

Application for Approval of Hinds Lake Unit Major Overhaul and Level II Penstock Assessments of Bay d'Espoir Penstock 4, Granite Canal Penstock, and Hinds Lake Penstock

May 22, 2019

A report to the Board of Commissioners of Public Utilities





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May 22, 2019

Board of Commissioners of Public Utilities
Prince Charles Building
120 Torbay Road, P.O. Box 21040
St. John's, NL A1A 5B2

Attention: Ms. Cheryl Blundon
Director of Corporate Services & Board Secretary

Dear Ms. Blundon:

Re: Application for Approval of Hinds Lake Unit Major Overhaul and Level II Penstock Assessments of Bay d'Espoir Penstock 4, Granite Canal Penstock, and Hinds Lake Penstock

Please find enclosed one original and eight copies of Newfoundland and Labrador Hydro's ("Hydro") Application, plus a supporting affidavit and project proposal.

The estimated capital cost of the Hinds Lake Unit Major Overhaul is \$259,500, and the estimated capital cost of the Penstock Level II Condition Assessments is \$414,300. The scope of both projects is set out in Schedule 1 to the Application. Hydro submits the proposed capital expenditures are necessary to ensure the continued provision of service which is safe and adequate and just and reasonable as required by section 37 of the Act.

Should you have any questions, please contact the undersigned.

Yours truly,

NEWFOUNDLAND & LABRADOR HYDRO

A handwritten signature in blue ink, appearing to read "Swalsh", written over a horizontal line.

Shirley A. Walsh
Senior Legal Counsel, Regulatory
SAW/sk

Encl.

cc: Gerard M. Hayes, Newfoundland Power
Paul L. Coxworthy, Stewart McKelvey
Dean A. Porter, Poole Althouse
ecc: Gregory Moores, Stewart McKelvey

Dennis Browne, Q.C., Browne Fitzgerald Morgan & Avis
Denis J. Fleming, Cox & Palmer
Senwung Luk, Olthuis Kleer Townshend LLP



Application

IN THE MATTER OF the *Electrical Power Control Act*, RSNL 1994, Chapter E-5.1 (the "EPCA") and the *Public Utilities Act*, RSNL 1990, Chapter P-47 (the "Act"), and regulations thereunder;

AND IN THE MATTER OF an Application by Newfoundland and Labrador Hydro ("Hydro") for the approval of the Hinds Lake Generating Station ("Hinds Lake") Unit Major Overhaul and Level II Penstocks Assessments for Bay d'Espoir Hydroelectric Generating Facility ("Bay d'Espoir") Penstock 4, Granite Canal Generating Station ("Granite Canal"), and Hinds Lake pursuant to Subsection 41(3) of the *Act*.

TO: The Board of Commissioners of Public Utilities (the "Board")

THE APPLICATION OF HYDRO STATES THAT:

1. Hydro is a corporation continued and existing under the *Hydro Corporation Act*, 2007, is a public utility within the meaning of the *Act*, and is subject to the provisions of the *EPCA*.
2. Hydro is the primary generator of electricity in Newfoundland and Labrador. The Bay d'Espoir Hydroelectric Generating Facility is the largest of Hydro's hydroelectric generating facilities. It provides 613 MW of electrical capacity and 2,560 GWh of energy annually to the Island Interconnected System. Bay d'Espoir consists of four penstocks that supply water to each of the seven generating units.
3. The unit at the Hinds Lake Hydroelectric Generating Station is a vertical Francis Turbine 75 MW hydroelectric unit in the Hydraulic Production fleet, which consists of a turbine and generator assembly that was commissioned in 1980.
4. The Granite Canal Hydroelectric Generating Station is located in central Newfoundland and was commissioned in 2003. It consists of a single Kaplan Turbine rated for 40 MW with an annual average energy production of approximately 220 GWh.
5. Bay d'Espoir Penstock 4, Granite Canal Penstock, and Hinds Lake Penstock provide the transmission of water from the intake structures to the generating units. Water transmission is

required for the generation of electricity at each of these sites, which produce a total of 269 MW (i.e., Hinds Lake: 75 MW, Granite Canal: 40 MW, Bay d'Espoir Unit 7: 154 MW)

Hinds Lake

6. Hinds Lake has a reliable operational history. Based on Original Equipment Manufacturer recommendations and industry standards, a regularly scheduled overhaul is performed on Hydro's hydraulic generation units every six years to inspect, test, clean, and refurbish and/or replace defective components.
7. In Hydro's 2019 Capital Budget Application ("2019 CBA"), Hydro submitted a proposal to refurbish the Hinds Lake generator rotor in a two-year project executed in 2019–2020 within the Hydraulic Generation Refurbishment and Modernization ("Rotor Refurbishment Project"). The Rotor Refurbishment Project was justified based on the decline in rotor resistance readings, which indicated a risk of rotor pole winding insulation failure. The 2019 CBA also noted that the unit was due for a six-year overhaul—also known as a Unit Major Overhaul ("Overhaul"). Hydro intended to propose the Overhaul in its 2020 CBA for execution in 2020 during the Rotor Refurbishment Project to take advantage of the unit outage.
8. The Rotor Refurbishment Project was advanced to a single-year 2019 project as noted in Hydro's correspondence to the Board (attached as Schedule 1, Attachment 1) and approved as such in Board Order P.U. 46(2018).
9. As a result of the advancement of the Rotor Refurbishment Project, approval of the Overhaul as planned would necessitate an additional outage in 2020. Advancing the Overhaul to 2019 would result in a reduction of the Overhaul project costs of approximately \$189,000 and prevent the addition of a major outage to the outage schedule. It would also help mitigate machine wear and tear associated with disassembly and reassembly since both projects require many similar activities for this work.
10. The Overhaul is estimated to cost \$259,500 and, if scheduled to coincide with the Rotor Refurbishment Project, is expected to be completed by November 11, 2019.
11. The scope of work is set out in the engineering report attached as Schedule 1 to this Application.

