Matter No. M10197

In the Matter of an Application by Nova Scotia Power Incorporated for Authorization to Overspend, in the amount of $18,668,510 for Capital Work Order Cl#29807 for its Tusket Main Dam Refurbishment project, for a total project cost of $36,826,119 Authorization to Overspend, in the amount of $18,668,510 for Capital Work Order Cl#29807 for its Tusket Main Dam Refurbishment project, for a total project cost of $36,826,119

EVIDENCE OF

JOHN D. WILSON

ON BEHALF OF

THE CONSUMER ADVOCATE

Resource Insight, Inc.

NOVEMBER 12, 2021

TABLE OF CONTENTS

TABLE OF ATTACHMENTS

I. Identification & Qualifications

Q: Mr. Wilson, please state your name, occupation, and business address.

A: I am John D. Wilson. I am the research director of Resource Insight, Inc., 10 Court St., Arlington, Massachusetts.

Q: Summarize your professional education and experience.

A: I received a BA degree from Rice University in 1990, with majors in physics and history, and an MPP degree from the Harvard Kennedy School of Government with an emphasis in energy and environmental policy, and economic and analytic methods.

I was deputy director of regulatory policy at the Southern Alliance for Clean Energy for more than twelve years, where I was the senior staff member responsible for SACE's utility regulatory research and advocacy, as well as energy resource analysis. I engaged with southeastern utilities through regulatory proceedings, formal workgroups, informal consultations, and research-driven advocacy.

My work has considered, among other things, the cost-effectiveness of prospective new electric generation plants and transmission lines, retrospective review of generation-planning decisions, conservation program design, ratemaking and cost recovery for utility efficiency programs, allocation of costs of service between rate classes and jurisdictions, design of retail rates, and performance-based ratemaking for electric utilities.

My professional qualifications are further summarized in Exhibit RII-1.

Q: Have you testified previously in utility proceedings?

A: Yes. I have testified more than thirty times before utility regulators in California, Colorado, Nova Scotia and the Southeast U.S., and appeared numerous additional times before various regulatory and legislative bodies.

Q: Have you previously testified in other proceedings before this Board?

A: Yes. I have filed testimony in nine matters. I have also assisted the Consumer Advocate in preparing comments and developing positions in numerous proceedings and stakeholder processes.

Q: On whose behalf are you testifying?

A: My testimony is sponsored by the Nova Scotia Consumer Advocate.

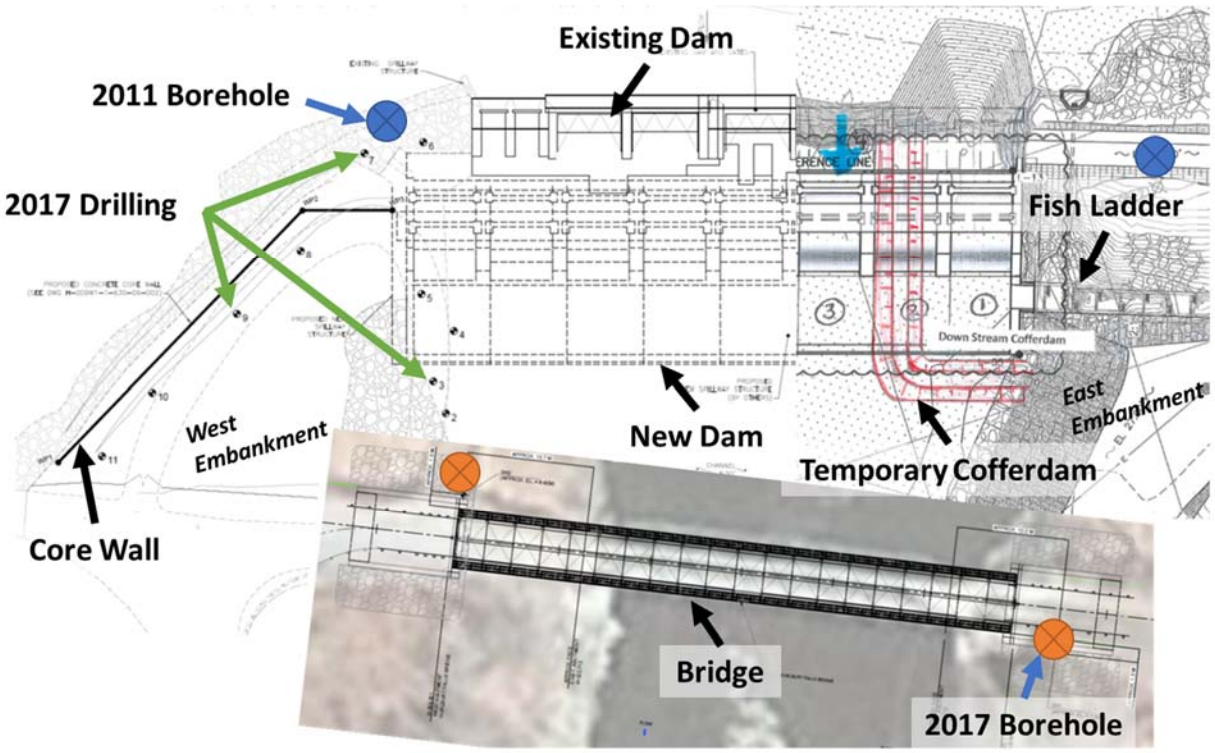
II. Introduction

A. Overview of Tusket ATO Application

Q: Please summarize NS Power's application.

A: Nova Scotia Power is requesting Board approval of an Authorization to Overspend in the amount of $18,668,510 for the Tusket Main Dam Refurbishment Project (M08162). The Tusket project involves building a replacement dam downstream of the existing dam. Progress to date includes construction of the core wall to reduce water infiltration during construction, construction of Bay 8 (next to the west embankment), and replacement of the Hurlburt Falls Bridge, as illustrated in Figure 1.

Figure 1: Composite Illustration of Tusket Project



Sources: Exhibit N-7, NS Power responses to Midgard IR-2, Attachment 1 and IR-8, Attachment 4, p. 26; Exhibit N-8, NS Power responses to NSUARB IR-3, Attachment 1, p. 3, and IR-11, Attachment 3.

The Board approved the original project budget of $18,157,609 on February 6, 2019. In its ATO Application, NS Power identified four primary drivers of the 103% overspend:

- Water infiltration related issues,
- Extended construction timeline,
- Environmental permitting requirements, and
- Archaeology and Mi'kmaw engagement.

The risk of overspending had become apparent during the original project approval proceeding. In its February 2019 approval, the Board expressed its belief that there was an "appreciable risk of project cost overruns."[1]

The Board's belief was manifest in less than eleven months: In its January 2020 response to NS Power's Contingency Report 4, the Board recognized that contingency spending had exceeded the threshold amount for an ATO submission, and asked, "when does NS Power intend to submit an ATO to the Board for approval?"[2] In its April 27, 2020 report, NS Power acknowledged that an ATO would be required.[3] In response, the Board stated, "The Board need not remind NS Power that approval of an ATO is not a foregone conclusion, and of the financial risks involved unless and until such approval is granted."[4]

Q: Please summarize the original budget, spend-to-date, and proposed budget.

A: InTable 1 , I have summarized the original approved estimate from the Board's decision in Matter No. M08162, three estimates of the spend-to-date, and the total budget proposed in this ATO.

[1] NSUARB, Board Decision, M08162 (February 6, 2019), para. 146.

[2] Exhibit N-3, NSUARB Letter of January 15, 2020 to NS Power, p. 2.

[3] Exhibit N-3, NS Power Letter of April 27, 2020 to NSUARB, p. 2.

[4] Exhibit N-3, NSUARB Letter of April 30, 2020 to NS Power, p. 2.

