

NOVA SCOTIA UTILITY AND REVIEW BOARD

IN THE MATTER OF THE PUBLIC UTILITIES ACT

- and -



IN THE MATTER OF AN APPLICATION by **NOVA SCOTIA POWER INCORPORATED**
for approval of capital work order CI#29807 for its Tusket Main Dam Refurbishment
project in the amount of \$18,157,609

BEFORE: Steven M. Murphy, MBA, P.Eng., Panel Chair
Roberta J. Clarke, Q.C., Member
Richard J. Melanson, LL.B., Member

APPLICANT: **NOVA SCOTIA POWER INCORPORATED**
Matthew Gorman, LL.B.

INTERVENORS: **ASSEMBLY OF NOVA SCOTIA MI'KMAQ CHIEFS**
Terrence Paul, Chief and Co-Chair
Sidney Peters, Chief and Co-Chair

ACADIA FIRST NATION
Deborah Robinson, Chief

CONSUMER ADVOCATE
William L. Mahody, Q.C.

INDUSTRIAL GROUP
Nancy G. Rubin, Q.C.

KWILMU'KW MAW-KLUSUAQN NEGOTIATION OFFICE
Janice M. Maloney, B.A., LL.B., Executive Director

PROVINCE OF NOVA SCOTIA
Sean Foreman, Q.C.

SMALL BUSINESS ADVOCATE
E.A. Nelson Blackburn, Q.C.

BOARD COUNSEL: S. Bruce Outhouse, Q.C.

FINAL SUBMISSIONS: November 16, 2018

DECISION DATE: February 6, 2019

DECISION: Application is approved, with directives as stated in paragraphs [143] and [147].

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I INTRODUCTION AND BACKGROUND

[1] Nova Scotia Power Incorporated (NS Power, Utility or Company) made an application to the Nova Scotia Utility and Review Board (Board) on July 5, 2017, for approval of capital work order CI#29807 for its Tusket Main Dam Refurbishment Project in the amount of \$18,157,609 (Application). NS Power also requested approval of its Confidentiality Undertaking and confidential treatment of certain information filed in support of the Application.

[2] The Application was brought pursuant to s. 35 of the *Public Utilities Act*, R.S.N.S. 1989, c. 380, as amended (*Act*), which states:

No public utility shall proceed with any new construction, improvements or betterments in or extensions or additions to its property used or useful in furnishing, rendering or supplying any service which requires the expenditure of more than two hundred and fifty thousand dollars without first securing the approval thereof by the Board.

[3] The Utility said the Project is required to help ensure the dam is compliant with current Canadian Dam Association (CDA) dam safety guidelines and Nova Scotia Environment (NSE) requirements. NS Power also indicated that the existing gates within the main dam structure have reached the end of their expected useful life and need replacement.

[4] The Tusket Dam Refurbishment Project was identified in the Company's 2016 Annual Capital Expenditure (ACE) Plan in the amount of \$6,543,233, as part of the proposed spending on subsequent approval items. NS Power subsequently deferred the project to allow for engagement with First Nations. The Project was again listed among projects for subsequent approval in the 2017 ACE Plan, for \$9,940,664.

[5] Given the amount of the capital work order, and in accordance with Board practice, on July 13, 2017, the Board advised a number of parties, who frequently

participate in Utility proceedings before the Board, that the Application had been filed and asked whether they wished to become Intervenors in the proceeding.

[6] A Notice of Intervention was filed by the Small Business Advocate (SBA), in response to the Board's notice of the proceeding.

[7] By letter dated July 21, 2017, the Board approved the Company's confidentiality requests and determined the matter could proceed by way of a paper hearing. A timetable was established for the issuance of, and responses to, Information Requests (IRs) and written submissions. This timetable was subsequently amended by letter dated July 26, 2017.

[8] The Board timetable envisaged the completion of the paper hearing by September 26, 2017, when NS Power's Reply Submissions were due.

[9] On August 29, 2017, NS Power responded to IRs from the SBA and Board staff. On August 31, 2017, after reviewing the IR responses, the Board advised the parties it was retaining an expert, in the field of dam refurbishment, construction and decommissioning, to assist in its review. The original timeline was suspended pending the retention of such an expert. Ultimately, Midgard Consulting Inc. (Midgard) was retained by the Board.

[10] After conducting a review and analysis of some recent Supreme Court of Canada cases, the Board determined a further process was required in this proceeding to address any potential duty to consult issues arising as a result of the Project.

[11] On September 29, 2017, the Board sent a letter to the Acadia First Nation, and Kwilmu'kw Maw-Klusuaqn Negotiation Office (KMKNO), which were the entities that

had been identified in the Application as having been engaged by NS Power in the First Nations consultation process. The letter said, in part:

...the Board must consider whether adequate Crown consultation with First Nations has occurred, if the concern is raised before it. This assumes both the Crown and any impacted Aboriginal group are aware of a matter before the Board that might require consultation.

...

The purpose of this correspondence is to bring the application to your attention, and to give you an opportunity to participate in the process, if KMKNO has any Aboriginal consultation issues which you wish the Board to consider in this matter.

Please note that if you wish to participate in this matter you can become a Formal Intervenor, which status includes the right to make Information Requests and view confidential filings, provided a Confidentiality Undertaking is signed. Alternatively, you may wish to comment on the application in writing.

...

Once the Board knows whether you wish to participate in this matter, and if so, in what capacity, a timeline will be developed to complete the review of this application.

[Letter to KMKNO, September 29, 2017]

[12] Similar correspondence was forwarded to the Province.

[13] On October 13, 2017, upon receiving correspondence from the Province and KMKNO, the Board issued a Hearing Order, and Notice of Paper Hearing, with a revised timeline, and further opportunity for the filing of interventions.

[14] Following the issuance of the Hearing Order, Notices of Intervention were received from the Consumer Advocate (CA), the Industrial Group, the Acadia First Nation, the Assembly of Nova Scotia Mi'kmaq Chiefs (ANSMC) and KMKNO.

[15] Evidence, including IR responses, was filed in this matter by NS Power, Midgard, the CA, and the SBA. In particular, Midgard filed a report (Midgard Review Report) with the Board on December 20, 2017. The report reviewed NS Power's estimated costs and key justifications for the Tusket Dam Refurbishment Project and expressed opinions as to whether these were sufficiently supported by the evidence. NS Power filed evidence in response to Midgard's report, including expert evidence from C. Richard Donnelly of Hatch Ltd. (Hatch), on dam engineering and CDA issues, and

Sandra Gogal, who responded to issues surrounding NS Power's obligations to protect First Nations archaeological assets. Having considered the additional evidence provided by NS Power, Midgard filed a second report (Midgard Review Report Update), dated April 20, 2018.

[16] The Province, ANSMC and Acadia First Nation filed evidence relating to the duty to consult, but no IRs were issued to these parties.

[17] Submissions were filed by NS Power, the CA, the SBA, the Industrial Group, the Province, ANSMC, and the Acadia First Nation, with final submissions being received on May 14, 2018.

[18] The Acadia First Nation and the ANSMC submitted that the Crown had not fulfilled its duty to consult in this case. The Province disagreed. No other party took a position on the issue.

[19] In a preliminary decision [2018 NSUARB 154], the Board found that the Crown had not adequately met its duty to consult obligations. In order to meet these obligations, as outlined in *Chippewas* and *Clyde River*, the Board decided that a further process was required. In an Order dated August 20, 2018, the Board ordered that the proceedings be adjourned to provide the parties with a further opportunity to complete consultations. The Board further ordered that the parties report back to the Board within three months of the preliminary decision to advise of the status of the consultations.

[20] On November 16, 2018, the Board received submissions from KMKNO, ANSMC, the Acadia First Nation, the Province and NS Power, each providing an update on the status of the consultations. In particular, on Page 4 of 4, the KMKNO, ANSMC and Acadia First Nation submission noted:

Provided the Crown continues with its commitment to better and earlier communications for the remainder of this particular project and other consultations; we report to the Board that, as long as Nova Scotia and NSPI continue to consult with us in good faith on the Tusket Dam refurbishment, continue to work with us to improve the consultation process in general and the Tusket Dam refurbishment in particular, work with us to reach agreement on outstanding issues such as consulting on Heritage Research Permits and on what constitutes delegated consultation activities by a proponent and what constitutes relationship building between a proponent and the Mi'kmaq, the ANSMC and Acadia First Nation are satisfied with the consultation to date on the Tusket Dam refurbishment.

[21] Having reviewed the submissions, the Board issued a letter to the parties on November 22, 2018. In that letter, the Board acknowledged that while outstanding issues remain relating to the overall consultation framework, the Board was satisfied that the Crown's consultation with the Acadia First Nation and the KMKNO, on behalf of the Assembly of Nova Scotia Mi'kmaq Chiefs, in relation to this particular project, to that point in time, had been sufficient to fulfill the Crown's duty to consult. As such, the Board indicated that it would proceed to make a determination on the merits of this Application and finalize its decision based on the evidence presented to date.

