arcadis, Calabogie Project Description, Draft 2, Section 4.2: Construction Sequencing, Stage #4 (February 14, 2019).

The selection of Alternative 3 involves a powerhouse slightly upstream from the existing one. The location of the new powerhouse upstream means the current and older powerhouse would be in the tailrace of the new facility. It would be impossible to construct or operate the new generating station in this location without the demolition of the old powerhouse. Therefore, the OWA Mitigation Options 1 through 6 are not feasible.

Mitigation Option 7 of the OWA, *Relocate built heritage attributes to an appropriate new site for continued use or adaptive re-use*, is not considered to be a feasible mitigation strategy for the original powerhouse building, which has significant damage from a tornado. OPG is proposing to re-locate significant piece(s) of equipment from the powerhouse, which addresses part of the intent of Mitigation Option 7. The OWA Mitigation Option 8 (b), *Undertake full recording and documentation of existing building*, is a required mitigation action.

Equipment

Components of the equipment are obsolete and/or have suffered significant damage from exposure to the elements. All equipment is scheduled to be removed from the existing powerhouse as part of the Preferred Alternative.

Most of the equipment in the powerhouse is over 100 years old and past its expected engineered life. The original equipment does not meet the design standards and requirements of hydropower equipment expected in the current era. Further, since a hydroelectric powerhouse works as one integrated unit designed to generate power re-using a single piece of equipment with a suite of engineered new equipment in a newly designed facility is technically difficult, costly and does not meet OPG quality and safety requirements. It is noted the equipment was left open to the elements after the September 2018 tornado resulting in it being non-functional.

Therefore, the OWA Mitigation Options 1 to 5 are not considered to be feasible. The OWA Mitigation Option 6, *Retain built heritage attributes as a monument or remnant for viewing purposes only*, and Mitigation Option 7, *Relocate built heritage attributes to an appropriate new site for continued use or adaptive re-use*, are both viable actions.

Entrance or cutoff dam removal

The removal of the entrance or cutoff dam is a functional requirement of the design for the new powerhouse to improve the flow conditions as part of the Preferred Alternative 3. Furthermore, a widening of the channel is required. The widening of the channel is intended to improve flow conditions allowing the new generating station to generate power at full capacity. If the cutoff dam is not removed it lessens the economic and technical rationale for the new generating station. The OWA Mitigation Options 1 to 7 are not considered to be feasible; however, Mitigation Option 8 (b), *Undertake full recording and documentation of existing building*, is considered to be a viable conservation action to be undertaken by OPG.

Access road realignment

The access road currently crosses to Cross Island on the top of the entrance or cutoff dam. With its removal as part of the Preferred Alternative 3 a new alignment is required for the roadway. The conceptual design proposes the access road will extend along the south side of the forebay to the location of the new powerhouse. Two one-way roadways will be incorporated into the new powerhouse design to permit access to Cross Island and the new switchyard.

Therefore, the OWA Mitigation Options 1 to 7 are not considered to be feasible. Mitigation Option 8 (b), *Undertake full recording and documentation of existing building*, is considered to be a viable action.

Excavation of the forebay and tailrace

The forebay and the tailrace will be retained, de-watered and excavated as part of the Preferred Alternative 3. Therefore, the OWA Mitigation Options 3 and 8 are considered to be a viable actions.

7.0 SUMMARY OF COMMUNITY ENGAGEMENT

Unterman McPhail Associates consulted with the Township of Greater Madawaska during the preparation of the CHER and again during the preparation of the HIA. The municipality has not identified the Calabogie GS of cultural value or interest. The property is not listed in a local inventory. Furthermore, no formally recognized heritage properties were identified in proximity to the subject property.

The Ontario Heritage Trust and the MTCS were contacted as part of the CHER. No heritage conservation issues were raised during these consultations in respect to the Calabogie GS. The MTCS has indicated that although the Calabogie GS has not yet been added to the List of Provincial Heritage Properties as a PHP, it is considered to be a PHP of local significance. The MTCS confirms it has received the CHER (research reports and SCHV) from OPG to include the property on the list and are waiting for OPG to confirm its heritage committee has reviewed the CHER (research reports and SCHV).⁷

No comments relating to cultural heritage were raised at the Public Open House #1 held in Calabogie on Monday, March 5, 2018, although one individual highlighted the importance of OPG as a member of the community and the value of continuing to use the waterway. The most common questions and concerns related to water level fluctuations and flow rates.

⁷ Email correspondence from Rosi Zierger, A/Heritage Advisor, Ministry of Tourism, Culture & Sport Culture Division | Programs & Services Branch | Heritage Programs Unit to Richard Unterman, Unterman McPhail Associates, April 8, 2019.

8.0 CONSERVATION RECOMMENDATIONS

The CHER (March 2017) for the Calabogie GS determined the property is of cultural heritage value or interest as set out in Ontario Regulation 9/06 under the OHA for local significance; however, it was determined the property did not meet the criteria for provincial significance in Ontario Regulation 10/06. Therefore, the Calabogie GS meets the criteria to be considered a PHP but not a PHPPS. The Calabogie GS will be added to the List of Provincial Heritage Properties and as a PHP the provisions of the MTCS *Standards & Guidelines* apply to the Calabogie GS.

The following six (6) conservation recommendations are provided to OPG to address the effects of the identified impacts to the Calabogie GS.

7) *Powerhouse and headworks*

OWA Mitigation Option 8 (b), *Undertake full recording and documentation of existing building*, i.e., the existing powerhouse and headworks, is not feasible due to safety issues as a result of the tornado damage.

Therefore, 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 in good standing with the Canadian Association of Heritage Professionals (CAHP) and with demonstrated experience in the preparation of documentation reports. 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 drawings to fulfill the requirements of OWA Mitigation Option 8 (b).

8) *Equipment*

OWA Mitigation Option 6, *Retain built heritage attributes as a monument or remnant for viewing purposes only*, will be implemented. 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 that would incorporate original plant equipment and a plaque describing the original development of Calabogie GS and its role in the community. An appropriate location for the installation is at the junction of Generating Station Lane and County Road 511 and in proximity to the K&T Trail.

The 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.

9) *Entrance or cutoff dam removal*

Photographs of the site showing the cutoff dam have been taken and they will serve as the documentation requirement for OWA Mitigation Option 8 (b), *Undertake full recording and documentation*. No other conservation measures are recommended.

10) *Access road realignment*

Photographs of the site showing access road alignment have been taken and with historical information will serve as the documentation requirement for OWA Mitigation Option 8 (b), *Undertake full recording and documentation*. No other conservation measures are recommended.

11) *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 OWA Mitigation Option 8 (b) should be implemented to assess and document these features as required.

12) *Allocation of 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.

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Contacts

Alison Holtzhauer, Chief Administrative Officer, Township of Greater Madawaska.

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