Bay d'Espoir Penstock 4, Hinds Lake Penstock, and Granite Canal Penstock


12. Bay d'Espoir Penstock 4, Granite Canal Penstock, and Hinds Lake Penstock have not undergone comprehensive internal assessments since they were commissioned in 1977, 2003, and 1980, respectively.
13. Bay d'Espoir Penstock 4, Granite Canal Penstock, and Hinds Lake Penstock have a good operational history. There have been no penstock forced outage occurrences since commissioning for each of these assets.
14. During the investigation of the Bay d'Espoir Penstock 1 failures in 2016–2017 Hydro was informed that internal coatings for steel penstocks are generally considered, in industry, to have an anticipated useful life of 15 years. The coating is a defence mechanism against weld and steel deterioration. After 15 years the welds and steel can become exposed and deterioration of the welds and steel can occur as time advances. The coatings for these penstocks have surpassed the 15-year cycle and have not undergone a comprehensive assessment. The maintenance history for the penstocks is included in the engineering report attached as Schedule 1 to this Application.
15. Hydro proposes completing Penstock Level II Condition Assessments ("Assessments") for the Bay d'Espoir Penstock 4 and Granite Canal Penstock simultaneously with the planned 2019 Overhauls currently scheduled for those locations. Hydro has considered completing the Assessments in 2020, utilizing an outage specifically planned for the assessment; however, paralleling penstock assessment activities with existing major overhaul work ensures cost efficiencies and reduces overall downtime associated with unit outage scheduling.
16. Hydro also considered deferring the Assessments beyond 2020 to the units' next scheduled Overhauls, which are planned for 2025. Based on recent findings on other penstocks and Hydro's commitment to assessing the whole penstock fleet, it is Hydro's opinion that waiting another six years to arrange completion of the Assessments to coincide with the next planned overhaul for these units is not necessary. The prudent approach is to take advantage of the current outages in 2019 to complete the Assessments. This affords the best opportunity to understand the current condition of the penstocks from a reliability perspective so that Hydro can make any future plans as necessary.

17. For the Hinds Lake Penstock, Hydro could complete only the rotor refurbishment in 2019 and then take a second outage one year later, in 2020, to complete the Overhaul and penstock assessment. However, as with the Bay d'Espoir Penstock 4 and Granite Canal Penstock, Hydro believes it is more cost efficient and appropriate to complete the rotor refurbishment, Overhaul, and the penstock assessment in 2019.
18. The scope of work for the Assessments is set out in Schedule 1 to this Application.
19. The estimated cost of the Assessments is \$414,300 and, if scheduled to coincide with Overhauls, the Assessments are expected to be completed by September 13, 2019.

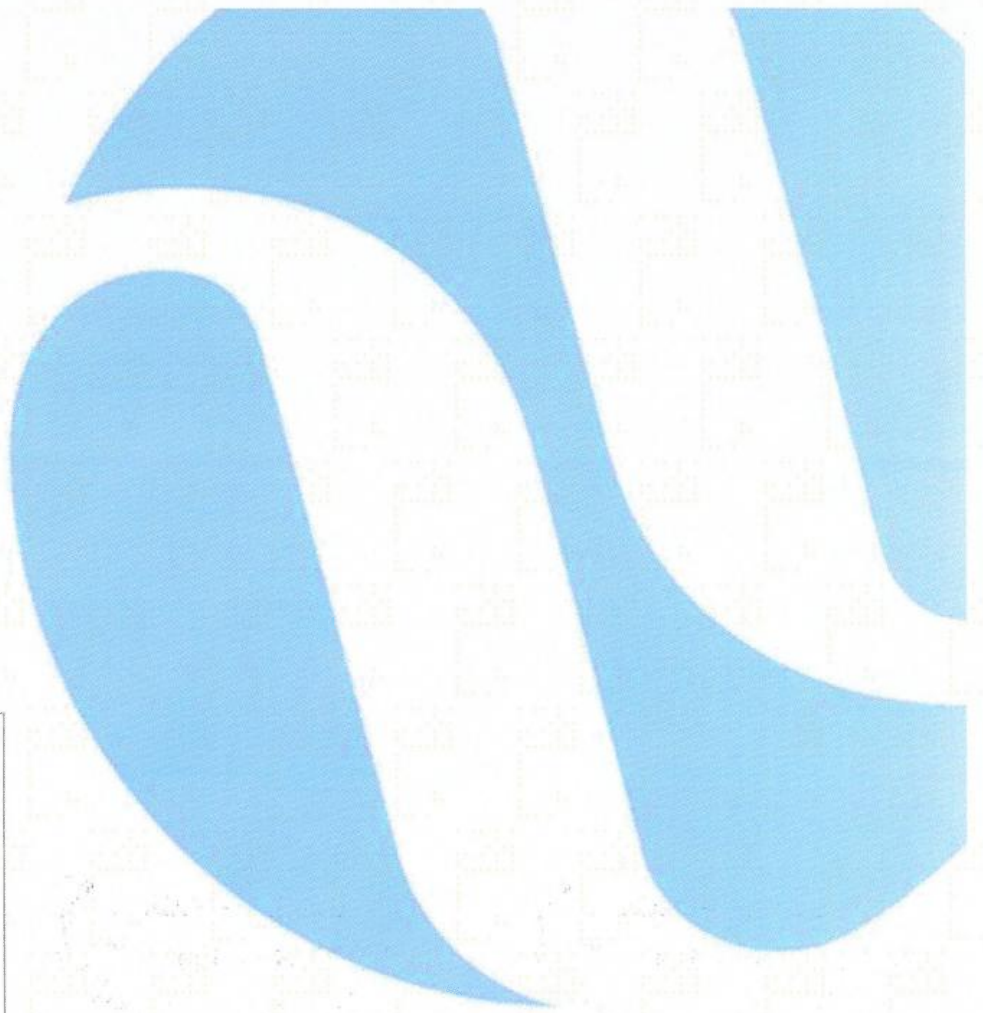
Summary

20. Hydro submits that scheduling the Hinds Lake Overhaul for 2019 to coincide with the Rotor Refurbishment Project, and scheduling the Assessments to coincide with Overhauls at each location, is the reasonable and prudent option. Completing the Assessments concurrently with major overhaul work ensures cost efficiencies and reduces overall downtime associated with unit outage scheduling while enabling Hydro to continue to provide service which is safe and adequate and just and reasonable as required by section 37 of the *Act*.
21. Hydro therefore makes Application for an Order pursuant to section 41(3) of the *Act* approving the Hinds Lake Unit Major Overhaul for 2019, at an estimated capital cost of \$259,500 as set out in this Application and in the attached project descriptions and justification documents.
22. Hydro further makes Application for an Order pursuant to section 41(3) of the *Act* approving the Penstock Level II Condition Assessments for Bay d'Espoir Penstock 4, Granite Canal Penstock, and Hinds Lake Penstock in 2019, at an estimated capital cost of \$414,300 as set out in this Application and in the attached project descriptions and justification documents.

DATED at St. John's in the Province of Newfoundland and Labrador this 12 day of May, 2019.



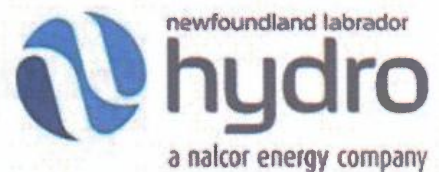
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Hinds Lake Unit Major Overhaul and Assessments of Bay d'Espoir Unit 7, Hinds Lake, and Granite Canal Penstocks

May 17, 2019

A report to the Board of Commissioners of Public Utilities



1 **Executive Summary**

2 The Bay d’Espoir Hydroelectric Generating Facility (“Bay d’Espoir”), Hinds Lake Hydroelectric Generating
3 Station (“Hinds Lake”), and Granite Canal Hydroelectric Generating Station (“Granite Canal”) all rely on
4 effective preventive maintenance practices to generate safe and reliable electricity. These practices
5 include six-year Unit Major Overhauls (“Overhaul”),¹ and penstock condition assessments.