Table 1: Original Budget, Spend-to-Date, and Proposed Budget

Account	UARB Approved	Spent-to-Date 2021 Q2			Total Request (Appendix C)
		Quarterly Reports	ATO Budget	CA IR-1	
Regular Labour	$ 431,410	$ 683,327	$ 648,504	$ 545,446	**$ 1,450,383**
Overtime Labour	$ 181	$ 22,316	$ 22,317	$ 24,652	**$ 22,316**
Term Labour	$ 1,301	$ 25,985	$ 25,984	$ 24,620	**$ 31,785**
Term Labour - Overtime		$ 8,528	$ 8,528	$ 8,115	**$ 8,528**
Travel Expense	$ 46,576	$ 37,032	$ 36,915	$ 21,672	**$ 123,915**
Materials	$ 7,160,707	$ 3,937,523	$ 3,707,730	$ 3,776,610	**$ 9,109,850**
Contracts	$ 6,277,910	$ 5,030,803	$ 4,958,512	$ 4,804,639	**$ 13,043,868**
Consulting	$ 1,514,804	$ 1,999,282	$ 1,794,819	$ 1,039,618	**$ 4,530,172**
External Legal & Audit	$ 9,161	$ 23,598	$ 33,850	$ 25,049	**$ 37,486**
Meals and Entertainment	$ 11,706	$ 13,217	$ 13,196	$ 10,138	**$ 45,546**
Rental/Main of Equipment		$ 73,467	$ 71,044	$ 82,403	**$ 127,915**
Other Goods and Services	$ 121	$ 1,926	$ 1,926	$ 1,807	**$ 1,926**
Admin Overheads (AO)	$ 883,714	$ 860,739	$ 860,739[a]	$ 812,650	**$ 622,929**
Contractor (AO)					**$ 1,382,057**
AFUDC Interest	$ 1,047,324	$ 1,200,588	$ 1,200,588[a]	$ 1,004,053	**$ 3,066,609**
First Nation Commitments				$ 769,612[b]	
Contingency	$ 772,694				**$ 3,220,834**
Pre-2017 Q3 Spend Estimate				$ 248,991[c]	
Total	**$ 18,157,609**	**$ 13,918,332**	**$ 13,384,652**	**$ 13,200,073**	**$ 36,826,119**

Sources: Exhibit N-3, NS Power quarterly contingency reports; Exhibit N-7, NS Power response to Midgard IR-12, Attachment 1; Exhibit N-1, Appendix C; and Exhibit N-4, NS Power responses to CA IR-1, Attachment 4, original and refiled.

(a) ATO Budget (Exhibit N-1, Appendix C) does not break out AO or AFUDC by spent-to-date. Values are obtained from Midgard IR-12, Attachment 1.

(b) First Nation Commitments are only broken out in CA IR-1, Attachment 4. It is not clear which accounts these values are related to.

(c) The pre-2017 Q3 spend estimate is based on comparing the 2019 Q1 Quarterly Compliance Report (Exhibit N-3) Spent-t0-Date value with the CA IR-1, Attachment 4 (original) values for 2017 Q3 to 2019 Q4 values.

The reason I am presenting three estimates of the spend-to-date is that the three cited sources of accounting data differ somewhat in both the total amount spent and the manner in which the data are allocated across accounts. In Section VI.C, I will discuss potential disallowance amounts. Because none of the three spend-to-date sources includes all the necessary detail for purposes of those calculations, I have combined the three spend-to-date sources—resulting in a fourth estimate of total spend-to-date. These estimates are fairly close to one another, but I am not certain which should be considered authoritative.

B. Standard of Review for ATO Applications

Q: What are the issues in this proceeding?

A: I am advised by counsel that in this Application, the burden of proof remains with the Applicant (NS Power) to satisfy the Board on a balance of probabilities that the relief sought in the Application (i.e., authority to overspend) should be granted.[5] To meet this burden, NS Power must demonstrate that the costs for which it seeks authorization to overspend are reasonable and prudent.[6]

In its decision on the Tufts Cove 6 Waste Heat Recovery Project ATO ("TUC6 ATO"), the Board noted that review of an authorization to overspend would be conducted in accordance with its responsibility pursuant to s. 35 of the Public Utilities Act, and the ATO would be carefully scrutinized to ensure the project "continues to be economically justifiable and in the best interest of ratepayers."[7] Based on this approach, the Board determined that the issue to be decided in the ATO review was:

> ... whether the Project continues to be **economically justified** and in the **best interest of ratepayers** and, in addition, whether NSPI has **managed the Project** to the **lowest reasonable cost** to customers.[8]

My testimony will follow these criteria.

C. Recommendations

Q: What are your recommendations to the Board?

A: I have identified two issues that I believe the Board should make its focus: Whether the project should proceed as proposed by NS Power, and whether NS Power should be authorized to receive approval of the ATO in full or in part. While the evidence suggests that NS Power's revised project should proceed as proposed, I do not believe that NS Power has justified full cost recovery for the proposed ATO.

The appropriate level of cost recovery hinges on the prudence of NS Power's planning process, particularly its reliance on limited geotechnical investigation data and historical experience at other sites. I recommend that the Board ensure that it obtains independent

[5] Nova Scotia Power Inc. (Re), 2012 NSUARB 133, at paras 32 & 36.

[6] Nova Scotia Power Incorporated (Re), 2021 NSUARB 126 at para 26.

[7] Nova Scotia Power Incorporated (Re), 2010 NSUARB 220, at para 6.

[8] *Id.* at para 67. Emphasis in the original.

geologic expertise to inform its review of the quality and sufficiency of the information NS Power relied upon when developing its original project design and construction plan.

With respect to approval of the ATO, the Board should reach two determinations. First, the Board should determine whether the original geotechnical studies were adequate, or whether NS Power or its consultant failed to conduct those studies to professional standards. If the Board determines that NS Power imprudently developed the Tusket project budget, design and construction plan based on incorrect assumptions about the condition of the embankment and bedrock, then the Board should disallow the resulting unreasonable costs. I recommend several standards that the Board may wish to apply in identifying the costs that should be disallowed. I estimate that applying those standards will result in disallowing $6.4 million, or 47%, of the spend-to-date as well as some costs incurred beginning in July 2021.

Second, if the Board believes that NS Power's original project design and construction plan was prudently developed, the Board should determine whether NS Power should have stopped construction in order to conduct new geotechnical studies after the first unexpected fissures were found. My testimony will discuss the consequences on the costs of the decision to attempt a series of "on the fly" fixes to resolve the water infiltration problems. This finding would result in a smaller disallowance than the first finding, and I have not attempted to calculate an estimate.

If the Board is satisfied that the original geotechnical studies were directed and conducted in an appropriate manner, and that the decision to attempt a series of "on the fly" fixes to the water infiltration problems was prudent, then I see no reason not to approve the ATO.

My testimony also describes how the Board might view the Tusket ATO in the context of NS Power's track record of cost estimation—how well budgets line up with actual spending. A cost overrun of more than 100 percent on a project that was budgeted with a 5 percent contingency factor is statistically improbable for a project that is properly planned and executed. The burden of proof remains with NS Power to satisfy the Board on a balance of probabilities that ATO should be approved, and the "probabilities" suggest that a reasonable cost overrun of this magnitude is statistically improbable.

III. NS Power's Track Record on Cost Estimation

Q: How closely has NS Power's actual spending on broadly similar projects matched with the original project budgets?

A: For most civil hydroelectric projects, NS Power's project budgets are reasonably reflective of actual spending. Over the past decade, NS Power has completed 42 hydroelectric projects involving civil engineering or civil works construction.[9] Three of those projects had actual spend that was more than double the cost estimate (excluding contingency).[10] Average spending for the remaining 39 projects was 3 percent above the cost estimate, or 2 percent below budget (including contingency).

As illustrated in Figure 2, for all but the three outlier projects, the actual cost of projects is distributed in a range from -27 to +26 percent of the cost estimate.[11] This is roughly consistent with the AACE International expected accuracy range for hydroelectric projects: For Class 3 cost estimates, the typical variation in low and high ranges at an 80 percent confidence level is -20 to +30 percent of the cost estimate.

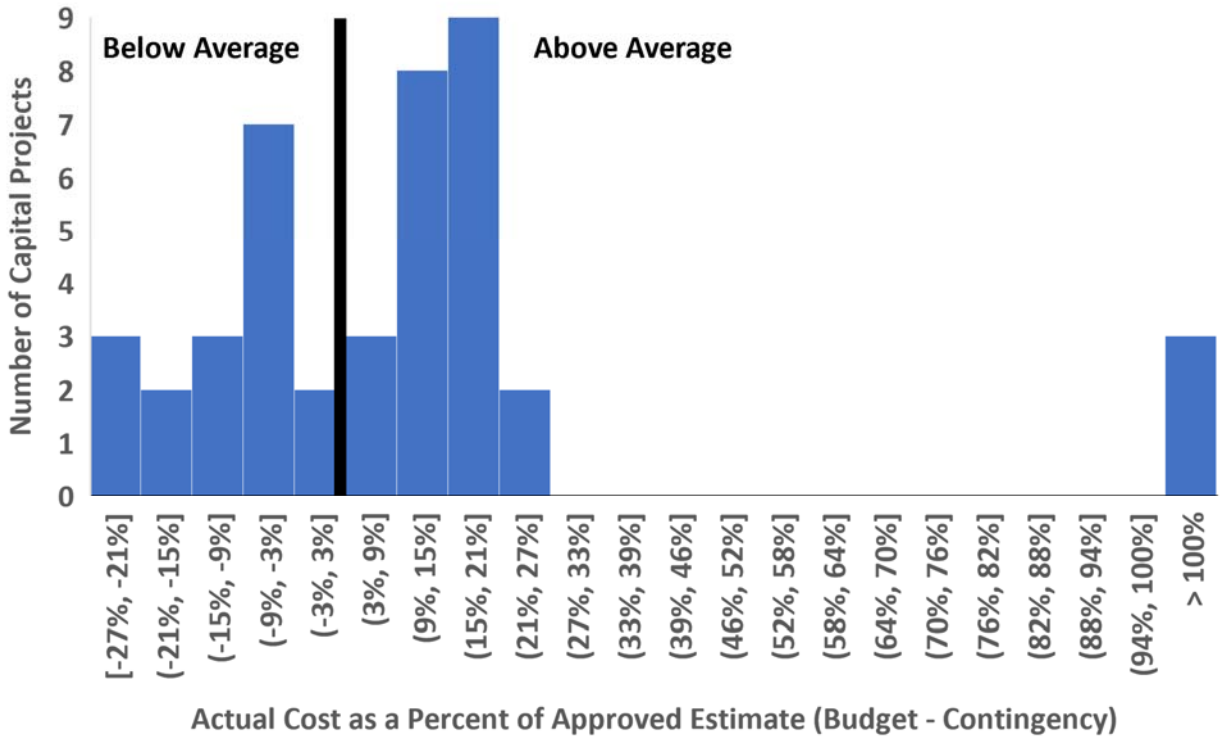
AACE's expected accuracy range suggests that a histogram of those variation should appear more like a bell curve rather than one that is skewed somewhat to the high-cost side. Yet since the overspend for all but the three outlier projects averages 3 percent above the cost estimate, those 39 projects exhibit a reasonably close correspondence to AACE's expected variation in project costs.