[22] The following presents the Board's Decision.

II TUSKET HYDRO SYSTEM

[23] The Tusket Hydro System is located on the Tusket River in Yarmouth County, Nova Scotia. The Tusket Hydro System was originally constructed in 1929 and operates by capturing runoff from a 1,462 km² watershed. The powerhouse on the Tusket Hydro System has a nameplate capacity of 2.7 MW and generates approximately 12 GWh annually. The system also includes four storage reservoirs at Lake Vaughan, Raynards Lake, Mink Lake and Great Barren Lake.

[24] The Tusket Hydro System consists of the following infrastructure components:

- **Tusket Main Dam:** the main control structure for Lake Vaughan, is a concrete gravity structure that is approximately 226 feet long (69 metres) and 18 feet (5.5 metres) high. It includes four wood sheathed tainter gates (an upgrade that was added in the 1980's) and six spillway sections (four of which have been blocked with concrete, leaving only two operable stoplog-controlled sections). Short earthfill embankment sections are located on either side of the concrete section. Additionally, there is a fish bypass channel located at the right abutment.
- **Tusket Powerhouse:** a concrete powerhouse containing three Kaplan turbines, each with a nameplate capacity of 0.9 MW, and associated hydro-mechanical equipment. The Tusket Powerhouse is supplied by the power canal, which leads water from the river-right abutment of the Tusket Main Dam to the headpond (where the Tusket Powerhouse is located). A regional NS Power substation is located adjacent to the Tusket Powerhouse.
- **Tusket Powerhouse Dam:** The Tusket Powerhouse is built into the Tusket Powerhouse Dam. The Tusket Powerhouse Dam is located on the power canal and comprises a concrete structure with abutting earthfill embankments on each side. The earthfill embankments contain timber cores that have been reinforced with steel sheet piles and grout.
- **Western Wing Dam:** also located on the power canal, is located at a low point in the local topography north of the Tusket Powerhouse Dam. The Western Wing Dam is an earthfill embankment structure.

- **Tusket Canal Embankment Dam:** also located on the power canal.
- **Carleton Dam:** comprises of right and left earthfill embankment abutments, a gated sluice, a central free overflow concrete ogee spillway, and a fish ladder.
- **Mink Lake Dam:** located at the northwest end of Mink Lake, is a rock dam with a free overflow spillway.
- **Great Barren Dam:** located in the northeast section of the Tusket Hydro System, consists of a concrete free overflow spillway section with a low-level gated sluice and earthfill embankment dam abutments.

[25] The lakes created by the Tusket Hydro System (Lake Vaughan, Carleton Lake, Mink Lake, and Great Barren Lake) feature waterfront residential and recreational properties, and support business and recreational activities. Previous archaeological assessments have noted that some of the lands inundated by the Tusket Hydro System reservoirs contain registered pre-contact First Nations sites. However, the exact extent of pre-contact First Nations sites is currently unknown, as the reservoirs have not been completely dewatered since the system was originally developed.

[26] The Hurlburt Falls Bridge is located just downstream of the Tusket Main Dam. The bridge is owned by the Province of Nova Scotia.

III PROPOSED PROJECT SCOPE

[27] In the current Application before the Board, NS Power is proposing to replace the Tusket Main Dam and refurbish certain associated structures. The proposed scope of work includes:

- Construct a new dam immediately downstream of the current Tusket Main Dam. The new dam is to include eight spillway gates (and associated superstructure, hoists, stoplogs, etc.), which will allow the dam to pass a 1 in 1000-year (1:1000-year) flood while maintaining the level of Lake Vaughan within NS Power's flowage rights;
- Demolish the existing Tusket Main Dam concrete sections (after they have served as a cofferdam for the construction of the new dam);
- Refurbish various dams that form the power canal (including the Tusket Canal Embankment, the Tusket Powerhouse Embankment, and the Western Wing Dam);
- Refurbish the Tusket Main Dam earth-filled embankments;
- Modify the Tusket Main Dam fish bypass; and
- Construct a new permanent bridge in place of the existing Hurlburt Falls Bridge, in order to allow 1:1000-year flood flows to pass the bridge without backing tailwater levels up to an elevation that would impact the new Tusket Main Dam (a temporary bridge is planned to maintain road access across the Tusket River during the time between the demolition of the existing Hurlburt Falls Bridge and the completion of the new bridge).

[28] The overall cost of NS Power's proposed option (as presented in the Application) is \$18,157,609.

IV ISSUE

[29] Is the Tusket Main Dam Replacement and Refurbishment Project, as proposed, necessary and is the corresponding cost justified?

[30] For the reasons that follow, the Board finds the answers are yes.

V IS THE PROJECT NECESSARY AS PROPOSED?

a. Dam Safety Requirements

[31] NS Power's primary justification for this project is safety related:

...this investment is required to ensure the Tusket Main Dam structure is compliant with current Canadian Dam Association (CDA) dam safety guidelines and Nova Scotia Environment requirements. Additionally, the existing gates within the main dam structure have reached the end of their expected useful life and must be replaced.

[Exhibit N-1, p. 6]

[32] CDA guidelines define principles and outline guidelines so that the safety of existing dams can be evaluated in a consistent manner across Canada. These guidelines also help to ensure that new dams are designed and constructed to appropriate safety standards. In 2013, MECO Consultants (MECO), on behalf of NS Power, completed a Dam Safety Review (DSR) of the Tusket Hydro System in accordance with CDA guidelines. A DSR is a systematic review and evaluation of all aspects of design, construction, maintenance, operation, processes and systems affecting a dam's safety. In addition, the Company undertook a flood study of the Tusket Hydro System in 2012.

With respect to the Tusket Main Dam, the findings and conclusions of these studies are summarized as follows:

- The left embankment is in good condition, while the right embankment is in fair to good condition;
- The concrete structure and gates are in fair to poor condition, with signs of deterioration;
- The condition of the gates and related components are deteriorating;
- The consequence classification of the dam is “Significant”;
- The Inflow Design Flood (IDF) for the dam is the 1:1000-year flood;
- The dam does not meet minimum stability criteria for sliding and overturning for the usual condition; however, the structure is adequate when ice loading is removed;
- The dam does not meet normal and minimum freeboard requirements; and
- The top of the core is overtopped under IDF conditions (i.e., the dam has insufficient discharge capacity to meet minimum freeboard requirements under the IDF).

[33] NS Power has used the findings and conclusions of the DSR to support its Application to replace and refurbish the Tusket Main Dam to meet CDA guidelines.

[34] Midgard’s Review Report indicated that the evidence presented by NS Power, adequately supported the following assertions advanced by NS Power:

- The Tusket Main Dam should be classified as “significant” pursuant to the CDA Guidelines;

- Normal and minimum freeboard provisions at the Tusket Main Dam are deficient and that corrective action is required; and
- The Tusket Main Dam tainter spillway gates are at the end of their useful life and need refurbishment or replacement.

[35] The Midgard Review Report also found that the evidence only partially supported the following NS Power claims:

- The existing Tusket Main Dam cannot pass the required design flood flow (specifically that the use of the 1:1000-year IDF is justified); and
- The Tusket Main Dam fails to meet CDA Guidelines for sliding and overturning conditions.

[36] NS Power subsequently provided IR responses to further support its use of the 1:1000-year IDF. In addition, as it relates to sliding and overturning conditions, Mr. Donnelly responded:

...it is concluded that the stability issues with the concrete dam are only a contributing factor in the justification for dam replacement but not the overriding reason. Issues with discharge capacity and the flow control equipment lead to this conclusion.

[Exhibit N-21, Appendix A, p. 18]

[37] Based on this additional information, Midgard's Review Report Update found that use of the 1:1000-year IDF is justified. Midgard also concluded that there is enough justification to support NS Power's claim that action must be taken regarding the Tusket Main Dam. However, Midgard also noted that this justification does not determine which action (repair, replace or service) should be followed.

[38] In their initial submissions, the SBA and CA raised concerns with respect to whether the Tusket Main Dam must meet CDA standards to pass a 1:1000-year IDF. In

their respective closing submissions though, neither party took issue with Midgard's Review Report Update finding that a 1:1000-year IDF is justifiable. The SBA also highlighted Midgard's contention that such an IDF does not determine whether dam refurbishment or decommissioning is appropriate.