6
7 Bay d’Espoir Unit 7, Hinds Lake, and Granite Canal all have penstocks that supply water from the intake
8 structures to the hydraulic generation units. After ruptures of Bay d’Espoir Penstock 1 in 2016 and 2017,
9 there has been material investment to perform further condition assessment of Bay d’Espoir Penstocks
10 1 to 3 and complete refurbishment activities. This work has lead Newfoundland and Labrador Hydro
11 (“Hydro”) to develop an assessment program that coincides with the generating unit Overhauls.
12 Paralleling penstock assessment activities with major overhaul work ensures cost efficiencies and
13 reduces overall downtime associated with unit outage scheduling. Bay d’Espoir Penstock 4 and the Hinds
14 Lake and Granite Canal penstocks have not undergone a comprehensive assessment since
15 commissioning and therefore their condition is not well understood at this time. Hydro is planning
16 Overhauls for Bay d’Espoir and Granite Canal units in 2019, and proposing an Overhaul for the Hinds
17 Lake unit in 2019 as well. Hydro proposes to concurrently complete Level II Condition Assessments on
18 Bay d’Espoir Penstock 4 and the Hinds Lake and Granite Canal and penstocks to achieve efficiencies and
19 reduce overall downtime.

20
21 The Hinds Lake Generating Unit will be undergoing a capital program in 2019 to perform a rotor
22 refurbishment, and will require the unit to be offline for multiple weeks. The original planned Overhaul
23 for Hinds Lake was scheduled for 2020 and would have coincided with the originally planned timing for
24 the 2019–2020 Rotor Refurbishment project; however, with the advancement of the rotor
25 refurbishment work to 2019, as outlined in Attachment 1,² planned timing of the Overhaul in 2020 no
26 longer allows for the Overhaul to be performed in parallel with the rotor refurbishment. An opportunity
27 exists to execute the Hinds Lake Overhaul and Rotor Refurbishment projects concurrently during the
28 Rotor Refurbishment timeline. Advancing the Overhaul will help to mitigate machine wear and tear

¹ Unit Major Overhaul: Planned six-year overhaul of a hydraulic generation unit, which includes testing and performing preventive and corrective maintenance.

² This work, originally scheduled as a 2019–2020 project was advanced to a single-year 2019 project.

1 associated with assembly and disassembly since both projects require many similar activities for this
2 work. Performing both projects together in 2019 will reduce costs and will also remove a major outage
3 for Hinds Lake from the 2020 outage schedule.

4

5 The Hinds Lake Overhaul is estimated to cost approximately \$259,500 and the Penstock Level II
6 Condition Assessments for Bay d’Espoir Penstock 4, Granite Canal, and Hinds Lake are estimated to cost
7 approximately \$414,300. These projects will maintain the long-term reliability of the Hinds Lake
8 hydraulic unit as well as the penstocks associated with Hinds Lake, Granite Canal, and Bay d’Espoir Unit
9 7.

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Attachment 1: Proposed Project Advancement Letter for Hinds Lake

Attachment 2: Planned vs. Actual Unit Major Overhaul Schedule

Attachment 3: Penstock Assessment Schedule

1.0 Introduction

This supplemental application to the 2019 Capital Budget Application (“CBA”) consists of two projects that directly relate to the established frequency for Overhauls. The projects include:

- Overhaul for Hinds Lake; and
- Penstock Level II Condition Assessments³ for Bay d’Espoir Unit 7, Hinds Lake, and Granite Canal Penstocks.

Hydro is making this application for these projects to take advantage of the planned 2019 unit outages associated with Bay d’Espoir Unit 7, Hinds Lake, and Granite Canal to reduce wear and tear on the units and to optimize outage planning for annual unit outages (penstock inspections). Given the current Hinds Lake rotor winding resistance readings and Hydro’s continuing work in assessing hydraulic generation penstocks, the items proposed in this supplemental application could not have been planned in the 2019 CBA as the need to complete them in 2019 was not identified at the time the 2019 CBA was submitted. Further, paralleling penstock assessment activities with existing major overhaul work ensures cost efficiencies and reduces overall downtime associated with unit outage scheduling. Waiting to include an application in the 2020 CBA would not allow Hydro to take advantage of the 2019 equipment outage schedule.

In Hydro’s 2019 CBA, Hydro submitted a proposal to refurbish the Hinds Lake generator rotor.⁴ The project justification was based on the decline in rotor resistance readings, which indicated a risk of rotor pole winding insulation failure. As a result of that risk, refurbishment of the rotor is necessary. This work was proposed as a two-year project to be executed in 2019–2020. It was noted in the generator rotor refurbishment proposal that the unit was due for a six-year Overhaul in 2020, which would be conducted at the same time as the rotor refurbishment so as to avoid wear and tear due to an additional disassembly and reassembly to the unit. As the Overhaul is a one-year project, Hydro planned to include the unit Overhaul in its 2020 Capital Budget Application, for execution in 2020.

³ Specialized testing, third-party qualified inspector verification and development of life extension work as required.

⁴ Hydro’s “2019 Capital Budget Application,” Vol. II, Tab 1: Hydraulic Generation Refurbishment and Modernization (2019–2020), at p. 20.

1 Bay d’Espoir Unit 7 and Granite Canal generating units are undergoing Overhauls in 2019. The associated
2 penstocks for Bay d’Espoir Unit 7, Granite Canal, and Hinds Lake have not undergone comprehensive
3 internal assessments since they were commissioned in 1977, 2003, and 1980, respectively. The
4 combination of executing the Hinds Lake Overhaul as well as the Penstock Assessment with the Hinds
5 Lake Rotor Refurbishment project and Granite Canal and Bay d’Espoir Unit 7 Overhaul was reviewed,
6 and Hydro believes it provides an opportunity to perform the overhaul and penstock assessment more
7 efficiently as it relates to unit outage management.

8 **2.0 Background**

9 **2.1 Existing System**

10 **2.1.1 Hinds Lake Generation Unit**

11 The Hinds Lake generation unit is a vertical Francis Turbine 75 MW hydroelectric unit in the Hydraulic
12 Production fleet, which consists of a turbine and generator assembly that was commissioned in 1980.