[9] Exhibit N-4, NS Power response to CA IR-4, Attachment 1. The specific request covered projects with in-service dates of 2012-2021 and approved budgets of $500,000 or more. Three projects with in-service dates of 2019 or 2020 where work is ongoing are excluded from the analysis in this testimony. Notably, the Gaspereau ATO project is not included in this analysis because it is not yet in-service. Based on a spot check of FIN reports, the contingencies for CI 31246 and 40308 were corrected. The spot check also indicated that the contingencies for CI 41143 and 40282 are likely to be incorrect, but the actual values were redacted from the 2012 ACE Plans. I did not attempt to verify contingency values for all 39 projects.

[10] I will use the term "cost estimate" to indicate the original budget excluding contingency and "budget" where I am also including contingency. This distinction is important for evaluation against AACE International standards.

[11] AACE accuracy ranges are compared with the cost estimate, not budget. AACE considers contingency to be an important component of a project budget, but the contingency is not included for purposes of establishing the accuracy range. This practice differs from the filing requirement for an ATO, which does include the contingency in considering whether the overspend amount triggers an ATO filing.

Figure 2: Actual Cost Compared to Approved Estimate, NS Power Completed Hydro Capital Projects 2012–2021



Source: Exhibit N-4, NS Power response to CA IR-4, Attachment 1. (See footnote 9.)

While the cost variances for most of the historical projects are reasonably close to expectations, that is not true for the three projects with overspending in excess of 100 percent. In addition, the Gaspereau ATO approved total spending of $22.7 million over five times the original approval of $4.4 million. I will refer to these four hydroelectric projects with an ATO in excess of 100 percent as the high-overspend ATOs. Thus, the Tusket ATO is one of five large hydroelectric projects over the past decade for which NS Power has requested an ATO in excess of 100 percent of the original cost estimate (excluding contingency), as summarized in Table 2.[12]

[12] If the budget (including contingency) is used instead, three of the ATO's are over 100%, and the Wreck Cove ATO spend was 89% above the original budget, over five times the overrun for the worst of the 39 non-high-overspend ATOs.

Table 2: NS Power Hydro ATO Projects with More than 100 Percent Overspending

ATO Project	Weymouth Falls Tailrace Deck Refurbishment[13]	Sissiboo Pipeline Replacement[13]	Wreck Cove Fire Suppression Upgrades[13]	Gaspereau Dam Safety Remedial Works[14]	Tusket Main Dam Refurbishment[15]
Matter	M07459	M07554	M07662	M09579	M10197
Planned In-Service	2013 / 09	2014 / 10	2015 / 10	2008 / 06	2019 / 10
Actual In-Service	2016 / 11	2015 / 12	2017 / 1	2021 / 12	2023 / 02
Months of Delay	**38**	**14**	**15**	**162**	**40**
Budget	$ 371,469	$ 475,082	$ 1,034,915	$ 4,354,889	$ 18,157,609
Contingency	2,000	-	104,824	-	77,694
Cost Estimate	369,469	475,082	930,091	4,354,889	18,079,915
Actual Spend	840,914	955,561	1,952,660	22,703,451[a]	36,826,119[a]
Overspend	**128 %**	**101 %**	**110 %**	**421 %**	**103 %**

(a) The actual in-service date and actual spend is not yet known; the ATO planned in-service date and budget is provided instead.

[13] Exhibit N-4, CA IR-04, Attachment 1.

[14] NSUARB, Board Decision, Gaspereau Dam Safety Remedial Works ATO (December 21, 2020), M09579; NS Power, 2007 Annual Capital Expenditure Plan, p. 24.

[15] Exhibit N-1, Application, p. 7, Appendix C, p. 3; Exhibit N-1, Application M08162, p. 21.

A concern about a large number of projects with high overspending has been expressed by the Board in Annual Capital Expenditure Plan decisions. In 2021, the Board observed that 14 percent of capital projects "incurred overspending beyond the AACE +30% upper accuracy limit for Class 3 estimates. This exceeds the 10% expectation prescribed by AACE."[16]

Q: Did the Board approve the full ATO request for the high-overspend ATOs and, if so, why?

A: Yes. In three cases, the Board approved the full ATO request because it found that NS Power learned of additional costs after project approval during detailed engineering, but prior to beginning construction. I will discuss these findings in greater detail in Section VI.

In the recent Gaspereau ATO decision, the Board approved the full ATO request because it found that NS Power incurred additional costs as a result of significant archaeological finds. However, the Board also noted that, "NS Power proceeded with significant spending on archaeology and Mi'kmaq engagement related activities without prior Board approval." The Board did not disallow the overspending but noted that, because the overspending was not included in its regulated rate base from 2012 to 2020, the Company did not request (nor receive) $627,543 in foregone earnings on unapproved spending.[17]

Q: What critiques of NS Power has the Board expressed in the high-overspend ATO decisions?

A: In the Gaspereau ATO, the Board stated, "NS Power might have come to the Board earlier for approval of overspending and approval of a scope change."[18]

In the Wreck Cove ATO, the Board stated, "The Board is concerned with the inaccurate explanation of the project cost variance prior to receiving the clarification noted in the third set of IRs." It also stated, "The Board fully expects project cost estimates (upon which capital item approvals are submitted) to be fairly representative of expected final costs. In fact, the Board notes that economic analysis modelling of project alternatives and selection of

[16] NSUARB, Board Decision, 2021 Annual Capital Expenditure Plan (June 10, 2021), M09920, para 51.

[17] NSUARB, Board Decision, Gaspereau Dam Safety Remedial Works ATO (December 21, 2020), M09579, p. 5.

[18] *Id.*, p. 3.

preferred economic options can be skewed incorrectly by inaccurate project cost estimates."[19] Similarly, in the Sissiboo ATO, the Board stated,

> In the Board's view, a proper on-site inspection by qualified personnel should have identified conditions at the Sissiboo location requiring changes to the design and installation. This omission appears to have largely contributed to the resulting over-expenditure and grossly underestimated the scope and cost of the project when it was presented for approval. The Board expects NSPI's capital expenditure applications to accurately describe and justify the scope of work and the associated cost being submitted for approval.[20]

Q: Has the Board expressed concerns about budget preparation and project management in other ATOs?

A: Yes. In addition to the concerns summarized above for the TUC6, Gaspereau, Wreck Cove, and Sissiboo ATOs, I am aware of eight other ATOs where the Board has expressed concerns about NS Power's project management.

- Tidewater Unit 1 and Methals ATOs: The Board's decision commented on additional expense in two projects. Both budgets increased due to unbudgeted engagement of full-time construction supervisor, whose regular base was considerably distant from the construction site. The Board stated, "these instances may indicate a weakness in NSPI's project management and resource planning."[21]
- Weymouth and Sissiboo Electrical Refurbishment ATOs: The Board expressed concern "that in both instances NSPI failed to complete a proper and timely investigation of the scope of work and associated costs related to these projects. The Board expects NSPI to undertake proper on-site inspections by qualified personnel to accurately describe and justify the scope of work and associated cost being submitted for approval."[22]
- TRE Ash Lagoon ATO: The Board stated that, "NS Power's reliance on information shown to be incorrect does not relieve NS Power of its responsibility and duty to confirm land ownership prior to proceeding with construction. This confirmation could have been obtained by NS Power ... it is fair and reasonable

[19] NSUARB, Board Decision, Wreck Cove Upgrades ATO (December 23, 2016), M07662, p. 2.