[39] The CA further contended that the necessity to replace the existing six main dam spillways with eight spillways had not been fully justified by NS Power. He suggested that prior to requesting approval for main dam replacement, NS Power analyze the options to repair the existing inoperable gates and improve the gates to allow higher flow. NS Power submitted that the CA's suggestion is not warranted, as the Company's evidence (supported by Mr. Donnelly) showed the existing six spillways are not sufficient to safely pass the IDF associated with the "Significant" dam rating. NS Power's response to Midgard IR-12, also showed that five gates are required to pass the 1:100-year IDF and seven gates are required to pass the 1:500-year IDF. Further, NS Power stated that the existing inactive spillways are a part of the original 1929 concrete structure, are much smaller than the proposed new gate openings, and were sealed with concrete, which is now degrading. NS Power contended that the effort required to design and execute a project to re-activate those sections would be extremely complex and costly and could require NS Power to dewater Lake Vaughan. In addition, the existing tainter gates would still have to be replaced and the dam would still not be able to safely pass the IDF associated with the determined dam significance rating.

i. Findings

[40] The evidence presented does not appear to suggest an imminent safety concern related to the Tusket Main Dam. Nonetheless, it seems clear to the Board that

some form of action is required to address the dam's current physical state. Further, neither Midgard nor the Intervenor have taken issue with NS Power's claim that work needs to be undertaken to address existing dam safety deficiencies. The Board, therefore, finds that it is appropriate for NS Power to take action regarding these deficiencies. The issue of what action should be taken will be addressed elsewhere in this Decision.

[41] The Board also finds that the 1:1000-year IDF is appropriate for the Tusket Main Dam. The Board is also satisfied eight spillways are required to meet the 1:1000-year IDF.

b. Tusket Hydro System Capacity and Energy

[42] NS Power indicated that the Tusket Main Dam is a significant component of the Tusket Hydro System, and without it, all generation from the Tusket Powerhouse would be lost. The Company also stated:

NS Power's hydro assets including the Tusket system play an important role in NS Power's ability to meet environmental and emission regulations. Generation from NS Power's legacy hydro facilities qualifies under the provisions of the Nova Scotia Renewable Electricity Regulations and contributes to the Renewable Electricity Standard to serve 25 percent of sales from qualifying renewable generation sources, increasing to 40 percent by 2020. As well, hydro generation is non-emitting and supports NS Power's ability to meet both the Nova Scotia Greenhouse Gas Emissions Regulations and the Nova Scotia Air Quality Regulations, which specify reductions in CO₂, SO₂, NO_x and mercury through to 2030.

[Exhibit N-1, p. 6]

[43] If rebuilding and refurbishing the Tusket Main Dam is approved, NS Power asserted that the Tusket Hydro System will continue to provide dispatchable, firm, renewable energy for years to come. The Company contended that this will add customer value at a time when NS Power is subject to *Renewable Energy Standards (RES)*, *Nova Scotia Greenhouse Gas Emissions Regulations*, *Nova Scotia Air Quality Regulations*, and exploring options to reduce the Company's reliance on coal-fired generation.

[44] In particular, NS Power noted that the flow of energy from the Maritime Link is not expected to commence until April 2020. As such, in 2020, the Company will only achieve 39.9% renewable energy, 0.1% short of its target of 40%. This is the only year in which NS Power forecasts that it will not be RES compliant. The Company argued, therefore, that the renewable energy from the Tusket system will be required to comply with the RES legislation in the year 2020.

[45] In its Review Report, Midgard agreed with NS Power that the Tusket Hydro System provides renewable energy and dispatchable renewable capacity. However, Midgard argued that the quantity of each is immaterial in the context of NS Power's capacity and energy portfolios:

While it is true that the Tusket Hydro System does contribute to NSPI's renewable energy portfolio, its contribution is immaterial. The Tusket Hydro System represents just 0.12% of NSPI's overall total energy portfolio, and 0.3% of its renewable energy portfolio [NSUARB RIR-2].

[Exhibit N-9, p. 15]

The Midgard Review Report also stated that the impact of the Tusket Hydro System on NS Power's ability to meet its RES targets is negligible.

[46] With respect to energy from the Tusket system being needed to meet 2020 RES requirements, Midgard noted that an entire year of Tusket Hydro System energy would equate to less than four days of Maritime Link energy. Consequently, Midgard contended that the Tusket Hydro System's impact on achieving the RES is likely immaterial and would certainly be inadequate if the Maritime Link project is delayed beyond April 2020.

[47] Midgard's Review Report also stated that the Tusket Hydro System's annual energy output of 12 GWh would represent an immaterial offset of greenhouse gas-emitting and pollutant-emitting generation (as the Tusket Hydro System represents just

0.3% of its renewable energy portfolio). As such, Midgard asserted that the system's impact on NS Power's compliance with these regulations is immaterial.

[48] The SBA suggested that the need for specific renewable energy output from the Tusket Hydro System is overstated. Specifically, John Athas, on behalf of the SBA, stated that Tusket energy production is not significant in either meeting NS Power's RES legislative obligations in 2020, nor would the decommissioning of the Tusket Hydro System cause NS Power difficulty in providing reliable electric service.

[49] The CA agreed with Mr. Athas and Midgard that, aside from renewable energy generation required in 2020, the generation from the Tusket Hydro System is not significant. The CA also expressed concern that locking into the high-price Tusket energy for decades would be a very expensive way to comply with the RES for a part of 2020.

[50] NS Power disagreed with Midgard's contention that the Tusket Hydro System's renewable energy and dispatchable renewable capacity is immaterial in the context of the Company's capacity and energy portfolios. In its reply submission, NS Power stated:

NS Power Hydro produces on average approximately one terawatt-hour of renewable electricity annually. This is the product of sustained operations of 17 hydro systems. The majority of this production comes from the larger systems (over 15 MW of installed capacity), but the other systems of less than 15 MW of installed capacity produce more than 20 percent of NS Power's annual hydroelectric production. It could be argued that any one of these systems, in isolation, is "immaterial" or does not make a "meaningful" contribution, but collectively these small systems represent more than one fifth of all hydroelectric energy generated in Nova Scotia. As such, and like all of its small hydro facilities with installed capacities of 15 MW or less, NS Power views the Tusket Hydro System as a meaningful renewable generating source, which contributes to the Company's requirement of 40 percent renewable generation by 2020 pursuant to the Nova Scotia Renewable Electricity Standard (RES) and compliance with Nova Scotia *Greenhouse Gas Emissions Regulations* and Nova Scotia *Air Quality Regulations*. The question is not whether the Tusket Hydro System is a 'material' generating source, but whether it provides customer value, which it does.

[Exhibit N-21, p. 47]

[51] In response to Midgard IRs, the Company provided further information related to its hydro systems that provide less than 15 MW each. This information is summarized as follows:

- Twelve systems have an installed capacity of less than 15 MW.
- Of the twelve projects, eight have larger installed capacities than the Tusket Hydro System.
- The average installed capacity of the twelve projects is approximately 6 MW (roughly 2.5 times as large as the Tusket Hydro System).
- The Tusket Hydro System's installed capacity accounts for just 3.3% of the installed capacity of the twelve projects.

i. Findings

[52] The Board understands the value that NS Power's hydro systems provide with respect to renewable energy generation, RES standards and reduction of greenhouse gas emissions. However, the Board agrees with Midgard and the Intervenors, and finds the evidence presented by NS Power does not make a compelling case to suggest that the energy provided by the Tusket Hydro System provides a significant contribution to the Company's hydroelectric production.

[53] Additionally, the Board agrees with Midgard that:

NSPI's line of reasoning disregards the fact that, for the purposes of NSPI's Application, the Tusket Hydro System is being considered in isolation. It is not reasonable to draw equivalence between the capacity of the Tusket Hydro System and the total capacity of a large group of projects of which the Tusket Hydro System capacity actually comprises a very small share (i.e. 3.3%). [Emphasis in original]

[Exhibit N-25, p. 8]

[54] The Board finds, therefore, that the contribution of the Tusket Hydro System to NS Power's overall generation and renewable generation portfolios is minimal. As such, in deciding whether to approve the current Application, the Board assigns little weight to NS Power's claims that the Tusket Hydro System is needed for NS Power to meet RES standards and greenhouse gas emissions targets.

VI IS THE PROJECT COST ECONOMICALLY JUSTIFIED?

[55] Having found that the Tusket Main Dam currently requires corrective measures to preserve public safety, the issue remains what corrective measures need to be undertaken. As the Midgard Review Report Update pointed out, while NS Power's conclusion that action is required in relation to the Tusket Main Dam was supported "... the decision on which 'action' to take (be it repair, replace, or remove) is a separate discussion and conclusion."

[56] In the Application, NS Power indicated refurbishment of the existing Tusket Main Dam was not a viable option. It analyzed three potential replacement and refurbishment options, as well as decommissioning. The economic analysis provided by NS Power indicated that replacing and refurbishing the Tusket Main Dam and replacing the Hurlburt Falls Bridge, as proposed, was less expensive, both in terms of cost and impact on revenue requirement, on a net present value (NPV) basis, than the other options.

[57] The Midgard Review Report expressed reservations related to NS Power's cost estimates and inputs included in the replacement and decommissioning options. NS Power's Reply Evidence did not alleviate some of Midgard's concerns.

a. Cost Estimates - Replacement and Refurbishment Option - Midgard Review and Position of the Parties

[58] Midgard, the SBA and the CA all raised concerns about whether the costs associated with the replacement and refurbishment option had been adequately assessed.