13

14 **2.1.2 Bay d’Espoir Penstock 4, Granite Canal Penstock, and Hinds Lake Penstock**

15 Bay d’Espoir Penstock 4, Granite Canal Penstock, and Hinds Lake Penstock provide the transmission of
16 water from the intake structures to the generating units. Water transmission is required for the
17 generation of electricity at each of these sites, which produce a total of 269 MW (i.e., Hinds Lake: 75
18 MW; Granite Canal: 40 MW; and Bay d’Espoir Unit 7: 154 MW)

19

20 Bay d’Espoir Penstock 4 provides water to Unit 7 and was commissioned in 1977. Unit 7 is a single
21 Francis Turbine rated at 154 MW with an annual average energy production of approximately 900
22 gigawatt hours (“GWh”). The Unit operates with an average net head of approximately 183 m with a
23 rated flow of 141 m³/s. The entire water passage is as follows:

24

- 25 ● A welded steel, buried penstock approximately 1036 m long.
- 26 ● The slope of the penstock varies from 8° to 27° from horizontal.
- 27 ● The diameter varies from approximately 5.2 m at the intake structure to 3.7 m near the
28 powerhouse.

- 1 • Nine inverted culverts contained within the penstock drainage system permit monitoring of
2 drainage flows from potential penstock leaks and ground saturation.

3 Granite Canal is located in central Newfoundland and was commissioned in 2003. It consists of a single
4 Kaplan Turbine rated for 40 MW with an annual average energy production of approximately 220 GWh.
5 The plant operates with an average net head of approximately 37 m with a rated plant flow of 122.4
6 m³/s. The entire water passage is as follows:

- 7
- 8 • A welded steel, buried penstock approximately 201 m long.
 - 9 • The slope of the penstock varies from 3.50° to 22.50° from horizontal.
 - 10 • Ten perforated PVC drainage pipes to relieve water pressure.
 - 11 • A diameter of 5.4 m from the intake to the powerhouse.

12 Hinds Lake is located on the western portion of Newfoundland and was commissioned in 1980. It
13 consists of a single, vertical Francis Turbine rated for 75 MW with an annual average energy production
14 of approximately 340 GWh. The plant operates with an average net head of approximately 214 m and a
15 rated flow of approximately 40 m³/s. The entire water passage is as follows:

- 16
- 17 • A welded steel, buried penstock approximately 1,400 m long.
 - 18 • The penstock varies in diameter from approximately 4.57 m at the intake structure to 3.56 m at
19 the powerhouse.
 - 20 • The slope of the penstock varies between 0° and 27° from horizontal.
 - 21 • The penstock is fully buried along the entire length with six manholes for access and no surge
22 tank.
 - 23 • The penstock has drainage pipes along its length to monitor drainage from potential penstock
24 leaks and ground saturation.

1 **2.2 Operating Experience**

2 **2.2.1 Hinds Lake Generation Unit**

3 The Hinds Lake Unit has had a reliable operational history.

4 **2.2.2 Bay d’Espoir Penstock 4, Granite Canal Penstock and Hinds Lake Penstock**

5 Bay d’Espoir Penstock 4, Granite Canal Penstock, and Hinds Lake Penstock all have a good operational
6 history. There have been no penstock forced outage occurrences since commissioning of each of these
7 assets. During the investigation of the Bay d’Espoir Penstock 1 failures in 2016–2017 Hydro was
8 informed that internal coatings for steel penstocks are generally considered, in industry, to have an
9 anticipated useful life of 15 years. The coating is a defence mechanism against weld and steel
10 deterioration. After 15 years the welds and steel can become exposed and deterioration of the welds
11 and steel can occur as time advances. The coatings for these penstocks have surpassed the 15-year cycle
12 and have not undergone a comprehensive assessment.

13 **2.3 Maintenance History**

14 **2.3.1 Hinds Lake Generation Unit**

15 Some of the electrical/mechanical components on hydraulic generation units degrade over time. Based
16 on Original Equipment Manufacturer recommendations and industry standards, a regularly scheduled
17 overhaul is performed on Hydro’s hydraulic generation units every six years to inspect, test, clean, and
18 refurbish and/or replace defective components. Work of a more material nature performed on the
19 Hinds Lake Unit in the last 15 years is shown in Table 1.

Table 1: Hinds Lake Unit Corrective and Preventive Tasks from Previous Years

Action Performed	Year
Runner Cavitation/Cracking Repaired	2006
Cooling Water Piping Replacement (Inside Unit)	2008
Unit Overhaul/Alignment	2009
Runner Cavitation/Cracking Repaired	2010
Replaced Exciter	2012
Replaced Generator Main Breaker	2013
Unit Overhaul/Alignment	2014

1 **2.3.2 Bay d’Espoir Penstock 4, Granite Canal Penstock, and Hinds Lake Penstock**

2 Bay d’Espoir Penstock 4 was commissioned in 1977. The last internal assessment of Penstock 4, which
3 consisted of a visual inspection (“VT”), was completed in August 2016 when the generation unit was
4 scheduled for annual maintenance and the Penstock was dewatered. The inspection indicated that the
5 Penstock welds and seams were in good condition but the corrosion-resistant coating was deteriorated
6 and the surface of the penstock metal was corroded and lightly pitted.

7
8 The Hinds Lake Penstock has been in operation since 1980. The last assessment of the Penstock was
9 completed by an external consultant, Kleinschmidt, in November 2016. This assessment mainly
10 consisted of an internal and external VT that indicated the Penstock was in good condition. Some
11 ultrasonic thickness measurements were also taken as part of this assessment. The Penstock had not
12 significantly ovalized,⁵ the plate thickness was comparable to the construction drawings, and the interior
13 of the shell had a light layer of rust with scattered moderate corrosion and pitting. Steel stress testing
14 showed that the steel was thicker than the design thickness, resulting in stresses within the shell less
15 than or equal to allowable.

16
17 Granite Canal Penstock was installed in 2003 and no condition assessment has been conducted since,
18 therefore the state of the equipment is unknown.

19 **3.0 Analysis**

20 **3.1 Identification of Alternatives**

21 **3.1.1 Hinds Lake Generation Unit**

- 22 **1)** Reschedule the Overhaul in 2019 to be completed concurrently with the planned rotor
23 refurbishment, or
- 24 **2)** Perform the Overhaul in 2020 as originally planned, requiring a second maintenance outage.

25 **3.1.2 Bay d’Espoir Penstock 4, Granite Canal and Hinds Lake Penstocks**

- 26 **1)** Execute the penstock Assessments in 2019 concurrent with the planned Overhauls for the
27 associated generating units,

⁵ Steel penstocks are generally round in nature and have acceptable tolerances for the extent of “out-of-roundness” or ovalization that can be tolerated across the cross section area.