[20] NSUARB, Board Decision, Sissiboo Pipeline Replacement ATO (August 15, 2016), M07554, p. 2.

[21] NSUARB, Board Decision, Tidewater Unit 1 Overhaul ATO (December 6, 2016), M07683, p. 2.

[22] NSUARB, Board Decision, Weymouth Electrical Replacement ATO (July 11, 2017), M08053, p. 2. See also NSUARB, Board Decision, Sissiboo Powerhouse Electrical Refurbishment ATO (April 11, 2017), M07939.

that the claimed extra costs resulting from the delay ... be shared equally between ratepayers and NS Power."[23]

- Burnside Unit 4 ATO: "Board reviews of this project, and several other projects ... indicate that NSPI might not have a full grasp of the scope of work and costs required to refurbish these units. Significant changes in the scope of work and increased costs raise questions related to the quality of NSPI's asset management methodology and its project management."[24]
- TUC2 Generator ATO: "NS Power should have completed a more thorough review of this project before declaring it 'similar' to CI 44592."[25]
- Spider Lake Substation ATO: In spite of performing a site inspection, NS Power's original application relied on the 'historical experience' approach and overlooked conditions that "would require much more effort and resources than would be expected by simply using the "historical experience" approach."[26]

In reflecting on the overall trend in overspending compared to approved project cost estimates, the Board's 2021 ACE Plan decision stated that it is not clear "whether this overspending pattern is related to inadequate NS Power capital cost estimating/budgeting practices, inadequate costs minimization efforts by NS Power, or a combination of both." [27]

Q: What conclusions do you draw from your review of NS Power's track record on cost estimation and the Board's decisions on high-overspend ATOs and other ATOs?

A: The Board clearly expects NS Power's initial application to include all relevant information that would allow for approval of a cost estimate, including contingency, that is generally sufficient to achieve the project objectives. When the Board has critiqued NS Power in an ATO, it has usually expressed concern about shortcomings in initial investigations and an overreliance on historical experience.

In the Gaspereau ATO, the archaeological findings resulted in a change to the project objectives, which presented unique circumstances. NS Power's decision to forego AFUDC

[23] NSUARB, Board Decision, TRE Ash Lagoon Site Closure ATO (January 15, 2018), M08180, pp. 2-3. In this decision, the Board also disallowed costs related to replacement of improperly specified materials and additional wet ash handling (pp. 4, 7).

[24] NSUARB, Board Decision, Burnside Unit #4 Restoration ATO (January 19, 2018), M08293, p. 2.

[25] NSUARB, Board Decision, TUC2 Generator Bushing Replacement ATO (July 26, 2018), M08637, p. 1.

[26] NSUARB, Board Decision, Spider Lake Substation Addition ATO, M09110, p. 6.

[27] NSUARB, Board Decision, 2021 Annual Capital Expenditure Plan (June 10, 2021), M09920, para 56.

earnings in that case preempted Board decision on the scope of earnings that should be disallowed when major project design changes occur.

The evidence indicates that for roughly 90 percent of its hydro capital projects, NS Power has completed work at costs that seem statistically consistent with its approved estimates. However, in the cases where those costs vastly exceed the approved estimates, the Board has clearly put NS Power on notice that it expects projects that are presented for approval to include project cost estimates based on competent initial investigations, accurate project designs, and well-supported cost estimates.

IV. Economic Justification

Q: What is the Board's standard of review for project economics in an ATO?

A: In its decision on the Gaspereau Dam Safety Remedial Works ATO ("Gaspereau ATO"), the Board found that the revised project was "the lowest cost option" based on its review of NS Power's analysis of multiple design options, including decommissioning, using the Economic Analysis Model (EAM).[28] A comprehensive EAM is routinely accepted by the Board to demonstrate that a project is economically justified.

The Board has also discussed its concerns with conducting economic justification on a project-by-project basis when multiple projects are included in the plant's overall generation investment plan. The Board stated, "Where a plant has a limited lifespan, it is conceivable total cost overruns on the same unit could reach a tipping point."[29]

Q: Should the EAM inputs and assumptions reflect the circumstances that existed when the project was proposed, or should an updated analysis be conducted?

A: In the Gaspereau ATO, the Board and intervenors identified significant weaknesses in the EAM, and NS Power provided updated and revised analyses of the options.[30] This updated

[28] NSUARB, Board Decision, Gaspereau ATO, M09579, p. 4.

[29] NSUARB, Board Decision, TRE5 Boiler Refurbishment 2016 (June 26, 2017), M07987, p. 2. Similar and related concerns were raised in NSUARB Board Decisions in M08483 (April 4, 2018) and M08477 (April 20, 2018). The Board stated, "both economic analyses included the full cost of replacement power. If both projects were reviewed together, the replacement power required would be double the system's capacity. If all eight items, indicated in the IR response, were submitted in the same manner, total replacement power from all the CIs be 800% of the capacity. Performing individual economic analysis in this manner skews the results by overstating the NPV of individual CIs and makes the payback periods appear much shorter than if the total investment was used." NSUARB, Board Decision, LEA Plant Output Cable Replacement U&U (April 4, 2018), M08483, p. 2.

[30] NSUARB, Board Decision, Gaspereau ATO, M09579, p. 4.

and revised EAM was used to determine whether to finish Gaspereau or select another alternative. The Gaspereau ATO standard indicates that an ATO application should compare the project with viable alternatives using the most updated and revised EAM.

However, when determining whether the project should have been pursued in the first place (i.e., in the original application), it is preferable for EAM to reflect the circumstances that existed when the project was proposed. In the TUC6 ATO, the Board considered whether it would have "approved the higher cost Project with a reduced NPV benefit," and determined that it should not give weight to a "perfect 'hindsight'" analysis by using updated system planning assumptions.[31] Thus, I will apply the TUC6 ATO standard in Section VI of my testimony (Project Management) to evaluate the prudence of the original scope of work considering the circumstances at the time of the original project application rather than "perfect hindsight."

Q: Did NS Power provide an EAM of multiple design options, including decommissioning, that considered the full life-cycle costs of the Tusket Hydro System?

A: No. NS Power only considered the proposed ATO project and partial decommissioning of the Tusket Hydro System in its updated EAM.[32] NS Power did not identify any other alternatives feasible alternatives.[33] The EAM includes updates to its prior partial decommissioning assumptions with new refurbishment cost information.[34]

It is also worth noting that the partial decommissioning alternative includes $9.5 million in costs for the bridge replacement and pre-ATO dam redevelopment costs.[35] Even

[31] Nova Scotia Power Incorporated (Re), 2010 NSUARB 220, paras 61 & 63.

[32] NS Power did not consider full decommissioning, which would also include costs to decommission upstream structures. NS Power, Application, p. 35, lines 20-23. In the original Tusket Application, the Board found that "NS Power did not sufficiently consider the full life-cycle costs when it filed the Application ... [but that] a fuller analysis has resulted, due to the review by Midgard, and the comments of Intervenors." The Board found that, "... the determination of this matter does not turn on whether or not Tusket Powerhouse Dam expenditures are included in the EAM." NSUARB, Board Decision, M08162 (February 6, 2019), paras. 124-125. In the Tusket ATO filing, it appears that the EAM includes a fuller analysis of life-cycle costs for the Tusket Hydro System than in its original Tusket project application.

[33] NS Power explained why it considered several dam refurbishment alternatives to be infeasible in Exhibit N-7, NS Power response to Midgard IR-10.

[34] Exhibit N-1(i), Appendix A, Economic Analysis Model, tab Data A, rows 10-27.

[35] Exhibit N-8, NS Power response to NSUARB IR-8(a)(i); Exhibit N-1(i), Appendix A, Economic Analysis Model, tab Data B, rows 12-13.

after accounting for the removal of AFUDC (which is not included in EAM cost inputs), this value is at least $1 million less than the spend-to-date as summarized in Table 1.

Table 3: Impact of pre-ATO costs on EAM Results

Alternative	Present Value of Revenue Requirement
Tusket Main Dam Refurbishment	$ 40.9 million
Partial Decommissioning, Including Pre-ATO Costs	$ 74.2 million
Partial Decommissioning, Excluding Pre-ATO Costs	$ 62.5 million

Source: Exhibit N-1, Application, Figure 11, p. 37, line 10. Estimate excluding pre-ATO costs calculated using EAM filed as Exhibit N-1(C)(i), deleting items 4 and 5 from Alternative B.

Q: Are the methods and inputs considered in the EAM appropriate?