[59] Midgard concluded that NS Power had not considered the full life-cycle costs of operating the entire Tusket Hydro System in its economic analysis used to support the Application. It focused on two issues which it said NS Power had ignored:

- Upgrade costs for the Powerhouse Dam; and,
- Capital expenditures beyond 2023 and operations and management costs.

[60] Midgard also questioned whether the costs associated with replacement of the Hurlburt Falls Bridge should be a ratepayer responsibility.

[61] As well, Midgard raised concerns about the contingency amount used by NS Power in its economic analysis.

i. Powerhouse Dam

[62] The DSR completed by MECO and filed with the Application identified several issues relating to work needed at the Powerhouse Dam. MECO described it as being in poor to fair condition and suggested that the dam does not meet stability criteria due to ice loading.

[63] NS Power stated in its Reply Evidence that it had not incorporated any costs for upgrades for the Powerhouse Dam "...because such upgrades will likely never be required, subject to a change in CDA Guidelines." It went on to say:

...The Tusket Powerhouse Dam meets the requirements of the CDA Guidelines, as the risk associated with sliding conditions under ice loading is not present given NS Power's operating procedures and the Company's knowledge of operating conditions. This is the only identifiable risk that would drive an investment in the Powerhouse Dam. Through NS Power's 88 years of operating experience with the Tusket Hydro System, it knows that ice does not form in the power canal in substantial enough amounts to place a load on the Powerhouse Dam structure. Further, the DSR did not recommend the replacement of the Tusket Powerhouse Dam. Therefore, NS Power did not include a cost estimate for Powerhouse Dam costs in its economic model. This would have been an unnecessary upgrade to the Powerhouse dam and is not indicative of any failure to consider the full life-cycle costs of the Tusket Hydro System.

[Exhibit N-21, pp. 36-37]

[64] Midgard did not accept this explanation, and in its Closing Submission dated May 7, 2018, NS Power maintained its position. The Company said that the Powerhouse Dam would not be replaced except as part of the redevelopment of the Powerhouse itself, and that NS Power has no plans to redevelop it in its "long range capital investment strategy for hydro assets." Further, it said that based on the evidence of Mr. Donnelly, any costs to remediate stability issues at the dam would be minor and thus not impact its economic analysis.

[65] The CA expressed concerns that there were missing costs in the economic analysis, including those related to the Powerhouse Dam. In its Final Submission, NS Power maintained its view that the proposed project "remains the least cost alternative for customers by a significant margin" and costs related to the Powerhouse Dam were properly excluded from its life-cycle analysis, based on its experience in operating the system.

ii. Capital Expenditure Estimates Beyond 2023 and Operations and Maintenance Costs

[66] In its Review Report, Midgard stated:

...full future O&M costs are not being considered; and NSPI is assuming that capital costs beyond 2023 are zero or negligible (i.e.: carrying no allowances for spending such as additional equipment overhauls, upgrades, and/or the ultimate decommissioning costs at asset end of life, all of which would impact NSPI's life-cycle economic modeling).

[Exhibit N-9, p. 30]

[67] In response, NS Power included, in its Reply Evidence, Appendix C. This was a revised Economic Analysis Model (EAM) which it said updated costs by including:

...the most current forecasts for capital projects to be completed on the Tusket Hydro System in the near term, the projected capital maintenance costs for the entire Tusket Hydro System, primarily the hydroelectric turbines and generators, over the next 40 years, and future operating and maintenance expenses for the Tusket Hydro System.

[Exhibit N-21, p. 39]

[68] NS Power went on to say that, even with the inclusion of these additional costs beyond 2023, the refurbishment of the Tusket Dam as proposed remains the "best option for customers."

[69] Because the revised EAM did not include any costs for replacing the Powerhouse or Powerhouse Dam, Midgard expressed little confidence in NS Power's conclusions in its Review Report Update. NS Power's position on this point did not change in its Closing or Final Submissions.

iii. Hurlburt Falls Bridge

[70] The Hurlburt Falls Bridge is located just downstream of the Tusket Main Dam. The bridge is owned and maintained by the Province of Nova Scotia through the Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR). NS Power contends that the existing bridge presents a flow restriction for the 1:1000-year flood event, and must, therefore be addressed. NS Power's proposed solution is to replace the bridge with a new one capable of passing the 1:1000-year flood associated with the Tusket Main Dam. The Company indicated that if the bridge is not replaced with a structure that can pass the 1:1000-year flood, the Tusket Main Dam, embankment

dams, canal dykes, powerhouse dam and structures will have to be further raised to prevent overtopping and potential dam failure during a 1:1000-year flood event.

[71] Both Midgard and Mr. Athas argued that NS Power should pursue potential cost mitigation by investigating whether costs associated with replacement of the Hurlburt Falls Bridge should be the responsibility of the Provincial government, since the bridge is owned by NSTIR. In its February 14, 2018, submission, however, the Province responded as follows:

Evidence filed by Midgard Consulting and by John Athas on behalf of the Small Business Advocate (“SBA”), poses some questions regarding the potential responsibility for “government” to pay for certain costs estimated by NSPI, based on Crown ownership of the Hurlburt Falls Bridge and the assertion of a “broader societal issue better handled by appropriate government agencies”. The Province confirms the evidence given by NSPI, that the Province does not accept responsibility to pay for such costs that may be required to complete this Project.

...

The Province does not “require” replacement of the bridge. It is not a “government” requirement to do so. If replacement of the bridge is authorized by the Board, as requested by NSPI as part of the overall Project for which it seeks cost approval, that is properly a ratepayer (not general taxpayer) cost.

[Exhibit N-18, pp. 6-7]

[72] The SBA also questioned why the costs associated with constructing the new Hurlburt Falls Bridge would be included in NS Power’s rate base even though NS Power would not own the bridge. NS Power responded as follow:

NS Power’s replacement of the bridge is prudent and necessary to safety place the asset in service. NS Power Board-approved Accounting Policy 6100 (Cost) states the following:

03 The cost of a capital asset includes all expenditures necessary to place the asset in service. Therefore, cost not only includes the purchase price, but also other acquisition costs such as brokers' commissions, installation costs, architectural fees, design and engineering fees, legal fees, survey costs, site preparation costs, freight charges, transportation insurance costs, duties, testing, taxes and preparation charges.

As NS Power has determined that rebuilding the dam is the lowest cost option for customers and this work cannot be completed without this expenditure being incurred, this is a prudent investment to be capitalized as part of the Tusket Hydro System asset.

[Exhibit N-6, Response to IR-38, pp. 1-2]

iv. Contingency Amount

[73] NS Power's project cost estimate associated with its Application included a contingency amount of \$772,694. This amounts to five percent (5%) of all estimated project costs, including administrative overhead (AO) and allowance for funds used during construction (AFUDC). In establishing this contingency amount, the Company noted:

The design and construction of a hydroelectric dam presents inherent risks, and the costs associated with completing this proposed scope can be expected to change as the project progresses, leading to higher costs than originally budgeted. However, due to the level of engineering design and project costing already completed on the project, along with the site investigation, First Nations engagement and stakeholder consultation, **a significant number of risks associated with this capital project have already been mitigated, and this is reflected in the lower than usual contingency.** [Emphasis added]

[Exhibit N-1, p. 29]

[74] NS Power's Application also identified the four primary risks associated with the proposed project's design and execution. These included environmental issues, known archaeological sites, First Nations engagement and local community stakeholders. The Company further described the strategies it would employ to reduce the impacts of these risks. In NSUARB IR-15, Board staff questioned NS Power whether it had considered any other construction related risks in developing its contingency cost estimate. In response, NS Power indicated that other construction related risks it considered included:

- Material delivery delays;
- Adverse weather;
- Water management issues;
- Unexpected geological conditions; and
- Archeological finds.

[75] The Company also noted that these risks were not factored into the calculation of its contingency amount based on mitigation efforts it would undertake to address each risk. Some of these risk mitigation measures were described as follows:

Material delivery delays were considered when selecting a vendor to supply the gates and hoists. The vendor has confirmed that it can meet the project construction schedule and the order for the gates and hoists was placed with the vendor with sufficient time for design and manufacturing. The remainder of the materials required to construct the dam are readily available from multiple suppliers within Nova Scotia.

Adverse weather, high river flows, and water management issues have all been considered and the risk minimized in the development of the project schedule....Furthermore, the contractor selected to refurbish the dam is required to develop and implement a site specific water management plan as a part of the contracted scope of work....The additional cost to implement the additional efforts required to implement a water management strategy and span two construction seasons have been included in the project budget.