- 1 **2)** Execute the assessments in 2020 utilizing an additional outage specifically planned for the
2 Granite Canal and Bay d’Espoir Penstock 4 assessments and an outage for the Hinds Lake
3 overhaul and penstock assessment; or
- 4 **3)** Defer the assessments beyond 2020 so as to occur concurrent with the units’ next scheduled
5 Overhauls, which are planned for 2025.⁶

6 **3.2 Evaluation of Alternatives**

7 **3.2.1 Hinds Lake Generation Unit**

8 Hydro’s preferred practice avoids frequent removal of unit rotors by limiting removal to Overhauls or
9 breakdowns, thus limiting the degradation of critical components and avoiding accelerated wear on
10 critical hardware such as coupling bolts and windings. As the unit is already being disassembled in 2019
11 to facilitate the rotor refurbishment, waiting to execute the Overhaul in 2020 will result in an additional
12 disassembly and reassembly of the unit, as well as repeated stator cleaning and an additional unit
13 outage. As well, moving the Overhaul from 2020 to 2019 will reduce total unit downtime, allowing for
14 improved optimization of system outages.

15

16 Advancing the six-year Hinds Lake Overhaul to coincide with the Hinds Lake rotor refurbishment in 2019
17 will result in a reduction of the Overhaul project cost, with savings estimated to be \$189,000. The last
18 Hinds Lake six-year Overhaul was completed in 2014 at a cost of \$403,260, which included \$62,356 for
19 corrective maintenance activities. Executing the Overhaul during rotor refurbishment activities would
20 result in lower costs for:

- 21
- 22 • Travel: Optimization of staff already on site for the rotor refurbishment capital project;
 - 23 • Rotor/Stator Cleaning: Rotor undergoing refurbishment and thus will not be required to be
24 cleaned;
 - 25 • Operator Duties: Unit isolations already in place as part of the rotor refurbishment capital
26 project; and

⁶ If the Hinds Lake Overhaul is not approved for execution in 2019, the next scheduled Overhaul is 2020.

- 1 • Execution Activities: Disassembly and reassembly of the generator is required as part of the
- 2 rotor refurbishment project.

- 3 Cost reductions are shown in Table 2.

**Table 2: Cost Savings Achieved by Completing the Hinds Lake Overhaul in 2019
Concurrent with the Rotor Refurbishment**

Year	Travel	Rotor/Stator Cleaning	Operational Duties	Execution Activities
2014 Actual Cost	106,810.83	24,489.25	46,496.28	67,250.00
2020 Estimated Cost	115,000.00	29,000.00	50,000.00	72,500.00
2019 Estimated Cost	57,560.00	15,000.00	5,000.00	0.00
Cost Reduction 2019 vs. 2020	57,440.00	14,000.00	45,000.00	72,500.00

4 3.2.2 Bay d’Espoir Penstock 4, Granite Canal Penstock, and Hinds Lake Penstock

5 Using criteria set out in CEATI⁷ “Hydraulic Generating Station Penstock Inspection and Assessment
6 Reference Manual”⁸ and ASCE⁹ “Manuals and Reports on Engineering Practice Manual No.79 Steel
7 Penstocks” for internal assessment of penstocks, Hydro has developed a comprehensive practice¹⁰ to
8 complete internal assessment of penstocks, utilizing a third-party consultant to verify that the scope of
9 the practice was complete and comprehensive. The practice requires use of specialized technology¹¹
10 operated by certified specialists to measure the characteristics of the penstock major elements such as
11 longitudinal and circumferential welds, material thickness, and ovalization surveys. Subject matter
12 experts in penstock design and operation will assess and evaluate this data to determine if any
13 corrective actions have to be undertaken to ensure reliable operation of a penstock for the next six
14 years. As the practice was developed in the fourth quarter of 2018, this work was not included in
15 Hydro’s 2019 CBA, filed with the Board on July 31, 2018.

⁷ The Centre for Energy Advancement Through Technical Innovation (“CEATI”).

⁸ A “Centre for Energy Advancement Through Technical Innovation Manual” was sponsored by 23 organizations ranging from electric generation to transmission utilities.

⁹ American Society of Civil Engineers (“ASCE”).

¹⁰ Formally known as “Penstock PM9 Assessment.” These assessments will be undertaken on a six-year frequency to coincide with unit overhauls to avoid creating additional unit outages. On-site detailed engineering inspections include: (i) visual inspections of the entire length of penstock, (ii) magnetic particle inspection of 8-10% of the penstock longitudinal welds, (iii) steel thickness readings along 8-10% of the length at pre-determined locations, and (iv) out of roundness laser surveys along 2-5% of the penstock at pre-determined locations.

¹¹ Testing equipment includes an ultrasonic thickness gauge, and 3D laser scanner.

1 The Hinds Lake and Bay d’Espoir Penstocks have had preliminary inspections but the three penstocks
2 referenced in this supplemental application have not undergone comprehensive internal assessments
3 since the commissioning of these assets. For Granite Canal and Bay d’Espoir Penstocks, Hydro could wait
4 to complete the penstock assessment during the next scheduled overhaul in 2025 as opposed to
5 completing it concurrently with planned overhauls in 2019. Based on recent findings on other penstocks
6 and Hydro’s commitment to assessing the whole penstock fleet, it is Hydro’s opinion that waiting
7 another six years to arrange completion of the penstock assessments to coincide with the next planned
8 overhaul for these units is not necessary. The prudent approach is to take advantage of the current
9 outage to complete the assessment in 2019. This affords the best opportunity to understand the current
10 condition of the penstocks from a reliability perspective so that Hydro can make any future plans as
11 necessary. For the Hinds Lake Penstock, Hydro could complete only the rotor refurbishment in 2019 and
12 then take a second outage one year later, in 2020, to complete the overhaul and penstock assessment.
13 Hydro believes it is more cost efficient and appropriate to complete all three packages of work (i.e., the
14 rotor refurbishment, the overhaul, and the penstock assessment) in 2019. As noted in Section 3.2.1,
15 Table 2, completing the overhaul and rotor refurbishment in the same outage is estimated to save
16 approximately \$189,000 in execution costs compared to completing the overhaul in a separate outage in
17 2020.

18

19 **3.3 Recommended Alternatives**

20 **3.3.1 Hinds Lake Generation Unit**

21 The recommended alternative for Hinds Lake is to proceed with moving the Overhaul from 2020 to
22 2019. This is based on cost efficiencies that can be gained by performing the work in parallel with the
23 Hinds Lake Rotor Refurbishment project, submitted as part of Hydro’s 2019 CBA. The Planned vs. Actual
24 Unit Major Overhaul schedule is included as Attachment 2.

25

26 **3.3.2 Bay d’Espoir Penstock 4, Granite Canal Penstock, and Hinds Lake Penstock**

27 The recommended alternative for Bay d’Espoir Penstock 4, Granite Canal Penstock, and Hinds Lake
28 Penstock is to complete the condition assessment work at the same time as the Overhauls on Bay
29 d’Espoir Unit 7, Granite Canal, and Hinds Lake generation units in 2019. This is recommended since the
30 penstocks have not undergone a comprehensive assessment as part the expected operation life of the

1 coatings. This will allow Hydro to follow and implement its Penstock Assessment Schedule as shown in
2 Attachment 3.