A: Based on a general review of the EAM and NS Power's responses to information requests, it appears that the EAM in Appendix A to the current Application used reasonable methods and inputs. Because the EAM showed a large advantage for the Tusket Dam refurbishment (even including the full costs requested in this ATO) over the Partial Decommissioning option, I did not conduct a detailed review of the EAM. If other evidence is filed that raises significant issues with the EAM, I will review that evidence to further inform my opinion.

Q: Does the Tusket Main Dam Refurbishment Project continue to be economically justified?

A: Yes, considering the approach the Board took to evaluating the Tusket project in the original application, and based on the updated EAM evidence filed by NS Power, the project appears to have a net benefit to customers, even if the pre-ATO costs are excluded.

However, the benefits to the electric system of this $36.9 million project are not significant. A simple calculation considering just the energy benefits (valued at replacement energy cost) net of Tusket Hydro System operating costs indicates an electric system net benefit of only $7.5 million.

As with some other NS Power lifetime extension projects, a significant portion of the benefit is accounted for as either financial benefits (e.g., tax effects) or simply the benefit of deferring archaeological and other decommissioning costs. As discussed in evidence I have filed in other matters, the EAM improperly excludes the eventually unavoidable cost of decommissioning hydro assets in its "end effects" treatment for lifetime extension projects such as this one.

Nonetheless, from the perspective of current customers, the EAM demonstrates that the Tusket project is economically justified by providing some electric system benefits and by deferring costly decommissioning work well into the future.

V. Ratepayer Interest

Q: What issues, beyond project economics, might be considered "ratepayer interest" matters?

A: Although the Board identified "ratepayer interest" as a distinct criterion in the TUC ATO decision as discussed above in Section II.B, I have not identified any Board decisions on ATOs that discussed ratepayer interests beyond project economics, generally summarized through the EAM findings.

In the Gaspereau ATO proceeding, topics such as recreational impacts and flood control were discussed in evidence, but the Board's decision did not evaluate them. Perhaps the Board might consider reliability, regulatory or contractual risks as ratepayer interests that would be outside the scope of the project economics considered in the EAM.

Q: Are any ratepayer interests, beyond project economics, at issue in this proceeding?

A: NS Power states that there is a potential for unwatering of archeological sites, property damage and loss of life during a 1:1000 annual exceedance probability flood.[36]

Q: Is the Tusket Main Dam Refurbishment Project still in the interests of ratepayers?

A: Yes. Considering the project economics and other topics discussed in NS Power's evidence, the Tusket project appears to be in the interests of today's ratepayers. As mentioned above, if other evidence is filed that raises significant issues with the EAM or any other ratepayer interest, I will review that evidence to further inform my opinion.

[36] Exhibit N-7, NS Power response to Midgard IR-13 (a-b).

VI. Project Management

A. Board Standard of Review for Project Management

Q: What is the Board's standard of review with respect to project management?

A: I am aware of two categories of project management issues that the Board has considered in prior ATOs: sufficiency of design prior to commencing construction and the impact of project delays once construction has begun. As discussed in Section III, the Board has expressed concern about shortcomings in initial investigations and an overreliance on historical experience in at least ten ATOs over the past decade.

Q: How does the Board consider the sufficiency of design prior to commencing construction?

A: Based on the Board's decisions on ATO applications that I have reviewed, it appears that the key question appears to be whether costs would have been incurred (or could have been avoided) with better information if further design or cost discovery had occurred prior to commencing construction.

Generally, the Board has found that the costs included in NS Power's ATOs would have been required even if the design changes had been identified prior to the original application. At least, this is what occurred in nine of the ten ATOs I discussed above in Section III.

For example, in the TUC6 ATO, the Board recognized that "it is a matter of judgment as to how much effort in, and funding of, engineering design should be put into a project at the preliminary stage as opposed to detailed engineering."[37] But the Board did not answer that question in its decision, since it appears to have been convinced that the changes discovered during its detailed design phase, as one witness described, did not represent "a cost that you would have been able to avoid."[38]

Similarly, in the Board's decision regarding the Wreck Cove Fire Suppression Upgrades ATO, the Board found that the RFP process determined costs to be much higher than the original third-party estimate. The Board accepted that:

[37] Nova Scotia Power Incorporated (Re), 2010 NSUARB 220, para 58.

[38] *Id.*, para 57.

> All costs associated with the ATO application would have been incurred regardless of whether a more accurate estimate had been provided for the original application.[39]

In the only case where the Board found that better information in the original application would have resulted in lower costs, the Board did make significant disallowances. In the TRE Ash Lagoon ATO, the Board made significant disallowances because NS Power relied on incorrect information (causing extra costs resulting from delays), improperly specified materials, and inaccurate estimates of required wet ash handling.[40] The Board's decision includes thorough analysis of the factors weighing in favor of full disallowance and mitigating factors, and determined that for each issue, a partial disallowance would reflect a fair and reasonable assignment of the extra costs to ratepayers and NS Power.

Q: How does the Board view the impact of project delays?

A: The Board's consideration of project delays has been limited. I did not locate any decisions that considered whether a project could have been completed on the original schedule (or something closer to the original schedule) if NS Power's original application had relied on better information.

This question is particularly relevant because some of the cost increases described by NS Power result from price increases that occurred due to construction delays, such as increases in the price of steel.[41] I am not aware of any Board decision that addresses whether NS Power or ratepayers should bear the costs resulting from delay-induced price increases.

I am aware of three ATOs in which the Board considered the impact of project delays. One of those ATOs was the TRE Ash Lagoon ATO discussed just above, in which the Board considered the roles of a government agency, NS Power Corporation (NS Power's predecessor), and NS Power's duty to confirm land ownership. The cause of the delays, and not the delays in and of themselves, informed the Board's decision to impose a disallowance.

In the TUC6 ATO, the Board commented on the impact of project delays, which it viewed as arising from an unrealistic project schedule.[42] The Board directed NS Power to

[39] NSUARB, Board Decision, Wreck Cove ATO (December 23, 2016), M07662, p. 2. Another decision with similar findings is NSUARB, Board Decision, Sissiboo ATO (August 15, 2016), M07554, p. 2.

[40] NSUARB, Board Decision, TRE Ash Lagoon ATO (January 15, 2018), M08180, pp. 2-3, 4, 7.

[41] Exhibit N-1, Application, p. 19, lines 4-8.

[42] *Id.*, para 61.

"submit its capital expenditure requests on a more timely basis, with greater detailed information and more accurate budgets."[43] Despite those comments, the Board's decision did not reach findings regarding whether the project could have been completed on the original schedule or what impact a more timely completion would have had on the project economics.

In its Gaspereau ATO decision, the Board remarked on NS Power's failure to follow the provisions of the Board-approved Capital Expenditure Justification Criteria (CEJC) regarding overspending and changes in scope.[44] The Gaspereau ATO was required due to the discovery of Mi'kmaq archaeological sites in the project area. Project development was halted, and new design work was undertaken once engagement with the Mi'kmaq was concluded. In evaluating the significance of NS Power's delay in filing an ATO and request for scope change, the Board gave weight to the fact that no party questioned the original scope of work and that all parties agreed that the original project was no longer feasible.

In summary, if the Board finds that NS Power should have planned and executed the Tusket project in a more timely manner, it should determine whether NS Power or ratepayers will bear the costs associated with delay-induced price increases.

B. NS Power's Use of Geotechnical Investigations in Project Design

Q: Please summarize NS Power's geotechnical investigations prior to submitting the initial Tusket project application in 2017.

A: NS Power appears to have conducted two geotechnical investigations prior to 2017, one in October 2011 near the existing dam and another in August 2017 near the Hurlburt Falls Bridge.

In October 2011, NS Power completed a three-page geotechnical investigation that involved one borehole each on the east and west embankments. NS Power states that the borehole "did not indicate the presence of water ... there was no reason to suspect that water was passing through the west embankment."[45] The bedrock was described as "fair to good quality" in one location and "poor to excellent quality" in the other.[46] NS Power states that,

[43] *Id.*, para 66.

[44] NSUARB, Board Decision, Gaspereau ATO, M09579, p. 2.

[45] Exhibit N-8, NS Power response to NSUARB IR-3(a).

[46] *Id.*, Attachment 1.

"Although boreholes only provide information that is accurate for their exact location, it is common to use their results to estimate the depth to bedrock in areas where boreholes could not be drilled."[47]

The October 2011 study did not include boreholes downstream of the existing spillway structure because the "area is always submerged." Instead, NS Power states that "soundings were carried out to determine ground surface elevations." Information on these soundings was not included in NS Power's responses to requests for geotechnical studies.