...The risk associated with unknown geological conditions has been reduced by gathering as much information about the site as possible....**The potential for additional costs as a result of unknown geological conditions has been considered and the five percent contingency is expected to cover any additional costs.**

...The major risk associated with finding an item of archaeological interest is the delay to the project schedule, and the additional expenditure required to complete a more detailed archaeological assessment of the site and any required mitigation efforts. The cost associated with this additional risk is unknown and cannot be established until an item of archaeological interest is discovered. **However, NS Power believes that the five percent contingency is reasonable to cover additional costs.** [Emphasis added]

[Exhibit N-2, Response to IR-15, pp. 2-3]

[76] Midgard asked NS Power to provide a list of all unknown geotechnical, hydrological, environmental or other site-specific project parameters that were identified by the Company as having potential project cost and scope impacts when the project cost estimate was being developed. In addition, Midgard asked NS Power whether its five percent contingency cost estimate is adequate to cover these unknown project parameters should they, in fact, arise. The Company responded as follows:

- (a) The following is a list of the unknown geotechnical, hydrological, environmental or other site-specific project parameters that were identified by NS Power as having potential project cost and scope impacts when the project cost estimate was being developed:
 - Condition of the bedrock downstream of the existing dam;

- Bedrock elevations in the exact locations where the bridge abutments are to be constructed;
 - The total volume of lean concrete required due to the water scouring away the bedrock downstream of the existing dam;
 - Condition of the existing concrete apron downstream of the existing dam to determine the exact location of the new dam;
 - How fish will interact with the existing fish ladder with the construction of the new dam which may require modification to the fish ladder; and
 - Additional requirements from NSE or DFO within the granted permits that had not been discussed during preliminary meetings for monitoring or water management.
- (b) **Based on previous experience with hydroelectric system refurbishments and the stage of the procurement process for labour and materials to execute the project at the time the Application was submitted, NS Power anticipates that the 5 percent contingency allowance incorporated in the project cost estimate is adequate to cover the expected cost impacts should one or more of the unknown conditions identified in part (a) prove to be unfavourable.**

It is not possible to estimate the costs associated with each of the conditions identified in part (a) with complete accuracy to enable incorporation of those costs into the project cost estimate. **Although the exact solutions to mitigate or eliminate the identified risks are unknown, should any become a reality, NS Power believes the 5 percent contingency amount provided within the Application is appropriate.** [Emphasis added]

[Exhibit N-4, Response to IR-4, pp. 2-3]

[77] In response to Midgard's IR-18, NS Power indicated that following the start of construction (which NS Power commenced in advance of any Board approval, and, therefore, at shareholder risk), the Company believed its total cost estimate for the project remained appropriate. However, the Company noted that an unforeseen water migration issue had arisen between the power canal and areas downstream of the main dam. NS Power stated that it believed it could resolve the issue within the project cost estimate and contingency by using stringent procurement practices and continued prudent management.

[78] Midgard's Review Report subsequently indicated there is a high probability that NS Power will overspend while solving the canal water migration issues, given that

there is no project budget explicitly allocated to this work and the small (five percent) contingency allowance. The Report also observed that NS Power may be carrying a contingency allowance that is too small for the proposed option, given the outstanding subsurface, geotechnical, archeological, environmental, and contractual risks. As such, Midgard expressed concern that NS Power's estimated project cost may be materially understated.

[79] In its Reply, NS Power confirmed that it did not incorporate the cost of the water migration issue into its budget as it was not a risk contemplated when the budget and the contingency value for the project were established. The Company also indicated that installing a concrete core wall founded in bedrock would be the best solution to address the issue. Based on its preliminary cost estimates, the Company believed the cost to complete the required scope of work could be managed within the project budget as set out in the Application. In response to the CA's IR-19, NS Power stated the water migration mitigation efforts are expected to cost an amount approximately consistent with the contingency amount. The Midgard Review Report noted that such an approach would leave no contingency for the remaining expected project costs, and that NS Power is moving forward with underestimated costs without updating budgets and/or contingencies.

b. Decommissioning Costs – Midgard Review and Position of the Parties

[80] In the Application, NS Power indicated that if the Tusket Main Dam was decommissioned, the Tusket Powerhouse could no longer generate electricity. Decommissioning would therefore involve dismantling the entire Tusket Hydro System and returning it to its natural state.

[81] In response to NSUARB IR-1(c), NS Power explained its understanding of its obligations if it proceeded to decommission the Tusket Main Dam:

(b) "Natural state" is a term NS Power used in the application to describe what it understands is required upon decommissioning a dam. NS Power defines "natural state" as a natural environment similar to what existed prior to construction of the dam. The CDA Dam Safety Guidelines provide the following:

Prior to decommissioning and closure, the dam owner should prepare a detailed plan for withdrawing the dam from service, indicating measures necessary for site safety. The possibility that any remaining structures might be exposed to loads or combinations of loads not foreseen in the original design or exposed to otherwise unacceptable conditions should be carefully addressed.

Further, NS Power is required to decommission any dam structure after the end of its useful life in accordance with Condition 4(g) of Attachment 1, Tusket Operating Approval, which states:

The Approval Holder shall remove any...dam...used or maintained in and on the watercourse at the end of the useful life of the structure, to the satisfaction of the Minister.¹

NS Power interprets this to mean the dam structure is to be removed in such a manner that allows the watercourse to be restored to a natural state as defined above, to the extent possible. This is the primary objective of a dam decommissioning project, based on industry and NS Power best practice.

[Exhibit N-2, Response to NSUARB IR-1, pp. 1-2]

[82] NS Power retained Hatch to perform an assessment of the removal costs of the hydro structures. This initial cost estimate, without contingencies, was \$12,310,000. The Board notes Hatch's total estimated cost of removal, with contingencies and engineering costs, as set out in Appendix D of the Application, was \$18,290,000.

[83] The decommissioning EAM used by NS Power in the Application only included the removal costs, without contingencies, and an estimate of potential archaeological costs associated with the "surface collection and some mitigation of First Nations archaeological assets." It did not include other environmental remediation costs,

sedimentation costs, or costs associated with any financial compensation for residential and business uses served by the Tusket Hydro System.

[84] Figure 15 of the Application, reproduced below, indicated the EAM, as prepared by NS Power, favoured replacement to decommissioning with surface and some mitigation by a significant margin:

Scenario	Cost*	Revenue Requirement
Rebuild Dam & Replace Bridge	\$17,384,915	\$11,839,950
Surface & Some Mitigation	\$23,348,783	\$22,263,149

[Exhibit N-1, p. 35]

[85] The Application discussed the potential additional costs to decommission could include:

...management and removal of reservoir sediments, re-vegetation measures, new fish passage structures, fish habitat reconstruction, and archaeological protection and recovery measures. It could also include financial compensation to recreational users and financial compensation to residents/businesses surrounding the Tusket Hydro System.

[Exhibit N-1, p. 33]

[86] The Hatch report included with the Application estimated potential costs for environmental assessment and permitting, with post-remedial environmental monitoring, at \$7,500,000. Adding a contingency factor of 50%, because of the uncertainty in determining the extent of environmental obligations, the total estimated environmental costs were \$11,250,000.

[87] In addition, Hatch suggested that the typical cost breakdown, for a decommissioning project, includes 48% of the total cost for sediment management. Hatch set out the extrapolated estimate for this at \$27,260,000.

[88] The Hatch report at Appendix D of the Application suggests a total decommissioning cost estimate of \$56,800,000.

[89] The main concerns with the decommissioning option set out in the Midgard Review Report related to the costs associated with, and the extent of, archaeological mitigation and preservation. In particular, ratepayers' responsibility for these costs was questioned, as opposed to a broader societal cost to be borne by government, and the stakeholders. Midgard suggested the decommissioning costs might therefore be overstated.

[90] The evidence of Mr. Donnelly, who has extensive experience in dam decommissioning, attached as Appendix A to NS Power's Reply Evidence, summarizes his opinions on the costs associated with the decommissioning option, as follows:

...

- The estimated costs for the infrastructure removal required to decommission the Tusket Hydro System were developed by engineering professionals and are appropriate based on a review of precedent.
- The costs for archeological, environmental and cultural-heritage mitigation have not been fully developed. However, while these costs may decrease, or increase, sediment management requirements in many precedent dam decommissioning examples have added costs that, in the case of the Tusket system, could double the current cost estimate.
- Dam safety principles and precedent practice would require mitigation of the impacts of the option that is selected by NSPI.
- There are significant post removal risks associated with any dam decommissioning that have not yet been fully identified and were not recognized in the Midgard Report. Sediment management in particular, typically represents roughly 50% of the overall cost of decommissioning in precedent example projects. This significant cost is not currently included in the NSPI analyses.
- An important issue that Midgard has failed to recognize is the very significant environmental and societal risks that can occur when a dam is decommissioned.

[Exhibit N-21, Appendix A, p. 6]

[91] NS Power submitted the evidence clearly shows the decommissioning option is a substantially less economically attractive alternative than the replacement option.

i. Archeological Mitigation Requirements

[92] In its Application, NS Power observed that “Previous archeological assessments have confirmed the Tusket Hydro System contains registered pre-contact First Nations sites.” This means that if NS Power were to decommission the system, there would be “unknown and potentially costly” steps to be taken. NS Power stated, however, that the proposed replacement and refurbishment would not impact the archeological resources.