3 **4.0 Project Description**

4 **4.1.1 Hinds Lake Generation Unit**

5 This project involves further disassembly and reassembly, beyond the work required for the Rotor
6 Refurbishment Project, of the Hinds Lake generating unit. The further disassembly will allow full access
7 to the turbine section of the unit to inspect, test, clean, refurbish and/or replace defective components.

8 This major overhaul inspection involves:

- 9 • Cleaning and inspecting rotor and stator assembly;
- 10 • Electrical testing on rotor/stator assembly;
- 11 • Calibrating and testing of turbine and generator protection devices;
- 12 • Verifying bearing and seal clearances; and
- 13 • Performing a thorough inspection of turbine and draft tube.

14 Defective components expected to be refurbished, replaced, or adjusted shall include, but may not be
15 limited to:

- 16 • Wicket gate stem seals;
- 17 • Runner repairs;
- 18 • Governor restore cable;
- 19 • Governor rod end; and
- 20 • Governor rod end; and
- 21 • Digital tachometer.

1 **4.1.2 Bay d’Espoir Penstock 4, Granite Canal, and Hinds Lake Penstocks**

2 This project consists of a Level II Condition Assessment of Bay d’Espoir Penstock 4, Hinds Lake Penstock,
3 and Granite Canal Penstock. The assessment will include, but may not be limited to:

- 4 • Preparation work including: drawing review, pre-assessment work, inspection preparation, and
5 pre-documentation submission for on-site work required by Hydro labour;
- 6 • On-site detailed engineering inspections as follows:
 - 7 ○ VT of the entire length of penstock;
 - 8 ○ Magnetic particle (“MT”) inspection of 8-10% of the penstock longitudinal welds;
 - 9 ○ Steel thickness readings (“UT”) along 8-10% of the length at pre-determined locations;
 - 10 ○ Out of roundness laser surveys along 2-5% of the penstock at pre-determined locations;
- 11 • Field investigation interim and project reports;
- 12 • Detailed condition assessment and analysis of each penstock; and
- 13 • Recommendations and insight into penstock operability for a six-year outlook.

14 Information gathered from the on-site inspections will be reviewed by hydraulic unit penstock
15 assessment specialists who will determine if any corrective actions have to be undertaken to ensure
16 reliable operation of a penstock for the next six years.

17

18 Table 3 and Table 4 provide the Project Estimates for the projects, and Table 5 and Table 6 provide the
19 Project Schedules.

Table 3: Project Estimate for Hinds Lake Unit Major Overhaul (\$000)

	2019	2020	Beyond	Total
Material Supply	46.5	0	0	46.5
Labour	141.2	0	0	141.2
Consultant	0	0	0	0.0
Contract Work	0	0	0	0.0
Other Direct Costs	59.4	0	0	59.4
Interest and Escalation	0	0	0	0.0
Contingency	12.4	0	0	12.4
Total	259.5	0.0	0.0	259.5

**Table 4: Project Estimate for Bay d'Espoir Penstock 4,
Granite Canal and Hinds Lake Penstock Assessments (\$000)**

	2020	2021	Beyond	Total
Material Supply	12.0	0.0	0.0	12.0
Labour	87.8	0.0	0.0	87.8
Consultant	270.0	0.0	0.0	270.0
Contract Work	0.0	0.0	0.0	0.0
Other Direct Costs	6.8	0.0	0.0	6.8
Interest and Escalation	0.0	0.0	0.0	0.0
Contingency	37.7	0.0	0.0	37.7
Total	414.3	0.0	0.0	414.3

Table 5: Project Schedule for Hinds Lake Unit Major Overhaul

Activity		Start Date	End Date
Planning	Front-End Review of Work Orders and Associated Work	1-May-2019	19-May-2019
Design	Prepare for Preventive and Corrective Work Order Tasks	20-May-2019	2-Jun-2019
Procurement	Order and Kit Materials for Overhaul	3-Jun-2019	17-Aug-2019
Construction	Preventive and Corrective Maintenance Work Activities	18-Aug-2019	31-Oct-2019
Commissioning	Commissioning of all Preventive and Corrective Maintenance Work Order as Required	1-Nov-2019	21-Nov-2019
Closeout	Project Documentation	22-Nov-2019	13-Dec-2019

**Table 6: Project Schedule for Bay d’Espoir Penstock 4,
Granite Canal, and Hinds Lake Penstock Assessments**

Activity		Start Date	End Date
Planning	Review of Historical Information	20-Apr-2019	31-Apr-2019
Design	Contract Development	1-May-2019	5-May-2019
Procurement	Contract Tendering and Award	6-May-2019	24-May-2019
Construction	Granite Canal Penstock Inspections	24-Jun-2019	28-Jun-2019
	Bay d’Espoir Penstock 4 Inspections	17-Jun-2019	21-Jun-2019
	Hinds Lake Penstock Inspections	9-Sep-2019	13-Sep-2019
Commissioning	Report Development	14-Sep-2019	8-Nov-2019
Closeout	Project Documentation	9-Nov-2019	29-Nov-2019

1 **5.0 Conclusion**

2 Completing a six-year Overhaul on the unit at Hinds Lake and Level II Condition Assessments on Bay
3 d’Espoir Penstock 4, Granite Canal Penstock, and Hinds Lake Penstock will allow Hydro to maintain
4 reliability, save execution costs, reduce wear and tear from additional disassembly and reassembly of
5 the Hinds Lake Generating Unit, and reduce the requirement for additional outages in 2020 for penstock
6 inspections. Completing this work in 2019 will allow Hydro to perform the associated work in a timely
7 and cost-effective manner.

Attachment 1

Proposed Project Advancement Letter for Hinds Lake



Hydro Place, 500 Columbus Drive.
P.O. Box 12400, St. John's, NL
Canada A1B 4K7
t. 709.737.1400 f. 709.737.1800
www.nlh.nl.ca

November 14, 2018

The Board of Commissioners of Public Utilities
Prince Charles Building
120 Torbay Road, P.O. Box 21040
St. John's, NL A1A 5B2

Attention: Ms. Cheryl Blundon
Director Corporate Services & Board Secretary

Dear Ms. Blundon:

**Re: Newfoundland and Labrador Hydro ("Hydro") – 2019-2020 Proposed Capital Project –
Refurbish Generator Rotor – Hinds Lake**

Introduction

In its 2019 Capital Budget Application ("CBA"), Hydro submitted a proposal to refurbish the generator rotor for Hinds Lake.¹ This project was justified based on the decline in rotor resistance readings, which indicated that there is a risk of rotor pole winding insulation failure. As a result, refurbishment of the rotor is necessary. This work was proposed as a two-year project² at an estimated cost of \$1,379,200.