NS Power also relied on its historical experience and general surface observations, as follows:

> NS Power 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. There were no visible signs such as soil slumping or sink holes in the land mass dividing the two areas, eddies in the water flow, sediment in the riverbed, or displacement of the rip rap along the slope of the river that could indicate that there was a water migration issue. This is not an issue that has arisen at any of NS Power's other hydroelectric sites.[48]

Based on the 2011 investigation and general surface observations, NS Power (incorrectly, as it has learned) assumed that the underwater surface was competent bedrock, "scoured of fractured or weathered rock."[49] As a result, NS Power considered uncertainty about the bedrock condition to mainly relate to the volume of concrete required—water infiltration was not among the nine risks identified in NS Power's 2017 risk register.[50]

In summary, NS Power relied on incorrect assumptions about the condition of the embankment and bedrock. As a result, the Company's project design and construction plans did not contemplate the possibility of substantial water infiltration issues prior to beginning preliminary work.

Q: Please summarize NS Power's geotechnical investigations after beginning construction of the dam.

A: After submitting the original Tusket project application and beginning construction, NS Power conducted several additional investigations of the site geology.

[47] Exhibit N-8, NS Power response to NSUARB IR-10(c).

[48] NS Power, Reply Evidence (February 28, 2018), M08162, p. 38, lines 1-6.

[49] Exhibit N-8, NS Power response to NSUARB IR-10(c).

[50] Exhibit N-4, NS Power response to Midgard IR-4(a) and (c), Attachment 1 (December 6, 2017), M08162.

In August 2017, NS Power's consultant drilled two boreholes for the geotechnical investigation of the Hurlburt Falls Bridge, about 100 feet from the new dam construction area (see Figure 1). These boreholes indicated a layer of 1.7 – 2.5 meters of "Severely Fractured Bedrock" and a further layer of bedrock with "close to moderate," "moderate to wide" fracture spacing and partial dissolution of calcite veins.[51] NS Power's evidence does not include any indication that it considered the relevance of the bridge boreholes to the construction plan for the dam at that time.

NS Power first considered the water infiltration issue in September 2017, when its contractor was unable to de-water the cofferdam area behind the existing dam and determined that it was due to an unforeseen water migration issue.

Following this discovery, NS Power conducted further geotechnical investigations. Together with "general geological information about the area, and photos from the initial dam construction," this study led to NS Power determining that installing a concrete core wall along with grouting the bedrock under the core wall would be "the best solution to mitigate the water issue."[52] The investigation included two phases.

First, in October 2017, "test pits were dug on the west side of the dam, in the embankment. The condition of the bedrock could not be observed due to the infiltration of water ... Water was observed flowing into ... and out of the test pit ..."[53] (The test pits are not identified in Figure 1 because none of the evidence provides further location information.)

Second, after the test pits were refilled, eleven holes were drilled in the west embankment to locate the bedrock elevation (see Figure 1). NS Power stated that, "All of the holes drilled contained some volume of water within the holes."[54] In the single page drawing that NS Power provided to document the study, the water elevation is reported as "no water" for one hole, 17-23 feet in six locations, and is not reported at four locations.[55] It does not appear that NS Power obtained information regarding the condition of the bedrock (e.g., the

[51] Exhibit N-8, NS Power response to NSUARB IR-11, Attachment 3. Note that the logs indicate that they were drilled in 2016, but each log report page is dated 2017 and NS Power's timeline indicates that they were drilled in August 2017. (Application, Appendix D, p. 1.) NS Power should confirm whether the boreholes were drilled in 2016 or 2017.

[52] NS Power, Reply Evidence (February 28, 2018), M08162, p. 38, lines 17-20.

[53] Exhibit N-1, NS Power Application, Appendix D, p. 2.

[54] Exhibit N-1, NS Power Application, Appendix D, p. 3.

[55] Exhibit N-7, NS Power response to Midgard IR-2, Attachment 1.

extent of fracturing). As illustrated in Figure 1, two of the holes drilled in October 2017 appear to be within just a few feet of one of the 2011 borehole drilling locations.

Q: Does the evidence suggest that NS Power made effective use of its geotechnical investigations prior to submitting the original Tusket project application?

A: NS Power may not have conducted sufficient geotechnical investigations prior to filing the original Tusket project application. The project application relied exclusively on the two boreholes drilled in 2011 and "historical experience." This raises three questions.

First, there is evidence that the 2011 investigation may not have been thorough or accurate. All the test pits and drill holes dug in 2017 contained water, many contained substantial amounts, including holes drilled in approximately the same location as one of the 2011 holes.[56] This is a major difference from the October 2011 investigation.

Second, even if the 2011 investigation was accurate, over five years elapsed between that investigation and the filing of the original Tusket project application. It is possible that conditions on the west embankment changed during that time. I do not have the geological expertise to judge whether, for example, dissolution in the bedrock could have resulted in a major increase in water infiltration over a five- or six-year timeframe.

Third, NS Power may have overlooked some significant clues that water infiltration would be a risk. In 2011, the borehole log indicates that some of the bedrock was of "poor" quality. I cannot determine whether the 2011 observation of poor-quality bedrock was intended as a warning that the bedrock was susceptible to fracturing and water infiltration; it is not clear how much lower than "poor" the rating could have been or what the significance of that rating is without a report of water in the borehole.

It is not even clear whether NS Power paid any attention to the poor quality of the bedrock found in the boreholes drilled for the bridge construction in August 2017. That information came just prior to the observation of infiltration at the cofferdam site, so it was unlikely to have significantly improved NS Power's execution of the project, even if the Company had paid attention to the results. But the lack of any apparent reaction to the news from the bridge site suggests that NS Power was not optimizing its opportunities to improve its assessment of the Tusket project.

[56] There is a slight discrepancy in the evidence regarding the presence of water at one drill location.

If NS Power had conducted further borehole investigations prior to completing the Tusket project design, the findings from the boreholes at the bridge site suggest that the Company might have learned that the bedrock was susceptible to "occasional partial dissolution of calcite veins." The implications of this appear very significant. For example, according to NS Power, this dissolution may explain the large void in the bedrock that NS Power discovered during construction of the west embankment core wall.[57]

As noted above, in developing the design for the Tusket project, NS Power assumed that the underwater surface was competent bedrock, "scoured of fractured or weathered rock."[58] While I am not an expert in geology, the 2017 bridge borehole findings—as interpreted by NS Power—certainly suggest that since the dam was built, the elevated lake level could have gradually dissolved calcite veins in the bedrock, which may have already contained significant fractures, creating the fissures in the bedrock and under the sill of the existing dam. Had NS Power paid attention to the uneven results of the 2011 geotechnical investigation or performed additional testing for any other reason, the Company likely would have found additional evidence contradicting its initial assumptions.

Q: Has NS Power's evidence met its burden to prove that it undertook and justified "the necessary level of detailed engineering at early stages"[59] of the Tusket project?

A: No, I suspect that NS Power should have (a) verified the 2011 borehole findings with additional testing (such as test pits) to verify that the embankments were not a source of water infiltration and (b) conducted additional geotechnical investigations to verify the condition of the bedrock as close to the new dam construction site as possible. If NS Power had engaged geotechnical experts more deeply in the design and development of the construction plan, then it is likely that the Company would have proposed a different design and construction plan in the original application for the Tusket project.

While I cannot provide evidence as to what a prudent geologist would have done, NSP has not met its burden of proof to demonstrate that a prudent geologist would have concluded (incorrectly) that the bedrock around the Tusket project site and under the

[57] NS Power states that "a hypothesis is that the void could have been the result of calcite veins in the bedrock being dissolved by water seeping from the excavated canal." Exhibit N-4, NS Power response to CA IR-2(b).

[58] Exhibit N-8, NS Power response to NSUARB IR-10(c).

[59] Nova Scotia Power Incorporated (Re), 2010 NSUARB 220, para 60.

Tusket dam was capable of blocking water infiltration. Instead, it appears that NS Power relied heavily on its experience "using an existing dam and spillway structure as an upstream cofferdam ... at several other NS Power hydro dam and spillway refurbishments."[60]

The decision to rely on experience at other projects echoes the causes of the overspending in many of the ATOs discussed above in Section III above. For example, in the Weymouth Falls project, NS Power based its original project design and construction plan for the Weymouth Falls on experience with another tailrace deck refurbishment. Then, in the Weymouth Falls ATO application, NS Power revised the project "due to the need for a cofferdam during construction."[61] Fortunately, as with other ATOs discussed above, the Board determined that because the project was revised prior to construction, the overspend for Weymouth Falls ATO could not have been avoided.

In contrast, as discussed in Section VI.A, the Board determined that the project management problems affecting the TRE Ash Lagoon ATO were not uncovered until construction work was underway, resulting in project delay and material cost increases.

Similarly, even though the Tusket ATO may still be economically justified and in the best interest of ratepayers, the evidence suggests that NS Power's management of the Tusket project resulted in unreasonable costs, which should not be collected from customers.