[93] The CA and the SBA expressed concerns about the vetting, scope, time and costs associated with archeological mitigation. Midgard did not accept that ratepayers should be solely responsible for these costs and suggested seeking contribution from other sources, calling it a “broader societal issue,” a view shared by the SBA. Further, in its Review Report, Midgard considered the archeological costs associated with decommissioning were overstated; ultimately, it concluded in its Review Report Update that the mitigation measures under this option were reasonable, although it remained uncertain whether ratepayers should remain responsible for the costs. Midgard suggested that NS Power had not explored options for defraying the costs.

[94] The Province, in its submission, accepted no responsibility for costs to complete the project, and specifically stated any costs relating to archeological study and protection of artifacts is a ratepayer cost and not a “...‘societal cost’ to be paid by taxpayers at large.”

[95] NS Power said that under the *Special Places Protection Act*, R.S.N.S. 1989, c. 438 (*SPPA*), it is required to mitigate archeological impacts, and therefore is responsible for the related costs. Noting that the Province made its position clear, NS

Power said that the extent and costs of the work was difficult to estimate, and it had included only costs of some mitigation in its economic analysis. Most importantly, NS Power said, archeological risks and mitigation costs are avoided if the dam is replaced, rather than decommissioned.

[96] With respect to responsibility for the archeological costs associated with preservation of Aboriginal artifacts, NS Power presented the evidence of Sandra Gogal, who has a nationally recognized practice in Aboriginal and Environmental Law.

[97] Ms. Gogal, after a review of principles related to Aboriginal consultation and engagement, offered the following conclusions:

6.5 The works associated with Archeological assessment, surveys, excavation and protection in relation to the decommissioning are, in light of the facts outlined above, reasonable and necessary to ensure that the interests of Mi'kmaq are adequately addressed. In my view, consultation with respect to the Heritage Research Permit and watercourse Alteration Permit will be assessed carefully in light of the potential to damage archeological sites or sites of cultural significance to the Mi'kmaq. Any decommissioning of the Tusket Dam will likely be seen as having significant impacts to the rights asserted by the Mi'kmaq, and consequently the scope of consultation should be deep. While the duty to consult and provincial guidelines do not specify the types of activities or costs which should be incurred by the proponent of a project through its engagement, the facts of this case suggest doing the types of activities proposed by NS Power. Meaningful consultation requires a process whereby the Aboriginal concerns are taken seriously and incorporated where reasonable and appropriate. Having made initial assessments of archaeological potential in the area previous occupied by the Mi'kmaq and now under water, it is likely the Mi'kmaq would expect a level of engagement reflecting a deep level of consultation, one aimed at addressing Mi'kmaq concerns. While consultation is forward looking, reconciliation necessitates looking at history with a view to reconciling trans-generational grievances. As consultation is an ongoing obligation, and a tool to achieve reconciliation, it must be adaptive to new information that comes to light and seek to incorporate measures that may mitigate any on-going infringements.

Based on this, any costs incurred by NS Power in order to meet this obligation, in my view, would be considered reasonable in these circumstances. Moreover, costs associated with archeological assessments, studies, site remediation, enhancement or replacement and costs for compensation and Agreements with Aboriginal communities are typically included within the capital costs of any capital works project submitted by other utilities and I am unaware of any circumstances where they have been excluded.

[Exhibit N-21, Appendix B, pp. 17-18]

[98] With the benefit of NS Power's Reply Evidence, and the opinion of Ms. Gogal, Midgard continued to have concerns about ratepayer responsibility:

In general, Midgard believes that the archaeological mitigation measures being proposed in the case of Decommissioning Option are reasonable and per industry practice. However, Midgard feels that NSPI has not completely supported the claim that all costs associated with a potential decommissioning of Lake Vaughn are the sole responsibility of NSPI ratepayers. [Emphasis in original]

[Exhibit N-25, p.15]

ii. Social Benefits

[99] NS Power stated that it had consulted with several stakeholder groups as well as local residents in the Lake Vaughan area regarding its plans to rebuild the dam. It had responded to concerns about the water levels in the Lake, water quality, the gaspereau fishery, and the Hurlburt Falls Bridge.

[100] Midgard noted that NS Power had identified a “societal cost” associated with decommissioning, including changes to recreational uses which might result in public opposition. It said that NS Power had not looked to local authorities or government agencies which might take over the “operation of the control dams on behalf of the public, given the societal benefits”, other than generating electricity. Midgard did not accept that NS Power should be responsible for the costs of maintaining lake levels for “non-utility purposes.”

[101] In its Review Report Update, Midgard continued to question why ratepayers should “pay for the costs of maintaining Lake Vaughan in perpetuity” and said:

NSPI's reasoning indicates that the Tusket Hydro System has ceased to primarily function as a power production facility and has instead become a recreational/commercial water management and archeological artifact preservation system that can incidentally generate a small quantity of expensive power.

[Exhibit N-25, p. 6]

[102] In its conclusions, however, Midgard said:

Midgard now views NSPI's argument as justifiable in that it is socially beneficial to maintain Lake Vaughn at its current elevation.

However, as discussed further in Section 4, Midgard considers the issue of maintaining Lake Vaughn at its current elevation to be separate from the question of whether or not the Tusket Hydro System's generation capabilities should be maintained.

[Exhibit N-25, p. 20]

[103] NS Power maintained that the replacement and refurbishment of the Tusket Main Dam, which it claims to be the lowest cost option for customers, will avoid societal costs. It stated in its Final Submission that the impacts to local residents and stakeholders are related to decommissioning and had not been quantified. These impacts were not included in the EAMs filed in support of the Application.

c. Project Alternatives – Midgard Review and Position of the Parties

[104] As previously discussed, in addition to a full decommissioning option, NS Power discussed three potential replacement scenarios in the Application:

- The chosen option of rebuilding and refurbishing the Tusket Main Dam and replacing the Hurlburt Falls Bridge so that both meet a 1:1000-year IDF standard;
- Rebuilding the Tusket Main Dam and retaining the existing Hurlburt Falls Bridge, thus accepting the associated risk in the event of a 1:1000-year flood event; and
- Rebuilding the Tusket Main Dam and constructing a low-level sluice.

[105] Midgard was originally concerned that NS Power had not rigorously investigated other plausible cost-effective alternatives to the proposed option, such as:

- Continuing to operate the upstream control dams, while decommissioning the remainder of the Tusket Hydro System facilities; and
- Approaching external government agencies regarding potential divestment of dam assets.

[106] In response to the alternative suggested in the Midgard Review Report, NS Power's Reply Evidence stated:

Such a scenario involves maintaining upstream hydraulic structures for an undetermined amount of time, at customers' expense, while forever foregoing the opportunity to generate power. This differs significantly from a hydro site stabilization, where the option to redevelop generation or eventually decommission, are left available for the customers' benefit in the future. If the Main Dam were to be decommissioned with continuing operating of the upstream control dams, not only would NS Power lose the opportunity to generate power, but the customer would be exposed to the same risk as those faced with a full decommissioning, such a significant environmental, legal, archaeological, and ecological risks, which are quantified and discussed later in this document. In addition, such an option passes costs to future generations that did not receive the benefit of renewable electricity generation from the site.

[Exhibit N-21, p. 22]

[107] In addition, in its May 7, 2018 submission, NS Power stated:

Although partial decommissioning would not have been considered for the above reasons, NS Power prepared an EAM to evaluate the economics of operating the upstream dams while decommissioning the remainder of the Tusket Hydro System, as recommended by Midgard and the CA. A copy of the EAM showing the costs associated with a partial decommissioning option is included in Appendix C of NS Power's Reply, which is an updated version of Application Appendix A-5, Decommissioning Economic Analysis Model. The EAM confirms that, after further analyzing both the partial and full decommissioning options, rebuilding the Main Dam continues to be the best choice for customers by a large margin, even without inclusion of potential additional costs that remain unquantified (e.g. fish habitat reconstruction or compensation measures, hazardous material abatement, and any other compensation NS Power may be required to provide at law). Quantification of such additional amounts in NS Power modeling would make the case for refurbishing the Main Dam even stronger. Figure 1 summarizes the results of the EAM provided in Appendix C, of NS Power's Reply.

[NS Power Submission, May 7, 2018, p. 7]

[108] The Midgard Review Report Update made it clear that Midgard had not been retained to present and model the cost of various potential alternatives on behalf of NS Power, but to review NS Power's proposal.

[109] Midgard further elaborated on its suggested alternative, which would involve:

...decommissioning the Tusket Powerhouse, reconfiguring the Tusket Main Dam and Tusket Powerhouse Dam as less expensive fixed overflow dams (with a lower Lake Vaughan surface level to increase the flood routing abilities of the fixed overflow dams), continued operation of the upstream dams, and purchase of offsetting electricity from other sources.

[Exhibit N-25, pp. 16-17]

[110] Midgard suggested potential upsides of this suggested option:

- Decommissioning costs and archeological mitigation costs would be completely avoided for upstream dams.

- Archeological mitigation work for the incrementally exposed shoreline of Lake Vaughn would be required, but at a fraction of the costs involved in lowering Lake Vaughan to its natural level.
- Sediment management costs and associated environmental engineering and monitoring costs would be largely avoided.
- Costs to remove the Hurlburt Falls Bridge may be avoided by making use of additional flood routing via the power canal.