Background

In its response to a 2019 CBA Request for Information, PUB-NLH-009, on October 3, 2018, Hydro provided additional data on rotor resistance. The reading as of that date was 0.435 Mohms, which is above safe operation levels. Hydro considered the rotor to be safe for operation throughout the 2018-2019 winter season. Hydro also engaged Voith Hydro ("Voith") to perform an assessment of the data, provide a rotor cleaning plan, and provide field execution expertise.

Hydro's opinion on the safe operation for the coming winter has not changed, and staff continue to monitor the rotor resistance in real-time, including continual analysis of the results. However, working with Hydro staff, Voith analyzed the available data and recommended completion of the rotor refurbishment in 2019. Voith recommended not extending the execution timing to 2020 given the marginal gains achieved through extensive cleaning and the estimated remaining life in the rotor winding insulation.

Proposed Project Advancement

The project to refurbish the Hinds Lake generator rotor remains before the Board as part of the 2019 CBA. Provided this project is approved by the Board, Hydro proposes to advance the project such that the refurbishment of the Hinds Lake rotor is completed in 2019, instead of as per the 2019-2020 schedule detailed in the 2019 CBA. The scope of work and direct costs remain the same.

¹ Hydraulic Generation Refurbishment and Modernization, section 2.1.4.

² 2019-2020.

Ms. C. Blundon
Public Utilities Board

2

The proposed Hydraulic Generation Refurbishment and Modernization Project, in which the Hinds Lake Rotor Refurbishment is included, entailed expenditures of \$9,097,700 in 2019 and \$6,745,200 in 2020. The Hinds Lake Rotor Refurbishment aspect of this project included proposed expenditures of \$120,400 in 2019 and \$1,258,800 in 2020. The estimate for advancing the Hinds Lake generator rotor project is \$1,340,300 in 2019, with \$0 in 2020. As a result of this proposed change, the Hydraulic Generation Refurbishment and Modernization Project estimate is revised as shown in Table 1.

Table1: Hydraulic Generation Refurbishment and Modernization – Project Estimate (\$000s)

Project Cost	2019	2020	Beyond	Total
Material Supply	1,027.2	416.0	0.0	1,443.2
Labour	2,937.7	627.6	0.0	3,565.3
Consultant	922.8	101.0	0.0	1,023.8
Contract Work	3,157.9	2,651.8	0.0	5,809.7
Other Direct Costs	317.7	128.8	0.0	446.5
Interest and Escalation	597.5	514.4	0.0	1,111.9
Contingency	1,352.8	1,046.9	0.0	2,399.7
Total	10,313.6	5,486.5	0.0	15,800.1

Should you have any questions, please contact the undersigned.

Yours truly,

NEWFOUNDLAND AND LABRADOR HYDRO



Shirley A. Walsh
Senior Legal Counsel – Regulatory
SW/kd

cc: Gerard Hayes – Newfoundland Power
Paul Coxworthy – Stewart McKelvey
ecc: Denis J. Fleming – Cox & Palmer
Sherly Nisenbaum – Praxair Canada Inc.
Van Alexopoulos – Iron Ore Company
Senwung Luk – Olthuis Kleer Townshend LLP

Dennis Browne, Q.C. – Browne Fitzgerald Morgan & Avis
Dean Porter – Poole Althouse
Larry Bartlett – Teck Resources Ltd.
Benoît Pepin – Rio Tinto

Attachment 2

Planned vs. Actual Unit Major Overhaul Schedule

Hydraulic Generator Unit Inspection Schedule

Planned vs. Actual

Description		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
BDE Unit 1	Planned	PM6	PM9	PM6	PM6	PM6	PM6	PM6	PM9	PM6	PM6	PM6	PM6	PM6
	Actual	PM6	PM9	PM6	PM6	PM6	PM6	PM6						
BDE Unit 2	Planned	PM9	PM6	PM6	PM6	PM6	PM6	TR	PM6	PM6	PM6	PM6	PM6	PM9
	Actual	PM9	PM6	PM6	PM6	PM6	PM6	TR						
BDE Unit 3	Planned	PM6	PM6	PM9	PM6	PM6	TR	PM6	PM6	PM6	PM6	PM6	PM9	PM6
	Actual	PM6	PM6	PM9	PM6	PM6	TR	PM6						
BDE Unit 4	Planned	PM6	PM6	PM6	PM6	PM6	PM6	PM6	PM6	PM6	PM6	PM9	PM6	PM6
	Actual	PM6	PM6	PM6	PM6	TR	PM6	PM6						
BDE Unit 5	Planned	PM6	PM6	PM6	PM9	PM6	PM6	PM6	PM6	PM6	PM9	PM6	PM6	PM6
	Actual	PM6	PM6	PM6	PM9	PM6	PM6	PM6						
BDE Unit 6	Planned	PM6	PM6	PM6	PM6	PM9	PM6	PM6	PM6	PM6	PM6	PM9	PM6	PM6
	Actual	PM6	PM6	PM6	PM6	PM6	PM6	PM6						
BDE Unit 7	Planned	PM6	PM6	PM6	PM6	PM9	PM6	PM6	TR	PM6	PM6	PM9	PM6	PM6
	Actual	PM6	PM6	PM6	PM6	PM9	PM6	PM6						
USL Unit	Planned	PM9	PM6	PM6	PM6	PM6	PM6	PM9	PM6	PM6	PM6	PM6	PM6	PM9
	Actual	PM9	PM6	PM6	PM6	PM6	PM6	PM9						
HLK Unit	Planned	PM6	PM6	PM9	PM6	PM6	PM6	PM6	PM6	PM9	PM6	PM6	PM6	PM6
	Actual	PM6	PM6	PM9	PM6	PM6	PM6	PM6						
CAT Unit 1	Planned	PM6	PM6	PM6	PM6	PM6	PM9	PM6	PM6	PM6	PM6	PM6	PM9	PM6
	Actual	PM6	PM6	PM6	PM6	PM6	PM9	PM6						
CAT Unit 2	Planned	PM6	PM9	PM6	PM6	PM6	PM6	PM6	PM6	PM9	PM6	PM6	PM6	PM6
	Actual	PM6	PM9	PM6	PM6	PM6	PM6	PM6						
PRV Unit	Planned	PM6	PM6	PM6	PM9	PM6	PM6	PM6	PM6	PM6	PM9	PM6	PM6	PM6
	Actual	PM6	PM6	PM6	PM9	PM6	PM6	PM6						
GCL Unit	Planned	PM9	PM6	PM6	PM6	PM6	PM6	PM6	PM9	PM6	PM6	PM6	PM6	PM6
	Actual	PM9	PM6	PM6	PM6	PM6	PM6	PM6						
SLK Unit	Planned	PM6	PM6	PM6	PM6	PM9	PM6	PM6	PM6	PM6	PM6	PM9	PM6	PM6
	Actual	PM6	PM6	PM6	PM6	PM9	PM6	PM6						
S.A. Unit	Planned	PM6	PM6	PM6	PM6	PM6	PM6	PM6	PM6	PM6	PM6	PM6	PM6	PM6
	Actual	N/A	N/A	PM6	PM6	N/A	N/A	N/A						
V.B. Unit	Planned	PM6	PM6	PM6	PM6	PM6	PM6	PM6	PM6	PM6	PM6	PM6	PM6	PM6
	Actual	N/A	N/A	N/A	N/A	N/A	N/A	N/A						