Q: Might the Board wish to conduct further investigations to establish the prudence of the design work included in the original application?

A: NS Power is likely to argue that its actions were prudent because the water infiltration was unusual and unexpected. As discussed above, NS Power considered uncertainty about the bedrock condition to mainly relate to the volume of concrete required—water infiltration was not among the nine risks identified in NS Power's 2017 risk register.[62]

Unfortunately, the site investigations that NS Power relied upon in formulating its project design and construction plan were focused on the dam's condition and related safety risks. NS Power states that,

[60] Exhibit N-8, NS Power response to NSUARB IR-12(b).

[61] NS Power, Weymouth Falls ATO Application, M07459, p. 2.

[62] The 2017 risk register identified only one medium risk issue (heavy rains), and eight low risk issues. Exhibit N-4, NS Power response to Midgard IR-4(a) and (c), Attachment 1 (December 6, 2017), M08162. Notably, NS Power's assessment of the risks associated with the Tusket project has now expanded to tracking 26 to 27 risks. One risk register has 12 high, 8 medium, and 7 low risks. The other risk register has 9 high, 8 medium, and 9 low risks. Exhibit N-5, NS Power response to GT IR-1, Attachments 1 and 2.

> As water infiltration had not been identified as a concern during the *Dam Safety Review* of the Tusket Hydro System or in the bi-annual *dam condition assessments*, further geotechnical investigation of the embankments was not required to develop the design of the new dam structure.[63] (*emphasis added)*

This defense is weak, at best. NS Power has not shown that the infiltration problems that have complicated the construction of the new dam would or should have raised safety concerns in the review or dam condition assessments. The question is whether a prudent geologist would recommend relying on safety and dam condition assessments as the basis for a design and construction plan to build a new dam.

If the evidence submitted in this matter is insufficient to inform the Board as to whether NS Power's original project plans were prudent, it could engage an additional geologist to provide further expert review of NS Power's project planning decisions. Such evidence should be important in determining whether NS Power managed the Tusket project to the lowest reasonable cost and aid the Board in making a decision regarding the requested variance in costs.

Q: After recognizing the potential for overspending, did NS Power halt the project and undertake new design work?

A: No. NS Power states:

> NS Power did not terminate the contract with the existing civil construction contractor once the company knew the construction schedule and requirements for water management for the project was going to change significantly because the work had begun and the design of the dam to be constructed had not changed.[64]

While the design of the dam had not changed, the "project schedule, project scope, and project permitting considerations" changed substantially. A major reason that NS Power did not cancel and re-tender the project was that only two heavy civil construction firms participated in the RFP. Instead, NS Power incurred costs due to the extended construction timeline that it believes are justified considering the re-negotiated pricing compared to the

[63] Exhibit N-8, NS Power response to NSUARB IR-16(b).

[64] Exhibit N-8, NS Power response to NSUARB IR-5(a).

other bidder's 2017 pricing.[65] While it is unlikely that re-bidding the project in 2018 would have resulted in substantially lower pricing, that is not the only relevant question.

As discussed in Section II, the Board's decision in the TUC6 ATO matter indicates that the prudence of the original scope of work should be evaluated considering the circumstances at the time of the original project application rather than "perfect hindsight." By the time NS Power realized that it had misjudged the risk of water infiltration into the construction area, it also had the 2017 bridge borehole findings. Those findings appear to indicate a potential for extensive fracturing of the bedrock. If the Board does not determine that NS Power should have engaged in deeper geotechnical investigations prior to commencing construction, then the Board should also consider whether it would have been more prudent to immediately halt construction in September 2017 and undertake new design work rather than attempt to continue construction.

C. Cost Impacts of Failure to Identify Water Infiltration Risk

Q: Could NS Power have avoided costs if it had completed more detailed engineering work prior to commencing construction in 2017?

A: Yes. The original construction costs have increased due to delay claims, price increases, and other factors that have nothing to do with the changes to the scope of work. These cost drivers were not a significant factor in any of the other ATOs reviewed in Sections II and III.

If NS Power's original RFP and applications for environmental permits had identified the water infiltration through the west embankment and the potential for other sources of water infiltration to require lowering of the reservoir, then it could have avoided costs caused by the extended construction timeline and associated AFUDC and administrative overhead (AO). The increased construction timeline resulted in an increase in labour rates and material prices, an increase in the amount of labour, and inefficiencies in construction activities "as fewer Project scope items were being completed concurrently."[66] Some examples of specific costs that could have been avoided if the water infiltration issues had been identified by early 2017 include:

1. Delay claim costs for costs incurred by the civil contractor.[67]

[65] Exhibit N-8, NS Power response to NSUARB IR-1.

[66] Exhibit N-1, Application, pp. 18-20; quoting p. 19, lines 25-27.

[67] Exhibit N-8, NS Power response to NSUARB IR-17(a-b).

2. The 2017 construction of a cofferdam, including pumping and a tremie concrete pour.[68] It appears that this construction work was abandoned and thus was neither used nor useful, as construction did not proceed until the core wall was constructed. NS Power also concluded from the results of the tremie pour that, "the water was not migrating through the fissures in the bedrock,"[69] but this appears to refer to two specific fissures.[70] It is possible that the tremie pour formed a part of the construction of Bay 8, which is discussed elsewhere, but the evidence is unclear on this point.
3. Costs to modify the walls of the fish ladder that increased due to labour and material cost increases.[71]
4. Delays in awarding the contract for the supply of the vertical lift gates resulted in further delays in designing of the steel superstructure so that competitive market pricing be obtained, at which time market pricing for construction and manufacturing increased.[72]
5. The lack of an opportunity to competitively bid environmental monitoring services.[73]

Some of these cost increases were negotiated between NS Power and its contractors because NS Power decided not to re-bid the project. NS Power judged that accepting the extra costs was warranted because of the small pool of competent bidders for the project scope and the increased market prices in 2020 and 2021 as compared to 2017 and 2018.[74]

In some cases, NS Power's evidence does not make it entirely clear if the full scope of the cost impacts is reflected in NS Power's estimate of costs associated with the extended construction timeline. For example, NS Power states that it has not taken delivery of spillway gates, even though it has incurred costs associated with their construction. NS Power does not explain whether there may be additional costs (e.g., storage) associated with delay in

[68] Exhibit N-3, NS Power response to NSUARB IR-1 on Contingency Report 2.

[69] *Id.*, p. 2, lines 21-22.

[70] Exhibit N-3, NS Power response to NSUARB IR-1 on Contingency Report 4.

[71] Exhibit N-8, NS Power response to NSUARB IR-11(b).

[72] Exhibit N-8, NS Power response to NSUARB IR-17(c).

[73] Because construction contracts were obtained in advance of receiving Fisheries Act Authorization, undertaking an RFP process for environmental monitoring would have delayed the start of the work and led to additional costs. The lack of competitive bidding for this work may have resulted in increased costs. Exhibit N-8, NS Power response to NSUARB IR-20(c).

[74] Exhibit N-8, NS Power responses to NSUARB IR-1(a) and 17(a-b).

taking delivery.[75] For another example, bridge construction was delayed from 2017 to 2019 to avoid potential uncontrolled sedimentation issues related to water infiltration from the power canal.[76] NS Power does not state whether this delay affected costs.

NS Power has classified some costs as being due to the extended construction timeline that were *not* related to the water infiltration issues. Some examples of justified variances from the approved project estimate include:

1. Due to heavy rainfall in November and December of 2019, Hurlburt Falls Bridge construction was delayed, increasing NS Power's project management, overhead, and AFUDC costs.[77]
2. The revised project design requires scheduling around two drawdowns "to accommodate the length of time required for construction while reducing potential impacts to upstream gaspereau migration."[78] This change to the structure and length of the construction schedule extends the timeline and increases costs.

Q: What standard of review should the Board apply if it determines that NS Power failed to manage the Tusket project to the lowest reasonable cost?

A: I recommend that if the Board determines that NS Power has not met its evidentiary burden, then it should apply the following standards to determine whether or not costs should be disallowed.[79]

1. Construction work through 2017 was largely based on incorrect assumptions about the condition of the embankment and bedrock. For example, costs related to the 2017 tremie concrete pour, cofferdam construction, and pumping should be disallowed.
2. Construction related to the core wall and Bay 8 of the new dam should be allowed since it contributes to the completion of the new dam. This work began with the test pits and drilling investigations in October 2017. Most of the costs for this work occurred in 2018 through September 2019. The Board could consider

[75] Exhibit N-8, NS Power response to NSUARB IR-17(c)(ii).

[76] Exhibit N-8, NS Power response to NSUARB IR-7(b)(i).