[Exhibit N-25, p.17]

[111] Midgard continued to call into question the thoroughness of NS Power's evaluation of potentially viable alternatives.

[112] Responding to the further details with respect to an alternative set out in Midgard's Review Report Update, NS Power made the following submission:

This suggested alternative was not expanded upon until the Midgard Updated Review and the alternative described in their Updated Review is different from the footnoted alternative in the Midgard Report. The Updated Review suggests lowering Lake Vaughan, while the Midgard Report states that Lake Vaughan be maintained near current elevations. This alternative in the Midgard Report was not considered by NS Power because if the elevation of the lake is maintained "near its current elevation", as suggested by Midgard, it has the same hydraulic conditions as NS Power's submitted replacement option, but without the economic benefit of generation (i.e. the overflow weir would still have to pass the 1:1000 year IDF and meet CDA freeboard requirements). As outlined in NS Power's response to Midgard IR-37, a free overflow spillway was eliminated from further consideration as it requires more crest length than is available.

If the lake were permanently lowered, as suggested in the Midgard Updated Review, and if the required length could be made available, this would not be a "seemingly viable option." Richard Donnelly, in the Donnelly Evidence, stated that in his experience, "...attempts to undertake such significant interventions to rehabilitate an ageing and deteriorating dam behind what would be a significant cofferdam would never be a preferred solution." The alternative solution now argued by Midgard in the Midgard Updated Review would require an even more substantial concrete structure with associated energy dissipation provisions to be constructed downstream of the existing dam; such a structure would very likely be as expensive, or more expensive than the optimized engineered solution that has already been developed by NS Power. Permanently lowering the head pond would also result in impacts to aquatic habitat and the need for riverbank stabilization and other environmental remediation requirements. Added to these costs would be the decommissioning costs for the Tuskett Powerhouse.

[NS Power Submission, May 7, 2018, pp. 8-9]

d. Discussion and Findings

i. Alternative Options

[113] The Board notes that refurbishing, without replacing, the existing Tusket Main Dam does not appear to be a viable option, primarily due to the costs associated with installing a coffer dam to substantially lower the water level in Lake Vaughan. This option would also increase environmental risks, water management risks, and archeological risks.

[114] Based on NS Power's Reply Evidence, it appears various alternatives were considered and rejected based on other technical or cost issues, prior to formulating the options indicated in the Application.

[115] Leaving aside the issue of decommissioning, of the three options to replace and refurbish the Tusket Main Dam discussed by NS Power in the Application, the Board is satisfied NS Power's proposal to replace the Tusket Main Dam and the Hurlburt Falls Bridge, with the refurbishment of associated structures, is the preferable economic option. The Board findings in relation to replacing the Hurlburt Falls Bridge are discussed in more detail elsewhere in this Decision.

[116] The Board has also considered the partial decommissioning scenarios discussed in the evidence. While Midgard correctly pointed out it was retained to review the Application, and not to devise and perform an economic analysis of all possible alternatives, the Board finds it helpful that alternative scenarios were raised, as the Board had concerns that the option proposed by NS Power had not been tested to any great degree in relation to other potential solutions.

[117] While the Board understands Midgard's lingering concerns as to whether NS Power has rigorously investigated all viable scenarios, based on the evidence before it, the Board is satisfied, on a balance of probabilities, that partial decommissioning scenarios do not present alternatives that would be demonstrably less costly than NS Power's proposed option, and would run a substantial risk of becoming considerably more costly. There are also technical reasons, described by Mr. Donnelly, as to why the partial decommissioning options are not necessarily desirable.

ii. The Replacement/Refurbishment Option

[118] With respect to the option proposed by NS Power, the Board agrees with Midgard, and the Intervenors, that when comparing replacement with decommissioning, full life-cycle costs, for the hydro system under consideration, are important in the analysis.

[119] As is evident from the filings in this Application, key difficulties with incorporating full life-cycle costs in an EAM, associated with replacing and refurbishing a major asset, relate to: planning horizons; the time period an EAM can reasonably address; and, the level of confidence in cost estimates for future expenditures in relation to an asset with the long useful life of a dam, when compared with a current project which has reached a detailed engineering stage.

[120] Despite these difficulties, the Board finds full life-cycle costs beyond 2023 should be considered when comparing NS Power's proposed option to the decommissioning and partial decommissioning options. This said, the Board understands the Tusket Main Dam itself will be replaced, thus becoming a new asset, where major capital expenditures may not be required in the foreseeable future.

[121] In response to Midgard's concerns, NS Power incorporated additional capital, sustaining capital and OEM expenditures in the EAM at Appendix C to its Reply Evidence. No capital expenditures were included in relation to the Tusket Powerhouse Dam.

[122] While NS Power says the Tusket Powerhouse Dam was properly excluded because it is not considering investment in this dam in its current long-term capital plan, the Board is of the view there is a reasonable prospect some work will be needed for safety purposes at some point. This said, based on the evidence, it appears the work required for safety purposes is not as extensive as the complete replacement of the Tusket Main Dam. As well, any such expenditures are not planned in the foreseeable future. The Board is mindful that because of the time-value of money, the later in time an expenditure occurs, the less impact it has on a Net Present Value (NPV) calculation.

[123] The Board is not persuaded that NS Power's assessment of the concerns related to the Powerhouse Dam is wholly appropriate. The Board acknowledges that NS Power has had many years of experience in operating the entire system. It is reluctant to discount that experience; however, MECO identified several areas where upgrades would be needed. The Board has, however, no evidence of the costs associated with these upgrades, and no evidence fully evaluating the risk.

[124] The Board agrees that NS Power did not sufficiently consider the full life-cycle costs when it filed the Application for this Project. However, the Board is satisfied that a fuller analysis has resulted, due to the review by Midgard, and the comments of Intervenors.

[125] While the Board is concerned with NS Power's original approach in preparing the EAM, the Board is satisfied the costs which can reasonably be identified were included in the revised EAM, except for the Tusket Powerhouse Dam. In the Board's view, given the potential magnitude of the decommissioning expenses, and the expected timing of Tusket Powerhouse Dam expenditures, the determination of this matter does not turn on whether or not Tusket Powerhouse Dam expenditures are included in the EAM.

[126] The Board observes that capital costs and operating and maintenance costs beyond 2023 were only included by NS Power in its economic analysis as a result of Midgard's comments. The Board notes that NS Power said that the revised EAM demonstrates that the project remains the best option for customers. That is what the numbers show.

[127] Like Midgard and the Intervenors, the Board has expressed concerns in the past, with respect to cost overruns relating to hydro assets. This said, the Board must assess such requests on the evidence before it. There can be many reasons why original cost estimates vary from actual expenditures. In this case, the Board has firm estimates for the majority of the costs associated with the replacement and refurbishment option. It is satisfied they form a reasonable basis for assessing the Application.

iii. Decommissioning Option

[128] With respect to decommissioning costs, the Board is satisfied the estimated cost of removal prepared by Hatch is reasonable, based on current knowledge.

[129] The area of greatest uncertainty relates to archaeological and environmental costs. As these costs cannot be known with the same degree of accuracy

as the costs outlined in the replacement option, NS Power is left to rely on the expertise of the consultants retained to make these estimates. This expertise is based on the experience of these consultants; on precedent; and, on subject matter literature.

[130] The requirements for environmental remediation, including sediment management, have not been established with any degree of certainty. Given the requirements of NS Power's operating permit, and applicable environmental legislation, it is apparent the Province of Nova Scotia, and probably the Federal Government, would play a significant role in determining what mitigation measures could be required if the Tusket Hydro System is decommissioned.

[131] The evidence of Mr. Donnelly is compelling. It suggests that there is a real likelihood that sedimentation management, and other means of environmental remediation, will be required. Expensive sampling processes, and input from responsible government departments (which may be difficult to obtain without a detailed project proposal) would be required to obtain cost estimates with a higher confidence level.

[132] The Board accepts that there are archeological resources in the area of the Tusket Hydro System. It considers that NS Power is bound by the *SPPA* to take measures to protect them. Such measures would also be required in order to meet proponent engagement and Crown consultation obligations. The extent of the archaeological resources cannot be completely determined without dewatering the reservoirs. The Board agrees that NS Power has not overestimated the costs associated with archeological mitigation, should it proceed to decommission the system. The Board observes that Midgard ultimately agreed on this point, even though it suggested some other sources might contribute to the cost.

[133] The Crown consultation and engagement process endorsed by the Board in relation to the replacement option contemplates that NS Power is responsible for the archaeological costs, which admittedly are substantially lower, and a different kind in many respects, than those estimated for the decommissioning option.

[134] There is an element of speculation as to what a consultation between the Province and the Mi'kmaq of Nova Scotia, including any delegated responsibility to NS Power, would ultimately determine as to responsibilities for cost in the decommissioning scenario. Precedent and the current state of the law, as discussed by Ms. Gogal, would indicate the likely outcome would be that NS Power would be liable for such costs.