BDE: Bay d'Espoir

USL: Upper Salmon

HLK: Hinds Lake

CAT: Cat Arm

PRV: Paradise River

GCL: Granite Canal

SLK: Star Lake

S.A.: Snook's Arm

V.B.: Venam's Bight

PM6: Annual Inspection

PM9: Six-Year Inspection

TR/PM9: Turbine Refurbishment

Attachment 3

Penstock Assessment Schedule

Penstock Inspection Plan

Location	Capacity (MW)	In Service	Year												
			2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
BDE 1	153	1967	PM9	PM9	PM9	PM9	PM9	-	-	-	-	-	PM9	-	-
BDE 2	153	1967	PM9	PM9	PM9	PM9	PM9	PM9	-	-	-	-	-	PM9	-
BDE 3	153	1970	PM9	PM9	PM9	PM9	PM9	PM9	PM9	-	-	-	-	-	PM9
BDE 4	154	1977	-	PM9	-	-	PM9	-	-	-	-	-	PM9	-	-
USL	84	1983	PM9	-	-	-	-	-	PM9	-	-	-	-	-	PM9
HLK	75	1980	-	PM9	-	-	-	-	-	-	PM9	-	-	-	-
GCL	40	2003	-	PM9	-	-	-	-	-	PM9	-	-	-	-	-
CAT	134	1985	-	-	PM9	-	-	-	-	-	PM9	-	-	-	-
PRV	8	1989	-	-	-	PM9	-	-	-	-	-	PM9	-	-	-
SLK	18	1998	-	-	-	-	PM9	-	-	-	-	-	PM9	-	-

Penstock Refurbishment Plan

Location	Capacity (MW)	In Service	Year												
			2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
BDE 1	153	1967	-	-	CP	CP	CP	CP	-	-	-	-	-	-	-
BDE 2	153	1967	-	-	-	CP	CP	CP	CP	-	-	-	-	-	-
BDE 3	153	1970	-	-	-	-	CP	CP	CP	CP	-	-	-	-	-
BDE 4	154	1977	-	-	-	-	-	-	-	-	-	-	CP	-	-
USL	84	1983	-	-	-	-	-	-	CP	-	-	-	-	-	-
HLK	75	1980	-	-	-	-	-	-	-	-	CP	-	-	-	-
GCL	40	2003	-	-	-	-	-	-	-	-	-	-	-	-	-
CAT	134	1985	-	-	-	-	-	-	-	-	-	-	-	CP	-
PRV	8	1989	-	-	-	-	-	-	-	-	-	CP	-	-	-
SLK	18	1998	-	-	-	-	-	-	-	-	-	-	CP	-	-

Definitions:

PM9: Six-year frequency. Comprehensive internal inspection using external consultant resources for technical assistance. Includes magnetic particle and ultrasonic thickness Non-Destructive Evaluation as well as laser survey for concentricity checks. (Cat Arm: underwater imaging ROV to avoid dewatering)

PM6: Annual frequency. Cursory external inspection using internal resources. Preventive Maintenance ("PM") checklist used that has been developed and implemented by Bay d'Espoir Long Term Asset Planning department using industry best standards.

PM4: Monthly frequency. Cursory external inspection using internal resources. PM checklist used that has been developed and implemented by Bay d'Espoir Long Term Asset Planning department using industry best standards.

CP: Capital program for 25+ year life extension work.

Notes:

- A plan for the life extension refurbishment of penstocks is determined based on PM9 inspections. The Bay d'Espoir Long Term Asset Planning department will use the results from the PM9 assessment to build a scope and program within the 5- and 20-year capital plans.
- Life extension work for units outside of Bay d'Espoir Units 1–3 is based solely on age of interior coating.
- The refurbishment plan will likely change as PM9s are carried out for other sites. Other sites outside of Bay d'Espoir Units 1–3 are not expected to be of any concern given the age of the penstocks and tunnels, however all sites will undergo a PM9 within the next 5 years.
- Plan for refurbishment of penstocks outside of Bay d'Espoir has not yet been developed. The plan is to carry out the PM9 inspections as noted in the table and then determine a path forward.
- As per Hatch's recommendations, until a life extension program is implemented an annual PM9 is to be carried out for Bay d'Espoir 1-3 penstocks. Afterwards the six-year frequency will be re-established in line with unit majors.
- Life extension work for Bay d'Espoir Penstocks is estimated to be carried out over 6–7 years; however, this could increase based on results from 2018 Level Condition Assessment. First year engineering and second year refurbishment. This will be continued for the life of the Penstocks. A detailed plan for life extension work to be developed in 2019 as part of Hatch's assessment activities.
- PM6 & PM4 have not been added to the table since they are performed annually; logged and tracked by Bay d'Espoir Long Term Asset Planning to determine the need for intervention if any abnormalities are found.
- BDE P1-3 PM9 will be carried under operating until life extension work since it is an annual activity at the moment to ensure winter readiness.



Affidavit

IN THE MATTER OF the *Electrical Power Control Act*, RSNL 1994, Chapter E-5.1 (the "EPCA") and the *Public Utilities Act*, RSNL 1990, Chapter P-47 (the "Act"), and regulations thereunder;

AND IN THE MATTER OF an Application by Newfoundland and Labrador Hydro ("Hydro") for the approval of the Hinds Lake Generating Station ("Hinds Lake") Unit Major Overhaul and Level II Penstocks Assessments for Bay d'Espoir Hydroelectric Generating Facility ("Bay d'Espoir") Penstock 4, Granite Canal Generating Station ("Granite Canal"), and Hinds Lake pursuant to Subsection 41(3) of the Act.

AFFIDAVIT

I, Jennifer Williams, Professional Engineer, of St. John's in the Province of Newfoundland and Labrador, make oath and say as follows:

1. I am the President of Newfoundland and Labrador Hydro, the Applicant named in the attached Application.
2. I have read and understand the foregoing Application.
3. I have personal knowledge of the facts contained therein, except where otherwise indicated, and they are true to the best of my knowledge, information and belief.

SWORN at St. John's in the)
Province of Newfoundland and)
Labrador this 22 day of May)
2019, before me:)



Barrister, Newfoundland and Labrador



Jennifer Williams