[77] Exhibit N-8, NS Power response to NSUARB IR-11(d). However, please note discussion related to AFUDC and bridge construction later in this section.

[78] Exhibit N-7, NS Power response to Midgard IR-8, Attachment 9, p. 26.

[79] The chronology discussed in the Standards is from Exhibit N-1, Application, Attachment D.

whether the construction process would have been more efficient and less costly if construction on the core wall and Bay 8 of the new dam did not occur separately from the construction planned beginning July 2021.[80]

3. Costs related to bridge construction, including contingency expenses related to bridge relocation, are also reasonable and contribute to the completion of the new dam and the Board determined in its Supplementary Decision.
4. Construction costs for the dam beginning in mid-September 2019 relied on the incorrect assumption that the only source of water infiltration was through the west embankment. Construction costs mid-September 2019 through June 2021 should be disallowed.
5. Costs related to the extended project timeline, such as materials and labour price increases and particularly as related to suspending materials procurement and construction activities should be disallowed, even beyond June 2021.
6. Generally, construction costs that are forecast to occur beginning July 2021 are justified unless they are disallowed based on Standard 5. For example, costs related to limitations on lake lowering, which require a longer construction timeline than originally envisioned are justified since they are a requirement of environmental permitting that cannot be avoided.
7. Administrative overhead related to any disallowed costs should be disallowed.
8. AFUDC incurred prior to re-starting construction should be disallowed.

These standards are applied to the variances requested in NS Power's application are included in Attachment 2.

Q: Why do you suggest that NS Power's request to incur AFUDC for expenses prior to re-starting construction may not be appropriate?

A: NS Power's Accounting Policy 6240 for AFUDC does not clearly apply to the specific circumstances of the Tusket project. NS Power's position is that:

[80] The core wall and bay 8 construction sequencing is discussed in Exhibit N-3, NS Power response to NSUARB IR-1, Contingency Report 4.

> Although active construction work on the dam component of the Project ended in December 2019, construction work on the bridge component continued until February 2020. Project work continued from March until August and AFUDC was incurred on the Project until August 2020, when the decision was made to defer the project until 2021 as a result of the Company not receiving the regulatory permits to complete the work in 2020. The Project will not begin incurring AFUDC again until construction work resumes in July 2021.[81]

Application of Policy 6240 to the circumstances of the Tusket project raises issues in three respects.

First, the approved Tusket project has been substantially re-designed. Policy 6240 states that, "AFUDC application begins in the month in which a work order receives charges and continues until the month the work order becomes operational plant." The Board will need to determine whether the original Tusket project application represents "a work order." If the Board finds that NS Power did not meet its burden to prove that it undertook the necessary level of detailed engineering at early stages of project design, then it may determine that the original Tusket project application no longer represents a valid work order.

Second, NS Power argues that construction on the replacement dam began in 2017 and continued through February 2020 when it was deferred until July 2021.[82] This is also questionable. The only completed construction work prior to July 2021 is the Hurlburt Falls Bridge, the core wall and Bay 8 of the new dam.

Other than Bay 8 of the new dam, those construction costs are not independently eligible for inclusion in allowable costs for rate-making purposes because neither is properly viewed as an asset that will be used or useful to the power supply system. Policy 6240 states,

> The AFUDC includes a designated cost of equity funds, to be capitalized as part of the acquisition of the related asset. That cost shall be capitalized under those circumstances only if its subsequent inclusion in allowable costs for rate-making purposes is probable.

In the case of the bridge, the Board gave extensive consideration as to the question as to whether the bridge should be considered used and useful for rate base calculation. The Board found that, "NS Power is seeking to capitalize and place into rate base a cost

[81] Exhibit N-3, NS Power response to NSUARB Additional Questions on Report 7 IR-1 (November 2, 2019).
[82] *Id*.

associated with the betterment of the Tusket Main Dam, which is an NS Power asset."[83] The bridge itself is not an asset, but rather forms "part of the construction costs associated with replacing the Tusket Main Dam."[84]

In the case of the core wall, its construction is not necessary to the Tusket Hydro System. Its construction was only necessary to prevent water infiltration during construction of the replacement dam. While there is no reason to do so, it appears that the core wall could be removed once the new dam is completed. Thus, the core wall costs are similar to the bridge costs and can be viewed as construction costs associated with replacing the Tusket Main Dam.

Only Bay 8 of the new dam is properly viewed as a constructed asset. However, as noted above, the Board may wish to consider whether the construction schedule that resulted from the incorrect assumptions about the condition of the bedrock and west embankment resulted in an efficient construction schedule.

Third, NS Power's interpretation of Policy 6240's delay clause is also questionable. Policy 6240 states,

> Allowance for funds used during construction should be capitalized at the effective cost-of-capital rate, compounded semi-annually, except in the following circumstances:
>
> a. Projects that will be under construction for less than a predetermined time;
> b. Projects delayed for more than one year due to extraordinary circumstances; and
> c. Projects with an economic value or future benefits that will be exceeded by such capitalization.

As noted above, NS Power recognizes that the delay clause applies to this project. What is not clear is whether the delay clause is meant to allow for AFUDC to be incurred both before and after the delay. The phrase "except in the following circumstances" is unambiguous and does not indicate that some AFUDC is allowed and other AFUDC is not when the circumstances apply. Neither exceptions (a) nor (c) indicate that some AFUDC may be collected. Read strictly, the delay clause suggests that no AFUDC should be allowed *at all* for projects delayed by more than one year.

[83] NSUARB, Supplementary Decision (March 12, 2019), M08162, para 18.

[84] *Id.*, para 29.

In summary, it is highly questionable whether AFUDC should be capitalized prior to re-start of construction (July 2021). The Board may determine that the applicable work order relates to construction beginning July 2021, that those costs incurred prior to July 2021 preceded the start of construction on the asset to be placed in service, and that if construction did begin prior to July 2021, then the delay clause excepts AFUDC because the construction was delayed for more than one year.

Q: What is your estimate of costs that may not meet your recommended standards of review?

A: I estimate that applying the standards recommended above will result in a $6.4 million disallowance of spend-to-date costs, plus costs that occur beyond June 2021 related to the extended project timeline, such as materials and labour price increases and particularly as related to suspending materials procurement and construction activities should be disallowed, as summarized in Table 4. This works out to a 47% disallowance of spend-to-date.

Table 4: Estimated Disallowance in Spend-to-Date Based on Recommended Standards

	Disallowance	Spent-to-Date	Percent Disallowed
Costs through 2017	1,525,457	2,703,686	56 %
2018-2019[a]	2,686,612	5,823,757	23 %
2020-2021	1,969,716	2,940,591	67 %
Administrative Overhead[b]	361,902	860,739	42 %
AFUDC	1,200,588	1,200,588	100 %
Total	**$ 6,384,275**	**$ 13,529,361**	**47 %**

(a) The disallowance for construction costs from 2018-2019, when bridge construction occurred, is adjusted to remove bridge-related contingency expenditures (Exhibit N-4, NS Power Response to CA IR-1, Attachment 1, refile), and the original budget for bridge construction, as detailed in NS Power's response to NSUARB IR-17, Attachment 2 in M08162.

(b) Administrative overhead allowance is estimated based on the ratio of AO to total spend-t0-date.

D. Considerations Beyond the Tusket ATO

Q: What application does your review have for the Board's consideration of other capital project applications?

A: As noted in Section III, in its 2021 ACE Plan decision, the Board questioned "whether this overspending pattern is related to inadequate NS Power capital cost estimating/budgeting practices, inadequate costs minimization efforts by NS Power, or a combination of both." [85]

The Tusket ATO case appears to be a relatively unusual situation in that NS Power's overreliance on historical experience in its capital planning and budgeting practices may be determined to have resulted in unnecessary cost overruns. If so, then those planning and budgeting practices are an example of inadequate cost minimization.

Q: Are there any other aspects of the application you wish to comment on?

A: Yes. In recent ACE Plan proceedings, I have submitted evidence regarding NS Power's methods for developing its contingency. NS Power's submission of its project estimate checklist and maturity matrix (Application Appendix I) and details regarding its calculation of the contingency amount (Application Appendix J) are welcome improvements.

Regarding the contingency, the additional detail provided in Appendix J will provide a measure of accountability for NS Power should there be further unforeseen overspending. The contingency should not be viewed as an absolute cost cap but does provide evidence that would be relevant should NS Power submit a further ATO application. Although the methods may vary by project, this level of detail is appropriate for major capital project applications and should be encouraged by the Board.

Q: Does this conclude your testimony?

A: Yes.

[85] NSUARB, Board Decision, 2021 Annual Capital Expenditure Plan (June 10, 2021), M09920, para 56. Somewhat ironically, NS Power cited the Tusket project as one of its two best examples of cost minimization efforts (paras 67, 71, 73).