[135] The Board accepts NS Power's assertion that the social costs related to a change in the level of Lake Vaughan are not quantified and observes it would be difficult to do so.

[136] In the view of the Board, NS Power is aware that there are social benefits to maintaining Lake Vaughan's level or elevation, although the Board does not consider this to be sufficient reason alone to refurbish or replace the dam. As NS Power has not included any societal costs, other than those associated with archaeology, in its economic analysis, it is not necessary to consider this issue further.

[137] On a balance of probabilities, the Board finds the decommissioning EAM, proposed by NS Power, with the assistance of expertise from Hatch (in particular Mr. Donnelly, in relation to dam engineering) and Davis MacIntyre & Associates with respect to archaeology, reasonably captures the potential financial exposure to NS Power, and its ratepayers, if the decommissioning option proceeds.

iv. Results of Economic Analysis

[138] The results of the new EAM attached as Appendix C to NS Power's Reply Evidence indicates the following:

Figure 5. Summary of Project Alternatives

	Alternative	PV of Revenue Requirement	Rank
A	Refurbish Main Dam	17,042,259	1
B	System Partial Decommissioning	28,260,981	2
C	System Full Decommissioning	55,176,532	3

[Exhibit N-21, p. 40]

[139] While not entirely convinced that the cost differences would be as large as suggested by NS Power, given the magnitude of the potential decommissioning costs, and the potential they could be understated, from an economic analysis perspective, in the particular circumstances of this Application, NS Power has satisfied the Board that replacement of the Tusket Main Dam, as proposed, is justified.

v. Hurlburt Falls Bridge

[140] NS Power's Application argued that replacement of the Tusket Main Dam and the Hurlburt Falls Bridge is the best option for customers, as it offers the lowest present value of revenue requirements. Given that the Board has approved the use of the 1:1000-year IDF for the Tusket Main Dam, the Board also approves the same IDF for the new bridge.

[141] Replacement of the Hurlburt Falls Bridge has not been proposed by NSTIR, nor is it required by NSTIR. Instead, the need to replace the bridge is driven by the design requirements of the Tusket Main Dam replacement project, as proposed by NS Power. As such, the Province has argued that the capital cost for the bridge replacement is not

the responsibility of the Province, and rests with NS Power ratepayers. The Board agrees and finds that NS Power is entitled to its return of capital associated with the Hurlburt Falls Bridge replacement.

[142] However, the Hurlburt Falls Bridge is owned by NSTIR, not NS Power. The replacement bridge will also be maintained by NSTIR. Generally speaking, an asset should be owned by NS Power to be included in rate base. But as NS Power correctly indicated in its response to the SBA IR-38, the accounting policy on cost does allow some costs required to complete a project as a cost of the investment that can be capitalized.

[143] It is not immediately clear whether the costs related to the Hurlburt Falls Bridge meets the tests as set out in the accounting policy and the *Act*. As such, the Board invites submissions from the parties on whether the cost to replace the Hurlburt Falls Bridge should be included in NS Power's rate base. These submissions are to be provided to the Board by February 26, 2019.

vi. Contingency

[144] NS Power has expressed confidence that the project contingency amount identified in its Application is adequate. However, Midgard has expressed concern that given the potential risks associated with the project, the contingency amount is understated. The Board is concerned that NS Power is heavily reliant on the contingency to cover the water migration issue. In fact, it would appear that the cost to address the water migration issue has already consumed the Application's contingency amount. Even NS Power's own expert, Mr. Donnelly, suggested the issue could be mitigated through an increase in contingency. But yet, NS Power has remained firm that its identified contingency amount is appropriate.

[145] As is usual for NS Power capital approval requests, this project will be subject to the Board approved Capital Expenditure Justification Criteria (CEJC). Under the CEJC, the Board will review final project costs. In this particular matter, despite the water migration issue, NS Power has not requested an increase in the project cost for which it is seeking Board approval.

[146] However, the Board is concerned, and even skeptical, that the contingency amount used by NS Power in the Application is adequate. As such, the Board believes there is appreciable risk of project cost overruns. The Board is also concerned that the use of this seemingly low contingency amount in the Application may distort the results of the economic analysis in favor of the proposed project.

[147] Given these concerns, the expenditure of funds beyond the Application's identified contingency, will be closely scrutinized by the Board. As always, the Board expects that all costs will be well documented and justified to the Board's satisfaction. Therefore, the Board directs NS Power to provide the Board with quarterly reporting, commencing on March 31, 2019, on the use of any contingency funds. Such reporting is to include:

- detailed accounting identifying costs associated with each item spent under the contingency;
- a detailed explanation describing the reason for requiring each item; and
- a detailed explanation describing why such costs could not have been included in the Application.

e. NS Power's Asset Management Practices

[148] Midgard stated in its Review Report that "NSPI has not applied modern asset management practices in its operation and management of the Tusket Hydro System." It said that:

Effective asset management, in the utility context, balances capital expenditures (i.e.: rate base additions) with operations and maintenance program costs (i.e.: annually expensed activities) to achieve acceptable long-term system performance at the lowest cost to ratepayers.

[Exhibit N-9, p. 26]

[149] Midgard opined that NS Power should have examined decommissioning of the system before 2009 and had not looked at refurbishing on an overall basis. Thus, life-cycle costs, which are discussed elsewhere in this Decision, were not properly considered. Further, it said that NS Power had not taken future capital costs into account. It described NS Power's asset management practices generally as *ad hoc*, noting a history of underestimating costs for the Tusket system, as well as other projects; a history of cost overruns; the provision of insufficient information on projects; and reactive management practices.

[150] The Industrial Group noted the comments made by Midgard and said:

It is of significant concern to the Industrial Group to hear that imprudent ad hoc asset management practices will result in significant depreciation expense, in addition to other costs. The question is who should bear the burden of those costs.

The issue of a comprehensive approach to hydro management is not new.

...

The Industrial Group respectfully submits that the Board should carefully consider whether it is fair and just for ratepayers to entirely shoulder the burden of what Midgard describes as imprudent ad hoc asset management practices and their associated costs. The Industrial Group believes it is not.

[Exhibit N-17, pp. 2-3]

[151] NS Power took exception to Midgard's characterization of its project cost estimates and controls, noting it follows the CEJC processes, with relatively few projects

resulting in applications for approval of overspending. Further, it described its asset management practices, noting it considers “foreseeable capital expenditures for a 10-year timeline.”

[152] Midgard noted in its Review Report Update that, despite explanations offered by NS Power, it “remains uncomfortable with NSPI’s approach to project cost estimation.”

[153] In its Closing Submission, NS Power said that Midgard had apparently misunderstood NS Power’s processes in cost estimation. It also disagreed with the Midgard and Industrial Group suggestion that it engages in *ad hoc* asset management practices.

[154] The Board has, on several occasions, expressed concerns about the reliability of cost estimates used by NS Power in capital project approval applications. As far as consideration of decommissioning the Tusket Hydro System is concerned, this option has been discussed elsewhere in this Decision. The Board is reluctant to take a hindsight approach and conclude that this option should have been considered in the past.

[155] The Board considers that NS Power generally follows the CEJC processes, which have been the subject of recent review by the Board. While the Board is not prepared to make a finding that NS Power’s practices with respect to this hydro system are deficient, the Board notes the assurances provided by NS Power in this Application. The Board considers that improvement in scoping and cost estimation for projects can always occur. NS Power is encouraged to ensure that it does.

VII CONCLUSION

[156] While the Board has expressed some concerns about the Application, the Board has determined, on a balance of probabilities, that NS Power's proposal to rebuild the Tusket Main Dam; refurbish associated structures; and, replace the Hurlburt Falls Bridge, is both necessary and economically justified.

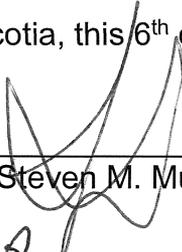
[157] In the circumstances, the Board approves capital work order CI#29807 for NS Power's Tusket Main Dam Refurbishment Project in the amount of \$18,157,609, in accordance with section 35 of the *Act*, subject to the following:

- NS Power is to provide the Board with quarterly reporting, commencing on March 31, 2019, on the use of any contingency amounts, in accordance with Paragraph [147] of this Decision; and
- The Board will entertain submissions on whether the expenditures associated with the replacement of the Hurlburt Falls Bridge should be included in NS Power's rate base. Submissions are due on or before February 26, 2019.

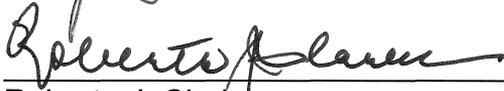
[158] The Board will make a final determination on the issue of the inclusion of costs related to replacing the Hurlburt Falls Bridge in rate base following the receipt of submissions.

[159] An Order will issue accordingly.

DATED at Halifax, Nova Scotia, this 6th day of February 2019.



Steven M. Murphy



Roberta J. Clarke



Richard J. Melanson